Big Valley Groundwater Sustainability Plan

Adopted December 15, 2021
Revised GSP Adopted April 9 and 15, 2024

No. 5-004 Big Valley Groundwater Basin

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Big Valley Groundwater Sustainability Plan

Adopted December 15, 2021; Revised GSP adopted April 9 and 15, 2024

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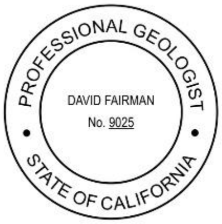

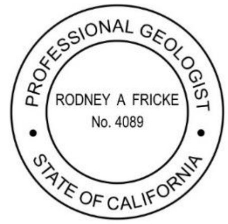

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The Groundwater Sustainability Agencies' resolutions adopting the original and revised Groundwater Sustainability Plan are included in Appendix 11F

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Acronyms and Abbreviations

ACWA	Ash Creek Wildlife Area
AF	Acre-Feet
AFY	Acre-Feet Per Year
ASR	Aquifer Storage and Recovery
Basin	Big Valley Groundwater Basin
Basin Plan	Water Quality Control Plan
bgs	Below Ground Surface
BIA	U.S. Bureau of Indian Affairs
Big Valley	Big Valley Groundwater Basin
BLM	U.S. Bureau of Land Management
BMO	Basin Management Objective
BMP	Best Management Practices
BVGB	Big Valley Groundwater Basin
BVAC	Big Valley Groundwater Basin Advisory Committee
BVWUA	Big Valley Water Users Association
C&E	Communication and Engagement
CAL FIRE	California Department of Forestry and Fire Protection
CASGEM	California Statewide Groundwater Elevation Monitoring
CDEC	California Data Exchange Center
CDFA	California Dept of Food and Agriculture
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFCC	California Financing Coordinating Committee
CGPS	Continuous Global Positioning System
CIMIS	California Irrigation Management Information System
CGS	California Geological Survey
CRP	Conservation Reserve Program
CVSC	Central Valley Salinity Coalition
CWA	Clean Water Act
CWC	California Water Code
DDW	State Water Resources Control Board's Division of Drinking Water
District	Lassen-Modoc County Flood Control and Water Conservation District
DMS	Data Management System
DOI	Department of the Interior
DTW	Depth to Water
DWR	California Department of Water Resources
EC	Electrical conductivity
EQIP	Environmental Quality Incentives Program
ET	Evapotranspiration
ETo	Reference Evapotranspiration
°F	Degrees Fahrenheit
Forest Service	U.S. Forest Service
FSA	Farm Service Agency
ft bgs	Feet Below Ground Surface

ft/d	Foor or Feet Per Day
ft/yr	Foot or Feet Per Year
GAMA	Groundwater Ambient Monitoring and Assessment Program
GAMA GIS	GAMA Groundwater Information System
GDE	Groundwater Dependent Ecosystem
GEI	GEI Consultants Inc.
General Order	Statewide ASR General Order
GIS	Geographic Information System
GP	General Plan
gpm	Gallons Per Minute
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	Hydrogeologic Conceptual Model
HSG	Hydrologic Soils Group
IC	Institutional Controls
ILRP	Irrigated Lands Regulatory Program
IM	Interim Milestone
in/hr	Inches Per Hour
InSAR	Interferometric Synthetic Aperture Radar, a technology used to detect subsidence
IRWMP	Upper Pit Integrated Regional Water Management Plan
IWFM	Integrated Water Flow Model
LCGMP	Lassen County Groundwater Management Plan
LCWD #1	Lassen County Waterworks District #1
LNAPL	Light non-aqueous phase liquid (found in petroleum hydrocarbons)
LUST	Leaking underground storage tank
M	Million
MCL	Maximum Contaminant Level
Mn	Manganese
MO	Measurable Objective
MOU	Memorandum of Understanding
msl	Mean Sea Level
MT	Minimum Threshold
MTBE	Methyl tert-butyl ether
MW	Monitoring Well
ng/L	Nanograms Per Liter
NCCAG	Natural Communities Commonly Associated with Groundwater
NGO	Non-Governmental Organization
North Cal-Neva	North Cal-Neva Resource Conservation and Development Council
NCWA	Northern California Water Association
NECWA	Northeastern California Water Association
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NR	Natural Resources
NRCS	Natural Resources Conservation Service
NSP	Nonpoint Source Program
OS	Open Space
OWTS	Onsite Water Treatment System

PFAS	Per/Polyfluoroalkyl Substances
PFOS	Perfluorooctane Sulfonate
PG&E	Pacific Gas and Electric
Plan	Groundwater Sustainability Plan
Reclamation	United States Bureau of Reclamation
RWMG	Regional Water Management Group
RWQCB	Regional Water Quality Control Board
RWQCB-R5	Regional Water Quality Control Board Region 5
Regulations	GSP Regulations, California Code of Regulations Title 23, Division 2, Chapter 1.5
SAGBI	Soil Agricultural Groundwater Banking Index
SB	Senate Bill
SC	Specific Conductance
SGMA	Sustainable Groundwater Management Act of 2014
SMC	Sustainable Management Criteria
SRI	Sacramento River Index of water year types
SSURGO	Soil Survey Geographic Database
State Water Board	California State Water Resources Control Board
SVE	Surprise Valley Electric
SVWQC	Sacramento Valley Water Quality Coalition
SWEEP	State Water Efficiency and Enhancement Program
SWRCB	State Water Resources Control Board
SY	Specific Yield
TBA	tert-Butyl alcohol
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Load Program
TNC	The Nature Conservancy
UCCE	University of California Cooperative Extension
U.S.	United States
USCB	United States Census Bureau
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGS	United States Geologic Survey
UST	Underground Storage Tank
WAA	Water Availability Analysis
WCR	Well Completion Report
WDR	Waste Discharge Requirement
WMSA	Watermaster Service Area
WRP	Wetland Reserve Program
WY	Water Year (October 1 – September 30)

Executive Summary

ES.1. Introduction & Plan Area (Chapters 1 – 3)

The Big Valley Groundwater Basin (BVGB, Basin, or Big Valley) lies on the border of Modoc and Lassen counties in one of the most remote and untouched areas of California. The sparsely populated Big Valley has a rich biodiversity of wildlife and native species who live, feed and raise young on the irrigated lands throughout the Basin. The snow-fed high desert streams entering the Basin have seasonal hydrographs with natural periods of reduced flows or complete cessation of flows late in the summer season. The Pit River is the largest stream and is so named because of the practice, employed by the Achumawi and other Native American bands that are now part of the Pit River Tribe, of digging pits in the river channel when it went dry to expose water and trap game that came to water at the river. Farming and ranching in Big Valley date back to the late 19th and early 20th centuries, when families immigrated to Big Valley and made use of the existing water resources. A large amount of the land in the Basin is still owned and farmed by the families who homesteaded here.

Historically, agriculture was complemented by a robust timber industry as a key component of the economy for Big Valley, which supported four lumber mills. Due to regulations and policies imposed by state and federal governments, the timber industry has been diminished over time and subsequently caused a great economic hardship to the Big Valley communities. Stakeholders realize that the Sustainable Groundwater Management Act of 2014 (SGMA) will unfortunately cause a similar decline to agriculture. The change in land management has transformed once-thriving communities in the Basin to "disadvantaged" and "severely disadvantaged" communities. Viable agriculture is of paramount importance to the residents of Big Valley because it supports the local economy and unique character of the community. As required by SGMA, stakeholders have developed a sustainability goal:

> 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.

Lassen and Modoc counties are fulfilling their unfunded, mandated roles as Groundwater Sustainability Agencies (GSAs) to develop this Groundwater Sustainability Plan (GSP) after exhausting its administrative challenges to the California Department of Water Resources' (DWR's) determination that Big Valley qualifies as a medium-priority basin. Both counties are disadvantaged, have declining populations, and have no ability to cover the costs of GSP development and implementation.

The Basin, shown on **Figure ES-1**, encompasses an area of about 144 square miles (92,057 acres), with Modoc County representing 28 percent and Lassen County comprising 72 percent of the Basin by area. The Basin includes the towns of Adin and Lookout in Modoc County and the towns of Bieber and

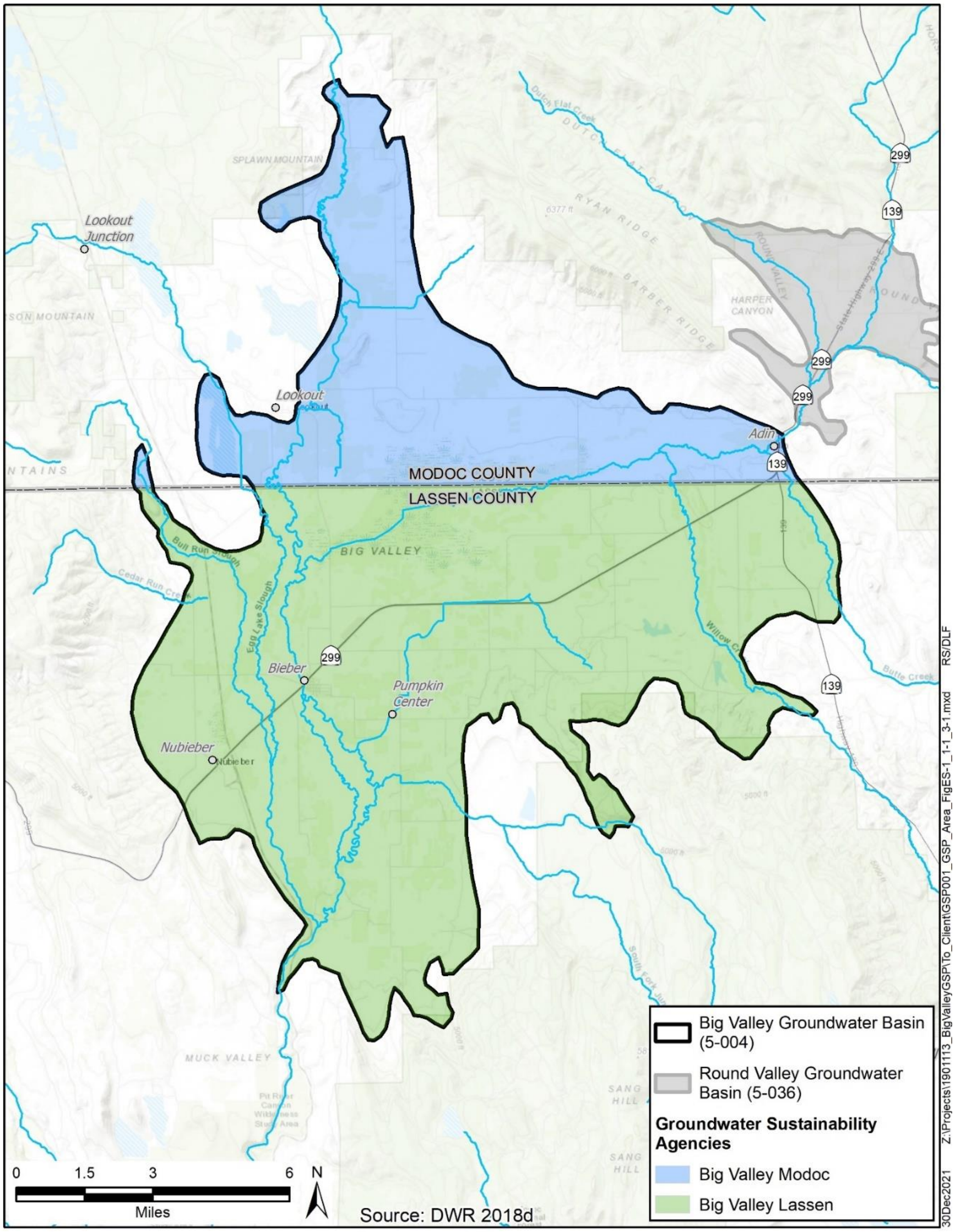


Figure ES-1-1 Groundwater Sustainability Agencies in Big Valley Groundwater Basin

Nubieber in Lassen County. The Ash Creek State Wildlife Area straddles both counties occupying 22.5 square miles in the center of the Basin in the marshy/swampy areas along Ash Creek. Land use in the BVGB is detailed in **Table ES-1**.

Table ES-1-1 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	16%
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: See Chapter 6 – Water Budget for explanation of approach

ES.2. Basin Setting (Chapters 4 – 6)

Hydrogeologic Setting

The topography of BVGB is relatively flat in the central area with increasing elevations along the perimeter, particularly in the eastern portions where Willow and Ash Creeks enter the Basin. This low relief in the Basin results in a meandering river morphology and widespread flooding during large storm events. The Basin is underlain by a thick sequence of sediment derived from the surrounding mountains of volcanic rocks and is interbedded with lava flows and water-lain tuffs. The volcanic material is variable in composition and is Miocene to Holocene age (23 million to several hundred years ago). The compositions of the lava flows are primarily basalt[1] and basaltic andesite[2], while pyroclastic[3] ash deposits are rhyolitic[4] composition. In general, the Basin boundary drawn by DWR was intended to define the contact between the valley alluvial deposits and the surrounding mountains of volcanic rocks. During development of this GSP, the Basin boundary has been found to be grossly inaccurate in many areas and is not clearly isolated from areas outside the valley floor. The mountains outside of the groundwater Basin capture and accumulate precipitation, which produces runoff that flows into BVGB. Moreover, DWR (1963) stated that these mountains serve as "upland recharge areas" and provide subsurface recharge to BVGB *via* fractures in the rock and water bearing formations that underlie the volcanics.

[1] Basalt is an extrusive (volcanic) rock with relatively low silica content and high iron and magnesium content.
[2] Andesite is an extrusive rock with intermediate silica content and intermediate iron and magnesium content.
[3] Pyroclastic rocks are formed during volcanic eruptions, typically not from lava flows, but from material (clasts) ejected from the eruption such as ash, blocks, or "bombs."
[4] Rhyolitic rocks are extrusive with relatively high silica content and low iron and magnesium. Rhyolites are the volcanic equivalent of granite.

The Bieber Formation (TQb), formed in the Pliocene-Pleistocene age (5.3 million to 12 thousand years ago) and shown in **Figure ES-2**, is the main formation of aquifer material defined within the BVGB, and DWR (1963) estimates that it ranges in thickness from a thin veneer to over 1,000 feet. The formation was deposited in a lacustrine (lake) environment and is comprised of unconsolidated to semi-consolidated layers of interbedded clay, silt, sand, gravel, and diatomite. The coarse-grained deposits (gravel and sand) are aquifer material[5] and are part of the Big Valley principal aquifer. The "physical bottom" has not been clearly encountered or defined but may extend 4,000 to 7,000 feet or deeper. The "practical bottom" of the aquifer is 1,200 feet because that depth encompasses the known production wells and water quality may be poorer below that depth. As required by SGMA, 1,200 feet is used as the "definable bottom" for this GSP. A single principal aquifer is used for this GSP because distinct, widespread confining beds have not been identified in the subsurface.

The Natural Resources Conservation Service (NRCS) Hydrologic Soils Group (HSG) classifications provide an indication of soil infiltration potential and ability to transmit water under saturated conditions based on hydraulic conductivities of shallow, surficial soils. Characterizing these soils is important because water must first penetrate the shallow subsurface to provide any chance of groundwater recharge. According to the HSG dataset, the Basin is composed of only soils with "slow" or "very slow" infiltration rates. While the soils are not highly permeable, some research and historical evidence has found that water will penetrate through these soils, indicating that managed aquifer recharge projects such as on-farm recharge may be viable.

Groundwater Conditions

Historical groundwater elevations are available from a total of 22 wells in Big Valley that are part of the CASGEM[6] monitoring network, six located in Modoc County and 16 in Lassen County**.** In addition to these 22 wells, five well clusters were constructed in late 2019 and early 2020 to support the GSP. Groundwater level hydrographs from the historical wells show that most areas of the Basin have remained stable, and a few areas have seen some decline averaging 0.53 feet per year of groundwater level decline in the last 38 years.[7]

To determine the annual and seasonal change in groundwater storage, groundwater elevation surfaces[8] were developed for spring and fall for each year between 1983 and 2018. **Figure ES-3** shows this information graphically, along with the annual precipitation. This graph shows that groundwater storage generally declines during dry years and stays stable or increases during normal or wet years. During the period from 1983 to 2000, groundwater levels dipped in the late 1980s and early 1990s, then recovered during the wet period of the late 1990s. After 2000, while most wells are still stable, a few wells have

[5] Meaning the sediments contain porous material with recoverable water.
[6] California Statewide Groundwater Elevation Monitoring Program
[7] Average slope of the trend lines in Appendix 5A.
[8] Groundwater elevation surfaces are developed from the known groundwater elevations at wells throughout the Basin and then estimating/interpolating elevations at intermediate locations *via* a mathematical method known as kriging. The kriging elevation surface is based on a grid covering the entire basin that has interpolated groundwater elevation values for each node of the grid.

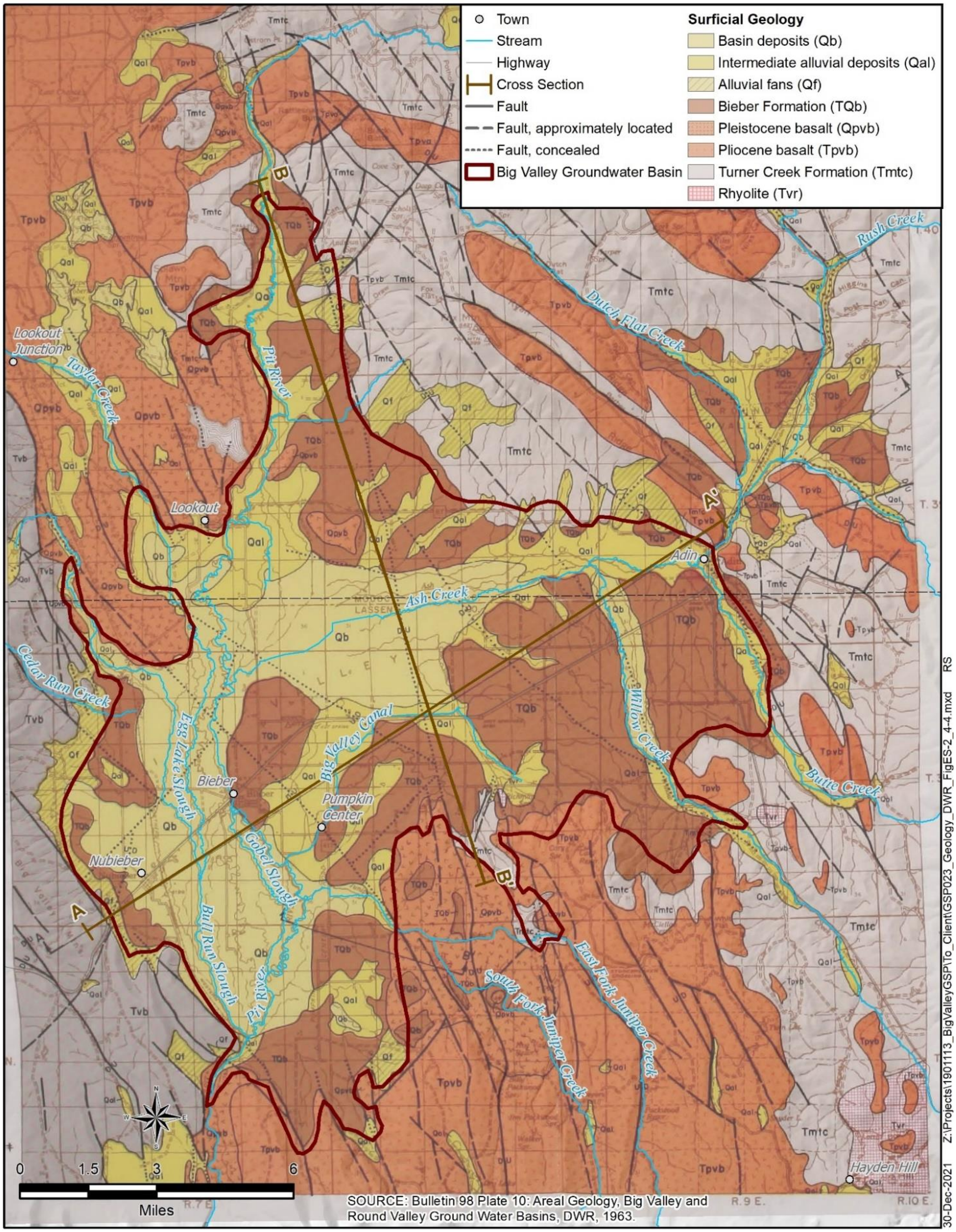


Figure ES-1-2 DWR 1963 Local Geologic Map

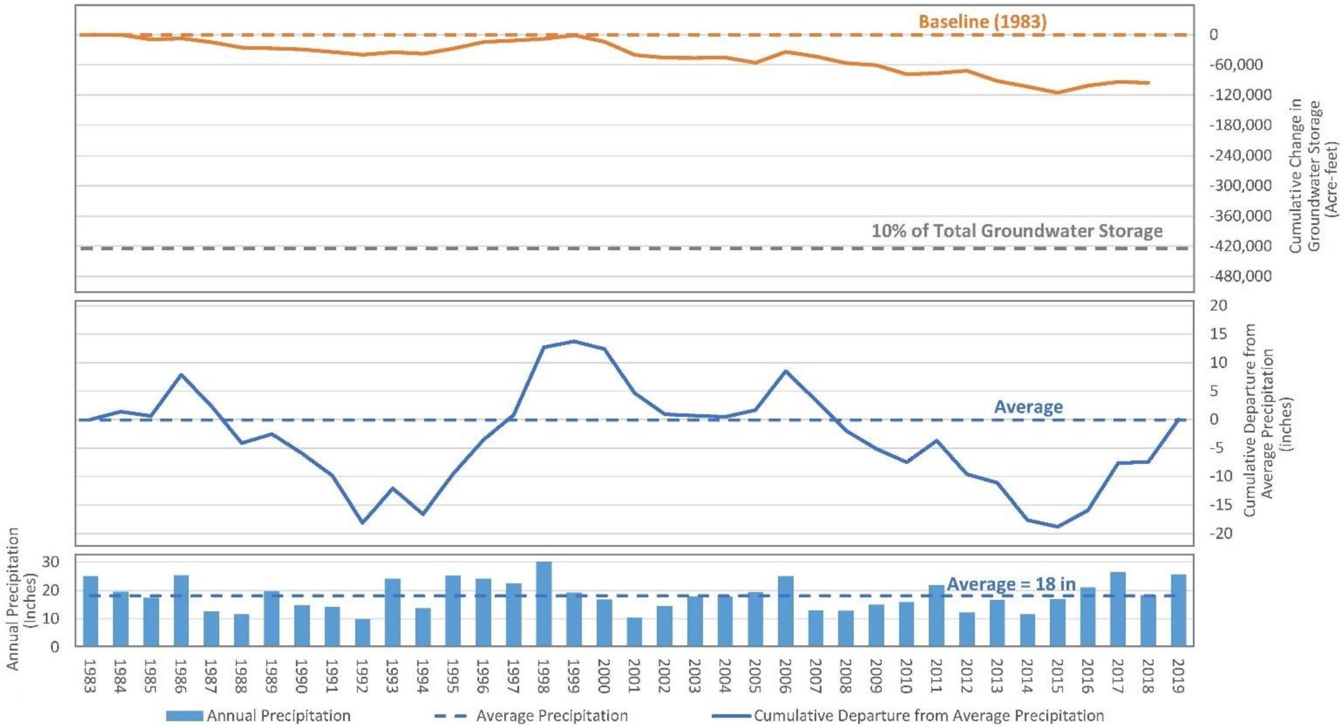


Figure ES-1-3 Cumulative Change in Groundwater Storage and Precipitation

generally declined, resulting in a reduction in overall groundwater storage. The amount of decline represents a cumulative reduction in storage of less than 2 percent of groundwater storage.[9]

Groundwater in the BVGB is generally of good to excellent quality (DWR 1963, United States Bureau of Reclamation [Reclamation] 1979). An analysis of available historical water quality indicates that some naturally occurring constituents associated with volcanic formations and thermal waters are slightly elevated. These elevated concentrations are extremely isolated and primarily not above thresholds that are a risk to human health nor does the water quality affect beneficial uses. There are no contamination plumes or cleanup sites that are likely to affect groundwater quality for beneficial use.

Water Budget

A historical water budget was developed for the 1983-2018 timeframe, shown in **Figure ES-4.** From this water budget analysis, a rough estimate for the sustainable yield is about 39,300 acre-feet per year (AFY) and a rough estimate of average annual overdraft is 5,000 AFY.

[9] Based on assessment in Section 5.2, indicating storage has been reduced by about 96,000 AF since 1983 and using a total storage of about 5.2 million AF (92,057 acre basin area * 1,200 feet to definable bottom * 5% specific yield)

item	Flow Type	Origin/ Destination	Component	Estimated
	TOTAL BASIN WATER BUDGET			**Acre-Feet**
(1)	Inflow	Into Basin	Precipitation on Land System	136,800
(14)	Inflow	Into Basin	Precipitation on Reservoirs	500
(13)	Inflow	Into Basin	Stream Inflow	371,100
(27)	Inflow	Into Basin	Subsurface Inflow	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*508,400*
(5)	Outflow	Out of Basin	Evapotranspiration	154,000
(24)	Outflow	Out of Basin	Stream Evaporation	400
(23)	Outflow	Out of Basin	Reservoir Evaporation	700
(19)	Outflow	Out of Basin	Conveyance Evaporation	-
(18)	Outflow	Out of Basin	Stream Outflow	358,500
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*513,600*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(5,000)

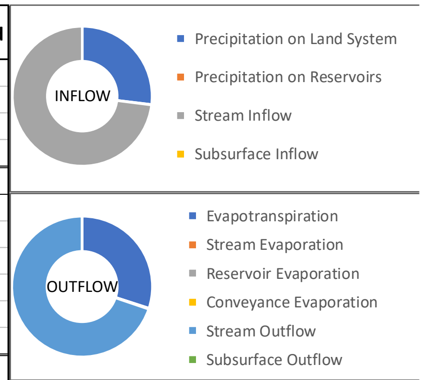


Figure ES-1-4 Average Total Basin Water Budget 1984-2018

ES.3. Sustainable Management (Chapters 7 – 9)

Sustainable Management Criteria

Sustainable Management Criteria (SMC) define the conditions that constitute sustainable groundwater management. The following is a description of the SMC for each of the six sustainability indicators:

- **Groundwater Levels:** Do not allow groundwater levels to decline to a level where the depletion of supply results in significant and undesirable reductions in the long-term viability of agriculture, community, domestic, and natural/wildlife uses in the Basin. The minimum threshold for each well in the monitoring network was determined to be 50 feet below the Spring 2015 groundwater level, or the Spring 2022 groundwater level for wells constructed after 2015.
- **Groundwater Storage:** Groundwater levels are used as a proxy for this sustainability indicator because change in storage is directly correlated to changes in groundwater levels.
- **Seawater Intrusion:** This sustainability indicator does not apply to Big Valley.
- **Water Quality:** Undesirable results for degraded water quality are defined as when the degradation of quality results in significant and undesirable impacts to the long-term viability of agriculture, community, domestic, and natural/wildlife uses in the Basin. Following the state's drinking water standards, the maximum thresholds for TDS and nitrate are set at their respective maximum contaminant levels (MCLs): 500 mg/L for total dissolved solids (TDS) (secondary MCL) and 10 mg/L for nitrate (primary MCL). Measurable objectives (MOs) for TDS and nitrate are the current quality, which is about 300 mg/L for TDS and less than 1 mg/L for nitrate. MOs are developed for each monitoring well.
- **Land Subsidence:** Based on evaluation of subsidence data from a continuous GPS station and Interferometric Synthetic Aperture Radar (InSAR) provided by DWR, no significant subsidence has occurred. Therefore, per §354.26(d), SMCs were not established for subsidence because undesirable results are not present and not likely to occur. At the five-year update of this GSP, subsidence data will be assessed for any trends that can be correlated with groundwater pumping.

- **Interconnected Surface Water:** Data for this sustainability indicator is limited. Currently there is no evidence to suggest that undesirable results have occurred or are likely to occur. At the five-year update, future data will be evaluated.

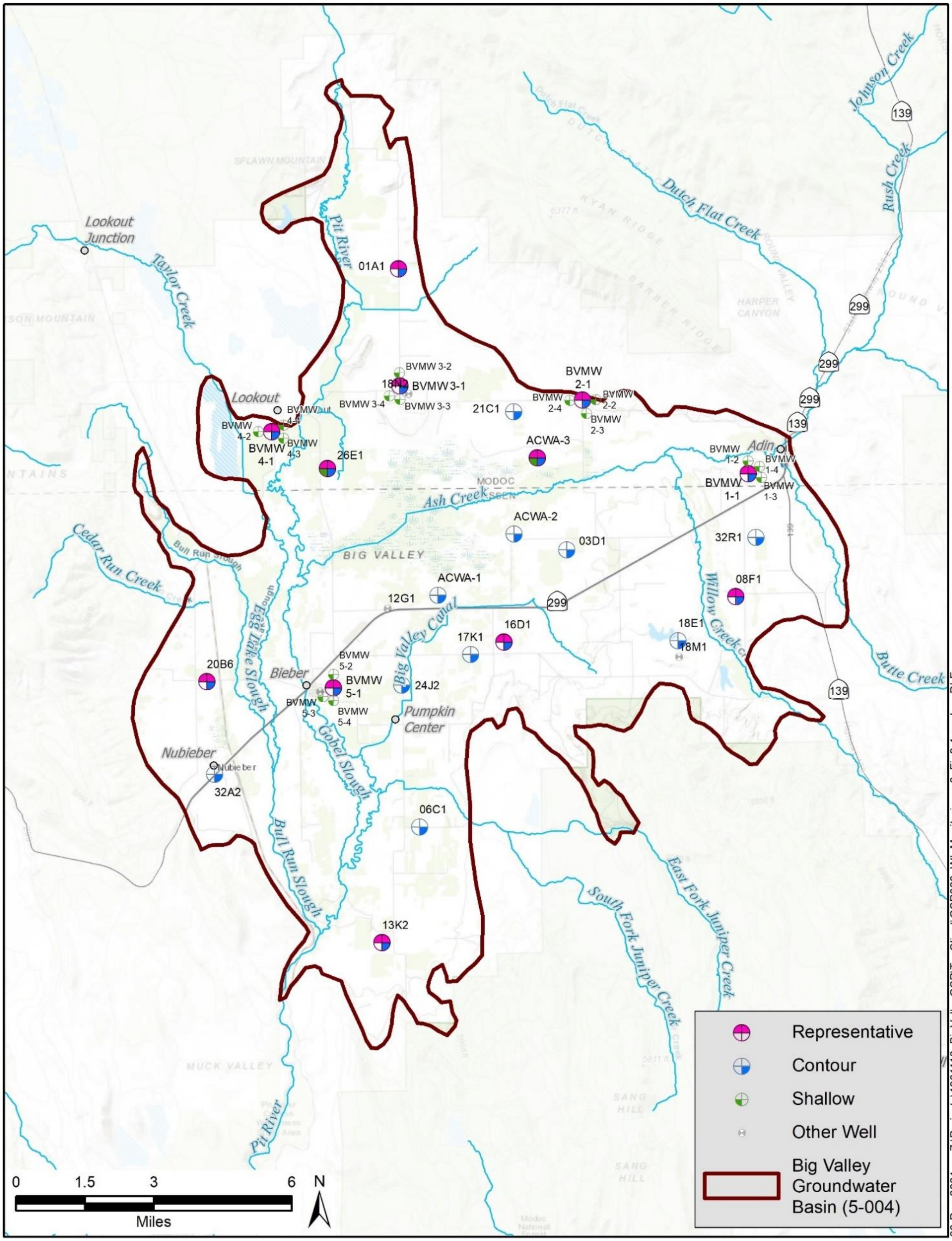
Monitoring Network

Monitoring networks are developed to promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface-water conditions in the Basin and to evaluate changing conditions that occur as the Plan is implemented. The GSAs developed monitoring networks for the parameters listed below. **Figure ES-5** shows the water level monitoring networks.

- Groundwater levels
- Groundwater storage *via* groundwater levels as proxy
- Shallow groundwater for interconnection of groundwater and surface water
- Groundwater quality
- Land subsidence
- Streamflow and climate
- Land use

Projects and Management Actions

Through an extensive planning and public outreach process, the GSAs have identified an array of projects and management measures that may be implemented to meet sustainability objectives in the BVGB. Some of the projects can be implemented immediately while others will take significantly more time for necessary planning and environmental review, navigation of regulatory processes, and implementation. The various projects and estimated timeline can be found in **Table ES-2**.



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158 **Figure ES-1-5 Groundwater Level Monitoring Networks**

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Table ES-1-2 Projects and Potential Implementation Timeline

No.	Category	Description	Estimated Time for Potential Implementation (years)[1]		
			0-2	2-8	>8
1	9.1 Basin Recharge Projects	Agriculture Managed Aquifer Recharge	X	X	X
2		Drainage or Basin Recharge	X	X	X
3		Aquifer Storage and Recovery and Injection Wells			X
4	9.2 Research and Data Development	Additional Stream Gages and Flow Measurement	C		
5		Refined Water Budget and Domestic and Adin Community Supply Assessment	X	X	
6		• CIMIS Station	C		
7		• Voluntary Installation of Well Meters	C	X	
8		Adaptive Management	X	X	X
9		Mapping and Land Use	X	X	X
10	9.3 Increased Surface-water Storage Capacity	Expanding Existing Reservoirs	X	X	X
11		Allen Camp Dam			X
12	9.4 Improved Hydrologic Function and Upland Recharge	Forest Health / Conifer and Juniper Thinning	X	X	X
13		Stream Channel Enhancement and Meadow Restoration	X	X	X
14	9.5 Water Conservation	Irrigation Efficiency	X	X	X
15		Landscaping and Domestic Water Conservation	X	X	X
16		Illegal Diversions and Groundwater Uses	X	X	X
17	9.6 Public Education and Outreach	Public Communication	X	X	X
18		Information and Data Sharing	X	X	X
19		Fostering Relationships	X	X	X
20		Compiling Efforts	X	X	X
21		Educational Workshops	X	X	X
22	9.7 Domestic Well Mitigation Program	Development and implementation of a domestic well mitigation program to assist domestic water users if their wells go dry due to declining groundwater levels	X	X	X

[1] C = Completed

ES.4. Plan Implementation (Chapters 10 – 11)

The GSP lays out a roadmap for addressing the activities needed for GSP implementation. Implementing this GSP requires the following activities:

- **GSA Administration and Public Outreach:** The fundamental activities that will need to be performed by the GSAs are public outreach and coordination of GSP activities. Public outreach will entail updates at County Board of Supervisors' meetings and/or public outreach meetings. At a minimum, the GSAs will receive and respond to public input on the Plan and inform the public about progress implementing the Plan as required by §354.10(d)(4) of the Regulations.

Coordination activities would include ensuring monitoring is performed, annual reports to DWR, five-year GSP updates, and coordinating projects and management actions.

- **Monitoring and Data Management:** Data collection and management will be required for both annual reporting and five-year updates. Monitoring data that will be collected and stored in the data management system (DMS) for reporting will include water levels, precipitation, evapotranspiration, streamflow, water quality, land use, and subsidence.
- **Annual Reporting:** According to §356.2 of the Regulations, the Big Valley GSAs are required to provide an annual report to DWR by April 1 of each year following the adoption of the GSP. The GSAs have developed and submitted annual reports for Water Years (WYs) 2019 through 2022 and are developing the annual report for WY 2023 concurrent with the development of the revised GSP. The WY 2023 Annual Report will be submitted by the April 1, 2024 deadline. The GSAs contend that DWR's definition of a WY does not adequately characterize the climate and water use patterns in Big Valley[10]. The Annual Reports establish current conditions of groundwater within the BVGB, the status of the GSP implementation, and the trend towards maintaining sustainability.
- **2024 GSP Revision:** DWR's comment letter dated October 26, 2023 notifying the GSAs that the DWR determined the GSP was incomplete and identified corrective actions that needed to be addressed in a revised submittal. The DWR provided the GSAs 180 days to revise the GSP, adopt the revised GSP, and submit the revised GSP to the DWR for review. The revision process involved significant communication with the GSAs, their consultants, and the BVAC and two of its ad-hoc committees. The revision process began in December 2023 and concluded in April 2024. A table documenting the responses to DWR's corrective actions can be found in **Appendix 14**.
- **Plan Evaluation (Five-Year Update)**: Updates and amendments to the GSP can be performed at any time, but at a minimum the GSAs must submit an update and evaluation of the plan every 5 years (§356.4). While much of the content of the GSP will likely remain unchanged for these five-year updates, the Regulations require that most chapters of the plan be updated and supplemented with any new information obtained in the preceding 5 years.

Cost of Implementation

Cost is a fundamental concern to the GSAs and stakeholders in the BVGB, as the Basin is disadvantaged and there is no revenue generated in the counties to fund the state-mandated requirements of SGMA. Therefore, the GSAs will rely on outside funding to implement this unfunded mandated Plan.

[10] The water year defined by DWR runs from October 1-September 30 to accommodate for the unique Mediterranean and annual grass growing season in much of the state. It does not fit well in the mountainous and great basin areas of the state like Big Valley that are primarily perennial native vegetation and cropping systems which do not follow the same growing cycle. In the annual system, plants start growing around the end of October, but in the perennial system, plants are still growing from the prior water year and October and soon go dormant for winter. This also mirrors the way that water is used in these areas as well. The end of irrigation season extends into October in the perennial system making water measurements sometimes difficult and not truly marking the end of the irrigation season. (Snell 2021)

1. Introduction § 354.2-4

1.1 Introduction

The Big Valley Groundwater Basin (BVGB, Basin, or Big Valley) is located in one of the most remote and untouched areas of California. The sparsely populated Big Valley has a rich biodiversity of wildlife and native species who feed, live, and raise young primarily on the irrigated lands throughout the Basin. The Basin has multiple streams which enter from the North, East, and West. The Pit River is the only surface-water outflow and exits at the southern tip of the Basin. The streams that enter the Basin are some of the most remote, least improved, and most pristine surface waters in all of California. The snow-fed high desert streams entering the Basin have seasonal hydrographs with natural periods of reduced flows or complete cessation of flows late in the summer season. The Pit River is the largest stream and is so named because of the practice, employed by the Achumawi and other Native American bands that are now part of the Pit River Tribe, of digging pits in the river channel when it went dry to expose water and trap game that came to water at the river. In addition to the Pit River, the Basin is also fed by Ash Creek year-round, along with Willow Creek and many seasonal streams and springs.

Farming and ranching in Big Valley date back to the late 19th and early 20th centuries, when families immigrated to Big Valley and made use of the existing water resources. A large amount of the land in the Basin is still owned and farmed by the families that homesteaded here. The surnames on the tombstones at any of the three cemeteries are the same names that can be overheard during a visit to the Bieber Market or the Adin Supply store, local institutions and gathering places for the residents of this tight-knit community. These stores are remaining evidence of a much more vibrant time in Big Valley.

Following World War II, with the advent and widespread use of vertical turbine pumps, farmers and ranchers began using groundwater to irrigate the land, supplementing their surface-water supplies to make a living in Big Valley. The local driller, Conner’s Well Drilling, has drilled the majority of wells in Big Valley and the third-generation driller, Duane Conner has been on the advisory committee during the development of this Groundwater Sustainability Plan (GSP or Plan) (Conner 2020-2021).

Historically, agriculture was complemented by a robust timber industry, a key component of the economy for Big Valley, which supported four lumber mills. Due to regulations and policies imposed by state and federal government, the timber industry has been diminished over time which has caused a great economic hardship to the Big Valley communities. Stakeholders realize that the Sustainable Groundwater Management Act of 2014 (SGMA) will unfortunately cause a similar decline to agriculture. The loss of jobs due to the closure of all four lumber mills and the reduction of timber yield tax, which had provided financial support to the small rural schools and roads, is evident in the many vacant buildings which once had thriving businesses. In addition to the loss of jobs, the reduced student enrollment in local schools has caused an economic hardship to the school district, which struggles to remain viable. The change in land management has transformed once-thriving communities in the Basin to “disadvantaged” and “severely disadvantaged” communities as defined by multiple state agencies, including the Department of Water Resources (DWR). The addition of SGMA will increase the severity of the disadvantaged and severely disadvantaged status in the Basin due to increased regulatory costs and potential actions that must be taken to comply with SGMA and is likely to intensify rural decline in this area. With the increased cost of this unfunded mandate for monitoring, annual reports and GSP updates, land values will likely decline and lower the property tax base.

The two counties that overlie the BVGB are fulfilling their unfunded mandated role as the Groundwater Sustainability Agencies (GSAs) since there are no other viable entities that can serve as GSAs. Both counties have severe financial struggles as their populations and tax base are continually declining. The counties not only lack the tax revenue generated out of Big Valley to implement SGMA, but they have no buffer from revenue generated county-wide to cover such costs. As such, the GSAs are depending almost solely on outside funding sources for development and implementation of this Plan.

With the demise of the timber industry, agriculture has been the only viable industry remaining to support residents living and working in the Basin, with many of the families who ranch and farm today having cultivated the land for over a century. These families are fighting to maintain the viability and productivity of their land so that their children and grandchildren can continue to pursue the rural lifestyle that their forebearers established.

The ranchers and farmers have developed strategies to enhance the land with not only farming and ranching in mind, but also partnerships with state and federal agencies as well as local non-governmental organizations (NGOs). The purpose of these partnerships is to maintain and improve the condition of privately-owned land for the enhancement of plant and animal populations while addressing invasive plant and pest concerns.

The Ash Creek Wildlife Area (ACWA) is an example of a local rancher who provided land for conservation efforts with an understanding that managed lands promote wildlife enhancement for the enjoyment of all. The California Department of Fish and Wildlife (CDFW) has largely left the property unmanaged. (Albaugh 2021, Conner 2021) While the ACWA does offer some refuge, most species graze and rear their young on the private lands around the Basin which are actively being cultivated because those lands offer better forage and protection from predators. Below is an account from the former landowner of how the ACWA property has fared since being sold to the government.

> The government bought the ranch as a refuge for birds and wildlife. When I was running cattle on that ranch it was alive with waterfowl. They fed around and amongst the cattle. It was a natural refuge. The cattle kept the feed down so the birds didn’t have to worry about predators, and they could feed on the new growth grass. After the government got their hands on it all the fences were removed, at taxpayer expense. In the years since, the meadows have turned into a jungle -- old dead feed and tules. The birds are gone, moved to other ranches where they get protection from skunks and coyotes and other predators that work on waterfowl and wildlife. Under the management of the U.S. Fish and Wildlife the value of the land has been completely destroyed. All those acres of wonderful grass and the irrigation

> system that for generations have produced food for the people of this country now *produce nothing*. (Stadtler 2007)

Recently the CDFW has attempted to manage the property by constructing a 65-acre wetland using their water rights from the Big Valley Canal. In conjunction with the project and to more efficiently move adjudicated water to users (including ACWA) down-canal, the CDFW constructed a ¾-mile pipeline to replace an unlined portion of the canal. The pipeline has purportedly increased flows down-canal of the pipeline from 4cfs to 8cfs. The abandoned portion of unlined canal travels through a private land-owner's property. Although CDFW asserts that there are no documented water rights holders on the abandoned canal, it has dried that portion of the land-owner's property and reduced groundwater recharge there. However, the constructed wetlands likely provide more recharge on the ACWA property than the abandoned canal provided on private property.[11] (CDFW 2021)

Such projects which advance state priorities over private landowners exacerbate the negative sentiments from local stakeholders toward state government and make them extremely wary of unintended consequences of government programs. This distrust, coupled with the burden imposed on locals through regulations such as SGMA, are some of the fundamental reasons why residents of this area generally consider themselves distinct from the rest of the state. Furthermore, local political leaders have pointed out that the state is behind on tax payments to the disadvantaged counties. (Albaugh 2021)

The BVGB differs physically from California's other groundwater basins because the climate sees extreme cold. On average, there are fewer warm-temperature days, making the growing season considerably shorter than in other parts of the state. Ground elevations in the Basin range from about 4,100 to over 5,000 feet, and along with its northerly latitude in the state, this creates conditions where snow can fall in any month of the year. According to the Farmer's Almanac, the average growing season for the Big Valley Basin is about 101 days. The typical crops for the Big Valley Basin are low-land-use-intensity and low-value crops such as native pasture, grass hay, alfalfa hay, and rangeland.

The vast majority of the farmed land utilizes low-impact farming, employing no-till methods to grow nitrogen-fixing crops which require little to no fertilizer or pesticide application. While this climate and range of viable crops is a challenge to farmers and ranchers, it helps maintain the pristine nature of surface water and groundwater. As an example of how local landowners have been good stewards of their water resources, they have participated in the Natural Resources Conservation Service's (NRCS's) Environmental Quality Incentives Program (EQIP), drilling wells away from streams to encourage watering of cattle outside of riparian corridors. Now these additional wells have increased the inventory of wells in the Basin, one of the criteria used by DWR to categorize Big Valley as medium priority and subject to the SGMA unfunded mandate of developing a GSP. (Albaugh 2020-2021)

The GSAs are also aware of the impact of poor water stewardship, such as illegal water uses (e.g. unlicensed marijuana growers). These operations may utilize groundwater, are known to have illegal diversions of surface water, and have a negative impact on water quality. However, the counties have not received the state and federal support needed to identify, eliminate, and prosecute these operations.

[11] This paragraph is based on information provided by CDFW and hasn't been verified.

The Big Valley Basin has a population of 1,046 residents and a projected slow growth of 1,086 by 2030. (DWR 2021a). The largest town (unincorporated community) within the Basin is Adin, California, which had a population of 272 residents according to the 2010 Census (USCB 2021). Located in Modoc County, Adin had a 2.43 percent decline in population from 2017 to 2018. Both Modoc and Lassen are experiencing a decline in population county-wide (USCB 2021).

As detailed in this GSP, there are three major beneficial uses of groundwater: agriculture, community/domestic, and environmental. However, the importance of agriculture to Big Valley cannot be overstated, as it is the economic base upon which community/domestic users rely and provides the habitat for many species important to healthy wildlife and biodiversity. Both groundwater and surface water are important to maintaining this ecosystem. There are efforts being made to diversify the economic base of the community. While economic diversity of Big Valley is not the purview of this GSP, it is acknowledged that at present and for the foreseeable future, the Big Valley communities rely almost solely on farming and ranching to support their residents. The financial and regulatory impact of implementing SGMA will negatively affect this disadvantaged community. Therefore, minimizing the GSP's impact to agriculture while complying with SGMA and working to enhance water supply in Big Valley is the thrust of this GSP.

1.2 Sustainability Goal

The GSAs are developing this GSP to comply with SGMA's unfunded mandates, maintain local control and preclude intervention by the State Water Resources Control Board (State Water Board), and prove that the Basin is sustainable and should be ranked as low priority. Satisfying the requirements of SGMA generally requires four activities:

1. Formation of at least one GSA to fully cover the basin (Multiple GSAs are acceptable and Big Valley has two GSAs.)
2. Development of this GSP that fully covers the Basin
3. Implementation of this GSP and management to achieve quantifiable objectives
4. Regular reporting to DWR

Two GSAs were established in the Basin: County of Modoc GSA and County of Lassen GSA, each covering the portion of the Basin in their respective jurisdictions. This document is a single GSP, developed jointly by both GSAs for the entire Basin. This GSP describes the BVGB, develops quantifiable management criteria that accounts for the interests of the Basin's legal beneficial groundwater uses and users, and identifies projects and management actions to ensure and maintain sustainability.

The Lassen and Modoc GSAs developed a Memorandum of Understanding (MOU) which details the coordination between the two GSAs. The MOU states that the Big Valley Advisory Committee (BVAC) is to be established to provide local input and direction on the development of a GSP. The counties solicited applicants to be members of the BVAC through public noticing protocols. Big Valley landowners and residents submitted applications to the County Boards of Supervisors, who then appointed the members of the BVAC. The BVAC is comprised of one county board member from each county, one alternate board member from each county, and two public applicants from each county. The

BVAC and county staff have dedicated countless hours to reviewing the data and content of the GSP, largely uncompensated. After careful consideration of the available data and community input from the BVAC and interested parties, the GSAs have developed the following sustainability goal:

> 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.

The BVGB sustainability goal will be culminated through DWR's better understanding of the surface-water and groundwater conditions over time and the implementation of projects and management actions described in this GSP. Several areas of identified data gaps have been established, and while an estimated future water budget has been completed, its accuracy is uncertain since many assumptions had to be made due to the lack of available data. The monitoring network established under this Plan includes new and existing monitoring wells, inflow/outflow measurement of surface water, groundwater quality, and land subsidence.

The implementation of projects such as winter recharge studies currently in progress will help establish the feasibility of immediate actions the GSAs can take to improve Basin conditions. A detailed off-season water availability analysis has not been conducted on the Upper Pit River watershed, and this has been identified as a data gap within the Basin. The GSAs are working to locate funds to conduct an off-season and storage-capacity water accounting, which will provide the amount of available surface water for potential winter recharge in the Basin. Additional research will be conducted on the available use of non-active surface-water rights for storage. An additional stream gage is being installed where the Pit River enters the Basin and will provide a more accurate accounting of the amount of surface water entering the Big Valley Basin from the Pit River. While better accounting is needed, it should be noted that SGMA and this GSP will not affect existing water rights in the Basin.

The understanding that has been further engrained by the GSAs is that with proper management, coordination and support from federal and state landowner partners, the Big Valley Basin, which is not currently at risk of overdraft, will remain sustainable for the benefit of all interested parties. The BVGB should be re-ranked as low priority.

1.3 Background of Basin Prioritization

The Big Valley GSAs are being forced to develop this GSP after exhausting their challenges to the California Department of Water Resources' (DWR's) determination that Big Valley qualifies as a medium-priority basin. DWR first prioritized the state's basins in 2014, at which time Big Valley was the lowest-ranked medium-priority basin that had to develop a GSP. In 2019, DWR changed their prioritization process and criteria and issued draft and final prioritizations. In the end, Big Valley is still the lowest-ranked medium-priority basin.

From the draft to final re-prioritization, the Big Valley GSAs recognize the scoring revisions made by DWR for Component 8.b, "Other Information Deemed Relevant by the Department." However, the GSAs continue to firmly believe that the all-or-nothing scoring for Component 7.a, regarding documented declining groundwater levels, is inconsistent with the premise of SGMA: that prioritization levels recognize different levels of impact and conditions across the basins of the state. DWR's adherence to treating all declines the same, assigning a fixed 7.5 points for any amount of documented groundwater level decline, renders meaningless the degrees of groundwater decline and penalizes those basins experiencing minor levels of decline, including Big Valley which has only experienced approximately 0.53 feet per year of groundwater level decline on average in the last 38 years.

Additionally, the GSAs recognize the adjustments made to Component 7.d regarding overall total water quality degradation. Noting that degradation implies a lowering from human-caused conditions, the Big Valley GSAs urge DWR to further refine the groundwater quality scoring process for Secondary MCLs – which are not tied to public health concerns, but rather aesthetic issues such as taste and odor. Secondary MCLs which are due to naturally occurring minerals should not be factored into the scoring process. In the BVGB, the water quality conditions reflect the natural baseline and are not indicative of human-caused degradation and cannot be substantially improved through better groundwater management.

The inaccurate Basin boundary was drawn with a 63-year-old regional scale map (CGS 1958), and subsequent geologic maps with more precision and detail are available. Additionally, the "upland" areas outside the Basin boundary are postulated to be recharge areas interconnected to the Basin, which is contrary to DWR's definition of a lateral basin boundary as being, "…features that significantly impede groundwater flow" (DWR 2016c). The GSAs submitted a request to DWR for basin boundary modification to integrate planning at the watershed level and leverage a wider array of multi-benefit water management options and strategies within the Basin and larger watershed. DWR's denial of the boundary modification request greatly hampers jurisdictional opportunities to protect groundwater recharge areas in higher elevations. The final boundary significantly curtails management options to increase supply through upland recharge, requiring that groundwater levels be addressed primarily through demand restrictions. *See* **Appendix 1A** for communications with DWR regarding Basin prioritization ranking and boundary modification. Due to information that has come to light during this process, the Basin boundary has been shown to be inaccurate. The GSAs will submit a Basin boundary modification.

Development of this GSP by the GSAs, in partnership with the BVAC and members of the community, does not constitute agreement with DWR's classification as a medium-priority basin – nor does it preclude the possibility of other actions by the GSAs or by individuals within the Basin seeking regulatory relief.

1.3.1 Timeline

In September 2014, the state of California enacted SGMA. This law requires medium- and high-priority groundwater basins in California to take actions to ensure they are managed sustainably. DWR is tasked with prioritizing all 515 defined groundwater basins in the state as high, medium, low and very-low priority. Prioritization establishes which basins need to go through the process of developing a GSP. When SGMA was passed, basins had already been prioritized under the California Statewide Groundwater Elevation Monitoring (CASGEM) program, and that existing ranking process was used as the initial priority baseline for SGMA.

DWR was required to develop its rankings for SGMA based on the first seven criteria listed in **Table 1-1**. For the final SGMA scoring process, groundwater basins with a score of 14 or greater (up to a score of 21) were ranked as medium-priority basins (DWR 2019). Big Valley scored 13.5 and DWR chose to arbitrarily round the score up to put it in the medium-priority category as the lowest-ranked basin in the state required to develop a GSP. Lassen County reviewed the 2014 ranking process and criteria that were used and found erroneous data. The County made a request to DWR for the raw data that was used, which were eventually provided, and verified the error that would have put the BVGB into the low priority category. However, because the comment period for these rankings had already expired in 2014 (prior to the passage of SGMA), DWR would not revise their ranking. County staff were misled because when the rankings were first publicized, SGMA had not yet existed, and County staff were told that being ranked as a medium priority basin was insignificant and would actually be a benefit to the counties.

Table 1-1 Big Valley Groundwater Basin Prioritization

Criteria	2014	2018	2019	Comments
2010 Population	1	1	1	
Population Growth	0	0	0	
Public Supply Wells	1	1	1	
Total # of Wells	1.5	2	2	Existing information inaccurate and includes all types of wells, including newly constructed stockwatering wells under EQIP
Irrigated Acreage	4	3	3	
Groundwater Reliance	3	3.5	3.5	
Impacts	3	3	2	Declining water levels, water quality
Other Information	0	7	2	Streamflow, habitat, and "other information determined to be relevant"
Total Score	**13.5**	**20.5**	**14.5**	**Medium priority each year**

Source: DWR 2019

Once SGMA was passed and the onerous repercussions of being ranked as medium priority were better understood (and the counties identified erroneous data), DWR did not offer any recourse, simply saying the Big Valley Basin would remain ranked as medium priority and that the basins would soon be re-prioritized anyway.

In 2016, Lassen County submitted a request for a basin boundary modification as allowed under SGMA. The request was to extend the boundaries of the BVGB to the boundary of the watershed. The purpose of the proposed modification was to enhance management by including the volcanic areas surrounding the valley sediments, including federally managed timberlands and rangelands, that have an impact on groundwater recharge. The modification was proposed on a scientific basis but was denied by DWR because the request, "…did not include sufficient detail and/or required components necessary and evidence was not provided to substantiate the connection [of volcanic rock] to the porous permeable alluvial basin, nor were conditions presented that could potentially support radial groundwater flow as observed in alluvial basins." DWR therefore justifies denial based on inadequate scientific evidence, yet as stated above they used inaccurate, unscientific information to rank the Basin as medium priority in the first place.

In 2018, DWR released an updated draft basin prioritization based on the eight components shown in **Table 1-1** using slightly different data and methodology than previously used. For this prioritization, Big Valley's score increased from 13.5 to 20.5, primarily because of an addition of 5 ranking points awarded under the category of "other information determined to be relevant" by DWR. DWR's justification for the five points was poorly substantiated as "Headwaters for Pit River/Central Valley Project – Lake Shasta." Lassen and Modoc counties sent a joint comment letter questioning DWR's justification and inconsistent assessment of these five points as well as their methodology for awarding the same number of points for water level and water quality impacts to basins throughout the state regardless of the severity of the impacts.

In 2019, DWR released their final prioritization with the BVGB score reduced to 14.5, but still ranked as medium priority and subject to the development of a GSP. DWR's documentation of the 2019 prioritization can be viewed on their website (DWR 2019).

Meanwhile, throughout this time, Lassen and Modoc counties began moving forward to comply with SGMA unfunded mandates through a public process that established them as the GSAs in 2017. The establishing resolutions forming the GSAs adopted findings that it was in the public interest of both counties to maintain local control by declaring themselves the GSA for the respective portion of the Basin. The Water Resources Control Board would become the regulating agency if the counties did not agree to be the GSAs since there were no other local agencies in a position or qualified to assume GSA responsibility. The counties obtained state grant funding to develop the GSP in 2018 and began the GSP development process and associated public outreach in 2019.

1.4 Description of Big Valley Groundwater Basin

The BVGB is identified by DWR in Bulletin 118 as Basin No. 5-004 (DWR, 2016a). The inaccurate Basin boundary was drawn by DWR using a 1:250,000 scale geologic map produced by the California Geological Survey (CGS 1958) along the boundary between formations labeled as volcanic and those labeled as alluvial. The Basin boundary was not drawn with as much precision as subsequent geologic maps, and because of this the "uplands" areas outside the Basin boundary are postulated to be recharge areas interconnected to the Basin. The 63-year old map being used to define the Basin boundary is inadequate and contrary to DWR's definition of a lateral basin boundary as being "features that significantly impede groundwater flow" (DWR 2016c).

The Basin is one of many small, isolated basins in the northeastern region of California, an area with widespread volcanic formations, many of which produce large quantities of groundwater and are not included within the defined groundwater basin due to their classification as "volcanic" rather than "alluvial."

The boundary between Lassen and Modoc counties runs west-east across the Basin. Each county formed a GSA for its respective portion of the Basin and the counties are working together to manage the Basin under a single GSP. The Basin, shown on **Figure 1-1**, encompasses an area of about 144 square miles with Modoc County comprising 40 square miles (28 percent) on the north and Lassen County comprising 104 square miles (72 percent) on the south. The Basin includes the towns of Adin and Lookout in Modoc County and the towns of Bieber and Nubieber in Lassen County. The ACWA is located along the boundary of both counties, occupying 22.5 square miles in the center of the Basin encompassing the marshy/swampy areas along Ash Creek.

The BVGB, as drawn by DWR, is isolated and does not share a boundary with another groundwater basin. However, Ash Creek flows into Big Valley from the Round Valley Groundwater Basin at the town of Adin. Despite the half-mile gap of alluvium which may provide subsurface flow between the two basins, DWR doesn't consider them interconnected due to the way the basin boundary was defined.

The surface expression of the Basin boundary is defined as the contact of the valley sedimentary deposits with the surrounding volcanic rocks. The sediments in the Basin are comprised of mostly Plio-Pleistocene alluvial deposits and Quaternary lake deposits eroded from the volcanic highlands and some volcanic layers interbedded within the alluvial and lake deposits. The Basin is surrounded by Tertiary- and Miocene-age volcanic rocks of andesitic, basaltic, and pyroclastic composition. These volcanic deposits may be underlain by alluvial deposits in these upland areas. The boundary between the BVGB and the surrounding volcanic rocks generally correlates with change in topography along the margin of the valley.

Throughout the development of this GSP, the inaccuracies of the Basin boundary have become clear and revisions to the boundary are needed. The hydrogeology of Big Valley is complex and requiring an all-or-nothing (inside or outside Basin Boundary), one-size-fits-all approach to the Basin under SGMA does not sit well with stakeholders and will be difficult to implement by the GSAs.

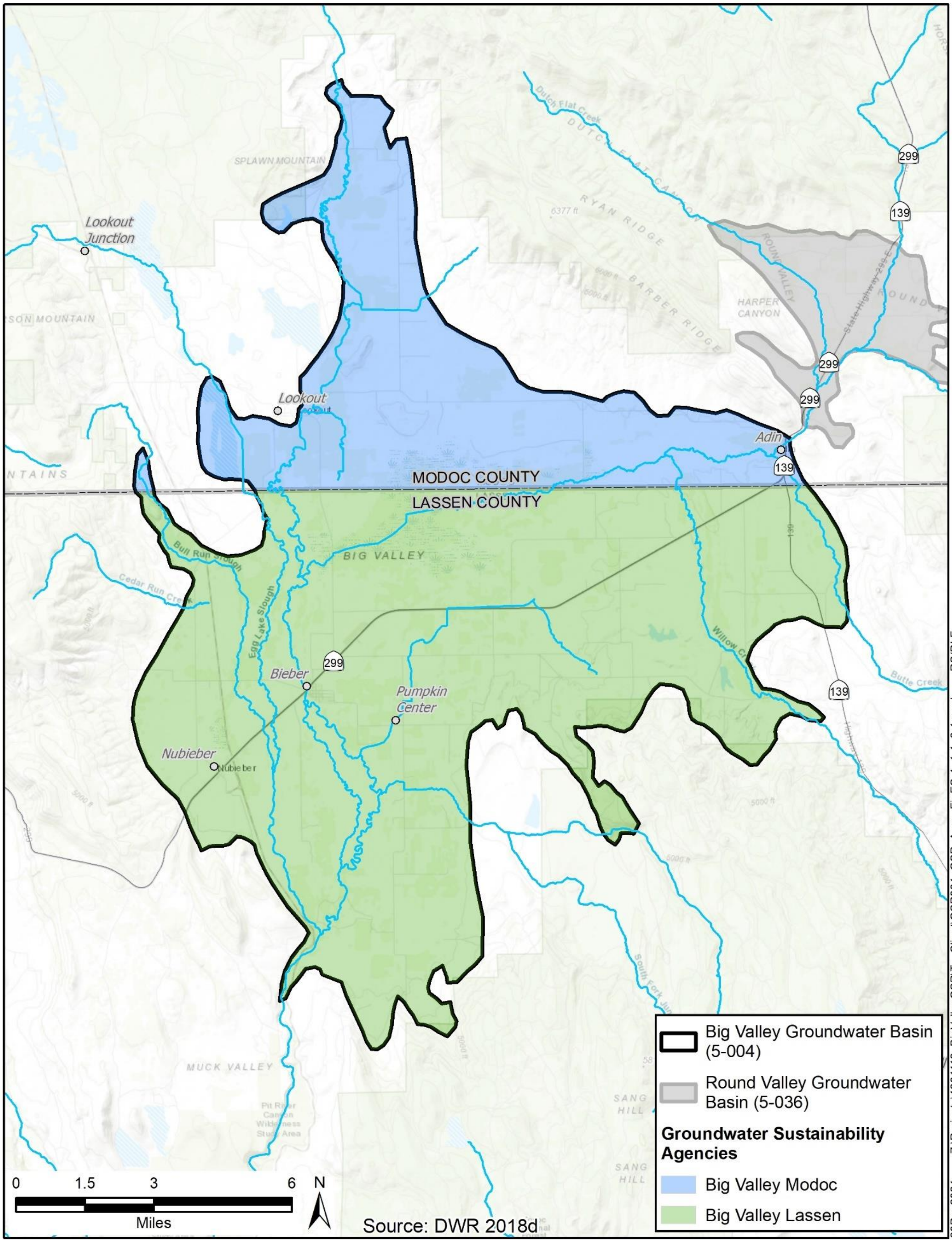


Figure 1-1 Big Valley Groundwater Basin, Surrounding Basins and GSAs

2. Agency Information § 354.6

The two Big Valley GSAs were established for the entire BVGB to jointly develop, adopt, and implement a single mandated GSP for the BVGB pursuant to SGMA and other applicable provisions of law.

2.1 Agency Names and Mailing Addresses

The following contact information is provided for each GSA pursuant to California Water Code (CWC) §10723.8.

Modoc County
204 S. Court Street
Alturas, CA 96101
(530) 233-6201
tiffanymartinez@co.modoc.ca.us

Lassen County
Department of Planning and Building Services
707 Nevada Street, Suite 5
Susanville, CA 96130
(530) 251-8269
landuse@co.lassen.ca.us

2.2 Agency Organization and Management Structure

The two GSAs, Lassen and Modoc counties, were established in 2017 as required by the unfunded SGMA-mandated legislation. **Appendix 2A** contains Lassen County resolution 17-013 and Modoc County resolution 2017-09 forming the two agencies. Each GSA is governed by a five-member Board of Supervisors. In 2019, the two GSAs established the BVAC through an MOU, included as **Appendix 2B**. The membership of the BVAC is comprised of:

- one member of the Lassen County Board of Supervisors selected by said Board.
- one alternate member of the Lassen County Board of Supervisors selected by said Board.
- one member of the Modoc County Board of Supervisors selected by said Board.
- one alternate member of the Modoc County Board of Supervisors selected by said Board.
- two public members selected by the Lassen County Board of Supervisors. Said members must either reside or own property within the Lassen County portion of the BVGB.
- two public members selected by the Modoc County Board of Supervisors. Said members must either reside or own property within the Modoc County portion of the BVGB.

The decisions made by the BVAC are not binding, but the committee serves the important role of providing formalized, local stakeholder input and guidance to the GSA governing bodies, GSA staff, and consultants in developing and implementing the GSP.

2.3 Contact Information for Plan Manager

The plan manager is from Lassen County and can be contacted at:

Gaylon Norwood
Deputy Director
Lassen County Department of Planning and Building Services
707 Nevada Street, Suite 5
Susanville, CA 96130
(530) 251-8269
gnorwood@co.lassen.ca.us

2.4 Authority of Agencies

The GSAs were formed in accordance with the requirements of CWC §10723 et seq. Both GSAs are local public agencies organized as general law counties under the State Constitution and have land-use responsibility for their respective portions of the Basin. The resolutions of formation for the GSAs are included in **Appendix 2B**.

2.4.1 Memorandum of Understanding

In addition to the MOU establishing the BVAC, the two GSAs may enter into an agreement to jointly implement the GSP for the Basin. However, this agreement is not a SGMA requirement.

3. Plan Area § 354.8

3.1 Area of the Plan

This GSP covers the BVGB, which is located within Modoc and Lassen counties and is about 144 square miles (92,057 acres). The Basin is a broad, flat plain extending about 20 miles north to south and 15 miles east to west and consists of depressed fault blocks surrounded by tilted fault-block ridges. The BVGB is designated as basin number 5-004 by the DWR and was most recently described in the 2003 update of Bulletin 118 (DWR 2003):

> The basin 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.

Communities in the Basin are Nubieber, Bieber, Lookout, and Adin which are categorized as census-designated places. Highway 299 is the most significant east-to-west highway in the Basin, with Highway 139 at the eastern border of the Basin. **Figure 3-1** shows the extent of the GSP area (the BVGB), as well as the significant water bodies, communities, and highways.

Lassen and Modoc counties were established as the exclusive GSAs for their respective portions of the Basin in 2017. **Figure 3-1** shows the two GSAs within the Basin. Round Valley Basin (5-036) is a very low-priority basin to the northeast; DWR does not consider it to be connected to Big Valley Basin, but there is a half-mile-wide gap of alluvium between the basins. The ACWA occupies 22.5 square miles (14,400 acres) in the center of Big Valley.

No other GSAs are associated with the Basin, nor are there any areas of the Basin that are adjudicated or covered by an alternative to a GSP. **Landowners have the right to extract and use groundwater beneath their property.**

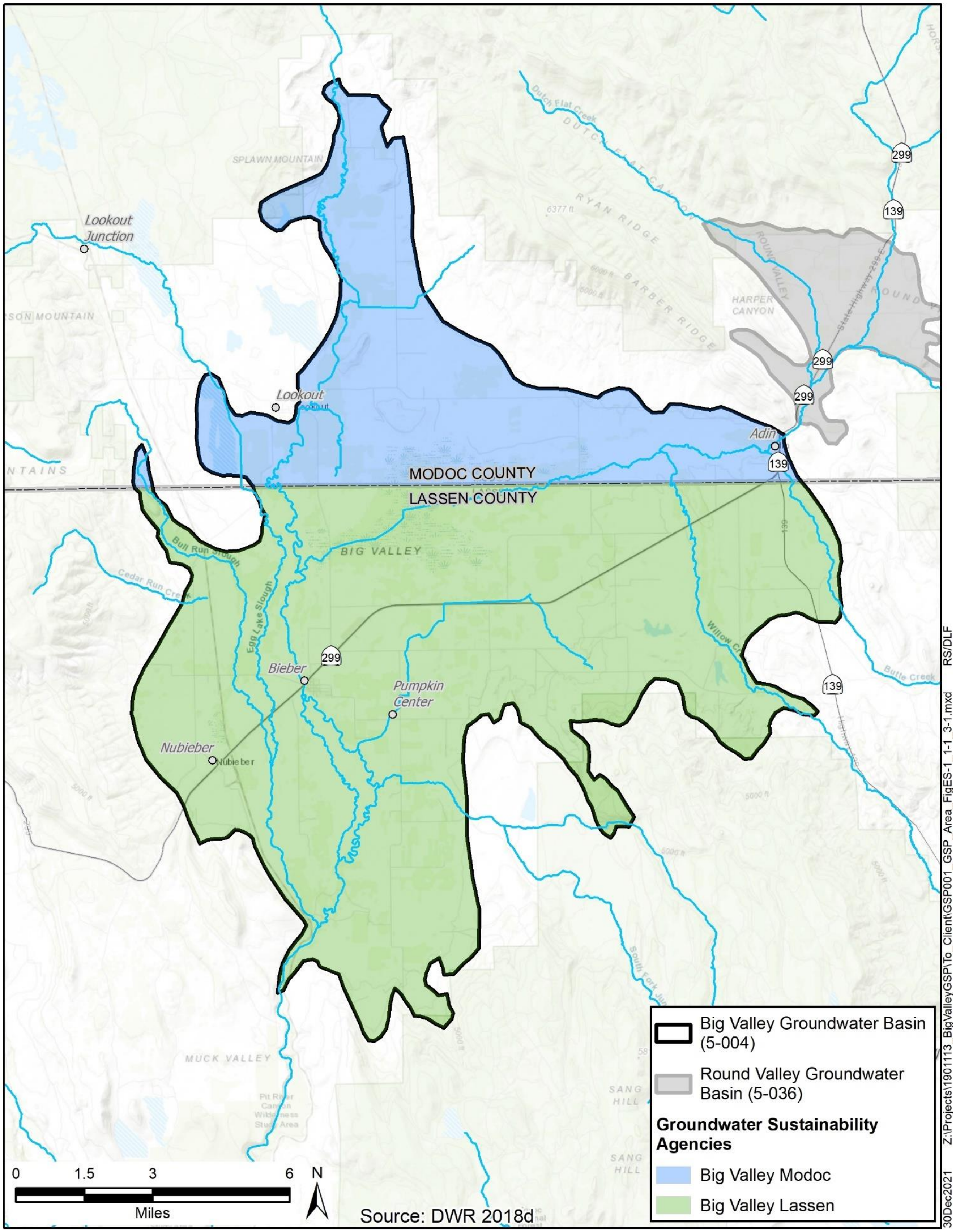


Figure 3-1 Area Covered by the GSP

3.2 Jurisdictional Areas

In addition to the GSAs, other entities have water management authority or planning responsibilities in the Basin, as discussed below. A map of the jurisdictional areas within the Basin is shown on **Figure 3-2**.

3.2.1 Superior Courts

SGMA does not alter existing water rights. Therefore, water use in the Basin exists within the confines of state water law and existing water rights. These rights are ultimately governed by court decisions. In Big Valley, two decrees govern much of the surface-water rights allocations: Decree 3670 (1947) for Ash Creek and Decree 6395 (1959) for the Pit River. Any changes to these and any other judgments relevant to Big Valley would have to go through the Superior Court of Modoc County.

3.2.2 Federal Jurisdictions

The U.S. Bureau of Land Management (BLM) and the U.S. Forest Service (USFS or Forest Service) have jurisdiction over land within the Basin including portions of the Modoc National Forest, shown on **Figure 3-2**. Information on their Land and Resource Management Plan is described in Section 3.8. The Forest Service Ranger Station in Adin is a non-community public water supplier with a groundwater well, identified as Water System No. CA2500547 (SWRCB 2021).

3.2.3 Tribal Jurisdictions

The U.S. Bureau of Indian Affairs (BIA) Land Area Representations database identifies one tribal property in the BVGB (BIA 2020a). Lookout Rancheria, shown on **Figure 3-2**, is associated with the Pit River Tribe. There are other "public domain allotments" or lands held in trust for the exclusive use of individual tribal members within the Basin not shown (BIA 2020b).

3.2.4 State Jurisdictions

The CDFW has jurisdiction over the ACWA, as shown on **Figure 3-2**.

3.2.5 County Jurisdictions

The County of Modoc and the County of Lassen have jurisdiction over the land within the Basin in their respective counties as shown on **Figure 3-1** and **Figure 3-2**. Information on their respective General Plans is provided in Section 3.7 – Land Use Plans. Within the Basin, Modoc County includes the census-designated community of Adin and part of the community of Lookout. Lassen County contains the census-designated communities of Bieber and Nubieber.

3.2.6 Agencies with Water Management Responsibilities

Upper Pit Integrated Regional Water Management Plan

Big Valley lies within the area of the Upper Pit Integrated Regional Water Management Plan (IRWMP), which was developed by the Regional Water Management Group (RWMG). The IRWMP is managed by the North Cal-Neva Resource Conservation and Development Council (North Cal-Neva), a member of the RWMG along with 27 other stakeholders. Other stakeholders include community organizations,

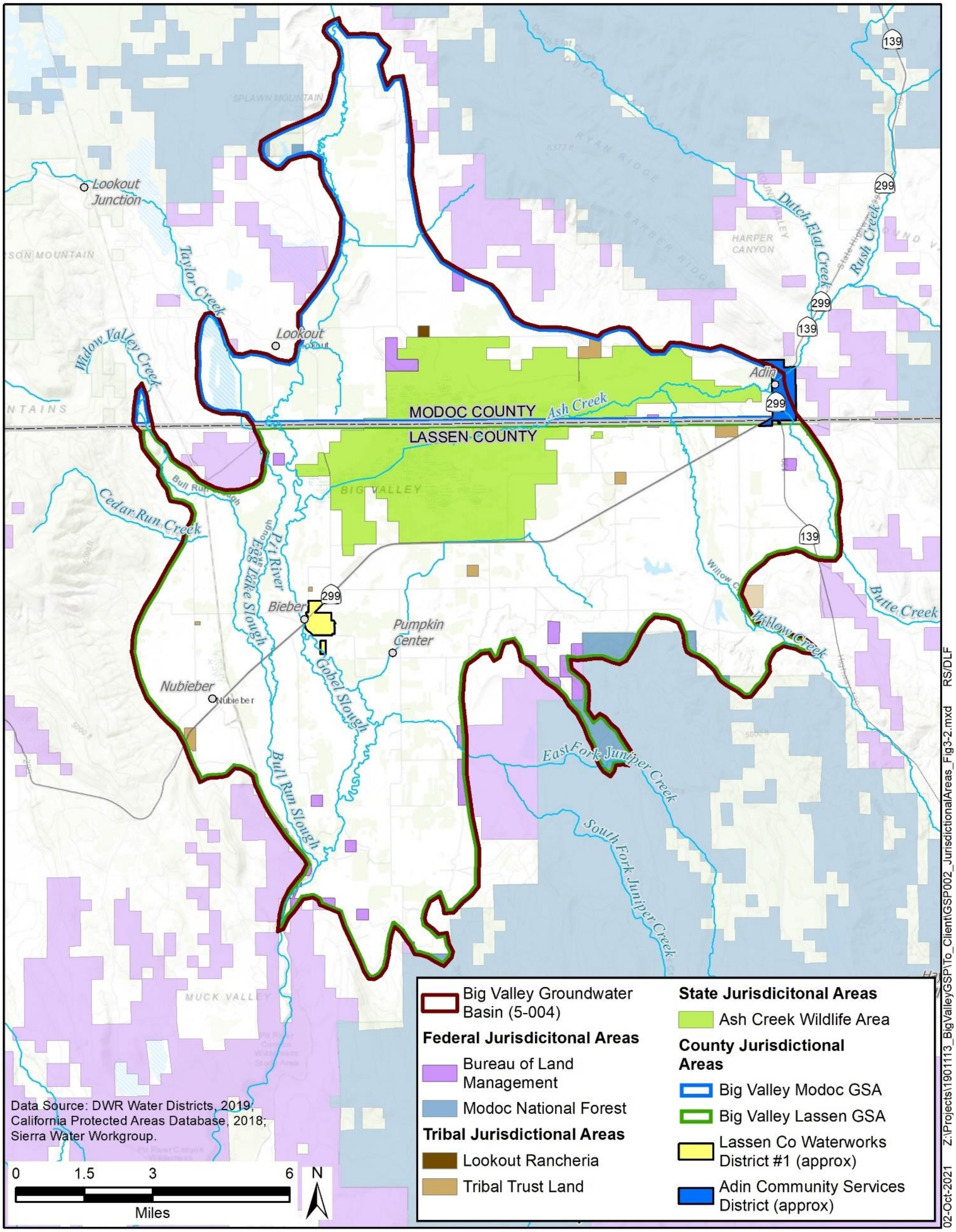


Figure 3-2 Jurisdictional Areas

environmental stewards, water purveyors, numerous local, county, state and federal agencies, industry, the University of California, and the Pit River Tribe. The IRWMP addresses a 3-million-acre watershed across four counties in northeastern California. **Figure 3-3** shows the Upper Pit IRWMP boundary and the BVGB's location in the center of the IRWMP area. **Figure 3-3** also shows the complete watershed that flows into the BVGB and the local watershed area. At 92,057 acres, the BVGB comprises about 3 percent of the IRWMP area at its center.

The IRWMP was established under the Integrated Regional Water Management Act (Senate Bill [SB]1672) which was passed in 2002 to foster local management of water supplies to improve reliability, quantity, and quality, and to enhance environmental stewardship. Several propositions were subsequently passed by voters to provide funding grants for planning and implementation. Beginning in early 2011, an IRWMP was developed for the Upper Pit River area and was adopted in late 2013. During 2017 and 2018, the IRWMP was revised according to 2016 guidelines.

Lassen-Modoc County Flood Control and Water Conservation District

The Lassen-Modoc County Flood Control and Water Conservation District (District) was established in 1959 by the California Legislature and was activated in 1960 by the Lassen County Board of Supervisors (LAFCo 2018). The entirety of the Lassen and Modoc counties portions of the Basin is covered by the District, extending from the common boundary northward beyond Canby and Alturas, as shown on **Figure 3-3**. In 1965, the District established Zone 2 in a nearly 1000-square mile area encompassing and surrounding Big Valley. In 1994, the District designated boundaries for management Zone 2A for, "…groundwater management including the exploration of the feasibility of replenishing, augmenting and preventing interference with or depletion of the subterranean supply of waters used or useful or of common benefit to the lands within the zone" (LAFCo 2018). These zones are shown on **Figure 3-4**.

Watermasters

Two entities measure water diversions for reporting to the State Water Resources Control Board (SWRCB). These include the Big Valley Water Users Association (BVWUA) and the Modoc County Watermaster. The boundaries of these two entities are shown on **Figure 3-4**. Numerous private parties also measure and report their water diversions.

Lassen County Waterworks District #1

Lassen County Waterworks District #1 (LCWD #1) was established in 1932 originally for the purpose of fire protection. Homes started being added to the system in the 1940s. Eventually all residential and commercial properties became part of the system, with most properties leaving their private wells unused. LCWD #1 now provides both water and sewer services to the customers within its boundary shown on **Figure 3-2**. (Hutchinson 2021)

Adin Community Services District

Adin Community Services District provides wastewater services to the town of Adin. The district boundary is shown on **Figure 3-2**.

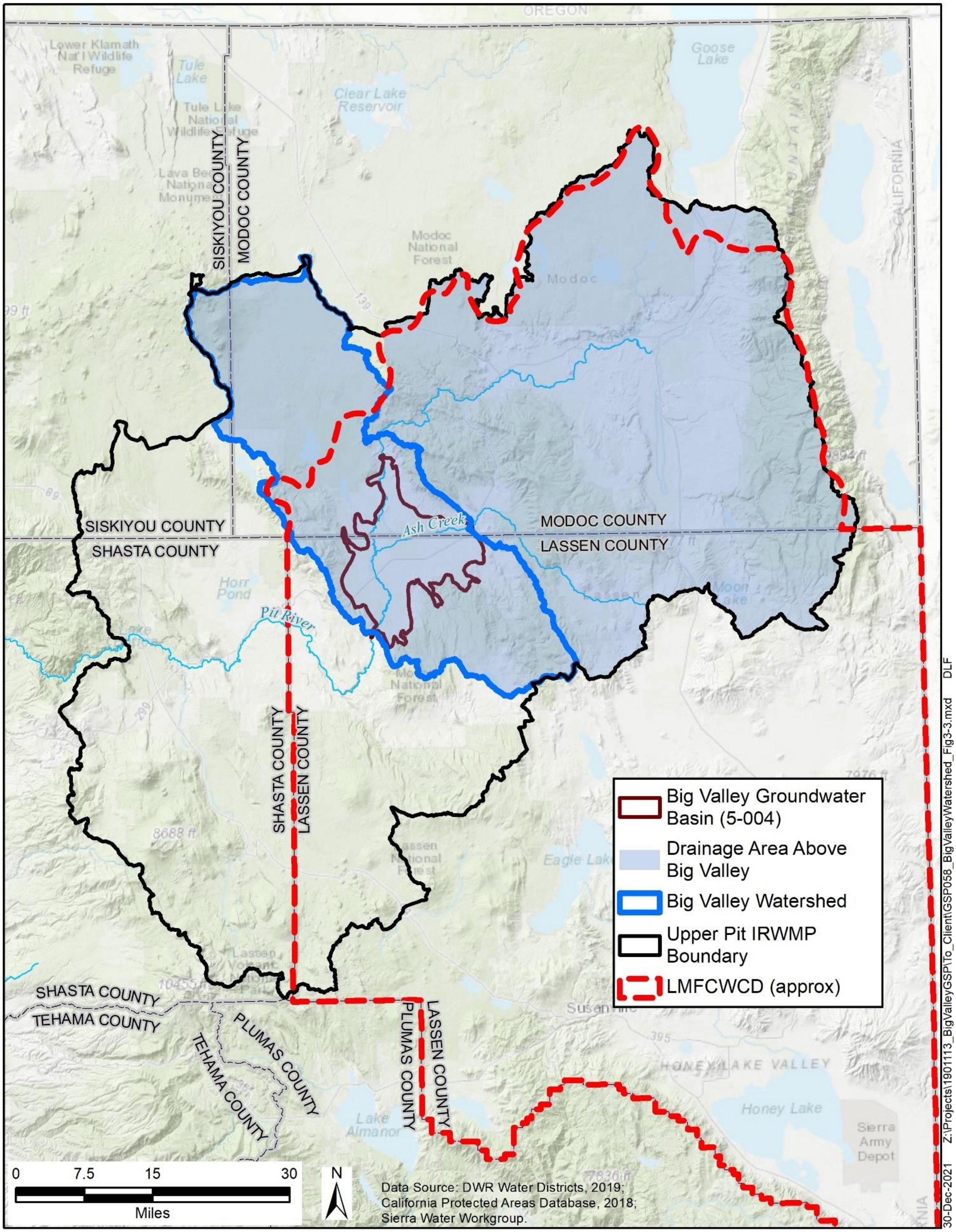


Figure 3-3 Upper Pit IRWMP, Watershed, and LMFCWCD Boundaries

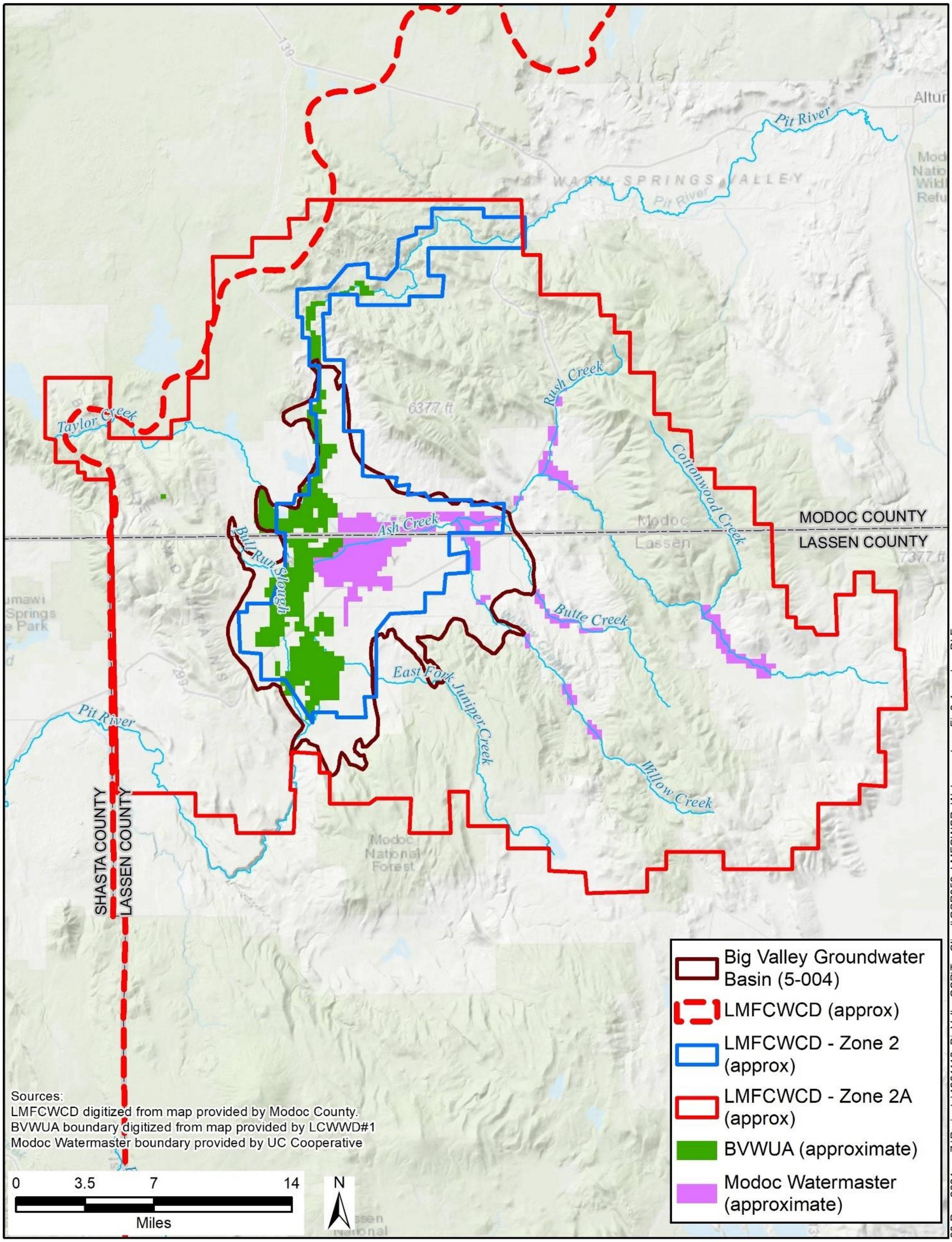


Figure 3-4 LMFCWCD Zones and Watermaster Service Areas

3.3 Land and Water Use

This section describes land use in the BVGB, water use sectors, and water source types using the best available data. The most recent, best available data for distinguishing surface-water and groundwater uses comes from DWR land-use datasets. This data is developed by DWR "…to serve as a basis for calculating current and projected water uses" (DWR 2021d). Surveys performed prior to 2014 were developed by DWR using some aerial imagery with field verification. These previous surveys also included DWR's estimate of water source.

Since 2014, DWR has developed more sophisticated methods of performing the surveys with a higher reliance on remote sensing information. These more recent surveys do not make available the water source. **Table 3-1** is a listing of the years for which surveys are available.

Table 3-1 Available DWR Land Use Surveys

Year	Modoc County	Lassen County	Water Source Included
1997	Yes	Yes	Yes
2011	Yes	No	Yes
2013	No	Yes	Yes
2014	Yes	Yes	No
2016	Yes	Yes	No[a]

Note:
[a] DWR provided the GSAs a hybrid dataset with the 2011 and 2013 water sources superimposed onto the 2016 land use
Source: DWR 2020d

Land use in the BVGB is organized into the water use sectors listed in **Table 3-2**. These sectors 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. **Figure 3-5** shows the 2016 distribution of land uses and **Table 3-2** summarizes the acreages of each. Several data sources were used to designate land uses as described below, including information provided by DWR through a remote sensing process developed by Land IQ (DWR 2016d). Other data sources are described below.

- **Community** This is non-agricultural, non-industrial water use in the census-designated places of Bieber, Nubieber, and Adin, although some of these areas may also have some minor industrial uses. These community areas were delineated using the areas designated as "urban" by DWR (2016d). DWR's data included the areas north and northeast of Bieber (area of the former mill and medical center) as "urban." For this GSP, those areas were re-categorized from urban to industrial, as that is more descriptive of the actual land use. In addition, parcels that make up the core of Nubieber were included as community.
- **Industrial** There is limited industrial use in the Basin. The DWR well log inventory shows 6 industrial wells, all located at the inactive mill in Bieber. The areas north and northeast of Bieber, including the former mill and the medical center, have been categorized as industrial. In addition, the parcels associated with railroad operations in Nubieber were added. There is

some industrial use associated with agriculture, but that is included under the agricultural water use sector.

- **Agricultural** Agricultural use is spread across the Basin and was delineated using DWR's (2016g) land-use data.[12] Agricultural users often use groundwater for both agricultural and domestic use.
- **State Wildlife Area** The area delineated in **Figure 3-5** is the boundary of the ACWA, located within the center of the Basin. The area includes some wetlands created by the seasonal flow of 6 streams and year-round flow from Ash Creek. The area also has upland ecosystems.
- **Managed Recharge** Flood irrigation of some fields and natural flooding of lowland areas provides recharge to the Basin even though it is not of a formalized nature that would put it into this managed recharge category. Some of the future projects and management actions in this GSP include managed recharge.
- **Native Vegetation** Native vegetation is widespread throughout the Basin. Many of the areas under this category also have domestic users. Native vegetation and domestic land uses are categorized together because it is not possible to distinguish between the two with readily available data.
- **Domestic** This sector includes water use for domestic purposes, for users that aren't located in a community service district. Domestic use generally occurs in conjunction with agricultural and native vegetation and is best represented on the map categorized with native vegetation, as most of the agricultural area is delineated by each field and does not include residences.

Table 3-2 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	16%
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 2020d

Many of the lands within the Basin are enrolled in the Conservation Reserve Program (CRP) and Wetlands Reserve Program (WRP). The CRP is a land conservation program administered by the Farm

[12] This dataset has been identified as being inaccurate and has been included as a data gap.

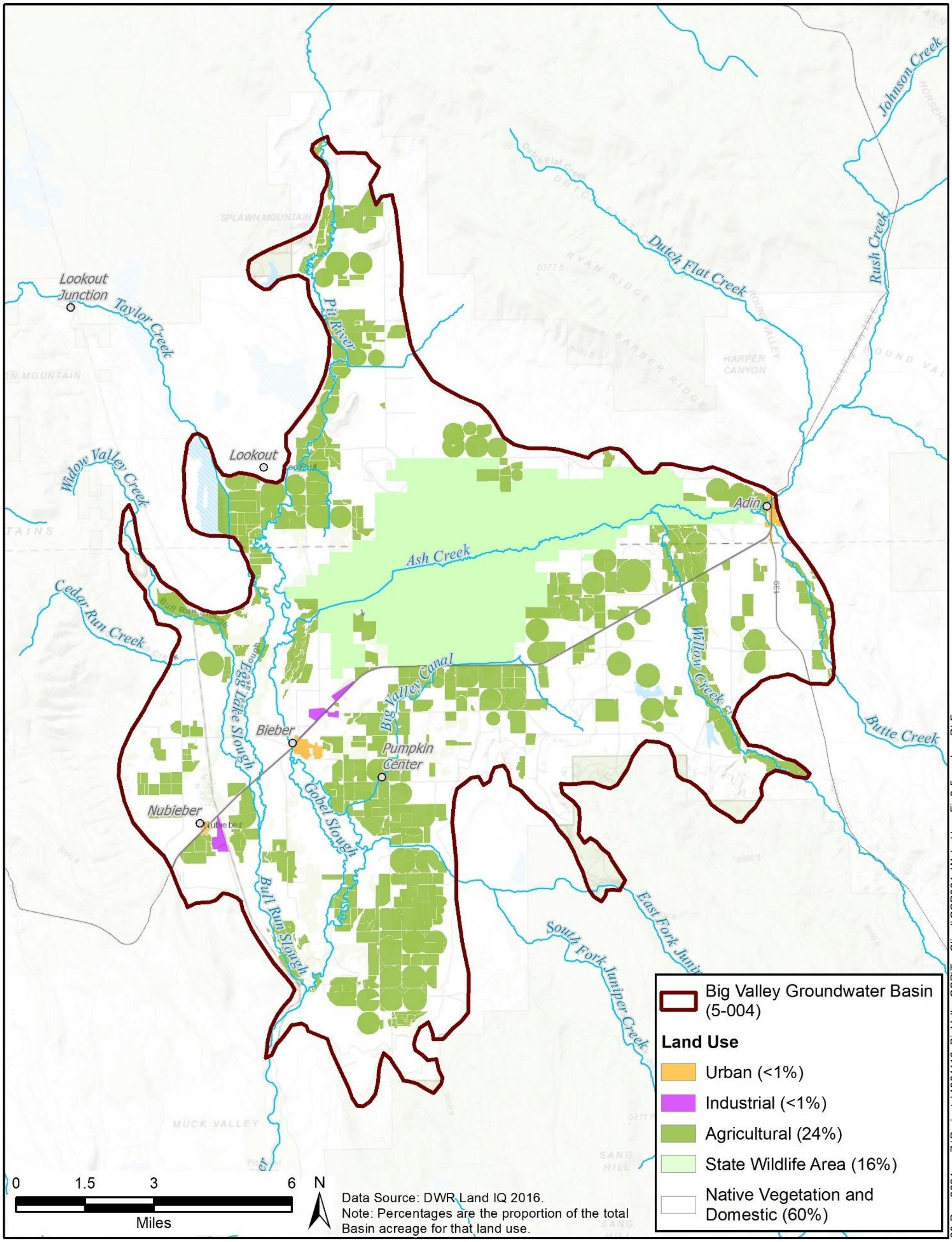


Figure 3-5 Land Use by Water Use Sector

Service Agency (FSA). In exchange for a yearly rental payment, farmers enrolled in the program agree to promote plant species that will improve environmental health and quality. Contracts for land enrolled in the CRP vary in length. The WRP is a similar program for wetlands and was available for enrollment until February 7, 2014. Land enrolled in the program before the end date continues to be enrolled until the termination of the contract.

In addition to the uses described above, the Big Valley GSAs are aware of illegal land-use activity within the Basin (i.e., unlicensed marijuana cultivation), which is likely having a negative impact on surface-water quality and quantity within the Basin and watershed. This illegal activity is occurring both within the alluvial portion of the Basin and the upstream watershed and may utilize groundwater and/or illegal diversions of surface water for cultivation. Lassen and Modoc counties have limited staff to monitor and enforce this situation on private land. However, in the last two growing seasons Lassen County Code Enforcement have identified and abated seven large-scale commercial marijuana grows within the Basin as public nuisances, and the Lassen County Sherriff has eradicated at least two under penal code. Some enforcement action is also within the purview of state and federal agencies. These agencies include the Bureau of Cannabis Control, CDFW, State Water Board, USFS, and BLM. The GSAs are not aware that these state and federal agencies have taken aggressive enforcement action against this illegal activity and according to county staff, the problem is getting noticeably worse over time. The timing and volume of water used for illegal marijuana cultivation and extent of the potential contamination cannot be quantified at this time.

3.3.1 Water Source Types

The Basin has two water source types: groundwater and surface water. Recycled water[13] and desalinated water are not formally utilized in the Basin, nor is stormwater used as a formal, measured supplemental water supply at the time of the development of this GSP. Informal reuse of irrigation water occurs with capture and reuse of tail water by farmers and ranchers. Storm water is stored in reservoirs for future use as a water source. **Figure 3-6** and shows an approximate distribution of water sources to lands throughout the Basin. Chapter 6 – Water Budget provides details on how the sources were mapped for this figure.

There are three public water suppliers (as designated by the State Water Board) in the Basin which use groundwater: LCWD #1 in Bieber, the Forest Service Ranger Station in Adin, and the California Department of Forestry and Fire Protection (CAL FIRE) conservation camp west of the BVGB. The conservation camp is located outside the Basin boundary, but their supply well is inside the Basin and the water is pumped to the camp. Many domestic users have groundwater wells, but there are some surface-water rights from Ash Creek and the Pit River that are designated for domestic use. The ACWA is fundamentally supported by surface water, but the CDFW does have three wells that are utilized in the fall for ecological enhancement.

[13] Recycled water generally refers to treated urban wastewater that is used more than once before it passes back into the water cycle. (WateReuse Association, 2020)

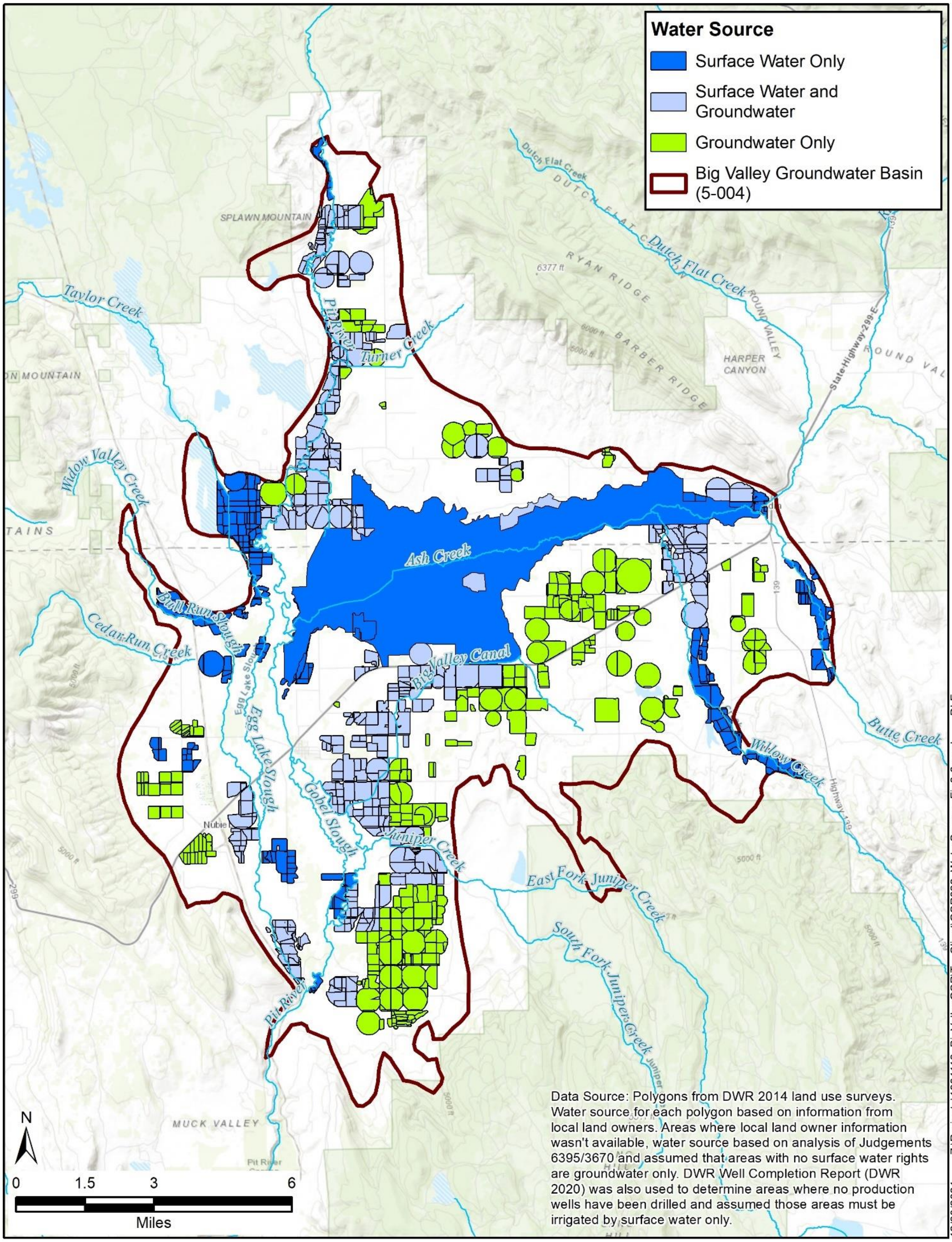


Figure 3-6 Water Sources

3.4 Inventory and Density of Wells

3.4.1 Well Inventory

The best available information about the number, distribution and types of wells in Big Valley comes from well completion reports (WCRs) maintained by DWR.[14] The most recent catalog of WCRs was provided through their website (DWR, 2018c) as a statewide map layer. This data includes an inventory and statistics about the number of wells in each section under three categories: domestic, production, or public supply.[15] **Table 3-3** shows the unverified number of wells in the BVGB for each county from this data. Many wells may be inactive or abandoned and this data gap will need to be filled over time. Once this data gap is filled, Basin priority could be affected.

Table 3-3 Well Inventory in the BVGB

WCR 2018 DWR Map Layer				DWR 2015 and 2017 WCR Inventory		
Type of Well [a]	**Lassen County Total Wells**	**Modoc County Total Wells**		**Proposed Use of Well [b]**	**Lassen County Total Wells**	**Modoc County Total Wells**
Domestic	136	81		Domestic	142	79
Production	177	76		Irrigation	157	65
				Stock	11	5
				Industrial	6	0
Public Supply	5	1		Public	5	1
Subtotal =476	**318**	**158**		**Subtotal = 471**	**321**	**150**
				Monitor	55	0
				Test	25	29
				Other	7	2
				Unknown	27	7
Total =476	**318**	**158**		**Total = 623**	**435**	**188**

Source:
[a] DWR 2018 Statewide Well Completion Report Map Layer; downloaded April 2019
[b] DWR Well Completion Report Inventories from DWR data provided to the counties in 2015 and 2017

Lassen and Modoc counties had requested and received WCRs for their areas from DWR during 2015 and 2017, respectively. An inventory of the wells was included by DWR. This data source had additional well categories included as shown in **Table 3-3**, which are more closely tied to the categories identified by the well drillers when each WCR is submitted and provides additional information about the use of the wells.

The correlation between the 2018 WCR map layer categories and the categories in the 2015 and 2017 WCR inventory provided to the counties is indicated in **Table 3-3** by the grey shading. The table shows

[14] All water-well drillers with a C57 drilling license in California are required to submit a well completion report to DWR whenever a well is drilled, modified, or destroyed.
[15] A section is defined through the public land survey system as a 1 mile by 1 mile square of land.

similar totals from the two datasets for the number of domestic, production, and public supply wells. It is unknown why these two datasets don't match exactly, but both datasets are provided to represent the data available for this GSP. As stated earlier, verification of the data in this table needs to occur. This table shows that more than 600 wells have been drilled, of which 476 are of a type that could involve extraction (e.g., domestic, production, or public supply).[16] It is unknown how many wells are actively used, as some portion of them are likely abandoned. Abandoned wells no longer in use should be formally destroyed in accordance with state well standards. The 2015 and 2017 inventory of WCRs showed six well destructions, all on the Lassen County side of the Basin. It should be noted that some of the recent wells in the Basin were drilled in cooperation with the EQUIP program to provide stock watering outside the riparian area to improve surface-water quality.

3.4.2 Well Density

Figure 3-7, **Figure 3-8**, and **Figure 3-9** show the density of wells in the Basin per square mile for domestic, production, and public supply, respectively, based on the 2018 WCR DWR map layer. These maps provide an approximation of extraction-well distributions and give a general sense of where groundwater use occurs.

Figure 3-7 shows that domestic wells are in 74 of the 180 sections (including partial sections) that comprise the BVGB. The density varies from 0 to 18 wells per square mile with a median value of two wells per section and an average of three wells per section. The highest densities of domestic wells are located near Adin, Bieber and Lookout. There are also sections east of Lookout and south of Adin which have high densities. In addition, 22 wells are present in the four sections around the town of Nubieber. Virtually all the domestic wells in Bieber are no longer used since the community water system was developed (Hutchinson 2020-2021).

Figure 3-8 shows that production wells (primarily for irrigation) are located in 93 of the 180 sections with a maximum density of nine wells per section (median: 2 wells per section, average: nearly 3 wells per section). The highest densities of production wells are located between the towns of Bieber and Adin, to the southeast of Bieber, and one section northeast of Lookout.

Figure 3-9 shows that public supply wells have been drilled in four sections. It should be noted that the designation as a public supply well that is depicted on the map is from the designation provided in the WCR by the driller when the well was drilled. The State Water Board identifies three public water suppliers in the BVGB: LCWD #1 which is a community system with two wells serve Bieber; the Forest Service station in Adin which maintains a well for non-community supply to its employees and visitors; and the CAL FIRE conservation camp west of the Basin. These public suppliers account for three of the six public wells with WCRs. The other three are either inactive or aren't designated by the State Water Board as public supply. The CAL FIRE conservation camp well does not show up as a public supply well in the WCR inventory, but its location is shown on **Figure 3-9**.

[16] It should be noted that the majority of the stock watering wells were drilled in the 2009 to 2014 timeframe as part of the EQIP program to move watering of stock away from stream channels and that this increase in the inventory of wells in the Basin was used by DWR to put Big Valley into the medium prioritization category.

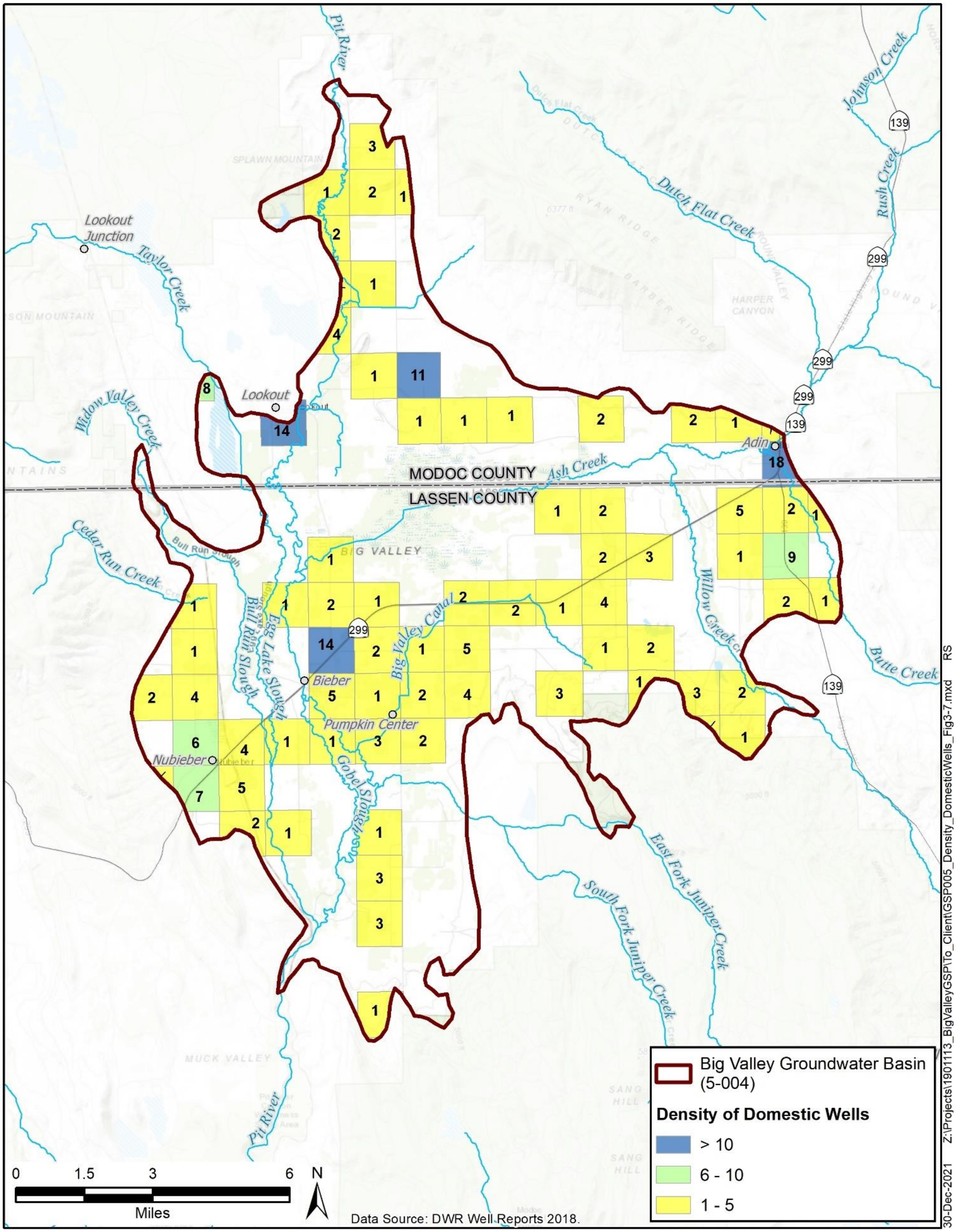


Figure 3-7 **Density of Domestic Wells**

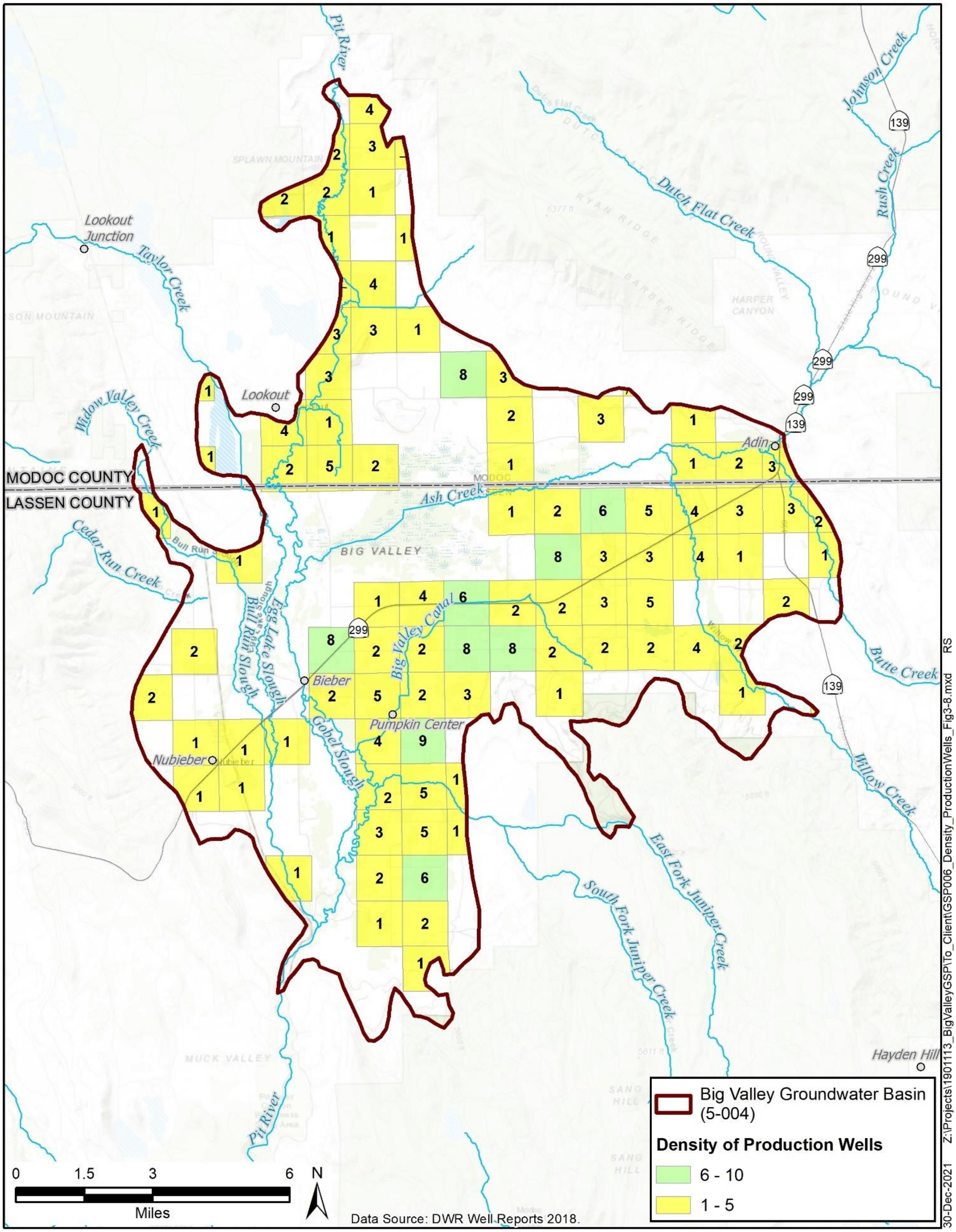


Figure 3-8 Density of Production Wells

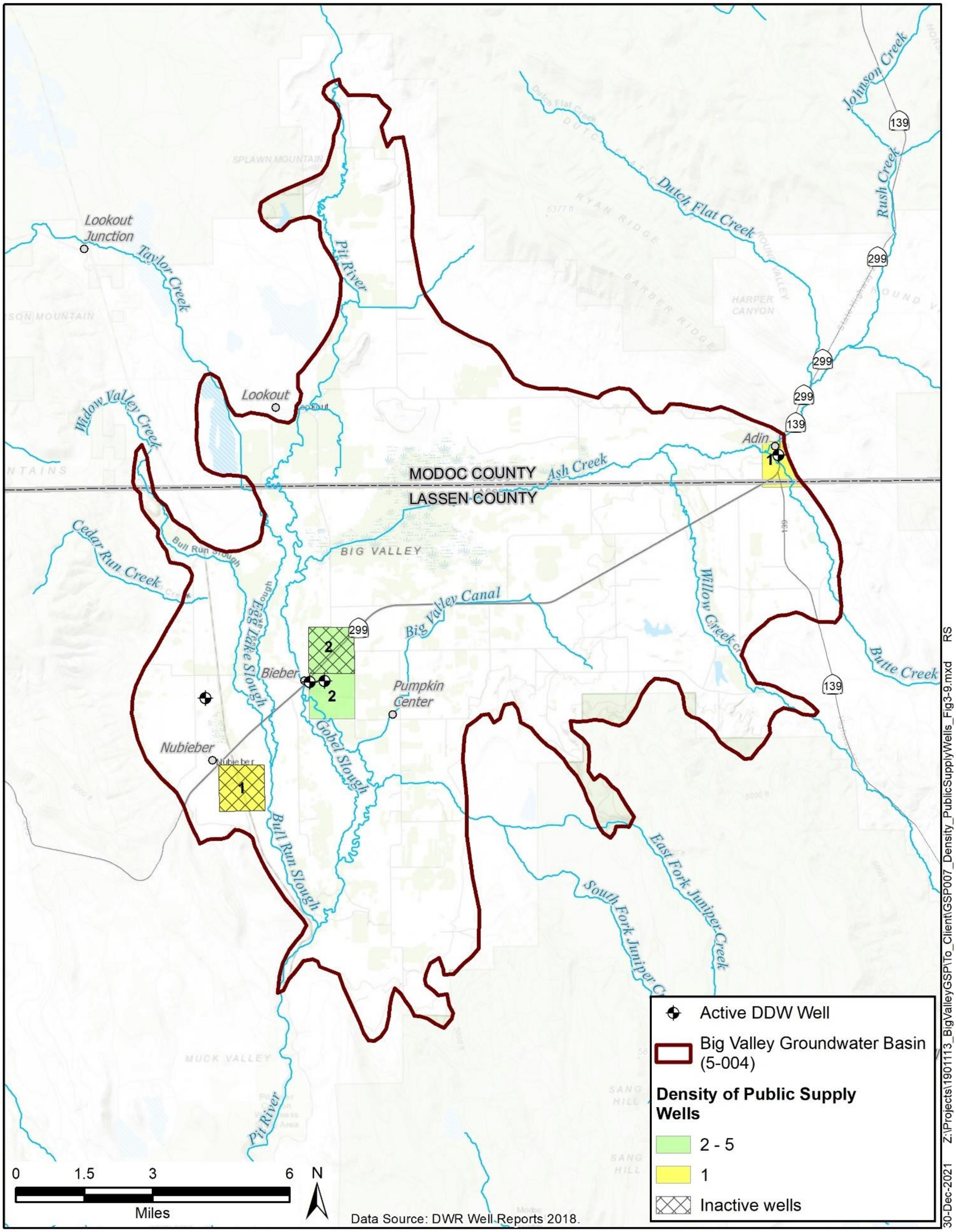


Figure 3-9 Density of Public Supply Wells

3.5 Existing Monitoring, Management and Regulatory Programs

3.5.1 Monitoring Programs

This section describes the existing monitoring programs for data used in this GSP and describes sources that can be used for the GSP monitoring networks.

3.5.1.1 Groundwater Monitoring

Levels

Lassen and Modoc counties are the monitoring entities for the CASGEM program. Each county has an approved CASGEM monitoring plan which provides for water level measurements twice a year (spring and fall) for 21 wells. The monitoring is performed by staff from DWR on behalf of the counties. All but one of the wells have depth information, and depths range from 73 to 800 feet below ground surface [ft bgs] (median: 270 ft bgs, mean: 335 ft bgs). **Figure 3-10** shows the locations of the 21 CASGEM wells and one additional well which has historical data, but measurements were discontinued in the 1990s.

Lassen and Modoc counties drilled five monitoring well clusters between 2019 and 2020. Each cluster consists of three shallow wells and one deep well. The locations of these clusters and the depth of the deep well at each site is shown on **Figure 3-10**.

Quality

Water quality is regulated and monitored under a myriad of programs. **Table 3-4** describes the programs relevant to Big Valley. The State Water Board makes groundwater data from many of these programs available on their Groundwater Ambient Monitoring and Assessment (GAMA) Groundwater Information System (GAMA GIS) website (State Water Board 2019). **Table 3-5** lists and describes the groundwater programs from which historical data is available on GAMA GIS. The locations of wells with historical water quality data from GAMA GIS are shown on **Figure 3-11.**

Along with the many programs that monitor surface-water quality, the following are currently in place to monitor groundwater quality on an ongoing basis:

- Public Drinking Water Systems (State Water Board's Division of Drinking Water [DDW])
- Monitoring associated with Underground Storage Tanks (USTs) and Waste Discharge Requirement

The BVGB contains three active public water suppliers regulated by the DDW: Lassen County Water District #1 in Bieber, the Forest Service station in Adin, and the CAL FIRE conservation camp west of the Basin. Water quality monitoring at wells regulated by the DDW can be used for ongoing monitoring in the Basin, and their locations are shown on **Figure 3-11**. At each of five newly-constructed monitoring well clusters, the deep well at each site was sampled for water quality after construction. The locations of the well cluster sites are shown on **Figure 3-11**.

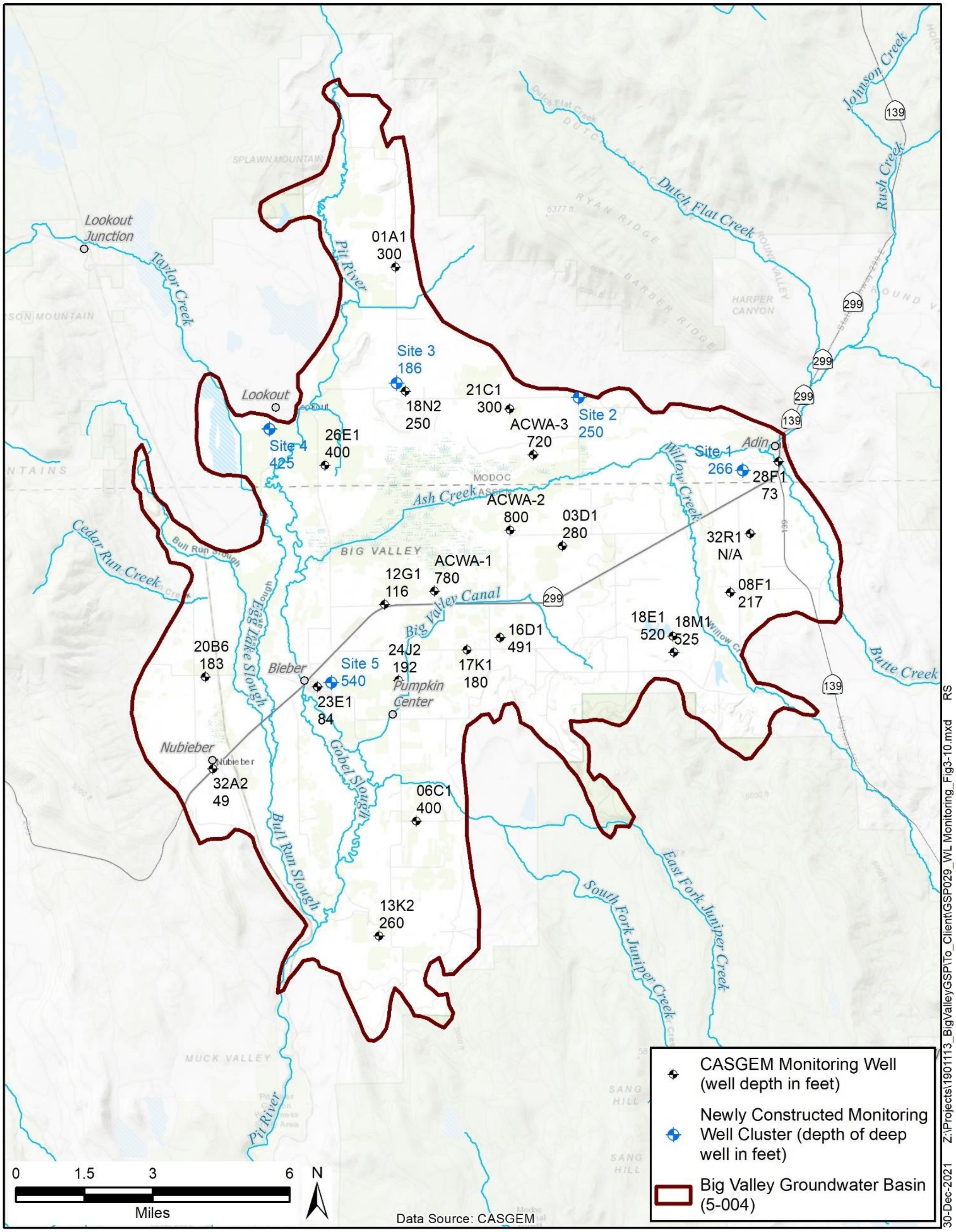


Figure 3-10 Water Level Monitoring Network

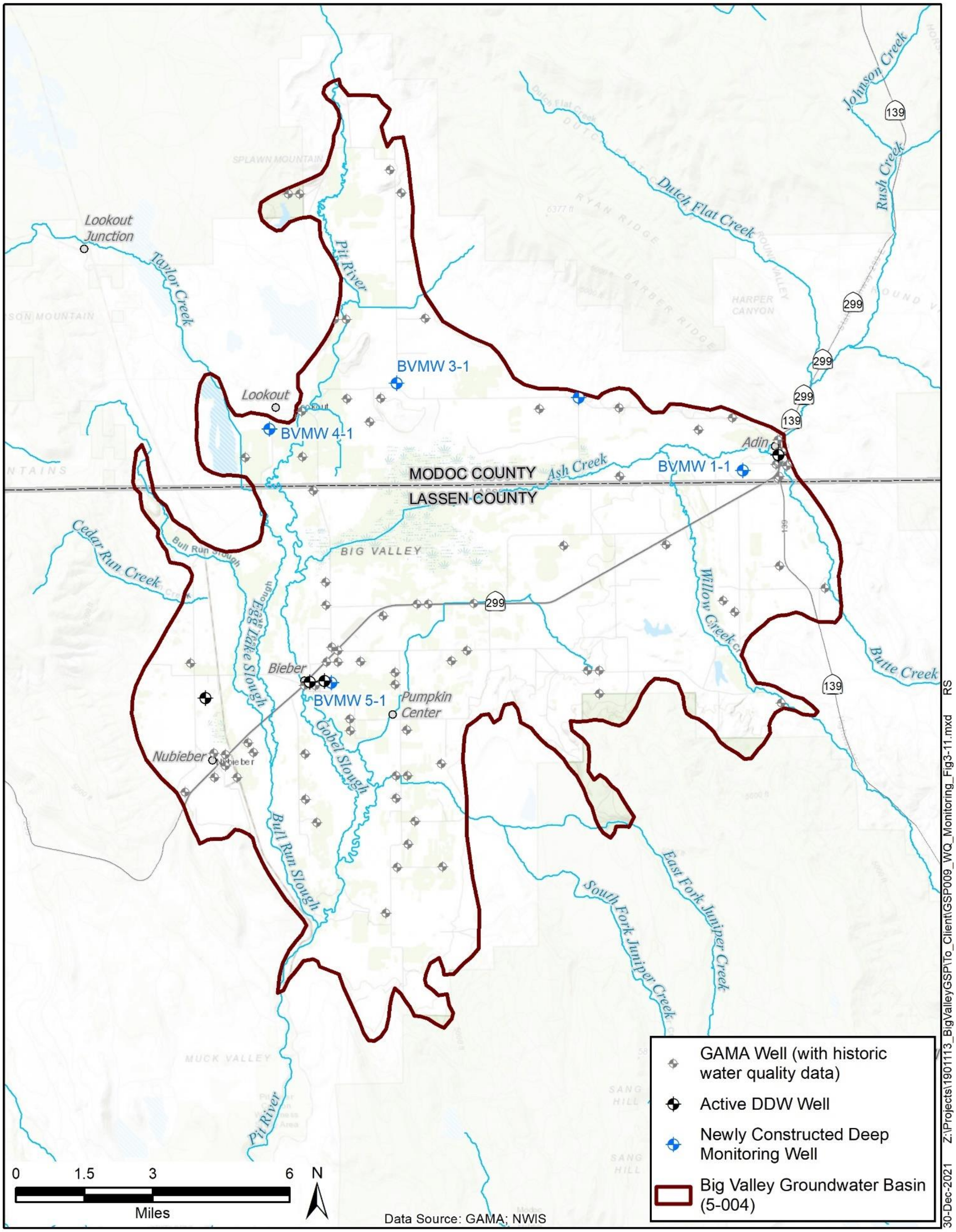


Figure 3-11 Water Quality Monitoring

Table 3-4 Water Quality Monitoring Programs

Program	Description
Irrigated Lands Regulatory Program (ILRP)	Initiated in 2003 to prevent agricultural runoff from impairing surface waters; in 2012 groundwater regulations were added to the program. To comply with the ILRP, Big Valley growers were forced to join the Northeastern California Water Association (NECWA), which is a sub-watershed coalition of the Northern California Water Association. Growers pay increasing fees to NECWA for monitoring and compliance with the ILRP even though Big Valley farmers grow low intensity crops that generally don't require nitrogen application or cause water quality degradation.
Waste Discharge Requirements (WDR) Program	Also known as the Non-Chapter 15 Permitting, Surveillance and Enforcement Program, this is a mandated program issuing WDRs to regulate the discharge of municipal, industrial, commercial, and other wastes to the land that will, or has the potential to, affect groundwater.
Central Valley Salinity Coalition (CVSC)	Represents the stakeholder groups working with the State Water Board in the CV-SALTS collaborative basin planning process.
RWQCB Basin Plan	Adopted by the Regional Water Board and approved by the State Water Board and the Office of Administrative Law. The U.S. Environmental Protection Agency approves the water quality standards contained in the Basin Plan, as required by the Clean Water Act (CWA).
Public Drinking Water Regulations	Effective July 1, 2018, various sections of California Code of Regulations, Title 27 were revised. Revisions to Title 27 were necessary in order to reorganize, update and incorporate new parameters for administering the Unified Program and accomplishing the objectives of coordination, consolidation and consistency in the protection of human health, safety, and the environment.
Total Maximum Daily Load Program (TMDL) Program	TMDLs are established at the level necessary to implement the applicable water quality standards.
Local Agency Management Programs	These programs regulate Onsite Water Treatment Systems (OWTSs); the programs are designed to "correct and prevent system failures due to poor siting and design and excessive OWTS densities" (RWQCB 2021).
Underground Storage Tank Site Cleanup Program (UST)	The purpose of the UST Program is to protect the public health and safety and the environment from releases of petroleum and other hazardous substances from USTs.
National Pollutant Discharge Elimination System (NPDES)	The NPDES permit program, created in 1972 by the CWA, helps address water pollution by regulating point sources that discharge pollutants to waters of the U.S. The permit provides two levels of control: technology-based limits and water quality-based limits (if technology-based limits are not sufficient to provide protection of the water body).
Nonpoint Source Program (NSP)	NSP focuses and expands the state's efforts over the next 13 years to prevent and control nonpoint source pollution. Its long-term goal is to implement management measures by the year 2013 to ensure the protection and restoration of the state's water quality, existing and potential beneficial uses, critical coastal areas, and pristine areas. The state's nonpoint source program addresses both surface and ground water quality.
Other	Water quality samples are required when a property is sold and when a foster child is placed.

Table 3-5 Datasets Available from State Water Board's GAMA Groundwater Information System

Name	Source
DDW	Division of Drinking Water, State Water Board
DPR	Department of Pesticide Regulation
DWR	California Department of Water Resources
GAMA_USGS	Groundwater Ambient Monitoring and Assessment Program performed by USGS
USGS_NWIS	USGS National Water Information System
WB_CLEANUP	Water Board Cleanup
WB_ILRP	Water Board Irrigated Lands Regulatory Program
Source: GAMA GIS available at https://gamagroundwater.waterboards.ca.gov/gama/gamamap/public/	

The Basin has five active groundwater cleanup sites in various stages of assessment and remediation, all located in the town of Bieber. These sites are not appropriate for ongoing monitoring for the GSP because they monitor only the shallow aquifer and represent a localized condition that may not be representative of the overall quality of groundwater resources in the Basin. One of the open sites is the Bieber Class II Solid Waste Municipal Landfill which has ongoing water quality monitoring. The Lookout Transfer Station also has ongoing water quality monitoring but is located outside the boundaries of the BVGB.

Growers in Big Valley are required to participate in the ILRP, which imposes a fee per acre, through the Sacramento Valley Water Quality Coalition (SVWQC). The SVWQC Monitoring and Reporting Plan does not include any wells within the BVGB. Basin residents have expressed concerns with regulatory programs that involve costs, especially ongoing costs, particularly for a disadvantaged community. The Goose Lake Basin, which has similar land use and land-use practices, has recently been exempted from the ILRP by the SWRCB.

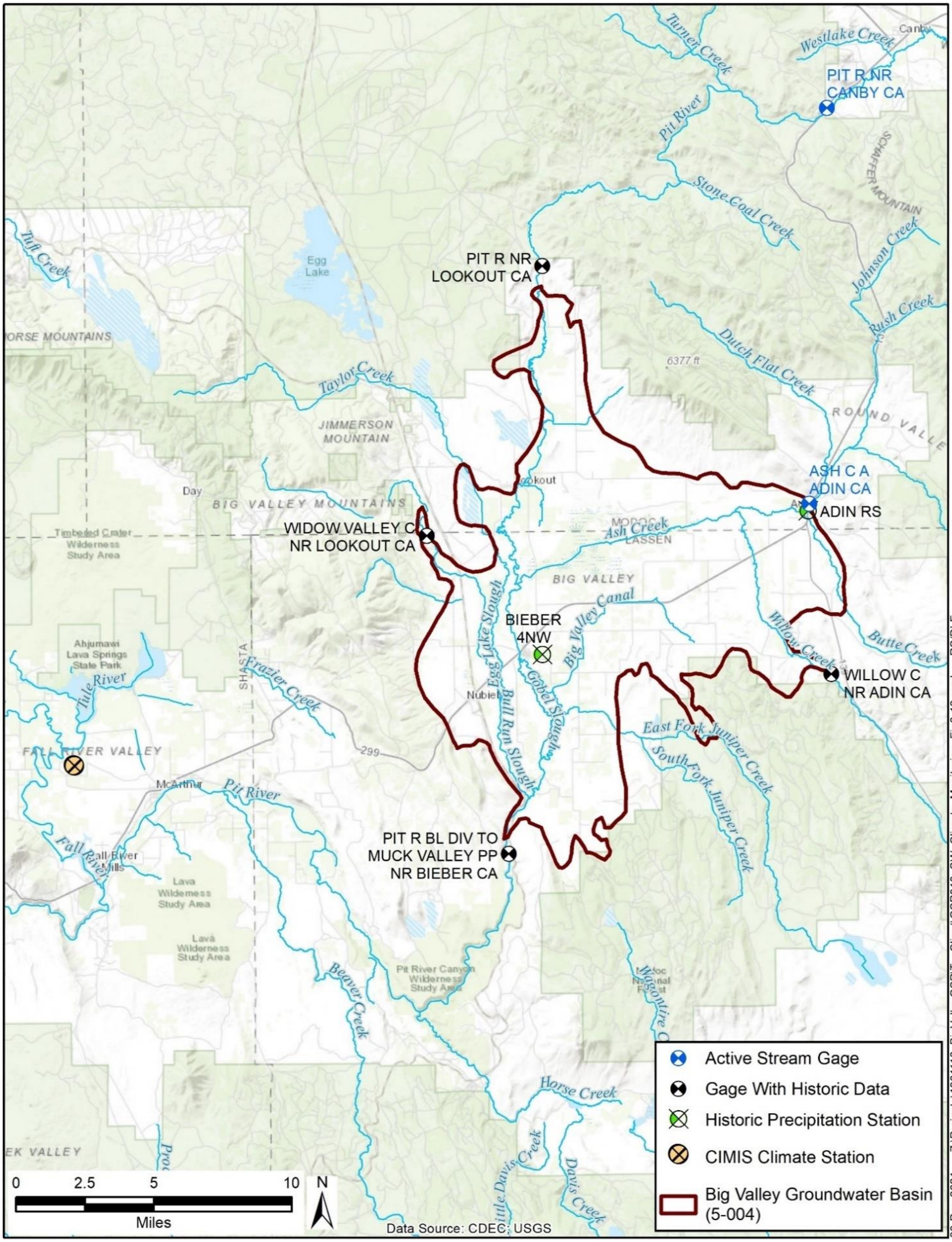
3.5.1.2 Surface-water Monitoring

Streamflow

Streamflow gages have historically been constructed and monitored within the BVGB, but active, maintained streamflow gages for streams in BVGB are limited. For the Pit River, the closest active gage that monitors stage and streamflow is located at Canby, 20 miles upstream of Big Valley. Flow on Ash Creek was measured at a gage in Adin from 1981 to 1999 and was reactivated in Fall 2019 to provide stream stage data at 15-minute intervals. There is a gage where the Pit River exits the Basin in the south at the diversion for the Muck Valley Hydro Power Plant. Stream gages are shown on **Figure 3-12**.

Diversions

Two watermasters, described below, measure diversions in the BVGB. Those surface-water rights holders who divert more than 10 AFY whose rights are not measured by a watermaster must measure and report their diversions to the State Water Board.



886
887 **Figure 3-12 Historical Surface-water and Climate Monitoring Network**

Diversions from the Pit River are detailed in water rights Decree #6395. In 2006, the BVWUA petitioned the Modoc Superior Court who granted permission to separate from the costly state watermaster service. A private watermaster service is now contracted by the BVWUA to administer/distribute allocated 2nd priority rights in conjunction with state watermaster guidelines during the irrigation season (April 1 through September 30) each year as a neutral 3rd party. The watermaster service measures diversions every two weeks and reports the data to each water rights holder. At the end of the irrigation season, the watermaster sends each member a yearly use report. The water rights holder is responsible to submit their reports to the State Water Board. Currently there are five Pit River water rights holders that do not participate in the BVWUA watermaster service. (Hutchinson 2021)

Ash Creek water rights are governed by Decree 3670 and Willow Creek by Decree 1237. Ash Creek and Willow Creek are within the Ash Creek Watermaster Service Area (WMSA). The WMSA also includes Butte and Rush Creeks and is under the jurisdiction of the Modoc County Watermaster. The Watermaster files the annual reports to DWR and Modoc County Superior Court. (Modoc County Watermaster 2021)

3.5.1.3 Climate Monitoring

The National Oceanic and Atmospheric Administration (NOAA) has two stations located in the Basin: Bieber 4 NW and Adin RS. Neither station is active, thus they only provide historical data. Annual precipitation at the Bieber station is shown for 1985 to 1995 in **Table 3-6**.

Table 3-6 Annual Precipitation at Bieber from 1985 to 1995

Water Year	Precipitation at Station ID: BBR (inches)
1985	14.1
1986	25.4
1987	11.6
1988	10.9
1989	20.2
1990	16.1
1991	16.5
1992	10.4
1993	28.2
1994	16.3
1995	31.8
Minimum	10.4
Maximum	31.8
Average	18.3

Source: DWR 2021b

The closest California Irrigation Management Information System (CIMIS) station, number 43, is in McArthur, CA, and measures several climatic factors that allow a calculation of daily reference evapotranspiration for the area. This station is approximately 10 miles southwest of the western boundary of the Basin. **Table 3-7** provides a summary of average monthly rainfall, temperature and reference evapotranspiration (ETo) for the Basin, and **Figure 3-13** shows annual rainfall for 1984 through 2018. The bar graph along the bottom shows annual precipitation, and the line graph on top shows the cumulative departure from average. The cumulative departure graph indicates when there are dry periods (downward slope of the line), wet periods (upward slope of the line), and average periods (flat slope of the line). Each time the line graph crosses the dashed line indicates that an average set of years has occurred. A set of average years has occurred between 1983-1997, 1997 to 2010, and 2010 to 2019. The locations of all climate monitoring stations are shown on **Figure 3-12**. Climate monitoring is a data gap that could be filled with a CIMIS station located in the Basin.

Table 3-7 Monthly Climate Data from CIMIS Station in McArthur (1984-2018)

Month	Average Rainfall (inches)	Average ET_o (inches)	Average Daily Temperature (°F)
October	1.4	3.02	49.5
November	2.3	1.21	38.2
December	2.9	0.75	32.1
January	2.5	0.89	32.5
February	2.6	1.57	36.8
March	2.4	3.01	42.4
April	1.8	4.39	48.2
May	1.6	5.93	55.1
June	0.7	7.24	62.8
July	0.2	8.17	69.1
August	0.2	7.18	66.1
September	0.4	5.02	59.5
Monthly Average	1.6	4.03	49.4
Average Water Year	18.8	48.3	49.4

Source: DWR 2020c

3.5.1.4 Subsidence Monitoring

Subsidence monitoring is available in the BVGB at a single continuous global positioning satellite station (P347) on the south side of Adin. P347 began operation in September 2007 and provides daily readings. The five monitoring well clusters constructed in 2019-2020 were surveyed and a benchmark established at each site. These sites can be re-surveyed in the future to determine changes in ground elevation at those points if needed. The surveyor’s report is included as **Appendix 3A**.

In addition, DWR has provided data processed from InSAR collected by the European Space Agency. The InSAR data currently available provides vertical displacement information between January 2015 and September 2019. InSAR is a promising, cost-effective technique, and DWR will likely provide additional data and information going forward.

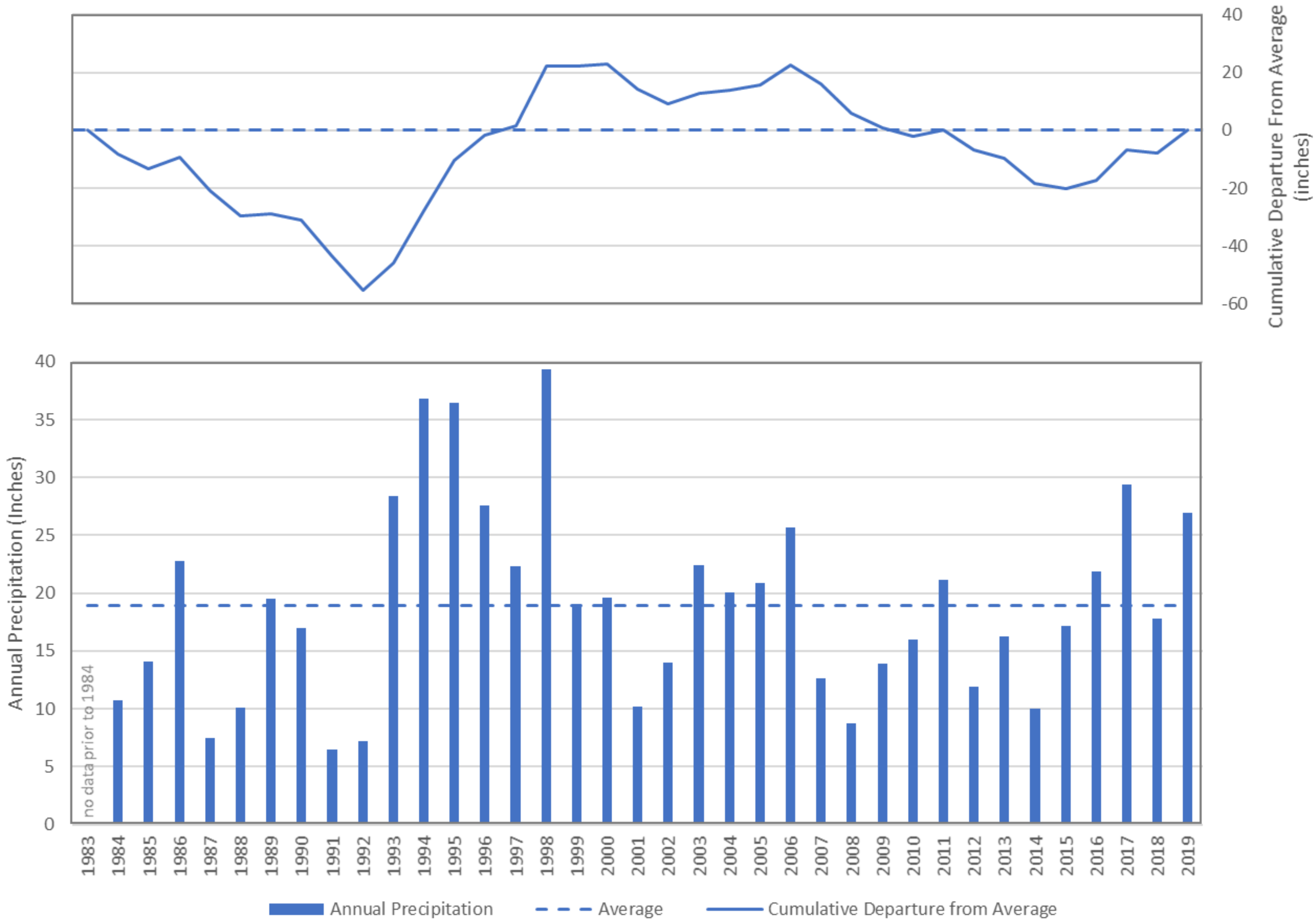


Figure 3-13 Annual Precipitation at the McArthur CIMIS Station

3.5.2 Water Management Plans

Two water management plans exist that cover the BVGB: the Lassen County Groundwater Management Plan (LCGMP) and the Upper Pit River IRWMP.

Lassen County Groundwater Management Plan

The LCGMP was completed in 2007 and covers all groundwater basins in Lassen County, including the Lassen County portion of the BVGB. The goal of the LCGMP is to, "…maintain or enhance groundwater quantity and quality, thereby providing a sustainable, high-quality supply for agricultural, environmental and urban use…" (Brown and Caldwell 2007). The LCGMP achieves this through the implementation of Basin Management Objectives[17] (BMOs), which establish key wells for monitoring groundwater levels and define "action levels," which, when exceeded, activate stakeholder engagement to determine actions to remedy the exceedance. Action levels are similar to minimum thresholds in SGMA. A BMO ordinance was passed by Lassen County in 2011 and codified in Chapter 17.02 of the Lassen County Code.

Upper Pit River Watershed IRWMP

The Upper Pit IRWMP was adopted by the RWMG in 2013. Twenty-five regional entities were involved in the plan development, which included water user groups, federal, state and county agencies, tribal groups, and conservation groups. The management of the IRWMP has now transferred to North Cal-Neva who has been working to update the IRWMP. The goal of the IRWMP is to:

> …maintain or improve water quality within the watershed; maintain availability of water for irrigation demands and ecological needs (both ground and surface water); sustain/improve aquatic, riparian and wetland communities; sustain and improve upland vegetation and wildlife communities; control & prevent the spread of invasive noxious weeds; strengthen community watershed stewardship; reduce river and stream channel erosion and restore channel morphology; support community sustainability by strengthening natural-resource-based economies; support and encourage better coordination of data, collection, sharing and reporting in the watershed; improve domestic drinking water supply efficiency/reliability; address the water-related needs of disadvantaged communities; conserve energy, address the effects of climate variability and reduce greenhouse gas emissions. (NECWA 2017)

The Upper Pit IRWMP contains the entire Watershed above Burney and extends past Alturas to the northeast (see **Figure 3-3**) and includes the entire BVGB. This GSP has been identified as a "Project" in the IRWMP.

[17] Codified as Chapter 17.02 of Lassen County Code.

3.5.3 Groundwater Regulatory Programs

The Basin is located within the jurisdiction of the Regional Water Quality Control Board (RWQCB) Region 5 (R5) and subject to a Basin Plan, which is required by the CWC (§13240) and supported by the federal Clean Water Act. The Basin Plan for the Sacramento River Basin and the San Joaquin River Basin was first adopted by the RWQCB-R5 in 1975. The current version of the Basin Plan was adopted in 2018. The Porter-Cologne Water Quality Control Act requires that basin plans address beneficial uses, water quality objectives, and a program of implementation for achieving water quality objectives. Water Quality Objectives for both groundwater (drinking water and irrigation) and surface water are provided in Chapter 3 of the Basin Plan (State Water Board, 2020c).

Lassen County Water Well Ordinance

Lassen County adopted a water well ordinance in 1988 to provide for the construction, repair, modification, and destruction of wells in such a manner that the groundwater of Lassen County aquifers will not be contaminated or polluted. The ordinance ensures that water obtained from wells will be suitable for beneficial use and will not jeopardize the health, safety, or welfare of the people of Lassen County. The ordinance includes requirements for permits, fees, appeals, standards and specifications, inspection, log of the well (lithology and casing), abandonment, stop work, enforcement, and violations and well disinfection. Lassen County Environmental Health Department is responsible for the code enforcement related to wells.

In 1999, Lassen County adopted an ordinance requiring a permit for export of groundwater outside the county (Lassen County Code Chapter 17.01).

Modoc County Water Well Requirements

Modoc County Environmental Health Department established its requirements for the permitting of work on water wells in 1990, based on the requirements of the CWC (§13750.5). The fee structure was last revised in 2018. Modoc County also has an ordinance prohibiting the extraction of groundwater for use outside of the groundwater basin from which it was extracted (Modoc County Code Chapter 20.04).

California DWR Well Standards

DWR is responsible for setting the minimum standards for the construction, alteration, and destruction of wells in California to protect groundwater quality, as allowed by CWC §13700 to §13806. DWR began this effort in 1949 and has published several versions of standards in Bulletin 74, and are working on an update that has yet to be released. Current requirements are provided in Bulletin 74-81, Water Well Standards: state of California and in Bulletin 74-90 (Supplement) (DWR 2021c). Cities, counties, and water agencies have regulatory authority over wells and can adopt local well ordinances that meet or exceed the state standards. Lassen and Modoc Counties are the well permitting agencies for their respective portions of the Basin.

Title 22 Drinking Water Program

The DDW was established in 2014 when the regulatory responsibilities were transferred from the California Department of Public Health. DDW regulates public water systems that provide, "…water for human consumption through pipes or other constructed conveyances that have 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year," as defined by the Health and Safety Code (§116275(h)). DDW further defines public water systems as:

- Community: Serves at least 15 service connections used by year-round residents or regularly serves 25-year-round residents. LCWD #1 is a community system that provides groundwater in Bieber.
- Non-Transient Non-Community: Serves at least the same 25 non-residential individuals during 6 months of the year. The State Water Board classifies the Adin Ranger Station and the Intermountain Conservation Camp as systems in this category which serve groundwater.
- Transient Non-Community: Regularly serves at least 25 non-residential individuals (transient) during 60 or more days per year. There is no system of this category in the BVGB.

Private domestic wells, industrial wells, and irrigation wells are not regulated by the DDW.

The State Water Board-DDW enforces the monitoring requirements established in Title 22 of the California Code of Regulations for public water system wells and all the data collected must be reported to the DDW. Title 22 designates the regulatory limits (e.g., MCLs) for various constituents, including naturally occurring inorganic chemicals and metals and general characteristics and sets limits for man-made contaminants, including volatile and non-volatile organic compounds, pesticides, herbicides, disinfection byproducts, and other parameters.

3.5.4 Incorporation Into GSP

Information in these and other various and numerous programs have been incorporated into this GSP and used during the preparation of Sustainability Management Criteria (minimum thresholds, measurable objectives, interim milestones) and have been considered during development of Projects and Management Actions.

3.5.5 Limits to Operational Flexibility

While some of the existing management programs and ordinances may have the potential to affect operational flexibility, they are not likely to be a factor in the Basin. For example, runoff and stormwater quality is of high quality and would not constrain recharge options. Similarly, groundwater export limitations by Lassen County and Modoc County would be considered for any decisions in the Basin.

3.6 Conjunctive Use Programs

Formally established conjunctive use programs are not currently operating within the Basin.

3.7 Land Use Plans

The following sections provide a general description of the land-use plans and how implementation may affect groundwater. Section 3.2 – Jurisdictional Areas, describes the jurisdictional areas within the BVGB and many of these entities have developed land-use plans for their respective jurisdictions. This includes the general plans (GPs) for Modoc County and Lassen County and the Modoc National Forest Land and Resource Management Plan.

3.7.1 Modoc County General Plan

The 1988 Modoc County GP was developed to meet a state requirement and to serve as the "constitution" for the community development and use of land. The GP discusses the mandatory elements of a GP, including land use, housing, circulation (transportation), conservation and open space, noise and safety, as well as economic development and an action program in the county. The GP was intended to serve as a guide for growth and change in Modoc County. Under the Conservation Element, Modoc County recognizes the importance of "use-capacity" for groundwater, among other issues, and the minimization of "adverse resource-use," such as "groundwater mining." The Water Resources section advocates the "wise and prudent" management of groundwater resources to support a sustainable economy as well as maintaining adequate supplies for domestic wells for rural subdivisions. Groundwater quality was recognized as good to excellent within the county's basins.

Policy items from the Modoc GP related to groundwater include:

- Cooperate with responsible agencies and organizations to solve water quality problems
- Work with the agricultural community to resolve any groundwater overdraft problems
- Require adequate domestic water supply for all rural subdivisions

The action program included several general statements for water, including:

- Initiate a cooperative effort among state and local agencies and special districts to explore appropriate actions necessary to resolve long-term water supply and quality problems in the counties
- Require as a part of the review of any subdivision approval a demonstration to the satisfaction of the county that the following conditions exist for every lot in the proposed development:
  - An adequate domestic water supply
  - Suitable soil depth, slope, and surface acreage capable of supporting an approved sewage disposal system

In 2018, a GP amendment was adopted to update the housing element section.

3.7.2 Lassen County General Plan

The Lassen County GP 2000 was adopted in 1999 by the Lassen County Board of Supervisors (Resolution 99-060) to address the requirements of California Government Code Section 65300 et seq and related provisions of California law pertaining to GPs. The GP reflects the concerns and efforts of the County to efficiently and equitably address a wide range of development issues which confront residents, property owners, and business operators. Many of these issues also challenge organizations and agencies concerned with the management of land and resources and the provisions of community services within Lassen County.

The goals of the GP are to:

- Protect the rural character and culture of Lassen County life
- Maintain economic viability for existing industries such as agriculture, timber, and mining
- Promote new compatible industries to provide a broader economic base
- Create livable communities through carefully planned development which efficiently utilize natural resources and provide amenities for residents
- Maintain and enhance natural wildlife communities and recreational opportunities
- Sustain the beauty and open space around use in this effort

The GP addresses the mandatory elements (land use, circulation, housing, conservation, open space, noise, and safety) *via* several GP documents and alternate element titles. The 1999 GP elements include land use, natural resources (conservation), agriculture, wildlife, open space, circulation, and safety. Separate documents were produced for housing, noise, and energy. The land-use element designates the proposed general distribution and intensity of uses of the land, serves as the central framework for the entire GP, and correlates all land-use issues into a set of coherent development policies. The GP land-use map from 1999, shown on **Figure 3-14,** shows Intensive Agriculture as the dominant land use within the Big Valley area, along with scattered population (small) centers. Otherwise, Extensive Agriculture is the dominant land use.

Groundwater is addressed in several elements, including agriculture, land use, and natural resources. The GP identified the BVGB as a ‘major ground water basin’ due to the operation of wells at over 100 gallons per minute (gpm). Moreover, the GP expressed concern about water transfers and their impact on local water needs and environmental impacts due to the possibility of water marketeers either pumping groundwater from the BVGB into the Pit River and selling it to downstream water districts or municipalities or using groundwater to augment summer flow through the Delta. The GP recognized that safe yield is dependent on recharge and that overdraft pumping would increase operating costs due to a greater pumping lift. The GP also recognized that overdraft pumping could result in subsidence and water quality degradation. In addition, the GP referred to 1980s legislation that authorized the formation of water districts in Lassen County to manage and regulate the use of groundwater resources and to the 1959 Lassen-Modoc County Flood Control and Water Conservation District, as discussed above. The SGMA process established the requirements for a GSP in the BVGB and creation of the two GSAs. The land-use element identified several issues related to groundwater, including public services where 62 percent of rural, unincorporated housing units relied on individual (domestic) wells for their water.

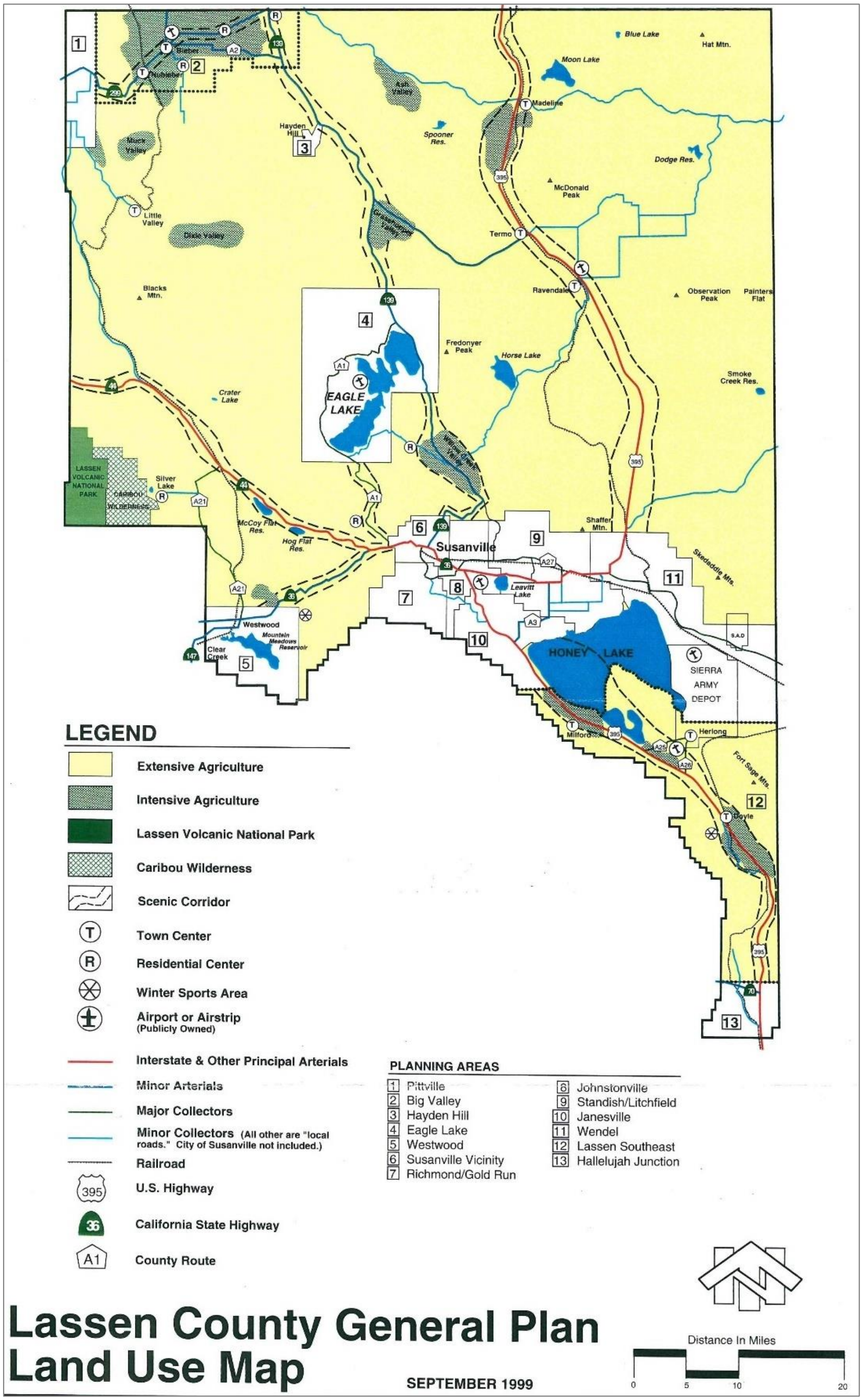


Figure 3-14 Lassen County General Plan Land Use Map

Another issue included open space and the managed production of resources, which includes areas for recharge of groundwater, among others. The GP referred to the 1972 Open Space Plan, which required that residential sewage disposal systems would not contaminate groundwater supplies. The agriculture element identified an issue with incompatible land uses where agricultural pumping lowers the groundwater level and impacts the use of domestic wells. The wildlife element recognized that changes in groundwater storage could impact wet meadow ecosystems and threaten fish and wildlife species. Groundwater is included in polices under the water resources section of the Natural Resources (NR) and Open Space (OS) Elements, as listed below:

- NR15 POLICY: Lassen County advocates the cooperation of state and federal agencies, including the State Water Board and its regional boards, in considering programs and actions to protect the quality of ground water and surface-water resources.
- NR17 POLICY: Lassen County supports measures to protect and ensure the integrity of water supplies and is opposed to proposals for the exportation of ground water and surface waters from ground water basins and aquifers located in Lassen County (in whole or part) to areas outside those basins.
    - Implementation Measure:

      NR-H: Lassen County will maintain ground water ordinances and other forms of regulatory authority to protect the integrity of water supplies in the county and regulate the exportation of water from ground water basins and aquifers in the county to areas outside those basins.
- NR19 POLICY: Lassen County supports control of water resources at the local level, including the formation of local ground water management districts to appropriately manage and protect the long-term viability of ground water resources in the interest of county residents and the county's resources.
- OS27 POLICY: Lassen County recognizes that its surface and ground water resources are especially valuable resources which deserve and need appropriate measures to protect their quality and quantity.
- OS28 POLICY: Lassen County shall, in conjunction with the Water Quality Control Board, adopt specific resource policies and development restrictions to protect specified water resources (e.g., Eagle Lake, Honey Lake, special recharge areas, etc.) and to support the protection of those resources from development or other damage which may diminish or destroy their resource value.
    - Implementation Measure:

      OS-N: When warranted, Lassen County shall consider special restrictions to development in and around recharge areas of domestic water sources and other special water resource areas to prevent or reduce possible adverse impacts to the quality or quantity of water resources.

3.7.3 Modoc National Forest Land and Resource Management Plan

Modoc National Forest lies in the mountain areas surrounding Big Valley to the south and northeast. A small portion of the National Forest extends into the Basin boundary in the south as shown in **Figure 3-2**.

The U.S. Forest Service developed their Land and Resource Management Plan in 1991 to, "…guide natural resource management activities and establish management standards and guidelines." Regarding water resources, the Modoc National Forest Land and Resource Management Plan seeks to "maintain and improve the quality of surface water" through the implementation of Best Management Practices (BMPs) among other goals. The plan is available on the Modoc National Forest website (USFS 1991).

3.7.4 GSP Implementation Effects on Existing Land Use

The implementation of this GSP is not expected to affect existing designation of land use.

3.7.5 GSP Implementation Effects on Water Supply

The implementation of this GSP is not expected to influence water supply. Prior to the development of this GSP, the counties had established several policies and ordinances for the management of water and land use in the BVGB. This GSP will incorporate the previous work and will establish sustainable management criteria to continue the successful use of the groundwater resources during the SGMA implementation period and beyond.

3.7.6 Well Permitting

Lassen and Modoc counties both require a permit to install a well. The Lassen County Municipal Code (§7.28.030) states that, "…no person, firm, corporation, governmental agency or any other legal entity shall, within the unincorporated area of Lassen County, construct, repair, modify or destroy any well unless a written permit has first been obtained from the health officer of the county." Further, Modoc County Code (§13.12.020) states that, "…No person shall dig, bore, drill, deepen, modify, repair or destroy a water well … without first applying for and receiving a permit…"

3.7.7 Land Use Plans Outside of the Basin

Areas inside and outside the Basin are subject to the Lassen and Modoc County General Plans or the Modoc National Forest Land Resource and Management Plan. Other land-use plans by organizations such as the BLM also exist in the watershed.

3.8 Management Areas

SGMA allows for the Basin to be delineated into management areas which:

> "…may be defined by natural or jurisdictional boundaries, and may be based on differences in water use sector, water source type, geology, or aquifer characteristics. Management areas may have different minimum thresholds and measurable objectives than the basin at large and may be monitored to a different level. However, GSAs in the basin must provide descriptions of why those differences are appropriate for the management area, relative to the rest of the basin." (DWR 2017)

It should be noted that minimum thresholds and measurable objectives can vary throughout the Basin even without established management areas. The GSAs have not defined management areas within the BVGB.

3.9 Additional GSP Elements, if Applicable

The plan elements from CWC Section 10727.4 require GSPs to address numerous components listed in **Table 3-8**. The table lists the agency or department with whom the GSA will coordinate or where it is addressed in the GSP.

Table 3-8 Plan Elements from CWC Section 10727.4

Element of Section 10727.4	Approach
(a) Control of saline water intrusion	Not applicable
(b) Wellhead protection areas and recharge areas	To be coordinated with county environmental health departments
(c) Migration of contaminated groundwater	Coordinated with RWQCB
(d) A well abandonment and well destruction program	To be coordinated with county environmental health departments
(e) Replenishment of groundwater extractions	Chapter 9, Projects and Management Actions
(f) Activities implementing, opportunities for and removing impediments to, conjunctive use or underground storage	Chapter 9, Projects and Management Actions
(g) Well construction policies	To be coordinated with county environmental health departments
(h) Measures addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects	Coordinated with RWQCB and in Chapter 9, Projects and Management Actions
(i) Efficient water management practices, as defined in Section 10902, for the delivery of water and water conservation methods to improve the efficiency of water use	To be coordinated with county farm advisors
(j) Efforts to develop relationships with state and federal regulatory agencies	Chapter 8, Plan Implementation
(k) Processes to review land-use plans and efforts to coordinate with land-use planning agencies to assess activities that potentially create risks to groundwater quality or quantity	To be coordinated with appropriate county departments.
(l) Impacts on groundwater-dependent ecosystems	Chapter 5, Groundwater Conditions

4. Hydrogeologic Conceptual Model §354.14

A hydrogeologic conceptual model (HCM) is a description of the physical characteristics of a groundwater basin related to the hydrology and geology, which defines the principal aquifer based on the best available information. The HCM provides the context for the water budget (Chapter 6), sustainable management criteria (Chapter 7), and monitoring network (Chapter 8).

This chapter presents the HCM for the BVGB and was developed by GEI Consultants Inc. (GEI) for the Lassen and Modoc GSAs. The content of this HCM is defined by the regulations of SGMA – Chapter 1.5, Article 5, Subarticle 2: 354.14.

Groundwater characteristics and dynamics in the Basin are variable. Located in a sparsely-populated area, the amount of existing data and literature to support this HCM is limited, with the most thorough studies being conducted prior to the 1980s. This HCM provides some limited new data and analyses that further the understanding. With that said, there are many data gaps in the HCM that have been identified in this chapter. The HCM presents best available information and expert opinion to form the basis for descriptions of elements of this GSP: basin boundary, confining conditions, definable bottom, nature of flows near or across faults, soil permeability, and recharge potential. Significant uncertainty exists in this HCM, and stakeholders have expressed concern about the possible regulatory repercussions associated with making decisions using incomplete and/or uncertain information, particularly as the relevance of the information changes under evolving regulatory frameworks.

Recommendations and options for prioritizing and addressing the data gaps are part of this document. The stakeholders in the disadvantaged communities of the BVGB have limited financial means to address data gaps, so the data gaps presented at the end of this chapter are contingent on outside funding.

4.1 Basin Setting

BVGB is located in Lassen and Modoc counties in northeastern California, 50 miles north-northwest of Susanville and 70 miles east-northeast of Redding (road distances are greater). Most of BVGB is in Lassen County (72 percent) with the remainder in Modoc County. At its widest points, the BVGB is approximately 20 miles long (north-south) in the vicinity of the Pit River and 15 miles wide (east-west) south of ACWA. The Basin has an irregular shape totaling about 144 square miles or 92,057 acres. (DWR 2004) The topography of BVGB is relatively flat within the central area with increasing elevations along the perimeter, particularly in the eastern portions where Willow and Ash Creeks enter the Basin. Ground surface elevations range from about 4,100 feet above mean sea level (msl) near the south end of BVGB to over 4,500 feet msl at the eastern edge of the Basin. In the north-central portion of the Basin, two buttes protrude from the valley (Pilot Butte and Roberts Butte). The Pit River enters the BVGB at an elevation of 4,150 feet msl and leaves the Basin at 4,100 feet msl over the course of about 30 river miles, giving the Pit River a gradient of less than 2 feet per mile. By contrast, the Pit River above and below Big Valley has a gradient over 50 feet per mile. This low gradient in the Basin results in a meandering river morphology and widespread flooding during large storm events. Ash Creek enters the Basin at Adin at an elevation of 4,200 feet msl, eventually joining the Pit River when flows are sufficient to make it past Big Swamp. **Figure 4-1** shows the ground topography for the BVGB.

Portions of eight topographic maps (7.5-minute) cover the BVGB area and are named as follows (north-south, west-east):

Donica Mountain	Halls Canyon	
Lookout	Big Swamp	Adin
Bieber	Hog Valley	Letterbox Hill

4.2 Regional Geology and Structure

The regional geology is depicted on the Alturas Sheet (CGS 1958), a 1:250,000 scale map with an excerpt shown on **Figure 4-2**. The BVGB is in the central area of the Modoc Plateau geomorphic province. According to the California Geological Survey (CGS 2002), the Modoc Plateau is, "…a volcanic table land" broken into blocks by north-south faults. The Basin is underlain by a thick sequence of lava flows and tuffs. The volcanic material is variable in composition as described below, is Miocene to Holocene age,[18] and erupted into sediment-filled basins between the block-faulted mountain ranges (Norris and Webb 1990).

According to MacDonald (1966), the Modoc Plateau is transitional between two geomorphic provinces: block faulting of the Basin and Range to the east and volcanism of the Cascade Range to the west. This transition can be observed on **Figure 4-2** with the numerous faults trending north-northwest surrounding Big Valley and the most recent center of volcanism (indicated by the numerous cinders [asterisks] centered around Medicine Lake, with several eruptions about 1000 years before present) about 30 miles northwest of Big Valley. Moreover, the historical volcanism and tectonics occurred concurrently, which disrupted the drainage from the province and resulted in the formation of numerous lakes, including an ancestral lake in Big Valley. Volcanic material was deposited as lava flows, ignimbrites (hot ash flows), subaerial and water-laid layers of ash (cooler), and mudflows combined with sedimentary material, although thick sections of rock can be either entirely sedimentary or volcanic. The composition of the lava flows is primarily basalt[19] and basaltic andesite[20], while pyroclastic[21] ash deposits are rhyolitic[22] composition.

[18] Miocene is 23 million to 5.3 million years ago; Holocene is 12,000 years ago to present.
[19] Basalt is an extrusive (volcanic) rock with relatively low silica content and high iron and magnesium content.
[20] Andesite is an extrusive rock with intermediate silica content and intermediate iron and magnesium content.
[21] Pyroclastic means formed from volcanic eruptions, typically not from lava flows, but from material (clasts) ejected from the eruption such as ash, blocks, or "bombs."
[22] Rhyolitic rocks are extrusive with relatively high silica content and low iron and magnesium. Rhyolites are the volcanic equivalent of granite.

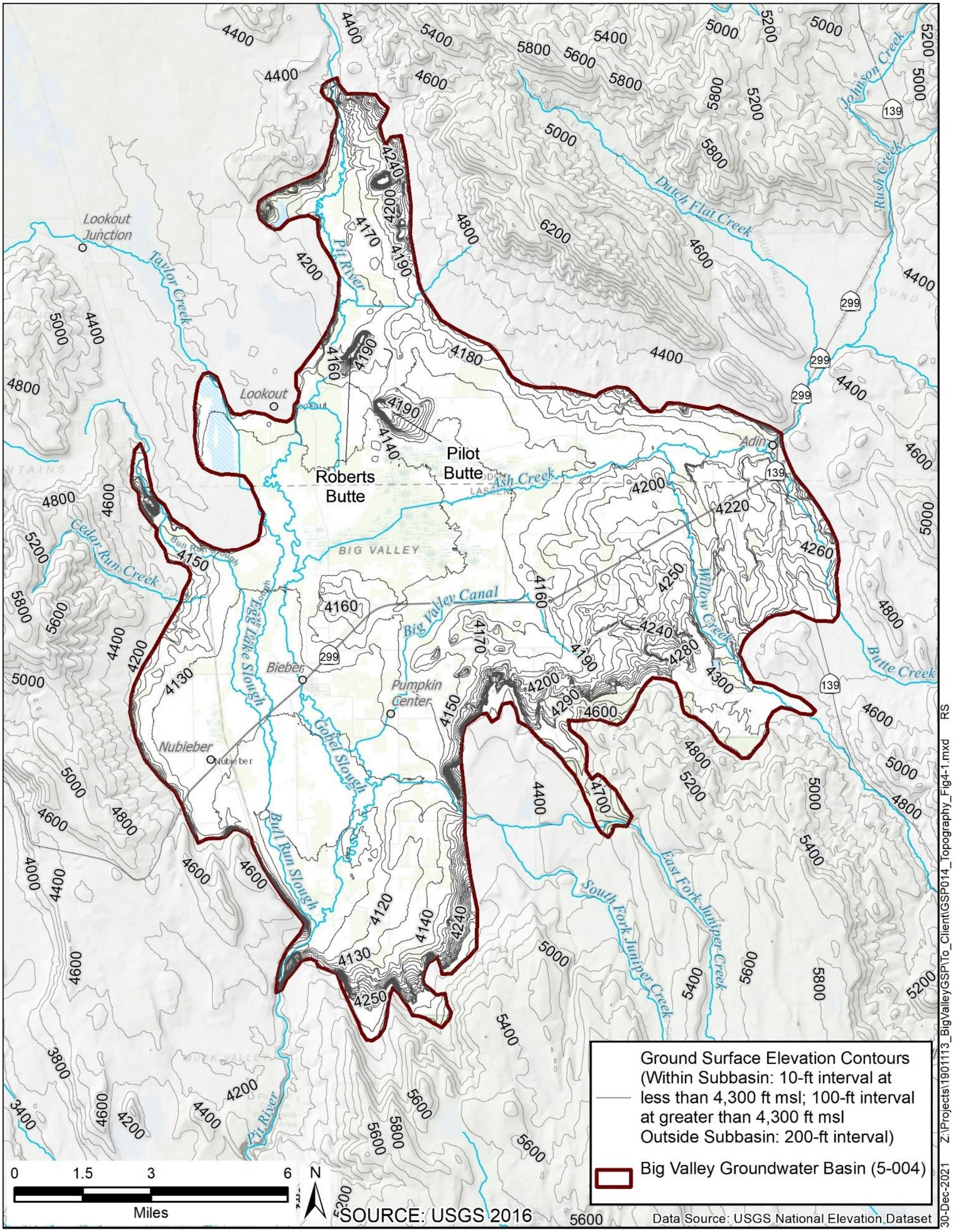


Figure 4-1 Topography

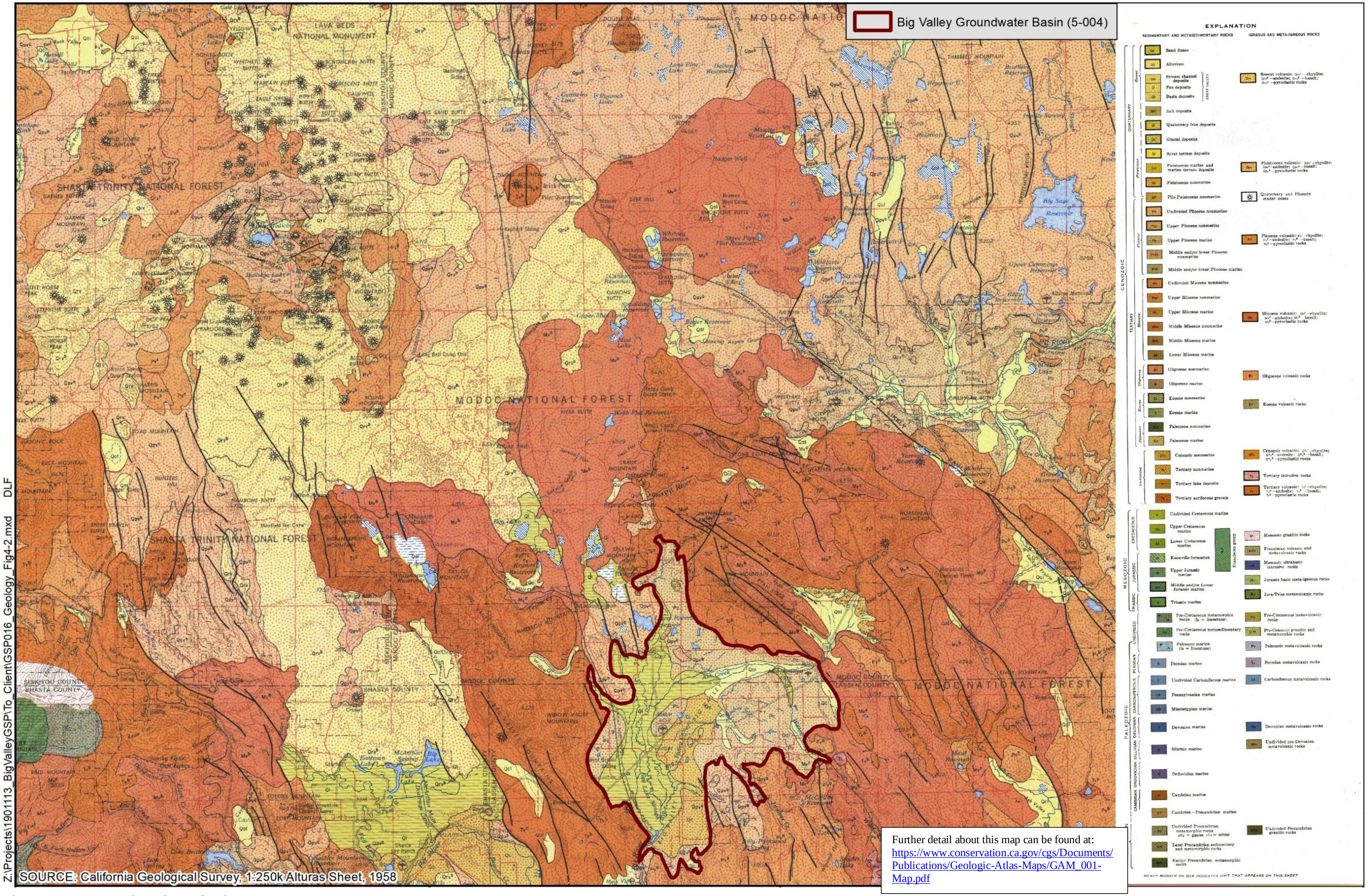


Figure 4-2 Regional Geologic Map

4.2.1 Lateral Basin Boundaries

The CGS (1958) geology map (**Figure 4-2**) was used by DWR to draw the BVGB boundary. That 63-year-old map has proven to be inaccurate in many places, and more recent, more accurate geologic maps are available (DWR 1963, GeothermEx 1975). The lateral boundaries of BVGB are described by DWR (2004) as, "…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." In general, the boundary drawn by DWR was intended to define the contact between the valley alluvial deposits and the surrounding volcanic rocks. Because this boundary was drawn using a regional-scale map from 1958 that was drawn with the surface expression of geologic units, a basin boundary modification at a future date would be more precise and would include the aquifer materials which extend outside of the current boundary. This future modification could include consideration of the "upland recharge areas" described by DWR (1963).

Additionally, the Basin boundary is inaccurate in the southeastern portion of the Basin where two fingers extend into the uplands area. The narrower of the two fingers extends too far into the upland elevations and intersects with East Fork Juniper Creek which doesn't drain into the finger, as shown in **Figure 4-1**. East Fork Juniper Creek naturally flows to the west and is confluent with the Pit River south of Pumpkin Center. A more thorough mapping of the elevations and geologic contacts in the upper area of East Fork Juniper Creek would help to refine the boundary between alluvium and upland volcanics as some areas are clearly not underlain by alluvial deposits.

In the northeastern portion of the Basin, the boundary curves around the base of the Barber Ridge and Fox Mountain. The CGS contact between the alluvium and volcanics here is well below the change in slope of the mountain range. More recent mapping (GeothermEx 1975) extends alluvium 1.5 miles further upslope as shown on **Figure 4-3**. This 1975 mapping also shows other locations along the current basin boundary that should be modified, including the aforementioned narrow finger at East Fork Juniper Creek.

4.3 Local Geology

Several geologic maps were available at a more detailed scale than the CGS (1958) map. Two of them had accompanying studies that more thoroughly described the geology. Although relatively old studies, they both provide useful information. However, they differ slightly on some details, particularly the surface geology. Further refinement of their contacts may be necessary. The two maps are shown on **Figure 4-3** and **Figure 4-4**.

The two different reports were written for different purposes, with DWR (1963) being developed as a general investigation of the potential groundwater resources, and GeothermEx (1975) as a specific investigation of potential hydrothermal groundwater resources. All reviewed sources agree that the BVGB is surrounded by mountain blocks of volcanic rocks of somewhat variable composition, but primarily basalt. Although these mountains are outside of the groundwater basin, they may be underlain by alluvial formations. The mountains capture and accumulate precipitation, which produces runoff that flows into BVGB. Moreover, DWR (1963) stated that these mountains serve as "upland recharge areas"

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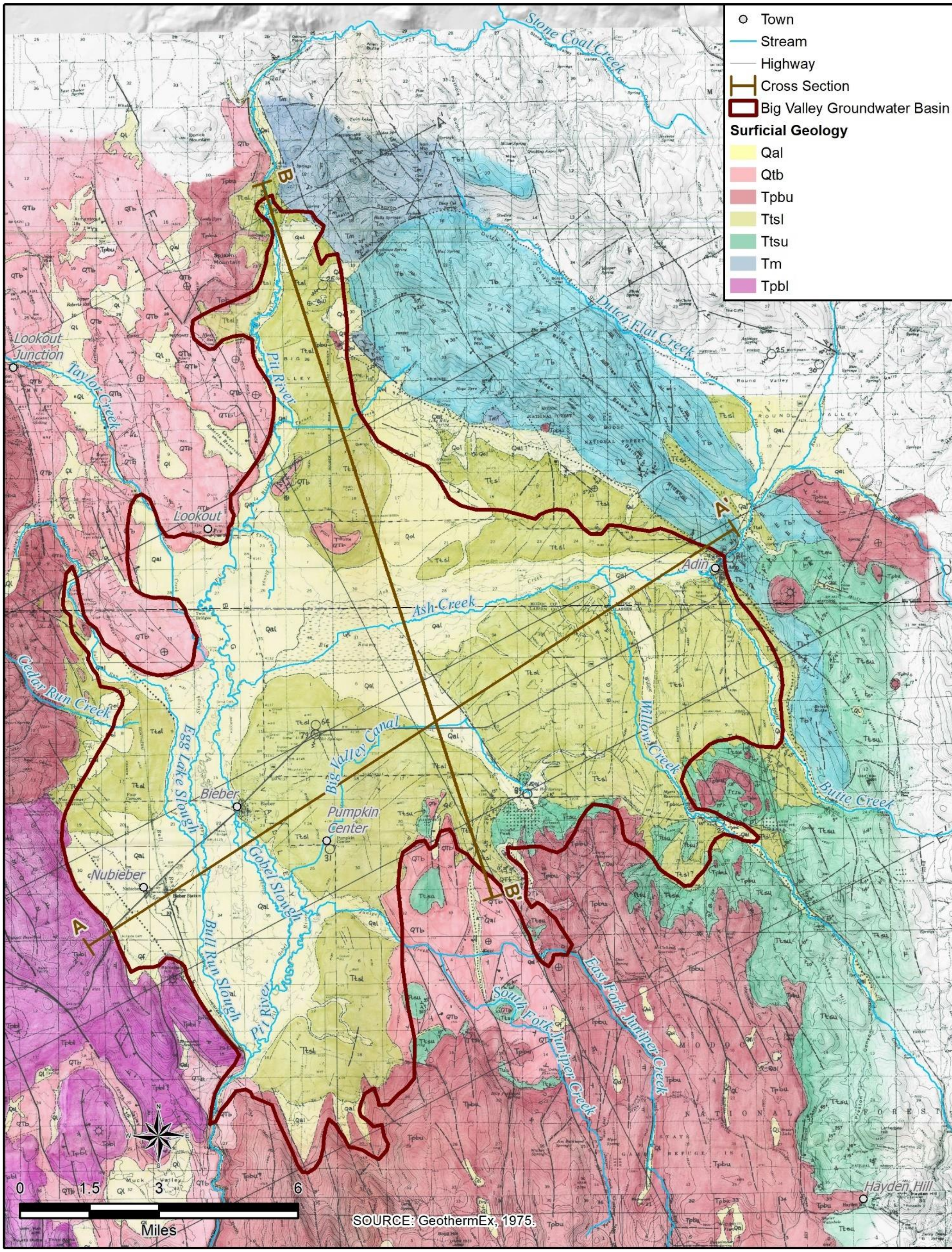
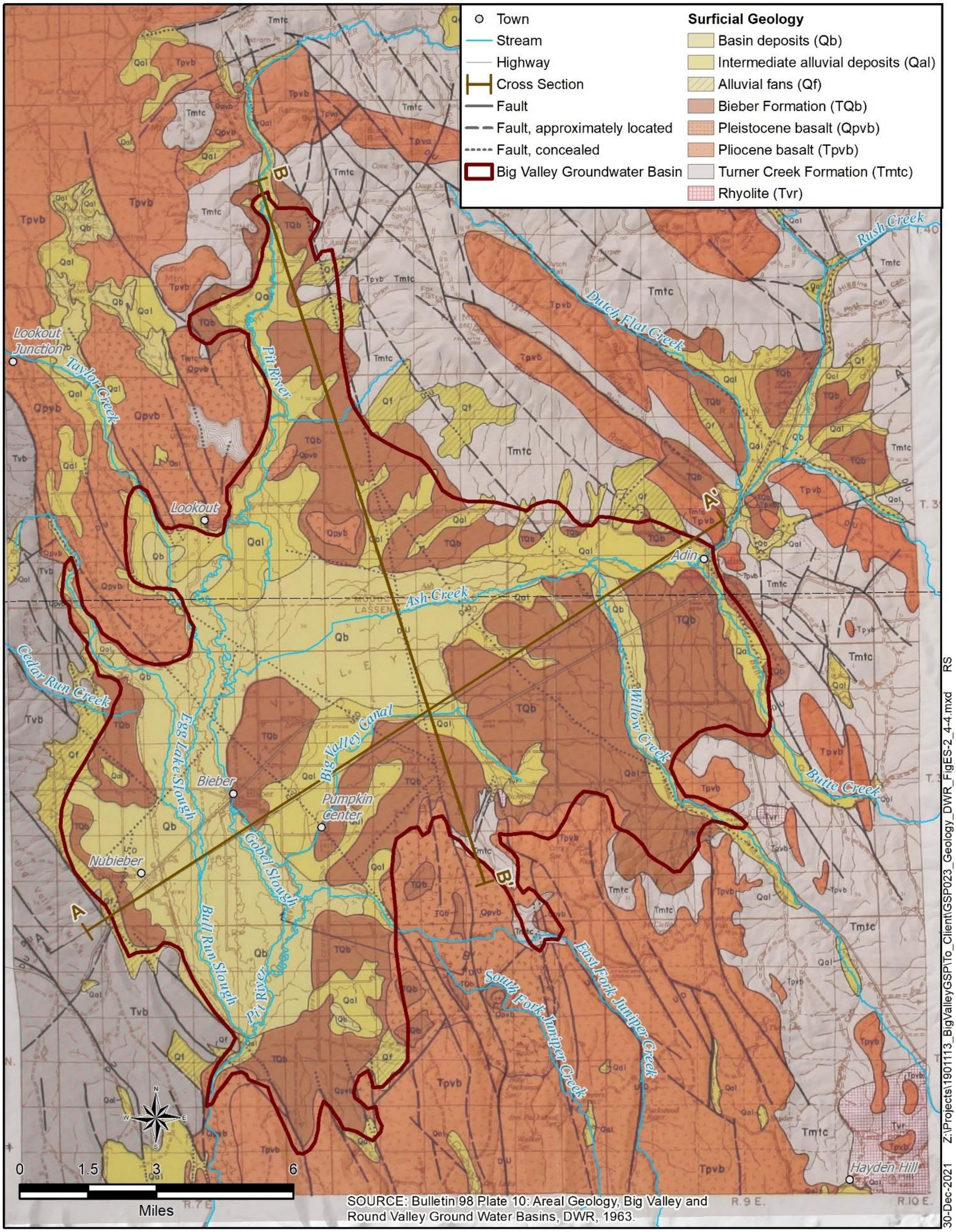


1296 **Figure 4-3 GeothermEx 1975 Local Geologic Map**



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1298 **Figure 4-4 DWR 1963 Local Geologic Map** and provide subsurface recharge to the BVGB. These recharge areas suggested by DWR are shown in red shading on **Figure 4-5** and correlate with Pliocene to Pleistocene[23] basalts (Tpbv and Qpbv). These units are mapped by DWR (1963) outside the Basin to the northwest and southeast, as well as along the crests of Barber and Ryan Ridges to the northeast of Big Valley.[24] GeothermEx (1975) generally concurs with this mapping, except for the areas along Barber and Ryan Ridges, which they map as a much older unit (Miocene), corroborated by a radiometric age date measured at 13.8 million years. This distinction is important because an older unit is more likely to underlie the Basin sediments and is less likely to be hydraulically connected to the BVGB. At the northwestern end of Barber Ridge, GeothermEx mapped the oldest unit in the BVGB area (Tm) of andesitic composition. This unit contains the site of the Shaw Pit quarry.

4.4 Principal Aquifer

4.4.1 Formation Names

The Pliocene-Pleistocene[23] age Bieber Formation (TQb) is the main formation of aquifer material defined within BVGB, and DWR (1963) estimates that it ranges in thickness from a thin veneer to over 1,000 feet. It meets the ground surface around the perimeter of the Basin, especially on the southeast side (DWR 1963). The formation was deposited in a lacustrine (lake) environment and is comprised of unconsolidated to semi-consolidated layers of interbedded clay, silt, sand, gravel, and diatomite[25]. Layers of black sand and white sand (pumiceous) were identified as highly permeable but discontinuous and mostly thin. GeothermEx (1975) did not embrace the DWR name and identified this formation as an assemblage of tuffaceous, diatomaceous lacustrine, and fluvial sediments (Ttsu, Ttsl). Both investigations identified the formation in the same overall location based on a comparison of the two geologic maps, but the GeothermEx map provides more detail and resolution than the DWR map. For the purposes of the GSP, the name Bieber Formation will be used.

Recent Holocene[26] deposits (labeled with Q) were mapped within the center of the Basin and along drainage courses from the upland areas and are identified by DWR (1963) as alluvial fans (Qf), intermediate alluvium (Qal) and Basin deposits (Qb). The composition of these unconsolidated deposits varies from irregular layers of gravel, sand and silt with clay to poorly sorted silt and sand with minor clay and gravel (Qal) to interbedded silt, clay and "organic muck" (Qb). The latter two deposits occur in poorly drained, low-lying areas where alkali[27] could accumulate. The thickness of these sediments is estimated to be less than 150 feet. GeothermEx (1975) identified these deposits as older valley fill (Qol), lake and swamp deposits (Ql), fan deposits (Qf) and undifferentiated alluvium (Qal). All these recent deposits are aquifer material[28] and are part of the Big Valley principal aquifer. There is discrepancy

[23] 5.3 million years to 12 thousand years ago.

[24] The GSAs specifically requested a basin boundary modification to include these upland recharge areas within the Basin boundary. The request was denied by DWR as not being sufficiently substantiated. (*See* **Appendix 1A**)

[25] Diatomite is a fine-grained sedimentary rock made primarily of silica, and is formed from the deposition of diatoms, which are microscopic creatures with shells made from silica.

[26] Recent geologic period from 12 thousand years old to present.

[27] Alkali means relatively high in alkali and alkali earth metals (primarily sodium, potassium, calcium, and magnesium) and generally results in a high pH (greater than 7 or 8).

[28] Meaning they contain porous material with recoverable water.

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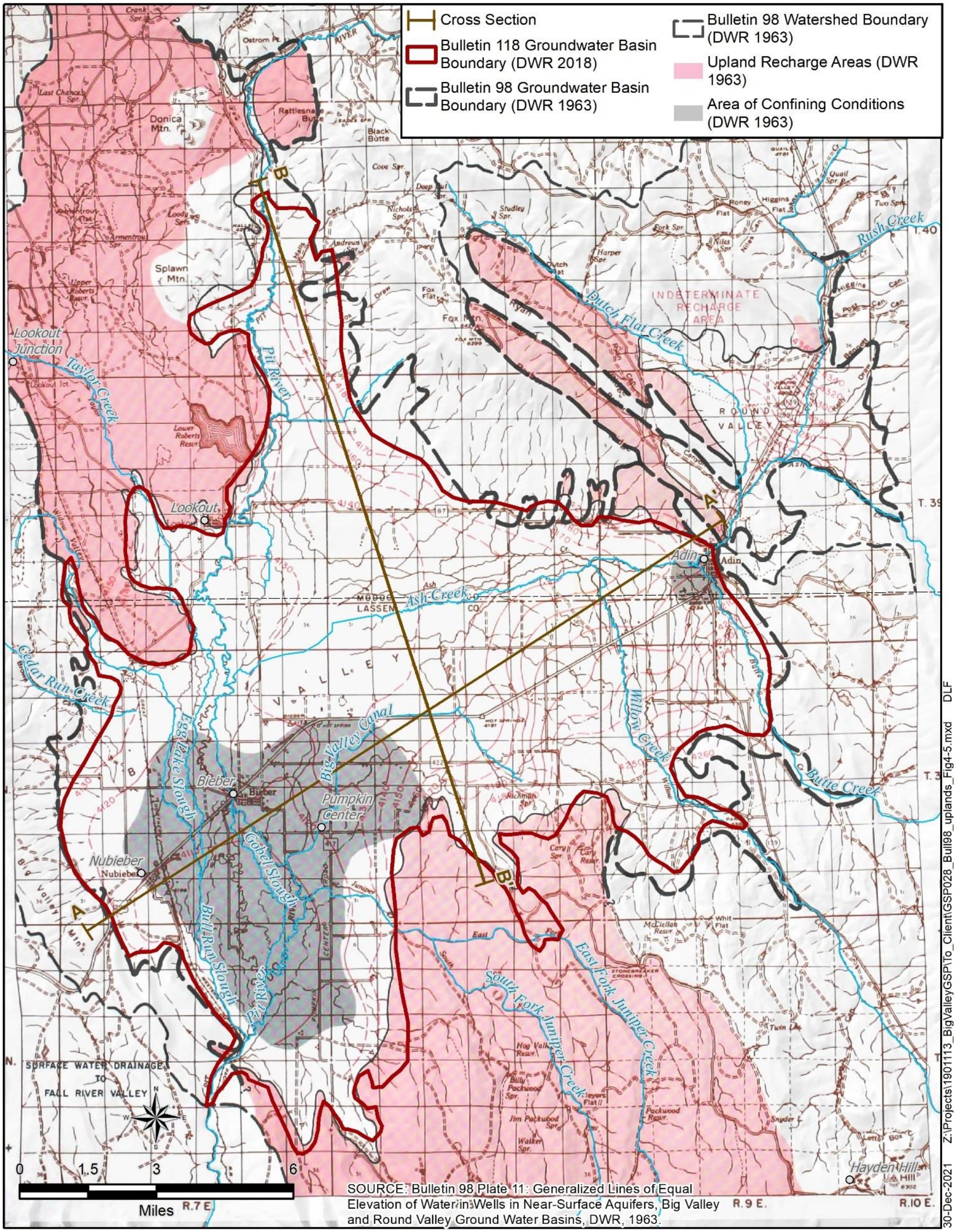


1332 **Figure 4-5 DWR 1963 Upland Recharge Areas and Areas of Confining Conditions** between the two maps in the northeastern portion of the Basin, where GeothermEx extends the alluvial sediments much further upslope toward Barber Ridge and Fox Mountain as discussed in Section 4.3 – Local Geology.

The principal aquifer consists of the Bieber Formation (TQb and recent deposits (Qal, Qg, Qb)). While DWR (1963) delineates an "area of confining conditions" in the southwest area of the Basin on **Figure 4-5**, the data to support the confinement and the definition of a broad-scale, well-defined aquitard[29] is not currently available.

As described herein, aquifer conditions vary greatly throughout the Basin. However, clearly defined, widespread distinct aquifer units have not been identified, and with the data currently available all the water bearing units in the Basin are defined as a single principal aquifer for this GSP.

4.4.2 Geologic Profiles

Figure 4-6 and **Figure 4-7** show cross-sections across Big Valley. The locations of the cross-sections are shown on **Figure 4-3**, **Figure 4-4** and **Figure 4-5**. The locations of these sections were drawn to be similar to those drawn by DWR (1963) and GeothermEx (1975) and characterize the aquifers in two directions (southwest-northeast and northwest-southeast). The sections show the lithology of numerous wells across the Basin. Very little geological correlation could be made across each section which is likely to be related to the concurrent block faulting and volcanic and alluvial depositional input from various highland areas flowing radially into Big Valley. These complex structural and depositional variables result in great stratigraphic variation over short distances. The pertinent information from cross-sections presented by DWR (1963) and GeothermEx (1975) are shown on the sections.

4.4.3 Definable Bottom

The SGMA and DWR GSP regulations do not provide clear guidance for what constitutes a "definable bottom" of a basin. However, DWR (2016a) Bulletin 118 Interim Update describe the "physical bottom" as where the porous sediments contact the underlying bedrock and the "effective bottom" as the depth below which water could be unusable because it is brackish or saline.

The "physical bottom" of BVGB is difficult to define because few borings have been drilled deeper than 1200 feet and the compositions of the alluvial and bedrock formations are similar (derived from active volcanism), with contacts that are gradational. Also, some of the lavas most likely flowed into Big Valley forming lava lenses that are now interlayered with permeable aquifer sediments. Moreover, the base of the aquifer system is likely variable across BVGB due to the concurrent volcanism and horst/graben faulting of the bedrock.

The deepest lithologic information in the Basin is derived from two test borings by DWR to depths of 1843 and 1231 feet and from two geothermal test wells near Bieber to depths of 2125 and 7000 feet. The 7000-foot well is east of Bieber, but only has lithologic descriptions to a depth of 4100 feet, including descriptions of aquifer-type materials (sands) throughout. The other three deep lithologies give similar indication of aquifer material to their total depth.

[29] Layer of low permeability that prevents significant flow, except at very slow rates.

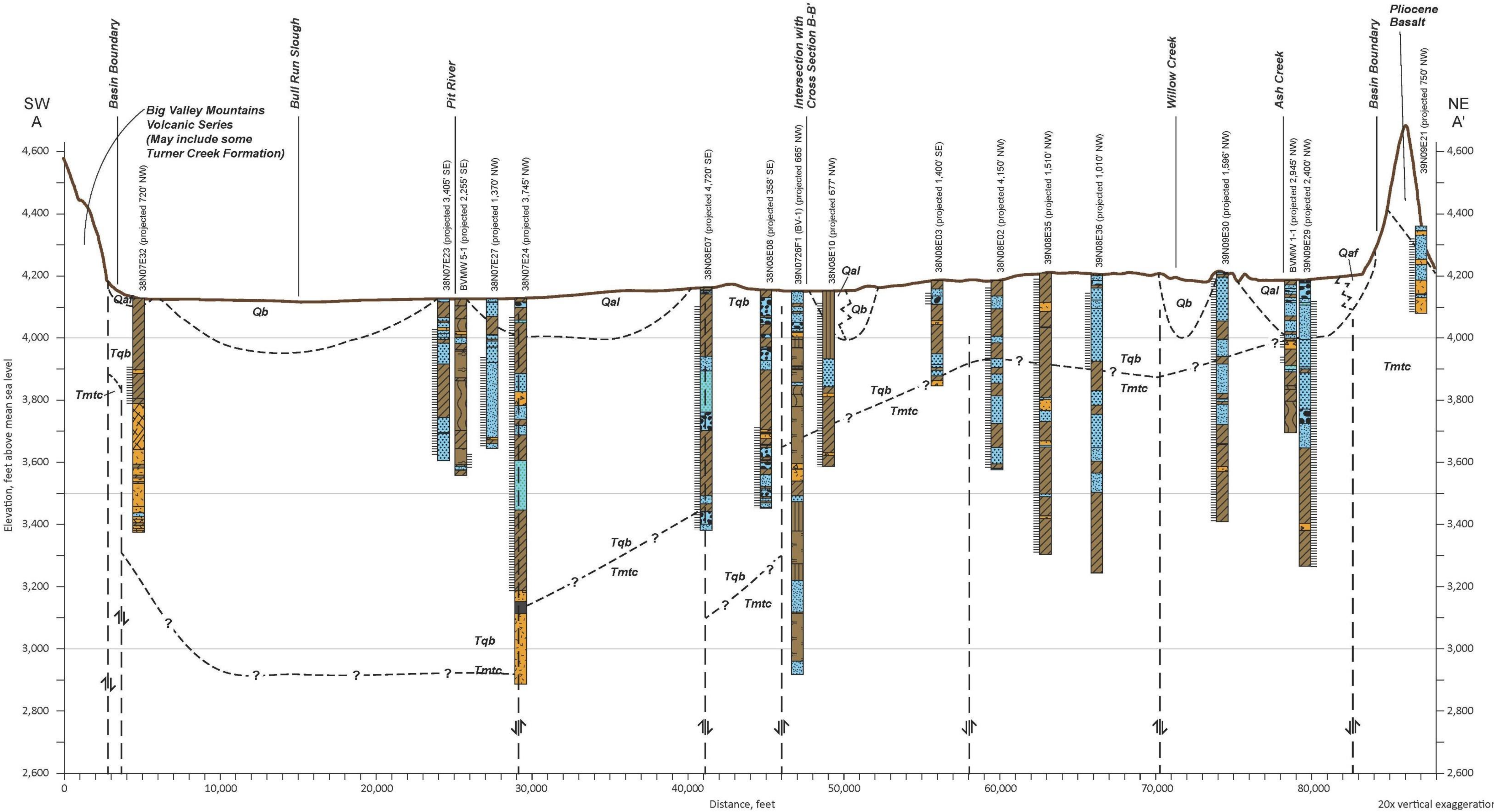
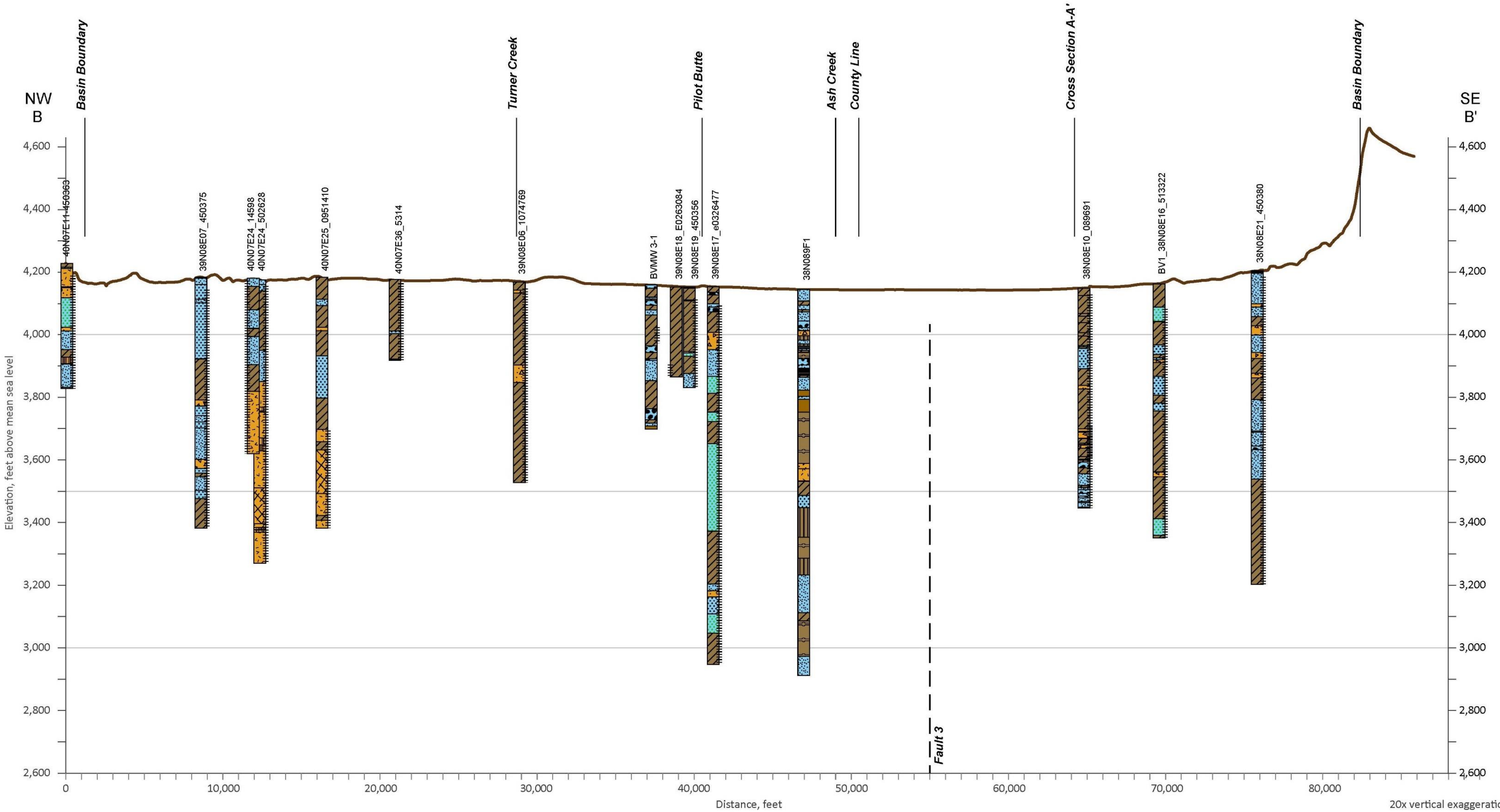


Figure 4-6 Geologic Cross Section A-A'



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1373 **Figure 4-7 Geologic Cross Section B-B'**

The two geothermal wells also had temperature logs and some water quality. Water temperatures increased to over 100°F at depths of about 2000 to 3000 feet. One of them located near the Bieber School had water quality samples collected from the 1665- to 2000-foot interval and indicated water quality higher in total dissolved solids (632 milligrams per liter) than is present in shallower portions of the Basin.

The information from these two wells indicated that temperature and water quality concerns increase with depth, but a clear delineation of where water becomes unusable cannot be determined with the data available. With limited scientific evidence to clearly define a physical or effective bottom of the aquifer, an approach to define a practical bottom is being used to satisfy the GSP Regulations which require the aquifer bottom to be defined (§ 354.14(a)(1)), as described below.

The approach for defining the practical bottom is to ensure that all known water wells are included within the aquifer. DWR's well log inventory shows that over 600 wells have been installed in the BVGB. Although DWR's well log inventory does not completely and precisely assess the total number or status of the wells (e.g. abandoned), it is the only readily-available data. The well inventory has been identified as a data gap within this GSP. Wells in this inventory with known depths are summarized in **Table 4-1**. The only borings drilled deeper than 1,200 feet are the two DWR test borings and two geothermal wells discussed previously.

Table 4-1 Well Depths in DWR Inventory

Depth Interval (ft bgs)	Deepest Well per Section[a]		Count of All Wells
< 200	10%		41%
200 – 400	16%	43%	25%
400 – 600	27%		17%
600 – 800	28%	42%	12%
800 – 1000	14%		4%
1000 – 1200	4%		1%
> 1200[b]	1%		< 1%

Notes:
[a] Section is a 1 mile by 1 mile square. There are 134 sections in the BVGB
[b] Test borings: BV-1 and BV-2 were drilled deeper than 1200 feet

For this GSP, the "practical bottom" of the aquifer is set at 1200 feet but may extend to 4,100 or deeper. This delineation of 1200 feet is consistent with DWR's approach, established over 50 years ago, which declared a practical bottom of 1000 feet. A depth of 1200 feet encompasses the levels where groundwater can be accessed and monitored for beneficial use but does not preclude drilling and pumping from greater depths.

4.4.4 Structural Properties with Potential to Restrict Groundwater Flow

Faults can sometimes affect flow, but sufficient evidence has not been gathered and analyzed to determine whether any of the faults in Big Valley restrict or facilitate flow. The mountains around BVGB are heavily faulted, with older basalt units more faulted than younger basalt units.

Most of the faults trend to the north/northwest with some perpendicular faulting oriented northeasterly. **Figure 4-8** is an excerpt of the regional fault map by the California Geological Survey (2010). Faults on the western side of BVGB are shown to be Quaternary in age, while faults on the eastern side are pre-Quaternary (older than 2.6 million years). Note that numerous faults to the west of BVGB were identified as late Quaternary to Holocene-age faults (displacement during the last 700,000 years or within the last 12 thousand years, respectively).

Some of the faults extend across the Basin, concealed beneath the alluvial materials. Two hot springs are located in the Basin near these faults. DWR (1963) acknowledged the potential restriction of groundwater flow by faults but did not provide specific information. However, such fault impacts on groundwater flow cannot be determined with certainty at this time with the available groundwater level data, given the limited number and the wide spacing of wells, and the absence of a pumping test to verify restricting conditions.

4.4.5 Physical Properties and Hydraulic Characteristics

The physical properties of a groundwater system are typically defined by the hydraulic conductivity,[30] transmissivity,[31] and storativity[32] of the aquifer. The preferred method of defining hydraulic characteristics is a pumping test with pumping rates and water levels monitored (either in the pumping well or preferably a nearby monitoring well) throughout the test. Such pumping tests were performed after the construction of five sets of monitoring wells (MWs) in late 2019 and early 2020.

The tests were performed by pumping each 2.5-inch-diameter MW for 1 hour at a rate of 8 gpm while measuring water level drawdown in the pumping well. A well efficiency[33] of 70 percent was assumed, and the length of the well screen was used as a proxy for the aquifer thickness (b). **Table 4-2** shows the results of the Theis[34] solution that best matched the drawdown curve at each well. Storativity (S) ranged from highly confined (3.0×10^{-6} at BVMW 3-1) to unconfined (1.5×10^{-1} at BVMW 4-1).

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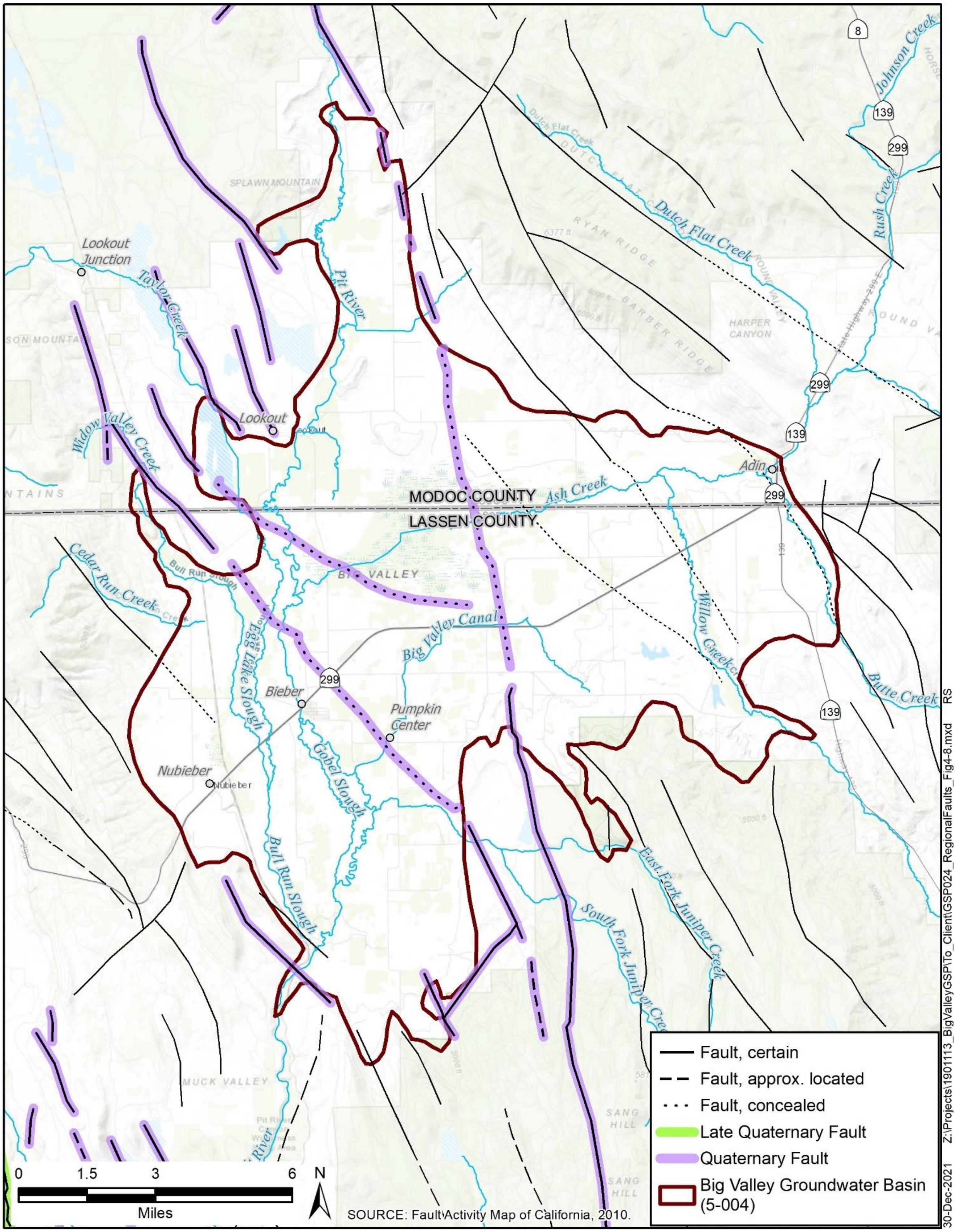
[30] Hydraulic conductivity (K) is defined as the volume of water that will move in a unit of time under a unit hydraulic gradient through a unit area. It is a measure of how easily water moves through a material and is usually given in gallons per day per square foot (gpd/ft^2) or feet per day (ft/d).

[31] Transmissivity (T) is the product of K and aquifer thickness (b) and is a measure of how easily water moves through a thickness of aquifer. It is usually expressed in units of gallons per day per foot of aquifer (gpd/ft) or square feet per day (ft^2/day).

[32] Storativity (S, also called storage coefficient) is defined as the volume of water that an aquifer releases from or takes into storage per unit surface area per unit change in groundwater elevation. High values of S are indicative of unconfined or water table aquifers, while low values indicate confined (pressurized) aquifers. S does not have units.

[33] A pumping well will experience more groundwater level drawdown than a nearby non-pumping well due to inefficiency in the movement of groundwater from the aquifer into the well. The predicted drawdown divided by the actual drawdown is well efficiency.

[34] Theis is a mathematical solution to estimate K, T, and S and is based on pumping rate and the resultant rate of groundwater level drawdown (Theis, 1935).



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1426 **Figure 4-8 Local Faults**

Table 4-2 Aquifer Test Results

Parameter	Units	BVMW 1-1	BVMW 2-1	BVMW 3-1	BVMW 4-1	BVMW 5-1
Well depth	ft	265.5	250.5	185.5	425	540
Thickness[a] (b)	ft	50	40	50	30	50
Flow (Q)	gpm	8	8	8	8	8
Drawdown after 1 hour	ft	4.3	16.0	27.5	2.0	3.0
Transmissivity (T)	gpd/ft	3000	750	700	4200	4500
Storativity (S)	unitless	1.5x10^{-3}	1.0 x10^{-3}	3.0x10^{-6}	1.0 x10^{-1}	2.0 x10^{-3}
Hydraulic Conductivity (K)	ft/d	8	3	2	19	12

[a] Assumed to be the length of the screen interval

Source: GEI 2021

Hydraulic conductivity (K) ranged from 2 feet per day (ft/d) to 19 ft/d, which is consistent with silty sand and clean, fine sand. The K values may range higher since pumping tests in larger wells with larger pumps for longer periods of time tend to give higher T and K values. The results of these five pumping tests are documented further in **Appendix 4A**. More thorough assessment of Basin aquifer characteristics is needed and is identified as a data gap.

Specific yield (SY) is another important aquifer characteristic, as it defines the fraction of the aquifer that contains recoverable water and therefore governs the volume of groundwater stored in the Basin. Reclamation (1979) discussed the SY in Big Valley and postulated that it varies with depth, at 7 percent for the first 100 ft bgs, 6 percent for the 100 to 200 ft bgs and 5 percent from 200 to 1000 ft bgs. However, Reclamation doesn’t give any supporting evidence for these percentages. SY in the Sacramento Valley has been estimated to vary between 5 to 10 percent (DWR 1978). Since Big Valley aquifer materials were primarily deposited in a lacustrine environment (as opposed to Sacramento Valley which has a higher percentage of riverine deposits), Big Valley’s SY is likely on the lower end at 5 percent. This conservative percentage was used in the original GSP for calculations related to the total storage and change in storage.

For the revised GSP, West Yost reexamined the assumptions for SY by reviewing lithologic descriptions from well completion reports for select wells within the Basin. SYs were calculated in the upper 150 feet (i.e., the approximate total range over which the water table has fluctuated and is expected to fluctuate) using twelve of the monitoring network’s well completion reports by assigning SYs based on lithologic descriptions (Johnson, 1967; **Figure 4-9**). Following estimation of SYs by depth, a weighted average was calculated for the upper 150 feet of the borehole, or the approximate maximum depth that groundwater levels have reached within the basin. The average SYs for each borehole were used to interpolate a SY “surface” across the Basin. Average estimated SYs ranged from approximately 3 to 16 percent in the upper 150 feet across the Basin and averaged 6.85 percent.

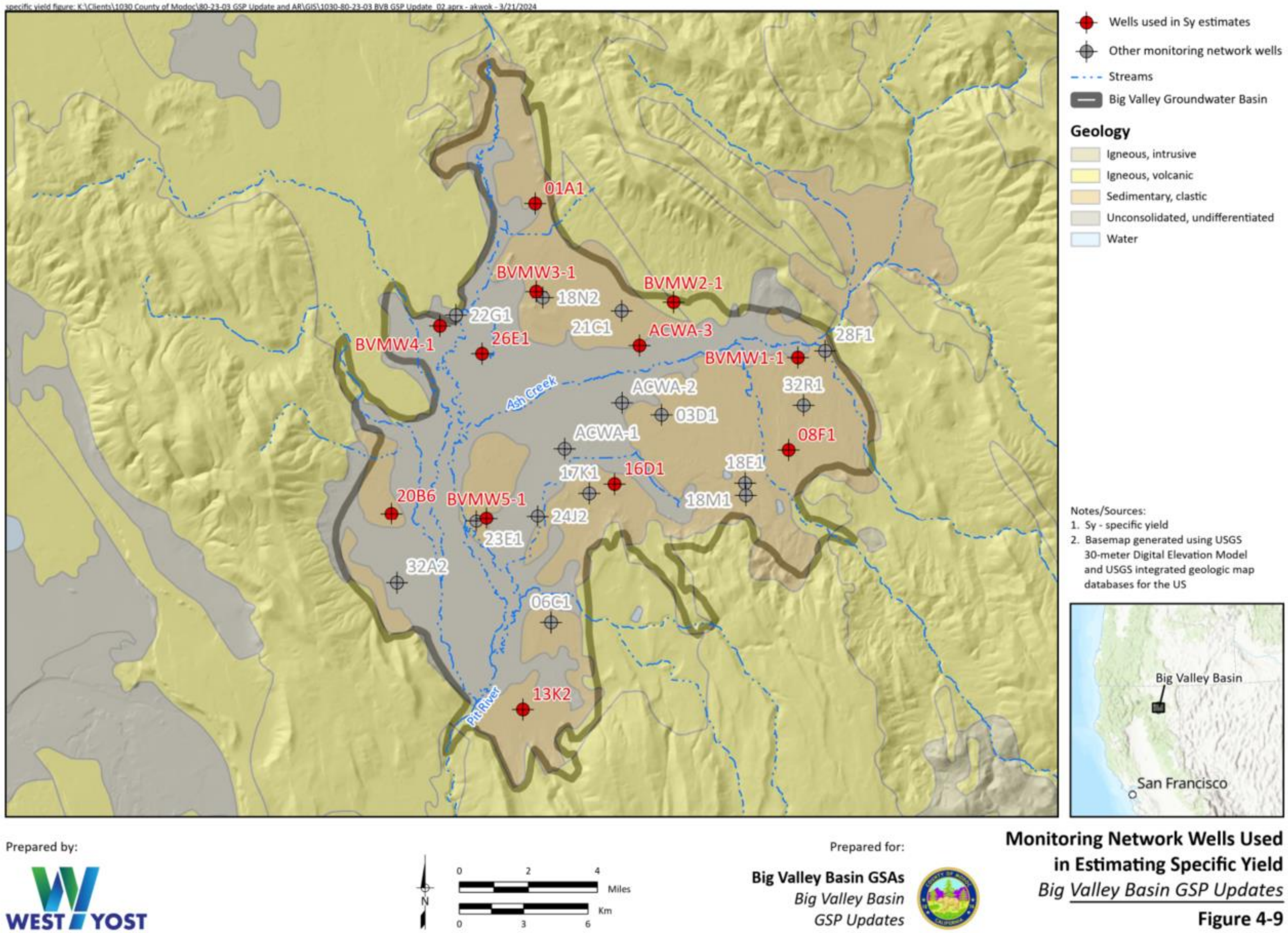

Figure 4-9 Monitoring Network Wells Used in Estimating Specific Yield

4.5 Soils

Information on soils within the BVGB were obtained from the Soil Survey Geographic Database (SSURGO) of the NRCS. The SSURGO data includes two categories of information relevant to the GSP: taxonomic soil orders and hydrologic soil groups. Taxonomic data include general characteristics of a soil and the processes of formation, while hydrologic data relate to the soil's ability to transmit water under saturated conditions and is an important consideration for hydrology, runoff, and groundwater recharge. The following section describes the soils of BVGB.

4.5.1 Taxonomic Soil Orders

Of the 12 established taxonomic soil orders, three were found within the BVGB, as listed below, and their distributions are presented in **Figure 4-10**. Descriptions below were taken from the Illustrated Guide to Soil Taxonomy (NRCS, 2015):

- Alfisol – Naturally fertile soils with high base saturation and a clay-enriched subsoil horizon. Alfisols develop from a wide range of parent materials and occur under broad environmental conditions, ranging from tropical to boreal. The movement of clay and other weathering products from the upper layers of the soil and their subsequent accumulation in the subsoil are important processes. The soil-forming processes are in relative balance. As a result, nutrient bases (such as calcium, magnesium, and potassium) are supplied to the soil through weathering, and the leaching process is not sufficiently intense to remove them from the soil before plants can use and recycle them.

    - Mollisol – Very dark-colored, naturally very fertile soils of grasslands. Mollisols develop predominantly from grasslands in temperate regions at mid-latitudes and result from deep inputs of organic matter and nutrients from decaying roots, especially the short, mid, and tall grasses common to prairie and steppe areas. Mollisols have high contents of base nutrients throughout their profile due to mostly non-acid parent materials in environments (subhumid to semiarid) where the soil was not subject to intense leaching of nutrients.

    - Vertisol – Very clayey soils that shrink and crack when dry and expand when wet. Vertisols are dominated by clay minerals (smectites) and tend to be very sticky and plastic when wet and very firm and hard when dry. Vertisols are commonly very dark in color and distinct soil horizons are often difficult to discern due to the deep mixing (churning) that results from the shrink-swell cycles. Vertisols form over a variety of parent materials, most of which are neutral or calcareous, over a wide range of climatic environments, but all Vertisols require seasonal drying.

Mollisols are the most prominent soil order within the BVGB occupying nearly 78 percent of the total area. Vertisols occupy over 16 percent and are found mostly on the southwestern side of BVGB within the floodplain of the Pit River. Small patches of Vertisols are scattered in the remainder of the Basin. Alfisols occupy over 5 percent of the Basin and are found mostly on the west side of the Basin and along Hot Spring Slough in the south-central portion of the Basin.

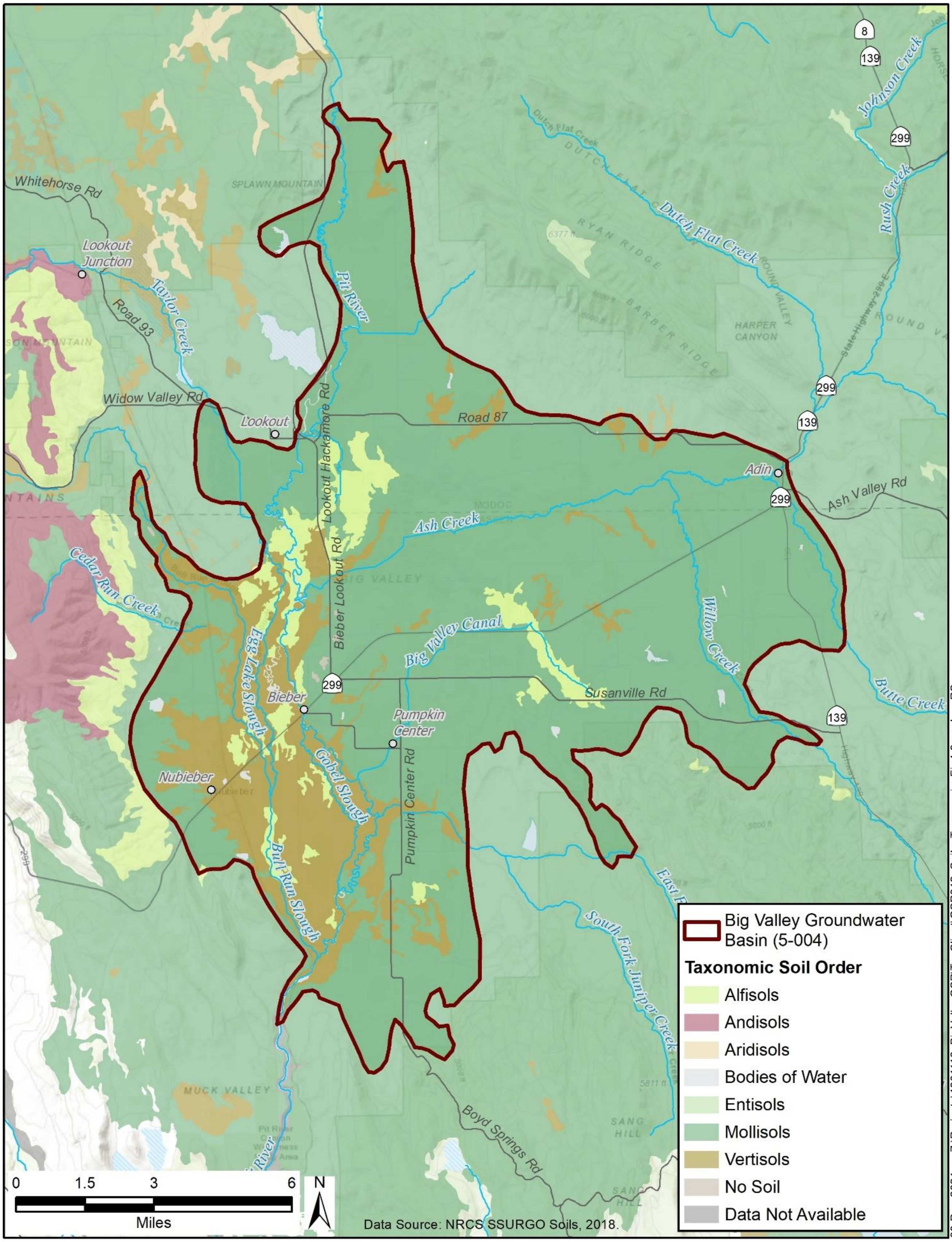

Figure 4-10 Taxonomic Soils Classifications

4.5.2 Hydrologic Soil Groups

The NRCS Hydrologic Soils Group (HSG) classifications provide an indication of soil infiltration potential and ability to transmit water under saturated conditions, based on hydraulic conductivities of shallow, surficial soils. **Figure 4-11** shows the distribution of the hydrologic soil groups, where higher conductivities (greater infiltration) are labeled as Group A and lowest conductivities (lower infiltration) as Group D. As defined by the NRCS (2012), the four HSGs are:

- Hydrologic Group A – "Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10% clay and more than 90% sand or gravel and have gravel or sand textures." Group A soils have the highest conductivity values (greater than 5.67 inches per hour [in/hr]) and therefore a high infiltration rate.

Hydrologic Group B – "Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission is unimpeded. Group B soils typically have between 10 and 20% clay and 50 to 90% sand and have loamy sand or sandy loam textures." Group B soils have a wide range of conductivity values (1.42 in/hr to 5.67 in/hr), and a moderate infiltration rate.

- Hydrologic Group C – "Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 and 40% clay and less than 50% sand and have loam, silt loam, sandy clay loam, clay loam and silty clay loam textures." Group C soils have a relatively low range of conductivity values (0.14 to 1.42 in/hr), and a slow infiltration rate.
- Hydrologic Group D – "Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40% clay, less than 50% sand and have clayey textures. In some areas, [Group D soils] also have high shrink-swell potential." Group D soils have conductivity values less than 0.14 in/hr, a very slow infiltration rate.

A dual hydrologic group (C/D) is assigned to an area to characterize runoff potential under drained and undrained conditions, where the first letter represents drained conditions, and the second letter applies to undrained conditions.

According to this HSG dataset, BVGB does not show high infiltration rates (Group A) and only a tiny area (<0.1%) of Group B soil (moderate infiltration) are present, located on the western edge of the Basin at the top of Bull Run Slough near Kramer Reservoir. The remainder of the Basin is shown with hydrologic soils Groups C and D, slow to very slow infiltration rates (Group C at 30% and Group D at 58% of Basin area). Most of the ACWA is underlain by the dual hydrologic group C/D (11% of Basin area) and due to the wetland nature of this area contains primarily undrained soils corresponding to the very slow infiltration rates.

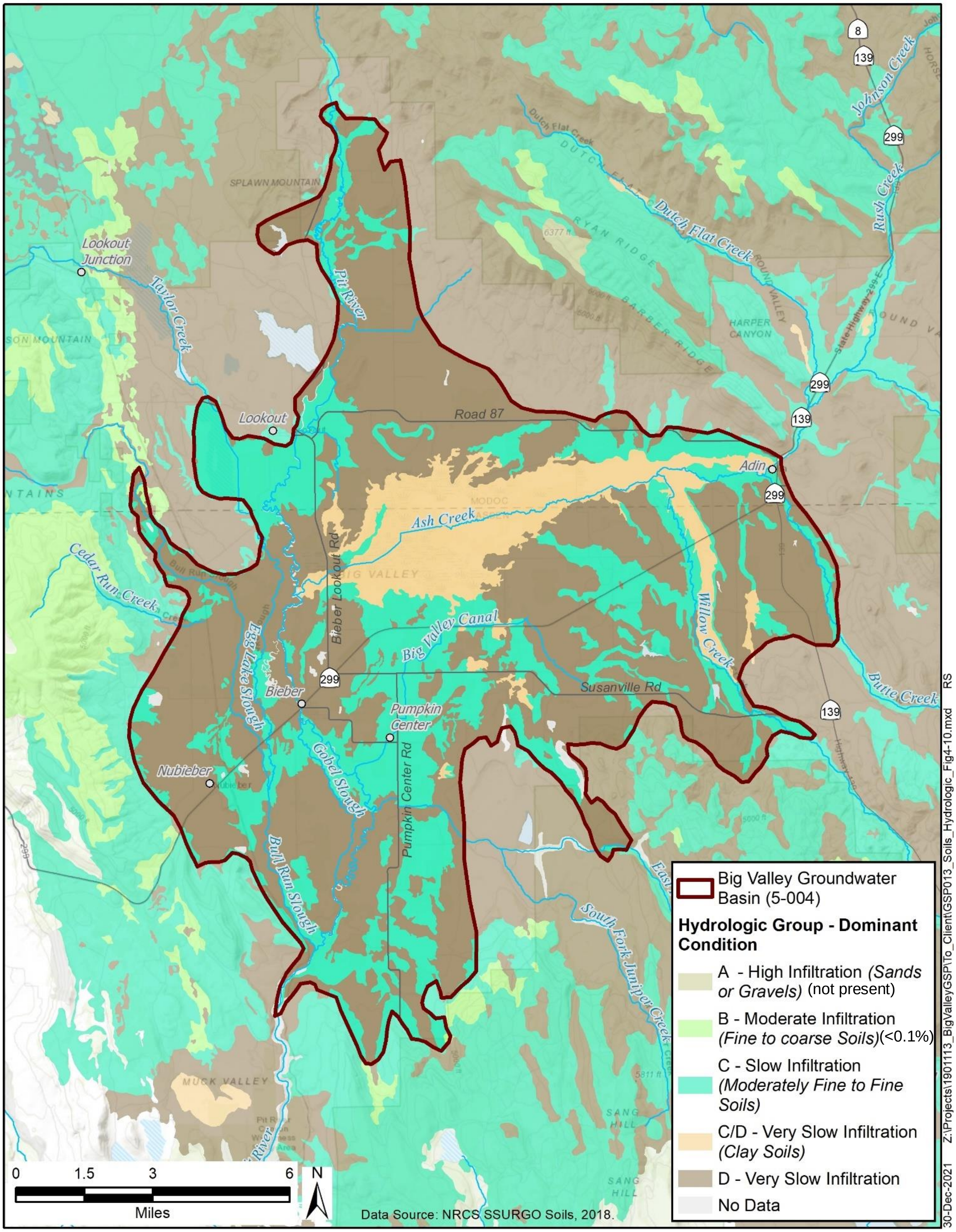

Figure 4-11 Hydrologic Soils Group Classifications

It should be noted that the NRCS develops these maps using a variety of information including remote sensing and some limited field data collection and does not always capture variations that may occur on a small scale. Historical experience from landowners and additional field data could identify areas of better infiltration. These soils groups do not necessarily preclude vertical movement of water and, while recharge may be slower than desired, recharge is still possible. Additionally, Group C and D soils may have slow infiltration rates due to shallow hardpan, and groundwater recharge could potentially be enhanced if this hardpan can be disrupted. Soil permeability has been identified as a data gap, particularly at the small scale.

4.5.3 Soil Agricultural Groundwater Banking Index

The University of California at Davis has established the Soil Agricultural Groundwater Banking Index (SAGBI) using data within the SSURGO database, which gives a rating of suitability of the soils for groundwater recharge. This index expands on the HSG to include topography, chemical limitations, and soil surface condition. This effort has resulted in a mapping tool that illustrates six SAGBI classes (excellent-very poor) and has been completed for much of the state. This mapping tool is only available for the Modoc County portion of BVGB as shown on **Figure 4-12**, and the index varies mostly between moderately poor to very poor. Small areas of moderately good are present along the Pit River as it enters BVGB and to the west of Adin. It should be noted that the SAGBI is a large-scale, planning level tool and does not preclude local site conditions that are good for groundwater recharge.

4.6 Beneficial Uses of Principal Aquifer

Primary beneficial uses of groundwater in the BVGB include agricultural, environmental, municipal and domestic uses. A description of each is provided below.

Agricultural

Agricultural users get their supply from surface-water diversions, groundwater, or a combination of the two. **Figure 3-6** from the previous chapter illustrates DWR's estimate of the primary source being used around the Basin. The primary crops are grain and hay crops (primarily alfalfa) with some wild rice. Agricultural use provides numerous environmental benefits and the majority of wildlife habitat in the Basin. (Albaugh 2021)

Industrial

Industrial groundwater use is limited in the BVGB. According to DWR well logs, six industrial wells have been drilled, all of them near Bieber at Big Valley Lumber, which is not currently in operation. **Figure 3-5** shows some areas of industrial use, but more use is likely present throughout the Basin as agricultural users have some associated industrial needs.

Environmental

Environmental uses for wetland and riparian botanical and wildlife habitat occur within the ACWA in the center of the Basin, near the overflow channels adjacent to the Pit River in the southern portion of the Basin, and along the riparian corridors of some of the minor streams that flow into Big Valley. Additionally, private lands throughout the Basin provide for environmental uses, including those enrolled in the CRP and WRP programs discussed in Section 3.3.

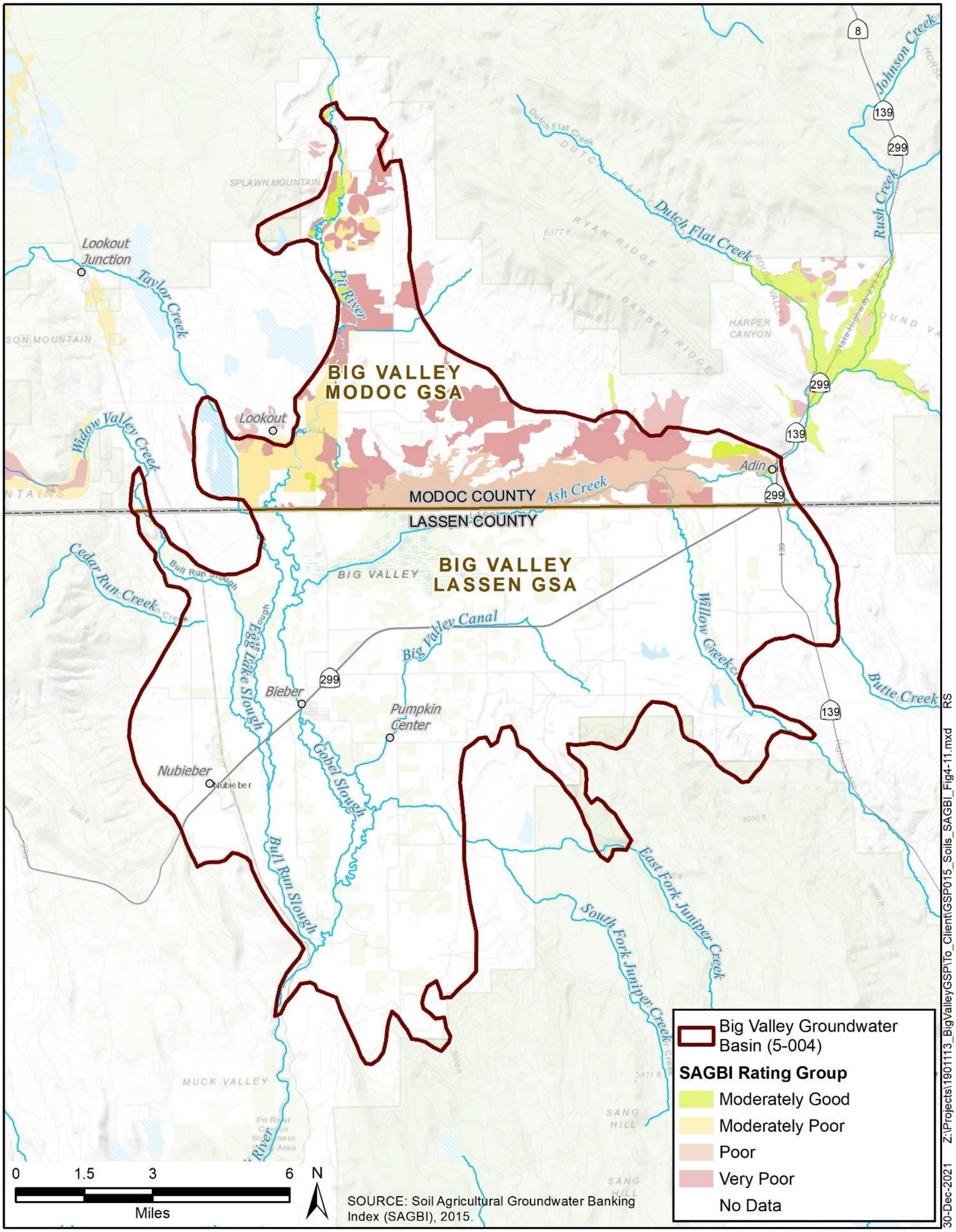

Figure 4-12 SAGBI Classifications

Municipal

The State Water Board recognizes three public water systems that use groundwater under the purview of the DDW: LCWD #1 which serves the community of Bieber, the Forest Service Station in Adin (a non-community, non-transient system), and the CAL FIRE conservation camp west of the Basin whose well is located within the Basin boundary.

Domestic

Domestic users include residents who use their own wells for household purposes. The BVGB has a population of about 1,046. With the 312 Bieber residents receiving water from municipal supply, the majority of the remaining 734 residents are domestic users.

4.7 General Water Quality

Previous reports have characterized the water quality as excellent (DWR 1963, Reclamation 1979). The central area of the Basin, where naturally occurring hot springs influence the chemistry, has elevated levels of sulfate, fluoride, boron, and arsenic (Reclamation 1979). These localized areas with higher mineral content occur near the major faults that traverse the valley. A more detailed description of water quality based on recent data is described in Section 5.4.

Figure 4-13 shows a Piper Diagram for water samples that were collected in late 2019 and early 2020, and it characterizes the relative concentrations of the major cations (Ca, Mg, Na, K) and anions (SO_4, Cl, HCO_3). The dominant cations are derived from the minerals in the aquifer and range from sodium-rich to mixed with higher amounts of calcium and magnesium, which increases the water hardness. The major anion is strongly bicarbonate, which is derived from carbon dioxide in the atmosphere and soil zone and indicates that the water is generally young in geologic terms.

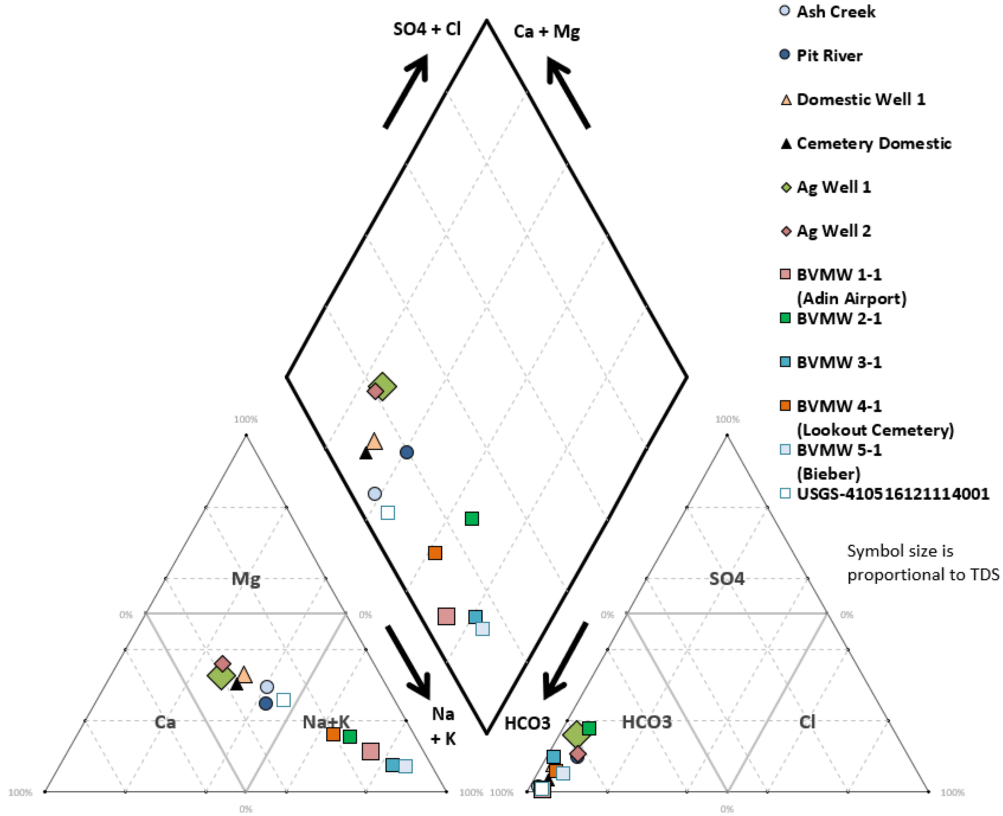

Figure 4-13 Piper Diagram showing major cations and anions

Some areas in the Basin have elevated levels of iron, manganese, and/or arsenic, all of which are naturally occurring in volcanic terrains such as Big Valley. The nature and distribution of these constituents will be discussed further in Chapter 5 – Groundwater Conditions.

4.8 Groundwater Recharge and Discharge Areas

4.8.1 Recharge

Groundwater recharge in BVGB likely occurs *via* several mechanisms discussed below.

Underflow from adjacent upland areas and other areas outside the Basin

The upland areas consist of fractured basalt flows where the precipitation infiltrates vertically through joints and fractures until it reaches underlying aquifer material and then travels horizontally into the Basin. DWR has postulated that the areas shown in pink on **Figure 4-14** provide recharge in such a way. However, other areas adjacent to the Basin could provide some recharge in a similar fashion. In addition, underflow enters the Basin where the Pit River and Ash Creek enter the Basin. A Basin boundary modification is needed to encompass other important recharge areas outside the currently defined Basin boundary.

Infiltration of precipitation on the valley floor

Some direct infiltration of rain and snow on the valley floor occurs. However, because the aquifer materials in the Basin are largely lacustrine and much of the soils have slow infiltration rates, a high proportion of the precipitation likely runs off or is evapotranspirated. **Figure 4-14** shows the areas from the NRCS datasets that may have a slightly higher infiltration rate (HSG B and HSG C) than the other areas and therefore potentially more recharge.

Rivers and streams that flow through the Basin

Streams that flow through the Basin lose water to the aquifer, particularly where they enter the Basin. Aquifer materials are typically coarser on the fringes of the Basin where the stream gradient begins to flatten. In general, recharge likely occurs in the eastern portions of the Basin along Ash Creek, Butte Creek, and Willow Creek and then flows westerly through the subsurface. As Ash Creek flows to the center of the Basin and Big Swamp, the water slows and spreads out into a large marsh. The CDFW has recently enhanced this slowing and spreading of water through “pond and plug” projects which bring the water up out of the previously incised channel. Other pond and plug projects have been successfully implemented in the region. Even though the soils and aquifer materials in this portion of the Basin have slow infiltration rates, recharge is likely to occur from Big Swamp because of the long period of time that the shallow soils remain wet and saturated. Support from the public has been received at outreach meetings to conduct more pond and plug projects within and near the Basin.

Deep percolation of irrigation water

Depending on the irrigation method, particularly flood irrigation, deep percolation of irrigation water into the aquifer occurs. Flood irrigation is an active practice in the Basin and provides valuable recharge.

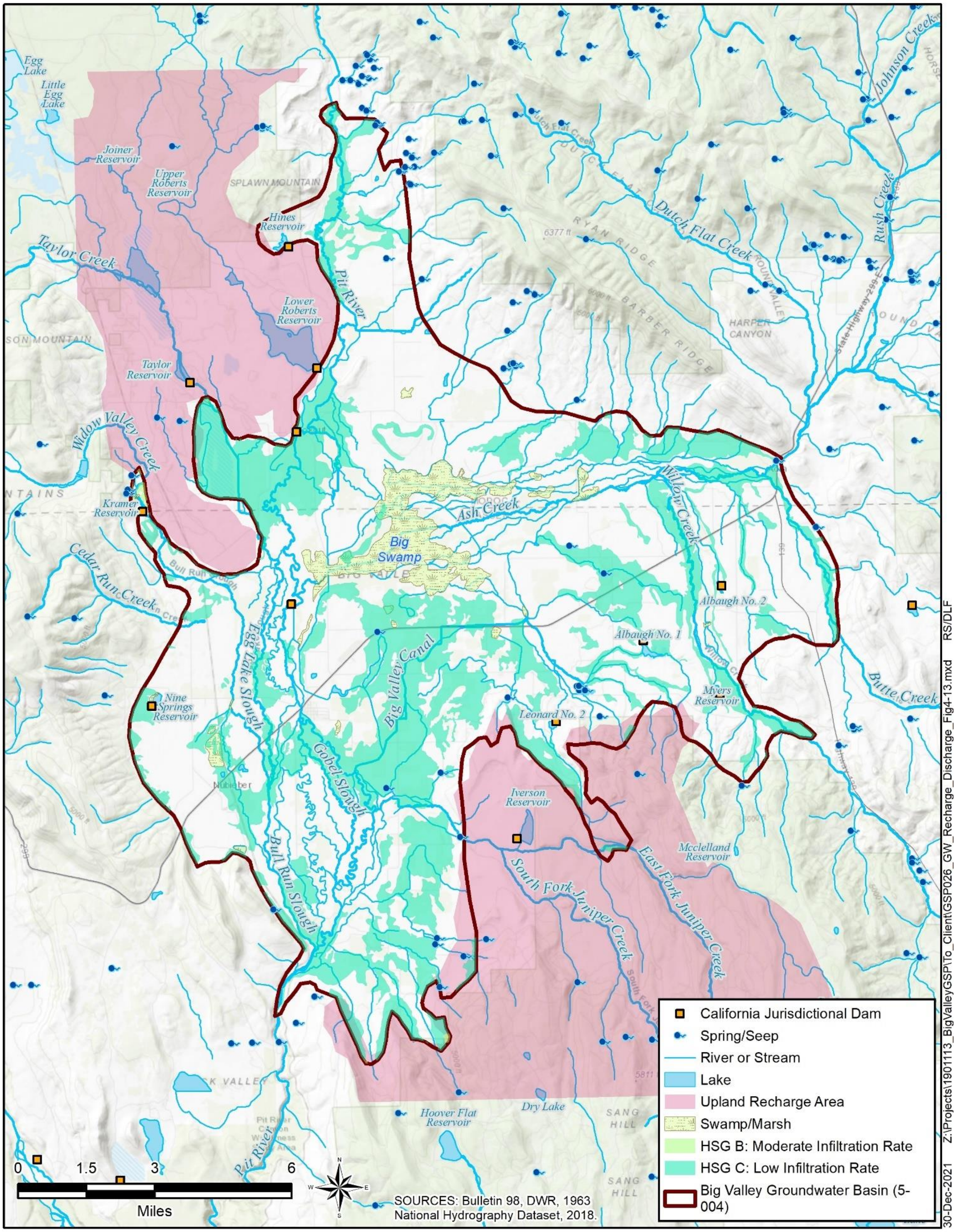

Figure 4-14 Recharge, Discharge and Major Surface-water Bodies

4.8.2 Discharge

Historically, flow out of the groundwater aquifer (and out of the Basin) most likely occurred at the southern portion of the Basin where the aquifer discharged to the Pit River. DWR (1963) indicates that artesian[35] conditions occurred in this southwestern area. The gaining river[36] then transported the water out of the Basin. However, based on currently documented water levels, this area is no longer artesian and likely hasn't been a gaining stream for decades. There are numerous springs throughout the Basin shown on **Figure 4-14** where groundwater is discharged, including several hot springs in the center of the Basin. Evapotranspiration may also be a significant discharge mechanism.

4.9 Surface-Water Bodies

Figure 4-14 shows the numerous small streams that enter the Basin and flow towards the center where they connect with the two major streams: Pit River and Ash Creek. The figure also shows the many small ponds and several reservoirs that are in and around the perimeter of the Basin. The dams that are within the jurisdiction of the DWR Division of Safety of Dams are shown. While many of these impoundments are located outside of Basin boundaries, they represent supplies that hydrologically flow to/through the Basin. The reservoirs provide options for the timing of release of those waters, rather than importing supplies from sources external to the Basin.

4.10 Imported Water Supplies

BVGB users do not import surface water into the Basin because all surface water used in the Basin originates in the watershed of the Pit River or the watershed of a local BVGB stream.

4.11 Data Gaps in the Hydrogeologic Conceptual Model

As discussed in the introduction, hydrogeology has inherent uncertainties due to sparse data and in the case of Big Valley, a limited number of detailed studies on the groundwater resources in the Basin. Identified below are some of the uncertainties associated with the hydrogeology in the Basin. In some instances, this uncertainty can be reduced while other uncertainties will remain. The filling of the data gaps below is contingent on the needs that arise as the GSP is developed and implemented and the level of available outside funding.

Basin Boundary

The current, inaccurate Basin boundary was drawn by DWR with a regional scale map (CGS 1958) and was not drawn with as much precision as subsequent geologic maps. Additionally, the "uplands" areas outside the Basin boundary are postulated to be recharge areas interconnected to the Basin, which is contrary to DWR's definition of a lateral Basin boundary as being "…features that significantly impede groundwater flow" (DWR 2016c). Further refinement of the Basin boundary is desired and necessary, particularly in the areas of "upland recharge" mapped by DWR, the fingers in the southeastern portion of the Basin, and in the northeastern portion of the Basin below Barber Ridge and Fox Mountain.

[35] Artesian aquifers are under pressure and wells screened in them flow at the surface.
[36] Gaining rivers are where groundwater flows toward the river and contributes to surface-water flow.

Confining Conditions

Confining conditions probably exist throughout much of the Basin. Often, the confinement is simply a result of depth and the fact that horizontal hydraulic conductivities are 10 times (or more) greater than vertical conductivities. However, in the southwest portion of the Basin, DWR (1963) documented an area of confined groundwater conditions. It is unknown whether that confinement is due to a single, coherent aquitard or is just a result of depth. In addition, aquifer characteristics in the various areas of the Basin are not thoroughly understood as discussed in Section 4.4.5, and an assessment is needed on how aquifer characteristics vary throughout the Basin in shallow and deep portions of the aquifer.

Definable Bottom

This HCM has used the "practical" depth of 1,200 feet as the definable bottom. If stakeholders seek to develop groundwater deeper than this depth, newly constructed wells will demonstrate that the "physical bottom" and the base of fresh water ("effective bottom") extend deeper.

Faults as Barriers to Flow

It is unknown if the faults which traverse the Basin are barriers to flow. Groundwater contours indicate that there is east-to-west flow, but this flow is uncertain due to a mapped fault between the two areas. This uncertainty could be reduced by conducting a pumping test with observation well(s) on the other side of the fault.

Soil Permeability

The NRCS mapping of soils indicates primarily low- to very-low-permeability soils throughout the Basin. However, there is some variation of permeabilities indicated by the maps, which are drawn at a large scale with limited field verification. Further field investigation of soils and permeability tests could help identify more permeable areas where groundwater recharge could be enhanced.

Recharge

The recharge sources below have been identified, but the rate and amount of recharge is unknown. In the water budget (*see* Chapter 6 – Water Budget), the amount of recharge is roughly estimated. Below are the data gaps related to recharge.

- Effect of Ash Creek on recharge (including Big Swamp)
- Effect of Pit River on recharge (including overflow channels)
- Effect of smaller streams on recharge (including Willow Creek)
- Amount of recharge from direct precipitation
- Amount of recharge from deep percolation of applied water
- Amount of recharge from upland recharge areas
- Amount of recharge from seepage of ditches, canals, and reservoirs

5. Groundwater Conditions §354.16

This chapter presents available information on groundwater conditions for the BVGB developed by GEI for the Lassen County and Modoc County GSAs. This chapter provides some of the information needed for the development of the monitoring network and the sustainable management criteria of this GSP. The content of this chapter is defined by the regulations of SGMA (Chapter 1.5, Article 5, Subarticle 2: 354.16). GEI Professional Geologists provided the content of this chapter and will affix their professional stamps (as required by the regulations) certifying that it was developed under their supervision once the chapter is finalized into the GSP.[37]

5.1 Groundwater Elevations

Historical groundwater elevations are available from a total of 22 wells in Big Valley, six located in Modoc County and 16 in Lassen County as shown on **Figure 5-1** and listed in **Table 5-1**. Twenty of the wells are part of Lassen and Modoc counties' monitoring network, which was approved by the counties in 2011, in compliance with the CASGEM program. DWR staff measure water levels in these wells twice annually (spring and fall) on behalf of the counties. Some measurements from wells are missing, which is typically a result of access issues to the wells site, or occasionally a well owner who has removed their well from the monitoring program. These wells may or may not be used as part of the GSP monitoring network, which will be addressed in Chapter 8 – Monitoring Networks.

The first water level measurements in the BVGB began in the late 1950s at two wells near Bieber (17K1) and Nubieber (32A2). Regular monitoring of these two wells began in the mid-1960s and monitoring began in most of the other wells during the late 1970s or early 1980s. Three wells located on the ACWA were added to the CASGEM networks in 2016. Of the 22 historically monitored wells, one well (12G1) has not been monitored since 1992 and one well (06C1) has no measurements since 2015. Construction details are not available for one well (32R1) and could benefit from a 'downhole' video inspection of the well casing to determine the depth interval associated with the water levels.

In addition to these 22 wells, five well clusters were constructed in late 2019 and early 2020 to support the GSP. Their locations are also shown on **Figure 5-1**. Each cluster consists of a deep well (200-500 feet) and three shallow wells (60-100 feet). These wells were drilled to explore the geology, with the deep well giving water level information for the main portion of the aquifer at that location. The three shallow wells are screened shallow to determine the direction and magnitude of flow in the shallow subsurface and potentially to give an indication if groundwater interacts with surface water and possibly the location of groundwater recharge. Limited water level information is available from these five clusters.

[37] West Yost geologists and engineers updated portions of this Chapter as part of the GSP revisions completed in April 2024.

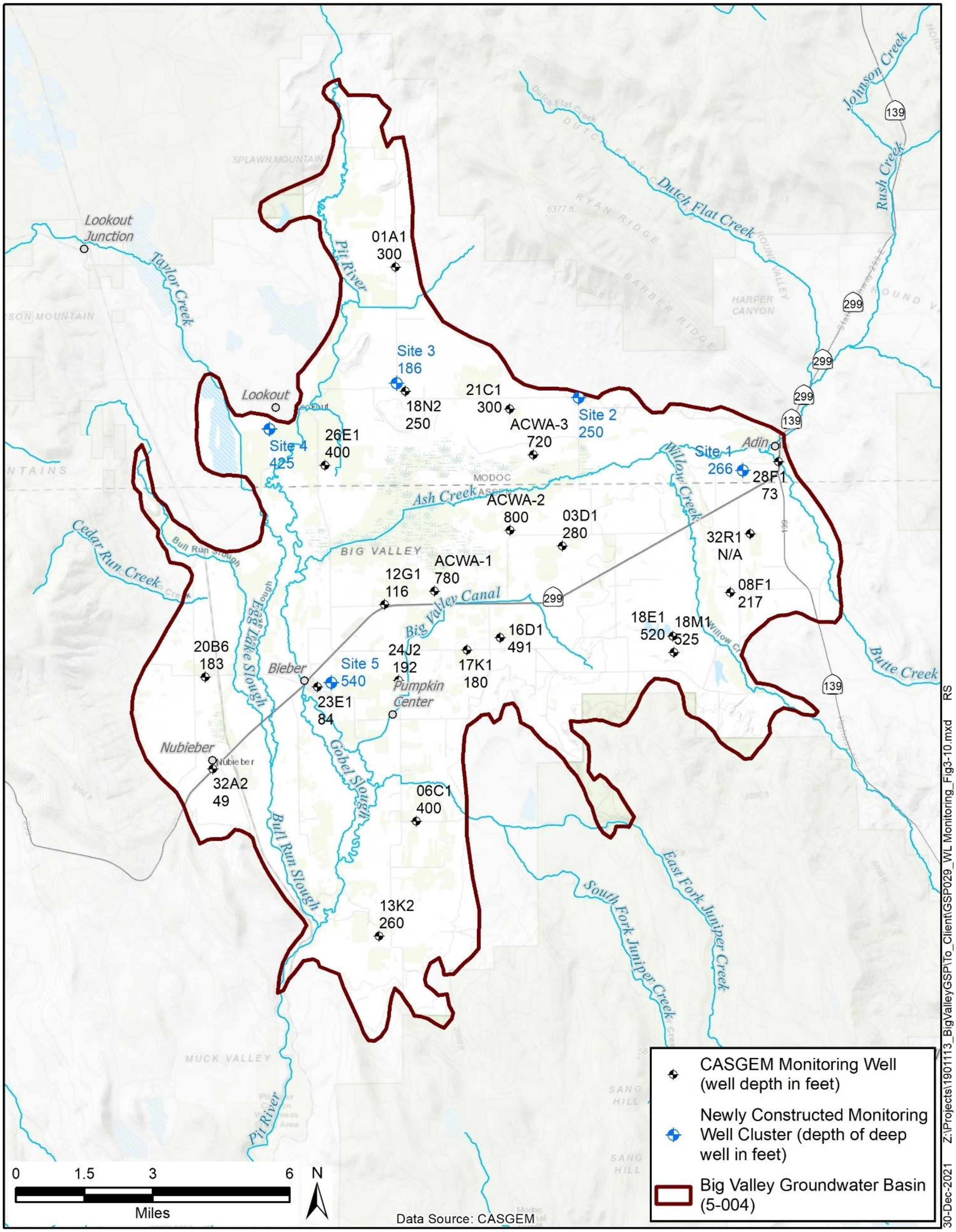

Figure 5-1 Water Level Monitoring

Table 5-1 Historical Water Level Monitoring Wells

Well Name	State Well Number	CASGEM ID	County	Well Use	Well Depth (feet bgs)	Ground Elevation (feet msl)	Reference Point Elevation (feet msl)	Period of Record Start Year	Period of Record End Year	Number of Measure-ments	Minimum Groundwater Elevation (feet msl)	Maximum Groundwater Elevation (feet msl)
18E1	38N09E18E001M	411356N1209900W001	Lassen	Irrigation	520	4248.40	4249.50	1981	2019	73	4198.20	4234.10
23E1	38N07E23E001M	411207N1211395W001	Lassen	Residential	84	4123.40	4123.40	1979	2020	81	4070.40	4109.10
260	39N07E26E001M	411911N1211354W001	Modoc	Irrigation	400	4133.40	4135.00	1979	2020	79	4088.90	4131.30
01A1	39N07E01A001M	412539N1211050W001	Modoc	Stockwatering	300	4183.40	4184.40	1979	2020	81	4035.40	4163.90
03D1	38N08E03D001M	411647N1210358W001	Lassen	Irrigation	280	4163.40	4163.40	1982	2020	71	4076.60	4148.60
06C1	37N08E06C001M	410777N1210986W001	Lassen	Irrigation	400	4133.40	4133.90	1982	2016	69	4066.20	4126.80
08F1	38N09E08F001M	411493N1209656W001	Lassen	Other	217	4253.40	4255.40	1979	2020	83	4167.90	4229.50
12G1	38N07E12G001M	411467N1211110W001	Lassen	Residential	116	4143.38	4144.38	1979	1993	28	4130.98	4138.68
13K2	37N07E13K002M	410413N1211147W001	Lassen	Irrigation	260	4127.40	4127.90	1982	2018	70	4061.90	4109.70
16D1	38N08E16D001M	411359N1210625W001	Lassen	Irrigation	491	4171.40	4171.60	1982	2020	74	4078.73	4162.40
17K1	38N08E17K001M	411320N1210766W001	Lassen	Residential	180	4153.30	4154.30	1957	2020	146	4115.08	4150.00
18M1	38N09E18M001M	411305N1209896W001	Lassen	Irrigation	525	4288.40	4288.90	1981	2020	74	4192.30	4232.70
18N2	39N08E18N002M	412144N1211013W001	Modoc	Residential	250	4163.40	4164.40	1979	2020	80	4136.60	4160.20
20B6	38N07E20B006M	411242N1211866W001	Lassen	Residential	183	4126.30	4127.30	1979	2019	80	4076.94	4116.60
21C1	39N08E21C001M	412086N1210574W001	Modoc	Irrigation	300	4161.40	4161.70	1979	2020	79	4082.10	4148.50
24J2	38N07E24J002M	411228N1211054W001	Lassen	Irrigation	192	4138.40	4139.40	1979	2019	77	4056.70	4137.70
28F1	39N09E28F001M	411907N1209447W001	Modoc	Residential	73	4206.60	4207.10	1982	2020	76	4194.57	4202.10
32A2	38N07E32A002M	410950N1211839W001	Lassen	Other	49	4118.80	4119.50	1959	2020	133	4106.70	4118.80
32R1	39N09E32R001M	411649N1209569W001	Lassen	Irrigation	unknown	4243.40	4243.60	1981	2020	64	4161.20	4205.50
ACWA-1	38N08E07A001M	411508N1210900W001	Lassen	Irrigation	780	4142.00	4142.75	2016	2020	8	4039.15	4126.35
ACWA-2	39N08E33P002M	411699N1210579W001	Lassen	Irrigation	800	4153.00	4153.20	2016	2020	8	4126.40	4139.35
ACWA-3	39N08E28A001M	411938N1210478W001	Modoc	Irrigation	720	4159.00	4159.83	2016	2020	7	4136.23	4150.58

Notes:
bgs = below ground surface
msl = above mean sea level
source: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

5.1.1 Groundwater Level Trends

Figure 5-2 and **Figure 5-3** show hydrographs for the two wells with the longest monitoring records along with background colors representing the Water Year (WY) type: wet, below normal, above normal, dry, and critical dry. These WY types are developed from the Sacramento River Index (SRI), which is calculated from annual runoff of the Sacramento River Watershed, of which the Pit River is a tributary. The SRI (no units) has varied between 3.1 and 15.3 (average: 8.1) over its 115-year history (1906-2020) and is divided into the five WY categories. For 1983 to 2018, the average SRI is 7.9.

Figure 5-2 Hydrograph of Well 17K1

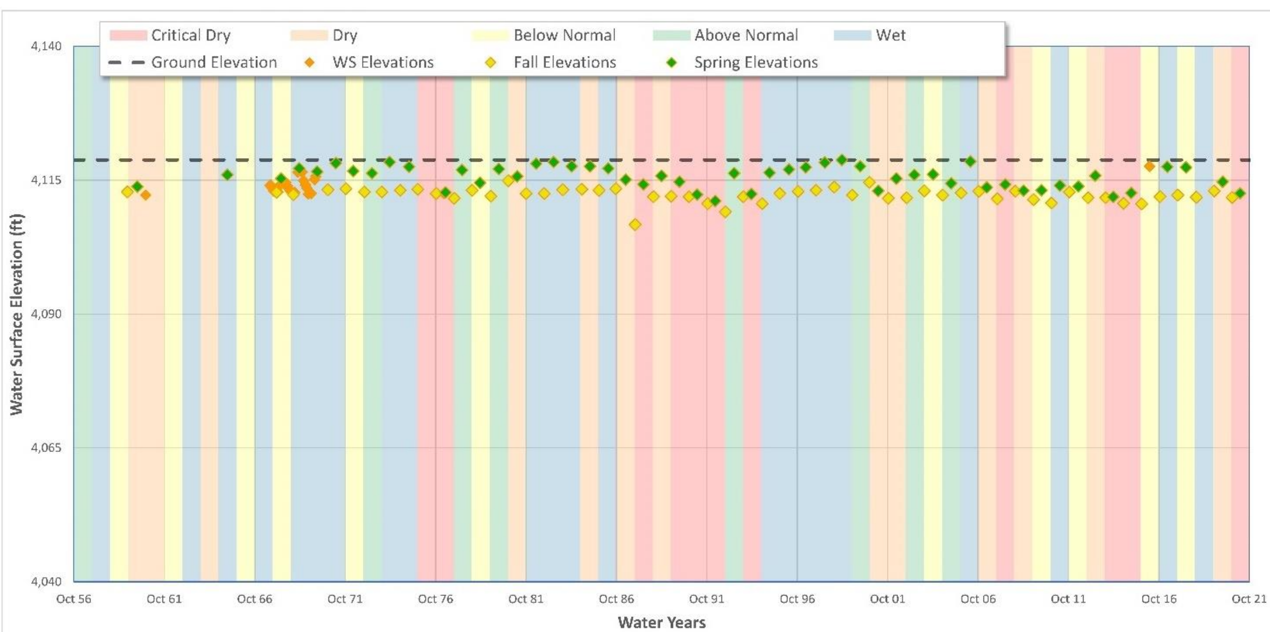

Figure 5-3 Hydrograph of Well 32A2

The water level record for these two wells illustrates that some areas of the Basin have experienced little to no change in water levels, while other areas have fluctuated and declined during the last 20 years. Declines during the drought period of the late 1980s and early 1990s were offset by recovery during the wet period of the late 1990s. Water levels in some wells have declined during the sustained dry period that has occurred since 2000. Hydrographs for all 22 wells are presented in **Appendix 5A**. On each of these hydrographs, an orange trend line is shown, which is determined from a line of best fit for the spring water level measurements between WY 1979 and 2021. The average water level change during that period, in feet per year, is also shown. Sixteen wells show relatively stable (less than -1.0 foot per year [ft/yr] of decline) or rising water levels, and six wells show declining water from -1.0 ft/yr to -3.1 ft/yr. The locations of these water level changes are shown graphically on **Figure 5-4**, with the stable or rising water levels shown in green, and areas with declines more than -1.0 ft/yr in orange.

5.1.2 Vertical Groundwater Gradients

Vertical hydraulic gradients are apparent when groundwater levels in wells screened deep in the aquifer differ from water levels measured shallow in the aquifer at the same general location. Significant vertical gradients can indicate that the deep portion of the aquifer is separate from the shallow (e.g., by a very low permeability clay layer) and/or that pumping in one of the aquifers has occurred and the vertical flow between the aquifers is in progress of stabilizing. Chapter 4 – Hydrogeologic Conceptual Model defines a single principal aquifer in the BVGB. However, vertical gradients likely exist, and the five recently constructed well clusters will have data to describe these gradients once sufficient water level data are available from those wells. The locations of the clusters are shown on **Figure 5-1**.

5.1.3 Groundwater Contours

Spring and fall 2018 water level measurements from the 21 active CASGEM wells were used to illustrate current groundwater conditions. The 2018 data was used to illustrate current conditions because there were several wells without data for 2019 or 2020. **Figure 5-5** and **Figure 5-6** show the 2018 seasonal high and seasonal low groundwater elevation contours, respectively, which were interpolated from the locations of the 21 active wells. Each contour line shows equal groundwater elevation. Groundwater flows from higher elevations to lower elevations, perpendicular to the contour lines. The direction of flow is emphasized on the figures in certain areas with arrows. In general, groundwater is highest in the east, where Ash, Willow and Butte Creeks enter the Basin. The general flow of water is to the west and south. The contours do indicate, however, northerly flow from the lower reaches of Ash Creek. In the southern portions of the BVGB, groundwater flows toward the east.

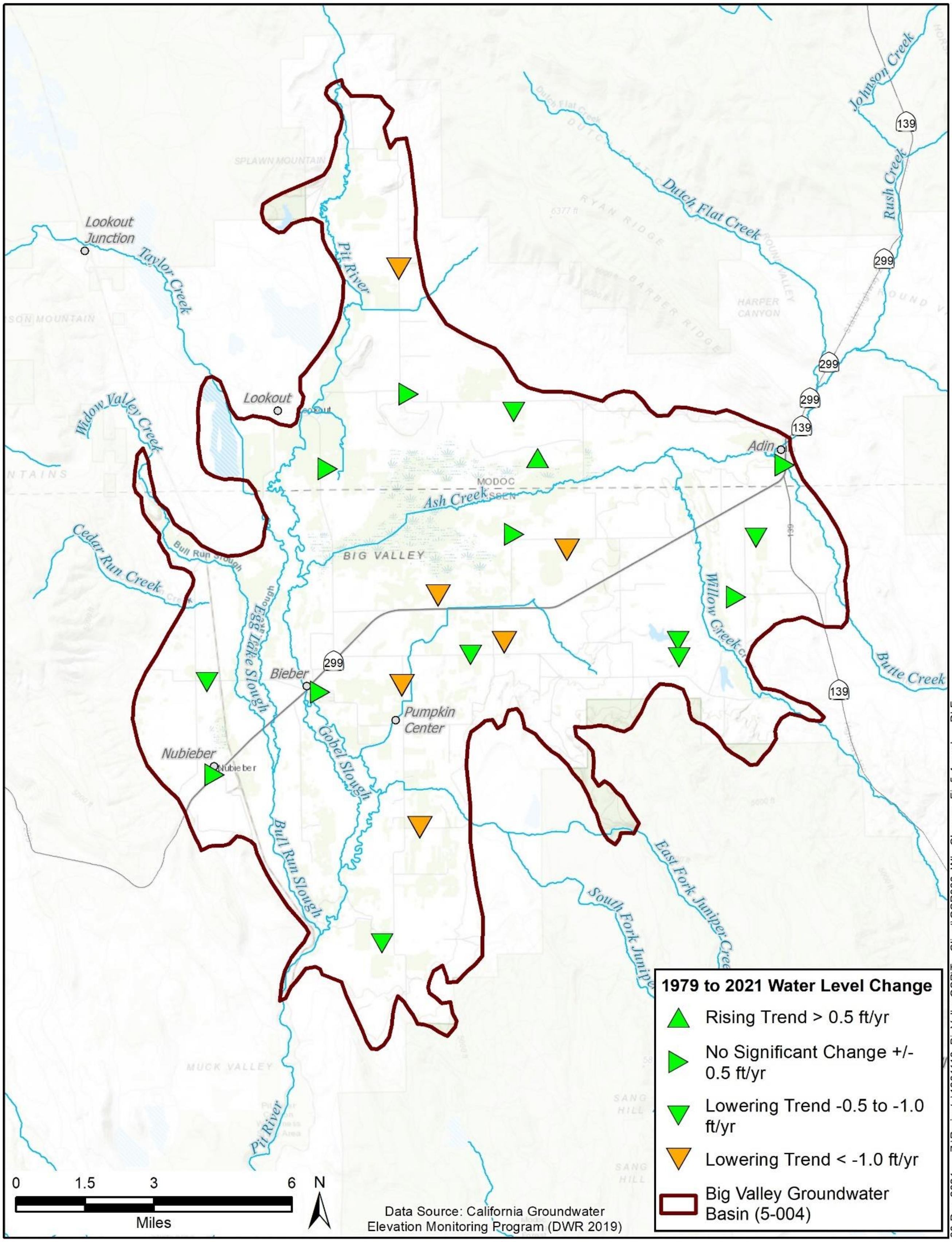

Figure 5-4 Average Water Level Change Since 1979 Using Spring Measurements

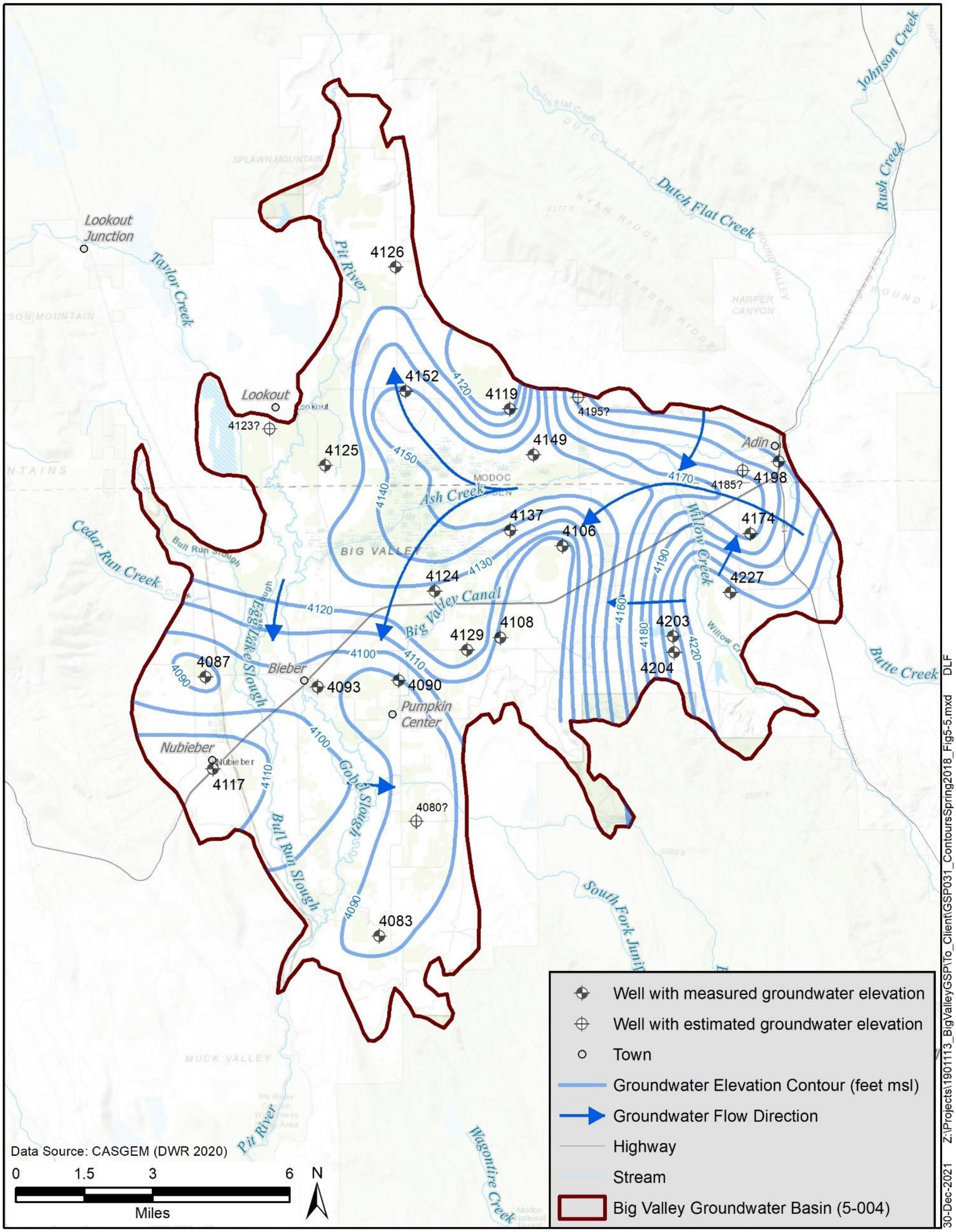

Figure 5-5 Groundwater Elevation Contours and Flow Direction Spring 2018

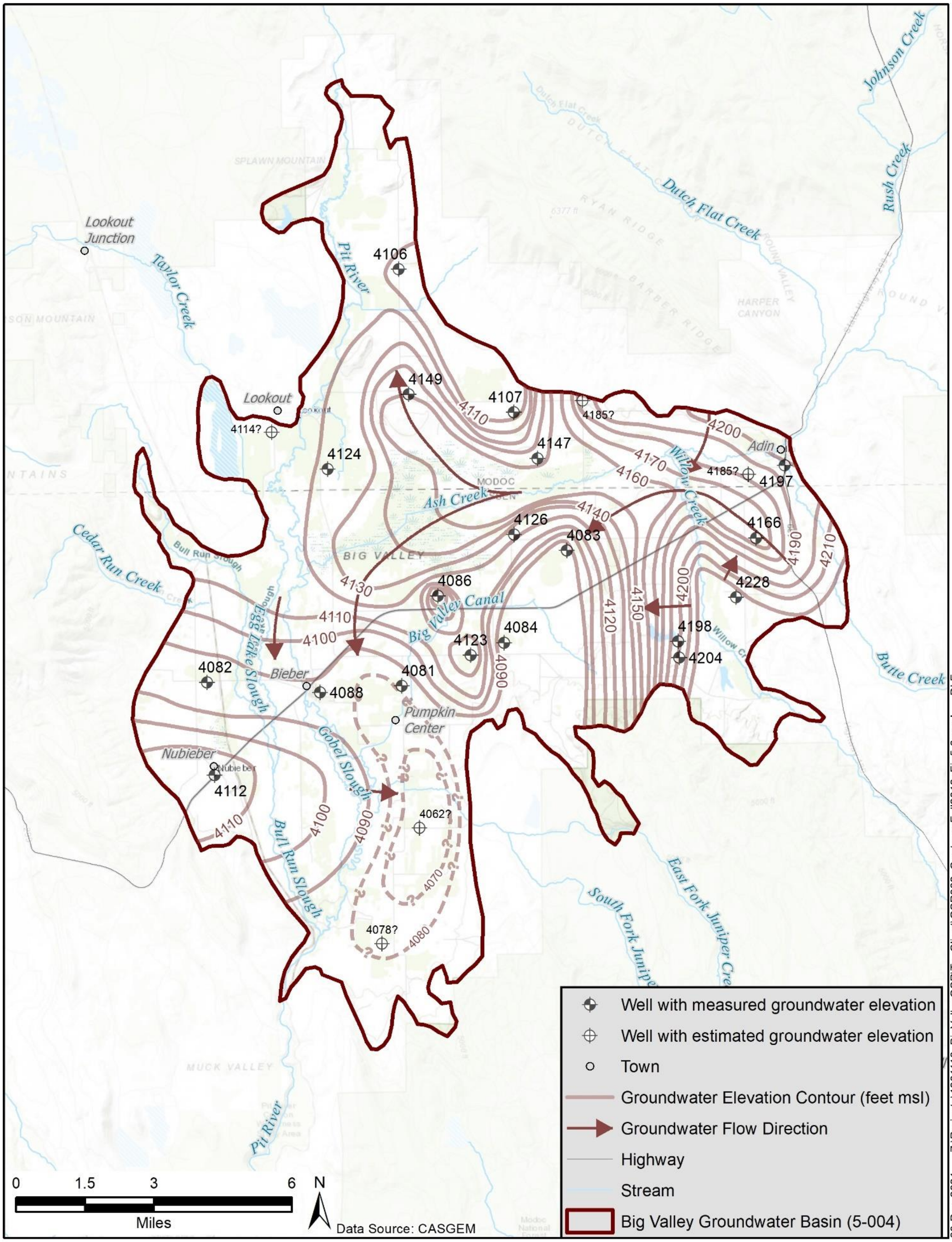

Figure 5-6 Groundwater Elevation Contours and Flow Direction Fall 2018

5.2 Change in Storage

To determine the annual and seasonal change in groundwater storage, groundwater elevation contoured surfaces[38] were developed for spring and fall for each year between 1983 and 2018. These surfaces are included in **Appendix 5B**. The amount of groundwater in storage for each set of contours was calculated using software which subtracted the groundwater surface elevation from the ground surface elevation (using a digital elevation model) at each grid cell (pixel) and calculated the average depth to water (DTW) for the entire Basin. The average spring DTW was then subtracted from the previous year's average spring DTW, multiplied by the area of the Basin, and then multiplied by 6.85-percent average specific yield[39] to calculate the annual spring-to-spring change in storage.

The average depth to groundwater and average specific yield capture the spatial variability in groundwater elevations and unconfined storage throughout the Basin. To confirm the calculations based on basin-wide averages, the spring 2022 and spring 2023 change in storage was also calculated using the groundwater elevation and specific yield surfaces contoured over the entire Basin. Annual differences were calculated on a cell-by-cell basis. The two methods yielded changes in storage within 50 AF of one another (9,683 AF for the average method and 9,729 AF for the cell-by-cell method). The average method (average values for depth to water and specific yield) was deemed appropriate for calculating annual changes in storage.

Figure 5-7 shows the cumulative change in storage from 1983 to 2023 in relation to the SRI. The highest SRI occurred in 1983 and the fourth lowest SRI occurred in 2015. Moreover, this 36-year period also include five of the lowest ten SRIs and five of the highest ten SRIs, which demonstrates the high degree of variability in climatic conditions.

Figure 5-7 shows this information graphically, along with the annual precipitation from PRISM data in the Basin. This graph shows that groundwater storage generally declines during dry years and stays stable or increases during normal or wet years. During the early portion of the 36-year period, groundwater levels dipped, then recovered to 1983 conditions by 1999 due to six consecutive years of above-average precipitation. Since 2000, groundwater storage has generally declined by about 108,000 acre-feet (AF) (using spring measurements) which is a slight increase from the historical low of about 158,000 AF in spring 2015.

Annual groundwater use is not shown on **Figure 5-7** as required by SGMA regulations. Groundwater use will be addressed in Chapter 6 – Water Budget.

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[38] Groundwater elevation surfaces are developed using a kriging mathematically method and the known groundwater elevations at wells throughout the Basin. Kriging predicts (interpolates) what groundwater levels are between known points. The kriging surface consists of a grid (pixels) covering the entire basin that has interpolated groundwater elevation values for each node of the grid.

[39] The fraction of the aquifer material that contains recoverable water. Specific yield is described in more detail in Chapter 4 – Hydrologic Conceptual Model.

Table 5-2 Change in Storage 1983-2023

Year	Average Spring Depth to Water[1] (feet)	Change in Storage from Previous Year[2] (Acre-feet)	Cumulative Change in Storage[3] (Acre-feet)	Sacramento River Index (SRI) of Water Year Types
1983	29.3	-	-	W
1984	29.4	(631)	(631)	W
1985	31.4	(12,619)	(13,250)	D
1986	31.0	2,524	(10,727)	W
1987	32.6	(10,096)	(20,822)	D
1988	34.9	(14,512)	(35,334)	C
1989	35.2	(1,893)	(37,227)	D
1990	35.6	(2,524)	(39,751)	C
1991	36.8	(7,572)	(47,323)	C
1992	38.0	(7,572)	(54,895)	C
1993	36.9	6,941	(47,954)	AN
1994	37.5	(3,786)	(51,740)	C
1995	35.3	13,881	(37,858)	W
1996	32.4	18,298	(19,560)	W
1997	31.8	3,786	(15,774)	W
1998	31.1	4,417	(11,358)	W
1999	29.5	10,096	(1,262)	W
2000	32.3	(17,667)	(18,929)	AN
2001	38.0	(35,965)	(54,895)	D
2002	39.3	(8,203)	(63,097)	D
2003	39.4	(631)	(63,728)	AN
2004	39.2	1,262	(62,466)	BN
2005	41.5	(14,512)	(76,979)	AN
2006	36.7	30,287	(46,692)	W
2007	38.8	(13,250)	(59,942)	D
2008	41.6	(17,667)	(77,610)	C
2009	42.5	(5,679)	(83,288)	D
2010	46.4	(24,608)	(107,896)	BN
2011	45.9	3,155	(104,742)	W
2012	44.9	6,310	(98,432)	BN
2013	49.3	(27,763)	(126,195)	D
2014	51.7	(15,143)	(141,338)	C
2015	54.4	(17,036)	(158,374)	C
2016	51.3	19,560	(138,814)	BN
2017	49.7	10,096	(128,719)	W
2018	50.1	(2,524)	(131,242)	BN
2019	49.5	3,619	(127,623)	W
2020	47.9	10,110	(117,514)	D
2021	49.3	(8,819)	(126,333)	C
2022	51.0	(10,321)	(136,653)	C
2023	49.4	9,683	(126,970)	AN[4]

Note: Parentheses indicate negative numbers
[1] From water surface elevation contours - Appendix 5A
[2] Calculated from average depth to water, area of basin, 1,200 foot aquifer bottom, and specific yield of 6.85%
[3] This is the total change in storage since the baseline, defined as Spring 1983.
[4] Estimated

Water Year Type:
W - wet
AN - above normal year type
BN - below normal year type
D - dry year type
C - critical year type

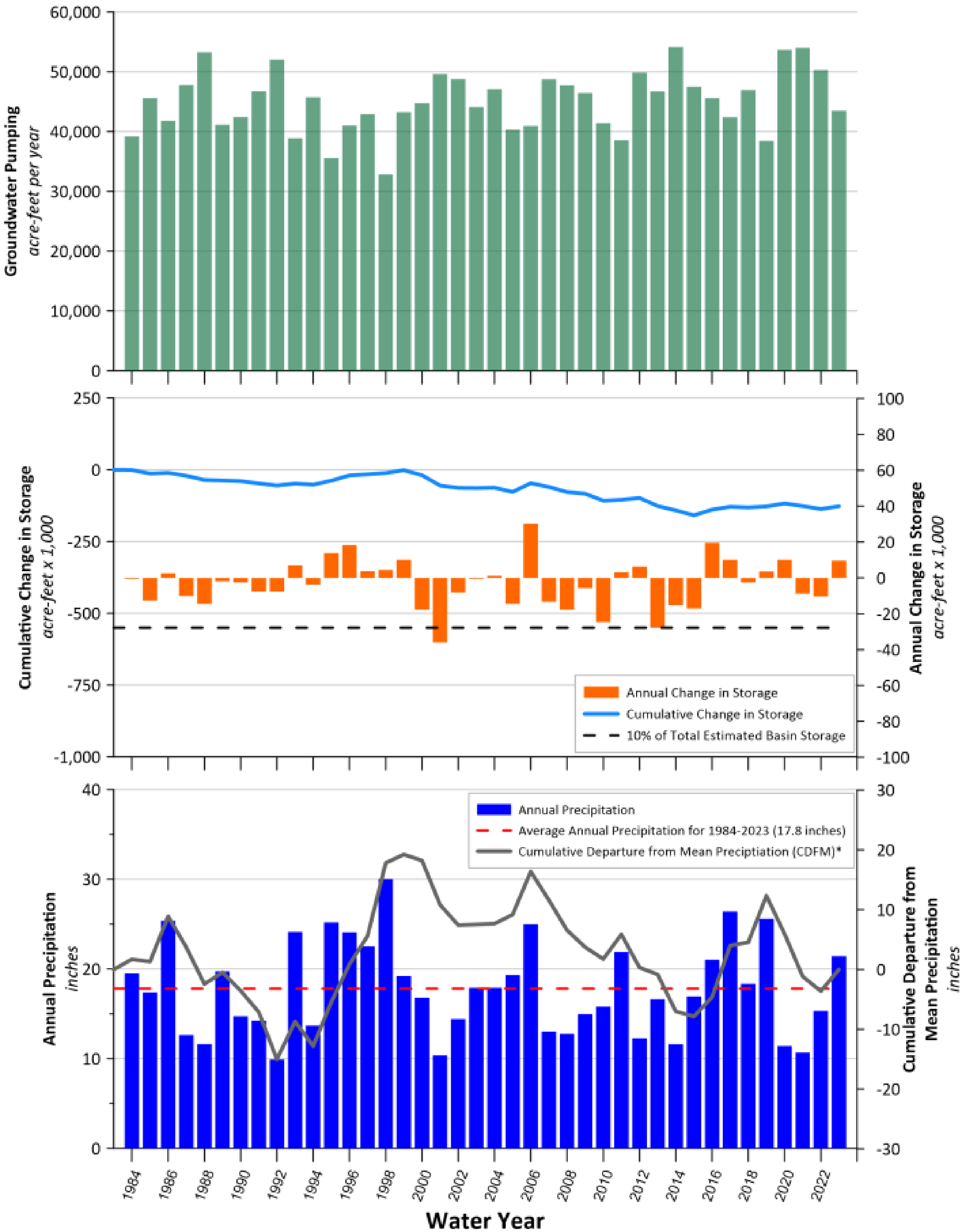


Figure 5-7 Precipitation, Pumping and Spring-to-Spring Change in Groundwater Storage

5.3 Seawater Intrusion

The BVGB is not located near the ocean, and therefore seawater intrusion is not applicable to this GSP.

5.4 Groundwater Quality Conditions

As noted in Chapter 4, previous reports have characterized the water quality in the BVGB as excellent (DWR 1963, Reclamation 1979). As described herein, recent groundwater quality samples confirm this statement. Groundwater is generally suitable for all beneficial uses and only localized contamination plumes have been identified in the BVGB. This section presents an analysis of recent groundwater quality conditions and the distribution of known groundwater contamination sites in compliance with GSP Regulation §354.16(d).

In the Basin, groundwater quality data are available from production and monitoring wells. Groundwater quality samples from municipal production wells are collected by well owners and reported to the State as required by the California Code of Regulations for drinking water. Groundwater quality samples from monitoring wells in the Basin are collected by public entities and private companies and their consultants to characterize point-source contamination for which they are potentially responsible.

Recent conditions were analyzed using a statistical approach applied to available data from the GAMA Groundwater Information System [GAMA GIS] (State Water Board 2020a). The GAMA GIS data provides the most comprehensive, readily available water quality dataset and contains results from numerous programs, including:

- Division of Drinking Water (public supply systems)
- Department of Pesticide Regulation
- Department of Water Resources (historical ambient monitoring)
- Environmental Monitoring Wells (regulated facilities and cleanup sites)
- U.S. Geological Survey (USGS) GAMA program
- USGS National Water Information System data

Figure 5-8 shows the location of wells with water quality data symbolized by the most recent water quality measurement.

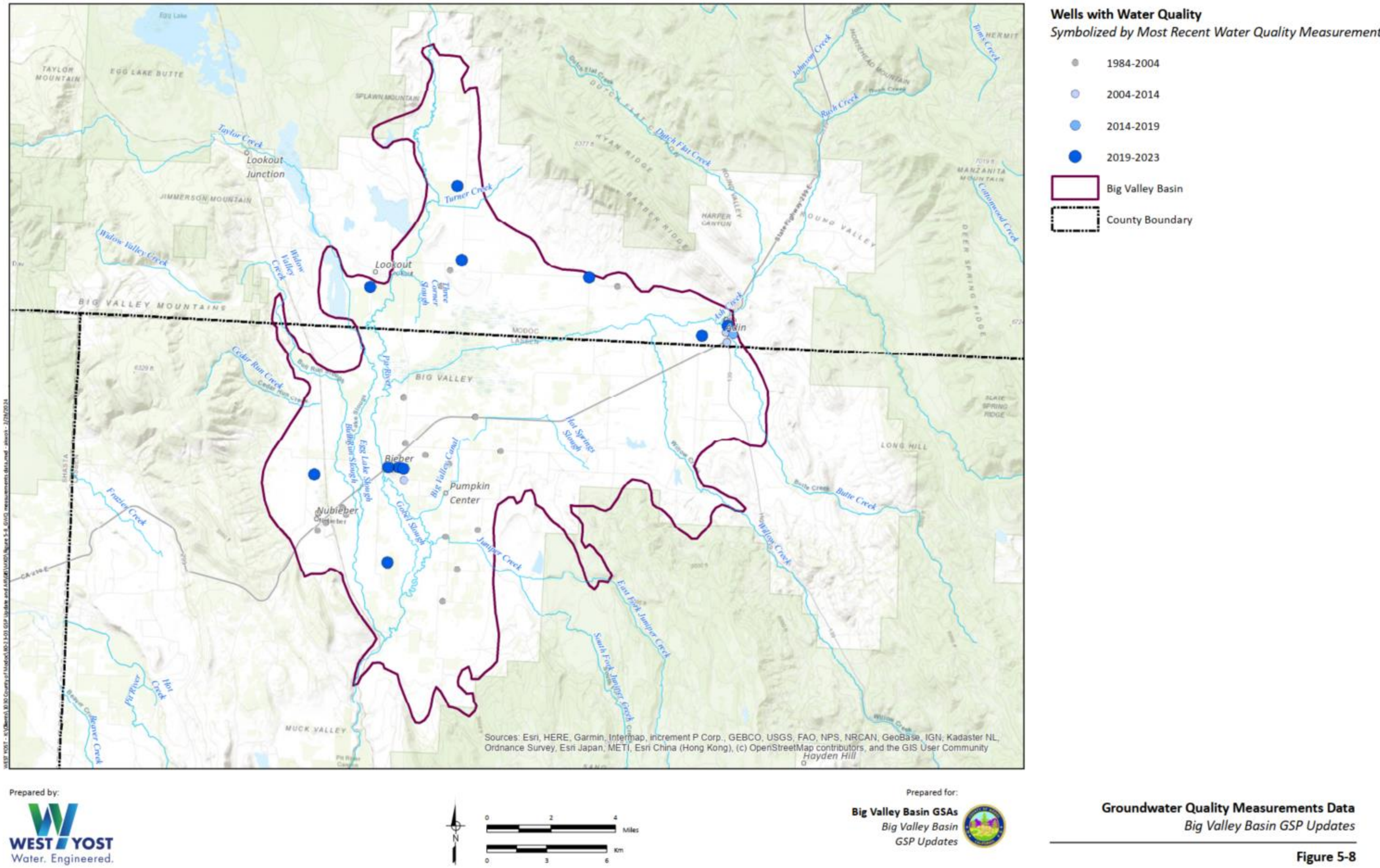


Figure 5-8 Groundwater Quality Measurements in Big Valley Basin

5.4.1 Comparison of Groundwater Quality with Regulatory Standards

The concentration of naturally occurring constituents varies throughout the BVGB. Previous reports have noted the potential elevated concentrations of arsenic, boron, fluoride, iron, manganese, and sulfate (DWR 1963, Reclamation 1979). All of these constituents are naturally occurring, and in these historical reports, they indicate that most of these constituents are associated with localized thermal waters found near hot springs in the center of the Basin.

Water quality results in these datasets go back to the 1950s. Because conditions can change as groundwater is used over time, data prior to the WY 1983 were eliminated from the statistical analysis of the data. WY 1983 was chosen because the bulk of the historical water level data (**Figure 5-1**) was measured at wells that came online by 1983. Data from the Environmental Monitoring Wells programs were also eliminated since water quality issues associated with these regulated sites are typically highly localized, often are associated with isolated, perched groundwater, and are already regulated. The nature and location of groundwater contamination sites are discussed in Section 5.4.2 – Groundwater Contamination Sites and Plumes.

Table 5-3 shows the statistical evaluation of the filtered GAMA water quality data along with the water quality results obtained from the five well clusters constructed to support the GSP. The constituents selected to assess the suitability in the Basin are based on thresholds for different beneficial uses. For domestic and municipal uses, the inorganic constituents that are regulated under state drinking water standards are shown. Boron and sodium are also shown because elevated concentrations can affect the suitability of the water for agricultural uses. The suitability threshold concentration for each constituent is shown, using either the MCL or agricultural threshold, whichever was lower. Iron and manganese were evaluated for both drinking water and agricultural thresholds. It is assumed that water suitable for domestic, municipal, and agricultural purposes would also be suitable for environmental and industrial beneficial uses.

Table 5-3 Water Quality Statistics – 1983 - 2020

Constituent Name	Suitability Threshold Concentration	Suitability Threshold Type	Total # of Meas	min	max	# Meas Above Threshold	% of Meas Above Threshold	# Wells With Meas	# Wells with Average Above Threshold	% of Wells with Average Above Threshold	# Wells with Most Recent Meas Above Threshold	% of Wells with Most Recent Meas Above Threshold	Comment
Aluminum	200	DW1	41	0	552	2	5%	18	1	6%	0	0%	Low concern due to only two threshold exceedances and zero recent measurements above MCL
Antimony	6	DW1	45	0	36	1	2%	20	1	5%	0	0%	Low concern due to only one threshold exceedance and zero recent measurements above MCL
Arsenic	10	DW1	53	0	12	4	8%	23	3	13%	3	13%	
Barium	1000	DW1	49	0	600	0	0%	23	0	0%	0	0%	
Beryllium	4	DW1	48	0	1	0	0%	23	0	0%	0	0%	
Cadmium	5	DW1	49	0	1	0	0%	23	0	0%	0	0%	
Chromium (Total)	50	DW1	36	0	20	0	0%	13	0	0%	0	0%	
Chromium (Hexavalent)	10	DW1*	13	0.05	3.29	0	0%	13	0	0%	0	0%	
Copper	1300	DW1	34	0	190	0	0%	21	0	0%	0	0%	
Fluoride	2000	DW1	42	0	500	0	0%	16	0	0%	0	0%	
Lead	15	DW1	28	0	6.2	0	0%	16	0	0%	0	0%	
Mercury	2	DW1	44	0	1	0	0%	19	0	0%	0	0%	
Nickel	100	DW1	46	0	10	0	0%	20	0	0%	0	0%	
Nitrate (as N)	10000	DW1	151	0	4610	0	0%	24	0	0%	0	0%	
Nitrite	1000	DW1	62	0	930	0	0%	20	0	0%	0	0%	
Nitrate + Nitrite (as N)	10000	DW1	2	40	2250	0	0%	2	0	0%	0	0%	
Selenium	50	DW1	49	0	5	0	0%	23	0	0%	0	0%	
Thallium	2	DW1	46	0	1	0	0%	20	0	0%	0	0%	
Chloride	250000	DW2	66	1400	79000	0	0%	43	0	0%	0	0%	
Iron	300	DW2	50	0	11900	26	52%	21	8	38%	9	43%	Low human health concern due to being a secondary MCL for aesthetics
Iron	5000	AG	50	0	11900	2	4%	21	2	10%	2	10%	
Manganese	50	DW2	45	0	807	28	62%	21	12	57%	11	52%	Low human health concern due to being a secondary MCL for aesthetics
Manganese	200	AG	45	0	807	22	49%	21	7	33%	7	33%	
Silver	100	DW2	36	0	20	0	0%	19	0	0%	0	0%	
Specific Conductance	900	DW2	66	125	1220	3	5%	42	1	2%	1	2%	
Sulfate	250000	DW2	60	500	1143000	1	2%	40	0	0%	0	0%	Low concern due to only one threshold exceedance and zero recent measurements above MCL
Total Dissolved Solids (TDS)	500000	DW2	57	131000	492000	0	0%	39	0	0%	0	0%	
Zinc	5000	DW2	34	0	500	0	0%	20	0	0%	0	0%	
Boron	700	AG	40	0	100	0	0%	34	0	0%	0	0%	
Sodium	69000	AG	33	11600	69000	0	0%	21	0	0%	0	0%	

Sources:

GAMA Groundwater Information System, accessed June 5, 2020 (SWRCB 2020)

University of California Cooperative Extension Farm Advisor (UCCE 2020)

Notes:

GAMA data was filtered to remove all measurements before Oct 1, 1982 and all GeoTracker cleanup sites

Constituents listed are all inorganic naturally occurring elements and compounds that have a SWRCB drinking water maximum contaminant limit (MCL), plus Boron, which has a threshold for agricultural use.

All measurements in micrograms per liter, except specific conductance which is measured in microsiemens per centimeter.

Green indicates less than 1%

Yellow indicates between 1% and 10%

Red indicates greater than 10%

Threshold Types:

DW1: Primary drinking water MCL

DW2: Secondary drinking water MCL (for aesthetics such as taste, color, and odor)

AG: Agricultural threshold based on guidelines by the Food and Agricultural Organization of the United Nations (Ayers and Westcot 1985)

* Hexavalent chromium was regulated under a primary drinking water MCL until the MCL was invalidated in 2017. The SWRCB is working to re-establish the MCL.

Table 5-4 is similar to Table 5-3; however, it shows data for the last 20 years only (2004 to 2023).

Table 5-4 Water Quality Statistics – 2004 to 2023

Constituent Name	Units	Suitability Threshold Concentration	Suitability Threshold Type	Total # of Measurements (2004-2023)	Minimum (2004-2023)	Maximum (2004-2023)	# Measured Above Threshold (2004-2023)	% of Measured Above Threshold (2004-2023)	# Wells With Measurements (2004-2023)	# Wells with Average Above Threshold (2004-2023)
Aluminum	UG/L	200	DW1	23	2.7	88	0	0%	18	0
Antimony	UG/L	6	DW1	21	0.0	6	0	0%	16	0
Arsenic	UG/L	10	DW1	24	1.6	12	2	8%	18	**2**
Barium	UG/L	1000	DW1	26	0.5	100	0	0%	18	0
Beryllium	UG/L	4	DW1	23	0.0	1	0	0%	18	0
Boron	UG/L	700	AG	19	11.0	100	0	0%	17	0
Cadmium	UG/L	5	DW1	26	0.0	1	0	0%	18	0
Chloride	UG/L	250000	DW1	20	2200.0	32900	0	0%	16	0
Chromium (Hexavalent)	UG/L	10	DW1*	13	0.1	3	0	0%	13	0
Chromium (Total)	UG/L	50	DW1	14	0.1	10	0	0%	9	0
Copper	UG/L	1300	DW1	22	0.7	52	0	0%	16	0
Fluoride	UG/L	2000	DW1	18	0.1	350	0	0%	11	0
Iron	UG/L	300	DW2	36	6.0	11900	28	78%	16	**9**
Iron	UG/L	5000	AG	36	6.0	11900	2	6%	16	**9**
Lead	UG/L	15	DW1	9	0.3	5	0	0%	6	0
Manganese	UG/L	50	DW2	37	0.3	540	31	84%	16	**11**
Manganese	UG/L	200	AG	37	0.3	540	24	65%	16	**6**
Mercury	UG/L	2	DW1	22	0.1	1	0	0%	14	0
Nickel	UG/L	100	DW1	19	0.5	10	0	0%	14	0
Nitrate (as N)	UG/L	10000	DW1	104	40.0	3850	0	0%	22	0
Nitrate + Nitrite (as N)	UG/L	10000	DW1	6	40.0	2250	0	0%	6	0
Nitrite	UG/L	1000	DW1	38	0.1	400	0	0%	14	0
Selenium	UG/L	50	DW1	26	0.0	5	0	0%	18	0
Silver	UG/L	100	DW2	17	0.0	10	0	0%	10	0
Sodium	UG/L	69000	AG	21	12100.0	69000	0	0%	16	0
Specific Conductance	UMHOS/CM	900	DW2	24	206.0	611	0	0%	16	0
Sulfate	UG/L	250000	DW2	21	770.0	48100	0	0%	16	0
Thallium	UG/L	2	DW1	21	0.0	1	0	0%	16	0
Total Dissolved Solids	UG/L	500000	DW2	20	169000.0	479000	0	0%	16	0
Zinc	UG/L	5000	DW2	20	6.9	320	0	0%	14	0

Cells highlighted in red represent constituents with at least one well with exceedances.

Sources:

GAMA Groundwater Information System, accessed December 27, 2023 (SWRCB 2023)

University of California Cooperative Extension Farm Advisor (UCCE 2020)

Big Valley Monitoring Well Construction Report (GEI 2021)

Water Quality Sampling Results Fall 2019 (Big Valley Basin)

Notes:

GAMA data was filtered to remove all Geotracker cleanup sites

Constituents listed are all inorganic naturally occuring elements and compounds that have a SWRCB drinking water maximum contaminant level (MCL, plus Boron, which has a threshold for agricultural use.

All measurements in micrograms per liter, except specific conductance which is measured in microsiemens per centimeter.

Green indicates less than 1%

Yellow indicates betweel 1% and 10%

Red indicates greater than 10%

Threshold Types:

DW1: Primary drinking water MCL

DW2: Secondary drinking water MCL (for aesthetics such as taste, color and odor)

AG: Agricultural threshold based on guidelines by the Food and Agricultural Organization of the United Nations (Ayers and Westcot 1985)

* Hexavalent Chromium was regulated under a primary drinking water MCL until the MCL was invalidated in 2017. The SWRCB is working to re-establish the MCL.

Table 5-3 and **Table 5-4** show that most constituents have not had concentrations measured above their corresponding threshold. Tables 5-3 and 5-4 show that the main constituents of concern in the Basin are iron and manganese, and to a lesser extent arsenic, based on the percentages of wells exceeding the applicable thresholds.

According to the State Water Resources Control Board "Groundwater Quality Consideration for High and Medium Priority Basins" dated November 22, 2022, the GSP should consider a constituent as a constituent of concern if a constituent exceeded the suitability threshold in untreated water of three or more of domestic, irrigation/industrial, municipal and/or water supply wells. Based on this screening criteria, the following constituents are described in further detail below:

- Iron
- Manganese

Sulfate, aluminum, and antimony were detected only once or twice above their respective thresholds. However, since these values were not recent, these constituents were not investigated further.

In addition to iron (Fe) and manganese (Mn), the section below also describes:

- Arsenic (As)
- Nitrate (as N), hereafter referred to as nitrate
- Specific conductance (SC) and total dissolved solids (TDS)
- PFOS

With the exception of PFOS, all these constituents are naturally occurring. Arsenic is included in the discussion due to the exceedances observed during the longer time period (see Table 5-3), nitrate and TDS are included in the discussion due to the prevalence as groundwater contaminants in California, and PFOS are included due to a recent finding by the State that a small area within the Basin is at high water quality risk due to PFOS (see additional details below).

Iron, Manganese, and Arsenic

In the last 20 years, there have been wells with Fe, Mn, and As concentrations above the MCL (nine, eleven, and two wells, respectively). Although iron and manganese are regulated under secondary drinking water standards (for aesthetics such as color, taste, and odor) but are not of concern for human health as drinking water[40], these constituents were still chosen for further investigation because they also have multiple detections above the agricultural suitability threshold (Ayers and Westcot 1985). **Figures 5-9** and **Figure 5-11** show the trends over time for these three constituents. Wells with single measurements are shown as dots, where wells that had multiple measurements are shown as lines.

[40] Although there is currently no primary MCL for manganese, the SWRCB has proposed a notification level for manganese. Per the SWRCB "Manganese is an essential nutrient and enzyme cofactor that is naturally present in many foods and available as a dietary supplement, but despite its nutritional benefits, adverse health effects can be caused by over-exposure. There is evidence that demonstrates that exposure to manganese at high levels can pose a neurotoxic risk. Young children can be particularly susceptible to adverse effects from manganese exposure because they absorb and retain more manganese than adults." The proposed notification level at this time is 20 ug/L.

Key findings from Figure 5-9 include:

- Iron concentrations are generally below the agricultural suitability threshold (Ayers and Westcot, 1985), and some are above the secondary MCL.
- The two recent elevated iron measurements were obtained from the monitoring wells constructed in support of the GSP and appear to be outliers. Additional sampling should be conducted after verifying the wells are adequately developed and purged.
- Based on wells with more than one sample in recent years, there are no trends observed in iron concentrations within the Basin.

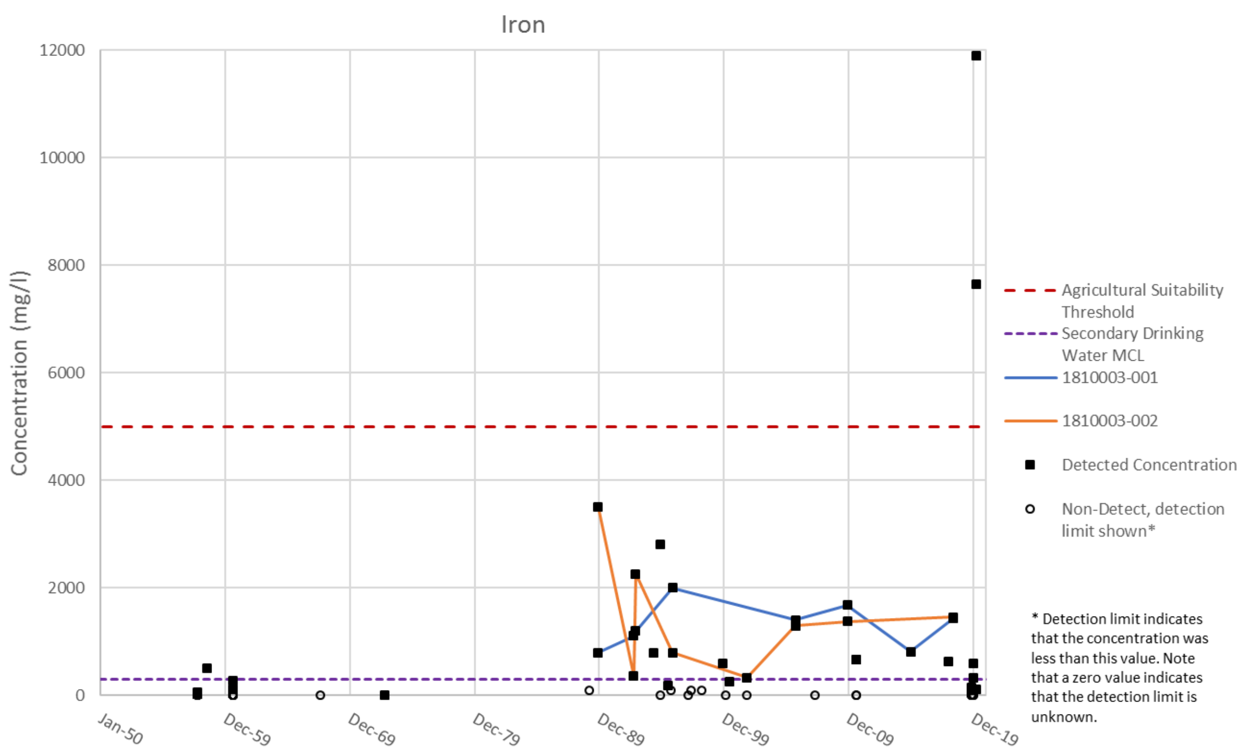


Figure 5-9 Iron Trends

Key findings from Figure 5-10 include:

- Based on wells with more than one sample in recent years, there are no trends observed in manganese concentrations within the Basin, and their concentrations are greater than the agricultural threshold and secondary MCL.

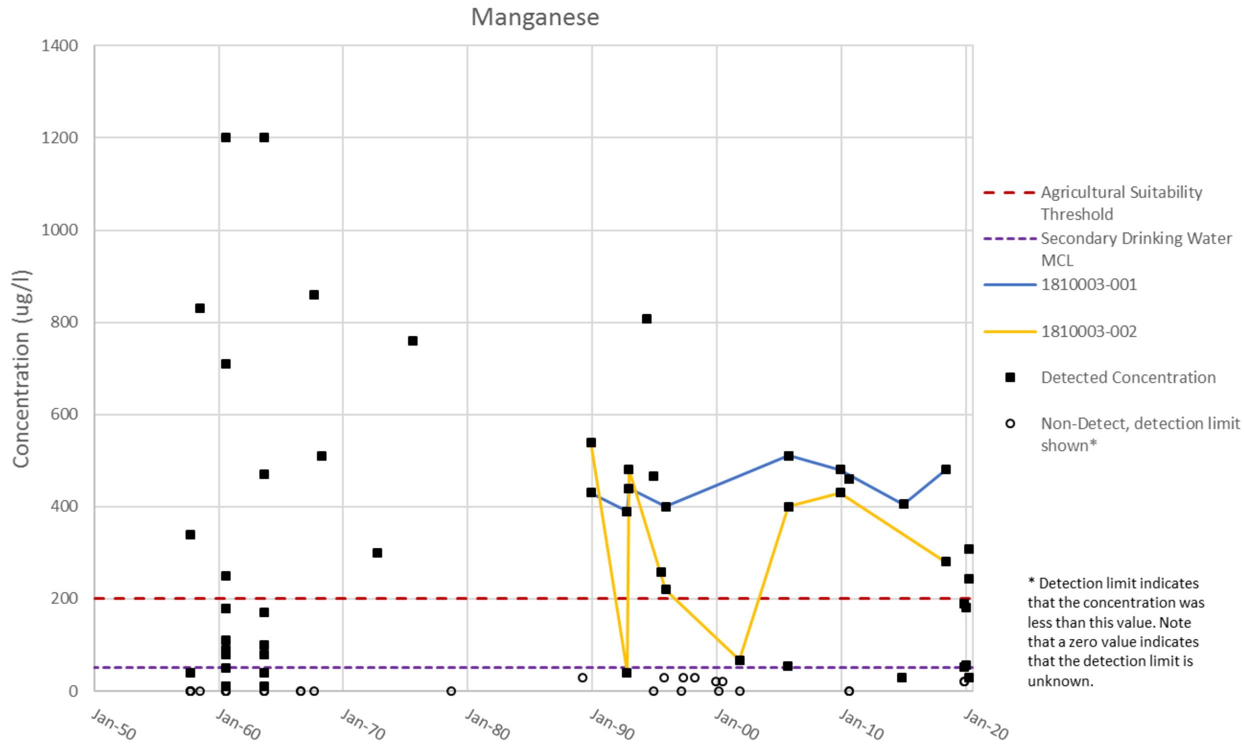


Figure 5-10 Manganese Trends

Key findings from Figure 5-11 include:

- Based on wells with more than one sample in recent years (wells shown with lines connecting the sample concentrations), arsenic concentrations are below the MCL since 2000, and have no trends.
- The two recent arsenic samples were at or just above (10.5 and 12 ug/L, respectively) the MCL. These wells are located close to the basin boundary, where there may be more direct impact from the volcanic rocks.

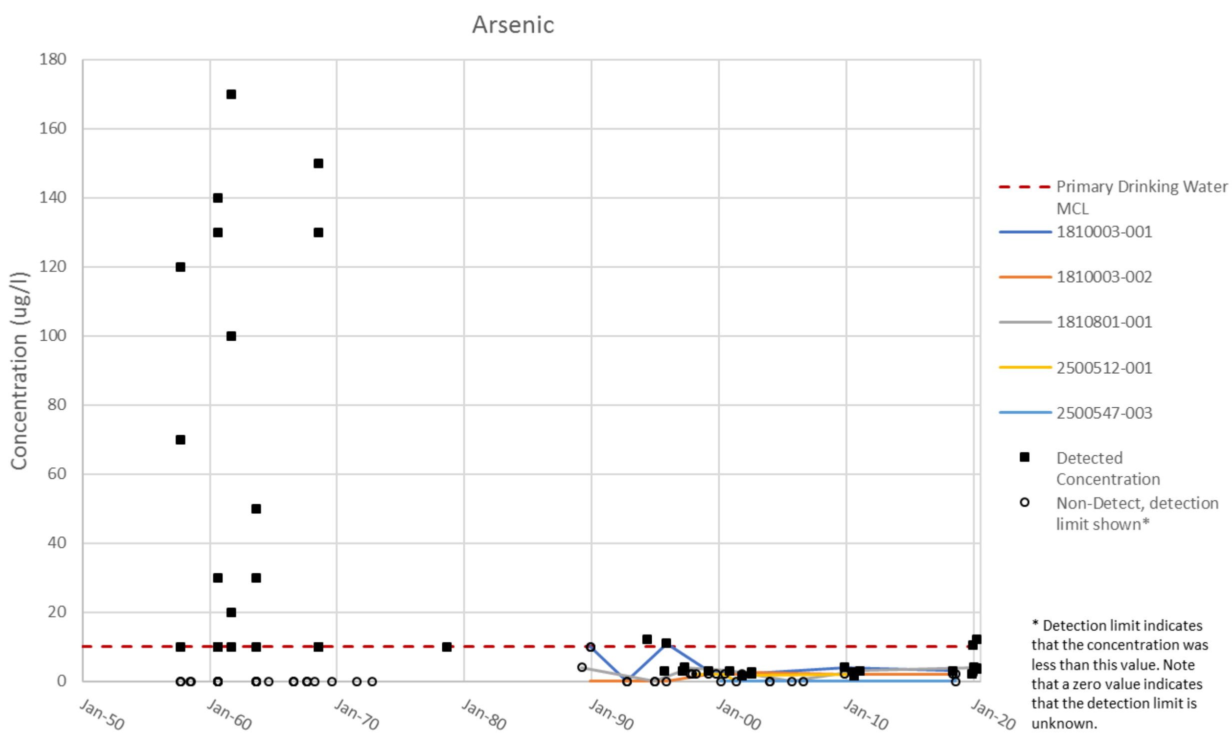


Figure 5-11 Arsenic Trends

Similar to other Basins, iron, manganese, and arsenic are naturally occurring constituents and their elevated concentrations cannot be controlled by the GSAs. A description of how project management actions may impact the concentrations of these constituents is described in Section 9.

Nitrate

As described earlier, most of the farmed land in the Basin utilizes low-impact farming, employing no-till methods to grow nitrogen-fixing crops which require little to no fertilizer or pesticide application. However, nitrate is included in this discussion due to concerns over its potential impacts from Ash Creek Wildlife Area. In this area, there is a concern that decomposition of organic matter could result in nitrate impacts to groundwater. Additionally, a concern was raised over discharge of domestic wastewater, which could result in nitrate impacts to groundwater.

Nitrate has been analyzed in groundwater throughout the Basin from 1952 through 2023 and was detected above its MCL of 10 mg/L in less than 1 percent of samples. Nitrate was not detected above the MCL within the last 30 years, with the last reported detection above the MCL in 1978. **Figure 5-12** shows detections of nitrate in groundwater samples between 2013 and 2023. Based on **Figure 5-12**, nitrate concentrations within the Big Valley Basin in the last ten years are all below 5 mg/L, which is half of the MCL. Review of all historical data suggests that all reported concentrations of nitrate detected in groundwater are below the MCL throughout the Basin from 1978 to 2023. These results are consistent with the current understanding of land uses in the Basin and the limited use of fertilizers. Decomposition of organic matter and the discharge of domestic wastewater do not appear to cause nitrate impacts to groundwater.

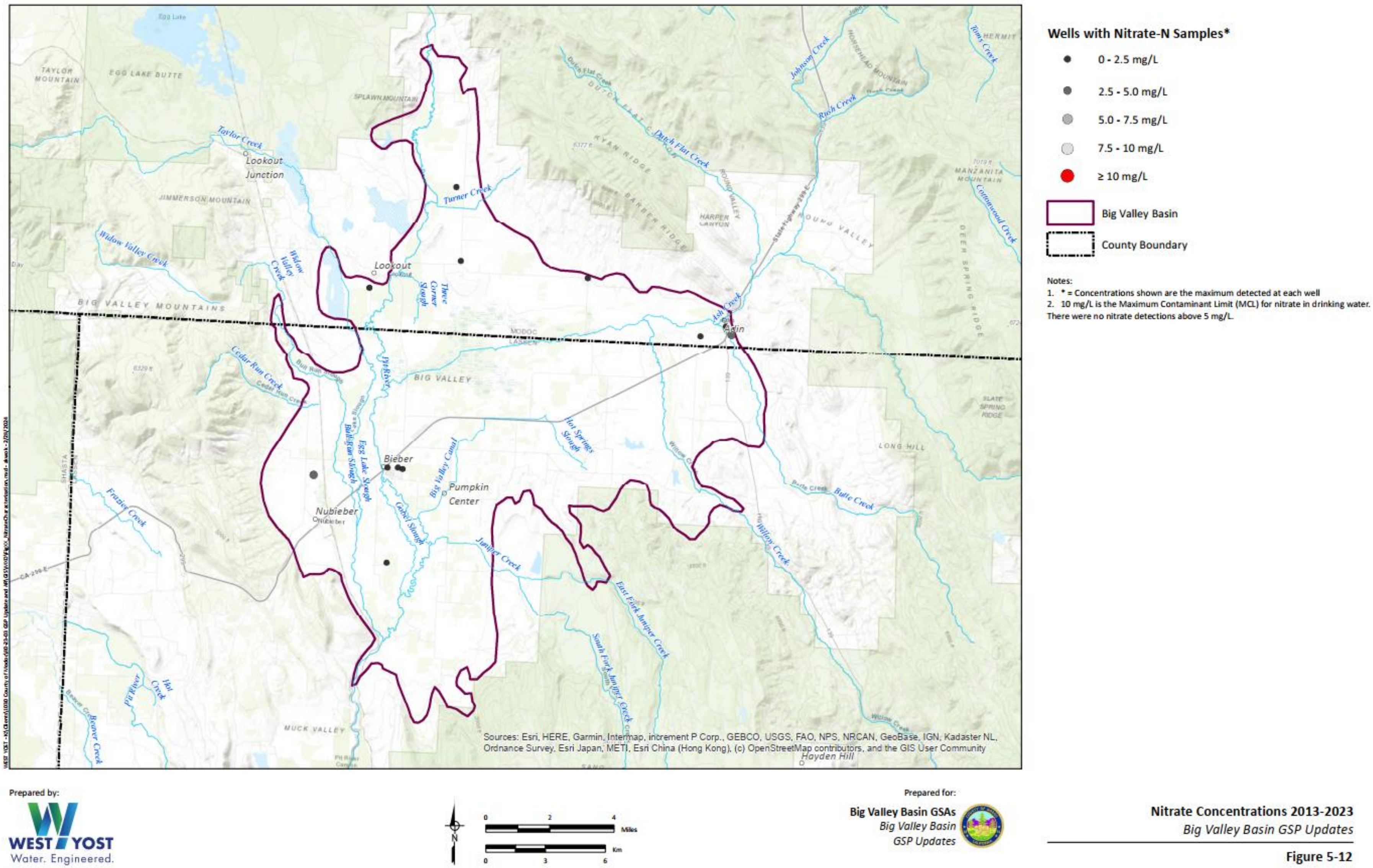


Figure 5-12 Nitrate Concentration 2013-2023

Specific Conductance and Total Dissolved Solids

Specific conductance (SC) is a measure of the water's ability to conduct electricity. TDS is a measure of the total amount of dissolved materials (e.g., salts) in water. For groundwater in the Basin, a linear relationship exists between TDS and SC (Rusydi, A., 2018); therefore, SC is an appropriate and cost-effective proxy to determine the salinity trends in the Basin. SC and TDS are included in this discussion due to the impacts TDS can have on agricultural productivity. **Figure 5-13** shows the concurrent TDS and SC measurements taken at wells in the Basin since 1990. This figure shows the linear relationship between TDS and SC, where TDS (mg/L) is approximately 0.66 times the SC (microsiemens per centimeter [µS/cm]). This ratio falls within the normal range of natural waters (Marandi et al., 2013). The coefficient of determination (R-squared) of the data is 0.98, indicating a strong correlation between TDS and SC in the Basin.

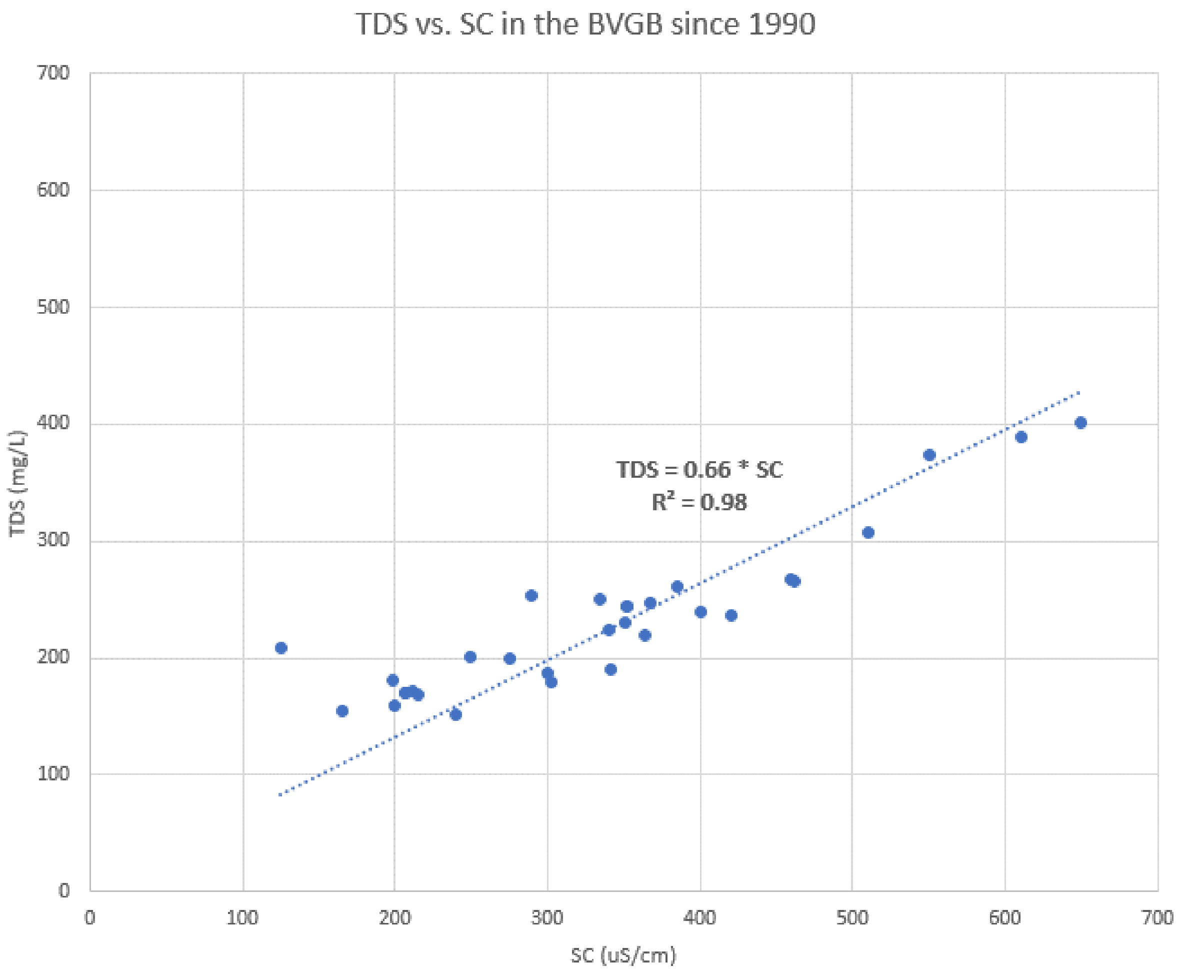


Figure 5-13 TDS vs. SC in the BVGB since 1990

Figure 5-14 and **Figure 5-15** show historical trends of SC and TDS, respectively. Wells with single measurements are shown as dots, where wells that had multiple measurements are shown as lines. These figures indicate that the number of wells with highly elevated concentrations of SC and TDS may have decreased over the last 40 years. **Figure 5-16** and **Figure 5-17** show the distribution of SC and TDS concentrations around the Basin. These data show that SC and TDS concentrations are generally low across the basin and that wells with sufficient historical data do not suggest that there are increasing trends in either constituent.

Figure 5-18 shows the distribution of TDS concentration around the Basin from 2013 to 2023. TDS concentrations have been less than 400 mg/L, except for one well, which had an observed concentration of 479 mg/L in March 2020.

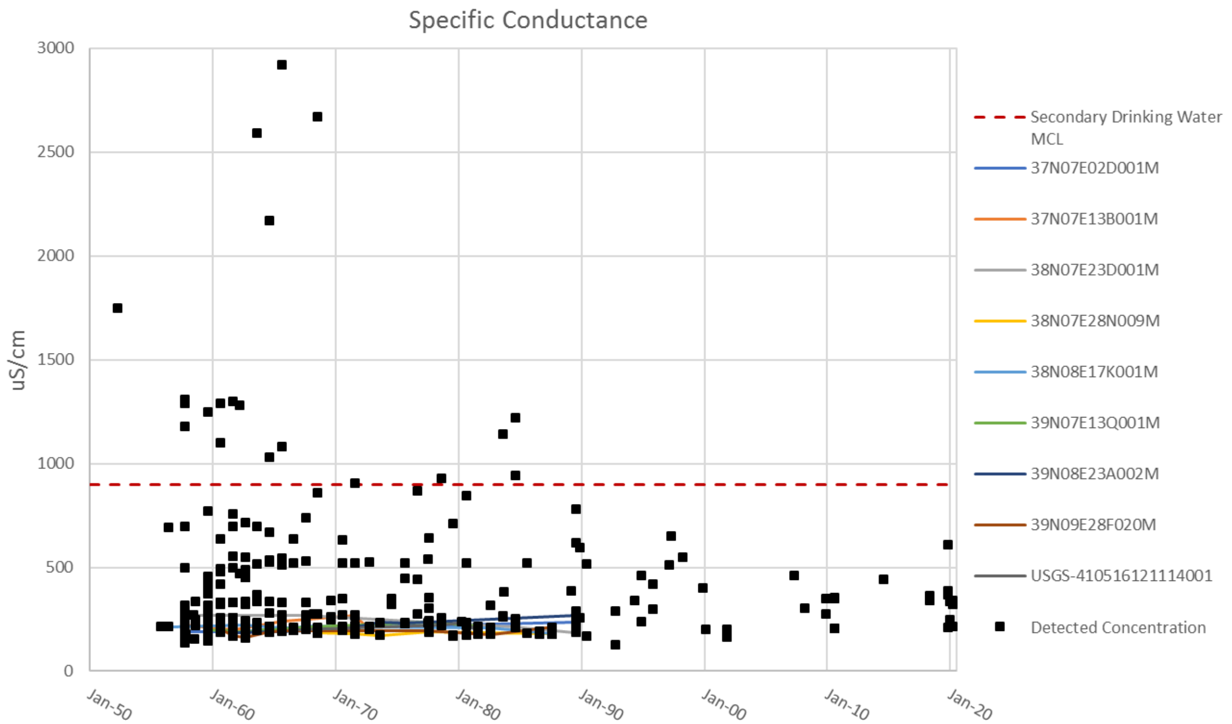


Figure 5-14 Specific Conductance Trends

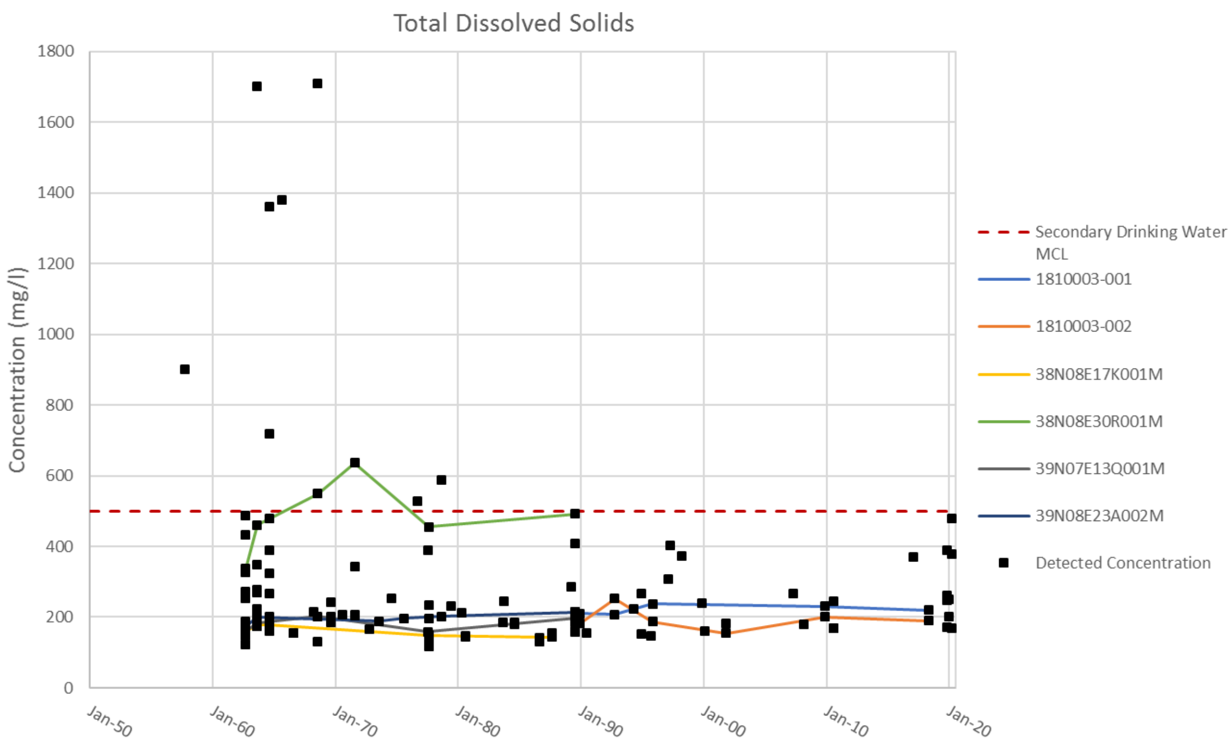
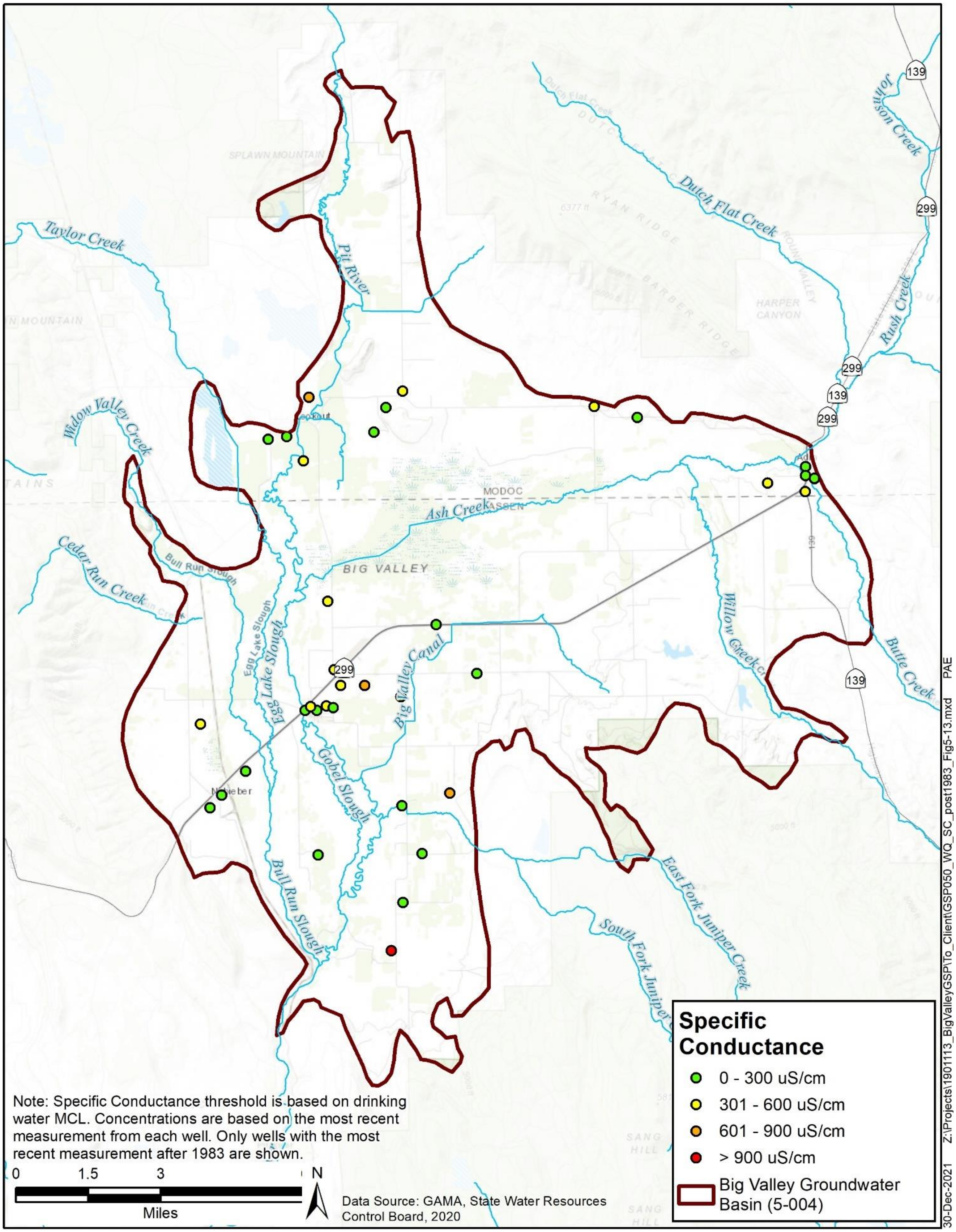


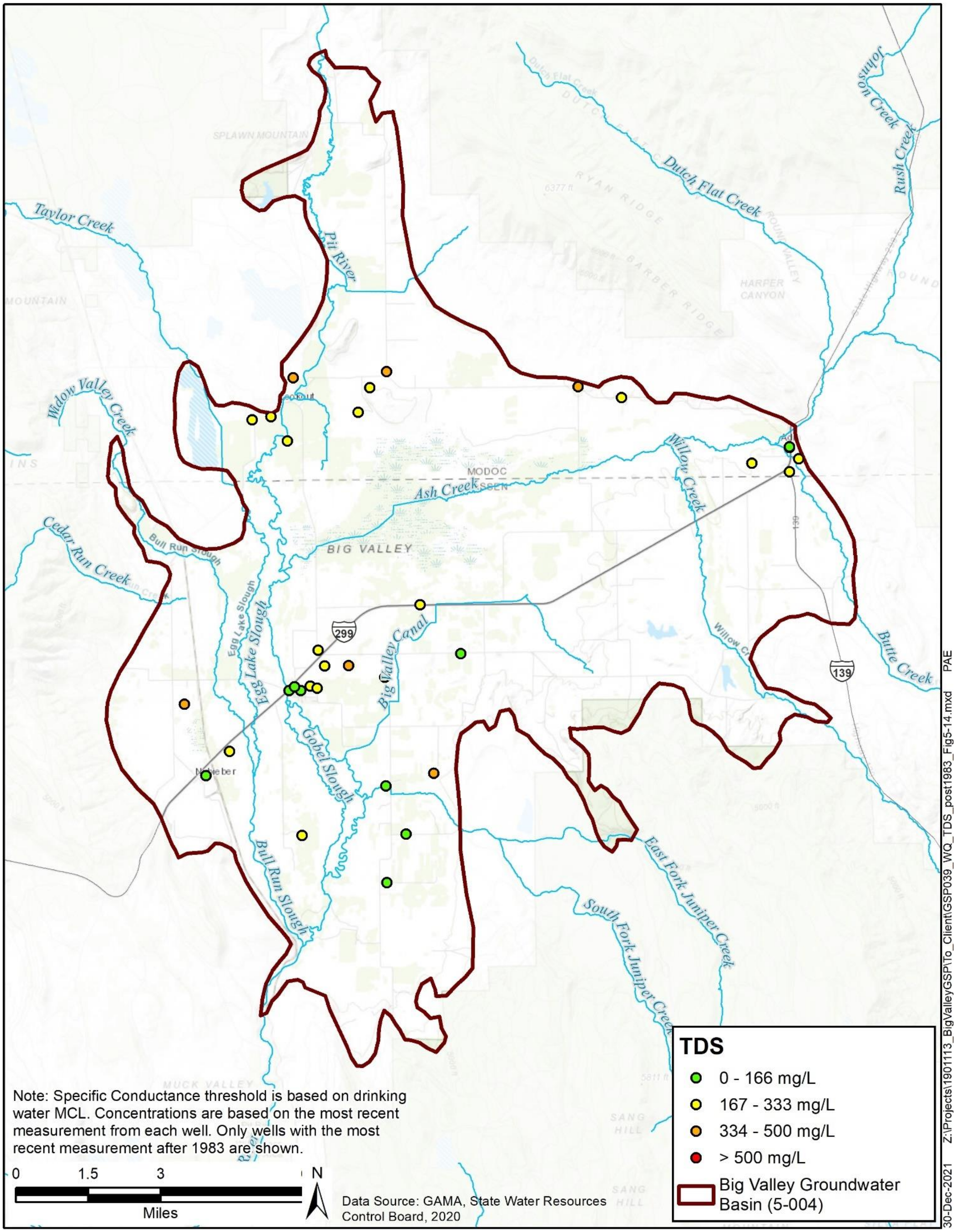
Figure 5-15 TDS Trends

1979

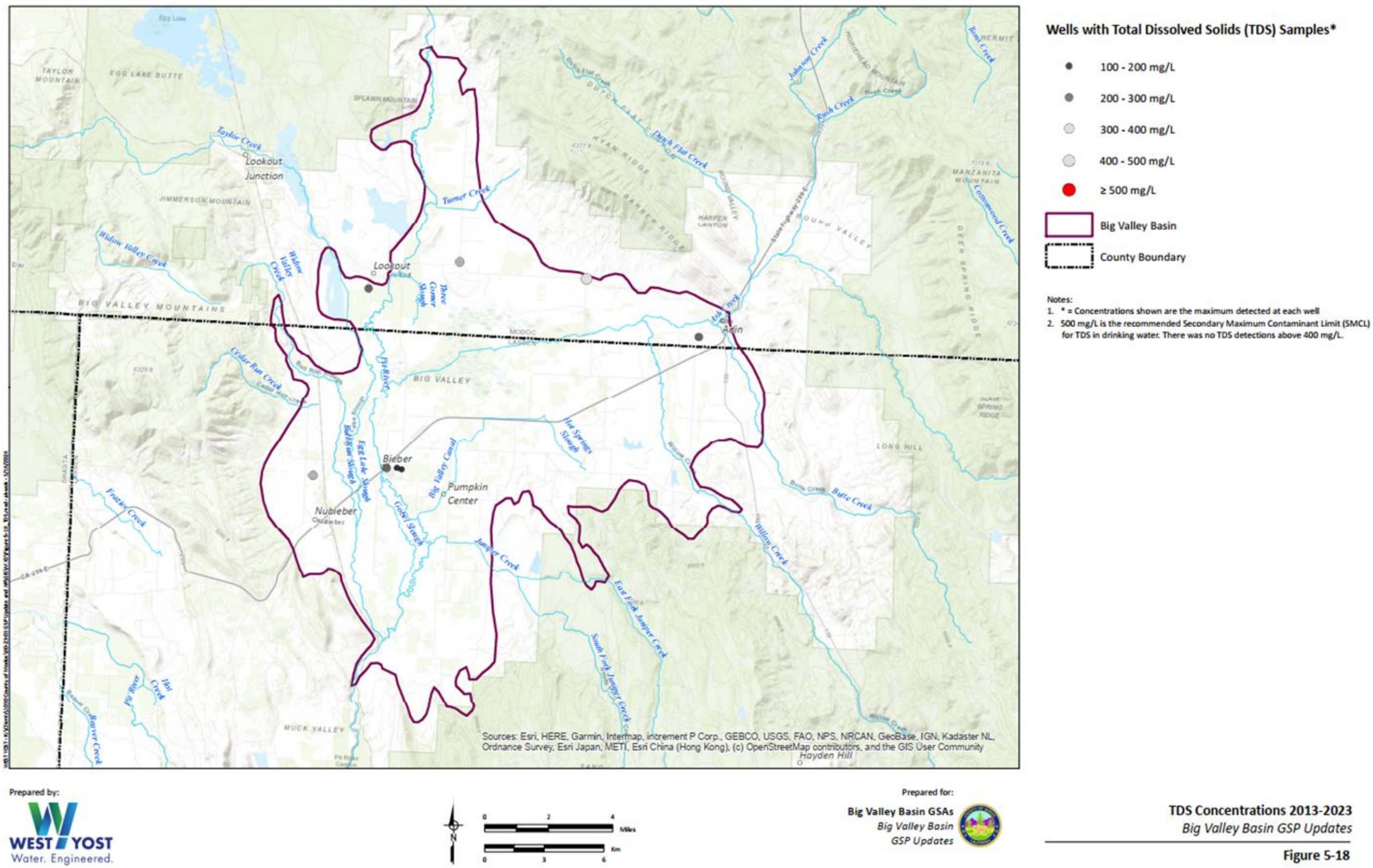


1980 **Figure 5-16 Distribution of Specific Conductance**

1981



1982 **Figure 5-17 Distribution of TDS Concentrations**



1983

1984 **Figure 5-18 TDS Concentration 2013-2023**

Perfluorooctanesulfonic Acid (PFOS)

LCWD #1 conducted nine rounds of sampling for several per- and polyfluoroalkyl substances (PFAS) between 2019 and 2022. PFOS, one of the more prevalent PFAS compounds, was detected above the notification level of 6.5 nanograms per liter (ng/L) in both wells (Well 01 and Well 02). The PFOS results exceeding the notification level were as follows:

- 6.9 ng/L in one sample collected on December 12, 2019 from Well 01
- 86 ng/L in one sample on December 12, 2019 from Well 02

The State Water Board assigned the area around these wells as high water quality risk in its 2024 assessment of water quality risks for domestic wells and state small water systems (State Water Board, 2024). However, PFAS samples collected before and after the December 12, 2019 samples were below either the laboratory reporting limits, method detection limits, or the notification levels. Based on the detection of PFOS in a single sample event, and ubiquity of PFAS in commonly used products, the December 12, 2019 results above the notification level are likely the result of inadvertently introducing PFOS during sample collection, transport, or analysis.

5.4.2 Groundwater Contamination Sites and Plumes

To determine the location of potential groundwater contamination sites and plumes, the State Water Board's GeoTracker website was consulted. GeoTracker catalogs known groundwater contamination sites and waste disposal sites (State Water Board 2020b). A search of GeoTracker identified ten sites where groundwater could potentially be contaminated. These sites are in the vicinity of Bieber and Nubieber as listed in **Table 5-5** and shown on **Figure 5-19**. The sites include leaking underground storage tanks (LUSTs), cleanup program sites, and a land disposal site. Half of the sites are open and subject to ongoing regulatory requirements. The contaminants are listed in **Table 5-5**, which also gives a summary of the case history.

Most of the contaminants originated at LUST sites are leaking petroleum hydrocarbons, which are light non-aqueous phase liquids (LNAPLs). LNAPLs are less dense than water and their solubility is quite low, meaning that if they reach groundwater, they float on top and generally do not migrate into the deeper portions of the aquifer. Moreover, many of the constituents can be degraded by naturally occurring bacteria in soil and groundwater so the hydrocarbons do not migrate far from the LUST sites. However, MTBE,[41] TBA,[42] and fuel oxygenates are more soluble in water. Two LUST sites and the landfill site are subject to long-term monitoring while a fourth site is ready for case closure.

The Bieber Landfill is subject to ongoing semi-annual monitoring of groundwater levels and groundwater quality at four shallow wells. This monitoring is required by the RWQCB

[41] Methyl tert-butyl ether (MTBE) is a fuel additive that was used starting in 1979 and was banned in California after 2002. MTBE is sparingly soluble in water and has a primary MCL of 13 ug/l for human health and a secondary MCL of 5 ug/l for aesthetics.

[42] tert-Butyl alcohol (TBA) is also a fuel additive and is used to produce MTBE. TBA does not have a drinking water MCL in California.

(Order No. R5-2007-0175) after the formal closure of the landfill in the early 2000s. Trace concentrations of several organic constituents[43] have been detected at MW-1, the closest downgradient well to the site, but rarely at the other three wells. Higher concentrations of inorganic constituents (e.g., TDS, SC, others) are also present at MW-1. During 2019, the landfill was also required to analyze groundwater samples from MW-1, MW-2, and MW-4 for per/polyfluoroalkyl substances (PFAS), which are an emerging group of contaminants that are being studied for their effect on human health and may be subject to very low regulatory criteria (parts per trillion). Fifteen of 28 PFASs were detected at MW-1, and nine of 28 PFASs were detected at MW-4 (none at MW-2). The State Water Board/RWQCB evaluation of these data is still pending.

[43] 1,1-dichoroethane, 1,4-dichlorobenzene, cis-1,2-dichloroethylene, benzene, chlorobenzene, MTBE, 2,4,5-trichlorophenoxyacetic acid

Table 5-5 Known Potential Groundwater Contamination Sites in the BVGB

GeoTracker ID	Latitude	Longitude	Case Type	Status	Last Regulatory Acitivity	Case Begin Date	Potential Contaminants of Concern	Site Summary
T10000003882	41.12050	-121.14605	LUST Cleanup Site	Open - Assessment & Interim Remedial Action	04/16/20	10/17/11	Benzene, Diesel, Ethylbenzene, Total Petroleum Hydrocarbons (TPH), Xylene	The case was opened following an unauthorized release from an UST(s). Tank removal and further site assessment, including installation of 8 monitoring wells, led to remedial actions. Periodic groundwater monitoring started in October 2013 and has been ongoing though March 2020.
T0603593601	41.13230	-121.13070	LUST Cleanup Site	Open - Remediation	07/29/20	03/22/00	Gasoline	Active gas station with groundwater impacts. Full-scale remediation *via* groundwater extraction and treatment began in September 2013 and was shut down in April 2017 because it was determined that it was no longer an effective remedy to treat soil and groundwater. At the time of system shutdown, the influent MTBE concentration was 5,650 micrograms per liter which exceeds the Low-Threat Closure Policy criteria. Additionally, high levels of TPHg and sheen/free product are present. A soil vapor extraction system operated for a limited time in 2016/2017 but was not effective. In April 2018, it was determined that active remediation is not a cost-effective path to closure given low permeability of site soils. Staff suggested incorporating institutional controls (IC) and risk-based cleanup objectives instead of active remediation of soil and groundwater. The IC approach was dependent on the submittal of several documents related to soil management, deed restriction, risk modeling and annual groundwater sampling. This information has not been provided, and the RWQCB sent an Order for this information.
T0603500006	41.12241	-121.14128	LUST Cleanup Site	Completed - Case Closed	01/04/00	06/28/99	Diesel	A 2000-gallon UST was removed, and limited contaminated soil was present in the excavation. Petroleum hydrocarbons were not found in the uppermost groundwater. These findings led to the closure of the case.
L10005078943	41.12941	-121.14169	Land Disposal Site	Open - Closed facility with Monitoring*	06/26/20	06/30/08	Higher levels of Inorganic constituents, organic chemicals (synthetic), per/polyfluoroalkyl substances	Disposal activities at Bieber Landfill occurred from the early 1950s until 1994. The landfill was closed during the early 2000s. While active, the site received residential, commercial, and industrial non-hazardous solid waste. Formerly an unlined burn dump, the site was converted to cut-and-cover landfill operation in 1974. Landfill refuse is estimated to occupy less than 13 acres of the 20-acre site. Wastes are estimated to be approximately 10-15 feet thick. The Class III landfill was closed in accordance with Title 27 of the California Code of Regulations. A transfer station was established at the site for the transportation of waste to another landfill. Groundwater levels and quality are monitored twice per year at 4 wells.
T0603500003	41.12124	-121.14061	LUST Cleanup Site	Completed - Case Closed	09/13/94	07/31/91	Heating Oil / Fuel Oil	A 1000-gallon UST was removed, and contaminated soil was present beneath the tank, which led to installation of nine soil borings and three monitoring wells. Contaminated soil was removed but an adjacent building limited the extent of the excavation so contaminated soil remains under the building. Hydrocarbons were initially found in 1 well but not in subsequent sampling. The RWQCB concurred with a request to close the investigation.
T10000003101	41.13151	-121.13658	Cleanup Program Site	Open - Assessment & Interim Remedial Action	07/22/20	04/03/07	Benzene, Toluene, Xylene, MTBE / TBA / Other Fuel Oxygenates, Gasoline, Other Petroleum	A diesel leak was found in association with an industrial chipper. Corrective action included excavation of diesel-impacted soil, removing contaminated water and groundwater monitoring. Results of soil and groundwater sampling indicate low concentrations of TPHg and BTEX and that there is no offsite migration. Staff have determined that the case is ready for closure, pending decommissioning of the site monitoring wells.
SL0603581829	41.09251	-121.17904	Cleanup Program Site	Completed - Case Closed	09/01/05	01/08/05	Petroleum - Diesel fuels, Petroleum - Other	Contaminated soil excavated and transported to Forward Landfill for disposal. Contaminated groundwater (7,000 gallons) extracted with vacuum truck for disposal.
T0603500002	41.12188	-121.13546	LUST Cleanup Site	Completed - Case Closed	07/17/06	10/20/86	Gasoline / diesel	Three USTs were removed, and contaminated soil was present beneath the tank, which led to installation of nine monitoring wells and three remediation wells. Natural attenuation of the hydrocarbon impact was acceptable to the RWQCB due to the limited, well-defined extent of the impact and the limited and declining impact to groundwater. The RWQCB concurred with a request to close the site.
T0603500004	41.12134	-121.13547	LUST Cleanup Site	Completed - Case Closed	03/12/99	06/12/97	Diesel	A 5000-gallon UST was removed and very low levels of petroluem hydrocarbons were detected in the soil, which was allowed to be spread onsite and the case was closed.
T10000002713	41.11993	-121.14271	Cleanup Program Site	Open - Site Assessment	12/30/16	03/10/10	Other Petroleum	The site is an old bulk plant which was built in the 1930s and handled gasoline and diesel. During a routine inspection in March 2010, evidence of petroleum spills were identified at the loading dock area. A follow-up inspection was conducted in April 2010. The ASTs and loading dock were removed but additional contamination was noted under the removed structures. Furthermore, a shallow excavation contained standing water with a sheen. Due to the potential impacts to shallow groundwater, the Regional Water Board became the lead agency in December 2010. Additional information was requested in December 2016. A response is not evident.

*This terminology indicates that the landfill is closed (no new material being disposed), but the site is open with regard to ongoing groundwater monitoring.

Source: GeoTracker (State Water Board 2020b)

MTBE = Methyl tert-butyl ether; TBA = tert-Butyl alcohol

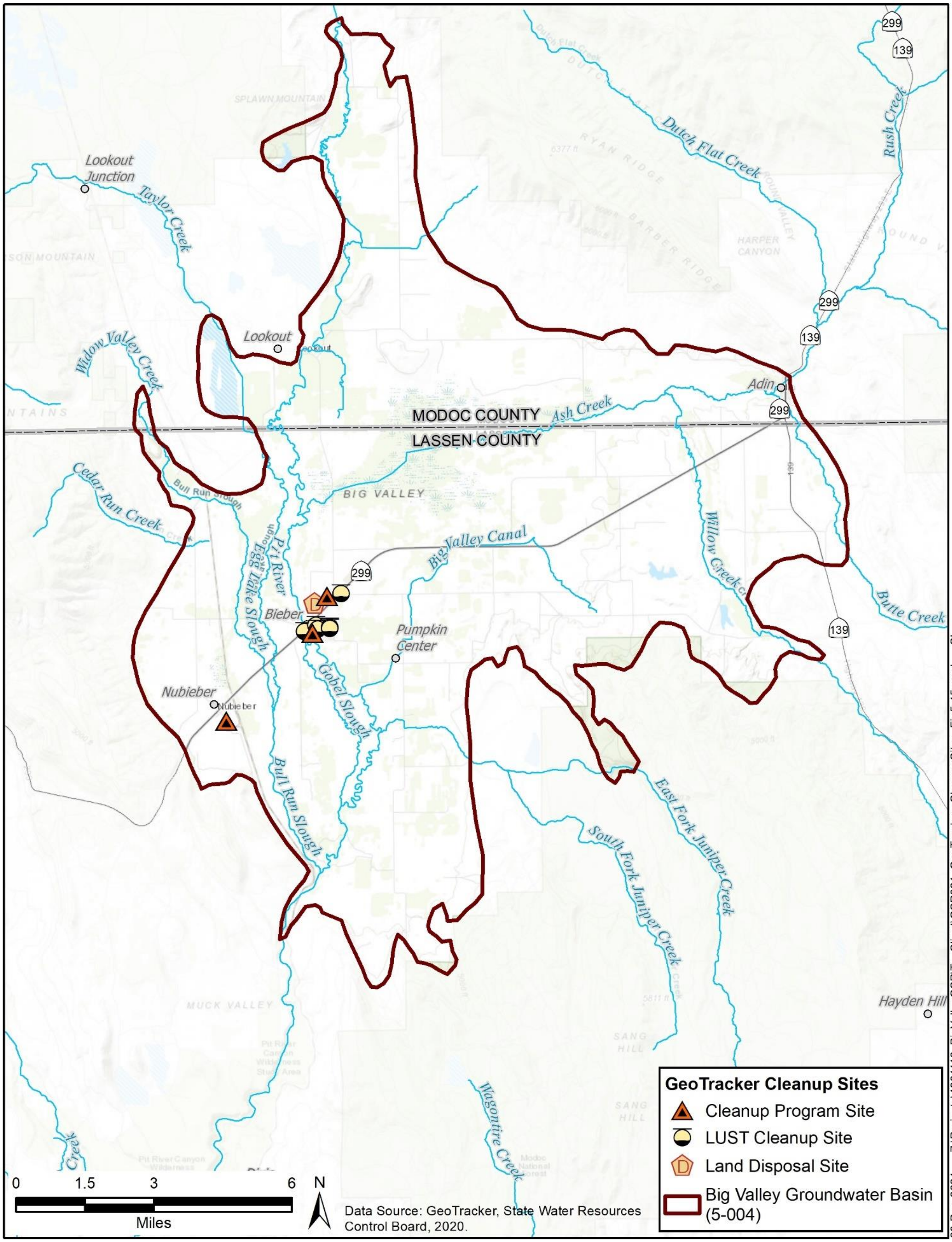


Figure 5-19 Location of Known Potential Groundwater Contamination Sites

5.5 Subsidence

Vertical displacement of the land surface (subsidence) is comprised of two components: 1) elastic displacement which fluctuates according to various cycles (daily, seasonally, and annually) due to temporary changes in hydrostatic pressure (e.g., atmospheric pressure and changes in groundwater levels) and 2) inelastic displacement or permanent subsidence which can occur from a variety of natural and human-caused phenomena. Lowering of groundwater levels can cause prolonged and/or extreme decrease in the hydrostatic pressure of the aquifer. This decrease in pressure can allow the aquifer to compress, primarily within fine-grained beds (clays). Inelastic subsidence cannot be restored after the hydrostatic pressure increases. Other causes of inelastic subsidence include natural geologic processes (e.g., faulting) and the oxidation of organic rich (peat) soils as well as human activities such as mining and grading of land surfaces.

Subsidence can be measured by a variety of methods, including:

- Regular measurements of any vertical space between the ground surface and the concrete pad surrounding a well. If space is present and increasing over time, subsidence may be occurring at that location. If a space is not present, subsidence may not be occurring, or the well is not deep enough to show that subsidence is occurring because the well and ground are subsiding together.
- Terrestrial (ground-based) surveys of paved roads and benchmarks.
- Global Positioning Survey (GPS) of benchmarks. GPS uses a constellation of satellites to measure the 3-dimensional position of a benchmark. The longer the time that the GPS is left to collect measurements, the higher the precision. Big Valley has one continuously operating GPS (CGPS) station near Adin.
- Monitoring of specially constructed “extensometer” wells. There are no extensometers in the BVGB.
- Use of InSAR, which is microwave-based satellite technology that has been used to evaluate ground surface elevation and deformation since the early 1990s. InSAR can document changes in ground elevation between successive passes of the satellite. Between 2015 and 2019, InSAR was used to evaluate subsidence throughout California, including Big Valley.

Subsidence was recognized as an important consideration in the 2007 LCGMP (Brown and Caldwell 2007) but was not identified as an issue for Big Valley specifically. The analysis in the LCGMP was based on indirect observations (groundwater levels) and anecdotal information. This section presents additional data that has become available since the development of the LCGMP.

5.5.1 Continuous GPS Station P347

A CGPS station (P347) was installed at the CalTrans yard near Adin in September 2007. The station is part of the Plate Boundary Observatory, which is measuring 3-dimensional changes in the Earth surface due to the movement of tectonic plates (e.g., Pacific and North American plates).

Figure 5-20 is a plot of the vertical displacement at P347 and shows a slight decline (0.6 inch) over the first 11 years of operation, based on the annual mean values (large black open circles). Daily values (blue dots) show substantial variation, as much as an inch, but more typically only 0.1 inch on average. This scattering of daily values around the annual mean provides an indication of the elastic nature of the displacement. The overall decline of 0.6 inch is an indication of inelastic displacement has occurred over an 11-year period, which equates to a rate of -0.05 inch per year at this location near Adin.

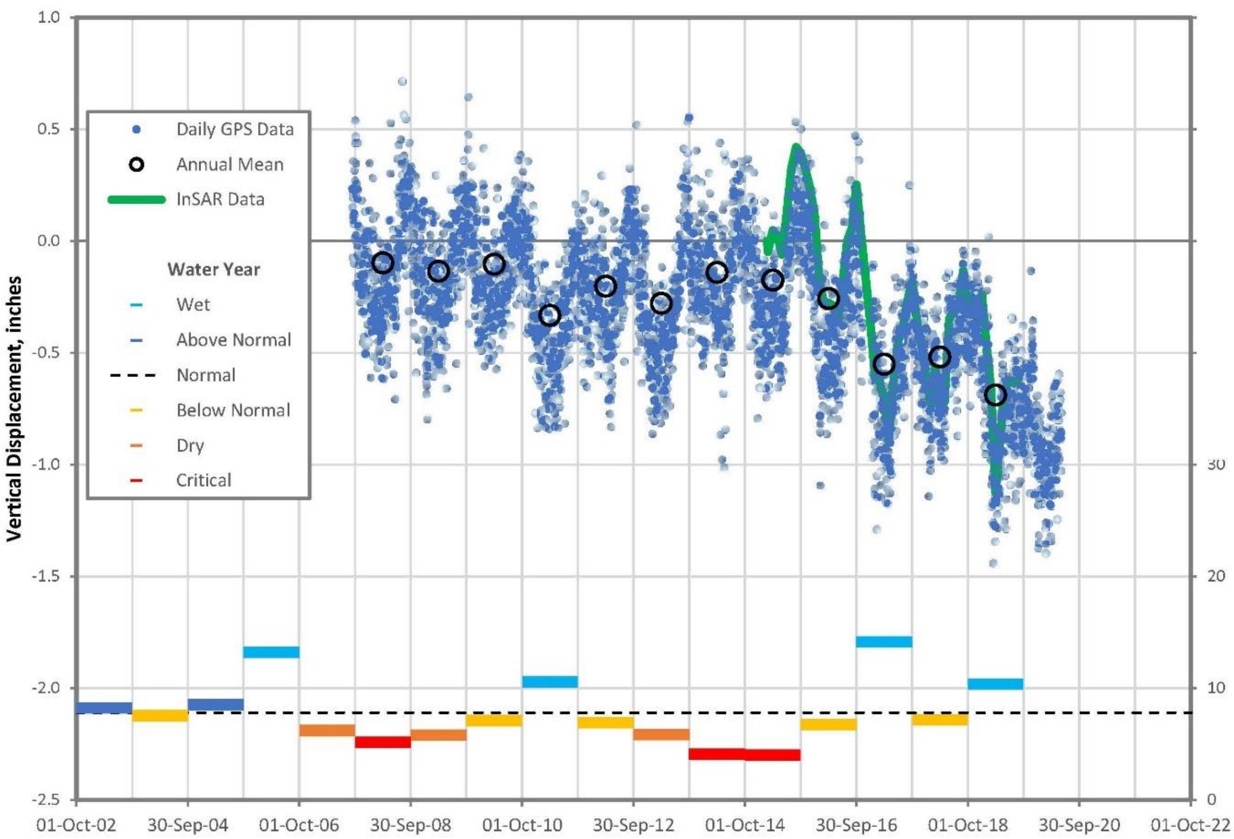


Figure 5-20 Vertical Displacement at CGPS P347

5.5.2 Interferometric Synthetic Aperture Radar

Figure 5-21 is a map of InSAR data made available by DWR for the 4.3-year period between June 2015 and September 2019. The majority of Big Valley was addressed by this InSAR survey, although the survey excludes some areas (shown in white on **Figure 5-21**), including much of the Big Swamp (ACWA), areas along the Pit River near Lookout, and areas south of Bieber. The accuracy of this type of InSAR data in California has been calculated at 18mm (0.7 inches) at a 95% confidence level (Towill 2021). Most of the survey shows downward displacement between 0 and -1 inch throughout Big Valley. This small displacement is close to the level of accuracy of the data, but if true is likely due to natural geologic activities due to its widespread nature.

Two localized areas of subsidence exceeding -1.5 inches are apparent from this data, one in the east-central portion of the Basin north of Highway 299 and one in the southern portion of the Basin between the Pit River and Bull Run Slough. Maximum downward displacement in the Basin is -3.3 inches, over the 4.3-year period. Some of the downward displacement in the Basin may be due to laser leveling of fields, particularly for production of wild rice.

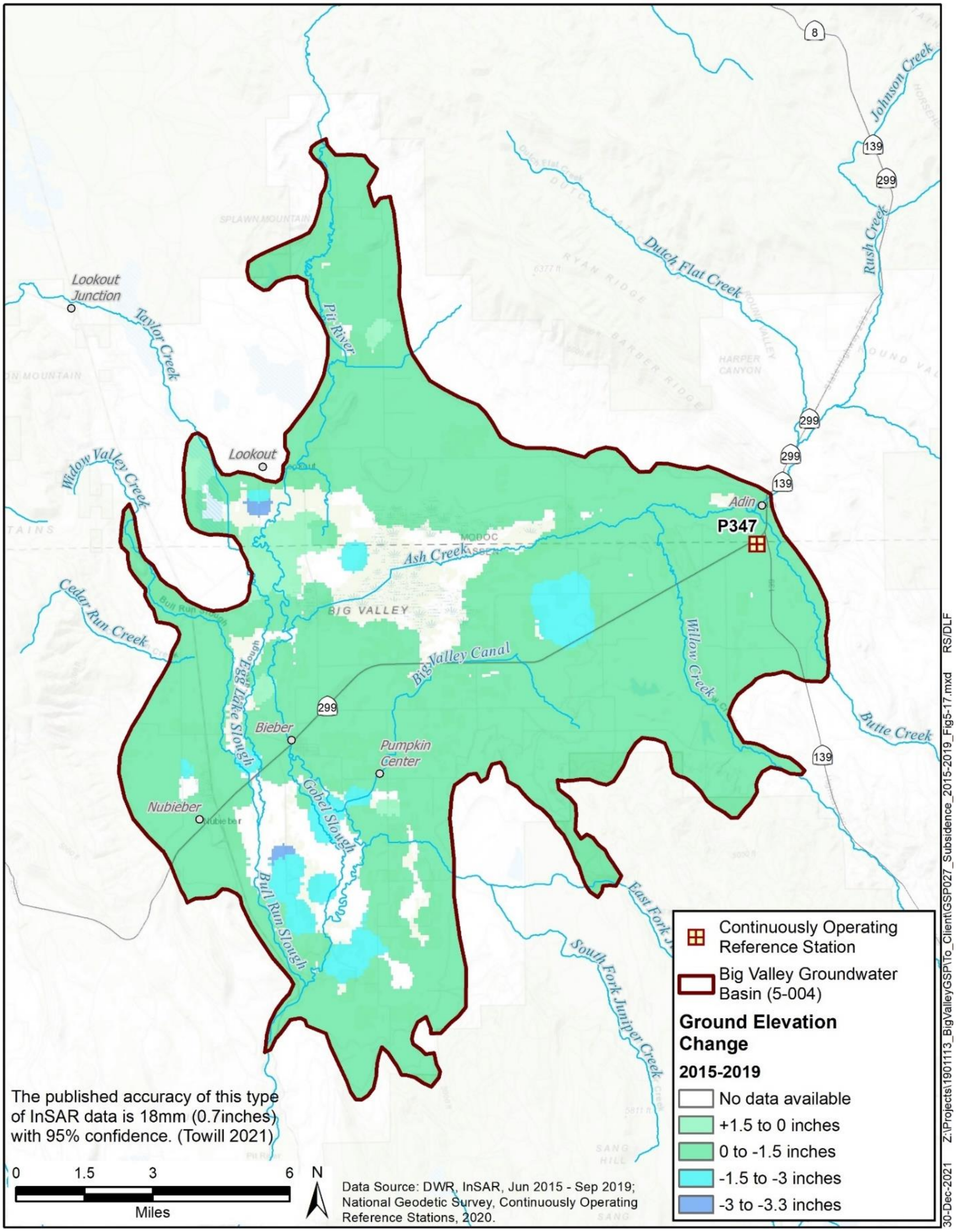


Figure 5-21 InSAR Change in Ground Elevation 2015 to 2019

5.6 Interconnected Surface Water

Interconnected surface water refers to surface water that is "hydraulically connected at any point by a continuous saturated zone to the underlying aquifer and the overlying surface water is not completely depleted" (DWR 2016c). For the principal aquifer to be interconnected to surface-water streams, groundwater levels need to be near ground surface. As a first determination of where surface water *may* be interconnected, **Figure 5-22** shows the major[44] streams in the Basin which have groundwater levels near ground surface, with a depth to water of less than 15 feet based on spring 2015 groundwater contours. These areas *may* have the potential to be interconnected with surface water.

Interconnected streams can be gaining (groundwater flowing toward the stream) or losing (groundwater flowing away from the stream). Preliminary data from the shallow monitoring well clusters[45] give an indication the direction of shallow groundwater flow adjacent to streams in two locations in the Basin as shown by the black arrows on **Figure 5-22**.

Section §354.16(f) of the regulations require an estimate of the "quantity and timing of depletions of [interconnected surface water] systems, utilizing…best available information." The existence and quantity cannot be determined with any reasonable level of accuracy using empirical data, so the best available information is presented in Chapter 6 – Water Budget. The timing of depletions also cannot be determined with existing data.

5.7 Groundwater-Dependent Ecosystems

SGMA requires GSPs to identify groundwater-dependent ecosystems (GDEs) but does not explicitly state the requirements that warrant a GDE designation. SGMA defines a GDE as "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" (DWR 2016c). GDEs are considered a beneficial use of groundwater.

The most comprehensive and readily accessible data to identify GDEs is referred to as the NCCAG[46] dataset. Upon inspection of the data,[47] many inaccuracies were noted. The abstract of the dataset documentation reads:

> The Natural Communities dataset is a compilation of 48 publicly available State and federal agency datasets that map vegetation, wetlands, springs, and seeps in California. A working group comprised of DWR, the California Department of Fish and Wildlife (CDFW), and The Nature Conservancy (TNC) reviewed the compiled dataset and conducted a screening process to exclude vegetation and wetland types less likely to be associated with

[44] Named streams from the National Hydrography Dataset [NHD] (USGS 2020a)

[45] The clusters are sets of three wells drilled in close proximity to each other for the purpose of determining shallow groundwater flow direction and gradient. At the time of writing this draft chapter, 2 clusters have enough data to determine flow direction; one cluster near Adin and one cluster near Lookout. **Appendix 5C** contains data collected at the two clusters and their flow directions.

[46] Natural communities commonly associated with groundwater

[47] By local landowners and local experts familiar with the Basin and its ecological communities.

groundwater and retain types commonly associated with groundwater, based on criteria described in Klausmeyer et al. (2018).

Two habitat classes are included in the Natural Communities dataset: (1) wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions; and (2) vegetation types commonly associated with the sub-surface presence of groundwater (phreatophytes).

The data included in the Natural Communities dataset do not represent DWRs determination of a GDE. However, the Natural Communities dataset can be used by GSAs as a starting point when approaching the task of identifying GDEs within a groundwater basin. (DWR 2018a)

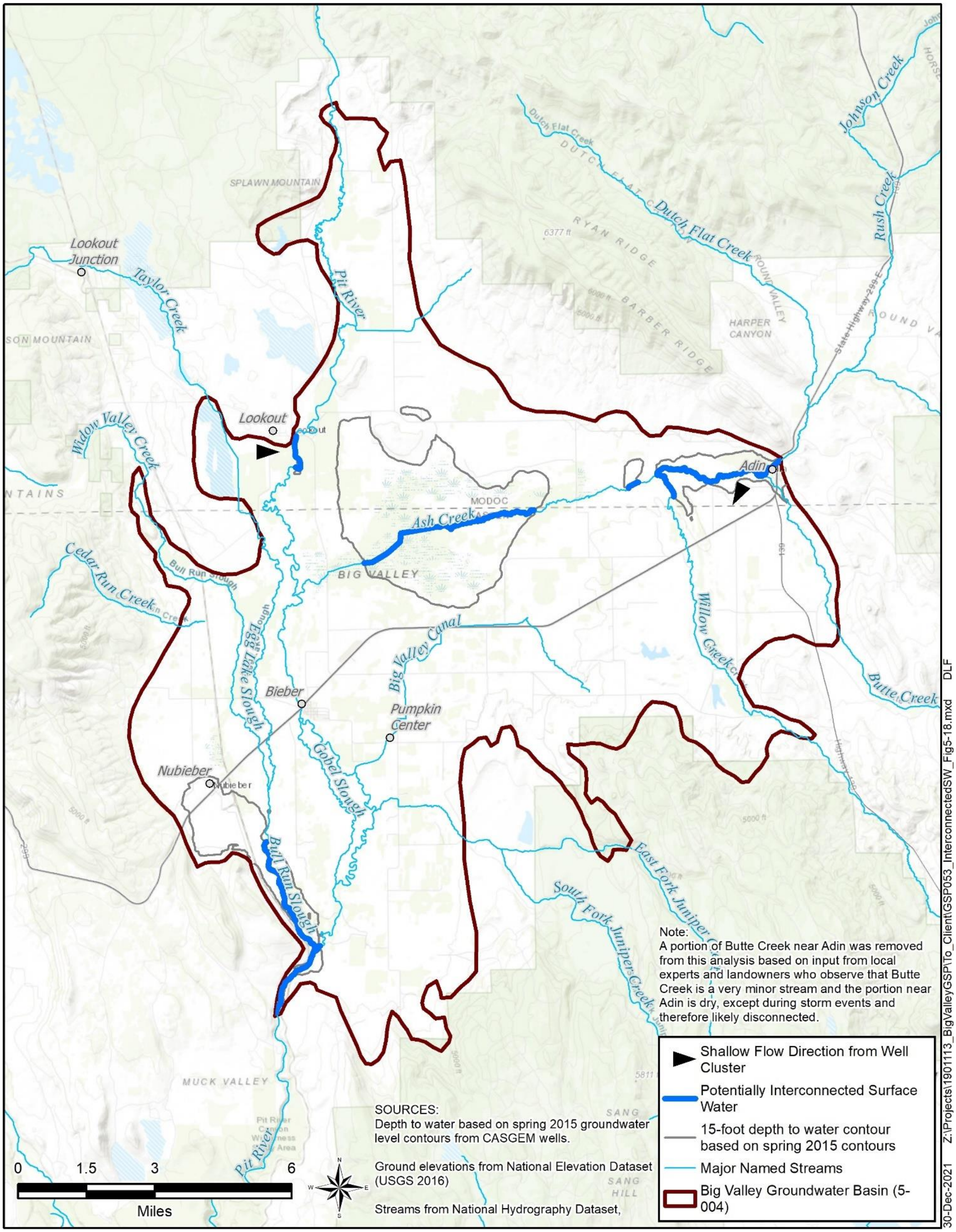


Figure 5-22 Potentially Interconnected Surface Water

The NCCAG geospatial data (DWR 2018a) is separated into two categories: wetlands and vegetation, respectively.

The Wetlands area is subdivided into two primary habitats present in Big Valley: palustrine[48] and riverine.[49] Palustrine is the dominant habitat at 96 percent of the total wetland area, while riverine is present at four percent and occurs along river courses. Sixteen springs account for a very small area. Most of the springs are in Lassen County (13), although numerous springs are located outside the BVGB boundary.

The Vegetation area is subdivided into two primary habitats, based on the plant species. Wet Meadows was the largest primary habitat at 59 percent of the vegetation area, but there was no dominant species. Willow was the second largest habitat at 41 percent of the vegetation area.

For the NCCAG areas to be designated as actual GDEs, the groundwater level needs to be close enough to the ground surface that it would support the vegetation. For determining potential GDEs, fall 2015[50] depth to water is used, because mid-summer months are the critical limiting factor for plant communities. Furthermore, if groundwater moisture isn’t available later in the summer, then the groundwater dependent communities don’t have an advantage over communities that are typically not associated with groundwater, such as sagebrush, juniper, and bunchgrass (Lile 2021).

The depth to water that could potentially be accessed by GDEs depends on the rooting depth of the vegetation. An assessment of native plants in the BVGB found that maximum rooting depths of species present is 10 feet as shown in **Table 5-6**. Access to groundwater by plant roots extends above the water table because the groundwater is drawn upward to fill soil pores, and this zone is known as the capillary fringe. The thickness of the capillary fringe extends upward several feet, depending on the soil type.

Table 5-6 Big Valley Common Plant Species Rooting Depths

Species	Rooting Depth
Carex spp.	Up to 5 feet
Alfalfa	9 feet
Aspen	10 feet and less
Willow	2-10 feet
Elderberry	10 feet and less
Saltgrass	2 feet
Sources: CNPS 2020, TNC 2020, Snell 2020	

As a conservative estimate, a capillary fringe of 10 feet is used. In order for plants to access the water and thrive, not just barely touch, there needs to be significant overlap (of several feet) between the rooting depth and the capillary fringe (Lile 2021). Furthermore, while roots may extend to a deep level,

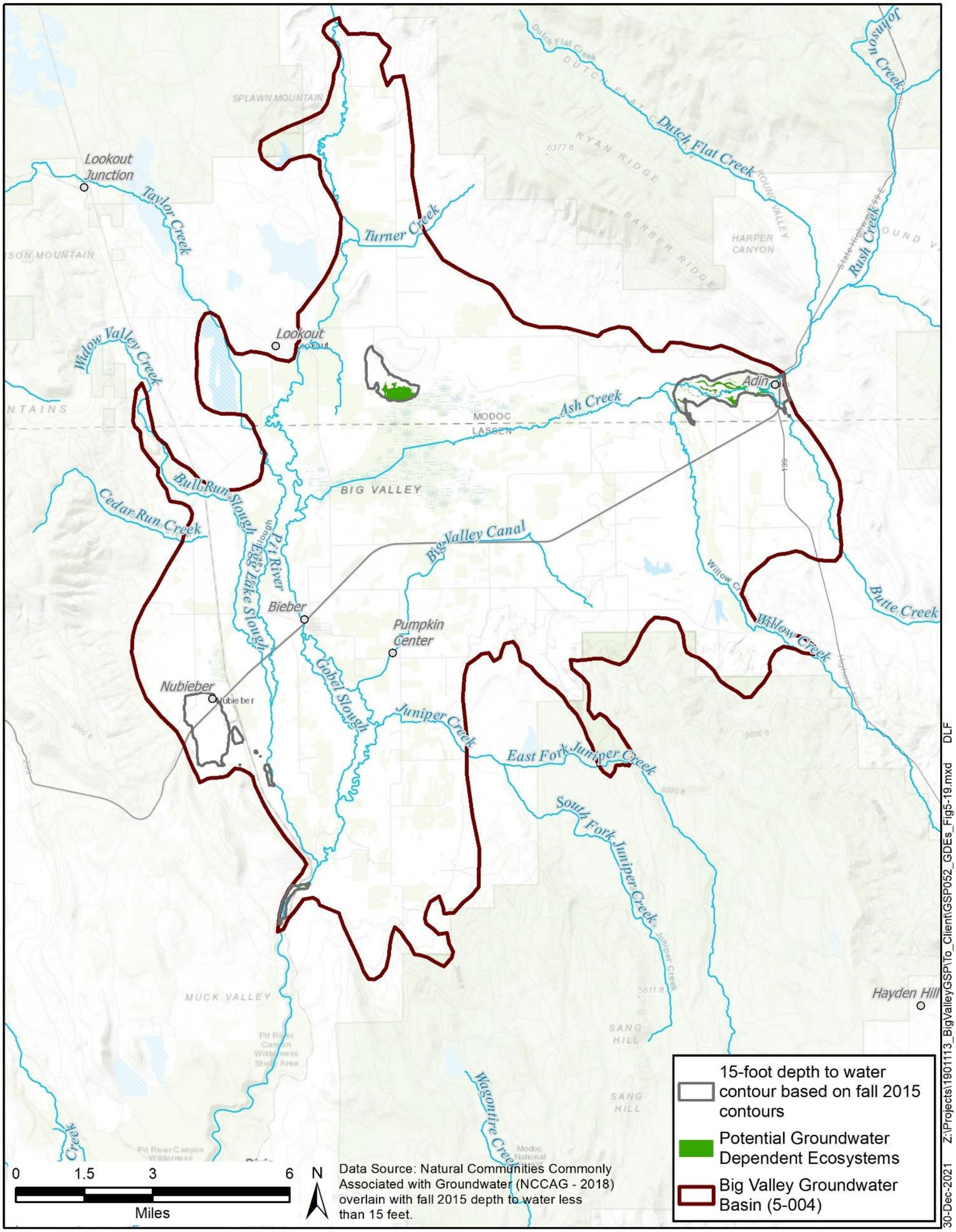
[48] Palustrine are freshwater wetlands, such as marshes, swamps and bogs, not associated with flowing water (Cowardin et al. 2013).

[49] Riverine are freshwater wetlands located in or near a flowing stream (Cowardin et al. 2013).

[50] 2015 is used because it is the baseline for SGMA.

documentation of maximum depth to water for some of the deep-rooting species in **Table 5-6** to thrive is on the order of 2-3 meters (6-9 feet) (Pezeshki and Shields 2006, Springer et. al. 1999). Therefore, as a conservative estimate for the purposes of delineating GDEs, only those areas in the NCCAG datasets that are in areas with fall 2015 groundwater less than 15 feet are classified as potential GDEs.

Figure 5-23 shows the area with potential GDEs, which is a preliminary assessment and needs to be ground-truthed. Moreover, the data are inaccurate in many places.



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2169 **Figure 5-23 Potential Groundwater-Dependent Ecosystems**

6. Water Budget § 354.18

The hydrologic cycle describes how water is moved on the earth among the oceans, atmosphere, land, surface-water bodies, and groundwater bodies. **Figure 6-1** is a depiction of the hydrologic cycle.

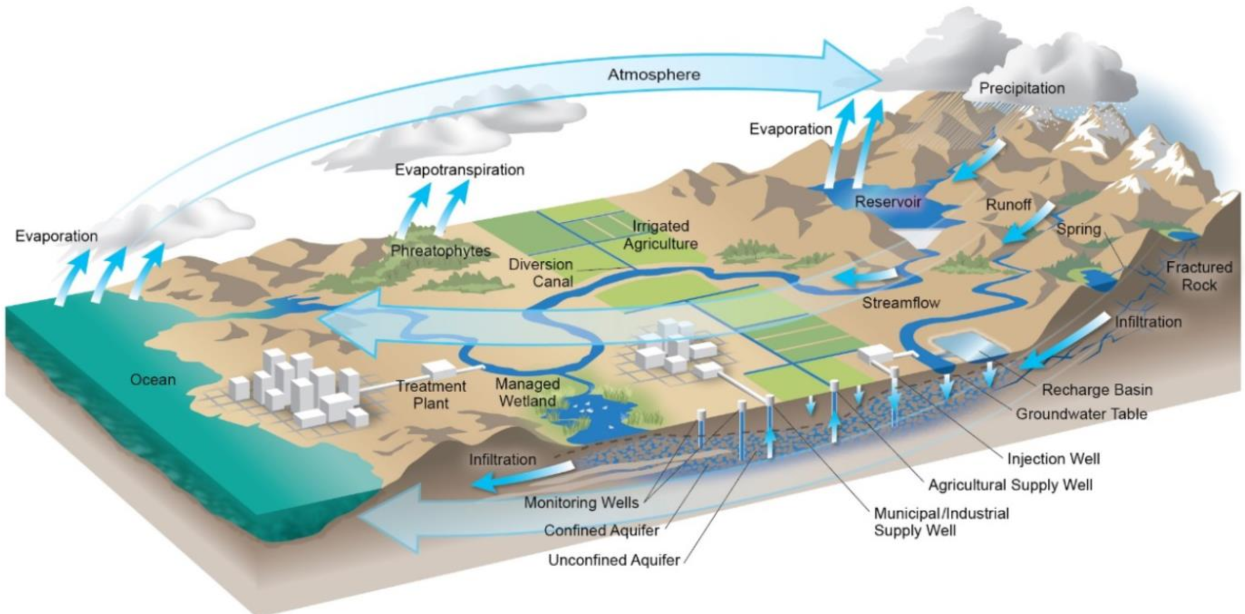


Figure 6-1 Hydrologic Cycle

A water budget accounts for the movement of water among the four major systems in Big Valley: atmospheric, land surface, surface water, and groundwater. The BVGB consists of the latter three systems (land surface, surface water, and groundwater) as shown by the black outline on **Figure 6-2**. This figure shows the exchange between the systems and identifies the specific components of the water budget. The systems and the flow arrows are color coded. Inflows to the BVGB are shown with blue arrows, and outflows from the BVGB are shown with orange arrows. Flows between the systems are shown with green arrows, and flows within a system are shown in purple. The land system, surface-water system, and groundwater system are green, blue, and brown respectively.

Like a checking account, a water budget helps the GSA and stakeholders better understand the deposits and withdrawals and identify what conditions result in positive and negative balances. It should be noted that the development of a water budget is required by the GSP regulations, but the regulations don't require actions based directly on the water budget. Actions are only required based on outcomes related to the six sustainability indicators: groundwater levels, groundwater storage, water quality, subsidence, seawater intrusion, and surface-water depletions. Therefore, a water budget should be viewed as a tool to develop a common understanding of the Basin and a basis for making decisions to achieve sustainability and avoid undesirable results with the sustainability indicators.

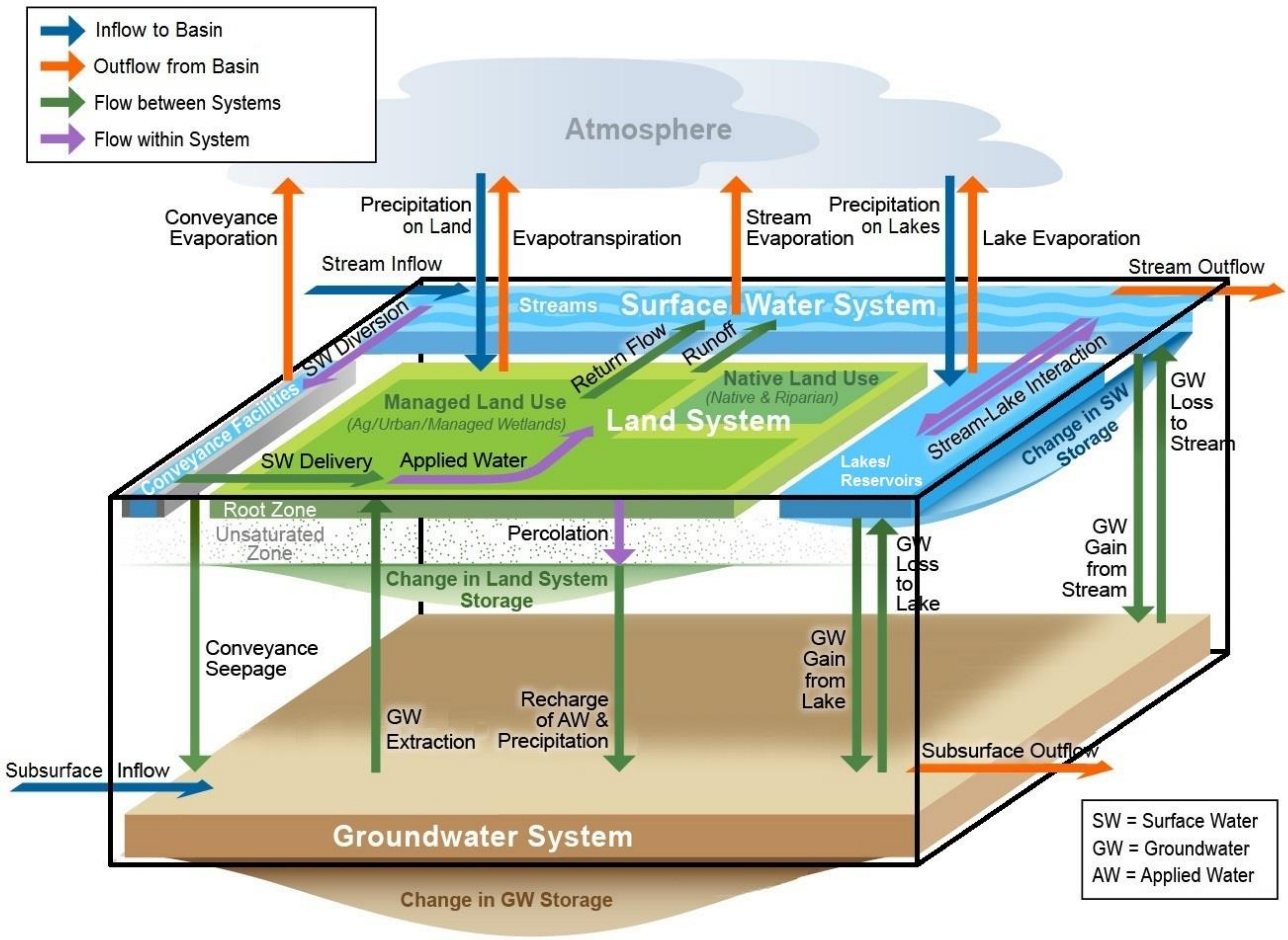


Figure 6-2 Water Budget Components and Systems

6.1 Water Budget Data Sources

Each component shown in **Figure 6-2** was estimated using readily available-data and assembled into a budget spreadsheet. Many groundwater basins in California utilize a numerical groundwater model, such as MODFLOW[51] or IWFM,[52] to calculate the water budget. These models require a specialized hydrogeologist to run them, and the methodology by which the water budget is calculated is not readily apparent to the lay person. For the BVGB, a non-modeling (spreadsheet) approach was used so that future iterations of the water budget could be performed by a wider range of hydrology professionals (potentially reducing future GSP implementation costs) and so that the calculations of the specific components could be understood by a broader range of people.

In concept, each component is quantified precisely and accurately, and the resultant budget is balanced. In practice, most of the components can only be roughly estimated and in many cases not at all. Therefore, much of the work to balance the water budget is adjusting some of the unknown or

[51] Modular Finite-Difference Groundwater Flow model, developed by USGS.
[52] Integrated Water Flow Model, developed by DWR.

roughly-estimated parameters within acceptable ranges until the budget is balanced and all components are deemed reasonable.

As such, the water budget calculations presented herein are not unique, and the precision of the component estimates are within an order of magnitude. Estimation of nearly all components involves assumptions and, with more Basin-specific data, the accuracy and precision of many of the components are improved. Additional and improved data will result in a budget that more closely reflects the Basin conditions and allows the GSAs to make more informed decisions to sustainably maintain groundwater resources. **Appendix 6A** show the components of the water budget, their data source(s), assumptions, and relative level of precision.

Major data sources include the PRISM[53] model (NACSE 2020) for precipitation, CIMIS (DWR 2020c) for evapotranspiration data, the National Water Information System (USGS 2020b) for surface-water flows, and DWR land-use surveys (DWR 2020d).

6.2 Historical Water Budget

The historical water budget presented in this section covers 1984 to 2018. This period was chosen because it represents an average set of climatic conditions. **Figure 6-3** shows the annual precipitation and year type for the period. The criteria for year types were critical dry below 70 percent of average precipitation, dry between 70 and 85 percent of average precipitation, normal between 85 and 115 percent of average precipitation and wet years greater than 115 percent of average precipitation.

[53] PRISM stands for Parameter-elevation Regression on Independent Slopes Model and is provided by the Northwest Alliance for Computational Science and Engineering from Oregon State University. This model provides location-specific, historical precipitation values on monthly and annual time scales. Precipitation was evaluated at Bieber.

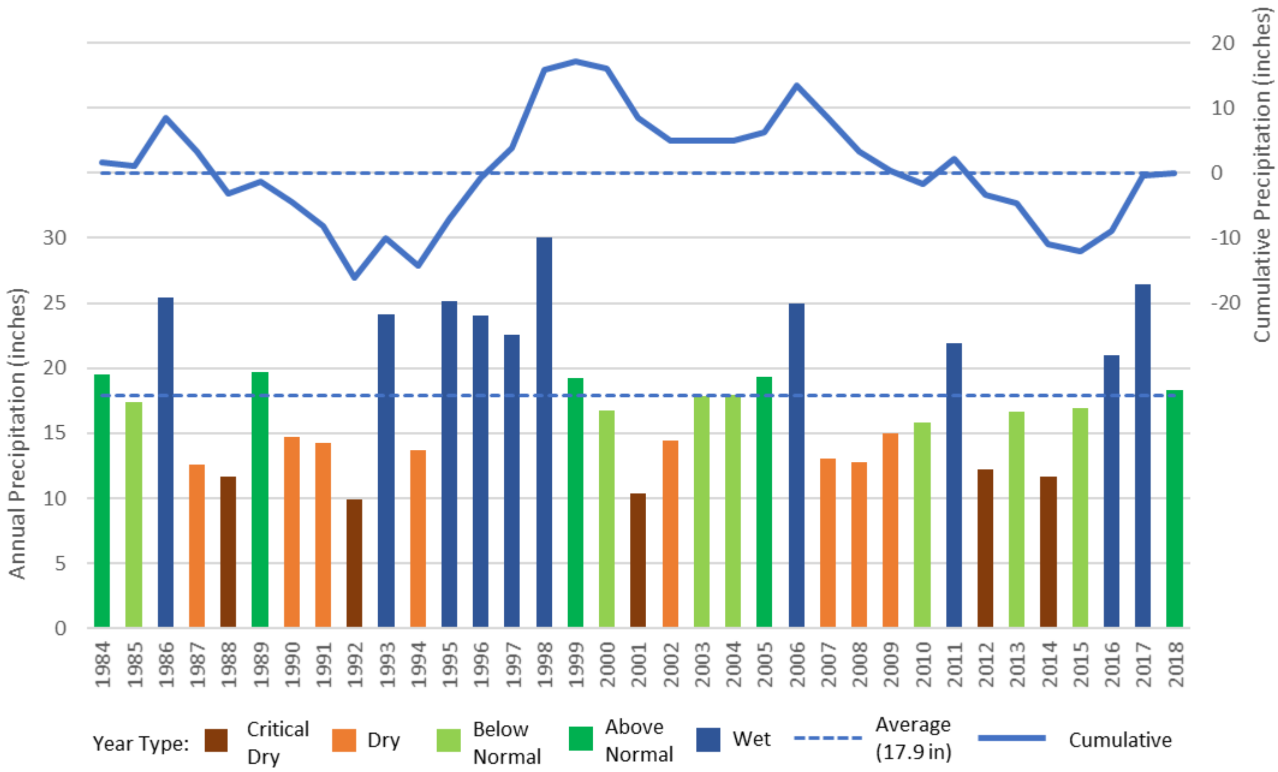
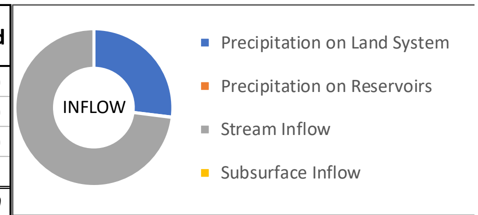


Figure 6-3 Annual and Cumulative Precipitation and Water Year Types 1984 to 2018

The budget was developed using this precipitation and other climate data (evapotranspiration) along with stream flow to estimate the inflows (credits) and outflows (debits) to the total BVGB. The budget was balanced by assuming that the land and surface-water systems remain nearly in balance from year to year and allowing the groundwater system to vary. **Figure 6-4** shows the average annual values for the overall water budget. The detailed water budget for each year is included in **Appendix 6B**. **Appendix 6C** shows graphically how the water budget varies over time.

item	Flow Type	Origin/ Destination	Component	Estimated
	TOTAL BASIN WATER BUDGET			**Acre-Feet**
(1)	Inflow	Into Basin	Precipitation on Land System	136,800
(14)	Inflow	Into Basin	Precipitation on Reservoirs	500
(13)	Inflow	Into Basin	Stream Inflow	371,100
(27)	Inflow	Into Basin	Subsurface Inflow	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*508,400*
(5)	Outflow	Out of Basin	Evapotranspiration	154,000
(24)	Outflow	Out of Basin	Stream Evaporation	400
(23)	Outflow	Out of Basin	Reservoir Evaporation	700
(19)	Outflow	Out of Basin	Conveyance Evaporation	-
(18)	Outflow	Out of Basin	Stream Outflow	358,500
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*513,600*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(5,000)



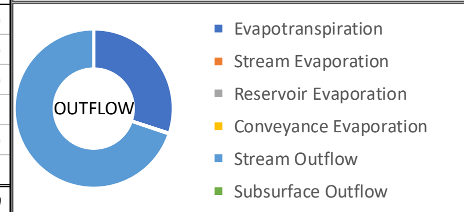


Figure 6-4 Average Total Basin Water Budget 1984-2018 (Historical)[54]

The evapotranspiration value was calculated using land-use data (crop and wetland acreages) from DWR for 2014, and land use was assumed to be constant throughout the water budget period.

Using the evapotranspiration for irrigated lands, the amount of irrigation from surface water and groundwater was determined using 85 percent irrigation efficiency (NRCS 2020) and a respective 35 to 65 percent split between surface water and groundwater. This surface water – groundwater split was determined from input received from local landowners, an assessment of surface-water rights (areas without surface-water rights were assumed to use 100 percent groundwater), well drilling records (areas without wells drilled were assumed to use 100 percent surface water), and an assessment of aerial imagery to see if water source could be determined. For the evapotranspiration associated with the ACWA, the ecosystem largely relies on surface water and very shallow subsurface[55] water. This surface-water delivery[56] was enhanced by implementation of a "pond and plug" project in 2012 to keep the water table higher and broader throughout ACWA. The ACWA also has three wells that extract groundwater from the deeper aquifers which is applied in portions of the habitat during dry months (fall). These areas with groundwater use are indicated by the light blue areas within ACWA. Based on the limited area and time groundwater is used to support the habitat, 98 percent of the evapotranspiration for ACWA is estimated to come from surface water and two percent from groundwater. **Figure 3-6** shows the lands with applied water and their water source based on this assessment.

Stakeholders have noted that despite the efforts to improve estimates of water source and some input from local residents, **Figure 3-6** still contains significant inaccuracies and further refinement of this dataset is needed.

The average annual water budgets for the three systems (land, surface water, and groundwater) are shown on **Figure 6-5**, **Figure 6-6,** and **Figure 6-7**. The detailed water budget for each year is included in **Appendix 6B**. **Appendix 6C** shows graphically how the system water budgets vary over time.

[54] To re-emphasize, these are rough estimates and better and more accurate data are needed.
[55] Within about the top 10 feet that plant roots can access.
[56] For the purposes of the water budget, water from Ash Creek is considered "delivered" to the wetland areas.

item	Flow Type	Origin/ Destination	Component	Estimated
	LAND SYSTEM			**Acre-Feet**
(1)	Inflow	Into Basin	Precipitation on Land System	136,800
(2)	Inflow	Between Systems	Surface Water Delivery	75,800
(3)	Inflow	Between Systems	Groundwater Extraction	44,600
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*257,000*
(5)	Outflow	Out of Basin	Evapotranspiration	154,000
(6)	Outflow	Between Systems	Runoff	83,400
(7)	Outflow	Between Systems	Return Flow	5,000
(8)	Outflow	Between Systems	Recharge of Applied Water	13,100
(9)	Outflow	Between Systems	Recharge of Precipitation	1,600
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*257,000*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-

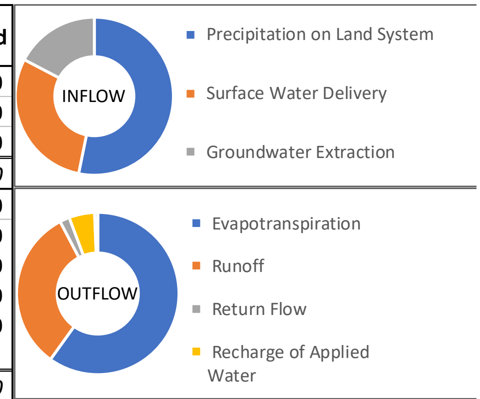


Figure 6-5 Average Land System Water Budget 1984-2018 (Historical)

item	Flow Type	Origin/ Destination	Component	Estimated
	SURFACE WATER SYSTEM			**Acre-Feet**
(13)	Inflow	Into Basin	Stream Inflow	371,100
(14)	Inflow	Into Basin	Precipitation on Reservoirs	500
(6)	Inflow	Between Systems	Runoff	83,400
(7)	Inflow	Between Systems	Return Flow	5,000
(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*	*460,000*
(18)	Outflow	Out of Basin	Stream Outflow	358,500
(19)	Outflow	Out of Basin	Conveyance Evaporation	50
(20)	Outflow	Between Systems	Conveyance Seepage	30
(2)	Outflow	Between Systems	Surface Water Delivery	75,800
(21)	Outflow	Between Systems	Stream Loss to Groundwater	24,000
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	600
(23)	Outflow	Out of Basin	Reservoir Evaporation	700
(24)	Outflow	Out of Basin	Stream Evaporation	400
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*460,000*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-

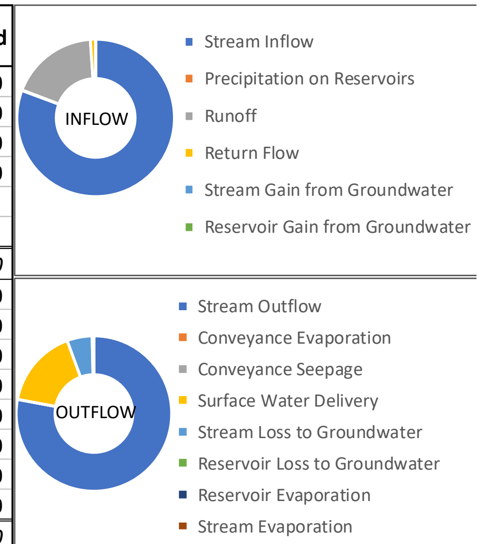
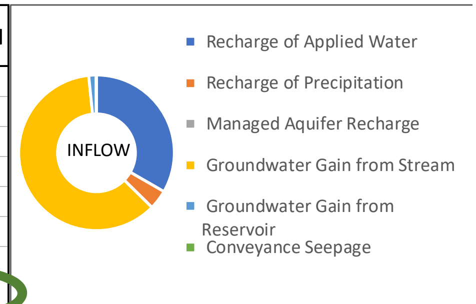


Figure 6-6 Average Surface-Water System Water Budget 1984-2018 (Historical)

item	Flow Type	Origin/ Destination	Component	Estimated
	GROUNDWATER SYSTEM			**Acre-Feet**
(8)	Inflow	Between Systems	Recharge of Applied Water	13,100
(9)	Inflow	Between Systems	Recharge of Precipitation	1,600
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	24,000
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	600
(20)	Inflow	Between Systems	Conveyance Seepage	30
(27)	Inflow	Into Basin	Subsurface Inflow	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*39,300*
(3)	Outflow	Between Systems	Groundwater Extraction	44,600
(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*	*44,600*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(5,000)



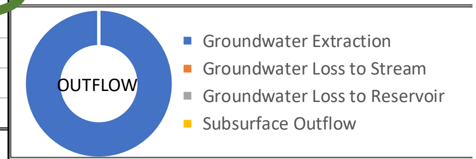


Figure 6-7 Average Groundwater System Water Budget 1984 to 2018 (Historical)

With the land system and surface-water system assumed to be in balance, the groundwater system varies and reflects the change in water stored in the Basin. This change in storage is shown in **Figure 6-8** and is analogous to the change in storage presented in Chapter 5 – Groundwater Conditions, which used groundwater contours to calculate the change. These two approaches show similar trends, but the magnitude of the changes differs slightly, with the groundwater contours showing a maximum cumulative overdraft (2015) of about 158,000 AF and the water budget indicating about 183,000 AF. Furthermore, the water budget indicates two periods when the cumulative change in storage is positive (approximately 1984 to 1999 and 1995 to 2002), whereas the groundwater levels do not indicate any periods of a positive change in cumulative storage since 1983. These differences suggest that the water budget overestimates the fluctuations in groundwater storage and overestimates the decline in groundwater storage over the historical period.

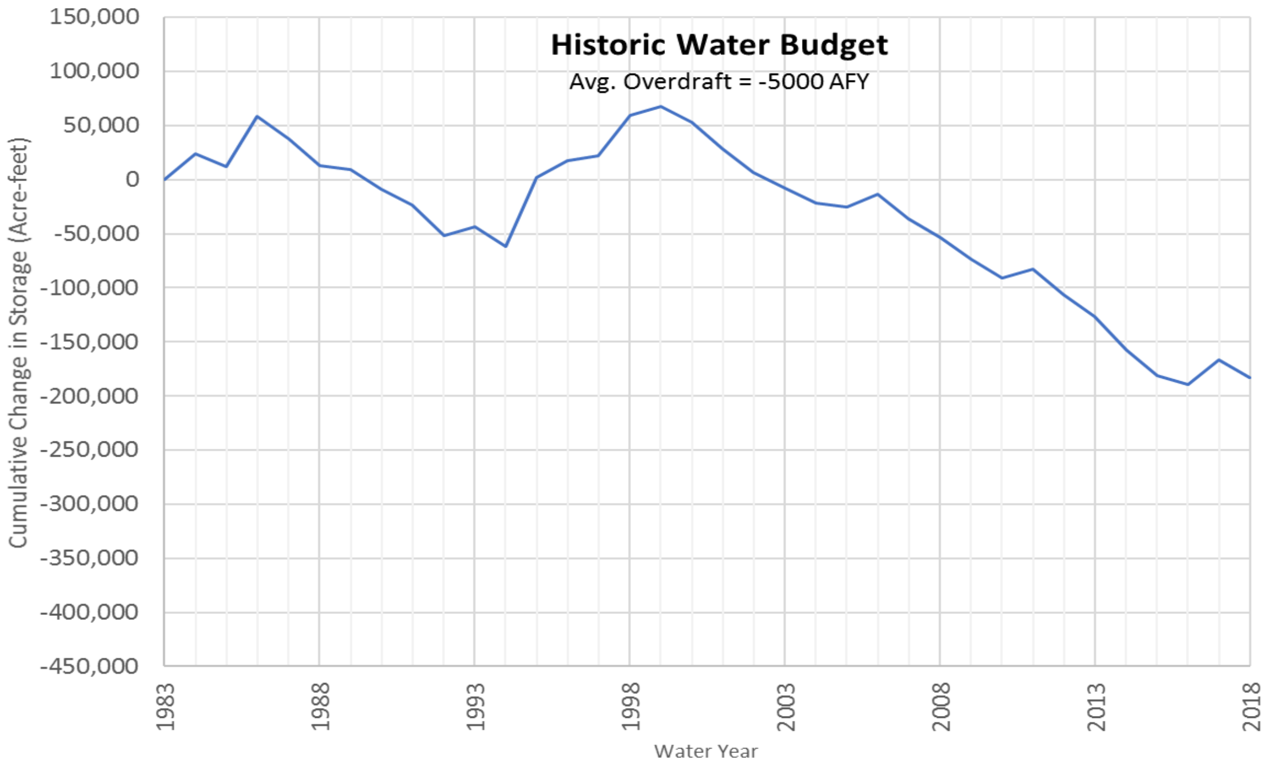


Figure 6-8 Cumulative Groundwater Change in Storage 1984 to 2018 (Historical)

The GSP regulations require an estimate of the sustainable yield[57] for the Basin (§354.18(b)(7)). This requirement is interpreted as the average annual inflow to the groundwater system, which for the 34-year period of the historical water budget is approximately 39,300 AF, as indicated on item 28 of **Figure 6-7** (circled in green) for the groundwater system. The estimate of annual average groundwater use is approximately 44,600 AFY.

The regulations also require a quantification of overdraft[58] (§354.18(b)(5)). For the water budget period of 1984 to 2018, overdraft is estimated at approximately 5,000 AFY, shown as the average annual groundwater system change in storage, circled in red on **Figure 6-7** (item 31).

6.3 Current Water Budget

The current water budget is demonstrated by estimating future water budget holding current conditions, land use and water use. The projection described in section 6.4.1 below holds these values constant and therefore represents both the current and projected.

[57] The state defines sustainable yield as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result." (CWC §10721(w))

[58] DWR defines overdraft as "the condition of a groundwater basin or Subbasin 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 the water supply conditions approximate average conditions." (DWR 2016b)

6.4 Projected Water Budget

As required by the GSP Regulations, the projected water budget is developed using at least 50 years of historical climate data (precipitation, evapotranspiration, and streamflow) along with estimates of future land and water use. The climate data from 1962 to 2011 was used as an estimate of future climate baseline conditions.

6.4.1 Projection Baseline

The baseline projected water budget uses the most recent estimates of population and land use and keeps them constant. **Figure 6-9** shows the average annual future water budget. Long-term overdraft is projected to be about 2,000 AFY, which is less than the overdraft for the historical water budget because it uses a longer, wetter time-period for its projections. **Figure 6-10** shows the projected cumulative change in groundwater storage.

TOTAL BASIN WATER BUDGET — **Acre-Feet**

item	Flow Type	Origin/ Destination	Component	Estimated
(1)	Inflow	Into Basin	Precipitation on Land System	143,200
(14)	Inflow	Into Basin	Precipitation on Reservoirs	500
(13)	Inflow	Into Basin	Stream Inflow	430,200
(27)	Inflow	Into Basin	Subsurface Inflow	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*574,000*
(5)	Outflow	Out of Basin	Evapotranspiration	156,900
(24)	Outflow	Out of Basin	Stream Evaporation	400
(23)	Outflow	Out of Basin	Reservoir Evaporation	700
(19)	Outflow	Out of Basin	Conveyance Evaporation	50
(18)	Outflow	Out of Basin	Stream Outflow	418,000
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*576,000*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(2,000)

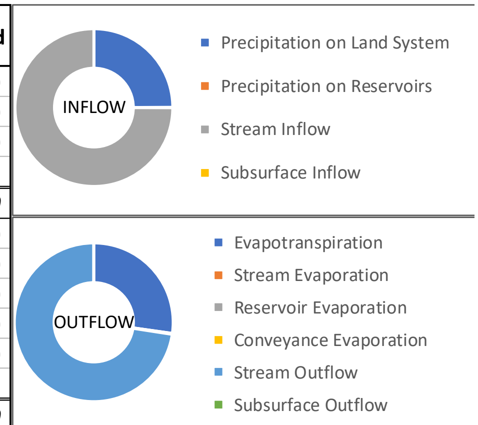


Figure 6-9 Average Projected Total Basin Water Budget 2019-2068 (Future Baseline)

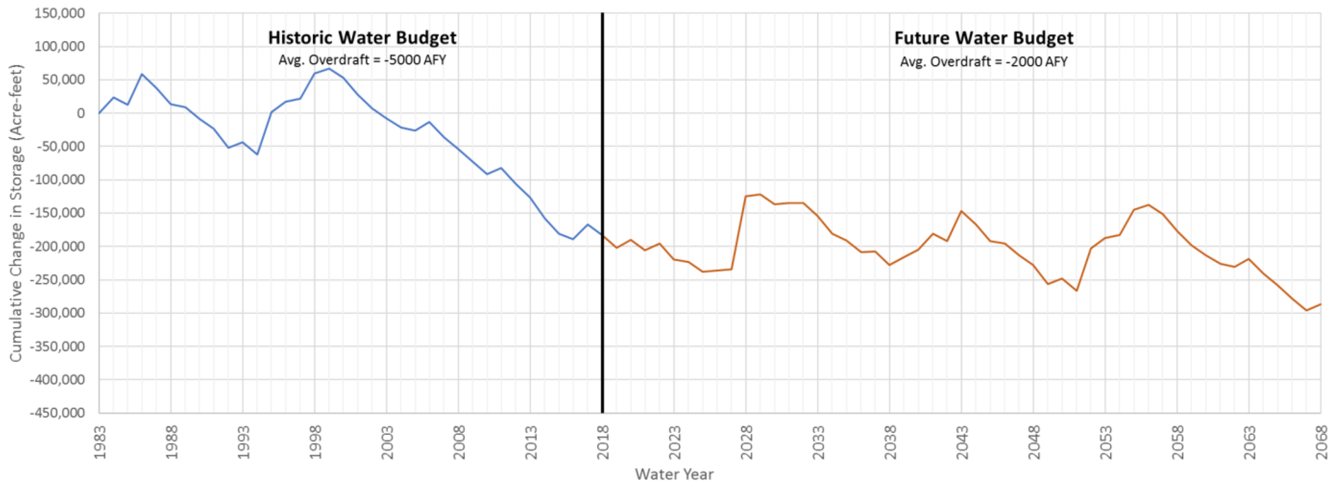


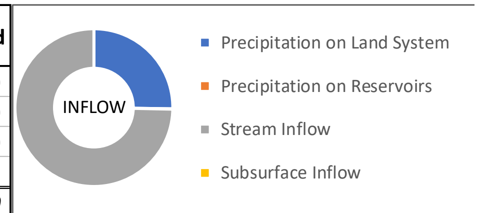
Figure 6-10 Cumulative Groundwater Change in Storage 1984 to 2068 (Future Baseline)

6.4.2 Projection with Climate Change

The SGMA regulations require an analysis of future conditions based on a potential change in climate. DWR provides location-specific, monthly change factors for precipitation, evapotranspiration, and streamflow based on climate change models which estimates the how climactic parameters are expected to change over historical conditions by 2070. While there is variability in the climate change models, they indicate that the future climate in Big Valley will be wetter and warmer, resulting in more precipitation and more of that precipitation falling in the form of rain rather than snow. The change factors were applied to the baseline water budget and are shown on **Figure 6-11** and **Figure 6-12**. Land use was assumed to be constant, with conditions the same as DWR's 2014 land-use survey. Future conditions with climate change projections indicate that the Basin may be nearly in balance, with overdraft of only about 1,000 AFY.

The estimated reduction in overdraft due to climate change (from 2,000 AFY to 1,000 AFY) reflects the assumptions that more precipitation and streamflow will result in more recharge to the BVGB, and this additional recharge will offset the increased ET expected with warmer temperatures. The consequences of these assumptions to the water budget calculations are that (1) change factors were applied over an entire month and (2) the percentage of stream flow resulting in recharge was assumed to be constant. Given that precipitation events (storms) are expected to be more variable in the future with climate change, assuming a constant proportion of recharge from streamflow may not be appropriate. The GSAs plan to address this limitation in future water budget updates, as discussed in Chapter 9 – Projects and Management Actions.

item	Flow Type	Origin/ Destination	Component	Estimated
	TOTAL BASIN WATER BUDGET			**Acre-Feet**
(1)	**Inflow**	Into Basin	Precipitation on Land System	152,200
(14)	**Inflow**	Into Basin	Precipitation on Reservoirs	600
(13)	**Inflow**	Into Basin	Stream Inflow	450,400
(27)	**Inflow**	Into Basin	Subsurface Inflow	-
(32)	**Inflow**	*(1)+(14)+(13)+(27)*	*Total Inflow*	*603,000*
(5)	**Outflow**	Out of Basin	Evapotranspiration	165,800
(24)	**Outflow**	Out of Basin	Stream Evaporation	400
(23)	**Outflow**	Out of Basin	Reservoir Evaporation	800
(19)	**Outflow**	Out of Basin	Conveyance Evaporation	-
(18)	**Outflow**	Out of Basin	Stream Outflow	436,700
(29)	**Outflow**	Out of Basin	Subsurface Outflow	-
(33)	**Outflow**	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*604,000*
(34)	**Storage Change**	**(32)-(33)**	Change in Total System Storage	(1,000)



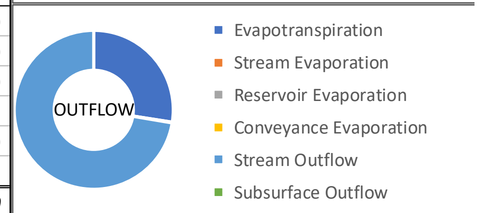


Figure 6-11 Average Projected Total Basin Water Budget 2019-2068 (Future with Climate Change)

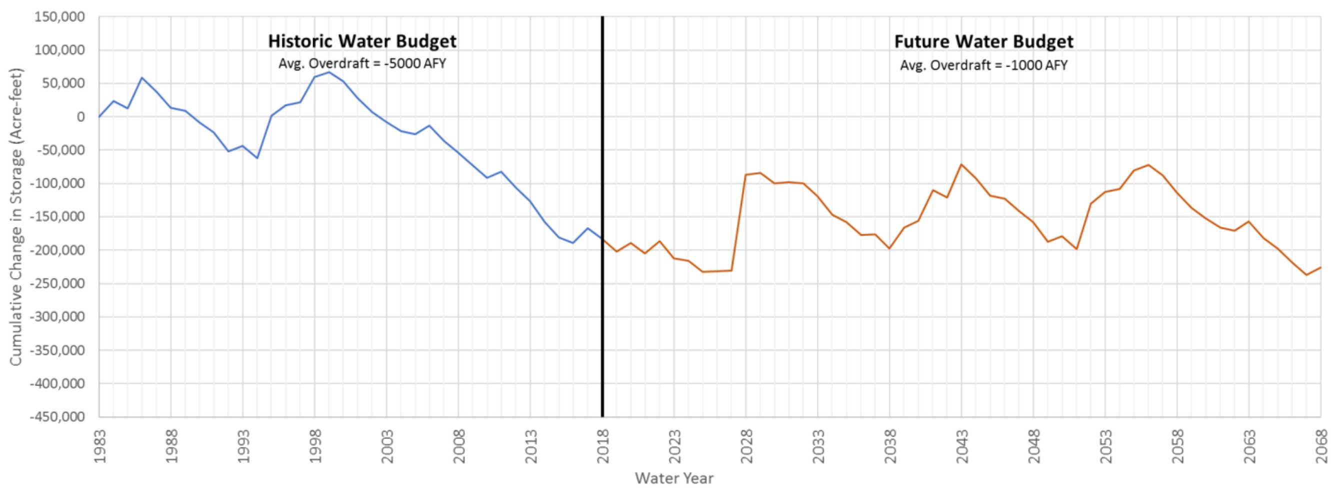


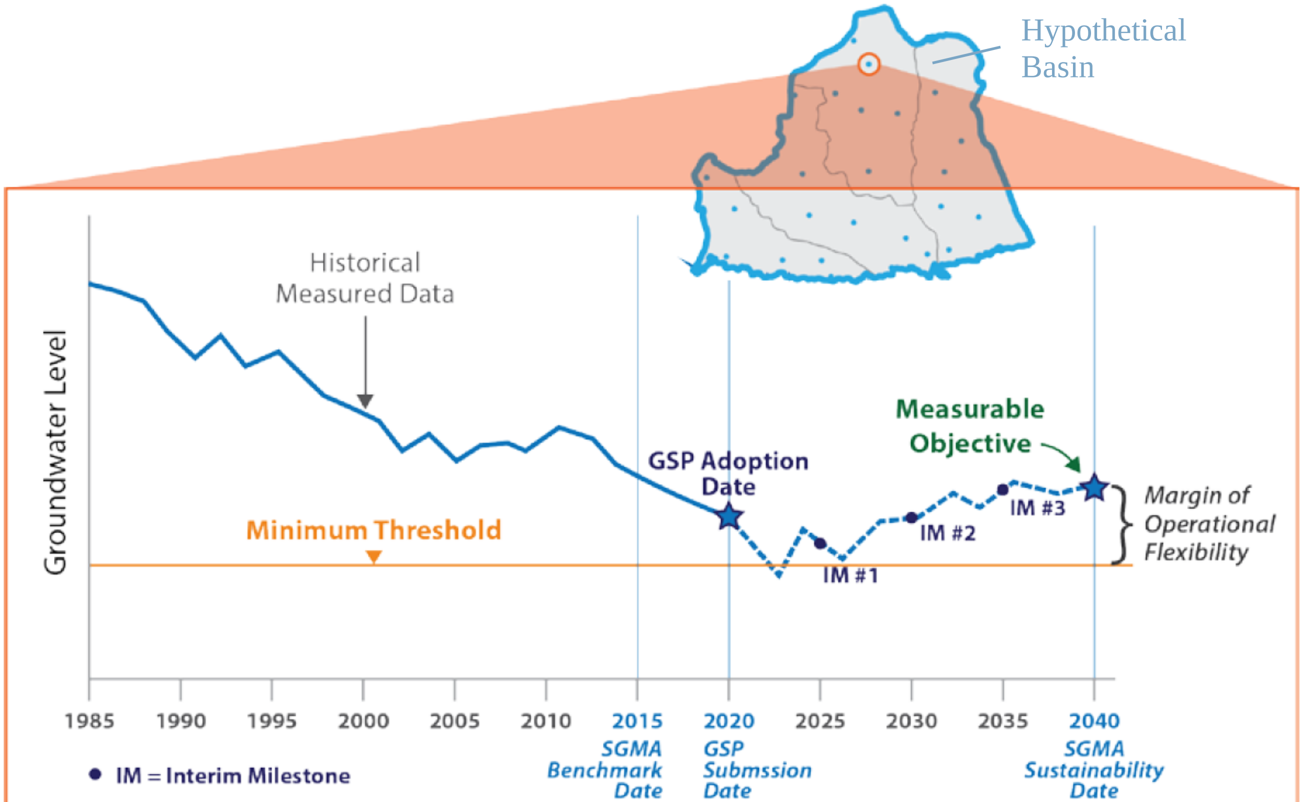
Figure 6-12 Cumulative Groundwater Change in Storage 1984 to 2068 (Future with Climate Change)

7. Sustainable Management Criteria § 354.20

This chapter describes criteria and conditions that constitute sustainable groundwater management for the BVGB, also known as Sustainable Management Criteria (or SMC). Below are descriptions of key terms used in the GSP Regulations and described in this chapter:

- **Sustainability goal:** This is a qualitative, narrative description of the GSP's objective and desired conditions for the BVGB and how these conditions will be achieved. The Regulations require that the goal should, "culminate in the absence of undesirable results within 20 years" (§ 354.22).
- **Undesirable result:** This is a description of the condition(s) that constitute "significant and unreasonable" effects (results) for each of the 6 sustainability indicators:
    - Chronic lowering of *groundwater levels*
    - Reduction in *groundwater storage*
    - *Seawater intrusion* – Not applicable to BVGB
    - Degraded *water quality*
    - Land *subsidence*
    - Depletion of *interconnected surface water*
- **Minimum threshold (MT):** Numeric values that define when conditions have become undesirable ("significant and unreasonable"). Minimum thresholds are established for representative monitoring sites. Undesirable results are defined by minimum threshold exceedance(s) and define when the Basin conditions are unsustainable (i.e., out of compliance with SGMA).
- **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.
- **Interim milestones (IMs):** Numeric values for every 5 years between the GSP adoption and sustainability (20 years, 2042) that indicate how the Basin will reach the MO (if levels are below the MO). IMs are optional criteria and not subject to enforcement.

Figure 7-1 shows the relationship of the MT, MO, and IMs. In addition to these regulatory requirements, some GSAs in other basins have developed "action levels," applicable when levels are above the MT but below the MO, for each well to indicate where and when to focus projects and management actions. This GSP also has action levels that are described in this chapter.



Source: DWR 2017

Figure 7-1 Relationship among the MTs, MOs, and IMs for a hypothetical basin

7.1 Process for Establishing SMCs

The SMCs detailed in this chapter were developed by the GSAs through consultation with the BVAC. The sustainability goal was developed by an ad hoc committee and presented to the larger BVAC, GSA staff, and the public for review and comment. The BVAC also formed ad hoc committees for each sustainability indicator and evaluated the data and information presented in Chapters 1-6. In consultation with GSA staff, each committee determined whether significant and unreasonable effects for each sustainability indicator have occurred historically and the likelihood of significant and unreasonable effects occurring in the future. The sections below reflect the guidance given to the GSAs and consultants by the ad hoc committees.

7.2 Sustainability Goal

The sustainability goal was presented in Chapter 1 and is reiterated here:

> 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.

7.3 Undesirable Results

Undesirable results must be described for each Sustainability Indicator. To comply with §354.26 of the Regulations, the narrative for each applicable indicator includes:

- *Description* of the "significant and unreasonable" conditions that are undesirable
- Potential *causes* of the undesirable results
- *Criteria* used to define when and where the effects are undesirable
- Potential *effects* on the beneficial uses and users of groundwater, on land uses, and on property interests

Sustainability indicators that have not experienced undesirable results and are unlikely to do so in the future describe the justification for non-applicability of that Sustainability Indicator.

7.3.1 Groundwater Levels

For this section, it is necessary to understand that it is natural (and expected) that groundwater levels will rise and fall during a particular year and over the course of many years. Chapters 4 through 6 describe the nature of groundwater levels throughout the Basin and how levels have changed over time. These chapters conclude that many areas of the Basin have seen no significant change. Other areas saw a lowering of levels in the late 1980s and early 1990s, recovery during the wet period of the late 1990s and lowering water levels since 2000. Groundwater usage has only seen minor increases since 2000, therefore the declines are more related to climatic conditions than to a lack of stewardship of the resource. As illustrated in **Figure 5-4**, water levels in 12 wells have shown stable (less than one foot of change) or rising water levels. Nine wells have shown declining trends, with only three of those wells declining by more than two feet per year.

This context is given both to set the stage for discussion of undesirable results and to illustrate that water levels overall have not declined significantly. This re-emphasizes the point raised in Section 1.3 that the GSAs believe the Basin should be ranked as low priority. As mentioned previously, the GSAs also believe its ranking of medium priority is due in large part to the DWR's scoring of all basins with water level declines with a fixed number of points rather than considering the severity of declines. Big Valley has seen only minor declines in comparison to the widespread decline of hundreds of feet experienced elsewhere in the state. The Basin has demonstrated that it can recover during wet climatic cycles (e.g., late 1990s) as shown in **Figure 5-7**. There have not been widespread reports of issues or concerns regarding groundwater levels from the residents of the Basin (whether agricultural producers or domestic users or others). The GSAs contend that Big Valley's medium priority ranking is based on unscientific concerns raised by DWR based on isolated wells that experienced limited decline during a below-average climatic cycle.

Therefore, undesirable results have not occurred in the past and the measurable objective established in this section is set at the fall 2015 groundwater level for each well in the monitoring network (*see* Chapter 8 – Monitoring Networks). Fall 2015 is a recent measurement based on a wide distribution of wells and is generally the lowest groundwater level throughout the period of record. Since these levels are feasible for agricultural, community, domestic, and natural/wildlife uses, this level is a reasonable proxy for the desired conditions.

Description

This section describes undesirable results for groundwater levels by defining significant and unreasonable impacts on beneficial uses. To define the significant and unreasonable impacts to groundwater levels, the GSAs and the BVAC gathered extensive public input in meetings with landowners, other community members, tribal members, and local and state agencies (including CalFire, the CDFW, and the United States Forest Service) to identify potential undesirable results regarding groundwater levels. Undesirable results identified included (1) domestic, agricultural, and public wells going dry, experiencing reduced capacity, requiring lowering of pumps, or requiring deeper well installations, (2) depletion of supply leading to agriculture becoming economically unviable, and (3) adverse impacts to wildlife and recreational activities.

As described in Section 1.1 and emphasized in the Sustainability Goal, agricultural production is of paramount importance due to its economic, cultural, and environmental benefits. Therefore, the undesirable results related to agriculture were substantially considered in the development of the definition of undesirable results.

Consistent with the Sustainability Goal, undesirable results for the chronic lowering of groundwater levels are defined at the level where the depletion of supply results in significant and undesirable reductions in the long-term viability of agriculture, community, domestic, and natural/wildlife uses.

Causes

Potential causes resulting in the chronic lowering of groundwater levels include reductions in recharge or increases in pumping.

Recharge to the basin includes rainfall, surface water that infiltrates the basin, and applied water for agriculture. Acute changes in climate conditions (e.g., short-term dry periods) that include less surface water and/or precipitation can lead to declines in groundwater levels. Lower-than-average precipitation and snowpack since 1999 has resulted in declining groundwater levels in some parts of the Basin. A similar period of declining groundwater levels occurred in the late 1980s through the middle of the 1990s. In the late 1990s, several years in a row of above-average precipitation caused groundwater levels to fully recover. Longer-term dry periods could result in more consistent lowering of groundwater levels in the absence of other changes, while longer-term wet periods could result in additional recharge and increasing groundwater levels. In addition, if irrigation efficiency were to increase, this could result in less recharge to the basin; however, this impact may be offset by reduced groundwater demand.

Increased pumping for agriculture or other uses could also cause the chronic lowering of groundwater levels. Increased pumping could occur due to reduced surface water available for diversions or the State Water Board curtailing surface water rights for water rights holders in the Basin. However, increased groundwater demands are unlikely to be a major cause of lowering groundwater levels in the future, as land uses are not expected to change significantly, and any water rights curtailments or reduced surface water availability is expected to be temporary.

Future wet periods, enhanced recharge, increased storage, and addressing data gaps will likely cause groundwater levels to experience a similar recovery and maintain balance within the Basin.

Criteria

Operationally, undesirable results for groundwater levels would occur when at least one third of representative monitoring wells fall below their MT for three consecutive years. The MT for each well is set at 50 feet below the reference groundwater level. For most wells, the reference groundwater level is from Spring 2015; however, if the well was completed after 2015, the reference groundwater level is the Spring 2022 groundwater level. Spring 2022 groundwater levels are generally higher than Spring 2015 groundwater levels; therefore, the use of Spring 2022 groundwater levels to calculate the MT for newer wells is conservative. The BVAC ad hoc committees developed these definitions and the MT considering all beneficial uses and users with an emphasis on domestic and agricultural users, two of the primary uses and users that may be affected by potential groundwater level declines. The spatial and temporal coverage of the undesirable results (i.e., at least one third of wells and three consecutive years) was defined to (1) acknowledge the uncertainty in groundwater level data; (2) mitigate the potential influence of nearby pumping wells, and (3) allow for time to characterize the impacts and develop plans to address them.

First, the BVAC ad hoc committees considered the potential impacts of groundwater level declines on the agricultural users. For agricultural pursuits to be viable, growers need an adequate margin of operational flexibility (see **Figure 7-1**) so that crops can be irrigated even during dry years. Through discussions in BVAC ad hoc committee meetings among committee members, a local well driller (Conner, 2021) and the Lassen County Farm Advisor (Lile, 2021), the committee members determined the depth at which groundwater pumping becomes economically unfeasible for agricultural use is about 140 feet below 2015 groundwater levels. This is based on the following assumptions:

- The profit margin on a typical alfalfa farm is estimated at less than $25 per ton assuming an average yield of 5 tons per acre (Wilson et al 2020). Small increases in input costs, such as electricity required for pumping at greater depths, can render hay production uneconomical.
- Based on recent basin conditions, local hay yields, operating costs, and current hay prices, the BVAC ad hoc committees determined that hay production would become uneconomical if groundwater level declines increased the cost to pump groundwater by about $30 per acre-foot.
- Appendix 7A documents the information used to convert this volumetric cost to a decline in groundwater levels. The increase in horsepower required to pump from a well approaching 140 feet below 2015 groundwater levels would result in an increased cost of $15 per acre-foot of water using Surprise Valley Electric (SVE) rates and $30 per acre foot using Pacific Gas and Electric (PG&E) rates (Conner, 2021). SVE and PG&E are two of the predominant energy suppliers in the region. If these costs are converted to a cost per ton of produced grass hay (assuming about 2.3 acre-feet per ton of hay), the increased cost of water level decline to the MT translates to about $6.50 per ton using SVE power and $13 per ton with PG&E power based on 2021 costs.

Second, the BVAC ad hoc committee considered the impact of groundwater level declines on domestic and public supply wells. The GSAs and the BVAC ad hoc committee indicated that potentially up to 14 percent of domestic wells going dry does not constitute a significant and unreasonable impact. This was decided based on acknowledging that (1) it is not practical to manage to a few shallow wells going dry, (2) setting minimum thresholds to maintain water levels at the shallowest domestic wells would cause significant and unreasonable impacts to agricultural pumping not being able to operate within a flexible range, and (3) the GSAs will develop mechanisms to address domestic wells that may go dry as a result of declining groundwater levels. The analysis to develop the MT based on domestic well impacts is below.

Data on domestic wells are limited; the DWR's well completion report database is the best available dataset to understand the magnitude of impact of lowering groundwater levels on domestic wells. To analyze the impact of groundwater level declines on domestic wells, the following analysis was completed:

1. A groundwater level surface was developed based on the reference groundwater levels at representative monitoring wells across the basin. **Figure 7-2** shows the map of the representative monitoring wells with the reference depth-to-water (either Spring 2015 or Spring 2022).
2. Based on this groundwater level surface, each DWR well log was assigned a reference groundwater level. **Figure 7-3** shows the density of domestic wells across the basin. Domestic well density is not evenly distributed throughout the Basin, but representative wells are located near the areas of highest domestic well density. Many of the domestic well logs do not have precise locations in the database and are assumed to be in the center of the Public Land Survey System (PLSS) section identified in the log. Wells that were assumed to be in the center of the PLSS sections that fall outside of the basin boundary were not included in the analysis. By using the groundwater level surface to develop reference groundwater levels for which domestic well impacts can be quantified, this analysis assumes a direct relationship between the groundwater levels at the representative monitoring wells and domestic wells.
3. For each well in the database, it is assumed that a well would be unable to pump if the groundwater level were less than 20 feet above the total constructed well depth. Most wells in the database lack reported screen intervals or other information that would help refine this estimate.
4. It is assumed that all wells that were constructed prior to 1978 are inactive. Evaluating the domestic wells relative to the groundwater level surface resulted in several wells that would be unable to pump at that level, all of which were constructed in 1977 or prior. 1976-1977 was a period of significant statewide drought, which probably resulted in the replacement of these older wells. Given that there are no reports of dry wells based on discussions with the local well driller and the state's Dry Well Reporting System, this is a defensible assumption to filter the well dataset to a more realistic sample.

Figure 7-4 is an exceedance chart that shows the results of the analysis described above. For each well type, it shows the percentage of wells that would be unable to pump at that depth below the reference groundwater levels. At 50 feet below the reference groundwater levels, shown as the black dotted line, about 8 percent of all wells would be unable to pump, including about 14 percent of domestic wells (15 wells).

Figure 7-5 shows a breakdown of the proportion and number of wells in each category that would be unable to pump at the MT. No public or industrial wells are projected to be unable to pump, 2 percent (3 wells) of irrigation wells are projected to be unable to pump, and 14 percent (15 wells) of domestic wells are projected to be unable to pump at the MT. **Figure 7-6** shows the spatial distribution of domestic wells that would be unable to pump at the MT. Five of the impacted wells are near Bieber, which has a public supply system (Lassen County Water District) that could potentially work with the well mitigation program to provide temporary or long-term relief to impacted well owners in the area.

As the MT is defined as when at least one third of representative monitoring wells fall below their MT for three consecutive years, it is unlikely that all 15 wells identified above would go dry at the MT. Therefore, this estimate of impacts is conservative, and the MT would impact closer to 5 to 10 percent of domestic wells.

The DWR well completion report database has several known errors and inconsistencies, and it is not clear whether all wells are active. As part of the well mitigation program outlined in Section 9, the GSAs will develop a system for voluntary well registration and inventory that will allow the GSAs to update and refine the discussion of undesirable results and potentially revise the MTs in future GSP updates.

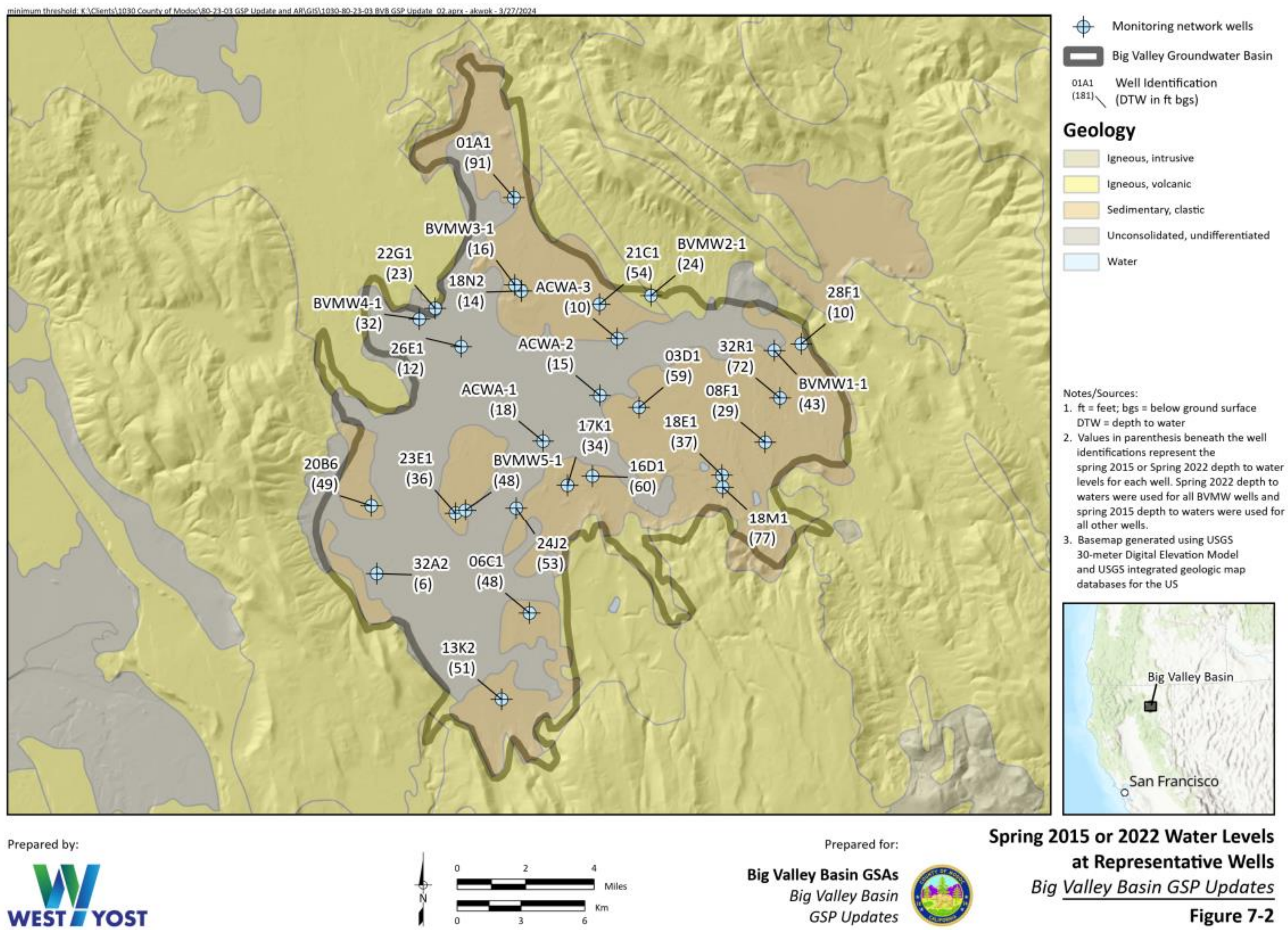


Figure 7-2 Spring 2015 or 2022 Water Levels at Representative Wells

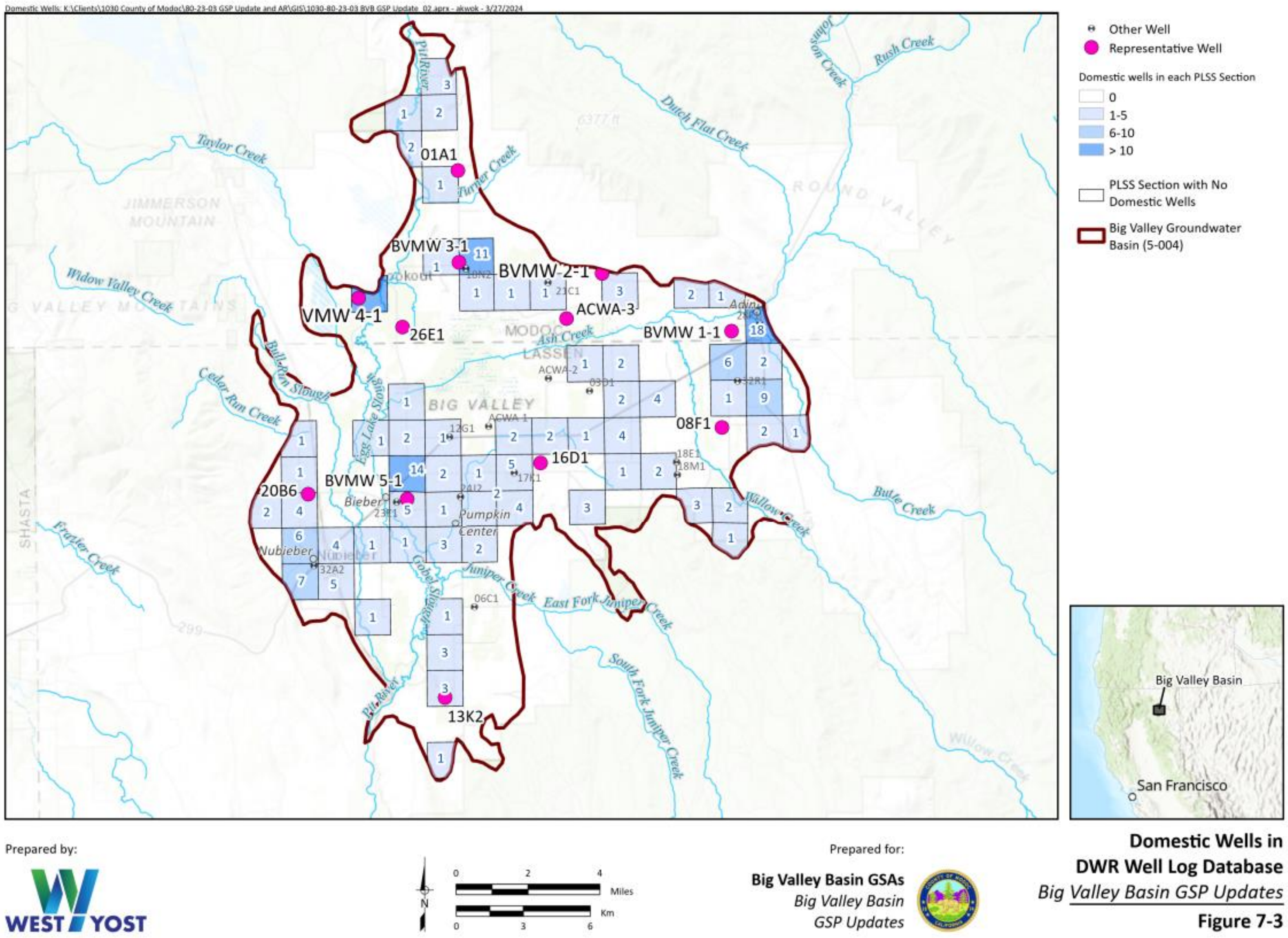


Figure 7-3 **Domestic Wells in DWR Well Log Database**

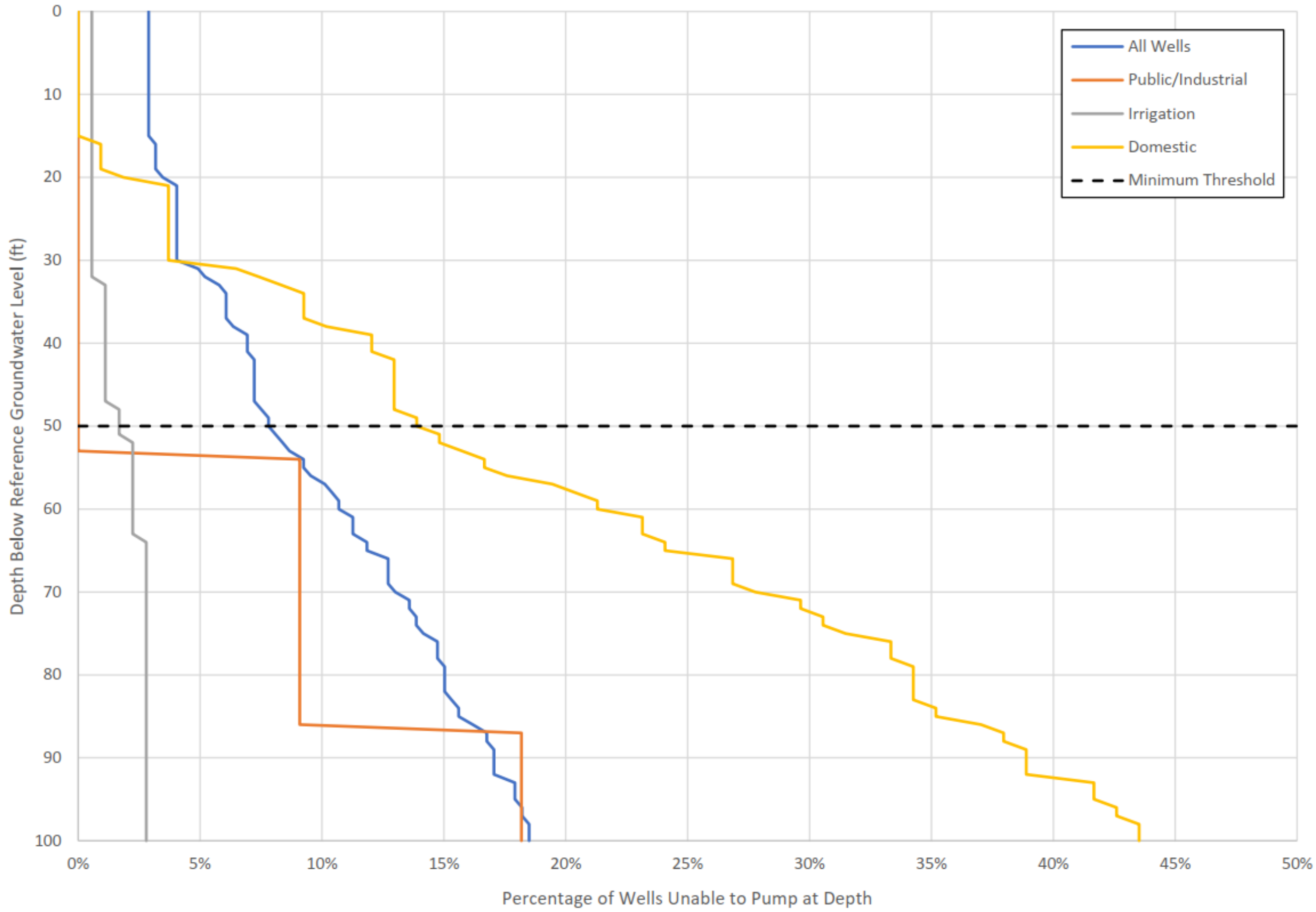


Figure 7-4 Estimated Well Performance at Various Depths Below Reference Groundwater Level

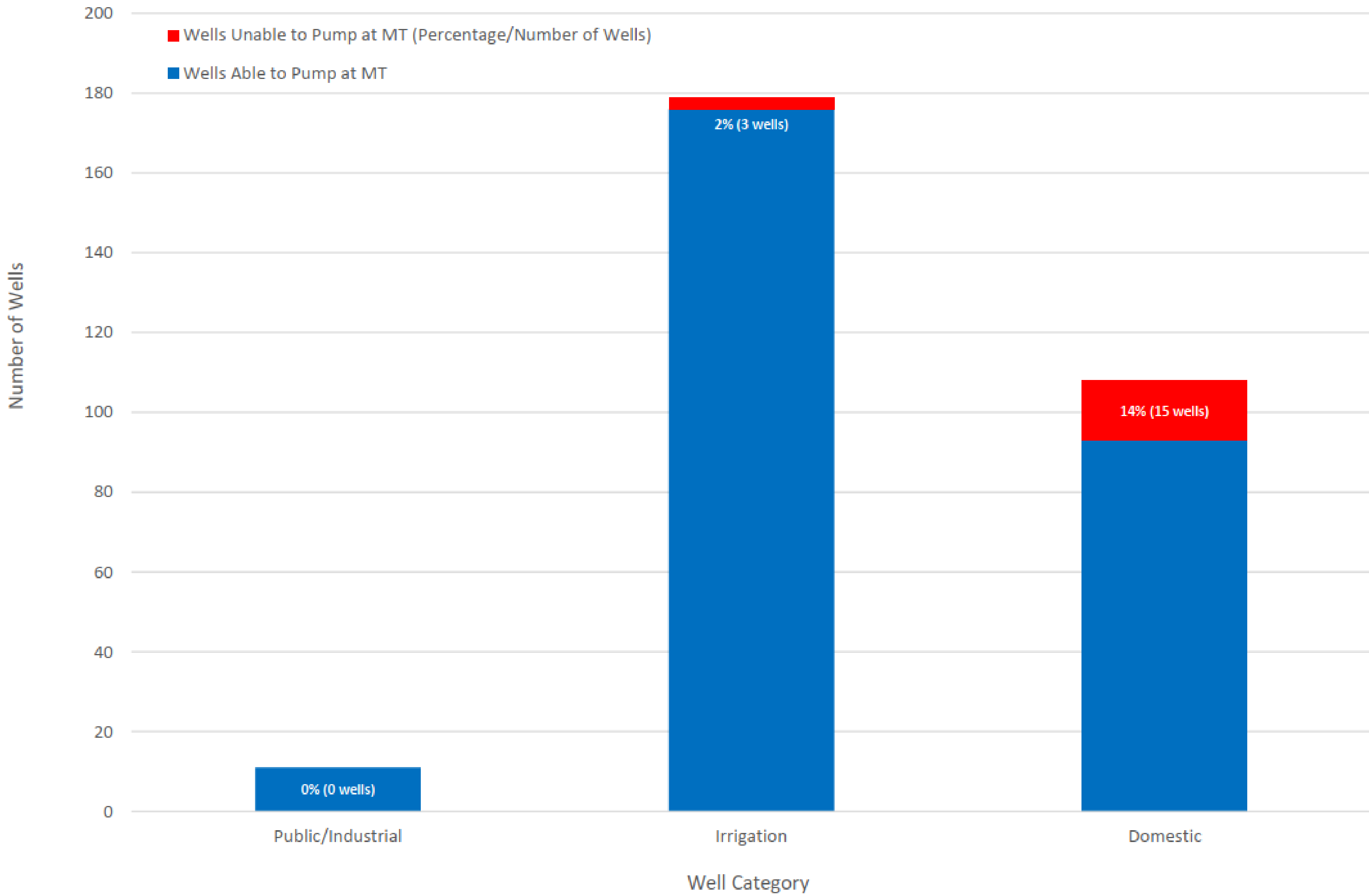


Figure 7-5 Estimated Well Performance at Minimum Threshold (50 feet below Reference Groundwater Level) in the Big Valley Groundwater Basin based on DWR Well Logs

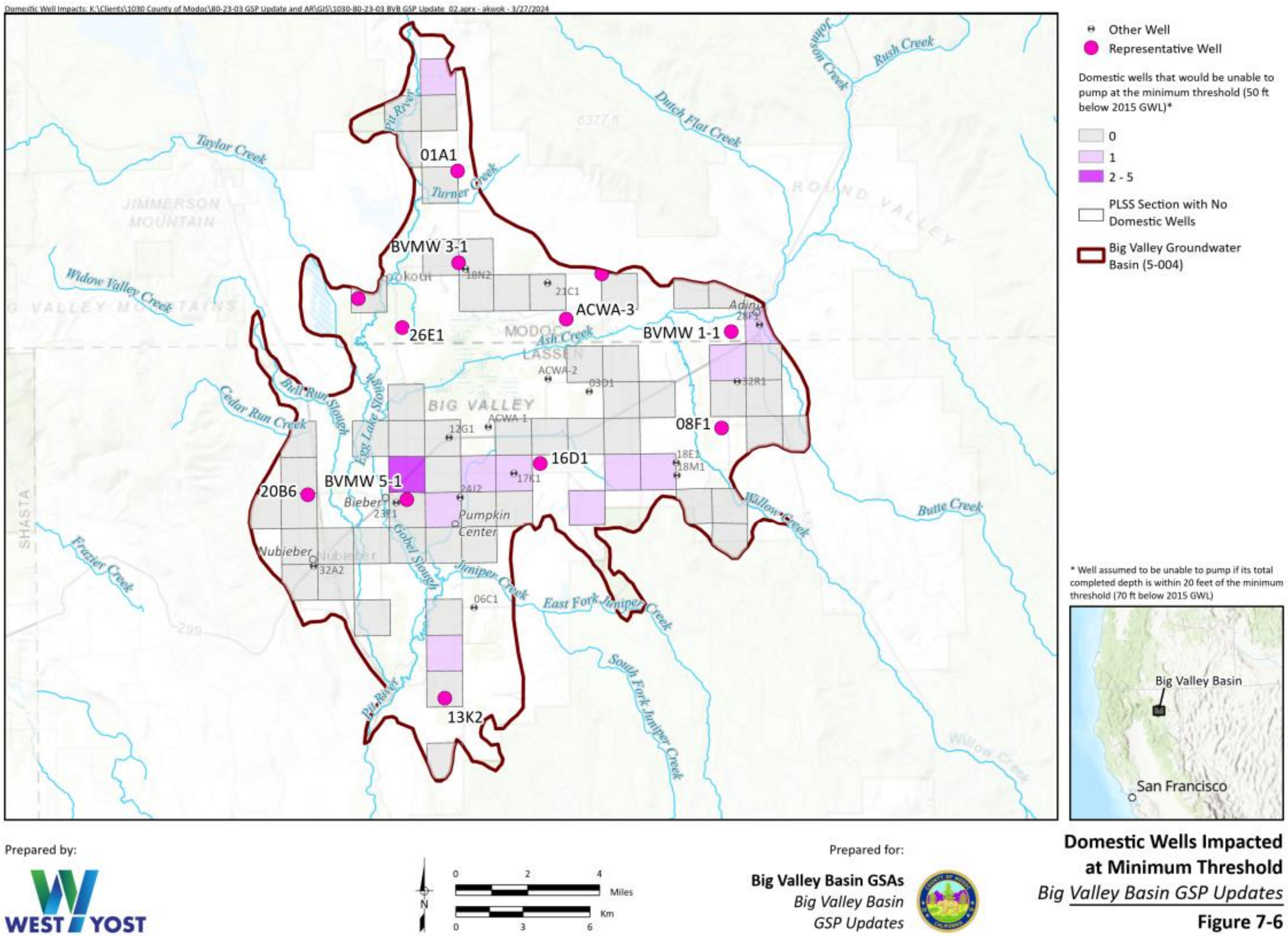


Figure 7-6 Domestic Wells Impacted at Minimum Threshold

Effects

As discussed above, if groundwater levels were to fall below the minimum threshold, pumping costs would increase potentially rendering agricultural pursuits unviable. Without agriculture, the unique culture, character of the community, and quality of life for Big Valley residents would be drastically changed. Reductions in agriculture would also affect wildlife who use irrigated lands as habitat, breeding grounds, and feeding grounds.

It is also acknowledged that utilizing the margin of operational flexibility by agriculture could have impacts on users of surface water if it is determined to be interconnected. This potentially includes groundwater-dependent ecosystems and surface-water rights holders. Discussion of this effect is included in Section 7.3.6 – Interconnected Surface Water.

Low water levels could cause domestic wells to go dry, requiring deepening, redrilling, or developing a new water source. However, the long-term costs of agriculture becoming unviable causing reduced property values and tax revenue outweigh the short-term costs of investing in deeper wells or alternative water supplies. The potential effect could be offset by a shallow well mitigation program, which would apply to domestic wells that have gone dry because water levels have fallen below the measurable objective. A framework for addressing the impacts of the chronic lowering of groundwater levels on domestic wells is described in Section 9 – Projects and Management Actions.

7.3.2 Groundwater Storage

The discussion and analysis regarding groundwater levels is directly related to groundwater storage. The groundwater levels for the fall 2015 measurement for each of the wells in the monitoring network (*see* Chapter 8 – Monitoring Network) is established as the measurable objective for groundwater storage (identical to the groundwater level measurable objective). The measurable objective is established at this level for storage using the same reasons discussed in Section 7.3.1 – Groundwater Levels. In summary, through public outreach, coordination with the BVAC and analysis of available data, the GSAs have determined that groundwater storage has not reached significant and unreasonable levels historically. Like the groundwater levels minimum threshold, the minimum threshold for groundwater storage is the same as for groundwater levels. The minimum threshold is set at this level for the same reasons discussed in Section 7.3.1 – Groundwater Levels.

Chapter 5 contains estimates of groundwater storage from 1983 to 2018 using groundwater contours from each year and an assumption that the definable bottom of the groundwater basin is 1,200 feet bgs. During this period, storage has fluctuated between a high of about 5,390,000 AF in fall 1983 (and 1999) to a low of 5,214,000 AF in fall 2015.

Description

Like groundwater levels, significant and unreasonable reduction in groundwater storage is defined as a level at which the energy cost to lift the groundwater exceeds the economic value of the water for agriculture or when a significant number of domestic wells are affected.

Justification of Groundwater Elevations as a Proxy

Again, the use of groundwater elevations as a substitute metric for groundwater storage is appropriate because change in storage is directly correlated to changes in groundwater elevation.

Causes

Long-term sustainability of groundwater is achieved when pumping and recharge are measured and balanced over multiple wet and dry cycles. When the groundwater pumping exceeds recharge, groundwater levels may decline. Similarly, when recharge exceeds pumping, groundwater levels may rise. Lower-than-average precipitation and snowpack over the last 20 years have resulted in declining groundwater levels in some parts of the Basin. A similar period of declining water levels occurred in the late 1980s through the middle of the 1990s. In the late 1990s, several years in a row of above-average precipitation caused groundwater levels to fully recover. Future wet periods, enhanced recharge, increased storage, and addressing data gaps will likely cause groundwater storage to experience a similar recovery and maintain balance within the Basin.

Criteria

As said, the measurable objective and the minimum threshold for groundwater levels and groundwater storage are the same. The monitoring network described in Chapter 8 – Monitoring Networks is also the same for both groundwater levels and storage. As such, the GSAs will use the voluntary and discretionary protocol described in the groundwater level section and the well mitigation program described in Section 9 as a technique to improve management of groundwater when groundwater storage is below the measurable objective but above the minimum threshold.

Effects

Please *refer to* the "Effects" discussion in the groundwater levels section of this chapter, as the content in both sections is the same.

7.3.3 Seawater Intrusion

§354.26(d) of the GSP Regulations states that "An agency that is able to demonstrate that Undesirable Results related to one or more sustainability indicators are not present and are not likely to occur in a basin shall not be required to establish criteria for undesirable results related to those sustainability indicators."

The BVGB is not located near an ocean and ground surface elevations are over 4000 feet above msl. Seawater intrusion is not present and is not likely to occur. Therefore, SMCs are not required for seawater intrusion as per §354.26(d) cited above.

7.3.4 Water Quality

As described in Chapter 5 – Groundwater Conditions, the groundwater quality conditions in the Basin are overall excellent (DWR 1963, Reclamation 1979). While the water quality is considered excellent in the Basin, water quality is an important issue to both agricultural and domestic users within the Basin and they are working in coordination to maintain excellent water quality. The multitude of programs which regulate water quality is listed in Section 3.5.

In addition, Big Valley residents are voluntarily coordinating and participating in activities that will ensure continued excellent quality water in the Basin (see Section 9). Over the last 15 years, landowners have drilled stock watering wells as part of the EQIP program to protect water quality in streams. In 2018, the Upper Pit River Watershed IRWMP 2017 Update was completed. This document conducted a thorough analysis of the entire Pit River Watershed and found no water quality issues within the BVGB. Agricultural users are also proactively managing water quality *via* partnerships with agencies such as the NRCS to implement on-site programs which are designed to protect water quality as detailed in Chapter 9 – Projects and Management Actions. As described in Section 1.1 – Introduction, agricultural users primarily grow low-impact crops with no-till methods and little application of fertilizer or pesticides. Domestic water users are also assisting in maintaining good water quality within the Basin through community action. Through the civic process, Big Valley residents were engaged in the development of the Modoc and Lassen County ordinances to deter unlicensed outdoor marijuana growers and the unpermitted use of pesticides and rodenticides, which may make their way into the groundwater and surface water. The domestic water users are also actively seeking to assist in code enforcement and reduce the amount of harmful debris within the Big Valley communities that may cause water quality issues. Public outreach through the offices of Public Health, Environmental Health, and the Regional Recycling Group Recycle Used Oil and Filter Campaign will assist in maintaining excellent water quality. These outreach efforts are further discussed in Chapter 9 – Projects and Management Actions. The definition of undesirable results, measurable objectives, and minimum thresholds for water quality are described below.

Description

Consistent with the guidance provided in §354.28(b)(4) of the GSP Regulations related to groundwater quality, undesirable results for degraded water quality are defined as when the degradation of quality results in significant and undesirable impacts to the long-term viability of agriculture, community, domestic, and natural/wildlife uses in the Basin.

Causes

Earlier sections of the GSP have described the low-impact land uses across the Basin and describe the reasoning that significant changes are unlikely to occur in the future. Although highly improbable, there are several potential causes of future degradation of groundwater quality in the Basin, including:

- Point-source chemical contamination from unregulated waste discharge (e.g., wastewater, septic, industry) or leaking fuel storage tanks
- In the unlikely event that agricultural practices shift toward more fertilizer-intensive practices than currently exists, there would be a potential for nutrient accumulation in groundwater.
- Declining groundwater levels that result in the mobilization of constituents of concern and increased concentrations of these constituents in groundwater

- Groundwater pumping or projects resulting in the mobilization of constituents of concern and/or groundwater contaminant plumes

These causes are unlikely to occur given the low-impact land uses in the Basin, the short growing season, the controlled nature of the current groundwater contaminant plumes, and the agricultural and domestic users' robust effort to conduct conservation.

Criteria

In identifying the constituents of concern for which the GSAs would develop SMCs, the GSAs considered the following:

- Feedback from stakeholders on water quality concerns, including the groups identified in Section 7.3.1 – Groundwater Levels.
- Historical groundwater quality in the Basin and recent trends (see Chapter 5) compared to water quality objectives.
- Role of other agencies in managing constituents of concern.

The GSAs concluded that SMCs should be developed for TDS and nitrate due to their nexus to the sustainability goal, the definition of undesirable results regarding groundwater quality, and the ability of the GSAs to measurably impact TDS and nitrate via PMAs. The GSAs chose not to develop SMCs for constituents of concern that are found and managed via other regulatory programs (e.g., DTSC, DDW). However, the GSAs will continue to coordinate with relevant regulatory agencies and water users to ensure that beneficial uses and users are protected.

The GSAs also chose not to develop SMCs for other naturally occurring constituents of concern. The most recent available data on water quality in the Basin indicate that most constituents which have recent exceedances of primary or secondary MCLs (i.e., arsenic, iron, and manganese) are naturally occurring. These constituents are driven primarily by natural processes and local hydrogeologic conditions, and the GSAs cannot control them through groundwater management processes. Therefore, the GSAs do not propose any criteria related to naturally occurring constituents.

Following the state's drinking water standards, the maximum thresholds for TDS and nitrate are set at their respective MCLs: 500 mg/L for TDS (secondary MCL) and 10 mg/L for nitrate (primary MCL). MOs for TDS and nitrate are the current quality, which is about 300 mg/L for TDS and less than 1 mg/L for nitrate. MOs are developed for each monitoring well.

The maximum threshold is defined as three or more wells with a TDS[59] and/or nitrate measurements that are above the MCL for three consecutive years. This occurrence would indicate changed conditions that

[59] SC will be used as a proxy for TDS. Chapter 5.4 demonstrates a strong correlation between TDS and SC in Basin groundwater, indicating that TDS is approximately 0.66 times the SC in the Basin. Therefore, the maximum threshold of TDS equals about 760 μS/cm of SC. The MO for TDS equates to about 450 μS/cm of SC.

would require management actions to address. The monitoring programs associated with these criteria are defined in Section 8.2.2.

Effects

If groundwater quality were to degrade to or beyond the MTs for TDS and nitrate, undesirable results would occur for all beneficial uses and users to varying degrees. These impacts include:

- Agricultural uses: Increases in TDS of water used to irrigate crops could reduce water uptake in crops and increase crop toxicity, leading to reduced crop yields and damaged crops. Furthermore, the accumulation of TDS in soils over time can render land unsuitable for crop irrigation.
- Municipal water users: For municipal water users in the Basin that rely on supply wells for drinking water, degraded groundwater quality could cause service interruptions and increased costs due to the need for additional treatment to meet water quality standards.
- Domestic users: Degraded groundwater quality in domestic wells could result in health impacts for users. Domestic users could incur increased costs in response to degraded groundwater quality due to a need to modify wells, add well-head treatment, or find alternative water supplies. In addition, degraded groundwater quality could impact property values, as wells are typically sampled during property transactions.
- Natural and wildlife uses: Degraded groundwater quality could impact the viability of the habitats and ecosystems that rely on groundwater and those who rely on these for recreation.

7.3.5 Land Subsidence

As detailed in Section 5.5, little-to-no measurable subsidence is occurring in the Basin. Furthermore, causes of micro-subsidence identified by the InSAR data presented in Section 5.5 are likely due to either agricultural land leveling operations or natural geologic activity. The specific identified areas of subsidence are considered acceptable and necessary agricultural operations to promote efficient irrigation. Similar situations may occur throughout the Basin and will be investigated if identified through InSAR. As detailed in Chapter 5, very minor areas of land subsidence have been observed in the Basin by the Continuous Global Positioning System site near Adin (CGPS P347, -0.6 inch over 11 years) and by the InSAR data provided by DWR (maximum of -3.3 inches over 4 years). The cause of these downward displacements has not been determined conclusively, but due to the widespread nature is likely natural and unavoidable due to the movement of Tectonic plates.

Given the lack of significant subsidence and the fact that some subsidence is acceptable to stakeholders in the absence of impacts on infrastructure (roadways, railroads, conveyance canals, and wells among others), no undesirable results have occurred, and none are likely to occur. Therefore, per §354.26(d), SMCs were not established for subsidence. At the five-year updates of this GSP, data from GPS P347 and InSAR data provided by DWR will be assessed for notable subsidence trends that can be correlated with groundwater pumping. SMCs and undesirable results for subsidence will be established at the five-year update only if trends indicate significant and unreasonable subsidence is likely to occur in the subsequent 5 years.

7.3.6 Interconnected Surface Water

The rivers and streams of the Basin are an important and vital resource for all interested parties. The agricultural industry has an extensive history of surface-water use in the Basin and has operated for over a century. Many of the surface-water rights on farms and ranches are pre-1914 water rights. All surface water flowing in the Basin during irrigation season is fully allocated. For all interested parties, there is need for better tracking of surface-water allocations.

Section 5.6 presents the available information related to interconnected surface water. It is nearly impossible to quantify surface-water depletion impact based on flow alone, even in an area where there is good data, such as pumping quantity, deep aquifer groundwater elevation, precipitation, and surface flow. Many of these criteria are current data gaps in the Basin, particularly the variation in precipitation and flow across the Basin. Uncertainty in the amount of surface water entering the Basin and the unpredictability of weather patterns has already been established and will continue to be a barrier. Pumping data in the Basin is also a data gap as there is no current monitoring system which annually measures the amount of water pumped. The connection between upland recharge areas and the unique volcanic geologic features surrounding the Basin are mostly unknown and make understanding the connectivity of surface and groundwater very difficult, if not impossible.

Furthermore, the number of wells located next to streams and the river in the Basin are not quantified. While Chapter 5 – Groundwater Conditions details the streams in Big Valley which *may* be interconnected by a "…continuous saturated zone to the underlying aquifer and the overlying surface water…" (DWR 2016c), there is currently no evidence to support interconnected surface water. Therefore, there is a lack of evidence for interconnection of streams. **Figure 5-22** overlays the general direction(s) of groundwater flow around the Basin in relation to the major streams. Also shown is the general direction of flow determined from the newly constructed well clusters near Adin and Lookout. The remaining clusters were constructed later and do not yet have a sufficient period of data to determine flow directions with certainty. The newly constructed monitoring wells will continue to gather data on whether there is any evidence of interconnected surface water.

Chapter 4 – Hydrogeological Conceptual Model identified data gaps related to the effect of Ash Creek, Pit River, and smaller streams on recharge. These data gaps may partially be filled once adequate data from the five monitoring well clusters are collected. Scientific research related to groundwater and surface water will improve over time. As this science is made available, the GSAs will work to locate funding for improved data depending on available staffing and financial resources.

SMCs were not established for interconnected surface water because there is insufficient evidence to determine that Undesirable Results are present or likely to occur. At the five-year updates of this GSP, data from newly established well clusters, new and historical stream gages, and the monitoring network detailed in Chapter 9 – Projects and Management Actions will be assessed to determine if undesirable trends are occurring in the principal aquifer. At the five-year update, SMCs will be considered only if the trends indicate that undesirable results are likely to occur in the subsequent 5 years.

7.4 Management Areas

Management areas are not being established for this GSP. As the GSAs address data gaps and improve their understanding of the basin, the GSAs may consider developing management areas in a future update.

8. Monitoring Networks § 354.34

8.1 Monitoring Objectives

This chapter describes the monitoring networks necessary to implement the BVGB GSP. The monitoring objectives under this GSP are twofold:

- to characterize groundwater and related conditions to evaluate the Basin's short-term, seasonal, and long-term trends related to the six sustainability indicators, and
- to provide the information necessary for annual reports, including water levels and updates to the water budget.[60]

The sections below describe the different types of monitoring required to meet the above objectives, including groundwater levels, groundwater quality, subsidence, streamflow, climate, and land use. Each type of monitoring relies on existing programs not governed by the GSAs and therefore the monitoring networks described in this chapter are subject to change if the outside agencies modify or discontinue their monitoring. The monitoring networks will generally be adjusted to the availability of data collected and provided by the outside agencies.

8.2 Monitoring Network

8.2.1 Groundwater Levels

Monitoring of groundwater levels is necessary to meet several needs based on the above stated objectives of the monitoring networks, including:

- Representative monitoring for groundwater levels
- The groundwater contours required for annual reports
- Shallow groundwater monitoring to help define potential interconnection of groundwater aquifers with surface-water bodies

Table 8-1 lists existing wells that have been used for groundwater monitoring and includes the newly-constructed, dedicated monitoring wells. The table indicates which wells are used for each of the three groundwater level monitoring networks. A more detailed table with elements required under §352.4(c) is included in **Appendix 8A**. Further details for each well and water level hydrographs are included in **Appendix 5A**. **Appendix 8B** contains the As-Built Drawings for the dedicated monitoring wells, also required by §352.4(c). The locations of the wells are shown on **Figure 8-1**.

[60] Water levels are needed to generate hydrographs, contours, and an estimate of change in storage as required for the annual report. Also required for the annual reports are estimates of groundwater pumping, surface-water use, and total water use which can be estimated from the water budget.

Table 8-1 Big Valley Groundwater Basin Water Level Monitoring Network

Well Name	Well Use	Well Depth (feet bgs)	Screen[1] Interval (feet bgs)	Representative Well[2]	Depth to Water (feet bgs)		Groundwater Elevation (feet msl)		Contour Well	Shallow Well	Monitoring Frequency
					Measurable Objective[3]	Minimum Threshold[4]	Measurable Objective[3]	Minimum Threshold[4]			
01A1	Stockwatering	300	40 - 300	X	148	288	4035	3895	X		biannual
03D1	Irrigation	280	50 - 280						X		biannual
06C1	Irrigation	400	20 - 400						X		biannual
08F1	Other	217	26 - 217	X	32	172	4222	4082	X		biannual
12G1	Residential	116	--								biannual
13K2	Irrigation	260	20 - 260	X	66	206	4062	3922	X		biannual
16D1	Irrigation	491	100 - 491	X	93	233	4079	3939	X		biannual
17K1	Residential	180	30 - 180						X		biannual
18E1	Irrigation	520	21 - 520						X		biannual
18M1	Irrigation	525	40 - 525								biannual
18N2	Residential	250	40 - 250								biannual
20B6	Residential	183	41 - 183	X	41	181	4085	3945	X		biannual
21C1	Irrigation	300	30 - 300						X		biannual
22G1	Residential	260	115 - 260								biannual
23E1	Residential	84	28 - 84								biannual
24J2	Irrigation	192	1 - 192						X		biannual
26E1	Irrigation	400	20 - 400	X	20	160	4114	3974	X	X	biannual
28F1	Residential	73	--								biannual
32A2	Other	49	--						X		biannual
32R1	Irrigation	--	--						X		biannual
ACWA-1	Irrigation	780	60 - 780						X		biannual
ACWA-2	Irrigation	800	50 - 800						X		biannual
ACWA-3	Irrigation	720	60 - 720	X	23	163	4136	3996	X	X	biannual
BVMW 1-1	Observation	265	175 - 265	X	53	193	4162	4022	X		continuous[5]
BVMW 1-2	Observation	52	32 - 52[6]							X	continuous[5]
BVMW 1-3	Observation	50	30 - 50[6]							X	continuous[5]
BVMW 1-4	Observation	49	29 - 49[6]							X	continuous[5]
BVMW 2-1	Observation	250	210 - 250	X	22	162	4194	4054	X		continuous[5]
BVMW 2-2	Observation	70	50 - 70[6]							X	continuous[5]
BVMW 2-3	Observation	70	50 - 70[6]							X	continuous[5]
BVMW 2-4	Observation	60	40 - 60[6]							X	continuous[5]
BVMW 3-1	Observation	185	135 - 185	X	18	158	4146	4006	X		continuous[5]
BVMW 3-2	Observation	40	25 - 40[6]							X	continuous[5]
BVMW 3-3	Observation	50	25 - 50[6]							X	continuous[5]
BVMW 3-4	Observation	50	25 - 50[6]							X	continuous[5]
BVMW 4-1	Observation	425	385 - 415	X	65	205	4088	3948	X		continuous[5]
BVMW 4-2	Observation	74	54 - 74[6]							X	continuous[5]
BVMW 4-3	Observation	80	60 - 80[6]							X	continuous[5]
BVMW 4-4	Observation	93	73 - 93[6]							X	continuous[5]
BVMW 5-1	Observation	540	485 - 535	X	47	187	4082	3942	X		continuous[5]
BVMW 5-2	Observation	115	65 - 115[6]							X	continuous[5]
BVMW 5-3	Observation	85	65 - 85[6]							X	continuous[5]
BVMW 5-4	Observation	90	70 - 90[6]							X	continuous[5]

Notes:

-- = information not available

feet bgs = feet below ground surface (depth to water)

feet msl = feet above mean sea level (groundwater elevation NAVD88)

water year = October 1 to September 30

[1] For the purposes of this GSP, the terms "screen" or "perforation" encompases any interval that allows water to enter the well from the aquifer, including casing perforations, well screens, or open hole.

[2] Respresentative wells for Water Levels and Groundwater Storage

[3] Measurable objective is set at the Fall 2015 water level or at the lowest water level measured for wells that don't have a Fall 2015 measurement

[4] Minimum threshold is set at 140 feet below the measurable objective

[5] Continuous measurements are currently available due to the water level transducers installed in the wells. Less frequent monitoring may be appropriate in the future once the period of record of these wells is longer and interconnection of surface and groundwater is better understood.

[6] These shallow wells were constructed for this Plan at the recommendation of certified hydrogeologists.

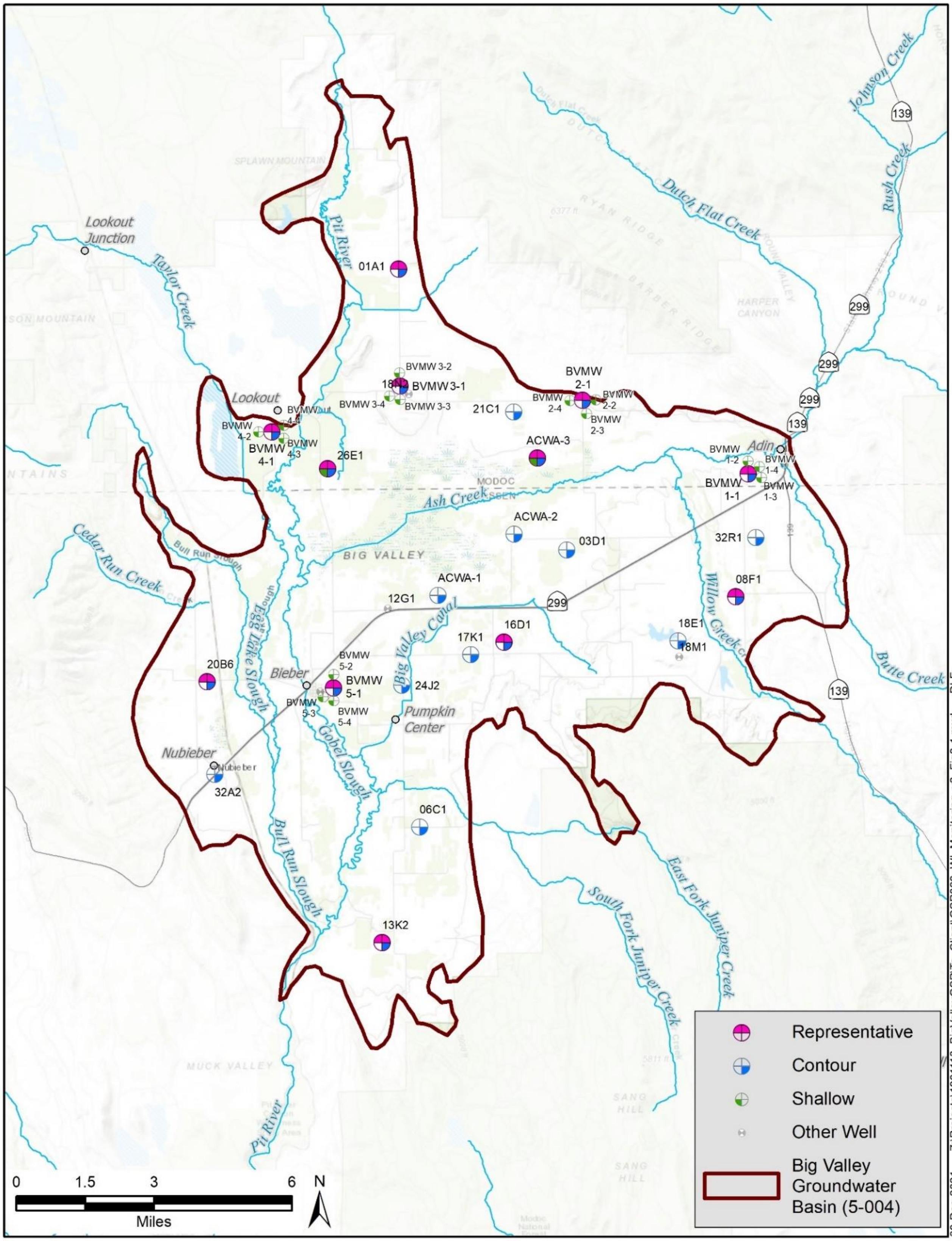


Figure 8-1 Water Level Monitoring Networks

GSP Regulation §352.4 states that monitoring sites that do not conform to DWR BMPs, "…shall be identified and the nature of the divergence from [BMPs] described." DWR's BMP (DWR 2016e) states that wells should be dedicated to groundwater monitoring. In addition, §354.34 indicates that wells in the monitoring network should have "depth-discrete[61] perforated intervals." Many of the historical wells listed in **Table 8-1** diverge from these standards and the explanation of their suitability for monitoring is described below.

Previous groundwater level monitoring in the Basin has relied on existing domestic and irrigation wells that often have pumps in them used for irrigation, stock watering, or domestic uses. The intent of groundwater level monitoring is to capture static (non-pumping) water levels. However, historical monitoring is performed before and after the irrigation season: March or April for spring measurements and October for fall measurements.[62] Since these measurements are taken at a time when large-scale groundwater use is typically not active, using production wells is acceptable in the absence of dedicated monitoring wells. DWR staff who monitor the wells will indicate if the well (or a nearby well) is pumping in order to be considered when assessing water level measurements.

In addition to the well use considerations, most of the historical wells do not have depth-discrete screen intervals,[63] as the typical well construction practice in the Basin has been to use long (100 feet up to 800 feet) screens, perforations, or open hole below about 30 to 40 feet of blank well casing. This construction practice is designed to maximize well yield. The use of such long-screen wells is acceptable for monitoring in Big Valley because multiple principal aquifers have not been defined in the Basin and therefore these long intervals do not cross defined principal aquifers. Since most wells are constructed with this practice, water levels in these long-screen wells should be indicative of the aquifer as a whole and less likely to be affected by perched water or isolated portions of the aquifer that may not be interconnected over large areas.

8.2.1.1 Representative Groundwater Levels and Storage Monitoring Network

The representative monitoring network includes all wells that have been assigned sustainable management criteria (minimum thresholds and measurable objectives). DWR does not give strict guidance on the number or density of wells appropriate for representative monitoring. DWR's BMP document cites sources that recommend well densities ranging from 0.2 to 10 wells per 100 square miles (DWR 2016e). Through consultation with the BVAC, 12 wells were selected for representative monitoring of the Basin (which has an area of about 144 square miles), a density of 8.3 wells per 100 square miles.

[61] "Depth-discrete" means that the screens, perforations, or open hole is relatively short (typically less than about 20 feet).

[62] Local stakeholders have advocated for future measurements to occur in mid-March and late-October to ensure they are taken before and after the irrigation season.

[63] Screens in this context includes perforated casing, well screens, or open hole, all of which allow water to flow into the well.

Extensive discussion and consideration were performed by the GSAs and local stakeholders to determine an appropriate water level monitoring network. Based on the comprehensive review of the wells, the network was selected based on:

- Spatial distribution throughout the Basin to represent agricultural pumping areas
- Areas with a high density of domestic wells
- An existing monitoring record (where available) to track long-term trends
- Access for long-term future monitoring
- Well depth (greater than the MT)
- Wells dedicated to monitoring where available

Table 8-1 shows the MOs and MTs for the 12 representative wells. As stated in Chapter 7 – Sustainable Management Criteria, MOs are set at the fall 2015 water level. MTs are shown in **Table 8-1** to protect agricultural beneficial use.

8.2.1.2 Groundwater Contour Monitoring Network.

The GSP Regulations (§356.2) require that annual reports include groundwater contours for the previous year (spring and fall) as well as an estimate of change in groundwater storage. Historical groundwater storage changes were estimated in Chapter 5 – Groundwater Conditions, using groundwater contours contained in **Appendix 5B**. Therefore, for annual reports to be comparable to historical conditions, the wells used for groundwater contouring should be the same, or nearly the same, as those used for the historical contours. Five wells that were used in the historical contours are not included in the groundwater contour monitoring network (18M1, 18N2, 22G1, 23E1 and 28F1), because they were either replaced by a new dedicated monitoring well or there was another well close by that makes the measurement unnecessary. **Table 8-1** lists the groundwater contour monitoring network and **Figure 8-1** shows their locations.

8.2.1.3 Shallow Groundwater Monitoring Network

Chapter 5 – Groundwater Conditions discusses interconnected surface water and describes the major streams in the BVGB. As described in Chapter 7 – Sustainable Management Criteria, there is currently no conclusive evidence for interconnection of streams with the groundwater aquifer and all summer flows are 100 percent allocated based on existing surface-water rights. Therefore, measurable objectives, minimum thresholds, and a representative monitoring network for interconnected surface water have not been established. Monitoring will be assessed at the five-year update. Through consultation with the BVAC, a shallow monitoring network has been established that includes the shallow wells from each of the five monitoring well clusters. These clusters were designed to measure the magnitude and direction of shallow groundwater flow and are equipped with water level transducers that collect continuous (15-minute interval) water level measurements so that potential correlations with streamflow gages can be assessed. Well 26E1 was also added to the shallow network due to its position between the two major streams (Pit River and Ash Creek), its shallow screen depth (20 feet bgs), and its lack of a pump. Well number ACWA-3 was also selected for the shallow network due to its location on the ACWA within the northern portion of the Ash Creek wetlands associated with Big Swamp and the possible groundwater-dependent ecosystems shown in **Figure 5-23**. **Table 8-1** lists the shallow groundwater monitoring network, and **Figure 8-1** shows the well locations.

8.2.1.4 Monitoring Protocols and Data Reporting Standards

Currently, DWR measures groundwater levels at 21 wells in Big Valley. The expectation of the GSAs is that DWR will also monitor levels at the dedicated monitoring wells and download the transducer data from these wells. Transducer data will be corrected for barometric fluctuations using data from two barometric probes installed at two of the clusters. Water level data will be made available on the state's SGMA Data Viewer website for use by the GSAs in their annual reports and GSP updates. DWR's water level monitoring protocols are documented in their Monitoring Protocols, Standards and Sites BMP (DWR 2016b). Portions of the BMP relevant to water levels are included in **Appendix 8C**.

8.2.1.5 Data Gaps in the Water Level Monitoring Network

Data gaps are identified in this section using guidelines in SGMA Regulations and BMP published by DWR on monitoring networks (DWR, 2016e). **Table 8-2** summarizes the suggested attributes of a groundwater-level monitoring network from the BMP in comparison to the current network and identifies data gaps. No data gaps exist except the area near well 06C1, shown on **Figure 8-1**.

8.2.2 Groundwater Quality

Chapter 5 describes overall water quality conditions as excellent, and the few constituents that are infrequently elevated in Big Valley are all naturally occurring. Based on the information described in Chapter 5, measurable objectives were defined for TDS and nitrate.

The GSAs will leverage water quality reported for wells regulated by the State Water Board's DDW. DDW wells are shown on **Figure 8-2** and are in Bieber and Adin, with one well in the western portion of the Basin. In addition to data from DDW, the GSAs have installed three transducers to measure electrical conductivity (EC) and specific conductance (SC), which is used as a proxy for TDS, at wells BVMW 1-1, 4-1, and 5-1, shown on **Figure 8-2**. These transducers increase the distribution of the monitoring network around the Basin and with increased frequency of measurement will allow the GSAs to better understand temporal trends in TDS that may not be apparent from infrequent DDW measurements. The EC/SC transducers may be able to put anomalous[64] measurements from DDW into better context. **Table 8-3** lists the groundwater quality monitoring sites and their details.

[64] Anomalous measurements are those that are out of the norm or deviate from what would be expected. The source of the deviation from the norm should be noted and if errors are identified, the measurement(s) removed from the dataset based on professional judgment. At a minimum, anomalous measurements are marked as questionable, and the potential source(s) of the deviation documented.

Table 8-2 Summary of Best Management Practices, Groundwater Level Monitoring Well Network and Data Gaps

Best Management Practice (DWR, 2016d)	Current Monitoring Network	Data Gap
Groundwater level data will be collected from each principal aquifer in the Basin.	12 representative wells	None. There is a single principal aquifer and therefore all wells monitor the aquifer.
Groundwater level data must be sufficient to produce seasonal maps of groundwater elevations throughout the Basin that clearly identify changes in groundwater flow direction and gradient (Spatial Density).	22 contour wells	21 of the 22 proposed contour wells are currently monitored. Well 06C1 was monitored up until WY 2016. This well fills an important spatial area in the southern part of the Basin. To fill the data gap, the well could be re-activated, a new willing well owner found, or a dedicated monitoring well constructed in the area.
Groundwater levels will be collected during the middle of October and March for comparative reporting purposes, although more frequent monitoring may be required (Frequency).	All proposed monitoring network wells, except 06C1, are measured biannually, with the dedicated monitoring wells collecting continuous (15-minute) measurements	None. Current DWR monitoring occurs in March or April and in October for seasonal high (spring) and low (fall) respectively.
Data must be sufficient for mapping groundwater depressions, recharge areas, and along margins of basins where groundwater flow is known to enter or leave a basin.	Groundwater depressions are present in the east-central part of the Basin near 03D1 and in the southern portion of the Basin near Well 06D1 and Well 13K2	03D1 defines the east-central depression. To ensure adequate definition of the southern depression, well 06C1 could be re-activated, a new, willing well owner found, or a dedicated monitoring well constructed in the area.
Well density must be adequate to determine changes in storage.	22 contour wells	Filling of data gap near 06C1.
Data must be able to demonstrate the interconnectivity between shallow groundwater and surface-water bodies, where appropriate.	17 shallow wells, including 5 clusters of 3 shallow wells each	None.
Data must be able to map the effects of management actions, i.e., managed aquifer recharge.	22 contour wells and 17 shallow wells	None. Once projects and management actions are defined, monitoring specific to those projects and management actions will be identified.
Data must be able to demonstrate conditions near Basin boundaries; agencies may consider coordinating monitoring efforts with adjacent basins to provide consistent data across Basin boundaries. Agencies may consider characterization and continued impacts of internal hydraulic boundary conditions, such as faults, disconformities, or other internal boundary types.	22 contour wells and 17 shallow wells	None. There are no direct boundaries with adjacent Basins. Inflow/outflow from Basin addressed above.
Data must be able to characterize conditions and monitor adverse impacts to beneficial uses and users identified within the Basin.	12 representative wells	None

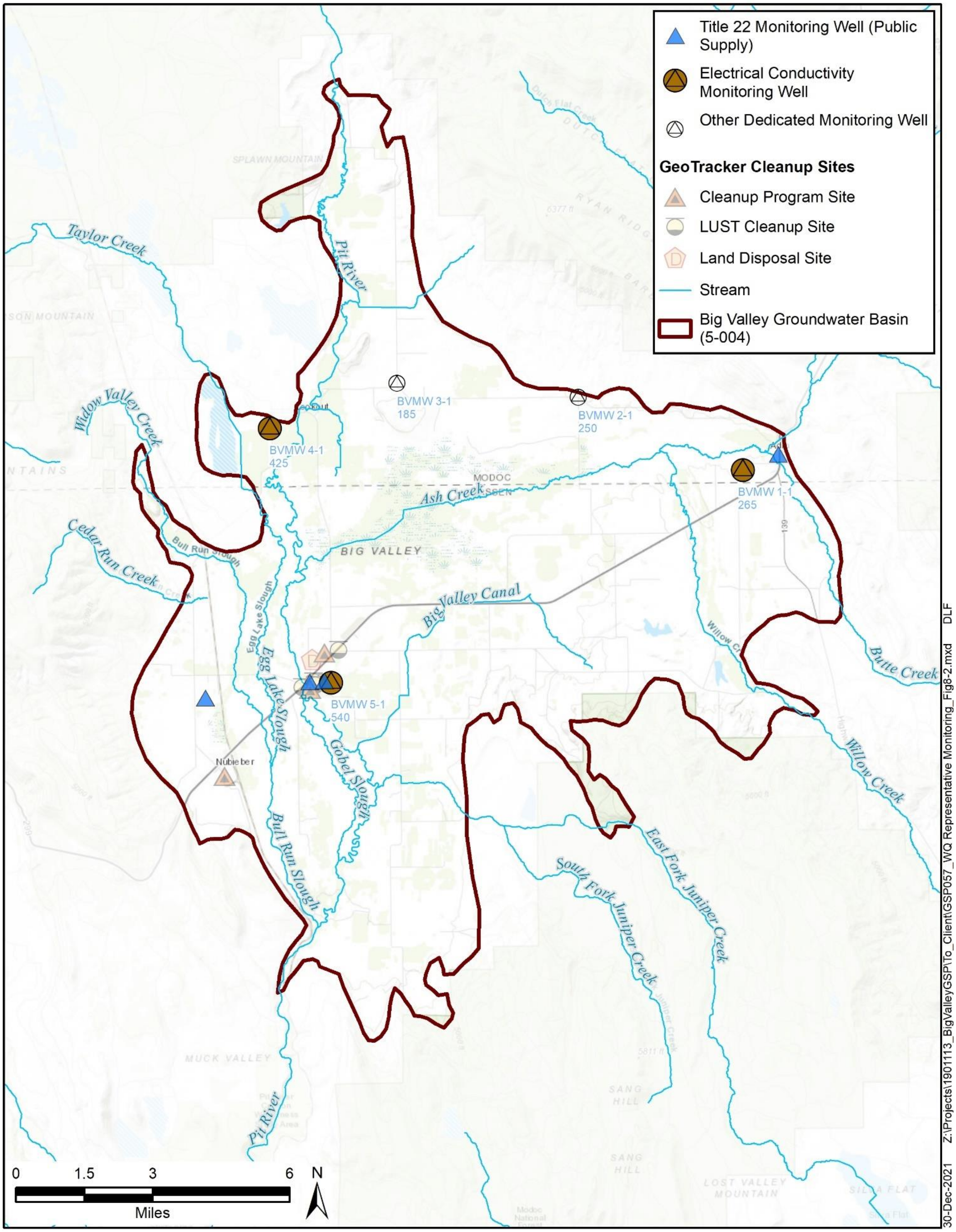


Figure 8-2 Water Quality Monitoring Network

Table 8-3 Big Valley Groundwater Basin Water Quality Monitoring Network

Well Name	SWRCB Public Source Code	DWR Site Code	Well Use	Well Depth (feet bgs)	Open Hole	Screen[1] Interval (feet bgs)	Constituents
Bieber Town Well 1	1810003-001		Public Supply	200	yes	62 - 200	Title 22
Bieber Town Well 2	1810003-002		Public Supply	240	no	60 - 240	Title 22
Adin Ranger Station Well 3	2500547-003		Public Supply	--	--	--	Title 22
Intermountain Conservation Camp Well 1	1810801-001		Public Supply	--	--	--	Title 22
BVMW 1-1		411880N1209599W001	Observation	265	no	175 - 265	Electrical conductivity
BVMW 3-1		412029N1211587W001	Observation	185	no	135 - 185	Electrical conductivity
BVMW 5-1		411219N1211339W001	Observation	540	no	485 - 535	Electrical conductivity

Notes:
-- = information not available
feet bgs = feet below ground surface (depth to water)
[1] For the purposes of this GSP, the terms "screen" or "perforation" encompases any interval that allows water to enter the well from the aquifer, including casing perforations, well screens, or open hole.

Additionally, the GSAs will implement a voluntary water quality monitoring program for nitrate and arsenic. The GSAs understand that it is important to provide tools to domestic well users to understand their water quality. To empower domestic well users to understand their water quality at their wells, the GSAs will support the University of California Cooperative Extension (UCCE)/County farm advisors to provide at-home nitrate and arsenic test strips to domestic well users in the Basin at no cost. In addition, the UCCE/County farm advisors will provide guidance on how to administer the tests and, if desired by and with permission from the domestic well owner, document the water quality findings to aid the GSAs in understanding Basin water quality.

It should be noted that monitoring also occurs at local restaurants/markets and at domestic wells during land transactions. The former is reported to the counties and can be reviewed periodically as a supplement to the public supply well data. The latter is not publicly available; however, it provides existing and future landowners the information necessary to understand the water quality of domestic wells.

8.2.2.1 Monitoring Protocols and Data Reporting Standards

While DWR provides guidance on protocols and standards for water quality in their BMP (DWR 2016f), these don't generally apply to the Big Valley water quality monitoring network. For the DDW wells, monitoring protocols used by the parties responsible for collecting and analyzing samples will be relied upon. DDW and other data regulated by the State Water Board is made available on their GAMA GIS website. At the five-year update, the GSAs will obtain and analyze the available data. The measurements for EC/SC transducers are made in situ with no samples collected or analyzed in a laboratory. Monitoring will be assessed at the 5-year update.

8.2.2.2 Data Gaps in the Water Quality Monitoring Network

Table 8-4 summarizes the recommendations for groundwater quality monitoring from DWR's BMPs, the current network, and data gaps. There are no data gaps in the water quality monitoring network.

8.2.3 Land Subsidence

As described in Chapter 5 - Groundwater Conditions and Chapter 7 – Sustainable Management Criteria, no significant land subsidence has occurred in the BVGB, and no significant subsidence is likely to occur. Therefore, MOs, MTs and a representative monitoring network have not been established. This assessment was made based on a CGPS station near Adin (P347) and InSAR data provided by DWR. Future assessment of subsidence at the five-year GSP update will rely on data provided by NOAA, who operates Well P347, and updated InSAR data provided by DWR. The data will be assessed to determine if significant subsidence is occurring and the source of that subsidence.

Table 8-4 Summary of Groundwater Quality Monitoring, Best Management Practices and Data Gaps

Best Management Practices (DWR, 2016a)	Current Network	Data Gap
Monitor groundwater quality data from each principal aquifer in the Basin that is currently, or may be in the future, impacted by degraded water quality. The spatial distribution must be adequate to map or supplement mapping of known contaminants. Monitoring should occur based upon professional opinion, but generally correlate to the seasonal high and low groundwater level, or more frequent as appropriate.	• 4 public supply wells sampled per DDW standards • 3 monitoring wells with continuous EC/SC data measured by transducers (proxy for TDS) • Voluntary nitrate and arsenic monitoring and reporting	None. Most known contaminants are located in Bieber and Nubieber. Monitoring at wells in Bieber and in BVMW 5-1 have not shown contaminants, but monitoring there would indicate if they became present.
Collect groundwater quality data from each principal aquifer in the Basin that is currently, or may be in the future, impacted by degraded water quality. Agencies should use existing water quality monitoring data to the greatest degree possible. For example, these could include ILRP, GAMA, existing RWQCB monitoring and remediation programs and drinking water source assessment programs.	• 4 public supply wells sampled per DDW standards • 3 monitoring wells with continuous EC/SC data measured by transducers (proxy for TDS) • Voluntary nitrate and arsenic monitoring and reporting • Other publicly available data from GAMA	None.
Define the three-dimensional extent of any existing degraded water quality impact.	No degraded water quality impacts are present.	None.
Data should be sufficient for mapping movement of degraded water quality.	No degraded water quality impacts are present.	None.
Data should be sufficient to assess groundwater quality impacts to beneficial uses and users.	Voluntary nitrate and arsenic monitoring and documentation	None.
Data should be adequate to evaluate whether management activities are contributing to water quality degradation.	None at this time. PMAs that are implemented will assess potential water quality impacts.	None that will not be addressed by the PMAs.

8.2.3.1 Monitoring Protocols and Data Reporting Standards

Since the monitoring network relies on NOAA and DWR-provided data, the monitoring protocols and reporting standards for those organizations apply.

8.2.3.2 Data Gaps in the Subsidence Monitoring Network

Since InSAR data is contiguous across the Basin, there are no spatial data gaps. If subsidence is indicated by future InSAR datasets, there may be a need to field verify those areas to determine if field leveling has occurred or there is another reason or cause for the subsidence. Additional field validation could potentially be made by re-surveying monuments in the Basin, including those installed at the new monitoring wells.

8.2.4 Monitoring to Support Water Budget

8.2.4.1 Streamflow and Climate

Streamflow and climate data are needed to update the water budget. Current monitoring sites are shown on **Figure 8-3**. Modoc County has been working to improve water budget estimates and is proposing to add a stream gage on the Pit River just north of the BVGB, shown on **Figure 8-3**, which will be maintained by the state. Data gaps for smaller streams, such as inflow from Roberts Reservoir, Taylor Creek and Juniper Creek are proposed to be filled by investigating SB-88 stream diversion records submitted to the State Water Board.

8.2.4.2 Land Use

Land use data is needed for updates to the water budget. Since 2014, DWR has provided land-use mapping using remote sensing processed by DWR's LandIQ mapping resource. DWR has provided these datasets for 2014, 2016, and 2018.[65] The GSAs will rely on DWR continuing to provide this land- use data to generate annual updates to the water budget. The most recent land-use data available will be used to generate the evapotranspiration estimates. Current research is being performed to develop the relationship between evapotranspiration (ET) and applied water. This research indicates that crops in this area are typically irrigated less than indicated by the assumptions made by multiplying ETo by crop coefficients.

[65] Landowners in the Basin have pointed out that these datasets are inaccurate, but they represent the best available information.

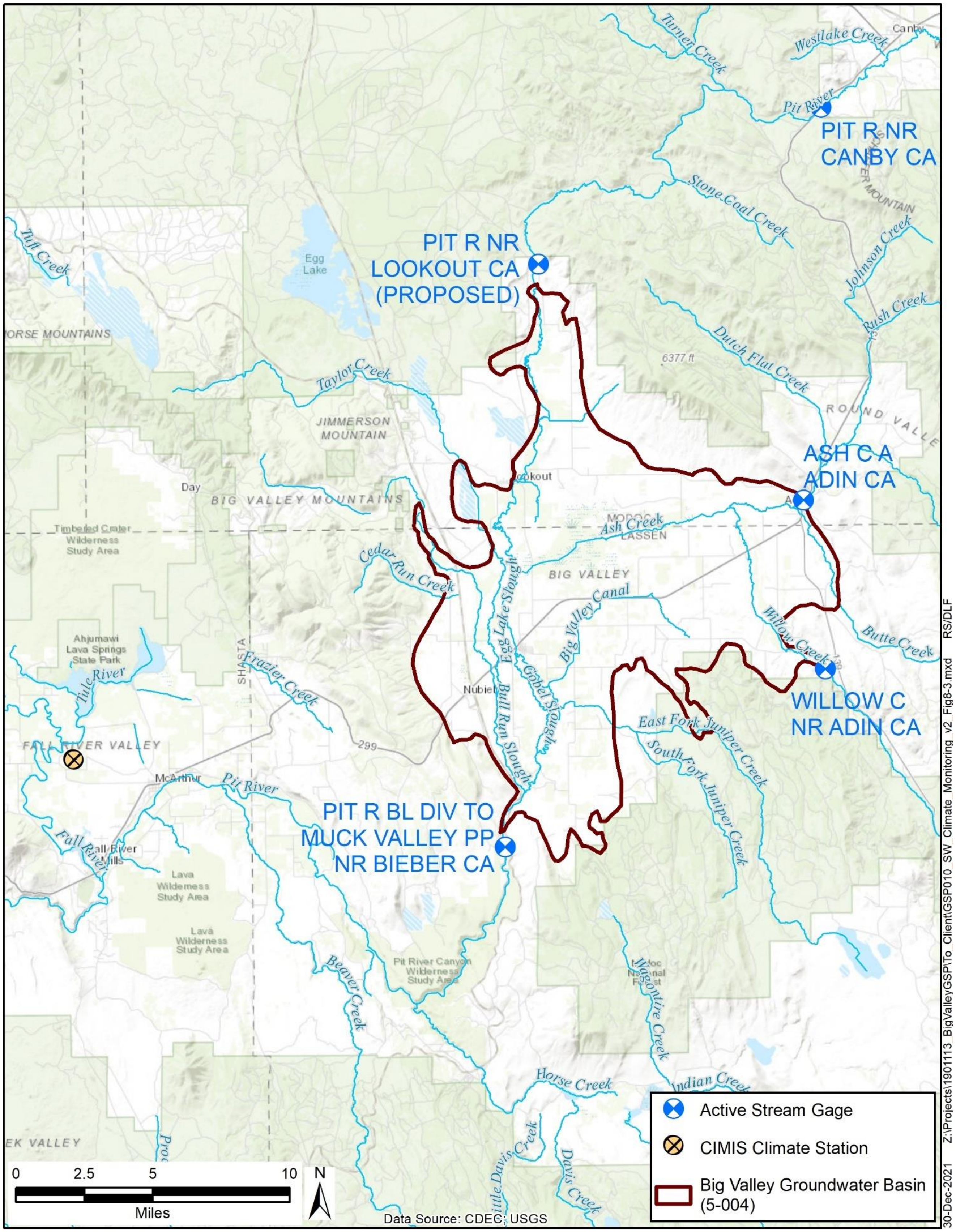


Figure 8-3 **Proposed Surface-water and Climate Monitoring Network**

9. Projects and Management Actions §354.44

Through an extensive planning and public outreach process, the GSAs have identified an array of projects and management actions (PMAs) that may be implemented to meet sustainability objectives in the BVGB. Additionally, numerous state and federal programs are available in the Basin to help meet the sustainability goals. Some of the projects can be implemented immediately, while others will take significantly more time for necessary planning and environmental review, navigation of regulatory processes, and implementation. The Big Valley Basin is relatively small, and while recharge does occur within the Basin itself, significant recharge comes from the extensive uplands surrounding the Basin. Projects will be located within the greater Big Valley watershed boundary shown in **Figure 9-1**.

Although the Big Valley area is extremely rural and economically disadvantaged, and resource capacity is limited, there are several local, state, and federal agencies that can assist in project development.

Project implementation will also be impacted by funding acquisition. **Table 9-1** lists current state and local funding sources that can be targeted to support project planning and implementation. Modoc County's current SGMA Implementation Grant (acquired in 2023) is funding several of these projects and management actions.

Chapter 5 demonstrates that most of the historical groundwater level changes are correlated to precipitation patterns, and the limitations and discrepancies described in the water budget (Chapter 6) demonstrate that the water budget tool tends to overestimate historical overdraft. However, the water budget tool is the best available tool currently available to project future conditions, and it indicates that future overdraft averages in the range of 1,000 to 2,000 AFY, depending on long-term climate impacts. If the Basin were to experience these conditions, then the GSAs would need to develop PMAs that would be reasonable to mitigate this overdraft.

With a proactive approach to identify projects for increased recharge and conservation in the Big Valley Basin and surrounding watershed, it is envisioned that the GSAs will be successful in remaining a sustainable groundwater basin. Should sustainability not be realized, or projects not deemed feasible, additional projects and management actions will be considered and developed as appropriate.

A timeline for projects can be found in **Table 9-2**. The Regulations require details about each project to satisfy CWC§354.44. Most of those details can be found in **Table 9-3**. One of the items not included in **Table 9-3** is a description of the legal authority required for each project per CWC§354.44(b)(7). The GSAs have the legal authority to coordinate and/or implement each of the projects described based on their authority under SGMA and state law. Some of these projects include aspects that will be implemented on private and public land. In those cases, permission and authority to implement the project will be obtained from the landowner.

Table 9-3 also shows the expected benefits of each PMA, with an estimated volume (in AFY) where applicable. Two of the PMAs that are expected to be implemented in the shorter term (Basin Recharge Projects and Water Conservation Projects) are expected to have a cumulative benefit of around 2,800 AFY once completed, which would address the expected future overdraft. Furthermore, if the PMA of Increased Surface-Water Storage Capacity (9.3) were implemented, an additional 2,000 AFY of storage would be expected. As the GSAs advance the implementation of these PMAs, they will improve their understanding of the Basin, refine the need for PMAs and the expected benefits of the PMAs, and adapt these to meet the needs of the Basin and the beneficial uses and users.

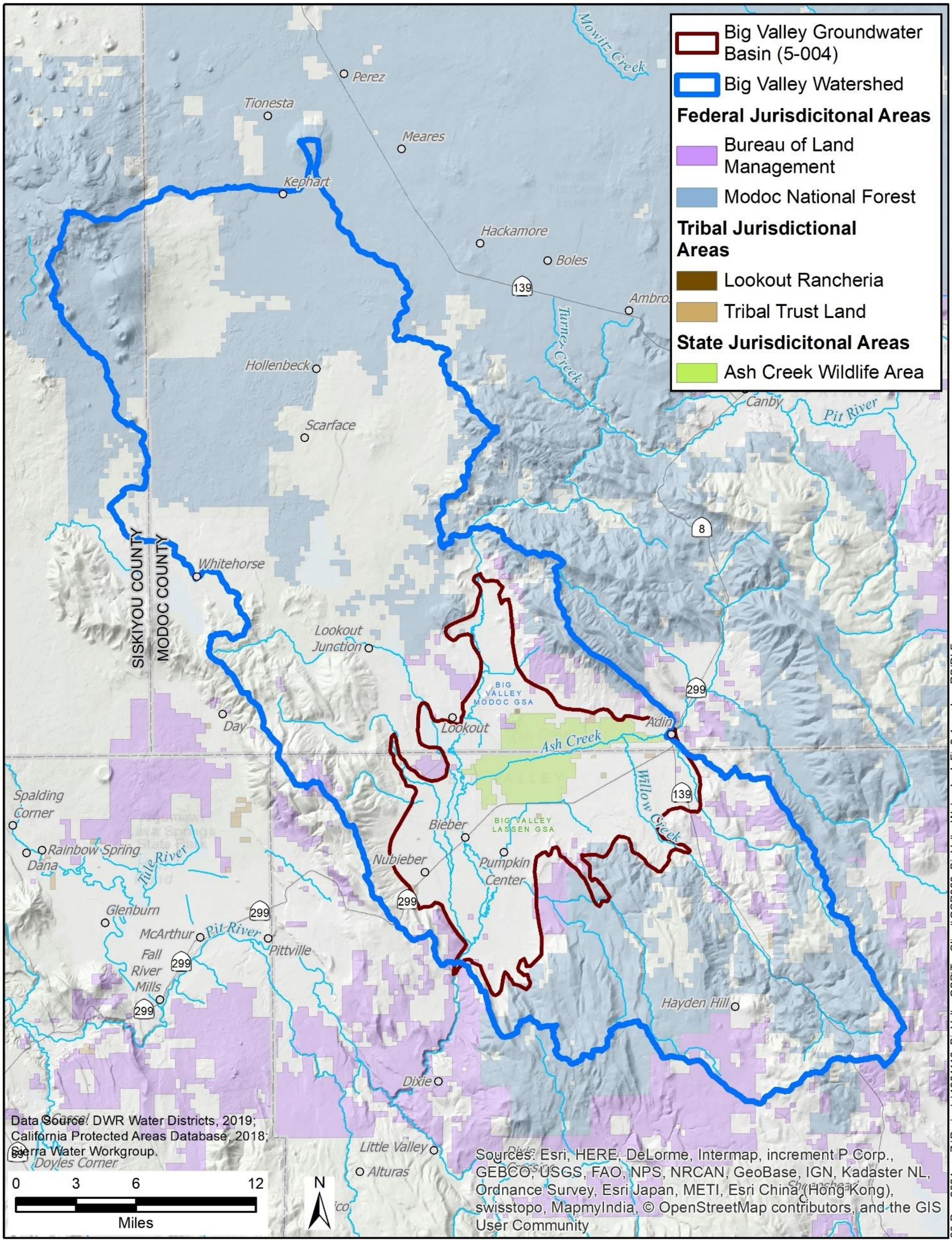


Figure 9-1 Big Valley Watershed Boundary

Table 9-1 Available Funding Supporting Water Conservation

Funding Program Title	Managing Agency	Description of Funding
Wetlands Reserve Program, Crop Reserve Program, Environmental Quality Improvement Program	NRCS (website)	Cost-share funding for wide array of soil, water, and wildlife conservation practices. Funding priorities developed locally.
Conservation Innovation Grants	NRCS (website)	Supports development of new tools, approaches, practices, and technologies to further conservation on private lands.
Partners for Fish and Wildlife Program	US Fish and Wildlife Service (website)	Private land meadow, forest, or rangeland restoration, conservation easement.
State Water Efficiency and Enhancement Program (SWEEP)	California Dept of Food and Agriculture (CDFA) (website)	Supports implementation of water-saving irrigation systems.
Healthy Soils Program	CDFA (website)	Supporting management and conservation practices for enhancing soil health (which includes water holding capacity).
Farmer/Rancher and/or Professional + Producer grants	Western Sustainable Agriculture Research and Education (website)	Farmer-driven innovations in agricultural sustainability including profitability, stewardship, and quality of life.
Alternative Manure Management Program (AMMP) (link)	CDFA (website)	Financial assistance for non-digester manure management.
Sustainable Groundwater Management	DWR (website)	Planning and implementation grants supporting sustainable groundwater management with preference toward disadvantaged communities and economically distressed areas.
State Forest Health Program	CAL FIRE (website)	Improve forest health throughout California.
USDA for household well deepening	USDA Rural Development (website)	No interest loan up to $11K to improve existing domestic wells.

Table 9-2 Projects and Potential Implementation Timeline

No.	Category	Description	Estimated Time for Potential Implementation (years)		
			0-2	2-8	>8
1	9.1 Basin Recharge Projects	Agriculture Managed Aquifer Recharge	X	X	X
2		Drainage or Basin Recharge	X	X	X
3		Aquifer Storage and Recovery and Injection Wells			X
4	9.2 Research and Data Development	Additional Stream Gages and Flow Measurement	C		
5		Refined Water Budget and Domestic and Adin Community Supply Assessment	X	X	
6		• CIMIS Station	C		
7		• Voluntary Installation of Well Meters	C	X	
8		Adaptive Management	X	X	X
9		Mapping and Land Use	X	X	X
10	9.3 Increased Surface-water Storage Capacity	Expanding Existing Reservoirs		X	
11		Allen Camp Dam			X
12	9.4 Improved Hydrologic Function and Upland Recharge	Forest Health / Conifer and Juniper Thinning	X	X	X
13		Stream Channel Enhancement and Meadow Restoration	X	X	X
14	9.5 Water Conservation	Irrigation Efficiency	X	X	X
15		Landscaping and Domestic Water Conservation	X	X	X
16		Illegal Diversions and Groundwater Uses	X	X	X
17	9.6 Public Education and Outreach	Public Communication	X	X	X
18		Information and Data Sharing	X	X	X
19		Fostering Relationships	X	X	X
20		Compiling Efforts	X	X	X
21		Educational Workshops	X	X	X
22	9.7 Domestic Well Mitigation Program	Development and implementation of a domestic well mitigation program to assist domestic water users if their wells go dry due to declining groundwater levels	X	X	X

[1] C = Completed

Table 9-3 Required Elements for Projects and Management Actions

Project	Brief description	Circumstances under which the project will be implemented	Public notification process	Permitting and regulatory process	Benefits	Schedule	Estimated cost
9.1 Basin Recharge Projects	Agricultural Managed Aquifer Recharge is the practice of using excess surface water (when available) and applying it to agricultural fields to intentionally recharge groundwater aquifers	AgMAR will be performed during winter months during high surface flows. The nature, frequency and timing of these flows will be evaluated through a Water Availability Analysis (WAA). A partial WAA analyzing data from 2000 through 2019 suggests that water would be available for diversion about 3 out of every 10 years. In addition, locations in the BVGB must be found that are suitable for AgMAR.	Notification of available water and success of this projects will be communicated at public GSA meetings. Agreements will be made between the GSAs and interested landowners.	Following completion of the WAA, an AgMAR permit for temporary surface-water diversions can be solicited from the State Water Board. Currently this permitting process can take 6-18+ months and cause significant economic burden to the applicant. An organized application for Basin-wide winter diversions by the GSAs could lessen some of the regulatory burden since they qualify for a streamlined process but a waiver of fees for extremely disadvantaged communities working to improve groundwater recharge may also be needed.	Based on the current WAA and the AgMAR research completed in the Basin, using 500 to 1,000 acres for AgMAR could yield approximately 2,600 AFY in wet years, or about 800 AFY on average. Using irrigation canals, drainage canals, and recharge basins could provide additional capacity for diversion and recharge, yielding a similar volume to AgMAR. In total, basin recharge projects could be expected to yield over 1,500 AFY.	The WAA is partially completed, and the remainder of the work will be funded through the DWR's SGMA Implementation Grant. Based on the current state of the WAA, and current understanding of the permitting process potential sites for winter recharge, AgMAR could start being used at productive scale by winter of Water Year 2025 if all processes go smoothly.	The GSAs estimated a cost of $250,000 for completion of the WAA, acquisition of a temporary permit for AgMAR, conducting recharge, and documenting the process.
9.2 Research and Data Development	Stream gages are scientific instruments used to collect streamflow and water quality data to decrease scientific uncertainty in order to inform water management decisions. Agri-Climate/CIMIS stations are helpful in monitoring for climatic factors such as temperature, humidity, wind speed, etc., and overall help refine estimates of ET in the Basin. Refining the water budget for the Basin will improve the accuracy with which management decisions are made because many of the assumptions used to generate the water budget stem from data gaps that need to be addressed, or other efforts to collect and analyze data submitted through other regulatory programs.	Research and data development will be implemented on a continuous basis, with specific approaches being adapted to the current needs and data gaps that will best facilitate adaptive management.	All research and data development progress will be shared at public GSA meetings. Data collected from gaging stations will be publicly available.	We will continue to work with DWR to ensure compliance with any relevant laws and to obtain any necessary permits related to stream gage installation and maintenance, as well as for other projects that fall under adaptive management strategies and the water budget.	Addressing data gaps would reduce the uncertainty of assumptions to govern groundwater management decisions. As more data becomes available, more accurate estimates of evapotranspiration and other water budget components will improve the understanding of the Basin.	Two stream gages and a CIMIS station have been installed to date. They will be monitored throughout GSP implementation. Adaptive management strategies are anticipated to be employed throughout the GSP development and implementation phases. Refining the water budget is a priority for the GSAs and will be completed for the five-year GSP update to inform future adaptive management.	Funding is available for the development of new gaging stations. Maintenance costs may vary, but one estimate projects the annual maintenance cost for a single gage to be around $15,000. Funding for projects related to adaptive management and refining the water budget will be acquired as necessary and will include some of the funding provided by the DWR for the five-year GSP update through the SGMA Implementation Grant. Presently, there is funding to maintain or install flow meters on private wells. More funding is likely available for similar projects, such as refining mapping and land-use designations within the Basin.

Project	Brief description	Circumstances under which the project will be implemented	Public notification process	Permitting and regulatory process	Benefits	Schedule	Estimated cost
9.3 Increased Surface-water Storage Capacity	Surface-water storage can reduce reliance on groundwater by offering an alternative water source. Currently, reservoirs like Roberts, Iverson, Silva, and BLM help manage potential overdraft. As streams and watercourses shrink during dry months, existing diversions may fall short. Expanding reservoir capacity and building new ones (like the Allen Camp Project) would store additional water from snowmelt and storms, ensuring reliable surface-water supplies.	Projects intended to increase surface-water storage will be implemented when it is economically advisable to do so and when they may help mitigate Basin overdraft.	Pursuant to environmental review, these projects will have opportunities for public comment and project documents will be made publicly available whenever appropriate. Both National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) compliance mandate opportunities for public comment.	Permitting for surface-water storage projects will be subject to NEPA and CEQA depending on whether the project sites are located on federal or state land respectively.	Increasing the capacity to store surface water by capturing runoff could reduce reliance on groundwater during summer months. Further, increasing surface-water storage would improve water security during dry years. Based on the current WAA, raising the Roberts Reservoir would allow for additional storage of up to 7,600 AF, or about 2,300 AFY.	The timeframe for largescale infrastructure projects would likely be upwards of 8 years, as the regulatory and environmental review processes generally require extensive coordination between agencies and stakeholders for planning and compliance. Feasibility studies can be initiated within the next two to three years to determine existing reservoirs that may be best suited for augmentation. The results of these feasibility studies will determine next steps.	Large infrastructure projects can be quite expensive. $1 in May 1981 had the same buying power as $2.97 in April 2021. A ballpark estimate of the capital costs for the Allen Camp Project in its entirety would amount to approximately $344,041,830, with the dam and reservoir component amounting to an additional $174,487,500. These figures assume funding may be available from the federal government in the form of loans under the Small Reclamation Projects Act of 1956. The cost associated with expanding existing reservoirs depends on the method employed. Sediment removal typically costs between "$8,000 and $32,000 per acre foot," (Lund 2014) and would be done infrequently. Increasing dam height typically costs between "1,700 to $2,700 per acre foot" (Lund 2014).
9.4 Improved Hydrologic Function and Upland Recharge	Upland forest recharge enhancement occurs in conjunction with vegetation management and forest fuels reduction by increasing snow-water content and reducing dense forest canopy and associated evapotranspiration.	Upland forest recharge will be enhanced by implementation of forest health and fuels reduction projects within the Big Valley watershed. Such projects are ongoing and in varying stages of planning and implantation. Support from GSAs and local, state, and federal partners will increase implementation rate and scope. Water availability and recharge enhancement will be realized along with fire/fuels and wildlife habitat benefits.	On federally managed lands, public notification of projects will be conducted under NEPA by the Modoc National Forest or Applegate BLM. State funded projects will follow CEQA public notification process. Opportunities on private land be communicated by GSAs, Pit Resource Conservation District, and other state and local entities.	Projects permitting will vary by land ownership. On federal lands: NEPA and applicable federal land policies. On private lands: state forestry rules are applicable and programs such as CAL FIRE's Forest Health Program will help clarify and streamline permitting processes.	Snow-water content has been shown to increase by 33% to 44% from a dense conifer canopy to an open area. Surface runoff has also been shown to respond to treatments. Recharge figures are difficult to quantify, but even a modest increase in recharge over 10% of the potential upland recharge area could result several thousand AF of water.	The initial upland forest recharge project "Wagontire Project" is scheduled for implementation in 2022 and is expected completion in a 2- to 4-year window.	Project costs vary by site, but an estimated average is from $500 to $650 per acre.
9.5 Water Conservation Projects	Water conservation and water use efficiency projects would primarily be adopted by growers and homeowners on their private property. Infrastructure improvements, while requiring capital outlay, are not subject to permitting or public environmental review.	Project implementation will be voluntary with cost-share incentives. Projects will be implemented on a site-by-site basis and designed for overall production and economic efficiency, along with water use savings.	Notification of opportunity to participate will be through local agricultural organizations, extension outreach meetings, and by sponsoring agencies. Broad public notification of individual projects is not required.	Projects in this category such as upgrading irrigation infrastructure, irrigation management techniques, home landscaping, etc. are generally not subject to permitting requirements.	Some practices have been shown to result in efficiency increases in the range of 10% at the field scale. Basin-wide efficiency increases of 5 to 10 percent would result in water savings of up to 2,000 AFY.	Irrigation infrastructure and water-use efficiency incentives are ongoing. UC Cooperative Extension provides extension education on irrigation management and scheduling to promote water use efficiency.	Costs vary widely. New irrigation infrastructure on a field scale can exceed $100,000. Soil moisture meters for irrigation scheduling can be in the $100s to $1,000s of dollars per farm. Landscaping and homeowner water efficiency projects in the $100s to $1,000s per home. However, public outreach and education for water conservation activities is a lower-cost action that can have immediate impact.
9.6 Education and Outreach	Education and outreach efforts can drive beneficial changes in patterns of use and protect water resources. Existing efforts employed by the GSAs include outreach about funding opportunities that support water conservation methods or to address SMCs, coordinating information sharing efforts, and facilitating informational meetings with stakeholder groups. Additionally, the GSAs may support local entities in applying for funding to address SMCs.	As an essential part of sustainability, outreach and education will be conducted throughout the development of the GSP, with many opportunities for public engagement, including the maintenance of a GSA website.	Public information is available through the SGMA sections of Modoc and Lassen Counties' websites. Informational brochures will be distributed to interested parties to make information about the GSP more accessible.	Public engagement is important to the regulatory process of SGMA and other acts that the GSP may be subject to. However, education and outreach are an incredibly important part of meeting the sustainability goals of this GSP, especially as it relates to equity and inclusion.	Public involvement in the GSP development is crucial in attaining sustainability. Research (OECD 2015) has shown that here are many social, economic, and environmental benefits to education and outreach efforts in water management. These benefits can vary widely, but generally include increased levels of social cohesion, equity and conflict avoidance, improved water	Ongoing efforts to engage the public in outreach and education programs related to groundwater management are essential as part of the Groundwater Sustainability Plan. The anticipated timeline for outreach and education efforts is indefinite, but it is especially important throughout the planning and implementation process of the GSP.	Costs may vary depending on program type.

					use efficiency, and improved water quality.		
9.7 Domestic Well Mitigation Program	The Domestic Well Mitigation Program (Program) would allow domestic well owners to receive support if their well goes dry due to chronic lowering of groundwater. Domestic well owners would qualify if their well were unable to pump groundwater due to declining groundwater levels and are permitted with the County.	The project and its policies will be developed and implemented following GSP development and will include input from the GSAs, BVAC, and the public. The program will provide many benefits for domestic wells in the Basin and therefore the GSAs are committed to the success of the program. However, funding is currently not available for implementation and funding sources will have to be explored. Further, the program will only apply to legally established domestic well owners.	Following development of the program, information on the well mitigation program will be made available to the public through the SGMA sections of Modoc and Lassen Counties' websites.	It is unclear if this project would fall under CEQA and this will be explored during the implementation phase. Permitting requirements for this program would foreseeably take place during implementation of mitigation measures, such as well installation or expanding of water systems through the County and/or State.	The Program will help mitigate impacts due to lowering groundwater levels and provide assistance to domestic well owners to secure access to drinking water.	The schedule for this Program will include development of the policies and procedures (1-2 years), securing of funding (1-2 years), public outreach and identification of at-risk domestic wells (2-3 years), development of criteria for qualifying wells (1 year), and development of voluntary registration program for well mitigation assistance (1 year). Because some of these tasks can be completed concurrently, development of the Program will take an estimated 2 to 10 years.	Costs will vary depending on number of wells going dry and amount of assistance from the GSAs. Additionally, the costs are difficult to quantify due to limited well data in the Basin. If a new well is required under the Program and the cost for a new well is approximately $50,000, then the cost of the program could be upwards of $750,000 if the minimum threshold is reached across the Basin, 15 wells go dry, and the program deems it necessary to drill new wells.

9.1 Basin Recharge Projects

Enhancing recharge to get more of the available water into the aquifer is one of the key means to attaining sustainability. Priority is given to the immediate Big Valley watershed, but additional recharge projects will be considered for surrounding upland and upstream areas of the Pit River watershed. A more detailed watershed map is provided in Chapter 3 – Plan Area. To implement off-season diversion and recharge, the GSAs will require either a temporary or standard water right diversion permit from the State Water Board. Temporary permits require a less rigorous process to determine water availability than a standard permit and can be valid for 180 days or 5 years. Both permit types require a water availability analysis (WAA) to demonstrate water availability in the context of hydrologic conditions and existing water rights; however, the WAA for a standard permit is much more rigorous than a temporary permit, and the time and resources required to develop a WAA for a standard permit would not be practical at this time given the preliminary state of recharge projects. Furthermore, the State has implemented policies to streamline the process to procure a temporary water rights permit, including direct technical assistance from the DWR.[66]

A WAA for the Big Valley watershed was initiated in 2022 to help facilitate a pilot project to support the development of AgMAR in the BVGB (see 9.1.1 below). This process included the following steps to quantify the water availability in the watershed:

1. Close coordination with the State Water Board, the DWR, the California Department of Fish and Wildlife, and other relevant agencies throughout the process to ensure a correct approach to developing the WAA and supporting a temporary water rights permit application
2. Collection and evaluation of data including streamflow, water rights, reservoir conditions (i.e., Shasta Lake), and Delta conditions
3. Analysis of the data collected in Step 2 to determine the historical water available for diversion in the BVGB, pursuant to the State Water Board's guidance and policies regarding thresholds for water availability
4. Documentation of the WAA
5. Evaluation of the applicability of obtaining a temporary water rights transfer as an alternative to obtaining a temporary water rights permit

Steps 1 through 4 were completed by January 2023. This scope of work was developed pursuant to the State Water Board's recommendation that the GSAs pursue a temporary permit in lieu of a standard permit due to the additional time and expense required to obtain a standard permit. The documentation of the WAA is attached as Appendix 12. The water available for potential diversion was determined by applying the DWR's "90/20 Method"[67] to historical streamflow data at two USGS gages along the Pit River upstream of the BVGB. The availability of water was further screened based on senior water rights holders, including the availability at Shasta Lake and the Delta. Based on an analysis of historical data from Water Year 2000 through 2019, water was available for diversion in 6 of the 20 years. In these

[66] California's Water Supply Strategy Aug 2022
[67] Water Availability Analysis for Streamlined Recharge Permitting (ca.gov)

six years, the divertible volumes ranged from 1,600 to 33,600 AFY at diversion rates of 1 to over 1,000 cubic feet per second (cfs). The median volume of available surface water for diversion in years when it was available is 5,200 AFY.

The DWR's climate change factors indicate that future precipitation and streamflow will be greater in the future and more heavily concentrated in the winter months. This suggests that, on average, more water will be available for diversion in the future compared to historical conditions. Since the availability of water for recharge is limited by senior water rights and permitting limitations (e.g., the 90/20 method), recharging excess water would not reduce water availability in other parts of the BVGB.

The WAA is expected to be completed in 2024. Once the WAA is finished and a project is identified, such as the AgMAR project mentioned below, one of the GSAs can apply for a temporary diversion permit from the State Water Board. If an application were to be submitted by June or July, a temporary permit could be issued prior to the upcoming winter diversion season.[68] Therefore, the GSAs intend to conduct a pilot project as early as the beginning of Water Year 2025. The GSAs have allocated about $250,000 of funding via the SGM Implementation Grant towards completing the WAA and obtaining a temporary permit for a groundwater recharge project, likely involving AgMAR (9.1.1). Feasibility of using existing drainage canals or recharge basins will be explored further prior to the five-year GSP update.

9.1.1 Agriculture Managed Aquifer Recharge

One approach to Basin recharge currently being considered is AgMAR, which is the intentional recharge of groundwater aquifers by spreading water over agricultural fields at times when excess surface water is available (Kocis & Dahlke, 2017, Dahlke et al. 2018). With significant surface-water irrigation and diversions already present in Big Valley, AgMAR is a viable option in the Basin. Much of the current research on AgMAR has been completed on relatively well-drained soils that are not present in Big Valley. Research on Big Valley soils with slow to very-slow infiltration rates appears to be initially promising. While recharge of groundwater may be slower in the Basin, it could still be a feasible means for deep water recharge and filling the shallow aquifer and root zone. AgMAR can be utilized for both, increasing recharge and decreasing water application of groundwater during the growing season due to a saturated soil profile. A conservative estimate suggests that 25,000 acres in Big Valley of agricultural and native vegetation lands are accessible to surface water and available for AgMAR. Priority will be given to low infiltration over very-low infiltration soils for recharge and areas addressing more critical groundwater levels.

Among the perennial crops, alfalfa is considered a promising candidate for AgMAR for several reasons, and significant initial research has been completed throughout California on its feasibility (Dahlke et al. 2018). Eighty to eighty-five percent of the alfalfa in California is irrigated by flood irrigation, which in turn could allow for areas where surface water can be utilized for groundwater recharge (Dahlke et al. 2018). Alfalfa is widely grown in Big Valley and flood irrigation is common. Alfalfa is a nitrogen-fixing

[68] The DWR and the State Water Board have indicated that the process for the GSAs' to obtain a temporary permit should be relatively straightforward given the progress of the WAA and the statewide emphasis on facilitating recharge of excess flows.

plant that seldom receives nitrogen fertilizer, which reduces the risk of leaching excess nitrate to groundwater, one of the main concerns of AgMAR (Putnam and Lin, 2016; Walley et al., 1996). Dahlke et. al. (2018) found that winter recharge had no discernible effect on alfalfa yield (first and second cutting) and led to increased crop water availability in the deep soil profile, offsetting potential irrigation deficits during the growing season.

Research currently being completed in Big Valley on the feasibility of AgMAR on perennial grass pasture and hay fields looks promising. Although soils in Big Valley have lower infiltration rates, winter recharge rates of 0.2 - 0.5 AF per acre per irrigation between March and April have shown no damage to crops. Soil infiltration rates show 2 to 3.5 inches of infiltration over a 24-hour period to be feasible. Irrigating every 7 to 10 days for six irrigations in the winter/spring would benefit 1 to 2 AF of water per acre into groundwater storage. This is the first AgMAR research completed on grass, which is a dominant perennial crop in Big Valley. Given that some forms of applied nitrogen, particularly nitrate, have a propensity for leaching, which has presented a challenge in other parts of the state, there has been some concern over nitrogen application and AgMAR. This can easily be addressed with BMPs of applying nitrogen outside of the winter recharge window. This work could also be easily applied to AgMAR feasibility on adjacent rangeland, conservation reserve program (CRP), or NRCS WRP land.

The expected benefit of AgMAR depends on the availability of suitable land and surface water for diversion and recharge. Based on the WAA discussed above, the availability of surface water appears to be the controlling factor. The annual recharge benefit is estimated with the following assumptions:

- Excess surface water is available for diversion in 3 out of 10 years at a median volume of 5,200 AFY and a median availability of 10 days, based on the WAA results shown in Appendix 12.
- If capacity exists to divert half of the available surface water, the recharge benefit in years when water is available would be about 2,600 AFY. This would require 500 to 1,000 acres of suitable land based on the infiltration rates discussed above and assuming that water will infiltrate for 15 days out of the year (50 percent longer than the days of assumed diversion).
- Therefore, the average annual recharge benefit would be about 800 AFY (5,200 AFY * 30 percent water availability * 50 percent diversion capacity).

An estimated 500 to 1,000 acres will be required to facilitate AgMAR. There are over 25,000 acres in Big Valley of agricultural and native vegetation lands that are accessible to surface water and available for AgMAR. Land acquisition will be conducted with the following process:

1. **Conduct initial screening.** The GSAs will use various datasets to identify a preliminary list of potential suitable sites in the BVGB. These datasets include land use data, soil data, the DWR’s Airborne Electromagnetic (AEM) Survey data, surface water diversion locations, and property rights data.
2. **Determine feasibility by discussing with landowners.** The GSAs will engage with the property owners of the areas identified in Step 1 to determine the feasibility of partnering with multiple landowners to conduct pilot tests to further assess the feasibility of the property for AgMAR.

Determine potential costs of infrastructure, labor, and power needed to facilitate recharge, and determine feasibility.

3. **Evaluate recharge potential of feasible sites.** Using pilot tests like those used in the AgMAR research described above, evaluate the recharge potential of each site, identifying the most favorable sites.
4. **Negotiate long-term recharge agreements with landowners.** Considering the potential recharge activities and costs of recharge, the GSAs will develop agreements with landowners to conduct regular recharge activities during wet years.

After agreements with landowners are reached, the GSAs will procure water rights permits to facilitate the recharge. The GSAs will then conduct, measure, and improve recharge operations over time to optimize the use of agricultural lands for recharge.

9.1.2 Drainage or Basin Recharge

Using the same principles as used in AgMAR, excess surface water can be diverted into irrigation drainages or canals and recharge basins to percolate into the groundwater table and replenish upper levels of the aquifer. This water is then available to be extracted later for beneficial use. The volume of water recharged is limited by the availability and access to surface water, infiltration rates of the soils, losses to evaporation, and available infrastructure.

The total number of feet or miles of irrigation canals or ditches needs to be determined, along with the availability of current water storage basins (reservoirs) for recharge. Additional basins may need to be created for the sole purpose of groundwater recharge. Producers wanting to participate in this program would notify the GSA and report diverted water for the purpose of drainage or Basin recharge. The development of a water availability study and permitting as described above and in **Table 9-3** also applies to this project. Unlined drainages, canals, and basins could recharge up to 90 percent of diverted surface water to the aquifer. Based on the WAA results and assumptions used for the availability of water for recharge described in Section 9.1.1, recharge from additional drainage or recharge basins could yield an additional 700 AFY of recharge (5,200 AFY * 30 percent water availability * 50 percent diversion capacity * 90 percent of diverted surface water recharging the aquifer).

9.1.3 Aquifer Storage and Recovery and Injection Wells

Aquifer storage and recovery (ASR) is the use of a new or existing well to inject and store water underground during wet periods and then extract by the same or other nearby wells to meet demand during dry periods. Increased aquifer storage provides some of the same benefits as new surface storage but can be phased in over time and can be less expensive. From an operations perspective, increased aquifer storage is a practical option since it involves the use of new or existing groundwater wells retrofitted for injection. ASR projects require a permit from the RWQCB, and the permitting method is usually the Statewide ASR General Order (General Order)[69] adopted by the State Water Board in 2012.

[69] https://www.waterboards.ca.gov/water_issues/programs/asr/

The General Order requires that the water being injected into aquifer storage meet drinking water standards, so in the case of Big Valley, this will require filtration and chlorination of surface water prior to injection into aquifer storage.

Because pre-treatment of the water source for injection and operation and maintenance of ASR wells is relatively expensive, ASR is typically used when surface spreading *via* basins or flooded fields is not feasible. ASR may be favored in areas of the Basin constrained by land area limitations, unfavorable surface soils, or shallow confining layers at or near the ground surface preventing deep percolation of applied water.

In Big Valley, the most likely scenarios in which ASR would be implemented are when under the following conditions:

- Flood MAR projects are not able to stabilize groundwater levels in some locations due to the presence of impermeable soils at or near the surface, or
- As mitigation to reverse declining groundwater levels near public or domestic supply wells.

ASR would be implemented in phases if the conditions above warrant it. ASR would only be feasible with outside funding assistance through either state or federal grant programs to both cover the capital expenses and assist with the monitoring required for compliance with the ASR General Order. Under these conditions, ASR will be developed in phases as summarized below:

- Phase 1 – Assessment of wells and hydrogeology culminating in a technical report to accompany a notice of intent to inject provided to the RWQCB. This phase will identify locations and monitoring during ASR pilot testing.
- Phase 2 – ASR pilot testing following receipt of a Notice of Applicability from the RWQCB. Pilot testing may include a single well test or may involve multiple wells throughout the Basin based on the finding and recommendations in the technical report developed in Phase 1.
- Phase 3 – Implementation including retrofit of existing wells, construction of new wells, and operation of these facilities to stabilize or increase aquifer storage.

More information about ASR is available from the U.S. Environmental Protection Agency.[70]

9.2 Research and Data Development

Data gaps are mentioned and detailed throughout the GSP chapters. Continuing to fill these gaps, participate in research, and collect data to support the GSP is necessary to support sustainability using the best science available.

[70] https://www.epa.gov/uic/aquifer-recharge-and-aquifer-storage-and-recovery

9.2.1 Additional Stream Gages and Flow Measurement

Several seasonal streams contribute inflow to the Big Valley Basin (**Figure 9-2**). Many of these streams had historical stream gages or have current gages monitored by the USGS and DWR. The Pit River, which is a major inflow river and significant contributor of surface-water irrigation and recharge in Big Valley, has a gage 13 miles from where the Pit River enters Big Valley at the Canby bridge. There are many springs and small tributaries that flow into the Pit River after the Canby bridge, as well as irrigated-lands water use between Canby and the Big Valley Basin. Modoc County has been working to install an additional stream gage where the Pit River enters the Basin to fill this data gap and provide more current stream flow information for GSP development and water management. There is also funding for additional stream gages if locations of need can be determined. The current stream gages are in **Figure 9-2**. Two stream gages were recently added to the system, one on the Pit River near the Basin mouth[71] and a second at Robert's Reservoir[72].

9.2.2 Refined Water Budget and Domestic and Adin Community Supply Assessment

Many assumptions were taken to create the Big Valley water budget in Chapter 6 – Water Budget. Some of these assumptions stem from data gaps that need to be addressed, and other areas are opportunities to collect and analyze data that is being submitted through other regulatory programs. This section describes a combination of projects that will help improve the accuracy of the water budget and, in turn, better inform groundwater management in Big Valley.

1. **ET measurement and installation of a CIMIS station.** To improve the understanding of ET across Big Valley, the GSAs worked with the DWR to install a CIMIS station in 2023 in Nubieber. CIMIS stations have more sensors than typical weather stations, including solar radiation, soil temperature, air temperature, wind speed and direction, relative humidity, soil moisture, and rain gauging. These measurements can determine accurate ET, which is very helpful in creating a more refined water budget for the Basin and help maintain sustainable groundwater conditions. ET is used as a metric for applied water, especially when meters on actual applied water are not available. These stations can also help farmers in determining irrigation needs and promote water conversation, particularly early in the growing season.
2. **Applied water estimates.** With an accurate estimate of ET, the next assumption is the relationship between ET and applied water in Big Valley. Since most crops grown in Big Valley are hay crops, irrigation must be stopped when cutting, drying, and baling even though ET continues. Pinpointing the relationship between ET and applied water could greatly refine the water budget and amount of irrigation water that is being applied.
3. **Land use mapping.** An effort to refine mapping and land-use designations would further increase the accuracy of estimates related to water use within Big Valley. The water budget's assumptions are primarily derived from historical sources, many of which may need to be updated or expanded upon to reflect current conditions. The GSAs worked with Land IQ

[71] Additional information available in the DWR's California Data Exchange Center website.
[72] Additional information available in the DWR's California Data Exchange Center website.

beginning in 2020 to update the land use classifications and determine irrigation water sources across the Basin. This information was not completed in time to be included in this GSP and will be used for the five-year update. The GSAs intend to continue working to further improve land use and source water mapping.

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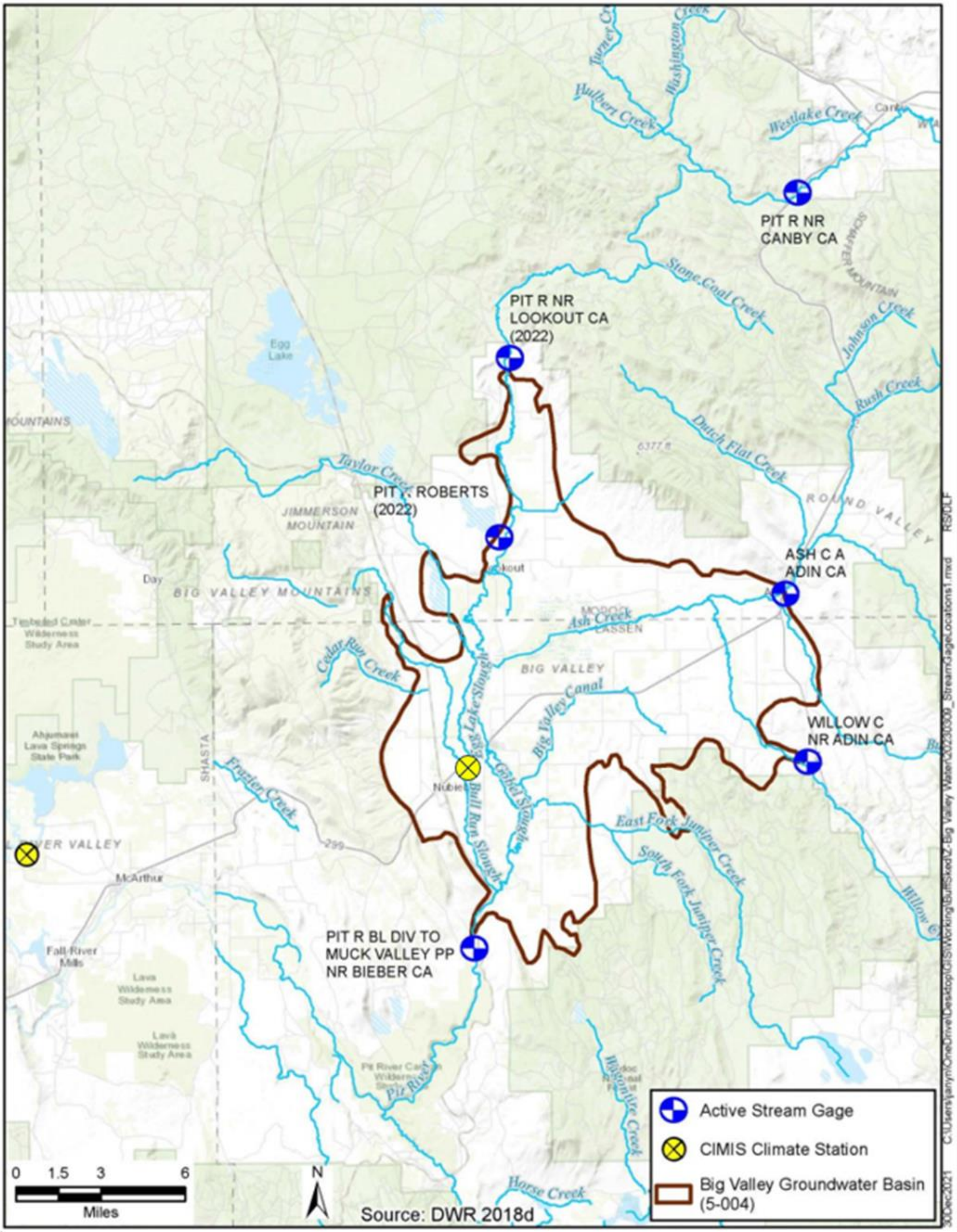


3242 **Figure 9-2 Current Stream Gages and CIMIS Stations**

4. **Determining sources of irrigation water.** There is considerable uncertainty in the proportions of groundwater and surface water that are used for irrigating cropland across the BVGB, which is a key data gap in constraining the water budget. To better understand the uses of surface water and groundwater across the BVGB, the GSAs plan to collect surface water diversion data from the State Water Board's water rights reporting database, survey landowners as feasible near waterways, and continue work to better understand land use classifications to refine these estimates and update the water budget.

5. **Voluntary well metering.** A voluntary well monitoring program has been available in Big Valley for upwards of two decades through the Lassen-Modoc Flood Control and Water Conservation District.[73] Through this program, meters are available for agricultural and domestic water users. Reinvigorating this program by identifying meters that need to be replaced, conducting outreach to add new wells to the program, and organizing the historical data to fill data gaps would both provide critical data to refine the water budget and create the framework for the development of a basin wide well registry program. Although de minimis extractors (i.e. those that extract 10 AF per year or less for domestic use) have a minimal impact on the water budget and are not regulated under SGMA or by the Big Valley GSAs, management actions should reflect their intrinsic connection from both water quality and water availability perspectives. Water level and water quality data collected from this program and from the strictly-monitoring wells located throughout the basin can be used to assess domestic well supply and to pinpoint areas of concern, such as shallow and non-operational wells. Additionally, this registry could be used to assess both the need and feasibility of drilling a community supply well for the town of Adin. Funding from DWR in a grant to Modoc County is currently available to provide flow meters to voluntary applicants.

6. **Monitoring wells and surface water quality gages.** It would also be beneficial to identify additional monitoring wells to provide unobstructed measurements year-round. Several such wells have been installed at five sites within the Basin and generate continuous water level and water quality data across 15-minute intervals. Surface-water quality data is also periodically collected from points in Adin, Bieber, and Lookout within the Basin when funding allows. Expanding on this existing program would further refine the water budget and improve the capacity of the GSAs to make management decisions to the benefit of all users.

   Additionally, funding is available to install satellite transducers in key areas throughout the Basin, which would allow for real-time monitoring of domestic well levels. Coupled with an increased effort to both verify well numbers and update lists to reflect active *versus* inactive wells, these real-time monitoring locations will provide more accurate estimates of domestic groundwater demand and supply within the Basin. Thus, these combined actions will further inform water management strategies to ensure that domestic users' groundwater needs are represented equitably in the water budget.

7. **Subsurface flow.** The current water budget tool assumes that there is no subsurface inflow or outflow in the BVGB. However, as noted in Chapter 4 – Hydrogeologic Conceptual Model, there is evidence of upland recharge that feeds subsurface inflow. In addition, a 2022 study completed

[73] Lassen-Modoc County Flood Control and Water Conservation District

as part of GSP implementation has helped to refine the hydrogeologic understanding of the connection of surrounding areas to the Basin (Appendix 13). Building on this understanding to develop a program to estimate subsurface inflow and outflow in the BVGB will assist refining the water budget and evaluating the impact of the PMAs listed under Section 9.4 – Improved Hydrologic Function and Upland Recharge.

Collectively, the continuation of applied research efforts will help to better quantify the impacts from those actions and thus help refine the water budget. Such research efforts, which will be discussed in depth in later sections of this chapter include: evaluating the effectiveness of off-season groundwater recharge in hay crop fields and pastures; the impacts of forest thinning projects such as fuels reductions and the removal of invasive junipers on water availability within the watershed; and the extent to which surface-water systems, including drainages, canals, and reservoirs contribute to recharge within the Basin. Additional research projects to support the water budget will be identified and undertaken as needed, contingent on funding.

9.2.3 Adaptive Management

There are many unknowns and data gaps with respect to groundwater resources in the Big Valley Basin. As a result, estimates and assumptions are currently used in the plan to determine several key variables. To address the lack of necessary information, a significant commitment to the continued monitoring of both ground and surface water is described in this plan. By further developing and enhancing monitoring networks in Big Valley, we can gather the data necessary to inform management and set criteria as more information becomes available.

Adaptive management is an approach to improve natural resource management which focuses on learning by doing. Learning occurs through monitoring, data development, outreach, and collaborative interpretation. Then, the adaptation of management criteria and tools is applied to existing practices as critical information becomes available. This approach is very applicable to the BVGB and will serve to maintain sustainability by providing current site-specific information to inform appropriate SMCs and thresholds as well as the ongoing assessment of projects and management actions in the Basin.

Although it is recognized and proven that the Big Valley Basin does not have the unsustainable conditions seen in other basins around the state, monitoring and filling data gaps from SMCs that were determined to not require thresholds helps us prepare for annual reports and five-year revisions and make management decisions. These SMCs without identified thresholds include interconnected surface water and groundwater, water quality, and subsidence. Additionally, monitoring could aid in the analysis of the relationship between groundwater levels and GDEs.

9.3 Increased Surface-water Storage Capacity

Increasing the capacity to store surface-water runoff during winter/spring high-flow periods could provide significant amounts of water for summer irrigation. An increase in surface water available for irrigation would lessen the reliance on groundwater and thus improve the Basin’s ability to remain sustainable.

9.3.1 Expanding Existing Reservoirs

Expansion of several existing reservoirs serving Big Valley Basin would increase the capacity of surface water for irrigation and recharge projects, as well as help balance the water budget. An increase in water storage would make the Basin more sustainable regarding climate variability and decreases in snowpack while also relieving pressure on groundwater for irrigation in Big Valley. One larger reservoir, Roberts Reservoir, is located northeast of Lookout and has a current capacity of 5,500 AF. Possible scenarios for raising this reservoir's dam are shown on **Figure 9-3**. For example, raising Roberts Reservoir 3 feet would increase capacity by 35 percent, resulting in a total additional 1,900 AF of storage.

Other reservoirs include Iverson, Silva, and BLM reservoirs. From an engineering perspective, the base of the Iverson reservoir is much wider than it needed to be at the time it was built. This suggests that the foundation would easily support construction to increase its height.

Expanding current reservoirs may possibly be the most time- and cost-effective alternative for expanding surface-water storage compared with building new reservoirs, for which navigating the environmental review process and other regulations can be difficult.

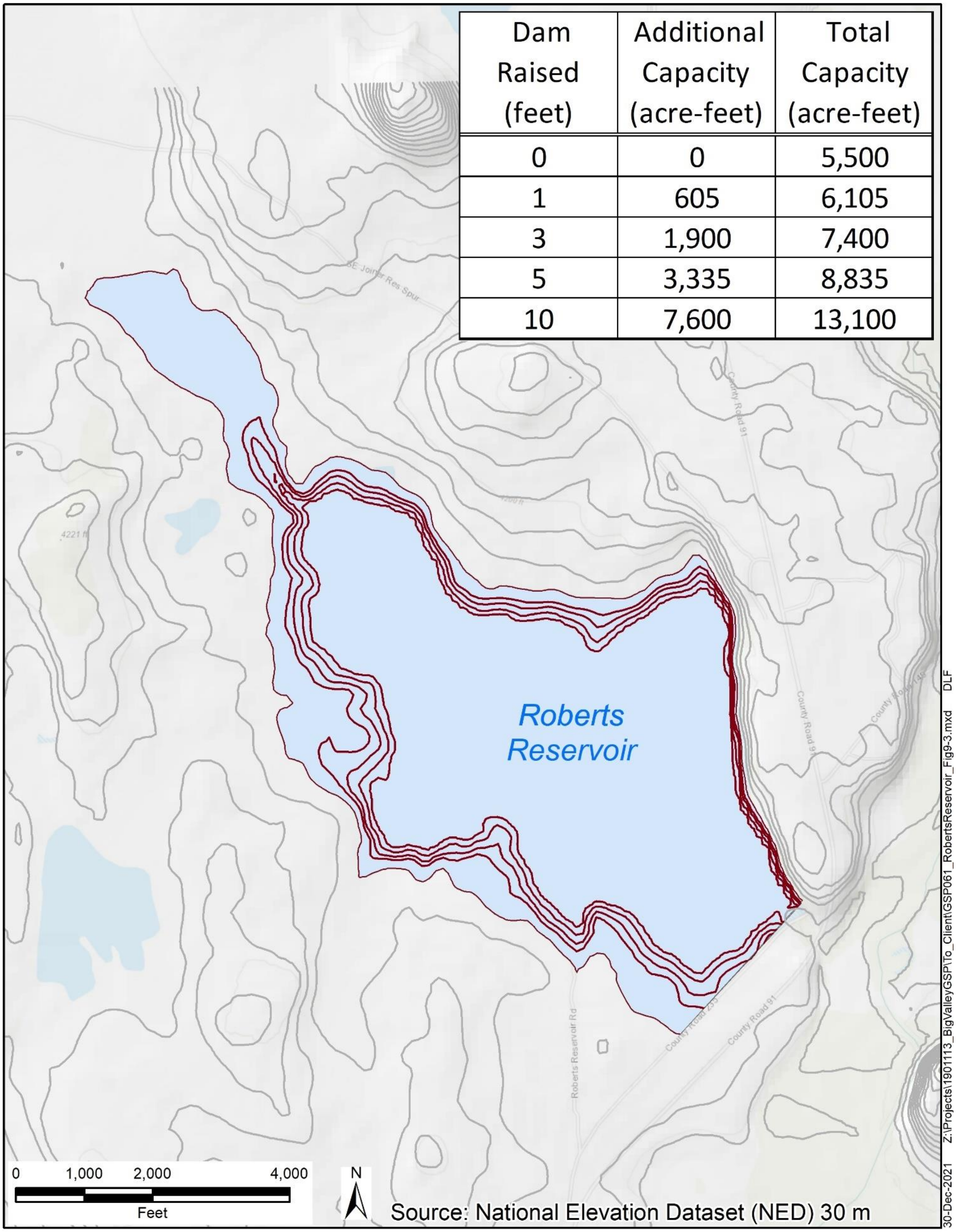
All reservoir expansion projects would undergo three phases:

- Phase 1: Feasibility study. The feasibility study would include:
    - A preliminary site assessment to evaluate the existing structure and assess risks
    - Hydraulic and hydrological studies to project future inflows and determine the impact of the expanded reservoir on downstream uses and users
    - A structural assessment to evaluate the reservoir's structural integrity and foundational stability
    - An environmental impact analysis to identify potential impacts ahead of any formal permitting, and determine mitigation measures for these impacts
    - A cost-benefit analysis to determine the extent to which the reservoir should be expanded based on technical feasibility, safety, and cost-effectiveness
    - Feasibility report documenting Phase 1 and including recommendations for the next steps for the reservoir expansion
- Phase 2: Engineering design and permitting. This phase would include:
    - Engineering design to develop a detailed design of the dam height increase, perform geotechnical investigations, and perform structural and hydraulic analyses
    - Permitting and regulatory compliance to augment or develop an Environmental Impact Report to comply with the California Environmental Quality Act, obtain or update water rights permits with the State Water Board, and any other regulatory compliance
- Phase 3: Construction and implementation.

Reservoir expansion is typically done through either sediment removal or by physically raising the height of the dam. Typically, expanding reservoirs through sediment removal is very costly, between

“8,000 and 32,000 dollars per acre foot” and would be done very infrequently (Lund 2014). Raising dam heights or building new reservoirs is also expensive; an acre foot of storage space generally costs between “1,700 and 2,700 dollars” (Lund 2014). Depending on funding, sediment removal may be investigated, and removed sediment could potentially be repurposed to reinforce existing infrastructure such as the levees that protect Bieber and Lookout from Pit River flood events.

Depending on funding availability, one or more feasibility studies could be initiated within the next two to three years. Assuming a typical timeline for each phase, it is reasonable to expect that one of the reservoirs could be expanded within the next 10 years. Based on the WAA results described in Section 9.1, excess water is available for diversion and storage about 3 out of every 10 years. The excess flows that would be captured by the expanded reservoirs would have to be excess flows due to water rights permitting requirements, and therefore it would not impact downstream needs or water rights. Based on the potential expansion of the Roberts Reservoir and the expected water availability, additional surface water storage could exceed 2,000 AFY (7,600 AF of storage * 30% water availability). This additional storage could be used to offset groundwater supplies in dry years, reducing the impact to the basin.



Dam Raised (feet)	Additional Capacity (acre-feet)	Total Capacity (acre-feet)
0	0	5,500
1	605	6,105
3	1,900	7,400
5	3,335	8,835
10	7,600	13,100

Figure 9-3 Roberts Reservoir Scenarios

9.3.2 Allen Camp Dam

The Allen Camp Dam and Reservoir (**Figure 9-4**) was authorized by the Department of the Interior (DOI) as part of the Allen Camp Unit of the Central Valley project in 1976 to regulate flows of the Pit River primarily for irrigation and fish and wildlife purposes, as well as flood control and recreation services. Despite strong local support for the project, the DOI's concluding report (DOI 1981) determined that the proposed project was economically advisable based on the existing criteria of the time. Now it may be appropriate to conduct a new investigation into the feasibility of this project to reflect the changes to water needs of the community, environment and state that have occurred over the last 40 years.

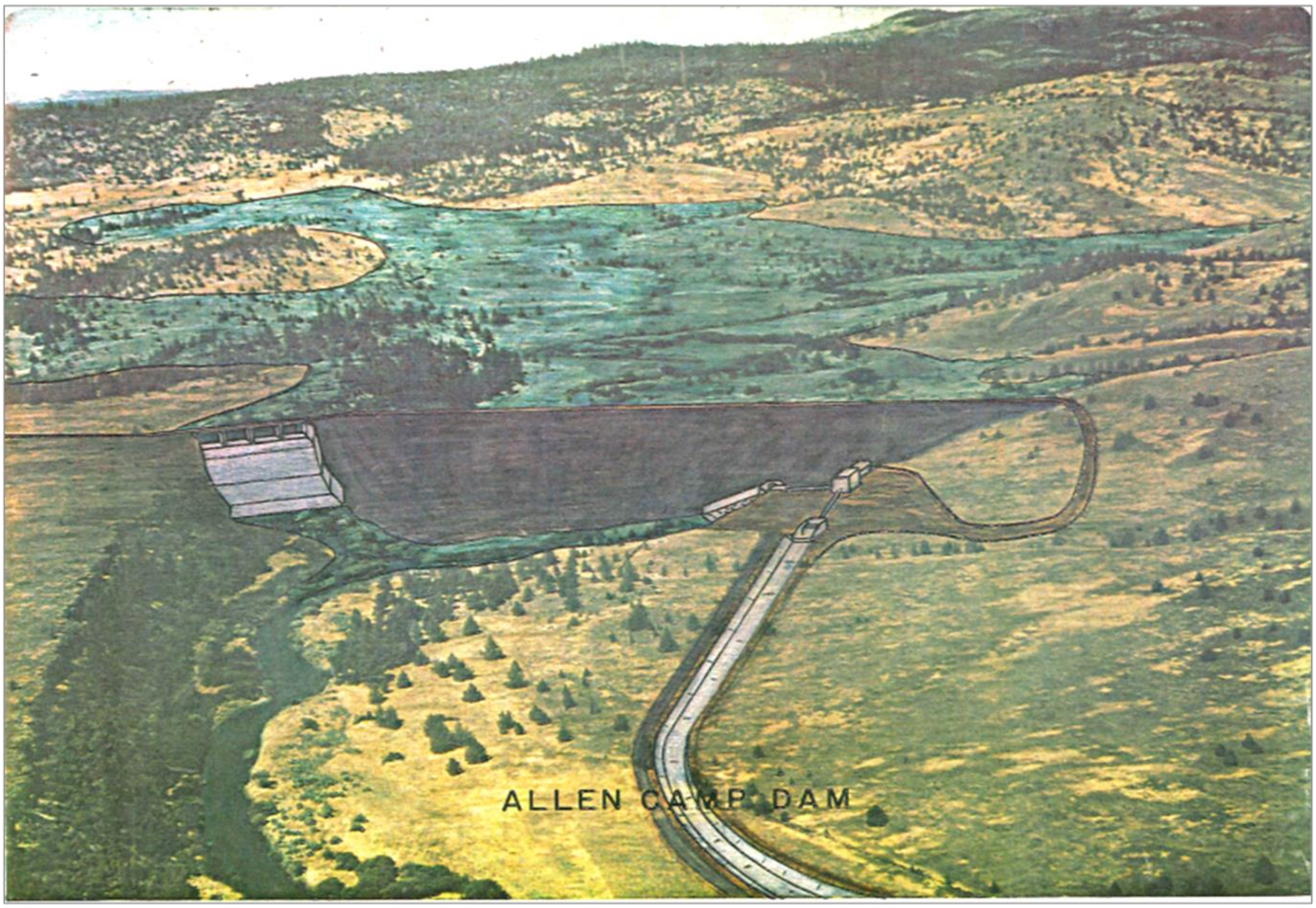


Figure 9-4 Allen Camp Dam Drawing

According to the original feasibility study (DOI 1981) the dam would be located around 11 miles north of the Modoc-Lassen County line, Allen Camp Reservoir would have a 90,000-AF storage capacity, a 18,000-AF surcharge, 2,350 acres of water surface area and a normal year yield of 22,400 AF. The dam would be constructed from earth and rock fill and would measure 103 feet from the streambed. The construction of the various proposed project components would require the acquisition of about 18,240 acres of private land through easements or through fee titles and the withdrawal of roughly 11,845 acres of public land. Most of the land acquired would be allocated for the dam and reservoir project features, a total of 18,015 acres. In the original document, another significant allocation, 11,562 acres, was for the proposed Big Valley National Wildlife Refuge. This addition was intended to offset habitat loss for species such as deer and migratory waterfowl. An updated feasibility study for this project should consider the expansion of the Ash Creek Wildlife Refuge since 1970 as an alternative for this proposed mitigation measure. The remaining land would be partitioned at 355 acres for the Hillside Canal, 148 acres for the lateral distribution system and 5 acres for the Nubieber protective dike.

In 1981, there were 62 ownerships slotted to receive deliveries from this project, accounting for a total 11,700 irrigable acres all of which would benefit from full or supplemental water deliveries. The report stated that the groundwater basin area of the project has a storage capacity of roughly 532,000 AF with a safe yield of 7,000 AFY, with 5,000 AF of that developed. These numbers may have changed over the 40 years that have elapsed since the report was published and should be reviewed under an updated feasibility study. An increasingly variable climate casts uncertainty over water availability, with drier years driving an increased reliance on groundwater supplies. Further, an updated feasibility study might consider how this project could mitigate some of the effects of climate variability and watershed conditions on the BVGB by providing a reliable source of surface water, thereby reducing dependence on groundwater.

9.4 Improved Hydrologic Function and Upland Recharge

9.4.1 Forest Health / Conifer and Juniper Thinning

The watershed surrounding the Big Valley Basin is comprised of approximately 800,000 acres of conifer forest and rangeland (**Figure 9-5**). Management policies, such as fire suppression, have resulted in tree densities that are currently much higher than at the beginning of the 20th century. This includes western juniper and other mixed conifers (Stephens et al. 2016) (Miller and Tausch 2001).

There are two main mechanisms by which dense junipers and other conifers impact water availability in forested watersheds. First is the interception of snow (primarily) and rain that gets caught in branches and needles and evaporates before ever reaching soil surface, and second is the high rate of transpiration due to dense layered canopy and vigorous network of roots (Ryel and Leffler 2011). An excellent summary paper by Smerdon et al. (2009) describes linkages between forest health and tree density and groundwater recharge in a variety of landscapes.

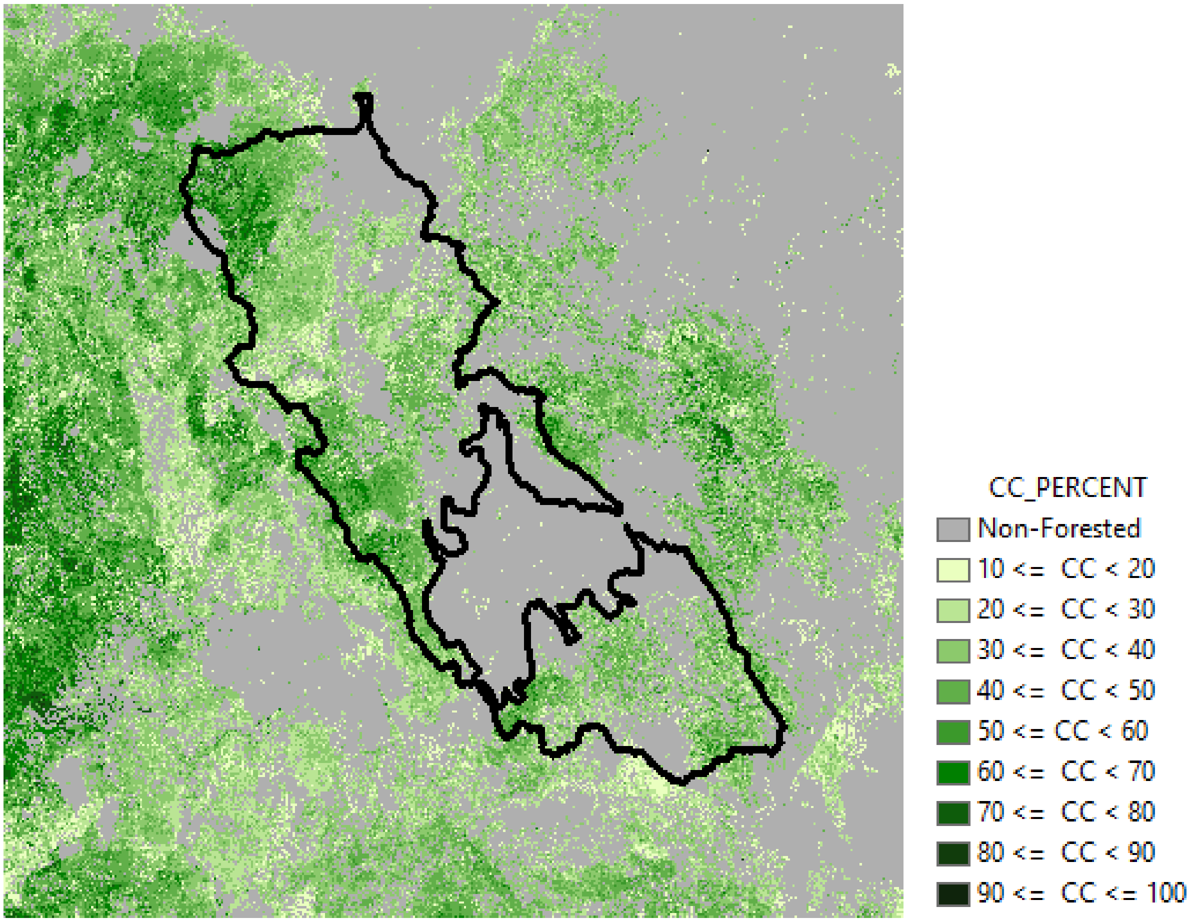


Figure 9-5 Canopy cover percentage of forested areas within the Big Valley watershed

Spring snow water content ranged from 33 to 44 percent higher in the aspen and an open meadow snowpack telemetry (SNOTEL[74]) site *versus* adjacent juniper and conifer forest, where interception of snowfall was much higher (LaMalfa and Ryel 2008). Averaged over the entire catchment, strategically placed fuel treatments in the wetter central Sierra Nevada (American River) creating a relatively light vegetation decrease (8%), resulted in a 12 percent runoff increase, averaged over wet and dry years. With forest treatments, wildfire reduced vegetation by 38 percent and increased runoff by 55 percent. Without treatments, wildfire reduced vegetation by 50 percent and increased runoff by 67 percent.

Forest fuel reduction in drier sites in the southern Sierra had less increase in runoff than wetter sites in the central Sierra Nevada Range. (Saska 2019).

A similar increase in water availability has been documented on juniper-invaded rangelands. During the period of maximum water uptake, mature trees used between 45 and 69 times more water than juniper saplings depending on precipitation and, consequently, soil water availability. In summary, 1) juniper water use varies greatly with precipitation, and 2) because of the large difference between mature and sapling trees, juniper control results in considerable water savings, even after a 14-year period of juniper

[74] SNOTEL is an automated system of snowpack and related climate sensors operated by the NRCS of the USDA in the Western U.S.

regrowth (Mata-Gonzales, et al. 2021). Paired watershed studies in Oregon have demonstrated increased deep soil moisture, increased spring flow, and increased surface-water runoff after juniper harvest compared to untreated areas. They have also documented a hydrologic connection between shallow groundwater on juniper sites and a nearby riparian valley (Ochoa et. al. 2016).

The opportunity to enhance upland watershed recharge is significant as projects are already in planning and implementation stages to reduce fire risk and improved wildlife habitat (Miller 2001), and programs such as CAL FIRE's Forest Health Program support project implementation funding. Forest health projects can be developed and meet multiple resource objectives including hydrologic values. Removal of conifers from meadow edges, drainages, and spring areas, as well as improving hydrologic function of road crossings, ditches, and stream channels (where feasible) will enhance hydrologic and recharge benefits of forest health projects. Given the vast land area surrounding Big Valley, treatment of even a fraction of the land area would result in a significant amount of recharge. This could help mitigate any deficit. Recently, controlled burns and fuels reductions have gained considerable traction as forest management tools and could be utilized for the purposes discussed. It should be noted that federal support is required for projects that take place on Forest Service and Bureau of Land Management lands, which much of the watershed surrounding Big Valley is comprised of. Most if not all forest health projects mentioned here exceed the capacity of the local community to fund and implement, and require support from state and federal agencies.

9.4.2 Stream Channel Enhancement and Meadow Restoration

Several meadow restoration techniques exist for the purpose of returning proper hydrologic function to montane and rangeland meadows. Two used in the Big Valley Basin and surrounding uplands include pond and plug and beaver dam analogs. Both techniques result in reconnection of a stream channel with a functioning floodplain and restoration of a degraded meadow's water table up to its historical level. Restoration of the meadow water table results in re-watering of meadow soils and vegetation, with significant effects throughout the restored floodplain for meadow hydrology, wildlife use, and forage. Restored floodplain connectivity spreads flood flows so that a meadow's natural ability to settle the coarse or fine sediment delivered from steeper stream reaches is restored and natural percolation can occur. When floodplain function is restored, a portion of winter and spring runoff is stored in meadow soils rather than racing down the pre-project gully during the runoff season. Data indicates that release of this stored runoff results in increased stream flow in late spring. (Hunt et. al. 2018)

In mountains of the western U.S., channel incision has drawn down the water table in many meadow floodplains. Increasing climate variability is resulting in earlier melt and reduced snowpack, and water resource managers are investing in meadow restoration which can increase springtime storage and summer flows. Between 2012 and 2015, during a record setting drought, a pond and plug restoration in Indian Valley in the Sierra Nevada Mountains was implemented and monitored. Despite sustained drought conditions after restoration, summer base-flow from the meadow increased 5 to 12 times. Before restoration, the total summer outflow from the meadow was five percent more than the total summer inflow. After restoration, total summer outflow from the meadow was between 35 and 95 percent more than total summer inflow. In the worst year of the drought (2015), when inflow to the meadow ceased for at least one month, summer base-flow was at least five times greater than before restoration. Groundwater levels also rose at four out of five sites near the stream channel. Filling the incised channel and reconnecting the meadow floodplain increased water availability and streamflow, despite unprecedented drought conditions. (Hunt et. al. 2018)

Other studies have also shown that these techniques may increase surface and subsurface storage and groundwater elevations that contribute to channel complexity and residence times. These factors could lead to stronger flow permanence in channels subject to seasonal drying. Increased availability of water and productivity of riparian vegetation can also support human uses in arid regions, such as irrigation and livestock production. (Pilliod et. al. 2018)

9.5 Water Conservation

9.5.1 Irrigation Efficiency

The fundamental objective of an irrigation system is to deliver an optimum amount of water for crop growth during spring, summer, and fall growing seasons while temperature and daylength are conducive to plant growth but natural precipitation is lacking. Irrigation water and water application costs comprise the single biggest operational cost associated with alfalfa or grass hay production in the intermountain area, accounting for approximately 30 percent of total operating costs (Wilson et al. 2020) (Orloff et al. 2016). Increasing the efficiency of crop water use is an economic, as well as a conservation-minded, goal. Farmers in the Big Valley area have been adopting water conservation measures as feasible opportunities arise and will continue to do so. Support for infrastructure, new technology, and education outreach will help attain this goal.

Flood, wheel-line, and center pivot irrigation systems are all used on Big Valley farms. The best irrigation system depends on water availability, crop, soil type, and infrastructure. Commonly, center-pivots are rated as the most efficient systems, but there are appropriate uses for all three types. Many advancements in irrigation efficiency have been made and will continue to be developed and implemented. It is critical that implementation is done at a farm-by-farm basis in such a way as to fit specific conditions and production systems. A one-size-fits-all approach, such as SGMA, will be neither effective nor economically viable for the BVGB.

It is important that any irrigation system be well-maintained to operate properly. Flood-irrigated fields should be appropriately leveled with appropriate width and length of irrigation check to provide for a uniform application of water. Sprinkler systems should be regularly checked for function and be designed with the right nozzle size for available flow and pressure. Systems that can utilize larger diameter nozzles can reduce droplet size and evaporation loss. Length of irrigation set should make use of soil water-holding capacity without incurring excessive tailwater. Specialized systems such as Low Energy Sprinkler Application (LESA) can improve water-use efficiency up to 15 percent.[75] Length of irrigation set should make full use of soil water-holding capacity without incurring excessive runoff.

[75] Low Energy Irrigation Technology - Bonneville Power Administration (bpa.gov)

To optimize efficiency of water use, the amount and timing of irrigation water applied should closely match the amount of water needed by the crop, thus maintaining adequate soil moisture for crop growth while minimizing tail water runoff. Effective use of irrigation technology such as soil moisture sensors, tracking of evapotranspiration, flow meters, etc. are available to help farmers manage irrigation timing and length of set to get the most of their irrigation system. These irrigation efficiency techniques are already being used to some extent in the BVGB but could have a greater impact if used more widely. The State Water Efficiency Enhancement Program (SWEEP) Irrigation Water Savings Assessment Tool[76] indicates irrigation efficiency improvements of 5 to 15 percent, with 15 percent being the greatest improvement occurring with the installation and use of soil moisture equipment, flow meters, and volumetric irrigation management.

Genetic selection and the continued improvement of forage crop species has resulted in the increased availability of drought tolerant, heat tolerant, or short-season forage grasses that may provide growers with viable alternatives in certain situations, where water availability is otherwise limited. Crop selection is often based on the best fit for a particular soil depth, soil texture, and water availability, in conjunction with value and marketability. Although Big Valley cropping systems are heavily constrained by climate and growing season, ongoing forage crop improvement may provide growers with a wider range of species and variety options.

Overall good agronomic practices in terms of soil fertility, weed control, harvest, etc. are critical and promote an efficient use of all resources, including water. As mentioned in other places in this plan, agricultural fields and farms provide important wildlife habitat in the valley. Irrigated lands are an important part of the overall landscape. A good example is that flood irrigated pastures are highly valued by migratory birds, particularly in the spring. Emphasis on water efficiency is important but should not become such a single-focused objective that other resource values or farm profitability are ignored.

It should be clear that efficient use of water for irrigated forage crop production is multi-faceted, and several small improvements, strategically coupled together to fit on-farm conditions, are the most effective approaches. To this end, education outreach *via* U.C. Cooperative Extension, technical support from NRCS, and cost-share and grant programs are all critical to supporting water use efficiency measures. Support and incentive programs that have been used and can be further expanded upon in Big Valley are listed in **Table 9-1** (funding program table).

Reductions in water demand due to improvements in irrigation efficiency will vary depending on the type of technology adopted, the extent of adoption, state of continued maintenance, and other factors. Based on the assumptions documented in Chapter 6 and Appendix 6A, the projected applied groundwater for irrigation averages about 44,000 acre-feet per year, assuming an 85 percent irrigation efficiency. Using a conservative estimate of basin-wide adoption in irrigation improvements, irrigation efficiency across the basin could improve by 5 to 10 percent. Assuming that half of the reduced irrigation would have recharged the groundwater basin, the net benefit to the groundwater basin would be about 1,000 to 2,000 acre-feet per year.

[76] https://www.cdfa.ca.gov/oefi/sweep/docs/IrrigationWaterSavingsAssessmentTool.xlsx

9.5.2 Landscaping and Domestic Water Conservation

While Big Valley is extremely rural and economically disadvantaged, there are opportunities to enhance water conservation among domestic water users, particularly regarding domestic landscaping, use of native drought adapted plants, irrigation timers, effective mulch, and rainwater/snow water catchments to reduce water requirements. Low-water landscaping can also be integrated with homeowner firesafe planning. Landscaping guides for homeowners can be distributed at public centers and at regional garden supply stores (Hartin et. al. 2014) (California Native Plant Society, 2021). Improvements in water conservation by domestic water uses will likely have a minimal benefit given the small population of the BVGB (on the order of tens of acre-feet per year), but working with the community to educate and implement domestic water conservation will further awareness and engagement in stewarding the BVGB.

9.5.3 Illegal Diversions and Groundwater Uses

As detailed in Section 3.3 – Land and Water Use, water use for illegal activities (i.e., unlicensed marijuana cultivation) occurs in the Basin and surrounding watershed. Lassen and Modoc County staff have limited time and resources to address this issue, but they do actively enforce their local cultivation ordinance (which does not allow for commercial marijuana cultivation). Staff in Lassen County conduct areal patrols and utilize high-resolution aerial imagery from an imaging contractor as part of their effort to identify and abate illegal cultivation. Unfortunately, federal and state agencies responsible for taking enforcement action against illegal marijuana grows in their jurisdictions (e.g., on public lands or when illegally diverting surface water) have not been aggressive in identifying and removing said illegal grows in the Basin and watershed. That said, when county resources are available, staff will continue to work in the field and with their imaging contractors to identify and abate illegal marijuana cultivation on private land. County staff will continue to report cultivation activities outside of their purview to the BLM, USFS, CDFW, State Water Board and the Bureau of Cannabis Control. The GSAs will rely on these agencies to take an aggressive approach in Big Valley with the objective of eradicating the Basin and watershed of illegal groundwater pumping and surface-water diversions. The potential for reduced water demands resulting from reducing or eliminating illegal diversions and groundwater uses is unknown but is expected to be on the order of hundreds of acre-feet per year.

9.6 Public Education and Outreach

The GSAs believe that public education and outreach are an important component of this GSP. Education can change use patterns that promote water conservation and protection of water resources. The GSAs support continued education on preventing illegal dumping, illegal marijuana growers, properly sealing abandoned wells and BMPs. Continued outreach to support the coordination of efforts and information sharing, fostering relationships with relevant agencies and organizations and attending meetings with local and regional groups involved in water management are also important. This includes increasing public outreach about funding opportunities and programs that support water conservation methods, increased recharge, mediation opportunities for decreasing water levels, and addressing other SMCs like water quality. **Table 9-1** lists current state and local funding sources that can be targeted to support project planning and implementation. The GSAs plan to leverage existing grant information to maintain a list of funding sources for pumpers to monitor and address challenges at their wells.

Additionally, the GSAs may elect to support local entities in applying for funding. More information on public outreach and communication can be found in Chapter 11 – Notice and Communications.

As described in Chapter 8.2.2, the UCCE, with support from the GSAs, will implement a voluntary water quality monitoring program for nitrate and arsenic that will include materials for guidance on how to administer the tests and allow for voluntary reporting of water quality.

Outreach methods that can be expanded include radio public service announcements, cooperator workshops with UCCE and social media posts informing the public about upcoming meetings and deadlines, BMPs, Plan updates, recharge opportunities and updated water conditions. An organized effort to compile recharge and conservation activities would aid GSAs in tracking impacts for future Plan revisions.

9.7 Domestic Well Mitigation Program

A domestic well mitigation program will be developed by the GSAs to support domestic well owners if their well goes dry or the quality of groundwater degrades due to the chronic lowering of groundwater levels.

Only domestic wells would be eligible for this program (i.e., agricultural or irrigation wells would not qualify). The GSAs define domestic wells based on SGMA's definition of de minimis extractors, which are "a person who extracts, for domestic purposes, two acre-feet or less (of groundwater) per year." [77] This covers homes that rely "on a single domestic well and [that is] not watering crops or large areas of landscape."[78] This definition generally covers water uses for household interior uses (e.g., drinking, cooking, sanitation) and outdoor uses (e.g., watering shrubs, gardens, and small lawns).

A general outline for a plan to implement a domestic well mitigation program is described below as many of the details have yet to be formulated. The development of the framework of the program will begin immediately following the development of the GSP, however securing funding for the mitigation measures of the program would likely occur once the measurable objective is exceeded.

The following guidance documents were consulted in drafting the outline and general overview of the well mitigation program summarized herein, and each document will inform the development of the program:

- California Department of Water Resources (DWR), 2023. Considerations for Identifying and Addressing Drinking Water Well Impacts, Guidance for Sustainable Groundwater Management Act Implementation. March.
- Self-Help Enterprises, Leadership Counsel for Justice and Accountability, and the Community Water Center, 2022. Framework for a Drinking Water Well Impact Mitigation Program. July.

[77] Domestic Well Brochure (ca.gov)
[78] Ibid.

The domestic well mitigation program is a necessary component of the Big Valley GSP and will be developed following the completion of the GSP to mitigate impacts to domestic wells. The general outline for implementation will be as follows:

1. Review existing and expected well mitigation programs within the State.
2. Explore opportunities and secure long-term funding for program and/or collaboration with local agencies.
3. Develop policies and procedures with GSAs, BVAC, and public input.
4. Identify wells that may be or are at risk of being impacted.
5. Develop criteria for qualifying wells.
6. Develop an adaptive management trigger system.
7. Develop mitigation measures for qualifying wells.
8. Perform public outreach to landowners and stakeholders.
9. Develop voluntary registration program for well mitigation assistance.

Each of these above steps will culminate in a comprehensive domestic well mitigation program that will address wells that go dry within the Basin. Each step is described further below.

<u>Review of Existing Well Mitigation Programs</u>

Many existing programs within the State can serve as a model for the Big Valley Basin's domestic well mitigation program. The GSAs will perform a thorough review of existing programs to understand what will work for the GSAs.

<u>Funding and Collaboration with Local Agencies</u>

Funding sources will be explored at the federal, state, and local levels. A funding plan will be developed for the GSAs if the measurable objective is reached at one third of wells within the water level monitoring well network for two back-to-back spring measurements. Coordination with the Counties of Lassen and Modoc will also occur as related to SB 552.

<u>Development of Policies and Procedures with Local Input</u>

Following development and/or approval of this GSP, the GSAs will solicit local input on the policies and procedures that will govern the well mitigation program. Although the general outline of the program is described herein, the procedures and policies will be developed following input from the GSAs, BVAC, and Big Valley Basin locals.

<u>Identify "At Risk" Domestic Wells</u>

The GSAs will review their existing dataset for domestic wells that are "at risk" of going dry. The dataset will be compared against the water level minimum thresholds to identify wells that are at risk. The GSAs will update the existing dataset of domestic wells with a voluntary domestic well registration program.

Develop Criteria for Qualifying Wells

An application and evaluation process will be developed to identify active and permitted domestic wells that qualify for the program. The following are general criteria that may qualify or disqualify a domestic well for mitigation efforts covered by the GSAs and are subject to change:

- Must be a domestic well within the Big Valley Basin and permitted with one of the Counties.
- Undesirable results have occurred in the Basin.
- Groundwater levels in the vicinity of the domestic well are below the minimum threshold.
- Loss in well production capacity must be related to declining water levels and not issues with the well or pump itself, such as mechanical issues with the pump, broken well components due to well age, etc.
- The optimal and most realistic mitigation measures will be applied to domestic wells that qualify for GSAs assistance under this program. For example, a new well will not be drilled if lowering of a pump would solve the issue.

Develop Adaptive Management Trigger System

An adaptive management trigger system may be developed for implementing the domestic well mitigation program, which will rely on the monitoring of groundwater for levels and quality at the monitoring network wells. The adaptive management trigger system is a tiered management response to changes in groundwater elevations. These management actions may be developed following the completion of this GSP to provide a guide for the GSAs to assist domestic well owners if groundwater falls below the depth of a domestic well due to chronic lowering of groundwater levels. Adaptive management trigger systems typically rely on measurable thresholds that when exceeded trigger a management response to attempt to correct the exceedance. It should be noted that any or all corrective actions undertaken by the GSAs are contingent on funding to the program, which will be developed once the measurable objectives are exceeded.

Develop Mitigation Measures for Qualifying Wells

Mitigation measures will be developed to provide qualifying domestic well users assistance if their well is to go dry related to the chronic lowering of groundwater levels in the Basin. The GSAs, BVAC, and local community will determine criteria for domestic wells that qualify for mitigation support from the GSAs and the appropriate timing of mitigation actions. At a minimum, the GSAs would initiate the domestic well mitigation program when undesirable results occur in the vicinity of qualifying domestic wells.[79] Mitigation measures can be broken up into short-term and long-term and can range from providing a short-term water supply such as bottled water to funding assistance to drill a new domestic well. Some examples of mitigation are listed below and may not represent the final program’s mitigation measures:

- Providing a short-term mitigation measure while a longer-term mitigation measure is pursued. For example, bottled water or a water tank (short-term mitigation measure) while the domestic well user is connected to a nearby water system (long-term mitigation measure). This solution would foreseeably work for both water quantity and quality issues.
- Facilitating the domestic well user to connect to a nearby water system (long-term mitigation).
- Providing funding for lowering a pump, deepening the well, drilling a new well, or an alternative equivalent water supply (such as a surface water source; long-term mitigation).
- Reducing or adjusting pumping near the affected domestic well(s) (long-term mitigation).

Perform Public Outreach and Develop Voluntary Registration Program

The GSAs will perform public outreach to let residents of the Big Valley Basin know of the domestic well mitigation program and voluntary registration program. Those who wish to benefit from the program must have a county-permitted well that was affected by the lowering of groundwater levels and has or will register for the program. The GSAs will work with other local organizations to publicize and improve access to the program.

[79] Undesirable results for groundwater levels would occur when at least one third of representative monitoring wells fall below their minimum thresholds for three consecutive years. The minimum threshold is defined as 50 feet below the Spring 2015 groundwater levels.

10. Implementation Plan

GSP implementation generally consists of five categories of activities:

- GSA Administration and Public Outreach
- Monitoring and Data Management
- Annual Reporting
- Plan Evaluation (five-year updates)
- Projects and Management Actions

This chapter contains discussion of the details for each of these activities, then sets forth a schedule for implementation, estimates costs of implementation and discusses funding alternatives.

10.1 GSA Administration and Public Outreach

The nature of GSA administration is not addressed explicitly in the GSP Emergency Regulations. Much of the work to implement portions of the GSP (e.g., monitoring and projects and management actions) must be performed by outside entities such as DWR and hydrology professionals. However, this work will need to be coordinated by the GSAs, and some work will need to be performed by GSA staff.

One category of work that rests on GSAs' shoulders is public outreach. The level of effort needed from GSA staff depends greatly on the details of public outreach discussed in Chapter 11 – Notice and Communications. In addition to the public outreach performed during GSP development, Regulations (§354.10(d)) require GSAs to develop a communication section of the plan that includes the following:

1. An explanation of the Agency's decision-making process.
2. Identification of opportunities for public engagement and a discussion of how public input and response will be used.
3. A description of how the Agency encourages the active involvement of diverse social, cultural and economic elements of the population within the basin.
4. The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.

Chapter 11 will contain the Communications and Engagement Plan, but the requirements of the Regulations are presented here for awareness by GSA staff to refine this chapter and understand the level of effort and expense that will be required for this component of GSP implementation. Decisions will need to be made regarding whether the BVAC continues as a functioning body after completion of the GSP. If the BVAC continues, what role they take and how often they meet will determine the level of GSA staff effort needed to facilitate BVAC meetings and activities.

10.2 GSP Annual Reporting

According to §356.2 of the Regulations, the Big Valley GSAs are required to provide an annual report to DWR by April 1 of each year following the adoption of the GSP. The first Annual Report will be provided to DWR by April 1, 2022, and will include data for the prior WY, which will be WY 2021 (October 1, 2020 – September 30, 2021). While the WY as defined by DWR isn't ideal for use in Big Valley, because it doesn't correlate with the growing season or surface-water irrigation season in Big Valley, the GSAs will assemble data based on DWR's definition as per SGMA statute and regulations. The Annual Report will establish the historical conditions of groundwater within the BVGB, the status of the GSP implementation and the trend towards maintaining sustainability. Unfortunately, while conditions won't differ significantly from when the GSP was developed, the GSAs are still required to submit the Annual Report to comply with GSP regulations. A general outline is included below:

- General Information
  - Executive Summary
  - Introduction (1 map of Basin)
- Basin Conditions
  - Groundwater Elevations (2 contour maps, 12 hydrographs)
  - Estimated Groundwater Extractions (1 table from water budget)
  - Estimated Surface-water Supply (1 table from water budget)
  - Estimated Total Water Use (1 table from water budget)
  - Estimated Change in Groundwater Storage (2 maps, 1 graph and 1 table)
- GSP Implementation Progress
  - Progress Toward Measurable Objectives
  - Updates on Projects and Management Actions

Another way to organize this requirement, and for GSA staff and stakeholders to understand the level of effort and expense involved in developing annual reports, is to outline major technical tasks. Much of the effort to develop the annual reports is to take available data collected by outside agencies, generate figures based on that data and then re-submit to DWR. Below is a summary outline of tasks to be performed by GSA staff and/or consultants to develop the annual report:

- Download Water Level Data from state website and generate:
  - Hydrographs for 12 representative wells
  - Assumed spring and fall groundwater contours
  - Assumed groundwater difference contours (e.g., fall 2020 to fall 2021)

- Download water budget data from state websites[80]
    - Run water budget for the WY and generate estimates of:
        - Groundwater extractions
        - Surface-water supply
        - Total water use
- Assemble and write Annual Report, including the estimates and assumptions
- Upload report and data, including the estimates and assumptions, to state website

10.2.1 General Information

In accordance with §356.2(a), each Annual Report will include, at the front of the report, an executive summary that will summarize the activities and the condition of groundwater levels within the BVGB for the prior year. The executive summary shall also include a map of the BVGB, its GSAs, and the monitoring network.

The Annual Report will include an introduction that will describe the following:

- A description of the BVGB and the two GSAs
- The general conditions of the BVGB for the prior WY (precipitation, surface-water allocations, crop demands, municipal demands, etc.)
- Any significant activities or events that would impact the water supply and/or groundwater conditions for the BVGB

10.2.2 Basin Conditions

Included in the Annual Report will be a discussion of specific local water supply conditions per §356.2(b). This section will provide a description of the water supply conditions for the WY being reported along with a graphical representation of the conditions. A WY shall be defined as the 12-month period starting October 1 through September 30 of the following year. Water supply conditions that will be discussed include:

- Assumed Groundwater Elevations – elevation data from the monitoring network, including hydrographs for the representative wells and groundwater contours for spring and fall.
- Assumed Groundwater Extractions – groundwater pumping estimates and measurements for agricultural, municipal, domestic and industrial[81] pumping; generated from the water budget.
- Assumed Surface-water Supply – data from surface-water supplies to irrigation demand,[82] conveyance losses and groundwater recharge; generated from the water budget.

[80] This includes precipitation and reference evapotranspiration (ETo) from CIMIS and streamflow data from CDEC, BVWUA, Brookfield Energy, and other sources.
[81] This includes both in-basin industries as well as fire, wildlife, logging, and construction (which use both surface and groundwater).
[82] Summer flows in the BVGB are 100% allocated under existing water rights.

- Assumed Total Water Use – total water uses by agricultural, municipal, domestic and industrial sectors; generated from the water budget.
- Assumed Change in Groundwater Storage – a determination of the groundwater (volumetric) change; calculated from groundwater difference contours and/or the water budget.

10.2.3 Plan Progress

The Annual Report also needs to describe the progress of the Plan since the previous report, including progress in maintaining measurable objectives and status of projects and management actions.

10.3 Data Management System

The Regulations require a data management system (DMS), but do not give strict guidance on format or how to develop and maintain the DMS. §352.6 of the Regulations states:

> 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.

The DMS proposed for Big Valley is separated into two categories: data for annual reports and data for GSP updates, much of which is taking data already managed by the state and returning it to the state in a new format.

10.3.1 Annual Report DMS

Annual reports require water-level data and other data to update the water budget. **Table 10-1** lists the data needed and the sources of those data. The DMS can be stored using common software (Microsoft Excel and ArcGIS) on GSA servers. Water-level data will be downloaded from the state website[83] and stored in an Excel hydrograph spreadsheet tool. This tool will store the well information, water-level data, WY types and sustainable management criteria (minimum thresholds and measurable objectives). The tool will allow users to generate hydrographs and provide the data needed to generate contours. **Figure 10-1** shows a screenshot of the Excel Water Level Tool for storing water-well and water-level data and generating hydrographs.

Table 10-1 Annual Report DMS Data Types

Data Type	Collecting Entity	Data Source	DMS Tool
Water Levels	DWR	SGMA Data Viewer	Excel Water Level Tool
Precipitation	DWR	CIMIS	Excel Water Budget Tool
Evapotranspiration	DWR	CIMIS	Excel Water Budget Tool
Streamflow (gages)	USGS/DWR	CDEC	Excel Water Budget Tool
Streamflow (water rights reporting)	State Water Board	eWRIMS	Excel Water Budget Tool
GIS Base Data[1]	GSAs	various	GIS Database
Notes:			

[83] Currently water level data for Big Valley is being managed and stored through DWR's CASGEM system. Once the GSP is completed, the data will be brought into DWR's new SGMA Portal Monitoring Network Module (MNM). Data from either of these systems is available through the SGMA Data Viewer.

[1]Base data includes GIS layers such as the county boundaries, streams, roads, well locations, etc., which generally don't change over time and don't need to be updated.
CDEC = California Data Exchange Center

Water budget data will also be stored in an Excel spreadsheet tool as shown in **Figure 10-2**. Each of these spreadsheet tools has instructions, sheets to store raw data, and sheets that perform calculations and generate the needed figures for annual reports or other purposes.

Annual reports require maps, which are generated with widely-used ArcGIS software. The geographic information system (GIS) data, including base data such as streams, roads and well locations, will be organized into a folder structure as shown in **Figure 10-3**. Water level data will be imported into GIS to generate contours for annual reports.

10.3.2 GSP Update DMS

Additional types of data are needed to update the GSP, listed in **Table 10-2**. Much of this additional data is GIS-based and will be stored in the GIS database, shown in **Figure 10-3**. Water quality data will need to be downloaded from the State Water Board's GAMA groundwater system in 2026 to support the five-year update.

Table 10-2 GSP Update DMS Data Types

Data Type	Collecting Entity	Data Source	DMS Tool
Water Levels	DWR	SGMA Data Viewer	Excel Water Level Tool
Precipitation	DWR	CIMIS	Excel Water Budget Tool
Evapotranspiration	DWR	CIMIS	Excel Water Budget Tool
Streamflow (gages)	USGS/DWR	CDEC	Excel Water Budget Tool
Streamflow (water rights reporting)	State Water Board	eWRIMS	Excel Water Budget Tool
Water Quality	State Water Board	GAMA	Data to be downloaded for five-year update.
Land Use	DWR	SGMA Data Viewer	GIS Database
Subsidence (InSAR)	DWR	SGMA Data Viewer	GIS Database
GIS Base Data[1]	GSAs	various	GIS Database

Note:
[1] Base data includes GIS layers such as the county boundaries, streams, roads, well locations, etc., which generally don't change over time and won't need to be updated.

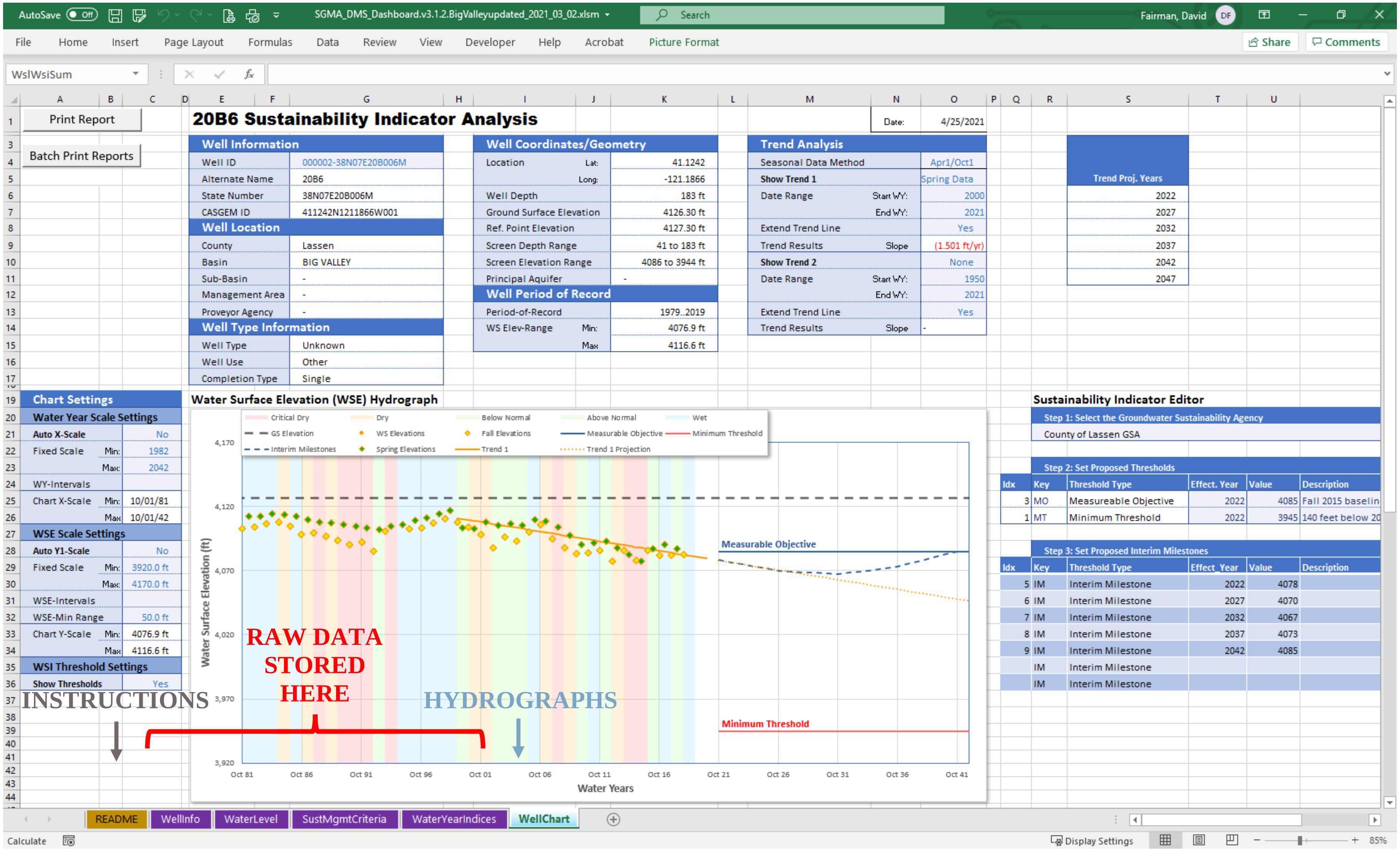
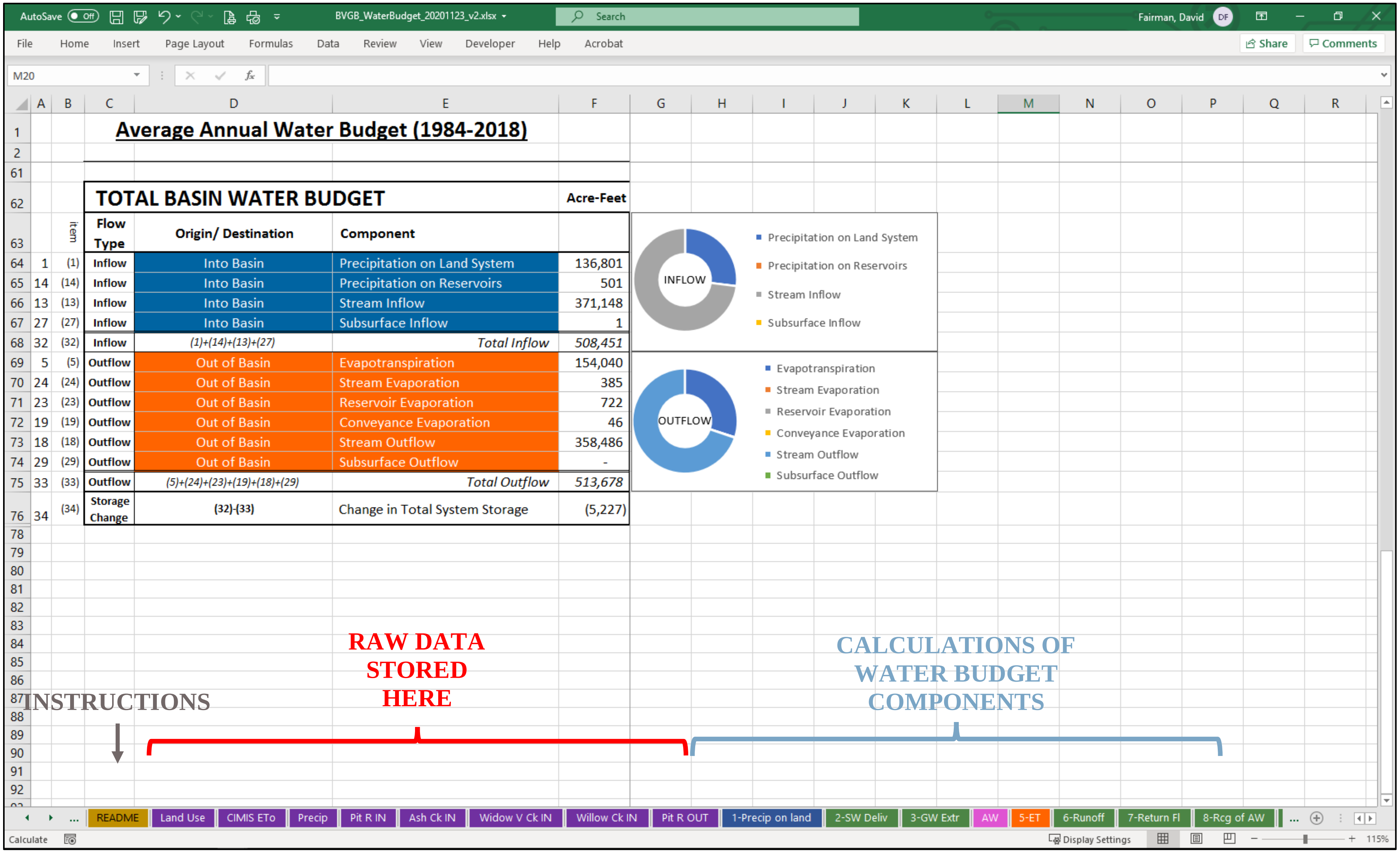


Figure 10-1 Excel Water Level Tool



Average Annual Water Budget (1984-2018)

Item	Item	Flow Type	Origin/ Destination	Component	Acre-Feet
1	(1)	Inflow	Into Basin	Precipitation on Land System	136,801
14	(14)	Inflow	Into Basin	Precipitation on Reservoirs	501
13	(13)	Inflow	Into Basin	Stream Inflow	371,148
27	(27)	Inflow	Into Basin	Subsurface Inflow	1
32	(32)	Inflow	(1)+(14)+(13)+(27)	*Total Inflow*	*508,451*
5	(5)	Outflow	Out of Basin	Evapotranspiration	154,040
24	(24)	Outflow	Out of Basin	Stream Evaporation	385
23	(23)	Outflow	Out of Basin	Reservoir Evaporation	722
19	(19)	Outflow	Out of Basin	Conveyance Evaporation	46
18	(18)	Outflow	Out of Basin	Stream Outflow	358,486
29	(29)	Outflow	Out of Basin	Subsurface Outflow	-
33	(33)	Outflow	(5)+(24)+(23)+(19)+(18)+(29)	*Total Outflow*	*513,678*
34	(34)	Storage Change	(32)-(33)	Change in Total System Storage	(5,227)

Figure 10-2 Excel Water Budget Tool

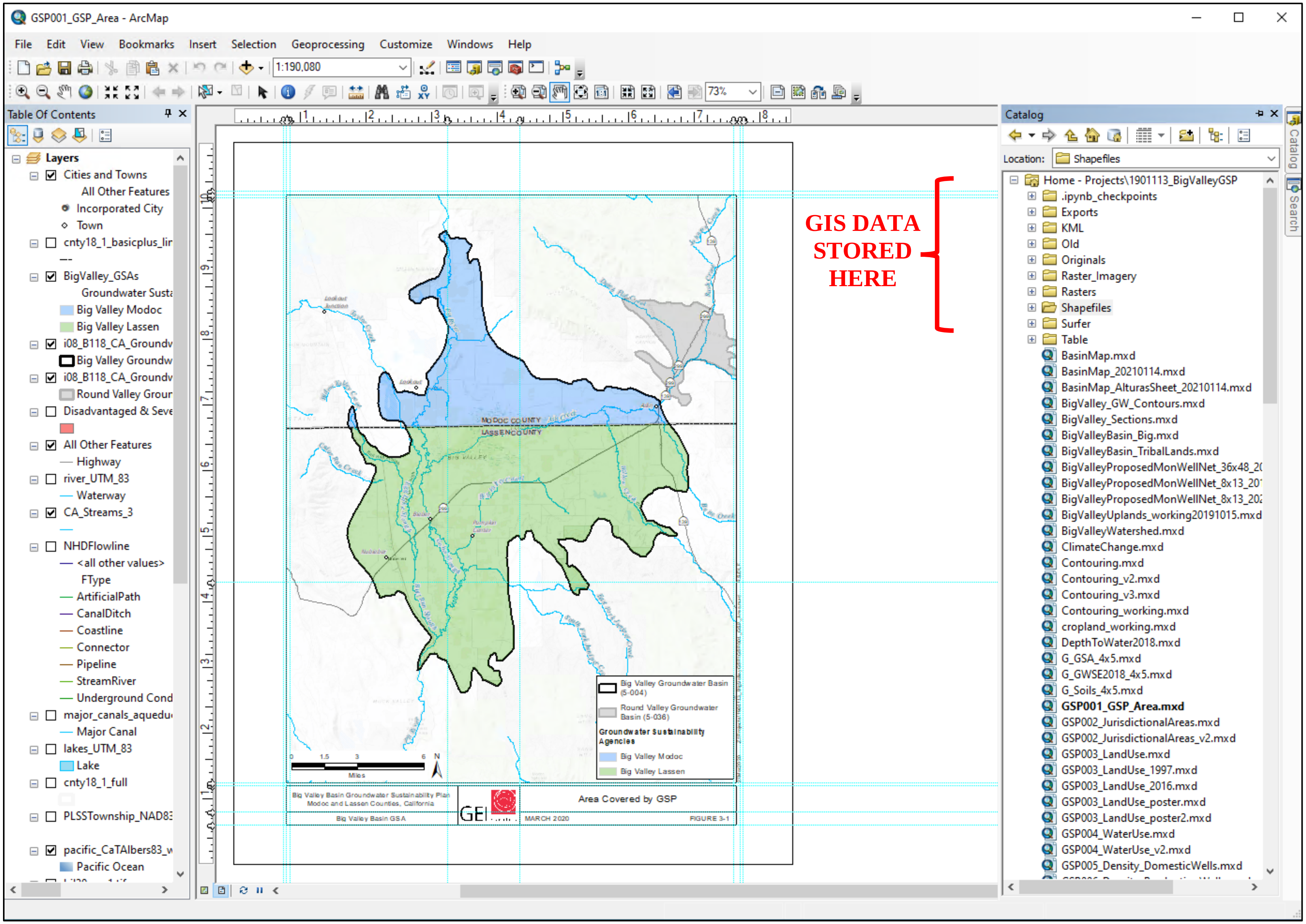


Figure 10-3 GIS Database

10.4 Periodic Evaluations of GSP (Five-Year Updates)

Updates and amendments to the GSP can be performed at any time, but at a minimum the GSAs must submit an update and evaluation of the plan every five years (CWC §356.4). While much of the content of the GSP will likely remain unchanged for these five-year updates, the Regulations require that most chapters of the plan be updated and supplemented with any new information obtained in the preceding five years. Chapters that are likely to require significant updates and re-evaluation include:

- Chapter 4 – Hydrogeologic Conceptual Model
- Chapter 5 – Groundwater Conditions
- Chapter 6 – Water Budget
- Chapter 7 – Sustainable Management Criteria
- Chapter 8 – Monitoring Network
- Chapter 9 – Projects and Management Actions

The Basin Setting (Chapters 4-6) is signed and stamped by a California Professional Geologist or Engineer.

10.5 Implementation Schedule

Figure 10-5 shows the implementation schedule. *See* Chapter 9 – Projects and Management Actions for the schedules for individual projects that are still under development.

10.6 Cost of Implementation

The legislation and regulations provide little guidance on how to develop and define costs. An analysis of GSPs from critically overdrafted basins found a broad variety of approaches, categories of costs and level of detail, from a single cost with no detail or justification to detailed costs for multiple categories. The purpose of this section is to present some information of cost ranges given for other basins and to give estimates of costs for the categories of implementation presented in this chapter, listed below. These costs may change based on how the GSAs choose to implement the GSP (e.g., the amount and type of public outreach and the amount and type of support sought from outside hydrology professionals such as consultants and/or UCCE).

- GSA Administration and Public Outreach
- Monitoring and Data Management
- Annual Reporting
- Plan Evaluation (five-year updates)
- Projects and Management Actions

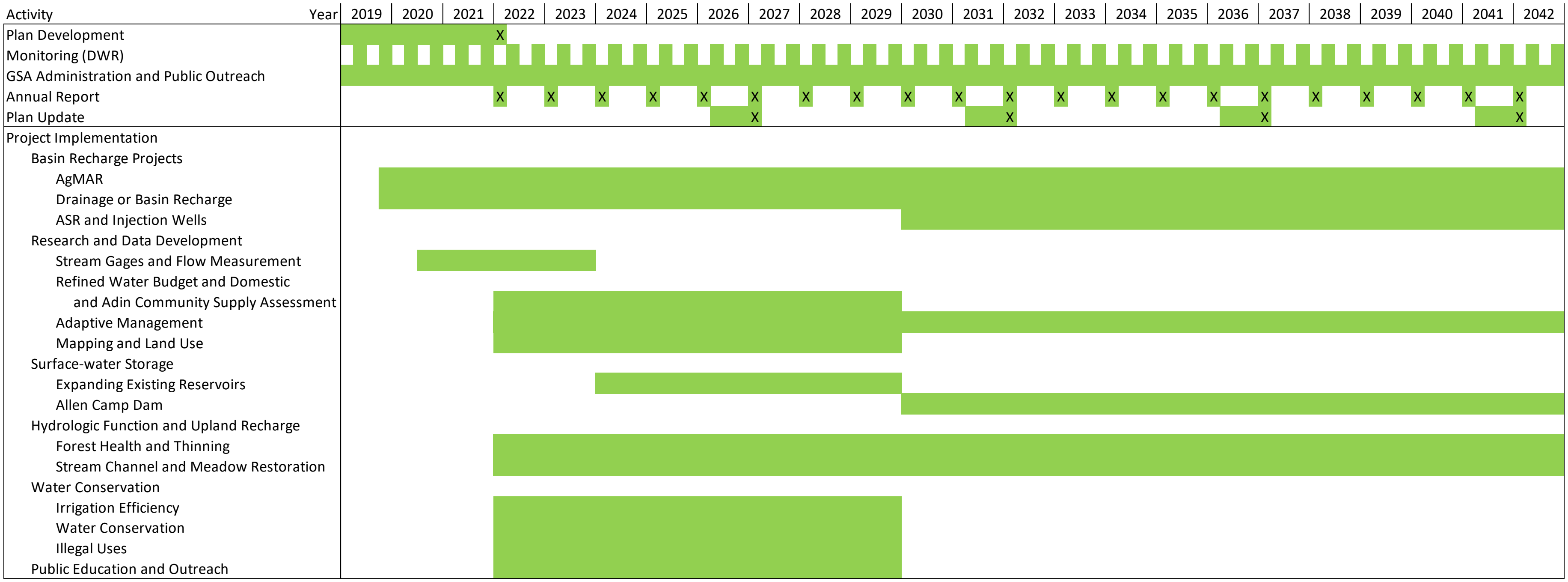


Figure 10-4 Implementation Schedule

Cost is a fundamental concern to the GSAs and stakeholders in the BVGB, as the Basin is a disadvantaged community and there is little to no revenue generated in the counties to fund the state unfunded mandates of SGMA. This is a big burden for a small, disadvantaged Basin that has no incorporated cities, low value crops and no revenue stream to pay the costs for the mandated GSP. Therefore, the approach in implementing the plan and estimating costs is to leverage as much outside funding and technical support as possible to cover costs. For costs that must be borne by the GSAs, efficient implementation methods while still meeting SGMA requirements to support the GSP is the desired outcome. **Table 10-3** shows a summary of the costs from GSPs submitted in 2020. As mentioned, not every GSP had every category of costs listed, but the number of GSPs that did detail costs for each category is shown. It should be noted that Big Valley is extremely unique in a variety of ways documented in Chapter 1 – Introduction.

Table 10-3 GSP Implementation Cost Statistics for 2020 GSPs in California

		Annual Cost Details					
	Total Annual	GSA Admin	Public Outreach	Annual Monitoring	DMS Update	Annual Report	5-Year Update
count	34	21	11	23	8	15	20
min	$ 50,000	$ 51,000	$ 5,000	$ 20,000	$ 10,000	$ 20,000	$ 50,000
max	$ 2,596,384	$ 1,538,794	$ 75,000	$ 1,057,590	$ 170,000	$ 350,000	$ 1,400,000
mean	$ 981,296	$ 607,861	$ 27,573	$ 293,907	$ 42,875	$ 56,267	$ 455,369
median	$ 720,100	$ 418,900	$ 20,000	$ 136,000	$ 20,000	$ 25,000	$ 330,000

Source: Fricke 2020

10.6.1 GSA Administration and Public Outreach

The fundamental activities that will need to be performed by the GSAs are public outreach and coordination of GSP activities. Public outreach may entail updates at County Board of Supervisors' meetings and/or public outreach meetings. At a minimum the GSAs will receive and respond to public input on the Plan and inform the public about progress implementing the GSP as required by §354.10(d)(4) of the Regulations. Coordination activities would include ensuring monitoring is performed, annual reports to DWR, five-year GSP updates, and projects and management action coordination. Based on current grants which have funded filling of data gaps and identifying recharge opportunities, the GSA administrative costs of projects and management actions may be largely covered by grant funds.

In other GSPs already submitted, 21 GSPs itemized GSA administration and had estimates ranging from $51,000 to over $1.5 million (M) per year, with a median of about $200,000. However, most of these basins are much larger than Big Valley, have more complex governance structures (i.e., have multiple GSPs in the basin) and have more stakeholder groups. This cost for Big Valley could vary depending on the nature of public outreach written in the GSP.

10.6.2 Monitoring and Data Management

Twenty-three GSPs submitted to DWR to date have itemized annual monitoring with cost estimates ranging from $20,000 to over $1M per year, with a median of about $65,000. Twelve GSPs itemized DMS updates with costs ranging from $3,000 to $170,000, with a median cost of $15,000.

DWR staff currently measure water levels in the Basin and posts results on their website and have indicated that they will continue to do so for the foreseeable future. DWR has also indicated that they could monitor water levels in the newly constructed monitoring wells. If DWR follows through on this assumption, there would be little to no costs to the GSAs for monitoring. The GSAs would need to download and populate the DMS tools detailed above. However, for costing purposes, we have assumed this to be covered under the Annual Report cost category.

If DWR chooses to discontinue its water level monitoring of wells in Big Valley, the cost could be on the order of $2,000 to $3,000, which equates to 40 to 60 staff-hours.

10.6.3 Annual Reporting

Annual Report costs were estimated in 15 GSPs ranging from $20,000 to $350,000, with a median cost of $25,000. Annual reports have substantial requirements, including assembling the data, processing and generating the necessary charts, maps and tables and writing the text described in Section 10.2 – GSP Annual Reporting. There are ways to streamline and automate the process of retrieving, reformatting and returning the data to the state, many of which are described in Section 10.2.3 – Plan Progress. The level of effort and cost will be reduced over the course of the first few years. The cost of developing an Annual Report initially is estimated to be $25,000 for the first year, then reducing to approximately $10,000, if written and submitted by GSA staff. This equates to about 200 county unreimbursable staff hours per Annual Report.

10.6.4 Plan Evaluation (Five-Year Updates)

The cost of updates to the GSP will be lower than the cost of initially developing the GSP. However, the Regulations require all parts of the GSP to be updated with recent data and information and will require substantial effort from a licensed professional. Of the 20 GSPs submitted that had GSP update cost estimates, they ranged from $50,000 to $1.4M with a median cost of $330,000. However, many of the GSPs already submitted are in basins with multiple GSPs. In those types of basins, the Basin Setting (Chapters 4-6) is typically performed on a basin-wide basis. Big Valley will have to update the complete document. Therefore, a range of about $200,000 to $300,000 is estimated to update the GSP. **Table 10-4** summarizes the cost estimates of Annual Reports and five-year updates.

10.6.5 Projects and Management Actions

Costs of projects and management actions are addressed in Chapter 9 – Projects and Management Actions. If, and when, the GSAs seek outside funding, the costs will be put out to bid to ensure the reasonableness of the costs when implemented.

Table 10-4 Summary of Big Valley Cost Estimates

		Annual Cost Details			
	Total Annual	GSA Admin and Public Outreach	Annual Monitoring and DMS Update	Annual Report	5-Year Update
Low	$ 30,000	$ 20,000	$ -	$ 10,000	$ 200,000
High	$ 68,000	$ 40,000	$ 3,000	$ 25,000	$ 300,000

10.7 Funding Alternatives

This section discusses funding alternatives. As discussed in various parts of this GSP, the GSAs and residents of Big Valley have no ability to take on the ongoing costs of implementing this GSP and contend that SGMA is an unfunded mandate. Therefore, the GSAs are forced to rely on outside sources to fund the Plan. **Table 10-5** describes the various funding options available to the GSAs. The table describes both outside funding (state and federal assistance and grants) and local funding (general fund, fees and taxes). Annual costs are less likely to be funded directly by outside sources because of the premise of SGMA that groundwater basins are best managed locally, and administration, monitoring and reporting costs are most likely to be seen as an obligation for the local GSAs under this premise. However, five-year updates and projects and management actions are good candidates for outside funding. Some of this outside funding that currently exists could be through the DWR Prop 1 grants obtained by the North Cal-Neva, and Modoc County could potentially be leveraged to support annual reporting in the near term. This depends on the degree of overlap between the scopes of work for the grants and the annual report requirements. These two existing grants are laying the groundwork for recharge projects and filling data gaps.

In addition, the Modoc County GSA received $2.6 million from the DWR's Sustainable Groundwater Management Grant Program in 2023 to support its GSP implementation in the BVGB.[84] The scope of work covered by this funding includes:

- Modifying the GSP in response to DWR's review and determination.
- Preparing Annual Reports, the five-year GSP update, and an update of the water budget presented in the GSP.
- Conducting GSP engagement and outreach (Project 9.6).
- Monitoring and conducting research to fill data gaps in the BVGB (Project 9.2).
- Completing a Water Availability Analysis and applying for a temporary diversion permit for groundwater recharge (Project 9.1).
- Completing a water storage and community supply feasibility assessment.
- Completing and submitting a basin boundary modification for the BVGB.

[84] award-list_sgma_r2_final_list_sept2023_w_components.xlsx (ca.gov)

The GSAs are committed to implementing the scope covered by the DWR's grant in the agreed-upon timeline.

The entire BVGB is a disadvantaged community with much of the Basin designated as severely disadvantaged. The GSAs adamantly oppose new taxes or fees as additional taxes or fees would harm the community and alter the ability of residents to live and work in the Basin. The GSAs will identify and pursue grants to fund the implementation of this GSP. To that end the GSA will look toward funding options presented by the California Financing Coordinating Committee (CFCC) through their Funding Fairs.[85]

[85] More information on CFCC including their 2021 Funding Fairs Handbook is available at https://www.cfcc.ca.gov/funding-fairs/.

Table 10-5 Summary of GSP Funding Mechanisms

Funding Mechanism		Description
Assistance Programs		DWR offers Technical Services Support and Facilitation Services Support Programs to assistance GSAs in development and implementation of their GSPs. If granted, services provided under these programs are offered at no-cost to the GSAs.
Grant Funding	State Grants	DWR’s Sustainable Groundwater Management Grant Program, funded by Proposition 1 and Proposition 68, provides funding for sustainable groundwater planning and implementation projects. Both DWR and the State Water Board offer a number of grant and loan programs that support integrated water management, watershed protection, water quality improvement and access to safe drinking water. Other state agencies and entities with grant or loan programs related to water and environment include the CDFW and California Water Commission.
	Federal Grants	Federal grant and loan programs related to water planning and infrastructure include the Water Infrastructure Finance and Innovation Act, Water Infrastructure Improvement for the Nation Act and the DOI Reclamation’s WaterSMART program.
General Funds		Cities and counties maintain a general fund which include funding from taxes, certain fees, state shared revenue, interest income and other revenues. While not a funding mechanism, the general funds from cities and counties may be used to fund or provide in-kind services for GSA activities and GSP implementation.
Fees	Fees	Fees include “various charges levied in exchanges for a specific service” (Hanak et al., 2014). This includes water and wastewater bills, or developer or connection fees, and permitting fees. Under rules established by Proposition 218 (1996), new property-related fee increases are subject to a public hearing and must be approved by either a simple majority of property owners subject to the fee or by two-thirds of all registered voters (Hanak et al., 2014; League of California Cities, 2019).
	Groundwater Extraction Fees	SGMA grants GSAs certain powers and authorities, including the authority to impose fees. Section 10730 of the Water Code states that a GSA may “permit fees and fees on groundwater extraction or other regulated activity, to fund the costs of a groundwater sustainability program, including, but not limited to, preparation, adoption and amendment of a groundwater sustainability plan, and investigations, inspections, compliance assistance, enforcement, and program administration, including a prudent reserve.”
	Assessments	Assessments are a specific type of fee that are levied on property to pay for a public improvement or service that benefits that property.
Taxes		Taxes imposed by local agencies include general taxes, special taxes, and property taxes. Taxes generally fall into one of two categories: general or special (Institute for Local Government, 2016). *General taxes* are defined as “any tax imposed for general governmental purposes” (Cal. Const. art. XIII C, § 1, subd. [a]). *Special taxes* are “any tax imposed for specific purposes, including a tax imposed for a specific purpose, which is placed into a general fund” (Cal. Const. art. XIII C, § 1, subd. [d]). Proposition 218 (1996) states that special districts, "could not levy general taxes, but only special taxes, and it clarified that local general taxes always required simple majority voter approval and that local special taxes always required two-thirds voter approval.”

11. Notice and Communications §354.10

11.1 Background

SGMA compliance, outreach and communication efforts in the BVGB began before GSP development. When SGMA was signed into law, local agencies in the BVGB explored options for forming GSAs by the June 30, 2017 statutory deadline. On February 23, 2016, Lassen and Modoc counties held a public meeting of the Lassen and Modoc County Boards of Supervisors in Adin to explore whether the District[86] could become a GSA for the Basin and if that option was preferred over the two counties becoming the GSAs. These were the only two options available under existing public agency structures. The preferred options resulting from the meeting was that the two counties become the GSAs for their respective Basin jurisdictions and develop a single, coordinated GSP.

The county boards moved forward to become GSAs, held public hearings and passed resolutions in early 2017, included in **Appendix 2A**. They registered with DWR as the Big Valley Modoc GSA and Big Valley Lassen GSA, each covering the portion of the Basin in their respective county. After becoming established as the GSAs, the counties developed a workplan under guidance from consultants to determine the scope, schedule and cost for GSP development; an application for a state grant was submitted and grant awarded; and the GSAs submitted a notice of intent to develop one GSP to cover the entire BVGB. A timeline of these events is presented in **Table 11-1**.

Table 11-1 Pre-GSP Development Outreach Efforts

Date	Activity
November 2015	Public Outreach meeting in Adin
February 2016	Joint Lassen-Modoc Board of Supervisors meeting to explore GSA options to comply with SGMA
February 2016 to present	Modoc County Groundwater Advisory Committee Meetings (bimonthly)
January 2017	Public outreach meeting in Bieber to solicit comment on the counties becoming GSAs
February 2017	County of Modoc GSA Formation Public Hearing
March 2017	County of Lassen GSA Formation Public Hearing
July-September 2017	GSP Workplan developed to determine scope, schedule and cost of GSP development
November 2017	Lassen County submits application for state grant to fund GSP development
June 2018	Notice of Intent to develop one GSP for the entire BVGB submitted to DWR
November 2018	Lassen County entered into SGMA grant agreement with the state

[86] Lassen-Modoc Flood Control and Water Conservation District

February 2019	GSP development started

11.2 Challenges of Developing GSP in a Rural Area and During the COVID-19 Pandemic

A major challenge and constraint during the development of the GSP was the COVID-19 pandemic that started in early 2020. The pandemic made thorough and proper public outreach and participation impossible throughout 2020 and early 2021, the time during which key GSP content was developed and discussed by consultants, GSA staff and the BVAC. Due to state restrictions from the Governor's executive orders, GSA staff had to cancel BVAC meetings, restrict public attendance at meetings and facilitate participation through remote technology. Many interested parties did not feel safe attending meetings in person, and remote attendance did not facilitate appropriate participation.

Internet connectivity and quality in this portion of the state is poor to nonexistent, and the counties have very limited technological resources. These disadvantaged communities are on the losing end of the digital divide. While the GSAs made every attempt to conduct BVAC meetings with the ability for remote public participation, there were still major logistical and technical challenges both with conducting such meetings and members of the public participating. Those participants that had internet connectivity frequently could not hear or understand the dialogue in the Big Valley community venues and could not interact in the most effective way. However, the GSAs made the best of the circumstances and addressed all comments provided through the various means.

The GSAs recognized the obstacles presented by the COVID-19 pandemic early in the efforts to develop a GSP and were proactive in reaching out to both the Governor and Legislature to identify potential solutions. The Governor severely restricted public meetings (and initially did not allow public meetings at all) because of the pandemic. Obviously, this made the GSAs' efforts to develop a GSP with constructive input from the public extremely difficult since, as outlined above, there is limited internet connectivity to conduct meetings remotely. Further, the limited GSA staff and technology was challenged to offer meetings remotely.

One obvious solution would be to recognize the emergency that is occurring across the state (and nation) and provide additional time to submit the required GSP. As such, on August 11, 2020, a letter was sent from the Lassen County Board of Supervisors (acting as the Lassen County GSA) to both the Legislature and the Governor requesting additional time. There was no response from either the Legislature or the Governor, so the Lassen County Board of Supervisors sent follow-up letters to the Governor on November 17, 2020, February 16, 2021, March 23, 2021, and April 27, 2021. Neither the Legislature nor the Governor responded. However, a response was eventually received (dated June 3, 2021) from Karla A. Nemeth, with DWR denying the request, even though the Board of Supervisors sent the above letters to the Governor and not to DWR.

In February 2021, State Assembly Member Devon Mathis introduced Assembly Bill 754 which would have extended the GSP deadline. The Lassen and Modoc County Boards of Supervisors sent letters to State Assembly committee leaders in support of the bill. Supervisor Byrne testified before both the Senate and Assembly committees in support of the bill citing the constraints of inadequate broadband in the community for meaningful public participation. The bill was passed by the State Assembly but did not pass out of committee in the State Senate.

Letters from the GSA to the governor and assembly, along with the response letter from DWR, are included in **Appendix 11A**.

11.3 Goals of Communication and Engagement

In developing the GSP, the GSAs implemented communication and engagement (C&E) with the goals of:

Educating the public about the importance of the GSP and their input. Public input is an important part of the GSP development process. The local community defines the values of the Basin and the priorities for groundwater management. This input guided decision-making and development of the GSP, particularly the development of the sustainability goal, sustainable management criteria and projects and management actions.

Engaging stakeholders through a variety of methods. One size does not fit all when it comes to stakeholder engagement in GSP development. This chapter outlines how the GSAs performed C&E at multiple venues through a variety of media to reach varied audiences.

Making public participation easy and accessible. The C&E described in this chapter describes the many methods employed to make it easy for the public to be informed and provide input.

Providing a roadmap for GSP development. The GSAs provided a schedule for stakeholders, keeping C&E efforts consistent and on track.

11.4 Stakeholder Identification

The Water Code §10723.2 requires consideration of all beneficial uses and users of groundwater. Primary beneficial uses of groundwater in the BVGB include agriculture, domestic use and habitat. In addition to farmers and individual well owners in the valley, this includes a small community system in Bieber, the Intermountain Conservation Camp and CDFW, which uses groundwater to supplement and maintain some habitat in the ACWA in the center of the Basin. Other significant uses include industrial uses such as logging, construction and fire suppression.

The Big Valley GSAs recognize that C&E with Big Valley water users and stakeholders is key to the success of GSP development and implementation. Particularly important is the engagement of local landowners given that both county seats are distant from Big Valley. Both counties have engaged stakeholders through various processes and efforts, including Modoc County's Groundwater Resources Advisory Committee, the LCGMP development and Basin Management Objectives program implementation and the BVAC described in this chapter. In addition, the GSAs performed several public workshops to solicit more input from interested parties. A listing of the BVAC, public workshop and other public outreach meetings is included in **Appendix 11B**.

The following is an initial list of interested parties that were contacted during GSA formation and GSP development:

- Agricultural users
- Domestic well owners
- Public water systems
- CDFW
- Surface-water user groups (including BVWUA and the Roberts Reservoir group)
- Lassen-Modoc County Flood Control and Water Conservation District
- Modoc County Groundwater Resources Advisory Committee
- Federal agencies (including the Forest Service and BLM)
- Tribes (including the Pit River Tribe)
- DWR
- North Cal-Neva

Prior to establishing themselves as the GSAs, the names and contact information for the above groups were compiled in spreadsheets. People on the interested parties lists were under no obligations and received information about GSP development, including meeting announcements and opportunities to provide input and become more involved.

The GSAs developed a website (described below) to facilitate C&E, and anyone interested in GSP development or implementation in the BVGB was able add themselves to the interested parties list. In addition, sign-in sheets at all public meetings allowed attendees to add themselves to the interested parties list.

Outreach with the Pit River Tribe was performed, and tribal contacts were added to the interested parties list when it was first developed in February 2016. Therefore, tribal contacts have received all notifications of GSP development activity. Applications to become members of the BVAC were sent to the tribes. In addition, the Modoc County Groundwater Resources Advisory Committee, a committee of the Modoc County Board and a forum for obtaining updates about GSP development, has a tribal position. Numerous contacts between Modoc County staff and tribal contacts have occurred during GSP development. A list of outreach activities with tribal contacts is included in **Appendix 11B**.

11.5 Venues and Tools

11.5.1 Stakeholder Survey

The GSAs performed a C&E survey with the purpose of soliciting information about how stakeholders wish to be involved in the GSP and what concerns they have relevant to the GSP. Paper copies of the survey were available at public meetings and was also available online.[87]

11.5.2 Website and Communication Portal

A website[88] was deployed for GSP development to facilitate communication and track the communication in a database. The website is meant to enhance, not replace outreach efforts. Tools of the website allowed the GSAs to communicate with interested parties. These tools include the following:

- **Calendar.** The website includes a calendar with meeting dates, locations, times and documents such as meeting agendas, meeting minutes, presentations and BVAC packets.
- **Interested Parties List.** The website allows users to add themselves to the interested parties list and to select whether they wish to receive communication through email or physical mail.
- **Documents.** In addition to the meeting documents mentioned above, the website has a general documents page where the GSAs posted GSP chapters, scientific references and other supported documents related to GSP development.
- **E-Blast.** E-mails are sent to interested parties using the e-blast tool. E-blasts help to notify interested parties with email addresses to receive information about GSP development progress, upcoming meetings and new information or documents available.
- **Public Comment.** GSP chapters posted on the website are available for public comment during comment periods throughout GSP development. A web form is available for anyone to submit comments on documents open for comment. The form allows the user to comment by page and line number for GSA review and response.

The website address is included on printed materials and announced at public meetings.

11.5.3 Community Flyers

Physical copies of flyers announcing upcoming public meetings are posted in high-traffic locations such as community centers, public buildings, local markets and post offices.

11.5.4 Newspaper

All public meetings, including BVAC meetings, are announced in the Lassen County Times, the Modoc Record, The Intermountain News and the Mountain Echo.

[87] https://www.surveymonkey.com/r/TQ9HCQK
[88] https://bigvalleygsp.org

11.5.5 Social Media

Information about GSP development and meeting announcements have been, and will continue to be, made available through social media. UC Cooperative Extension in Modoc County hosts the Devil's Garden Research and Education Facebook page, as well as a website with the same name. Through their Facebook page,[89] events are publicized and shared with other connected pages in the area to reach a wider stakeholder base. This platform also enables workshops and other events to be shared through live video and recordings. Recently, a blog detailing stakeholder engagement in Big Valley was published to the website.[90]

11.5.6 Brochure

In 2021, the GSAs transitioned from the background and scientific portions of the GSP (Chapters 1-6, including Basin Setting and Water Budget) to the policy and decision-making portions of the GSP (Chapters 7-9, Sustainable Management Criteria, Monitoring Networks and Projects and Management Actions). To facilitate engagement of people who may have been coming into the process at that time, a four-page informational brochure was developed, summarizing Chapters 1 through 6. This brochure was distributed on the website, through email and at public meetings. The brochure is included as **Appendix 11C**.

11.5.7 Big Valley Advisory Committee

The GSAs established the BVAC through an MOU to advise both Lassen and Modoc counties on GSP preparation. The goals of the BVAC, as stated in the MOU (**Appendix 2B**), include the following:

- Advise the two GSAs on the preparation of a GSP.
- Provide a forum for the public to comment during the preparation of the GSP.
- Provide recommendations to the two GSAs that would result in actions which have as minimal impact as possible on the residents of Big Valley.
- Advise the two GSAs on the preparation of a GSP to produce the lowest possible future costs to the residents of Big Valley.
- Ensure local control of the BVGB be maintained by the two GSAs.

Prepare a product that is acceptable to the GSA Boards for approval. Membership of the BVAC is composed of:

- one member of the Lassen County Board of Supervisors selected by said Board.
- one alternate member of the Lassen County Board of Supervisors selected by said Board.
- one member of the Modoc County Board of Supervisors selected by said Board.
- one alternate member of the Modoc County Board of Supervisors selected by said Board.

[89] http://www.facebook.com/devilsgardenresearchandeducation
[90] http://www.devilsgardenucce.org/

- two public members selected by the Lassen County Board of Supervisors. Said members must either reside or own property within the Lassen County portion of the BVGB.
- two public members selected by the Modoc County Board of Supervisors. Said members must either reside or own property within the Modoc County portion of the BVGB.

The BVAC operates in compliance with the Ralph M. Brown Act (Brown Act). BVAC meetings are noticed and agendas posted according to the Brown Act. BVAC meetings are open to the public and public comment is allowed as much as possible given COVID-19 pandemic restrictions.

During the development of Chapters 7 through 9, the BVAC established Ad Hoc committees to investigate, discuss and recommend content for the sustainability goal, sustainable management criteria, monitoring network and projects and management actions.

11.6 Decision-Making Process

The MOU describes the decision-making process for the BVAC. However, while the BVAC made recommendations, it was not a formal decision-making body like the Lassen or Modoc GSAs. The Lassen County GSA, led by the Lassen County Board of Supervisors and the Modoc County GSA, led by the Modoc County Board of Supervisors, were ultimately responsible for adopting and submitting a GSP to DWR. The GSAs considered all input received from the BVAC and other interested parties.

To develop each chapter of the GSP, the GSAs followed an iterative process illustrated in **Figure 11-1**. The process involved multiple drafts of each chapter, including administrative, public and (often multiple) revised drafts. Once the BVAC was satisfied that the chapter was at a point where the GSAs were comfortable to move on, they voted to "set aside" the chapter until the entire draft GSP was assembled. This recommendation did not indicate approval but was implemented to keep the development process moving forward. The GSP was then assembled into a complete draft to undergo the same process of administrative, public and revised drafts. The BVAC will then vote whether to recommend to the GSA boards if they should approve the GSP. The GSA boards will vote whether to approve the GSP prior to submittal to DWR.

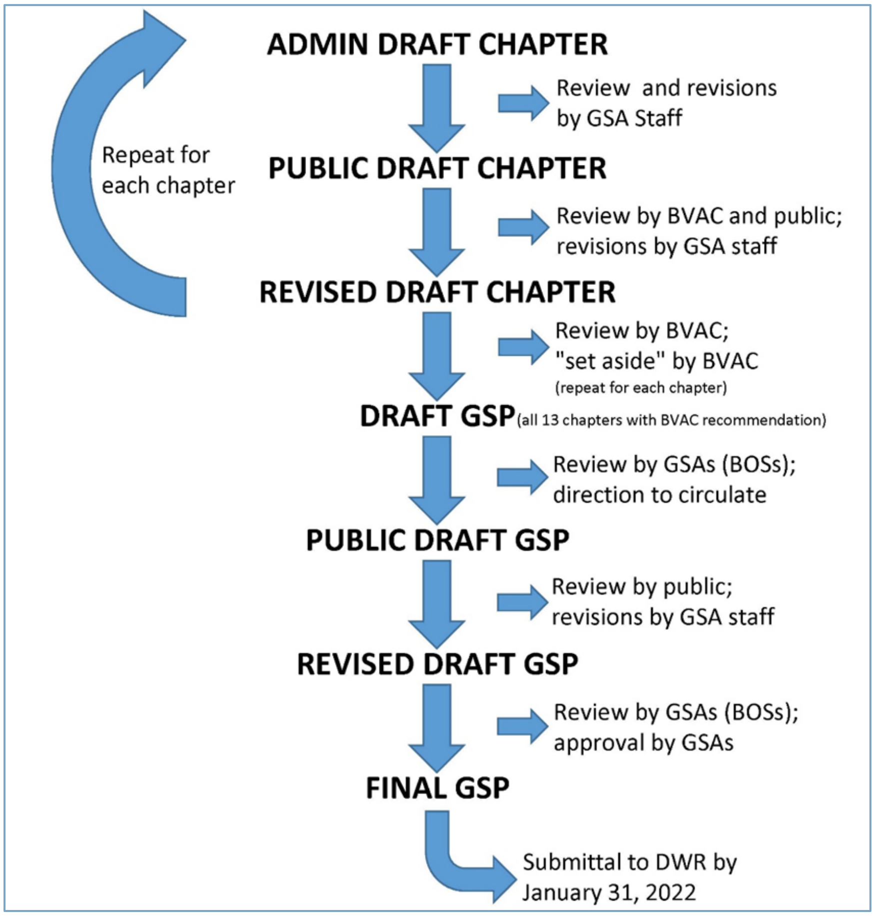


Figure 11-1 GSP Development Process

11.7 Comments and Incorporation of Feedback

All formal feedback on the GSP was documented both through the GSP website and from public meetings. The comments received, including how each comment was addressed, is included in **Appendix 11D**. The BVAC passed resolution BVAC-2021-1 recommending adoption of the original (2022) GSP, included in **Appendix 11E**. The GSA resolutions adopting the original GSP are included in **Appendix 11F**.

11.8 GSP Revision Process

Portions of this GSP were revised in response to the DWR's comment letter dated October 26, 2023 notifying the GSAs that the DWR determined the GSP was incomplete. The DWR provided the GSAs 180 days to revise the GSP, adopt the revised GSP, and submit the revised GSP to the DWR for review. The revision process involved significant communication with the GSAs, their consultants, and the BVAC and two of its ad-hoc committees. The revision process began in December 2023. The GSP revision process timeline included:

- Seven meetings with DWR staff from December 2023 to March 2024. The objectives of these meetings were to clarify DWR's comments and to review and gather feedback on the proposed revisions.

- Two meetings each with the ad-hoc committees responsible for subject matter related to groundwater levels and groundwater quality in the Basin. These meetings occurred in January and February 2024. The objectives of these meetings were to discuss the GSP revisions and to communicate feedback from DWR staff.

- Field visit to the Big Valley Basin on February 22, 2024 and meetings with several stakeholders. West Yost, the ad-hoc committees, and the GSA staff travelled to visit relevant hydrogeologic landmarks around the Basin and met with Basin stakeholders such as Lassen County Water District (public supplier in the Bieber area) and the CA DFW at Ash Creek Wildlife Refuge.

- Over 15 meetings between West Yost and the GSAs from December 2023 through April 2024. The objectives of these meetings were to coordinate DWR/ad-hoc committee/BVAC meetings, review draft meeting materials, and gather initial feedback on draft GSP revisions.

- One BVAC meeting on March 14, 2024. The objectives for this meeting included reconvening the BVAC, re-electing a BVAC Chair and Vice Chair, and reviewing the draft GSP revisions to gather feedback from the public and the BVAC. The BVAC passed a motion to recommend the GSP updates to the GSAs (i.e., Boards) with the authority of the Chair and Vice Chair to make changes prior to submission to the GSAs.

    - The BVAC meeting was widely noticed through the proper communication channels and conducted to facilitate public attendance pursuant to the Brown Act. Meeting notices included publication of meeting information in two editions of Modoc County's local newspaper (The Modoc Record), Modoc and Lassen Counties' websites,[91] advertisement through social media and via the County Farm Advisors, and flyer announcements in major public locations. In addition, the information on Modoc and Lassen Counties' websites and outreach to the interested parties list (see 11.4 and 11.5) included sharing the meeting agenda and packet, containing the draft GSP revisions, eight days prior to the meeting. Meeting advertisement included a video link to facilitate remote attendance. Public attendees included residents of Bieber, Adin, Lookout, and Round Valley, representing diverse geographic areas of the Basin.

  - Following the BVAC meeting, the BVAC Chair and Vice Chair met with the GSAs and West Yost to review final edits made since the BVAC meeting. In addition, a member of the public submitted comments to the BVAC Chair following the BVAC meeting. These comments and the GSAs' responses to them are appended to **Appendix 11D**.

- One hearing at each of the Modoc and Lassen County Boards of Supervisors to gather further public comment and consider adoption of the revised GSP. These hearings will take place on April 9, 2024.

The Modoc and Lassen County Boards of Supervisors are expected to adopt the revised GSP in April 2024. Following its adoption, the revised GSP will be resubmitted to the DWR, where it will be available for public review and comment.

11.9 Communication and Engagement During Plan Implementation

The BVAC was established by the GSAs for the specific purpose of advising during development of the GSP and providing a product that is acceptable to the GSA Boards for approval. The MOU establishing the BVAC therefore expires after the GSP is adopted by the GSAs and submitted to DWR. The C&E during Plan implementation will then shift to the GSA Boards who will continue to inform the public about Plan progress and status of projects and management actions as required by §354.10(d)(4) of the Regulations.

This ongoing C&E will be performed through the forum of meetings of the County Boards of Supervisors where GSA staff will give regular reports to the Boards and the public along with annual reports to be submitted to DWR as required by GSP Regulations. Communication to stakeholders on the interested parties list will continue to occur *via* email and physical mail. Development of annual reports and coordination and implementation of projects and management actions will require significant effort from GSA staff. The GSAs are considering the development of an MOU to clearly define roles, responsibilities, and costs of each GSA.

[91] Sustainable Groundwater Management Act (SGMA) | Lassen County

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Appendix 1A Background Information Regarding Basin Prioritization and Boundary

DEPARTMENT OF WATER RESOURCES
NORTHERN REGION OFFICE
2440 MAIN STREET
RED BLUFF, CA 96080-2356

April 15, 2016

Mr. Richard Egan, Administrative Officer
County of Lassen
Administrative Services
221 S. Roop Street, Suite 4
Susanville, California 96130

Dear Mr. Egan

This letter is in response to your request for information regarding the number of irrigated acres reported in the Big Valley Basin prioritization dataset.

As part of the California Statewide Groundwater Elevation Monitoring (CASGEM) Program legislation, and pursuant to the California Water Code, Section 10933, the Department of Water Resources (DWR) is required to prioritize California's 515 groundwater basins. CASGEM directs DWR to consider, to the extent available, all of the data components listed below:

1. The population overlying the basin
2. The rate of current and projected growth of the population overlying the basin
3. The number of public supply wells that draw from the basin
4. The total number of wells that draw from the basin
5. The irrigated acreage overlying the basin
6. The degree to which persons overlying the basin rely on groundwater as their primary source of water
7. Any documented impacts on the groundwater within the basin, including overdraft, subsidence, saline intrusion, and other water quality degradation
8. Any other information determined to be relevant by DWR (subsequently modified in 2014 to included adverse impacts on local habitat and local streamflow)

In response to the CASGEM legislation, each groundwater basin was prioritized with the best available data and statistically given one of the following rankings: very low, low, medium, or high. To calculate the total irrigated acreage for the initial prioritization, DWR relied on a land survey using detailed analysis units (DAU). Because the DAUs cover a different area than the groundwater basin, DWR estimated the proportion of overlap. For the Big Valley Basin, DWR estimated the irrigated acres for Big Valley groundwater basin based on the proportional amount of irrigated lands in the DAU and additional information gleaned from satellite imagery, ultimately arriving at a figure of 34,129 acres. Recognizing this method was an estimate, all of the groundwater basins were further analyzed by using their actual basin areas for the ranking. This step would have reduced the estimated value of irrigated acreage for the Big Valley basin to 25,545 acres but, for some reason, that did not occur and the value remained at 34,129 acres based on the estimated proportion from the DAU.

On the other hand, the portion of land in the basin identified as partially irrigated land or meadow pasture, which should have been included in the irrigated acreage calculation, was inadvertently omitted. Including this additional area of 26,260 acres brings the total irrigated acreage for the basin to over 51,800 acres.

DWR completed the initial draft basin prioritization in December of 2013. Public outreach for the draft basin prioritization consisted of three public workshops throughout the State and a statewide Webinar where DWR explained the basin prioritization process and requested feedback and comments. The public outreach for basin prioritization was followed by a three-month window where local agencies and water resource managers were encouraged to provide comments and information. During this time, DWR received and addressed a number of comments and data, and made adjustments to the basin prioritizations accordingly, but DWR did not receive any comments regarding the irrigated lands estimate for the Big Valley Basin. The basin prioritization was finalized in June 2014.

In September 2014, the Sustainable Groundwater Management Act (SGMA) was passed requiring all CASGEM medium and high priority basins to comply with the new SGMA law. SGMA also directed DWR to develop regulations to allow local agencies to revise their groundwater basin boundaries to help improve sustainable groundwater management, to update the basin prioritization once the basin boundaries have been modified, and to consider a new SGMA requirements for data component number eight on the previous page that includes adverse groundwater impacts on local habitat and local stream flows during the next basin prioritization update. (See the list of data components shown on the previous page.) The basin boundary regulation was adopted on October 21, 2015, and the solicitation for groundwater basin boundary changes ended in March 31, 2016. The 2016 basin boundary modifications will change basin areas and the number of basins, which could result in ranking changes for some basins. In addition, DWR is currently working with agencies and local water managers to identify the best available data, to gather and update many of the individual basin prioritization data components, and to improve the overall quality of the basin prioritization. Improvements to the basin prioritization data will include the following updated information:

1. Population and population growth will be recalculated for each of the modified basins, with new ranking breakpoints as necessary.
2. Public Supply Wells will be reprocessed for all basins with the assistance of California State Water Resources Control Board, Division of Drinking Water, employing additional selection criteria, with new ranking breakpoints as necessary.
3. The number of Total Wells will be reprocessed for all basins using DWR 's Online System for Well Completion Reports (OSWCR), employing production well selection criteria, with new ranking breakpoints as necessary;
4. Groundwater Reliance (Groundwater Use and percent of total supply) and Irrigated Acreage will be updated for all basins using the latest land use surveys (possibly 2015 statewide) and 2014 water year information.
5. Existing groundwater-related impacts will be reviewed and updated.
6. Potential adverse impacts to local habitat and streamflow due to groundwater extraction will be identified, and a process will be established for ranking these impacts.

DWR plans to begin public outreach for the updated draft basin prioritization in fall 2016, with the final basin prioritization update occurring between December 2016 and February 2017. Unfortunately, it is not possible to reprioritize individual basins outside of this process. Because the individual basin priority is dependent on the relative statewide distribution of each data component, there is no way to predict how the updated prioritization would affect the ranking of any particular basin. Even for those basins where it is known that individual data components have been changed due to improved data, the overall basin priority may remain the same, or even increase due to new SGMA requirements for data component number eight and improvements to the other seven data components. DWR is using new data to estimate irrigated acreage in the Big Valley Basin and, as noted above, the newer data, which was provided to Lassen County Administrative Office, supports a higher value (approximately 51,000 acres).

In closing, I encourage you to visit DWR's basin prioritization website at the following address: http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm. The website contains all of the groundwater basin ranking results, as well as the methodology used in the statistical analysis. If you have additional question concerning basin prioritization or if you might possibly have additional data associated with components one through eight (shown on the first page of this letter) that you would like DWR to consider during the next basin prioritization update, please contact Roy Hull, Engineering Geologist, at (530) 529-7337.

If you have any questions or need additional information, please contact me at (530) 528-7403.

Sincerely,

William Ehorn, Chief
Regional Planning Branch

cc: Scott Morgan, DWR Legal

County of Lassen
ADMINISTRATIVE SERVICES

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CERTIFIED MAIL/ RETURN RECEIPT
7015 0640 0005 0681 0168; 7015 0640 0005 0681 0175

March 18, 2016

Regional Planning Branch
Department of Water Resources
901 P Street, Room 213
Sacramento, CA 94236

Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236

RE: Basin Boundary Modification - Big Valley, Bulletin 118 Basin 5-4

To Whom It May Concern:

This letter is intended to supplement a request by Lassen County to modify Bulletin 118 Basin 5-4 (Big Valley) as permitted under water code, section 340. The adjustment request is External and Scientific and primarily correlates to unmanaged (in terms of contemplating groundwater recharge) portions of the watershed directly impacting recharge in Big Valley.

Summary

The proposed boundary adjustment does not examine, or seek to alter, the extent of water-bearing formations identified in the Bulletin 118 Hydrogeologic analysis. Fundamentally (because Big Valley has been designated as medium priority by the Department of Water Resources), this request is an attempt by Lassen County to ensure management of Big Valley, as required by the Sustainable Groundwater Management Act (SGMA), is successful. Lassen County considers the proposed boundary adjustment to be a critical step toward effective and sustainable management because it empowers the Groundwater Sustainability Agency (GSA) with the ability to identify, consider, and mitigate potential impacts to basin recharge, originating in the basins watershed.

Description

Watershed and subwatershed hydrologic unit boundaries created by the Natural Resource Conservation Service (NRCS) form the proposed perimeter of the basin, after the adjustment. This data set was designed by the NRCS to be used as a tool for water-resource management and planning activities. The original dataset boundaries were adjusted by Lassen County at two points to exclude subwatershed boundaries providing recharge for two or more Bulletin 118 basins.

The NRCS data (table 1 below) assign 9 subwatershed basins to Big Valley totaling approximately 380 square miles. However, an adjustment of roughly 200 acres was applied to the Butte Creek subwatershed polygon, in order to include a portion of the Big Valley basin that had been assigned to the Bulletin 118 Basin 5-36 (Round Valley) watershed.

Table 1: Watershed data

OBJECTID	ACRES	HU_10_NAME	HU_12_NAME	HU_12_TYPE	STATES	SHAPE_Length	SHAPE_Area	
99800	31362	Blacks Canyon-Pit River	Roberts Reservoir-Pit River	S	CA	0.663846	0.013641	1
99589	11815	Juniper Creek	Deer Spring-Juniper Creek	S	CA	0.534262	0.005124	1
99607	9327	Butte Creek-Ash Creek	Hot Springs Slough	U	CA	0.284423	0.004047	1
99624	51531	Widow Valley Creek-Pit River	Bull Run Slough-Pit River	S	CA	0.878017	0.022349	1
99640	24868	Butte Creek-Ash Creek	Butte Creek	S	CA	0.594983	0.01079	1
99641	26769	Willow Creek	Lower Willow Creek	S	CA	0.682247	0.011607	1
99681	20256	Widow Valley Creek-Pit River	Widow Valley Creek	S	CA	0.493075	0.008799	1
99704	43355	Butte Creek-Ash Creek	Big Swamp-Ash Creek	S	CA	0.883789	0.018833	1
99746	24340	Taylor Reservoir	Taylor Creek	S	CA	0.723431	0.010581	1

The proposed boundary will include roughly 50,000 acres of federally managed timberland, 40,000 acres of privately managed timberland, and 60,000 acres of private and public range/grassland currently outside of the Big Valley (Bulletin 118) perimeter. Presently, management of these lands encompassing the Big Valley watershed does not actively consider implications to groundwater recharge. Lassen County contends that effective management of a groundwater basin must consider connectivity of groundwater/ surface water systems. The most basic form of combined groundwater surface water management seeks to ensure sustainable groundwater supplies, by managing and maintaining watersheds and thereby promoting desirable streamflow.

Watershed development to enhance groundwater would promote the use of natural resources, while mitigating the detrimental impacts of land-use activities on soil and water. This proposed adjustment and management approach recognizes that soil, water, and land use occurring in the upland watersheds, are all fundamentally connected to groundwater basins. Some components of watershed development and its role to groundwater are listed in Table 2 below.

Table 2 Common Components of watershed development and its role.

Activity	Objective	Impact
Check dams	Stop/slow down water runoff in gullies	Recharge of groundwater and nearby wells. Creations of open water bodies
Ponds	Groundwater recharge water for cattle	Recharge of groundwater. Creation of big open water bodies
Gully plugs, Gabions	Primarily to trap sediment/silt in gullies and to stabilize	Keeps sediment out of downstream areas. Increased water infiltration due to slowing down water

The intended impact of this proposal, to adjust the Big Valley basin boundary, is to ensure that watershed development is a function of the GSA through an adopted Groundwater Sustainability Plan (GSP). A coordinated management approach, which includes watershed development aimed at increasing groundwater recharge and overall water resource availability, will be necessary to ensure successful implementation of a GSP.

Lassen County has been in contact with Modoc County, the only other Local Agency with jurisdiction over Big Valley, and they are aware of this request. Please contact the Department of Planning and Building Services at (530) 251-8269, if there are any questions.

Sincerely,

FOR: Richard Egan
County Administrative Officer

RE:MLA:mm

Cc: Supervisor Chapman, Chairman District 2; Supervisor Pyle, District 1; Supervisor Hemphill, District 3; Supervisor Albaugh, District 4; Supervisor Hammond, District 5; Bob Burns, County Counsel; Richard Egan, County Administrative Officer.

S:\PLA\Admin\FILES\1252\Response to denial of Big Valley boundary adjustment

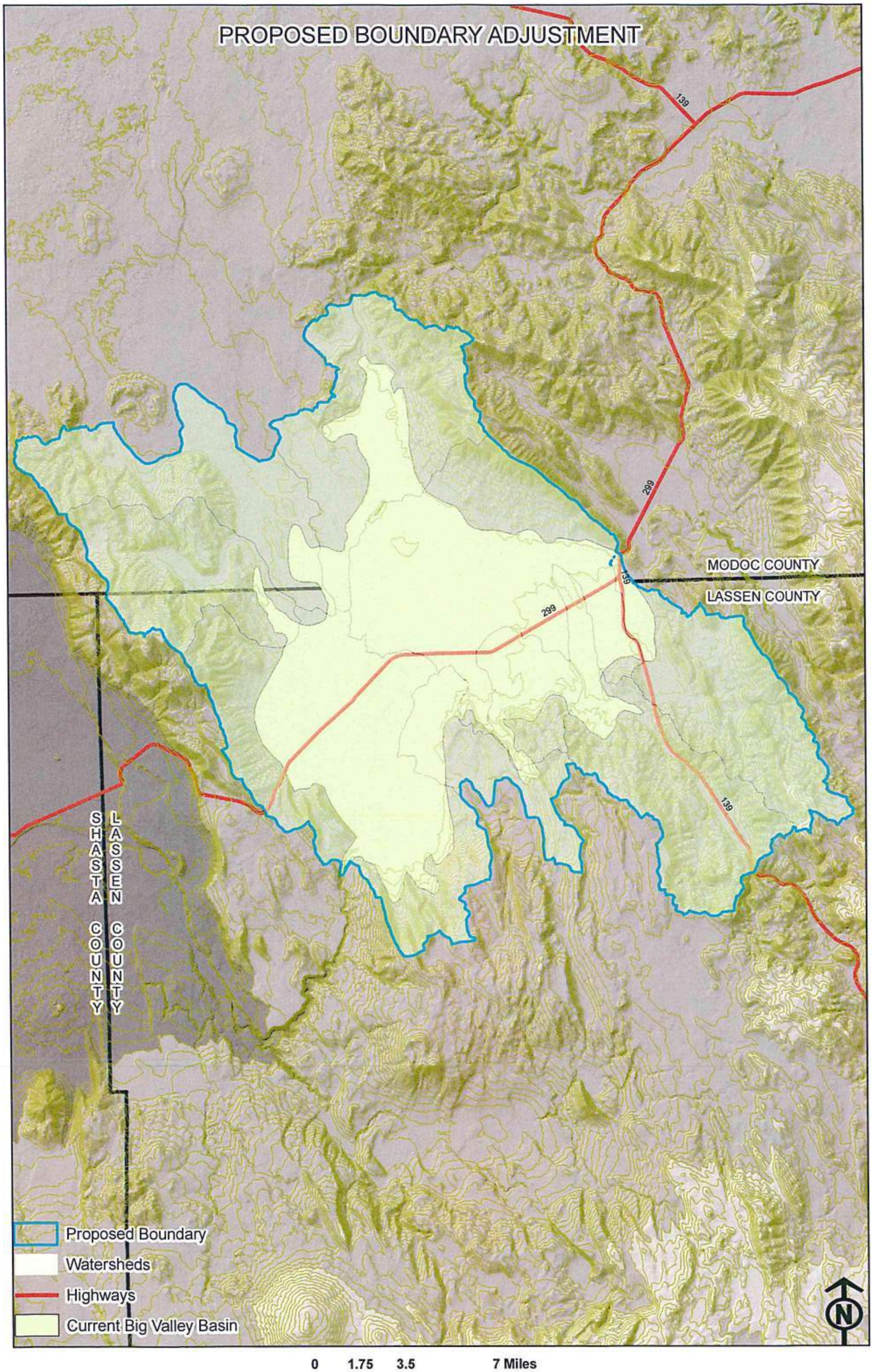
PROPOSED BOUNDARY ADJUSTMENT
139
299
MODOC COUNTY
LASSEN COUNTY
139
299
139
SHASTA COUNTY
LASSEN COUNTY
Proposed Boundary
Watersheds
Highways
Current Big Valley Basin
N
0
1.75
3.5
7 Miles

Table 1. 2016 Final Basin Boundary Modifications

Basin/Subbasin	Request Agency	Lead Region Office	Short Description	Modification Type	Recommendation	Regulatory Basis for Denial Article 6	Summary Draft Decisions
1-02.01 KLAMATH RIVER VALLEY - TULELAKE	Tulelake Irrigation District	NRO	Tulelake Irrigation District (TID) is exploring a modification to the Tule Lake...	Scientific External	**Approved**		This request was approved because it met the technical requirements of the regulation and provided the necessary supporting documentation, technical studies, local outreach and/or notification.
5-04 BIG VALLEY	Lassen County	NRO	Watershed and subwatershed hydrologic unit boundaries form the proposed perimeter...	Scientific External	**Denied**	345.2(c) and (d)	This request did not include sufficient detail and/or required components necessary to support approval of the request. The proposed modification included volcanic rock geologic units (not alluvial basin material) and evidence was not provided to substantiate the connection to the porous permeable alluvial basin, nor were conditions presented that could potentially support radial groundwater flow as observed in alluvial basins.
5-21.52 SACRAMENTO VALLEY - COLUSA, 5-21.51 SACRAMENTO VALLEY - CORNING	Tehama County Flood Control & Water Conservation District	NRO	Jurisdictional Consolidation of the Tehama County portion of the Colusa Subbasin...	Jurisdiction Consolidation	**Approved**		This request was approved because it met the technical requirements of the regulation and provided the necessary supporting documentation, technical studies, local outreach and/or notification.
2-9.04 SANTA CLARA VALLEY - EAST BAY PLAIN, 2-9.01 SANTA CLARA VALLEY - NILES CONE	Alameda County Water District	NCRO	Request to correct the boundary of the Niles Cone Groundwater Basin (Niles Cone...	Jurisdiction Internal	**Approved, as modified**		This request was approved with minor modifications to the eastern boundary to align with the lateral extent of alluvium. The request for jurisdictional modification was supported by sufficient technical information and necessary affected local agencies provided letters in support of the modification.
3-03.01 GILROY-HOLLISTER VALLEY - LLAGAS AREA	Santa Clara Valley Water District	NCRO	Modify eastern Llagas Subbasin boundary to match extent of water-bearing sediment...	Scientific External	**Approved**		This request was approved because it met the technical requirements of the regulation and provided the necessary supporting documentation, technical studies, local outreach and/or notification.
5-21.60 SACRAMENTO VALLEY - NORTH YUBA	Yuba County Water Agency	NCRO	Subdivision of the North Yuba Subbasin along the Butte-Yuba county line	Jurisdiction Subdivision	**Approved, as modified**		The modification request was originally submitted as a jurisdictional subdivision, however, during the review of the request it was revealed that the Department introduced a significant error in the basin boundary sometime between 2003 and 2014, resulting in a portion of Butte County being applied to the North Yuba subbasin. The Department corrected the error during this modification submission period.
5-21.61 SACRAMENTO VALLEY - SOUTH YUBA, 5-21.64 SACRAMENTO VALLEY - NORTH AMERICAN	Placer County	NCRO	Request to adjust the subbasin boundary to align with the Yuba / Placer county ...	Jurisdiction Internal	**Approved**		This request was approved because it met the technical requirements of the regulation and provided the necessary supporting documentation, technical studies, local outreach and/or notification.
5-21.67 SACRAMENTO VALLEY - YOLO, 5-21.52 SACRAMENTO VALLEY - COLUSA, 5-21.68 SACRAMENTO VALLEY - CAPAY VALLEY, 5-21.66 SACRAMENTO VALLEY - SOLANO	Yolo County Flood Control And Water Conservation District	NCRO	County Basin Consolidation of four subbasins within Yolo County to existing County...	Jurisdiction Internal, Jurisdiction Consolidation	**Approved, as modified**		The request was approved as a county consolidation of basins within Yolo County with additional internal jurisdictional modifications. The internal jurisdictional modifications included exclusion of some local agency areas within Yolo County which remained in the Solano subbasin. There were also minor jurisdictional modifications applied to the eastern edge of the proposed subbasin and coincident boundaries of Sutter, North American and South American subbasins to align the boundary along county boundaries rather than along hydrologic features.
5-22.01 SAN JOAQUIN VALLEY - EASTERN SAN JOAQUIN, 5-22.16 SAN JOAQUIN VALLEY - COSUMNES	Eastern San Joaquin County Groundwater Basin Authority	NCRO	A boundary modification to merge a portion of the Cosumnes Subbasin into the Ea...	Jurisdiction Internal	**Approved**		This request was approved because it met the technical requirements of the regulation and provided the necessary supporting documentation, technical studies, local outreach and/or notification.

County of Lassen
ADMINISTRATIVE SERVICES

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August 14, 2018

Trevor Joseph
Department of Water Resources
Sustainable Groundwater Management Office
P.O. Box 942836
Sacramento CA 94236-0001

Dear Mr. Joseph:

This letter is in regard to the proposed ranking of the Big Valley Groundwater Basin as a medium priority basin pursuant to the Sustainable Groundwater Management Act (Part 2.74 of the California Water Code). The Lassen County Board of Supervisors has elected to be the Groundwater Sustainability Agency for the Lassen County portion of the basin and the Modoc County Board of Supervisors has elected to be the Groundwater Sustainability Agency for the Modoc County portion of the basin pursuant to said Act and has been designated as such. Lassen and Modoc County are working in a coordinated effort to comply with the Sustainable Groundwater Management Act by retaining local control for the benefit of our constituents.

This letter is to provide comments regarding the above ranking and present justification for consideration to reduce the 2018 Big Valley Groundwater Basin prioritization score.

The 2018 ranking considered the following additional criteria that were not previously considered for the 2014 prioritization (2018 SGMA Basin Prioritization Process and Results):

- The updated SGMA provision in component 8 that requires consideration of *"…adverse impacts on local habitat and local stream flows";*
- Other information from a sustainable groundwater management perspective in accordance with the provision *"Any other information determined to be relevant by the Department...";*
- Use of updated datasets and information in accordance with the provision *"…to the extent data are available"*.

Based on the SGMA updates to component 8, the 2018 SGMA Basin Prioritization considered the following four new sub-components:

- Adverse impacts on local habitat and local streamflows

- Adjudicated areas
- Critically overdrafted basins
- Groundwater related transfers

Lassen and Modoc County have carefully evaluated the information and data provided to establish the 2018 SGMA Basin Prioritization results. The datasets, methodologies, and documentation provided for this process are an improvement over the previous prioritization, and DWR made efforts to standardize the datasets and criteria used for nearly all the components including Component 7: Impacts. However, DWR did not make adequate consideration of the severity of the impacts for Component 7 and did not apply consistent methodologies and justification for Component 8. Particular inadequacies related to Big Valley's prioritization include:

Component 7 Impacts: Declining Groundwater Levels

Groundwater levels in Big Valley have remained stable in some areas and declined in others over the last 10 years. Declines have been as much as 30 feet, but have been rising since 2016. Prioritization points for declining groundwater level are appropriate in this basin, however the identical score was given to all basins in the state with documented water level declines. This includes critically overdrafted basins where water levels have declined hundreds of feet, chronically over the course of many decades. Evaluating Big Valley's water level declines on par with these basins does not adequately represent Big Valley's priority in the state and therefore we would like to request DWR reconsider the points associated with this portion of the scoring criteria.

Component 7 Impacts: Water Quality

This scoring appears to be based on 14 measurements that exceeded the Secondary MCL (maximum contaminant level) for iron and manganese at the two wells used to supply water to the town of Bieber. Although secondary MCLs are enforceable standards in California, they are *not* due to public health concerns but, due to nuisance and aesthetics such as taste, color, and odor. Iron and manganese are not typically concerns for agricultural use, which is the primary beneficial use in Big Valley. Iron and manganese are naturally occurring minerals that are prevalent in volcanic areas such as Big Valley. These water quality issues are therefore not due to mismanagement of the resource and conversely cannot be substantially addressed through better management. Again, DWR did not make adequate consideration of the severity of this issue, with Big Valley receiving the same number of points as areas of the state that have significant issues with salinity, nitrate, and toxic metals that have a much greater impact on beneficial uses and human health and have the potential to be better managed under SGMA.

Further we ask that DWR consider methodologies for Component 7 to account for the severity of each impact. If those methodologies cannot be developed, we ask that DWR use their discretion to adjust points in consideration of the low level of severity of these impacts for Big Valley.

Component 8b: Other Information Deemed Relevant by the Department

While DWR did apply their methodologies consistently for Components 1 through 7, they were not consistent with Component 8 and provided little justification in applying five (5) points to Big Valley Basin for:

1. "Headwaters for Pit River/Central Valley Project - Lake Shasta"
2. "Extensive restoration project at Ash Creek State Wildlife Area has improved groundwater levels in immediate vicinity of project but declining groundwater levels over past 10 years persist outside of project area which includes numerous wetlands and tributaries to the Pit River."

This limited information about the application of DWR's discretion on these points begs numerous questions such as:

1. What headwaters does this refer to? Headwaters of the Pit River? Headwaters of the CVP? Headwaters of Lake Shasta?
2. What are DWR's concerns relative to Big Valley's position within the watershed?
3. What concerns does DWR have specific to Big Valley, given that there are numerous other groundwater basins within the Pit River, Lake Shasta, CVP and State Water Project watersheds that were not awarded these points?
4. Why are water levels in the vicinity of Ash Creek and other wetlands considered "other information deemed relevant"? Wasn't this information already considered in Component 7: Declining Groundwater Levels and Component 8a: Streamflow and Habitat?

Due to the need for further clarification on the preceeding questions regarding component 8b, both Lassen and Modoc GSAs would like to request the points associated with this portion of the scoring criteria be reconsidered.

Lassen and Modoc County understand the vast complexity of evaluating each basins data and information, however, we feel a further assessment of the 2018 SGMA Basin Prioritization score is desired by both GSAs. For the above reasons, Lassen and Modoc County GSAs would like to request an assessment of the questions regarding the basins data, detailed in this letter, to be reviewed for a potential lowering of the overall basin score. We appreciate the consideration of our comments and look forward to hearing from you.

Sincerely,

Chris Gallagher, Chairman
Lassen County Board of Supervisors

Patricia Cullins, Chair
Modoc County Board of Supervisors

Appendix 2A Resolutions Establishing Lassen and Modoc Counties as the GSAs for the BVGB

RESOLUTION NO. 17-013

A RESOLUTION OF THE BOARD OF SUPERVISORS OF LASSEN COUNTY ELECTING TO BE THE GROUNDWATER SUSTAINABILITY AGENCY FOR ALL PORTIONS OF THE BIG VALLEY (BASIN NUMBER 5-004) GROUNDWATER BASIN LOCATED WITHIN LASSEN COUNTY, PURSUANT TO THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT OF 2014

WHEREAS, the Legislature has adopted, and the Governor has signed into law, Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act of 2014 (SGMA); and

WHEREAS, the Sustainable Groundwater Management Act of 2014 went into effect on January 1, 2015; and

WHEREAS, the legislative intent of SGMA is to, among other goals, provide for sustainable management of groundwater basins and sub-basins defined by the California Department of Water Resources (DWR), to enhance local management of groundwater, to establish minimum standards for sustainable groundwater management, and to provide specified local agencies with authority and technical and financial assistance necessary to sustainably manage groundwater; and

WHEREAS, the Sustainable Groundwater Management Act of 2014 enables the State Water Resources Control Board to intervene in groundwater basins unless a local public agency or combination of local public agencies form a groundwater sustainability agency (GSA) or agencies by June 30, 2017; and

WHEREAS, retaining local jurisdiction over water management and land use is essential to sustainably manage groundwater and to the vitality of Lassen County's economy, communities and environment, and

WHEREAS, any local public agency that has water supply, water management or land use responsibilities within a groundwater basin may elect to be the groundwater sustainability agency for that basin; and

WHEREAS, Lassen County is a local public agency organized as a general law County under the State Constitution; and

WHEREAS, in 1995 the California Supreme Court declined to review an appeal of a lower court decision, *Baldwin v. County of Tehama* (1994), that holds that State law does not occupy the field of groundwater management and does not prevent cities and counties from adopting ordinances to manage groundwater under their police powers; and

WHEREAS, in 1999 the Lassen County Board of Supervisors adopted Ordinance Number 539 (codified at Chapter 17.01 of County Code), requiring a permit to export any groundwater from Lassen County; and

WHEREAS in 2007, the Lassen County Board of Supervisors adopted a *Groundwater*

Management Plan; as authorized by California Water Code Section 10753(a); and

WHEREAS, in 2012 the Lassen County Board of Supervisors adopted Ordinance Number 2012-001 (codified at Chapter 17.02 of County Code), which in part adopts a basin management objective program to facilitate the understanding and public dissemination of groundwater information in Lassen County; and

WHEREAS, in December of 2015, the Lassen County Board of Supervisors adopted the *Groundwater Monitoring Plan for Lassen County*, which was in turn approved by the California Department of Water Resources, making Lassen County the designated monitoring entity pursuant to the California Statewide Groundwater Elevation Monitoring (CASGEM) program; and

WHEREAS, the County overlies those portions of the Big Valley (Basin 5-004) Groundwater Basin located within Lassen County; and

WHEREAS, Section 10723.2 of the Sustainable Groundwater Management Act of 2014 requires that a GSA consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans; and

WHEREAS, Section 10723.8 of the Sustainable Groundwater Management Act of 2014 requires that a local agency electing to be a GSA notify the California Department of Water Resources of its election and its intent to undertake sustainable groundwater management within a basin; and

WHEREAS, On January 26, 2017, the Lassen County Planning and Building Services Department conducted a public meeting within the affected basin, in the community of Bieber, to solicit comment as to whether the Board of Supervisors should or should not be the sustainable groundwater agency for the Big Valley Basin. Notice of said public meeting was published in the Lassen County Times, Mountain Echo, and Modoc County Record; mailed to the list of interested parties; and posted at various places around the basin where announcements are posted; and

WHEREAS, The January 26, 2017, meeting resulted in the identification of additional "interested parties", that were added to the previously compiled list of interested parties.

WHEREAS, the County held a public hearing on this date after publication of notice pursuant to Government Code section 6066 to consider adoption of this Resolution. Notice, as provided for at Government Code Section 6066 was published in the Lassen County Times, Mountain Echo, and Modoc County Record; mailed to the list of interested parties; and posted at various places around the basin where announcements are posted; and

WHEREAS, it would be in the public interest of the people of Lassen County for the County to become the groundwater sustainability agency for all those portions of the Big Valley (Basin 5-004) Groundwater Basin located within Lassen County; and

WHEREAS, the County and other local public agencies have a long history of coordination and cooperation on water management; and

WHEREAS, it is the intent of the County to work cooperatively with other local agencies and Counties to manage the aforementioned groundwater basin in a sustainable fashion; and

WHEREAS, The Environmental Review Officer of Lassen County has determined that the action taken under this Resolution is exempt from the California Environmental Quality Act (Public Resources Code §21000, et seq.) ("CEQA") Under the Class 7 and Class 8, CEQA Guidelines Exemptions §§15307, 15308, and 15320 because the formation of a GSA, as provided for under state law, is meant to assure the maintenance, restoration, or enhancement of a natural resource and the regulatory process involves procedures for the protection of the environment.

NOW, THEREFORE BE IT RESOLVED AS FOLLOWS:

1. The foregoing recitals are true and correct.

2. The Board of Supervisors further finds that:

   a. The Board of Supervisors hereby concurs with the Lassen County Environmental Review Officer that adoption of this Resolution is exempt from the California Environmental Quality Act under CEQA Guidelines Exemptions §§15307, 15308, and 15320. The Environmental Review Officer is hereby directed to file a Notice of Exemption with the Lassen County Clerk for the actions taken in this Resolution.

   b. The proposed boundaries of the basin that the County intends to manage under the Sustainable Groundwater Management Act of 2014 shall be the entirety of the boundaries for the aforementioned groundwater basin, as set forth in California Department of Water Resources Bulletin 118 (updated in 2003), that lie within the County of Lassen; provided that the Board of Supervisors is authorized and directed to evaluate whether basin boundaries should be adjusted in a manner that will improve the likelihood of achieving sustainable groundwater management.

   c. Lassen County hereby elects to become the groundwater sustainability agency, as defined at Section 10721 of the California Water Code, for all those portions of the Big Valley (Basin 5-004) Groundwater Basin located within Lassen County.

   d. Within thirty days of the date of this Resolution, the Director of the Planning and Building Services Department is directed to provide notice of this election to the California Department of Water Resources in the manner required by law. Such notification shall include a map of the portion of the basin that the County intends to manage under the Sustainable Groundwater Management Act of 2014, a copy of this resolution, a list of interested parties developed pursuant to Section 10723.2 of the Act, and an explanation of how their interests will be considered in the development and operation of the groundwater sustainability agency and the development and implementation of the agency's groundwater sustainability plan.

   e. The Director of the Planning and Building Services Department and legal counsel are hereby directed to promptly prepare a Memorandum of Understanding with Modoc County to collaboratively develop a groundwater sustainability plan for the Big Valley (Basin 5-004) Groundwater Basin for Board consideration.

f. The Director of the Planning and Building Services Department shall begin discussions with other local agencies in this basin in order to begin the process of developing a groundwater sustainability plan for the basin, in consultation and close coordination with other local agencies, as contemplated by the Act.

g. The Director of the Planning and Building Services Department be directed to report back to the Board at least quarterly on the progress toward developing the groundwater sustainability plan.

The foregoing resolution was adopted at a regular meeting of the Lassen County Board of Supervisors of the County of Lassen, State of California, held on the 14 th day of March, 2017 by the following vote:

AYES: Supervisors Gallagher, Teeter, Hemphill, Albaugh and Hammond

NOES: NONE

ABSTAIN: NONE

ABSENT: NONE

Aaron Albaugh

Chairman of the Board of Supervisors
County of Lassen, State of California

ATTEST:
JULIE BUSTAMANTE
Clerk of the Board

BY Crystle Henderson
~~SUSAN OSGOOD~~ Crystle Henderson, Deputy Clerk of the Board

I, ~~SUSAN OSGOOD~~ Crystle Henderson, Deputy Clerk of the Board of the Board of Supervisors, County of Lassen, do hereby certify that the foregoing resolution was adopted by the said Board of Supervisors at a regular meeting thereof held on the 14 th day of March, 2017

Crystle Henderson

Deputy Clerk of the County of Lassen Board of Supervisors

s/pla/admin/files/1252.02/3-14-17 resolution

RESOLUTION # 2017-09

A RESOLUTION OF THE BOARD OF SUPERVISORS OF THE COUNTY OF MODOC ELECTING TO BE THE GROUNDWATER SUSTAINABILITY AGENCY FOR PORTIONS OF THE BIG VALLEY GROUNDWATER BASIN (BASIN NUMBER 5-004) WITHIN MODOC COUNTY

WHEREAS, the Legislature has adopted, and the Governor has signed into law, Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act of 2014; and

WHEREAS, the Sustainable Groundwater Management Act of 2014 went into effect on January 1, 2015; and

WHEREAS, the Sustainable Groundwater Management Act of 2014 enables the State Water Resources Control Board to intervene in groundwater basins unless a local public agency or combination of local public agencies form a Groundwater Sustainability Agency or Agencies (GSA) by June 30, 2017; and

WHEREAS, retaining local jurisdiction over water management and land use is essential to sustainably manage groundwater and to the vitality of Modoc County's economy, communities, and environment, and

WHEREAS, any local public agency that has water supply, water management, or land use responsibilities within a groundwater basin may elect to be the Groundwater Sustainability Agency for that basin; and

WHEREAS, Modoc County is a public agency as defined by 10721 of the Water Code; and

WHEREAS, under Section 10723(a), the County is responsible for portions of the Big Valley Groundwater Basin as shown on the map hereto in "Exhibit A"; and

WHEREAS, the County overlies those portions of the Big Valley 5-004 located within Modoc County; and

WHEREAS, Section 10723.2 of the Sustainable Groundwater Management Act of 2014 requires that a GSA consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans; and

WHEREAS, Section 10723.8 of the Sustainable Groundwater Management Act of 2014 requires that a local agency electing to be a GSA notify the Department of Water Resources of its election and its intent to undertake sustainable groundwater management within a basin; and

WHEREAS, the County held a public hearing on this date after publication of notice in the Modoc Record pursuant to Government Code section 6066 to consider adoption of this Resolution; and

WHEREAS, it would be in the public interest of the people of Modoc County for the County to become the groundwater sustainability agency for all those portions of the Big Valley 5-004 Groundwater Basin located within Modoc County; and

WHEREAS, the County and other local public agencies have a long history of coordination and cooperation on water management; and

WHEREAS, it is the intent of the County to work cooperatively with other local agencies and Counties to manage the aforementioned groundwater basins in a sustainable fashion;

NOW, THEREFORE, BE IT RESOLVED, that Modoc County hereby elects to become the Groundwater Sustainability Agency for all those portions of the Big Valley 5-004 Groundwater Basin located within Modoc County.

BE IT FURTHER RESOLVED that the proposed boundaries of the basin that the County intends to manage under the Sustainable Groundwater Management Act of 2014 shall be the entirety of the boundaries for the aforementioned basin, as set forth in California Department of Water Resources Bulletin 118 (updated in 2003), that lie within the County of Modoc; provided that the Board of Supervisors is authorized and directed to evaluate whether basin boundaries should be adjusted in a manner that will improve the likelihood of achieving sustainable groundwater management.

BE IT FURTHER RESOLVED that within thirty days of the date of this Resolution, the designated Staff Liaison to the Groundwater Resources Advisory Committee ("GRAC") is directed to provide notice of this election to the California Department of Water Resources in the manner required by law. Such notification shall include a map of the portion of the basin that the County intends to manage under the Sustainable Groundwater Management Act of 2014, a copy of this resolution, a list of interested parties developed pursuant to Section 10723.2 of the Act, and an explanation of how their interests will be considered in the development and operation of the groundwater sustainability agency and the development and implementation of the agency's groundwater sustainability plan.

BE IT FURTHER RESOLVED that the designated Staff Liaison to the GRAC and County Counsel are hereby directed to promptly prepare a Memorandum of Understanding with Lassen County to collaboratively develop a Groundwater Sustainability Plan for the Big Valley 5-04 Groundwater Basin for Board consideration.

BE IT FURTHER RESOLVED that the designated Staff Liaison to the GRAC shall begin discussions with other local agencies in this basin in order to begin the process of developing groundwater sustainability plans for the basin, in consultation and close coordination with other local agencies, as contemplated by the Act.

BE IT FURTHER RESOLVED that that the designated Staff Liaison to the GRAC or the Chairman of the GRAC be directed to report back to the Board at least quarterly on the progress toward developing the groundwater sustainability plans.

PASSED AND ADOPTED by the Board of Supervisors of the County of Modoc, State of California, on the 28th day of February, 2017 by the following vote:

Motion Approved:

RESULT:	**APPROVED [UNANIMOUS]**
MOVER:	David Allan, Supervisor District I
SECONDER:	Patricia Cullins, Supervisor District II
AYES:	David Allan, Supervisor District I, Patricia Cullins, Supervisor District II, Kathie Rhoads, Supervisor District III, Geri Byrne, Supervisor District V
ABSENT:	Elizabeth Cavasso, Supervisor District IV

BOARD OF SUPERVISORS
OF THE COUNTY OF MODOC

Geri Byrne

Geri Byrne, Chair
Modoc County Board of Supervisors

BOARD OF SUPERVISORS MODOC COUNTY, CALIFORNIA

ATTEST:

Tiffany Martinez

Tiffany Martinez
Deputy Clerk of the Board

Appendix 2B MOU Establishing the Big Valley Groundwater Advisory Committee

CONTRACT
#19-69

MEMORANDUM OF UNDERSTANDING FORMING THE BIG VALLEY GROUNDWATER BASIN ADVISORY COMMITTEE (BVAC) TO ADVISE THE LASSEN AND MODOC GROUNDWATER SUSTAINABILITY AGENCIES DURING THE DEVELOPMENT OF THE GROUNDWATER SUSTAINABILITY PLAN REQUIRED UNDER THE 2014 SUSTAINABLE GROUNDWATER MANAGEMENT ACT FOR THE BIG VALLEY GROUNDWATER BASIN

1. Background

The Sustainable Groundwater Management Act (SGMA) is codified as Part 2.74 of the California Water Code (Section 10720 et seq). The regulations adopted to enforce the provisions of the Act are found in Section 350 et seq, Division 2, Chapter 1.5, Subchapter 2 of Title 23 of the California Code of Regulations. The Sustainable Groundwater Management Act (SGMA) became effective January 1, 2015.

This memorandum of understanding pertains to the Big Valley Groundwater Basin (BVGB), which has been designated as a "medium priority" basin by the California Department of Water Resources (DWR). This designation as a medium priority basin requires preparation of a Groundwater Sustainability Plan (GSP) under the Act.

The SGMA was created to ensure groundwater basins throughout the state are managed to reliably meet the needs of all users, while mitigating changes in the quality and quantity of groundwater. The intent of the Act as described in section 10720.1 of the Water Code is to:

- Provide for the sustainable management of groundwater basins.
- Enhance local management of groundwater consistent with rights to use or store groundwater.
- Establish minimum standards for sustainable groundwater management.
- Provide local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater.
- Avoid or minimize subsidence.
- Improve data collection and understanding about groundwater.
- Increase groundwater storage and remove impediments to recharge.
- Manage groundwater basins through the action of local governmental agencies to the greatest extent feasible, while minimizing state intervention to only when necessary to ensure that local agencies manage groundwater in a sustainable manner.

The role of the Groundwater Sustainability Agency (GSA) is to create a GSP and then to implement and enforce that plan. The plan must include measurable objectives that can be used to demonstrate the basin is sustainably managed within twenty (20) years of implementation.

2. Purpose

The purpose of this memorandum is to:

a. Establish the Big Valley Groundwater Basin Advisory Committee (BVAC) and its responsibilities.
b. Establish the membership of the BVAC.
c. Describe how meetings of the BVAC will be conducted and how information, findings, conclusions, decisions, etc. of the BVAC will be conveyed to the Lassen County Groundwater Sustainability Agency (GSA) and to the Modoc County Groundwater Sustainability Agency (GSA).

3. Recitals

a. In September 2014, the Governor signed into law a legislative package (three bills), collectively known as the Sustainable Groundwater Management Act (SGMA), which requires local agencies with land use and/or water management or water supply authority to do certain things to reach sustainability of medium and high priority groundwater basins as designated by the State of California Department of Water Resources (DWR). SGMA became effective on January 1, 2015.

b. The Big Valley Groundwater Basin has been designated a medium priority basin by the DWR.

c. This MOU is dedicated to the Big Valley Groundwater Basin, not any other basin in either Lassen or Modoc Counties.

d. The Lassen and Modoc County Board of Supervisors have adopted resolutions (17-013 and 2017-09 respectively) declaring themselves to be the Groundwater Sustainability Agency (GSA) for the portion of the Big Valley Groundwater Basin within their respective jurisdictions.

e. No other agency pursued GSA status and therefore Lassen and Modoc Counties were awarded exclusive GSA status by DWR for the portion of the Big Valley Groundwater Basin within their respective jurisdictions.

f. GSAs are required to develop Groundwater Sustainability Plans (GSP) for all medium and high priority basins, and said GSP for the BVGB is to be submitted to the DWR by January 31, 2022.

g. Absent a qualified planning process which produces a Groundwater Sustainability Plan, the State Water Resources Control Board (State Board) is authorized to declare that the subbasins are out of compliance and thereby they will intervene and place the subbasins on probation with regard to SGMA.

h. Lassen County has been awarded a grant (Grant Number 4600012669) to provide funding for the preparation of a GSP for the BVGB.

i. Lassen and Modoc Counties intend to work cooperatively in the preparation of a GSP for the BVGB and prepare one GSP that covers the entirety of the basin.

j. Lassen and Modoc Counties see the value of stakeholder input into the development and implementation of a Groundwater Sustainability Plan for the Big Valley Groundwater Basin.

k. It is the intent of this MOU to form an advisory committee that would advise both Lassen and Modoc Counties on the preparation of a GSP for the basin.

4. Goals of the BVAC are as follows:

a. Work collaboratively and transparently with other members to identify common goals, foster mutual understanding, and develop a GSP that all members and their constituents can live with and support;
b. Develop a common understanding of existing groundwater resources, including groundwater dependent habitats, public trust resources and the current and future needs of all beneficial uses and users in the Big Valley groundwater basin, as well as current and future water needs;
c. Solicit and incorporate community and stakeholder interests into committee discussions and emerging committee agreements in order to develop a locally-informed and broadly supported GSP;
d. Consider and integrate science, to the best of its ability and with support from qualified scientific consultants, during GSP development and implementation;
e. Support implementation efforts guided by GSP goals to use, monitor, and manage water resources in a sustainable manner, ensure local control, address current and future local water needs, and support the agricultural economy, Adin, Bieber, Nubieber, Lookout, and outlying communities, tourist visitation and fish and wildlife habitat in the basin;
f. Negotiate in good faith to achieve consensus on management of groundwater resources in the Big Valley groundwater basin into the future;
g. Advise the Lassen and Modoc GSAs on the preparation of a Groundwater Sustainability Plan (GSP);
h. Provide a forum for the public to comment during the preparation of the GSP;
i. Provide recommendations to the Lassen and Modoc GSAs that would result in actions which have as minimal impact as possible on the residents of Big Valley groundwater basin;
j. Advise the Lassen and Modoc GSAs on the preparation of a GSP to produce the lowest possible future costs to the residents of Big Valley; and
k. Ensure local control of the Big Valley Groundwater Basin be maintained by the Lassen and Modoc GSAs.

As a standing committee of the Lassen and Modoc GSA's, the Advisory Committee will operate in compliance with the Ralph M. Brown Act (Brown Act). Committee meetings will be noticed and agendas posted according to the Brown Act. All meetings will be open to the public and allow public comment. Speakers will generally be limited to three minutes, but time may be adjusted based upon meeting circumstances. As needed, the Chair may place time limits on public comments to ensure that the committee is reasonably able to address all agenda items during the course of a meeting. The Lassen GSA will announce committee meetings on its website and through its regular communication channels. Recommendations and advice from the committee will be presented to the Lassen and Modoc GSA's through their staff.

5. BVAC Membership Composition

1. One (1) member of the Lassen County Board of Supervisors selected by said Board.
2. One (1) alternate member of the Lassen County Board of Supervisors selected by said Board
3. One (1) member of the Modoc County Board of Supervisors selected by said Board.
4. One (1) alternate member of the Modoc County Board of Supervisors selected by said Board
5. Two (2) public members selected by the Lassen County Board of Supervisors. Said members must either reside or own property within the Lassen County portion of the Big Valley Groundwater Basin.
6. Two (2) public members selected by the Modoc County Board of Supervisors. Said members must either reside or own property within the Modoc County portion of the Big Valley Groundwater Basin.

Member vacancies

If a vacancy occurs, the respective GSA will select a new committee member. Applications or letter of intent for all members of the committee must be kept on file with the respective GSA. An appointing GSA must notify the other GSA in writing if a member of the BVAC has been replaced.

Committee Member Terms

- Committee members serve four (4) year terms starting from the date of their appointment. If any committee member decides, for any reason, to terminate his or her role, he/she will notify GSA staff as soon as possible after making such a determination. Committee members interested in serving beyond four (4) years must re-apply through the GSA's application process.
- The chair and vice-chair will serve one a (1) year term. At the culmination of the term of a chair or vice-chair, the committee will use its decision-making procedures to nominate and confirm a new chair and vice-chair. Any interested chair or vice chair may be nominated for a second term, however, no chair or vice-chair shall serve more than two (2) consecutive terms.

6. BVAC Roles and Responsibilities

This section describes roles and responsibilities that the Big Valley Advisory Committee Members commit to during development and implementation of the Big Valley groundwater basin GSP.

Convener

The Lassen and Modoc GSA's, are the final decision maker in the GSP process. The GSA's will:

- Provide guidance, evaluation and feedback that directs GSA staff and Advisory Committee members to build and implement an effective GSP;

- Work collaboratively with GSA staff, Advisory Committee members, consultants, and constituents;
- Receive, evaluate, and decide on all GSP and SGMA related actions that come in the form of advice and recommendations from the Big Valley Advisory Committee;
- Welcome feedback that pertains to the GSP from all diverse stakeholder interests in each groundwater basin; and
- Serve as a representative for the basin, making decisions in the best interest of achieving and maintaining long-term groundwater sustainability for all beneficial uses and users of water in the basin.

Advisory Committee Members
Members of the Advisory Committee ("members") collectively represent the diversity of beneficial groundwater uses and users in the Big Valley groundwater basin. Committee members commit to:

- Serve as strong, effective advocates and educators for the interest group (constituency) represented;
- Nominate and confirm a committee chair and vice chair every year;
- Arrive at each meeting fully prepared to discuss all agenda items and relevant issues. Preparation may include, but is not limited to, reviewing previous meeting summaries, draft and final GSP chapters, and other information distributed in advance of each meeting;
- Develop an innovative problem-solving approach in which the interests and viewpoints of all members are considered;
- Explore all options to resolve disagreements, including, as needed, one-on-one discussions with GSA staff, or, at Advisory Committee meetings, interest-based caucuses or small group discussions;
- Act as liaisons throughout the GSP development and implementation process to educate, inform and solicit input from the wider local community and interested constituencies not represented on the committee;
- Present constituent views on the issues being discussed and commit to engage in civil, respectful and constructive dialogue with other members, as well as GSA staff, technical team members and potentially a facilitator;
- Ensure accuracy of information dissemination during or outside meetings, and correct false information as needed or appropriate;
- Avoid representing individual viewpoints as those of the committee and respect confidential conversations;
- Work collaboratively to ensure broad constituent understanding and support for any advice and recommendations that the committee shares with the Lassen and Modoc GSA Boards;
- Coordinate with Lassen and Modoc GSA staff regarding recommendations for any additional committee tasks that should be undertaken by the committee, and which items shall be presented to the GSA Boards for its review and approval;
- Operate at all times in compliance with the Brown Act;
- Attend meetings consistently – participation in 75% of the meetings is the minimum expectation. (*Given the volume of information to be considered and discussed, it is*

essential that members actively participate in committee meetings on a consistent basis. It is understood that professional and personal commitments may at times prevent members from attending committee meetings. In such cases, members shall notify Lassen GSA staff no less than 24 hours in advance to be excused from attending any given committee meeting. As needed, staff will reach out to members who are not actively participating to give them the opportunity to explain their absence and reaffirm their interest to participate on the committee, and thus not lose their seat. Members who do not meet the threshold for active participation, and have not expressed an interest to continue participating, will, at the recommendation of Lassen and Modoc GSA staff, be automatically removed by the appropriate GSA Board from the committee. Alternates may attend in the absence of a committee member but must alert the Lassen and Modoc GSA staff prior to the meeting.); and

- Recuse him/herself from discussion and voting if he/she has a personal interest or stake in the outcome [BVAC members are subject to recusal due to conflicts of interest (as that term is defined by the Political Reform Act) in accordance with *Government Code Title 9, Political Reform; Chapter 7, Conflicts of Interest*].

Through its public meetings, the committee shall serve as an additional forum for public dialogue on SGMA and GSP development. Finally, with approval by the Lassen and Modoc GSA's, committee tasks may be amended, repealed, or additionally added at any time with the intent to comply with SGMA related activities provided said activities comply under the authorities granted by SGMA law. Alternates may vote on all matters before the BVAC in the absence of the appointed member. Each alternate shall be informed of the business of the BVAC and the actions to be taken when acting on behalf of a member.

The following are desired attributes for BVAC members:

a. Have knowledge and experience in water resources management.
b. Represent an agency, organization, tribe, academia, or interest that is under-represented in the region (e.g., disadvantaged communities or unincorporated areas).
c. Have the ability and desire to objectively articulate the perspective of his/her BVAC seat and caucus at a level beyond that of his/her individual interest.
d. Provide recommendations with the best interests of the entire Big Valley region in mind.

7. Appointment

Members of the BVAC shall be appointed by the respective Board of Supervisors acting as the GSA. Members will serve at the pleasure of said Boards and may be terminated at any time without cause. Persons interested in serving on the BVAC shall submit a letter of interest or application to the pertinent Clerk of the Board of Supervisors which includes the following:

a. Current level of SGMA knowledge;
b. Knowledge of groundwater in the Big Valley Groundwater Basin;
c. Their ability to commit to attending meetings of the Advisory Committee
d. Committee members should have demonstrated ability to work collaboratively with others of differing viewpoints and achieve good faith compromise.

8. BVAC Chair and Vice Chair Roles

The BVAC Chair and Vice Chair must be BVAC members. The Chair and Vice Chair will be determined by a majority vote of the BVAC. The Chair and Vice Chair shall serve for one (1) year term (multiple terms may be held, not to exceed two (2) years).

Although not required, the following attributes are desirable for the Chair and Vice Chair:

- Chair: prior experience working in the role of a Chair of a committee.
- Vice Chair: attributes and ability to assume Chair role and responsibilities, but not necessarily as much experience as the Chair.
- Chair and Vice Chair should come from different GSAs.
- Familiar with the purpose, structure, and content of meetings.
- Willing and able to attend each BVAC meeting until the GSP is drafted. The GSP must be submitted to the DWR by January 31, 2022.
- Ability to even-handedly articulate all interests.
- Consensus-builder.

The role of the Chair and Vice Chair will vary between BVAC meetings; however, the Vice Chair's primary role is to take on Chair responsibilities in the absence of the Chair and/or at the discretion of the Chair. General responsibilities for the Chair are as follows:

a. Review BVAC agenda prior to finalization and distribution to stakeholders (one week prior to BVAC meetings);
b. Meet with staff prior to each BVAC meeting to go over the BVAC agenda and presentation(s) so that the BVAC meeting runs smoothly and without interruption;
c. Manage the BVAC agenda, select members to speak in turn, and keep the BVAC on task and on time;
d. Convene each BVAC meeting and initiate introductions;
e. Organize and call on public speakers during appropriate agenda items (if applicable) and determine public comment procedures;
f. Identify when the BVAC has reached an impasse and needs to move forward with formal voting to resolve an issue;
g. Summarize key decisions and action items at the end of each BVAC meeting.
h. Close meetings;
i. Ensure that notes are prepared summarizing discussion, agreements, and decisions; and
j. Review and provide comments on BVAC meeting notes.

9. Meetings

Meetings will be conducted on a monthly basis or as often as is needed during preparation of the Big Valley Groundwater Basin GSP. Meetings shall be noticed in accordance with the Brown Act. The Lassen County Department of Planning and Building Services will coordinate Brown Act noticing and any other noticing that is executed. The Lassen County Department of Planning and Building Services will prepare and disseminate packets in advance of all meetings, if applicable. Said Department shall serve as staff to the BVAC, and be the repository of all associated records, with a copy of all records sent to the Modoc County Clerk of the Board. The

Director of the Lassen County Planning and Building Services Department or his or her designee shall serve as secretary of the BVAC and may comment on any item but does not have a vote. The designated Modoc County GSA groundwater staff member may comment on any item but does not have a vote. Legal counsel shall be provided by the Modoc County Counsel.

Meetings shall be conducted in accordance with this MOU, SGMA and any other applicable rules or regulations. A quorum is required to convene. The BVAC Chair or Vice Chair will determine if a quorum exists at any BVAC meeting. Formal voting may not occur without a quorum of BVAC members; however, presentations and discussion of agenda topics may occur. A quorum shall be defined as having at least four BVAC representatives, present at every meeting.

Meeting Location

All meetings of the Big Valley Groundwater Advisory Committee must be held within the boundary of the Big Valley Groundwater basin. Lassen GSA staff will work collaboratively with the Chair to determine a location which will encourage the most participation from all stakeholders. Meeting locations shall remain consistent to prevent reduced participation from all stakeholders.

10. Public Comments at BVAC Meetings

BVAC meetings are open to the public, and public comments are welcomed and encouraged. To ensure that members of the public have an adequate chance to provide comments, the BVAC Chair will invite public comments by members of the public in attendance on any agenda item in which the BVAC is making a decision or formulating a recommendation. An open public comment period will be offered at the end of BVAC meetings to allow members of the public to speak to non-agenda topics.

If there is substantial public interest or comment on a topic, the BVAC Chair or Vice Chair may implement the following procedures to ensure that such comments are received in a timely manner:

- Members of the public will be asked to fill out a speaker card to indicate their name, affiliation, contact, and the specific agenda item they wish to speak to (if applicable).
- Speaker cards will be limited to one per person per agenda item. Participants may submit multiple speaker cards to address multiple agenda items.
- The BVAC Chair or Vice Chair will invite those who submitted speaker cards to address the agenda item prior to calling for a consensus decision and/or vote on that item.
- Speaker cards will generally allow three minutes of public speaking time per speaker. However, in the event that there are a large number of public speaker comments, it will be up to the discretion of the BVAC Chair or Vice Chair to reduce the time for each public speaker to ensure that all agenda items are addressed and that the BVAC meeting closes on time.

11. Decision-making Procedures

In order to hold a meeting and conduct its work, a quorum of the Big Valley GSA Advisory Committee must be present.

1) **Consensus as the Fundamental Principle:** The advisory committee shall strive for consensus (agreement among all participants) in all of its decision-making. Working toward consensus is a fundamental principle which will guide group efforts, particularly when crafting any draft or final advisory committee proposals, reports or recommendations for GSA Boards consideration. If the committee is unable to reach consensus, the range of opinions provided, including areas of agreement and disagreement, will be documented in meeting summaries or otherwise communicated in written reports when advisory committee work is shared with the GSA Boards.

2) **Definition of Consensus:** Consensus means all committee members either fully support or can live with a particular decision and believe that their constituents can as well. In reaching consensus, some committee members may strongly endorse a particular proposal, report or recommendation while others may simply accept it as "workable." Others may only be able to "live with it" as less than desired but still acceptable. Still others may choose to "stand aside" by verbally noting disagreement, yet allowing the group to reach consensus without them, or by abstaining altogether. Any of these actions constitutes consensus.

3) **Types of Decision-Making:**
    a. Administrative: Decisions about the daily administrative activities of the committee—including, but not limited to meeting logistics, meeting dates and times, agenda revisions and schedules. A*dministrative decisions* will typically be put forward to the group by Lassen County Department of Planning and Building Services staff. As needed, staff will consult with the committee. Any administrative decisions by the committee will be made on a simple majority vote of all members present at a meeting. The committee will defer to the decision-making procedures outlined in this section of the MOU in circumstances where it is unclear if a committee decision is *administrative* in nature, or represents a more substantive *GSP/SGMA* decision (described below).

    b. Groundwater Sustainability Planning/SGMA Advice and Recommendations: Advice and recommendations about the Big Valley GSP—including but not limited to topics mandated by SGMA and other groundwater related topics that the committee chooses to address. All *GSP/SGMA advice and recommendation decisions* will be made by the decision-making procedures outlined in this section of the MOU.

4) **Consensus with Accountability:** Consensus seeking efforts recognize that a convened group such as Big Valley Advisory Committee makes recommendations, but is not a formal decision-making body like the Lassen or Modoc GSA's. That said, achieving consensus is the goal, as this allows all stakeholder interests represented on the committee to communicate a unified group perspective to the GSA Boards as it considers public policy decisions and actions which may affect the constituencies that members represent, and the wider community. Using a model of consensus with accountability, all committee members shall commit to two principles:
    a. All members are expected to routinely express their interests and analyze conditions to ensure they have clarity on how their interests and those of others may shift over time;

b. All members shall negotiate agreements in a manner that serves their interests, and offers either neutral impact to others, or ideally provides benefit to others' interests as well as their own.

Operating by consensus with accountability will encourage multi-interest solutions based on shared member interests. Such solutions are in turn more sustainable and durable as they represent shared agreements rather than majority/minority dynamics. Most consensus building during the course of GSP development and SGMA implementation will be based on verbal dialogue, deliberation and iterative development of group ideas. The Chair may commonly ask, when it appears consensus or near consensus agreement has emerged or is emerging, if any member cannot live with said agreement. For any final decisions, committee members will demonstrate consensus, or lack thereof, in the following manner:

Nay:	*I do not support the proposal.*
Aye:	*I support the proposal.*
Stand Aside:	*Member verbally notes he/she is willing to stand aside and allow group consensus*
Abstention:	*At times, a pending decision may be infeasible for a participant to weigh in on. Member verbally notes he/she abstains. Abstentions do not prevent group consensus.*

Any member that stands aside or abstains from a decision is encouraged to explain why his/her choice is in his/her best interest.

5) **Less than 100% Consensus Decision Making:** The advisory committee is consensus seeking but shall not limit itself to strict consensus if 100% agreement among all participants cannot be reached after all interests and options have been thoroughly identified, explored and discussed. Less-than-consensus decision-making shall not be undertaken lightly. If the committee cannot come to 100% agreement, it could set aside the particular issue while it continues work on other issues, then revisit the disagreement later in the process. Finally, the committee recognizes that certain deadlines must be met during the collaborative process to ensure completion of all SGMA opportunities and requirements on time.

   If, after thoroughly exploring all ideas and options, consensus is absent or otherwise not forthcoming, the committee, with assistance from the GSA staff, will clearly document majority and minority viewpoints. The Chair and Vice-Chair will then work with GSA staff to incorporate all viewpoints into the meeting summary, and, as warranted, prepare a committee report to the GSA Boards. The chair, in coordination with GSA staff, will then present the report to the GSA Boards, ensuring that all majority and minority viewpoints are clearly communicated and accurately represent the outcomes of committee discussions. Any committee member holding minority viewpoints will have the opportunity, if he/she is not comfortable with the process, to present his/her viewpoints directly to the GSA Boards at the time the report is presented. Members wishing to do this will express their interest and minority viewpoints with GSA staff in advance of said GSA Board meetings.

6) **Decision Outcomes:** Advisory committee decisions will be made at appropriate meetings and, in accordance with the Brown Act, will be publicly noticed in advance and shared via the Lassen County GSA's website and SGMA interested parties email list. As described above, all committee proposals, reports and recommendations will reflect the outcomes of collaborative member discussions. All consensus agreements and other negotiated outcomes during GSP development and implementation, as well as discussion outcomes when consensus is not forthcoming, will be documented, as described above, and shared with the GSA Boards.

12. Collaborative Process Agreements and Meeting Ground Rules

Members commit to the following process agreements during discussion, deliberation and attempts to find consensus-based solutions to sustainable groundwater management in the Big Valley groundwater basin. Moreover, members also agree to abide by meeting ground rules in order to intentionally and consistently engage each other in civil and constructive dialogue during the collaborative process.

Process Agreements

- **Strive to focus on interests versus positions.** A focus on interests instead of positions will help reveal the needs, hopes or concerns behind any member's words. By extension this can help identify shared interests among committee members and, based on those shared interests, multiple options for mutually beneficial agreements.

- **Foster mutual understanding and attempt to address the interests and concerns of all participants.** For the collaborative process to be successful, all members must seek to understand the interests and concerns of other members, then strive to reach agreements that take all member interests under consideration.

- **Inform, educate and seek input from community constituents.** To the extent possible, members will share information and solicit input from their constituents, scientific advisors, and others about ongoing committee discussions and potential agreements or recommendations as they emerge.

- **View challenges as problems to be solved rather than battles to be won.** Challenges will at times arise during discussion of issues. Remember to focus on the challenge versus on each other. Search for multi-interest solutions, rather than win/lose agreements.

- **Be creative and innovative problem solvers.** Creative thinking and problem solving are essential to success in any collaboration. Get beyond the past, climb out of the perceived "box" and attempt to think about the problem, and potential solutions, in new ways.

- **Negotiate in good faith.** All members agree to candidly and honestly participate in decision making, to act in good faith in all aspects of this effort, and to communicate their interests in group meetings. Good faith also requires that parties not make commitments for which they cannot or do not intend to honor.

- **Consider the long-term view.** SGMA requires submission and approval of a Big Valley GSP by January 31st, 2022. Taking a long-term view of the planning horizon, may help inform collaborative discussions, reduce conflict and thereby ensure long-term sustainability of groundwater resources.

Ground rules

- **Use common conversational courtesy and treat each other with respect.** Civil and respectful dialogue tends to foster a constructive, thorough and solutions-oriented environment within multi-stakeholder groups.

- **Remember that all ideas and points of view linked to the committee's charge have value.** All ideas have value in this setting. Simply listen, you do not have to agree. If you hear something you do not agree with or you think is silly or wrong, please remember that a fundamental purpose of this forum is to encourage diverse ideas.

- **Be candid, listen actively and seek to understand others.** This promotes genuine dialogue and mutual understanding. Mutual understanding in turn helps parties identify shared interests. Shared interests set the foundation to finding and developing mutually acceptable agreements.

- **Be concise and share the air.** Keep in mind that time is limited at meetings. Be concise when sharing your perspective so that all members can participate in the discussion. And remember, people's time is precious, treat it with respect.

- **Avoid editorial comments.** At times it will be tempting to try and interpret the intentions or motivations of others. Please avoid this temptation and instead speak to your own interests and the motivation behind them.

- **Stay focused on the meeting agenda.** The committee is a Brown Act compliant body. As such it is important to stay focused on the posted agenda for any given meeting.

- **Welcome levity and humor to the discussions.** Work around water can at times be daunting and filled with challenges. Levity and humor is both welcome and helpful at times, as long as it does not come at the expense of others.

- **Turn cell phones off or to vibrate.** Help the group avoid distractions by turning cell phones to vibrate, not checking email during meetings and, if you must take a call, taking it outside the room.

13. Communications/Media Relations

Members are asked to speak only for themselves or the constituency they represent when asked by external parties, including the media, about the committee's work, unless there has been a formal adoption of a statement, report or recommendations by the committee. Members will refer media inquiries to GSA staff while also having the freedom to express their own opinions to the media. Members should inform media and external parties that they only speak for themselves and do not represent other members or the committee as a whole. The temptation to discuss someone else's statements or positions should be avoided.

14. Indemnification/Defense

Claims Arising from Acts or Omissions.

No GSA, nor any officer or employee of a GSA, shall be responsible for any damage or liability occurring by reason of anything done or omitted to be done by another GSA under or in connection with this MOU. The GSA's further agree, pursuant to California Government Code section 895.4, that each GSA shall fully indemnify and hold harmless each other GSA and its agents, officers, employees and contractors from and against all claims, damages, losses, judgements, liabilities, expenses, and other costs, including litigation costs and attorney fees, arising out of, resulting from, or in connection with any work delegated to or action taken or omitted to be taken by such GSA under this MOU.

15. Litigation

In the event that any lawsuit is brought by a third party against any Party based upon or arising out of the terms of this MOU, the Parties shall cooperate in the defense of the action. Each Party shall bear its own legal costs associated with such litigation.

16. Books and Records

Each Governing Body will be entitled to receive copies of documents, records, historical data, data compiled through consultants and any and all information related to groundwater within the Big Valley Groundwater basin developed pursuant to this MOU; provided that nothing in this paragraph shall be construed to operate as a waiver of any right to assert any privilege that might apply to protect the disclosure to information or materials subject to the attorney-client privilege, attorney work product privilege, or other applicable privilege or exception to disclosure.

17. Miscellaneous

A. Term of Agreement.

This MOU shall remain in full force and effect until the date upon which all Parties have executed a document terminating the provisions of this MOU.

B. No Third-Party Beneficiaries.

This MOU is not intended and will not be construed to confer a benefit or create any right on any third party, or the power or right to bring an action to implement any of its terms.

C. Amendments.

This MOU may be amended only by written instrument duly signed and executed by all Parties.

D. Compliance with Law.

In performing their respective obligations under this MOU, the Parties shall comply with and conform to all applicable laws, rules, regulations and ordinances.

E. Construction of Agreement.

This MOU shall be construed and enforced in accordance with the laws of the United States and the State of California.

18. All notice required by this MOU will be deemed to have been given when made in writing and delivered or mailed to the respective representatives of the Parties at their respective addresses as follows:

For the County of Modoc:
Clerk of the Board
204 South Court Street
Alturas, CA 96101

For the County of Lassen:
Lassen County Planning and Building Services
707 Nevada Street, Suite 5
Susanville, CA 96130

19. Signature

The parties hereto have executed this Memorandum of Understanding as of the dates shown below.

The effective date of this MOU is the latest signature date affixed to this page. This MOU may be executed in multiple originals or counterparts. A complete original of this MOU shall be maintained in the records of each of the parties.

COUNTY OF LASSEN

By: ______________________________ Date: __________
Chairman, Lassen County Board of Supervisors

ATTEST:

By: ______________________________ Date: __________
Clerk of the Board

APPROVED AS TO FORM:

______________________________ Date: __________
Lassen County Counsel

COUNTY OF MODOC

By: Rachel Rhoads Date: MAY 21 2019
Chairman, Modoc County Board of Supervisors

ATTEST:

By: Tiffany A. Martinez Date: MAY 21 2019
Clerk of the Board

APPROVED AS TO FORM:

______________________________ Date: MAY 28 2019
Modoc County Counsel

19. Signature

The parties hereto have executed this Memorandum of Understanding as of the dates shown below.

The effective date of this MOU is the latest signature date affixed to this page. This MOU may be executed in multiple originals or counterparts. A complete original of this MOU shall be maintained in the records of each of the parties.

COUNTY OF LASSEN

By: Jeff Hemphill Date: 6-11-19
Chairman, Lassen County Board of Supervisors

ATTEST:

By: _______________ Date: 6/11/2019
Clerk of the Board

APPROVED AS TO FORM:

_______________ Date: __________
Lassen County Counsel

COUNTY OF MODOC

By: Geri Byrne Date: MAY 2 1 2019
Chairman, Modoc County Board of Supervisors

ATTEST:

By: Tiffany A. Martinez Date: MAY 2 1 2019
Clerk of the Board

APPROVED AS TO FORM:

_______________ Date: MAY 2 6 2019
Modoc County Counsel

Appendix 3A Monitoring Well Surveyors Report

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Project: Big Valley Groundwater Basin Survey, Adin, Ca.
Client: GEI Consultants
2868 Prospect Park Drive, Suite 400
Rancho Cordova, Ca 95670

PROFESSIONAL ENGINEER
KEVIN R. BUTLER
No. C057153
CIVIL
STATE OF CALIFORNIA
REGISTERED

Project Details

Equipment Used:
Trimble Precision GPS R-12 Surveying System
SECO 4811-32 Level System

Report Units:

Lat/Lon:	WGS84 formatted Degree, Minutes, Seconds
Elevation:	US Survey Feet
Grid Coordinates:	California State Plane Zone 1 Coordinates

Survey Conditions:

Date Surveyed:	7.28.2020
Date of Report:	8.3.2020, Revised 8.5.2020
Weather:	Sunny 60°F - 95°F, Smokey, Wind <10 MPH

Survey Benchmarks:

Source:	National Geodetic Survey	
Designation:	"B 136 RM 2"	
Description:	Brass disc set in concrete	
Location:	Northeast end of runway near Adin, Ca.	
	NAD 83 (2011)	
	Latitude	41° 11' 04.52985" N
	Longitude	120° 57' 00.44655" W
	Ortho Height	4237.75 ft.
	California State Plane Zone 1 Coordinates	
	Northing:	2,316,557.62
	Easting:	6,850,625.60

Source:	National Geodetic Survey	
Designation:	"W 135 RESET"	
Description:	Brass disc set in concrete	
Location:	Approximately 2.5 miles North on HWY 299 from Bieber	
	NAD 83 (2011)	
	Latitude	41° 08' 43.09015" N
	Longitude	120° 06' 43.08683" W
	Ortho Height	4152.57 ft.
	California State Plane Zone 1 Coordinates	
	Northing:	2,301,751.78
	Easting:	6,806,227.62

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Project Procedures:

Project control was established by using our GPS equipment to calibrate to the two NGS benchmarks described above.
Horizontal control is derived from both of the NGS benchmarks, Vertical control is derived from one NGS benchmark designation "B 136 RM 2".

At each site, all monitoring wells were located and each vault lid and casing plug was removed. Then a notch approximately 1/4" wide x 1/4" deep was cut into the side of the PVC well casing in line with the two vault lid mounting bolts. This notch is the elevation point for each well per tasks #1 & #2

At each site, all monitoring wells were located and the center of the vault lid was shot for horizontal location. This was recorded as Latitude / Longitude per task #1 & #2

At each site monitoring well 3 was identified and a PK nail was inserted into the concrete well pad 4" away from the vault lid in line with the two mounting fasteners. This PK nail serves at the site control for subsidence monitoring per task #3

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Task #1 Lassen County Monitoring Well Survey

Site 5 Survey Data

Well ID	Description of Surveyed Point	Latitude	Longitude	Elevation (ft.)
MW 5-1	Center of Lid	41°07'18.77103"N	121°08'01.91978"W	-
	Notch on PVC Casing	-	-	4,128.72
MW 5-2	Center of Lid	41°07'19.02273"N	121°08'01.90396"W	-
	Notch on PVC Casing	-	-	4,128.59
MW 5-3	Center of Lid	41°07'16.26339"N	121°08'11.92014"W	-
	Notch on PVC Casing	-	-	4,131.40
MW 5-4	Center of Lid	41°07'14.01725"N	121°08'02.37919"W	-
	Notch on PVC Casing	-	-	4,129.90

Site 5 Survey Accuracy

The elevation accuracy of the "Notch on PVC Casing" is ± 0.01 ft. in realtion to eachother which is based on the site control "PK Nail" from task 3 which is ± 0.04 ft. to the benchmark.

The horizontal accuracy of the "Center of Lid" to the benchmark is ± 0.1 ft.

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Task #2 Modoc County Monitoring Well Survey

Site 1 Survey Data

Well ID	Description of Surveyed Point	Latitude	Longitude	Elevation (ft.)
MW 1-1	Center of Lid	41°11'16.91704"N	120°57'35.46950"W	-
	Notch on PVC Casing	-	-	4,213.84
MW 1-2	Center of Lid	41°11'17.17232"N	120°57'35.20508"W	-
	Notch on PVC Casing	-	-	4,214.21
MW 1-3	Center of Lid	41°11'16.05393"N	120°57'33.61346"W	-
	Notch on PVC Casing	-	-	4,218.17
MW 1-4	Center of Lid	41°11'16.95194"N	120°57'32.38078"W	-
	Notch on PVC Casing	-	-	4,218.06

Site 1 Survey Accuracy

The elevation accuracy of the "Notch on PVC Casing" is ± 0.01 ft. in realtion to eachother which is based on the site control "PK Nail" from task 3 which is ± 0.03 ft. to the benchmark.

The horizontal accuracy of the "Center of Lid" to the benchmark is ± 0.1 ft.

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Task #2 Modoc County Monitoring Well Survey

Site 2 Survey Data

Well ID	Description of Surveyed Point	Latitude	Longitude	Elevation (ft.)
MW 2-1	Center of Lid	41°12'42.69267"N	121°01'43.03716"W	-
	Notch on PVC Casing	-	-	4,216.18
MW 2-2	Center of Lid	41°12'42.61763"N	121°01'42.78528"W	-
	Notch on PVC Casing	-	-	4,216.44
MW 2-3	Center of Lid	41°12'39.42222"N	121°01'43.25643"W	-
	Notch on PVC Casing	-	-	4,213.93
MW 2-4	Center of Lid	41°12'43.18967"N	121°01'45.76289"W	-
	Notch on PVC Casing	-	-	4,209.62

Site 2 Survey Accuracy

The elevation accuracy of the "Notch on PVC Casing" is ± 0.01 ft. in realtion to eachother which is based on the site control "PK Nail" from task 3 which is ± 0.03 ft. to the benchmark.

The horizontal accuracy of the "Center of Lid" to the benchmark is ± 0.1 ft.

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Task #2 Modoc County Monitoring Well Survey

Site 3 Survey Data

Well ID	Description of Surveyed Point	Latitude	Longitude	Elevation (ft.)
MW 3-1	Center of Lid	41°13'00.98392"N	121°06'17.84041"W	-
	Notch on PVC Casing	-	-	4,164.41
MW 3-2	Center of Lid	41°13'01.22973"N	121°06'17.84528"W	-
	Notch on PVC Casing	-	-	4,164.58
MW 3-3	Center of Lid	41°12'56.58659"N	121°06'18.32460"W	-
	Notch on PVC Casing	-	-	4,164.02
MW 3-4	Center of Lid	41°12'56.60289"N	121°06'19.47421"W	-
	Notch on PVC Casing	-	-	4,164.97

Site 3 Survey Accuracy

The elevation accuracy of the "Notch on PVC Casing" is ± 0.01 ft. in realtion to eachother which is based on the site control "PK Nail" from task 3 which is ± 0.04 ft. to the benchmark.

The horizontal accuracy of the "Center of Lid" to the benchmark is ± 0.1 ft.

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Task #2 Modoc County Monitoring Well Survey

Site 4 Survey Data

Well ID	Description of Surveyed Point	Latitude	Longitude	Elevation (ft.)
MW 4-1	Center of Lid	41°12'10.53971"N	121°09'31.31845"W	-
	Notch on PVC Casing	-	-	4,152.40
MW 4-2	Center of Lid	41°12'10.56692"N	121°09'31.64559"W	-
	Notch on PVC Casing	-	-	4,152.73
MW 4-3	Center of Lid	41°12'10.76781"N	121°09'28.29350"W	-
	Notch on PVC Casing	-	-	4,152.33
MW 4-4	Center of Lid	41°12'12.74277"N	121°09'28.23603"W	-
	Notch on PVC Casing	-	-	4,161.32

Site 4 Survey Accuracy

The elevation accuracy of the "Notch on PVC Casing" is ± 0.01 ft. in realtion to eachother which is based on the site control "PK Nail" from task 3 which is ± 0.04 ft. to the benchmark.

The horizontal accuracy of the "Center of Lid" to the benchmark is ± 0.1 ft.

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Task #3 Subsidence Monitoring Network

Well ID	Description of Surveyed Point	California State Plane Zone 1		Elevation (ft.)	Accuracy	
		Northing	Easting		Horizontal	Vertical
MW 1-3	PK Nail in Concrete	2,317,688.600	6,848,083.631	4,218.51	±0.01 ft.	±0.03 ft.
MW 2-3	PK Nail in Concrete	2,325,906.143	6,828,905.491	4,214.55	±0.01 ft.	±0.03 ft.
MW 3-3	PK Nail in Concrete	2,327,419.328	6,807,866.938	4,164.48	±0.02 ft.	±0.04 ft.
MW 4-3	PK Nail in Concrete	2,322,637.642	6,793,395.855	4,152.75	±0.02 ft.	±0.04 ft.
MW 5-3	PK Nail in Concrete	2,292,892.375	6,799,525.718	4,131.74	±0.02 ft.	±0.04 ft.

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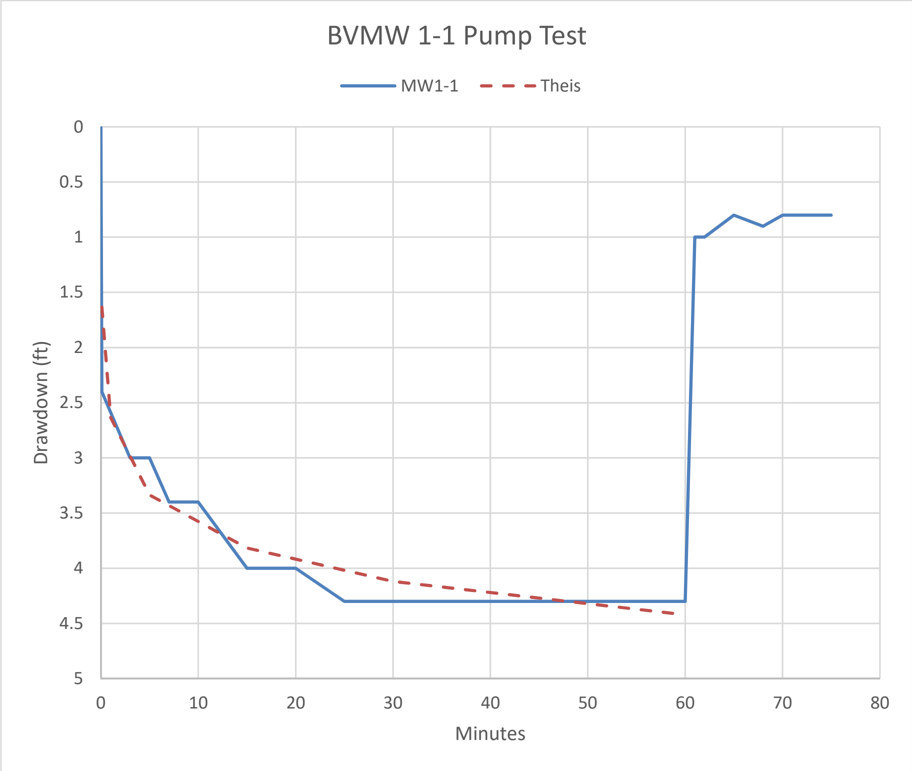
Appendix 4A Aquifer Test Results

Pumping Test

MW1-1		**Adin Airport**	
Time	**Minutes**	**Depth to Water (ft)**	**Drawdown**
10:59	0.0	31.6	0
11:00	0.1	34	2.4
11:03	3	34.6	3
11:05	5	34.6	3
11:07	7	35	3.4
11:10	10	35	3.4
11:15	15	35.6	4
11:20	20	35.6	4
11:25	25	35.9	4.3
11:30	30	35.9	4.3
11:35	35	35.9	4.3
11:40	40	35.9	4.3
11:45	45	35.9	4.3
11:50	50	35.9	4.3
11:55	55	35.9	4.3
12:00	60	35.9	4.3
12:01	61	32.6	1
12:02	62	32.6	1
12:05	65	32.4	0.8
12:08	68	32.5	0.9
12:10	70	32.4	0.8
12:15	75	32.4	0.8



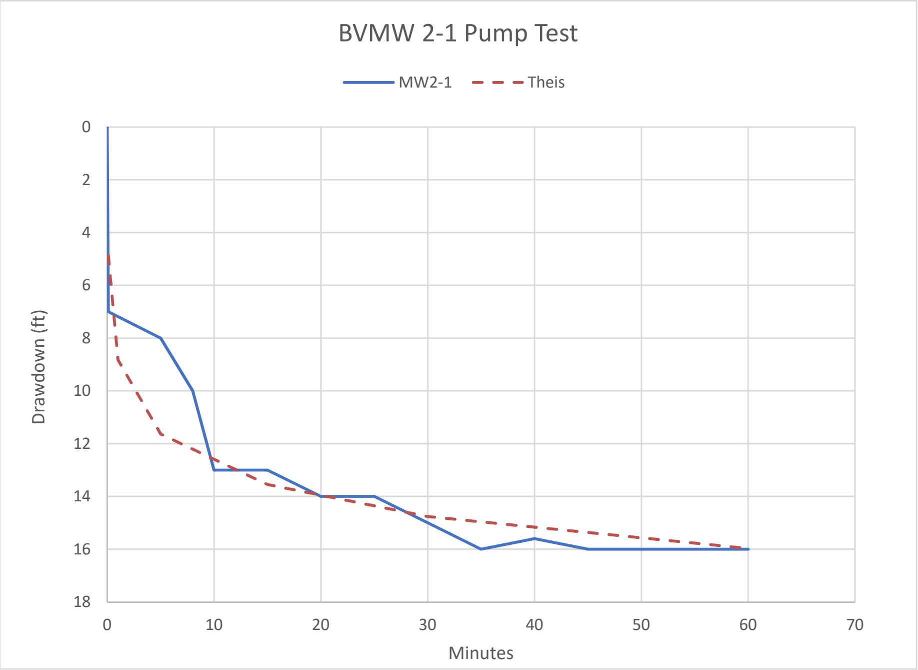
Theis Solution

Thickness (b)	50	ft
Flow (Q)	8	gpm
Well Efficiency	0.7	unitless
Transmissivity (T)	3000	gpd/ft
Radius (r)	1	ft
Storativity (S)1	1.5E-03	unitless
Hydraulic Conductivity (K)	8	ft/d

Pumping Test

MW2-1

Time	**Minutes**	**Depth to Water (ft)**	**Drawdown**
7:40	0	26	0
7:41	0.1	33	7
7:45	5	34	8
7:48	8	36	10
7:50	10	39	13
7:55	15	39	13
8:00	20	40	14
8:05	25	40	14
8:10	30	41	15
8:15	35	42	16
8:20	40	41.6	15.6
8:25	45	42	16
8:30	50	42	16
8:35	55	42	16
8:40	60	42	16



Theis Solution

Thickness (b)	40	ft
Flow (Q)	8	gpm
Well Efficiency	13	unitless
Transmissivity (T)	750	gpd/ft
Radius (r)	1	ft
Storativity (S)1	0	unitless
Hydraulic Conductivity (K)	3	ft/d

Pumpng Test

MW3-1		Lookout	
Time	**Minutes**	**Depth to Water (ft)**	**Drawdown**
9:20	0	18	0
9:21	0.1	34	16
9:22	2	38	20
9:23	3	40	22
9:25	5	41	23
9:30	10	42	24
9:35	15	44	26
9:40	20	44	26
9:45	25	44	26
9:50	30	44	26
9:55	35	45	27
10:00	40	45	27
10:05	45	45	27
10:10	50	45.5	27.5
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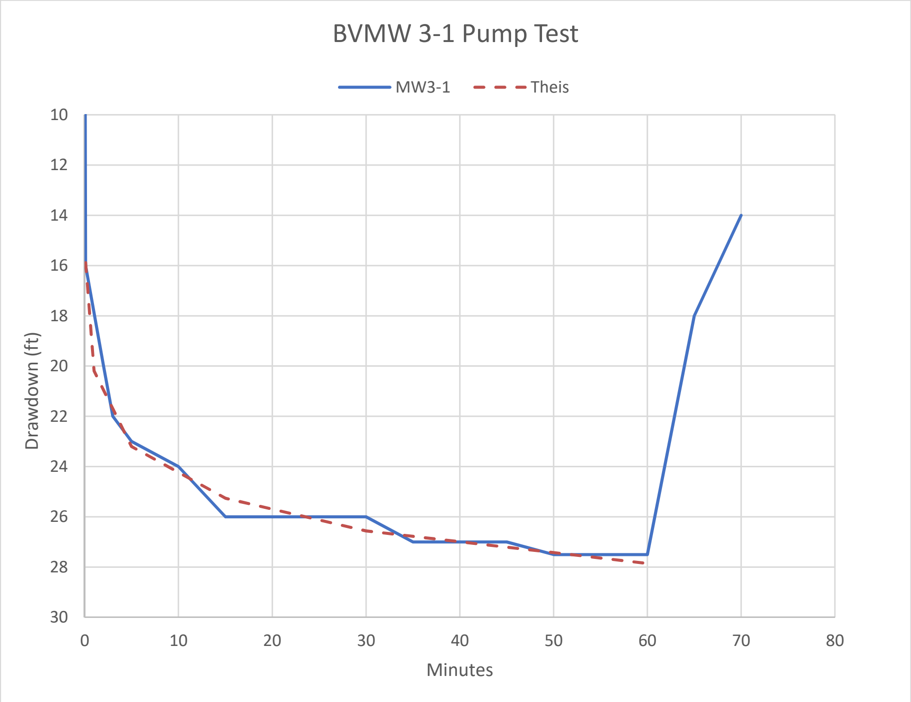
10:20	60	45.5	27.5
10:25	65	36	18
10:30	70	32	14



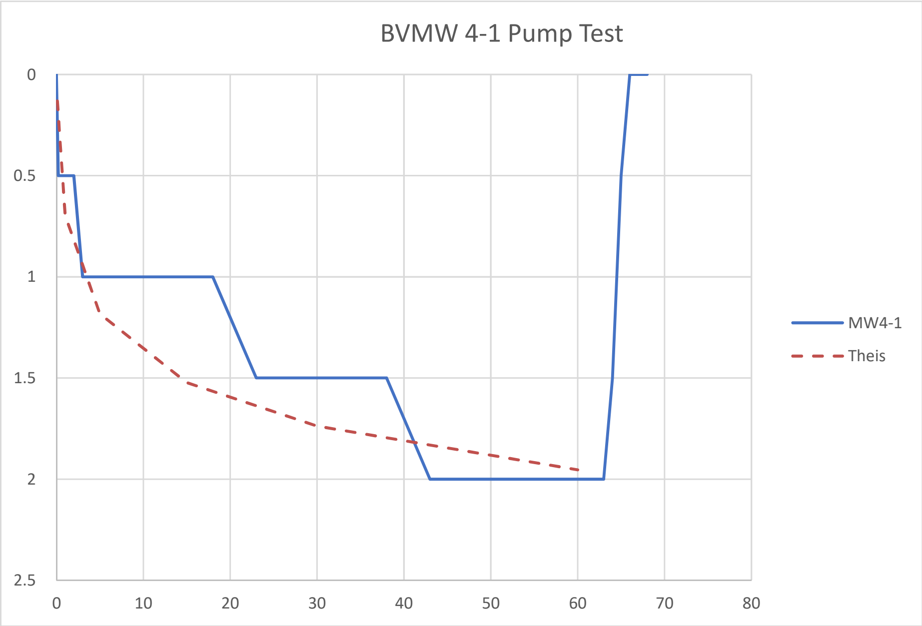
Theis Solution

Thickness (b)	50	ft
Flow (Q)	8	gpm
Well Efficiency	13	unitless
Transmissivity (T)	700	gpd/ft
Radius (r)	1	ft
Storativity (S)1	0.000003	unitless
Hydraulic Conductivity (	1.87	ft/d

Pumping Test

MW4-1

Time	**Minutes**	**Depth to Water (ft)**	**Drawdown**
1:55	0	33.5	0
1:57	0.2	34	0.5
1:58	1	34	0.5
1:59	2	34	0.5
2:00	3	34.5	1
2:05	8	34.5	1
2:10	13	34.5	1
2:15	18	34.5	1
2:20	23	35	1.5
2:25	28	35	1.5
2:30	33	35	1.5
2:35	38	35	1.5
2:40	43	35.5	2
2:45	48	35.5	2
2:50	53	35.5	2
2:55	58	35.5	2
3:00	63	35.5	2
3:01	64	35	1.5
3:02	65	34	0.5
3:03	66	33.5	0
3:04	67	33.5	0
3:05	68	33.5	0



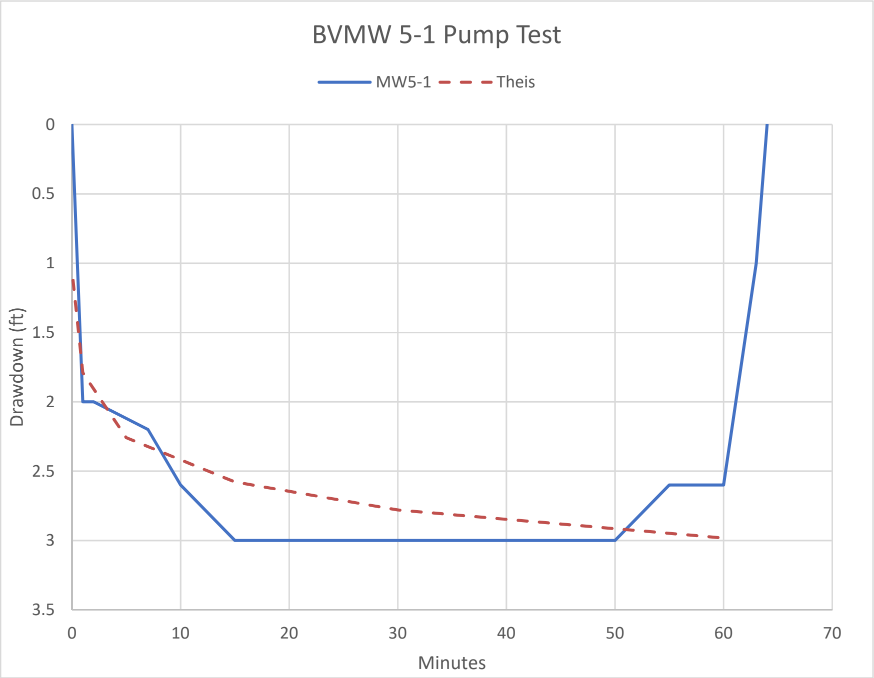
Theis Solution

Thickness (b)	30	ft
Flow (Q)	8	gpm
Well Efficiency	13	unitless
Transmissivity (T)	4200	gpd/ft
Radius (r)	1	ft
Storativity (S)1	0.1	unitless
Hydraulic Conductivity (K)	19	ft/d

Pumping Test

MW5-1

Time	Minutes	Depth to Water (ft)	Drawdown
11:50	0	42	0
11:51	1	44	2
11:52	2	44	2
11:57	7	44.2	2.2
12:00	10	44.6	2.6
12:05	15	45	3
12:10	20	45	3
12:15	25	45	3
12:20	30	45	3
12:30	40	45	3
12:35	45	45	3
12:40	50	45	3
12:45	55	44.6	2.6
12:50	60	44.6	2.6
12:57	63	43	1
12:58	64	42	0



Theis Solution

Thickness (b)	50	ft
Flow (Q)	8	gpm
Well Efficiency	13	unitless
Transmissivity (T)	4500	gpd/ft
Radius (r)	1	ft
Storativity (S)1	0.002	unitless
Hydraulic Conductivity (K)	12	ft/d

Appendix 5A Water Level Hydrographs

Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	022094_38N07E20B006M
Well Name	20B6
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		183.00 ft
Ground Surface Elevation		4126.30 ft
Ref. Point Elevation		4127.30 ft
Screen Depth Range		-
Screen Elevation Range		-

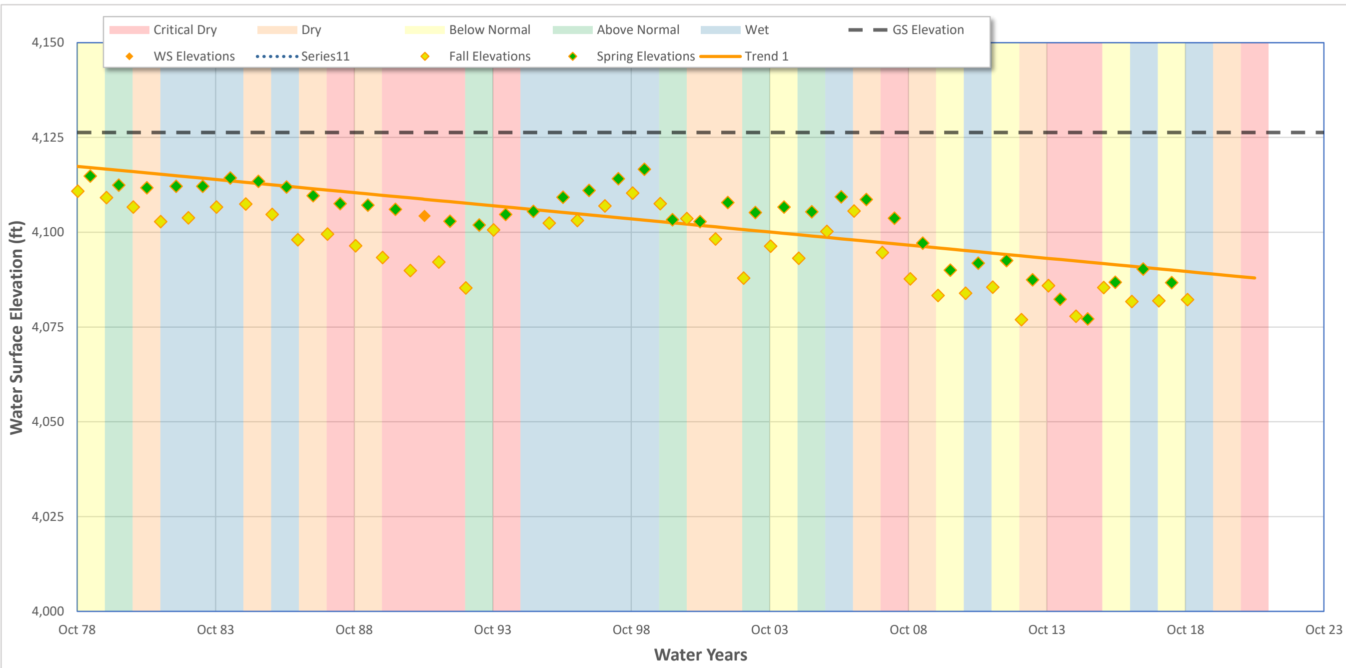
Well Period of Record

Period-of-Record		1979..2021
WS Elev-Range	Min:	4076.9 ft
	Max	4116.6 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.692 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	022095_38N07E24J002M
Well Name	24J2
State Number	38N07E24J002M
WCR Number	5327
Site Code	411228N1211054W001

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:	41.1226
	Long:	-121.1054
Well Depth		192.00 ft
Ground Surface Elevation		4138.40 ft
Ref. Point Elevation		4139.40 ft
Screen Depth Range		1 to 192 ft
Screen Elevation Range		4128 to 3937 ft

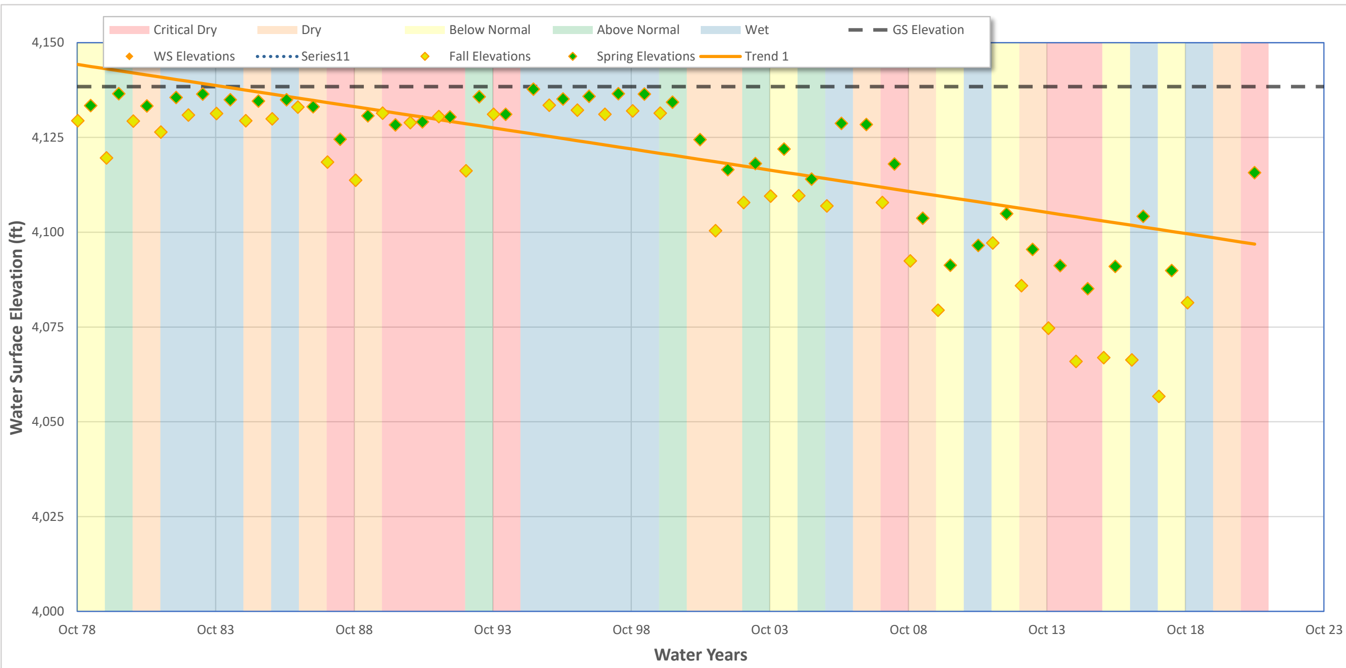
Well Period of Record

Period-of-Record		1979..2021
WS Elev-Range	Min:	4056.7 ft
	Max	4137.7 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(1.115 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	022096_38N07E32A002M
Well Name	32A2
State Number	38N07E32A002M
WCR Number	-
Site Code	410950N1211839W001

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:	41.0950
	Long:	-121.1839
Well Depth		49.00 ft
Ground Surface Elevation		4118.80 ft
Ref. Point Elevation		4119.50 ft
Screen Depth Range		-
Screen Elevation Range		-

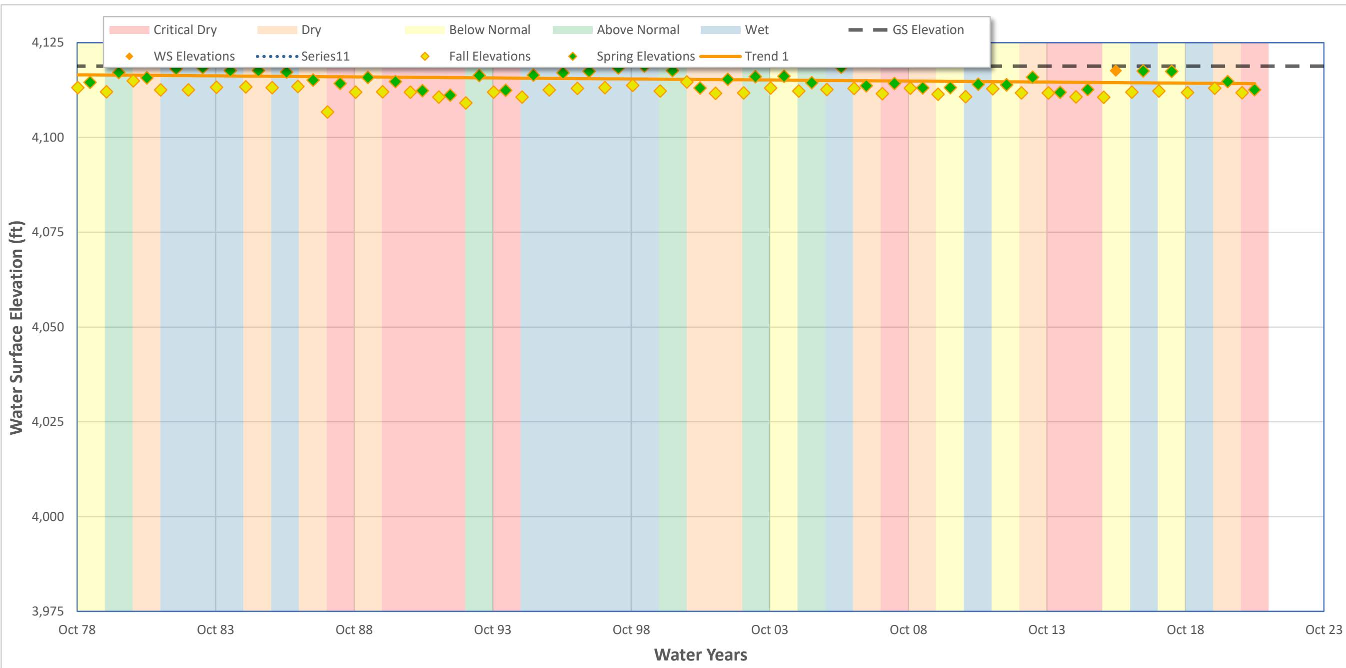
Well Period of Record

Period-of-Record		1959..2021
WS Elev-Range	Min:	4106.7 ft
	Max	4118.8 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.055 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

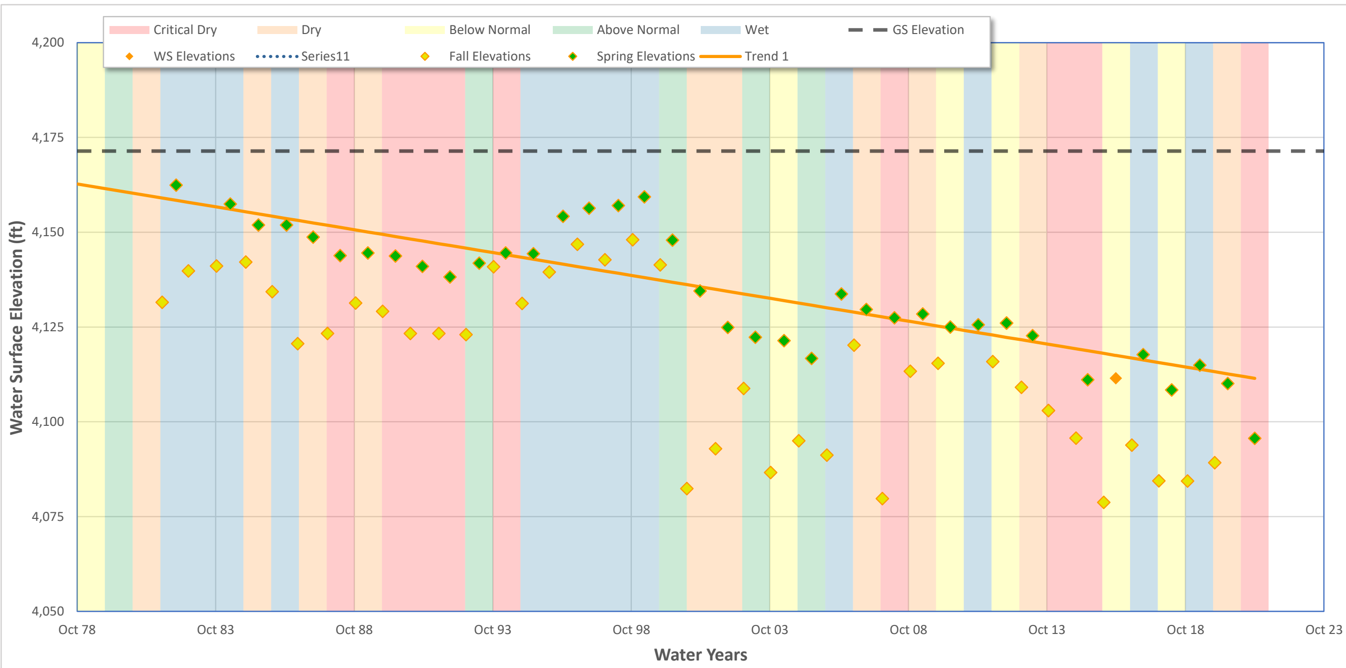
Date: 8/17/2021

Well Information	
Well ID	022097_38N08E16D001M
Well Name	16D1
State Number	38N08E16D001M
WCR Number	090143
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		491.00 ft
Ground Surface Elevation		4171.40 ft
Ref. Point Elevation		4171.60 ft
Screen Depth Range		-
Screen Elevation Range		-
Well Period of Record		
Period-of-Record		1982..2021
WS Elev-Range	Min:	4078.7 ft
	Max	4162.4 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(1.206 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

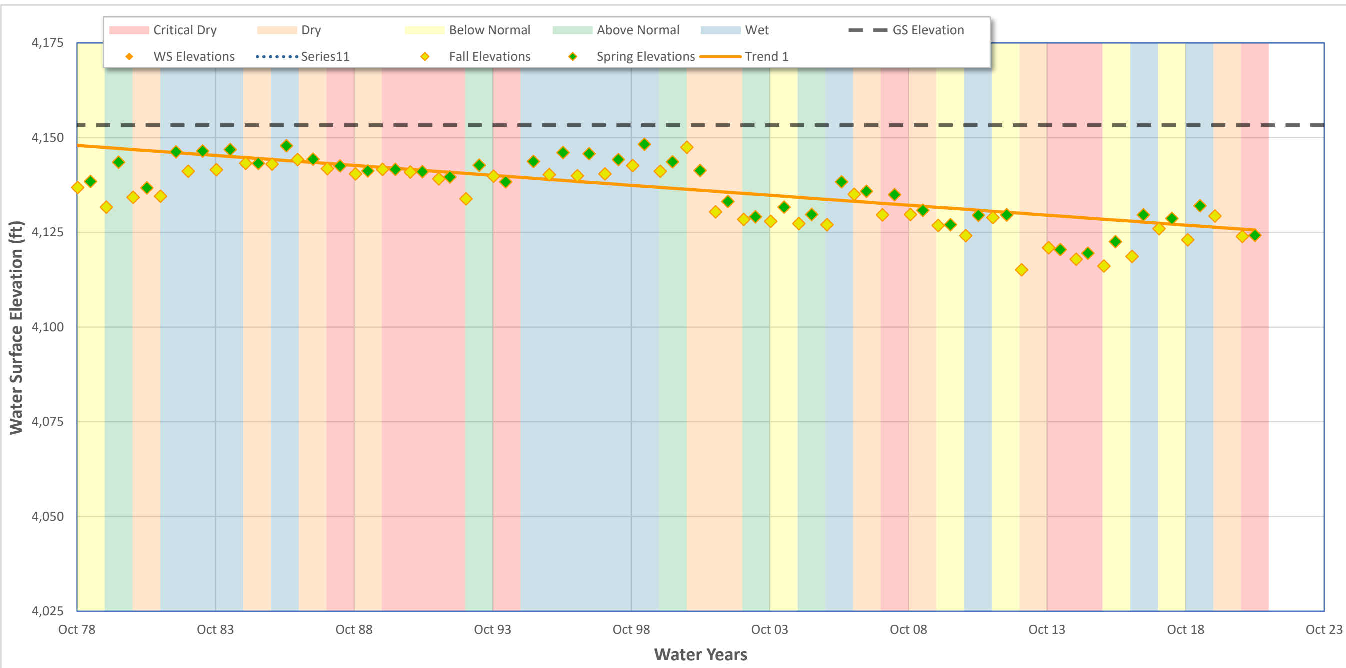
Date: 8/17/2021

Well Information	
Well ID	022098_38N08E17K001M
Well Name	17K1
State Number	38N08E17K001M
WCR Number	218
Site Code	411320N1210766W001
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:	41.1320
	Long:	-121.0766
Well Depth		180.00 ft
Ground Surface Elevation		4153.30 ft
Ref. Point Elevation		4154.30 ft
Screen Depth Range		30 to 180 ft
Screen Elevation Range		4259 to 4109 ft
Well Period of Record		
Period-of-Record		1957..2021
WS Elev-Range	Min:	4115.1 ft
	Max	4150.0 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.525 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	022099_38N09E18E001M
Well Name	18E1
State Number	38N09E18E001M
WCR Number	138559
Site Code	411356N1209900W001

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:	41.1356
	Long:	-120.9900
Well Depth		520.00 ft
Ground Surface Elevation		4248.40 ft
Ref. Point Elevation		4249.50 ft
Screen Depth Range		-
Screen Elevation Range		-

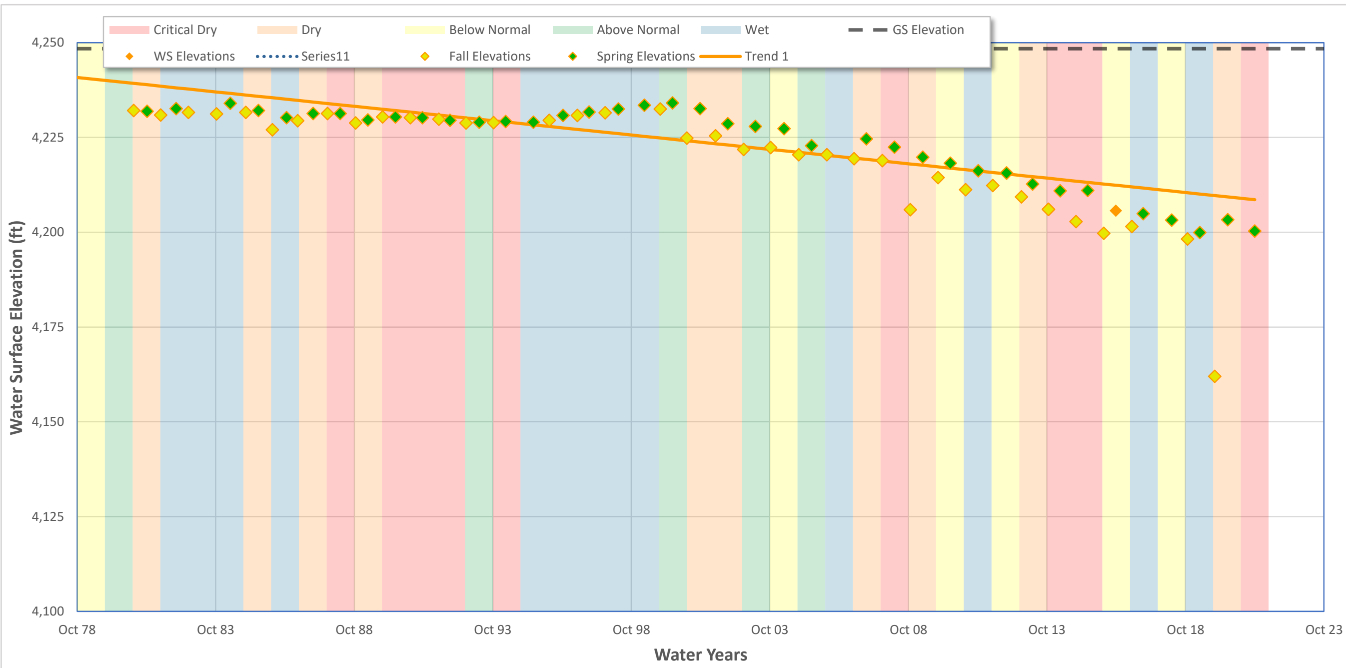
Well Period of Record

Period-of-Record		1981..2021
WS Elev-Range	Min:	4162.0 ft
	Max	4234.1 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.758 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	022100_38N09E18M001M
Well Name	18M1
State Number	38N09E18M001M
WCR Number	138563
Site Code	411305N1209896W001

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:	41.1305
	Long:	-120.9897
Well Depth		525.00 ft
Ground Surface Elevation		4288.40 ft
Ref. Point Elevation		4288.90 ft
Screen Depth Range		-
Screen Elevation Range		-

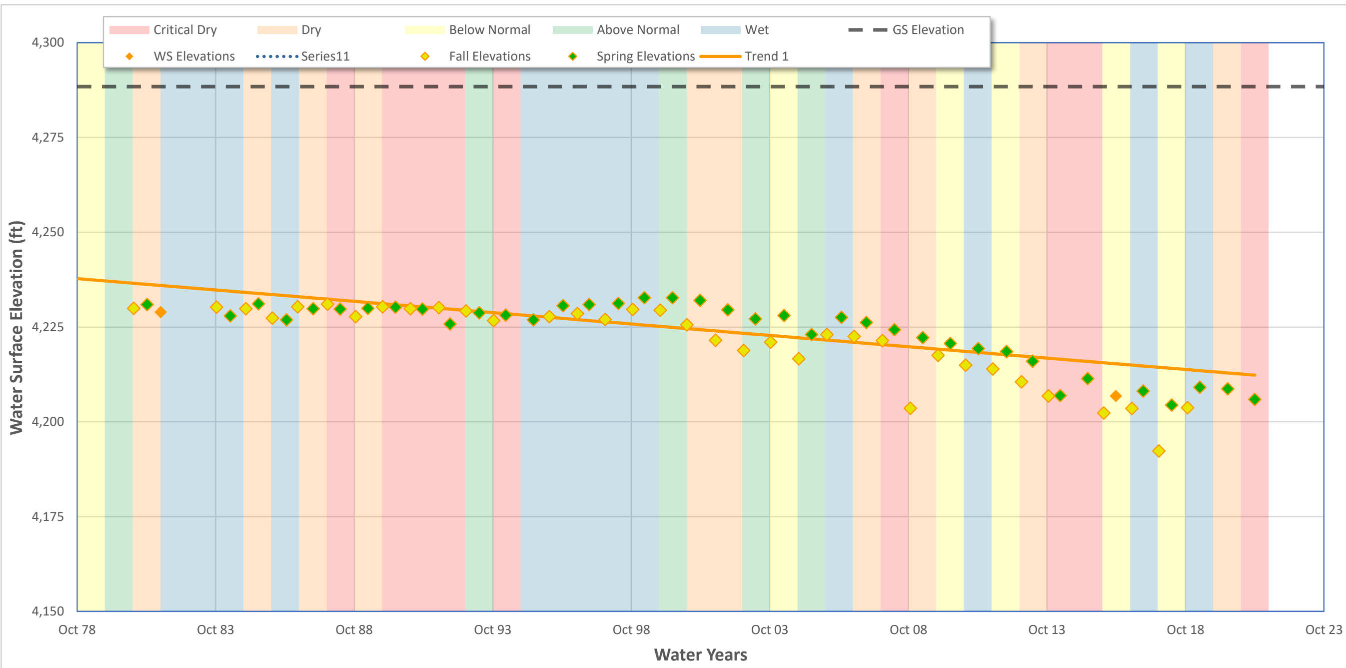
Well Period of Record

Period-of-Record		1981..2021
WS Elev-Range	Min:	4192.3 ft
	Max	4232.7 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.599 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	022102_39N07E26E001M
Well Name	26E1
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		400.00 ft
Ground Surface Elevation		4133.40 ft
Ref. Point Elevation		4135.00 ft
Screen Depth Range		20 to 400 ft
Screen Elevation Range		4187 to 3807 ft

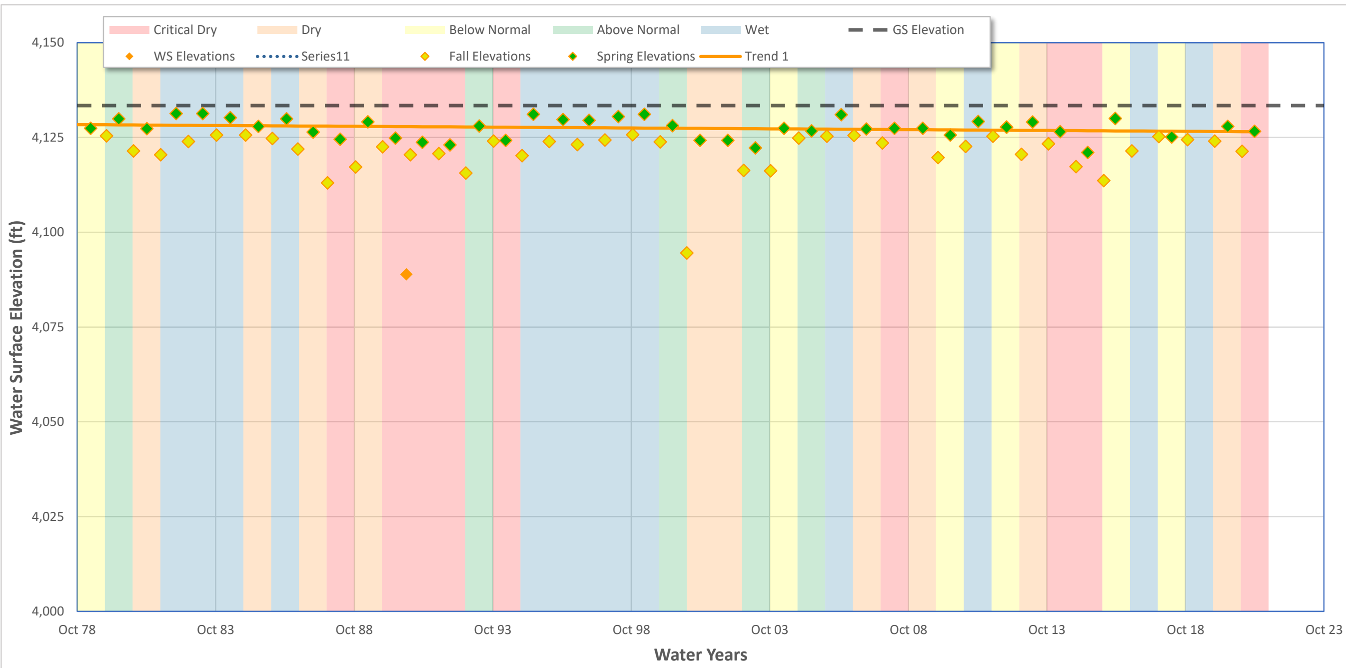
Well Period of Record

Period-of-Record		1979..2021
WS Elev-Range	Min:	4088.9 ft
	Max	4131.3 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.044 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	022103_39N08E21C001M
Well Name	21C1
State Number	39N08E21C001M
WCR Number	127008
Site Code	412086N1210574W001

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:	41.2084
	Long:	-121.0576
Well Depth		300.00 ft
Ground Surface Elevation		4161.40 ft
Ref. Point Elevation		4161.70 ft
Screen Depth Range		30 to 40 ft
Screen Elevation Range		4114 to 4104 ft

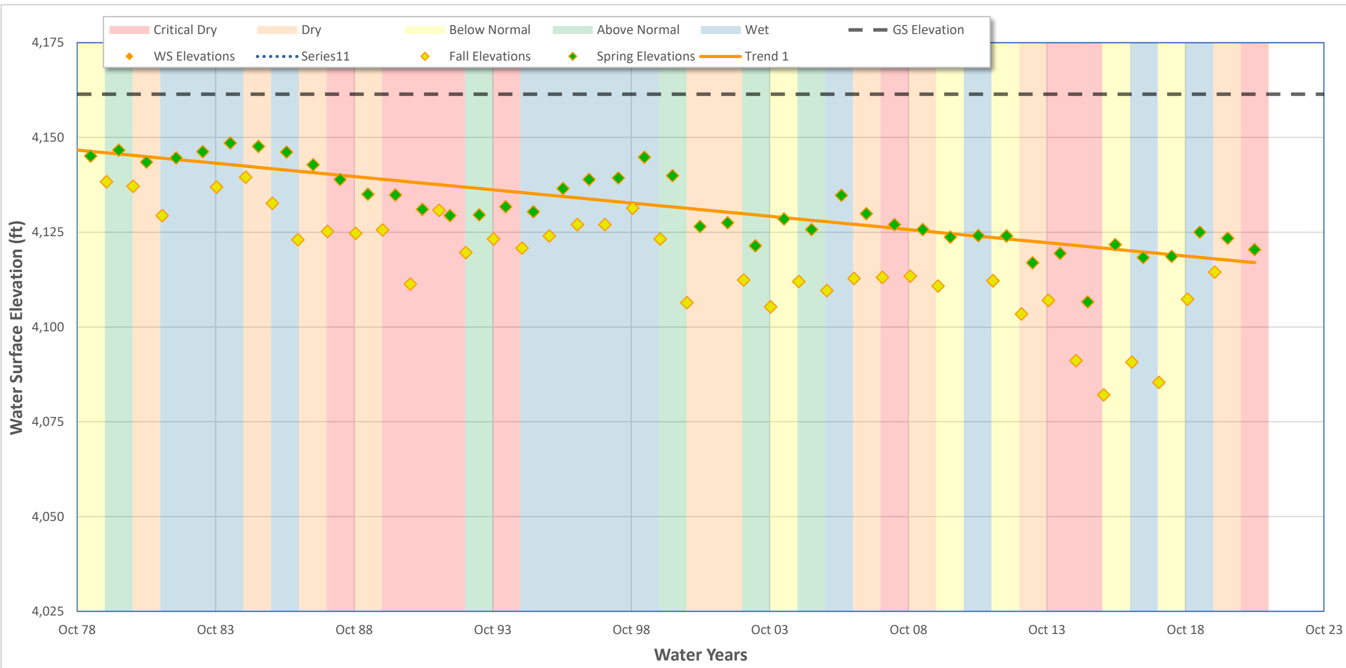
Well Period of Record

Period-of-Record		1979..2021
WS Elev-Range	Min:	4082.1 ft
	Max	4148.5 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.699 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	022107_39N09E28F001M
Well Name	28F1
State Number	39N09E28F001M
WCR Number	-
Site Code	411907N1209447W001

Well Location

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

Well Type Information

Well Use	Residential
Completion Type	Single Well

Well Coordinates/Geometry

Location	Lat:	41.1907
	Long:	-120.9447
Well Depth		73.00 ft
Ground Surface Elevation		4206.60 ft
Ref. Point Elevation		4207.10 ft
Screen Depth Range		-
Screen Elevation Range		-

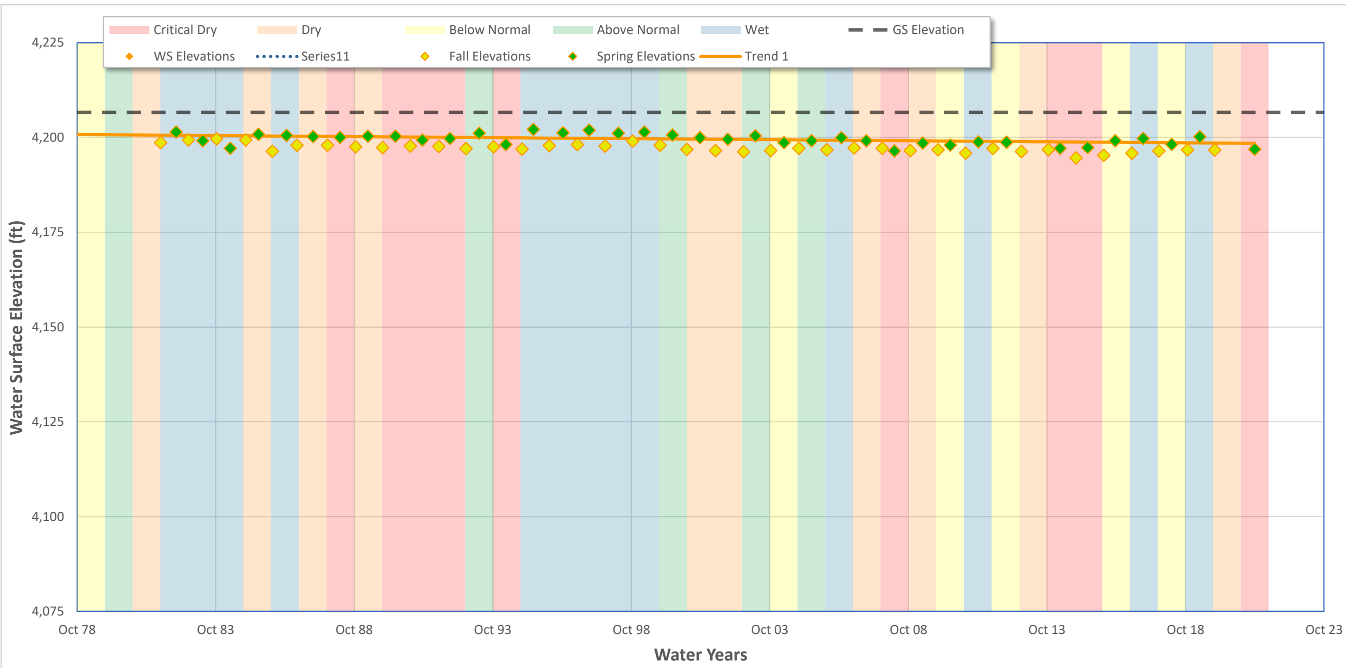
Well Period of Record

Period-of-Record		1982..2021
WS Elev-Range	Min:	4194.6 ft
	Max	4202.1 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.055 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

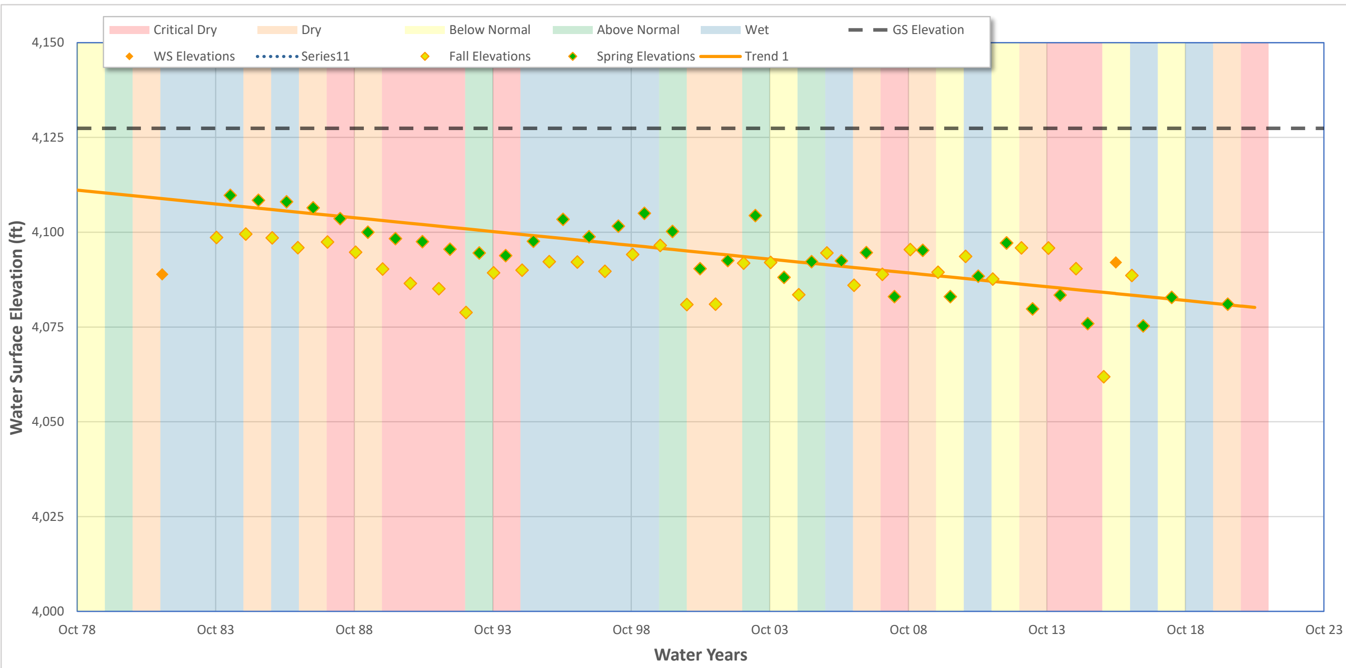
Date: 8/17/2021

Well Information	
Well ID	036667_37N07E13K002M
Well Name	13K2
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		260.00 ft
Ground Surface Elevation		4127.40 ft
Ref. Point Elevation		4127.90 ft
Screen Depth Range		-
Screen Elevation Range		-
Well Period of Record		
Period-of-Record		1982..2021
WS Elev-Range	Min:	4061.9 ft
	Max	4109.7 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.728 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

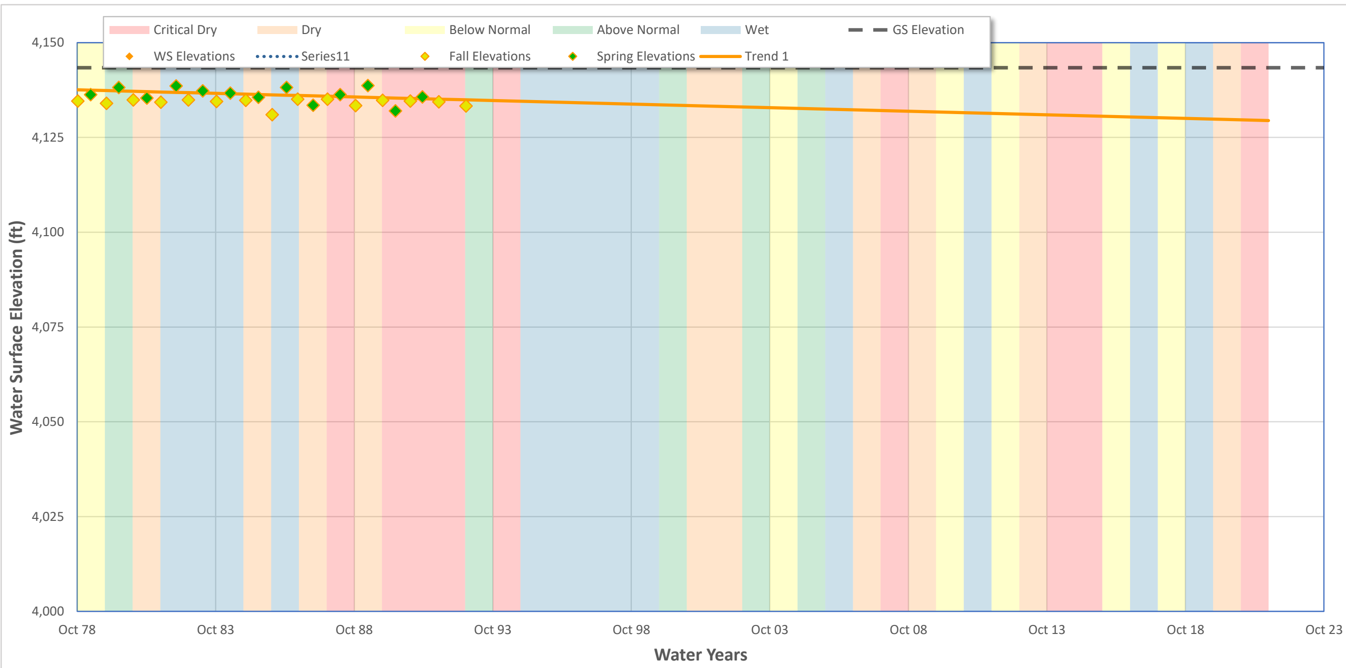
Date: 8/17/2021

Well Information	
Well ID	036669_38N07E12G001M
Well Name	12G1
State Number	38N07E12G001M
WCR Number	49866
Site Code	411467N1211110W001
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:	41.1467
	Long:	-121.1110
Well Depth		116.00 ft
Ground Surface Elevation		4143.38 ft
Ref. Point Elevation		4144.38 ft
Screen Depth Range		-
Screen Elevation Range		-
Well Period of Record		
Period-of-Record		1979..1994
WS Elev-Range	Min:	4131.0 ft
	Max	4138.7 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.189 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

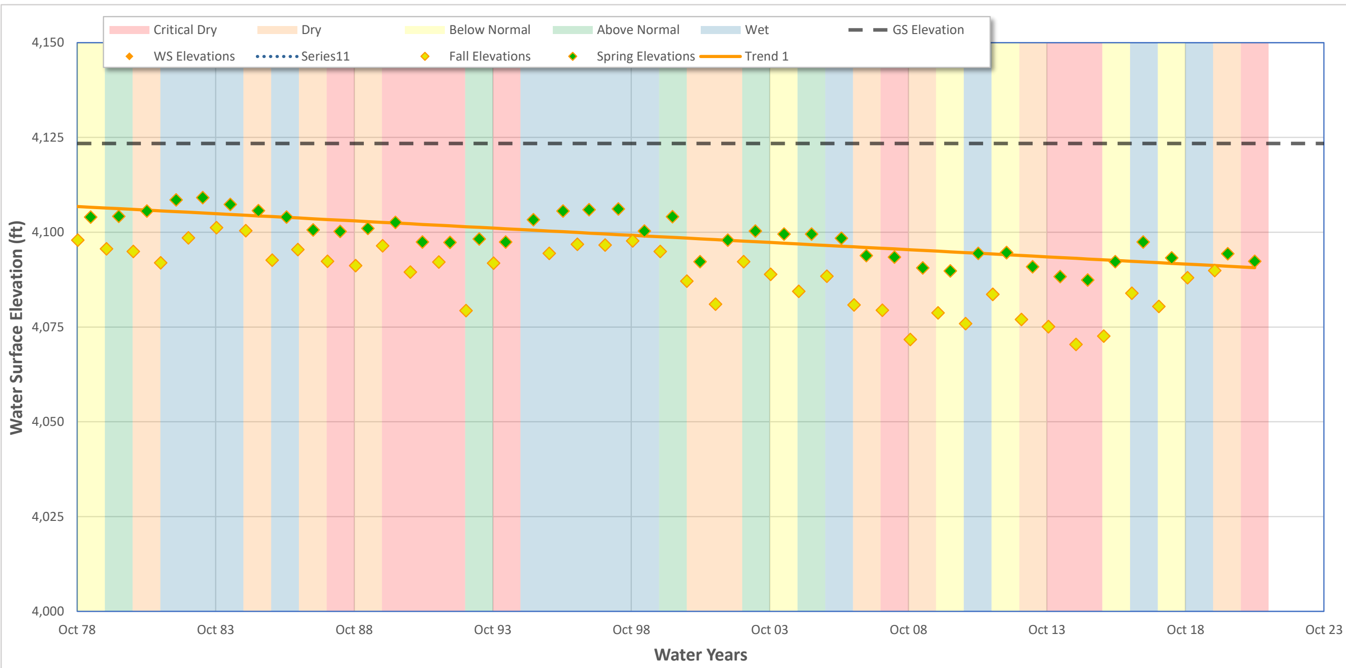
Date: 8/17/2021

Well Information	
Well ID	036670_38N07E23E001M
Well Name	23E1
State Number	38N07E23E001M
WCR Number	38108
Site Code	411207N1211395W001
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:	41.1207
	Long:	-121.1395
Well Depth		84.00 ft
Ground Surface Elevation		4123.40 ft
Ref. Point Elevation		4123.40 ft
Screen Depth Range		-
Screen Elevation Range		-
Well Period of Record		
Period-of-Record		1979..2021
WS Elev-Range	Min:	4070.4 ft
	Max	4109.1 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.379 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	036671_38N08E03D001M
Well Name	03D1
State Number	38N08E03D001M
WCR Number	16564
Site Code	411647N1210358W001

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:	41.1646
	Long:	-121.0360
Well Depth		280.00 ft
Ground Surface Elevation		4163.40 ft
Ref. Point Elevation		4163.40 ft
Screen Depth Range		50 to 280 ft
Screen Elevation Range		4093 to 3863 ft

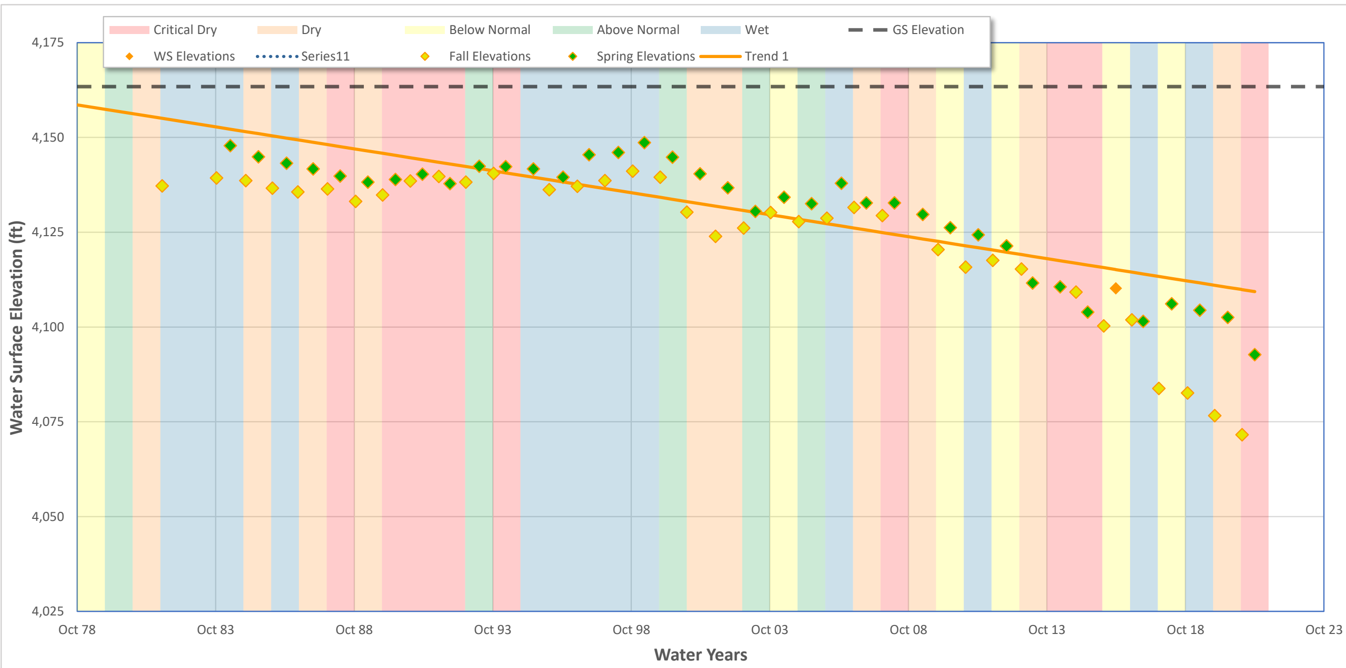
Well Period of Record

Period-of-Record		1982..2021
WS Elev-Range	Min:	4071.6 ft
	Max	4148.6 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(1.158 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	036672_38N09E08F001M
Well Name	08F1
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		217.00 ft
Ground Surface Elevation		4253.40 ft
Ref. Point Elevation		4255.40 ft
Screen Depth Range		-
Screen Elevation Range		-

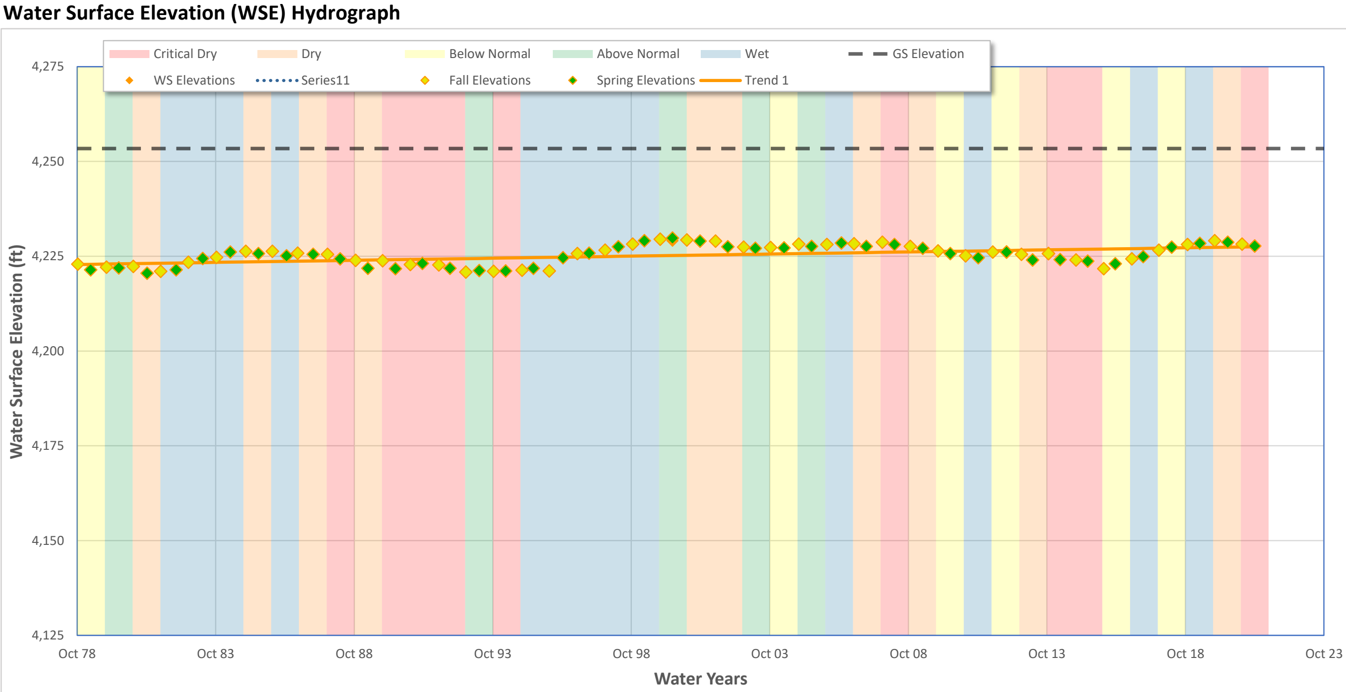
Well Period of Record

Period-of-Record		1979..2021
WS Elev-Range	Min:	4220.5 ft
	Max	4229.8 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	0.110 ft/yr
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

Date: 8/17/2021

Well Information

Well ID	036673_39N07E01A001M
Well Name	01A1
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		300.00 ft
Ground Surface Elevation		4183.40 ft
Ref. Point Elevation		4184.40 ft
Screen Depth Range		-
Screen Elevation Range		-

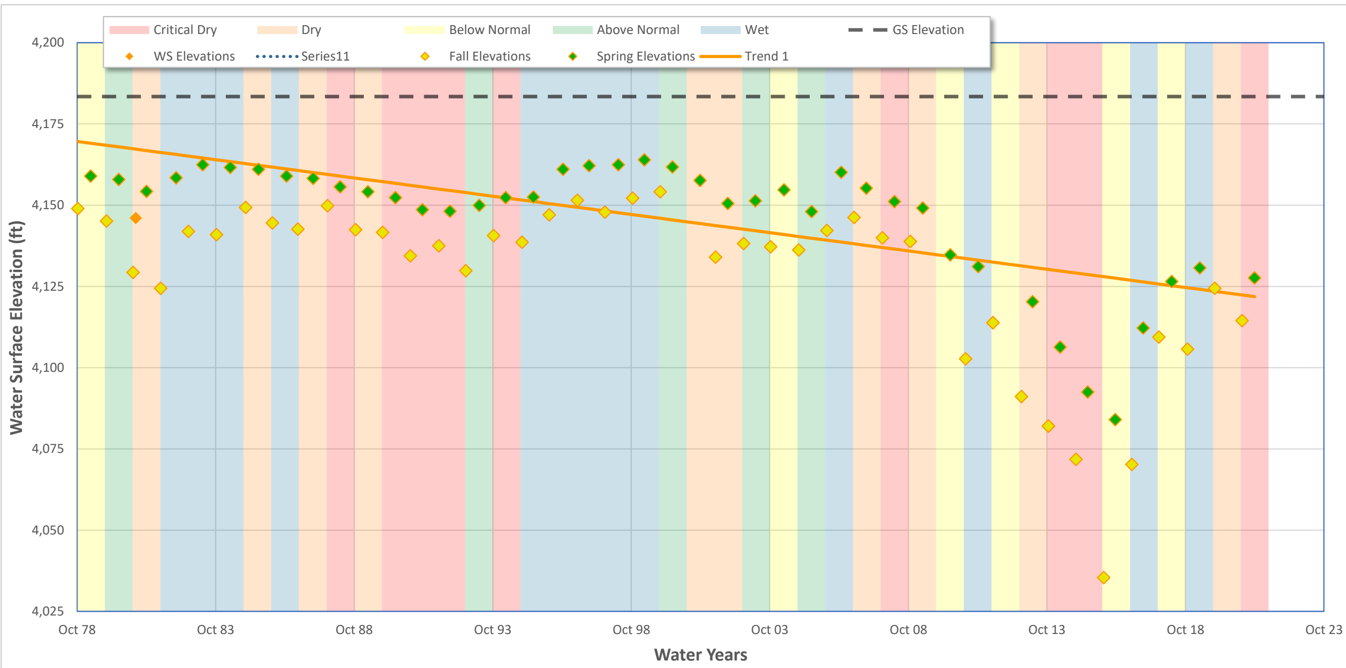
Well Period of Record

Period-of-Record		1979..2021
WS Elev-Range	Min:	4035.4 ft
	Max	4163.9 ft

Trend Analysis

Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(1.123 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

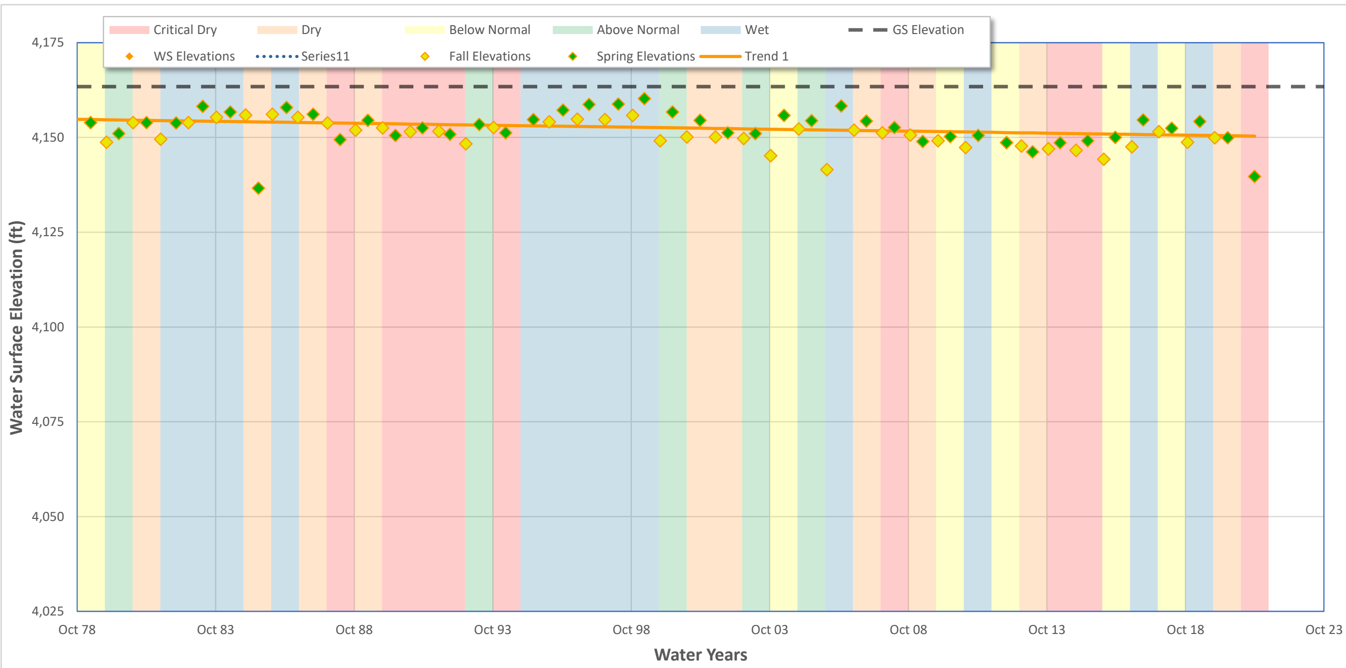
Date: 8/17/2021

Well Information	
Well ID	036754_39N08E18N002M
Well Name	18N2
State Number	39N08E18N002M
WCR Number	127457
Site Code	412144N1211013W001
Well Location	
County	Modoc
Basin	Big Valley
Hydrologic Region	Sacramento River
Station Organization	Modoc County Planning Department
Well Type Information	
Well Use	Residential
Completion Type	Single Well

Well Coordinates/Geometry		
Location	Lat:	41.2144
	Long:	-121.1013
Well Depth		250.00 ft
Ground Surface Elevation		4163.40 ft
Ref. Point Elevation		4164.40 ft
Screen Depth Range		-
Screen Elevation Range		-
Well Period of Record		
Period-of-Record		1979..2021
WS Elev-Range	Min:	4136.6 ft
	Max	4160.2 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.104 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

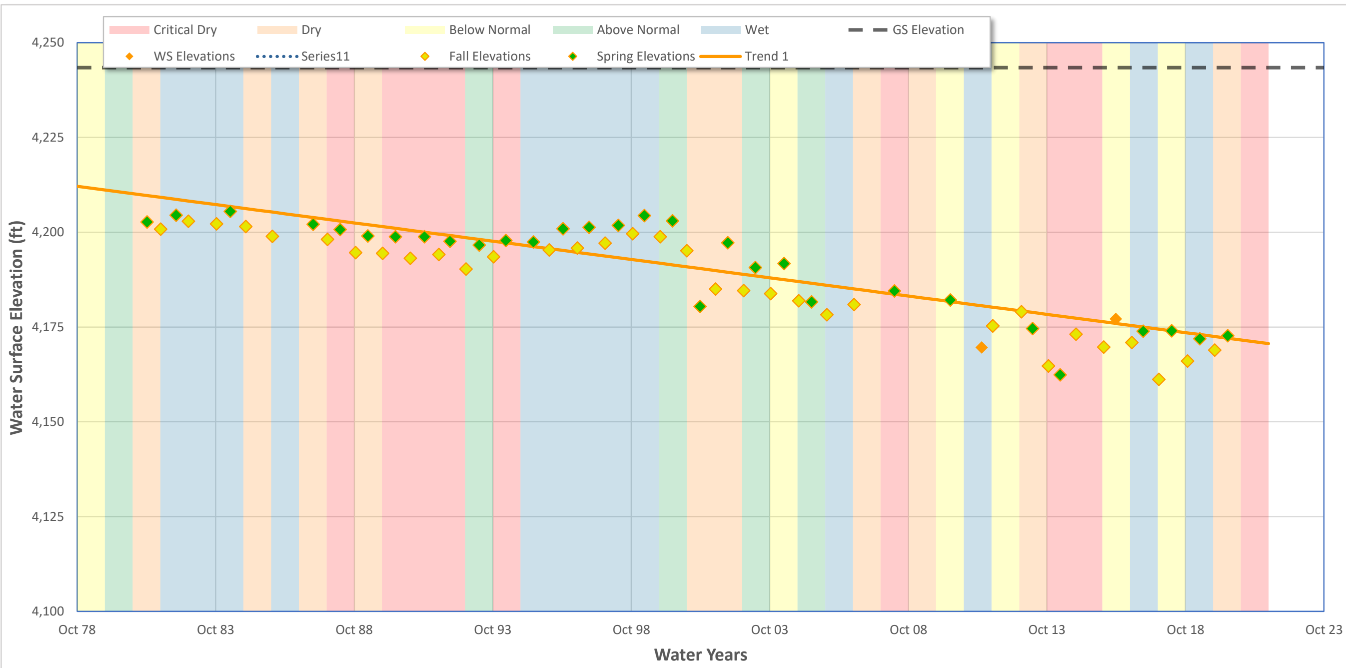
Date: 8/17/2021

Well Information	
Well ID	036757_39N09E32R001M
Well Name	32R1
State Number	39N09E32R001M
WCR Number	-
Site Code	411649N1209569W001
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:	41.1680
	Long:	-120.9570
Well Depth		-
Ground Surface Elevation		4243.40 ft
Ref. Point Elevation		4243.60 ft
Screen Depth Range		-
Screen Elevation Range		-
Well Period of Record		
Period-of-Record		1981..2021
WS Elev-Range	Min:	4161.2 ft
	Max	4205.5 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(0.964 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

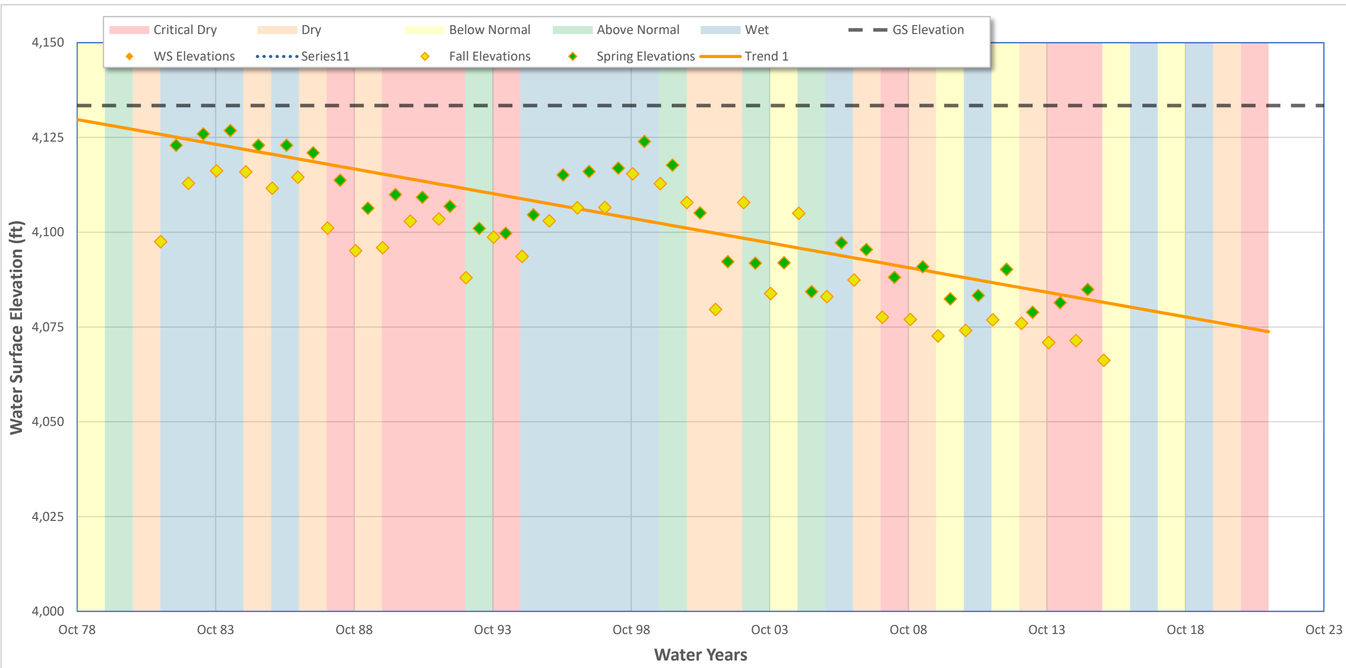
Date: 8/17/2021

Well Information	
Well ID	039199_37N08E06C001M
Well Name	06C1
State Number	37N08E06C001M
WCR Number	14580
Site Code	410777N1210986W001
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:	41.0777
	Long:	-121.0986
Well Depth		400.00 ft
Ground Surface Elevation		4133.40 ft
Ref. Point Elevation		4133.90 ft
Screen Depth Range		-
Screen Elevation Range		-
Well Period of Record		
Period-of-Record		1982..2016
WS Elev-Range	Min:	4066.2 ft
	Max	4126.8 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(1.301 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

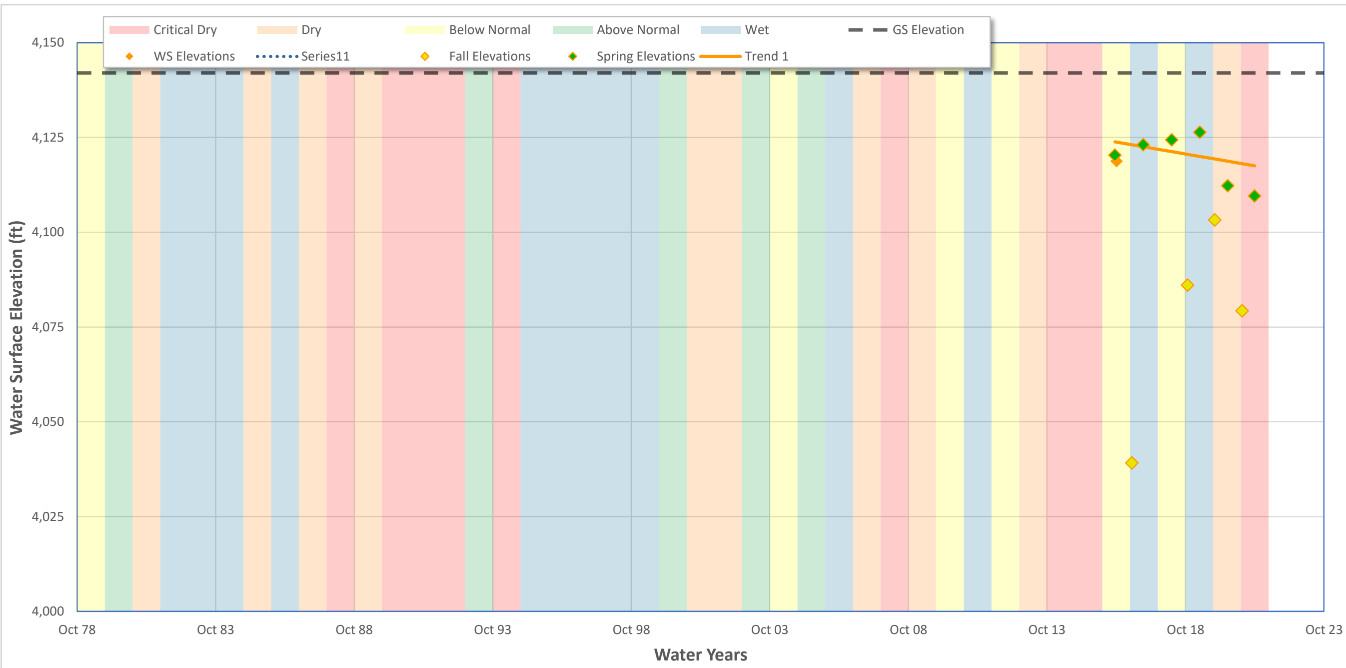
Date: 8/17/2021

Well Information	
Well ID	051402_ACWA-1
Well Name	ACWA-1
State Number	38N08E07A001M
WCR Number	0962825
Site Code	411508N1210900W001
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:	41.1508
	Long:	-121.0900
Well Depth		780.00 ft
Ground Surface Elevation		4142.00 ft
Ref. Point Elevation		4142.75 ft
Screen Depth Range		60 to 780 ft
Screen Elevation Range		4083 to 3363 ft
Well Period of Record		
Period-of-Record		2016..2021
WS Elev-Range	Min:	4039.2 ft
	Max	4126.4 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	2016
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	(1.253 ft/yr)
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

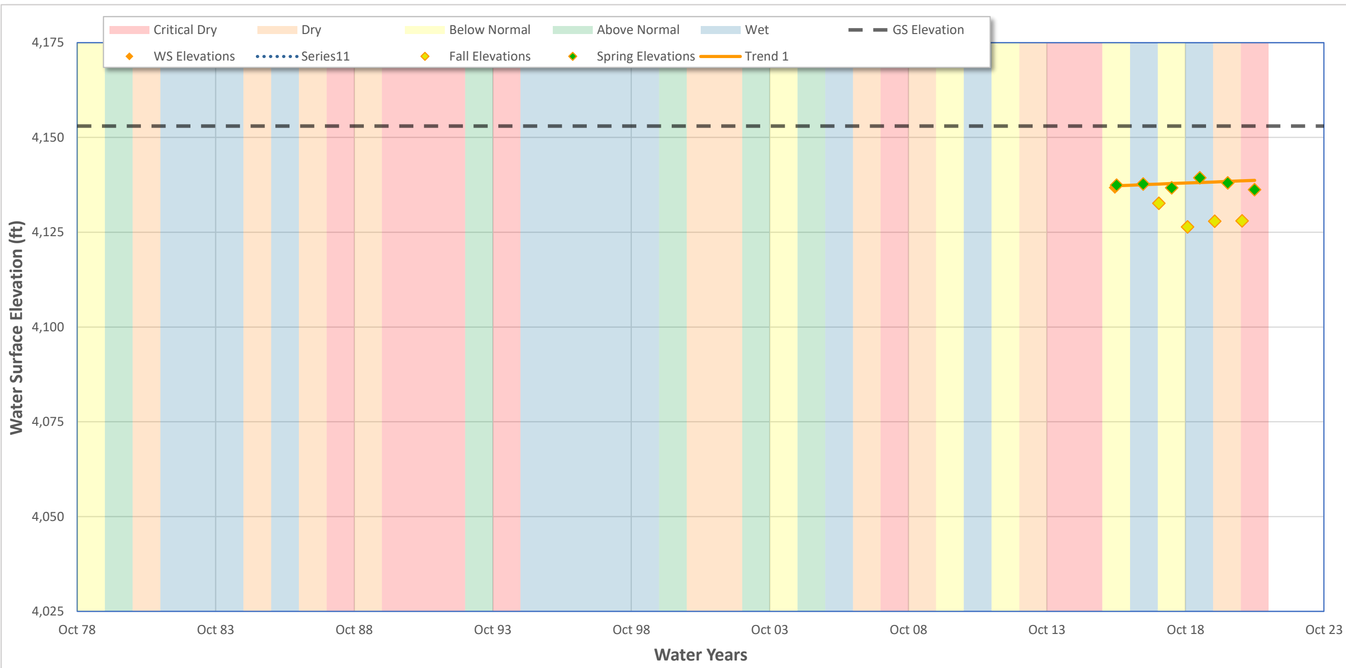
Date: 8/17/2021

Well Information	
Well ID	051403_ACWA-2
Well Name	ACWA-2
State Number	39N08E33P002M
WCR Number	484622
Site Code	411699N1210579W001
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:	41.1699
	Long:	-121.0579
Well Depth		800.00 ft
Ground Surface Elevation		4153.00 ft
Ref. Point Elevation		4153.20 ft
Screen Depth Range		50 to 800 ft
Screen Elevation Range		4093 to 3343 ft
Well Period of Record		
Period-of-Record		2016..2021
WS Elev-Range	Min:	4126.4 ft
	Max	4139.4 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	2016
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	0.283 ft/yr
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Groundwater Level Report

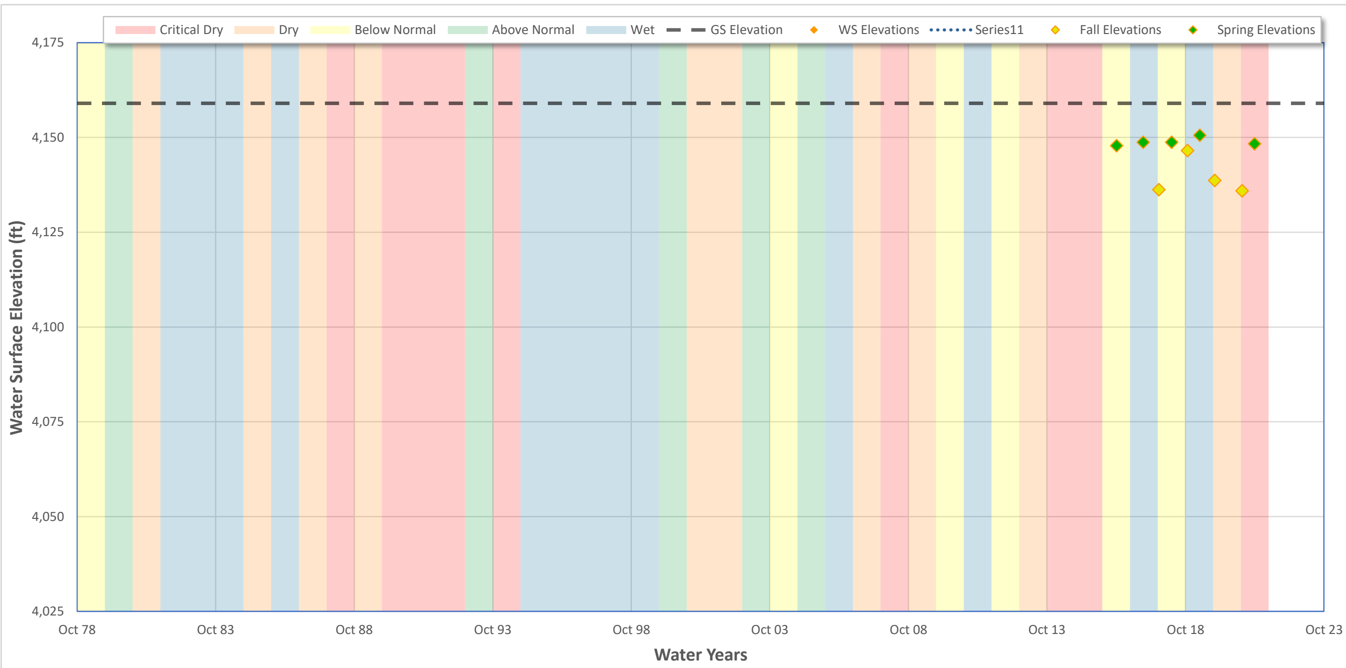
Date: 8/17/2021

Well Information	
Well ID	051537_ACWA-3
Well Name	ACWA-3
State Number	39N08E28A001M
WCR Number	0951365
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

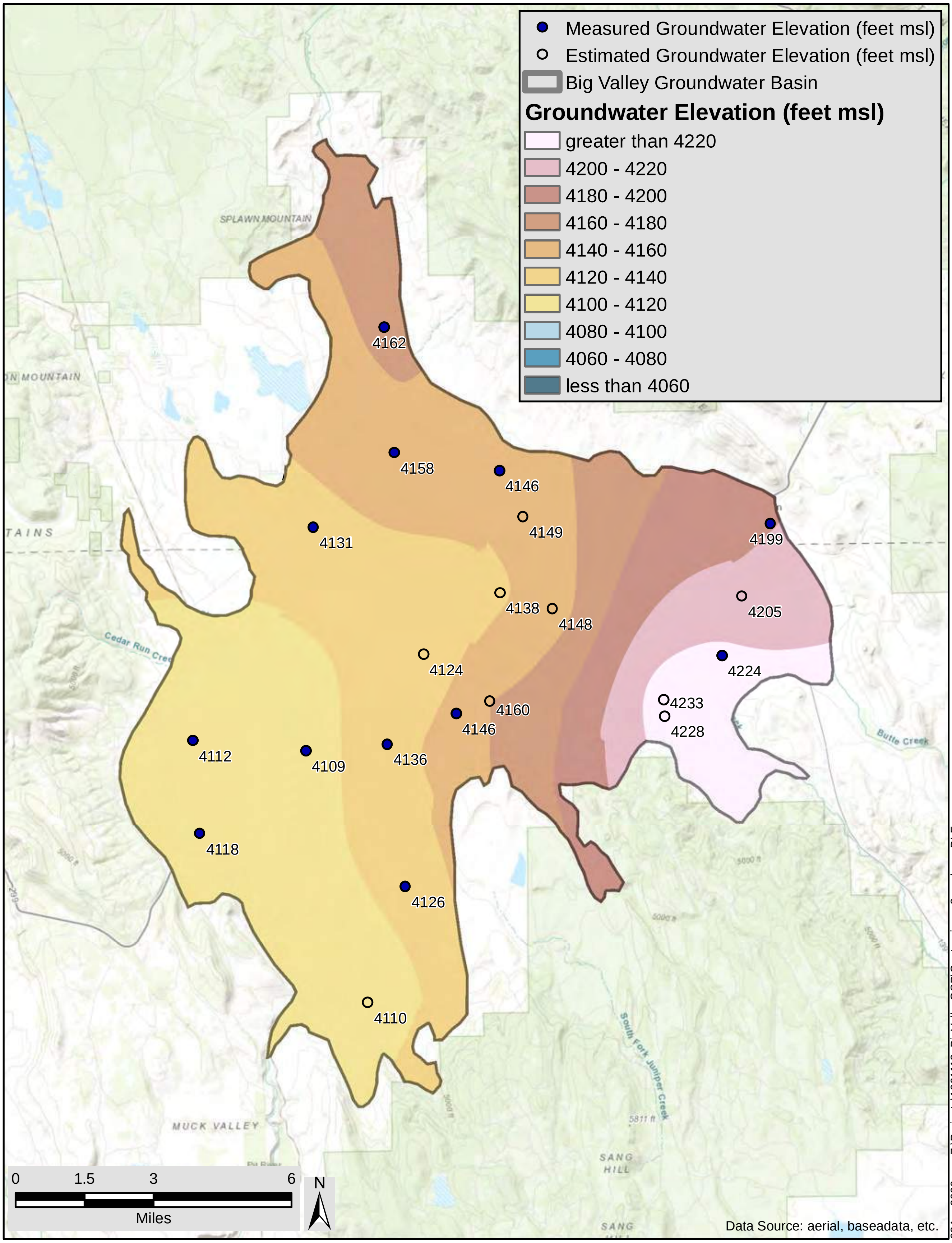
Well Coordinates/Geometry		
Location	Lat:	41.1938
	Long:	-121.0478
Well Depth		720.00 ft
Ground Surface Elevation		4159.00 ft
Ref. Point Elevation		4159.83 ft
Screen Depth Range		60 to 720 ft
Screen Elevation Range		4075 to 3415 ft
Well Period of Record		
Period-of-Record		2016..2021
WS Elev-Range	Min:	4135.9 ft
	Max	4150.6 ft

Trend Analysis		
Seasonal Data Method		Max/Min
Show Trend 1		Spring Data
Date Range (Optional)	Start WY:	1979
	End WY:	2021
Extend Trend Line		No
Trend Results	Slope	0.821 ft/yr
Show Trend 2		None
Date Range (Optional)	Start WY:	
	End WY:	
Extend Trend Line		Yes
Trend Results	Slope	-

Water Surface Elevation (WSE) Hydrograph



Appendix 5B Groundwater Elevation Contours 1983 to 2018



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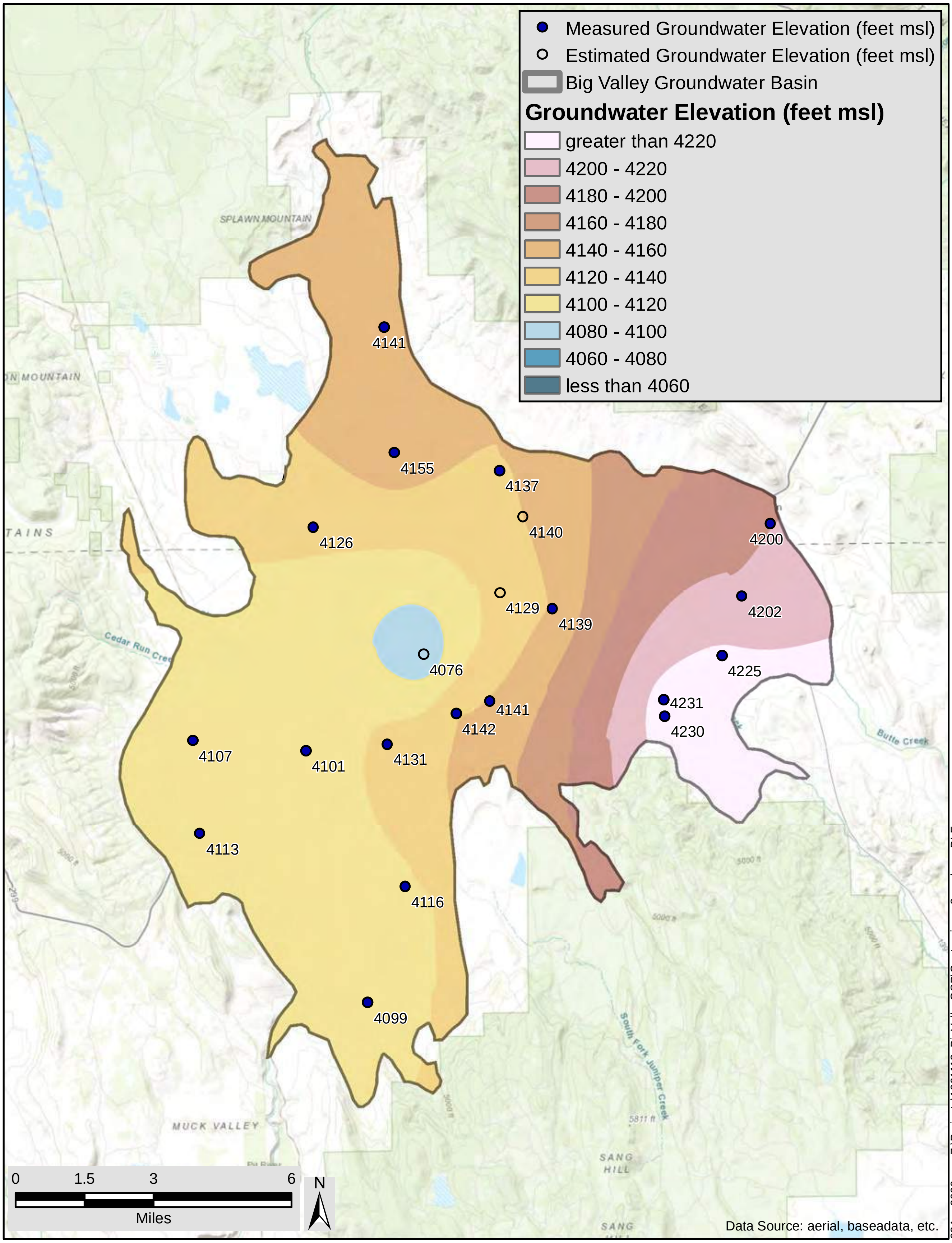
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1983
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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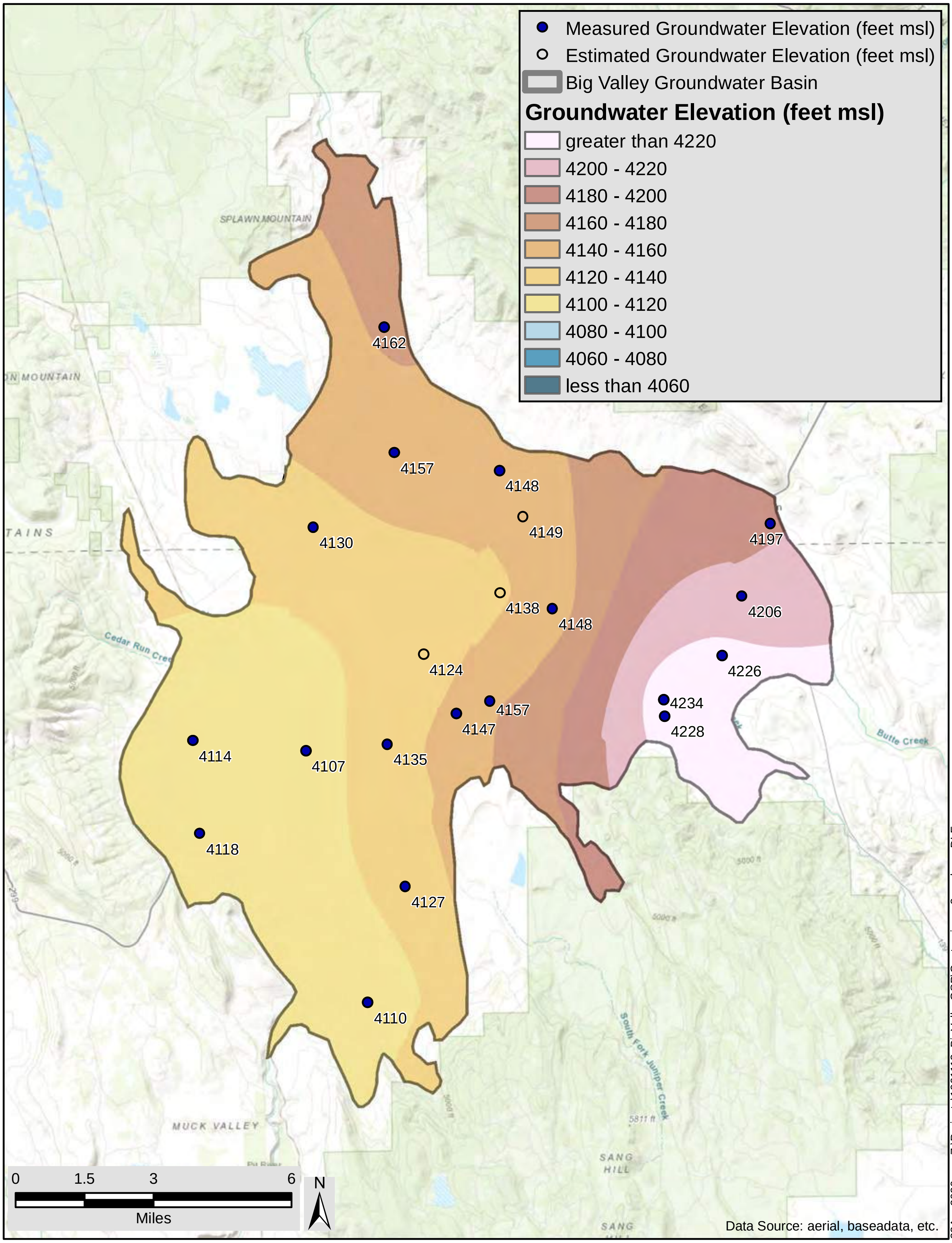
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1983
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



Big Valley Basin Groundwater Sustainability Plan
Modoc and Lassen Counties, California

Big Valley Groundwater Basin GSAs

GEI Consultants

Groundwater Elevations
Spring 1984

AUGUST 2020 DRAFT FIGURE

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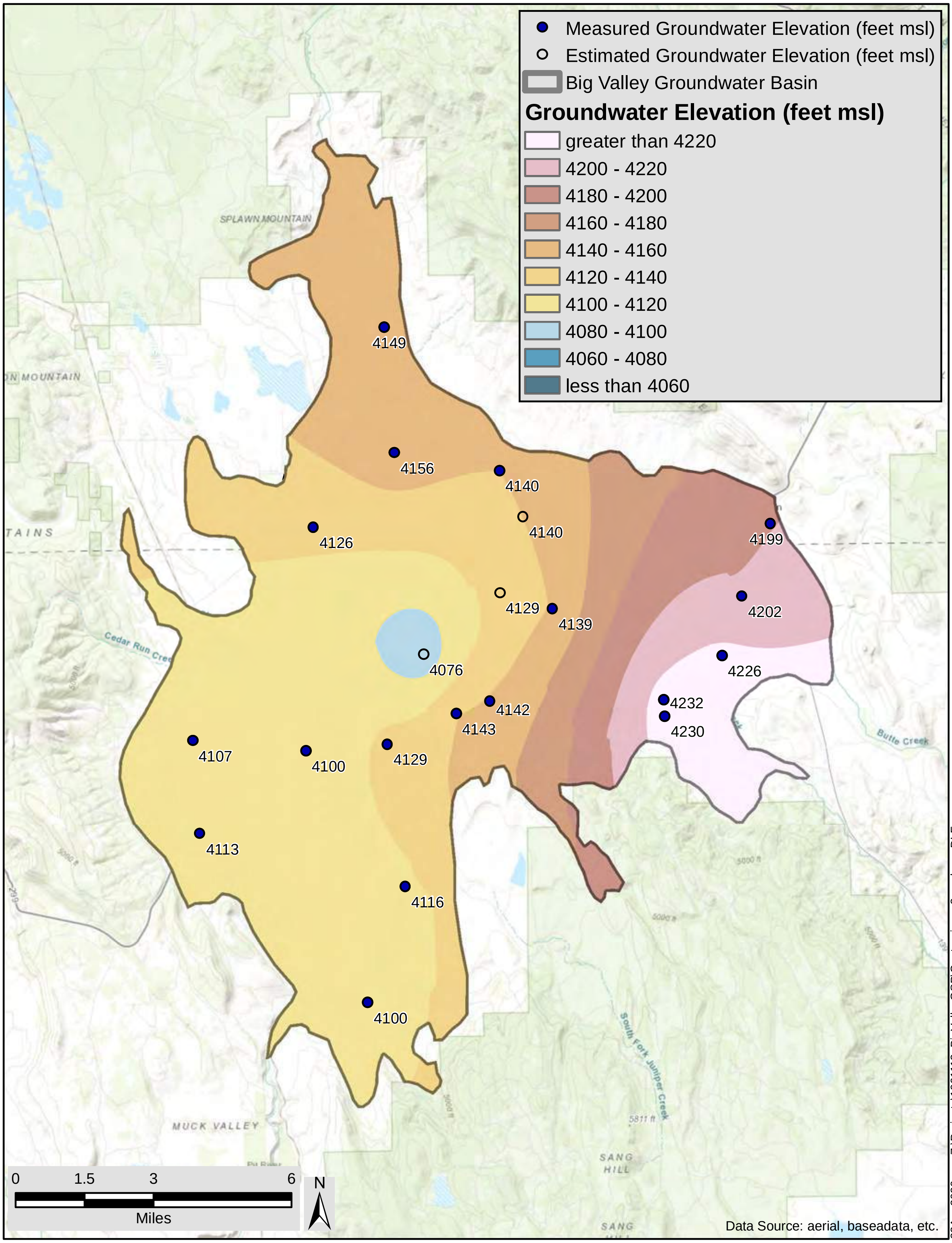

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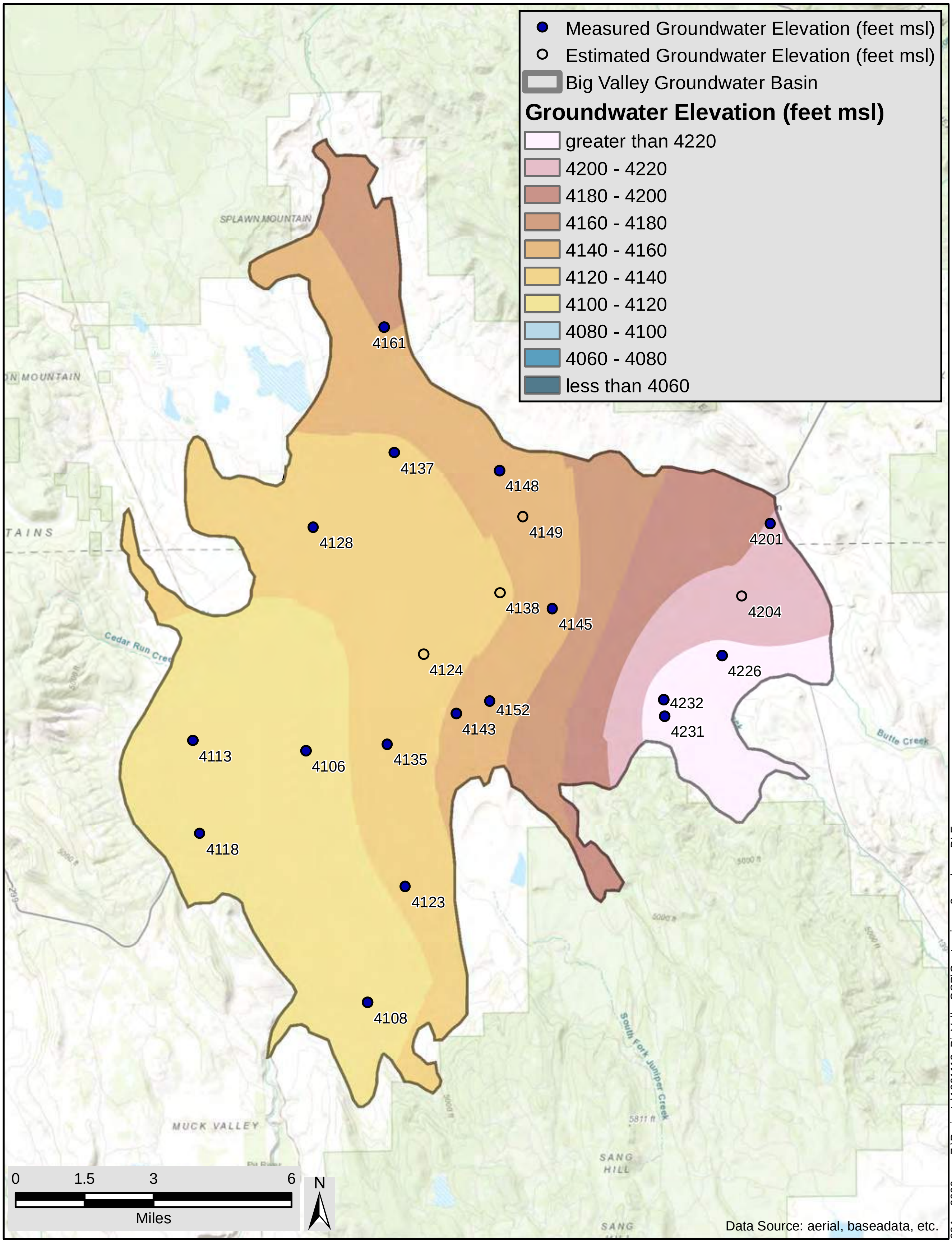
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1984		
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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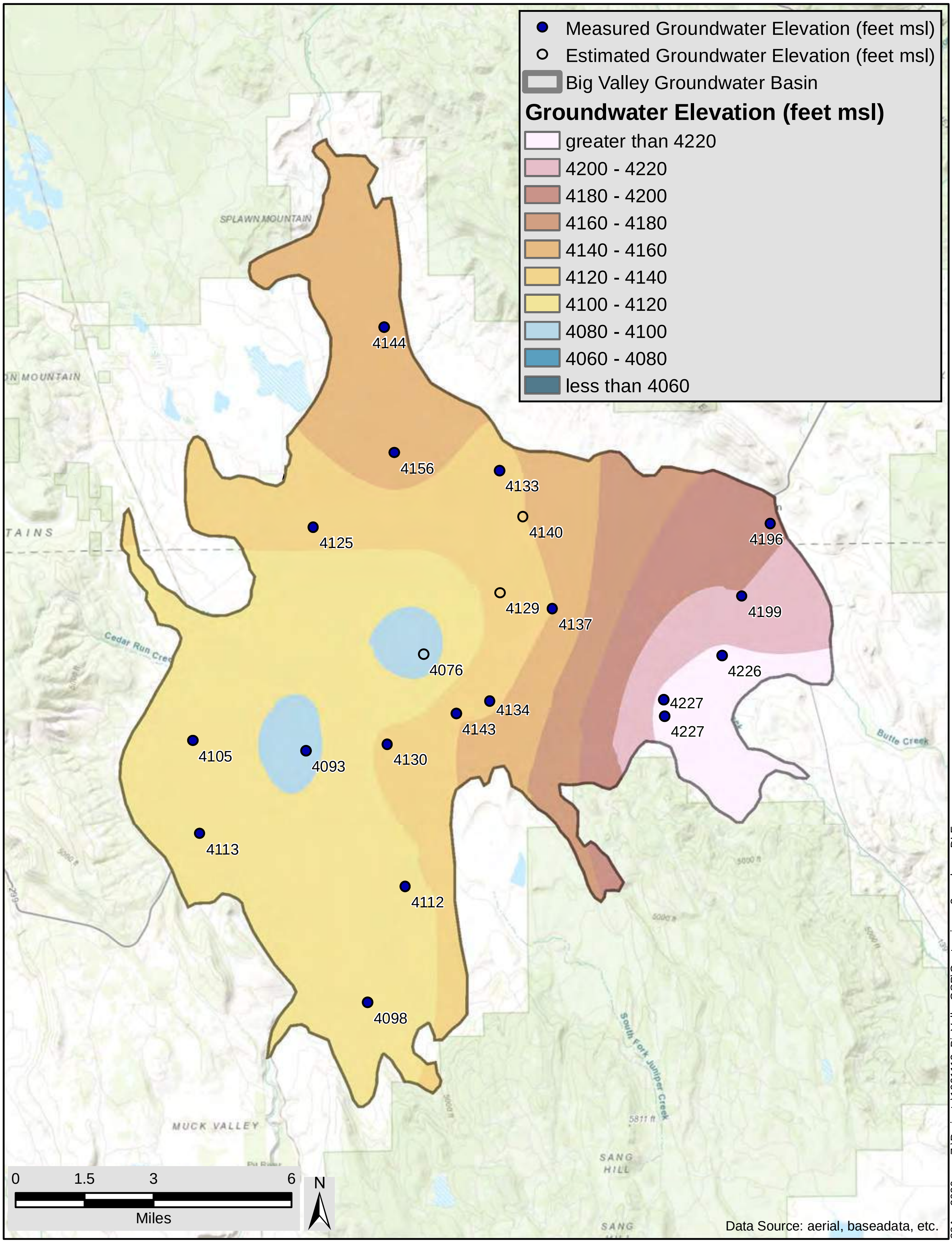
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1985
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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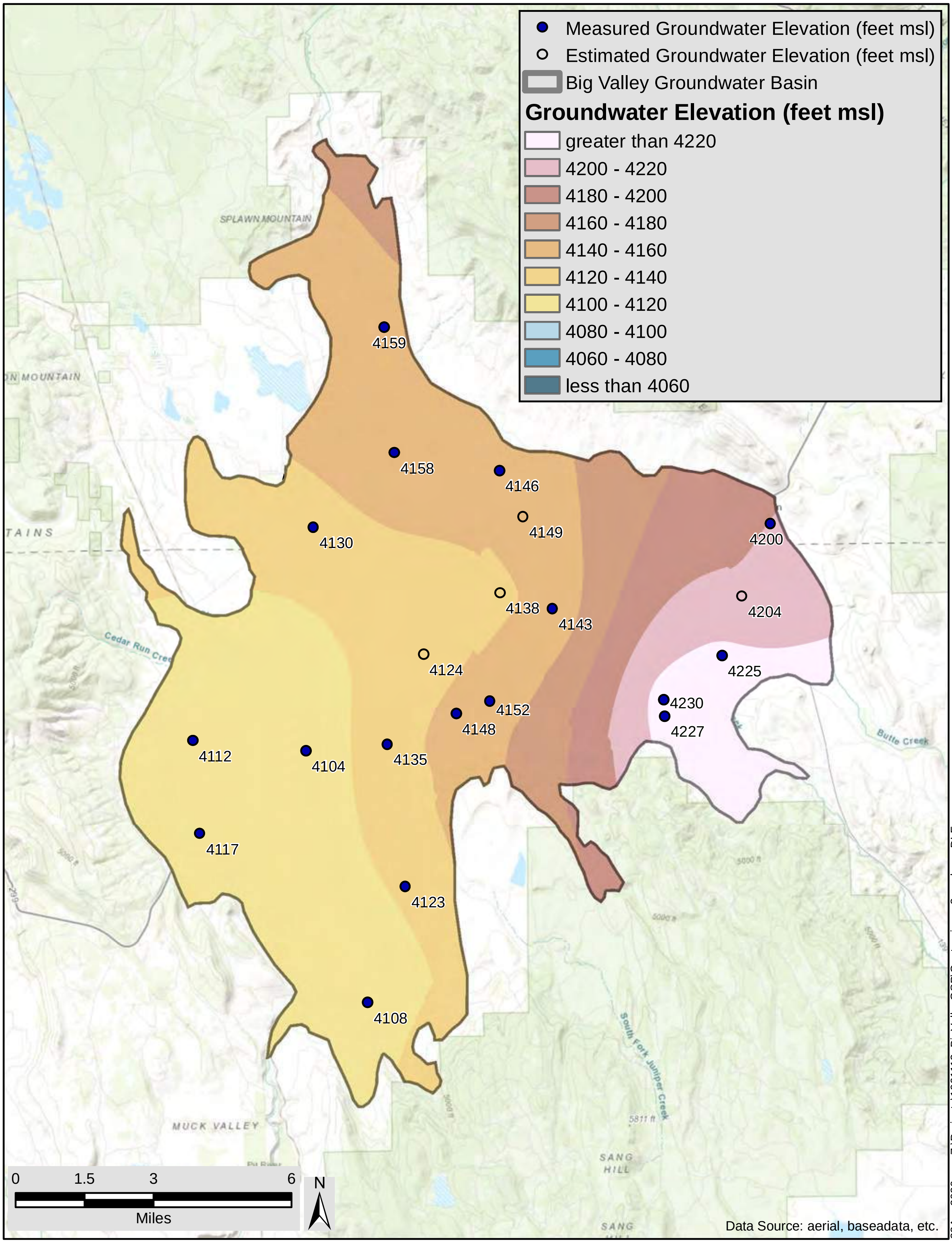
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1985		
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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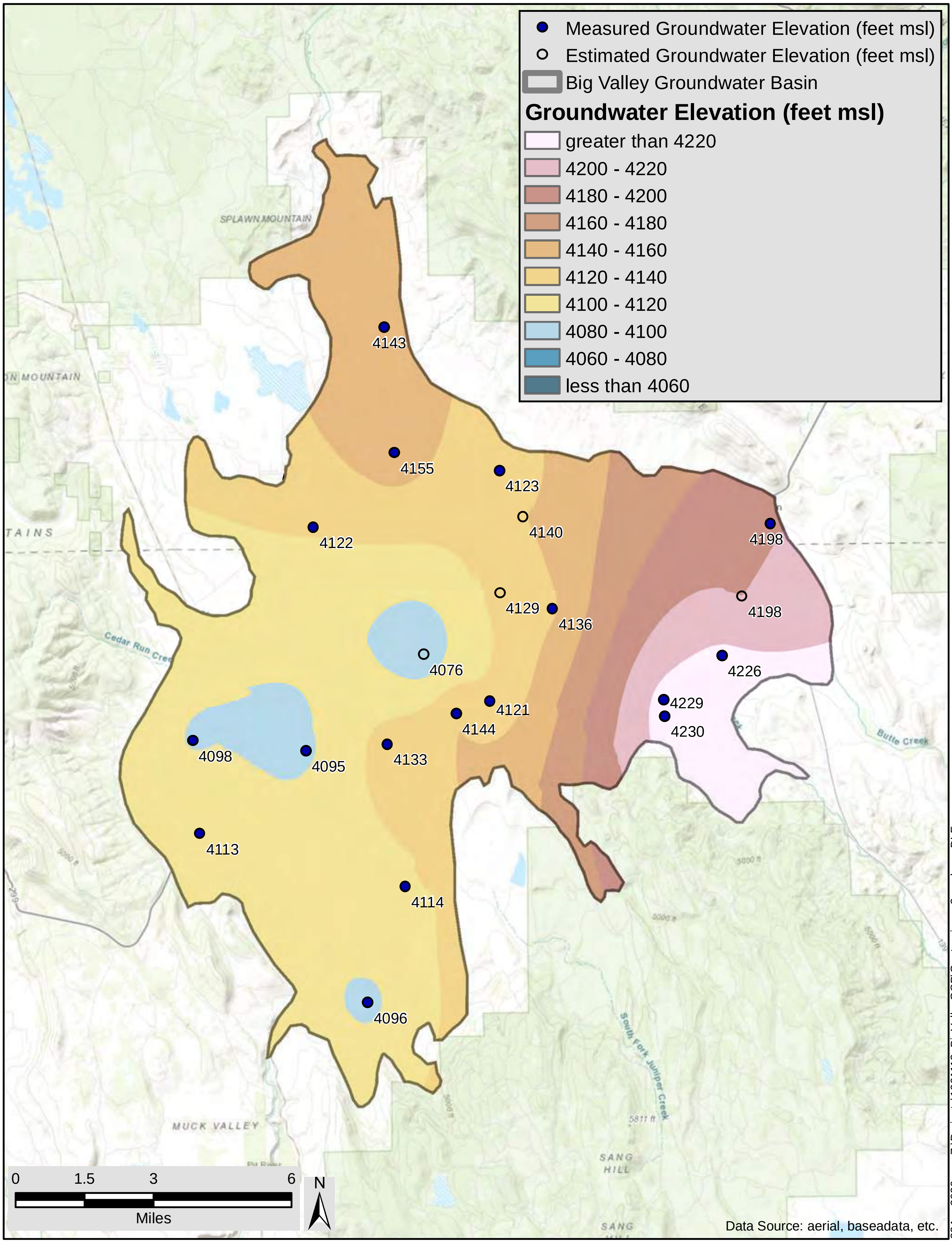
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1986		
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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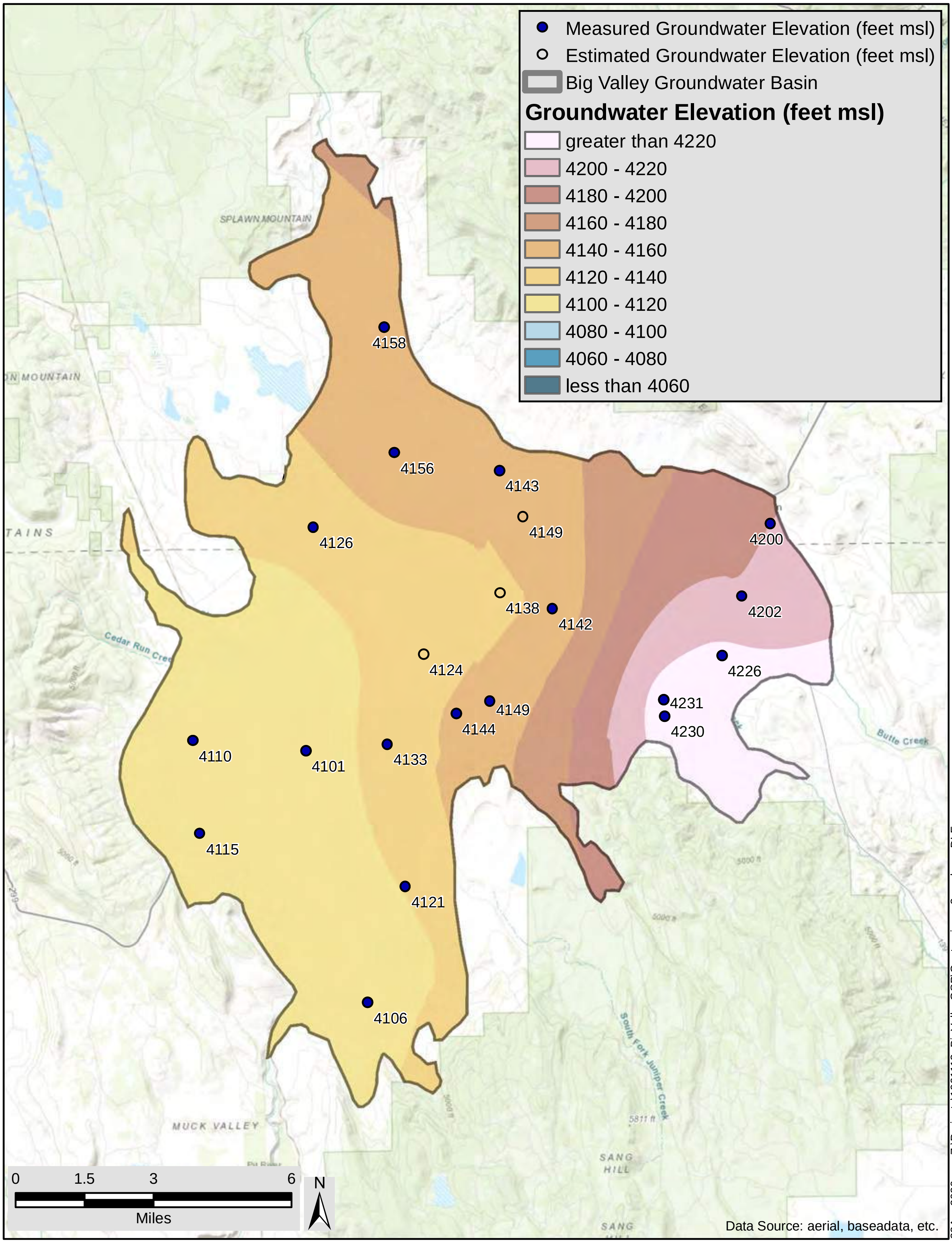
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1986
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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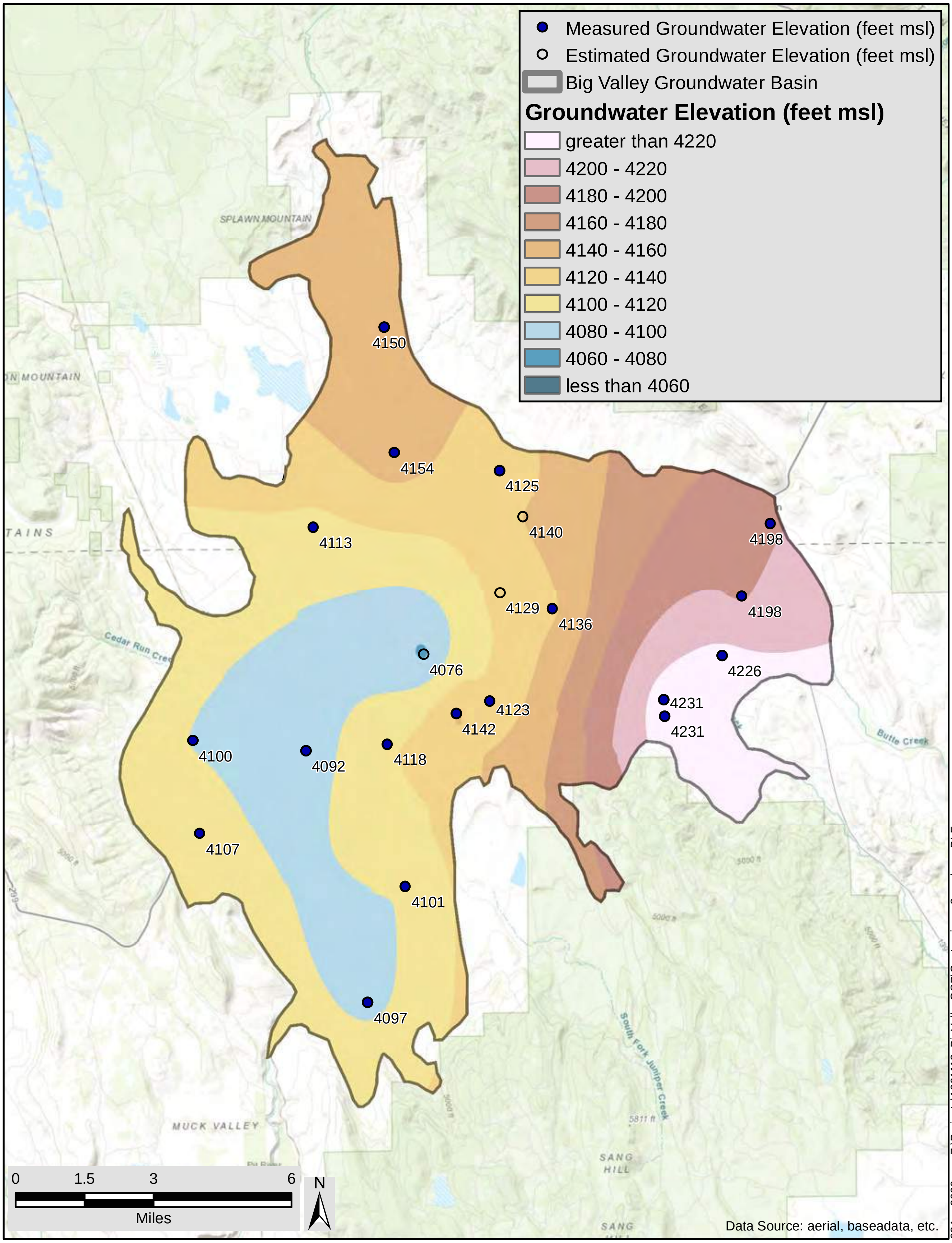
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1987
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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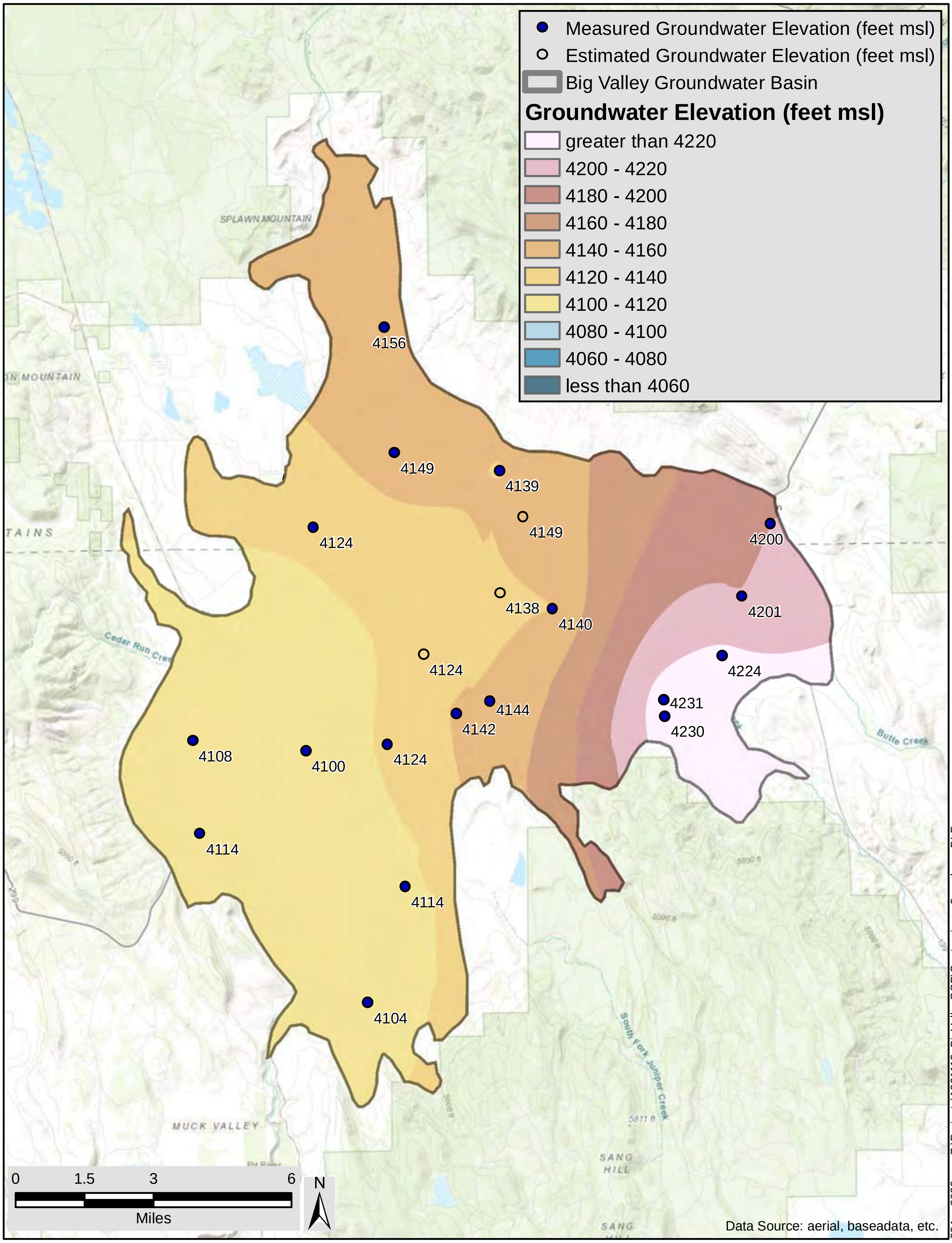
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1987
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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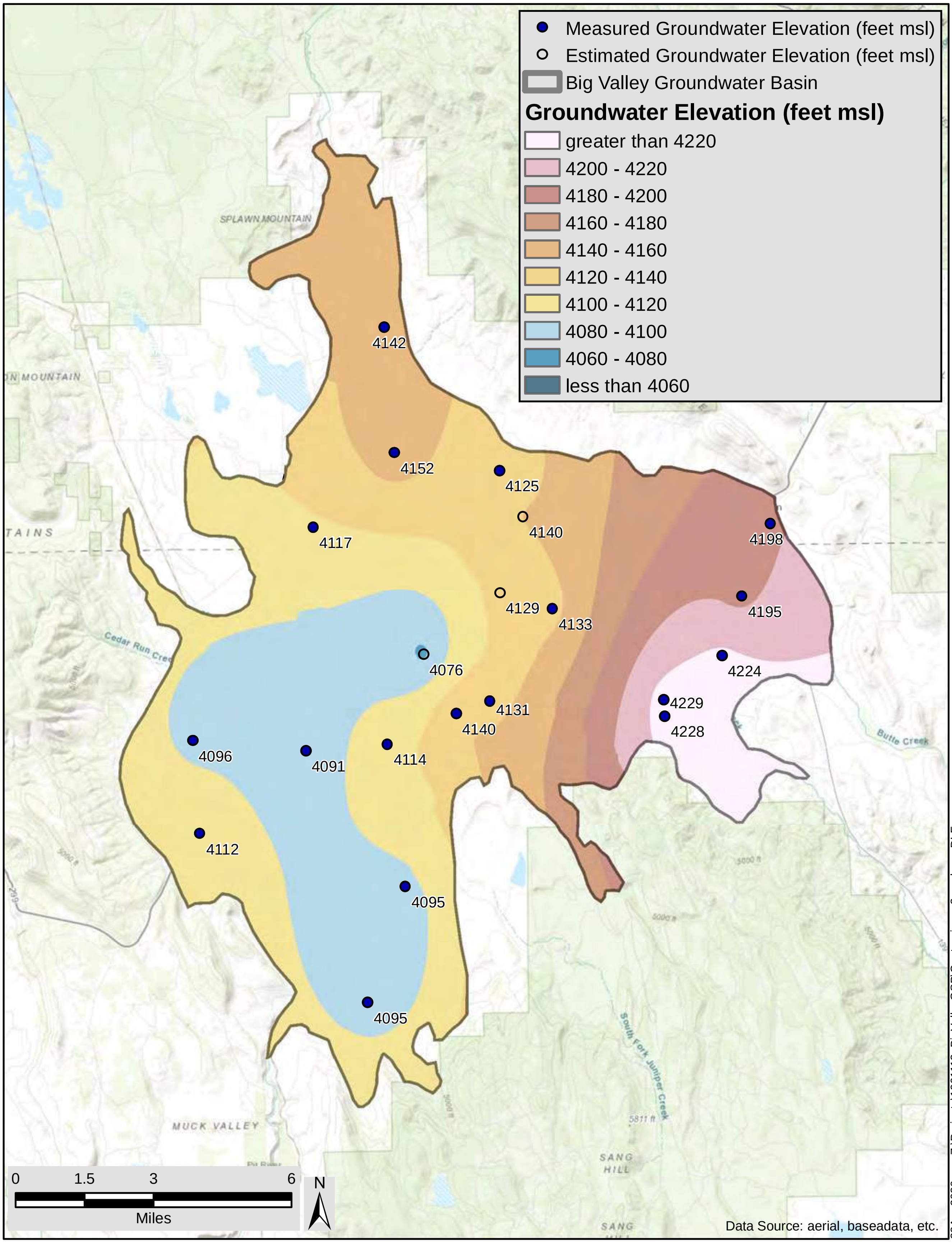
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1988
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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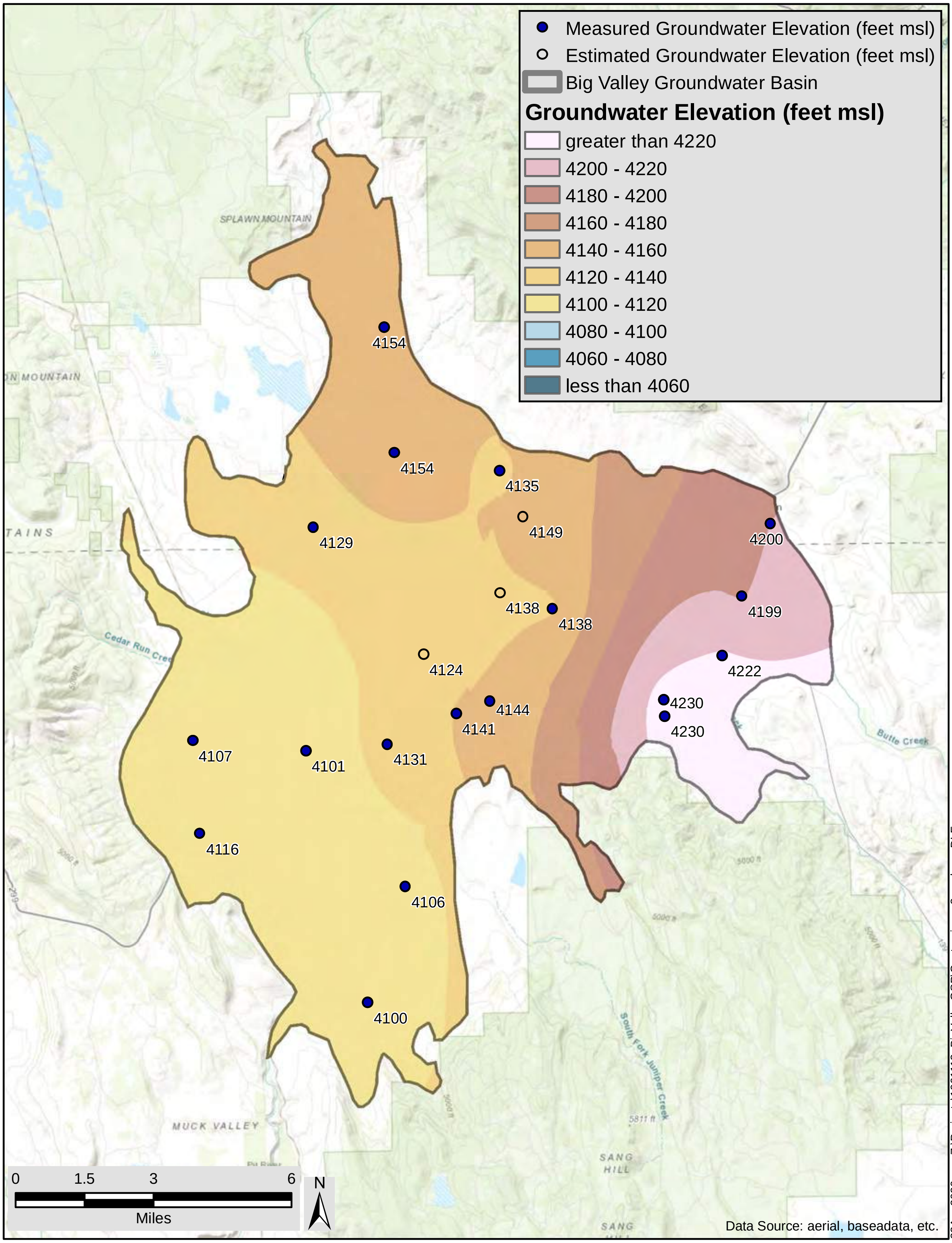
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1988		
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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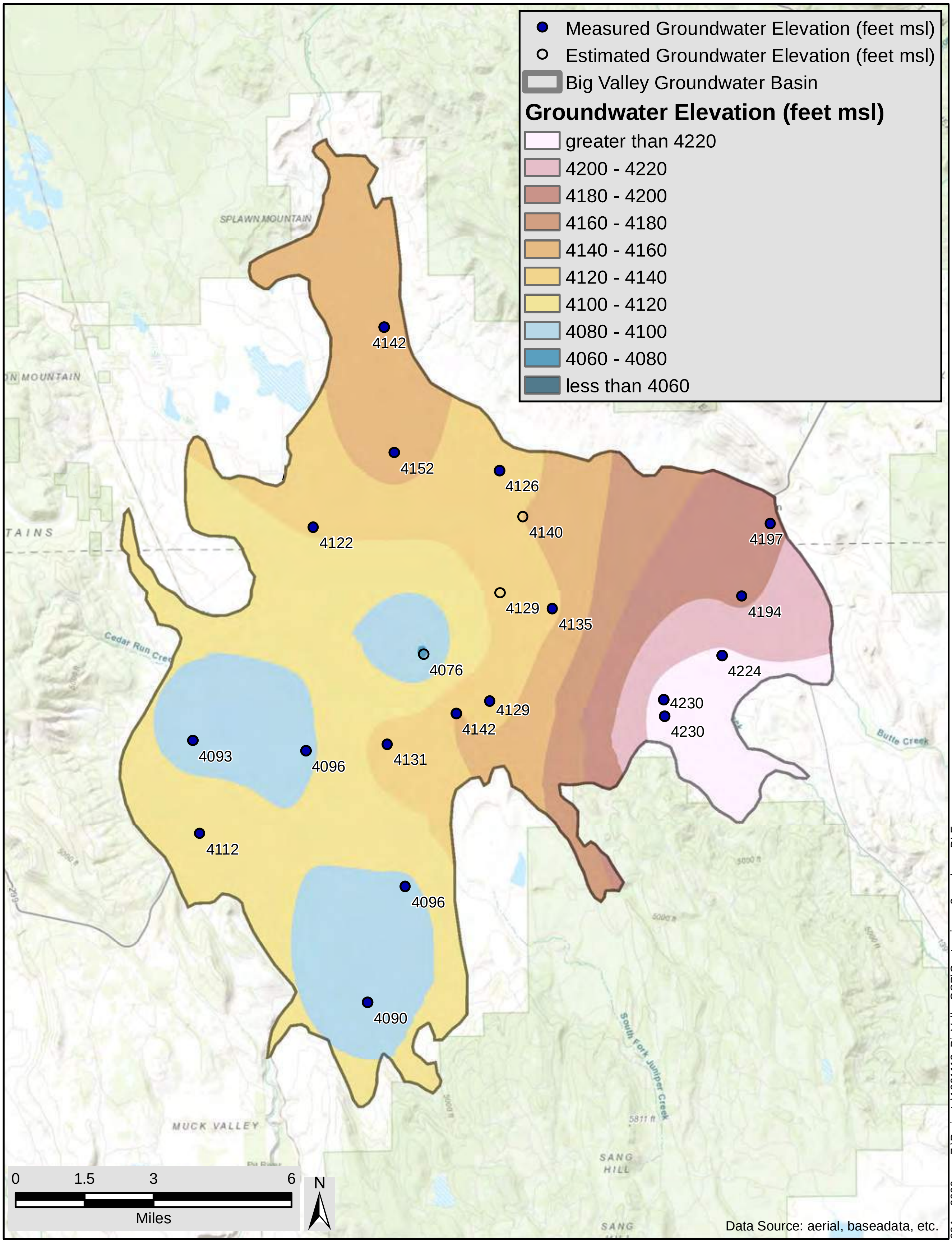
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1989
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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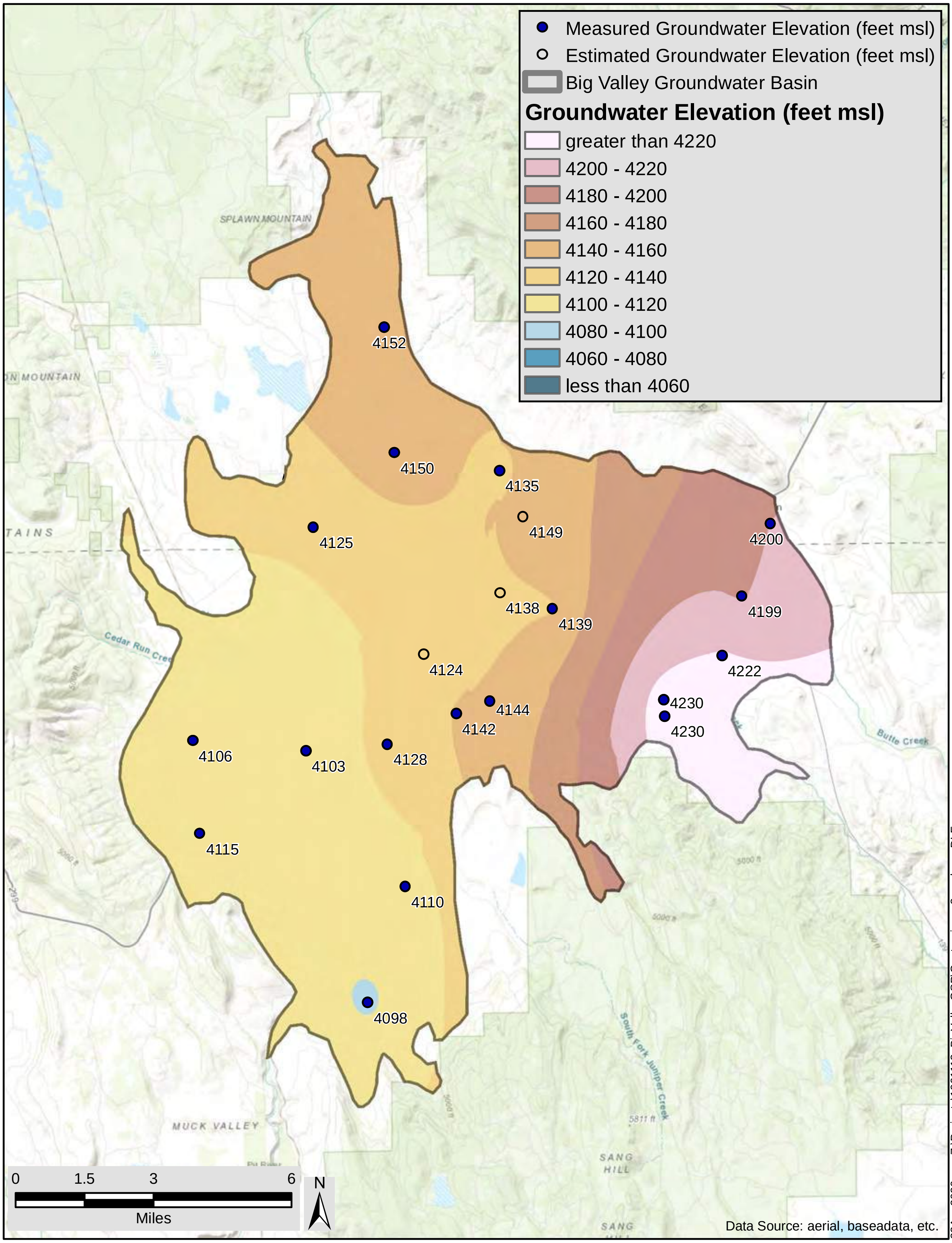
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1989
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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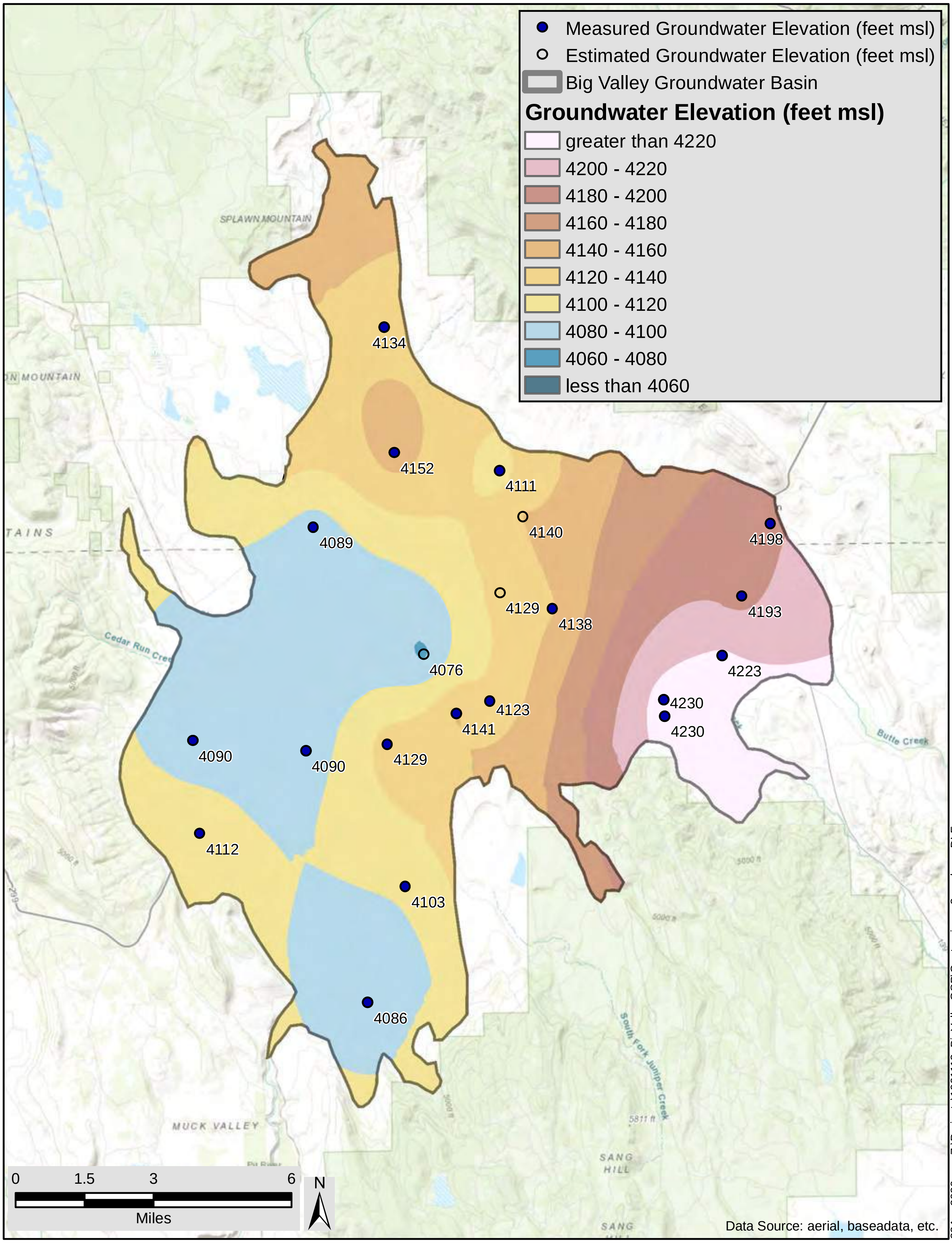
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1990
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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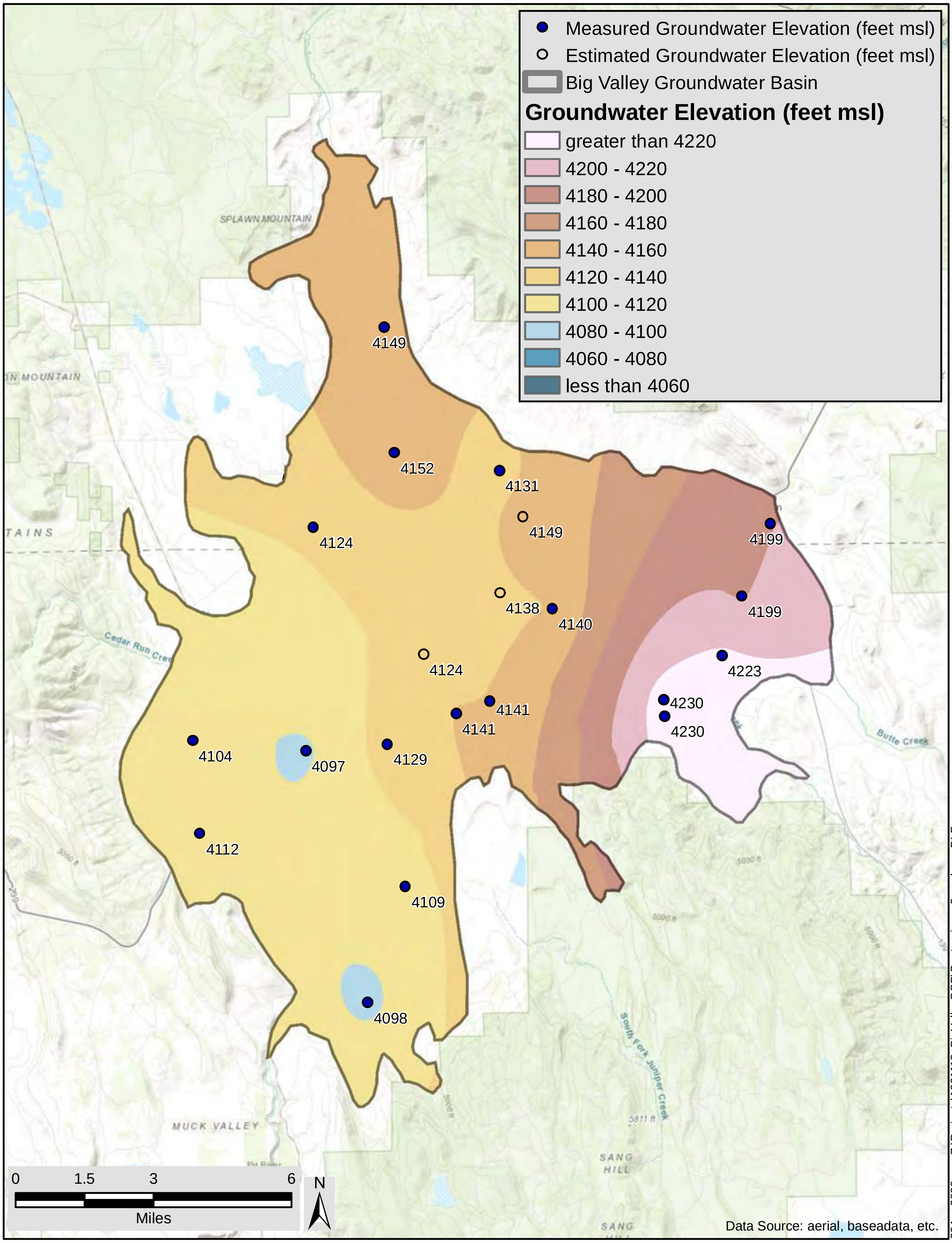
22Aug2020

Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1990		
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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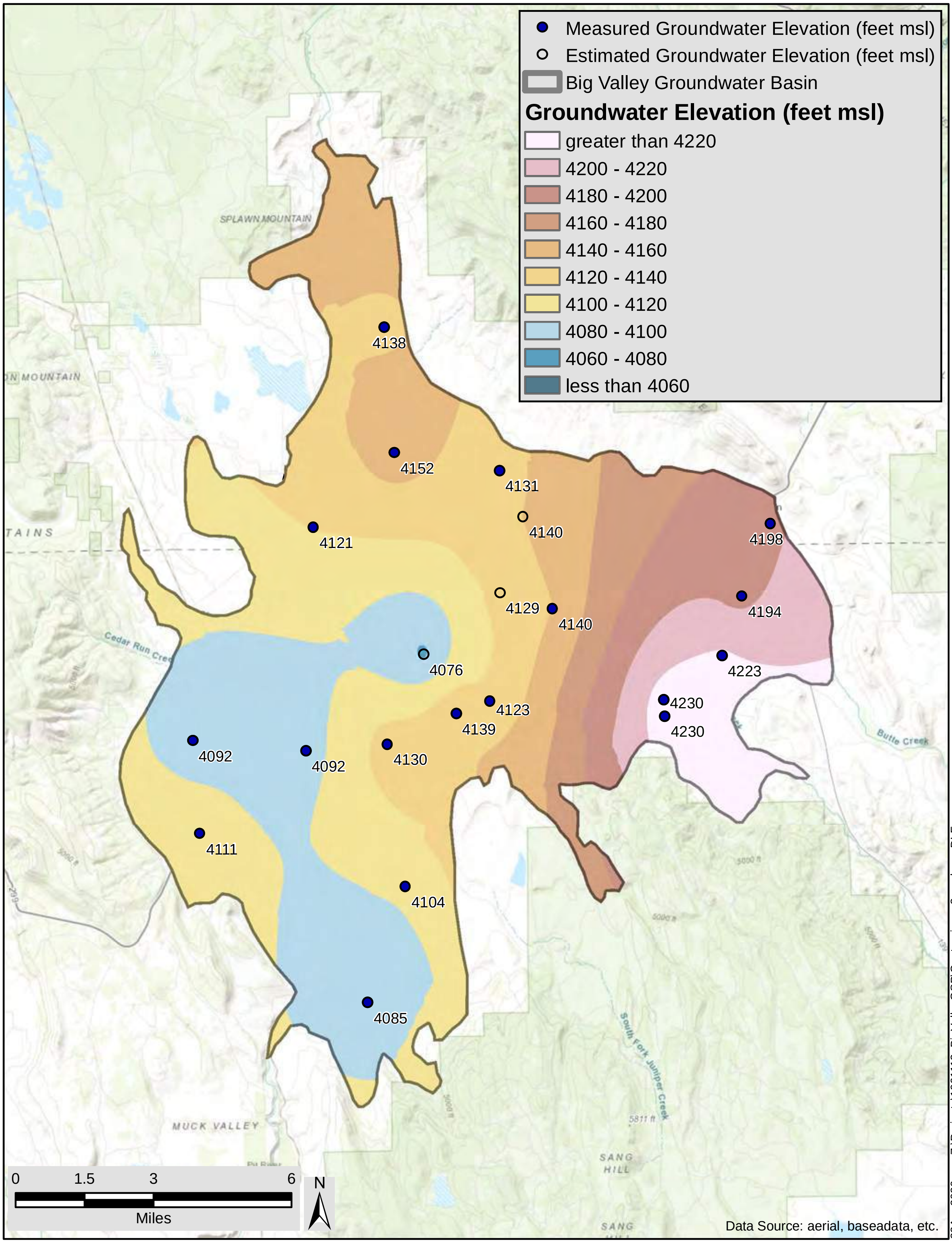
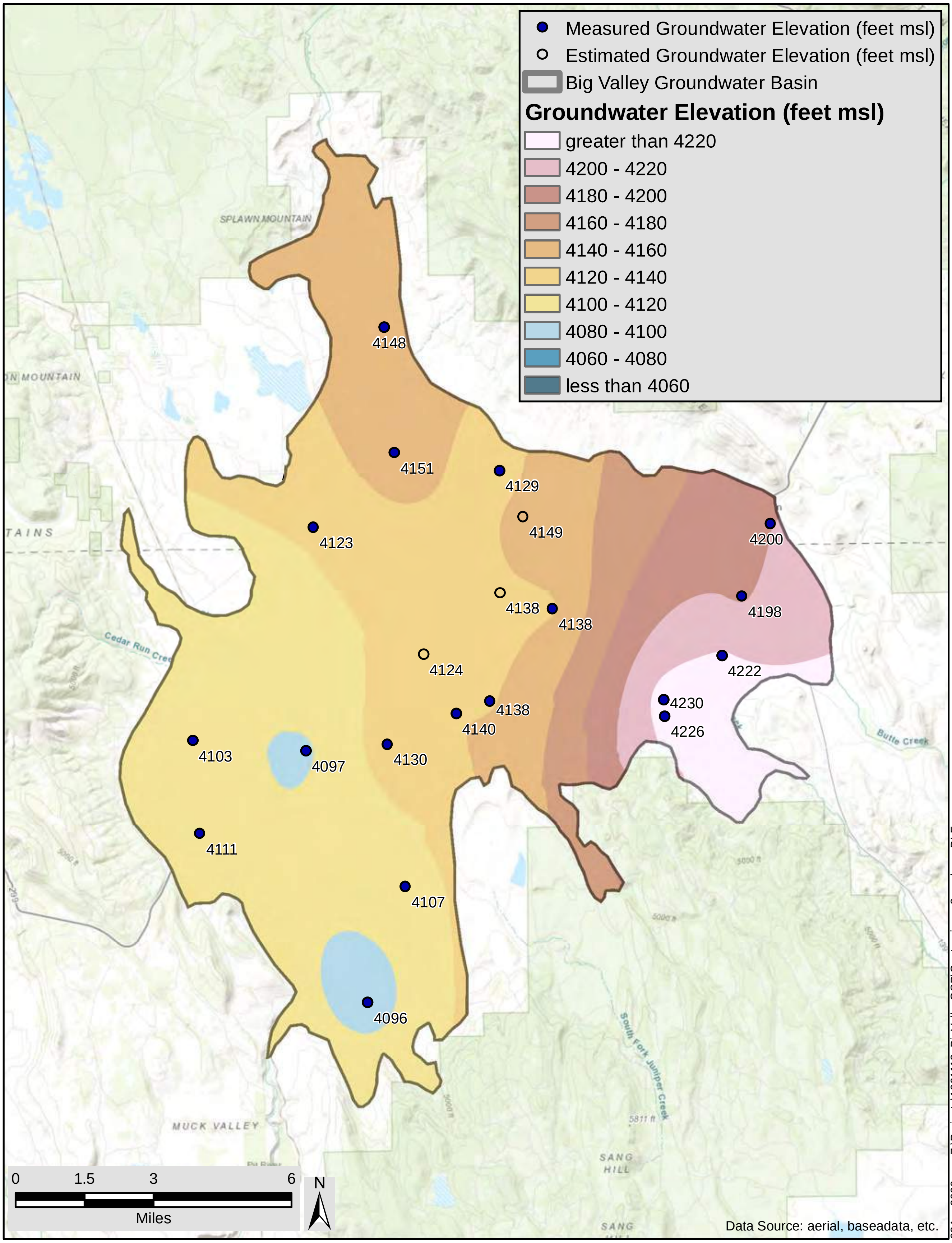
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1991
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1991
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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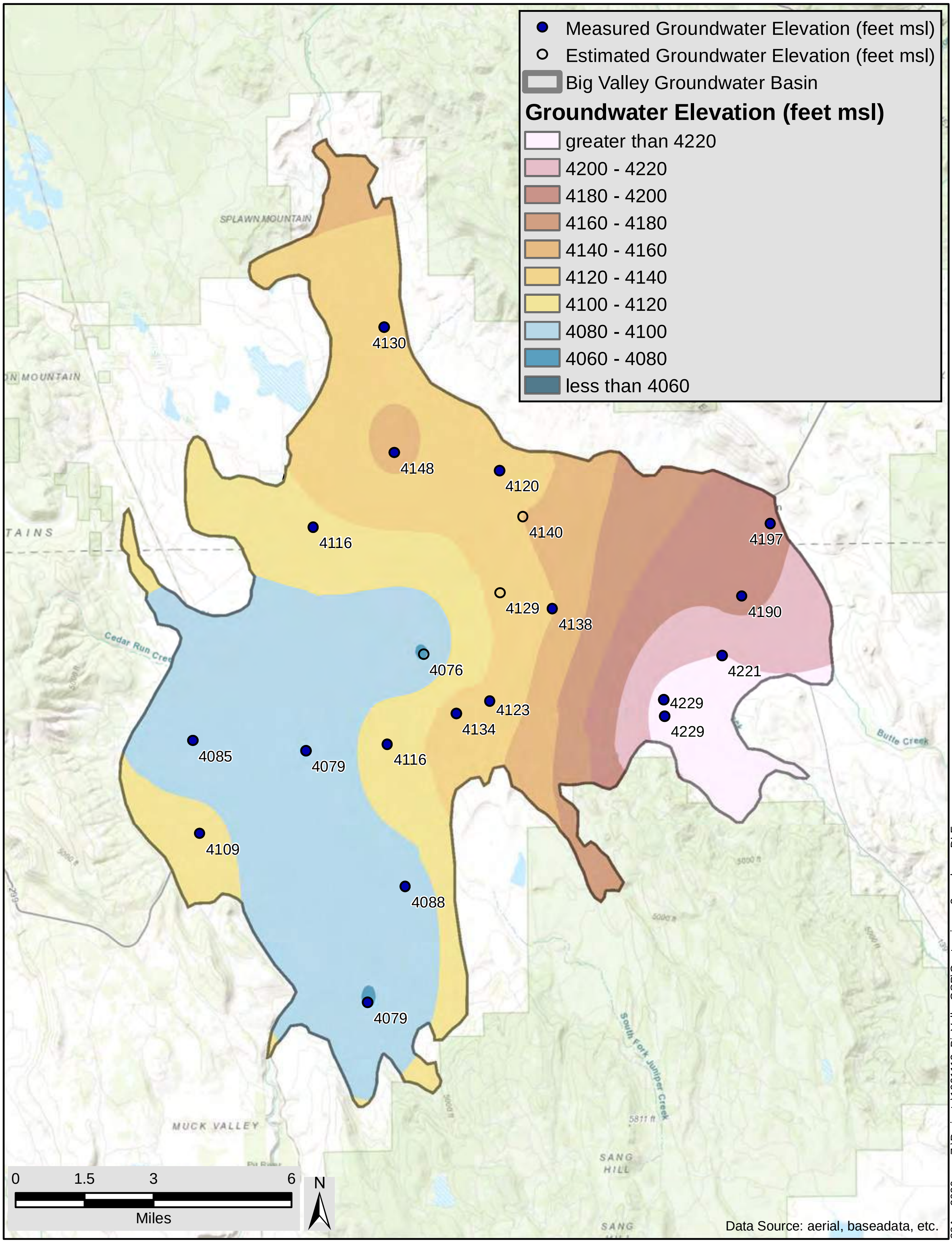
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1992
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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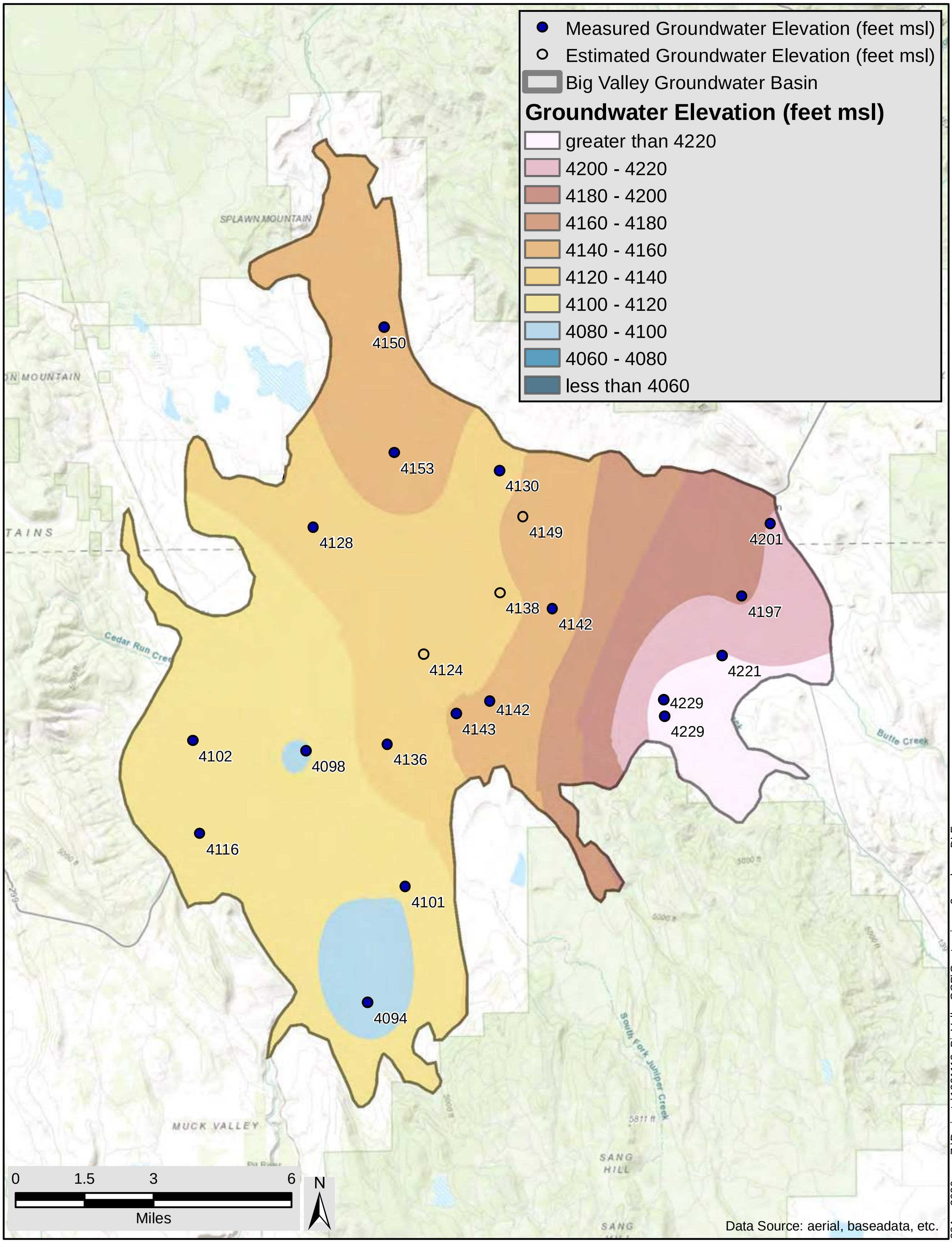
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1992
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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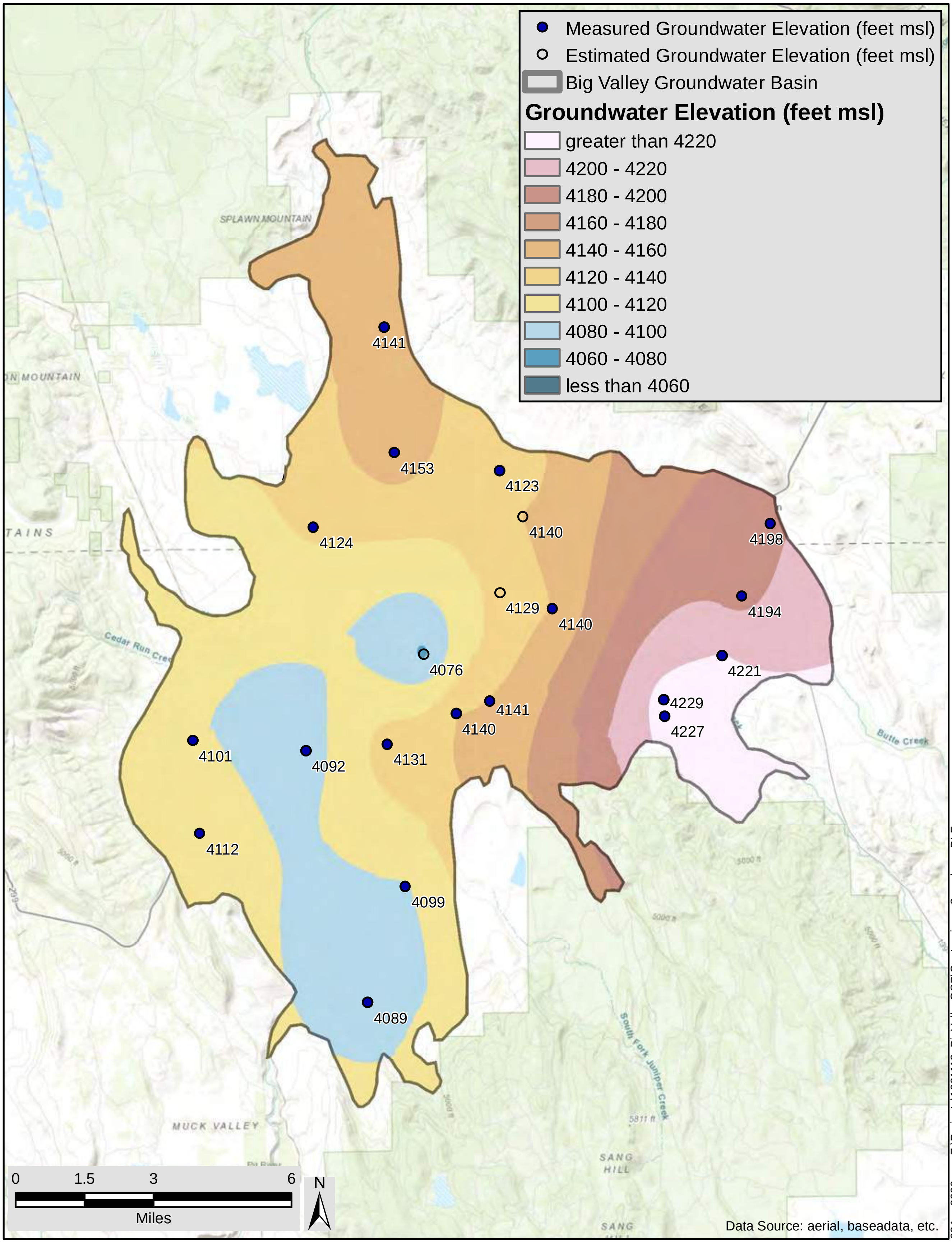
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1993
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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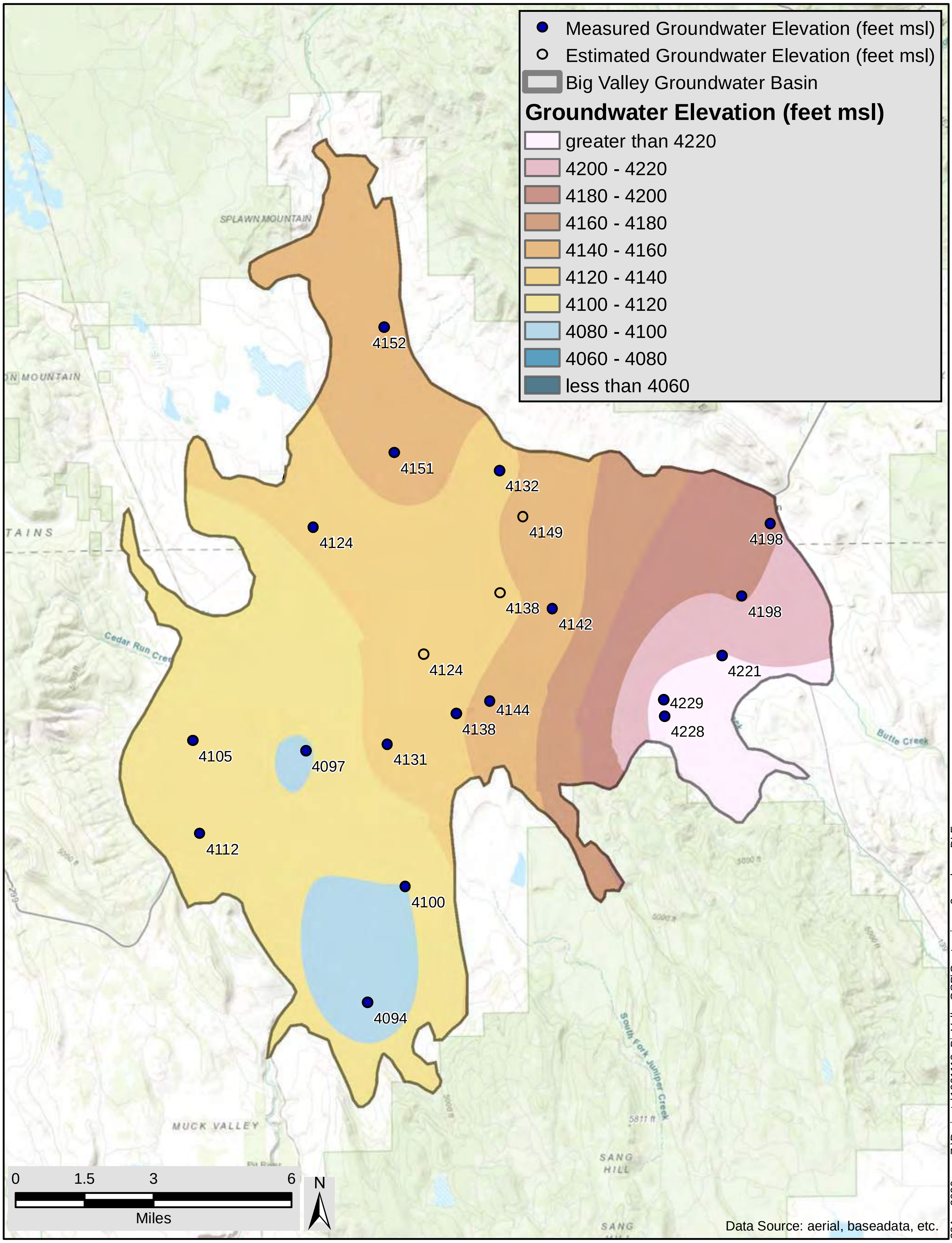
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1993
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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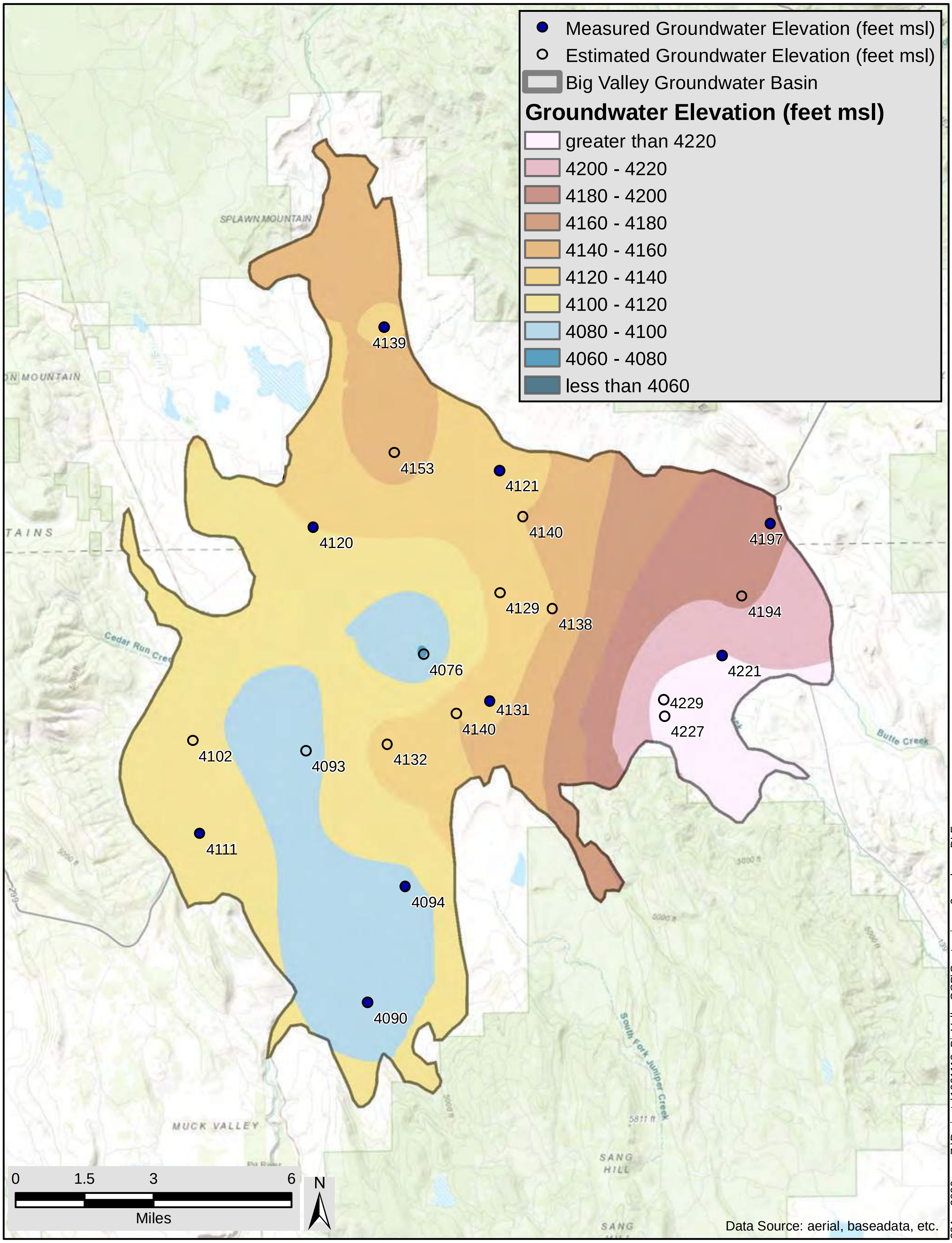
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1994
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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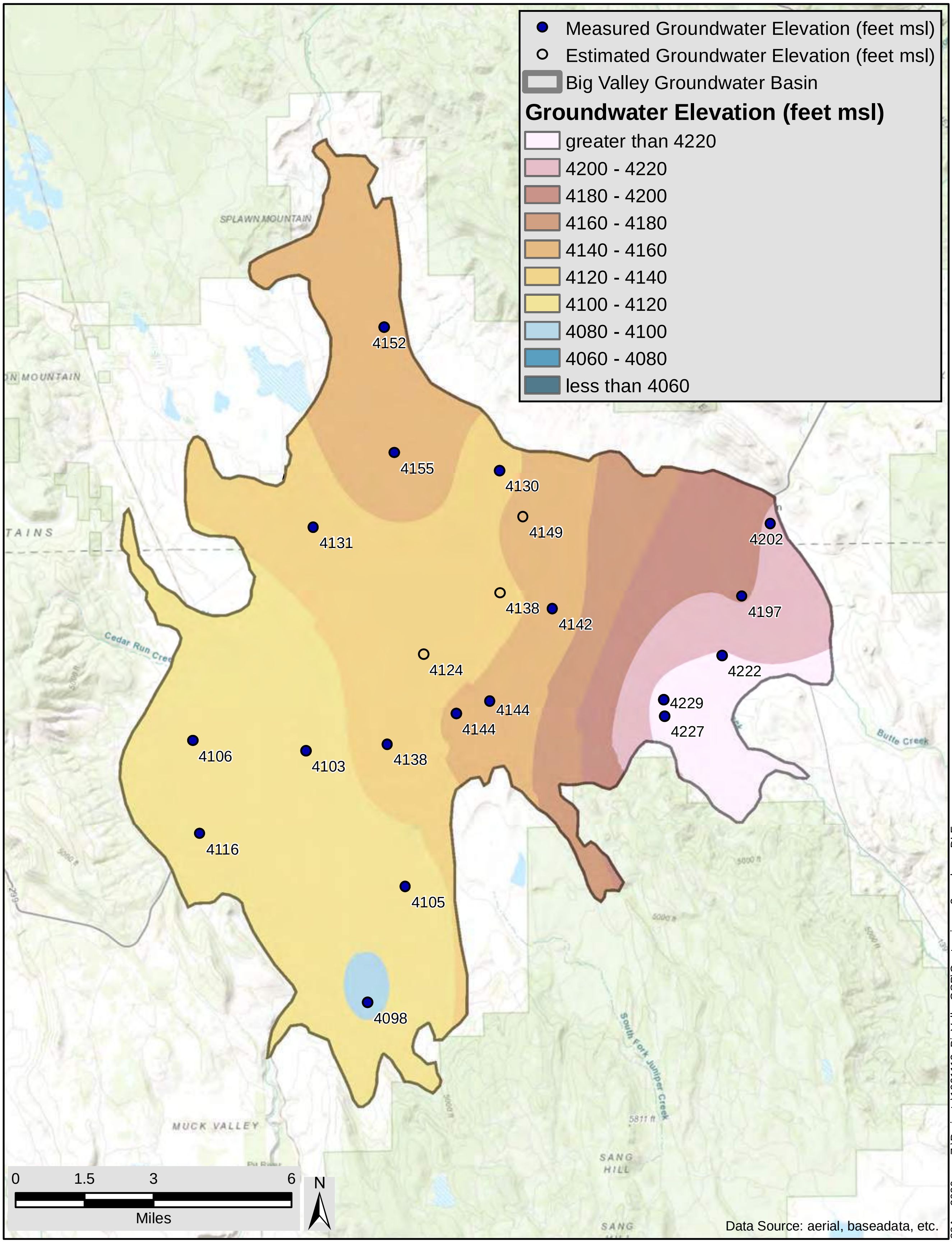
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1994
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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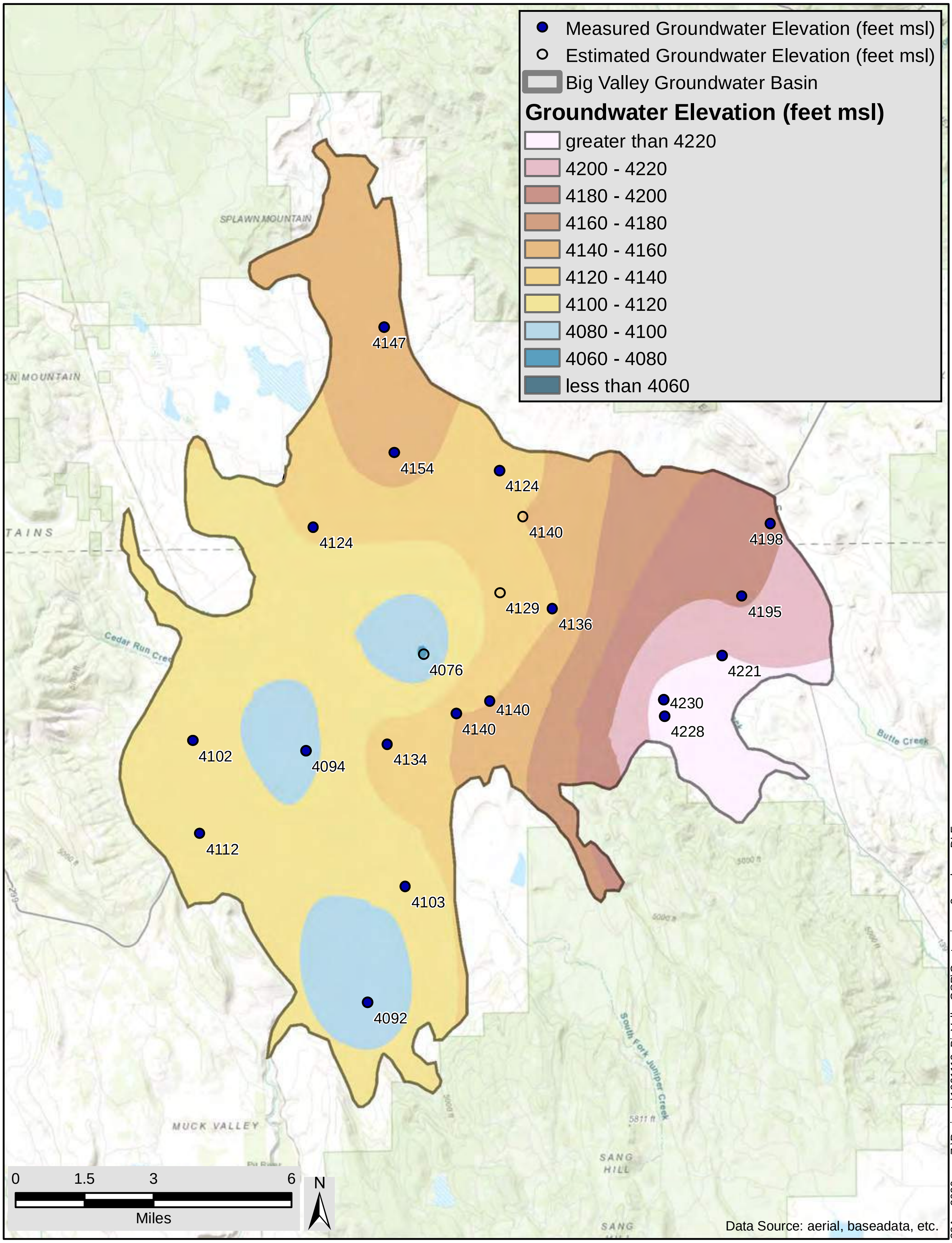
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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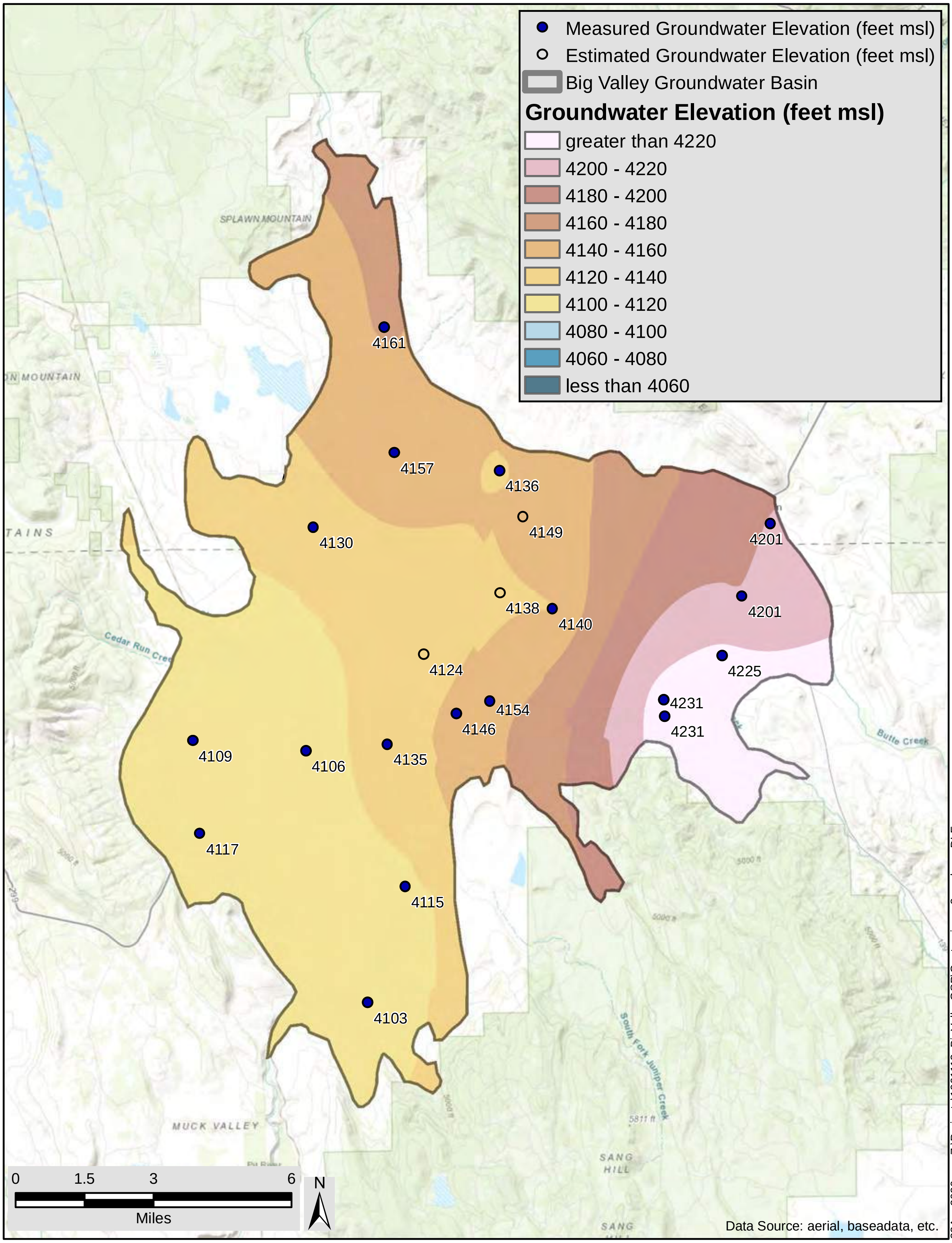

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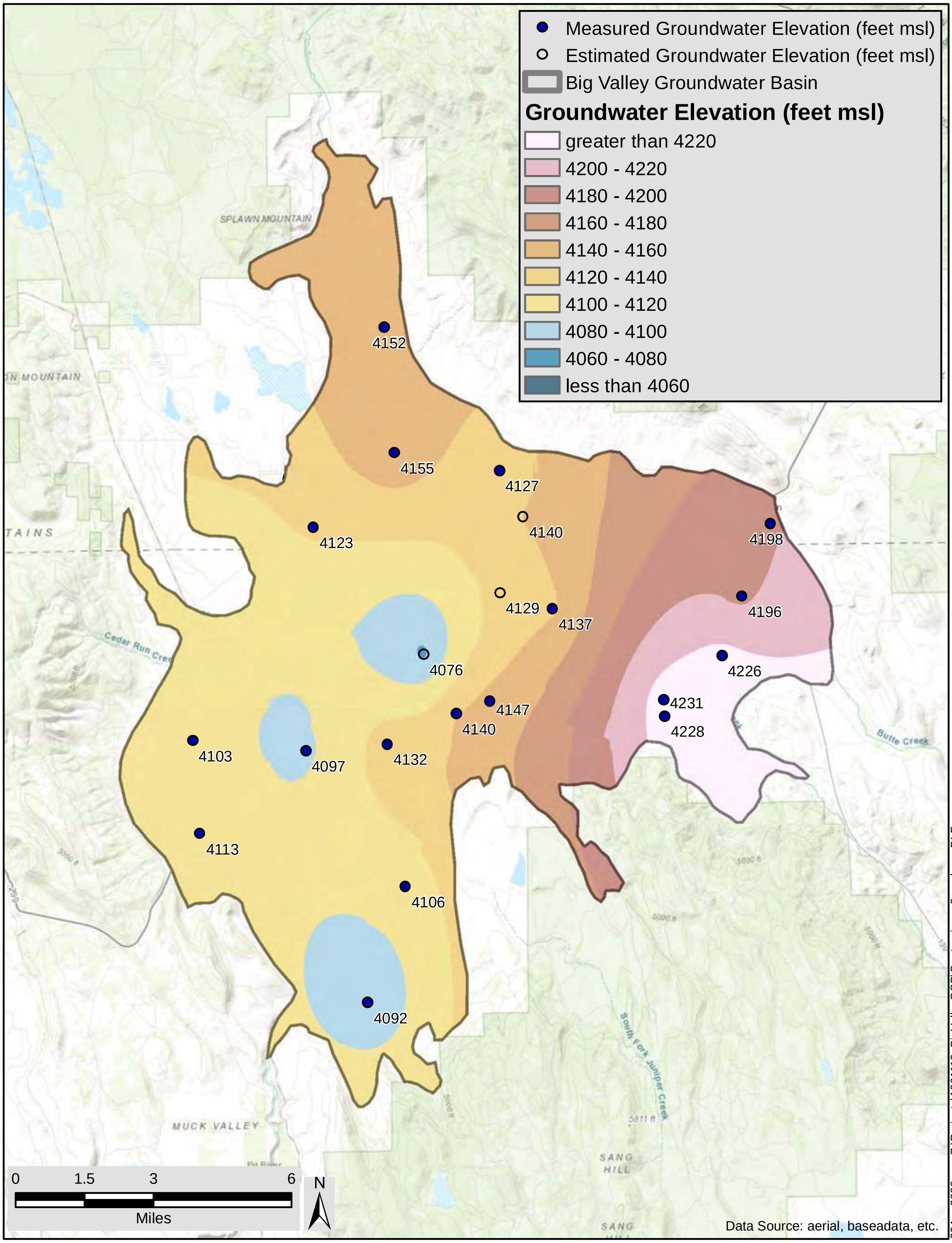

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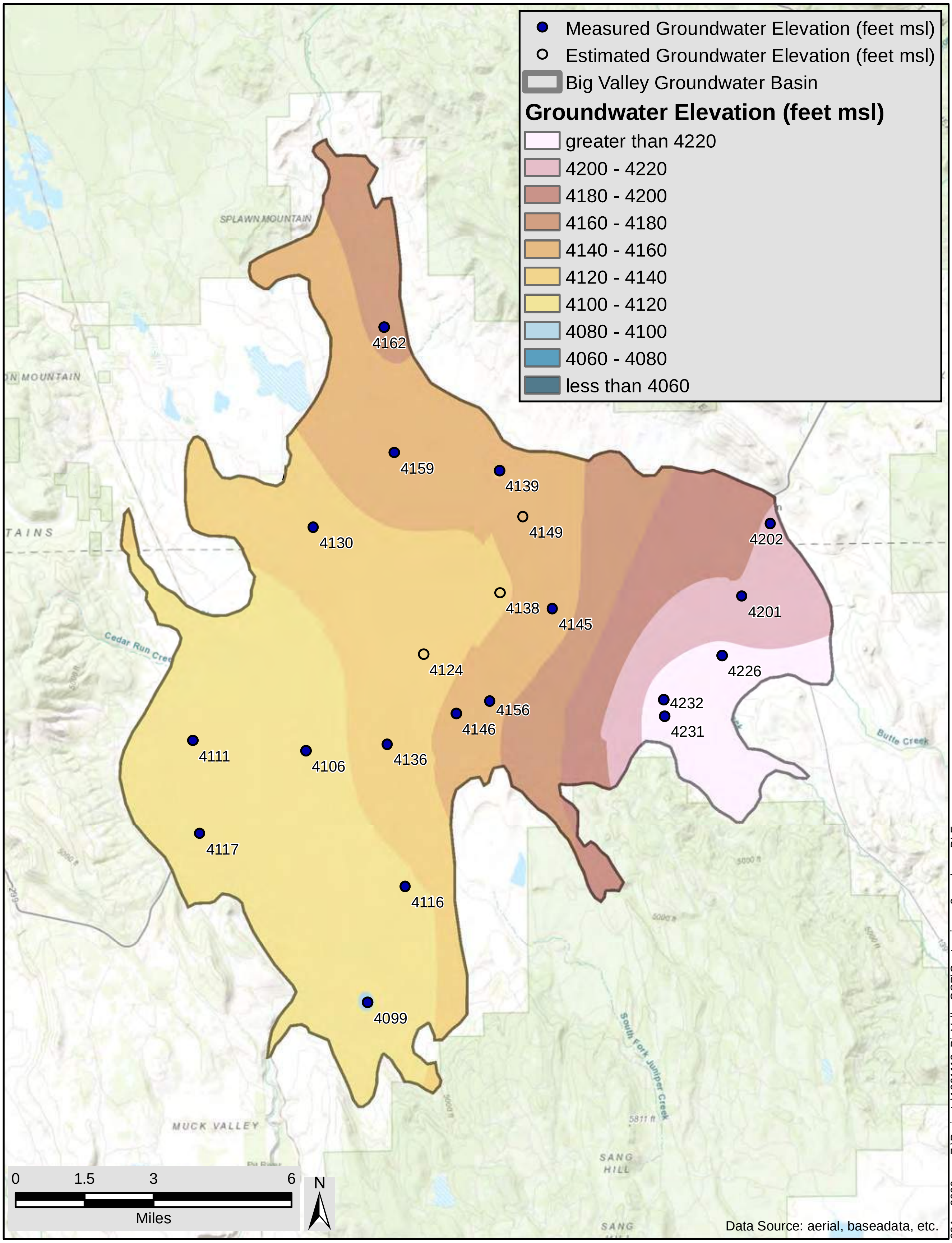
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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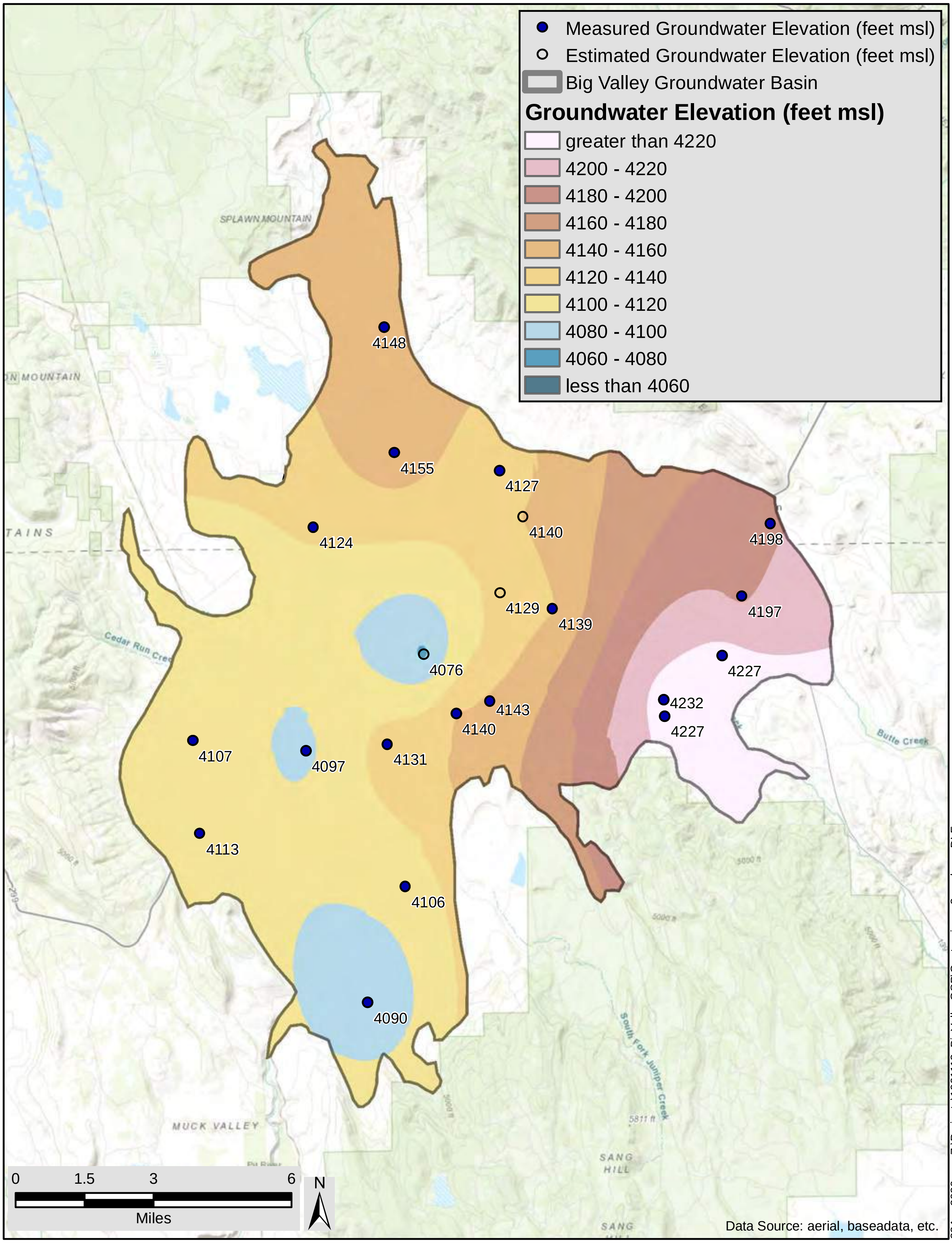
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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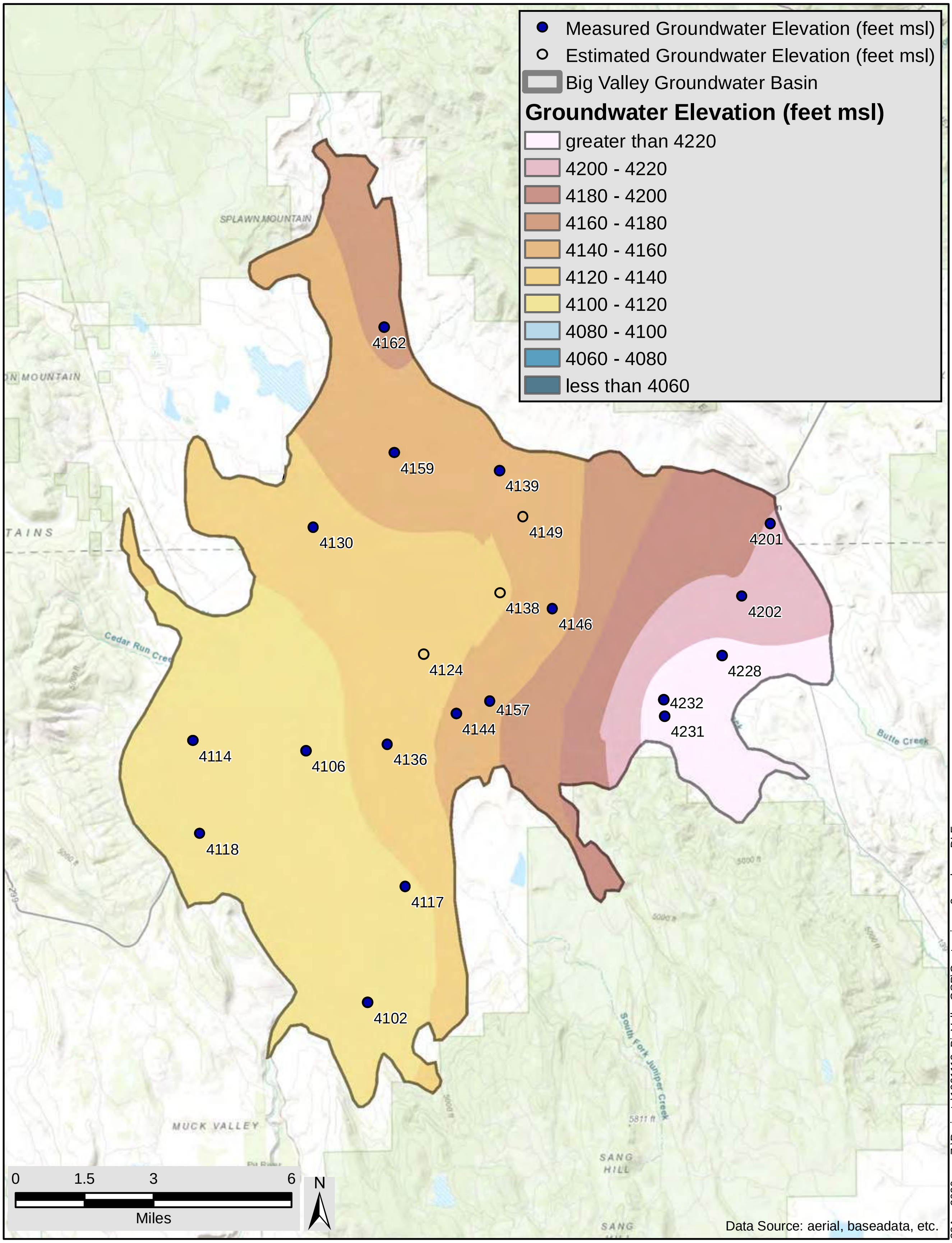

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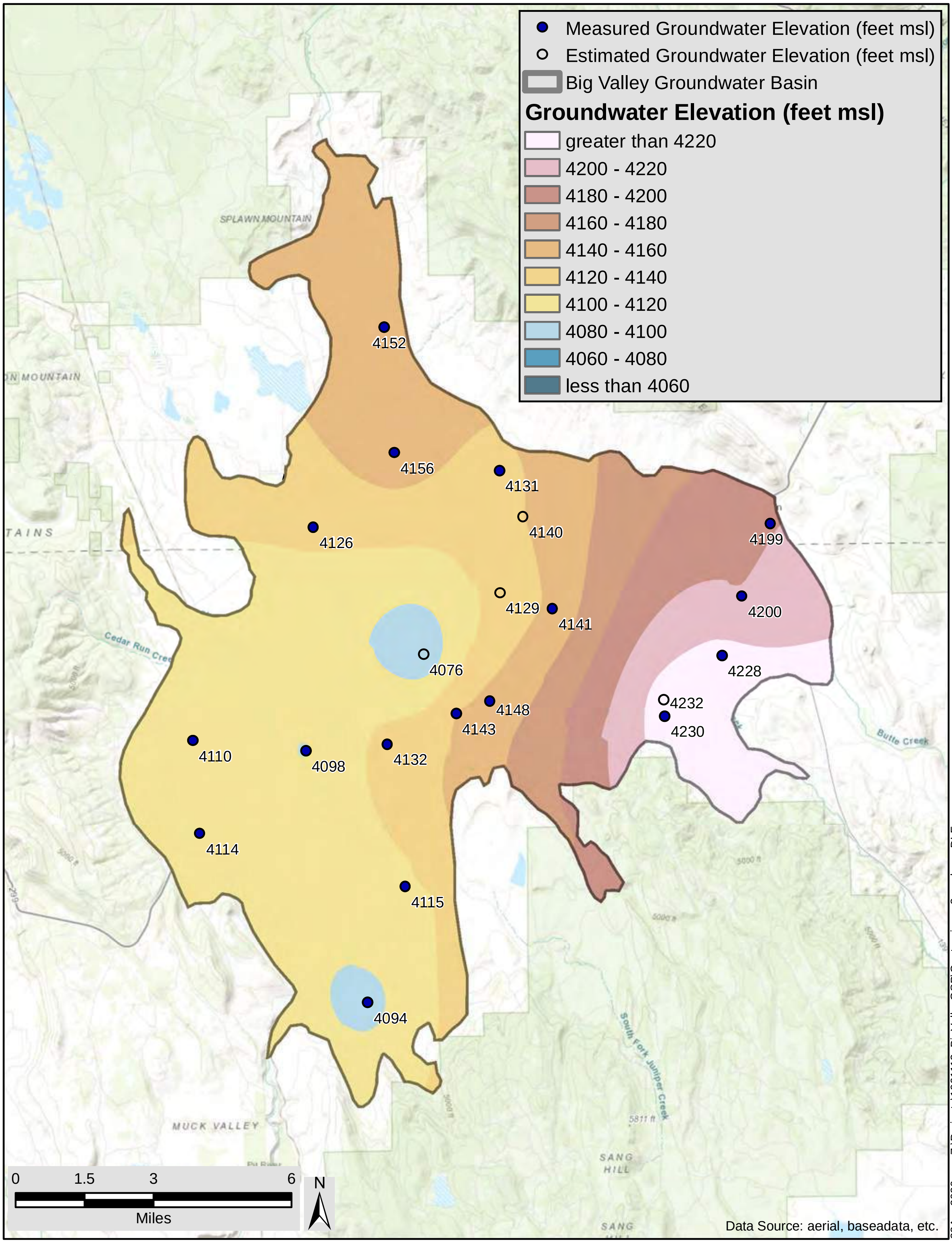
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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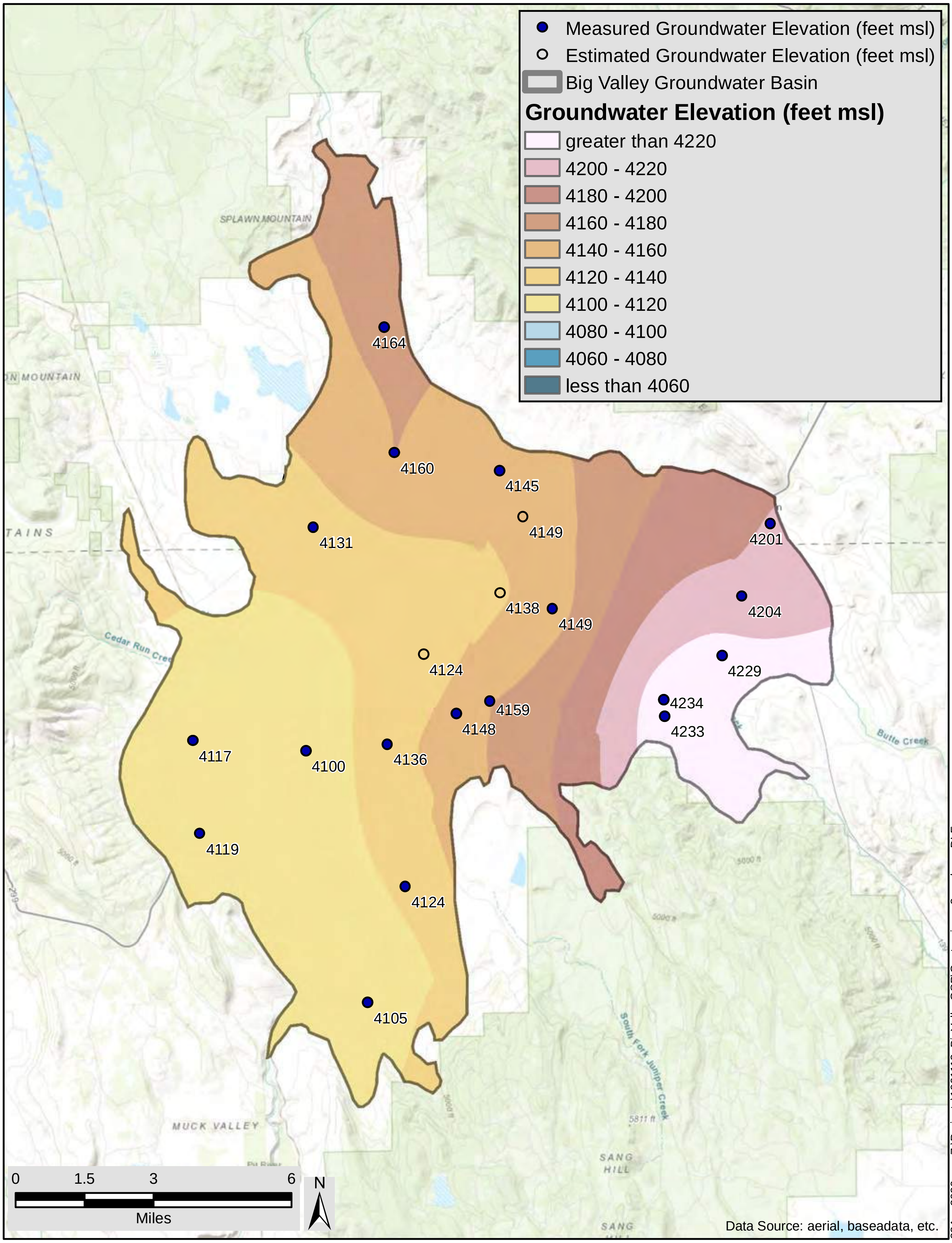

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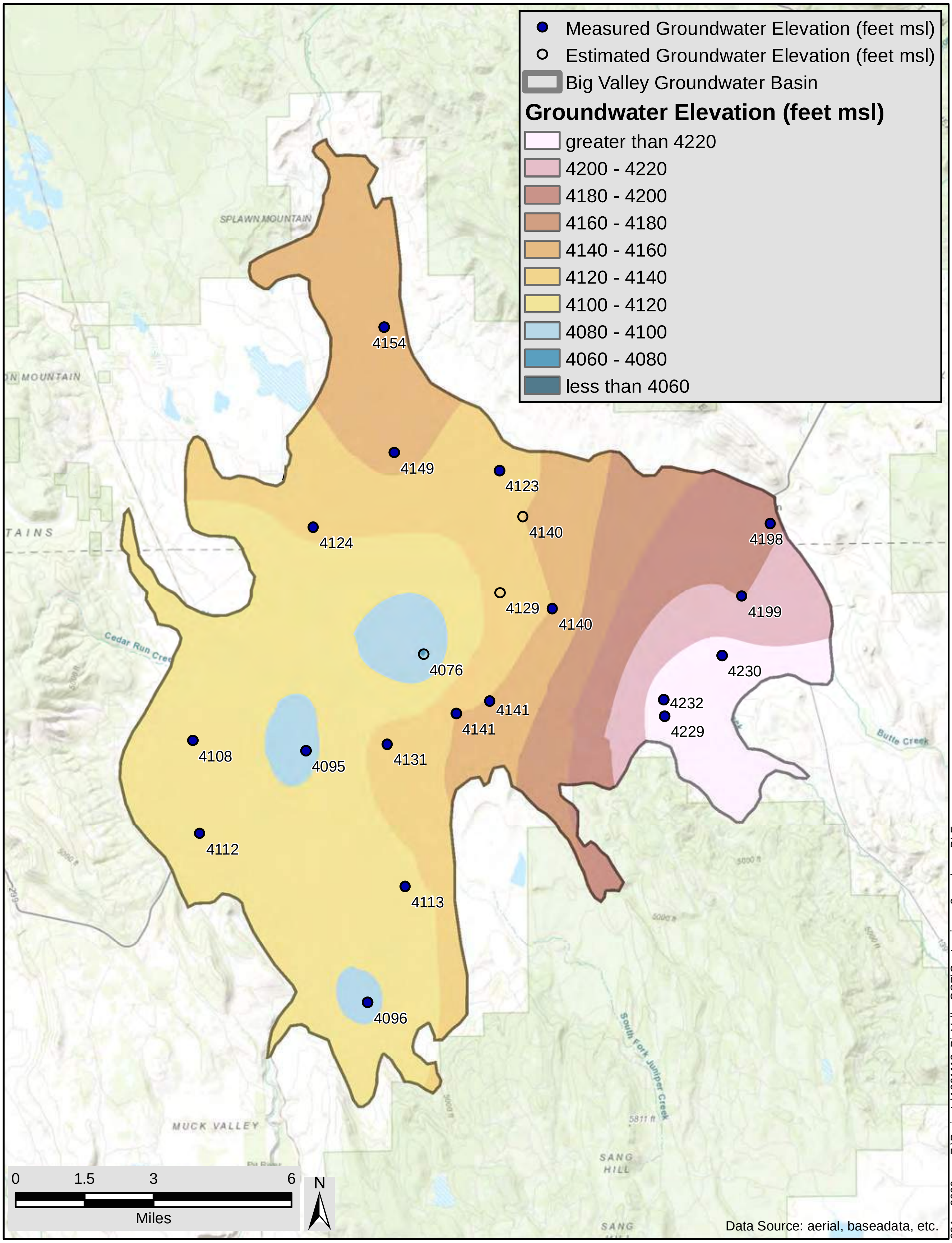
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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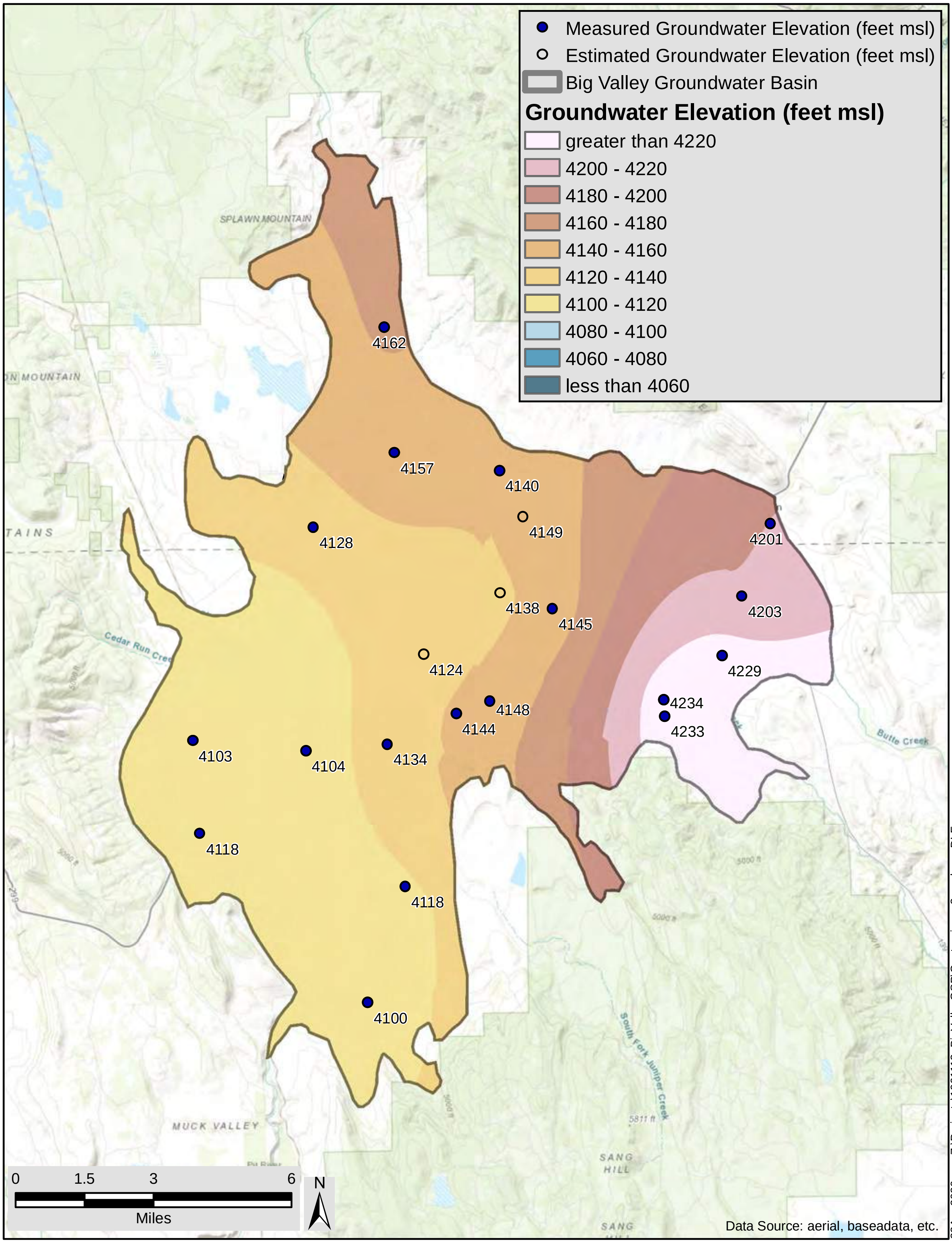
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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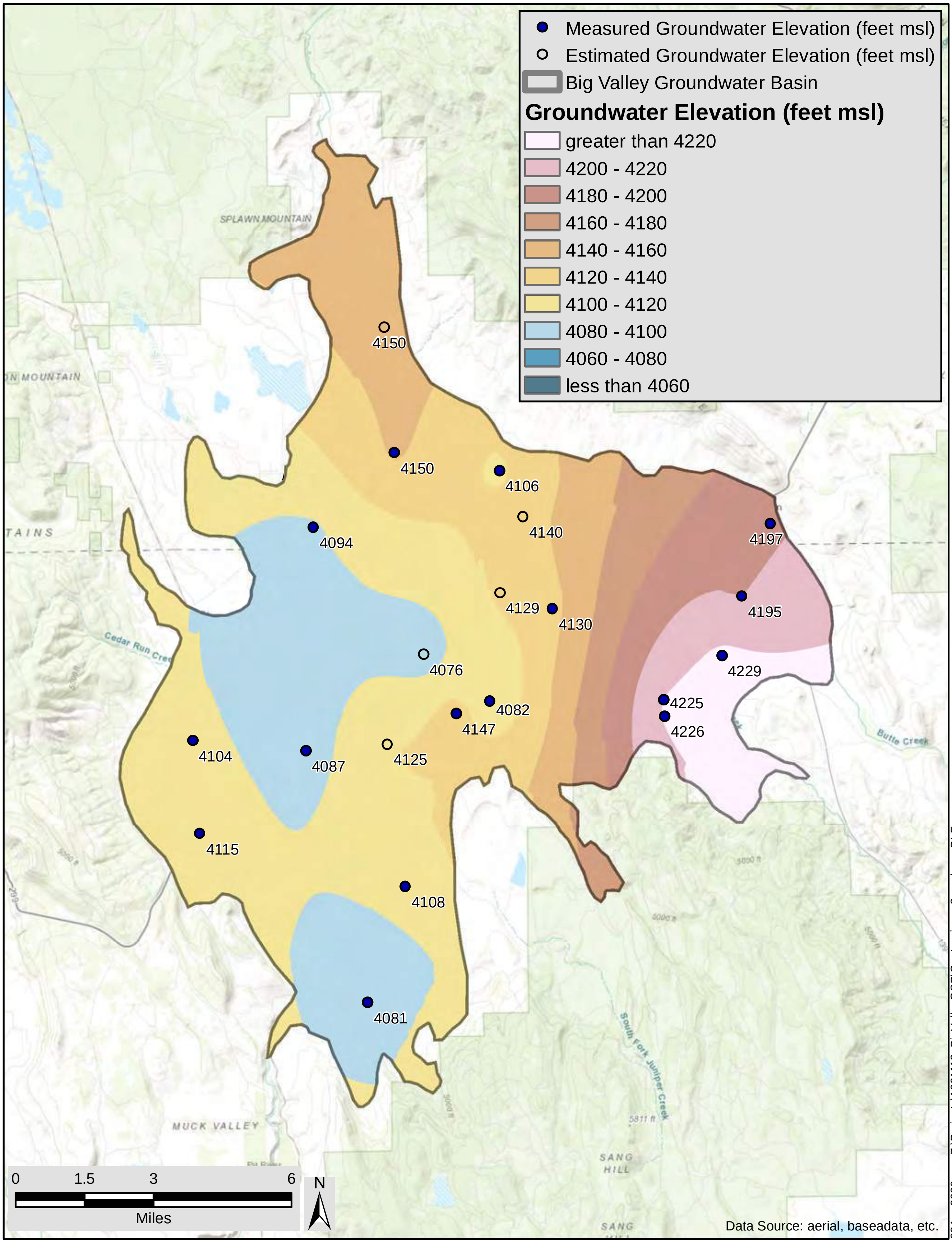

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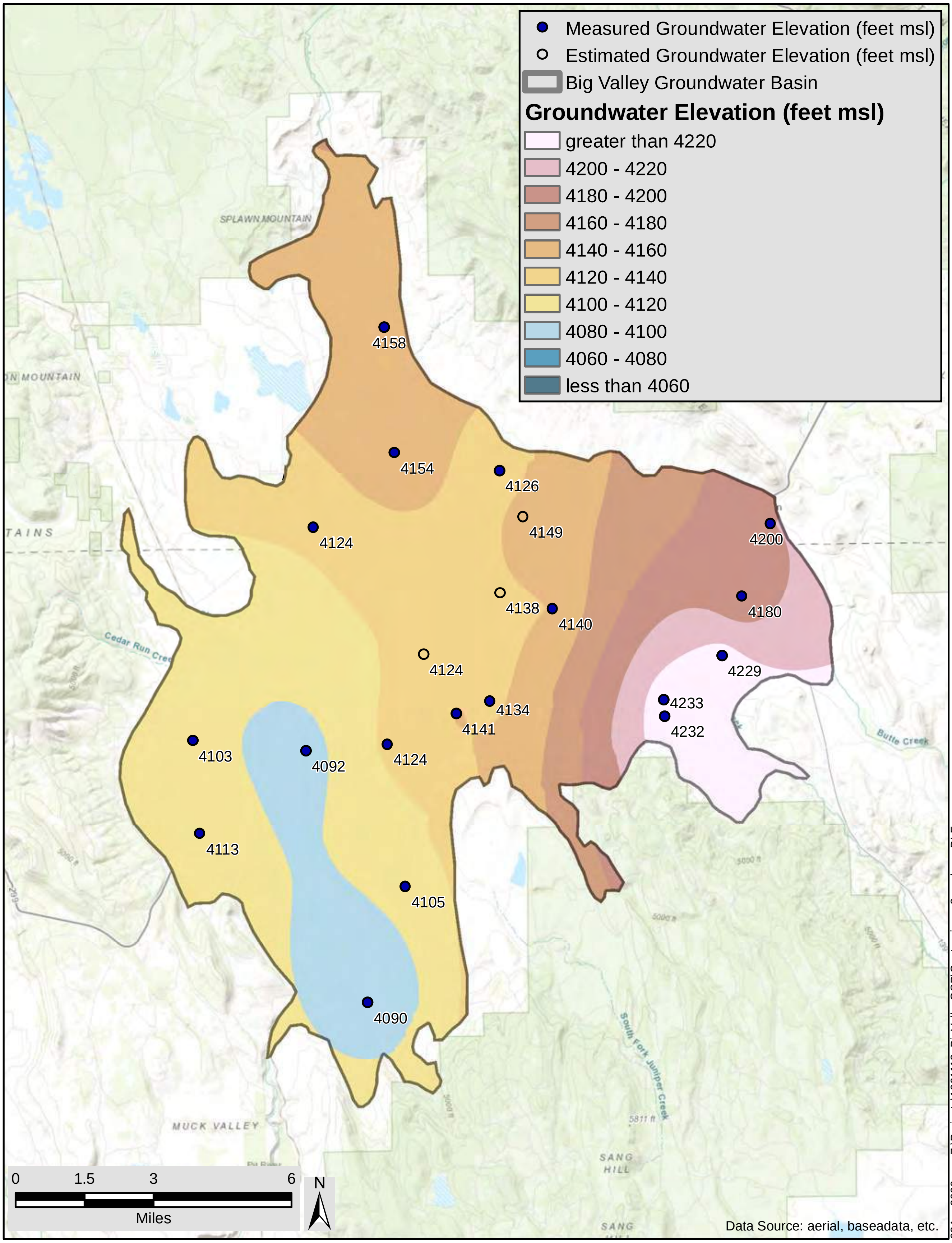
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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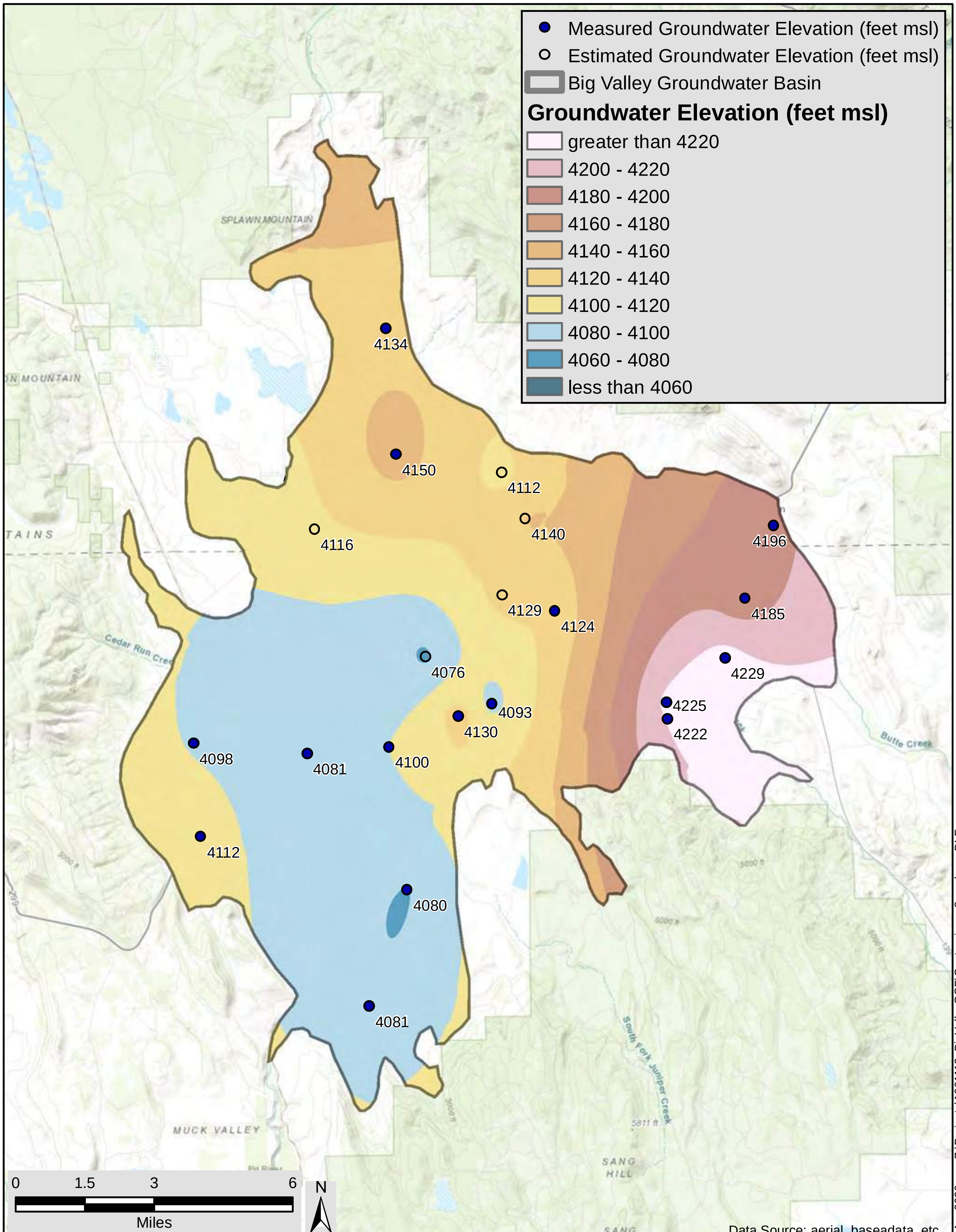
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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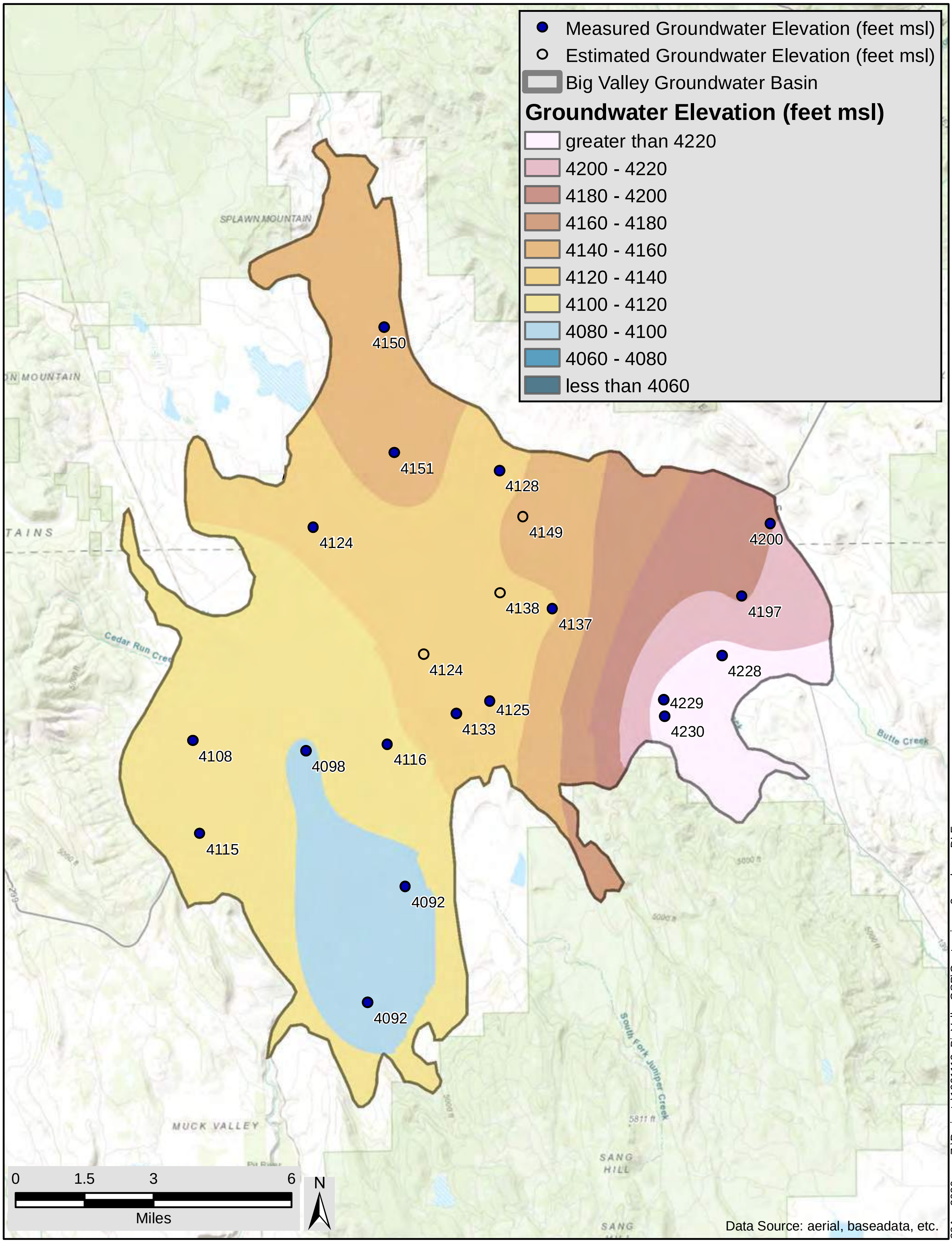
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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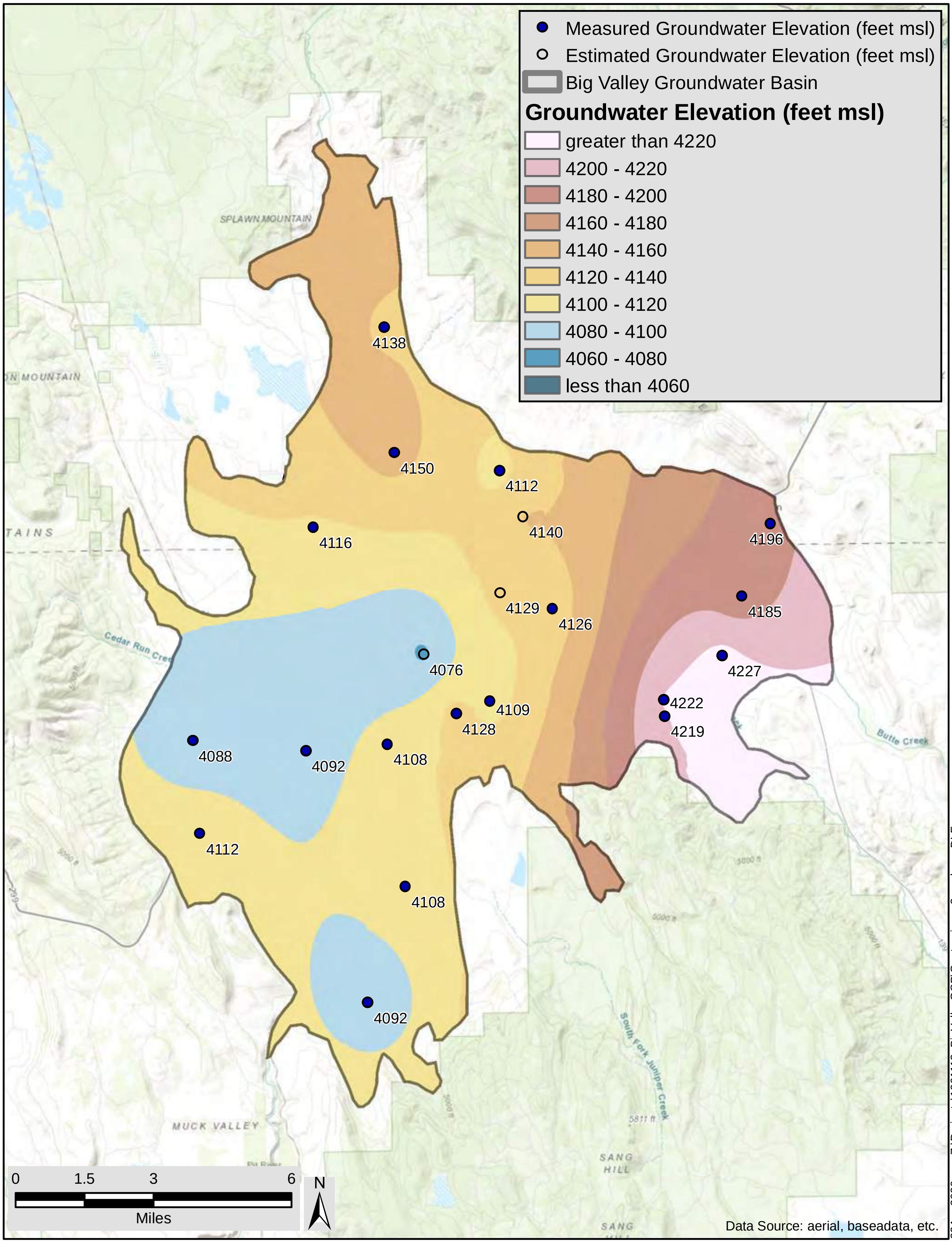
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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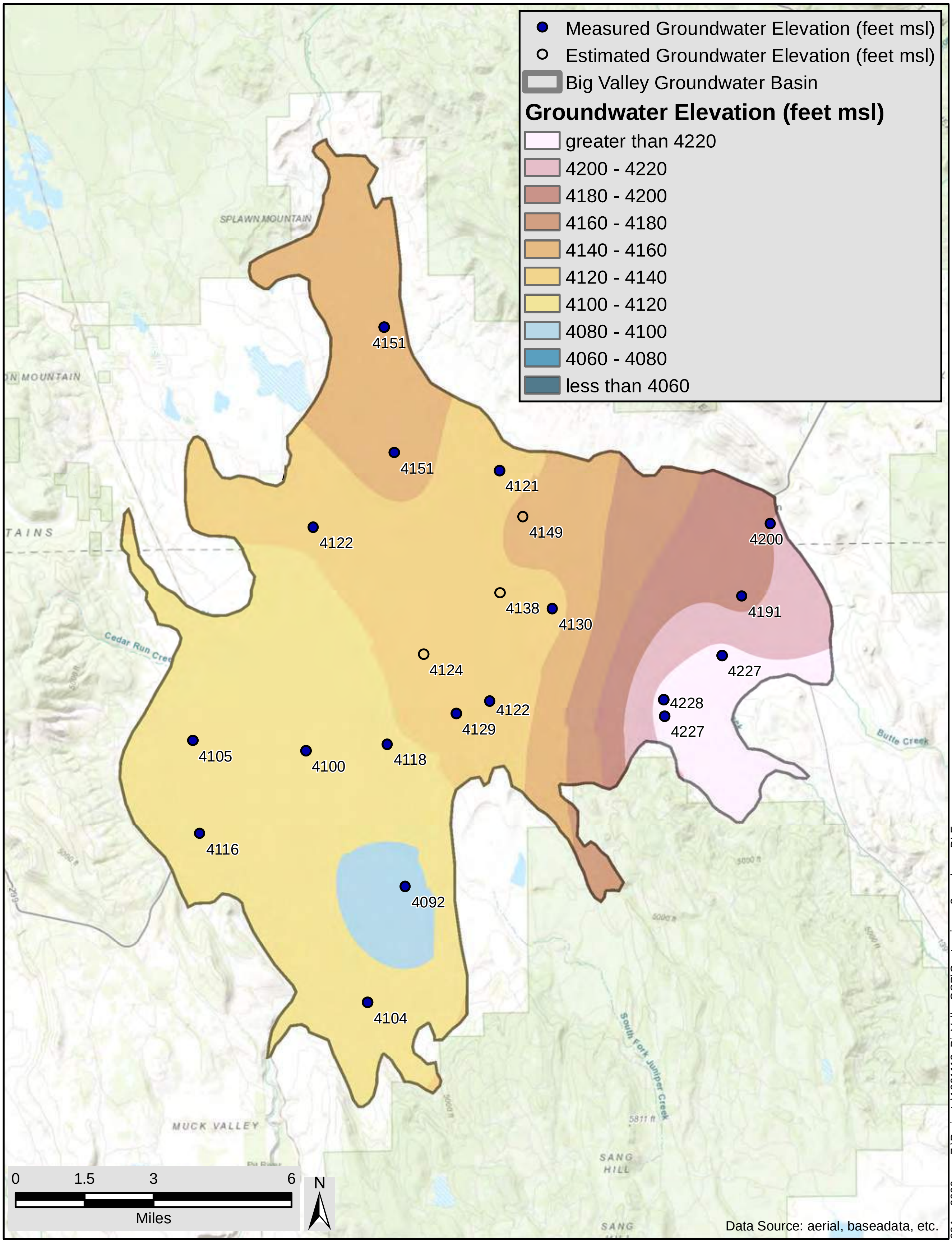
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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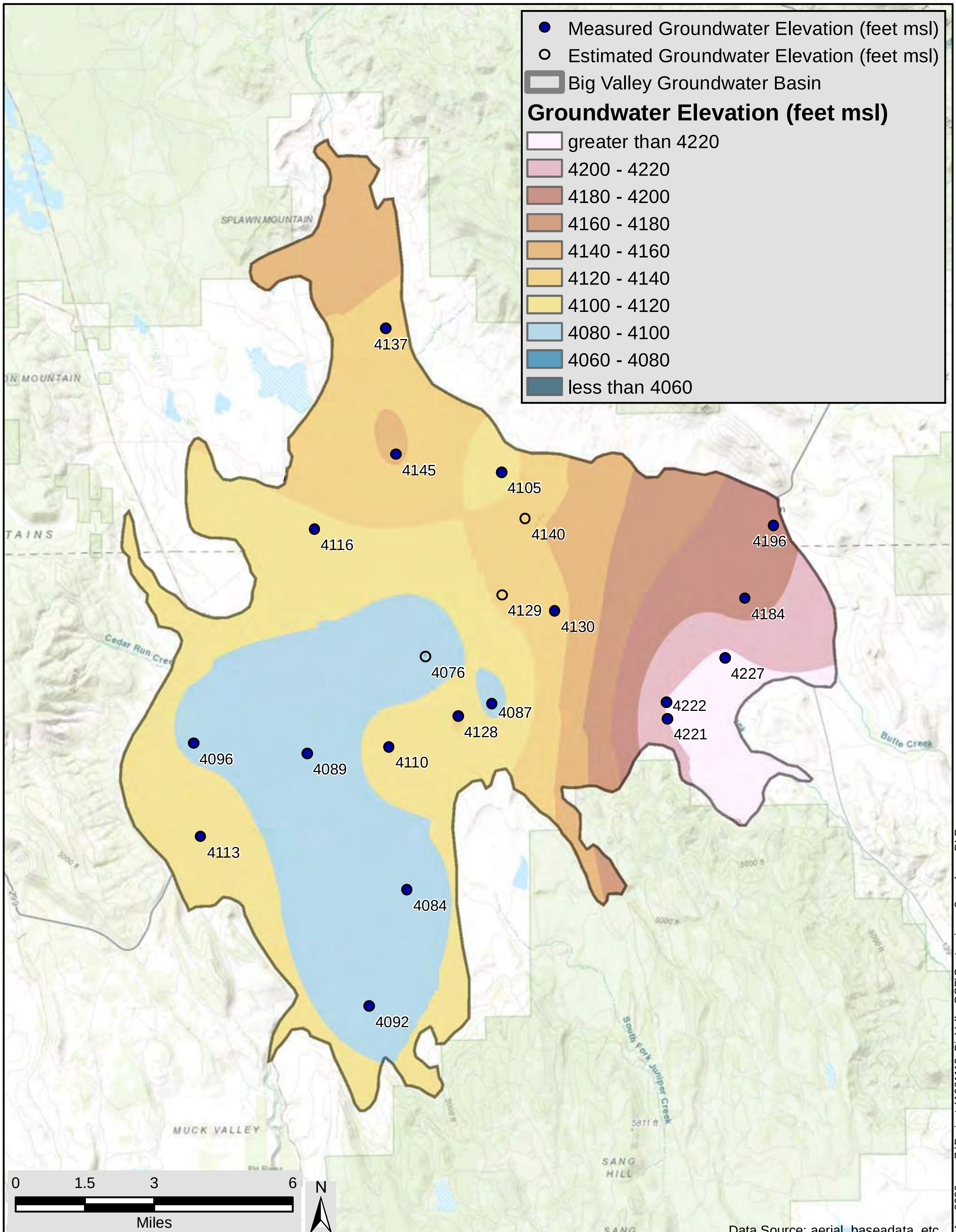
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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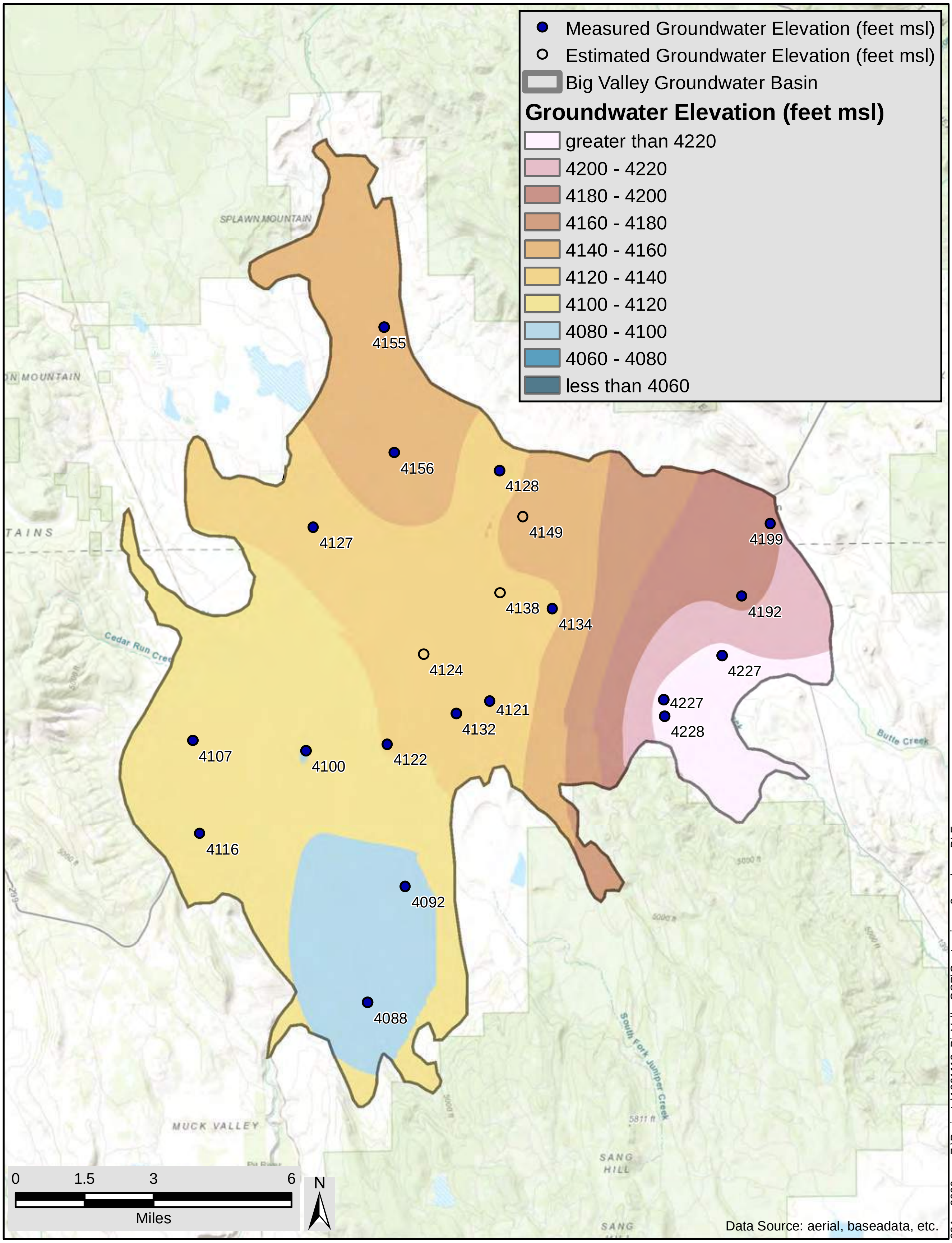
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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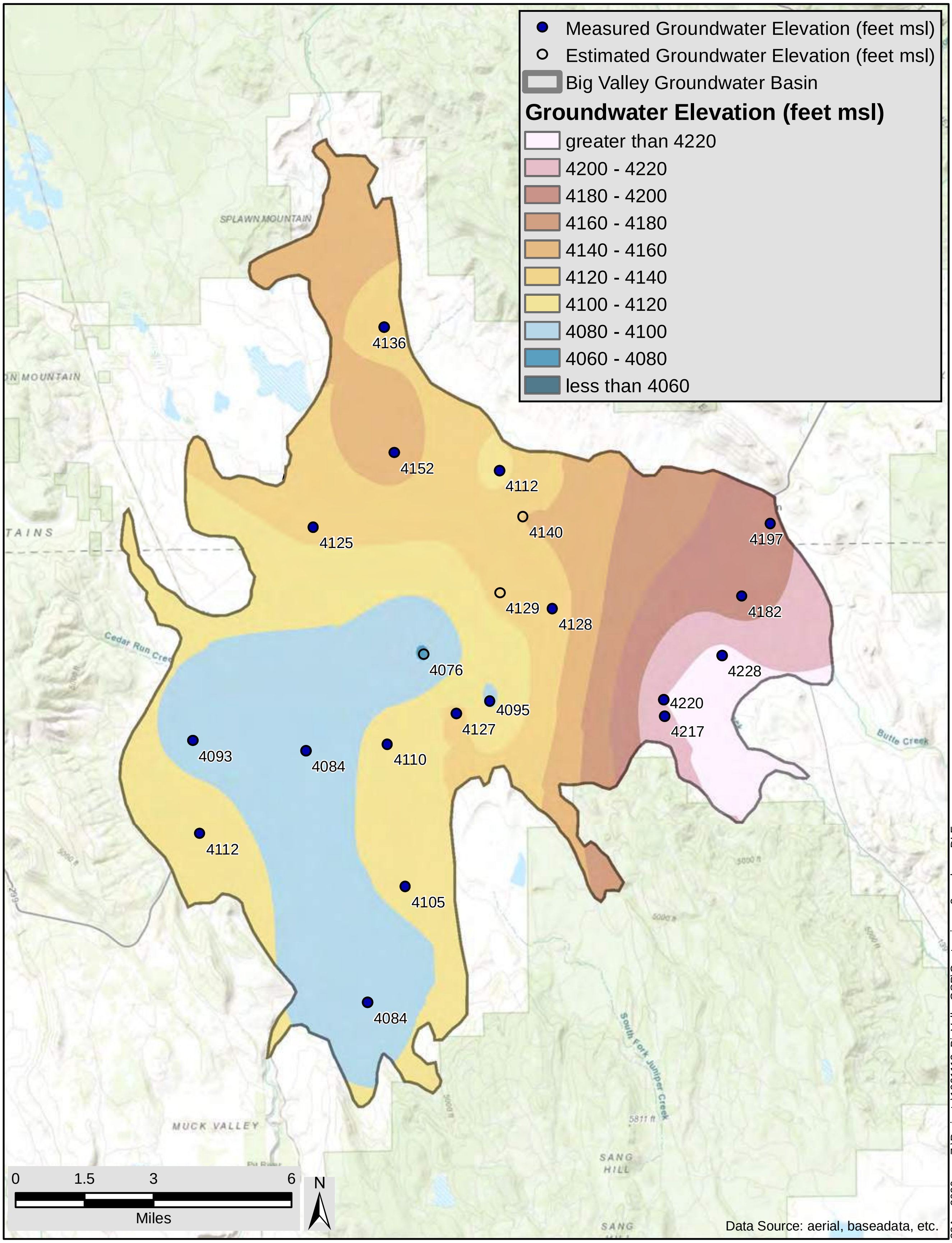
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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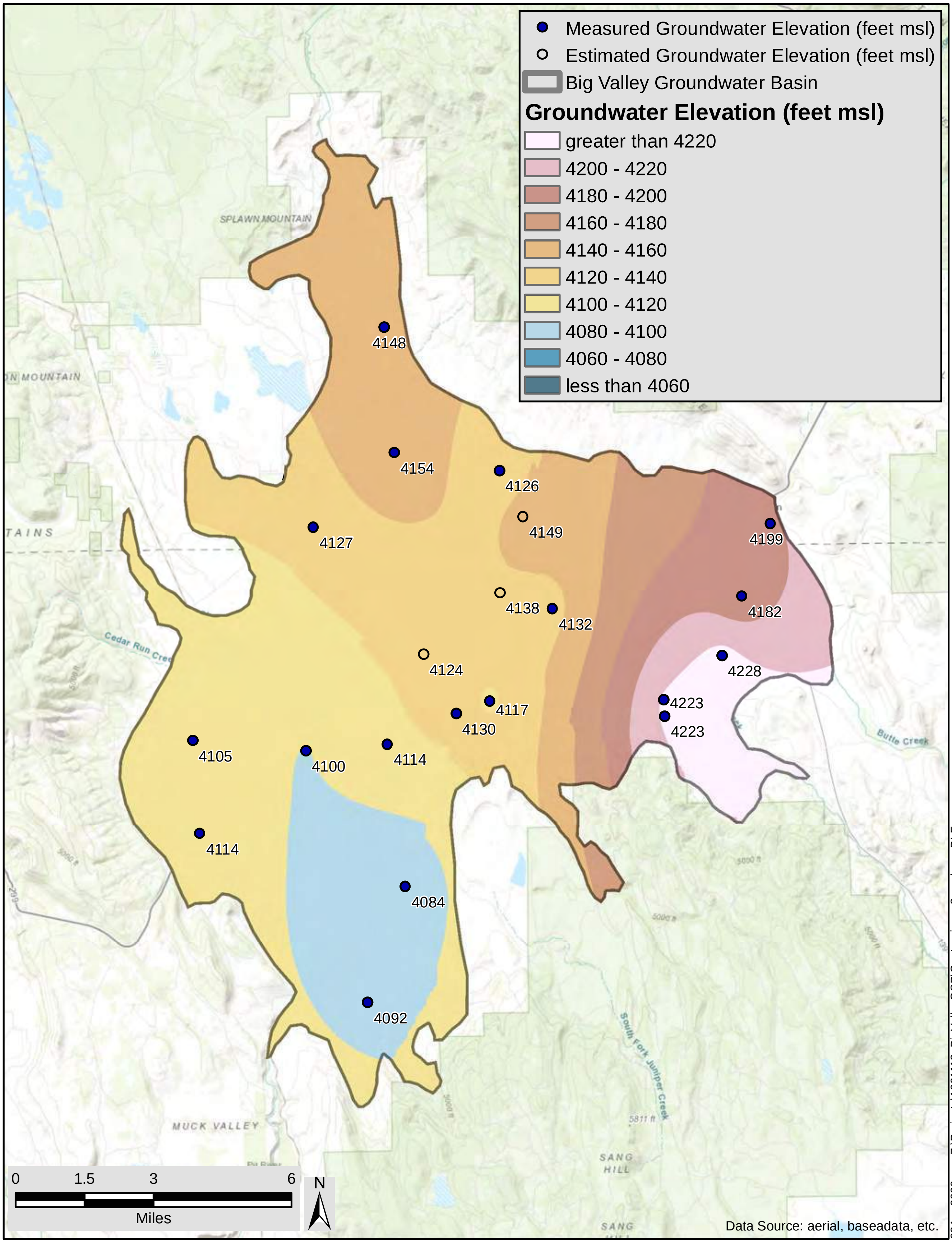
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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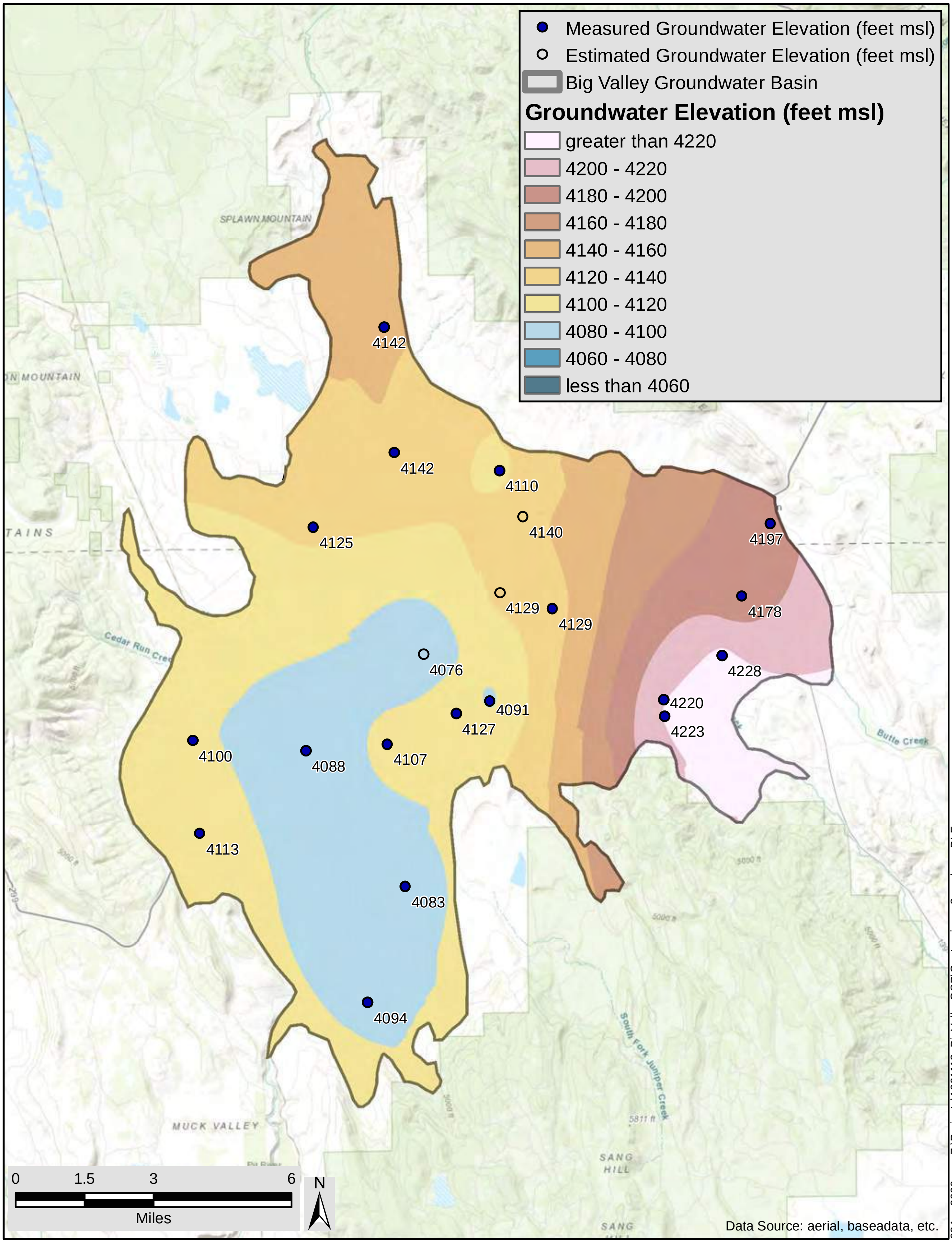
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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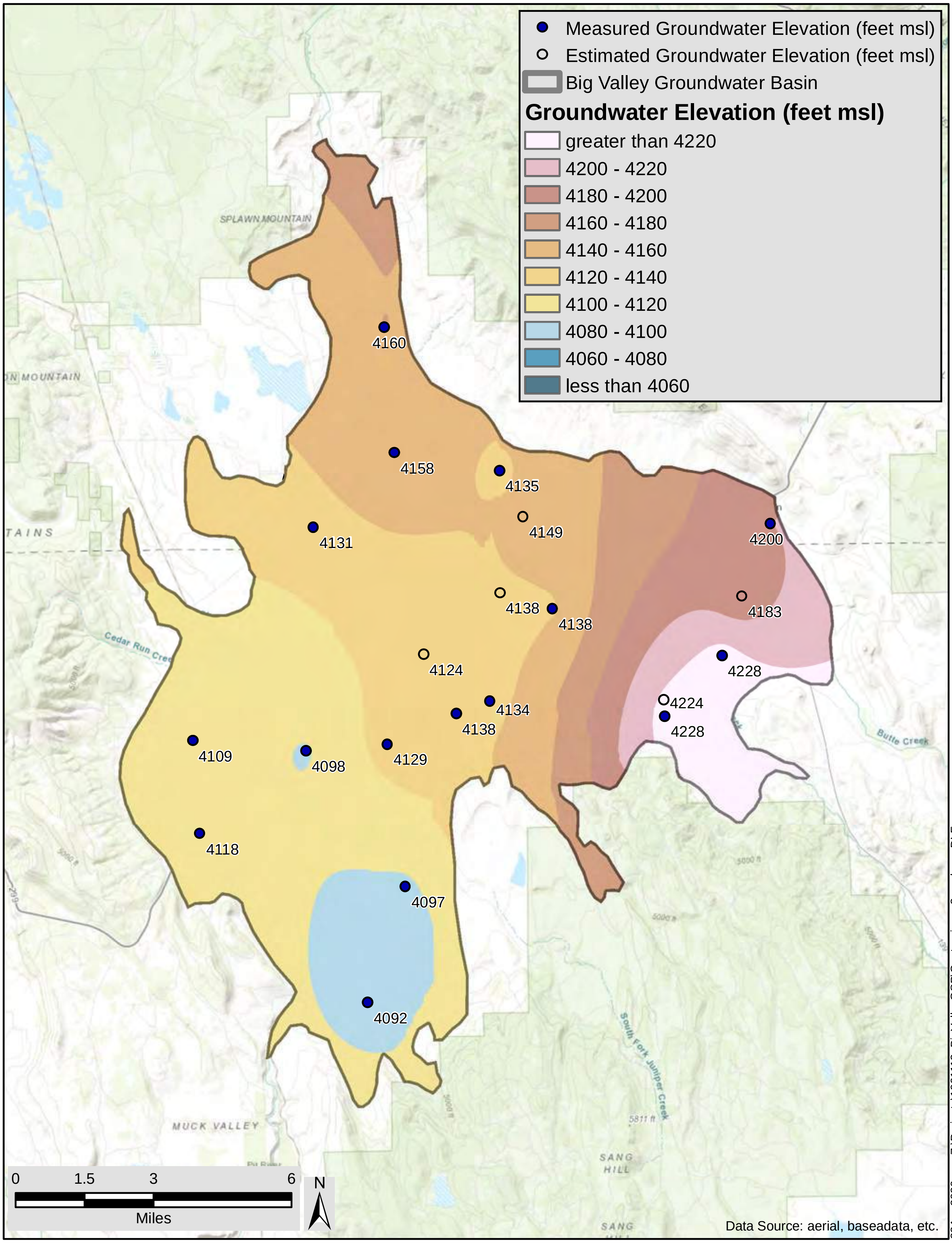
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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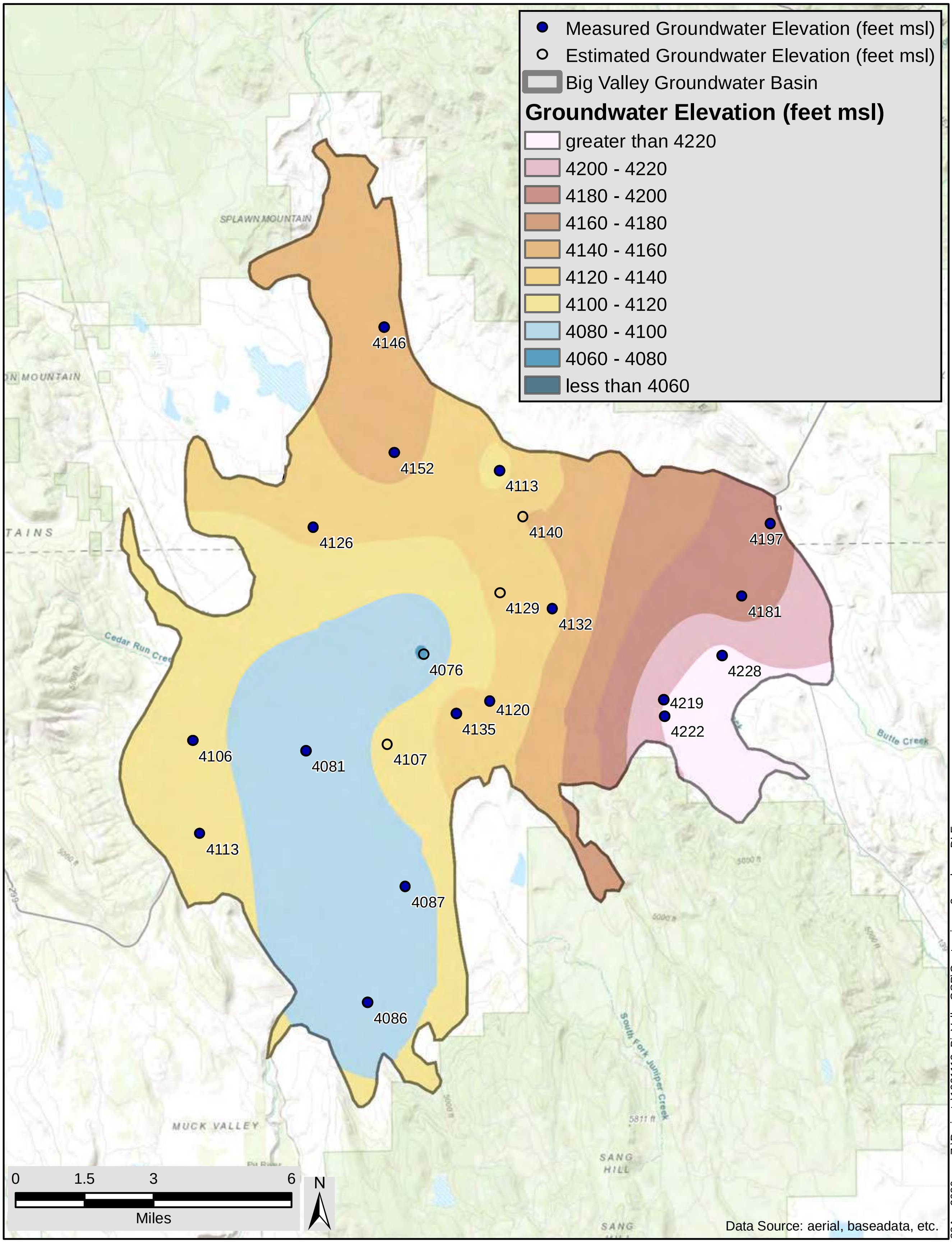
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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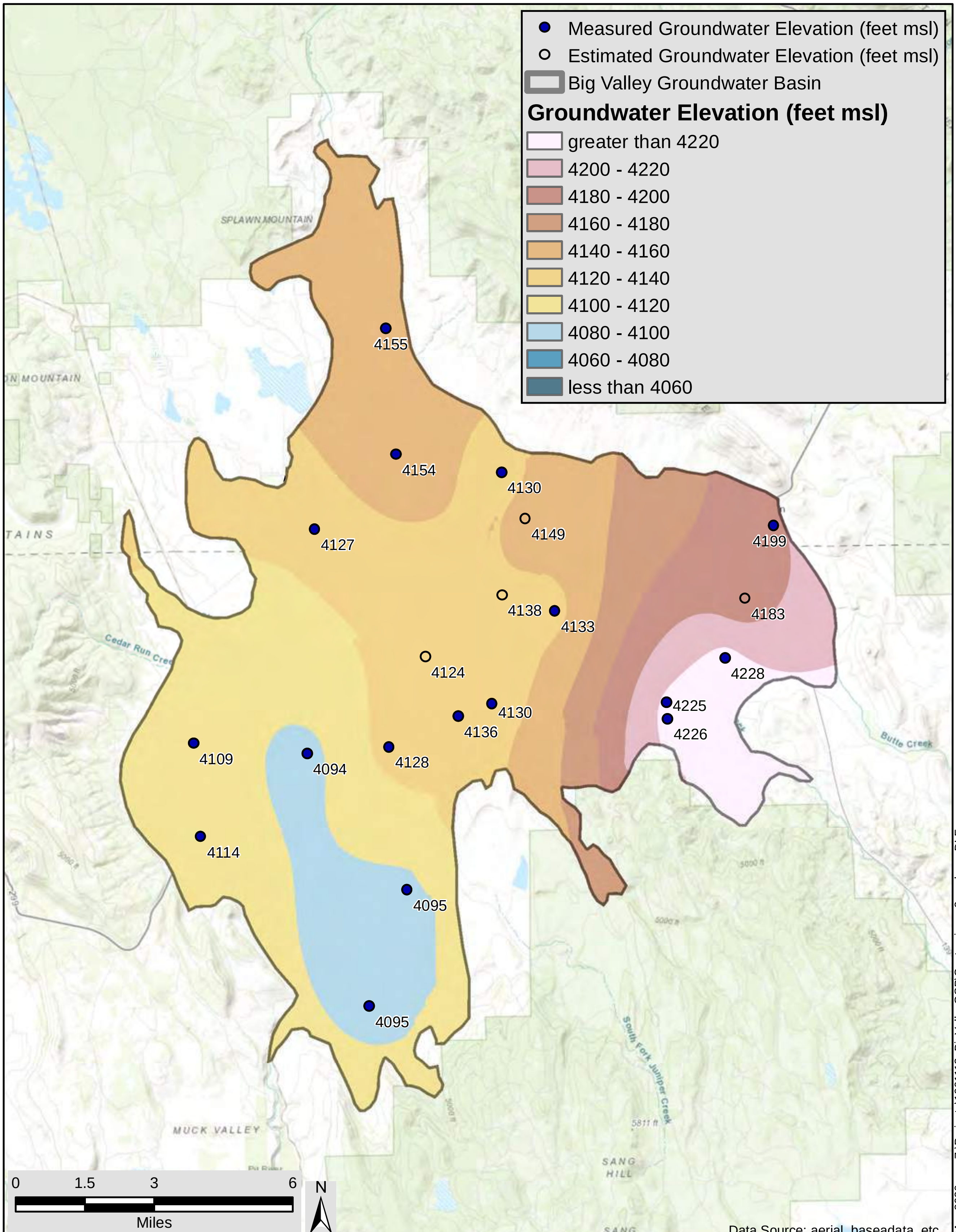

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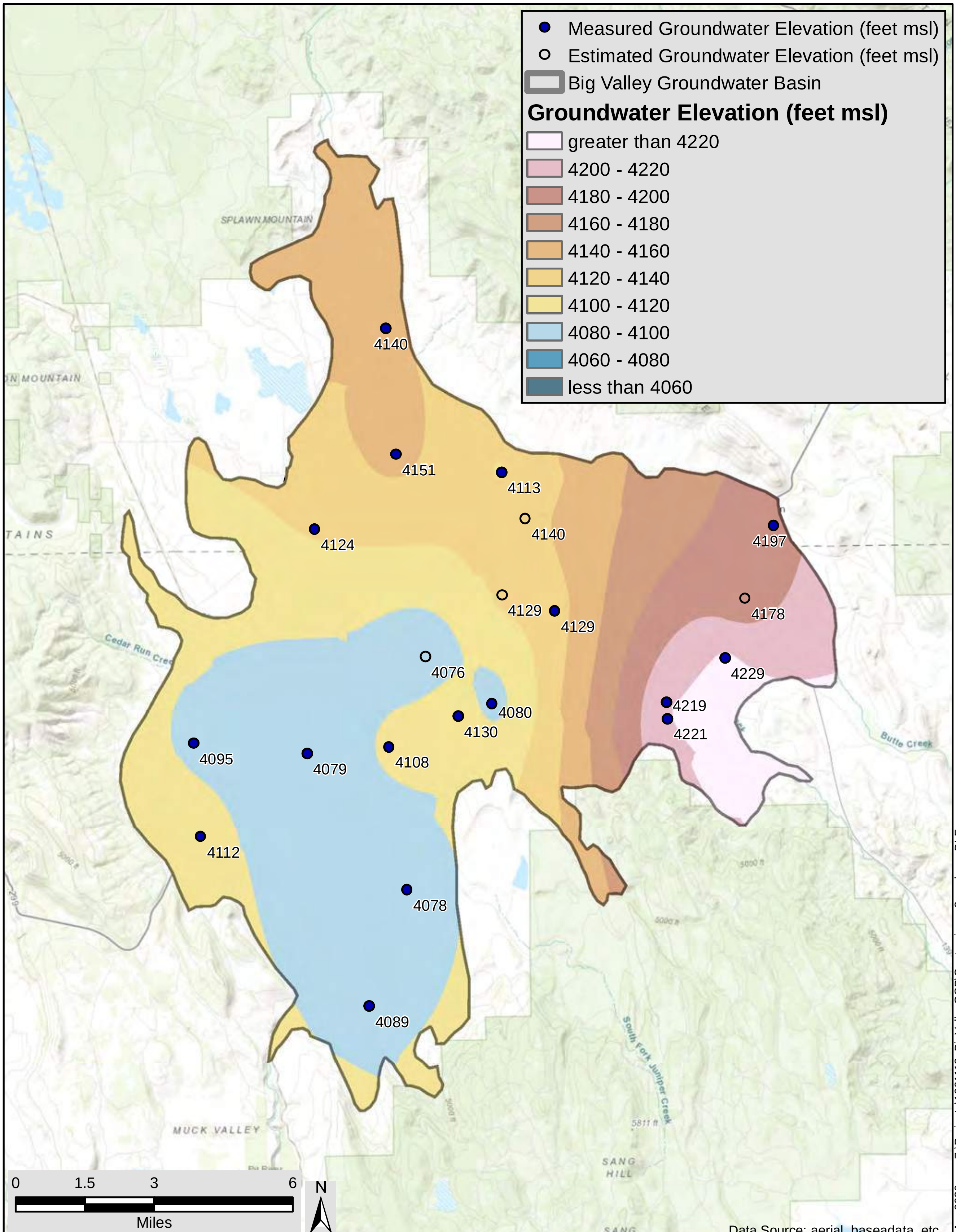

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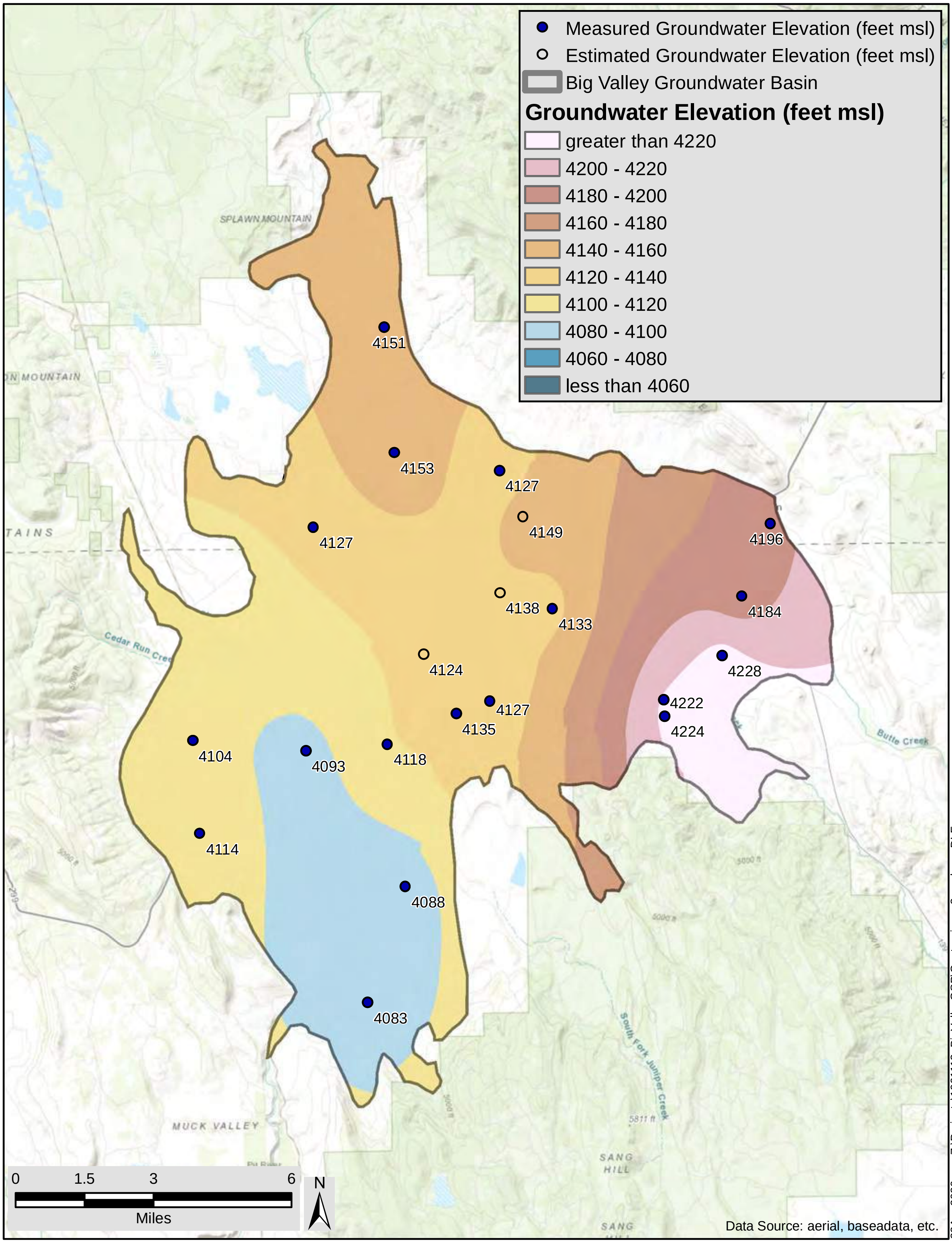
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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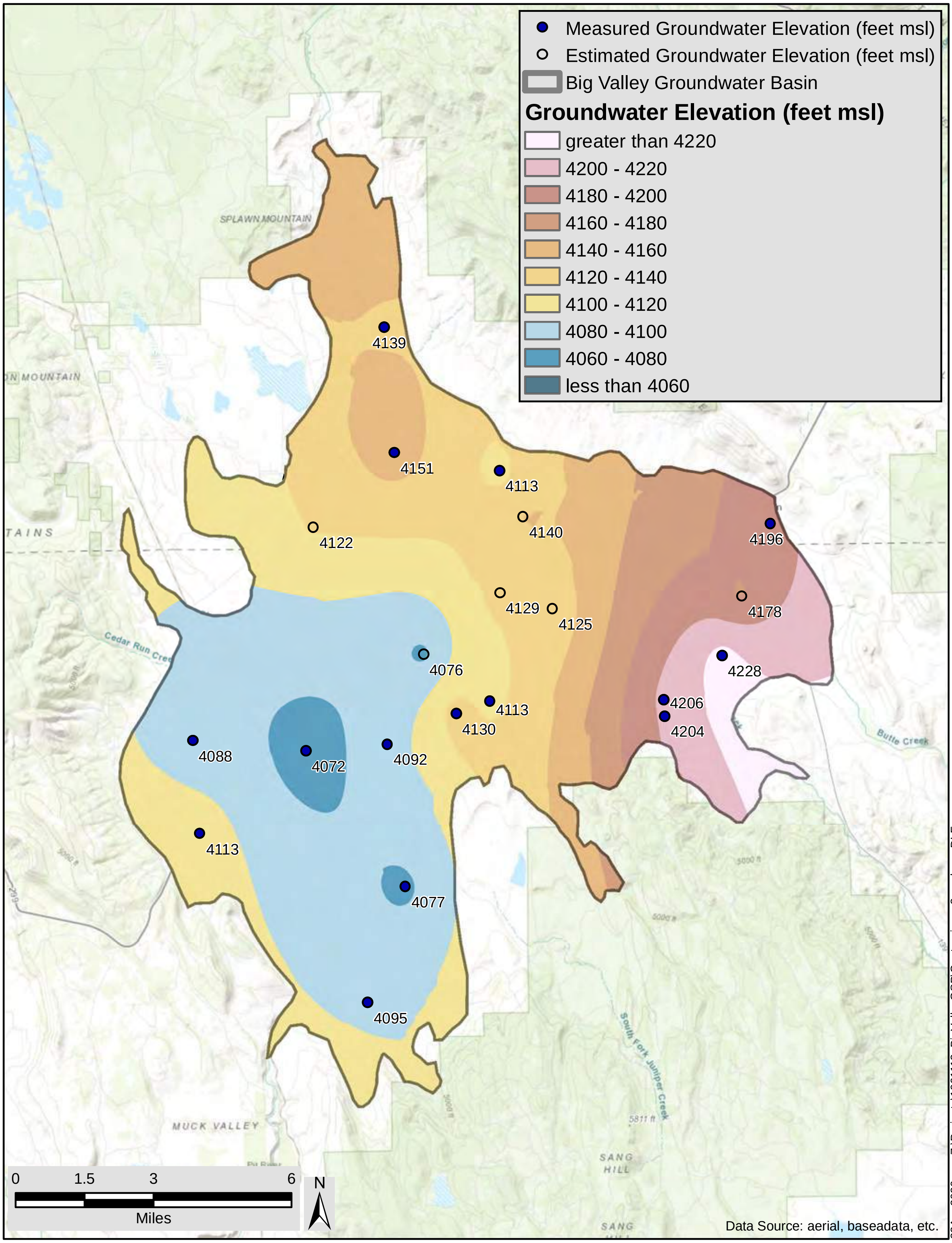
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 2008		
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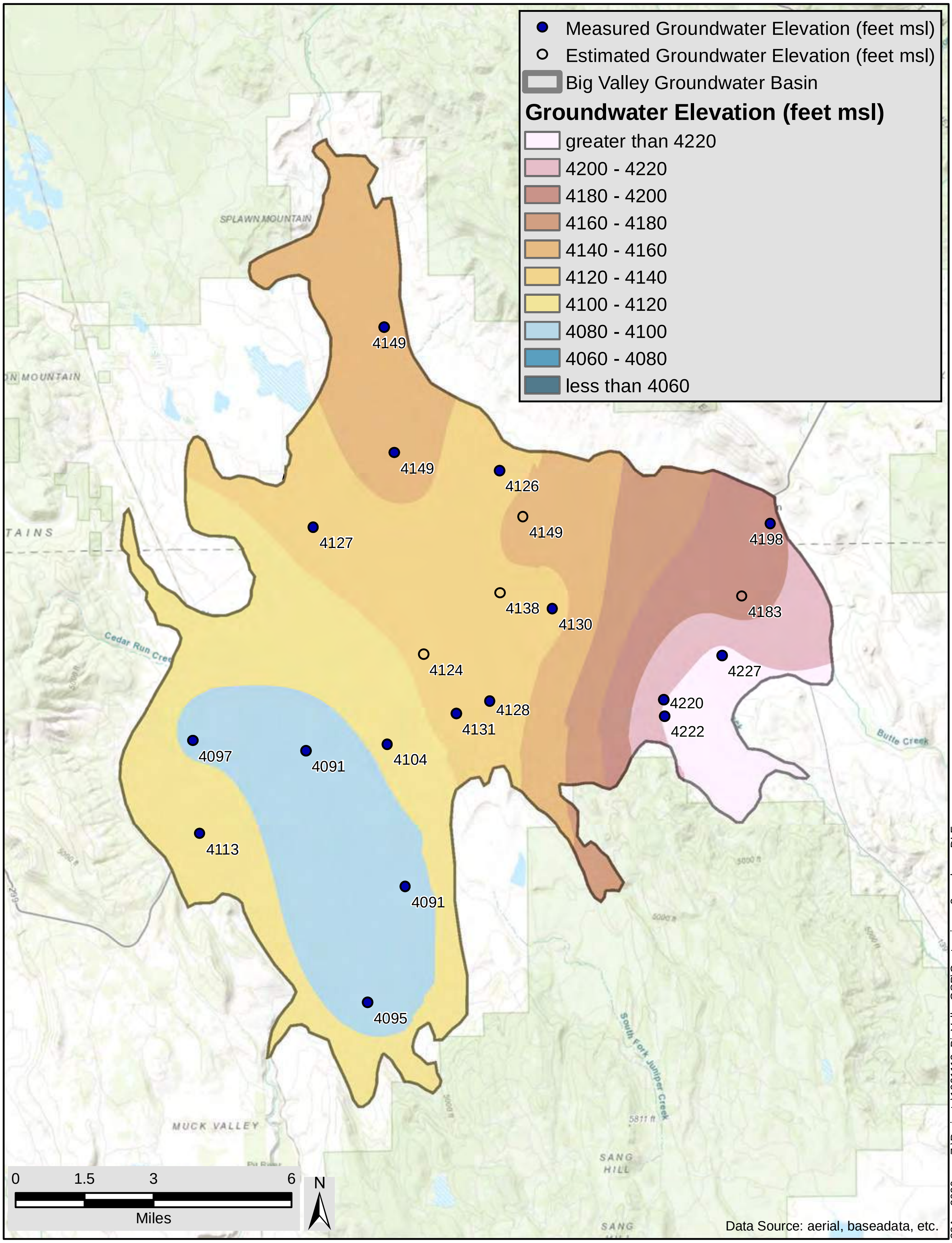

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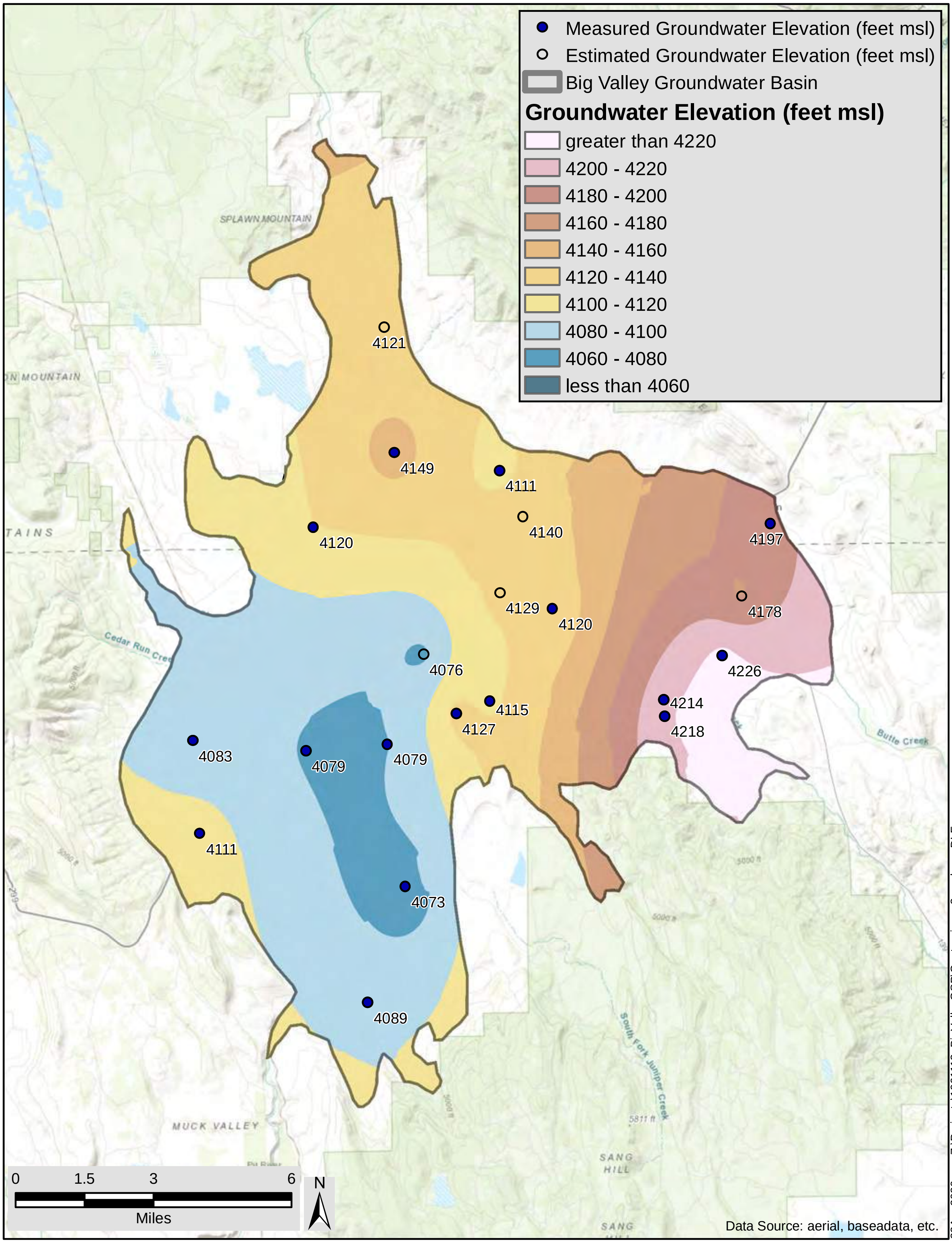

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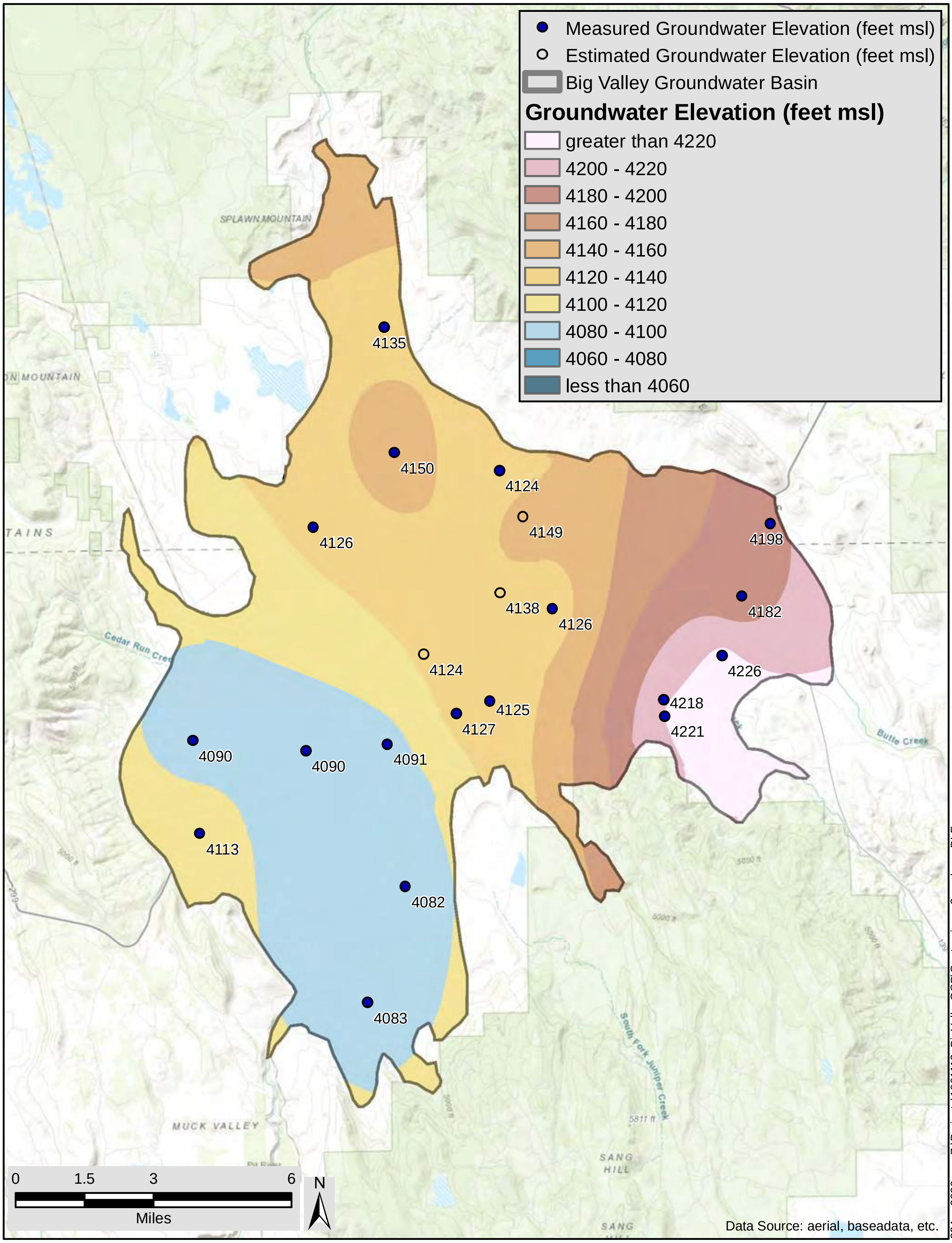
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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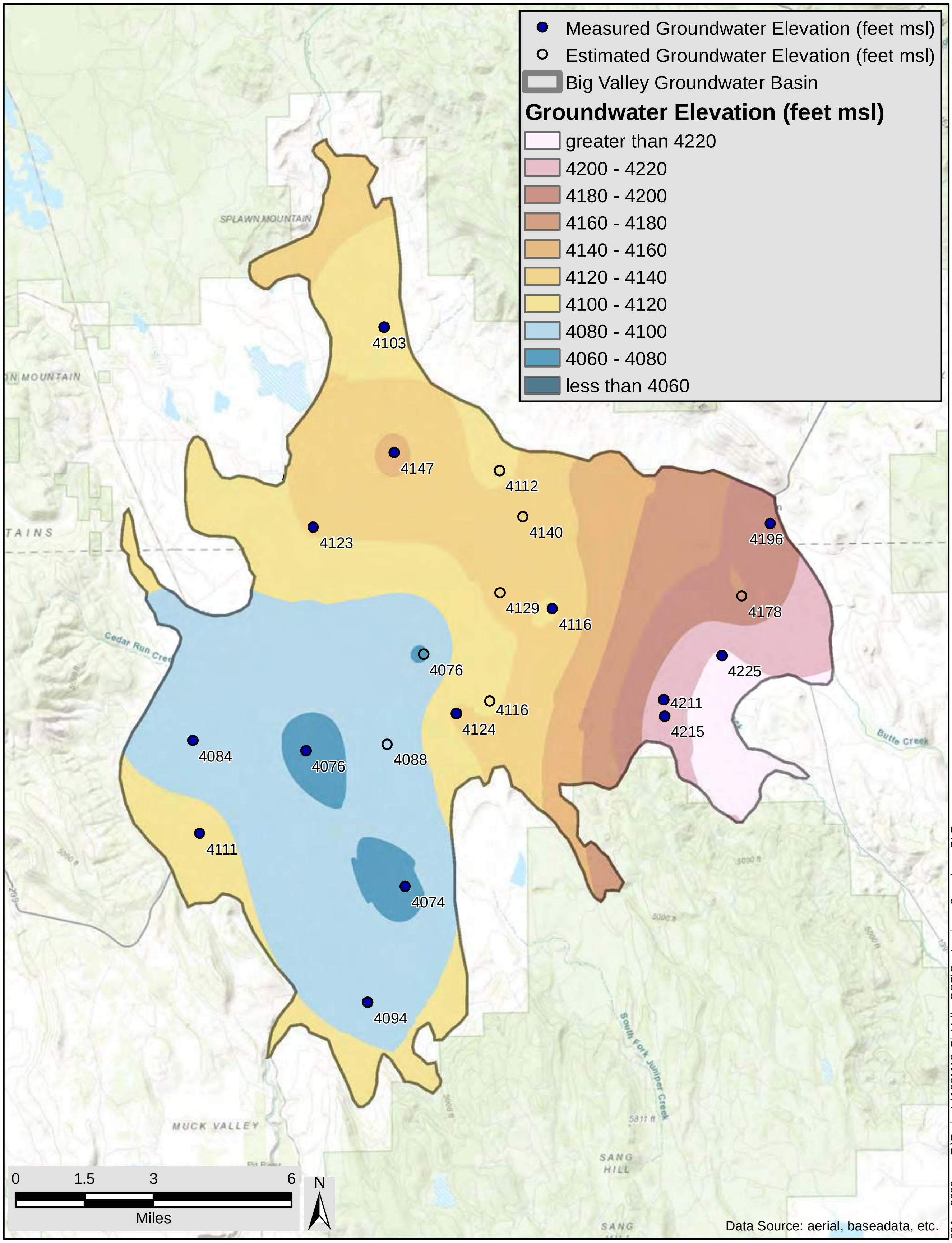
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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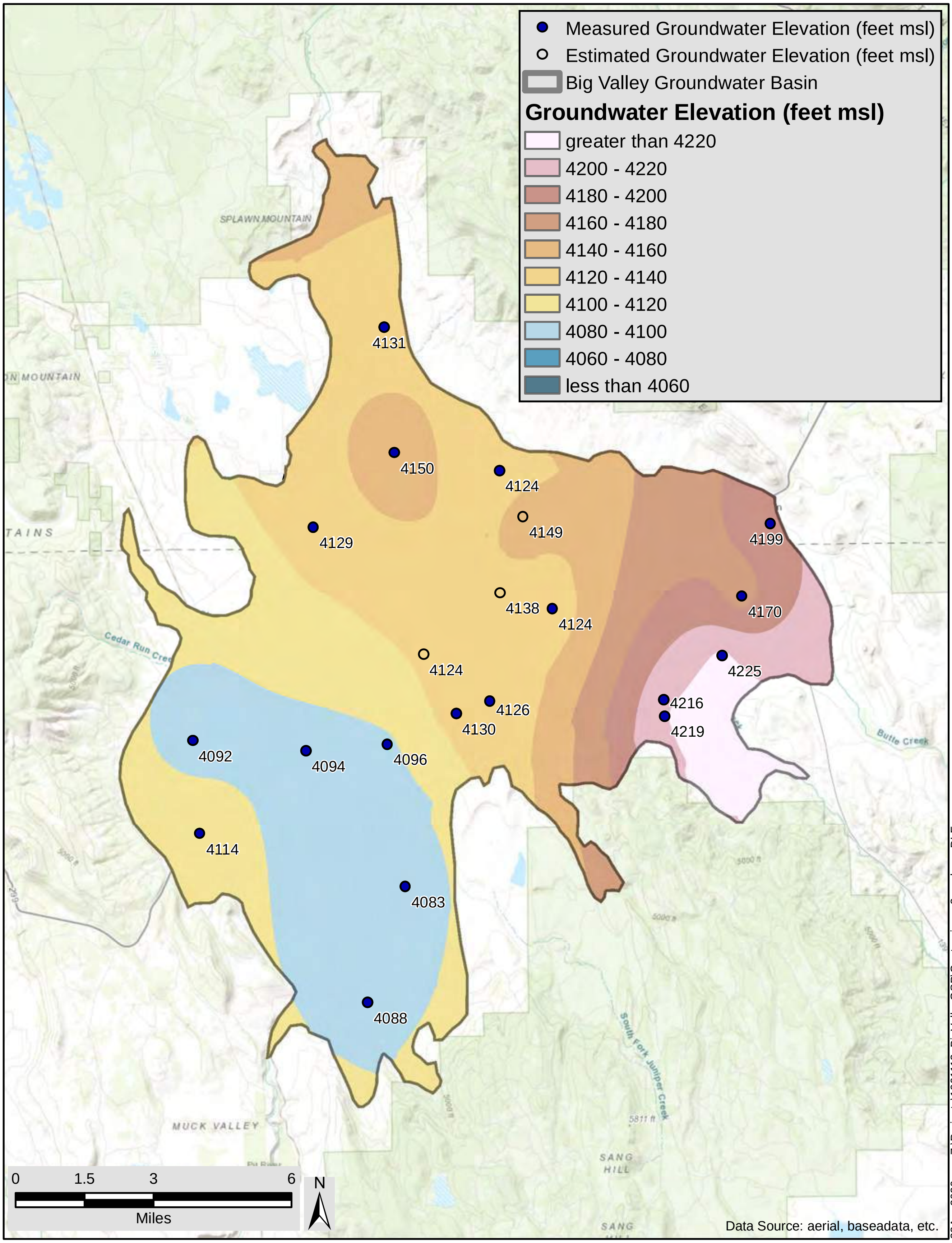
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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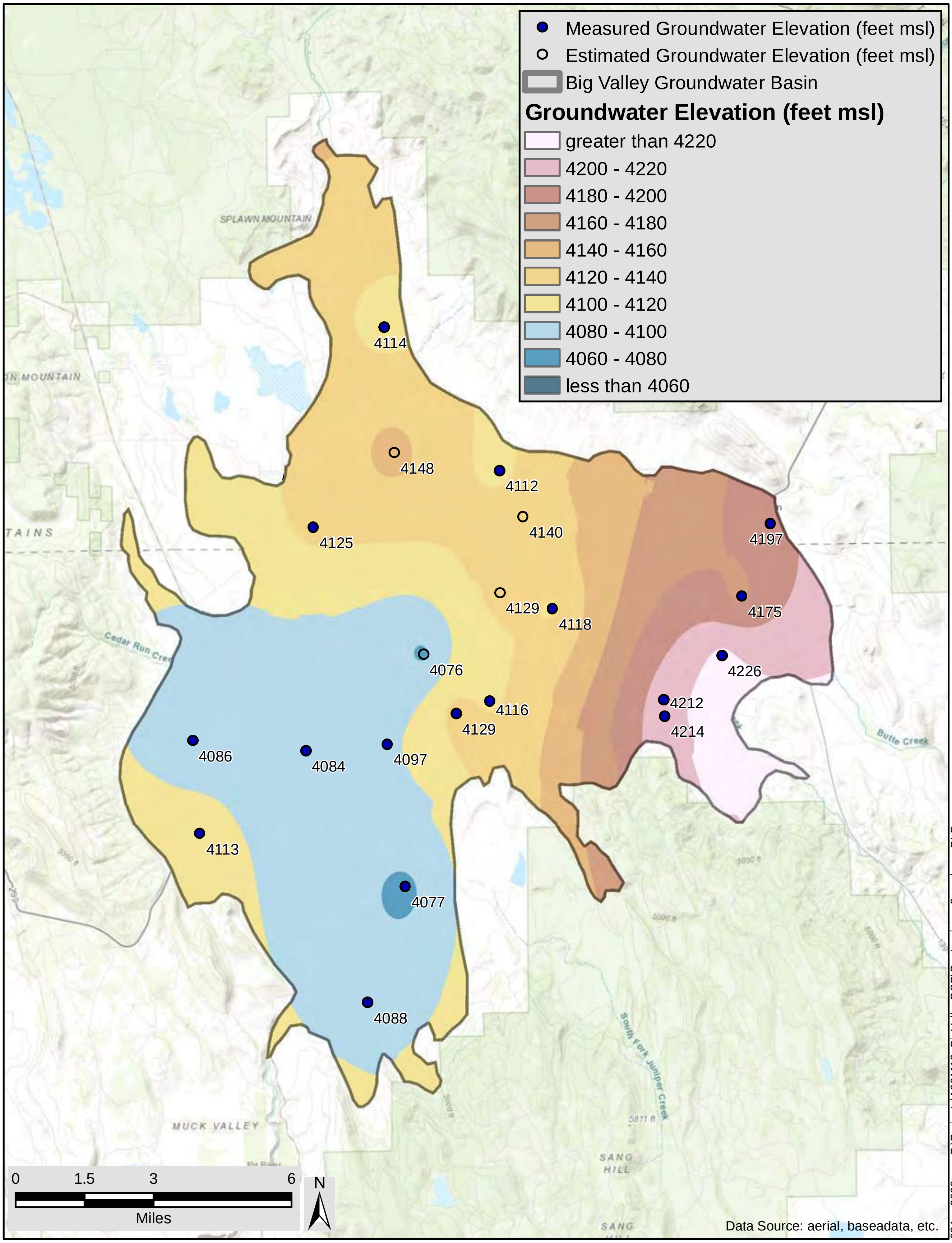

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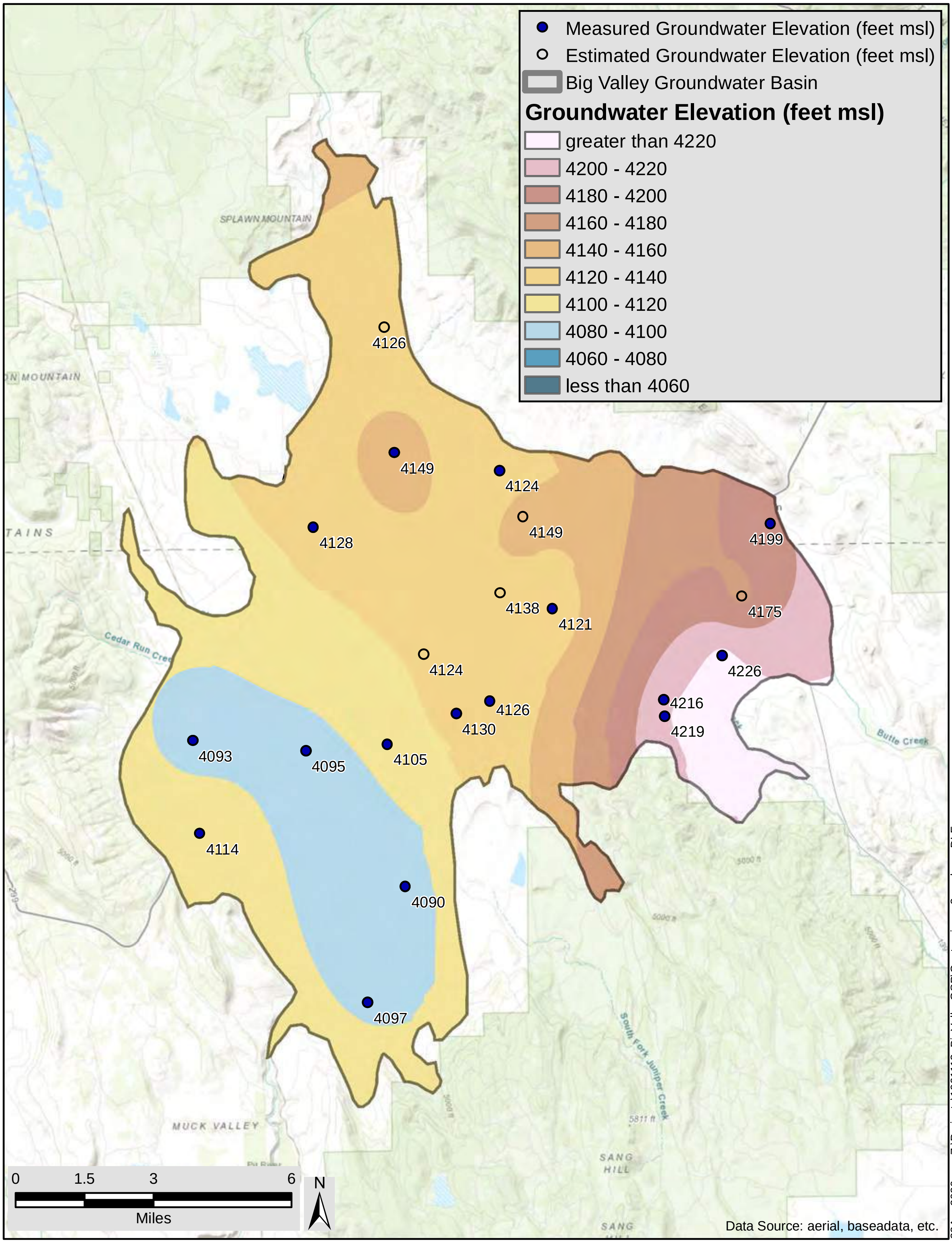
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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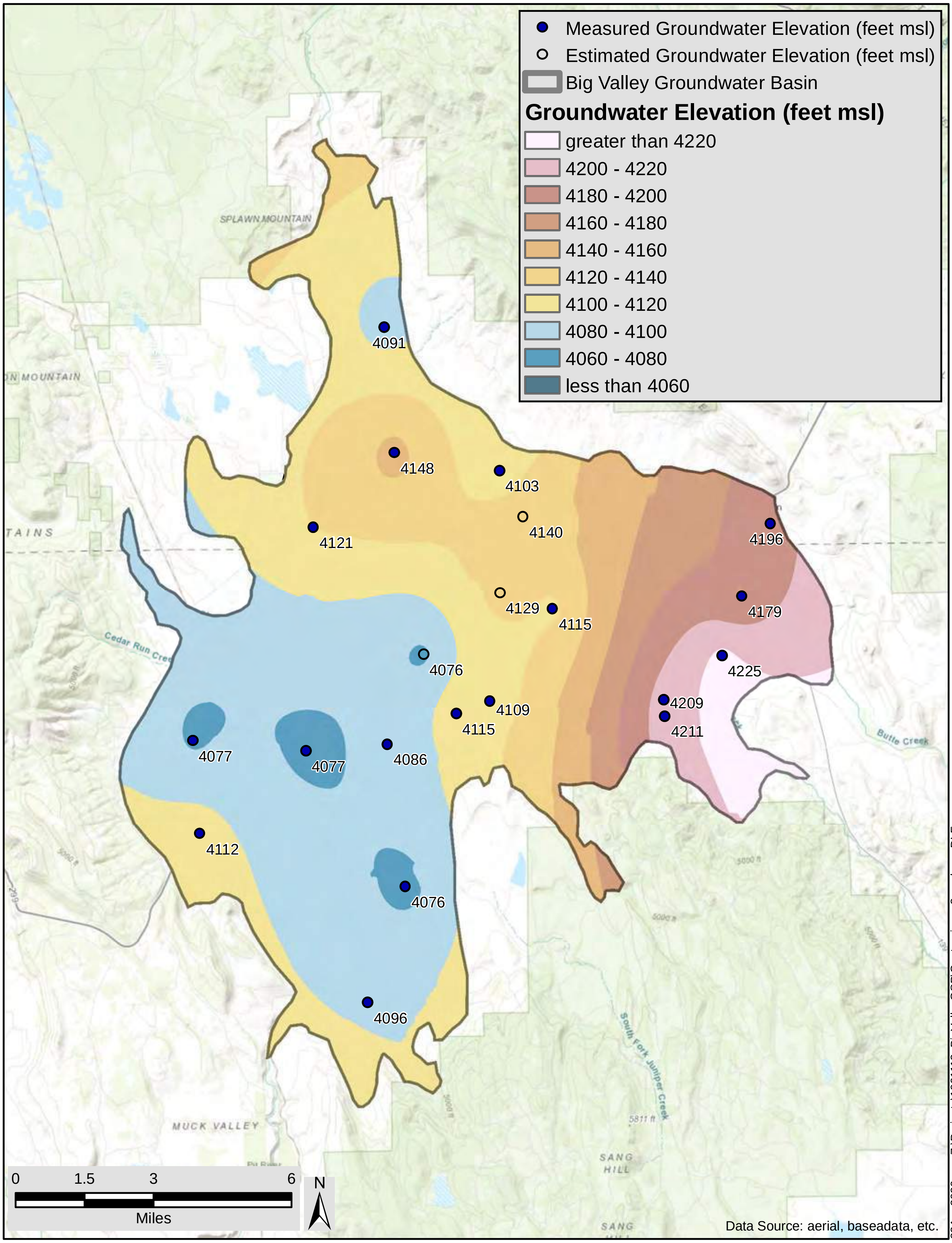
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE

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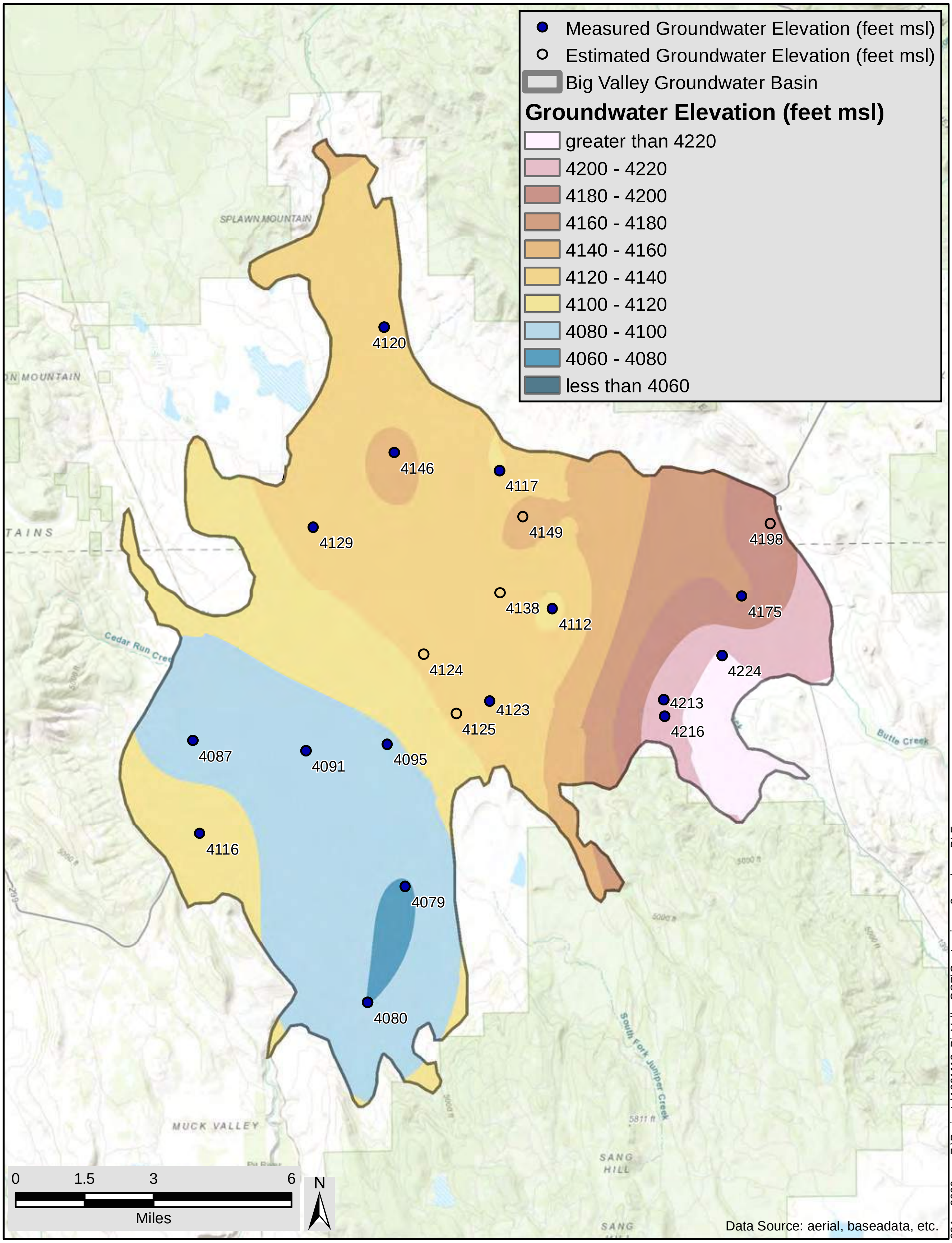

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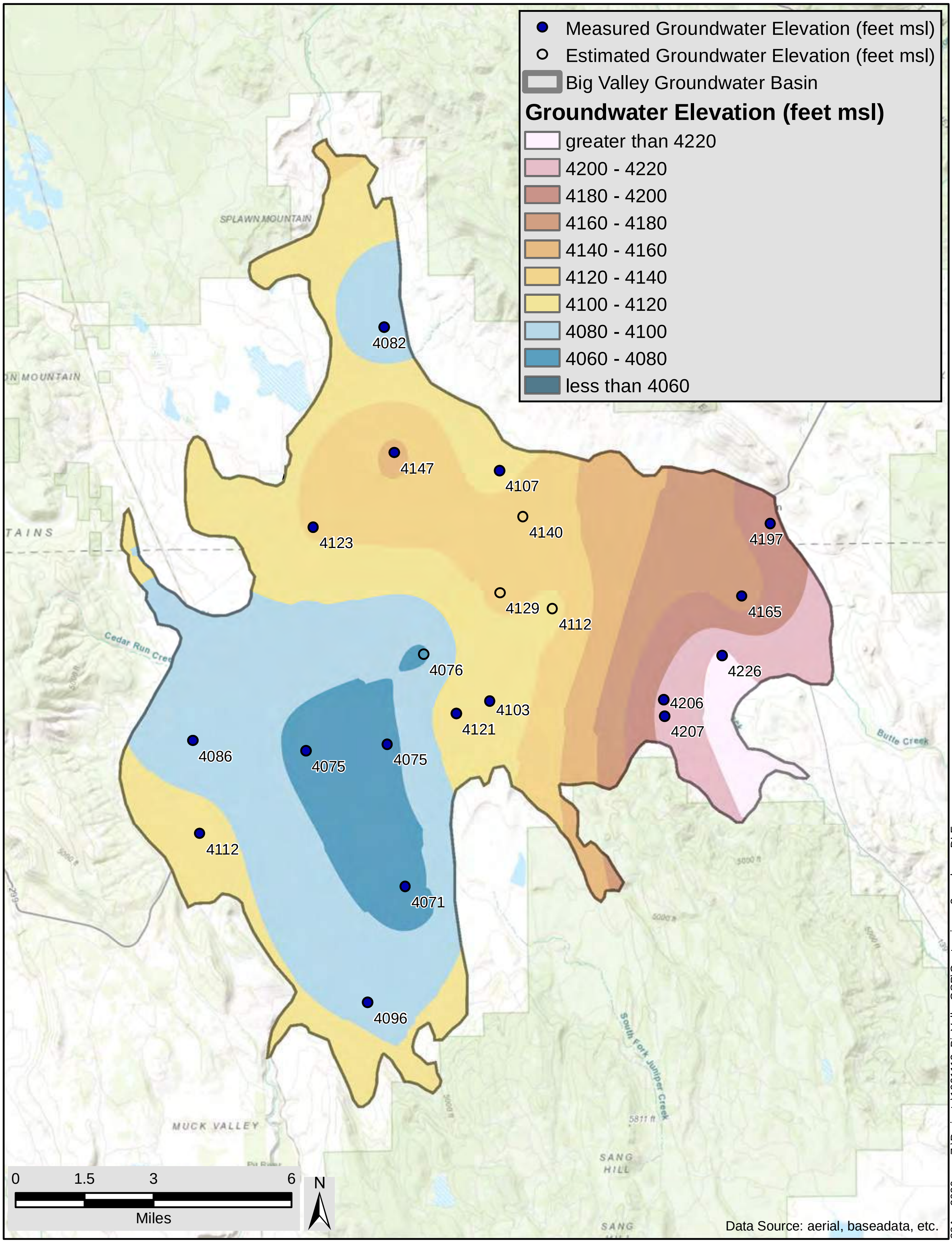
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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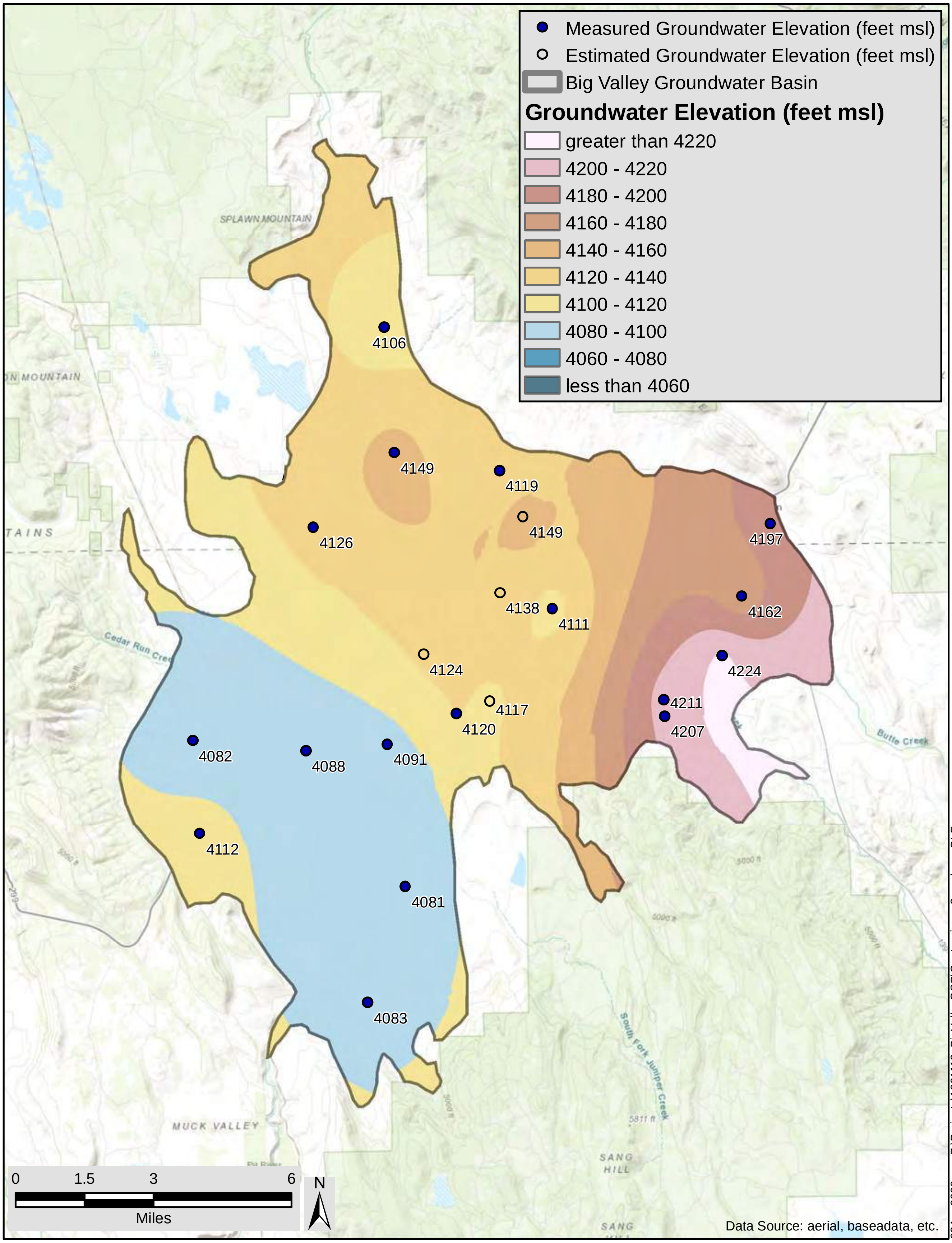
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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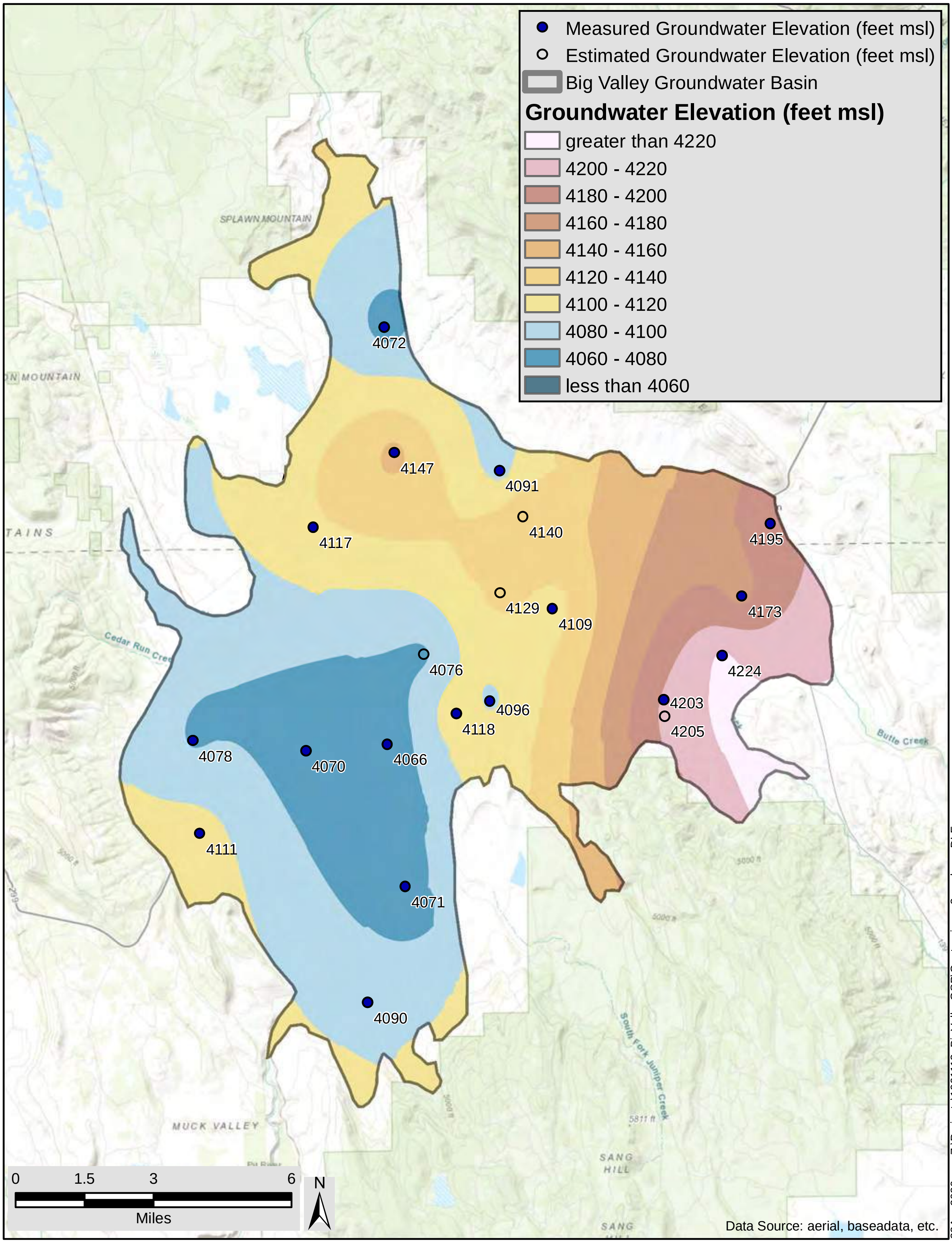
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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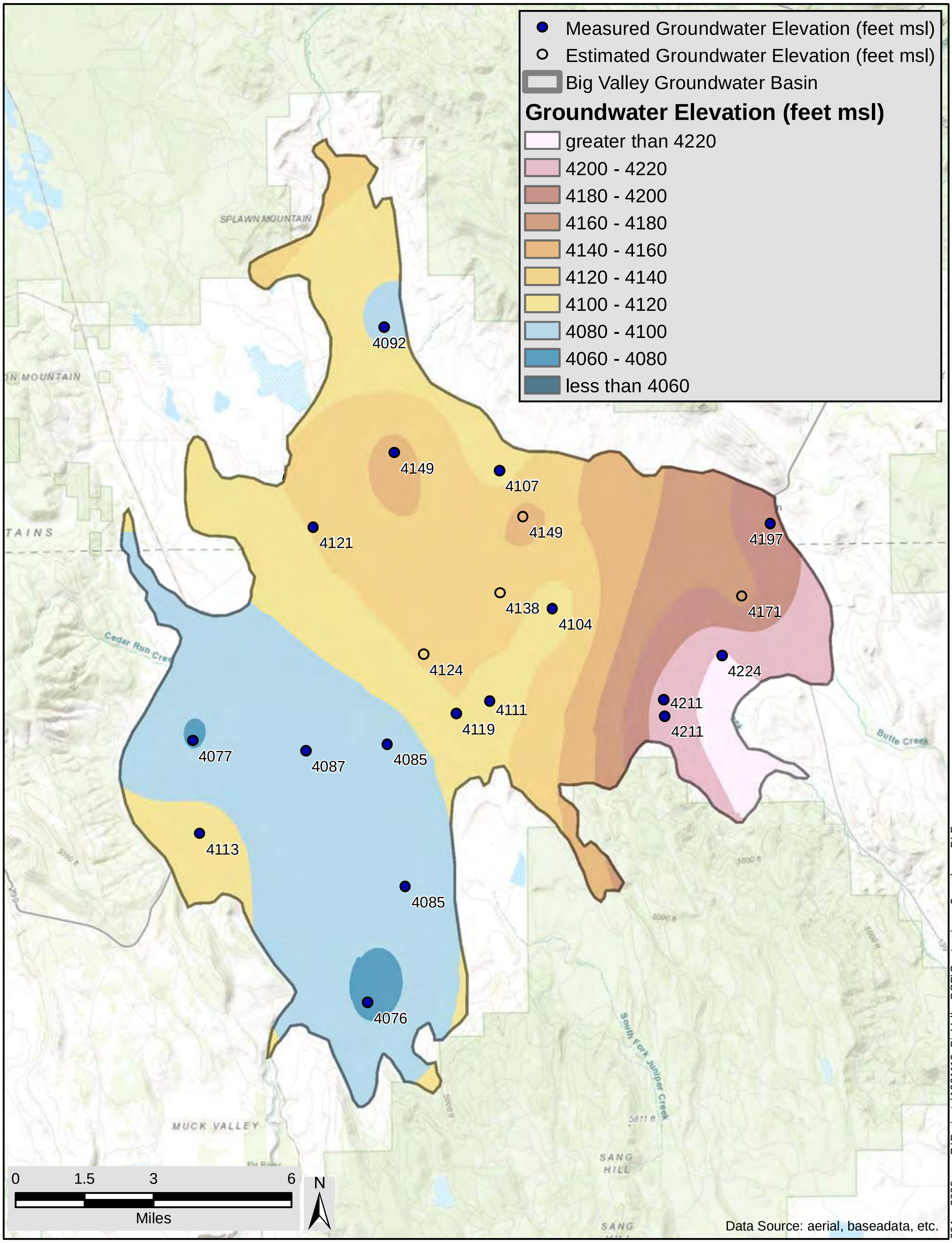

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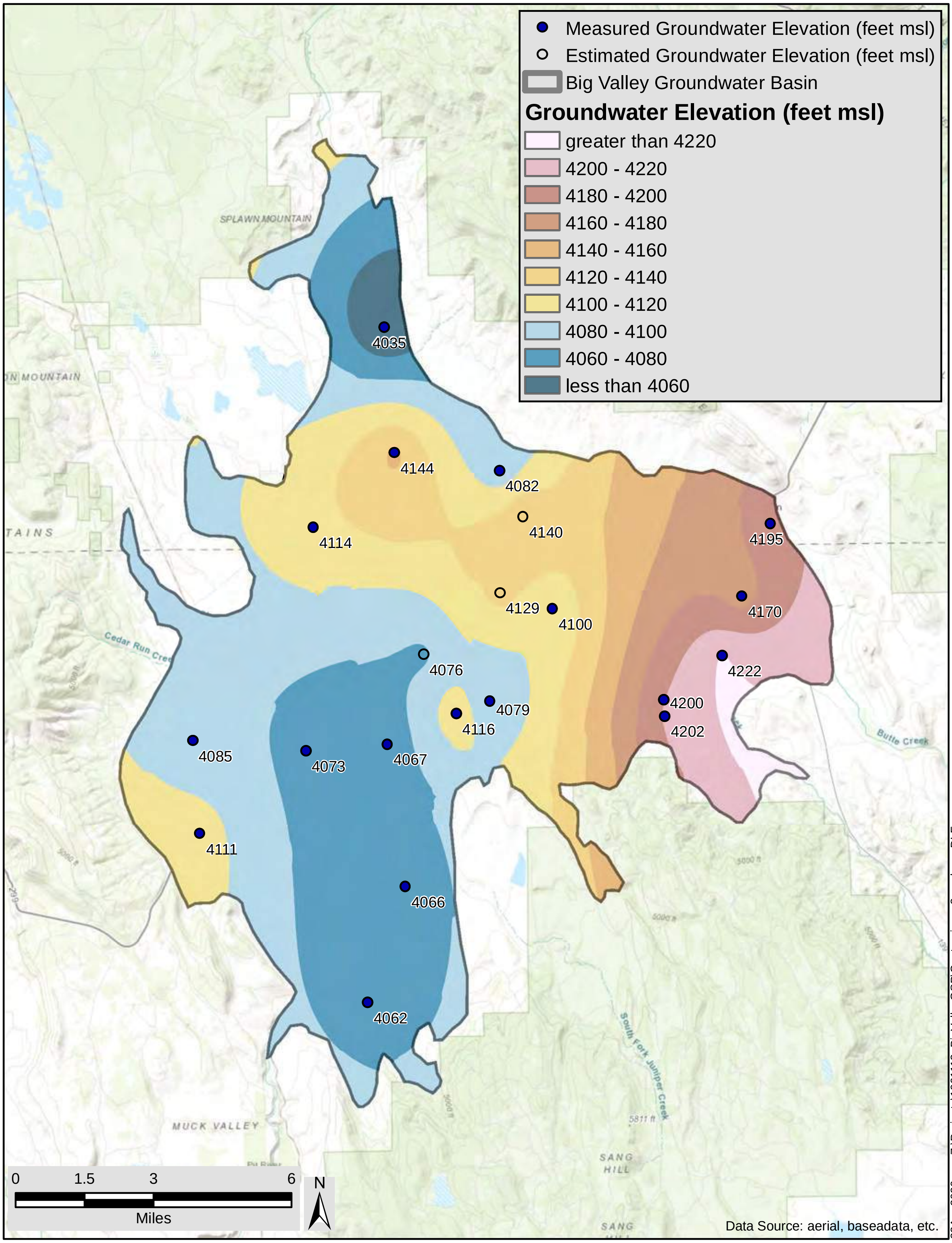
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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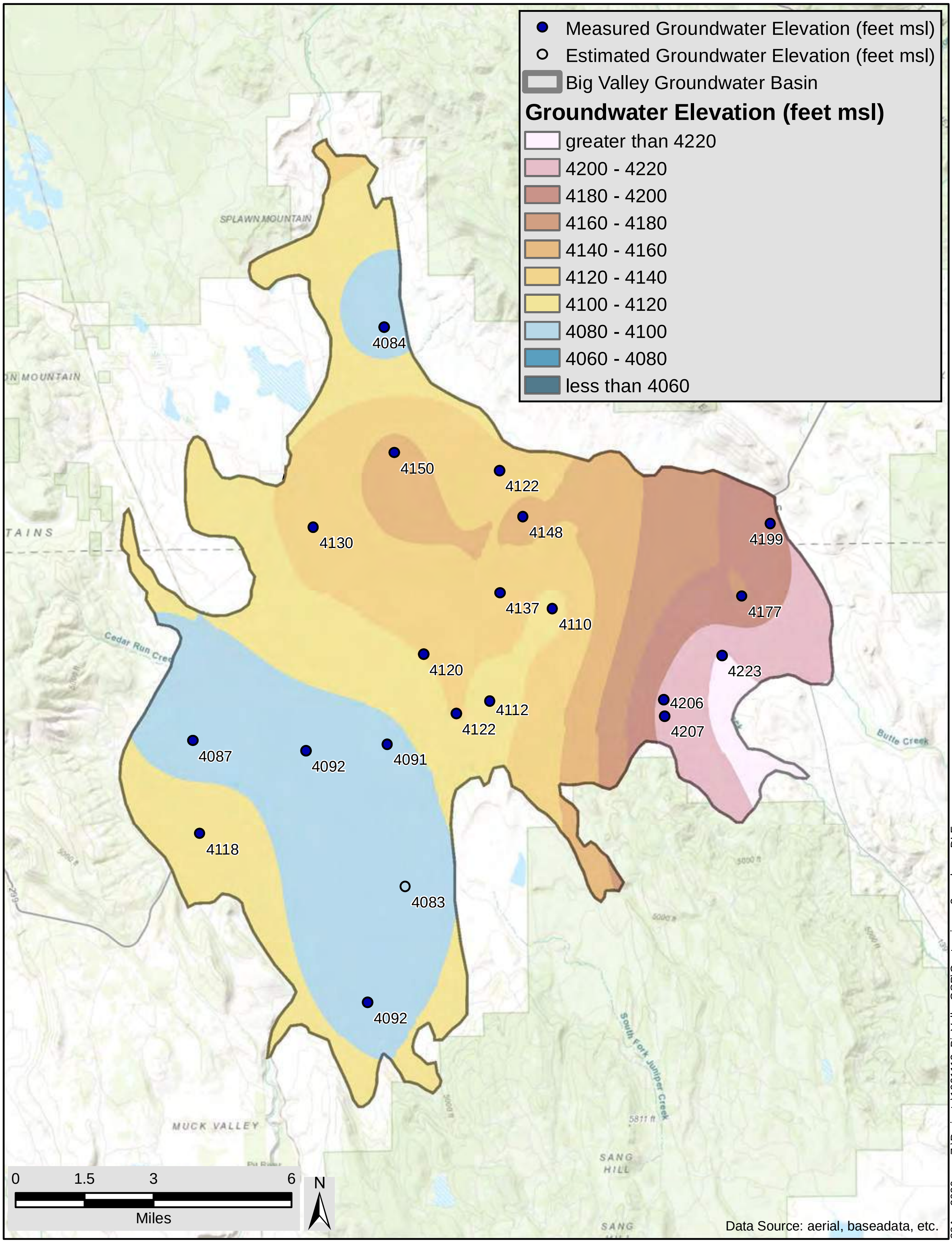
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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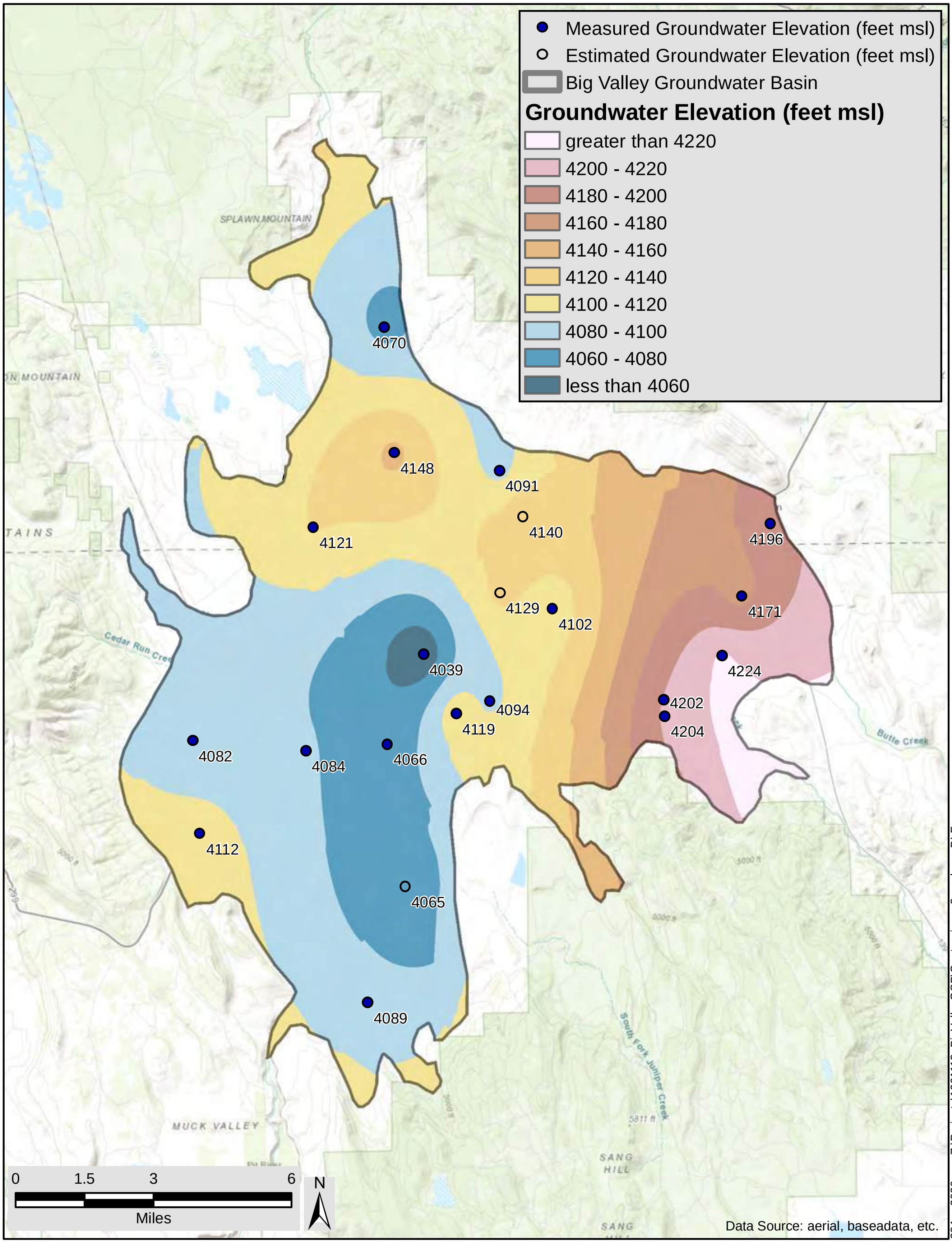
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 2016
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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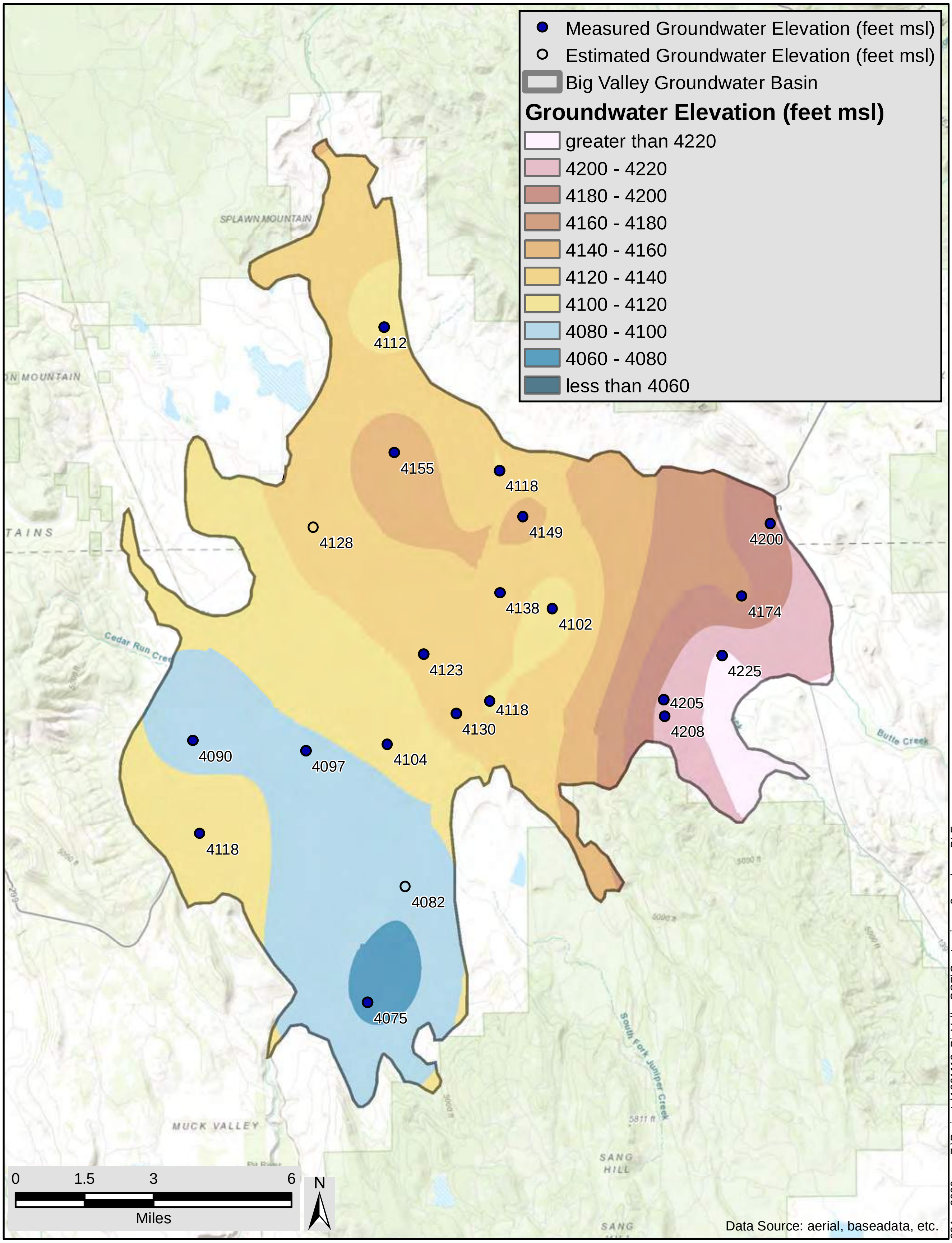
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 2016
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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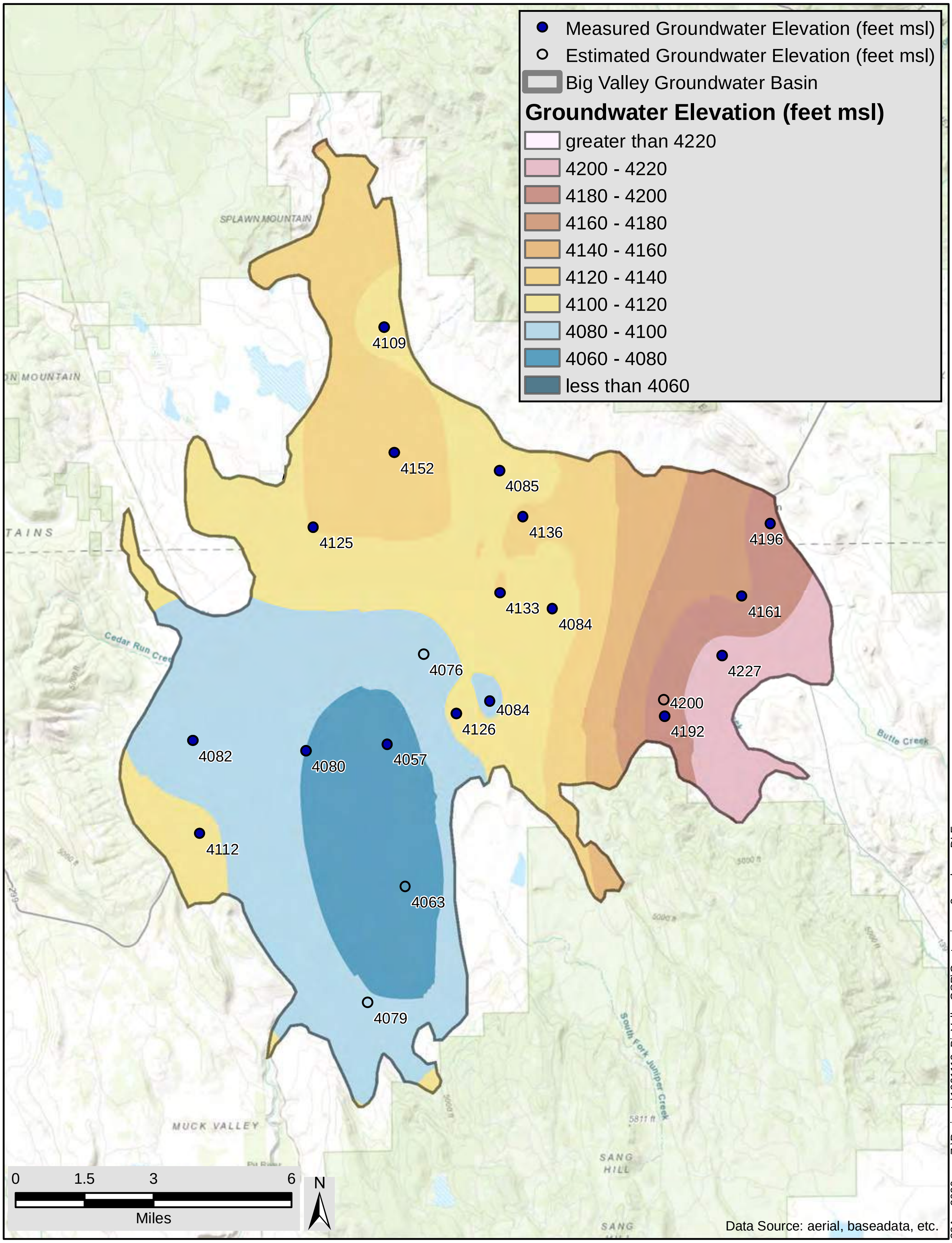
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 2017		
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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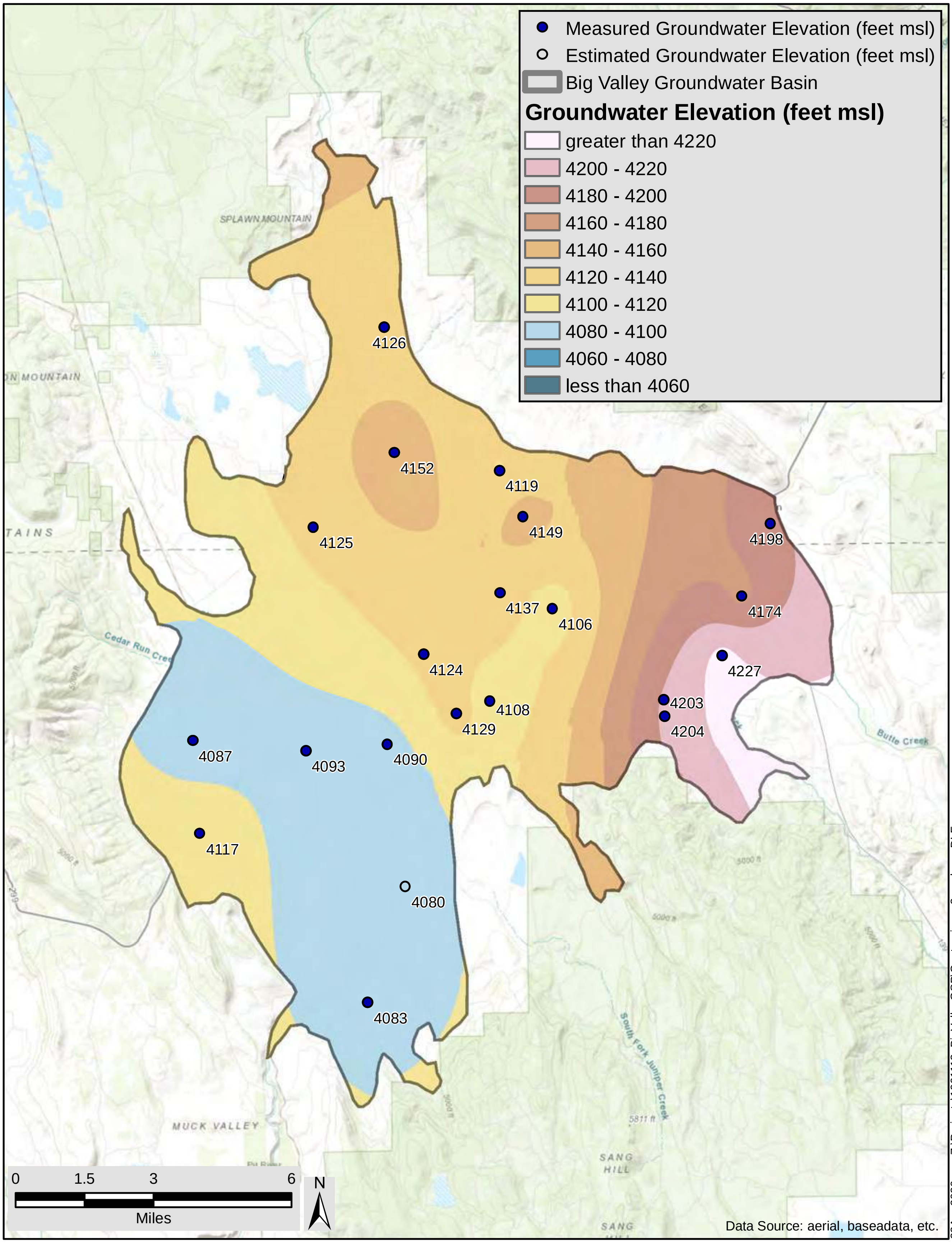
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 2017
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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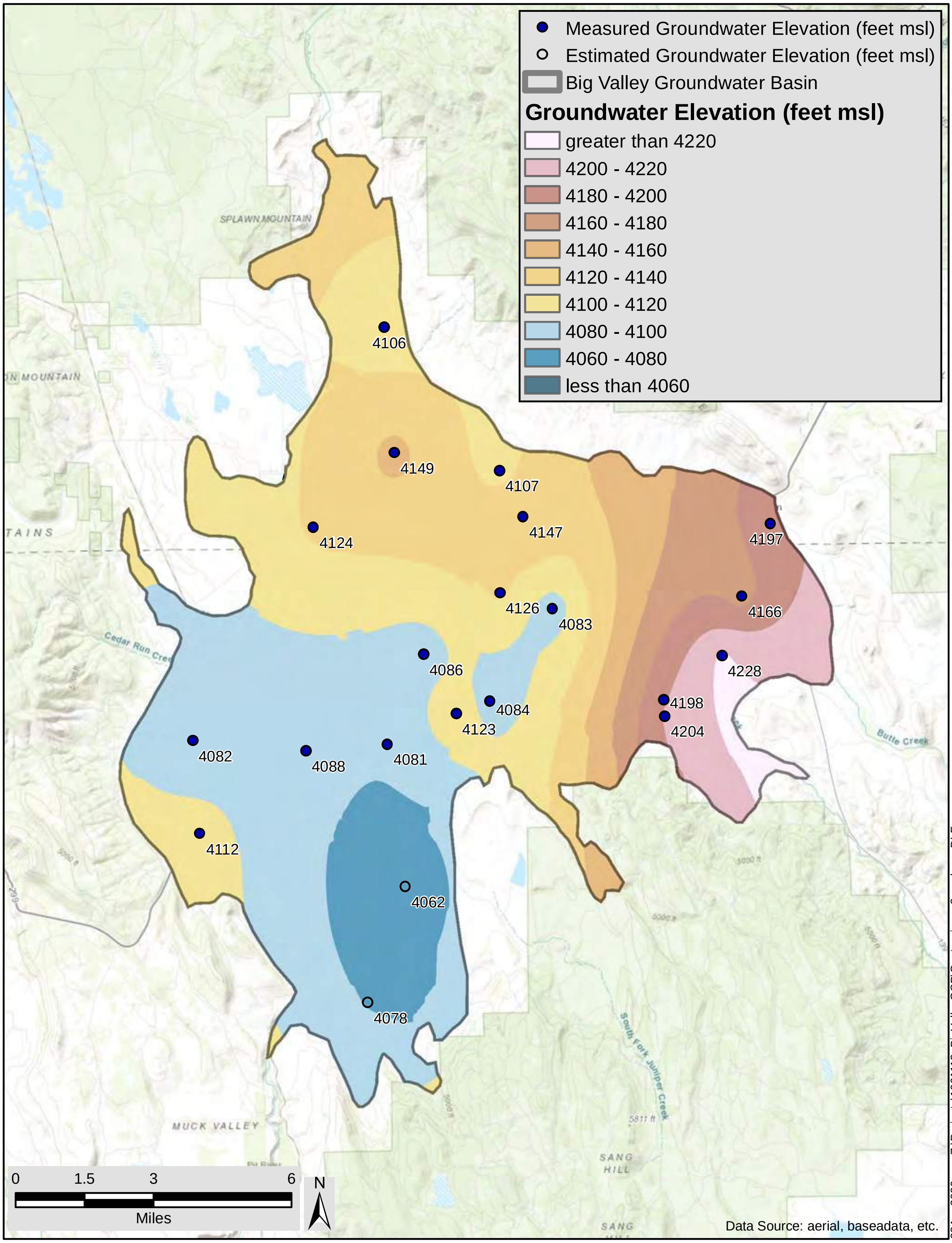
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 2018
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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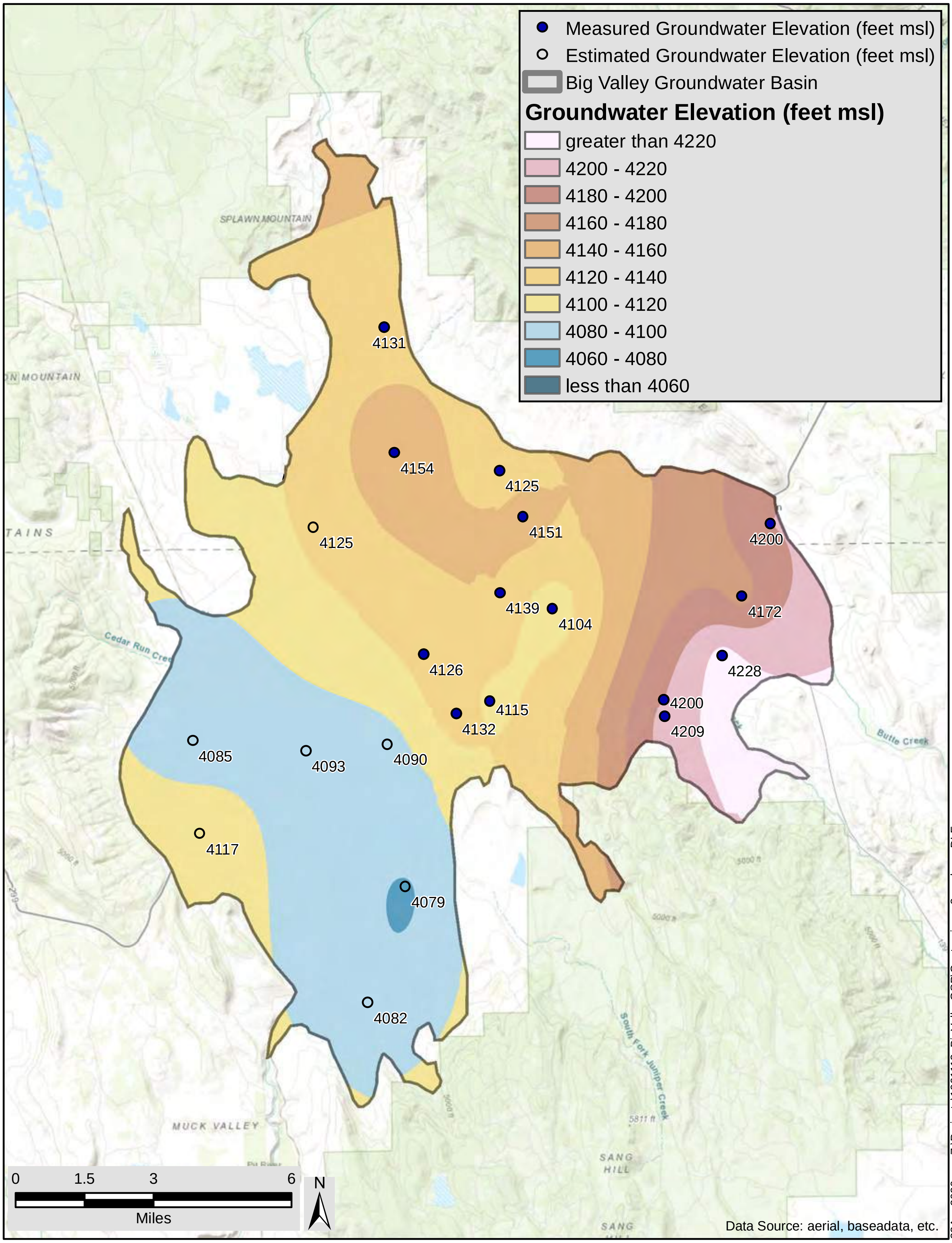
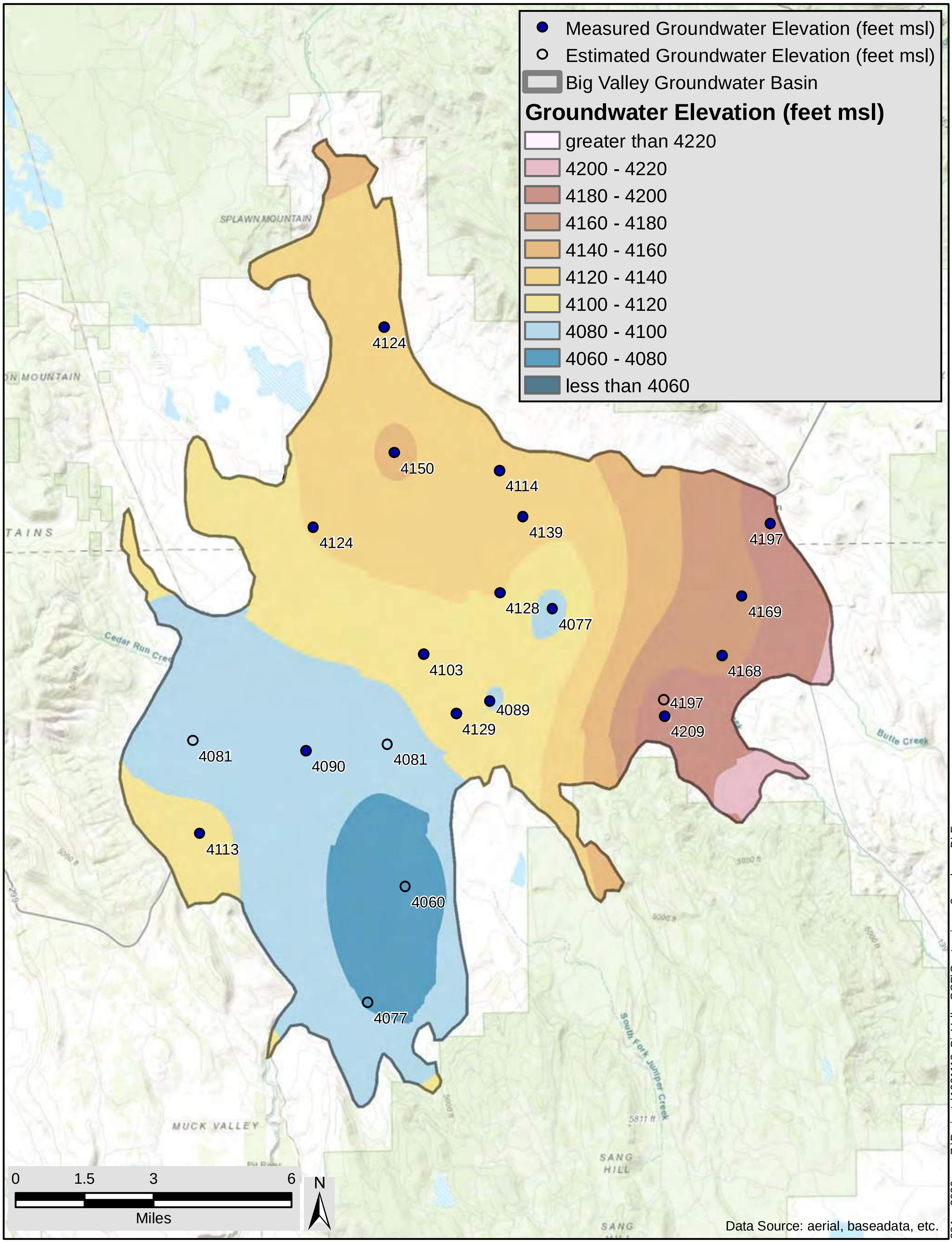
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 2018
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 2019
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE

22Aug2020 Z:\Projects\1901113_BigValleyGSP\Contouring_v3.mxd DLF



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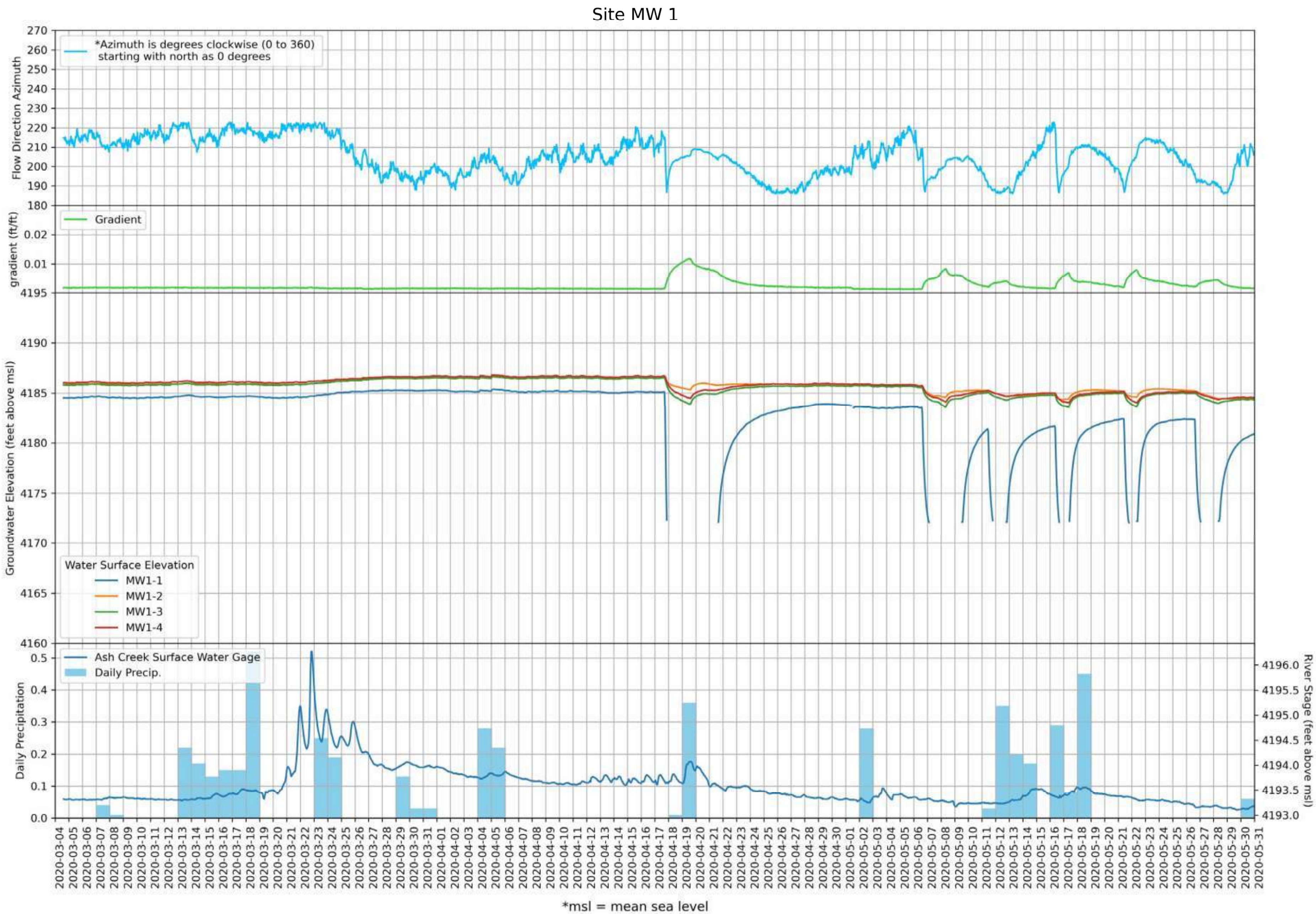
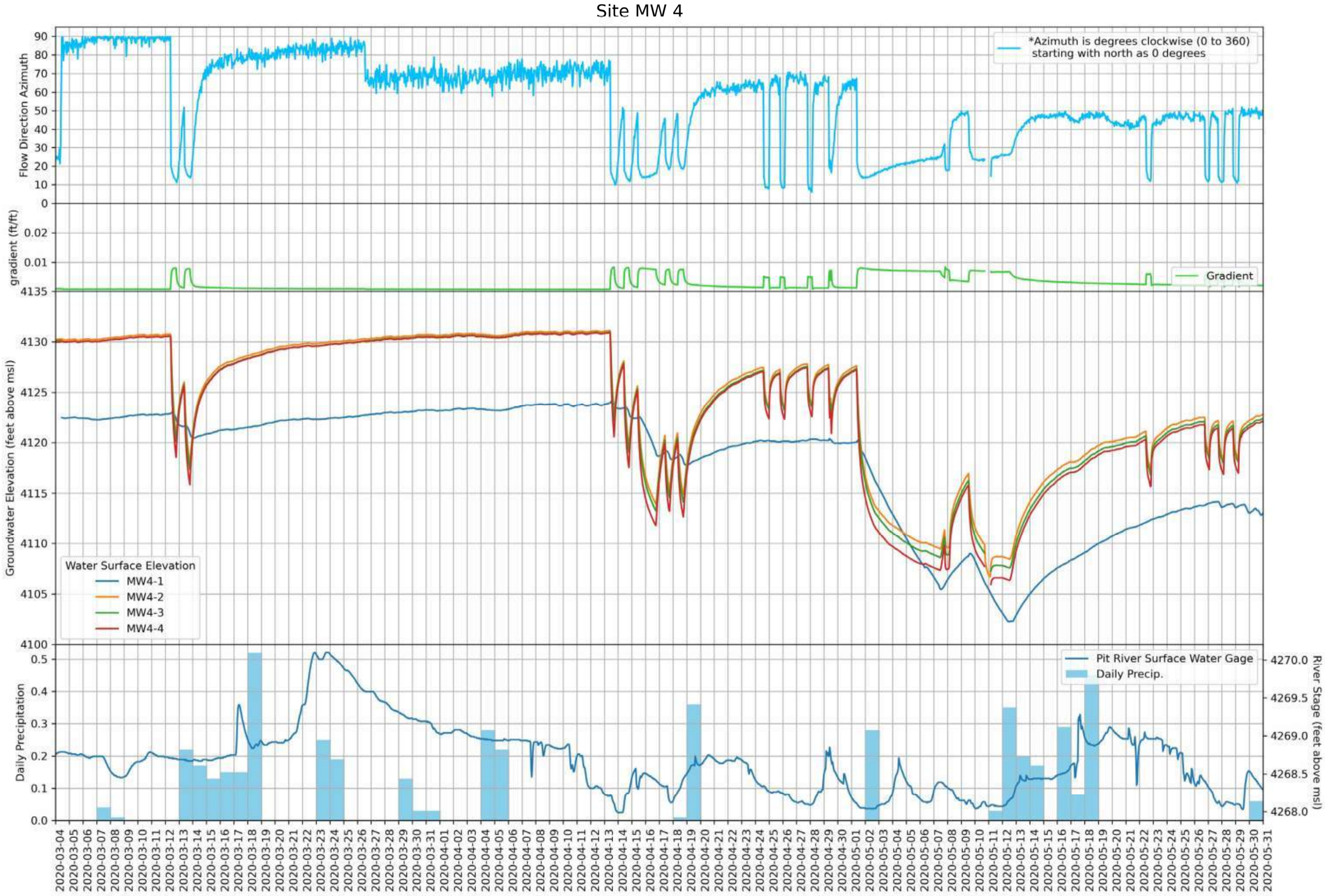
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 2019		
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE

Appendix 5C Transducer Data from Monitoring Well Clusters 1 and 4


Site MW 1
*Azimuth is degrees clockwise (0 to 360) starting with north as 0 degrees
Flow Direction Azimuth
Gradient
gradient (ft/ft)
Groundwater Elevation (feet above msl)
Water Surface Elevation
MW1-1
MW1-2
MW1-3
MW1-4
Ash Creek Surface Water Gage
Daily Precip.
Daily Precipitation
River Stage (feet above msl)
*msl = mean sea level



*msl = mean sea level

Appendix 6A Water Budget Components

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Credit(+)/ Debit(-)	Relationship with Other Systems	Data Source(s)	Assumptions	Relative Level of Precision
(1)	**Inflow**	Into Basin	Precipitation on Land System	+		-Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber -Basin Land area from DWR (2018). -Area of rivers, conveyance, and lakes from USGS (2020).	-Precipitation does not vary spatially throughout the Basin	High
(2)	**Inflow**	Between Systems	Surface Water Delivery	+	Equal to the *Surface Water Delivery* term in the surface water system outflow	-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Crop Coefficients (Kc) adapted from FAO (1998) using CUP model (Orange, et al 2004) -Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber	-Agriculture and wetland habitats are the only sectors that use surface water. Other uses such as illegal irrigation and fire suppression may use surface water, but there is no way to quantify. -Irrigation efficiency = 85% (NRCS 2020) -35% of agricultural irrigation uses surface water -98% of riparian demands are met by surface water	Low
(3)	**Inflow**	Between Systems	Groundwater Extraction	+	Equal to the *Groundwater Extraction* term in the groundwater system outflow	-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Crop Coefficients (Kc) adapted from FAO (1998) using CUP model (Orange, et al 2004) -Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber Population of Big Valley from DWR (2018) Population of Bieber from United States Census Bureau (2020)	-Irrigation efficiency = 85% (NRCS 2020) -65% of agricultural irrigation uses groundwater -2% of riparian demands are met by groundwater -Per capita water use is 100 gallons/day/person -All domestic users use groundwater	Low
(4)	**Inflow**		*Total Inflow*		*(1)+(2)+(3)*			
(5)	**Outflow**	Out of Basin	Evapotranspiration	-		-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Crop Coefficients (Kc) adapted from FAO (1998) using CUP model (Orange, et al 2004) -Land use and crop acreages from DWR (2014)	-ETo does not vary throughout the Basin -The land system remains in balance from year to year (no change in land system storage).	Moderate
(6)	**Outflow**	Between Systems	Runoff	-	Equal to the *Runoff* term in Surface Water System*	-Precipitation from PRISM Model (NACSE 2020) evaluated at Bieber	-Curve number method was used to estimate the amount of runoff (NRCS 1986)	Low
(7)	**Outflow**	Between Systems	Return Flow	-	Equal to the *Return Flow* term in Surface Water System*	-See surface water delivery and groundwater extraction above	-50% of agricultural inefficiency results in return flow (7.5% of applied water)	Low
(8)	**Outflow**	Between Systems	Recharge of Applied Water	-	Equal to the *Recharge of Applied Water* term in the groundwater system	-See surface water delivery and groundwater extraction above	-50% of agricultural inefficiency results in recharge of grounwater (7.5% of applied water)	Low
(9)	**Outflow**	Between Systems	Recharge of Precipitation	-	Equal to the *Recharge of Precipitation* term in the groundwater system	-Precipitation from PRISM Model (NACSE 2020) evaluated at Bieber	-2% of precipitation results in recharge to groundwater	Moderate
(10)	**Outflow**	Between Systems	Managed Aquifer Recharge	-	Equal to the *Managed Aquifer Recharge* term in the groundwater system	No managed recharge is currently documented in the Big Valley Groundwater basin		
(11)	**Outflow**		*Total Outflow*		*(5)+(6)+(7)+(8)+(9)+(10)*			
(12)	**Storage Change**		Change in Land System Storage		*(4)-(11)*			

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Credit(+)/ Debit(-)	Relationship with Other Systems	Data Source(s)	Assumptions	Relative Level of Precision
(13)	**Inflow**	Into Basin	Stream Inflow	+		-Historic and current data from Pit River gage at Canby -Historic data from gage on Pit River north of Lookout (where it enters basin), Ash Creek at Adin, Widow Valley Creek, Willow Creek	-Historic relationship between flow at Canby and flow at historic gages is the same as current. E.g. flow during winter events is about 40% higher than Canby once the Pit River reaches Big Valley -Watershed areas outside of those with historic gage measurements have same runoff per acre as the gaged watersheds	Moderate
(14)	**Inflow**	Into Basin	Precipitation on Lakes	+		-Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber -Area of rivers, conveyance, and lakes from USGS (2020).	-precipitation does not vary spatially throughout the Basin	High
(6)	**Inflow**	Between Systems	Runoff	+	Equal to the *Runoff* term in land system (6)	-Precipitation from PRISM Model (NACSE 2020) evaluated at Bieber	-Curve number method was used to estimate the amount of runoff (NRCS 1986)	Low
(7)	**Inflow**	Between Systems	Return Flow	+	Equal to the *Return Flow* term in the land system (7)	-See surface water delivery and groundwater extraction above	-50% of agricultural inefficiency results in return flow (7.5% of applied water)	Low
(15)	**Inflow**	Between Systems	Stream Gain from Groundwater	+	Equal to the *Groundwater Loss to Stream* term in the groundwater system	-None	-Assumed to be 0 until further analysis of transducer data from new monitoring wells	Low
(16)	**Inflow**	Between Systems	Lake Gain from Groundwater	+	Equal to the *Groundwater Loss to Lake* term in the groundwater system	-None	-Assumed to be 0 because most lakes are above the groundwater levels	High
(17)	**Inflow**		*Total Inflow*		*(13)+(14)+(6)+(7)+(15)+(16)*			
(18)	**Outflow**	Out of Basin	Stream Outflow	-		-Estimated based on this water budget -Estimates verified using analysis of historic gage data from Pit River south of Bieber (exit from Basin)	-The surface water system remains in balance from year to year (no change in surface water storage)	Low
(19)	**Outflow**	Out of Basin	Conveyance Evaporation	-		-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Area of conveyance from USGS (2020)	-Each year, conveyance is full from May to September and empty from October to April	Moderate
(20)	**Outflow**	Between Systems	Conveyance Seepage	-	Equal to the *Conveyance Seepage* term in the groundwater system	-Area of conveyance from USGS (2020)	-Each year, conveyance is full from May to September and empty from October to April -Seepage rate of 0.01 ft/day	Moderate
(2)	**Outflow**	Between Systems	Surface Water Delivery	-	Equal to the *Surface Water Delivery* term in land system (2)	-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Crop Coefficients (Kc) adapted from FAO (1998) using CUP model (Orange, et al 2004) -Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber	-Agriculture and wetland habitats are the only sectors that use surface water. Other uses such as illegal irrigation and fire suppression may use surface water, but there is no way to quantify. -Irrigation efficiency = 85% (NRCS 2020) -35% of agricultural irrigation uses surface water -98% of riparian demands are met by surface water	Low
(21)	**Outflow**	Between Systems	Stream Loss to Groundwater	-	Equal to the *Gain from Stream* term in the groundwater system	-Historic and current data from Pit River gage at Canby -Historic data from gage on Pit River north of Lookout (where it enters Basin), Ash Creek at Adin, Widow Valley Creek, Willow Creek, Pit River at exit from Basin.	-Calculated from the historic inflow - outflow relationship.	Low
(22)	**Outflow**	Between Systems	Lake Loss to Groundwater	-	Equal to the *Groundwater Gain from Lake* term in the groundwater system	-Area of lakes from USGS (2020)	-Each year, lakes are full (100%) and surface area drops throughout summer to 10% in September, then gradually refill over the winter. -Seepage rate of 0.01 ft/day	Moderate

(23)	**Outflow**	Out of Basin	Lake Evaporation	-		-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Area of lakes from USGS (2020)	-Each year, lakes are full (100%) and surface area drops throughout summer to 10% in September, then gradually refill over the winter.	High
(24)	**Outflow**	Out of Basin	Stream Evaporation	-		-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Area of streams from USGS (2020)		High
(25)	**Outflow**		*Total Outflow*		*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*			
(26)	**Storage Change**		Change in Surface Water Storage		*(17)-(25)*			

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Credit(+)/ Debit(-)	Relationship with Other Systems	Data Source(s)	Assumptions	Relative Level of Precision
(8)	Inflow	Between Systems	Recharge of Applied Water	+	Equal to the *Recharge of Applied Water* term in the land system (8)	-See surface water delivery and groundwater extraction above	-50% of agricultural inefficiency results in recharge of grounwater (7.5% of applied water)	Low
(9)	Inflow	Between Systems	Recharge of Precipitation	+	Equal to the *Recharge of Precipitation* term in the land system (9)	-Precipitation from PRISM Model (NACSE 2020) evaluated at Bieber	-2% of precipitation results in recharge to groundwater	Moderate
(10)	Inflow	Between Systems	Managed Aquifer Recharge	+	Equal to the *Managed Aquifer Recharge* term in the land system (10)	No managed recharge is currently documented in the Big Valley Groundwater basin		
(21)	Inflow	Between Systems	Groundwater Gain from Stream	+	Equal to the *Stream Loss to Groundwater* term in the surface water system (21)	-Historic and current data from Pit River gage at Canby -Historic data from gage on Pit River north of Lookout (where it enters Basin), Ash Creek at Adin, Widow Valley Creek, Willow Creek, Pit River at exit from Basin.	-Calculated from the historic inflow - outflow relationship.	Low
(22)	Inflow	Between Systems	Groundwater Gain from Lake	+	Equal to the *Lake Loss to Groundwater* term in the surface water system (22)	-Area of lakes from USGS (2020)	-Each year, lakes are full (100%) and surface area drops throughout summer to 10% in September, then gradually refill over the winter. -Seepage rate of 0.01 ft/day	Moderate
(20)	Inflow	Between Systems	Conveyance Seepage	+	Equal to the *Conveyance Seepage* term in the surface water system (20)	-Area of conveyance from USGS (2020)	-Each year, conveyance is full from May to September and empty from October to April -Seepage rate of 0.01 ft/day	Moderate
(27)	Inflow	Into Basin	Subsurface Inflow	+		-Water level data from wells in Round Valley and Adin -Estimate of cross-sectional area of canyon between Round Valley and Big Valley	-Other than subsurface flow from Round Valley (about 1AFY), no subsurface inflow occurs in the BVGB	Moderate
(28)	Inflow		*Total Inflow*		*(8)+(9)+(10)+(21)+(22)+(20)+(27)*			
(3)	Outflow	Between Systems	Groundwater Extraction	-	Equal to the *Groundwater Extraction* term in the land system (3)	-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Crop Coefficients (Kc) adapted from FAO (1998) using CUP model (Orange, et al 2004) -Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber Population of Big Valley from DWR (2018) Population of Bieber from United States Census Bureau (2020)	-Irrigation efficiency = 85% (NRCS 2020) -65% of agricultural irrigation uses groundwater -2% of riparian demands are met by groundwater -Per capita water use is 100 gallons/day/person -All domestic users use groundwater	Low
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	Equal to the *Stream Gain from Groundwater* term in the surface water system (15)	-None	-Assumed to be 0 until further analysis of transducer data from new monitoring wells	Low
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-	Equal to the *Lake Gain from Groundwater* term in the surface water system (16)	-None	-Assumed to be 0 because most lakes are above the groundwater levels	High
(29)	Outflow	Out of Basin	Subsurface Outflow	-			-No subsurface outflow occurs in the BVGB	Moderate
(30)	Outflow		*Total Outflow*		*(3)+(15)+(16)+(29)*			
(31)	Storage Change		Change in Groundwater Storage		(28)-(30)			

TOTAL WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Credit(+)/ Debit(-)	Relationship with Other Systems	Data Source(s)	Assumptions	Relative Level of Precision
(1)	**Inflow**	Into Basin	Precipitation on Land System	+	Equal to the *Precipitation* term in the land system	-Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber -Basin Land area from DWR (2018). -Area of rivers, conveyance, and lakes from USGS (2020).		High
(14)	**Inflow**	Into Basin	Precipitation on Lakes	+	Equal to the *Precipitation on Lakes* term in the surface water system	-Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber -Basin Land area from DWR (2018). -Area of rivers, conveyance, and lakes from USGS (2020).	-Precipitation does not vary spatially throughout the Basin	High
(13)	**Inflow**	Into Basin	Stream Inflow	+	Equal to the *Stream Inflow* term in the surface water system	-Historic and current data from Pit River gage at Canby -Historic data from gage on Pit River north of Lookout (where it enters basin), Ash Creek at Adin, Widow Valley Creek, Willow Creek	-Historic relationship between flow at Canby and flow at historic gages is the same as current. E.g. flow during winter events is about 40% higher than Canby once the Pit River reaches Big Valley -Watershed areas outside of those with historic gage measurements have same runoff per acre as the gaged watersheds	Moderate
(27)	**Inflow**	Into Basin	Subsurface Inflow	+	Equal to the *Subsurface Inflow* term in the groundwater system	-Water level data from wells in Round Valley and Adin -Estimate of cross-sectional area of canyon between Round Valley and Big Valley	-Other than subsurface flow from Round Valley (about 1AFY), no subsurface inflow occurs in the BVGB	Moderate
(32)	**Inflow**		*Total Inflow*		*(1)+(14)+(13)+(27)*			
(5)	**Outflow**	Out of Basin	Evapotranspiration	-	Equal to the *Evapotranspiration* term in the land system	-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Crop Coefficients (Kc) adapted from FAO (1998) using CUP model (Orange, et al 2004) -Land use and crop acreages from DWR (2014)	-ETo does not vary throughout the Basin -The land system remains in balance from year to year (no change in land system storage).	Moderate
(24)	**Outflow**	Out of Basin	Stream Evaporation	-	Equal to the *Stream Evaporation* term in the surface water system	-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Area of streams from USGS (2020)		High
(23)	**Outflow**	Out of Basin	Lake Evaporation	-	Equal to the *Lake Evaporation* term in the surface water system	-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Area of lakes from USGS (2020)	-Each year, lakes are full (100%) and surface area drops throughout summer to 10% in September, then gradually refill over the winter.	High
(19)	**Outflow**	Out of Basin	Conveyance Evaporation	-	Equal to the *Conveyance Evaporation* term in the surface water system	-Reference Evapotranspiration (ETo) from CIMIS spatial data model evaluated at Bieber (DWR 2020b) -Area of conveyance from USGS (2020)	-Each year, conveyance is full from May to September and empty from October to April	Moderate
(18)	**Outflow**	Out of Basin	Stream Outflow	-	Equal to the *Stream Outflow* term in the surface water system	-Estimated based on this water budget -Estimates verified using analysis of historic gage data from Pit River south of Bieber (exit from Basin)	-The surface water system remains in balance from year to year (no change in surface water storage)	Low
(29)	**Outflow**	Out of Basin	Subsurface Outflow	-	Equal to the *Subsurface Outflow* term in the groundwater system		-No subsurface outflow occurs in the BVGB	Moderate
(33)	**Outflow**		*Total Outflow*		*(5)+(24)+(23)+(19)+(18)+(29)*			
(34)	**Storage Change**		Change in Total System Storage		(32)-(33)			

Appendix 6B Water Budget Details

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Average (1984-2018)	1984	1985	1986	1987	1988
(1)	Inflow	Into Basin	Precipitation on Land System	136,801	148,899	132,719	193,698	96,315	88,835
(2)	Inflow	Between Systems	Surface Water Delivery	75,811	68,516	76,750	74,262	78,850	85,952
(3)	Inflow	Between Systems	Groundwater Extraction	44,622	39,192	45,598	41,789	47,782	53,245
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*257,234*	*256,607*	*255,067*	*309,749*	*222,946*	*228,032*
(5)	Outflow	Out of Basin	Evapotranspiration	154,040	146,344	152,399	160,318	155,136	159,362
(6)	Outflow	Between Systems	Runoff	83,449	92,329	82,737	130,033	47,265	46,439
(7)	Outflow	Between Systems	Return Flow	5,012	4,396	5,123	4,685	5,373	5,994
(8)	Outflow	Between Systems	Recharge of Applied Water	13,133	11,840	13,309	12,802	13,701	14,966
(9)	Outflow	Between Systems	Recharge of Precipitation	1,601	1,697	1,499	1,910	1,471	1,272
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*257,234*	*256,607*	*255,067*	*309,749*	*222,946*	*228,032*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Average (1984-2018)	1984	1985	1986	1987	1988
(13)	Inflow	Into Basin	Stream Inflow	371,148	808,462	310,960	878,565	161,807	162,980
(14)	Inflow	Into Basin	Precipitation on Reservoirs	501	546	486	710	353	326
(6)	Inflow	Between Systems	Runoff	83,449	92,329	82,737	130,033	47,265	46,439
(7)	Inflow	Between Systems	Return Flow	5,012	4,396	5,123	4,685	5,373	5,994
(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*	*460,110*	*905,732*	*399,306*	*1,013,993*	*214,798*	*215,738*
(18)	Outflow	Out of Basin	Stream Outflow	358,486	786,443	302,274	865,544	122,626	116,338
(19)	Outflow	Out of Basin	Conveyance Evaporation	46	44	46	45	45	50
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	75,811	68,516	76,750	74,262	78,850	85,952
(21)	Outflow	Between Systems	Stream Loss to Groundwater	24,037	49,085	18,460	72,401	11,524	11,579
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	722	667	760	727	736	777
(24)	Outflow	Out of Basin	Stream Evaporation	385	354	393	389	393	420
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*460,110*	*905,732*	*399,306*	*1,013,993*	*214,798*	*215,738*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Average (1984-2018)	1984	1985	1986	1987	1988
(8)	Inflow	Between Systems	Recharge of Applied Water	13,133	11,840	13,309	12,802	13,701	14,966
(9)	Inflow	Between Systems	Recharge of Precipitation	1,601	1,697	1,499	1,910	1,471	1,272
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	24,037	49,085	18,460	72,401	11,524	11,579
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*39,395*	*63,247*	*33,892*	*87,738*	*27,321*	*28,441*
(3)	Outflow	Between Systems	Groundwater Extraction	44,622	39,192	45,598	41,789	47,782	53,245
(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*	*44,622*	*39,192*	*45,598*	*41,789*	*47,782*	*53,245*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	(5,227)	24,055	(11,706)	45,949	(20,461)	(24,804)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Average (1984-2018)	1984	1985	1986	1987	1988
(1)	Inflow	Into Basin	Precipitation on Land System	136,801	148,899	132,719	193,698	96,315	88,835
(14)	Inflow	Into Basin	Precipitation on Reservoirs	501	546	486	710	353	326
(13)	Inflow	Into Basin	Stream Inflow	371,148	808,462	310,960	878,565	161,807	162,980
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*508,451*	*957,907*	*444,166*	*1,072,973*	*258,475*	*252,142*
(5)	Outflow	Out of Basin	Evapotranspiration	154,040	146,344	152,399	160,318	155,136	159,362
(24)	Outflow	Out of Basin	Stream Evaporation	385	354	393	389	393	420
(23)	Outflow	Out of Basin	Reservoir Evaporation	722	667	760	727	736	777
(19)	Outflow	Out of Basin	Conveyance Evaporation	46	44	46	45	45	50
(18)	Outflow	Out of Basin	Stream Outflow	358,486	786,443	302,274	865,544	122,626	116,338
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*513,678*	*933,852*	*455,872*	*1,027,024*	*278,936*	*276,946*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	(5,227)	24,055	(11,706)	45,949	(20,461)	(24,804)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1989	1990	1991	1992	1993	1994
(1)	Inflow	Into Basin	Precipitation on Land System	150,654	112,418	108,526	75,556	184,082	104,481
(2)	Inflow	Between Systems	Surface Water Delivery	72,061	72,399	77,619	82,827	70,993	76,177
(3)	Inflow	Between Systems	Groundwater Extraction	41,145	42,407	46,745	52,036	38,861	45,730
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*263,860*	*227,224*	*232,890*	*210,419*	*293,936*	*226,387*
(5)	Outflow	Out of Basin	Evapotranspiration	151,287	148,958	153,216	155,932	156,238	153,369
(6)	Outflow	Between Systems	Runoff	93,806	59,374	59,468	32,898	119,194	53,112
(7)	Outflow	Between Systems	Return Flow	4,615	4,761	5,255	5,860	4,351	5,140
(8)	Outflow	Between Systems	Recharge of Applied Water	12,446	12,539	13,479	14,449	12,207	13,226
(9)	Outflow	Between Systems	Recharge of Precipitation	1,705	1,591	1,472	1,280	1,947	1,541
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*263,860*	*227,224*	*232,890*	*210,419*	*293,936*	*226,387*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1989	1990	1991	1992	1993	1994
(13)	Inflow	Into Basin	Stream Inflow	390,854	133,594	263,663	76,254	602,999	167,393
(14)	Inflow	Into Basin	Precipitation on Reservoirs	552	412	398	277	675	383
(6)	Inflow	Between Systems	Runoff	93,806	59,374	59,468	32,898	119,194	53,112
(7)	Inflow	Between Systems	Return Flow	4,615	4,761	5,255	5,860	4,351	5,140
(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*	*489,827*	*198,142*	*328,784*	*115,288*	*727,219*	*226,028*
(18)	Outflow	Out of Basin	Stream Outflow	393,854	113,802	233,159	23,084	622,453	136,286
(19)	Outflow	Out of Basin	Conveyance Evaporation	45	44	47	48	46	46
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	72,061	72,399	77,619	82,827	70,993	76,177
(21)	Outflow	Between Systems	Stream Loss to Groundwater	22,175	10,212	16,260	7,546	32,039	11,784
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	697	693	693	754	693	726
(24)	Outflow	Out of Basin	Stream Evaporation	371	368	382	406	370	386
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*489,827*	*198,142*	*328,784*	*115,288*	*727,219*	*226,028*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1989	1990	1991	1992	1993	1994
(8)	Inflow	Between Systems	Recharge of Applied Water	12,446	12,539	13,479	14,449	12,207	13,226
(9)	Inflow	Between Systems	Recharge of Precipitation	1,705	1,591	1,472	1,280	1,947	1,541
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	22,175	10,212	16,260	7,546	32,039	11,784
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*36,950*	*24,967*	*31,836*	*23,899*	*46,817*	*27,175*
(3)	Outflow	Between Systems	Groundwater Extraction	41,145	42,407	46,745	52,036	38,861	45,730
(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*	*41,145*	*42,407*	*46,745*	*52,036*	*38,861*	*45,730*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	(4,194)	(17,440)	(14,909)	(28,137)	7,956	(18,555)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1989	1990	1991	1992	1993	1994
(1)	Inflow	Into Basin	Precipitation on Land System	150,654	112,418	108,526	75,556	184,082	104,481
(14)	Inflow	Into Basin	Precipitation on Reservoirs	552	412	398	277	675	383
(13)	Inflow	Into Basin	Stream Inflow	390,854	133,594	263,663	76,254	602,999	167,393
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*542,060*	*246,425*	*372,587*	*152,087*	*787,756*	*272,257*
(5)	Outflow	Out of Basin	Evapotranspiration	151,287	148,958	153,216	155,932	156,238	153,369
(24)	Outflow	Out of Basin	Stream Evaporation	371	368	382	406	370	386
(23)	Outflow	Out of Basin	Reservoir Evaporation	697	693	693	754	693	726
(19)	Outflow	Out of Basin	Conveyance Evaporation	45	44	47	48	46	46
(18)	Outflow	Out of Basin	Stream Outflow	393,854	113,802	233,159	23,084	622,453	136,286
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*546,255*	*263,865*	*387,496*	*180,224*	*779,799*	*290,812*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	(4,194)	(17,440)	(14,909)	(28,137)	7,956	(18,555)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1995	1996	1997	1998	1999	2000
(1)	Inflow	Into Basin	Precipitation on Land System	192,248	183,776	171,871	229,110	146,533	128,140
(2)	Inflow	Between Systems	Surface Water Delivery	65,439	70,985	74,958	64,027	74,092	76,327
(3)	Inflow	Between Systems	Groundwater Extraction	35,592	41,037	42,916	32,854	43,259	44,735
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*293,278*	*295,799*	*289,744*	*325,992*	*263,883*	*249,201*
(5)	Outflow	Out of Basin	Evapotranspiration	143,128	150,803	159,397	151,378	152,590	157,889
(6)	Outflow	Between Systems	Runoff	133,143	126,391	110,752	157,864	91,975	71,370
(7)	Outflow	Between Systems	Return Flow	3,983	4,605	4,815	3,667	4,857	5,024
(8)	Outflow	Between Systems	Recharge of Applied Water	11,251	12,278	12,946	10,945	12,826	13,215
(9)	Outflow	Between Systems	Recharge of Precipitation	1,773	1,722	1,834	2,137	1,637	1,703
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*293,278*	*295,799*	*289,744*	*325,992*	*263,883*	*249,201*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1995	1996	1997	1998	1999	2000
(13)	Inflow	Into Basin	Stream Inflow	912,444	780,720	614,680	832,300	691,739	240,124
(14)	Inflow	Into Basin	Precipitation on Reservoirs	704	673	630	840	537	470
(6)	Inflow	Between Systems	Runoff	133,143	126,391	110,752	157,864	91,975	71,370
(7)	Inflow	Between Systems	Return Flow	3,983	4,605	4,815	3,667	4,857	5,024
(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*	*1,050,275*	*912,389*	*730,877*	*994,671*	*789,107*	*316,987*
(18)	Outflow	Out of Basin	Stream Outflow	897,057	798,101	621,549	872,733	677,081	223,698
(19)	Outflow	Out of Basin	Conveyance Evaporation	41	44	46	42	45	47
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	65,439	70,985	74,958	64,027	74,092	76,327
(21)	Outflow	Between Systems	Stream Loss to Groundwater	86,149	41,575	32,583	56,285	36,166	15,166
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	625	692	729	619	720	736
(24)	Outflow	Out of Basin	Stream Evaporation	340	369	388	340	379	390
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*1,050,275*	*912,389*	*730,877*	*994,671*	*789,107*	*316,987*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1995	1996	1997	1998	1999	2000
(8)	Inflow	Between Systems	Recharge of Applied Water	11,251	12,278	12,946	10,945	12,826	13,215
(9)	Inflow	Between Systems	Recharge of Precipitation	1,773	1,722	1,834	2,137	1,637	1,703
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	86,149	41,575	32,583	56,285	36,166	15,166
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*99,798*	*56,199*	*47,987*	*69,992*	*51,253*	*30,709*
(3)	Outflow	Between Systems	Groundwater Extraction	35,592	41,037	42,916	32,854	43,259	44,735
(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*	*35,592*	*41,037*	*42,916*	*32,854*	*43,259*	*44,735*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	64,206	15,162	5,071	37,138	7,994	(14,026)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1995	1996	1997	1998	1999	2000
(1)	Inflow	Into Basin	Precipitation on Land System	192,248	183,776	171,871	229,110	146,533	128,140
(14)	Inflow	Into Basin	Precipitation on Reservoirs	704	673	630	840	537	470
(13)	Inflow	Into Basin	Stream Inflow	912,444	780,720	614,680	832,300	691,739	240,124
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*1,105,397*	*965,170*	*787,182*	*1,062,250*	*838,809*	*368,734*
(5)	Outflow	Out of Basin	Evapotranspiration	143,128	150,803	159,397	151,378	152,590	157,889
(24)	Outflow	Out of Basin	Stream Evaporation	340	369	388	340	379	390
(23)	Outflow	Out of Basin	Reservoir Evaporation	625	692	729	619	720	736
(19)	Outflow	Out of Basin	Conveyance Evaporation	41	44	46	42	45	47
(18)	Outflow	Out of Basin	Stream Outflow	897,057	798,101	621,549	872,733	677,081	223,698
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*1,041,192*	*950,008*	*782,111*	*1,025,112*	*830,815*	*382,760*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	64,206	15,162	5,071	37,138	7,994	(14,026)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2001	2002	2003	2004	2005	2006	2007
(1)	Inflow	Into Basin	Precipitation on Land System	79,296	109,976	136,611	136,687	147,525	190,721	99,291
(2)	Inflow	Between Systems	Surface Water Delivery	80,992	80,604	75,245	78,776	70,606	72,295	78,989
(3)	Inflow	Between Systems	Groundwater Extraction	49,626	48,753	44,131	47,093	40,332	40,960	48,745
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*209,913*	*239,333*	*255,987*	*262,556*	*258,462*	*303,976*	*227,025*
(5)	Outflow	Out of Basin	Evapotranspiration	152,585	153,349	151,547	153,751	149,036	151,973	156,935
(6)	Outflow	Between Systems	Runoff	36,368	65,156	84,903	88,396	91,011	133,210	49,352
(7)	Outflow	Between Systems	Return Flow	5,583	5,482	4,956	5,293	4,524	4,593	5,485
(8)	Outflow	Between Systems	Recharge of Applied Water	14,089	14,001	13,030	13,667	12,197	12,475	13,755
(9)	Outflow	Between Systems	Recharge of Precipitation	1,288	1,345	1,551	1,449	1,695	1,725	1,498
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*209,913*	*239,333*	*255,987*	*262,556*	*258,462*	*303,976*	*227,025*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2001	2002	2003	2004	2005	2006	2007
(13)	Inflow	Into Basin	Stream Inflow	100,742	153,035	219,963	295,581	381,347	735,770	127,762
(14)	Inflow	Into Basin	Precipitation on Reservoirs	291	403	501	501	541	699	364
(6)	Inflow	Between Systems	Runoff	36,368	65,156	84,903	88,396	91,011	133,210	49,352
(7)	Inflow	Between Systems	Return Flow	5,583	5,482	4,956	5,293	4,524	4,593	5,485
(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*	*142,983*	*224,076*	*310,322*	*389,772*	*477,422*	*874,271*	*182,963*
(18)	Outflow	Out of Basin	Stream Outflow	51,472	130,528	219,088	291,439	383,378	762,028	92,199
(19)	Outflow	Out of Basin	Conveyance Evaporation	48	48	45	46	43	45	47
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	80,992	80,604	75,245	78,776	70,606	72,295	78,989
(21)	Outflow	Between Systems	Stream Loss to Groundwater	8,684	11,116	14,228	17,745	21,733	38,213	9,941
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	763	756	711	747	675	694	762
(24)	Outflow	Out of Basin	Stream Evaporation	400	400	380	395	364	372	402
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*142,983*	*224,076*	*310,322*	*389,772*	*477,422*	*874,271*	*182,963*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2001	2002	2003	2004	2005	2006	2007
(8)	Inflow	Between Systems	Recharge of Applied Water	14,089	14,001	13,030	13,667	12,197	12,475	13,755
(9)	Inflow	Between Systems	Recharge of Precipitation	1,288	1,345	1,551	1,449	1,695	1,725	1,498
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	8,684	11,116	14,228	17,745	21,733	38,213	9,941
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*24,686*	*27,086*	*29,435*	*33,485*	*36,249*	*53,038*	*25,818*
(3)	Outflow	Between Systems	Groundwater Extraction	49,626	48,753	44,131	47,093	40,332	40,960	48,745
(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*	*49,626*	*48,753*	*44,131*	*47,093*	*40,332*	*40,960*	*48,745*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(24,940)	(21,666)	(14,696)	(13,608)	(4,082)	12,079	(22,927)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2001	2002	2003	2004	2005	2006	2007
(1)	Inflow	Into Basin	Precipitation on Land System	79,296	109,976	136,611	136,687	147,525	190,721	99,291
(14)	Inflow	Into Basin	Precipitation on Reservoirs	291	403	501	501	541	699	364
(13)	Inflow	Into Basin	Stream Inflow	100,742	153,035	219,963	295,581	381,347	735,770	127,762
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*180,328*	*263,415*	*357,075*	*432,770*	*529,413*	*927,191*	*227,418*
(5)	Outflow	Out of Basin	Evapotranspiration	152,585	153,349	151,547	153,751	149,036	151,973	156,935
(24)	Outflow	Out of Basin	Stream Evaporation	400	400	380	395	364	372	402
(23)	Outflow	Out of Basin	Reservoir Evaporation	763	756	711	747	675	694	762
(19)	Outflow	Out of Basin	Conveyance Evaporation	48	48	45	46	43	45	47
(18)	Outflow	Out of Basin	Stream Outflow	51,472	130,528	219,088	291,439	383,378	762,028	92,199
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*205,269*	*285,081*	*371,772*	*446,379*	*533,495*	*915,112*	*250,345*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(24,940)	(21,666)	(14,696)	(13,608)	(4,082)	12,079	(22,927)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2008	2009	2010	2011	2012	2013	2014
(1)	Inflow	Into Basin	Precipitation on Land System	97,459	114,173	120,660	167,215	93,491	126,995	88,759
(2)	Inflow	Between Systems	Surface Water Delivery	78,709	78,245	71,749	68,856	81,443	78,026	85,157
(3)	Inflow	Between Systems	Groundwater Extraction	47,716	46,430	41,387	38,575	49,850	46,719	54,126
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*223,885*	*238,849*	*233,797*	*274,646*	*224,784*	*251,740*	*228,042*
(5)	Outflow	Out of Basin	Evapotranspiration	151,305	156,057	151,911	146,988	154,515	161,099	159,338
(6)	Outflow	Between Systems	Runoff	52,178	62,460	63,110	109,739	49,166	70,144	46,463
(7)	Outflow	Between Systems	Return Flow	5,366	5,217	4,644	4,323	5,608	5,251	6,098
(8)	Outflow	Between Systems	Recharge of Applied Water	13,678	13,564	12,406	11,872	14,165	13,540	14,874
(9)	Outflow	Between Systems	Recharge of Precipitation	1,358	1,551	1,727	1,724	1,330	1,706	1,269
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*223,885*	*238,849*	*233,797*	*274,646*	*224,784*	*251,740*	*228,042*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2008	2009	2010	2011	2012	2013	2014
(13)	Inflow	Into Basin	Stream Inflow	240,456	143,169	103,605	629,359	125,535	142,221	52,739
(14)	Inflow	Into Basin	Precipitation on Reservoirs	357	418	442	613	343	465	325
(6)	Inflow	Between Systems	Runoff	52,178	62,460	63,110	109,739	49,166	70,144	46,463
(7)	Inflow	Between Systems	Return Flow	5,366	5,217	4,644	4,323	5,608	5,251	6,098
(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*	*298,356*	*211,263*	*171,801*	*744,034*	*180,651*	*218,081*	*105,625*
(18)	Outflow	Out of Basin	Stream Outflow	202,668	120,562	89,515	640,247	87,552	127,602	12,117
(19)	Outflow	Out of Basin	Conveyance Evaporation	46	46	44	42	47	47	49
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	78,709	78,245	71,749	68,856	81,443	78,026	85,157
(21)	Outflow	Between Systems	Stream Loss to Groundwater	15,181	10,657	8,818	33,265	9,837	10,613	6,452
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	737	736	684	648	748	766	802
(24)	Outflow	Out of Basin	Stream Evaporation	391	393	368	352	401	403	423
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*298,356*	*211,263*	*171,801*	*744,034*	*180,651*	*218,081*	*105,625*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2008	2009	2010	2011	2012	2013	2014
(8)	Inflow	Between Systems	Recharge of Applied Water	13,678	13,564	12,406	11,872	14,165	13,540	14,874
(9)	Inflow	Between Systems	Recharge of Precipitation	1,358	1,551	1,727	1,724	1,330	1,706	1,269
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	15,181	10,657	8,818	33,265	9,837	10,613	6,452
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*30,842*	*26,398*	*23,575*	*47,486*	*25,957*	*26,484*	*23,220*
(3)	Outflow	Between Systems	Groundwater Extraction	47,716	46,430	41,387	38,575	49,850	46,719	54,126
(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*	*47,716*	*46,430*	*41,387*	*38,575*	*49,850*	*46,719*	*54,126*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(16,874)	(20,033)	(17,812)	8,910	(23,893)	(20,235)	(30,907)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2008	2009	2010	2011	2012	2013	2014
(1)	Inflow	Into Basin	Precipitation on Land System	97,459	114,173	120,660	167,215	93,491	126,995	88,759
(14)	Inflow	Into Basin	Precipitation on Reservoirs	357	418	442	613	343	465	325
(13)	Inflow	Into Basin	Stream Inflow	240,456	143,169	103,605	629,359	125,535	142,221	52,739
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*338,273*	*257,761*	*224,709*	*797,188*	*219,369*	*269,682*	*141,824*
(5)	Outflow	Out of Basin	Evapotranspiration	151,305	156,057	151,911	146,988	154,515	161,099	159,338
(24)	Outflow	Out of Basin	Stream Evaporation	391	393	368	352	401	403	423
(23)	Outflow	Out of Basin	Reservoir Evaporation	737	736	684	648	748	766	802
(19)	Outflow	Out of Basin	Conveyance Evaporation	46	46	44	42	47	47	49
(18)	Outflow	Out of Basin	Stream Outflow	202,668	120,562	89,515	640,247	87,552	127,602	12,117
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*355,147*	*277,794*	*242,521*	*788,277*	*243,262*	*289,917*	*172,731*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(16,874)	(20,033)	(17,812)	8,910	(23,893)	(20,235)	(30,907)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2015	2016	2017	2018
(1)	Inflow	Into Basin	Precipitation on Land System	129,361	160,423	201,559	139,969
(2)	Inflow	Between Systems	Surface Water Delivery	80,035	78,452	75,027	77,947
(3)	Inflow	Between Systems	Groundwater Extraction	47,485	45,590	42,392	46,930
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*256,881*	*284,465*	*318,977*	*264,846*
(5)	Outflow	Out of Basin	Evapotranspiration	161,258	158,534	159,998	153,469
(6)	Outflow	Between Systems	Runoff	74,778	105,600	139,423	91,100
(7)	Outflow	Between Systems	Return Flow	5,336	5,118	4,753	5,276
(8)	Outflow	Between Systems	Recharge of Applied Water	13,872	13,568	12,939	13,535
(9)	Outflow	Between Systems	Recharge of Precipitation	1,637	1,645	1,864	1,466
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*256,881*	*284,465*	*318,977*	*264,846*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2015	2016	2017	2018
(13)	Inflow	Into Basin	Stream Inflow	82,881	374,311	809,028	243,145
(14)	Inflow	Into Basin	Precipitation on Reservoirs	474	588	739	513
(6)	Inflow	Between Systems	Runoff	74,778	105,600	139,423	91,100
(7)	Inflow	Between Systems	Return Flow	5,336	5,118	4,753	5,276
(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*	*163,468*	*485,618*	*953,943*	*340,034*
(18)	Outflow	Out of Basin	Stream Outflow	73,721	383,946	827,869	244,988
(19)	Outflow	Out of Basin	Conveyance Evaporation	47	47	48	47
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	80,035	78,452	75,027	77,947
(21)	Outflow	Between Systems	Stream Loss to Groundwater	7,854	21,405	49,248	15,306
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	778	746	737	730
(24)	Outflow	Out of Basin	Stream Evaporation	409	398	391	392
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*163,468*	*485,618*	*953,943*	*340,034*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2015	2016	2017	2018
(8)	Inflow	Between Systems	Recharge of Applied Water	13,872	13,568	12,939	13,535
(9)	Inflow	Between Systems	Recharge of Precipitation	1,637	1,645	1,864	1,466
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	7,854	21,405	49,248	15,306
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*23,988*	*37,242*	*64,675*	*30,932*
(3)	Outflow	Between Systems	Groundwater Extraction	47,485	45,590	42,392	46,930
(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*	*47,485*	*45,590*	*42,392*	*46,930*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	(23,497)	(8,348)	22,283	(15,998)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2015	2016	2017	2018
(1)	Inflow	Into Basin	Precipitation on Land System	129,361	160,423	201,559	139,969
(14)	Inflow	Into Basin	Precipitation on Reservoirs	474	588	739	513
(13)	Inflow	Into Basin	Stream Inflow	82,881	374,311	809,028	243,145
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*212,717*	*535,323*	*1,011,326*	*383,627*
(5)	Outflow	Out of Basin	Evapotranspiration	161,258	158,534	159,998	153,469
(24)	Outflow	Out of Basin	Stream Evaporation	409	398	391	392
(23)	Outflow	Out of Basin	Reservoir Evaporation	778	746	737	730
(19)	Outflow	Out of Basin	Conveyance Evaporation	47	47	48	47
(18)	Outflow	Out of Basin	Stream Outflow	73,721	383,946	827,869	244,988
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*236,214*	*543,670*	*989,042*	*399,625*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	(23,497)	(8,348)	22,283	(15,998)

LAND SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	Average (2019-2068)
Inflow	Into Basin	Precipitation on Land System	143,208
Inflow	Between Systems	Surface Water Delivery	77,048
Inflow	Between Systems	Groundwater Extraction	45,162
Inflow	*(1)+(2)+(3)*	*Total Inflow*	*265,418*
Outflow	Out of Basin	Evapotranspiration	156,873
Outflow	Between Systems	Runoff	88,493
Outflow	Between Systems	Return Flow	5,072
Outflow	Between Systems	Recharge of Applied Water	13,339
Outflow	Between Systems	Recharge of Precipitation	1,641
Outflow	Between Systems	Managed Aquifer Recharge	-
Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*265,418*
Storage Change	**(4)-(11)**	Change in Land System Storage	-

SURFACE WATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	Average (2019-2068)
Inflow	Into Basin	Stream Inflow	430,242
Inflow	Into Basin	Precipitation on Reservoirs	525
Inflow	Between Systems	Runoff	88,493
Inflow	Between Systems	Return Flow	5,072
Inflow	Between Systems	Stream Gain from Groundwater	-
Inflow	Between Systems	Reservoir Gain from Groundwater	-
Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*524,331*
Outflow	Out of Basin	Stream Outflow	418,003
Outflow	Out of Basin	Conveyance Evaporation	47
Outflow	Between Systems	Conveyance Seepage	27
Outflow	Between Systems	Surface Water Delivery	77,048
Outflow	Between Systems	Stream Loss to Groundwater	27,476
Outflow	Between Systems	Reservoir Loss to Groundwater	596
Outflow	Out of Basin	Reservoir Evaporation	741
Outflow	Out of Basin	Stream Evaporation	393
Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*524,331*
Storage Change	**(17)-(25)**	Change in Surface Water Storage	-

GROUNDWATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	Average (2019-2068)
Inflow	Between Systems	Recharge of Applied Water	13,339
Inflow	Between Systems	Recharge of Precipitation	1,641
Inflow	Between Systems	Managed Aquifer Recharge	-
Inflow	Between Systems	Groundwater Gain from Stream	27,476
Inflow	Between Systems	Groundwater Gain from Reservoir	596
Inflow	Between Systems	Conveyance Seepage	27
Inflow	Into Basin	Subsurface Inflow	1
Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*43,081*
Outflow	Between Systems	Groundwater Extraction	45,162
Outflow	Between Systems	Groundwater Loss to Stream	-
Outflow	Between Systems	Groundwater Loss to Reservoir s	-
Outflow	Out of Basin	Subsurface Outflow	-
Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*45,162*
Storage Change	**(28)-(30)**	Change in Groundwater Storage	(2,080)

TOTAL BASIN WATER BUDGET

Flow Type	Origin/ Destination	Component	Average (2019-2068)
Inflow	Into Basin	Precipitation on Land System	143,208
Inflow	Into Basin	Precipitation on Reservoirs	525
Inflow	Into Basin	Stream Inflow	430,242
Inflow	Into Basin	Subsurface Inflow	1
Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*573,975*
Outflow	Out of Basin	Evapotranspiration	156,873
Outflow	Out of Basin	Stream Evaporation	393
Outflow	Out of Basin	Reservoir Evaporation	741
Outflow	Out of Basin	Conveyance Evaporation	47
Outflow	Out of Basin	Stream Outflow	418,003
Outflow	Out of Basin	Subsurface Outflow	-
Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*576,056*
Storage Change	**(32)-(33)**	Change in Total System Storage	(2,080)

LAND SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2019	2020	2021	2022	2023	2024
Inflow	Into Basin	Precipitation on Land System	124,782	214,533	111,731	190,645	87,538	177,442
Inflow	Between Systems	Surface Water Delivery	82,510	73,612	82,236	77,699	85,805	79,223
Inflow	Between Systems	Groundwater Extraction	49,372	40,325	49,679	45,952	53,502	46,213
Inflow	*(1)+(2)+(3)*	*Total Inflow*	*256,664*	*328,470*	*243,646*	*314,297*	*226,845*	*302,878*
Outflow	Out of Basin	Evapotranspiration	161,959	157,895	160,313	160,477	160,427	158,375
Outflow	Between Systems	Runoff	73,298	151,514	61,974	133,477	44,140	124,005
Outflow	Between Systems	Return Flow	5,550	4,516	5,586	5,162	6,024	5,189
Outflow	Between Systems	Recharge of Applied Water	14,312	12,655	14,281	13,465	14,952	13,706
Outflow	Between Systems	Recharge of Precipitation	1,545	1,891	1,493	1,715	1,302	1,603
Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*256,664*	*328,470*	*243,646*	*314,297*	*226,845*	*302,878*
Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2019	2020	2021	2022	2023	2024
Inflow	Into Basin	Stream Inflow	218,123	697,723	307,955	767,905	183,806	502,177
Inflow	Into Basin	Precipitation on Reservoirs	457	786	409	699	321	650
Inflow	Between Systems	Runoff	73,298	151,514	61,974	133,477	44,140	124,005
Inflow	Between Systems	Return Flow	5,550	4,516	5,586	5,162	6,024	5,189
Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-
Inflow	Between Systems	Reservoir Gain from Groundwater	-	-	-	-	-	-
Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*297,429*	*854,539*	*375,924*	*907,243*	*234,290*	*632,021*
Outflow	Out of Basin	Stream Outflow	198,898	742,701	273,501	787,992	134,030	523,627
Outflow	Out of Basin	Conveyance Evaporation	49	48	48	47	50	49
Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27
Outflow	Between Systems	Surface Water Delivery	82,510	73,612	82,236	77,699	85,805	79,223
Outflow	Between Systems	Stream Loss to Groundwater	14,143	36,444	18,320	39,708	12,547	27,351
Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596
Outflow	Out of Basin	Reservoir Evaporation	790	727	782	770	809	747
Outflow	Out of Basin	Stream Evaporation	416	383	414	403	426	400
Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*297,429*	*854,539*	*375,924*	*907,243*	*234,290*	*632,021*
Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2019	2020	2021	2022	2023	2024
Inflow	Between Systems	Recharge of Applied Water	14,312	12,655	14,281	13,465	14,952	13,706
Inflow	Between Systems	Recharge of Precipitation	1,545	1,891	1,493	1,715	1,302	1,603
Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
Inflow	Between Systems	Groundwater Gain from Stream	14,143	36,444	18,320	39,708	12,547	27,351
Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596
Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1
Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*30,624*	*51,614*	*34,718*	*55,512*	*29,425*	*43,285*
Outflow	Between Systems	Groundwater Extraction	49,372	40,325	49,679	45,952	53,502	46,213
Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-
Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*49,372*	*40,325*	*49,679*	*45,952*	*53,502*	*46,213*
Storage Change	**(28)-(30)**	Change in Groundwater Storage	(18,748)	11,289	(14,961)	9,560	(24,077)	(2,928)

TOTAL BASIN WATER BUDGET

Flow Type	Origin/ Destination	Component	2019	2020	2021	2022	2023	2024
Inflow	Into Basin	Precipitation on Land System	124,782	214,533	111,731	190,645	87,538	177,442
Inflow	Into Basin	Precipitation on Reservoirs	457	786	409	699	321	650
Inflow	Into Basin	Stream Inflow	218,123	697,723	307,955	767,905	183,806	502,177
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1
Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*343,363*	*913,043*	*420,096*	*959,249*	*271,665*	*680,269*
Outflow	Out of Basin	Evapotranspiration	161,959	157,895	160,313	160,477	160,427	158,375
Outflow	Out of Basin	Stream Evaporation	416	383	414	403	426	400
Outflow	Out of Basin	Reservoir Evaporation	790	727	782	770	809	747
Outflow	Out of Basin	Conveyance Evaporation	49	48	48	47	50	49
Outflow	Out of Basin	Stream Outflow	198,898	742,701	273,501	787,992	134,030	523,627
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*362,111*	*901,754*	*435,058*	*949,689*	*295,742*	*683,197*
Storage Change	**(32)-(33)**	Change in Total System Storage	(18,748)	11,289	(14,961)	9,560	(24,077)	(2,928)

LAND SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2025	2026	2027	2028	2029	2030	2031
Inflow	Into Basin	Precipitation on Land System	133,558	164,010	182,632	204,764	123,866	115,700	185,913
Inflow	Between Systems	Surface Water Delivery	79,192	82,117	81,376	74,115	82,207	83,257	79,490
Inflow	Between Systems	Groundwater Extraction	46,615	48,324	47,544	41,095	48,483	49,808	45,707
Inflow	*(1)+(2)+(3)*	*Total Inflow*	*259,366*	*294,451*	*311,552*	*319,974*	*254,556*	*248,765*	*311,111*
Outflow	Out of Basin	Evapotranspiration	160,592	163,111	162,673	161,164	164,323	164,927	162,327
Outflow	Between Systems	Runoff	78,161	110,076	127,816	139,490	68,901	62,194	128,193
Outflow	Between Systems	Return Flow	5,236	5,429	5,339	4,604	5,447	5,599	5,130
Outflow	Between Systems	Recharge of Applied Water	13,715	14,217	14,078	12,757	14,236	14,440	13,730
Outflow	Between Systems	Recharge of Precipitation	1,662	1,618	1,644	1,958	1,649	1,605	1,732
Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*259,366*	*294,451*	*311,552*	*319,974*	*254,556*	*248,765*	*311,111*
Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2025	2026	2027	2028	2029	2030	2031
Inflow	Into Basin	Stream Inflow	255,335	637,275	624,047	1,007,609	667,874	318,068	592,563
Inflow	Into Basin	Precipitation on Reservoirs	489	601	669	750	454	424	681
Inflow	Between Systems	Runoff	78,161	110,076	127,816	139,490	68,901	62,194	128,193
Inflow	Between Systems	Return Flow	5,236	5,429	5,339	4,604	5,447	5,599	5,130
Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-	-
Inflow	Between Systems	Reservoir Gain from Groundwater	-	-	-	-	-	-	-
Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*339,222*	*753,380*	*757,872*	*1,152,454*	*742,676*	*386,285*	*726,567*
Outflow	Out of Basin	Stream Outflow	242,296	635,748	641,606	941,819	623,530	282,329	613,664
Outflow	Out of Basin	Conveyance Evaporation	46	49	49	46	49	49	49
Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
Outflow	Between Systems	Surface Water Delivery	79,192	82,117	81,376	74,115	82,207	83,257	79,490
Outflow	Between Systems	Stream Loss to Groundwater	15,873	33,633	33,018	134,726	35,056	18,790	31,554
Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
Outflow	Out of Basin	Reservoir Evaporation	783	792	785	733	793	811	778
Outflow	Out of Basin	Stream Evaporation	408	417	413	390	417	423	407
Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*339,222*	*753,380*	*757,872*	*1,152,454*	*742,676*	*386,285*	*726,567*
Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2025	2026	2027	2028	2029	2030	2031
Inflow	Between Systems	Recharge of Applied Water	13,715	14,217	14,078	12,757	14,236	14,440	13,730
Inflow	Between Systems	Recharge of Precipitation	1,662	1,618	1,644	1,958	1,649	1,605	1,732
Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
Inflow	Between Systems	Groundwater Gain from Stream	15,873	33,633	33,018	134,726	35,056	18,790	31,554
Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*31,874*	*50,093*	*49,366*	*150,066*	*51,566*	*35,460*	*47,640*
Outflow	Between Systems	Groundwater Extraction	46,615	48,324	47,544	41,095	48,483	49,808	45,707
Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-
Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*46,615*	*48,324*	*47,544*	*41,095*	*48,483*	*49,808*	*45,707*
Storage Change	**(28)-(30)**	Change in Groundwater Storage	(14,741)	1,769	1,822	108,971	3,083	(14,348)	1,933

TOTAL BASIN WATER BUDGET

Flow Type	Origin/ Destination	Component	2025	2026	2027	2028	2029	2030	2031
Inflow	Into Basin	Precipitation on Land System	133,558	164,010	182,632	204,764	123,866	115,700	185,913
Inflow	Into Basin	Precipitation on Reservoirs	489	601	669	750	454	424	681
Inflow	Into Basin	Stream Inflow	255,335	637,275	624,047	1,007,609	667,874	318,068	592,563
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*389,384*	*801,886*	*807,348*	*1,213,124*	*792,195*	*434,193*	*779,158*
Outflow	Out of Basin	Evapotranspiration	160,592	163,111	162,673	161,164	164,323	164,927	162,327
Outflow	Out of Basin	Stream Evaporation	408	417	413	390	417	423	407
Outflow	Out of Basin	Reservoir Evaporation	783	792	785	733	793	811	778
Outflow	Out of Basin	Conveyance Evaporation	46	49	49	46	49	49	49
Outflow	Out of Basin	Stream Outflow	242,296	635,748	641,606	941,819	623,530	282,329	613,664
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*404,125*	*800,117*	*805,527*	*1,104,153*	*789,112*	*448,540*	*777,226*
Storage Change	**(32)-(33)**	Change in Total System Storage	(14,741)	1,769	1,822	108,971	3,083	(14,348)	1,933

LAND SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2032	2033	2034	2035	2036	2037	2038	2039
Inflow	Into Basin	Precipitation on Land System	139,206	110,510	85,325	164,468	106,923	179,197	114,326	204,535
Inflow	Between Systems	Surface Water Delivery	79,545	79,582	82,522	77,244	81,768	78,012	81,900	76,749
Inflow	Between Systems	Groundwater Extraction	46,907	48,100	51,806	43,861	49,645	43,934	48,901	42,492
Inflow	*(1)+(2)+(3)*	*Total Inflow*	*265,658*	*238,192*	*219,653*	*285,573*	*238,337*	*301,143*	*245,127*	*323,776*
Outflow	Out of Basin	Evapotranspiration	162,112	159,554	157,350	163,976	159,997	166,332	163,172	165,607
Outflow	Between Systems	Runoff	82,807	57,826	40,736	101,461	57,051	114,498	60,644	138,214
Outflow	Between Systems	Return Flow	5,269	5,409	5,834	4,920	5,584	4,926	5,496	4,761
Outflow	Between Systems	Recharge of Applied Water	13,778	13,823	14,395	13,326	14,208	13,445	14,203	13,205
Outflow	Between Systems	Recharge of Precipitation	1,692	1,581	1,338	1,890	1,496	1,941	1,610	1,990
Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-	-
Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*265,658*	*238,192*	*219,653*	*285,573*	*238,337*	*301,143*	*245,127*	*323,776*
Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2032	2033	2034	2035	2036	2037	2038	2039
Inflow	Into Basin	Stream Inflow	557,523	196,081	110,187	299,161	236,541	547,651	165,958	760,457
Inflow	Into Basin	Precipitation on Reservoirs	510	405	313	603	392	657	419	749
Inflow	Between Systems	Runoff	82,807	57,826	40,736	101,461	57,051	114,498	60,644	138,214
Inflow	Between Systems	Return Flow	5,269	5,409	5,834	4,920	5,584	4,926	5,496	4,761
Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-	-	-
Inflow	Between Systems	Reservoir Gain from Groundwater	-	-	-	-	-	-	-	-
Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*646,109*	*259,720*	*157,070*	*406,144*	*299,568*	*667,733*	*232,517*	*904,181*
Outflow	Out of Basin	Stream Outflow	534,796	165,138	63,542	309,163	200,936	558,396	137,030	786,222
Outflow	Out of Basin	Conveyance Evaporation	48	46	47	48	48	48	49	49
Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27	27
Outflow	Between Systems	Surface Water Delivery	79,545	79,582	82,522	77,244	81,768	78,012	81,900	76,749
Outflow	Between Systems	Stream Loss to Groundwater	29,925	13,118	9,124	17,911	14,999	29,466	11,717	39,361
Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596	596
Outflow	Out of Basin	Reservoir Evaporation	766	802	794	754	781	779	783	773
Outflow	Out of Basin	Stream Evaporation	404	411	416	400	412	408	414	403
Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*646,109*	*259,720*	*157,070*	*406,144*	*299,568*	*667,733*	*232,517*	*904,181*
Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2032	2033	2034	2035	2036	2037	2038	2039
Inflow	Between Systems	Recharge of Applied Water	13,778	13,823	14,395	13,326	14,208	13,445	14,203	13,205
Inflow	Between Systems	Recharge of Precipitation	1,692	1,581	1,338	1,890	1,496	1,941	1,610	1,990
Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-	-
Inflow	Between Systems	Groundwater Gain from Stream	29,925	13,118	9,124	17,911	14,999	29,466	11,717	39,361
Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596	596
Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27	27
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1	1
Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*46,020*	*29,146*	*25,481*	*33,752*	*31,328*	*45,477*	*28,156*	*55,180*
Outflow	Between Systems	Groundwater Extraction	46,907	48,100	51,806	43,861	49,645	43,934	48,901	42,492
Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-	-
Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-	-
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-	-
Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*46,907*	*48,100*	*51,806*	*43,861*	*49,645*	*43,934*	*48,901*	*42,492*
Storage Change	**(28)-(30)**	Change in Groundwater Storage	(888)	(18,954)	(26,325)	(10,109)	(18,317)	1,543	(20,745)	12,688

TOTAL BASIN WATER BUDGET

Flow Type	Origin/ Destination	Component	2032	2033	2034	2035	2036	2037	2038	2039
Inflow	Into Basin	Precipitation on Land System	139,206	110,510	85,325	164,468	106,923	179,197	114,326	204,535
Inflow	Into Basin	Precipitation on Reservoirs	510	405	313	603	392	657	419	749
Inflow	Into Basin	Stream Inflow	557,523	196,081	110,187	299,161	236,541	547,651	165,958	760,457
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1	1
Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*697,240*	*306,996*	*195,825*	*464,232*	*343,856*	*727,506*	*280,703*	*965,743*
Outflow	Out of Basin	Evapotranspiration	162,112	159,554	157,350	163,976	159,997	166,332	163,172	165,607
Outflow	Out of Basin	Stream Evaporation	404	411	416	400	412	408	414	403
Outflow	Out of Basin	Reservoir Evaporation	766	802	794	754	781	779	783	773
Outflow	Out of Basin	Conveyance Evaporation	48	46	47	48	48	48	49	49
Outflow	Out of Basin	Stream Outflow	534,796	165,138	63,542	309,163	200,936	558,396	137,030	786,222
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-	-
Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*698,127*	*325,950*	*222,150*	*474,341*	*362,174*	*725,963*	*301,449*	*953,054*
Storage Change	**(32)-(33)**	Change in Total System Storage	(888)	(18,954)	(26,325)	(10,109)	(18,317)	1,543	(20,745)	12,688

LAND SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2040	2041	2042	2043	2044	2045	2046	2047
Inflow	Into Basin	Precipitation on Land System	191,332	148,899	132,719	193,698	96,315	88,835	150,654	112,418
Inflow	Between Systems	Surface Water Delivery	74,947	68,516	76,750	74,262	78,850	85,952	72,061	72,399
Inflow	Between Systems	Groundwater Extraction	41,152	39,192	45,598	41,789	47,782	53,245	41,145	42,407
Inflow	*(1)+(2)+(3)*	*Total Inflow*	*307,432*	*256,607*	*255,067*	*309,749*	*222,946*	*228,032*	*263,860*	*227,224*
Outflow	Out of Basin	Evapotranspiration	163,789	146,344	152,399	160,318	155,136	159,362	151,287	148,958
Outflow	Between Systems	Runoff	124,132	92,329	82,737	130,033	47,265	46,439	93,806	59,374
Outflow	Between Systems	Return Flow	4,609	4,396	5,123	4,685	5,373	5,994	4,615	4,761
Outflow	Between Systems	Recharge of Applied Water	12,886	11,840	13,309	12,802	13,701	14,966	12,446	12,539
Outflow	Between Systems	Recharge of Precipitation	2,016	1,697	1,499	1,910	1,471	1,272	1,705	1,591
Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-	-
Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*307,432*	*256,607*	*255,067*	*309,749*	*222,946*	*228,032*	*263,860*	*227,224*
Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2040	2041	2042	2043	2044	2045	2046	2047
Inflow	Into Basin	Stream Inflow	697,741	808,462	310,960	878,565	161,807	162,980	390,854	133,594
Inflow	Into Basin	Precipitation on Reservoirs	701	546	486	710	353	326	552	412
Inflow	Between Systems	Runoff	124,132	92,329	82,737	130,033	47,265	46,439	93,806	59,374
Inflow	Between Systems	Return Flow	4,609	4,396	5,123	4,685	5,373	5,994	4,615	4,761
Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-	-	-
Inflow	Between Systems	Reservoir Gain from Groundwater	-	-	-	-	-	-	-	-
Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*827,183*	*905,732*	*399,306*	*#######*	*214,798*	*215,738*	*489,827*	*198,142*
Outflow	Out of Basin	Stream Outflow	713,968	786,443	302,274	865,544	122,626	116,338	393,854	113,802
Outflow	Out of Basin	Conveyance Evaporation	47	44	46	45	45	50	45	44
Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27	27
Outflow	Between Systems	Surface Water Delivery	74,947	68,516	76,750	74,262	78,850	85,952	72,061	72,399
Outflow	Between Systems	Stream Loss to Groundwater	36,445	49,085	18,460	72,401	11,524	11,579	22,175	10,212
Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596	596
Outflow	Out of Basin	Reservoir Evaporation	757	667	760	727	736	777	697	693
Outflow	Out of Basin	Stream Evaporation	395	354	393	389	393	420	371	368
Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*827,183*	*905,732*	*399,306*	*#######*	*214,798*	*215,738*	*489,827*	*198,142*
Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2040	2041	2042	2043	2044	2045	2046	2047
Inflow	Between Systems	Recharge of Applied Water	12,886	11,840	13,309	12,802	13,701	14,966	12,446	12,539
Inflow	Between Systems	Recharge of Precipitation	2,016	1,697	1,499	1,910	1,471	1,272	1,705	1,591
Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-	-
Inflow	Between Systems	Groundwater Gain from Stream	36,445	49,085	18,460	72,401	11,524	11,579	22,175	10,212
Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596	596
Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27	27
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1	1
Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*51,971*	*63,247*	*33,892*	*87,738*	*27,321*	*28,441*	*36,950*	*24,967*
Outflow	Between Systems	Groundwater Extraction	41,152	39,192	45,598	41,789	47,782	53,245	41,145	42,407
Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-	-
Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-	-
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-	-
Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*41,152*	*39,192*	*45,598*	*41,789*	*47,782*	*53,245*	*41,145*	*42,407*
Storage Change	**(28)-(30)**	Change in Groundwater Storage	10,819	24,055	(11,706)	45,949	(20,461)	(24,804)	(4,194)	(17,440)

TOTAL BASIN WATER BUDGET

Flow Type	Origin/ Destination	Component	2040	2041	2042	2043	2044	2045	2046	2047
Inflow	Into Basin	Precipitation on Land System	191,332	148,899	132,719	193,698	96,315	88,835	150,654	112,418
Inflow	Into Basin	Precipitation on Reservoirs	701	546	486	710	353	326	552	412
Inflow	Into Basin	Stream Inflow	697,741	808,462	310,960	878,565	161,807	162,980	390,854	133,594
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1	1
Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*889,774*	*957,907*	*444,166*	*#######*	*258,475*	*252,142*	*542,060*	*246,425*
Outflow	Out of Basin	Evapotranspiration	163,789	146,344	152,399	160,318	155,136	159,362	151,287	148,958
Outflow	Out of Basin	Stream Evaporation	395	354	393	389	393	420	371	368
Outflow	Out of Basin	Reservoir Evaporation	757	667	760	727	736	777	697	693
Outflow	Out of Basin	Conveyance Evaporation	47	44	46	45	45	50	45	44
Outflow	Out of Basin	Stream Outflow	713,968	786,443	302,274	865,544	122,626	116,338	393,854	113,802
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-	-
Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*878,956*	*933,852*	*455,872*	*#######*	*278,936*	*276,946*	*546,255*	*263,865*
Storage Change	**(32)-(33)**	Change in Total System Storage	10,819	24,055	(11,706)	45,949	(20,461)	(24,804)	(4,194)	(17,440)

LAND SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2048	2049	2050	2051	2052	2053	2054	2055
Inflow	Into Basin	Precipitation on Land System	108,526	75,556	184,082	104,481	192,248	183,776	171,871	229,110
Inflow	Between Systems	Surface Water Delivery	77,619	82,827	70,993	76,177	65,439	70,985	74,958	64,027
Inflow	Between Systems	Groundwater Extraction	46,745	52,036	38,861	45,730	35,592	41,037	42,916	32,854
Inflow	*(1)+(2)+(3)*	*Total Inflow*	*232,890*	*210,419*	*293,936*	*226,387*	*293,278*	*295,799*	*289,744*	*325,992*
Outflow	Out of Basin	Evapotranspiration	153,216	155,932	156,238	153,369	143,128	150,803	159,397	151,378
Outflow	Between Systems	Runoff	59,468	32,898	119,194	53,112	133,143	126,391	110,752	157,864
Outflow	Between Systems	Return Flow	5,255	5,860	4,351	5,140	3,983	4,605	4,815	3,667
Outflow	Between Systems	Recharge of Applied Water	13,479	14,449	12,207	13,226	11,251	12,278	12,946	10,945
Outflow	Between Systems	Recharge of Precipitation	1,472	1,280	1,947	1,541	1,773	1,722	1,834	2,137
Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-	-
Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*232,890*	*210,419*	*293,936*	*226,387*	*293,278*	*295,799*	*289,744*	*325,992*
Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2048	2049	2050	2051	2052	2053	2054	2055
Inflow	Into Basin	Stream Inflow	263,663	76,254	602,999	167,393	912,444	780,720	614,680	832,300
Inflow	Into Basin	Precipitation on Reservoirs	398	277	675	383	704	673	630	840
Inflow	Between Systems	Runoff	59,468	32,898	119,194	53,112	133,143	126,391	110,752	157,864
Inflow	Between Systems	Return Flow	5,255	5,860	4,351	5,140	3,983	4,605	4,815	3,667
Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-	-	-
Inflow	Between Systems	Reservoir Gain from Groundwater	-	-	-	-	-	-	-	-
Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*328,784*	*115,288*	*727,219*	*226,028*	*1,050,275*	*912,389*	*730,877*	*994,671*
Outflow	Out of Basin	Stream Outflow	233,159	23,084	622,453	136,286	897,057	798,101	621,549	872,733
Outflow	Out of Basin	Conveyance Evaporation	47	48	46	46	41	44	46	42
Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27	27
Outflow	Between Systems	Surface Water Delivery	77,619	82,827	70,993	76,177	65,439	70,985	74,958	64,027
Outflow	Between Systems	Stream Loss to Groundwater	16,260	7,546	32,039	11,784	86,149	41,575	32,583	56,285
Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596	596
Outflow	Out of Basin	Reservoir Evaporation	693	754	693	726	625	692	729	619
Outflow	Out of Basin	Stream Evaporation	382	406	370	386	340	369	388	340
Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*328,784*	*115,288*	*727,219*	*226,028*	*1,050,275*	*912,389*	*730,877*	*994,671*
Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2048	2049	2050	2051	2052	2053	2054	2055
Inflow	Between Systems	Recharge of Applied Water	13,479	14,449	12,207	13,226	11,251	12,278	12,946	10,945
Inflow	Between Systems	Recharge of Precipitation	1,472	1,280	1,947	1,541	1,773	1,722	1,834	2,137
Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-	-
Inflow	Between Systems	Groundwater Gain from Stream	16,260	7,546	32,039	11,784	86,149	41,575	32,583	56,285
Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596	596
Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27	27
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1	1
Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*31,836*	*23,899*	*46,817*	*27,175*	*99,798*	*56,199*	*47,987*	*69,992*
Outflow	Between Systems	Groundwater Extraction	46,745	52,036	38,861	45,730	35,592	41,037	42,916	32,854
Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-	-
Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-	-
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-	-
Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*46,745*	*52,036*	*38,861*	*45,730*	*35,592*	*41,037*	*42,916*	*32,854*
Storage Change	**(28)-(30)**	Change in Groundwater Storage	(14,909)	(28,137)	7,956	(18,555)	64,206	15,162	5,071	37,138

TOTAL BASIN WATER BUDGET

Flow Type	Origin/ Destination	Component	2048	2049	2050	2051	2052	2053	2054	2055
Inflow	Into Basin	Precipitation on Land System	108,526	75,556	184,082	104,481	192,248	183,776	171,871	229,110
Inflow	Into Basin	Precipitation on Reservoirs	398	277	675	383	704	673	630	840
Inflow	Into Basin	Stream Inflow	263,663	76,254	602,999	167,393	912,444	780,720	614,680	832,300
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1	1
Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*372,587*	*152,087*	*787,756*	*272,257*	*1,105,397*	*965,170*	*787,182*	*#######*
Outflow	Out of Basin	Evapotranspiration	153,216	155,932	156,238	153,369	143,128	150,803	159,397	151,378
Outflow	Out of Basin	Stream Evaporation	382	406	370	386	340	369	388	340
Outflow	Out of Basin	Reservoir Evaporation	693	754	693	726	625	692	729	619
Outflow	Out of Basin	Conveyance Evaporation	47	48	46	46	41	44	46	42
Outflow	Out of Basin	Stream Outflow	233,159	23,084	622,453	136,286	897,057	798,101	621,549	872,733
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-	-
Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*387,496*	*180,224*	*779,799*	*290,812*	*1,041,192*	*950,008*	*782,111*	*#######*
Storage Change	**(32)-(33)**	Change in Total System Storage	(14,909)	(28,137)	7,956	(18,555)	64,206	15,162	5,071	37,138

LAND SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2056	2057	2058	2059	2060	2061	2062	2063
Inflow	Into Basin	Precipitation on Land System	146,533	128,140	79,296	109,976	136,611	136,687	147,525	190,721
Inflow	Between Systems	Surface Water Delivery	74,092	76,327	80,992	80,604	75,245	78,776	70,606	72,295
Inflow	Between Systems	Groundwater Extraction	43,259	44,735	49,626	48,753	44,131	47,093	40,332	40,960
Inflow	*(1)+(2)+(3)*	*Total Inflow*	*263,883*	*249,201*	*209,913*	*239,333*	*255,987*	*262,556*	*258,462*	*303,976*
Outflow	Out of Basin	Evapotranspiration	152,590	157,889	152,585	153,349	151,547	153,751	149,036	151,973
Outflow	Between Systems	Runoff	91,975	71,370	36,368	65,156	84,903	88,396	91,011	133,210
Outflow	Between Systems	Return Flow	4,857	5,024	5,583	5,482	4,956	5,293	4,524	4,593
Outflow	Between Systems	Recharge of Applied Water	12,826	13,215	14,089	14,001	13,030	13,667	12,197	12,475
Outflow	Between Systems	Recharge of Precipitation	1,637	1,703	1,288	1,345	1,551	1,449	1,695	1,725
Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-	-
Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*263,883*	*249,201*	*209,913*	*239,333*	*255,987*	*262,556*	*258,462*	*303,976*
Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2056	2057	2058	2059	2060	2061	2062	2063
Inflow	Into Basin	Stream Inflow	691,739	240,124	100,742	153,035	219,963	295,581	381,347	735,770
Inflow	Into Basin	Precipitation on Reservoirs	537	470	291	403	501	501	541	699
Inflow	Between Systems	Runoff	91,975	71,370	36,368	65,156	84,903	88,396	91,011	133,210
Inflow	Between Systems	Return Flow	4,857	5,024	5,583	5,482	4,956	5,293	4,524	4,593
Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-	-	-
Inflow	Between Systems	Reservoir Gain from Groundwater	-	-	-	-	-	-	-	-
Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*789,107*	*316,987*	*142,983*	*224,076*	*310,322*	*389,772*	*477,422*	*874,271*
Outflow	Out of Basin	Stream Outflow	677,081	223,698	51,472	130,528	219,088	291,439	383,378	762,028
Outflow	Out of Basin	Conveyance Evaporation	45	47	48	48	45	46	43	45
Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27	27
Outflow	Between Systems	Surface Water Delivery	74,092	76,327	80,992	80,604	75,245	78,776	70,606	72,295
Outflow	Between Systems	Stream Loss to Groundwater	36,166	15,166	8,684	11,116	14,228	17,745	21,733	38,213
Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596	596
Outflow	Out of Basin	Reservoir Evaporation	720	736	763	756	711	747	675	694
Outflow	Out of Basin	Stream Evaporation	379	390	400	400	380	395	364	372
Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*789,107*	*316,987*	*142,983*	*224,076*	*310,322*	*389,772*	*477,422*	*874,271*
Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2056	2057	2058	2059	2060	2061	2062	2063
Inflow	Between Systems	Recharge of Applied Water	12,826	13,215	14,089	14,001	13,030	13,667	12,197	12,475
Inflow	Between Systems	Recharge of Precipitation	1,637	1,703	1,288	1,345	1,551	1,449	1,695	1,725
Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-	-
Inflow	Between Systems	Groundwater Gain from Stream	36,166	15,166	8,684	11,116	14,228	17,745	21,733	38,213
Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596	596
Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27	27
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1	1
Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*51,253*	*30,709*	*24,686*	*27,086*	*29,435*	*33,485*	*36,249*	*53,038*
Outflow	Between Systems	Groundwater Extraction	43,259	44,735	49,626	48,753	44,131	47,093	40,332	40,960
Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-	-
Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-	-
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-	-
Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*43,259*	*44,735*	*49,626*	*48,753*	*44,131*	*47,093*	*40,332*	*40,960*
Storage Change	**(28)-(30)**	Change in Groundwater Storage	7,994	(14,026)	(24,940)	(21,666)	(14,696)	(13,608)	(4,082)	12,079

TOTAL BASIN WATER BUDGET

Flow Type	Origin/ Destination	Component	2056	2057	2058	2059	2060	2061	2062	2063
Inflow	Into Basin	Precipitation on Land System	146,533	128,140	79,296	109,976	136,611	136,687	147,525	190,721
Inflow	Into Basin	Precipitation on Reservoirs	537	470	291	403	501	501	541	699
Inflow	Into Basin	Stream Inflow	691,739	240,124	100,742	153,035	219,963	295,581	381,347	735,770
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1	1
Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*838,809*	*368,734*	*180,328*	*263,415*	*357,075*	*432,770*	*529,413*	*927,191*
Outflow	Out of Basin	Evapotranspiration	152,590	157,889	152,585	153,349	151,547	153,751	149,036	151,973
Outflow	Out of Basin	Stream Evaporation	379	390	400	400	380	395	364	372
Outflow	Out of Basin	Reservoir Evaporation	720	736	763	756	711	747	675	694
Outflow	Out of Basin	Conveyance Evaporation	45	47	48	48	45	46	43	45
Outflow	Out of Basin	Stream Outflow	677,081	223,698	51,472	130,528	219,088	291,439	383,378	762,028
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-	-
Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*830,815*	*382,760*	*205,269*	*285,081*	*371,772*	*446,379*	*533,495*	*915,112*
Storage Change	**(32)-(33)**	Change in Total System Storage	7,994	(14,026)	(24,940)	(21,666)	(14,696)	(13,608)	(4,082)	12,079

LAND SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2064	2065	2066	2067	2068
Inflow	Into Basin	Precipitation on Land System	99,291	97,459	114,173	120,660	167,215
Inflow	Between Systems	Surface Water Delivery	78,989	78,709	78,245	71,749	68,856
Inflow	Between Systems	Groundwater Extraction	48,745	47,716	46,430	41,387	38,575
Inflow	*(1)+(2)+(3)*	*Total Inflow*	*227,025*	*223,885*	*238,849*	*233,797*	*274,646*
Outflow	Out of Basin	Evapotranspiration	156,935	151,305	156,057	151,911	146,988
Outflow	Between Systems	Runoff	49,352	52,178	62,460	63,110	109,739
Outflow	Between Systems	Return Flow	5,485	5,366	5,217	4,644	4,323
Outflow	Between Systems	Recharge of Applied Water	13,755	13,678	13,564	12,406	11,872
Outflow	Between Systems	Recharge of Precipitation	1,498	1,358	1,551	1,727	1,724
Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-
Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*227,025*	*223,885*	*238,849*	*233,797*	*274,646*
Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2064	2065	2066	2067	2068
Inflow	Into Basin	Stream Inflow	127,762	240,456	143,169	103,605	629,359
Inflow	Into Basin	Precipitation on Reservoirs	364	357	418	442	613
Inflow	Between Systems	Runoff	49,352	52,178	62,460	63,110	109,739
Inflow	Between Systems	Return Flow	5,485	5,366	5,217	4,644	4,323
Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-
Inflow	Between Systems	Reservoir Gain from Groundwater	-	-	-	-	-
Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*182,963*	*298,356*	*211,263*	*171,801*	*744,034*
Outflow	Out of Basin	Stream Outflow	92,199	202,668	120,562	89,515	640,247
Outflow	Out of Basin	Conveyance Evaporation	47	46	46	44	42
Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27
Outflow	Between Systems	Surface Water Delivery	78,989	78,709	78,245	71,749	68,856
Outflow	Between Systems	Stream Loss to Groundwater	9,941	15,181	10,657	8,818	33,265
Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596
Outflow	Out of Basin	Reservoir Evaporation	762	737	736	684	648
Outflow	Out of Basin	Stream Evaporation	402	391	393	368	352
Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*182,963*	*298,356*	*211,263*	*171,801*	*744,034*
Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

Flow Type	Origin/ Destination	Component	2064	2065	2066	2067	2068
Inflow	Between Systems	Recharge of Applied Water	13,755	13,678	13,564	12,406	11,872
Inflow	Between Systems	Recharge of Precipitation	1,498	1,358	1,551	1,727	1,724
Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-
Inflow	Between Systems	Groundwater Gain from Stream	9,941	15,181	10,657	8,818	33,265
Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596
Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1
Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*25,818*	*30,842*	*26,398*	*23,575*	*47,486*
Outflow	Between Systems	Groundwater Extraction	48,745	47,716	46,430	41,387	38,575
Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-
Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-
Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*48,745*	*47,716*	*46,430*	*41,387*	*38,575*
Storage Change	**(28)-(30)**	Change in Groundwater Storage	(22,927)	(16,874)	(20,033)	(17,812)	8,910

TOTAL BASIN WATER BUDGET

Flow Type	Origin/ Destination	Component	2064	2065	2066	2067	2068
Inflow	Into Basin	Precipitation on Land System	99,291	97,459	114,173	120,660	167,215
Inflow	Into Basin	Precipitation on Reservoirs	364	357	418	442	613
Inflow	Into Basin	Stream Inflow	127,762	240,456	143,169	103,605	629,359
Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1
Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*227,418*	*338,273*	*257,761*	*224,709*	*797,188*
Outflow	Out of Basin	Evapotranspiration	156,935	151,305	156,057	151,911	146,988
Outflow	Out of Basin	Stream Evaporation	402	391	393	368	352
Outflow	Out of Basin	Reservoir Evaporation	762	737	736	684	648
Outflow	Out of Basin	Conveyance Evaporation	47	46	46	44	42
Outflow	Out of Basin	Stream Outflow	92,199	202,668	120,562	89,515	640,247
Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-
Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*250,345*	*355,147*	*277,794*	*242,521*	*788,277*
Storage Change	**(32)-(33)**	Change in Total System Storage	(22,927)	(16,874)	(20,033)	(17,812)	8,910

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Average (2019-2068)
(1)	Inflow	Into Basin	Precipitation on Land System	152,224
(2)	Inflow	Between Systems	Surface Water Delivery	81,239
(3)	Inflow	Between Systems	Groundwater Extraction	47,500
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*280,964*
(5)	Outflow	Out of Basin	Evapotranspiration	165,795
(6)	Outflow	Between Systems	Runoff	94,032
(7)	Outflow	Between Systems	Return Flow	5,335
(8)	Outflow	Between Systems	Recharge of Applied Water	14,056
(9)	Outflow	Between Systems	Recharge of Precipitation	1,746
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*280,964*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Average (2019-2068)
(13)	Inflow	Into Basin	Stream Inflow	450,360
(14)	Inflow	Into Basin	Precipitation on Reservoirs	558
(6)	Inflow	Between Systems	Runoff	94,032
(7)	Inflow	Between Systems	Return Flow	5,335
(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*	*550,284*
(18)	Outflow	Out of Basin	Stream Outflow	436,663
(19)	Outflow	Out of Basin	Conveyance Evaporation	50
(20)	Outflow	Between Systems	Conveyance Seepage	27
(2)	Outflow	Between Systems	Surface Water Delivery	81,239
(21)	Outflow	Between Systems	Stream Loss to Groundwater	30,515
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	780
(24)	Outflow	Out of Basin	Stream Evaporation	414
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*550,284*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Average (2019-2068)
(8)	Inflow	Between Systems	Recharge of Applied Water	14,056
(9)	Inflow	Between Systems	Recharge of Precipitation	1,746
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	30,515
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596
(20)	Inflow	Between Systems	Conveyance Seepage	27
(27)	Inflow	Into Basin	Subsurface Inflow	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*46,942*
(3)	Outflow	Between Systems	Groundwater Extraction	47,500
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir s	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*47,500*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(558)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	Average (2019-2068)
(1)	Inflow	Into Basin	Precipitation on Land System	152,224
(14)	Inflow	Into Basin	Precipitation on Reservoirs	558
(13)	Inflow	Into Basin	Stream Inflow	450,360
(27)	Inflow	Into Basin	Subsurface Inflow	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*603,143*
(5)	Outflow	Out of Basin	Evapotranspiration	165,795
(24)	Outflow	Out of Basin	Stream Evaporation	414
(23)	Outflow	Out of Basin	Reservoir Evaporation	780
(19)	Outflow	Out of Basin	Conveyance Evaporation	50
(18)	Outflow	Out of Basin	Stream Outflow	436,663
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*603,701*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(558)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2019	2020	2021	2022	2023	2024	2025
(1)	Inflow	Into Basin	Precipitation on Land System	129,500	222,333	117,416	190,878	86,735	178,276	131,750
(2)	Inflow	Between Systems	Surface Water Delivery	85,796	76,976	85,067	81,416	89,423	82,756	83,061
(3)	Inflow	Between Systems	Groundwater Extraction	51,348	42,198	51,204	48,394	55,962	48,513	49,306
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*266,644*	*341,507*	*253,687*	*320,687*	*232,119*	*309,545*	*264,117*
(5)	Outflow	Out of Basin	Evapotranspiration	168,320	164,569	166,471	165,779	165,207	163,577	165,440
(6)	Outflow	Between Systems	Runoff	76,070	157,023	65,127	133,640	43,735	124,588	77,103
(7)	Outflow	Between Systems	Return Flow	5,773	4,726	5,758	5,438	6,302	5,449	5,541
(8)	Outflow	Between Systems	Recharge of Applied Water	14,879	13,230	14,763	14,113	15,585	14,321	14,394
(9)	Outflow	Between Systems	Recharge of Precipitation	1,603	1,959	1,569	1,717	1,290	1,611	1,639
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*266,644*	*341,507*	*253,687*	*320,687*	*232,119*	*309,545*	*264,117*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2019	2020	2021	2022	2023	2024	2025
(13)	Inflow	Into Basin	Stream Inflow	231,125	772,605	313,116	811,978	194,478	508,919	263,663
(14)	Inflow	Into Basin	Precipitation on Reservoirs	475	815	430	699	318	653	483
(6)	Inflow	Between Systems	Runoff	76,070	157,023	65,127	133,640	43,735	124,588	77,103
(7)	Inflow	Between Systems	Return Flow	5,773	4,726	5,758	5,438	6,302	5,449	5,541
(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*	*313,442*	*935,169*	*384,431*	*951,756*	*244,833*	*639,609*	*346,789*
(18)	Outflow	Out of Basin	Stream Outflow	210,973	816,434	278,896	818,346	140,411	527,323	245,560
(19)	Outflow	Out of Basin	Conveyance Evaporation	51	50	50	49	52	51	48
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	85,796	76,976	85,067	81,416	89,423	82,756	83,061
(21)	Outflow	Between Systems	Stream Loss to Groundwater	14,747	39,926	18,560	50,102	13,043	27,665	16,260
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	818	759	807	799	839	775	812
(24)	Outflow	Out of Basin	Stream Evaporation	432	400	428	419	442	415	424
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*313,442*	*935,169*	*384,431*	*951,756*	*244,833*	*639,609*	*346,789*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2019	2020	2021	2022	2023	2024	2025
(8)	Inflow	Between Systems	Recharge of Applied Water	14,879	13,230	14,763	14,113	15,585	14,321	14,394
(9)	Inflow	Between Systems	Recharge of Precipitation	1,603	1,959	1,569	1,717	1,290	1,611	1,639
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	14,747	39,926	18,560	50,102	13,043	27,665	16,260
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*31,854*	*55,740*	*35,516*	*66,557*	*30,543*	*44,221*	*32,918*
(3)	Outflow	Between Systems	Groundwater Extraction	51,348	42,198	51,204	48,394	55,962	48,513	49,306
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*51,348*	*42,198*	*51,204*	*48,394*	*55,962*	*48,513*	*49,306*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(19,494)	13,542	(15,688)	18,163	(25,419)	(4,292)	(16,388)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2019	2020	2021	2022	2023	2024	2025
(1)	Inflow	Into Basin	Precipitation on Land System	129,500	222,333	117,416	190,878	86,735	178,276	131,750
(14)	Inflow	Into Basin	Precipitation on Reservoirs	475	815	430	699	318	653	483
(13)	Inflow	Into Basin	Stream Inflow	231,125	772,605	313,116	811,978	194,478	508,919	263,663
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*361,100*	*995,753*	*430,963*	*1,003,556*	*281,532*	*687,849*	*395,896*
(5)	Outflow	Out of Basin	Evapotranspiration	168,320	164,569	166,471	165,779	165,207	163,577	165,440
(24)	Outflow	Out of Basin	Stream Evaporation	432	400	428	419	442	415	424
(23)	Outflow	Out of Basin	Reservoir Evaporation	818	759	807	799	839	775	812
(19)	Outflow	Out of Basin	Conveyance Evaporation	51	50	50	49	52	51	48
(18)	Outflow	Out of Basin	Stream Outflow	210,973	816,434	278,896	818,346	140,411	527,323	245,560
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*380,595*	*982,212*	*446,651*	*985,392*	*306,950*	*692,141*	*412,284*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(19,494)	13,542	(15,688)	18,163	(25,419)	(4,292)	(16,388)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2026	2027	2028	2029	2030	2031	2032
(1)	Inflow	Into Basin	Precipitation on Land System	169,078	181,223	223,561	122,811	117,302	187,191	133,627
(2)	Inflow	Between Systems	Surface Water Delivery	85,585	85,130	76,120	85,600	86,677	82,850	83,904
(3)	Inflow	Between Systems	Groundwater Extraction	50,419	50,097	41,580	50,791	52,010	47,910	50,101
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*305,082*	*316,450*	*341,260*	*259,201*	*255,989*	*317,951*	*267,632*
(5)	Outflow	Out of Basin	Evapotranspiration	169,456	167,624	169,093	168,714	170,424	167,439	166,339
(6)	Outflow	Between Systems	Runoff	113,477	126,831	152,295	68,314	63,055	129,075	79,488
(7)	Outflow	Between Systems	Return Flow	5,665	5,628	4,656	5,708	5,848	5,379	5,632
(8)	Outflow	Between Systems	Recharge of Applied Water	14,816	14,735	13,079	14,830	15,035	14,315	14,549
(9)	Outflow	Between Systems	Recharge of Precipitation	1,668	1,632	2,138	1,635	1,627	1,743	1,624
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*305,082*	*316,450*	*341,260*	*259,201*	*255,989*	*317,951*	*267,632*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2026	2027	2028	2029	2030	2031	2032
(13)	Inflow	Into Basin	Stream Inflow	657,649	631,029	1,061,564	701,971	332,242	627,237	588,265
(14)	Inflow	Into Basin	Precipitation on Reservoirs	620	664	819	450	430	686	490
(6)	Inflow	Between Systems	Runoff	113,477	126,831	152,295	68,314	63,055	129,075	79,488
(7)	Inflow	Between Systems	Return Flow	5,665	5,628	4,656	5,708	5,848	5,379	5,632
(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*	*777,411*	*764,153*	*1,219,334*	*776,443*	*401,574*	*762,376*	*673,874*
(18)	Outflow	Out of Basin	Stream Outflow	655,315	643,761	971,790	652,274	293,494	644,456	556,723
(19)	Outflow	Out of Basin	Conveyance Evaporation	52	51	48	51	52	51	51
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	85,585	85,130	76,120	85,600	86,677	82,850	83,904
(21)	Outflow	Between Systems	Stream Loss to Groundwater	34,581	33,343	169,590	36,642	19,449	33,167	31,354
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	822	814	759	820	840	806	796
(24)	Outflow	Out of Basin	Stream Evaporation	433	429	404	432	439	423	421
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*777,411*	*764,153*	*1,219,334*	*776,443*	*401,574*	*762,376*	*673,874*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2026	2027	2028	2029	2030	2031	2032
(8)	Inflow	Between Systems	Recharge of Applied Water	14,816	14,735	13,079	14,830	15,035	14,315	14,549
(9)	Inflow	Between Systems	Recharge of Precipitation	1,668	1,632	2,138	1,635	1,627	1,743	1,624
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	34,581	33,343	169,590	36,642	19,449	33,167	31,354
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*51,689*	*50,335*	*185,432*	*53,731*	*36,736*	*49,850*	*48,152*
(3)	Outflow	Between Systems	Groundwater Extraction	50,419	50,097	41,580	50,791	52,010	47,910	50,101
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*50,419*	*50,097*	*41,580*	*50,791*	*52,010*	*47,910*	*50,101*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	1,270	238	143,851	2,941	(15,273)	1,939	(1,949)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2026	2027	2028	2029	2030	2031	2032
(1)	Inflow	Into Basin	Precipitation on Land System	169,078	181,223	223,561	122,811	117,302	187,191	133,627
(14)	Inflow	Into Basin	Precipitation on Reservoirs	620	664	819	450	430	686	490
(13)	Inflow	Into Basin	Stream Inflow	657,649	631,029	1,061,564	701,971	332,242	627,237	588,265
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*827,348*	*812,918*	*1,285,945*	*825,232*	*449,974*	*815,115*	*722,382*
(5)	Outflow	Out of Basin	Evapotranspiration	169,456	167,624	169,093	168,714	170,424	167,439	166,339
(24)	Outflow	Out of Basin	Stream Evaporation	433	429	404	432	439	423	421
(23)	Outflow	Out of Basin	Reservoir Evaporation	822	814	759	820	840	806	796
(19)	Outflow	Out of Basin	Conveyance Evaporation	52	51	48	51	52	51	51
(18)	Outflow	Out of Basin	Stream Outflow	655,315	643,761	971,790	652,274	293,494	644,456	556,723
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*826,078*	*812,679*	*1,142,093*	*822,292*	*465,248*	*813,176*	*724,331*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	1,270	238	143,851	2,941	(15,273)	1,939	(1,949)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2033	2034	2035	2036	2037	2038	2039
(1)	Inflow	Into Basin	Precipitation on Land System	112,985	87,563	166,097	108,662	182,240	116,838	212,359
(2)	Inflow	Between Systems	Surface Water Delivery	82,916	85,651	80,321	84,772	81,197	84,997	79,509
(3)	Inflow	Between Systems	Groundwater Extraction	50,186	53,811	45,810	51,508	45,858	50,845	43,902
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*246,087*	*227,025*	*292,228*	*244,942*	*309,296*	*252,680*	*335,770*
(5)	Outflow	Out of Basin	Evapotranspiration	165,305	162,848	168,854	164,920	171,741	168,601	171,612
(6)	Outflow	Between Systems	Runoff	59,121	41,805	102,466	57,979	116,443	61,977	143,501
(7)	Outflow	Between Systems	Return Flow	5,644	6,060	5,140	5,794	5,143	5,716	4,919
(8)	Outflow	Between Systems	Recharge of Applied Water	14,401	14,939	13,860	14,728	13,995	14,740	13,672
(9)	Outflow	Between Systems	Recharge of Precipitation	1,616	1,373	1,909	1,520	1,974	1,646	2,066
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*246,087*	*227,025*	*292,228*	*244,942*	*309,296*	*252,680*	*335,770*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2033	2034	2035	2036	2037	2038	2039
(13)	Inflow	Into Basin	Stream Inflow	207,813	116,791	312,968	249,739	560,602	170,483	840,537
(14)	Inflow	Into Basin	Precipitation on Reservoirs	414	321	609	398	668	428	778
(6)	Inflow	Between Systems	Runoff	59,121	41,805	102,466	57,979	116,443	61,977	143,501
(7)	Inflow	Between Systems	Return Flow	5,644	6,060	5,140	5,794	5,143	5,716	4,919
(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*	*272,991*	*164,977*	*421,182*	*313,910*	*682,856*	*238,603*	*989,735*
(18)	Outflow	Out of Basin	Stream Outflow	174,482	67,971	320,441	211,623	569,687	139,767	849,395
(19)	Outflow	Out of Basin	Conveyance Evaporation	49	49	50	50	51	51	51
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	82,916	85,651	80,321	84,772	81,197	84,997	79,509
(21)	Outflow	Between Systems	Stream Loss to Groundwater	13,663	9,431	18,553	15,613	30,068	11,927	58,942
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	831	821	779	804	807	809	798
(24)	Outflow	Out of Basin	Stream Evaporation	427	431	413	425	422	429	417
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*272,991*	*164,977*	*421,182*	*313,910*	*682,856*	*238,603*	*989,735*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2033	2034	2035	2036	2037	2038	2039
(8)	Inflow	Between Systems	Recharge of Applied Water	14,401	14,939	13,860	14,728	13,995	14,740	13,672
(9)	Inflow	Between Systems	Recharge of Precipitation	1,616	1,373	1,909	1,520	1,974	1,646	2,066
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	13,663	9,431	18,553	15,613	30,068	11,927	58,942
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*30,305*	*26,367*	*34,946*	*32,486*	*46,661*	*28,938*	*75,305*
(3)	Outflow	Between Systems	Groundwater Extraction	50,186	53,811	45,810	51,508	45,858	50,845	43,902
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*50,186*	*53,811*	*45,810*	*51,508*	*45,858*	*50,845*	*43,902*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	(19,881)	(27,444)	(10,864)	(19,022)	803	(21,907)	31,402

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2033	2034	2035	2036	2037	2038	2039
(1)	Inflow	Into Basin	Precipitation on Land System	112,985	87,563	166,097	108,662	182,240	116,838	212,359
(14)	Inflow	Into Basin	Precipitation on Reservoirs	414	321	609	398	668	428	778
(13)	Inflow	Into Basin	Stream Inflow	207,813	116,791	312,968	249,739	560,602	170,483	840,537
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*321,212*	*204,676*	*479,674*	*358,800*	*743,511*	*287,749*	*#######*
(5)	Outflow	Out of Basin	Evapotranspiration	165,305	162,848	168,854	164,920	171,741	168,601	171,612
(24)	Outflow	Out of Basin	Stream Evaporation	427	431	413	425	422	429	417
(23)	Outflow	Out of Basin	Reservoir Evaporation	831	821	779	804	807	809	798
(19)	Outflow	Out of Basin	Conveyance Evaporation	49	49	50	50	51	51	51
(18)	Outflow	Out of Basin	Stream Outflow	174,482	67,971	320,441	211,623	569,687	139,767	849,395
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*341,093*	*232,120*	*490,538*	*377,822*	*742,708*	*309,656*	*#######*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	(19,881)	(27,444)	(10,864)	(19,022)	803	(21,907)	31,402

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2040	2041	2042	2043	2044	2045	2046
(1)	Inflow	Into Basin	Precipitation on Land System	194,896	150,631	141,993	197,252	96,916	93,605	146,583
(2)	Inflow	Between Systems	Surface Water Delivery	78,633	71,640	78,677	77,256	81,529	88,716	75,392
(3)	Inflow	Between Systems	Groundwater Extraction	43,464	41,156	46,349	43,597	49,524	54,803	43,509
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*316,993*	*263,426*	*267,019*	*318,105*	*227,969*	*237,125*	*265,484*
(5)	Outflow	Out of Basin	Evapotranspiration	170,100	151,307	158,063	165,533	159,191	165,244	154,639
(6)	Outflow	Between Systems	Runoff	126,445	93,403	88,518	132,419	47,560	48,932	91,271
(7)	Outflow	Between Systems	Return Flow	4,870	4,617	5,206	4,889	5,570	6,169	4,883
(8)	Outflow	Between Systems	Recharge of Applied Water	13,524	12,382	13,627	13,319	14,168	15,439	13,032
(9)	Outflow	Between Systems	Recharge of Precipitation	2,054	1,717	1,604	1,945	1,481	1,340	1,659
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*316,993*	*263,426*	*267,019*	*318,105*	*227,969*	*237,125*	*265,484*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2040	2041	2042	2043	2044	2045	2046
(13)	Inflow	Into Basin	Stream Inflow	727,089	878,808	337,563	890,868	170,896	171,875	421,974
(14)	Inflow	Into Basin	Precipitation on Reservoirs	714	552	520	723	355	343	537
(6)	Inflow	Between Systems	Runoff	126,445	93,403	88,518	132,419	47,560	48,932	91,271
(7)	Inflow	Between Systems	Return Flow	4,870	4,617	5,206	4,889	5,570	6,169	4,883
(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*	*859,118*	*977,381*	*431,808*	*#######*	*224,381*	*227,319*	*518,665*
(18)	Outflow	Out of Basin	Stream Outflow	740,802	831,518	331,578	872,619	129,071	124,699	417,877
(19)	Outflow	Out of Basin	Conveyance Evaporation	49	46	48	47	47	52	47
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	78,633	71,640	78,677	77,256	81,529	88,716	75,392
(21)	Outflow	Between Systems	Stream Loss to Groundwater	37,810	72,494	19,697	77,195	11,947	11,992	23,622
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	789	691	781	754	758	802	720
(24)	Outflow	Out of Basin	Stream Evaporation	412	368	404	403	405	433	384
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*859,118*	*977,381*	*431,808*	*#######*	*224,381*	*227,319*	*518,665*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2040	2041	2042	2043	2044	2045	2046
(8)	Inflow	Between Systems	Recharge of Applied Water	13,524	12,382	13,627	13,319	14,168	15,439	13,032
(9)	Inflow	Between Systems	Recharge of Precipitation	2,054	1,717	1,604	1,945	1,481	1,340	1,659
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	37,810	72,494	19,697	77,195	11,947	11,992	23,622
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*54,012*	*87,217*	*35,553*	*93,084*	*28,220*	*29,396*	*38,938*
(3)	Outflow	Between Systems	Groundwater Extraction	43,464	41,156	46,349	43,597	49,524	54,803	43,509
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*43,464*	*41,156*	*46,349*	*43,597*	*49,524*	*54,803*	*43,509*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	10,548	46,061	(10,796)	49,487	(21,304)	(25,407)	(4,571)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2040	2041	2042	2043	2044	2045	2046
(1)	Inflow	Into Basin	Precipitation on Land System	194,896	150,631	141,993	197,252	96,916	93,605	146,583
(14)	Inflow	Into Basin	Precipitation on Reservoirs	714	552	520	723	355	343	537
(13)	Inflow	Into Basin	Stream Inflow	727,089	878,808	337,563	890,868	170,896	171,875	421,974
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*922,700*	*#######*	*480,077*	*#######*	*268,168*	*265,823*	*569,095*
(5)	Outflow	Out of Basin	Evapotranspiration	170,100	151,307	158,063	165,533	159,191	165,244	154,639
(24)	Outflow	Out of Basin	Stream Evaporation	412	368	404	403	405	433	384
(23)	Outflow	Out of Basin	Reservoir Evaporation	789	691	781	754	758	802	720
(19)	Outflow	Out of Basin	Conveyance Evaporation	49	46	48	47	47	52	47
(18)	Outflow	Out of Basin	Stream Outflow	740,802	831,518	331,578	872,619	129,071	124,699	417,877
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*912,152*	*983,931*	*490,873*	*#######*	*289,472*	*291,231*	*573,666*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	10,548	46,061	(10,796)	49,487	(21,304)	(25,407)	(4,571)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2047	2048	2049	2050	2051	2052	2053
(1)	Inflow	Into Basin	Precipitation on Land System	112,828	109,588	75,064	225,757	109,477	199,671	205,058
(2)	Inflow	Between Systems	Surface Water Delivery	75,481	81,148	86,327	75,721	83,120	71,972	76,728
(3)	Inflow	Between Systems	Groundwater Extraction	44,408	49,085	54,406	39,876	50,096	39,618	44,076
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*232,717*	*239,821*	*215,797*	*341,355*	*242,692*	*311,261*	*325,861*
(5)	Outflow	Out of Basin	Evapotranspiration	153,467	158,670	160,652	175,368	165,364	154,317	164,713
(6)	Outflow	Between Systems	Runoff	59,591	60,050	32,684	146,180	55,652	138,285	141,027
(7)	Outflow	Between Systems	Return Flow	4,988	5,520	6,128	4,458	5,633	4,437	4,946
(8)	Outflow	Between Systems	Recharge of Applied Water	13,076	14,095	15,061	12,961	14,429	12,381	13,254
(9)	Outflow	Between Systems	Recharge of Precipitation	1,597	1,486	1,271	2,387	1,615	1,842	1,921
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*232,717*	*239,821*	*215,797*	*341,355*	*242,692*	*311,261*	*325,861*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2047	2048	2049	2050	2051	2052	2053
(13)	Inflow	Into Basin	Stream Inflow	136,845	266,826	77,677	639,443	168,796	939,201	838,666
(14)	Inflow	Into Basin	Precipitation on Reservoirs	413	402	275	827	401	732	751
(6)	Inflow	Between Systems	Runoff	59,591	60,050	32,684	146,180	55,652	138,285	141,027
(7)	Inflow	Between Systems	Return Flow	4,988	5,520	6,128	4,458	5,633	4,437	4,946
(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*	*201,836*	*332,797*	*116,764*	*790,908*	*230,482*	*1,082,654*	*985,391*
(18)	Outflow	Out of Basin	Stream Outflow	114,222	233,452	20,949	679,625	133,636	910,698	848,509
(19)	Outflow	Out of Basin	Conveyance Evaporation	46	49	50	50	51	46	48
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	75,481	81,148	86,327	75,721	83,120	71,972	76,728
(21)	Outflow	Between Systems	Stream Loss to Groundwater	10,363	16,407	7,612	33,734	11,849	98,262	58,331
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	719	720	781	752	785	682	751
(24)	Outflow	Out of Basin	Stream Evaporation	381	397	421	402	418	371	400
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*201,836*	*332,797*	*116,764*	*790,908*	*230,482*	*1,082,654*	*985,391*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2047	2048	2049	2050	2051	2052	2053
(8)	Inflow	Between Systems	Recharge of Applied Water	13,076	14,095	15,061	12,961	14,429	12,381	13,254
(9)	Inflow	Between Systems	Recharge of Precipitation	1,597	1,486	1,271	2,387	1,615	1,842	1,921
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	10,363	16,407	7,612	33,734	11,849	98,262	58,331
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*25,661*	*32,613*	*24,569*	*49,707*	*28,518*	*113,109*	*74,131*
(3)	Outflow	Between Systems	Groundwater Extraction	44,408	49,085	54,406	39,876	50,096	39,618	44,076
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*44,408*	*49,085*	*54,406*	*39,876*	*50,096*	*39,618*	*44,076*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(18,748)	(16,471)	(29,836)	9,832	(21,578)	73,491	30,055

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2047	2048	2049	2050	2051	2052	2053
(1)	Inflow	Into Basin	Precipitation on Land System	112,828	109,588	75,064	225,757	109,477	199,671	205,058
(14)	Inflow	Into Basin	Precipitation on Reservoirs	413	402	275	827	401	732	751
(13)	Inflow	Into Basin	Stream Inflow	136,845	266,826	77,677	639,443	168,796	939,201	838,666
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*250,087*	*376,817*	*153,017*	*866,029*	*278,675*	*1,139,604*	*#######*
(5)	Outflow	Out of Basin	Evapotranspiration	153,467	158,670	160,652	175,368	165,364	154,317	164,713
(24)	Outflow	Out of Basin	Stream Evaporation	381	397	421	402	418	371	400
(23)	Outflow	Out of Basin	Reservoir Evaporation	719	720	781	752	785	682	751
(19)	Outflow	Out of Basin	Conveyance Evaporation	46	49	50	50	51	46	48
(18)	Outflow	Out of Basin	Stream Outflow	114,222	233,452	20,949	679,625	133,636	910,698	848,509
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*268,834*	*393,288*	*182,853*	*856,197*	*300,253*	*1,066,113*	*#######*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(18,748)	(16,471)	(29,836)	9,832	(21,578)	73,491	30,055

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2054	2055	2056	2057	2058	2059	2060
(1)	Inflow	Into Basin	Precipitation on Land System	181,148	240,300	165,297	145,585	86,442	130,562	161,922
(2)	Inflow	Between Systems	Surface Water Delivery	81,726	69,567	80,770	82,627	87,201	86,559	80,563
(3)	Inflow	Between Systems	Groundwater Extraction	46,992	36,069	46,825	47,959	53,321	51,640	46,430
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*309,865*	*345,936*	*292,892*	*276,171*	*226,963*	*268,760*	*288,915*
(5)	Outflow	Out of Basin	Evapotranspiration	171,815	162,194	168,075	173,482	164,756	169,002	167,314
(6)	Outflow	Between Systems	Runoff	116,731	165,574	103,752	81,087	39,646	77,352	100,633
(7)	Outflow	Between Systems	Return Flow	5,274	4,029	5,257	5,385	5,999	5,805	5,211
(8)	Outflow	Between Systems	Recharge of Applied Water	14,113	11,896	13,962	14,283	15,158	15,005	13,917
(9)	Outflow	Between Systems	Recharge of Precipitation	1,933	2,242	1,846	1,935	1,404	1,596	1,839
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*309,865*	*345,936*	*292,892*	*276,171*	*226,963*	*268,760*	*288,915*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2054	2055	2056	2057	2058	2059	2060
(13)	Inflow	Into Basin	Stream Inflow	659,533	809,502	712,444	240,135	96,425	160,946	229,397
(14)	Inflow	Into Basin	Precipitation on Reservoirs	664	881	606	533	317	478	593
(6)	Inflow	Between Systems	Runoff	116,731	165,574	103,752	81,087	39,646	77,352	100,633
(7)	Inflow	Between Systems	Return Flow	5,274	4,029	5,257	5,385	5,999	5,805	5,211
(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*	*782,201*	*979,986*	*822,059*	*327,140*	*142,387*	*244,582*	*335,835*
(18)	Outflow	Out of Basin	Stream Outflow	663,923	859,330	702,286	227,447	44,776	144,611	238,751
(19)	Outflow	Out of Basin	Conveyance Evaporation	51	46	50	51	52	52	49
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	81,726	69,567	80,770	82,627	87,201	86,559	80,563
(21)	Outflow	Between Systems	Stream Loss to Groundwater	34,668	49,384	37,129	15,166	8,484	11,484	14,667
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	789	668	786	801	820	819	769
(24)	Outflow	Out of Basin	Stream Evaporation	420	367	414	424	430	433	412
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*782,201*	*979,986*	*822,059*	*327,140*	*142,387*	*244,582*	*335,835*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2054	2055	2056	2057	2058	2059	2060
(8)	Inflow	Between Systems	Recharge of Applied Water	14,113	11,896	13,962	14,283	15,158	15,005	13,917
(9)	Inflow	Between Systems	Recharge of Precipitation	1,933	2,242	1,846	1,935	1,404	1,596	1,839
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	34,668	49,384	37,129	15,166	8,484	11,484	14,667
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*51,339*	*64,147*	*53,562*	*32,009*	*25,671*	*28,710*	*31,048*
(3)	Outflow	Between Systems	Groundwater Extraction	46,992	36,069	46,825	47,959	53,321	51,640	46,430
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*46,992*	*36,069*	*46,825*	*47,959*	*53,321*	*51,640*	*46,430*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	4,347	28,079	6,736	(15,950)	(27,650)	(22,930)	(15,382)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2054	2055	2056	2057	2058	2059	2060
(1)	Inflow	Into Basin	Precipitation on Land System	181,148	240,300	165,297	145,585	86,442	130,562	161,922
(14)	Inflow	Into Basin	Precipitation on Reservoirs	664	881	606	533	317	478	593
(13)	Inflow	Into Basin	Stream Inflow	659,533	809,502	712,444	240,135	96,425	160,946	229,397
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*841,345*	*#######*	*878,347*	*386,254*	*183,184*	*291,987*	*391,913*
(5)	Outflow	Out of Basin	Evapotranspiration	171,815	162,194	168,075	173,482	164,756	169,002	167,314
(24)	Outflow	Out of Basin	Stream Evaporation	420	367	414	424	430	433	412
(23)	Outflow	Out of Basin	Reservoir Evaporation	789	668	786	801	820	819	769
(19)	Outflow	Out of Basin	Conveyance Evaporation	51	46	50	51	52	52	49
(18)	Outflow	Out of Basin	Stream Outflow	663,923	859,330	702,286	227,447	44,776	144,611	238,751
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*836,998*	*#######*	*871,611*	*402,204*	*210,835*	*314,917*	*407,295*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	4,347	28,079	6,736	(15,950)	(27,650)	(22,930)	(15,382)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2061	2062	2063	2064	2065	2066	2067
(1)	Inflow	Into Basin	Precipitation on Land System	146,572	148,701	232,665	118,707	132,516	149,197	135,123
(2)	Inflow	Between Systems	Surface Water Delivery	85,780	77,131	76,997	84,401	82,618	83,095	77,644
(3)	Inflow	Between Systems	Groundwater Extraction	51,324	44,577	42,403	51,384	48,300	47,652	44,474
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*283,677*	*270,410*	*352,064*	*254,491*	*263,434*	*279,943*	*257,241*
(5)	Outflow	Out of Basin	Evapotranspiration	166,689	158,629	169,465	173,250	170,923	176,605	166,236
(6)	Outflow	Between Systems	Runoff	94,789	91,736	162,505	59,003	70,946	81,620	70,674
(7)	Outflow	Between Systems	Return Flow	5,770	5,003	4,750	5,780	5,425	5,348	4,990
(8)	Outflow	Between Systems	Recharge of Applied Water	14,876	13,333	13,240	14,667	14,293	14,344	13,407
(9)	Outflow	Between Systems	Recharge of Precipitation	1,554	1,709	2,105	1,791	1,847	2,027	1,933
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*283,677*	*270,410*	*352,064*	*254,491*	*263,434*	*279,943*	*257,241*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-	-	-	-	-	-	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2061	2062	2063	2064	2065	2066	2067
(13)	Inflow	Into Basin	Stream Inflow	321,321	372,195	798,642	131,362	254,574	150,766	106,628
(14)	Inflow	Into Basin	Precipitation on Reservoirs	537	545	853	435	486	547	495
(6)	Inflow	Between Systems	Runoff	94,789	91,736	162,505	59,003	70,946	81,620	70,674
(7)	Inflow	Between Systems	Return Flow	5,770	5,003	4,750	5,780	5,425	5,348	4,990
(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*	*422,417*	*469,479*	*966,750*	*196,580*	*331,430*	*238,280*	*182,788*
(18)	Outflow	Out of Basin	Stream Outflow	315,780	369,247	841,604	100,139	231,086	142,278	94,373
(19)	Outflow	Out of Basin	Conveyance Evaporation	51	47	49	51	51	50	48
(20)	Outflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(2)	Outflow	Between Systems	Surface Water Delivery	85,780	77,131	76,997	84,401	82,618	83,095	77,644
(21)	Outflow	Between Systems	Stream Loss to Groundwater	18,941	21,307	46,323	10,108	15,838	11,011	8,958
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596	596	596	596	596	596	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	811	730	750	823	793	797	742
(24)	Outflow	Out of Basin	Stream Evaporation	429	393	403	434	420	427	399
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*422,417*	*469,479*	*966,750*	*196,580*	*331,430*	*238,280*	*182,788*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2061	2062	2063	2064	2065	2066	2067
(8)	Inflow	Between Systems	Recharge of Applied Water	14,876	13,333	13,240	14,667	14,293	14,344	13,407
(9)	Inflow	Between Systems	Recharge of Precipitation	1,554	1,709	2,105	1,791	1,847	2,027	1,933
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	18,941	21,307	46,323	10,108	15,838	11,011	8,958
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596	596	596	596	596	596	596
(20)	Inflow	Between Systems	Conveyance Seepage	27	27	27	27	27	27	27
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*35,995*	*36,973*	*62,292*	*27,191*	*32,602*	*28,006*	*24,924*
(3)	Outflow	Between Systems	Groundwater Extraction	51,324	44,577	42,403	51,384	48,300	47,652	44,474
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir s	-	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*51,324*	*44,577*	*42,403*	*51,384*	*48,300*	*47,652*	*44,474*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(15,329)	(7,604)	19,889	(24,192)	(15,698)	(19,646)	(19,550)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2061	2062	2063	2064	2065	2066	2067
(1)	Inflow	Into Basin	Precipitation on Land System	146,572	148,701	232,665	118,707	132,516	149,197	135,123
(14)	Inflow	Into Basin	Precipitation on Reservoirs	537	545	853	435	486	547	495
(13)	Inflow	Into Basin	Stream Inflow	321,321	372,195	798,642	131,362	254,574	150,766	106,628
(27)	Inflow	Into Basin	Subsurface Inflow	1	1	1	1	1	1	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*468,431*	*521,442*	*#######*	*250,505*	*387,576*	*300,511*	*242,247*
(5)	Outflow	Out of Basin	Evapotranspiration	166,689	158,629	169,465	173,250	170,923	176,605	166,236
(24)	Outflow	Out of Basin	Stream Evaporation	429	393	403	434	420	427	399
(23)	Outflow	Out of Basin	Reservoir Evaporation	811	730	750	823	793	797	742
(19)	Outflow	Out of Basin	Conveyance Evaporation	51	47	49	51	51	50	48
(18)	Outflow	Out of Basin	Stream Outflow	315,780	369,247	841,604	100,139	231,086	142,278	94,373
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*483,760*	*529,046*	*#######*	*274,697*	*403,274*	*320,156*	*261,797*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(15,329)	(7,604)	19,889	(24,192)	(15,698)	(19,646)	(19,550)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2068
(1)	Inflow	Into Basin	Precipitation on Land System	198,737
(2)	Inflow	Between Systems	Surface Water Delivery	73,214
(3)	Inflow	Between Systems	Groundwater Extraction	39,935
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*311,886*
(5)	Outflow	Out of Basin	Evapotranspiration	162,359
(6)	Outflow	Between Systems	Runoff	130,426
(7)	Outflow	Between Systems	Return Flow	4,471
(8)	Outflow	Between Systems	Recharge of Applied Water	12,581
(9)	Outflow	Between Systems	Recharge of Precipitation	2,049
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*311,886*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	-

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2068
(13)	Inflow	Into Basin	Stream Inflow	652,832
(14)	Inflow	Into Basin	Precipitation on Reservoirs	728
(6)	Inflow	Between Systems	Runoff	130,426
(7)	Inflow	Between Systems	Return Flow	4,471
(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*	*788,457*
(18)	Outflow	Out of Basin	Stream Outflow	679,139
(19)	Outflow	Out of Basin	Conveyance Evaporation	46
(20)	Outflow	Between Systems	Conveyance Seepage	27
(2)	Outflow	Between Systems	Surface Water Delivery	73,214
(21)	Outflow	Between Systems	Stream Loss to Groundwater	34,357
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	697
(24)	Outflow	Out of Basin	Stream Evaporation	380
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*788,457*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-

GROUNDWATER SYSTEM WATER BUDGET

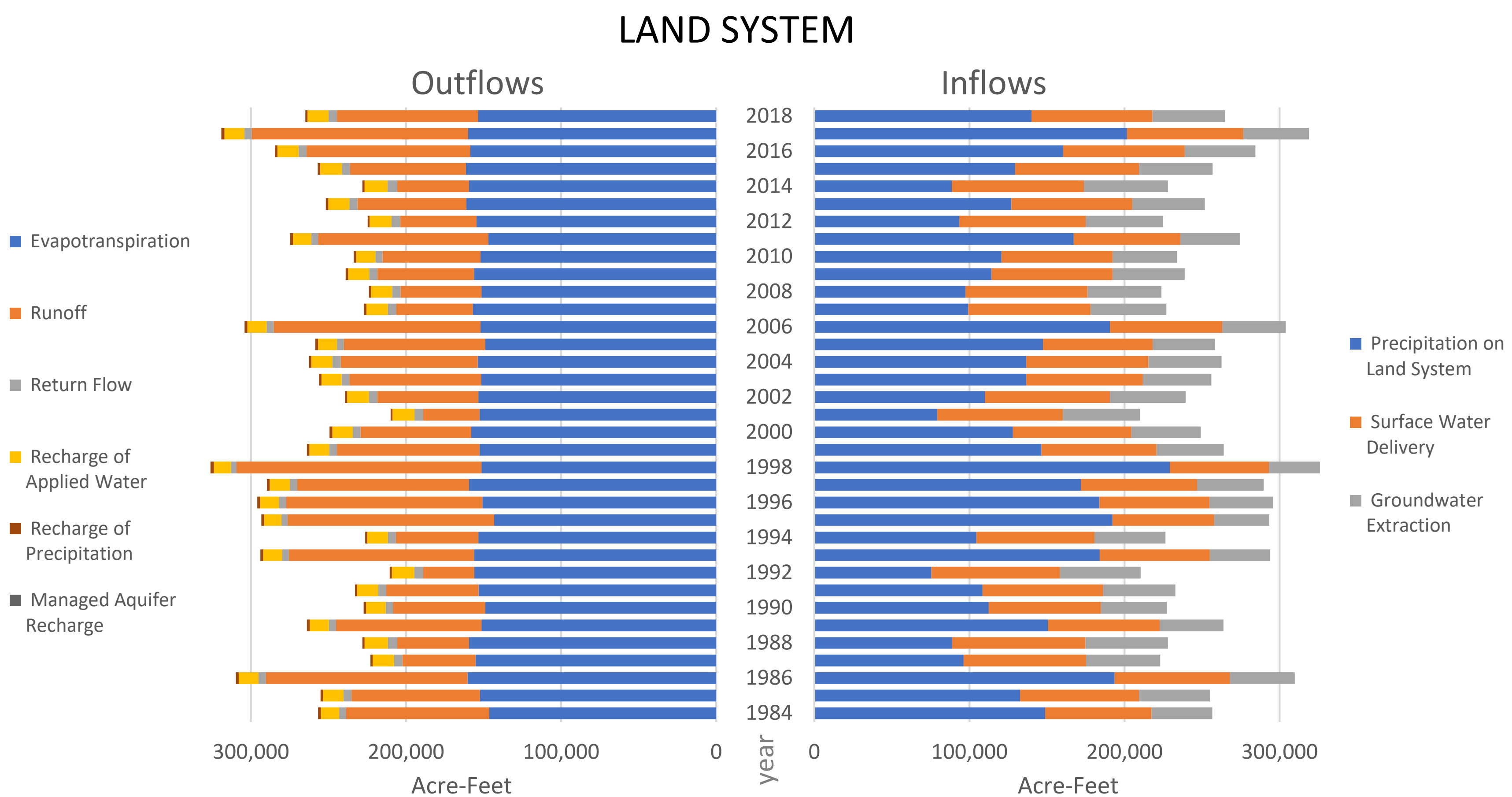
item	Flow Type	Origin/ Destination	Component	2068
(8)	Inflow	Between Systems	Recharge of Applied Water	12,581
(9)	Inflow	Between Systems	Recharge of Precipitation	2,049
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	34,357
(22)	Inflow	Between Systems	Groundwater Gain from Reservoir	596
(20)	Inflow	Between Systems	Conveyance Seepage	27
(27)	Inflow	Into Basin	Subsurface Inflow	1
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*49,612*
(3)	Outflow	Between Systems	Groundwater Extraction	39,935
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-
(16)	Outflow	Between Systems	Groundwater Loss to Reservoir s	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*39,935*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	9,676

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2068
(1)	Inflow	Into Basin	Precipitation on Land System	198,737
(14)	Inflow	Into Basin	Precipitation on Reservoirs	728
(13)	Inflow	Into Basin	Stream Inflow	652,832
(27)	Inflow	Into Basin	Subsurface Inflow	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*852,297*
(5)	Outflow	Out of Basin	Evapotranspiration	162,359
(24)	Outflow	Out of Basin	Stream Evaporation	380
(23)	Outflow	Out of Basin	Reservoir Evaporation	697
(19)	Outflow	Out of Basin	Conveyance Evaporation	46
(18)	Outflow	Out of Basin	Stream Outflow	679,139
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*842,621*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	9,676

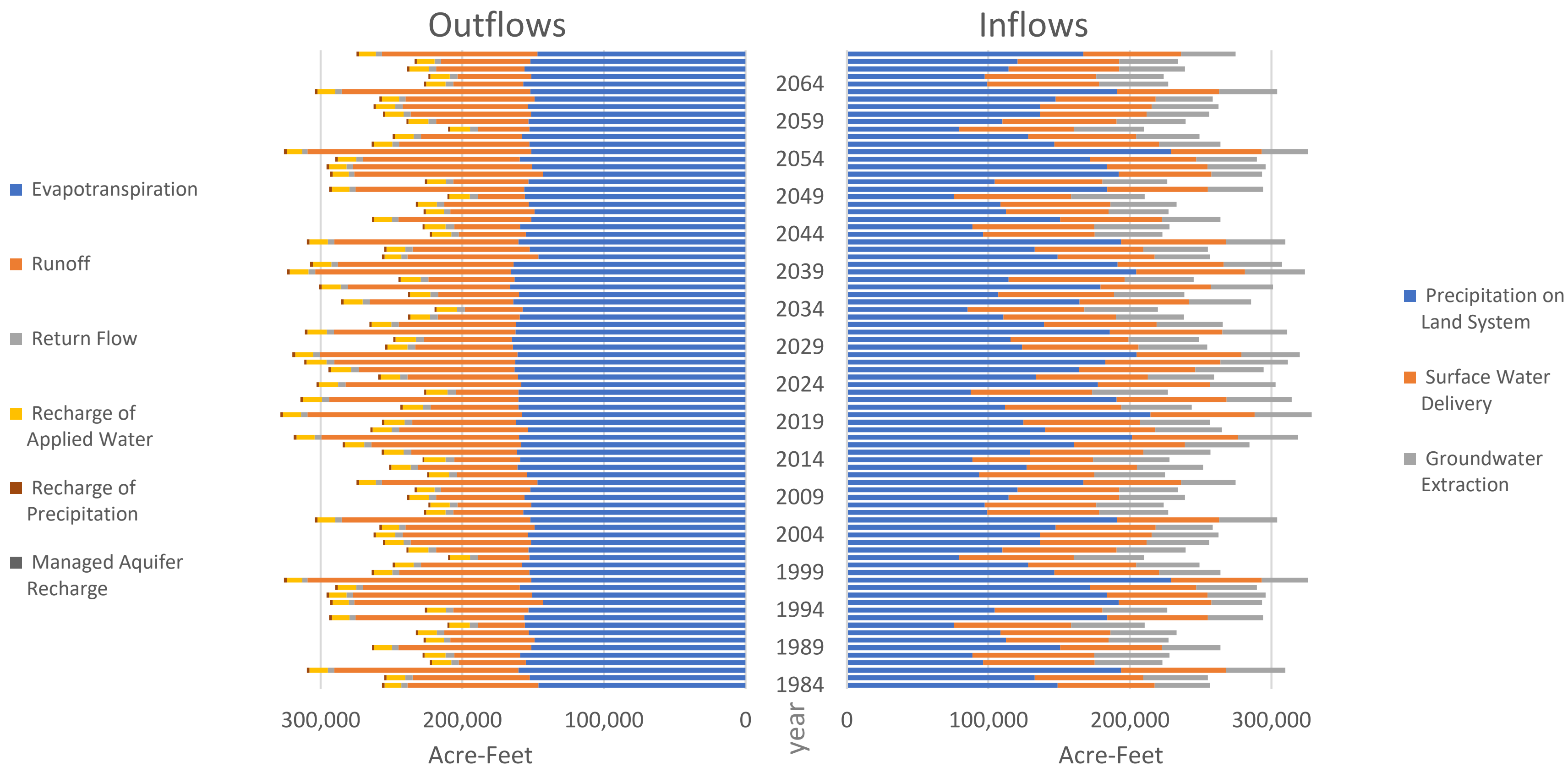
Appendix 6C Water Budget Bar Charts

Historic Water Budget

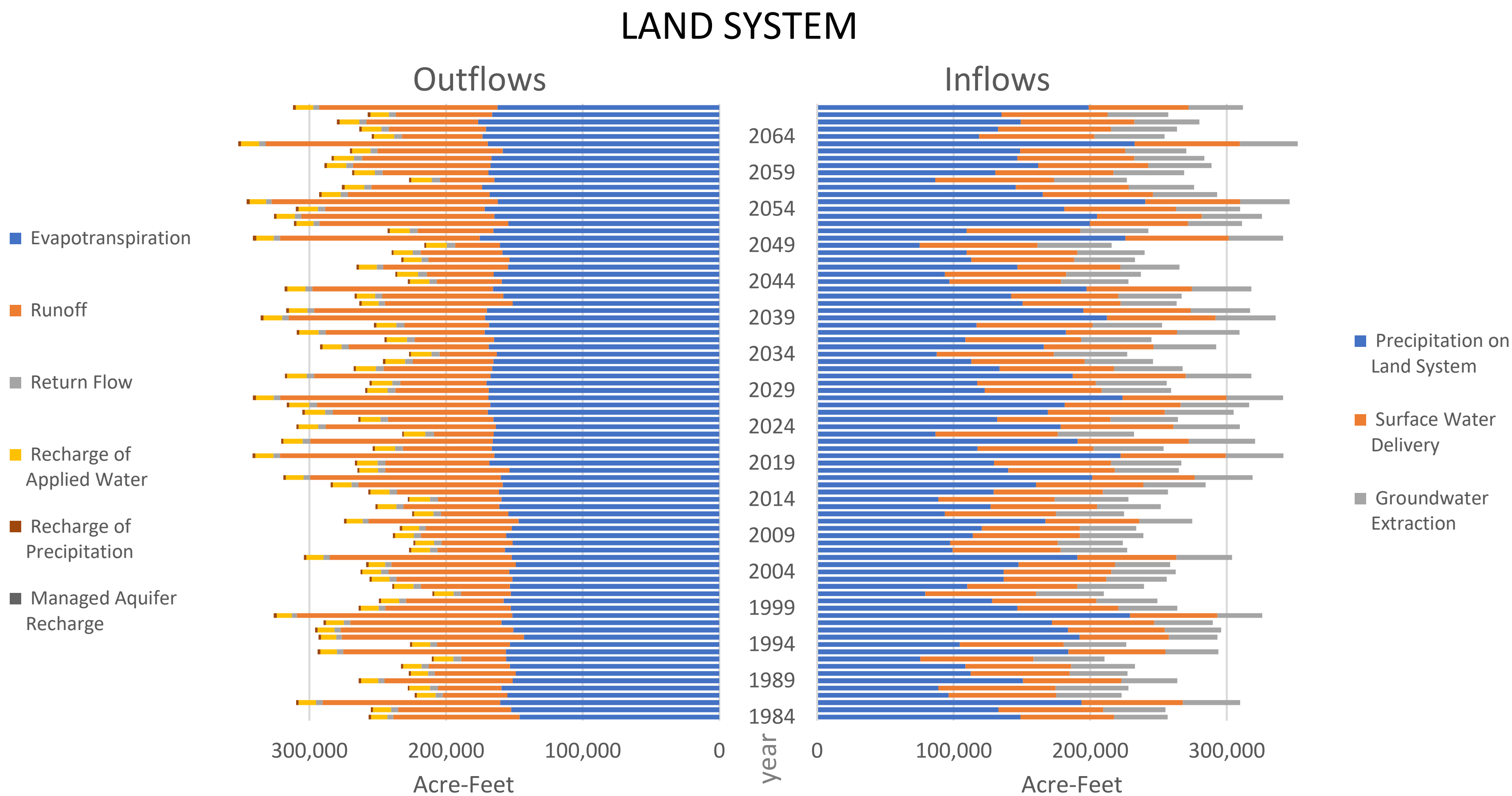


Future Water Budget

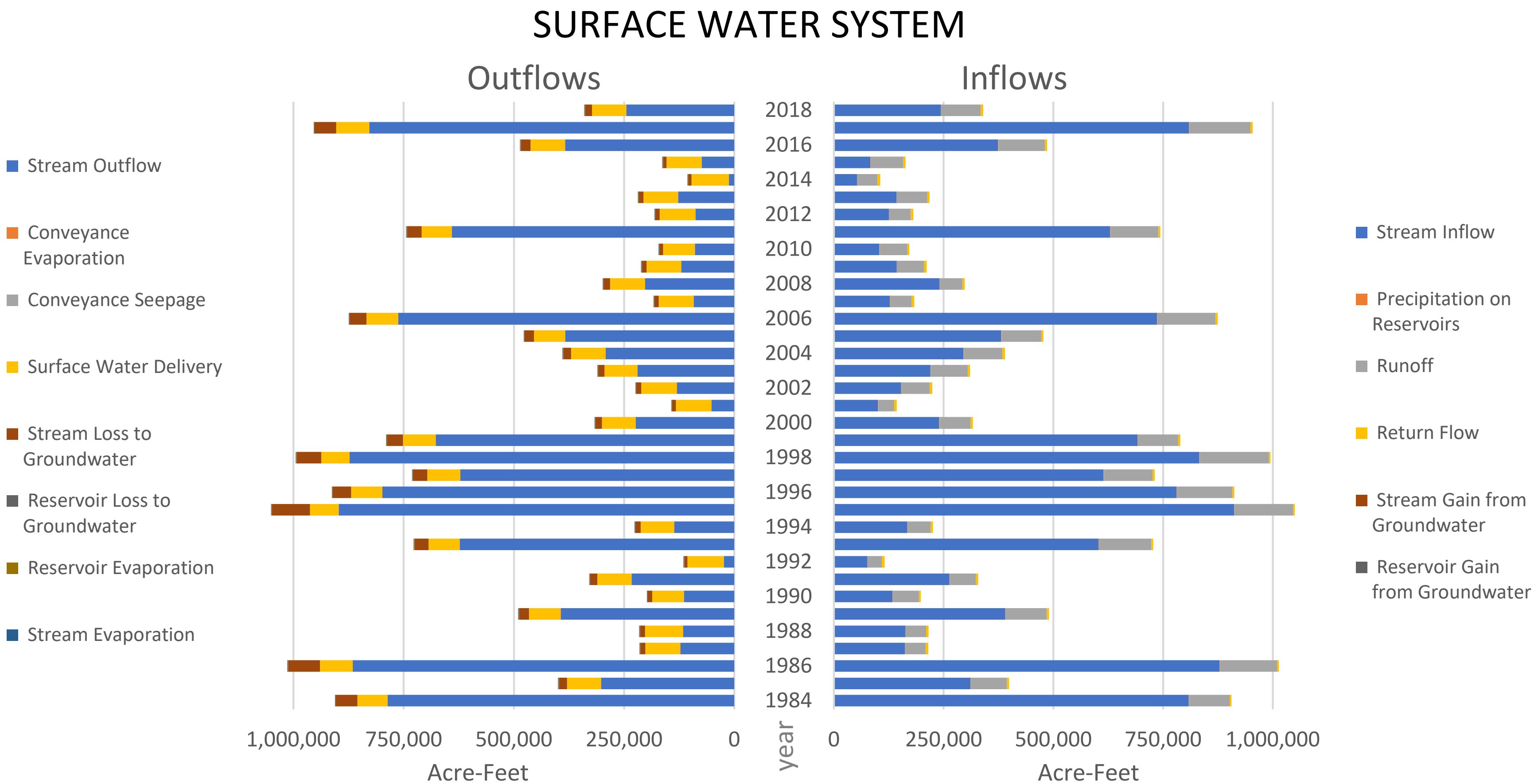
LAND SYSTEM



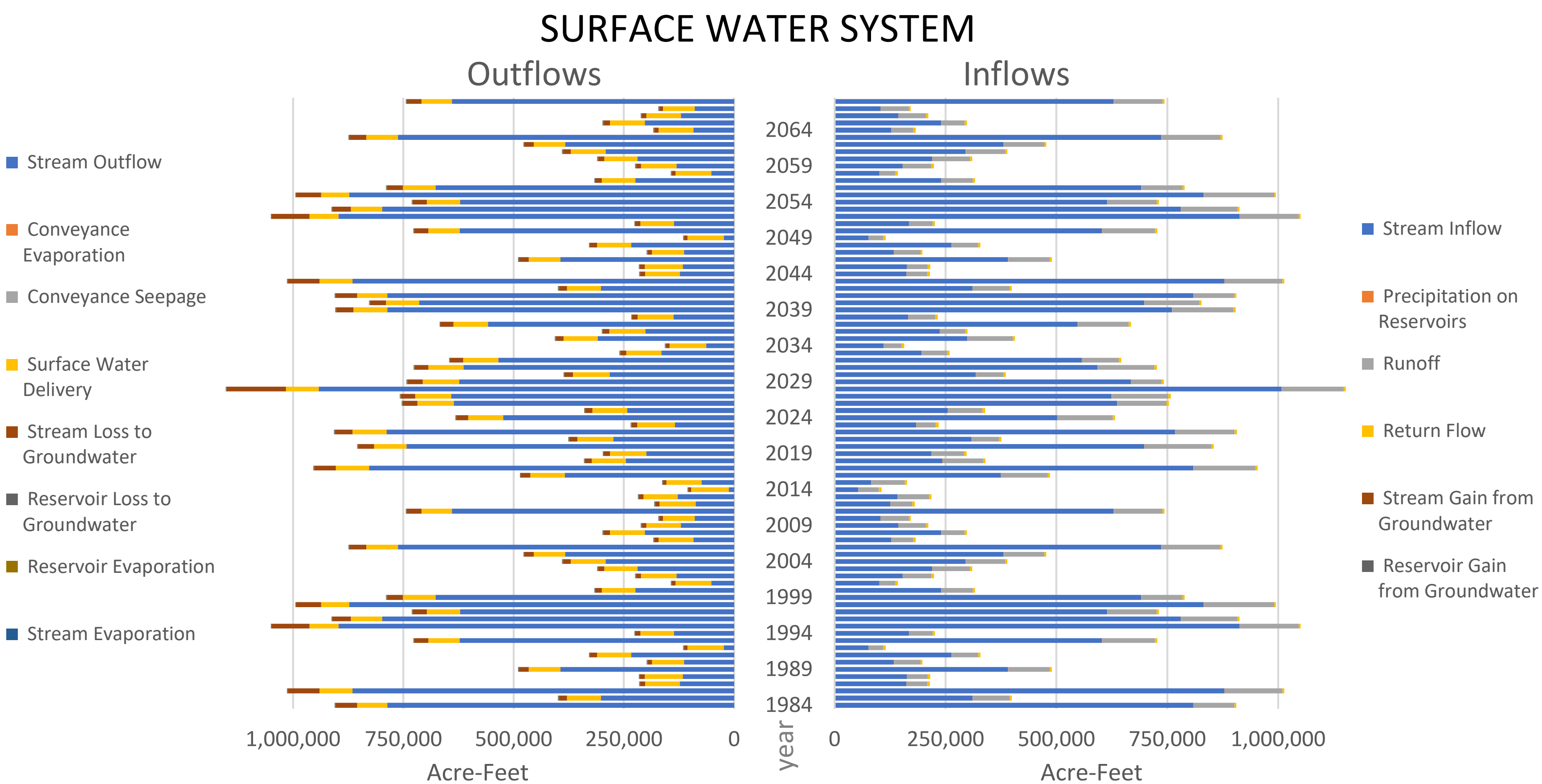
Future Water Budget With Climate Change



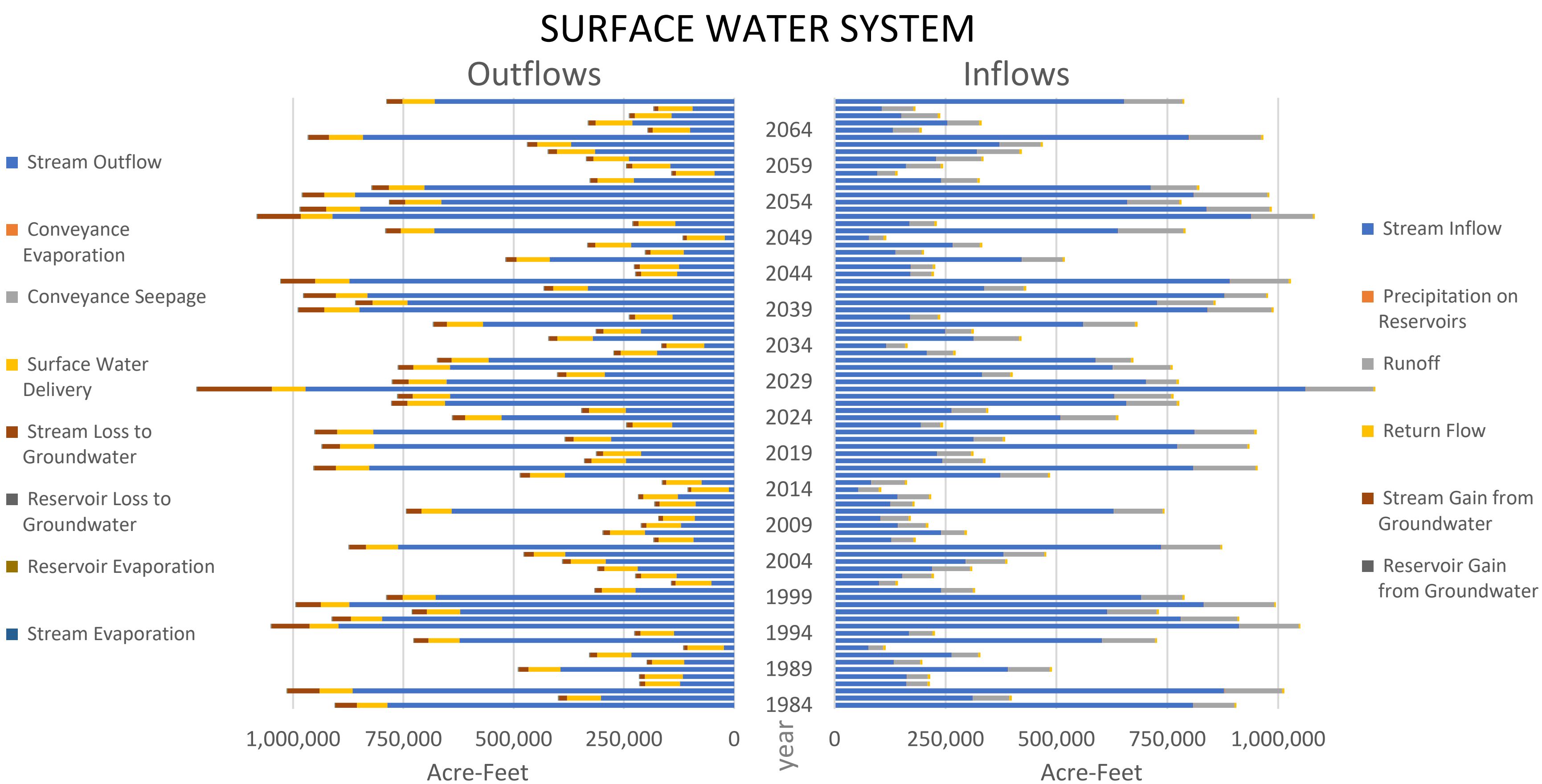
Historic Water Budget



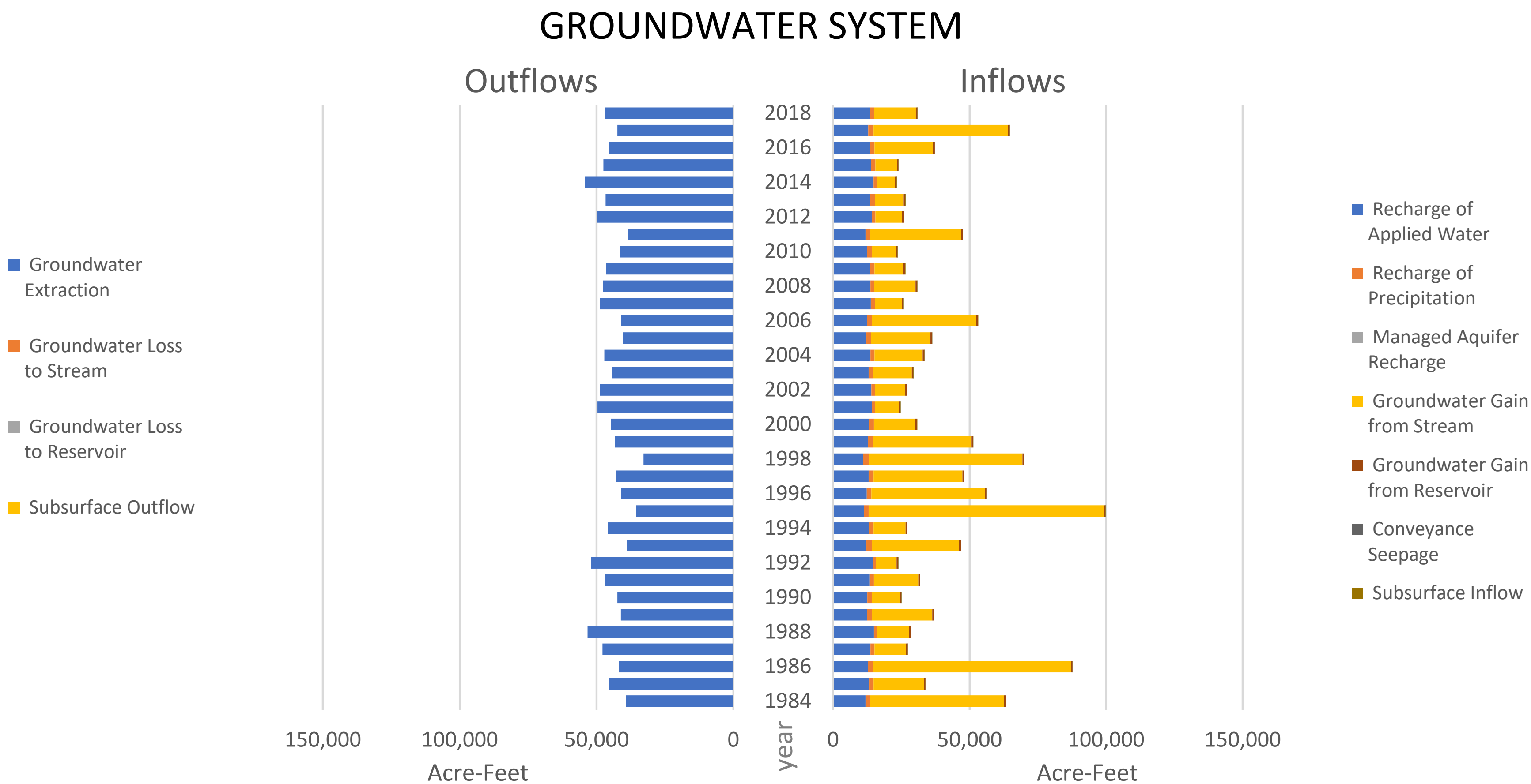
Future Water Budget



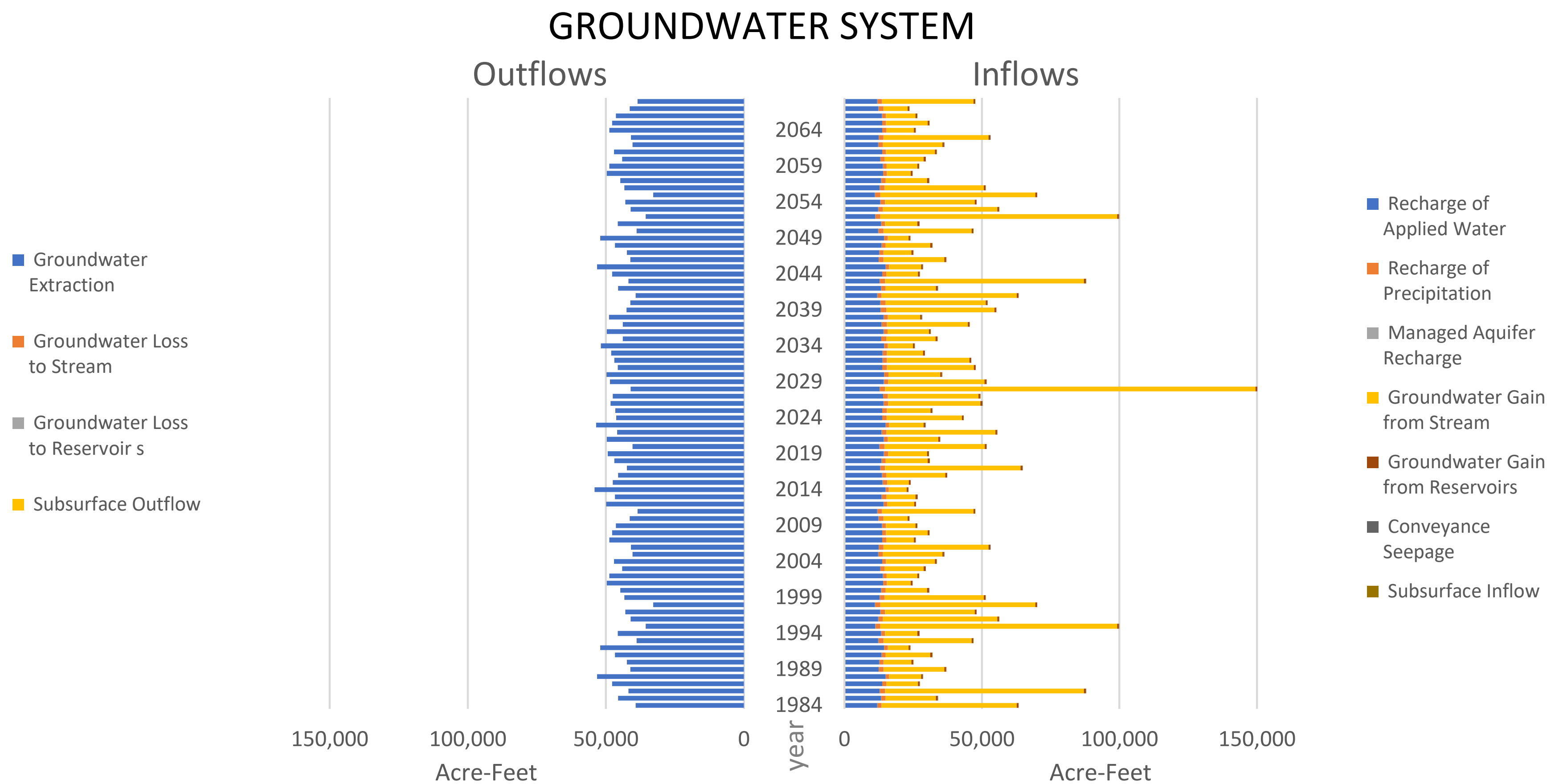
Future Water Budget With Climate Change



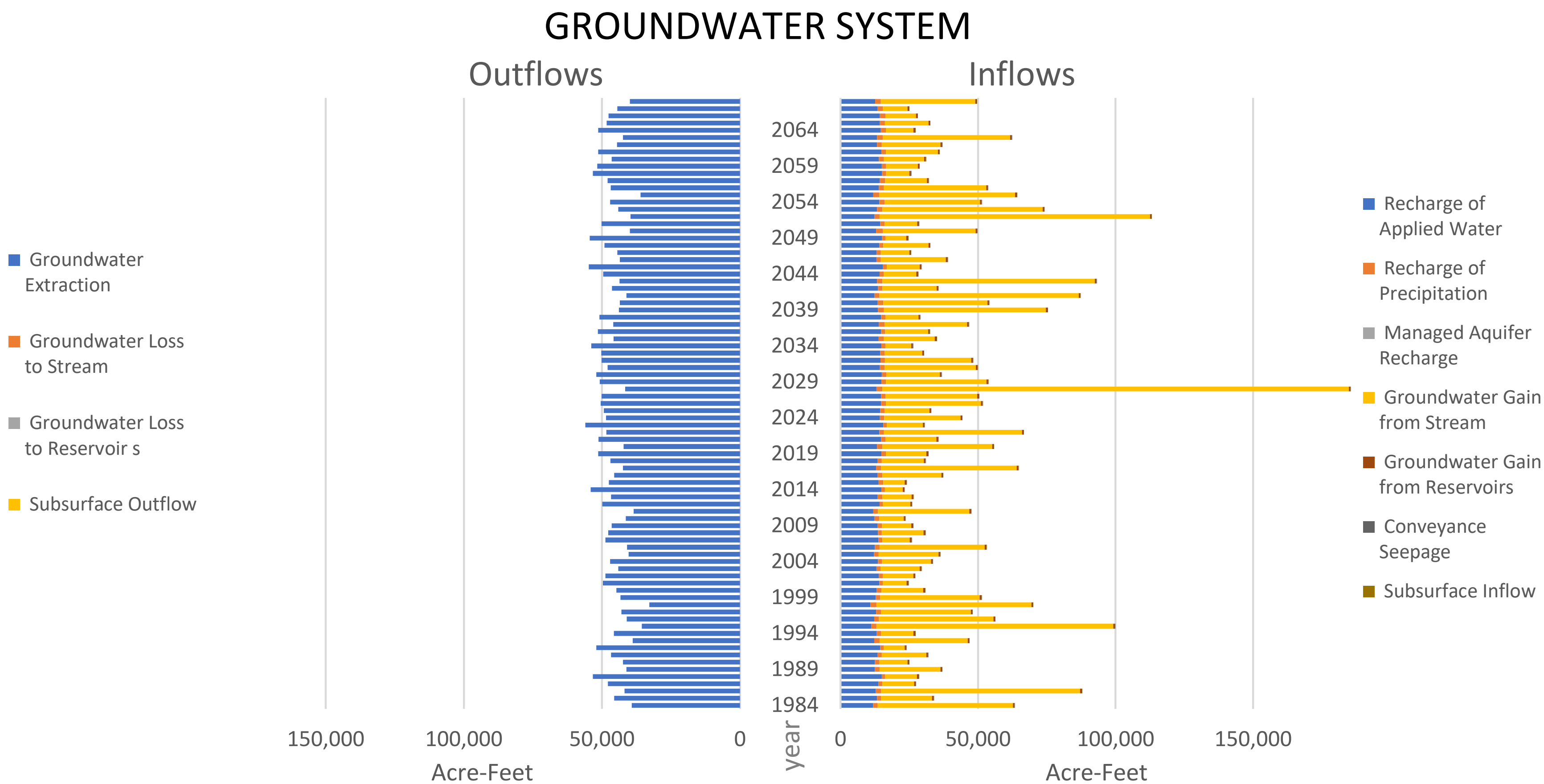
Historic Water Budget



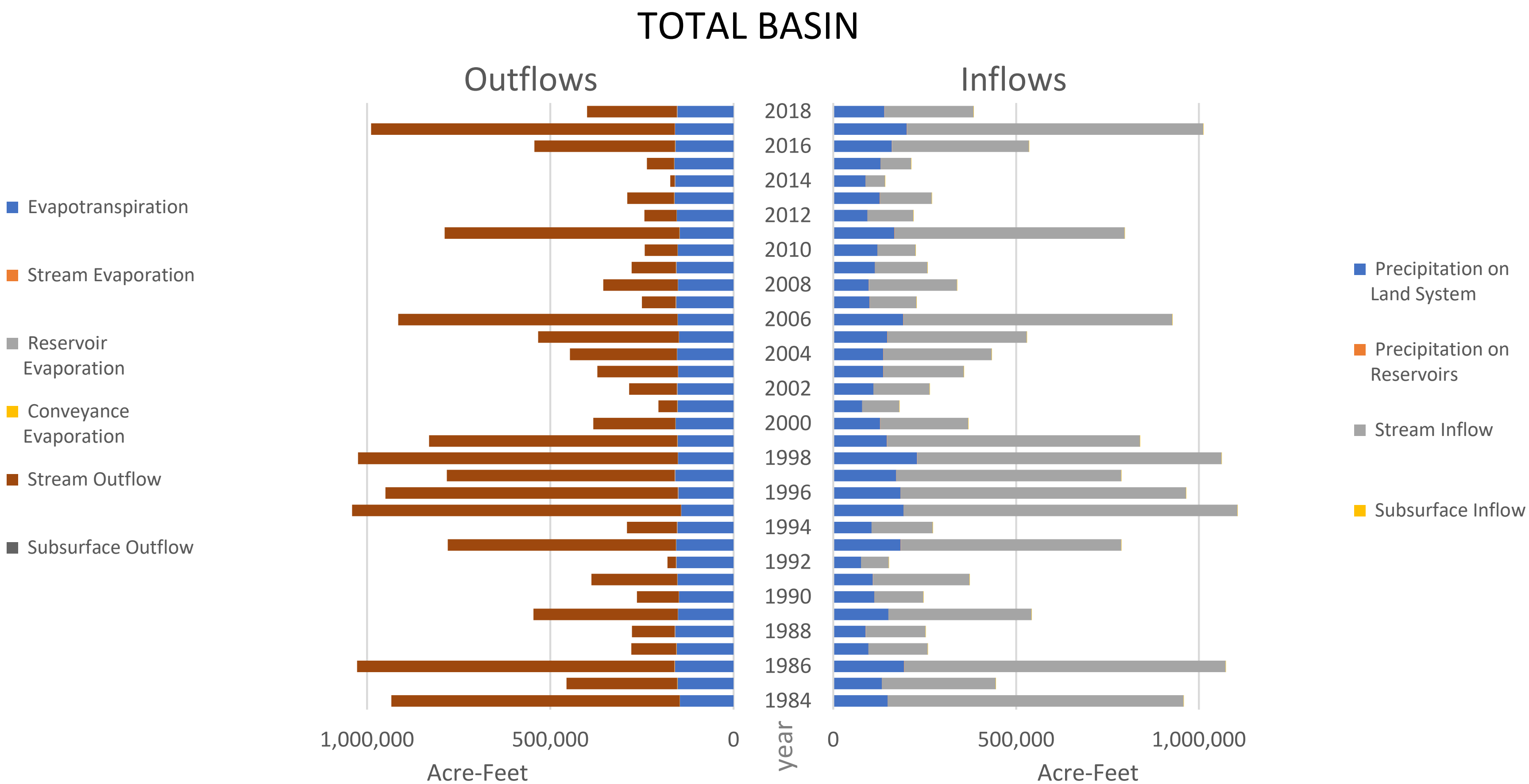
Future Water Budget



Future Water Budget With Climate Change

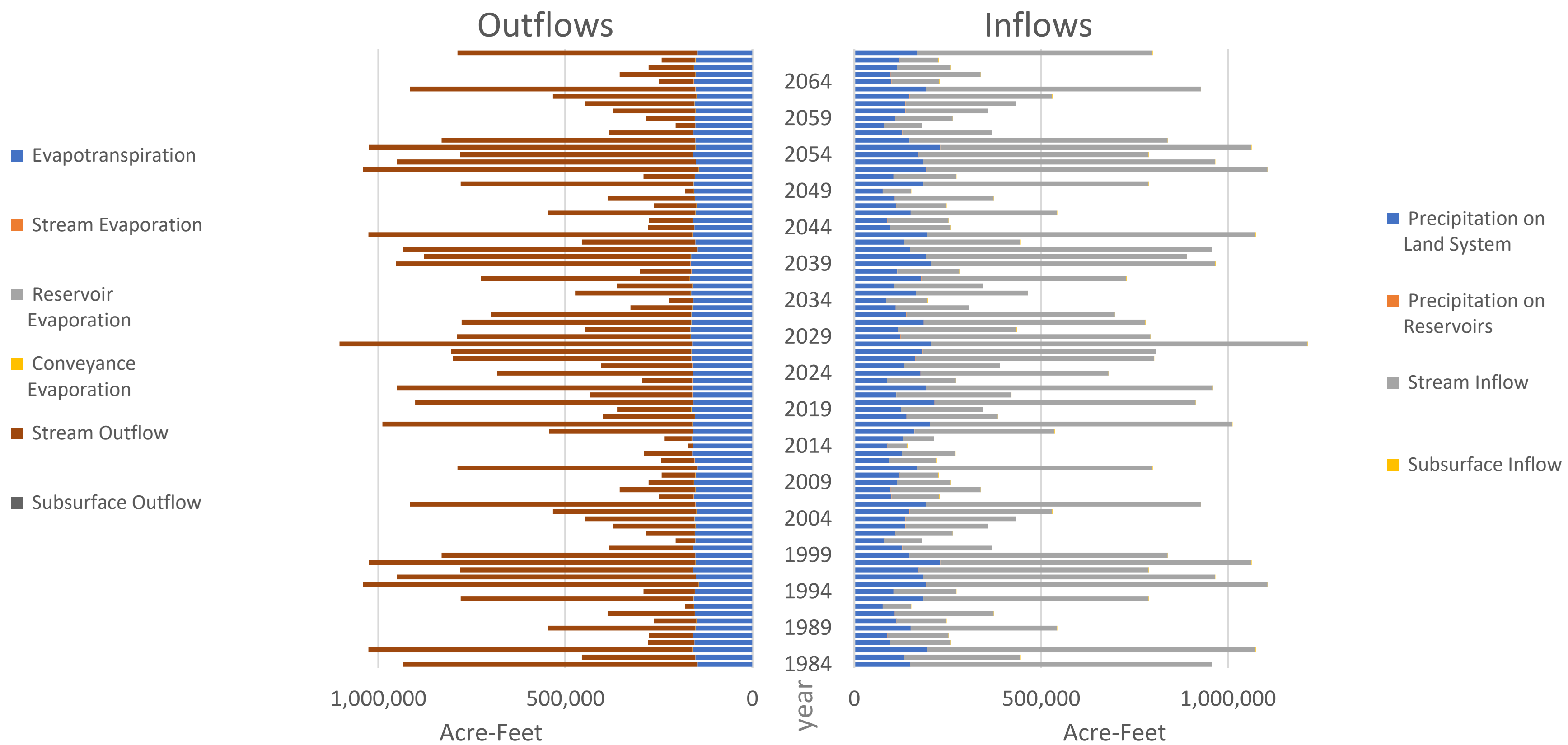


Historic Water Budget

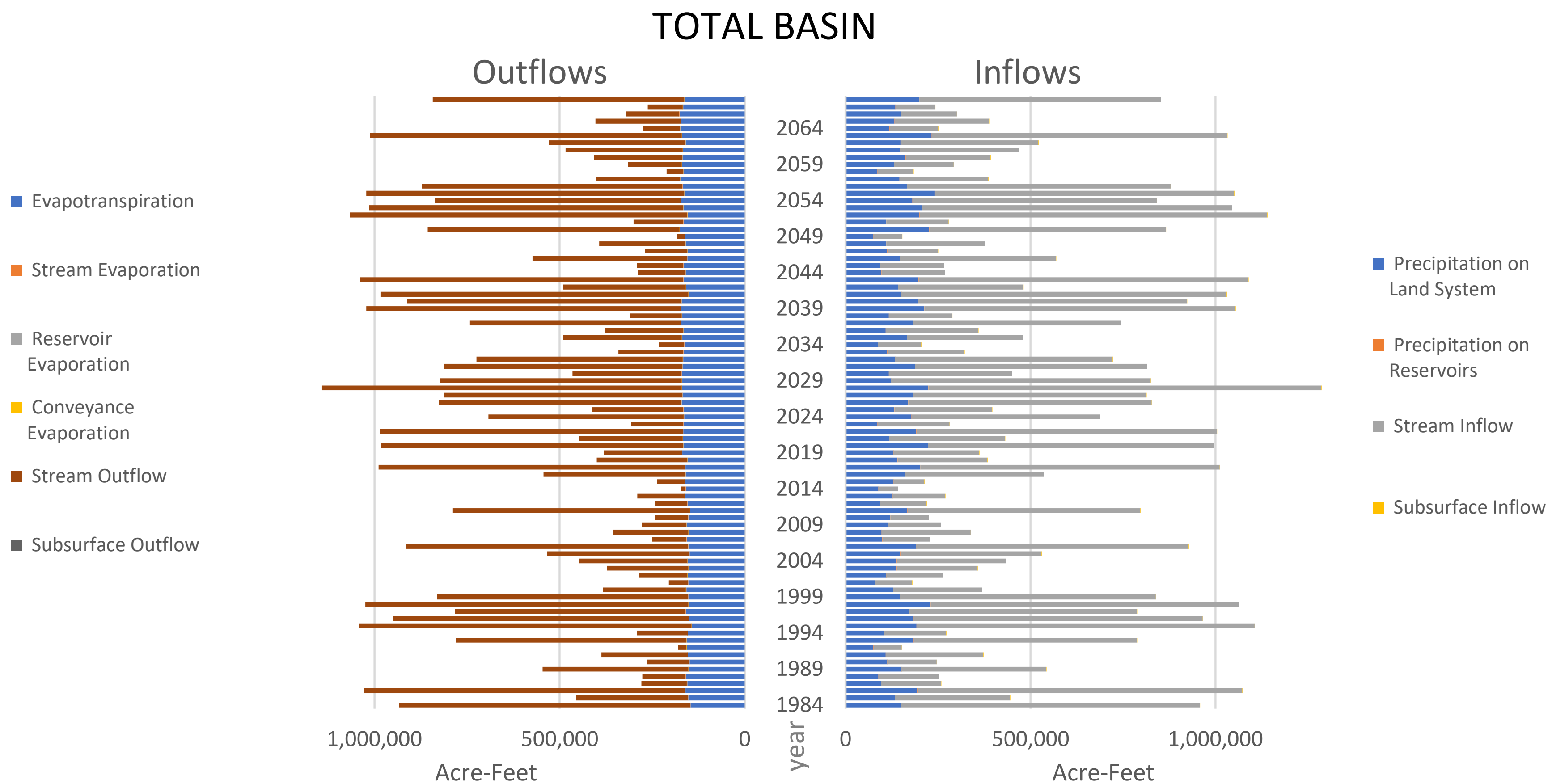


Future Water Budget

TOTAL BASIN



Future Water Budget With Climate Change



Appendix 7A Pumping Cost Calculations

Example of Typical Well Pumps And Capabilities

Horsepower	Gallons per minute	Pumping head or lift
50 HP	500 GPM	304’
75 HP	500 GPM	456’
		(152’ drop)
100 HP	1000 GPM	320’
150 HP	1000 GPM	480’
		(160’ drop)
144 HP	1500 GPM	328’
216 HP	1500 GPM	492’
		(164’ drop)

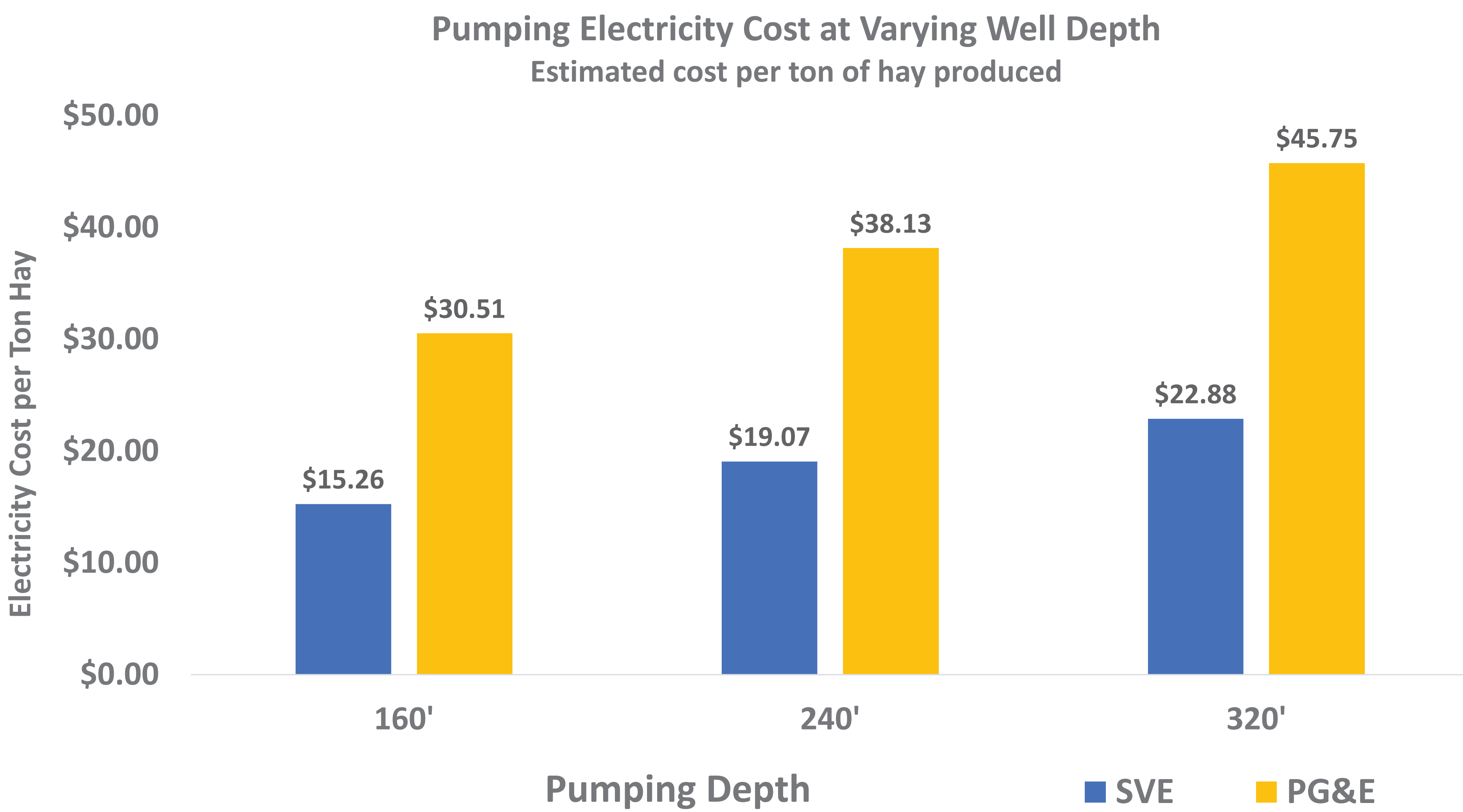
- For every 50 ft of drop in pumping level 16.66% increase in horsepower or cost. 150 ft drop = 50 HP increase in HP or cost

Surprise Valley Electric
Cost to Pump 2021

50 HP uses	41.45 kWh per hour so 41.45 X 24 =	994.80 kWh
75 HP uses	62.18 kWh per hour so 62.18 X 24 =	1492.32 kWh
100 HP uses	82.90 kWh per hour so 82.90 X 24 =	1989.6 kWh
125 HP uses	103.63 kWh per hour so 103.63 X24 =	2487.12 kWh
150 HP uses	124.35 kWh per hour so 124.36 X 24 =	2984.64 kWh
200 HP uses	165.80 kWh per hour so 165.80 X 24 =	3979.20 kWh

*Basic Charge for irrigation accounts is $2.67 per HP

	BASIC/MONTH	KWh/DAY	IRRIGATION RATE	DAILY COST
50 HP	$133.50	994.80	$.069	$68.64
75 HP	$200.25	1492.32	$.069	$102.97
100 HP	$267.00	1989.60	$.069	$137.28
125 HP	$333.75	2487.12	$.069	$171.61
150 HP	$400.50	2984.64	$.069	$205.94
200 HP	$534.00	3979.20	$.069	$274.56



Pumping Electricity Cost at Varying Well Depth
Estimated cost per ton of hay produced
$50.00
$40.00
$30.00
$20.00
$10.00
$0.00
Electricity Cost per Ton Hay
$15.26
$30.51
$19.07
$38.13
$22.88
$45.75
160'
240'
320'
Pumping Depth
SVE
PG&E

Appendix 8A Water Level Monitoring Well Details

Well Name	State Well Number	DWR Site Code	DWR Well Completion Report Number	Well Use	Ground Surface Elevation (feet msl)	Reference Point Elevation (feet msl)	Reference Point Description	Well Depth (feet bgs)	Open Hole	Screen[1] Interval (feet bgs)	Period of Record Start (water year)	Period of Record End (water year)	Highest Depth to Water (feet bgs)	Lowest Depth to Water (feet bgs)	Depth to Water Range (feet bgs)	Groundwater Elevation Range (feet msl)	Comments
01A1	39N07E01A001M	412539N1211050W001	14565	Stockwatering	4183.40	4184.40	Hole in plate at TOC.	300	yes	40 - 300	1979	2021	19.50	148.00	20 - 148	4164 - 4035	
03D1	38N08E03D001M	411647N1210358W001	16564	Irrigation	4163.40	4163.40	TOC below pump base, west side.	280	no	50 - 280	1982	2021	14.80	91.80	15 - 92	4149 - 4072	
06C1	37N08E06C001M	410777N1210986W001	14580	Irrigation	4133.40	4133.90	Hole in pump base on NW side.	400	yes	20 - 400	1982	2016	6.60	67.20	7 - 67	4127 - 4066	
08F1	38N09E08F001M	411493N1209656W001	49934	Other	4253.40	4255.40	Top of casing below welded plate.	217	yes	26 - 217	1979	2021	23.60	32.90	24 - 33	4230 - 4221	
12G1	38N07E12G001M	411467N1211110W001	--	Residential	4143.38	4144.38	None Provided	116	no	--	1979	1994	4.70	12.40	5 - 12	4139 - 4131	Measurements stopped in 1994
13K2	37N07E13K002M	410413N1211147W001	090029	Irrigation	4127.40	4127.90	Hole in pump base NE side; remove bolt.	260	yes	20 - 260	1982	2021	17.70	65.50	18 - 66	4110 - 4062	
16D1	38N08E16D001M	411359N1210625W001	090143	Irrigation	4171.40	4171.60	2" access tube, SW side.	491	yes	100 - 491	1982	2021	9.00	92.67	9 - 93	4162 - 4079	
17K1	38N08E17K001M	411320N1210766W001	218	Residential	4153.30	4154.30	TOC	180	yes	30 - 180	1957	2021	3.30	38.20	3 - 38	4150 - 4115	
18E1	38N09E18E001M	411356N1209900W001	138559	Irrigation	4248.40	4249.50	Hole in pumpbase, SE side.	520	yes	21 - 520	1981	2021	14.30	86.40	14 - 86	4234 - 4162	
18M1	38N09E18M001M	411305N1209896W001	138563	Irrigation	4288.40	4288.90	Under cap plate, southwest side.	525	yes	40 - 525	1981	2021	55.70	96.10	56 - 96	4233 - 4192	Located next to 18E1
18N2	39N08E18N002M	412144N1211013W001	127457	Residential	4163.40	4164.40	TOC	250	yes	40 - 250	1979	2021	3.20	26.80	3 - 27	4160 - 4137	Located next to BVMW-3
20B6	38N07E20B006M	411242N1211866W001	128135	Residential	4126.30	4127.30	TOC where rope goes in well.	183	yes	41 - 183	1979	2021	9.70	49.40	10 - 49	4117 - 4077	
21C1	39N08E21C001M	412086N1210574W001	127008	Irrigation	4161.40	4161.70	TOC; remove bolt from 3/8" hole in steel plate SE side	300	yes	30 - 300	1979	2021	12.90	79.30	13 - 79	4149 - 4082	
22G1	39N07E22G001M	412074N1211497W001	5322	Residential	4143.40	4144.40	TOC under plate -- SW side.	260	yes	115 - 260	1979	2021	6.70	38.20	7 - 38	4137 - 4105	In Lookout, outside basin
23E1	38N07E23E001M	411207N1211395W001	38108	Residential	4123.40	4123.40	TOC where rope goes in.	84	yes	28 - 84	1979	2021	14.30	53.00	14 - 53	4109 - 4070	In Bieber next to BVMW-5
24J2	38N07E24J002M	411228N1211054W001	--	Irrigation	4138.40	4139.40	Hole in pump base.	192	yes	1 - 192	1979	2021	0.70	81.70	1 - 82	4138 - 4057	
26E1	39N07E26E001M	411911N1211354W001	127484	Irrigation	4133.40	4135.00	Hole inside SE corner of pumpbase.	400	no	20 - 400	1979	2021	2.10	44.50	2 - 45	4131 - 4089	
28F1	39N09E28F001M	411907N1209447W001	--	Residential	4206.60	4207.10	None Provided	73	no	--	1982	2021	4.50	12.03	5 - 12	4202 - 4195	In Adin next to BVMW-1
32A2	38N07E32A002M	410950N1211839W001	--	Other	4118.80	4119.50	TOC	49	no	--	1959	2021	0.00	12.10	0 - 12	4119 - 4107	
32R1	39N09E32R001M	411649N1209569W001	--	Irrigation	4243.40	4243.60	Hole in pumpbase, south side.	--	no	--	1981	2021	37.90	82.20	38 - 82	4206 - 4161	
ACWA-1	38N08E07A001M	411508N1210900W001	0962825	Irrigation	4142.00	4142.75	Access port on NE side of wellhead.	780	no	60 - 780	2016	2021	15.65	102.85	16 - 103	4126 - 4039	
ACWA-2	39N08E33P002M	411699N1210579W001	484622	Irrigation	4153.00	4153.20	Access on SE side of well casing	800	no	50 - 800	2016	2021	13.65	26.60	14 - 27	4139 - 4126	
ACWA-3	39N08E28A001M	411938N1210478W001	0951365	Irrigation	4159.00	4159.83	Hole in pump base, remove plug. Same access as airline.	720	no	60 - 720	2016	2021	8.42	23.07	8 - 23	4151 - 4136	
BVMW 1-1	--	411880N1209599W001	2020-006214	Observation	4214.17	4213.84	Notch on PVC casing	265	no	175 - 265	2020	2021	29.66	52.66	30 - 53	4185 - 4162	
BVMW 1-2	--	411881N1209598W001	2020-006283	Observation	4214.54	4214.21	Notch on PVC casing	52	no	32 - 52	2020	2021	28.69	36.82	29 - 37	4186 - 4178	
BVMW 1-3	--	411878N1209593W001	2020-006285	Observation	4218.50	4218.17	Notch on PVC casing	50	no	30 - 50	2020	2021	32.69	40.84	33 - 41	4186 - 4178	
BVMW 1-4	--	411880N1209590W001	2020-006328	Observation	4218.39	4218.06	Notch on PVC casing	49	no	29 - 49	2020	2021	32.38	40.36	32 - 40	4186 - 4178	
BVMW 2-1	--	412119N1210286W001	2020-006667	Observation	4216.51	4216.18	Notch on PVC casing	250	no	210 - 250	2020	2021	21.66	22.33	22 - 22	4195 - 4194	
BVMW 2-2	--	412118N1210286W001	2020-006670	Observation	4216.77	4216.44	Notch on PVC casing	70	no	50 - 70	2020	2021	17.48	20.82	17 - 21	4199 - 4196	
BVMW 2-3	--	412110N1210287W001	2020-006674	Observation	4214.26	4213.93	Notch on PVC casing	70	no	50 - 70	2020	2021	31.30	34.73	31 - 35	4183 - 4180	
BVMW 2-4	--	412120N1210294W001	2020-006677	Observation	4209.95	4209.62	Notch on PVC casing	60	no	40 - 60	2020	2021	19.77	23.63	20 - 24	4190 - 4186	
BVMW 3-1	--	412169N1211050W001	2020-006592	Observation	4164.75	4164.41	Notch on PVC casing	185	no	135 - 185	2020	2021	14.86	18.34	15 - 18	4150 - 4146	
BVMW 3-2	--	412170N1211050W001	2020-006595	Observation	4164.92	4164.58	Notch on PVC casing	40	no	25 - 40	2020	2021	9.96	13.60	10 - 14	4155 - 4151	
BVMW 3-3	--	412157N1211051W001	2020-006593	Observation	4164.36	4164.02	Notch on PVC casing	50	no	25 - 50	2020	2021	5.70	8.56	6 - 9	4159 - 4156	
BVMW 3-4	--	412157N1211054W001	2020-006596	Observation	4165.31	4164.97	Notch on PVC casing	50	no	25 - 50	2020	2021	6.83	9.81	7 - 10	4158 - 4156	
BVMW 4-1	--	412029N1211587W001	2019-017359	Observation	4152.73	4152.40	Notch on PVC casing	425	no	385 - 415	2020	2021	37.43	64.75	37 - 65	4115 - 4088	
BVMW 4-2	--	412029N1211588W001	2019-017360	Observation	4153.06	4152.73	Notch on PVC casing	74	no	54 - 74	2020	2021	29.77	48.57	30 - 49	4123 - 4104	
BVMW 4-3	--	412030N1211579W001	2019-017361	Observation	4152.66	4152.33	Notch on PVC casing	80	no	60 - 80	2020	2021	29.68	48.96	30 - 49	4123 - 4104	
BVMW 4-4	--	412035N1211578W001	2019-017362	Observation	4161.65	4161.32	Notch on PVC casing	93	no	73 - 93	2020	2021	39.06	58.80	39 - 59	4123 - 4103	
BVMW 5-1	--	411219N1211339W001	2020-006658	Observation	4129.05	4129.05	Notch on PVC casing	540	no	485 - 535	2020	2021	40.35	46.65	40 - 47	4089 - 4082	
BVMW 5-2	--	411220N1211339W001	2020-006659	Observation	4128.92	4128.92	Notch on PVC casing	115	no	65 - 115	2020	2021	20.40	25.80	20 - 26	4109 - 4103	
BVMW 5-3	--	411212N1211366W001	2020-006661	Observation	4131.73	4131.73	Notch on PVC casing	85	no	65 - 85	2020	2021	34.86	45.02	35 - 45	4097 - 4087	
BVMW 5-4	--	411206N1211340W001	2020-006663	Observation	4130.23	4130.23	Notch on PVC casing	90	no	70 - 90	2020	2021	33.67	43.27	34 - 43	4097 - 4087	

Notes:

-- = information not available

feet bgs = feet below ground surface (depth to water)

feet msl = feet above mean sea level (groundwater elevation NAVD88)

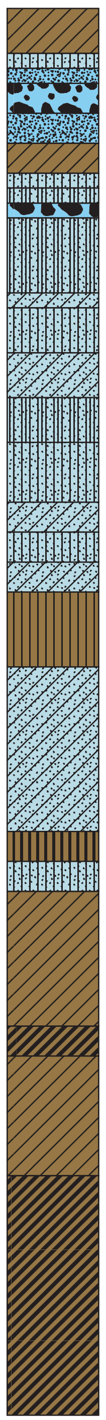
water year = October 1 to September 30

[1] For the purposes of this GSP, the terms "screen" or "perforation" encompases any interval that allows water to enter the well from the aquifer, including casing perforations, well screens, or open hole.

Appendix 8B New Monitoring Well As-Built Drawings

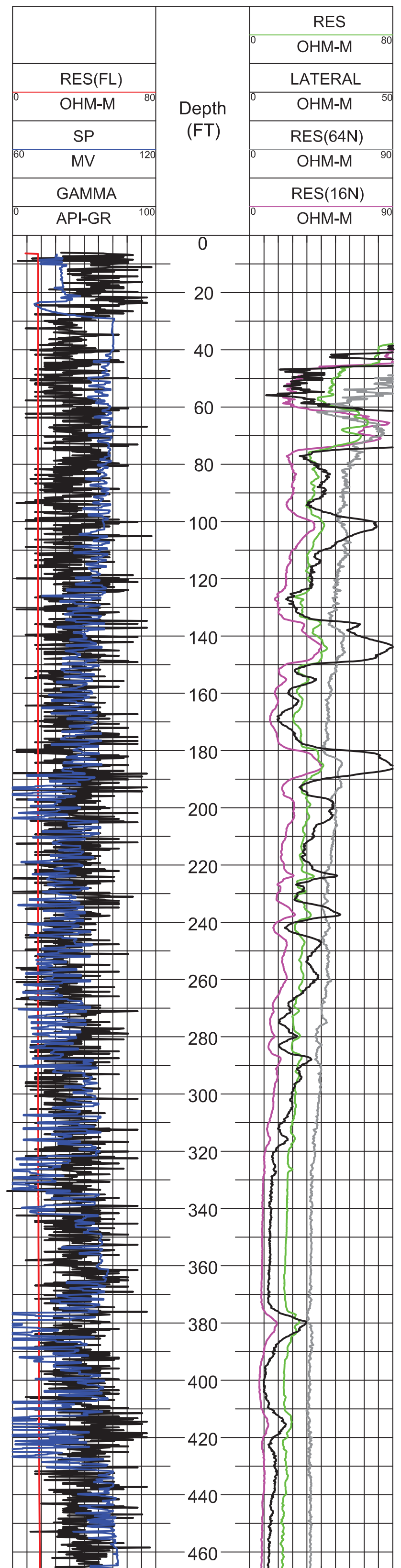
LITHOLOGIC LOG

Depth (FT) | DESCRIPTION



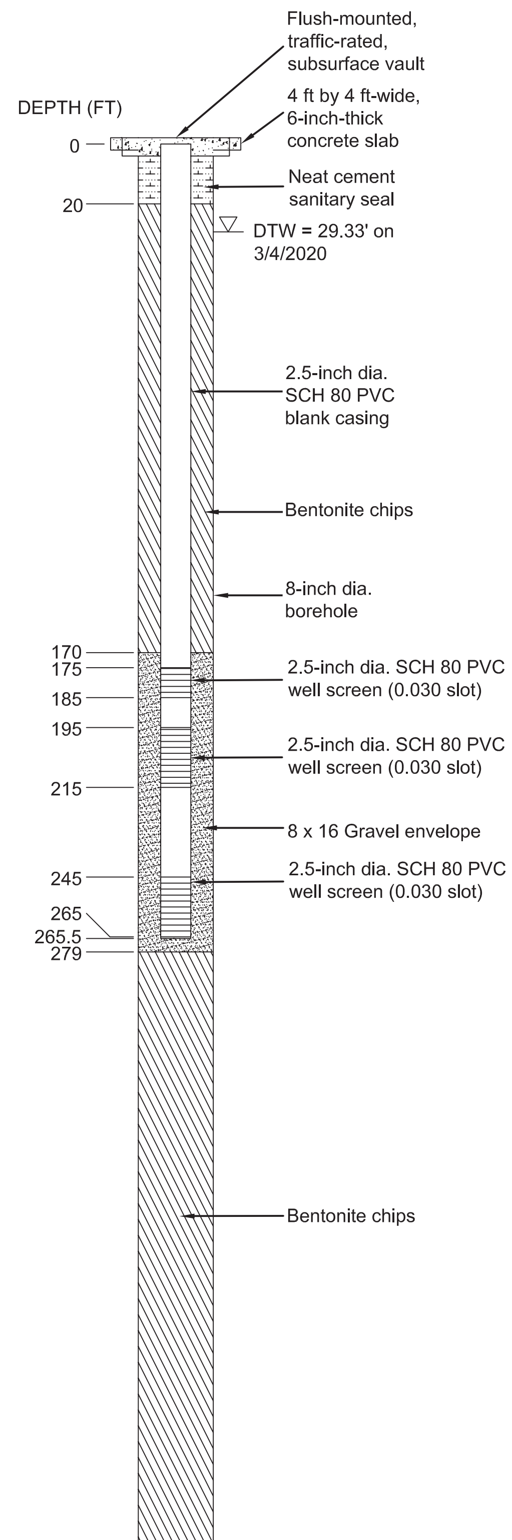
Depth (FT)	Description
0	Sandy Lean Clay (CL), dark yellowish brown
15	Silty Sand (SM)
20	Well Graded Sand (SW)
25	Well Graded Gravel (GW), very dark gray
35	Well Graded Sand with Gravel (SW), dark grayish brown
45	Sandy Lean Clay (CL), brown
55	Silty Sand (SM), brown
60	Poorly Graded Sand with Silt (SP-SM)
65	Well Graded Gravel with Sand (GW)
70	Poorly Graded Sand with Silt (SP-SM), fine to coarse grained sand, dark yellowish brown to dark grayish brown
95	Clayey Sand (SC), brown
100	Silty Sand (SM), dark yellowish brown and dark grayish brown
115	Clayey Sand (SC), dark grayish brown and brown
130	Poorly Graded Sand with Silt (SP-SM)
145	Silty Sand (SM), very dark gray and very dark grayish brown
165	Clayey Sand (SC), dark gray
175	Silty Sand (SM), dark gray
185	Clayey Sand (SC)vey dark grayish brown
195	Sandy Silt (ML), very dark grayish brown and very dark brown
220	Clayey Sand (SC), dark grayish brown
275	Elastic Silt (MH), very dark gray
285	Sandy Sily (SM), sand is fine
295	Sandy Lean Clay (CL), very dark gray, sand is fine grained
340	Fat Clay (CH), very dark graysih brown, high plasticity
350	Lean Clay (CL), very dark graysih brown
390	Fat Clay (CH), very dark graysih brown and very dark gray
470	

E-LOGS



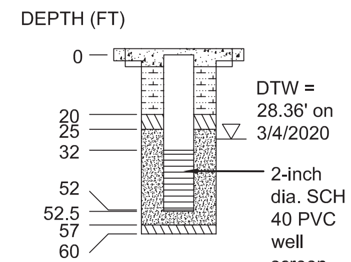
BVMW 1-1

Latitude (WGS84): 41.1880325
Longitude (WGS84): -120.9598526
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4213.84
Top of Well Vault: 4214.17



BVMW 1-2

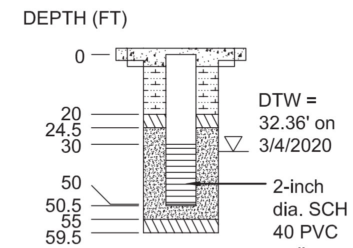
Latitude (WGS84): 41.1881034
Longitude (WGS84): -120.9597792
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4214.21
Top of Well Vault: 4214.54



Note: Well materials same as BVMW 1-1 unless otherwise noted

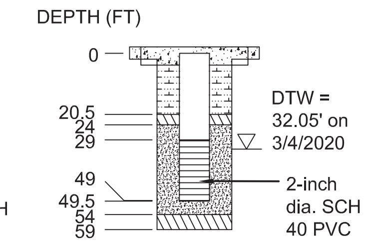
BVMW 1-3

Latitude (WGS84): 41.1877928
Longitude (WGS84): -120.9593371
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4218.17
Top of Well Vault: 4218.50

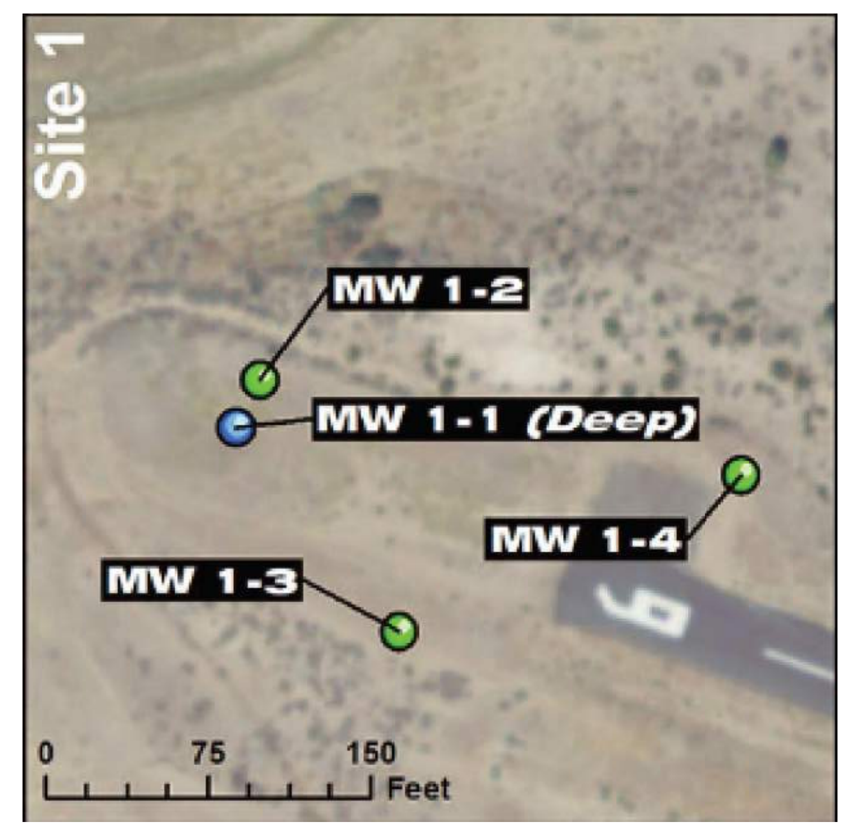


BVMW 1-4

Latitude (WGS84): 41.1880422
Longitude (WGS84): -120.9589947
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4218.06
Top of Well Vault: 4218.39



SITE MAP



NORTH CAL-NEVA RESOURCE CONSERVATION AND DEVELOPMENT COUNCIL

ON BEHALF OF:

COUNTY OF MODOC CALIFORNIA 18 74

FUNDED BY:

DEPARTMENT OF WATER RESOURCES STATE OF CALIFORNIA

PROJECT ENGINEER:

GEI Consultants
2868 PROSPECT PARK DRIVE
SUITE 400
RANCHO CORDOVA, CA 95670
(916)631-4500

DESIGNED: D. Fairman	CHECKED: J. Zumbro
DRAWN: F. Olson / V. Yap	REVIEWED: D. Fairman

PROFESSIONAL GEOLOGIST DAVID FAIRMAN No. 9025 STATE OF CALIFORNIA

Date: 4/13/2021

Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Nov-Dec 2019

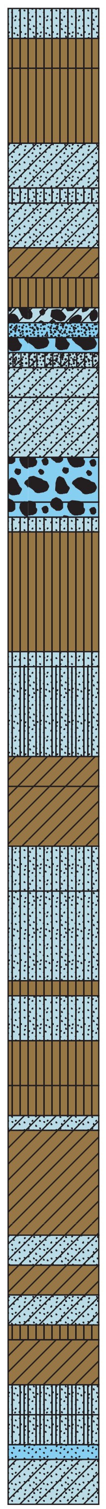
BIG VALLEY GROUNDWATER BASIN

AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 1 ADIN AIRPORT

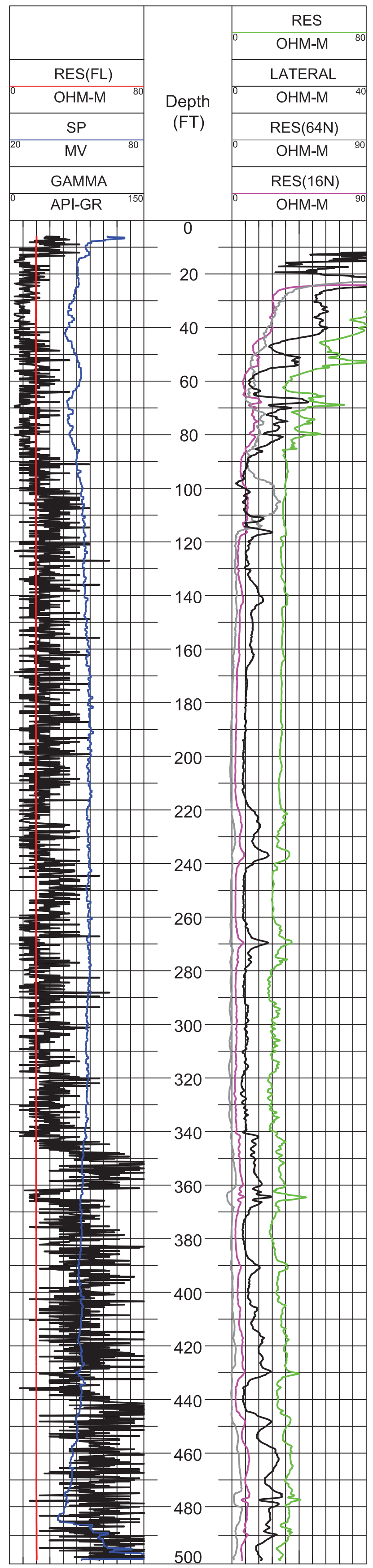
DRAWING 1

LITHOLOGIC LOG

Depth (FT)	DESCRIPTION
0	Silty Sand, (SM) dark reddish brown
10	Silt and Silt with Sand, (ML) dark reddish brown
20	Silt, (ML) dark grayish brown
45	Clayey Sand and Lean Clay, (SC) dark yellowish brown
60	Silty Sand, (SM) cemented, finely bedded
65	Clayey Sand, (SC) dark brown, cemented, finely bedded
80	Sandy Lean Clay, (CL) dark gray and black
90	Silt with Sand, (ML) dark gray
100	Clayey Gravel (GC)
105	Well Graded Sand, (SW) greenish gray
110	Well Graded Gravel with Sand (GW)
115	Well Graded Sand with Gravel (SW-SC)
120	Silt with Gravel, (SC) dark brown
130	Clayey Sand, (SC) dark grayish brown
150	Well graded Sand with Gravel, (GW) dark grayish brown
165	Well graded Gravel with Sand, (GW) dark grayish brown
170	Silty Sand, (SM) dark grayish brown
175	Silt and Sandy Silt Interbedded, (ML) very dark grayish brown and dark brown
215	Silty Sand, (SM) dark brown
220	Poorly Graded Sand with Silt, (SP-SM) varicolored: dark gray, black, reddish brown
250	Sandy Lean Clay, (CL) dark gray
260	Lean Clay and Sandy Lean Clay, (CL) cemented, finely bedded, dark gray
280	Silty Sand, (SM) locally cemented and finely bedded
295	Silty Sand, (SM) gray to light gray, locally cemented, fine to coarse grained
325	Silt,(ML) grayish brown
330	Silty Sand, (SM) very dark grayish brown, locally cemented
345	Silt and silt with sand, (ML) light brownish gray
360	Sandy Silt, (ML) dark gray and dark brown
370	Clayey Sand, (SC) dark gray, fine to coarse grained
375	Lean Clay and Lean Clay with Sand (CL)
410	Clayey Sand, (SC) fine to coarse
420	Lean Clay with Sand, (CL) sand is fine to coarse
430	Clayey Sand, (SC) fine to coarse grained
440	Silt, (ML) dark greenish gray
445	Lean Clay and Sandy Lean Clay, (CL) dark greenish gray
460	Poorly Graded Sand with Silt, (SP-SM) black to dark gray
470	Poorly Graded Sand with Silt, (SP-SM) black and gray, abundant quartz grains
480	Poorly graded sand, (SP) white, fine coarse grained
485	Clayey Sand, (SC) black and light gray
500	

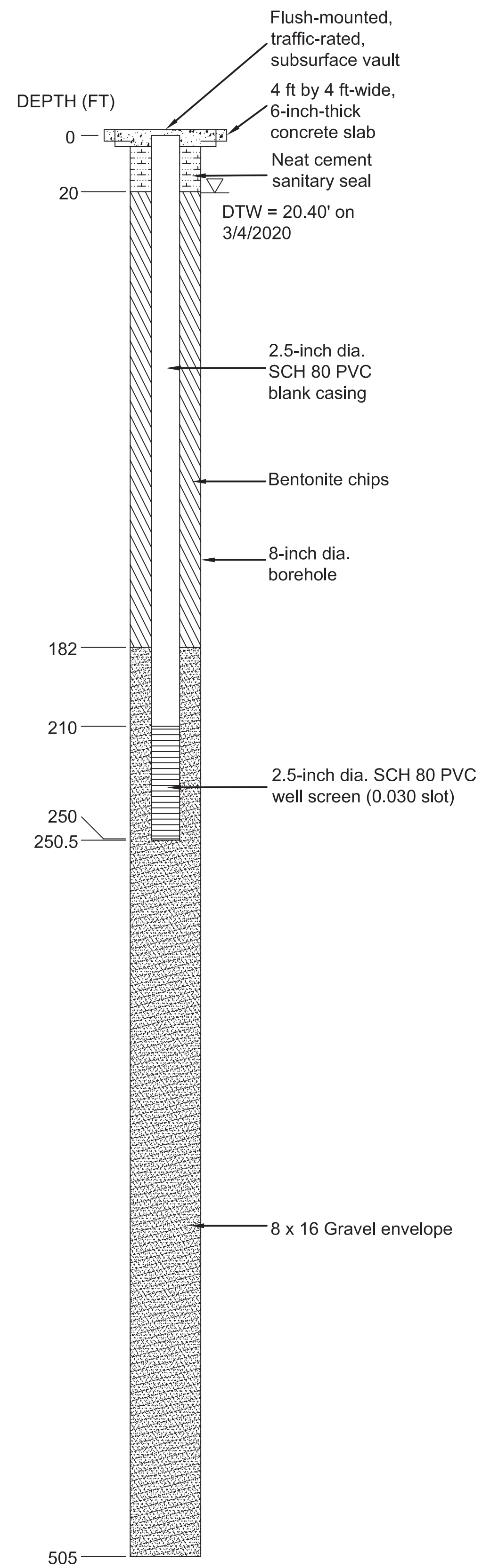


E-LOGS



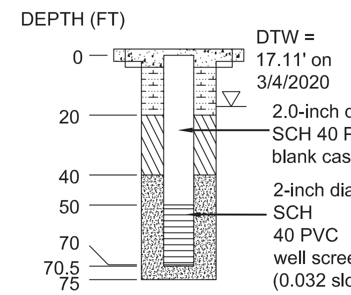
BVMW 2-1

Latitude (WGS84): 41.2118591
Longitude (WGS84): -121.0286214
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4216.18
Top of Well Vault: 4216.51



BVMW 2-2

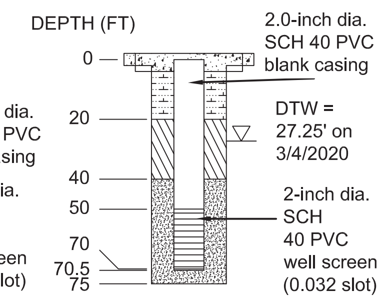
Latitude (WGS84): 41.2118382
Longitude (WGS84): -121.0285515
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4216.44
Top of Well Vault: 4216.77



Note: Well materials same as BVMW 2-1 unless otherwise noted

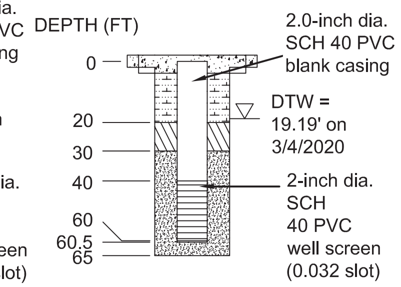
BVMW 2-3

Latitude (WGS84): 41.2109506
Longitude (WGS84): -121.0286823
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4213.93
Top of Well Vault: 4214.26

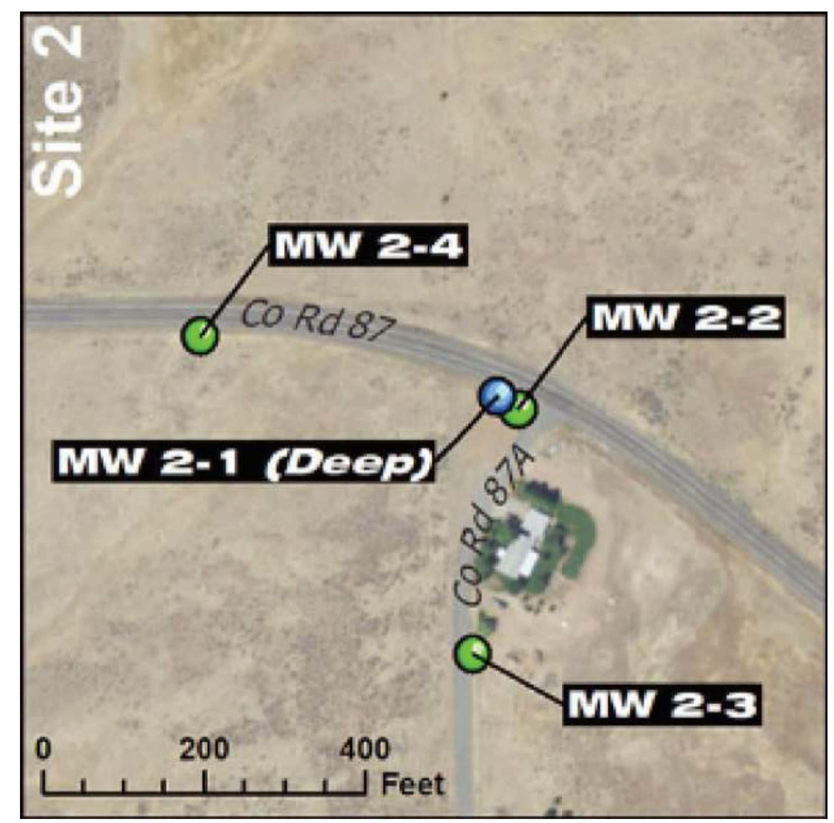


BVMW 2-4

Latitude (WGS84): 41.2119971
Longitude (WGS84): -121.0293786
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4209.62
Top of Well Vault: 4209.95



SITE MAP



NORTH CAL-NEVA RESOURCE CONSERVATION AND DEVELOPMENT COUNCIL

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FUNDED BY:

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PROJECT ENGINEER:

GEI Consultants
2868 PROSPECT PARK DRIVE
SUITE 400
RANCHO CORDOVA, CA 95670
(916)631-4500

DESIGNED: D. Fairman	CHECKED: J. Zumbro
DRAWN: F. Olson / V. Yap	REVIEWED: D. Fairman

PROFESSIONAL GEOLOGIST DAVID FAIRMAN No. 9025 STATE OF CALIFORNIA

Date: 4/13/2021

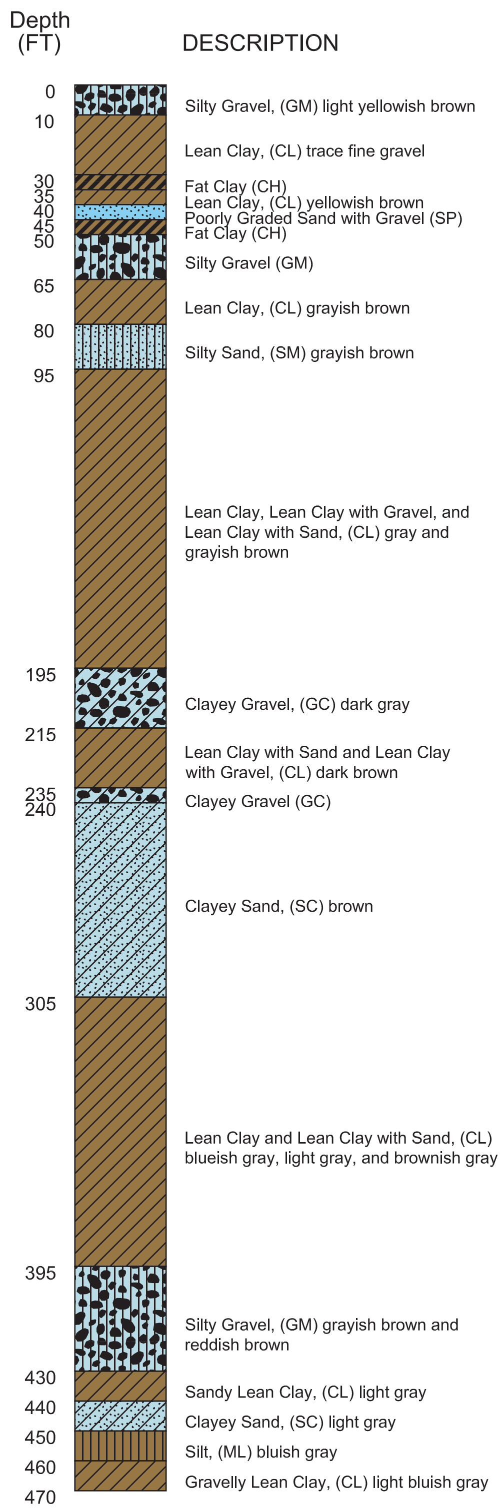
Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Feb 2020

BIG VALLEY GROUNDWATER BASIN

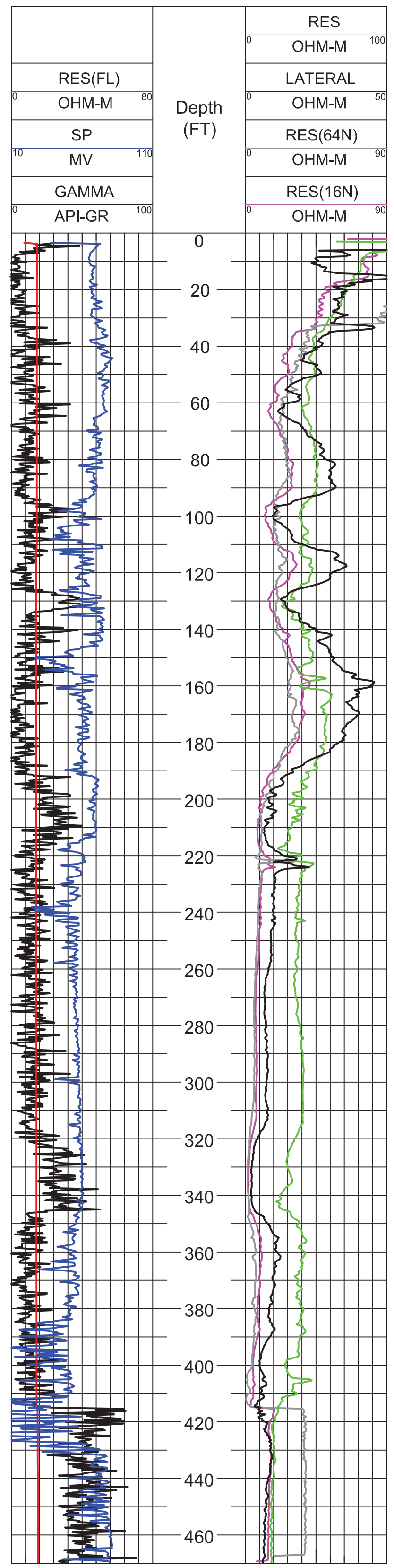
AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 2 ROADS 87 & 87A

DRAWING 2

LITHOLOGIC LOG

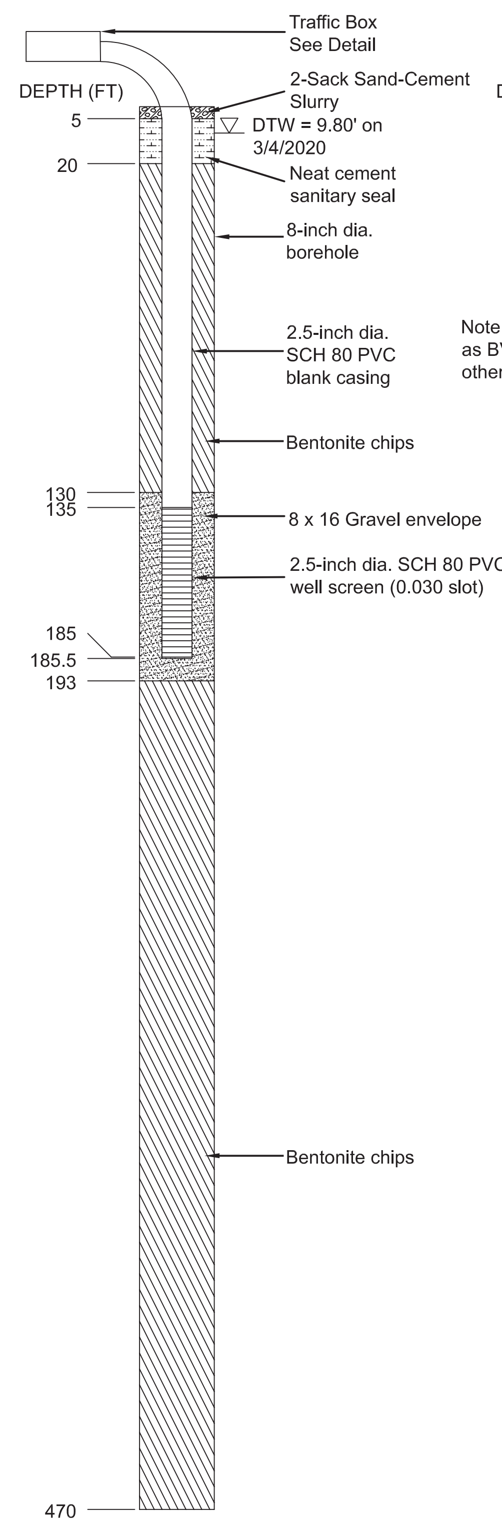


E-LOGS



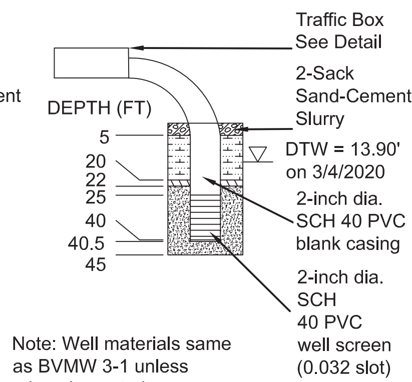
BVMW 3-1

Latitude (WGS84): 41.2169400
Longitude (WGS84): -121.1049557
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.41
Corrected Reference Pt.: 4167.41
Top of Well Vault: 4164.75



BVMW 3-2

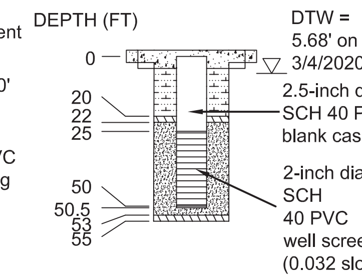
Latitude (WGS84): 41.2170083
Longitude (WGS84): -121.1049570
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.58
Corrected Reference Pt.: 4167.58
Top of Well Vault: 4164.92



Note: Well materials same as BVMW 3-1 unless otherwise noted

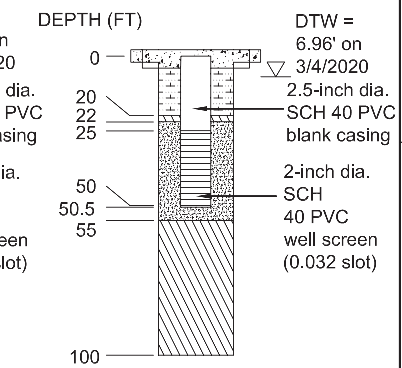
BVMW 3-3

Latitude (WGS84): 41.2157185
Longitude (WGS84): -121.1050902
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.02
Top of Well Vault: 4164.36

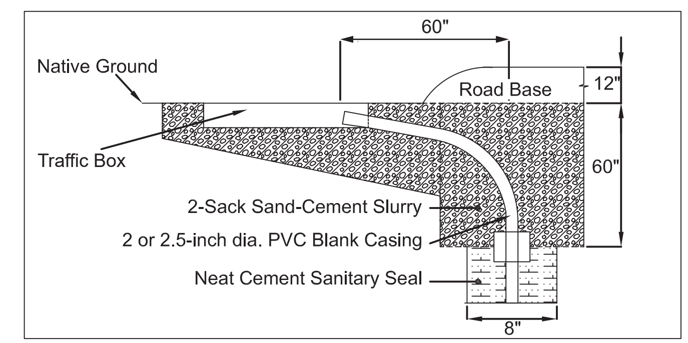


BVMW 3-4

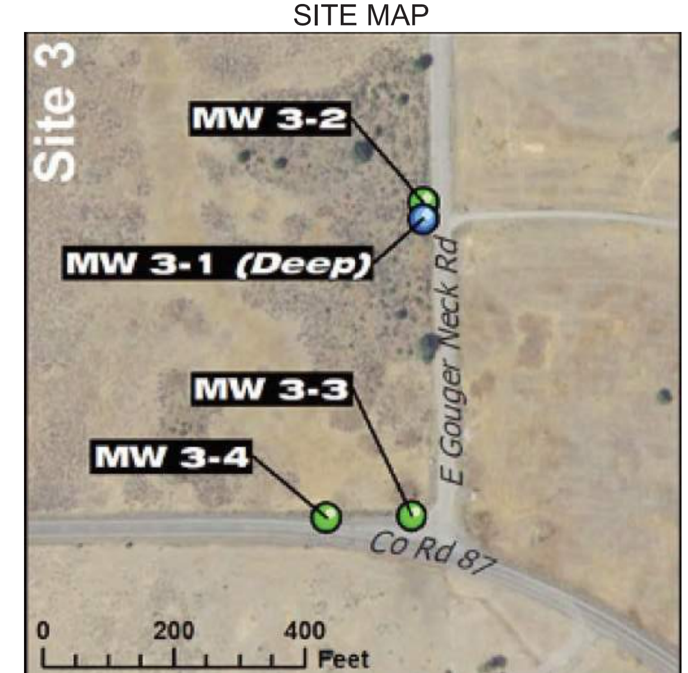
Latitude (WGS84): 41.2157230
Longitude (WGS84): -121.1054095
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.97
Top of Well Vault: 4165.31



Traffic Box Detail



SITE MAP



**Corrected reference point elevation should be used for water level measurements and accounts for horizontal offset and curvature of casing.*

NORTH CAL-NEVA RESOURCE CONSERVATION AND DEVELOPMENT COUNCIL

ON BEHALF OF:

FUNDED BY:

PROJECT ENGINEER:

GEI Consultants
2868 PROSPECT PARK DRIVE
SUITE 400
RANCHO CORDOVA, CA 95670
(916)631-4500

DESIGNED: D. Fairman	CHECKED: J. Zumbro
DRAWN: F. Olson / V. Yap	REVIEWED: D. Fairman

PROFESSIONAL GEOLOGIST
DAVID FAIRMAN
No. 9025
STATE OF CALIFORNIA

Date: 4/13/2021

Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Jan-Feb 2020

BIG VALLEY GROUNDWATER BASIN

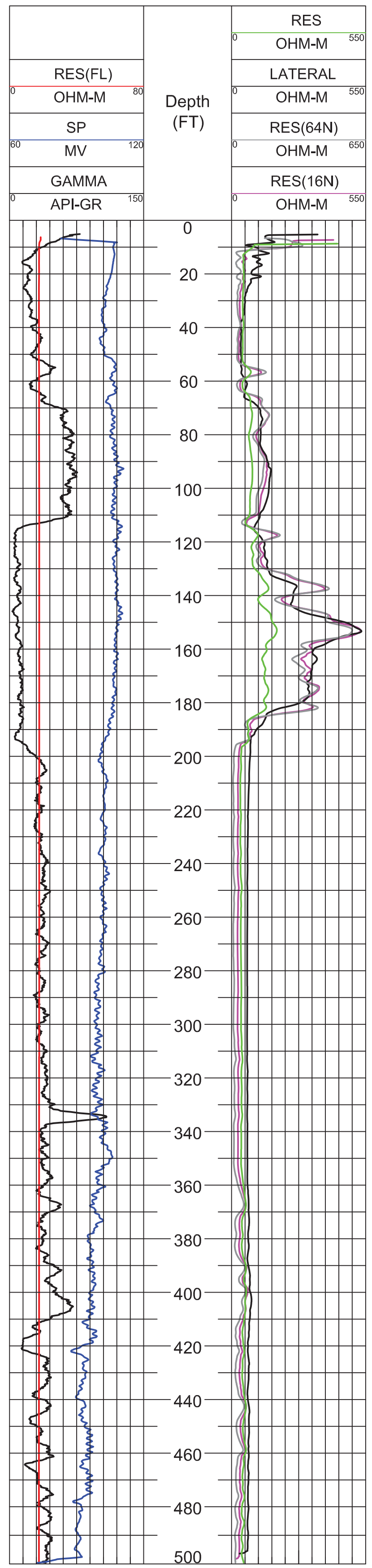
AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 3 ROADS 87 & 90

DRAWING 3

LITHOLOGIC LOG

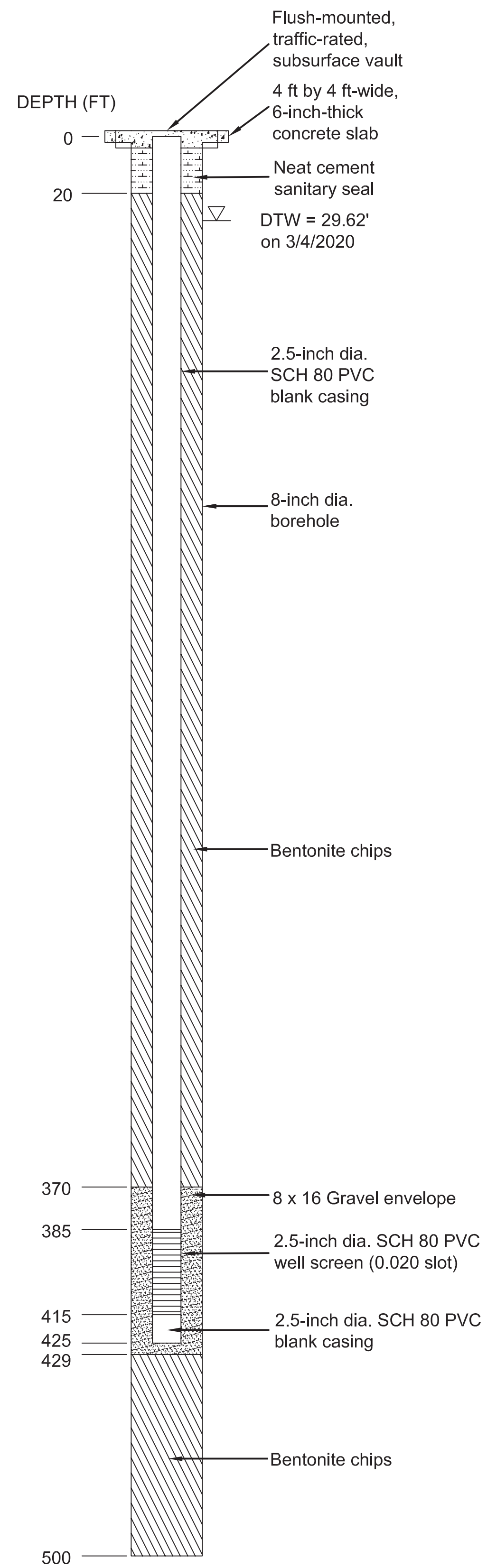
Depth (FT)	DESCRIPTION
0	Poorly Graded Sand with Gravel (SP)
10	Lean Clay, (CL) brown and dark grayish brown
20	Fat Clay, (CH) black
30	Lean Clay, (CL) black, light brownish gray, light yellowish brown
50	Silt, (ML) light yellowish brown
55	Poorly Graded Sand (SP)
60	Lean Clay, (CL) dark yellowish brown
65	Poorly Graded Sand with Gravel (SP)
70	Clayey Gravel, (GC) pinkish gray
75	Lean Clay, (CL) grayish brown
80	Silty Sand, (SM) grayish brown
85	Volcanic ash, white, quartz and glass-rich, trace basalt fragments
106	Interbedded Sand and Gravel, (SP), (GP), and (GC), angular Gravel up to 1"
114	Basalt, black, with quartz phenocrysts, trace olivine
179	Basalt layers with interbedded, baked blue clay and white diatomite
193	Silty Sand, (SM) grayish brown, fine to coarse grained
205	Lean Clay, (CL) very dark graysih brown, dark gray, and gray
310	Fat Clay, (CH) dark and very dark greenish gray and greenish black
355	Clayey Sand, (SC) dark greenish gray
360	Well Graded Sand with Gravel, (SW) black
365	Clayey Sand, (SC) black
375	Lean clay to Lean Clay with Sand, (CL) very dark gray
385	Poorly Graded Sand with Gravel, (SP) gray, gravel is fine, rounded
412	Organic Silt, (OH) oily texture, dark olive brown, black, with some interbedded dark gray Clayey Sand
445	Clayey Sand, (SC) dark gray
450	Fat Clay, (CH) very dark gray
460	Lean Clay with Sand, (CL) very dark gray
495	Fat Clay, (CH) dark greenish gray
500	

E-LOGS



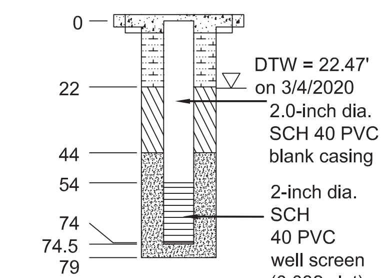
BVMW 4-1

Latitude (WGS84): 41.2029277
Longitude (WGS84): -121.1586996
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4152.40
Top of Well Vault: 4152.73



BVMW 4-2

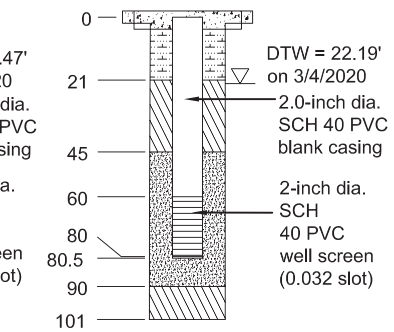
Latitude (WGS84): 41.2029353
Longitude (WGS84): -121.1587904
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4152.73
Top of Well Vault: 4153.06



Note: Well materials same as BVMW 4-1 unless otherwise noted

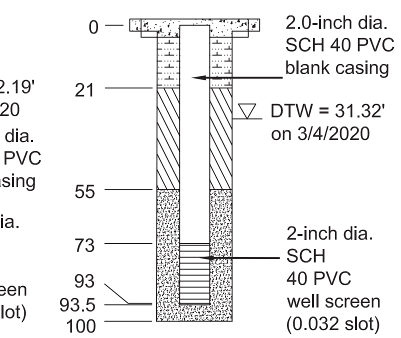
BVMW 4-3

Latitude (WGS84): 41.2029911
Longitude (WGS84): -121.1578593
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4152.33
Top of Well Vault: 4152.66

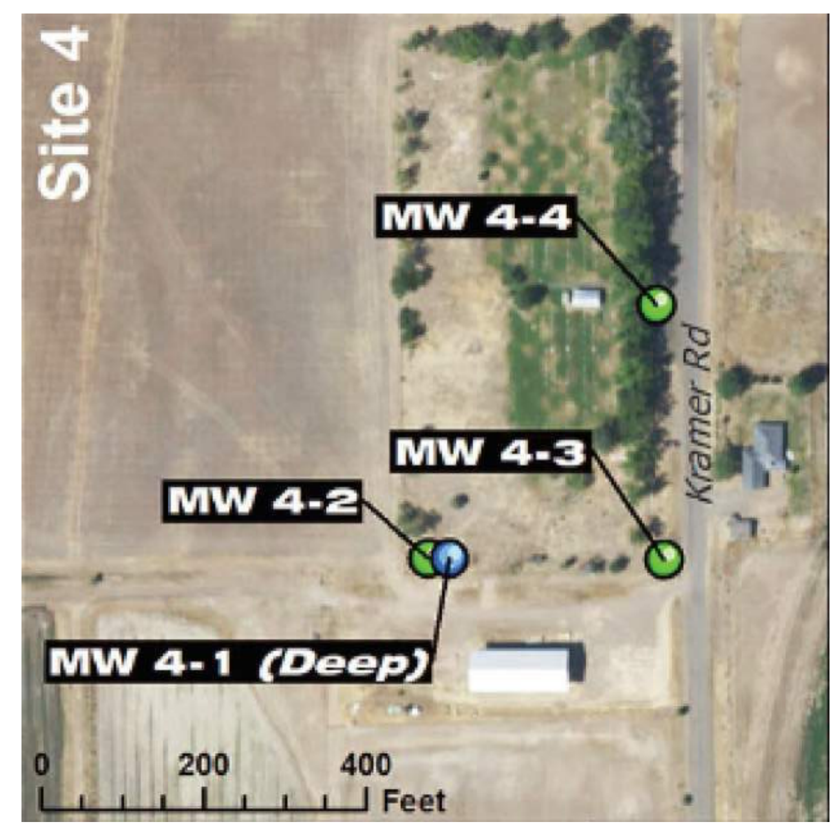


BVMW 4-4

Latitude (WGS84): 41.2035397
Longitude (WGS84): -121.1578433
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4161.32
Top of Well Vault: 4161.65



SITE MAP



NORTH CAL-NEVA RESOURCE CONSERVATION AND DEVELOPMENT COUNCIL

ON BEHALF OF:

COUNTY OF MODOC CALIFORNIA 18 74

FUNDED BY:

DEPARTMENT OF WATER RESOURCES STATE OF CALIFORNIA

PROJECT ENGINEER:

GEI Consultants
2868 PROSPECT PARK DRIVE
SUITE 400
RANCHO CORDOVA, CA 95670
(916)631-4500

DESIGNED: D. Fairman	CHECKED: J. Zumbro
DRAWN: F. Olson / V. Yap	REVIEWED: D. Fairman

PROFESSIONAL GEOLOGIST DAVID FAIRMAN No. 9025 STATE OF CALIFORNIA

Date: 4/13/2021

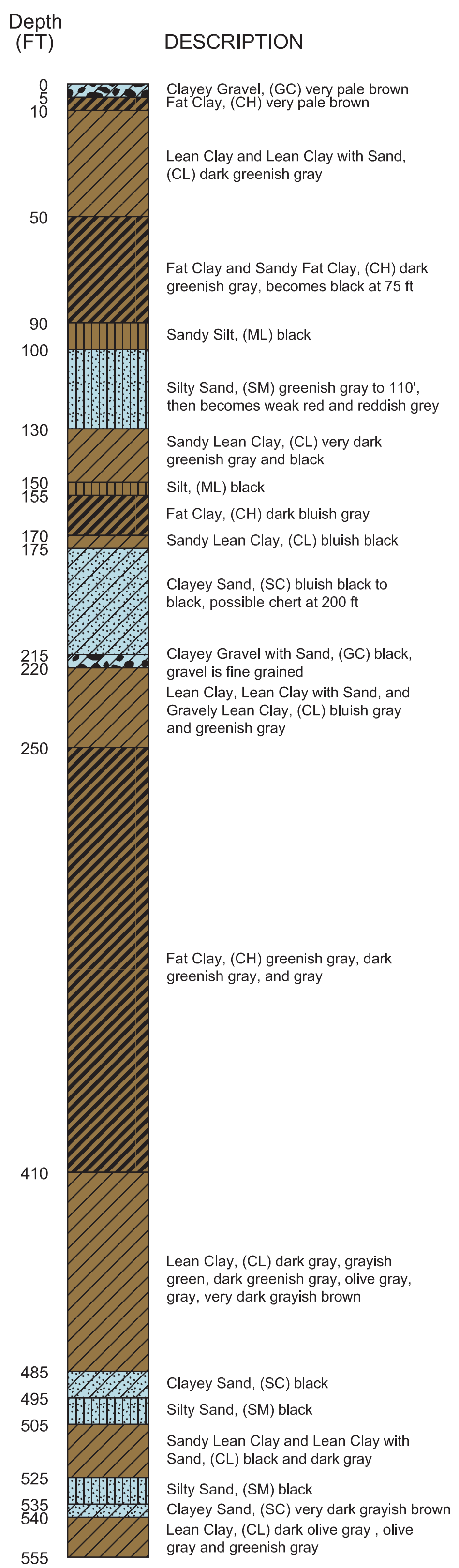
Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Nov 2019

BIG VALLEY GROUNDWATER BASIN

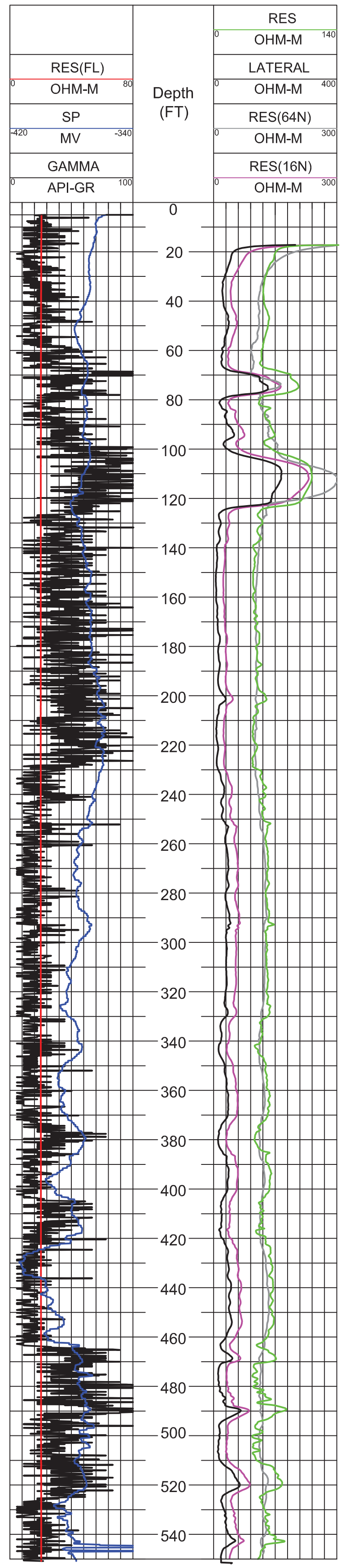
AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 4 LOOKOUT CEMETERY

DRAWING 4

LITHOLOGIC LOG

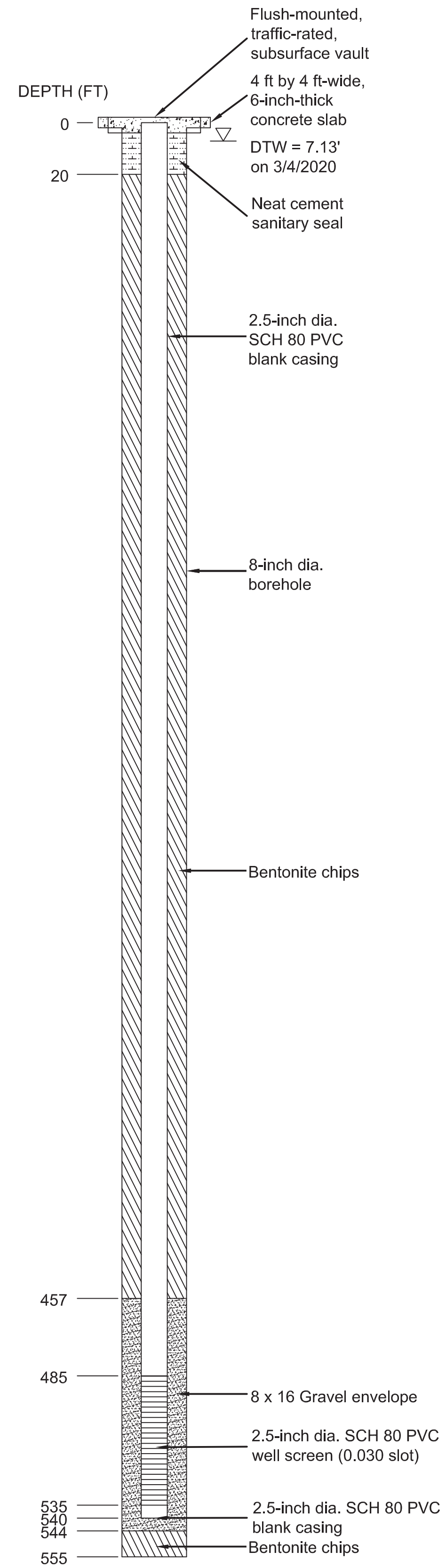


E-LOGS



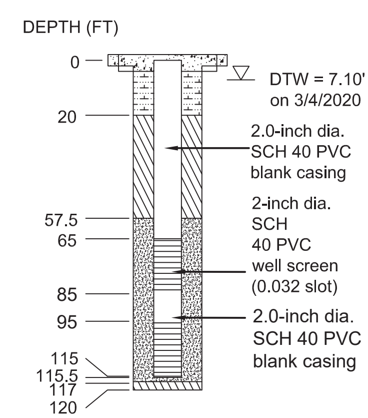
BVMW 5-1

Latitude (WGS84): 41.1218808
Longitude (WGS84): -121.1338666
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4128.72
Top of Well Vault: 4129.05



BVMW 5-2

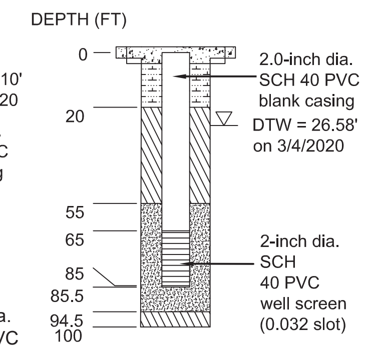
Latitude (WGS84): 41.1219508
Longitude (WGS84): -121.1338622
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4128.59
Top of Well Vault: 4128.92



Note: Well materials same as BVMW 5-1 unless otherwise noted

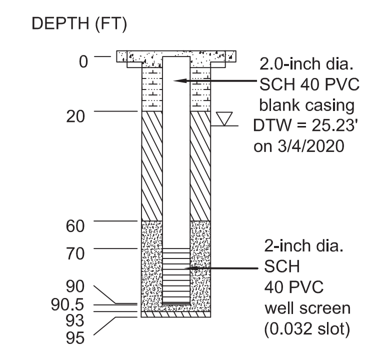
BVMW 5-3

Latitude (WGS84): 41.1211843
Longitude (WGS84): -121.1366445
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4131.40
Top of Well Vault: 4131.73

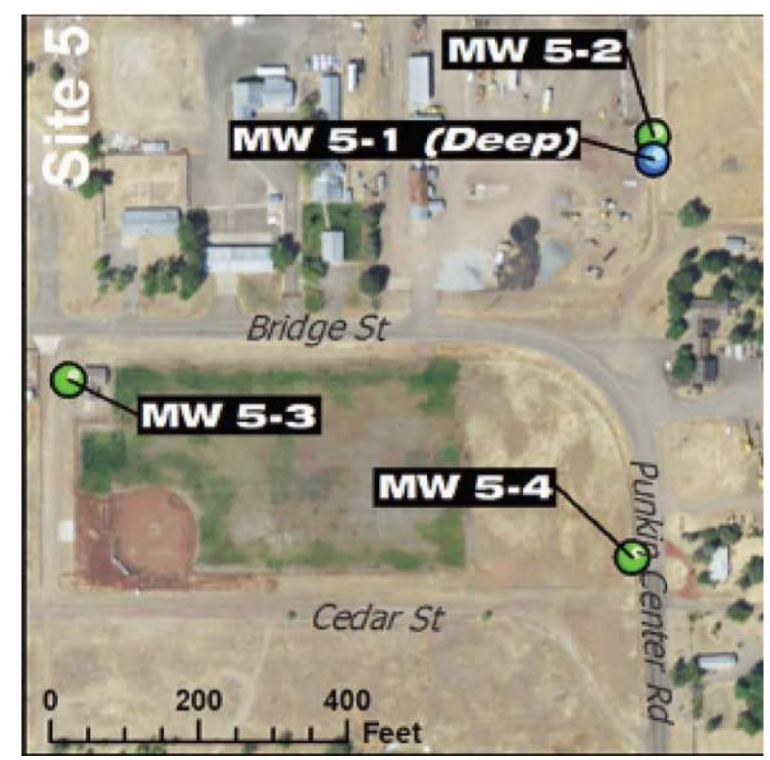


BVMW 5-4

Latitude (WGS84): 41.1205603
Longitude (WGS84): -121.1339942
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4129.90
Top of Well Vault: 4130.23



SITE MAP



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DESIGNED: D. Fairman	CHECKED: J. Zumbro
DRAWN: F. Olson / V. Yap	REVIEWED: D. Fairman

PROFESSIONAL GEOLOGIST
DAVID FAIRMAN
No. 9025
STATE OF CALIFORNIA

Date: 4/13/2021

Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Dec 2019 - Jan 2020

BIG VALLEY GROUNDWATER BASIN

AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 5 BIEBER

DRAWING 5

Appendix 8C Selection from DWR Monitoring BMP

PROTOCOLS FOR MEASURING GROUNDWATER LEVELS

This section presents considerations for the methodology of collection of groundwater level data such that it meets the requirements of the GSP Regulations and the DQOs of the specific GSP. Groundwater levels are a fundamental measure of the status of groundwater conditions within a basin. In many cases, relationships of the sustainability indicators may be able to be correlated with groundwater levels. The quality of this data must consider the specific aquifer being monitored and the methodology for collecting these levels.

The following considerations for groundwater level measuring protocols should ensure the following:

- Groundwater level data are taken from the correct location, well ID, and screen interval depth
- Groundwater level data are accurate and reproducible
- Groundwater level data represent conditions that inform appropriate basin management DQOs
- All salient information is recorded to correct, if necessary, and compare data
- Data are handled in a way that ensures data integrity

General Well Monitoring Information

The following presents considerations for collection of water level data that include regulatory required components as well as those which are recommended.

- Groundwater elevation data will form the basis of basin-wide water-table and piezometric maps, and should approximate conditions at a discrete period in time. Therefore, all groundwater levels in a basin should be collected within as short a time as possible, preferably within a 1 to 2 week period.
- Depth to groundwater must be measured relative to an established Reference Point (RP) on the well casing. The RP is usually identified with a permanent marker, paint spot, or a notch in the lip of the well casing. By convention in open casing monitoring wells, the RP reference point is located on the north side of the well casing. If no mark is apparent, the person performing the measurement should measure the depth to groundwater from the north side of the top of the well casing.
- The elevation of the RP of each well must be surveyed to the North American Vertical Datum of 1988 (NAVD88), or a local datum that can be converted to NAVD88. The elevation of the RP must be accurate to within 0.5 foot. It is preferable for the RP elevation to be accurate to 0.1 foot or less. Survey grade global navigation satellite system (GNSS) global positioning system (GPS) equipment can achieve similar vertical accuracy when corrected. Guidance for use of GPS can be found at USGS http://water.usgs.gov/osw/gps/. Hand-held GPS units likely will not produce reliable vertical elevation measurement accurate enough for the casing elevation consistent with the DQOs and regulatory requirements.
- The sampler should remove the appropriate cap, lid, or plug that covers the monitoring access point listening for pressure release. If a release is observed, the measurement should follow a period of time to allow the water level to equilibrate.
- Depth to groundwater must be measured to an accuracy of 0.1 foot below the RP. It is preferable to measure depth to groundwater to an accuracy of 0.01 foot. Air lines and acoustic sounders may not provide the required accuracy of 0.1 foot.
- The water level meter should be decontaminated after measuring each well.

Where existing wells do not meet the base standard as described in the GSP Regulations or the considerations provided above, new monitoring wells may need to be constructed to meet the DQOs of the GSP. The design, installation, and documentation of new monitoring wells must consider the following:

- Construction consistent with California Well Standards as described in Bulletins 74-81 and 74-90, and local permitting agency standards of practice.
- Logging of borehole cuttings under the supervision of a California Professional Geologist and described consistent with the Unified Soil Classification System methods according to ASTM standard D2487-11.
- Written criteria for logging of borehole cuttings for comparison to known geologic formations, principal aquifers and aquitards/aquicludes, or specific marker beds to aid in consistent stratigraphic correlation within and across basins.
- Geophysical surveys of boreholes to aid in consistency of logging practices. Methodologies should include resistivity, spontaneous potential, spectral gamma, or other methods as appropriate for the conditions. Selection of geophysical methods should be based upon the opinion of a professional geologist or professional engineer, and address the DQOs for the specific borehole and characterization needs.
- Prepare and submit State well completion reports according to the requirements of §13752. Well completion report documentation should include geophysical logs, detailed geologic log, and formation identification as attachments. An example well completion as-built log is illustrated in **Figure 2.** DWR well completion reports can be filed directly at the Online System for Well Completion Reports (OSWCR) http://water.ca.gov/oswcr/index.cfm.

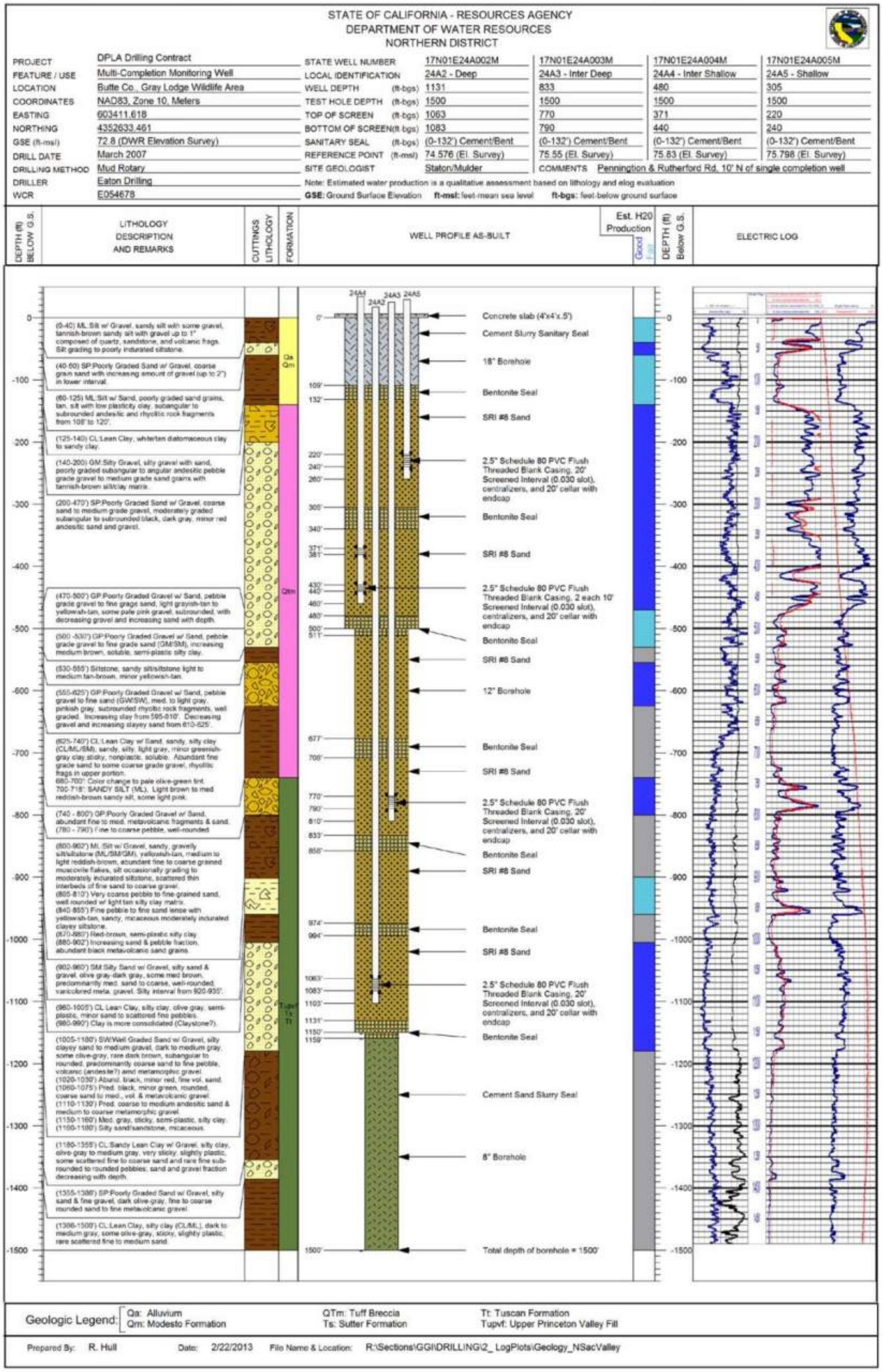

Figure 2 – Example As-Built Multi-Completion Monitoring Well Log

Measuring Groundwater Levels

Well construction, anticipated groundwater level, groundwater level measuring equipment, field conditions, and well operations should be considered prior collection of the groundwater level measurement. The USGS *Groundwater Technical Procedures* (Cunningham and Schalk, 2011) provide a thorough set of procedures which can be used to establish specific Standard Operating Procedures (SOPs) for a local agency. **Figure 3** illustrates a typical groundwater level measuring event and simultaneous pressure transducer download.

Figure 3 – Collection of Water Level Measurement and Pressure Transducer Download

The following points provide a general approach for collecting groundwater level measurements:

- Measure depth to water in the well using procedures appropriate for the measuring device. Equipment must be operated and maintained in accordance with manufacturer's instructions. Groundwater levels should be measured to the nearest 0.01 foot relative to the RP.
- For measuring wells that are under pressure, allow a period of time for the groundwater levels to stabilize. In these cases, multiple measurements should be collected to ensure the well has reached equilibrium such that no significant changes in water level are observed. Every effort should be made to ensure that a representative stable depth to groundwater is recorded. If a well does not stabilize, the quality of the value should be appropriately qualified as a

questionable measurement. In the event that a well is artesian, site specific procedures should be developed to collect accurate information and be protective of safety conditions associated with a pressurized well. In many cases, an extension pipe may be adequate to stabilize head in the well. Record the dimension of the extension and document measurements and configuration.

- The sampler should calculate the groundwater elevation as:

$$GWE = RPE - DTW$$

Where:

GWE = Groundwater Elevation
RPE = Reference Point Elevation
DTW = Depth to Water

The sampler must ensure that all measurements are in consistent units of feet, tenths of feet, and hundredths of feet. Measurements and RPEs should not be recorded in feet and inches.

Recording Groundwater Levels

- The sampler should record the well identifier, date, time (24-hour format), RPE, height of RP above or below ground surface, DTW, GWE, and comments regarding any factors that may influence the depth to water readings such as weather, nearby irrigation, flooding, potential for tidal influence, or well condition. If there is a questionable measurement or the measurement cannot be obtained, it should be noted. An example of a field sheet with the required information is shown in **Figure 4**. It includes questionable measurement and no measurement codes that should be noted. This field sheet is provided as an example. Standardized field forms should be used for all data collection. The aforementioned USGS *Groundwater Technical Procedures* offers a number of example forms.
- The sampler should replace any well caps or plugs, and lock any well buildings or covers.
- All data should be entered into the GSA data management system (DMS) as soon as possible. Care should be taken to avoid data entry mistakes and the entries should be checked by a second person for compliance with the DQOs.

STATE OF CALIFORNA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

STATE WELL NUMBER	COUNTY	REFERENCE POINT ELEV.	MEASURING AGENCY
			DWR

NO MEASUREMENT	QUESTIONABLE MEASUREMENT
0. Measurement discontinued	0. Caved or deepened
1. Pumping	1. Pumping
2. Pump house locked	2. Nearby pump operating
3. Tape hung up	3. Casing leaky or wet
4. Can't get tape in casing	4. Pumped recently
5. Unable to locate well	5. Air or pressure gauge measurement
6. Well has been destroyed	6. Other
7. Special	7. Recharge operation at or nearby well
8. Casing leaky or wet	8. Oil in casing
9. Temporarily inaccessible	

DATE	N M	Q M	TAPE AT RP	TAPE AT WS	RP to WS	OBSR VR	COMMENTS

DWR 1213

Figure 4 – Example of Water Level Well Data Field Collection Form

Pressure Transducers

Groundwater levels and/or calculated groundwater elevations may be recorded using pressure transducers equipped with data loggers installed in monitoring wells. When installing pressure transducers, care must be exercised to ensure that the data recorded by the transducers is confirmed with hand measurements.

The following general protocols must be followed when installing a pressure transducer in a monitoring well:

- The sampler must use an electronic sounder or chalked steel tape and follow the protocols listed above to measure the groundwater level and calculate the groundwater elevation in the monitoring well to properly program and reference the installation. It is recommended that transducers record measured groundwater level to conserve data capacity; groundwater elevations can be calculated at a later time after downloading.
- The sampler must note the well identifier, the associated transducer serial number, transducer range, transducer accuracy, and cable serial number.
- Transducers must be able to record groundwater levels with an accuracy of at least 0.1 foot. Professional judgment should be exercised to ensure that the data being collected is meeting the DQO and that the instrument is capable. Consideration of the battery life, data storage capacity, range of groundwater level fluctuations, and natural pressure drift of the transducers should be included in the evaluation.
- The sampler must note whether the pressure transducer uses a vented or non-vented cable for barometric compensation. Vented cables are preferred, but non-vented units provide accurate data if properly corrected for natural barometric pressure changes. This requires the consistent logging of barometric pressures to coincide with measurement intervals.
- Follow manufacturer specifications for installation, calibration, data logging intervals, battery life, correction procedure (if non-vented cables used), and anticipated life expectancy to assure that DQOs are being met for the GSP.
- Secure the cable to the well head with a well dock or another reliable method. Mark the cable at the elevation of the reference point with tape or an indelible marker. This will allow estimates of future cable slippage.
- The transducer data should periodically be checked against hand measured groundwater levels to monitor electronic drift or cable movement. This should happen during routine site visits, at least annually or as necessary to maintain data integrity.

- The data should be downloaded as necessary to ensure no data is lost and entered into the basin's DMS following the QA/QC program established for the GSP. Data collected with non-vented data logger cables should be corrected for atmospheric barometric pressure changes, as appropriate. After the sampler is confident that the transducer data have been safely downloaded and stored, the data should be deleted from the data logger to ensure that adequate data logger memory remains.

PROTOCOLS FOR SAMPLING GROUNDWATER QUALITY

The following protocols can be incorporated into a GSP's monitoring protocols for collecting groundwater quality data. More detailed sampling procedures and protocols are included in the standards and guidance documents listed at the end of this BMP. A GSP that adopts protocols that deviate from these BMPs must demonstrate that the adopted protocols will yield comparable data.

In general, the use of existing water quality data within the basin should be done to the greatest extent possible if it achieves the DQOs for the GSP. In some cases it may be necessary to collect additional water quality data to support monitoring programs or evaluate specific projects. The USGS *National Field Manual for the Collection of Water Quality Data* (Wilde, 2005) should be used to guide the collection of reliable data. **Figure 5** illustrates a typical groundwater quality sampling setup.

Figure 5 – Typical Groundwater Quality Sampling Event

Appendix 11A GSA Letters to Governor and Legislature

County of Lassen
Board of Supervisors

CHRIS GALLAGHER
District 1
DAVID TEETER
District 2
JEFF HEMPHILL
District 3
AARON ALBAUGH
District 4
TOM HAMMOND
District 5

County Administration Office
221 S. Roop Street, Suite 4
Susanville, CA 96130
Phone: 530-251-8333
Fax: 530-251-2663

August 11, 2020

Gavin Newsom
Governor, State of California
1303 10th Street, Suite 1173
Sacramento, CA 95814

RE: Request for Extension for Submittal of a Groundwater Sustainability Plan for the Big Valley Groundwater Basin

Dear Governor Newsom:

COVID-19 has had (and continues to have) a monumental impact on the ability of State and local government to conduct the people's business. Accordingly, as the Governor of the State of California, you have, on multiple occasions, exercised authority granted to you pursuant to the State's police power and through the Emergency Services Act to issue Executive Orders in response to the COVID-19 emergency. As discussed herein, these orders have often altered the implementation of various Statutes and Regulations. This letter is to request that you use your authority to extend the January 31, 2022, deadline to submit a Groundwater Sustainability Plan (GSP) to the Department of Water Resources (DWR) for the Big Valley Groundwater Basin (DWR Bulletin 118 Basin 5-004) as required by the Sustainable Groundwater Management Act (SGMA).

The Big Valley Groundwater Basin is located in two counties (Lassen and Modoc), and the counties have stepped forward to act as the Groundwater Sustainability Agencies (GSAs) for their respective portions of the Basin. Big Valley is a rural, agricultural area where ranching and farming make up the bulk of the economy by producing alfalfa, hay, wild rice, pasture and range. Ranching and farming have a long history in Big Valley and many current, active ranchers are the same families that homesteaded here. In addition, there is a state wildlife refuge in the middle of the Basin that supports important species and acts as part of the Pacific flyway. Big Valley is designated as a disadvantaged community. To say that there is a high level of interest in how the GSP for Big Valley is developed is an understatement.

The GSAs have been unable to successfully conduct the public outreach expected by stakeholders and required by the SGMA during the COVID-19 emergency. Further, the ability to conduct telephonic or web-based participation is highly limited in Big Valley because there is inadequate internet access and in some cases no internet access at all for stakeholders to participate in public meetings.

While the GSP deadline is still 16 months away, it is clear that we do not have enough time to meet the robust public participation requirements found in the SGMA (summarized in this letter) while also meeting the current submittal deadline. The combination of complex GSP Regulations which require highly technical content and the need for public participation mean that the outreach process will take a lot of time for all parties to come to a shared understanding of what the Regulations require and what the content of the GSP means to them. Decisions that will have a huge impact in the Basin will be made and implemented through the GSP.

The public outreach and participation plan we developed prior to COVID-19 requires frequent public meetings between now and January 31, 2022, to prepare a draft GSP that the GSAs can approve and submit to DWR as required by the SGMA. Between now and the due date, we will be working chapter by chapter, requirement by requirement, attempting to develop a shared understanding and make reasoned decisions. Even before COVID-19, the schedule was tight and the GSAs were challenged to accommodate adequate public involvement, which is focused through the Big Valley Groundwater Basin Advisory Committee (BVAC). The BVAC is formed through a memorandum of understanding between the two GSAs and is proving ineffective because COVID-19 requirements and health considerations have made it difficult or impossible to conduct public meetings. Given the realities of the COVID-19 emergency, many will be left out of the conversation unless additional time is provided.

You have responded to difficulties that agencies are experiencing conducting public meetings during COVID-19 by relaxing certain Brown Act meeting requirements. Through Executive Order Numbers N-25-20 and N-29-20, your Administration has taken important steps to ensure that public meetings are able to convene and conduct necessary public business during the COVID-19 emergency. Again, you issued the above and many other executive orders, as authorized by the State's police power and through the Emergency Services Act to maintain proper functioning of state and local governments. In summary, said Executive Orders modified certain requirements for noticing and conducting public meetings, as described in Government Code sections 54950-54963 (Chapter 9, Meetings). In part, provisions of these orders allow remote (web or phone-based) meetings to be conducted from multiple locations, without meeting all of the requirements of the above sections. This includes allowing elected or appointed representatives to participate remotely.

The intent for meeting in this fashion is to allow government to continue functioning while those that need to can maintain isolation. This is necessary and prudent for routine functions, but the SGMA is different. This legislation is new territory for all involved and has wide reaching impacts on stakeholders of all varieties. Because of the long-term nature of the SGMA, the GSAs and stakeholders want to develop a GSP off the bat that stakeholders can live with and reduces the uncertainty that the future holds.

Unfortunately, the above orders are not enough in the Big Valley Groundwater Basin because this remote area of rural, mountainous, northeastern California does not have the digital connectivity required to successfully conduct remote meetings. As discussed herein, attempts to conduct remote meetings in Big Valley have been unsuccessful due to the exceptionally poor internet connectivity. Allowing the public to attend meetings through the internet may be a good strategy for areas that have reliable internet connectivity, but not in rural mountain areas. For internet-based meetings to be successful, infrastructure is needed. This infrastructure is severely lacking in Big Valley and surrounding areas.

In addition to the lack of internet capability, Big Valley is already recognized by the DWR and other State Departments as an economically disadvantaged area. The reality is that many of the citizens in Big Valley do not have the resources, both technical and financial, to access the internet, even if adequate internet connectivity were available. The internet access disparity between urban and rural areas is well-documented. Further, many of the residents are not familiar with the mechanics of participating in meetings electronically. They have had no training or exposure to this technology and meeting venue. Another challenge is staff availability to facilitate internet-based meetings. The two Big Valley Groundwater Basin GSAs, like many rural governments, have very limited staff, especially technical staff.

On July 1, 2020, the GSAs attempted to conduct a combined live and internet-based meeting in lieu of a traditional live-only public outreach meeting. We attempted to conduct the meeting with "Go-To-Webinar" and failed miserably with unintelligible audio. After thirty minutes, one stakeholder who tried to participate from home decided to take the risk of coming to the live portion of the meeting because of the webinar problems even though her spouse has health concerns that make him high risk.

As stated, the fundamental issue we are working through is that, because of COVID-19, there are now two sections of the SGMA that conflict with each other. The legislation provides a deadline, but the same legislation also requires meaningful public involvement. Because of COVID-19, the public in the Big Valley Groundwater Basin has shown a reluctance to attend public meetings to discuss development of the GSP. Further, and again as a direct result of COVID-19, limitations and requirements have been placed on local governments on how public meetings are to be conducted. Below is a summary of some of the public participation requirements found in the SGMA that, as a result of this health emergency, are at odds with the January 31, 2022, deadline:

- In part, Water Code section 10723.2 states *"[t]he groundwater sustainability agency shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans. These interests include, but are not limited to, all of the following..."* Without providing an effective means of participation and in the current COVID-19 environment, it is not possible to consider the interest of all beneficial users or to work with our professional staff on the implementation of whatever plan is ultimately adopted. More time is necessary or an important part of the SGMA will be meaningless. This weakens the resulting GSP, making it more difficult to implement and subjecting the GSP to added scrutiny and challenge. Again, we cannot meet the above public participation requirement while also meeting the January 31, 2022, deadline.

- In part, Water Code section 10727.8 states *"Prior to initiating the development of a groundwater sustainability plan, the groundwater sustainability agency shall make available to the public and the department a written statement describing the manner in which interested parties may participate in the development and implementation of the groundwater sustainability plan..."* In accordance with said section, the GSA's have adopted a memorandum of understanding that establishes an Advisory Committee. A primary function of the Advisory Committee is to facilitate public comment. A meeting format has been established to incorporate public comment. In light of COVID-19, the above process has proved itself insufficient to capture and facilitate public comment regarding development of the GSP.

Clearly it was the intent of the legislature in adopting the SGMA that GSPs be prepared with broad public participation. Unfortunately, COVID-19 has restricted the ways in which public meetings can be conducted. The GSP will have a huge impact on the lives of the residents and their children. As such, the SGMA rightfully provides the requirement to include the public in the preparation of the GSP. COVID-19, is jeopardizing the public's participation in the very process that the SGMA assured them they could be part of. It is not realistic to expect the public to be satisfied with our limited ability to conduct internet and phone-based meetings for a process they were assured by the legislature that they would be allowed to participate in. Given the lack of alternatives we have for engaging the public in the GSP development process, it seems clear that we will not be able to meet the January 31, 2022, deadline the legislature established for submittal of the GSP to DWR.

We owe it to the public to provide an opportunity to meaningfully participate. In the end, allowing additional time to prepare the GSP is not likely to have as profound an impact as preparing and submitting a GSP without involving the affected public. The GSP is a major undertaking that will affect the lives of the residents and generations to come. For the GSP to be implemented successfully, the legislature recognized the importance of public participation. Submittal of a plan that will take more than 20 years to implement without the involvement and participation of the very people it will affect is not a good way to start.

As stated, an Executive Order is an appropriate mechanism to grant our request to provide additional time for the GSAs to more fully engage the public in this process as intended by the SGMA. The authority of the Executive to temporarily modify the implementation of Statute and Regulation is demonstrated through the many other Executive Orders you have issued in response to the COVID-19 pandemic. Examples of Statutes affected by Executive Orders you have issued include the Elections Code, Insurance Code, Education Code, Penal Code, Civil Code, Code of Civil Procedure, Vehicle Code, Labor Code, Welfare and Institutions Code, Health and Safety Code, Public Resources Code, Government Code, Unemployment Insurance Code and others. As said, there are also examples of Regulations that have been affected by your Executive Orders.

As a result of this health emergency, you are authorized to issue an Executive Order allowing more time to submit the required GSP to DWR. The COVID-19 emergency has directly hindered our ability to conduct the public outreach and participation required by the SGMA to prepare said GSP. You continue to issue executive orders in response to this pandemic that affect our ability to properly engage the public. Thus, such an order falls under your authority pursuant to the State police power and through the Emergency Services Act. There are various ways in which such an order could implemented:

- You could simply issue an Executive Order extending the deadline to submit a GSP by one year (until January 31, 2023, or further). In summary, support for such an order is demonstrated through the continued quarantine limitations that are in effect and in the continued advice from health professionals for at risk segments of the population to avoid public gatherings. After a year, the need for any further extension could be evaluated based on the status of the COVID-19 pandemic at that time.

- Another (or additional), more specific way, to implement such an Order is through section 10735.2 of the Water Code. Said section requires the Water Resources Control Board to schedule a public hearing to designate Big Valley as a "probationary basin" if the GSP is not submitted by January 31, 2022. In summary, your Executive Order could direct the Water Resources Control Board to postpone scheduling said public hearing, should we not meet the January 31, 2022, GSP submittal deadline.

Thank you for considering our request.

Sincerely,

David Teeter, Chairman
Lassen County Board of Supervisors

DT:MLA:gfn

cc: Toni G. Atkins, President pro Tempore, California Senate
Anthony Rendon, California State Assembly, Speaker
Brian Dahle, Senator, California Senate
Megan Dahle, Assembly Member, California State Assembly
Modoc County Board of Supervisors as the Big Valley Modoc GSA
Big Valley Groundwater Basin Advisory Committee
Department of Water Resources

c/sustainable groundwater management/extend deadline

County of Lassen
Board of Supervisors

CHRIS GALLAGHER
District 1
DAVID TEETER
District 2
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District 3
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Fax: 530-251-2663

November 17, 2020

CERTIFIED MAIL/RETURN RECEIPT
7017 1070 0000 7544 8450
Gavin Newsom
Governor, State of California
1303 10th Street
Sacramento, CA 95814

RE: Inquiry Regarding an August 11, 2020, Letter Requesting an Extension for Submittal of a Groundwater Sustainability Plan for the Big Valley Groundwater Basin (DWR Bulletin 118 Basin 5-004)

Dear Governor Gavin Newsom:

This letter is to request a response from you to our letter to you dated August 11, 2020 (attached), in regard to preparation of the Groundwater Sustainability Plan (GSP) required to be submitted to the Department of Water Resources by January 31, 2022, pursuant to the Sustainable Groundwater Management Act of 2014 (SGMA), for the Big Valley Groundwater Basin. To date, we have not received communication of any type regarding said letter (by telephone, letter or email).

As stated in more detail in our previous letter, COVID-19 has drastically limited our ability, and the public's willingness, to have the in-person public meetings necessary to prepare the required GSP. This has left both the Lassen and Modoc Groundwater Sustainability Agencies (GSAs) with few options. Many around the state have turned to internet-based meetings during this pandemic. However, conducting meetings through the internet is a poor substitution in Big Valley because there is not sufficient internet access. Further, we do not have sufficient resources to conduct internet-based meetings in a meaningful way. Again, our letter to you describes our challenges in great detail.

Even though the GSP deadline is still a little over a year away, it is clear that we do not have enough time to prepare a GSP supported by the level of public participation a plan of this magnitude deserves. Lassen County and the residents of Big Valley have accepted the responsibility required by SGMA to prepare the GSP when no one else would. Neither Lassen County or Modoc County were required by SGMA to accept the responsibility (financially and in terms of land use responsibility) to serve as the GSAs for Big Valley, but that is exactly what we have done. We have more than demonstrated our willingness to meet the challenges presented by SGMA head-on. That said, if we are going to prepare this GSP, it is in the interest of everyone, including you, that it be done right.

This was a serious enough subject to warrant passage of SGMA and signature by the prior Governor. We can assure you that preparation of the GSP for the Basin is certainly a matter of direct concern to the citizens of Big Valley. As such, this Board deserves an answer to our letter, and, even more so, the citizens of Big Valley deserve the courtesy of an answer, even if the answer is contrary to our request. To give the GSP the service it truly deserves, we simply need a little more time. That's all.

Thank you for considering our request and we look forward to your prompt response.

Thank you in advance,

David Teeter, Chairman
Lassen County Board of Supervisors

DT:MLA:gfn

cc: Brian Dahle, Senator, California Senate
Megan Dahle, Assembly Member, California State Assembly
Modoc County Board of Supervisors as the Big Valley Modoc GSA
Big Valley Groundwater Basin Advisory Committee
Department of Water Resources

County of Lassen
Board of Supervisors

CHRIS GALLAGHER
District 1
DAVID TEETER
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JEFF HEMPHILL
District 3
AARON ALBAUGH
District 4
TOM HAMMOND
District 5

County Administration Office
221 S. Roop Street, Suite 4
Susanville, CA 96130
Phone: 530-251-8333
Fax: 530-251-2663

February 16, 2021

CERTIFIED RETURN RECEIPT
7020 1290 0000 0270 7632
Gavin Newsom
Governor, State of California
1303 10th Street
Sacramento, CA 95814

RE: Inquiry Regarding an August 11, 2020, Letter Requesting an Extension for Submittal of a Groundwater Sustainability Plan for the Big Valley Groundwater Basin (DWR Bulletin 118 Basin 5-004)

Dear Governor Gavin Newsom:

This letter is to request a response from you to our letters to you dated August 11, 2020 and November 17, 2020 (attached), in regard to preparation of the Groundwater Sustainability Plan (GSP) required to be submitted to the Department of Water Resources by January 31, 2022, pursuant to the Sustainable Groundwater Management Act of 2014 (SGMA), for the Big Valley Groundwater Basin. To date, we have not received communication of any type regarding said letter (by telephone, letter or email).

As stated in more detail in our previous letter, COVID-19 has drastically limited our ability, and the public's willingness, to have the in-person public meetings necessary to prepare the required GSP. This has left both the Lassen and Modoc Groundwater Sustainability Agencies (GSAs) with few options. Many around the state have turned to internet-based meetings during this pandemic. However, conducting meetings through the internet is a poor substitution in Big Valley because there is not sufficient internet access. Further, we do not have sufficient resources to conduct internet-based meetings in a meaningful way. Again, our letter to you describes our challenges in great detail.

Even though the GSP deadline is still a little over a year away, it is clear that we do not have enough time to prepare a GSP supported by the level of public participation a plan of this magnitude deserves. Lassen County and the residents of Big Valley have accepted the responsibility required by SGMA to prepare the GSP when no one else would. Neither Lassen County or Modoc County were required by SGMA to accept the responsibility (financially and in terms of land use responsibility) to serve as the GSAs for Big Valley, but that is exactly what we have done. We have more than demonstrated our willingness to meet the challenges presented by SGMA head-on. That said, if we are going to prepare this GSP, it is in the interest of everyone, including you, that it be done right.

This was a serious enough subject to warrant passage of SGMA and signature by the prior Governor. We can assure you that preparation of the GSP for the Basin is certainly a matter of direct concern to the citizens of Big Valley. As such, this Board deserves an answer to our letter, and, even more so, the citizens of Big Valley deserve the courtesy of an answer, even if the answer is contrary to our request. To give the GSP the service it truly deserves, we simply need a little more time. That's all.

Thank you for considering our request and we look forward to your prompt response.

Thank you in advance,

Aaron Albaugh

Aaron Albaugh, Chairman
Lassen County Board of Supervisors

DT:MLA:gfn

cc: Brian Dahle, Senator, California Senate
Megan Dahle, Assembly Member, California State Assembly
Modoc County Board of Supervisors as the Big Valley Modoc GSA
Big Valley Groundwater Basin Advisory Committee
Department of Water Resources

County of Lassen
Board of Supervisors

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Susanville, CA 96130
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Fax: 530-251-2663

March 23, 2021

CERTIFIED RETURN RECEIPT
7017 0660 0000 6271 1758
Gavin Newsom
Governor, State of California
1303 10th Street
Sacramento, CA 95814

COPY

RE: Inquiry Regarding the February 16, 2020, Letter Requesting an Extension for Submittal of a Groundwater Sustainability Plan for the Big Valley Groundwater Basin (DWR Bulletin 118 Basin 5-004)

Dear Governor Gavin Newsom:

This letter is to request a response from you to our letters to you dated February 16, 2021, August 11, 2020 and November 17, 2020 (attached), in regard to preparation of the Groundwater Sustainability Plan (GSP) required to be submitted to the Department of Water Resources by January 31, 2022, pursuant to the Sustainable Groundwater Management Act of 2014 (SGMA), for the Big Valley Groundwater Basin. To date, we have not received communication of any type regarding said letter (by telephone, letter or email).

As stated in more detail in our previous letter, Government imposed COVID-19 restrictions have drastically limited our ability, and the public's willingness, to have the in-person public meetings necessary to prepare the required GSP. This has left both the Lassen and Modoc Groundwater Sustainability Agencies (GSAs) with few options. Many around the state have turned to internet-based meetings during this pandemic. However, conducting meetings through the internet is a poor substitution in Big Valley because there is not sufficient internet access. Further, we do not have sufficient resources to conduct internet-based meetings in a meaningful way. Again, our letter to you describes our challenges in great detail.

The GSP deadline is approximately 7 months away and it is clear that we do not have enough time to prepare a GSP supported by the level of public participation a plan of this magnitude deserves. Lassen County and the residents of Big Valley have accepted the responsibility required by SGMA to prepare the GSP when no one else would. Neither Lassen County or Modoc County were required by SGMA to accept the responsibility (financially and in terms of land use responsibility) to serve as the GSAs for Big Valley, but that is exactly what we have done. We have more than demonstrated our willingness to meet the challenges presented by SGMA head-on. That said, if we are going to prepare this GSP, it is in the interest of everyone, including you, that it be done right.

This was a serious enough subject to warrant passage of SGMA and signature by the prior Governor. We can assure you that preparation of the GSP for the Basin is certainly a matter of direct concern to the citizens of Big Valley. As such, this Board deserves an answer to our letter, and, even more so, the citizens of Big Valley deserve the courtesy of an answer, even if the answer is contrary to our request. To give the GSP the service it truly deserves, we simply need a little more time or simply remove the Government imposed regulations. That's all.

Thank you for considering our request and we look forward to your prompt response.

Thank you in advance,

Aaron Albaugh

Aaron Albaugh, Chairman
Lassen County Board of Supervisors

AA:MLA:gfn

cc: Brian Dahle, Senator, California Senate
Megan Dahle, Assembly Member, California State Assembly
Modoc County Board of Supervisors as the Big Valley Modoc GSA
Big Valley Groundwater Basin Advisory Committee
Department of Water Resources

County of Lassen
Board of Supervisors

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April 13, 2021

CERTIFIED RETURN RECEIPT
7017 0660 0000 6271 3752 & 7017 0660 0000 6271 3745

Assembly Member Eduardo Garcia
Chair of the Water, Parks, and Wildlife Committee
Legislative Office Building
1020 N. Street, Room 160
Sacramento, CA 95814

Assembly Member Megan Dahle
Vice Chair of the Water, Parks, and Wildlife Committee
Legislative Office Building
1020 N. Street, Room 160
Sacramento, CA 95814

Dear Chair Garcia and Vice Chair Dahle:

This letter is in support of Assembly Bill 754, which was introduced by Assembly Member Devon Mathis. Said Assembly Bill was referred to the Water, Parks, and Wildlife Committee on March 15, 2021. In summary, this bill would extend the due date to January 31, 2023, for Groundwater Sustainability Agencies (GSA) in basins that are not critically over drafted to submit a Groundwater Sustainability Plan (GSP) to the Department of Water Resources.

Lassen County and Modoc County serve as the GSAs for the Big Valley Groundwater Basin, for the portion of the basin within their respective jurisdiction. Said GSAs have been working cooperatively (through a memorandum of understanding) to prepare a single GSP for the entire basin.

Preparation of said GSP has been negatively impacted by the Governor's Executive Orders. Specifically, the Governor's order has made it difficult to conduct the public outreach needed to prepare the plan. Over the last year, the public has been less inclined to meet physically because of the Executive Orders. We have attempted to accommodate by conducting more internet and phone-based meetings. However, internet connectivity in Big Valley is exceedingly poor and the basin is not well situated to allow online type public meetings. We were very pleased to see proposed legislation to provide more time to submit the required GSP. In fact, on August 11, 2020, we sent a letter to the legislature requesting additional time (see attached) for this very reason (lack of ability to have meaningful public dialogue because of COVID-19). We have also sent multiple letters to the Governor, requesting an executive order allowing more time.

If adopted, this legislation will greatly improve upon the GSP that is ultimately adopted by ensuring the time needed for adequate public participation. The above said, please understand that we support this legislation only to the extent that it will provide more time to submit the required GSP. We are not supportive at all of the bill becoming a vehicle to legislate additional requirements. It is our position that the requirements of the Sustainable Groundwater Management Act are already too onerous, especially in basins like ours that were only designated a "medium priority basin" by half of one point.

Sincerely,

Aaron Albaugh

Aaron Albaugh, Chairman,
Lassen County Board of Supervisors
Big Valley Lassen Groundwater Sustainability Agency

AA:MLA:gfn
Enclosure

cc: Devon Mathis, Assembly Member, California State Assembly
Modoc County Board of Supervisors as the Big Valley Modoc GSA
Rural County Representatives of California (RCRC)
California State Association of Counties (CSAC)

County of Lassen
Board of Supervisors

CHRIS GALLAGHER
District 1
DAVID TEETER
District 2
JEFF HEMPHILL
District 3
AARON ALBAUGH
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TOM HAMMOND
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221 S. Roop Street, Suite 4
Susanville, CA 96130
Phone: 530-251-8333
Fax: 530-251-2663

April 27, 2021

CERTIFIED RETURN RECEIPT
7020 1290 0000 0270 7649

Gavin Newsom
Governor, State of California
1303 10th Street
Sacramento, CA 95814

RE: Inquiry Regarding the March 23, 2021, Letter Requesting an Extension for Submittal of a Groundwater Sustainability Plan for the Big Valley Groundwater Basin (DWR Bulletin 118 Basin 5-004)

Dear Governor Gavin Newsom:

This letter is to request a response from you to our letters to you dated March 23, 2021, February 9, 2021, November 17, 2020, and August 11, 2020 (attached), in regard to preparation of the Groundwater Sustainability Plan (GSP) required to be submitted to the Department of Water Resources by January 31, 2022, pursuant to the Sustainable Groundwater Management Act of 2014 (SGMA), for the Big Valley Groundwater Basin. To date, we have not received communication of any type regarding said letter (by telephone, letter or email).

As stated in more detail in our previous letter, your Executive Orders have drastically limited our ability, and the public's willingness, to have the in-person public meetings necessary to prepare the required GSP. This has left both the Lassen and Modoc Groundwater Sustainability Agencies (GSAs) with few options. Many around the state have turned to internet-based meetings during this pandemic. However, conducting meetings through the internet is a poor substitution in Big Valley because there is not sufficient internet access. Further, we do not have sufficient resources to conduct internet-based meetings in a meaningful way. Again, our letter to you describes our challenges in great detail.

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY

GAVIN NEWSOM, *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

June 3, 2021

County of Lassen
Board of Supervisors
ATTN: Chairman David Teeter
221 S. Roop Street, Suite 4
Susanville, CA 96130

Dear Chaiman Teeter,

On behalf of Governor Newsom, I first want to thank you for your dedicated leadership in your community during these challenging times. The COVID-19 pandemic is a continuing and unprecedented global crisis and it has impacted our communities across California in many ways. I appreciate your attention to these impacts weighing on your community.

Your recent letter(s) submitted to the Governor requests an extension of the deadline for submitting your groundwater sustainability plan (GSP) to the Department of Water Resources (DWR) and highlights your concerns over your ability to ensure robust public outreach and stakeholder engagement with the limitations on public interaction resulting from COVID-19. We recognize the limitations all state and local entities have experienced with holding meetings virtually, especially in rural and mountainous areas where internet connectivity is less available and reliable. Despite these COVID-19 challenges, public agencies, such as yours, are continuing to provide their best efforts to ensure public engagement and oversight of activities in the public's interest.

With this in mind, a suspension or change to the submittal deadline cannot be granted. The GSP submittal process and deadline is in the Sustainable Groundwater Management Act (SGMA), which cannot be changed without an amendment to the law and approval by the Legislature. If a local agency does not submit a GSP by the statutory deadline, DWR is required to refer the basin to the State Water Board for intervention.

The Administration is committed to the central tenant of SGMA which is local control. To facilitate such, SGMA establishes a timeframe of 20 years for basins to achieve their sustainability goals and provides an outcome-based process for SGMA implementation to occur. Through this outcome-based process, local agencies have an opportunity to improve plans and continue public outreach over time. A number of DWR and other state agency assistance programs have been established to help with public outreach and to assist groundwater managers in maintaining local control throughout GSP development and implementation.

DWR values the working partnership with water managers in your basin, which have been established through continued dialogue and dedicated planning and financial assistance (summarized in Attachment A) to support your plan development and facilitate engagement among stakeholders. If you find your local outreach efforts lacking, even with this assistance and the efforts we have collectively undertaken, I encourage you to review the attached summary of state assistance (Attachment B) and reach out to my staff (identified below) so you can use all applicable programs that will aid in your local SGMA efforts.

For these reasons, I encourage you to continue working towards submitting your GSP by the statutory deadline. Within that plan, you may identify any data gaps, including how stakeholder engagement has been impacted by COVID-19, and document the next steps that will be taken to fill those gaps. As locals continue to conduct engagement efforts, GSAs can amend their plans at any time to reflect stakeholder input. This documentation in the GSP will allow DWR to understand your planning efforts and complete the evaluation of your plan. Given this information, DWR will be able to align future assistance to continue to support locals in implementing their GSP and filling the specified data gaps.

Please contact Acting Deputy Director Steven Springhorn (Steven.Springhorn@water.ca.gov) or DWR's Northern Region Office Chief Teresa Connor (Teresa.Connor@water.ca.gov) if you have any additional questions, or if you need help in navigating moving forward.

Sincerely,

Karla Nemeth

Karla A. Nemeth

cc:
The Honorable Gavin Newsom, Governor, State of California
The Honorable Toni G. Atkins, President pro Tempore, California State Senate
The Honorable Anthony Rendon, Speaker, California State Assembly
The Honorable Brian Dahle, California State Senate
The Honorable Megan Dahle, California State Assembly
Christine Hironaka, Deputy Cabinet Secretary, Office of the Governor
Angela Pontes, Deputy Legislative Secretary, Office of the Governor
Sidd Nag, Legislative Advocate, Rural County Representatives of California
Catherine Freeman, Legislative Representative, California State Association of Counties
Gaylon Norwood, Assistant Director, County of Lassen GSA

Enclosure:
Attachment A: Summary Table of DWR Facilitation and Grant Funding Support
Attachment B: Summary of Statewide SGMA Assistance (June 2021)

Attachment A:

Summary Table of DWR Facilitation and Grant Funding Support				
Subbasin	**Funding Recipient**	**DWR Facilitation Funding**	**DWR Planning Funding**	**Total DWR Funding Support**
Vina Subbasin, Butte Subbasin, Wyandotte Creek Subbasin	Butte County	$173,000	$1,498,800	**$1,725,800**
Vina Subbasin	Vina GSA	$54,000	--	
Big Valley Basin	County of Modoc GSA	$82,000	$987,660	**$2,068,845**
	Lassen County	--	$999,185	
Colusa Subbasin	Colusa County	$112,000	--	**$2,171,600**
	Colusa Groundwater Authority	$60,000	$1,999,600	

Attachment B:

Summary of Statewide SGMA Assistance
(As of June 2021)

The State is committed to supporting locals to develop and implement their Groundwater Sustainability Plans (GSPs). In addition to the two agencies (Department of Water Resources and State Water Resources Control Board) with defined roles in SGMA, there are other State agencies with existing programs that support local groundwater management. The following summarizes that assistance.

Department of Water Resources (DWR)

Since 2015 DWR has provided planning, technical, and financial assistance to support locals with SGMA implementation.

Planning Assistance

- **Basin Points of Contact/Regional Coordinators:** Each of the 94 high- and medium- priority basins are assigned a Point of Contact (POC) and a Regional Coordinator (RC) from DWR Region Offices. POCs and RCs assist Ground Sustainability Agencies and stakeholders in the basin to connect with DWR and locate resources for assistance. The following links contain each basin's POC and their respective contact information:
    - Northern Region – RC: Pat Vellines (Patricia.Vellines@water.ca.gov)
    - North Central Region – RC: Chelsea Spier (Chelsea.Spier@water.ca.gov)
    - South Central Region – RC: Amanda Peisch-Derby (Amanda.Peisch@water.ca.gov)
    - Southern Region – RC: Brian Moniz (Brian.Moniz@water.ca.gov)

- **Facilitation Support Services (FSS):** Provides professional facilitators to help Groundwater Sustainability Agencies (GSAs) foster discussions among diverse water management interest groups.
    - GSAs or other groups coordinating with the GSAs to develop GSPs, are eligible to apply on a continuous basis using the following link: https://sgma.gsae.water.ca.gov/SGMPUB/Facilitation/2020/FSSApp2020.aspx

- **Written Translation Services (WTS):** Available to help GSAs, or other groups assisting in local SGMA implementation efforts, to communicate the groundwater planning activities with their non-English speaking constituents.
    - GSAs or other groups coordinating with the GSAs to develop GSPs, are eligible to apply on a continuous basis using the following link: https://sgma.gsae.water.ca.gov/SGMPUB/Translation/TranslationServiceRequest.aspx

Technical Assistance

- **Technical Support Services (TSS):** Provides DWR technical staff and drilling and other contractors to assist GSAs with the installation of dedicated groundwater monitoring wells and other monitoring stations to fill data gaps identified in the basins.
    - For more information or help starting a TSS application, contact DWR's Region Coordinators at sgmp_rc@water.ca.gov

- **Data and Tools:** Statewide datasets and models have been developed to assist GSAs and the public by providing information to help inform the development of GSP elements. The following datasets and tools have been made available:

- Eight new online interactive maps for the public to view and download SGMA datasets: groundwater levels, wells, environmental, land use, and subsidence data
- A water resources management and planning model that simulates groundwater, surface water, stream-groundwater interaction (C2VSim-FG)
- https://water.ca.gov/Programs/Groundwater-Management/Data-and-Tools

- **Guidance and Education:**
  - Six Best Management Practices (BMPs) and five Guidance Documents to provide clarification, guidance, and examples to help GSAs develop elements of a GSP.
  - California's Groundwater Update: State's official publication on the occurrence and nature of groundwater in California.

Financial Assistance

- **Sustainable Groundwater Management (SGM) Grant Programs:**
  - **SGM Planning Grant Program:** provides funds to develop and implement sustainable groundwater planning and projects. Approximately $150 million (M) has been awarded to date through three rounds of solicitations. Funding has been provided by Proposition 1 and Proposition 68.
  - **SGM Implementation Grant Program:** designed to fund projects and programs that will assist GSAs implement their GSPs. Proposition 68 authorized ~$100M for this new program.
    - The FY 20/21 Budget directed the acceleration of $26M for the critically overdrafted (COD) basins responsible for implementing GSPs or Alternatives to a GSP. Final awards for this first round were announced April 23, 2021.
    - The second round for the remaining funds will begin in early 2022.

- **Integrated Regional Water Management (IRWM) Implementation Grant Program**: provides funding for projects and programs that implement an IRWM Plan, including groundwater management projects. Approximately $220M of Proposition 1 funding has been awarded in 2019/2020.
  - Another $180M in Proposition 1 funds will be available in 2021-2022 timeframe.

- **Drainage Reuse Grant Program**: provides funds to local public agencies, including public universities, in the state of California for research and/or programs that resolve agricultural subsurface drainage water issues. The program is funded by Proposition 204, through the California Department of Food and Agriculture (CDFA), who has entered into a memorandum of understanding to transfer the funds, as well as the responsibility for implementing the programs required by the legislation, to DWR. Approximately $1.1M was awarded in 2020.

State Water Resources Control Board (State Water Board)

SGMA requires the State Water Board protect basins that are not managed sustainably through a process called State Intervention. In addition to this responsibility, the State Water Board has initiated assistance that will support locals with SGMA implementation. Assistance has been organized and distributed by the following categories:

Planning Assistance

- **Recharge Permitting Options**: Capturing surface water to artificially recharge groundwater aquifers is a potential method for improving groundwater basin conditions. To help support this method, the Division of Water Rights has developed a streamlined permitting process for diversions of water from high flow events to underground storage.

- Streamlining is primarily achieved through identifying eligibility criteria and a simplified water availability analysis targeting diversion of high flow events during winter.
- Temporary water right permits for groundwater recharge may be appropriate for short-term projects where an urgent need exists.
- New legislation through AB 658 gave the State Water Board a new 5-year temporary permitting option, also authorizing a 5-year temporary change petition.

Technical Assistance

- **Water Availability Tool**: State Water Board staff has developed an interactive Fully Appropriated Stream Systems (FASS) GIS Web Map, which provides users with information on fully appropriated stream systems, including seasonal limitations, relevant court references, and Board decisions/orders.
  - The interactive map can be accessed online and includes an overview and quick reference guide.
  - State and Federal Wild and Scenic Rivers are included as separate layers in the web map, as those systems also have limitations on new water right applications.

Financial Assistance

- **Groundwater Grant Program**: will administer a total of $800M to prevent and cleanup contamination of groundwater that serves (or has served) as a source of drinking water. The funds are available as planning grants and construction grants.
  - Round 3 Solicitation is expected to open in Summer 2021.

- **Water Recycling Funding Program (WRFP)**: promotes the beneficial use of treated municipal wastewater to augment fresh water supplies in California, by providing technical and financial assistance to agencies and other stakeholders in support of water recycling projects and research. The funds are available as planning grants and construction grants.

- **Clean Water State Revolving Fund (CWSRF) Program**: provides low-interest loans to public agencies for planning, design, and construction of water recycling projects.

- **Small Community Funding**: is available to help small DACs, providing drinking water service to less than 10,000 people or wastewater service to less than 20,000 people, with: technical assistance needs, interim water supplies, and implement eligible drinking water or wastewater capital improvement projects. The funds are available as planning grants and construction grants.

- **Drinking Water State Revolving Fund (DWRSF) program**: assists public water systems in financing the cost of drinking water infrastructure projects needed to achieve or maintain compliance with Safe Drinking Water Act requirements. The funds are available as planning grants and construction grants.

- **Groundwater Treatment and Remediation Grant Program**: will administer $74M in grants from Proposition 68 for treatment and remediation activities that prevent or reduce the contamination of groundwater that serves as a source of drinking water.

Department of Conservation (DOC)

The DOC offers financial incentive programs to further California's goals to conserve agricultural lands, restore and manage watersheds, and reduce greenhouse gas emissions.

- **2020 Sustainable Groundwater Management Watershed Coordinator (SGMA) Grant Program**: awards funding for watershed coordinators that will build broad coalitions of government, stakeholders, and communities to develop plans and projects to improve watershed health and meet California's groundwater sustainability goals. Awarded $1.5M in January 2021.

- Sustainable Agricultural Lands Conservation (SALC) Program: SALC is a component of the SGC's Affordable Housing and Sustainable Communities (AHSC) Program. SALC complements investments made in urban areas with the purchase of agricultural conservation easements, development of agricultural land strategy plans, and other mechanisms that result in GHG reductions and a more resilient agricultural sector.
    - Draft Guidelines for Round 7 were released February 19, 2021

Department of Food and Agriculture (CDFA)

CDFA supports agricultural production by incentivizing practices resulting in a net benefit for the environment through innovation, efficient management and science.

- State Water Efficiency and Enhancement Program (SWEEP): provides grant funding to implement irrigation systems that reduce greenhouse gases and save water on California agricultural operations. Eligible system components include (among others) soil moisture monitoring, drip systems, switching to low pressure irrigation systems, pump retrofits, variable frequency drives and installation of renewable energy to reduce on-farm water use and energy. Approximately, $81.1M has been awarded to date to nearly 835 projects, covering over 137,000 acres. CDFA estimates that over 81,000 metric tons of CO_2 emissions will be reduced annually.

- Healthy Soils Program (HSP): consists of two components: the HSP Incentives Program and the HSP Demonstration Projects.
    - HSP Incentives Program provides financial assistance for implementation of conservation management that improve soil health, sequester carbon and reduce greenhouse gas emissions. The 2020 HSP Incentives Program selected 324 projects for award, requesting almost a total of $22M.
    - HSP Demonstration Projects showcase California farmers and rancher's implementation of HSP practices. The 2020 HSP Demonstration Projects selected 20 projects for award, requesting a total of over $2.9M.

Appendix 11B List of Public Meetings

Meetings Held By Lassen and Modoc Counties Related to GSP Development

Event	GSA(s)	Date	Time	Location
Special Joint Meeting of the Lassen County and Modoc County Board of Supervisors	Lassen County, Modoc County	2/23/2016	2:00:00 PM	Adin Community Building 609 Main Street Adin, CA 96006
Meeting of the Lassen-Modoc County Flood Control and Water Conservation District	Lassen County, Modoc County	2/23/2016	2:00:00 PM	Adin Community Building 609 Main Street Adin, CA 96006
Public Outreach Meeting	Lassen County, Modoc County	1/27/2017	9:00:00 AM	Bieber Veterans Memorial Hall 657-575 Bridge Street Bieber, CA 96009
Meeting of Modoc County Board of Supervisors	Modoc County	2/28/2017	10:00:00 AM	Board of Supervisors Room 204 South Court Street #203 Alturas, CA 96101
Lassen County Board of Supervisors Meeting	Lassen County	3/14/2017	9:00:00 AM	Board Chambers 707 Nevada Street Susanville, CA 96130
Public Outreach Meeting June 2019	Lassen County, Modoc County	6/3/2019	2:00:00 PM	Bieber Veterans Memorial Hall 657-575 Bridge Street Bieber, CA 96009
Public Outreach Meeting Sept 2019	Lassen County, Modoc County	9/4/2019	4:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Big Valley Groundwater Basin Advisory Committee (BVAC) Meeting	Lassen County, Modoc County	2/3/2020	4:00:00 PM	Bieber Veterans Memorial Hall 657-575 Bridge Street Bieber, CA 96009
Big Valley Groundwater Basin Advisory Committee (BVAC) Meeting	Lassen County, Modoc County	3/4/2020	4:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Big Valley Groundwater Basin Advisory Committee (BVAC) Meeting	Lassen County, Modoc County	5/6/2020	4:00:00 PM	Bieber Veterans Memorial Hall 657-575 Bridge Street Bieber, CA 96009
Big Valley Groundwater Basin Advisory Committee (BVAC) Meeting	Lassen County, Modoc County	7/1/2020	4:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Big Valley Groundwater Basin Advisory Committee (BVAC) Special Meeting	Lassen County, Modoc County	9/24/2020	4:00:00 PM	Bieber Veterans Memorial Hall 657-575 Bridge Street Bieber, CA 96009
Big Valley Groundwater Basin Advisory Committee (BVAC) Meeting	Lassen County, Modoc County	11/4/2020	4:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Big Valley Groundwater Basin Advisory Committee (BVAC) Special Meeting	Lassen County, Modoc County	12/2/2020	4:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Big Valley Groundwater Basin Advisory Committee (BVAC) Meeting	Lassen County, Modoc County	2/3/2021	4:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Big Valley Groundwater Basin Advisory Committee (BVAC) Special Meeting	Lassen County, Modoc County	3/3/2021	4:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Groundwater Management Workshop	Lassen County, Modoc County	3/24/2021	5:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Big Valley Groundwater Basin Advisory Committee (BVAC) Meeting	Lassen County, Modoc County	4/7/2021	4:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Big Valley Groundwater Basin Advisory Committee (BVAC) Special Meeting	Lassen County, Modoc County	5/5/2021	2:00:00 PM	Bieber Veterans Memorial Hall 657-575 Bridge Street Bieber, CA 96009
Big Valley Groundwater Basin Advisory Committee (BVAC) Meeting	Lassen County, Modoc County	6/2/2021	2:00:00 PM	Adin Community Center 605 Highway 299 Adin, CA 96006
Big Valley Groundwater Basin Advisory Committee (BVAC) Meeting	Lassen County, Modoc County	7/7/2021	2:00:00 PM	Bieber Veterans Memorial Hall 657-575 Bridge Street Bieber, CA 96009

Assembled 6/18/2021

Appendix 11C Brochure Summarizing the Big Valley GSP May 2021

Summary of the Big Valley Groundwater Sustainability Plan

bigvalleygsp.org

May 2021

In 2014, California's Sustainable Groundwater Management Act (SGMA) was signed into law, requiring local governments and agencies in groundwater basins designated as high and medium priority to create governance structures and develop, adopt, and implement a Groundwater Sustainability Plan (GSP) for each basin. The Big Valley Groundwater Basin (BVGB) is identified as a medium-priority basin by the California Department of Water Resources (DWR) and is therefore subject to SGMA. The "high" and "medium" designations were assigned by DWR prior to the adoption of SGMA. Local agencies in the BVGB contested the medium-priority designation, which DWR denied, and are preparing a GSP to comply with the law because non-compliance may result in intervention by the State Water Board. Intervention could include metering, reporting, and fees for pumping groundwater. All formal basin-priority challenges have been denied to-date but may be revisited in the future.

Location and Boundaries

BVGB is a small basin in the north-eastern region of California. It encompasses a 144-square-mile area located in portions of Modoc and Lassen counties, including the unincorporated communities of Adin, Lookout, Bieber, and Nubieber. SGMA applies only to the areas inside the basin boundary (**Figure 1**), but GSP projects may include areas outside the boundary. The boundary lacks accurate detail in places and does not follow the DWR boundary definition, so leaders in the BVGB submitted a basin boundary modification request to DWR in 2016 that was denied. There are plans to submit another basin boundary modification request in the future.

GSP Content and Structure

Governments and agencies in basins subject to SGMA form one or more Groundwater Sustainability Agencies (GSA) to develop a GSP and oversee its implementation. The two counties, Lassen and Modoc, have designated themselves as the GSAs for the Basin and that designation has been confirmed by DWR. The counties took on this huge responsibly because no other local agencies were able to serve as the GSAs. If the counties had not agreed to be the GSAs, the State Water Board would have assumed management responsibility (e.g.. "intervention"). Each GSA manages the portion of the basin in its county. In 2019, the Big Valley Groundwater Basin Advisory Committee (BVAC) was formed to advise the GSAs on preparation of a single GSP for the entire BVGB. The BVAC consists of representatives from each county's board of supervisors and two BVGB residents from each county who were appointed by the GSAs after extensive outreach was conducted to all residents of the BVGB. The BVAC holds regular meetings which are open to the public. Meeting information can be found on the Big Valley GSP website: https://bigvalleygsp.org.

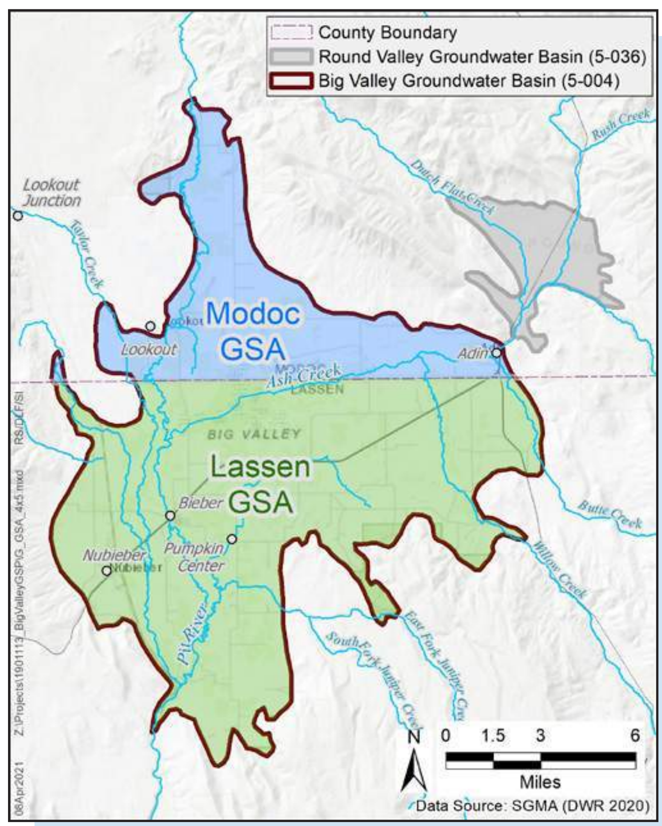

FIGURE 1: BIG VALLEY GROUNDWATER BASIN AND GSA BOUNDARIES

Physical Characteristics

The BVGB GSP follows a very specific structure because SGMA regulatory requirements dictate the information that must be contained within the document. First, the GSP must describe the general background and physical characteristics of the groundwater basin. In the BVGB GSP, this information is covered in Chapters 1 through 4 as follows:

- **Chapter 1.** Introduction to BVGB
- **Chapter 2.** Agency Information
- **Chapter 3.** Plan Area
- **Chapter 4.** Hydrogeologic Conceptual Model

Plan Area (Chapter 3) and Hydrogeologic Conceptual Model (Chapter 4) introduce important information, such as land use, geology, and hydrology, that will be used to make decisions throughout the planning process. They are based on the best available scientific data, but also include assumptions where reliable data is not available. The term 'hydrogeologic conceptual model' refers to a written description of the physical characteristics of the basin – where the water flows, the makeup of the soils, how deep the groundwater is, etc.

Drafts of Chapters 1 through 4 were developed in 2020, reviewed by the BVAC and the public, and "set aside" in order to move forward with the GSP. They will be revisited once the entire document is assembled. The "set aside" drafts are available and open for comment on the home page of the BGVB website (https://bigvalleygsp.org). Previous chapter versions, comments submitted, and other relevant information is available on the documents page. **Figures 2 and 3** show data highlights from Chapters 3 and 4 of the GSP.

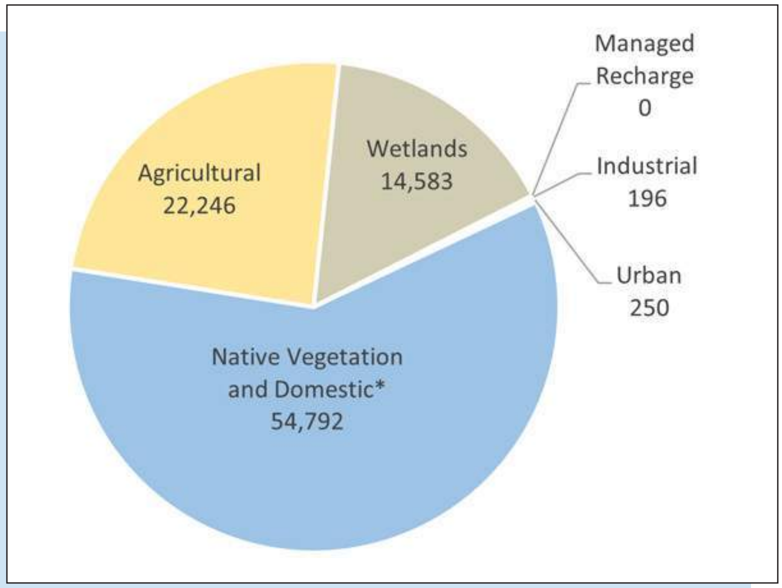

FIGURE 2: BIG VALLEY GROUNDWATER BASIN LAND USE

* Domestic use generally occurs in conjunction with agricultural and native vegetation and is best categorized with native vegetation, as most of the agricultural area is delineated by field and does not include residences.

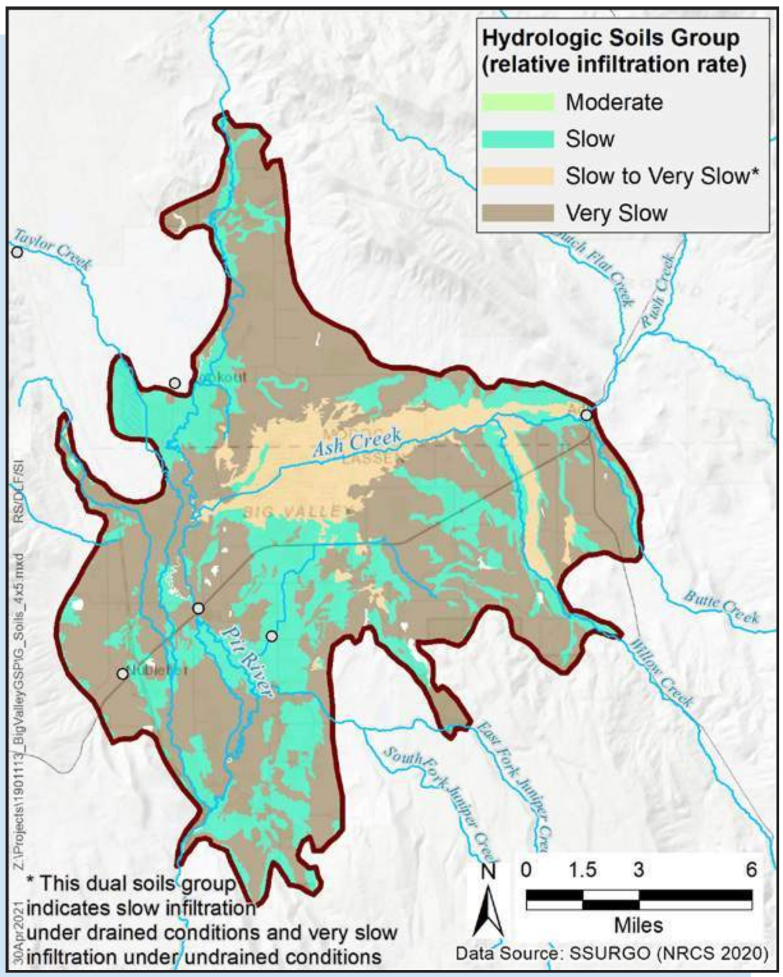

FIGURE 3: BIG VALLEY GROUNDWATER BASIN HYDROLOGIC SOILS GROUPS

Groundwater Conditions

Professional geologists and hydrogeologists examined data from wells throughout BVGB to determine groundwater conditions. They observed that most areas of the BVGB have experienced little to no change in water levels, while other areas have fluctuated more. They also found that groundwater in the BVGB is generally of excellent quality. The details of their findings are available in BVGB GSP **Chapter 5. Groundwater Conditions** (which has been temporarily "set aside" by the BVAC). Chapter 5 also includes other data required by the GSP regulations including changes in groundwater storage, water quality, land subsidence, and interconnected surface water. None of these indicators have shown undesirable results. **Figure 4** shows the estimated direction of groundwater flow in the BVGB.

An important tool to monitor groundwater sustainability is a water budget. BVGB GSP **Chapter 6. Water Budget** ("set aside") has estimates of the volume of water flowing into and out of the basin – from causes such as rain, rivers, and evaporation. Comparing the volumes of water entering and exiting the basin indicates if the basin is in balance, is in overdraft, or has surplus water. **Figure 5** shows the draft historical water budget (1984 to 2018).

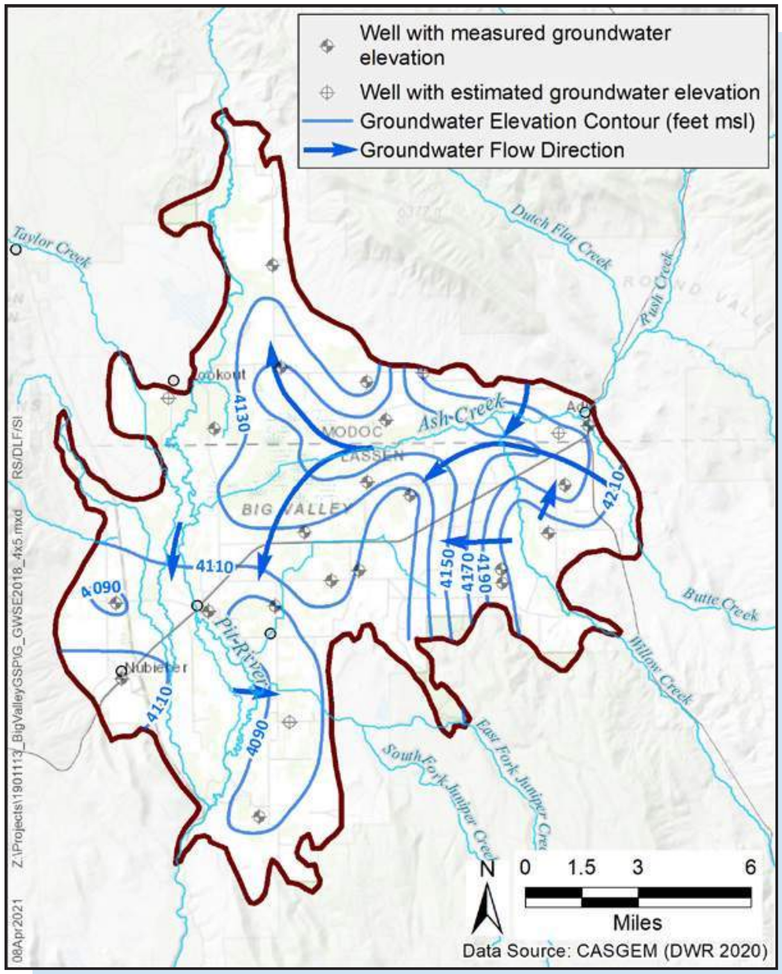

FIGURE 4: BIG VALLEY GROUNDWATER BASIN GROUNDWATER CONTOURS AND ESTIMATED FLOW DIRECTION

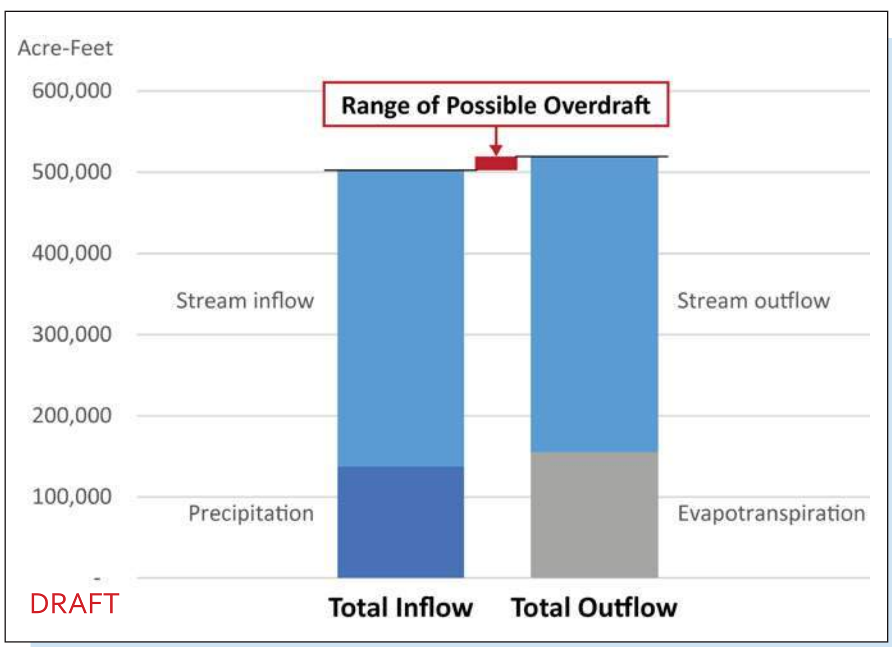

FIGURE 5: DRAFT AVERAGE ANNUAL WATER BUDGET (1984–2018)

Figure 6 shows the change in groundwater storage and indicates that most of the deficit is due to the 2000-2018 time frame being drier than it had been historically. Conversely, the extended wet periods that occurred in the late 1990s caused groundwater levels to recover.

FIGURE 6: CUMULATIVE CHANGE IN STORAGE (1982-2018)

Up Next: Projects and Actions

The next steps in the GSP process are to set measurable criteria to track progress toward sustainability and to define projects and actions to help move the basin toward sustainable groundwater management. The BVAC and GSAs are currently developing these items, and **you are invited** to participate.

How to Participate

- Register as an interested party on our website: https://bigvalleygsp.org.
- Attend BVAC meetings, which are advertised to interested parties and viewable on the online calendar: https://bigvalleygsp.org/calendar.
- View draft GSP documents and offer your comments using the online form: https://bigvalleygsp.org/comment/new.

Thank you for your interest in the Big Valley GSP.

Appendix 11D Comment Matrix

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
Aaron Albaugh	Public Draft Chapters 1 and 2	Section 1.2, line 23	Prove description of Lassen County Basin. DWR boundary definitions and the GSP need to be more specific.	3/4/2020	The boundaries of the basin are established by DWR in their Bulletin 118 for SGMA. A basin boundary modification process is allowed under SGMA and can be investigated, but is outside the scope of writing the GSP. A background section has been added to Chap 1 that describes the County's request for basin boundary modification that was denied by DWR.
Aaron Albaugh	Public Draft Chapters 1 and 2	Section 1.3	DWR prioritization criteria are subjective. Groundwater irrigated acres need to be differentiated from surface water irrigation. DWR doesn't respond to questions.	3/4/2020	A section was added describing the basin prioritization process and the interaction between the counties and DWR regarding the ranking. DWR's dataset that they used to determine irrigated acres is documented on their website. The acreage irrigated by groundwater will be evaluated in Chapter 6: Water Budget. The extent of lowering groundwater levels in the basin will be evaluated in Chapter 5: Groundwater Conditions. DWR's lack of responsiveness to questions is noted.
Aaron Albaugh	Public Draft Chapters 1 and 2	Chap 2 Line 61	Add that GSA was established because we have to, it is not voluntary	3/4/2020	A Background section was added describing the basin prioritization, basin boundary modification request, and correspondence between the counties and DWR. The overarching message of this new text is to document that the counties did not start this process willingly. Wording was changed in Chap 2 to add the word "mandate" when referring to SGMA to emphasize that compliance with this law is not voluntary.
Bryan Hutchinson	Public Draft Chapters 1 and 2	Page #: 1.1, Line #: 6,7,&8	1.1 Lines 6,7,&8 Should state in the body with verbiage of the fact that the Stake Holders" contested DWR findings and protested the priority ranking.1.3 Line 54 graphWhat is it? Where do these numbers come from?I also think that we should refer to the land owners with wells effected by the basin should be referred to as "Stake Holders"	3/5/2020	A background section has been added to Chap 1 that describes the prioritization and the Counties' responses. DWR provides some of the data it used for prioritization on its website, at the URL shown on Line 53. Use of the term "stakeholders" will be defined and used in future chapters.

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
Barbara Donohue	Public Draft Chapters 1 and 2	Page #: 1-2, Line #: 42	I would like to recommend that the description of the boundary of the Big Valley Basin be amended to include the water delivery sources which feed into the water table of the valley. These water sources are varied and include a number of perennial and ephemeral drainages, springs and reservoirs. For example:North: Halls Canyon Creek, Howell Canyon Creek, Fox Draw, Hayes Canyon and seventeen (17) Unnamed ephemeral drainages along Barber and Ryan Ridges.East: Ash Creek, Butte Creek and seven (7) Unnamed Ephemeral drainages.South: Willow Creek, Juniper Creek, Juniper Creek Ã¢€" South Fork, Hot Springs Slough, Gobel Slough, Big Valley Canal and twenty (20) Unnamed ephemeral drainages.West: Taylor Reservoir, Kramer Reservoir, Lower Roberts Reservoir, Taylor Creek, Widow Valley Creek, Bull Run Slough, Egg Lake Slough and fifteen (15) Unnamed ephemeral drainages.My reasoning for this recommendation to include these delivery systems is due to the topographic gradients that assist in the recharging of the Big Valley Basin groundwater. The Pit River itself offers limited influence on recharging groundwater levels to the West and southwest areas of the basin. It offers very little to no influence to the north, east and southern areas. The elevation gradient in the basin varies approximately from 4450 feet in the east to 4160 feet in the westÃ¢€¦ a drop of a few hundred feet. These areas are vital to not only modeling the water budget for the Basin, but provide potential areas for remediation projects. It will make it easier for project planning in the future since we will not have to go through amending the original boundaries at a later date.Although DWR Bulletin 118 determines the boundary based on alluvial deposits, the basin does not exist in an environmental vacuum and is dependent upon all of its water delivery systems.	3/8/2020	A background section has been added to Chap 1 that, in part, describes Lassen County's request for a basin boundary modification that was denied by DWR in 2016. DWR may again accept requests for basin boundary modifications in the future, but DWR has not indicated a timeline. The current GSP will need to honor the currently established basin boundary. With that said, the GSP will acknowledge the importance of areas outside the basin on recharge. Projects and management actions described in the Plan are not restricted to being inside the groundwater basin.
Aaron Albaugh	Public Draft Chapter 3	Section 3.1 lines 23-34	Says that Round Valley is separated from the basin by a 1/2 mile gap. What is the proof of that?	5/6/2020	This text describes how the basin boundaries were drawn by DWR. The text has been updated to reflect this. Connectivity to the Round Valley groundwater basin has been investigated and estimated at about 1 Acre-foot per year.
Geri Byrne	Public Draft Chapter 3	Section 3.4.2	Concern expressed that domestic well is being combined with agricultural use.	5/6/2020	Text has been updated and domestic categorized as a separate use from agriculture
Aaron Albaugh	Public Draft Chapter 3	Section 3.4.1	Disagree with USGS being represented as a public supply well.	5/6/2020	There are specific definitions used by the SWRCB with regard to a public water supply system, and the text reflects this categorization. Text has been modified to emphasize that the USFS station does not serve a resident population.
Aaron Albaugh	Public Draft Chapter 3	Section 3.5	The addition of monitoring wells into the well inventory increases the well density per square mile. This is not right. There is some confusion on the public supply wells, with 6 on the maps, but only 2 public water supply systems.	5/6/2020	The figures in this section only show wells that are designated by drillers on their well completion reports as production, domestic, and public supply. Some of the public supply wells on the map are inactive. The map has been updated to indicate inactive public supply wells.
Geri Byrne	Public Draft Chapter 3	Section 3.6.1	Information on wells monitored by LMFCWCD says information is not readily available. This information should be public.	5/6/2020	The information has been obtained and assessed by UC Cooperative Extension. Some of the results of the assessment have been considered in the GSP.
Geri Byrne	Public Draft Chapter 3	3.6.6	Should say that the Lassen County ordinance prohibits extraction of groundwater for use outside the County.	5/6/2020	Text modified to be accurate.
Julie	Public Draft Chapter 3	Fig. 3-2 Jurisdictions	There may be some areas indicated as BLM, that are not BLM. It's possible that this is the same for some Tribal lands.	7/1/2020	The maps in the GSP are based on the best available data from BLM and DWR.

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
Julie	Public Draft Chapter 3		There is significant new irrigated acreage in the basin since 2014.	7/1/2020	Maps have been updated to use 2016 land use data.
Ned Coe	Public Draft Chapter 3	Table 3-1 Crop Use	The crop of rice should say wild rice - this should be changed wherever referenced	7/1/2020	Change made
Ned Coe	Public Draft Chapter 3		Do USFS mangagement plans need to be included in the section on Land Use plans? (Are there USFS lands within the Basin?)	7/1/2020	A reference to the Modoc National Forest Land and Resource Management Plan from 1991 has been added to Section 3.7.3
BVAC	Public Draft Chapter 3		Regarding response to question about whether surface water supplies are adequate for irrigation, the answer is "YES." There is significant acreage irrigated with surface water supplies.	7/1/2020	Comment received.
Sup. Albaugh	Public Draft Chapter 3		Ash Creek Wildlife Area: This is a "potentially" managed area.	7/1/2020	New text clarifies that the wildlife area is minimally improved.
BVAC	Public Draft Chapter 3		In response to the question of: "How should Wildlife Area and riparian be represented?" - Show riparian areas along creeks and Pit River, where wetlands make it too wet to farm. Use the footprint of the Wildlife Area in all maps and add riparian lines along the river. For example; "x" number of feet along Pit River, other creeks. Either map it or put it into text - explaining number of river miles and estimating width of riparian corridor. (e.g. 363 acres for Pit River)	7/1/2020	The category of "riparian areas" is removed from the maps, per discussion at the July 1, 2020 BVAC meeting in Adin. Table 3-1, Land Use Summary, has been revised to show 12,407 acres of riparian areas (including Ash Creek Wildlife Management area and corridors along waterways.
BVAC	Public Draft Chapter 3		The document reports the Wildlife Area and/or riparian area as 12,000 acres v. 14,000. There is a discrepancy in the numbers.	7/1/2020	See previous reponse.
BVAC	Public Draft Chapter 3		Much of the area of Ash Creek Wildlife Area is not riparian. Some areas along Ash Creek are not riparian. Water supplies for the Wildlife Area include a mix of surface water and groundwater supplies.	7/1/2020	See previous reponse.
BVAC	Public Draft Chapter 3		Water bodies should be on the map, including lower Roberts Reservoir.	7/1/2020	Water bodies are shown on Map
BVAC	Public Draft Chapter 3		How is mixed source shown on the map? There are areas represented as groundwater only, where landowners also irrigate with surface water.	7/1/2020	Looking at water rights information from the Modoc County watermaster and Water Boards. If information cannot resolve the question, it may need to be listed as a data gap.
Laura	Public Draft Chapter 3	line 91	Remove language on LMFCWCD.	7/1/2020	Deleted.
Sup. Albaugh	Public Draft Chapter 3		Beneficial uses: reassess categories of municipal, domestic, recreation (both contact and non-contact).	7/1/2020	First paragraph on surface water regulation reivsed (section 3.5.6) and added new section 3.3.3, Beneficial Uses of Groundwater
BVAC	Public Draft Chapter 3		There are questions about the accuracy of information (data gaps). Be clear about degrees of uncertainty. How will the GSP deal with data gaps - where is it so wrong that additional survey or study must be done? The GSP needs to note inaccuracies. 70% - 80% accuracy is not good enough.	7/1/2020	The GSAs are being cautious about identifying data gaps, commmitting to activities without providing funding to do so.
M. Anderson	Public Draft Chapter 3		It's not the level of importance about certain points of data. The fact is, that it's not right that we have to make decisions based on inaccuracies. That's an imposition. Having to accept inaccuracies is not reasonable. Where there are questions, Big Valley can make estimate and assumptions to our benefit.	7/1/2020	A paragraph of draft text discusses data uncertainties and decision-making. This will be presented at the next BVAC meeting. Currently place in Chapter 4, page 4-1.
T. Martinez	Public Draft Chapter 3		It's not clear what's important. The better information that is collected now, perhaps the basin prioritization will be lowered in the future.	7/1/2020	Other data sets may help increase accuracy - those will need to be looked at.
BVAC	Ch. 3 Plan Area		The term managed wetlands should be changed to state wildlife habitat	9/24/2020	Change made in text

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
BVAC	Ch.3 Plan Area	page 173, line 399	In reference to Diversions: There are claimants on the river that do their own measurments and recordings separate from Water Master. Document set aside with the condition that the language is revised.	9/24/2020	Changes made in text
BVAC	Ch 3 Plan Area	Line 404	Ash Creek diversions are not measure past Modoc county line by water master	9/24/2020	Changes made in text
Nancy Monchamp	Revised Draft Chapters 1-2 v2	Page #:, Line #:	Currently BV Groundwater District mapping has defined groundwater zones within its boundaries. Will the district consider groundwater use similar to surface water use (CA riparian doctrine) in that beneficial use and waste or unreasonable use is first applied within zones to help alleviate projected over draft of groundwater reserves within zones? Does the SWRCB have guidance regarding this subject under the current groundwater law ? Has this been applied in other groundwater management plans in California?	2/17/2021	Surface water rights and the consideration of highest and best use are not under the purview of the GSP.
Barbara Donohue	BigValleyGSP_Ch3_RevisedDraft_2020_08_19.pdf	Page #: 3-15, Line #: 323	The estimate of 18 well in the town of Adin is too low. I would guestimate the number of wells to match the number of parcels and homes in town which would come close to 60+ Each home has its own well, and some parcels have two. Many of these wells were put in place long before well drillers appeared in the community. The town sits a the edge of a very large artesian system and many of the homes have wells less than 100 feet deep. For example, my home was built in 1868 with a hand dug well system that reaches down 80 feet.	3/15/2021	Comment received. The data displayed represents the wells that have been constructed since DWR has required drillers to submit well completion reports. The purpose of displaying the number of wells per 1-mile section is to identify where there are higher densities of the various well types. This map achieves this goal, despite the numbers potentially being too low. Well inventory has been identified as a data gap.
Barbara Donohue	BigValleyGSP_Ch3_RevisedDraft_2020_08_19.pdf	Page #: 3-21, Line #: 403	There is a great deal of precipitation monitoring performed by the US Forest Service Big Valley Ranger Station. they collect both monthly and annual estimates. As a matter of fact, this will be their 78th year of providing this data to NOAA (they received a plaque from NOAA a couple of years ago celebrating their 75th year in providing weather information). Please call Lennie Edgerton who has this information in spreadsheet form at the Forest Service: (530) 299-8444	3/15/2021	Comment received. The GSP contains the best readily available information regarding precipitation.
Barbara Donohue	BigValleyGSP_Ch3_RevisedDraft_2020_08_19.pdf	Page #: 3-21, Line #: 407	Using CIMIS data from McArthur CA is incongruous at best. The nearest CIMIS Station that best represents the weather attributes of the Big Valley area is located in Alturas, CA (CIMIS #90).Although located 40 miles to the east, both Alturas and the Big Valley area are located within the Modoc Plateau Physiographic Province, NOT the Fall River Valley. Being over 1000 feet higher in elevation can drive significant differences in precipitation levels and evapotranspiration rates as well as significant differences in soil types. Please reconsider your "source data" ... Even NOAA uses weather information from the Alturas Airport to estimate changes in weather for this area.	3/15/2021	Comment received. In the water budget, McArthur climate data was not used directly. The water budget uses interpolated values for the town of Bieber.
Barbara Donohue	BigValleyGSP_Ch3_RevisedDraft_2020_08_19.pdf	Page #: 3-21, Line #: 407	Continuation of limited climate information for the Big Valley Basin.There is a Remote Access Weather Station (RAWS) that is located just north of Round Valley on a west facing slope. It has been collecting local weather information for decades. You can find its weather data here:https://raws.dri.edu/cgi-bin/rawMAIN.pl?caCRUSIt is named "Rush Creek RAWS"	3/15/2021	Comment received. The GSP contains the best readily available information regarding climate.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Chapt 1	Comment was made that the Ash Creek Wildlife Area is a "disaster". Before it was taken on by the state, the local land owner was farming the property and the area was teeming with wildlife. Since taking over, the state has left the property unmanaged and it does not support the wildlife that it used to	9/9/2021	Text was added to Section 1.1 describing this mismanagement.

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Chapt 1	Comment was made that many Big Valley residents participated in a program with the State Board where they put in stockwatering wells off-stream to keep cattle out of the riparian areas to improve water quality. Now those extra wells drilled are being used against the residents due to the prioritization including the number of wells as one of the prioritization criteria	9/9/2021	Text was added to Section 1.1 regarding residents participating in this program to protect water quality. Text added to section 1.3 describing how the inventory of wells has been used against the landowners.
Sup. Byrne	Big Valley GSP All Chapters Public Draft 8/26/21	Line 132	Don't like sentence. Change to Currently there is no evidence to suggest that…	9/9/2021	Sentence changed
Sup. Byrne	Big Valley GSP All Chapters Public Draft 8/26/21	Line 164	Change may to will.. Capitalize Board of Supervisors	9/9/2021	Text changed
Sup. Byrne	Big Valley GSP All Chapters Public Draft 8/26/21	Line 234	Strike contend	9/9/2021	Word stricken
Sup. Byrne	Big Valley GSP All Chapters Public Draft 8/26/21	Line 809	The Goose Lake Basin statement needs further clarification such as "The Goose Lake Basin, with similar land use practices"	9/9/2021	Text changed
Doreen SmithPower	BigValleyGSP_Ch1_2_RevisedDraft_2021_03_21_set aside.pdf	Page #:, Line #:	See Letter 1 from Doreen Smith Power to BVAC dates 9/11/21. General comments on chapters 1-6.: https://bigvalleygsp.org/service/document/download/281	9/13/2021	Letter received and included in GSP Appendix
Doreen SmithPower	BigValleyGSP_Ch1_2_RevisedDraft_2021_03_21_set aside.pdf	Page #: 1-90, Line #:	See Letter 2 from Doreen SmithPower to BVAC Dated 9/9/21. BigValley GSP Chapters 1-3, Comments are both editorial and content. See attached memo. https://bigvalleygsp.org/service/document/download/280	9/13/2021	Memo received and included in GSP Appendix.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 230	Add text "of this unfunded mandate"	9/9/2021	Text added
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Lines 243-245	There are local conservation groups such as the FSA that have helped	9/9/2021	Text modified to include NGOs.

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 251	Wildlife grazes on ag lands and also rear their young and seek protection from predators	9/9/2021	Text modified. Quote from Stadtler (2007), former land owner, added.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Chapter 1	We installed off-stream stockwatering wells to improve water quality. Now this increase in well inventory is coming back to bite us.	9/9/2021	Text added regarding participation in the EQUIP program. Text added to Table 1-1. Text added to section 3.4.1
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 299	BVAC members were appointed, not elected	9/9/2021	Text changed
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 302	BVAC and county staff have devoted their hours without compensation	9/9/2021	Text added, stating that time was largely uncompensated.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 318	DWR needs the better understanding of the Basin	9/9/2021	Text added.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 390	County staff didn't "feel" misled, they "were" misled	9/9/2021	Text changed.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 428-434	Please point out the inadequacy of using a 60 year old map to draw basin boundries	9/9/2021	Text changed.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Lines 531-532	Last sentence regarding right to pump water should be bold	9/9/2021	Text bolded
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 3.2	The Superior Court has jurisdiction over water rights.	9/9/2021	Section added regarding court role. Text will be added

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 3.2	Don't like saying that federal and state agencies "own" land.	9/9/2021	Text changed to "has jurisdiction over".
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 647	Change "Habitat" to "Area"	9/9/2021	Text changed.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Figure 3-5	Don't like this map it is grossly inaccurate	9/9/2021	Map replaced with the one used in Chapter 6
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Lines 685-686	Pumping on ACWA is for growing feed stock, not for creating wetlands	9/9/2021	Text changed to be more general "habitat".
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 25	Reference to Conner 2021 should be for multiple years	10/6/2021	Reference changed to 2020-2021
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 26	Ag was not supplemented by timber. Both were equally important	10/6/2021	Text changed from "supplemented" to "complemented"
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 36-37	Doesn't the designation of "disadvantaged" comes from the state, not DWR in particular?	10/6/2021	For the purposes of SGMA and grant funding, DWR has performed an analysis of the status of communities throughout the state and designates areas that are "disadvantaged" and "severely disadvantaged". The information is available on their map viewer: https://gis.water.ca.gov/app/dacs/
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Lines 93, 254, 310	Change "SGMA mandate" to "SGMA unfunded mandate"	10/6/2021	Text changed

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 97	Add text "and prosecute" with respect to the illegal marijuana grows	10/6/2021	Text added
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 107	Change "habitat" to "ecosystem"	10/6/2021	Text changed
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Lines 107-108	This sentence about diversification of the economy is unclear	10/6/2021	Sentence modified for clarity.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Lines 115-116	Add "prove that the Basin is low priority" to the list of reasons why the GSP is being developed	10/6/2021	Sentence modified
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 127	Add "and maintain" sustainability	10/6/2021	Text added
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 151	Don't understand why "understanding upland recharge" and "improved estimate of crop water usage" are listed here.	10/6/2021	Sentence shortened to remove those elements
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 163	Change "should" to "will"	10/6/2021	Text changed

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Name	Document	Page & Line Number	Comment	Date	Response
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 166	Add "and should be re-ranked as low priority"	10/6/2021	Text added
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 191	Add "inaccurate" basin boundary	10/6/2021	Text added
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Lines 232-240	Point out that DWR's denial was based on a lack of scientific justification, yet they used inaccurate, unscientific information in their ranking process.	10/6/2021	Sentence added.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 262	Add "inaccurate" basin boundary	10/6/2021	Text added
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 345	It states "about 144 square miles" here, yet elsewhere it says "approximately" or just states "144 square miles". Which is it?	10/6/2021	Text changed in the document to consistently be "about 144 square miles"
BVAC	Changes made between 9/22 & 10/5/21 introduced at 10/6/21 BVAC	Lines 4573-4577	SGMA cannot alter existing water rights	10/6/2021	Text changed to state that SGMA does not alter existing water rights.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 498	The Forest Service is also an agency with jurisdiction over illegal cannibis operations	10/6/2021	Text modified to add USFS to list of agencies

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Name	Document	Page & Line Number	Comment	Date	Response
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Lines 638-643	The language regarding the BVWUA measurement and reporting of diversions may be inaccurate	10/6/2021	Text changed and verified with BVWUA and Modoc Watermaster.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 666	The historic gages on the map are hard to see	10/6/2021	Map updated with color of historic gages changed
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 668	Table 3-12 needs to be explained better	10/6/2021	Additional explanation added to section 3.5.1.3
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 774	Groundwater export ordinances aren't requirements as much as they are limitations	10/6/2021	Text changed from "requirements" to "limitations".
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 905	Sentence ends in a preposition	10/6/2021	Sentence modified as requested.
BVAC	Changes made between 9/22 & 10/5/21 introduced at 10/6/21 BVAC	Line 4703	Many CRP and WRP contracts do not end after 10-15 years	10/6/2021	Text modified to remove the time and just state until end of contract.
BVAC	Changes made between 9/22 & 10/5/21 introduced at 10/6/21 BVAC	Line 4696	Sometimes reserve lands are kept in agricultural production to enhance habitat	10/6/2021	Text changed to simply state that the land owner agrees to promote plant species that will improve environmental health and quality.

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Name	Document	Page & Line Number	Comment	Date	Response
BVAC	Changes made between 9/22 & 10/5/21 introduced at 10/6/21 BVAC	Line 5516	Misspelling	10/6/2021	Corrected.
BVAC	Changes made between 9/22 & 10/5/21 introduced at 10/6/21 BVAC	Line 4628	Private parties also report diversions	10/6/2021	Text added.
BVAC	Changes made between 9/22 & 10/5/21 introduced at 10/6/21 BVAC	Lines 65-77	It's not clear who this quote is from.	10/6/2021	Reference moved to after the quote.
Julie	Draft GSP 9/22/21	Lines 369-370	For public comment period: Chapt 3: Line 369-370 in today's packet version: " Landowners have the right to extract and use groundwaterbeneath their property." Please provide legal reference for that right, including whether there are any limitations, conditions, or requirements on that right. (e.g. historical/previous use)	10/6/2021	Water rights are not addressed directly in the GSP. However, BVAC members and stakeholders advocated for this language to be added to the text to emphasize that private well owners do have water rights. This statement is consistent with current water rights law. More detail about water rights can be found at: https://www.waterboards.ca.gov/waterrights/board_info/
Julie	BigValleyGSP Revised Draft 10/18/2021	Page #: 3-11 Line #: 753	Sec 3.4.1: Emphasis of data gap is on removing abandoned wells from inventory. At least in Adin, it is obvious that 18 wells is an undercount of wells to standard. I have mentioned this before.	10/20/2021	Comment received. The data displayed represents the wells that have been constructed since DWR has required drillers to submit well completion reports. The purpose of displaying the number of wells per 1-mile section is to identify where there are higher densities of the various well types. This map achieves this goal, despite the numbers potentially being too low. Well inventory has been identified as a data gap.
NGOs	BigValleyGSP _PublicRevie wDraft_2021 _10_28	Section 3.2	See Letter 3 from NGOs to GSAs dated 11/28/21. While the plan identifies Modoc County and Lassen County as DACs, it fails to provide a map identifying the locations of each DAC by census block groups, tracts, or places. The plan also fails to clearly state the population of each DAC or include the population dependent on groundwater as their source of drinking water in the basin.	11/28/2021	Maps of DACs are not required by the regulations. The text clearly states that both counties are disadvantaged and therefore the entire basin is disadvantaged. Furthermore, the population of the Basin is stated in the GSP and therefore the entire Basin population is disadvantaged.

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 3.4	See Letter 3 from NGOs to GSAs dated 11/28/21. The GSP provides a density map of domestic wells in the basin (Figure 3-7). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range). This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the basin.	11/28/2021	An analysis of well depth was performed basin-wide and is included in Chapter 7, Figure 7-2.
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 1.1	In this section and elsewhere, the poor opinion of the ACWA is apparent. The quote from Phillip Stadtler's book "I Made A Lot of Tracks" is typical and, I believe, not relevant or appropriate. Mr Stadtler was a cattle and land trader, an apparent master of the deal (until he wasn't,) who appears to have leased then owned ~15,000 acres (plus a smaller 300-acre parcel) in Big Valley for decades. Stadtler does not state the dates that he bought and sold (part of) the Hunt and Woods Ranch, but he spent 6 years in court fighting to buy it and a ranch in Red Bluff (he only got the former,) probably in the 1960's (the book jumps around,) and the ACWA was created in 1986. It appears that Stadtler rarely visited the area. Instead, his home base was mostly Hilmar, California. He also moved to Texas when the banks were hounding him in the 1970's, and he traveled and traded all over Mexico, throughout the Western US, Iran, and more. By his own account in the 1960's, "Every time I turned around, I was buying another ranch. I bought the Oak Flat Ranch in California, one in Kansas, and one in Minnesota with Terrell Spence. I bought four or five ranches in Arizona and a couple in Texas. Everything seemed to be falling into place. I didn't always make money, though…." (p. 137)	11/29/2021	Comment received. The quote in the GSP text is appropriately referenced and its sentiment and appropriateness was supported by the BVAC members and was not questioned by other members of the public.
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 1.1	Stadtler was a master of "shrinkage" and other shipping logistics. His major story about the ranch involved shipping an estimated 7000 cattle out of the ranch over about a week's time because "the market got tough and it was getting late in the year and the grass was going away on us." However, shipping out was apparently delayed to "the last part of October, icy and froze up. The cattle should have been out of there a long time before but the market was bad." (p. 133) No mention of the effect on the wildlife. Actually, Stadtler seems to have little interest in or knowledge of wildlife habitat requirements, groundwater recharge, or wetlands diversity in general. The quote in the Groundwater Plan (p134-135) is a rare mention of wildlife in his book. Also, to my knowledge, the land was sold directly to the state of California, so CDFG (at the time), not US Fish and Wildlife Service bought it. Since Stadtler appears to have an encyclopedic memory of his deals, partners, towns, visitor accommodations, and adventures, it is telling that he can't keep his agencies straight. In BVAC advisory committee meetings, I have commented on the diversity of wildlife and their habitats within the ACWA and surrounding agricultural, forested, and sage steppe ecotypes. I suggest that the GSP take a more factual and open-minded view toward the ACWA. This may lead to a recognition of the value of the ACWA's wildlife and groundwater recharge (both current and potential future.)	11/29/2021	Comment received. The quote in the GSP text is appropriately referenced and its sentiment and appropriateness was supported by the BVAC members and was not questioned by other members of the public.

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 1.1	(continued) Blaming the closure of the four mills in Big Valley on state and federal regulations is not factually appropriate and could lead to missing opportunities that the actual facts would suggest. Most of the decreased number of timber jobs, both in the woods and in the mills, here and elsewhere, is due to economies of scale, mechanization, and change of ownerships. The assessment in the GSP appears influenced by politics more than reality. Actually, there is plenty of logging occurring in the Big Valley area, but the timber products are going to mills elsewhere: Burney, Klamath Falls, Lakeview, and occasionally other mills. This includes a significant increase in the rate of SPI clearcutting land that previously was managed by Beaty, and often processed locally.	11/29/2021	Comment received. The nexus between state and federal regulations and the demise of the timber industry in Big Valley and elsewhere is well established and accepted by the County's GSP development team, including UC Cooperative Extension rangeland experts.
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 1.2	I repeatedly have questioned the goal of agriculture having the sole mentioned “vested right” to groundwater. I found an excellent summary of groundwater rights law (at least up to 2004) in the Upper Pit Watershed Assessment, 2004. All land owners have “overlying rights;” there is no prescriptive right based on past use. Instead, groundwater rights are based on current, reasonable, and beneficial uses. It appears that this claimed “vested right” is being used to justify discounting the rights of community members and possible industry, including revival of the Bieber mill site to utilize fuels removal materials. It is also being used to justify allowing the groundwater levels to drop 140’ from current levels, based on the economics of agriculture alone. I believe our goal should be much more focused on sustainability with actions taken much sooner. We have an opportunity to avoid the Undesirable Outcomes in the more-concerning high- and medium-priority basins and already occurring especially on the west side of the BV groundwater basin as evidenced by the groundwater contour maps and wells going (functionally) dry.	11/29/2021	Comment received. More information about water rights can be found at: https://www.waterboards.ca.gov/waterrights/board_info/. The importance of agriculture was consistently expressed and supported by the BVAC and was not questioned by others during the GSP development process. The feeling is that since agriculture is virtually the only economic activity in the Basin that directly supports the local economy, other uses such as domestic would not exist without agriculture. An inventory of wells (including domestic) has been identified as a data gap and the GSAs will seek funding.
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 3.2.6	Upper Pit IRWMP: Can this plan be found anywhere on the web? I looked and didn’t find it. If it isn’t there, can it be posted? I did find the Watershed Assessment, which has a lot of helpful information, and which the GSP doesn’t list as a reference either. Fig 3-2: There is no BLM land along Hwy 139, approximately 2 miles S of Adin.	11/29/2021	The IRWMP has been uploaded to the GSP website and is available at: https://bigvalleygsp.org/service/document/download/341

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 3.3	The GSP doesn't mention the increasing number of wells and irrigated acres (often converted from sagebrush steppe or unirrigated pasture.) This has been occurring for some time. From Upper Pit River Watershed Assessment, prepared by Vestra for Pit River Alliance, 2004: If the number of irrigation wells can be used as an indicator, groundwater usage in the Upper Pit River Watershed has increased approximately 10 fold in the last 40 years. For example, the number of irrigation and municipal wells within the Alturas basin increased 3.6 times between 1960 and 1979, and 2.3 times between 1979 and 1997. Within the Big Valley basin, the number of municipal and irrigation wells increased by 5.9 times between 1960 and 1979, and 1.8 times between 1979 and 1997. Statewide, well drilling peaked in 1977, in response to the 1975–76 drought; and in 1993, in response to the 1987–92 drought (DWR, 2000). USGS estimated that approximately 50,000 acre-feet of water were used consumptively for irrigation in the watershed in 1990, and approximately 80,000 acre-feet of water were used consumptively for irrigation in 1995 (USGS, The National Water-Use Program, 2003). The Assessment then provides a table of older well inventories, broken down by groundwater basin. New well drilling and conversion of native vegetation to agriculture have continued since 2004. This is obvious looking at the historical imagery vs most recent on Google Earth. Recent imagery will be helpful in updating the GSP's facts and figures. For instance, a large (3700' diameter circle) center pivot recently was installed just W of Hwy 139, less than a mile south of Adin. It is not visible in 2015 imagery, the conversion was in progress in 2017, and the field is actively being farmed in 2021 imagery. This field is not shown on Figs 3-5 or 3-6. A note on Fig 3-5 states that the map may be updated with 2018 Land IQ data. I suggest even more recent data will be required.	11/29/2021	Comment received. The GSP presents the best readily available information and data on these topics. Updated land use data provided by DWR will be used for annual reports and future updates of the GSP.

Big Valley GSP Comment Matrix Chapters 1-3

Name	Document	Page & Line Number	Comment	Date	Response
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 3.4	Figure 3-7 and almost certainly the well inventory are incomplete and inaccurate. Rather than make an effort to update the well count, the GSP instead emphasizes that wells have been abandoned and need to be subtracted from the count. For instance, the main Adin block shows 18 wells in the Groundwater Plan. I repeatedly have commented that this is an undercount of domestic wells. There are at least 50 wells in this block, as most houses have their own well with only occasionally several houses on one well. All the blocks surrounding the main Adin block also are undercounted. Yes, some of these wells are shallow, with jet surface pumps, and possibly may be accessing a perched aquifer. But over the years, these pumps are being replaced with submersible pumps as the water table slowly lowers. However, the GSP appears to discount many of Adin's wells as "hand-dug," and therefore does not include them in the inventory. The comment was made during a BVAC meeting that any well less than 100' deep is "substandard" and needs to be deepened and improved. I believe you will have a revolt on your hands if the County insists on this and/or the water table continues to drop. Either that, or a significant percentage of Adin's housing (mostly lower-value rentals) will become unusable, because many home owners will not be able to improve their wells either economically or logistically. I suspect that a community water system would be prohibitively expensive to install. And yes, the water table is slowly sinking. See Sec 5.1 comments. My concern is that the GSP's under-count also under-values the importance of Adin's wells to maintaining the house stock in our community, and therefore lowering of the groundwater levels here doesn't rate seriously as an Undesirable Outcome.	11/29/2021	Comment received. The data displayed represents the wells that have been constructed since DWR has required drillers to submit well completion reports. The purpose of displaying the number of wells per 1-mile section is to identify where there are higher densities of the various well types. This map achieves this goal, despite the numbers potentially being too low. The well inventory has been identified as a data gap so that future updates can be more accurate.
Julie Dawson-Parlee	BigValleyGSP_PublicReviewDraft_2021_10_28		With all the evidence of how inaccurate and unfair the Basin boundary is, it seems abrupt to just say that the GSAs will submit a Basin boundary modification. Perhaps it should say that the GSAs will continue to submit Basin boundary modification requests as long as DWR continues to ignore the science and updated information available. This section also needs to be specific in mentioning that the majority neighboring landholder to the Basin is the USFS, so accurate boundaries would increase the likelihood of cooperation and partnership in recharge projects.	11/28/2021	Comment received. There is lengthy discussion in the introduction and throughout the text about the inaccuracy of the basin boundary, the GSA's request to change it which was denied, and the current intention is to submit a future modification request.

Big Valley GSP Comment Matrix Chapter 4

Name	Document	Page & Line Number	Comment (NOTE: break from 02:19:30-02:28:00	Date	Response
Julie	Public Draft Chapter 4		How much UC Davis information is included in Chapter 4? Is preliminary information available from that Study?	3/19/2021	The UC Davis groundwater recharge study is ongoing. Specific information and data is not included in the GSP, as it was not finalized and available during the GSP development process.
Presentation	Public Draft Chapter 4		DWR identifies options for defining a basin bottom: bedrock, water quality that precludes use (using resistivity) It's not clear where bedrock occurs, or where water quality decreases. Are using 1,200' as a definable bottom, to capture existing wells.	3/19/2021	See conceptual language at the bottom of page 4-10 and at the top of page 4-13.
Presentation	Public Draft Chapter 4		Data gaps include: basin boundary, confining conditions, definable bottom, faults as barriers to flow, soil permeability, recharge	3/19/2021	See language on page 4-1
Sup. Albaugh	Public Draft Chapter 4	Page 1 line 13	Dimensions of basins do not match with Chapter 3.	3/19/2021	Text has been modified for consistency of dimensions and acreage.
Sup. Albaugh	Public Draft Chapter 4	Page 1 Line 21	Add in 363.63 acres of riparian area (30 miles of Pit River, 50' on each side)	3/19/2021	Riparian area is captured in Table 3-1
Sup. Albaugh	Public Draft Chapter 4	Sec. 4.4.1	Single principal aquifer is most appropriate for managing groundwater. This should be removed. The BVAC is not interested in managing groundwater. What is the basis for the determination of a single aquifer? To define multiple aquifers, there would need to be evidence of hydrologic separation (such as clay layers). Pumps that have different levels of production could be connected - the differences resulting from the fact that aquifers are not consistent throughout. Also, there is a stream between the upper basin and lower basin. Laura: If there was a bathtub filled with sand, everyone would have the same pumping. However, the bathtub is filled with sand, gravel, clay and silt. There are also layers of lava, faults and streams. Additionally, the basin is thinner at the edges. Better pumping occurs in sand, less production is found where drilling occurred where there is more clay or silt. Wells were drilled to see what the layers of materials are in areas where there aren't many wells. Tiffany: These wells supllement the CASGEM wells. Also: the Wildlife Area looked at adding a monitoring well. However, it is not likely that that the well would have been permitted in time to inform the GSP. (Note:Check into whether this is proceeding?)	3/19/2021	Language for section 4.4.1 is that: "a single principal aquifer will be used for this GSP." (will not say "for managing groundwater") Explain that there are potential differences across the basin. There are 21 CASGEM wells. Ranging in depth from 800' to 50'-100'. It's hard to pin down details and distinctions with 21 wells with a wide range in depth. There are three wells in Lookout (or south of Bieber) that provide a clue that something might be different. There is language in the Plan that the GSAs are being forced to use inaccurate data to make the decisions. "Adaptive Management" is stated as a concept in the GSP where the Plan can adapt as more and better data and information is obtained.
Sup. Albaugh	Public Draft Chapter 4	page 26 Line 423	Shows many small towns and reservoirs. There are also small ponds and reservoirs within the basin. Ranchers have to pay dam fees for reservoirs and water rights fees for stock ponds. These are surface supplies. These should be shown on the maps or described in text.	3/19/2021	There will be an opportunity to mark up maps and revise presentation of waterbodies. (Map -14)
Sup. Albaugh	Public Draft Chapter 4	page 26 Line 425	Importing surface water into the basin: Roberts Reservoir and Silver Reservoir has water rights used in this basin, that is stored outside the basin boundaries. Clarify language on imported water. Explain that some water sources used in the basin is stored outside the basin boundaries. Ensure that all incoming supplies are accounted for in water balances.	3/19/2021	Imported water refers to surface water supplies that originate from outside the watershed where the supplies are used. This is clarified.

Big Valley GSP Comment Matrix Chapter 4

Name	Document	Page & Line Number	Comment (NOTE: break from 02:19:30-02:28:00	Date	Response
Sup. Albaugh	Public Draft Chapter 4	page 27	The issue of definable bottom: What value works to the favor, in the interests of, Big Valley residents? Say that the definable bottom has not been established, there is much variability, and that a bottom is set at "x" for the purposes of the plan. Helpful to know when things are, or are not, in our interest - and to explain why that is so. If the definable bottom needs to be in the plan, say so. Then heavily caveat the number. Any uncertainties should be evaluated in favor of the Basin.	3/19/2021	Annual reports require calculations on change in storage for the basin. Those calculations are multiplied by the number of aquifers. Then definable bottoms must be determined for each aquifer. The change in storage is what is important, not the overall storage. The key is to understand the conditions and the best options for optimizing and using the resource to make sure there are not dire consequences in the future. NOTE: GEI provides a list of required elements for each chapter.
Sup. Byrne	Public Draft Chapter 4	Page 23 Line 360	Replace the word "poorer." Perhaps lesser - keep looking… The quality of water that is naturally occuring will not be affected by management decisions. Clarify that this is not about good water quality being degraded.	3/19/2021	Language changed.
Julie	Public Draft Chapter 4		Explain that there is a lot of complexity across the basin, including termperature and water quality. Show the variety in where water levels are maintaining or going down. Want to focus on the goals, for example - wells not drying up, supporting agriculture, springs going dry. Management will focus on the goals rather than absolute numbers.	3/19/2021	This is a central discussion for creating Sustainable Management Criteria - this suggestion has been considered in developing the sustainable management criteria.
Julie	Public Draft Chapter 4		How can the GSP use remedial soils, outside of basin boundaries, to help support recharge to the basin?	3/19/2021	Projects in Chapter 9 help address this.
Barbara Donohue	BigValleyGSP_Ch4_RevisedDraft_2020_08_19.pdf	Page #: 4-16, Line #: 270	Figure 4.5.1 Taxonomic Soil Orders identified for the Basin are oversimplified and are too "Coarse Grain" to be used effectively for any management implications. It certainly simplifies the landscape analysis process, but does not adequately describe in enough detail as to the attributes of soil classification that supports the poor infiltration and problems with groundwater recharge found in throughout this area. Please include more extensive soil classification descriptions. NRCS soil maps provide a more comprehensive backdrop to the soils out here	3/19/2021	Soils maps are a required element of the GSP. The maps presented represent the best readily available information.
Barbara Donohue	BigValleyGSP_Ch4_RevisedDraft_2020_08_19.pdf	Page #: 4-18, Line #: 303	Table 4.5.2 Hydrologic soil descriptions .... Again, the Hydrologic Soil Descriptions identified for the Basin are oversimplified and are too "Coarse Grain" to be used effectively for any management implications. They do not adequately describe in enough detail as to the attributes of different hydrologic soil classifications that support this area. Please include more extensive hydrologic soil descriptions. These hydrologic soil descriptions are important for protection of rare habitat types found within the Valley which include northern basalt vernal pools.	3/19/2021	Soils maps are a required element of the GSP. The maps presented represent the best readily available information.

Big Valley GSP Comment Matrix Chapter 4

Name	Document	Page & Line Number	Comment (NOTE: break from 02:19:30-02:28:00	Date	Response
Barbara Donohue	BigValleyGSP_Ch4_RevisedDraft_2020_08_19.pdf	Page #: 4-23, Line #: 400	Figure 4-12 NCCAG Wetland delineation.I am challenging the use of the NCCAG dataset at the principal data source for the delineation of wetland systems in the Big Valley Basin. It appears that wetland acreages are under represented in their data set due to the fact that it is based upon "natural community types", i.e; vegetation. The USGS National Wetlands Inventory Wetland Mapper utilizes multiple variables including soil type, soil profile, oxidation within the soil profile, depth to water, vegetation, hydrologic factors and more when delineating and describing wetland types in their mapping data. I would recommend that the information provided by the USGS National Wetland Inventory be compared with the NCCAG dataset. The history of land use in the Valley by ranching and agricultural activity has has a direct effect on the "vegetation community types" one can identify on an aerial photograph. These activities however, do not necessarily change the underlying attributes of wetland characteristics within the soil. You can access this information via the USGS website: https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/	3/19/2021	The NCCAG dataset is currently the best available information, and this has been suplemented with local knowledge including local experts. Further refinement of the data and field verification of the habitat has been identified as a data gap.
Barbara Donohue	BigValleyGSP_Ch4_RevisedDraft_2020_08_19.pdf	Page #: 4-26, Line #: 454	Figure 4-14 Recharge, discharge and major surface water bodies.The legend that is presented with this Figure has an item listed as "Lake". As mentioned on page 4-27, line 466, this figure represents the streams, ponds and surface waters within and adjacent to the Basin. There are little "lake" effects in the Valley. The surface waters present in the Basin are over-represented in this Figure. We have no reservoirs within the Valley basin. We DO have stock ponds, small impoundments and freshwater ponds located on the Ash Creek Wildlife Refuge. More current aerial photographs of the Basin clearly show extant, smaller and more depleted surface waters than what is presented in this Figure. Please review this data.	3/19/2021	Figure 4-14 presents the best available information to address the GSP requirement for a map that depicts the surface water bodies in the Basin.
Doreen SmithPower	BigValleyGSP_Ch4_RevisedDraft_2021_03_21_setaside.pdf	Page #: 1-90, Line #:	See Letter 1 from Doreen Smith Power to BVAC dates 9/11/21. General comments on chapters 1-6.: https://bigvalleygsp.org/service/document/download/281	9/13/2021	Comments received.
Doreen SmithPower	BigValleyGSP_Ch4_RevisedDraft_2021_03_21_setaside.pdf	Page #: 1-90, Line #:	See Letter 2 from Doreen SmithPower to BVAC Dated 9/9/21. BigValley GSP Chapters 1-3, Comments are both editorial and content. See attached memo. https://bigvalleygsp.org/service/document/download/280	9/13/2021	Comments received.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 4.2.1	Add more language regarding the inaccuracies in the Basin Boundary, particularly the finger that includes E. Fork Juniper Creek	9/9/2021	Text modified.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Lines 1274-1275	Delete last sentence	9/9/2021	Sentence deleted

Big Valley GSP Comment Matrix Chapter 4

Name	Document	Page & Line Number	Comment (NOTE: break from 02:19:30-02:28:00	Date	Response
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 4.6, Environmental Uses	Don't like map and discussion of NCCAG	9/9/2021	The NCCAG dataset is currently the best available information, and this has been suplemented with local knowledge including local experts. Further refinement of the data and field verification of the habitat has been identified as a data gap.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 1515	Does young water mean we are not in overdraft?	9/9/2021	Young water indicates that the water is being flushed through the system.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Lines 1555-1558	Flood irrigation doesn't occur just on lower portions of Pit River	9/9/2021	Text changed to state flood irrigation occurs in the Basin generally.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Figures 4-9 through 4-11	Expand these maps so they include areas outside the Basin	9/9/2021	This will be done before the final GSP is submitted.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1017	With regard to the basin boundary modification, change "may be necessary" to "is necessary"	9/9/2021	Text modified.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1020	Change "may be inaccurate" to "is inaccurate"	9/9/2021	Text modified.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1043	Change "suggested that these mountains serve as recharge" to "stated that…"	10/6/2021	Text modified.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1106	Big Valley doesn't have brackish or saline water. Why is this term in here?	10/6/2021	This reference to brackish or saline water does not indicate that it exists in the Basin, it is a reference to what DWR defines as an "effective bottom"

Big Valley GSP Comment Matrix Chapter 4

Name	Document	Page & Line Number	Comment (NOTE: break from 02:19:30-02:28:00	Date	Response
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1050	What is the dashed line on the map?	10/6/2021	Map changed and dashed line added to legend.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Lines 1163-1188	The data that was used to determine the aquifer characteristics came from the new monitoring wells which are small diameter and were pumped at a very low rate (8 gpm). Is this sufficient to determine the aquifer characteristics	10/6/2021	The text does acknowledge that larger wells pumped at higher rates would give higher values for the aquifer characteristics. This has been added as a data gap.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1338	Change "underflow could enter the basin" to "underflow does enter the basin"	10/6/2021	Text changed
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1344	Don't like the blanket statement that precipitation that doesn't infiltrate runs off or is consumed through evapotranspiration	10/6/2021	Conceptually, precipitation that hits the ground must go in one of three places: deep infiltration, runoff, or remains in the soil and is eventually evapotranspirated. Text changed to remove the word "consumed".
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Lines 937 to 938	Add "assumed" physical characteristics and "estimates" the principal aquifer	10/6/2021	These terms diminish and degrade the quality of the work put into the HCM. The changes are not necessary and the statement as written is complete and accurate. The statement ends by qualifying the HCM as being based on best available information. This is the appropriate language for introducing the chapter.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 949	Add "estimated" before HCM	10/6/2021	See response above.

Big Valley GSP Comment Matrix Chapter 5

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
BVAC	Public Draft Chapter 5	Subsidence, Section 5.5, pages 5-22 to 5-24	How do the measurements account for agricultural practices that affect ground level? That should be discussed. Subsidence may not be due to changes in groundwater levels. It could be compaction, grazing land converted to row crops - with soils used to enhance levees. Or earthwork done at Caltrans. Or erosion. There may be other actions affecting ground levels, such as new ground disturbance. • Consider a footnote on land use, saying that additional on-ground monitoring is needed. Explain that these measurements show where ground is lower or higher.	9/24/2020	Subsidence associated with groundwater dynamics and pumping generally result in "bulls-eye" patterns of subsidence. Some of the subsidence in Big Valley is likely due to oxidation of organic materials. There are other options for monitoring subsidence, including the survey markers embedded in the new well monitoring foundations. Local knowledge was used in refinement of the map and in the discussion in the text.
BVAC	Public Draft Chapter 5	Water Quality Section 5.4, pages 5-9 to 5-22.	There are concerns that providing quantitative measurements on water quality will encourage micro-analysis by the state.	9/24/2020	Elevated constituents are naturally occurring (iron, manganese, arsenic). Specific conductance is also naturally occurring and is a general measure of water quality. The GSP is required to report on contamination sites (such as gas stations and landfills). The graphs do show that there is better water quality (graphs 5-8, 5-9 and 5-10). It can support a baseline groundwater quality monitoring in the GSP. Additional data on water quality can show that conditions are even better than what was seen with Bieber samples.
BVAC	Public Draft Chapter 5	Groundwater Levels (and surface water interactions)	Don't groundwater levels necessarily need to be the same across the basin? Explain how it's determined that a stream is gaining or losing. It is not understandable.	9/24/2020	Two reasons why surface water depletions are a critical element: surface water rights and groundwater dependent ecosystems. (Response: as long as the wells are in the same geologic formation, the levels should be very close. If a pump is located in a different formation, the response times may be different - and affect the levels) (Response: Pit River and Ash Creek have different water signatures. Additional monitoring and samples will better inform the patterns of gaining and losing.
BVAC	Public Draft Chapter 5	GDEs, Sec. 5.7, pages 5-26 to 5-31	• The acreage for amount of willows in the basin is overstated. There is not 4,700 acres of willows in the basin. • Ash Creek Refuge uses surface water supplies. There was discussion about groundwater levels in that specific area, which are closer to the surface and contribute to surface water supplies. Table 5.5, page • Alfalfa is listed as a native species – change this • Is aspen found in the basin? • Is elderberry found in the basin? • Change "salix" to "willow"	9/24/2020	Ash Creek Refuge does also use groundwater pumping to irrigate at Ash Creek. This area is known as an ecological preserve and land uses are not likely to change. The consultants were careful to clearly delineate what truly qualifies as a GDE. This current text is about describing likely or potential GDE. The big question is about managing for GDEs, which comes later in the Plan Species listings are obtained from the Native CalFlora website. The Nature Conservancy website was also reviewed and many of the species listed were deleted for the Big Valley GSP. Local knowledge from residents and local experts was used to develop this approach and text.
BVAC	Public Draft Chapter 5	GDEs	Do not say that Ash Crrek is "managed" Descriptions of GDEs should be verified by those who are working on the land	9/24/2020	Chapter 5 does not contain the word "managed" or "managed wetlands" - the area is referred to as Ash Creek Wildlife Area
BVAC	Public Draft Chapter 5	River reaches: Page 5-25 b and c	• Reaches 6 and 9 are both labled Upper Pit River • Reach 3 is Willow Creek: water rights and diversions mean that Willow Creek does not exist after a certain point during the summer (Sup. Albaugh spoke to David Fairman about the issue, briefly, before the meeting) -	9/24/2020	Figure updated

Big Valley GSP Comment Matrix Chapter 5

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
BVAC	Public Draft Chapter 5		Referring to the Elements checklist guide, there was a question about which items are required.	9/24/2020	Clarification was provided during the presentation.
Barbara Donohue	BigValleyGSP_Ch5_RevisedDraft_2020_10_22.pdf	Page #: 5-29, Line #: 361	Regarding key "Vegetation Areas" ... "Willow" is described as the second largest habitat comprising 41% of the area.Wrong. If anything, we lack willow as a component within or adjacent to creeks, ditches and ponds in this area. We have no habitat for the Willow Flycatcher here. There are scant distributions of willow species among the Ash trees along the full length of Ash Creek, along the edges of freshwater ponds and water compounds on ranches and within the wildlife refuge as well as along Willow Creek. There is a dearth of willow in the basin... especially enough to cover 41% of your vegetative composition. Please review this classification as a vegetation area. Something is in error here	3/19/2021	The data presented in this chapter is the best available at the time of development of the GSP. Ground truthing of the groundwater dependent ecosystems has been identified as a data gap. The list of species in the Basin was developed based on local knowledge, local experts, and information obtained from public available datasets
Barbara Donohue	BigValleyGSP_Ch5_RevisedDraft_2020_10_22.pdf	Page #: 5-30, Line #: 365	Figure 5-19 NCCAG Wetlands lacks the locations of "riverine" and "seep or spring" on the map ...	3/19/2021	This figure was removed from the GSP, and the included maps and text were developed based on local knowledge and local experts.
Barbara Donohue	BigValleyGSP_Ch5_RevisedDraft_2020_10_22.pdf	Page #: 5-31, Line #: 368	Figure 5-20 NCCAG Vegetation. The "willow" component in this figure is in error. The vegetation composition along Ash Creek is not willow at all but Oregon Ash (Fraxinus latifolia). There are a few individual willow shrubs on the ACWR along with a few Black Cottonwoon (Populous trichocarpa ssp. trichocarpa) as well as a few other Ash trees distributed here or there. No grand distribution of willow...Has your environmental staff been on the ground here to support your vegetation suppositions? This entire "Willow" vegetation type needs to be reassessed ...	3/19/2021	This figure was removed from the GSP, and the included maps and text were developed based on local knowledge and local experts.
Barbara Donohue	BigValleyGSP_Ch5_RevisedDraft_2020_10_22.pdf	Page #: 5-32, Line #: 389	Table 5-5 "Big Valley Common Plant Species"Three out of the six plant species listed in this table do not occur in Big Valley. Carex sp., Alfalfa sp.,and Salix sp. are the only ones that occur here. Aspen sp., Sambucus sp. (Elderberry) and Distichlis sp. (saltgrass) do not occur very often if at all in the local landscape. i is recommended that Oregon Ash (Fraxinus latifolia) or Black Cottonwood (Populus trichocarpa) be used for tree species that occur in these areas. There is rooting depth data available for both of these species. Wild rose (Rosa woodsii) is commonly found along Ash Creek and within the ACWR. We KNOW that Idaho fescue (Festuca idahoensis) and Tufted hair grass (Deschampsia cespitosa) are commonly found within wet meadow types, adjacent to ponds and along creekbanks in this area. Develop a more localized species list to use for rooting depth estimates.	3/19/2021	This table was developed by local experts (UCCE) based on literature research and local knowledge.
Sup. Byrne	Big Valley GSP All Chapters Public Draft 8/26/21	Line 1929	"It is unknown if the subsidence in these areas has been induced by groundwater extraction." We argue earlier that we don't have any and this is opening the door to saying we do.	9/9/2021	Text has been modified to reduce discussion of the nexus between groundwater extraction and subsidence.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Lines 1685-1586	Do we need the sentence describing the declines in water levels	9/9/2021	This is a factual statement and is important to putting changes in water levels in context.

Big Valley GSP Comment Matrix Chapter 5

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 1874	Delete "including groundwater pumping".	9/9/2021	Text removed.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 5.5	Subsidence is not happening in the Basin, yet we use the word subsidence many times	9/9/2021	Text changed to talk about "lowering of ground" where appropriate.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 5.7	We don't like this section, don't like the maps. This data is inaccurate	9/9/2021	Two maps removed, text changed to emphasize need to field verify GDEs and the discussion was based on local knowledge and local expert opinion.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1486	Why is the word "regression" used here? Not all the lines are going down.	10/6/2021	Regression refers to the mathematical method used to detemine the line. Wording changed to "line of best fit".
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1728 Figure 5-17	Don't like this figure. Change the scaling so that each color is 3 inches	10/6/2021	The current scaling of 1.5" per color is appropriate given that the published accuracy of the data. Figure modified to show that white areas don't have data and that the lowest gradation goes from -3 to -3.2 rather than < -3. Also added the published accuracy of 0.7"
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1779	What does areal mean?	10/6/2021	Areal means how much space it takes up. Wording edited.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1735	What is the definition of a perrennial stream? Why use perennial streams?	10/6/2021	A stream that flows year-round or nearly year-round indicates that it is not completely depleted. Using perennial streams is not a requirement of SGMA. Identification of interconnected surface water is a requirement. The word perennial was removed and the streams analyzed are seen to be the "major", defined as streams that are named in the National Hydrologic Dataset from USGS.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1736 and 1794	Why use 20 feet. Isn't 15 feet more realistiz?	10/6/2021	Text and figures have been changed to 15 feet, and justification for that depth has been added to the text based on local knowledge and local expert opinion.

Big Valley GSP Comment Matrix Chapter 5

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie	Draft GSP 9/22/21	Page #: 5-17 Line #: 1729 Figure 5-17	In Fig 5-17, what are the areas with no color within the groundwater basin? I see nothing in the legend. Also, what is the largest negative value recorded?	10/6/2021	Legend has been modified to indicate that the white areas are where there was "No data available".
Doreen SmithPower	Draft GSP 9/22/21	Page #: 5-28 Line #: 1735	Perennial stream Definition: 399 Samples | Law Insiderhttps://www.lawinsider.com/dictionary/perennial-streamPerennial stream means a well- defined channel that contains water year round during a year of normal rainfall with the aquatic bed located below the water table for most of the year.	10/6/2021	Comment received. Text was modified to eliminate the discussion of perennial streams.
Doreen SmithPower	Draft GSP 9/22/21	Page #: 5-28 Line #: 1735	I did not find a definition for 'perennial stream' from DWR or in the Water Code. Looking at the definition for interconnected surface water, it seems that a stream being perennial or non-perennial stream would not preclude it from being considered interconnected. From the regulations: "Interconnected surface water" refers to conditions where surface water and theunderlying aquifer are hydraulically connected by a continuous saturated zone and theoverlying surface water is not completely depleted.	10/6/2021	Comment received. Text was modified to eliminate the discussion of perennial streams.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 5.6	See Letter 3 from NGOs to GSAs dated 11/28/21. The identification of Interconnected Surface Waters (ISWs) is insufficient, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the GSP assumes streams to be interconnected where the depth to water is less than 15 feet below ground surface, based on spring 2015 contours. However, it is common practice to utilize deeper thresholds, such as 50 feet below groundwater surface, to indicate a disconnected stream reach , . Furthermore, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. Using depth-to-groundwater contours from one point in time is not sufficient evidence to state that reaches are not connected to groundwater. In California's Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually, and that natural variability needs to be considered when identifying ISWs.	11/28/2021	The GSP identifies ISWs as a data gap and they will continue to be assessed as more data is available. At this time, there is insufficient data to clearly identify ISWs. 15 feet was used to identify "potential" ISWs was a conservative estimate, based on the observation that the channel banks of the major streams are largely less than 10 feet. Spring water levels were used for this potential ISW assessment to represent the highest groundwater levels that could occur seasonally, accounting for the fact that potentially interconnected surface water could become disconnected in the dry season. Furthermore, 2015 water levels were used because that is the baseline for SGMA, which does not required conditions to be improved to a condition that may have occurred prior to SGMA.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 5.7	See Letter 3 from NGOs to GSAs dated 11/28/21. The identification of Groundwater Dependent Ecosystems (GDEs) is insufficient. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, insufficient groundwater data was used to characterize groundwater conditions in the basin's GDEs. The GSP uses depth-to-groundwater data from fall 2015 to characterize areas where the depth to groundwater was less than 15 feet to identify potential GDEs. We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs and is necessary to capture the variability in groundwater conditions inherent in California's Mediterranean climate.	11/28/2021	The rationale for using Fall 2015 groundwater levels and less than 15 feet to groundwater are presented in the GSP.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 5.7	See Letter 3 from NGOs to GSAs dated 11/28/21. The GSP does not provide an inventory of the flora or fauna species present in the basin's GDEs, except to present the common plant species and their rooting depths. Furthermore, the GSP does not acknowledge endangered, threatened, or special status species in the basin.	11/28/2021	GSP regulations do not require an inventory of the flora and fauna species present.

Big Valley GSP Comment Matrix Chapter 5

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 5.1	560-295 Hwy 139, S of Adin 72-acre parcel. I rented a house on property from 2001 to 2019. Three wells on property:Main ag well: ~2015, this well went (functionally?) dry mid-summer. When the property sold in 2019, it was under condition that the well be deepened by 80'. Pasture well: for watering livestock. Fall 2016, the faucet was left on moderate flow for at least a day, and the well began spitting air. It took a week to recover. House well: Can't find exact records, but the water depth did drop over time, such that I had to water the lawn with piped pasture well water. Also, the house well water quality became "hot spring" earlier each summer until I only got drinking water from the pasture well or filtered the house well water. 420 Spring St, AdinLived here 2.5 years so far. Well is ~100' deep, standard well (1940's?) with sanitary seal installed and pump lowered as of 4/2019. I had to stop watering the back yard July 2020 due to water quality changing. I watered the front & side yards less, too, this year, and the water quality stayed OK until a couple days in late Sept/early Oct when I increased watering (so I stopped.) Neighbors to north have 80' deep well, with limited capacity. They can't water front & back yards at the same time. They are putting in more xeriscape landscaping throughout property, trying to avoid drilling deeper. US Forest ServiceWhen I arrived in 1988, there was an artesian well in the middle of the parking lot. Within a couple years, this well no longer functioned and it was paved over. The USFS had to drill more wells. Additional wells in Adin having problems, but you said you only wanted first person knowledge.Adin Wells in generalAgain, discounting Adin's wells discounts the economic impact lowering water tables have had and will have on this town. Loans must still be repaid, and regardless of federal or state help, drilling wells deeper is expensive. Plus, I see no "good neighbor policy" happening for Adin wells.	11/29/2021	Comment received. The data displayed represents the wells that have been constructed since DWR has required drillers to submit well completion reports. The purpose of displaying the number of wells per 1-mile section is to identify where there are higher densities of the various well types. This map achieves this goal, despite the numbers potentially being too low. Better understanding of the inventory of wells in the Basin (including domestic) has been identified as a data gap.
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28	Section 5.6	Biologist friends who spend more time in ACWA than I, one issue stands out: water. I participated in the late 1980's planning for the ACWA, and it was very clear that the need to continue to respect and deliver on previous agricultural water rights outside the ACWA greatly constrained what CDFG could do. One comment made by the public was that there was insufficient water to implement the planned ponds as "the ranch had been traditionally short of water." My friends assure me this is still true. Rather than write off the ACWA as a recharge area, I propose that we see the value it likely had in the past as a recharge area, thus at least helping to maintain the groundwater levels in BV basin. And we should look at our options to revive that interconnection and the groundwater dependent ecosystems associated with it. Also, springs are considered GDE's, and I don't believe their sustainability is adequately addressed in the GSP. They are mapped in Fig 4-13, but not on Fig 5-19 as GDE's.	11/29/2021	Comment received. The GSP does not contain any text that discounts the ACWA as a recharge area.

Big Valley GSP Comment Matrix Chapter 6

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
BVAC	Public Draft Ch 6, Historic Wtr Budget	Figure 6-2, page 6-2	Why is the atmospheric system not incorporated into the water budget	11/4/2020	Inputs from the atmospheric system appear as precipitation, which is about 12" - 15" per year. The water budget accounts for precipitation as either falling onto land or onto water bodies.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Figure 6-4, page 6-4	If inflow were to equal outflow, that would represent a balanced system. There are some streams that have crazy flows during periods of high precipitation.	11/4/2020	Yes, which is why it's important to recharge groundwater during high flows - so that stored groundwater can be used during dry periods.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Section 6.2, page 6-4 and elsewhere	There are no naturally occuring lakes in the basin. Any standing bodies of water are reservoirs.	11/4/2020	Changed terms in text to "lakes/reservoirs" including bar charts and figures.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Footnote 1, page 6-6	What is the definition of long-term (e.g. long-term sustainability)?	11/4/2020	By 2042, mechanisms should be in place to manage water from year to year. When it comes to setting thresholds, those levels should provide room so as to stay in compliance during periods of variation or fluctuation. It may be that, during the next 20 years, conditions might get worse before they get better.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Figure 6-8, page 6-6; and PPT slide #15	Double-check the lines calculated by excel.	11/4/2020	The results where checked to see if they were reasonable.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6-A, Land System, Line 1	How are inflows from areas outside the basin boundaries represented? [Note: This is paraphrased from a question by Aaron asking if calcualtions can be provided to support future requests for boundary modifications.]	11/4/2020	GEI calculated the inflow through the gap between Round Valley and Big Valley based on the geometry of the gap, water levels, and hydraulic characteristics.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Page 6-3, Line 49	Has the data from the CIMIS station in McArthur been adjusted for Bieber?	11/4/2020	That is being adjusted for. Also, Steve Orloff has a paper on percent application of water, in terms of ET, for alfalfa in Scott Valley - which may be a helpful estimate.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6-B, (multiple locations)	Why is Managed Aquifer Recharge set at zero?	11/4/2020	Managed Aquifer Recharge refers to actions where the primary objective is recharge (e.g., as opposed to reservoirs, where surface water storage is the primary objective, with recharge as a secondary result). Projects such as flooding for habitat might quantify as Managed Aquifer Recharge. It would be necessary to state that groundwater recharge is an intended benefit from the flooding.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Figure 6-4, page 6-4	Question from the public: you mentioned approximately 100K error in stream outflow out of the basin. Also, you said that we know that more water actually flows into the basin than out. (Fig 6-4) Does this explain the approximately 80K difference between the estimated and actual groundwater budget? (not sure of slide #)	11/4/2020	Comment received. No, these are separate components of the water budget.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6A Land System, line 2, assumptions	Ag is not the only user of surface water: surface water is also used by loggers, fire-fighters, Caltrans, illegal marijuana grows, wildlife, etc.	11/4/2020	There is no quantification of other surface water uses.

Big Valley GSP Comment Matrix Chapter 6

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6A Land System, line 2, data needs	Ash Creek Wildlife Area and Groundwater Pumping: (someone) retired and had maintained a lot of data on groundwater pumping.	11/4/2020	This data was obtained and considered in the GSP.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6A Land System, line 3, data source	Population source shows Bieber - there are other communities as well.	11/4/2020	Bieber has a municipal system, which is different from domestic extractions. Adin will be added in as a public water supply which is a non-municipal use.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6C Land System chart	Do inflows on the Land System bar chart include surface water sources from outside the basin what provide water for irrigation uses within the basin? (e.g., Roberts Reservoir, Silva Flat, etc.)	11/4/2020	Those reservoirs outside the basin are not per se considered here. The flows out of the reservoir are included in the category of the watershed that are ungaged. While flow out of the reservoir is measured, there is not access to a long-term record of that. It is shown as an inflow coming in as stream flow. The diversion of the stream flow to application to the field or ditch is represented as a surface water delivery. (40% of applied water is from surface water.)
BVAC	Public Draft Ch 6, Historic Wtr Budget	6-4 and 6-5, Section 6.2	How is it possible that inflow exceeds outflow?	######## #	While inflow and outflow may be more equal during certain seasons, outflow may exceed inflow during other seasons. This data represents the total annual inflow and outflow. *Figure 6-4 through 6-7 will be changed to read "Total Annual Water Budget" for clarity.
BVAC	Public Draft Ch 6, Historic Wtr Budget	pg. 6-5, Figures 6-5, 6- 6, 6-7	A better explanation of "Between Systems" is needed.	######## #	Flow between systems is depicted in Figure 6-2 (pg. 6-2) and will be further explained during 11/4/20 BVAC meeting. *Figure 6-2 can be referenced on page 6-5
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6A, Land System, items 2 & 3	Need clarification on where assumption of 40% surface water and 60% groundwater used for irrigation comes from.	######## #	Further study of water sources was performed and incorporated into the water budget.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6A, Land System, items 7 & 8	Need clarification on percentages under "Assumptions" column; change "grounwater" to "groundwater".	######## #	*Explanation about the 85% irrigation efficiency and the 15% inefficiency, resulting in 7.5% return flow and 7.5% recharge, will be included for clarification; typo corrected.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6A, GW System item 27	Is it true that no subsurface inflow occurs in the basin?	######## #	Until it can be shown otherwise, it will be assumed that there are no inflows and 1 acre-foot per year of connection to Round Valley.
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6C, Total Basin bar chart	Stream inflow and outflow are even during some parts of the year but not others; It would be helpful to see exact number of acre-feet on Appendix 6C bar charts	######## #	*Text will be added to read something like "Stream flow varies throughout the year."; Actual number of acre-feet will be added to some of the years on Appendix 6C bar charts
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6C, Surface Water bar chart	Explanation is needed for Surface Water Delivery as an outflow. If a percentage used for irrigation goes to the plants, is the percentage that goes back to the groundwater captured in one of the categories on the inflow side of the chart?	######## #	The routing of water within the water budget is shown in Figure 6-2

Big Valley GSP Comment Matrix Chapter 6

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
BVAC	Public Draft Ch 6, Historic Wtr Budget	Appendix 6C, Groundwater bar chart	Because the colors are similar, it appears that there is a small amount of subsurface inflow on the bar	#########	*Subsurface Inflow will be removed from the bar chart key
BVAC	Public Draft Ch 6, Current Wtr Budget		The Tables in Chapter 6 should say "ESTIMATED" or "ASSUMED" for Inflow, Outflow.	12/2/2020	Data is used where it's available, rough estimates are made in other areas, and assumptions based on best professional judgement in still other areas. The water budget is balanced by adjusting the estimates and assumptions within generally acceptable ranges until the budget is balanced. As such, the water budget is not necessarily a unique solution, but represents the best professional estimate. Water budget estimates of this type are considered order of magnitude estimates and can be refined as new data becomes available (i.e. Adaptive Management)
BVAC	Public Draft Ch 6, Current Wtr Budget		Some areas are shown on the map as irrigated, when they are actually dry farmed. These areas have only been irrigated on a select few occasions.	12/2/2020	In order to reflect these farming practices, the GSP development team needs data to substantiate it. Input was requested on water source throughout the Basin in previous BVAC meetings. Similar input will be solicited at upcoming meetings and the new information can be incorporated into the Water Budget in future revisions.
BVAC	Public Draft Ch 6, Current Wtr Budget		Concern that the 14,000 acres of the wetland don't show irrigation. Ash Creek Refuge is white on the map, rather than blue.	12/2/2020	The focus was on calculating irrigated acreage. Wetlands are a water use in the water budget - the assumption is that 98% of the water supply on the refuge is from surface water, and 2% groundwater. The wetlands in the Ash Creek Wildlife area have been added to Figure 6-5.
BVAC	Public Draft Ch 6, Current Wtr Budget		How were the percentages of 98% surface water and 2% groundwater derived for the wetlands?	12/2/2020	Starting with the area of the wetlands, the evapatranspiration values (more specific to the conditions in Big Valley) are combined with crop co-efficients. A coefficient was used for crops similar to the vegetation of the wetland. The yields an estimate of evapotranspiration associated with the plants in the wetland. If the refuge did not run any groundwater pumps, then the refuge would be supplied 100% by surface water. Because there are three pumps that are occasionally run, there is some source from groundwater. The 2% was estimated based on professional judgement due to knowledge of the locations of the wells, the areas that they irrigate and conversations from the CDFW about how often they use them (typically for a month or two in the fall to bridge the driest part of the year). Consultant staff has reached out to the CDFW to obtain pumping data, but they have indicated that the data does not exist. As such, 2% is currently the best estimate. Text was added to the chapter to document this estimate.
BVAC	Public Draft Ch 6, Current Wtr Budget		What are the options for determining runoff? Which way is best?	12/2/2020	Modeling or calculations using the "Curve Number Method" (CNM) are the two widely accepted options to determine runoff. In the opinion of the consultants, modeling runoff would not produce significantly improved estimates from CNM, but would take additional time and budget.

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
BVAC	Public Draft Ch 6, Current Wtr Budget		Is there a way to get a larger map, or better electronic version, to take a closer look at the basin boundary?	12/2/2020	A KMZ file (viewable in Google Earth) of the Basin Boundary has been posted on the website. An email notification was sent to the interested parties notifying them of the file and how to use it.
BVAC	Public Draft Ch 6, Current Wtr Budget		Using the numbers on this chart, does this mean that a 7-8% reduction in pumping is needed?	12/2/2020	What this means is that there needs to be about 5,000 AF per year on average in compensation to reduce overdraft. It might involve managed aquifer recharge, reduced pumping or combination of the two. Reducing overdraft can be achieved in various ways.
BVAC	Public Draft Ch 6, Future Wtr Budget		Is it required to use 50 years of data? Does it specify which years of data need to be used?	12/2/2020	At least 50 years of historical data are required as per the GSP Regulations. Going back further would include data from a time period with higher uncertainty and lower accuracy.
BVAC	Public Draft Ch 6, Future Wtr Budget		How does an overdraft of about 5-10% compare with other basins? It's surprising that the number is so small, but it would still impact a lot of people.	12/2/2020	Not sure, but there are certainly a lot other basins that are much worse off.
BVAC	Public Draft Ch 6, Future Wtr Budget		Land System Water Budget Chart, item 2 (inflow between systems): This uses surface water. Ash Creek Wildlife Refuge is here. The assumption is that ag is the only sector that uses surface water. There are other uses and users of surface water.	12/2/2020	The wetlands are also a surface water user and text has been added to describe that. There are also illegal uses, fire uses. There is not a way to measure or quantify those uses. If some reasonable and defensible data or assumptions were provided to the GSP development team, then those uses could be incorporated into the budget.
BVAC	Public Draft Ch 6, Future Wtr Budget		Land System Water Budget Chart, item 3 (population): This only uses the population from the census of Bieber, there's Adin, New Bieber and Lookout. Those need to be added in.	12/2/2020	The water budget considers the entire population of Big Valley published by DWR. A distinction is made between Bieber and the rest of Big Valley, because Bieber is served by a public water supply system while the rest of domestic use in Big Valley is from individual wells. This is a distinction between "municipal" and "domestic" uses, which SGMA categorizes differently. However, all household use is considered and accounted for in the water budget.
BVAC	Public Draft Ch 6, Future Wtr Budget		There's a piece of ground that's not on the map that needs to be included (Jimmy Nunn).	1/22/2021	This information can be incorporated once the land is clearly identified. Such information will be solicited at future BVAC and/or public outreach meetings.
BVAC	Public Draft Ch 6, Future Wtr Budget	Line 38	~~Ideally~~ In concept,each component could be quantified precisely and accurately, and the budget ~~would~~ could	Jan. 22	Changes will be made to next iteration of chapter.
BVAC	Public Draft Ch 6, Future Wtr Budget	Line 39	come out balanced. In practice, ~~many~~ most of the components can only be roughly estimated, and in	1/22/2021	Changes will be made to next iteration of chapter.
BVAC	Public Draft Ch 6, Future Wtr Budget	Line 40	~~some~~ many cases not at all. Therefore, much of the work to balancethe water budget is adjusting ~~some~~ many	1/22/2021	Changes will be made to next iteration of chapter.
BVAC	Public Draft Ch 6, Future Wtr Budget	Line 44	components estimated through the use of the water budget are order of magnitude. Estimation of Suggested wording change to "order of magnitude" comments were that the content needs to be made clearer to the reader	1/22/2021	Wording will be adjusted in the next iteration to make the concept of "order of magnitude" estimates more clear.

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
BVAC	Public Draft Ch 6, Future Wtr Budget	Line 56	because it represents an average set of climatic conditions and adequate water level, land use, "adequate water level" What is adequate? Define adequate water levels	1/22/2021	This refers to the fact that many of the wells with water level measurements started in 1983, so the amount of data was "adequate". We can remove the word "adequate"
BVAC	Public Draft Ch 6, Future Wtr Budget	Line 73	Add a footnote to Figure 6-4 regarding DWR using inaccurate data. Including in the footnote there should be a mention of better data needed for the waterbudget and that observational and public input has been received regarding the inaccuary of the map from DWR. (crop and wetland acreages)	1/22/2021	The land use data used for the water budget is different from the data used for basin prioritization. This part of the GSP is not addressing prioritization. We discuss data gaps in previous chapters, but can re-emphasize here.
BVAC	Public Draft Ch 6, Future Wtr Budget	Line 87	also has three wells that extract groundwater from the deeper aquifers and is applied in portions	1/22/2021	Not sure what the comment is here. Deeper aquifers emphasizes that the ACWA wells are around 800 feet deep and are not pulling solely from shallow (wetland) portion of the aquifer. In other words, the wells are simply re-distributing groundwater from deep portions of the aquifer to shallow (wetland) portions.
BVAC	Public Draft Ch 6, Future Wtr Budget	Line 110-111	~~Overdraft occurs when the groundwater system change in storage is negative over a long period~~. (Remove this sentence)	1/22/2021	Change will be made to next iteration of chapter.
BVAC	Public Draft Ch 6, Future Wtr Budget	Line 115-116	The current water budget is demonstrated by looking at water year 2018, which is the most recent year with reliable data. (Is 2018 the only year with reliable data? Who states what is reliable?)	1/22/2021	GEI has determined that 2018 is more reliable than 2019 because there were several wells without measurements. We can remove the "~~which is the most recent year with reliable data~~." in the next iteration of the Chapter.
BVAC	Public Draft Ch 6, Future Wtr Budget	Footnote	long-term undesirable results Who determines this? Suggested to add a note to the chapter where information which covers the details of DWR guidelines for estabilishing long-term undesirable results.	1/22/2021	Undesirable results are locally defined. This will be discussed in Chapter 7
BVAC	Revised Draft Chapter 6		This chapter is full of estimates and assumptions. It's not fair to have to make decisions based no such inaccurate and incomplete data	2/3/2021	The water budget uses the best, readily available data to develop the estimates. Improvements to the water budget can and should be made over time as more data is gathered and estimates and assumptions are refined with objective information.
BVAC	Revised Draft Chapter 6		Figure 6-5: Primary Applied Water Sources is inaccurate.	2/3/2021	Some input from local stakeholders has been used in the map. More field-by-field information will continue to be solicited and incorporated as it becomes available. Text was added to the chapter emphasizing the inaccurate nature of the map.
Barbara Donohue	BigValleyGSP_Ch6_RevisedDraft_2021_01_14.pdf	Page #: 6-3, Line #: 62	Please update your precipitation estimates using local precipitation data from the US Forest Service in Adin and local RAWS (Remote Access Weather Station) on Rush Creek. Weather is significantly different between the Fall River Valley out of McArthur and what we experience here in Big Valley. Part of that is due to the orographic effect of Big Valley Mountain...	3/20/2021	The water budget is based on data interpolated between the McArthur, Alturas, and other stations to represent local conditions in the center of the Basin (Bieber).
Barbara Donohue	BigValleyGSP_Ch6_RevisedDraft_2021_01_14.pdf	Page #: 6-8, Line #: 132	Land use patterns are changing significantly right now. I have lived in the Valley for 30 years, and have never observed the number of acres under vegetation type conversion and we are seeing now. Hundreds of acres this year alone are being converted from native sagebrush steppe into alfalfa (which demands so much more water). It looks like most of these acreages are being watered using agricultural wells. Land use patterns are not static here ... this variable is currently experiencing a change in what has been known to occur in the past.	3/20/2021	There was no readily available information to indicate a projected growth rate, but populations in the two counties have been decreasing. Therefore a constant land use projection was used in the water budget.

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Barbara Donohue	BigValleyGSP_Ch6_RevisedDraft_2021_01_14.pdf	Page #: 6-9, Line #: 149	I challenge the results of your predictive modeling regarding Climate Change for this area. For the last 30+ years Big Valley has been experiencing a contracted drying spell. Winter precipitation in both the form of snow and rain has significantly reduced over that period of time. I do not believe that the choice of your Climate Change predictive model adequately addresses the reality of what is actually happening in this Basin. What many of the locals have observed here are warming temps, drying climate, higher ET rates and less recharge to surface waters. I am challenging you on your "baseline" weather data utilized in all of your hydrologic and climatic models. Consider this a "fatal flaw" that is consistent in the underpinning of a lot of your generated analyses. Your models are only as good as the original data allows, and you utilize data that IS NOT specific to our area ...	3/20/2021	Climate change projections were based on "VIC" climate change factors provided by DWR. This represents the best available, scientifically defensible data for climate change projections.
Barbara Donohue	BigValleyGSP_Ch6_RevisedDraft_2021_03_21_setaside.pdf	Page #: 6-9, Line #: 150	Projection with Climate Change.I challenge your projection of the effects of climate change on soil water use and availability in the Big Valley basin. "Wetter and warmer" climate prediction may apply to central California up to its northern boundary at Santa Rosa... but not here.Although the Big Valley area is located within California its floristic, hydrologic and geologic attributes are more similiar to the "Great Basin" province of the Intermountain West. The boundaries of the northeastern reach of the Great Basin province are located less than 50 miles east from Big Valley. Future effects of climate change in this area will definitely be seen as reductions in winter snow levels with precipitation coming in the form of rain. Summer temperatures are anticipated to increase as well as the number of days of warm/hot weather. The summer season will become longer and the night time temperatures warmer.Climatic predictions for both Nevada and California were identified in November 2020 in an article presented by the Desert Research Institute.	3/24/2021	Climate change projections were based on "VIC" climate change factors provided by DWR. This represents the best available, scientifically defensible data for climate change projections.

Big Valley GSP Comment Matrix Chapter 6

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Barbara Donohue	BigValleyGSP_Ch6_RevisedDraft_2021_03_21_setaside.pdf	Page #: 6-9, Line #: 150	(continued) Climate change and a Ã¢€œthirsty atmosphereÃ¢€ will bring more extreme wildfire danger and multi-year droughts to Nevada and California by the end of this century, according to new research from the Desert Research Institute (DRI), the Scripps Institution of Oceanography at the University of California, San Diego, and the University of California, Merced. According to their results, climate change projections show consistent future increases in atmospheric evaporative demand (or the Ã¢€œatmospheric thirstÃ¢€) over California and Nevada. These changes are largely driven by warmer temperatures, and would likely lead to significant on-the-ground environmental impacts. "Higher evaporative demand during summer and autumn means ... faster drying of soil moisture and vegetation" ... explains lead author Dan McEvoy, Ph.D., Assistant Research Professor of Climatology at DRI.With very little recharge coming off of the surrounding mountains due to lack of snow cover, both surface and subsurface water will be affected ... especially with changes in land use patterns. Land use patterns are not static here in Big Valley, and it is unwise to use this variable as a constant for future water use predictions. Vegetation type conversion is changing right now as I write this comment. Hundreds of acres are currently being converted from natural vegetation community types into alfalfa monocultures. New wells are going in by the handful and the agricultural demand for water has already increased for the growing year of 2021. Higher evapotranspiration demands for longer daytime hours for more days in the growing year will create a significantly different drawdown amount than what you predict in your model. References:https://www.dri.edu/climate-change-and-atmospheric-thirst/	3/24/2021	Climate change projections were based on "VIC" climate change factors provided by DWR. This represents the best available, scientifically defensible data for climate change projections.
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-3, 91-92	Groundwater extractions should also include water used for fire, wildlife, logging, and construction.	6/2/2021	There is no quantification of these surface water uses.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Chapter 6 figures	This budget has many assumptions. The numbers in the tables give the impression that it is highly accurate	9/9/2021	"Estimated" added to all figures. Figures rounded to indicate less accuracy.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Lines 1882-1883	Remove "that may be interconnected with Ash Creek"	10/6/2021	Text removed
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 1886	Don't like the term "groundwater-enhanced habitat"	10/6/2021	Text changed

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Jessica Boyt	BigValleyGSPChapter 6 Public Draft 10/23/2020		There is also on-farm managed aquifer recharge. There are several GSA's that are doing pilot programs, 1 example is https://birdreturns.org/multi-benefit-groundwater-recharge/#:~:text=Working%20in%20partnership%20with%20the%20Colusa%20Groundwater%20Authority%2C,have%20nowhere%20to%20stop%20over%20on%20long%20migrations.	11/4/2020	Comment received.
Julie Retchin	BigValleyGSPChapter 6 Public Draft 10/23/2020	Page #: 6-2 Line #: 27	David & Aaron: Are the non-ag water uses (residential, watering roads, firefighting?) significant within the overall level of acre-feet under discussion?	11/4/2020	These uses are not included in the water budget. Future iterations of the water budget may contain these uses.
BVAC	BigValleyGSPChapter 6 Public Draft 10/23/2020	Page #: 6-2 Line #: 27	Julie: During the discussion, it was mentioned that it might be difficult to quantified - it could be mentioned in narrative that there are other uses of surface water (even though it might be relatively minor or unquantifiable).	11/4/2020	Comment received.
Julie Retchin	BigValleyGSPChapter 6 Public Draft 10/23/2020	Page #: 6-2 Line #: 27	Aren't Silva Flat reservoir water rights split between East Fork of Juniper Creek and Dixie Valley? If so, you'd have to split the acres (and the precipitation falling on them) in the Silva Flat reservoir watershed.	11/4/2020	Comment received.
Julie Retchin	BigValleyGSPChapter 6 Public Draft		For subsurface inflow: If there is so little outflow from Round Valley, why doesn't it fill up like a bathtub, resulting in at least the lowest part of it being a wetland or an inland lake?	12/2/2020	Groundwater at the outlet of Round Valley is near ground surface and groundwater is likely losing to the stream which transports the water out of the Round Valley Basin.
Rodney Fricke	BigValleyGSPChapter 6 Public Draft		Ash Creek is the drain for Round Valley. During the summer (no rain), flow in Ash Creek is groundwater.	12/2/2020	Summer flows in streams comes from adjacent groundwater throughout the length of the stream. The location and amount of groundwater contribution outside of the Basin is not in the scope of the GSP. Flows into the Basin are measured at the DWR stream gage in Adin.
Julie Retchin	BigValleyGSPChapter 6 Public Draft		If our goal is truly sustainability, why not assume more erratic climate/precipitation, and plan for as much resilience as possible: e.g. water retention during wet weather to allow for maximum recharge?	12/2/2020	The water budget presents the climate change scenario based on best available data provided by DWR, which indicates more precipitation, but with a higher proportion falling as rain rather than snow.
Julie Retchin	BigValleyGSPChapter 6 Public Draft		I agree with Aaron on better local data refining our water budget numbers.	12/2/2020	Better local data to support the water budget has been identified as a data gap.
Julie Retchin	BigValleyGSPChapter 6 Public Draft		My mic doesn't work, hence chat...This is one place where our lack of knowledge of local subsurface geology, including complex aquifers that create variable effects on groundwater levels in different parts of the basis, really hurts us. I agree with Geri; lowering water tables do impact some people significantly.	12/2/2020	Comment received.

Big Valley GSP Comment Matrix Chapter 6

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget. , The integration of native vegetation into the water budget is insufficient. The water budget did not include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.	#########	Native vegetation is included in the water budget, as it is assumed to consume all of the remaining moisture from precipitation after removing runoff and deep percolation.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The integration of climate change into the projected water budget is insufficient. The GSP incorporates climate change into the projected water budget using DWR change factors. However, the plan does not clearly indicate which DWR change factors (2030, 2070, or both) were incorporated into the projected water budget. In addition, the GSP does not indicate whether multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) were considered in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management. The GSP integrates climate change into key inputs (e.g., changes in precipitation, evapotranspiration, and surface water flow) of the projected water budget. However, the sustainable yield is based on the historic water budget, instead of the projected water budget with climate change incorporated. If the water budgets are incomplete, including the omission of extremely wet and dry scenarios and the omission of climate change projections in the sustainable yield calculations, then there is increased uncertainty in virtually every subsequent calculation used to plan for projects, derive measurable objectives, and set minimum thresholds. Plans that do not adequately include climate change projections may underestimate future impacts on vulnerable beneficial users of groundwater such as ecosystems, DACs, tribes, and domestic well owners.	#########	The climate change scenario is based on climate change data provided by DWR. The projection uses the 2070 condition. The text in Section 6.4.2 has been updated to clarify which dataset is used. Analysis of extreme wet and extreme dry scenarios is not required by the regulations.

Big Valley GSP Comment Matrix Chapter 7

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	5, 113	Deep freezes can occur from September to May	4/7/2021	Text changed
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	6, 125	Environmental regulations include SGMA	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	6, 133	Change "may" to "will"	4/7/2021	Text changed
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	6, 135	Change "may" to "is likely to"	4/7/2021	Text changed
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	6,144-146	Ash creek wildlife area is 14,000 acres of unmanaged land	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	7, 197-199	The Basin needs the support of Federal management	4/7/2021	Text changed
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	8, 215	Monitoring also helps DWR	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	8, 224	Remove slightly	4/7/2021	Text changed
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	9, 261	If there is no Ag there is no community.	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	11, 314-321	Paragraph needs clarification, table or example	4/7/2021	Section was re-worded for clarity
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	11, 327	Add "and breeding grounds"	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	11, 328	Add "develop" a new water source	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	11, 350	Add text clarifying that storage estimates are based on an assumed aquifer depth of 1200 feet	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	15, 479	NCWA is a regulatory program	4/7/2021	Text added. Detail on the nature of the program, regulations and fees needed
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	5, 95-98	Add spring-fed streams verbiage	4/7/2021	Text added

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	6, 127	Add "and roads"	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	6, 127	Add "reduction of timber yield tax"	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	6, 135	Include effect of low land values, the ongoing cost of monitoring and updates, lower property tax base	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	8, 217	Remove "chronic"	4/7/2021	Text removed
Geri Byrne	Public Draft Chap 7 (4/1/2021)	11, 321	1/3 of representative wells	4/7/2021	Text altered
Duane Conner	Public Draft Chap 7 (4/1/2021)	12, 353	decline was less than 16.5 feet in fall, 19.77 in spring	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	15, 480	Water quality sample required when home is sold or foster chlid is placed	4/7/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	16, 508-510	Remove "Continued… flood risk" sentence	4/7/2021	Text removed
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	16, 519 and 522	Add spring-fed streams verbiage	4/7/2021	Text added
Julie	Public Draft Chap 7 (4/1/2021)		Cost of drilling deeper wells needs to be considered	4/7/2021	Right now the GSP only addresses costs of pumping.
Barbara Donahue	Public Draft Chap 7 (4/1/2021)		There is need for domestic users to be considered and need for some domestic users to have to drop their domestic wells and install filters. Calcium is up. Some wells are 20-foot hand-dug wells. Fingers are not being pointed at ag. There are other people coming to the basin for recreation, fishing, and hunting.	4/7/2021	Comment received. Readily available water quality and water level data were used in the GSP.
Doreen Smith Powers	Public Draft Chap 7 (4/1/2021)		Need better definition of threshold, number of wells by type. How do ditches and canals factor in? Water quality is important.	4/7/2021	The threshold has been defined as 140 feet below the fall 2015 baseline (or lowest water level if there was no 2015 measurement). Chapter 8 details the representative wells, their depths, screen intervals and types. Undesireable results have been defined as when 1/3 of the representative wells are below their MT for 5 years. Recharge from ditches and canals is estimated in the water budget. The guidance from the BVAC has been to not set thresholds for water quality, but to assess at the 5-year updates due to the current high quality conditions.
Barbara Raymond	Public Draft Chap 7 (4/1/2021)		What about habitat? Special status? How are we monitoring?	4/7/2021	A set of shallow monitoring wells has been established and will be assessed further at the 5-year update.

Big Valley GSP Comment Matrix Chapter 7

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie	Public Draft Chap 7 (4/1/2021)		Of the GDEs, how much of it is springs?	4/7/2021	A map of GDEs can be found in Chapter 5 (Figure 5-20). A map of springs can be found in Chapter 4 (Figure 4-14).
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	6, 119	This helps to justify reasoning to get boundary modification	4/7/2021	The basin boundary and its limitations are discussed in Chapter 4. SGMA applies to areas within the basin boundary, but projects that benefit the basin can be outside the basin boundary.
Aaron Albaugh	Public Draft Chap 7 (4/1/2021)	16	DWR induced additional wells because they required off-stream watering sources to have grazing away from streams due to water quality concerns	4/7/2021	This EQUIP program is independent of the GSP and is described in the introduction.
Julie	Public Draft Chap 7 (4/1/2021)		Are we writing off that the Bieber mill site will be revived for novel wood products uses that require significant water?	4/7/2021	The GSP and water budget consider known uses. The future projection of the water budget assumes negligible industrial groundwater use.
Julie	Public Draft Chap 7 (4/1/2021)		Can we calculate and add in the cost per foot of deepening wells?	4/7/2021	Right now the GSP only addresses costs of pumping.
Julie	Public Draft Chap 7 (4/1/2021)		Any ideas on how to use monitoring data in innovative ways to solve some of Big Valley's specific data aps and questions that have arisen… beyond the reasons that DWR wants the data collected.	4/7/2021	The detailed water level data from the new monitoring wells is being evaluated and may provide insights into recharge areas, interconnection of streams, and other questions.
Aaron Albaugh	Public Draft Chap 7 (4/22/2021)	7-5, 178	Add "California" Department of Fish and Wildlife	5/4/2021	Added and moved to Chapter 1
Aaron Albaugh	Public Draft Chap 7 (4/22/2021)	7-5, 187	Add further clarification: appropriately advertised, not much interest in being on BVAC	5/4/2021	Text added and moved to Chapter 1
Aaron Albaugh	Public Draft Chap 7 (4/22/2021)	7-6, 246	Insert "…enacting various projects to improve management during the drought periods and wet periods experienced in the Basin…"	5/4/2021	Text added
Aaron Albaugh	Public Draft Chap 7 (4/22/2021)	7-6, 263	Insert "In summary, there have not been wide-spread reports of issues or concerns regarding groundwater levels from the residents of the Basin (whether agriculture producers or domestic users or others). Instead the concern was raised by DWR based on isolated wells that experienced limited decline during a drought."	5/4/2021	Text changed
Aaron Albaugh	Public Draft Chap 7 (4/22/2021)	7-8, 295	re: word "diminished, work on wording (perhaps that it would be a ghost town or similar	5/4/2021	Text added "and the ability of people to live and work in the basin would be largely absent."
Aaron Albaugh	Public Draft Chap 7 (4/22/2021)	7-12, 402-406	All of these should be activated when 1/3 of the wells meet the action level.	5/4/2021	Text changed.
Aaron Albaugh	Public Draft Chap 7 (4/22/2021)	Appendix: Monitoring Well Construction Report, Page 6	Would like to see more GEI accountability, and that the public and BVAC wanted the wells re-drilled	5/4/2021	Text changed in the well construction report. Report text removed from the appendix. Appendix now only contains the as-built drawings of the wells.
Aaron Albaugh	Public Draft Chap 7 (4/22/2021)	7-16, 550	LAMP needs to be added as a water quality regulatory program	5/21/2021	Text added.

Big Valley GSP Comment Matrix Chapter 7

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Geri Byrne	Big Valley GSP All Chapters Public Draft 8/26/21	Line 2516	"For all interested parties, there is need for a greater understanding of interconnected surface water that may be present in the Basin" Still opening the door. Recommend scratching the first part of the sentence	9/9/2021	Sentence modified
Geri Byrne	Big Valley GSP All Chapters Public Draft 8/26/21	Line 2531	"conclusive evidence of stream interconnection is not available." Recommend changing to "there is currently no evidence to support interconnected surface water."	9/9/2021	Text changed.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 7.3	Add "medium ranking" as undesirable result	9/9/2021	Undesirable result is a term defined in SGMA and the ranking is unrelated to undesirable results as defined.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Lines 2348-2351	Remove last paragraph	9/9/2021	Paragraph removed.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 7.3.6	We need better tracking of surface water allocations	9/9/2021	Text discusses data gap of surface water tracking.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 7.3.6	There is a lot of unpredictability of weather patterns	9/9/2021	Text added
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 2052	Add the word "unscientific"	10/6/2021	Word added
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 2059	Remove the words "assumed to be"	10/6/2021	Words deleted
Julie	BigValleyGSP Chapter 7 Public Draft 1/20/21	Line 364	Please give examples of groundwater-dependent ecosystems...marshes? groves of certain trees? ephemeral pools?	2/3/2021	DWR defines GDE's as "ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface".
Julie	BigValleyGSP Chapter 7 Public Draft 1/20/21		The well density map is incorrect. There are at least 50 wells in Adin. Some of them have already had to have their pumps lowered. These are locals who won't be happy if the groundwater level lowers too much. Please take this into account.	2/3/2021	The inaccuracy of the well inventory has been identified as a data gap and funding for such a study will be sought by the GSAs.
Julie	BigValleyGSP Chapter 7 Public Draft 4/1/2021		Data gap for Adin wells.	4/7/2021	The inaccuracy of the well inventory has been identified as a data gap and funding for such a study will be sought by the GSAs.

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie	BigValleyGSP Chapter 7 Public Draft 1/20/21	Line 285	There was a comment about most shallow wells being uncertified, and "should" be decommissioned or properly drilled as sanitary. Easily half the wells in Adin must be uncertified as the certified well count in the main Adin square mile block was 18, and we figure there are at least 50. (Adin has a sewer system but no water system. Each house or group of house has a well.) Are our wells illegal? Do we have no right to groundwater?	3/3/2021	The inaccuracy of the well inventory has been identified as a data gap and funding for such a study will be sought by the GSAs.
Julie	BigValleyGSP Chapter 7 Public Draft 1/20/21	Appendix 7B	If I understand the implications of these well measurements correctly, Ash Creek and Pit River are recharging Big Valley's groundwater? Isn't this what we want with our recharge projects?	3/3/2021	Because there are no major impoundments on the Pit River and Ash Creek upstream of Big Valley, there is no way to regulate flow for the benefit of groundwater recharge. Slowing small impoundments (e.g. beaver dam analogs) have been proposed in Chapter 9.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. For chronic lowering of groundwater levels, measurable objectives are set at the Fall 2015 water level, or at the lowest water level measured for wells that don't have a Fall 2015 measurement. Minimum thresholds are set at 140 feet below the measurable objective. While acknowledging that lowering of water levels throughout the Basin to the minimum threshold could result in a significant percentage of wells going dry, the GSP does not quantify the number of domestic wells that could go dry or otherwise consider or analyze the impact of minimum thresholds on domestic wells. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with the Human Right to Water policy.	11/28/2021	The GSP considers effects on other users as shown in Figure 7-2. Included in the GSP is a shallow well mitigation program.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The GSP states that the undesirable result criterion for the groundwater level sustainability indicator occurs when the groundwater level in one-third of the representative monitoring wells drop below their minimum threshold for five consecutive years. Using this definition of undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the basin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that one-third of monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the one-third threshold isn't triggered.	11/28/2021	Levels dropping to minimum threshold levels would be preceded by triggering of action levels.

Big Valley GSP Comment Matrix Chapter 7

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The GSP does not establish SMC for groundwater quality. The GSP states (p. 7-10): "Due to the existence of excellent water quality in the Basin, significant amount of existing water quality monitoring, generally low impact land uses, and a robust effort to conduct conservation efforts by agricultural and domestic users, per §354.26(d), SMCs were not established for water quality because Undesirable Results are not present and not likely to occur." However, the GSP states (p. 7-9): "After a review of the best available data on water quality in the Basin, it was concluded that all the constituents which were elevated above suitable thresholds are naturally occurring. There has been no identifiable increase in the level of concentrations over time, and several constituents have indications of improvement in recent decades compared to concentrations in the 1950s and 1960s." All COCs in the basin that may be impacted or exacerbated by groundwater use and/or management should have established SMC, in addition to coordinating with water quality regulatory programs.	11/28/2021	The data presented in Chapter 5 supports excellent water quality and supports not setting thresholds based on Section 354.28(e) which states that "An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in the basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators."
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. Sustainable management criteria for chronic lowering of groundwater levels provided in the GSP do not consider potential impacts to environmental beneficial users. The GSP neither describes nor analyzes direct or indirect impacts on environmental users of groundwater when defining undesirable results. This is problematic because without identifying potential impacts on GDEs, minimum thresholds may compromise, or even destroy, these environmental beneficial users. Since GDEs are present in the basin, they must be considered when developing SMC.	11/28/2021	The GSAs have identified field verification of GDE's as a data gap.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The GSP does not establish SMC for depletion of interconnected surface water. The GSP acknowledges data gaps for interconnected surface water and states (p. 7-11): "At the five-year update, SMCs will be considered only if the trends indicate that undesirable results are likely to occur in the subsequent 5 years." The GSP continues (p. 7-11): "While Chapter 5 – Groundwater Conditions details the streams in Big Valley which may be interconnected by a "…continuous saturated zone to the underlying aquifer and the overlying surface water…" (DWR 2016c), there is currently no evidence to support interconnected surface water. Therefore, there is a lack of evidence for interconnection of streams." However, the absence of evidence is not evidence of absence. The GSP should establish interim SMC for the depletion of interconnected surface water condition indicator until more data is gathered. The GSP should discuss how the interim SMC will affect beneficial users, and more specifically GDEs, and the impact of these minimum thresholds on GDEs in the basin. The GSP should evaluate how the proposed minimum thresholds and measurable objectives will avoid significant and unreasonable effects on surface water beneficial users in the basin (see Attachment C for a list of environmental users in the basin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).	11/28/2021	The lack of evidence and ability to quantify any depletions that may be occurring preclude any meaningful thresholds. Therefore, the GSAs will continue to collect and assemble data to develop a better understanding on if and where surface water may be interconnected before establishing thresholds. For this sustainability indicator (and all others) the GSAs will implement "adaptive management", which is fully within the spirit and intention of SGMA statute and regulatioins.

Big Valley GSP Comment Matrix Chapter 7

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The GSP has not established SMC or a monitoring network for water quality. As stated above in the SMC section of this letter, concentrations of COCs in the basin may be impacted or exacerbated by groundwater use and/or management, and therefore must be monitored. The GSAs should conduct and report water quality monitoring in coordination with the other water quality regulatory programs discussed in the GSP.	11/28/2021	The data presented in Chapter 5 supports excellent water quality and supports not setting thresholds based on Section 354.28(e) which states that "An Agency that has demonstrated that undesirable results related to one or more sustainability indicators are not present and are not likely to occur in the basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators." None the less, the GSAs have established a monitoring network to all them to "adaptively manage" this sustainability indicator at the 5-year update as required under SGMA.
Julie Dawson-Parlee	BigValleyGSP_PublicReviewDraft_2021_10_28	Lines 2207-2211	Of the Action Levels listed, only the first one requires five years of measurable change, but the other two only require one year of decline, which seems like an error. One dry year hardly seems justification for drastic action, but this section seems to indicate that could be the case. But, on the other hand, it's also quite vague on line 2205 to say that "...actions may be considered, at the discretion of the GSAs..." and it seems to render the thresholds inconsequential if the GSAs don't want to take action.	11/28/2021	The actions levels described in the GSP are not intended to be regulatory in nature (i.e. not intended to "require" actions). They are established in the spirit of "adaptive management" where the GSAs, stakeholders, and the public are informed when potential problems may be occurring and adapt the implementation of projects and management actions accordingly.

Big Valley GSP Comment Matrix Chapter 8

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Geri Byrne and Aaron Albaugh	Chapter 8 Public Draft	Appendix 8B	Don't like the inclusion of well logs	4/27/2021	Well logs removed from appendix and well log number added to Appendix 8A.
Aaron Albaugh	Chapter 8 Public Draft	1, 67	Add "The assumed" groundwater contours…	5/24/2021	Text added
Aaron Albaugh	Chapter 8 Public Draft	1, 68	Shallow groundwater monitoring to "help" define the potential interconnection of groundwater aquifers with surface water bodies	5/24/2021	Text added
Aaron Albaugh	Chapter 8 Public Draft	Table 8-1	Revise table to adjust to 140 feet below 2015 baseline	5/24/2021	Table replaced.
Aaron Albaugh	Chapter 8 Public Draft	Figure 8-1	During the summer, Willow Creek is 100% allocated. There is no water. If you were going to argue that there is a surface water/groundwater connection, what is it connected to if there is no water? Same for Ash Creek west of Adin.	5/24/2021	This comment should be addressed in Chapter 5, when it is updated and compiled into the entire draft of the GSP.
Aaron Albaugh	Chapter 8 Public Draft	4, 89:97	It is noted that many of the DWR wells are domestic which have pumps all the time. How is this accounted for?	5/24/2021	The end of the paragraph addresses this, where staff that monitor the wells should be noting when the well or a nearby well is pumping.
Aaron Albaugh	Chapter 8 Public Draft	4, footnote 2	Moniutoring needs to be late october. Needs to be communicated and coordinated with DWR who collects level measurements.	5/24/2021	Text changed to "late-October"
Aaron Albaugh	Chapter 8 Public Draft	5, 116	It needs to be noted that the BVAC has done a great job making sure the wells are spatially distributed.	5/24/2021	The factual statement that the wells are distributed throughout the basin should suffice. DWR or other readers can make their own judgment on this.
Aaron Albaugh	Chapter 8 Public Draft	5, 8.2.1.2	We would like to understand the contour mapping requirements better. Doesn't make sense.	5/24/2021	Groundwater contours are presented in Chapters 4 and 5

Big Valley GSP Comment Matrix Chapter 8

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Aaron Albaugh	Chapter 8 Public Draft	5, 136:143	Modify text: Chapter 5 discusses the lack of interconnected surface water and describes the perennial streams in the BVGB which may be interconnected to the groundwater aquifer. As described in Chapter 7 there is currently no conclusive evidence for interconnection of perennial streams with the groundwater aquifer, ~~and the volume of depletions (if any) is unknown.~~ Therefore, measurable objectives, minimum thresholds, and a representative monitoring network ~~for depletion~~ of interconnected surface water have not been established.	5/24/2021	Text modified.
Aaron Albaugh	Chapter 8 Public Draft	Table 8-2	DWR, 2016a : What is this?	5/24/2021	This is a reference (documented in the references list) to a best management practices paper published by DWR. This is used as guidance on monitoring standards so that data gaps can be assessed.
Aaron Albaugh	Chapter 8 Public Draft	Table 8-2	"Data must be sufficient for mapping groundwater depressions, recharge areas, and along margins of basins where groundwater flow is known to enter or leave a basin" Comment: There is no data.	5/24/2021	This table identifies the data gaps
Aaron Albaugh	Chapter 8 Revised Draft 5/24/21	8-1, 60	If monitoring from outside agencies change their monitoring, it shouldn't be up to the counties (GSAs) to pick up the slack.	6/2/2021	Text added: "The monitoring networks will generally be adjusted to the availability of data collected and provided by the outside agencies."
Aaron Albaugh	Chapter 8 Revised Draft 5/24/21	8-1, 65	What is the "groundwater storage" sustainability indicator?	6/2/2021	Text regarding groundwater storage removed.
Aaron Albaugh	Chapter 8 Revised Draft 5/24/21	8-4, 93-94	Measurements need to be taken March 15 or before beginning of pumping season in spring, and taken after Oct 15 in the fall	6/2/2021	This statement refers to historic data. Footnote (3) clarifies when measurements should be taken in the future.
Aaron Albaugh	Chapter 8 Revised Draft 5/24/21	8-5, 116	Need to point out that the the distribution of representative wells is excellent and based on a thoughtful, comprehensive review of the wells	6/2/2021	Text changed and added: "Extensive discussion and consideration was performed by the GSAs and local stakeholders to determine an appropriate water level monitoring monitoring network. Based on the comprehensive review of the wells, the network was selected based on:"
Aaron Albaugh	Chapter 8 Revised Draft 5/24/21	8-5, 136	Note that water in the basin is 100% allocated.	6/2/2021	Text added: "and all summer flows are 100% allocated based on existing surface water rights."
Aaron Albaugh	Chapter 8 Revised Draft 5/24/21	8-5, 137	Delete "which may be interconnected to the groundwater aquifer"	6/2/2021	Text removed
Aaron Albaugh	Chapter 8 Revised Draft 5/24/21	8-7, 181	second row, last column. Owner of well 06C1 is very unlikely to agree to monitoring again	6/2/2021	Comment noted. The table states that the absence of that well is a data gap.

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Aaron Albaugh	Chapter 8 Revised Draft 5/24/21	8-8, 183	Please define "anomalous", perhaps in a footnote	6/2/2021	Footnote added.
Aaron Albaugh	Chapter 8 Revised Draft 5/24/21	8-11, 231	We don't want to have the land use data collection fall on the GSAs	6/2/2021	The text is written in a way that states the GSAs will rely on DWR for land use data.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Section 8.2.3	Subsidence is not happening	9/9/2021	Text changed to emphasize micro-subsidence in section 7.3.5
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 2486	The land use data provided by DWR is inaccurate	10/6/2021	Footnote added.
Doreen SmithPower	Chapter 8 Public Draft		From: Doreen SmithPower I will forward a letter. However, the well measurements should be posted on the DWR website. The water quality information is set to the DWR and that has NOT been available on the DWR website and needs to be included in the water budget. The water budget is defined as the total of all water surface and below the surface entering and stored within the basin.	5/5/2021	Water level and water quality data will be reported to the state and made available to the public as required by SGMA and other regulatory programs.
Doreen SmithPower	Chapter 8 Revised Draft 5/24/21	Section 9.2.3	Adaptive Management/data gap/monitoring: Some domestic wells increasingly are having recharge issues, people are sinking wells deeper. If projects can be focused where this is happening, you will forestall the "revolt." (as one friend said to me.)	6/2/2021	Comment received.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The consideration of beneficial users when establishing monitoring networks is insufficient, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.	11/28/2021	The locations of the representative monitoring wells have considered all beneficial uses, and they are distributed among areas of agriculture, towns (domestic), and environmental (ACWA). Further refinement and expansion of the monitoring network is being sought through grant funding and a voluntary well monitoring program.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. Figure 8-1 (Water Level Monitoring Networks) shows insufficient representation of GDEs, DACs, drinkingwater users, and tribes for shallow groundwater elevation monitoring.	11/28/2021	Figure 8-1 shows the locations of the water level monitoring network. Mapping of the locations of different user groups on the same map is not required by SGMA.

Big Valley GSP Comment Matrix Chapter 9

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	1, 21	change "returning to" to "remaining"	6/2/2021	Already resolved
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	4, 95	What is meant by a "water storage basin"	6/2/2021	Clarification of reservoirs made
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	6, 120-121 7, 180-181	Change "towards sustainability" to "remain sustainable"	6/2/2021	1 already resolved, line 216 revised (page line and number do not line up with this version of the text)
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	7, 160-161	Regarding sentence "Development of additional wells strictly for monitoring is also of interest as they provide unobstructed measurements year round". It's not necessarily desirable. Remove or change wording.	6/2/2021	wording changed to beneficial previously (line 187)
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	8, 195-196	change "achieve sustainability" to "maintain sustainability"	6/2/2021	Changed
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	8, 198	Insert "several" to discussion of reservoirs. Multiple reservoirs could be expanded.	6/2/2021	discussion added previously
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	9, 228-235	In discussion of Allen Camp Dam, strengthen language regarding the need for the reservoir	6/2/2021	Language is adequate
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	9, 240 et seq	Add controlled burns to potential actions	6/2/2021	discussed
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	12, 329	add "as compared to SGMA". to end of sentence	6/2/2021	Already resolved
Aaron Albaugh	Chapter 9 Public Draft 5/24/21	14, 375	Add text about illegal marijuana grows	6/2/2021	Already resolved
Geri Byrne	Big Valley GSP All Chapters Public Draft 8/26/21	Line 2776	Table 9-3 - 9.1 and 9.2 "projects will be communicated through the Big Valley Groundwater Advisory Committee." Have we determined if the Advisory Committee will continue to exist after plan adoption?	9/9/2021	Text changed to reflect communication from GSAs rather than BVAC.
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 2755	Add "and economically disadvantaged.	9/9/2021	Text added
BVAC	Big Valley GSP All Chapters Public Draft 8/26/21	Line 3184	Add "and economically disadvantaged.	9/9/2021	Text added

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie	BigValleyGSP Chapter 9 Revised Draft 6/23/2021	Page #: 9-15 Line #: 264 Section 9.4.1	Sec 9.4.1: I read most of the supporting references. It appears that the original articles were more nuanced and less definitive than represented. For instance, the Plan appears to say that increased Snow Water Content always correlates with potential groundwater recharge, and increased SWC occurs in more open areas, therefore opening up tree canopy is (always) desirable. In dry, volcanic, geologically-complex areas like ours, the situation is much more complex than the reference locations. Yes, juniper removal does usually result in more water release, but it may just be surface water. Removal of understory conifers (in this area, often incense cedar and white fir) also generally is helpful, but again may only indirectly contribute to groundwater. Large severe wildfires also can greatly impact quantity and timing of run-off and potential recharge. I recommend leaving the details of determination of whether a potential project would increase groundwater to the specialists involved with that project.	7/7/2021	Specialists have been consulted and wildfire potential evaluated in cited studies. Surface water runoff is not an undesirable result for additional catchment and forest health projects. Comment reinforces point of this section, so no further action is required.
Julie	BigValleyGSP Chapter 9 Revised Draft 6/23/2021	Page #: 9-17 Line #: 306 Section 9.4.2	9.4.2: re Beaver analogs: Do we have examples of currently-implemented projects? I proposed this, as well as beaver reintroduction, for future projects. Also, probably better to use the spelling "analogue."	7/7/2021	Analog is the correct spelling. Projects have been completed in several upland areas around Big Valley and the greater watershed.
Julie	BigValleyGSP Chapter 9 Revised Draft 6/23/2021	Page #: 9-2 Line #: 25 Figure 9-1	9.1: "watershed map" Why cut off the Pit River at that point?	7/7/2021	Watersheds are defined by topography. Rivers can run through multiple watersheds.
Julie	BigValleyGSP Chapter 9 Revised Draft 6/23/2021	Page #: 9-2 Line #: 25 Figure 9-1	Figure 9.1: is this a watershed map or a groundwater map?	7/7/2021	Both combined
Julie	BigValleyGSP Chapter 9 Revised Draft 6/23/2021	Page #: 9-2 Line #: 25 Figure 9-1	If it is a watershed map, then Round Valley watershed would be included. If it is a groundwater recharge map, then basin cut-offs, like Round Valley wouldn't be included.	7/7/2021	Watersheds are defined by topography. Round valley is its own watershed.
Julie	BigValleyGSP Revised Draft 10/18/2021	Page #: 9-18 Line #: 3058	Sec 9.4.2: Beaver dam analogues are not "commonly used"...yet. But they could be. I also note that a previous mention concerning beaver reintroduction has been removed, which is fine, because they evidently are still within the region enough that they could repopulate if we provided attractive habitat, such as dam analogues. There is also recent genetics research on beavers that they should not be moved long distances as they are genetically distinct by watershed. So we could relocate unwanted beavers off private land to other local locations.	10/20/2021	Addressed in 9.4.2.
Julie	BigValleyGSP Revised Draft 10/18/2021	Page 9-14	I thought DWR instructed that the headgate not be closed on Roberts Reservoir thus preventing its use for storage and recharge. This needs to be addressed. They can't have it both ways	10/20/2021	The operation of the reservoir is not under the purview of the GSP.
Julie	BigValleyGSP Revised Draft 10/18/2021	Section 9.3.2	I think we are selling ourselves short on Roberts Reservoir. I would like to see more language about the economic benefits, jobs, recreation, etc.	10/20/2021	Local support for this project is acknowledged in section 9.3.2

Big Valley GSP Comment Matrix Chapter 9

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The consideration of beneficial users when developing projects and management actions is insufficient, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for all beneficial users.	11/28/2021	There is no need to consider benefits or impacts at this level for identified projects until the planning process, during which state and federal permits will be applied for as necessary. Projects and management actions identified in this section are noted for their potential to avoid undesirable results.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. We commend the GSAs for including projects and management actions with explicit environmental benefits, such as Agriculture Managed Aquifer Recharge (Section 9.1.1.) and Forest Health / Conifer and Juniper Thinning (Section 9.4.1). However, the GSP fails to describe this or other projects' explicit benefits or impacts to beneficial users such as DACs and tribes.	11/28/2021	Since the entire basin is part of the DAC, all projects and mangement actions benefit DACs. Project impacting tribes will include trical consultation.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. We note that the plan does not include a domestic well mitigation program to avoid significant and unreasonable loss of drinking water. We strongly recommend inclusion of a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation.	11/28/2021	Appropriately addressed in section 9.2.2
Jim Copp	BigValleyGSP_PublicReviewDraft_2021_10_28.pdf	Page #: 9-7, Line #:	The problem with all the recharge options is figuring out where the water comes from to do the recharge. With 100% of the water rights in the valley allocated, that only leaves high water events (which are not clearly defined), and there are few good options to capture and store that water when it comes--if the government even lets us. Allen Camp Dam, or other large-scale surface-water storage options, are the best hope for long-term effective groundwater management in Big Valley.	11/28/2021	Water rights are not directly in the purview of the GSP. Future actions can (and likely will) include a water availability assessment (WAA) to determine if water rights can be obtained for high flow events (flood and/or storm flows).
Jim Copp	BigValleyGSP_PublicReviewDraft_2021_10_28.pdf	Page #: 9-15, Line #:	The Allen Camp Dam section should mention that the 1981 feasibility study only considered the barest economic benefit to users within Big Valley, did not take into account the power generation that now exists downstream, and vastly underestimated the economic benefits to agriculture both in Big Valley and to downstream users. Positive impacts of this project could reach all the way to southern California and need to be acknowledged.	11/28/2021	The current feasibility study is the best readily available information.
Jim Copp	BigValleyGSP_PublicReviewDraft_2021_10_28.pdf	Page #: 9-19, Line #: 2904-2907	The last sentence is a repeat of the sentence that comes two sentences earlier.	11/28/2021	Text modified.
Jim Copp	BigValleyGSP_PublicReviewDraft_2021_10_28.pdf	Page #: 9-6, Line #:	In the chart, under Project 9.3 Benefits, lines are cut off but it seems the phrase should read "...would reduce reliance..."	11/28/2021	Formatting repaired

Big Valley GSP Comment Matrix Chapter 9

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28.pdf	Section 9.3.2	I have only started to wade into the history and specs of this project. I suspect that within the current contexts of increasing prolonged droughts and restructuring of energy production away from fossil fuels, Central Valley agriculture and power generation would be prioritized over Big Valley's low-value agriculture. I also note that much of the water that was to be delivered to Big Valley was dedicated to the National Wildlife Refuge that was proposed in the current location of Ash Creek Wildlife Area. And PG&E was assured by court ruling that no water would be diverted to Big Valley if the water flows were below specific levels at Pit 3 project. There is also some question of whether upstream water rights would impede the ability of the reservoir to fill to capacity. And, of course, all dams have a limited lifespan due to sedimentation…would it be cost effective to dredge out the sediments? I am concerned that this project isn't being examined from all angles. It is wishful thinking to avoid implementing restrictions on new well drilling, land conversion to agriculture, etc.	11/29/2021	Comment received.
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28.pdf	Section 9.4.1	Smerdon et all isn't the best reference for this area. That study is based on and for British Columbia, a very different ecosystem than Big Valley. Furthermore, throughout the report, there are numerous disclaimers and qualifying statements, basically that recharge is very situation-dependent. To make broad statements about snow cover and vegetation removal from that report is inappropriate. I am concerned at the rush to attribute groundwater benefits to any forest treatment. Removing conifers along drainages is mentioned in Sec 9.4.1; be careful with this! Timing of run-off is as important as quantity. And retaining water on the landscape longer allows it more chance to recharge groundwater tables. Opening up the overstory canopy allows the sun to heat up and dry out the forest floor and creeks, decreasing water retention, encouraging flammable brush and thick understory reproduction (which then competes with the larger fire-resistant trees for water,) decreasing humus depth, etc. Which trees are removed is critical. Severely burnt landscapes lose protective soil and even become hydrophobic, therefore decreasing water retention. The goal should be fire resilience by removal of ladder fuels, by prescribed fire ideally. Mastication has been shown to decrease risk of crown fire but increase heat and smoldering of masticated materials. Masticated fuels also tend to decay slowly, so they remain flammable longer.	11/29/2021	These concerns will be addressed in the planning and permitting processes for the specific projects proposed in this section. Smerdon et al. is cited once and not in the manner suggested by this comment. Many other sources and experts have been consulted in the development of this section to identify possible projects to enhance forest health.

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28.pdf	Section 9.4.2	Mention of beavers has dropped to a sole sentence stating that pond and plug and beaver dam analogs (sic: analogues) are two commonly used techniques for meadow restoration in Big Valley basin. This isn't true of the beaver dams yet. I actually suggested reintroducing beavers and my comment was immediately discounted as impractical (or undesirable?) I suggest the book "Eager: The Surprising, Secret Life of Beavers and Why They Matter" by Ben Goldfarb. It is the 2019 winner of the PEN/EO Wilson Award for Literary Science Writing. It totally changed how I see the landscape of North America. Locally and historically, Dan Bouse (who is 80 years old) told me of beavers in Round Valley, along Ash Creek, and in the sloughs of Pit River when he was young. He said their dens were in the riverbanks. In the 1980's, I saw evidence of beavers in Rush Creek above Round Valley and upper Ash Creek near Ash Valley. The hydrogeomorphology of many of the tributaries to of these creeks, including specifically Dutch Flat Creek, indicates to me that beavers were resident there in the past.	11/29/2021	Fits into the scope of projects discussed.
Julie Rechtin	BigValleyGSP_PublicReviewDraft_2021_10_28.pdf	Section 9.4.2	(continued) As for moving beavers, they can move themselves 50+ miles, even across dry land. However, recent research has revealed that beaver genetics are hyper-local and complex, so relocating them for significant distances isn't a good idea anyhow. Best strategy would be to make some locations more attractive, which is where beaver dam analogues fit in. Plan B would be to relocate beavers that are unwanted locally, although if their new home isn't high enough quality habitat, they won't stay put and/or survive. Beavers need relatively gentle gradients with plenty of willows, cottonwoods, etc. I recently found out that there are still some beavers here. This summer, according to reports, beaver-chewed sticks floated down Ash Creek to below the low-water bridge in Adin. Aaron Albaugh apparently knows where beavers are on Ash Creek now but won't divulge due to them being on private land. Yes, beaver dam analogue dams can help. But they are much more expensive to build and maintain. Instead, as we say, "let the rodent do the work." An diversity of "beaver deceivers" and other tactics are available to deal with any threats to infrastructure.	11/29/2021	Fits into the scope of projects discussed.

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie Dawson-Parlee	BigValleyGSP_PublicReviewDraft_2021_10_28	Lines 2596-2626	RE: AgMAR -- What constitutes "excess surface water"—how is "excess" defined? Will there be expedited processes and money awarded for citizens to build safer water storage options that do not require them to endanger themselves by manually replacing boards in diversions during high water events in order to capture surface water? There needs to be discussion in this section of the report about the necessity of a dam further upstream to regulate the flow of this "excess" water in order for it to be slowed enough to be captured for future use and recharge. Currently, high water events saturate the valley and flow downstream out of Big Valley, leaving very little actual stored water. Additionally, existing water regulations require discharge of captured excess surface water after 30 days, but that limits our ability to actually use surface water toward groundwater recharge. With the unpredictable timing of winter storms, it means that water captured in March won't be available in May, when it might actually be useful to use for irrigation, thus reducing the dependence on groundwater. Historically, the highest water events in Big Valley have happened in February and March, too early to be used when it's time to irrigate. Will new policies be considered as a result of SGMA to assist stakeholders in actually achieving recharge? However, early capture of excess surface water could lead to saturation of water storage areas and an elevated risk of flooding should another high water event occur when storage areas are already full. The unintended risks and consequences of recharge projects need to be acknowledged.	11/28/2021	Elevated flood risk related to AgMar is not anticipated at this level. The project planning process will provide a more comprehensive evaluation of possible costs and benefits. The projects in this section are identified for their potential to benefit basin recharge and draw upon existing practices.
Julie Dawson-Parlee	BigValleyGSP_PublicReviewDraft_2021_10_28	Lines 2628-2638	RE: Drainage or Basin Recharge -- The same risk applies to capturing water to fill storage areas, then causing excessive flooding if a big storm hits. Legal action was taken years ago in Big Valley by a landowner whose land was damaged by a neighbor's water management that caused flooding; will there be protection for landowners participating in this kind of recharge if it has unintended consequences? What recourse will there be for neighbors affected by recharge projects gone awry?	11/28/2021	elevated flood risk associated with drainage recharge is not anticipated at this level. Project planning will identify and address these concerns where applicable.
Julie Dawson-Parlee	BigValleyGSP_PublicReviewDraft_2021_10_28	Lines 2640-2671	RE: Aquifer Storage and Recovery and Injection Wells -- Again, worth asking: WHERE WILL THE RECHARGE WATER COME FROM, WHO CONTROLS IT, WHO PAYS & HOW MUCH, AND HOW WILL STAKEHOLDERS ACCESS IT? And what could be some unintended consequences of adding chlorine to our groundwater? Would others affected by this action be able to sue if it's found to be detrimental to the overall groundwater quality?	11/28/2021	Exceeds the capacity of this plan to address at this level.
Julie Dawson-Parlee	BigValleyGSP_PublicReviewDraft_2021_10_28	Lines 2580-2594	For every recharge method, it must be asked and answered: WHERE WILL THE RECHARGE WATER COME FROM, WHO CONTROLS IT, WHO PAYS & HOW MUCH, AND HOW WILL STAKEHOLDERS ACCESS IT? Otherwise, this document is just a theoretical fantasy (which it largely is due to the acknowledged data gaps and uncertain outcomes of everything except Allen Camp Dam).	11/28/2021	This section of the plan is meant to identify projects and management actions that are anticipated to ameliorate potential adverse effects before they come to pass. The planning and permitting processes for identified projects will provide a more comprehensive evaluation of these areas of concern, which exceed the capacity of the plan to perform at this level.

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Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie Dawson-Parlee	BigValleyGSP_PublicReviewDraft_2021_10_28	Lines 2757-2778	9.3.1 Expanding Existing Reservoirs -- Given the very small number of beneficiaries currently controlling and receiving water from the existing reservoirs in Big Valley, how could this option be used to benefit a greater number of stakeholders and effectively contribute to groundwater recharge? To refill Roberts Reservoir during high water events, the water must be pumped from the Pit. Who would incur that cost? How will this be achieved if the watermaster is already being told by DWR not to put the headgate in this year to capture what little rain we've already had, after a record dry year when there's no guarantee of more rain this season? How can we as a local community control the water needed to achieve recharge? Will additional funding be made available to encourage private water storage projects, and will permits be expedited and new policies implemented to allow for more effective water capture and storage? Without assistance and accommodations, this valley is being asked to complete these tasks with our hands tied.	11/28/2021	These concerns exceed the capacity of this plan to address but the planning process for identified projects are anticipated to encompass them.
Julie Dawson-Parlee	BigValleyGSP_PublicReviewDraft_2021_10_28	Lines 2783-2813	9.3.2 Allen Camp Dam: The Allen Camp Dam project is widely acknowledged to be the one action that would make the most significant difference in Big Valley's water situation and solve virtually all the problems the GSP outlines, yet it gets very little support in this document as a top priority. With the Federal Government releasing record amounts of spending on "infrastructure" right now, it seems worth adding as much support as possible for moving forward with Allen Camp. Costs and government regulations are typically cited as the reason the Dam isn't aggressively pursued, but looking realistically at the money proposed for just the studies and smaller alternative recharge projects, it seems a case could be made for putting that energy, effort, and expense into a solution that will actually fix the problem for the long term. Additionally, the economic impact study that effectively killed the Dam project in 1981 was an inadequate, incompetent, and not-in-good-faith effort, which did not really even consider any possible economic benefit beyond Big Valley. The mathematical formula used to justify abandoning the Dam plan was wholly inadequate to portray any realistic economic impact. We need to point out the multitude of benefits to the entire region that could come from a sizable lake's recreation area, wildlife habitat, downstream users, power generation, constant and controllable flow of the Pit River year-round, and potential benefit to users all the way down the state.	11/28/2021	It is beyond the scope of this plan to conduct an updated feasibility study for Allen Camp Dam.
Julie Dawson-Parlee	BigValleyGSP_PublicReviewDraft_2021_10_28	Lines 2816-2855	9.4.1 Forest Health / Conifer and Juniper Thinning: The point needs to be made that prompt and beneficial action from the USFS and other government agencies is essential for Big Valley to be successful in reaching its recharge goals. If DWR is holding Big Valley water users to these standards of water management, then the government agencies who are our neighbors need to do their part in managing resources appropriately to help toward the same goals. Which USFS actions (or lack of action) cause recharge not to happen as effectively? What recourse do we as a community have to point out problems and expect results in order to achieve recharge?	11/28/2021	Comment addressed by including more explicit language to engage federal agency involvement and support.

Big Valley GSP Comment Matrix Chapter 10

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-2, 45-56	Why do we have to download, repackage, and send data back to state	6/2/2021	The GSP Regulations require this to be done as per §356 et. seq. Unlike most other basins in California, all Big VAlley data is being collected by outside agencies, including DWR taking water level measurements in the Basin. Therefore, the GSAs are downloading the data from the collecting agencies (e.g. DWR) to include in the annual report. The GSAs and their consultants are working to ensure that the data and figures that need to be submitted in the annual reports are able to be generated and submitted as easily as possible with little effort from GSA staff and/or consultants. Text has been added to point out the fact that the GSAs are regurgitating data.
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-3, 91-92	Groundwater extractions should also include water used for fire, wildlife, logging, and construction.	6/2/2021	A note has been made for future updates to Chapter 6 (Water Budget) to include these items. For water budgeting purposes these will fit under the umbrella of industrial uses. A footnote was added to this portion of Chapter 10 referring to these uses
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-3, 93-94	Surface water supply is 100% allocated	6/2/2021	A footnote was added to emphasize this point.
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-3, 95-96	Add industrial uses	6/2/2021	Industrial was added, with a footnote detailing the various users.
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-3, 101	"Progress toward achieving measurable objectives". Change wording to reflect that already sustainable.	6/2/2021	Wording changed
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-7, 138	Why do we need to manage water quality when it is already good.	6/2/2021	The discussion and approach to water quality data was changed to reflect that the GSAs will rely on the SWRCB to store and provide water quality data via their GAMA Groundwater Information System.
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-2, 40	The water year is difficult to apply to Big Valley	6/2/2021	Sentence added, pointing this out. "While the WY as defined by DWR isn't ideal for use in Big Valley, the GSAs will assemble data based on DWR's definition as per SGMA statute and regulationsThe discussion and approach to water quality data was changed to reflect that the GSAs will rely on the SWRCB to store and provide water quality data via their GAMA Groundwater Information System.
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-13, 234	Poor wording	6/2/2021	Wording changed
Aaron Albaugh	Chap 10 Public Draft 5/26/21	10-15, 270	Poor wording. Rewrite to emphasize that basin is economically disadvantaged and residents can't afford new taxes or fees	6/2/2021	Wording changed

Big Valley GSP Comment Matrix Chapter 10

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Aaron Albaugh	Chap 10 Public Draft 5/26/21	Appendix 10A	Don't like grant funding	6/2/2021	Wording changed
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 3115	Change requirement of SGMA to mandates of SGMA	10/6/2021	Text changed.
Julie	BigValleyGSP Chapter Revised Draft 6/23/2021		To me, it is important for monitoring to not just provide specified info to the state, but to help us achieve our goals locally. Given the many unknowns within Big Valley Groundwater Basin, recharge areas, etc, I would like to see more emphasis on specific data gaps as "monitoring" needs in Chapt 10. Gathering this kind of data is expensive and requires specialized knowledge, but especially as the droughts continue, it is critical to us having the knowledge required for us to sustainable groundwater levels here. Discussing this here could help us attract or justify more of this type of support from state Universities etc.	7/7/2021	Comment received.
Julie	BigValleyGSP Chapter Revised Draft 6/23/2021	Appendix 10A	Appendix 10A: Why does this long document need to be included? Why not just a link to a web site where this can be accessed?	7/7/2021	Appendix removed. Link provided in text.

Big Valley GSP Comment Matrix Chapter 11

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Geri Byrne	Big Valley GSP All Chapters Public Draft 8/26/21	Line 2776	Lassen and Modoc County Boards of Supervisors sent letters. Supervisor Byrne testified before both the Senate and Assembly committees in support of this bill citing the constraints of inadequate broadband in the community for meaningful public participation.	9/9/2021	Text added
BVAC	9/22/21 Draft GSP as introduced at	Lines 3326 to 3345	Grammatical tenses are inconsistent	10/6/2021	Section edited for tense agreement.
BVAC	9/22/21 Draft GSP as introduced at 10/6/2021 BVAC meeting	Line 3378	Isn't the purpose of the BVAC to provide a product that the Boards of Supervisors can approve?	10/6/2021	The MOU states that the BVAC is to provide a recommendation.
Julie			First, Chapter 11 is the first time I have seen some of the comments within the comment matrix. They make some good points, and often there are no responses to them. They definitely change my perception of some of the issues in previous chapters. Second, I think one cause of this situation is that when accessing the GSP web site, older versions of the chapters were posted as available to the public for comments. Revised versions were only in the meeting Packets. I didn't understand this at first. And it appears this impacted the public's ability to make informed comments, and it backs up our request to extend the planning process. If we can't have an extension, then we need more (financial or logistic) support for the 5-year review.	7/7/2021	The GSAs have provided multiple ways for stakeholders to participate and comment on the GSP, one of which is the website. The main page of the website always displays the current versions of the chapters/draft GSP that are open for comment. All comments received on the website and by other means are included in this comment matrix.
Julie			Some of the comments in the comment matrix were cut off. This likely is an artifact of Excel software. Please fix.	7/7/2021	All comments received on the website and by other means are included in this comment matrix.
Julie		Appendix 11C	I would like you to at least consider the comments in the matrices for which there were no responses, if not for this document, for 5-year review.	7/7/2021	For the final GSP, all comments will be addressed in this "Notes and Responses" column of the comment matrix.
Julie	BigValleyGSP Revised Draft 10/18/2021		Might be good to note that the USPS routinely fails to deliver mail in Big Valley, there are many homes without reliable internet (or with none at all), there are no local TV stations, social media is distrusted and has very limited reach to ag groundwater users, and posters in the post offices need to go up at least two to three weeks in advance since many people only go in once every week or two. There are significatn challenges to reaching involved parties in this valley! And for the love of groundwater, if you want public participation, DO NOT schedule midweek, mid-day mid-summer meetings! You might have noticed a dramatic drop in participation, which was entirelly avoidable.	7/7/2021	Comment received. All required noticing with the appropriate timing as required by the Brown Act and other noticing regulations have been followed during the development of the GSP.

Big Valley GSP Comment Matrix Chapter 11

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The GSP documents opportunities for public involvement and engagement in very general terms for listed stakeholders. Public outreach and engagement activities include updates to the GSP website and communication portal, community flyers, notices in the local newspaper, social media updates, brochures, and the formation of the Big Valley Advisory Committee. The GSP does not state whether DACs and environmental stakeholders are represented on the Big Valley Advisory Committee.	11/28/2021	The BVAC was established by an MOU between the counties which is included in this GSP. The process for appointment to the BVAC were spelled out in the MOU. Applications were solicited and very few received. Appointments were made by the GSAs as indicated in the MOU and described in Chapter 11. DACs are represented by the fact that the whole basin is disadvantaged and the BVAC members are Basin residents. Also, CDFW and USFS were present at BVAC meetings both in person and remotely. ACWA staff, CALFIRE. Bryan Hutchinson (Bieber WW Dist) as well as BLM staff. GSAs wanted to do more, but broadband and COVID precluded this and an extension was requested but not granted.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The plan does not include documentation on how stakeholder input from the above mentioned outreach and engagement was considered and incorporated into the GSP development process.	11/28/2021	Stakeholder input was received in various ways described in Chapter 11. All formal comments are included in this comment matrix and include "Notes and Responses" for each.
NGOs	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 3 from NGOs to GSAs dated 11/28/21. The GSP states the MOU establishing the Big Valley Advisory Committee will expire after the adoption of the GSP. As such, communication and engagement will (p. 11-8) "shift to the GSA Boards who will continue to inform the public about Plan progress and status of projects and management actions." Communication and engagement during implementation will include meetings of County Boards of Supervisors and updates provided to the interested parties list. The GSP does not include a detailed plan for continual opportunities for engagement during GSP implementation that is specifically directed to DACs, domestic well owners, tribes, and environmental stakeholders within the basin.	11/28/2021	The purpose of the BVAC as per the MOU is to provide input during GSP development and provide a recommendation to the GSAs regarding the adoption of the GSP. Therefore, the BVAC does not have a role after the GSP is adopted. The GSAs have not established an advisory body for Plan implementation and will continue their outreach through available means (i.e. County Board of Supervisors announcements, meetings, and actions. The GSAs are discussing the future of the BVAC and the possibility of an addendum to the BVAC MOU for implementation.
The Nature Conservancy	BigValleyGSP_PublicReviewDraft_2021_10_28		See Letter 4. Email correspondence between the Nature Conservancy and Nancy McAllister		Emails received.

Big Valley GSP Comment Matrix Chapter 12

Name	Document	Page & Line Number	Comment	Date	Notes and Responses

Big Valley GSP Comment Matrix General Comments

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Doreen SmithPower	General Comment	Page #:, Line #:	See Letter 1 from Doreen Smith Power to BVAC dates 9/11/21. General comments on chapters 1-6.: https://bigvalleygsp.org/service/document/download/281	9/13/2021	Letter received and included in GSP Appendix
Doreen SmithPower	General Comment	Page #:, Line #:	See Letter 5 From Doreen SmithPower to the BVAC dated 10/5/21. My comments refer to the document as a whole. I appreciate the committees time and efforts. I hope my comments are utilized. https://bigvalleygsp.org/service/document/download/299	10/5/2021	Letter received and included in GSP Appendix
jeffrey middlebrook	General Comment	Page #:, Line #:	My lady and I attended the meeting yesterday (Oct. 6, 2021) in Bieber mostly to learn what's going on regarding water rights in Big Valley, and if offered the opportunity, to ask questions and/or comment. We ended up leaving when a brief break was called because it was obvious that just more of the nitpicking over spelling, grammar, and semantics was going to drag on. This sort of very boring off-topic obsession over irrelevant minutia might be somewhat humorous at some level, but all of that needs to be done prior to a public meeting so that the meat of the issue(s) can be addressed and discussed. We ended up over at the Roundup and sat next to another couple that also bailed out of the meeting for the same reason I state above. Public meetings are supposed to be for the PUBLIC, not for inane grade school lessons regarding how to properly compose sentences. I have a degree in geology (though I never worked as a geologist) and a degree in civil engineering (which I worked in professionally for a couple of years in the 1970s). I independently study climate dynamics and I have a solid base of knowledge regarding paleo climate in our greater geographical region. We'd love to be involved in what looms on the horizon regarding the State's possible future water-snatching efforts, but if every "public" meeting is going to involve the nitpicking over how something has been structurally written then we will be loathe to be involved.	10/7/2021	Comment received.
Jessica Boyt	General Comment	Page #:, Line #:	Siskiyou, Shasta Valley, and Butte Valley did a work shop recently like what Tiffany and Laura were talking about. I can give either contact info to connect with them and confer about what they did and how it worked.	11/4/2020	Comment received. The GSAs performed two public outreach workshops during GSP development.
Julie Rechtin	General Comment	Page #:, Line #:	Can we add to our request for extension mentioning how these additional needs for large group public involvement/education and gathering additional data? I've been able to participate via internet better this meeting, but many people don't and would need to attend in person. And as has been mentioned, this may not be possible during COVID, especially when we can't ventilate during cold weather.	11/4/2020	The GSAs have actively advocated for the GSP deadline to be extended, but such an extension was not granted by the state.
Jessica Boyt	General Comment	Page #:, Line #:	Prop 1 or Prop 68 grants can not pay for food.	11/4/2020	Comment received. No food at meetings was paid for by the grants.
Rodney Fricke	General Comment	Page #:, Line #:	Science is not without assumptions. Science uses available data to develop a hypothesis, gathers more data to test the hypothesis, and progressively makes conclusions about the topic during the various phases of the project.	11/4/2020	Comment received. The GSP presents the best available science and the GSP intends to "adaptively manage" the Basin as more data is available.
Julie Rechtin	General Comment	Page #:, Line #:	Yes, please, we want to support an extension!	12/2/2020	The GSAs have actively advocated for the GSP deadline to be extended, but such an extension was not granted by the state.
Pat Vellines	General Comment	Page #:, Line #:	SWRCB probationary rate - $40 AF, Interim Plan Rate $55 ac/ft	2/3/2021	Comment received.

Big Valley GSP Comment Matrix General Comments

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Doreen SmithPower	General Comment	Page #:, Line #:	I attended a webinar re: AES Airborn Electromegnetic System on June 28, 2021. This system was being done to study and gather information on the Glenn and Butte Counties. They use a loop and a plain hovers over an area to gather such information as 1) Subsurface groundwater levels to wells and amounts thereof ….this includes some water quality information also 2) one type of graph showed electroconductivity of the type of ground coverage 3) another graph showed the type of ground coverage such as course or fine but did not show the soil type 4) the system can also give information regarding fault lines and activity.	7/7/2021	The AEM surveys have been completed. Data and analysis from the flights will be available in 2022.
Doreen SmithPower	General Comment	Page #:, Line #:	I was not finished with the last chat. I asked if the AEMS study was dangerous or posed a fire danger and was told no. I am not giving you this information to add to the load of the planning document you are preparing. I am telling you this because this information will be available through the CVWB and conducted through Butte College. Again it is information regarding water quality and subsurface information that through previous comments … attendees thought was not available.	7/7/2021	The AEM surveys were completed safely.
Pat Vellines	General Comment	Page #:, Line #:	A couple of websites for low interest loans or grants for dry wells: https://www.rcac.org/lending/household-water-well-loans/	7/7/2021	Comment received.
Pat Vellines	General Comment	Page #:, Line #:	USDA website - grants - rd.usda.gov.	7/7/2021	Comment received.
Pat Vellines	General Comment	Page #:, Line #:	report dry wells to https://mydrywatersupply.water.ca.gov/report/	7/7/2021	Comment received.
Doreen SmithPower	General Comment	Page #:, Line #:	I submitted a letter last night before five o'clock and I submitted a memo over a week ago with detailed comments and I would like it acknowledged that you received both. My name is misspelled in the minutes it is Doreen SmithPower	10/6/2021	Letters received.
Doreen SmithPower	General Comment	Page #:, Line #:	I put forth correspondence during the last meeting. That correspondence was not entered into the record. Please find that correspondence and enter it into the record. Thank you doreen Smithpower	10/20/2021	All relevant correspondence in the chat during BVAC meetings was included in this comment matrix.
Julie	General Comment	Page #:, Line #:	Won't there be a 30-day comment period for the public?	10/20/2021	Yes, the Public Review Draft was open for comment from 10/28/21 to 11/28/21.
BVAC	General Comment	Page #:, Line #:	The resolution in todays meeting packet, if adopted by the BVAC, states "The BVAC hereby recommends that the GSAs (or GSA staff) initiate a 30-day public comment period for the Draft Groundwater Sustainability Plan."	10/20/2021	Comment received.
BVAC	General Comment	Page #:, Line #:	The document is currently open for public comment and when an end date for comment is established, a notice will be sent to our interested parties list, at minimum.	10/20/2021	Comment received.
Julie	General Comment	Page #:, Line #:	Limiting or discouraging comment isn't appropriate. We do not yet have a final document on which to comment. And many people have been limited by lack of internet access and COVID.	10/20/2021	Yes, the Public Review Draft was open for comment from 10/28/21 to 11/28/21.
Doreen SmithPower	General Comment	Page #:, Line #:	The Resolution is before the Board can you limit the comments?	10/20/2021	The BVAC passed the resolution to recommend approval of the GSP.
Doreen SmithPower	General Comment	Page #:, Line #:	Public comments were invited on the resolution before the advisory committee.	10/20/2021	The BVAC passed the resolution to recommend approval of the GSP.

Big Valley GSP Comment Matrix General Comments

Name	Document	Page & Line Number	Comment	Date	Notes and Responses
Julie	General Comment	Page #:, Line #:	The "vested right of agricultural pursuits" seems to imply that other users' access to water is secondary. Such other users could be residents, potential industry, tribes, wildlife/fish. Is this what is meant?	3/3/2021	Page 7 of the packet - thought would include in case can edit. Under "The following text was recommended for the Sustainability Goal". The BVAC recognized that Ag is important role and it affects all users. Important to the economic viability of the community.
Julie	General Comment	Page #:, Line #:	could we use "just" instead of "right" in the second sentence?	3/3/2021	Page 7 of the packet - thought would include in case can edit. Under "The following text was recommended for the Sustainability Goal"
Julie	General Comment	Page #:, Line #:	A summary for the public is going to be needed to bring folks up to speed. Especially with COVID, public participation has been tough for those without DSL. Thank you.	3/3/2021	A public information brochure was developed, distributed, and included in an appendix of the GSP. The brochure gives an overview of GSP chapters 1-6.
Julie	General Comment		I have attended most of the BVAC meetings. I tried to focus on facts or background that weren't mentioned by others. I have made comments and asked questions that weren't always answered, and I have noticed the same with other participants' comments. Unfortunately, I have had limited time to comment this month. I and others will continue to participate in the 5-year update, hopefully with some of the data gaps filled in so we can push for more informed changes and decisions. I also am concerned that the lack of diversity of stakeholder values on the BVAC may have led them to a too-narrow view of the current situation as well as the opportunities available. Above all, we need to assure a sustainable economy and the ecosystems that support it and us in the BV groundwater basin.	11/28/2021	Comment received.
Julie Dawson-Parlee	General Comments		See Letter 6, email from Julie Dawson-Parlee to Tiffany Martinez and GEI.	11/28/2021	Email received.

Letter 1

Doreen Smith Power

PO Box 208

Alturas, CA 96101

September 11, 2021

Big Valley Advisory Committee

BVGSMP – Big Valley Groundwater Sustainability Management Plan Committee(s)

Dear Committee Members:

Please review the following comments regarding July 7, 2021 meeting minutes that were approved during the September 9, 2021 meeting of the BVGSP committee as the BVAC Big Valley Advisory Committee.

Meeting information:

Big Valley Groundwater Basin Advisory Committee (BVAC) Unapproved Meeting Minutes

Lassen County BVAC – Aaron Albaugh, Board Representative; Gary Bridges, Alt. Board Representative; Kevin Mitchell, Public Representative; Duane Conner, Public Representative Modoc County BVAC – Geri Byrne, Board Representative; Ned Coe, Alt. Board Representative; Jimmy Nunn, Public Representative; John Ohm, Public Representative Wednesday, July 7, 2021 2:00 PM Veterans Memorial Hall 657-575 Bridge Street Bieber, CA 96009

The following was in the meeting minutes of July 7, 2021 groundwater meeting. These minutes were approved by the "BVAC Committee Members" without any comment from the public.

NO COMMENT FROM THE PUBLIC WAS REQUESTED.

On line public comment: Doreen had attended a webinar on the Airborne Electromagnetic System and shared information on what she learned.

Number One I provided a summary overview of the Airborne Electromagnetic System. I provided my full name of Doreen SmithPower and I cannot believe that you did not provide my full name in the meeting minutes. Furthermore, I provided these comments at the beginning of the meeting and NOT as part of your agenda. I have a two college degrees from California State University Chico. The information was initially put on by Butte College. I went over everything that Ian Espinoza went over and I gave details such as…..

AES uses a helicopter to fly a hoop over the forest and ground. The hoop measures the groundwater to indicate the type soil or layering present on the earth such as clay, sand, silt or limestone. I also stated the maps were provided to show the level groundwater by color. I was told the AES system did not harm the environment but was only about 60% accurate. I provided the Butte College website information.

I am really tired of being overlooked for the work and effort I do to provide you with information. I urge you to get the information from Butte College. The maps provided are easier to read.

There were "breakouts" I could not attend because I attended online. Yes I could have driven there to attend. I have a car to do so but gas prices are not cheap. I also went onto the Modoc County Board of Supervisors website and applied to be on a Groundwater Sustainability Management Plan Committee. I have noted that there was a meeting on June 5, 2021. I applied in May 2021. I was not even given the courtesy of a reply.

DWR AEM- Ian Espinoza (In put the same information on the Devils Garden Website – It was not stated <u>if he actually got permission from Butte College or if this has been plagiarized</u>.)

• Provided an overview of the Airborne Electro Magnetic (AEM) Project.

• Provided an overview of the Airborne Electro Magnetic (AEM) Project. In short, AEM "is a geophysical method that measures the electrical properties of the subsurface from helicopter mounted equipment." • Objective is to better understand underlying aquifer structures by differentiating sediments (gravels, sands, silts and clays). • As a medium priority basin, Big Valley will be flown starting in October 2021. • AEM SGMA Goal: "To improve the understanding of largescale aquifer structures which aids in the development or refinement of hydrologic conceptual model and identification of possible groundwater recharge areas." ……

The BVGSMP committee also known as BVAC needs to acknowledge the public as a valuable resource and stop ignoring comments. Source the information, plagiarism is illegal.

Doreen SmithPower, Paralegal

Letter 2

Doreen SmithPower Comments to BVAC and

BV Sustainable Groundwater Management Plan Committee

Page: Line 44:103-106; 45:15-16

Editorial Comment : You have Figures and Tables that contain information in the document Figure ES-1 - ES-5 the figures are maps and graphs however you have one table ES-4 that is labeled as a Figure and should be renamed a Table. Also this Figure/Table is really hard to read – the color should be removed so the data is legible and the font should be a little bigger.

Content Comment: On page 44 E-S 4 **the water budgets** states and estimated 39,400 acre feet yield for water with 5,200 acre feet overdraft. Does overdraft mean 5,200 acre fee, the threshold was reached and well water was need to be pumped up from the aquifer? It does not state the total number of acres in BV water budget for domestic, farming, ranching, and wildlife preserve here. Later the total number of acres in the BV basin is stated later at page **60:509** although not broken down is 92,057 acres and 144 miles. So this data needs to be worked into the water budget information. If the water budget only allow for 39,400 acre feet yield – the **92,057 less 39,400 = 52,657** as the overdraft. The total number of acres and how you got to the "overdraft" should be both in the report and Es-4 table. At page **66: 624** the acreage is broken down by type: Community (commercial and domestic?), Industrial, Agriculture, Wildlife Preserve, Manage Recharge (?), Native Vegetation and Rural Domestic (Table 3-2). Note 66:624 and 60:509 total acreage do not match. (**66:624 says 92,067 and 60:509 states 92,057 pick one and make the total acreage consistent. If the total acreage is 92,067 the overdraft changes to 52,667**.) The underlined information needs to be included in the Water Budget at page 44 and this tables that appear later can be used in the explanation. The Water Budget needs to be stated is further discussed infra @ Chapter 6.

Infra @ page __ line __ means information that appears later in the document. If you want to reference information that you have previously cited use Id at page ___ line ___.

Pages:Line 159:2123, 162:2169-2177

Editorial Comment: Figure 6-4 relabeled to Table and make the table legible by removing the color and increasing font. Figures 6-6- 6-8 relabeled to Table same comment re: legibility.

Page 44:98-102

"Groundwater in the BVGB is generally of good to excellent quality. (DWR 1963, USBR 1979) An analysis of available historic water quality indicates some naturally occurring constituents are slightly elevated, associated with volcanic formations and thermal waters. Elevated concentrations are extremely isolated and primarily not above thresholds that are a risk to human health. There are no contamination plumes or cleanup sites that are likely to affect groundwater quality for beneficial use."

Content Comment: This information from 1096 and 1979 can be used for historical references in the plan document. However, the information concerning thresholds and contamination plumes and clean up sites is OUTDATED AND SHOULD BE FROM 2018 FORWARD.

Page 42:65-69

“The coarse-grained deposits (gravel & sand) are aquifer materials and are part of the Big Valley principal aquifer. The “physical bottom” has not been clearly encountered or defined, but may extend 4,000 to 7,000 feet or deeper. The “practical bottom” of the aquifer is 1,200 feet because that depth encompasses the known production wells and water quality may be poorer below that depth.”

Content Comment: There have been wells that have gone been drilled to 2,000 feet. What have you found that makes the quality poor after a depth of 1,200 feet? Is this the fault line or volcanic activity depth or something else?

Why did the baseline definition change to an aquifer definition for the entire BV Basin? The BV basin is not just sand and gravel or are we that low on topsoil and nutrient rich soil. Mountains contain waterfalls and spring which could be defined as aquifers within the mountain. Was an AES study done in Lassen County? If so, you should remember that Butte College did the AES studies in both Glenn and Butte Counties and the accuracy rate was only 60% utilizing the Airborne Electromagnetic System to measure groundwater to gather information on soil/ground cover layering. In previous drafts it was explained that the from the average height (sea level to the average height of the monitoring wells) created the baseline then the depth on average of the wells was 1,200 feet then the threshold was 150 feet to get to the water within the wells. Once the threshold dropped below 150 feet the cost went up to pump the water. The cost of producing hay was in the report and I would like to see the cost of producing a crop for human consumption fruit: strawberries, raspberries, and vegetation such as carrots, potatoes and onions, and trees such as apple, pear, and peaches and nuts as almonds and walnuts. The table timeline should include the following information: The type of vegetation grown, the month and date the surface water depleted so that groundwater needed to be pumped for irrigation and the yield of the vegetation and the quality of the vegetation. Finally, was there contamination to the end product and was there any health issues reported as a result.

Chapter 1

Page:Line

1.2: 247-252

“The Ash Creek Wildlife Area (ACWA) is an example of a local rancher who provided land for conservation efforts with an understanding that managed lands promote wildlife enhancement for the enjoyment of all. The California Department of Fish and Wildlife has largely left the property unmanaged. While the ACWA does offer refuge for waterfowl and other species, most species feed graze on the private lands around the Basin which are actively being cultivated because those lands offer better forage.”

Content Comment:

The Bureau of Land Management has management responsibility. The Applegate BLM should be contacted. The National BLM – Department of the Interior, I believe has oversight to the California BLM. BLM has leasing authority and also has the authority to transfer management responsibility to other State Agencies such as the CALFIRE and the US Forest Service. BLM grants overlapping management. BLM also has the authority to sell the property. BLM – Department of the Interior goes through the Army Corp of Engineers, located in Washington State for hiring. If the BLM – Department of Interior has oversight they may be able to create positions to manage that land.

This is a sideline informational comment that effects the groundwater situation and should be kept in mind.

The Jordan Cove Pipeline which hubs in Malin, California and connects three LGN pipelines to extend to Coos Bay, California effects the groundwater in this Plan. The three lines are the Ruby from Nevada-Lassen, the Pembina from Canada -Oregon and the Jordan from Malin to Coos Bay. The pipeline goes under the waterways (rivers streams etc.) in over 300 spots and also highways. The Federal Energy Regulatory Commission (FERC) approved the pipeline in 2020. When FERC approved BLM granted state agencies management authority so right of ways could be granted and water rights transferred. This is just so the committee is aware and I am not stating this should become a part of the plan.

Chapter 1 Page 53: 354-357

"Secondary MCLs which are due to naturally occurring minerals should not be factored into the scoring process. Here, the water quality conditions reflect the natural baseline and are not indicative of human-caused degradation and cannot be substantially improved through better groundwater management."

Content Comment: I do not agree. The naturally occurring minerals that could residual waste from industry and what is left of un-reclaimed property. Overpowering minerals: limestone and residual waste from digging such as arsenic effect the water. Limestone is another that effects the water and other minerals attach and make it hard to filter out. This has health side effects. The reports were due in 2020 to DWR I would like the results. This report references "secondary" MCL… I would like the initial Maximum Contaminant Levels.

Chapter 3 Page 62:565-566

Editorial Comment:

"…other stakeholders, including community organizations; environmental stewards; water purveyors; numerous local, county, state, and federal agencies; industry;…"

This line is cut off at the top making the sentence hard to read. Also starting at the point above, the font either changed or went down.

Chapter 3 Page 62:570-571

Editorial Comment:

"At **92,057 acres**, the 571 BVGB comprises about three percent of the IRWMP area at its center."

It appears that when you have redlined the document then accept the changes, the font is either changed in the document or the size of the font is changing within the document. You can't tell when it is copied to word. The acres is either 92,057 or 92,067 – do a search and replace throughout the document.

Chapter 3 Page 66:624 & 625

<u>Editorial Comment</u>: Table 3-2 has some information necessary for explanation in the water budget. The table can be used by stating "infra at page 66:624". This states the total acreage by category: Community, Industrial, Agricultural, State Wildlife Habitat, Managed Recharge, Native and Rural Domestic totaling 92, 067 The water budget is at page 44. At page 60:509 the total acreage is listed at 92,057. The total acreage should be consistent.

The Table in 3-2 was redlined from Urban to Community the Key in the Figure 3-4 needs to be Changed from Urban to Community.

The Definitions of property type: Community, Industrial Agricultural State Wildlife Habitat, Managed Recharge and Native and Rural Domestic should be cited to as in the glossary of terms @ page ___. Then the table of information can be enlarged and more legible and any further definitions can be cited within the document and the definitions can be added to the glossary of terms making the current draft easier to read and future drafts easier to update. The total number of wells by well type (irrigation, domestic, monitoring) should be included in the definition of property type in the glossary. Information in Table 3-3 Well inventory number of wells by type can be added to the property type information.

Chapter 3 @ Page 65:603

"This data is developed by DWR "to serve as a 604 basis for calculating current and projected water uses. Surveys performed prior to 2014 were developed 605 by DWR using some <u>aerial imagery with significant field verification</u>. These surveys also included 606 DWR's <u>estimate of water source</u>."

<u>Editorial Comment</u>: Again the underline indicates that the top of the letters are cut off within the document and the font either changed or went down went the changes were accepted.

<u>Content Comment</u>: Is this the Airborne Electric Magnetic Survey? If so, please provide the accuracy rate. Or this is a completely different survey. At any rate the accuracy rate needs to be provided. Please explain "significant field verification". DWR has not provided any new information since 2014 and then superimposed the 2011-2014 information into 2016 datasets without updating the information… The information should be updated from 2018 forward. This information should be in the appendix of evidence and the new information should be included in the report.

Chapter 3.3.1 Water Source Types pages 68-69

Figure 3-5 gives a map submitted by DWR with Surface and Groundwater percentages from 2011 & 2013.

Content Comment: This GSMP is going to be worthless unless this information is more current that that. 2019-2021 is necessary and the 2011-2013 can be moved to historical data and referenced as historical data in the glossary then updated in the report.

Chapter 3 page 71:714-715

" This table shows that more than 600 wells have been drilled, of which about **<u>475</u>** (471) are of a type that could involve extraction (i.e. domestic, production, or public supply). It is unknown how many wells are actively used, as some portion of them are likely abandoned. Abandoned wells no longer in use should be formally destroyed by state well standards. The 2015/2017 inventory of WCRs showed 6 well destructions, all on the Lassen County side of the Basin ."

Editorial Comment (475 should be changed to 471). After state well standards insert… Well Code §§ cited infra at page 86 line 919-926.

Content Comment: It is unknown how many wells are actively used. The wells should be identified by parcel number and by well type as properties sell and added to the glossary of terms. "State Well Standards" should be defined in the glossary of terms and State Well Standard code §§ infra at page 86 line 919-926 – also copy this to glossary of terms.

3.4.2 Well Density Chapter at page 70 -75 lines 705-747

Content Comment: The table at 3-3 gives the well types as Domestic, Production & Public for 2018, and Domestic, Irrigation, stock, industrial, public, monitor, test other and unknown for 2017. Definitions for each well type should be provided and added to the Glossary of Terms. Each type of well should state the well capacity. Most Domestic well capacity are ___ gallons, irrigation ____ (___gallons for __ acre feet), Stock wells : not included in any definitions capacity ___, industrial not defined __ capacity, Public not defined ____ capacity. Monitor, Test, other and unknown should state the capacity. The unknown should looked at first 27 in Lassen and 7 in Modoc.

Chapter 3.5.1.1 Well Monitoring

page 75: 758-761

All but one of the wells have depth information ranging from 73 to 800 feet bgs (median: 270 ft bgs, mean: 335 ft bgs)11. Figure 3-9 shows the locations of the 21 CASGEM wells and one additional well which has historic data, but measurements were discontinued in the 1990's.

Content Comment: The Irrigation District in the Tulelake Basin measures the levels CSEGEM wells and they are paid to do so. Also, you should provide the well depth, with the levels so the cost of pumping upward is feasible. When the surface water depletes well water is tapped and the levels should be provided so the, the cost can be estimated when needed (knowing when the threshold of below 150 feet may be critical. The property type should list the number of monitoring wells each: Community, Industrial, Agricultural, State Wildlife Habitat, Managed Recharge, Native and Rural Domestic referenced Id @ Chapter 3 pages 570-571.

Chapter 3 page 76:771-773

"Water quality is regulated and monitored under a myriad of programs. Table 3-4 describes the programs 772 relevant to Big Valley. …."

Editorial Comment: Table 3-4 **infra at page 79** to be inserted.

Chapter 3 Figure 3-10 @ page 78:792 Water Quality Monitoring (Gama Well Monitoring with historical water quality data)

Content Comment: What is historical water quality and where is the data?

Surface Water Monitoring

Page 80:819-820

“Stream gauges are shown on Figure 3-11.”

Editorial Comment: Stream gauges are shown on Figure 3-11 infra @ page 82.

Climate Monitoring 3.5.13

Page:line 81:831-832

“Annual precipitation at the Bieber station is shown for 1985 to 1995 in Table 3-6.”

Editorial Comment: “…. In Table 3-6 infra @ page 84.”

Page 81:836

“Table 3-7 provides a summary of average monthly rainfall, temperature, an…”

Editorial Comment: “Table 3-7 infra @ page 84, provides a summary of average monthly rainfall, temperature and…”

Page 81:837-838

“Figure 3-12 shows annual rainfall for 1984 838 through 2018. The locations of all climate monitoring stations are shown on Figure 3-11.”

Editorial Comment: “Figure 3-12 infra @ page 83 …… shown on Figure 3-11 infra at page 82.”

Modoc County General Plan 3.7.1

Page 88:971

“ The Water Resources section advocates the “wise and prudent”….

Editorial and Content Comment: The Water Resource Section _____ advocates the “wise and prudent management of groundwater resources to support a sustainable economy as well as maintaining 976 adequate supplies for domestic wells for rural subdivisions.”” Code § Missing

Chapter 3 page 89:1014-1015

“The Lassen County GP land use map from 1999 is shown in Figure 3-13 shows intensive agriculture as the…”

“The Lassen Count GP land use map from 1999 is shown in Figure 3-13 infra at pg. 90….”

Chapter 3

Page 90:1018-1033

“ Groundwater is addressed in several elements, including agriculture, land use, and natural resources. The GP identified the BVGB as a ‘major ground water basin’ due to the operation of wells at over 100 gallons per minute. Moreover, the GP expressed concern about water transfers and their impact on local water needs and environmental impacts due to water marketeers pumping groundwater from the BVGB into the Pit River and selling it to downstream water districts or municipalities or using groundwater to augment summer flow through the Delta. The GP recognized that safe yield is dependent on recharge and that overdraft pumping would increase operating costs due to a greater pumping lift and could result in subsidence and water quality degradation. In addition, the GP referred to 1980s legislation that authorized the formation of water districts in Lassen County to manage and regulate the use of groundwater resources and to the 1959 Lassen-Modoc County Flood Control and Water Conservation District, as discussed above. The SGMA process established the requirements for a GSP in the BVGB and creation of the two GSAs.

The land use element identified several issues related to groundwater, including public services where 62 percent of rural, unincorporated housing units relied on individual (domestic) wells for their water. Another issue included open space and the managed production of resources, which includes areas for recharge of groundwater among others. The GP referred to the 1972 Open Space Plan, which required"

Editorial Comment: This above paragraph needs to be reinserted or retyped into the document. The lines are cutting off and the font size and/or type needs to be checked.

Comments through page 90 Chapter 3 both editorial and content dsp.

Letter 3

November 28, 2021

Lassen and Modoc County Groundwater Sustainability Agencies (GSAs)

Submitted via web:
https://bigvalleygsp.org/comment/new;jsessionid=5F3A0C5993B56E3B5F68A22E8CD4ECF3

Re: Public Comment Letter for Big Valley Draft GSP

Dear Tiffany Martinez,

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

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

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

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

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

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

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

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

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

Best Regards,

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

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

Samantha Arthur
Working Lands Program Director
Audubon California

Danielle V. Dolan
Water Program Director
Local Government Commission

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

Melissa M. Rohde
Groundwater Scientist
The Nature Conservancy

Attachment A

Specific Comments on the Big Valley Draft Groundwater Sustainability Plan

1. Consideration of Beneficial Uses and Users in GSP development

Consideration of beneficial uses and users in GSP development is contingent upon adequate identification and engagement of the appropriate stakeholders. The (A) identification, (B) engagement, and (C) consideration of disadvantaged communities, drinking water users, tribes,[1] groundwater dependent ecosystems, streams, wetlands, and freshwater species are essential for ensuring the GSP integrates existing state policies on the Human Right to Water and the Public Trust Doctrine.

A. Identification of Key Beneficial Uses and Users

Disadvantaged Communities, Drinking Water Users, and Tribes

The identification of Disadvantaged Communities (DACs), drinking water users, and tribes is **insufficient**. The GSP maps tribal areas on Figure 3-2 (Jurisdictional Areas), with Lookout Rancheria and Tribal Trust Land included on the map. However, we note the following deficiencies with the identification of these key beneficial users.

- While the plan identifies Modoc County and Lassen County as DACs, it fails to provide a map identifying the locations of each DAC by census block groups, tracts, or places. The plan also fails to clearly state the population of each DAC or include the population dependent on groundwater as their source of drinking water in the basin.

- The GSP provides a density map of domestic wells in the basin (Figure 3-7). However, the plan fails to provide depth of these wells (such as minimum well depth, average well depth, or depth range). This information is necessary to understand the distribution of shallow and vulnerable drinking water wells within the basin.

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

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

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

Interconnected Surface Waters

The identification of Interconnected Surface Waters (ISWs) is **insufficient**, due to lack of supporting information provided for the ISW analysis. To assess ISWs, the GSP assumes streams to be interconnected where the depth to water is less than 15 feet below ground surface, based on spring 2015 contours. However, it is common practice to utilize deeper thresholds, such as 50 feet below groundwater surface, to indicate a disconnected stream reach[2,3]. Furthermore, using seasonal groundwater elevation data over multiple water year types is an essential component of identifying ISWs. Using depth-to-groundwater contours from one point in time is not sufficient evidence to state that reaches are not connected to groundwater. In California's Mediterranean climate, groundwater interconnections with surface water can vary seasonally and interannually, and that natural variability needs to be considered when identifying ISWs.

RECOMMENDATIONS

- Use a deeper screening depth, such as 50 feet, to determine which stream reaches in the basin are potentially interconnected with groundwater.
- Use seasonal data over multiple water year types to capture the variability in environmental conditions inherent in California's climate, when mapping ISWs. We recommend the 10-year pre-SGMA baseline period of 2005 to 2015.
- Provide depth-to-groundwater contour maps using the best practices presented in Attachment D, to aid in the determination of ISWs. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a digital elevation model (DEM) to estimate depth-to-groundwater contours across the landscape. This will provide accurate contours of depth-to-groundwater along streams and other land surface depressions where GDEs are commonly found.
- On the map of stream reaches in the basin (Figure 5-18), consider any segments with data gaps as potential ISWs and clearly mark them as such. Reconcile ISW data gaps with specific measures (shallow monitoring wells, stream gauges, and nested/clustered wells) along surface water features in the Monitoring Network section of the GSP.

Groundwater Dependent Ecosystems

The identification of Groundwater Dependent Ecosystems (GDEs) is **insufficient**. The GSP took initial steps to identify and map GDEs using the Natural Communities Commonly Associated with Groundwater dataset (NC dataset). However, insufficient groundwater data was used to characterize groundwater conditions in the basin's GDEs. The GSP uses depth-to-groundwater data from fall 2015 to characterize areas where the depth to groundwater was less than 15 feet to identify potential GDEs. We recommend using groundwater data from multiple seasons and water year types to determine the range of depth to groundwater around NC dataset polygons. Using seasonal groundwater elevation data over multiple water year types is an essential component of identifying GDEs and is necessary to capture the variability in groundwater conditions inherent in California's Mediterranean climate.

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[2] Jasechko, S. et al. 2021. Widespread potential loss of streamflow into underlying aquifers across the USA. Nature, 591: 391-395. doi: https://doi.org/10.1038/s41586-021-03311-x

[3] The Nature Conservancy. 2021. ICONS Tool. Available at: https://icons.codefornature.org/

The GSP does not provide an inventory of the flora or fauna species present in the basin's GDEs, except to present the common plant species and their rooting depths. Furthermore, the GSP does not acknowledge endangered, threatened, or special status species in the basin.

RECOMMENDATIONS

- Use depth-to-groundwater data from multiple seasons and water year types (e.g., wet, dry, average, drought) to determine the range of depth to groundwater around NC dataset polygons. We recommend that a baseline period (10 years from 2005 to 2015) be established to characterize groundwater conditions over multiple water year types. Refer to Attachment D of this letter for best practices for using local groundwater data to verify whether polygons in the NC Dataset are supported by groundwater in an aquifer.

- Provide depth-to-groundwater contour maps, noting the best practices presented in Attachment D. Specifically, ensure that the first step is contouring groundwater elevations, and then subtracting this layer from land surface elevations from a DEM to estimate depth-to-groundwater contours across the landscape. Map the location of groundwater wells on the contour maps to illustrate monitoring locations in relation to GDEs.

- If insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons as "Potential GDEs" in the GSP until data gaps are reconciled in the monitoring network.

- Include an inventory of the fauna and flora present within the basin's GDEs (see Attachment C of this letter for a list of freshwater species located in the Big Valley Basin). Note any threatened or endangered species.

Native Vegetation and Managed Wetlands

Native vegetation and managed wetlands are water use sectors that are required to be included in the water budget.[4,5] The integration of native vegetation into the water budget is **insufficient**. The water budget did not include the current, historical, and projected demands of native vegetation. The omission of explicit water demands for native vegetation is problematic because key environmental uses of groundwater are not being accounted for as water supply decisions are made using this budget, nor will they likely be considered in project and management actions. Managed wetlands are not mentioned in the GSP, so it is not known whether or not they are present in the basin.

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

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

RECOMMENDATIONS
● Quantify and present all water use sector demands in the historical, current, and projected water budgets with individual line items for each water use sector, including native vegetation. ● State whether or not there are managed wetlands in the basin. If there are, ensure that their groundwater demands are included as separate line items in the historical, current, and projected water budgets.

B. Engaging Stakeholders

Stakeholder Engagement During GSP Development
Stakeholder engagement during GSP development is **insufficient**. SGMA's requirement for public notice and engagement of stakeholders is not fully met by the description in the Notice and Communication chapter.[6]

The GSP documents targeted outreach to tribes, including inviting the Pit River Tribe to be a member of the Big Valley Advisory Committee. However, we note the following deficiencies with the overall stakeholder engagement process:

- The GSP documents opportunities for public involvement and engagement in very general terms for listed stakeholders. Public outreach and engagement activities include updates to the GSP website and communication portal, community flyers, notices in the local newspaper, social media updates, brochures, and the formation of the Big Valley Advisory Committee. The GSP does not state whether DACs and environmental stakeholders are represented on the Big Valley Advisory Committee.

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

- The GSP states the MOU establishing the Big Valley Advisory Committee will expire after the adoption of the GSP. As such, communication and engagement will (p. 11-8) "*shift to the GSA Boards who will continue to inform the public about Plan progress and status of projects and management actions.*" Communication and engagement during implementation will include meetings of County Boards of Supervisors and updates provided to the interested parties list. The GSP does not include a detailed plan for continual opportunities for engagement during GSP implementation that is specifically directed to DACs, domestic well owners, tribes, and environmental stakeholders within the basin.

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

RECOMMENDATIONS

- In the Notice and Communication chapter, describe active and targeted outreach to engage all stakeholders throughout the GSP development and implementation phases. Refer to Attachment B for specific recommendations on how to actively engage stakeholders during all phases of the GSP process. While some of these resources have already been stated in the GSP, we recommend that the GSAs should improve utilization of these resources and documentation of the engagement process.

- Provide documentation on how stakeholder input was incorporated into the GSP development process.

- Utilize DWR's tribal engagement guidance to comprehensively identify, involve, and address all tribes and tribal interests that may be present in the basin.[7]

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

The consideration of beneficial uses and users when establishing sustainable management criteria (SMC) is **insufficient**. The consideration of potential impacts on all beneficial users of groundwater in the basin are required when defining undesirable results and establishing minimum thresholds.[8,9,10]

Disadvantaged Communities and Drinking Water Users

For chronic lowering of groundwater levels, measurable objectives are set at the Fall 2015 water level, or at the lowest water level measured for wells that don't have a Fall 2015 measurement. Minimum thresholds are set at 140 feet below the measurable objective. While acknowledging that lowering of water levels throughout the Basin to the minimum threshold could result in a significant percentage of wells going dry, the GSP does not quantify the number of domestic wells that could go dry or otherwise consider or analyze the impact of minimum thresholds on domestic wells. The GSP does not sufficiently describe whether minimum thresholds will avoid significant and unreasonable loss of drinking water to domestic well users that are not protected by the minimum threshold. In addition, the GSP does not sufficiently describe or analyze direct or indirect impacts on DACs, drinking water users, or tribes when defining undesirable results, nor does it describe how the groundwater level minimum thresholds are consistent with the Human Right to Water policy.[11]

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

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

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

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

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

The GSP states that the undesirable result criterion for the groundwater level sustainability indicator occurs when the groundwater level in one-third of the representative monitoring wells drop below their minimum threshold for five consecutive years. Using this definition of undesirable results for groundwater levels, significant and unreasonable impacts to beneficial users experienced during dry years or periods of drought will not result in an undesirable result. This is problematic since the GSP is failing to manage the basin in such a way that strives to minimize significant adverse impacts to beneficial users, which are often felt greatest in below-average, dry, and drought years. Furthermore, the requirement that one-third of monitoring wells exceed the minimum threshold before triggering an undesirable result means that areas with high concentrations of domestic wells may experience impacts significantly greater than the established minimum threshold because the one-third threshold isn't triggered.

The GSP does not establish SMC for groundwater quality. The GSP states (p. 7-10): *"Due to the existence of excellent water quality in the Basin, significant amount of existing water quality monitoring, generally low impact land uses, and a robust effort to conduct conservation efforts by agricultural and domestic users, per §354.26(d), SMCs were not established for water quality because Undesirable Results are not present and not likely to occur."* However, the GSP states (p. 7-9): *"After a review of the best available data on water quality in the Basin, it was concluded that all the constituents which were elevated above suitable thresholds are naturally occurring. There has been no identifiable increase in the level of concentrations over time, and several constituents have indications of improvement in recent decades compared to concentrations in the 1950s and 1960s."* All COCs in the basin that may be impacted or exacerbated by groundwater use and/or management should have established SMC, in addition to coordinating with water quality regulatory programs.

RECOMMENDATIONS

Chronic Lowering of Groundwater Levels

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when describing undesirable results and defining minimum thresholds for chronic lowering of groundwater levels. Include information on the impacts during prolonged periods of below average water years.

- Consider and evaluate the impacts of selected minimum thresholds and measurable objectives on drinking water users, DACs, and tribes within the basin. Further describe the impact of passing the minimum threshold for these users. For example, provide the number of domestic wells that would be fully or partially de-watered at the minimum threshold.

- Consider minimum threshold exceedances during drought years when defining the groundwater level undesirable result across the basin.

Degraded Water Quality

- Establish water quality SMC. Set minimum thresholds and measurable objectives for all water quality constituents within the basin that can be impacted and/or exacerbated as a result of groundwater use or groundwater management.

- Describe direct and indirect impacts on drinking water users, DACs, and tribes when defining undesirable results for degraded water quality.[12] For specific guidance on how to consider these users, refer to "Guide to Protecting Water Quality Under the Sustainable Groundwater Management Act."[13]

- Evaluate the cumulative or indirect impacts of proposed minimum thresholds for degraded water quality on drinking water users, DACs, and tribes.

Groundwater Dependent Ecosystems and Interconnected Surface Waters

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

The GSP does not establish SMC for depletion of interconnected surface water. The GSP acknowledges data gaps for interconnected surface water and states (p. 7-11): *"At the five-year update, SMCs will be considered only if the trends indicate that undesirable results are likely to occur in the subsequent 5 years."* The GSP continues (p. 7-11): *"While Chapter 5 – Groundwater Conditions details the streams in Big Valley which may be interconnected by a "…continuous saturated zone to the underlying aquifer and the overlying surface water…" (DWR 2016c), there is currently no evidence to support interconnected surface water. Therefore, there is a lack of evidence for interconnection of streams."* However, the absence of evidence is not evidence of absence. The GSP should establish interim SMC for the depletion of interconnected surface water condition indicator until more data is gathered. The GSP should discuss how the interim SMC will affect beneficial users, and more specifically GDEs, and the impact of these minimum thresholds on GDEs in the basin. The GSP should evaluate how the proposed minimum thresholds and measurable objectives will avoid significant and unreasonable effects on surface water beneficial users in the basin (see Attachment C for a list of environmental users in the basin), such as increased mortality and inability to perform key life processes (e.g., reproduction, migration).

RECOMMENDATIONS

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

- When defining undesirable results for chronic lowering of groundwater levels, provide specifics on what biological responses (e.g., extent of habitat, growth, recruitment rates) would best characterize a significant and unreasonable impact to GDEs. Undesirable results to environmental users occur when 'significant and unreasonable'

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

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

effects on beneficial users are caused by one of the sustainability indicators (i.e., chronic lowering of groundwater levels, degraded water quality, or depletion of interconnected surface water). Thus, potential impacts on environmental beneficial uses and users need to be considered when defining undesirable results in the basin.[14] Defining undesirable results is the crucial first step before the minimum thresholds can be determined.[15]

- When defining undesirable results for depletion of interconnected surface water, include a description of potential impacts on instream habitats within ISWs when minimum thresholds in the basin are reached.[16] The GSP should confirm that minimum thresholds for ISWs avoid adverse impacts on environmental beneficial users of interconnected surface waters as these environmental users could be left unprotected by the GSP. These recommendations apply especially to environmental beneficial users that are already protected under pre-existing state or federal law.[8,17]

2. Climate Change

The SGMA statute identifies climate change as a significant threat to groundwater resources and one that must be examined and incorporated in the GSPs. The GSP Regulations require integration of climate change into the projected water budget to ensure that projects and management actions sufficiently account for the range of potential climate futures.[18] The effects of climate change will intensify the impacts of water stress on GDEs, making available shallow groundwater resources especially critical to their survival. Condon *et al.* (2020) shows that GDEs are more likely to succumb to water stress and rely more on groundwater during times of drought.[19] When shallow groundwater is unavailable, riparian forests can die off and key life processes (e.g., migration and spawning) for aquatic organisms, such as steelhead, can be impeded.

The integration of climate change into the projected water budget is **insufficient**. The GSP incorporates climate change into the projected water budget using DWR change factors. However, the plan does not clearly indicate which DWR change factors (2030, 2070, or both) were incorporated into the projected water budget. In addition, the GSP does not indicate whether multiple climate scenarios (e.g., the 2070 extremely wet and extremely dry climate scenarios) were considered in the projected water budget. The GSP would benefit from clearly and transparently incorporating the extremely wet and dry scenarios

[14] "The description of undesirable results shall include [...] potential effects on the beneficial uses and users of groundwater, on land uses and property interests, and other potential effects that may occur or are occurring from undesirable results". [23 CCR §354.26(b)(3)]
[15] The description of minimum thresholds shall include [...] how minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests." [23 CCR §354.28(b)(4)]
[16] "The minimum threshold for depletions of interconnected surface water shall be the rate or volume of surface water depletions caused by groundwater use that has adverse impacts on beneficial uses of the surface water and may lead to undesirable results." [23 CCR §354.28(c)(6)]
[17] Rohde MM, Seapy B, Rogers R, Castañeda X, editors. 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California. Available at: https://groundwaterresourcehub.org/public/uploads/pdfs/Critical_Species_LookBook_91819.pdf
[18] "Each Plan shall rely on the best available information and best available science to quantify the water budget for the basin in order to provide an understanding of historical and projected hydrology, water demand, water supply, land use, population, climate change, sea level rise, groundwater and surface water interaction, and subsurface groundwater flow." [23 CCR §354.18(e)]
[19] Condon et al. 2020. Evapotranspiration depletes groundwater under warming over the contiguous United States. Nature Communications. Available at: https://www.nature.com/articles/s41467-020-14688-0

provided by DWR into projected water budgets or select more appropriate extreme scenarios for the basin. While these extreme scenarios may have a lower likelihood of occurring, their consequences could be significant and their inclusion can help identify important vulnerabilities in the basin's approach to groundwater management.

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

RECOMMENDATIONS

- Clearly indicate which of the DWR change factors (2030, 2070, or both) were incorporated into the projected water budget.
- Integrate climate change, including extreme climate scenarios, into all elements of the projected water budget to form the basis for development of sustainable management criteria and projects and management actions
- Calculate sustainable yield based on the projected water budget with climate change incorporated.
- Incorporate climate change scenarios into projects and management actions.

3. Data Gaps

The consideration of beneficial users when establishing monitoring networks is **insufficient**, due to lack of specific plans to increase the Representative Monitoring Wells (RMWs) in the monitoring network that represent water quality conditions and shallow groundwater elevations around DACs, domestic wells, tribes, GDEs, and ISWs in the subbasin. These beneficial users may remain unprotected by the GSP without adequate monitoring and identification of data gaps in the shallow aquifer. The Plan therefore fails to meet SGMA's requirements for the monitoring network.[20]

Figure 8-1 (Water Level Monitoring Networks) shows insufficient representation of GDEs, DACs, drinking water users, and tribes for shallow groundwater elevation monitoring. Refer to Attachment E for maps of these monitoring sites in relation to key beneficial users of groundwater.

The GSP has not established SMC or a monitoring network for water quality. As stated above in the SMC section of this letter, concentrations of COCs in the basin may be impacted or exacerbated by groundwater use and/or management, and therefore must be monitored. The GSAs should conduct and report water quality monitoring in coordination with the other water quality regulatory programs discussed in the GSP.

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

As stated in Section 8.2.1.3 of the GSP, a representative monitoring network for ISW has not been established in the basin. Section 9.2.3 acknowledges that (p. 9-13) *"monitoring could aid in the analysis of the relationship between groundwater levels and GDEs."* However, the GSP fails to provide specific plans for establishing a monitoring network to adequately assess the presence of GDEs and ISWs, and to monitor the impact of SMC on these ecosystems.

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

4. Addressing Beneficial Users in Projects and Management Actions

The consideration of beneficial users when developing projects and management actions is **insufficient**, due to the failure to completely identify benefits or impacts of identified projects and management actions, including water quality impacts, to key beneficial users of groundwater such as GDEs, aquatic habitats, surface water users, DACs, tribes, and drinking water users. Therefore, potential project and management actions may not protect these beneficial users. Groundwater sustainability under SGMA is defined not just by sustainable yield, but by the avoidance of undesirable results for *all* beneficial users.

We commend the GSAs for including projects and management actions with explicit environmental benefits, such as Agriculture Managed Aquifer Recharge (Section 9.1.1.) and Forest Health / Conifer and Juniper Thinning (Section 9.4.1). However, the GSP fails to describe this or other projects' explicit benefits or impacts to beneficial users such as DACs and tribes.

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

RECOMMENDATIONS

- For DACs and domestic well owners, include a drinking water well impact mitigation program to proactively monitor and protect drinking water wells through GSP implementation. Refer to Attachment B for specific recommendations on how to implement a drinking water well mitigation program.

- For DACs and domestic well owners, include a discussion of whether potential impacts to water quality from projects and management actions could occur and how the GSAs plan to mitigate such impacts.

- Recharge ponds, reservoirs, and facilities for managed aquifer recharge can be designed as multiple-benefit projects to include elements that act functionally as wetlands and provide a benefit for wildlife and aquatic species. For guidance on how to integrate multi-benefit recharge projects into your GSP, refer to the "Multi-Benefit Recharge Project Methodology Guidance Document."[21]

- Develop management actions that incorporate climate and water delivery uncertainties to address future water demand and prevent future undesirable results.

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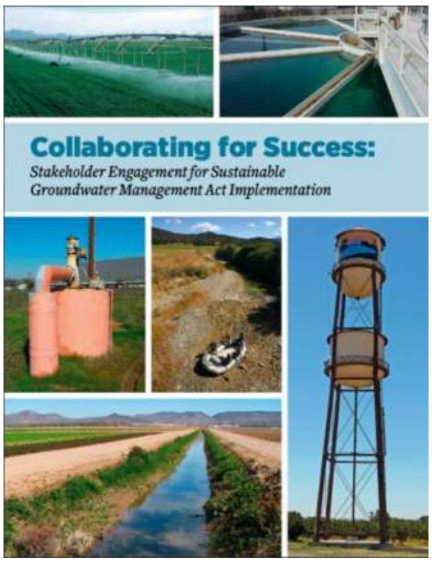
[21] The Nature Conservancy. 2021. Multi-Benefit Recharge Project Methodology for Inclusion in Groundwater Sustainability Plans. Sacramento. Available at: https://groundwaterresourcehub.org/sgma-tools/multi-benefit-recharge-project-methodology-guidance/

Attachment B

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

Stakeholder Engagement and Outreach



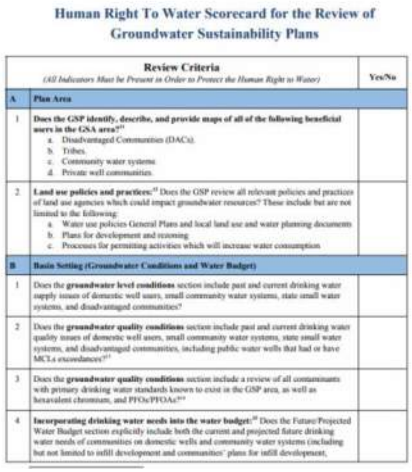
Clean Water Action, Community Water Center and Union of Concerned Scientists developed a guidance document called Collaborating for success: Stakeholder engagement for Sustainable Groundwater Management Act Implementation. It provides details on how to conduct targeted and broad outreach and engagement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

- Developing a robust Stakeholder Communication and Engagement plan that includes outreach at frequented locations (schools, farmers markets, religious settings, events) across the plan area to increase the involvement and participation of disadvantaged communities, drinking water users and the environmental stakeholders.

- Providing translation services during meetings and technical assistance to enable easy participation for non-English speaking stakeholders.

- GSP should adequately describe the process for requesting input from beneficial users and provide details on how input is incorporated into the GSP.

The Human Right to Water

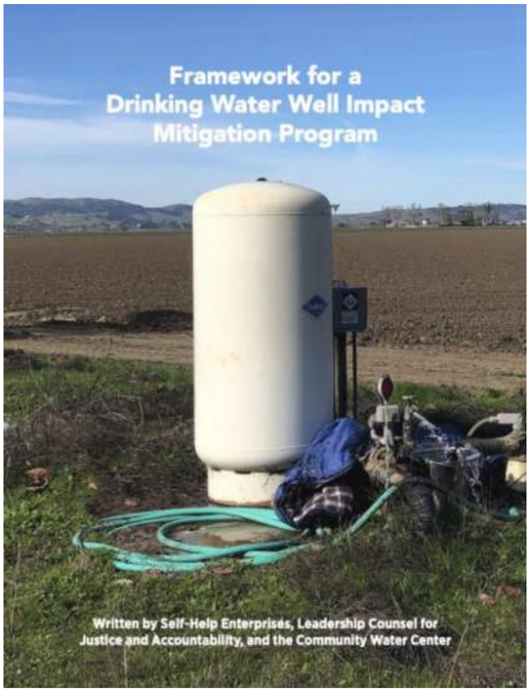


Human Right To Water Scorecard for the Review of Groundwater Sustainability Plans

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

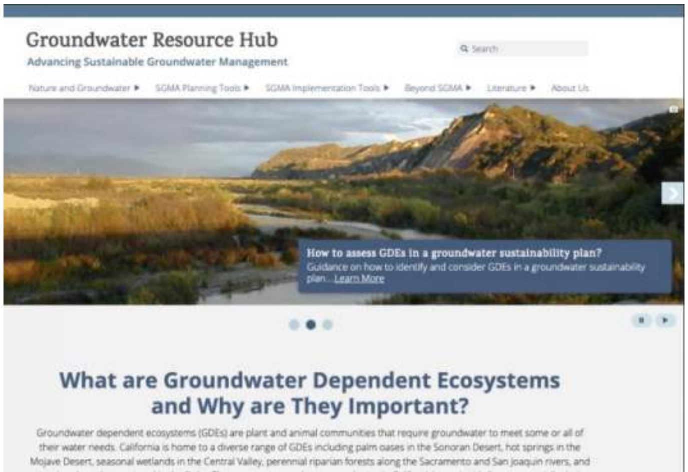
The Human Right to Water Scorecard was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid Groundwater Sustainability Agencies (GSAs) in prioritizing drinking water needs in SGMA. The scorecard identifies elements that must exist in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

Drinking Water Well Impact Mitigation Framework



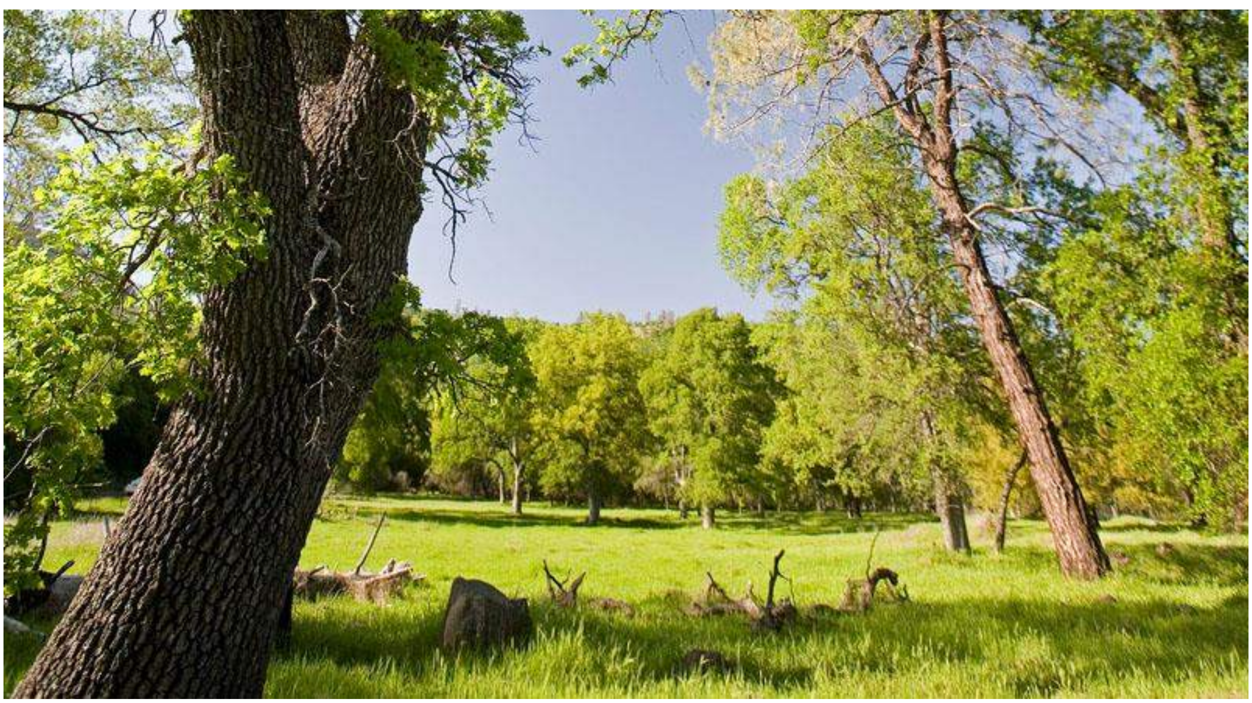
The Drinking Water Well Impact Mitigation Framework was developed by Community Water Center, Leadership Counsel for Justice and Accountability and Self Help Enterprises to aid GSAs in the development and implementation of their GSPs. The framework provides a clear roadmap for how a GSA can best structure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

Groundwater Resource Hub



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

Rooting Depth Database



The Plant Rooting Depth Database provides information that can help assess whether groundwater-dependent vegetation are accessing groundwater. Actual rooting depths will depend on the plant species and site-specific conditions, such as soil type and availability of other water sources. Site-specific knowledge of depth to groundwater combined with rooting depths will help provide an understanding of the potential groundwater levels are needed to sustain GDEs.

How to use the database

The maximum rooting depth information in the Plant Rooting Depth Database is useful when verifying whether vegetation in the Natural Communities Commonly Associated with Groundwater (NC Dataset) are connected to groundwater. A 30 ft depth-to-groundwater threshold, which is based on averaged global rooting depth data for phreatophytes[1], is relevant for most plants identified in the NC Dataset since most plants have a max rooting depth of less than 30 feet. However, it is important to note that deeper thresholds are necessary for other plants that have reported maximum root depths that exceed the averaged 30 feet threshold, such as valley oak (*Quercus lobata*), Euphrates poplar (*Populus euphratica*), salt cedar (*Tamarix spp.*), and shadescale (*Atriplex confertifolia*). The Nature Conservancy advises that the reported max rooting depth for these deeper-rooted plants be used. For example, a depth-to groundwater threshold of 80 feet should be used instead of the 30 ft threshold, when verifying whether valley oak polygons from the NC Dataset are connected to groundwater. It is important to re-emphasize that actual rooting depth data are limited and will depend on the plant species and site-specific conditions such as soil and aquifer types, and availability to other water sources.

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

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

How the database was compiled

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

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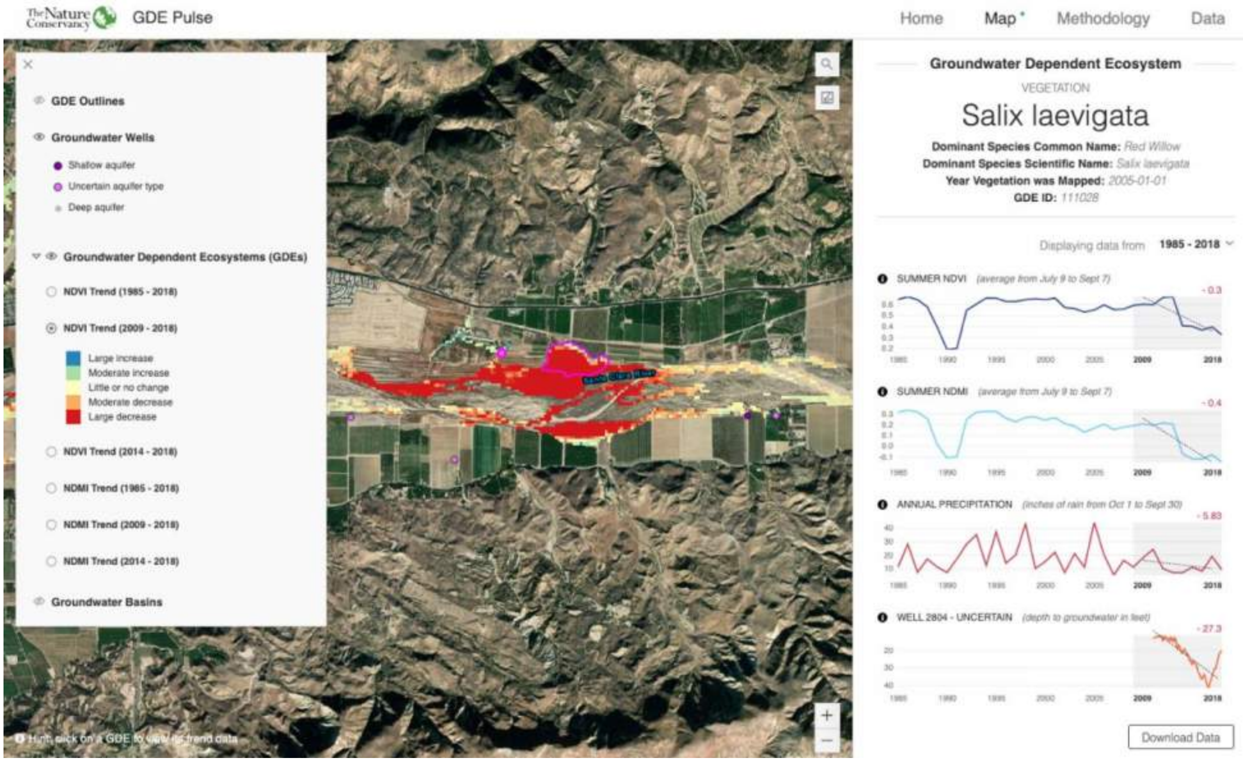
[1] Canadell, J., Jackson, R.B., Ehleringer, J.B. et al. 1996. Maximum rooting depth of vegetation types at the global scale. Oecologia 108, 583–595. https://doi.org/10.1007/BF00329030

GDE Pulse



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

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

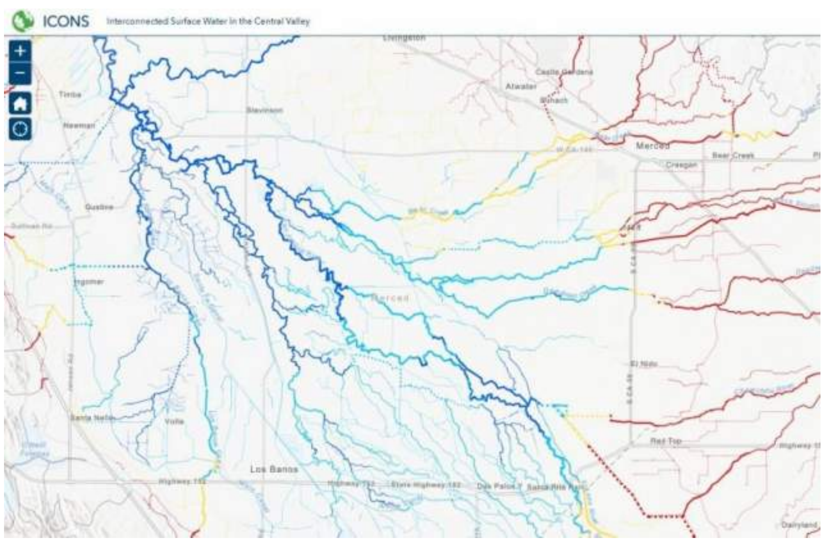
Normalized Difference Moisture Index (NDMI) is a satellite-derived index that represents water content in vegetation. NDMI is derived from the Near-Infrared (NIR) and Short-Wave Infrared (SWIR) channels. Vegetation with adequate access to water tends to have higher NDMI, while vegetation that is water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

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

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

ICONOS Mapper

Interconnected Surface Water in the Central Valley



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

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

Attachment C

Freshwater Species Located in the Big Valley Basin

To assist in identifying the beneficial users of surface water necessary to assess the undesirable result "depletion of interconnected surface waters", Attachment C provides a list of freshwater species located in the Big Valley Basin. To produce the freshwater species list, we used ArcGIS to select features within the California Freshwater Species Database version 2.0.9 within the basin boundary. This database contains information on ~4,000 vertebrates, macroinvertebrates and vascular plants that depend on fresh water for at least one stage of their life cycle. The methods used to compile the California Freshwater Species Database can be found in Howard et al. 2015[1]. The spatial database contains locality observations and/or distribution information from ~400 data sources. The database is housed in the California Department of Fish and Wildlife's BIOS[2] as well as on The Nature Conservancy's science website[3].

Scientific Name	Common Name	Legal Protected Status		
		Federal	**State**	**Other**
BIRDS				
Agelaius tricolor	Tricolored Blackbird	Bird of Conservation Concern	Special Concern	BSSC - First priority
Grus canadensis tabida	Greater Sandhill Crane		Threatened	
Actitis macularius	Spotted Sandpiper			
Aechmophorus clarkii	Clark's Grebe			
Aechmophorus occidentalis	Western Grebe			
Aix sponsa	Wood Duck			
Anas acuta	Northern Pintail			
Anas americana	American Wigeon			
Anas clypeata	Northern Shoveler			
Anas crecca	Green-winged Teal			
Anas cyanoptera	Cinnamon Teal			
Anas 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 americana	Redhead		Special Concern	BSSC - Third priority

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

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

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

Aythya collaris	Ring-necked Duck			
Aythya marila	Greater Scaup			
Aythya valisineria	Canvasback		Special	
Botaurus lentiginosus	American Bittern			
Bucephala albeola	Bufflehead			
Bucephala clangula	Common Goldeneye			
Butorides virescens	Green Heron			
Calidris alpina	Dunlin			
Calidris mauri	Western Sandpiper			
Calidris minutilla	Least Sandpiper			
Chen caerulescens	Snow Goose			
Chen rossii	Ross's Goose			
Chlidonias niger	Black Tern		Special Concern	BSSC - Second priority
Chroicocephalus philadelphia	Bonaparte's Gull			
Cistothorus palustris palustris	Marsh Wren			
Cygnus columbianus	Tundra Swan			
Egretta thula	Snowy Egret			
Fulica americana	American Coot			
Gallinago delicata	Wilson's Snipe			
Gallinula chloropus	Common Moorhen			
Grus canadensis	Sandhill Crane			
Haliaeetus leucocephalus	Bald Eagle	Bird of Conservation Concern	Endangered	
Himantopus mexicanus	Black-necked Stilt			
Limnodromus scolopaceus	Long-billed Dowitcher			
Lophodytes cucullatus	Hooded Merganser			
Megaceryle alcyon	Belted Kingfisher			
Mergus merganser	Common Merganser			
Numenius americanus	Long-billed Curlew			
Nycticorax nycticorax	Black-crowned Night-Heron			
Oxyura jamaicensis	Ruddy Duck			
Pelecanus erythrorhynchos	American White Pelican		Special Concern	BSSC - First priority
Phalacrocorax auritus	Double-crested Cormorant			

Phalaropus tricolor	Wilson's Phalarope			
Plegadis chihi	White-faced Ibis		Watch list	
Podiceps nigricollis	Eared Grebe			
Podilymbus podiceps	Pied-billed Grebe			
Porzana carolina	Sora			
Rallus limicola	Virginia Rail			
Recurvirostra americana	American Avocet			
Setophaga petechia	Yellow Warbler			BSSC - Second priority
Tachycineta bicolor	Tree Swallow			
Tringa melanoleuca	Greater Yellowlegs			
Tringa semipalmata	Willet			
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		Special Concern	BSSC - Third priority
CRUSTACEANS				
Calasellus californicus	An Isopod		Special	
Cambaridae fam.	Cambaridae fam.			
Cyprididae fam.	Cyprididae fam.			
Hyalella azteca	An Amphipod			
Hyalella spp.	Hyalella spp.			
HERPS				
Actinemys marmorata marmorata	Western Pond Turtle		Special Concern	ARSSC
Anaxyrus boreas boreas	Boreal Toad			
Dicamptodon ensatus	California Giant Salamander			ARSSC
Dicamptodon tenebrosus	Pacific Giant Salamander			
Lithobates pipiens	Northern Leopard Frog		Special Concern	ARSSC
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
Taricha granulosa	Rough-skinned Newt			
Taricha rivularis	Red-bellied Newt			ARSSC
Taricha torosa	Coast Range Newt		Special Concern	ARSSC
Thamnophis couchii	Sierra Gartersnake			
Thamnophis sirtalis sirtalis	Common Gartersnake			

Pseudacris regilla	Northern Pacific Chorus Frog			
Thamnophis elegans elegans	Mountain Gartersnake			Not on any status lists
INSECTS & OTHER INVERTS				
Dubiraphia brunnescens	Brownish Dubiraphian Riffle Beetle		Special	
Ablabesmyia spp.	Ablabesmyia spp.			
Acentrella spp.	Acentrella spp.			
Aeshnidae fam.	Aeshnidae fam.			
Ambrysus mormon				Not on any status lists
Ampumixis dispar				Not on any status lists
Anopheles spp.	Anopheles spp.			
Baetidae fam.	Baetidae fam.			
Baetis adonis	A Mayfly			
Baetis spp.	Baetis spp.			
Berosus spp.	Berosus spp.			
Brachycentrus occidentalis				Not on any status lists
Brachycentrus spp.	Brachycentrus spp.			
Caenis spp.	Caenis spp.			
Callibaetis spp.	Callibaetis spp.			
Cenocorixa wileyae				Not on any status lists
Centroptilum spp.	Centroptilum spp.			
Cheumatopsyche spp.	Cheumatopsyche spp.			
Chironomidae fam.	Chironomidae fam.			
Chironomus spp.	Chironomus spp.			
Chloroperlidae fam.	Chloroperlidae fam.			
Coenagrionidae fam.	Coenagrionidae fam.			
Corisella spp.	Corisella spp.			
Corixidae fam.	Corixidae fam.			
Cricotopus spp.	Cricotopus spp.			
Diphetor hageni	Hagen's Small Minnow Mayfly			
Dubiraphia spp.	Dubiraphia spp.			
Dytiscidae fam.	Dytiscidae fam.			
Enallagma spp.	Enallagma spp.			
Epeorus spp.	Epeorus spp.			
Ephemerella spp.	Ephemerella spp.			
Ephydridae fam.	Ephydridae fam.			
Fallceon quilleri	A Mayfly			

Glossosoma alascense	A Caddisfly			
Glossosoma spp.	Glossosoma spp.			
Goera archaon	A Caddisfly			
Haliplus spp.	Haliplus spp.			
Heptagenia spp.	Heptagenia spp.			
Heptageniidae fam.	Heptageniidae fam.			
Hesperocorixa laevigata				Not on any status lists
Hesperocorixa spp.	Hesperocorixa spp.			
Hesperoperla pacifica	Golden Stone			
Hetaerina americana	American Rubyspot			
Hexagenia limbata	A Mayfly			
Hydropsyche alternans				Not on any status lists
Hydropsyche spp.	Hydropsyche spp.			
Hydroptila spp.	Hydroptila spp.			
Ischnura spp.	Ischnura spp.			
Isonychia intermedia				Not on any status lists
Isonychia spp.	Isonychia spp.			
Isonychia velma	A Mayfly			
Isoperla spp.	Isoperla spp.			
Laccophilus spp.	Laccophilus spp.			
Lepidostoma spp.	Lepidostoma spp.			
Libellula nodisticta	Hoary Skimmer			
Limnophyes spp.	Limnophyes spp.			
Liodessus obscurellus				Not on any status lists
Malenka spp.	Malenka spp.			
Micropsectra spp.	Micropsectra spp.			
Mideopsis spp.	Mideopsis spp.			
Nectopsyche spp.	Nectopsyche spp.			
Neophylax spp.	Neophylax spp.			
Neotrichia spp.	Neotrichia spp.			
Nixe kennedyi	A Mayfly			
Notonecta spp.	Notonecta spp.			
Ophiogomphus spp.	Ophiogomphus spp.			
Optioservus canus	Pinnacles Optioservus Riffle Beetle		Special	
Optioservus quadrimaculatus				Not on any status lists
Optioservus spp.	Optioservus spp.			
Ordobrevia nubifera				Not on any status lists

Paraleptophlebia spp.	Paraleptophlebia spp.			
Peltodytes callosus				Not on any status lists
Peltodytes spp.	Peltodytes spp.			
Petrophila spp.	Petrophila spp.			
Plathemis lydia	Common Whitetail			
Procladius spp.	Procladius spp.			
Protoptila balmorhea				Not on any status lists
Protoptila spp.	Protoptila spp.			
Psectrocladius spp.	Psectrocladius spp.			
Psephenus falli				Not on any status lists
Pseudochironomus spp.	Pseudochironomus spp.			
Pteronarcys californica	Giant Salmonfly			
Pteronarcys spp.	Pteronarcys spp.			
Rheotanytarsus spp.	Rheotanytarsus spp.			
Rhithrogena spp.	Rhithrogena spp.			
Rhyacophila spp.	Rhyacophila spp.			
Sanfilippodytes spp.	Sanfilippodytes spp.			
Serratella spp.	Serratella spp.			
Sialis spp.	Sialis spp.			
Sigara spp.	Sigara spp.			
Simulium anduzei				Not on any status lists
Simulium spp.	Simulium spp.			
Skwala americana	American Springfly			
Sperchon spp.	Sperchon spp.			
Stictotarsus spp.	Stictotarsus spp.			
Taeniopteryx nivalis	Boreal Willowfly			
Tanypus spp.	Tanypus spp.			
Tanytarsus spp.	Tanytarsus spp.			
Tricorythodes explicatus	A Mayfly			
Tricorythodes spp.	Tricorythodes spp.			
Zaitzevia parvula				Not on any status lists
Zaitzevia spp.	Zaitzevia spp.			
MAMMALS				
Castor canadensis	American Beaver			Not on any status lists
Lontra canadensis canadensis	North American River Otter			Not on any status lists
Neovison vison	American Mink			Not on any status lists

Ondatra zibethicus	Common Muskrat			Not on any status lists
MOLLUSKS				
Helisoma minus	A Freshwater Snail			E
Anodonta californiensis	California Floater		Special	
Ferrissia spp.	Ferrissia spp.			
Fluminicola turbiniformis	Turban Pebblesnail			V
Gonidea angulata	Western Ridged Mussel		Special	
Gyraulus spp.	Gyraulus spp.			
Hydrobiidae fam.	Hydrobiidae fam.			
Lanx klamathensis	Scale Lanx		Special	E
Lymnaea spp.	Lymnaea spp.			
Lymnaeidae fam.	Lymnaeidae fam.			
Margaritifera falcata	Western Pearlshell		Special	
Menetus opercularis	Button Sprite			CS
Physa spp.	Physa spp.			
Pisidium spp.	Pisidium spp.			
Sphaeriidae fam.	Sphaeriidae fam.			
Sphaerium spp.	Sphaerium spp.			
Valvata spp.	Valvata spp.			
PLANTS				
Carex sheldonii	Sheldon's Sedge		Special	CRPR - 2B.2
Downingia laeta	Great Basin Downingia		Special	CRPR - 2B.2
Ranunculus macounii	Macoun's Buttercup		Special	CRPR - 2B.2
Scutellaria galericulata	Hooded Skullcap		Special	CRPR - 2B.2
Alisma triviale	Northern Water-plantain			
Alopecurus aequalis aequalis	Short-awn Foxtail			
Alopecurus carolinianus	Tufted Foxtail			
Alopecurus geniculatus geniculatus	Meadow Foxtail			
Alopecurus pratensis	NA			
Alopecurus saccatus	Pacific Foxtail			
Arundo donax	NA			
Beckmannia syzigachne	American Sloughgrass			
Bidens cernua	Nodding Beggarticks			

Callitriche heterophylla bolanderi	Large Water-starwort			
Callitriche palustris	Vernal Water-starwort			
Calochortus uniflorus	Shortstem Mariposa Lily		Special	CRPR - 4.2
Carex integra	Smooth-beak Sedge			
Carex lasiocarpa	Slender Sedge		Special	CRPR - 2B.3
Carex nebrascensis	Nebraska Sedge			
Carex pellita	Woolly Sedge			
Damasonium californicum				Not on any status lists
Downingia bacigalupii	Bacigalup's Downingia			
Downingia cuspidata	Toothed Calicoflower			
Downingia elegans	NA			
Downingia insignis	Parti-color Downingia			
Elatine californica	California Waterwort			
Elatine rubella	Southwestern Waterwort			
Eleocharis acicularis acicularis	Least Spikerush			
Eleocharis macrostachya	Creeping Spikerush			
Elodea canadensis	Broad Waterweed			
Epilobium campestre	NA			Not on any status lists
Epilobium hallianum				Not on any status lists
Eryngium alismifolium	Inland Coyote-thistle			
Eryngium aristulatum aristulatum	California Eryngo			
Eryngium articulatum	Jointed Coyote-thistle			
Eryngium mathiasiae	Mathias' Coyote-thistle			
Euthamia occidentalis	Western Fragrant Goldenrod			
Floerkea proserpinacoides	False Mermaidweed			
Glyceria borealis	Small Floating Mannagrass			

Gratiola ebracteata	Bractless Hedge-hyssop			
Gratiola heterosepala	Boggs Lake Hedge-hyssop		Endangered	CRPR - 1B.2
Gratiola neglecta	Clammy Hedge-hyssop			
Juncus uncialis	Inch-high Rush			
Lemna minor	Lesser Duckweed			
Lemna minuta	Least Duckweed			
Limosella acaulis	Southern Mudwort			
Limosella aquatica	Northern Mudwort			
Ludwigia palustris	Marsh Seedbox			
Marsilea vestita vestita	NA			Not on any status lists
Mimulus latidens	Broad-tooth Monkeyflower			
Myosurus apetalus	Bristly Mousetail			
Myosurus minimus	NA			
Navarretia heterandra	Tehama Navarretia			
Navarretia intertexta	Needleleaf Navarretia			
Navarretia leucocephala minima	Least Navarretia			
Perideridia oregana	Oregon Yampah			
Persicaria amphibia				Not on any status lists
Persicaria lapathifolia				Not on any status lists
Persicaria maculosa	NA			Not on any status lists
Phacelia distans	NA			
Phalaris arundinacea	Reed Canarygrass			
Phyla nodiflora	Common Frog-fruit			
Pilularia americana	NA			
Plagiobothrys leptocladus	Alkali Popcorn-flower			
Pogogyne douglasii	NA			
Porterella carnosula	Western Porterella			
Potamogeton foliosus foliosus	Leafy Pondweed			
Potamogeton pusillus pusillus	Slender Pondweed			
Psilocarphus brevissimus brevissimus	Dwarf Woolly-heads			

Psilocarphus oregonus	Oregon Woolly-heads			
Ranunculus aquatilis aquatilis	White Water Buttercup			
Ranunculus aquatilis diffusus				Not on any status lists
Rorippa curvipes	Rocky Mountain Yellowcress			
Rumex salicifolius salicifolius	Willow Dock			
Rumex triangulivalvis				Not on any status lists
Sagittaria cuneata	Wapatum Arrowhead			
Sagittaria latifolia latifolia	Broadleaf Arrowhead			
Salix exigua exigua	Narrowleaf Willow			
Salix exigua hindsiana				Not on any status lists
Salix gooddingii	Gooding's Willow			
Salix laevigata	Polished Willow			
Salix lasiandra lasiandra				Not on any status lists
Salix lutea	Yellow Willow			
Schoenoplectus acutus occidentalis	Hardstem Bulrush			
Scirpus microcarpus	Small-fruit Bulrush			
Senecio hydrophiloides	Sweet Marsh Ragwort		Special	CRPR - 4.2
Senecio hydrophilus	Great Swamp Ragwort			
Sidalcea oregana oregana	Oregon Checker-mallow			
Spirodela polyrhiza	NA			
Stuckenia pectinata				Not on any status lists
Symphyotrichum frondosum	Alkali Aster			
Typha latifolia	Broadleaf Cattail			
Veronica anagallis-aquatica	NA			
Veronica catenata	NA			Not on any status lists

Attachment D

The Nature Conservancy

July 2019

IDENTIFYING GDEs UNDER SGMA

Best Practices for using the NC Dataset

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

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

[1] NC Dataset Online Viewer: https://gis.water.ca.gov/app/NCDatasetViewer/

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

The NC Dataset identifies vegetation and wetland features that are good indicators of a GDE. The dataset is comprised of 48 publicly available state and federal datasets that map vegetation, wetlands, springs, and seeps commonly associated with groundwater in California[3]. It was developed through a collaboration between DWR, the Department of Fish and Wildlife, and The Nature Conservancy (TNC). TNC has also provided detailed guidance on identifying GDEs from the NC dataset[4] on the Groundwater Resource Hub[5], a website dedicated to GDEs.

BEST PRACTICE #1. Establishing a Connection to Groundwater

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

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

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

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

[5] The Groundwater Resource Hub: www.GroundwaterResourceHub.org

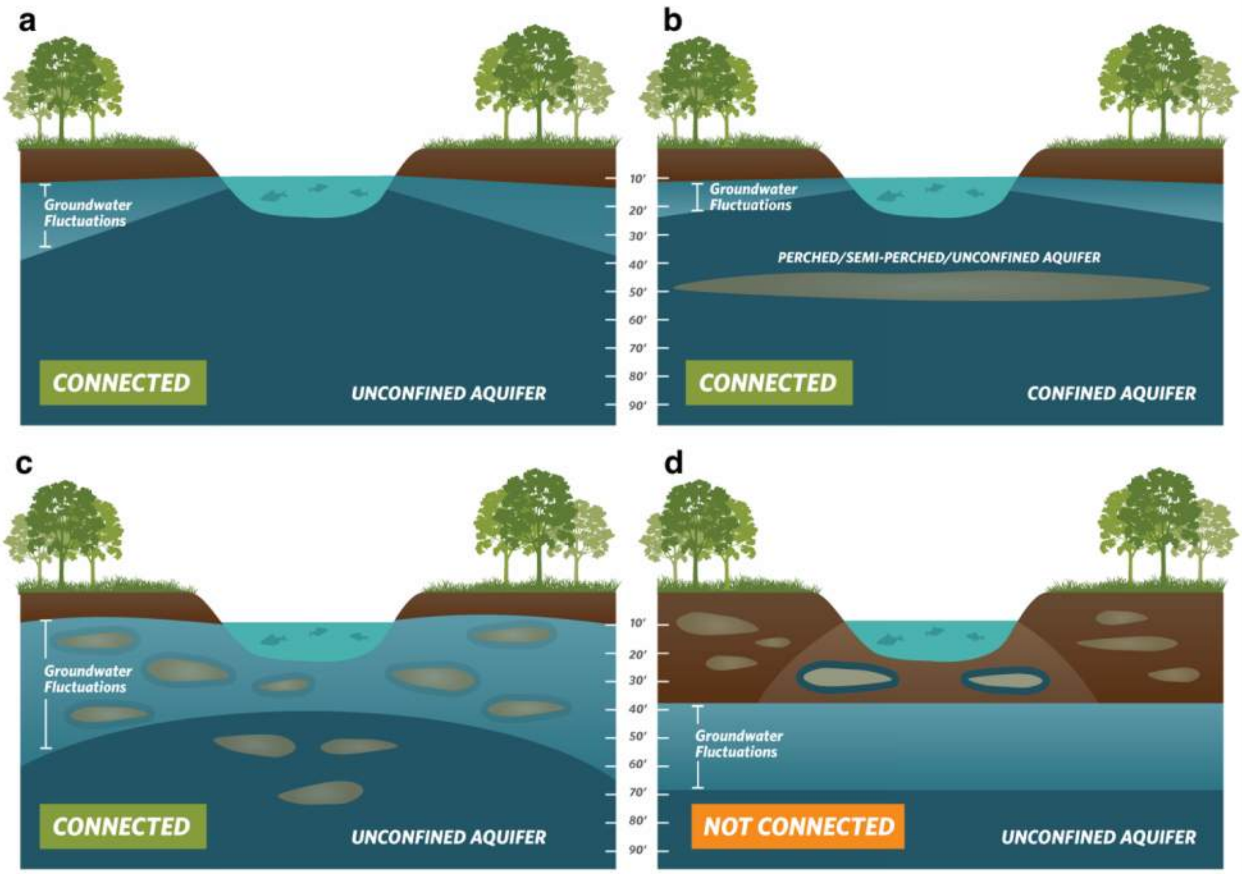

Figure 2. Confirming whether an ecosystem is connected to groundwater. Top: (a) Under the ecosystem is an unconfined aquifer with depth-to-groundwater fluctuating seasonally and interannually within 30 feet from land surface. **(b)** Depth-to-groundwater in the shallow aquifer is connected to overlying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

BEST PRACTICE #2. Characterize Seasonal and Interannual Groundwater Conditions

SGMA requires GSAs to describe current and historical groundwater conditions when identifying GDEs [23 CCR §354.16(g)]. Relying solely on the SGMA benchmark date (January 1, 2015) or any other single point in time to characterize groundwater conditions (e.g., depth-to-groundwater) is inadequate because managing groundwater conditions with data from one time point fails to capture the seasonal and interannual variability typical of California's climate. DWR's Best Management Practices document on water budgets[6] recommends using 10 years of water supply and water budget information to describe how historical conditions have impacted the operation of the basin within sustainable yield, implying that a baseline[7] could be determined based on data between 2005 and 2015. Using this or a similar time period, depending on data availability, is recommended for determining the depth-to-groundwater.

GDEs depend on groundwater levels being close enough to the land surface to interconnect with surface water systems or plant rooting networks. The most practical approach[8] for a GSA to assess whether polygons in the NC dataset are connected to groundwater is to rely on groundwater elevation data. As detailed in TNC's GDE guidance document[4], one of the key factors to consider when mapping GDEs is to contour depth-to-groundwater in the aquifer that is supporting the ecosystem (see Best Practice #5).

Groundwater levels fluctuate over time and space due to California's Mediterranean climate (dry summers and wet winters), climate change (flood and drought years), and subsurface heterogeneity in the subsurface (Figure 3). Many of California's GDEs have adapted to dealing with intermittent periods of water stress, however if these groundwater conditions are prolonged, adverse impacts to GDEs can result. While depth-to-groundwater levels within 30 feet[4] of the land surface are generally accepted as being a proxy for confirming that polygons in the NC dataset are supported by groundwater, it is highly advised that fluctuations in the groundwater regime be characterized to understand the seasonal and interannual groundwater variability in GDEs. Utilizing groundwater data from one point in time can misrepresent groundwater levels required by GDEs, and inadvertently result in adverse impacts to the GDEs. Time series data on groundwater elevations and depths are available on the SGMA Data Viewer[9]. However, if insufficient data are available to describe groundwater conditions within or near polygons from the NC dataset, include those polygons in the GSP until data gaps are reconciled in the monitoring network (see Best Practice #6).

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

[6] DWR. 2016. Water Budget Best Management Practice. Available at: https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/BMP_Water_Budget_Final_2016-12-23.pdf

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

[8] Groundwater reliance can also be confirmed via stable isotope analysis and geophysical surveys. For more information see The GDE Assessment Toolbox (Appendix IV, GDE Guidance Document for GSPs[4]).

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

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

GDEs are plants and animals that rely on groundwater for all or some of its water needs, and thus can be supported by multiple water sources. The presence of non-groundwater sources (e.g., surface water, soil moisture in the vadose zone, applied water, treated wastewater effluent, urban stormwater, irrigated return flow) within and around a GDE does not preclude the possibility that it is supported by groundwater, too. SGMA defines GDEs as "ecological communities and species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface" [23 CCR §351(m)]. Hence, depth-to-groundwater data should be used to identify whether NC polygons are supported by groundwater and should be considered GDEs. In addition, SGMA requires that significant and undesirable adverse impacts to beneficial users of surface water be avoided. Beneficial users of surface water include environmental users such as plants or animals[10], which therefore must be considered when developing minimum thresholds for depletions of interconnected surface water.

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

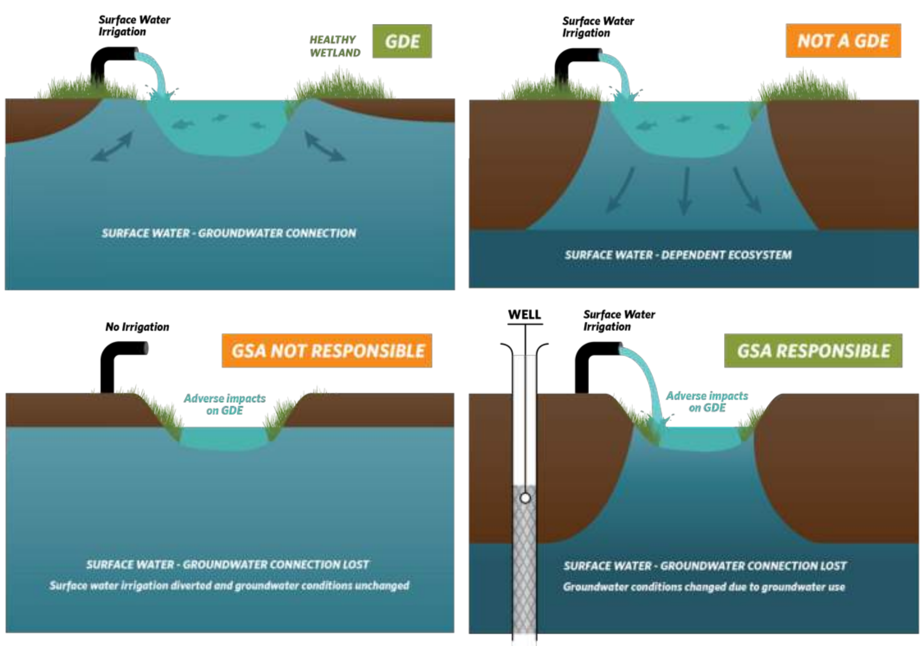

Figure 4. Ecosystems often depend on multiple sources of water. Top: (Left) Surface water and groundwater are interconnected, meaning that the GDE is supported by both groundwater and surface water. **(Right)** Ecosystems that are only reliant on non-groundwater sources are not groundwater-dependent.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

---

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

BEST PRACTICE #4. Select Representative Groundwater Wells

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

- Choose wells that are within 5 kilometers (3.1 miles) of each NC Dataset polygons because they are more likely to reflect the local conditions relevant to the ecosystem. If there are no wells within 5km of the center of a NC dataset polygon, then there is insufficient information to remove the polygon based on groundwater depth. Instead, it should be retained as a potential GDE until there are sufficient data to determine whether or not the NC Dataset polygon is supported by groundwater.

- Choose wells that are screened within the surficial unconfined aquifer and capable of measuring the true water table.

- Avoid relying on wells that have insufficient information on the screened well depth interval for excluding GDEs because they could be providing data on the wrong aquifer. This type of well data should not be used to remove any NC polygons.

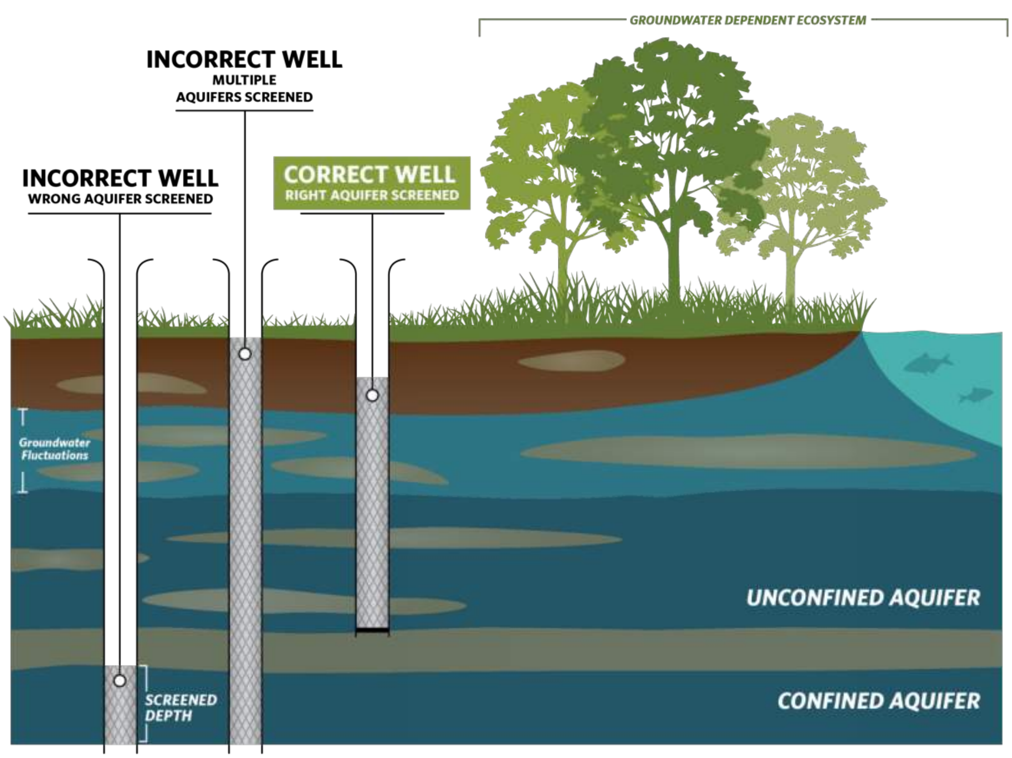

Figure 5. Selecting representative wells to characterize groundwater conditions near GDEs.

BEST PRACTICE #5. Contouring Groundwater Elevations

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

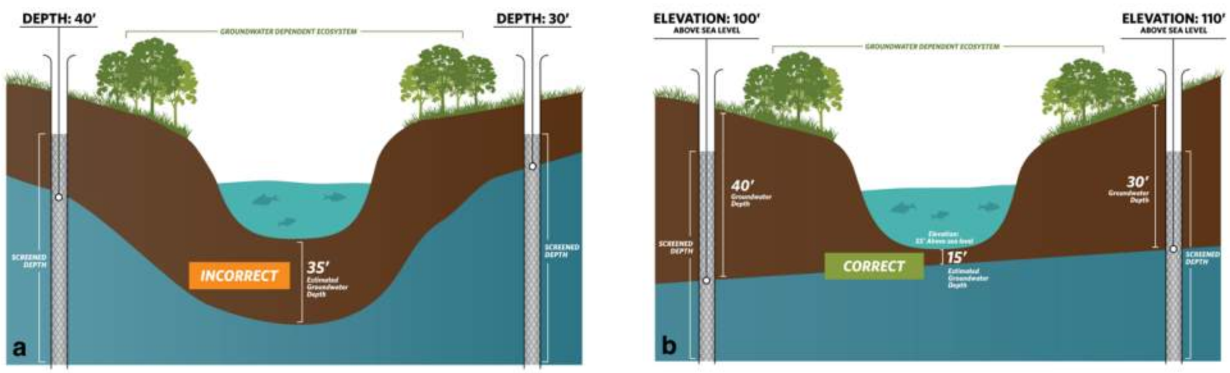

Figure 6. Contouring depth-to-groundwater around surface water features and GDEs. (a) Groundwater level interpolation using depth-to-groundwater data from monitoring wells. **(b)** Groundwater level interpolation using groundwater elevation data from monitoring wells and DEM data.

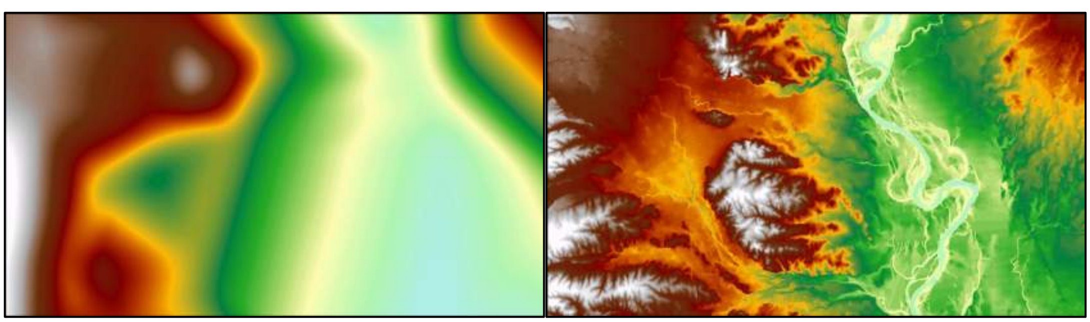

Figure 7. Depth-to-groundwater contours in Northern California. (Left) Contours were interpolated using depth-to-groundwater measurements determined at each well. **(Right)** Contours were determined by interpolating groundwater elevation measurements at each well and superimposing ground surface elevation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

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

BEST PRACTICE #6. Best Available Science

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

KEY DEFINITIONS

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

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

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

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

ABOUT US

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

Attachment E

Maps of representative monitoring sites in relation to key beneficial users

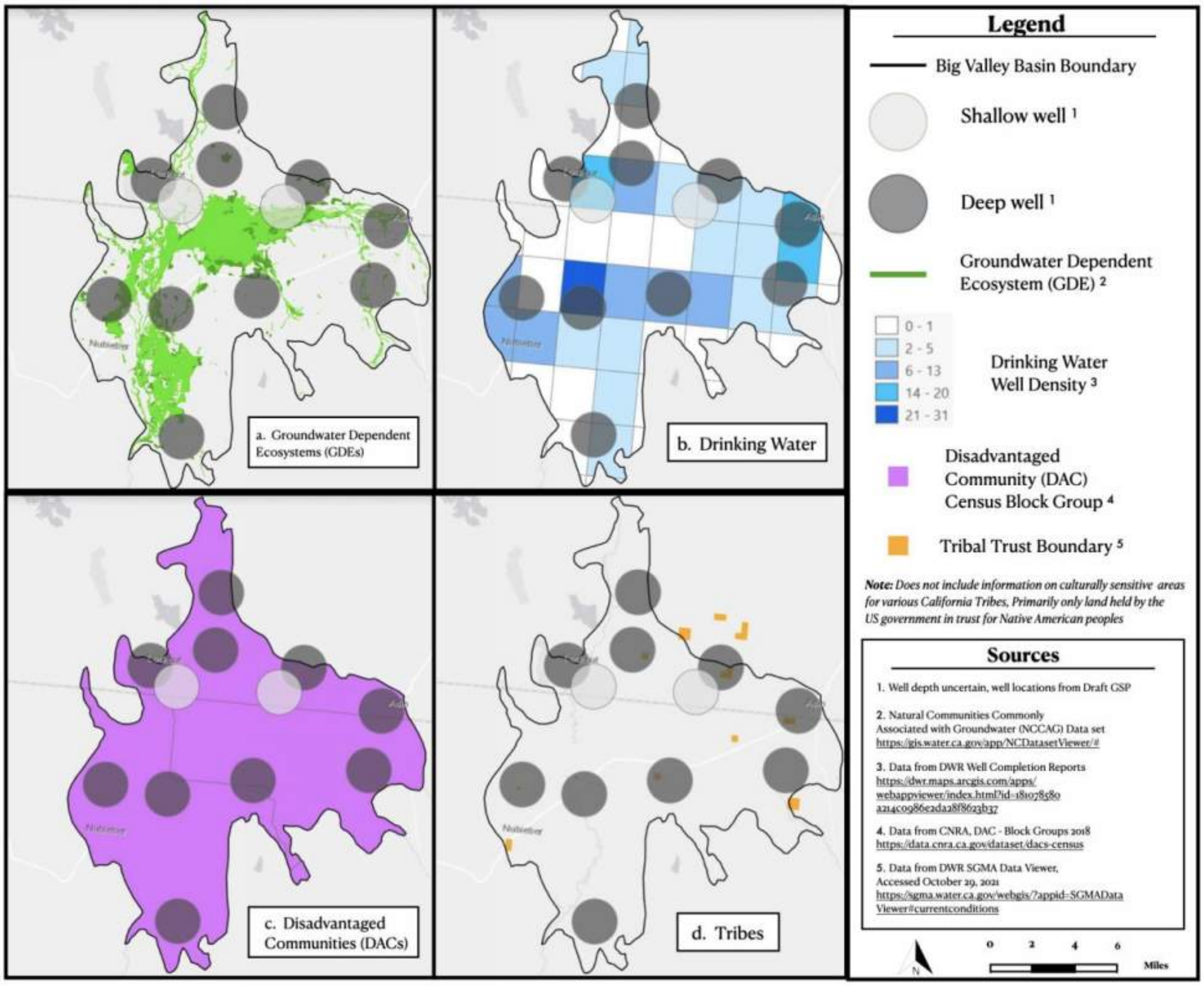


Figure 1. Groundwater elevation representative monitoring sites in relation to key beneficial users: a) Groundwater Dependent Ecosystems (GDEs), b) Drinking Water users, c) Disadvantaged Communities (DACs), and d) Tribes.

Letter 4

Nancy McAllister

From: Land Use
Sent: Thursday, October 7, 2021 2:05 PM
To: The Nature Conservancy
Cc: Gaylon Norwood; Tiffany Martinez (tiffanymartinez@co.modoc.ca.us); Nancy McAllister
Subject: RE: Big Valley GSP Public comment period

Hi Paige,

As mentioned, **the draft GSP is currently open for comment** (see "Documents Open for Comment" at https://bigvalleygsp.org/) and it is anticipated that the end date for comment submittals will be determined at least 30 days in advance of the given date. A notice will be sent to our interested parties list once this end date has been established. As always, early comment submittals are greatly appreciated.

Thank you,

Land Use
Planning and Building Services
707 Nevada St. Suite 5
Susanville CA 96130
Phone: (530) 251-8269
Fax: (530) 251-8373

From: The Nature Conservancy <tncgroundwater@gmail.com>
Sent: Tuesday, October 5, 2021 3:37 PM
To: Land Use <landuse@co.lassen.ca.us>
Cc: Gaylon Norwood <GNorwood@co.lassen.ca.us>; Tiffany Martinez (tiffanymartinez@co.modoc.ca.us) <tiffanymartinez@co.modoc.ca.us>; Nancy McAllister <nmcallister@co.lassen.ca.us>
Subject: Re: Big Valley GSP Public comment period

Hi there,

Thank you for your response and this information. Our team intends to only comment on GSPs when they have been released for final public comments due to our goal of commenting on all medium and high priority basins. Will there be a release for a final public comment period after the committee meeting on 10/6? If not, I will keep an eye out for the 30-day notice end date of comment submissions.

Take care,
Paige
Operations Coordinator

The Nature Conservancy

On Fri, Oct 1, 2021 at 4:03 PM Land Use <landuse@co.lassen.ca.us> wrote:

Hi Paige,

The Draft GSP that was presented to the Big Valley Groundwater Basin Advisory Committee (BVAC) on 9/9/21 (the version that is currently on the portal for comment - https://bigvalleygsp.org/) has been revised and the revised Draft GSP will be presented to the BVAC at their 10/6/21 meeting. This revised Draft GSP is contained in the meeting packet that was recently distributed to the BVAC members and posted for the public in the following locations:

https://bigvalleygsp.org/event/25

(under "Event Documents")

http://www.lassencounty.org/dept/planning-and-building-services/sustainable-groundwater-management-act/sgma-division

(attached at bottom of page)

As this email address is on the interested parties list, you should have received a notice regarding the 10/6/21 meeting and location of the meeting materials. Please let us know if you are not receiving notices. The BVAC has not yet made a recommendation to the Lassen and Modoc County GSAs. **The document is currently open for comment** and comments are greatly appreciated during this early revision period. The BVAC was formed and has been holding public meetings since 2/3/20 so that interested parties could participate in shaping this document by providing useful comment throughout the process. An end date for the submittal of comments has not yet been determined. It is anticipated that this end date will be determined at least 30 days in advance of the given date. Please let us know if you have any other questions.

Thank you,

Land Use

Planning and Building Services

707 Nevada St. Suite 5

Susanville CA 96130

Phone: (530) 251-8269

Fax: (530) 251-8373

From: The Nature Conservancy <tncgroundwater@gmail.com>
Sent: Friday, October 1, 2021 11:57 AM
To: Land Use <landuse@co.lassen.ca.us>
Subject: Big Valley GSP Public comment period

This message comes from an external sender. EXTERNAL SENDER WARNING!

Hello,

I wanted to reach out to see when Lassen and Modoc County intend to release the Big Valley GSP for a public comment period. I see on the Big Valley portal all chapters have been released but I was informed that after the BVAC has made a recommendation on the draft GSP, it will be presented to the GSAs and the GSAs will then initiate a comment period. Do you know when this period will be?

Thank you,

Paige Hughes

Operations Coordinator

The Nature Conservancy

Nancy McAllister

From: The Nature Conservancy <tncgroundwater@gmail.com>
Sent: Thursday, September 16, 2021 9:43 AM
To: Nancy McAllister
Cc: Gaylon Norwood; Tiffany Martinez
Subject: Re: Big Valley GSP drafts public comments deadline

This message comes from an external sender. EXTERNAL SENDER WARNING!

Thank you, Nancy! Yes, this is clear now. I will keep a lookout for when the GSAs have opened the public draft GSP for public comments.

Take care,
Paige

On Thu, Sep 16, 2021 at 9:25 AM Nancy McAllister <nmcallister@co.lassen.ca.us> wrote:

> Hi Paige,
>
> The attached schedule is only tentative and the timeline on the bottom of page 2 has not yet been reviewed or approved by the GSAs. That said, the expectation is that after the BVAC has made a recommendation on the draft GSP, it will be presented to the GSAs and the GSAs will then initiate a comment period. The exact dates for this comment period are currently unknown, but it will be set to end with enough time for comments to be considered and revisions made to the draft GSP in order for it to be approved by both GSAs prior to the January 31, 2022, deadline for submittal to DWR. The interested parties list will continue to receive updates on future meetings and developments. I hope that this information is helpful. Please let us know if you have any other questions.
>
> Thank you,
>
> **Nancy J. McAllister**
>
> Associate Planner
>
> Planning and Building Services
>
> 707 Nevada St. Suite 5
>
> Susanville CA 96130
>
> Phone: (530) 251-8269
>
> Fax: (530) 251-8373

From: The Nature Conservancy <tncgroundwater@gmail.com>
Sent: Thursday, September 16, 2021 9:05 AM
To: Nancy McAllister <nmcallister@co.lassen.ca.us>
Cc: Gaylon Norwood <GNorwood@co.lassen.ca.us>; Tiffany Martinez <tiffanymartinez@co.modoc.ca.us>
Subject: Re: Big Valley GSP drafts public comments deadline

This message comes from an external sender. EXTERNAL SENDER WARNING!

Thank you Nancy.

I was looking over the Tentative GSP schedule again, and it looks like there will be another public review starting on October 19th and ending December 3rd, could you confirm if this is still scheduled?

Paige

On Wed, Sep 15, 2021 at 4:26 PM Nancy McAllister <nmcallister@co.lassen.ca.us> wrote:

> Hi Paige,
>
> To be considered at the 10/6/21 BVAC meeting, comments must just be submitted prior to that date. If comments are submitted too late to be considered for the draft GSP revisions that will be presented at this meeting, the comments will be introduced separately during the meeting.
>
> **Nancy J. McAllister**
>
> Associate Planner

Planning and Building Services

707 Nevada St. Suite 5

Susanville CA 96130

Phone: (530) 251-8269

Fax: (530) 251-8373

From: The Nature Conservancy <tncgroundwater@gmail.com>
Sent: Wednesday, September 15, 2021 11:05 AM
To: Nancy McAllister <nmcallister@co.lassen.ca.us>
Cc: Gaylon Norwood <GNorwood@co.lassen.ca.us>; Tiffany Martinez <tiffanymartinez@co.modoc.ca.us>
Subject: Re: Big Valley GSP drafts public comments deadline

This message comes from an external sender. EXTERNAL SENDER WARNING!

Hi Nancy,

Thank you for this information. Is there an official deadline for when public comments are to be submitted?

Paige

On Wed, Sep 15, 2021 at 9:22 AM Nancy McAllister <nmcallister@co.lassen.ca.us> wrote:

Hi Paige,

The draft GSP is currently open for public comment and can be found at https://bigvalleygsp.org/ under the "Public Comments" section of the homepage. The draft GSP was introduced at the 9/9/21 Big Valley Groundwater Basin Advisory Committee (BVAC) meeting and contains the most current versions of all chapters. The goal is to revise this draft, considering all comments received in a timely manner by the BVAC and public, and bring it back to the October BVAC meeting. Again, we hope to address as many comments as possible in this revised GSP, in order for the BVAC to make a recommendation to the Groundwater Sustainability Agencies (GSAs). Please let us know if you have any other questions.

Thank you,

Nancy J. McAllister

Associate Planner

Planning and Building Services

707 Nevada St. Suite 5

Susanville CA 96130

Phone: (530) 251-8269

Fax: (530) 251-8373

From: The Nature Conservancy <tncgroundwater@gmail.com>
Sent: Wednesday, September 15, 2021 8:27 AM
To: Nancy McAllister <nmcallister@co.lassen.ca.us>

Cc: Gaylon Norwood <GNorwood@co.lassen.ca.us>; Tiffany Martinez <tiffanymartinez@co.modoc.ca.us>
Subject: Re: Big Valley GSP drafts public comments deadline

This message comes from an external sender. EXTERNAL SENDER WARNING!

Good morning Nancy,

I have been checking the Big Valley website and I see that all the chapters are available online but haven't received a notice about public comments on the complete draft. Thanks for your patience with me as I continue to check in on this, I just wanted to make sure I haven't missed anything about the public comment period. Since my team will be commenting on all medium and high priority GSPs, we haven't had the bandwidth to comment on Big Valley's chapters yet, but we intend to do a thorough review when the complete draft is open for comments.

Thank you,

Paige

On Thu, Aug 19, 2021 at 8:06 AM Nancy McAllister <nmcallister@co.lassen.ca.us> wrote:

Hi Page,

Our goal is to have the complete draft GSP ready to introduce at the September 9, 2021, meeting of the Big Valley Groundwater Basin Advisory Committee (BVAC). If we are able to meet this goal, the GSP should be available online prior to the meeting date. Public comment on the draft GSP will be accepted starting as soon as it is released to the public, and ideally the bulk of comments would be submitted at this time, before we make our first round of revisions to the complete document. We hope to address as many comments as possible in the revised draft GSP that is scheduled to be presented to the BVAC in October, in order for the BVAC to make a recommendation to the Groundwater Sustainability Agencies (GSAs). As you are on the interested parties list, you will receive email notification regarding the upcoming meeting and materials available for review. Please let us know if you have any other questions.

Thank you,

Nancy J. McAllister

Associate Planner

Planning and Building Services

707 Nevada St. Suite 5

Susanville CA 96130

Phone: (530) 251-8269

Fax: (530) 251-8373

From: The Nature Conservancy <tncgroundwater@gmail.com>
Sent: Wednesday, August 18, 2021 1:38 PM
To: Nancy McAllister <nmcallister@co.lassen.ca.us>
Subject: Re: Big Valley GSP drafts public comments deadline

Good afternoon Nancy,

I'm reaching out to confirm the public comment period for the complete draft GSP. In the tentative GSP schedule it looks like mid-October will be the starting date - is this still the case?

Thank you,
Paige Hughes

Operations Coordinator

The Nature Conservancy

On Fri, May 28, 2021 at 9:27 AM Nancy McAllister <nmcallister@co.lassen.ca.us> wrote:

Hi Paige,

Public comment will be accepted on all draft chapters of the Big Valley Groundwater Sustainability Plan (GSP) until the entire draft GSP has been completed. That said, we certainly encourage interested parties to review and comment on each "Public Draft" chapter as it is being actively reviewed by the Big Valley Groundwater Basin Advisory Committee (BVAC), so that comments can be efficiently considered prior to the BVAC "setting aside" the "Revised Draft" version. I have attached a flow chart that shows our local process for reviewing/revising GSP chapters. Once completed, a Public Draft chapter is typically included in the meeting packet for the next BVAC meeting, which is made available to the public on our websites one to two weeks ahead of said meeting (https://bigvalleygsp.org/; http://www.lassencounty.org/dept/planning-and-building-services/sustainable-groundwater-management-act-sgma). If public comment is received quickly enough, it can be considered during development of the Revised Draft chapter, which is typically introduced to the BVAC at the following meeting (these meetings have recently been occurring monthly). Once the BVAC has "set aside" a chapter, discussion of the chapter will no longer be placed on the agenda, and additional comments pertaining to that chapter will likely not be considered, until the entire draft GSP has been compiled. After the BVAC makes its recommendation to the Groundwater Sustainability Agencies (GSAs) regarding approval of the GSP, the entire Public Draft GSP will be circulated at the direction of the GSAs, prior to their final approval and subsequent submittal to the Department of Water Resources. For your reference, I have also attached the most recent version of our tentative GSP schedule, presented at the May BVAC meeting. Again, it is most helpful to receive comments early on. Please let us know if you have any other questions.

Thank you,

Nancy J. McAllister

Associate Planner

Planning and Building Services

707 Nevada St. Suite 5

Susanville CA 96130

Phone: (530) 251-8269

Fax: (530) 251-8373

From: The Nature Conservancy <tncgroundwater@gmail.com>
Sent: Thursday, May 27, 2021 9:24 AM
To: Nancy McAllister <nmcallister@co.lassen.ca.us>; tiffanymartinez@co.modoc.ca.us
Subject: Big Valley GSP drafts public comments deadline

This message comes from an external sender. EXTERNAL SENDER WARNING!

Good morning,

I see that the following Chapters are available for public comment:

Plan area

Hydrogeologic Conceptual Model

Groundwater Conditions

Water Budget

Sustainability Goal

Undesirable Results

Do you know when public comments are due for these chapters?

Thank you,

Paige Hughes

Operations Coordinator

The Nature Conservancy

GSP Development Process Chart

DEPARTMENT OF PLANNING AND BUILDING SERVICES
707 Nevada Street, Suite 5 · Susanville, CA 96130-3912
(530) 251-8269 · (530) 251-8373 (fax)
www.co.lassen.ca.us

Repeat for each chapter

ADMIN DRAFT CHAPTER

→ Review and revisions by GSA Staff

PUBLIC DRAFT CHAPTER

→ Review by BVAC and public; revisions by GSA staff

REVISED DRAFT CHAPTER

→ Review by BVAC; "set aside" by BVAC (repeat for each chapter)

DRAFT GSP (all 13 chapters with BVAC recommendation)

→ Review by GSAs (BOSs); direction to circulate

PUBLIC DRAFT GSP

→ Review by public; revisions by GSA staff

REVISED DRAFT GSP

→ Review by GSAs (BOSs); approval by GSAs

FINAL GSP

→ Submittal to DWR by January 31, 2022

Tentative GSP and Meeting Schedule
Proposed to the Big Valley Groundwater Advisory Committee (BVAC) on May 5, 2021

The intent of this document is to outline the meeting schedule of the Big Valley Groundwater Basin Advisory Committee (BVAC) in their effort to recommend a Groundwater Sustainability Plan (GSP) to the two Groundwater Sustainability Agencies (GSAs). This schedule outlines the anticipated remaining meetings for this effort (starting with the June 2, 2021, meeting). As of this date, the BVAC has "set aside" GSP Chapters One through Six. These "set aside" chapters will be considered again by the BVAC at one or more future meetings (starting with the October 6, 2021, meeting), after the entire draft GSP has been prepared. These "set aside" chapters are available on the project website: https://bigvalleygsp.org

The meeting dates and content indicated below are subject to change. Please visit the project website for the most current meeting information. In addition to the meetings listed below, a "special meeting" of the BVAC may be scheduled at any time. The agenda for any such special meeting will be published on the project website and posted in accordance with the Brown Act.

This schedule does not introduce all of the content that will be presented for any particular BVAC meeting. The intent of this document is to list, as accurately as possible, specific dates when it is anticipated that the various chapters of the GSP will be presented to the BVAC and public. Again, this schedule will be updated/confirmed as necessary.

The meeting dates provided below are followed by a "notes" section that further explain the anticipated review process and schedule. Dates presented in italics, on the second page of this document, after the dashed line, describe the steps required after BVAC involvement (i.e. after the BVAC has made a recommendation to the two GSAs).

Big Valley Groundwater Basin (BVAC) meeting dates:

May 5, 2021 – Present Revised Draft Chapters 7 (*Sustainable Management Criteria*) to set aside; Introduce Public Draft Chapter 8 (*Monitoring Networks*); Start comment period for Public Draft Chapter 8

June 2, 2021 – Discuss revisions to Chapter 8; Introduce Public Draft Chapters 9 and 10 (*Projects and Management Actions* and *Implementation Plan*); Start comment period for Public Draft Chapters 9 and 10

July 7, 2021 – Present Revised Draft Chapter 8 to set aside; Discuss revisions to Chapters 9 and 10; Introduce Public Draft Chapters 11-13 (*Notice and Communications*, *Interagency Agreements*, & *Reference List*); Start comment period for Public Draft Chapters 11-13

August 4, 2021 – Present Revised Draft Chapters 9 and 10 for BVAC to set aside; Discuss revisions to Chapters 11-13

September 1, 2021 – Present Revised Draft Chapters 11-13 for BVAC to set aside; Discuss additional revisions to all chapters previously set aside

October 6, 2021 – Present Revised Draft of Entire GSP; **BVAC vote to recommend approval of "Draft GSP" (all Revised Draft Chapters) to GSAs**

November 3, 2021 – ***special meeting if necessary***

December 1, 2021 – ***special meeting if necessary***

NOTES:

- The schedule above allows two months for each Chapter, including Chapters identified as requiring high input from stakeholders (i.e. *Sustainable Management Criteria*, *Projects and Management Actions*), to allow time for comments to be received and incorporated. This schedule references only the progression of the review of the individual Chapters of the GSP. In actuality, it is anticipated that some components of the GSP will be discussed at meetings prior to the date on which the associated Chapter is fully prepared and formally introduced. Discussion on additional information outside of the GSP chapters may also occur during the BVAC meetings. Those interested should consult the pertinent agenda.
- Meetings will be conducted at either the Adin Community Center (605 Highway 299, Adin, CA 96006) or at the Veterans Memorial Hall in Bieber (657-575 Bridge Street, Bieber, CA 96009). Please consult the appropriate agenda prior to any meeting.
- The meeting time for the above regularly scheduled meetings will be 2:00 p.m.

The GSA meeting dates proposed below are hypothetical, as they have not been approved by the GSAs. The dates are intended to present possible meeting dates, recognizing that the approved "Final GSP" must be submitted to the DWR by January 31, 2022.

October 19, 2021 – The Draft GSP will be presented to the two GSAs (Board packet to be available October 8, 2021); the two GSAs initiate a comment period for the "Public Draft GSP" and approve publication of a "Notice of Intent to Adopt the Big Valley Groundwater Basin Groundwater Sustainability Plan" no earlier than 90 days from Notice.

December 3, 2021 (45 days) – End of the comment period for the Public Draft GSP; potential Board agenda item for GSAs to discuss comments/edits; begin incorporation of comments for GSA approval of "Revised Draft GSP"

January 18, 2022 – Conduct public hearings for approval of the Final GSP by both GSAs (and direction to submit the Final GSP to the Department of Water Resources (DWR) by the ***January 31, 2022*** *deadline (public hearing)*

Letter 5

Doreen SmithPower

Alturas California 96101

10/5/2021

Big Valley Advisory Committee re: Ground Water Plan

RE: Meeting Date of October 6, 2021

Dear Committee Members:

I have summitted comments on previous chapters and Chapters 1-6 were previously approved for publication, and after that several and I mean several changes were made. I have read through all the chapters initially once.

General Comments: I commented earlier that there graphs and figures references and some are incorrectly referenced. If you simple pulled all graphs, figures, maps, & tables in other words all (referenced data) (which the legal community refers to as evidence) and put it in "Appendix of Referenced Data or Information" it would be much and I mean much easier to understand and read the text portion of the document. Also putting all referenced data in a separate document would eliminate the duplication of referenced data and would help clarify the referenced data that you have in place because all of the writers would have to refer to the same referenced data to prepare his/her or their agency segment. The TEXT of the document would simply refer to the Reference Appendix Data at page ___, and an Index of the Appendix of Referenced data would be prepared and should cross reference the page numbers in the text of the document. The committee indicated earlier that the plan would not be in print format and would only be available on line. However, the committee should make the "Appendix of Referenced Data available to all agencies and the public through a print shop and that should be published within the text of the document.

Another overall general comment: I have heard several people including committee members state that we don't fully understand "Recharge". Recharge in the document has been referred recharge areas and simply replenishing the water system.

Recharge needs to be DEFINED – replenish the water system yes—but in terms; state the objectives then the goal; and then the many outcomes –

- Into the river
- Into the wells (through plug and pull ponding – rainwater replenishing – treated before into wells) Referenced to the water quality well information data would be helpful.
- Into canals
- Into irrigation (healthy crops – into water for ranching animals)
- Into drinking water ("systems" open and closed – end uses and users to be notified of which)
- Water flows down hill and mountains generally have snow that flows down hill in creeks (some seasonal or rivers) the water is replenished naturally (mountains are terms recharge areas)
- Recharge is identified but not defined

The information thus far is valuable. I would like to see the information used as it was intended by participating agencies, and water users (yes that covers – who everybody). Thank you for your time. I will be attending the meeting via zoom.

Doreen SmithPower

Letter 6

Fairman, David

From: Tiffany Martinez <tiffanymartinez@co.modoc.ca.us>
Sent: Monday, November 29, 2021 10:15 AM
To: Fairman, David; Gaylon Norwood; Nancy McAllister; Laura Snell; David Lile; Maurice Anderson; Petersen, Christian; Aaron Albaugh
Subject: [EXT] Fwd: Comment submission glitch

EXTERNAL EMAIL

Tiffany Martinez
Clerk of the Board/Assistant County Administrative Officer
Modoc County
204 South Court Street
Alturas, CA 96101
Office: (530) 233-6201
tiffanymartinez@co.modoc.ca.us
"The capacity to learn is a gift; the ability to learn is a skill; the willingness to learn is a choice."
Brian Herbert

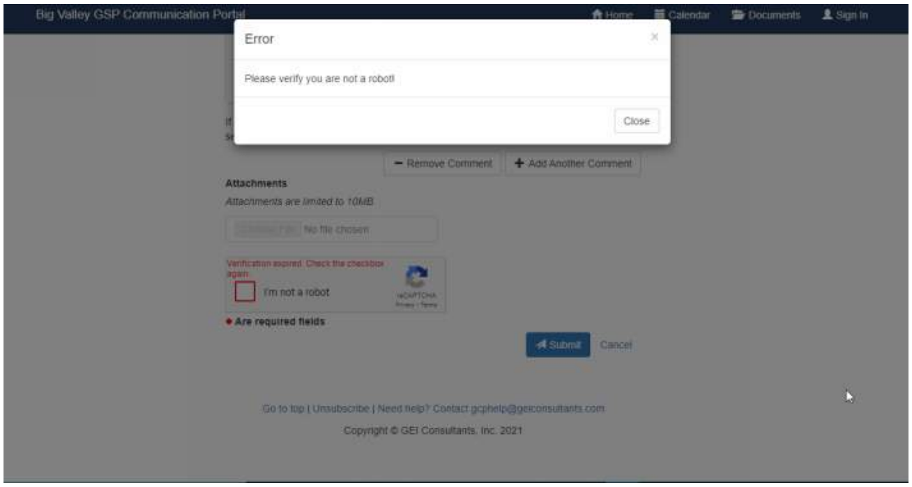
---------- Forwarded message ---------
From: **Julie Dawson-Parlee** <julie.parlee@gmail.com>
Date: Sun, Nov 28, 2021 at 10:56 PM
Subject: Comment submission glitch
To: Tiffany Martinez <tiffanymartinez@co.modoc.ca.us>, <gcphelp@geiconsultants.com>

Hi Tiffany & GEI,
I've tried multiple times now to submit my list of comments on the GSP website tonight, and I have yet to get a confirmation email, so I assume none of my attempts have been successful. When I click the "I'm not a robot" button, the first time it didn't bring up a photo collage so I clicked "Submit" and it gave me an error message that I had to click the "I'm not a robot" button again. I've gone through this process four or five times and it's the same every time. Nothing I do can convince the program I'm not a robot, apparently. Or, because I took a while putting in multiple comments, the form might have timed out before I was done. Since the comment deadline is soon, I'm copying and pasting it into this email and you guys can figure out what's wrong with the website.

Additionally, I have a fairly long list of punctuation and grammar edits if anyone is still interested. I might just scan the list I've written out and send it once I've gotten through the whole document. It might be a little cryptic, but most things are pretty clear if you reference the page and line number. There are also inconsistencies that could be addressed, like the capitalization on the Acronyms & Abbreviations section: if they're not acronyms for proper nouns, the description doesn't have to be capitalized (IM, IWFM, LNAPL, LUST, MCL, MOU, MT, MTBE, NCAG, NR, NSP --unless Nonpoint Source Program is a proper name, OS, OWTS, SB, SMC, TMDL, WAA, WDR, WY). There are spacing issues that appeared on this draft, as well, on GIS, MO, MT, and SY. I'll try to finish the list and get it to you since I've marked the binder again, but it's far less than the first round and I don't want to give up this copy. Lol! Tiffany, it's been really helpful to have these copies of the Plan--thank you again!

Thanks,

Julie Parlee
530-260-0236



First Name

Last Name

Agency/Organization

Property Address
[Property address -Only-]

City

Zip Code

Email

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With all the evidence of how inaccurate and unfair the Basin boundary is, it seems abrupt to just say that the GSAs will submit a Basin boundary modification. Perhaps it should say that the GSAs will continue to submit Basin boundary modification requests as long as DWR continues to ignore the science and updated information available. This section also needs to be specific in mentioning that the majority neighboring landholder to the Basin is the USFS, so accurate boundaries would increase the likelihood of cooperation and partnership in recharge projects.

If commenting on multiple documents or multiple sections of a document, please submit as separate comments.

Add Another Comment

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Page Number(s)

Line Number(s) 2207-2211

Of the Action Levels listed, only the first one requires five years of measurable change, but the other two only require one year of decline, which seems like an error. One dry year hardly seems justification for drastic action, but this section seems to indicate that could be the case. But, on the other hand, it's also quite vague on line 2205 to say that "...actions may be considered, at the discretion of the GSAs..." and it seems to render the thresholds inconsequential if the GSAs don't want to take action.

If commenting on multiple documents or multiple sections of a document, please submit as separate comments.

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Page Number(s)

Line Number(s) 2596-2626

RE: AgMAR -- What constitutes “excess surface water”—how is “excess” defined? Will there be expedited processes and money awarded for citizens to build safer water storage options that do not require them to endanger themselves by manually replacing boards in diversions during high water events in order to capture surface water? There needs to be discussion in this section of the report about the necessity of a dam further upstream to regulate the flow of this “excess” water in order for it to be slowed enough to be captured for future use and recharge. Currently, high water events saturate the valley and flow downstream out of Big Valley, leaving very little actual stored water. Additionally, existing water regulations require discharge of captured excess surface water after 30 days, but that limits our ability to actually use surface water toward groundwater recharge. With the unpredictable timing of winter storms, it means that water captured in March won’t be available in May, when it might actually be useful to use for irrigation, thus reducing the dependence on groundwater. Historically, the highest water events in Big Valley have happened in February and March, too early to be used when it's time to irrigate. Will new policies be considered as a result of SGMA to assist stakeholders in actually achieving recharge? However, early capture of excess surface water could lead to saturation of water storage areas and an elevated risk of flooding should another high water event occur when storage areas are already full. The unintended risks and consequences of recharge projects need to be acknowledged.

If commenting on multiple documents or multiple sections of a document, please submit as separate comments.

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Page Number(s)

Line Number(s) 2628-2638

RE: Drainage or Basin Recharge -- The same risk applies to capturing water to fill storage areas, then causing excessive flooding if a big storm hits. Legal action was taken years ago in Big Valley by a landowner whose land was damaged by a neighbor's water management that caused flooding; will there be protection for landowners participating in this kind of recharge if it has unintended consequences? What recourse will there be for neighbors affected by recharge projects gone awry?

If commenting on multiple documents or multiple sections of a document, please submit as separate comments.

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Page Number(s)

Line Number(s) 2640-2671

RE: Aquifer Storage and Recovery and Injection Wells -- Again, worth asking: WHERE WILL THE RECHARGE WATER COME FROM, WHO CONTROLS IT, WHO PAYS & HOW MUCH, AND HOW WILL STAKEHOLDERS ACCESS IT? And what could be some unintended consequences of adding chlorine to our groundwater? Would others affected by this action be able to sue if it's found to be detrimental to the overall groundwater quality?

If commenting on multiple documents or multiple sections of a document, please submit as separate comments.

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Page Number(s)

Line Number(s) 2580-2594

For every recharge method, it must be asked and answered: WHERE WILL THE RECHARGE WATER COME FROM, WHO CONTROLS IT, WHO PAYS & HOW MUCH, AND HOW WILL STAKEHOLDERS ACCESS IT? Otherwise, this document is just a theoretical fantasy (which it largely is due to the acknowledged data gaps and uncertain outcomes of everything except Allen Camp Dam).

If commenting on multiple documents or multiple sections of a document, please submit as separate comments.

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Page Number(s)

Line Number(s) 2757-2778

9.3.1 Expanding Existing Reservoirs -- Given the very small number of beneficiaries currently controlling and receiving water from the existing reservoirs in Big Valley, how could this option be used to benefit a greater number of stakeholders and effectively contribute to groundwater recharge? To refill Roberts Reservoir during high water events, the water must be pumped from the Pit. Who would incur that cost? How will this be achieved if the watermaster is already being told by DWR not to put the headgate in this year to capture what little rain we've already had, after a record dry year when there's no guarantee of more rain this season? How can we as a local community control the water needed to achieve recharge? Will additional funding be made available to encourage private water storage projects, and will permits be expedited and new policies implemented to allow for more effective water capture and storage? Without assistance and accommodations, this valley is being asked to complete these tasks with our hands tied.

If commenting on multiple documents or multiple sections of a document, please submit as separate comments.

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Line Number(s) 2783-2813

9.3.2 Allen Camp Dam: The Allen Camp Dam project is widely acknowledged to be the one action that would make the most significant difference in Big Valley's water situation and solve virtually all the problems the GSP outlines, yet it gets very little support in this document as a top priority. With the Federal Government releasing record amounts of spending on "infrastructure" right now, it seems worth adding as much support as possible for moving forward with Allen Camp. Costs and government regulations are typically cited as the reason the Dam isn't aggressively pursued, but looking realistically at the money proposed for just the studies and smaller alternative recharge projects, it seems a case could be made for putting that energy, effort, and expense into a solution that will actually fix the problem for the long term. Additionally, the economic impact study that effectively killed the Dam project in 1981 was an inadequate, incompetent, and not-in-good-faith effort, which did not really even consider any possible economic benefit beyond Big Valley. The mathematical formula used to justify abandoning the Dam plan was wholly inadequate to portray any realistic economic impact. We need to point out the multitude of benefits to the entire region that could come from a sizable lake's recreation area, wildlife habitat, downstream users, power generation, constant and controllable flow of the Pit River year-round, and potential benefit to users all the way down the state.

If commenting on multiple documents or multiple sections of a document, please submit as separate comments.

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Line Number(s) 2816-2855

9.4.1 Forest Health / Conifer and Juniper Thinning: The point needs to be made that prompt and beneficial action from the USFS and other government agencies is essential for Big Valley to be successful in reaching its recharge goals. If DWR is holding Big Valley water users to these standards of water management, then the government agencies who are our neighbors need to do their part in managing resources appropriately to help toward the same goals. Which USFS actions (or lack of action) cause recharge not to happen as effectively? What recourse do we as a community have to point out problems and expect results in order to achieve recharge?

Letter 7

March 18, 2024

Paul Gosselin
Deputy Director Sustainable Groundwater Management
California Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001

Gaylon Norwood
County of Lassen Groundwater Sustainability Agency
707 Nevada Street, Suite 5
Susanville, CA 96130

Lassen County Big Valley Advisory Committee
c/o Aaron Albaugh, Board Representative

Modoc County Big Valley Advisory Committee
c/o Geri Byrne, Board Representative

RE: Agriculture use superseding water rights of domestic well users located in the Big Valley Groundwater Basin.

Dear Sir or Madam,

I am a domestic water user located in Adin California which is within the boundary of the Big Valley Groundwater Basin. I am writing this letter in protest to misinformation presented at the Big Valley Groundwater Basin Advisory Committee (BVAC) on March 14, 2024 at the Adin Community Center.

In 2014, the California State Legislature adopted the historic Sustainable Groundwater Management Act (SGMA), which established a statewide framework to help protect groundwater resources. Groundwater is one of California's greatest natural resources, making up a significant portion of the state's water supply, and serving as a buffer against the impacts of drought and climate change. Groundwater is a major source of the state's drinking water supply and other household uses. Overreliance on groundwater has caused both domestic well and agricultural issues in many of California's groundwater basins. The Sustainable Groundwater Management Act (SGMA) was enacted to halt overdraft and bring basins into balanced levels of pumping and recharge. SGMA requires local agencies to adopt groundwater sustainability plans for high- and medium-priority groundwater basins. Under SGMA, basins must reach sustainability within 20 years of implementing their plans. The Big Valley Groundwater Basin has been identified as a "medium priority" due to historical data that showed consistent reduction in groundwater levels over the past 40 years and potential water quality issues. The local communities of Adin and Lookout (Modoc County) and Bieber (Lassen County) lie within the Big Valley Groundwater Basin.

The local Big Valley Groundwater Advisory Committees (BVGAC) were formed to represent both Modoc and Lassen counties in 2020 and have been working closely with environmental firms, agricultural and land planning use agencies, and the California State University Davis to develop a groundwater sustainability plan (GSP or Plan} to fulfill State requirements. I have no qualms regarding the quality of the environmental work that has been completed in the Basin. Geomorphology, hydrology, water sources, landscape analysis, water quality and electrical conductance measurements and the compilation of historical groundwater levels is excellent. The installation of additional monitoring wells and a local California Irrigation Management Information System (CIMIS) sensor in the valley is all excellent work. I also appreciate the efforts of the advisory board members in showing up to quarterly meetings and offering some overview suggestions to the development of the sustained groundwater plan.

The following contains a list of discrepancies regarding the Big Valley Groundwater Advisory Committees (BVAC) efforts:

(1) The BVAC has primarily defined agricultural users as the primary key constituents who use groundwater here in the Basin. I understand the importance of agricultural livelihoods and their continuation for future generations, it has been documented that irrigation utilizes thousands of acre feet of groundwater per year out of the Big Valley Basin compared to domestic wells used for drinking water. At the recent meeting held in Adin on March 14th 2024, it was clearly stated that the "majority" of constituents "agreed" that agriculture groundwater use superseded community needs for fresh drinking water. They misrepresented domestic water use fragility by stating that "0%" of local wells went dry during previous drought years. As a domestic water user for 30+ years in this basin, I personally know of households who had wells dry up or become undrinkable during recent drought years.

These advisory boards Aaron Albaugh (Lassen County Board of Supervisors District 4) and Geri Byrne (Modoc County Board of Supervisors District 5) have systematically left out the fresh water domestic well users in their discussions. There has been zero attempt over the past 4 years to have a conversation with the domestic well users of Adin, Lookout or Bieber. Not one town hall or meeting has been called to discuss how domestic water is used, the effects of drought years on our well systems, how many wells have gone dry or how many domestic users have had to deepen their wells or lower their pumps. They have made no to little attempt to quantify the number of wells in any of the communities. The "knowledge" they claim to have of our domestic well systems is nothing but bias and assumptions. They have demonstrated that community domestic well users are more than invisible … we don't matter.

Our communities have been thrown under the bus by the BVGAC with little regard for the fragile complexities that influence our domestic well functions. I am talking fresh drinking water here …California Water Code supports the protection of fresh drinking water. For context, California Water Code §106 states that "the use of water for **domestic purposes** is the highest use of water and that the next use is for **irrigation."** In addition, California Water Code §116270 states that the Legislature "finds and declares … the following: (a) Every resident of California has the right to pure and safe drinking water." The advisory board have based ALL their acceptable "minimum threshold" groundwater depth estimates based on their agricultural wells that go down hundreds of feet. Most domestic wells utilized by our communities are shallow, far above the depths accessed by the agricultural wells here in the valley. The BVAC estimate of a "safe" depth for groundwater withdrawal is based on nothing in reality, nor with the domestic water users in mind.

2) The BVAC downplay the importance of Ash Creek Wildlife Area, suggesting that it has been "unmanaged" for decades. An outright lie. And I quote "The Ash Creek Wildlife Area (ACWA) is an example of a local rancher who provided land for conservation efforts with an understanding that managed lands promote wildlife enhancement for the enjoyment of all**. The California Department of Fish and Wildlife (CDFW) "has largely left the property unmanaged. (Albaugh 2021, Conner 2021)".** Again, hearsay and assumption, demeaning the importance of this wildlife area for hundreds and thousands of migrating birds in Spring and Fall. The BVAC has sabotaged the appearance of this much respected holding of the California Department of Fish and Wildlife to NOT ADDRESS the water needs of this area in the Plan.

3) Unprofessionalism and special interests are apparent in the BVAC. In addition to the lack of engagement with other Basin water users, multiple Board members have expressed hostility and unwillingness to participate in this planning process at open public meetings. Dissention to participate has primarily been expressed by members of the Lassen County BVAC, including its chairperson. Water use discussions have been centered on irrigation use with the advisory boards keen on creating a story of how agricultural activity is the saving grace of our communities. Thus, agricultural use should be considered "first" above the clean water requirements of local communities. This perspective stands directly against the fundamental water rights of domestic well users to fresh water in this Basin, as well as California Water Code law.

The BVAC is comprised of 8 members, 85% which represent agriculture interests, 0% representing domestic water users in the basin, and 0% representing other water users including wildlife needs. This board is greatly skewed to the special interests of agriculture. A recommendation to replace or add additional members that reflect a greater diversity of other water users in the basin is warranted.

3) The BVAC has developed NO mitigation measures that apply directly to agricultural practices to offset decreasing groundwater levels in dry years. Perhaps farming practices could be reviewed including the reasoning for planting of alfalfa which is secondary to rice when it comes to water use and plant water use efficiency. The Board has developed NO mitigation measures that would assure Big Valley communities of access to fresh drinking water when groundwater drawdown affects well depth and water quality due to silt.

It is recommended that the Big Valley Groundwater Basin Advisory Committee start representing ALL the water users that utilize the groundwater of this Basin. The special interests brought forward in this Plan by this board has already been rejected as "incomplete" by the California Department of Water Resources. Why? Because they have not considered other water users and stakeholders in this Basin, nor mitigation measures that can kick into gear when falling groundwater levels (due to agricultural drafting and climate) effect our drinking water. BVAC has not represented our communities water interests in this planning process. So, what's next? I bet we are going to see yet another rejection of this Plan by the California Department of Water Resources due to this board's behavior. Welcome to the next phase, State Probation …

Barbara Donohue, Adin CA.
BSc Forestry
BSc Wildlife Biology
MSc Wetland Ecology
foxmtn@outlook.com

Appendix 11E Big Valley Advisory Committee Resolution No. BVAC-2021-1

RESOLUTION NO. BVAC-2021-1

RESOLUTION OF THE BIG VALLEY GROUNDWATER BASIN ADVISORY COMMITTEE MAKING RECOMMENDATION TO THE LASSEN AND MODOC COUNTY GROUNDWATER SUSTAINABILITY AGENCIES REGARDING A GROUNDWATER SUSTAINABILITY PLAN.

WHEREAS, in September 2014, the Governor signed into law a legislative package (three bills), collectively known as the Sustainable Groundwater Management Act (SGMA), which requires local agencies with land use and/or water management or water supply authority to do certain things to reach sustainability of medium and high priority groundwater basins as designated by the State of California Department of Water Resources (DWR). SGMA became effective on January 1, 2015; and

WHEREAS, the Big Valley Groundwater Basin (BVGB) has been erroneously designated a medium priority basin by the DWR; and

WHEREAS, the Lassen and Modoc County Board of Supervisors adopted resolutions (17-013 and 2017-09 respectively) declaring themselves to be the Groundwater Sustainability Agency (GSA) for the portion of the BVGB within their respective jurisdictions; and

WHEREAS, GSAs are required to develop Groundwater Sustainability Plans (GSP) for all medium and high priority basins, and said GSP for the BVGB is to be submitted to the DWR by January 31, 2022; and

WHEREAS, the Big Valley Groundwater Basin Advisory Committee (BVAC) was formed through a memorandum of understanding (MOU) to advise both the Lassen and Modoc County GSAs on the preparation of a GSP for the basin; and

WHEREAS, the BVAC has held approximately fifteen public meetings, devoted countless hours, and conducted multiple outreach meetings to review and propose draft text for a GSP and to receive and consider public comment from local stakeholders; and

WHEREAS, the BVAC has welcomed and encouraged public comment as early as possible during the process to have the most meaningful impact; and

WHEREAS, a revised draft GSP has been assembled with BVAC guidance.

NOW, THEREFORE, BE IT RESOLVED AS FOLLOWS:

1. The BVAC hereby recommends that the GSAs receive the Draft Groundwater Sustainability Plan, including incorporation of all edits and corrections identified at the October 20, 2021, meeting of the BVAC, including grammatical corrections or corrections approved by the chair and vice chair.

2. The BVAC hereby recommends that the GSAs (or GSA staff) initiate a 30-day public comment period for the Draft Groundwater Sustainability Plan.

3. The BVAC hereby recommends that each GSA conduct at least one public hearing jointly in the Basin to consider adoption of said Groundwater Sustainability Plan, as is required by the Sustainable Groundwater Management Act.

4. The BVAC hereby recommends that the GSAs provide direction to staff, consultants or others to make any edits or corrections the GSAs may identify and adopt and submit the final Groundwater Sustainability Plan to the Department of Water Resources by January 31, 2022.

PASSED AND ADOPTED at a regular meeting of the Big Valley Groundwater Basin Advisory Committee, on the 20th day of October 2021, by the following vote:

AYES: Committee Members Albaugh, Byrne, Conner, Mitchell, Nunn, Ohm

NOES: None.

ABSTAIN: None.

ABSENT: None.

Geri Byrne
Chairman
Big Valley Groundwater Basin Advisory Committee

ATTEST:

Maurice L. Anderson, Secretary
Big Valley Groundwater Basin Advisory Committee

Appendix 11F GSA Resolutions Adopting the GSP

RESOLUTION NO. 21-062

RESOLUTION OF THE BOARD OF SUPERVISORS, COUNTY OF LASSEN, ACTING AS THE GROUNDWATER SUSTAINABILITY AGENCY FOR ALL THOSE PORTIONS OF THE BIG VALLEY GROUNDWATER BASIN LOCATED WITHIN LASSEN COUNTY, TO ADOPT THE BIG VALLEY GROUNDWATER SUSTAINABILITY PLAN (GSP), IN COORDINATION WITH THE MODOC COUNTY GROUNDWATER SUSTAINABILITY AGENCY, AND TO DIRECT STAFF TO SUBMIT THE GSP TO THE CALIFORNIA DEPARTMENT OF WATER RESOURCES.

WHEREAS, in September of 2014, the Governor signed into law a legislative package, consisting of three bills, collectively known as the Sustainable Groundwater Management Act (SGMA), which requires local agencies with land use and/or water management or water supply authority to do certain things in order for medium and high priority groundwater basins, as designated by the State of California Department of Water Resources (DWR), to reach sustainability; and

WHEREAS, SGMA became effective on January 1, 2015; and

WHEREAS, the Big Valley 5-004 Groundwater Basin (BVGB) has been erroneously designated a medium priority basin by the DWR; and

WHEREAS, the Lassen County Board of Supervisors and the Modoc County Board of Supervisors adopted resolutions (17-013 and 2017-09 respectively) declaring themselves to be the Groundwater Sustainability Agency (GSA) for the portion of the BVGB within their respective jurisdictions; and

WHEREAS, GSAs are required to develop Groundwater Sustainability Plans (GSP) for all medium and high priority basins, and said GSP for the BVGB is to be submitted to the DWR by January 31, 2022; and

WHEREAS, The Big Valley Groundwater Basin Advisory Committee (BVAC) was formed to advise both the Lassen and Modoc County GSAs on the preparation of a GSP for the basin and held approximately fifteen public meetings to review and propose draft text for a GSP and to receive and consider public comment from local stakeholders; and

WHEREAS, A Draft GSP was assembled by staff and consultants with BVAC guidance and the BVAC adopted Resolution No. BVAC-2021-1 on October 20, 2021, recommending that the GSAs receive the Draft GSP, conduct at least one public hearing to consider adoption of said GSP, provide direction to staff to make any edits or corrections the GSAs may identify, and adopt and submit the final GSP to the DWR by January 31, 2022; and

WHEREAS, the Draft GSP was released for a 30-day public comment period, starting October 28, 2021, and ending November 28, 2021, and all comments were considered and incorporated as appropriate.

NOW, THEREFORE, BE IT RESOLVED, the Board of Supervisors, acting as the Lassen County Groundwater Sustainability Agency, hereby adopts the Big Valley Groundwater Sustainability Plan with any edits or corrections identified by the GSAs during the December 15, 2021, public hearing; and

BE IT FURTHER RESOLVED, that the Board of Supervisors of the County of Lassen directs staff to make said edits or corrections and submit the final GSP to the DWR by January 31, 2022.

PASSED AND ADOPTED at a regular meeting of the Board of Supervisors of the County of Lassen, State of California, on the 15th day of December, 2021, by the following vote:

AYES: Supervisors Albaugh, Gallagher, and Bridges.

NOES: None.

ABSTAIN: None.

ABSENT: Supervisors Hemphill, and Hammond.

Aaron Albaugh
Chairman of the Board of Supervisors
County of Lassen, State of California

Attest:
JULIE BUSTAMANTE
Clerk of the Board

By: ______________________
MICHELE YDERRAGA, Deputy Clerk of the Board

I, MICHELE YDERRAGA, Deputy Clerk of the Board of the Board of Supervisors, County of Lassen, do hereby certify that the foregoing resolution was adopted by the said Board of Supervisors at a regular meeting thereof held on the 15th day of December, 2021.

____
Deputy Clerk of the County of Lassen Board of Supervisors

BOARD OF SUPERVISORS EUREKA LASSEN COUNTY

RESOLUTION # 2021-66

A RESOLUTION OF THE BOARD OF SUPERVISORS OF THE COUNTY OF MODOC ACTING AS THE GROUNDWATER SUSTAINABILITY AGENCY, FOR ALL THOSE PORTIONS OF THE BIG VALLEY GROUNDWATER BASIN LOCATED WITHIN MODOC COUNTY, TO ADOPT THE BIG VALLEY GROUNDWATER SUSTAINABILITY PLAN IN COORDINATION WITH THE LASSEN COUNTY GROUNDWATER SUSTAINABILITY AGENCY AND DIRECT STAFF TO SUBMIT THE GSP TO THE CALIFORNIA DEPARTMENT OF WATER RESOURCES

WHEREAS, in September of 2014, the Governor signed into law a legislative package consisting of (three bills), collectively known as the Sustainable Groundwater Management Act (SGMA), which requires local agencies with land use and/or water management or water supply authority to do certain things in order for medium and high priority groundwater basins, as designated by the State of California Department of Water Resources (DWR), to reach sustainability; and

WHEREAS, SGMA became effective on January 1, 2015; and

WHEREAS, the Big Valley 5-004 Groundwater Basin (BVGB) has been designated a medium priority basin by the DWR; and

WHEREAS, the Lassen County Board of Supervisors and the Modoc County Board of Supervisors adopted resolutions (17-013 and 2017-09 respectively) declaring themselves to be the Groundwater Sustainability Agency (GSA) for the portion of the BVGB within their respective jurisdictions; and

WHEREAS, GSAs are required to develop Groundwater Sustainability Plans (GSP) for all medium and high priority basins, and said GSP for the BVGB is to be submitted to the DWR by January 31, 2022; and

WHEREAS, The Big Valley Groundwater Basin Advisory Committee (BVAC) was formed to advise both the Lassen and Modoc County GSAs on the preparation of a GSP for the basin and held approximately fifteen public meetings to review and propose draft text for a GSP and to receive and consider public comment from local stakeholders; and

WHEREAS, A Draft GSP was assembled by staff and consultants with BVAC guidance and the BVAC adopted Resolution No. BVAC-2021-1 on October 20, 2021, recommending that the GSAs receive the Draft GSP, conduct at least one public hearing to consider adoption of said GSP, provide direction to staff to make any edits or corrections the GSAs may identify, and adopt and submit the final GSP to the Department of Water Resources by January 31, 2022; and

WHEREAS, the Draft GSP was released for a 30-day public comment period, starting October 28, 2021, and ending November 28, 2021, and all comments were considered and incorporated as appropriate.

NOW, THEREFORE, BE IT RESOLVED, the Board of Supervisors, acting as the Modoc County Groundwater Sustainability Agency, hereby adopts the Big Valley Groundwater Sustainability Plan with any edits or corrections identified by and approved by the GSAs during the December 15, 2021, public hearing; and

BE IT FURTHER RESOLVED, that the Board of Supervisors of the County of Modoc directs staff to make said edits or corrections and submit the final GSP to DWR by January 31, 2022.

PASSED AND ADOPTED by the Board of Supervisors of the County of Modoc, State of California, on the 15th day of December, 2021 by the following vote:

Motion Approved:
RESULT: **APPROVED [UNANIMOUS]**
MOVER: Geri Byrne, Supervisor District V
SECONDER: Kathie Rhoads, Supervisor District III
AYES: Ned Coe, Supervisor District I, Kathie Rhoads, Supervisor District III, Elizabeth Cavasso, Supervisor District IV, Geri Byrne, Supervisor District V

BOARD OF SUPERVISORS MODOC COUNTY, CALIFORNIA

BOARD OF SUPERVISORS
OF THE COUNTY OF MODOC

Ned Coe, Chair
Modoc County Board of Supervisors

ATTEST:

Tiffany Martinez
Clerk of the Board

RESOLUTION # 2024-24

A RESOLUTION OF THE BOARD OF SUPERVISORS OF THE COUNTY OF MODOC ACTING AS THE GROUNDWATER SUSTAINABILITY AGENCY FOR ALL THOSE PORTIONS OF THE BIG VALLEY GROUNDWATER BASIN LOCATED WITHIN MODOC COUNTY, TO ADOPT THE REVISED BIG VALLEY GROUNDWATER BASIN SUSTAINABILITY PLAN (GSP), IN COORDINATION WITH THE LASSEN COUNTY GROUNDWATER SUSTAINABILITY AGENCY, AND TO DIRECT STAFF TO SUBMIT THE REVISED GSP TO THE CALIFORNIA DEPARTMENT OF WATER RESOURCES.

WHEREAS, in September of 2014, the Governor signed into law a legislative package, consisting of three bills, collectively known as the Sustainable Groundwater Management Act (SGMA), which requires local agencies with land use and/or water management or water supply authority to do certain things in order for medium and high priority groundwater basins, as designated by the State of California Department of Water Resources (DWR), to reach sustainability; and

WHEREAS, SGMA became effective on January 1, 2015; and

WHEREAS, the Big Valley 5-004 Groundwater Basin (BVGB) has been designated a medium-priority basin by the DWR; and

WHEREAS, the Modoc County Board of Supervisors and the Lassen County Board of Supervisors adopted resolutions (2017-09 and 17-013 respectively) declaring themselves to be the Groundwater Sustainability Agency (GSA) for the portion of the BVGB within their respective jurisdictions; and

WHEREAS, The Big Valley Groundwater Basin Advisory Committee (BVAC) was formed to advise both the Modoc and Lassen County GSAs on the preparation of a GSP for the basin and held approximately fifteen (15) public meetings to review and propose draft text for a GSP and to receive and consider public comment from local stakeholders; and

WHEREAS, as required by the SGMA, the GSAs submitted the Big Valley Groundwater Basin to the DWR prior to the January 31, 2022, deadline; and

WHEREAS, on October 26, 2023, the Department of Water Resources (DWR) determined that the Big Valley Groundwater Sustainability Plan is "incomplete"; and

WHEREAS, in accordance with the SGMA, the GSAs had until April 23, 2024, to submit a revised GSP, responding to the DWR's comments; and

WHEREAS, a revised GSP was assembled by staff and consultants, and, on March 14, 2024, the BVAC conducted a well-noticed public meeting to consider the proposed revised GSP. After conducting said public meeting, the BVAC then recommended that the GSA adopt said revised GSP with the edits made at said meeting.

NOW, THEREFORE, BE IT RESOLVED, the Board of Supervisors, acting as the Modoc County Groundwater Sustainability Agency, hereby adopts the revised Big Valley Groundwater Sustainability Plan (GSP) with edits and corrections identified by the GSAs during their public hearings at which the revised GSP was considered; and

BE IT FURTHER RESOLVED, that the Board of Supervisors of the County of Modoc directs staff to make said edits or corrections and submit the final revised GSP to the DWR by April 23, 2024.

PASSED AND ADOPTED by the Board of Supervisors of the County of Modoc, State of California, on the 15th day of April, 2024 by the following vote:

Motion Approved:
RESULT: **APPROVED [UNANIMOUS]**
MOVER: Geri Byrne, Supervisor District V
SECONDER: Ned Coe, Supervisor District I
AYES: Ned Coe, Supervisor District I, Shane Starr, Supervisor District II, Kathie Rhoads, Supervisor District III, Elizabeth Cavasso, Supervisor District IV, Geri Byrne, Supervisor District V

BOARD OF SUPERVISORS MODOC COUNTY, CALIFORNIA

BOARD OF SUPERVISORS
OF THE COUNTY OF MODOC

Shane Starr, Chair
Modoc County Board of Supervisors

ATTEST:

Tiffany Martinez
Clerk of the Board

RESOLUTION NO. 24-019

RESOLUTION OF THE BOARD OF SUPERVISORS, COUNTY OF LASSEN, ACTING AS THE GROUNDWATER SUSTAINABILITY AGENCY FOR ALL THOSE PORTIONS OF THE BIG VALLEY GROUNDWATER BASIN LOCATED WITHIN LASSEN COUNTY, TO ADOPT THE REVISED BIG VALLEY GROUNDWATER BASIN SUSTAINABILITY PLAN (GSP), IN COORDINATION WITH THE MODOC COUNTY GROUNDWATER SUSTAINABILITY AGENCY, AND TO DIRECT STAFF TO SUBMIT THE REVISED GSP TO THE CALIFORNIA DEPARTMENT OF WATER RESOURCES.

WHEREAS, in September of 2014, the Governor signed into law a legislative package, consisting of three bills, collectively known as the Sustainable Groundwater Management Act (SGMA), which requires local agencies with land use and/or water management or water supply authority to do certain things in order for medium and high priority groundwater basins, as designated by the State of California Department of Water Resources (DWR), to reach sustainability; and

WHEREAS, SGMA became effective on January 1, 2015; and

WHEREAS, the Big Valley 5-004 Groundwater Basin (BVGB) has been erroneously designated a medium priority basin by the DWR; and

WHEREAS, the Lassen County Board of Supervisors and the Modoc County Board of Supervisors adopted resolutions (17-013 and 2017-09 respectively) declaring themselves to be the Groundwater Sustainability Agency (GSA) for the portion of the BVGB within their respective jurisdictions; and

WHEREAS, The Big Valley Groundwater Basin Advisory Committee (BVAC) was formed to advise both the Lassen and Modoc County GSAs on the preparation of a GSP for the basin and held approximately fifteen public meetings to review and propose draft text for a GSP and to receive and consider public comment from local stakeholders; and

WHEREAS, as required by the SGMA, the GSAs submitted the Big Valley Groundwater Basin GSP to the DWR prior to the January 31, 2022, deadline; and

WHEREAS, on October 26, 2023, the Department of Water Resources (DWR) determined that the Big Valley Groundwater Sustainability Plan is "incomplete"; and

WHEREAS, in accordance with the SGMA, the GSAs had until April 23, 2024, to submit a revised GSP, responding to the DWR's comments; and

WHEREAS, a revised GSP was assembled by staff and consultants, and, on March 14, 2024, the BVAC conducted a well-noticed public meeting to consider the proposed revised GSP. After conducting said public meeting the BVAC then recommended that the GSA adopt said revised GSP with the edits made at said meeting.

NOW, THEREFORE, BE IT RESOLVED, the Board of Supervisors, acting as the Lassen County Groundwater Sustainability Agency, hereby adopts the revised Big Valley Groundwater Sustainability Plan (GSP) with edits and corrections identified by the GSAs during their public hearings at which the revised GSP was considered; and

BE IT FURTHER RESOLVED, that the Board of Supervisors of the County of Lassen directs staff to make said edits or corrections and submit the final revised GSP to the DWR by April 23, 2024.

PASSED AND ADOPTED at a regular meeting of the Board of Supervisors of the County of Lassen, State of California, on the 9th day of April, 2024, by the following vote:

AYES: Supervisors Albaugh, Gallagher, Bridges, Neely, and Ingram.

NOES: None.

ABSTAIN: None.

ABSENT: None.

Chairman of the Board of Supervisors
County of Lassen, State of California

Attest:
JULIE BUSTAMANTE
Clerk of the Board

By: ______________________
MICHELE YDERRAGA, Deputy Clerk of the Board

I, MICHELE YDERRAGA, Deputy Clerk of the Board of the Board of Supervisors, County of Lassen, do hereby certify that the foregoing resolution was adopted by the said Board of Supervisors at a regular meeting thereof held on the 9th day of April, 2024.

____
Deputy Clerk of the County of Lassen Board of Supervisors

Appendix 12 Water Availability Analysis for a Water Right Application Workplan

WEST YOST
Water. Engineered.

23692 Birtcher Drive
Lake Forest CA 92630

949.420.3030 phone
530.756.5991 fax
westyost.com

TECHNICAL MEMORANDUM

DATE: January 31, 2023

Project No.: 1030-80-22-01
SENT VIA: EMAIL

TO: Tiffany Martinez, Clerk of the Board/Assistant County Administrative Officer for the County of Modoc

FROM: Garrett Rapp, PE, RCE #86007
Carolina Sanchez, PE, RCE #85598

REVIEWED BY: Polly Boissevain, PE, RCE #36164

REGISTERED PROFESSIONAL ENGINEER
GARRETT RAPP
No. C86007
Exp. 9-30-24
CIVIL
STATE OF CALIFORNIA

SUBJECT: Water Availability Analysis for a Water Right Application Workplan

BACKGROUND AND OBJECTIVES

The County of Modoc (County) and the County of Lassen are the two Groundwater Sustainability Agencies (GSAs) overlying the Big Valley Groundwater Basin (Basin). Figure 1 shows the location of the Basin, the watershed tributary to the Basin, and the boundaries of Modoc and Lassen Counties.

The Groundwater Sustainability Plan (GSP) for the Basin was completed in December 2021 and includes recommendations for projects and management actions (PMAs) to achieve long-term sustainability of the Basin. One of the PMAs involves investigating and implementing groundwater recharge projects through agricultural managed aquifer recharge (AgMAR). There are several challenges in implementing AgMAR in the Basin, including:

- There is a limited understanding of the impacts of AgMAR on the types of crops grown in the Basin, such as irrigated pasture and hay fields
- There is a limited understanding on the existing water rights in the Basin
- There is a limited understanding of the volume of water available for AgMAR
- The potential surface water diversion period may be impacted by the cold winters that cause the ground to freeze

To address the crop-specific questions, the County is working with the University of California Cooperative Extension, Modoc County (UCCE), to research crop responses to AgMAR. The research is ongoing, and the next steps include the implementation of AgMAR at a small scale. In order to implement any type of AgMAR project, the County (or AgMAR project implementer) will require a water right diversion permit from the State Water Resources Control Board (State Board).

Water right permits can either be standard or temporary. Standard permits require a rigorous water availability analysis (WAA) to demonstrate that a proposed diversion does not encroach upon senior water rights holders or impair environmental or other flow requirements. Temporary permits require a simpler WAA than a standard permit and may be valid for either 180 days or 5 years. The State Board expects a temporary permit to serve as a foundation for the eventual application for a standard permit. Thus, before applying for a standard permit, the County will apply for a 180-day temporary permit to continue exploring methods and locations to implement AgMAR.

The application for a temporary water right permit requires a WAA; however, the State Board does not provide clear direction on how to perform it. On May 6, 2022, the County, West Yost, and UCCE staff met with the State Board staff responsible for reviewing all water right permit applications related to groundwater storage (i.e., diversions for groundwater recharge projects). During this meeting, State Board staff explained that there is no specific scope that can be followed to ensure the approval of a water right permit application and provided a general framework of the types of data and analyses that can be used to conduct a WAA.

The next step for the County is to determine the scope of the technical demonstrations that need to be performed to complete the WAA for a temporary water right permit application to perform the pilot AgMAR project. The technical scope is dependent on a variety of factors, including: 1) the complexity and number of existing water right permits within and downstream of the Basin, 2) the availability of surface water data within and downstream of the Basin, 3) the timing of the proposed diversions for AgMAR, 4) potential impacts to the Sacramento-San Joaquin Delta (Delta), and 4) other factors that may be introduced by the State Board during the application process.

This technical memorandum describes the proposed technical scope to complete a WAA, including the portion of the scope that has been completed thus far.

WAA SCOPE OF WORK

The following are the key tasks necessary to perform the proposed scope of services, each further described below:

- Task 1 – Coordination with the State Board, California Department of Fish and Wildlife, and Other Agencies
- Task 2 – Collect and Evaluate Data
- Task 3 – Conduct WAA
- Task 4 – Document the WAA
- Task 5 – Evaluate Applicability of Temporary Transfers

Task 1 – Coordinate with the State Board, California Department of Fish and Wildlife, and Other Agencies

The objective of this task is to obtain buy-in from the State Board and other relevant agencies on the WAA. This includes, but is not limited to:

- Coordinating with the State Board continuously through the development of the WAA to obtain input on the methods and analyses being used. The State can provide important input on: (1) the aptness of the WAA analyses; (2) the required documentation for submitting the WAA to the State; and, (3) other general input.

- Consulting with the California Department of Fish and Wildlife (CDFW) once the WAA is completed to discuss the project and how the proposed diversion will be protective of fish and wildlife. A temporary permit application requires a consultation with CDFW prior to its submittal.
- Consulting with the US Bureau of Reclamation (USBR) to ensure the WAA is responsive to its Shasta Dam operations and permit.

In addition to the May 6, 2022 meeting with State Board staff, West Yost and the County have met with State Board staff regularly through the development of the technical scope of work for the WAA to ensure that the data collection, research, and recommendations are in line with the State Board's expectations. Additionally, West Yost staff met with the California Department of Water Resources (DWR) to discuss its technical regulatory assistance for temporary water rights for groundwater recharge;[1] and with the USBR to discuss operations and water demands at Shasta Dam. A total of seven meetings were conducted. Agendas for the six meetings with the State Board are included as Attachment A. A summary of the outcomes of each meeting is below.

- August 5, 2022 meeting with State Board staff, in which staff:
  - Provided resources summarizing the difference between the types of water right permit applications (180-day temporary permit, 5-year temporary permit, etc.).[2]
  - Recommended applying for a 180-day temporary permit using the WAA for streamlined recharge permitting (streamlined WAA).[3] The streamlined WAA requires an application of a "90th Percentile/20 Percent method" (90/20 method) to define daily limits on diversion. The 90/20 method is described in Task 3.
  - Emphasized that the information supporting a temporary permit application should be consistent with the information that would be used in a future standard permit application. For example, if the temporary permit is conducted as part of the streamlined recharge permitting process (i.e., for high flow events from December to March), the standard permit should as well.
  - Did not provide a specific method to address the time-step discrepancies between the 90/20 method, which relies on daily estimates, and water right permits, which specify monthly limits.
  - Restated that there is no specific scope that can be followed to ensure the approval of a water right permit application.
- August 22, 2022 meeting with State Board staff, in which staff:
  - Underlined their concerns of the impacts this project may have on Shasta Dam operations.
  - Agreed to put more thought into their concerns with Shasta Dam to provide direction on how to address their concerns.

[1] https://resources.ca.gov/-/media/DWR-Website/Web-Pages/Water-Basics/Drought/Files/Groundwater/Expediting-Water-Rights-FactsheetFINAL2-20220919.pdf

[2] State Board Water Rights Fiscal Year 2021-2022 Fee Schedule Summary

[3] Water Availability Analysis for Streamline Recharge Permitting

- Recommended that West Yost reach out to the USBR to obtain their feedback on reconciling Shasta Dam water rights in the WAA.
- The State Board staff mentioned a bill (Senate Bill No. 1205)[4] that may result in the standardization of WAAs. The bill was signed by the Governor and filed with Secretary of State on September 16, 2022. As of this meeting, there was no timeline associated with the implementation of the bill.

- September 13, 2022 meeting with USBR staff, in which staff:
  - Stated their general view that new diversions upstream of their reservoirs would adversely affect their storage operations. However, it is possible to characterize conditions when both Shasta Lake's water demands are met, and new upstream diversions can take place.
  - Indicated that demonstrating that Shasta Lake's water demands are met includes demonstrating at least two criteria:
    - Shasta Dam is releasing water to increase available storage capacity. USBR staff provided link to Army Corps of Engineers website to find historical operations data.
    - The Delta is in "excess" condition and Term 91[5] is not in effect. USBR staff provided link to monthly SWP-CVP Coordinated Operations Agreement reports, which list the Delta status daily through 2019.
  - Suggested that West Yost schedule a follow-up meeting with the USBR after compiling the data and developing a proposed characterization of water availability in the Pit River upstream of Shasta Lake.
- October 3, 2022 meeting with State Board staff:
  - The State Board staff shared the operations manual for Shasta Dam.
  - The meeting attendees discussed and agreed on a general process of what the permit conditions may entail, which can be translated into the steps that need to be addressed in the WAA. These steps included:
    - Identifying if flow at the proposed point of diversion (POD) meets the flow thresholds established with the 90/20 method and is protective of Shasta Dam water rights and operations
    - Identifying if the Delta is in "excess" per Term 91
    - Identifying if flows in the Sacramento River, downstream of Shasta Dam and upstream of the Delta, are sufficient to meet water rights requirements along the Sacramento River

[4] Senate Bill No. 1205

[5] Term 91 has been included in permits and licenses, granted after 1965, for diversion and use of water in the Delta watershed. Term 91 requires that those holding such permits and licenses cease diverting water when the State Water Resources Control Board's Division of Water Rights (Division) gives notice that water is not available for use under those permits and licenses. This occurs at times when the State Water Project and Central Valley Project are releasing previously stored water to meet water quality and flow requirements in the Delta and the Delta is termed to be in "balanced conditions," generally during the summer and fall. The Division will also give notice when Term 91 is no longer in effect (i.e., when the Delta is in "excess conditions"). (State Board website accessed on October 3, 2022).

    - Diverting water per the WAA and permit conditions
  - The State Board staff clarified that a separate department leads the petitions for water transfers. The State Board staff provided resources to better understand the requirements for and potential challenges involved in temporary water transfers.
  - The State Board staff offered to review the proposed technical scope for the WAA.
- November 18, 2022 meeting with DWR staff, in which staff:
  - Indicated that they could provide technical assistance to GSAs developing applications for 180-day temporary water right permits for groundwater recharge. This assistance is available to GSAs in the order that they contact the DWR for this assistance. Based on West Yost's initial contact with the DWR on November 8, 2022, the DWR staff estimated that they would be available to provide technical assistance to the Basin GSAs in the spring of 2023.
  - Explained that the DWR requires that a potential recharge project have a refined level of detail (i.e., defined PODs, diversion rates, and fields on which the water will be recharged) before providing technical assistance.
  - Generally agreed with the proposed WAA.
  - Suggested considering using a "flood threshold" method to define available water for diversion as opposed to the 90/20 method. The flood threshold method would involve defining flood conditions in the area of diversion as a threshold for diverting flows. This approach has the potential benefits of being easier to define than the 90/20 method and allowing for an extension of the diversion period beyond March 31, possibly to the end of May. Note that the potential for extension of the diversion season is not written anywhere, but the DWR indicated that they have some discretion when evaluating permit applications. The DWR staff indicated their willingness to assist with developing a flood threshold method.
- December 12, 2022 meeting with State Board staff:
  - West Yost staff presented preliminary results on the analysis of the flows at the Canby gage using the 90/20 method, including considerations for the diversion rights for Shasta Dam
  - The State Board staff proposed several considerations and recommendations, including:
    - General agreement with the WAA approach outlined in the October 26, 2022 draft workplan provided to them on November 8, 2022 for review and comment.
    - Recommendation to focus on application for a 180-day temporary permit for submittal by June or July if possible. This will provide ample time for resolving any potential conflict or opposition.
    - Recommendation to engage with the CDFW as soon as practical to discuss need for notification of streambed alteration, fish screens, or other requirements.
    - Recommendation to review temporary permits that the State Board will be approving soon. The State Board staff will notify us when they are approved, and documentation is available.
    - Note that Ash Creek is fully appropriated from March 15th to October 31st each year, and the Pit River is fully appropriated from April 1st to October 31st each year.

- The State Board staff agreed to review water rights on the flow path between: 1) the Basin and Shasta Dam; and, 2) from Shasta Dam to the Delta to support our analysis of the water rights downstream of the Basin. West Yost staff agreed to compile the water rights information on these segments to send to the State Board staff.
  - State applications do not need to be included in the analysis of downstream water rights.
- January 9, 2023 meeting with State Board staff, in which staff:
  - Explained that they had not yet reviewed the water right information that West Yost staff sent on January 5, 2023. They expect to have more availability to assist in mid-February.
  - Sent information to West Yost staff regarding recently approved temporary permits that use the 90/20 method for the WAA.
  - Committed to send West Yost staff a statewide dataset of monthly demands for statements of diversions that was compiled in 2018, to assist in the quantification of water demands for statements of diversion.
  - Stated that there were no defined thresholds to demonstrate water availability in a WAA.

Additional meetings with the State Board and DWR staff will be required to complete the WAA. At least one additional meeting with the USBR will be required to approve the proposed analysis to consider the storage requirements at Shasta Dam (see Task 3.3). Additionally, the County will need to meet with the CDFW to discuss any conditions that they may require for the permit. These coordination meetings have and will continue to guide the scope of the subsequent tasks.

Task 2 – Collect and Evaluate Data

The objective of this task is to ensure that all data required to for the WAA is collected and analyzed. As described herein, much of the available data has already been collected and processed for use in the WAA.

The following data were collected to characterize the surface water and permitted points of diversion in the study area:

- Surface water flow data. Historical and current surface water flow data was collected and reviewed. Table 1 summarizes the gages within the Big Valley watershed, the data collector, watershed area, and period of record. Figure 1 shows the locations of these gages.
- Water rights data. Two sets of water rights data were collected and reviewed:
  - Water rights data and point of diversion locations from eWRIMS. Figure 2 shows the location of all points of diversion downstream of the Basin to Shasta Dam and upstream of the Basin to the Warner Mountains that are in the eWRIMS database. This does not include the pre-1914 water rights that have not been geolocated.
  - Water rights data from a recent WAA to support an application for a water right permit downstream of the Pit River. A permit applicant (Downstream Applicant) recently developed a tool that includes all water rights upstream of Freeport, near Sacramento, which includes the Pit River watershed. This tool, herein referred to as the Face Value (FV) Tool, includes all water rights information (water right type, effective date, status, face value, etc.) from the Sacramento Delta to the Warner Mountains. The tool was

developed in May 2022 and thus is missing the water rights information for any new water rights approved/applied for since May 2022.

- Information and data on the operations of Shasta Dam. During the August 22, 2022 meeting with the State Board, State Board staff recommended meeting with the USBR to determine the analysis necessary to demonstrate that any new diversions upstream of Shasta Dam do not encroach upon the diversion rights of Shasta Dam. West Yost staff met with USBR staff on September 13, 2022 to discuss the recommendations and available data for this analysis. USBR staff indicated that the following two conditions generally indicate that any new diversions upstream of Shasta Dam do not encroach upon the diversion rights of Shasta Dam:
  - Water levels behind Shasta Dam are higher than the conservation water level. The USBR operates Shasta Dam for water storage, flood management, and hydropower. The operations of the dam vary based on antecedent conditions, predicted inflows, and required outflows, and does not operate based on rigid thresholds. USBR staff recommended using the historical operation data to characterize conditions when water levels behind the dam are higher than the conservation water level. Data on historical operations beginning in 1995 are found on the Army Corps of Engineers' website.[6]
  - The Delta is in "excess." The USBR publishes monthly reports characterizing the daily coordinated operations between the Central Valley Project and the State Water Project.[7] These reports indicate whether the Delta is in "balance" or "excess."
- Basin water budget and other GSP data. The Basin water budget was obtained to identify the method use to estimate surface water flow inputs and output to the Basin. Initially, the intent was to utilize this data in the WAA, however the data was on an annual time-step and this did not meet the needs of the WAA. In addition to the water budget information, GIS files of the basin boundary, surface water gages, etc. were collected.
- Technical Information for Preparing Water Transfer Proposals. The DWR developed a white paper[8] with information on preparing proposals for water rights transfers. This white paper was downloaded and reviewed for the County to consider transfers as a potential alternative to obtaining a temporary permit.

Table 1. Surface Water Gages within the Big Valley Subbasin Watershed

Gage Name	Gage Number	Data Collector	Watershed Area, acres	Period of Record
Ash C A Adin CA	11350500	USGS	165,120	Aug 1904 to Sep 1982
Ash C A Ash Valley CA	11349500	USGS	87,040	Oct 1928 to Sep 1931
Willow Creek Nr Adin CA	11351000	USGS	40,320	Apr 1930 to Sep 1931
Widow Valley C Nr Lookout CA	11351500	USGS	17,728	Apr 1930 to Sep 1931
Pit R Nr Lookout CA	11349000	USGS	1,014,400	Apr 1929 to Sep 1980

[6] SPK WCDS - California Plots (army.mil)

[7] Water Accounting Reports (usbr.gov)

[8] Technical Information for Preparing Water Transfer Proposals (Water Transfer White Paper) Information for Parties Preparing Proposals for Water Transfers Requiring Department of Water Resources or Bureau of Reclamation Approval (DWR, 2019)

Table 1. Surface Water Gages within the Big Valley Subbasin Watershed

Gage Name	Gage Number	Data Collector	Watershed Area, acres	Period of Record
Pit R Nr Canby CA	11348500	USGS	915,840	Oct 1929 to Present
Muck Valley PP nr Bieber CA	n/a	Private	1,584,000	Jan 2010 to Present
Pit R Nr County Rd [(a)]	n/a	Private	1,014,400	Sep 2022 to Present

(a) This gage was recently installed by the County with support from DWR. The data will become available online in the near future.

Additional data may be required based on future coordination with the State Board, CDFW, and others.

Task 3 – Conduct WAA

Task 3 involves an evaluation of the data collected in Task 2 pursuant to the streamlined WAA process. The streamlined WAA presents two methods for demonstrating water availability for a diversion permit application:

- The 90/20 method, which relies on historical data at local surface water gages to derive a conservative threshold for the volume of divertible water. By using the surface water gage data, the 90/20 method assumes that upstream diversions and water rights are reflected in the flow at the gage.
- Demonstrating the imminent threat of flood conditions in the source waters and the need for flood control actions to identify water available for diversions.

Since a flood control agency does not operate in the region of the proposed diversions, the method of demonstrating flood conditions may not applicable and will require discussions with DWR staff to determine applicability to the Basin. Therefore, the 90/20 method is appropriate for demonstrating water availability. The following describes the four steps of the 90/20 method.

1. *Gage selection.* An appropriate stream gage must be selected to estimate the 90th percentile flows at or near the project's proposed POD. Ideally, the gage would be operated by the United States Geological Survey (USGS) and have a record of at least 30 years. The State Board provides recommendations for alternative solutions if no appropriate gage exists, including using data from multiple gages.
2. *90th percentile diversion threshold.* The 90th percentile diversion threshold must be calculated for each day over the proposed diversion period (December 1 through March 31). When using paired gages, the 90th percentile flows must be prorated to the POD based on the relative drainage areas and precipitation over the drainage areas using the following formula:

$$Q_{POD} = Q_{gage} * \left(\frac{DA_{POD}}{DA_{gage}}\right) * \left(\frac{P_{POD}}{P_{gage}}\right)$$

Where:

— Q_{POD} = 90th percentile flow at the POD;

— Q_{gage} = 90th percentile flow calculated for the gage;

— DA_{POD} = drainage area at the POD;

— DA_{gage} = drainage area at gage;

— P_{POD} = average annual precipitation at the POD; and

— P_{gage} = average annual precipitation at the gage.

3. *Downstream demand.* The streamlined WAA states that "[s]enior demands and environmental flows along the source water body's downstream flow path need to be compiled and compared against the 90th percentile flow at the POD to verify that the 90th percentile is a high enough flow rate to ensure downstream demands are satisfied… Projects located within the Sacramento-San Joaquin Watershed may calculate demands along a flow path that ends at the Legal Delta and accept terms related to the Delta, including a term based on the Net Delta Outflow Index to ensure demands on the Delta are satisfied."
4. *Diversion threshold and downstream demand comparison.* The calculated downstream demands should be compared to the 90th percentile flow at the POD(s). The streamlined WAA states that "If the needs of downstream diverters and the environment exceed the chosen diversion thresholds, then further analysis or a higher threshold will be needed to demonstrate that instream beneficial uses and senior water rights are protected."

In addition to establishing the 90th percentile (or greater) threshold for diversion, the total daily diversion cannot exceed 20 percent of the total estimated daily flow at the POD.

The streamlined WAA process is parallel to the potential permit conditions discussed at the October 3, 2022 coordination meeting with the State Board staff. The process consists of:

- Identifying if flow at the study area meets the flow thresholds established with the 90/20 method and is protective of Shasta Dam water rights and operations
- Identifying if the Delta is in "excess" per Term 91
- Identifying if flows in the Sacramento River, downstream of Shasta Dam and upstream of the Delta, are sufficient to meet water rights requirements along the Sacramento River
- Diverting water per the WAA and permit conditions

Tasks 3.1 through 3.4 discuss the application of the four steps of the streamlined WAA to the Big Valley Basin and how the potential permit conditions are addressed. Figure 3 shows these steps graphically and is explained along with each task.

Task 3.1 Select Appropriate Gage(s) for the WAA

The objective of this task is to select the correct local gage to perform the WAA. Table 1 and Figure 1 summarize the stream gages proximate to the watershed. Based on the locations and period of record, West Yost proposes to use a combination of the two USGS gages along the Pit River (Pit R Nr Lookout CA and Pit R Nr Canby CA) to apply the 90/20 method. The "Pit R Nr Lookout CA" gage (Lookout gage) is closer to the Basin than the "Pit R Nr Canby CA" gage (Canby gage), but the Canby gage has a more complete period of record. The daily streamflow measurements for these gages over the concurrent period of record[9] are highly correlated (r-squared = 0.96), and there are few additional inputs or diversions from

[9] The Canby and Lookout gages have concurrent daily streamflow measurements for about 32 percent of their 51-year concurrent period of record.

the Pit River between the two gages (see Figures 1 and 2). Therefore, using both gages to define the 90th percentile flow at the Lookout gage would be appropriate.

Task 3.2 Estimate the 90th Percentile Diversion Threshold

The objective of this task is to estimate the 90th percentile diversion threshold per the streamlined WAA. The threshold was estimated for the Lookout and Canby gages. Figure 3a shows the 90th percentile daily flows at the Canby gage based on its entire period of record, and the daily flows at the Canby gage for Water Year (WY) 2017 during the WAA period of December 1 through March 31. Table 2 summarizes the statistics of the 90th percentile daily flows at the Lookout and Canby gages by each month over the WAA period.

Table 2. 90th Percentile Flows at Lookout and Canby Gages

Gage Name	Month	90th Percentile Daily Flow Statistic, cfs			
		Minimum	Maximum	Mean	Median
Pit R Nr Lookout CA	December	181	728	342	305
	January	340	1,270	656	583
	February	553	1,460	900	858
	March	866	1,530	1,152	1,120
Pit R Nr Canby CA	December	194	711	394	351
	January	228	3,180	1,668	2,174
	February	778	3,284	1,299	1,234
	March	589	1,830	1,110	1,087

Task 3.3 Evaluate Downstream Demands

The objective of this task is to identify all downstream demands and evaluate how they may be impacted by the proposed diversion. The streamlined WAA suggests collecting and reviewing water rights data using eWRIMS tools to determine downstream water demands. Based on initial discussions with the State Board staff, water rights information downstream of Shasta Dam did not seem to be applicable to a WAA for a temporary permit. Thus, West Yost's original intent was to collect and review all water rights data upstream of the Basin and along the downstream trace of the Pit River to Shasta Dam. Figure 2 shows the locations of the points of diversions downstream of the Basin to Shasta Dam and upstream of the Basin to the Warner Mountains. However, the State Board later emphasized the need to include Shasta Dam operations in the WAA (see Task 1).

A challenge to the data collected from eWRIMS is that no digital documentation of pre-1914 rights exists other than Supplemental Statements of Diversion and Use and limited location information. Analyzing Supplemental Statements of Diversion and Use would require digitizing information from PDFs to a usable format like Excel. Additional challenges include interpreting the diverse conditions of water right permits, which can define storage rights, rights to divert water for non-consumptive use, or may include multiple PODs. The State Board recommended that West Yost contact the Downstream Applicant to obtain their FV tool to leverage for our water rights analysis. West Yost has obtained the FV tool, the data from which should be used to complete Task 3.3.

Quantification of Water Availability Based on 90/20 Method and Shasta Dam Demands

As described earlier, one of the State Board staff's main concerns is how the WAA will address the water right permits and operations at Shasta Dam. As such, the first step in continuing the WAA analysis is to correlate the gaged data within the Study Area to Shasta Dam Operations as described by and with additional input from the USBR. To complete this analysis, West Yost compared the following datasets of daily data for their concurrent period of record:

- Streamflow data at the Canby gage
- 90th percentile daily streamflow at the Canby gage
- Shasta Dam operational data, including water levels and conservation storage levels
- The USBR's monthly reports characterizing the daily coordinated operations between the Central Valley Project and the State Water Project to determine when the Delta is in "excess" condition.

The Shasta Dam operational data and the USBR data were concurrent for WYs 2000 through 2019, covering 20 years. For each of the 20 years over the temporary permit diversion period of December 1 through March 31, the daily streamflow data at the Canby gage was compared to the Shasta Dam operational data and the Delta condition. This analysis quantifies the number of days when the following criteria are met:

1. Daily flow at the Canby gage is above the 90th percentile threshold.
2. Water levels at the Shasta Dam are above the conservation storage levels, indicating that the Shasta Dam will be releasing water to increase storage capacity.
3. The Delta is in "excess" condition.

This analysis assumes that the lag time between flows at the Canby gage and Shasta Dam are negligible, and thus, the gaged flows at the Canby gage and conditions at Shasta Dam can be compared on the same day that they are recorded. To determine the validity of this assumption, a cross-correlation analysis was completed between the daily flows at the Canby gage and a gage just upstream of Shasta Lake. The greatest correlation coefficient between the two daily flows occurred without any lag time, suggesting that this assumption is valid. Of the 20 years analyzed, six of the years had at least one day where the three criteria were met, and four of those years were considered wet water years. Table 3 below summarizes the results of the analysis, including the water year type, divertible volume, and minimum and maximum potential diversion rates.

Table 3. Analysis of Water Availability Considering Shasta Dam Operations and Delta Conditions

Water Year—Year Type[10]	Number of Days Meeting Criteria	Total Divertible Volume Considering 20 Percent Limit, af	Minimum Potential Diversion Rate, cfs	Maximum Potential Diversion Rate, cfs
2000-AN	0	-	-	-
2001-D	0	-	-	-
2002-D	0	-	-	-
2003=AN	0	-	-	-
2004-BN	4	3,128	35	566
2005=AN	0	-	-	-
2006-W	30	14,231	6	726
2007-D	0	-	-	-
2008-C	0	-	-	-
2009-D	0	-	-	-
2010-BN	0	-	-	-
2011-W	6	1,642	5	318
2012-BN	0	-	-	-
2013-D	0	-	-	-
2014-C	0	-	-	-
2015-C	0	-	-	-
2016-BN	3	1,908	190	418
2017-W	43	33,557	10	1,096
2018-BN	0	-	-	-
2019-W	14	7,381	1	566

Of the six years where the three criteria were met, the total divertible volume ranged from 1,600 afy to 33,600 afy. The total divertible volume accounts for the limitation specified in the 90/20 method that no more than 20 percent of flow can be diverted per day. The minimum average daily diversion rate was 1 cfs (2019), and the maximum average daily diversion rate was over 1,000 cfs (2017).

Figure 3b demonstrates these conditions graphically for WY 2017. Days when the measured daily flow (green line) is greater than the 90th percentile daily flow (blue line) indicates that criterion 1 is met. The periods shaded in pink in Figure 3b are periods where criteria 2 and 3 are met. The three criteria are met in January, February, and March 2017. This analysis demonstrates that there may be water available for diversion under certain hydrologic conditions.

This task should be updated when the diversion capacity of the project is defined to refine the divertible volume and flow rate based on the expected project capacity.

[10] Based on the Sacramento Valley Water Year Index and Type: C = Critical; D = Dry; BN = Below Normal; AN = Above Normal; W = Wet

Task 3.4 Compare the Diversion Threshold to Downstream Demands

The objective of this task is to determine whether flows during potential diversion periods, as characterized in Task 3.3, are sufficient to meet downstream demands. The recommended method to perform this is by:

1. Identifying the existing points of diversion along the Pit River between the northern-most boundary of Big Valley Basin and Shasta Dam
2. Quantifying the sum of the direct diversion amounts for the points of diversion identified in Step 1, which represents the downstream demands between the northern-most boundary of Big Valley Basin and Shasta Dam
3. Identifying a representative gage immediately upstream of Shasta Dam
4. Comparing the gaged flow at the gage selected in Step 3 to the downstream demands between the northern-most boundary of Big Valley Basin and Shasta Dam
5. Repeat the process in Steps 1 through 4 for the flow line along the Sacramento River between Shasta Dam and the Delta

As of January 31, 2023, Step 1 has been completed for both the: (1) flow line along the Pit River between the northern-most boundary of Big Valley Basin and Shasta Dam; and (2) flow line along the Sacramento River between Shasta Dam and the Delta. Items 2 through 4 still need to be completed.

Figure 3c is a concept graphic of how downstream water rights may be included in the analysis: the same information from Figure 3b will be plotted along with the period of sufficient flow for water rights downstream of the POD. The days when the flow at the gage is: (1) above the 90th percentile; (2) during the time when Shasta Dam storage is above the conservation storage and Delta outflow is in “excess” per Term 91; and (3) during a period when flow is sufficient to meet downstream demands represent times when water is available. Figure 3d is a concept graphic of the water availability determination by day, the total daily flow is broken down as follows:

- Volume of water allocated to satisfy senior downstream water rights.
- Volume of water required to meet instream flow requirements (to be determined in coordination with the CDFW).
  - To assist an understanding of the potential instream flow requirements, the State Board provided information on a policy that establishes instream flow requirements for major stream locations across California, including in the Pit River at the Muck Valley Dam downstream of the Basin.[11] The flow requirement in the Pit River at the Muck Valley Dam downstream of the Basin from November to March ranges from 216 cfs in February to 255 cfs in December. The 90th percentile daily flows at the Canby and Lookout gages exceed the instream flow requirements at the Muck Valley Dam over 95 percent of the time.
  - The hypothetical example shown in Figure 3d assumes that the water required for senior downstream water rights and instream flows is less than the 90th percentile daily flow volume. If “the needs of downstream diverters and the environment exceed the chosen diversion thresholds” (see step 4 of the streamlined WAA), then the threshold

[11] Pit River at the Muck Valley Dam Instream Flow Requirements

would have to be increased above the 90th percentile daily flow based on further analysis.

- Unallocated volume under the 90th percentile
- Divertible water, which is the lesser of:
  - Total daily flow minus the 90th percentile flow for that day, or
  - 20 percent of the total daily flow.
- Volume of water greater than the 20 percent threshold

Task 4 – Document the WAA

The objective of this task is to document the WAA for review by the State Board. The WAA documentation will include:

- Summary of the County's objectives and background information on the Basin.
- Summary of feedback obtained by the State Board staff throughout the process and how the feedback was addressed in the WAA.
- Detailed description of methodology used to address each step in the streamlined WAA and the State Board staff's comments.
- Detailed charts and graphics explaining the analysis performed for each step in the streamlined WAA.
- Conclusion of the water availability, comparing (1) the average, minimum and maximum annual volume of water available and (2) the frequency of water availability to the anticipated capacity of the project.
- Backup documentation of the analysis performed for each step in the streamlined WAA.

Optional Task 5 – Evaluate Applicability of Temporary Transfers

The objective of this task is to determine the applicability of obtaining a temporary water rights transfer as an alternative to obtaining a temporary permit. This would provide the County with flexibility to temporarily divert water if there are any delays with the temporary permit application. As such, it is an optional task.

The DWR developed a white paper[12] with information on preparing proposals for water rights transfers. The DWR white paper outlines a set of criteria for eligible transfers. Eligible transfers include transfers based on cropland idling and crop shifting, which may be an applicable transfer for the County. Under this type of transfer, only certain crops are allowed for transfers, including alfalfa (limited to the Sacramento Valley floor and north of the American River), rice, wild rice, Sudan grass, etc. Crops not allowed for transfer include alfalfa in the delta region, pastures, orchards, mixed and miscellaneous grasses, etc. The types of crops for the Basin include native pasture, grass hay, alfalfa hay, wild rice, and rangeland. Based

[12] Technical Information for Preparing Water Transfer Proposals (Water Transfer White Paper) Information for Parties Preparing Proposals for Water Transfers Requiring Department of Water Resources or Bureau of Reclamation Approval (DWR, 2019)

on these guidelines, there is a potential to temporarily transfer water rights for idled lands of alfalfa and wild rice in the Basin.

There is some uncertainty around the applicability of this alternative to meet the County's objectives and the level of effort to move forward with a transfer application. As such, this task includes:

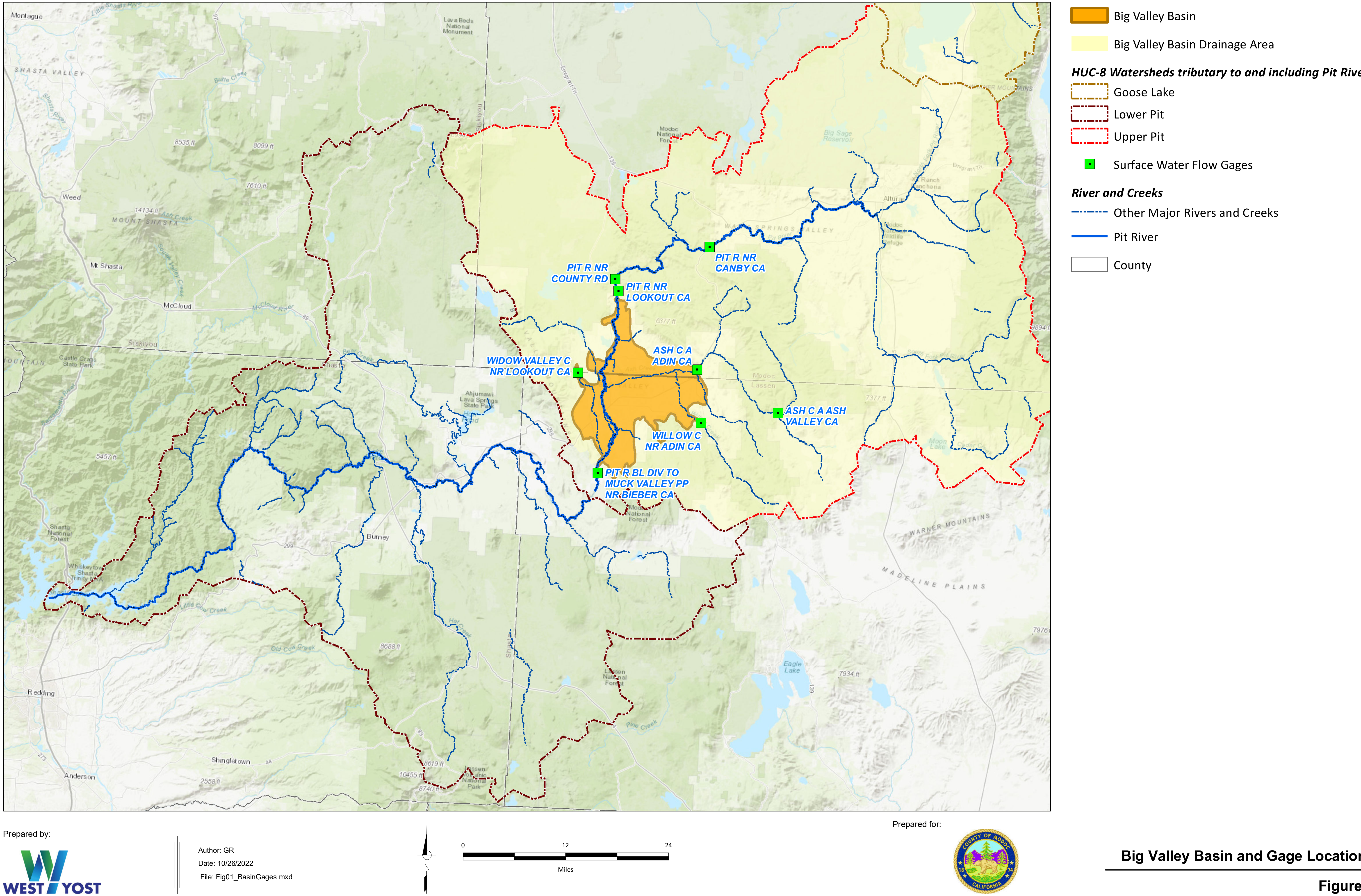
- Coordinating with the DWR to obtain guidance and input on the transfer process
- Conducting research to identify lands currently growing the types of crops eligible for transfer that hold water rights with the Basin
- Working with the growers from the lands identified to determine any plans for fallowing/idling the lands

SUMMARY OF NEXT STEPS TO COMPLETE THE WAA AND ADDITIONAL CONSIDERATIONS

The WAA scope of work described herein includes a description of work that has already been completed and the specific steps required to complete the WAA, by task, including:

- **Task 1 – Coordination with the State Board, California Department of Fish and Wildlife, and Other Agencies.** Although the County has been in communication with the State since May 2022, additional meetings will be required to complete the WAA. Additionally, the County will need to meet with the CDFW and USBR. These coordination meetings have and will continue to guide the scope of the subsequent tasks.
- **Task 2 – Collect and Evaluate Data.** At this time, it appears all relevant data to conduct the WAA has been collected and reviewed. However, additional data may be required based on future coordination with the State Board, CDFW and others.
- **Task 3 – Conduct WAA.** Tasks 3.1 and 3.2 have been completed. Tasks 3.3 and 3.4 have been partially completed and their completion will be required to finalize the WAA.
- **Task 4 – Document the WAA.** This TM partly documents the WAA, specifically the data collected thus far, and the analysis performed for Task 3. The documentation will need to be expanded to document the final WAA once Tasks 3.3 and 3.4 are completed.
- **Optional Task 5 – Evaluate Applicability of Temporary Transfers.** This task has yet to be initiated.

The work completed thus far has emphasized the complexity of the water right application process and the potential risks involved due to the location of the Basin and proposed diversion upstream of Shasta Dam, the Delta, and myriad downstream senior water rights. Because of this complexity, West Yost recommends acquiring legal advice to guide the County in the process to develop the WAA and the temporary permit application or to assist with a temporary water rights transfer if that becomes the preferred option.



Prepared by:

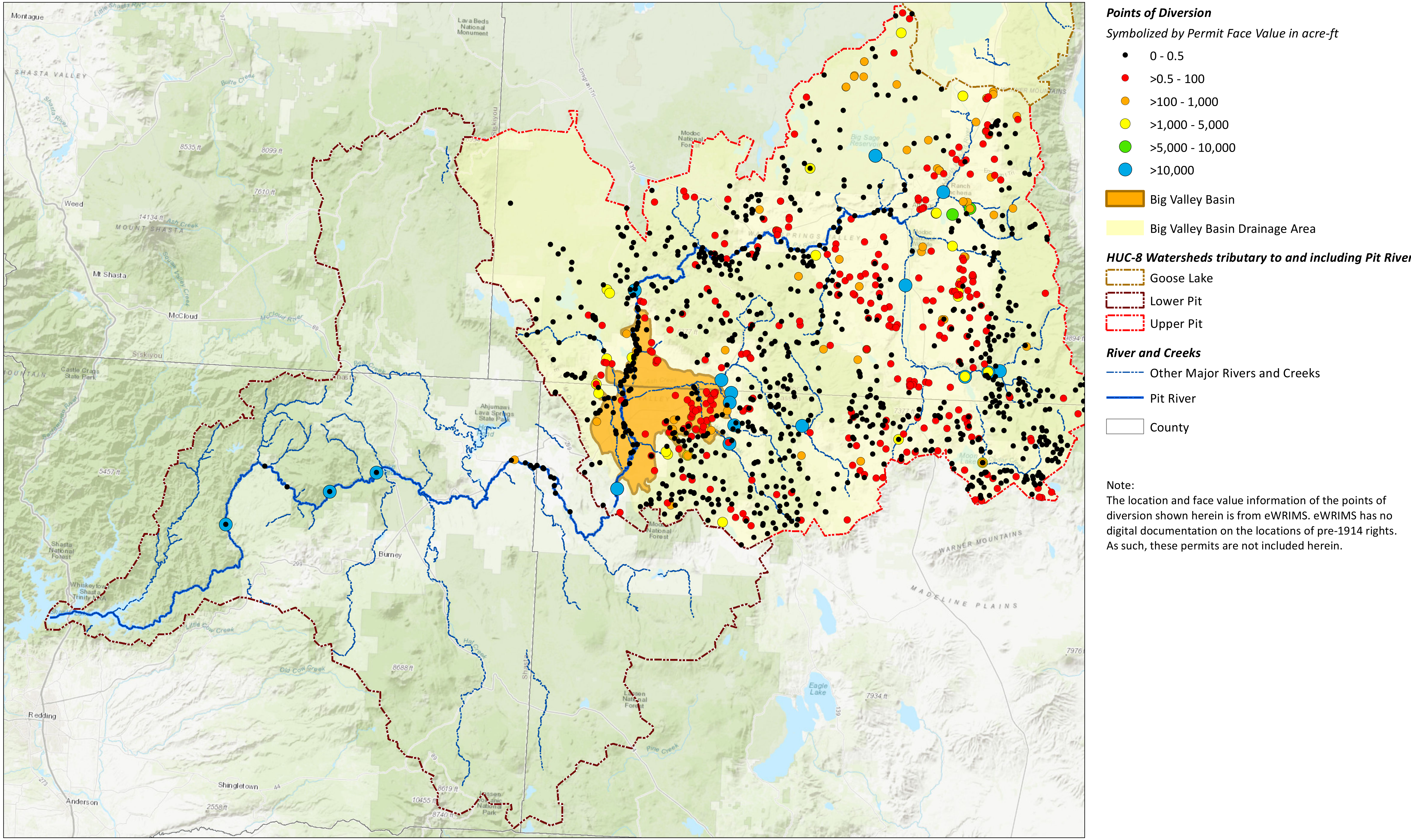
WEST YOST

Author: GR
Date: 10/26/2022
File: Fig01_BasinGages.mxd

Prepared for:

Big Valley Basin and Gage Locations

Figure 1



Note:
The location and face value information of the points of diversion shown herein is from eWRIMS. eWRIMS has no digital documentation on the locations of pre-1914 rights. As such, these permits are not included herein.

Prepared by:

WEST YOST

Author: GR
Date: 10/26/2022
File: Fig02_PODs.mxd

Prepared for:

Relevant Points of Diversion
Upstream of Shasta Dam

Figure 2

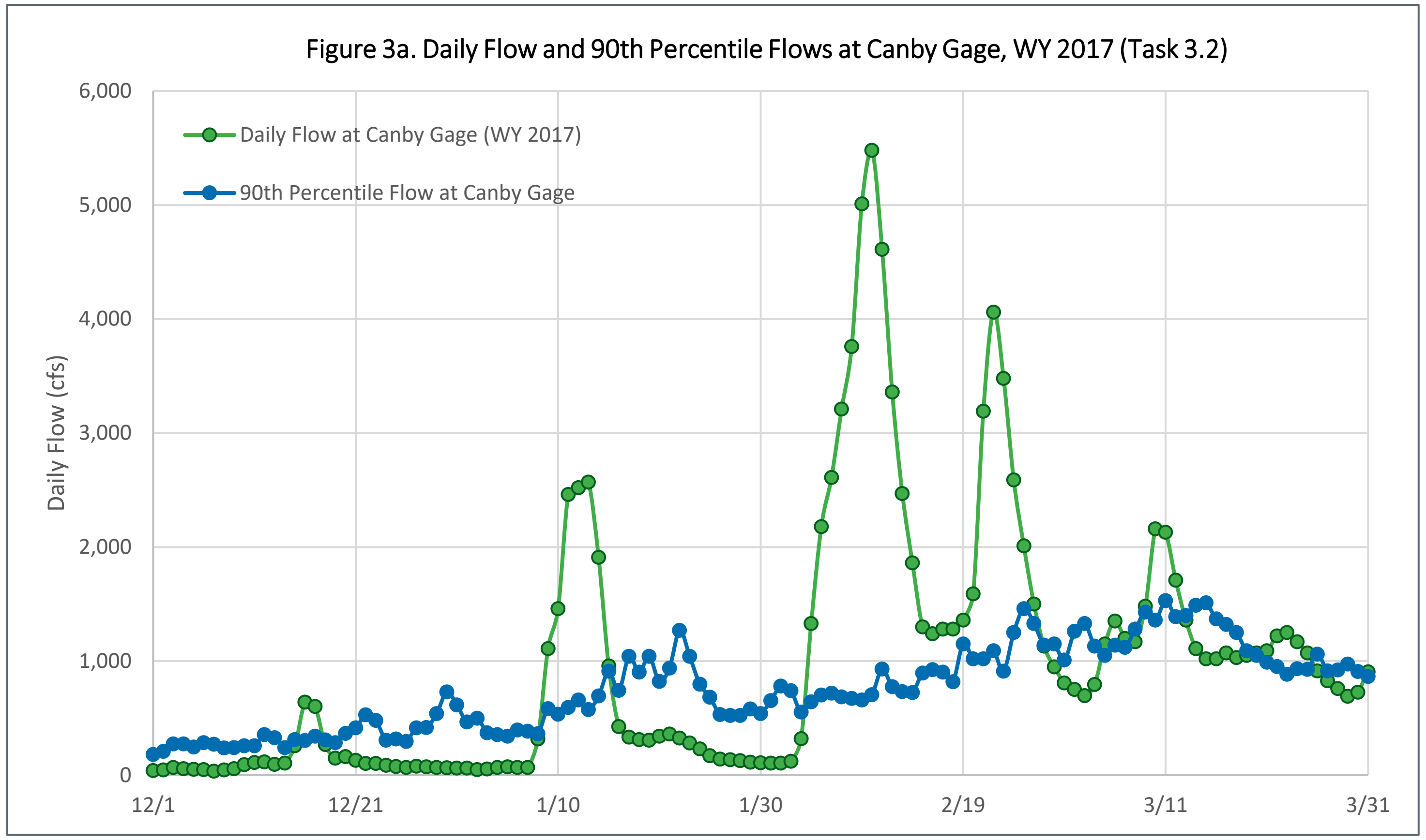


Figure 3a. Daily Flow and 90th Percentile Flows at Canby Gage, WY 2017 (Task 3.2)
Daily Flow at Canby Gage (WY 2017)
90th Percentile Flow at Canby Gage
Daily Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
12/1
12/21
1/10
1/30
2/19
3/11
3/31

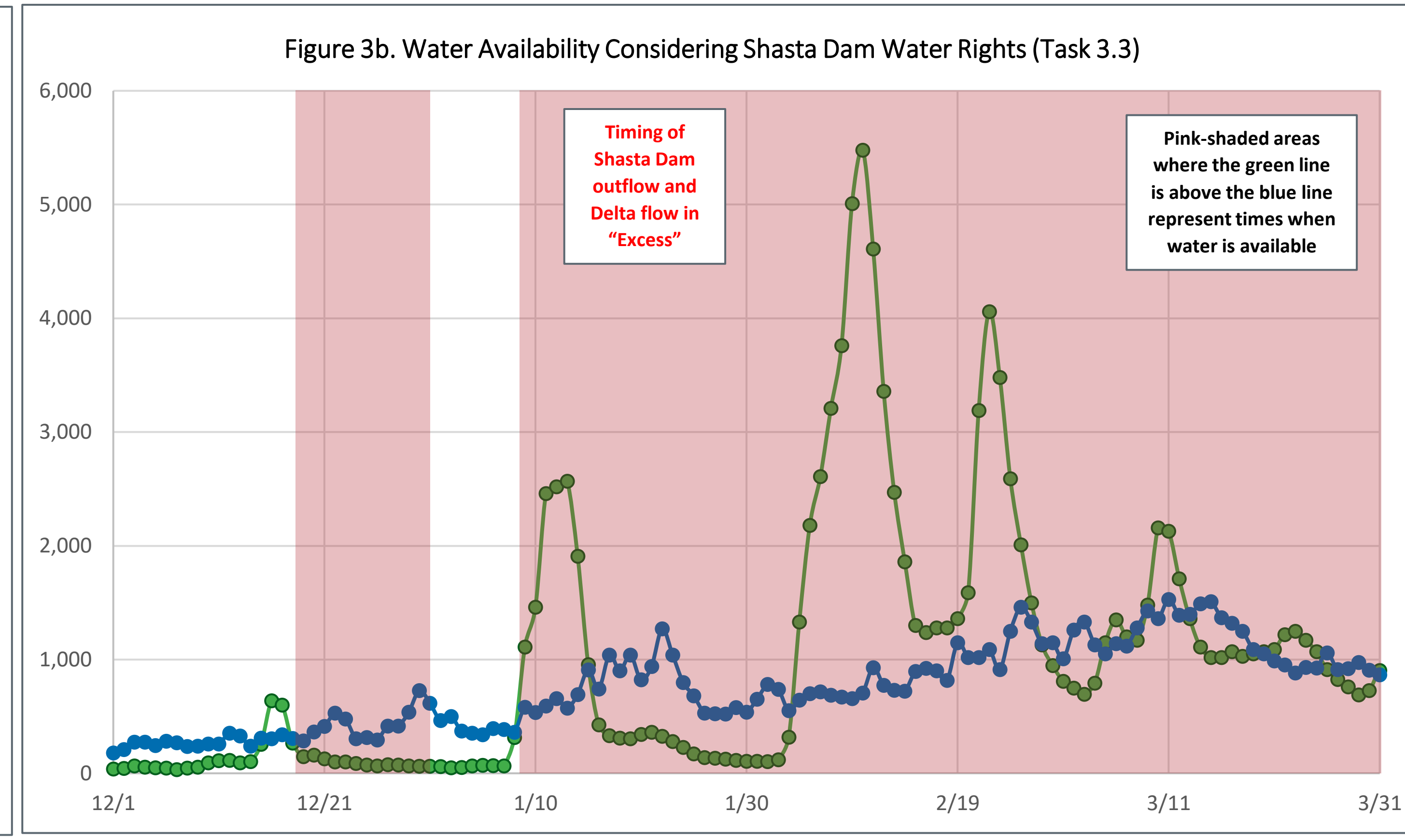


Figure 3b. Water Availability Considering Shasta Dam Water Rights (Task 3.3)
Timing of Shasta Dam outflow and Delta flow in "Excess"
Pink-shaded areas where the green line is above the blue line represent times when water is available
6,000
5,000
4,000
3,000
2,000
1,000
0
12/1
12/21
1/10
1/30
2/19
3/11
3/31

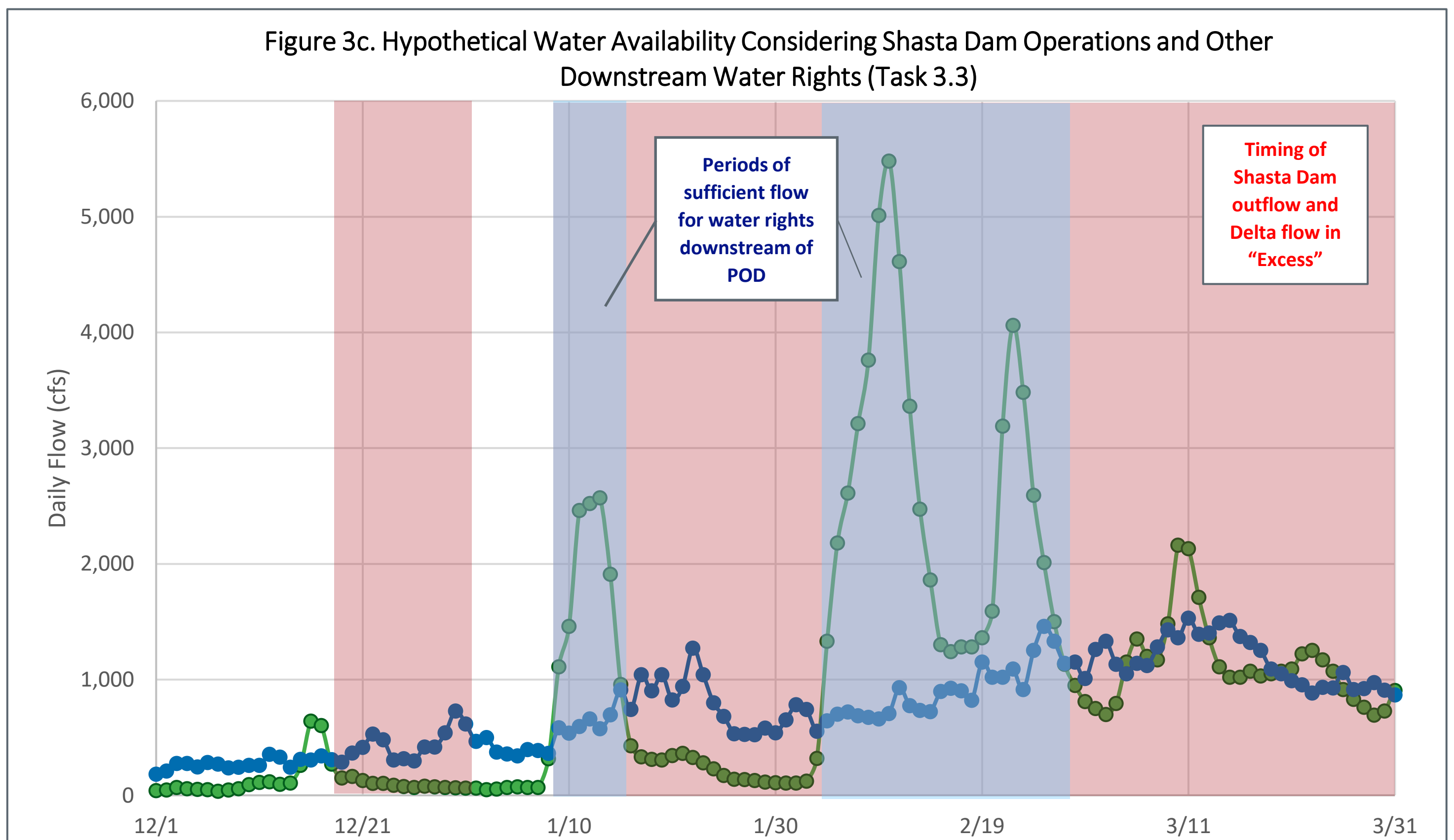


Figure 3c. Hypothetical Water Availability Considering Shasta Dam Operations and Other Downstream Water Rights (Task 3.3)
Periods of sufficient flow for water rights downstream of POD
Timing of Shasta Dam outflow and Delta flow in "Excess"
Daily Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
12/1
12/21
1/10
1/30
2/19
3/11
3/31

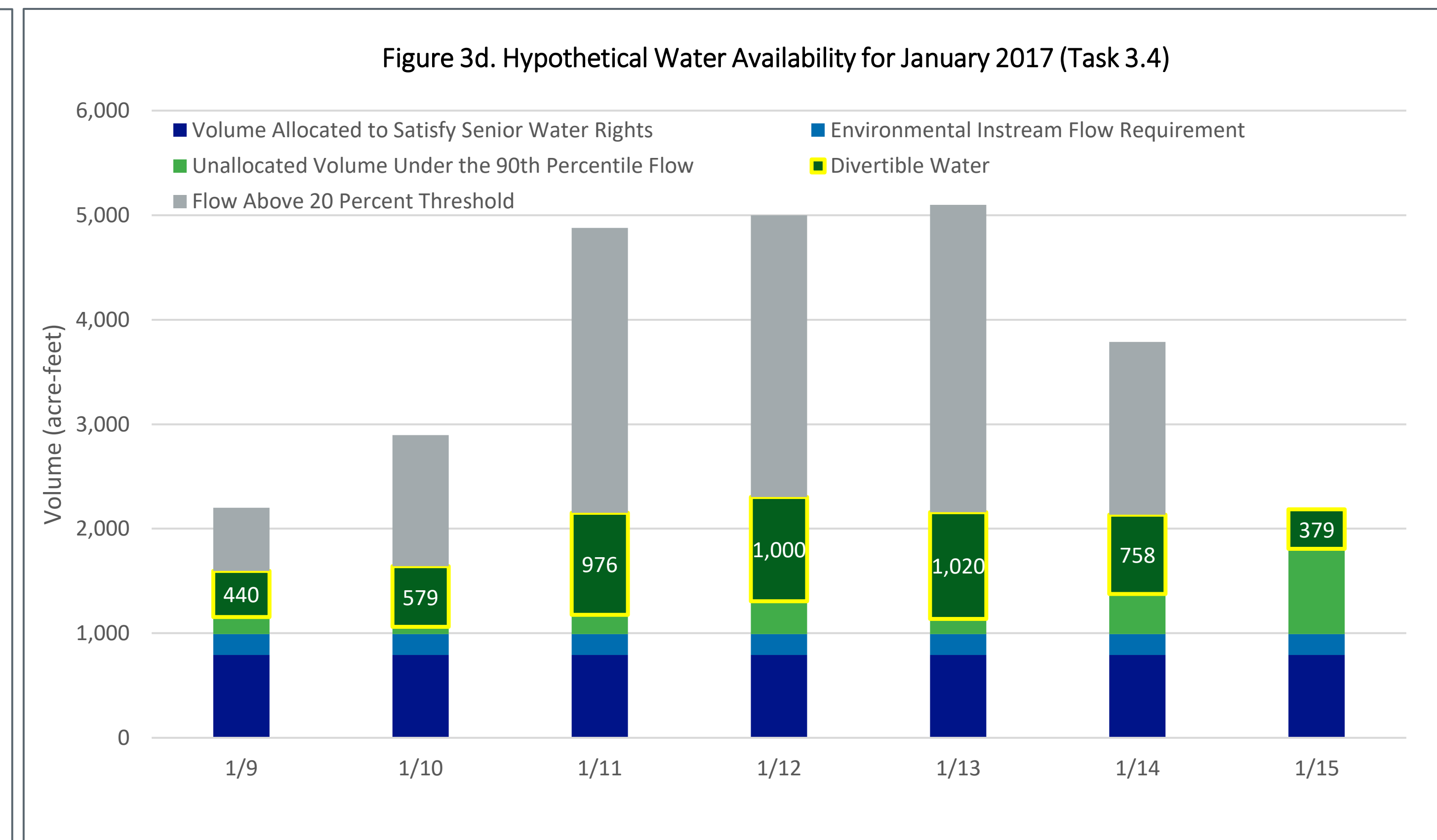


Figure 3d. Hypothetical Water Availability for January 2017 (Task 3.4)
Volume Allocated to Satisfy Senior Water Rights
Environmental Instream Flow Requirement
Unallocated Volume Under the 90th Percentile Flow
Divertible Water
Flow Above 20 Percent Threshold
Volume (acre-feet)
6,000
5,000
4,000
3,000
2,000
1,000
0
440
579
976
1,000
1,020
758
379
1/9
1/10
1/11
1/12
1/13
1/14
1/15

Attachment A

Agendas for Meetings with State Board Staff, May 2022 through January 2023

State Board and County of Modoc

Water Availability Analysis for the Big Valley Groundwater Basin

Location:	Teams Video Call
Date:	May 6, 2022
Time:	1:00 PM
Attendees:	Nick Kehrlein (State Board)
	Tiffany Martinez (County of Modoc)
	Claire Bjork (UC Davis Extension)
	Garrett Rapp, Carolina Sanchez (West Yost)

AGENDA ITEMS

1. Background and objectives
    a. Overview of the Big Valley Groundwater Basin and its recharge goals
    b. Meeting objectives
        i. Improve understanding of the water rights permitting process and the requirements to prepare a water availability analysis
2. State Board Water Rights Process
    a. What is the process to apply for a water rights permit?
    b. What is the correct type of water right to divert surface water for groundwater recharge?
    c. Are there any recent applications for water rights in the area that can be shared with the County?
    d. What level of involvement/support can be expected from State Board staff?
3. Water Availability Analysis Resources from State Board
    a. Does the State Board still support the "rainfall-runoff" and "area-ratio" methods to estimate water availability?
        i. If so, are these methods considered a final or preliminary method?
    b. What other methods are supported (excluding watershed modeling)?
    c. eWRIMS – Confirmation that the existing database is comprehensive of all water rights
    d. The State Board suggests taking climate change into consideration when performing a water availability analysis, how has this been done when using simplified methods like the "area-ratio" method?

Additional Information

We obtained the "Water Availability Analysis Resources" from the State Board's website here: https://www.waterboards.ca.gov/waterrights/water_issues/programs/water_availability/

State Board and County of Modoc

Water Availability Analysis for the Pit River/Big Valley Groundwater Basin

Location:	Teams Video Call
Date:	August 5, 2022
Time:	10:00 AM
Attendees:	Nick Kehrlein (State Board) Mike Conway (State Board) Julian Storelli (State Board) Tiffany Martinez (County of Modoc) Garrett Rapp, Carolina Sanchez (West Yost)

AGENDA ITEMS

1. Background and objectives
    a. Overview of the Big Valley Groundwater Basin and its recharge goals
    b. Recap of discussion on 5/6/2022
    c. Meeting objectives
        i. Gather feedback on the current process to develop WAA
        ii. Understand instream flow requirements
2. Process to develop WAA
    a. West Yost to give background and explain proposed process to determine water availability
        i. Water rights records database – Annual water use reports, maximum rates of diversion, permit face value
        ii. Comparison to stream gage data and instream flow requirements
    b. Discussion on proposed process, recommendations from State Board staff
    c. Questions on instream flow requirements:
        i. Confirm understanding of instream flow requirements.
        ii. Is it sufficient to demonstrate that the Cannabis Policy Flow Requirement is met in the months specified?
        iii. Can we propose a compliance gage to evaluate instream flow requirements if one is not specified? (e.g., Muck Valley Dam)
        iv. Is there an instream flow requirement for months outside of those specified? Does it revert to the existing flow requirement?
        v. Do all diversions need to comply with the 50% bypass requirement discussed on p. 12 of the Cannabis Cultivation Policy? Is there any information that can be provided to be exempt from that requirement?
        vi. Recommendations on addressing different time step in data vs. requirements (monthly reporting vs. daily instream flow requirements).
3. Next steps
    a. Schedule next monthly meeting

State Board and County of Modoc

Water Availability Analysis for the Pit River/Big Valley Groundwater Basin

Location:	Teams Video Call
Date:	October 3, 2022
Time:	11:00 AM
Attendees:	Ben McCovery (State Board) Mike Conway (State Board) Julian Storelli (State Board) Tiffany Martinez (County of Modoc) Garrett Rapp, Carolina Sanchez (West Yost)

AGENDA ITEMS

1. Background and objectives
    a. Overview of the Big Valley Groundwater Basin and its recharge goals
    b. Recap of discussion on 8/22/2022
    c. Meeting objectives
        i. Gather feedback on proposed WAA process
2. Process to develop WAA
    a. Shasta Lake water rights and data
    b. West Yost explains proposed WAA process based on guidelines for WAA for Streamlined Recharge Permitting
        i. 90/20 estimates at nearby gages
        ii. Using daily values for monthly/annual face values
        iii. Transfers of water rights
3. Next steps
    a. Review of proposed scope of work for conducting a WAA for Streamlined Recharge Permitting

State Board and County of Modoc

Water Availability Analysis for the Pit River/Big Valley Groundwater Basin

Location:	Teams Video Call
Date:	December 12, 2022
Time:	10:00 AM
Attendees:	Ben McCovery (State Board) Mike Conway (State Board) Julian Storelli (State Board) Tiffany Martinez (County of Modoc) Garrett Rapp, Carolina Sanchez (West Yost)

AGENDA ITEMS

1. Background and objectives
    a. Overview of the Big Valley Groundwater Basin and its recharge goals
    b. Recap of discussion on 10/3/2022
    c. Meeting objectives
        i. Discuss feedback on proposed WAA scope document
2. Feedback on proposed WAA scope document
    a. State Board comments
    b. West Yost presents preliminary results on 90/20 analysis
3. Summary of West Yost discussion with DWR on regulatory support
    a. Suggestion of flood threshold for determining water availability
4. Next steps
    a. Address State Board comments
    b. Continue project definition (location, diversion volume, etc.)

State Board and County of Modoc

Water Availability Analysis for the Pit River/Big Valley Groundwater Basin

Location:	Teams Video Call
Date:	January 10, 2023
Time:	10:00 AM
Attendees:	Ben McCovery (State Board) Julian Storelli (State Board) Tiffany Martinez (County of Modoc) Garrett Rapp, Carolina Sanchez (West Yost)

AGENDA ITEMS

1. Feedback on proposed WAA scope document and water rights
    a. Insights and advice from recent temporary permits
    b. Feedback on water right data provided by West Yost
    c. Initial Statements of Diversion and Use or other data that can be used to quantify pre-1914 diversions
    d. Recommendations for methods to compare the water rights to the chosen gage for the 90/20 analysis to determine availability
    e. Other considerations and specific feedback on workplan
2. Optional discussion - Summary of West Yost discussion with DWR on regulatory support
    a. Suggestion of flood threshold for determining water availability
3. Next steps
    a. Address State Board comments
    b. Continue project definition (location, diversion volume, etc.)
    c. Engage with CDFW

Appendix 13 Uplands Geologic Assessment - Big Valley Groundwater Basin

Memo

To:	Mr. Gaylon Norwood
From:	Chris Petersen, Brian Hausback, David Fairman
Date:	April 11, 2022
Re:	Uplands Geologic Assessment Big Valley Groundwater Basin GEI Project 1901113

Dear Mr. Norwood:

GEI Consultants, Inc. (GEI), in coordination with volcanologist Brian Hausback from Sacramento State University, prepared this technical memorandum to describe the results of the Uplands Geologic Assessment (UGA) for the Big Valley Groundwater Basin (BVGB or Basin). The UGA was performed during development of the Groundwater Sustainability Plan (GSP) for the BVGB to investigate the geologic conditions in the areas surrounding the BVGB and further understand the role of these areas related to groundwater in the BVGB and, in particular, recharge to the BVGB originating from uplands areas.

Background and Geologic Units

The BVGB is located on the border between Lassen and Modoc counties in northeastern California and is identified by the California Department of Water Resources (DWR) as Basin No. 5-004. The Basin boundary was drawn by DWR using a 1958, 1:250,000 scale geologic map produced by the California Geologic Survey (CGS 1958), included as **Figure 1**. This map shows the source of recent lava flows northwest of the BVGB. This source area can be identified by the numerous cinders labeled as asterisks (*). Further information about the geology of the BVGB and surrounding areas can be found in the GSP. (Lassen and Modoc GSAs 2021)

DWR defines a groundwater basin as 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…" (DWR 2020) DWR's delineation of the BVGB was determined by DWR to coincide with the boundary between units described as alluvial and those described as volcanic on the CGS (1958) map.

However, the BVGB boundary as drawn may not represent "…features that significantly impede groundwater flow…" because in volcanic areas such as this, volcanic, alluvial, and lake deposits often interfinger with one another for long distances away from the valley floor. Furthermore, volcanic deposits themselves can often transmit water readily due to being either highly fractured, or porous in nature such as ash, tuff, pumice, and cinder deposits. Some volcanic deposits, such as ash-fall, can be altered into clays to form aquicludes. However, these horizontal confining layers do not affect the ability of groundwater to move laterally across the basin boundary.

DWR's (1963) investigation of groundwater resources in the region specifically identified areas outside of the valley floor as "forebays" for recharge into the valley. Those "upland recharge" areas are shown on **Figure 2** and are generally in three locations relative to the BVGB: to the northeast (along Barber

Ridge), northwest, and southeast. The UGA investigates each of these regions for their potential to provide recharge to the BVGB.

In addition to geologic maps from the CGS (1958) and DWR (1963), a more detailed geologic map was drawn by GeothermEx (1975) during an investigation of geothermal resources in the area. This map, shown on **Figure 3**, is considerably more detailed than the previous ones. A summary of the geologic units defined by GeothermEx is included in **Attachment A**.

Methods of Analysis

For this UGA, several methods of analysis were employed. On October 21-22, 2019, Modoc County Farm Advisor, Laura Snell, accompanied volcanologist Brian Hausback and David Fairman on a field survey of the upland area geologic units. Hand samples were collected representative of different upland areas and different geologic units identified by GeothermEx (1975). Locations of the hand samples are shown on **Figure 3**. Samples were analyzed for geochemical composition or assessed by microscopic thin section, or both. Geochemical analysis was performed by ALS Global[1] for a combination of major elements, rare earth and trace elements from method ME-MS81d and for major and minor oxides using method ME-ICP06. Thin sections were prepared by Wagner Petrographic[2] using a blue epoxy impregnation to allow visualization of sample pore spaces. Additionally, an analysis of well completion reports[3] in the upland areas northwest and southeast of Big Valley was performed to evaluate the amount of interfingering of alluvial deposits among these areas mapped as volcanic.

Results

Attachment B contains the geochemical evaluation of the samples analyzed. **Attachment C** contains the petrographic analysis of the thin sections analyzed. Locations of the samples are shown on **Figure 3**. **Table 1** contains a summary of the findings from these assessments. Based on the assessment, distinction among the older Tertiary (T) units distinguished by GeothermEx (Tpbu, Tpbl, and Tm) could not be made. Identification of these older units were combined into a single summary unit: Tb. More recent volcanic units are summarized as Qtb. Finally, the sedimentary units that make up much of the BVGB aquifer and are exposed in areas around the basin are summarized as Ttsl and Ttsu. The criteria used to designate the units are shown in **Table 2**.

Well log records from DWR (2022) from northwest and southeast of the BVGB were inspected and digitized. Each of the material descriptions were transcribed and converted to standardized lithologies. These lithologies were then classified as alluvial or non-alluvial (i.e. hard rock) and the percentage of alluvial sediments for each well calculated. **Table 3** summarizes the results of this analysis and the raw data is included in **Attachment D**. These results indicate that there is likely significant interfingering of alluvial sediments (38-86%) with areas northwest of the BVGB. Results from the area southeast of the BVGB are less clear, as there were fewer well logs to analyze and the variability was greater (8-100%).

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[1] ALS Minerals Division – Geochemsitry located in Reno, NV. https://www.alsglobal.com/en/locations/americas/north-america/usa/nevada/reno-geochemistry
[2] Located in Linden, UT. https://www.wagnerpetrographic.com/
[3] Assembled by DWR in their OSWCR database and made available on the SGMA Data Viewer. https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

Findings

DWR (1963) delineates recharge areas northeast (along Barber Ridge), northwest, and southeast of the BVGB. Assessment of the likelihood of recharge from these upland areas into the BVGB is discussed below.

Contrary to the mapping by DWR (1963), the uplands northeast of the BVGB along Barber Ridge are unlikely to provide subsurface recharge. Based on both the GeothermEx map and the samples collected in this study, that area is of Tertiary age and has a low probability that it is significantly interconnected to the groundwater basin through the subsurface. The primary route for recharge of precipitation on Barber Ridge to the BVGB is likely through surface or shallow subsurface flow off the mountains encountering the coarse alluvial deposits (Qal) along the edge of the valley. Managed recharge efforts could be focused on this edge of the basin.

To the northwest, subsurface recharge from the uplands to the BVGB is likely to occur. The GeothermEx map and results of this study validate that area as being of relatively young (Quaternary) volcanics. Interfingering of alluvial deposits is indicated by the high percentage of alluvial descriptions in well logs in that area.

To the southeast, subsurface recharge from the uplands to the BVGB may occur. This study validated most of the GeothermEx mapping which shows older (Tertiary) volcanic deposits in much of the uplands area. The small area of younger (Quaternary) volcanics may provide recharge. Additionally, these younger deposits may extend further south than mapped by GeothermEx because sample BH19BV-02 was sampled in an area mapped as older, but the chemical and petrographic analyses indicate it is more likely younger. The interfingering of alluvial deposits was less clear in the analysis of well logs.

Conclusions

Subsurface recharge from uplands areas northwest and southeast of the BVGB is likely to occur. This study validates that the GeothermEx geologic map (GeothermEx 1975) is more detailed and likely more accurate than the one used by DWR (CGS 1958) to delineate the basin boundary. Usage of the GeothermEx map in any future basin boundary modifications may be warranted. Furthermore, inclusion of upland young volcanics (Qtb) within the groundwater basin may be justified due to their ability to store and transmit groundwater, their interfingering with alluvial sediments, and their potentially significant role in providing recharge to the BVGB.

Please let us know if you have any questions about this memorandum.

Regards,

Chris Petersen | Brian Hausback | David Fairman

Enclosures:

Tables 1-3

Figures 1-3

Attachment A: Big Valley Upland Geologic Units

Attachment B: Geochemical Evaluation of Upland Lavas Surrounding Big Valley

Attachment C: Big Valley Petrography

Attachment D: Well Log Analysis

Attachment E: References

Table 1: Summary of Geochemical-Petrographic Unit Designations

SAMPLE	GeothermEx Unit	Field Unit	Geochem Unit	SiO2	Petrographic Unit	Summary Unit
BH19BV-01	Tpbu	Tpbu	Tb-like	52.48	Tb-like	Tb
BH19BV-01A	Tpbu	Tpbu			Tb-like ash	Tb
BH19BV-02	Tpbu	Qtb	Qtb-like	47.65	Qtb-like	Qtb*
BH19BV-03	Qtb	Qtb	Qtb-like	47.53	Qtb-like	Qtb
BH19BV-04	Qtb	Qtb	Qtb-like	48.03	Qtb-like	Qtb
BH19BV-05	Ttsu	Ttsu			Ttsu	Ttsu
BH19BV-06	Ttsu	Ttsu			Ttsu	Ttsu
BH19BV-08	Tpbl	Tpbl	Tb-like	56.07	Tb-like	Tb
BH19BV-10	Tm	Tb	Tb-like	51.10	Tb-like	Tb
BH19BV-11	Tm	Tb	Tb-like	53.83	Tb-like	Tb
BH19BV-12	Tm	Tb			Tb-like	Tb
BH19BV-13	Qtb	Qtb	Qtb-like	47.17	Qtb-like	Qtb
BH19BV-15	Ttsl	Ttsl			Ttsl	Ttsl
BH19BV-16A	Ttsl	Ttsl			Ttsl	Ttsl
BH19BV-16B	Ttsl	Ttsl			Ttsl	Ttsl
BH19BV-17	Tpbl	Qtb	Qtb-like	47.42	Qtb-like	Qtb
BH19BV-18	Tpbu	Tpbu	Tb-like	54.08	Tb-like	Tb

* indicates that summary unit is different from unit mapped by GeothermEx

Table 2: Summary Unit Designation Criteria

Summary Unit	**Age**	**Rock Type**	**Petrographic Designation Criteria**
Qtb	Quaternary-Pliocene	basalt	Plagioclase = Clinopyroxene > Olivine Distinctive Subophitic groundmass texture ± Phenocrysts of olivine (up to 2 mm)
Tb	Tertiary-Miocene	basaltic andesite	Plagioclase dominant > olivine; ± groundmass clinopyroxene; ± orthopyroxene Variable texture: trachytic, intersertal, intergranular ± Phenocrysts of olivine (up to 3mm); uncommon plagioclase
Ttsl and Ttsu	Tertiary	sedimentary (Bieber Formation)	Reworked siliceous ash and volcanic sandstone. Upper part (Ttsu) fresh and glassy, angular clasts (less reworked). Lower part (Ttsl) altered, rounded clasts (more reworked);significant clay content; possibly hydrothermal alteration.

***Table* 3**: Well Log Assessment for Areas Northwest and Southeast of the BVGB

Well Completion Report Number	Total Well Depth (feet)	Length of Alluvial Sediments (feet)	Length of Hard Rock (feet)	Percent Alluvial Sediments
Northwest of Big Valley				
WCR1980-006723	140	71	69	51%
WCR2006-007508	145	125	20	86%
WCR1993-009774	185	100	85	54%
WCR1992-013718	205	127	78	62%
WCR2006-007502	225	85	140	38%
WCR2004-011016	775	435	340	56%
Southeast of Big Valley				
WCR1993-009636	302	24	278	8%
WCR2006-009179	246	246	0	100%
WCR1977-007356	648	299	349	46%
WCR1985-008010	152	70	82	46%

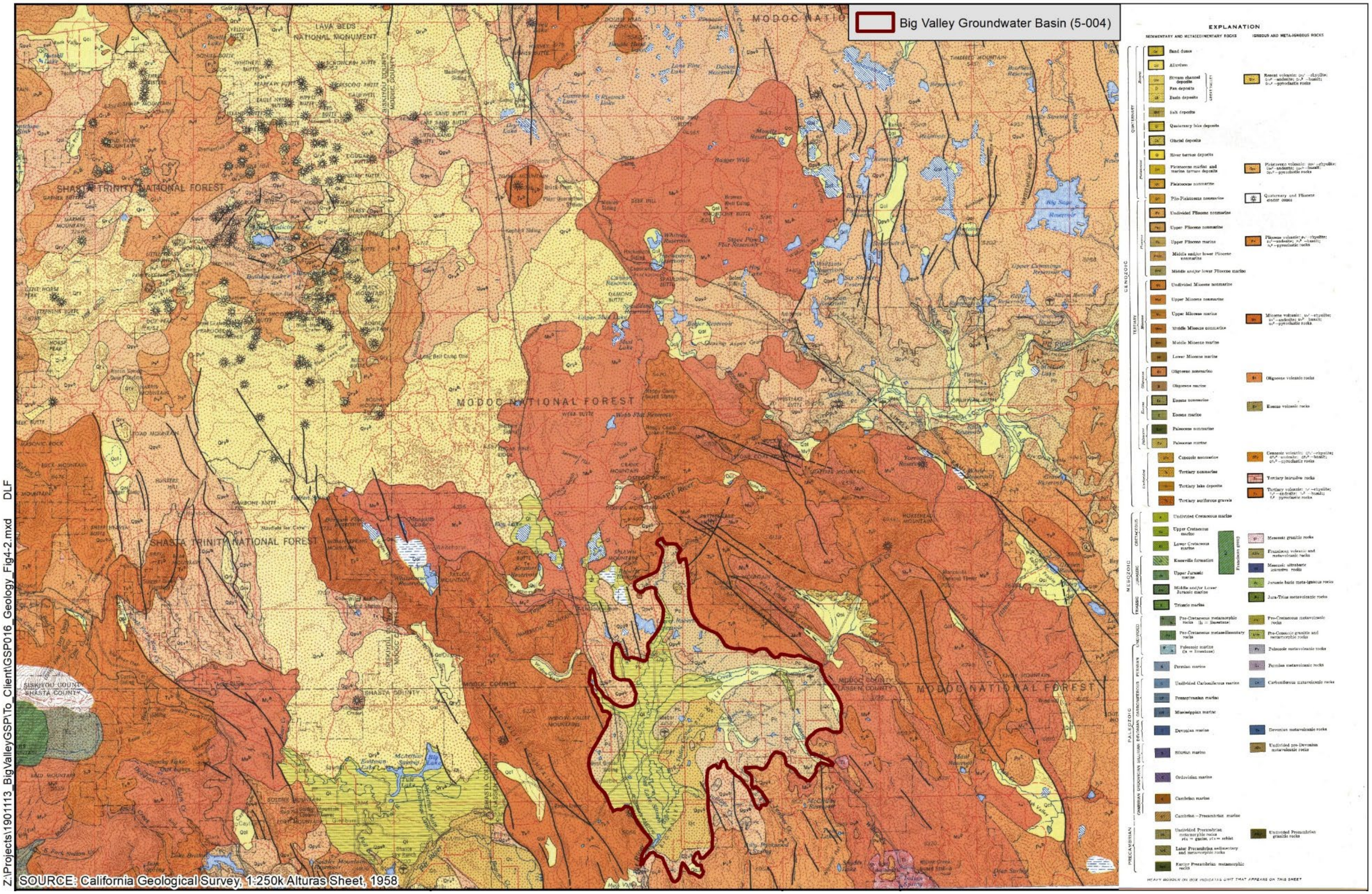


Figure 1: *Regional Geology, Alturas Sheet: California Geological Survey 1:250,000* scale

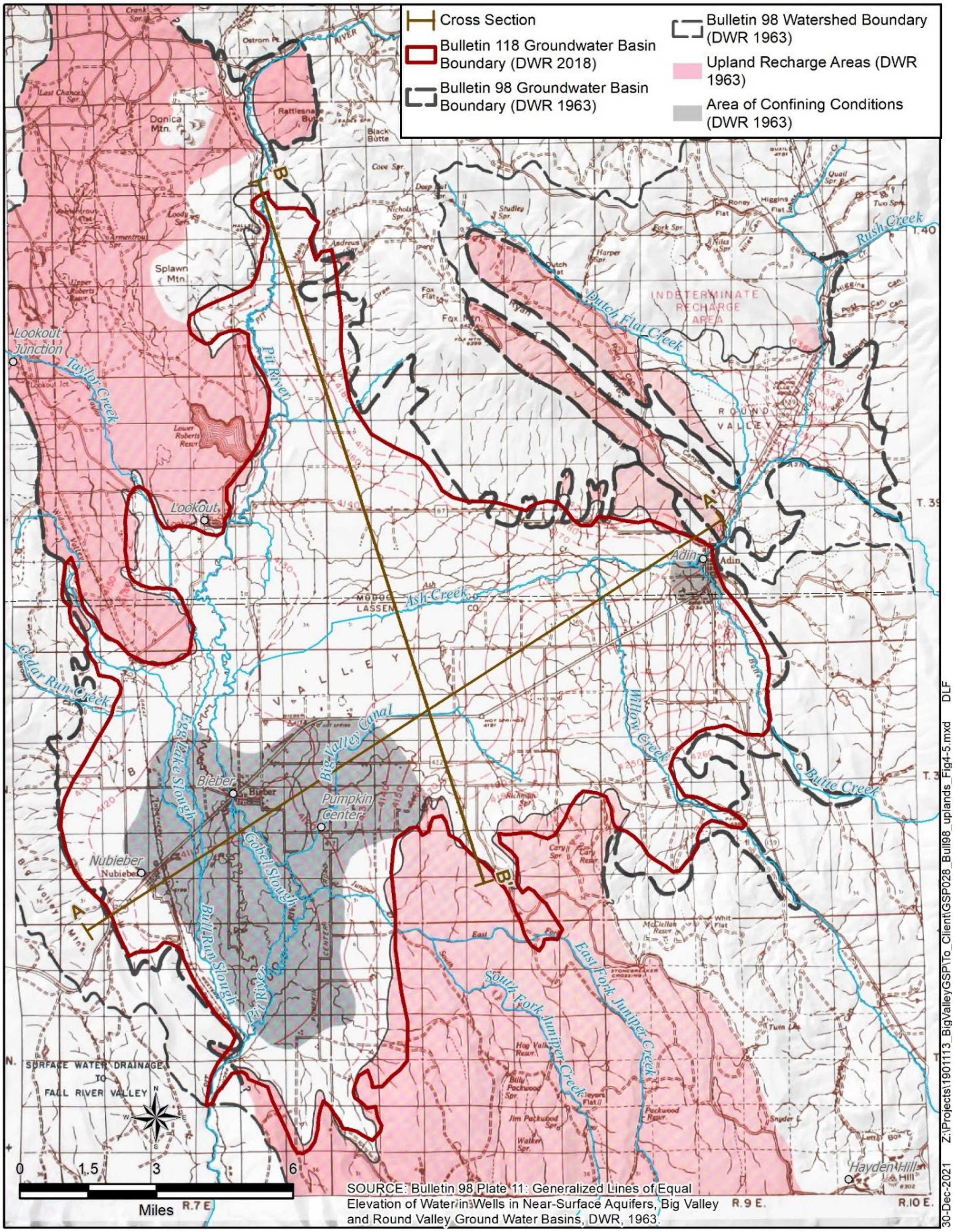


Figure 2: *Upland Recharge Areas, Northeastern Counties Ground Water Investigation, Bulletin 98, DWR (1963)*

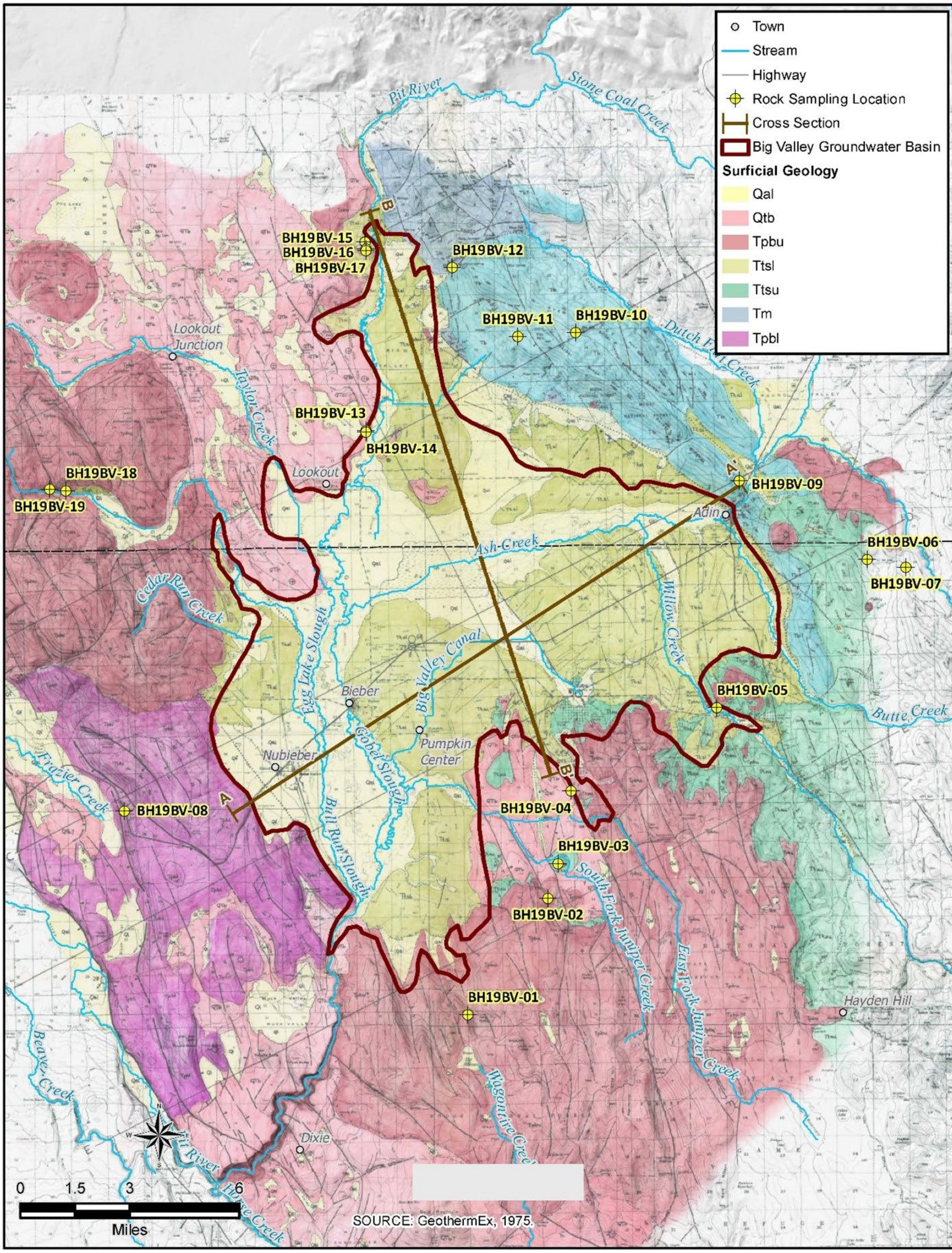


Figure 3: *Geologic Map, Geology of the Big Valley Geothermal Prospect, GeothermEx (1975)*

Attachment A

Big Valley Upland Geologic Units

Big Valley Upland Geologic Units

Unit names and symbols from Geothermix Study, 1975; <u>Listed young to old</u>

Compiled by Brian Hausback, 2019

QTb – basalt flows and eruptive centers

Description: light grey, plagioclase-rich flows, as are all the others in this general group. Cover an eroded surface developed on (Tts) rocks, similar to the position held by certain (Tpbu) units. They form a continuous plateau in the northern part of the mapped area, north of Lookout. Isolated erosional remnants of flows also are present in the northern Juniper Creek Hills and elsewhere. These may not all be part of a formerly continuous sheet, but they occupy a generally similar position in the stratigraphic sequence of the area. The thickness of the isolated basalt caps in the southern part of the region amount to a few tens of feet. Thickness appears to increase northward from Lookout.

Stratigraphy-Age: Spans the Plio-Pleistocene interval, based on stratigraphic relations, and amount of weathering, dissection, and deformation. At the north end of the valley (Ttsl) is covered by flood basalts of the (QTb) unit. Tpbl is overlain by QTb in the Pit River gorge

Distinction: less faulted than adjacent older flows.

Unit – Ttsu

Description: Thinly bedded tuffaceous siltstone, which may be diatomaceous; poorly consolidated cross-bedded sands and pebbly sands; beds of massive, light-colored ash-flow tuff, with large, fresh pumice fragments; two, or possibly more, massive units of dark gray ash-flow tuff characterized by large fragments of black pumice, dacite glass and basalt; and at least two thin, glassy basalt flows showing evidence of extrusion into water. Ttsu unit is the most recent product of silicic volcanism in the project area.

Stratigraphy-Age: 6.67 ± 2.5Ma from welded tuff from near the top of the section in the Hayden Hill area. Ttsu is at least 1,000 feet thick. The massive tuffs appear to be thickest and most coarsely textured in the Hayden Hill area and in the hills to the east of Highway 139. The thin bedded, fine-grained water-laid materials increase northward, toward Big Valley. It appears to overlie (Tb) in the hills southeast of Adin. Dacite or rhyolite intrude the tuffs near Hayden Hill. Altered andesite dikes intrude the unit at Little Gold Hill. The largest of these intrusions is only a few acres in extent. In both of these areas the surrounding tuffs have undergone silicification, kaolinization and zeolitic alteration. A gold mining district was developed at Hayden Hill in mineralization related to these intrusives. The intrusives are younger than the upper member tuffs which they penetrate, but they appear to be similar in composition to the tuffs and probably are essentially contemporaneous with them.

Unit – Ttsl - Diatomaceous and tuffaceous sediments of Big Valley

Description: Characteristic lithologies are white, tuffaceous diatomite in beds up to 10 feet or more thick, and thin-bedded grey sandstone containing basalt fragments. Cross-bedded fluvial sands are present locally. Thin scoriaceous basalt flows were extruded into the lacustrine beds in the northern and northwestern parts of the area. Surface exposures are limited to a few tens of feet of section in any one locality.

Stratigraphy-Age: Pliocene. More than 1200 feet thickness in water wells in Big Valley. The relationship of the (Ttsl) unit to older rocks is not exposed in any field locality, and none of the well logs in Big Valley provides information on the materials underlying it. On the west side of the valley, general field relationships suggest that the basalt flows of the southern Big Valley Mountains (Tpbl) are older than Ttsl and underlie the unit at least locally. Farther north, along the west side of the valley, the large basalt eruptive centers of Widow Mountain and Jimmerson Mountain appear to be either contemporaneous with or slightly younger than Ttsl. At the north end of the valley (Ttsl) is covered by flood basalts of the (QTb) unit.

Tpbl – Lower Unit Basalt Flows of Pliocene Age

Description: basalt flows and cindery agglutinate within which minor amounts of basaltic tuff. Mostly of light grey plagioclase-rich holocrystalline basalt, with a range of textures including slightly porphyritic and diktytaxitic variations. Locally, near eruptive centers, the rock is a red, cindery breccia. The flows average 15 to 20 feet in thickness. Adjacent flows are often separated by a foot or two of red, cindery soil. Representative exposure can be seen along Highway 299, between MacArthur and Nubieber. Distinguished from petrologically similar, younger, plagioclase-rich basalts by its weathering characteristics. Most of the original scoriaceous surfaces have been destroyed, soils are well-developed, and the interior parts of flows often are weathered into rounded boulders.

Stratigraphy-Age: ….believed to be contemporaneous with parts of the Tts. Equivalent to the "Big Valley Mountains Volcanic Series" of Hail (1961). General field relationships suggest that the basalt flows of the southern Big Valley Mountains (Tpbl) are older than (Ttsl).

Distinction: Distinguishable from younger flows of the (Qb) assemblage on the basis of the amount of deformation and erosion effecting them and by their apparent relationships to Pliocene-age sediments (Tts).

Tb - Basalt Flows, Breccias and Lithic Tuff

Description: Interbedded basalt flows, flow breccias and lithic ash-flow tuffs. Typical basalts of this unit are dark grey and fine grained, with small (<2mm) phenocrysts of olivine and plagioclase. Pyroclastic rocks, which make up the largest part of the member, consist of massive tuff breccias containing basalt fragments, and lapilli tuff with abundant white pumice fragments. These tuffs show a moderate to high degree of induration. Glass in the characteristic white pumice fragments appears to be devitrified, at least in surface outcrops. The pyroclastic units seem to increase in abundance upward in the section.

Stratigraphy-Age: late Miocene. 13.8 ± 2. 4 Ma from a basalt at Barber Ridge. In Turner Canyon, an estimated thickness of 3,500 feet of the unit is present, without either top or base being exposed.

Distinction: The olivine characteristically is altered to iddingsite, an important factor in distinguishing these flows from younger basalts.

Tm – Andesite and Tuff

Description: The most characteristic rock type is red, porphyritic andesite, containing phenocrysts of plagioclase and hornblende. The vesicles are filled with zeolite minerals, calcite or chalcedony. Calcite veins are common. Estimated that about 65 percent of the member is pyroclastic in origin, consisting of tuff breccia and air-fall tuff. About 15 percent is made up of tuffaceous sediments and about 25 percent consists of flows and flow breccias of andesite or basalt. Poorly exposed and details of the lithology are known only in small areas. It tends to form smooth, moderately steep slopes where tuffs predominate. Areas underlain by lava flows are characterized by poorly defined ledges. Some of the tuffaceous rocks of this unit are green, apparently due to alteration. Fine-grained, tuffaceous sediments and lignite are reported from this member also, with petrified wood float associated with it.

Stratigraphy-Age: Miocene. Oldest stratigraphic unit exposed in the project area. More than 2,000 feet of strata are exposed south of Black Butte. Neither the top nor the bottom of the unit is exposed. Its only contact with the overlying unit (Tb) appears to be a fault.

Distinction: In general, unit Tm is distinguished by its abundance of andesite flows as compared to the predominantly basalt character in the overlying Tb unit. The degree of alteration and fracturing distinguish it from other, younger andesite units.

Attachment B

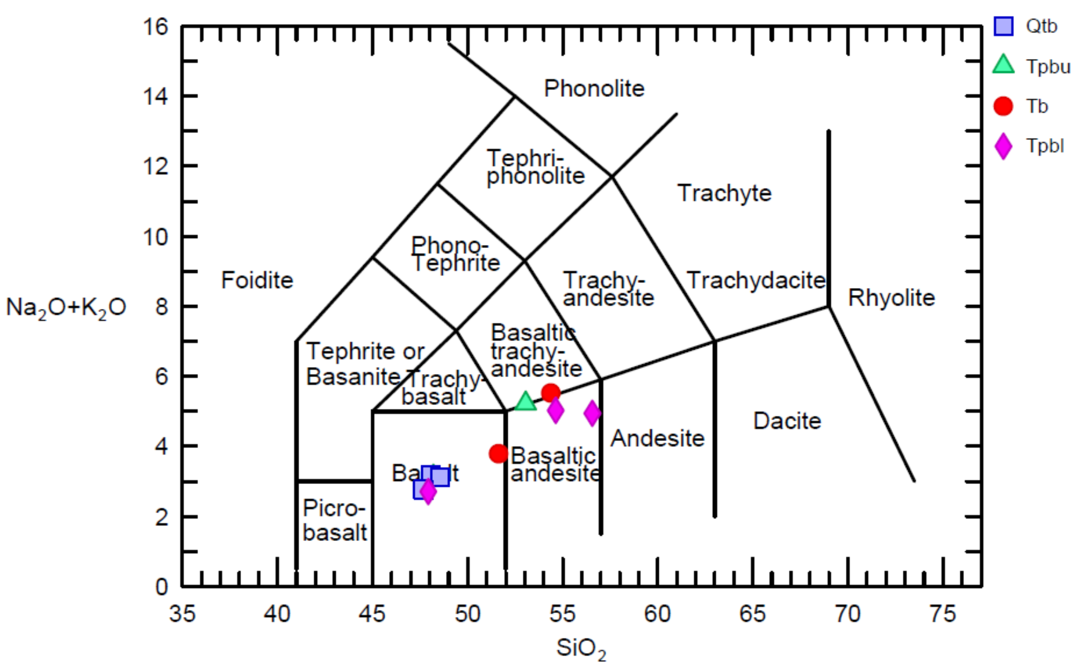
Geochemical Evaluation of Upland Lavas Surrounding Big Valley

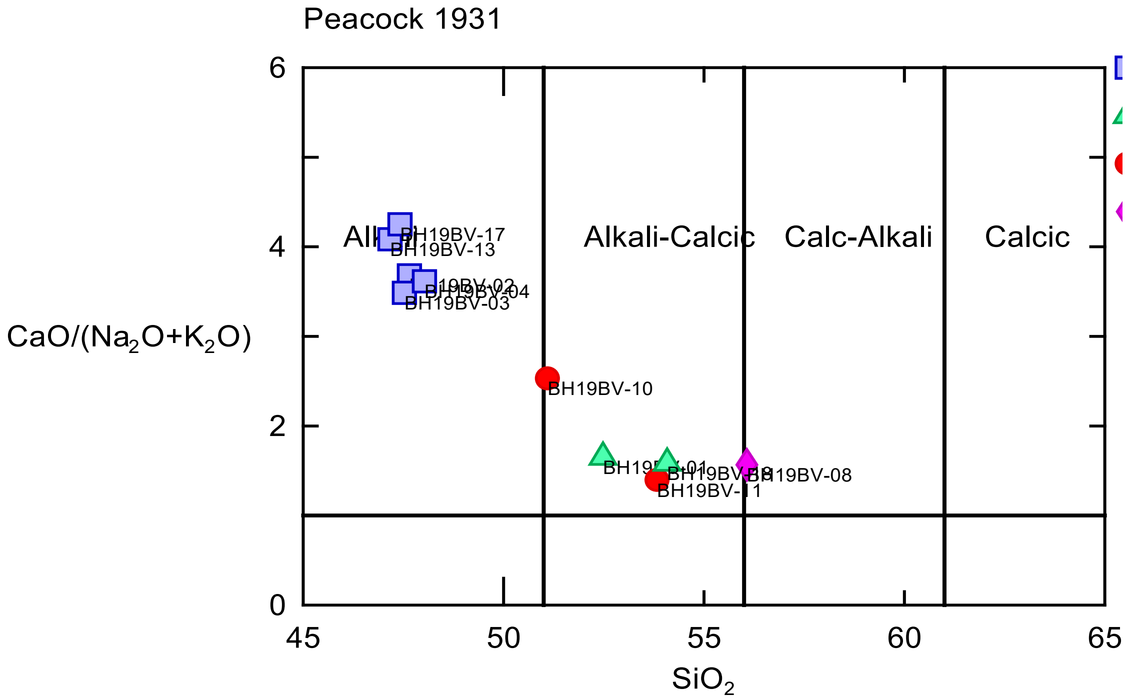
Geochemical Evaluation of Upland Lavas Surrounding Big Valley, California

Brian Hausback

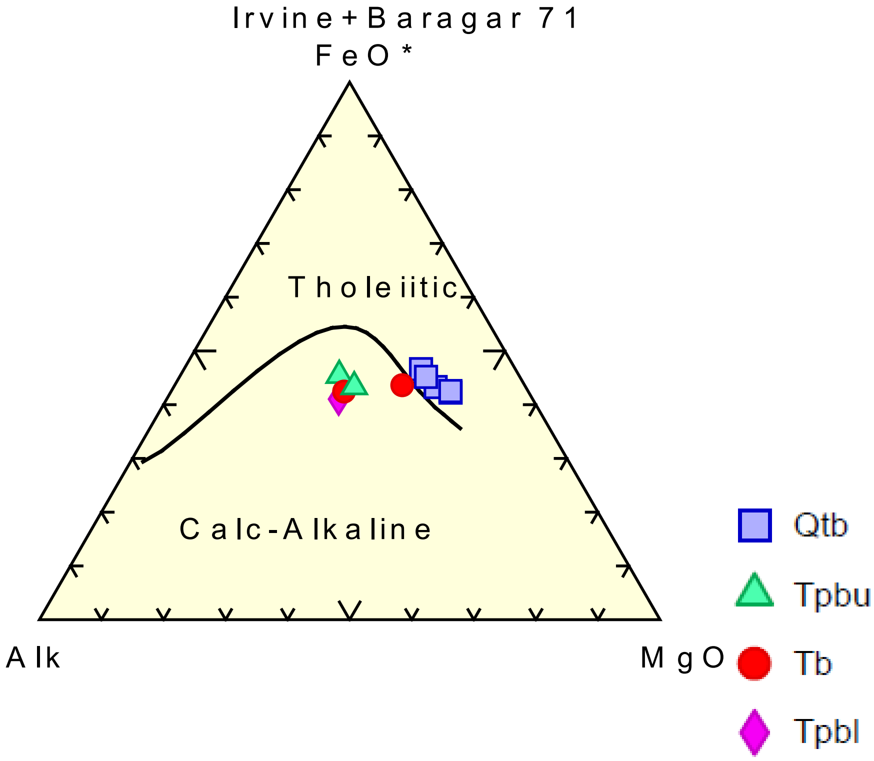
Summary and Interpretation of Geochemistry

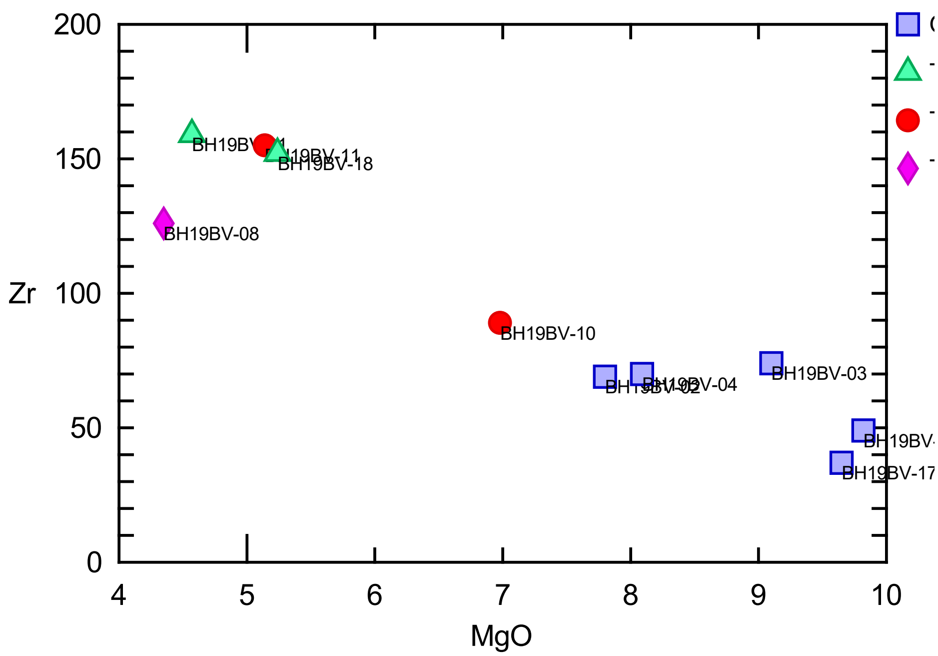
There appear to be two suites of lavas surrounding Big Valley. The two suites are distinctive in their geochemical patterns, in both combinations of major and trace elements. QTb, the younger (Quaternary-Pliocene) unit consists of true basalts and show a mantle geochemical affinity. The older (Miocene) unit (combination of Tb, Tpbu, and Tpbl) are an assortment of basaltic andesites with a distinctive subduction zone chemical affinity. The volcanic evolution of the area began with Miocene subduction volcanism from scattered vents in the eastern portion of the Cascade arc. Probably associated with Pliocene to Recent, Basin and Range structural extension, the tholeiitic, shallow mantle melts of the QTb unit erupted from fissure vents along a developing normal fault system. The extension produced shallow mantle melting and developed the modern topography that includes graben-basins such as Big Valley.

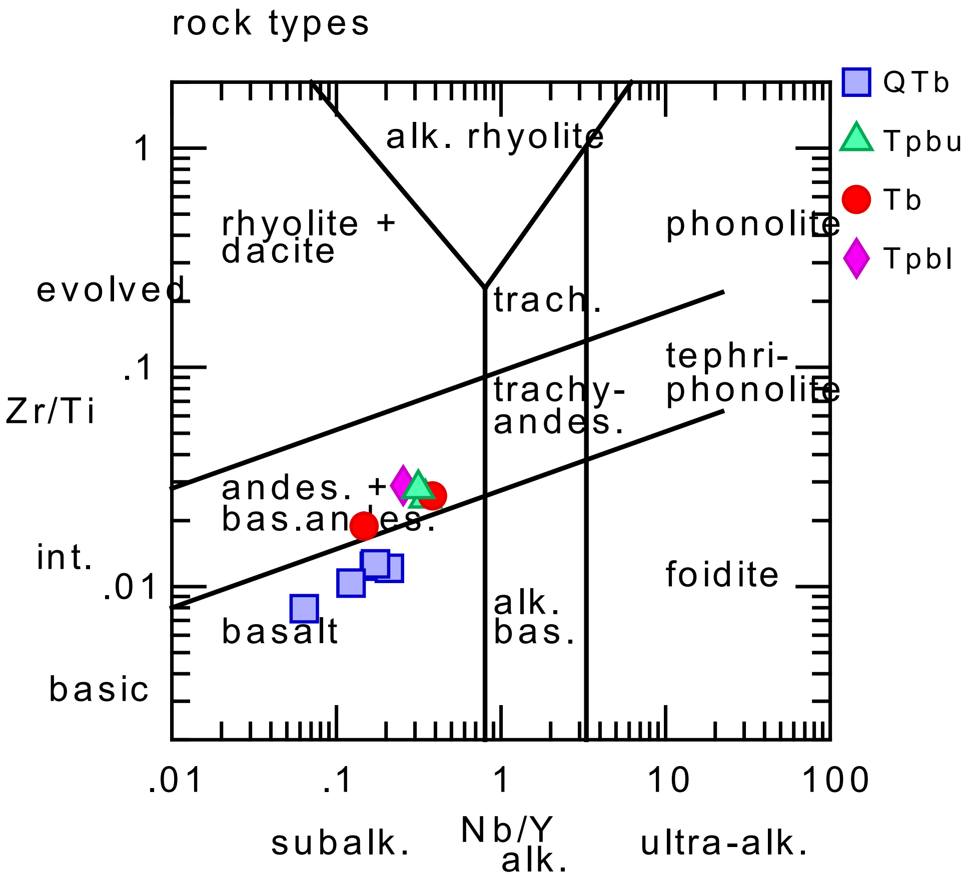




Peacock 1931
CaO/(Na2O+K2O)
SiO2
Alkali-Calcic
Calc-Alkali
Calcic
BH19BV-17
BH19BV-13
BH19BV-04
BH19BV-03
BH19BV-10
BH19BV-11
BH19BV-08


Irvine+Baragar 71
FeO*
Tholeiitic
Calc-Alkaline
Alk
MgO
Qtb
Tpbu
Tb
Tpbl


Zr
MgO
BH19BV-08
BH19BV-10
BH19BV-18
BH19BV-04
BH19BV-03
BH19BV-17



rock types
QTb
Tpbu
Tb
Tpbl
alk. rhyolite
rhyolite +
dacite
phonolite
evolved
trach.
tephri-
phonolite
trachy-
andes.
Zr/Ti
andes. +
bas.andes.
int.
foidite
alk.
bas.
basalt
basic
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.01
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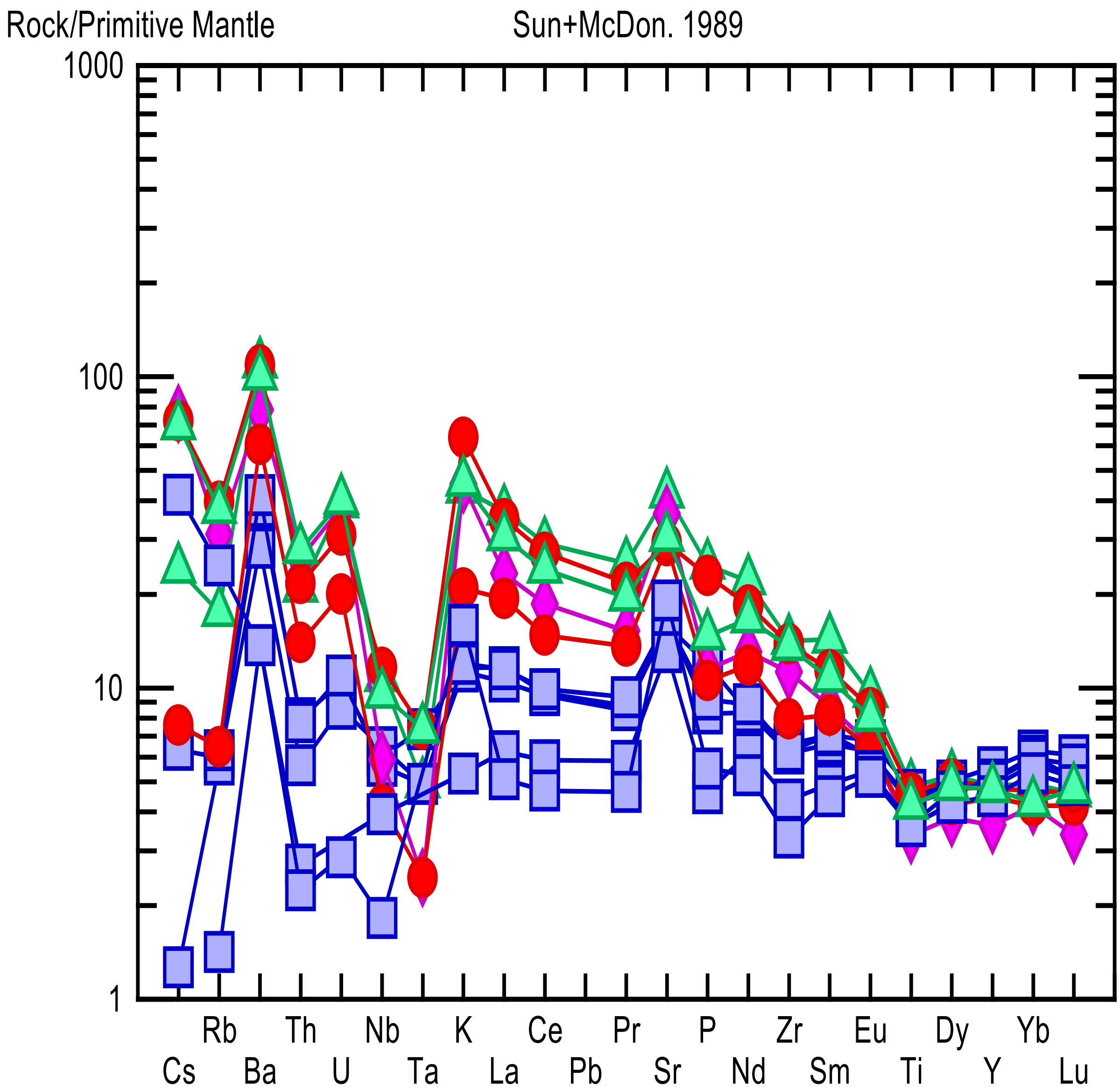
100
subalk.
Nb/Y
alk.
ultra-alk.



Rock/Primitive Mantle
Sun+McDon. 1989
1000
100
10
1
Rb
Th
Nb
K
Ce
Pr
P
Zr
Eu
Dy
Yb
Cs
Ba
U
Ta
La
Pb
Sr
Nd
Sm
Ti
Y
Lu

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SACRAMENTO CA 95819-6043

Finalized Date: 28-NOV-2019
Account: CALSSA

CERTIFICATE RE19279282

Project: Volcanic petrologic geochem

This report is for 10 Rock samples submitted to our lab in Reno, NV, USA on 4-NOV-2019.

The following have access to data associated with this certificate:

DAVID FAIRMAN	BRIAN HAUSBACK	

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
SND-ALS	Send samples to internal laboratory
CRU-QC	Crushing QC Test
LOG-22	Sample login - Rcd w/o BarCode
CRU-31	Fine crushing - 70% <2mm
PUL-31	Pulverize up to 250g 85% <75 um

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	INSTRUMENT
ME-ICP06	Whole Rock Package - ICP-AES	ICP-AES
OA-GRA05	Loss on Ignition at 1000C	WST-SEQ
ME-MS81	Lithium Borate Fusion ICP-MS	ICP-MS
TOT-ICP06	Total Calculation for ICP06	

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Comments: full project name: Volcanic Petrologic Geochemistry

Signature:
Saa Traxler, General Manager, North Vancouver

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Finalized Date: 28-NOV-2019
Account: CALSSA

Project: Volcanic petrologic geochem

CERTIFICATE OF ANALYSIS RE19279282

Sample Description	Method / Analyte / Units / LOD	WEI-21 Recvd Wt. kg 0.02	ME-MS81 Ba ppm 0.5	ME-MS81 Ce ppm 0.1	ME-MS81 Cr ppm 10	ME-MS81 Cs ppm 0.01	ME-MS81 Dy ppm 0.05	ME-MS81 Er ppm 0.03	ME-MS81 Eu ppm 0.03	ME-MS81 Ga ppm 0.1	ME-MS81 Gd ppm 0.05	ME-MS81 Hf ppm 0.2	ME-MS81 Ho ppm 0.01	ME-MS81 La ppm 0.1	ME-MS81 Lu ppm 0.01	ME-MS81 Nb ppm 0.2
BH19BV-01		0.08	767	51.7	80	0.19	3.84	2.46	1.61	19.3	5.35	3.8	0.84	25.4	0.34	7.7
BH19BV-02		0.14	267	17.1	200	0.05	3.71	2.79	1.05	15.4	3.60	1.8	0.89	8.0	0.45	4.3
BH19BV-03		0.16	197.0	16.8	210	0.01	3.50	2.58	1.14	14.4	3.65	1.7	0.88	7.2	0.38	4.6
BH19BV-04		0.20	291	17.6	210	<0.01	3.46	2.64	1.02	15.2	3.36	1.7	0.89	7.9	0.38	4.0
BH19BV-08		0.14	547	33.1	60	0.60	2.82	1.84	1.10	19.1	3.39	2.9	0.62	16.0	0.25	4.2
BH19BV-10		0.22	423	26.2	210	0.06	3.10	2.13	1.07	17.8	3.59	2.3	0.72	13.3	0.31	3.0
BH19BV-11		0.12	762	48.3	120	0.57	3.75	2.43	1.45	18.2	4.76	3.4	0.82	24.0	0.34	8.3
BH19BV-13		0.14	95.8	10.4	200	<0.01	3.43	2.80	0.91	14.6	3.19	1.3	0.82	4.3	0.42	2.8
BH19BV-17		0.20	95.8	8.3	220	0.33	3.15	2.36	0.87	13.1	2.90	1.1	0.81	3.5	0.36	1.3
BH19BV-18		0.10	702	42.7	140	0.55	3.55	2.15	1.35	18.5	4.75	3.6	0.78	21.0	0.35	6.8

Comments: full project name: Volcanic Petrologic Geochemistry

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CERTIFICATE OF ANALYSIS RE19279282

Sample Description / Method / Analyte / Units / LOD	ME-MS81 Nd ppm 0.1	ME-MS81 Pr ppm 0.03	ME-MS81 Rb ppm 0.2	ME-MS81 Sm ppm 0.03	ME-MS81 Sn ppm 1	ME-MS81 Sr ppm 0.1	ME-MS81 Ta ppm 0.1	ME-MS81 Tb ppm 0.01	ME-MS81 Th ppm 0.05	ME-MS81 Tm ppm 0.01	ME-MS81 U ppm 0.05	ME-MS81 V ppm 5	ME-MS81 W ppm 1	ME-MS81 Y ppm 0.1	ME-MS81 Yb ppm 0.03
BH19BV-01	29.9	6.93	11.1	6.36	1	884	0.2	0.73	1.78	0.32	0.82	213	1	22.2	2.42
BH19BV-02	11.3	2.42	3.8	2.94	1	355	0.3	0.60	0.68	0.41	0.22	249	1	25.3	3.10
BH19BV-03	11.3	2.34	3.6	3.13	1	335	0.2	0.61	0.48	0.36	0.18	231	1	21.9	2.80
BH19BV-04	12.0	2.58	4.0	3.15	1	347	0.2	0.57	0.66	0.42	0.23	255	1	23.1	2.98
BH19BV-08	17.7	4.21	19.8	3.87	1	765	0.1	0.48	2.23	0.24	0.80	163	1	16.5	2.06
BH19BV-10	16.0	3.76	4.1	3.63	1	604	0.1	0.52	1.19	0.30	0.42	244	1	20.3	2.06
BH19BV-11	25.0	6.02	25.2	5.08	1	616	0.3	0.64	1.84	0.33	0.65	194	1	21.6	2.31
BH19BV-13	8.4	1.61	0.9	2.18	1	275	<0.1	0.54	0.23	0.40	<0.05	240	<1	22.8	2.93
BH19BV-17	7.1	1.28	15.7	1.99	1	403	<0.1	0.52	0.19	0.35	0.06	264	<1	20.4	2.62
BH19BV-18	22.6	5.40	23.8	4.77	1	643	0.3	0.63	2.37	0.31	0.84	195	1	21.6	2.11

Comments: full project name: Volcanic Petrologic Geochemistry

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Project: Volcanic petrologic geochem

CERTIFICATE OF ANALYSIS RE19279282

Sample Description	Method / Analyte / Units / LOD	ME-MS81 Zr ppm 2	ME-ICP06 SiO2 % 0.01	ME-ICP06 Al2O3 % 0.01	ME-ICP06 Fe2O3 % 0.01	ME-ICP06 CaO % 0.01	ME-ICP06 MgO % 0.01	ME-ICP06 Na2O % 0.01	ME-ICP06 K2O % 0.01	ME-ICP06 Cr2O3 % 0.002	ME-ICP06 TiO2 % 0.01	ME-ICP06 MnO % 0.01	ME-ICP06 P2O5 % 0.01	ME-ICP06 SrO % 0.01	ME-ICP06 BaO % 0.01	OA-GRA05 LOI % 0.01
BH19BV-01		159	52.5	18.35	9.00	8.52	4.57	3.86	1.31	0.011	1.05	0.14	0.54	0.10	0.09	0.80
BH19BV-02		69	47.8	18.15	10.60	11.45	7.82	2.76	0.35	0.027	0.93	0.17	0.18	0.04	0.03	0.26
BH19BV-03		74	47.7	17.50	10.40	10.95	9.13	2.80	0.34	0.030	1.02	0.17	0.26	0.04	0.02	-0.46
BH19BV-04		70	47.7	17.95	10.15	11.05	8.03	2.70	0.36	0.028	0.91	0.17	0.20	0.04	0.03	0.41
BH19BV-08		126	56.3	18.70	7.18	7.70	4.37	3.55	1.37	0.008	0.73	0.11	0.25	0.09	0.06	0.60
BH19BV-10		89	51.8	18.40	9.34	9.62	7.08	3.16	0.64	0.029	0.80	0.15	0.23	0.07	0.05	0.31
BH19BV-11		155	53.2	17.25	8.58	7.53	5.08	3.50	1.90	0.017	0.99	0.14	0.49	0.07	0.09	0.41
BH19BV-13		49	47.4	17.85	10.25	11.25	9.87	2.59	0.16	0.028	0.79	0.17	0.10	0.03	0.01	-0.46
BH19BV-17		37	46.4	17.20	9.91	11.15	9.44	2.15	0.47	0.031	0.76	0.17	0.12	0.04	0.01	2.39
BH19BV-18		152	55.1	17.95	8.83	8.02	5.34	3.66	1.41	0.020	0.93	0.15	0.33	0.07	0.08	0.00

Comments: full project name: Volcanic Petrologic Geochemistry

***** See Appendix Page for comments regarding this certificate *****

ALS USA Inc.
4977 Energy Way
Reno NV 89502
Phone: +1 775 356 5395 Fax: +1 775 355 0179
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To: CALIFORNIA STATE UNIVERSITY
SACRAMENTO
DEPT.GEOLOGY CALIFORNIA STATE
U-SACRAMENTO
6000 J ST
SACRAMENTO CA 95819-6043
Project: Volcanic petrologic geochem

Finalized Date: 28-NOV-2019
Account: CALSSA

CERTIFICATE OF ANALYSIS RE19279282

Sample Description	Method Analyte Units LOD	TOT-ICP06 Total % 0.01
BH19BV-01		100.84
BH19BV-02		100.57
BH19BV-03		99.90
BH19BV-04		99.73
BH19BV-08		101.02
BH19BV-10		101.68
BH19BV-11		99.25
BH19BV-13		100.04
BH19BV-17		100.24
BH19BV-18		101.89

Comments: full project name: Volcanic Petrologic Geochemistry

***** See Appendix Page for comments regarding this certificate *****

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Finalized Date: 28-NOV-2019
Account: CALSSA

Project: Volcanic petrologic geochem

CERTIFICATE OF ANALYSIS RE19279282

CERTIFICATE COMMENTS

LABORATORY ADDRESSES

Processed at ALS Reno located at 4977 Energy Way, Reno, NV, USA.

Applies to Method:	CRU-31	CRU-QC	LOG-22	PUL-31
	SND-ALS	WEI-21		

Processed at ALS Vancouver located at 2103 Dollarton Hwy, North Vancouver, BC, Canada.

Applies to Method:	ME-ICP06	ME-MS81	OA-GRA05	TOT-ICP06

Attachment C

Big Valley Petrography

Big Valley Petrography

Brian Hausback

2021

General microscopy setup: All thin sections are mounted with blue-stained epoxy to illustrate pore space. Photographs are taken in pairs with plane-polarized light (PPL) on the left and cross-polarized light (XPL) on the right. The first row of photos is taken with a 4x objective lens; the second row is taken with a 10x objective lens.

Sample BH19BV-01

Location: 2 km north of Hoover Flat Reservoir; 14.4 km SE of Bieber

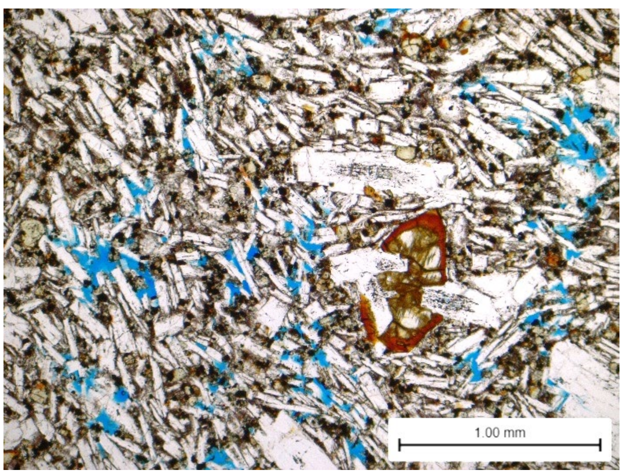
Map Unit: Tpbu

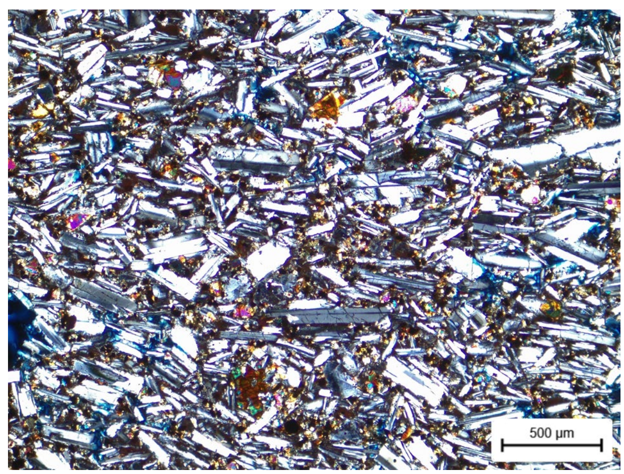
Interpretation: basaltic lava

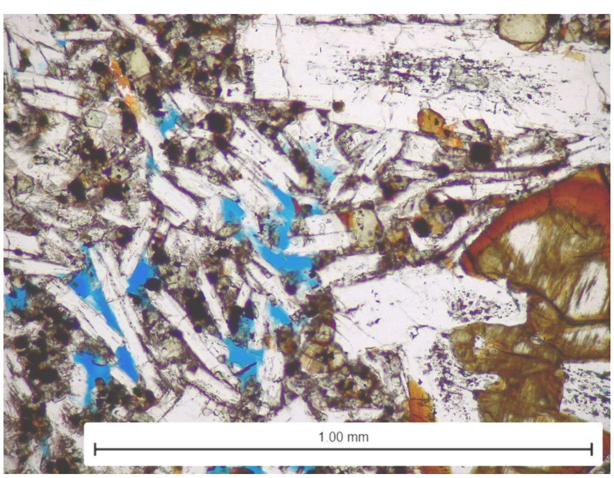
Texture: fine-grained intergranular to micro-diktytaxitic trachytic groundmass (<1mm); seriate with micro-phenocrysts (1-3mm)

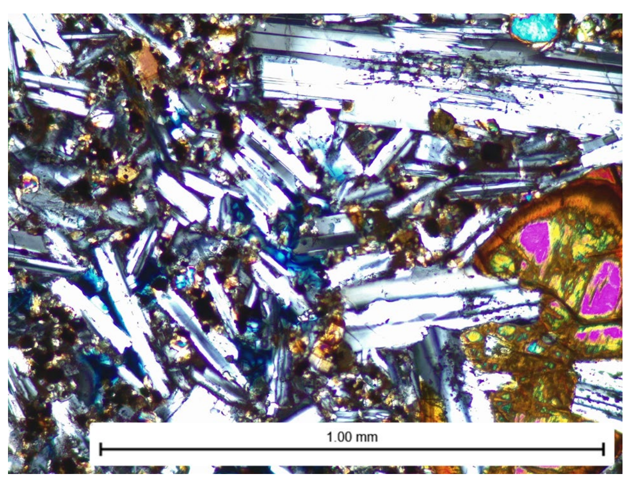
90% Groundmass: plagioclase > opaque> clinopyroxene > olivine

10% Micro-phenocrsts: plagioclase > olivine (strong iddingsite alteration)



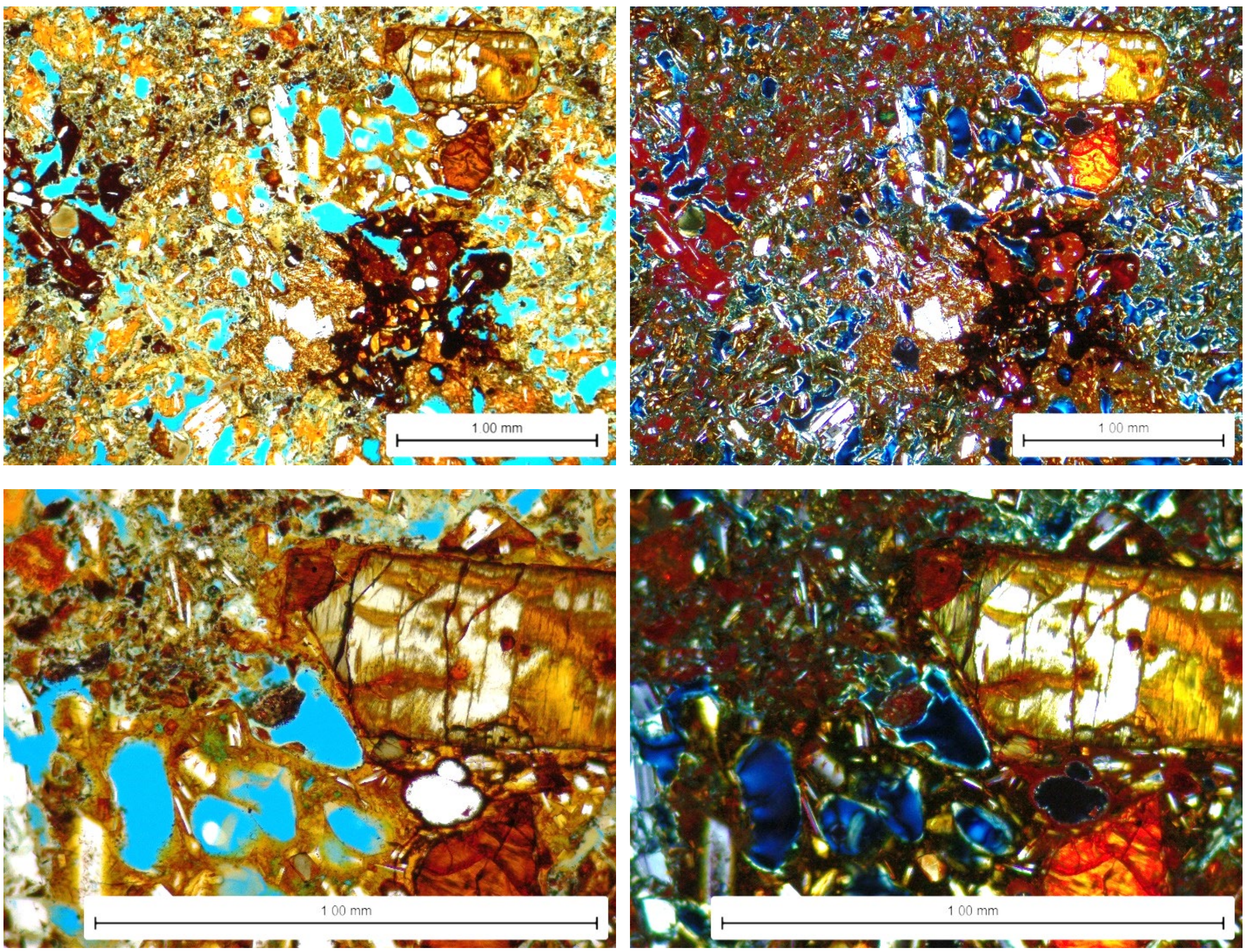






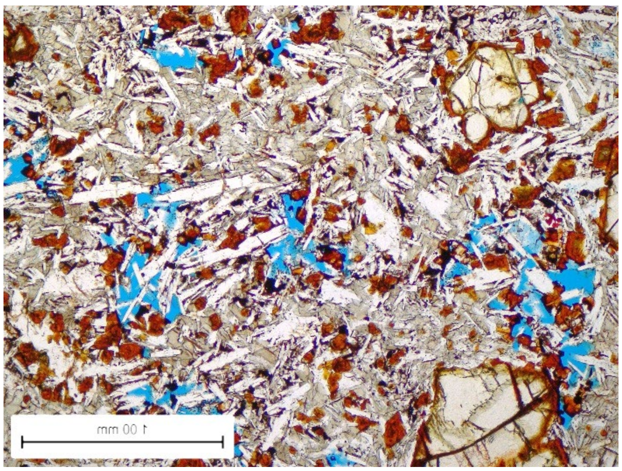
<u>Sample BH19BV-01A</u>
Location: 2 km north of Hoover Flat Reservoir; 14.4 km SE of Bieber
Map Unit: Tpbu
Interpretation: basaltic lapilli tuff, fall deposit

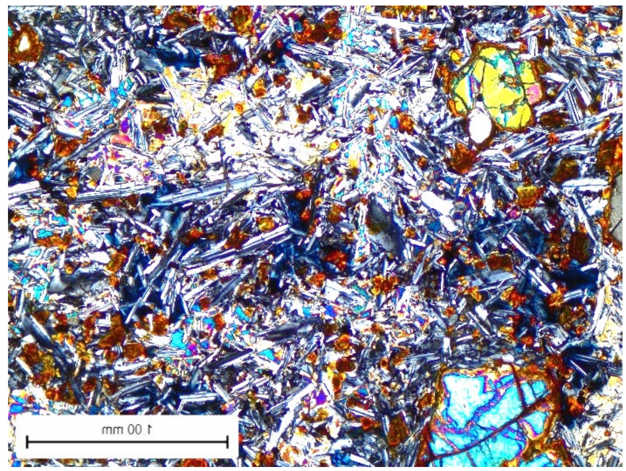
Texture: Very angular ash and fine lapilli clasts (up to 5mm diameter) of glassy to mildy altered finely-vesicular olivine, clinopyroxene, plagioclase basalt. Rock is lithified and clast boundaries are indistinct. Fresh basaltic glass (sideromelane) is orange-brown and locally altered to dark-brown and green.

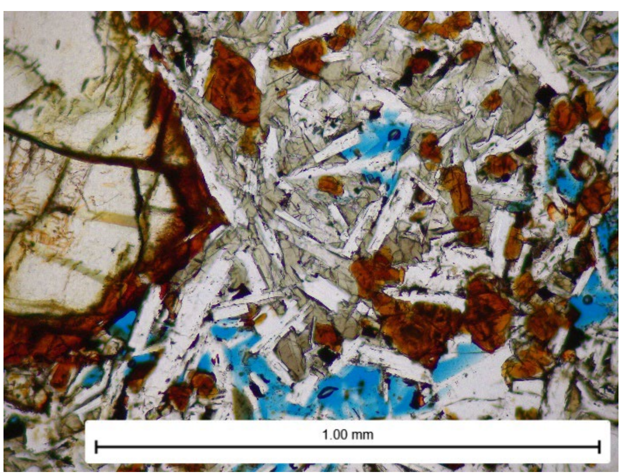


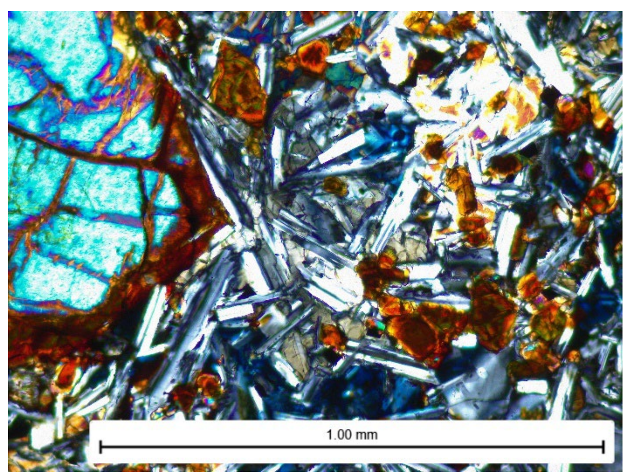
<u>Sample BH19BV-02</u>
Location: Along Juniper Road; 12 km SE of Bieber
Map Unit: originally mapped as Tpbu <u>(prob QTb)</u>
Interpretation: basaltic lava

Texture: fine-grained subophitic and micro-diktytaxitic groundmass (<1mm); optically-continuous intergrown subophitic clinopyroxene (green in PPL) up to 3mm.
No phenocrysts.
Plagioclase = clinopyroxene > olivine (strong iddingsite alteration) >> opaques





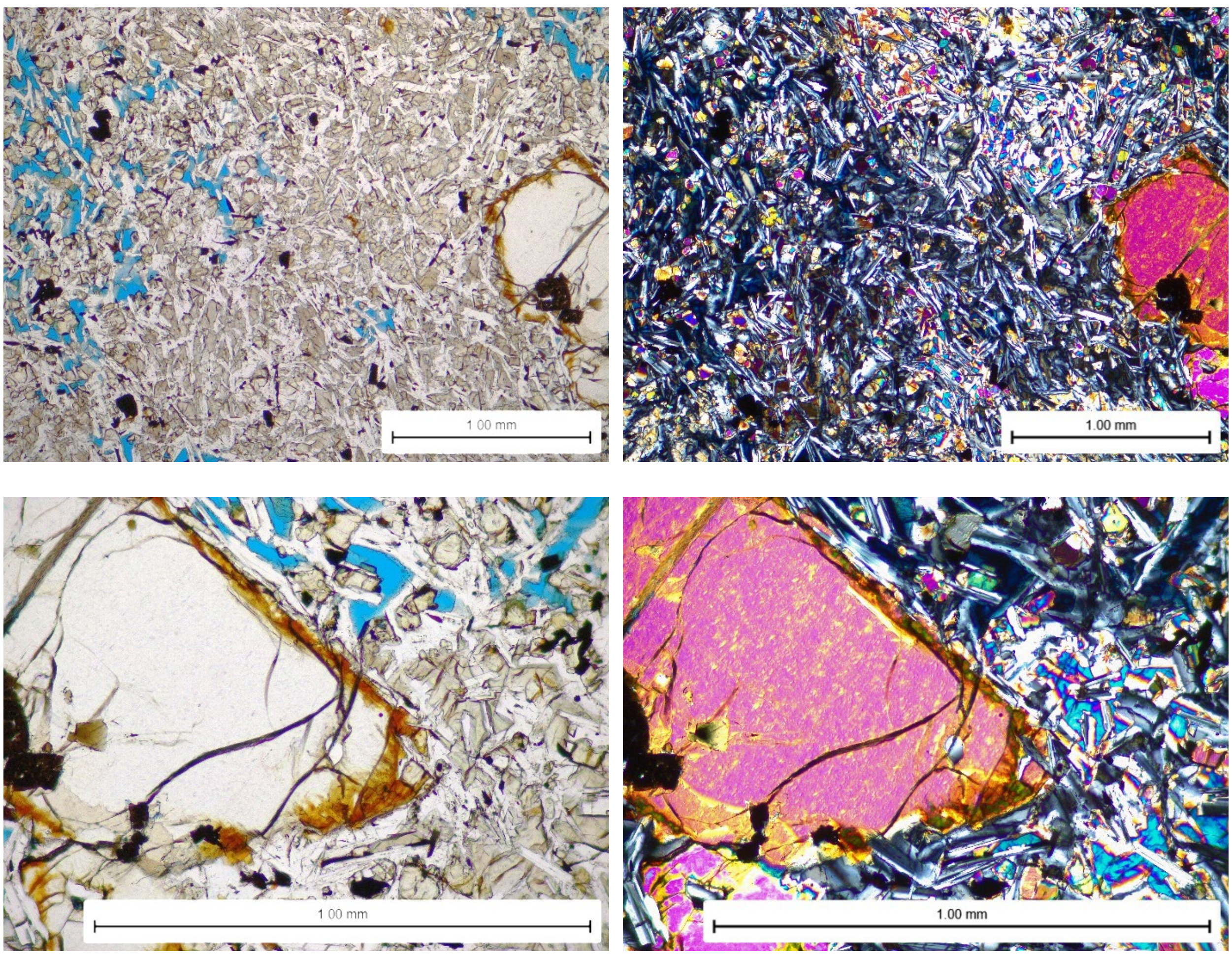




<u>Sample BH19BV-03</u>
Location: Small mesa cap along South Fork of Juniper Creek; 11.5 km SE of Bieber
Map Unit: QTb
Interpretation: basaltic lava

Texture: fine-grained ophitic and patchy diktytaxitic groundmass (<1mm); optically-continuous intergrown subophitic clinopyroxene (green-tan in PPL) up to 2mm

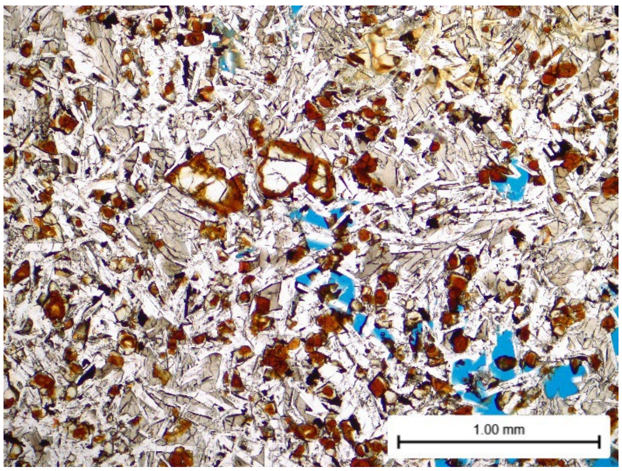
Mineralogy:
99% Groundmass: Plagioclase = clinopyroxene > opaques >> olivine
<1% Phenocrsts of olivine up to 2 mm (mild iddingsite alteration)

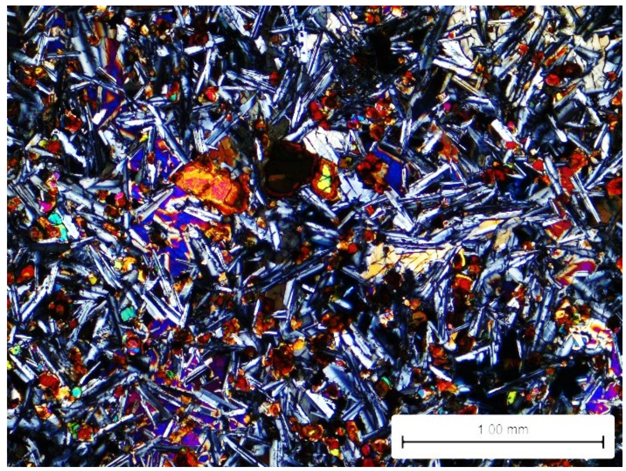


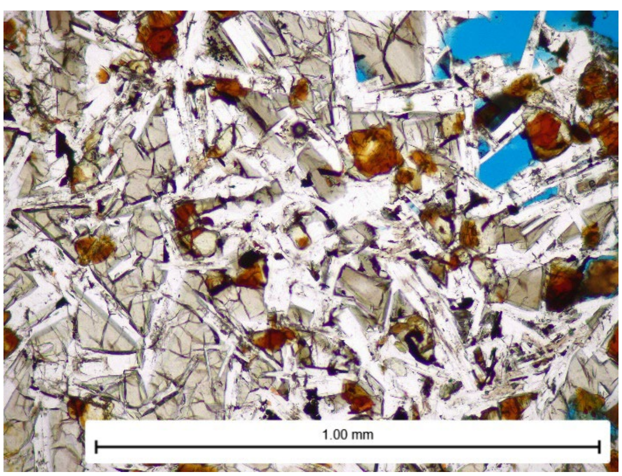
<u>Sample BH19BV-04</u>
Location: Along Stone Breaker Road; 4.2 km SE of junction with Susanville Road
Map Unit: QTb
Interpretation: basaltic lava

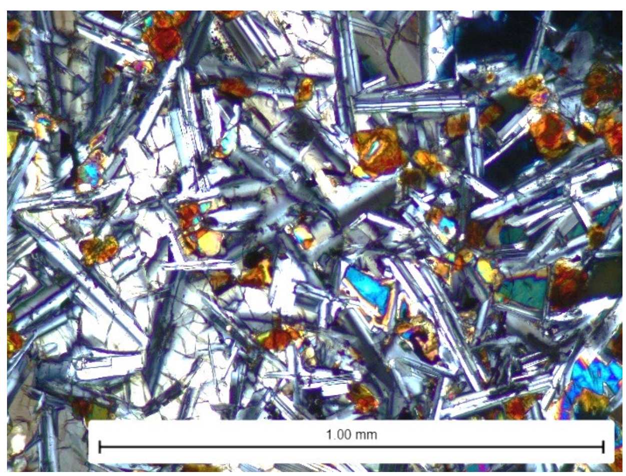
Texture: fine-grained ophitic and patchy diktytaxitic groundmass (<1mm); optically-continuous intergrown subophitic clinopyroxene (green-tan in PPL) up to 2mm.

Mineralogy:
No phenocrysts.
Plagioclase = clinopyroxene > olivine (moderate iddingsite alteration) > opaques





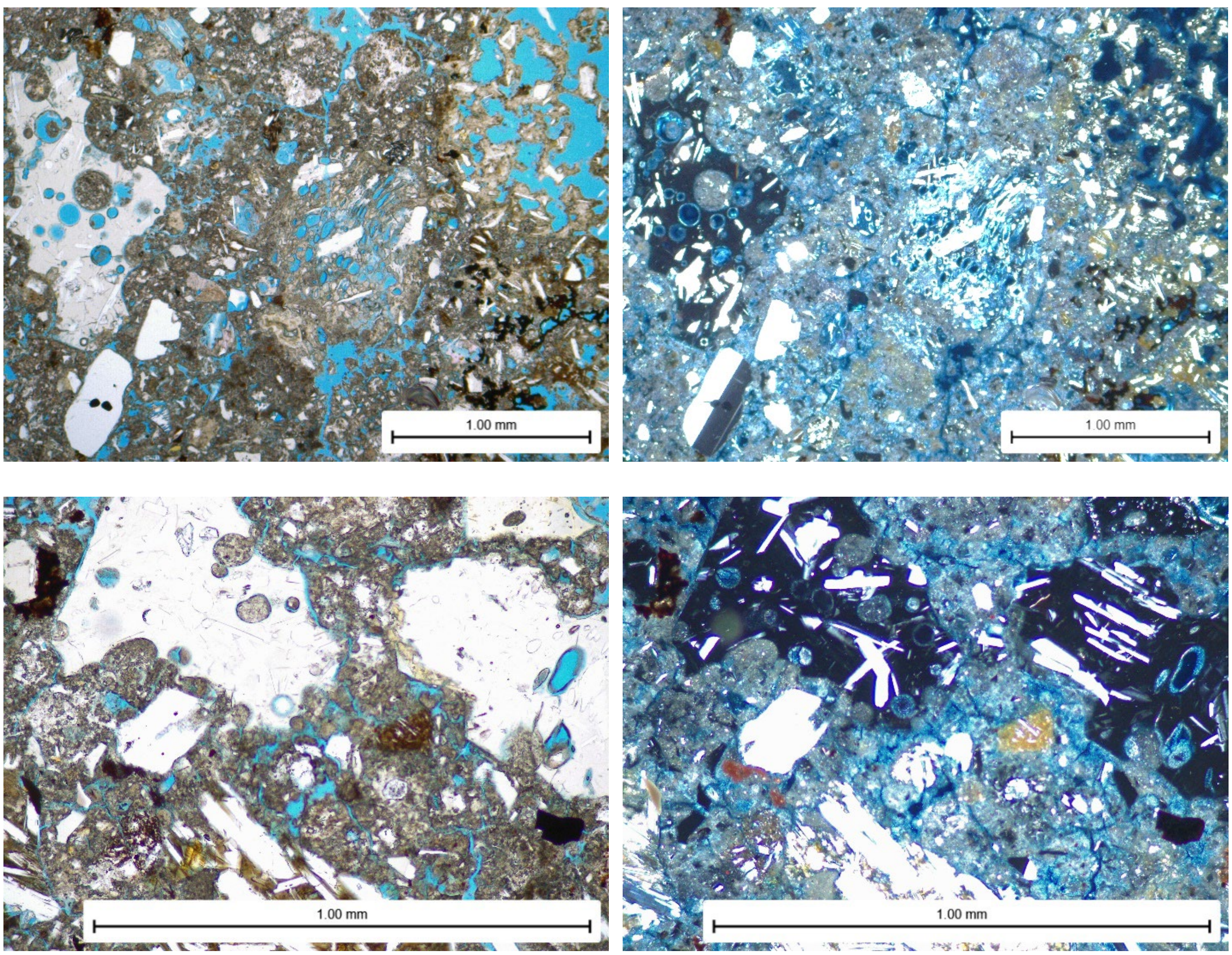




Sample BH19BV-05
Location: North side of Susanville Road; 2.6 km west of junction with Highway 139
Map Unit: Ttsu (upper Bieber Formation)
Interpretation: impure silicic tuff; possibly a reworked deposit

Texture: Poorly-sorted ash to fine lapilli (up to 5mm). Clasts are crystal to lithic and angular to subangular.

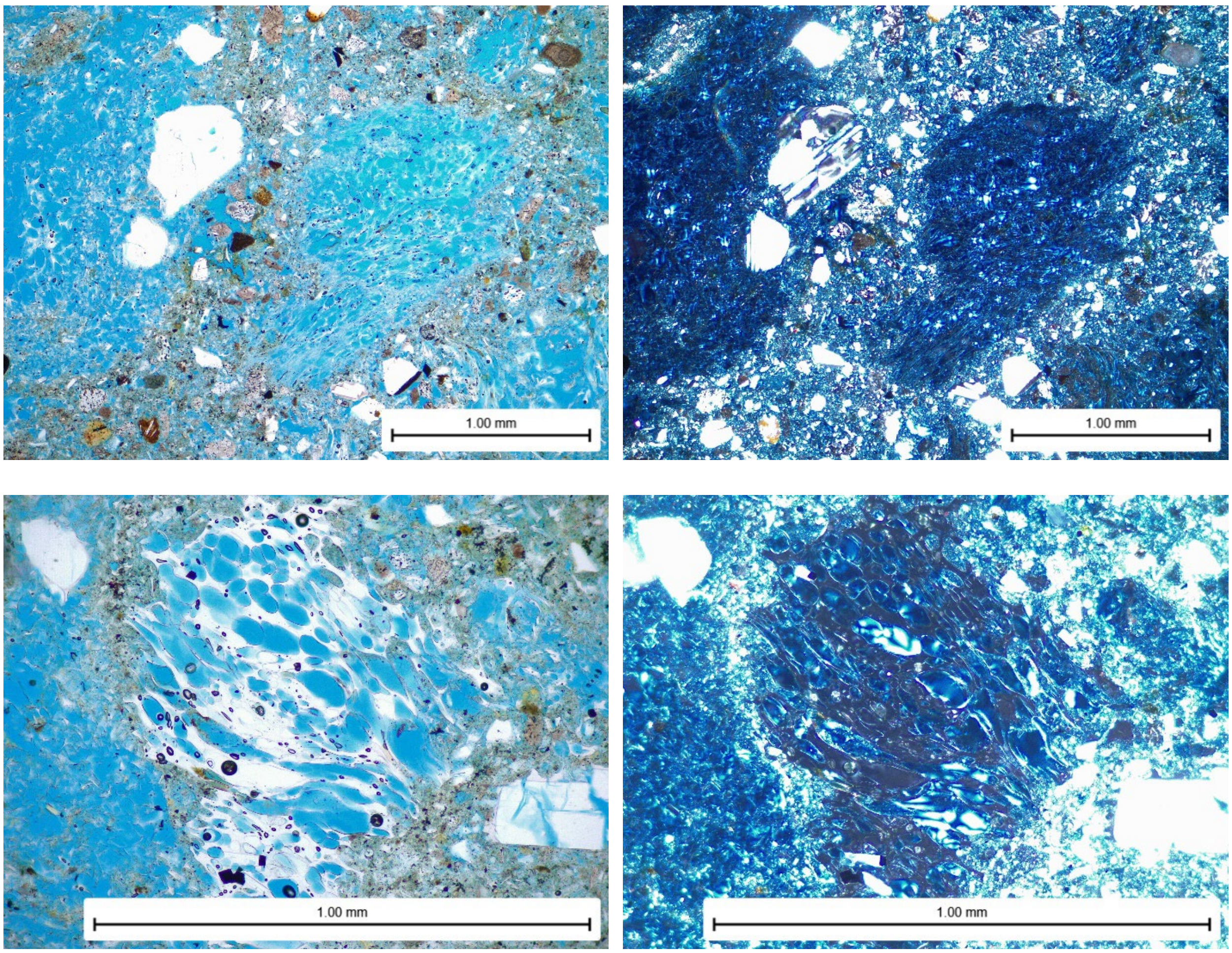
Mineralogy:
Composed of fresh glassy (isotropic) vesicular rhyolite lithics, feldspar, quartz, and minor intermediate to mafic lithics



<u>Sample BH19BV-06</u>
Location: Along Ash Valley Road; 6.3 km SE of Adin
Map Unit: Ttsu (upper Bieber Formation)
Interpretation: Dacitic(?) crystal-lithic lapilli tuff. Probably reworked.

Texture: Poorly-sorted fine-ash to fine lapilli (up to 5mm). Angular to subangular highly-inflated pumice lapilli with large (up to 2mm plagioclase phenocrysts) set in a fine crystal-vitric ash matrix that includes some plagioclase-rich andesitic(?) lithic fragments.

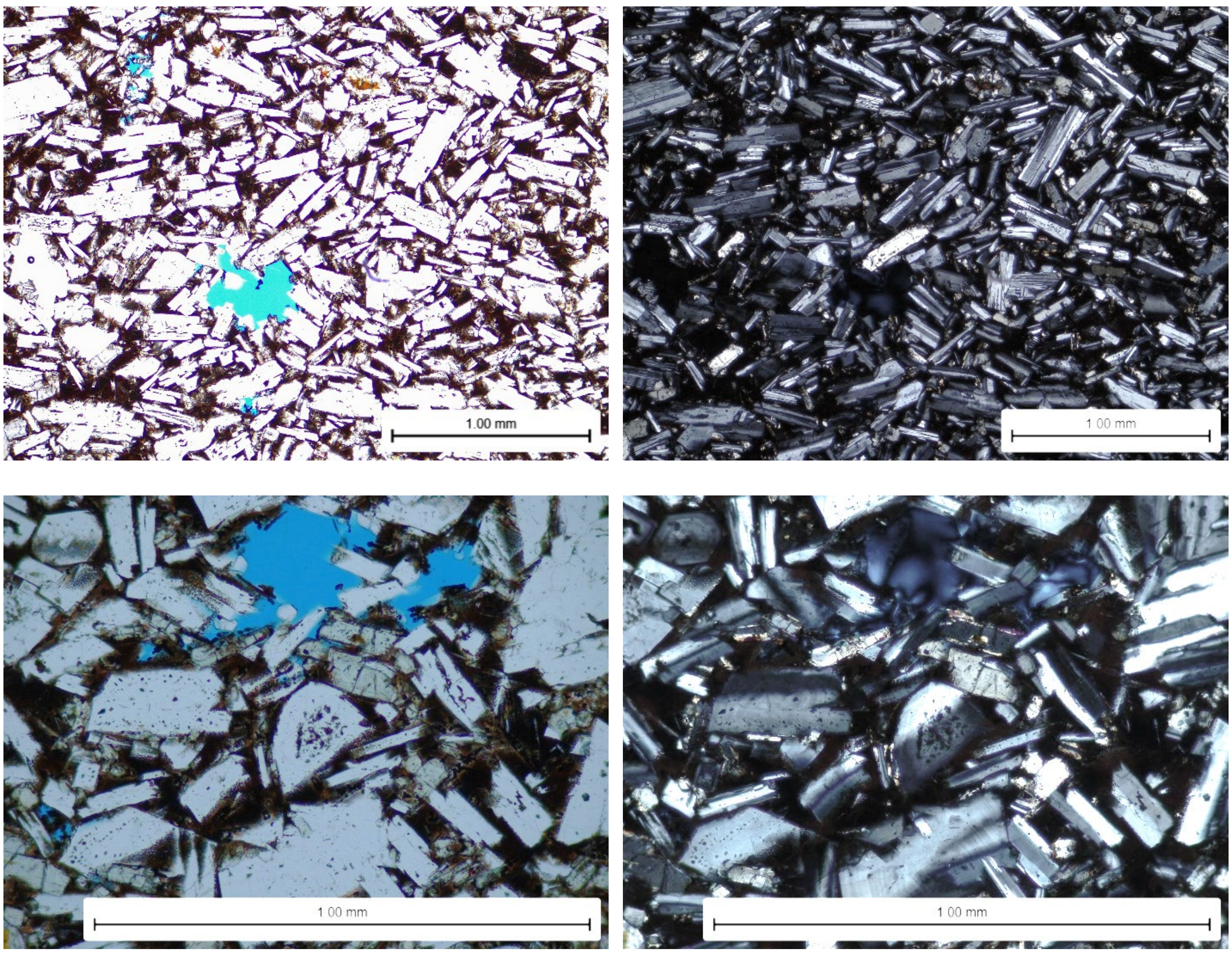
Mineralogy:
Pumicious glass is fresh and isotropic. Lack of quartz and ferromagnesian grains suggests pumice is dacitic.



<u>Sample BH19BV-08</u>
Location: Roadcut on Hwy 299; 10 km road distance west of Nubieber
Map Unit: Tpbl
Interpretation: basaltic andesite lava

Texture: fine-grained intersertal groundmass (<1mm); with very little, scattered diktytaxitic vesicularity.

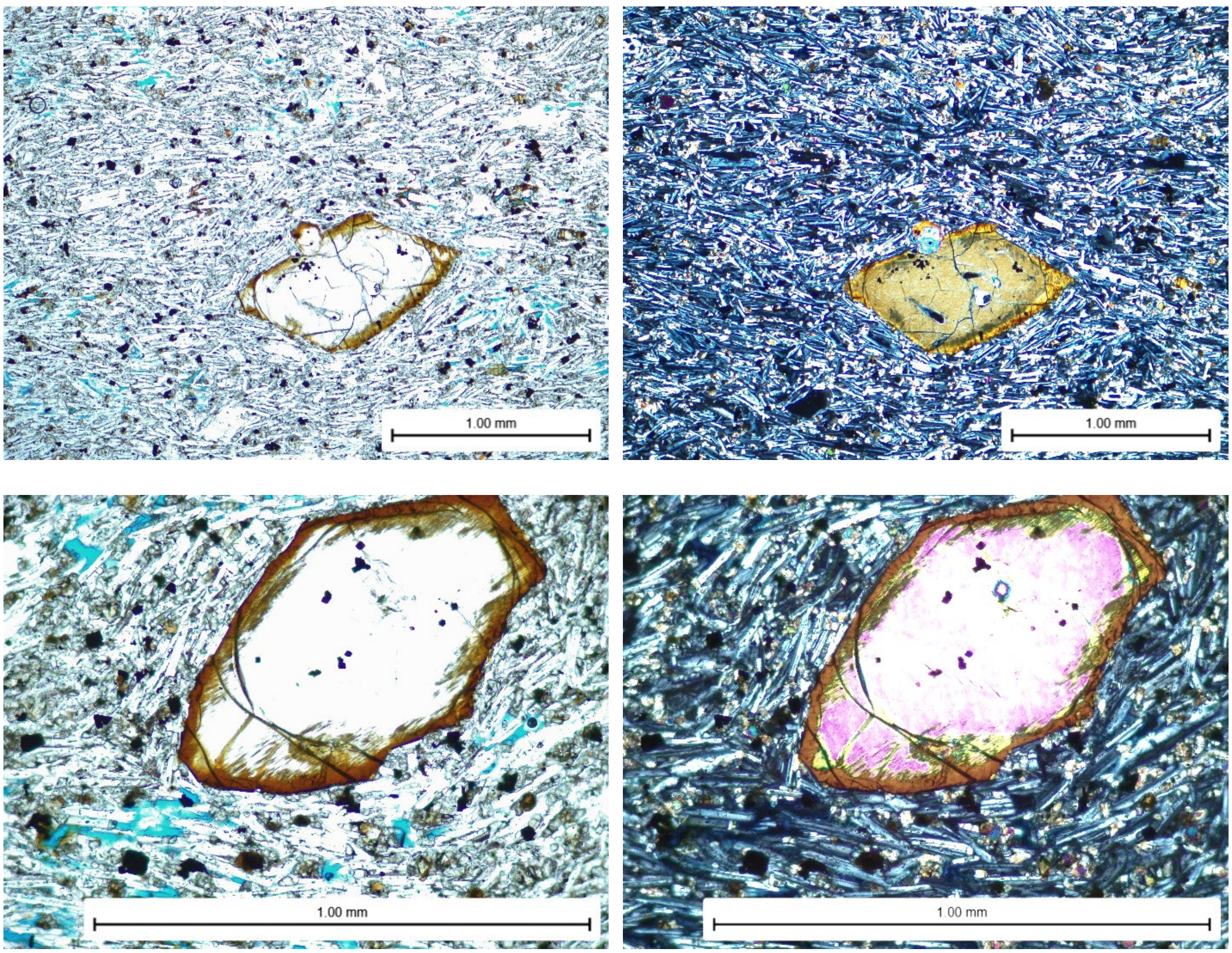
Mineralogy:
No phenocrysts.
Plagioclase > devitrified red-brown glass > orthopyroxene >> olivine (strong iddingsite alteration)



<u>Sample BH19BV-10</u>
Location: Roadside exposure in upper Barber Canyon; 1.4 km east of Fox Mtn
Map Unit: Tb
Interpretation: basaltic lava

Texture: fine-grained strongly-trachytic with intergranular groundmass (<1mm); scattered, minor micro-diktytaxitic voids.

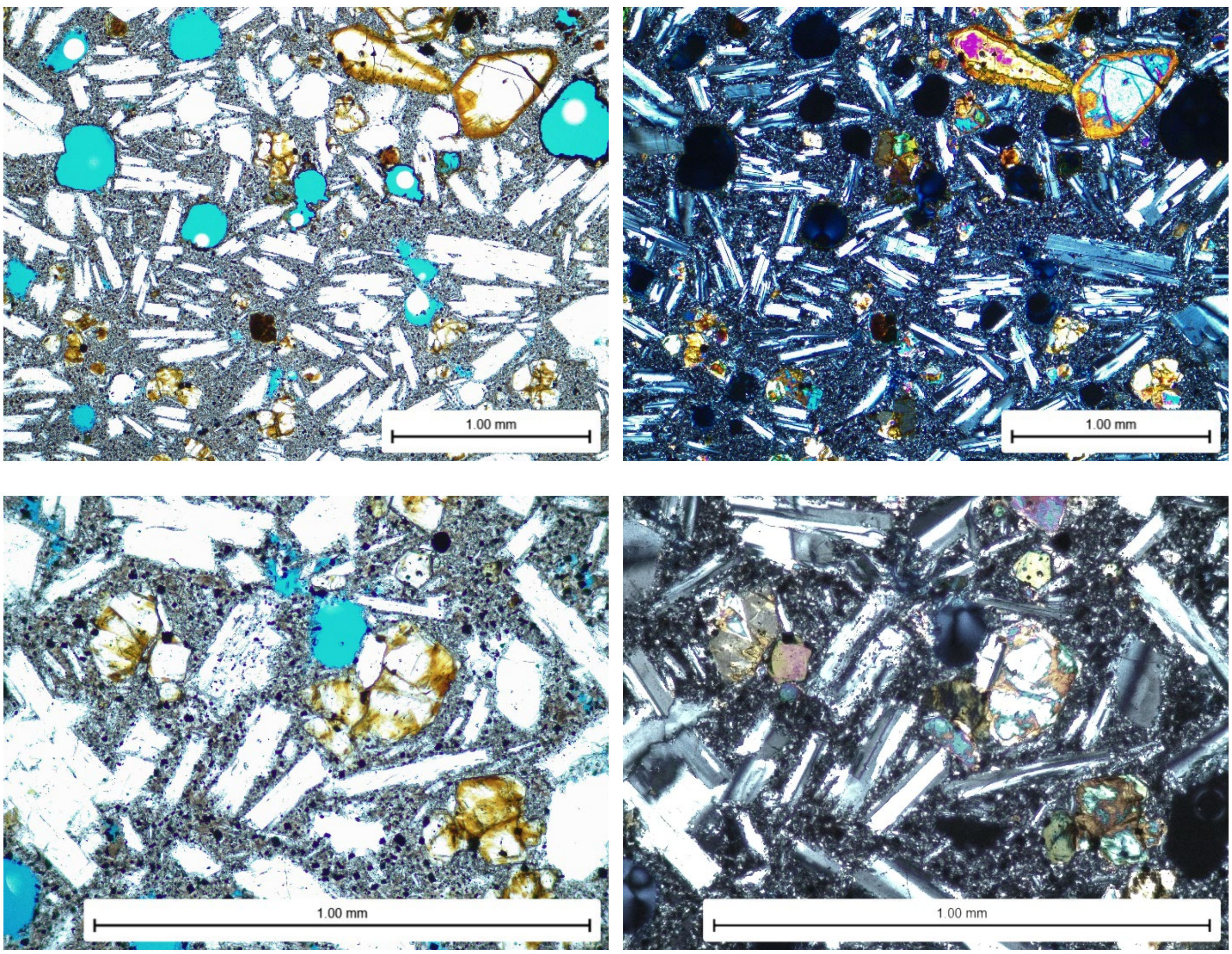
Mineralogy:
97% Groundmass: plagioclase > clinopyroxene > opaques
3% Phenocrysts (up to 2 mm) of olivine (mild iddingsite alteration) and a trace of plagioclase



__Sample BH19BV-11__
Location: Top of NW-trending ridge; 1.2 km SW of Fox Mtn; same locality as Geothermex dated sample of 13.8 Ma.
Map Unit: Tb
Interpretation: basaltic lava. Erupted with very fluid/liquid groundmass that probably quenched to glass and partly devitrified, massive groundmass texture.

Texture: Strongly bimodal texture with phenocrysts set in an extremely fine-grained (intersertal to vitrophyric); 3% round vesicles up to 0.5mm diameter.

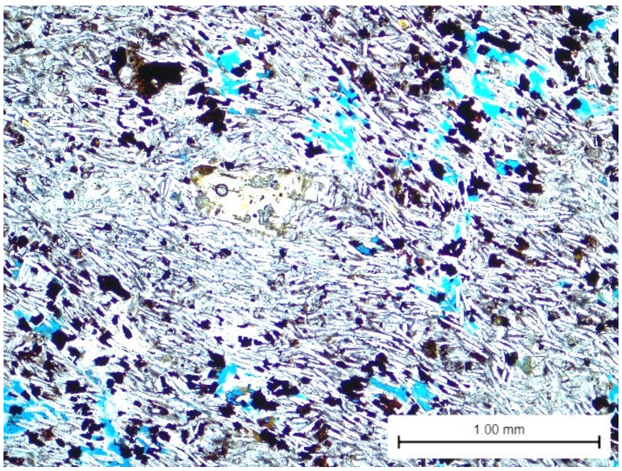
Mineralogy:
40% Groundmass: microgranular felsic and glass(?) with opaques (all < 0.01mm)
60% Phenocrysts (0.1 – 2.5 mm) Plagioclase >> olivine (mild iddingsite alteration)

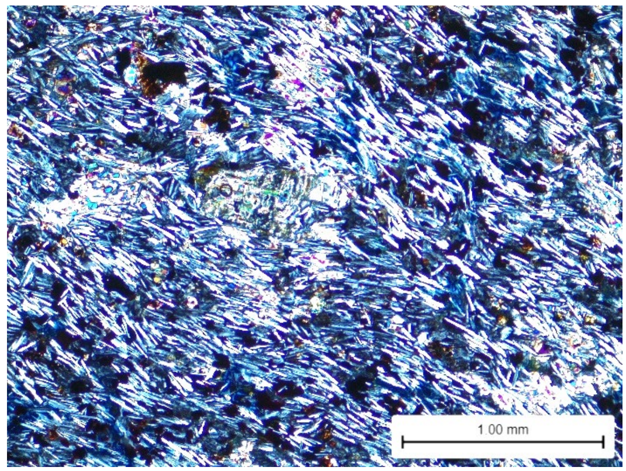


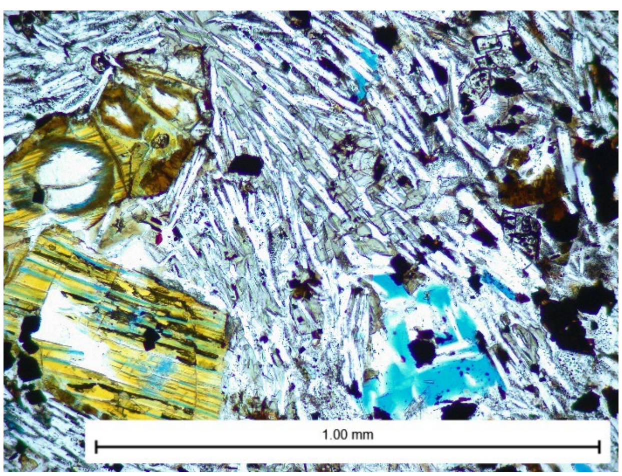
<u>Sample BH19BV-12</u>
Location: Lower Howell Canyon; 5.5 km east of Splawn Mtn.
Map Unit: Tb
Interpretation: basaltic lava.

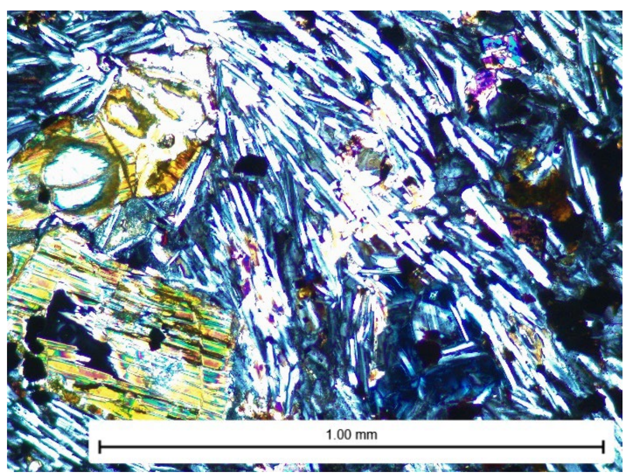
Texture: Very fine-grained with strongly trachytic texture; groundmass is a combination of intergranular, intersertal, and subophitic texture; patchy micro-diktytaxitic vesicularity throughout.

Mineralogy:
99% Groundmass:).01-0.2 Plagioclase > clinopyroxene > opaque > brown-gray glass > olivine
1% Phenocrysts (0.3 – 1 mm) Olivine (strong iddingsite alteration and locally replaced by cpx and opaque)





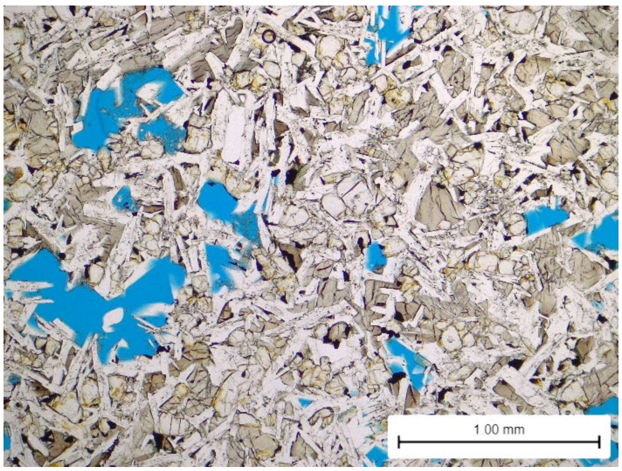


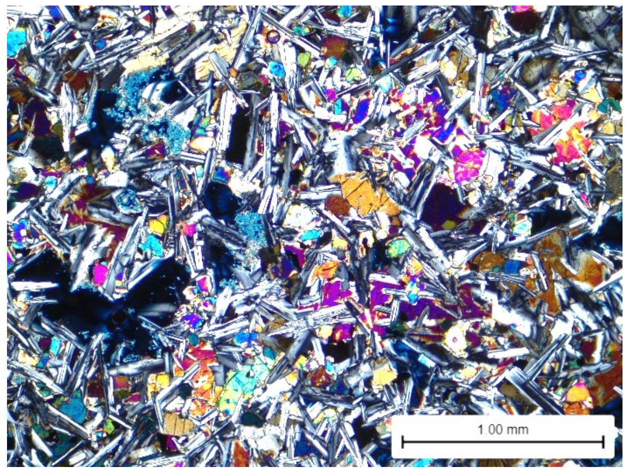


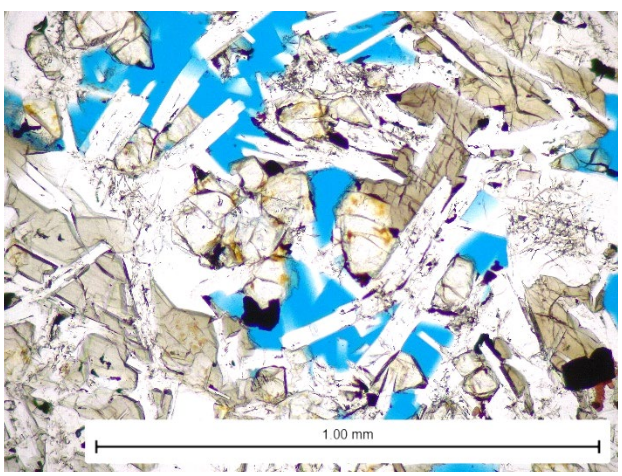
<u>Sample BH19BV-13</u>
Location: Near spillway of Lower Roberts Reservoir
Map Unit: QTb
Interpretation: basaltic lava

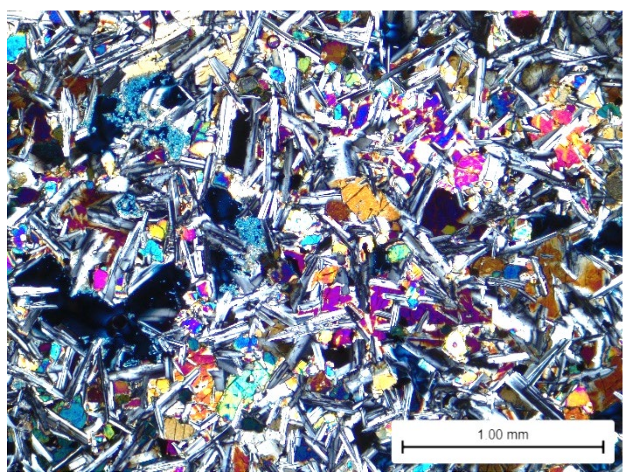
Texture: fine-grained intergranular and diktytaxitic groundmass (<1mm); minor optically-continuous intergrown subophitic clinopyroxene (green-tan in PPL) up to 1mm.

Mineralogy:
No phenocrysts.
Plagioclase = clinopyroxene > olivine (incipient iddingsite alteration) > opaques









<u>Sample BH19BV-15</u>
Location: Roadcut on Lookout-Hackamore Road; 1.9 km NE of Splawn Mtn.
Map Unit: Ttsl (lower Bieber Formation)
Interpretation: volcanic sandstone. Mostly well rounded, silicic clasts; well size sorted

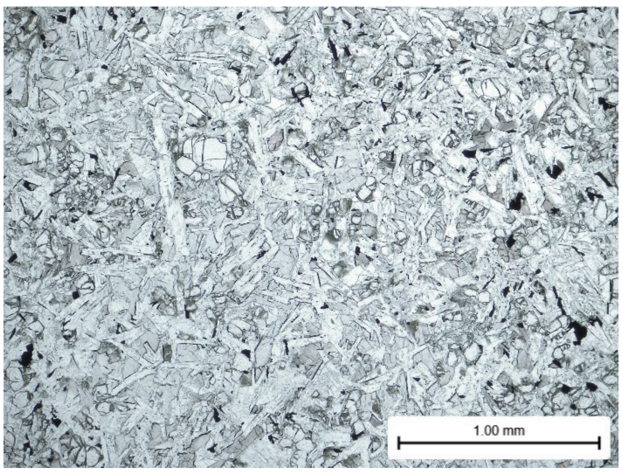
<u>Sample BH19BV-16A</u>
Location: Roadcut on Lookout-Hackamore Road; 1.7 km NE of Splawn Mtn.
Map Unit: Ttsl (lower Bieber Formation)
Interpretation: volcanic sandstone. Mostly well rounded, silicic clasts; well size sorted

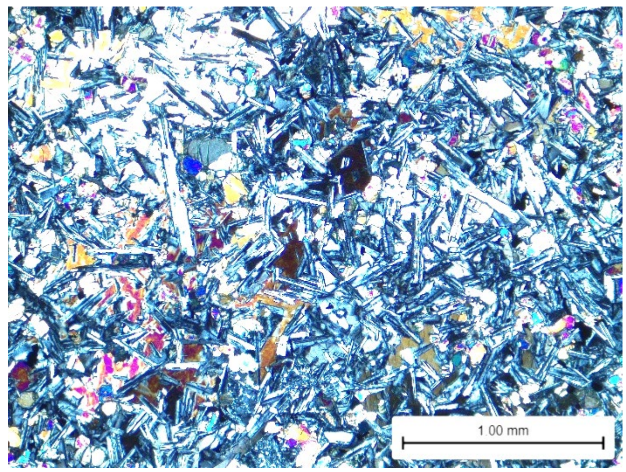
<u>Sample BH19BV-16B</u>
Location: Roadcut on Lookout-Hackamore Road; 1.7 km NE of Splawn Mtn.
Map Unit: Ttsl (lower Bieber Formation)
Interpretation: volcanic sandstone. Mostly well rounded, silicic clasts; fragments of welded tuff and pumice; very altered

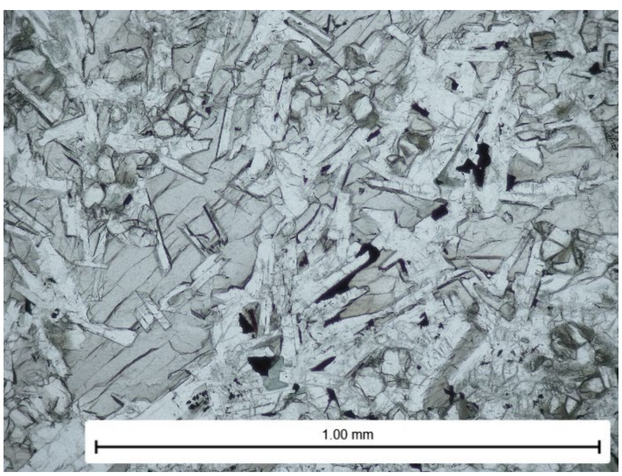
Sample BH19BV-17
Location: Roadcut on Lookout-Hackamore Road; 1.7 km NE of Splawn Mtn.
Map Unit: Originally mapped as Tpbl (Probably QTb)
Interpretation: basaltic shallow intrusive or lava

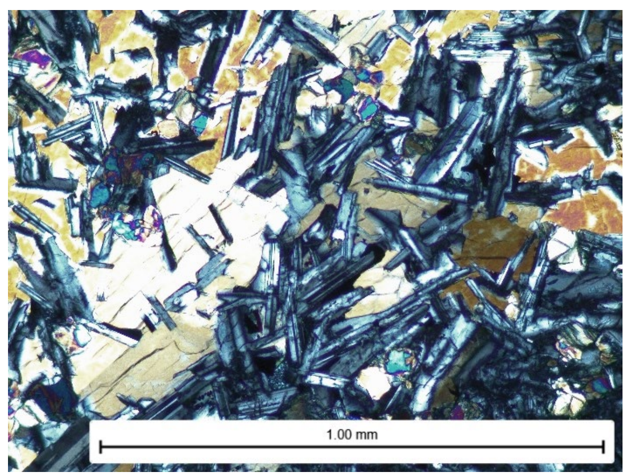
Texture: fine-grained; patchy optically-continuous intergrown subophitic clinopyroxene (tan in PPL) up to 2mm; No vesicularity

Mineralogy:
No phenocrysts.
Plagioclase = clinopyroxene > olivine (incipient green bowlingite alteration) > opaques





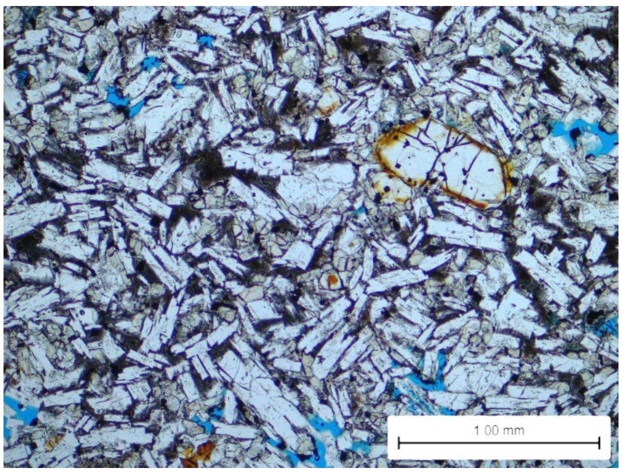


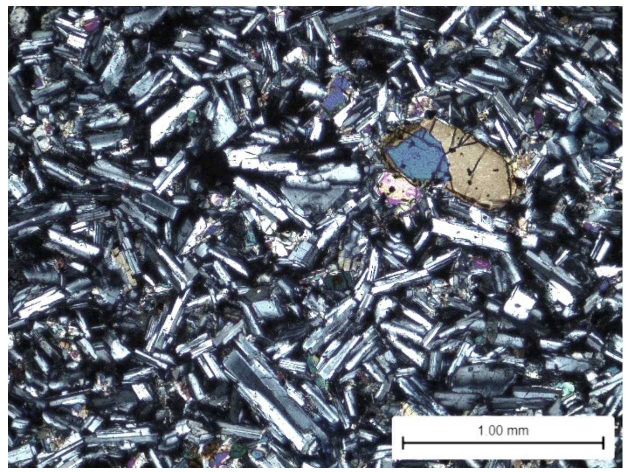


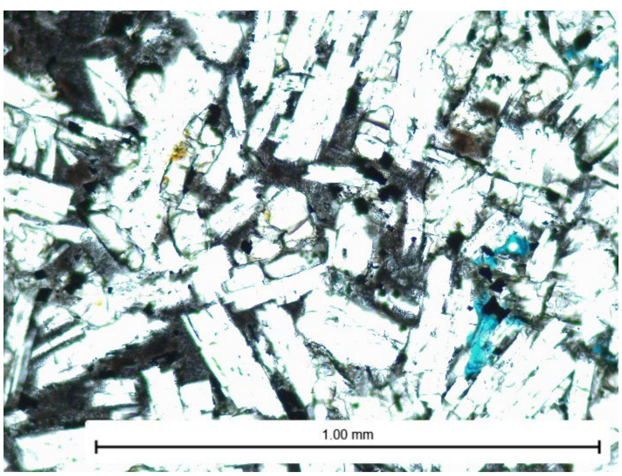
<u>**Sample BH19BV-18**</u>
Location: West end of Widow Valley
Map Unit: Tpbu
Interpretation: basaltic andesite lava

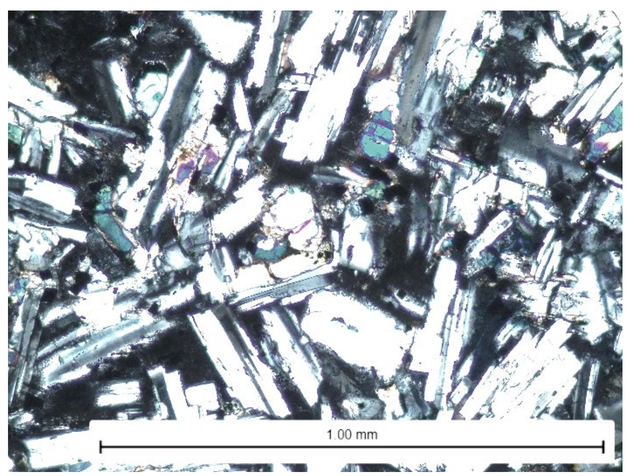
Texture: fine-grained intersertal to intergranular groundmass (up to ~1mm); with scattered diktytaxitic vesicularity.

Mineralogy:
No outsized phenocrysts but some olivine grains are up to about 1mm diameter.
Plagioclase > dark gray devitrified glass = orthopyroxene + clinopyroxene > olivine (mild iddingsite alteration)









Attachment D

Well Log Analysis

Well Info - Northwest

WCR_Number	Legacy_Log_Num	Lat_Approx	Lon_Approx	WCR_Link	File_Name	Total_Depth_ft	Alluvial_Thkness_ft	Pct_Alluvial
WCR1980-006723	112441	41.24858	-121.17223	https://cadwr.app.box.com/v/WellCompletionReports/file/463440903500	39N07E04_112441.pdf	140	71	51%
WCR2006-007508	1093237	41.23388	-121.17228	https://cadwr.app.box.com/v/WellCompletionReports/file/463438494236	39N07E09_1093237.pdf	145	125	86%
WCR1993-009774	431766	41.23365	-121.19156	https://cadwr.app.box.com/v/WellCompletionReports/file/463434667365	39N07E08_431766.pdf	185	100	54%
WCR1992-013718	393960	41.23363	-121.21039	https://cadwr.app.box.com/v/WellCompletionReports/file/463448070235	39N07E07_393960.pdf	205	127	62%
WCR2006-007502	1093234	41.24839	-121.2104	https://cadwr.app.box.com/v/WellCompletionReports/file/463448962037	39N07E06_1093234.pdf	225	85	38%
WCR2004-011016	1075204	41.27754	-121.21054	https://cadwr.app.box.com/v/WellCompletionReports/file/463444799136	40N07E30_1075204.pdf	775	435	56%

Lithology - Northwest

WCR_Number	TopDepth_ft	BotDepth_ft	Transcription	Lithology	Alluvial	Length_ft
WCR1980-006723	0	4	Soil Red	soil	1	4
WCR1980-006723	4	12	LAVA Broken	rock	0	8
WCR1980-006723	12	46	LAVA HARD	rock	0	34
WCR1980-006723	46	64	Cemented Material Small Gravel	gravel	1	18
WCR1980-006723	64	75	LAVA HARD	rock	0	11
WCR1980-006723	75	109	Cemented 1/2 & smaller gravel	gravel	1	34
WCR1980-006723	109	126	Very Hard Lava	rock	0	17
WCR1980-006723	126	139	Cemented material 1/2&smaller gravel	gravel	1	13
WCR1980-006723	138	140	Cemented clay	clay	1	2
WCR2006-007508	0	3	brown clay	clay	1	3
WCR2006-007508	3	10	brown sandstone	sand	1	7
WCR2006-007508	10	30	hard grey rock	rock	0	20
WCR2006-007508	30	90	brown clay & sandstone	clay	1	60
WCR2006-007508	90	105	porous brown sandstone	sand	1	15
WCR2006-007508	105	120	white pumice&sand	sand	1	15
WCR2006-007508	120	130	Black cinders & sand	sand	1	10
WCR2006-007508	130	135	sticky brown clay	clay	1	5
WCR2006-007508	135	145	porous brown sandstone	sand	1	10
WCR1993-009774	0	1	top soil	soil	1	1
WCR1993-009774	1	30	brown clay	clay	1	29
WCR1993-009774	30	50	green&black rock	rock	0	20
WCR1993-009774	50	70	hard black rock	rock	0	20
WCR1993-009774	70	105	grey lava rock	rock	0	35
WCR1993-009774	105	115	black rock	rock	0	10
WCR1993-009774	115	185	green sandstone layers of clay	sand	1	70
WCR1992-013718	0	2	top soil	soil	1	2
WCR1992-013718	2	44	hard grey rock	rock	0	42
WCR1992-013718	44	107	soft red&brown clay	clay	1	63
WCR1992-013718	107	119	hard black rock	rock	0	12
WCR1992-013718	119	150	grey rock	rock	0	31
WCR1992-013718	125	140	brown sandstone	sand	1	15
WCR1992-013718	140	180	grey sandstone	sand	1	40
WCR1992-013718	180	187	red&grey sandstone fractured	sand	1	7
WCR1992-013718	187	205	black rock	rock	0	18
WCR2006-007502	0	2	br clay	clay	1	2
WCR2006-007502	2	12	boulders & soil	boulders	1	10
WCR2006-007502	12	25	brown sandstone	sand	1	13
WCR2006-007502	25	45	hard grey rock	rock	0	20
WCR2006-007502	45	70	broken grey lava & clay	rock	0	25
WCR2006-007502	70	90	hard grey rock	rock	0	20
WCR2006-007502	90	105	grey lava some clay	rock	0	15
WCR2006-007502	105	125	brown sandstone	sand	1	20
WCR2006-007502	125	185	grey lava rock & talc	rock	0	60
WCR2006-007502	185	200	green clay & sandstone	clay	1	15
WCR2006-007502	200	225	porous green sandstone	sand	1	25
WCR2004-011016	0	8	brown clay	clay	1	8
WCR2004-011016	8	10	brown sandstone	sand	1	2
WCR2004-011016	10	27	grey rock	rock	0	17
WCR2004-011016	27	33	brown lava rock	rock	0	6
WCR2004-011016	75	104	broken grey rock	rock	0	29
WCR2004-011016	104	110	red lava rock	rock	0	6

WCR_Number	TopDepth_ft	BotDepth_ft	Transcription	Lithology	Alluvial	Length_ft
WCR2004-011016	110	130	broken brown and grey rock	rock	0	20
WCR2004-011016	130	164	grey rock	rock	0	34
WCR2004-011016	164	190	brown lava rock & talc	rock	0	26
WCR2004-011016	190	215	grey rock	rock	0	25
WCR2004-011016	215	220	brown lava	rock	0	5
WCR2004-011016	220	270	broken fractured grey & brown lava	rock	0	50
WCR2004-011016	270	307	grey rock	rock	0	37
WCR2004-011016	307	315	red lava rock	rock	0	8
WCR2004-011016	315	332	grey rock	rock	0	17
WCR2004-011016	332	345	brown lava rock	rock	0	13
WCR2004-011016	345	355	tan clay	clay	1	10
WCR2004-011016	355	360	black lava	rock	0	5
WCR2004-011016	360	370	grey sandstone&pumice	sand	1	10
WCR2004-011016	370	375	green clay	clay	1	5
WCR2004-011016	375	380	loose black sand	sand	1	5
WCR2004-011016	380	460	grey & green sandstone	sand	1	80
WCR2004-011016	460	575	green clay some sticky	clay	1	115
WCR2004-011016	575	580	brown clay rotten wood	clay	1	5
WCR2004-011016	580	620	porous green sandstone	sand	1	40
WCR2004-011016	620	675	green clay	clay	1	55
WCR2004-011016	675	710	white pumice	sand	1	35
WCR2004-011016	710	775	hard grey sandstone	sand	1	65

Well Info - Southeast

WCR_Number	Legacy_Log_Num	Lat_Approx	Lon_Approx	WCR_Link	File_Name	Total_Depth_ft	Alluvial_Thkness_ft	Pct_Alluvial
WCR1993-009636	406921	41.07416	-121.05718	https://cadwr.app.box.com/v/WellCompletionReports/file/461652724524	37N08E04_406921.pdf	302	24	8%
WCR2006-009179	1074760	41.08871	-120.99936	https://cadwr.app.box.com/v/WellCompletionReports/file/461646165434	38N08E36_1074760.pdf	246	246	100%
WCR1977-007356	14591	41.01521	-120.99902	https://cadwr.app.box.com/v/WellCompletionReports/file/461650296685	37N08E25_14591.pdf	648	299	46%
WCR1985-008010	091146	40.98635	-120.94095	https://cadwr.app.box.com/v/WellCompletionReports/file/461640914068	36N09E04_091146.pdf	152	70	46%

Lithology - Southeast

WCR_Number	TopDepth_ft	BotDepth_ft	Transcription	Lithology	Alluvial	Length_ft
WCR1993-009636	0	1	top soil	soil	1	1
WCR1993-009636	1	8	clay brown	clay	1	7
WCR1993-009636	8	19	clay brown lava boulders	clay	1	11
WCR1993-009636	19	38	lava gray	rock	0	19
WCR1993-009636	38	43	clay brown	clay	1	5
WCR1993-009636	43	68	lava gray frac	rock	0	25
WCR1993-009636	68	121	lava gray	rock	0	53
WCR1993-009636	121	180	lava gray clay seams	rock	0	59
WCR1993-009636	180	231	lava gray frac	rock	0	51
WCR1993-009636	231	258	lava gray	rock	0	27
WCR1993-009636	258	302	lava gray sandstone seams	rock	0	44
WCR2006-009179	0	1	top soil	soil	1	1
WCR2006-009179	1	20	brown sandstone	sand	1	19
WCR2006-009179	20	31	dark brown sandstone	sand	1	11
WCR2006-009179	31	60	brown sandy clay	clay	1	29
WCR2006-009179	60	69	brown sandstone	sand	1	9
WCR2006-009179	69	82	brown sand loose	sand	1	13
WCR2006-009179	82	98	black clay	clay	1	16
WCR2006-009179	98	115	yellow clay	clay	1	17
WCR2006-009179	115	132	gray clay	clay	1	17
WCR2006-009179	132	161	dark gray clay	clay	1	29
WCR2006-009179	161	170	green clay	clay	1	9
WCR2006-009179	170	225	gray clay	clay	1	55
WCR2006-009179	225	243	green clay	clay	1	18
WCR2006-009179	243	246	gray with white sand loose	sand	1	3
WCR1977-007356	0	2	soil & boulders	soil	1	2
WCR1977-007356	2	75	brown sandy claystone	clay	1	73
WCR1977-007356	75	79	boulders & clay	boulders	1	4
WCR1977-007356	79	83	brown sandstone	sand	1	4
WCR1977-007356	83	146	boulders & clay	boulders	1	63
WCR1977-007356	146	165	black basalt	rock	0	19
WCR1977-007356	165	195	red&brown basalt	rock	0	30
WCR1977-007356	195	200	black basalt	rock	0	5
WCR1977-007356	200	212	gray basalt hard	rock	0	12
WCR1977-007356	212	218	red basalt	rock	0	6
WCR1977-007356	218	225	black basalt some clay	rock	0	7
WCR1977-007356	225	290	red basalt	rock	0	65
WCR1977-007356	290	315	gray basalt hard	rock	0	25
WCR1977-007356	315	335	redish brown basalt	rock	0	20
WCR1977-007356	335	360	redish gray basalt	rock	0	25
WCR1977-007356	360	435	black rock fractured & clay	rock	0	75
WCR1977-007356	435	525	brown sandstone & pumice	sand	1	90
WCR1977-007356	525	540	black basalt & clay	rock	0	15
WCR1977-007356	540	560	gray basalt hard	rock	0	20
WCR1977-007356	560	585	red cinders	rock	0	25
WCR1977-007356	585	605	brown sandstone	sand	1	20
WCR1977-007356	605	648	brown sandstone & pumice	sand	1	43
WCR1985-008010	0	1	top soil	soil	1	1
WCR1985-008010	1	36	brn clay hard pan	clay	1	35
WCR1985-008010	36	40	grey rock	rock	0	4
WCR1985-008010	40	58	brn sand stone	sand	1	18

WCR_Number	TopDepth_ft	BotDepth_ft	Transcription	Lithology	Alluvial	Length_ft
WCR1985-008010	58	135	brn rock	rock	0	77
WCR1985-008010	135	136	broken rock	rock	0	1
WCR1985-008010	136	152	large gravel 1" loose	gravel	1	16

Attachment E

References

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Appendix 14 Response to Corrective Action Table

Appendix 14. Response to Corrective Actions			
Staff Report Sections	Deficiency/Corrective Action	Document which section(s) / page number(s) that address the Corrective Action (Clean Version)	Document which section(s) / page number(s) that address the Corrective Action (Redline Version)
3.1	Deficiency 1. The GSP does not include a reasonable assessment of overdraft conditions and reasonable means to mitigate overdraft		
3.1.3	*Corrective Action 1*		
The GSAs should revise the GSP to provide a reasonable assessment of overdraft conditions and include a reasonable means to mitigate overdraft. Specifically, the Plan must be amended as follows:			
a.	Reevaluate the assessment of overdraft conditions in the Basin. Specifically, the GSAs should examine the assumptions that were used to develop the projected overdraft estimates in the projected water budget considering the results vary greatly from the values reported in the historical and current water budgets and the recent annual report data. The assessment should include the latest information for the Basin to ensure the GSP includes the required projects and management actions to mitigate overdraft in the Basin.	Chapter 5.2: Lines 1788 to 1816	Chapter 5.2: Lines 18010 to 1839
b.	Provide a reasonable means to mitigate the overdraft that is continuing to occur in the Basin. Specifically, the GSAs should describe feasible proposed management actions that are commensurate with the level of understanding of groundwater conditions of the Basin and with sufficient details for Department staff to be able to clearly understand how the Plan's projects and management actions will mitigate overdraft in the Basin under different climate scenarios.	Chapter 9: Lines 2989 to 2995 Lines 3007 to 3014 Table 9-3 Chapter 9.1: Lines 3029 to 3077 Lines 3113 to 3145 Lines 3158 to 3161 Chapter 9.3 Lines 3334 to 3352 Chapter 9.5: Liens 3512 to 3516 Lines 3536 to 3543 Lines 3550 to 3553 Lines 3568 to 3570	Chapter 9: Lines 3131 to 3137 Lines 3152 to 3159 Table 9-3 Chapter 9.1: Lines 3179 to 3235 Lines 3271 to 3303 Lines 3316 to 3319 Chapter 9.3: Lines 3501 to 3535 Chapter 9.5: Lines 3679 to 3683 Lines 3703 to 3710 Lines 3717 to 3720 Lines 3735 to 3737
	For projects and management actions that involve supply augmentation or groundwater recharge, the GSP should clarify whether the source of water would reduce water availability in other parts of the	Chapter 9.1: Lines 3029 to 3077	Chapter 9.1: Lines 3179 to 3235
	The Department plans to release guidance on funding in early 2024. The GSAs are encouraged to review the guidance for options to fund projects and management actions.	Chapter 10.7: Lines 3948 to 3961	Chapter 10.7: Lines 4118 to 4131

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Staff Report Sections	Deficiency/Corrective Action	Document which section(s) / page number(s) that address the Corrective Action (Clean Version)	Document which section(s) / page number(s) that address the Corrective Action (Redline Version)
3.2	Deficiency 2. The GSP does not establish sustainable management criteria for chronic lowering of groundwater levels in a manner substantially compliant with the GSP regulations		
3.2.3	*Corrective Action 2*		
The GSAs must provide a thorough explanation and justification regarding the selection of the sustainable management criteria for groundwater levels, particularly undesirable results and minimum thresholds, and quantitatively describe the effects of those criteria on the interests of beneficial uses and users of groundwater. Department staff recommend the GSAs consider and address the following:			
a.	Refine the description of undesirable results to clearly describe the significant and unreasonable conditions the GSAs are managing the Basin to avoid. This must include a quantitative description of the negative effects to all beneficial uses and users that would be experienced at undesirable result conditions.	Chapter 7.3.1: Lines 2433 to 2435	Chapter 7.3.1: Lines 2492 to 2527
	The GSAs should fully disclose, describe, and explain the rationale for determining the number of wells that may be dewatered and the level of impacts that may occur without rising to significant and unreasonable levels constituting undesirable results.	Chapter 7.3.1: Lines 2421 to 2428 Lines 2458 to 2561	Chapter 7.3.1: Lines 2477 to 2484 Lines 2562 to 2674
	Lastly, the GSAs should explain how well mitigation will be considered by the GSAs during management of the Basin in a project or management action as part of the GSP. Department staff also encourage the GSAs to review the Department’s April 2023 guidance document titled Considerations for Identifying and Addressing Drinking Water Well Impacts.	Chapter 7.3.1: Lines 2568 to 2578 Chapter 9.7 (all lines)	Chapter 7.3.1: Lines 2679 to 2697 Chapter 9.7 (all lines)
b.	The GSAs should revise minimum thresholds to be set at the level where the depletion of supply across the Basin may lead to undesirable results and provide the criteria used to establish and justify minimum thresholds.	Chapter 7.3.1: Lines 2458 to 2561	Chapter 7.3.1: Lines 2553 to 2672
	Fully document the justifications and analysis performed to establish the criteria used to establish minimum thresholds. Clearly show each step of the analysis and provide supporting information used in the analysis.	Chapter 7.3.1: Lines 2421 to 2428 Lines 2458 to 2561	Chapter 7.3.1: Lines 2477 to 2484 Lines 2553 to 2672
c.	Provide an evaluation of how minimum thresholds may affect the interests of beneficial uses and users of groundwater, as well as land uses and property interests. Identify the number and location of wells that may be negatively affected when minimum thresholds are reached.	Chapter 7.3.1: Lines 2421 to 2428 Lines 2458 to 2561	Chapter 7.3.1: Lines 2477 to 2484 Lines 2553 to 2672
	Compare well infrastructure for all well types in the Basin with minimum thresholds at nearby representative monitoring sites. Document all assumptions and steps clearly so it will be understood by readers of the GSP. Include maps of potentially affected well locations, identify the number of potentially affected wells by well type, and provide a supporting discussion of the effects.	Chapter 7.3.1: Lines 2530 to 2549 Figure 7-4, Figure 7-5, Figure 7-6	Chapter 7.3.1: Lines 2641 to 2660 Figure 7-4, Figure 7-5, Figure 7-6

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Staff Report Sections	Deficiency/Corrective Action	Document which section(s) / page number(s) that address the Corrective Action (Clean Version)	Document which section(s) / page number(s) that address the Corrective Action (Redline Version)
3.3	Deficiency 3. The GSP does not develop sustainable management criteria for degraded water quality.		
3.3.3	*Corrective Action 3*		
	Establish sustainable management criteria for degraded water quality, as required in the GSP Regulations, based on the best available information and science.	Chapter 7.3.4 (all lines)	Chapter 7.3.4 (all lines)
	The GSAs should evaluate the occurrence of constituents of concern in the Basin, to either explain why each constituent of concern is not likely to affect sustainability or cause undesirable results in the Basin or, alternatively, the GSAs should include monitoring and sustainable management criteria for each constituent of concern, which would allow the GSAs to develop an understanding of the connection between pumping in the Basin and the migration or concentration of constituents of concern over the	Chapter 5.4 (all lines)	Chapter 5.4 (all lines)
	Department staff also encourage the GSAs to continue coordinating with the appropriate groundwater users, including drinking water, environmental, and agricultural users as identified in the Plan, and water quality regulatory agencies and programs in the Basin to understand and develop a process for determining if groundwater management and extraction is resulting in migration or concentration of constituents of concern or degraded water quality in the Basin.	Chapter 8.2.2 (all lines)	Chapter 8.2.2 (all lines)

Note: All revisions to the GSP were part of a large stakeholder effort as summarized in Chapter 11.8.