Big Valley Basin Groundwater Sustainability Plan

Annual Report for Water Year 2022

No. 5-004 Big Valley Groundwater Basin

Prepared by:

Contributors

Prepared by:

Lassen County
Groundwater Sustainability Agency

Modoc County
Groundwater Sustainability Agency

Board Members

Gary Bridges (District 2), Chair
Chris Gallagher (District 1)
Tom Neely (District 3)
Aaron Albaugh (District 4), Vice-Chair
Jason Ingram (District 5)

Kathie Rhoads (District 3), Chair
Shane Starr (District 2), Vice-Chair
Geri Byrne (District 5), Chair
Elizabeth Cavasso (District 4)
Ned Coe (District 1)

County Staff

Department of Planning and Building Services
Maurice Anderson, Director
Gaylon Norwood, Deputy Director
Cortney Flather, Natural Resources Coordinator
Brooke Suarez, Fiscal Officer
Dana Hopkins, Administrative Assistant
Jason Housel, Information Services Supervisor

Office of Administration
Chester Robertson, County Administrative Officer
Tiffany Martinez, Assistant County Administrative Officer

Technical Team

Mavrick Farnam, University of California Cooperative Extension Modoc County
Janyne M. Little, University of California Cooperative Extension Lassen County
Laura K. Snell, University of California Cooperative Extension Modoc County
David F. Lile, University of California Cooperative Extension Lassen County

Big Valley Advisory Committee

Aaron Albaugh
Kevin Mitchell
Duane Connor
Gary Bridges (alternate)

Geri Byrne
Jimmy Nunn
John Olm
Ned Coe (alternate)

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Abbreviations

AEM	Airborne Electromagnetic Surveys
AF	Acre-feet
AgMAR	Agricultural Managed Recharge
BVAC	Big Valley Advisory Committee
BVGB	Big Valley Groundwater Basin
BVGSP	Big Valley Groundwater Sustainability Plan
BVMW	Big Valley Monitoring Well
CASGEM	California Statewide Groundwater Elevation Monitoring Program
CCR	California Code of Regulations
CIMIS	California Irrigation Management Information System
DWR	California Department of Water Resources
ET	Evapotranspiration
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IM	Interim Milestone
MOU	Memorandum of Understanding
MO	Measurable Objective
MT	Minimum Threshold
NOAA	National Oceanic and Atmospheric Administration
RMW	Representative Monitoring Well
RVB	Round Valley Basin
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
USGS	United States Geological Survey
UCCE	University of California Cooperative Extension
WY	Water year

Executive Summary

The Big Valley Groundwater Basin (referred to herein as "the basin," or "BVGB" interchangeably), California Department of Water Resources (DWR) Basin No. 5-004 is classified as a "medium" priority basin. (DWR, 2019). The basin, shown in **Figure 1.1,** spans a land area of about 144 square miles in Modoc and Lassen counties (28 and 72 percent respectively). To comply with the requirements set forth by the 2014 Sustainable Groundwater Management Act (SGMA) (California Water Code, Section 10720 et seq.), both counties have taken on the role of Groundwater Sustainability Agency (GSA) for the portion of the basin within their jurisdictional boundaries.

The Groundwater Sustainability Plan (BVGSP or GSP) was adopted by both County Boards of Supervisors on December 15, 2021 and submitted to DWR on January 27, 2022. Per California Code of Regulations (CCR) 23 § 356.2, an Annual Report must be submitted to DWR by April 1 of each year following the adoption of the GSP, providing updates to basin conditions for the preceding water year (October 1 through September 30). Data covered in the basin GSP concludes in water year (WY) 2018. The first annual report provided an update on basin conditions for the subsequent water years, 2019 through 2021. This annual report covers WY 2022, October 1, 2021 through September 30, 2022.

The GSA technical team has worked diligently to provide the best available data for this annual report but are constrained by data availability, lack of funding, and no supporting consulting firm. We were left with a flawed water budget from our GSP development that we have updated for WY 2022 but still lacks basin specifics needed for management. We hope to address these in the five year update. A majority of the wells used for the annual report are measured by DWR and due to technical difficulties, the SGMA portal was not available for download until March 2022 and many wells do not have consistent monitoring during to staffing at DWR.

Conditions in the Basin during the 2022 WY have remained consistent with those discussed in the GSP with relation to sustainability criteria. Even during this critical water year, water elevations at all representative monitoring wells with significant historic data to analyze remained above their measurable objectives.

The 2022 WY is considered critical with Pit River stream flows only slightly higher than 2021 and precipitation 85% of average. Stream flows were not as high as precipitation levels would have predicted most likely due to the dry nature of the basin following 2020 and 2021. The Pit River and Ash Creek, major tributaries in the basin, typically experience high flows occurring during the winter/spring months and lows during the summer/fall, correlating with trends in precipitation and snowpack melt. Summer flows of the Pit River and all tributaries are fully allocated under existing water rights.

Within the BVGB, 22 wells were enrolled in the California Statewide Groundwater Elevation Monitoring Program (CASGEM.). During GSP implementation, five deep wells were constructed to support additional monitoring and were added to the CASGEM program. These deep wells, along with 7 other CASGEM wells, were selected to be Representative Monitoring Wells (RMWs) for basin conditions and assigned Sustainable Management Criteria (SMC). Hydrographs for each RMW are provided in **Appendix A** and summarized in **Table 2.1.2** relative to their SMCs**.**

Depth-to-groundwater data taken from the RMWs was used to generate groundwater elevation contours for Fall and Spring for 2022 water year. These wells are also used to determine change in groundwater storage. The hydraulic gradients illustrated by the contour maps generally indicate north-south directional flow on the west side of the basin, and east-west directional flow on the east side of the basin. Seasonal variations are apparent as gradient steepness increases in the fall and decreases in the spring across the basin, corresponding with times of groundwater extraction and recharge respectively. Updated estimates of groundwater storage for water year 2022 are reported in **Figure 2.2.4,** which shows water year type (precipitation), the annual change in groundwater storage, and the cumulative change in groundwater storage from WY 1983 to WY 2022.

Although this model is limited by its reliance on assumptions about aquifer structure and the quality of data available for the water budget, it is sufficiently accurate for this report. As implementation progresses and more data is made available, refining this and other models will improve the accuracy of estimates. A map showing annual changes in groundwater storage between the fall season of WY 2021 to 2022 can be found in **Appendix E.**

As described in the GSP, land use sectors in Big Valley "differ from DWR's water use sectors identified in Article 2 of the GSP regulations because DWR's sectors don't adequately describe the uses in Big Valley." (BVGSP 3-8). At the time of this report, the best data available to estimate land use by water use sector remains that which was reported in the development of the GSP. However, this dataset was identified as inaccurate, and as such, remains a data gap in this report. **Table 2.2.1** (Table 3-2 in the GSP**)** continues to provide the best summary of water use sectors for water year 2022.

Overall, basin conditions during the 2022 water year have remained consistent with the trends anticipated in the GSP. **Table 2.1.2** provides a summary of water levels and SMCs in the RMWs. For wells where there is sufficient data to analyze, groundwater levels have remained above the measurable objectives and as such, remain well above Minimum Thresholds.

Implementation of the GSP has been ongoing concurrently with its development, as outlined in Chapter 9: Project and Management Actions. Due to limited data availability, as with in the GSP, the water budget and other models used in this report draw heavily on assumptions about environmental factors such as evapotranspiration (ET), crop water use efficiency, and land use data. Improving data quality for basin management is a major goal of the GSAs. Therefore, the primary focus of work at this time has been to address the data gaps identified in the GSP, many of which carry over into this report. Research has produced preliminary results about the relationship between ET and applied water in the basin as well as possible groundwater winter recharge in fields and unlined canals and ditches. Two gages were installed, one on the Pit River north of lookout and one on the outflow of Robert's reservoir. The proposed installation of a California Irrigation Management Information System (CIMIS) sensor in the basin would help refine estimates of a number of variables, none the least of which include precipitation and evapotranspiration.

1. General Information

1.1 Background

The local community in the Big Valley Groundwater Basin and surrounding areas is extremely rural, economically disadvantaged and resource capacity limited. As with much of the surrounding region, the economy is largely agricultural, but unlike many other groundwater basins in California, the growing season in Big Valley is constrained to about 101 days per year by hard freezes and snow. Considering these limitations, the majority of farmed land employs low impact farming techniques to produce low-input crops such as hay and pasture crops. The ensuing cropping systems support an abundance of wildlife habitat and help maintain pristine quality in both surface and groundwater systems.

1.1.1 Big Valley Basin GSAs and Big Valley Advisory Committee

With no other existing agency to take up this task, Modoc and Lassen Counties were established as GSAs for their respective portions of the basin in 2017 to attempt to retain local control of groundwater management.

When DWR finalized the basin's medium priority designation in 2019, the GSAs elected to collaborate on a single GSP and developed a Memorandum of Understanding (MOU) which details the coordination between the two GSAs. The MOU provided for the establishment of a local advisory committee to oversee the development of the GSP. Applications for this committee, known as the Big Valley Advisory Committee (BVAC) were solicited from local landowners and residents following public noticing protocols. Appointments were made by the County Boards of Supervisors. The BVAC was comprised of a board member from each county, one alternate board member from each county, and two public applicants from each county.

1.1.2 Big Valley Basin Groundwater Sustainability Plan

From chapter one of the Big Valley GSP, "the sustainability goal for the Big Valley Groundwater Basin is to maintain a locally governed, economically feasible, sustainable groundwater basin and surrounding watershed for existing and future legal beneficial uses with a concentration on agriculture. Sustainable management will be conducted in context with the unique culture of the basin, character of the community, quality of life of the Big Valley residents, and the vested right of agricultural pursuits through the continued use of groundwater and surface water." (BVGSP p. 1-5).

Management of the basin prioritizes the interests of the basin's legal beneficial users in all decisions, as defined under the sustainability goal. To this effect, projects and management actions were identified in Chapter 9 of the GSP and are being implemented to refine existing data gaps. Consistent with this objective and to avoid undesirable results, monitoring networks to evaluate quantifiable management criteria (minimum thresholds, measurable objectives, and interim milestones[1]) were established for the six sustainability indicators[2].

In compliance with 23 CCR §352.6[3], monitoring data is stored on a SharePoint site, accessible by Modoc and Lassen GSAs, and technical support staff.

1.2 Plan Area

With ground elevations averaging around 4,500 feet, the basin is located in the volcanic high desert region of California's far northeastern corner. It is one of many similar basins spread throughout the region classified by their relative isolation and small size. The total land area covered by the basin is about 144 square miles, with Modoc County representing around 40 square miles in the north and Lassen County comprising roughly 104 square miles in the south. A map showing the basin boundary and county jurisdictions is provided in **Figure 1.1**.

Geologically, "The BVGB is bounded to the north and south by Pleistocene and Pliocene basalt and Tertiary pyroclastic rocks of the Turner Creek Formation, to the west by Tertiary rocks of the Big Valley Mountain volcanic series and to the east by the Turner Creek Formation. The Pit River enters the Basin from the north and exits at the southernmost tip of the valley through a narrow canyon gorge. Ash Creek flows into the valley from Round Valley and disperses into Big Swamp. Near its confluence with the Pit River, Ash Creek reforms as a tributary at the western edge of Big Swamp. Annual precipitation ranges from 13 to 17 inches." (DWR 2003). Since 2003, the Ash Creek Wildlife Refuge was established and now occupies most of the area formerly known as Big Swamp. A series of restoration projects and farming practices have been implemented within its boundaries, resulting in changes to the stream channel where it flows through the refuge.

The definable bottom of the aquifer sits at about 1,200 feet (BVGSP, ES-4), at which depth all production wells are represented. Models used in basin management assume a single principle aquifer because no distinct, widespread confining beds have been identified in the subsurface.

Although the BVGB is isolated and does not share a boundary with another basin, the Round Valley Basin (RVB), which received a very low prioritization, is located directly to the north from where Ash Creek flows into the BVGB at the town of Adin. Hydraulic communication between the two basins where they are separated by a half-mile gap of alluvium is suspected by the GSAs but has not been confirmed. Surrounding upland areas are also thought to contribute to

[1] Interim Milestones are optional criteria not subject to enforcement and none have been set for the BVGB.
[2] The six sustainability indicators defined under SGMA are: chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletions of interconnected surface water. The BVGB was not found to experience direct impacts from seawater intrusion, subsidence, depletion of interconnected surface water, or degraded water quality.
[3] 23 CCR §352.6. Data Management System, "Each Agency shall develop and maintain a data management system that is capable of storing and reporting information relevant to the development or implementation of the Plan and monitoring of the basin."

basin recharge and were mapped as such by DWR in 1963. An upland assessment completed by GEI also supports this relationship.

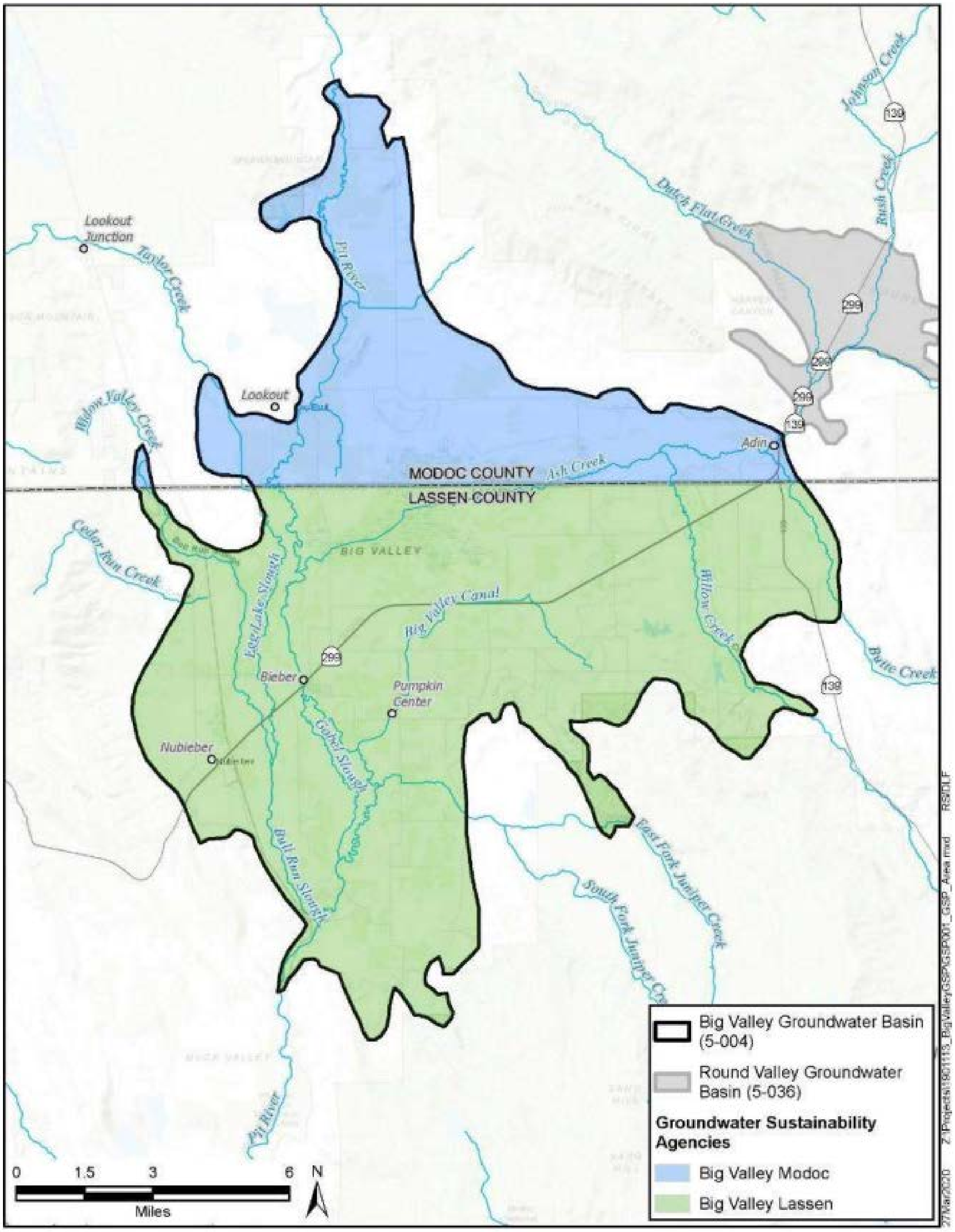

Figure 1.1 Big Valley Groundwater Basin Map (BVGSP ES-2*)*

1.2.1 Climate

The climate of the BVGB is highly variable depending on season and year. On average, temperatures range between 32 and 69 degrees Fahrenheit. However, the summer months regularly see temperatures exceeding 90°F, and temperatures in winter months can fall as low as -10°F. These hard freezes limit agricultural production for much of the year.

Historic climate data was recorded in the basin at two stations, Bieber 4 NW and Adin RS, which were administered by the National Oceanic and Atmospheric Administration (NOAA). Both stations are no longer active. Current Evapotranspiration (ET) data used in the water budget estimations is drawn from the nearest CIMIS station in McArthur CA, #43, which is separated from the BVGB by the Big Valley Mountains to the west. Current precipitation data is from estimated precipitation data using PRISM provided Oregon state university (https://prism.oregonstate.edu/explorer/).

1.2.2 Surface Water and Drainage Features

The two major sources of surface water in the BVGB are the Pit River and Ash Creek, which enter the basin near the towns of Lookout and Adin respectively. There are several other small creeks which connect into the two larger systems throughout the basin. Water is diverted through a series of unlined drainage ditches and canals, which have been identified along with agricultural land for their potential to contribute to recharge. Historically, several stream gages have monitored water levels on the Pit River, Ash Creek, and Willow Creek, shown in **Figure 1.2**. For this reporting period, the water budget is estimating inflow from streams using the USGS Canby Gage. Future data inputs could include a new gage on the Pit River just above where it enters the basin, a new gage at Robert's Reservoir, the Muck Valley output on the Pit River, and the Willow Creek gage.

Annual average daily streamflow at the Canby gage is reported for water years 2010 through 2022 in **Table 1.2.1.** Flows are shown to correlate with water year type, with highest daily averages occurring concurrently with the wet years in 2011, 2017 and 2019, and the lowest daily flows occurring during the less than normal years of 2014, 2021 and 2022. This data demonstrates the extreme variability in surface water availability in the Pit River. The wettest year recorded 20 times more volume in surface water flows than the driest.

Table 1.2.1 Annual Average Daily Streamflow at the Canby USGS Gage

Water Year	Average Daily Flow (cfs) at Canby Gage	SRI Water Year[1]
2010	56.4	BN
2011	380.8	W
2012	66	BN
2013	73.6	D
2014	20.9	C
2015	41.7	C
2016	208.2	BN
2017	456.1	W
2018	138.5	BN
2019	387.2	W
2020	69.3	D
2021	30.6	C
2022	38.5	C

Notes:

1Sacramento Valley Water Year Indices Water year type. C = Critical, D = Dry, BN = Below Normal, AN = Above Normal, W = Wet

Source(s): USGS Surface Water Data; DWR Data Exchange Center Historic Water Year Hydrologic Classification Indices.

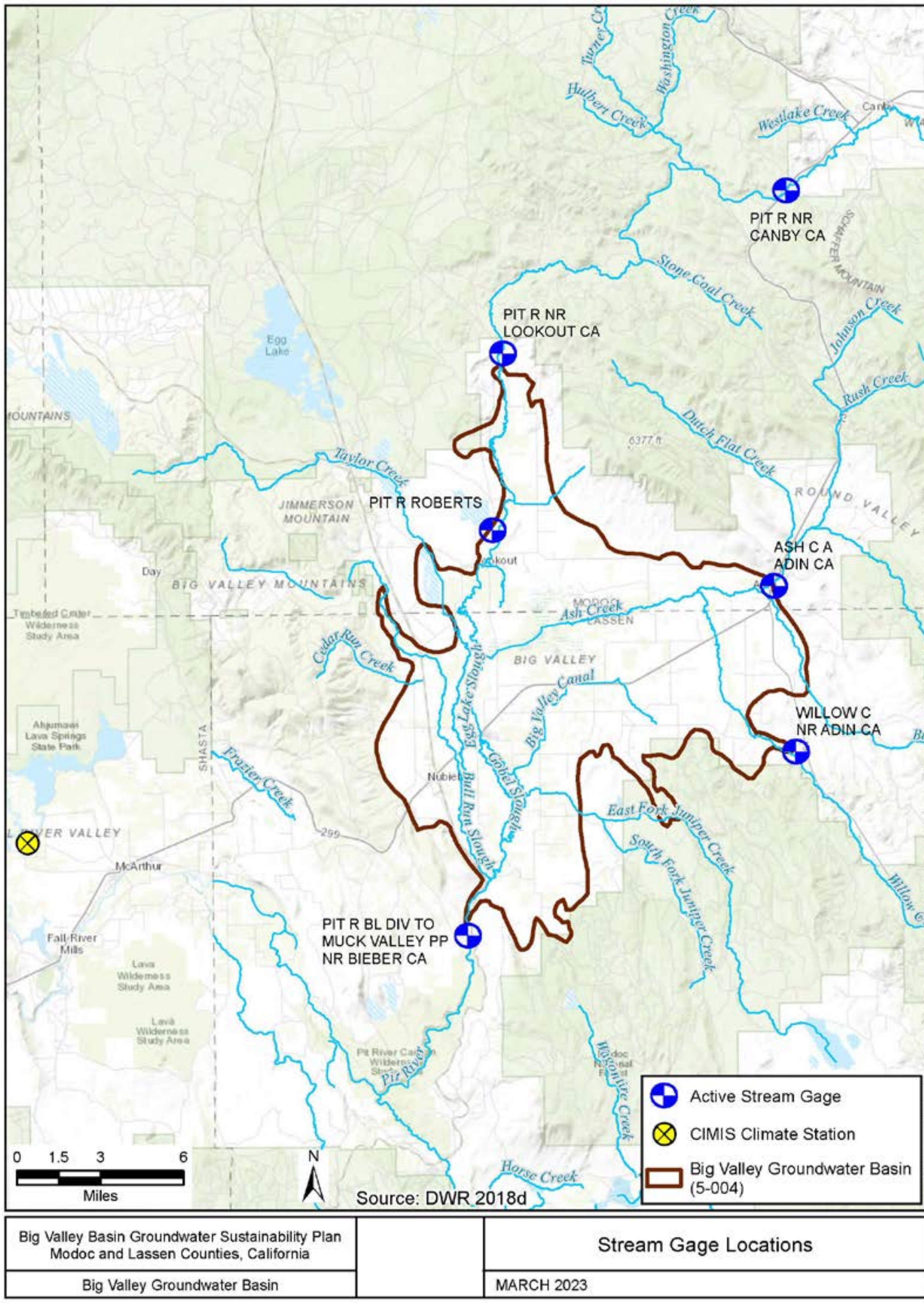

Figure 1.2 Map of Current and Proposed Stream Gage Locations (BVGSP 9-11)

2 Groundwater Conditions

This section provides an update on changes in groundwater conditions in the BVGB for the 2022 water year.

2.1 Groundwater Elevations

2.1.1 Groundwater Elevation Contour Maps

Spring and fall groundwater contours included in the GSP are current through the 2019 WY. Similarly, groundwater contours for water years 2019, 2020 and 2021 were presented in the 2021 Annual Report. Spring and fall groundwater contour maps for water year 2022 are presented in Appendix B of this report.

The water year 2022 saw a continuation of the critically dry conditions in 2021. Although 2022 had an uptick in annual precipitation the overall pattern was dry, especially considering the two dry years preceding 2022. Contour maps reflect varying effects within the basin. Some areas gained in well level elevation while other areas particularly in the far northern edge of the basin declined.

Notably, well levels measured in the fall of 2022 showed higher levels (less apparent draw down) than in 2021. Some areas were 10 – 19 feet higher, while other areas were 3 – 4 feet higher in fall of 2022 compared to the fall of 2021.

These trends suggest that the basin's storage capacity is resilient, provided that sufficient water is available for recharge. In years where precipitation is limited, a combination of surface water storage options and off-season recharge projects may help enhance this process and mitigate further groundwater level decline.

The contour maps are reliant on good well monitoring data from the field. Each monitoring well reflects a significant area. Thus, missing data from even a few wells, can have a substantial effect on the contour maps. As more data is gleaned from the new wells added as part of the GSP process, overall accuracy of the contour data will be improved.

DWR has measured water levels for many decades and has indicated that it will continue to measure water levels for the foreseeable future. The period preceded by this report coincides with an extended period of limited data availability, particularly in the southern portion of the basin for the 2019-2021 water years. Covid-19 is suspected to have contributed to this data gap by constraining the ability of DWR staff to conduct necessary field work, which has required technical staff to estimate water levels for some parts of the basin. This uncertainty is expected to be ameliorated in future reports if data availability and reporting improve.

2.1.2 Groundwater Elevation Hydrographs

Twelve Representative Monitoring Wells were selected and assigned measurable objectives[4] (MOs) and minimum thresholds (MTs) to assess groundwater elevation and depth to water conditions. **Figure 2.1.2** shows the relative distribution of these RMWs within the BVGB. Of these, the five Big Valley Monitoring Wells (BVMWs) are each located at one of the clusters of monitoring wells that the GSAs received funding from DWR to drill in 2019 and 2020. Data from the BVMW clusters notably can be used to determine the directional flow of groundwater within the basin. MOs were set at the 2015[5] fall water elevation levels wherever possible. The newer wells included in the monitoring network were assigned MOs at the earliest fall water elevation reported. For the five new BVMWs, 2020 was the first year fall monitoring data was collected. The ACWA-3 well was assigned an MO at its 2017 fall level. Given the differences in conditions that occurred in the basin between the 2015, 2017 and 2019 water years, the MOs set for the newer wells may be adjusted in the future to better reflect basin conditions.

During the time period covered by this report, conditions in the basin have remained sustainable. Substantively, the wells with sufficient historic data to predict future trends are all projected to remain above their respective MOs through 2040 except one, 20B6. Wells installed or added to the representative monitoring network after 2015, which include the five new BVMWs and ACWA-3, do not have significant historical data to analyze at this point. However, preliminary data suggests low seasonal variance across these sites.

Water level trends for all wells appear to correlate with water year type, although the degree of change differs from site to site. Three wells, 08F1, ACWA-3, and 26E1 have fluctuated minimally with projected rates of change falling between a very slight decline of .078 ft/year and a slight increase of .97 ft/year. Preliminary data from BVMW wells 2-1, 3-1, and 5-1 appear to reflect similar trends. Again, however, empirical data from the five new monitoring wells cannot be meaningfully interpreted at this time due to the limited period for which it has been collected. Preliminary trends for BVMW 1-1 and 4-1 are not apparent for this reason. By the time of the five-year report, however, that is expected to change as six years of monitoring will have been completed.

Two wells, 13K2 and 20B6 have demonstrated slight declining trends in water levels at a rate of 0.69 and 0.72 ft/year respectively. It should be noted that since 2015, data has not been reported for 20B6 and has been reported sporadically for 13K2. Given the uncertainty produced by this lack of data, it is imperative that either efforts to consistently collect and report data for these sites are improved, or new sites are selected to reflect basin conditions in future reports. The first

[4] "Measurable objective (MO): Numeric Values that reflect the desired groundwater conditions at a particular monitoring site. MOs must be set for the same monitoring sites as the MTs and are not subject to enforcement." (BVGSP 7-1)

[5] Measurable objectives were set at the fall 2015 levels, which were generally the lowest, most recent groundwater level measurements prior to the adoption of the BVGSP. These levels provide a reasonable proxy for desired conditions because agricultural uses remain feasible at them. (BVGSP 7-3).

of these options is the most desirable outcome to maintain reporting consistency through future years, keeping in mind that these wells are also used for contour mapping.

The trends reflected in 01A1 and 16D1 indicate moderate levels of decline at the rates of 1.25 and 1.38 ft/year respectively. Of the twelve RMWs, the data represented in the hydrographs for these sites are the most variable, particularly during the dry period from 2011 to 2016. The fall 16D1 measurement is considerable lower than any other measurement taken and does not correspond with other measurements taken at other wells, future measurements may suggest this measurement as an outlier. The relationship between depletion and recharge appears nonlinear and elastic, with greater differences between fall and spring water levels observed the closer fall water levels come to the measurable objective.

This relationship highlights the correlation between recharge and seasonality which suggests that much of the water pumped in the basin from one year to another was likely recharged during the preceding year. The GSAs suspect that much of the recharge observed in the basin is contributed by upland areas within the watershed, but which fall outside the basin's current boundaries. For this reason, the GSAs are interested in expanding basin boundaries. Additionally, increases in demand on groundwater supplies correlate with dry periods such as seen in the hydrograph for well 01A1, which implies that groundwater is used most often when surface water is not available. This can also be seen in the groundwater pumping numbers produced by the water budget. Economically, this makes sense because groundwater extraction is much more energy intensive than surface water diversions and thus more expensive. The trends observed in the hydrographs support the need for enhancements to surface water storage capacity in and around the basin. Even an additional 5,000 AF of storage would greatly help to offset the slight overdraft estimated in the water budget.

A summary of spring and fall elevations for the 2022 water year and corresponding sustainable management criteria is provided in **Table 2.1.2** to highlight current conditions in the basin.

Table 2.1.2 Water Year 2022 RMW Hydrograph Summary Table[1]				
Well Name	Spring Groundwater Elevation (ft)	Fall Groundwater Elevation (ft)	Minimum Threshold (ft)	Measurable Objective (ft)
01A1	4183.4	4088.0	3895	4035
08F1	4248.4	4223.5	4082	4222
13K2	4127.4	4081.7	3922	4062
16D1	4171.4	4032	3939	4079
20B6	4126.3	4081.4	3945	4085
26E1	4133.3	4114.1	3974	4114
ACWA-3	4159.0	4131.6	3996	4136
BVMW 1-1	4171.3	4161.5	4022	4162
BVMW 2-1	4192.0	4192.5	4054	4194
BVMW 3-1	4149.2	4145.5	4006	4146
BVMW 4-1	4120.7	4092.3	3948	4088
BVMW 5-1	4081.6	4078.2	3942	4082

Notes:

1 Data reported in this table was downloaded from the online SGMA Data Viewer (https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer)

Minimum thresholds were set to reflect the water level at which pumping costs would render agricultural pursuits unviable. For this reporting period, water levels have remained well above these levels and are not projected to come anywhere near to them within the next 20 years. Conditions in the basin will continue to be monitored at these locations with respect to their sustainable management criteria, and updates will be provided in future reports.

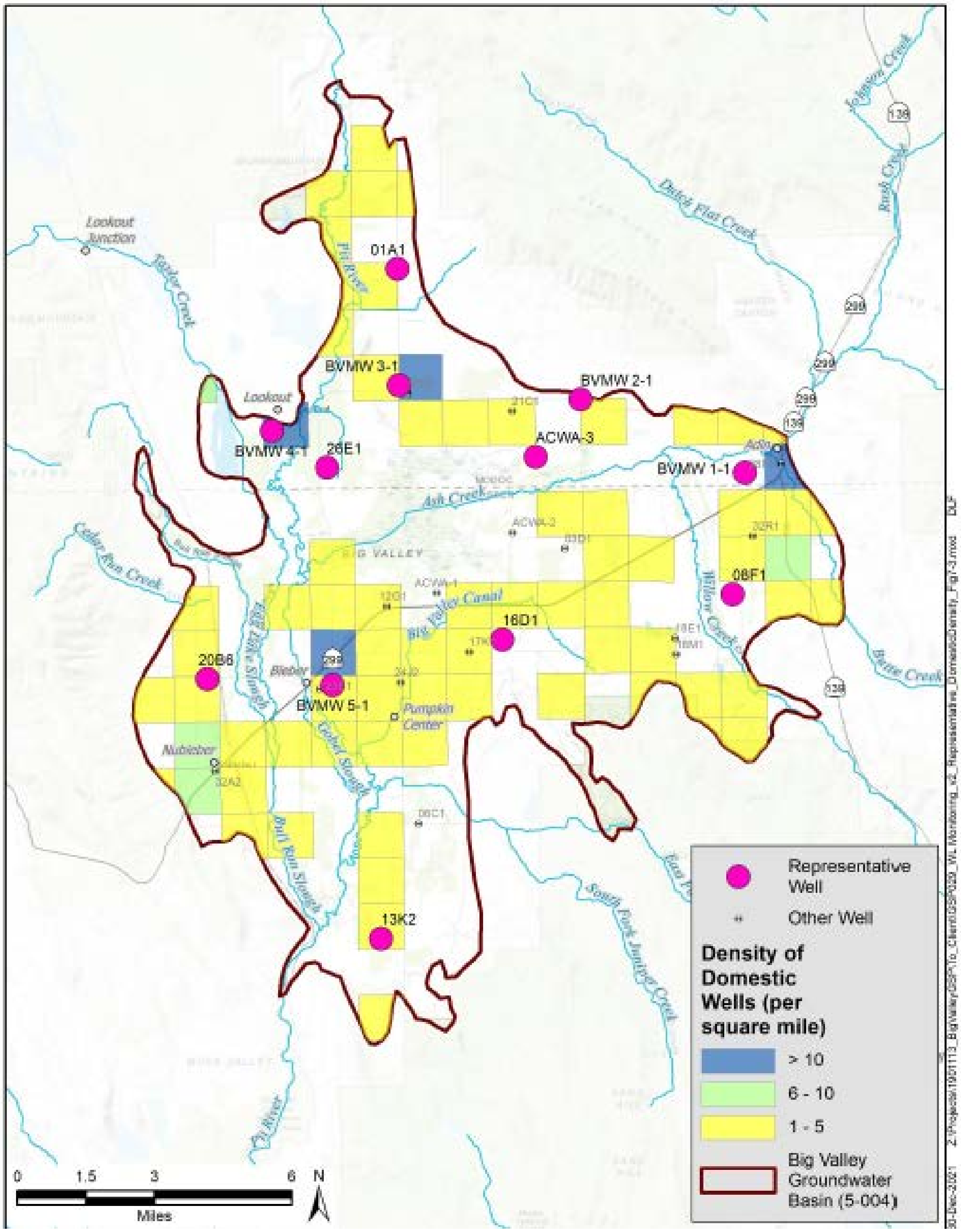

Figure 2.1.2 Map of Domestic Well Densities and Representative Groundwater Wells (BVGSP 7-6)

2.2 Water Budget

GEI, the engineering firm contracted to be the technical lead for the Big Valley GSP, chose to develop the water budget (**Appendix D**) using an excel spreadsheet tool. This method was selected as both an economically and technologically feasible way for the GSAs to create the water budget for the GSP, and to calculate water budget estimates for future reports. As discussed in depth in the GSP, the many assumptions and data gaps that were present when completing the water budget carry over into this report. The water budget included in this report continues to rely upon the assumptions determined by GEI.

2.2.1 Groundwater Extraction

Groundwater extraction within Big Valley is estimated in the water budget using a combination of pumping, land use, ET, and extraction data. Groundwater extraction by land use sector has not been quantified due to the data gaps from the GSP that carry over into this report. The exact amount of extraction occurring within the basin is not easily quantified, and current estimates draw on the locations of wells shown in **Figure 2.1.2** (above). Using the estimates that were first created by GEI for the GSP, it is apparent that there are strong positive relationships between groundwater pumping, surface water availability and annual precipitation. 2022 was another critically dry year and saw groundwater pumping similar to 2020 and 2021 at 50,400 acre-feet.

Future reports will include estimates of groundwater extraction by sector, once the data and methodology used to make these estimates is available to the GSAs. For now, the general understanding of extractions within the basin is sufficient to manage the basin until more data becomes available. Table 3-2, carried over from the GSP, summarizes land use by water use sector. A map illustrating the distribution of land use sectors throughout the basin is available in **Appendix C**. Evaluated together, these figures indicate the areas where groundwater extraction is most likely to occur, although they do not provide good estimates of extraction. For this reason, it is necessary to refer to the contour maps to intuit where most extraction occurs which can be accomplished by analyzing the hydrologic gradients. In doing so, the agricultural sector generally represents the greatest amount of groundwater extraction within the basin, most notably in years when there is not sufficient surface water to maintain crop yield and survival.

Table 2.2.1 2016 Land Use Summary by Water Use Sector

Water use sector	Acres	Percent of Total
Community[a]	250	<1%
Industrial	196	<1%
Agricultural	22,246	24%
State Wildlife Area[b]	14,583	26%
Managed Recharge	-	0%
Native Vegetation and Rural Domestic[c]	54,782	60%
Total	92,057	100%
Notes:		

a Includes the use in the communities of Bieber, Nubieber and Adin
b Made up of a combination of wetlands and non-irrigated upland areas
c Includes the large areas of land in the Valley which have domestic wells interspersed (Source: Modified from DWR 2020b by GEI)

BVGSP (3-9)

2.2.2 Surface Water Supply

The Pit River and Ash Creek are the primary sources of surface water into the BVGB. Stream inflow and outflow volume is not well understood in the basin, but recent efforts to increase data sharing between entities and a new stream gage on the Pit River should improve estimates in the future. Surface water supply in 2022 was similar to 2020 and 2021, all critically dry years. From the water budget tables provided in **Appendix C,** in 2022, stream flow was slightly over 78,000 AF.

Drastic variation in stream flow is reflected in the water budget between wet and dry years. The water budget highlights the importance of surface water availability for meeting the needs of agriculture production and habitat in the basin. During critically dry years, as established in previous sections, demand for groundwater is also higher. Cumulatively, the relationships between water supply and demand both from surface and groundwater sources indicate that increased surface water storage options are required to support the continued sustainability of the basin. DWR climate model forecasts, which predict increased precipitation and in the form of rain instead of snow in the Big Valley Region in years to come, provide another reason for more surface water storage and water buffering availability to create a sustainable water resource for basin users.

2.2.3 Total Water Available

As discussed in preceding sections, there is currently not sufficient data available to quantify water use by sector for the basin. For the period covered by this report, a definite relationship can be seen between surface water availability and groundwater extraction in Big Valley. In years high surface water availability, considerably less groundwater is used to support all water users. **Table 2.2.3** provides a summary of water budget estimates of water available for use by all sectors. Although users do tend to use less water overall in dry and critically dry years, developing more surface storage and off-season recharge opportunities for plentiful years could significantly abate groundwater dependence. Comparing total outflow in the land system verse the surface water system, in dry years water coming from groundwater and the land system is marginally more than coming from the surface water system. In wet years, the water coming from the land system is markedly less than that coming from the surface water system. This indicates that water is leaving the basin in large quantities, again pointing to the importance of expanding surface water storage opportunities.

Table 2.2.3 Total Available Water For Use By All Sectors[1]

Water Year	Groundwater (AF)	Surface Water (AF)	Total Water (AF)
2022	50,400	82,000	132,400

Notes:

1 Numbers reported in this table are derived from the water budget provided by GEI (**Appendix C**). Data available for use in future reports is anticipated to improve in quality, at which point water use by sector can be estimated with greater accuracy. Estimates of combined water sources are not available at this time.

2.2.4 Change in Groundwater Storage

As explained in section 5.2 of the BVGSP, change in groundwater elevation is directly correlated with change in groundwater storage. (BVGSP 5-9). The contour maps included in **Appendix B** provide a static representation of groundwater storage for the spring and fall seasons of water year 2022. Therefore, the annual change in groundwater storage for the 2021-2022 WY was estimated in ArcGIS by calculating the difference in groundwater surface elevation between spring 2021 and spring 2022. Spring values were used for this estimate as they provide a more stable short-term reference to measure storage capacity than fall values, given the amount of recharge that occurs between the two seasons. The resulting map is provided in **Appendix E.** Simply put, this estimate draws on the basin storage model, represented by the following equation: (1200ft definable bottom- average depth to water) x (92,057 Acre Basin Area) x (5% specific yield). Trends, delineated by the contours, show that the basin fluctuated depending on location. Some areas saw an increase in storage up by up to 10 feet increase in well level elevation. Other areas in the basin had a decline in well level elevations of about 20 feet. **Figure 2.2.4** shows the cumulative change in storage vs. precipitation for water years 1983-2022. Basin storage has tracked precipitation patterns over that period. Continuing critically dry weather conditions in 2022 resulted in a modest overall decline in basin storage. Since water year 2016, overall basin storage has remained relatively level with wet years of 2017 and 2019, counterbalanced by dry years in 2020 through 2022.

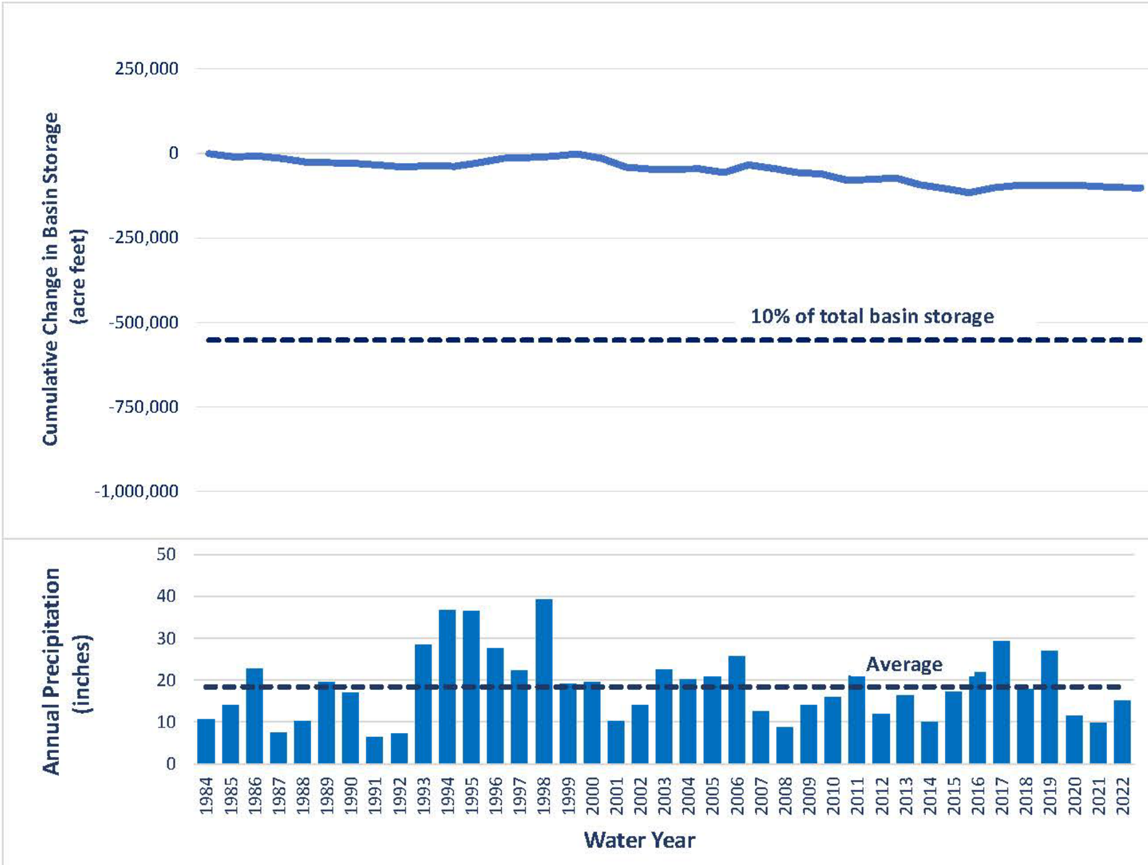

Figure 2.2.4: Estimated Cumulative Change in Groundwater Storage Vs. Precipitation

Cumulatively, the storage capacity of the basin has remained arguably flat since 2016. Intuitively this figure suggests that the basin will remain sustainable well into the future, as the decrease in storage capacity has not approached 10% of the total basin storage.

3 GSP Implementation Progress

The objectives of the projects laid out in Ch. 9 of the GSP, Projects and Management Actions, target the data gaps which have driven the current assumptions about basin conditions. For this reason, adaptive management is a strategy identified in the GSP to inform its implementation as better data becomes available. In support of this, many of the projects identified in the GSP have been running concurrently with its development.

Throughout the development of the GSP, strong efforts were made to engage stakeholders at monthly BVAC meetings, University of California Cooperative Extension (UCCE) workshops and mailings, and via social media. These interactions have helped inform the types and scopes of projects important to Big Valley groundwater users and other represented groups. Communication through mailings, social media, and email has also been used to keep interested parties up to date and informed about opportunities to participate.

Two new stream gages have been installed to support GSP data development. One is located at the outflow of Robert's Reservoir, the largest reservoir providing water to the basin. The second one is located on the Pit River north of Lookout, CA near the top of the basin to capture inflows to the basin. This second gage should provide more accurate data than the USGS Canby gage. Long-term calibrating of these gages is needed and the GSAs hope that these can be absorbed into the USGS or DWR programs to decrease the funding burden on the basin long term. A voluntary well metering program has also been established and new meters were installed at voluntary locations throughout the basin.

As part of a wider research effort led by UCCE in cooperation with local landowners, data for the feasibility of Agricultural Managed Recharge (AgMAR) was collected in 2022 and is currently being analyzed. A study evaluating the relationship between evapotranspiration and applied water was also conducted to help refine future water budget estimates. The widespread implementation of these projects in the basin has been impeded by regulatory limitations and the financial burden of off-season diversions. More work is necessary to determine the circumstances under which AgMAR projects present viable options for recharge given these constraints. An uplands winter water availability study was completed by West Yost to support AgMAR and the state regulations for applying for a diversion.

Progress has also been made in identifying potential upland areas for juniper removal and other forest health projects to improve water availability for the basin. It is anticipated that these projects, combined with efforts to improve mapping accuracy, may be used to support the expansion of basin boundaries. Current state and federal funding for watershed health, forest thinning, and other activities may be available to help offset the costs of implementing these types of projects. GEI completed an upland assessment which was started in October 2019 and supports uplands recharge and geologic connection. DWR completed an AEM survey of the basin in October 2021 to better understand the basin's hydrogeological structure. We are currently working on how to interpret these results and how they can be used to better the basin. We have also worked towards improving the long-term accuracy of land use mapping in the basin working with Land IQ and conversations with residents. By increasing accuracy in land-use we are able to make adjustments in the water budget and determine water use more accurately.

Following the installation of five representative monitoring well clusters in 2019 and 2020, data has been continuously downloaded from the transducers, which are set to record at 15-minute intervals. Depth-to-water measurements at these wells have been hand recorded monthly by GSA affiliate staff since 2020 through the end of grant funding in January 2023. Surface water quality has been sampled on the same days that staff monitors the wells from sites on the Pit River and Ash Creek.

The GSAs are currently in a period between grant cycles so new project implementation has temporarily slowed. With additional grant funding, more GSP implementation activities will be completed in the future.

4. References

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5. Appendices

Appendix A: Hydrographs

Groundwater Level Report

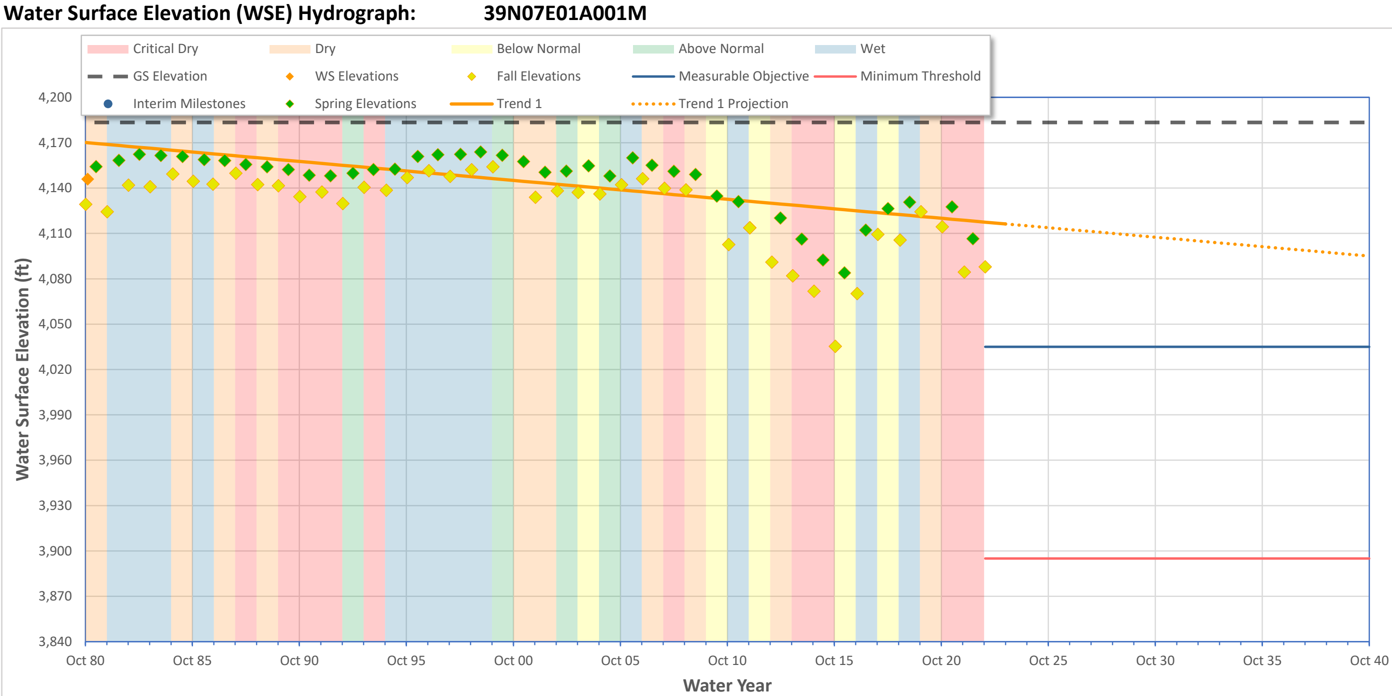
Date: 3/7/2023

Well Information	
Well ID	036673_39N07E01A001M
Well Name	39N07E01A001M
State Number	39N07E01A001M
WCR Number	14565
Site Code	412539N1211050W001
Well Location	
County	Modoc
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Modoc County Planning Department
Well Type Information	
Well Use	Stockwatering
Completion Type	Single Well

Well Coordinates/Geometry		
Location	Lat:	41.2539
	Long:	-121.1050
Well Depth		300 ft
Ground Surface Elevation		4183.4 ft
Ref. Point Elevation		4184.40 ft
Screen Depth Range		-
Screen Elevation Range		-
Well Period of Record		
Period-of-Record		1979..2023
WS Elev-Range	Min:	4035.4 ft
	Max	4163.9 ft

Trend Analysis		
Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(1.252 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: 39N07E01A001M



Sustainability Indicator Considerations

Observed WS Elevations		
Parameter		**Value**
WS Elevation Range	Min:	4035.4 ft
	Max	4163.9 ft
2015 WS Elevations	Spring:	4092.5 ft
	Fall:	4035.4 ft
Current WS Elevations	Spring:	4106.5 ft
	Fall:	4088.0 ft

Trend Projections		
Year	**Trend 1**	**Trend 2**
2025	4113.8 ft	-
2030	4107.5 ft	-
2035	4101.3 ft	-
2040	4095.0 ft	-
	-	-
	-	-

Sustainability Indicator Settings

Key	Threshold Type	Effect. Yr.	Value	Description
MT	Minimum Threshold	2022	3895.0 ft	
MO	Measureable Objective	2022	4035.0 ft	

Groundwater Level Report

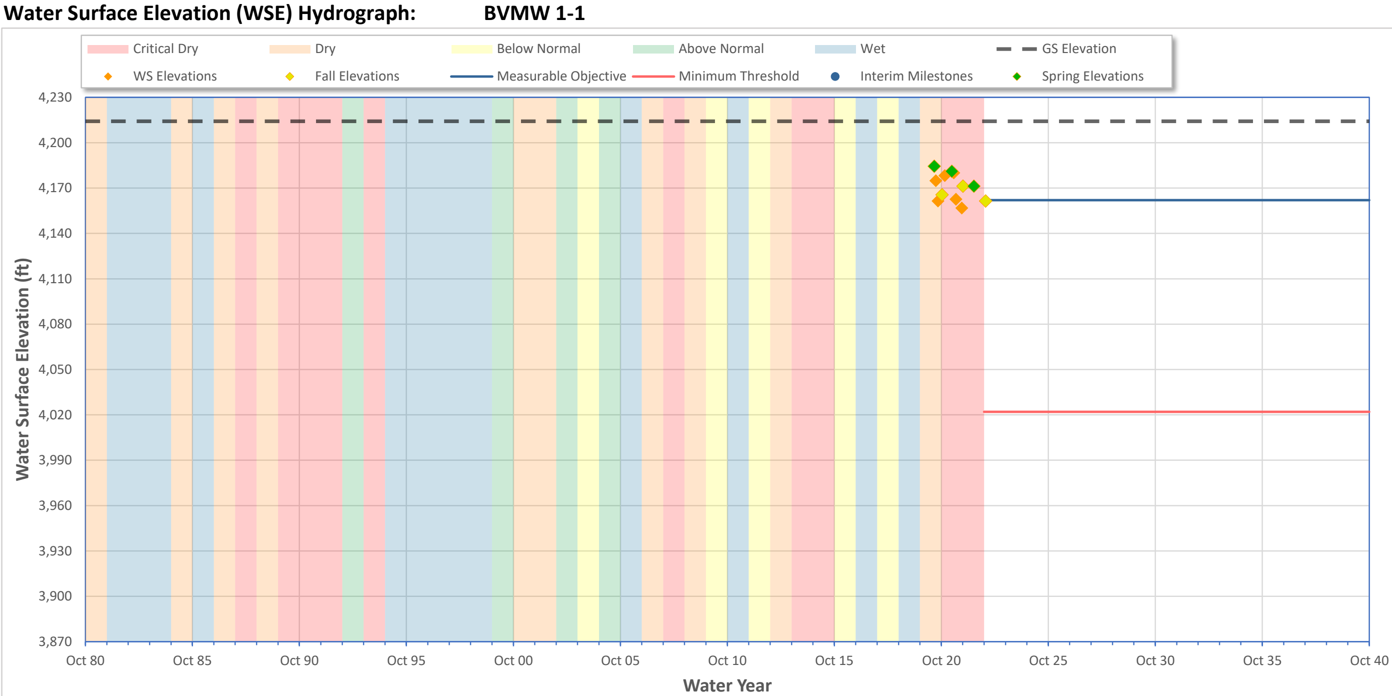
Date: 3/7/2023

Well Information	
Well ID	055615_BVMW 1-1
Well Name	BVMW 1-1
State Number	-
WCR Number	WCR2020-006214
Site Code	411880N1209599W001
Well Location	
County	Lassen
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Modoc County Planning Department
Well Type Information	
Well Use	Observation
Completion Type	Single Well

Well Coordinates/Geometry		
Location	Lat:	41.1880
	Long:	-120.9599
Well Depth		265 ft
Ground Surface Elevation		4214.2 ft
Ref. Point Elevation		4213.84 ft
Screen Depth Range		175 to 265 ft
Screen Elevation Range		3985 to 3895 ft
Well Period of Record		
Period-of-Record		2020..2023
WS Elev-Range	Min:	4156.8 ft
	Max	4184.5 ft

Trend Analysis		
Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(7.190 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: BVMW 1-1



Groundwater Level Report

Date: 3/7/2023

Well Information

Well ID	055619_BVMW 2-1
Well Name	BVMW 2-1
State Number	-
WCR Number	WCR2020-006667
Site Code	412119N1210286W001

Well Location

County	Lassen
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Modoc County Planning Department

Well Type Information

Well Use	Observation
Completion Type	Single Well

Well Coordinates/Geometry

Location	Lat:	41.2119
	Long:	-121.0286
Well Depth		250 ft
Ground Surface Elevation		4216.5 ft
Ref. Point Elevation		4216.18 ft
Screen Depth Range		210 to 250 ft
Screen Elevation Range		4004 to 3964 ft

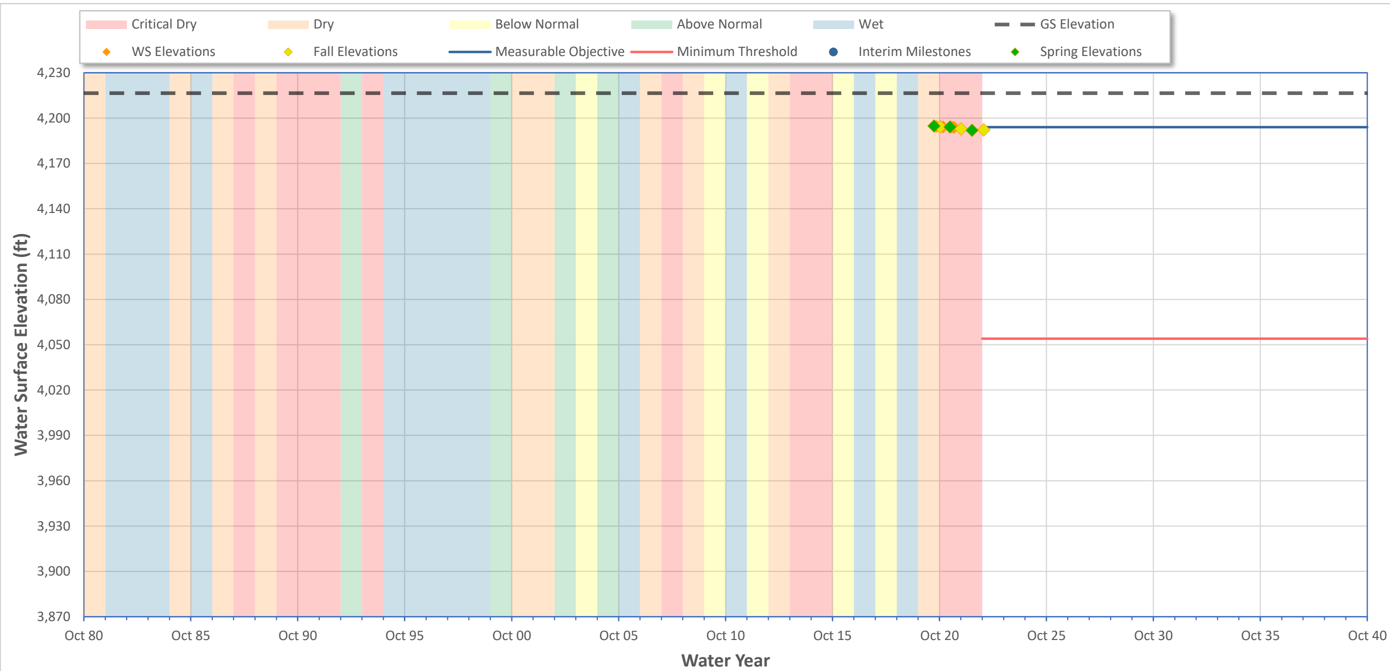
Well Period of Record

Period-of-Record		2020..2023
WS Elev-Range	Min:	4192.0 ft
	Max	4194.9 ft

Trend Analysis

Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(1.601 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: BVMW 2-1



Groundwater Level Report

Date: 3/7/2023

Well Information

Well ID	055623_BVMW 3-1
Well Name	BVMW 3-1
State Number	-
WCR Number	WCR2020-006592
Site Code	412169N1211050W001

Well Location

County	Lassen
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Modoc County Planning Department

Well Type Information

Well Use	Observation
Completion Type	Single Well

Well Coordinates/Geometry

Location	Lat:	41.2169
	Long:	-121.1050
Well Depth		185 ft
Ground Surface Elevation		4164.8 ft
Ref. Point Elevation		4167.41 ft
Screen Depth Range		135 to 185 ft
Screen Elevation Range		4081 to 4031 ft

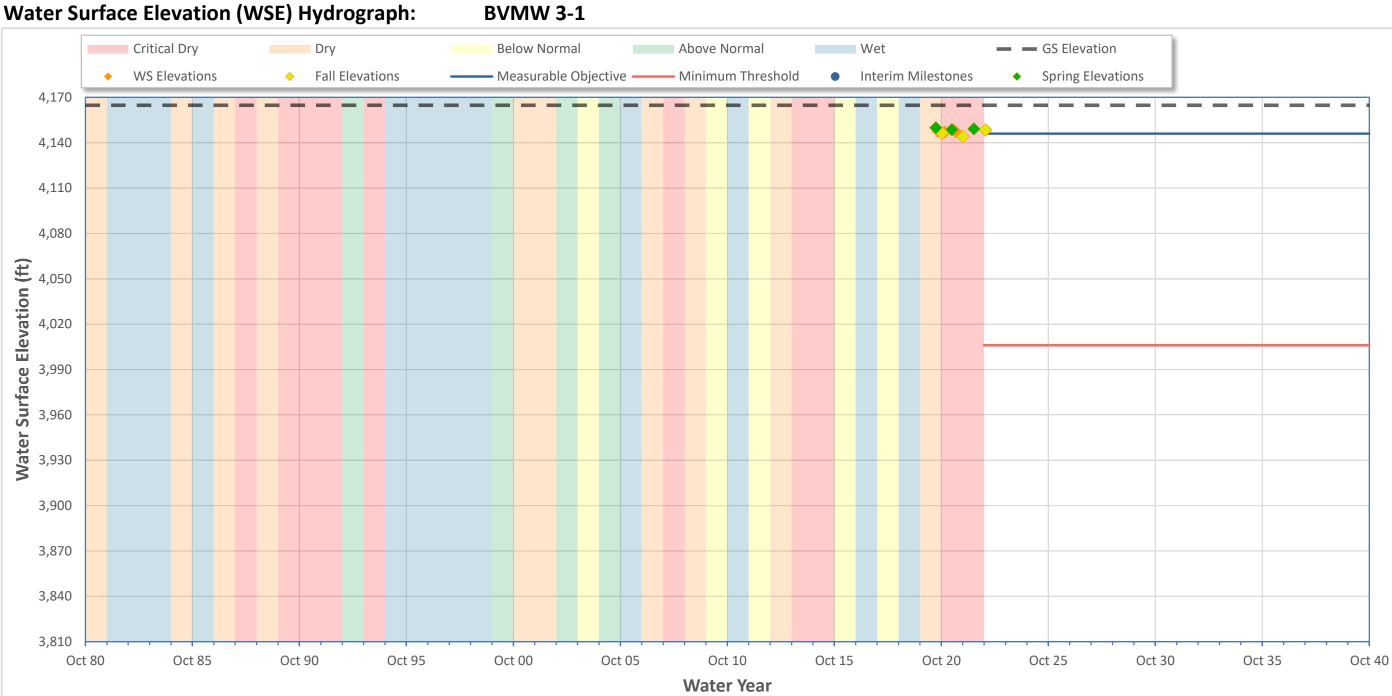
Well Period of Record

Period-of-Record		2020..2023
WS Elev-Range	Min:	4144.2 ft
	Max	4149.9 ft

Trend Analysis

Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(0.316 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: **BVMW 3-1**



Groundwater Level Report

Date: 3/7/2023

Well Information

Well ID	055627_BVMW 4-1
Well Name	BVMW 4-1
State Number	-
WCR Number	WCR2019-017359
Site Code	412029N1211587W001

Well Location

County	Lassen
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Modoc County Planning Department

Well Type Information

Well Use	Observation
Completion Type	Single Well

Well Coordinates/Geometry

Location	Lat:	41.2029
	Long:	-121.1587
Well Depth		425 ft
Ground Surface Elevation		4152.7 ft
Ref. Point Elevation		4152.40 ft
Screen Depth Range		385 to 415 ft
Screen Elevation Range		3782 to 3752 ft

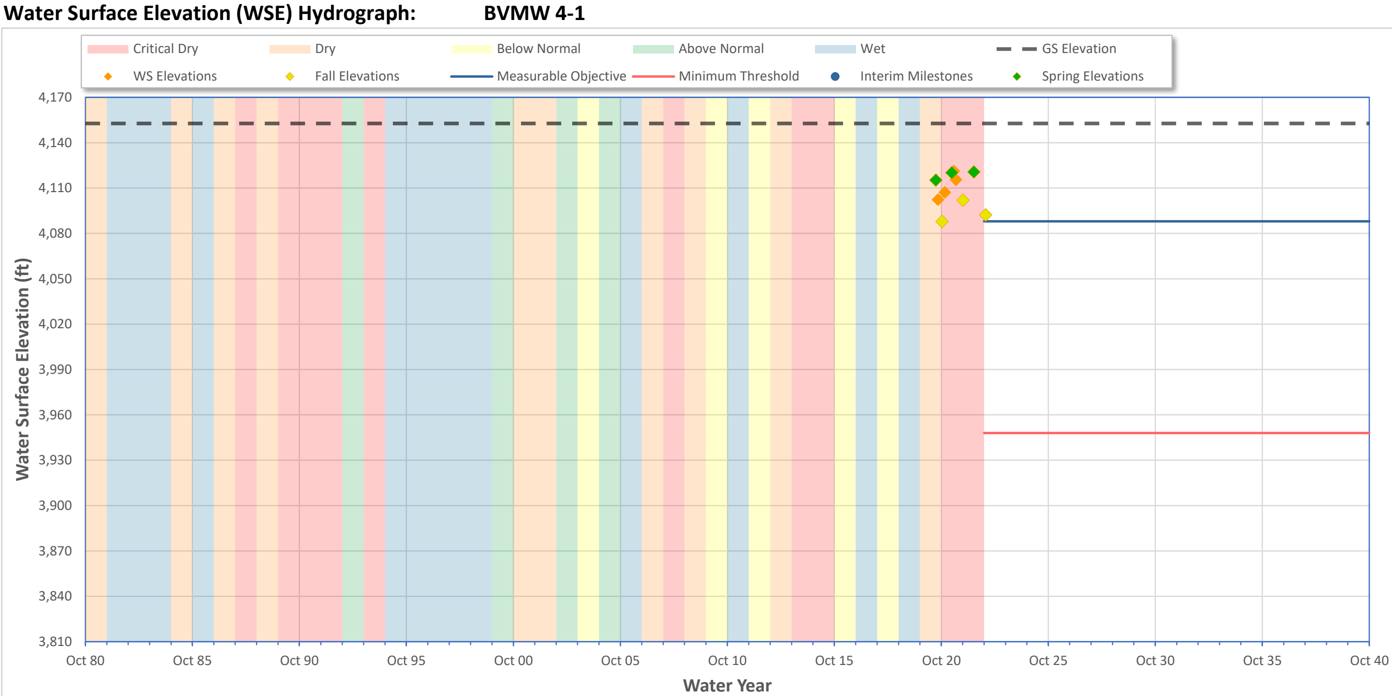
Well Period of Record

Period-of-Record		2020..2023
WS Elev-Range	Min:	4088.0 ft
	Max	4121.3 ft

Trend Analysis

Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	2.868 ft/yr
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: BVMW 4-1



Sustainability Indicator Considerations

Observed WS Elevations

Parameter		Value
WS Elevation Range	Min:	4088.0 ft
	Max	4121.3 ft
2015 WS Elevations	Spring:	-
	Fall:	-
Current WS Elevations	Spring:	4120.7 ft
	Fall:	4092.3 ft

Trend Projections

Year	Trend 1	Trend 2
2025	4131.4 ft	-
2030	4145.8 ft	-
2035	4160.1 ft	-
2040	4174.4 ft	-
	-	-
	-	-

Sustainability Indicator Settings

Key	Threshold Type	Effect. Yr.	Value	Description
MT	Minimum Threshold	2022	3948.0 ft	
MO	Measureable Objective	2022	4088.0 ft	

Groundwater Level Report

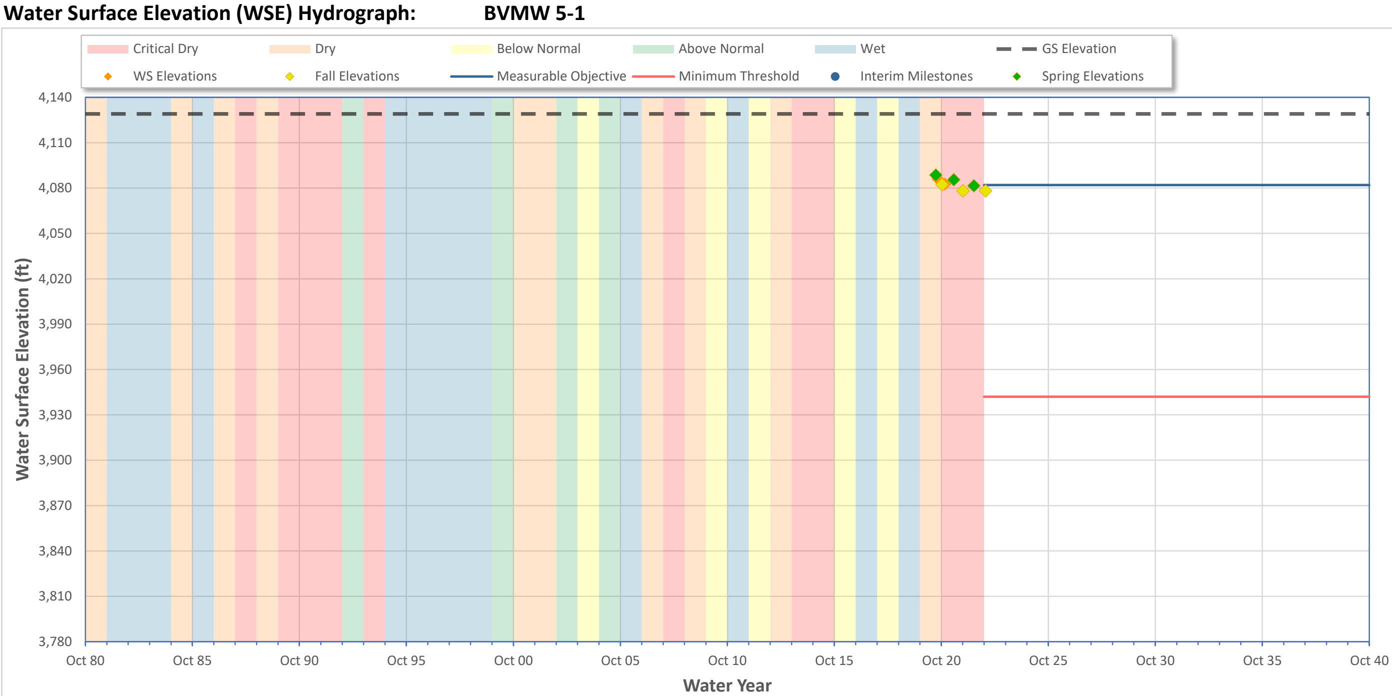
Date: 3/7/2023

Well Information	
Well ID	055525_BVMW 5-1
Well Name	BVMW 5-1
State Number	-
WCR Number	WCR2020-006658
Site Code	411219N1211339W001
Well Location	
County	Lassen
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Lassen County Department of Planning and Building Services
Well Type Information	
Well Use	Observation
Completion Type	Single Well

Well Coordinates/Geometry		
Location	Lat:	41.1219
	Long:	-121.1339
Well Depth		540 ft
Ground Surface Elevation		4129.1 ft
Ref. Point Elevation		4128.72 ft
Screen Depth Range		485 to 535 ft
Screen Elevation Range		3667 to 3617 ft
Well Period of Record		
Period-of-Record		2020..2023
WS Elev-Range	Min:	4078.2 ft
	Max	4088.7 ft

Trend Analysis		
Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(4.011 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: **BVMW 5-1**



Sustainability Indicator Considerations

Observed WS Elevations		
Parameter		**Value**
WS Elevation Range	Min:	4078.2 ft
	Max	4088.7 ft
2015 WS Elevations	Spring:	-
	Fall:	-
Current WS Elevations	Spring:	4081.6 ft
	Fall:	4078.2 ft

Trend Projections		
Year	**Trend 1**	**Trend 2**
2025	4067.7 ft	-
2030	4047.7 ft	-
2035	4027.6 ft	-
2040	4007.5 ft	-
	-	-
	-	-

Sustainability Indicator Settings

Key	Threshold Type	Effect. Yr.	Value	Description
MT	Minimum Threshold	2022	3942.0 ft	
MO	Measureable Objective	2022	4082.0 ft	

Groundwater Level Report

Date: 3/7/2023

Well Information

Well ID	036672_38N09E08F001M
Well Name	38N09E08F001M
State Number	38N09E08F001M
WCR Number	49934
Site Code	411493N1209656W001

Well Location

County	Lassen
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Lassen County Department of Planning and Building Services

Well Type Information

Well Use	Other
Completion Type	Single Well

Well Coordinates/Geometry

Location	Lat:	41.1493
	Long:	-120.9656
Well Depth		217 ft
Ground Surface Elevation		4253.4 ft
Ref. Point Elevation		4255.40 ft
Screen Depth Range		-
Screen Elevation Range		-

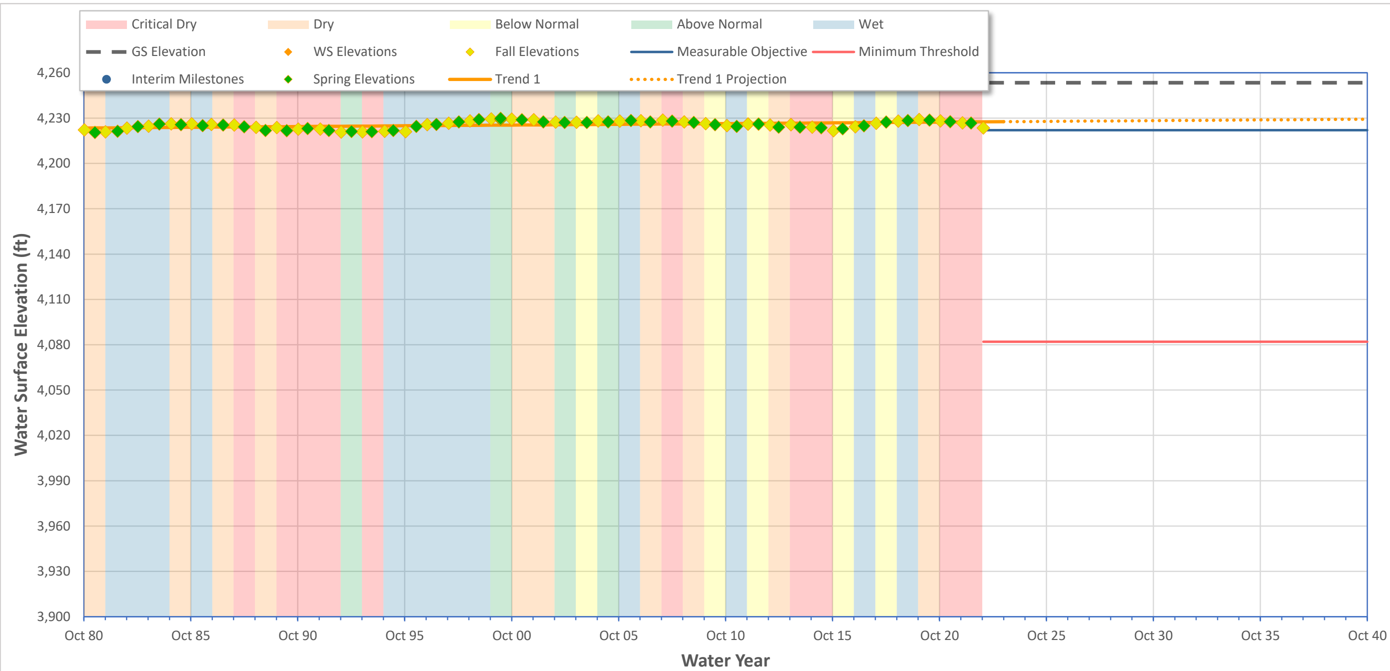
Well Period of Record

Period-of-Record		1979..2023
WS Elev-Range	Min:	4220.5 ft
	Max	4229.8 ft

Trend Analysis

Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	0.097 ft/yr
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: **38N09E08F001M**



Groundwater Level Report

Date: 3/7/2023

Well Information

Well ID	036667_37N07E13K002M
Well Name	37N07E13K002M
State Number	37N07E13K002M
WCR Number	90029
Site Code	410413N1211147W001

Well Location

County	Lassen
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Lassen County Department of Planning and Building Services

Well Type Information

Well Use	Irrigation
Completion Type	Single Well

Well Coordinates/Geometry

Location	Lat:	41.0413
	Long:	-121.1147
Well Depth		260 ft
Ground Surface Elevation		4127.4 ft
Ref. Point Elevation		4127.90 ft
Screen Depth Range		-
Screen Elevation Range		-

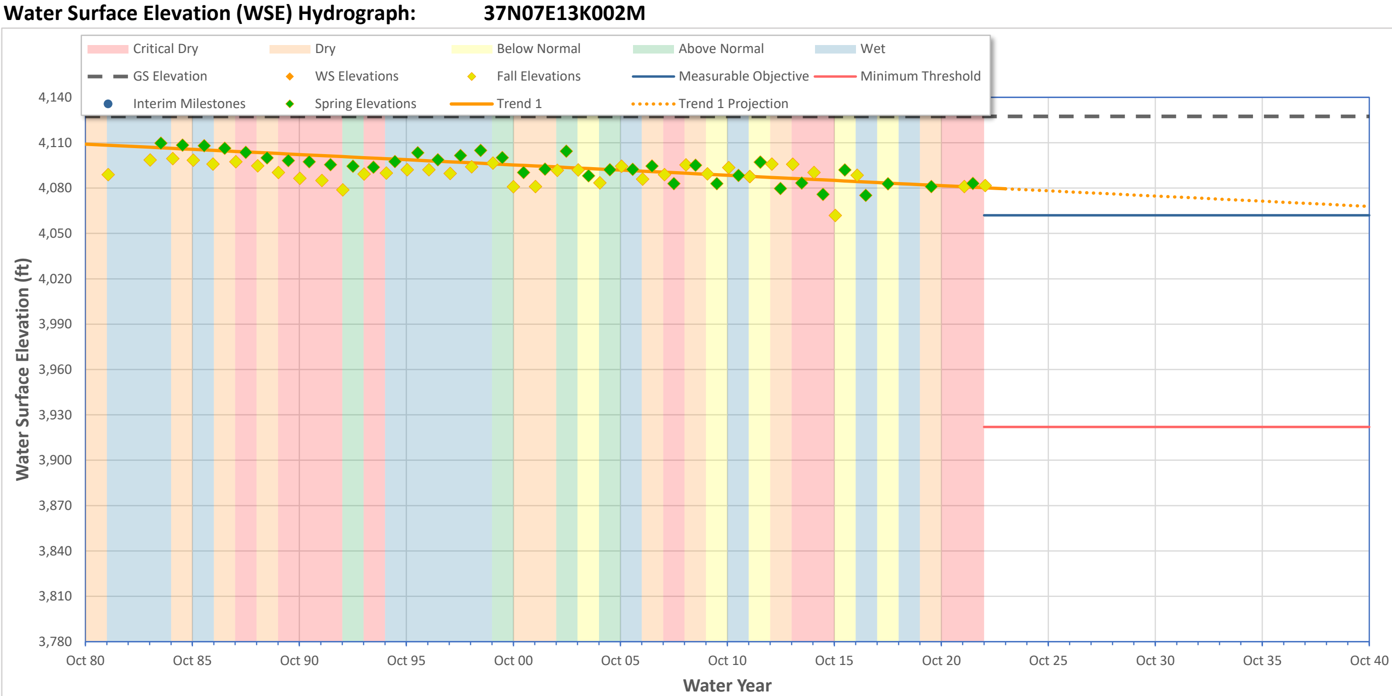
Well Period of Record

Period-of-Record		1982..2023
WS Elev-Range	Min:	4061.9 ft
	Max	4109.7 ft

Trend Analysis

Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(0.686 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: 37N07E13K002M



Groundwater Level Report

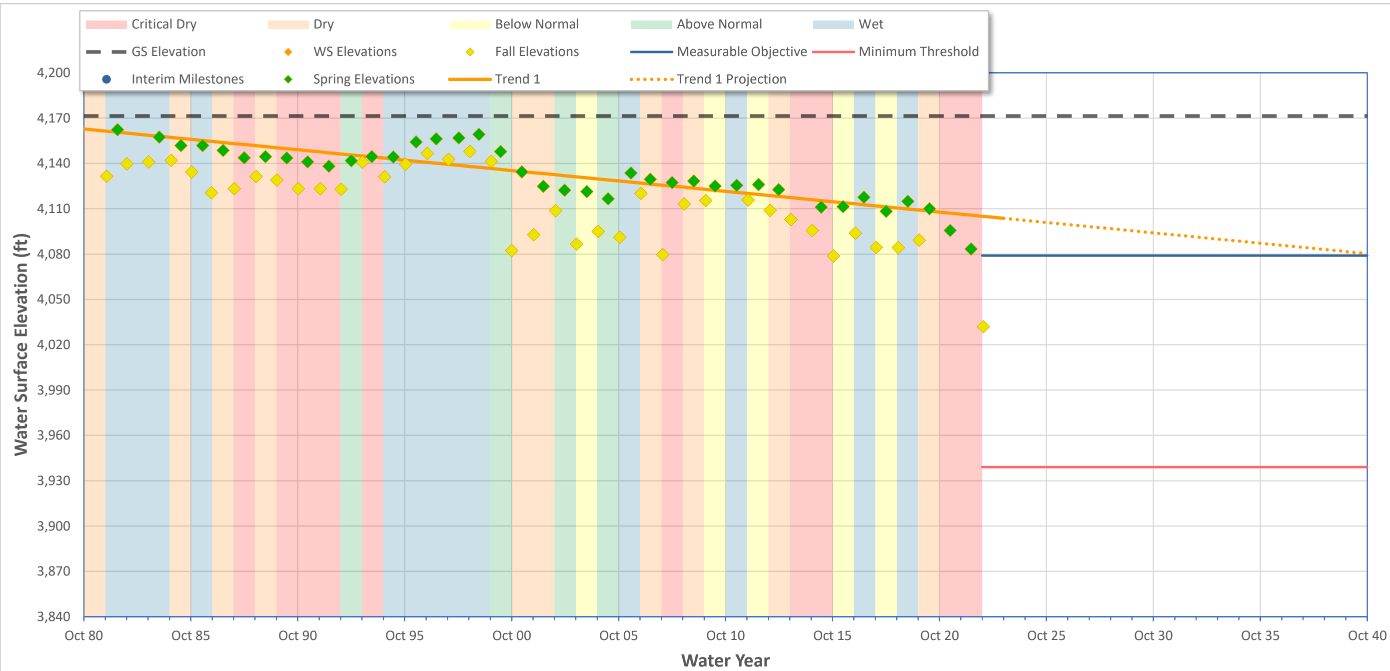
Date: 3/7/2023

Well Information	
Well ID	022097_38N08E16D001M
Well Name	38N08E16D001M
State Number	38N08E16D001M
WCR Number	90143
Site Code	411359N1210625W001
Well Location	
County	Lassen
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Lassen County Department of Planning and Building Services
Well Type Information	
Well Use	Irrigation
Completion Type	Single Well

Well Coordinates/Geometry		
Location	Lat:	41.1358
	Long:	-121.0625
Well Depth		491 ft
Ground Surface Elevation		4171.4 ft
Ref. Point Elevation		4171.60 ft
Screen Depth Range		-
Screen Elevation Range		-
Well Period of Record		
Period-of-Record		1982..2023
WS Elev-Range	Min:	4032.0 ft
	Max	4162.4 ft

Trend Analysis		
Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(1.375 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: 38N08E16D001M



Sustainability Indicator Considerations

Observed WS Elevations		
Parameter		**Value**
WS Elevation Range	Min:	4032.0 ft
	Max	4162.4 ft
2015 WS Elevations	Spring:	4111.1 ft
	Fall:	4078.7 ft
Current WS Elevations	Spring:	4083.5 ft
	Fall:	4032.0 ft

Trend Projections		
Year	**Trend 1**	**Trend 2**
2025	4100.9 ft	-
2030	4094.1 ft	-
2035	4087.2 ft	-
2040	4080.3 ft	-
	-	-
	-	-

Sustainability Indicator Settings

Key	Threshold Type	Effect. Yr.	Value	Description
MT	Minimum Threshold	2022	3939.0 ft	
MO	Measureable Objective	2022	4079.0 ft	

Groundwater Level Report

Date: 3/7/2023

Well Information

Well ID	022094_38N07E20B006M
Well Name	38N07E20B006M
State Number	38N07E20B006M
WCR Number	128135
Site Code	411242N1211866W001

Well Location

County	Lassen
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Lassen County Department of Planning and Building Services

Well Type Information

Well Use	Residential
Completion Type	Single Well

Well Coordinates/Geometry

Location	Lat:	41.1242
	Long:	-121.1866
Well Depth		183 ft
Ground Surface Elevation		4126.3 ft
Ref. Point Elevation		4127.30 ft
Screen Depth Range		-
Screen Elevation Range		-

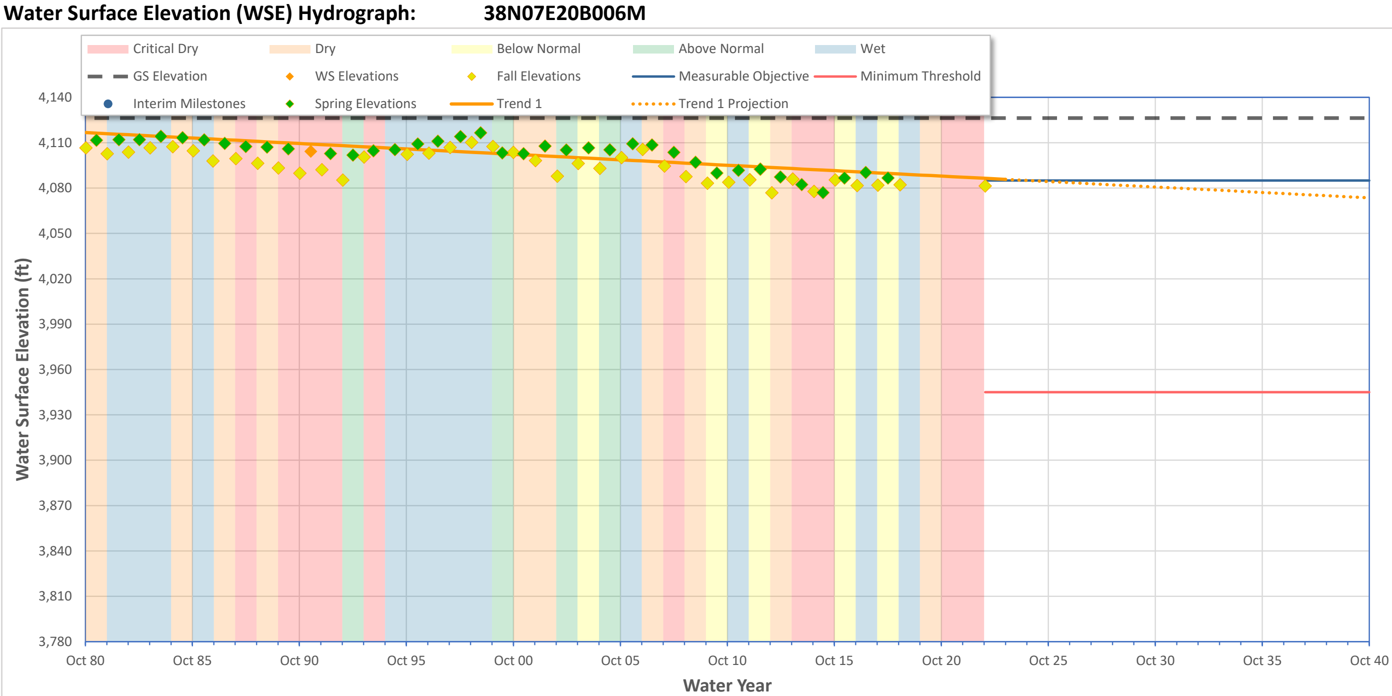
Well Period of Record

Period-of-Record		1979..2023
WS Elev-Range	Min:	4076.9 ft
	Max	4116.6 ft

Trend Analysis

Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(0.720 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: 38N07E20B006M



Sustainability Indicator Considerations

Observed WS Elevations

Parameter		Value
WS Elevation Range	Min:	4076.9 ft
	Max	4116.6 ft
2015 WS Elevations	Spring:	4077.1 ft
	Fall:	4085.4 ft
Current WS Elevations	Spring:	4086.7 ft
	Fall:	4081.4 ft

Trend Projections

Year	Trend 1	Trend 2
2025	4084.3 ft	-
2030	4080.7 ft	-
2035	4077.1 ft	-
2040	4073.5 ft	-
	-	-
	-	-

Sustainability Indicator Settings

Key	Threshold Type	Effect. Yr.	Value	Description
MT	Minimum Threshold	2022	3945.0 ft	
MO	Measureable Objective	2022	4085.0 ft	

Groundwater Level Report

Date: 3/7/2023

Well Information	
Well ID	022102_39N07E26E001M
Well Name	39N07E26E001M
State Number	39N07E26E001M
WCR Number	127484
Site Code	411911N1211354W001
Well Location	
County	Modoc
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Modoc County Planning Department
Well Type Information	
Well Use	Irrigation
Completion Type	Single Well

Well Coordinates/Geometry		
Location	Lat:	41.1911
	Long:	-121.1354
Well Depth		400 ft
Ground Surface Elevation		4133.4 ft
Ref. Point Elevation		4135.00 ft
Screen Depth Range		20 to 400 ft
Screen Elevation Range		4107 to 3727 ft
Well Period of Record		
Period-of-Record		1979..2023
WS Elev-Range	Min:	4088.9 ft
	Max	4131.3 ft

Trend Analysis		
Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(0.078 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph: 39N07E26E001M

Sustainability Indicator Considerations

Observed WS Elevations		
Parameter		**Value**
WS Elevation Range	Min:	4088.9 ft
	Max	4131.3 ft
2015 WS Elevations	Spring:	4121.0 ft
	Fall:	4113.6 ft
Current WS Elevations	Spring:	4116.6 ft
	Fall:	4114.9 ft

Trend Projections		
Year	**Trend 1**	**Trend 2**
2025	4125.2 ft	-
2030	4124.8 ft	-
2035	4124.4 ft	-
2040	4124.0 ft	-
	-	-
	-	-

Sustainability Indicator Settings

Key	Threshold Type	Effect. Yr.	Value	Description
MT	Minimum Threshold	2022	3974.0 ft	
MO	Measureable Objective	2022	4114.0 ft	

Groundwater Level Report

Date: 3/7/2023

Well Information

Well ID	051537_ACWA-3
Well Name	ACWA-3
State Number	39N08E28A001M
WCR Number	951365
Site Code	411938N1210478W001

Well Location

County	Modoc
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Lassen County Department of Planning and Building Services

Well Type Information

Well Use	Irrigation
Completion Type	Single Well

Well Coordinates/Geometry

Location	Lat:	41.1938
	Long:	-121.0478
Well Depth		720 ft
Ground Surface Elevation		4159.0 ft
Ref. Point Elevation		4159.83 ft
Screen Depth Range		60 to 720 ft
Screen Elevation Range		4075 to 3415 ft

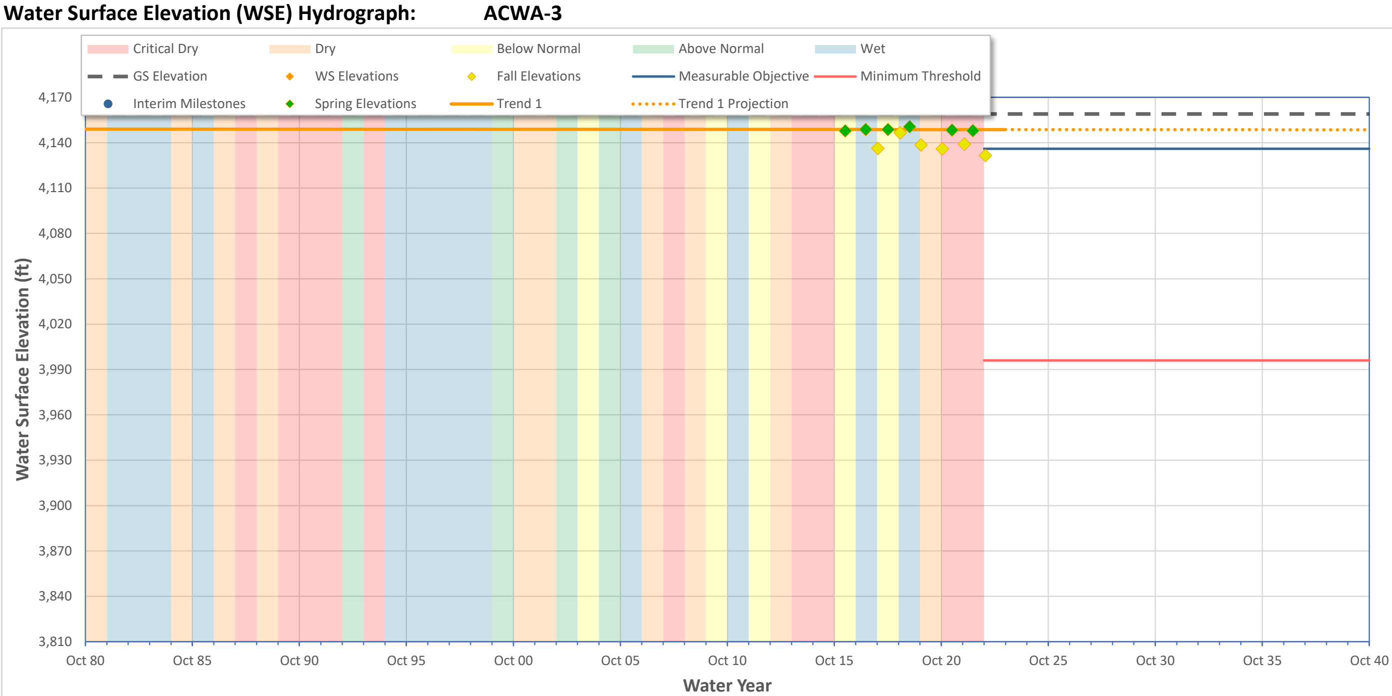
Well Period of Record

Period-of-Record		2016..2023
WS Elev-Range	Min:	4131.6 ft
	Max	4150.6 ft

Trend Analysis

Seasonal Data Method		Apr1/Oct1
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	(0.007 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		No
Trend Results	Slope	-

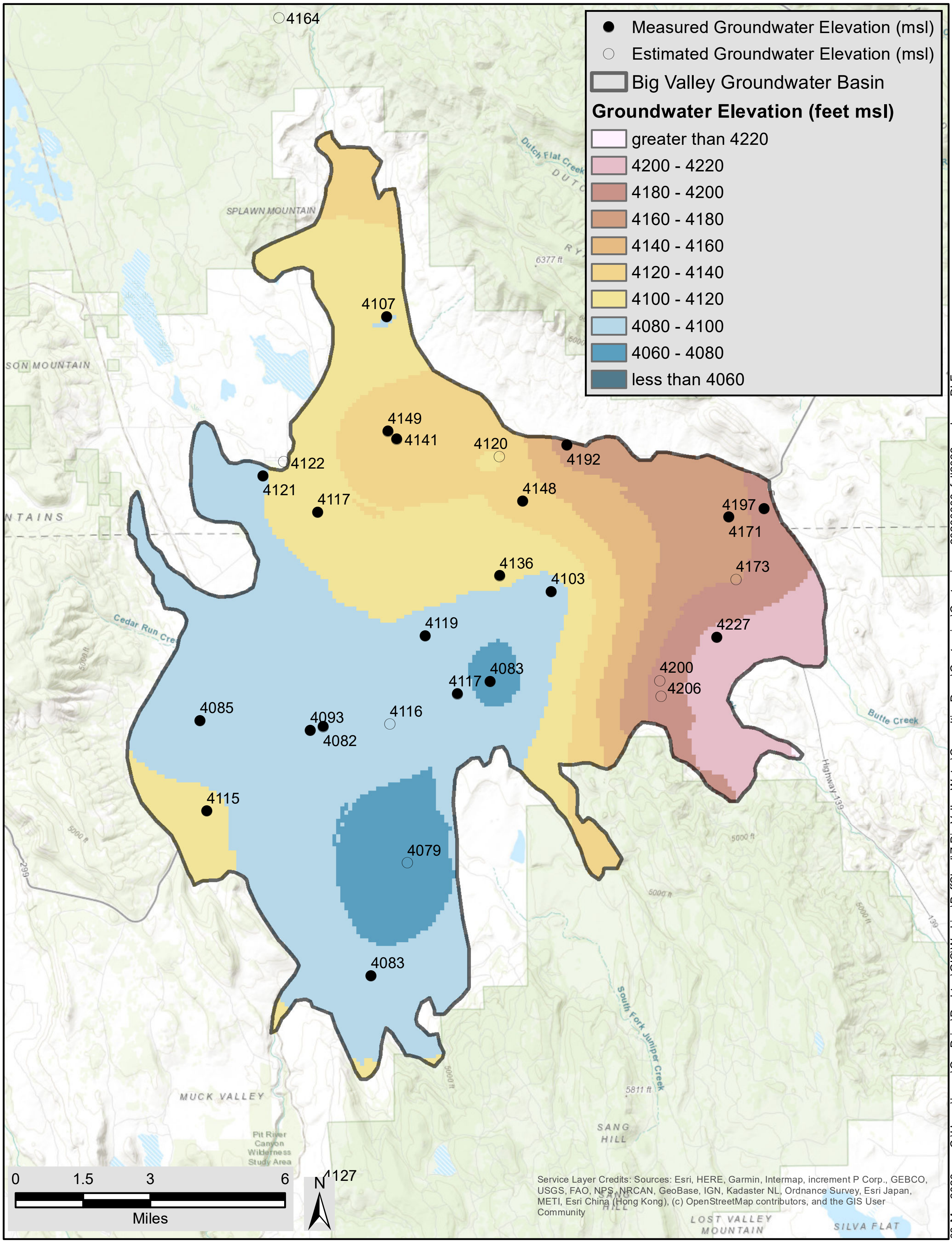
Water Surface Elevation (WSE) Hydrograph: ACWA-3



Sustainability Indicator Settings

Key	Threshold Type	Effect. Yr.	Value	Description
MT	Minimum Threshold	2022	3996.0 ft	
MO	Measureable Objective	2022	4136.0 ft	

Appendix B: Groundwater Elevation Contours



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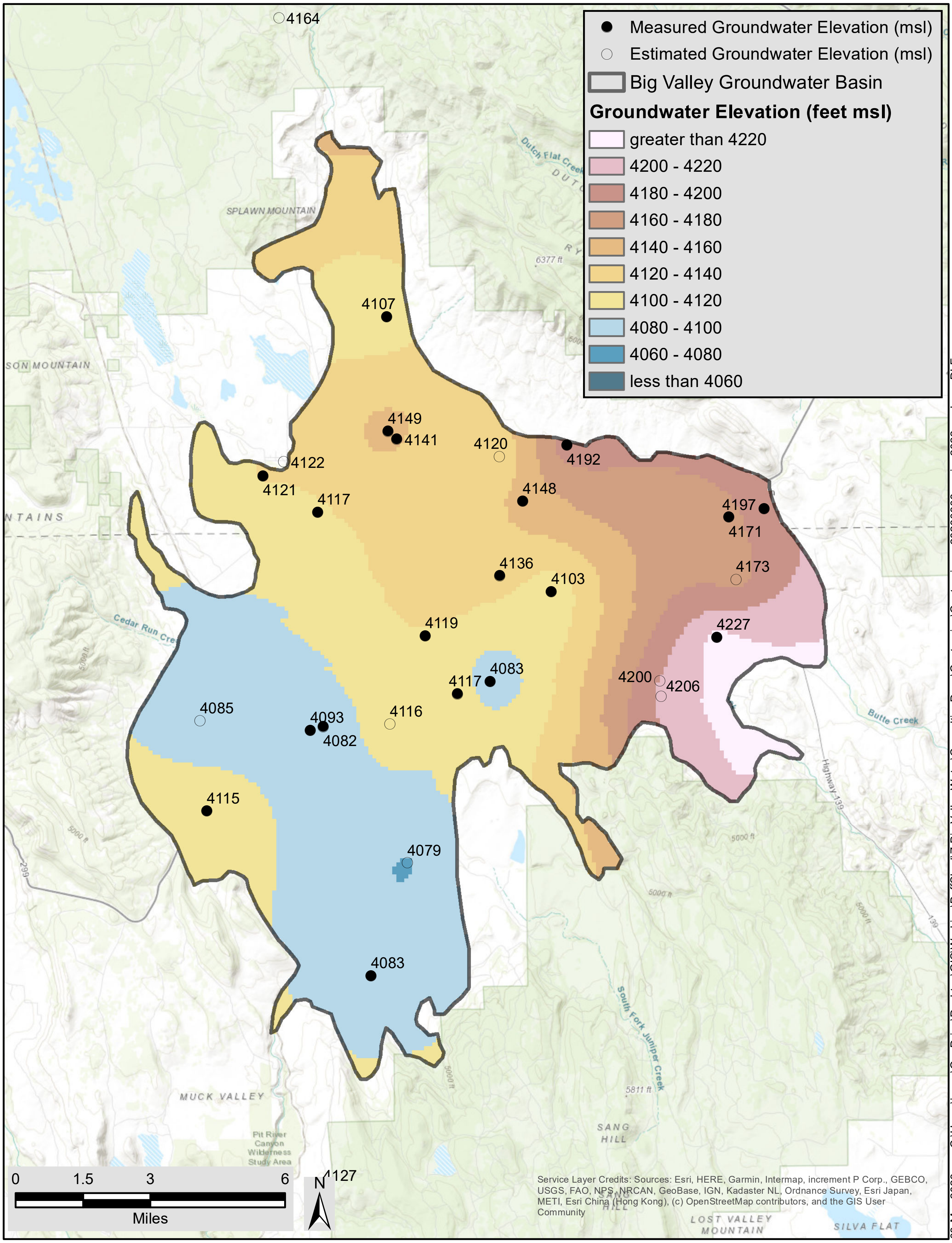
08-Mar-2023

Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California		Groundwater Elevations Fall 2022		
Big Valley Groundwater Basin GSAs		MARCH 2023	**DRAFT**	FIGURE



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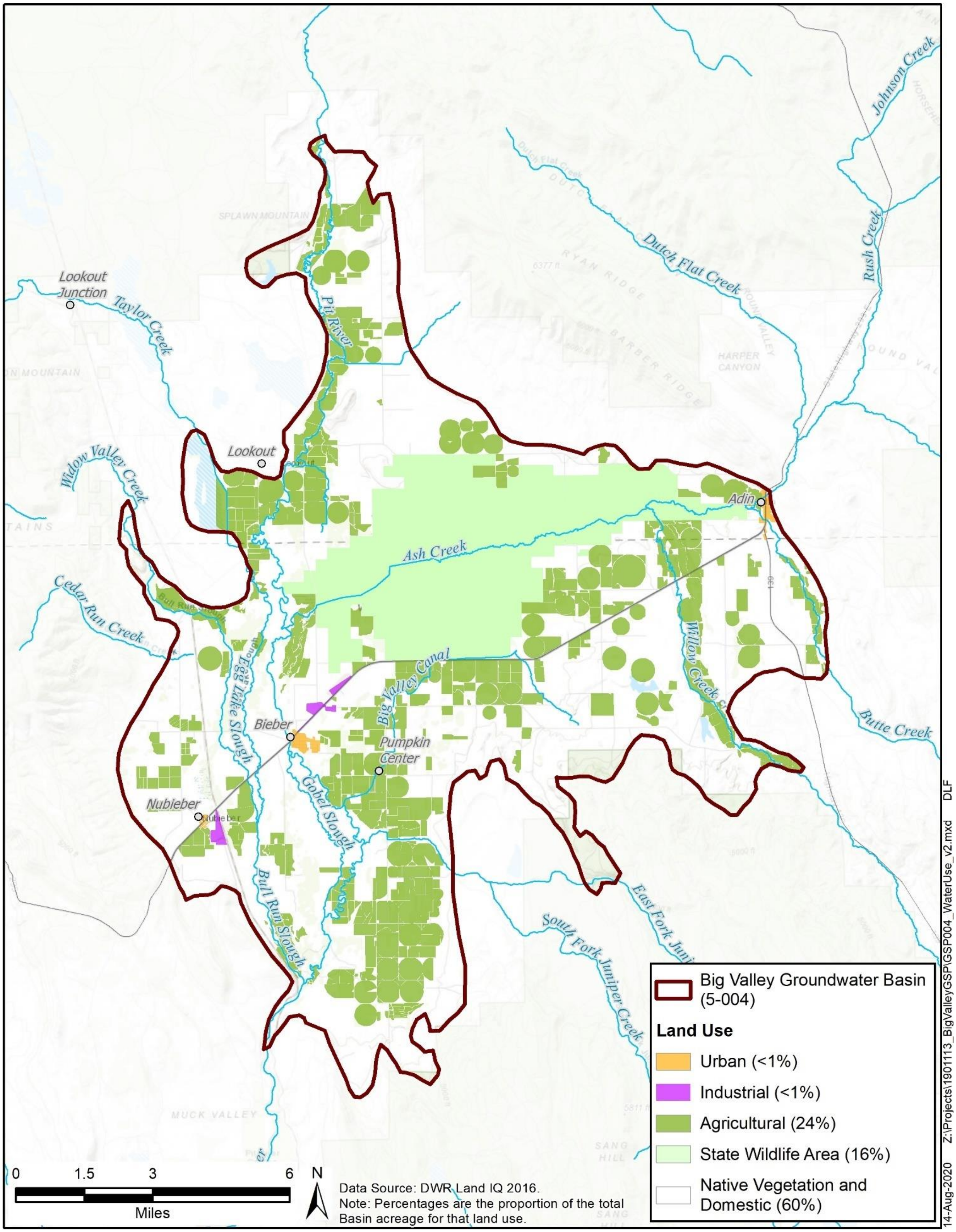
08-Mar-2023

Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California		Groundwater Elevations Spring 2022
Big Valley Groundwater Basin GSAs		MARCH 2023 **DRAFT** FIGURE

Appendix C: Land Use by Water Use Sector Map



Land Use by Water Use Sector

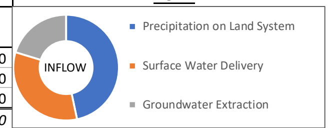
Appendix D: Water Budget

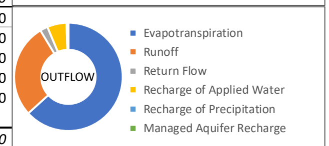
Big Valley Groundwater Basin Water Budget

LAND SYSTEM

Item	Flow Type	Origin/ Destination	Component	2018 Estimated Acre-Feet	2019 Estimated Acre-Feet	2020 Estimated Acre-Feet	2021 Estimated Acre-Feet	2022 Estimated Acre-Feet
(1)	Inflow	Into Basin	Precipitation on Land System	140,000	195,300	87,100	81,500	115,900
(2)	Inflow	Between Systems	Surface Water Delivery	77,900	70,000	84,900	86,400	82,000
(3)	Inflow	Between Systems	Groundwater Extraction	46,900	38,400	53,700	54,000	50,400
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*265,000*	*304,000*	*226,000*	*222,000*	*248,000*
(5)	Outflow	Out of Basin	Evapotranspiration	153,500	154,400	155,000	158,900	157,100
(6)	Outflow	Between Systems	Runoff	91,100	131,100	48,700	40,700	69,900
(7)	Outflow	Between Systems	Return Flow	5,300	4,300	6,000	6,100	5,700
(8)	Outflow	Between Systems	Recharge of Applied Water	13,500	12,000	14,800	15,100	14,300
(9)	Outflow	Between Systems	Recharge of Precipitation	1,500	1,900	1,200	1,200	1,400
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*265,000*	*304,000*	*226,000*	*222,000*	*248,000*
(12)								

2022

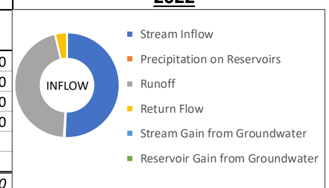


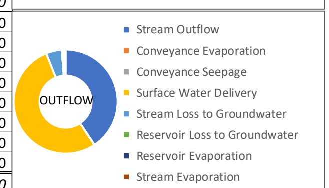


SURFACE WATER SYSTEM

Item	Flow Type	Origin/ Destination	Component	2018 Estimated Acre-Feet	2019 Estimated Acre-Feet	2020 Estimated Acre-Feet	2021 Estimated Acre-Feet	2022 Estimated Acre-Feet
(13)	Inflow	Into Basin	Stream Inflow	243,100	683,300	130,700	67,900	78,200
(14)	Inflow	Into Basin	Precipitation on Reservoirs	500	700	300	300	400
(6)	Inflow	Between Systems	Runoff	91,100	131,100	48,700	40,700	69,900
(7)	Inflow	Between Systems	Return Flow	5,300	4,300	6,000	6,100	5,700
(15)	Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-
(16)	Inflow	Between Systems	Reservoir Gain from Groundwater	-	-	-	-	-
(17)	Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*340,000*	*819,000*	*186,000*	*115,000*	*154,000*
(18)	Outflow	Out of Basin	Stream Outflow	245,000	712,000	88,800	19,500	62,600
(19)	Outflow	Out of Basin	Conveyance Evaporation	50	40	50	50	50
(20)	Outflow	Between Systems	Conveyance Seepage	30	30	30	30	30
(2)	Outflow	Between Systems	Surface Water Delivery	77,900	70,000	84,900	86,400	82,000
(21)	Outflow	Between Systems	Stream Loss to Groundwater	15,300	35,800	10,100	7,200	7,600
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	600	600	600	600	600
(23)	Outflow	Out of Basin	Reservoir Evaporation	700	700	800	800	800
(24)	Outflow	Out of Basin	Stream Evaporation	400	400	400	400	400
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*340,000*	*819,000*	*186,000*	*115,000*	*154,000*
(26)								

2022

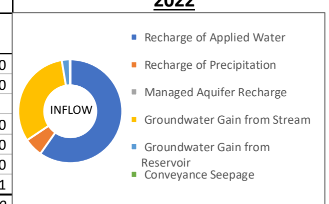


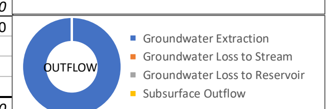


GROUNDWATER SYSTEM

Item	Flow Type	Origin/ Destination	Component	2018 Estimated Acre-Feet	2019 Estimated Acre-Feet	2020 Estimated Acre-Feet	2021 Estimated Acre-Feet	2022 Estimated Acre-Feet
(8)	Inflow	Between Systems	Recharge of Applied Water	13,500	12,000	14,800	15,100	14,300
(9)	Inflow	Between Systems	Recharge of Precipitation	1,500	1,900	1,200	1,200	1,400
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	15,300	35,800	10,100	7,200	7,600
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	600	600	600	600	600
(20)	Inflow	Between Systems	Conveyance Seepage	30	30	30	30	30
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*30,900*	*50,400*	*26,700*	*24,100*	*23,900*
(3)	Outflow	Between Systems	Groundwater Extraction	46,900	38,400	53,700	54,000	50,400
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*46,900*	*38,400*	*53,700*	*54,000*	*50,400*
(31)								

2022

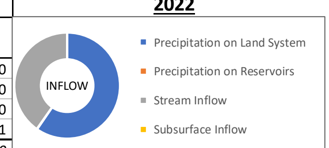


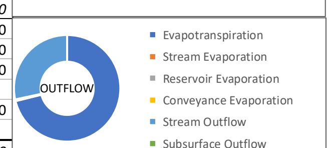


TOTAL BASIN WATER BUDGET

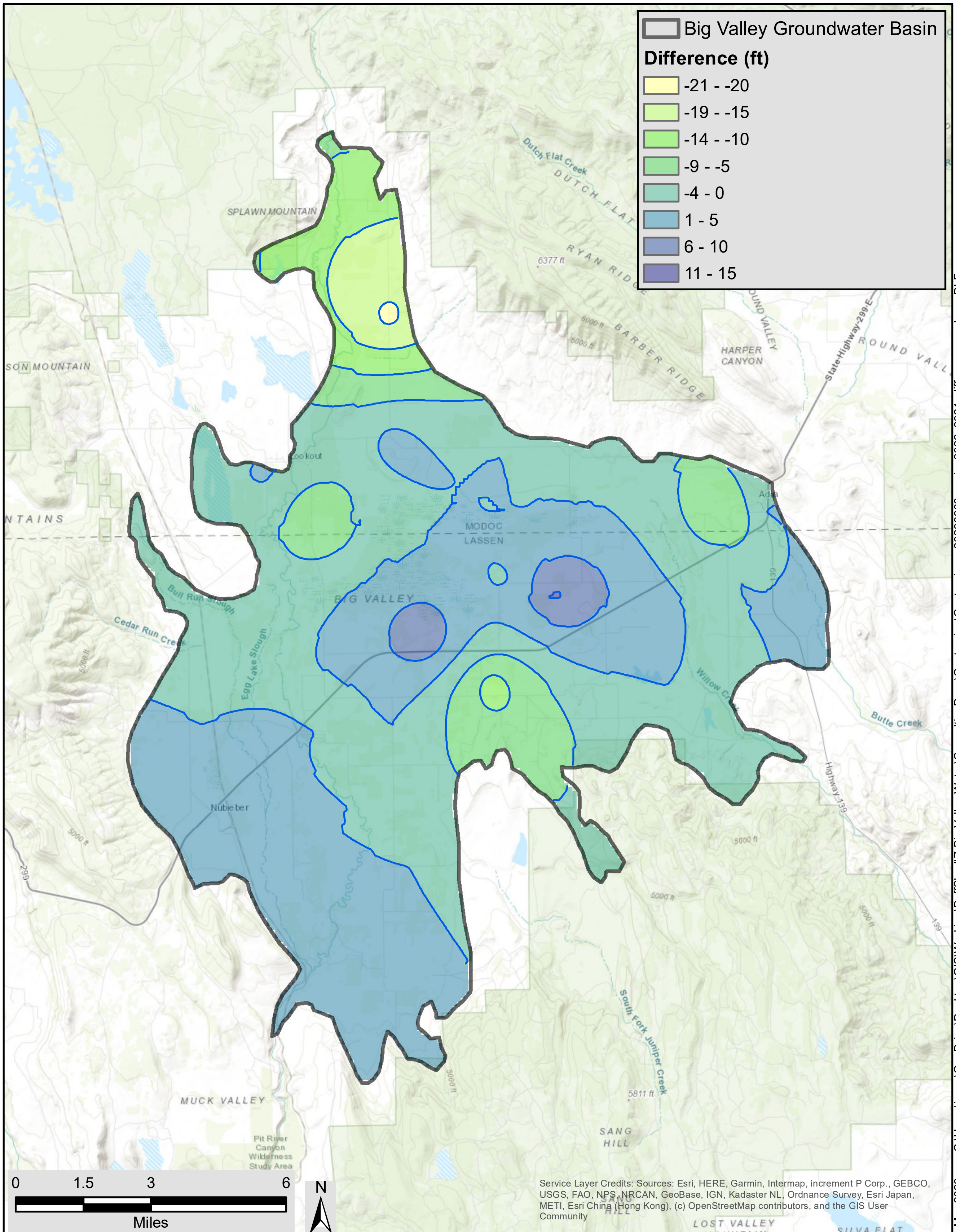
Item	Flow Type	Origin/ Destination	Component	2018 Estimated Acre-Feet	2019 Estimated Acre-Feet	2020 Estimated Acre-Feet	2021 Estimated Acre-Feet	2022 Estimated Acre-Feet
(1)	Inflow	Into Basin	Precipitation on Land System	140,000	195,300	87,100	81,500	115,900
(14)	Inflow	Into Basin	Precipitation on Reservoirs	500	700	300	300	400
(13)	Inflow	Into Basin	Stream Inflow	243,100	683,300	130,700	67,900	78,200
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*383,600*	*879,300*	*218,100*	*149,700*	*194,500*
(5)	Outflow	Out of Basin	Evapotranspiration	153,500	154,400	155,000	158,900	157,100
(24)	Outflow	Out of Basin	Stream Evaporation	400	400	400	400	400
(23)	Outflow	Out of Basin	Reservoir Evaporation	700	700	800	800	800
(19)	Outflow	Out of Basin	Conveyance Evaporation	-	-	-	-	-
(18)	Outflow	Out of Basin	Stream Outflow	245,000	712,000	88,800	19,500	62,600
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*399,600*	*867,500*	*245,000*	*179,600*	*220,900*
(34)								

2022





Appendix E: Map of Storage Change



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Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California		Groundwater Elevations Spring 2021 and 2022 Difference
Big Valley Groundwater Basin GSAs		MARCH 2023 **DRAFT** FIGURE