# Appendix N

## Public Comments
## Attachments

*All comments received through the PasoGCP.com site were automatically recorded with the time and date of the comment as well as the name of the commenter and, if applicable based on the physical address provided, their GSA. The comments were forwarded to the GSAs and the commenter was notified that their comment had been received. The GSAs reviewed each comment received and incorporated the comment into the text as the GSA felt appropriate. Comments received by mail or other means were considered and incorporated in the same manner. The final GSP reflects the responses to comments incorporated by all four GSAs.*

Gregory T. Grewal
[redacted]

[redacted] Residence
Cellular

HAND DELIVERED

May 14, 2018

Mr. John Hamon, Chairperson, Paso Basin Cooperative Committee

Mr. Derek Williams, President, Hydro Metrics

Gentlemen:

I have found the last few meetings of the Paso Basin Cooperative Committee interesting and informative. Likewise the two public workshops have been informative. However, a common occurrence at all meetings has been that very few of the important questions or issues brought forward during public comment are answered or actually addressed by staff or consultants. I believe the lack of thoughtful responses undermines the trustworthiness of the process.

I am also of the opinion that the credibility of the GSP development process would be strengthened if Hydro Metrics staff would quickly endeavor to obtain copies of all of the studies and reports relating to the Paso Robles Groundwater basin completed or sanctioned by the County of San Luis Obispo or the City of Paso Robles since January 2000. Part of this document accumulation should include the Paso Robles Groundwater Basin Agreement of November 8, 2005, commonly known as the PRIOR Agreement.

Since 2013 I have been a member of the Paso Basin Committee and more recently of the Water Resources Advisory Committee (WRAC) representing rural residents. I have also attended many meetings or programs sponsored by the DWR. Accordingly, I am familiar with most of the documents I am encouraging you to compile. A review of these documents will shine light on the history of Paso Basin inter-agency water politics, which produced both successes and failures over the last many years.

Sincerely,

**To:** Donald Morris; [redacted]
**Subject:** RE: Comments for the Groundwater Basin Workshop

**From:** Donald Morris [redacted]
**Sent:** Monday, May 21, 2018 10:14 AM
**To:** [redacted]
**Subject:** Comments for the Groundwater Basin Workshop

Fellow owners in the Basin.

I'm disappointed that I haven't been able to attend the workshops and am not up on what has been decided/discussed. I would like to give an input on my experience and perceptions.
My well water table cycled nearly 20 feet every year but returned until the late 90's when it started progressively getting deeper, in concert with the large plantings of grapes. My Well was drilled in the late 40's and irrigated about 40 acres of alfalfa, but that was a hobby, not a business and was discontinued.
When we joined to form a water district, I was disappointed as to the approach for water usage, which appeared to me to be that the current large users would get a reduced portion and low level users would be forever locked out. Obviously, the investment in the property deserves consideration, but all our deeds have the same rights and I believe, after a transition, that all should be left on some semblance of the same rights, not a pure confiscation of deed rights. My general outline of a "fair and legal" process would be.

1: Determine the long term acceptable draw on the aquifer( I suspect that it is 1/2 or less of current usage)
2: Set a transition period to reduce the usage to #1 draws based on total acreage owned (5 years?)
3: Concurrent with #2 and possibly extending beyond #2 time period, transition from current users having full access to the decreasing draw to a system where each owner has acreage access to their portion and may use, save, or sell/lease their allotment to a pool of users or individually to a user.

This would acknowledge the different levels of investments, but transition to a system that leaves each deeded owner of water rights equal standing based on acreage. Those that choose to not irrigate, could still have land value by leasing their rights to users and the users could maintain some fraction of their plantings. The district should also be inventive to secure/create additional capture and creation of additional sources and sell based on cost. Without #3, the process is a pure confiscation of property rights by a quasi-government agency to the benefit of others without compensation and is a selective destruction of property values. Fairness requires a transition and equal rights at the end.

Donald H Morris

# Creston Advisory Body

Chairperson: Sheila Lyons [redacted]

July 18, 2018

San Luis Obsipo County Supervisor John Peschong jpeschong@co.slo.ca.us
San Luis Obisbo County Supervisor Debbie Arnold darnold@co.slo.ca.us
Chairperson the Paso Basin Cooperative Committee, John Hamon JHamon@prcity.com

Dear Distinquished Representatives,

The Creston Advisory Body (CAB) represents the landowners of approximately 40,000 acres in District #5, the majority of which live over the Paso Robles Groundwater Basin (Basin), including many who chose not to join the Estrella/El Pomar/Creston Water District but fall well within the general land area that this district overlays. Consequently the management of the Basin is of great concern to those who live here and invariably we discuss "the water situation" at the majority of our monthly meetings. It is our understanding that the County serves as the GSA which represents us as Rural Residents as part of the Memorandum of Agreement (MOA) established to create a Groundwater Sustainability Plan (GSP) for the Basin. The County also represents thousands of other Rural Residents that do not live within the CAB Boundaries and do not have Community Advisory Councils who can take a stand and represent them in these matters. With these facts in evidence we wish to weigh in and express our views on how we believe the Basin should be managed to the benefit of all who live here. First and foremost, we believe that water is a "common resource" and this principle should be accepted as an undisputed fact.

We have summarized below the three top goals that have consistently been expressed during our meetings. We have also assembled the details behind each of these goals, along with additional concerns, in the attached document in order to communicate to you directly our rationale behind the goals recommended. Is is our hope that you will use these goals, along with our concerns and recommendations, as an important resource as you move forward making the momentous water management decisions that will impact our communities at large.

The three top goals for Basin management as recommended by CAB:

1. Declare the non-commercial Rural Residents over the Basin di minimis users exempting them from monitoring and fees for water management and future supplemental projects.
2. Insist upon aggressive conservation efforts by the majority of the Basin's largest pumpers, including irrigated agriculture (Ag) and the City of Paso Robles, thereby minimizing the overall number of shallower well failures across the Basin. Those that can have the greatest impact need to be particularly conscientious and step up to make the most difference.
3. Use County authority to re-examine existing ordinances and policies as a mechanism for developing regulations that equitably apply to ALL residents and businesses over the Basin and work towards achieving Basin sustainability.

Clearly, any fair and sustainable water management program cannot be accomplished in the absence of thorough and thoughtful consideration, and fair resolution, of citizen's concerns. We believe that our claim to the use of Basin water for domestic purposes is codified in Water Code Section 106 which provides as follows: "It is hereby declared to be the established policy of this State that the use of water for domestic purposes is the highest use of water and that the next highest use of water is for irrigation." It is of utmost importance to the Rural Residents of our community that the final management solutions decided upon by your committee take into account the impact they will have on the quality of our lives, in some cases, our very existence.

Thank you for your attention to our concerns.

Sincerely,

Sheila Lyons, CAB Chairperson

CC: Derrik Williams, President HyroMetrics Water Resources, Inc. derrik@hydrometricswri.com

# Summary of Concerns and Recommendations

# by Rural Residents-at-large over the PR Basin

July 2018

## Three Top Goals:

1. Declare the non-commercial Rural Residents over the Basin de minimis users exempting them from monitoring and fees for water management and future supplemental projects.
2. Insist upon aggressive conservation efforts by the majority of the Basin's largest pumpers, including irrigated agriculture (Ag) and the City of Paso Robles, thereby minimizing the overall number of shallower well failures across the Basin. Those that can have the greatest impact need to be particularly conscientious and step up to the make the most difference.
3. Use County authority to re-examine existing ordinances and policies as a mechanism for developing regulations that equitably apply to ALL residents and businesses over the Basin and work towards achieving Basin sustainability.

**Goal #1: Declare the non-commercial Rural Residents over the Basin de minimis users exempting them from monitoring and fees for water management and future supplemental projects.**

- Rural Residential users should be entitled to at least a de minimis per residence allowance for water usage. They already pay property taxes for management by Flood Control and Water Conservation District The State defines a de minimis allowance below which the user should not be burdened with additional interference of their water usage.
- It should be noted that the average Rural Residential parcel has animals, vegetable gardens, fruit trees and landscaping in addition to the residence itself. Many residents rely upon their small plots as subsistence for their families. Rural Residents have been estimated in County commissioned studies to use between 0.5 and 3.0 AF/year [1], [2] depending on parcel size and the number of residences on the parcel. Whereas, irrigated Ag parcels, such as those with vineyards, typically use 1.0 AF/acre/yr, or more in many cases. County commissioned studies show that Rural Residential has been estimated to only use somewhere in the neighborhood of 13% of the perennial yield, a level that has held consistent over time. This clearly demonstrates that Rural Residential uses have not pushed us into the current water crisis.
- Charges for additional AF over and above de minimis allowances should be on a graduated scale with less unit price for the first AF over the allowance and increased costs as consumption increases. This would encourage conservation efforts by all.
- Non-commercial Rural Residents are the most vulnerable of all entities over the Basin. Historically Rural Residential wells have been much shallower and smaller bores (~100- 400 ft deep, bores of typically 5-6 inches) than Ag wells (several hundred to > 1000 ft deep, bores of a minimum 8 inches).

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[1] Fugro West and Cleath and Associates. August 2002. Paso Robles Groundwater Basin Study (Phase I). Prepared for County of San Luis Obispo County Public Works Department.

[2] Fugro West, ETIC Engineers, and Cleath and Associates. February 2005. Paso Robles Groundwater Basin Study, Phase II, Numeri cal Model Development, Calibration, and Application. Prepared for County of San Luis Obispo County Public Works Department.

Many residential wells in Creston are as shallow as 100-200ft (reports from local residents). Some wells have already gone dry. There are several thousand Rural Residential wells over the Basin.

- We believe that our claim to the use of Basin water for domestic purposes is codified in California Water Code Section 106 which provides as follows: "It is hereby declared to be the established policy of this State that the use of water for domestic purposes is the highest use of water and that the next highest use of water is for irrigation." This principle has been upheld in the courts consistently. A local organization, North County Watch, brought this to the attention of The PR Groundwater Basin Blue Ribbon Committee back in 2013 (see the following attached letter).
- Rural Residents are all on septic systems and some 90% of the water they pump from the Basin goes right back into the Basin.
- The monitoring de minimis users would incur an excessive cost to the overall management program for the several thousand residential parcels whose uses are far smaller than irrigated Ag. Large water users should be the first to be monitored and charged for their usage.
- Rural Residents lack the significant financial resources in general (shallow pockets) to deal with the issue (no lobbyists, no public relations people, no board of director members who can attend endless meetings) versus the large Agri-businesses (deep pockets) with the incentive to pass costs on to other entities in order to increase their profits. Additional costs passed on to Rural Residents to solve a problem that irrigated agriculture has created would be an undue burden.
- The owners of vacant parcels should have the right to reasonable & beneficial use of their property, to build a residence if they so desire, even though they have no history of "prior use" water.
- An important consideration is the protection of property values of ALL residents who live over the Basin. In an effort to protect Rural Residential families' health and welfare, as well as property values, the definition of sustainability for Rural Residents must be to minimize the number of overall wells that will fail due to over-drafting and the consequent drop in the water table. Protection of the rights of Rural Residents to "reasonable and beneficial use" of water must be set as a priority equal to, or greater than, the priority set for protecting Agriculture.

**Goal #2: Insist upon aggressive conservation efforts by the majority of the Basin's largest pumpers, including irrigated agriculture (Ag) and the City of Paso Robles, thereby minimizing the overall number of shallower well failures across the Basin. Those that can have the greatest impact need to be particularly conscientious and step up to the make the most difference.**

- Irrigated agriculture has consistently and significantly increased in acreage over the Basin in the last 20 years. According to the Agricultural Commissioner's Crop Reports, the acreage in vineyards in the County, of which the majority is in the North County, has increased from around 5000 acres in 1999 to nearly 50,000 acres today.
- Irrigation water does not contribute significantly to the recharge of the Basin. It only accounts for 2% of the total recharge[3].
- The outdated concept of "prior use" as establishing, or justifying, a new future use must be reconsidered. Many agriculturalists have intentionally over irrigated in order to establish favorable usage numbers. Additionally, some have planted elaborate landscaping to enhance their properties. Prior usage numbers may have been inflated due to over irrigation in anticipation of future restrictions. Irrigated Ag pumps well over 80% of the perennial yield from the Basin annually,

[3] Hydrologic Budget Summary of the PR Groundwater Basin from Phase I Report Fugro and Cleath 2002.

as estimated in 2005[4], and planting has continued since then. In contrast, many rural residents, who have pumped much less water, but fearing that their wells would go dry, have implemented unilateral cut backs in their water usage, and in many cases let their landscaping die.

- Reasonable and fair controls and limits must be instituted on new permits for large commercial and agricultural developments. There is no reason why so many such projects (new wineries and other commercial developments, etc.), many with extensive landscaping plans, are allowed to proceed, when they are so openly damaging to the welfare and interests of other non-commercial landowners whose numbers so clearly are the majority. Additionally, this type of growth is contradictory to the goal of achieving Basin sustainability.
- A high percentage of the new irrigated acreage within the Basin **is** owned by corporations whose investors do not live here, and who are looking at short-term bottom line profits rather than long-term Basin sustainability. Up until recently some of these corporations have touted their water resources as marketable assets on their websites.
- Water "off sets" should be retired completely, given that the overall goals are Basin sustainability and future growth. Most certainly, offsets from water rich areas of the Basin should not be used over other parts of the Basin, particularly in areas with more severe issues.
- If crop duty factors are used for setting allowance (these would be preferential to prior usage) then the crop factors used need to be realistic, not the inflated values used to set up the Shandon San Juan Water District.
- There should be no "vested rights," beyond a fixed de minimis value, based on prior water usage. There should be no selling of "excess water" when conservation measures are implemented. There is no "excess water." Water is a "common interest" resource and the "excess" should remain in the Basin to prevent further well failures. Fox Canyon Groundwater Management Agency is a well-known example where farmers were allowed to sell off "excess water" much to the detriment of improving water resources for the district's customers.
- Restriction on using overhead sprinklers should be considered. For example: No watering mid-day (between noon and 6 pm) or when it is raining.
- Management of the Basin's groundwater should be paid for pro rata based on usage by the large water users. It was suggested that there should be a County ordinance calling for a proportional fee structure based on specific measurable factors, such as the size of the pump, the number of irrigated acres, and the number of Acre Feet of water pumped.
- The issue of why Paso Robles continues to pump so much groundwater contributing to the problem in Estrella needs to be addressed. Why is additional development getting approved prior to the completion of purification plants that would provide new water supplies? The City of Paso Robles has been behind the curve in constructing water treatment facilities to accommodate their full contractual rights to Lake Nacimiento water causing excessive dependence on groundwater.
- As stated in the PR Groundwater Basin Study, Phase II in 2005, "Because future agricultural trends are so problematic to forecast, slight mis-forecasts in agricultural demand predictions could have large implications relative to changes in groundwater storage and water levels. It is clear a relatively slight adjustment in "build-out" agricultural pumping could make the difference between potential basin overdraft or non-overdraft conditions.[5]"

[4] PR Groundwater Basin Study, Phase II, Fugro, Etic Engineering, and Cleath, 2005
[5] PR Groundwater Basin Study, Phase II, Fugro, Etic Engineering and Cleath, 2005

- "Current (2006) agricultural and commercial pumping have reached or exceeded the amounts estimated as build-out in the Phase II Report Model Scenario 2 while municipal and rural pumping are well below the build-out predictions. " "Given that agriculture accounts for two-thirds of pumping, regular updating of agricultural pumping (land use, cropping, and irrigation rate data) is essential to management of groundwater resources for long-term sustainability[6]."
- It is clear now, in 2018, that the attempt in 2011 to draft and follow voluntary BMO's (Basin Management Objectives) was unsuccessful in stopping the downward trend in water levels in the Basin. Although Rural Residents unilaterally adopted conservation measures in hopes of staving off the continuation of residential well failures, irrigated Ag acreage continued to grow and consume water from the Basin at accelerated rates. As a result, Rural Residential wells have continued to fail.
- Trying to calculate the number of years that we can continue the growth of irrigated Ag, with annual overdrafts, and still not pump the Basin dry is foolhardy. The consequential impact to the longevity of the Basin is unpredictable at best and unreasonable at the very least.

Goal #3: **Use County authority to re-examine existing ordinances and policies as a mechanism for developing regulations that equitably apply to ALL residents and businesses over the Basin and work towards achieving Basin sustainability.**

- Land use zoning needs to be reviewed and potentially revised to assist with water management.
- Why does the County continue to allow planting of more vineyards? Why are Ag ponds allowed at all? Wind machines are more effective and should be used for frost protection, not water. Should we allow ponds to be filled with groundwater? Restrictions on planting must be implemented. Drought tolerant rootstocks and improved irrigation practices need to be conditions required for any future vineyard planting, or replanting, to occur. The County should implement an allocation program, similar to the one that exists for allowing the construction of new residences, that limits the number of acres of irrigated crops that can be planted each year. Establish a fixed number of acres for irrigated crops, that can be planted, or a fixed number of AF that can be pumped, over the Basin, a number that would ensure Basin sustainability. Hold fast to that limit unless significant recharge of the Basin has occurred.
- A review of the County's Agricultural Element, and the provisions in Right to Farm Ordinance (Title 5, Chapter 5.16) of 2002, and how they are contradictory to the mandate by the State to establish Basin sustainability needs to occur. Agriculture is of great importance to San Luis Obispo County but the degree of deferential treatment should be commensurate and complementary to other equally important goals and mandates that the County is committed to achieving. Once again, the rights of Rural Residents to reasonable and beneficial use of water must be given equal priority.
- Permit applications for the drilling of new wells need to be scrutinized thoroughly before issuance, including an evaluation of the harm that could be done to neighboring properties. Deep wells in particular need to be assessed before permits are granted to avoid a future harmful event such as the Cotta well incident that recently occurred in Creston which cross-contaminated water strata. Deeply drilled wells risk cross contamination of multiple strata of our aquifer(s), can't be replenished in a timely manner and can therefore cause permanent damage.

**Additional Comments and Recommendations that do not immediately fall within the above three goals, but would assist in achieving these goals:**

[6] Evaluation of Paso Robles Groundwater Basin Pumping, Water Year 2006; Todd Engineering, May 2009

- There should be no exporting of water from the Basin.
- The Creston area is located in the southern most portion of the Paso Robles Groundwater Basin. The Paso basin groundwater aquifers generally run north from Creston[7]. The significant pumping by the City of Paso Robles downstream from Creston, has accelerated aquifer flows out of Creston and is also a contributing factor in the decline of Creston groundwater levels. Creston is the "fountainhead" of a significant portion of the groundwater ultimately contained within the Paso basin. Therefore, pragmatically Creston groundwater deserves to receive specific safeguarding, the benefits of which would accrue ultimately to the entire basin.
- There should be no water banking projects considered. In 2008 a SLO County groundwater study identified the greater Shandon area as having the ideal characteristics for water banking activities.[8] In water banking not all acquisitions of water involve the receipt of wet water. The receipt of "paper water," which is an IOU for water delivery in the future, involves a risk that the water delivery may not be made when the water is needed. Water banking can also involve the transfer of water between water districts for delivery to a third party. A benefit to a water district holding water IOUs can be the manipulation of data on the actual water under their control thereby allowing greater water usage. Big money interests want to control water banking activities within the Paso basin, not unlike the Kern Water Bank. The coastal branch pipeline of the State Water Project traverses Shandon on its way south through SLO County and recently, a "Turnout Valve" was installed on that pipeline in Shandon. With only modest modification this valve could be used as part of a water banking operation. Recognize that water banking is not an acceptable activity to alleviate Paso basin issues. Rather it is a scheme for exceedingly large money interests to control and profit from water.
- Recharge efforts are acceptable but only if the water is left in the Basin for normal usage. It should not be withdrawn for other purposes.
- No transferring water from areas with minimal issues to problem areas (e.g. Creston to Estrella) should be allowed.
- Recognize that the state water project is over committed (by seven fold according to some news reports) and has under delivered by less than, or equal to, half of contracted water during the last few years. The state water project water is not a reliable or satisfactory approach to augmenting Paso basin water. It is unlikely that a new contract for state water project water can be negotiated currently.
- To ensure of full compliance to any regulation set forth, inspections need to be conducted on all monitored landowners to determine their degree of compliance. Where violations are found, serious consequences should be instituted and enforced. Large water users need to pay the majority of the enforcement costs, in particular when violations occur and follow-up is required to ensure compliance.
- When Rural Residential properties lose value due to water issues costing thousands to remedy how will those owners be compensated for the loss of value? Will the property taxes be lowered? Ag gets breaks that Rural Residents do not and current practices are clearly discriminatory. Ag gets

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[7] Paso Robles Groundwater Sub-basin Water Banking Feasibility Study, 2002.
[8] Paso Robles Groundwater Sub-basin Water Banking Feasibility Study, 2002. Water banking is: any transaction involving water, wet water movement, water contracts, paper water, and the storage of actual water.

crop insurance for failed crops due to drought. Ag gets property tax breaks through the Williamson Act. Ag gets low interest loans for new wells and other infrastructure projects. Also, tax write-offs for losses and depreciation costs of equipment& fences. Rural residents get no such benefits. Some Rural Residents whose wells failed, and who could not afford to drill a new well ($20,000-$30,000), have had to purchase additional storage tanks and resort to water deliveries…all expenses they could ill afford. Programs to assist Rural Residents need to be implemented to offset the burden some are sure to bear when their wells go dry, especially if the final basin management plan exacerbates the problem and wells continue to fail (e.g. Low interest loans, compensation for losses, no permit fees to drill new wells, reduced property taxes (maybe reduce overall property value, or improvements being taxed, by the cost of the new well), loans (like those for special districts) paid back over time). Ideally fines to violators who over pump could also be used to compensate those whose wells have gone dry, for the cost of drilling a new well. Once again, Rural residents did not cause the problem and should not bear the burden of fixing it.

- It should be noted that there is a reason that the majority (some 78% of the voters overall on AB2453) rejected the idea that we should have a water district managed by a few wealthy landowners as board members. No one believed that these members would have the Rural Residents best interests at heart.
- Finally, and one of the most frequently expressed concerns, is that the final basin management solutions will be driven by big money interests at the expense of the majority of the landowners over the Basin. Rural Resident landowners lack the resources to be represented by lobbyists, or public relations agents, but rather must rely on the efforts of unpaid volunteer community advisory representatives trying to protect their interests.

**What will determine success? Has sustainability been achieved?**

Successful management of the Basin should have measurable outcomes.

1. Keep the number of Rural Residential wells that have failed due to the drop in the water table to less than 10% of the total.
2. Water tables across the Basin have recovered to their 2014 levels (or previous years) and remained there for 5 years or more.
3. The downward slope of the graph showing overall Basin decline has become measurably more positive. For example, if the current downward slope is 4 ft/yr drop, then a recovery to 2ft/yr or better would be showing a positive improvement.

The majority of landowners on wells within the Basin are in unincorporated areas and most are de minimis water users. The GSP will be developed with the participation of competing interests, some powerful and some with limited influence. Nevertheless, four principles must guide the process, namely; 1) water is a common resource; 2) the quantity of Paso basin water is ultimately finite; 3) damage to the basin has been done and needs to be reversed; 4) the GSP must provide for the equitable use of water by all parties with water rights.

North County Watch

Looking Out Today For Tomorrow

MEMO TO: Paso Robles Groundwater Basin Blue Ribbon Committee

FROM: Susan Harvey, President
North County Watch

DATE: May 17, 2013

RE: Water Code Section 106

North County Watch is a 501 c3 non-profit Public Benefit corporation. We are an all-volunteer organization committed to sustainable development in and around north San Luis Obispo County.

We would like to addresses issues around a discussion at the BRC meeting on May 16th, regarding the accuracy of our *a priori* statement regarding the superior rights of rural residential users. Thank you for raising the issue and this opportunity to elucidate our position.

Water Code Section 106

Water Code Section 106 provides "It is hereby declared to be the established policy of this State that the use of water for domestic purposes is the highest use of water and that the next highest use is for irrigation."

Court Support for Section 106

California courts have consistently supported the policy codified in Section 106. In *City of Beaumont v. Beaumont Irrigation District* (1965)[i], the court held that Section 106 is a policy that governs administrative agencies' water allocation decisions, stating that application of "section 106 of the Water Code...is binding upon every California agency," including irrigation districts which were parties to the case.

*Meridian v. San Francisco* (1939)[ii] stated "It should be the first concern of the court in any case pending before it and of the department in the exercise of its powers under the act to recognize and protect the interests of those who have prior and paramount right to the use the waters and streams. The highest use in accordance with the law is for domestic purposes, and next highest use is for irrigation."



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The California Supreme Court in *National Audubon Society v. Superior Court* (1983)[iii] stated "[a]lthough the primary function of [Water Code Sections 106 and 106.5], particularly section 106, is to establish priorities between competing appropriators, these enactments also declare principles of California water policy applicable to any allocation of water resources."

*Central & West Water Basin Replenishment District v. So. California Water Co.* (2003)[iv] held that court-supervised mass adjudications of water rights are subject to and governed by Section 106, and it therefore rejected a proposal for water banking by some of the adjudicated parties because the proposal did not comply with the policy in Section 106 of prioritizing domestic use.

<u>California Common Law Supports Section 106</u>

California Common Law codifies the longstanding principle that in allocating California's limited water supplies in time and places of scarcity, water needs for domestic purposes must take priority over water needs for commercial profit, including agriculture.

> *Alta Land & Water Co. v. Hancock* (1890)[v] "the rights…to the use of water for the supply of the natural wants of man and beast" must take precedence over "the rights…to use the water for purposes of irrigation."
>
> *Smith v. Carter* (1897)[vi] "both parties [to the water rights dispute] were entitled to have their natural wants supplied, that is, to use so much of water as was necessary for strictly domestic purposes and to furnish drink for man and beast, before any could be used for irrigation purposes" and that "[a]fter their natural wants were supplied each party was entitled to reasonable use of the remaining water for irrigation".
>
> *Drake v. Tucker* (1919)[vii] the trial court "properly decided that it would be an unreasonable use of the water under all the facts and circumstances for the plaintiff to use it for irrigation before the domestic uses of the defendant had been satisfied."
>
> *Cowell v. Armstrong* (1930)[viii] "Natural uses are those arising out of the necessities of life…such as household use, drinking, [and] watering domestic animals…[and] unquestionably the term 'domestic purposes' would extend to culinary purposes and the purposes of cleaning, washing, the feeding and supplying of an ordinary quantity of cattle, and so on."
>
> *Prather v. Hoberg* (1944)[ix] "Without question the authorities approve the use of water for domestic purposes as first entitled to preference. That use includes consumption for the sustenance of human beings, for household conveniences, and for the care for livestock."
>
> *Deetz v. Carter* (1965)[x] "[p]riority conferred on domestic users by Water Code section 106 is a statutory extension of a traditional preference accorded to 'natural' over 'artificial' uses."



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Reasonable and Beneficial

In "The Reasonable Use Doctrine and Agricultural Water Use Efficiency: A Report to the State Water Resources Control Board and the Delta Stewardship Council" authored by Delta Watermaster Craig M. Wilson, Mr. Wilson lays the foundation for the "reasonable use" doctrine based on the California Constitution Section Article 10 Sec. 2, California Statutes Water Code §§100, 275, 1059, 1051, 1825, 10608, 10801, 85023, and several court cases.

Mr. Wilson, comments that the Reasonable Use Doctrine has been broadly implemented: "The State Water Board and the courts have used the doctrine to find unreasonable water uses in a variety of settings: ...7) The storage and diversion of water that jeopardize compliance with water quality standards, the public trust, and other in situ beneficial uses; 8) Excessive use of groundwater by overlying landowners in an overdrafted basin."

Rights of the Rural Residential Overliers to the Basin

Our purpose for raising the issue is to inform the committee of the primary right of domestic user and to reinforce the importance of the standing of the rural residential user. The court cases arose out of adjudicative situations and while some members of the committee and others might argue that enforcement of Section 106 is only the purview of the courts, that is, strictly speaking, that all overliers have equal rights, it is in the best interest of the rural residential overliers to make it clear that the courts have repeatedly recognized the superior right of water uses for residential purposes over irrigated agriculture.

The question in point during the meeting and clarified by Chair Werner was "What issues do we want to see addressed in the investigation of basin management districts?" It is our position that the rights of rural residential users must be secured within the structure of any management district before the district is formed. Thus far, we have not seen discussion or attention given to these rights that are codified in Section 106. We have been attending committee meetings for over 6 months, and it is not an exaggeration to say that focus has been primarily the needs of irrigated agriculture.

California Water District Not Equitable to Rural Residential Overliers

We are even more concerned about the rights of the rural residential overlier when there appears to be a well orchestrated push to form a California Water District. Water Code Section 35003[xi] [Water Code§§ 34000-35003 codify a California Water District] states that voting rights are based on one vote for each dollar of assessed valuation. North County Watch continues to raise the issue of the rights of the rural residential user because we have not heard anything that would give comfort to the thousands of rural residential users as to how their rights and concerns might be addressed in a California Water District.

Conclusion

North County Watch appreciates that this discussion of management districts is nascent and we fully support the efforts to establish a management structure. We clearly stated this position in



North County Watch P.O. Box 455 Templeton, CA 93465
501(c)(3) nonprofit corporation (77-0576955)

our letter of March 18, 2013 on the failure of the county to manage the basin. We would be remiss if we waited until a district is formed to see if it protects the rights of rural residential users. We all have the goal of avoiding adjudication. Thus, the time to remind the committee and others of the priority rights of the rural residential user, per Section 106, is now, so that we get some acknowledgement and protection of those rights. Furthermore, North County Watch believes that domestic use includes a level of reasonable use commensurate with social and cultural norms of our community.

CC: Mr. Paavo Ogren, Director of Public Works
Ms. Courtney Howard, P.E.,Water Resources Engineer
SLO County Board of Supervisors

---

[i] *City of Beaumont v. Beaumont Irrigation District* (1965), 63 Cal.2d 291, 381, 46 Cal.Rptr. 465, 469

[ii] *Meridian v. San Francisco* (1939), 13 Cal.2d424, 450, 90 P.2d 537, 550

[iii] *National Audubon Society v. Superior Court* (1983), 33 Cal3d 419, 448, n.30, 189 Cal.Rptr. 346,366 n.30

[iv] *Central & West Water Basin Replenishment District v. So. California Water Co.* (2003), 109 Cal.App.4th 891, 912-13, 135 Cal.Rptr.2d 486

[v] *Alta Land & Water Co. v. Hancock* (1890), 85 Cal.219, 230

[vi] *Smith v. Carter* (1897), 116 Cal. 587, 592

[vii] *Drake v. Tucker* (1919), 43 Cal.App 53, 58

[viii] *Cowell v. Armstrong* (1930), 210 Cal. 218, 225

[ix] *Prather v. Hoberg* (1944), 24 Cal.2d 549, 5562, 150 P.2d 405, 412

[x] *Deetz v. Carter* (1965), 232,Cal.App2d 851, 854-55, 43 Cal.Rptr. 321, 323

[xi] 35003. Each voter shall have one vote for each dollar's worth of land to which he or she holds title. The last equalized assessment book of the district is conclusive evidence of ownership and of the value of the land so owned except that in the event that an assessment for a district shall not have been made and levied for the year in which the election is held, the last assessment roll of each affected county shall be used in lieu of the assessment book of the district as evidence of ownership. However, the board may determine by resolution that the assessment book or assessment roll of each affected county shall be corrected to reflect, in the case of transfers of land, those persons who as of the 45th day prior to the election appear as owners on the records of the county. If an equalized assessment book of the district does not exist, then each voter shall be entitled to cast one vote for each acre owned by the voter within the district, provided that if the voter owns less than one acre then the voter shall be entitled to one vote and any fraction shall be rounded to the nearest full acre.



North County Watch P.O. Box 455 Templeton, CA 93465
501(c)(3) nonprofit corporation (77-0576955)

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**From:** William Enholm
**Sent:** Wednesday, July 25, 2018 12:17 PM
**To:** John Peschong <jpeschong@co.slo.ca.us>; Debbie Arnold <darnold@co.slo.ca.us>; JHamon_prcity.com <JHamon@prcity.com>
**Cc:**
**Subject:** Re: CAB letter and attachment to Paso Basin Cooperative Committee

Distinguished Representatives,

I make my living financing vineyards and wineries. I love to see Paso regaining its “mojo” and growing. I also live in rural Creston and share the concerns so eloquently expressed in the CAB letter. Please help balance the water concerns of so many. I support the priorities as expressed by the CAB, in their letter dated 7/18/18.

Sincerely,

Bill Enholm

Sent from my iPhone

On Jul 25, 2018, at 10:32 AM,

Important water info

Begin forwarded message:

**From:** Sheila Lyons
**Date:** July 25, 2018 at 9:30:15 AM PDT
**Subject: CAB letter and attachment to Paso Basin Cooperative Committee**

Please find attached the letter from CAB to the Paso Basin Cooperative Committee and the attachment with the supporting information collected from the public and CAB members at meetings over the years.

The Paso Basin Cooperative Committee is responsible for generating the Groundwater Sustainability Plan (GSP) for the management of the Paso Groundwater Basin. This GSP is required by the State of CA to address the Paso Basin's decline. This committee is made up of five entities whose votes on the committee are weighted. As rural residents over the Paso Basin we are represented by the County through Supervisor John Peschong on this committee, with Supervisor Debbie Arnold as his alternate.

Paso Basin Cooperative Committee: 61% San Luis Obispo County, 15% City of Paso Robles, 20% Shandon/San Juan Water District, 3% San Miguel, 1% Heritage Ranch.

Sheila Lyons
CAB Chairperson

<CAB Cover Letter to Paso Basin CC.pdf>

<CAB Summary Goals July 2018 Paso Basin CC.pdf>

In review of the draft, sustainability plan one aspect of the plan that I found of interest was Chapter 3.4 Land Use.

Table 3-1 listed the land use categories, 10 in total, ranging from Citrus, deciduous fruits and nuts, Vineyard, Urban, Grain, Pasture etc.

The table listed the number of acres as of 2014 that were planted in the Paso Robles Basin. What was missing was the amount of water typically applied to these categories on a yearly basis.

In order to be able to manage water usage, a reliable means of determining how much water the basin is using needs to be determined. Since the draft did not include this data, I utilized the average acre-feet per year from Table 9 that was published in the Agricultural Water Offset Program of 2014.

Based on Table 3-1 in the Draft and Table 9, the total that I was able to estimate was just under 100,000 acre feet per year for the basin. No water allowance was given for idle or native vegetation. My urban estimate methodology is flawed in that it is based in acres and not residential units. Having said that, at .75 per acre the urban allowance was 16,649ac ft., so hopefully it is in the ballpark.

My estimate is that the 438,000 acres in the basin utilizes approx. 100,000 acre-feet per year.

It is vitally important that the methodology in estimating water use totals be well scrutinized. A case in point is when you examine the Engineer's report for the EPC Water District (2016), their methodology estimated that their water use for 41,000 acres would be 59,000 acre feet per year. Their estimates did not breakout the various land use categories as listed in Table 3-1, they just averaged all water use factors for seven Ag uses and came up with 3.5 acre feet per Irrigated acre in their district. This resulted in a grossly inflated figure.

So, as you can see Methodology is very important, 100,000 acre–feet for 438,000 acres verses 59,000 acre-feet for 41,000 acres.

My suggestion is the following:

1. Compare 2014 Land Use Summary to a current Land Use Summary, acres planted as well as estimated water use.
2. Add Cattle operations to Land Use Summary
3. Urban category needs more itemization; residential, industrial, hotel.

Dennis Loucks
7/25/2018

## 3.4 LAND USE

Land use planning authority in the Subbasin is the responsibility of the County of San Luis Obispo and the City of Paso Robles. Land use information for the Subbasin was collected Department of Water Resources, the County of San Luis Obispo's Agricultural Commissioner Offices and from other County departments. Current land use in the Subbasin is shown on Figure 3-4 and is summarized by group in Table 3-1. All land use categories except native vegetation listed on Table 3-1 are the land use categories provided by DWR (2014). The balance of the approximately 438,000 acres in the GSP Plan Area is largely native vegetation and could include dry farmed land.

Table 3-1: Land Use Summary

| Land Use Category | Acres | | |
|---|---|---|---|
| Citrus and subtropical | 304 | 2.3 | 699.- |
| Deciduous fruits and nuts | 2,339 | 3.5 | 8,186- |
| Grain and hay crops | 266 | 4.5 | 1,197 |
| Idle | 10,096 | ∅ | |
| Pasture | 3,254 | 4.8 | 15,619 |
| Truck nursery and berry crops | 955 | 2.5 | 2,387 |
| Urban | 22,199 | .75 | 16,649 |
| Vineyard | 32,076 | 1.7 | 54,529 |
| Young perennial | 71 | 1.9 | 134 |
| **Native vegetation** | 366,440 | ∅ | |
| **Total** | **438,000** | | |

99,400 ac ft/year total

Source: DWR, 2014

1) 2 Land Use - 433,000 / 99,400 Acft what is it now four years later?

2) EPC 41,000 Ac - 59,360 acft

# 3. Possible Sources of Offset Credits

Credits for the Ag Water Offset Program, within the PRGWB, may come from a combination of sources. As technology, information, practices, and irrigation efficiencies evolve and improve, other forms and sources of credits may become available to offset new water use in the PRGWB. Below is a list of potential sources of credits available from current documented practices.

- Fallowing of irrigated land resulting in less pumping;
- Crop conversion(s) to less water intensive crops as designated by the adopted program water use charts (e.g. alfalfa to olives, irrigated pasture to dryland range, water intense deciduous crops to less intensive deciduous, grain or vegetable crops, etc).

## 3.1 Water available from crop conversion

Calculating the amount of water that is made available by switching from a specific crop to one requiring less water can be done by using the annual crop-specific applied water calculated for each Crop Group within each WPA (SLO 2012). However, as noted above, the methodology used to derive the listed numbers is a standardized accepted approach. This information for the Salinas/Estrella WPA, using the medium value, is shown in Table 9.

**Table 9. Existing Crop-Specific Applied Water by Crop Group**

| Crop Group | Applied Water (AF/Ac/Yr) |
|---|---|
| Alfalfa | 4.5 |
| Citrus | 2.3 |
| Deciduous | 3.5 |
| Strawberries | 2.3[1] |
| Nursery | 2.5 |
| Pasture | 4.8 |
| Small Grain | 1.2[1] |
| Vegetables | 1.9 |
| Vineyard | 1.7 |

1. Information obtained from Current Cost and Return Studies, UCCE, UC Davis (Small grains 2013 data, Strawberries 2011 data), see section "Strawberries" and "Small Grains" in this report to understand how these crop requirement numbers were derived using the methodology of the Master Water Report

being directly represented in the SGMA process as non-irrigated lands do have overlying groundwater rights and, in the future may rely on groundwater to a greater degree than now. Also as outlined above in addressing the rotation of parcels, or portions of parcels, in and out of irrigation, a database will be maintained to modify assessments accordingly. So even though there may be irrigation facilities (pipes etc.) available to a parcel or portion of the parcel, if no irrigation is applied, then that acreage will be treated as non-irrigated.

### Residential

**Residential development** depends upon a potable, adequate water supply for household needs and therefore will receive an assessment. The PRGWB studies provided research to estimate the average water usage for rural homesteads.[3] However, because the District is focused on the agricultural operations/properties, it is not foreseen that the District will have the capability to serve small lot rural subdivisions

### Commercial Operations

**Commercial operations** depend upon a potable supply for workers and customers alike, similar to residential uses associated with agricultural operations. However, the water usage for these land uses will need to be determined on a case by case basis. For initial funding purposes, commercial uses are proposed to be assessed as if they were a residential use.

## 4.2 Water Use Factors

The following provides a discussion on the water use factors identified for each assessment class.

### Irrigated Agriculture

The Estrella, El Pomar, Creston Water District is home to hundreds of acres of farmed land with a variety of crops. The water use for these crops varies and thus an average water use has been determined for Irrigated Agriculture. The water use for the crops that are typically farmed in the District are as follows:

| Land Use Category | Ave. Water Use Factor (AF/acre/yr) |
|---|---|
| Alfalfa | 4.8 |
| Citrus | 2.3 |
| Deciduous | 4.1 |
| Nursery | 2.4 |
| Irrigated Pasture | 5.0 |
| Vegetables | 3.9 |
| Vineyards | 1.8 |
| Total | 24.3 |
| Average | 3.5 |

*Source: applied water factors, SLO County, Paso Robles Groundwater Basin Model Update, 2014, Table 10[4]

**The water usage of 1.0 AFY will be utilized as one benefit unit for the purposes of establishing an assessment spread.**

### Non-Irrigated Agriculture

[3] Ibid, PRGWB Model Update, December 19, 2014
[4] Ibid, PRGWG Model Update, December 19, 2014, Table 10

Depending on the terrain and carrying capacity of the land, non-irrigated agriculture can be dry farmed for hay, other non-irrigated crops, and for grazing. These uses are minimal and are best evaluated as a cattle grazing operation. These operations typically utilize between 0.03 and 0.003 AFY/ac and therefore are minimal users. However, the project proponents have provided an estimate of local non-irrigated water usage as a percentage of irrigated usage; ie. 1.69% of Irrigated Agriculture Usage. This results in 0.06 AFY/ac (1.69% x 3.5 AFY/ac = 0.06 AFY/ac) for a benefit unit to calculate an assessment to be applied to non-irrigated agriculture.

### Residential

Residences nominally use 0.29 AFY indoor and 0.46 AFY outdoor for a total of 0.75 AFY per residence in rural hot areas of the county[5]. Therefore, it is assumed that a rural residence is equivalent to: (0.75 AFY/3.5AFY) or 21.4% of water usage for an acre of irrigated crop.

### Commercial Operations

Commercial Operation uses will be evaluated as a resident if a small operation on a small lot. Larger commercial users will need to be evaluated on a case by case basis.

## 4.3 Voluntary Funding

The District will be formed on a voluntary basis. **All the voluntary members of the District will be asked to agree to a maximum funding assessment not to exceed $35.00/acre for irrigated agriculture. Non-irrigated agriculture parcels will be assessed at 1.69% of irrigated agriculture's cost, or $0.59/acre. Each residence or commercial operation will be assessed at $7.50 (maximum) for each unit (0.75AFY/3.5AFY = 21.4% of an irrigated acre assessment = 21.4% x $35 = $7.50).** However, as a basic minimum cost, **all ownerships,** whether made up of one parcel or many parcels will have a minimum assessment of **up to $50 per ownership**, depending on the overall administrative costs to service the GSA. These rates are within the same order of magnitude of the data developed above and are proportional to the special benefit received by each category of parcel based on water usage per parcel. It is noted that one parcel may be assessed for all three classes.

## 4.4 Benefit Units

A benefit unit is a method of calculating a property's proportional share of the assessment costs. **One benefit unit (BU) is equivalent to the use of 1.0 Acre-foot of water/year.** Table 2 identifies the total number of benefit units assigned to each Assessment Class utilizing the target acreages in each category petitioning at this time. These acreages will vary until District formation is approved.

Table 2-Assessment Class and Total Benefit Units

| Assessment Class | Total Acreage or Units (estimated) | | Water Use Factor AFY | Benefit Units (rounded) |
|---|---|---|---|---|
| Irrigated Agriculture | 16,500 | Acres | 3.50 | 57,750 |
| Non-irrigated Agriculture | 24,300 | Acres | 0.06 | 1,460 |
| Residential and Commercial Operations | 200 | Each | 0.75 | 150 |
| **Total Benefit Units** | 41,000 | | | **59,360** |

[5] Ibid, PRGWB Model Update, December 19, 2014, Table 13 Rural Residential Water Demand, SLO County,

From: Carol Rowland [redacted]
Sent: Thursday, July 26, 2018 11:01 AM
To: John Peschong <jpeschong@co.slo.ca.us>; Debbie Arnold <darnold@co.slo.ca.us>; jJHamon@prcity.com
Cc: [redacted]
Subject: RE CAB letter of 7/18/18 to Paso Basin Cooperative Committee

Dear Distinguished Representatives of the Paso Basin Cooperative Committee,

I am writing to express my support for the CAB letter and the CAB Summary Goals of July 2018 included at the end of my letter.

I have read the attached CAB letter and the attachment carefully and am in total agreement with everything contained in them.

I have spoken and written to the County BOS on many occasions on this subject and will summarize briefly what my position has been.

We are an older retired couple living in the Creston area since 1975, not far from the Cotta Well property Every year for the last few years we have been afraid our well will go dry.

We have given up our vegetable gardens, our lawn, and have lost or pulled out many landscaping plants and areas. We have replaced some plants in limited areas with drought resistant plants. We are careful with our water use, taking fewer baths and showers, wearing clothes longer before washing, flushing toilets less frequently, etc.

We are living on a fixed income and cannot afford to drill a new well. We are still paying off a mortgage.

In May of 2013 when we started noticing our well was recovering very slowly every day, water delivery was a fixed amount and you had to pay for a full delivery regardless of how much you could accept. We installed another water storage tank so we could accept all the water we paid for if we had to have it delivered because our well had failed.

Our only asset is our property. We are concerned that our property value will drop as the water disappears. How can we sell our property at a reasonable price without a working well and as property values are devalued as a result of lack of water?

Thank you for considering the concerns of one of many thousands of rural residents depending on the Paso Robles Groundwater Basis for water.

Thank you for considering our concerns,

Carol and Harold Rowland
[redacted]

**From:** Tommy & Kathy Carter [redacted]
**Sent:** Thursday, July 26, 2018 9:04 PM
**To:** Debbie Arnold <darnold@co.slo.ca.us>
**Subject:** Re: paso basin cooperative committee

Dear Supervisor Arnold,

Thank you for standing with all the little people in this water conflict.

Tommy and Kathy Carter

On Thu, Jul 26, 2018 at 11:28 AM, Debbie Arnold <darnold@co.slo.ca.us> wrote:

> Thank you for sharing your comments.
>
> Sincerely,
>
> **Debbie Arnold**
>
> **Supervisor, District 5**
>
> (p) 805-781-4339
>
> (f) 805-781-1350
>
> darnold@co.slo.ca.us

**COUNTY OF SAN LUIS OBISPO**

**BOARD OF SUPERVISORS**

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**From:** Tommy & Kathy Carter [mailto[redacted]
**Sent:** Wednesday, July 25, 2018 7:55 PM
**To:** Debbie Arnold <darnold@co.slo.ca.us>
**Subject:** paso basin cooperative committee

We are fully in agreement with the goals of the Creston Advisory Body, and the explanations of these goals.

Tommy and Kathy Carter
[redacted]

The Nature Conservancy

CALIFORNIA WATER | **GROUNDWATER**

To: GSAs

We write to provide a starting point for addressing environmental beneficial users of surface water, as required under the Sustainable Groundwater Management Act (SGMA).

SGMA seeks to achieve sustainability, which is defined as the absence of several undesirable results, including "depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial users of surface water" (Water Code §10721).

The Nature Conservancy (TNC) is a science-based, nonprofit organization with a mission *to conserve the lands and waters on which all life depends*. Like humans, plants and animals often rely on groundwater for survival, which is why TNC helped develop, and is now helping to implement, SGMA. Earlier this year, we launched the Groundwater Resource Hub, which is an online resource intended to help make it easier and cheaper to address environmental requirements under SGMA.

As a first step in addressing when depletions might have an adverse impact, The Nature Conservancy recommends identifying the beneficial users of surface water, which include environmental users. This is a critical step, as it is impossible to define "significant and unreasonable adverse impacts" without knowing *what* is being impacted. To make this easy, we are providing this letter and the accompanying documents as the best available science on the freshwater species within the boundary of your groundwater sustainability agency (GSA). Our hope is that this information will help the GSA better evaluate the impacts of groundwater management on environmental beneficial users of surface water.

To help the GSA take this first step, we are providing the following references:

- **Freshwater Species List**. The excel file named for the GSA is a spreadsheet that includes a list of freshwater species found within the GSA's jurisdiction. The list includes fish, amphibians, reptiles, birds, plants, macroinvertebrates and mammals, and provides both the scientific (column C) and common (column D) names for each.

  The freshwater species list includes the conservation status for each species, indicating whether federal (column E) and/or state (column F) endangered species laws may apply to management of the species. The list also includes the sources of the data. Historical observations (pre-1980) and observations of extirpated species were excluded from the analysis.

To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the GSA's 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 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 as well as on The Nature Conservancy's science website.

- **Field/Column definitions**. This table provides a definition for the column headings in the excel freshwater species list. The title of this file is "Field_Descriptions.xls".

- **Data Sources**. This document describes the data sources for each species in freshwater species list. The document, titled "Freshwater_Species_Data_Sources.xls", provides the name of each source, citation and a link to the data source, if available.

- **PLoSONE Publication**. As evidence that the California Freshwater Species Database is the best available science, we are attaching a peer-reviewed publication, which was the basis of the California Freshwater Species Database. The paper, which is attached as "FW_Paper_PLoSONE", appeared in PLoSONE, an online scientific journal. This paper describes the methods used to compile the freshwater species database, and patterns of species richness (the density and diversity of species), endemism (species found only in a particular region) and vulnerability of freshwater species in California. Also attached is the supplemental material published in PLoSONE (FW_Paper_PLOSONE_S1, FW_Paper_PLOSONE_S2, FW_Paper_PLOSONE_S3, and FW_Paper_PLOSONE_S4).

As next steps, we suggest three actions. First, please share these materials with your consultants and stakeholders, and use them as a starting point to identify environmental beneficial users of surface water. Second, contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the GSA's freshwater species list. Third, please visit the Groundwater Resource Hub at the end of the year, when we will be releasing a Freshwater Species Guidebook, which is under development by a collaboration of agencies and nonprofits, including TNC, CDFW, USFWS and NMFS. The Guidebook will provide a summary of information on each individual freshwater species, which should be useful in determining surface water needs and the habitat conditions needed to sustain these important resources.

Given all that must be accomplished to meet SGMA deadlines, The Nature Conservancy is working hard to provide resources to make addressing environmental beneficial users of groundwater and surface water as simple and inexpensive as possible. With this freshwater species list tailored to the GSA, as well as the Indicators of Groundwater Dependent Ecosystems Database (also known by the Department of Water Resources as the Natural Communities Dataset), we hope to make the first, critical step in managing groundwater resources, which includes identifying environmental users, an easy SGMA requirement to satisfy.

If you have any questions about these materials, please contact me or Jeanette Howard, [redacted]

Sincerely,

Sandi Matsumoto
Associate Director
California Water Program
[redacted]

PLOS | ONE

RESEARCH ARTICLE

# Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California

**Jeanette K. Howard[1☯*], Kirk R. Klausmeyer[1☯], Kurt A. Fesenmyer[2☯], Joseph Furnish[3], Thomas Gardali[4], Ted Grantham[5], Jacob V. E. Katz[5], Sarah Kupferberg[6], Patrick McIntyre[7], Peter B. Moyle[5], Peter R. Ode[8], Ryan Peek[5], Rebecca M. Quiñones[5], Andrew C. Rehn[7], Nick Santos[5], Steve Schoenig[7], Larry Serpa[1], Jackson D. Shedd[1], Joe Slusark[7], Joshua H. Viers[9], Amber Wright[10], Scott A. Morrison[1]**

**1** The Nature Conservancy, San Francisco, California, United States of America, **2** Trout Unlimited, Boise, Idaho, United States of America, **3** USDA Forest Service, Vallejo, California, United States of America, **4** Point Blue Conservation Science, Petaluma, California, United States of America, **5** Center for Watershed Sciences and Department of Wildlife Fish and Conservation Biology, University of California Davis, Davis, California, United States of America, **6** Integrative Biology, University of California, Berkeley, Berkeley, California, United States of America, **7** Biogeographic Data Branch, California Department of Fish and Wildlife, Sacramento, California, United States of America, **8** Aquatic Bioassessment Laboratory, California Department of Fish and Wildlife, Rancho Cordova, California, United States of America, **9** School of Engineering, University of California Merced, Merced, California, United States of America, **10** Department of Biology, University of Hawaii at Manoa, Honolulu, Hawaii, United States of America

☯ These authors contributed equally to this work.
* jeanette_howard@tnc.org



OPEN ACCESS

**Citation:** Howard JK, Klausmeyer KR, Fesenmyer KA, Furnish J, Gardali T, Grantham T, et al. (2015) Patterns of Freshwater Species Richness, Endemism, and Vulnerability in California. PLoS ONE 10(7): e0130710. doi:10.1371/journal.pone.0130710

**Editor:** Brian Gratwicke, Smithsonian's National Zoological Park, UNITED STATES

**Received:** February 7, 2015

**Accepted:** May 22, 2015

**Published:** July 6, 2015



**Data Availability Statement:** All data are available from The Nature Conservancy website: scienceforconservation.org. The data used in the study are third-party data. The data sources and third-party contacts are provided in S3 Table. We received permissions from all data providers to publicly use and release the data.

**Funding:** We thank The Nature Conservancy for supporting development of this database and this research, with additional support from the U. S. Bureau of Land Management. With the exception of the authors, the funders had no role in study design,

## Abstract

The ranges and abundances of species that depend on freshwater habitats are declining worldwide. Efforts to counteract those trends are often hampered by a lack of information about species distribution and conservation status and are often strongly biased toward a few well-studied groups. We identified the 3,906 vascular plants, macroinvertebrates, and vertebrates native to California, USA, that depend on fresh water for at least one stage of their life history. We evaluated the conservation status for these taxa using existing government and non-governmental organization assessments (e.g., endangered species act, NatureServe), created a spatial database of locality observations or distribution information from ~400 data sources, and mapped patterns of richness, endemism, and vulnerability. Although nearly half of all taxa with conservation status (n = 1,939) are vulnerable to extinction, only 114 (6%) of those vulnerable taxa have a legal mandate for protection in the form of formal inclusion on a state or federal endangered species list. Endemic taxa are at greater risk than non-endemics, with 90% of the 927 endemic taxa vulnerable to extinction. Records with spatial data were available for a total of 2,276 species (61%). The patterns of species richness differ depending on the taxonomic group analyzed, but are similar across taxonomic level. No particular taxonomic group represents an umbrella for all species, but hotspots of high richness for listed species cover 40% of the hotspots for all other species and 58% of the hotspots for vulnerable freshwater species. By mapping freshwater species hotspots we show locations that represent the top priority for conservation action in the state. This study identifies opportunities to fill gaps in the evaluation of conservation status for freshwater taxa in California, to address the lack of occurrence information for nearly

data collection and analysis, decision to publish, or preparation of the manuscript.

**Competing Interests:** The authors have declared that no competing interests exist.

40% of freshwater taxa and nearly 40% of watersheds in the state, and to implement adequate protections for freshwater taxa where they are currently lacking.

## Introduction

Freshwater habitats cover less than 1% of the earth's surface (about the size of the European Union) but support roughly 125,000 described species, or 10% of the described species on the planet [1]. Species dependent on freshwater habitats are in decline globally [2, 3]; between 10,000 and 20,000 freshwater species are thought to be extinct or imperiled by human activities [1, 3], with freshwater species at higher risk of extinction than their terrestrial counterparts [4]. In North America, extinction rates for freshwater species are four to five times greater than those for terrestrial species [5–7], and increasing human population and climate change are predicted to exacerbate extinctions in the future [7–10]. Estimates of known extinctions however, are likely gross underestimates because most groups of freshwater organisms are understudied [11]. The insular and fragmented nature of freshwater habitats, which often results in high levels of endemism, makes freshwater populations highly vulnerable to extirpation [1].

Although great strides are being made in the methods to adapt conservation planning principals and conservation strategies to the particularities of freshwater systems [12–13], conservation action is hampered by a lack of basic information about the definition and location of these species. The first stage of systematic conservation planning is compiling information about the location of threatened and rare species in a region [14], but for freshwater species, this information tends to be lacking, dispersed, or focused on limited taxonomic groups even in data rich areas.

Because data is lacking, conservation groups often focus on focal species or taxonomic groups that have better distribution data. Recent studies have attempted to systematically address broad-scale patterns of freshwater species distribution, and spatial congruence among taxonomic groups [4, 15]. These studies show that congruence between taxonomic groups at global and continental scales are low, suggesting that focusing on a single species or taxonomic group may not benefit all freshwater species[4, 15].

California (USA) encompasses an exceptionally diverse array of freshwater ecosystem types, from rivers flowing through temperate rainforests to desert springs where ancient aquifers come to the surface [16]. In addition, demands on California's freshwater resources to meet human needs are intensifying as its population grows, and climate change further strains an already over-allocated water supply system [17–18]. Water allocations are currently five times the state's mean annual runoff and, in many of the state's major river basins, rights to divert water lay claim to up to 1,000% of natural surface water supplies [19].

Recent studies have highlighted dramatic declines of California native fishes with 80% either extinct or threatened with extinction within 100 years [10, 20]. Yet, the composition, distribution, and status of the broader suite of freshwater taxa in the state are not well understood. To address this need, we assembled the first comprehensive database of spatial observations for freshwater vascular plants, macroinvertebrates, and vertebrates in California. Here, we use this new and now publicly available database [21] to evaluate the patterns of freshwater species richness, endemism, and vulnerability, identify hotspots of freshwater richness, and to evaluate the spatial congruence of species richness across taxonomic groups.


**Fig 1. Study area.** The extent of the study area in California and the major hydrologic regions it contains. Inset shows the location of California in North America. Shaded relief is from "The National Map" by the U.S. Geological Survey.

doi:10.1371/journal.pone.0130710.g001

## Materials and Methods

### Study Area

The spatial unit of analysis for this assessment was the smallest-size watershed (12-digit hydrologic unit code, or HUC12, watershed) available in the nested national dataset compiled by the US Department of Agriculture Natural Resource Conservation Service [22]. Our study area included those watersheds (n = 4,450) within the administrative boundary of the state of California, totaling 410,515 km$^2$ (Fig 1). For reporting results, we nested the HUC12 watersheds within 10 major hydrologic management regions defined by California's Department of Water Resources corresponding to the state's major drainage basins [23] (Fig 1)(S1 Table).

### Taxa List

The taxonomic units of analysis for this assessment were drawn from an initial list of species and sub-species known to utilize freshwater habitats within California from NatureServe (http://natureserve.org) (n = 1,903)[24]. Because NatureServe collects and manages information for only a subset of species throughout the U.S., Canada, Latin America, and the Caribbean we assessed regional and specific taxonomic reviews and checklists to identify missing taxa (S2 Table). For example, we relied on the PISCES for all fish data because the software and database is comprehensive and quality-controlled [25–26].

Comprehensive taxonomic reviews are not available in California for non-vascular plants, such as benthic algae and mosses, planktonic microcrustacea, segmented worms, and water mites; consequently, these groups are excluded from our effort. The authors, selected for their taxonomic expertise in the state, compiled and reviewed lists of freshwater dependent species and subspecies that occur within California (S1 Table). The experts removed redundancies due to changes in taxonomy or nomenclature, and assembled a definitive list of freshwater taxa (S3 Table). Our final database augmented the freshwater taxa included in the NatureServe list by 105% (n = 2,003), for a total of 3,906 taxa (S3 Table). Species, subspecies, Evolutionary Significant Units, and Distinct Population Segments are hereafter referred to as "taxa" for convenience.

Criteria for categorizing taxa as "freshwater dependent" varied by taxonomic group (S1 File). For example, freshwater fishes were defined as those that spawn in freshwater habitats. Herpetofauna, were included if: 1) they rely on fresh water to complete one or more life stage (e.g., all anurans and many caudates); or, 2) forage within fresh water as obligates (e.g., western pond turtle, *Actinemys marmorata marmorata*) or non-obligates (e.g., western terrestrial garter snake, *Thamnophis elegans elegans*) at some stage of development; or, 3) they would not persist without freshwater microhabitats (e.g., Inyo mountain salamander, *Batrachoseps campi*); or, 4) they are found within splash zones of freshwater springs and creeks (e.g., Dunn's salamander, *Plethodon dunni*). Plant species were included if: 1) they occur exclusively in fresh water and have special adaptations for living submerged in water, or at the water's surface; or, 2) occur primarily in freshwater wetland habitats but are not strictly aquatic; or, 3) require freshwater inundation to complete their life-cycle, such as plants occurring in long-inundated portions of vernal pools (e.g., *Orcuttia californica*); or, 4) were identified in the Jepson Manual of Vascular Plants of California [27] as associated with wetland habitats such as marshes, lakes, vernal pools, fens, springs, and bogs, and dependent on wetland habitat; or, 5) were included as wetland obligates or as facultative wetland plants in the U.S. Army Corps of Engineers list of wetland plant species [28]. See S1 File for criteria used for birds, mammals, vascular plants and invertebrates. We limited our list to taxa native to California.

Taxa were classified as endemic if they are known to be restricted to California based on available data sources (S2 Table).

## Conservation Status

We evaluated the conservation status for all taxa on our final list (S3 Table) by reviewing the scientific literature, NatureServe, state and federal Endangered Species Act lists, management agency designations, and taxonomic group reviews (S1 Table). We attempted to be as complete as possible, and use available conservation status sources for the taxonomic groups considered in this study. Table 1 provides sources and criteria for classifying taxon as listed, vulnerable or apparently secure. Note that taxa were not classified as "apparently secure" if they fell under any criteria listed under "vulnerable" in Table 1.

## Spatial Data and Summaries

We collected spatial data related to the occurrence or distribution of the freshwater taxa included on our final list (S3 Table), and assembled a geographic database using Esri ArcGIS version 10.1 software. Due to taxonomic changes and differences among data sources, we were not always able to attribute spatial records at the subspecies level. As a result, all spatial data summaries and analyses are conducted at the species level. Data were collected from a variety of sources (S2 Table). The subsequent database includes available spatial data for each taxon categorized by observation type (Table 2), data format (i.e. point, line, and polygon), origin (i.e. native range vs. translocation), conservation status, and habitat usage (e.g. seasonal or migratory use).

**Table 1. Sources and criteria used to rank taxa.**

| Source | Criteria for "listed ranking" | Criteria for "Vulnerable" ranking | Criteria for "Apparently Secure" ranking |
|---|---|---|---|
| ESA federal or state lists [29–30] | • Endangered OR | • Under Review in the Candidate or Petition Process OR | |
| | • Threatened | • Proposed Threatened OR | |
| | | • Species of Special Concern OR | |
| | | • Candidate OR | |
| | | • Bird of Conservation Concern OR | |
| | | • Special Concern OR | |
| | | • Special | |
| NatureServe [24] | | Ranked at either the global (G) or state (S) scales as: | Ranked at either the global (G) or state (S) scales as: |
| | | • Vulnerable (NatureServe ranking of 3) OR | • Apparently Secure (NatureServe ranking of 4) OR |
| | | • Imperiled (NatureServe ranking of 2) OR Critically imperiled (NatureServe ranking of 1) | • Secure" (NatureServe ranking of 5 |
| Status assessment of California's native inland fishes [20] | | • EN (endangered) OR | • NT (near-threatened) OR |
| | | • VU (vulnerable)(following IUCN definitions) | • LC (least concern) |
| Conservation Status of Freshwater Gastropods of Canada and the United States [31] | | • Endangered OR | Currently Stable (CS) |
| | | • Threatened OR | |
| | | • Vulnerable | |
| California Native Plant Society – Rare Plant Inventory [32] | | • 1A (Plants Presumed Extirpated in California and Either Rare or Extinct Elsewhere) OR | |
| | | • 1B (Plants Rare, Threatened, or Endangered in California and Elsewhere) OR | |
| | | • 2A (Plants Presumed Extirpated in California, But Common Elsewhere) OR | |
| | | • 2B (Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere | |
| Amphibian and Reptile Species of Special Concern (ARSSC) [33] | | Appears on list | |
| California Department of Fish and Wildlife (CDFW) Species of Special Concern [34] | | Appears on list | |
| USFWS Species of Concern [35] | | Appears on list | |
| USFWS Birds of Conservation Concern [36] | | Appears on list | |
| US Forest Service National Threatened, Endangered and Sensitive Species (TES) Program [37] | | Appears on list | |
| US Bureau of Land Management Special Status Species [38] | | Appears on list | |

A taxon was classified as listed, vulnerable or apparently secure if one of the criteria conditions were met. For example, if a taxon is classified as endangered on the federal ESA list, we designated the taxon as "listed" in our database. Alternatively, if a taxon was classified as EN (endangered) in Moyle et al. 2011, we classified the taxon as "vulnerable" in our database.

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While this effort represents the most comprehensive compilation of freshwater species occurrence in the state, we acknowledge that data quality may vary among sources. With the exception of PISCES, which has been expert reviewed for data quality, other data sources have

**Table 2. Classifications used to group spatial data records in the California Freshwater Species Database.**

| Spatial Data Classification Groups |
| --- |
| Current observations (post-1980) |
| Observation with undefined date |
| Historical observation (pre-1980) |
| Extirpated |
| Modeled habitat/ generalized observation |
| Expert Opinion |
| Management area designations* |
| Range |
| Historical range |
| Unknown |

* e.g., Critical Habitat designation by the U.S. Fish and Wildlife Service

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not undergone such review, and therefore may not accurately represent species ranges. For example, most invertebrate data come from bioassessment monitoring efforts which are known to under sample certain habitats such as non-perennial streams, large rivers, springs, high altitude streams, and wet meadows.

To examine and compare patterns of freshwater species richness, endemism, and vulnerability, we summed and mapped unique species by HUC12 watershed, and calculated the percentage of species that are endemic, vulnerable, and listed in each watershed. We also mapped richness by eight taxonomic groups (fish, herpteofauna, mollusks, birds, crustaceans, plants, mammals, insects and other invertebrates) by summing the number of species in each taxonomic group within the HUC12s. We identified hotspots as the top 5% richest watersheds [39].

We recognize that spatial data for freshwater species is often lacking, so we tested how each taxonomic group serves as a proxy for the full suite of freshwater species. First we calculated the pairwise Pearson's correlation coefficient of species richness counts in HUC12 watersheds by taxonomic group to evaluate the relationship between taxonomic groups. Next, we calculated the Pearson's correlation coefficient for each taxonomic group compared to all other freshwater species not in that taxonomic group. For example, we calculated the correlation coefficient for fish richness compared to all other freshwater species (excluding fish) by HUC12 watershed. In addition, we calculated the correlation of all listed species in each HUC12 compared to all other non-listed species.

We also tested whether geographical patterns of richness in one group act as a surrogate for those in other groups by comparing the overlap of hotspots for one group with corresponding hotspots for other groups [39]. Finally, we compared the hotspots for each group with vulnerable freshwater species to test how well each group acts as a surrogate for vulnerable freshwater biodiversity in most need of conservation action.

## Results

### Richness, Endemism, and Vulnerability

We identified 3,906 freshwater taxa in California (S3 Table) which included 336 subspecies, evolutionary significant units, or distinct population segments. Insects, arachnids,

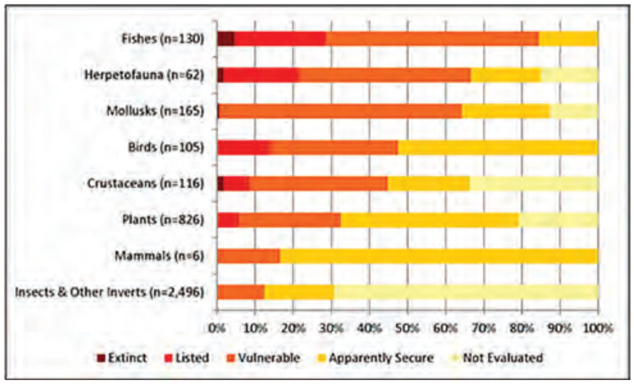


**Fig 2. Taxonomic grouping and conservation status of freshwater taxa native to California.** Percentage of freshwater species by taxonomic groups that are considered vulnerable (at risk of extinction) in California watersheds, "Insects and other invertebrates" includes the classes Arachnida, Branchiopoda, Insecta and Polychaeta.

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branchiopods, and polychaetes (referred to henceforth as "insects and other invertebrates") comprise over two-thirds (63%) of the freshwater taxa in the study, with 2,496 taxa (Fig 2). The next largest group is vascular plants (n = 826), followed by mollusks (n = 165), fish (n = 130), crustaceans (n = 116) birds (n = 105), herpetofauna (n = 62), and mammals (n = 6) (Table 3). Eleven freshwater taxa that were once found in the study area are now considered extinct, including one plant (*Potentilla multijuga*), two crustaceans (*Pacifastacus nigrescens* and *Syncaris pasadenae*), one mollusk (*Planorbella traski*), one frog (*Rana lithobates] yavapaiensis*), and six fishes (*Cyprinodon nevadensis calidae*, *Siphatales bicolor ssp. 11*, *Gila crassicauda*, *Pogonichthys ciscoides*, *Ptychocheilus lucius*, and *Salvelinus confluentus*). An additional 14 species considered possibly extinct include eight insects (*Farula davisi*, *Hygrotus artus*, *Mesocapnia bakeri*, *Paraleptophlebia californica*, *Paraleptophlebia clara*, *Paraleptophlebia rufivenosa*, *Parapsyche extensa*, *Rhyacophila amabilis*), two amphibians (*Rana pretiosa*, and *Incilius alvarius*), one mollusk (*Valvata virens*), two plants (*Plagiobothrys glaber* and *Potentilla uliginosa*), and one turtle (*Kinosternon sonoriense*).

To date, conservation status has been assessed for only 50% (N = 1,939) of the state's freshwater taxa (Table 3). Moreover, the conservation status of some taxonomic groups is

**Table 3. Number of taxa included in each taxonomic group along with the number and percentage of species by conservation status.**

| Group | All | Extinct | Listed | Vulnerable (but not listed) | Apparently Secure | Not Evaluated |
|---|---|---|---|---|---|---|
| Insects and Other Inverts* | 2,496 | 0 | 0 | 309 (12%) | 460 (18%) | 1,727 (70%) |
| Plants[1] | 826 | 1 (0%) | 47 (5%) | 220 (27%) | 387 (47%) | 171 (21%) |
| Mollusks | 165 | 1 (0.5%) | 0 | 105 (63.5%) | 38 (23%) | 21 (13%) |
| Fishes | 130 | 6 (5%) | 31 (24%) | 73 (56%) | 20 (15%) | 0 |
| Crustaceans | 116 | 2 (2%) | 8 (7%) | 42 (36%) | 25 (21%) | 39 (34%) |
| Birds | 105 | 0 | 15 (14%) | 35 (34%) | 55 (52%) | 0 |
| Herpetofauna | 62 | 1 (2%) | 12 (19%) | 29 (46%) | 11 (18%) | 9 (15%) |
| Mammals | 6 | 0 | 0 | 1 (17%) | 5 (83%) | 0 |
| Total | 3,906 | 11 (0.3%) | 113 (3%) | 814 (21%) | 1,001 (26%) | 1,967 (50%) |

* Includes Arachnida, Branchiopoda, Insecta and Polychaeta.

[1]All California plants are evaluated for rarity. Due to the lack of a 'secure' category in the CNPS ranking system, common taxa may not appear to have been evaluated.

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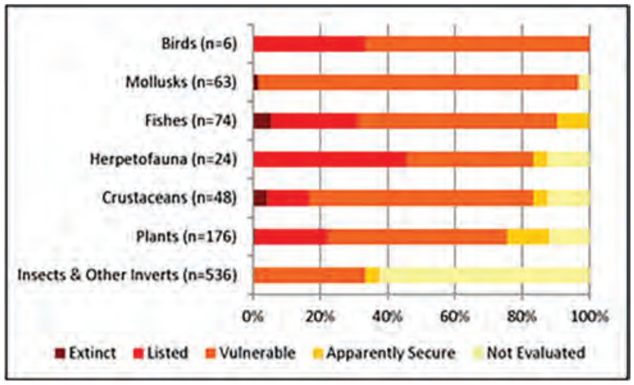


**Fig 3. Taxonomic grouping and conservation rank of freshwater taxa endemic to study area.** Percentage of freshwater endemic species by taxonomic groups that are considered vulnerable (at risk of extinction) in California watersheds. "Insects and other invertebrates" includes the classes Arachnida, Branchiopoda, Insecta and Polychaeta.

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disproportionally understudied. For example, the conservation status of all fish and bird taxa have been evaluated, but only 31% (n = 769) of insects and other invertebrates (Table 3). Of the freshwater taxa evaluated, 51.5% are considered secure (n = 1,001), 48% are ranked as vulnerable (n = 927), and 0.5% (n = 11) are now considered extinct. Although nearly half of the freshwater taxa were classified as vulnerable, only 113 (6%) are listed as endangered or threatened under the federal or state ESA.

Some taxonomic groups contain considerably more vulnerable taxa than others (Fig 2). For example, 104 of the 130 (80%) fishes, 66% of herpetofauna (n = 41) and 64% (n = 105) of mollusks are considered vulnerable. On the other hand, 83% of the mammals, 52% of the birds, and 47% of the plants are considered secure. However, as noted above, the comprehensiveness of data varies by taxonomic group such that the true level of imperilment could be much greater for taxonomic groups such as insects, other invertebrates and crustaceans where the majority of known taxa have not been evaluated for conservation state (Fig 2 and Table 3).

Nearly a quarter of the 3,906 native freshwater taxa found in California are endemic (n = 927), including 536 insects and other non-molluscan invertebrates, 176 plants, 74 fishes, 63 mollusks, 48 crustaceans, 24 herpetofauna, and 6 birds (Fig 3). Of the 560 endemic taxa that were evaluated for conservation status, nearly 90% (n = 498) are considered vulnerable (Fig 3). All 6 endemic birds are considered vulnerable, as are 98% of the endemic mollusk taxa. In addition, 85% of endemic fishes are considered vulnerable (Fig 3). Eight endemic taxa are considered extinct including four fishes (*Cyprinodon nevadensis calidae*, *Siphatales bicolor ssp. 11*, *Gila crassicauda*, and *Pogonichthys ciscoides*), two crustaceans (*Pacifastacus nigrescens* and *Syncaris pasadenae)*, one plant (*Potentilla multijuga*) and one mollusk (*Planorbella traski*). Only 76 (14%) of vulnerable endemic taxa are formally listed on state or federal endangered species lists.

## Spatial Data and Summaries

To map spatial patterns of freshwater diversity in the state, we compiled spatial data from 408 different sources (S2 Table) and assembled a database with over 9,000 polygon, 23,000 line, and 3,484,000 point records. As noted in the above Methods, we compiled spatial data only at the species level. Therefore, although our final species list contains information on 3,906 taxa, we compiled spatial data for the 3,727 species in the database. It should be noted that although there are 336 subspecies, ESUs, or DPSs in the database, 179 species are comprised of at least two subspecies.

We obtained spatial data (see Table 2 for data types) for 2,276 (61%) of the 3,727 total freshwater species, including 588 (68%) of the 862 endemic species, 752 (90%) of the 838 vulnerable species, and all 94 species listed under state or federal Endangered Species Acts [29–30]. We were unable to find any spatially explicit data for 1,451 (39%) of the species.

Hydrologic regions with the greatest species richness include portions of the San Francisco Bay (average species richness by HUC12 = 111 species), South Coast (average species richness by HUC12 = 91) and Sacramento River (average species richness by HUC12 = 74) (Fig 4A). The average richness of vulnerable taxa per HUC12 by hydrologic regions was greatest in the San Francisco Bay (n = 31), South Coast and San Joaquin (n = 22), Sacramento (n = 21), and North Coast (n = 19). However, the regions with the highest percentage of vulnerable species per HUC12 are the South Lahontan, Tulare Lake, South Coast, Colorado, and Central Coast regions (Fig 4B). Listed species are found across the study area with at least one being as either currently or historically found in watersheds that cover 76% of the state (Fig 4C). However, in contrast to vulnerable species (Fig 4B), the proportion of listed species per HUC12 watershed is relatively low (Fig 4C).

The average richness of endemic taxa per HUC12 by hydrologic regions was greatest in the San Francisco Bay (n = 19), San Joaquin (n = 15), South Coast (n = 14), Sacramento (n = 12), and the Central Coast (n = 11) (Fig 5A). Regions with hydrological connections outside of California–North Coast, North and South Lahontan, and Colorado River–have a lower percentage of California endemic species (n = 7, 5, 3, 4 on average, respectively). More than half of the study area (61%) is comprised of HUC12 watersheds in which over 60% of the endemic species found in those watersheds are considered vulnerable (Fig 5B). As with all native freshwater species, the proportion of endemic species that are listed under state or federal ESA lists is considerably less than the proportion of those considered vulnerable in most HUC12 watersheds (Fig 5C).

Spatial patterns of richness vary by taxonomic group and appear to correspond with distribution of freshwater habitat (Fig 6). For example, fish richness is highest in major rivers in the state including the Sacramento and Klamath river watersheds located in the Sacramento and North Coast hydrologic regions (Fig 6A)(S1 Table). Herpetofauna richness is highest in

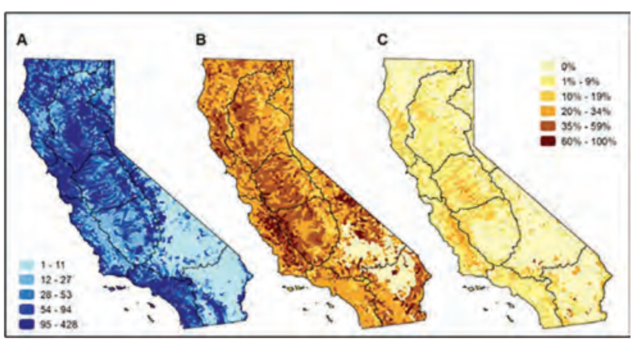


**Fig 4. Patterns of richness and vulnerability of freshwater species native to California watersheds.** Maps of (A) the number of native freshwater species in each HUC12 watershed (includes current, historic, range and modeled data). The range of species richness is shown in quintiles, therefore the darkest blue is the top 20% of species richness, the lightest blue the lowest 20%.; (B) percentage of species in each HUC12 watershed that are ranked as vulnerable; and (C) percentage of species in each HUC12 watershed that are listed as endangered or threatened under state or federal ESA lists. Maps in panels B and C share the legend on the right of the figure. The black lines on the maps represent the major hydrologic regions in the study area.

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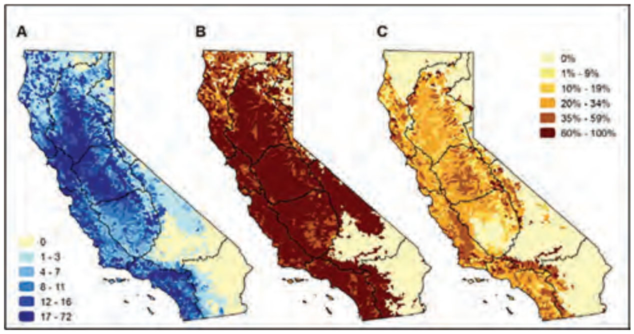


**Fig 5. Patterns of richness and vulnerability of freshwater species endemic to California, watersheds.** Maps of (A) the number of endemic freshwater species in each HUC12 watershed (includes current, historic, range and modeled data). The range of endemic species richness is shown in quintiles, therefore the darkest blue is the top 20% of species richness, the lightest blue the lowest 20%.; (; (B) percentage of endemic species considered vulnerable in each HUC12 watershed; and (C) percentage of endemic species in each HUC12 watershed that are listed as endangered or threatened under state or federal ESA lists. Maps in panels B and C share the legend on the right of the figure. The black lines on the maps represent the major hydrologic regions in the study area.

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mountain foothill and coastal areas (Fig 6B), with bird richness being highest in wetland, coastal, and compatible agriculture (e.g., flooded rice) regions of the state (Fig 6C). Richness of mollusks/crustaceans, insects and other invertebrates is concentrated in headwater, spring systems and more isolated pockets of habitat (Fig 6D and 6E). Plant richness appears distributed throughout the state with pockets of high richness even in desert regions which are underrepresented by other taxonomic groups (Fig 6F).

Geographies noted for high species richness are consistent regardless of observation type (Table 2). The San Francisco Bay, Sacramento River, and portions of the South Coast hydrologic regions are consistently identified as biodiversity hotpots whether observational, range, or modeled data are considered (Fig 7). Patterns of diversity for historical observations and

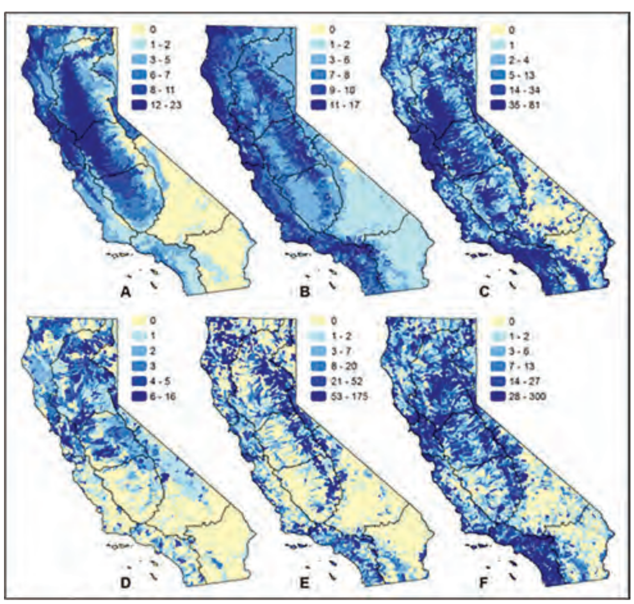


**Fig 6. Patterns of freshwater species richness by taxonomic group.** Maps show richness of: (A) fishes; (B) herpetofauna; (C) birds; (D) mollusks/crustaceans; (E) insects and other invertebrates; (F) plants.

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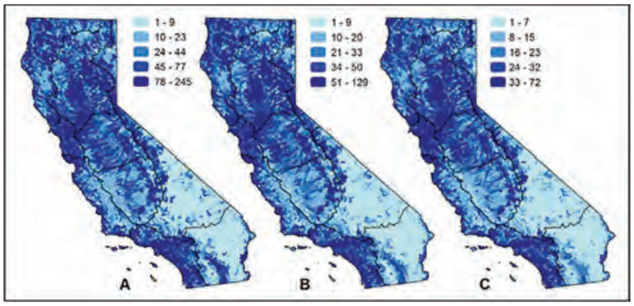


**Fig 7. Patterns of richness by data type of California freshwater species.** Maps show the number of native freshwater species when summarized by: (A) observational data recorded after 1980; (B) observational data recorded before 1980 or observations of extirpated populations; and (C) data that includes range maps, historical range maps, modeled habitat, professional judgment, critical habitat designations, and management area designations. Spatial data with an unknown observation date or unknown type are not included in any panel. The black lines on the maps represent the major hydrologic regions in the study area.

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extirpated populations appear similar to current observations (Fig 7A and 7B). Modeled and generalized data such as range maps completely cover the study area and provide perhaps the clearest pattern of diversity of freshwater taxa (Fig 7C); however, these patterns are only predictions of taxa presence. Nearly 40% of the study area does not contain a recent (post-1980) observation for any of the freshwater taxa considered in this study (Fig 7A).

The correlation coefficients of species richness at the HUC12 watershed scale between the various taxonomic groups are relatively low (Table 4), with the highest being between mollusks and mammals (0.52); fishes and mammals (0.52); and fishes and herps (0.51). The lowest correlations coefficients are between insects and other inverts and birds (0.03); crustaceans (0.06) and fishes (0.07).

We tested how the richness of various groups of species (taxonomic groups and listed species) serve as a proxy for the richness of all other freshwater species using correlation and hotspot overlap analysis. Listed species were the most correlated at the HUC12 watershed scale with the richness of all other freshwater species (0.63), followed by herpetofauna (0.51) and mollusks and plants (0.45) (Fig 8). Insects and other invertebrates had the lowest correlation to all other species (0.23). With the hotspot overlap analysis, we found again that listed species serve as the best proxy for all other species, with a 40% overlap in hotspots, followed by plants (29%), mollusks (27%) and crustaceans (25%) (Fig 9). We also compared hotspots for each group with hotspots of vulnerable freshwater species, since these are in the highest need of conservation action. Hotspots for listed species overlapped with 58% of the hotspots for vulnerable

**Table 4. Correlation matrix of the richness within each HUC12 watershed summarized by taxonomic groups.**

| | Fishes | Crustaceans | Herps | Insects & Other Inverts | Mollusks | Plants | Birds | Mammals |
|---|---|---|---|---|---|---|---|---|
| Fishes | 1.00 | 0.33 | 0.51 | 0.07 | 0.35 | 0.22 | 0.42 | 0.52 |
| Crustaceans | | 1.00 | 0.09 | 0.06 | 0.14 | 0.20 | 0.26 | 0.11 |
| Herps | | | 1.00 | 0.32 | 0.32 | 0.34 | 0.32 | 0.32 |
| Insects & Other Inverts | | | | 1.00 | 0.44 | 0.26 | 0.03 | 0.28 |
| Mollusks | | | | | 1.00 | 0.23 | 0.17 | 0.52 |
| Plants | | | | | | 1.00 | 0.38 | 0.15 |
| Birds | | | | | | | 1.00 | 0.09 |
| Mammals | | | | | | | | 1.00 |

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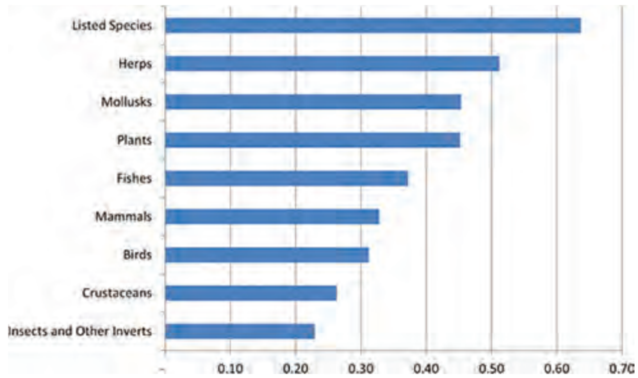


**Fig 8. Relationship among taxonomic groups.** Correlation of the richness within each HUC12 watershed for taxonomic groups of species when compared to all other freshwater species (excluding that group).

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freshwater species (excluding listed species). Mapping the hotspots shows that hotspots for listed species overlap with hotspots for all other species in the Sacramento River, San Francisco Bay, and South Coast hydrologic regions (Fig 10). However, hotspots congruence is lower in the North Coast and San Joaquin hydrologic regions.

## Discussion

We compiled the most comprehensive database of freshwater species richness and distribution for the state of California to date. Using that database, we provide the first multi-taxa analysis of richness, endemism, and vulnerability for the majority of freshwater diversity in the state. Our study finds that the plight of freshwater species in California mirrors global trends [1–3]. We found that nearly half of freshwater taxa native to California are considered vulnerable to extinction, however only 6% of those taxa are currently listed under state or federal ESA. Even more disconcerting is that 90% of the freshwater taxa endemic to California—and so wholly reliant on conservation actions within the state—are vulnerable to extinction. However, only 14% of these endemic taxa are listed under state or federal ESAs (Fig 3). Therefore, legal listing does not appear to accurately reflect the state of vulnerability of freshwater taxa in the state.

We found that freshwater fishes, amphibians, reptiles, and mollusks are the most vulnerable taxonomic groups, a finding that is consistent with other studies [5, 10, 40–42]. However, this

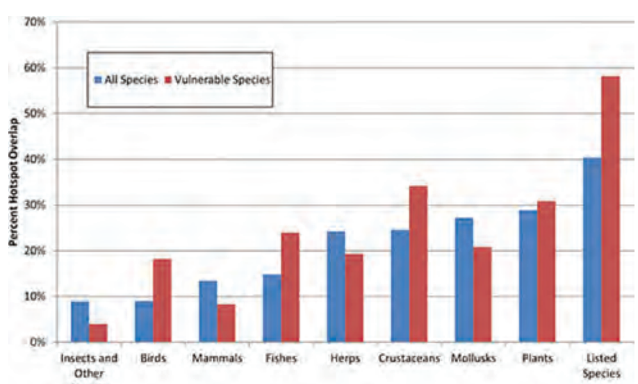


**Fig 9. Overlap of hotspots.** The relative performance of hotspots (top 5% of watersheds by richness) for taxonomic groups of species in matching hotspots for all (blue bars) and vulnerable (red bars) freshwater species. To avoid double counting, hotspots for all and vulnerable species were identified excluding the species in each subgroup for each comparison.

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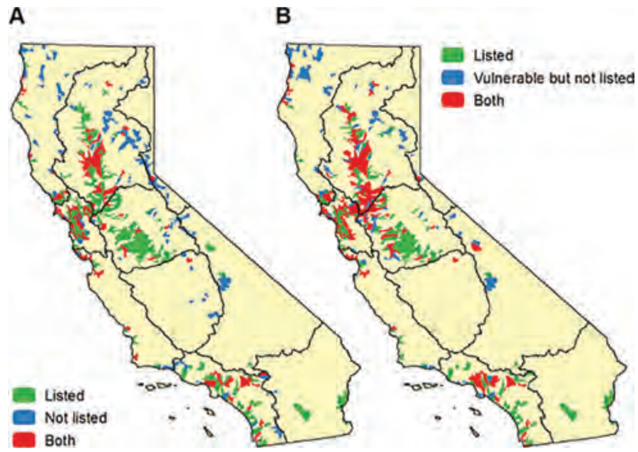


**Fig 10. Location of hotspots.** Comparison of the location of hotspot watersheds (top 5% by richness) for A) listed species with all non-listed species, and B) vulnerable but non-listed species.

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finding could be biased by the general lack of information about vulnerability of other taxonomic groups (Fig 3). These results provide evidence that some taxonomic groups are much better evaluated for conservation status than others (Table 3). For example, all fish and bird taxa have been evaluated as have most of the reptiles, amphibians, plants, and mollusks. In contrast, only 31% of the insects and other invertebrates have been evaluated for conservation status. Furthermore, we still lack spatially-explicit information for 1,448 freshwater species, including many known or suspected to be vulnerable to extinction. Evaluating the conservation status and locations of understudied freshwater species is priority for future research. Given that data acquisition is costly and time intensive, a recent study has shown that concentrating survey efforts on species with the highest uncertainty, such as rare species, provides an effective way to enhance the accuracy of conservation planning [43].

While there are some significant data gaps in our knowledge about the locations of many freshwater species, we were able to compile spatial data for 90% of the vulnerable species in the state, and all of the listed species. With this rich dataset, we were able to test how well a conservation focus on a particular subset of species would benefit other freshwater species. We found that a conservation focus on hotspots for a single taxonomic group such as fishes would provide poor overlap with hotspots for all other freshwater species. Our results are similar to a recent study on global patterns of freshwater species distribution [4]. Interestingly, we found that listed species do provide a reasonable proxy for other freshwater species, since hotspots for listed species cover 40% of the hotspots for non-listed species and 58% of the hotspots for non-listed vulnerable species (Figs 9 and 10). In our study area, focusing conservation action on the hotspots for listed species will likely benefit other freshwater species that need conservation action but have not yet been listed. If these patterns hold for other locations, this finding has implications for conservation strategies outside of our study area because there is generally more spatially explicit information about the distribution of listed species.

The publicly-available dataset [21] we have produced provides a means to place a wide range of freshwater management actions, including water rights administration and water use permitting within the larger context of freshwater-dependent species conservation. Furthermore, the dataset supports conservation planning initiatives by federal and state agencies and non-governmental organizations at the landscape scale, including efforts to delineate priority watershed networks which, if protected or restored, can most efficiently encompass freshwater biodiversity in the state for multiple species groups.

## Conclusions

Human population growth, increasing demands for freshwater resources, and climate change are projected to exacerbate strains on freshwater resources and lead to further imperilment and extinction of freshwater taxa [1, 8–10, 44–45]. Fundamental to addressing this conservation challenge is information to elucidate what taxa are at risk and where best to focus efforts to improve conservation of freshwater species diversity. This study provides a foundation for freshwater conservation planning in California and highlights key hotspots of freshwater species which serve as priorities for conservation action. Yet, major gaps remain in our understanding of freshwater species distribution and status, as well as in the conservation protections afforded that diversity. Filling these knowledge gaps–e.g., with targeted surveys for understudied taxa, especially the listed, vulnerable, and endemic forms–is essential to inform current and future water management decisions. Addressing the gaps and inadequacies in conservation protections will be critical if we are to reverse the alarming declines of freshwater diversity seen in California as around the world.

## Supporting Information

**S1 File. Criteria used to define freshwater species by taxonomic group.**
(DOCX)

**S1 Table. Summary of stream characteristics for regions.** Values from National Hydrography Dataset Plus, version 1 (EPA and USGS).
(DOCX)

**S2 Table. List of sources for freshwater taxa included in our freshwater species list.**
(DOCX)

**S3 Table. List of sources that supplied spatial data for freshwater species occurrence.**
(DOCX)

**S4 Table. List of freshwater taxa included in study.**
(DOCX)

## Acknowledgments

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## Author Contributions

Conceived and designed the experiments: JKH KRK KAF JF T. Gardali T. Grantham JVEK SK PM PBM PRO RP RMQ ACR NS SS LS JDS JS JHV AW SAM. Performed the experiments: JKH KRK KAF JF T. Gardali T. Grantham JVEK SK PM PBM PRO RP RMQ ACR NS SS LS JDS JS JHV AW SAM. Analyzed the data: JKH KRK KAF JF T. Gardali T. Grantham JVEK SK PM PBM PRO RP RMQ ACR NS SS LS JDS JS JHV AW SAM. Contributed reagents/materials/analysis tools: JKH KRK KAF JF T. Gardali T. Grantham JVEK SK PM PBM PRO RP RMQ ACR NS SS LS JDS JS JHV AW SAM. Wrote the paper: JKH KRK KAF JF T. Gardali T. Grantham JVEK SK PM PBM PRO RP RMQ ACR NS SS LS JDS JS JHV AW SAM.

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**S1 File.** Criteria used to define freshwater species

1. FISH

- Freshwater fishes are defined as those that spawn in freshwater. Catadromous species wouldn't qualify, however, we do not have any catadromous species in California. This also precludes several estuarine species commonly found in brackish water such as starry flounder, striped mullet and staghorn sculpin.

2. PLANTS

- Plant species that occur exclusively in freshwater and have special adaptations for living submerged in water, or at the water's surface. Includes free-floating aquatic plans and emergent wetland plants rooted beneath the water surface (e.g., *Nuphar polysepala*).
- Plant species that occur primarily in freshwater wetland habitats but are not strictly aquatic (e.g. *Typha angustifolia*).
- Plant species requiring freshwater inundation to complete their life-cycle, such as plants occurring in long-inundated portions of vernal pools (e.g., *Orcuttia californica*).
- Plant species associated with freshwater and aquatic habitats over much of their range or life-cycle as identified by expert botanists.
- Plant species identified in the Jepson Manual of Vascular Plants of California as associated with wetland habitats such as marshes, lakes, vernal pools, fens, springs, and bogs, and dependent on wetland habitat.
- Plant species identified as Wetland Obligates in the U.S. Army Corps of Engineers list of wetland plant species.
- Plant species identified as Facultative Wetland plants in the U.S. Army Corps of Engineers list of wetland plant species, and identified by expert botanists as dependent on freshwater wetland or aquatic habitats.

3. HERPETOFAUNA

- Species that exclusively rely on freshwater or freshwater-dependent vegetation communities in California in order to complete one or more stages of a reproductive cycle.
- Species that forage within freshwater, either as obligates (e.g., *Actinemys marmorata* and *Thamnophis gigas*), non-obligates (e.g., *T. elegans* and *T. ordinoides*), or as obligates and non-obligates depending on point of ontogeny (i.e., larval and adult amphibian of a single species).
- Relict species occurring within mesic microhabitats within xeric landscapes that would not persist in such regions without freshwater springs, such as *Batrachoseps campi* (a plethodontid salamander that exhibits direct development and does not have a larval stage).
- Species that do not require freshwater for foraging or any part of their reproductive cycle, but are typically found in California occurring within the splash zone of freshwater springs and creeks, such as *Plethodon dunni* (a plethodontid salamander with direct development).

4. BIRDS

A) Criteria for Inclusion

- Species that exclusively rely on freshwater or freshwater-dependent vegetation communities in California, including taxa strongly associated with riparian vegetation.
- Species that breed widely across western North America in freshwater habitats and migrate to California where a substantial portion, but not all, of their wintering habitat consists of freshwater habitats
- Species that use coastal waters during winter and migration but rely completely on freshwater for breeding in California (e.g, Harlequin Duck, American White Pelican, Western Grebe)
- Species that require freshwater inputs in to saline systems where reductions in freshwater inputs could result in complete habitat loss or substantial changes vegetation and habitat suitability (e.g., species that are only found at the Salton Sea , Saltmarsh Common Yellowthroat).
- Species that winter or breed in both freshwater and saline wetlands, but have large portions of their California population dependent on inland freshwater habitats, including flooded agriculture.

B) Criteria for Exclusion

- Species not dependent on the regular presence of freshwater or freshwater-dependent habitats.
- Species that no longer occur in or are not native to the region.
- Species were omitted if they are rare and do not contribute in a meaningful way to the avifauna of the region. – i.e., primarily lost “vagrants,” even if the occur every year (e.g., Swamp Sparrow, American Redstart).

5. INVERTEBRATES

- Benthic macroinvertebrates (BMIs) are those included on the Southwest Association of Freshwater Invertebrate Taxonomists (SAFIT) Standard Taxonomic Effort (STE) list collected as part of freshwater bioassessment in the southwestern United States. The list contains BMI species known to occur in streams, lakes, or wetlands, including vernal pools, but special emphasis was placed on stream taxa since freshwater bioassessment is most frequently conducted in that habitat type. The list was compiled from published literature sources and from records in the State Water Board’s bioassessment database, the latter being derived from surveys of thousands of stream sites throughout California.
- All species in the SAFIT list are benthic in one or more life stages and utilize freshwater habitats in one or more of the following critical life functions: feeding, mating, egg deposition/development, and larval development to maturity.
- The species list is more comprehensive for some taxonomic groups than others, reflecting the knowledge base and interests of the authors and other taxonomists at California’s Aquatic Bioassessment Lab, availability and regional synoptic coverage of primary taxonomic literature, and likelihood of obtaining properly preserved specimens in typical benthic samples. For example, the list is comprehensive for most aquatic insect groups such as mayflies, stoneflies, dragonflies, caddisflies, beetles, the dipteran suborder Nematocera, etc. The dipteran suborder Brachycera is a notable exception, with most taxa being listed at genus level. The species lists also include surface-dwelling groups like Gerridae (water striders, order Hemiptera) and Gyrinidae (whirligig beetles, order Coleoptera), but exclude taxa associated with riparian zones,

shore-dwelling species, and plant tissue inhabitants in taxonomic groups such as Collembola, Staphylinidae, Heteroceridae, Chrysomelidae, Curculionidae, Saldidae, Isopoda and Amphipoda.

- The list is comprehensive for benthic crustaceans except Ostracoda. The list does not include planktonic microcrustacea (Copepoda and Cladocera). No attempt has been made to provide comprehensive species lists for freshwater Annelida (segmented worms) as preservation is typically poor in benthic samples, but generic lists are provided for leeches and polychaetes. Similarly, generic listings are included for Acari (water mites). An extensive taxonomic literature is available for these groups and could support compilation of species lists by appropriate experts in future versions. The list also excludes freshwater parasites such as Branchiura and mermithid Nematoda, the Branchiobdella, which are commensals on crayfish, and the Nematomorpha which are parasitic on terrestrial insects but are found in freshwater for part of their life cycle.
- Phylum Mollusca is variably treated: species lists are generally comprehensive for taxa that occur in larger streams and rivers, despite improper preservation that prevents species-level identifications in typical benthic samples that are collected for bioassessment purposes. Pebblesnails (Families Hydrobiidae and Lithoglyphidae) are a diverse group in springs of the southwestern US, but a species list has not been included.

**S1 Table.** Summary of stream characteristics for regions. Values from National Hydrography Dataset Plus, version 1 (EPA and USGS).

| Region | Area ($km^2$) | Streams (km) | Ratio of perennial to intermittent stream km | Canals & pipelines (km) | Ave. stream slope (%) | Ave. mean annual flow ($m^3$/sec.) | Ave. annual temp. (°C) | Ave. annual total ppt (cm) | Hydrological connections outside CA | Major features |
|---|---|---|---|---|---|---|---|---|---|---|
| Central Coast | 29,313 | 27,830 | 0.15 | 228 | 0.07 | 0.13 | 14.0 | 52 | - | Salinas River |
| Colorado River | 51,431 | 31,668 | 0.04 | 3,859 | 0.04 | 18.20 | 18.8 | 21 | Colorado basin (WY, CO, UT, AZ, NM, NV) | Colorado River, Salton Sea |
| North Coast | 50,662 | 34,915 | 2.14 | 796 | 0.18 | 8.42 | 11.5 | 145 | Klamath basin (OR) | Klamath, Trinity, Mad, Russian rivers |
| North Lahontan | 15,863 | 8,917 | 0.75 | 391 | 0.07 | 0.85 | 6.4 | 74 | Drains to closed basins in NV | Lake Tahoe, terminal basins |
| Sacramento River | 70,684 | 49,773 | 0.72 | 11,306 | 0.06 | 6.23 | 12.2 | 98 | - | Sacramento and Pit rivers, springs |
| San Francisco Bay | 11,718 | 7,984 | 0.58 | 1,531 | 0.04 | 1.61 | 14.7 | 66 | - | San Francisco Bay, vernal pools |
| San Joaquin River | 39,686 | 29,145 | 0.57 | 9,559 | 0.06 | 4.03 | 12.5 | 77 | - | San Joaquin River |
| South Coast | 28,295 | 22,400 | 0.10 | 1,694 | 0.07 | 0.08 | 14.9 | 51 | - | Santa Clara River |
| South Lahontan | 69,063 | 43,867 | 0.07 | 1,179 | 0.06 | 0.41 | 14.1 | 27 | Drains to closed basins in NV | Owens River, isolated springs |
| Tulare Lake | 43,592 | 25,412 | 0.30 | 9,591 | 0.09 | 1.41 | 12.2 | 50 | - | Kern River |

**S3 Table.** Sources used to compile spatial data occurrences.

| ***Citation*** | ***Weblink*** |
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**S4 Table.** List of taxa included in the database.

| Scientific Name | Common Name | Group |
|---|---|---|
| Abedus breviceps | | Insects & other |
| Abedus herberti | | Insects & other |
| Abedus indentatus | | Insects & other |
| Abedus ovatus | | Insects & other |
| Abedus parkeri | | Insects & other |
| Abedus vicinus | | Insects & other |
| Ablabesmyia annulata | | Insects & other |
| Ablabesmyia aspera | | Insects & other |
| Ablabesmyia cinctipes | | Insects & other |
| Ablabesmyia mallochi | | Insects & other |
| Ablabesmyia monilis | | Insects & other |
| Ablabesmyia peleensis | | Insects & other |
| Acalyptonotus pacificus | | Insects & other |
| Acanthomysis aspera | | Crustaceans |
| Acanthomysis hwanhaiensis | | Crustaceans |
| Acentrella insignificans | A Mayfly | Insects & other |
| Acentrella turbida | A Mayfly | Insects & other |
| Acerpenna pygmaea | | Insects & other |
| Acilius abbreviatus | | Insects & other |
| Acipenser medirostris ssp. 1 | Southern green sturgeon | Fishes |
| Acipenser medirostris ssp. 2 | Northern green sturgeon | Fishes |
| Acipenser transmontanus | White sturgeon | Fishes |
| Acneus beeri | | Insects & other |
| Acneus burnelli | | Insects & other |
| Acneus oregonensis | | Insects & other |
| Acneus quadrimaculatus | | Insects & other |
| Actinemys marmorata marmorata | Western Pond Turtle | Herps |
| Actinemys marmorata pallida | Southern Pacific Pond Turtle | Herps |
| Actitis macularius | Spotted Sandpiper | Birds |
| Aechmophorus clarkii | Clark's Grebe | Birds |
| Aechmophorus occidentalis | Western Grebe | Birds |
| Aedes aegypti | | Insects & other |
| Aedes cinereus | | Insects & other |
| Aedes vexans | | Insects & other |
| Aeshna canadensis | Canada Darner | Insects & other |
| Aeshna interrupta interna | | Insects & other |
| Aeshna juncea | | Insects & other |
| Aeshna palmata | Paddle-tailed Darner | Insects & other |

| | | |
|---|---|---|
| Aeshna persephone | | Insects & other |
| Aeshna subarctica | | Insects & other |
| Aeshna umbrosa occidentalis | Shadow Darner | Insects & other |
| Aeshna walkeri | Walker's Darner | Insects & other |
| Agabinus glabrellus | | Insects & other |
| Agabinus sculpturellus | | Insects & other |
| Agabus ancillus | | Insects & other |
| Agabus anthracinus | | Insects & other |
| Agabus apache | | Insects & other |
| Agabus approximatus | | Insects & other |
| Agabus austinii | | Insects & other |
| Agabus austrodiscors | | Insects & other |
| Agabus bjorkmanae | | Insects & other |
| Agabus brevicollis | | Insects & other |
| Agabus confertus | | Insects & other |
| Agabus cordatus | | Insects & other |
| Agabus discors | | Insects & other |
| Agabus disintegratus | | Insects & other |
| Agabus erichsoni | | Insects & other |
| Agabus euryomus | | Insects & other |
| Agabus griseipennis | | Insects & other |
| Agabus hoppingi | | Insects & other |
| Agabus hypomelas | | Insects & other |
| Agabus ilybiiformis | | Insects & other |
| Agabus jimzim | | Insects & other |
| Agabus klamathensis | | Insects & other |
| Agabus kootenai | | Insects & other |
| Agabus lineelus | | Insects & other |
| Agabus lugens | | Insects & other |
| Agabus lutosus | | Insects & other |
| Agabus minnesotensis | | Insects & other |
| Agabus morosus | | Insects & other |
| Agabus obliteratus nectris | | Insects & other |
| Agabus obliteratus obliteratus | | Insects & other |
| Agabus oblongulus | | Insects & other |
| Agabus obsoletus | | Insects & other |
| Agabus pandurus | | Insects & other |
| Agabus perplexus | | Insects & other |
| Agabus punctulatus | | Insects & other |
| Agabus regularis | | Insects & other |
| Agabus roguus | | Insects & other |
| Agabus rumppi | Death Valley Agabus Diving Beetle | Insects & other |

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|---|---|---|
| Agabus sasquatch | | Insects & other |
| Agabus semivittatus | | Insects & other |
| Agabus seriatus | | Insects & other |
| Agabus smithi | | Insects & other |
| Agabus strigulosus | | Insects & other |
| Agabus tristis | | Insects & other |
| Agabus vandykei | | Insects & other |
| Agabus versimilis | | Insects & other |
| Agabus walsinghami | | Insects & other |
| Agapetus arcita | A Caddisfly | Insects & other |
| Agapetus bifidus | | Insects & other |
| Agapetus boulderensis | | Insects & other |
| Agapetus celatus | A Caddisfly | Insects & other |
| Agapetus denningi | | Insects & other |
| Agapetus joannia | A Caddisfly | Insects & other |
| Agapetus malleatus | A Caddisfly | Insects & other |
| Agapetus marlo | A Caddisfly | Insects & other |
| Agapetus occidentis | | Insects & other |
| Agapetus orosus | A Caddisfly | Insects & other |
| Agapetus taho | A Caddisfly | Insects & other |
| Agathon arizonica | | Insects & other |
| Agathon aylmeri | | Insects & other |
| Agathon comstocki | | Insects & other |
| Agathon dismalea | | Insects & other |
| Agathon doanei | A Net-winged Midge | Insects & other |
| Agathon elegantulus | | Insects & other |
| Agathon markii | | Insects & other |
| Agathon sequoiarum | | Insects & other |
| Agelaius phoeniceus aciculatus | Kern Red-winged Blackbird | Birds |
| Agelaius tricolor | Tricolored Blackbird | Birds |
| Agraylea multipunctata | | Insects & other |
| Agraylea saltesea | A Caddisfly | Insects & other |
| Agrostis oregonensis | Oregon Bentgrass | Plants |
| Agrypnia dextra | | Insects & other |
| Agrypnia glacialis | A Caddisfly | Insects & other |
| Agrypnia improba | | Insects & other |
| Agrypnia vestita | | Insects & other |
| Aix sponsa | Wood Duck | Birds |
| Alienacanthomysis macropsis | | Crustaceans |
| Alisma gramineum | Narrowleaf Water-plantain | Plants |
| Alisma triviale | Northern Water-plantain | Plants |

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| Alisotrichia arizonica | | Insects & other |
| Allium validum | Tall Swamp Onion | Plants |
| Allocosmoecus partitus | A Caddisfly | Insects & other |
| Allomyia acanthis | | Insects & other |
| Allomyia cascadis | | Insects & other |
| Allomyia cidoipes | A Caddisfly | Insects & other |
| Allomyia renoa | | Insects & other |
| Alloperla chandleri | Mariposa Sallfly | Insects & other |
| Alloperla delicata | Delicate Sallfly | Insects & other |
| Alloperla elevata | A Stonefly | Insects & other |
| Alloperla fraterna | Cascades Sallfly | Insects & other |
| Alloperla thalia | | Insects & other |
| Alnus rhombifolia | White Alder | Plants |
| Alnus rubra | Red Alder | Plants |
| Alnus viridis fruticosa | Siberian Alder | Plants |
| Alnus viridis sinuata | Sitka Alder | Plants |
| Alnus viridis virdis | Green Alder | Plants |
| Alopecurus aequalis aequalis | Short-awn Foxtail | Plants |
| Alopecurus aequalis sonomensis | Sonoma Shortawn Foxtail | Plants |
| Alopecurus carolinianus | Tufted Foxtail | Plants |
| Alopecurus geniculatus geniculatus | Meadow Foxtail | Plants |
| Alopecurus myosuroides | NA | Plants |
| Alopecurus pratensis | NA | Plants |
| Alopecurus saccatus | Pacific Foxtail | Plants |
| Alotanypus venustus | | Insects & other |
| Ambrysus amargosus | Ash Meadows Naucorid | Insects & other |
| Ambrysus arizonus | | Insects & other |
| Ambrysus californicus | | Insects & other |
| Ambrysus circumcinctus | | Insects & other |
| Ambrysus funebris | Nevares Spring Naucorid Bug | Insects & other |
| Ambrysus melanopterus | | Insects & other |
| Ambrysus mormon | | Insects & other |
| Ambrysus occidentalis | | Insects & other |
| Ambrysus pulchellus | | Insects & other |
| Ambrysus puncticollis | | Insects & other |
| Ambrysus relictus | | Insects & other |
| Ambrysus thermarum | | Insects & other |
| Ambrysus woodburyi | | Insects & other |
| Ambystoma californiense "Santa Barbara" | Santa Barbara Tiger Salamander | Herps |
| Ambystoma californiense | Sonoma Tiger Salamander | Herps |

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| "Sonoma" | | |
| Ambystoma californiense californiense | California Tiger Salamander | Herps |
| Ambystoma gracile | Northwestern Salamander | Herps |
| Ambystoma macrodactylum | | Herps |
| Ambystoma macrodactylum croceum | Santa Cruz Long-toed Salamander | Herps |
| Ambystoma macrodactylum sigillatum | Southern Long-toed Salamander | Herps |
| Ameletus amador | A Mayfly | Insects & other |
| Ameletus andersoni | A Mayfly | Insects & other |
| Ameletus bellulus | A Mayfly | Insects & other |
| Ameletus celer | A Mayfly | Insects & other |
| Ameletus cooki | A Mayfly | Insects & other |
| Ameletus dissitus | A Mayfly | Insects & other |
| Ameletus doddsianus | | Insects & other |
| Ameletus edmundsi | A Mayfly | Insects & other |
| Ameletus exquisitus | | Insects & other |
| Ameletus falsus | | Insects & other |
| Ameletus imbellis | A Mayfly | Insects & other |
| Ameletus majusculus | A Mayfly | Insects & other |
| Ameletus minimus | A Mayfly | Insects & other |
| Ameletus oregonensis | | Insects & other |
| Ameletus pritchardi | A Mayfly | Insects & other |
| Ameletus quadratus | | Insects & other |
| Ameletus shepherdi | A Mayfly | Insects & other |
| Ameletus similior | A Mayfly | Insects & other |
| Ameletus sparsatus | A Mayfly | Insects & other |
| Ameletus subnotatus | A Mayfly | Insects & other |
| Ameletus suffusus | A Mayfly | Insects & other |
| Ameletus tolae | | Insects & other |
| Ameletus validus | A Mayfly | Insects & other |
| Ameletus vancouverensis | A Mayfly | Insects & other |
| Ameletus velox | A Mayfly | Insects & other |
| Ameletus vernalis | A Mayfly | Insects & other |
| Americorophium salmonis | | Crustaceans |
| Americorophium spinicorne | | Crustaceans |
| Americorophium stimpsoni | | Crustaceans |
| Ametor latus | | Insects & other |
| Ametor scabrosus | | Insects & other |
| Ametropus ammophilus | A Mayfly | Insects & other |
| Amiocentrus aspilus | A Caddisfly | Insects & other |

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| Ammannia coccinea | Scarlet Ammannia | Plants |
| Ammannia robusta | Grand Redstem | Plants |
| Amnicola limosa | | Mollusks |
| Amphiagrion abbreviatum | Western Red Damsel | Insects & other |
| Amphicosmoecus canax | A Caddisfly | Insects & other |
| Amphinemura apache | | Insects & other |
| Amphinemura mogollonica | | Insects & other |
| Amphinemura venusta | | Insects & other |
| Amphiscirpus nevadensis | | Plants |
| Amphizoa insolens | | Insects & other |
| Amphizoa lecontei | | Insects & other |
| Amphizoa striata | | Insects & other |
| Ampumixis dispar | | Insects & other |
| Anabolia bimaculata | | Insects & other |
| Anacaena limbata | | Insects & other |
| Anacaena signaticollis | | Insects & other |
| Anacroneuria wipukupa | | Insects & other |
| Anagapetus aisha | A Caddisfly | Insects & other |
| Anagapetus bernea | A Caddisfly | Insects & other |
| Anagapetus chandleri | A Caddisfly | Insects & other |
| Anagapetus debilis | | Insects & other |
| Anagapetus hoodi | | Insects & other |
| Anas acuta | Northern Pintail | Birds |
| Anas americana | American Wigeon | Birds |
| Anas clypeata | Northern Shoveler | Birds |
| Anas crecca | Green-winged Teal | Birds |
| Anas cyanoptera | Cinnamon Teal | Birds |
| Anas discors | Blue-winged Teal | Birds |
| Anas platyrhynchos | Mallard | Birds |
| Anas strepera | Gadwall | Birds |
| Anax junius | Common Green Darner | Insects & other |
| Anax walsinghami | Giant Green Darner | Insects & other |
| Anaxyrus boreas boreas | Boreal Toad | Herps |
| Anaxyrus boreas halophilus | California Toad | Herps |
| Anaxyrus californicus | Arroyo Toad | Herps |
| Anaxyrus canorus | Yosemite Toad | Herps |
| Anaxyrus cognatus | Great Plains Toad | Herps |
| Anaxyrus exsul | Black Toad | Herps |
| Anaxyrus punctatus | Red-spotted Toad | Herps |
| Anaxyrus woodhousii woodhousii | Rocky Mountain Toad | Herps |

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| Anchycteis velutina | | Insects & other |
| Anemopsis californica | Yerba Mansa | Plants |
| Anodonta californiensis | California Floater | Mollusks |
| Anodonta dejecta | Woebegone Floater | Mollusks |
| Anodonta oregonensis | Oregon Floater | Mollusks |
| Anopheles franciscanus | | Insects & other |
| Anopheles freeborni | | Insects & other |
| Anopheles hermsi | | Insects & other |
| Anopheles judithae | | Insects & other |
| Anopheles occidentalis | | Insects & other |
| Anopheles punctipennis | | Insects & other |
| Anser albifrons | Greater White-fronted Goose | Birds |
| Anser albifrons elgasi | Tule White-fronted Goose | Birds |
| Anthopotamus verticis | Walker's Tusked Sprawler | Insects & other |
| Antocha monticola | | Insects & other |
| Apanisagrion lais | | Insects & other |
| Apatania arizona | | Insects & other |
| Apatania chasica | | Insects & other |
| Apatania sorex | A Caddisfly | Insects & other |
| Apatania tavala | Cascades Apatanian Caddisfly | Insects & other |
| Apedilum elachistum | | Insects & other |
| Apedilum subcinctum | | Insects & other |
| Aphodius alternatus | | Insects & other |
| Apobaetis etowah | A Mayfly | Insects & other |
| Aponogeton distachyos | NA | Plants |
| Apsectrotanypus florens | | Insects & other |
| Apteraliplus parvulus | | Insects & other |
| Aquarius amplus arizonensis | | Insects & other |
| Aquarius remigis | | Insects & other |
| Aquilegia eximia | Van Houtte's Columbine | Plants |
| Aquilegia shockleyi | NA | Plants |
| Araeopidius monochus | | Insects & other |
| Archilestes californica | California Spreadwing | Insects & other |
| Archilestes grandis | Great Spreadwing | Insects & other |
| Archoplites interruptus | Sacramento perch | Fishes |
| Arctitalitus sylvaticus | | Crustaceans |
| Arctocorisa sutilis | | Insects & other |
| Arctopsyche californica | A Caddisfly | Insects & other |
| Arctopsyche grandis | A Caddisfly | Insects & other |
| Ardea alba | Great Egret | Birds |
| Ardea herodias | Great Blue Heron | Birds |

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| Arenaria paludicola | Marsh Sandwort | Plants |
| Argia agrioides | California Dancer | Insects & other |
| Argia alberta | Paiute Dancer | Insects & other |
| Argia emma | Emma's Dancer | Insects & other |
| Argia fumipennis | | Insects & other |
| Argia hinei | Lavender Dancer | Insects & other |
| Argia immunda | Kiowa Dancer | Insects & other |
| Argia lacrimans | | Insects & other |
| Argia lugens | Sooty Dancer | Insects & other |
| Argia moesta | Powdered Dancer | Insects & other |
| Argia munda | | Insects & other |
| Argia nahuana | Aztec Dancer | Insects & other |
| Argia oenea | | Insects & other |
| Argia pallens | | Insects & other |
| Argia pima | | Insects & other |
| Argia plana | | Insects & other |
| Argia sabino | | Insects & other |
| Argia sedula | Blue-ringed Dancer | Insects & other |
| Argia tarascana | | Insects & other |
| Argia tezpi | | Insects & other |
| Argia tonto | | Insects & other |
| Argia translata | | Insects & other |
| Argia vivida | Vivid Dancer | Insects & other |
| Artemia franciscana | San Francisco Brine Shrimp | Crustaceans |
| Artemia monica | Mono Lake Brine Shrimp | Crustaceans |
| Arundo donax | NA | Plants |
| Asarum lemmonii | Lemmon's Wild Ginger | Plants |
| Ascaphus truei | Coastal Tailed Frog | Herps |
| Asioplax edmundsi | A Mayfly | Insects & other |
| Assiminea californica | | Mollusks |
| Assiminea infima | Badwater Snail | Mollusks |
| Asynarchus aldinus | | Insects & other |
| Asynarchus cinnamoneus | | Insects & other |
| Asynarchus montanus | | Insects & other |
| Asynarchus pacificus | | Insects & other |
| Atherix pachypus | | Insects & other |
| Atopsyche sperryi | | Insects & other |
| Atopsyche tripunctata | | Insects & other |
| Atractelmis wawona | Wawona Riffle Beetle | Insects & other |
| Attenella attenuata | | Insects & other |
| Attenella delantala | A Mayfly | Insects & other |

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| Attenella margarita | A Mayfly | Insects & other |
| Attenella soquele | A Mayfly | Insects & other |
| Augyles mundulus | | Insects & other |
| Axonopsis californica | | Insects & other |
| Aythya affinis | Lesser Scaup | Birds |
| Aythya americana | Redhead | Birds |
| Aythya collaris | Ring-necked Duck | Birds |
| Aythya marila | Greater Scaup | Birds |
| Aythya valisineria | Canvasback | Birds |
| Azolla filiculoides | NA | Plants |
| Azolla microphylla | Mexican mosquito fern | Plants |
| Baccharis glutinosa | NA | Plants |
| Baccharis salicina | | Plants |
| Bacopa eisenii | Gila River Water-hyssop | Plants |
| Bacopa monnieri | NA | Plants |
| Bacopa rotundifolia | NA | Plants |
| Baetis adonis | A Mayfly | Insects & other |
| Baetis alius | A Mayfly | Insects & other |
| Baetis bicaudatus | A Mayfly | Insects & other |
| Baetis diablus | A Mayfly | Insects & other |
| Baetis flavistriga | A Mayfly | Insects & other |
| Baetis magnus | A Mayfly | Insects & other |
| Baetis notos | A Mayfly | Insects & other |
| Baetis palisadi | A Mayfly | Insects & other |
| Baetis piscatoris | A Mayfly | Insects & other |
| Baetis tricaudatus | A Mayfly | Insects & other |
| Baetisca lacustris | | Insects & other |
| Baetodes alleni | | Insects & other |
| Baetodes arizonensis | | Insects & other |
| Baetodes bibranchius | | Insects & other |
| Baetodes edmundsi | | Insects & other |
| Bandakia fragilis | | Insects & other |
| Bandakia longipalpis | | Insects & other |
| Bandakia oregonensis | | Insects & other |
| Banksiola crotchi | A Caddisfly | Insects & other |
| Batis maritima | Saltwort | Plants |
| Batrachoseps campi | Inyo Mountains Salamander | Herps |
| Baumannella alameda | Alameda Springfly | Insects & other |
| Beckmannia syzigachne | American Sloughgrass | Plants |
| Belostoma bakeri | | Insects & other |
| Belostoma confusum | | Insects & other |

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| Belostoma flumineum | | Insects & other |
| Belostoma saratogae | Saratoga Springs Belostoman Bug | Insects & other |
| Belostoma subspinosum | | Insects & other |
| Bergia texana | Texas Bergia | Plants |
| Berosus fraternus | | Insects & other |
| Berosus hatchi | | Insects & other |
| Berosus infuscatus | | Insects & other |
| Berosus ingeminatus | | Insects & other |
| Berosus maculosus | | Insects & other |
| Berosus metalliceps | | Insects & other |
| Berosus notapeltatus | | Insects & other |
| Berosus oregonensis | | Insects & other |
| Berosus punctatissimus | | Insects & other |
| Berosus sayi | | Insects & other |
| Berosus stylifera | | Insects & other |
| Berula erecta | Wild Parsnip | Plants |
| Betula glandulosa | Resin Birch | Plants |
| Bibiocephala grandis | | Insects & other |
| Bidens cernua | Nodding Beggarticks | Plants |
| Bidens laevis | Smooth Bur-marigold | Plants |
| Bidens tripartita | NA | Plants |
| Bidens vulgata | NA | Plants |
| Bilyjomyia algens | | Insects & other |
| Biomphalaria havanensis | Ghost Rams-horn | Mollusks |
| Bisancora pastina | Antelope Sallfly | Insects & other |
| Bisancora rutriformis | Scooped Sallfly | Insects & other |
| Bistorta bistortoides | | Plants |
| Bittacomorpha clavipes | | Insects & other |
| Bittacomorpha occidentalis | | Insects & other |
| Bittacomorphella ostenii | | Insects & other |
| Bittacomorphella pacifica | | Insects & other |
| Blennosperma bakeri | Baker's Blennosperma | Plants |
| Blephariceera jordani | | Insects & other |
| Blephariceera kalmiopsis | | Insects & other |
| Blephariceera micheneri | A Net-winged Midge | Insects & other |
| Blephariceera ostensackeni | | Insects & other |
| Blephariceera zionensis | | Insects & other |
| Boehmeria cylindrica | NA | Plants |
| Bolboschoenus fluviatilis | | Plants |
| Bolboschoenus glaucus | NA | Plants |
| Bolboschoenus maritimus | NA | Plants |

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| paludosus | | |
| Bolboschoenus robustus | | Plants |
| Bolshecapnia maculata | Spotted Snowfly | Insects & other |
| Boreoclus persimilis | | Insects & other |
| Boreoclus sinuaticornis | | Insects & other |
| Boreoheptagyia lurida | | Insects & other |
| Botaurus lentiginosus | American Bittern | Birds |
| Bowmanasellus sequoiae | Sequoia cave isopod | Crustaceans |
| Brachycentrus americanus | A Caddisfly | Insects & other |
| Brachycentrus echo | A Caddisfly | Insects & other |
| Brachycentrus occidentalis | | Insects & other |
| Brachymesia furcata | Red-tailed Pennant | Insects & other |
| Brachymesia gravida | | Insects & other |
| Branchinecta campestris | Pocket Pouch Fairy Shrimp | Crustaceans |
| Branchinecta coloradensis | Colorado Fairy Shrimp | Crustaceans |
| Branchinecta conservatio | Conservancy Fairy Shrimp | Crustaceans |
| Branchinecta cornigera | | Crustaceans |
| Branchinecta dissimilis | Dissimilar Fairy Shrimp | Crustaceans |
| Branchinecta gigas | Giant Fairy Shrimp | Crustaceans |
| Branchinecta hiberna | Winter Fairy Shrimp | Crustaceans |
| Branchinecta kaibabensis | | Crustaceans |
| Branchinecta lindahli | Versatile Fairy Shrimp | Crustaceans |
| Branchinecta longiantenna | Longhorn Fairy Shrimp | Crustaceans |
| Branchinecta lynchi | Vernal Pool Fairy Shrimp | Crustaceans |
| Branchinecta mackini | Alkali Fairy Shrimp | Crustaceans |
| Branchinecta mesovallensis | Midvalley Fairy Shrimp | Crustaceans |
| Branchinecta oriena | A Fairy Shrimp | Crustaceans |
| Branchinecta packardi | | Crustaceans |
| Branchinecta sandiegonensis | San Diego Fairy Shrimp | Crustaceans |
| Brasenia schreberi | Watershield | Plants |
| Brechmorhoga mendax | Pale-faced Clubskimmer | Insects & other |
| Brechmorhoga pertinax | | Insects & other |
| Brillia flavifrons | | Insects & other |
| Brillia laculata | | Insects & other |
| Brillia parva | | Insects & other |
| Brillia retifinis | | Insects & other |
| Brodiaea nana | | Plants |
| Brodiaea orcuttii | Orcutt's Brodiaea | Plants |
| Brodiaea pallida | Chinese Camp Brodiaea | Plants |
| Brundiniella eumorpha | | Insects & other |
| Brychius hornii | | Insects & other |

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| Brychius pacificus | | Insects & other |
| Bucephala albeola | Bufflehead | Birds |
| Bucephala clangula | Common Goldeneye | Birds |
| Buenoa arida | | Insects & other |
| Buenoa arizonis | | Insects & other |
| Buenoa hungerfordi | | Insects & other |
| Buenoa margaritacea | | Insects & other |
| Buenoa omani | | Insects & other |
| Buenoa scimitra | | Insects & other |
| Buenoa uhleri | | Insects & other |
| Butorides virescens | Green Heron | Birds |
| Caecidotea sequoiae | An Isopod | Crustaceans |
| Caecidotea tomalensis | Tomales Isopod | Crustaceans |
| Caenis amica | A Mayfly | Insects & other |
| Caenis bajaensis | A Mayfly | Insects & other |
| Caenis latipennis | A Mayfly | Insects & other |
| Caenis punctata | A Mayfly | Insects & other |
| Caenis youngi | A Mayfly | Insects & other |
| Caladomyia pistra | | Insects & other |
| Calamagrostis nutkaensis | Pacific Small-reedgrass | Plants |
| Calasellus californicus | An Isopod | Crustaceans |
| Calasellus longus | An Isopod | Crustaceans |
| Calidris alpina | Dunlin | Birds |
| Calidris mauri | Western Sandpiper | Birds |
| Calidris minutilla | Least Sandpiper | Birds |
| Calileuctra dobryi | Elsmere Needlefly | Insects & other |
| Calileuctra ephemera | Napa Needlefly | Insects & other |
| Calineuria californica | Western Stone | Insects & other |
| Callibaetis californicus | A Mayfly | Insects & other |
| Callibaetis ferrugineus | A Mayfly | Insects & other |
| Callibaetis fluctuans | A Mayfly | Insects & other |
| Callibaetis montanus | | Insects & other |
| Callibaetis pallidus | A Mayfly | Insects & other |
| Callibaetis pictus | A Mayfly | Insects & other |
| Callicorixa audeni | | Insects & other |
| Callicorixa scudderi | | Insects & other |
| Callicorixa vulnerata | | Insects & other |
| Calliperla luctuosa | Coast Stripetail | Insects & other |
| Callitriche fassettii | NA | Plants |
| Callitriche heterophylla bolanderi | Large Water-starwort | Plants |

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| Callitriche heterophylla heterophylla | Northern Water-starwort | Plants |
| Callitriche longipedunculata | Longstock Water-starwort | Plants |
| Callitriche marginata | Winged Water-starwort | Plants |
| Callitriche palustris | Vernal Water-starwort | Plants |
| Callitriche trochlearis | Waste-water Water-starwort | Plants |
| Calochortus uniflorus | Shortstem Mariposa Lily | Plants |
| Calopteryx aequabilis | River Jewelwing | Insects & other |
| Caltha leptosepala | Slender-sepal Marsh-marigold | Plants |
| Caltha palustris | NA | Plants |
| Camelobaetidius kickapoo | | Insects & other |
| Camelobaetidius maidu | Maidu Mayfly | Insects & other |
| Camelobaetidius mexicanus | | Insects & other |
| Camelobaetidius musseri | | Insects & other |
| Camelobaetidius warreni | A Mayfly | Insects & other |
| Campanula californica | Swamp Harebell | Plants |
| Capnia barberi | Plumas Snowfly | Insects & other |
| Capnia californica | California Snowfly | Insects & other |
| Capnia caryi | | Insects & other |
| Capnia confusa | | Insects & other |
| Capnia coyote | Coyote Snowfly | Insects & other |
| Capnia decepta | | Insects & other |
| Capnia elongata | Caascades Snowfly | Insects & other |
| Capnia erecta | | Insects & other |
| Capnia excavata | Saddleback Snowfly | Insects & other |
| Capnia fialai | Humboldt Snowfly | Insects & other |
| Capnia giulianii | Whitney Snowfly | Insects & other |
| Capnia glabra | Smooth Snowfly | Insects & other |
| Capnia gracilaria | Slender Snowfly | Insects & other |
| Capnia hitchcocki | Arroyo Snowfly | Insects & other |
| Capnia hornigi | | Insects & other |
| Capnia inyo | Inyo Snowfly | Insects & other |
| Capnia jewetti | | Insects & other |
| Capnia kersti | | Insects & other |
| Capnia lacustra | Lake Snowfly | Insects & other |
| Capnia licina | | Insects & other |
| Capnia lineata | Straight Snowfly | Insects & other |
| Capnia mariposa | Mariposa Snowfly | Insects & other |
| Capnia melia | Northwest Snowfly | Insects & other |
| Capnia mono | Mono Snowfly | Insects & other |
| Capnia nana | | Insects & other |

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| Capnia nedia | | Insects & other |
| Capnia ophiona | Snakehead Snowfly | Insects & other |
| Capnia oregona | | Insects & other |
| Capnia palomar | Palomar Snowfly | Insects & other |
| Capnia petila | | Insects & other |
| Capnia pileata | Birdhead Snowfly | Insects & other |
| Capnia promota | Pacific Snowfly | Insects & other |
| Capnia quadrituberosa | Four-knobbed Snowfly | Insects & other |
| Capnia regilla | Royal Snowfly | Insects & other |
| Capnia saratoga | Saratoga Snowfly | Insects & other |
| Capnia scobina | Rasp Snowfly | Insects & other |
| Capnia sequoia | Sequoia Snowfly | Insects & other |
| Capnia sextuberculata | | Insects & other |
| Capnia shasta | | Insects & other |
| Capnia shepardi | Yuba Snowfly | Insects & other |
| Capnia spinulosa | San Gabriel Snowfly | Insects & other |
| Capnia teresa | Bernardino Snowfly | Insects & other |
| Capnia tumida | Swollen Snowfly | Insects & other |
| Capnia uintahi | | Insects & other |
| Capnia umpqua | Umpqua Snowfly | Insects & other |
| Capnia utahensis | Utah Snowfly | Insects & other |
| Capnia valhalla | Viking Snowfly | Insects & other |
| Capnia ventura | Ventura Snowfly | Insects & other |
| Capnia willametta | | Insects & other |
| Capnia yosemite | Yosemite Snowfly | Insects & other |
| Capnura anas | | Insects & other |
| Capnura elevata | | Insects & other |
| Capnura fibula | | Insects & other |
| Capnura intermontana | | Insects & other |
| Capnura venosa | | Insects & other |
| Capnura wanica | | Insects & other |
| Cardiocladius platypus | | Insects & other |
| Carex alma | Sturdy Sedge | Plants |
| Carex amplifolia | Bigleaf Sedge | Plants |
| Carex aquatilis aquatilis | Water Sedge | Plants |
| Carex aquatilis dives | Sitka Sedge | Plants |
| Carex arcta | Northern Clustered Sedge | Plants |
| Carex atherodes | Awned Sedge | Plants |
| Carex aurea | Golden-fruit Sedge | Plants |
| Carex buxbaumii | Buxbaum's Sedge | Plants |
| Carex canescens canescens | Hoary Sedge | Plants |

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| Carex comosa | Bristly Sedge | Plants |
| Carex cusickii | Cusick's Sedge | Plants |
| Carex densa | Dense Sedge | Plants |
| Carex diandra | Lesser Panicled Sedge | Plants |
| Carex disperma | Softleaf Sedge | Plants |
| Carex echinata echinata | Little Prickly Sedge | Plants |
| Carex echinata phyllomanica | Star Sedge | Plants |
| Carex exsiccata | Beaked Sedge | Plants |
| Carex feta | Green-sheath Sedge | Plants |
| Carex fissuricola | Cleft Sedge | Plants |
| Carex harfordii | Harford's Sedge | Plants |
| Carex hendersonii | Henderson's Sedge | Plants |
| Carex hirtissima | Fuzzy Sedge | Plants |
| Carex hystericina | Porcupine Sedge | Plants |
| Carex integra | Smooth-beak Sedge | Plants |
| Carex interior | Inland Sedge | Plants |
| Carex jonesii | Jones' Sedge | Plants |
| Carex klamathensis | | Plants |
| Carex lasiocarpa | Slender Sedge | Plants |
| Carex lemmonii | Lemmon's Sedge | Plants |
| Carex lenticularis | Shore Sedge | Plants |
| Carex leporina | | Plants |
| Carex leporinella | Sierra Hare Sedge | Plants |
| Carex leptalea | NA | Plants |
| Carex limosa | Mud Sedge | Plants |
| Carex livida | Livid Sedge | Plants |
| Carex longii | NA | Plants |
| Carex luzulina luzulina | Woodrush Sedge | Plants |
| Carex lyngbyei | Lyngbye's Sedge | Plants |
| Carex mertensii | Mertens' Sedge | Plants |
| Carex nebrascensis | Nebraska Sedge | Plants |
| Carex nervina | Sierra Sedge | Plants |
| Carex neurophora | Alpine-nerved Sedge | Plants |
| Carex nigricans | Black Alpine Sedge | Plants |
| Carex nudata | Torrent Sedge | Plants |
| Carex obnupta | Slough Sedge | Plants |
| Carex pellita | Woolly Sedge | Plants |
| Carex praeceptorum | Teacher's Sedge | Plants |
| Carex praticola | Northern Meadow Sedge | Plants |
| Carex saliniformis | Santa Cruz Sedge | Plants |
| Carex sartwelliana | Yosemite Sedge | Plants |

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| Carex scabriuscula | Cascade Sedge | Plants |
| Carex schottii | Schott's Sedge | Plants |
| Carex scoparia scoparia | Broom Sedge | Plants |
| Carex scopulorum bracteosa | Holm's Rocky Mountain Sedge | Plants |
| Carex senta | Western Rough Sedge | Plants |
| Carex sheldonii | Sheldon's Sedge | Plants |
| Carex simulata | Copycat Sedge | Plants |
| Carex spectabilis | Northwestern Showy Sedge | Plants |
| Carex stipata stipata | Stalk-grain Sedge | Plants |
| Carex utriculata | Beaked Sedge | Plants |
| Carex vesicaria vesicaria | Inflated Sedge | Plants |
| Carex viridula viridula | Little Green Sedge | Plants |
| Carex vulpinoidea | NA | Plants |
| Cascadia nuttallii | NA | Plants |
| Cascadoperla trictura | Cascades Stripetail | Insects & other |
| Castilleja campestris succulenta | Fleshy Owl's-clover | Plants |
| Castilleja miniata elata | Siskiyou Indian-paintbrush | Plants |
| Castilleja miniata miniata | Greater Red Indian-paintbrush | Plants |
| Castilleja minor minor | Alkali Indian-paintbrush | Plants |
| Castilleja minor spiralis | Large-flower Annual Indian-paintbrush | Plants |
| Castor canadensis | American Beaver | Mammals |
| Catostomus fumeiventris | Owens sucker | Fishes |
| Catostomus latipinnis | Flannelmouth sucker | Fishes |
| Catostomus luxatus | Lost River sucker | Fishes |
| Catostomus microps | Modoc sucker | Fishes |
| Catostomus occidentalis humboldtianus | Humboldt sucker | Fishes |
| Catostomus occidentalis lacusanserinus | Goose Lake sucker | Fishes |
| Catostomus occidentalis mnioltiltus | Monterey sucker | Fishes |
| Catostomus occidentalis occidentalis | Sacramento sucker | Fishes |
| Catostomus platyrhynchus | Lahontan mountain sucker | Fishes |
| Catostomus rimiculus | Klamath smallscale sucker | Fishes |
| Catostomus santaanae | Santa Ana sucker | Fishes |
| Catostomus snyderi | Klamath largescale sucker | Fishes |
| Catostomus tahoensis | Tahoe sucker | Fishes |
| Caudatella columbiella | | Insects & other |
| Caudatella edmundsi | A Mayfly | Insects & other |
| Caudatella heterocaudata | A Mayfly | Insects & other |
| Caudatella hystrix | A Mayfly | Insects & other |

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| Caudatella jacobi | A Mayfly | Insects & other |
| Celina occidentalis | | Insects & other |
| Cenocorixa andersoni | | Insects & other |
| Cenocorixa blaisdelli | | Insects & other |
| Cenocorixa kuiterti | A Water Boatman | Insects & other |
| Cenocorixa utahensis | | Insects & other |
| Cenocorixa wileyae | | Insects & other |
| Centroptilum album | A Mayfly | Insects & other |
| Centroptilum asperatum | A Mayfly | Insects & other |
| Centroptilum bifurcatum | A Mayfly | Insects & other |
| Centroptilum conturbatum | A Mayfly | Insects & other |
| Centroptilum elsa | | Insects & other |
| Centroptilum oreophilum | | Insects & other |
| Centroptilum selanderorum | | Insects & other |
| Cephalanthus occidentalis | Common Buttonbush | Plants |
| Ceraclea annulicornis | A Caddisfly | Insects & other |
| Ceraclea latahensis | A Caddisfly | Insects & other |
| Ceraclea maculata | A Caddisfly | Insects & other |
| Ceraclea resurgens | | Insects & other |
| Ceraclea tarsipunctata | A Caddisfly | Insects & other |
| Ceraclea vertreesi | | Insects & other |
| Ceratophyllum demersum | Common Hornwort | Plants |
| Chaetarthria bicolor | | Insects & other |
| Chaetarthria hespera | | Insects & other |
| Chaetarthria leechi | Leech's Chaetarthrian Water Scavenger Beetle | Insects & other |
| Chaetarthria magna | | Insects & other |
| Chaetarthria nigrella | | Insects & other |
| Chaetarthria ochra | | Insects & other |
| Chaetarthria pallida | | Insects & other |
| Chaetarthria punctulata | | Insects & other |
| Chaetarthria pusilla | | Insects & other |
| Chaetarthria spinata | | Insects & other |
| Chaetarthria truncata | | Insects & other |
| Chaetocladius ligni | | Insects & other |
| Chamaecyparis lawsoniana | | Plants |
| Chasmatonotus hyalinus | | Insects & other |
| Chasmatonotus maculipennis | | Insects & other |
| Chasmatonotus univittatus | | Insects & other |
| Chasmistes brevirostris | Shortnose sucker | Fishes |
| Chelomideopsis brunsoni | | Insects & other |

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| Chelomideopsis minuta | | Insects & other |
| Chelomideopsis occidentalis | | Insects & other |
| Chelomideopsis siskiyouensis | | Insects & other |
| Chen caerulescens | Snow Goose | Birds |
| Chen rossii | Ross's Goose | Birds |
| Chernokrilus misnomus | Oregon Springfly | Insects & other |
| Chernovskiia orbicus | | Insects & other |
| Cheumatopsyche analis | | Insects & other |
| Cheumatopsyche arizonensis | A Caddisfly | Insects & other |
| Cheumatopsyche campyla | A Caddisfly | Insects & other |
| Cheumatopsyche enonis | | Insects & other |
| Cheumatopsyche gelita | | Insects & other |
| Cheumatopsyche lasia | | Insects & other |
| Cheumatopsyche mickeli | A Caddisfly | Insects & other |
| Cheumatopsyche mollala | A Caddisfly | Insects & other |
| Cheumatopsyche pasella | | Insects & other |
| Cheumatopsyche pinula | | Insects & other |
| Cheumatopsyche wabasha | | Insects & other |
| Chimarra adella | | Insects & other |
| Chimarra angustipennis | A Caddisfly | Insects & other |
| Chimarra butleri | A Caddisfly | Insects & other |
| Chimarra elia | A Caddisfly | Insects & other |
| Chimarra lara | | Insects & other |
| Chimarra primula | | Insects & other |
| Chimarra ridleyi | | Insects & other |
| Chimarra schiza | | Insects & other |
| Chimarra siva | | Insects & other |
| Chimarra texana | | Insects & other |
| Chimarra utahensis | A Caddisfly | Insects & other |
| Chironomus anonymus | | Insects & other |
| Chironomus anthracinus | | Insects & other |
| Chironomus atrella | | Insects & other |
| Chironomus calligraphus | | Insects & other |
| Chironomus cucini | | Insects & other |
| Chironomus decorus | | Insects & other |
| Chironomus frommeri | | Insects & other |
| Chironomus longipes | | Insects & other |
| Chironomus maturus | | Insects & other |
| Chironomus mendax | | Insects & other |
| Chironomus plumosus | | Insects & other |
| Chironomus riparius | | Insects & other |

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| Chironomus staegeri | | Insects & other |
| Chironomus stigmaterus | | Insects & other |
| Chironomus tuxis | | Insects & other |
| Chironomus utahensis | | Insects & other |
| Chironomus whitseli | | Insects & other |
| Chlidonias niger | Black Tern | Birds |
| Chloropyron maritimum canescens | | Plants |
| Chloropyron maritimum maritimum | | Plants |
| Chloropyron maritimum palustre | | Plants |
| Chloropyron molle hispidum | | Plants |
| Chloropyron molle molle | | Plants |
| Chloropyron palmatum | NA | Plants |
| Chloropyron tecopense | | Plants |
| Choroterpes albiannulata | A Mayfly | Insects & other |
| Choroterpes inornata | A Mayfly | Insects & other |
| Choroterpes terratoma | A Mayfly | Insects & other |
| Chroicocephalus philadelphia | Bonaparte's Gull | Birds |
| Chrysosplenium glechomifolium | Pacific Golden-saxifrage | Plants |
| Chyrandra centralis | A Caddisfly | Insects & other |
| Cicendia quadrangularis | Oregon Microcala | Plants |
| Cicuta douglasii | Western Water-hemlock | Plants |
| Cicuta maculata angustifolia | Spotted Water-hemlock | Plants |
| Cicuta maculata bolanderi | Bolander's Water-hemlock | Plants |
| Cicuta maculata maculata | Spotted Water-hemlock | Plants |
| Cinclus mexicanus | American Dipper | Birds |
| Cinygma dimicki | A Mayfly | Insects & other |
| Cinygma integrum | A Mayfly | Insects & other |
| Cinygma lyriforme | A Mayfly | Insects & other |
| Cinygmula gartrelli | A Mayfly | Insects & other |
| Cinygmula mimus | A Mayfly | Insects & other |
| Cinygmula par | A Mayfly | Insects & other |
| Cinygmula ramaleyi | A Mayfly | Insects & other |
| Cinygmula reticulata | A Mayfly | Insects & other |
| Cinygmula tarda | | Insects & other |
| Cinygmula tioga | A Mayfly | Insects & other |
| Cinygmula uniformis | A Mayfly | Insects & other |
| Cirsium crassicaule | Slough Thistle | Plants |
| Cirsium douglasii breweri | | Plants |

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| Cirsium douglasii douglasii | Douglas' Thistle | Plants |
| Cirsium fontinale campylon | Mt. Hamilton Thistle | Plants |
| Cirsium fontinale fontinale | Fountain Thistle | Plants |
| Cirsium fontinale obispoense | Chorro Creek Bog Thistle | Plants |
| Cirsium hydrophilum hydrophilum | Suisun Thistle | Plants |
| Cirsium hydrophilum vaseyi | Mt. Tamalpais Thistle | Plants |
| Cirsium scariosum loncholepis | | Plants |
| Cirsium scariosum robustum | | Plants |
| Cirsium scariosum scariosum | Drummond's Thistle | Plants |
| Cistothorus palustris clarkae | Clark's Marsh Wren | Birds |
| Cistothorus palustris palustris | Marsh Wren | Birds |
| Claassenia sabulosa | Shortwing Stone | Insects & other |
| Cladium californicum | California Sawgrass | Plants |
| Cladopelma amachaerum | | Insects & other |
| Cladopelma edwardsi | | Insects & other |
| Cladopelma forcipis | | Insects & other |
| Cladopelma viridulum | | Insects & other |
| Cladotanytarsus marki | | Insects & other |
| Cladotanytarsus viridiventris | | Insects & other |
| Cleptelmis addenda | | Insects & other |
| Climacia californica | | Insects & other |
| Clinopodium mimuloides | Monkey-flower Savory | Plants |
| Clinotanypus pinguis | | Insects & other |
| Clistoronia formosa | | Insects & other |
| Clistoronia maculata | | Insects & other |
| Clistoronia magnifica | A Caddisfly | Insects & other |
| Cloeodes excogitatus | A Mayfly | Insects & other |
| Cloeodes macrolamellus | | Insects & other |
| Cloeodes peninsulus | | Insects & other |
| Clostoeca disjuncta | A Caddisfly | Insects & other |
| Clunio californiensis | | Insects & other |
| Cnodocentron yavapai | | Insects & other |
| Coccyzus americanus occidentalis | Western Yellow-billed Cuckoo | Birds |
| Coenagrion resolutum | Taiga Bluet | Insects & other |
| Colligyrus convexus | Canary Duskysnail | Mollusks |
| Colligyrus greggi | | Mollusks |
| Colymbetes crotchi | | Insects & other |
| Colymbetes densus | | Insects & other |
| Colymbetes incognitus | | Insects & other |
| Colymbetes strigatus | | Insects & other |

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| Comarum palustre | Marsh Cinquefoil | Plants |
| Conchapelopia mera | | Insects & other |
| Conchapelopia pallens | | Insects & other |
| Copelatus chevrolati | | Insects & other |
| Copelatus glyphicus | | Insects & other |
| Coptotomus longulus longulus | | Insects & other |
| Coquillettidia peturbans | | Insects & other |
| Cordulegaster diadema | | Insects & other |
| Cordulegaster dorsalis | Pacific Spiketail | Insects & other |
| Cordulia shurtleffii | American Emerald | Insects & other |
| Corisella decolor | | Insects & other |
| Corisella edulis | | Insects & other |
| Corisella inscripta | | Insects & other |
| Corisella tarsalis | | Insects & other |
| Corydalus bidenticulatus | | Insects & other |
| Corydalus texanus | | Insects & other |
| Cosumnoperla hypocrena | Cosumnes Stripetail | Insects & other |
| Cosumnoperla sequoia | A Stonefly | Insects & other |
| Cottus aleuticus | Coastrange sculpin | Fishes |
| Cottus asper ssp. 1 | Prickly sculpin | Fishes |
| Cottus asper ssp. 2 | Clear Lake prickly sculpin | Fishes |
| Cottus asperrimus | Rough sculpin | Fishes |
| Cottus beldingi | Paiute sculpin | Fishes |
| Cottus gulosus | Riffle sculpin | Fishes |
| Cottus klamathensis klamathensis | Upper Klamath marbled sculpin | Fishes |
| Cottus klamathensis macrops | Bigeye marbled sculpin | Fishes |
| Cottus klamathensis polyporus | Lower Klamath marbled sculpin | Fishes |
| Cottus perplexus | Reticulate sculpin | Fishes |
| Cottus pitensis | Pit sculpin | Fishes |
| Cotula coronopifolia | NA | Plants |
| Coturnicops noveboracensis | Yellow Rail | Birds |
| Crangonyx richmondensis | Ellis Bog Crangonyctid | Crustaceans |
| Crassula aquatica | Water Pygmyweed | Plants |
| Crassula solieri | NA | Plants |
| Crenitis alticola | | Insects & other |
| Crenitis dissimilis | | Insects & other |
| Crenitis malkini | | Insects & other |
| Crenitis morata | | Insects & other |
| Crenitis palpalis | | Insects & other |
| Crenitis paradigma | | Insects & other |

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| Crenitis rufiventris | | Insects & other |
| Crenitis seriellus | | Insects & other |
| Crenitis snoqualmie | | Insects & other |
| Crenophylax sperryi | | Insects & other |
| Cricotopus annulator | | Insects & other |
| Cricotopus bicinctus | | Insects & other |
| Cricotopus blinni | | Insects & other |
| Cricotopus edurus | | Insects & other |
| Cricotopus furtivus | | Insects & other |
| Cricotopus fuscatus | | Insects & other |
| Cricotopus globistylus | | Insects & other |
| Cricotopus herrmanni | | Insects & other |
| Cricotopus infuscatus | | Insects & other |
| Cricotopus nostocicola | | Insects & other |
| Cricotopus obscurifuscus | | Insects & other |
| Cricotopus ornatus | | Insects & other |
| Cricotopus parafuscatus | | Insects & other |
| Cricotopus subfuscus | | Insects & other |
| Cricotopus subletteorum | | Insects & other |
| Cricotopus sylvestris | | Insects & other |
| Cricotopus tremulus | | Insects & other |
| Cricotopus trifascia | | Insects & other |
| Crypsis vaginiflora | NA | Plants |
| Cryptochia califca | A Caddisfly | Insects & other |
| Cryptochia denningi | Denning's Cryptic Caddisfly | Insects & other |
| Cryptochia excella | Kings Canyon Cryptochian Caddisfly | Insects & other |
| Cryptochia neosa | | Insects & other |
| Cryptochia pilosa | | Insects & other |
| Cryptochia shasta | Confusion Caddisfly | Insects & other |
| Cryptochironomus curryi | | Insects & other |
| Cryptochironomus digitatus | | Insects & other |
| Cryptochironomus fulvus | | Insects & other |
| Cryptochironomus ponderosus | | Insects & other |
| Cryptochironomus psittacinus | | Insects & other |
| Cryptotendipes ariel | | Insects & other |
| Cryptotendipes darbyi | | Insects & other |
| Culex anips | | Insects & other |
| Culex apicalis | | Insects & other |
| Culex arizonensis | | Insects & other |
| Culex boharti | | Insects & other |
| Culex coronator | | Insects & other |

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| Culex erythrothorax | | Insects & other |
| Culex interrogator | | Insects & other |
| Culex pipiens | | Insects & other |
| Culex quinquefasciatus | | Insects & other |
| Culex reevesi | | Insects & other |
| Culex restuans | | Insects & other |
| Culex salinarius | | Insects & other |
| Culex stigmatosoma | | Insects & other |
| Culex tarsalis | | Insects & other |
| Culex territans | | Insects & other |
| Culex thriambus | | Insects & other |
| Culiseta impatiens | | Insects & other |
| Culiseta incidens | | Insects & other |
| Culiseta inornata | | Insects & other |
| Culiseta minnesotae | | Insects & other |
| Culiseta morsitans | | Insects & other |
| Culiseta particeps | | Insects & other |
| Culoptila cantha | | Insects & other |
| Culoptila kimminsi | | Insects & other |
| Culoptila moselyi | | Insects & other |
| Culoptila thoracica | | Insects & other |
| Cultus aestivalis | | Insects & other |
| Cultus pilatus | | Insects & other |
| Cultus tostonus | Toston Springfly | Insects & other |
| Curicta pronotata | | Insects & other |
| Cybister ellipticus | | Insects & other |
| Cybister explanatus | | Insects & other |
| Cyclothyas siskiyouensis | | Insects & other |
| Cygnus buccinator | Trumpeter Swan | Birds |
| Cygnus columbianus | Tundra Swan | Birds |
| Cylloepus abnormis | | Insects & other |
| Cylloepus parkeri | | Insects & other |
| Cymbiodyta arizonica | | Insects & other |
| Cymbiodyta columbiana | | Insects & other |
| Cymbiodyta dorsalis | | Insects & other |
| Cymbiodyta fraterculus | | Insects & other |
| Cymbiodyta howdeni | | Insects & other |
| Cymbiodyta imbellis | | Insects & other |
| Cymbiodyta leechi | | Insects & other |
| Cymbiodyta minima | | Insects & other |
| Cymbiodyta occidentalis | | Insects & other |

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| Cymbiodyta pacifica | | Insects & other |
| Cymbiodyta pseudopacifica | | Insects & other |
| Cymbiodyta puella | | Insects & other |
| Cymbiodyta punctatostriata | | Insects & other |
| Cymbiodyta seriata | | Insects & other |
| Cyperus acuminatus | Short-point Flatsedge | Plants |
| Cyperus bipartitus | Shining Flatsedge | Plants |
| Cyperus erythrorhizos | Red-root Flatsedge | Plants |
| Cyperus flavescens | NA | Plants |
| Cyperus fuscus | NA | Plants |
| Cyperus involucratus | NA | Plants |
| Cyperus iria | NA | Plants |
| Cyperus squarrosus | Awned Cyperus | Plants |
| Cyphomella gibbera | | Insects & other |
| Cyphon arcuatus | | Insects & other |
| Cyphon brevicollis | | Insects & other |
| Cyphon exiguus | | Insects & other |
| Cyphon johni | | Insects & other |
| Cyphon spinulosus | | Insects & other |
| Cyphon variabilis | | Insects & other |
| Cyprinodon macularius | Desert pupfish | Fishes |
| Cyprinodon nevadensis amargosae | Amargosa River pupfish | Fishes |
| Cyprinodon nevadensis calidae | Tecopa Pupfish | Fishes |
| Cyprinodon nevadensis nevadensis | Saratoga Springs pupfish | Fishes |
| Cyprinodon nevadensis shoshone | Shoshone pupfish | Fishes |
| Cyprinodon radiosus | Owens pupfish | Fishes |
| Cyprinodon salinus milleri | Cottonball Marsh pupfish | Fishes |
| Cyprinodon salinus salinus | Salt Creek pupfish | Fishes |
| Cypripedium californicum | California Lady's-slipper | Plants |
| Cypseloides niger | Black Swift | Birds |
| Cyzicus californicus | California Clam Shrimp | Crustaceans |
| Cyzicus elongatus | Elongate Clam Shrimp | Crustaceans |
| Cyzicus mexicanus | Mexican Clam Shrimp | Crustaceans |
| Cyzicus setosa | Bristletail Clam Shrimp | Crustaceans |
| Damasonium californicum | | Plants |
| Darlingtonia californica | California Pitcherplant | Plants |
| Darmera peltata | Umbrella Plant | Plants |
| Datisca glomerata | Durango Root | Plants |
| Delphinium uliginosum | Swamp Larkspur | Plants |

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| Deltamysis homquistae | | Crustaceans |
| Demeijerea brachialis | | Insects & other |
| Dendrocygna bicolor | Fulvous Whistling-Duck | Birds |
| Derotanypus aclines | | Insects & other |
| Desmona bethula | Amphibious Caddisfly | Insects & other |
| Desmona mono | A Caddisfly | Insects & other |
| Desmopachria dispersa | | Insects & other |
| Desmopachria latissima | | Insects & other |
| Desmopachria mexicana | | Insects & other |
| Desmopachria portmanni | | Insects & other |
| Despaxia augusta | Smooth Needleflyl | Insects & other |
| Deuterophlebia coloradensis | | Insects & other |
| Deuterophlebia inyoensis | | Insects & other |
| Deuterophlebia nielsoni | | Insects & other |
| Deuterophlebia personata | | Insects & other |
| Deuterophlebia shasta | A Mountain Midge | Insects & other |
| Diamesa aberrata | | Insects & other |
| Diamesa ancysta | | Insects & other |
| Diamesa chorea | | Insects & other |
| Diamesa davisi | | Insects & other |
| Diamesa haydaki | | Insects & other |
| Diamesa heteropus | | Insects & other |
| Diamesa japonica | | Insects & other |
| Diamesa sonorae | | Insects & other |
| Diamesa spinacies | | Insects & other |
| Dicamptodon ensatus | California Giant Salamander | Herps |
| Dicamptodon tenebrosus | Pacific Giant Salamander | Herps |
| Dicosmoecus atripes | A Caddisfly | Insects & other |
| Dicosmoecus gilvipes | A Caddisfly | Insects & other |
| Dicosmoecus pallicornis | A Caddisfly | Insects & other |
| Dicrotendipes adnilus | | Insects & other |
| Dicrotendipes aethiops | | Insects & other |
| Dicrotendipes californicus | | Insects & other |
| Dicrotendipes crypticus | | Insects & other |
| Dicrotendipes fumidus | | Insects & other |
| Dicrotendipes milleri | | Insects & other |
| Dicrotendipes modestus | | Insects & other |
| Dicrotendipes nervosus | | Insects & other |
| Dicrotendipes tritomus | | Insects & other |
| Dineutus solitarius | | Insects & other |
| Dineutus sublineatus | | Insects & other |

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|---|---|---|
| Diphetor hageni | Hagen's Small Minnow Mayfly | Insects & other |
| Diplectrona californica | California Diplectronan Caddisfly | Insects & other |
| Distichlis littoralis | NA | Plants |
| Diura knowltoni | Nearctic Springfly | Insects & other |
| Doddsia occidentalis | Western Willowfly | Insects & other |
| Doithrix barberi | | Insects & other |
| Doithrix ensifer | | Insects & other |
| Dolophilodes aequalis | A Caddisfly | Insects & other |
| Dolophilodes andora | A Caddisfly | Insects & other |
| Dolophilodes dorcus | A Caddisfly | Insects & other |
| Dolophilodes novusamericanus | A Caddisfly | Insects & other |
| Dolophilodes pallidipes | A Caddisfly | Insects & other |
| Doroneuria baumanni | Cascades Stone | Insects & other |
| Downingia bacigalupii | Bacigalup's Downingia | Plants |
| Downingia bella | Hoover's Downingia | Plants |
| Downingia bicornuta | NA | Plants |
| Downingia concolor | NA | Plants |
| Downingia cuspidata | Toothed Calicoflower | Plants |
| Downingia elegans | NA | Plants |
| Downingia insignis | Parti-color Downingia | Plants |
| Downingia laeta | Great Basin Downingia | Plants |
| Downingia montana | Sierra Downingia | Plants |
| Downingia ornatissima | NA | Plants |
| Downingia pulchella | Flat-face Downingia | Plants |
| Downingia pulcherrima | | Plants |
| Downingia pusilla | Dwarf Downingia | Plants |
| Downingia willamettensis | | Plants |
| Downingia yina | NA | Plants |
| Drosera anglica | English Sundew | Plants |
| Drosera rotundifolia | NA | Plants |
| Drunella coloradensis | A Mayfly | Insects & other |
| Drunella doddsii | A Mayfly | Insects & other |
| Drunella flavilinea | A Mayfly | Insects & other |
| Drunella grandis | A Mayfly | Insects & other |
| Drunella pelosa | A Mayfly | Insects & other |
| Drunella spinifera | A Mayfly | Insects & other |
| Drymocallis cuneifolia ewanii | | Plants |
| Dryops arizonensis | | Insects & other |
| Dubiraphia brunnescens | Brownish Dubiraphian Riffle Beetle | Insects & other |
| Dubiraphia giulianii | Giuliani's Dubiraphian Riffle Beetle | Insects & other |
| Dulichium arundinaceum | NA | Plants |

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|---|---|---|
| Dumontia oregonensis | A Water Flea | Crustaceans |
| Dysmicohermes disjunctus | | Insects & other |
| Dysmicohermes ingens | | Insects & other |
| Dythemis fugax | | Insects & other |
| Dythemis nigrescens | | Insects & other |
| Dythemis velox | | Insects & other |
| Dytiscus cordieri | | Insects & other |
| Dytiscus dauricus | | Insects & other |
| Dytiscus habilis | | Insects & other |
| Dytiscus hatchi | | Insects & other |
| Dytiscus hybridus | | Insects & other |
| Dytiscus marginicollis | | Insects & other |
| Ecclisocosmoecus scylla | | Insects & other |
| Ecclisomyia bilera | King's Creek Ecclisomyian Caddisfly | Insects & other |
| Ecclisomyia conspersa | A Caddisfly | Insects & other |
| Ecclisomyia maculosa | A Caddisfly | Insects & other |
| Ecdyonurus criddlei | A Mayfly | Insects & other |
| Ecdyonurus simplicoides | | Insects & other |
| Echinochloa oryzoides | NA | Plants |
| Echinodorus berteroi | Upright Burhead | Plants |
| Edmundsius agilis | A Mayfly | Insects & other |
| Egretta thula | Snowy Egret | Birds |
| Elatine brachysperma | Shortseed Waterwort | Plants |
| Elatine californica | California Waterwort | Plants |
| Elatine heterandra | Mosquito Waterwort | Plants |
| Elatine rubella | Southwestern Waterwort | Plants |
| Eleocharis acicularis acicularis | Least Spikerush | Plants |
| Eleocharis acicularis gracilescens | Least Spikerush | Plants |
| Eleocharis acicularis occidentalis | | Plants |
| Eleocharis atropurpurea | Purple Spikerush | Plants |
| Eleocharis bella | Delicate Spikerush | Plants |
| Eleocharis bernardina | | Plants |
| Eleocharis bolanderi | Bolander's Spikerush | Plants |
| Eleocharis coloradoensis | | Plants |
| Eleocharis decumbens | Decumbent Spikerush | Plants |
| Eleocharis engelmannii detonsa | | Plants |
| Eleocharis engelmannii engelmannii | Engelmann's Spikerush | Plants |
| Eleocharis flavescens flavescens | Pale Spikerush | Plants |
| Eleocharis geniculata | Capitate Spikerush | Plants |

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| Eleocharis macrostachya | Creeping Spikerush | Plants |
| Eleocharis montevidensis | Sand Spikerush | Plants |
| Eleocharis obtusa | Blunt Spikerush | Plants |
| Eleocharis ovata | | Plants |
| Eleocharis palustris | Creeping Spikerush | Plants |
| Eleocharis parishii | Parish's Spikerush | Plants |
| Eleocharis parvula | Small Spikerush | Plants |
| Eleocharis quadrangulata | NA | Plants |
| Eleocharis quinqueflora | Few-flower Spikerush | Plants |
| Eleocharis radicans | Rooted Spikerush | Plants |
| Eleocharis rostellata | Beaked Spikerush | Plants |
| Eleocharis suksdorfiana | NA | Plants |
| Eleocharis torticulmis | Twisted Spikerush | Plants |
| Elodea bifoliata | NA | Plants |
| Elodea canadensis | Broad Waterweed | Plants |
| Elodea nuttallii | Nuttall's Waterweed | Plants |
| Elodes angusta | | Insects & other |
| Elodes apicalis | | Insects & other |
| Elodes aquatica | | Insects & other |
| Elodes emarginata | | Insects & other |
| Elodes impressa | | Insects & other |
| Elodes nunenmacheri | | Insects & other |
| Empidonax traillii | Willow Flycatcher | Birds |
| Empidonax traillii adastus | A Willow Flycatcher | Birds |
| Empidonax traillii brewsteri | Willow Flycatcher | Birds |
| Empidonax traillii extimus | Southwestern Willow Flycatcher | Birds |
| Enallagma anna | River Bluet | Insects & other |
| Enallagma basidens | Double-striped Bluet | Insects & other |
| Enallagma boreale | Boreal Bluet | Insects & other |
| Enallagma carunculatum | Tule Bluet | Insects & other |
| Enallagma civile | Familiar Bluet | Insects & other |
| Enallagma clausum | Alkali Bluet | Insects & other |
| Enallagma cyathigerum | | Insects & other |
| Enallagma praevarum | Arroyo Bluet | Insects & other |
| Enallagma semicirculare | | Insects & other |
| Endochironomus nigricans | | Insects & other |
| Endotribelos hesperium | | Insects & other |
| Enochrus aridus | | Insects & other |
| Enochrus californicus | | Insects & other |
| Enochrus carinatus | | Insects & other |
| Enochrus cristatus | | Insects & other |

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| Enochrus cuspidatus | | Insects & other |
| Enochrus diffusus | | Insects & other |
| Enochrus fimbriatus | | Insects & other |
| Enochrus hamiltoni | | Insects & other |
| Enochrus ochraceus | | Insects & other |
| Enochrus piceus | | Insects & other |
| Enochrus pygmaeus | | Insects & other |
| Entosphenus folletti | Northern California brook lamprey | Fishes |
| Entosphenus similis | Klamath River lamprey | Fishes |
| Entosphenus tridentata ssp. 1 | Pacific lamprey | Fishes |
| Entosphenus tridentata ssp. 2 | Goose Lake lamprey | Fishes |
| Eobrachycentrus gelidae | | Insects & other |
| Eocosmoecus frontalis | | Insects & other |
| Eocyzicus digueti | Straightbacked Clam Shrimp | Crustaceans |
| Epeorus albertae | A Mayfly | Insects & other |
| Epeorus deceptivus | A Mayfly | Insects & other |
| Epeorus dulciana | A Mayfly | Insects & other |
| Epeorus grandis | A Mayfly | Insects & other |
| Epeorus hesperus | A Mayfly | Insects & other |
| Epeorus lagunitas | A Mayfly | Insects & other |
| Epeorus longimanus | A Mayfly | Insects & other |
| Epeorus margarita | A Mayfly | Insects & other |
| Epeorus permagnus | | Insects & other |
| Ephemera simulans | | Insects & other |
| Ephemerella alleni | | Insects & other |
| Ephemerella aurivillii | A Mayfly | Insects & other |
| Ephemerella dorothea dorothea | A Mayfly | Insects & other |
| Ephemerella excrucians | A Mayfly | Insects & other |
| Ephemerella maculata | A Mayfly | Insects & other |
| Ephemerella tibialis | A Mayfly | Insects & other |
| Ephemerella velmae | A Mayfly | Insects & other |
| Ephemerella verruca | | Insects & other |
| Ephoron album | A Mayfly | Insects & other |
| Epilobium campestre | NA | Plants |
| Epilobium cleistogamum | Cleistogamous Spike-primrose | Plants |
| Epilobium hallianum | | Plants |
| Epilobium oreganum | Oregon Willowherb | Plants |
| Epilobium oregonense | Oregon Willow-herb | Plants |
| Epilobium palustre | Marsh Willowherb | Plants |
| Epipactis gigantea | Giant Helleborine | Plants |
| Epitheca canis | Beaverpond Baskettail | Insects & other |

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|---|---|---|
| Epitheca spinigera | Spiny Baskettail | Insects & other |
| Equisetum palustre | NA | Plants |
| Eragrostis hypnoides | Teal Lovegrass | Plants |
| Erebaxonopsis nearctica | | Insects & other |
| Eremopyrgus eganensis | | Mollusks |
| Eretes sticticus | | Insects & other |
| Eretmoptera browni | | Insects & other |
| Erigeron coulteri | Coulter's Fleabane | Plants |
| Eriophorum crinigerum | Fringed Cotton-grass | Plants |
| Eriophorum gracile gracile | Slender Cotton-grass | Plants |
| Erpetogomphus compositus | White-belted Ringtail | Insects & other |
| Erpetogomphus crotalinus | | Insects & other |
| Erpetogomphus designatus | | Insects & other |
| Erpetogomphus lampropeltis lampropeltis | Serpent Ringtail | Insects & other |
| Eryngium alismifolium | Inland Coyote-thistle | Plants |
| Eryngium aristulatum aristulatum | California Eryngo | Plants |
| Eryngium aristulatum hooveri | Hoover's Coyote-thistle | Plants |
| Eryngium aristulatum parishii | San Diego Button Celery | Plants |
| Eryngium articulatum | Jointed Coyote-thistle | Plants |
| Eryngium castrense | Great Valley Eryngo | Plants |
| Eryngium constancei | Loch Lomond Button-celery | Plants |
| Eryngium jepsonii | NA | Plants |
| Eryngium mathiasiae | Mathias' Coyote-thistle | Plants |
| Eryngium pinnatisectum | Tuolumne Coyote-thistle | Plants |
| Eryngium racemosum | Delta Coyote-thistle | Plants |
| Eryngium spinosepalum | Spiny Sepaled Coyote-thistle | Plants |
| Eryngium vaseyi vallicola | | Plants |
| Eryngium vaseyi vaseyi | Vasey's Coyote-thistle | Plants |
| Erythemis collocata | Western Pondhawk | Insects & other |
| Erythemis simplicicollis | | Insects & other |
| Erythemis vesiculosa | | Insects & other |
| Erythrodiplax basifusca | | Insects & other |
| Erythrodiplax funerea | | Insects & other |
| Eubranchipus bundyi | Knobbedlip Fairy Shrimp | Crustaceans |
| Eubranchipus oregonus | Oregon Fairy Shrimp | Crustaceans |
| Eubranchipus serratus | Ethologist Fairy Shrimp | Crustaceans |
| Eubrianax edwardsii | | Insects & other |
| Eucapnopsis brevicauda | Shorttailed Snowfly | Insects & other |
| Eucorethra underwoodi | | Insects & other |
| Eucyclogobius newberryi | Tidewater goby | Fishes |

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|---|---|---|
| Eukiefferiella claripennis | | Insects & other |
| Eukiefferiella coerulescens | | Insects & other |
| Eukiefferiella cyanea | | Insects & other |
| Eukiefferiella devonica | | Insects & other |
| Eukiefferiella ilkleyensis | | Insects & other |
| Eulimnadia diversa | Diversity Clam Shrimp | Crustaceans |
| Eulimnadia texana | Texan Clam Shrimp | Crustaceans |
| Eulimnichus analis | | Insects & other |
| Eulimnichus californicus | | Insects & other |
| Eulimnichus evanescens | | Insects & other |
| Eulimnichus montanus | | Insects & other |
| Eulimnichus perpolitus | | Insects & other |
| Euphorbia hooveri | NA | Plants |
| Euryhapsis annuliventris | | Insects & other |
| Euryhapsis illoba | | Insects & other |
| Eurylophella lodi | A Mayfly | Insects & other |
| Eustoma exaltatum | NA | Plants |
| Euthamia occidentalis | Western Fragrant Goldenrod | Plants |
| Exopalaemon carinicauda | | Crustaceans |
| Fallceon eatoni | A Mayfly | Insects & other |
| Fallceon quilleri | A Mayfly | Insects & other |
| Fallceon sonora | A Mayfly | Insects & other |
| Fallceon thermophilos | A Mayfly | Insects & other |
| Farula davisi | Green Springs Mountain Farulan Caddisfly | Insects & other |
| Farula geyseri | A Farulan Caddisfly | Insects & other |
| Farula honeyi | A Farulan Caddisfly | Insects & other |
| Farula jewetti | | Insects & other |
| Farula malkini | | Insects & other |
| Farula moweri | A Caddisfly | Insects & other |
| Farula petersoni | A Farulan Caddisfly | Insects & other |
| Farula praelonga | Long-tailed Caddisfly | Insects & other |
| Farula raineri | | Insects & other |
| Farula reapiri | | Insects & other |
| Farula wigginsi | | Insects & other |
| Ferrissia fragilis | Fragile Ancylid | Mollusks |
| Ferrissia rivularis | Creeping Ancylid | Mollusks |
| Ferrissia walkeri | Cloche Ancylid | Mollusks |
| Ficopotamus enigmaticus | | Insects & other |
| Fimbristylis autumnalis | NA | Plants |
| Fimbristylis thermalis | Hot Springs Fimbry | Plants |
| Floerkea proserpinacoides | False Mermaidweed | Plants |

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|---|---|---|
| Fluminicola ahjumawi | Ahjumawi pebblesnail | Mollusks |
| Fluminicola anserinus | Goose Valley pebblesnail | Mollusks |
| Fluminicola caballensis | Horse Creek pebblesnail | Mollusks |
| Fluminicola erosus | Smokey Charley pebblesnail | Mollusks |
| Fluminicola favillaceus | Ash Valley pebblesnail | Mollusks |
| Fluminicola fremonti | Fremont pebblesnail | Mollusks |
| Fluminicola lunsfordensis | Lunsford pebblesnail | Mollusks |
| Fluminicola modoci | Modoc Pebblesnail | Mollusks |
| Fluminicola multifarius | Shasta pebblesnail | Mollusks |
| Fluminicola neritoides | Willow Creek pebblesnail | Mollusks |
| Fluminicola potemicus | Potem Creek pebblesnail | Mollusks |
| Fluminicola scopulinus | Castle Creek pebblesnail | Mollusks |
| Fluminicola seminalis | Nugget Pebblesnail | Mollusks |
| Fluminicola turbiniformis | Turban Pebblesnail | Mollusks |
| Fluminicola umbilicatus | Hat Creek pebblesnail | Mollusks |
| Fluminicola warnerensis | Warner pebblesnail | Mollusks |
| Frankenia palmeri | Palmer's Frankenia | Plants |
| Frisonia picticeps | Painted Springfly | Insects & other |
| Fulica americana | American Coot | Birds |
| Fundulus parvipinnis | California killifish | Fishes |
| Galba bulimoides | Prairie Fossaria | Mollusks |
| Galba cubensis | Carib Fossaria | Mollusks |
| Galba modicella | Rock Fossaria | Mollusks |
| Galba obrussa | Golden Fossaria | Mollusks |
| Galba perplexa | A Freshwater Snail | Mollusks |
| Galba sonomaensis | Sonoma Fossaria | Mollusks |
| Galba techella | A Freshwater Snail | Mollusks |
| Galium trifidum | Small Bedstraw | Plants |
| Gallinago delicata | Wilson's Snipe | Birds |
| Gallinula chloropus | Common Moorhen | Birds |
| Gammarus lacustris | | Crustaceans |
| Gasterosteus aculeatus aculeatus | Coastal threespine stickleback | Fishes |
| Gasterosteus aculeatus microcephalus | Inland threespine stickleback | Fishes |
| Gasterosteus aculeatus ssp. 1 | Shay Creek stickleback | Fishes |
| Gasterosteus aculeatus williamsoni | Unarmored threespine stickleback | Fishes |
| Gelastocoris oculatus | | Insects & other |
| Gelastocoris rotundatus | | Insects & other |
| Gelochelidon nilotica vanrossemi | Gull-billed Tern | Birds |
| Gentiana calycosa | Explorer's Gentian | Plants |

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|---|---|---|
| Gentiana sceptrum | Pacific Gentian | Plants |
| Gentiana setigera | Elegant Gentian | Plants |
| Gentianella amarella acuta | Autumn Dwarf Gentian | Plants |
| Gentianopsis holopetala | Sierra Gentian | Plants |
| Gentianopsis simplex | One-flower Gentian | Plants |
| Georissus californicus | | Insects & other |
| Georthocladius platystylus | | Insects & other |
| Georthocladius wirthi | | Insects & other |
| Geothelpusa dehaani | | Crustaceans |
| Geothlypis trichas sinuosa | Saltmarsh Common Yellowthroat | Birds |
| Geothlypis trichas trichas | Common Yellowthroat | Birds |
| Gerris comatus | | Insects & other |
| Gerris gillettei | | Insects & other |
| Gerris incognitis | | Insects & other |
| Gerris incurvatus | | Insects & other |
| Gerris insperatus | | Insects & other |
| Gigantodax adleri | | Insects & other |
| Gila coerulea | Blue chub | Fishes |
| Gila crassicauda | Thicktail Chub | Fishes |
| Gila elegans | Bonytail | Fishes |
| Gila orcutti | Arroyo chub | Fishes |
| Glinus radiatus | NA | Plants |
| Glossosoma alascense | A Caddisfly | Insects & other |
| Glossosoma bruna | A Caddisfly | Insects & other |
| Glossosoma califica | A Caddisfly | Insects & other |
| Glossosoma excitum | | Insects & other |
| Glossosoma mereca | A Caddisfly | Insects & other |
| Glossosoma montanum | | Insects & other |
| Glossosoma oregonense | A Caddisfly | Insects & other |
| Glossosoma penitum | A Caddisfly | Insects & other |
| Glossosoma pternum | A Caddisfly | Insects & other |
| Glossosoma pyroxum | | Insects & other |
| Glossosoma schuhi | | Insects & other |
| Glossosoma sequoia | A Caddisfly | Insects & other |
| Glossosoma traviatum | | Insects & other |
| Glossosoma velonum | | Insects & other |
| Glossosoma ventrale | | Insects & other |
| Glossosoma verdonum | A Caddisfly | Insects & other |
| Glossosoma wenatchee | | Insects & other |
| Glyceria borealis | Small Floating Mannagrass | Plants |
| Glyceria elata | Tall Mannagrass | Plants |

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|---|---|---|
| Glyceria fluitans | NA | Plants |
| Glyceria grandis | American Mannagrass | Plants |
| Glyceria leptostachya | Slim-head Mannagrass | Plants |
| Glyceria striata var. stricta | Fowl Mannagrass | Plants |
| Glyphopsyche irrorata | A Caddisfly | Insects & other |
| Glyptotendipes barbipes | | Insects & other |
| Glyptotendipes lobiferus | | Insects & other |
| Glyptotendipes paripes | | Insects & other |
| Gnorimosphaeroma insulare | An Isopod | Crustaceans |
| Gnorimosphaeroma noblei | An Isopod | Crustaceans |
| Goeldichironomus amazonicus | | Insects & other |
| Goeldichironomus holoprasinus | | Insects & other |
| Goera archaon | A Caddisfly | Insects & other |
| Goeracea genota | | Insects & other |
| Goeracea oregona | Sagehen Creek Goeracean Caddisfly | Insects & other |
| Gomphus kurilis | Pacific Clubtail | Insects & other |
| Gomphus lynnae | | Insects & other |
| Gonidea angulata | Western Ridged Mussel | Mollusks |
| Grammotaulius betteni | | Insects & other |
| Graphoderus liberus | | Insects & other |
| Graphoderus occidentalis | | Insects & other |
| Graphoderus perplexus | | Insects & other |
| Graptocorixa abdominalis | | Insects & other |
| Graptocorixa californica | | Insects & other |
| Graptocorixa gerhardi | | Insects & other |
| Graptocorixa serrulata | | Insects & other |
| Graptocorixa uhleri | | Insects & other |
| Graptocorixa uhleroidea | A Water Boatman | Insects & other |
| Gratiola ebracteata | Bractless Hedge-hyssop | Plants |
| Gratiola heterosepala | Boggs Lake Hedge-hyssop | Plants |
| Gratiola neglecta | Clammy Hedge-hyssop | Plants |
| Greneria humeralis | | Insects & other |
| Grus canadensis | Sandhill Crane | Birds |
| Grus canadensis canadensis | Lesser Sandhill Crane | Birds |
| Grus canadensis tabida | Greater Sandhill Crane | Birds |
| Gumaga griseola | A Bushtailed Caddisfly | Insects & other |
| Gumaga nigricula | A Bushtailed Caddisfly | Insects & other |
| Gymnochthebius falli | | Insects & other |
| Gymnochthebius fossatus | | Insects & other |
| Gymnochthebius laevipennis | | Insects & other |
| Gyraulus circumstriatus | Disc Gyro | Mollusks |

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| Gyraulus crista | Star Gyro | Mollusks |
| Gyraulus deflectus | | Mollusks |
| Gyraulus parvus | Ash Gyro | Mollusks |
| Gyraulus vermicularis | Pacific Coast Gyraulus | Mollusks |
| Gyretes sinuatus | | Insects & other |
| Gyretes torosus | | Insects & other |
| Gyrinus affinis | | Insects & other |
| Gyrinus bifarius | | Insects & other |
| Gyrinus confinis | | Insects & other |
| Gyrinus consobrinus | | Insects & other |
| Gyrinus latilimbus | | Insects & other |
| Gyrinus maculiventris | | Insects & other |
| Gyrinus parcus | | Insects & other |
| Gyrinus picipes | | Insects & other |
| Gyrinus pleuralis | | Insects & other |
| Gyrinus plicifer | | Insects & other |
| Gyrinus rugosus | | Insects & other |
| Halesochila taylori | | Insects & other |
| Haliaeetus leucocephalus | Bald Eagle | Birds |
| Haliaeetus leucocephalus pop. 4 | Bald Eagle - Wintering Population | Birds |
| Haliplus concolor | | Insects & other |
| Haliplus cylindricus | | Insects & other |
| Haliplus distinctus | | Insects & other |
| Haliplus dorsomaculatus | | Insects & other |
| Haliplus eremicus | | Insects & other |
| Haliplus gracilis | | Insects & other |
| Haliplus leechi | | Insects & other |
| Haliplus longulus | | Insects & other |
| Haliplus mimeticus | | Insects & other |
| Haliplus robertsi | | Insects & other |
| Haliplus rugosus | | Insects & other |
| Haliplus subguttatus | | Insects & other |
| Haliplus tumidus | | Insects & other |
| Halobates sericeus | | Insects & other |
| Haploperla chilnualna | Yosemite Sallfly | Insects & other |
| Harnischia curtilamellata | | Insects & other |
| Hastingsia alba | White Rushlily | Plants |
| Hayesomyia senata | | Insects & other |
| Hebrus buenoi | | Insects & other |
| Hebrus hubbardi | | Insects & other |
| Hebrus longivillus | | Insects & other |

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| Hebrus major | | Insects & other |
| Hebrus obscurus | | Insects & other |
| Hebrus sobrinus | | Insects & other |
| Helenium autumnale | Common Sneezeweed | Plants |
| Helenium bigelovii | Bigelow's Sneezeweed | Plants |
| Helenium bolanderi | Coast Sneezeweed | Plants |
| Helenium puberulum | Rosilla | Plants |
| Helichus columbianus | | Insects & other |
| Helichus striatus | | Insects & other |
| Helichus suturalis | | Insects & other |
| Helichus triangularis | | Insects & other |
| Helicopsyche borealis | A Caddisfly | Insects & other |
| Helicopsyche mexicana | A Caddisfly | Insects & other |
| Helicopsyche pietia | | Insects & other |
| Helicopsyche sinuata | A Caddisfly | Insects & other |
| Helisoma anceps | Two-ridge Rams-horn | Mollusks |
| Helisoma minus | A Freshwater Snail | Mollusks |
| Helisoma newberryi newberryi | Great Basin Rams-horn | Mollusks |
| Helisoma subcrenatum | | Mollusks |
| Helochares normatus | | Insects & other |
| Helodon beardi | | Insects & other |
| Helodon chaos | | Insects & other |
| Helodon diadelphus | | Insects & other |
| Helodon mccreadiei | | Insects & other |
| Helodon newmani | | Insects & other |
| Helodon onchyodactylus | | Insects & other |
| Helodon protus | | Insects & other |
| Helodon susanae | | Insects & other |
| Helodon trochus | | Insects & other |
| Helophorus alternatus | | Insects & other |
| Helophorus auricollis | | Insects & other |
| Helophorus californicus | | Insects & other |
| Helophorus columbianus | | Insects & other |
| Helophorus cuspifer | | Insects & other |
| Helophorus eclectus | | Insects & other |
| Helophorus fenderi | | Insects & other |
| Helophorus fortis | | Insects & other |
| Helophorus hatchi | | Insects & other |
| Helophorus lacustris | | Insects & other |
| Helophorus lecontei | | Insects & other |
| Helophorus ledatus | | Insects & other |

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|---|---|---|
| Helophorus leechi | | Insects & other |
| Helophorus linearis | | Insects & other |
| Helophorus linearoides | | Insects & other |
| Helophorus nitiduloides | | Insects & other |
| Helophorus nitidulus | | Insects & other |
| Helophorus oblongus | | Insects & other |
| Helophorus oregonus | | Insects & other |
| Helophorus orientalis | | Insects & other |
| Helophorus parasplendidus | | Insects & other |
| Helophorus robertsi | | Insects & other |
| Helophorus schuhi | | Insects & other |
| Helophorus tuberculatus | | Insects & other |
| Hemiosus exilis | | Insects & other |
| Heptagenia adaequata | | Insects & other |
| Heptagenia elegantula | A Mayfly | Insects & other |
| Heptagenia solitaria | A Mayfly | Insects & other |
| Herthania compta | | Insects & other |
| Herthania concinna | | Insects & other |
| Hesperagrion heterodoxum | | Insects & other |
| Hesperocorixa atopodonta | | Insects & other |
| Hesperocorixa laevigata | | Insects & other |
| Hesperocorixa vulgaris | | Insects & other |
| Hesperoperla hoguei | Banded Stone | Insects & other |
| Hesperoperla pacifica | Golden Stone | Insects & other |
| Hesperophylax alaskensis | A Caddisfly | Insects & other |
| Hesperophylax consimilis | | Insects & other |
| Hesperophylax designatus | A Caddisfly | Insects & other |
| Hesperophylax magnus | A Caddisfly | Insects & other |
| Hesperophylax minutus | A Caddisfly | Insects & other |
| Hesperophylax occidentalis | A Caddisfly | Insects & other |
| Hetaerina americana | American Rubyspot | Insects & other |
| Hetaerina vulnerata | | Insects & other |
| Heteranthera limosa | NA | Plants |
| Heterelmis glabra | | Insects & other |
| Heterelmis obesa | | Insects & other |
| Heterelmis stephani | | Insects & other |
| Heterlimnius corpulentus | | Insects & other |
| Heterlimnius koebelei | | Insects & other |
| Heterocerus brunneus | | Insects & other |
| Heterocerus gemmatus | | Insects & other |
| Heterocerus gnatho | | Insects & other |

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| Heterocerus mexicanus | | Insects & other |
| Heterocerus mollinus | | Insects & other |
| Heterocerus parrotus | | Insects & other |
| Heterocerus sinuosus | | Insects & other |
| Heterocerus tristis | | Insects & other |
| Heterocerus unicus | | Insects & other |
| Heterocloeon anoka | | Insects & other |
| Heteroplectron californicum | A Caddisfly | Insects & other |
| Heterotrissocladius oliveri | | Insects & other |
| Hexagenia limbata | A Mayfly | Insects & other |
| Hibiscus lasiocarpos occidentalis | | Plants |
| Himalopsyche phryganea | A Caddisfly | Insects & other |
| Himantopus mexicanus | Black-necked Stilt | Birds |
| Hippuris vulgaris | Common Mare's-tail | Plants |
| Histrionicus histrionicus | Harlequin Duck | Birds |
| Holorusia hespera | | Insects & other |
| Homoleptohyphes dimorphus | A Mayfly | Insects & other |
| Homoleptohyphes mirus | | Insects & other |
| Homoleptohyphes quercus | | Insects & other |
| Homophylax adriana | | Insects & other |
| Homophylax andax | | Insects & other |
| Homophylax flavipennis | | Insects & other |
| Homophylax insulas | A Caddisfly | Insects & other |
| Homophylax nevadensis | A Caddisfly | Insects & other |
| Homophylax rentzi | A Caddisfly | Insects & other |
| Homoplectra alseae | | Insects & other |
| Homoplectra luchia | | Insects & other |
| Homoplectra nigripennis | A Caddisfly | Insects & other |
| Homoplectra norada | A Caddisfly | Insects & other |
| Homoplectra oaklandensis | A Caddisfly | Insects & other |
| Homoplectra schuhi | Schuh's Homoplectran Caddisfly | Insects & other |
| Homoplectra shasta | A Caddisfly | Insects & other |
| Homoplectra sierra | A Caddisfly | Insects & other |
| Homoplectra spora | A Caddisfly | Insects & other |
| Hosackia oblongifolia | NA | Plants |
| Howellia aquatilis | Water Howellia | Plants |
| Hyalella azteca | An Amphipod | Crustaceans |
| Hyalella muerta | An Amphipod | Crustaceans |
| Hyalella sandra | An Amphipod | Crustaceans |
| Hydaticus aruspex | | Insects & other |

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| Hydatophylax hesperus | A Caddisfly | Insects & other |
| Hydraena alternata | | Insects & other |
| Hydraena arenicola | | Insects & other |
| Hydraena arizonica | | Insects & other |
| Hydraena bituberculata | | Insects & other |
| Hydraena californica | | Insects & other |
| Hydraena circulata | | Insects & other |
| Hydraena leechi | | Insects & other |
| Hydraena mignymixys | | Insects & other |
| Hydraena nigra | | Insects & other |
| Hydraena occidentalis | | Insects & other |
| Hydraena pacifica | | Insects & other |
| Hydraena petila | | Insects & other |
| Hydraena sierra | | Insects & other |
| Hydraena tuolumne | | Insects & other |
| Hydraena vandykei | | Insects & other |
| Hydraena yosemitensis | | Insects & other |
| Hydrobaenus pilipes | | Insects & other |
| Hydrobaenus saetheri | | Insects & other |
| Hydrobius fuscipes | | Insects & other |
| Hydrochara lineata | | Insects & other |
| Hydrochara rickseckeri | Ricksecker's Water Scavenger Beetle | Insects & other |
| Hydrochus pseudosquamifer | | Insects & other |
| Hydrochus squamifer | | Insects & other |
| Hydrochus vagus | | Insects & other |
| Hydrochus variolatus | | Insects & other |
| Hydrocotyle ranunculoides | Floating Marsh-pennywort | Plants |
| Hydrocotyle umbellata | Many-flower Marsh-pennywort | Plants |
| Hydrocotyle verticillata verticillata | Whorled Marsh-pennywort | Plants |
| Hydrometra aemula | | Insects & other |
| Hydrometra australis | | Insects & other |
| Hydrometra lillianis | | Insects & other |
| Hydrometra martini | | Insects & other |
| Hydrophilus insularis | | Insects & other |
| Hydrophilus triangularis | | Insects & other |
| Hydroporus axillaris | | Insects & other |
| Hydroporus carri | | Insects & other |
| Hydroporus despectus | | Insects & other |
| Hydroporus fortis | | Insects & other |
| Hydroporus klamathensis | | Insects & other |

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| Hydroporus leechi | Leech's Skyline Diving Beetle | Insects & other |
| Hydroporus longiusculus | | Insects & other |
| Hydroporus mannerheimi | | Insects & other |
| Hydroporus notabilis | | Insects & other |
| Hydroporus occidentalis | | Insects & other |
| Hydroporus pervicinus | Wooly Hydroporus Diving Beetle | Insects & other |
| Hydroporus simplex | Simple Hydroporus Diving Beetle | Insects & other |
| Hydroporus sinuatipes | | Insects & other |
| Hydroporus subpubescens | | Insects & other |
| Hydroporus tademus | | Insects & other |
| Hydroporus tenebrosus | | Insects & other |
| Hydroporus transpunctatus | | Insects & other |
| Hydroporus tristis | | Insects & other |
| Hydroporus zackii | | Insects & other |
| Hydropsyche alternans | | Insects & other |
| Hydropsyche amblis | A Caddisfly | Insects & other |
| Hydropsyche andersoni | | Insects & other |
| Hydropsyche auricolor | | Insects & other |
| Hydropsyche californica | A Caddisfly | Insects & other |
| Hydropsyche centra | | Insects & other |
| Hydropsyche cockerelli | A Caddisfly | Insects & other |
| Hydropsyche cora | A Caddisfly | Insects & other |
| Hydropsyche dorata | | Insects & other |
| Hydropsyche intrica | A Caddisfly | Insects & other |
| Hydropsyche occidentalis | A Caddisfly | Insects & other |
| Hydropsyche oslari | A Caddisfly | Insects & other |
| Hydropsyche philo | A Caddisfly | Insects & other |
| Hydropsyche protis | | Insects & other |
| Hydropsyche tana | A Caddisfly | Insects & other |
| Hydropsyche venada | | Insects & other |
| Hydropsyche winema | | Insects & other |
| Hydroptila ajax | A Caddisfly | Insects & other |
| Hydroptila arctia | A Caddisfly | Insects & other |
| Hydroptila argosa | A Caddisfly | Insects & other |
| Hydroptila consimilis | | Insects & other |
| Hydroptila hamata | A Caddisfly | Insects & other |
| Hydroptila icona | A Caddisfly | Insects & other |
| Hydroptila lenora | | Insects & other |
| Hydroptila modica | | Insects & other |
| Hydroptila pecos | | Insects & other |
| Hydroptila rono | A Caddisfly | Insects & other |

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|---|---|---|
| Hydroptila xera | A Caddisfly | Insects & other |
| Hydroscapha natans | | Insects & other |
| Hydrotrupes palpalis | | Insects & other |
| Hydrovatus brevipes | | Insects & other |
| Hydrovatus davidis | | Insects & other |
| Hygrotus acaroides | | Insects & other |
| Hygrotus artus | Mono Lake Hygrotus Diving Beetle | Insects & other |
| Hygrotus bruesi | | Insects & other |
| Hygrotus collatus | | Insects & other |
| Hygrotus curvipes | Curved-foot Hygrotus Diving Beetle | Insects & other |
| Hygrotus dissimilis | | Insects & other |
| Hygrotus femoratus | | Insects & other |
| Hygrotus fontinalis | Travertine Band-thigh Diving Beetle | Insects & other |
| Hygrotus fraternus | | Insects & other |
| Hygrotus hydropicus | | Insects & other |
| Hygrotus impressopunctatus | | Insects & other |
| Hygrotus infuscatus | | Insects & other |
| Hygrotus intermedius | | Insects & other |
| Hygrotus lutescens | | Insects & other |
| Hygrotus marklini | | Insects & other |
| Hygrotus masculinus | | Insects & other |
| Hygrotus nigrescens | | Insects & other |
| Hygrotus nubilis | | Insects & other |
| Hygrotus obscureplagiatus | | Insects & other |
| Hygrotus patruelis | | Insects & other |
| Hygrotus pedalis | | Insects & other |
| Hygrotus sayi | | Insects & other |
| Hygrotus semivittatus | | Insects & other |
| Hygrotus sharpi | | Insects & other |
| Hygrotus thermarum | | Insects & other |
| Hygrotus tumidiventris | | Insects & other |
| Hygrotus turbidus | | Insects & other |
| Hygrotus unguicularis | | Insects & other |
| Hygrotus wardii | | Insects & other |
| Hyperacanthomysis longirostris | | Crustaceans |
| Hypericum anagalloides | Tinker's-penny | Plants |
| Hypomesus pacificus | Delta smelt | Fishes |
| Hysterocarpus traskii lagunae | Clear Lake tule perch | Fishes |
| Hysterocarpus traskii pomo | Russian River tule perch | Fishes |
| Hysterocarpus traskii traskii | Sacramento tule perch | Fishes |
| Icteria virens | Yellow-breasted Chat | Birds |

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|---|---|---|
| Iliamna rivularis | | Plants |
| Ilybius angustior | | Insects & other |
| Ilybius fraterculus | | Insects & other |
| Ilybius quadrimaculatus | | Insects & other |
| Incilius alvarius | Colorado River Toad | Herps |
| Ioscytus cobbeni | | Insects & other |
| Ioscytus franciscanus | | Insects & other |
| Ioscytus nasti | | Insects & other |
| Ioscytus politus | | Insects & other |
| Ioscytus tepidarius | | Insects & other |
| Ipnobius robustus | Robust Tryonia | Mollusks |
| Iris missouriensis | Western Blue Iris | Plants |
| Ironodes arcticus | | Insects & other |
| Ironodes californicus | A Mayfly | Insects & other |
| Ironodes lepidus | A Mayfly | Insects & other |
| Ironodes nitidus | A Mayfly | Insects & other |
| Ischnura barberi | Desert Forktail | Insects & other |
| Ischnura cervula | Pacific Forktail | Insects & other |
| Ischnura damula | | Insects & other |
| Ischnura demorsa | | Insects & other |
| Ischnura denticollis | Black-fronted Forktail | Insects & other |
| Ischnura erratica | Swift Forktail | Insects & other |
| Ischnura gemina | San Francisco Forktail | Insects & other |
| Ischnura hastata | Citrine Forktail | Insects & other |
| Ischnura perparva | Western Forktail | Insects & other |
| Ischnura ramburii | | Insects & other |
| Isocapnia abbreviata | Shortlimb Snowfly | Insects & other |
| Isocapnia agassizi | | Insects & other |
| Isocapnia eichlini | A Stonefly | Insects & other |
| Isocapnia grandis | Giant Snowfly | Insects & other |
| Isocapnia mogila | Irregular Snowfly | Insects & other |
| Isocapnia palousa | | Insects & other |
| Isocapnia rickeri | | Insects & other |
| Isocapnia spenceri | Chilliwack Snowfly | Insects & other |
| Isocapnia vedderensis | | Insects & other |
| Isoetes bolanderi | NA | Plants |
| Isoetes echinospora | NA | Plants |
| Isoetes howellii | NA | Plants |
| Isoetes nuttallii | NA | Plants |
| Isoetes occidentalis | NA | Plants |
| Isoetes orcuttii | NA | Plants |

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| Isogenoides colubrinus | Blackfoot Springfly | Insects & other |
| Isogenoides elongatus | | Insects & other |
| Isogenoides zionensis | | Insects & other |
| Isolepis cernua | Low Bulrush | Plants |
| Isolepis setacea | NA | Plants |
| Isonychia intermedia | | Insects & other |
| Isonychia velma | A Mayfly | Insects & other |
| Isoperla acula | Fresno Stipetail | Insects & other |
| Isoperla adunca | Arroyo Stripetail | Insects & other |
| Isoperla baumanni | California Stripetail | Insects & other |
| Isoperla bifurcata | Forked Stripetail | Insects & other |
| Isoperla denningi | Angeles Stripetail | Insects & other |
| Isoperla fulva | Western Stripetail | Insects & other |
| Isoperla gravitans | | Insects & other |
| Isoperla karuk | Klamath Stripetail | Insects & other |
| Isoperla laucki | Humboldt Stripetail | Insects & other |
| Isoperla marmorata | Red Stripetail | Insects & other |
| Isoperla miwok | Miwok Stripetail | Insects & other |
| Isoperla mormona | Mormon Stripetail | Insects & other |
| Isoperla muir | | Insects & other |
| Isoperla phalerata | | Insects & other |
| Isoperla pinta | Checkered Stripetail | Insects & other |
| Isoperla quinquepunctata | Fivespot Stripetail | Insects & other |
| Isoperla raineri | | Insects & other |
| Isoperla roguensis | Rogue Stripetail | Insects & other |
| Isoperla sobria | Colorado Stripetail | Insects & other |
| Isoperla sordida | Notched Stripetail | Insects & other |
| Isoperla tilasqua | | Insects & other |
| Ithytrichia clavata | A Caddisfly | Insects & other |
| Ithytrichia mexicana | | Insects & other |
| Ixobrychus exilis hesperis | Western Least Bittern | Birds |
| Jaumea carnosa | Fleshy Jaumea | Plants |
| Juga acutifilosa | Topaz Juga | Mollusks |
| Juga chacei | Chace Juga | Mollusks |
| Juga nigrina | Black Juga | Mollusks |
| Juga occata | Scalloped Juga | Mollusks |
| Juga orickensis | Redwood Juga | Mollusks |
| Juncus acuminatus | Sharp-fruit Rush | Plants |
| Juncus acutus leopoldii | Spiny Rush | Plants |
| Juncus anthelatus | NA | Plants |
| Juncus articulatus articulatus | | Plants |

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|---|---|---|
| Juncus bolanderi | Bolander's Rush | Plants |
| Juncus bryoides | Moss Rush | Plants |
| Juncus chlorocephalus | Green-head Rush | Plants |
| Juncus diffusissimus | NA | Plants |
| Juncus digitatus | Finger Rush | Plants |
| Juncus dubius | Mariposa Rush | Plants |
| Juncus duranii | Duran's Rush | Plants |
| Juncus effusus austrocalifornicus | | Plants |
| Juncus effusus effusus | NA | Plants |
| Juncus effusus pacificus | | Plants |
| Juncus exiguus | | Plants |
| Juncus falcatus falcatus | Sickle-leaf Rush | Plants |
| Juncus falcatus sitchensis | | Plants |
| Juncus hemiendytus abjectus | Dwarf Rush | Plants |
| Juncus hemiendytus hemiendytus | Dwarf Rush | Plants |
| Juncus hesperius | | Plants |
| Juncus leiospermus | NA | Plants |
| Juncus lescurii | | Plants |
| Juncus luciensis | Santa Lucia Dwarf Rush | Plants |
| Juncus macrandrus | Long-anther Rush | Plants |
| Juncus macrophyllus | Longleaf Rush | Plants |
| Juncus marginatus | NA | Plants |
| Juncus mertensianus | Mertens' Rush | Plants |
| Juncus nevadensis inventus | Sierra Rush | Plants |
| Juncus nodosus | NA | Plants |
| Juncus phaeocephalus paniculatus | Brownhead Rush | Plants |
| Juncus phaeocephalus phaeocephalus | Brown-head Rush | Plants |
| Juncus planifolius | NA | Plants |
| Juncus regelii | Regel's Rush | Plants |
| Juncus rugulosus | Wrinkled Rush | Plants |
| Juncus saximontanus | Rocky Mountain Rush | Plants |
| Juncus supiniformis | Hairyleaf Rush | Plants |
| Juncus textilis | Basket Rush | Plants |
| Juncus uncialis | Inch-high Rush | Plants |
| Juncus usitatus | NA | Plants |
| Juncus xiphioides | Iris-leaf Rush | Plants |
| Kathroperla perdita | Longhead Sallfly | Insects & other |
| Kathroperla takhoma | Slenderhead Sallfly | Insects & other |

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| Kiefferulus dux | | Insects & other |
| Kiefferulus modocensis | | Insects & other |
| Kinosternon sonoriense | Sonoran Mud Turtle | Herps |
| Kobresia myosuroides | Pacific Kobresia | Plants |
| Kogotus nonus | Smooth Springfly | Insects & other |
| Konikea expansipalpis | | Insects & other |
| Krenopelopia narda | | Insects & other |
| Kyhosia bolanderi | | Plants |
| Labrundinia maculata | | Insects & other |
| Labrundinia pilosella | | Insects & other |
| Laccobius acutipenis | | Insects & other |
| Laccobius agilis | | Insects & other |
| Laccobius borealis | | Insects & other |
| Laccobius bruesi | | Insects & other |
| Laccobius californicus | | Insects & other |
| Laccobius carri | | Insects & other |
| Laccobius ellipticus | | Insects & other |
| Laccobius hardyi | | Insects & other |
| Laccobius insolitus | | Insects & other |
| Laccobius leechi | | Insects & other |
| Laccobius mexicanus | | Insects & other |
| Laccobius nevadensis | | Insects & other |
| Laccobius occidentalis | | Insects & other |
| Laccobius oregonensis | | Insects & other |
| Laccobius pacificus | | Insects & other |
| Laccobius piceus | | Insects & other |
| Laccobius tridentipenis | | Insects & other |
| Laccobius truncatipenis | | Insects & other |
| Laccophilus biguttatus | | Insects & other |
| Laccophilus fasciatus terminalis | | Insects & other |
| Laccophilus horni | | Insects & other |
| Laccophilus maculosus | | Insects & other |
| Laccophilus maculosus decipiens | | Insects & other |
| Laccophilus maculosus shermani | | Insects & other |
| Laccophilus mexicanus atristernalis | | Insects & other |
| Laccophilus mexicanus mexicanus | | Insects & other |
| Laccophilus oscillator | | Insects & other |
| Laccophilus pictus | | Insects & other |

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| Laccophilus quadrilineatus quadrilineatus | | Insects & other |
| Laccophilus salvini | | Insects & other |
| Laccophilus sonorensis | | Insects & other |
| Laccophilus vacaensis | | Insects & other |
| Laccornis pacificus | | Insects & other |
| Lachlania saskatchewanensis | | Insects & other |
| Ladona julia | Chalk-fronted Corporal | Insects & other |
| Lampetra ayersi | River lamprey | Fishes |
| Lampetra hubbsi | Kern brook lamprey | Fishes |
| Lampetra lethophaga | Pit-Klamath brook lamprey | Fishes |
| Lampetra richardsoni | Western brook lamprey | Fishes |
| Landoltia punctata | NA | Plants |
| Lanx alta | Highcap Lanx | Mollusks |
| Lanx hannai | | Mollusks |
| Lanx klamathensis | Scale Lanx | Mollusks |
| Lanx patelloides | Kneecap Lanx | Mollusks |
| Lanx subrotundatus | | Mollusks |
| Lara avara | | Insects & other |
| Lara gehringi | | Insects & other |
| Larsia decolorata | | Insects & other |
| Larsia lyra | | Insects & other |
| Larsia marginella | | Insects & other |
| Larsia planensis | | Insects & other |
| Larsia sequoiaensis | | Insects & other |
| Larus livens | Yellow-footed Gull | Birds |
| Lasthenia burkei | Burke's Goldfields | Plants |
| Lasthenia conjugens | Contra Costa Goldfields | Plants |
| Lasthenia ferrisiae | Ferris' Goldfields | Plants |
| Lasthenia fremontii | Fremont's Goldfields | Plants |
| Lasthenia glabrata coulteri | Coulter's Goldfields | Plants |
| Laterallus jamaicensis coturniculus | California Black Rail | Birds |
| Lathyrus jepsonii | NA | Plants |
| Lathyrus palustris | Vetchling Peavine | Plants |
| Lauterborniella agrayloides | | Insects & other |
| Lavinia exilicauda chi | Clear Lake hitch | Fishes |
| Lavinia exilicauda exilicauda | Sacramento hitch | Fishes |
| Lavinia exilicauda harengeus | Monterey hitch | Fishes |
| Lavinia mitrulus | Northern (Pit) roach | Fishes |
| Lavinia parvipinnus | Gualala roach | Fishes |
| Lavinia symmetricus navarroensis | Navarro roach | Fishes |

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| Lavinia symmetricus ssp. 1 | Russian River roach | Fishes |
| Lavinia symmetricus ssp. 2 | Red Hills roach | Fishes |
| Lavinia symmetricus ssp. 3 | Clear Lake roach | Fishes |
| Lavinia symmetricus ssp. 4 | Tomales roach | Fishes |
| Lavinia symmetricus subditus | Monterey roach | Fishes |
| Lavinia symmetricus symmetricus | Central California roach | Fishes |
| Lednia sierra | A Stonefly | Insects & other |
| Leersia oryzoides | Rice Cutgrass | Plants |
| Legenere limosa | False Venus'-looking-glass | Plants |
| Lemna aequinoctialis | Lesser Duckweed | Plants |
| Lemna gibba | Inflated Duckweed | Plants |
| Lemna minor | Lesser Duckweed | Plants |
| Lemna minuta | Least Duckweed | Plants |
| Lemna trisulca | Star Duckweed | Plants |
| Lemna turionifera | Turion Duckweed | Plants |
| Lemna valdiviana | Pale Duckweed | Plants |
| Lenarchus brevipennis | | Insects & other |
| Lenarchus gravidus | A Caddisfly | Insects & other |
| Lenarchus rho | | Insects & other |
| Lenarchus rillus | A Caddisfly | Insects & other |
| Lenarchus vastus | A Caddisfly | Insects & other |
| Lepania cascada | | Insects & other |
| Lepidium jaredii jaredii | Jared's Pepper-grass | Plants |
| Lepidium oxycarpum | Sharp-pod Pepper-grass | Plants |
| Lepidostoma acarolum | | Insects & other |
| Lepidostoma apache | | Insects & other |
| Lepidostoma apornum | | Insects & other |
| Lepidostoma astaneum | A Caddisfly | Insects & other |
| Lepidostoma bakeri | | Insects & other |
| Lepidostoma baxea | A Caddisfly | Insects & other |
| Lepidostoma canthum | A Caddisfly | Insects & other |
| Lepidostoma cascadense | A Caddisfly | Insects & other |
| Lepidostoma castalianum | A Caddisfly | Insects & other |
| Lepidostoma cinereum | A Caddisfly | Insects & other |
| Lepidostoma ermanae | Cold Spring Caddisfly | Insects & other |
| Lepidostoma errigenum | A Caddisfly | Insects & other |
| Lepidostoma hoodi | | Insects & other |
| Lepidostoma jewetti | A Caddisfly | Insects & other |
| Lepidostoma knulli | | Insects & other |
| Lepidostoma lacinatum | | Insects & other |

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| Lepidostoma licolum | A Caddisfly | Insects & other |
| Lepidostoma lotor | A Caddisfly | Insects & other |
| Lepidostoma mexicanum | | Insects & other |
| Lepidostoma ojanum | A Caddisfly | Insects & other |
| Lepidostoma ormeum | | Insects & other |
| Lepidostoma pluviale | A Caddisfly | Insects & other |
| Lepidostoma podagrum | A Caddisfly | Insects & other |
| Lepidostoma quericinum | | Insects & other |
| Lepidostoma rayneri | A Caddisfly | Insects & other |
| Lepidostoma recinum | A Caddisfly | Insects & other |
| Lepidostoma roafi | A Caddisfly | Insects & other |
| Lepidostoma stigma | | Insects & other |
| Lepidostoma unicolor | A Caddisfly | Insects & other |
| Lepidostoma verodum | A Caddisfly | Insects & other |
| Lepidurus bilobatus | | Crustaceans |
| Lepidurus cryptus | Cryptic Tadpole Shrimp | Crustaceans |
| Lepidurus lemmoni | Lynch Tadpole Shrimp | Crustaceans |
| Lepidurus packardi | Vernal Pool Tadpole Shrimp | Crustaceans |
| Leptestheria compleximanus | Spineynose Clam Shrimp | Crustaceans |
| Leptohyphes apache | | Insects & other |
| Leptohyphes ferruginus | | Insects & other |
| Leptohyphes lestes | | Insects & other |
| Leptohyphes zalope | | Insects & other |
| Leptophlebia cupida | A Mayfly | Insects & other |
| Leptophlebia pacifica | A Mayfly | Insects & other |
| Lestes alacer | | Insects & other |
| Lestes congener | Spotted Spreadwing | Insects & other |
| Lestes disjunctus | Northern Spreadwing | Insects & other |
| Lestes dryas | Emerald Spreadwing | Insects & other |
| Lestes stultus | Black Spreadwing | Insects & other |
| Lestes unguiculatus | Lyre-tipped Spreadwing | Insects & other |
| Lethocerus americanus | | Insects & other |
| Lethocerus angustipes | | Insects & other |
| Lethocerus medius | | Insects & other |
| Leucorrhinia glacialis | Crimson-ringed Whiteface | Insects & other |
| Leucorrhinia hudsonica | Hudsonian Whiteface | Insects & other |
| Leucorrhinia intacta | Dot-tailed Whiteface | Insects & other |
| Leucorrhinia proxima | Belted Whiteface | Insects & other |
| Leucothoe davisiae | Western Doghobble | Plants |
| Leucotrichia limpia | | Insects & other |
| Leucotrichia pictipes | A Micro Caddisfly | Insects & other |

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| Leucotrichia sarita | | Insects & other |
| Leucrocuta jewetti | | Insects & other |
| Lewisia cantelovii | Cantelow's Lewisia | Plants |
| Libellula comanche | Comanche Skimmer | Insects & other |
| Libellula composita | Bleached Skimmer | Insects & other |
| Libellula croceipennis | Neon Skimmer | Insects & other |
| Libellula forensis | Eight-spotted Skimmer | Insects & other |
| Libellula luctuosa | Widow Skimmer | Insects & other |
| Libellula nodisticta | Hoary Skimmer | Insects & other |
| Libellula pulchella | Twelve-spotted Skimmer | Insects & other |
| Libellula quadrimaculata | Four-spotted Skimmer | Insects & other |
| Libellula saturata | Flame Skimmer | Insects & other |
| Lichminus tenuicornis | | Insects & other |
| Ligidium kofoidi | A Cave Obligate Isopod | Crustaceans |
| Lilaeopsis masonii | Mason's Lilaeopsis | Plants |
| Lilaeopsis occidentalis | Western Lilaeopsis | Plants |
| Lilium kelleyanum | Kelley's Lily | Plants |
| Lilium pardalinum pardalinum | Leopard Lily | Plants |
| Lilium pardalinum pitkinense | Pitkin Marsh Lily | Plants |
| Lilium pardalinum shastense | Leopard Lily | Plants |
| Lilium pardalinum vollmeri | Vollmer's Lily | Plants |
| Lilium pardalinum wigginsii | Wiggin's Lily | Plants |
| Lilium parryi | Lemon Lily | Plants |
| Lilium parvum | Small Tiger Lily | Plants |
| Limnanthes alba alba | White Meadowfoam | Plants |
| Limnanthes alba parishii | NA | Plants |
| Limnanthes alba versicolor | White Meadowfoam | Plants |
| Limnanthes bakeri | Baker's Meadowfoam | Plants |
| Limnanthes douglasii douglasii | Douglas' Meadowfoam | Plants |
| Limnanthes douglasii nivea | Douglas' Meadowfoam | Plants |
| Limnanthes douglasii rosea | Douglas' Meadowfoam | Plants |
| Limnanthes douglasii striata | | Plants |
| Limnanthes douglasii sulphurea | Pt. Reyes Meadowfoam | Plants |
| Limnanthes floccosa bellingeriana | Bellinger's Meadowfoam | Plants |
| Limnanthes floccosa californica | Shippee Meadowfoam | Plants |
| Limnanthes floccosa floccosa | Woolly Meadowfoam | Plants |
| Limnanthes montana | Mountain Meadowfoam | Plants |
| Limnanthes vinculans | Sebastopol Meadowfoam | Plants |
| Limnebius alutaceous | | Insects & other |
| Limnebius arenicolus | | Insects & other |

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| Limnebius leechi | | Insects & other |
| Limnebius piceus | | Insects & other |
| Limnebius sinuatus | | Insects & other |
| Limnephilus abbreviatus | | Insects & other |
| Limnephilus acnestus | A Caddisfly | Insects & other |
| Limnephilus acula | A Caddisfly | Insects & other |
| Limnephilus alconura | Klamath Limnephilan Caddisfly | Insects & other |
| Limnephilus apache | | Insects & other |
| Limnephilus aretto | A Caddisfly | Insects & other |
| Limnephilus arizona | | Insects & other |
| Limnephilus assimilis | A Caddisfly | Insects & other |
| Limnephilus atercus | Fort Dick Limnephilus Caddisfly | Insects & other |
| Limnephilus bucketti | A Caddisfly | Insects & other |
| Limnephilus canadensis | | Insects & other |
| Limnephilus catula | A Caddisfly | Insects & other |
| Limnephilus coloradensis | A Caddisfly | Insects & other |
| Limnephilus concolor | A Caddisfly | Insects & other |
| Limnephilus diversus | | Insects & other |
| Limnephilus ectus | | Insects & other |
| Limnephilus elongatus | | Insects & other |
| Limnephilus externus | A Caddisfly | Insects & other |
| Limnephilus fagus | | Insects & other |
| Limnephilus frijole | A Caddisfly | Insects & other |
| Limnephilus granti | | Insects & other |
| Limnephilus hyalinus | | Insects & other |
| Limnephilus insularis | | Insects & other |
| Limnephilus kalama | | Insects & other |
| Limnephilus kennicotti | | Insects & other |
| Limnephilus lithus | | Insects & other |
| Limnephilus lopho | | Insects & other |
| Limnephilus lunonus | | Insects & other |
| Limnephilus moestus | | Insects & other |
| Limnephilus morrisoni | A Caddisfly | Insects & other |
| Limnephilus neoacula | | Insects & other |
| Limnephilus nogus | A Caddisfly | Insects & other |
| Limnephilus occidentalis | A Caddisfly | Insects & other |
| Limnephilus peltus | A Caddisfly | Insects & other |
| Limnephilus productus | A Caddisfly | Insects & other |
| Limnephilus rothi | | Insects & other |
| Limnephilus santanus | | Insects & other |
| Limnephilus secludens | A Caddisfly | Insects & other |

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| Limnephilus sericeus | | Insects & other |
| Limnephilus sierrata | A Caddisfly | Insects & other |
| Limnephilus silviae | | Insects & other |
| Limnephilus sitchensis | | Insects & other |
| Limnephilus spinatus | A Caddisfly | Insects & other |
| Limnephilus tulatus | | Insects & other |
| Limnichites foraminosus | | Insects & other |
| Limnichites nebulosus | | Insects & other |
| Limnichites perforatus | | Insects & other |
| Limnichoderus lutrochinus | | Insects & other |
| Limnichoderus naviculatus | | Insects & other |
| Limnobium spongia | NA | Plants |
| Limnochares anomala | | Insects & other |
| Limnocoris moapensis | | Insects & other |
| Limnodromus scolopaceus | Long-billed Dowitcher | Birds |
| Limnophyes asquamatus | | Insects & other |
| Limnophyes doughmani | | Insects & other |
| Limnophyes hamiltoni | | Insects & other |
| Limnophyes natalensis | | Insects & other |
| Limnophyes pilicistulus | | Insects & other |
| Limnoporus notabilis | | Insects & other |
| Limonium californicum | California Sea-lavender | Plants |
| Limosella acaulis | Southern Mudwort | Plants |
| Limosella aquatica | Northern Mudwort | Plants |
| Limosella australis | NA | Plants |
| Linderiella occidentalis | California Fairy Shrimp | Crustaceans |
| Linderiella santarosae | Santa Rosa Plateau Fairy Shrimp | Crustaceans |
| Lindernia dubia | Yellowseed False Pimpernel | Plants |
| Liodessus obscurellus | | Insects & other |
| Liodessus saratogae | | Insects & other |
| Lipocarpha micrantha | Dwarf Bulrush | Plants |
| Lithobates pipiens | Northern Leopard Frog | Herps |
| Lithobates yavapaiensis | Yavapai Leopard Frog | Herps |
| Lobelia cardinalis cardinalis | NA | Plants |
| Lobelia cardinalis pseudosplendens | | Plants |
| Lobelia dunnii serrata | Dunn's Lobelia | Plants |
| Lontra canadensis canadensis | North American River Otter | Mammals |
| Lontra canadensis sonora | Southwestern River Otter | Mammals |
| Lophodytes cucullatus | Hooded Merganser | Birds |
| Ludwigia grandiflora | NA | Plants |

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| Ludwigia hexapetala | NA | Plants |
| Ludwigia palustris | Marsh Seedbox | Plants |
| Ludwigia peploides montevidensis | NA | Plants |
| Ludwigia peploides peploides | NA | Plants |
| Ludwigia repens | Creeping Seedbox | Plants |
| Lupinus polyphyllus burkei | | Plants |
| Lupinus polyphyllus pallidipes | Largeleaf Lupine | Plants |
| Lupinus polyphyllus polyphyllus | Bigleaf Lupine | Plants |
| Lutrochus arizonensis | | Insects & other |
| Lycastoides alticola | | Insects & other |
| Lycopodiella inundata | NA | Plants |
| Lycopus americanus | American Bugleweed | Plants |
| Lycopus uniflorus uniflorus | Northern Bugleweed | Plants |
| Lymnaea stagnalis | Swamp Lymnaea | Mollusks |
| Lynceus brachyurus | Holarctic Clam Shrimp | Crustaceans |
| Lynceus brevifrons | | Crustaceans |
| Lysichiton americanus | Yellow Skunk-cabbage | Plants |
| Lysimachia thyrsiflora | Water Loosestrife | Plants |
| Lythrum californicum | California Loosestrife | Plants |
| Lythrum portula | NA | Plants |
| Maccaffertium terminatum | A Mayfly | Insects & other |
| Macrelmis moestus | | Insects & other |
| Macrodiplax balteata | Marl Pennant | Insects & other |
| Macromia magnifica | Western River Cruiser | Insects & other |
| Macrothemis inacuta | | Insects & other |
| Macrovelia hornii | | Insects & other |
| Malenka bifurcata | | Insects & other |
| Malenka biloba | Two-lobed Forestfly | Insects & other |
| Malenka californica | California Forestfly | Insects & other |
| Malenka coloradensis | | Insects & other |
| Malenka cornuta | Horned Forestfly | Insects & other |
| Malenka depressa | Bluntlobe Forestfly | Insects & other |
| Malenka flexura | | Insects & other |
| Malenka marionae | Sagehen Forestfly | Insects & other |
| Malenka murvoshi | | Insects & other |
| Malenka perplexa | | Insects & other |
| Malenka tina | | Insects & other |
| Margaritifera falcata | Western Pearlshell | Mollusks |
| Marilia flexuosa | A Caddisfly | Insects & other |
| Marilia nobsca | | Insects & other |

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|---|---|---|
| Marsilea oligospora | NA | Plants |
| Marsilea vestita vestita | NA | Plants |
| Martarega mexicana | | Insects & other |
| Maruina lanceolata | | Insects & other |
| Matriella teresa | A Mayfly | Insects & other |
| Mayatrichia acuna | | Insects & other |
| Mayatrichia ayama | | Insects & other |
| Mayatrichia ponta | | Insects & other |
| Megaceryle alcyon | Belted Kingfisher | Birds |
| Megaleuctra complicata | | Insects & other |
| Megaleuctra kincaidi | | Insects & other |
| Megaleuctra sierra | Sierra Needlefly | Insects & other |
| Megarcys signata | | Insects & other |
| Megarcys subtruncata | | Insects & other |
| Megarcys yosemite | Yosemite Springfly | Insects & other |
| Menetus opercularis | Button Sprite | Mollusks |
| Menyanthes trifoliata | Bog Buckbean | Plants |
| Mergus merganser | Common Merganser | Birds |
| Mergus serrator | Red-breasted Merganser | Birds |
| Meringodixa chalonensis | | Insects & other |
| Meropelopia flavifrons | | Insects & other |
| Merragata hebroides | | Insects & other |
| Mesocapnia arizonensis | | Insects & other |
| Mesocapnia autumna | | Insects & other |
| Mesocapnia bakeri | Pomona Snowfly | Insects & other |
| Mesocapnia bulbosa | Bulbous Snowfly | Insects & other |
| Mesocapnia frisoni | | Insects & other |
| Mesocapnia lapwae | | Insects & other |
| Mesocapnia oenone | | Insects & other |
| Mesocapnia porrecta | Stretched Snowfly | Insects & other |
| Mesocapnia projecta | Spined Snowfly | Insects & other |
| Mesocapnia werneri | Sabino Snowfly | Insects & other |
| Mesocapnia yoloensis | Yolo Snowfly | Insects & other |
| Mesovelia amoena | | Insects & other |
| Mesovelia mulsanti | | Insects & other |
| Metacnephia coloradensis | | Insects & other |
| Metacnephia jeanae | | Insects & other |
| Metacnephia villosa | | Insects & other |
| Metrichia arizonensis | | Insects & other |
| Metrichia nigritta | | Insects & other |
| Metriocnemus edwardsi | | Insects & other |

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| Metriocnemus stevensi | | Insects & other |
| Metriocnemus yaquina | | Insects & other |
| Metrobates denticornis | | Insects & other |
| Metrobates trux | | Insects & other |
| Micracanthia fennica | | Insects & other |
| Micracanthia humilis | | Insects & other |
| Micracanthia quadrimaculata | | Insects & other |
| Micracanthia schuhi | | Insects & other |
| Micracanthia utahensis | | Insects & other |
| Micranthes aprica | | Plants |
| Micranthes marshallii | NA | Plants |
| Micranthes odontoloma | | Plants |
| Micranthes oregana | NA | Plants |
| Micrasema arizonica | | Insects & other |
| Micrasema bactro | A Caddisfly | Insects & other |
| Micrasema dimicki | | Insects & other |
| Micrasema diteris | A Caddisfly | Insects & other |
| Micrasema onisca | A Caddisfly | Insects & other |
| Micrasema oregona | | Insects & other |
| Microchironomus nigrovittatus | | Insects & other |
| Microcylloepus formicoideus | Furnace Creek Riffle Beetle | Insects & other |
| Microcylloepus moapus | | Insects & other |
| Microcylloepus similis | | Insects & other |
| Microcylloepus thermarum | | Insects & other |
| Micromenetus dilatatus | Bugle Sprite | Mollusks |
| Micropsectra nigripila | | Insects & other |
| Micropsectra polita | | Insects & other |
| Microtendipes caducus | | Insects & other |
| Microtendipes pedellus | | Insects & other |
| Microvelia beameri | | Insects & other |
| Microvelia buenoi | | Insects & other |
| Microvelia californiensis | | Insects & other |
| Microvelia cerifera | | Insects & other |
| Microvelia fasculifera | | Insects & other |
| Microvelia gerhardi | | Insects & other |
| Microvelia glabrosulcata | | Insects & other |
| Microvelia hinei | | Insects & other |
| Microvelia paludicola | | Insects & other |
| Microvelia pulchella | | Insects & other |
| Microvelia rasilis | | Insects & other |
| Microvelia rufescens | | Insects & other |

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| Microvelia signata | | Insects & other |
| Microvelia torquata | | Insects & other |
| Mideopsis pumila | | Insects & other |
| Mimulus alsinoides | Chickweed Monkeyflower | Plants |
| Mimulus angustatus | Narrowleaf Pansy Monkeyflower | Plants |
| Mimulus breviflorus | Short-flower Monkeyflower | Plants |
| Mimulus cardinalis | Scarlet Monkeyflower | Plants |
| Mimulus dentatus | Tooth-leaf Monkeyflower | Plants |
| Mimulus evanescens | Disappearing Monkeyflower | Plants |
| Mimulus glaucescens | Shield-bract Monkeyflower | Plants |
| Mimulus guttatus | Common Large Monkeyflower | Plants |
| Mimulus laciniatus | Cutleaf Monkeyflower | Plants |
| Mimulus latidens | Broad-tooth Monkeyflower | Plants |
| Mimulus lewisii | Lewis' Monkeyflower | Plants |
| Mimulus nudatus | Bare Monkeyflower | Plants |
| Mimulus parishii | Parish's Monkeyflower | Plants |
| Mimulus pilosus | | Plants |
| Mimulus primuloides linearifolius | Primrose Monkeyflower | Plants |
| Mimulus primuloides primuloides | Primrose Monkeyflower | Plants |
| Mimulus pulchellus | Pansy Monkeyflower | Plants |
| Mimulus ringens | Square-stem Monkeyflower | Plants |
| Mimulus tilingii tilingii | Subalpine Monkeyflower | Plants |
| Mimulus tricolor | Tricolor Monkeyflower | Plants |
| Mitellastra caulescens | | Plants |
| Momonia projecta | | Insects & other |
| Monopelopia tenuicalcar | | Insects & other |
| Montia chamissoi | Chamisso's Miner's-lettuce | Plants |
| Montia fontana fontana | Fountain Miner's-lettuce | Plants |
| Montia howellii | Howell's Miner's-lettuce | Plants |
| Moribaetis mimbresaurus | | Insects & other |
| Morphocorixa lundbladi | | Insects & other |
| Moselia infuscata | Hairy Needlefly | Insects & other |
| Moselyana comosa | | Insects & other |
| Muhlenbergia utilis | Aparejo Grass | Plants |
| Musulium partumeium | | Mollusks |
| Musulium secuirs | | Mollusks |
| Mycteria americana | Wood Stork | Birds |
| Mylopharodon conocephalus | Hardhead | Fishes |
| Myosotis laxa | Small Forget-me-not | Plants |
| Myosotis scorpioides | NA | Plants |

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| Myosurus apetalus | Bristly Mousetail | Plants |
| Myosurus minimus | NA | Plants |
| Myosurus sessilis | Sessile Mousetail | Plants |
| Myriophyllum aquaticum | NA | Plants |
| Myriophyllum hippuroides | Western Water-milfoil | Plants |
| Myriophyllum quitense | Andean Water-milfoil | Plants |
| Myriophyllum sibiricum | Common Water-milfoil | Plants |
| Myriophyllum verticillatum | Whorled Water-milfoil | Plants |
| Mysis diluviana | | Crustaceans |
| Mystacides alafimbriatus | A Caddisfly | Insects & other |
| Mystacides interjecta | | Insects & other |
| Mystacides sepulchralis | A Caddisfly | Insects & other |
| Najas flexilis | Slender Naiad | Plants |
| Najas gracillima | NA | Plants |
| Najas guadalupensis guadalupensis | Southern Naiad | Plants |
| Namamyia plutonis | A Caddisfly | Insects & other |
| Namanereis hawaiiensis | | Insects & other |
| Nanocladius anderseni | | Insects & other |
| Nanonemoura wahkeena | | Insects & other |
| Narpus angustus | | Insects & other |
| Narpus arizonicus | | Insects & other |
| Narpus concolor | | Insects & other |
| Narthecium californicum | California Bog Asphodel | Plants |
| Nasturtium gambelii | NA | Plants |
| Natarsia miripes | | Insects & other |
| Navarretia cotulifolia | Cotula Navarretia | Plants |
| Navarretia fossalis | Spreading Navarretia | Plants |
| Navarretia heterandra | Tehama Navarretia | Plants |
| Navarretia intertexta | Needleleaf Navarretia | Plants |
| Navarretia leucocephala bakeri | Baker's Navarretia | Plants |
| Navarretia leucocephala leucocephala | White-flower Navarretia | Plants |
| Navarretia leucocephala minima | Least Navarretia | Plants |
| Navarretia leucocephala pauciflora | Few-flower Navarretia | Plants |
| Navarretia leucocephala plieantha | Many-flower Navarretia | Plants |
| Navarretia myersii deminuta | Small Pincushion Navarretia | Plants |
| Navarretia myersii myersii | Pincushion Navarretia | Plants |
| Navarretia prostrata | Prostrate Navarretia | Plants |
| Neanthes limnicola | | Insects & other |

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| Nectopsyche dorsalis | A Caddisfly | Insects & other |
| Nectopsyche gracilis | A Caddisfly | Insects & other |
| Nectopsyche lahontanensis | A Caddisfly | Insects & other |
| Nectopsyche minuta | A Caddisfly | Insects & other |
| Nectopsyche stigmatica | | Insects & other |
| Nehalennia irene | Sedge Sprite | Insects & other |
| Nemotaulius hostilis | | Insects & other |
| Nemoura spiniloba | Spiny Forestfly | Insects & other |
| Neochoroterpes kossi | | Insects & other |
| Neochthebius vandykei | | Insects & other |
| Neoclypeodytes amybethae | | Insects & other |
| Neoclypeodytes cinctellus | | Insects & other |
| Neoclypeodytes fryii | | Insects & other |
| Neoclypeodytes haroldi | | Insects & other |
| Neoclypeodytes leachi | | Insects & other |
| Neoclypeodytes ornatellus | | Insects & other |
| Neoclypeodytes pictodes | | Insects & other |
| Neoclypeodytes plicipennis | | Insects & other |
| Neoclypeodytes quadripustulatus | | Insects & other |
| Neoclypeodytes roughleyi | | Insects & other |
| Neocorixa snowi | | Insects & other |
| Neohermes californicus | | Insects & other |
| Neohermes filicornis | | Insects & other |
| Neomideopsis siuslawensis | | Insects & other |
| Neomysis kadiakensis | A Mysid Shrimp | Crustaceans |
| Neomysis mercedis | | Crustaceans |
| Neophylax occidentis | A Caddisfly | Insects & other |
| Neophylax rickeri | A Caddisfly | Insects & other |
| Neophylax splendens | A Caddisfly | Insects & other |
| Neoplea striola | | Insects & other |
| Neoporus arizonicus | | Insects & other |
| Neoporus dimidiatus | | Insects & other |
| Neoporus undulatus | | Insects & other |
| Neostapfia colusana | Colusa Grass | Plants |
| Neothremma alicia | A Caddisfly | Insects & other |
| Neothremma andersoni | | Insects & other |
| Neothremma didactyla | | Insects & other |
| Neothremma genella | Golden-horned Caddisfly | Insects & other |
| Neothremma macronata | A Caddisfly | Insects & other |
| Neothremma siskiyou | Siskiyou Caddisfly | Insects & other |

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|---|---|---|
| Neotrichia blinni | | Insects & other |
| Neotrichia halia | A Caddisfly | Insects & other |
| Neotrichia okopa | A Caddisfly | Insects & other |
| Neotrichia olorino | | Insects & other |
| Neotrichia osmena | | Insects & other |
| Neotrichia sandyae | | Insects & other |
| Neotrichia sonoroa | | Insects & other |
| Neovison vison | American Mink | Mammals |
| Nereis succinea | | Insects & other |
| Nerophilus californicus | A Caddisfly | Insects & other |
| Nerthra manni | | Insects & other |
| Nerthra martini | | Insects & other |
| Nerthra mexicana | | Insects & other |
| Nilotanypus fimbriatus | | Insects & other |
| Nilothauma babiyi | | Insects & other |
| Nilothauma mirabile | | Insects & other |
| Nitrophila mohavensis | Amargosa Niterwort | Plants |
| Nixe kennedyi | A Mayfly | Insects & other |
| Nothotrichia shasta | | Insects & other |
| Notonecta hoffmani | | Insects & other |
| Notonecta indica | | Insects & other |
| Notonecta irrorata | | Insects & other |
| Notonecta kirbyi | | Insects & other |
| Notonecta lobata | | Insects & other |
| Notonecta repanda | | Insects & other |
| Notonecta shooteri | | Insects & other |
| Notonecta spinosa | | Insects & other |
| Notonecta undulata | | Insects & other |
| Notonecta unifasciata | | Insects & other |
| Numenius americanus | Long-billed Curlew | Birds |
| Numenius phaeopus | Whimbrel | Birds |
| Nuphar polysepala | | Plants |
| Nycticorax nycticorax | Black-crowned Night-Heron | Birds |
| Nyctiophylax moestus | | Insects & other |
| Nymphaea mexicana | NA | Plants |
| Ochlerotatus aboriginis | | Insects & other |
| Ochlerotatus aloponotum | | Insects & other |
| Ochlerotatus bicristatus | | Insects & other |
| Ochlerotatus burgeri | | Insects & other |
| Ochlerotatus campestris | | Insects & other |
| Ochlerotatus cataphylla | | Insects & other |

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| Ochlerotatus clivis | | Insects & other |
| Ochlerotatus communis | | Insects & other |
| Ochlerotatus deserticola | | Insects & other |
| Ochlerotatus dorsalis | | Insects & other |
| Ochlerotatus epactius | | Insects & other |
| Ochlerotatus excrucians | | Insects & other |
| Ochlerotatus fitchii | | Insects & other |
| Ochlerotatus flavescens | | Insects & other |
| Ochlerotatus hendersoni | | Insects & other |
| Ochlerotatus hexodontus | | Insects & other |
| Ochlerotatus impiger | | Insects & other |
| Ochlerotatus implicatus | | Insects & other |
| Ochlerotatus increpitus | | Insects & other |
| Ochlerotatus intrudens | | Insects & other |
| Ochlerotatus melanimon | | Insects & other |
| Ochlerotatus monticola | | Insects & other |
| Ochlerotatus muelleri | | Insects & other |
| Ochlerotatus nevadensis | | Insects & other |
| Ochlerotatus nigromaculatus | | Insects & other |
| Ochlerotatus niphadopsis | | Insects & other |
| Ochlerotatus papago | | Insects & other |
| Ochlerotatus provocans | | Insects & other |
| Ochlerotatus pullatus | | Insects & other |
| Ochlerotatus purpureipes | | Insects & other |
| Ochlerotatus schizopinax | | Insects & other |
| Ochlerotatus sierrensis | | Insects & other |
| Ochlerotatus sollicitans | | Insects & other |
| Ochlerotatus squamiger | | Insects & other |
| Ochlerotatus sticticus | | Insects & other |
| Ochlerotatus taeniorhynchus | | Insects & other |
| Ochlerotatus tahoensis | | Insects & other |
| Ochlerotatus thelcter | | Insects & other |
| Ochlerotatus trivittatus | | Insects & other |
| Ochlerotatus varipalpus | | Insects & other |
| Ochlerotatus ventrovittus | | Insects & other |
| Ochlerotatus washinoi | | Insects & other |
| Ochrotrichia alexanderi | A Caddisfly | Insects & other |
| Ochrotrichia alsea | Alsea Ochrotrichian Micro Caddisfly | Insects & other |
| Ochrotrichia argentea | | Insects & other |
| Ochrotrichia arizonica | A Caddisfly | Insects & other |
| Ochrotrichia buccata | A Caddisfly | Insects & other |

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| Ochrotrichia burdicki | A Caddisfly | Insects & other |
| Ochrotrichia dactylophora | | Insects & other |
| Ochrotrichia hadria | A Caddisfly | Insects & other |
| Ochrotrichia honeyi | A Caddisfly | Insects & other |
| Ochrotrichia ildria | | Insects & other |
| Ochrotrichia logana | A Caddisfly | Insects & other |
| Ochrotrichia lometa | A Caddisfly | Insects & other |
| Ochrotrichia lucia | A Caddisfly | Insects & other |
| Ochrotrichia mono | A Caddisfly | Insects & other |
| Ochrotrichia nacora | A Caddisfly | Insects & other |
| Ochrotrichia okanoganensis | | Insects & other |
| Ochrotrichia oregona | | Insects & other |
| Ochrotrichia phenosa | Deschutes Ochrotrichian Micro Caddisfly | Insects & other |
| Ochrotrichia quadrispina | A Caddisfly | Insects & other |
| Ochrotrichia rothi | | Insects & other |
| Ochrotrichia salaris | A Caddisfly | Insects & other |
| Ochrotrichia spinulata | | Insects & other |
| Ochrotrichia stylata | A Caddisfly | Insects & other |
| Ochrotrichia tarsalis | | Insects & other |
| Ochrotrichia tenuata | A Caddisfly | Insects & other |
| Ochrotrichia trapoiza | A Caddisfly | Insects & other |
| Ochrotrichia vertreesi | Vertrees's Ochrotrichian Micro Caddisfly | Insects & other |
| Ochterus barberi | | Insects & other |
| Ochterus perbosci | | Insects & other |
| Ochterus rotundus | | Insects & other |
| Ochthebius apache | | Insects & other |
| Ochthebius arenicolus | | Insects & other |
| Ochthebius arizonicus | | Insects & other |
| Ochthebius aztecus | | Insects & other |
| Ochthebius biinicisus | | Insects & other |
| Ochthebius bisinuatus | | Insects & other |
| Ochthebius borealis | | Insects & other |
| Ochthebius brevipennis | | Insects & other |
| Ochthebius californicus | | Insects & other |
| Ochthebius costipennis | | Insects & other |
| Ochthebius crassalus | Wing-shoulder Minute Moss Beetle | Insects & other |
| Ochthebius crenatus | | Insects & other |
| Ochthebius cribricollis | | Insects & other |
| Ochthebius discretus | | Insects & other |
| Ochthebius gruwelli | | Insects & other |
| Ochthebius interruptus | | Insects & other |

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| Ochthebius lecontei | | Insects & other |
| Ochthebius leechi | | Insects & other |
| Ochthebius lineatus | | Insects & other |
| Ochthebius madrensis | | Insects & other |
| Ochthebius marinus | | Insects & other |
| Ochthebius martini | | Insects & other |
| Ochthebius mimicus | | Insects & other |
| Ochthebius orbus | | Insects & other |
| Ochthebius pacificus | | Insects & other |
| Ochthebius puncticollis | | Insects & other |
| Ochthebius recticulus | Wilbur Springs Minute Moss Beetle | Insects & other |
| Ochthebius rectus | | Insects & other |
| Ochthebius rectusalus | | Insects & other |
| Ochthebius richmondi | | Insects & other |
| Ochthebius sculptoides | | Insects & other |
| Ochthebius sculptus | | Insects & other |
| Ochthebius sierrensis | | Insects & other |
| Ochthebius similis | | Insects & other |
| Ochthebius tubus | | Insects & other |
| Ochthebius uniformis | | Insects & other |
| Octogomphus specularis | Grappletail | Insects & other |
| Oecetis arizonica | | Insects & other |
| Oecetis avara | A Caddisfly | Insects & other |
| Oecetis disjuncta | A Caddisfly | Insects & other |
| Oecetis inconspicua | A Caddisfly | Insects & other |
| Oecetis metlacensis | | Insects & other |
| Oecetis ochracea | A Caddisfly | Insects & other |
| Oemopteryx leei | A Stonefly | Insects & other |
| Oemopteryx vanduzeea | Alpine Willowfly | Insects & other |
| Oenanthe sarmentosa | Water-parsley | Plants |
| Oenothera longissima | Long-stem Evening-primrose | Plants |
| Oligophlebodes minutus | | Insects & other |
| Oligophlebodes mostbento | | Insects & other |
| Oligophlebodes ruthae | | Insects & other |
| Oligophlebodes sierra | A Caddisfly | Insects & other |
| Oligophlebodes sigma | | Insects & other |
| Onconeura semifimbriata | | Insects & other |
| Oncorhynchus clarki clarki | Coastal cutthroat trout | Fishes |
| Oncorhynchus clarki henshawi | Lahontan cutthroat trout | Fishes |
| Oncorhynchus clarki seleneris | Paiute cutthroat trout | Fishes |
| Oncorhynchus gorbuscha | Pink salmon | Fishes |

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| Oncorhynchus keta | Chum salmon | Fishes |
| Oncorhynchus kisutch - CCC | Central Coast coho salmon | Fishes |
| Oncorhynchus kisutch - SONCC | Southern Oregon Northern California coast coho salmon | Fishes |
| Oncorhynchus mykiss - CCC winter | Central California coast winter steelhead | Fishes |
| Oncorhynchus mykiss - CV | Central Valley steelhead | Fishes |
| Oncorhynchus mykiss - KMP summer | Klamath Mountains Province summer steelhead | Fishes |
| Oncorhynchus mykiss - KMP winter | Klamath Mountains Province winter steelhead | Fishes |
| Oncorhynchus mykiss - NC summer | Northern California coast summer steelhead | Fishes |
| Oncorhynchus mykiss - NC winter | Northern California coast winter steelhead | Fishes |
| Oncorhynchus mykiss - SCCC | South Central California coast steelhead | Fishes |
| Oncorhynchus mykiss - Southern CA | Southern California steelhead | Fishes |
| Oncorhynchus mykiss aguabonita | California golden trout | Fishes |
| Oncorhynchus mykiss aquilarum | Eagle Lake rainbow trout | Fishes |
| Oncorhynchus mykiss gilberti | Kern River rainbow trout | Fishes |
| Oncorhynchus mykiss irideus | Coastal rainbow trout | Fishes |
| Oncorhynchus mykiss ssp. 1 | Goose Lake redband trout | Fishes |
| Oncorhynchus mykiss stonei | McCloud River redband trout | Fishes |
| Oncorhynchus mykiss whitei | Little Kern golden trout | Fishes |
| Oncorhynchus tshawytscha - CCC fall | California Coast fall Chinook salmon | Fishes |
| Oncorhynchus tshawytscha - CV fall | Central Valley fall Chinook salmon | Fishes |
| Oncorhynchus tshawytscha - CV late fall | Central Valley late fall Chinook salmon | Fishes |
| Oncorhynchus tshawytscha - CV spring | Central Valley spring Chinook salmon | Fishes |
| Oncorhynchus tshawytscha - CV winter | Central Valley winter Chinook salmon | Fishes |
| Oncorhynchus tshawytscha - SONCC fall | Southern Oregon Northern California coast fall Chinook salmon | Fishes |
| Oncorhynchus tshawytscha - UKT fall | Upper Klamath-Trinity fall Chinook salmon | Fishes |
| Oncorhynchus tshawytscha - UKT spring | Upper Klamath-Trinity spring Chinook salmon | Fishes |
| Ondatra zibethicus | Common Muskrat | Mammals |

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| Onocosmoecus sequoiae | A Caddisfly | Insects & other |
| Onocosmoecus unicolor | A Caddisfly | Insects & other |
| Ophiogomphus arizonicus | | Insects & other |
| Ophiogomphus bison | Bison Snaketail | Insects & other |
| Ophiogomphus morrisoni | Great Basin Snaketail | Insects & other |
| Ophiogomphus occidentis | Sinuous Snaketail | Insects & other |
| Ophiogomphus severus | Pale Snaketail | Insects & other |
| Oplonaeschna armata | | Insects & other |
| Optioservus canus | Pinnacles Optioservus Riffle Beetle | Insects & other |
| Optioservus divergens | | Insects & other |
| Optioservus heteroclitus | | Insects & other |
| Optioservus quadrimaculatus | | Insects & other |
| Optioservus seriatus | | Insects & other |
| Oravelia pege | Dry Creek Cliff Strider Bug | Insects & other |
| Orconectes neglectus neglectus | | Crustaceans |
| Orcuttia californica | California Orcutt Grass | Plants |
| Orcuttia inaequalis | San Joaquin Valley Orcutt Grass | Plants |
| Orcuttia pilosa | Hairy Orcutt Grass | Plants |
| Orcuttia tenuis | Slender Orcutt Grass | Plants |
| Orcuttia viscida | Sacramento Orcutt Grass | Plants |
| Ordobrevia nubifera | | Insects & other |
| Oregonasellus elliotti | | Crustaceans |
| Oreodytes abbreviatus | | Insects & other |
| Oreodytes angustior | | Insects & other |
| Oreodytes congruus | | Insects & other |
| Oreodytes crassulus | | Insects & other |
| Oreodytes humboltensis | | Insects & other |
| Oreodytes obesus cordillerensis | | Insects & other |
| Oreodytes obesus obesus | | Insects & other |
| Oreodytes picturatus | | Insects & other |
| Oreodytes quadrimaculatus | | Insects & other |
| Oreodytes rhyacophilus | | Insects & other |
| Oreodytes scitulus bisulcatus | | Insects & other |
| Oreodytes scitulus scitulus | | Insects & other |
| Oreodytes sierrae | | Insects & other |
| Oreodytes subrotundus | | Insects & other |
| Oreoleptis torrenticola | | Insects & other |
| Oreostemma alpigenum andersonii | Anderson's Tundra Aster | Plants |
| Oreostemma elatum | Plumas Mountaincrown | Plants |
| Oreostemma peirsonii | Peirson's Aster | Plants |

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| Oreothlypis luciae | Lucy's Warbler | Birds |
| Orohermes crepusculus | | Insects & other |
| Oroperla barbara | Gilltail Springfly | Insects & other |
| Orthemis discolor | | Insects & other |
| Orthemis ferruginea | Roseate Skimmer | Insects & other |
| Orthilia secunda | One-side Wintergreen | Plants |
| Orthocladius appersoni | | Insects & other |
| Orthocladius carlatus | | Insects & other |
| Orthocladius dentifer | | Insects & other |
| Orthocladius dorenus | | Insects & other |
| Orthocladius dubitatus | | Insects & other |
| Orthocladius frigidus | | Insects & other |
| Orthocladius hellenthali | | Insects & other |
| Orthocladius lignicola | | Insects & other |
| Orthocladius luteipes | | Insects & other |
| Orthocladius mallochi | | Insects & other |
| Orthocladius obumbratus | | Insects & other |
| Orthocladius oliveri | | Insects & other |
| Orthocladius rivicola | | Insects & other |
| Orthocladius rubicundus | | Insects & other |
| Orthocladius subletti | | Insects & other |
| Orthodon microlepidotus | Sacramento blackfish | Fishes |
| Orthopodomyia kummi | | Insects & other |
| Orthopodomyia signifera | | Insects & other |
| Osobenus yakimae | Yakima Springfly | Insects & other |
| Ostrocerca dimicki | | Insects & other |
| Ostrocerca foersteri | | Insects & other |
| Oxyethira aculea | | Insects & other |
| Oxyethira aeola | | Insects & other |
| Oxyethira arizona | A Caddisfly | Insects & other |
| Oxyethira dualis | A Caddisfly | Insects & other |
| Oxyethira pallida | A Caddisfly | Insects & other |
| Oxypolis occidentalis | Western Cowbane | Plants |
| Oxyura jamaicensis | Ruddy Duck | Birds |
| Pachydiplax longipennis | Blue Dasher | Insects & other |
| Pacifastacus connectens | | Crustaceans |
| Pacifastacus fortis | Shasta Crayfish | Crustaceans |
| Pacifastacus gambelii | Pilose Crayfish | Crustaceans |
| Pacifastacus leniusculus klamathensis | Klamath Signal Crayfish | Crustaceans |
| Pacifastacus leniusculus leniusculus | Signal Crayfish | Crustaceans |

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| Pacifastacus leniusculus trowbridgii | Columbia River Signal Crayfish | Crustaceans |
| Pacifastacus nigrescens | Sooty Crayfish | Crustaceans |
| Palaeagapetus guppyi | | Insects & other |
| Palaeagapetus nearcticus | A Caddisfly | Insects & other |
| Palaemnema domina | | Insects & other |
| Palaemon macrodactylus | | Crustaceans |
| Palmacorixa buenoi | | Insects & other |
| Paltothemis lineatipes | Red Rock Skimmer | Insects & other |
| Pandion haliaetus | Osprey | Birds |
| Panicum acuminatum acuminatum | | Plants |
| Panicum acuminatum fasciculatum | | Plants |
| Panicum acuminatum lindheimeri | | Plants |
| Panicum acuminatum thermale | | Plants |
| Panicum dichotomiflorum | NA | Plants |
| Pantala flavescens | Wandering Glider | Insects & other |
| Pantala hymenaea | Spot-winged Glider | Insects & other |
| Paracapnia baumanni | A Stonefly | Insects & other |
| Paracapnia boris | A Stonefly | Insects & other |
| Paracapnia disala | Dirty Snowfly | Insects & other |
| Paracapnia ensicala | | Insects & other |
| Paracapnia humboldta | A Stonefly | Insects & other |
| Parachaetocladius imberbus | | Insects & other |
| Parachironomus abortivus | | Insects & other |
| Parachironomus chaetaolus | | Insects & other |
| Parachironomus directus | | Insects & other |
| Parachironomus frequens | | Insects & other |
| Parachironomus hazelriggi | | Insects & other |
| Parachironomus hirtalatus | | Insects & other |
| Parachironomus tenuicaudatus | | Insects & other |
| Paracladius conversus | | Insects & other |
| Paracladopelma alphaeus | | Insects & other |
| Paracloeodes minutus | A Small Minnow Mayfly | Insects & other |
| Paracoenia calida | Wilber Springs Shore Fly | Insects & other |
| Paracymus communis | | Insects & other |
| Paracymus confusus | | Insects & other |
| Paracymus elegans | | Insects & other |
| Paracymus ellipsis | | Insects & other |
| Paracymus restrictus | | Insects & other |

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| Paracymus subcupreus | | Insects & other |
| Paracymus tarsalis | | Insects & other |
| Parakiefferiella subaterrima | | Insects & other |
| Paralauterborniella nigrohalteris | | Insects & other |
| Paraleptophlebia altana | A Mayfly | Insects & other |
| Paraleptophlebia aquilina | | Insects & other |
| Paraleptophlebia associata | A Mayfly | Insects & other |
| Paraleptophlebia bicornuta | | Insects & other |
| Paraleptophlebia brunneipennis | | Insects & other |
| Paraleptophlebia cachea | A Mayfly | Insects & other |
| Paraleptophlebia californica | A Mayfly | Insects & other |
| Paraleptophlebia clara | A Mayfly | Insects & other |
| Paraleptophlebia debilis | A Mayfly | Insects & other |
| Paraleptophlebia falcula | | Insects & other |
| Paraleptophlebia gregalis | A Mayfly | Insects & other |
| Paraleptophlebia helena | A Mayfly | Insects & other |
| Paraleptophlebia heteronea | A Mayfly | Insects & other |
| Paraleptophlebia memorialis | A Mayfly | Insects & other |
| Paraleptophlebia packii | A Mayfly | Insects & other |
| Paraleptophlebia placeri | A Mayfly | Insects & other |
| Paraleptophlebia quisquilia | A Mayfly | Insects & other |
| Paraleptophlebia rufivenosa | A Mayfly | Insects & other |
| Paraleptophlebia sculleni | | Insects & other |
| Paraleptophlebia temporalis | A Mayfly | Insects & other |
| Paraleptophlebia vaciva | A Mayfly | Insects & other |
| Paraleptophlebia zayante | A Mayfly | Insects & other |
| Paraleuctra divisa | California Needlefly | Insects & other |
| Paraleuctra forcipata | Bullshorn Needlefly | Insects & other |
| Paraleuctra occidentalis | Western Needlefly | Insects & other |
| Paraleuctra projecta | | Insects & other |
| Paraleuctra vershina | Summit Needlefly | Insects & other |
| Paramerina fragilis | | Insects & other |
| Paramerina smithae | | Insects & other |
| Parametriocnemus lundbeckii | | Insects & other |
| Paraperla frontalis | Hyporheic Sallfly | Insects & other |
| Paraperla wilsoni | Chilliwack Sallfly | Insects & other |
| Paraphaenocladius exagitans | | Insects & other |
| Paraphaenocladius innasus | | Insects & other |
| Parapholis strigosa | NA | Plants |
| Parapsyche almota | A Caddisfly | Insects & other |
| Parapsyche elsis | A Caddisfly | Insects & other |

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| Parapsyche extensa | King's Creek Parapsyche Caddisfly | Insects & other |
| Parapsyche spinata | A Caddisfly | Insects & other |
| Parapsyche turbinata | A Caddisfly | Insects & other |
| Parasimulium crosskeyi | | Insects & other |
| Parasimulium furcatum | | Insects & other |
| Parasimulium species | | Insects & other |
| Parasimulium stonei | | Insects & other |
| Paratanytarsus grimmii | | Insects & other |
| Paratendipes albimanus | | Insects & other |
| Paratendipes basidens | | Insects & other |
| Paratendipes fuscitibia | | Insects & other |
| Paratendipes subaequalis | | Insects & other |
| Paratendipes thermophilus | | Insects & other |
| Paratrichocladius rufiventris | | Insects & other |
| Parnassia cirrata cirrata | Fringed Grass-of-Parnassus | Plants |
| Parnassia cirrata intermedia | | Plants |
| Parnassia fimbriata fimbriata | Fringed Grass-of-Parnassus | Plants |
| Parnassia palustris | Marsh Grass-of-Parnassus | Plants |
| Parnassia parviflora | Small-flower Grass-of-parnassus | Plants |
| Parochlus kiefferi | | Insects & other |
| Parthina linea | A Caddisfly | Insects & other |
| Parthina vierra | A Caddisfly | Insects & other |
| Paspalum distichum | Joint Paspalum | Plants |
| Patapius spinosus | | Insects & other |
| Pectiantia ovalis | NA | Plants |
| Pectiantia pentandra | | Plants |
| Pedicularis attollens | NA | Plants |
| Pedicularis groenlandica | NA | Plants |
| Pedomoecus sierra | A Caddisfly | Insects & other |
| Pelecanus erythrorhynchos | American White Pelican | Birds |
| Pelocoris biimpressus | | Insects & other |
| Peltodytes callosus | | Insects & other |
| Peltodytes dispersus | | Insects & other |
| Peltodytes mexicanus | | Insects & other |
| Peltodytes simplex | | Insects & other |
| Pentacora saratogae | | Insects & other |
| Pentacora signoreti | | Insects & other |
| Pentacora sphacelata | | Insects & other |
| Pentaneura inconspicua | | Insects & other |
| Pentaneura inyoensis | | Insects & other |
| Perideridia bacigalupii | Bacigalupi's Perideridia | Plants |

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|---|---|---|
| Perideridia bolanderi bolanderi | Bolander's Yampah | Plants |
| Perideridia bolanderi involucrata | Bolander's Yampah | Plants |
| Perideridia californica | California Yampah | Plants |
| Perideridia gairdneri borealis | Gairdner's Yampah | Plants |
| Perideridia gairdneri gairdneri | Gairdner's Yampah | Plants |
| Perideridia howellii | Howell's False Caraway | Plants |
| Perideridia kelloggii | Kellogg's Yampah | Plants |
| Perideridia lemmonii | Lemmon's Yampah | Plants |
| Perideridia leptocarpa | Narrow-seeded Yampah | Plants |
| Perideridia oregana | Oregon Yampah | Plants |
| Perideridia parishii latifolia | Parish's Yampah | Plants |
| Perideridia parishii parishii | Parish's Yampah | Plants |
| Perideridia pringlei | Pringle's Yampah | Plants |
| Perithemis domitia | | Insects & other |
| Perithemis intensa | Mexican Amberwing | Insects & other |
| Perithemis tenera | | Insects & other |
| Perlinodes aurea | Longgill Springfly | Insects & other |
| Perlomyia collaris | Black Needlefly | Insects & other |
| Perlomyia utahensis | Utah Needlefly | Insects & other |
| Persicaria amphibia | | Plants |
| Persicaria hydropiper | NA | Plants |
| Persicaria hydropiperoides | | Plants |
| Persicaria lapathifolia | | Plants |
| Persicaria maculosa | NA | Plants |
| Persicaria orientalis | NA | Plants |
| Persicaria pensylvanica | NA | Plants |
| Persicaria punctata | NA | Plants |
| Persicaria wallichii | NA | Plants |
| Petrophila confusalis | | Insects & other |
| Petrophila jaliscalis | | Insects & other |
| Petrophila kearfottalis | | Insects & other |
| Phacelia distans | NA | Plants |
| Phaenopsectra dyari | | Insects & other |
| Phaenopsectra flavipes | | Insects & other |
| Phaenopsectra mortensoni | | Insects & other |
| Phaenopsectra pilicellata | | Insects & other |
| Phaenopsectra profusa | | Insects & other |
| Phalacrocorax auritus | Double-crested Cormorant | Birds |
| Phalacroseris bolanderi | NA | Plants |
| Phalaris arundinacea | Reed Canarygrass | Plants |
| Phalaropus tricolor | Wilson's Phalarope | Birds |

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|---|---|---|
| Philarctus bergrothi | | Insects & other |
| Philocasca demita | | Insects & other |
| Philocasca oron | | Insects & other |
| Philocasca rivularis | A Caddisfly | Insects & other |
| Philorus californica | A Net-winged Midge | Insects & other |
| Philorus jacinto | A Net-winged Midge | Insects & other |
| Philorus vanduzeei | A Net-winged Midge | Insects & other |
| Philorus yosemite | A Net-winged Midge | Insects & other |
| Phragmites australis australis | Common Reed | Plants |
| Phreatobrachypoda robusta | | Insects & other |
| Phryganea cinerea | A Caddisfly | Insects & other |
| Phyla lanceolata | Fog-fruit | Plants |
| Phyla nodiflora | Common Frog-fruit | Plants |
| Phylloicus aeneus | | Insects & other |
| Phylloicus mexicanus | | Insects & other |
| Phyllospadix scouleri | Scouler's Surf-grass | Plants |
| Phyllospadix torreyi | Torrey's Surf-grass | Plants |
| Physa acuta | Pewter Physa | Mollusks |
| Physa gyrina | Tadpole Physa | Mollusks |
| Physella boucardi | Desert Physa | Mollusks |
| Physella cooperi | Olive Physa | Mollusks |
| Physella costata | Ornate Physa | Mollusks |
| Physella humerosa | Corkscrew Physa | Mollusks |
| Physella lordi | Twisted Physa | Mollusks |
| Physella osculans | Cayuse Physa | Mollusks |
| Physella propinqua | Rocky Mountain Physa | Mollusks |
| Physella traski | Sculpted Physa | Mollusks |
| Physella virgata | Protean Physa | Mollusks |
| Physella virginea | Sunset Physa | Mollusks |
| Physemus minutus | | Insects & other |
| Pilularia americana | NA | Plants |
| Pinguicula macroceras | NA | Plants |
| Pipilo aberti | Abert's Towhee | Birds |
| Pipilo crissalis eremophilus | Inyo California Towhee | Birds |
| Piranga rubra | Summer Tanager | Birds |
| Pisidium casertanum | | Mollusks |
| Pisidium compressum | | Mollusks |
| Pisidium idahoense | | Mollusks |
| Pisidium lilljeborgi | | Mollusks |
| Pisidium nitidum | | Mollusks |
| Pisidium subtruncatum | | Mollusks |

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| Pisidium ultramontanum | Montane Peaclam | Mollusks |
| Pisidium variabile | | Mollusks |
| Pisidium walkeri | | Mollusks |
| Plagiobothrys acanthocarpus | Adobe Popcorn-flower | Plants |
| Plagiobothrys austiniae | Austin's Popcorn-flower | Plants |
| Plagiobothrys chorisianus | NA | Plants |
| Plagiobothrys distantiflorus | California Popcorn-flower | Plants |
| Plagiobothrys glaber | Hairless Allocarya | Plants |
| Plagiobothrys greenei | Greene's Popcorn-flower | Plants |
| Plagiobothrys humistratus | Dwarf Popcorn-flower | Plants |
| Plagiobothrys leptocladus | Alkali Popcorn-flower | Plants |
| Plagiobothrys nitens | | Plants |
| Plagiobothrys parishii | Parish's Popcorn-flower | Plants |
| Plagiobothrys reticulatus reticulatus | | Plants |
| Plagiobothrys reticulatus rossianorum | | Plants |
| Plagiobothrys tener | NA | Plants |
| Plagiobothrys undulatus | NA | Plants |
| Planorbella binneyi | Coarse Rams-horn | Mollusks |
| Planorbella occidentalis | Fine-lined Rams-horn | Mollusks |
| Planorbella subcrenata | Rough Rams-horn | Mollusks |
| Planorbella tenuis | Mexican Rams-horn | Mollusks |
| Planorbella traski | Keeled Rams-horn | Mollusks |
| Planorbella trivolvis | Marsh Rams-horn | Mollusks |
| Plantago elongata elongata | Slender Plantain | Plants |
| Platanthera dilatata leucostachys | | Plants |
| Platanthera sparsiflora sparsiflora | Canyon Bog Orchid | Plants |
| Platanthera stricta | Slender Bog Orchid | Plants |
| Platanthera tescamnis | NA | Plants |
| Platanthera yosemitensis | Yosemite Bog-Orchid | Plants |
| Platanus racemosa | California Sycamore | Plants |
| Plathemis lydia | Common Whitetail | Insects & other |
| Plathemis subornata | Desert Whitetail | Insects & other |
| Platyhydracarus juliani | | Insects & other |
| Platyhydracarus parvipalpis | | Insects & other |
| Platyvelia beameri | | Insects & other |
| Platyvelia brachialis | | Insects & other |
| Platyvelia summersi | | Insects & other |
| Plauditus punctiventris | | Insects & other |
| Plegadis chihi | White-faced Ibis | Birds |

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|---|---|---|
| Plethodon dunni | Dunn's Salamander | Herps |
| Pleuropogon californicus californicus | | Plants |
| Pleuropogon californicus davyi | | Plants |
| Pleuropogon hooverianus | North Coast False Semaphore Grass | Plants |
| Pleuropogon refractus | Nodding False Semaphore Grass | Plants |
| Pluchea odorata odorata | Scented Conyza | Plants |
| Pluchea sericea | Arrow-weed | Plants |
| Plumiperla diversa | Margined Sallfly | Insects & other |
| Plumiperla spinosa | Spiny Sallfly | Insects & other |
| Pluvialis squatarola | Black-bellied Plover | Birds |
| Podiceps nigricollis | Eared Grebe | Birds |
| Podilymbus podiceps | Pied-billed Grebe | Birds |
| Podmosta decepta | | Insects & other |
| Podmosta delicatula | Delicate Forestfly | Insects & other |
| Podmosta obscura | | Insects & other |
| Pogogyne abramsii | San Diego Mesamint | Plants |
| Pogogyne douglasii | NA | Plants |
| Pogogyne floribunda | Profuse-flowered Pogogyne | Plants |
| Pogogyne nudiuscula | Otay Mesamint | Plants |
| Pogogyne zizyphoroides | | Plants |
| Pogonichthys ciscoides | Clear Lake Splittail | Fishes |
| Pogonichthys macrolepidotus | Sacramento splittail | Fishes |
| Polycentropus arizonensis | | Insects & other |
| Polycentropus aztecus | | Insects & other |
| Polycentropus cinereus | | Insects & other |
| Polycentropus denningi | | Insects & other |
| Polycentropus flavus | A Caddisfly | Insects & other |
| Polycentropus gertschi | | Insects & other |
| Polycentropus halidus | A Caddisfly | Insects & other |
| Polycentropus variegatus | A Caddisfly | Insects & other |
| Polygonum marinense | Marin Knotweed | Plants |
| Polypedilum albicorne | | Insects & other |
| Polypedilum albinodus | | Insects & other |
| Polypedilum angustum | | Insects & other |
| Polypedilum apicatum | | Insects & other |
| Polypedilum artifer | | Insects & other |
| Polypedilum aviceps | | Insects & other |
| Polypedilum braseniae | | Insects & other |
| Polypedilum californicum | | Insects & other |
| Polypedilum cinctum | | Insects & other |

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| Polypedilum cultellatum | | Insects & other |
| Polypedilum digitifer | | Insects & other |
| Polypedilum halterale | | Insects & other |
| Polypedilum illinoense | | Insects & other |
| Polypedilum isocerus | | Insects & other |
| Polypedilum labeculosum | | Insects & other |
| Polypedilum laetum | | Insects & other |
| Polypedilum obelos | | Insects & other |
| Polypedilum ophioides | | Insects & other |
| Polypedilum parvum | | Insects & other |
| Polypedilum pedatum | | Insects & other |
| Polypedilum pterospilus | | Insects & other |
| Polypedilum scalaenum | | Insects & other |
| Polypedilum sulaceps | | Insects & other |
| Polypedilum trigonus | | Insects & other |
| Polypedilum tritum | | Insects & other |
| Polypedilum vibex | | Insects & other |
| Polyplectropus charlesi | | Insects & other |
| Pomacea bridgesii | | Mollusks |
| Pomacea paludosa | | Mollusks |
| Pomatiopsis binneyi | Robust Walker | Mollusks |
| Pomatiopsis californica | Pacific Walker | Mollusks |
| Pomatiopsis chacei | Marsh Walker | Mollusks |
| Pomoleuctra andersoni | Oregon Needlefly | Insects & other |
| Pomoleuctra purcellana | | Insects & other |
| Populus trichocarpa | NA | Plants |
| Porterella carnosula | Western Porterella | Plants |
| Porzana carolina | Sora | Birds |
| Postelichus confluentus | | Insects & other |
| Postelichus immsi | | Insects & other |
| Postelichus productus | | Insects & other |
| Potamogeton alpinus | Northern Pondweed | Plants |
| Potamogeton amplifolius | Largeleaf Pondweed | Plants |
| Potamogeton berchtoldii | NA | Plants |
| Potamogeton diversifolius | Water-thread Pondweed | Plants |
| Potamogeton epihydrus | Nuttall's Pondweed | Plants |
| Potamogeton foliosus fibrillosus | Fibrous Pondweed | Plants |
| Potamogeton foliosus foliosus | Leafy Pondweed | Plants |
| Potamogeton gramineus | Grassy Pondweed | Plants |
| Potamogeton illinoensis | Illinois Pondweed | Plants |
| Potamogeton natans | Floating Pondweed | Plants |

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| Potamogeton nodosus | Longleaf Pondweed | Plants |
| Potamogeton praelongus | White-stem Pondweed | Plants |
| Potamogeton pusillus pusillus | Slender Pondweed | Plants |
| Potamogeton richardsonii | Richardson's Pondweed | Plants |
| Potamogeton robbinsii | Flatleaf Pondweed | Plants |
| Potamogeton zosteriformis | Flatstem Pondweed | Plants |
| Potentilla anserina anserina | | Plants |
| Potentilla anserina pacifica | | Plants |
| Potentilla multijuga | Ballona Cinquefoil | Plants |
| Potentilla newberryi | Newberry's Cinquefoil | Plants |
| Potentilla uliginosa | Cunningham Marsh cinquefoil | Plants |
| Primula jeffreyi | | Plants |
| Primula pauciflora | | Plants |
| Primula subalpina | | Plants |
| Primula tetrandra | NA | Plants |
| Prionocera oregonica | | Insects & other |
| Pristinicola hemphilli | Pristine Pyrg | Mollusks |
| Procladius barbatulus | | Insects & other |
| Procladius bellus | | Insects & other |
| Procladius culiciformis | | Insects & other |
| Procladius denticulatus | | Insects & other |
| Procladius freemani | | Insects & other |
| Procladius sublettei | | Insects & other |
| Procloeon pennulatum | A Mayfly | Insects & other |
| Procloeon rivulare | A Mayfly | Insects & other |
| Procloeon venosum | A Mayfly | Insects & other |
| Progomphus borealis | Gray Sanddragon | Insects & other |
| Promenetus exacuous | Sharp Sprite | Mollusks |
| Promenetus umbilicatellus | Umbilicate Sprite | Mollusks |
| Prosimulium caudatum | | Insects & other |
| Prosimulium constrictistylum | | Insects & other |
| Prosimulium davesi | | Insects & other |
| Prosimulium dicentum | | Insects & other |
| Prosimulium dicum | | Insects & other |
| Prosimulium esselbaughi | | Insects & other |
| Prosimulium exigens | | Insects & other |
| Prosimulium flaviantennus | | Insects & other |
| Prosimulium formosum | | Insects & other |
| Prosimulium frohnei | | Insects & other |
| Prosimulium fulvithorax | | Insects & other |
| Prosimulium fulvum | | Insects & other |

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| Prosimulium idemai | | Insects & other |
| Prosimulium imposter | | Insects & other |
| Prosimulium longirostrum | | Insects & other |
| Prosimulium minifulvum | | Insects & other |
| Prosimulium rusticum | | Insects & other |
| Prosimulium secretum | | Insects & other |
| Prosimulium shewelli | | Insects & other |
| Prosimulium travisi | | Insects & other |
| Prosimulium uinta | | Insects & other |
| Prosimulium unicum | | Insects & other |
| Prosopium williamsoni | Mountain whitefish | Fishes |
| Prostoia besametsa | Bended Forestfly | Insects & other |
| Protanyderus margarita | | Insects & other |
| Protanyderus vanduzeei | | Insects & other |
| Protanyderus vipio | | Insects & other |
| Protochauliodes aridus | | Insects & other |
| Protochauliodes cascadius | | Insects & other |
| Protochauliodes minimus | | Insects & other |
| Protochauliodes montivagus | | Insects & other |
| Protochauliodes simplus | | Insects & other |
| Protochauliodes spenceri | | Insects & other |
| Protoptila balmorhea | | Insects & other |
| Protoptila coloma | A Caddisfly | Insects & other |
| Protoptila erotica | | Insects & other |
| Psectrocladius barbimanus | | Insects & other |
| Psectrocladius spinifer | | Insects & other |
| Psectrocladius vernalis | | Insects & other |
| Psectrotanypus dyari | | Insects & other |
| Psephenus arizonensis | | Insects & other |
| Psephenus falli | | Insects & other |
| Psephenus minckleyi | | Insects & other |
| Psephenus montanus | | Insects & other |
| Psephenus murvoshi | | Insects & other |
| Pseudacris cadaverina | California Treefrog | Herps |
| Pseudacris hypochondriaca | Baja California Treefrog | Herps |
| Pseudacris regilla | Northern Pacific Chorus Frog | Herps |
| Pseudacris sierra | Sierran Treefrog | Herps |
| Pseudiron centralis | White Sand-river Mayfly | Insects & other |
| Pseudochironomus richardsoni | | Insects & other |
| Pseudocloeon apache | | Insects & other |
| Pseudocloeon propinquum | A Mayfly | Insects & other |

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|---|---|---|
| Pseudocorixa beameri | | Insects & other |
| Pseudodiamesa branickii | | Insects & other |
| Pseudoleon superbus | | Insects & other |
| Pseudorthocladius dumicaudus | | Insects & other |
| Pseudorthocladius uniserratus | | Insects & other |
| Pseudosmittia forcipata | | Insects & other |
| Pseudosmittia nanseni | | Insects & other |
| Pseudostenophylax edwardsi | A Caddisfly | Insects & other |
| Psilocarphus brevissimus brevissimus | Dwarf Woolly-heads | Plants |
| Psilocarphus brevissimus multiflorus | Delta Woolly Marbles | Plants |
| Psilocarphus oregonus | Oregon Woolly-heads | Plants |
| Psilocarphus tenellus | NA | Plants |
| Psorophora columbiae | | Insects & other |
| Psorophora discolor | | Insects & other |
| Psorophora howardii | | Insects & other |
| Psorophora signipennis | | Insects & other |
| Psychoglypha alascensis | | Insects & other |
| Psychoglypha avigo | A Caddisfly | Insects & other |
| Psychoglypha bella | A Caddisfly | Insects & other |
| Psychoglypha browni | | Insects & other |
| Psychoglypha klamathi | A Caddisfly | Insects & other |
| Psychoglypha leechi | A Caddisfly | Insects & other |
| Psychoglypha mazamae | A Caddisfly | Insects & other |
| Psychoglypha ormiae | A Caddisfly | Insects & other |
| Psychoglypha prita | | Insects & other |
| Psychoglypha schuhi | | Insects & other |
| Psychoglypha subborealis | A Caddisfly | Insects & other |
| Psychomyia flavida | A Caddisfly | Insects & other |
| Psychomyia lumina | A Caddisfly | Insects & other |
| Psychomyia nomada | | Insects & other |
| Pteronarcella badia | | Insects & other |
| Pteronarcella regularis | Dwarf Salmonfly | Insects & other |
| Pteronarcys californica | Giant Salmonfly | Insects & other |
| Pteronarcys princeps | Ebony Salmonfly | Insects & other |
| Ptychocheilus grandis | Sacramento pikeminnow | Fishes |
| Ptychocheilus lucius | Colorado Pikeminnow | Fishes |
| Ptychoptera byersi | | Insects & other |
| Ptychoptera lenis | | Insects & other |
| Ptychoptera minor | | Insects & other |
| Ptychoptera monoensis | | Insects & other |

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| Ptychoptera pendula | | Insects & other |
| Ptychoptera sculleni | | Insects & other |
| Ptychoptera townesi | | Insects & other |
| Puccinellia howellii | Trinity Mountains Alkali Grass | Plants |
| Puccinellia nutkaensis | Alaska Alkaligrass | Plants |
| Puccinellia nuttalliana | Nuttall's Alkali Grass | Plants |
| Puccinellia parishii | Parish's Alkali Grass | Plants |
| Puccinellia pumila | | Plants |
| Puccinellia simplex | Little Alkali Grass | Plants |
| Pyrgulopsis aardahli | Benton Valley Springsnail | Mollusks |
| Pyrgulopsis amargosae | Amargosa Springsnail | Mollusks |
| Pyrgulopsis archimedis | Archimedes Pyrg | Mollusks |
| Pyrgulopsis californiensis | Laguna Mountain Springsnail | Mollusks |
| Pyrgulopsis castaicensis | A Freshwater Snail | Mollusks |
| Pyrgulopsis cinerana | Ash Valley Pyrg | Mollusks |
| Pyrgulopsis diablensis | Diablo Range Pyrg | Mollusks |
| Pyrgulopsis eremica | Smoke Creek Pyrg | Mollusks |
| Pyrgulopsis falciglans | Likely Pyrg | Mollusks |
| Pyrgulopsis gibba | Surprise Valley Pyrg | Mollusks |
| Pyrgulopsis giuliani | Southern Sierra Nevada Springsnail | Mollusks |
| Pyrgulopsis greggi | Kern River Pyrg | Mollusks |
| Pyrgulopsis intermedia | Crooked Creek Springsnail | Mollusks |
| Pyrgulopsis lasseni | Willow Creek Pyrg | Mollusks |
| Pyrgulopsis licina | | Mollusks |
| Pyrgulopsis longae | Long Valley Pyrg | Mollusks |
| Pyrgulopsis longinqua | Salton Sea Springsnail | Mollusks |
| Pyrgulopsis micrococcus | Oasis Valley Springsnail | Mollusks |
| Pyrgulopsis milleri | A Freshwater Snail | Mollusks |
| Pyrgulopsis owensensis | Owens Valley Springsnail | Mollusks |
| Pyrgulopsis perforata | | Mollusks |
| Pyrgulopsis perturbata | Fish Slough Springsnail | Mollusks |
| Pyrgulopsis rupinicola | Sucker Springs Pyrg | Mollusks |
| Pyrgulopsis sanchezi | | Mollusks |
| Pyrgulopsis stearnsiana | Yaqui Springsnail | Mollusks |
| Pyrgulopsis taylori | San Luis Obispo Pyrg | Mollusks |
| Pyrgulopsis turbatrix | Southeast Nevada Pyrg | Mollusks |
| Pyrgulopsis ventricosa | Clear Lake Pyrg | Mollusks |
| Pyrgulopsis wongi | Wong's Springsnail | Mollusks |
| Radotanypus submarginella | | Insects & other |
| Rallus limicola | Virginia Rail | Birds |
| Rallus longirostris yumanensis | Yuma Clapper Rail | Birds |

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| Ramellogammarus californicus | | Crustaceans |
| Ramellogammarus campestris | | Crustaceans |
| Ramellogammarus columbianus | | Crustaceans |
| Ramellogammarus littoralis | | Crustaceans |
| Ramellogammarus oregonensis | | Crustaceans |
| Ramellogammarus ramellus | | Crustaceans |
| Ramellogammarus similimanus | | Crustaceans |
| Ramphocorixa rotundocephala | | Insects & other |
| Rana aurora | Northern Red-legged Frog | Herps |
| Rana boylii | Foothill Yellow-legged Frog | Herps |
| Rana cascadae | Cascades Frog | Herps |
| Rana draytonii | California Red-legged Frog | Herps |
| Rana muscosa | Southern Mountain Yellow-legged Frog | Herps |
| Rana pretiosa | Oregon Spotted Frog | Herps |
| Rana sierrae | Sierra Nevada Yellow-legged Frog | Herps |
| Ranatra brevicollis | A Water Scorpion | Insects & other |
| Ranatra fusca | | Insects & other |
| Ranatra montezuma | | Insects & other |
| Ranatra quadridentata | | Insects & other |
| Ranunculus alismifolius alismellus | Water-plantain Buttercup | Plants |
| Ranunculus alismifolius alismifolius | Water-plantain Buttercup | Plants |
| Ranunculus alismifolius hartwegii | | Plants |
| Ranunculus alismifolius lemmonii | | Plants |
| Ranunculus andersonii andersonii | Anderson's Buttercup | Plants |
| Ranunculus aquatilis aquatilis | White Water Buttercup | Plants |
| Ranunculus aquatilis diffusus | | Plants |
| Ranunculus bonariensis | NA | Plants |
| Ranunculus flabellaris | Yellow Water-crowfoot | Plants |
| Ranunculus flammula flammula | Lesser Spearwort | Plants |
| Ranunculus flammula ovalis | | Plants |
| Ranunculus hydrocharoides | NA | Plants |
| Ranunculus hystriculus | | Plants |
| Ranunculus lobbii | Lobb's Water Buttercup | Plants |
| Ranunculus macounii | Macoun's Buttercup | Plants |
| Ranunculus populago | Mountain Buttercup | Plants |
| Ranunculus pusillus pusillus | Pursh's Buttercup | Plants |
| Ranunculus repens | NA | Plants |

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| Ranunculus sardous | NA | Plants |
| Ranunculus sceleratus | NA | Plants |
| Recurvirostra americana | American Avocet | Birds |
| Remartinia luteipennis | | Insects & other |
| Reomyia wartinbei | | Insects & other |
| Rhagovelia becki | | Insects & other |
| Rhagovelia choreutes | | Insects & other |
| Rhagovelia distincta | | Insects & other |
| Rhagovelia varipes | | Insects & other |
| Rhamnus alnifolia | Alderleaf Buckthorn | Plants |
| Rhantus anisonychus | | Insects & other |
| Rhantus atricolor | | Insects & other |
| Rhantus binotatus | | Insects & other |
| Rhantus consimilis | | Insects & other |
| Rhantus gutticollis | | Insects & other |
| Rhantus sericans | | Insects & other |
| Rhantus wallisi | | Insects & other |
| Rheotanytarsus hamatus | | Insects & other |
| Rheumatobates hungerfordi | | Insects & other |
| Rhinichthys osculus klamathensis | Klamath speckled dace | Fishes |
| Rhinichthys osculus nevadensis | Amargosa Canyon speckled dace | Fishes |
| Rhinichthys osculus robustus | Lahontan speckled dace | Fishes |
| Rhinichthys osculus ssp. 1 | Sacramento speckled dace | Fishes |
| Rhinichthys osculus ssp. 2 | Owens speckled dace | Fishes |
| Rhinichthys osculus ssp. 3 | Long Valley speckled dace | Fishes |
| Rhinichthys osculus ssp. 4 | Santa Ana speckled dace | Fishes |
| Rhionaeschna californica | California Darner | Insects & other |
| Rhionaeschna multicolor | Blue-eyed Darner | Insects & other |
| Rhionaeshna dugesi | | Insects & other |
| Rhionaeshna psillus | | Insects & other |
| Rhithrogena decora | A Mayfly | Insects & other |
| Rhithrogena flavianula | A Mayfly | Insects & other |
| Rhithrogena hageni | A Mayfly | Insects & other |
| Rhithrogena morrisoni | A Mayfly | Insects & other |
| Rhithrogena plana | A Mayfly | Insects & other |
| Rhithrogena robusta | A Mayfly | Insects & other |
| Rhithrogena undulata | A Mayfly | Insects & other |
| Rhithrogena virilis | | Insects & other |
| Rhizelmis nigra | | Insects & other |
| Rhododendron columbianum | | Plants |

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| Rhododendron occidentale occidentale | Western Azalea | Plants |
| Rhyacophila acuminata | A Caddisfly | Insects & other |
| Rhyacophila alberta | | Insects & other |
| Rhyacophila amabilis | Castle Lake Rhyacophilan Caddisfly | Insects & other |
| Rhyacophila angelita | A Caddisfly | Insects & other |
| Rhyacophila arcella | A Caddisfly | Insects & other |
| Rhyacophila ardala | A Caddisfly | Insects & other |
| Rhyacophila arnaudi | A Caddisfly | Insects & other |
| Rhyacophila balosa | A Caddisfly | Insects & other |
| Rhyacophila basalis | A Caddisfly | Insects & other |
| Rhyacophila betteni | A Caddisfly | Insects & other |
| Rhyacophila bifila | A Caddisfly | Insects & other |
| Rhyacophila blarina | | Insects & other |
| Rhyacophila californica | A Caddisfly | Insects & other |
| Rhyacophila cerita | A Caddisfly | Insects & other |
| Rhyacophila chandleri | A Caddisfly | Insects & other |
| Rhyacophila chilsia | | Insects & other |
| Rhyacophila chordata | A Caddisfly | Insects & other |
| Rhyacophila colonus | Obrien Rhyacophilan Caddisfly | Insects & other |
| Rhyacophila coloradensis | A Caddisfly | Insects & other |
| Rhyacophila darbyi | A Caddisfly | Insects & other |
| Rhyacophila ebria | | Insects & other |
| Rhyacophila ecosa | A Caddisfly | Insects & other |
| Rhyacophila fenderi | Fender's Rhyacophilan Caddisfly | Insects & other |
| Rhyacophila grandis | A Caddisfly | Insects & other |
| Rhyacophila haddocki | | Insects & other |
| Rhyacophila harmstoni | A Caddisfly | Insects & other |
| Rhyacophila hyalinata | A Caddisfly | Insects & other |
| Rhyacophila inculta | A Caddisfly | Insects & other |
| Rhyacophila insularis | A Caddisfly | Insects & other |
| Rhyacophila iranda | | Insects & other |
| Rhyacophila jenniferae | A Caddisfly | Insects & other |
| Rhyacophila jewetti | A Caddisfly | Insects & other |
| Rhyacophila karila | A Caddisfly | Insects & other |
| Rhyacophila kernada | A Caddisfly | Insects & other |
| Rhyacophila kincaidi | | Insects & other |
| Rhyacophila leechi | A Caddisfly | Insects & other |
| Rhyacophila lineata | Castle Crags Rhyacophilan Caddisfly | Insects & other |
| Rhyacophila lurella | A Caddisfly | Insects & other |
| Rhyacophila malkini | | Insects & other |

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| Rhyacophila mosana | Bilobed Rhyacophilan Caddisfly | Insects & other |
| Rhyacophila narvae | A Caddisfly | Insects & other |
| Rhyacophila neograndis | A Caddisfly | Insects & other |
| Rhyacophila nevadensis | A Caddisfly | Insects & other |
| Rhyacophila norcuta | A Caddisfly | Insects & other |
| Rhyacophila oreta | A Caddisfly | Insects & other |
| Rhyacophila pellisa | A Caddisfly | Insects & other |
| Rhyacophila perda | | Insects & other |
| Rhyacophila perplana | | Insects & other |
| Rhyacophila pichaca | | Insects & other |
| Rhyacophila rayneri | A Caddisfly | Insects & other |
| Rhyacophila reyesi | A Caddisfly | Insects & other |
| Rhyacophila rotunda | A Caddisfly | Insects & other |
| Rhyacophila sequoia | A Caddisfly | Insects & other |
| Rhyacophila sierra | A Caddisfly | Insects & other |
| Rhyacophila siskiyou | A Caddisfly | Insects & other |
| Rhyacophila spinata | Spiny Rhyacophilan Caddisfly | Insects & other |
| Rhyacophila starki | A Caddisfly | Insects & other |
| Rhyacophila tamalpaisi | A Caddisfly | Insects & other |
| Rhyacophila tehama | A Caddisfly | Insects & other |
| Rhyacophila tralala | | Insects & other |
| Rhyacophila tucula | A Caddisfly | Insects & other |
| Rhyacophila unipunctata | | Insects & other |
| Rhyacophila vaccua | A Caddisfly | Insects & other |
| Rhyacophila vaefes | A Caddisfly | Insects & other |
| Rhyacophila vagrita | | Insects & other |
| Rhyacophila valuma | A Caddisfly | Insects & other |
| Rhyacophila vao | A Caddisfly | Insects & other |
| Rhyacophila vedra | A Caddisfly | Insects & other |
| Rhyacophila velora | A Caddisfly | Insects & other |
| Rhyacophila vemna | | Insects & other |
| Rhyacophila verrula | A Caddisfly | Insects & other |
| Rhyacophila vetina | | Insects & other |
| Rhyacophila viquaea | | Insects & other |
| Rhyacophila visor | | Insects & other |
| Rhyacophila vobara | | Insects & other |
| Rhyacophila vocala | A Caddisfly | Insects & other |
| Rhyacophila vuzana | A Caddisfly | Insects & other |
| Rhyacophila willametta | | Insects & other |
| Rhyacotriton variegatus | Southern Torrent Salamander | Herps |
| Rhynchospora alba | White Beakrush | Plants |

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|---|---|---|
| Rhynchospora californica | California Beakrush | Plants |
| Rhynchospora capitellata | Brownish Beakrush | Plants |
| Rhynchospora globularis | NA | Plants |
| Richardsonius egregius | Lahontan redside | Fishes |
| Rickera sorpta | Palestripe Springfly | Insects & other |
| Riparia riparia | Bank Swallow | Birds |
| Robackia demeijeri | | Insects & other |
| Rorippa columbiae | Columbia Yellowcress | Plants |
| Rorippa curvipes | Rocky Mountain Yellowcress | Plants |
| Rorippa curvisiliqua curvisiliqua | Curve-pod Yellowcress | Plants |
| Rorippa palustris palustris | Bog Yellowcress | Plants |
| Rorippa sphaerocarpa | Round-fruit Yellowcress | Plants |
| Rorippa subumbellata | Tahoe Yellowcress | Plants |
| Rotala ramosior | Toothcup | Plants |
| Rudbeckia klamathensis | | Plants |
| Rumex britannica | NA | Plants |
| Rumex californicus | | Plants |
| Rumex conglomeratus | NA | Plants |
| Rumex crassus | | Plants |
| Rumex fueginus | | Plants |
| Rumex kerneri | NA | Plants |
| Rumex lacustris | | Plants |
| Rumex occidentalis | | Plants |
| Rumex persicarioides | | Plants |
| Rumex salicifolius salicifolius | Willow Dock | Plants |
| Rumex stenophyllus | NA | Plants |
| Rumex transitorius | | Plants |
| Rumex triangulivalvis | | Plants |
| Rumex utahensis | | Plants |
| Rumex violascens | Violet Dock | Plants |
| Rupisalda dewsi | | Insects & other |
| Rupisalda saxicola | | Insects & other |
| Rupisalda teretis | | Insects & other |
| Ruppia cirrhosa | Widgeon-grass | Plants |
| Ruppia maritima | Ditch-grass | Plants |
| Rynchops niger | Black Skimmer | Birds |
| Sagina saginoides | Arctic Pearlwort | Plants |
| Sagittaria cuneata | Wapatum Arrowhead | Plants |
| Sagittaria latifolia latifolia | Broadleaf Arrowhead | Plants |
| Sagittaria longiloba | Longbarb Arrowhead | Plants |
| Sagittaria montevidensis | | Plants |

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| calycina | | |
| Sagittaria sanfordii | Sanford's Arrowhead | Plants |
| Salda buenoi | | Insects & other |
| Salda littoralis | | Insects & other |
| Salda lugubris | | Insects & other |
| Salda obscura | | Insects & other |
| Salda provancheri | | Insects & other |
| Saldula andrei | | Insects & other |
| Saldula balli | | Insects & other |
| Saldula basingeri | | Insects & other |
| Saldula comatula | | Insects & other |
| Saldula dispersa | | Insects & other |
| Saldula explanata | | Insects & other |
| Saldula latticollis | | Insects & other |
| Saldula lattini | | Insects & other |
| Saldula luctuosa | | Insects & other |
| Saldula nigrita | | Insects & other |
| Saldula opacula | | Insects & other |
| Saldula opiparia | | Insects & other |
| Saldula orbiculata | | Insects & other |
| Saldula pallipes | | Insects & other |
| Saldula palustris | | Insects & other |
| Saldula pexa | | Insects & other |
| Saldula saltatoria | | Insects & other |
| Saldula severini | | Insects & other |
| Saldula sulcicollis | | Insects & other |
| Saldula usingeri | Wilbur Springs Shorebug | Insects & other |
| Saldula villosa | | Insects & other |
| Salicornia bigelovii | Dwarf Glasswort | Plants |
| Salicornia rubra | Western Glasswort | Plants |
| Salix babylonica | NA | Plants |
| Salix boothii | Booth's Willow | Plants |
| Salix breweri | Brewer's Willow | Plants |
| Salix delnortensis | Del Norte Willow | Plants |
| Salix drummondiana | Satiny Salix | Plants |
| Salix eastwoodiae | Eastwood's Willow | Plants |
| Salix exigua exigua | Narrowleaf Willow | Plants |
| Salix exigua hindsiana | | Plants |
| Salix geyeriana | Geyer's Willow | Plants |
| Salix gooddingii | Goodding's Willow | Plants |
| Salix hookeriana | Hooker's Willow | Plants |

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| Salix jepsonii | Jepson's Willow | Plants |
| Salix laevigata | Polished Willow | Plants |
| Salix lasiandra caudata | | Plants |
| Salix lasiandra lasiandra | | Plants |
| Salix lasiolepis lasiolepis | Arroyo Willow | Plants |
| Salix lemmonii | Lemmon's Willow | Plants |
| Salix lutea | Yellow Willow | Plants |
| Salix melanopsis | Dusky Willow | Plants |
| Salix planifolia | NA | Plants |
| Salix prolixa | Mackenzie's Willow | Plants |
| Salix purpurea | NA | Plants |
| Salix sitchensis | Sitka Willow | Plants |
| Salix tracyi | | Plants |
| Salmasellus howarthi | | Crustaceans |
| Salmoperla sylvanica | Bighead Springfly | Insects & other |
| Salvelinus confluentus | Bull Trout | Fishes |
| Salvinia minima | NA | Plants |
| Salvinia oblongifolia | NA | Plants |
| Samolus parviflorus | NA | Plants |
| Sanfilippodytes adelardi | A Predaceous Diving Beetle | Insects & other |
| Sanfilippodytes barbarae | | Insects & other |
| Sanfilippodytes barbarensis | | Insects & other |
| Sanfilippodytes belfragei | | Insects & other |
| Sanfilippodytes bidessoides | A Predaceous Diving Beetle | Insects & other |
| Sanfilippodytes corvallis | | Insects & other |
| Sanfilippodytes hardyi | | Insects & other |
| Sanfilippodytes kingi | | Insects & other |
| Sanfilippodytes latebrosus | | Insects & other |
| Sanfilippodytes malkini | | Insects & other |
| Sanfilippodytes palliatus | | Insects & other |
| Sanfilippodytes rossi | | Insects & other |
| Sanfilippodytes setifer | A Predaceous Diving Beetle | Insects & other |
| Sanfilippodytes terminalis | | Insects & other |
| Sanfilippodytes veronicae | | Insects & other |
| Sanfilippodytes vilis | | Insects & other |
| Sanfilippodytes williami | | Insects & other |
| Sarracenia purpurea | NA | Plants |
| Sasquaperla hoopa | A Stonefly | Insects & other |
| Scaphiopus couchii | Couch's Spadefoot | Herps |
| Scheuchzeria palustris | Pod Grass | Plants |
| Schoenoplectus acutus acutus | NA | Plants |

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| Schoenoplectus acutus occidentalis | Hardstem Bulrush | Plants |
| Schoenoplectus americanus | Three-square Bulrush | Plants |
| Schoenoplectus californicus | California Bulrush | Plants |
| Schoenoplectus heterochaetus | Slender Bulrush | Plants |
| Schoenoplectus mucronatus | NA | Plants |
| Schoenoplectus pungens longispicatus | Three-square Bulrush | Plants |
| Schoenoplectus pungens pungens | NA | Plants |
| Schoenoplectus saximontanus | Rocky Mountain Bulrush | Plants |
| Schoenoplectus subterminalis | Water Bulrush | Plants |
| Schoenoplectus tabernaemontani | Softstem Bulrush | Plants |
| Schoenoplectus triqueter | NA | Plants |
| Schoenus nigricans | Blacksedge | Plants |
| Scirpus congdonii | Congdon's Bulrush | Plants |
| Scirpus cyperinus | NA | Plants |
| Scirpus diffusus | Umbrella Bulrush | Plants |
| Scirpus microcarpus | Small-fruit Bulrush | Plants |
| Scirpus pendulus | Pendulous Bulrush | Plants |
| Scirtes californicus | | Insects & other |
| Scirtes orbiculatus | | Insects & other |
| Scirtes plagiatus | | Insects & other |
| Scutellaria galericulata | Hooded Skullcap | Plants |
| Sedella leiocarpa | Lake County Mock Stonecrop | Plants |
| Senecio hydrophiloides | Sweet Marsh Ragwort | Plants |
| Senecio hydrophilus | Great Swamp Ragwort | Plants |
| Senecio triangularis | Arrow-leaf Groundsel | Plants |
| Sequoia sempervirens | | Plants |
| Sergentia albescens | | Insects & other |
| Serratella levis | A Mayfly | Insects & other |
| Serratella micheneri | A Mayfly | Insects & other |
| Sesbania herbacea | | Plants |
| Setophaga petechia | Yellow Warbler | Birds |
| Setophaga petechia brewsteri | A Yellow Warbler | Birds |
| Setophaga petechia sonorana | Sonoran Yellow Warbler | Birds |
| Setvena tibialis | | Insects & other |
| Setvena wahkeena | | Insects & other |
| Sialis arvalis | | Insects & other |
| Sialis bilobata | | Insects & other |
| Sialis californica | | Insects & other |

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| Sialis cornuta | | Insects & other |
| Sialis hamata | | Insects & other |
| Sialis nevadensis | | Insects & other |
| Sialis occidens | | Insects & other |
| Sialis rotunda | | Insects & other |
| Sidalcea calycosa calycosa | Annual Checker-mallow | Plants |
| Sidalcea calycosa rhizomata | Point Reyes Checkerbloom | Plants |
| Sidalcea gigantea | | Plants |
| Sidalcea hirsuta | Hairy Checker-mallow | Plants |
| Sidalcea neomexicana | Rocky Mountain Checker-mallow | Plants |
| Sidalcea oregana hydrophila | Water-loving Checker-mallow | Plants |
| Sidalcea oregana oregana | Oregon Checker-mallow | Plants |
| Sidalcea oregana valida | Kenwood Marsh Checker-mallow | Plants |
| Sidalcea pedata | Pedate Checker-mallow | Plants |
| Sidalcea ranunculacea | Marsh Checker-mallow | Plants |
| Sidalcea reptans | Creeping Checker-mallow | Plants |
| Sierraperla cora | Giant Roachfly | Insects & other |
| Sigara alternata | | Insects & other |
| Sigara grossolineata | | Insects & other |
| Sigara krafti | | Insects & other |
| Sigara mckinstryi | A Water Boatman | Insects & other |
| Sigara nevadensis | | Insects & other |
| Sigara omani | | Insects & other |
| Sigara vallis | A Water Boatman | Insects & other |
| Sigara vandykei | | Insects & other |
| Sigara washingtonensis | | Insects & other |
| Simulium anduzei | | Insects & other |
| Simulium apricarium | | Insects & other |
| Simulium argus | | Insects & other |
| Simulium balteatum | | Insects & other |
| Simulium bivittatum | | Insects & other |
| Simulium brevicercum | | Insects & other |
| Simulium bricenoi | | Insects & other |
| Simulium canadensis | | Insects & other |
| Simulium canonicolum | | Insects & other |
| Simulium carbunculum | | Insects & other |
| Simulium chromatinum | | Insects & other |
| Simulium chromocentrum | | Insects & other |
| Simulium clarum | | Insects & other |
| Simulium conicum | | Insects & other |
| Simulium craigi | | Insects & other |

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| Simulium curiei | | Insects & other |
| Simulium decorum | | Insects & other |
| Simulium defoliarti | | Insects & other |
| Simulium donovani | | Insects & other |
| Simulium encisoi | | Insects & other |
| Simulium exculatum | | Insects & other |
| Simulium freemani | | Insects & other |
| Simulium griseum | | Insects & other |
| Simulium hechti | | Insects & other |
| Simulium hippovorum | | Insects & other |
| Simulium hunteri | | Insects & other |
| Simulium infernale | | Insects & other |
| Simulium iriartei | | Insects & other |
| Simulium jacumbae | | Insects & other |
| Simulium joculator | | Insects & other |
| Simulium longithallum | | Insects & other |
| Simulium meridionale | | Insects & other |
| Simulium modicum | | Insects & other |
| Simulium mysterium | | Insects & other |
| Simulium nebulosum | | Insects & other |
| Simulium negativum | | Insects & other |
| Simulium notatum | | Insects & other |
| Simulium paynei | | Insects & other |
| Simulium petersoni | | Insects & other |
| Simulium pilosum | | Insects & other |
| Simulium piperi | | Insects & other |
| Simulium pugetense | | Insects & other |
| Simulium quadratum | | Insects & other |
| Simulium rostratum | | Insects & other |
| Simulium saxosum | | Insects & other |
| Simulium silvestre | | Insects & other |
| Simulium tescorum | | Insects & other |
| Simulium tribulatum | | Insects & other |
| Simulium twinni | | Insects & other |
| Simulium vandalicum | | Insects & other |
| Simulium venator | | Insects & other |
| Simulium venustum | | Insects & other |
| Simulium virgatum | | Insects & other |
| Simulium vittatum | | Insects & other |
| Simulium wyomingense | | Insects & other |
| Simulium zephyrus | | Insects & other |

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| Sinapis alba | NA | Plants |
| Siphatales bicolor bicolor | Klamath tui chub | Fishes |
| Siphatales bicolor obesus | Lahontan stream tui chub | Fishes |
| Siphatales bicolor pectinifer | Lahontan lake tui chub | Fishes |
| Siphatales bicolor snyderi | Owens tui chub | Fishes |
| Siphatales bicolor ssp. 1 | Eagle Lake tui chub | Fishes |
| Siphatales bicolor ssp. 11 | High Rock Spring Tui Chub | Fishes |
| Siphatales mohavensis | Mojave tui chub | Fishes |
| Siphatales thalassinus ssp. 1 | Pit River tui chub | Fishes |
| Siphatales thalassinus thalassinus | Goose Lake tui chub | Fishes |
| Siphatales thalassinus vaccaceps | Cow Head tui chub | Fishes |
| Siphlonurus columbianus | A Mayfly | Insects & other |
| Siphlonurus occidentalis | A Mayfly | Insects & other |
| Siphlonurus spectabilis | A Mayfly | Insects & other |
| Sisko oregona | | Insects & other |
| Sisko sisko | | Insects & other |
| Sisyra vicaria | | Insects & other |
| Sisyrinchium californicum | Golden Blue-eyed-grass | Plants |
| Sisyrinchium elmeri | Elmer's Blue-eyed-grass | Plants |
| Sisyrinchium longipes | Timberland Blue-eyed-grass | Plants |
| Sium suave | Hemlock Water-parsnip | Plants |
| Skwala americana | American Springfly | Insects & other |
| Skwala curvata | Curved Springfly | Insects & other |
| Smicridea arizonensis | A Caddisfly | Insects & other |
| Smicridea dispar | A Caddisfly | Insects & other |
| Smicridea fasciatella | A Caddisfly | Insects & other |
| Smicridea signata | | Insects & other |
| Solidago elongata | | Plants |
| Solidago guiradonis | Guirado's Goldenrod | Plants |
| Solidago lepida salebrosa | | Plants |
| Solidago spectabilis | Nevada Goldenrod | Plants |
| Soliperla campanula | | Insects & other |
| Soliperla quadrispinula | Four-spined Roachfly | Insects & other |
| Soliperla sierra | Sierra Roachfly | Insects & other |
| Soliperla thyra | California Roachfly | Insects & other |
| Soliperla tillamook | | Insects & other |
| Somatochlora albicincta | Ringed Emerald | Insects & other |
| Somatochlora minor | | Insects & other |
| Somatochlora semicircularis | Mountain Emerald | Insects & other |
| Sorex palustris | American Water Shrew | Mammals |

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| Soyedina interrupta | | Insects & other |
| Soyedina nevadensis | Nevada Forestfly | Insects & other |
| Soyedina producta | Knobbed Forestfly | Insects & other |
| Sparganium angustifolium | Narrowleaf Bur-reed | Plants |
| Sparganium emersum | | Plants |
| Sparganium eurycarpum eurycarpum | | Plants |
| Sparganium eurycarpum greenei | | Plants |
| Sparganium natans | Small Bur-reed | Plants |
| Spartina densiflora | NA | Plants |
| Spartina foliosa | California Cordgrass | Plants |
| Spartina gracilis | Alkali Cordgrass | Plants |
| Spea hammondii | Western Spadefoot | Herps |
| Spea intermontana | Great Basin Spadefoot | Herps |
| Sperchon stellata | | Insects & other |
| Sphaerium occidentale | | Mollusks |
| Sphaerium patella | Rocky Mountain Fingernailclam | Mollusks |
| Sphaerium striatum | | Mollusks |
| Sphenosciadium capitellatum | Swamp Whiteheads | Plants |
| Spiranthes romanzoffiana | Hooded Ladies'-tresses | Plants |
| Spirinchus thaleichthys | Longfin smelt | Fishes |
| Spirodela polyrhiza | NA | Plants |
| Stachys ajugoides | Bugle Hedge-nettle | Plants |
| Stachys albens | White-stem Hedge-nettle | Plants |
| Stachys chamissonis chamissonis | Coast Hedge-nettle | Plants |
| Stachys pycnantha | Short-spike Hedge-nettle | Plants |
| Stachys rigida quercetorum | | Plants |
| Stachys stricta | Sonoma Hedge-nettle | Plants |
| Stactobiella brustia | | Insects & other |
| Stactobiella delira | A Caddisfly | Insects & other |
| Stactobiella palmata | | Insects & other |
| Stagnicola caperata | Wrinkled Marshsnail | Mollusks |
| Stagnicola elodes | Marsh Pondsnail | Mollusks |
| Stagnicola gabbi | Striate Pondsnail | Mollusks |
| Stagnicola traski | Widelip Pondsnail | Mollusks |
| Stegopterna acra | | Insects & other |
| Stegopterna permutata | | Insects & other |
| Stegopterna xantha | | Insects & other |
| Stellaria littoralis | Beach Starwort | Plants |
| Stemodia durantifolia | White-woolly Stemodia | Plants |
| Stenelmis calida calida | Devil's Hole Warm Spring Riffle Beetle | Insects & other |

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| Stenelmis lariversi | | Insects & other |
| Stenelmis moapa | | Insects & other |
| Stenelmis occidentalis | | Insects & other |
| Stenochironomus colei | | Insects & other |
| Stenochironomus fuscipatellus | | Insects & other |
| Stenochironomus hilaris | | Insects & other |
| Stenochironomus totifuscus | | Insects & other |
| Stenocolus scutellaris | | Insects & other |
| Stenocypris archoplites | An Ostracod | Crustaceans |
| Stictochironomus naevus | | Insects & other |
| Stictochironomus quagga | | Insects & other |
| Stictotarsus aequinoctialis | | Insects & other |
| Stictotarsus coelamboides | | Insects & other |
| Stictotarsus corvinus | | Insects & other |
| Stictotarsus decemsignatus | | Insects & other |
| Stictotarsus deceptus | | Insects & other |
| Stictotarsus dolerosus | | Insects & other |
| Stictotarsus eximius | | Insects & other |
| Stictotarsus expositus | | Insects & other |
| Stictotarsus funereus | | Insects & other |
| Stictotarsus griseostriatus | | Insects & other |
| Stictotarsus panaminti | | Insects & other |
| Stictotarsus roffi | | Insects & other |
| Stictotarsus spectabilis | | Insects & other |
| Stictotarsus striatellus | | Insects & other |
| Streptocephalus dorothae | New Mexico Fairy Shrimp | Crustaceans |
| Streptocephalus mackini | | Crustaceans |
| Streptocephalus sealii | Spinytail Fairy Shrimp | Crustaceans |
| Streptocephalus texanus | Greater Plains Fairy Shrimp | Crustaceans |
| Streptocephalus woottoni | Riverside Fairy Shrimp | Crustaceans |
| Streptopus amplexifolius americanus | | Plants |
| Strix nebulosa | Great Gray Owl | Birds |
| Stuckenia filiformis alpina | | Plants |
| Stuckenia pectinata | | Plants |
| Stuckenia striata | | Plants |
| Stygalbiella affinis | | Insects & other |
| Stygalbiella arizonica | | Insects & other |
| Stygobromus cherylae | Barr's Amphipod | Crustaceans |
| Stygobromus cowani | Cowan's Amphipod | Crustaceans |
| Stygobromus gallawayae | Gallaway's Amphipod | Crustaceans |

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|---|---|---|
| Stygobromus gradyi | Grady's Cave Amphipod | Crustaceans |
| Stygobromus grahami | A Cave Obligate Amphipod | Crustaceans |
| Stygobromus harai | Hara's Cave Amphipod | Crustaceans |
| Stygobromus hyporheicus | Hypoheic Amphipod | Crustaceans |
| Stygobromus imperialis | Imperial Amphipod | Crustaceans |
| Stygobromus lacicolus | Lake Tahoe  Amphipod | Crustaceans |
| Stygobromus mackenziei | Mackenzie's Cave Amphipod | Crustaceans |
| Stygobromus myersae | Myers' Amphipod | Crustaceans |
| Stygobromus mysticus | A Cave Obligate Amphipod | Crustaceans |
| Stygobromus rudolphi | Rudolph's Amphipod | Crustaceans |
| Stygobromus sheldoni | Sheldon Stygobromid | Crustaceans |
| Stygobromus sierrensis | A Cave Obligate Amphipod | Crustaceans |
| Stygobromus tahoensis | Lake Tahoe Stygobromid | Crustaceans |
| Stygobromus trinus | Trinity County Amphipod | Crustaceans |
| Stygobromus wengerorum | Wenger Cave Stygobromid | Crustaceans |
| Stygonyx courtneyi | | Crustaceans |
| Stygoporus oregonensis | | Insects & other |
| Stylurus intricatus | Brimstone Clubtail | Insects & other |
| Stylurus olivaceus | Olive Clubtail | Insects & other |
| Stylurus plagiatus | Russet-tipped Clubtail | Insects & other |
| Suaeda calceoliformis | American Sea-blite | Plants |
| Suaeda californica | California Sea-blite | Plants |
| Suaeda esteroa | Estuary Suaeda | Plants |
| Sublettea coffmani | | Insects & other |
| Subularia aquatica americana | Water Awlwort | Plants |
| Suphisellus bicolor | | Insects & other |
| Susulus venustus | Beautiful Springfly | Insects & other |
| Suwallia amoenacolens | | Insects & other |
| Suwallia autumna | | Insects & other |
| Suwallia dubia | Pale Sallfly | Insects & other |
| Suwallia lineosa | | Insects & other |
| Suwallia pallidula | Yellow Sallfly | Insects & other |
| Suwallia shepardi | A Stonefly | Insects & other |
| Suwallia sierra | Sierra Sallfly | Insects & other |
| Suwallia starki | | Insects & other |
| Suwallia sublimis | A Stonefly | Insects & other |
| Sweltsa adamantea | | Insects & other |
| Sweltsa borealis | Boreal Sallfly | Insects & other |
| Sweltsa californica | Chico Sallfly | Insects & other |
| Sweltsa coloradensis | Colorado Sallfly | Insects & other |
| Sweltsa continua | Gabriel Sallfly | Insects & other |

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|---|---|---|
| Sweltsa exquisita | | Insects & other |
| Sweltsa fidelis | Mountain Sallfly | Insects & other |
| Sweltsa lamba | | Insects & other |
| Sweltsa occidens | | Insects & other |
| Sweltsa oregonensis | | Insects & other |
| Sweltsa pacifica | Pacific Sallfly | Insects & other |
| Sweltsa pisteri | Coastal Sallfly | Insects & other |
| Sweltsa resima | California Sallfly | Insects & other |
| Sweltsa revelstoka | | Insects & other |
| Sweltsa salix | A Stonefly | Insects & other |
| Sweltsa tamalpa | Tamalpais Sallfly | Insects & other |
| Sweltsa townesi | Sierra Sallfly | Insects & other |
| Sweltsa umbonata | Shasta Sallfly | Insects & other |
| Sweltsa yurok | A Stonefly | Insects & other |
| Symbiocladius equitans | | Insects & other |
| Sympetrum corruptum | Variegated Meadowhawk | Insects & other |
| Sympetrum costiferum | Saffron-winged Meadowhawk | Insects & other |
| Sympetrum danae | Black Meadowhawk | Insects & other |
| Sympetrum illotum | Cardinal Meadowhawk | Insects & other |
| Sympetrum internum | Cherry-faced Meadowhawk | Insects & other |
| Sympetrum madidum | Red-veined Meadowhawk | Insects & other |
| Sympetrum obtrusum | White-faced Meadowhawk | Insects & other |
| Sympetrum occidentale | | Insects & other |
| Sympetrum pallipes | Striped Meadowhawk | Insects & other |
| Sympetrum signiferum | | Insects & other |
| Sympetrum vicinum | Autumn Meadowhawk | Insects & other |
| Symphyotrichum bracteolatum | | Plants |
| Symphyotrichum frondosum | Alkali Aster | Plants |
| Symphyotrichum lanceolatum hesperium | Siskiyou Aster | Plants |
| Symphyotrichum lanceolatum lanceolatum | NA | Plants |
| Symphyotrichum lentum | Suisun Marsh Aster | Plants |
| Sympotthastia diastena | | Insects & other |
| Syncaris pacifica | California Freshwater Shrimp | Crustaceans |
| Syncaris pasadenae | Pasadena Freshwater Shrimp | Crustaceans |
| Synendotendipes luski | | Insects & other |
| Tachycineta bicolor | Tree Swallow | Birds |
| Taenionema californicum | California Willowfly | Insects & other |
| Taenionema grinnelli | Angeles Willowfly | Insects & other |
| Taenionema jacobii | | Insects & other |
| Taenionema jeanae | A Stonefly | Insects & other |

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|---|---|---|
| Taenionema jewetti | | Insects & other |
| Taenionema kincaidi | Pale Willowfly | Insects & other |
| Taenionema oregonense | | Insects & other |
| Taenionema pacificum | Pacific Willowfly | Insects & other |
| Taenionema pallidum | Common Willowfly | Insects & other |
| Taenionema raynorium | Yosemite Willowfly | Insects & other |
| Taenionema uinta | | Insects & other |
| Taenionema umatilla | | Insects & other |
| Taeniopteryx nivalis | Boreal Willowfly | Insects & other |
| Talitroides alluaudi | | Crustaceans |
| Talitroides topitotum | | Crustaceans |
| Tanypteryx hageni | Black Petaltail | Insects & other |
| Tanypus carinatus | | Insects & other |
| Tanypus grodhausi | | Insects & other |
| Tanypus imperialis | | Insects & other |
| Tanypus neopunctipennis | | Insects & other |
| Tanypus nubifer | | Insects & other |
| Tanypus parastellatus | | Insects & other |
| Tanypus punctipennis | | Insects & other |
| Tanypus stellatus | | Insects & other |
| Tanytarsus angulatus | | Insects & other |
| Tanytarsus challeti | | Insects & other |
| Tanytarsus dendyi | | Insects & other |
| Tanytarsus hastatus | | Insects & other |
| Tanytarsus limneticus | | Insects & other |
| Tanytarsus mendax | | Insects & other |
| Tanytarsus neoflavellus | | Insects & other |
| Tanytarsus pelsuei | | Insects & other |
| Taricha granulosa | Rough-skinned Newt | Herps |
| Taricha rivularis | Red-bellied Newt | Herps |
| Taricha sierrae | Sierra Newt | Herps |
| Taricha torosa | Coast Range Newt | Herps |
| Taxus brevifolia | | Plants |
| Telebasis salva | Desert Firetail | Insects & other |
| Telmatogeton alaskensis | | Insects & other |
| Telmatogeton japonicus | | Insects & other |
| Telmatogeton macswaini | | Insects & other |
| Telmatogeton spinosus | | Insects & other |
| Telmatogeton trilobatus | | Insects & other |
| Teloleuca bifasciata | | Insects & other |
| Teloleuca pellucens | | Insects & other |

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|---|---|---|
| Tempisquitoneura merrillorum | | Insects & other |
| Tethymyia aptena | | Insects & other |
| Thalassosmittia clavicornis | | Insects & other |
| Thalassosmittia marina | | Insects & other |
| Thalassosmittia pacifica | | Insects & other |
| Thalassotrechus barbarae | | Insects & other |
| Thaleichthys pacificus | Eulachon | Fishes |
| Thamnocephalus mexicanus | | Crustaceans |
| Thamnocephalus platyurus | Beavertail Fairy Shrimp | Crustaceans |
| Thamnophis atratus atratus | Santa Cruz Gartersnake | Herps |
| Thamnophis atratus hydrophilius | Oregon Gartersnake | Herps |
| Thamnophis atratus zaxanthus | Diablo Range Gartersnake | Herps |
| Thamnophis couchii | Sierra Gartersnake | Herps |
| Thamnophis elegans elegans | Mountain Gartersnake | Herps |
| Thamnophis elegans terrestris | Coast Gartersnake | Herps |
| Thamnophis elegans vagrans | Wandering Gartersnake | Herps |
| Thamnophis gigas | Giant Gartersnake | Herps |
| Thamnophis hammondii hammondii | Two-striped Gartersnake | Herps |
| Thamnophis hammondii ssp. 1 | Santa Catalina Gartersnake | Herps |
| Thamnophis marcianus marcianus | Marcy's Checkered Gartersnake | Herps |
| Thamnophis ordinoides | Northwestern Gartersnake | Herps |
| Thamnophis sirtalis fitchi | Valley Gartersnake | Herps |
| Thamnophis sirtalis infernalis | California Red-sided Gartersnake | Herps |
| Thamnophis sirtalis sirtalis | Common Gartersnake | Herps |
| Thamnophis sirtalis ssp. 1 | South Coast Gartersnake | Herps |
| Thamnophis sirtalis tetrataenia | San Francisco Gartersnake | Herps |
| Thelypteris puberula sonorensis | NA | Plants |
| Thermonectus intermedius | | Insects & other |
| Thermonectus marmoratus | | Insects & other |
| Thermonectus nigrofasciatus nigrofasciatus | | Insects & other |
| Thermonectus sibleyi | | Insects & other |
| Thienemannimyia barberi | | Insects & other |
| Thienemannimyia fusciceps | | Insects & other |
| Thienemannimyia norena | | Insects & other |
| Thraulodes brunneus | | Insects & other |
| Thraulodes gonzalesi | | Insects & other |
| Thraulodes tenulineus | | Insects & other |
| Throscinus crotchi | | Insects & other |
| Timpanoga hecuba | A Mayfly | Insects & other |

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|---|---|---|
| Tinodes belisus | A Caddisfly | Insects & other |
| Tinodes cascadius | A Caddisfly | Insects & other |
| Tinodes consuetus | A Caddisfly | Insects & other |
| Tinodes gabriella | A Caddisfly | Insects & other |
| Tinodes parvulus | A Caddisfly | Insects & other |
| Tinodes powelli | A Caddisfly | Insects & other |
| Tinodes provo | A Caddisfly | Insects & other |
| Tinodes schusteri | A Caddisfly | Insects & other |
| Tinodes sigodanus | A Caddisfly | Insects & other |
| Tinodes siskiyou | A Caddisfly | Insects & other |
| Tinodes twilus | A Caddisfly | Insects & other |
| Tinodes usillus | A Caddisfly | Insects & other |
| Tlalocomyia andersoni | | Insects & other |
| Tlalocomyia osbornii | | Insects & other |
| Tlalocomyia ramifera | | Insects & other |
| Tlalocomyia stewarti | | Insects & other |
| Torreyochloa pallida | NA | Plants |
| Toxicoscordion fontanum | NA | Plants |
| Toxicoscordion micranthum | NA | Plants |
| Toxicoscordion venenosum venenosum | | Plants |
| Toxorhynchites moctezuma | | Insects & other |
| Tramea calverti | | Insects & other |
| Tramea lacerata | Black Saddlebags | Insects & other |
| Tramea onusta | Red Saddlebags | Insects & other |
| Traverella albertana | | Insects & other |
| Trepobates becki | | Insects & other |
| Trepobates pictus | | Insects & other |
| Trepobates taylori | | Insects & other |
| Trepobates trepidus | | Insects & other |
| Triaenodes frontalis | | Insects & other |
| Triaenodes injustus | | Insects & other |
| Triaenodes reuteri | | Insects & other |
| Triaenodes tardus | A Caddisfly | Insects & other |
| Tribelos jucundum | | Insects & other |
| Tribelos subatrum | | Insects & other |
| Tribelos subletteorum | | Insects & other |
| Trichocorixa arizonensis | | Insects & other |
| Trichocorixa calva | | Insects & other |
| Trichocorixa reticulata | | Insects & other |
| Trichocorixa uhleri | | Insects & other |

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|---|---|---|
| Trichocorixa verticalis | | Insects & other |
| Tricoryhyphes condylus | | Insects & other |
| Tricorythodes explicatus | A Mayfly | Insects & other |
| Tricorythodes fictus | A Mayfly | Insects & other |
| Triglochin maritima | Common Bog Arrow-grass | Plants |
| Triglochin palustris | Slender Bog Arrow-grass | Plants |
| Triglochin scilloides | NA | Plants |
| Triglochin striata | Three-ribbed Arrow-grass | Plants |
| Tringa melanoleuca | Greater Yellowlegs | Birds |
| Tringa semipalmata | Willet | Birds |
| Tringa solitaria | Solitary Sandpiper | Birds |
| Triops longicaudatus | Summer tadpole shrimps | Crustaceans |
| Triznaka pintada | Rough Sallfly | Insects & other |
| Triznaka sheldoni | | Insects & other |
| Triznaka signata | | Insects & other |
| Tropicus pusillus | | Insects & other |
| Tropisternus californicus | | Insects & other |
| Tropisternus columbianus | | Insects & other |
| Tropisternus ellipticus | | Insects & other |
| Tropisternus lateralis | | Insects & other |
| Tropisternus orvus | | Insects & other |
| Tropisternus salsamentus | | Insects & other |
| Tropisternus sublaevis | | Insects & other |
| Tryonia margae | Grapevine Springs Elongate Tryonia | Mollusks |
| Tryonia porrecta | Desert Tryonia | Mollusks |
| Tryonia rowlandsi | Grapevine Springs Squat Tryonia | Mollusks |
| Tryonia salina | Cottonball Marsh Tryonia | Mollusks |
| Tryonia variegata | Amargosa Tryonia | Mollusks |
| Tuctoria greenei | Green's Awnless Orcutt Grass | Plants |
| Tuctoria mucronata | Mucronate Orcutt Grass | Plants |
| Tvetenia vitracies | | Insects & other |
| Twinnia hirticornis | | Insects & other |
| Typha domingensis | Southern Cattail | Plants |
| Typha latifolia | Broadleaf Cattail | Plants |
| Uca crenulata | | Crustaceans |
| Uranotaenia anhydor | | Insects & other |
| Utacapnia columbiana | Columbian Snowfly | Insects & other |
| Utacapnia imbera | | Insects & other |
| Utacapnia lemoniana | | Insects & other |
| Utacapnia sierra | Sierra Snowfly | Insects & other |
| Utacapnia tahoensis | Tahoe Snnowflyl | Insects & other |

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|---|---|---|
| Utaperla sopladora | | Insects & other |
| Utaxatax californiensis | | Insects & other |
| Utaxatax newelli | | Insects & other |
| Utaxatax ovalis | | Insects & other |
| Utricularia gibba | Humped Bladderwort | Plants |
| Utricularia intermedia | Flatleaf Bladderwort | Plants |
| Utricularia macrorhiza | Greater Bladderwort | Plants |
| Utricularia minor | Lesser Bladderwort | Plants |
| Utricularia ochroleuca | Northern Bladderwort | Plants |
| Utricularia subulata | NA | Plants |
| Uvarus amandus | | Insects & other |
| Uvarus subtilis | | Insects & other |
| Vaccinium macrocarpon | NA | Plants |
| Vaccinium uliginosum occidentale | | Plants |
| Vaccupernius packeri | | Insects & other |
| Valvata humeralis | Glossy Valvata | Mollusks |
| Valvata tricarinata | | Mollusks |
| Valvata utahensis | | Mollusks |
| Valvata virens | Emerald Valvata | Mollusks |
| Veratrum fimbriatum | Fringed False Hellebore | Plants |
| Verbena scabra | Sandpaper Vervain | Plants |
| Veronica americana | American Speedwell | Plants |
| Veronica anagallis-aquatica | NA | Plants |
| Veronica catenata | NA | Plants |
| Veronica peregrina | NA | Plants |
| Veronica scutellata | Marsh-speedwell | Plants |
| Vertigo ovata | Ovate Vertigo | Mollusks |
| Vespericola armiger | Santa Cruz Hesperian | Mollusks |
| Vespericola embertoni | Reeves Canyon Hesperian Snail | Mollusks |
| Vespericola eritrichius | Velvet Hesperian | Mollusks |
| Vespericola euthales | A Terrestrial Snail | Mollusks |
| Vespericola haplus | Butte Creek Hesperian | Mollusks |
| Vespericola karokorum | Karok Hesperian | Mollusks |
| Vespericola klamathicus | Klamath Hesperian | Mollusks |
| Vespericola marinensis | Marin Hesperian | Mollusks |
| Vespericola megasoma | Redwood Hesperian | Mollusks |
| Vespericola orius | El Dorado Hesperian | Mollusks |
| Vespericola pilosus | Brushfield Hesperian | Mollusks |
| Vespericola pinicola | Monterey Hesperian | Mollusks |
| Vespericola pressleyi | Big Bar Hesperian | Mollusks |

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|---|---|---|
| Vespericola rhodophila | Azalea Hesperian Snail | Mollusks |
| Vespericola rothi | Ellery Creek Hesperian | Mollusks |
| Vespericola sasquatch | Sasquatch Hesperian Snail | Mollusks |
| Vespericola scotti | Benson Gulch Hesperian | Mollusks |
| Vespericola shasta | Shasta Hesperian | Mollusks |
| Vespericola sierranus | Siskiyou Hesperian | Mollusks |
| Viola langsdorffii | NA | Plants |
| Viola macloskeyi | NA | Plants |
| Vireo bellii | Bell's Vireo | Birds |
| Vireo bellii arizonae | Arizona Bell's Vireo | Birds |
| Vireo bellii pusillus | Least Bell's Vireo | Birds |
| Visoka cataractae | Cataract Forestfly | Insects & other |
| Vorticifex effusa effusa | Artemesian Rams-horn | Mollusks |
| Vorticifex solida | A Freshwater Snail | Mollusks |
| Wolffia arrhiza | NA | Plants |
| Wolffia borealis | Dotted Watermeal | Plants |
| Wolffia brasiliensis | Pointed Watermeal | Plants |
| Wolffia columbiana | Columbian Watermeal | Plants |
| Wolffia globosa | Asian Watermeal | Plants |
| Wolffiella lingulata | Tongue Bogmat | Plants |
| Wolffiella oblonga | Saber-shape Bogmat | Plants |
| Wormaldia anilla | A Caddisfly | Insects & other |
| Wormaldia arizonensis | | Insects & other |
| Wormaldia birneyi | A Caddisfly | Insects & other |
| Wormaldia gabriella | A Caddisfly | Insects & other |
| Wormaldia gesugta | A Caddisfly | Insects & other |
| Wormaldia hamata | A Caddisfly | Insects & other |
| Wormaldia laona | A Caddisfly | Insects & other |
| Wormaldia occidea | A Caddisfly | Insects & other |
| Wormaldia pachita | A Caddisfly | Insects & other |
| Xanthocephalus xanthocephalus | Yellow-headed Blackbird | Birds |
| Xenelmis sandersoni | | Insects & other |
| Xenochironomus xenolabis | | Insects & other |
| Xenopelopia tincta | | Insects & other |
| Xyrauchen texanus | Razorback sucker | Fishes |
| Yoraperla brevis | Least Roachfly | Insects & other |
| Yoraperla mariana | | Insects & other |
| Yoraperla nigrisoma | Black Roachfly | Insects & other |
| Yoraperla siletz | Coastal Roachfly | Insects & other |
| Yphria californica | A Caddisfly | Insects & other |
| Zaitzevia parvula | | Insects & other |

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|---|---|---|
| Zaitzevia posthonia | | Insects & other |
| Zannichellia palustris | Horned Pondweed | Plants |
| Zapada cinctipes | Common Forestfly | Insects & other |
| Zapada columbiana | Columbian Forestfly | Insects & other |
| Zapada cordillera | Cordilleran Forestfly | Insects & other |
| Zapada frigida | Frigid Forestfly | Insects & other |
| Zapada haysi | Intermountain Forestfly | Insects & other |
| Zapada oregonensis | Oregon Forestfly | Insects & other |
| Zavrelimyia sinuosa | | Insects & other |
| Zavrelimyia thryptica | | Insects & other |
| Zizania palustris interior | NA | Plants |
| Zizania palustris palustris | NA | Plants |
| Zoniagrion exclamationis | Exclamation Damsel | Insects & other |
| Zumatrichia notosa | | Insects & other |

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| OBJECTID_1 | Elements_GROUP_ | Elements_ELM_SCINAM | Elements_ELM_COMNAM | Elements_Fed_list | Elements_State_list | Elements_Other_list | Elements_MgtAg_list | ObservationType_ObsTyp_Name | Format_Fmt_Name | HabitatUsage_HabU_Name | Source_Source_Name |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Crustaceans | Branchinecta lynchi | Vernal Pool Fairy Shrimp | Threatened | Special | IUCN - Vulnerable | | Critical habitat management area designations | Polygon | Undefined | USFWS Critical Habitat Designation |
| 2 | Crustaceans | Branchinecta lynchi | Vernal Pool Fairy Shrimp | Threatened | Special | IUCN - Vulnerable | | Current observations (post 1980) | Polygon | Undefined | California Natural Diversity Database (4/2016) |
| 3 | Crustaceans | Branchinecta lynchi | Vernal Pool Fairy Shrimp | Threatened | Special | IUCN - Vulnerable | | Range (current or unknown) | Polygon | Undefined | Range approx. from NatureServe Explorer descriptions |
| 4 | Herps | Actinemys marmorata marmorata | Western Pond Turtle | | Special Concern | ARSSC | BLM, USFS | Current observations (post 1980) | Polygon | Undefined | California Natural Diversity Database (4/2016) |
| 5 | Herps | Actinemys marmorata marmorata | Western Pond Turtle | | Special Concern | ARSSC | BLM, USFS | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 6 | Herps | Ambystoma californiense californiense | California Tiger Salamander | Threatened | Threatened | ARSSC | | Critical habitat management area designations | Polygon | Undefined | USFWS Critical Habitat Designation |
| 7 | Herps | Ambystoma californiense californiense | California Tiger Salamander | Threatened | Threatened | ARSSC | | Current observations (post 1980) | Polygon | Undefined | California Natural Diversity Database (4/2016) |
| 8 | Herps | Ambystoma californiense californiense | California Tiger Salamander | Threatened | Threatened | ARSSC | | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 9 | Herps | Anaxyrus boreas boreas | Boreal Toad | | | | | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 10 | Herps | Anaxyrus californicus | Arroyo Toad | Endangered | Special Concern | ARSSC | | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 11 | Herps | Pseudacris cadaverina | California Treefrog | | | ARSSC | | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 12 | Herps | Rana boylii | Foothill Yellow-legged Frog | Under Review in the Candidate or Petition Process | Special Concern | ARSSC | BLM, USFS | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 13 | Herps | Rana draytonii | California Red-legged Frog | Threatened | Special Concern | ARSSC | | Critical habitat management area designations | Polygon | Undefined | USFWS Critical Habitat Designation |
| 14 | Herps | Rana draytonii | California Red-legged Frog | Threatened | Special Concern | ARSSC | | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 15 | Herps | Spea hammondii | Western Spadefoot | Under Review in the Candidate or Petition Process | Special Concern | ARSSC | BLM | Current observations (post 1980) | Polygon | Undefined | California Natural Diversity Database (4/2016) |
| 16 | Herps | Spea hammondii | Western Spadefoot | Under Review in the Candidate or Petition Process | Special Concern | ARSSC | BLM | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 17 | Herps | Taricha torosa | Coast Range Newt | | Special Concern | ARSSC | | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 18 | Herps | Thamnophis hammondii hammondii | Two-striped Gartersnake | | Special Concern | ARSSC | BLM, USFS | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 19 | Herps | Thamnophis sirtalis sirtalis | Common Gartersnake | | | | | Modeled habitat generalized observation | Polygon | Undefined | California Wildlife Habitat Relationships |
| 20 | Plants | Navarretia prostrata | Prostrate Navarretia | | Special | CRPR - 1B.1 | | Current observations (post 1980) | Polygon | Undefined | California Natural Diversity Database (4/2016) |
| 21 | Birds | Actitis macularius | Spotted Sandpiper | | | | | Current observations (post 1980) | Point | Undefined | SBMNH OS |
| 22 | Birds | Actitis macularius | Spotted Sandpiper | | | | | Unknown | Point | Undefined | MVZ MVZ Birds |
| 23 | Birds | Aechmophorus occidentalis | Western Grebe | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 24 | Birds | Agelaius tricolor | Tricolored Blackbird | Bird of Conservation Concern | Special Concern | BSSC - First priority | BLM | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 25 | Birds | Agelaius tricolor | Tricolored Blackbird | Bird of Conservation Concern | Special Concern | BSSC - First priority | BLM | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 26 | Birds | Agelaius tricolor | Tricolored Blackbird | Bird of Conservation Concern | Special Concern | BSSC - First priority | BLM | Unknown | Point | Undefined | Royal Ontario Museum: ROM Birds |
| 27 | Birds | Aix sponsa | Wood Duck | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 28 | Birds | Aix sponsa | Wood Duck | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 29 | Birds | Anas americana | American Wigeon | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 30 | Birds | Anas americana | American Wigeon | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 31 | Birds | Anas americana | American Wigeon | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 32 | Birds | Anas clypeata | Northern Shoveler | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 33 | Birds | Anas crecca | Green-winged Teal | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 34 | Birds | Anas crecca | Green-winged Teal | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 35 | Birds | Anas cyanoptera | Cinnamon Teal | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 36 | Birds | Anas cyanoptera | Cinnamon Teal | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 37 | Birds | Anas platyrhynchos | Mallard | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 38 | Birds | Anas platyrhynchos | Mallard | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 39 | Birds | Anas platyrhynchos | Mallard | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 40 | Birds | Anas platyrhynchos | Mallard | | | | | Current observations (post 1980) | Point | Undefined | SBMNH AV |
| 41 | Birds | Anas platyrhynchos | Mallard | | | | | Current observations (post 1980) | Point | Undefined | SBMNH OS |
| 42 | Birds | Anas strepera | Gadwall | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 43 | Birds | Anas strepera | Gadwall | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 44 | Birds | Anas strepera | Gadwall | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 45 | Birds | Ardea alba | Great Egret | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 46 | Birds | Ardea alba | Great Egret | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 47 | Birds | Ardea alba | Great Egret | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 48 | Birds | Ardea herodias | Great Blue Heron | | | | | Current observations (post 1980) | Point | Undefined | California Avian Datacenter, Level 5 - Big Sur Ornithology Lab |
| 49 | Birds | Ardea herodias | Great Blue Heron | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 50 | Birds | Ardea herodias | Great Blue Heron | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 51 | Birds | Aythya collaris | Ring-necked Duck | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 52 | Birds | Aythya collaris | Ring-necked Duck | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 53 | Birds | Aythya collaris | Ring-necked Duck | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 54 | Birds | Bucephala albeola | Bufflehead | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 55 | Birds | Bucephala albeola | Bufflehead | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 56 | Birds | Bucephala albeola | Bufflehead | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 57 | Birds | Bucephala clangula | Common Goldeneye | | | | | Current observations (post 1980) | Point | Undefined | SBMNH AV |
| 58 | Birds | Butorides virescens | Green Heron | | | | | Current observations (post 1980) | Point | Undefined | California Avian Datacenter, Level 5 - Big Sur Ornithology Lab |
| 59 | Birds | Butorides virescens | Green Heron | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 60 | Birds | Chen caerulescens | Snow Goose | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 61 | Birds | Chen rossii | Ross's Goose | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 62 | Birds | Cistothorus palustris palustris | Marsh Wren | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 63 | Birds | Cistothorus palustris palustris | Marsh Wren | | | | | Unknown | Point | Undefined | Royal Ontario Museum: ROM Birds |
| 64 | Birds | Egretta thula | Snowy Egret | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 65 | Birds | Egretta thula | Snowy Egret | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 66 | Birds | Fulica americana | American Coot | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 67 | Birds | Fulica americana | American Coot | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 68 | Birds | Fulica americana | American Coot | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 69 | Birds | Gallinago delicata | Wilson's Snipe | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 70 | Birds | Gallinago delicata | Wilson's Snipe | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 71 | Birds | Gallinula chloropus | Common Moorhen | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 72 | Birds | Geothlypis trichas trichas | Common Yellowthroat | | | | | Current observations (post 1980) | Point | Undefined | California Avian Datacenter, Level 5 - Big Sur Ornithology Lab |
| 73 | Birds | Haliaeetus leucocephalus | Bald Eagle | Bird of Conservation Concern | Endangered | | USFS, BLM | Current observations (post 1980) | Point | Undefined | California Natural Diversity Database (4/2016) |
| 74 | Birds | Haliaeetus leucocephalus | Bald Eagle | Bird of Conservation Concern | Endangered | | USFS, BLM | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 75 | Birds | Haliaeetus leucocephalus | Bald Eagle | Bird of Conservation Concern | Endangered | | USFS, BLM | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 76 | Birds | Haliaeetus leucocephalus | Bald Eagle | Bird of Conservation Concern | Endangered | | USFS, BLM | Current observations (post 1980) | Point | Undefined | iNaturalist Observations |
| 77 | Birds | Lophodytes cucullatus | Hooded Merganser | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 78 | Birds | Lophodytes cucullatus | Hooded Merganser | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 79 | Birds | Lophodytes cucullatus | Hooded Merganser | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 80 | Birds | Megaceryle alcyon | Belted Kingfisher | | | | | Current observations (post 1980) | Point | Undefined | California Avian Datacenter, Level 5 - Big Sur Ornithology Lab |
| 81 | Birds | Megaceryle alcyon | Belted Kingfisher | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 82 | Birds | Megaceryle alcyon | Belted Kingfisher | | | | | Current observations (post 1980) | Point | Undefined | SBMNH AV |
| 83 | Birds | Mergus merganser | Common Merganser | | | | | Current observations (post 1980) | Point | Undefined | California Avian Datacenter, Level 5 - Big Sur Ornithology Lab |
| 84 | Birds | Mergus merganser | Common Merganser | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 85 | Birds | Nycticorax nycticorax | Black-crowned Night-Heron | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 86 | Birds | Oxyura jamaicensis | Ruddy Duck | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 87 | Birds | Oxyura jamaicensis | Ruddy Duck | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 88 | Birds | Phalacrocorax auritus | Double-crested Cormorant | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 89 | Birds | Phalacrocorax auritus | Double-crested Cormorant | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 90 | Birds | Podiceps nigricollis | Eared Grebe | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 91 | Birds | Podilymbus podiceps | Pied-billed Grebe | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 92 | Birds | Podilymbus podiceps | Pied-billed Grebe | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 93 | Birds | Porzana carolina | Sora | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 94 | Birds | Porzana carolina | Sora | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 95 | Birds | Porzana carolina | Sora | | | | | Unknown | Point | Undefined | Royal Ontario Museum: ROM Birds |
| 96 | Birds | Rallus limicola | Virginia Rail | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 97 | Birds | Riparia riparia | Bank Swallow | | Threatened | | | Current observations (post 1980) | Point | Undefined | California Natural Diversity Database (4/2016) |
| 98 | Birds | Setophaga petechia | Yellow Warbler | | | BSSC - Second priority | | Current observations (post 1980) | Point | Undefined | California Avian Datacenter, Level 5 - Big Sur Ornithology Lab |
| 99 | Birds | Setophaga petechia | Yellow Warbler | | | BSSC - Second priority | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 100 | Birds | Setophaga petechia | Yellow Warbler | | | BSSC - Second priority | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 101 | Birds | Tachycineta bicolor | Tree Swallow | | | | | Current observations (post 1980) | Point | Undefined | California Avian Datacenter, Level 5 - Big Sur Ornithology Lab |
| 102 | Birds | Tachycineta bicolor | Tree Swallow | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 103 | Birds | Tachycineta bicolor | Tree Swallow | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 104 | Birds | Tachycineta bicolor | Tree Swallow | | | | | Current observations (post 1980) | Point | Undefined | CLO GBBC |
| 105 | Birds | Tringa melanoleuca | Greater Yellowlegs | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 106 | Birds | Tringa melanoleuca | Greater Yellowlegs | | | | | Current observations (post 1980) | Point | Undefined | SBMNH AV |
| 107 | Birds | Tringa solitaria | Solitary Sandpiper | | | | | Current observations (post 1980) | Point | Undefined | CLO EBIRD_CA |
| 108 | Birds | Vireo bellii pusillus | Least Bell's Vireo | Endangered | Endangered | | BLM | Current observations (post 1980) | Point | Undefined | California Natural Diversity Database (4/2016) |
| 109 | Birds | Xanthocephalus xanthocephalus | Yellow-headed Blackbird | | Special Concern | BSSC - Third priority | | Current observations (post 1980) | Point | Undefined | California Avian Datacenter, Level 5 - Big Sur Ornithology Lab |
| 110 | Birds | Xanthocephalus xanthocephalus | Yellow-headed Blackbird | | Special Concern | BSSC - Third priority | | Current observations (post 1980) | Point | Undefined | CLO EBIRD |
| 111 | Crustaceans | Branchinecta lynchi | Vernal Pool Fairy Shrimp | Threatened | Special | IUCN - Vulnerable | | Current observations (post 1980) | Point | Undefined | California Natural Diversity Database (4/2016) |
| 112 | Crustaceans | Cyprididae fam. | Cyprididae fam. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 113 | Crustaceans | Hyalella spp. | Hyalella spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 114 | Crustaceans | Pacifastacus spp. | Pacifastacus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 115 | Herps | Actinemys marmorata marmorata | Western Pond Turtle | | Special Concern | ARSSC | BLM, USFS | Current observations (post 1980) | Point | Undefined | LACM Herps |
| 116 | Herps | Actinemys marmorata marmorata | Western Pond Turtle | | Special Concern | ARSSC | BLM, USFS | Unknown | Point | Undefined | California Natural Diversity Database (4/2016) |
| 117 | Herps | Anaxyrus boreas boreas | Boreal Toad | | | | | Current observations (post 1980) | Point | Undefined | iNaturalist Observations |
| 118 | Herps | Pseudacris hypochondriaca | Baja California Treefrog | | | | | Current observations (post 1980) | Point | Undefined | MHP MHP-H |
| 119 | Herps | Pseudacris regilla | Northern Pacific Chorus Frog | | | | | Current observations (post 1980) | Point | Undefined | CAS HERP |
| 120 | Herps | Pseudacris regilla | Northern Pacific Chorus Frog | | | | | Current observations (post 1980) | Point | Undefined | CCBER Herps |
| 121 | Herps | Pseudacris regilla | Northern Pacific Chorus Frog | | | | | Current observations (post 1980) | Point | Undefined | MHP MHP-H |
| 122 | Herps | Pseudacris regilla | Northern Pacific Chorus Frog | | | | | Current observations (post 1980) | Point | Undefined | SBMNH HE |
| 123 | Herps | Rana draytonii | California Red-legged Frog | Threatened | Special Concern | ARSSC | | Current observations (post 1980) | Point | Undefined | California Natural Diversity Database (4/2016) - 'Sensitive' |
| 124 | Herps | Rana draytonii | California Red-legged Frog | Threatened | Special Concern | ARSSC | | Current observations (post 1980) | Point | Undefined | SBMNH HE |
| 125 | Herps | Spea hammondii | Western Spadefoot | Under Review in the Candidate or Petition Process | Special Concern | ARSSC | BLM | Current observations (post 1980) | Point | Undefined | California Natural Diversity Database (4/2016) |
| 126 | Herps | Spea hammondii | Western Spadefoot | Under Review in the Candidate or Petition Process | Special Concern | ARSSC | BLM | Current observations (post 1980) | Point | Undefined | CAS HERP |
| 127 | Herps | Thamnophis sirtalis infernalis | California Red-sided Gartersnake | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | CAS HERP |
| 128 | Herps | Thamnophis sirtalis sirtalis | Common Gartersnake | | | | | Current observations (post 1980) | Point | Undefined | CAS HERP |
| 129 | Insects & other inverts | Agabus spp. | Agabus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 130 | Insects & other inverts | Berosus spp. | Berosus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 131 | Insects & other inverts | Callibaetis spp. | Callibaetis spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 132 | Insects & other inverts | Centroptilum spp. | Centroptilum spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 133 | Insects & other inverts | Chironomidae fam. | Chironomidae fam. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 134 | Insects & other inverts | Chironomus spp. | Chironomus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 135 | Insects & other inverts | Cladotanytarsus spp. | Cladotanytarsus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 136 | Insects & other inverts | Coenagrionidae fam. | Coenagrionidae fam. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 137 | Insects & other inverts | Corisella spp. | Corisella spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 138 | Insects & other inverts | Corixidae fam. | Corixidae fam. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 139 | Insects & other inverts | Cricotopus spp. | Cricotopus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 140 | Insects & other inverts | Dicrotendipes spp. | Dicrotendipes spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 141 | Insects & other inverts | Enochrus spp. | Enochrus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 142 | Insects & other inverts | Ephemerellidae fam. | Ephemerellidae fam. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 143 | Insects & other inverts | Eukiefferiella spp. | Eukiefferiella spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 144 | Insects & other inverts | Fallceon quilleri | A Mayfly | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 145 | Insects & other inverts | Gyrinus spp. | Gyrinus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 146 | Insects & other inverts | Helicopsyche spp. | Helicopsyche spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 147 | Insects & other inverts | Hydrophilidae fam. | Hydrophilidae fam. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 148 | Insects & other inverts | Hydroporus spp. | Hydroporus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 149 | Insects & other inverts | Hydropsyche spp. | Hydropsyche spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 150 | Insects & other inverts | Hydropsychidae fam. | Hydropsychidae fam. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 151 | Insects & other inverts | Hydroptila spp. | Hydroptila spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 152 | Insects & other inverts | Laccobius spp. | Laccobius spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 153 | Insects & other inverts | Lepidostoma spp. | Lepidostoma spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 154 | Insects & other inverts | Limnophyes spp. | Limnophyes spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 155 | Insects & other inverts | Liodessus obscurellus | | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 156 | Insects & other inverts | Microtendipes spp. | Microtendipes spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 157 | Insects & other inverts | Optioservus spp. | Optioservus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 158 | Insects & other inverts | Paratanytarsus spp. | Paratanytarsus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 159 | Insects & other inverts | Peltodytes spp. | Peltodytes spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 160 | Insects & other inverts | Phaenopsectra spp. | Phaenopsectra spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 161 | Insects & other inverts | Procladius spp. | Procladius spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 162 | Insects & other inverts | Rheotanytarsus spp. | Rheotanytarsus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 163 | Insects & other inverts | Sigara mckinstryi | A Water Boatman | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 164 | Insects & other inverts | Sigara spp. | Sigara spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 165 | Insects & other inverts | Simulium spp. | Simulium spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 166 | Insects & other inverts | Sperchon spp. | Sperchon spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 167 | Insects & other inverts | Tanytarsus spp. | Tanytarsus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 168 | Insects & other inverts | Tricorythodes spp. | Tricorythodes spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 169 | Mammals | Castor canadensis | American Beaver | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | MVZ MVZ Mammals |
| 170 | Mollusks | Gyraulus spp. | Gyraulus spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 171 | Mollusks | Lymnaea spp. | Lymnaea spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 172 | Mollusks | Physa spp. | Physa spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 173 | Mollusks | Pisidium spp. | Pisidium spp. | | | | | Current observations (post 1980) | Point | Undefined | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 July 2012 |
| 174 | Plants | Alnus rhombifolia | White Alder | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 175 | Plants | Alnus rhombifolia | White Alder | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 176 | Plants | Ammannia coccinea | Scarlet Ammannia | | | | | Current observations (post 1980) | Point | Undefined | UCR |
| 177 | Plants | Ammannia coccinea | Scarlet Ammannia | | | | | Current observations (post 1980) | Point | Undefined | UCR UCR |
| 178 | Plants | Anemopsis californica | Yerba Mansa | | | | | Unknown | Point | Undefined | UCJEPS UC |
| 179 | Plants | Azolla filiculoides | NA | | | | | Current observations (post 1980) | Point | Undefined | Calflora |
| 180 | Plants | Azolla filiculoides | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 181 | Plants | Azolla filiculoides | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 182 | Plants | Baccharis salicina | | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 183 | Plants | Bolboschoenus maritimus paludosus | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | CHSC |
| 184 | Plants | Bolboschoenus maritimus paludosus | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | CHSC CHSC |
| 185 | Plants | Callitriche heterophylla bolanderi | Large Water-starwort | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 186 | Plants | Callitriche heterophylla bolanderi | Large Water-starwort | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |

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|---|---|---|---|---|---|---|---|---|---|---|
| 187 | Plants | Callitriche heterophylla bolanderi | Large Water-starwort | | | | | Current observations (post 1980) | Point | Undefined | UCD |
| 188 | Plants | Callitriche heterophylla bolanderi | Large Water-starwort | | | | | Current observations (post 1980) | Point | Undefined | UCD UCD |
| 189 | Plants | Callitriche marginata | Winged Water-starwort | | | | | Current observations (post 1980) | Point | Undefined | Calflora |
| 190 | Plants | Callitriche marginata | Winged Water-starwort | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 191 | Plants | Callitriche marginata | Winged Water-starwort | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 192 | Plants | Crassula aquatica | Water Pygmyweed | | | | | Current observations (post 1980) | Point | Undefined | Calflora |
| 193 | Plants | Crassula aquatica | Water Pygmyweed | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 194 | Plants | Crassula aquatica | Water Pygmyweed | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 195 | Plants | Crassula aquatica | Water Pygmyweed | | | | | Current observations (post 1980) | Point | Undefined | UCD |
| 196 | Plants | Crassula aquatica | Water Pygmyweed | | | | | Current observations (post 1980) | Point | Undefined | UCD UCD |
| 197 | Plants | Crypsis vaginiflora | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 198 | Plants | Crypsis vaginiflora | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 199 | Plants | Cyperus erythrorhizos | Red-root Flatsedge | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 200 | Plants | Cyperus erythrorhizos | Red-root Flatsedge | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 201 | Plants | Cyperus erythrorhizos | Red-root Flatsedge | | | | | Current observations (post 1980) | Point | Undefined | UCR |
| 202 | Plants | Cyperus erythrorhizos | Red-root Flatsedge | | | | | Current observations (post 1980) | Point | Undefined | UCR UCR |
| 203 | Plants | Epilobium campestre | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG |
| 204 | Plants | Epilobium campestre | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 205 | Plants | Epilobium cleistogamum | Cleistogamous Spike-primrose | | | | | Current observations (post 1980) | Point | Undefined | UCD |
| 206 | Plants | Epilobium cleistogamum | Cleistogamous Spike-primrose | | | | | Current observations (post 1980) | Point | Undefined | UCD UCD |
| 207 | Plants | Eryngium vaseyi vaseyi | Vasey's Coyote-thistle | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | UCD UCD |
| 208 | Plants | Euthamia occidentalis | Western Fragrant Goldenrod | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 209 | Plants | Euthamia occidentalis | Western Fragrant Goldenrod | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 210 | Plants | Euthamia occidentalis | Western Fragrant Goldenrod | | | | | Unknown | Point | Undefined | UCJEPS JEPS |
| 211 | Plants | Helenium puberulum | Rosilla | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 212 | Plants | Helenium puberulum | Rosilla | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 213 | Plants | Hydrocotyle verticillata verticillata | Whorled Marsh-pennywort | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 214 | Plants | Juncus effusus effusus | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 215 | Plants | Juncus effusus effusus | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 216 | Plants | Juncus luciensis | Santa Lucia Dwarf Rush | | Special | CRPR - 1B.2 | USFS | Current observations (post 1980) | Point | Undefined | SBBG |
| 217 | Plants | Juncus luciensis | Santa Lucia Dwarf Rush | | Special | CRPR - 1B.2 | USFS | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 218 | Plants | Juncus xiphioides | Iris-leaf Rush | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 219 | Plants | Juncus xiphioides | Iris-leaf Rush | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 220 | Plants | Limosella aquatica | Northern Mudwort | | | | | Current observations (post 1980) | Point | Undefined | UCD |
| 221 | Plants | Limosella aquatica | Northern Mudwort | | | | | Current observations (post 1980) | Point | Undefined | UCD UCD |
| 222 | Plants | Limosella aquatica | Northern Mudwort | | | | | Current observations (post 1980) | Point | Undefined | UCR |
| 223 | Plants | Limosella aquatica | Northern Mudwort | | | | | Current observations (post 1980) | Point | Undefined | UCR UCR |
| 224 | Plants | Marsilea vestita vestita | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 225 | Plants | Marsilea vestita vestita | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | UCR UCR |
| 226 | Plants | Mimulus guttatus | Common Large Monkeyflower | | | | | Unknown | Point | Undefined | UCJEPS UC |
| 227 | Plants | Mimulus latidens | Broad-tooth Monkeyflower | | | | | Current observations (post 1980) | Point | Undefined | Calflora |
| 228 | Plants | Mimulus latidens | Broad-tooth Monkeyflower | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 229 | Plants | Mimulus pilosus | | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | UCR |
| 230 | Plants | Montia fontana fontana | Fountain Miner's-lettuce | | | | | Current observations (post 1980) | Point | Undefined | Calflora |
| 231 | Plants | Navarretia prostrata | Prostrate Navarretia | | Special | CRPR - 1B.1 | | Current observations (post 1980) | Point | Undefined | Calflora |
| 232 | Plants | Navarretia prostrata | Prostrate Navarretia | | Special | CRPR - 1B.1 | | Current observations (post 1980) | Point | Undefined | California Natural Diversity Database (4/2016) |
| 233 | Plants | Navarretia prostrata | Prostrate Navarretia | | Special | CRPR - 1B.1 | | Current observations (post 1980) | Point | Undefined | SBBG |
| 234 | Plants | Navarretia prostrata | Prostrate Navarretia | | Special | CRPR - 1B.1 | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 235 | Plants | Paspalum distichum | Joint Paspalum | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 236 | Plants | Paspalum distichum | Joint Paspalum | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 237 | Plants | Persicaria lapathifolia | | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG |
| 238 | Plants | Persicaria lapathifolia | | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 239 | Plants | Persicaria maculosa | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG |
| 240 | Plants | Persicaria maculosa | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 241 | Plants | Phacelia distans | NA | | | | | Current observations (post 1980) | Point | Undefined | Calflora |
| 242 | Plants | Phacelia distans | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 243 | Plants | Phacelia distans | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 244 | Plants | Pilularia americana | NA | | | | | Current observations (post 1980) | Point | Undefined | Calflora |
| 245 | Plants | Pilularia americana | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 246 | Plants | Pilularia americana | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 247 | Plants | Pilularia americana | NA | | | | | Current observations (post 1980) | Point | Undefined | UCD |
| 248 | Plants | Pilularia americana | NA | | | | | Current observations (post 1980) | Point | Undefined | UCD UCD |
| 249 | Plants | Plagiobothrys acanthocarpus | Adobe Popcorn-flower | | | | | Current observations (post 1980) | Point | Undefined | Calflora |
| 250 | Plants | Plagiobothrys acanthocarpus | Adobe Popcorn-flower | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 251 | Plants | Plagiobothrys acanthocarpus | Adobe Popcorn-flower | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 252 | Plants | Plagiobothrys acanthocarpus | Adobe Popcorn-flower | | | | | Current observations (post 1980) | Point | Undefined | UCD |
| 253 | Plants | Plagiobothrys acanthocarpus | Adobe Popcorn-flower | | | | | Current observations (post 1980) | Point | Undefined | UCD UCD |
| 254 | Plants | Platanus racemosa | California Sycamore | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 255 | Plants | Platanus racemosa | California Sycamore | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 256 | Plants | Psilocarphus brevissimus brevissimus | Dwarf Woolly-heads | | | | | Current observations (post 1980) | Point | Undefined | UCD UCD |
| 257 | Plants | Ranunculus aquatilis diffusus | | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG |
| 258 | Plants | Ranunculus aquatilis diffusus | | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 259 | Plants | Rorippa curvisiliqua curvisiliqua | Curve-pod Yellowcress | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 260 | Plants | Rumex salicifolius salicifolius | Willow Dock | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 261 | Plants | Salix exigua exigua | Narrowleaf Willow | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 262 | Plants | Salix laevigata | Polished Willow | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 263 | Plants | Salix laevigata | Polished Willow | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 264 | Plants | Salix laevigata | Polished Willow | | | | | Unknown | Point | Undefined | UCJEPS UC |
| 265 | Plants | Salix lasiolepis lasiolepis | Arroyo Willow | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 266 | Plants | Salix lasiolepis lasiolepis | Arroyo Willow | | | | | Unknown | Point | Undefined | UCJEPS UC |
| 267 | Plants | Schoenoplectus americanus | Three-square Bulrush | | | | | Current observations (post 1980) | Point | Undefined | CHSC |
| 268 | Plants | Schoenoplectus americanus | Three-square Bulrush | | | | | Current observations (post 1980) | Point | Undefined | CHSC CHSC |
| 269 | Plants | Schoenoplectus pungens pungens | NA | | | | | Current observations (post 1980) | Point | Undefined | CHSC CHSC |
| 270 | Plants | Schoenoplectus saximontanus | Rocky Mountain Bulrush | | | | | Current observations (post 1980) | Point | Undefined | UCR |
| 271 | Plants | Typha domingensis | Southern Cattail | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 272 | Plants | Typha domingensis | Southern Cattail | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 273 | Plants | Typha latifolia | Broadleaf Cattail | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 274 | Plants | Typha latifolia | Broadleaf Cattail | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 275 | Plants | Veronica anagallis-aquatica | NA | | | | | Current observations (post 1980) | Point | Undefined | JEPS |
| 276 | Plants | Veronica anagallis-aquatica | NA | | | | | Current observations (post 1980) | Point | Undefined | JEPS JEPS |
| 277 | Plants | Veronica anagallis-aquatica | NA | | | | | Current observations (post 1980) | Point | Undefined | RSA |
| 278 | Plants | Veronica anagallis-aquatica | NA | | | | | Current observations (post 1980) | Point | Undefined | RSA RSA |
| 279 | Plants | Veronica anagallis-aquatica | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG |
| 280 | Plants | Veronica anagallis-aquatica | NA | | | | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 281 | Plants | Veronica anagallis-aquatica | NA | | | | | Unknown | Point | Undefined | UCJEPS JEPS |
| 282 | Plants | Veronica catenata | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | JEPS |
| 283 | Plants | Veronica catenata | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | JEPS JEPS |
| 284 | Plants | Veronica catenata | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | OBI |
| 285 | Plants | Veronica catenata | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | OBI OBI |
| 286 | Plants | Veronica catenata | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | RSA |
| 287 | Plants | Veronica catenata | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | RSA RSA |
| 288 | Plants | Veronica catenata | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG |
| 289 | Plants | Veronica catenata | NA | | | Not on any status lists | | Current observations (post 1980) | Point | Undefined | SBBG SBBG |
| 290 | Plants | Veronica catenata | NA | | | Not on any status lists | | Unknown | Point | Undefined | UCJEPS JEPS |
| 291 | Fishes | Oncorhynchus mykiss - SCCC | South Central California coast steelhead | Threatened | Special Concern | Vulnerable - Moyle 2013 | | Critical habitat/ management area designations | Line | Undefined | NMFS Critical Habitat - Chinook and Steelhead |
| 292 | Fishes | Catostomus occidentalis mniotiltus | Monterey sucker | | | Least Concern - Moyle 2013 | | Professional judgement | Polygon | Undefined | PISCES (Jan 8, 2014 download) |
| 293 | Fishes | Catostomus occidentalis occidentalis | Sacramento sucker | | | Least Concern - Moyle 2013 | | Professional judgement | Polygon | Undefined | PISCES (Jan 8, 2014 download) |
| 294 | Fishes | Cottus gulosus | Riffle sculpin | | Special | Near-Threatened - Moyle 2013 | | Professional judgement | Polygon | Undefined | PISCES (Jan 8, 2014 download) |
| 295 | Fishes | Entosphenus tridentata ssp. 1 | Pacific lamprey | | Special | Near-Threatened - Moyle 2013 | BLM, USFS | Professional judgement | Polygon | Undefined | PISCES (Jan 8, 2014 download) |
| 296 | Fishes | Lavinia exilicauda exilicauda | Sacramento hitch | | Special | Near-Threatened - Moyle 2013 | | Modeled habitat/ generalized observation | Polygon | Undefined | PISCES (Jan 8, 2014 download) |
| 297 | Fishes | Lavinia exilicauda harengeus | Monterey hitch | | Special | Vulnerable - Moyle 2013 | | Professional judgement | Polygon | Undefined | PISCES (Jan 8, 2014 download) |
| 298 | Fishes | Oncorhynchus mykiss - SCCC | South Central California coast steelhead | Threatened | Special Concern | Vulnerable - Moyle 2013 | | Professional judgement | Polygon | Undefined | PISCES (Jan 8, 2014 download) |
| 299 | Fishes | Oncorhynchus mykiss irideus | Coastal rainbow trout | | | Least Concern - Moyle 2013 | | Professional judgement | Polygon | Undefined | PISCES (Jan 8, 2014 download) |
| 300 | Fishes | Ptychocheilus grandis | Sacramento pikeminnow | | | Least Concern - Moyle 2013 | | Professional judgement | Polygon | Undefined | PISCES (Jan 8, 2014 download) |

| Attribute | Explanation |
| --- | --- |
| OBJECTID | Processing field - ignore |
| Elements_GROUP_ | Taxonomic grouping (Mammal, Bird, Fishes, Herps, Mollusks, Crustaceans, Insects & other inverts, Plants) |
| Elements_ELM_SCINAM | Scientific name |
| Elements_ELM_COMNAM | Common name |
| Elements_Fed_list | Status on Federal Endangered Species List as of April 13, 2015 |
| Elements_State_list | Status on California Endangered Species or Sensitive Species lists as of April 13, 2015 |
| Elements_Other_list | Status on other sensitive species lists as of April 13, 2015 |
| Elements_MgtAg_list | Status on land management agency (USFS, BLM) sensitive species lists as of April 13, 2015 |
| ObservationType_ObsTyp_Name | Observation Type Name (e.g., observations, modeled habitat, range, critical habitat) |
| Format_Fmt_Name | Format Name (Point, Line, Polygon) |
| HabitatUsage_HabU_Name | Habitat Usage Name (e.g., spawning, migration, breeding, wintering) |
| Source_Source_Name | Short name for source of species occurrence information |

| OBJECTID | Source ID | Source Name | Citation | Weblink | Aggregator |
|---|---|---|---|---|---|
| 1 | 144 | PISCES (Jan 8, 2014 download) | Katz, J, P Moyle, R Peek, N Santos, A Bell, RQuiñones, and J Viers. PIS | http://pisces.ucdavis.edu/node | PISCES |
| 3 | 64 | NDOW Wildlife Action Plan 2012 revision | Nevada Department of Wildlife. 2012. Nevada Wildlife Action Plan. Ren | http://www.ndow.org/uploadedFiles/ndoworg/Content/Nevada Wildlife/Co | |
| 5 | 65 | Calflora | Calflora. 2008. The Calflora Database. Berkeley, CA. Available: http://ww | http://www.calflora.org | |
| 9 | 67 | Fairy Shrimps of CA's Puddles, Pools, and Playas | Eriksen, C. and D. Belk. 1999. Fairy Shrimps of California's Puddles, Po | n/a | |
| 10 | 43 | NV Natural Heritage Program | Nevada Natural Heritage Program. 2011. Biotics . Nevada Dept of Conservation and Natural Resources, Carson City, NV. | | |
| 23 | 51 | BLM/USU National Aquatic Monitoring Center (aka The BugLa | Western Center for Monitoring & Assessment of Freshwater Ecosystems. | http://www.usu.edu/buglab/ | Buglab |
| 40 | 27 | AZ Natural Heritage Program | Arizona Dept. of Game and Fish. 2011. Arizona Natural Heritage Progra | http://www.azgfd.gov/w c/edits/species concern.shtml | |
| 67 | 50 | Oregon GAP Analysis Wildlife Models | Oregon Biodiversity Information Center. 2004. GAP Wildlife Models. Por | http://www.pdx.edu/pnwlamp/wildlife-models | |
| 73 | 61 | Hovingh surveys | Hovingh, P. 2012. Field surveys of Great Basin spring habitats. Direct re | n/a | |
| 74 | 56 | SFEI San Francisco Bay Benthic Data | San Francisco Estuary Institute. 2008. SFEI San Francisco Bay Benthic | http://www.sfei.org/ | |
| 77 | 68 | Subterranean Institute database | Graening, G.O. et al. 2012. Unpublished data, database report. The Sul | http://www.subinstitute.org/ | |
| 89 | 66 | Occurrences approx. from NatureServe Explorer descriptions | NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [\ | http://www.natureserve.org/explorer | |
| 90 | 63 | Range approx. from NatureServe Explorer descriptions | NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [\ | http://www.natureserve.org/explorer | |
| 103 | 13 | USFWS Critical Habitat Designation | US Fish and Wildlife Service. 2011. Final Critical Habitat. Fort Collins, C | http://crithab.fws.gov/crithab/ | |
| 104 | 44 | SW Regional GAP Wildlife Habitat Relationship | Boykin, KG, et al. 2007. Predicted animal-habitat distributions and specie | http://swregap.nmsu.edu/ | |
| 105 | 40 | NPS Klamath Network Herp surveys 2002 | Bury, RB, LC Gangle III, and S Litrakis. 2002. Inventory for Amphibians a | http://irmafiles.nps.gov/reference/holding/472918 | |
| 106 | 41 | Sierra NV Nat Forests Critical Aquatic Refuges | US Forest Service. 2006. Critical Aquatic Refuges in Sierra Nevada Nati | http://www.fs.usda.gov/detail/r5/landmanagement/gis/?cid=fsbdev3 0483 | |
| 123 | 3 | Jeanette "Mussel Sites 2009 Final" | Howard, JK. 2010. Sensitive Freshwater Mussel Surveys in the Pacific S | n/a | |
| 124 | 4 | Jeanette "Forest Service Mussel Sites 062810v2" | Howard, JK. 2010. Sensitive Freshwater Mussel Surveys in the Pacific S | n/a | |
| 125 | 5 | Jeanette "Mussel Sites Final" | Howard, JK. 2010. Sensitive Freshwater Mussel Surveys in the Pacific S | n/a | |
| 126 | 14 | California Wildlife Habitat Relationships | California Department of Fish and Game. 2009. California Wildlife Habita | http://www.dfg.ca.gov/biogeodata/cwhr/downloads/GIS/cwhr gis.xml | CWHR |
| 128 | 28 | BIOS Tuolumne aquatic surveys ds193 | California Department of Fish and Game. 2009. Tuolumne Aquatic Reso | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 129 | 29 | BIOS Herps ds694 | Groff, L. 2010. Herptofauna Surveys, Northern California. Humboldt Sta | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 130 | 30 | BIOS Wildlife surveys ds325 | Garrison, BA. 2005. Wildlife Surveys - CDFG Lands, Region 2. CA Dep | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 131 | 33 | BIOS mussel sites 2010 ds662 | Krall, M, C Tennant, and ML Westover. 2010. Mussel Sites, Klamath Riv | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 132 | 32 | BIOS mussel sites 2007 ds661 | Krall, M, C Tennant, and ML Westover. 2007. Mussel Sites, Klamath Riv | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 133 | 38 | BIOS ds323 | Garrison, BA. 2005. Herp Coverboard Sampling - Spears and Didion Ra | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 134 | 31 | BIOS Western Pond Turtle ds313 | California Department of Fish and Game. 2010. Western Pond Turtle Ob | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 135 | 34 | BIOS ds431 | Spiegelberg, M. 2009. Sensitive Wildlife - Center for Natural Lands Mana | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 136 | 35 | BIOS San Diego plants ds121 | San Diego Dept. of Planning and Land Use. 2005. Species on Multiple S | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 137 | 36 | BIOS ds458 | Spiegelberg, M. 2007. Sensitive Plants - Center for Natural Lands Manag | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 138 | 37 | BIOS ds324 | Garrison, BA. 2006. Herp Coverboard Sampling - Spears and Didion Ra | http://bios.dfg.ca.gov/dataset index.asp | BIOS |
| 142 | 145 | SWAMP via CEDEN. Download 10 April 2014, Obs before 13 | California State Water Resources Control Board. 2014. Surface Water A | http://www.ceden.org | SWAMP |
| 143 | 146 | J Howard mussel data compilation | Howard, J. 2014. Compilation of Freshwater Mussel Surveys (Unpublish | n/a | |
| 144 | 147 | Frest and Johannes 1995 | Frest, T. J. and E. J. Johannes. 1995. Interior Columbia Basin mollusk sp | n/a | |
| 147 | 150 | Points approximated from Hershler et al. 2007. Extensive dive | Hershler et al. 2007. Extensive diversification of pebblesnails (Lithoglyphi | http://onlinelibrary.wiley.com/doi/10.1111/j.1096-3642.2007.00243.x/abstra | |
| 148 | 151 | California Natural Diversity Database (4/2016) | California Department of Fish and Wildlife. 2014. California Natural Divers | http://www.dfg.ca.gov/biogeodata/cnddb/ | CNDDB |
| 150 | 153 | California Natural Diversity Database (4/2016) - 'Sensitive' | | | CNDDB |
| 153 | 156 | Mussel ranges based on Xerces HUC8 occurrence or J Howa | Howard, J. 2014. Freshwater Mussel Range Analsyis (Unpublished data | n/a | |
| 158 | 161 | CAS HERP | California Academy of Sciences. Herpetology Collection. 2014. Species R | http://www.herpnet.org/ | HerpNet |
| 159 | 162 | CAS SUA | California Academy of Sciences. Amphibian Collection. 2014. Species Re | http://www.herpnet.org/ | HerpNet |
| 160 | 163 | CAS SUR | California Academy of Sciences. Reptile Collection. 2014. Species Recor | http://www.herpnet.org/ | HerpNet |
| 161 | 164 | CM Herps | Carnegie Museum of Natural History. Herpetology Collection. 2014. Speci | http://www.herpnet.org/ | HerpNet |
| 162 | 165 | CMC HERP-V | Cincinnati Museum Center. Herpetology Vouchers. 2014. Species Record | http://www.herpnet.org/ | HerpNet |
| 163 | 166 | CUMV Amphibian | Cornell University Museum of Vertebrates. Amphibian Collection. 2014. S | http://www.herpnet.org/ | HerpNet |
| 164 | 167 | CUMV Reptile | Cornell University Museum of Vertebrates. Reptile Collection. 2014. Speci | http://www.herpnet.org/ | HerpNet |
| 165 | 168 | KU KUH | University of Kansas. Herpetology Collection. 2014. Species Records. Ac | http://www.herpnet.org/ | HerpNet |
| 166 | 169 | LACM Herps | Natural History Museum of Los Angeles County. Herpetology Collection. 2 | http://www.herpnet.org/ | HerpNet |
| 167 | 170 | MCZ Herp | Harvard University Museum of Comparative Zoology. Herpetology Collecti | http://www.herpnet.org/ | HerpNet |
| 168 | 171 | MSB MSBHerp | Museum of Southwestern Biology. Herpetology Collection. 2014. Species | http://www.herpnet.org/ | HerpNet |
| 169 | 172 | MSUM HE | Michigan State University Museum. Herpetology Collection. 2014. Species | http://www.herpnet.org/ | HerpNet |
| 170 | 173 | MVZ Herp | University of California Berkeley Museum of Vertebrate Zoology. Herpetolo | http://www.herpnet.org/ | HerpNet |
| 171 | 174 | MVZ Hild | University of California Berkeley Museum of Vertebrate Zoology. Hildebrar | http://www.herpnet.org/ | HerpNet |
| 172 | 175 | MVZObs Herp | University of California Berkeley Museum of Vertebrate Zoology. Herpetolo | http://www.herpnet.org/ | HerpNet |
| 173 | 176 | PSM Herp | James R. Slater Museum of Natural History. Herpetology Collection. 2014 | http://www.herpnet.org/ | HerpNet |
| 174 | 177 | ROM Herps | Royal Ontario Museum. Herpetology Collection. 2014. Species Records. | http://www.herpnet.org/ | HerpNet |
| 175 | 178 | SBMNH HE | Santa Barbara Museum of Natural History. Herpetology Collection. 2014. | http://www.herpnet.org/ | HerpNet |
| 176 | 179 | SBMNH OS | Santa Barbara Museum of Natural History. Osteological Collection. 2014. | http://www.herpnet.org/ | HerpNet |
| 177 | 180 | SDNHM Herps | San Diego Natural History Museum. Herpetology Collection. 2014. Specie | http://www.herpnet.org/ | HerpNet |
| 178 | 181 | SMNS Herpetologie | Staatliches Museum für Naturkunde Stuttgart. Herpetology Collection. 201 | http://www.herpnet.org/ | HerpNet |
| 179 | 182 | UA UAMZ HERPETOLOGY | University of Alberta Museum of Zoology. Herpetology Collection. 2014. S | http://www.herpnet.org/ | HerpNet |
| 180 | 183 | UBCBBM CTC | University of British Columbia Beaty Biodiversity Museum. Cowan Tetrapo | http://www.herpnet.org/ | HerpNet |
| 181 | 184 | UCM Herps | University of Colorado Museum of Natural History. Herpetology Collection. | http://www.herpnet.org/ | HerpNet |
| 182 | 185 | UNR Herpetology | University of Nevada, Reno. Herpetology Collection. 2014. Species Recor | http://www.herpnet.org/ | HerpNet |
| 183 | 186 | USNM Vertebrate Zoology; Amphibians & Reptiles | Smithsonian Institution National Museum of Natural History. Amphibian & | http://www.herpnet.org/ | HerpNet |
| 184 | 187 | UWBM Herp | University of Washington Burke Museum. Herpetology Collection. 2014. S | http://www.herpnet.org/ | HerpNet |
| 185 | 188 | YPM HER | Yale University Peabody Museum Vertebrate Zoology Division. Herpetolog | http://www.herpnet.org/ | HerpNet |
| 186 | 189 | ZIN ZISP | Zoological Institute, Russian Academy of Sciences, St. Petersburg. Ampl | http://www.herpnet.org/ | HerpNet |
| 187 | 190 | CASENT | California Academy of Sciences. Entomology Collection. 2014. Species R | http://calbug.berkeley.edu/ | CalBug |
| 188 | 191 | CIS | University of California, Berkeley - Essig Museum. California Terrestrial A | http://calbug.berkeley.edu/ | CalBug |
| 189 | 192 | CSCA | California State Arthropod Collection. 2014. Species Records. Accessed | http://calbug.berkeley.edu/ | CalBug |
| 190 | 193 | EMEC | University of California, Berkeley - Essig Museum. California Terrestrial A | http://calbug.berkeley.edu/ | CalBug |
| 191 | 194 | LACMENT | Los Angeles County Museum. Entomology Collection. 2014. Species Rec | http://calbug.berkeley.edu/ | CalBug |
| 192 | 195 | OMC | Oakland Museum of California. 2014. Species Records. Accessed via Ca | http://calbug.berkeley.edu/ | CalBug |
| 193 | 196 | SBMNHENT | Santa Barbara Museum of Natural History. Entomology Collection. 2014. | http://calbug.berkeley.edu/ | CalBug |
| 194 | 197 | SDNHM | San Diego Natural History Museum. 2014. Species Records. Accessed v | http://calbug.berkeley.edu/ | CalBug |
| 195 | 198 | UCBME | University of California, Davis. Bohart Museum. 2014. Species Records. | http://calbug.berkeley.edu/ | CalBug |
| 196 | 199 | UCRCENT | University of California, Riverside. Entomology Research Museum. 2014. | http://calbug.berkeley.edu/ | CalBug |
| 197 | 200 | UMMZI | University of Michigan Museum of Zoology. 2014. Species Records. Acc | http://calbug.berkeley.edu/ | CalBug |
| 198 | 201 | A | President and Fellows of Harvard College. Herbarium of the Arnold Arbore | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 199 | 202 | AMES | President and Fellows of Harvard College. Oakes Ames Orchid Herbariun | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 200 | 203 | BLMAR | Bureau of Land Management, Arcata Field Office. Herbarium. Accessed v | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 201 | 204 | CAS | California Academy of Sciences. Herbarium. Accessed via Consortium of | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 202 | 205 | CDA | California Department of Food and Agriculture. Herbarium. Accessed via C | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 203 | 206 | CHSC | California State University, Chico. Chico State Herbarium. Accessed via C | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 204 | 207 | CLARK | Riverside Metropolitan Museum. The Clark Herbarium. Accessed via Cons | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 205 | 208 | CSUSB | California State University, San Bernardino. Herbarium. Accessed via Cor | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 206 | 209 | DS | California Academy of Sciences. Herbarium. Accessed via Consortium of | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 207 | 210 | ECON | Harvard University. Economic Herbarium of Oakes Ames. Accessed via C | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 208 | 211 | GH | Harvard University. Gray Herbarium. Accessed via Consortium of Californ | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 209 | 212 | HSC | Humboldt State University. Herbarium. Accessed via Consortium of Califo | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 210 | 213 | IRVC | University of California, Irvine. Herbarium. Accessed via Consortium of Ca | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 211 | 214 | JEPS | University of California, Berkeley. Jepson Herbarium. Accessed via Cons | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 212 | 215 | JOTR | Joshua Tree National Park. Herbarium. Accessed via Consortium of Calif | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 213 | 216 | JROH | Stanford University. Jasper Ridge Biological Preserve Herbarium. Access | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 214 | 217 | LA | University of California, Los Angeles. Herbarium. Accessed via Consortiu | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 215 | 218 | NY | New York Botanical Garden. Herbarium. Accessed via Consortium of Cali | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 216 | 219 | OBI | California Polytechnic State University, San Luis Obispo. Herbarium. Acce | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 217 | 220 | PGM | Pacific Grove Museum of Natural History. Herbarium. Accessed via Cons | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 218 | 221 | POM | Pomona College. Herbarium. Accessed via Consortium of California Herb | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 219 | 222 | RSA | Rancho Santa Ana Botanic Garden. Herbarium. Accessed via Consortium | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 220 | 223 | SACT | California State University, Sacramento. Herbarium. Accessed via Consor | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 221 | 224 | SBBG | Santa Barbara Botanic Garden. Herbarium. Accessed via Consortium of C | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 222 | 225 | SD | San Diego Natural History Museum. Herbarium. Accessed via Consortium | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 223 | 226 | SEINET | Southwest Environmental Information Network. Herbarium. Accessed via | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 224 | 227 | SFV | California State University, Northridge. Herbarium. Accessed via Consorti | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 225 | 228 | SJSU | San Jose State University. Herbarium. Accessed via Consortium of Califo | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 226 | 229 | UC | University of California, Berkeley. University Herbarium. Accessed via Co | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 227 | 230 | UCD | University of California, Davis. Herbarium. Accessed via Consortium of Ca | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 228 | 231 | UCLA | University of California, Los Angeles. Herbarium. Accessed via Consortiu | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 229 | 232 | UCR | University of California, Riverside. Herbarium. Accessed via Consortium o | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 230 | 233 | UCSB | University of California, Santa Barbara. Herbarium. Accessed via Consorti | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 231 | 234 | VVC | Victor Valley College. Herbarium. Accessed via Consortium of California H | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 232 | 235 | YM-YOSE | Yosemite National Park. Herbarium. Accessed via Consortium of Californi | http://ucjeps.berkeley.edu/consortium/ | Consortium of CA Herbaria |
| 233 | 236 | AAU Herbarium | The Aarhus University. Herbarium Database. Accessed via Global Biodive | http://www.gbif.org/dataset/833db434-f762-11e1-a439-00145eb45e9a | GBIF |
| 234 | 237 | AEZSC SBMNH-ENT | Santa Barbara Museum of Natural History. California Beetle Project. Acce | http://www.gbif.org/dataset/84b130ac-f762-11e1-a439-00145eb45e9a | GBIF |
| 235 | 238 | ANSP IndoPacfic Mollusc DB | Academy of Natural Sciences. Ocean Biogeographic Information System | | http://www.gbif.org/dataset/83a09216-f762-11e1-a439-00145eb45e9a | GBIF |
| 236 | 239 | ANSP Malacology | Academy of Natural Sciences. Malacology Philadelphia . Accessed via Gl | http://www.gbif.org/dataset/86b50d88-f762-11e1-a439-00145eb45e9a | GBIF |
| 237 | 240 | BLB Bird | Ohio State University Museum of Biological Diversity. Borror Laboratory of | http://www.gbif.org/dataset/85fd399c-f762-11e1-a439-00145eb45e9a | GBIF |
| 238 | 241 | BLB Insects | Ohio State University Museum of Biological Diversity. Charles A. Triplehor | http://www.gbif.org/dataset/84ab7b76-f762-11e1-a439-00145eb45e9a | GBIF |
| 239 | 242 | Borror Laboratory of Bioacoustics, Ohio State University, Colur | Ohio State University Museum of Biological Diversity. Borror Laboratory of | http://www.gbif.org/dataset/f11db245-3f9f-4fc6-a0cc-12b4124d081b | GBIF |
| 240 | 243 | C.A. Triplehorn Insect Collection, Ohio State University, Colum | Ohio State University Museum of Biological Diversity. Charles A. Triplehor | http://www.gbif.org/dataset/84ab7b76-f762-11e1-a439-00145eb45e9a | GBIF |
| 241 | 244 | CANB 516055 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 242 | 245 | CANB 516058 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 243 | 246 | CANB 518346 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 244 | 247 | CANB 589789 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 245 | 248 | CANB 762494 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 246 | 249 | CANB 762510 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 247 | 250 | CANB 796487 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 248 | 251 | CANB 796488 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 249 | 252 | CANB 796489 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 250 | 253 | CANB 809935 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 251 | 254 | CANB 825801 | Australian National Herbarium. Accessed via Global Biodiversity Informati | http://www.gbif.org/dataset/82cd8df8-f762-11e1-a439-00145eb45e9a | GBIF |
| 252 | 255 | CAS BOT | California Academy of Sciences. Botany Collection. Accessed via Global E | http://www.gbif.org/dataset/f934f8e2-32ca-46a7-b2f8-b032a4740454 | GBIF |
| 253 | 256 | CAS CAS | Consortium of California Herbaria, California Academy of Sciences. Botan | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 254 | 257 | CAS DS | California Academy of Sciences. Botany Collection. Accessed via Global E | http://www.gbif.org/dataset/f934f8e2-32ca-46a7-b2f8-b032a4740454 | GBIF |
| 255 | 258 | CAS HERP | California Academy of Sciences. Herpetology Collection. Accessed via Gl | http://www.gbif.org/dataset/cece4fc2-1fec-4bb5-a335-7252548e3f0b | GBIF |
| 256 | 259 | CAS IZ | California Academy of Sciences. Invertebrate Collection. Accessed via Gl | http://www.gbif.org/dataset/44bcde48-ac71-46f2-bf73-24fc3c008b6c | GBIF |
| 257 | 260 | CAS SUA | California Academy of Sciences. Amphibian Collection. Accessed via Glol | http://www.gbif.org/dataset/cece4fc2-1fec-4bb5-a335-7252548e3f0b | GBIF |
| 258 | 261 | CAS SUR | California Academy of Sciences. Reptile Collection. Accessed via Global E | http://www.gbif.org/dataset/cece4fc2-1fec-4bb5-a335-7252548e3f0b | GBIF |
| 259 | 262 | CASENT Arthropods | University of California, Berkeley - Essig Museum. California Terrestrial A | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 260 | 263 | CCBER Herps | Cheadle Center for Biodiversity and Ecological Restoration. Herpetology C | http://www.gbif.org/dataset/1050a336-b87a-44b1-b0ec-6fe5fcb3d298 | GBIF |
| 261 | 264 | CDA CDA | Consortium of California Herbaria. California Department of Food and Agr | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 262 | 265 | CHSC CHSC | Consortium of California Herbaria. California State University, Chico. Acce | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 264 | 267 | CIS Arthropods | University of California, Berkeley - Essig Museum. California Terrestrial A | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 265 | 268 | CLARK-A CLARK-A | Consortium of California Herbaria. Riverside Metropolitan Museum Clark I | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 266 | 269 | CM Herps | Carnegie Museums. Herpetology Collection. Accessed via Global Biodiver | http://www.gbif.org/dataset/76dd8f0d-2daa-4a69-9fcd-55e04230334a | GBIF |
| 267 | 270 | CMC HERP-V | Cincinnati Museum Center. Herpetology Vouchers. Accessed via Global E | http://www.gbif.org/dataset/81a975b3-d86f-434e-ad9e-16bc43f68a36 | GBIF |
| 268 | 271 | CMN CAN | Canadian Museum of Nature Herbarium. Vascular Plant Collection . Acce | http://www.gbif.org/dataset/830da118-f762-11e1-a439-00145eb45e9a | GBIF |

| | | | | | | |
|---|---|---|---|---|---|---|
| 269 | 272 | CMN CMNAR | | Canadian Museum of Nature. Amphibian and Reptile Collection - Anura. A | http://www.gbif.org/dataset/830a1f84-f762-11e1-a439-00145eb45e9a | GBIF |
| 270 | 273 | CMN CMNML | | Canadian Museum of Nature Mollusc Collection - Unionoida. Accessed vi | http://www.gbif.org/dataset/830c7b08-f762-11e1-a439-00145eb45e9a | GBIF |
| 271 | 274 | Consortium of California Herbaria CAS | | Consortium of California Herbaria. California Academy of Sciences. Acces | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 272 | 275 | Consortium of California Herbaria CDA | | Consortium of California Herbaria. California Department of Food and Agr | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 273 | 276 | Consortium of California Herbaria CHSC | | Consortium of California Herbaria. California State University, Chico. Acce | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 274 | 277 | Consortium of California Herbaria DS | | Consortium of California Herbaria. California Academy of Sciences. Acces | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 275 | 278 | Consortium of California Herbaria HSC | | Consortium of California Herbaria. Humboldt State University. Accessed v | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 276 | 279 | Consortium of California Herbaria IRVC | | Consortium of California Herbaria. University of California, Irvine. Accesse | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 277 | 280 | Consortium of California Herbaria JEPS | | Consortium of California Herbaria. University of California, Berkeley Jepsc | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 278 | 281 | Consortium of California Herbaria PGM | | Consortium of California Herbaria. Pacific Grove Museum of Natural Histc | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 279 | 282 | Consortium of California Herbaria POM | | Consortium of California Herbaria. Pomona College Herbaria. Accessed vi | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 280 | 283 | Consortium of California Herbaria RSA | | Consortium of California Herbaria. Rancho Santa Ana Botanic Garden He | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 281 | 284 | Consortium of California Herbaria SBBG | | Consortium of California Herbaria. Santa Barbara Botanic Garden. Access | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 282 | 285 | Consortium of California Herbaria SD | | Consortium of California Herbaria. San Diego Natural History Museum. Ac | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 283 | 286 | Consortium of California Herbaria SDSU | | Consortium of California Herbaria. San Diego State University. Accessed | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 284 | 287 | Consortium of California Herbaria SJSU | | Consortium of California Herbaria. San Jose State University. Accessed v | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 285 | 288 | Consortium of California Herbaria UC | | Consortium of California Herbaria. University of California, Berkeley Unive | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 286 | 289 | Consortium of California Herbaria UCLA | | Consortium of California Herbaria. University of California, Los Angeles. A | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 287 | 290 | Consortium of California Herbaria UCR | | Consortium of California Herbaria. University of California, Riverside. Acc | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 288 | 291 | Consortium of California Herbaria UCSB | | Consortium of California Herbaria. University of California, Santa Barbara. | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 289 | 292 | Consortium of California Herbaria UCSC | | Consortium of California Herbaria. University of California, Santa Cruz. Ac | http://www.gbif.org/dataset/0fb2c370-a84f-11de-978d-b8a03c50a862 | GBIF |
| 290 | 293 | CSCA Arthropods | | University of California, Berkeley - Essig Museum. California Terrestrial Ar | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 291 | 294 | CSUSB CSUSB | | Consortium of California Herbaria. California State University, San Bernar | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 292 | 295 | CUML Sound/Film | | Cornell Lab of Ornithology. Macaulay Library Audio and Video Collection. / | http://www.gbif.org/dataset/7f6dd0f7-9ed4-49c0-bb71-b2a9c7fed9f1 | GBIF |
| 293 | 296 | CUMV Amph | | Cornell University Museum of Vertebrates. Amphibian Collection. Accesse | http://www.gbif.org/dataset/a8ee9bc6-5914-427d-9fba-f8545250ac34 | GBIF |
| 294 | 297 | CUMV Rept | | Cornell University Museum of Vertebrates. Reptile Collection. Accessed vi | http://www.gbif.org/dataset/b99095f3-d1e9-4902-9938-10ff1711ca5d | GBIF |
| 295 | 298 | DS DS | | Consortium of California Herbaria. California Academy of Sciences. Acces | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 296 | 299 | E E | | Royal Botanic Garden Edinburgh. Royal Botanic Garden Edinburgh Living | http://www.gbif.org/dataset/7adf20e0-c955-11de-95c0-b8a03c50a862 | GBIF |
| 297 | 300 | EMAP NCA CAL00 | | Academy of Natural Sciences. Ocean Biogeographic Information System I | http://www.gbif.org/dataset/838bb5ee-f762-11e1-a439-00145eb45e9a | GBIF |
| 298 | 301 | EMAP NCA CAL02 | | Academy of Natural Sciences. Ocean Biogeographic Information System I | http://www.gbif.org/dataset/838bb5ee-f762-11e1-a439-00145eb45e9a | GBIF |
| 299 | 302 | EMAP NCA CAL03 | | Academy of Natural Sciences. Ocean Biogeographic Information System I | http://www.gbif.org/dataset/838bb5ee-f762-11e1-a439-00145eb45e9a | GBIF |
| 300 | 303 | EMAP NCA CAL99 | | Academy of Natural Sciences. Ocean Biogeographic Information System I | http://www.gbif.org/dataset/838bb5ee-f762-11e1-a439-00145eb45e9a | GBIF |
| 301 | 304 | EMAP NCA COL00 | | Academy of Natural Sciences. Ocean Biogeographic Information System I | http://www.gbif.org/dataset/838bb5ee-f762-11e1-a439-00145eb45e9a | GBIF |
| 303 | 306 | EMAP NCA COL99 | | Academy of Natural Sciences. Ocean Biogeographic Information System I | http://www.gbif.org/dataset/838bb5ee-f762-11e1-a439-00145eb45e9a | GBIF |
| 304 | 307 | EMEC Arthropods | | University of California, Berkeley - Essig Museum. California Terrestrial Ar | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 306 | 309 | F Botany | | Field Museum of Natural History (Botany). Seed Plant Collection. Accesse | http://www.gbif.org/dataset/90c853e6-56bd-480b-8e8f-6285c3f8d42b | GBIF |
| 307 | 310 | FLMNH Invertebrate Zoology | | Florida Museum of Natural History. Invertebrate Zoology. Accessed via Gl | http://www.gbif.org/dataset/85b1cfb6-f762-11e1-a439-00145eb45e9a | GBIF |
| 308 | 311 | FR Herbarium Senckenbergianum | | Senckenberg Nature Research Society. Herbarium Senckenbergianum. A | http://www.gbif.org/dataset/966426ce-f762-11e1-a439-00145eb45e9a | GBIF |
| 309 | 312 | GLM GLMcoll | | Staatliche Naturwissenschaftliche Sammlungen Bayerns. The Fungal Coll | http://www.gbif.org/dataset/7a2660bc-f762-11e1-a439-00145eb45e9a | GBIF |
| 310 | 313 | GZU Herbarium GZU | | Karl Franzens University of Graz. Insitute for Botany - Herbarium. Access | http://www.gbif.org/dataset/807a0573-87ec-4c1e-a23a-15a327c85dd3 | GBIF |
| 311 | 314 | Harvard University GH | | Harvard University Herbaria. Gray Herbarium. Accessed via Global Biodiv | http://www.gbif.org/dataset/861e6afe-f762-11e1-a439-00145eb45e9a | GBIF |
| 312 | 315 | Herbarium ARIZ | | University of Arizona Herbarium. Accessed via Global Biodiversity Informa | http://www.gbif.org/dataset/95b97882-f762-11e1-a439-00145eb45e9a | GBIF |
| 313 | 316 | HSC HSC | | Consortium of California Herbaria. Humboldt State University. Accessed v | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 315 | 318 | iNaturalist Observations | | iNaturalist.org. Research-Grade Observations. Accessed via Global Biodi | http://www.gbif.org/dataset/50c9509d-22c7-4a22-a47d-8c48425ef4a7 | GBIF |
| 316 | 319 | INHS Insect Collection | | Illinois Natural History Survey. Insect Collection. Accessed via Global Bioc | http://www.gbif.org/dataset/68513375-3aa5-4f6f-9975-d97d56c21d61 | GBIF |
| 317 | 320 | IRVC IRVC | | Consortium of California Herbaria. University of California, Irvine. Accesse | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 318 | 321 | JEPS JEPS | | Consortium of California Herbaria. University of California, Berkeley Jepsc | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 319 | 322 | JOTR JOTR | | Consortium of California Herbaria. Joshua Tree National Park. Accessed | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 320 | 323 | JROH JROH | | Consortium of California Herbaria. Jasper Ridge Biological Preserve, Stan | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 321 | 324 | K Herbarium | | Royal Botanic Gardens. Kew Herbarium. Accessed via Global Biodiversit | http://www.gbif.org/dataset/84aca1ae-f762-11e1-a439-00145eb45e9a | GBIF |
| 322 | 325 | KU KANU | | University of Kansas Biodiversity Institute. R. L. McGregor Herbarium Vas | http://www.gbif.org/dataset/95c938a8-f762-11e1-a439-00145eb45e9a | GBIF |
| 323 | 326 | KU KUH | | University of Kansas Biodiversity Institute. Herpetology Collection. Access | http://www.gbif.org/dataset/dce00a1f-f6b4-4e11-9771-92c62c40ad80 | GBIF |
| 324 | 327 | KU SEMC | | University of Kansas Biodiversity Institute. Snow Entomological Museum ( | http://www.gbif.org/dataset/aae308f4-9f9c-4cdd-b4ef-c026f48be551 | GBIF |
| 325 | 328 | L L | | Naturalis Biodiversity Center. Nationaal Herbarium Nederland. Accessed \ | http://www.gbif.org/dataset/7b33b040-f762-11e1-a439-00145eb45e9a | GBIF |
| 326 | 329 | LA LA | | Consortium of California Herbaria. University of California, Los Angeles. A | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 327 | 330 | LACM Herps | | Natural History Museum of Los Angeles County. Herpetology Collection. A | http://www.gbif.org/dataset/7a25f7aa-03fb-4322-aaeb-66719e1a9527 | GBIF |
| 328 | 331 | LACMENT Arthropods | | University of California, Berkeley - Essig Museum. California Terrestrial Ar | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 329 | 332 | LD General | | Lund Botanical Museum. Accessed via Global Biodiversity Information Fac | http://www.gbif.org/dataset/aab0cf80-0c64-11dd-84d1-b8a03c50a862 | GBIF |
| 330 | 333 | LI Biologiezentrum Linz | | Biologiezentrum Linz Oberoesterreich. Biologiezentrum Linz. Accessed vi | http://www.gbif.org/dataset/857bce66-f762-11e1-a439-00145eb45e9a | GBIF |
| 331 | 334 | LSU Herbarium | | Louisiana State University Herbarium. Accessed via Global Biodiversity In | http://www.gbif.org/dataset/56e9c560-bd2a-11dd-b15e-b8a03c50a862 | GBIF |
| 332 | 335 | M BSMeryscoll | | Staatliche Naturwissenschaftliche Sammlungen Bayerns. The Erysiphales | http://www.gbif.org/dataset/858d51e0-f762-11e1-a439-00145eb45e9a | GBIF |
| 333 | 336 | MA MA | | Real Jardin Botanico de Madrid. Algae Collection. Accessed via Global Bi | http://www.gbif.org/dataset/834c9918-f762-11e1-a439-00145eb45e9a | GBIF |
| 334 | 337 | MCZ Herp | | Harvard University Museum of Comparative Zoology. Herpetology Collect | http://www.gbif.org/dataset/4bfac3ea-8763-4f4b-a71a-76a6f5f243d3 | GBIF |
| 335 | 338 | MCZ IZ | | Harvard University Museum of Comparative Zoology. Invertebrate Zoolog | http://www.gbif.org/dataset/4bfac3ea-8763-4f4b-a71a-76a6f5f243d3 | GBIF |
| 336 | 339 | MCZ Mala | | Harvard University Museum of Comparative Zoology. Malcology Collectior | http://www.gbif.org/dataset/4bfac3ea-8763-4f4b-a71a-76a6f5f243d3 | GBIF |
| 337 | 340 | MCZC SBMNH-ENT | | Santa Barbara Museum of Natural History. California Beetle Project. Acce | http://www.gbif.org/dataset/84b130ac-f762-11e1-a439-00145eb45e9a | GBIF |
| 338 | 341 | MHP MHP-H | | Sternberg Museum of Natural History. Herpetology Collection. Accessed \ | http://www.gbif.org/dataset/84e823d2-f762-11e1-a439-00145eb45e9a | GBIF |
| 339 | 342 | MNHN P | | Muséum National d'Histoire Naturelle. Vascular Plants Collection. Access | http://www.gbif.org/dataset/b5cdf794-8fa4-4a85-8b26-755d087bf531 | GBIF |
| 340 | 343 | MO Tropicos | | Missouri Botanical Garden. Tropicos. Accessed via Global Biodiversity Inf | http://www.gbif.org/dataset/7bd65a7a-f762-11e1-a439-00145eb45e9a | GBIF |
| 342 | 345 | MSUM HE | | Michigan State University Museum. Ichthyology and Herpetology Collectio | http://www.gbif.org/dataset/847bbbde-f762-11e1-a439-00145eb45e9a | GBIF |
| 343 | 346 | MVZ Herp | | Museum of Vertebrate Zoology. Herpetology Collection. Accessed via Glol | http://www.gbif.org/dataset/09c4287e-e6d5-4552-a07f-bff8a00833d8 | GBIF |
| 344 | 347 | MVZ Hild | | Museum of Vertebrate Zoology. Hildebrand Collection. Accessed via Glob | http://www.gbif.org/dataset/423d9318-4dd4-4d31-81cb-27778c44a3bc | GBIF |
| 345 | 348 | MVZ MVZ Herps | | Museum of Vertebrate Zoology. Herpetology Collection. Accessed via Glol | http://www.gbif.org/dataset/09c4287e-e6d5-4552-a07f-bff8a00833d8 | GBIF |
| 346 | 349 | MVZ MVZ Hildebrand | | Museum of Vertebrate Zoology. Hildebrand Collection. Accessed via Glob | http://www.gbif.org/dataset/423d9318-4dd4-4d31-81cb-27778c44a3bc | GBIF |
| 347 | 350 | MVZ MVZ Observations-Herp | | Museum of Vertebrate Zoology. Herpetology Observations. Accessed via ( | http://www.gbif.org/dataset/f3e4b261-00c5-4f3a-a5b7-d66075b7f3e1 | GBIF |
| 348 | 351 | MVZObs Herp | | Museum of Vertebrate Zoology. Herpetology Observations. Accessed via ( | http://www.gbif.org/dataset/f3e4b261-00c5-4f3a-a5b7-d66075b7f3e1 | GBIF |
| 349 | 352 | NCSM NCSM-Invert | | North Carolina Museum of Natural Sciences. Invertebrates Collection. Acc | http://www.gbif.org/dataset/d7ce3688-e91d-4f26-b2bb-333357c6da9f | GBIF |
| 350 | 353 | NLD037 NLD | | Centre for Genetic Resources, the Netherlands. Plant Genetic Resouces | http://www.gbif.org/dataset/85796928-f762-11e1-a439-00145eb45e9a | GBIF |
| 351 | 354 | NMR Insecta | | Natural History Museum Rotterdam. Insecta collection. Accessed via Glob | http://www.gbif.org/dataset/d5e61920-9863-4fc3-8e5a-80f0c7bfe640 | GBIF |
| 352 | 355 | NOAA 2001 San Francisco Bay | | Ocean Biogeographic Information System. San Francisco Bay Data. Acce | http://www.gbif.org/dataset/8399a5be-f762-11e1-a439-00145eb45e9a | GBIF |
| 355 | 358 | NSW NSW | | National Herbarium of New South Wales. Herbarium Collection. Accessec | http://www.gbif.org/dataset/853006c0-f762-11e1-a439-00145eb45e9a | GBIF |
| 356 | 359 | NY Herbarium | | Consortium of California Herbarium. New York Botanical Garden. Access | http://www.gbif.org/dataset/7133ff0a-f762-11e1-a439-00145eb45e9a | GBIF |
| 358 | 361 | OBI OBI | | Consortium of California Herbaria. California Polytechnic State University, | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 359 | 362 | Ohio State University - Amphibian Division, Columbus, OH (OS | | Ohio State University Museum of Biological Diversity Tetrapod Division. A | http://www.gbif.org/dataset/3d84f407-8a76-473a-b8c8-54a58d5f581b | GBIF |
| 360 | 363 | Ohio State University - Reptile Division, Columbus, OH (OSUM | | Ohio State University Museum of Biological Diversity Tetrapod Division. R | http://www.gbif.org/dataset/51fa0155-a545-4154-ac20-b89dbb2c312b | GBIF |
| 361 | 364 | Ohio State University Acarology Laboratory, Columbus, OH (O | | Ohio State University Museum of Biological Diversity Acarology Laborator | http://www.gbif.org/dataset/96b54e8c-f762-11e1-a439-00145eb45e9a | GBIF |
| 362 | 365 | OMC Arthropods | | University of California, Berkeley - Essig Museum. California Terrestrial Ar | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 363 | 366 | OMNH Amphibians | | Sam Noble Oklahoma Museum of Natural History. Amphibian Specimens. | http://www.gbif.org/dataset/2e64dedd-0996-4cd6-b6cd-4f055a46c38c | GBIF |
| 364 | 367 | OMNH Reptiles | | Sam Noble Oklahoma Museum of Natural History. Reptile Specimens. Ac | http://www.gbif.org/dataset/ad0d4b56-c620-45a5-9152-7a0da3bd48e8 | GBIF |
| 365 | 368 | OMNH RINVRT | | Sam Noble Oklahoma Museum of Natural History. Recent Invertebrates S | http://www.gbif.org/dataset/5378e1cf-522d-4469-8776-b709579b4a3e | GBIF |
| 366 | 369 | OSAL Mites | | Ohio State University Museum of Biological Diversity Acarology Laborator | http://www.gbif.org/dataset/96b54e8c-f762-11e1-a439-00145eb45e9a | GBIF |
| 368 | 371 | OSC OSC | | Oregon State University. Vascular Plant Collection. Accessed via Global E | http://www.gbif.org/dataset/84aa5ee4-f762-11e1-a439-00145eb45e9a | GBIF |
| 369 | 372 | OSC WILLU | | Oregon State University. Vascular Plant Collection. Accessed via Global E | http://www.gbif.org/dataset/84aa5ee4-f762-11e1-a439-00145eb45e9a | GBIF |
| 370 | 373 | OSUC Insects | | Ohio State University Museum of Biological Diversity Acarology Laborator | http://www.gbif.org/dataset/84ab7b76-f762-11e1-a439-00145eb45e9a | GBIF |
| 371 | 374 | PBDB 19396 | | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 372 | 375 | PBDB 19397 | | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 373 | 376 | PBDB 19402 | | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 374 | 377 | PBDB 19407 | | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 375 | 378 | PBDB 19408 | | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 376 | 379 | PBDB 20327 | | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 377 | 380 | PBDB 20628 | | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 378 | 381 | PBDB 79630 | | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 379 | 382 | PBDB 85314 | | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 380 | 383 | PGM PGM | | Consortium of California Herbarium. Pacific Grove Museum of Natural His | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 381 | 384 | POM POM | | Consortium of California Herbarium. Pomona College Herbarium. Access | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 382 | 385 | PSM Herp | | James R. Slater Museum of Natural History. Herpetology Collection. Acce | http://www.gbif.org/dataset/8eddc200-f535-4c65-9b4d-f723eafe607e | GBIF |
| 383 | 386 | RMMU Herps | | McGill University Redpath Museum. Herpetological specimens. Accessed | http://www.gbif.org/dataset/7132ed22-f762-11e1-a439-00145eb45e9a | GBIF |
| 384 | 387 | ROM Herps | | Royal Ontario Museum. Herpetology Collection. Accessed via Global Biod | http://www.gbif.org/dataset/84bd4658-f762-11e1-a439-00145eb45e9a | GBIF |
| 385 | 388 | Royal Belgian Institute of natural Sciences Amphibia | | Royal Belgian Institute of Natural Sciences. Amphibian Collection. Access | http://www.gbif.org/dataset/8138eb72-f762-11e1-a439-00145eb45e9a | GBIF |
| 386 | 389 | Royal Belgian Institute of natural Sciences Types | | Royal Belgian Institute of Natural Sciences. Accessed via Global Biodivers | http://www.gbif.org/dataset/8138eb72-f762-11e1-a439-00145eb45e9a | GBIF |
| 387 | 390 | Royal Ontario Museum: ROM Reptiles and Amphibians | | Royal Ontario Museum. Herpetology Collection. Accessed via Global Biod | http://www.gbif.org/dataset/8c201186-d997-4b65-aac9-2fcf442a93f6 | GBIF |
| 388 | 391 | RSA RSA | | Consortium of California Herbarium. Rancho Santa Ana Botanic Garden H | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 389 | 392 | SACT SACT | | Consortium of California Herbaria. California State University, Sacramentc | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 390 | 393 | SBBG SBBG | | Consortium of California Herbaria. Santa Barbara Botanic Garden. Access | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 391 | 394 | SBMNH | SBMNH-ENT | Santa Barbara Museum of Natural History. Entomology Collection. Access | http://www.gbif.org/dataset/84b130ac-f762-11e1-a439-00145eb45e9a | GBIF |
| 392 | 395 | SBMNH HE | | Santa Barbara Museum of Natural History. Herpetology Collection. Access | http://www.gbif.org/dataset/75018539-6328-41de-b875-7c2e61dc1635 | GBIF |
| 393 | 396 | SBMNH OS | | Santa Barbara Museum of Natural History. Osteological Collection. Acces | http://www.gbif.org/dataset/75018539-6328-41de-b875-7c2e61dc1635 | GBIF |
| 394 | 397 | SBMNH SBMNH-ENT | | Santa Barbara Museum of Natural History. Entomology Collection. Access | http://www.gbif.org/dataset/84b130ac-f762-11e1-a439-00145eb45e9a | GBIF |
| 395 | 398 | SBMNHENT Arthropods | | Santa Barbara Museum of Natural History. Arthropods Collection. Access | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 396 | 399 | SD SD | | Consortium of California Herbaria. San Diego Natural History Museum. Ac | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 397 | 400 | SDNHM Arthropods | | University of California, Berkeley - Essig Museum. California Terrestrial Ar | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 398 | 401 | SDNHM Herps | | San Diego Natural History Museum. Herpetological specimens. Accessed | http://www.gbif.org/dataset/84b4d6e4-f762-11e1-a439-00145eb45e9a | GBIF |
| 399 | 402 | SDSU SDSU | | Consortium of California Herbaria. San Diego State University. Accessed | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 400 | 403 | SFV SFV | | Consortium of California Herbaria. California State University, Northridge. | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 401 | 404 | SJSU SJSU | | Consortium of California Herbaria. San Jose State University. Accessed v | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 402 | 405 | SMF Collection Crustacea | | Senckenberg Nature Research Society. Crustacean Collection. Accessed | http://www.gbif.org/dataset/9668b676-f762-11e1-a439-00145eb45e9a | GBIF |
| 403 | 406 | SMNK SMNKfungicoll | | Staatliche Naturwissenschaftliche Sammlungen Bayerns. Fungus Collecti | http://www.gbif.org/dataset/61a9ca38-b62f-11e2-afcb-00145eb45e9a | GBIF |
| 404 | 407 | SMNS Herpetologie | | Staatliches Museum für Naturkunde Stuttgart. Herpetology Collection. Acc | http://www.gbif.org/dataset/9cd0014c-b7b1-4ed1-bef7-0225acfa4ef2 | GBIF |
| 405 | 408 | TAMU ENTO | | Texas A&M University. Insect Collection. Accessed via Global Biodiversity | http://www.gbif.org/dataset/96193ea2-f762-11e1-a439-00145eb45e9a | GBIF |
| 406 | 409 | TNHC Herpetology | | The University of Texas at Austin - Texas Natural History Collections. Her | http://www.gbif.org/dataset/852628c6-f762-11e1-a439-00145eb45e9a | GBIF |
| 407 | 410 | UA ALTA-VP COLLECTION | | University of Alberta Museums. Vascular Plant Herbarium. Accessed via ( | http://www.gbif.org/dataset/7b3e4870-f762-11e1-a439-00145eb45e9a | GBIF |
| 408 | 411 | UA UAMZ HERPETOLOGY | | University of Alberta Museums. Amphibian and Reptile Collection. Access | http://www.gbif.org/dataset/88d7437e-f762-11e1-a439-00145eb45e9a | GBIF |
| 409 | 412 | UA UNA | | University of Alabama Biodiversity and Systematics. Herbarium. Accessec | http://www.gbif.org/dataset/84f9770e-f762-11e1-a439-00145eb45e9a | GBIF |
| 410 | 413 | UBCBBM CTC | | University of British Columbia. Cowan Tetrapod Collection - Herpetology. / | http://www.gbif.org/dataset/df9c8b86-9d36-4e29-91b3-4274dff053e5 | GBIF |
| 411 | 414 | UC UC | | Consortium of California Herbaria. University of California, Berkeley - Univ | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 413 | 416 | UCBG California | | University of California, Berkeley Natural History Museums. TAPIR Provid | http://www.gbif.org/dataset/51b92d4e-556f-4a05-bc5c-bfe982ee1156 | GBIF |
| 414 | 417 | UCBG Californian | | University of California, Berkeley Natural History Museums. TAPIR Provid | http://www.gbif.org/dataset/51b92d4e-556f-4a05-bc5c-bfe982ee1156 | GBIF |
| 415 | 418 | UCBG Mather Redwood Grove | | University of California, Berkeley Natural History Museums. Mather Redwc | http://www.gbif.org/dataset/51b92d4e-556f-4a05-bc5c-bfe982ee1156 | GBIF |
| 416 | 419 | UCBG Unspecified | | University of California, Berkeley Natural History Museums. Unspecified. / | http://www.gbif.org/dataset/51b92d4e-556f-4a05-bc5c-bfe982ee1156 | GBIF |
| 417 | 420 | UCBME Arthropods | | University of California, Berkeley - Essig Museum. California Terrestrial Ar | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 418 | 421 | UCD UCD | | Consortium of California Herbaria. University of California, Davis. Accesse | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 419 | 422 | UCJEPS JEPS | | Consortium of California Herbaria. University of California, Berkeley - Jeps | http://www.gbif.org/dataset/5729fd1d-04af-46bd-9da7-0ff79977c6f8 | GBIF |
| 420 | 423 | UCJEPS UC | | Consortium of California Herbaria. University of California, Berkeley - Univ | http://www.gbif.org/dataset/5729fd1d-04af-46bd-9da7-0ff79977c6f8 | GBIF |
| 421 | 424 | UCLA UCLA | | Consortium of California Herbaria. University of California, Los Angeles. A | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 422 | 425 | UCM Herps | | University of Colorado Museum of Natural History. Amphibian and Reptile | http://www.gbif.org/dataset/8935e64a-f762-11e1-a439-00145eb45e9a | GBIF |
| 423 | 426 | UConn CONN | | University of Connecticut. George Safford Torrey Herbarium. Accessed vi | http://www.gbif.org/dataset/5288946d-5fcf-4b53-8fd3-74f4cc6b53fc | GBIF |
| 424 | 427 | UCR UCR | | Consortium of California Herbaria. University of California, Riverside. Acc | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 425 | 428 | UCRCENT Arthropods | | University of California, Berkeley - Essig Museum. California Terrestrial Ar | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 426 | 429 | UCSB UCSB | | Consortium of California Herbaria. University of California, Santa Barbara. | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 427 | 430 | UCSC UCSC | | Consortium of California Herbaria. University of California, Santa Cruz. Ac | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |

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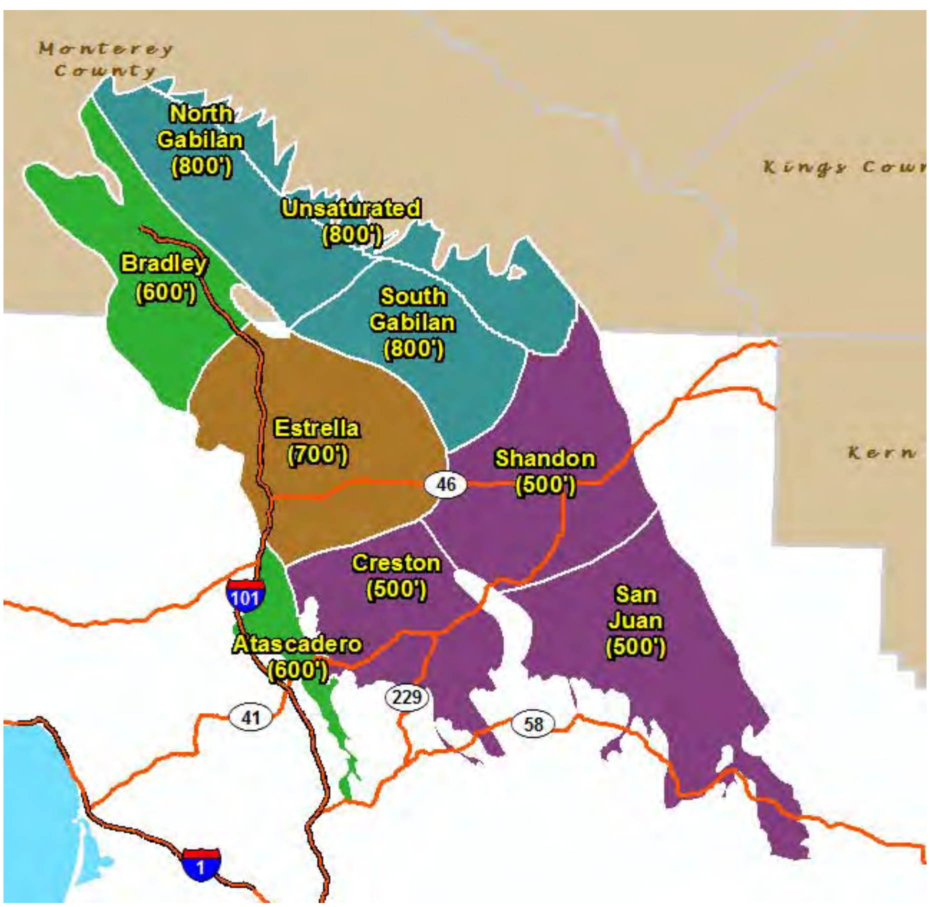
|---|---|---|---|---|---|
| 428 | 431 | UMMZI Arthropods | University of California, Berkeley - Essig Museum. California Terrestrial Ar | http://www.gbif.org/dataset/5d283bb6-64dd-4626-8b3b-a4e8db5415c3 | GBIF |
| 429 | 432 | University of Alberta Museums ALTA-VP | University of Alberta Museums. Vascular Plant Herbarium. Accessed via ( | http://www.gbif.org/dataset/2429287b-ef65-4cfd-afcc-11cc3ba95cca | GBIF |
| 430 | 433 | University of Alberta Museums UASM | University of Alberta Museums. Entomology Collection. Accessed via Glob | http://www.gbif.org/dataset/8971dfba-f762-11e1-a439-00145eb45e9a | GBIF |
| 431 | 434 | University of British Columbia UBC | University of British Columbia Herbarium. Accessed via Global Biodiversit | http://www.gbif.org/dataset/07fd0d79-4883-435f-bba1-58fef110cd13 | GBIF |
| 432 | 435 | UNR Herpetology | University of Nevada, Reno. Herpetology Collection. Accessed via Global I | http://www.gbif.org/dataset/c62f7574-d65a-4018-87a2-b96d6df5231b | GBIF |
| 433 | 436 | UPRM INVCOL | University of Puerto Rico. Invertebrate Collection. Accessed via Global Bic | http://www.gbif.org/dataset/1162234d-4e06-4d63-8a49-034184a38c7e | GBIF |
| 434 | 437 | US Botany | Smithsonian Institution National Museum of Natural History. Botany Colle | http://www.gbif.org/dataset/5df38344-b821-49c2-8174-cf0f29f4df0d | GBIF |
| 435 | 438 | USA151 USA151 | United States National Plant Germplasm System. USA151 Collection. Acc | http://www.gbif.org/dataset/85802736-f762-11e1-a439-00145eb45e9a | GBIF |
| 436 | 439 | USA955 USA955 | United States National Plant Germplasm System. USA955 Collection. Acc | http://www.gbif.org/dataset/85802736-f762-11e1-a439-00145eb45e9a | GBIF |
| 437 | 440 | USGS-NAS NAS | United Stated Geological Survey. Nonindigenous Aquatic Species. Access | http://www.gbif.org/dataset/d6cc311c-c5ab-4f23-9a20-10514f9eb9c4 | GBIF |
| 438 | 441 | USNM Amphibians & Reptiles | Smithsonian Institution National Museum of Natural History. Amphibian & | http://www.gbif.org/dataset/5df38344-b821-49c2-8174-cf0f29f4df0d | GBIF |
| 439 | 442 | USNM Entomology | Smithsonian Institution National Museum of Natural History. Entomology ( | http://www.gbif.org/dataset/5df38344-b821-49c2-8174-cf0f29f4df0d | GBIF |
| 440 | 443 | USNM Invertebrate Zoology | Smithsonian Institution National Museum of Natural History. Invertebrate . | http://www.gbif.org/dataset/5df38344-b821-49c2-8174-cf0f29f4df0d | GBIF |
| 441 | 444 | USU UTC | Utah State University. Specimen Database. Accessed via Global Biodivers | http://www.gbif.org/dataset/85ac3c18-f762-11e1-a439-00145eb45e9a | GBIF |
| 442 | 445 | UTEP Herps | University of Texas at El Paso. Herpetology Collection. Accessed via Glob | http://www.gbif.org/dataset/bd2feca8-ec39-4480-9dad-e353ab6a506d | GBIF |
| 443 | 446 | UVSC Herb | Utah Valley University. Utah Valley State College Herbarium. Accessed via | http://www.gbif.org/dataset/854a88d8-f762-11e1-a439-00145eb45e9a | GBIF |
| 444 | 447 | UWBM Herp | University of Washington Burke Museum. Herpetology Collection. Access | http://www.gbif.org/dataset/78122332-6315-41bd-914b-e9c1342d9093 | GBIF |
| 445 | 448 | UWBM Plant | University of Washington Burke Museum. Plant Collection. Accessed via ( | http://www.gbif.org/dataset/8310f570-f762-11e1-a439-00145eb45e9a | GBIF |
| 446 | 449 | UWBM Plants | University of Washington Burke Museum. Plant Collection. Accessed via ( | http://www.gbif.org/dataset/8310f570-f762-11e1-a439-00145eb45e9a | GBIF |
| 448 | 451 | VVC VVC | Consortium of California Herbaria. Victor Valley College. Accessed via Glc | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 449 | 452 | W Herbarium W | Vienna Natural History Museum. Herbarium. Accessed via Global Biodiver | http://www.gbif.org/dataset/7f5260c2-f762-11e1-a439-00145eb45e9a | GBIF |
| 450 | 453 | YM-YOSE YM-YOSE | Consortium of California Herbaria. Yosemite National Park Herbarium. Acc | http://www.gbif.org/dataset/4fa894f4-b6c6-4ec0-b816-9bb03b3ca106 | GBIF |
| 451 | 454 | YPM ENT | Yale University Peabody Museum. Entomology Division. Accessed via Glc | http://www.gbif.org/dataset/96404cc2-f762-11e1-a439-00145eb45e9a | GBIF |
| 452 | 455 | YPM HER | Yale University Peabody Museum. Vertebrate Zoology Division - Herpetolc | http://www.gbif.org/dataset/861d3d64-f762-11e1-a439-00145eb45e9a | GBIF |
| 453 | 456 | YPM IZ | Yale University Peabody Museum. Vertebrate Zoology Division - Invertebra | http://www.gbif.org/dataset/854e35e6-f762-11e1-a439-00145eb45e9a | GBIF |
| 454 | 457 | ZIN ZISP | Zoological Institute, Russian Academy of Sciences, St. Petersburg. Ampl | http://www.gbif.org/dataset/7e34ea34-f762-11e1-a439-00145eb45e9a | GBIF |
| 455 | 458 | ZMB Collection Crustacea | Senckenberg Nature Research Society: Crustacean Collection. Accessed | http://www.gbif.org/dataset/7b84c0a2-f762-11e1-a439-00145eb45e9a | GBIF |
| 456 | 459 | Don Sada Springsnails database 2003 | Sada, D. 2003. Desert Research Institute Springs Database (http://www.( | http://www.dri.edu/directory/4934-don-sada | |
| 457 | 460 | Hershler, Liu, Bradford 2013 | R. Hershler, H Liu, and C Bradford. 2013. Systematics of a widely distrib | http://zookeys.pensoft.net/articles.php?id=3635 | |
| 459 | 461 | Anymals.org user: 13 | Museum für Naturkunde Berlin. Anymals+plants - Citizen Science Data - I | http://www.gbif.org/dataset/e6c97f6e-e952-11e2-961f-00145eb45e9a | GBIF |
| 460 | 465 | CAS ORN | California Academy of Sciences. Ornithology Collection. Accessed via Glc | http://www.gbif.org/dataset/4f29b6ab-20c0-4479-8795-4915bedcebd1 | GBIF |
| 461 | 466 | CCBER Birds | Cheadle Center for Biodiversity and Ecological Restoration. Ornithology C | http://www.gbif.org/dataset/4ada1c77-3895-47d8-8dc9-9ce44e1df802 | GBIF |
| 462 | 467 | CLO EBIRD | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD' Collection | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 463 | 468 | CLO EBIRD AK | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD AK' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 464 | 469 | CLO EBIRD BCN | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD BCN' Coll | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 465 | 470 | CLO EBIRD CA | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD CA' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 466 | 471 | CLO EBIRD CAN | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD CAN' Coll | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 467 | 472 | CLO EBIRD CB | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD CB' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 468 | 473 | CLO EBIRD CBW | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD CBW' Co | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 469 | 474 | CLO EBIRD CL | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD CL' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 470 | 475 | CLO EBIRD CR | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD CR' Colle | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 471 | 476 | CLO EBIRD ISS | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD ISS' Colle | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 472 | 477 | CLO EBIRD KLAM SISK | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD KLAM SI | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 473 | 478 | CLO EBIRD LWBA | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD LWBA' C | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 474 | 479 | CLO EBIRD MA | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD MA' Colle | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 475 | 480 | CLO EBIRD MEX | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD MEX' Coll | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 476 | 481 | CLO EBIRD NH | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD NH' Colle | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 477 | 482 | CLO EBIRD NJ | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD NJ' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 478 | 483 | CLO EBIRD NY | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD NY' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 479 | 484 | CLO EBIRD NZ | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD NZ' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 480 | 485 | CLO EBIRD PA | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD PA' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 481 | 486 | CLO EBIRD PAN | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD PAN' Coll | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 482 | 487 | CLO EBIRD TX | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD TX' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 483 | 488 | CLO EBIRD VA | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD VA' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 484 | 489 | CLO EBIRD VINS | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD VINS' Col | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 485 | 490 | CLO EBIRD WI | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD WI' Collec | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 486 | 491 | CLO EBIRD YARD | Cornell Lab of Ornithology. eBird Observation Dataset, 'EBIRD YARD' Cc | http://www.gbif.org/dataset/4fa7b334-ce0d-4e88-aaae-2e0c138d049e | GBIF |
| 487 | 492 | CLO GBBC | Avian Knowledge Network. Great Backyard Bird Count. Accessed via Glol | http://www.gbif.org/dataset/82cb293c-f762-11e1-a439-00145eb45e9a | GBIF |
| 488 | 493 | CMN CMNAV | Canadian Museum of Nature. Bird Collection. Accessed via Global Biodiv | http://www.gbif.org/dataset/8309005e-f762-11e1-a439-00145eb45e9a | GBIF |
| 489 | 495 | CUMV Bird | Cornell University Museum of Vertebrates. Bird Collection. Accessed via ( | http://www.gbif.org/dataset/f96a6f8c-b992-4159-8039-db8f30bac985 | GBIF |
| 490 | 496 | DMNH Bird | Delaware Museum of Natural History. Bird Collection. Accessed via Globa | http://www.gbif.org/dataset/c21cd435-718a-4069-b503-776bf0e22b96 | GBIF |
| 491 | 497 | DMNS Bird | Denver Museum of Nature & Science. Bird Collection. Accessed via Glob: | http://www.gbif.org/dataset/2f54cb88-4167-499a-81fb-0a2d02465212 | GBIF |
| 492 | 498 | DMNS DMNS Birds | Denver Museum of Nature & Science. Bird Collection. Accessed via Glob: | http://www.gbif.org/dataset/2f54cb88-4167-499a-81fb-0a2d02465212 | GBIF |
| 493 | 499 | Facultad de Ciencias UNAM MZFC-A | Universidad Nacional Autónoma de México. Museo de Zoología "Alfonso L | http://www.gbif.org/dataset/890c34ee-f762-11e1-a439-00145eb45e9a | GBIF |
| 494 | 500 | HSU WildlifeBirds | Humboldt State University. Wildlife Birds Collection. Accessed via Global | http://www.gbif.org/dataset/9c007868-b667-4c07-9a1a-96b796066f64 | GBIF |
| 495 | 502 | LACM Birds | Natural History Museum of Los Angeles County. Birds Collection. Access | http://www.gbif.org/dataset/7a25f7aa-03fb-4322-aaeb-66719e1a9527 | GBIF |
| 496 | 503 | MCZ Bird | Harvard University Museum of Comparative Zoology. Bird Collection. Acc | http://www.gbif.org/dataset/4bfac3ea-8763-4f4b-a71a-76a6f5f243d3 | GBIF |
| 497 | 504 | MCZ Orn | Harvard University Museum of Comparative Zoology. Ornithology Collecti | http://www.gbif.org/dataset/4bfac3ea-8763-4f4b-a71a-76a6f5f243d3 | GBIF |
| 498 | 505 | MSB Bird | Museum of Southwestern Biology. Bird Collection. Accessed via Global Bi | http://www.gbif.org/dataset/c9076cd3-349f-4068-a5c7-bc34449c3916 | GBIF |
| 499 | 506 | MSB Host | Museum of Southwestern Biology. Division of Parasitology. Accessed via ( | http://www.gbif.org/dataset/b211f32f-326b-43d3-8012-2fbce0cc6dcc | GBIF |
| 500 | 507 | MSB MSB Birds | Museum of Southwestern Biology. Bird Collection. Accessed via Global Bi | http://www.gbif.org/dataset/c9076cd3-349f-4068-a5c7-bc34449c3916 | GBIF |
| 501 | 508 | MSB MSB Host | Museum of Southwestern Biology. Division of Parasitology. Accessed via ( | http://www.gbif.org/dataset/b211f32f-326b-43d3-8012-2fbce0cc6dcc | GBIF |
| 502 | 509 | MVZ Egg | Museum of Vertebrate Zoology. Egg and Nest Collection. Accessed via Gl | http://www.gbif.org/dataset/9ce52ff6-01b6-44a2-b617-9bc2ee8e8cd1 | GBIF |
| 503 | 511 | MVZ MVZ Birds | Museum of Vertebrate Zoology. Bird Collection. Accessed via Global Biod | http://www.gbif.org/dataset/e3b959d6-fcbe-4a28-a166-e4a807c340a0 | GBIF |
| 504 | 512 | MVZ MVZ Egg/Nest | Museum of Vertebrate Zoology. Egg and Nest Collection. Accessed via Gl | http://www.gbif.org/dataset/9ce52ff6-01b6-44a2-b617-9bc2ee8e8cd1 | GBIF |
| 505 | 514 | MVZ MVZ Observations-Bird | Museum of Vertebrate Zoology. Bird Observations. Accessed via Global E | http://www.gbif.org/dataset/62ad511d-d298-4fd7-80e7-f5d5bd32299e | GBIF |
| 506 | 515 | MVZObs Bird | Museum of Vertebrate Zoology. Bird Observations. Accessed via Global E | http://www.gbif.org/dataset/62ad511d-d298-4fd7-80e7-f5d5bd32299e | GBIF |
| 507 | 516 | naturgucker naturgucker | Naturgucker.de / enjoynature.net. Citizen Science Observations. Accesse | http://www.gbif.org/dataset/6ac3f774-d9fb-4796-b3e9-92bf6c81c084 | GBIF |
| 508 | 517 | NBM Aves | New Brunswick Museum. Bird Collection. Accessed via Global Biodiversit | http://www.gbif.org/dataset/84a80b12-f762-11e1-a439-00145eb45e9a | GBIF |
| 509 | 518 | OBIS-SEAMAP 41 | Ocean Biogeographic Information System. Spatial Ecological Analysis of I | http://www.gbif.org/dataset/83a1a8c2-f762-11e1-a439-00145eb45e9a | GBIF |
| 510 | 519 | OBIS-SEAMAP 47 | Ocean Biogeographic Information System. Spatial Ecological Analysis of I | http://www.gbif.org/dataset/83a1a8c2-f762-11e1-a439-00145eb45e9a | GBIF |
| 511 | 520 | OBIS-SEAMAP 48 | Ocean Biogeographic Information System. Spatial Ecological Analysis of I | http://www.gbif.org/dataset/83a1a8c2-f762-11e1-a439-00145eb45e9a | GBIF |
| 512 | 521 | Ohio State University - Bird Division, Columbus, OH (OSUM) I | Ohio State University Museum of Biological Diversity Tetrapod Division. B | http://www.gbif.org/dataset/91aa5e23-9cad-4751-86e0-241da77d7407 | GBIF |
| 513 | 522 | OMNH Birds | Sam Noble Oklahoma Museum of Natural History. Birds Specimens. Acce | http://www.gbif.org/dataset/84b018de-f762-11e1-a439-00145eb45e9a | GBIF |
| 514 | 523 | OMNH Egg | Sam Noble Oklahoma Museum of Natural History. Eggs Specimen. Acces | http://www.gbif.org/dataset/39f021d5-240c-445d-b62f-33bfed94938d | GBIF |
| 515 | 524 | PBDB 20585 | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 516 | 525 | PBDB 20624 | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 517 | 526 | PBDB 20639 | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 518 | 527 | PBDB 59063 | University of California, Santa Barbara Marine Science Institute. Paleobiol | http://www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 519 | 529 | PMAE Provincial Museum of Alberta | Canadian Biodiversity Information Facility. Provincial Museum of Alberta. / | http://www.gbif.org/dataset/843df0c4-f762-11e1-a439-00145eb45e9a | GBIF |
| 520 | 530 | PRBO PRBO-PC | Avian Knowledge Network. Point Reyes Bird Observatory - Point Counts. , | http://www.gbif.org/dataset/864c8736-f762-11e1-a439-00145eb45e9a | GBIF |
| 521 | 531 | PSM Bird | James R. Slater Museum of Natural History. Bird Collection. Accessed via | http://www.gbif.org/dataset/8eddc200-f535-4c65-9b4d-f723eafe607e | GBIF |
| 522 | 532 | Royal Belgian Institute of natural Sciences Aves | Royal Belgian Institute of Natural Sciences. Bird Collection. Accessed via | http://www.gbif.org/dataset/8138eb72-f762-11e1-a439-00145eb45e9a | GBIF |
| 523 | 533 | Royal Ontario Museum: ROM Birds | Royal Ontario Museum. Ornithology Collection Non Passeriformes. Acces | http://www.gbif.org/dataset/c0d6b7e8-8263-4224-8dac-32748d945555 | GBIF |
| 524 | 534 | RSL PC | Avian Knowledge Network. Redwood Sciences Laboratory - Lamna Point ( | http://www.gbif.org/dataset/864da4c2-f762-11e1-a439-00145eb45e9a | GBIF |
| 525 | 535 | SBMNH AV | Santa Barbara Museum of Natural History. Bird Collection. Accessed via ( | http://www.gbif.org/dataset/75018539-6328-41de-b875-7c2e61dc1635 | GBIF |
| 526 | 537 | SDNHM Birds | San Diego Natural History Museum. Bird specimens. Accessed via Globa | http://www.gbif.org/dataset/84b26828-f762-11e1-a439-00145eb45e9a | GBIF |
| 527 | 538 | SMF Collection Aves (bird skins) | Senckenberg Nature Research Society. Bird Skin Collection. Accessed vi | http://www.gbif.org/dataset/96678e90-f762-11e1-a439-00145eb45e9a | GBIF |
| 528 | 540 | UCLA Dickey-Birds | University of California, Los Angeles. Dickey Collection, Birds. Accessed ' | http://www.gbif.org/dataset/8631295a-f762-11e1-a439-00145eb45e9a | GBIF |
| 529 | 541 | UCM Birds | University of Colorado Museum of Natural History. Bird Collection. Access | http://www.gbif.org/dataset/89337996-f762-11e1-a439-00145eb45e9a | GBIF |
| 530 | 542 | UMMZ Birds | University of Michigan Museum of Zoology. Birds Collection. Accessed via | http://www.gbif.org/dataset/be5507b9-7abf-4b69-afe1-5ca2b7561734 | GBIF |
| 531 | 543 | UNSM Birds | University of Nebraska State Museum. Vertebrate Specimens. Accessed ' | http://www.gbif.org/dataset/851ab8c4-f762-11e1-a439-00145eb45e9a | GBIF |
| 532 | 544 | USNM Birds | Smithsonian Institution National Museum of Natural History. Bird Collectic | http://www.gbif.org/dataset/5df38344-b821-49c2-8174-cf0f29f4df0d | GBIF |
| 533 | 545 | UWBM Bird | University of Washington Burke Museum. Ornithology Collection. Access | http://www.gbif.org/dataset/830fd460-f762-11e1-a439-00145eb45e9a | GBIF |
| 534 | 546 | UWYMV Bird | University of Wyoming Museum of Vertebrates. Bird Collection. Accessed | http://www.gbif.org/dataset/abcaccad-9e01-4b2a-b493-32531cbed32a | GBIF |
| 535 | 547 | UWYMV UWYMV Bird | University of Wyoming Museum of Vertebrates. Bird Collection. Accessed | http://www.gbif.org/dataset/abcaccad-9e01-4b2a-b493-32531cbed32a | GBIF |
| 536 | 548 | WAM AVIF | Western Australian Museum. Western Australian Museum provider for OZ | http://www.gbif.org/dataset/7c93d290-6c8b-11de-8226-b8a03c50a862 | GBIF |
| 537 | 549 | WFVZ Bird | Western Foundation of Vertebrate Zoology. Bird Collection. Accessed via | http://www.gbif.org/dataset/8be43f9b-52e7-47d4-be3e-dbcc066d70ab | GBIF |
| 538 | 550 | WFVZ Eggs | Western Foundation of Vertebrate Zoology. Egg Collection. Accessed via | http://www.gbif.org/dataset/8be43f9b-52e7-47d4-be3e-dbcc066d70ab | GBIF |
| 539 | 551 | Wildlife Sightings Wildlife Sightings | Wildlife Sightings. Citizen Science Data. Accessed via Global Biodiversity | http://www.gbif.org/dataset/b70121ef-b7ea-4316-a05b-abdf30f5ca09 | GBIF |
| 540 | 552 | YPM ORN | Yale University Peabody Museum. Vertebrate Zoology Division - Ornitholo | http://www.gbif.org/dataset/854cf79e-f762-11e1-a439-00145eb45e9a | GBIF |
| 541 | 553 | California Avian Datacenter, Level 3 - Bodie Hills and Long Val | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 542 | 554 | California Avian Datacenter, Level 3 - Central Coast | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 543 | 555 | California Avian Datacenter, Level 3 - Clear Creek | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 544 | 556 | California Avian Datacenter, Level 3 - Coastal NPS Monitoring | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 545 | 557 | California Avian Datacenter, Level 3 - Cosumnes River | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 546 | 558 | California Avian Datacenter, Level 3 - Devil's Postpile National | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 547 | 559 | California Avian Datacenter, Level 3 - East/West Walker River | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 548 | 560 | California Avian Datacenter, Level 3 - Inyo National Forest Asp | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 549 | 561 | California Avian Datacenter, Level 3 - KBO Fuel Reduction K | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 551 | 563 | California Avian Datacenter, Level 3 - KBO Inventory KLMN I | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 552 | 564 | California Avian Datacenter, Level 3 - KBO Inventory KLMN I | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 553 | 565 | California Avian Datacenter, Level 3 - KBO Inventory KLMN \ | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 554 | 566 | California Avian Datacenter, Level 3 - KBO Longterm BBS | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 555 | 567 | California Avian Datacenter, Level 3 - KBO Longterm KLMN | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 556 | 568 | California Avian Datacenter, Level 3 - KBO Longterm KLMN | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 557 | 569 | California Avian Datacenter, Level 3 - KBO Longterm KLMN | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 558 | 570 | California Avian Datacenter, Level 3 - KBO Longterm KLMN | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 559 | 571 | California Avian Datacenter, Level 3 - KBO Longterm Norther | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 560 | 572 | California Avian Datacenter, Level 3 - KBO Water Manageme | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 561 | 573 | California Avian Datacenter, Level 3 - KBO Water Manageme | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 562 | 574 | California Avian Datacenter, Level 3 - Laguna de Santa Rosa | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 563 | 575 | California Avian Datacenter, Level 3 - Lands End | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 564 | 576 | California Avian Datacenter, Level 3 - Lassen Aspen | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 565 | 577 | California Avian Datacenter, Level 3 - Lassen Black Oak | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 566 | 578 | California Avian Datacenter, Level 3 - Lassen Foothills Oak | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 567 | 579 | California Avian Datacenter, Level 3 - Lassen Management Ind | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 568 | 580 | California Avian Datacenter, Level 3 - Lassen National Forest F | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 569 | 581 | California Avian Datacenter, Level 3 - LNF Inventory | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 570 | 582 | California Avian Datacenter, Level 3 - Long Valley Road Closur | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 571 | 583 | California Avian Datacenter, Level 3 - Lower Owens River Proj | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 572 | 584 | California Avian Datacenter, Level 3 - Lower Sacramento River | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 573 | 585 | California Avian Datacenter, Level 3 - Marble Creek | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 574 | 586 | California Avian Datacenter, Level 3 - Marin County Open Spa | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 575 | 587 | California Avian Datacenter, Level 3 - Merced River | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 576 | 588 | California Avian Datacenter, Level 3 - MMWD Monitoring | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 577 | 589 | California Avian Datacenter, Level 3 - Mono Basin Riparian | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 578 | 590 | California Avian Datacenter, Level 3 - Owens Valley Alluvial Fa | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 579 | 591 | California Avian Datacenter, Level 3 - Palomarin | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 580 | 592 | California Avian Datacenter, Level 3 - Pinnacles National Monu | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |

| | | | | | |
|---|---|---|---|---|---|
| 581 | 593 | California Avian Datacenter, Level 3 - Plumas/Lassen | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 582 | 594 | California Avian Datacenter, Level 3 - Presidio | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 583 | 595 | California Avian Datacenter, Level 3 - Rancheria Gulch | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 584 | 596 | California Avian Datacenter, Level 3 - RSLCOOPMONITORIN | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 585 | 597 | California Avian Datacenter, Level 3 - RSLCOOPMONITORIN | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 586 | 598 | California Avian Datacenter, Level 3 - RSLCOOPMONITORIN | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 587 | 599 | California Avian Datacenter, Level 3 - RSLLBMETHODSLON | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 588 | 600 | California Avian Datacenter, Level 3 - RSLTRRPMAINSTEM | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 589 | 601 | California Avian Datacenter, Level 3 - RSLTRRPSOUTHFOR | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 590 | 602 | California Avian Datacenter, Level 3 - RSLTRRPTRIBS | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 591 | 603 | California Avian Datacenter, Level 3 - RSLWILDFIREBISCUIT | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 592 | 604 | California Avian Datacenter, Level 3 - RSLWILDFIRECANOE | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 593 | 605 | California Avian Datacenter, Level 3 - RSLWILDFIRELEWIST | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 594 | 606 | California Avian Datacenter, Level 3 - RSLWILDFIREMEGRA | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 595 | 607 | California Avian Datacenter, Level 3 - San Joaquin BOR | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 596 | 608 | California Avian Datacenter, Level 3 - San Joaquin Experiment | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 597 | 609 | California Avian Datacenter, Level 3 - San Joaquin River NWR | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 598 | 610 | California Avian Datacenter, Level 3 - Sierra Meadows | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 599 | 611 | California Avian Datacenter, Level 3 - Sierra Nevada Mgmt Indi | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 600 | 612 | California Avian Datacenter, Level 3 - Sonoma Oaks | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 601 | 613 | California Avian Datacenter, Level 3 - Sonoma Riparian | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 602 | 614 | California Avian Datacenter, Level 3 - Susanville | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 603 | 615 | California Avian Datacenter, Level 3 - Tidal Marsh | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 604 | 616 | California Avian Datacenter, Level 3 - Upper Owens River Wat | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 605 | 617 | California Avian Datacenter, Level 5 - Big Sur Ornithology Lab | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 606 | 618 | California Avian Datacenter, Level 5 - BOR Grasslands | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 607 | 619 | California Avian Datacenter, Level 5 - Lassen Foothills Riparian | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 608 | 620 | California Avian Datacenter, Level 5 - Monterey RCD | Ballard, G., M. Herzog, M. Fitzgibbon, D. Moody, D. Jongsomjit, D. Stralb | http://data.prbo.org/cadc2/ | California Avian Datacenter |
| 609 | 621 | BIOS ds463 - Bird Species of Special Concern | Schoenig, S. 2009. Bird Species of Special Concern. Digitized range information from W.D. Shuford and T. Gardali, eds. 2008. California Bird Spe | | BIOS |
| 610 | 48 | USGS Nonindigenous Aquatic Species | US Geological Survey Southeast Ecological Science Center. 2011. Nonin | http://nas.er.usgs.gov/ | |
| 612 | 622 | CAS MAM | California Academy of Sciences. Mammalogy Collection. Accessed via Gl | www.gbif.org/dataset/6ce7290f-47f6-4046-8356-371f5b6749df | GBIF |
| 613 | 623 | CUMV CUMV Mammal | Cornell University Museum of Vertebrates. Mammal Collection. Accessed | www.gbif.org/dataset/35720b3e-aded-4b83-b4f1-967f1d457d6a | GBIF |
| 614 | 624 | CUMV Mammal | Cornell University Museum of Vertebrates. Mammal Collection. Accessed | www.gbif.org/dataset/35720b3e-aded-4b83-b4f1-967f1d457d6a | GBIF |
| 615 | 625 | FMNH Mammals | Field Museum of Natural History (Zoology). Mammal Collection. Accessed | www.gbif.org/dataset/41fc5c40-5e81-496f-9733-6b5681b3b7a5 | GBIF |
| 616 | 626 | KU KUM | University of Kansas Biodiversity Institute. Mammalogy Collection. Access | www.gbif.org/dataset/1d04e739-98a9-4e16-9970-8f8f3bf9e9e3 | GBIF |
| 617 | 627 | LACM Mammals | Natural History Museum of Los Angeles County. Mammal Collection. Acc | www.gbif.org/dataset/7a25f7aa-03fb-4322-aaeb-66719e1a9527 | GBIF |
| 618 | 628 | LSUMZ Mammals | Louisiana State University Herbarium. Mammals Collection. Accessed via | www.gbif.org/dataset/847e2306-f762-11e1-a439-00145eb45e9a | GBIF |
| 619 | 629 | MSB Mamm | Museum of Southwestern Biology. Mammal Collection. Accessed via Glob | www.gbif.org/dataset/b15d4952-7d20-46f1-8a3e-556a512b04c5 | GBIF |
| 621 | 631 | MVZ MVZ Mammals | Museum of Vertebrate Zoology. Mammal Collection. Accessed via Global | www.gbif.org/dataset/0daed095-478a-4af6-abf5-18acb790fbb2 | GBIF |
| 622 | 632 | PBDB 20122 | University of California, Santa Barbara Marine Science Institute. Paleobiol | www.gbif.org/dataset/84806e86-f762-11e1-a439-00145eb45e9a | GBIF |
| 624 | 634 | PSM Mammal | James R. Slater Museum of Natural History. Mammal Collection. Accesse | www.gbif.org/dataset/8eddc200-f535-4c65-9b4d-f723eafe607e | GBIF |
| 625 | 635 | Royal Ontario Museum: ROM Mammals | Royal Ontario Museum. Mammalogy Collection. Accessed via Global Biod | www.gbif.org/dataset/c5c4a23e-2035-4416-ab64-032d6df52ddb | GBIF |
| 626 | 636 | SBMNH MAM | Santa Barbara Museum of Natural History. Mammal Collection. Accessed | www.gbif.org/dataset/75018539-6328-41de-b875-7c2e61dc1635 | GBIF |
| 627 | 637 | TTU Mammals | Museum of Texas Tech University. Mammals Collection. Accessed via Gl | www.gbif.org/dataset/854f70cc-55e3-4af2-9417-0f47d6c7902d | GBIF |
| 628 | 638 | UCLA Mammals | University of California, Los Angeles. Dickey Collection, Mammals. Acces | www.gbif.org/dataset/8631295a-f762-11e1-a439-00145eb45e9a | GBIF |
| 629 | 639 | UMMZ Mammals | University of Michigan Museum of Zoology. Mammal Collection. Accessed | www.gbif.org/dataset/6d2cfc0a-9903-40b8-802b-403398218e4a | GBIF |
| 631 | 640 | NMFS Critical Habitat - Green Sturgeon | National Marine Fisheries Service. 2008. Green Sturgeon Critical Habitat. | http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm | |
| 632 | 641 | NMFS Critical Habitat - Winter Chinook | National Marine Fisheries Service. 1993. Sacramento River Winter-run Ch | http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm | |
| 633 | 642 | NMFS Critical Habitat - Chinook and Steelhead | National Marine Fisheries Service. 2005. Chinook and Steelhead Critical H | http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm | |
| 634 | 643 | USFWS Critical Habitat Designations (2011-2016) | US Fish and Wildlife Service. 2016. Critical Habitat Data. Sacramento, CA | http://www.fws.gov/sacramento/es/Critical-Habitat/Data/es critical-habitat data.htm | |
| 635 | 644 | California dragonfly and damselfly database | Ball-Damerow, JE, PT Oboyski, and VH Resh. 2015. California dragonfly | http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4337221/ | |
| 636 | 645 | Southern California Stormwater Monitoring Coalition database | Southern California Stormwater Monitoring Coalition. 2013. SMC databas | http://www.socalsmc.org/Bioassessment.aspx | |

# PRODUCTION WELLS APPROXIMATELY MAPPED WITHIN THE PRGWB

| PRGWB SUB-AREAS | PRODUCTION WELL COUNT | DRILLING THRESHOLD | > DRILLING THRESHOLD |
|---|---|---|---|
| ATASCADERO | 387 | 600 FEET | 3 |
| BRADLEY | 9 | 600 FEET | 0 |
| CRESTON | 950 | 500 FEET | 68 |
| ESTRELLA | 2,205 | 700 FEET | 253 |
| NORTH GABILAN | 0 | 800 FEET | 0 |
| SAN JUAN | 53 | 500 FEET | 12 |
| SHANDON | 285 | 500 FEET | 26 |
| SOUTH GABILAN | 56 | 800 FEET | 5 |
| UNSATURATED | 0 | 800 FEET | 0 |
| **TOTAL FOR PRGWB** | **3,945** | | **367** |

PLEASE NOTE THAT ENVIRONMENTAL HEALTH IS ACTIVELY WORKING ON INPUTING WELL INVENTORY INTO OUR DATABASE AND HAS CURRENTLY ENTERED 11,965/18,580 PRODUCTION WELLS (DOMESTIC PRIVATE, DOMESTIC PUBLIC AND IRRIGATION) THAT WERE PERMITTED FROM 1964 TO PRESENT. THIS SPREADSHEET DOES NOT REPRESENT OUR COMPLETE INVENTORY AT THIS TIME.



# SAN LUIS OBISPO COUNTY FARM BUREAU

4875 MORABITO PLACE, SAN LUIS OBISPO, CA 93401
® PHONE (805) 543-3654 ▪ FAX (805) 543-3697 ▪ www.slofarmbureau.org

October 8, 2018

Supervisor John Peschong, District 1
Supervisor Bruce Gibson, District 2
Supervisor Adam Hill, District 3
Supervisor Lynn Compton, District 4
Supervisor Debbie Arnold, District 5

San Luis Obispo County Board of Supervisors
1055 Monterey St. Room D430
San Luis Obispo, CA 93401

RE: County Groundwater Sustainability Agency (GSA) Meetings

Dear Supervisors:

The San Luis Obispo County Farm Bureau represents hundreds of members who are impacted and actively interested in local groundwater use and availability. As a stakeholder in the process and outcome, our members attend meetings or seek information about the implementation of the Sustainable Groundwater Management Act, which will determine local groundwater use for the designated over drafted basins. Public observation and input are a benefit to the decision-making process.

Farm Bureau is making a recommendation regarding the format of future San Luis Obispo County Groundwater Sustainability Agency (GSA) meetings for the groundwater basins the County serves.

1. Hold dedicated, formal County GSA meetings for each groundwater basin, with appropriate notification (that it will be a GSA meeting), agendas, and minutes.
2. At each meeting, have a presentation of the updates relevant to the individual groundwater basin.
3. Provide for recordation of public comment.

The above recommendations are important to conduct meaningful dialogue between represented landowners and the agency in charge of managing each groundwater basin. Having the GSA meetings incorporated into regular Board of Supervisor meetings creates uncertainty about intent and scope of the item and does not provide landowners or interested parties with clear notice, nor does it provide a forum for presentations and meaningful discussion – especially when the item is placed on your Board's consent agenda.

Thank you for your consideration of this recommendation.

Sincerely,

Anna Negranti

Anna Negranti, President
San Luis Obispo County Farm Bureau

CC: Colt Esenwein, Public Works Director
Carolyn Berg, Senior Water Resources Engineer

Dennis R Loucks
[redacted]

Re: Paso Robles Subbasin General Services Plan (GSP) Development
October 8, 2018

There are substantial concerns with regard to the contracted consultant, Montgomery & Associates performance as it relates to methodology and data that has been presented to date.

The comments listed generally pertain to the Power Point Presentation of September 12, 2018 and to comments made by Montgomery & Associated during a "Groundwater Sustainability Workshop" on October 4, 2018.

**Slide 21:** Estimated Sustainable Yield for GSP Area.
This slide indicated that the Estimated sustainable yield from 1981 to 2011 was 68,500 AFY.

The estimated sustainable yield from 1981 to 2016 was estimated at 62,300 AFY.

The slides were of surprise to people in attendance since prior scientific reports (Todd & Geoscience) estimated Safe Yields and Perennial Yields up to 97,700 AFY.

Why the drastic change?
When Derrick Williams was asked what his source was for these numbers; he told the group on October 4, that the source was Montgomery & Associates and as hydrologists that's what they do. That answer is insufficient. Where did the data originate? The slide also reflects groundwater pumping from 1981 to 2016 at 76,000 AFY. This figure is very close to the 76,658 AFY (Safe Yield) presented by the City of Paso Robles and County of San Luis Obispo, etal in the recent prescription trial. It should be noted that GSI Environmental (paid by citizens) in that trial estimated the safe yield at 92,000 AFY.

Historical context is in order:

| | | |
|---|---|---|
| 2002 Fugro West Study | 94,000 AFY | Paid by Taxpayers (Perennial Yield) |
| 2005 Fugro Study | 97,700 AFY | Paid by Taxpayers (Perennial Yield) |
| 2015 Geoscience | 90,215 AFY | Paid by Taxpayers (Safe Yield) |
| 2016 Montgomery & Assoc. | 62,300 AFY | Paid by Taxpayers (Sustainable Yield) |
| 2018 GSI Environmental | 92,000 AFY | Paid by Private Group, No tax dollars (Safe Yield) |

As indicated, the methodology is not clear in Montgomery Assoc. figures and is contrary to accepted previous scientific studies. Supporting evidence should be required of Montgomery & Associates.

During the presentation on October 4, terms were stated that have different meanings. Example: In the Power Point the term "overdraft" is used. Derrick Williams explained that their use of "overdraft" reflected a hydrologist's definition and not a legal definition. The other term that has been introduced is "Estimated sustainable yield" To help avoid the confusion of terms, listed below are definitions from the State Department of Water Resources.

Perennial yield — The maximum quantity of water that can be withdrawn annually from a groundwater basin over a long period of time (during which water supply conditions approximate average conditions) without developing an overdraft condition.

Safe yield — The maximum quantity of water that can be continuously withdrawn from a groundwater basin without adverse effect.

Sustainability — A sustainable system or process has longevity and resilience. A sustainable system manages risk but cannot eliminate it. A sustainable system generally provides for the economy, the ecosystem, and social equity. Water sustainability is the dynamic state of water use and supply that meets today's needs without compromising the long-term capacity of the natural and human aspects of the water system to meet the needs of future generations. For example, planning ways to eventually eliminate drafting more groundwater than can be recharged over the long term is one approach for improving sustainability.

Groundwater overdraft — The condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years during which water supply conditions approximate average conditions.

**Slide 29:** Process for Establishing Measurable Objectives:

The basis for establishing measurable objectives and particularly minimum threshold objectives was based on a survey that received 111 responses. The survey asked the property owners their well water level preferences. Did they prefer current water levels? Did they prefer higher water levels?

To establish minimum well water thresholds based on a survey without factual documentation is a flawed process. In essence, you are obtaining opinions and "beliefs" that the respondents well is fine or in some cases would like to see their water level higher, who wouldn't want more water in their wells. As we learned during the presentation of October 4, those that want more water or higher levels in their wells will have water projects presented to them that they will be expected to pay for. I don't recall that aspect being presented in the survey; perhaps it was omitted on purpose?

Considering the hundreds of thousands of dollars spent by the County, City of Paso Robles and other entities pursing an attempted theft of water from property owners overlying the basin, tax payer funds would be better served to establish monitoring stations throughout the basin that would reflect current water levels in real time. This would be actual factual information to determine minimum well thresholds. The property owners of this basin deserve accurate information so that informed decisions can be made.

**Slide 35:** Measurable Objective and Minimum Threshold at Example Creston Well

What is the source of this hydrograph?
The graph indicates a number 27S/13E-28F01 (Creston) In my research, I was able to determine that the number is from the State of California, Water Data Library/CASGEM program.

I felt it was necessary to examine the groundwater elevation graph presented in Slide 35 and compare with the Groundwater Level information from the State Water Data Library. The number referenced in your slide was determined to be a Station Name/Number. The web site only referenced Water Quality Data with Station Numbers and not Groundwater Levels. (Actually, I was unable to locate any reference to the number on your slide.) Groundwater Levels, for example, Creston is number 355262N1205215W001. Why are you listing Water Quality Data reference numbers when you are presenting Groundwater Level Data?

The graph in slide 35 references a period from about 1970 to about 2016 the information from the Water Data Library/CASGEM references a period from 2012 to 2018. I was unable to retrieve additional historical data for the example Creston area. The water levels from the period 2012 to 2018 were relatively flat, and appear to be different from those indicated in slide 35.

Again, this is why reliable and indisputable accurate well level data is critical to managing the groundwater levels in the basin.

Dennis R Loucks

Cc: Montgomery & Associates
Supervisor John Peschong
Supervisor Debbie Arnold

Frederick C. Hoey
[redacted]

October 12, 2018

Mr. Derrik Williams
Montgomery & Associates
1232 Park Street, Suite 201B
Paso Robles, CA 93446

Derrik:

I am writing as a follow-up to your recent meeting in Creston. Water issues have been front and center in Creston for quite some time and the turnout for the meeting was an indication of the intensity of our passion regarding protecting our water resources. I hope you discovered during the meeting that those of us in Creston are always up to date regarding the operation of our wells and the level of our water.

I also hope that you quickly discovered that Creston residents are familiar with the general condition of the Paso Robles Groundwater Basin and are protective of Creston's unique position within the basin. Therefore, we are offended when Creston data are co-mingled with data from other areas.

Several individuals who asked questions at the meeting were not necessarily familiar with the difference between a GSA and a Planning Sub Area or the fine points of writing the GSP, but that doesn't matter. What they do know is that including data from El Pomar, an area with existing groundwater problems, is a fraud on Creston's data[1]. A radius originating near the intersection of El Pomar and South El Pomar covering roughly 4,000 acres or greater, which comprises several very large vineyard operations, identifies an area with issues not found in Creston.

Creston landowners have always been concerned that our water resources could be used to alleviate problems in other areas of the Paso Basin such as Estrella; however, the co-mingling of Creston and El Pomar data has raised new fears among many Creston landowners that the El Pomar area may actually be the target. If you want people to trust your representations you must think in terms of "how will my audience actually

[1] With regard to the issue of data in general, all data that are referenced in your documents should be footnoted as to the sources of data and where and when published. When you have adjusted data that fact should also be noted along with the purpose and method of adjustment. When data are unreferenced or adjusted without explanation that calls into question the correctness and reliability of your work product.

Derrik Williams Letter, page 2

interpret what I am presenting or saying"?

Before the meeting in Creston, I posted on your groundwater communications portal, comments making the case that the Creston area should be designated a separate Planning Sub Area, a copy of which is enclosed. Clearly, the existing outline of the El Pomar-Estrella Sub Area identified in Figure 3-14 of Chapter 3 is what apparently made it convenient to co-mingle Creston data with El Pomar data. Creston is unique and deserves to be a separate Planning Sub Area.

Last Monday you discussed the need for more monitoring wells. In discussing that topic and related issues with some of my colleagues we have developed specific general thoughts based on the following thesis:

Given the size, the variety of topography, and the geological complexity, the Paso Robles Groundwater Basin presents a wide range of localized issues best managed by several localized Planning/Management areas in order to provide long term reliability to the Paso Robles Basin GSP, therefor:

- Rather than only a few Planning/Management areas a larger number of smaller separate areas should be created each sharing common conditions and issues.
- Ideally, each area would have 5 to 10 monitoring wells depending on the size of the area and specific conditions.
- With several smaller Planning/Management areas throughout the basin comparisons of progress or failure of specific policies, practices or tactics between areas could be easily compared and modified to achieve improved area results on a forward basis, thus contributing to improved basin wide results.
- Conversely, measuring the performance results of very large geographic areas is much more problematic in terms of understanding the actual causes of either over or under performance.

On a related matter I am sure that you are aware of subsidence of nearly two inches in the Shandon, Red Hills areas documented in the 1997 USGS report. However, the issue has not been addressed in subsequent reports, etc. My colleague Dennis Loucks and I believe that the matter deserves critical examination as do other areas of the basin with known significant lowering of water levels that may be prone to subsidence.

Since land subsidence is a sustainability indicator requiring examination under SGMA, it is recommended that the USGS report be updated to determine if land subsidence has been curtailed or if subsidence has continued to occur. The historical data that could be obtained by USGS would indicate areas in the basin that are in need of additional management. I strongly suggest that the Cooperative Committee be asked to make a formal written request to USGS to update their 1997 report. An updated report would be a vital management tool, and since it would be completed by another government entity presumably there should be no cost.

Another matter which concerns several of us is the potential for water banking schemes by very large landowners with high production wells located in strategic areas of the basin. There appear to be several candidates for this activity who would profit from their groundwater resources. A related activity is the sale of paper water allowing a purchaser to exceed their pumping limits in their physical location in exchange for the seller reducing pumping in an equal amount. I am acquainted with many landowners who are vehemently opposed to water banking, which the GSP should prohibit.

A related matter, which is prevalent in our basin, is the fact that the general lowering of groundwater has created void areas above the groundwater level as it may fluctuate season to season. Access to this "space" is attractive to entities wanting to engage in water banking activities. Something that you should present at your next workshops is data on how much of this space exists and how the basin can be protected from water banking activities utilizing this space.

Lastly, my colleagues and I request that you reconsider the management of your Groundwater Communications Portal. We learned on Monday that comments posted on the portal would be reviewed by staff and directed to appropriate GSP representatives. Moreover, the comments would not be available for public review until the plan is at the completion stage, several months hence. If what we understand is in fact accurate, this would be detrimental to the creation of the plan as it would be difficult to revisit chapters that were believed to have been completed. The process as outlined will be frustrating for the public as well as having a limiting influence on basin citizen comment and presumably a burdensome process for your staff. One can only conclude that the process has been designed to intentionally limit public interference with your development of the GSP. The GSP process is, after all, intended to be conducted with significant citizen input not a process principally influenced by large landowners with major water resources under their control.

Derrik Williams Letter, page 4

In reality Your process effectively excludes several thousand landowners reliant on wells who essentially have no responsibility for the current condition of the Paso Robles Groundwater Basin. When thinking about how you should change the Portal process you should review the events surrounding the rejection of the AB2453 mandatory water district, which was overwhelming rejected by basin voters in March 2016. Don't tell me that landowners don't understand basin water issues just because they don't flock to Cooperative Committee meetings. They understand very clearly the nature of the interests who want to control our basin water.

I look forward to hearing from you.

Sincerely,

Attachment: GCP Posting of October 6, 2018

Cc: Supervisor Debbie Arnold
Supervisor John Peschong

GSP Chapter 3 Comments
By
Fred C. Hoey
A Creston resident

Posted to the Paso Robles Groundwater Communications Portal

In reference to Chapter 3, Figure 3-14 North County Planning Subareas: I object to the El Pomar-Estrella-Sub Area as defined. Interestingly, this Sub Area is startlingly similar to the boundaries of the "area of influence" of the Estrella-El Pomar-Creston Water District as defined by SLO-LAFCO. I expect this harmony is deliberate.

The Creston area is distinctly different from both the El Pomar and Estrella areas; accordingly, actions that are appropriate and necessary for the El Pomar and Estrella areas will not be appropriate for Creston. For instance within the Estrella area a significant "cone of depression" has been created by the egregious groundwater pumping by the City of Paso Robles, which has been compounded by the local concentration of large vineyard operations.

Many Creston landowners have long been concerned that Creston groundwater would ultimately be utilized to remedy the damage that has been done to the Estrella groundwater levels.

By combining three geographic areas, each with their own unique issues, into a Planning Subarea the authors of Chapter 3 wrongly assumed that the citizens of Creston would not rise up in strong opposition to such blatant, potential piracy of our water resources to cover the sins of the City of Paso Robles through the exploitation of the Estrella area.

I strongly urge that the Creston area be identified as a separate Planning Subarea, a view shared by all of my Creston friends and connections.

October 6, 2018

Rainfall to Groundwater.net
Verna Jigour, PhD.
V•Jigour LLC
[redacted]

October 15, 2018

**Attn. Paso Robles Subbasin Cooperative Committee**

**Subject: GSP Process Comments: Addendum to comments on Chapters 1-3**

Dear Cooperative Committee Leaders,

I congratulate the Cooperative Committee on its exemplary, timely progress toward the Groundwater Sustainability Plan (GSP). Based on what I've been able to glean about the progress of other GSAs around the state, Paso Robles Subbasin appears to be at the forefront of groundwater sustainability planning.

Given my "outsider's" perspective, I attribute that to the combination of leadership by the County of San Luis Obispo, including its skilled planners, sound consultants and the apparent engagement of GSA stakeholders. Most of all, the elegance and efficiency of the cooperative, collaborative approach seems exemplified by the progress y'all have made. So, again, Congratulations!

Further congratulations are offered for your inviting public, including "outsider" interface such as mine via your Paso Robles Groundwater Communication Portal, through which I've been able to catch up some on your efforts to date.

The following offers more general and overall comments on your GSP in progress as background and support for my comments on the draft GSP chapters.

## Longtime Academic/Professional Concern with Paso Robles Subbasin

Labeling myself "outsider" is partly tongue-in-cheek. In truth, while I've not lived in San Luis Obispo County, its expansive rangelands have been "on my radar" for two decades. Throughout that time, I've viewed these lands more in the context of upper Salinas River watershed/ catchment.

Around the turn of the millennium, as part of my doctoral program I initiated and secured funding for the Ventana/ Central Coast Wildlands Project, which offered a Geographic Information System (GIS) analysis of habitat connectivity needs for a suite of focal wildlife species spanning the Central West California Ecoregion.

Veering a bit from related projects in California at that time, I selected steelhead as my own focal species and developed, with technical and even some volunteer assistance, a GIS database of historical steelhead streams and their watersheds, extending from San Francisco Bay southward to San Diego County, since my California Department of Fish and Game source data extended through that greater region.

During the second phase of project funding I relinquished project management to a colleague and the project's final report (Thorne and colleagues 2002) included only overall maps of the distribution of steelhead by population status, along with limited description of the database.

The results of analyses I conducted using the steelhead database during the first phase were relegated to my doctoral dissertation, which was approved by my doctoral committee in July 2008 [Jigour 2008 (2011) abstract attached]. The interval between the GIS analyses and committee approval mostly represents the time I spent conducting and documenting an extensive interdisciplinary literature review supporting the importance of woody plant cover to the detention (infiltration and percolation) functions of watersheds/ catchments.

Among the most striking results of my analyses was the massive expanse of **nonnative annual grasslands** in the watersheds of historical steelhead rivers and streams whose runoff is not controlled by large dams, nowhere better exemplified than in the upper Salinas River watershed/ catchment, a.k.a. region of Paso Robles Subbasin.

Note that this applies to much of the inland Monterey County watersheds/ catchments of Salinas River, as well, but especially with many rangelands "hidden" behind the foothills from the agricultural floodplain, the opportunities there are even farther out of sight and mind to Salinas Valley GSAs.

I must emphasize the ***nonnative*** part of that ecological description, which is absolutely the case, contrary to what the current GSP Chapter 3 suggests. That nonnative description is a clue to the fact that these nonnative annual rangelands represent anthropogenically degraded watersheds/ catchments. Thus, History, and even Prehistory of Land Use is an appropriate topic to at least summarily address in Chapter 3.

The fairly recent history of removal of oaks for use in the local charcoal industry is another clue that should be spatially analyzed, as only local sources may best do. My vision is that students could be supported by GSA scholarships in fleshing out such pertinent information as part of their academic programs.

The charcoal industry history should be compared with other historical land use trends, such as the state sanctioned/ funded mid-20th century efforts to remove oaks and other woody plants in the name of "rangeland improvement" summarized, with citations, in my blog post #6. Ball and Chain & Other Links

In recent decades landscape and restoration ecologists have increasingly recognized the influences on historic and current land cover/vegetation by intentional land management practices of indigenous Californians. While it may be impossible in most cases to document exactly how the landscape would look without the recently recognized indigenous land management skills, some inferences based on that awareness may be useful in establishing vegetative goals and processes to restore watershed/ catchment functions.

Thus, consideration of **all anthropogenic impacts (including prehistoric)** to the function of existing and prospective restored watersheds/ catchments is entirely germane to the GSP. For an overview, please see my blog post #4. Think Outside the Basin.

While my initial focus was on improving the function of the Salinas River and other Central West Ecoregion watersheds for steelhead – especially augmenting baseflow – it has always been clear that augmenting baseflow necessarily benefits regional groundwater stocks, since baseflow essentially reflects its net status.

Moreover, detention storage offered in watershed/ catchment vadose zones – "the soil profile as a natural reservoir" (Hursh and Fletcher 1942), as well as in the bedrock aquifers that provide longer-term storage but eventually drain to the alluvial aquifers GSAs are directly concerned with, offers the most cost-effective form of short and longer-term storage because: 1.) no hard infrastructure involved, 2.) reduced complexity of permitting ecological restoration projects, and 3.) over time, restored sites will become relatively self-sustaining, so much lest costly to maintain than engineered structures.

## 2018 Outreach to Paso Robles GSA Points of Contact

While this is my first input on the draft GSP in progress. I have sent email alerts for each of my seven blog posts to date, beginning January 2018, to the specific points of contact for each of the GSAs in the Paso Robles Subbasin. In mid-April I mailed hard copy letters to a couple of you. But to date I don't believe any of your contacts have taken time to explore the Rainfall to Groundwater web site to learn about these opportunities that you won't see proposed/ defined elsewhere.

To date Rainfall to Groundwater is the only proposed approach to groundwater recharge that does not involve diversion of surface waters. Please see Surface

Water Diversions vs Baseflow Augmentation. Furthermore, Paso Robles Subbasin watersheds/ catchments are the prototypical model of expansive opportunities within a single (greater) watershed/ catchment. So I do hope these comments may finally get your attention.

## Water Budget Model & Process

These comments pertain to the July 25, 2018 Project Status Update, Water Budget Status. The third page upper exhibit depicting, "Use Model(s) to Develop Water Budgets" indicates that the sole input to "Watershed Model" is "Daily Streamflow".

I assume that "daily streamflow' would be based on one or more stream gages, but draft chapter 3.6.3 and Figure 3-12: Surface Water Gauging and Precipitation Stations suggest few existing gauges relative to the expanses of associated watershed/ catchment area.

Certainly more gauges are welcome, but my critique here is that daily streamflow ***does not*** represent all contributions from the watershed/ catchment. It fails to account for subsurface detention in the vadose zone as well as in bedrock aquifers, and fails to acknowledge drainage, a.k.a. interflow into the alluvial basins of concern from upstream bedrock aquifers and vadose zones. As noted in the second page exhibit, the water budget must include accounting of all inflows. Since we're taking groundwater in the first place, it should be clear that not all groundwater arose from surface flows. So how can "daily streamflow" be the ***sole*** **input** to "Watershed Model"?

Nevertheless, your team is far from alone. That surface water bias is among the current prevailing paradigms that blinds practitioners, including DWR, to the opportunities for Rainfall to Groundwater. Please see Stream Networks vs Watersheds/ Catchments.

## Recommended Links

I'm running out of time and out of steam so I'll just point you to a few more links from my website and hope you'll try surfing a bit from those. California Case offers an overview. Also recommended for orientation are Surface-Groundwater Systems in a Holistic Water Cycle and Plants in an Ecohydrology Context, both of which emphasize the vadose zone – watershed/ catchment interface between surface and groundwater.

I posted an Executive Summary in May but plan to post an updated/ refined version within the next week. I'll be emailing an alert for a new blog post to the GSA points of contact (and anyone new who may sign up for my newsletter) soon.

I do hope my comments have opened your collective minds to new opportunities for the Paso Robles Subbasin GSP.

Sincerely,

Verna Jigour, PhD

## Citations

Hursh, C. R. and P. W. Fletcher. 1942. The soil profile as a natural reservoir. Proceedings Soil Science Society of America 7:480-486. http://cwt33.ecology.uga.edu/publications/801.pdf

Jigour, V. M. 2008 (2011). Watershed restoration for baseflow augmentation. Dissertation. Interdisciplinary Studies: Arts & Sciences: Conservation Ecology. Union Institute & University.

Thorne, J., D. Cameron, and V. Jigour. 2002. A guide to wildlands conservation in the central coast region of California. California Wilderness Coalition, Davis, California, USA.

To: Committee Members, Paso Robles Groundwater Sustainability Plan
From: Dennis R Loucks, Fred Hoey and Greg Grewal
Date: October 17,2018

**Re: Groundwater Sustainability Plan, Chapter 5, Subsidence.**

Dear Committee Members,

Our group is concerned that the consultant, Montgomery & Associates, is not adequately addressing the subsidence that has occurred in the Paso Robles Groundwater Basin.

We have reviewed the dismissive statements in the PowerPoint presentation and the incomplete statements made in Chapter 5.4 Subsidence. As you know, Subsidence is a key requirement in the Sustainability Plan and it cannot be cavalierly dismissed, as it has been to date.

Please take the time to review our research and reasons why this key SGMA requirement must be considered carefully.

**Background:**

Several weeks ago, we discovered a USGS report (open file report 00-447), Titled: **Use of InSAR to Identify Land-Surface Displacements Caused by Aquifer-System Compaction in the Paso Robles Area, San Luis Obispo County, California, March to August 1997**

The report authored by D.W. Valentine, Densmore, Galloway and Amelung was completed in 2001 and can be found on the USGS web site. The report, nine pages in length, discusses the methodology, results, areas of study, and provides a summary and conclusion. There are also four maps/images. We encourage the Committee Members to review this report and to compare with the findings of the Consultant.

**Our summary of USGS report:**

The report stated that in the Paso Robles area, about 3 miles northeast of Paso Robles there was downward land-surface displacement of .06 inches, northwest of Paso Robles, .08 inches downward displacement, and 2.1 inches in the southern signature area encompassing approx..75-squre-miles (Figure 4, USGS)

Subsidence was also located in other areas of the County:

**Atascadero Area:**

"The phase signature shows about 1 to 2 inches of downward ground displacement, which coincides with the seasonal water-level declines between spring and fall 1997 of about 54 feet (figure 4)"

**Paso Robles Groundwater Basin:**

"In the Shandon and Red Hills areas, as much as 2 inches of displacement was identified, which is apparently related to pumping for agricultural use." Other areas outside of our basin were also identified, Morro Bay, Arroyo Grande/Pismo Beach/Nipomo, Santa Maria Valley area, and Point Sal areas.

After reading the USGS report, we were astonished that this had not been, to our knowledge, ever discussed in the numerous engineering studies completed in the past twenty years. We felt it was a vital element that required further investigation. Considering the report is 21 years old, and subsidence of 2 inches was documented in a sixth month period, what is the current condition of the basin 21 years later? Has it stabilized? or has it continued to subside? Our fear is that with the growth of agriculture and rural development it may be unwelcome information. Be it as it may, it is necessary, in fact a requirement, of SGMA that subsidence be addressed.

Therefore it was our recommendation that the USGS study be updated and that monitoring stations be established with regard to subsidence. In fact, we forwarded a letter to California Department of Water Resources requesting that subsidence monitors be required in Groundwater Sustainability Plans. A copy was forwarded to the Consultant, Montgomery & Assoc.

Please compare our brief summary of the USGS report to that of Montgomery & Assoc.:

**5.4 Subsidence**

**Land subsidence is the lowering of the land surface. While several human-induced and natural causes of subsidence exist, the only process applicable to the GSP is subsidence due to lowered groundwater elevations caused by groundwater pumping.**

**Direct measurements of subsidence have not been made in the Subbasin using extensometers or repeat benchmark calibration; however, interferometric synthetic aperture radar (InSAR) has been used in the area to remotely map subsidence. This technology uses radar images taken from satellites that are used to create maps of changes in land surface elevation. The studies done in the area show that a localized area three miles northeast of the City of Paso Robles had a downward displacement of .06 to 2.1 inches between Spring 1997 and Fall 1997 (Valentine, D.W. et al., 2001)**

5.4 Subsidence, The Consultant's summary doesn't mention other relevant areas in the referenced USGS report, such as 2.1 inches in an approx. 75 square mile area, and about 2 inches of displacement in the Shandon and Red Hills area, apparently related to pumping for agricultural use.

To further compound this issue, when the Consultant presents a PowerPoint that states in reference to Subsidence:

"No direct measurements"
"Some satellite data suggest small ground surface drops over"
" Not a significant concern"
" Subsidence: Not a significant problem"

We find the Consultant's comments dismissive and incomplete.

**Conclusions/Recommendations:**

Our group of concerned citizen's are not Engineer's or Hydrologists but we, as many other concerned citizens, recognize that the current condition of the basin must be determined in order to effectively manage the basin in the future for the benefit of all residents.

We firmly believe that evidence exists that would lead a reasonable person to conclude that subsidence in the basin has occurred. We feel it is now reasonable to determine if subsidence has stabilized or has continued, please consider updating the InSAR through the USGS and consider installing subsidence monitors.

Enclosures: USGS Open file report 00-447

Cc: Committee Members

**From:** Jennifer Caffee
**Sent:** Tuesday, October 16, 2018 3:41 PM
**To:** Angela Ruberto
**Subject:** Fw: [EXTERNAL]SGMA Chapter 5 Subsidence
**Attachments:** Committee letter subsidence.docx

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**From:** Dennis <[redacted]>
**Sent:** Monday, October 15, 2018 5:02 PM
**To:** john@johnpeschong.com Peschong; BOS_District 5_Web Contact
**Cc:** [redacted]
**Subject:** [EXTERNAL]SGMA Chapter 5 Subsidence

**ATTENTION:** This email originated from outside the County's network. Use caution when opening attachments or links.

Attached are our thoughts regarding the subsidence chapter that will be presented tomorrow. Had difficulty scanning the USGS report. Please copy for the committee if possible.

Thank you,

Dennis Loucks

# Use of InSAR to Identify Land-Surface Displacements Caused by Aquifer-System Compaction in the Paso Robles Area, San Luis Obispo County, California, March to August 1997

By David W. Valentine[1], Jill N. Densmore[2], Devin L. Galloway[2], and Falk Amelung[3].

Open-File Report 00-447
Version 1.0
2001

U.S. Department of the Interior
Gail A. Norton, Secretary
U.S. Geological Survey
Charles G. Groat, Director

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey (USGS) editorial standards or with the North American Stratigraphic Code. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

[1]Davidson Library, Map and Imagery Laboratory, UCSB, Santa Barbara, CA 93106
[2]Placer Hall, 6000 J Street, Sacramento, CA 95819-6129
[3]HIGP/SOEST, University of Hawaii, 2525 Correa Rd., Honolulu, HI 96822

## Introduction

During the 1990's, the population of San Luis Obispo County has grown steadily, and some land use has been converted from dry farming and grazing to irrigated vineyards and urban areas. Because surface-water supplies are insufficient to meet the growing demand for water, ground-water pumpage has increased and the resulting water-level declines have raised concern that this water resource may become overstressed. To address this concern many questions need to be answered. One particular concern is whether the larger ground-water basins within the county function as large individual basins or whether subsurface structures divide these large basins into smaller subbasins, as differences in ground-water-level data suggest. In 1999, the San Luis Obispo County Flood Control and Water Conservation District entered into a cooperative agreement with the U.S. Geological Survey to test the validity of using Interferometric Synthetic Aperture Radar (InSAR) as a tool to aid in locating subsurface structures in ground-water basins by determining seasonal and historical land-surface changes. Spaceborne InSAR has been used to identify displacements of the land surface caused by aquifer-system compaction in other ground-water basins, such as the basins in Antelope Valley, California (Galloway and others, 1998); Santa Clara Valley, California (Ikehara and others, 1998); and in the Las Vegas area of Nevada (Amelung and others, 1999). Spatially detailed InSAR imagery of these basins show that InSAR can reveal sub-centimeter vertical land-surface displacements. Owing to the high spatial detail of InSAR imagery, the InSAR-derived displacement maps can be used with ground-water-level data to reveal differential aquifer-system compaction related to the presence of geological structures or the distribution of compressible sediments that may define subbasin boundaries. Many faults have already been identified in San Luis Obispo County, but identifying additional faults or other hydrologic barriers hidden in the subsurface is important to understanding ground-water flow. InSAR displacement maps of the Paso Robles area of San Luis Obispo County were compared with maps of seasonal changes in ground-water levels to detect the presence of aquifer-system compaction. Other areas of potential aquifer-system compaction within the county also were identified but are not discussed in detail here.

Location and Description of Study Area The area of the study includes most of San Luis Obispo County, California, which is located about 160 miles northeast of Los Angeles, California (Figure 1). The climate of the area is characterized by dry summers and relatively wet winters with most of the 13 inches of mean annual precipitation occurring during the winter (Paso Robles Information Services, www page, Internet URL <http://www.pasorobleschamber.com/facts/index.htm>). The primary focus of this study is a 400-square-mile area near Paso Robles, which includes part of the Paso Robles subunit of the Salinas ground-water basin (Figure 1). This area has been proposed for a more intense study and would benefit from better definition of the extent and continuity of the ground-water basin.

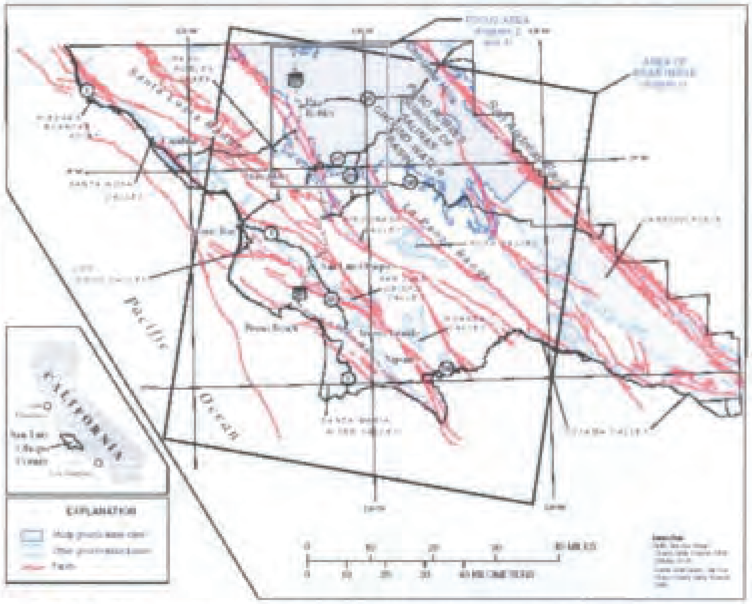


Figure 1. Map of focus area, ground-water basins, physical and cultural features of San Luis Obispo County and area of InSAR coverage.

The Paso Robles subunit is bounded by the Cholame Hills on the northeast, the Santa Lucia Range on the southwest and west, and the La Panza Range on the south. The main water-bearing units in the Paso Robles subunit are Quaternary younger and older alluvium and Quaternary and

Tertiary continental sediments of the Paso Robles Formation (Figure 2). The younger and older alluvium consists of poorly sorted, unconsolidated gravel, sand, and silt. The Paso Robles Formation consists of unconsolidated to poorly consolidated coarse sand and gravel, as well as finer sand, silt, and clay and some limestone that formed from deposition in floodplains and small lakes. The water-bearing units are underlain by non-water-bearing Tertiary and Cretaceous bedrock and granite. Mapped faults crossing the basin include the San Marcos, Rinconada, and La Panza faults (Campion and others, 1983).


Figure 2. Generalized geologic map of the Paso Robles area with water-surface elevation contours for spring 1997.

## Methodology

### InSAR

InSAR is a means for remotely mapping land-surface displacements. Paired, synthetic-aperture radar (SAR) images taken from earth-orbiting satellites are used to create an interference image or interferogram. The interferogram shows the change in the radar line-of-sight distance, or range, between land surface and the radar antenna between the paired images. The interferogram can be viewed as a spatially detailed displacement map with 1,600-6,400 square meter pixels generally attainable. For a particular pixel, a resolution of range displacement is on the order of hundredths of an inch (millimeters). In coherent radar echoes, the phase is exactly proportional to the measured time delay and effective path length of the signal. The path differences of two signals can be determined by observing the phase differences or signature of the echoes. This phase signature is represented graphically by a color fringe. Range displacements are identified from coherent phase signatures between the two radar scenes on the interferogram. For C-band radar of the European Remote Sensing (ERS) platforms, the maximum detectable phase shift is one-half the wavelength of the radar microwave, which represents 1.1 inches (28 millimeters) of range displacement. Larger range displacements are calculated by identifying multiple coherent phase signatures from color fringes on the image; 1.1 inches (28 millimeters) of range displacement for each color fringe plus some fraction of 1.1 inches (28 millimeters) for a partial color fringe. Thus, the interferogram represents a displacement map of phase signatures in the range of 0-1.1 inches (0-28 millimeters), but range displacements exceeding 1.1 inches (28 millimeters) can be calculated by counting color fringes on the imagery. Because the line-of-sight of the ERS satellites are reclined 23 degrees from vertical at the center of the radar image, an equivalent vertical displacement represented by one color fringe on an interferogram would be slightly larger than the range displacement, about 1.2 inches (30.5 millimeters).

The resulting map of phase signatures can be related to several factors; displacement of the land surface, topographic effects, and changes in the travel time of the radar signal owing to tropospheric delays. Topographic effects were removed using a 1-day tandem interferogram (Zebker and others, 1994b) processed from SAR scenes imaged on succeeding days. Subtraction of the tandem interferogram from the original interferogram results in the "change" interferogram that contains range displacements from ground displacements plus any tropospheric delays.

For this study, raw SAR images made by European Remote Sensing satellites ERS-1 and ERS-2 were used. Five-month, 7-month, 15-month, and 20-month interferograms were created using techniques described by Zebker and others (1994a), Peltzer and Rosen (1995), Peltzer and others (1996), and Galloway and others (1998). Each of the four interferograms (3861 square miles or 10,000 square kilometers) was examined for coherent phase signatures. Only the 5-month interferogram (Figures 3 and 4) from March 28 to August 15, 1997, showed coherent phase signatures that warranted further examination. Topographic effects were removed using a 1-day tandem interferogram processed from SAR scenes imaged on December 29 and 30, 1995. The lack of coherent phase signatures in the 7-, 15-, and 20-month interferograms is due to atmospheric effects on the radar signal or temporal decorrelation of the interferograms. Areas where it was not possible to correct for tandem effects are excluded from the differential interferograms, and instead, the gray-scale image of the radar amplitude is shown.

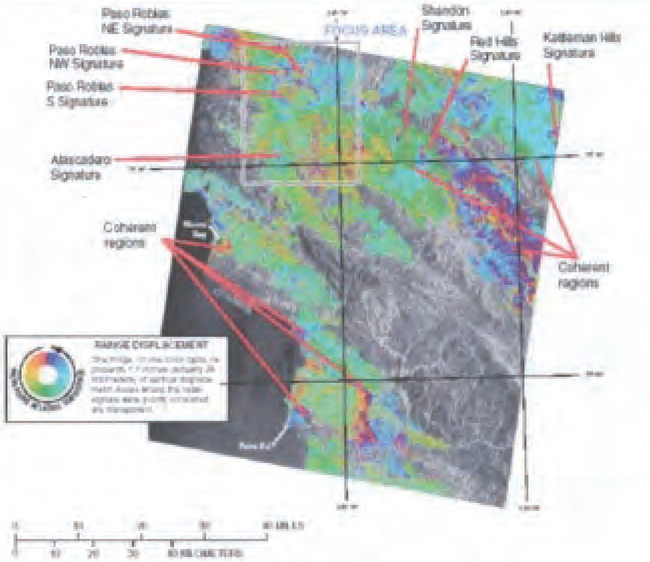


Figure 3. InSAR imagery of full scene covering most of San Luis Obispo County with focus area outlined (area outlined on figure 1).

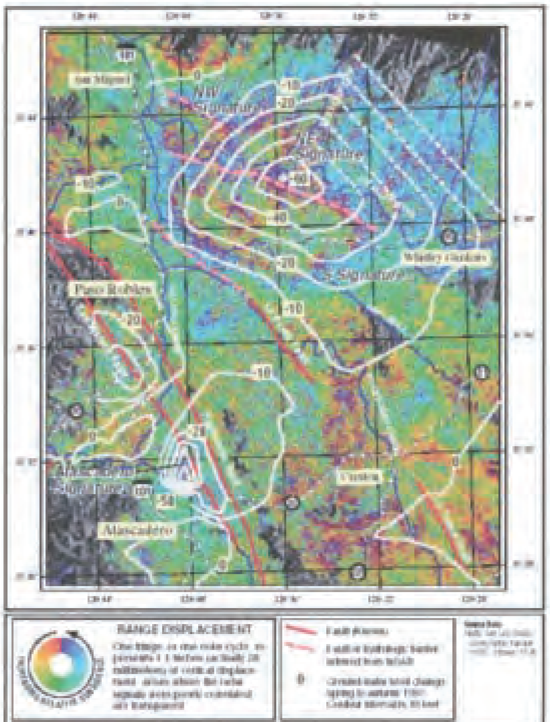


Figure 4. InSAR image of the Paso Robles area and seasonal ground-water level change for spring to autumn 1997.

Ground-Water Levels Water-level data for 58 wells for both the spring and fall of 1997 in 40 public land survey sections were obtained from San Luis Obispo County Flood Control and Water Conservation District (unpublished data, 1999). Although the state well number was provided for the wells, the exact well locations are not known. Therefore, all wells in a section were assigned an approximate position that corresponds with the center of the section, and thus well locations may be off by as much as 0.7 mile. Because the data are sparse, a triangular-irregular mesh was used to construct the contour maps of spring 1997 water-surface elevations (Figure 2) and the seasonal ground-water level change (Figure 4). The seasonal ground-water level change was calculated by subtracting fall 1997 water levels from spring 1997 water levels.

## Results

The interferogram for March 28-August 15, 1997, shows four phase signatures in two separate locations within the area of primary focus for this study (Figure 4). Three of these signatures are located northeast of Paso Robles and the other is northeast of Atascadero (Figure 4). Other coherent phase signals, outside of the area of primary focus, are also apparent on this interferogram.

## Paso Robles

The interferogram shows three phase signatures about 3 miles northeast of Paso Robles (Figure 4). These three phase signatures lie along the trend of an unmapped syncline with the thicknesses of Paso Robles formation sediments exceeding 4,000 feet (Dibblee, USGS, oral commun., 1999). The southern signature shows a relative change of about two phase signatures (2.1 inches or 56 millimeters) of increasing range distance (downward land-surface displacement) in an approximately 75-square-mile area. The maximum downward displacement in the northwest signature is about 0.8 inches (20 millimeters) and the northeast signature is 0.6 inches (about 14 millimeters). The southern and northeastern phase signatures coincide with an area of seasonal water-level decline of about 60 feet (Figure 4); downward displacement in these areas may be related to water-level declines. The northwestern phase signature also appears to coincide with a depression in the spring 1997 water-surface elevation (Figure 2). The southwestern boundary of the southern phase signature is subparallel to an extension of the La Panza Fault (Dibblee, 1974) and appears to be bounded by the fault. The northwestern and northeastern phase signatures do not appear to be related to any mapped geological structures, but their separation from the southern phase signature may suggest the presence of a ground-water boundary or barrier (Figure 4). The separation of the northeast and northwest phase signatures appear to coincide with the northeast trending ground-water contours (just north of Hog Canyon in Figure 2), which may indicate the presence of a ground-water boundary or barrier. It is also possible that the concentration of pumping in the areas of these three phase signatures and the subsequent water-level declines has caused localized ground-surface displacement and that these are not barriers or subbasin boundaries.

## Atascadero area

The interferogram (Figure 4) shows an areally small phase signature in the Atascadero area east of Highway 101 and the Salinas River. The eastern edge of the signature is bordered by the San Marcos and the Rinconada faults. The phase signature appears to be controlled, in part, by the ground-water barriers formed by the faults and by the geometry of the basins adjacent to the faults. The phase signature shows about 1 to 2 inches (28 to 56 millimeters) of downward ground displacement, which coincides with the seasonal water-level declines between spring and fall 1997 of about 54 feet (Figure 4).

## Other regions

In addition to the phase signatures identified in the area of primary focus, coherent regions also were identified in seven additional regions of the interferogram (Figure 3). In the Kettleman Hills area, as much as 4 inches (110 millimeters) of land-surface displacement was identified in two oil fields using InSAR (Fielding and others, 1998). This displacement probably is related to withdrawal of oil from the area and not to the withdrawal of ground water. In the Shandon and Red Hills areas, as much 2 inches (56 millimeters) of displacement was identified, which is apparently related to pumping for agricultural use. Coherent phase signals also were identified in the Morro Bay, Arroyo Grande/Pismo Beach/Nipomo, Santa Maria Valley area, and Point Sal areas.

## Summary And Conclusions

During the 1990's, the population of San Luis Obispo County has grown steadily and surface-water supplies have been insufficient to meet the growing demand for water. Ground-water pumpage has increased to meet this shortfall, resulting in seasonal water-level declines and concern that the water resources of the area may become overstressed. One particular concern is whether the larger ground-water basins within the county function as large individual basins or whether subsurface structures divide these large basins into smaller subbasins. Interferometric Synthetic Aperture Radar was tested for use as a tool to aid in locating subsurface structures in ground-water basins by determining land-surface changes. Owing to the high spatial detail of InSAR imagery, the InSAR-derived displacement maps can be used with ground-water-level data to reveal differential aquifer-system compaction related to the presence of geological structures or the distribution of compressible sediment that may define subbasins.

The area of this study includes most of San Luis Obispo County, California, which is located about 160 miles northwest of Los Angeles, California. The primary focus of this study is a 400-square-mile area near Paso Robles. This area was selected for more intense investigation because a ground-water study for the area has been proposed that would benefit from better definition of the extent and continuity of the ground-water basins. The main water-bearing units in the Paso Robles area are Quaternary younger and older alluvium and Quaternary/Tertiary continental sediments.

InSAR is a means of remotely mapping land-surface displacements using paired synthetic-aperture radar images taken from earth-orbiting satellites. These images are used to create an interferogram that shows the change in the range between the land surface and the radar antenna on the order of millimeters for the paired images. The differences between two signals can be determined by observing the phase signatures of the radar echoes. These differences are represented graphically by a color fringe, which represents about 1.1 inches (28 millimeters) of range displacement. For this study, raw SAR images taken on March 28 and August 15, 1997, were used to create an interferogram. Water levels from 58 wells with both spring and fall 1997 measurements were used to construct water-level contour map for spring of 1997 and a seasonal water-level-change map for spring to fall 1997.

The interferogram showed three phase signatures about 3 miles northeast of Paso Robles, which indicated ground-surface displacements of from 0.6 to 2.1 inches (14 to 58 millimeters); the southern and northeast phase signatures coincide with an area of water-level decline of over 60 feet. There appears to be a ground-water barrier between the southern signature and the northeast and northwest signatures and also between the northeast and northwest signatures. These may not be actual barriers but more related to concentrated ground-water pumpage in the area of these signatures. The interferogram also shows an areally small phase signature in the Atascadero area that is bounded on the east by previously mapped faults and coincides with an area of seasonal ground-water level change of about 54 feet. The ground deformation in this area is on the order of 1 to 2 inches. In addition to those phase signatures in the area of primary focus, seven additional coherent phase signals were identified in other areas covered by the interferogram; Kettleman Hills, Shandon, Red Hills, Morro Bay, Arroyo Grande/Pismo Beach/Nipomo, Santa Maria Valley area, and Point Sal.

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To view the PDF file, ofr00-447.pdf; 4 MB).

Green River
Mutual Water Company

[redacted]
www.greenrivermwc.com

California Water Rights Issues
January 2019

Under the California Constitution, water must be put to the reasonable and beneficial use of the citizens. No water rights grant any party the right to waste water or use more than is required for their reasonable and beneficial use. Waste by the holder of the water right can be curtailed or revoked.

No water user in the State of California "owns" any water. Instead a water right grants the holder only the right to access the water. Thus a landowner has the right to access the water beneath his property for his/her reasonable and beneficial use. The owner of all water in California is the State. The State is the trustee of the water for the benefit of the public. This is referred to as the Public Trust Doctrine. The benefits to the public that the State must consider are economic, recreational, aesthetic and environmental. If at any time the State determines that the current use does not benefit the public trust the State can reallocate the water. The Public Trust Doctrine therefore means no water rights in California are truly "vested" in the traditional sense of property rights. (A Primer On California Water Rights, Gary W. Sawyers, Esq.)

Unfortunately, there are groups which are manipulating the California Legislature in violation of the Public Trust Doctrine to transfer water allocations from groups such as mutual water companies to the water users who are then allowed to transfer water allocations over the objections of the mutual water companies.

The vast majority of all mutual water companies were organized to provide water to their members only. Green River Mutual Water Company is no exception. Stock of the Green River Mutual Water Company is held by the land owners within the Green River Mutual Water Company district and the shares are appurtenant to the land. However recent legislation is looking to take the private allocations of water of existing mutual water companies and require them to become quasi-public water companies with the ability of the recipients to transfer the water.

AB 240, passed by the California Legislature in 2014, requires existing and future mutual water companies in California to either amend or draft bylaws that allow the directors of the mutual water companies to sell water to others (state agencies, schools and other mutual water companies) at the expense of the members who either paid for the installation and maintenance of the water system or are going to pay for the installation and maintenance of a water system. For existing mutual water companies, AB 240 would appear to be an act of eminent domain without compensation to the members who own the wells, installed and maintain the systems. For newly formed mutual water companies, AB 240 appears to make the shareholders indorse, through their bylaws, the public access to their water.

It can be fairly said that AB 240 is a very clever legislative scheme to force private mutual water companies in California to allow the users to be able to transfer water allocations to others through subtle changes to the California Corporations Code. Some of the more onerous provisions are as follows:

1. The first requirement of AB 240 is for all mutual water companies to amend their articles and by laws incorporating the provisions of AB 240 pursuant to the Corporations Code sections 14300 et. seq.;
2. Once the bylaws and articles are amended, then the water companies are required to record certified copies of articles and bylaws with County Recorder, (Corp. Code Section 14300);
3. Once the provisions of AB 240 are accepted and incorporated in the articles and bylaws the directors may sell water to the state, any department or agency of the state, any school district, to any public agency or to any other mutual water company and, during emergencies, to the County for fire protections. Thus if the directors decide to sell water to another water company that is selling water to Los Angeles or some other public entity, the shareholders could not stop the directors from doing so even if the amount of water sold exceeds the capacity of the current system (Corp. Code 14300);
4. After amending the Corporation articles and bylaws to comply with AB 240, the Corporation is then required to submit a map to LAFCO showing the approximate boundaries of the area the water company serves. This triggers reporting to and oversight by LAFCO (Corp. Code 14301.1 (a));
5. Once the Corporation has registered with LAFCO the Corporation is then required to respond to all requests for information from LAFCO concerning the operation of the water system (Corp. Code 14301.1 (b));
6. Once AB 240 is adopted into the bylaws, the mutual water company must maintain a financial reserve fund for repairs and replacement to its water production, transmission and distribution facilities at a level sufficient for continuous operation in compliance with the federal Safe Drinking Act and the California Safe Drinking Water Act. This is over the top. Current corporate reserves for Green River Mutual Water Company are sufficient for repairs only and would require additional dues from the members to comply with the replacement requirement (Corp. Code 14301.3);

AB 240, under the guise of the Public Trust Doctrine, and through pressure from lobbying groups lobbying for individuals and large wealthy trusts are attempting to drive legislation aimed at granting water user's rights to transfer water allocations over the objections of the water suppliers. In other words, doing the very thing the California Constitution was designed to prevent; turning water into personal property that can be bought and sold for profit.

Green River
Mutual Water Company

[redacted]

www.greenrivermwc.com

# Water By-the Numbers

Sometimes it's a little easier to understand something if you break in down into a simpler form. The following is as simple as it gets.

The average person uses 80 - 100 gallons of water per day, which works out to 2,400 - 3,000 gallons per month. Whitley Gardens has 110 households with an average of 4 people per household. With 440 people using 100 gallons per day it works out to 44,000 gallons per day and 1,320,000 gallons of water per month. If you extend that out for a year, that number becomes 15,840,000 gallons. This number does not include livestock or agriculture.

The average vineyard, using a drip irrigation system uses 20 gallons per acre per minute. For 188 acres this works out to 3,760 gallons per hour. The average vineyard watering cycle is an 8 hour cycle, or 1,804,800 gallons of water per cycle/per day. That's 484,800 gallons more than Whitley Gardens uses in a month.

Let's take another step.

A 500hp pump with an 11inch line, pumps 800gpm. Pumping for 1 hour generates 48,000 gallons. Therefore, over an 8 hour period it pumps 384,000 gallons!

So the average vineyard watering cycle uses 1,804,800 gallons and it waters once a week. That works out to 7,219,200 gallons for a 4 week period. Take it a step further to an 8 month period of time (32 weeks) and it works out to 57,753,600 gallons. Twice a week works out to 115,507,200 gallons. New vines and hot weather would easily require more irrigation. To pump this much water would require 2,406 hours or 300 eight(8) hour days of operation.

Just a reminder, Whitley Gardens uses 15,840,000 per year. The vineyard uses just under 100,000,000 gallons more!

Let's go a step further and we'll call it the "what if" scenario.

What if the pump ran 12 hours a day 5 days a week 3,120 hours a year which equals 149,760,000 gallons of water. That's a lot of water, but that's not the end. This is only 1 well and one pipe. What are the numbers when you have 3 pumps? Yes, 3 wells, 3 - 500hp pumps! Those 3 wells total 1500hp, pumping 2400 gallons per minute, 144,000 gallons per hour and for an 8 hour day 1,152,000 gallons.

This begs the question, why do you need this kind of capacity? Where's the water going?

Whitley Gardens also has 3 wells serving its community. We use a 30hp pump on each well for a grand total of 90hp — 1410hp less than the vineyard!

*Respectfully,*

*Steve Pitts*
*Board Member*
*Green River Mutual Water Company*

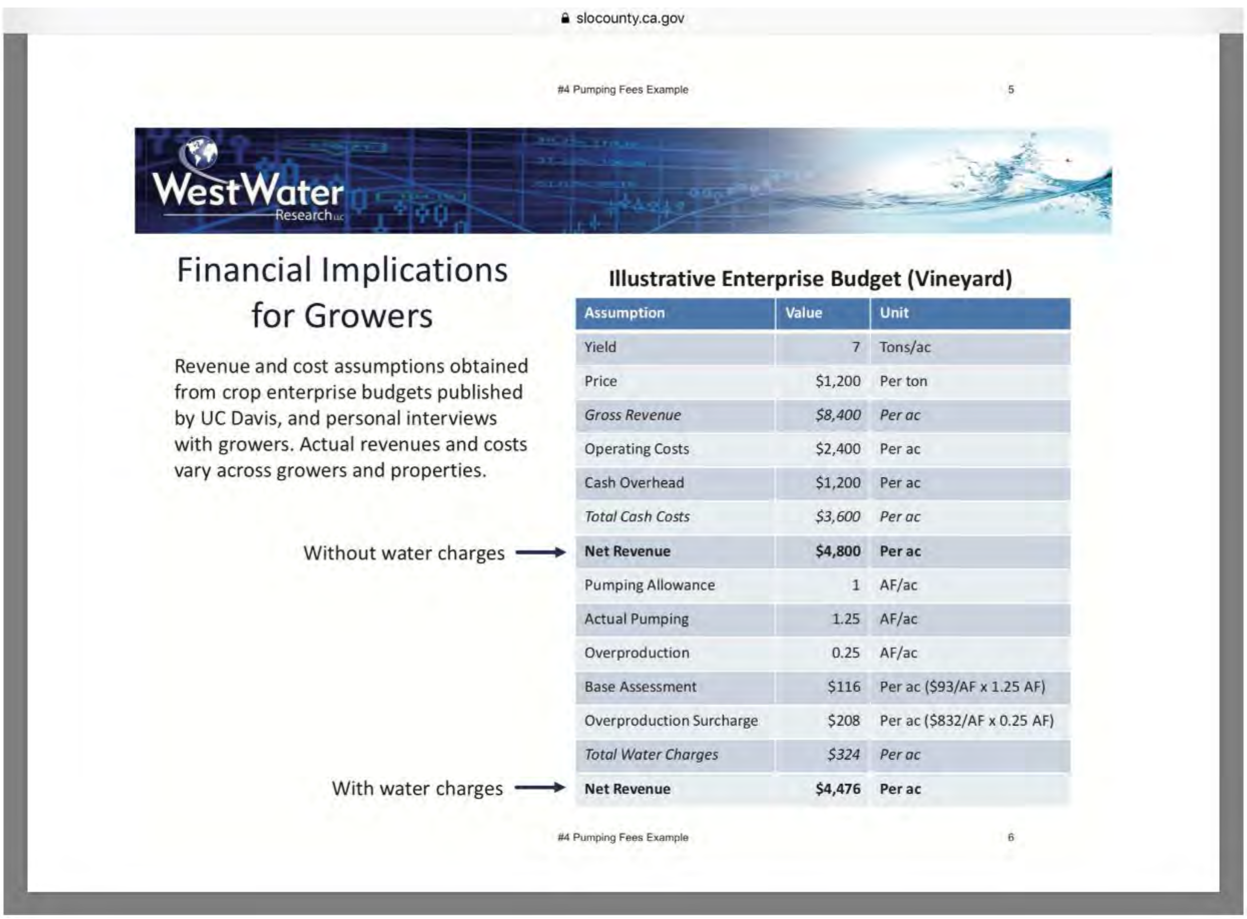
## Angela Ruberto

**From:** Dana Merrill <DMerrill@mesavineyard.com>
**Sent:** Tuesday, February 26, 2019 7:07 PM
**To:** Angela Ruberto
**Subject:** [EXT]Screenshot 2019-02-26 at 7.00.35 PM
**Attachments:** Image-1.jpg; ATT00001.txt

ATTENTION: This email originated from outside the County's network. Use caution when opening attachments or links.

This cost example has some flaws. 7 tons per acre is at least 2 tons per acre high. On the cost side, we are now spending closer to $4,500 per acre direct cost, plus the long term debt, taxes and equipment. The net revenue after adding the penalty is closer to zero and no way will a grower still net $4,800 per acre.

Who provided these numbers? Why not talk to some of us who own and manage, including budgeting and accounting, for the operations? Some higher grossing vineyards can pay more but the example overstates the average revenue potential of vineyards in the Paso Basin.




| Assumption | Value | Unit |
|---|---|---|
| Yield | 7 | Tons/ac |
| Price | $1,200 | Per ton |
| *Gross Revenue* | *$8,400* | *Per ac* |
| Operating Costs | $2,400 | Per ac |
| Cash Overhead | $1,200 | Per ac |
| *Total Cash Costs* | *$3,600* | *Per ac* |
| **Net Revenue** | **$4,800** | **Per ac** |
| Pumping Allowance | 1 | AF/ac |
| Actual Pumping | 1.25 | AF/ac |
| Overproduction | 0.25 | AF/ac |
| Base Assessment | $116 | Per ac ($93/AF x 1.25 AF) |
| Overproduction Surcharge | $208 | Per ac ($832/AF x 0.25 AF) |
| *Total Water Charges* | *$324* | *Per ac* |
| **Net Revenue** | **$4,476** | **Per ac** |

## Angela Ruberto

**From:** Dana Merrill <DMerrill@mesavineyard.com>
**Sent:** Monday, February 25, 2019 10:51 PM
**To:** Angela Ruberto
**Subject:** [EXT]Comments on projects etc

ATTENTION: This email originated from outside the County's network. Use caution when opening attachments or links.

Angela,

My comments in brief are:

1. Better detailed data is needed before selecting specific projects by area. Shandon and Creston (depending on where Creston extends) seem to have stable water levels vs the Red Zone. So recharge or supplemental water needs to be likely worth the cost to areas in better shape. Or prove taking there does help the Red Zone.
2. Many small users is Jardine, Squirrel Hollow, etc may need regional systems which could be a few deep Wells or supplemental water. Domestic and AG May have different solutions. Antiquated subdivisions have special challenges that require solutions different than commercial Agriculture. Those are a failure of good Planning which didn't exist when the lots created. Government should now help resolve but wells and septic systems on 1 acre parcels not sound planning. Same as Los Osos faced only worse.
3. More spending on dedicated monitoring has been promised for years but never built. Do that first to be sure the solutions will work.

4. Prioritize getting the County Naci share, where the County Paso Basin was left out, into the Basin. Get the city Paso Robles to take its full allotment which would lessen the salt level of its effluent. More purple pipe water could then go to vineyards . Basin landowners could subsidize the lake water treatment plant expansion cost for the city.
5.there should be an alternative to take State water before treatment at Polonio Pass. Maybe pipe to Estrella River then pump out by Whitley Gardens. Save pipeline costs perhaps. More water at lower cost is available although more pipeline is needed.
6. Get representative monitoring well system going and build projects as results of monitoring dictates. Figure out where our projects should be concentrated.
7. Get Irrigated Land Ordinance renewed for 5 years for stability. Expiring is not going to be good in 2020. County has a system and while it's not perfect it's a start we have experience with.
8 An Economic Study needs to be included to know whether Ramp Down or Supplemental water is best. A Ramp Down is not possible as we have few annual irrigated crops, the economic multiplier factor in reverse will devastate the local economy based on the wine and tourist industry. Winegrapes use so little water we have no lower use crop alternatives.
9. Get the Paso Basin on a priority list for State Water, otherwise urban uses will grab it and its gone. Buy a base amount the add annual purchases on high rainfall years at lower prices for recharge. Continue to rely on wells but support groundwater levels with supplemental water.
10. Adopt a Monterey County mandatory reporting system based on meters for Ag Wells 5 inch or larger. Exempt true non commercial de minimous users. They should contribute a minimal fixed admin fee to the system. Commercial Ag pay based on usage to incentivize efficiency. Group by zones as Monterey does.
11. Get more sophisticated data. Water levels have dropped most in the Red Zone but the Basin is deepest there. So many Wells still produce well. If we were to simply concentrate on the Red Zone and have the whole basin pay, would that be logical or fair? Do we know? If not, find out before proposing projects that likely can't pass a 218 election for funding anyway.
12. Our first 5 years post GSP submission need a vast improvement in data. Measure changes is water levels across the basin so we all have confidence in the data. And know the Economic impacts on us all, farmers, retired folks, city

residents. That should help with buy in. Other than the Purple Pipe city of Paso project and getting on the State Water reservation list we are not ready for projects or drastic Ramping Down. Those two projects might be all we need.

I may have further comments but wanted to get these in. Thanks for the opportunity.

Dana Merrill
Paso Robles, CA

Sent from my iPad

LIMONEIRA®
SINCE 1893

## Limoneira's Water Strategy

"When the well is dry, we know the worth of water," Ben Franklin advised. He could have been talking about the 21st Century. Today it should come as no surprise to anyone that, whether land is under active farming or being readied for urban development, the availability and cost of water are crucial to business plans and economic success.

Over the past decade, the availability of and the potential for rising costs of water that is largely supplied by public districts is believed to be a threat both to agriculture and to future urban development. At Limoneira, we have long understood that land with water is worth considerably more than land without it.

Water is often called a public resource, but it is also subject to private ownership, which comes with a responsibility of stewardship. Our land use practices are efficient, and our water use history is long and exemplary. We take our stewardship responsibility seriously and fully understand that our use of an important public natural resource is not only the essence of a public private partnership, but it is also our legacy.

Through our land position, historic water use, sustainable land use practices and by making investments in infrastructure, Limoneira has developed long-term, firm and reliable rights to water sufficient to meet any of our land use objectives. The fair market value of the Company should increase as the investment community begins to appreciate the linkage between Limoneira's water position and its long-term business objectives.

The value of water has escalated at rates greater than 6.5 percent per annum since at least the mid-1960s. There is no expectation that these historic increases, which are translated into higher costs for many companies, will be curtailed. In the face of forecasted increased water supply scarcity and cost, what distinguishes Limoneira from our competitors is our ability to directly and indirectly monetize the value of our water position through enhanced competitiveness positioning and profitability.

We expect to capitalize on our position with each of the following opportunities:

- Less expensive water supply costs. Imported water for the Bay-Delta and the Colorado River is becoming increasingly expensive. Regardless of whether there is an engineering solution to present infrastructure problems, there are no guarantees that quantities will be restored to earlier delivery levels or that environmental issues will be resolved. In any event, all imported water supply costs are expected to rise dramatically over the next several decades. By way of contrast, Limoneira holds rights

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to local groundwater and surface water for which development costs have largely been previously paid.

- High reliability of water (no shortages). Imported supplies are subject to ongoing environmental and regulatory challenges. There is no scenario where these risks can be eliminated. On the other hand, Limoneira has actively maintained sustainable land use practices that can be amply supplied from the company's existing sources of supply.

- Long-term water to support transitional land uses (ag to urban). Land development in the West requires the demonstration of a long-term reliable water supply, sufficient to meet the water supply needs of the land for a minimum of twenty years. Land without water rights and water supplies will struggle to satisfy this legal/planning requirement. Limoneira's historical water position will fulfill even the most stringent of tests for water, thereby ensuring that new development will not be constrained by the absence of water supply.

- Local water transfers. Water transfers and exchanges can create a free market short, interim and long-term return on the redistribution of water. Limoneira has the good fortune of possessing access to a variety of surface water and groundwater supplies that can be traded for compensation in those years where the water is not required for Limoneira's operations. The company's opportunity for success in carrying out water transfers will be enhanced by conditions of increased scarcity. Moreover, our ability to transfer water is inherently more feasible than in other parts of California because they would be local and, in many cases, conducted consistent with over-arching regulatory plans.

Water infrastructure agreements. It's one thing to have access to water rights. It's another thing to get the water from where it originates to where it is needed. Limoneira enjoys rights to water related infrastructure that will allow it to integrate its water supplies and to move water from its point of origin to its highest value use.

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LIMONEIRA
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October 1, 2018

Via Email

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805.259.4095
dwilliams@elmontgomery.com

Re: Paso Robles Basin GSP

Dear Derrik:

It was a pleasure to meet you at the groundwater sustainability planning meeting at Windfall Farms on September 19, 2018. As I briefly mentioned at the end of the meeting, Windfall Farms is willing to offer wells on our property for monitoring by the Cooperative Committee. Several of the wells are not in use, and thus, may be well situated to monitor static water levels in the basin. Please contact Lee Nesbitt, our general manager (805-239-0711; LNesbitt@limoneira.com), to coordinate this monitoring.

On a broader note, I appreciated your informative presentation of the options for managing groundwater resources in the basin. You asked for our opinion concerning where water levels should be maintained in the area. We wish to see water levels maintained close to current conditions. We could tolerate slightly lower levels if this is necessary to effectuate a gradual transition to sustainable groundwater management, but appreciate that production will need to be limited to achieve sustainable management consistent with SGMA's mandates. We do not anticipate that water levels will be materially raised in the near term and expect that the costs of achieving such result would be prohibitive. Additionally, we would certainly support the County looking at ways to import water utilizing available underground storage.

We look forward to further cooperation with you and the rest of the Cooperative Committee in developing an effective GSP for the basin.

Sincerely,

Alex M. Teague
Senior Vice President/COO
Limoneira Company

cc: Lee Nesbitt, Windfall Farms
Russell McGlothlin, Brownstein Hyatt Farber Schreck, LLP
Debbie Arnold, 5th District Supervisor

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Edits **(P. 3)**

## 8.1 Definitions

 **Minimum thresholds** refer to numeric values for each sustainability indicator used to define undesirable results.
*Minimum thresholds are indicators of where an unreasonable condition might occur. For example, current groundwater elevations might be a minimum threshold if lower groundwater elevations would result in significant and unreasonable costs.*

## 8.2 Sustainability Goal

## (P. 5)

The projects and management actions are designed to achieve sustainability within 20 years by one or more of the following means:

- Tiered groundwater pumping fees to promote conservation and fund water supply projects. The tiered fees could be established to promote pumping within the sustainable yield. Pumping that exceeds the sustainable yield would be subject to the higher tiered fees that would fund projects the GSAs find to be cost effective solutions to sustainable management.
- Diligent adherence to Best Management Practices and increased awareness to achieve decreased groundwater use will be pursued.
- Pumping rates could be ramped down until the cumulative pumping rate is at or below the sustainable yield of the Subbasin. This would ensure that the future pumping is within the sustainable yield, which would prevent further lowering of groundwater levels.
- Expanded use of recycled water to offset groundwater pumping in the Subbasin will be pursued. This would contribute to reducing groundwater pumping below its current levels and prevent further lowering of groundwater levels.
- Long-term and short-term contracts for excess surface water from the Nacimiento Reservoir to offset groundwater pumping in the Subbasin would contribute to reducing groundwater pumping below its current levels and prevent further lowering of groundwater levels.
- Long-term and short-term contracts for State Water Project water from the Coastal Branch Aqueduct to offset groundwater pumping in the Subbasin would contribute to reducing groundwater pumping from its current levels and prevent further lowering of groundwater levels.
- Storm water infiltration projects would increase basin recharge.
- Increased reservoir storage behind the Salinas Dam could provide additional water for either direct or in-lieu recharge.

- Enhanced best management practices for crop irrigation could minimize water loss from irrigation systems and agricultural reservoirs.

# 8.4 Chronic Lowering of Groundwater Levels Sustainable Management Criteria (p. 6)

## 8.4.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were determined based on hydrogeologic data and understanding, GSA input, the Sustainable Management Criteria survey, public meetings, and discussions with GSA staff. Significant and unreasonable groundwater levels in the Subbasin are those that:

- Cause significant financial burden to those who rely on the groundwater resource
  - Increased pumping costs due to greater lift
  - Shallow domestic wells going dry
  - Cost for deeper installation or construction of new wells
- Require reductions in groundwater extraction creating directly proportional reductions in the area economy
- Significantly interfere with other sustainability indicators

## 8.4.2 Minimum Thresholds (P. 7)

Section §354.28(c)(1) of the SGMA regulations states that "*The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results.*"

### 8.4.2.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

The information used for establishing the chronic lowering of groundwater levels minimum thresholds include:

- Information about public definitions of significant and unreasonable conditions and desired groundwater elevations, gathered from the SMC survey and public outreach meetings.
- Feedback about significant and unreasonable conditions gathered during public meetings.
- Historical groundwater elevation data from wells monitored by the County of San Luis Obispo
- Depths and locations of existing wells
- Maps of current and historical groundwater elevation data

Initial minimum thresholds and measurable objectives were established using the process described below.

**(P. 9)**

Based on hydrogeologic data and understanding of the Basin, the survey and public outreach results, historical groundwater elevations from monitoring wells that represented desired conditions were identified. These desired conditions were used to establish the initial measurable objectives and reasonable minimum thresholds in the Subbasin.

**Paso Robles Formation Aquifer**. Initial minimum thresholds were set using 2017 groundwater elevations. The thresholds were also based on current and historic groundwater elevations from monitoring wells along with depth of existing wells and of the aquifer in each area of the Basin represented by each specific monitoring well. 2017 standing groundwater levels have been selected as measureable objectives and minimum thresholds are set below those levels and sufficiently above the bottom of adjacent wells to protect groundwater extraction. Groundwater trends are analyzed and relative rates of decline of autumn standing groundwater levels over the last five years are projected to 2025 as an initial elevation for the minimum threshold. This allows at least a five year period for the Agency to begin GSP implementation. The numeric groundwater level selected at each monitoring site to represent the minimum threshold beyond which undesirable results may occur are adjusted to reflect the specific conditions at each monitoring site and the adjacent portion of the Basin the monitoring site is selected to reflect. Protecting a sustainable groundwater supply for existing wells was a guiding consideration. Minimum thresholds were selected to allow

#### 8.4.2.7 Effects on Beneficial Users and Land Uses (p. 16 + 17)

The groundwater elevation minimum thresholds may have several effects on beneficial users and land uses in the Subbasin.

**Agricultural land uses and users.** The groundwater elevation minimum thresholds limit lowering of groundwater levels in the Subbasin. In the absence of other effective measures this has the effect of potentially limiting the amount of groundwater pumping in the Subbasin. Limiting the amount of groundwater pumping will limit the amount and type of crops that can be grown in the Subbasin, which could result in a proportional reduction in the economic viability of some properties. The groundwater elevation minimum thresholds could therefore limit expansion of the Subbasin's agricultural economy. This could have various effects on beneficial users and land uses:

### 8.4 Chronic Lowering of Groundwater Levels Sustainable Management Criteria

## 8.4.4 Undesirable Results (P 24)

#### 8.4.4.1 Criteria for Defining Undesirable Results

The chronic lowering of groundwater elevation undesirable result is a quantitative combinations of groundwater elevation minimum threshold exceedances. For the Paso Robles Subbasin, the groundwater elevation undesirable result is:
*Over the course of two years, no more than two exceedances for the groundwater elevation minimum thresholds within a 5-mile radius or within a defined management area of the Basin for any single aquifer. If a single monitoring well is in exceedance for two consecutive years also represents an undesirable result for the area of the Basin represented by the monitoring well. Geographically*

*isolated exceedances will require investigation to determine if local or Basin wide actions are required in response.*

Undesirable results provide flexibility in defining sustainability. Increasing the number of allowed minimum threshold exceedances provides more flexibility, but may lead to significant and unreasonable conditions for a number of beneficial users. Reducing the number of allowed minimum threshold exceedances ensures strict adherence to minimum thresholds, but reduces flexibility due to unanticipated hydrogeologic conditions. The undesirable result was set to balance the interests of beneficial users with the practical aspects of groundwater management under uncertainty.
As the monitoring system grows, the number of exceedances allowed may be adjusted. One additional exceedance will be allowed for approximately every seven new monitoring wells. This was considered a reasonable number of exceedances given the hydrogeologic uncertainty of the basin. Close monitoring of groundwater data over the following years will allow actual numbers to be refined based on observable data. Management of the Basin will adapt to specific conditions and to a growing understanding of basin conditions and processes to adopt appropriate responses.

## 8.5 Reduction in Groundwater Storage Sustainable Management Criteria

### (p. 26)8.5.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions were assessed based on the Sustainable Management Criteria survey, public meetings, available data, and discussions with GSA staff. Significant and unreasonable changes in groundwater storage in the Subbasin are those that:

- Lead to long-term reduction in groundwater storage
- Interfere with other sustainability indicators

Responses to the Sustainable Management Criteria survey and public input suggest that most areas of the basin would like to see more groundwater in storage to help with droughts, and some areas of the basin would like to see significantly more groundwater in storage. Public input on which concessions would be acceptable to increase the amount of groundwater in storage revealed two highly ranked concessions:

1. New pumping be offset with new recharge or reduced pumping
2. Pumping be reduced in dry years

However, the concession that agricultural pumping be reduced in all years ranked relatively low. This suggests that, while stakeholders would prefer more groundwater in storage, they also would not prefer to reduce existing agricultural pumping during average years. Stakeholders also prefer that groundwater storage be increased by retaining wet year flows for local recharge and/or importing water.

### 8.5.2 Minimum Thresholds (p. 26)

Section §354.28(c)(2) of the SGMA regulations states that "*The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin* *without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.*"

The reduction of groundwater in storage minimum threshold is established for the Subbasin as a whole, not for individual aquifers. Therefore, one minimum threshold for groundwater in storage is established for the entire Subbasin, but any reduction in storage that would cause an undesirable result in only a limited portion of the basin shall be addressed in that area or areas where declining well levels indicate actions or projects will be effective..

In accordance with the SGMA regulation cited above, the minimum threshold metric is a volume of pumping per year, or an annual pumping rate. Conceptually, the total volume of groundwater that can be pumped annually from the Subbasin without leading to undesirable results is equal to the estimated sustainable yield of the Subbasin. As discussed in Chapter 6, absent the addition of supplemental water, the future estimated long-term sustainable yield of the Subbasin under reasonable climate change assumptions is 61,100 AFY. This estimated sustainable yield will change in the future as additional data become available.

This GSP adopts changes in groundwater elevation as a proxy for the change in groundwater storage metric. As allowed in § 354.36(b)(1) of the SGMA regulations, groundwater elevation data at the RMSs will be reported annually as a proxy to track changes in the amount of groundwater in storage.

The minimum threshold for change in groundwater storage is *the minimum threshold for chronic lowering of groundwater levels minimum threshold*. Based on well-established hydrogeologic principles, stable groundwater elevations held above this minimum threshold represent no change in groundwater storage . Therefore, the minimum threshold using groundwater elevations as a proxy is that the long term groundwater elevation averaged across all the wells in the groundwater level monitoring network will remain above the minimum threshold for chronic lowering of groundwater levels minimum threshold.

Exceedances of this minimum threshold, if limited to specific areas of the Basin, shall be addressed by projects or management actions taken where they will effect those areas of exceedance. Multiple exceedances appearing across the Basin will require proportional Basin wide responses.

### 8.5.2.4 Effect on Beneficial Uses and Users (P. 28)

The reduction in groundwater storage minimum threshold of maintaining stable average groundwater elevations along with its proxy, will potentially require a reduction in the amount of groundwater pumping in the Subbasin. Reducing pumping may impact the beneficial uses and users of groundwater in the Subbasin.

edits for 8.8.2.1 subsidence – reasonable and justifiable (P. 42)

## 8.8.2 Minimum Thresholds for Land Subsidence Management Criteria

Section 354.28(c)(5) of the SGMA regulations states that "*The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results.*"

### 8.8.2.1 Information Used and Methodology for Establishing Subsidence Minimum Thresholds

The information used for establishing the land subsidence minimum thresholds included:
- Historical land surface elevation data from continuous GSP locations in the Subbasin
- Feedback about significant and unreasonable conditions gathered from GSA staff members and stakeholders

Land surface elevation is measured by the University NAVSTAR Consortium (UNAVCO) at five continuous global positioning system (GPS) sites in and around the Subbasin (Figure 7-5). Minimum thresholds for subsidence are set at these five locations. The basis for the subsidence minimum threshold is to protect against long term subsidence that would create significant undesirable results. The five GPS sites in the monitoring network have displayed multi-year land surface fluctuations that do not display a long-term decline in land elevation that indicate subsidence is occurring in the Subbasin. Since 2001 four of the five stations show ground surface elevations are trending upwards. The historical land surface fluctuations at these five sites demonstrate that a decline in land surface observed in one year may be compensated for by a similar rise in land surface the following year.
Discussions with GSA staff and the public indicated that, people were generally in agreement with the goal of no significant subsidence that would harm infrastructure.

**Rate of Subsidence.** Any rate of subsidence, if maintained over a long period of time, could lead to significant and unreasonable conditions. A rate of subsidence that would represent significant loss of groundwater storage or produce significant harm to infrastructure over the following twenty years would be unreasonable. An unacceptable rate of subsidence is one that exceeds half inch (0.041 foot) per year over any five year period. Annual land surface fluctuations are acceptable, they occur naturally and do not indicate long-term subsidence.

As shown on Figure 7-6, most of the continuous GPS surface elevation monitors show more years with an annual rise in land surface elevation than not. This rise is likely part of a longer-term trend, and does not appear to be related to seasonal elastic subsidence. The maximum measured rate of rise for each of the five continuous GPS sites is tabulated in Table 8-10.

**Extent of Subsidence.** An amount of subsidence sufficient to damage infrastructure in any portion of the Subbasin would be significant and unreasonable. Therefore, the same minimum threshold is set for all five of the existing continuous GPS sites.

The State has suggested that there will likely be assistance available in the future for periodic USGS Lidar surveys that give very exacting surface elevation maps that when compared over time could be used to track changes across the whole Basin Surface.

# Land Surface Elevation Monitoring Data

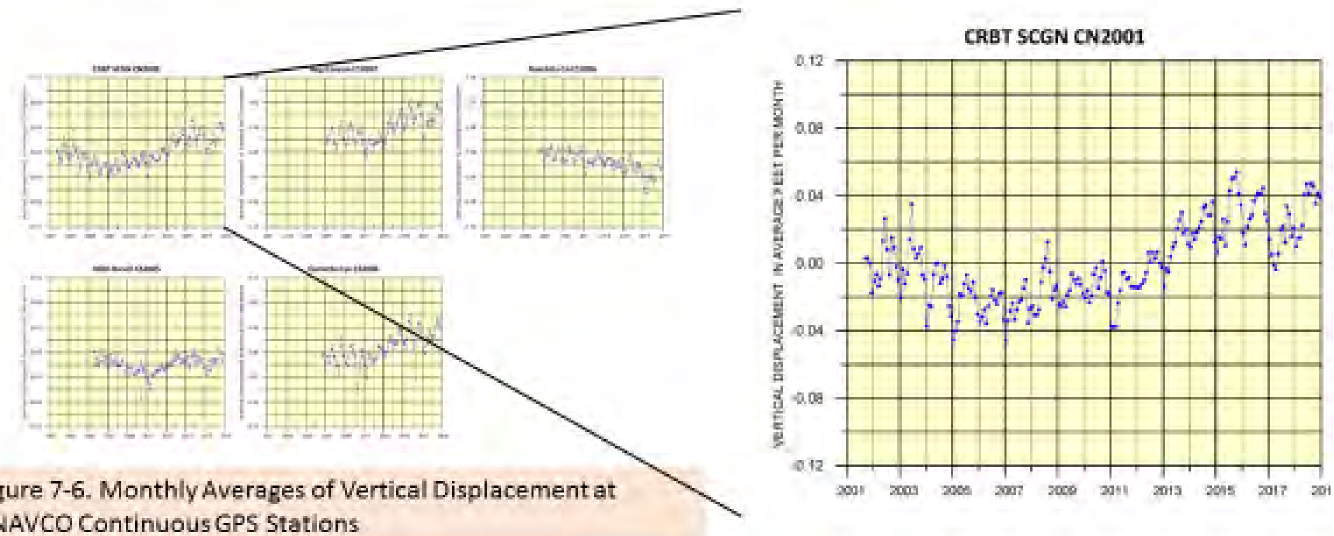


Figure 7-6. Monthly Averages of Vertical Displacement at UNAVCO Continuous GPS Stations

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15 April 2019

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*Submitted online via:* https://www.slocounty.ca.gov/Departments/Public-Works/Committees-Programs/Sustainable-Groundwater-Management-Act-(SGMA)/Paso-Robles-Groundwater-Basin/GSP-Development.aspx

Re: Chapters 4-8 and Appendix B of the Paso Robles Subbasin Draft GSP

Dear Angela Ruberto,

The Nature Conservancy (TNC) appreciates the opportunity to comment on Chapters 4-8 and Appendix B of the Paso Robles Subbasin Draft Groundwater Sustainability Plans (GSP) being prepared under the Sustainable Groundwater Management Act (SGMA).

*TNC as a Stakeholder Representative for the Environment*

TNC is a global, nonprofit organization dedicated to conserving the lands and waters on which all life depends. We seek to achieve our mission through science-based planning and implementation of conservation strategies. For decades, we have dedicated resources to establishing diverse partnerships and developing foundational science products for achieving positive outcomes for people and nature in California. TNC was part of a stakeholder group formed by the Water Foundation in early 2014 to develop recommendations for groundwater reform and actively worked to shape and pass SGMA.

Our reason for engaging is simple: California's freshwater biodiversity is highly imperiled. We have lost more than 90 percent of our native wetland and river habitats, leading to precipitous declines in native plants and the populations of animals that call these places home. These natural resources are intricately connected to California's economy providing direct benefits through industries such as fisheries, timber and hunting, as well as indirect benefits such as clean water supplies. SGMA must be successful for us to achieve a sustainable future, in which people and nature can thrive within the Paso Robles subbasin and California.

We believe that the success of SGMA depends on bringing the best available science to the table, engaging all stakeholders in robust dialog, providing strong incentives for beneficial outcomes and rigorous enforcement by the State of California.

Given our mission, we are particularly concerned about the inclusion of nature, as required, in GSPs. 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.

*Addressing Nature's Water Needs in GSPs*

SGMA requires that all beneficial uses and users, including environmental users of groundwater, be considered in the development and implementation of GSPs (Water Code § 10723.2).

The GSP Regulations include specific requirements to identify and consider groundwater dependent ecosystems (23 CCR §354.16(g)) when determining whether groundwater conditions are having potential effects on beneficial uses and users. GSAs must also assess whether sustainable management criteria may cause adverse impacts to beneficial uses, which include environmental uses, such as plants and animals. In addition, monitoring networks should be designed to detect potential adverse impacts to beneficial uses due to groundwater. 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 decision, and using data collected through monitoring to revise decisions in the future. Over time, GSPs should improve as data gaps are reduced and uncertainties addressed.

To help ensure that GSPs adequately address nature as required under SGMA, The Nature Conservancy has prepared a checklist (**Attachment A**) for GSAs and their consultants to use. The Nature Conservancy believes the following elements are foundational for 2020 GSP submittals. For detailed guidance on how to address the checklist items, please also see our publication, *GDEs under SGMA: Guidance for Preparing GSPs* (https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf).

**1. Environmental Representation**

SGMA requires that groundwater sustainability agencies (GSAs) consider the interests of all beneficial uses and users of groundwater. To meet this requirement, we recommend actively engaging environmental stakeholders by including environmental representation on the GSA board, technical advisory group, and/or working groups. This could include local staff from state and federal resource agencies, nonprofit organizations and other environmental interests. By engaging these stakeholders, GSAs will benefit from access to additional data and resources, as well as a more robust and inclusive GSP.

**2. Basin GDE and ISW Maps**

SGMA requires that groundwater dependent ecosystems (GDEs) and interconnected surface waters (ISWs) be identified in the GSP. We recommend using the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) provided online (https://gis.water.ca.gov/app/NCDatasetViewer/) by the Department of Water Resources (DWR) as a starting point for the GDE map. The NC Dataset was developed through a collaboration between DWR, the Department of Fish and Wildlife and TNC.

**3. Potential Effects on Environmental Beneficial Users**

SGMA requires that potential effects on GDEs and environmental surface water users be described when defining undesirable results. In addition to identifying GDEs in the basin, The Nature Conservancy recommends identifying beneficial users of surface water, which include environmental users. This is a critical step, as it is impossible to define "significant and unreasonable adverse impacts" without knowing *what* is being impacted. For your convenience, we've provided a list of freshwater species within the boundary of the Paso Robles basin in **Attachment C**. Our hope is that this information will help your GSA better evaluate the impacts of groundwater management on environmental beneficial users of surface water. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the freshwater species list. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs.

**4. Biological and Hydrological Monitoring**

If sufficient hydrological and biological data in and around GDEs is not available in time for the 2020/2022 plan, data gaps should be identified along with actions to reconcile the gaps in the monitoring network.

Our comments related to Chapters 4-8 of the Paso Robles Subbasin Draft GSP are provided in detail in **Attachment B,** and where applicable are in reference to the numbered items in **Attachment A. Attachment D** describes six best practices that GSAs and their consultants can apply when using local groundwater data to confirm a connection to groundwater for DWR's Natural Communities Commonly Associated with Groundwater Dataset (https://gis.water.ca.gov/app/NCDatasetViewer/).

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

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

# Attachment A
# Considering Nature under SGMA: A Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board. The checklist is available online: https://groundwaterresourcehub.org/public/uploads/pdfs/TNC_GDE_Checklist_for_SGMA_Sept2018.pdf

| GSP Plan Element* | | GDE Inclusion in GSPs: Identification and Consideration Elements | | Item Number |
|---|---|---|---|---|
| Admin Info | 2.1.5<br>Notice & Communication<br>*23 CCR §354.10* | Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP. | | 1. |
| Basin Setting | 2.2.2<br>Current & Historical Groundwater Conditions<br>*23 CCR §354.16* | Interconnected surface waters: | | 2. |
| | | Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal). | | 3. |
| | | Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type. | | 4. |
| | | Basin GDE map included (as figure in text & submitted as a shapefile on SGMA Portal). | | 5. |
| | | If NC Dataset *was* used: | Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0). | 6. |
| | | | The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed). | 7. |
| | | | GDEs polygons are consolidated into larger units and named for easier identification throughout GSP. | 8. |
| | | If NC Dataset *was not* used: | Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information. | 9. |
| | | Description of GDEs included: | | 10. |
| | | Historical and current groundwater conditions described in each GDE unit. | | 11. |
| | | Ecological condition described in each GDE unit. | | 12. |
| | | Each GDE unit has been characterized as having high, moderate, or low ecological value. | | 13. |
| | | Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0). | | 14. |

| | | | | |
|---|---|---|---|---|
| | 2.2.3 Water Budget *23 CCR §354.18* | Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget. | | 15. |
| | | Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget. | | 16. |
| Sustainable Management Criteria | 3.1 Sustainability Goal *23 CCR §354.24* | Environmental stakeholders/representatives were consulted. | | 17. |
| | | Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest. | | 18. |
| | | Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest. | | 19. |
| | 3.2 Measurable Objectives *23 CCR §354.30* | Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment. | | 20. |
| | 3.3 Minimum Thresholds *23 CCR §354.28* | Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators: | | 21. |
| | | Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds? | | 22. |
| | | Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters? | | 23. |
| | 3.4 Undesirable Results *23 CCR §354.26* | For GDEs, hydrological data are compiled and synthesized for each GDE unit: | | 24. |
| | | If hydrological data *are available* within/nearby the GDE | Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0). | 25. |
| | | | Baseline period in the hydrologic data is defined. | 26. |
| | | | GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater. | 27. |
| | | | Cause-and-effect relationships between groundwater changes and GDEs are explored. | 28. |
| | | If hydrological data *are not available* within/nearby the GDE | Data gaps/insufficiencies are described. | 29. |
| | | | Plans to reconcile data gaps in the monitoring network are stated. | 30. |
| | | For GDEs, biological data are compiled and synthesized for each GDE unit: | | 31. |
| | | Biological datasets are plotted and provided for each GDE unit. | | 32. |
| | | Data gaps/insufficiencies are described. | | 33. |
| | | Plans to reconcile data gaps in the monitoring network are stated. | | 34. |
| | | Description of potential effects on GDEs, land uses and property interests: | | 35. |

| | | | |
|---|---|---|---|
| | | Cause-and-effect relationships between GDE and groundwater conditions are described. | 36. |
| | | Impacts to GDEs that are considered to be "significant and unreasonable" are described. | 37. |
| | | Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for relevant species or ecological communities are reported. | 38. |
| | | Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating). | 39. |
| | | Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves. | 40. |
| Sustainable Management Criteria | 3.5 Monitoring Network *23 CCR §354.34* | Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit. | 41. |
| | | Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network. | 42. |
| | | Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions. | 43. |
| Projects & Mgmt Actions | 4.0. Projects & Mgmt Actions to Achieve Sustainability Goal *23 CCR §354.44* | Description of how GDEs will benefit from relevant project or management actions. | 44. |
| | | Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented. | 45. |

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

# Attachment B

## TNC Evaluation of Chapters 4 - 8 and Appendix B of the Paso Robles Subbasin GSP Draft

4.1 Subbasin Topography and Boundaries (p.3)

- [Paragraph 2] Please provide additional information on what data was used to determine that "poor quality" groundwater in the Paso Robles Formation would exclude groundwater from being part the subbasin.
- Defining the bottom of subbasin based on geochemical properties is a suitable approach for defining the base of freshwater, however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary.

4.7.2 Groundwater Discharge Areas Inside the Subbasin (p.31)

- [Paragraph 2] We support the use of the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) to map groundwater dependent ecosystems in the Paso Robles Groundwater Basin (GSP Draft Figure 4-18). Since the NC Dataset is intended as a starting point, The Nature Conservancy has developed a Guidance Document to assist GSAs and their consultants address GDEs in GSPs. Also refer to **Attachment D** for best practices when using the NC dataset.

- The identification of GDEs within GSPs is a required GSP element of the Basin Setting Section under the description of Current & Historical Groundwater Conditions (23 CCR §354.16). Recognizing natural points of discharge (seeps & springs) as GDEs is consistent with the SGMA definition of GDEs[1], however, we recommend **the identification of GDEs (GDE map Figure 4-18) for the Paso Robles basin be moved to Chapter 5: Groundwater Conditions and elaborated upon with a description of current and historical groundwater conditions in the GDE areas**. Chapter 5 is a more appropriate place for the identification of GDEs, since groundwater conditions (e.g., depth to groundwater, interconnected surface water maps, groundwater quality) are necessary local information and data from the GSP in assessing whether polygons in the NC dataset are connected to groundwater in a principal aquifer.
- Decisions to remove, keep, or add polygons from the NC dataset into a basin GDE map should be based on best available science in a manner that promotes transparency and accountability with stakeholders. Any polygons that are removed,

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

added, or kept should be inventoried in the submitted shapefile to DWR, and mapped in the plan. **We recommend revising Figure 4-18 to reflect this recommended methodology.**

5.2.1 Change in Groundwater Storage in the Alluvial Aquifer (p. 5-23)

- While it's true that there was no net change in groundwater storage in the Alluvial Aquifer between 1981 and 2011, groundwater storage losses certainly occurred during dry years and recovered in wet years. Potential impacts on groundwater storage loss due to groundwater is still very possible, especially since groundwater pumping data has been estimated from groundwater flow models populated with insufficient vertical groundwater gradient data, shallow monitoring data, and surface flow data. Groundwater storage in the Paso Robles formation has also be on a decline since 1980 due to groundwater pumping (Figure 5-15). Understanding groundwater storage fluctuations in the Alluvial Aquifer depends on how vertical groundwater gradients are impacted by pumping and groundwater storage changes in the Paso Robles Formation **Please address these data gaps in the monitoring network.**

5.5 Interconnected Surface waters (p. 5-27) - Environmental User Checklist (Attachment A) Items 2-4.

- **Please specify what data were used to determine the elevation of the stream or river bottom.**
- The regulations [23 CCR §351(o)] define interconnected surface waters (ISW) as "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". "At any point" has both a spatial and temporal component. Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. Thus, only considering ISWs as those where *simulated* groundwater elevations were above the stream or river bottom for at least half of the time between 2010 and 2016 does not meet the SGMA definition for the following reasons:
  1) groundwater elevations that are above the stream or river bottom only attempts to map gaining reaches, not losing reaches. ISWs can be either gaining and losing (see Figure 5-16). This is especially problematic in places where losing conditions existed, but the river bottom was used to compare groundwater elevations because stream elevation data was missing; however, in reality, the stream elevation was higher than the river bottom.
  2) looking for interconnections that last more than half of the time does not adequately take into consideration shorter interconnections between groundwater and surface water that occur "at any point" in time. This is especially true since the years between 2010 and 2016 were mostly drought years, which would reduce the number of interconnected surface water areas on Figure 5-17. As seen in section 5.2, significant losses in groundwater storage in both the alluvial and Paso Robles formations occur during drought years, thus potentially causing depletions of surface water (also quantified in Section 5.5.1).
  Due to limited shallow monitoring wells and stream gauges in the basin, **Mapping ISWs would be better estimated by first determining which reaches are**

**completely disconnected from groundwater. This approach would involve comparing simulated groundwater elevations with a land surface Digital Elevation Model that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. Groundwater elevations that are always deeper than 50 feet below the land surface can be identified as disconnected surface waters. Please also increase the simulated groundwater elevation time period to include 2017-2019 (which have relatively wetter conditions). Also, please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP to improve ISW mapping in future GSPs.**

<u>6. Water Budget (p.25) - Environmental User Checklist (Attachment A) Items 15-16:</u>

- **Please clarify what assumptions and data were used to calculate Riparian Evapotranspiration.**
- Why was evapotranspiration only calculated for riparian vegetation? In Chapter 3.4.2 of the Draft GSP, native vegetation was identified as the largest water use sector in the subbasin by land area. **Please estimate evapotranspiration for all native vegetation in the subbasin for the water budget.**

<u>7.2.1 Groundwater Level Monitoring Network Data Gaps (p.12) - Environmental User Checklist (Attachment A) Items 41-43:</u>

The last row of Table 7-2 states that "Data must be able to characterize conditions and monitor adverse impacts to beneficial uses and users identified within the basin". Aside from GDEs mapped in the basin (Figure 4-18), environmental surface water users have not been identified in the GSP thus far. SGMA requires that potential effects on GDEs and environmental surface water users be described when defining undesirable results. In addition to identifying GDEs in the basin, The Nature Conservancy recommends identifying beneficial users of surface water, which include environmental users. This is a critical step, as it is impossible to define "significant and unreasonable adverse impacts" without knowing *what* is being impacted, nor is possible to monitor ISWs in a way that can "identify adverse impacts on beneficial uses of surface water" [23 CCR §354.34(c)(6)(D)]. For your convenience, we've provided a list of freshwater species within the boundary of the Paso Robles basin in **Attachment C**. Our hope is that this information will help your GSA better evaluate and monitor the impacts of groundwater management on environmental beneficial users of surface water. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the freshwater species list, and how best to monitor them. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs. **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users as a current data gap, and make plans to reconcile these in Chapter 10 (Plan Implementation).**

<u>7.6 Interconnected Surface Water Monitoring Network (p.25) - Environmental User Checklist (Attachment A) Items 41-43:</u>

- The first sentence in this section is contradictory to the ISW mapping conducted in Chapter 5 - ISWs do exist in the Paso Robles Subbasin (Figure 5-17).
- Depletions of surface water were also estimated in Section 5.5.1, and the statement that "there is no need for a monitoring network that quantifies surface water depletion from ISW" is false and goes against SGMA requirements. SGMA requires that when monitoring depletions of interconnected surface water that "spatial and temporal exchanges between surface water and groundwater [...] are necessary to calculate depletions of surface water caused by groundwater extraction" [23CCR §354.34(c)(6)] and that the monitoring network "shall be designed to ensure adequate coverage of sustainability indicators" [23CCR § 354.34(d)]. Where minimum thresholds for ISWs are to be quantified by "The location, quantity, and timing of depletions of interconnected surface water" [23 CCR §354.28(c)(6)(A)]. **Thus, there is a need for a monitoring network that quantifies surface water depletion from interconnected surface waters.**
- In addition to the need for additional shallow monitoring wells in the Alluvial aquifer to map ISWs, **there is also a need to enhancing monitoring of stream flow and vertical groundwater gradients by installing more stream gauges and clustered/nested wells near streams, rivers or wetlands.** Ideally, co-locating stream gauges with clustered wells that can monitor groundwater levels in both the Alluvial and Paso Robles Formation aquifers would enhance understanding about where ISWs exist in the basin and whether pumping is causing depletions of surface water or impacts on beneficial users of surface water and groundwater.
- **There is a need to integrate biological indicators that can monitor adverse impacts to beneficial uses of surface water and groundwater within ISWs.**

<u>8.3 General Process for Establishing Sustainable Management Criteria - Environmental User Checklist (Attachment A) Items 17-40</u>

- Stakeholder involvement is crucial when establishing sustainable management criteria. The role of the GSA is to represent and balance the needs of *all groundwater* beneficial uses and users in the basin, which has been expressed in the Sustainability goal in Section 8.2. According to p.6, only rural residents, farmers, and local cities were surveyed to gather input on sustainable management criteria. **Please specify what information or efforts have been used/made to protect the interests of environmental users and disadvantaged community members.**
- SGMA requires that sustainable management criteria are consistent with other state, federal or local regulatory standards [23 CCR§354.28(b)(5)]. **Please describe what process was used to identify other regulatory standards that need consideration when establishing minimum thresholds for sustainability criteria.**

<u>8.4 Chronic Lowering of Groundwater Levels Sustainable Management Criteria</u>

- [8.4.1] The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, such that a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration. According to the

California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable". **Please modify the local definition for 'significant and unreasonable' (provided on p. 6), so that it also specifies potential effects on environmental beneficial users of groundwater in the basin, and addresses how water rights amongst beneficial users will be prioritized when establishing thresholds.**

- [8.4.2.1] The use of 2017 groundwater elevations to establish minimum thresholds for the Paso Robles Formation Aquifer is inadequate, since the SGMA benchmark date is January 1, 2015. Also, no scientific rationale was explained for using 2007 groundwater elevation data to establish initial minimum thresholds for the Alluvial Aquifer. SGMA is based on the use of best available science, and selecting minimum thresholds solely on public opinion from a select group of stakeholders (e.g., domestic well users, irrigators, municipalities) in the basin, is not a scientifically-based approach nor does it consider potential effects on environmental beneficial users of groundwater. A better approach is to use 10-year baseline period of groundwater elevation data (2005-2015) to establish how groundwater conditions during that time period affect different water users across the basin**. Please document the consideration of the following when establishing minimum thresholds for chronic lowering of groundwater levels:**
    - o Are groundwater elevations between 2005-2015 above the max screen depth for domestic, agriculture, municipal wells?
    - o Are the proposed minimum thresholds preserving water rights? [Water Code §10720.5(b)]
    - o Are the proposed minimum thresholds consistent with other state, federal or local regulatory standards? [23 CCR§354.28(b)(5)]
    - o Are there environmental beneficial groundwater users that need consideration, particularly those that are legally protected under the United States Endangered Species Act or California Endangered Species Act? (See **Attachment C** in the attached letter for a list of freshwater species located in the Paso Robles Subbasin).
    - o Is the equity being applied across different beneficial user groups (e.g., domestic, agriculture, municipal, environmental) when establishing minimum thresholds?
- [8.4.2.1] **Please provide a description for how the initial minimum threshold groundwater elevations for the Alluvial Aquifer (Figure 8-3) may impact environmental beneficial users of groundwater (e.g., GDEs) in the basin. When converting groundwater elevations to depth to groundwater contours, please use the USGS digital elevation model (see Attachment D in the letter).**
- [8.4.2.1] **Please make a back-up plan in the Monitoring network chapter on how the GSA will install shallow monitoring wells in the Alluvial Aquifer if confidentially agreements still prevent existing wells from being used as representative monitoring wells for the Chronic Lowering of Groundwater sustainability indicator.**
- [8.4.2.5] Depletions of interconnected surface waters do exist in the Paso Robles Subbasin (Figure 5-17). Depletions of surface water were also estimated in Section 5.5.1, and the statement that "there are no current minimum thresholds or undesirable

results "for interconnected surface water" is inadequate and goes against SGMA requirements. **Thus, there is a need to establish sustainable management criteria for interconnected surface waters in the basin. (See further comments in letter regarding Interconnected Surface Waters).**

- [8.4.2.7] The description of how the groundwater elevation minimum thresholds affect ecological land uses and users (Section 8.4.2.7 – p.17) is inadequate for the following reasons:
  - The draft GSP has failed to describe current and historical groundwater conditions with GDE areas. Thus, it is impossible to assess how the proposed minimum thresholds relate to historical groundwater conditions in the GDE and whether potential adverse effects could occur to the GDEs as a result of groundwater conditions.
  - Legally protected species located with GDEs have not been identified. Thus, it is impossible to evaluate whether federal, state, or local standards exist for groundwater elevations needed to protect these listed species (see Section 8.4.2.8).
- [8.4.3.1] Under SGMA, Measurable Objectives are to be established to achieve the sustainability goal of the basin within 20 years of Plan implementation [23 CCR § 354.30 (a)]. **Please modify the methodology for setting measurable objectives for groundwater levels (p.18-19) so that it helps attain the sustainability goal defined on p. 4 (Section 8.2):** "sustainably manage the groundwater resources of the Paso Robles Subbasin for <u>long-term community, financial, and environmental benefit of residents and business in the Subbasin</u>. This GSP outlines the approach to achieve a sustainable groundwater resource free of undesirable results within 20 years, while maintaining the unique cultural, community, and business aspects of the Subbasin. In adopting this GSP, it is the express goal of the GSAs to <u>balance the needs of all groundwater users in the Subbasin, within the sustainable limits of the Subbasin's resources</u>."
- [8.4.4.1] **Please elaborate how the 15% exceedance criteria balances the interests of environmental beneficial users in comparison with other groundwater users in the basin.**

<u>8.9 Depletion of Interconnected Surface Water Sustainable Management Criteria</u>

- [8.9.1] According to Chapter 5, interconnected surface waters exist in the Paso Robles Subbasin (Figure 5-17). Depletions of surface water were also estimated in Section 5.5.1. While there is certainly data gaps and a need for additional shallow monitoring wells in the Alluvial aquifer to map ISWs, there is also a need to enhancing monitoring of stream flow and vertical groundwater gradients by installing more stream. SGMA is based on best available science and adaptive management**, thus there should be an attempt to identify some minimum thresholds for ISWs,** which are to be quantified by "The location, quantity, and timing of depletions of interconnected surface water" [23 CCR §354.28(c)(6)(A)].
- [8.9.2] There is a need to evaluate potential effects on beneficial uses of surface and groundwater. **Please refer to Attachment C for a list of freshwater species in Paso Robles Subbasin that may be exist within ISWs. We recommend that after identifying which freshwater species exist in your basin, especially**

**federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the freshwater species list. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs.**

Appendix B: Methodology for Identifying Potential Groundwater Dependent Ecosystems - Environmental User Checklist (Attachment A) Items 5-14:

- For clarification, iGDEs are mapped polygons in DWR's NC dataset.
- Please specify what field verification methods (e.g., isotope analysis, enhanced shallow groundwater monitoring) will be used to definitively determine whether potential GDEs are true GDEs.
- It is highly advised that multiple depth to groundwater measurements are used to verify whether an iGDE (or NC dataset polygon) is connected to groundwater, so that fluctuations in the groundwater regime can be adequately represented. The analysis described on p.7 to create Figure B-3 only relies on Spring 2017 depth data, which is also after the Jan 1, 2015 SGMA benchmark date. Also, according to the shallow monitoring well data gaps described in Chapter 5 and 7, there is insufficient data to confidently remove data for NC polygons that are >5km away from a shallow well. See Attachment D of this letter for six best practices when using groundwater data to verify the NC dataset.
- The NC dataset needs to be groundtruthed with aerial photography to screen for changes in land use that many not be reflected in the NC dataset (e.g., recent development, cultivated agricultural land, obvious human-made features).
- Grouping multiple GDE polygons into larger units by location (proximity to each other) and principal aquifer will simplify the process of evaluating potential effects on GDE due to groundwater conditions under GSP Chapter 7: Sustainable Management Criteria.

- Groundwater conditions within GDEs should be briefly described within the portion of the Basin Setting Section where GDEs are being identified.
- Not all GDEs are created equal. Some GDEs may contain legally protected species or ecologically rich communities, whereas other GDEs may be highly degraded with little conservation value. Including a description of the types of species (protected status, native versus non-native), habitat, and environmental beneficial uses (Refer to **Attachment C** for a list of freshwater species found in the Paso Robles Subbasin and refer to Worksheet 2, p.74 of GDE Guidance Document) can be helpful in assigning an ecological value to the GDEs. Identifying an ecological value of each GDE can help prioritize limited resources when considering GDEs as well as prioritizing legally protected species or habitat that may need special consideration when setting sustainable management criteria.
- Decisions to remove, keep, or add polygons from the NC dataset into a basin GDE map should be based on best available science in a manner that promotes transparency and accountability with stakeholders. Any polygons that are removed, added, or kept should be inventoried in the submitted shapefile to DWR, and mapped in the plan. **We**

**recommend revising Figure 4-11, Appendix B, and including it in Chapter 5 to reflect this change.**

# Attachment C

## Freshwater Species Located in the Paso Robles 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 Paso Robles 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 Paso Robles groundwater 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[2]. 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[3] as well as on The Nature Conservancy's science website[4].

| Scientific Name | Common Name | Legally Protected Status | | |
|---|---|---|---|---|
| | | Federal | State | Other |
| **BIRD** | | | | |
| 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 americana | American Wigeon | | | |
| Anas clypeata | Northern Shoveler | | | |
| Anas crecca | Green-winged Teal | | | |
| Anas cyanoptera | Cinnamon 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 | | | |
| Aythya collaris | Ring-necked Duck | | | |
| Aythya valisineria | Canvasback | | Special | |
| Bucephala albeola | Bufflehead | | | |
| Bucephala clangula | Common Goldeneye | | | |
| Butorides virescens | Green Heron | | | |

[2] 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
[3] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[4] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

| | | | | |
|---|---|---|---|---|
| Calidris mauri | Western Sandpiper | | | |
| Chen caerulescens | Snow Goose | | | |
| Chen rossii | Ross's Goose | | | |
| Chroicocephalus philadelphia | Bonaparte's Gull | | | |
| Cistothorus palustris palustris | Marsh Wren | | | |
| Egretta thula | Snowy Egret | | | |
| Fulica americana | American Coot | | | |
| Gallinago delicata | Wilson's Snipe | | | |
| Gallinula chloropus | Common Moorhen | | | |
| Geothlypis trichas trichas | Common Yellowthroat | | | |
| Haliaeetus leucocephalus | Bald Eagle | Bird of Conservatio n Concern | Endangered | |
| Icteria virens | Yellow-breasted Chat | | Special Concern | BSSC - Third priority |
| Lophodytes cucullatus | Hooded Merganser | | | |
| Megaceryle alcyon | Belted Kingfisher | | | |
| Mergus merganser | Common Merganser | | | |
| Mergus serrator | Red-breasted Merganser | | | |
| Numenius americanus | Long-billed Curlew | | | |
| Nycticorax nycticorax | Black-crowned Night-Heron | | | |
| Oxyura jamaicensis | Ruddy Duck | | | |
| Pandion haliaetus | Osprey | | Watch list | |
| Pelecanus erythrorhynchos | American White Pelican | | Special Concern | BSSC - First priority |
| Phalacrocorax auritus | Double-crested Cormorant | | | |
| Podiceps nigricollis | Eared Grebe | | | |
| Podilymbus podiceps | Pied-billed Grebe | | | |
| Porzana carolina | Sora | | | |
| Rallus limicola | Virginia Rail | | | |
| Recurvirostra americana | American Avocet | | | |
| Riparia riparia | Bank Swallow | | Threatened | |
| Setophaga petechia | Yellow Warbler | | | BSSC - Second priority |
| Tachycineta bicolor | Tree Swallow | | | |
| Tringa melanoleuca | Greater Yellowlegs | | | |
| Tringa solitaria | Solitary Sandpiper | | | |
| Vireo bellii | Bell's Vireo | | | |
| Vireo bellii pusillus | Least Bell's Vireo | Endangered | Endangered | |

| | | | | |
|---|---|---|---|---|
| Xanthocephalus xanthocephalus | Yellow-headed Blackbird | | Special Concern | BSSC - Third priority |
| **CRUSTACEAN** | | | | |
| Branchinecta lynchi | Vernal Pool Fairy Shrimp | Threatened | Special | IUCN - Vulnerable |
| Cyprididae fam. | Cyprididae fam. | | | |
| Hyalella spp. | Hyalella spp. | | | |
| Pacifastacus spp. | Pacifastacus spp. | | | |
| **FISH** | | | | |
| Oncorhynchus mykiss - SCCC | South Central California coast steelhead | Threatened | Special Concern | Vulnerable - Moyle 2013 |
| Catostomus occidentalis mnioltiltus | Monterey sucker | | | Least Concern - Moyle 2013 |
| Catostomus occidentalis occidentalis | Sacramento sucker | | | Least Concern - Moyle 2013 |
| Cottus gulosus | Riffle sculpin | | Special | Near-Threatened - Moyle 2013 |
| Entosphenus tridentata ssp. 1 | Pacific lamprey | | Special | Near-Threatened - Moyle 2013 |
| Lavinia exilicauda exilicauda | Sacramento hitch | | Special | Near-Threatened - Moyle 2013 |
| Lavinia exilicauda harengeus | Monterey hitch | | Special | Vulnerable - Moyle 2013 |
| Oncorhynchus mykiss irideus | Coastal rainbow trout | | | Least Concern - Moyle 2013 |
| Orthodon microlepidotus | Sacramento blackfish | | | Least Concern - Moyle 2013 |
| Ptychocheilus grandis | Sacramento pikeminnow | | | Least Concern - Moyle 2013 |
| Oncorhynchus mykiss - SCCC | South Central California coast steelhead | Threatened | Special Concern | Vulnerable - Moyle 2013 |
| **HERP** | | | | |

| | | | | |
|---|---|---|---|---|
| Actinemys marmorata marmorata | Western Pond Turtle | | Special Concern | ARSSC |
| Ambystoma californiense californiense | California Tiger Salamander | Threatened | Threatened | ARSSC |
| Anaxyrus boreas boreas | Boreal Toad | | | |
| Anaxyrus boreas halophilus | California Toad | | | ARSSC |
| Anaxyrus californicus | Arroyo Toad | Endangered | Special Concern | ARSSC |
| Pseudacris cadaverina | California Treefrog | | | ARSSC |
| Pseudacris hypochondriaca | Baja California Treefrog | | | |
| Pseudacris regilla | Northern Pacific Chorus Frog | | | |
| Rana boylii | Foothill Yellow-legged Frog | Under Review in the Candidate or Petition Process | Special Concern | ARSSC |
| Rana draytonii | California Red-legged Frog | Threatened | Special Concern | ARSSC |
| Spea hammondii | Western Spadefoot | Under Review in the Candidate or Petition Process | Special Concern | ARSSC |
| Taricha torosa | Coast Range Newt | | Special Concern | ARSSC |
| Thamnophis hammondii hammondii | Two-striped Gartersnake | | Special Concern | ARSSC |
| Thamnophis sirtalis infernalis | California Red-sided Gartersnake | | | Not on any status lists |
| Thamnophis sirtalis sirtalis | Common Gartersnake | | | |
| **INSECT & OTHER INVERT** | | | | |
| Acentrella spp. | Acentrella spp. | | | |
| Agabus spp. | Agabus spp. | | | |
| Ambrysus mormon | | | | Not on any status lists |
| Antocha spp. | Antocha spp. | | | |
| Argia emma | Emma's Dancer | | | |
| Argia lugens | Sooty Dancer | | | |
| Argia spp. | Argia spp. | | | |
| Argia vivida | Vivid Dancer | | | |
| Baetidae fam. | Baetidae fam. | | | |
| Baetis spp. | Baetis spp. | | | |

| | | | | |
|---|---|---|---|---|
| Berosus punctatissimus | | | | Not on any status lists |
| Berosus spp. | Berosus spp. | | | |
| Callibaetis spp. | Callibaetis spp. | | | |
| Centroptilum spp. | Centroptilum spp. | | | |
| Chaetarthria bicolor | | | | Not on any status lists |
| Chaetarthria ochra | | | | Not on any status lists |
| Cheumatopsyche spp. | Cheumatopsyche spp. | | | |
| Chironomidae fam. | Chironomidae fam. | | | |
| Chironomus spp. | Chironomus spp. | | | |
| Cladotanytarsus spp. | Cladotanytarsus spp. | | | |
| Coenagrionidae fam. | Coenagrionidae fam. | | | |
| Corisella spp. | Corisella spp. | | | |
| Corixidae fam. | Corixidae fam. | | | |
| Cricotopus spp. | Cricotopus spp. | | | |
| Dicrotendipes spp. | Dicrotendipes spp. | | | |
| Dytiscidae fam. | Dytiscidae fam. | | | |
| Enallagma civile | Familiar Bluet | | | |
| Enallagma cyathigerum | | | | Not on any status lists |
| Enochrus carinatus | | | | Not on any status lists |
| Enochrus cristatus | | | | Not on any status lists |
| Enochrus piceus | | | | Not on any status lists |
| Enochrus pygmaeus | | | | Not on any status lists |
| Enochrus spp. | Enochrus spp. | | | |
| Ephemerella spp. | Ephemerella spp. | | | |
| Ephemerellidae fam. | Ephemerellidae fam. | | | |
| Ephydridae fam. | Ephydridae fam. | | | |
| Eukiefferiella spp. | Eukiefferiella spp. | | | |
| Fallceon quilleri | A Mayfly | | | |
| Graptocorixa spp. | Graptocorixa spp. | | | |
| Gyrinus spp. | Gyrinus spp. | | | |
| Helichus spp. | Helichus spp. | | | |
| Helicopsyche spp. | Helicopsyche spp. | | | |
| Hetaerina americana | American Rubyspot | | | |
| Hydrochus spp. | Hydrochus spp. | | | |
| Hydrophilidae fam. | Hydrophilidae fam. | | | |
| Hydroporus spp. | Hydroporus spp. | | | |
| Hydropsyche spp. | Hydropsyche spp. | | | |
| Hydropsychidae fam. | Hydropsychidae fam. | | | |
| Hydroptila spp. | Hydroptila spp. | | | |
| Hydryphantidae fam. | Hydryphantidae fam. | | | |

| | | | | |
|---|---|---|---|---|
| Ischnura spp. | Ischnura spp. | | | |
| Laccobius ellipticus | | | | Not on any status lists |
| Laccobius spp. | Laccobius spp. | | | |
| Laccophilus maculosus | | | | Not on any status lists |
| Lepidostoma spp. | Lepidostoma spp. | | | |
| Leptoceridae fam. | Leptoceridae fam. | | | |
| Libellula saturata | Flame Skimmer | | | |
| Limnophyes spp. | Limnophyes spp. | | | |
| Liodessus obscurellus | | | | Not on any status lists |
| Macromia magnifica | Western River Cruiser | | | |
| Malenka spp. | Malenka spp. | | | |
| Microcylloepus spp. | Microcylloepus spp. | | | |
| Microtendipes spp. | Microtendipes spp. | | | |
| Nectopsyche spp. | Nectopsyche spp. | | | |
| Ochthebius spp. | Ochthebius spp. | | | |
| Ophiogomphus bison | Bison Snaketail | | | |
| Optioservus spp. | Optioservus spp. | | | |
| Oreodytes spp. | Oreodytes spp. | | | |
| Paracloeodes minutus | A Small Minnow Mayfly | | | |
| Paracymus spp. | Paracymus spp. | | | |
| Paratanytarsus spp. | Paratanytarsus spp. | | | |
| Peltodytes spp. | Peltodytes spp. | | | |
| Phaenopsectra spp. | Phaenopsectra spp. | | | |
| Plathemis lydia | Common Whitetail | | | |
| Postelichus spp. | Postelichus spp. | | | |
| Procladius spp. | Procladius spp. | | | |
| Pseudochironomus spp. | Pseudochironomus spp. | | | |
| Psychodidae fam. | Psychodidae fam. | | | |
| Rheotanytarsus spp. | Rheotanytarsus spp. | | | |
| Rhyacophila spp. | Rhyacophila spp. | | | |
| Sigara mckinstryi | A Water Boatman | | | Not on any status lists |
| Sigara spp. | Sigara spp. | | | |
| Simuliidae fam. | Simuliidae fam. | | | |
| Simulium spp. | Simulium spp. | | | |
| Sperchon spp. | Sperchon spp. | | | |
| Sperchontidae fam. | Sperchontidae fam. | | | |
| Stictotarsus spp. | Stictotarsus spp. | | | |
| Sweltsa spp. | Sweltsa spp. | | | |
| Tanytarsus spp. | Tanytarsus spp. | | | |
| Tipulidae fam. | Tipulidae fam. | | | |
| Tramea lacerata | Black Saddlebags | | | |
| Tricorythodes spp. | Tricorythodes spp. | | | |

| | | | | |
|---|---|---|---|---|
| Wormaldia spp. | Wormaldia spp. | | | |
| **MAMMAL** | | | | |
| Castor canadensis | American Beaver | | | Not on any status lists |
| **MOLLUSK** | | | | |
| Gyraulus spp. | Gyraulus spp. | | | |
| Lymnaea spp. | Lymnaea spp. | | | |
| Menetus opercularis | Button Sprite | | | CS |
| Physa spp. | Physa spp. | | | |
| Pisidium spp. | Pisidium spp. | | | |
| Planorbidae fam. | Planorbidae fam. | | | |
| **PLANT** | | | | |
| Alnus rhombifolia | White Alder | | | |
| Ammannia coccinea | Scarlet Ammannia | | | |
| Anemopsis californica | Yerba Mansa | | | |
| Azolla filiculoides | NA | | | |
| Baccharis salicina | | | | Not on any status lists |
| Bolboschoenus maritimus paludosus | NA | | | Not on any status lists |
| Callitriche heterophylla bolanderi | Large Water-starwort | | | |
| Callitriche marginata | Winged Water-starwort | | | |
| Castilleja minor minor | Alkali Indian-paintbrush | | | |
| Castilleja minor spiralis | Large-flower Annual Indian-paintbrush | | | |
| Cotula coronopifolia | NA | | | |
| Crassula aquatica | Water Pygmyweed | | | |
| Crypsis vaginiflora | NA | | | |
| Cyperus erythrorhizos | Red-root Flatsedge | | | |
| Eleocharis macrostachya | Creeping Spikerush | | | |
| Eleocharis parishii | Parish's Spikerush | | | |
| Epilobium campestre | NA | | | Not on any status lists |
| Epilobium cleistogamum | Cleistogamous Spike-primrose | | | |
| Eryngium spinosepalum | Spiny Sepaled Coyote-thistle | | Special | CRPR - 1B.2 |
| Eryngium vaseyi vaseyi | Vasey's Coyote-thistle | | | Not on any status lists |
| Euthamia occidentalis | Western Fragrant Goldenrod | | | |
| Helenium puberulum | Rosilla | | | |
| Hydrocotyle verticillata verticillata | Whorled Marsh-pennywort | | | |
| Juncus dubius | Mariposa Rush | | | |
| Juncus effusus effusus | NA | | | |

| | | | | |
|---|---|---|---|---|
| Juncus luciensis | Santa Lucia Dwarf Rush | | Special | CRPR - 1B.2 |
| Juncus macrophyllus | Longleaf Rush | | | |
| Juncus xiphioides | Iris-leaf Rush | | | |
| Limosella aquatica | Northern Mudwort | | | |
| Marsilea vestita vestita | NA | | | Not on any status lists |
| Mimulus guttatus | Common Large Monkeyflower | | | |
| Mimulus latidens | Broad-tooth Monkeyflower | | | |
| Mimulus pilosus | | | | Not on any status lists |
| Montia fontana fontana | Fountain Miner's-lettuce | | | |
| Navarretia prostrata | Prostrate Navarretia | | Special | CRPR - 1B.1 |
| Paspalum distichum | Joint Paspalum | | | |
| Persicaria lapathifolia | | | | Not on any status lists |
| Persicaria maculosa | NA | | | Not on any status lists |
| Phacelia distans | NA | | | |
| Pilularia americana | NA | | | |
| Plagiobothrys acanthocarpus | Adobe Popcorn-flower | | | |
| Plantago elongata elongata | Slender Plantain | | | |
| Platanus racemosa | California Sycamore | | | |
| Psilocarphus brevissimus brevissimus | Dwarf Woolly-heads | | | |
| Ranunculus aquatilis diffusus | | | | Not on any status lists |
| Rorippa curvisiliqua curvisiliqua | Curve-pod Yellowcress | | | |
| Rumex conglomeratus | NA | | | |
| Rumex salicifolius salicifolius | Willow Dock | | | |
| Salix exigua exigua | Narrowleaf Willow | | | |
| Salix laevigata | Polished Willow | | | |
| Salix lasiolepis lasiolepis | Arroyo Willow | | | |
| Schoenoplectus americanus | Three-square Bulrush | | | |
| Schoenoplectus pungens longispicatus | Three-square Bulrush | | | |
| Schoenoplectus pungens pungens | NA | | | |
| Schoenoplectus saximontanus | Rocky Mountain Bulrush | | | |
| Typha domingensis | Southern Cattail | | | |

| | | | | |
|---|---|---|---|---|
| Typha latifolia | Broadleaf Cattail | | | |
| Veronica anagallis-aquatica | NA | | | |
| Veronica catenata | NA | | | Not on any status lists |

# Attachment D

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Protecting nature. Preserving life.

## 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). The California Department of Water Resources (DWR) has provided the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) online (https://gis.water.ca.gov/app/NCDatasetViewer/) to help Groundwater Sustainability Agencies (GSAs) identify GDEs within a groundwater basin. The NC Dataset is a compilation of 48 publicly available State and Federal agency datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[5].

The NC Dataset indicates the vegetation and wetland features that are good indicators of a GDE. The NC dataset is a starting point, and it is the responsibility of GSAs to utilize best available science and local knowledge on the hydrology, geology, and groundwater levels to verify its presence or absence, as well as whether a connection to groundwater in an aquifer exists (Figure 1)[6]. Detailed guidance on identifying GDEs within a groundwater basin from the NC dataset is available[7]. This document highlights six best practices that GSAs and their consultants can apply when using local groundwater data to confirm a connection to groundwater for the NC Dataset.

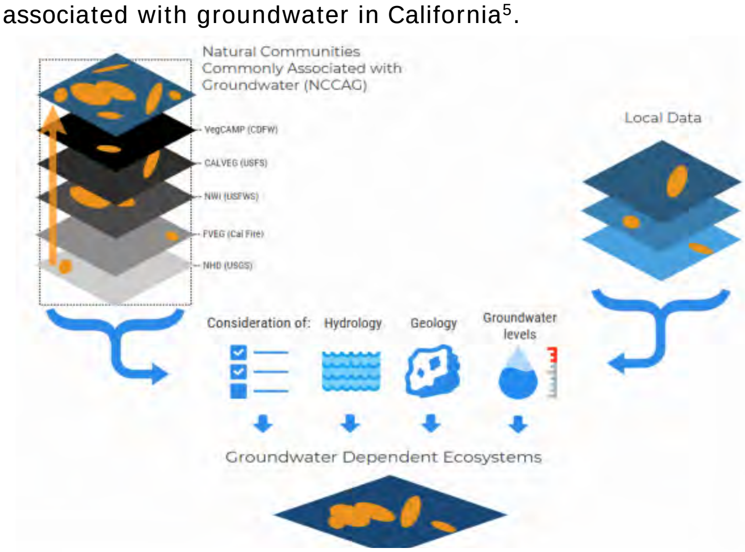


**Figure 1. Considerations for GDE identification. Source: DWR[2]**

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[5] 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

[6] *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*

[7] "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/

## BEST PRACTICE #1. Connection to an Aquifer

Groundwater basins can be comprised of one continuous aquifer or multiple aquifers stacked on top of each other. Basins with a stacked series of aquifers 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, and groundwater dependent ecosystems (Figure 2). This is because the goal of SGMA is to sustainably manage groundwater resources for current and future social, economic, and environmental benefits, and while groundwater pumping may not be currently occurring in a shallower aquifer, it could be in the future. For example, if a shallow perched aquifer is currently not being pumped due to poor water quality resulting from irrigation return flow, producing this water will 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 and a GSA's legal risk be minimized. A good rule of thumb to follow is: *if groundwater can be pumped from a well - it's an aquifer*.

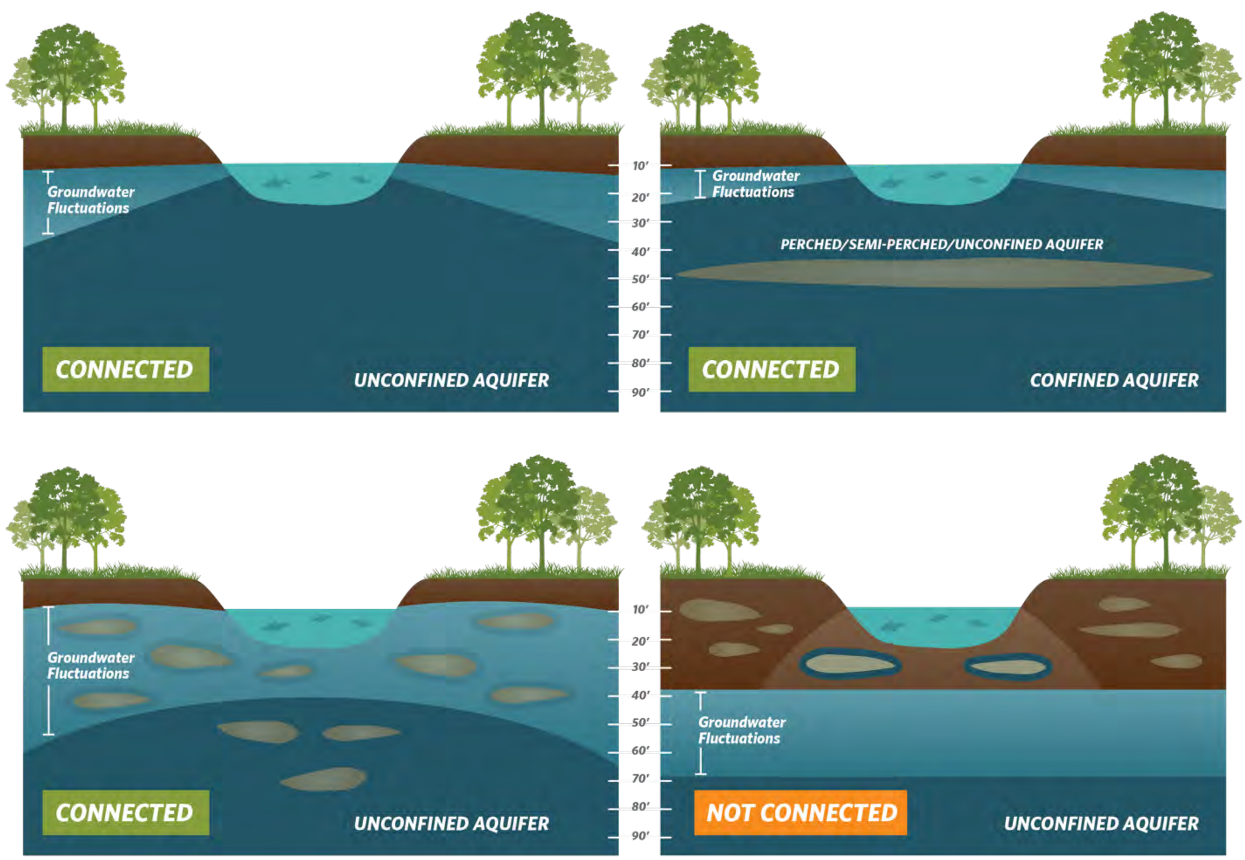


**Figure 2. Confirming whether an ecosystem is connected to groundwater in a principal aquifer. Top: (Left)** Depth to Groundwater in the aquifer under the ecosystem is an unconfined aquifer with depth to groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(Right)** 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: (Left)** Depth to groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystems connection to groundwater. (Right) 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 surface water feature.

## BEST PRACTICE #2. Characterize 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 (i.e., wet, average, dry, and drought years) that is characteristic of California's climate. DWR's Best Management Practices document on water budgets[8] 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[9] could be determined based on data between 2005 and 2015.

GDEs existing on the earth's surface 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[10] 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 the GDE guidance document[2], one of the key factors to consider when mapping GDEs is to contour depth to groundwater in the aquifer that is in direct contact with the ecosystem.

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[2] are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, it is highly advised that fluctuations in the groundwater regime are taken into consideration and to characterize 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[11]. However, if insufficient data are available to describe groundwater conditions within polygons from the NC dataset, it is highly advised that they be included in the GSP until data gaps are reconciled in the monitoring network (See Best Practice #6).

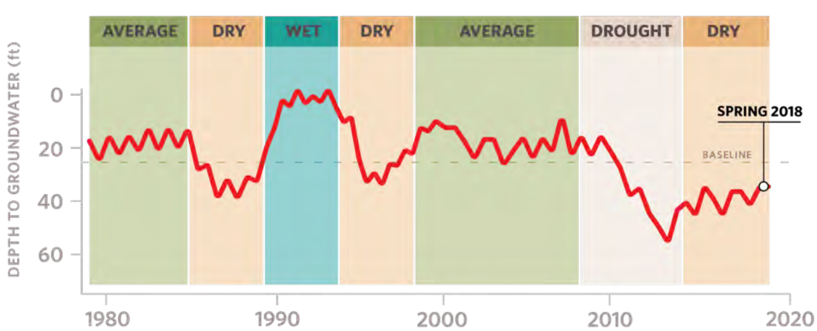


**Figure 3. Example seasonality and interannual variability in depth to groundwater over time.** Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future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

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[8] 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

[9] *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)]*

[10] 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 - link in footnote above).

[11] *SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer*

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

GDEs can rely on groundwater for all or some of its requirements, using multiple water sources simultaneously and at different temporal or spatial scales. 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 NC polygons does not preclude the possibility that a connection to groundwater exists. 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 connected to groundwater and should be considered GDEs.

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 would 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).

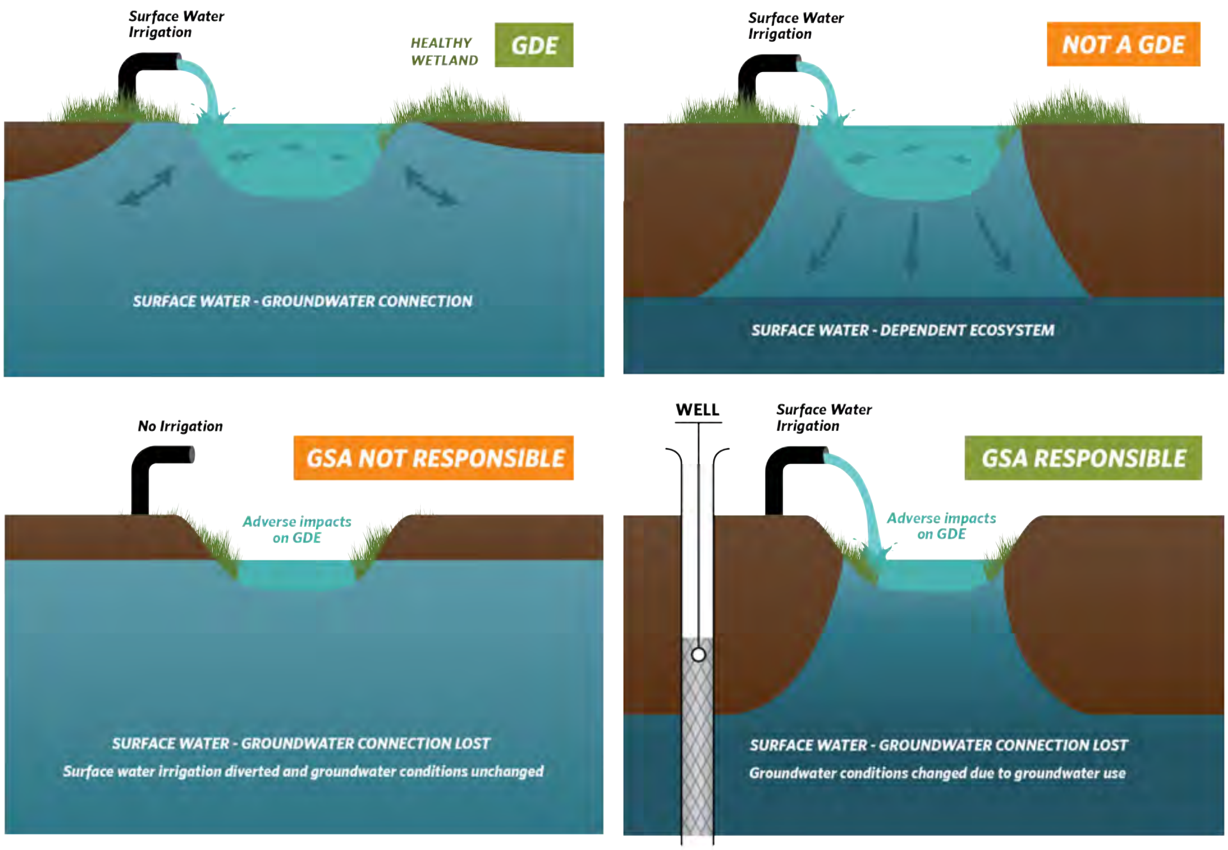


**Figure 4. Ecosystems can depend on multiple sources of water. Top: (Left)** Surface water and groundwater are interconnected, such that a connection to groundwater exists for the ecosystem. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent. **Bottom: (Left)** An ecosystem that was once dependent on an interconnected surface water and groundwater connection, but then loses this connection due to surface water diversions would not be the GSA's responsibility. **(Right)** Groundwater dependent ecosystems in places where a surface water – groundwater connection existed, but then loose that connection due to groundwater pumping would be the GSA's responsibility.

## BEST PRACTICE #4. Select Representative Groundwater Wells

Identifying GDEs in a basin require that groundwater conditions are characterized to confirm whether polygons in the NC dataset are connected to an underlying aquifer. Once an aquifer has been identified, representative groundwater wells are necessary to characterize groundwater conditions (Figure 5). 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 the NC Dataset polygons, and more likely to reflect the local conditions relevant to the ecosystem. NC dataset polygons that are farther than 5 km from a well should not be excluded because of interpolated groundwater depth conditions, as there is insufficient information to make that determination. Instead, they should be retained as potential GDEs until there is sufficient data to determine whether or not the NC Dataset polygon is connected to groundwater and is a GDE.
- 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 well information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer.

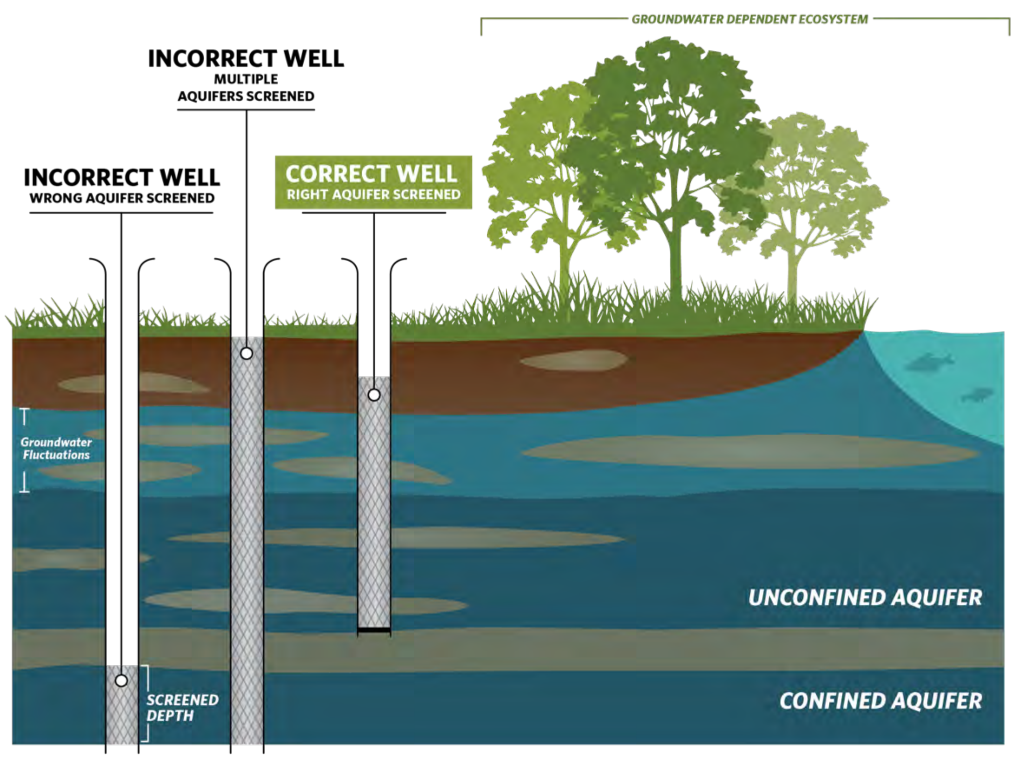


**Figure 5. Selecting representative wells to characterize groundwater conditions in the aquifers directly connected with GDEs.**

## BEST PRACTICE #5. Contouring Groundwater Elevations

A common, but error prone practice, to contour depth to groundwater over a large area is to interpolate depth to groundwater measurements at monitoring wells. This practice causes errors when the land surface contains features like streams and wetlands depressions because it assumes the land surface is constant across the landscape and depth to groundwater is constant below these low-lying areas (Figure 6). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get an estimate of groundwater elevation across the landscape. This layer can then be subtracted from the land surface elevation from a Digital Elevation Model (DEM)[12] to estimate depth to groundwater contours across the landscape (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.

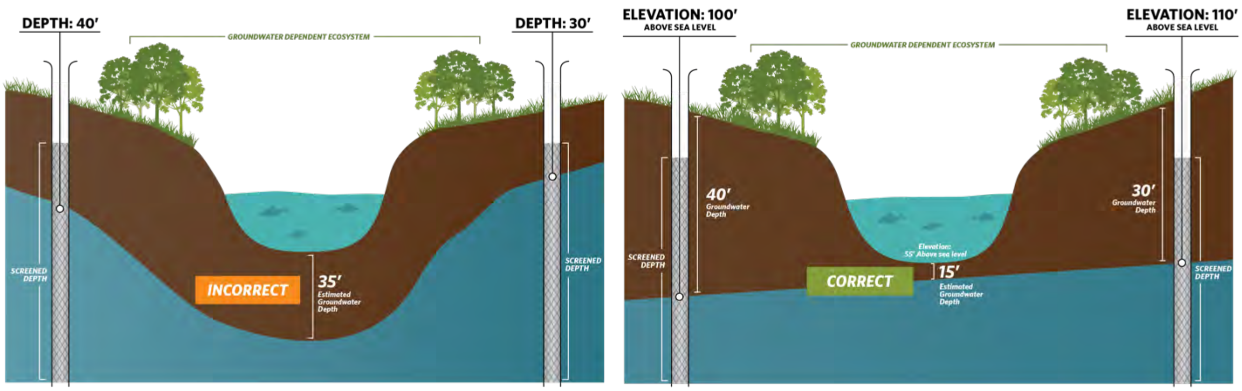


**Figure 6. Contouring depth to groundwater around surface water features and GDEs. (Left)** Groundwater level interpolation using depth to groundwater data from monitoring wells. **(Right)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

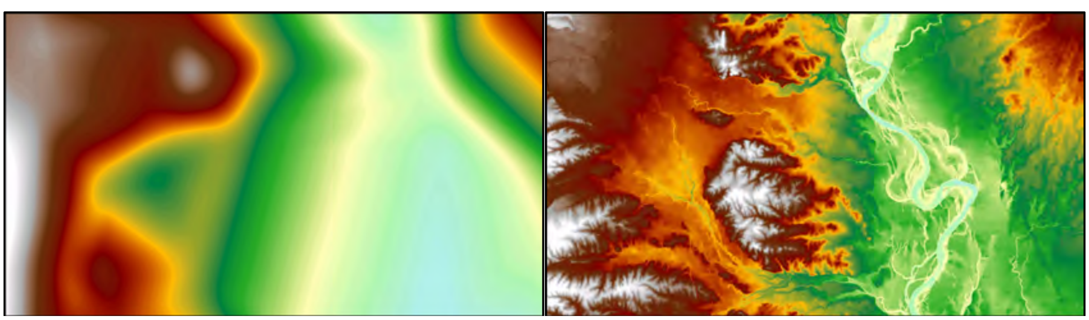

**Figure 7. Depth to Groundwater Contours in Northern California. (Left)** Contours were interpolated using depth to groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface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

[12] *Digital Elevation Model data is available at: https://catalog.data.gov/dataset/usgs-national-elevation-dataset-ned-1-meter-downloadable-data-collection-from-the-national-map-*

## 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 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.

## Comments of Chapter 6,7 & 8

I would like to submit the following comments on these Chapters.

**Minimum Thresholds**

I am against using the 2017 well level reading as the Minimum Thresholds. This will put the GSP at risk of going below the minimums before the GSP even starts to implement actions in the Basin. The two Water Districts, S/SJ and EPC have looked at a number of alternatives and I urge the CC Technical Staff to address this issue and set Minimum Thresholds below the 2017 levels.

**Criteria for Defining Undesirable Results, 8.4.4.1**

The current Chapter 8 suggest 15% as a trigger for management actions because of undesirable results. With only 12 wells in the GSP at this point, 15% of 12 wells is one perhaps two wells and is not a large enough of a sample to make decisions. I believe the number threshold of 15% is way too low. 30% might be a more realistic number. Also, as the number of wells increases in the monitoring network, the CC Technical Staff might consider a more refined methodology for determining exceedances.

**The Number of Well in the Monitoring Network**

It is my understanding that only 12 wells are included in the Monitoring Network at this point. Clearly this number is way too small. I am aware that Shandon/San Juan WD is working to increase this number in their area. EPC WD is also working with our Hydrologist, Paul Sorenson, to identify wells in the EPC area that can become candidates for monitoring well. EPC hopes to identify a dozen new wells that can be included. I would hope that the County GSA works on this as well.

**Sustainability Goals, 8.2**

The primary components of creating a Sustainability Plan for the Paso Robles Groundwater Basin are reduced extraction of groundwater and the availability of new sources of water.

It is my hope that these Chapters as well as Chapters 9 & 10 will include active management actions, programs, and recommendations that will incent pumpers to change their practices and pump less water or provide financial encouragement to farmers to fallow land which has become economically marginal.

In addition, it is my hope the CC and the GSP will help to create a political and social environment that will allow the Basin to pursue sources of 'new' water that are economically viable. The ability to have new supplemental water to offset the pumping deficit will be essential to maintaining agriculture as the economic pillar of our Basin and Community. We all use the same water and we must all participate in the solutions necessary for our Basin's health.

**Policy and Survey Results**

Early in the process, the CC conducted a survey of interested landowners and water users. The results were interesting but not meaningful for setting policy. The Survey was not scientific and with a small number of respondents. Questions were asked in a vacuum. It's easy to say yes to the question of would you like to see groundwater levels maintained or rise. But without consideration of the corresponding tradeoffs, the answer is meaningless.

I would encourage the CC to base their deliberations on facts and science and not preferences.

**Equal Treatment**

I would encourage the CC to make sure that all classes of 'extractors' are treated the same within their class and regardless of what jurisdiction they are in. Classes might be such things as agricultural pumpers, rural resident pumpers (de minimis), commercial pumpers and others. Also, any requirements of reporting usage and limits on extraction should also be the same within each class.

**Access versus Availability of Groundwater**

This is a simple but important distinction to these two aspects of groundwater. Access means how does a person get access to groundwater or more basically what kind of a well does one have. Availability means how much water is readily available in the Basin.

Agricultural pumpers solve their access problem on a routine basis by lowering their pumps, enhancing their equipment, drilling new wells or other efforts. It's just the price of doing business. On the other hand, agricultural users have an availability problem. How much water can our Basin support for agricultural use? That's what SGMA and GSP are all about.

De minimis users have the reverse situation. They have an access problem but not an availability problem. Because de minimis users use a relatively small amount of water, the Basin should be able to provide for their needs in the future.

However, some de minimis users do have a real access problem, their wells are going dry and this problem will likely continue until the Basin is stabilized. Many rural residents have older and/or shallow wells and groundwater levels have been declining.

I encourage the CC and the GSP to address the 'access' problem of rural residents with proposals for projects, managements actions and other efforts. A rural water company could be a cost-effective solution to wells going dry. Rural residents along with all pumpers of groundwater share the responsibility of a sustainable basin and should participate in the solutions. A GSP that does not address the needs and solutions of rural residents could be viewed as an incomplete plan.

Jerry Reaugh, personal comments, not EPC WD comments
April 15, 2019

3/15/83 P.R. Press

The main topic of conversation currently is the WEATHER. Many people are interested in the rainfall of past years so we are publishing our 113-year record.

| Season | Inches | Season | Inches | Season | Inches |
|---|---|---|---|---|---|
| 1869-70 | 11.83 | 1907-08 | 15.31 | 1945-46 | 12.05 |
| 1870-71 | 12.97 | 1908-09 | 24.21 | 1946-47 | 10.26 |
| 1871-72 | 27.02 | 1909-10 | 17.09 | 1947-48 | 10.47 |
| 1872-73 | 12.97 | 1910-11 | 26.64 | 1948-49 | 10.60 |
| 1873-74 | 20.52 | 1911-12 | 12.37 | 1949-50 | 13.74 |
| 1874-75 | 19.69 | 1912-13 | 8.06 | 1950-51 | 9.97 |
| 1875-76 | 30.12 | 1913-14 | 22.02 | 1951-52 | 18.09 |
| 1876-77 | 8.15 | 1914-15 | 24.96 | 1952-53 | 11.99 |
| 1877-78 | 30.60 | 1915-16 | 21.54 | 1953-54 | 11.32 |
| 1878-79 | 11.66 | 1916-17 | 18.51 | 1954-55 | 11.05 |
| 1879-80 | 25.12 | 1917-18 | 14.37 | 1955-56 | 17.77 |
| 1880-81 | 23.69 | 1918-19 | 11.91 | 1956-57 | 10.92 |
| 1881-82 | 7.66 | 1919-20 | 12.81 | 1957-58 | 25.10 |
| 1882-83 | 8.00 | 1920-21 | 13.70 | 1958-59 | 8.93 |
| 1883-84 | 42.40 | 1921-22 | 21.81 | 1959-60 | 9.56 |
| 1884-85 | 17.59 | 1922-23 | 15.45 | 1960-61 | 8.66 |
| 1885-86 | 19.30 | 1923-24 | 6.38 | 1961-62 | 17.23 |
| 1886-87 | 9.59 | 1924-25 | 12.74 | 1962-63 | 17.78 |
| 1887-88 | 14.30 | 1925-26 | 14.79 | 1963-64 | 10.25 |
| 1888-89 | 15.84 | 1926-27 | 21.91 | 1964-65 | 13.49 |
| 1889-90 | 30.57 | 1927-28 | 11.49 | 1965-66 | 11.83 |
| 1890-91 | 16.42 | 1928-29 | 9.82 | 1966-67 | 24.90 |
| 1891-92 | 11.98 | 1929-30 | 10.96 | 1967-68 | 8.76 |
| 1892-93 | 22.55 | 1930-31 | 12.13 | 1968-69 | 31.85 |
| 1893-94 | 5.94 | 1931-32 | 10.59 | 1969-70 | 9.17 |
| 1894-95 | 18.93 | 1932-33 | 9.62 | 1970-71 | 11.10 |
| 1895-96 | 13.14 | 1933-34 | 11.62 | 1971-72 | 7.69 |
| 1896-97 | 17.96 | 1934-35 | 20.77 | 1972-73 | 23.15 |
| 1897-98 | 4.77 | 1935-36 | 18.17 | 1973-74 | 17.42 |
| 1898-99 | 11.53 | 1936-37 | 20.26 | 1974-75 | 12.79 |
| 1899-00 | 11.66 | 1937-38 | 26.04 | 1975-76 | 5.66 |
| 1900-01 | 22.80 | 1938-39 | 7.51 | 1977-78 | 26.79 |
| 1901-02 | 12.75 | 1939-40 | 15.80 | 1798-79 | 13.95 |
| 1902-03 | 11.24 | 1940-41 | 30.64 | 1979-80 | 19.45 |
| 1903-04 | 14.51 | 1941-42 | 16.69 | 1980-81 | 12.31 |
| 1904-05 | 19.89 | 1942-43 | 18.37 | 1981-82 | 14.78 |
| 1905-06 | 15.23 | 1943-44 | 13.24 | 1982-83 | 22.63 |
| 1906-07 | 22.00 | 1944-45 | 13.01 | | |

**113 YEARS OF RAINFALL** — the above chart was compiled from several different sources. Seasons 1869-70 to 1880-81 were taken from a chart compiled by the Chamber of Commerce. Seasons 1881-82 and 1882-83 were found in Myron Angel's History of San Luis Obispo County. 1883-84 to 1886-87 were from the Chamber of Commerce chart. Years 1887-88 to 1929-30 were archived in a government pamphlet, A Climatic Summary of the United States. Years 1930-31 to 1945-46 were from the Chamber of Commerce list and 1946-47 to present were from the city water works records.

Paso Robles Subbasin GSP
Chapter 9
Draft of May 15, 2019
Required Corrections

## 9.1 Introduction

- Water budgets ........ Add: Reference should be made to the court mandated reduction in pumping by the City of Paso Robles, et al and the positive impact that will have on the current level of pumping.

Removed lined out portions:

To stop persistent declines in groundwater levels, ~~achieve the sustainability goal by 2040~~ and avoid undesirable results ~~through 2070~~ as required by SGMA regulations, groundwater pumping reductions will be needed. In most cases, a reduction in groundwater pumping will occur as a result of management actions, except where a new water supply is provided and used instead of pumping groundwater. ~~Projects to bring in new water supplies included in this chapter are based on pervious vetted feasibility studies.~~

Note: <u>the goal to reach sustainability should be 2030. To achieve sustainability a reduction in overall pumping will be required.</u>

## 9.2 Implementation Approach

Add:

- Expand and improve monitoring networks, e.g., the SLO County GSA will monitor water levels at public wells.

Remove:

- ~~Track the development of water supply projects.~~

Page 3:

- Present information on management actions and ~~projects~~ including ......

Add:

Because the amount of groundwater pumping in the Sub-basin is more than the estimated sustainability yield of about 61,000 AFY .........

Note: <u>the methodology of determining 61,000 AFY needs to be described in a footnote.</u>

Page 3 continued:

In general, management actions will be implemented in all areas ~~before projects because projects take many years to complete~~.

3rd line from the bottom of page3:

.....funds for alternative approaches ~~such as purchasing and following cropland and contributing to projects that bring in new water supplies to offset groundwater demand.~~

Page 4 Bottom Paragraph: Remove entire paragraph.

~~Any rules, ..........under this GSP.~~

## 9.3 Level 1 Management Actions

Level 1 management actions may include:

- ~~Initiate an interference program that includes~~
    - ~~Rotating groundwater pumping on agreed schedules to optimize and reduce groundwater use.~~
    - ~~Well spacing requirements~~

### 9.3.1.3 Circumstances for implementation

BMPs and related outreach will be promoted ~~and implemented~~ soon after adoption of the GSP.

### 9.3.1.4 Public Noticing top of page 8

~~The BMPs will be promoted through a focused outreach campaign.~~

### 9.3.1.6 Implementation Schedule

~~Implementing BMPs will begin immediately after the GSP is adopted and when funds become available.~~

### 9.3.1.8 Estimated Cost

The estimated cost ...........~~Monitoring of BMPs will have an estimated cost of $25,000 to $50,000.~~

## 9.3.2 Interference Mitigation Program

- Minimum well spacing requirements for new wells will be considered by SLO County.

### 9.3.2.1 Relevant Measurable Objectives

Remove this section

### 9.3.2.2. Expected Benefits and Evaluation of Benefits

The first paragraph comes out. Begins ~~The primary benefit~~ and ends with ~~the expected benefits.~~

The last sentence in the second paragraph (page 9) comes out. Begins ~~Isolating the effect of~~ and ends ~~in the subbasin.~~

### 9.3.2.3 Circumstances for implementation

Remove this section

### 9.3.2.4 Public Noticing

Remove this section

### 9.3.25 Permitting and Regulatory Process

Remove this section

### 9.3.2.6 Implementation Schedule

Remove this section

### 9.3.2.7 Legal Authority

Remove this section comes out

### 9.3.2.8 Estimated Cost

The existing paragraph comes out and in its place the following is inserted.

The interference mitigation program has been estimated at up to $750,000, which is deemed too expensive. Accordingly, the program components will be reviewed and revised in order to bring the cost down below $200,000.

### 9.3.3 Promote Stormwater Capture

First paragraph second line: Change "could" be promoted to "will" be promoted

### 9.3.3.1 Relevant Measure Objectives

Replace: Stormwater capture "may" benefit with "will" benefit

### 9.3.4 Voluntary Fallowing of Agriculture Land

Change the first sentence to: The GSAs may consider promoting voluntary fallowing of crop land to reduce overall groundwater demand.

Remove all 5 bullet points.

### 9.3.4.1 Relevant Measurable Objectives

The voluntary fallowing ~~program~~ would benefit........

### 9.3.4.2 Expected Benefits and Evaluation of Benefits

Remove all of this section

### 9.3.4.3 Circumstances for Implementation

Remove all of this section

### 9.3.4.4 Public Notice

Remove all of this section

### 9.3.4.5 Permitting and Regulatory Process

The land fallowing program is subject to CEQA, but only if it is a "formal program."

### 9.3.4.8 Estimated Cost

Remove all of this section as the estimated cost of a formal program is too expensive.

### 9.3.5 Groundwater Pumping Fees

Paragraph one. Add the concepts: 1) that pumping fees would be tiered, 2) that one of the goals is to reduce overall pumping in the subbasin, & 3) CASGEM data will be used as appropriate to avoid duplication.

Note: $500,000 is too expensive for the development of a fee structure lower this cost!

Page 14: ~~If needed, each GSA shall enact fees by ordinance or resolution that is materially comparable to similar levels and classes of use to the ordinance of the other GSAs.~~

### 9.4 Level 2 Management Actions

Remove second bullet point "Developing funding............................................the same reductions.

Remove last bullet point "Retirement of ..................................................groundwater pumping.

### 9.4.1 Mandatory pumping reductions in specific areas

In the second line "decline ranges from 25 – 65%.

Note: How was this range determined? Requires a_footnote to explain the numbers. Moreover, don't we need to know water levels first?

Items:

1. Determination of baseline pumping in specific areas based on:

   a. Area specific declines and estimated yield in that area

   b. Historical use — Explain how will historic use be determined and what evidence will be required over what period of time?

   c. Land uses and corresponding irrigation requirements

2. Remove this item.

3. Change to: The GSP should target achieving sustainability in the area of 2030 not use 2040 as the target.

The paragraph below item 3 on page 15:

Is the concept of "sustainable Yield" still being used? The rumor circulating is that it is not being used any longer.

In critical areas of the subbasin there should be an immediate ramp down of pumping.

4th line from the bottom of the paragraph – 2040 should be changed to 2030

## 9.4.2 Groundwater Conservation Program

The paragraphs at the bottom of page 15 & top of page 16:

These paragraphs are completely unacceptable and need to be eliminated or re-written.

The bullet points below the second paragraph on page 16:

- A tiered pumping rate structure is OK. The remainder of that point is out.
- Third bullet point is out.
- Fifth bullet point is out.
- Sixth bullet point is out.
- Seventh bullet point is out.
- Eighth bullet point is out. *de minimis* pumpers are exempt!

#### 9.4.2.1 Tiered Pumping Fee Structure

The first and second paragraphs are out and replaced by the following:

A tiered pumping fee structure should be implemented. The thresholds that define each tier along with the fee charged for each tier would be determined in hearings, public outreach and be subject to final Board approval. The tiers and fees will be established to address areas where reduced pumping is needed. Individual groundwater pumpers may choose to switch to less water intensive crops, or implement water use efficiencies.

The fee structure and allowances may not be uniform across the Subbasin in the final groundwater conservation program. Portions of the Subbasin with localized groundwater decline may be subject to different fee structures.

#### 9.4.2.2 Site Specific Carryover

Remove all of this section as it is unacceptable

#### 9.4.2.3 Re-location and Transfer of Pumping Allowances

Remove all of this section as it is unacceptable

#### 9.4.2.4 Non-Irrigated Land

Remove all the existing language and insert the underlined paragraph:

Note: This section needs to take into consideration those landowners who will achieve Quiet Title within the next several weeks some of which may or may not currently farm irrigated crops.

Owners of land that is not under irrigation will be surveyed prior to when the GSP is adopted to determine if they have plans to plant an irrigated crop or crops and, if so, would be assigned a two year provisional pumping allowance. If the landowner has not planted within two years the provisional allowance would expire; however, such landowners would have overlying rights to the reasonable beneficial use of groundwater on their parcels.

#### 9.4.2.5 Relevant Measurable Objectives

Add the use of CASGEM data in determining the progress toward objectives.

## 9.4.3 Agriculture Land and Pumping Allowance Retirement

Remove all of this section on pages 20 & 21

Note: This approach leads to Owen's Valley type results.
It is in SLO County's interest to keep water with the land on which it is pumped.
Who represents the local property owners in this plan?

### 9.4.3.1 Relevant Measurable Objectives

Remove the second sentence.

### 9.4.3.2 Expected Benefits and Evaluation of Benefits

Remove the first paragraph.

### 9.4.3.3 Circumstances for Implementation

Remove this section entirely.

### 9.4.3.4 Public Noticing

Remove this section entirely.

### 9.4.3.5 Permitting and Regulatory Process

Remove this section entirely.

### 9.4.3.6 Implementation Schedule

Remove this section entirely – this is a bad program!

### 9.4.3.7 Legal Authority

Remove – this is superfluous!

#### 9.4.3.8 Estimated Cost

Remove entirely.

## 9.5 Projects

Remove first paragraph entirely.

Add: Projects must not involve public funds, but private funds only. The projects presented in this GSP 1) rely on five potential sources of water for direct delivery only, and 2) cannot involve direct injection into the groundwater basin, as direct injection opens the issue of groundwater ownership.

Retain project numbers: 1, 3, 4, 5, & 6 – remove project number 2 SWP water

Add: /Stormwater capture to item 6

### 9.5.1 Overview of Project Types

1. Direct delivery for irrigation or municipal use only.

#### 9.5.1.1 In-Lieu Recharge through Direct Delivery

1. Add: in lieu of groundwater pumping.
2. Direct Delivery water may be stored above ground only.
3. Imported water MAY NOT be injected into the Subbasin.

#### 9.5.1.2 Direct Recharge through Recharge Basins

Add: Recharge Basins will be used only for the percolation of Stormwater capture into alluvial areas. Direct recharge through injection wells is not acceptable due to the possibility of contamination and the issue of ownership of injected groundwater.

## 9.5.2 General Project Provisions

Remove the last sentence: ~~This section assumes ........for illustrative purposes.~~

## 9.5.2.1 Summary of Permitting and Regulatory Processes

Remove the last paragraph.

## 9.5.3 Conceptual Projects

Add: a Stormwater Capture project where topographical conditions are compatible and where captured water can reasonably be diverted to alluvial or sandy soil can be used for percolation.

Note: The concept is that with a robust Stormwater capture program the need for any imported water will be obviated. Moreover, if groundwater pumping is reduced through the implementation of best farming practices the subbasin can achieve sustainability well before 2040.

Note: Stormwater capture and percolated into the aquifer is becoming popular in many areas of California to recharge groundwater basins.

## 9.5.4 Substitute Projects

Remove 9.5.4 and related sections on substitute projects

Note: First, Recharge Basins utilizing purchased or imported water are unacceptable.

The benefits described in 9.5.4 can easily be exceeded though a robust program of Stormwater capture and percolation.

## 9.8 Management of Groundwater Extractions and Recharge and Mitigation of Overdraft

Replace existing with the following:

This GSP is designed to mitigate the current moderate annual over drafting of the Subbasin through a combined program of management actions designed to promote a reduction in pumping and provide authority for mandatory pumping reductions as necessary.

A three-way program made up of 1) robust capture and percolation of annual Stormwater, 2) the utilization of recycled water (RW) where appropriate, and 3) the rational use of groundwater, for irrigated farming and commercial and domestic use, will result in subbasin sustainability well within the deadline of 2040.

Within a relatively short period of time overall pumping should be reduced to a level not exceeding annual natural recharge while respecting the correlated rights of all subbasin overliers. Also on a forward basis the current level of over pumping will be moderately reduced as a result of the Quiet Title litigation judgment and the required reduction in pumping by the litigation defendants.

In summary, this GSP will soon bring annual subbasin pumping in balance with the natural recharge of the subbasin thus achieving sustainability.

Comments received on Paso Basin GSP Draft Chapters 9-12 from the June 18, 2019 City of Paso Robles Council/GSA Meeting. To view the agenda for this meeting, please click here.

1. Dale Gustin: "As we all know this came about during the drought that hit all of California except maybe Sacramento, and since then, has there been any studies done to see if after the current rainfall, I mean I have a lot out at Oak Shores, and we can't even use our bottom parking lot because the lake is up so high. So that water basin has got to be not in overdraft at this point. Has anybody done a study to find that out?"
2. Gary Dunnivan: "I was just curious, how much water do the vineyards around here take away from us, out of our water basin? And that would be very interesting to me to find out. You know we have to cut back and cut back and people did a wonderful job of cutting back. With the vineyards I drive out in the country and water is blowing everywhere. So, we're all out of the same basin right?
3. Cody Ferguson: "There is one thing I'd like to establish here is the fourteen thousand acre feet per year. That's truth or consequences. That'll come out eventually when the final report is issued. There is one important thing, the previous speaker on another subject mentioned the court case that is going on over quiet title. Completely unnecessary court case, nonetheless it has been adjudicated, and during that court case people, one of them being Christopher Alakel, were asked a question on the stand under oath "are we in overdraft." The answer from both he and Courtney Howard, who is in charge of the water stuff for the County, (and of course Mr. Alakel was recognized as a City employee doing the same type of work) was 'no, we are not in overdraft.' And I don't want that coming out of this meeting that we're in overdraft. In fact, there is truth or consequences going on, manipulation going on, people are trying to fight over this water all the time. And some of these things get offered up and they aren't exactly true, but they will be when they are finished. But the one important thing I want you to take to the bank is, it's been testified to in court by both the City and the County you are not in overdraft.
4. Patty Smith: My concern is the water. There is a constant barrage of complaining we don't have enough water. Yet Mayor Strong can tell us we have excellent amount of water out of Lake Nacimiento. The flooding this year has been unreal, yet all we as residents get to hear about is cut back, cut back, cut back. Yet every vineyard out there… I understand that Paso Robles is becoming a wine town but at what cost to the people who live here, and are trying to raise families here? You know we've got the issue with the water, we have issues with the vineyards, we have the issue with the short term rentals. At what point does the City Council take the people, the residents, people who live here, into consideration and stop cowtowing to the vineyards and the wineries?

# Windfall Farms

Chair Supervisor Arnold
County Government Center
1055 Monterey Street
San Luis Obispo, CA 93408

**Re: Comments on April 17, 2019 Draft of Chapter 9 of the Paso Robles Basin Groundwater Sustainability Plan**

Chair Supervisor Arnold:

This is Lee Nesbitt, General Manager of Windfall Farms, a landowner overlying the Paso Robles Groundwater Basin. Windfall Farms and its predecessors in interest have relied on the basin since 1983 and before for numerous beneficial uses of the land. I have reviewed the April 17, 2019 Draft of Chapter 9 of the Paso Robles Sub-basin Groundwater Sustainability Plan ("Plan") and submit these comments on it for the Cooperative Committee's consideration.

**1. The Plan should be corrected to make clear that any restrictions on pumping will be consistent with common law water rights.** As drafted, Chapter 9 suggests that the burden of pumping restrictions could be geographically discriminatory. [1] This approach is inconsistent with the physically interconnected nature of the basin and with common law water rights.[2] Rather, the Plan should make clear that there will not be disparate treatment of pumpers based on physical location within the basin and that all pumpers on equal legal footing with regard to water rights must bear similar financial responsibility for solving the basin's challenges. Moreover, even "area-specific" responsive management actions must be specifically associated with avoiding undesirable results identified in the Plan. If pumping by a discrete area or growers must be physically restricted, that burden must be shared basin-wide by implementation of a physical solution that distributes that burden legally and equitably among all pumpers according to their allocations.

**2. New and expanded groundwater production should be prohibited.** Consistent with Water Code § 10720.5, the Plan should provide that no new or expanded production, in excess of

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[1] See Plan, p. 14 ("a pumping reduction of approximately 18% will be needed across the basin to reduce pumping to the sustainable yield. Larger pumping reductions will likely be necessary in specific areas to arrest groundwater level declines."); p. 15 ("the rate of ramp down would depend on when the program starts and projections of how long lower pumping rates are required in specific areas in order to achieve sustainability by 2040."); and p. 17 (expanding this concept to differential fees for pumping in "portions of the subbasin with localized groundwater decline."). (Emphasis added.)

[2] We recognize that actual physical pumping restrictions may be required in particular locations to address acute undesirable results. However, the Plan should expressly distinguish between such physical pumping restrictions and allocation of financial burden for reductions necessary to achieve sustainability. The basin is a hydrologically connected unit; pumping in one location affects others over time. Thus, if groundwater rights are determined, they will be determined on a basin-wide basis. (See Water Code § 10721(b); Civ. Proc. Code § 832 (indicating that a comprehensive groundwater adjudication will be made on a basin-wide basis, with "basin" being the hydrogeologic unit defined by Bulletin 118).)

P.O Box 1798, Paso Robles, CA 93447 Phone (805) 239-0711

# Windfall Farms

historical production, after January 1, 2015 will count toward any groundwater production allocations implemented to advance Level 2 PMAs. This would put all pumpers on notice that if they initiate new or expanded pumping, they do so at their own risk, and may need to acquire pumping allocation from others or pay surcharges to maintain such production.

3. **The Plan should encourage voluntary fallowing/reductions in pumping.** To encourage voluntary fallowing/reductions in pumping without risk of potential loss of water rights, the Plan rightfully provides, but should confirm, that historical pumping need not be maintained or continued to support a water right claim based on historical pumping from the basin.

4. **The Plan should not delay implementation of Level 2 Proposed Management Actions if required.** The Level 1 proposed management actions ("PMAs") are a valuable first step, may not be sufficient to achieve sustainability. If implementation of Level 2 PMAs are delayed, the impacts on groundwater pumpers may be significantly greater – i.e., more restrictive, more expensive, etc. – than would be the case if the Level 2 PMAs had commenced sooner. The Plan should provide a date (post 2020) for anticipated introduction of Level 2 PMAs **IF** Level 1 PMAs do not achieve sustainability goals.

5. **Implementation of Level 2 PMAs should be based on, and tied to, adaptive management principles based on evolving science.** The Plan should make clear that as the Plan is implemented, our technical understanding of the basin will continue to be evaluated and that target metrics will be refined accordingly.

6. **Level 2 PMAs require allocations and allocations necessarily implicate water rights.** The plan should recognize that implementation of any Level 2 PMAs will necessarily require determinations of pumping allocations across the basin, which necessarily implicates a pumper's water right claim. The Plan should acknowledge that it cannot determine or alter water rights (Water Code § 10720.5). Further, the Plan should anticipate that upon any determination that Level 2 PMAs are required, such PMAs may not go into effect during the pendency of any litigation.

7. **The Plan should include a process by which allocations necessary for Level 2 PMAs are determined.** In an effort to best anticipate the allocation determination process and streamline it, the Plan could provide that upon a determination that Level 2 PMAs are required, a structured and facilitated process will commence to engage stakeholders and seek a negotiated resolution. Ideally, the Plan would highlight the scope, stages, and timing of such a process, based on input from facilitators with relevant experience. By providing a process by which allocations may be determined, the Plan may ameliorate concerns about the Plan's impacts on water right.

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# Windfall Farms

We write these comments as part of the community of the Creston/Paso Robles. While this topic can always be a difficult one to discuss, we believe that positive dialogue with solutions based in science and law with a bit of reasonableness thrown in works best for all concerned. I want to thank you for your consideration of these comments. We look forward to continuing to work with you and the Cooperative Committee to develop a GSP that satisfies SGMA's regulatory requirements and benefits the basin as a whole.

Sincerely,

Lee Nesbitt-General Manager
Windfall Farms

P.O Box 1798, Paso Robles, CA 93447 Phone (805) 239-0711

I appreciate the changes made to Chapter 9, especially Section 9.3.4. In addition, I have the following comments and questions about, and recommendations for Chapter 9 of the proposed Paso Robles Groundwater Area Sub-basin Management Plan:

**Section 9.2**
Modify the criteria for inclusion in the well-monitoring network; monitoring needs to be extended to wells that do not meet all the current criteria for being included in the monitoring network. All wells, to the extent feasible, should be in the network.

Define "individual entities" who … "may choose to develop programs that would raise funds for alternative approaches…"

**Section 9.3**
Define by whom "Level 1 management actions will be developed and implemented"

**Section 9.3.1:**
Define "ET estimates"

**Section 9.3.1.4**
I request that this section, and all subsequent relevant sections, be re-titled "Public Notification," as "noticing" has other connotations, and "notification" is unequivocal.

**Section 9.3.2**
Define "well interference."

**Section 9.3.3**
Will "temporary diversions of storm flows from streams" require California Department of Fish and Wildlife approval? Will SLO County or GSA's have protocols for obtaining, or for helping obtain, such approval, and for designing said diversions?

**Section 9.3.4**
I most earnestly ask The Committee to adopt this section. This proposal will save water by not forcing users to pump from the basin when land is fallowed or when planted to a crop with less water demand. Also, it provides protection of irrigation rights for landowners, whom for whatever reasons, have decreased their water demand compared to their historical use.

**Section 9.4.1**
I reiterate here my request that more wells be monitored.

**Section 9.4.2**
Define "exempt" and "non-exempt" groundwater pumpers.

**Section 9.4.2.3**
I am adamantly opposed to permanent transfer/relocation of pumping allowances. Permanent removal of pumping rights from a property is the equivalent of condemnation. Previously productive sites will be unusable, and will become the equivalent of rural slums.

Temporary transfer/relocation of irrigation rights should be allowed only on neighboring or near-neighboring properties, as physical transfer of the water itself does not actually take place. Transferring **credits** to an area with historically low groundwater will not put more water into the sub-basin of that low-water area, and therefore will not reduce withdrawal pressure or basin depletion in that area.

**Section 9.4.2.4**
I am strongly against any interpretation of this section that does not comply with Section 9.3.4. I would agree to this section if it pertains only to land that has never been irrigated.

**Section 9.4.2.9**
Is it possible to include a brief summary of the requirements of Propositions 218 and 26 referred to?

**Section 9.4.3**
I feel very strongly that productive farmland should remain productive farmland. Once it is lost to even low-density development, the increased price per acre will prevent its return to agriculture, and small acreages are almost never dedicated to production. While I recognize that housing for an ever-increasing human population lags behind demand, productive land is all the more necessary to sustain that population. Marginally productive or non-productive land should be the highest priority for development.

**Section 9.5**
I do not support, and I doubt that the general public would support, general funding of any project that benefits mainly one or two growers.

The six potential sources for groundwater recharge or in-lieu use are highly suspect:
- State Water Project water is completely allocated.
- Nacimiento Water Project water is near complete allocation and has no infrastructure for individual delivery.
- Salinas Dam/Santa Margarita Reservoir water is needed to recharge the Salinas River. Communities at the northern end of the river are experiencing salt water intrusion, and less water delivered to the delta means more salt water in one of the nation's most productive growing areas.
- No infrastructure exists for private delivery of recycled water from either Paso Robles or San Miguel.
- Flood flows from local rivers and streams is subject to CA DFW regulation

**Section 9.5.3.3.3**
One monitoring well is entirely insufficient to trigger implementation of any project. Furthermore, no project should be initiated for the benefit of only one user. Allowing one monitoring well to be the trigger gives no incentive to reduce groundwater pumping if that user will then have the benefit of pooled funds to build a private delivery system. San Miguel CSD may improve the quality the town's waste effluent, but use thereof should benefit the entire community.

I, personally, would like to know the location and ownership of monitoring well 25S/12E-1605 and why it merits such individual consideration. Indeed, if pooled funds are to used for this project, then the public has the right to know this information.

**Section 9.5.3.3.5**
Do Montgomery and Associates and The Committee expect the public to pay for bonds that benefit only one or two users?

**Section 9.5.3.4**
This proposal is pure pork. If Figure 9-14 shows the route of the proposed delivery line, the route is nowhere near the confluence of the Salinas and Estrella. In addition, the three wells in the figure are south, southeast, and farther southeast of the confluence. Since both rivers run north, I fail to see how such delivery would recharge the areas of the wells. To top it off, I KNOW WHO OWNS THE PROPERTY situated at the confluence. NEVER ONCE HAS THE LANDOWNER BEEN QUESTIONED ABOUT THE NEED FOR SUCH A PROJECT. Indeed, the immediate Salinas River corridor appears to be a high-recharge area, with little fluctuation in groundwater levels. Again I am compelled to ask who devised this project, to whom the three listed wells belong, and who stands to benefit.

**Section 9.5.3.4.3**
Many more wells need to be monitored in any proposed project area to trigger implementation. Also, having the prospect of increased water delivery does not appear to be an incentive to decrease groundwater pumping. It seems to reward those who have been injudicious.

**Section 9.5.3.6**
I have the same objections as listed in Sections 9.5.3.3.3 and 9.5.3.4.3

**Section 9.5.3.7**
As above in Section 9.5.3.6. Additionally, this ain't gonna happen. Any alteration of Salinas Dam will be initiated by SLO County, and subject to years of study and permitting.

I think the first, best step for diminishing groundwater depletion is capping irrigation in historically non-irrigated locations at perhaps 80% of current usage. All wells pumping in such areas would be tested prior to the initiation of such measures, and again after one year, and pumping limits would be adjusted accordingly.

Thank you for your attention to my considerations.

dosrios

J. LOHR
VINEYARDS, INC.

June 28, 2019

The Honorable John Peschong
**San Luis Obispo County Supervisor, District 1**
County Government Center
1055 Monterey Street
San Luis Obispo, CA 93408

**RE:** Comments on Chapter 9 of the Paso Robles Basin Groundwater Sustainability Plan

Dear Supervisor Peschong,

I think it is quite clear that Paso Robles Groundwater Basin's (PRB) declining water levels are currently unsustainable. Reductions in groundwater pumping will be required and hopefully new sources of water (supplemental water) will become available through successful "Projects". The public and agricultural pumpers have heard some about this, but actions may not be taken until pumping ramp downs are required or threatened. This might cause litigation. Litigation can be a long and unproductive process during which time water levels continue to fall and the eventual remedial cost becomes much greater. The GSP is our best opportunity to reach accord amongst all stakeholders and avoid litigation.

**Chapter 9 is about Management Actions and Projects.**

Management Actions are "non-structural programs or policies that are intended to reduce or optimize local groundwater use". Some of the Management Actions under consideration are the following and I encourage the GSP Cooperative Committee to make specific policy recommendations in these areas and provide clear direction for Basin users.

1. Metering, water usage reporting, flowmeter program
2. Better understanding of Basin science
3. Basin best management practices
4. Pumping Allowance System
5. Well monitoring network and additional reference wells
6. Pumping fees and excessive pumping penalties
7. Fallowing both temporary and permanent
8. Restricting new groundwater pumping
9. The endorsement by the GSP of specific Projects "involving new or improved infrastructure to import or develop new water supplies".

I believe Chapter 9 should identify and endorse "projects" that are feasible and can have immediate impact on Basin Sustainability.

At J. Lohr, we have long practiced efficient use of irrigation water. In line with our interest in optimal farming practices, J. Lohr Vineyards and Wines have set a meeting for our growers on July 10, 2019 to discuss currently available research and best practices for vineyard irrigation. We have always taken a proactive approach to best practices and have supported research in farming practices for decades.

Supplemental Water should be the cornerstone of the Paso Robles Groundwater Sustainability Plan. Agricultural and rural water users are totally dependent on groundwater and the choices for these users is to either reduce pumping or find sources of supplemental water or both.

J. Lohr Vineyards and Wines has been working since 2014 to obtain supplemental irrigation water from the Nacimiento pipeline (NPW). Since 2015 we have been working very constructively with the City of Paso Robles to purchase recycled water (RW) from the City. We and other local vineyard owners have formed an LLC, have a State of California approved Mutual Water Company, retained many of the necessary consultants, and the project team is well along with a comprehensive design for the Blended Supplemental Water Project (BSWP). The project entails purchasing RW from Paso Robles and NPW from the Nacimiento Commission and blending and distributing the water through 6 miles of pipeline to areas northeast of Paso Robles and west and north of the Paso Robles airport. This system has the ability to deliver thousands of acre feet of supplemental water to users of the Basin's groundwater which will result in actual reduction in groundwater pumping. This project will have 3 phases:

1. Design, approvals and obtaining commitments to purchase public water for the benefit of the Basin
2. Funding and Construction
3. Providing blended water to offset groundwater pumping and the opportunity for pumpers to purchase in-lieu pumping credits to supplement their water needs.

The design and approval phase of this BSWP is being privately financed through the LLC and can be completed in the next 6 months to a year.

The funding and construction phase will not be able to start prior completion of the first phases of the GSP/SGMA process in which comprehensive landowners pumping allowances and potential cutbacks have been decided in a series of public meetings. Once cutback levels have been established and pumpers understand impacts on their operations, pumpers will be able to assess the need and value of supplemental water and their ability to purchase supplemental water. Commitments by pumpers to buy into the use of supplemental water will determine the funding mechanisms to construct the BSWP Pipeline. Private investors may initiate the funding but ultimately users of groundwater who benefit from the use of supplemental water will have to pay for the BSWP. This can be done without public funding.

I encourage the GSA's to include the Blended Supplemental Water Project as an integral part of the Paso Robles Groundwater Basin's Sustainability Plan. It is vital that the GSP addresses the issues of responsible basin management as well as exploring sources of new supplemental water. Without a balance between these factors and without meaningful options for groundwater users, the threat of litigation looms even larger.

Thank you for your consideration.

Regards,

Jerome J Lohr
Founder J. Lohr Vineyards and Wines

J. LOHR VINEYARDS, INC.
2021 THE ALAMEDA, SUITE 145, SAN JOSE, CA 95126 • 408.984.3355 • F 408.918.2188 • JLOHR.COM

May 23, 2019

Supervisor Peschong

1055 Monterey Street Room D430

San Luis Obispo, Ca 93408

Dear Supervisor Peschong,

I would like to thank you for taking the time to listen to my concerns last night after the Paso Robles Basin Cooperative Committee meeting. As I told you last night, our company is based in Coalinga Ca. but we own 2,680 acres south east of the city of Shandon. We have farmed the property in the past but currently run cattle on the land. We are large Farmers in the Central Valley and have put our efforts into developing our properties in Fresno, Kings, and Kern Counties. It has always been our plan to someday drill a well or two on the Shandon property that we have owned for almost forty years. We have already hired a Geologist to evaluate the property. He has designated several prime locations that water wells might be drilled.

I am writing you to express our strenuous opposition to any GSP that fails to recognize our overlying ground water rights or our right to pump water in the future. We have been good neighbors and good stewards of the land. We have not had a negative effect on the land or contributed to any over draft that may be occurring in that area. I hope that our conservative land practices will not be held against us during the GSP process. We feel that we have a right to access the water that is beneath our property in a thoughtful and sustainable way. Anything less would be an improper taking and would greatly diminish the value of our land. Again I would like to thank you for your time and input.

Sincerely

Craig Finster

William and Doris Land and Energy Co, LLC

June 28, 2019

The Honorable John Peschong
**San Luis Obispo County Supervisor, District 1**
County Government Center
1055 Monterey Street
San Luis Obispo, CA 93408

Chapter 9 Concepts and Policy

I am writing these comments as an interested and involved participant in groundwater issues in the Paso Robles Basin for many years. My comments have formed as a result of my extensive participation in the Paso Robles Basin. I have been retained by J. Lohr Vineyards and Wines as a Water Consultant and I am a Board Member of the Estrella-El Pomar-Creston Water District. However, these comments do not represent an official position of the EPC Water District. My comments are generally consistent with J. Lohr Vineyards and Wines opinions.

It is my understanding that the current Chapter 9 that was presented in April, 2019 at the Cooperative Committee Meetings is under review and likely to undergo substantial changes. Rather than comment on specifics of the current version of Chapter 9, I would like to present the following conceptual framework that addresses significant policy issues that must be resolved before Chapter 9 can move forward with its Management Actions and Projects. I believe these critical policy decisions must be resolved now in order to move forward. Without broad agreement on policy, details of implementation are impossible. These important policy decisions need to be made in open public discussions now and not buried in future regulations.

1. **Flow Meter Program** - It would be difficult to consider any GSP to be a comprehensive plan without a mechanism to measure groundwater production. Metering and reporting groundwater pumping should be the obvious first action of the GSP. Requiring the registration of wells and reporting of groundwater pumping will be an indication of the seriousness of the GSP. We can't manage what we don't measure. Also, any allocation system resulting in reductions in pumping will have to be based on observable numbers.

   The GSP should make metering mandatory and reporting of all wells other than domestic wells. This should be required by the end of 2020. Reporting of all groundwater extraction should be required starting in the calendar year of 2021 and reported early in the calendar year 2022.

   The GSP should develop its own database of wells and collect and maintain well information. Owners should be required to register their well(s) and provide such information as the APN Number, GPS location of the well, well size and depth, owners names and contact information, responsible person's name and contact information, information on the measuring device used and other information as needed. The GSP will need to develop a robust management structure to collect and maintain the Basin's well information as well as to enforce the requirements of the GSP. Communal data such as well information should be maintained in one location and administered uniformly across the Basin.

There should be a significant annual penalty for not registering wells and for not reporting groundwater production.

When an allocation system is implemented by the GSP using a crop load factor, then those landowners who do not report groundwater production to the GSP should be assumed to be using **double** the crop load duty factor. This assigned usage may be used to calculated extraction fees that may be implemented by the GSP and also the extraction penalty fees for those over producing more water than their allocated amount.

2. **No New Plantings** – the GSP must work closely with the County and the County's Land-use authority to ensure that there will be no new plantings.

3. **Base Pumping Fees –** should be implemented immediately or at least when pumping data is available, see item #1 above. The fees should be in the nominal range of $20 to $80 per AF of groundwater produced in any given year. These fees would be used to fund operation of the GSP and could cover such expenditures as Model refinements, Model Runs, hydrological studies, professional consultants, monitoring wells, well monitoring network, and GSP operations.

4. **Projects** – projects are important tools that can help bring the Basin into sustainability. By their very nature, project will take time, therefore projects need to be started sooner rather than later. Raising the Salinas Dam may take a decade or more, so the GSP must actively embrace this project along with other projects that represent real solutions by bringing supplemental water to the Basin, reduce pumping in the basin or enhance groundwater recharge. Viable projects must be endorsed and supported by the GSP. Projects should not be trivialized by relegating them to an Appendix.

   Specific tangible projects should be recognized and included as an integral component of Chapter 9.

   Cutbacks in groundwater pumping should not be considered until projects are implemented or at least started. A GSP that ignores projects that offer real opportunities to reduce groundwater pumping will be marginalized.

   Projects may take the form of private or public projects. Under either circumstance, the GSP will need to endorse the various projects and provide leadership, public support and outreach and the seek the political will to make them be successful.

5. **In-lieu Water Credits Exchange –** The GSP will need to provide provisions for the exchange of in-lieu 'water credits' resulting from the use of supplemental water.

6. **Mandatory Pumping Reductions and an Allocation System Based on County's Crop Type Factor –** pumping cutbacks seem to be a certainty in the future. The GSP will need to develop a system to determine the baseline pumping 'allowances' for groundwater users. These pumping allowances will likely be less than current pumping production and will represent the cutbacks necessary to bring the Basin into sustainability. Pumping allowances should be based on the County's Crop Type Factor and not on historical usage. The County Crop Type Factors are a more equitable way of allocation of water allotments by leveling the playing field rather than historical usage. Historical usage would tend to reward the over users and penalize the frugal users. Historical usage may also present a fundamental inequity between groundwater users.

   The GSP will grant groundwater users an annual allowance for groundwater production and the GSP will need to be able to verify compliance with these allowances in pumping through its groundwater pumping reporting and monitoring program.

7. **Significant Penalties for Over Production –** to meet the sustainability goals that SGMA mandates, pumpers in the Paso Robles Groundwater Basin will have to reduce groundwater pumping. It is the obligation of the GSP to ensure that groundwater users play fairly and operate within the prescribed limits set by the GSP. Whether by omission, indifference, or calculation by groundwater users, the GSP needs to make sure that over production of groundwater is economically unattractive. Chronic over production should not be tolerated. Over production should not be allowed as an on-going method of operation.

   The GSP should institute meaningful penalties for over production of water. Enforcement of groundwater usage rules will be an additional responsibility of the GSP.

   Users will have the choice of reducing pumping, securing supplemental water or face severe penalties.

8. **Basin Managed as Whole –** DWR's Bulletin 118 defines groundwater basins from a hydrological point of view. The Paso Robles Groundwater Basin should be managed as a single basin. All users share the benefits of the Basin and all users should participate in and share the responsibilities of maintaining the health and sustainability of the Basin on an equal basis.

   For consistency and conformity, all data gathering and storage should be in a repository maintained by the GSP. The GSP should also have one methodology for enforcement.

9. **Minimum Threshold Levels, Chapters 8 -** should be based on 2017 levels, using prior year's levels could result in severe, unrealistic and disruptive cut backs.

**10.** **Fallowing –**both temporary and permanent fallowing should be supported by the GSP. The GSP should not acquire land in order to permanently fallow land but rather just buyout the pumping allocations.

Voluntary, temporary fallowing should be encouraged and the GSP should support landowners choosing this path by allowing the land to go fallow without the landowner losing their allowances.

Finally, I am concerned about the autonomy granted to GSA's in the current version of Chapter 9. This could profoundly undermine the structure and decision-making process that the current MOA provides. SGMA requires multiple GSP's within a basin to have cooperating agreements. The current structure presented by Chapter 9 seems to be missing any substantial 'cooperating' language between GSA's. The GSP seems to be leaving all major policy decisions to the future and without providing any sort of supporting organizational structure.

Regards,

Jerry Reaugh

The Nature Conservancy
Protecting nature. Preserving life.

CALIFORNIA WATER | **GROUNDWATER**

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GroundwaterResourceHub.org

July 1, 2019

County Government Center
1055 Monterey Street, Room 206
San Luis Obispo, CA 93408

*Submitted online via:* https://www.slocounty.ca.gov/Departments/Public-Works/Committees-Programs/Sustainable-Groundwater-Management-Act-(SGMA)/Paso-Robles-Groundwater-Basin/GSP-Development.aspx

Re: Chapters 9-11 of the Paso Robles Subbasin Draft GSP

Dear Angela Ruberto,

The Nature Conservancy (TNC) appreciates the opportunity to comment on Chapters 9-11 of the Paso Robles Subbasin Draft Groundwater Sustainability Plan (GSP) being prepared under the Sustainable Groundwater Management Act (SGMA). Please note that we have previously submitted comments dated 15 April 2019 on Chapters 4-8 and Appendix B of the Paso Robles Subbasin Draft GSP.

TNC is a global, nonprofit organization dedicated to conserving the lands and waters on which all life depends. We seek to achieve our mission through science-based planning and implementation of conservation strategies. For decades, we have dedicated resources to establishing diverse partnerships and developing foundational science products for achieving positive outcomes for people and nature in California. TNC was part of a stakeholder group formed by the Water Foundation in early 2014 to develop recommendations for groundwater reform and actively worked to shape and pass SGMA. We believe that the success of SGMA depends on bringing the best available science to the table, engaging all stakeholders in robust dialog, providing strong incentives for beneficial outcomes and rigorous enforcement by the State of California.

Our specific comments related to Chapters 9-11 of the Draft GSP are provided in detail in **Attachment B** and are in reference to the numbered items in **Attachment A. Attachment C** provides a list of the freshwater species located in the Paso Robles Subbasin. **Attachment D** describes six best practices that GSAs and their consultants can apply when using local groundwater data to confirm a connection to groundwater for DWR's Natural Communities Commonly Associated with Groundwater Dataset[2]. **Attachment E** provides an overview of a new, free online tool that allows GSAs to assess changes in groundwater-dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

The Nature Conservancy

# Attachment A

## Considering Nature under SGMA: A Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

| GSP Plan Element* | | GDE Inclusion in GSPs: Identification and Consideration Elements | | Check Box |
|---|---|---|---|---|
| Admin Info | **2.1.5 Notice & Communication** *23 CCR §354.10* | **Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.** | | 1 |
| Planning Framework | **2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8* | **Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.** | | 2 |
| | | **Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.** | | 3 |
| | | **Summary of process for permitting new or replacement wells for the basin, and how the process incorporates protection of GDEs** | | 4 |
| Basin Setting | **2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14* | **Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions? | | 5 |
| | | **Principal aquifers and aquitards:** Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized? | | 6 |
| | | **Basin cross sections:** Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers? | | 7 |
| | **2.2.2 Current & Historical Groundwater Conditions** *23 CCR §354.16* | **Interconnected surface waters:** | | 8 |
| | | Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal). | | 9 |
| | | Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type. | | 10 |
| | | **Basin GDE map included** (as figure in text & submitted as a shapefile on SGMA Portal). | | 11 |
| | | If NC Dataset *was* used: | Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0). | 12 |

| | | | | |
|---|---|---|---|---|
| | | | The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed). | 13 |
| | | | GDEs polygons are consolidated into larger units and named for easier identification throughout GSP. | 14 |
| | | If NC Dataset *was not* used: | Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information. | 15 |
| | | **Description of GDEs included:** | | 16 |
| | | Historical and current groundwater conditions and variability are described in each GDE unit. | | 17 |
| | | Historical and current ecological condition and variability are described in each GDE unit and adequate to describe baseline as of 2015. | | 18 |
| | | Each GDE unit has been characterized as having high, moderate, or low ecological value. | | 19 |
| | | Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0). | | 20 |
| | **2.2.3 Water Budget** *23 CCR §354.18* | Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget. | | 21 |
| | | Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget. | | 22 |
| **Sustainable Management Criteria** | **3.1 Sustainability Goal** *23 CCR §354.24* | **Environmental stakeholders/representatives were consulted.** | | 23 |
| | | Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest. | | 24 |
| | | Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest. | | 25 |
| | **3.2 Measurable Objectives** *23 CCR §354.30* | **Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment, beneficial uses and managed areas.** | | 26 |
| | **3.3 Minimum Thresholds** *23 CCR §354.28* | **Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:** | | 27 |
| | | Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds? | | 28 |
| | | Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters? | | 29 |
| | **3.4 Undesirable Results** *23 CCR §354.26* | **For GDEs, hydrological data are compiled and synthesized for each GDE unit:** | | 30 |
| | | If hydrological data *are available* within/nearby the GDE | Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0). | 31 |
| | | | Baseline period in the hydrologic data is defined. | 32 |
| | | | GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater. | 33 |

| | | | | |
|---|---|---|---|---|
| | | | Cause-and-effect relationships between groundwater changes and GDEs are explored. | 34 |
| | | If hydrological data *are not available* within/nearby the GDE | Data gaps/insufficiencies are described. | 35 |
| | | | Plans to reconcile data gaps in the monitoring network are stated. | 36 |
| | | **For GDEs, biological data are compiled and synthesized for each GDE unit:** | | 37 |
| | | Biological datasets are plotted and provided for each GDE unit, and provide baseline conditions for assessment of trends and variability. | | 38 |
| | | Data gaps/insufficiencies are described. | | 39 |
| | | Plans to reconcile data gaps in the monitoring network are stated. | | 40 |
| | | **Description of potential effects on GDEs, land uses and property interests:** | | 41 |
| | | Cause-and-effect relationships between GDE and groundwater conditions are described. | | 42 |
| | | Impacts to GDEs that are considered to be "significant and unreasonable" are described. | | 43 |
| | | Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported. | | 44 |
| | | Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating). | | 45 |
| | | Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves. | | 46 |
| **Sustainable Management Criteria** | **3.5 Monitoring Network** *23 CCR §354.34* | Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit. | | 47 |
| | | Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network. | | 48 |
| | | Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions. | | 49 |
| **Projects & Mgmt Actions** | **4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44* | Description of how GDEs will benefit from relevant project or management actions. | | 50 |
| | | Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented. | | 51 |

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

# Attachment B

## TNC Evaluation of
## Chapters 9 - 11 of the Paso Robles Subbasin Draft GSP

This attachment summarizes our comments on Chapters 9-11 of the Paso Robles Subbasin Draft GSP. In this section, we refer to our previous comments, dated 15 April 2019, on Chapters 4-8 and Appendix B of the Draft GSP.

**Chapter 9 Management Actions and Projects**
[Checklist Items #50-51]:

- As stated in TNC's previous comments in our previous letter on Chapter 8, Sections 8.4 and 8.9, interconnected surface waters (ISWs) *do* exist in the Paso Robles Subbasin, and thus there is a need to establish sustainable management criteria for ISWs in the basin and minimum thresholds for these ISWs. After identifying these minimum thresholds, **please include ISWs as a specific sustainability indicator to be addressed by management actions and projects as described in Chapter 9**. For the management actions and projects already identified, state how ISWs will be benefited or protected. If ISWs will not be adequately protected by those listed, please include and describe additional management actions and projects.
- Page 1 states that the most important sustainability indicator used in development of the management actions and projects is the stabilization of groundwater levels. However, an important data gap already recognized is the lack of publicly available groundwater elevation data in the Alluvial Aquifer. As discussed in TNC's previous comments on Chapter 8, Section 8.4, a scientifically robust methodology must be proposed for establishing the initial minimum thresholds for the Alluvial Aquifer. **In light of the data gap regarding Alluvial Aquifer groundwater data, please be more specific in stating how GDEs and ISWs would benefit from management actions and projects, and how actions and projects will be evaluated to assess whether adverse impacts to GDEs will be mitigated or prevented**:
  - Well Interference Mitigation Program (Page 8): This management action could be expanded to benefit GDEs and ISWs by choosing wells for the rotation or well spacing program that are screened in the alluvial aquifer and located in close proximity to rivers and streams, thus spreading out potential drawdown effects.
  - Promote Stormwater Capture (Page 10): Please describe how recharge from unallocated storm flows will be evaluated to assess benefits to GDEs and ISWs.
  - Mandatory Pumping Reductions (Page 14): Please discuss the data gap for wells screened in the alluvial aquifer and the data gap for vertical gradient between the alluvial aquifer and Paso Robles Formation, since most wells are screened in the Paso Robles aquifer. When these data gaps are resolved, it will become clearer how mandatory pumping reductions could also benefit GDEs and ISWs.

- o Agricultural Land and Pumping Allowance Retirement (Page 21): Retirement of agricultural land may include land near rivers and streams, which could impact GDEs and ISWs by decreasing surface runoff and flow, or by decreasing recharge from deep percolation of irrigation water. Conversely, retirement of agricultural land would increase local groundwater levels in the pumped aquifers. The potential benefit or impact of agricultural retirement on GDEs needs to be evaluated.
- o Conceptual Projects (Pages 27-56): Most of the conceptual projects involve in-lieu recharge for the direct use of recycled wastewater. Thus, the recycled water would replace pumped groundwater. Since these conceptual projects are location-specific, please highlight the benefits of these conceptual projects on specific mapped GDEs and ISWs.
- o Substitute Project 4 (Page 73): The capture of 10 cfs of Salinas River flood flows for recharge in a basin should include investigation to see if there is an effect on any instream species, GDEs or wetland habitats located on the Salinas River or hydraulically connected to the river. How this diversion will affect instream flow requirements that are currently being met by dam releases should also be described. **Please state the impact of the diversion of 10 cfs Salinas River flow on freshwater species in the Paso Robles Subbasin (see Attachment C).**

- For more case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

Section 10.2.1.1 Improve Monitoring Network (p. 10-11)
(Checklist item #47-49]:

- **Please further describe the expansion of the monitoring program and specify what types of monitoring will be done to identify impacts to GDEs. Be more specific in describing wells and screened intervals that represent the water levels of both the Alluvial Aquifer and Paso Robles Formation Aquifer.**

Section 10.2.5 Evaluating Interconnected Surface Water (p. 14-15)
[Checklist Item #48]:

- The text states "*As discussed in Chapter 5, the consensus among local groundwater experts is that there is no interconnection between surface water and groundwater in the Subbasin*." (p. 14) This sentence is contradictory to the ISW mapping conducted in Chapter 5 (Figure 5-17). Per TNC's previous comments on Chapter 5, interconnected surface waters *do* exist in the Paso Robles Subbasin (Figure 5-17). Depletions of surface water were also estimated in Section 5.5.1. Therefore, sustainable management criteria and an associated monitoring network for interconnected surface water and groundwater *do* need to be developed in the GSP, as stated in our comments on Chapter 9 above, and depletion of ISWs should be monitored. The Draft GSP states that an initial hydrogeologic investigation will be conducted. **Please provide sufficient detail for the investigation and monitoring program including stream gauges, screened intervals and**

**aquifers of the shallow wells and frequency of monitoring, in order to describe monitoring of both the extent of ISWs and the quantity of surface water depletions from ISWs.**

- Wells should be selected that are at varying distances from the river to capture vertical gradients from one aquifer to the other and to determine the ISWs and monitor any depletion in ISWs. As stated in TNC's previous comments in our previous letter on Chapter 7, **there is a need to enhance monitoring of stream flow and vertical groundwater gradients by installing more stream gauges and clustered/nested wells near streams, rivers or wetlands.** Ideally, co-locating stream gauges with clustered wells that can monitor groundwater levels in both the Alluvial and Paso Robles Formation aquifers would enhance understanding about where ISWs exist in the basin and whether pumping is causing depletions of surface water or impacts on beneficial users of surface water and groundwater.
- As stated in TNC's previous comments in our previous letter on Chapter 7, the Nature Conservancy recommends identifying beneficial users of surface water, which include environmental users. This is a critical step, as it is impossible to define "significant and unreasonable adverse impacts" without knowing *what* is being impacted, nor is possible to monitor ISWs in a way that can "identify adverse impacts on beneficial uses of surface water". For your convenience, we've provided a list of freshwater species within the boundary of the Paso Robles basin in **Attachment C**. **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users as a current data gap and explain how this data gap will be filled.**

<u>Chapter 11 Notice and Communications (including separate Communications and Engagement Plan)</u>
[Checklist Item #1]:

- Section 3.0 of the Communications and Engagement Plan (Page 6) lists aquatic ecosystems as a beneficial groundwater use. However, no details are given as to the types and locations of environmental uses and habitats supported, or the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the subbasin. **To identify environmental users, please refer to the following**:
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
    - The list of freshwater species located in the Paso Robles Subbasin in **Attachment C** of this letter. Please take particular note of the species with protected status.
    - Lands that are protected as open space preserves, habitat reserves, wildlife refuges, etc. or other lands protected in perpetuity and supported by groundwater or ISWs should be identified and acknowledged.

# Attachment C

## Freshwater Species Located in the Paso Robles 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 Paso Robles 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 Paso Robles groundwater 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 | Legally Protected Status | | |
|---|---|---|---|---|
| | | Federal | State | Other |
| **BIRD** | | | | |
| Actitis macularius | Spotted Sandpiper | | | |
| Aechmophorus clarkii | Clark's Grebe | | | |
| Aechmophorus occidentalis | Western Grebe | | | |
| Agelaius tricolor | Tricolored Blackbird | Bird of Conservation Concern | SSC | BSSC - First priority |
| Aix sponsa | Wood Duck | | | |
| Anas americana | American Wigeon | | | |
| Anas clypeata | Northern Shoveler | | | |
| Anas crecca | Green-winged Teal | | | |
| Anas cyanoptera | Cinnamon 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 | | | |
| Aythya collaris | Ring-necked Duck | | | |
| Aythya valisineria | Canvasback | | SSC | |
| Bucephala albeola | Bufflehead | | | |
| Bucephala clangula | Common Goldeneye | | | |
| Butorides virescens | Green Heron | | | |

[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

| | | | | |
|---|---|---|---|---|
| Calidris mauri | Western Sandpiper | | | |
| Chen caerulescens | Snow Goose | | | |
| Chen rossii | Ross's Goose | | | |
| Chroicocephalus philadelphia | Bonaparte's Gull | | | |
| Cistothorus palustris palustris | Marsh Wren | | | |
| Egretta thula | Snowy Egret | | | |
| Fulica americana | American Coot | | | |
| Gallinago delicata | Wilson's Snipe | | | |
| Gallinula chloropus | Common Moorhen | | | |
| Geothlypis trichas trichas | Common Yellowthroat | | | |
| Haliaeetus leucocephalus | Bald Eagle | Bird of Conservation Concern | Endangered | |
| Icteria virens | Yellow-breasted Chat | | SSC | BSSC - Third priority |
| Lophodytes cucullatus | Hooded Merganser | | | |
| Megaceryle alcyon | Belted Kingfisher | | | |
| Mergus merganser | Common Merganser | | | |
| Mergus serrator | Red-breasted Merganser | | | |
| Numenius americanus | Long-billed Curlew | | | |
| Nycticorax nycticorax | Black-crowned Night-Heron | | | |
| Oxyura jamaicensis | Ruddy Duck | | | |
| Pandion haliaetus | Osprey | | Watch list | |
| Pelecanus erythrorhynchos | American White Pelican | | SSC | BSSC - First priority |
| Phalacrocorax auritus | Double-crested Cormorant | | | |
| Podiceps nigricollis | Eared Grebe | | | |
| Podilymbus podiceps | Pied-billed Grebe | | | |
| Porzana carolina | Sora | | | |
| Rallus limicola | Virginia Rail | | | |
| Recurvirostra americana | American Avocet | | | |
| Riparia riparia | Bank Swallow | | Threatened | |
| Setophaga petechia | Yellow Warbler | | | BSSC - Second priority |
| Tachycineta bicolor | Tree Swallow | | | |
| Tringa melanoleuca | Greater Yellowlegs | | | |
| Tringa solitaria | Solitary Sandpiper | | | |
| Vireo bellii | Bell's Vireo | | | |
| Vireo bellii pusillus | Least Bell's Vireo | Endangered | Endangered | |

| | | | | |
|---|---|---|---|---|
| Xanthocephalus xanthocephalus | Yellow-headed Blackbird | | SSC | BSSC - Third priority |
| **CRUSTACEAN** | | | | |
| Branchinecta lynchi | Vernal Pool Fairy Shrimp | Threatened | SSC | IUCN - Vulnerable |
| Cyprididae fam. | Cyprididae fam. | | | |
| Hyalella spp. | Hyalella spp. | | | |
| Pacifastacus spp. | Pacifastacus spp. | | | |
| **FISH** | | | | |
| Oncorhynchus mykiss - SCCC | South Central California coast steelhead | Threatened | SSC | Vulnerable - Moyle 2013 |
| Catostomus occidentalis mnioltiltus | Monterey sucker | | | Least Concern - Moyle 2013 |
| Catostomus occidentalis occidentalis | Sacramento sucker | | | Least Concern - Moyle 2013 |
| Cottus gulosus | Riffle sculpin | | SSC | Near-Threatened - Moyle 2013 |
| Entosphenus tridentata ssp. 1 | Pacific lamprey | | SSC | Near-Threatened - Moyle 2013 |
| Lavinia exilicauda exilicauda | Sacramento hitch | | SSC | Near-Threatened - Moyle 2013 |
| Lavinia exilicauda harengeus | Monterey hitch | | SSC | Vulnerable - Moyle 2013 |
| Oncorhynchus mykiss irideus | Coastal rainbow trout | | | Least Concern - Moyle 2013 |
| Orthodon microlepidotus | Sacramento blackfish | | | Least Concern - Moyle 2013 |
| Ptychocheilus grandis | Sacramento pikeminnow | | | Least Concern - Moyle 2013 |
| Oncorhynchus mykiss - SCCC | South Central California coast steelhead | Threatened | SSC | Vulnerable - Moyle 2013 |
| **HERP** | | | | |
| Actinemys marmorata marmorata | Western Pond Turtle | | SSC | ARSSC |

| | | | | |
|---|---|---|---|---|
| Ambystoma californiense californiense | California Tiger Salamander | Threatened | Threatened | ARSSC |
| Anaxyrus boreas boreas | Boreal Toad | | | |
| Anaxyrus boreas halophilus | California Toad | | | ARSSC |
| Anaxyrus californicus | Arroyo Toad | Endangered | SSC | ARSSC |
| Pseudacris cadaverina | California Treefrog | | | ARSSC |
| Pseudacris hypochondriaca | Baja California Treefrog | | | |
| Pseudacris regilla | Northern Pacific Chorus Frog | | | |
| Rana boylii | Foothill Yellow-legged Frog | Under Review in the Candidate or Petition Process | SSC | ARSSC |
| Rana draytonii | California Red-legged Frog | Threatened | SSC | ARSSC |
| Spea hammondii | Western Spadefoot | Under Review in the Candidate or Petition Process | SSC | ARSSC |
| Taricha torosa | Coast Range Newt | | SSC | ARSSC |
| Thamnophis hammondii hammondii | Two-striped Gartersnake | | SSC | ARSSC |
| Thamnophis sirtalis infernalis | California Red-sided Gartersnake | | | Not on any status lists |
| Thamnophis sirtalis sirtalis | Common Gartersnake | | | |
| **INSECT & OTHER INVERT** | | | | |
| Acentrella spp. | Acentrella spp. | | | |
| Agabus spp. | Agabus spp. | | | |
| Ambrysus mormon | Creeping water bug | | | Not on any status lists |
| Antocha spp. | Antocha spp. | | | |
| Argia emma | Emma's Dancer | | | |
| Argia lugens | Sooty Dancer | | | |
| Argia spp. | Argia spp. | | | |
| Argia vivida | Vivid Dancer | | | |
| Baetidae fam. | Baetidae fam. | | | |
| Baetis spp. | Baetis spp. | | | |
| Berosus punctatissimus | Water scavenger beetles | | | Not on any status lists |
| Berosus spp. | Berosus spp. | | | |
| Callibaetis spp. | Callibaetis spp. | | | |

| | | | | |
|---|---|---|---|---|
| Centroptilum spp. | Centroptilum spp. | | | |
| Chaetarthria bicolor | Water Scavenger Beetles | | | Not on any status lists |
| Chaetarthria ochra | Water Scavenger Beetles | | | Not on any status lists |
| Cheumatopsyche spp. | Cheumatopsyche spp. | | | |
| Chironomidae fam. | Chironomidae fam. | | | |
| Chironomus spp. | Chironomus spp. | | | |
| Cladotanytarsus spp. | Cladotanytarsus spp. | | | |
| Coenagrionidae fam. | Coenagrionidae fam. | | | |
| Corisella spp. | Corisella spp. | | | |
| Corixidae fam. | Corixidae fam. | | | |
| Cricotopus spp. | Cricotopus spp. | | | |
| Dicrotendipes spp. | Dicrotendipes spp. | | | |
| Dytiscidae fam. | Dytiscidae fam. | | | |
| Enallagma civile | Familiar Bluet | | | |
| Enallagma cyathigerum | Common blue damselfly | | | Not on any status lists |
| Enochrus carinatus | Water Scavenger Beetles | | | Not on any status lists |
| Enochrus cristatus | Water Scavenger Beetles | | | Not on any status lists |
| Enochrus piceus | Water Scavenger Beetles | | | Not on any status lists |
| Enochrus pygmaeus | Water Scavenger Beetles | | | Not on any status lists |
| Enochrus spp. | Enochrus spp. | | | |
| Ephemerella spp. | Ephemerella spp. | | | |
| Ephemerellidae fam. | Ephemerellidae fam. | | | |
| Ephydridae fam. | Ephydridae fam. | | | |
| Eukiefferiella spp. | Eukiefferiella spp. | | | |
| Fallceon quilleri | A Mayfly | | | |
| Graptocorixa spp. | Graptocorixa spp. | | | |
| Gyrinus spp. | Gyrinus spp. | | | |
| Helichus spp. | Helichus spp. | | | |
| Helicopsyche spp. | Helicopsyche spp. | | | |
| Hetaerina americana | American Rubyspot | | | |
| Hydrochus spp. | Hydrochus spp. | | | |
| Hydrophilidae fam. | Hydrophilidae fam. | | | |
| Hydroporus spp. | Hydroporus spp. | | | |
| Hydropsyche spp. | Hydropsyche spp. | | | |
| Hydropsychidae fam. | Hydropsychidae fam. | | | |
| Hydroptila spp. | Hydroptila spp. | | | |
| Hydryphantidae fam. | Hydryphantidae fam. | | | |
| Ischnura spp. | Ischnura spp. | | | |
| Laccobius ellipticus | Water scavenger beetles | | | Not on any status lists |
| Laccobius spp. | Laccobius spp. | | | |

| | | | | |
|---|---|---|---|---|
| Laccophilus maculosus | Dingy Diver | | | Not on any status lists |
| Lepidostoma spp. | Lepidostoma spp. | | | |
| Leptoceridae fam. | Leptoceridae fam. | | | |
| Libellula saturata | Flame Skimmer | | | |
| Limnophyes spp. | Limnophyes spp. | | | |
| Liodessus obscurellus | Predacious Diving Beetle | | | Not on any status lists |
| Macromia magnifica | Western River Cruiser | | | |
| Malenka spp. | Malenka spp. | | | |
| Microcylloepus spp. | Microcylloepus spp. | | | |
| Microtendipes spp. | Microtendipes spp. | | | |
| Nectopsyche spp. | Nectopsyche spp. | | | |
| Ochthebius spp. | Ochthebius spp. | | | |
| Ophiogomphus bison | Bison Snaketail | | | |
| Optioservus spp. | Optioservus spp. | | | |
| Oreodytes spp. | Oreodytes spp. | | | |
| Paracloeodes minutus | A Small Minnow Mayfly | | | |
| Paracymus spp. | Paracymus spp. | | | |
| Paratanytarsus spp. | Paratanytarsus spp. | | | |
| Peltodytes spp. | Peltodytes spp. | | | |
| Phaenopsectra spp. | Phaenopsectra spp. | | | |
| Plathemis lydia | Common Whitetail | | | |
| Postelichus spp. | Postelichus spp. | | | |
| Procladius spp. | Procladius spp. | | | |
| Pseudochironomus spp. | Pseudochironomus spp. | | | |
| Psychodidae fam. | Psychodidae fam. | | | |
| Rheotanytarsus spp. | Rheotanytarsus spp. | | | |
| Rhyacophila spp. | Rhyacophila spp. | | | |
| Sigara mckinstryi | A Water Boatman | | | Not on any status lists |
| Sigara spp. | Sigara spp. | | | |
| Simuliidae fam. | Simuliidae fam. | | | |
| Simulium spp. | Simulium spp. | | | |
| Sperchon spp. | Sperchon spp. | | | |
| Sperchontidae fam. | Sperchontidae fam. | | | |
| Stictotarsus spp. | Stictotarsus spp. | | | |
| Sweltsa spp. | Sweltsa spp. | | | |
| Tanytarsus spp. | Tanytarsus spp. | | | |
| Tipulidae fam. | Tipulidae fam. | | | |
| Tramea lacerata | Black Saddlebags | | | |
| Tricorythodes spp. | Tricorythodes spp. | | | |
| Wormaldia spp. | Wormaldia spp. | | | |
| **MAMMAL** | | | | |
| Castor canadensis | American Beaver | | | Not on any status lists |

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|---|---|---|---|---|
| **MOLLUSK** | | | | |
| Gyraulus spp. | Gyraulus spp. | | | |
| Lymnaea spp. | Lymnaea spp. | | | |
| Menetus opercularis | Button Sprite | | | CS |
| Physa spp. | Physa spp. | | | |
| Pisidium spp. | Pisidium spp. | | | |
| Planorbidae fam. | Planorbidae fam. | | | |
| **PLANT** | | | | |
| Alnus rhombifolia | White Alder | | | |
| Ammannia coccinea | Scarlet Ammannia | | | |
| Anemopsis californica | Yerba Mansa | | | |
| Azolla filiculoides | Mosquito Fern | | | |
| Baccharis salicina | Willow Baccharis | | | Not on any status lists |
| Bolboschoenus maritimus paludosus | Saltmarsh Bulrush | | | Not on any status lists |
| Callitriche heterophylla bolanderi | Large Water-starwort | | | |
| Callitriche marginata | Winged Water-starwort | | | |
| Castilleja minor minor | Alkali Indian-paintbrush | | | |
| Castilleja minor spiralis | Large-flower Annual Indian-paintbrush | | | |
| Cotula coronopifolia | Brass Buttons | | | |
| Crassula aquatica | Water Pygmyweed | | | |
| Crypsis vaginiflora | African Prickle Grass | | | |
| Cyperus erythrorhizos | Red-root Flatsedge | | | |
| Eleocharis macrostachya | Creeping Spikerush | | | |
| Eleocharis parishii | Parish's Spikerush | | | |
| Epilobium campestre | Smooth Boisduvalia | | | Not on any status lists |
| Epilobium cleistogamum | Cleistogamous Spike-primrose | | | |
| Eryngium spinosepalum | Spiny Sepaled Coyote-thistle | | SSC | CRPR - 1B.2 |
| Eryngium vaseyi vaseyi | Vasey's Coyote-thistle | | | Not on any status lists |
| Euthamia occidentalis | Western Fragrant Goldenrod | | | |
| Helenium puberulum | Rosilla | | | |
| Hydrocotyle verticillata verticillata | Whorled Marsh-pennywort | | | |
| Juncus dubius | Mariposa Rush | | | |
| Juncus effusus effusus | Common Bog Rush | | | |
| Juncus luciensis | Santa Lucia Dwarf Rush | | SSC | CRPR - 1B.2 |
| Juncus macrophyllus | Longleaf Rush | | | |
| Juncus xiphioides | Iris-leaf Rush | | | |

| | | | | |
|---|---|---|---|---|
| Limosella aquatica | Northern Mudwort | | | |
| Marsilea vestita vestita | Hairy Waterclover | | | Not on any status lists |
| Mimulus guttatus | Common Large Monkeyflower | | | |
| Mimulus latidens | Broad-tooth Monkeyflower | | | |
| Mimetanthe pilosa | Snouted Monkey Flower | | | Not on any status lists |
| Montia fontana fontana | Fountain Miner's-lettuce | | | |
| Navarretia prostrata | Prostrate Navarretia | | SSC | CRPR - 1B.1 |
| Paspalum distichum | Joint Paspalum | | | |
| Persicaria lapathifolia | Common Knotweed | | | Not on any status lists |
| Persicaria maculosa | Spotted Ladysthumb | | | Not on any status lists |
| Phacelia distans | Common Phacelia | | | |
| Pilularia americana | Pillwort | | | |
| Plagiobothrys acanthocarpus | Adobe Popcorn-flower | | | |
| Plantago elongata elongata | Slender Plantain | | | |
| Platanus racemosa | California Sycamore | | | |
| Psilocarphus brevissimus brevissimus | Dwarf Woolly-heads | | | |
| Ranunculus aquatilis diffusus | Whitewater Crowfoot | | | Not on any status lists |
| Rorippa curvisiliqua curvisiliqua | Curve-pod Yellowcress | | | |
| Rumex conglomeratus | Green Dock | | | |
| Rumex salicifolius salicifolius | Willow Dock | | | |
| Salix exigua exigua | Narrowleaf Willow | | | |
| Salix laevigata | Polished Willow | | | |
| Salix lasiolepis lasiolepis | Arroyo Willow | | | |
| Schoenoplectus americanus | Three-square Bulrush | | | |
| Schoenoplectus pungens longispicatus | Three-square Bulrush | | | |
| Schoenoplectus pungens pungens | Common Threesquare | | | |
| Schoenoplectus saximontanus | Rocky Mountain Bulrush | | | |
| Typha domingensis | Southern Cattail | | | |
| Typha latifolia | Broadleaf Cattail | | | |
| Veronica anagallis-aquatica | Water Speedwell | | | |

| | | | | |
|---|---|---|---|---|
| Veronica catenata | Chain Speedwell | | | Not on any status lists |

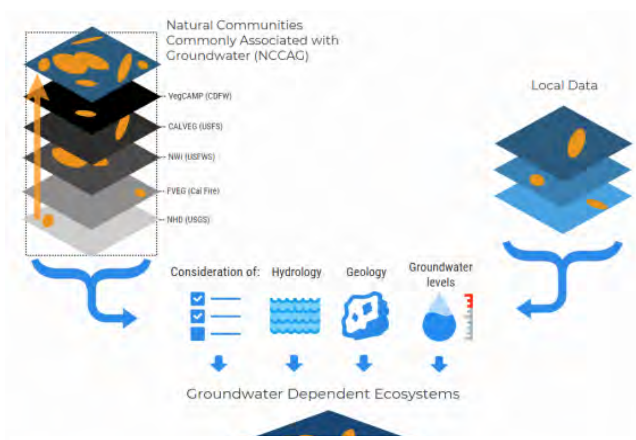
Notes:
ARSSC = At-Risk Species of Special Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
CS = Currently Stable
SSC = Species of Special Concern

# Attachment D

## 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[4] 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)[5]. This document highlights six best practices for using local groundwater data to confirm whether a potential GDE identified in the NC dataset is supported to groundwater.

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[6]. 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[7] on the Groundwater Resource Hub, a website dedicated to GDEs[8].

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[4] *NC Dataset Online Viewer is available at: https://gis.water.ca.gov/app/NCDatasetViewer/*
[5] 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
[6] *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*
[7] "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/
[8] *The Groundwater Resource Hub is available at: www.GroundwaterResourceHub.org*

## 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 determine 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 (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 groundwater dependent ecosystems (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*.

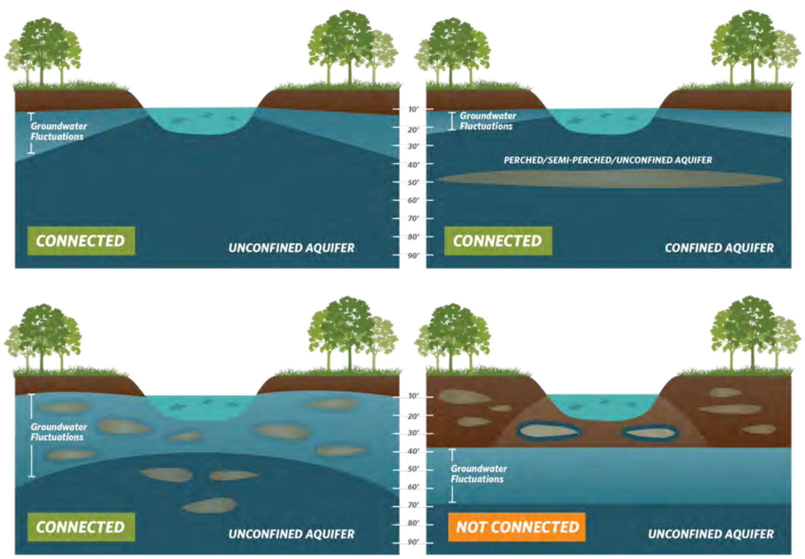



**Figure 2. Confirming whether an ecosystem is connected to groundwater in a principal aquifer. Top: (Left)** Depth to Groundwater in the aquifer under the ecosystem is an unconfined aquifer with depth to groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(Right)** 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: (Left)** Depth to groundwater fluctuations are seasonally and interannually large, however, clay layers in the near surface prolong the ecosystem's connection to groundwater. **(Right)** 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 surface water feature. These areas 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[9] 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[10] 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[11] 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] 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[12]. 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).

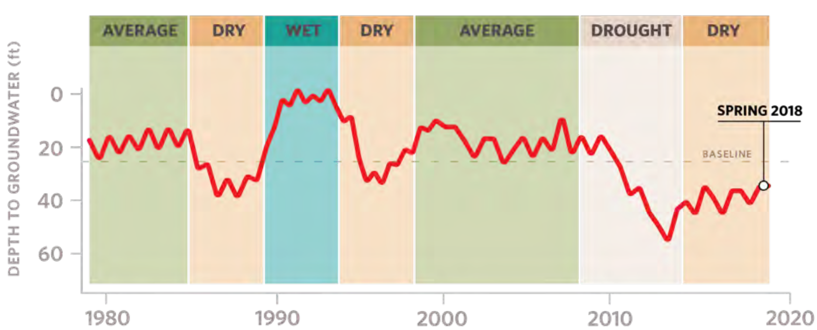



**Figure 3. Example seasonality and interannual variability in depth to groundwater over time.** Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future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

[9] 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

[10] *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)]*

[11] 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 - link in footnote above).

[12] *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 NC polygons does not preclude the possibility that a connection to groundwater exists. 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[13], 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).

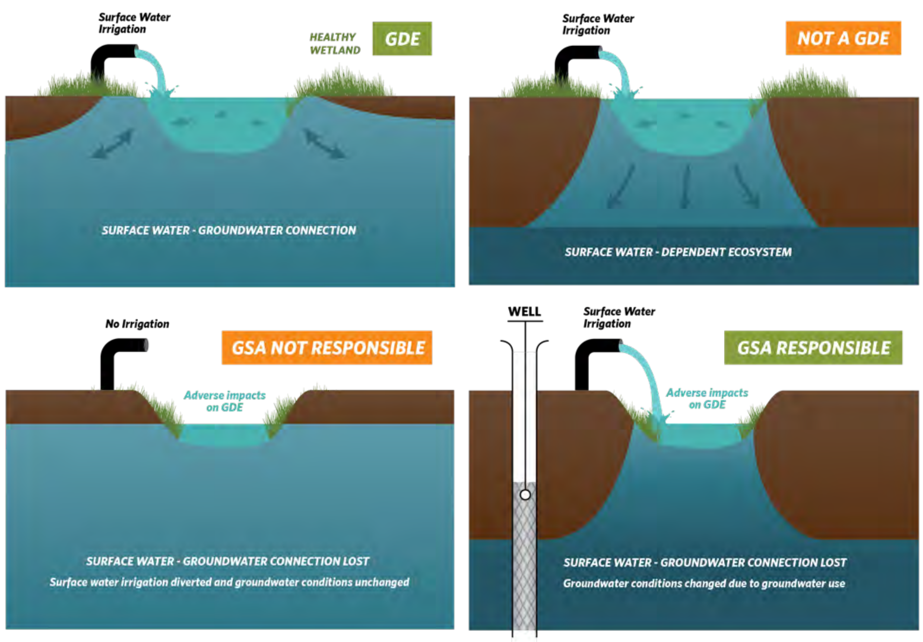



**Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left)** Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent.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

[13] *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.

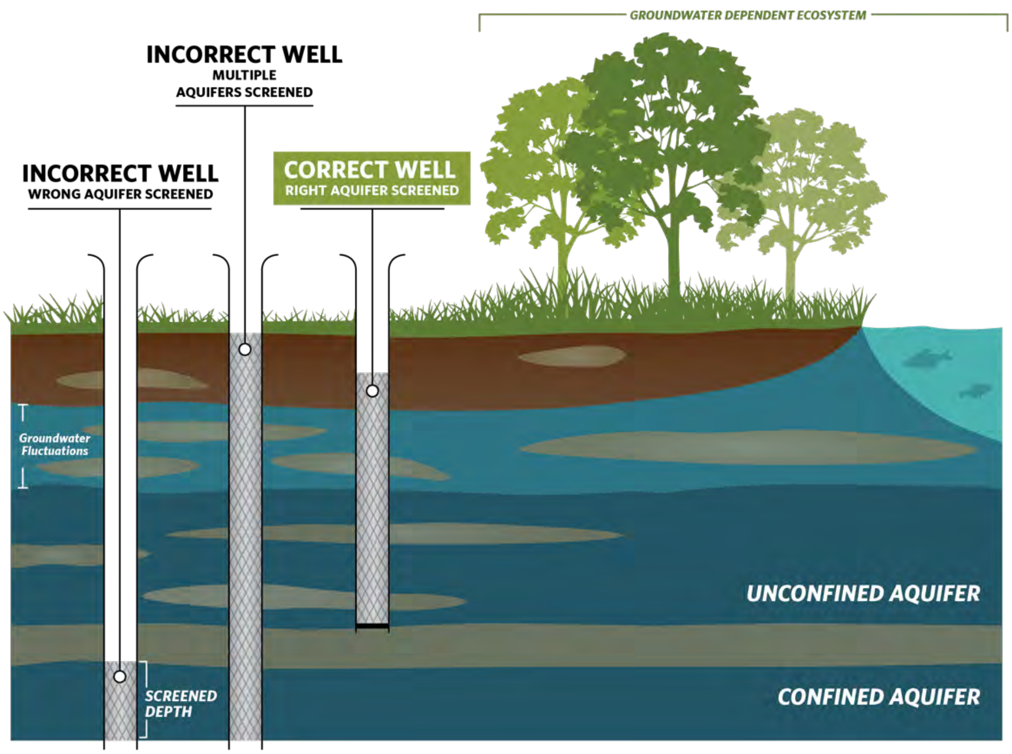



**Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.**

## 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 streams and wetlands depressions because it assumes the land surface is constant across the landscape and depth-to-groundwater is constant below these low-lying areas (Figure 6 - left panel). A more accurate approach is to interpolate **groundwater elevations** at monitoring wells to get an estimate of groundwater elevation across the landscape. This layer can then be subtracted from the land surface elevation from a Digital Elevation Model (DEM)[14] to estimate depth to groundwater contours across the landscape (Figure 6 – right panel; 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.

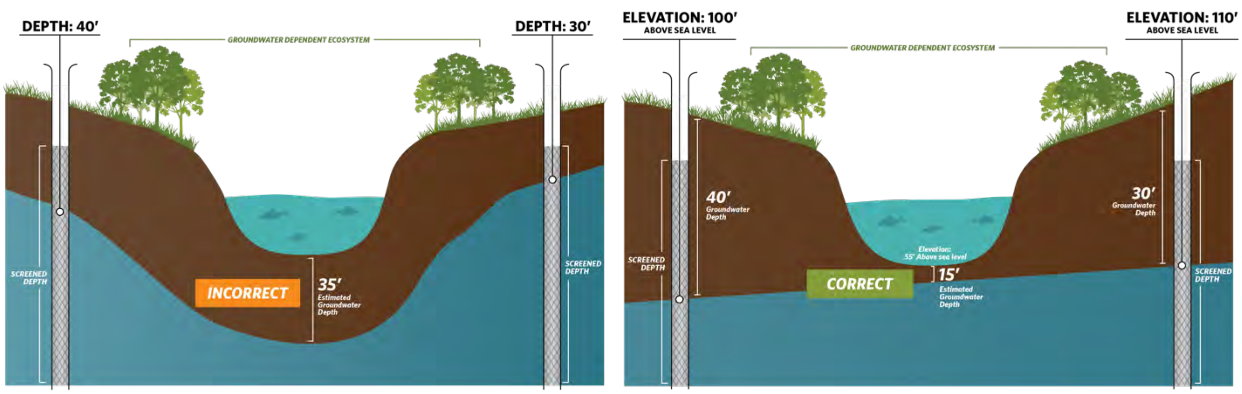



**Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (Left)** Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(Right)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

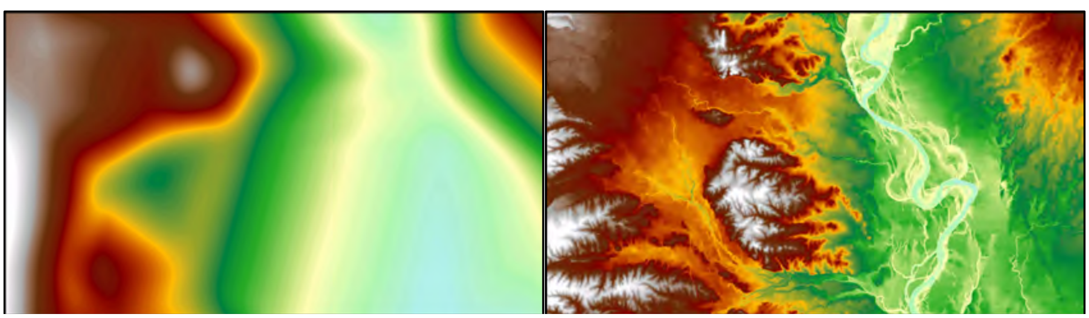


**Figure 7. Depth to Groundwater Contours in Northern California. (Left)** Contours were interpolated using depth to groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface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

[14] 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://viewer.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 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.

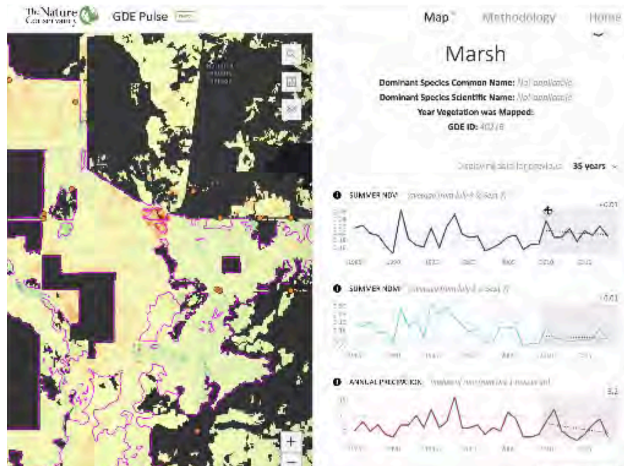
# Attachment E

## GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

The Nature Conservancy
Protecting nature. Preserving life.

Visit https://gde.codefornature.org/




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[15]. The following datasets are included:

**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[16]. 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.

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[15] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[16] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

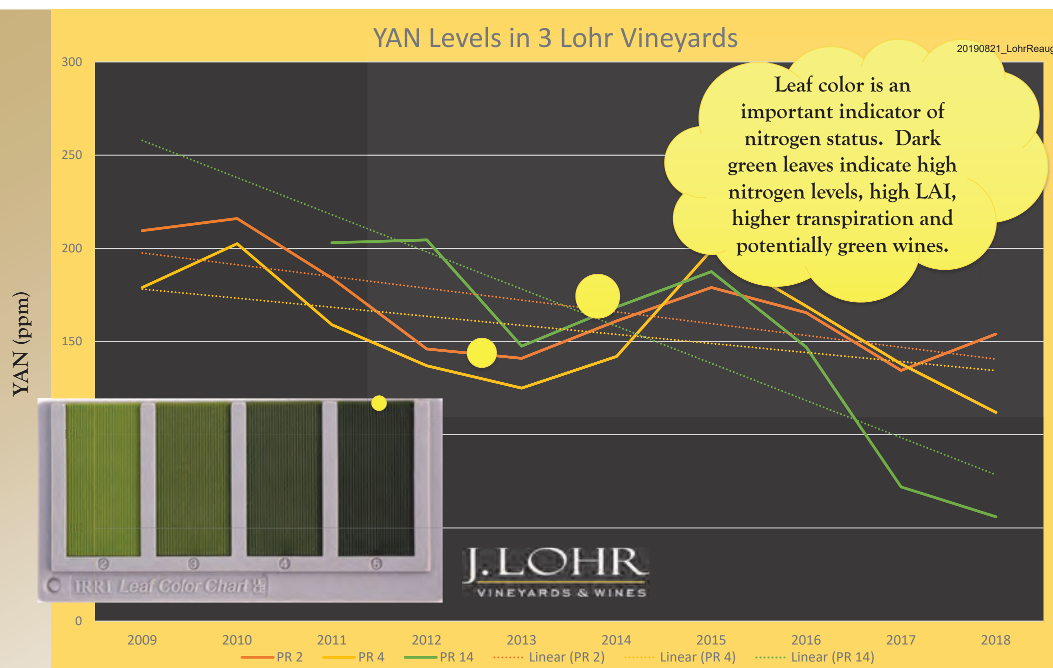
# Steve Lohr

## CEO, J. Lohr Vineyards & Wines



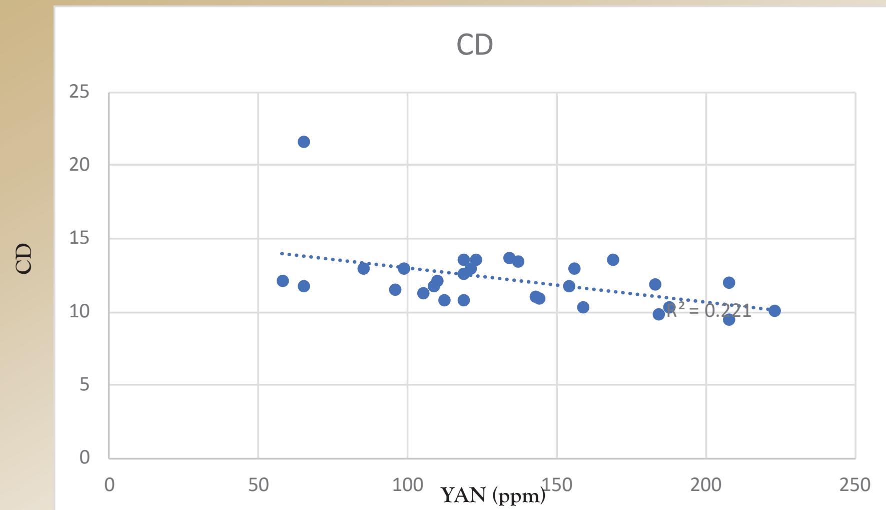
# Grower Strategies to Increase Color and Optimize Yields





# Survey of 2018 Cabernet Must YAN vs CD From Estrella & San Miguel sub-AVA's






J. LOHR VINEYARDS & WINES

# Summary Comments



- Vineyard derived Cabernet color (CD) is a focus (quality over quantity)
  - Likely CD Enhancers –
    - Pressure bomb guided irrigation (higher stress set points)
    - Lower nitrogen status (lower than current recommended levels?)
    - Appropriate fruit zone light environment
  - CD Diminishers
    - Elevated juice YAN's (increase in green flavors)
    - High density canopies (increase in green flavors)
    - Well watered vines

J. LOHR VINEYARDS & WINES




## Jerry Reaugh

Water Consultant, J. Lohr Vineyards & Wines


J. LOHR VINEYARDS & WINES

# *Supplemental Water*

## Essential Element to Achieve Sustainability

## BVB Blended Water Project

J. LOHR
VINEYARDS & WINES

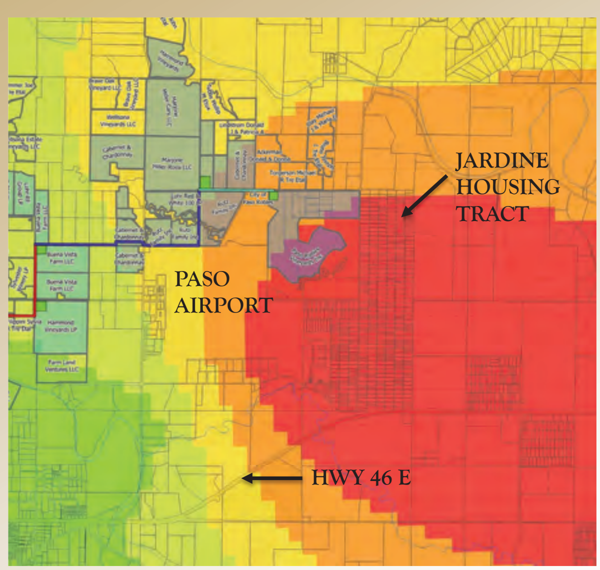


## There is Available Water Today!

- Paso Robles Treated Water
  - 1,000 - 1,500 AFY maybe more
- NACI Water
  - 4,000 - 6,000 AFY maybe more
- Blended Water to reduce salts

J. LOHR
VINEYARDS & WINES






J. LOHR
VINEYARDS & WINES

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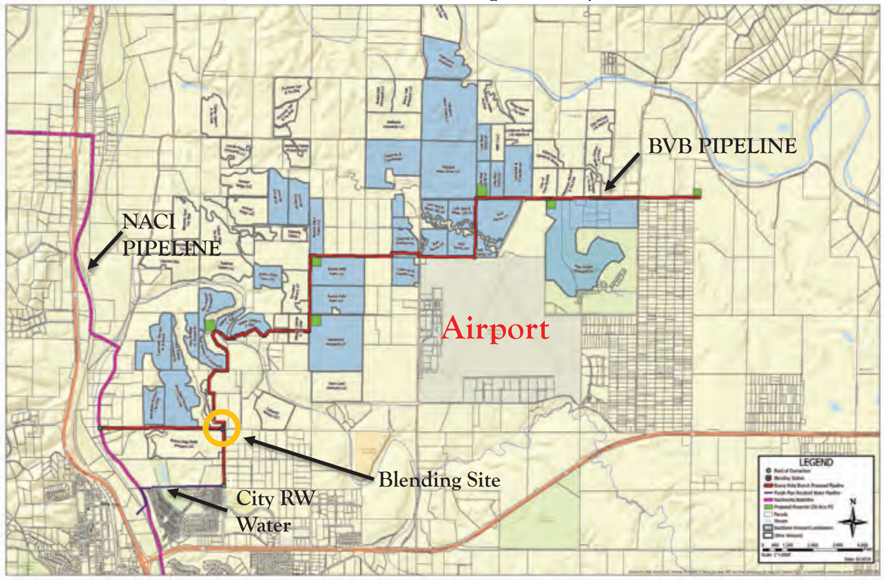
## BVB Blended Water Pipeline System

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# Amazing Benefits of Supplemental Water

- Red & Orange Zone pumpers greatly reduce groundwater pumping by 50% to 80%
- Red & Orange Zone pumpers irrigate with Supplemental Water
- Supplemental Water a hedge against negative impact on pumpers and to the local economy
- The entire Basin benefits, costs will be shared, all pumpers will remain under GSP Allocation

J. LOHR VINEYARDS & WINES

20190821_LohrReaugh

# Help us build this Project!

We can do this together.

J. LOHR VINEYARDS & WINES

# Jerry Lohr

## Founder and CFO, J. Lohr Vineyards & Wines

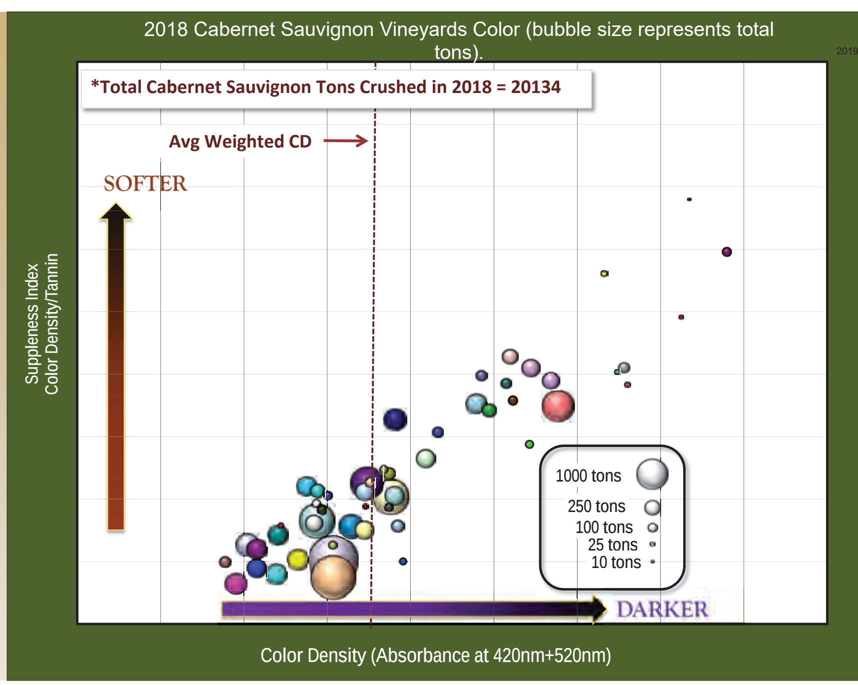
J. LOHR VINEYARDS & WINES



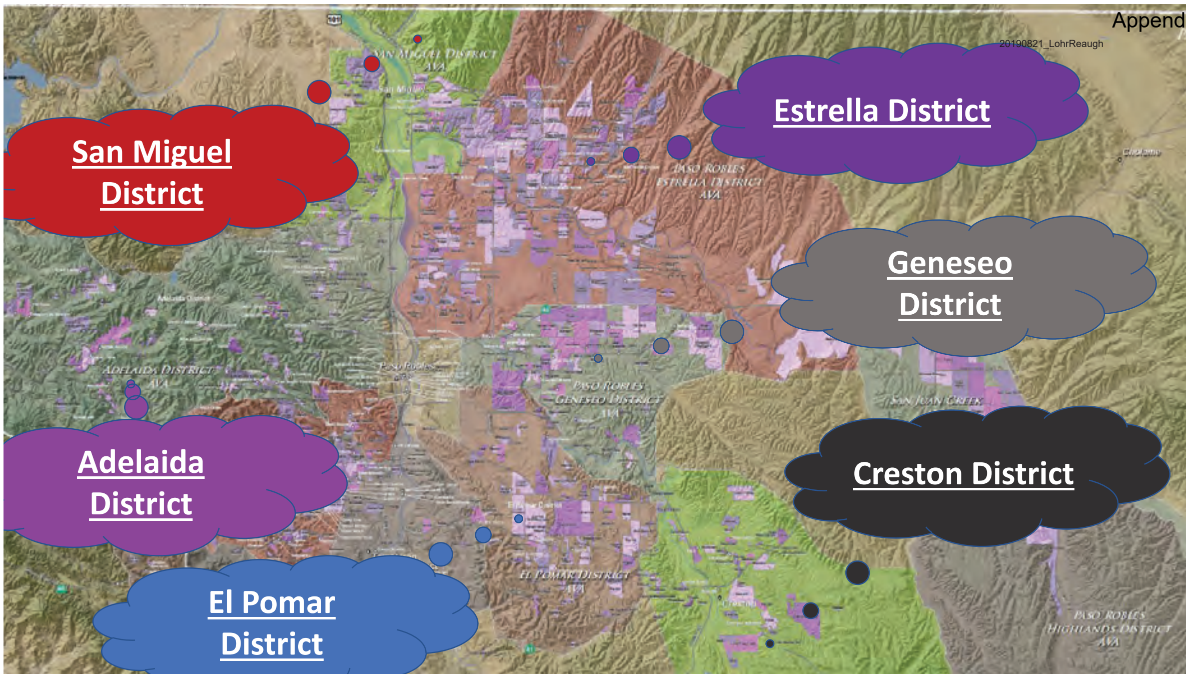
# J. Lohr Grower Seminar – July 10, 2019

J. LOHR VINEYARDS & WINES






J. LOHR VINEYARDS & WINES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San Miguel District
Estrella District
Geneseo District
Adelaida District
Creston District
El Pomar District
San Miguel District AVA
Paso Robles Estrella District AVA
Adelaida District AVA
Paso Robles Geneseo District AVA
San Juan Creek
El Pomar District AVA
Paso Robles Highlands District AVA

# Paso Basin Aerial Groundwater Mapping Pilot Study

**Paso Basin to Utilize Electromagnetic Measuring Technique to Map Local Aquifer System**

The San Luis Obispo County Flood Control and Water Conservation District will conduct a survey of our local aquifer systems using the Aerial Electromagnetic (AEM) method starting mid-October 2019 in the Paso Robles Basin. This will provide a more complete picture of the groundwater basin for more informed decisions with our water in the future.

The surveying method uses instruments mounted on a helicopter, which will fly approximately 497 line-miles in a strategic pattern approximately 100 feet above the ground to collect measurements down to 1,000 feet below the land surface. The survey will send and receive signals that maps out the subsurface geology and groundwater locations in the Paso Robles Basin. The 3 to 5 day study will take place in two areas of the Paso Robles Basin, on the east side of the valley, and the area near Highway 46 and Highway 229 by Creston and Whitley Gardens.

## Informational Presentations

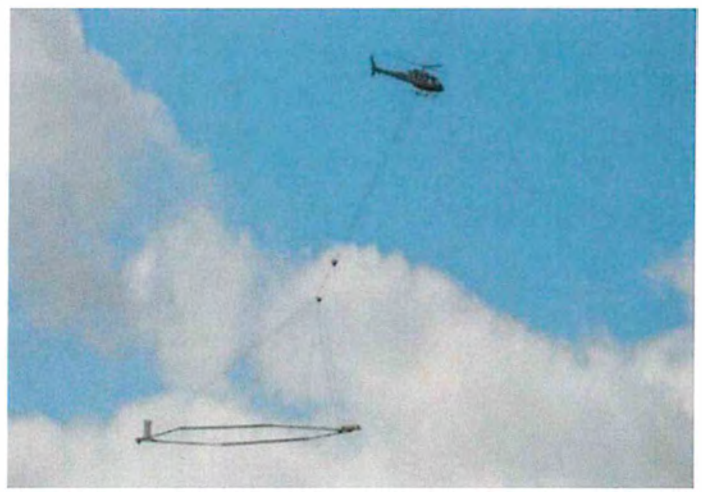
**8/13/2019, 9:00 AM:** Board of Supervisors Meeting

**8/21/2019, 4:00 PM:** Paso Basin Cooperative Committee

**8/21/2019, 7:00 PM:** Creston Advisory Body

**8/28/2019, 7:00 PM**: San Miguel Advisory Council

**9/4/2019, 7:00 PM:** Shandon Advisory Committee



## Current Status and Next Steps

- In August and September 2019, the District is providing an informational overview on the Pilot Study, meeting dates and times are listed above.
- The flight path will avoid metallic structures (causes interference in the data set); hence the flight areas will avoid urban areas, vineyards, powerlines, etc.
- This project does not pose a risk to health or safety.
- The very low magnetic field is comparable to standing 1 foot away from your toaster for a few seconds, as the helicopter flies over.
- Survey results will be presented in 2020. Stay tuned!

***To get involved please visit: SLOCounty.ca.gov/PW/PasoBasinPilotStudy***

September 27, 2019

**San Luis Obispo County Paso Robles Groundwater Subbasin GSA**
County Government Center
1055 Monterey Street
San Luis Obispo, CA 93408

Dear SLO County Paso Robles Subbasin GSA,

Re: Comments from the Estrella-El Pomar-Creston Water District regarding the Paso Robles Groundwater Subbasin GSP

In 2017, the Estrella El Pomar-Creston Water District (EPCWD) was established under the California Water Code (Water Code §§ 34000 et seq) to contribute to the solutions needed to address the Paso Robles Groundwater Subbasin overdraft. EPCWD's primary purpose was to become a Groundwater Sustainability Agency (GSA) and participate in the Groundwater Sustainability Plan (GSP) process.

Not only were the members of the EPCWD committed to help bring the Paso Subbasin into Sustainability, they also committed themselves, through self-assessment, to pay for a major portion of the GSP development. The graphic below shows EPC's commitment to pay for 29% of the costs.

## Paso Basin MOA Terms

| GSA | Recommended Voting / Cost Share | |
|---|---|---|
| | Current GSAs/ Without EPCWD | With EPCWD/ Upon County Action |
| County of SLO | 61% | 32% |
| City of Paso Robles | 15% | 15% |
| Shandon-San Juan Water District | 20% | 20% |
| San Miguel CSD | 3% | 3% |
| Heritage Ranch CSD | 1% | 1% |
| *If formed: Estrella-El Pomar-Creston Water District* | -- | 29% |
| TOTAL | **100%** | **100%** |

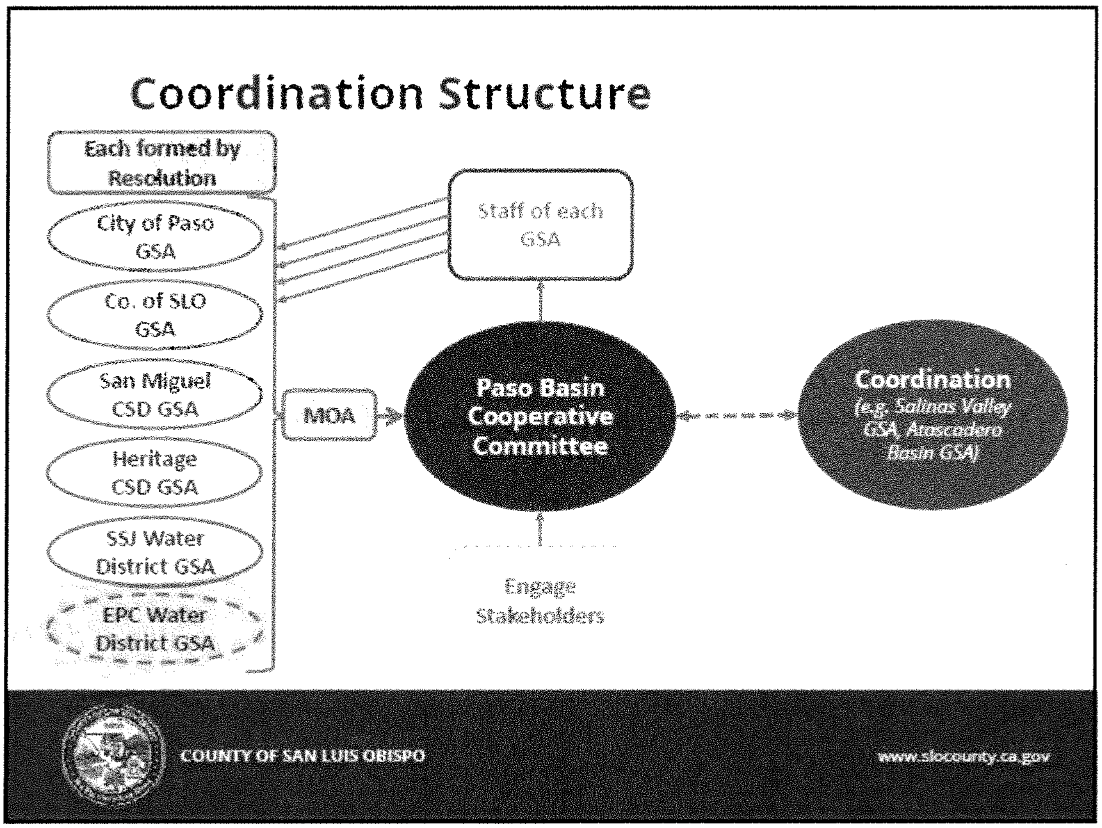
Minimum Voting Threshold: 67% Affirmative

** Exceptions requiring unanimous vote*

- *Recommendation to amend MOA*
- *Recommendation to adopt GSP*

COUNTY OF SAN LUIS OBISPO www.slocounty.ca.gov

In September 2016, a group of "Eligible Entities" started meeting to determine how the Paso Robles Groundwater Subbasin was going to prepare the GSP required by the State of California. It was well understood at the time that the EPCWD was forming with the intention of becoming a GSA. For eight months the "Eligible Entities" met on a regular basis. Dana Merrill and Jerry Reaugh, representing the forming EPCWD, were invited to these meetings, participated extensively in these meetings and helped craft the document now known as the Memorandum of Agreement (MOA). The graphic below, from a SLO County presentation, is indicative of EPCWD's inclusion in the process.




EPCWD intends to document in this letter the intentional exclusion of our Water District from the GSP process and the complete failure of the County GSA to satisfy the outreach and dialogue requirement with agricultural pumpers. It is important to address our concerns now as the GSP moves towards adoption and implementation Real choices and actions will be made in the implementation process and it is essential that those who will be asked to sacrifice the most will be included in the decision-making process.

The GSP as proposed in its final draft is a vague document which postpones any meaningful decisions and actions to the future. The organizational structure necessary for the future implementation of the GSP is absent and the various GSAs are granted much autonomy. Some agricultural interests are represented by the Shandon/San Juan Water District which accounts for 34% of agricultural pumping in the Subbasin[1]. What about the other 66% of agricultural pumping in the Subbasin?

**Agricultural pumpers must have a "seat at the table".**

The Estrella-El Pomar-Creston Water District is concerned about the systematic, intentional and perhaps predatory exclusion by County officials of a legitimate and consequential stakeholder group from the GSP Process. EPCWD represents 44% of agricultural pumping in the Subbasin and is the largest group of pumpers.

Attachment A chronicles the long history of EPCWD's commitment to the GSP and the County's support for EPCWD being included as a GSA. Initially, the County Board of Supervisors was supportive of our work and even encouraged the district formation. The EPC was listed as a party to the MOA. County Supervisors voted at least three times (5-0) in support of EPC becoming as GSA. After considerable effort and expense (over $200,000 of our members funds) EPCWD was formed in December, 2017 as a California Water District. EPCWD met all the requirements of the MOA to become a GSA.

Up until 2018, our EPCWD efforts aligned with San Luis Obispo County established policies. The County said repeatedly, "The County acknowledges that landowners and/or registered voters may prefer to form an eligible entity to ensure their representation on a GSA. The County supports landowner driven eligible entity formation processes".[2] Yet in the final hours, the San Luis Obispo Board of Supervisors reversed direction and voted to deny EPCWD GSA status and consequently excluded the largest group of groundwater pumpers from the GSP Process.

Since formation, EPCWD has operated as a water district with our members successfully self-accessing ourselves by passing two Prop 218 votes, raising over $300,000. These funds have allowed EPCWD to hire, in cooperation with the Shandon-San Juan Water District, a hydrogeologist who has participated in and contributed to the GSP technical committee. Both Districts have also jointly funded an economic study that will evaluate the potential economic impact the GSP might have on our local economy and community. EPCWD has remained engaged in the GSP process but with limited opportunity to influence decision making.

Attachment B reveals the extent of County official's effort to target and exclude the EPCWD. These terms were imposed on EPCWD as conditions for EPC's continued existence as a water district. It is clear that this was a predatory, overt and systematic effort to deny EPCWD and its members the right to represent their interests in determining how the Paso Robles Groundwater Subbasin is going to be managed for decades to come. It appears the EPC's misconduct was to try to be a GSA and to work alongside the rest of Subbasin stakeholders to bring the Subbasin into sustainability.

Even more egregious than EPCWD's exclusion, the County GSA has neglected all agricultural pumpers within their purview. The County GSA has failed its obligation to actively seek the involvement of agricultural stakeholders. This is contrary to the intentions of the SGMA Law and particularly troublesome when considering that the so-called County "white-areas", which includes the EPCWD area, represent 66% of groundwater pumpers. The County has never held an outreach meeting with the irrigated agriculture community. Not a single meeting or open forum for free discussion among irrigated

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[1] Agricultural pumping accounts for 90% of all groundwater pumping in the Subbasin, GSP Chapter 6, Table 6-5

[2] SLO County SGMA Strategy, revised March 7,2017, Policy Statement 3b. Membership and Participation on Governing Boards, 2nd bullet point

agricultural stakeholders and public officials has been held by our GSA. A 3-minute speaking time slot during "public comment periods" at Cooperative Committee Meetings does not constitute outreach. County officials have never attended a single EPCWD meeting. One of the cornerstones of SGMA is stakeholder involvement and the necessity of an inclusionary process.

In their own words, the County says, "the County advocates for fair and equitable representation in the decision making process".[3] "Fair and equitable representation could be accomplished in a number of ways, such as through inclusion of appointed seats on a GSA Board for certain beneficial user interests … or through a robust public process and formation of representative advisory committees, and should be negotiated by the eligible entities in each basin.".[4] When an advisory position representing irrigated agriculture was proposed, County officials opposed.

We have not been given one meeting in which the County GSA has met with the Ag Community, no committees, no open forum or dialogue, and no advisory position. The irrigated Ag Community in the County's GSA has been ignored.

EPCWD believes that the County Flood Control District operating as one of the Paso Robles Groundwater Subbasin's GSAs, has been derelict in their obligation to engage the irrigated Ag Community and make sure that the irrigated agriculture community interests have been addressed.

EPCWD feels that those who are going to be affected the most must be included in the process.

**Agricultural pumpers must have a "seat at the table".**

Regards,

Dana Merrill
President
Estrella-El-Pomar-Creston Water District

[3] SLO County SGMA Strategy, revised March 7,2017, Policy Statement 3b. Membership and Participation on Governing Boards, 3rd bullet point

[4] SLO County SGMA Strategy, revised March 7,2017, Policy Statement 3b. Membership and Participation on Governing Boards, 4th bullet point

# Attachment A

## Chronology:

- **Spring 2016** – Landowners in the Shandon/San Juan Area start organizing to form their own opt-in, Water District with the intention of being a GSA.

- **August 2016** –SLO County forms "Paso Basin Eligible Entities GSA Meetings". This group includes all agencies that might want to become a GSA. This group included City of Paso Robles, SLO County, Heritage Ranch, San Miguel CSD, Atascadero Mutual Water Company, Templeton CSD, Monterey County, and the proposed Shandon San Juan WD and along with other interested parties.

- **September 2016** – the emerging Estrella-EL Pomar-Creston Water District is invited to join the Paso Basin Eligible Entities GSA Meetings.

- **October 2016** – LAFCO approves the formation of the Shandon/San Juan Water District, SSJ WD. This Water District is a voluntary, opt-in, California Water District.

- **October 2016 through May 2017** – the Paso Basin Eligible Entities GSA Meetings continues to meet with participation of both of the proposed WD's. The MOA, Memorandum of Agreement, is drafted and finalized after considerable work and many revisions. Members from both Water Districts participate extensively in the drafting and re-drafting of the proposed MOA.

- **March 7, 2017** – SLO County updates its SGMA Strategy Document which recognizes both SSJWD and EPCWD as potential participants in the MOA. Quote from SLO County proceedings, "the County supports landowner driven eligible entity formation processes".

- **April 2017** – LAFCO approves the formation of Estrella-EL Pomar-Creston Water District (EPCWD). This Water District is a voluntary, opt-in, California Water District. The vote was 5-2 in favor.

- **May 16, 2017** – SLO County Board of Supervisors votes 5 to 0 to become a GSA. Supervisor Compton was part of this vote. Language in their resolution includes several references to EPC becoming a Water District and the County relinquishing GSA control over EPCWD's lands.

- **May, 29 2017** – The Basin MOA, Memorandum of Agreement, is finalized. The MOA forms a "Cooperative Committee" that will be responsible for creating a single GSP for the Paso Robles Groundwater Basin. It has five members: City of Paso, SLO County, Shandon/San Juan Water District, San Miguel CSD, Heritage Ranch CSD. The EPC Water District is not initially part of the MOA as it is not yet a Water District or a GSA. The MOA includes detailed provisions that will allow EPCWD to join the MOA once EPCWD becomes a GSA. For EPCWD to become a GSA, the EPCWD must be formed as a Water District by December 31, 2017 and SLO County Supervisors will have to vote to relinquish their authority over the lands that are in the EPCWD. This passes the Board of Supervisors by a vote of 5-0.

- **June 2017** – The proposed Shandon/San Juan Water District becomes a California Water District and applies successfully to DWR to become a GSA before the DWR deadline of June 30, 2017.

- **July & August 2017** – The five eligible agencies approve and sign the MOA including the County of San Luis Obispo.

- **October 18, 2017** – The Cooperative Committee holds its first meeting.

- **December 8, 2017** – EPCWD completes its district formation process and LAFCO files the Certificate of Completion. This formation meets the requirements established by the MOA.

- **January 2018** – EPCWD applies to the State DWR to become a GSA. The application is denied by DWR until SLO County relinquishes control.

- **March 6, 2018** – SLO County Supervisors votes 3 to 2 to **NOT** relinquish GSA authority, thus denying EPCWD GSA status and reversing months of understanding and support for EPCWD to become a GSA. Supervisor Compton, as a LAFCO Commissioner, voted to approve formation of EPCWD whose primary purpose was to become a GSA. Compton then reversed her position and voted against EPCWD becoming a GSA.

- **January through December 2018** – EPC Water District conducts normal water district activities including numerous Board Meetings, holding joint Board Meetings with the Shandon/San Juan Water District, signing a Cooperation Agreement with the Shandon/San Juan Water District, partnering with the S/SJ WD to hire a hydrogeologist as a consultant, and most significantly funds the District with Prop 218 assessments of over $200,000. The 2019 Prop 218 Assessment of Members has also been completed raising an additional $100,000.

- **November 15, 2018** – LAFCO holds an extensive hearing to review EPCWD's status and to determine if EPCWD has met its Conditions of Approval. EPCWD presents numerous documents and public testimony in support of EPCWD's successfully meeting LAFCO's Condition of Approval. LAFCO Staff also supported the Conditions of Approval had been met. Several LAFCO Commissioners expressed their belief that EPCWD has not met its Condition of Approval and that EPC WD should be dissolved. A further Hearing was scheduled.

- **Winter, 2018/2019** – EPCWD attorneys and LAFCO Attorney have several meetings, communications and negotiations. LAFCO demands that EPCWD submit to very restrictive terms, otherwise LAFCO will dissolve the Water District. These terms are presented in Appendix A.

- **February 21, 2019** – LAFCO holds its second Hearing. Several Commissioners wanted the Water District dissolved. EPCWD acquiesced to the new conditions imposed by LAFCO. LAFCO voted 4-3 to approve EPCWD continuing as a Water District.

# Attachment B

**Replacement Language to Condition 11**

1. The EPCWD shall be a district as allowed under the California Water District Law Code (Water Code §§ 34000 et seq.) and as determined by and subject to LAFCO's approval (Resolution 2017-02).
2. The LAFCO approval does not grant to EPCWD any additional power or authority beyond the law.
3. The EPCWD shall not become a Groundwater Sustainability Agency (GSA) as provided for in the Sustainable Groundwater Management Act ("SGMA", Water Code §§ 10720 et seq.) prior to the approval by the State Department of Water Resources ("DWR") of the Groundwater Sustainability Plan ("GSP") or January 31, 2022, whichever is earlier.
4. The EPCWD shall not become a party to the Memorandum of Agreement ("MOA") entered into by the GSAs within the Paso Robles Groundwater Basin in September 2017 prior to the approval by the DWR of the GSP or January 31, 2022, whichever is earlier.
5. The EPCWD shall not become a member of the Paso Basin Cooperative Committee established under the current MOA.
6. The District shall comply with SGMA and the subsequent GSP as implemented by the existing GSA with authority in its service area.

VMI
VITICULTURAL MANAGEMENT INC.

Paso Robles Groundwater Cooperative Committee

September 26, 2019

Dear Committee Members:

A great thank you is in order to the Paso Robles Subbasin representatives and other GSA's for the tremendous amount of work that has been put in to drafting the GSA. Creston Valley Vineyards has been a local SIP Certified grower in this community for over 20 years and active member in the Estrella-El Pomar-Creston Water District (EPC WD). As a SIP Certified vineyard, water conservation is of the utmost importance. Pumping reports are submitted annually and succession plans are made for future use. Along with the rest of the Agriculture community, we find it is the responsibility of all groundwater users in the basin to help eliminate the overdraft and ensure long-term groundwater sustainability. The purpose of this letter is to suggest possible improvements to the GSP that will increase its effectiveness, increase the likelihood that the Department of Water Resources will approve the GSP, and reduce the risk of a future groundwater adjudication. Thank you in advance for reading through the following comments and suggestions.

1. As a whole, the GSP is unclear as to what exactly the GSAs will tangibly do to ensure the elimination of the current overdraft in the Paso Robles Basin. This not only risks the health of the basin, but it increases the chances that the California Department of Water Resources will not approve the GSP. The GSP needs to clearly state what and how the GSAs will act.

2. A hallmark of SGMA is the call for including all stakeholders in the decision-making process. The County GSA, however, did not hold any outreach meetings with the Ag Community. Since the EPC WD represents 44% of the agriculture based pumped water, there should be more active involvement in developing the GSP. Successfully reducing the Ag pumping to benefit the groundwater basin will have to include the understanding and support of the Ag Community.

3. Groundwater pumping allocations, monitoring, and enforcement need to be clearly planned out. The implementation process will be doomed to failure if those who must sacrifice are not included in the decision to cutback pumping. Water use should be measured by meters to ensure accuracy. Violations must be enforced through both civil orders and penalties.

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5. The risk of growth in *de minimis* groundwater users needs to be fully addressed. The GSP notes that the current number of *de minimis* users is significant and that their growth could warrant regulation in the future, but it does not say how it will ensure that the growth will not eat into the rights of other existing users. Perhaps a cap should be placed on the total number of *de minimis* users, requiring that any growth is acquired voluntarily from others.

P.O. Box 2030 Paso Robles, CA 93447 P 805.238.3496 F 805.238.3498 www.vmi-inc.com

VMI
VITICULTURAL MANAGEMENT INC.

In closing, it is our hope here to help better develop the drafted GSP so that all parties involved may have appropriate representation. If there are any questions or points that need clarifying, we would be more than happy to continue this dialogue. All of your efforts are greatly appreciated.

Sincerely,

Carter Collins
*General Manager*
*Creston Valley Vineyards*

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VMI
VITICULTURAL MANAGEMENT INC.

Paso Robles Groundwater Cooperative Committee

September 26, 2019

Dear Committee Members:

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Carter Collins
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*Paso Robles Vineyards, Inc.*

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VMI
VITICULTURAL MANAGEMENT INC.

Paso Robles Groundwater Cooperative Committee

September 26, 2019

Dear Committee Members:

A great thank you is in order to the Paso Robles Subbasin representatives and other GSA's for the tremendous amount of work that has been put in to drafting the GSA. Collins Vineyard has been a local SIP Certified grower in this community for over 20 years and active member in the Estrella-El Pomar-Creston Water District (EPC WD). As a SIP Certified vineyard, water conservation is of the utmost importance. Pumping reports are submitted annually and succession plans are made for future use. Along with the rest of the Agriculture community, we find it is the responsibility of all groundwater users in the basin to help eliminate the overdraft and ensure long-term groundwater sustainability. The purpose of this letter is to suggest possible improvements to the GSP that will increase its effectiveness, increase the likelihood that the Department of Water Resources will approve the GSP, and reduce the risk of a future groundwater adjudication. Thank you in advance for reading through the following comments and suggestions.

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Carter Collins
*General Manager*
*Collins Vineyard Inc.*

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September 26, 2019

**Paso Robles Groundwater Sub-basin Cooperative Committee**
**San Luis Obispo County Paso Robles Groundwater Sub-basin GSA**
1055 Montery Street
San Luis Obispo, CA, 93408

Hello SLO County GSA

Re: Comments to the Paso Robles Groundwater Sub-basin GSP

On behalf of the Independent Grape Growers of the Paso Robles Area(IGGPRA), with almost 200 wine grape growers, wineries and business associates, I appreciate the opportunity to make some comments for the final version of the Paso Robles Groundwater Sub-basin GSP.

## Introduction

In 2001, IGGPRA was formed by a group of wine grape growers to help small to medium size vineyard owners understand how to plant and cultivate high quality grapes for sale to the wineries. At the time, there were about 60 wineries in the area, while there are now over 300. Today, the Association is dedicated to the advancement of superior grape growing in the Paso Robles Viticultural Area. Through our 8 Seminars per year, marketplace listing service and other critical services, we are able to provide our members with important grape growing methods, best practices and updates on how to most effectively use the water resources we have available.
IGGPRA is NOT a political organization and we do not entertain speakers with political affiliations or agendas. However, our wine grape growers and wineries will be strongly affected by any decisions made about the restrictions on groundwater use. WE ONLY ASK THAT THE AG COMMUNITY BE ADEQUATELY REPRESENTED IN ANY COMMITTEE MEETING AND DECISIONS. So far, that does not appear to be the case
With thousands of planted acres, our growers have a large stake in the economic impact of any decisions made.

## Comments on the GSP

1. With an approx.. 14,000 Acre feet per year of over draft, there is no clear picture of what the GSP plans to do about it. The Paso Robles Blended Water Project is an example of how a local community is trying to reduce the over draft, but with no involvement or support from the County.
2. There are other “real” projects that could be implemented in the area, but we have heard nothing from the GSP on proposed solutions. The County remains silent.
3. The County’s so called “white area” accounts for 66% of agricultural pumping. This significant group of groundwater pumpers have many issues that need to be addressed

by the GSP. HOW WILL THESE ISSUES BE HEARD, IF THERE IS NO AG REPRESENTATION??!!

4. The GSP, so far, appears to be full of conjecture, concepts and very few concrete plans for sustainability. Every year, groundwater levels will continue to decline, so "pushing the ball down the road" is not going to solve the problem

## Suggested/Needed Actions

A. First and foremost, there needs to be Agricultural representatives "at the table" of decision making. Ie. People who understand Ag, wine grape growing and the economic effects they have on the community
B. The GSP must have specific and actionable plans for use of:
    a. Available local water resources – Nacimiento allocation, Blended Water Project
    b. Accessing State Water Project resources to recharge the aquifer
    c. Reasonable, economically viable, water conservation requirements
C. Provide clear direction on how well water pumping will be monitored -- either by metering, crop type/acreage or formula.
D. The GSP needs to have timeframes for each action that will be taken. Keeping water stakeholders in limbo for too long could well cause a major exodus from the area and affect the overall economy.

I trust my points of concern and suggestions have been clear. The Ag community just wants to be part of the GSP process and decision making. Adding our Voice will only help the GSA make more informed decisions and represent a broader part of the community.

Thank you for this opportunity to submit comments.

Best Regards
Joe Irick
President
Independent Grape Growers of the Paso Robles Area
A 501c3 non profit organization
[redacted]

Comments on Paso Robles Basin GSP 9/26/19

Dana Merrill, Personal comments

[redacted]

The GSP process has a number of structural deficiencies which put agricultural landowners at a severe disadvantage that is disproportionate to their needs and use of groundwater. Economically viable agricultural is by necessity in the Paso Robles Basin “irrigated”; dryland agriculture cannot produce sufficient economic return. Irrigated lands can and often do generate significant income to owners, operators, cities and government entities. Pumping cutbacks will impact that income without sound strategies.

The GSP in process is to heavily dependent on cuts to agricultural pumpers and barely mentions projects for supplemental water. This despite the fact that property owners have paid to reserve rights to State Water for many years, have had rights to Lake Nacimiento water which to date has been allocated by the County to urban entities nearly exclusively and while other projects such as raising the San Luis Reservoir on the upper Salinas River have been mentioned, little in the way of progress has been made to actually take action to obtain its water. The newest positive development comes from private efforts by landowners interacting with the City of Paso Robles to utilize its recycled water, which may include blending with Nacimiento water that will further extend the supply as well as mitigate quality issues with the source if used as in lieu agricultural pumping. It has been frustrating to see no County Water Resources efforts to get projects going and even more frustrating to see some of our Boards of Supervisors actually seek to shut down efforts to form water districts, who have pledged funding as well, to take on the job.

At this point the GSP may be within months of being completed, subject to be approved by the four GSAs and submitted to the State. Whether it is sufficiently robust to be approved is anyone’s guess at this point and the SGMA law is so new, there is no historical standard of actual approval. Reading through hundreds of pages it is clear that there is much work to do in future years even with approval. A few that come to mind :

1. Increase the number of observation and monitoring wells: A number of the wells listed are very shallow by today’s standards and are unlikely to be viable and still being used a decade from now. Dedicated, smaller diameter wells used only for monitoring and not commercial pumping has been mentioned for years by County Water Resources, yet none to my knowledge have ever been drilled. Follow up on areas with data gap, many of us have worked to help sign up production wells that could contribute data without delay.

2. Subareas are poorly understood and undefined generally. Just where are the boundaries if it may be that pumping limits are to be imposed that are not equal across the entire basin?

3. Political decisions have impacted pumping. The original emergency ordinance dating back to 2012 introduced government action as a major force in the process. In the intervening years, times when the ordinance lapsed saw significant new irrigated lands developed by landowners

fearful that it was the last chance to do so. This essentially set aside supply and demand forces for irrigate crop development and made reacting to government policy the main motivator

4. The GSP has had no economic analysis component which would examine what our economy could pay for supplemental water and could help establish where the cost becomes simply higher than what economic return is generated. The economic impact extends far beyond the specific irrigators' interests as many other industries ranging from equipment sales to tourism to property and sales taxes will be impacted by pumping cutbacks. Cutbacks may have to be part of the resolution but their impact should be quantified economically.

5. The future must have more inclusion of those stakeholders left out of the process thus far. That includes most of the irrigated agricultural community. There was not one meeting held in the County GSA for the benefit of its landowners or irrigators. Other required meetings of the multiple GSAs and the comment period at the beginning of County supervisor meetings were judged adequate. This approach leaves out those impacted the most and calls into question how successful a GSP can be if the majority of the pumpers had no role in the process. It also leaves out significant expertise in water related matters that our world class agriculturists would bring to the table.

6. A word must be said about irrational fear of conspiracies by many in charge of the process. Ranging from fear of water export (which is banned by regulation and the GSP law itself in the Paso Robles Basin) has hurt chances for a positive, collaborative approach among stakeholders. This needs resolution beyond simply banishing a majority of agricultural pumpers from the process as has been done thus far. Encouraging "buy in" is what is needed, not expulsion from the process, for SGMA to be effective.

7. Creativity in solutions needs to be expanded. Incentivize short term and long term fallowing that allows individual landowners to utilize and mechanisms for their compensation for doing so. Utilize market forces so that low economic return discourages use while it encourages conservation and efficient use. Remove requirements to irrigate in order to maintain pumping rights which is still in effect as a regulation. If it costs more to irrigate a higher use crop, then let the farmer decide whether it is economically justified, do not ask more efficient water use crops to subsidize those that require more irrigation.

8. State Water Bulletins dating back to the early 1950's identified the likely need for supplemental water. In many respects, we actually have required less water that was projected in those years. Water use was projected to exceed 200,000 acre feet per year in the combined Paso Robles and Atascadero Basin and we have pumped less than half that annual total it appears. It is fortunate as it turned out but the fact that the area was projected to develop economically on many fronts led to forecasts of more water supply needs. It was not a surprise that water use increased.

Although I can go on listing deficiencies in the GSP and its process, the job remains to be done. If we have the cumulative will to succeed and work more collaboratively in the future, we can find a way to balance our Basin. Hopefully a new start can be made in 2020 for more inclusion and collaboration. If not,  it is hard to see how our SGMA effort will ultimately be successful.

September 24, 2019

TO: The Paso Basin Cooperative Committee

RE: Comments to be considered for the final draft of the PBCC

My family has been a landowner in the Paso Robles Groundwater Basin for over a decade.  We have been closely following the development of the SGMA-directed Groundwater Sustainability Plan.

The irrigated agricultural community has been largely excluded from the process. The County GSA represents 66% of irrigated agriculture and the County GSA has completely failed its responsibility to seek agriculture’s involvement in the GSP Process. The County failed to create any sort of ag advisory position in their GSP process. The County has not held a single outreach meeting with the Ag community. County officials have attended none of the EPC WD meetings and very few if any of the SSJ WD meetings. Also, the County has targeted and specifically excluded the EPC WD from participating directly in the GSP. Irrigated Ag needs a “seat at the table”.

The GSP is a weak document that defers meaningful actions and decisions to the future. It’s not clear how and when the GSP implementation process will begin and who will run it. There is no sense of urgency. Do we want the Subbasin continue to decline as we ponder what to do?

There is no clear management framework for how implementation decisions are going to be made. Who gets to vote? Who gets to veto? Who gets to cutback pumping?

Pumping cutbacks are coming but we don’t know where, when, or how much. Predictable and stable rules are essential for farmers to plan and make informed decisions.

The GSP provides little direction on how users in the Subbasin are going to reduce groundwater pumping and/or pursue additional sources of new water. It seems that projects are left for folks other than our water authorities to do. Why have these agencies if they are unwilling to do anything?

There seems to be no urgency in pursuing and gathering the essential data necessary for informed decisions about basin management.

Best regards,
Anthony Riboli
- Riboli Family of San Antonio Winery

The GSP needs to have strong monitoring, reporting and enforcement regulations. Reporting of groundwater pumping should be measured by water meters, should be mandatory and should start immediately.

De minimis users are largely give a pass in the GSP. However, the GSP should address how to prevent unlimited growth of this class of pumpers and require this group to acquire their own sources of water.

**SAN LUIS OBISPO COUNTY FARM BUREAU**
4875 MORABITO PLACE, SAN LUIS OBISPO, CA 93401
® PHONE (805) 543-3654 ▪ FAX (805) 543-3697 ▪ www.slofarmbureau.org

September 27, 2019

Paso Basin Cooperative Committee
City of Paso Robles
San Miguel Community Services District
County of San Luis Obispo
Shandon-San Juan Water District

*Submitted via pasogcp.com*

RE: Draft Paso Robles Groundwater Sustainability Plan

Dear Committee Members & Staff:

San Luis Obispo County Farm Bureau (Farm Bureau) thanks committee members and staff for their continued work to create a plan under the complex Sustainable Groundwater Management Act (SGMA). As you know, many of the 800 Farm Bureau members we represent will be directly impacted by the Paso Robles Groundwater Sustainability Plan (GSP). The $1 billion in annual crop and livestock sales produced in San Luis Obispo County drives our local economy, and the GSP must reflect an understanding by our local leaders that partnering with agriculture is essential to make meaningful progress towards sustainability.

Farm Bureau acknowledges that the Basin, or parts of the Basin, are in decline, and that workable, targeted solutions will come best from collaboration with all stakeholders. Clearly, there is no one, all-inclusive project, requirement, or regulation that can solve the overdraft conditions within the Basin.

We believe the Basin needs to be better defined by gathering more scientific data throughout different areas of the Basin over an extended period of time. It is not possible to address the Basin's challenges without accurate data, and we recognize the GSP as the framework for gathering data needed to develop real solutions. The GSP is a "roadmap" that must be flexible and able to change over time as new data becomes available. Currently, there are simply many unknowns, such as needed watershed data. Recognizing that a perfect picture of the Basin may never be attained, we still recommend the continuation of geographical data collection and analysis so that the Basin is as accurately defined as possible. This will help ensure groundwater users in noncritical areas do not incur unsubstantiated cuts that will potentially be economically disastrous yet do nothing to solve the problem.

As an organization made up of diverse interests, Farm Bureau knows first-hand the importance of having everyone at the table for discussion and especially when it comes to action. Exclusion of affected parties is a recipe for failure, and never more so than when it comes to water. This GSP, understandably, focuses on the largest water users, agriculture, but does not clearly bring them to the discussion. We strongly recommend that there be an open seat for irrigated agriculture on the Paso Basin Cooperative Committee, and ultimately, on whatever agency is charged with implementing the GSP. If all of agriculture is committed to working together, we are confident that meaningful solutions will be uncovered. But, if the responsibility to address the Basin's water issues is placed solely on agriculture, or on any single segment of agriculture, it will cripple the economic vitality of Paso Robles and the region.

There can be viable solutions achieved in the GSP through a combination of more data on pumping practices, increased adoption of Best Management Practices at the farm level, and the inclusion of realistic projects to introduce new water to the basin. In addition to the supply of potential existing resources like Nacimiento and State Water, and municipal recycling projects being developed, the development of streamflow capture projects could be key components in the journey towards basin balance. It is crucial to have water supply portfolio diversification and cooperative efforts among agencies to develop water sources. Agriculture is dedicated to doing our part, but we alone cannot solve the problem.

Farm Bureau looks forward to continuing being a partner in and helping to improve and refine the GSP so that all agriculture can continue to contribute to the economic vitality of the region.

Sincerely,

Hilary Graves, President
San Luis Obispo County Farm Bureau

**Background:** During the last thirty years the City of Paso Robles has experienced substantial population growth associated with an expanse of residential subdivisions accompanied by significant growth in hotel development and historic growth in both retail businesses along with business serving tourist activities. Moreover, developed irrigated agriculture expanded by 30% during the same period.

The growth and expanded development of the city of Paso Robles has resulted in greater consumption of water resources along with the conversion of undeveloped land area into greater use of land for roads and infrastructure. Thus reducing the historic volume of water percolating underground.

Also during this period the rapid growth of irrigated agriculture has converted largely grazing land and dry farmed land into irrigated land. Unfortunately, even after accounting for percolation there has been a net increase in the use of groundwater to accommodate the increase in irrigated Ag acreage.

**Offsetting Activity:** A robust program of stormwater capture and percolation into the groundwater would significantly offset the excessive pumping of groundwater associated with the growth of the City of Paso Robles and the introduction of significantly greater irrigated agriculture.

The outline of a plan for a stormwater capture and percolation ponding system must be added to the GSP. The plan must identify the areas where stormwater capture would be diverted and identify the best locations for percolation ponds. Lastly, the plan must identify the cost of developing, creating, and operating the plan. Ideally the County Flood Control and Water Conservation District would manage and operate the plan.

## Consider

The Paso Robles Area Sub-basin consists of 436,157 acres.

Assume that 30% of the area is conducive to stormwater capture, which rounded equals 131,000 acres.

Assume that average rainfall over the 131,000 acres is 12 inches on average annually, which would produce 131,000 acre feet of water.[1]

Assume only 20% of the average rainfall can be easily captured each year and 30% of that is lost to evaporation in the percolation ponding process. This produces a net of 26,000 AFY of water on average per year percolating into groundwater.

**Conclusion**

Montgomery & Associates indicates that 14,000 AFY in excess of the annual safe yield is pumped from the Paso Robles Area Sub-basin each year. Conservatively, a well-designed stormwater project would essentially put the Sub-basin in modest annual surplus as long as overall pumping activity is not allowed to grow beyond the availability of the resource.

An essential element of a robust stormwater capture and percolation program is the necessity to properly maintain the receptiveness of the creeks and rivers in order to facilitate capture and percolation. The creeks will need to be properly maintained in order to accommodate the transmission of stormwater into the larger tributaries; and the larger rivers must be relieved of excess sand in order to expose the alluvium layer, which is conducive to percolation. Also, the creeks and rivers must be cleared of excess brush and tree growth. Lastly, as appropriate percolation ponds must be created and maintained. A stormwater capture program must be actively managed and maintained in order to optimize effectiveness.

**For Section 3 as appropriate**

In 1972 the SWRCB amended the City of SLO's Salinas Dam Permit to impose a "live stream" requirement. This amendment was designed to override certain diversionary rights to ensure minimum flows for fish in the Salinas River. However, in reality the minimum flows have rarely been seen and the actual result, after the amendment, was less water being released from the Dam annually than had been the case under the voluntary release system. With SLO County managing a stormwater capture and percolation program not only will the Salinas River be healthier, but the recharge process would be enhanced. It should be noted that historically the Salinas River as well as lesser rivers and streams were noteworthy for their ability to "flush" our tributaries, but to enhance the level of groundwater. The management of the sub-basin needs to return to this type of activity, which was proved to be essential.

[1] 12 inches per year on 30% of the subject area is conservative in that areas with hills and low mountainous terrain typically produces more measurable rain than flatter terrain.

**All Sections** Early in the GSP drafting process the issue of the lack of explanatory footnotes in various chapters was identified. At that point Montgomery and Associates committed to the inclusion of appropriate footnotes. However, the absence of essential detailed footnotes continues unabated.

**General** The legal definitions of "Overlier" and "Purveyor" relative to groundwater need to be added early in the GSP document.

**Table 3.4** The source of the land use data needs to be identified and footnoted.

**Section 3.4.1** The outcome of the quite title Court action on June 7, 2019 is important to outline within the GSP as it limits the ability of the defendant purveyors to pump ground water.

| Defendant | Perfected Prescriptive Rights |
|---|---|
| City of El Paso de Robles | 1,267.70 AFY |
| County of San Luis Obispo | 310 AFY |
| San Miguel CSD | 177.03 AFY |
| Templeton CSD | 308.9 AFY |
| Combined | 2,063.63 AFY |

**Section 3.5** The number of agricultural and domestic wells should be identified and added to this section. This data should be available from SLO County records. Additionally, the number of domestic wells owned by de-Minimus pumpers should be revealed.

The City of Paso Robles Urban Water management Plan (2016) should be reviewed and critiqued in detail - in particular the representations regarding the water rights claimed by the City need to be corrected. Moreover, the very modest annual groundwater rights awarded to the City as a result of the Quiet Title litigation, in which the City was a defendant needs to be disclosed. Additionally, the City of Paso Robles Urban Water Management Plan should be modified in keeping with the judgment rendered by the Superior Court.

The County has land use authority in the unincorporated areas of the county. Accordingly, the GSP must follow the existing water offset ordinance.

Reference is made to the Salinas River Live Stream agreement:
This section should include data from the last three years indicating the results of recorded observations. Antidotal observations indicate that recent Salinas River Live Stream observations have been unsatisfactory, and have not involved the release of reservoir water. Also, the GSAs cannot use SGMA to ignore or "skirt" SLO County regulations.

**Section 4.7** Identifies areas which are receptive for natural recharge shown on Figure 4-16.

However, this chapter does not discuss the benefits of developing a robust stormwater capture program where feasible.

Moreover, the annual rainfall data are available for the last 100 years and should be added to the GSP document.

**Section 5.4** Describes the issue of Land Subsidence. However, the Draft GSP does not indicate how the issue of subsidence measurement should be approached.

Moreover, several months ago Montgomery & Associates committed to providing the Cooperative Committee with the cost of engaging USGS to update the data on subsidence collected in 1997.

To date the Committee has not made a decision on this critical matter.

It is essential that all of the data that the County has received or collected regarding subsidence should be added to Chapter 5.

**Section 6.3.2.1** Table 6-3 includes a value for Urban Irrigation Return Flow; however, the table does not include a similar value for rural-domestic Irrigation Return Flow. The latter group essentially represents de Minimus rural land owners who typically irrigate vegetable gardens, fruit trees, etc., and a factor should be included for this group. Essentially, all of their pumped groundwater is returned to the basin through their septic systems.

**Section 6.3.2.4** The sustainable yield estimate shown needs to be reconciled with **section 9.2**.

**Section 6.5.1.1** The City of Paso Robles Urban Water Management Plan needs to be updated based on the Court Judgment limiting groundwater pumping by the City.

**Section 9.2** The basis for the sentence "Because the amount of ground water pumping in the Subbasin is more than the estimated sustainable yield of about 61,000 AFY (see Chapter 6) and groundwater levels . . . . . . ." The representation of an estimated 61,000 AFY needs a footnote describing how this number was determined.

**Section 9.3.1.1** In the second line of this sentence "will" must be replaced by "may".[2]

**Section 9.3.2** **Promoting Best Water Use Practices** – includes the following:

"Optimization of irrigation needs for frost control if sprinklers are used."

Note: This concept is flawed in that sprinklers can be easily used for springtime irrigation in violation of rules. Moreover, frost protection can be achieved through wind machines, which do not use water. The GSP should require the phase out of frost protection using water within three years.

**Section 9.3.3** This section is a good start; but it needs to focus principally on major stormwater capture projects as a "residential" focus will yield limited benefits. Conversely, projects focusing on stormwater capture and diversion to recharge locations will provide the most benefit for the groundwater subbasin. Much of the topography of the land over the subbasin is ideal for stormwater capture, which can be easily diverted to locations providing ideal recharge conditions.

Note: Refer to the discussion on stormwater capture on page 2.

[2] This change is mandatory!

**Section 9.3.4** Voluntary fallowing of land planted to permanent crops will not yield much benefit. The majority of permanent crops over the subbasin are wine grapes many acres of which have been planted in the last several years. Fallowing grape land and replanting in future years is not economically beneficial. Therefore this section needs more study and analysis.

**Section 9.5 Projects** Number 2: State Water Project (SWP) is unacceptable and needs to be removed from the list.

Many of the reasons for not relying on additional SWP water are outlined in a June 6, 2018 letter authored by O'Laughlin & Paris LLP. Moreover, some recipients of SWP water will have a desire to inject the water into the groundwater basin, thus altering the ownership and pumping rights to basin water. Contracting for additional SWP water injected into groundwater is a non-starter and will not be allowed!

Note: At the September 18th meeting of LAFCO the Commission approved the detachment of 33,000 acres from the Shandon-San Juan Water District. Accordingly, that land will be transferred out of the Shandon-San Juan GSA and transferred into the jurisdiction of the SLO County GSA.

Therefore, the applicable maps need to be revised reflecting the transfer before the final GSP is submitted to the DWR.

J. LOHR
VINEYARDS, INC.

September 26, 2019

J. Lohr Vineyards and Wines
6169 Airport Rd.
Paso Robles, CA 93446

Paso Robles Groundwater Subbasin Cooperative Committee
Paso Robles Groundwater Sustainability Agency
1055 Monterey St.
San Luis Obispo, CA 93408

Dear Committee,

We at J. Lohr Vineyards and Wines (JLV&W) want to thank SLO County and the three other GSA's for all their efforts thus far. Our goal in this letter is to suggest improvements in the Groundwater Sustainability Plan (GSP) that will increase its effectiveness, increase the likelihood that the Department of Water Resources (DWR) will approve the GSP, and reduce the risk of a groundwater adjudication.

JLV&W started purchasing bulk wine and grapes from the Paso Robles area in 1981. We planted vineyards in 1986 and built our winery in 1987. We now farm almost 3,000 net vine count (nvc) acres of vineyards and purchase grapes from an additional ~3,000 nvc acres of vineyards. For 25+ years we have had our sales staff, deployed around the United States and Canada, work very hard to build awareness of Red and Rhone wines from Paso Robles. We are a major local employer. My children are all fully immersed in the business.

We recognize that the Paso Robles Groundwater Basin (PRGB) is in overdraft and that it should be the responsibility of all users, including agricultural pumpers, to help eliminate the overdraft and ensure long-term groundwater sustainability. We would like this to happen as soon as possible!

Three major efforts we are pushing to reduce groundwater pumping in the basin are:

A. Best Management Practices (BMPs)
B. Fallowing Policy
C. Investigation of a Blended Water Project (BWP)

We think the PRGB is best managed ***locally*** by the groundwater users and their local representatives. The GSP needs to be rigorous enough to satisfy DWR review. We are concerned that the current GSP lacks key features needed to satisfy that review such as:

1) A sense of urgency.
2) A timetable to involve local groundwater users in the complex decision of pumping allocations.
3) Incentives to increase supplies or decrease water use.
4) A predictable and stable set of rules developed as soon as possible to allow growers to make rational decisions.



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To further expand on the ***sense of urgency*** concern, consider the following:

a. At the end of harvest, growers review their yields, grape quality, and costs for the past year and plan for the next year. On July 10, 2019, we at JLV&W held a half day meeting on efficient water use for our own people and many of our outside growers. 45 people were in attendance. Three outside consultants presented their research, we tasted wines of different quality levels, and we discussed the reasons to limit nitrogen to have a higher probability of harvesting before frost. ***The simple BMP message was that we used less irrigation water, achieved better grape and subsequent wine quality, and had increased yields***. We immediately applied some of these successful irrigation practices working with some of our growers who were in attendance. Results will show up in their 2019 harvest! These and other BMP's could be *implemented* immediately across entire vineyards or on large experimental blocks in grower vineyards. It is our 10th year of using these methods. At JLV&W we clearly think that ***on average***, all growers could save at least 2" of irrigation water. On 36,000 acres, this is 6,000 acre feet of irrigated water saved per year. Rather than waiting a year, as the draft GSP suggests, we would like the GSP to immediately promote and actively encourage growers to participate in exploring BMP's to reduce their pumping now.
b. Another immediate opportunity is to include a policy for fallowing. This would include several concepts, that would ***not make it initially necessary to pay growers to fallow***. There are a number of vineyards in the area which are older, diseased or haven't found a market for their grapes in 2018 or 2019 and may not in 2020. If regulations were promptly passed to allow growers to keep their pumping rights, without a minimum of pumping each year, more growers would fallow sooner. They could then take some time to learn more about the market for grapes, which grapes grow best in their climate and soil, and current BPMs for pre-plant soil preparation, root stock choice, vine spacing, trellis methods, etc. These fallowing concepts could save 2,000 to 4,000 acre feet of irrigation water per year and reductions in groundwater pumping and could go into effect immediately.
c. We at JLV&W, several of our neighboring growers, and the City of Paso Robles have been working for several years on a ***Blended Water Project (BWP)*** which started with the concept of using treated waste water from the City of Paso Robles for irrigation to reduce pumping. Even though Paso Robles is using some Nacimiento water to supply its residents, the resultant treated water is still somewhat "salty" for long term use in irrigation. The Nacimiento pipeline is only a mile from our proposed treated water blending point. In further development of this concept, we growers realized we could build a "backbone" pipeline from the blending point to north and east of the airport and Jardine area. This is a very powerful opportunity to allow several growers in the new heart of the "red zone" to irrigate with a variable high percentage of blended water and other area growers to pay "in lieu" pumping fees. This saves the "in lieu" pumpers from needing to build reservoirs and filters and connect into their own systems. We think this system could be built for less than $10,000,000 compared to three possible systems listed in Chapter 9 which in total could cost $102,000,000. We already have the "backbone" project designed. The GSP should include reference to this project because it demonstrates progress and could be a crucial element of balancing local water needs.

In addressing the ***time table*** concern:

a. We believe it is necessary to help all growers understand we all need to pump less water. Their water use for the 2019 crop year must be reported by the GSP to the State by April 30, 2020. For those who don't have meters, an estimate will be used. This data should be quickly assembled and analyzed for trends and major indications. Individual growers should be able to compare their pumping data to overall basin pumping data.
b. The eventual assigning of pumping allocations is going to be exceedingly complex. It will not be possible to be done without extensive grower participation or the use of adjudication will loom large. We at JLV&W would like to minimize the risk of a full-fledged adjudication, because unless handled very differently from previous adjudications, it could be very costly and delay progress.
c. We suggest that the GSP provide for a facilitated process to establish pumping allocations. To accommodate busy schedules, the facilitated meetings could be held on a bi-weekly basis to give as many persons as possible a chance to attend, analyze data, go back and confer with others, talk among themselves etc. This effort needs legal input every step of the way and ***cannot be dictated but needs to be negotiated***. Because this process is urgent but will take time, it should start immediately after adoption of the GSP with a goal of finishing within two years.

In so far as ***incentives:***

Each of the actions discussed earlier--A (BMPs), B (Fallowing), C (BWP)-- needs a different set of incentives.

a. BMPs are something that all growers need to be aware of and growers shouldn't need to be paid to adopt. Growers do, however, need to know that they will need to live within groundwater restrictions.
b. Fallowing also does not need payments to growers. As described above, however, growers need to know that, if fallowing is done in the normal course of business, it will not affect their allocations in the future.
c. The BWP requires building a pipeline, amortizing its cost and paying an annual fee for management, maintenance and power. Similar projects exist all over California. In order to decide, and at what level, to participate, growers need to fully understand these costs as well as their pumping allocations. The plans, permits, contracts for supply, etc., therefore need to move forward in parallel with the process of setting pumping allocations and implementing other management actions. This will allow growers to make a business decision as to which, or all, of the BMPs, fallowing or BWP they want to use. If the BWP pipeline project is ready to be built by the time allocations are made, growers who are willing to pay a fee to participate in the BWP will not need to wait any unnecessary, additional time for the project to be built.

Addressing the concern around the ***set of rules as soon as possible***:

Growers need to know as soon as possible the rules by which groundwater will be managed in the Paso Robles basin. BMPs, fallowing, and groundwater allocations are all part of the solution, and work, therefore, should begin on all of these actions immediately and in parallel. There should be no doubt in anyone's mind that we have a major problem of pumping beyond the sustainable yield in the Paso Robles groundwater basin. We don't need to continue to study this problem for years. We need to immediately begin to take action. DWR expects a more aggressive plan than proposed at present.

In moving forward, there needs to be much greater participation by growers who are the major pumpers and this ***includes having irrigated agriculture as a full member of the process***.

Thus, let's get on very quickly with the work that needs to be done by including ***representation from all partners***. We all care about the health of the groundwater basin and the local economy as well as the health of our own employees and the community.

**Jerome J. Lohr**
President, J. Lohr Vineyards, Inc.
Founder, J. Lohr Winery

J. LOHR
VINEYARDS, INC.

# Comprehensive Plan to Bring the Paso Robles Groundwater Basin into Sustainability

### *Introduction*

It is apparent that groundwater levels in the Paso Robles Basin have been declining and that GSP Management Actions will be necessary to bring the Basin into sustainability. J. Lohr Vineyards & Wines (JLVW) believes that, with the cooperation of the agricultural community, significant reductions in groundwater pumping are achievable and much of the current 13,700 AFY overdraft can be overcome. JLVW would like to present two programs that are essential if pumpers in the Basin are to achieve meaningful reductions in groundwater pumping. ***First*** is the opportunity to bring supplemental water to the Basin. ***Second*** is to adopt Best Management Practices. It is important that these programs be considered for inclusion in the GSP

### *Supplemental Water*

For several years, JLVW has been working with the City of Paso Robles and other fellow growers to design a backbone pipeline system that would deliver 'blended' water to high density agricultural areas around the Airport and east over the Red Zone. By blending treated water from the City of Paso Robles with Nacimiento Lake water, the system could provide a supplemental water source to farmers in the area for irrigation 'in lieu' of pumping groundwater. This could achieve meaningful reductions in groundwater pumping and specifically target reduced pumping in the most impacted areas.

### *Best Management Practices (BPMs)*

1. On July 10th, 2019, JLVW held a seminar with its contracted growers. There were presentations by three outside experts. JLVW shared their accumulated knowledge on the optimal use of water in vineyard operations and attendees contributed to the discussion. There were 45 growers, vineyard managers and winery representatives in attendance. As an outcome, a list of management actions was generated which vineyard operators can implement immediately to reduce pumping while increasing fruit quality.
2. JLVW is currently individually contacting an expanded list of other vineyard owners and managers, wineries and local organizations to further discuss and refine best management practices. These BMPs (which we have been using at JLVW for 10 years) will demonstrate how others can increase quality, ***use less water and fertilizer***, and maintain or increase yields.
3. After the 2019 harvest, we will hold additional technical sessions and tastings, open to all basin residents as well as growers and vintners, to demonstrate these aspects. This, hopefully, will help prepare growers for the very complex discussions needed for future pumping allocations.

### *Conclusion*

J. Lohr Vineyards & Wines looks forward to leading this effort to bring Supplemental Water to the basin and to define and inculcate Best Management Practices to help ensure that Paso Robles remains one of the three featured wine regions in the United States while striving to create a sustainable groundwater basin for generations to come.

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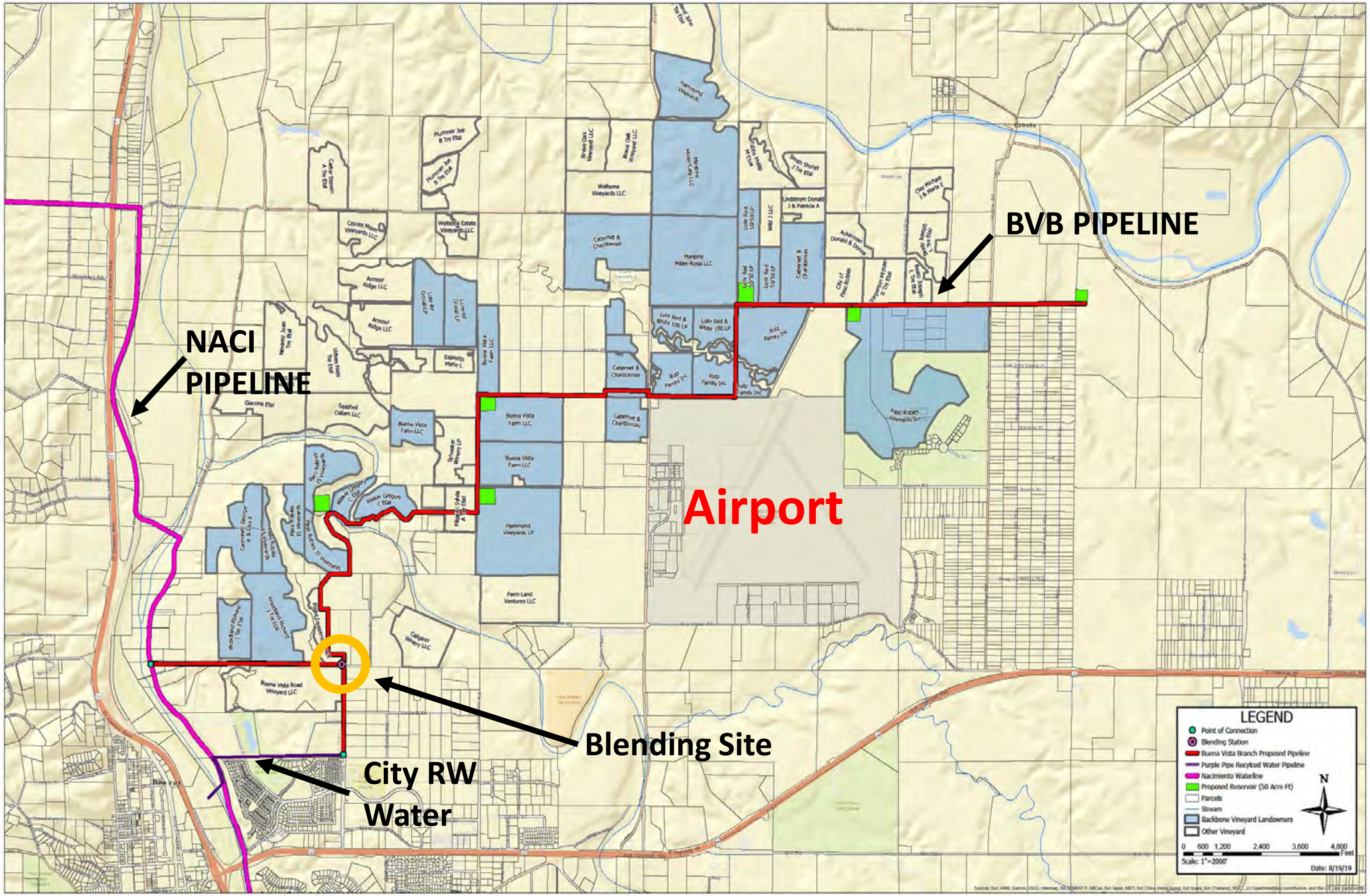
# BVB Blended Water Backbone System




OHR
...ARDS & WINES

September 27, 2019

**Paso Robles Groundwater Subbasin Cooperative Committee**
**San Luis Obispo County, Paso Robles Groundwater Subbasin GSA**
1055 Monterey Street
San Luis Obispo, CA 93408

Dear SLO County Paso Robles GSA,

Re: Comments of the Paso Roble Groundwater Subbasin GSP

I would like to thank all those who spent endless hours in developing the Groundwater Sustainability Plan (GSP). I appreciate this opportunity to submit my comments of the final version of the GSP.

I have been involved in the Subbasin's groundwater issues for almost a decade now. I was a leading figure in proposing the failed AB2453 Water District. I was a founding member of the group that formed the Estrella-El Pomar-Creston Water District (EPC WD). I currently serve on the Board of Directors of the EPC WD. I am a resident in the area for 21 years and a former winegrape grower for 18 years. I also served on the Board of Directors of the Paso Robles Wine Country Alliance for 6 years. My comments are presented as a concerned citizen and stakeholder and my comments do not represent any official position of the EPC WD.

I would like to split my comments into two categories. First, I'd like to discuss my general thoughts about the GSP and its shortcomings. Secondly, I'd like to comment on management actions that can be taken <u>immediately</u> and need to be pursued <u>now</u> as the GSP implementation begins.

## General Comments

The GSP is a weak document and almost all important decisions have been delayed to the future.

The GSP does not define a new management structure or the decision-making process necessary to implement the GSP. It seems clear that the current MOA structure has not been able to resolve the many critical decisions that have to be made. There needs to be a new MOA or some other governance structure.

Similar to the item above, the GSP provides little insight into how the GSP implementation is going to be funded. Like myself, I suspect that Subbasin stakeholders would like to know who pays for what and how much?

The GSP makes clear that pumping cutbacks are coming but doesn't say where, when, or by how much. Predictable and stable rules are essential for farmers to plan and make informed decisions. For this reason, the GSP should spell out clearly a process, to begin immediately upon adoption of the plan, to determine future groundwater allocations. This process should ensure that agriculture, like all groundwater users, have meaningful input and involvement. Allocating groundwater will be doomed to failure if those who must sacrifice are not included in the decision-making process.

The GSP seems to list projects in a perfunctory manner with pie in the sky generalities and hefty budgets. There is one project that's real, doable and has already received significant funding from private sources to development preliminary engineering plans, reviewed pipeline routes and has begun environmental studies. This 'real' project is the Blended Water Project which utilizes Nacimiento Lake Water along with the City of Paso Robles' Recycled Water. The Blended Water Project has the ability to bring needed supplemental water to the Paso Robles Subbasin. This project along with any other 'real' projects should receive the endorsement of the GSP and start immediately. Supplemental water is a key component to help solve the Subbasin's declining water levels.

The GSP is unclear and insufficiently aggressive in setting schedules and deadlines for its management actions. The GSP does not address who does what next? Who's in charge?

The GSP states that the GSAs will "promote" voluntary fallowing, but does not explain how. Fallowing of land could have a significant positive influence in groundwater levels but there is little in the GSP to ensure that pumpers who choose to fallow will be protected in the future in preserving their pumping allocations. In other word, if I stop irrigating a crop today, will I be able to pump in the future?

The GSP, for example, says that the GSAs will "promote" BMPs, but does not say how.

Without any sort of timetables or specific management action goals, the subbasin remains at risk of further decline while solutions are pondered. The GSP provides no timetable for implementing important actions of the GSP. The GSP commits to do nothing.

The GSP does not mandate metering and extraction reporting. How can you manage a basin if you don't know what's being pumped? Fair and equitable decisions about extraction must be backed up by a vigorous monitoring system and a policing mechanism. The GSP is mostly silent on this issue.

The GSP gives a pass to de minimis users and does not address future growth of de minimis users.

**Immediate Management Actions Needed**

There are certain management actions that need to start immediately. The following are several of these actions.

The GSP needs to establish a metering and groundwater pumping reporting system and it needs to start now. On April 1, 2020, our Subbasin will be required to report its groundwater status. Our Subbasin has very little 'data' on who pumps and how much. As we move towards possible pumping cutbacks, the GSP has to have answers to these basic facts. Monitoring and report must start now.

As a corollary to the previous item, the GSP needs to define and fund an immediate effort to determine what other data gaps exist and identify other informational needs that will be necessary in the decision-making process as GSP implementation proceeds.

Projects need to be identified, endorsed and started

**Concluding Comments**

As an early member of the group that formed the EPC WD and now as an EPC WD Board of Directors Member, I am particularly distressed about actions of County Supervisors that undermined the efforts of a legitimate and significant group of stakeholders in their efforts to participate in the SGMA/GSP process. EPC WD represents 40% of groundwater pumping in the subbasin. EPC WD is the largest group of pumpers in the subbasin and EPC WD was prevented from becoming a GSA and consequently denied the opportunity to represent its members in the GSP process. This is contrary to the spirit and intent of the SGMA Law.

Additionally, EPC WD members have been committed to working to achieve a sustainable Subbasin and have self-assessed themselves with Prop 218 votes to fund efforts in support of a sustainable Subbasin.

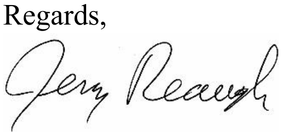
The County acting as the GSA for the so called "white area" has failed to properly represent the agricultural pumpers in the GSA. The County GSA did not hold a single outreach meeting. County GSA did not create any sort of ag advisory position for their GSA. The County GSA did not create any sort of forum where there could be open dialogue and exchange of ideas between stakeholders and public officials. Individuals speaking in 3-minute time slots at CC meetings does not constitute outreach by the County.

The irrigated agriculture community in the County's white area accounts for 55% of groundwater pumping in the Paso Robles Subbasin. The County has demonstrated its unwillingness or its inability to include this very large and significant group of groundwater pumpers in developing the current GSP. In addition, irrigate agriculture is one of the major economic drivers in the North County and continued success of the irrigated ag community must be considered.

Since irrigated ag in the white area represents more than 50% of the total pumping in the Subbasin, irrigated agriculture's interests should not be ignored by the lack of a 'seat at the table', a seat that has been unaccounted for in the GSP process to date as the County GSA has had virtually no outreach to these stakeholders. In that regard, the County GSA has severely underrepresented these constituents in the Subbasin by denying them any effective voice in the proceedings. Going forward, irrigated agriculture's input to the GSP will be vital to ensure the Subbasin moves towards sustainability while maintaining the economic powerhouse that is irrigated agriculture in the Subbasin. In conclusion, there needs to be an equal participant "seat" for irrigated agriculture on the new MOA which will define implementation of the Plan.

Thank you for this opportunity to submit my comments and I look forward to working with a newly constituted Memorandum of Agreement where irrigate ag is properly represented.

Regards,



Jerry Reaugh

The Nature Conservancy
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GroundwaterResourceHub.org

September 27, 2019

County Government Center
1055 Monterey Street, Room 206
San Luis Obispo, CA 93408

*Submitted online via:* https://www.slocounty.ca.gov/Departments/Public-Works/Committees-Programs/Sustainable-Groundwater-Management-Act-(SGMA)/Paso-Robles-Groundwater-Basin/GSP-Development.aspx

Re: Paso Robles Subbasin Draft Groundwater Sustainability Plan

Dear Angela Ruberto,

The Nature Conservancy (TNC) appreciates the opportunity to comment on the Paso Robles Subbasin Draft Groundwater Sustainability Plan (GSP) being prepared under the Sustainable Groundwater Management Act (SGMA). Please note that we have previously submitted comments dated 15 April 2019 on Chapters 4-8 and Appendix B and comments dated 1 July 2019 on Chapters 9-11 of the Paso Robles Subbasin Draft GSP. Where these comments have not yet been addressed in the most recent draft, they are restated in this letter with updated section number and page number callouts. In reviewing this version of the plan, we recognize that several TNC tools and approaches were used in the preparation of the sections related to ecosystems, notably the initial identification of groundwater dependent ecosystems (GDEs) in the Paso Robles Subbasin. This is clearly an important first step; however, our comments in this letter highlight additional refinement, monitoring, and future management activities that are needed to fulfil SGMA requirements with respect to GDEs in this basin.

*TNC as a Stakeholder Representative for the Environment*

TNC is a global, nonprofit organization dedicated to conserving the lands and waters on which all life depends. We seek to achieve our mission through science-based planning and implementation of conservation strategies. For decades, we have dedicated resources to establishing diverse partnerships and developing foundational science products for achieving positive outcomes for people and nature in California. TNC was part of a stakeholder group formed by the Water Foundation in early 2014 to develop recommendations for groundwater reform and actively worked to shape and pass SGMA.

Our reason for engaging is simple: California's freshwater biodiversity is highly imperiled. We have lost more than 90 percent of our native wetland and river habitats, leading to precipitous declines in native plants and the populations of animals that call these places home. These natural resources are intricately connected to California's economy providing direct benefits through industries such as fisheries, timber and hunting, as well as indirect benefits such as clean water supplies. SGMA must be successful for us to achieve a sustainable future, in which people and nature can thrive within Paso Robles Subbasin region and California.

We believe that the success of SGMA depends on bringing the best available science to the table, engaging all stakeholders in robust dialog, providing strong incentives for beneficial outcomes and rigorous enforcement by the State of California.

Given our mission, we are particularly concerned about the inclusion of nature, as required, in GSPs. 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. Some of these tools have been used in the preparation of the present draft plan. Additional resources are available and referred to in the comments that follow, and are considered pertinent to the development of this plan.

## ***Addressing Nature's Water Needs** in GSPs*

SGMA requires that all beneficial uses and users, including environmental users of groundwater, be considered in the development and implementation of GSPs (Water Code § 10723.2).

The GSP Regulations include specific requirements to identify and consider groundwater dependent ecosystems [23 CCR §354.16(g)] when determining whether groundwater conditions are having potential effects on beneficial uses and users. GSAs must also assess whether sustainable management criteria may cause adverse impacts to beneficial uses, which include environmental uses, such as plants and animals. The Nature Conservancy has identified each part of the GSP where consideration of beneficial uses and users are required. That list is available here: https://groundwaterresourcehub.org/importance-of-gdes/provisions-related-to-groundwater-dependent-ecosystems-in-the-groundwater-s.
Please ensure that environmental beneficial users are addressed accordingly throughout the GSP. 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 decision, and using data collected through monitoring to revise decisions in the future. Over time, GSPs should improve as data gaps are reduced and uncertainties addressed.

To help ensure that GSPs adequately address nature as required under SGMA, The Nature Conservancy has prepared a checklist (**Attachment A**) for GSAs and their consultants to use. The Nature Conservancy believes the following elements are foundational for 2020 GSP submittals and are developed from our publication, *GDEs under SGMA: Guidance for Preparing GSPs*[1].

## 1. Environmental Representation

SGMA requires that groundwater sustainability agencies (GSAs) consider the interests of all beneficial uses and users of groundwater. To meet this requirement, we recommend actively engaging environmental stakeholders by including environmental representation on the GSA board, technical advisory group, and/or working groups. This could include local staff from state and federal resource agencies, nonprofit organizations and other environmental interests. By engaging these stakeholders, GSAs will benefit from access to additional data and resources, as well as a more robust and inclusive GSP.

[1]GDEs under SGMA: Guidance for Preparing GSPs is available at:
https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

**2. Basin GDE and ISW Maps**
SGMA requires that groundwater dependent ecosystems (GDEs) and interconnected surface waters (ISWs) be identified in the GSP. We recommend using the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) provided online[2] by the Department of Water Resources (DWR) as a starting point for the GDE map. The NC Dataset was developed through a collaboration between DWR, the Department of Fish and Wildlife and TNC.

**3. Potential Effects on Environmental Beneficial Users**
SGMA requires that potential effects on GDEs and environmental surface water users be described when defining undesirable results. In addition to identifying GDEs in the basin, The Nature Conservancy recommends identifying beneficial users of surface water, which include environmental users. This is a critical step, as it is impossible to define "significant and unreasonable adverse impacts" without knowing *what* is being impacted. For your convenience, we've provided a list of freshwater species within the boundary of the Paso Robles Subbasin in **Attachment C**. Our hope is that this information will help your GSA better evaluate the impacts of groundwater management on environmental beneficial users of surface water. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the GSA's freshwater species list. We also refer you to the Critical Species Lookbook[3] prepared by The Nature Conservancy and partner organizations for additional background information on the water needs and groundwater reliance of critical species. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs.

**4. Biological and Hydrological Monitoring**
If sufficient hydrological and biological data in and around GDEs is not available in time for the 2020/2022 plan, data gaps should be identified along with actions to reconcile the gaps in the monitoring network.

The Nature Conservancy has reviewed the Paso Robles Draft GSP. We appreciate the work that has gone into the preparation of this plan. Specifically, we recognize the use of the NC dataset and other TNC guidance for initial identification of GDE areas in the basin. However, we believe that additional work is needed to refine the initial area estimates including identification of species that may be present in the GDEs, development of monitoring plans to address data gaps, and a more complete evaluation of future management actions to protect GDEs in the basin. Hence, we consider the current GSP draft to be **incomplete** under SGMA.

Our specific comments related to the Paso Robles Subbasin Draft GSP are provided in detail in **Attachment B** and are in reference to the numbered items in **Attachment A. Attachment C** provides a list of the freshwater species located in the Paso Robles Subbasin. **Attachment D** describes six best practices that GSAs and their consultants can apply when using local groundwater data to confirm a connection to groundwater for DWR's Natural Communities Commonly Associated with Groundwater Dataset[2]. **Attachment E** provides an overview of a

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[2] The Department of Water Resources' Natural Communities Commonly Associated with Groundwater dataset is available at: https://gis.water.ca.gov/app/NCDatasetViewer/
[3] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

new, free online tool that allows GSAs to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

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

Best Regards,

Sandi Matsumoto
Associate Director, California Water Program
The Nature Conservancy

# Attachment A

## Environmental User Checklist

The Nature Conservancy is neither dispensing legal advice nor warranting any outcome that could result from the use of this checklist. Following this checklist does not guarantee approval of a GSP or compliance with SGMA, both of which will be determined by DWR and the State Water Resources Control Board.

| GSP Plan Element* | | GDE Inclusion in GSPs: Identification and Consideration Elements | Check Box |
|---|---|---|---|
| Admin Info | **2.1.5 Notice & Communication** *23 CCR §354.10* | **Description of the types of environmental beneficial uses of groundwater that exist within GDEs and a description of how environmental stakeholders were engaged throughout the development of the GSP.** | 1 |
| Planning Framework | **2.1.2 to 2.1.4 Description of Plan Area** *23 CCR §354.8* | **Description of jurisdictional boundaries, existing land use designations, water use management and monitoring programs; general plans and other land use plans relevant to GDEs and their relationship to the GSP.** | 2 |
| | | **Description of instream flow requirements, threatened and endangered species habitat, critical habitat, and protected areas.** | 3 |
| | | **Summary of process for permitting new or replacement wells for the basin, and how the process incorporates any protection of GDEs** | 4 |
| Basin Setting | **2.2.1 Hydrogeologic Conceptual Model** *23 CCR §354.14* | **Basin Bottom Boundary:** Is the bottom of the basin defined as at least as deep as the deepest groundwater extractions? | 5 |
| | | **Principal aquifers and aquitards:** Are shallow aquifers adequately described, so that interconnections with surface water and vertical groundwater gradients with other aquifers can be characterized? | 6 |
| | | **Basin cross sections:** Do cross-sections illustrate the relationships between GDEs, surface waters and principal aquifers? | 7 |
| | **2.2.2 Current & Historical Groundwater Conditions** *23 CCR §354.16* | **Interconnected surface waters:** | 8 |
| | | Interconnected surface water maps for the basin with gaining and losing reaches defined (included as a figure in GSP & submitted as a shapefile on SGMA portal). | 9 |
| | | Estimates of current and historical surface water depletions for interconnected surface waters quantified and described by reach, season, and water year type. | 10 |
| | | **Basin GDE map included** (as figure in text & submitted as a shapefile on SGMA Portal). | 11 |

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| | | | | |
|---|---|---|---|---|
| | | If NC Dataset *was* used: | Basin GDE map denotes which polygons were kept, removed, and added from NC Dataset (Worksheet 1, can be attached in GSP section 6.0). | 12 |
| | | | The basin's GDE shapefile, which is submitted via the SGMA Portal, includes two new fields in its attribute table denoting: 1) which polygons were kept/removed/added, and 2) the change reason (e.g., why polygons were removed). | 13 |
| | | | GDEs polygons are consolidated into larger units and named for easier identification throughout GSP. | 14 |
| | | If NC Dataset *was not* used: | Description of why NC dataset was not used, and how an alternative dataset and/or mapping approach used is best available information. | 15 |
| | | **Description of GDEs included:** | | 16 |
| | | Historical and current groundwater conditions and variability are described in each GDE unit. | | 17 |
| | | Historical and current ecological conditions and variability are described in each GDE unit. | | 18 |
| | | Each GDE unit has been characterized as having high, moderate, or low ecological value. | | 19 |
| | | Inventory of species, habitats, and protected lands for each GDE unit with ecological importance (Worksheet 2, can be attached in GSP section 6.0). | | 20 |
| | **2.2.3 Water Budget** *23 CCR §354.18* | Groundwater inputs and outputs (e.g., evapotranspiration) of native vegetation and managed wetlands are included in the basin's historical and current water budget. | | 21 |
| | | Potential impacts to groundwater conditions due to land use changes, climate change, and population growth to GDEs and aquatic ecosystems are considered in the projected water budget. | | 22 |
| **Sustainable Management Criteria** | **3.1 Sustainability Goal** *23 CCR §354.24* | **Environmental stakeholders/representatives were consulted.** | | 23 |
| | | Sustainability goal mentions GDEs or species and habitats that are of particular concern or interest. | | 24 |
| | | Sustainability goal mentions whether the intention is to address pre-SGMA impacts, maintain or improve conditions within GDEs or species and habitats that are of particular concern or interest. | | 25 |
| | **3.2 Measurable Objectives** *23 CCR §354.30* | **Description of how GDEs were considered and whether the measurable objectives and interim milestones will help achieve the sustainability goal as it pertains to the environment.** | | 26 |
| | **3.3 Minimum Thresholds** *23 CCR §354.28* | **Description of how GDEs and environmental uses of surface water were considered when setting minimum thresholds for relevant sustainability indicators:** | | 27 |
| | | Will adverse impacts to GDEs and/or aquatic ecosystems dependent on interconnected surface waters (beneficial user of surface water) be avoided with the selected minimum thresholds? | | 28 |
| | | Are there any differences between the selected minimum threshold and state, federal, or local standards relevant to the species or habitats residing in GDEs or aquatic ecosystems dependent on interconnected surface waters? | | 29 |
| | **3.4 Undesirable Results** *23 CCR §354.26* | **For GDEs, hydrological data are compiled and synthesized for each GDE unit:** | | 30 |
| | | If hydrological data *are available* within/nearby the GDE | Hydrological datasets are plotted and provided for each GDE unit (Worksheet 3, can be attached in GSP Section 6.0). | 31 |
| | | | Baseline period in the hydrologic data is defined. | 32 |

| | | | | |
|---|---|---|---|---|
| | | | GDE unit is classified as having high, moderate, or low susceptibility to changes in groundwater. | 33 |
| | | | Cause-and-effect relationships between groundwater changes and GDEs are explored. | 34 |
| | | If hydrological data *are not available* within/nearby the GDE | Data gaps/insufficiencies are described. | 35 |
| | | | Plans to reconcile data gaps in the monitoring network are stated. | 36 |
| | | **For GDEs, biological data are compiled and synthesized for each GDE unit:** | | 37 |
| | | Biological datasets are plotted and provided for each GDE unit, and when possible provide baseline conditions for assessment of trends and variability. | | 38 |
| | | Data gaps/insufficiencies are described. | | 39 |
| | | Plans to reconcile data gaps in the monitoring network are stated. | | 40 |
| | | **Description of potential effects on GDEs, land uses and property interests:** | | 41 |
| | | Cause-and-effect relationships between GDE and groundwater conditions are described. | | 42 |
| | | Impacts to GDEs that are considered to be "significant and unreasonable" are described. | | 43 |
| | | Known hydrological thresholds or triggers (e.g., instream flow criteria, groundwater depths, water quality parameters) for significant impacts to relevant species or ecological communities are reported. | | 44 |
| | | Land uses include and consider recreational uses (e.g., fishing/hunting, hiking, boating). | | 45 |
| | | Property interests include and consider privately and publicly protected conservation lands and opens spaces, including wildlife refuges, parks, and natural preserves. | | 46 |
| **Sustainable Management Criteria** | **3.5 Monitoring Network** *23 CCR §354.34* | Description of whether hydrological data are spatially and temporally sufficient to monitor groundwater conditions for each GDE unit. | | 47 |
| | | Description of how hydrological data gaps and insufficiencies will be reconciled in the monitoring network. | | 48 |
| | | Description of how impacts to GDEs and environmental surface water users, as detected by biological responses, will be monitored and which GDE monitoring methods will be used in conjunction with hydrologic data to evaluate cause-and-effect relationships with groundwater conditions. | | 49 |
| **Projects & Mgmt Actions** | **4.0. Projects & Mgmt Actions to Achieve Sustainability Goal** *23 CCR §354.44* | Description of how GDEs will benefit from relevant project or management actions. | | 50 |
| | | Description of how projects and management actions will be evaluated to assess whether adverse impacts to the GDE will be mitigated or prevented. | | 51 |

* In reference to DWR's GSP annotated outline guidance document, available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GD_GSP_Outline_Final_2016-12-23.pdf

# Attachment B

**TNC Evaluation of the
Paso Robles Subbasin Groundwater Sustainability Plan**

A complete draft of the Paso Robles Subbasin Groundwater Sustainability Plan (GSP) Public Draft was provided for public review on August 14, 2019. This attachment summarizes our comments on the complete public draft GSP. Please note that we have previously submitted comments dated 15 April 2019 on Chapters 4-8 and Appendix B (now Appendix C) and comments dated 1 July 2019 on Chapters 9-11. Where these comments have not yet been addressed in the most recent draft, they are restated herein with updated section number and page number callouts. Comments are provided in the order of the checklist items included as Attachment A.

Checklist Item 1 - Notice & Communication (23 CCR §354.10)

[Chapter 11 Notice and Communications (including separate Communications and Engagement Plan, Appendix M)]

- Section 3.0 of the Communications and Engagement Plan (Page 6) lists aquatic ecosystems as a beneficial groundwater use. **However, no details are given as to the types and locations of environmental uses and habitats supported, or the designated beneficial environmental uses of surface waters that may be affected by groundwater extraction in the subbasin. To identify environmental users, please refer to the following**:
    - Natural Communities Commonly Associated with Groundwater dataset (NC Dataset) - https://gis.water.ca.gov/app/NCDatasetViewer/
    - The list of freshwater species located in the Paso Robles Subbasin in **Attachment C** of this letter. Please take particular note of the species with protected status.
    - Lands that are protected as open space preserves, habitat reserves, wildlife refuges, etc. or other lands protected in perpetuity and supported by groundwater or ISWs should be identified and acknowledged.

Checklist Items 2 to 4 - Description of general plans and other land use plans relevant to GDEs and their relationship to the GSP (23 CCR §354.8

[Section 3.6 Existing Monitoring Programs (p. 3-17)]

- Per the GSP Regulations (23 CCR §354.34 (a) and (b)), monitoring must address trends in groundwater and *related surface conditions* (emphasis added). In order for this section to provide the appropriate context and help assure integration of GSP implementation with other ongoing regulatory programs, this section should describe the following:

- o **Monitoring activities and responsibilities by State, Federal and local agencies and jurisdictions related to aquatic resources and GDEs that could be affected by groundwater withdrawals should be discussed.**
- o The Critical Habitat for Threatened and Endangered Species website maintained by the US Fish and Wildlife Service (https://fws.maps.arcgis.com/home/webmap/viewer.html?webmap=9d8de5e265ad4fe09893cf75b8dbfb77) identifies lands with endangered and threatened species in the Basin, including species potentially associated with interconnected surface waters ISWs, including Steelhead (Onocorhynchus mykiss). Also please refer to the Critical Species Lookbook[4] to review and discuss the potential groundwater reliance of critical species in the basin. **Please include a discussion regarding the management of critical habitat for these aquatic species and its relationship to the GSP.**

[Section 3.8.6 Requirements for New Wells (p. 3-30)]

- **Future well permitting must be coordinated with the GSP to assure achievement of the Plan's sustainability goals.**
- The State Third Appellate District recently found that Counties have a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting new wells near streams with public trust uses (ELF v. SWRCB and Siskiyou County, No. C083239). **The need for well permitting programs to comply with this requirement should be stated.**

[Section 3.10 Land Use Plans (p. 3-31)]

- This section should include a discussion of General Plan goals and policies related to the protection and management of GDEs and aquatic resources that could be affected by groundwater withdrawals. **Please include a discussion of how implementation of the GSP may affect and be coordinated with General Plan policies and procedures regarding the protection of wetlands, riparian areas, oak woodlands, aquatic resources and other GDEs and ISWs.**
- This section should identify Habitat Conservation Plans (HCPs) or Natural Community Conservation Plans (NCCPs) within the Subbasin and if they are associated with critical, GDE or ISW habitats. **Please identify all relevant HCPs and NCCPs within the Subbasin and address how GSP implementation will coordinate with the goals of these HCPs or NCCPs.**

<u>Checklist Items 5, 6, and 7 – Hydrogeologic Conceptual Model (23 CCR §354.14)</u>

[Section 4.1 Subbasin Topography and Boundaries (p. 4-1)]

- Please provide additional information on what data was used to determine that "poor quality" groundwater in the Paso Robles Formation would exclude groundwater from being part of the subbasin.

[4] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

- Defining the bottom of subbasin based on geochemical properties is a suitable approach for defining the base of freshwater, however, as noted on page 9 of DWR's Hydrogeologic Conceptual Model BMP (https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_HCM_Final_2016-12-23.pdf) "the definable bottom of the basin should be at least as deep as the deepest groundwater extractions". **Thus, groundwater extraction well depth data should also be included in the determination of the basin bottom.** This will prevent the possibility of extractors with wells deeper than the basin boundary (defined by the base of freshwater) from claiming exemption of SGMA due to their well residing outside the vertical extent of the basin boundary.

[Section 4.7.2 Groundwater Discharge Areas Inside the Subbasin (p. 4-32)]

- We support the use of the Natural Communities Commonly Associated with Groundwater Dataset (NC Dataset) to map groundwater dependent ecosystems in the Paso Robles Groundwater Basin (GSP Draft Figure 4-18). Since the NC Dataset is intended as a starting point, The Nature Conservancy has developed a Guidance Document to assist GSAs and their consultants in addressing GDEs in GSPs[5]. Also refer to **Attachment D** for best practices when using the NC dataset.
- The identification of GDEs within GSPs is a required GSP element of the Basin Setting Section under the description of Current & Historical Groundwater Conditions (23 CCR §354.16). Recognizing natural points of discharge (seeps & springs) as GDEs is consistent with the SGMA definition of GDEs[6]; **however, we recommend the identification of GDEs (GDE map Figure 4-18) for the Paso Robles basin be moved to Chapter 5: Groundwater Conditions, and elaborated upon with a description of current and historical groundwater conditions in the GDE areas.** Chapter 5 is a more appropriate place for the identification of GDEs, since groundwater conditions (e.g., depth to groundwater, interconnected surface water maps, groundwater quality) are necessary local information and data from the GSP in assessing whether polygons in the NC dataset are connected to groundwater in a principal aquifer.
- Decisions to remove, keep, or add polygons from the NC dataset into a basin GDE map should be based on best available science in a manner that promotes transparency and accountability with stakeholders. Any polygons that are removed, added, or kept should be inventoried in the submitted shapefile to DWR, and mapped in the plan. **We recommend revising Figure 4-18 to reflect this recommended methodology.**

[Section 5.2 Change in Groundwater Storage (p. 5-20)]

- Figure 5-11 illustrates that groundwater storage losses occurred during dry years and recovered in wet years. Potential impacts on groundwater storage loss due to

[5] GDEs under SGMA: Guidance for Preparing GSPs is available at: https://groundwaterresourcehub.org/public/uploads/pdfs/GWR_Hub_GDE_Guidance_Doc_2-1-18.pdf

[6] Groundwater dependent ecosystem refer to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. [23 CCR §351 (m)]

groundwater pumping is still very possible, especially since groundwater pumping data has been estimated from groundwater flow models populated with insufficient vertical groundwater gradient data, shallow monitoring data, and surface flow data. Groundwater storage in the Paso Robles formation has also been on a decline since 1980 due to groundwater pumping (Figure 5-12). Understanding groundwater storage fluctuations in the Alluvial Aquifer depends on how vertical groundwater gradients are impacted by pumping and groundwater storage changes in the Paso Robles Formation. **Please address these data gaps in the monitoring network.**

<u>Checklist Items 8, 9, and 10 – Interconnected Surface Waters (ISW) (23 CCR §354.16)</u>

[Section 5.5 Interconnected Surface Waters (p. 5-26)]

- **Please note the following best practices when filling the data gap in delineating any connections between surface water and groundwater.**
    - **Specify what data are used to determine the elevation of the stream or river bottom.**
    - The regulations [23 CCR §351(o)] define interconnected surface waters (ISW) as "surface water that is hydraulically connected <u>at any point</u> by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted". **"<u>At any point</u>" has both a spatial and temporal component.** Even short durations of interconnections of groundwater and surface water can be crucial for surface water flow and supporting environmental users of groundwater and surface water. ISWs can be either gaining or losing.
    - Due to limited shallow monitoring wells and stream gauges in the basin, **mapping ISWs are best estimated by first determining which reaches are completely disconnected from groundwater. This approach would involve comparing simulated groundwater elevations with a land surface Digital Elevation Model that could identify which surface waters have groundwater consistently below surface water features, such that an unsaturated zone would separate surface water from groundwater. Groundwater elevations that are always deeper than 50 feet below the land surface can be identified as disconnected surface waters. Also, please reconcile data gaps (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP to improve ISW mapping in future GSPs**.

<u>Checklist Items 11 to 20, Identifying, Mapping, and Describing GDEs (23 CCR §354.16)</u>

[Appendix C: Methodology for Identifying Potential Groundwater Dependent Ecosystems]

- For clarification, iGDEs are mapped polygons in DWR's NC dataset.

- **Please specify what field verification methods (e.g., isotope analysis, enhanced shallow groundwater monitoring) will be used to definitively determine whether potential GDEs are true GDEs.**
- **It is highly advised that multiple depth to groundwater measurements are used to verify whether an iGDE (or NC dataset polygon) is connected to groundwater, so that fluctuations in the groundwater regime can be adequately represented.** The analysis described on p.7 to create Figure C-3 only relies on Spring 2017 depth data, which is also after the Jan 1, 2015 SGMA benchmark date. Also, according to the shallow monitoring well data gaps described in Chapter 5 and 7, there is insufficient data to confidently remove data for NC polygons that are >5km away from a shallow well. See Attachment D of this letter for six best practices when using groundwater data to verify the NC dataset.
- **The NC dataset needs to be groundtruthed with aerial photography to screen for changes in land use that many not be reflected in the NC dataset (e.g., recent development, cultivated agricultural land, obvious human-made features).**
- Grouping multiple GDE polygons into larger units by location (proximity to each other) and principal aquifer will help to characterize GDEs under Section 4.7.2 and would simplify the process of evaluating potential effects on GDEs due to groundwater conditions under GSP Chapter 8: Sustainable Management Criteria.
- **Groundwater conditions within GDEs and the interaction between GDEs and groundwater should be briefly described within the portion of the Basin Setting Section (Section 4.7.2) where GDEs are being identified.**
- Not all GDEs are created equal. Some GDEs may contain legally protected species or ecologically rich communities, whereas other GDEs may be highly degraded with little conservation value. Including a description of the types of species (protected status, native versus non-native), habitat, and environmental beneficial uses (Refer to **Attachment C** for a list of freshwater species found in the Paso Robles Subbasin, refer to Worksheet 2, p.74 of GDE Guidance Document, and see the Critical Species Lookbook[7]) can be helpful in assigning an ecological value to the GDEs. **Identifying an ecological value of each GDE can help prioritize limited resources when considering GDEs as well as prioritizing legally protected species or habitat that may need special consideration when setting sustainable management criteria.**
- Decisions to remove, keep, or add polygons from the NC dataset into a subbasin GDE map should be based on best available science in a manner that promotes transparency and accountability with stakeholders. Any polygons that are removed, added, or kept should be inventoried in the submitted shapefile to DWR, and mapped in the plan. **We recommend revising Figure 4-18 (replicated as Figure C-7) and including it in Chapter 5 to reflect this change. Please provide the final acreage of subbasin GDE polygons.**
- While depth to groundwater levels within 30 feet are generally accepted as being a proxy for confirming that polygons in the NC dataset are connected to groundwater, the variable needs of plant species and their dependence on seasonal and inter-

[7] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

annual groundwater level fluctuations should be considered when applying this criterion. Studies have found the roots of oaks can extend deeper than 70 feet to extract water from the capillary fringe immediately above the water table during the summer and fall, and that groundwater reserves provide a buffer to rapid changes in their hydroclimate, as long as groundwater reserves are not depleted by drought or human consumption.[8] **It is highly advised that seasonal and interannual fluctuations in the groundwater regime are taken into consideration. Utilizing groundwater data from one point in time or contoured with too few shallow monitoring wells can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs.** Based on a study we recently submitted to Frontiers in Environmental Science Journal, we've observed riparian forests along the Cosumnes River to experience a range in groundwater levels between 1.5 and 75 feet over seasonal and interannual timescales. Seasonal fluctuations in the regional water table can support perched groundwater near an intermittent river that seasonally runs dry due to large seasonal fluctuations in the regional water table. While perched groundwater itself cannot directly be managed due to its position in the vadose zone, the water table position within the regional aquifer (via pumping rate restrictions, restricted pumping at certain depths, restricted pumping around GDEs, well density rules) and its interactions with surface water (e.g., timing and duration) can be managed to prevent adverse impacts to ecosystems due to changes in groundwater quality and quantity under SGMA.

Checklist Items 21 and 22 – Water Budget (23 CCR §354.18)

[Chapter 6. Water Budget (p. 6-1)]

- **Please clarify what assumptions and data were used to calculate Riparian Evapotranspiration**.
- Why was evapotranspiration only calculated for riparian vegetation? In Chapter 3.4.2 of the Draft GSP (p. 3-11), native vegetation was identified as the largest water use sector in the subbasin by land area. **Please estimate evapotranspiration for all native vegetation in the subbasin for the water budget. Environmental beneficial users of groundwater, such as wetlands and phreatophyte (oak) woodlands are of particular importance and should be explicitly mentioned. Calculations should be provided to quantify the amount of ET in the GDEs both spatially and temporally, including water year type. Please identify any data gaps.**

Checklist Items 23 to 46 – Sustainable Management Criteria

[Section 8.1 Sustainability Goal]

[8] Miller and others. 2009. Groundwater Uptake by Woody Vegetation in a Semi-Arid Oak Savannah. Water Resources Research. Volume 46. November.

- This section states that the groundwater resources in the Paso Robles Subbasin will be managed for the long-term community, financial and environmental benefit of Subbasin users. The discussion of how this goal will be achieved references cultural, community and business needs and related management actions and projects to obtain sustainability, but provides no explanation how environmental beneficial uses will be protected. **Please describe how the sustainability of environmental groundwater and interconnected surface water uses will be protected, and what management actions and conceptual projects will address environmental beneficial uses and users of groundwater.**

[Section 8.2 General Process for Establishing Sustainable Management Criteria]

- Stakeholder involvement is crucial when establishing sustainable management criteria. The role of the GSA is to represent and balance the needs of *all groundwater* beneficial uses and users in the basin, which has been expressed in the Sustainability goal in Section 8.1. According to p. 8-5, only rural residents, farmers, local cities and the county were surveyed to gather input on sustainable management criteria. **Please specify what information or efforts have been used/made to protect the interests of environmental users and disadvantaged community members.**
- SGMA requires that sustainable management criteria are consistent with other state, federal or local regulatory standards [23 CCR§354.28(b)(5)]. No reference is made to the review of supporting documents for General Plan Conservation or Land Use Elements, or to the review of environmental management studies and documents such as Biological Assessments, Biological Opinions, HCPs, NCCPs, or other studies regarding the current and historical conditions of the beneficial uses being evaluated. **Please describe what process was used to identify other regulatory standards that need consideration when establishing minimum thresholds for sustainability criteria, especially those related to protected habitats, minimum flow requirements and habitat conservation plans. Please provide detail on how sustainable management criteria were developed for GDEs and streamflow habitat, and how the above supporting documents were considered.**

[Section 8.3 Chronic Lowering of Groundwater Levels Sustainable Management Criteria]

- [8.3.2] The definition of 'significant and unreasonable' is a qualitative statement that is used to describe when undesirable results would occur in the basin, which is then related to how a minimum threshold can be quantified. Potential effects on all beneficial users of groundwater in the basin need to be taken into consideration. According to the California Constitution Article X, §2, water resources in California must be "put to beneficial use to the fullest extent of which they are capable"**. Please modify the local definition for 'significant and unreasonable' (provided on p. 8-7), so that it also specifies potential effects on environmental beneficial users of groundwater in the basin.**
- [8.3.3] Under SGMA, Measurable Objectives are to be established to achieve the sustainability goal of the basin within 20 years of Plan implementation [23 CCR §

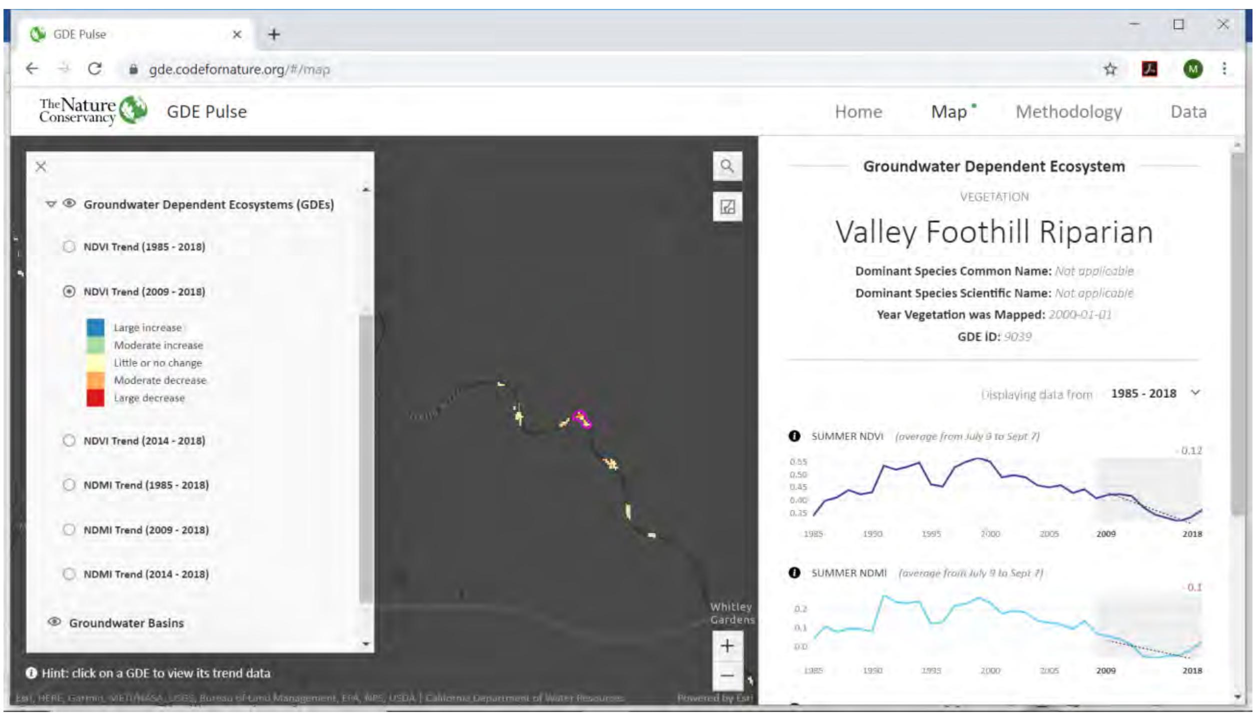
354.30 (a)]. **Please modify the methodology for setting measurable objectives for groundwater levels so that it helps attain the sustainability goal defined on p. 8-4:** "sustainably manage the groundwater resources of the Paso Robles Subbasin for <u>long-term community, financial, *and environmental* benefit of Subbasin users</u>. ... In adopting this GSP, <u>*it is the express goal of the GSAs to balance the needs of all groundwater users* in the Subbasin, within the sustainable limits of the Subbasin's resources</u>**.**" (emphasis added)

- Section 8.3.3.1 states that environmental interests were considered when establishing measurable objectives. **Please provide a discussion regarding the environmental beneficial uses and users that were considered and how this was accomplished.**
- Section 8.3.3.2 and 8.3.3.3 present measurable objective for specific wells completed in each principal aquifer, but provide no discussion how a determination was made that these groundwater levels are protective of environmental beneficial uses and users, including GDEs. **Chronic lowering of groundwater levels can have a direct effect on environmental beneficial users and this effect should be considered when setting measurable objectives for this sustainability indicator and discussed in this section and supporting materials provided. Section 8.3.3.1 should describe how environmental beneficial uses and users, including GDEs were considered when establishing measurable objectives for chronic lowering of groundwater levels. Section 8.3.3.2 and 8.3.3.3 should describe how the identified measurable objectives will succeed in preventing significant and unreasonable harm to environmental beneficial uses of groundwater, including GDEs.**

- [8.3.4] **Chronic lowering of groundwater levels can have a direct effect on environmental beneficial users and this effect should be considered when setting minimum thresholds for this sustainability indicator and discussed in this section and supporting materials provided.** A technically defensible approach is to use 10-year baseline period of groundwater elevation data (2005-2015) to establish how groundwater conditions during that time period affect different beneficial water uses and users across the basin, including GDEs**. Please document the consideration of the following when establishing minimum thresholds for chronic lowering of groundwater levels:**
  - The relationship between the minimum threshold for chronic lowering of groundwater levels and potential significant and unreasonable impacts to GDEs and ecological beneficial uses of surface water are not described. **Please provide additional analysis to substantiate that the potential impacts of applying the proposed minimum thresholds will not cause significant and unreasonable impacts to GDEs and ecological beneficial uses of ISW, or identify this as a data gap.**
  - The potential effects of undesirable results on environmental beneficial users are not described and quantified. **Please expand the section to describe the potential effects of undesirable results on all beneficial uses and users, including environmental uses and users.**

- Are the proposed minimum thresholds consistent with other state, federal or local regulatory standards, including those applicable to interconnected surface waters, protected habitats and habitat conservation plans? [23 CCR§354.28(b)(5)]?
- Are there environmental beneficial groundwater users that need consideration, particularly those that are legally protected under the United States Endangered Species Act or California Endangered Species Act? (See **Attachment C** in the attached letter for a list of freshwater species located in the Paso Robles Subbasin)?

o The GDE Pulse web application developed by The Nature Conservancy (**Attachment E**) provides easy access to 35 years of satellite data to view trends of vegetation metrics, groundwater depth (where available), and precipitation data. This satellite imagery can be used to observe trends for NC dataset polygons within the Subbasin, and relate those trends to nearby groundwater level trends. Over the past 10 years (2009-2018), some NC dataset vegetation polygons have experienced adverse impacts to vegetation growth and moisture in the western portion of the Subbasin. An example is shown in the screen shot below. **Please review these spatial patterns and, where possible, correlate them with water level trends when developing minimum thresholds. Any indications of adverse trends and any data gaps should be identified.**




- [8.3.4.2] This section states that only one monitoring well was identified where minimum thresholds could be assessed in the Alluvial Aquifer. This is a significant data gap for a variety of beneficial uses and users, including GDEs and interconnected surface water. **Please describe a plan in the Monitoring network chapter on how the GSA will install shallow monitoring wells in the alluvial aquifer if confidentially agreements prevent existing wells from being used as**

**representative monitoring wells for the Chronic Lowering of Groundwater sustainability indicator in this important aquifer.**

- [8.3.4.4 and 8.3.4.6] The description of how the groundwater elevation minimum thresholds affect interconnected surface waters and ecological land uses and users is inadequate for the following reasons:
  - The draft GSP has failed to describe current and historical groundwater conditions near GDE areas, the nature of the GDEs and their potential sensitivity to groundwater level declines, and the potential effect of groundwater level declines on GDEs. Thus, it is impossible to assess how the proposed minimum thresholds relate to historical groundwater conditions in the GDE and whether potential adverse effects could occur to the GDEs as a result of groundwater conditions. **Please include a discussion of how minimum thresholds will affect the GDEs identified in Appendix C and identify any data gaps.**
- [8.3.4.7] The identified GDEs have not been adequately described or characterized. Different GDE species will have different susceptibilities to groundwater level declines. Please refer to the Critical Species Lookbook[9] to review and discuss the potential groundwater reliance of critical species in the basin. Legally protected species located with GDEs have not been identified. Thus, it is impossible to evaluate whether federal, state, or local standards exist for groundwater elevations needed to protect these listed species. **Please provide a discussion regarding how the selected minimum thresholds will affect compliance with federal, state and local standards related to protected habitats, protected species, and other requirements, such as biological opinions, habitat conservation plans and other applicable standards.**
- [8.3.4.9] Irreversible harm to GDEs can occur within a relatively short period of time. This section summarizes interim milestones to prevent chronic lowering of groundwater levels to achieve the sustainability goal by at least 2040. **Please discuss how significant and unreasonable harm to GDEs will be prevented in the interim.**
- [8.3.5.1 and 8.3.5.3] The GSP proposes to allow violation of minimum thresholds at a certain percentage of locations prior to considering threshold violations as representative of an undesirable result. As stated above, damage to GDEs is often irreversible, leading to the permanent loss of a protected resource. A percentage violation trigger is therefore inadequate to assure that the sustainability goals of the GSP are met. **Please elaborate on how the exceedance criteria would be applied in a way that is protective of significant and unreasonable harm to GDEs. A procedure should be included for violation of minimum thresholds that includes early identification of potential GDE impacts and prioritization potentially impacted areas for investigation of impacts and appropriate response actions. This could be accomplished efficiently and cost-effectively through the use of remote sensing tools, such as GDE Pulse or other remote sensing approaches.**

[9] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

[Section 8.8 Depletion of Interconnected Surface Water Sustainable Management Criteria]

- The GSP fails to establish measurable objectives or minimum thresholds for this sustainability indicator, citing it as a data gap. The existence of riparian GDEs along the streams in the basin has been identified in Appendix C, and their connection to groundwater is assumed. Their occurrence in the riparian zone means that these GDEs should be considered a beneficial user of groundwater that could be affected by chronic groundwater level decline as discussed above, as well as beneficial users of surface water that could be depleted by groundwater extraction. **A more robust discussion of the known facts regarding these surface-groundwater interactions in the riparian zone should be provided. In addition, more detailed discussion regarding specific data gaps should be included. In our opinion, these changes are required in order for the GSP to be found adequate.**
- [8.8.1] While there are certainly data gaps and a need for additional shallow monitoring wells in the Alluvial aquifer to map ISWs, there is also a need to enhancing monitoring of stream flow and vertical groundwater gradients. After filling the data gaps for ISWs and further analysis**, specific plans and schedules should be provided for the establishment of minimum thresholds for ISWs.**
- [8.8.2] There is a need to evaluate and discuss potential effects on beneficial uses of surface and groundwater. In addition, the applicable state, federal and local standards for the protection of aquatic, riparian and other protected habitats should be discussed. This is necessary, at a minimum, so that the nature of the data gaps can be understood. **Please refer to Attachment C for a list of freshwater species in Paso Robles Subbasin that may be exist within ISWs. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the freshwater species list. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs. Please refer to the Critical Species Lookbook[10] to review and discuss the potential groundwater reliance of critical species in the basin.**

Checklist Items 47, 48 and 49 – Monitoring Network (23 CCR §354.34)

[Section 7.2.1 Groundwater Level Monitoring Network Data Gaps (p. 7-10)]

- The last row of Table 7-3 states that "Data must be able to characterize conditions and monitor adverse impacts to beneficial uses and users identified within the basin". Aside from GDEs mapped in the basin (Figure 4-18), environmental surface water

[10] Available online at: https://groundwaterresourcehub.org/sgma-tools/the-critical-species-lookbook/

users have not been identified in the GSP thus far. SGMA requires that potential effects on GDEs and environmental surface water users be described when defining undesirable results. In addition to identifying GDEs in the basin, The Nature Conservancy recommends identifying beneficial users of surface water, which include environmental users. This is a critical step, as it is impossible to define "significant and unreasonable adverse impacts" without knowing what is being impacted, nor is possible to monitor ISWs in a way that can "identify adverse impacts on beneficial uses of surface water" [23 CCR §354.34(c)(6)(D)]. For your convenience, we've provided a list of freshwater species within the boundary of the Paso Robles basin in **Attachment C**. Our hope is that this information will help your GSA better evaluate and monitor the impacts of groundwater management on environmental beneficial users of surface water. We recommend that after identifying which freshwater species exist in your basin, especially federal and state listed species, that you contact staff at the Department of Fish and Wildlife (DFW), United States Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Services (NMFS) to obtain their input on the groundwater and surface water needs of the organisms on the freshwater species list, and how best to monitor them. Because effects to plants and animals are difficult and sometimes impossible to reverse, we recommend erring on the side of caution to preserve sufficient groundwater conditions to sustain GDEs and ISWs. **Please identify appropriate biological indicators that can be used to monitor potential impacts to environmental beneficial users as a current data gap and make plans to reconcile these in Chapter 10 (Plan Implementation).**

[Section 7.6.1 Interconnected Surface Water Monitoring Data Gaps (p. 7-25)]

- In addition to the need for additional shallow monitoring wells in the Alluvial aquifer to map ISWs, **there is also a need to enhancing monitoring of stream flow and vertical groundwater gradients by installing more stream gauges and clustered/nested wells near streams, rivers or wetlands.** Ideally, co-locating stream gauges with clustered wells that can monitor groundwater levels in both the Alluvial and Paso Robles Formation aquifers would enhance understanding about where ISWs exist in the basin and whether pumping is causing depletions of surface water or impacts on beneficial users of surface water and groundwater.
- **There is a need to integrate biological indicators that can monitor adverse impacts to beneficial uses of surface water and groundwater within ISWs.**
- **Please provide sufficient detail for the investigation and monitoring program including stream gauges, screened intervals and aquifers of the shallow wells and frequency of monitoring, in order to describe monitoring of both the extent of ISWs and the quantity of surface water depletions from ISWs.**

[Chapter 10 Groundwater Sustainability Plan Implementation]

- **Please describe the expansion of the monitoring program and specify what types of monitoring will be done to identify impacts to GDEs. Be specific in describing wells and screened intervals that represent the water levels of both the Alluvial Aquifer and Paso Robles Formation Aquifer.**

Checklist Items 50 and 51 – Projects and Management Actions to Achieve Sustainability Goal (23 CCR §354.44)

[Chapter 9 Management Actions and Projects]

- As stated in GSP Section 5.5, a data gap exists around interconnected surface waters (ISWs) in the Paso Robles Subbasin. Please recognize the data gap in this Chapter and the possibility that if ISWs are present in the Subbasin, there is a need to establish sustainable management criteria for ISWs in the basin and include ISWs as a specific sustainability indicator to be addressed by management actions and projects as described herein. **For the management actions and projects already identified, state how GDEs and ISWs will be benefited or protected. If GDEs and ISWs will not be adequately protected by those listed, please include and describe additional management actions and projects.**
- An important data gap already recognized is the lack of publicly available groundwater elevation data in the Alluvial Aquifer. As discussed in TNC's comments on Section 8.3 above, a scientifically robust methodology must be proposed for establishing the initial minimum thresholds for the Alluvial Aquifer. **In light of the data gap regarding Alluvial Aquifer groundwater data, please be more specific in stating how GDEs and ISWs would benefit from management actions and projects, and how actions and projects will be evaluated to assess whether adverse impacts to GDEs will be mitigated or prevented**:
    - Promote Stormwater Capture (Page 9-10): Please describe how recharge from unallocated storm flows will be evaluated to assess benefits to GDEs and ISWs.
    - Mandatory Pumping Reductions (Page 9-13): Please discuss the data gap for wells screened in the alluvial aquifer and the data gap for vertical gradient between the alluvial aquifer and Paso Robles Formation, since most wells are screened in the Paso Robles aquifer. When these data gaps are resolved, it will become clearer how mandatory pumping reductions could also benefit GDEs and ISWs.
    - Conceptual Projects (Pages 9-18 to 9-44): Most of the conceptual projects involve in-lieu recharge for the direct use of recycled wastewater. Thus, the recycled water would replace pumped groundwater. Since these conceptual projects are location-specific, please highlight the benefits of these conceptual projects on specific mapped GDEs and ISWs.
- For more case studies on how to incorporate environmental benefits into groundwater projects, please visit our website: https://groundwaterresourcehub.org/case-studies/recharge-case-studies/

# Attachment C

## Freshwater Species Located in the Paso Robles 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 Paso Robles 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 Paso Robles groundwater 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[11]. 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[12] as well as on The Nature Conservancy's science website[13].

| Scientific Name | Common Name | Legally Protected Status | | |
|---|---|---|---|---|
| | | **Federal** | **State** | **Other** |
| | | **BIRD** | | |
| Actitis macularius | Spotted Sandpiper | | | |
| Aechmophorus clarkii | Clark's Grebe | | | |
| Aechmophorus occidentalis | Western Grebe | | | |
| Agelaius tricolor | Tricolored Blackbird | Bird of Conservation Concern | SSC | BSSC - First priority |
| Aix sponsa | Wood Duck | | | |
| Anas americana | American Wigeon | | | |
| Anas clypeata | Northern Shoveler | | | |
| Anas crecca | Green-winged Teal | | | |
| Anas cyanoptera | Cinnamon 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 | | | |
| Aythya collaris | Ring-necked Duck | | | |
| Aythya valisineria | Canvasback | | SSC | |
| Bucephala albeola | Bufflehead | | | |
| Bucephala clangula | Common Goldeneye | | | |
| Butorides virescens | Green Heron | | | |

[11] 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
[12] California Department of Fish and Wildlife BIOS: https://www.wildlife.ca.gov/data/BIOS
[13] Science for Conservation: https://www.scienceforconservation.org/products/california-freshwater-species-database

| | | | | |
|---|---|---|---|---|
| Calidris mauri | Western Sandpiper | | | |
| Chen caerulescens | Snow Goose | | | |
| Chen rossii | Ross's Goose | | | |
| Chroicocephalus philadelphia | Bonaparte's Gull | | | |
| Cistothorus palustris palustris | Marsh Wren | | | |
| Egretta thula | Snowy Egret | | | |
| Fulica americana | American Coot | | | |
| Gallinago delicata | Wilson's Snipe | | | |
| Gallinula chloropus | Common Moorhen | | | |
| Geothlypis trichas trichas | Common Yellowthroat | | | |
| Haliaeetus leucocephalus | Bald Eagle | Bird of Conservation Concern | Endangered | |
| Icteria virens | Yellow-breasted Chat | | SSC | BSSC - Third priority |
| Lophodytes cucullatus | Hooded Merganser | | | |
| Megaceryle alcyon | Belted Kingfisher | | | |
| Mergus merganser | Common Merganser | | | |
| Mergus serrator | Red-breasted Merganser | | | |
| Numenius americanus | Long-billed Curlew | | | |
| Nycticorax nycticorax | Black-crowned Night-Heron | | | |
| Oxyura jamaicensis | Ruddy Duck | | | |
| Pandion haliaetus | Osprey | | Watch list | |
| Pelecanus erythrorhynchos | American White Pelican | | SSC | BSSC - First priority |
| Phalacrocorax auritus | Double-crested Cormorant | | | |
| Podiceps nigricollis | Eared Grebe | | | |
| Podilymbus podiceps | Pied-billed Grebe | | | |
| Porzana carolina | Sora | | | |
| Rallus limicola | Virginia Rail | | | |
| Recurvirostra americana | American Avocet | | | |
| Riparia riparia | Bank Swallow | | Threatened | |
| Setophaga petechia | Yellow Warbler | | | BSSC - Second priority |
| Tachycineta bicolor | Tree Swallow | | | |
| Tringa melanoleuca | Greater Yellowlegs | | | |
| Tringa solitaria | Solitary Sandpiper | | | |
| Vireo bellii | Bell's Vireo | | | |
| Vireo bellii pusillus | Least Bell's Vireo | Endangered | Endangered | |

| | | | | |
|---|---|---|---|---|
| Xanthocephalus xanthocephalus | Yellow-headed Blackbird | | SSC | BSSC - Third priority |
| **CRUSTACEAN** | | | | |
| Branchinecta lynchi | Vernal Pool Fairy Shrimp | Threatened | SSC | IUCN - Vulnerable |
| Cyprididae fam. | Cyprididae fam. | | | |
| Hyalella spp. | Hyalella spp. | | | |
| Pacifastacus spp. | Pacifastacus spp. | | | |
| **FISH** | | | | |
| Oncorhynchus mykiss - SCCC | South Central California coast steelhead | Threatened | SSC | Vulnerable - Moyle 2013 |
| Catostomus occidentalis mnioltiltus | Monterey sucker | | | Least Concern - Moyle 2013 |
| Catostomus occidentalis occidentalis | Sacramento sucker | | | Least Concern - Moyle 2013 |
| Cottus gulosus | Riffle sculpin | | SSC | Near-Threatened - Moyle 2013 |
| Entosphenus tridentata ssp. 1 | Pacific lamprey | | SSC | Near-Threatened - Moyle 2013 |
| Lavinia exilicauda exilicauda | Sacramento hitch | | SSC | Near-Threatened - Moyle 2013 |
| Lavinia exilicauda harengeus | Monterey hitch | | SSC | Vulnerable - Moyle 2013 |
| Oncorhynchus mykiss irideus | Coastal rainbow trout | | | Least Concern - Moyle 2013 |
| Orthodon microlepidotus | Sacramento blackfish | | | Least Concern - Moyle 2013 |
| Ptychocheilus grandis | Sacramento pikeminnow | | | Least Concern - Moyle 2013 |
| Oncorhynchus mykiss - SCCC | South Central California coast steelhead | Threatened | SSC | Vulnerable - Moyle 2013 |
| **HERP** | | | | |
| Actinemys marmorata marmorata | Western Pond Turtle | | SSC | ARSSC |

| | | | | |
|---|---|---|---|---|
| Ambystoma californiense californiense | California Tiger Salamander | Threatened | Threatened | ARSSC |
| Anaxyrus boreas boreas | Boreal Toad | | | |
| Anaxyrus boreas halophilus | California Toad | | | ARSSC |
| Anaxyrus californicus | Arroyo Toad | Endangered | SSC | ARSSC |
| Pseudacris cadaverina | California Treefrog | | | ARSSC |
| Pseudacris hypochondriaca | Baja California Treefrog | | | |
| Pseudacris regilla | Northern Pacific Chorus Frog | | | |
| Rana boylii | Foothill Yellow-legged Frog | Under Review in the Candidate or Petition Process | SSC | ARSSC |
| Rana draytonii | California Red-legged Frog | Threatened | SSC | ARSSC |
| Spea hammondii | Western Spadefoot | Under Review in the Candidate or Petition Process | SSC | ARSSC |
| Taricha torosa | Coast Range Newt | | SSC | ARSSC |
| Thamnophis hammondii hammondii | Two-striped Gartersnake | | SSC | ARSSC |
| Thamnophis sirtalis infernalis | California Red-sided Gartersnake | | | Not on any status lists |
| Thamnophis sirtalis sirtalis | Common Gartersnake | | | |
| **INSECT & OTHER INVERT** | | | | |
| Acentrella spp. | Acentrella spp. | | | |
| Agabus spp. | Agabus spp. | | | |
| Ambrysus mormon | Creeping water bug | | | Not on any status lists |
| Antocha spp. | Antocha spp. | | | |
| Argia emma | Emma's Dancer | | | |
| Argia lugens | Sooty Dancer | | | |
| Argia spp. | Argia spp. | | | |
| Argia vivida | Vivid Dancer | | | |
| Baetidae fam. | Baetidae fam. | | | |
| Baetis spp. | Baetis spp. | | | |
| Berosus punctatissimus | Water scavenger beetles | | | Not on any status lists |
| Berosus spp. | Berosus spp. | | | |
| Callibaetis spp. | Callibaetis spp. | | | |

| | | | | |
|---|---|---|---|---|
| Centroptilum spp. | Centroptilum spp. | | | |
| Chaetarthria bicolor | Water Scavenger Beetles | | | Not on any status lists |
| Chaetarthria ochra | Water Scavenger Beetles | | | Not on any status lists |
| Cheumatopsyche spp. | Cheumatopsyche spp. | | | |
| Chironomidae fam. | Chironomidae fam. | | | |
| Chironomus spp. | Chironomus spp. | | | |
| Cladotanytarsus spp. | Cladotanytarsus spp. | | | |
| Coenagrionidae fam. | Coenagrionidae fam. | | | |
| Corisella spp. | Corisella spp. | | | |
| Corixidae fam. | Corixidae fam. | | | |
| Cricotopus spp. | Cricotopus spp. | | | |
| Dicrotendipes spp. | Dicrotendipes spp. | | | |
| Dytiscidae fam. | Dytiscidae fam. | | | |
| Enallagma civile | Familiar Bluet | | | |
| Enallagma cyathigerum | Common blue damselfly | | | Not on any status lists |
| Enochrus carinatus | Water Scavenger Beetles | | | Not on any status lists |
| Enochrus cristatus | Water Scavenger Beetles | | | Not on any status lists |
| Enochrus piceus | Water Scavenger Beetles | | | Not on any status lists |
| Enochrus pygmaeus | Water Scavenger Beetles | | | Not on any status lists |
| Enochrus spp. | Enochrus spp. | | | |
| Ephemerella spp. | Ephemerella spp. | | | |
| Ephemerellidae fam. | Ephemerellidae fam. | | | |
| Ephydridae fam. | Ephydridae fam. | | | |
| Eukiefferiella spp. | Eukiefferiella spp. | | | |
| Fallceon quilleri | A Mayfly | | | |
| Graptocorixa spp. | Graptocorixa spp. | | | |
| Gyrinus spp. | Gyrinus spp. | | | |
| Helichus spp. | Helichus spp. | | | |
| Helicopsyche spp. | Helicopsyche spp. | | | |
| Hetaerina americana | American Rubyspot | | | |
| Hydrochus spp. | Hydrochus spp. | | | |
| Hydrophilidae fam. | Hydrophilidae fam. | | | |
| Hydroporus spp. | Hydroporus spp. | | | |
| Hydropsyche spp. | Hydropsyche spp. | | | |
| Hydropsychidae fam. | Hydropsychidae fam. | | | |
| Hydroptila spp. | Hydroptila spp. | | | |
| Hydryphantidae fam. | Hydryphantidae fam. | | | |
| Ischnura spp. | Ischnura spp. | | | |
| Laccobius ellipticus | Water scavenger beetles | | | Not on any status lists |
| Laccobius spp. | Laccobius spp. | | | |

| | | | | |
|---|---|---|---|---|
| Laccophilus maculosus | Dingy Diver | | | Not on any status lists |
| Lepidostoma spp. | Lepidostoma spp. | | | |
| Leptoceridae fam. | Leptoceridae fam. | | | |
| Libellula saturata | Flame Skimmer | | | |
| Limnophyes spp. | Limnophyes spp. | | | |
| Liodessus obscurellus | Predacious Diving Beetle | | | Not on any status lists |
| Macromia magnifica | Western River Cruiser | | | |
| Malenka spp. | Malenka spp. | | | |
| Microcylloepus spp. | Microcylloepus spp. | | | |
| Microtendipes spp. | Microtendipes spp. | | | |
| Nectopsyche spp. | Nectopsyche spp. | | | |
| Ochthebius spp. | Ochthebius spp. | | | |
| Ophiogomphus bison | Bison Snaketail | | | |
| Optioservus spp. | Optioservus spp. | | | |
| Oreodytes spp. | Oreodytes spp. | | | |
| Paracloeodes minutus | A Small Minnow Mayfly | | | |
| Paracymus spp. | Paracymus spp. | | | |
| Paratanytarsus spp. | Paratanytarsus spp. | | | |
| Peltodytes spp. | Peltodytes spp. | | | |
| Phaenopsectra spp. | Phaenopsectra spp. | | | |
| Plathemis lydia | Common Whitetail | | | |
| Postelichus spp. | Postelichus spp. | | | |
| Procladius spp. | Procladius spp. | | | |
| Pseudochironomus spp. | Pseudochironomus spp. | | | |
| Psychodidae fam. | Psychodidae fam. | | | |
| Rheotanytarsus spp. | Rheotanytarsus spp. | | | |
| Rhyacophila spp. | Rhyacophila spp. | | | |
| Sigara mckinstryi | A Water Boatman | | | Not on any status lists |
| Sigara spp. | Sigara spp. | | | |
| Simuliidae fam. | Simuliidae fam. | | | |
| Simulium spp. | Simulium spp. | | | |
| Sperchon spp. | Sperchon spp. | | | |
| Sperchontidae fam. | Sperchontidae fam. | | | |
| Stictotarsus spp. | Stictotarsus spp. | | | |
| Sweltsa spp. | Sweltsa spp. | | | |
| Tanytarsus spp. | Tanytarsus spp. | | | |
| Tipulidae fam. | Tipulidae fam. | | | |
| Tramea lacerata | Black Saddlebags | | | |
| Tricorythodes spp. | Tricorythodes spp. | | | |
| Wormaldia spp. | Wormaldia spp. | | | |
| **MAMMAL** | | | | |
| Castor canadensis | American Beaver | | | Not on any status lists |

| | | | | |
|---|---|---|---|---|
| **MOLLUSK** | | | | |
| Gyraulus spp. | Gyraulus spp. | | | |
| Lymnaea spp. | Lymnaea spp. | | | |
| Menetus opercularis | Button Sprite | | | CS |
| Physa spp. | Physa spp. | | | |
| Pisidium spp. | Pisidium spp. | | | |
| Planorbidae fam. | Planorbidae fam. | | | |
| **PLANT** | | | | |
| Alnus rhombifolia | White Alder | | | |
| Ammannia coccinea | Scarlet Ammannia | | | |
| Anemopsis californica | Yerba Mansa | | | |
| Azolla filiculoides | Mosquito Fern | | | |
| Baccharis salicina | Willow Baccharis | | | Not on any status lists |
| Bolboschoenus maritimus paludosus | Saltmarsh Bulrush | | | Not on any status lists |
| Callitriche heterophylla bolanderi | Large Water-starwort | | | |
| Callitriche marginata | Winged Water-starwort | | | |
| Castilleja minor minor | Alkali Indian-paintbrush | | | |
| Castilleja minor spiralis | Large-flower Annual Indian-paintbrush | | | |
| Cotula coronopifolia | Brass Buttons | | | |
| Crassula aquatica | Water Pygmyweed | | | |
| Crypsis vaginiflora | African Prickle Grass | | | |
| Cyperus erythrorhizos | Red-root Flatsedge | | | |
| Eleocharis macrostachya | Creeping Spikerush | | | |
| Eleocharis parishii | Parish's Spikerush | | | |
| Epilobium campestre | Smooth Boisduvalia | | | Not on any status lists |
| Epilobium cleistogamum | Cleistogamous Spike-primrose | | | |
| Eryngium spinosepalum | Spiny Sepaled Coyote-thistle | | SSC | CRPR - 1B.2 |
| Eryngium vaseyi vaseyi | Vasey's Coyote-thistle | | | Not on any status lists |
| Euthamia occidentalis | Western Fragrant Goldenrod | | | |
| Helenium puberulum | Rosilla | | | |
| Hydrocotyle verticillata verticillata | Whorled Marsh-pennywort | | | |
| Juncus dubius | Mariposa Rush | | | |
| Juncus effusus effusus | Common Bog Rush | | | |
| Juncus luciensis | Santa Lucia Dwarf Rush | | SSC | CRPR - 1B.2 |
| Juncus macrophyllus | Longleaf Rush | | | |
| Juncus xiphioides | Iris-leaf Rush | | | |

| | | | | |
|---|---|---|---|---|
| Limosella aquatica | Northern Mudwort | | | |
| Marsilea vestita vestita | Hairy Waterclover | | | Not on any status lists |
| Mimulus guttatus | Common Large Monkeyflower | | | |
| Mimulus latidens | Broad-tooth Monkeyflower | | | |
| Mimetanthe pilosa | Snouted Monkey Flower | | | Not on any status lists |
| Montia fontana fontana | Fountain Miner's-lettuce | | | |
| Navarretia prostrata | Prostrate Navarretia | | SSC | CRPR - 1B.1 |
| Paspalum distichum | Joint Paspalum | | | |
| Persicaria lapathifolia | Common Knotweed | | | Not on any status lists |
| Persicaria maculosa | Spotted Ladysthumb | | | Not on any status lists |
| Phacelia distans | Common Phacelia | | | |
| Pilularia americana | Pillwort | | | |
| Plagiobothrys acanthocarpus | Adobe Popcorn-flower | | | |
| Plantago elongata elongata | Slender Plantain | | | |
| Platanus racemosa | California Sycamore | | | |
| Psilocarphus brevissimus brevissimus | Dwarf Woolly-heads | | | |
| Ranunculus aquatilis diffusus | Whitewater Crowfoot | | | Not on any status lists |
| Rorippa curvisiliqua curvisiliqua | Curve-pod Yellowcress | | | |
| Rumex conglomeratus | Green Dock | | | |
| Rumex salicifolius salicifolius | Willow Dock | | | |
| Salix exigua exigua | Narrowleaf Willow | | | |
| Salix laevigata | Polished Willow | | | |
| Salix lasiolepis lasiolepis | Arroyo Willow | | | |
| Schoenoplectus americanus | Three-square Bulrush | | | |
| Schoenoplectus pungens longispicatus | Three-square Bulrush | | | |
| Schoenoplectus pungens pungens | Common Threesquare | | | |
| Schoenoplectus saximontanus | Rocky Mountain Bulrush | | | |
| Typha domingensis | Southern Cattail | | | |
| Typha latifolia | Broadleaf Cattail | | | |
| Veronica anagallis-aquatica | Water Speedwell | | | |

| | | | | |
|---|---|---|---|---|
| Veronica catenata | Chain Speedwell | | | Not on any status lists |

Notes:
ARSSC = At-Risk Species of Special Concern
BSSC = Bird Species of Special Concern
CRPR = California Rare Plant Rank
CS = Currently Stable
SSC = Species of Special Concern

# Attachment D

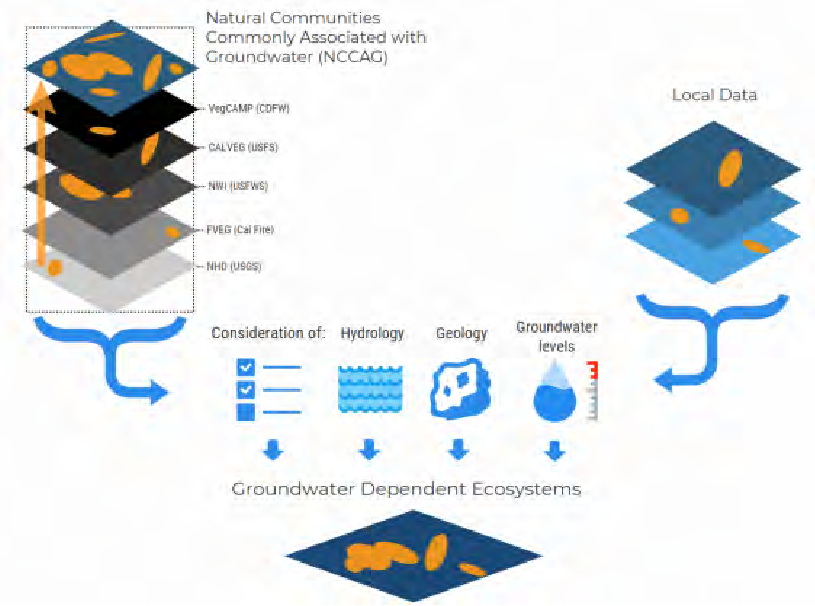
The Nature Conservancy

**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[14] 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)[15]. This document highlights six best practices for using local groundwater data to confirm whether mapped features in the NC dataset are supported by groundwater.




[14] *NC Dataset Online Viewer:* *https://gis.water.ca.gov/app/NCDatasetViewer/*

[15] 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[16]. 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[17] on the Groundwater Resource Hub[18], 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*.

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[16] *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*

[17] "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/

[18] *The Groundwater Resource Hub: www.GroundwaterResourceHub.org*

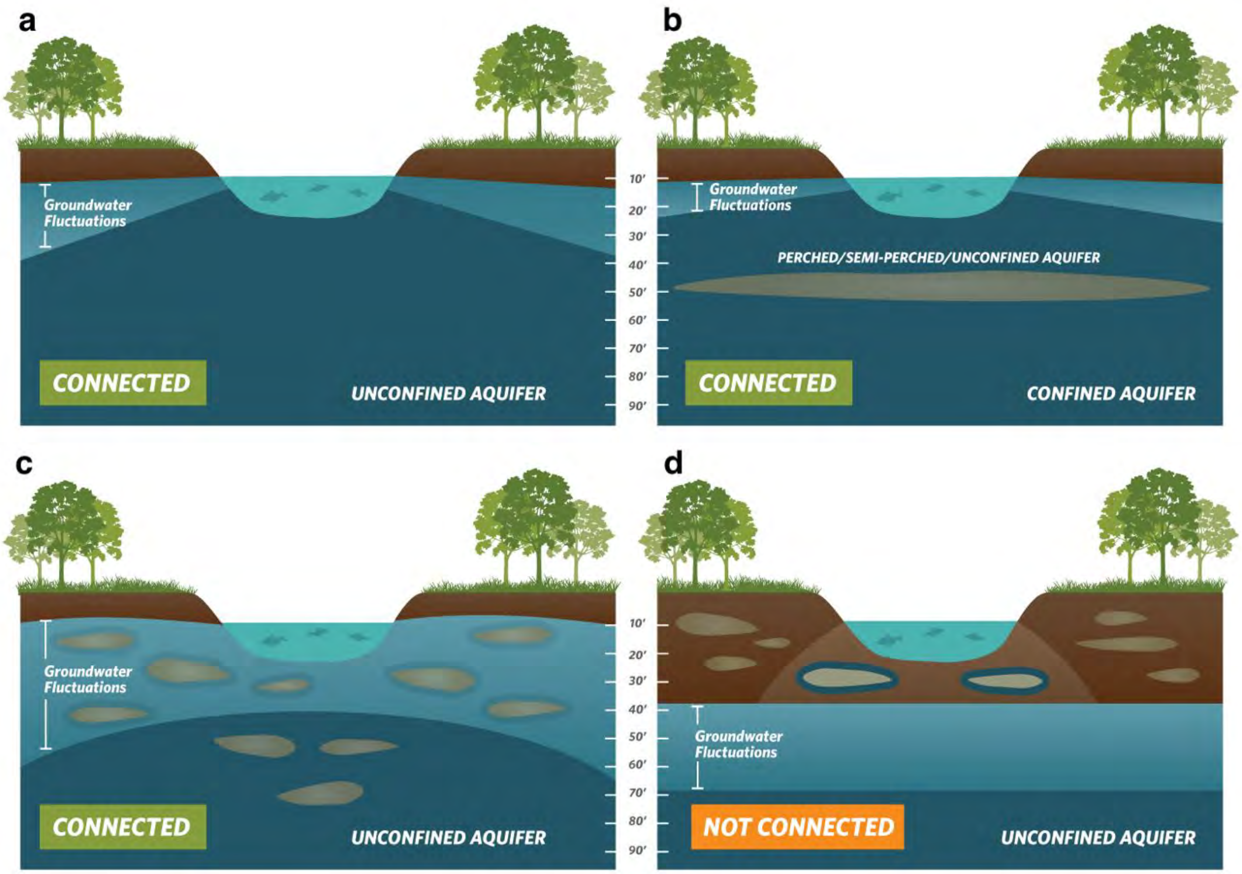


**Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a)** Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying 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[19] 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[20] 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[21] 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[22]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP <u>until</u> data gaps are reconciled in the monitoring network (see Best Practice #6).

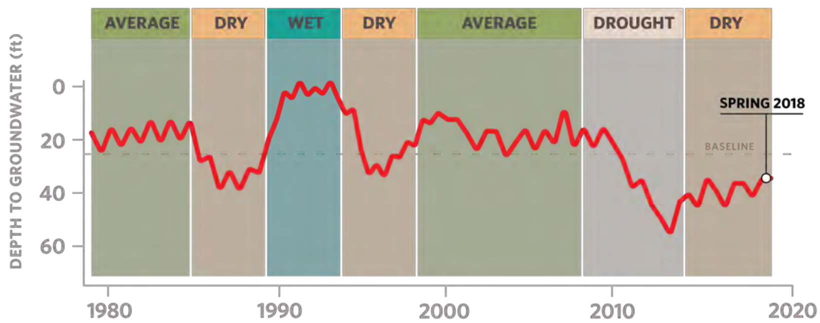


**Figure 3. Example seasonality and interannual variability in depth-to-groundwater over time.** Selecting one point in time, such as Spring 2018, to characterize groundwater conditions in GDEs fails to capture what groundwater conditions are necessary to maintain the ecosystem status into the future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

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[19] 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

[20] *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)]*

[21] 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]).

[22] *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[23], 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).

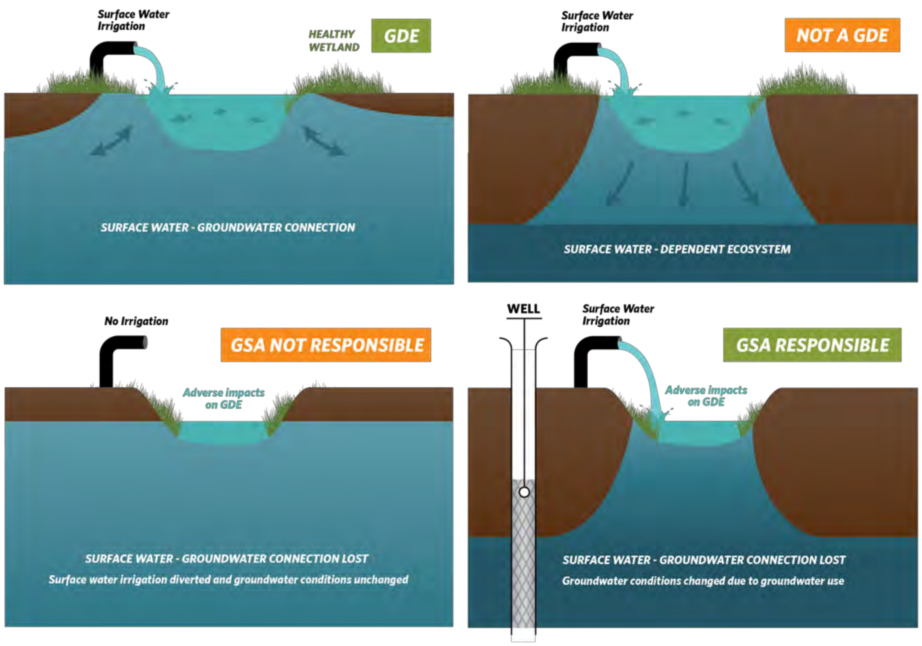



**Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left)** Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent.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

[23] *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.

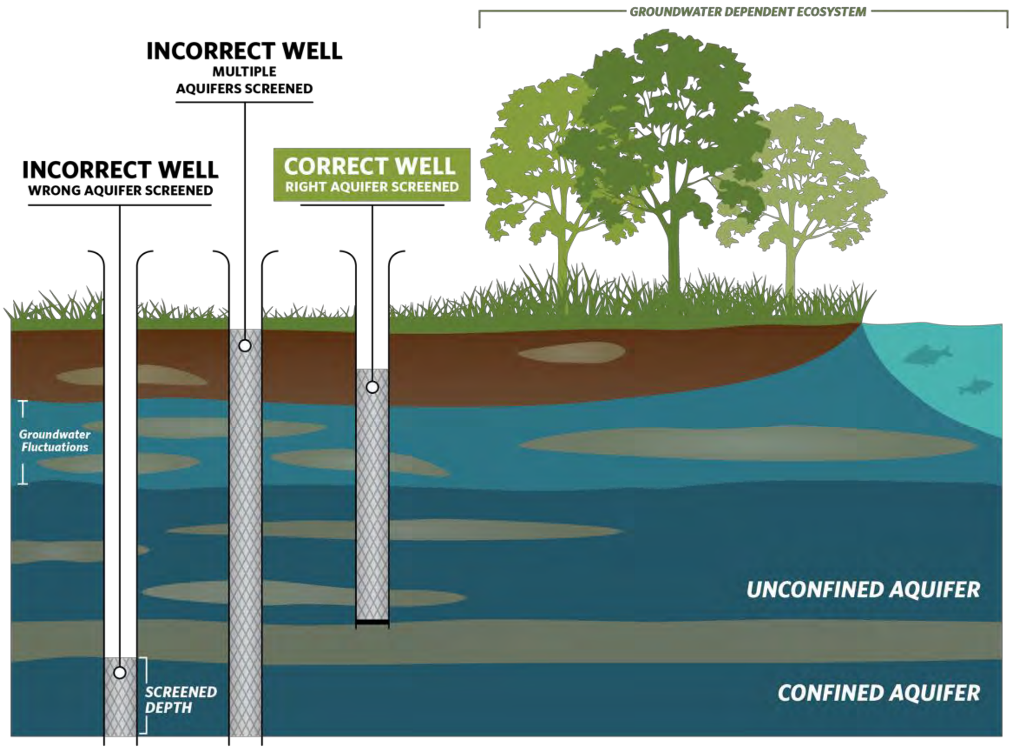



**Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.**

## 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)[24] 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.

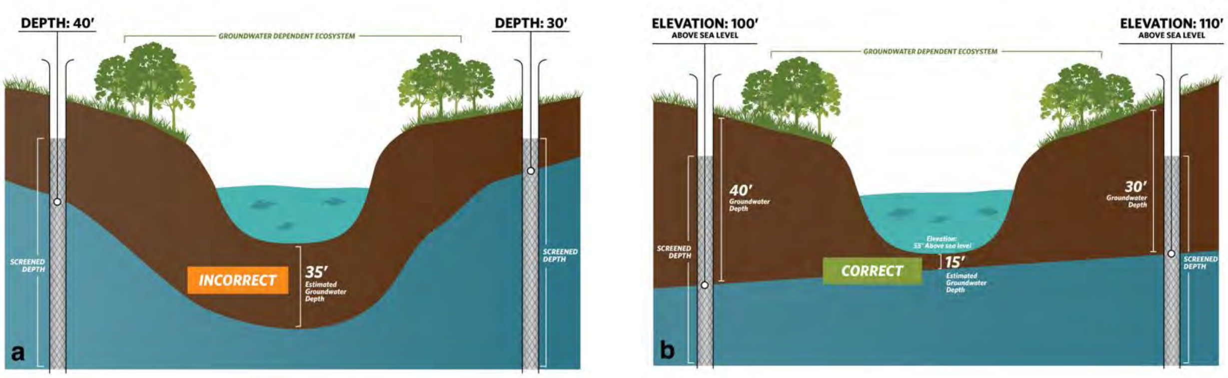



**Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a)** Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

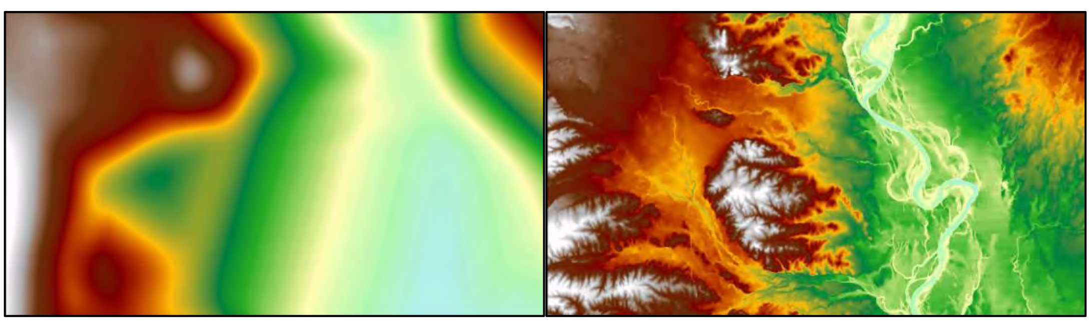


**Figure 7. Depth-to-groundwater contours in Northern California. (Left)** Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface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

[24] 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.

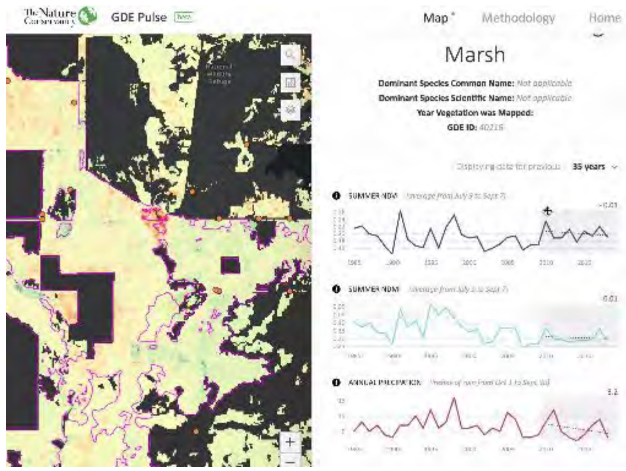
# Attachment E

## GDE Pulse

A new, free online tool that allows Groundwater Sustainability Agencies to assess changes in groundwater dependent ecosystem (GDE) health using satellite, rainfall, and groundwater data.

The Nature Conservancy
Protecting nature. Preserving life.

Visit https://gde.codefornature.org/




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[25]. The following datasets are included:

**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[26]. 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.

[25] *The Natural Communities Commonly Associated with Groundwater Dataset is hosted on the California Department of Water Resources' website: https://gis.water.ca.gov/app/NCDatasetViewer/#*

[26] The PRISM dataset is hosted on Oregon State University's website: http://www.prism.oregonstate.edu/

My name is Robert Woodland. My family has been part of San Luis Obispo county for three generations. We have been involved in Farming for many years. I am the managing member and or family representative of approx. 300 acres of vineyard in the north county.

Thank you SLO Co and the other GSAs for all of your time and effort in forming the current draft of the Groundwater Sustainability Plan.

There are a few issues that I am concerned about that aren't answered or addressed in the current draft.

I am concerned that there is no agriculture related representations or inclusion in the various GSP meetings or involvement in the draft policy. I am also concerned that in an agricultural county there is no agricultural voice and that there should be at least 1 voting representative from the ag community.

I am concerned that growth doesn't appear to have been considered regarding de minimis users and that there doesn't appear to be a way of monitoring or policing water use.

I am concerned that there has been nothing addressed regarding farmers that have been and are working on best farming practices versus farmers that don't. If there is a blanket cut back in water use, those who have invested time and money into reducing water usage will be hurt the most.

Thanks again to the County and other GSAs for your hard work and dedication. The GSP will impact everyone in the area and I believe should be represented by all facets of those impacted.

Respectfully,

Robert Woodland