Big Valley Groundwater Basin Advisory Committee (BVAC)

Unapproved Meeting Minutes

BVAC Members:

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

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Wednesday, July 7, 2021 2:00 PM Veterans Memorial Hall
657-575 Bridge Street
Bieber, CA 96009

BVAC Convene in Special Session.

Present: Committee Members: Byrne, Albaugh, Mitchell, and Nunn.
Absent: Committee Members: Conner and Ohm

Also in attendance: BVAC Staff Tiffany Martinez
BVAC Staff Gaylon Norwood, BVAC Secretary designee
BVAC Recorder Brooke Suarez
Alt. Board Representative Gary Bridges

BVAC Chairman Byrne called the meeting to order at 2:06 p.m. She read the public comment rules for the meeting.

Flag Salute: Chairman Byrne requested Representative Nunn lead the Pledge of Allegiance.

General Update by Secretary: None

Matters Initiated by Committee Members: Vice-Chairman Albaugh was glad to see more of the public attending the meeting now that Covid restrictions have been lifted. Chairman Byrne has heard that wells are going dry in the Tulelake basin. Also, Chairman Byrne is testifying at the State for AB742, the SGMA bill, which would extend the deadline for the GSP. She would like input from committee members for her testimony.

Representative Conner subsequently arrived at the meeting at 2:11.

Correspondence (unrelated to a specific agenda item): G. Norwood recapped the letter sent to Governor Newsom and stated that a response letter (Exhibit A) to the extension request was denied. The letter had come from DWR. Discussion was held on the response letter. Chairman Byrne would like the DWR response letter added in the GSP. Vice-Chairman Albaugh concurred.

Approval of Minutes (June 2, 2021) –

> **A motion was made by Vice-Chairman Albaugh to approve BVAC meeting minutes from June 2, 2021. The motion was seconded by Representative Nunn. The motion was carried by the following vote:**
>
> **Aye:** 5 – Byrne, Albaugh, Mitchell, Conner, and Nunn.

Laura Snell facilitated the meeting.

Tiffany Martinez reviewed the BVAC process for chapter approval and the time line to complete the GSP. The draft chapters go into the draft GSP which will be posted for public review prior to the committee making a recommendation to the Lassen and Modoc Boards of Supervisors. Once approved by the Lassen and Modoc Boards of Supervisors it will be submitted to DWR.

T. Martinez then read the sustainability goal and recapped the agenda for the meeting.

SUBJECT #1:
Introduction of Public Draft Chapter 11 (*Notice and Communications*) and Public Draft Chapter 12 (*Reference* List) of the Groundwater Sustainability Plan (GSP).

ACTION REQUESTED:

1. Receive reports from the pertinent ad hoc committees, BVAC Secretary, Staff, and/or Consultant.
2. Receive public comment after each chapter (or as seen fit by Chair).

T. Martinez reviewed the information going into the draft Chapter 11. She summarized the outreach that happened prior to the GSP development. Then she went over the outreach tools used and the information that went into them. She reviewed the decision-making process and focused on what happens after the completion of the draft GSP is completed. Chapter 12 is the reference list and the list is communicating that the GSP is based on the best available information and science that is available at this time.

Committee comment: Representative Nunn asked if there was text for 11.2 and David Fairman is working on it and will include reference to letter to the state and response as well as other difficulties related to the Covid pandemic. Vice-Chairman Albaugh agrees with what is going into 11.2. He would like to add the dinner meeting to the outreach list and also add picture of low public turn out at a meeting.

Vice-Chairman Albaugh had questions regarding reference to tribal outreach. D. Fairman said that DWR has guidance regarding tribal outreach. Vice-Chairman Albaugh stated that the tribes have been noticed, and if they wanted to be here they should have been. Any special write up about outreach to the tribes should not be in the GSP as they have been offered the opportunity to participate and have chosen not to. T. Martinez has documented outreach to tribes and are on the interested parties list. L. Snell stated that the GSP is required to show that tribal outreach has been done. Tribes are specifically called out by DWR as they are sovereign entities. Both Representative Mitchell and Representative Nunn think the outreach to the tribes should be documented in the GSP.

Chairman Byrne had verbiage changes.

Vice-Chairman Albaugh added references to include on reference list in Chapter 12.

T. Martinez introduced 11.5.8 (Exhibit B) which was added to Chapter 11. T. Martinez and L. Snell both brought up including meetings that were held that had conversed the GSP topic in the course of the meeting.

On line public comment: 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. Some comments in the comment matrix were cut off, please fix.”

Public comment: None

SUBJECT #2:
Introduction of Revised Draft Chapter 9 (*Project and Management Actions*) of the GSP.

ACTION REQUESTED:

1. Receive reports from the pertinent ad hoc committees, BVAC Secretary, Staff, and/or Consultant.
2. Receive public comment.
3. Accept and “set aside” Revised Draft Chapter 9 for future inclusion into the Draft GSP.

Laura Snell stated that more detail to the projects has been added in Chapter 9

Committee comment: Vice-Chairman Albaugh had verbiage changes. He also wanted the Aquafer Storage and Recovery (ASR) to be more definitive. He questioned why staff is writing Chapter 9 when GEI should be writing it. Representative Mitchell also had verbiage changes.

G. Norwood stated that there is preplanning for the Roberts Reservoir expansion. David Fairman went on to say that GEI has expertise of dam modifications. GEI has been involved in the planning, design, and construction phases of projects. State funding looks at funding by each phase, so GEI is able to provide the calculations for each phase. Representative Mitchell was concerned with the base of the dam. Representative Nunn asked that he be contacted in the future regarding any meetings regarding Roberts Reservoir.

Discussion was held regarding the possibility of using Stone Co. as part of the watershed. Staff said they would look into it.

On line public comment: Julie stated that "project decisions should be left to the professionals. She also wanted a future project to be the reintroduction of beavers. She was concerned that the water shed doesn't include Stone Co."

Public comment: None

Set aside Chapter 9 –

> **A motion was made by Vice-Chairman Albaugh to "set aside" Chapter 9. The motion was seconded by Representative Conner. The motion was carried by the following vote:**
>
> **Aye:** 5 – Byrne, Albaugh, Mitchell, Conner, and Nunn.

SUBJECT #3:
Introduction of Revised Draft Chapter 10 (*Implementation Plan*) of the GSP.

ACTION REQUESTED:

1. Receive report from the pertinent ad hoc committees, BVAC Secretary, Staff, and/or Consultant.
2. Receive public comment.
3. Accept and "set aside" Revised Draft Chapter 10 for future inclusion into the Draft GSP.

G. Norwood presented revisions in Chapter 10.

Committee comment: Chairman Byrne and Vice-Chairman Albaugh had verbiage changes. Discussion was held on the cost of hosting servers for the GSP information portal. David Fairman will talk to Lassen County IT supervisor Jason Housel. Vice-Chairman Albaugh stated that SGMA is an unfunded mandate by the state and it should be funded. Representative Mitchell and Vice-Chairman Albaugh both agree that all the negative aspects of preparing a GSP should be included in the GSP.

On line public comment: Julie commented that it is critical to have knowledge on groundwater.

Public comment: None

Set aside Chapter 10 –

A motion was made by Vice-Chairman Albaugh to "set aside" Chapter 10. The motion was seconded by Representative Nunn. The motion was carried by the following vote:

Aye: 5 – Byrne, Albaugh, Mitchell, Conner, and Nunn.

Reopen Chapter 9 –

A motion was made by Vice-Chairman Albaugh to reopen discussion on Chapter 9. The motion was seconded by Representative Conner. The motion was carried by the following vote:

Aye: 5 – Byrne, Albaugh, Mitchell, Conner, and Nunn.

Discussion was held regarding Table 9-3 and Vice-Chairman Albaugh had verbiage changes for the table.

Set aside Chapter 9 –

A motion was made by Vice-Chairman Albaugh to "set aside" Chapter 9. The motion was seconded by Representative Conner. The motion was carried by the following vote:

Aye: 5 – Byrne, Albaugh, Mitchell, Conner, and Nunn.

Ian Espinoza if DWR talked briefly about the aero-electromagnetic (AEM) survey that will be done in the fall. The committee would have to provide the flight path information. He then introduced Pat Vellines, DWR Regional Coordinator, who presented remotely, information on how AEM works. AEM provides a 3D graph of the subsurface. It gives a hydrologic conceptual model. The AEM measures resistivity and conductivity. The system can differentiate between air and ground static by eliminating background static. Groundwater depth and known information can help identify between fresh water and clay in the ground. It would take about five days for the AEM survey. GEI can provide boring information to correlate results. Discussion was held regarding the safety of an AEM survey. Pat Vellines' links will be sent to the committee members regarding the AEM survey.

Ian Espinoza brought up that the first GSPs from other basins have been turned in. T. Martinez asked how data gaps were handled. Espinoza said if data gaps hindered reporting then the GSP discussed how to close the data gap. Vice-Chairman asked about GSP review and response times. Vice-Chairman asked about changing the date of DWR's water year and Espinosa said it could not be changed because it is entrenched in a lot of other programs.

On line public comment: Doreen had attended a webinar on the Airborne Electromagnetic System and shared information on what she learned.

Public comment: None

Matters Initiated by the General Public (regarding subjects <u>not</u> on the agenda**):** Julie (online) would like the committee to at least consider the comments in the matrices for which there were no responses, if not for this document then for the 5-year review.

Establish next meeting date: There will be a public outreach meeting on August 14th in Bieber. The next BVAC meeting is a special meeting tentatively planned for September 9, 2021 at 2:00 pm. in Adin.

Adjournment: There being no further business, Chairman Byrne asked for a motion to adjourn.

A motion was made by Representative Nunn to adjourn the meeting which was seconded by Representative Conner at 5:39 pm.

The motion was carried by the following vote:

Aye: 5 – Byrne, Albaugh, Mitchell, Conner, and Nunn.

Groundwater and Watershed Health Workshop

August 14, 2021

Submitted by Laura Snell and Claire Bjork to the Big Valley Groundwater Advisory Committee

Summary of Presentations

Laura Snell: Big Valley Groundwater Basin GSP and projects update

- Presented on ongoing projects including winter recharge, brief history of SGMA covering prioritization, 2019 Modoc and Lassen Counties became GSAs for the Basin.
- 2020- history of BVAC, meeting monthly on groundwater sustainability plan. Showed recent map detailing the relationship between the Basin boundary, the watershed and upper Pit River watershed.
- Brief Overview Ch. 1-12
    - Ch. 1-3: Establishes unique characteristics of Basin, provides sustainability goals
    - Ch. 4-5 covered current groundwater conditions: good-excellent water quality, natural wetlands, changes in water levels and limnology and volcanic soils.
    - Ch. 6: Outlined water budget, balancing annual need with annual recharge.
    - Ch. 7: Went over sustainable groundwater management criteria applicable to this region
    - Ch. 8: monitoring networks, described existing and planned programs aimed at establishing monitoring networks to collect data for the Basin
    - Ch. 9 Projects and management actions- highlighted existing and upcoming projects to inform management decisions.
    - Ch. 10-12: implementation plan and administration, covering monitoring networks, annual reports and 5 year plan update intervals.
- Directed participants to enroll as interested parties to receive meeting notices, if they would like to become involved and received comments during breakout sessions.

Pit River RCD- Sharmie Stevenson

- Projects on forest health and fire prevention, work on reducing fuels working with outside contractors,
    - successfully treated Cove fire area, doing some roadsides to prevent erosion
    - Stone fire- treated some of the landscape there as well, restoration.
        - These two projects built trust between RCD and Forest Service, and
- Raised/borrowed money from local grassroots organizations, sold timber harvests on project areas to pay that money back. Look for future restoration opportunities on public and private land.
- Use forest thinning techniques such as chipping, mastication of biomass (chipping and broadcasting) and prescribed fire. (Mastication not ideal due to spread of fuels, but

limited infrastructure to handle processing of biomass otherwise.) Purpose is to reduce forest overgrowth to decrease fire risk and intensity. Looking to expand biomass processing facilities, including the timber mill in Bieber.

- Put over $5 million into projects within the RCD boundary over the last couple years
- Contracts with over 10 different LTOs, 6 local NGOs, and a budget of 5 million dollars from CalFire to work on watershed projects
- Additionally treating several projects:
  - Rush: East of Adin, mastication project 435 acres completed,
  - Completed Lava project: East of Whitehorse- 377 acres, and contract allowed for an additional 45 last month
  - Rush two dose springs project: total 550 acres, working jointly with forest service- they're completing 1170 acres on Snell project by whitehorse
  - Round mountain project: 1135 acres
  - Adin Canby and spider totaling 1840, by Cal Pines
  - Ash- 625 acres near Adin
- 5 million dollars from CalFire, competitive grant program. Work completed timely, and will be receiving addition 5 million from CalFire for projects on Devils garden- 3285 plantation 1200 acres in Wagon tire area in natural stands, and another 1200 in plantation, and then on Scarface 1763 acres there
  - Projects must be completed by March 2023.

Irrigated Lands Regulatory Program Update – Pam Giacomini

- Goose Lake received exemption from the irrigated lands regulatory program
- Surveys will be administered in Pit River Watershed to attempt to receive feedback to pursue additional exemptions for low nitrogen input crops such as irrigated pasturelands in both this region and the foothills.
- Funding was solicited and received from California Cattle Council

DWR AEM- Ian Espinoza

- 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."

- Geophysics studies the physical properties of the earth, such as electrical resistivity and conductivity. These values can then be related to material properties, such as lithology or porosity, effectively rendering a subsurface image of the Basin's aquifer.
- Data collected will be correlated with existing well logs
- Safety: AEM will not fly over residential areas, highways, confined livestock, endangered species, military bases and FAA no-fly zones. The AEM instrument will fly at 100 feet aboveground.
- Information can be used to refine groundwater models for GSPs, manage critical infrastructure, and identify places for further studies or projects.
- Local agencies may opt to conduct additional fine grid AEM and DWR will provide guidance.

Presentations were recorded and can be viewed on the Devil's Garden Research and Education Facebook page https://fb.watch/7rJXzyKBTY/. After the presentations, three breakout stations were set up; Big Valley Groundwater Sustainability Plan, Pit River RCD, and Domestic Wells and LMFCWCD Voluntary Well Monitoring.

Comments Received:

On Watershed Health:

- Need forest restoration on large burned areas (Cove and Gold Fires) and reforestation. Impact from fire does not just last one year or 10 years and by not managing after fire we are setting ourselves up for failure. These non-reforested areas are not resilient to climate change, create stronger winds, drier slopes, more erosion, washouts, poor hydrologic function etc. We also need brush control in these post fire areas.
- Add projects/summary on Pit River RCD projects for the past 30 years into chapter 9 and something smaller in an earlier chapter
- The new watershed map received praise for its levels
- Need increased presence of beavers

On Wells and Water:

- Reports of motor burnouts due to strain from low water levels
- Hot springs changing due to seismic activity- need this identified in the plan in the case that it changes water quality etc. Groundwater sources are not clearly understood in BV.
- Hot spring water coming in earlier in the year
- Domestic water conservation: suggesting rotating watering schedules
- Protecting groundwater supplies: screening production wells within residential areas, plug and pond to recharge Adin supply wells
- Possibility of Adin municipal supply project
- Well supply issues in Lookout area and north for agricultural pumping wells
- Questions about whether Lassen Office of Emergency Services will accept the Modoc County branded well problem reporting sheet
- Concerns about feasibility of deepening Adin wells- hard to access and expensive.

On AEM:

- Surveys need to cover a larger area
- Could this survey benefit the Pit RCD and their interest in projects?
- Water depth study completed 1990s? Is this data available? Similar to AEM for its time?

On Water Storage:

- Need increased surface water storage
- There is great local support for Allan Camp Dam, make sure this is clear in the document. Improving life for Big Valley residents but also downstream users.
- LMFCWCD could build the Allan Camp Dam

Miscellaneous-

- Worried about the future of Big Valley

Big Valley Groundwater Sustainability Plan GSP Regulations Checklist (Elements Guide) for Public Draft GSP: August 26, 2021

This checklist of the GSP Elements and indicates where in the GSP each element of the regulations is addressed.

Article 5.			Plan Contents for Big Valley Groundwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
§ 354.			**Introduction to Plan Contents**					
			This Article describes the required contents of Plans submitted to the Department for evaluation, including administrative information, a description of the basin setting, sustainable management criteria, description of the monitoring network, and projects and management actions.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
SubArticle 1.			**Administrative Information**					
§ 354.2.			**Introduction to Administrative Information**					
			This Subarticle describes information in the Plan relating to administrative and other general information about the Agency that has adopted the Plan and the area covered by the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.4.			**General Information**					
			Each Plan shall include the following general information:					
(a)			An executive summary written in plain language that provides an overview of the Plan and description of groundwater conditions in the basin.		ES			
(b)			A list of references and technical studies relied upon by the Agency in developing the Plan. Each Agency shall provide to the Department electronic copies of reports and other documents and materials cited as references that are not generally available to the public.		12			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
§ 354.6.			**Agency Information**					
			When submitting an adopted Plan to the Department, the Agency shall include a copy of the information provided pursuant to Water Code Section 10723.8, with any updates, if necessary, along with the following information:					
(a)			The name and mailing address of the Agency.		2.1			
(b)			The organization and management structure of the Agency, identifying persons with management authority for implementation of the Plan.		2.2, 2.3			
(c)			The name and contact information, including the phone number, mailing address and electronic mail address, of the plan manager.		2.3			
(d)			The legal authority of the Agency, with specific reference to citations setting forth the duties, powers, and responsibilities of the Agency, demonstrating that the Agency has the legal authority to implement the Plan.		2.4			
(e)			An estimate of the cost of implementing the Plan and a general description of how the Agency plans to meet those costs.		10.6,10.7		10-4, 10-5	
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.8, 10727.2, and 10733.2, Water Code.					
§ 354.8.			**Description of Plan Area**					

Article 5.			Plan Contents for Big Valley Groundwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
			Each Plan shall include a description of the geographic areas covered, including the following information:					
(a)			One or more maps of the basin that depict the following, as applicable:					
	(1)		The area covered by the Plan, delineating areas managed by the Agency as an exclusive Agency and any areas for which the Agency is not an exclusive Agency, and the name and location of any adjacent basins.		3.1	3-1		
	(2)		Adjudicated areas, other Agencies within the basin, and areas covered by an Alternative.	N/A	3.1			There are no no adjudicated areas or areas covered by an Alternative.
	(3)		Jurisdictional boundaries of federal or state land (including the identity of the agency with jurisdiction over that land), tribal land, cities, counties, agencies with water management responsibilities, and areas covered by relevant general plans.		3.2	3-2		
	(4)		Existing land use designations and the identification of water use sector and water source type.		3.3	3-3, 3-4	3-1, 3-2	
	(5)		The density of wells per square mile, by dasymetric or similar mapping techniques, showing the general distribution of agricultural, industrial, and domestic water supply wells in the basin, including de minimis extractors, and the location and extent of communities dependent upon groundwater, utilizing data provided by the Department, as specified in Section 353.2, or the best available information.		3.4	3-5, 3-6, 3-7	3-3	
(b)			A written description of the Plan area, including a summary of the jurisdictional areas and other features depicted on the map.		3.1, 3.2	3-1 , 3-2		
(c)			Identification of existing water resource monitoring and management programs, and description of any such programs the Agency plans to incorporate in its monitoring network or in development of its Plan. The Agency may coordinate with existing water resource monitoring and management programs to incorporate and adopt that program as part of the Plan.		3.5	3-8, 3-9, 3-10, 3-11	3-4,3-5	
(d)			A description of how existing water resource monitoring or management programs may limit operational flexibility in the basin, and how the Plan has been developed to adapt to those limits.		3.5.5			
(e)			A description of conjunctive use programs in the basin.		3.6			No formally established conjunctive use programs are operating in the Basin
(f)			A plain language description of the land use elements or topic categories of applicable general plans that includes the following:					
	(1)		A summary of general plans and other land use plans governing the basin.		3.7	3-12		
	(2)		A general description of how implementation of existing land use plans may change water demands within the basin or affect the ability of the Agency to achieve sustainable groundwater management over the planning and implementation horizon, and how the Plan addresses those potential effects		3.7.4, 3.7.5			
	(3)		A general description of how implementation of the Plan may affect the water supply assumptions of relevant land use plans over the planning and implementation horizon.		3.7.5			
	(4)		A summary of the process for permitting new or replacement wells in the basin, including adopted standards in local well ordinances, zoning codes, and policies contained in adopted land use plans.		3.7.6			

"X" indicates that the element has been addressed.
The page number will be filled in once the entire GSP is compiled.

Shaded areas are elements of the regulations that don't have to be addressed in the GSP

Article 5.			Plan Contents for Big Valley Groundwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(5)		To the extent known, the Agency may include information regarding the implementation of land use plans outside the basin that could affect the ability of the Agency to achieve sustainable groundwater management.		3.7.7			
(g)			A description of any of the additional Plan elements included in Water Code Section 10727.4 that the Agency determines to be appropriate.		3.9		3-6	
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10720.3, 10727.2, 10727.4, 10733, and 10733.2, Water Code.					
§ 354.10.			**Notice and Communication**					
			Each Plan shall include a summary of information relating to notification and communication by the Agency with other agencies and interested parties including the following:					
(a)			A description of the beneficial uses and users of groundwater in the basin, including the land uses and property interests potentially affected by the use of groundwater in the basin, the types of parties representing those interests, and the nature of consultation with those parties.		11.4			
(b)			A list of public meetings at which the Plan was discussed or considered by the Agency.		11.5		11-1	Also Appendix 11A
(c)			Comments regarding the Plan received by the Agency and a summary of any responses by the Agency.		11.7			Also Appendix 11C
(d)			A communication section of the Plan that includes the following:					
	(1)		An explanation of the Agency's decision-making process.		11.6	11-1		
	(2)		Identification of opportunities for public engagement and a discussion of how public input and response will be used.		11.5, 11.7			
	(3)		A description of how the Agency encourages the active involvement of diverse social, cultural, and economic elements of the population within the basin.		11.4			
	(4)		The method the Agency shall follow to inform the public about progress implementing the Plan, including the status of projects and actions.		11.8			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.8, 10728.4, and 10733.2, Water Code					
SubArticle 2.			**Basin Setting**					
§ 354.12.			**Introduction to Basin Setting**					
			This Subarticle describes the information about the physical setting and characteristics of the basin and current conditions of the basin that shall be part of each Plan, including the identification of data gaps and levels of uncertainty, which comprise the basin setting that serves as the basis for defining and assessing reasonable sustainable management criteria and projects and management actions. Information provided pursuant to this Subarticle shall be prepared by or under the direction of a professional geologist or professional engineer.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.14.			**Hydrogeologic Conceptual Model**					
(a)			Each Plan shall include a descriptive hydrogeologic conceptual model of the basin based on technical studies and qualified maps that characterizes the physical components and interaction of the surface water and groundwater systems in the basin.		4			

Article 5.			Plan Contents for Big Valley Groundwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(b)			The hydrogeologic conceptual model shall be summarized in a written description that includes the following:					
	(1)		The regional geologic and structural setting of the basin including the immediate surrounding area, as necessary for geologic consistency.		4.2	4-2		
	(2)		Lateral basin boundaries, including major geologic features that significantly affect groundwater flow.		4.2.1	4-2		
	(3)		The definable bottom of the basin.		4.4.3			
	(4)		Principal aquifers and aquitards, including the following information:					
		(A)	Formation names, if defined.		4.4.1	4-3,4-4		
		(B)	Physical properties of aquifers and aquitards, including the vertical and lateral extent, hydraulic conductivity, and storativity, which may be based on existing technical studies or other best available information.		4.4.5		4-2	
		(C)	Structural properties of the basin that restrict groundwater flow within the principal aquifers, including information regarding stratigraphic changes, truncation of units, or other features.		4.4.4	4-8		
		(D)	General water quality of the principal aquifers, which may be based on information derived from existing technical studies or regulatory programs.		4.7	4-13		
		(E)	Identification of the primary use or uses of each aquifer, such as domestic, irrigation, or municipal water supply.		4.6			
	(5)		Identification of data gaps and uncertainty within the hydrogeologic conceptual model		4.11			
(c)			The hydrogeologic conceptual model shall be represented graphically by at least two scaled cross-sections that display the information required by this section and are sufficient to depict major stratigraphic and structural features in the basin.		4.4.2	4-6,4-7		
(d)			Physical characteristics of the basin shall be represented on one or more maps that depict the following:					
	(1)		Topographic information derived from the U.S. Geological Survey or another reliable source.		4.1	4-1		
	(2)		Surficial geology derived from a qualified map including the locations of cross-sections required by this Section.		4.2,4.3	4-2,4-3,4-4		
	(3)		Soil characteristics as described by the appropriate Natural Resources Conservation Service soil survey or other applicable studies.		4.5	4-9,4-10,4-11		
	(4)		Delineation of existing recharge areas that substantially contribute to the replenishment of the basin, potential recharge areas, and discharge areas, including significant active springs, seeps, and wetlands within or adjacent to the basin.		4.8	4-14		
	(5)		Surface water bodies that are significant to the management of the basin.		4.9	4-14		
	(6)		The source and point of delivery for imported water supplies.	N/A				No water is imported to the BVGB
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10733, and 10733.2, Water Code.					
§ 354.16.			**Groundwater Conditions**					
			Each Plan shall provide a description of current and historical groundwater conditions in the basin, including data from January 1, 2015, to current conditions, based on the best available information that includes the following:					
(a)			Groundwater elevation data demonstrating flow directions, lateral and vertical gradients, and regional pumping patterns, including:					

				GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		Groundwater elevation contour maps depicting the groundwater table or potentiometric surface associated with the current seasonal high and seasonal low for each principal aquifer within the basin.		5.1.3	5-5,5-6		Also Appendix 5B
	(2)		Hydrographs depicting long-term groundwater elevations, historical highs and lows, and hydraulic gradients between principal aquifers.		5.1.1,5.1.2	5-2,5-3,5-4		Also Appendix 5A
(b)			A graph depicting estimates of the change in groundwater in storage, based on data, demonstrating the annual and cumulative change in the volume of groundwater in storage between seasonal high groundwater conditions, including the annual groundwater use and water year type.		5.2	5-7	5-2	
(c)			Seawater intrusion conditions in the basin, including maps and cross-sections of the seawater intrusion front for each principal aquifer.	N/A	5.3			Not applicable due to inland location.
(d)			Groundwater quality issues that may affect the supply and beneficial uses of groundwater, including a description and map of the location of known groundwater contamination sites and plumes.		5.4	5-8:5-15	5-3,5-4	
(e)			The extent, cumulative total, and annual rate of land subsidence, including maps depicting total subsidence, utilizing data available from the Department, as specified in Section 353.2, or the best available information.		5.5	5-16,5-17		
(f)			Identification of interconnected surface water systems within the basin and an estimate of the quantity and timing of depletions of those systems, utilizing data available from the Department, as specified in Section 353.2, or the best available information.		5.6	5-18		
(g)			Identification of groundwater dependent ecosystems within the basin, utilizing data available from the Department, as specified in Section 353.2, or the best available information.		5.7	5-19:5-22	5-5	
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, and 10733.2, Water Code.					
§ 354.18.			**Water Budget**					
(a)			Each Plan shall include a water budget for the basin that provides an accounting and assessment of the total annual volume of groundwater and surface water entering and leaving the basin, including historical, current and projected water budget conditions, and the change in the volume of water stored. Water budget information shall be reported in tabular and graphical form.		6			
(b)			The water budget shall quantify the following, either through direct measurements or estimates based on data:					
	(1)		Total surface water entering and leaving a basin by water source type.		6.2	6-7		Also Appendix 6B and 6C
	(2)		Inflow to the groundwater system by water source type, including subsurface groundwater inflow and infiltration of precipitation, applied water, and surface water systems, such as lakes, streams, rivers, canals, springs and conveyance systems.		6.2	6-8		Also Appendix 6B and 6C
	(3)		Outflows from the groundwater system by water use sector, including evapotranspiration, groundwater extraction, groundwater discharge to surface water sources, and subsurface groundwater outflow.		6.2	6-8		Also Appendix 6B and 6C
	(4)		The change in the annual volume of groundwater in storage between seasonal high conditions.		6.2	6-8		Also Appendix 6B and 6C

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(5)		If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions.		6.2	6-8		Also Appendix 6B and 6C
	(6)		The water year type associated with the annual supply, demand, and change in groundwater stored.		6.2	6-3		
	(7)		An estimate of sustainable yield for the basin.		6.2	6-8		
(c)			Each Plan shall quantify the current, historical, and projected water budget for the basin as follows:					
	(1)		Current water budget information shall quantify current inflows and outflows for the basin using the most recent hydrology, water supply, water demand, and land use information.		6.2, 6.3	6-4, 6-6:6-8		Also Appendix 6B and 6C
	(2)		Historical water budget information shall be used to evaluate availability or reliability of past surface water supply deliveries and aquifer response to water supply and demand trends relative to water year type. The historical water budget shall include the following:					
		(A)	A quantitative evaluation of the availability or reliability of historical surface water supply deliveries as a function of the historical planned versus actual annual surface water deliveries, by surface water source and water year type, and based on the most recent ten years of surface water supply information.		6.2			
		(B)	A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon.		6.2	6-4:6-7		Also Appendix 6B and 6C
		(C)	A description of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability of the Agency to operate the basin within sustainable yield. Basin hydrology may be characterized and evaluated using water year type.		6.2			
	(3)		Projected water budgets shall be used to estimate future baseline conditions of supply, demand, and aquifer response to Plan implementation, and to identify the uncertainties of these projected water budget components. The projected water budget shall utilize the following methodologies and assumptions to estimate future baseline conditions concerning hydrology, water demand and surface water supply availability or reliability over the planning and implementation horizon:					
		(A)	Projected hydrology shall utilize 50 years of historical precipitation, evapotranspiration, and streamflow information as the baseline condition for estimating future hydrology. The projected hydrology information shall also be applied as the baseline condition used to evaluate future scenarios of hydrologic uncertainty associated with projections of climate change and sea level rise.		6.4	6-10, 6-11		

				GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
		(B)	Projected water demand shall utilize the most recent land use, evapotranspiration, and crop coefficient information as the baseline condition for estimating future water demand. The projected water demand information shall also be applied as the baseline condition used to evaluate future scenarios of water demand uncertainty associated with projected changes in local land use planning, population growth, and climate.		6.4	6-10, 6-11		
		(C)	Projected surface water supply shall utilize the most recent water supply information as the baseline condition for estimating future surface water supply. The projected surface water supply shall also be applied as the baseline condition used to evaluate future scenarios of surface water supply availability and reliability as a function of the historical surface water supply identified in Section 354.18(c)(2)(A), and the projected changes in local land use planning, population growth, and climate.		6.4	6-10, 6-11		
(d)			The Agency shall utilize the following information provided, as available, by the Department pursuant to Section 353.2, or other data of comparable quality, to develop the water budget:					
	(1)		Historical water budget information for mean annual temperature, mean annual precipitation, water year type, and land use.		6.2	6-3		
	(2)		Current water budget information for temperature, water year type, evapotranspiration, and land use.		6.2, 6.3			
	(3)		Projected water budget information for population, population growth, climate change, and sea level rise.		6.4			
(e)			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. If a numerical groundwater and surface water model is not used to quantify and evaluate the projected water budget conditions and the potential impacts to beneficial uses and users of groundwater, the Plan shall identify and describe an equally effective method, tool, or analytical model to evaluate projected water budget conditions.		6			
(f)			The Department shall provide the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM) and the Integrated Water Flow Model (IWFM) for use by Agencies in developing the water budget. Each Agency may choose to use a different groundwater and surface water model, pursuant to Section 352.4.	N/A				C2VSIM does not apply to this Basin
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10727.6, 10729, and 10733.2, Water Code.					
§ 354.20.			**Management Areas**					
(a)			Each Agency may define one or more management areas within a basin if the Agency has determined that creation of management areas will facilitate implementation of the Plan. Management areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin.		7.4			No management areas were created for this GSP.
(b)			A basin that includes one or more management areas shall describe the following in the Plan:					

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		The reason for the creation of each management area.		7.4			No management areas were created for this GSP.
	(2)		The minimum thresholds and measurable objectives established for each management area, and an explanation of the rationale for selecting those values, if different from the basin at large.		7.4			No management areas were created for this GSP.
	(3)		The level of monitoring and analysis appropriate for each management area.		7.4			No management areas were created for this GSP.
	(4)		An explanation of how the management area can operate under different minimum thresholds and measurable objectives without causing undesirable results outside the management area, if applicable.		7.4			No management areas were created for this GSP.
(c)			If a Plan includes one or more management areas, the Plan shall include descriptions, maps, and other information required by this Subarticle sufficient to describe conditions in those areas.		7.4			No management areas were created for this GSP.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10733.2 and 10733.4, Water Code.					
SubArticle 3.			**Sustainable Management Criteria**					
§ 354.22.			**Introduction to Sustainable Management Criteria**					
			This Subarticle describes criteria by which an Agency defines conditions in its Plan that constitute sustainable groundwater management for the basin, including the process by which the Agency shall characterize undesirable results, and establish minimum thresholds and measurable objectives for each applicable sustainability indicator.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.24.			**Sustainability Goal**					
			Each Agency shall establish in its Plan a sustainability goal for the basin that culminates in the absence of undesirable results within 20 years of the applicable statutory deadline. The Plan shall include a description of the sustainability goal, including information from the basin setting used to establish the sustainability goal, a discussion of the measures that will be implemented to ensure that the basin will be operated within its sustainable yield, and an explanation of how the sustainability goal is likely to be achieved within 20 years of Plan implementation and is likely to be maintained through the planning and implementation horizon.		1.4			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10727, 10727.2, 10733.2, and 10733.8, Water Code.					
§ 354.26.			**Undesirable Results**					
(a)			Each Agency shall describe in its Plan the processes and criteria relied upon to define undesirable results applicable to the basin. Undesirable results occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the basin.		7.3			
(b)			The description of undesirable results shall include the following:					
	(1)		The cause of groundwater conditions occurring throughout the basin that would lead to or has led to undesirable results based on information described in the basin setting, and other data or models as appropriate.		7.3			

Article 5.			Plan Contents for Big Valley Groundwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(2)		The criteria used to define when and where the effects of the groundwater conditions cause undesirable results for each applicable sustainability indicator. The criteria shall be based on a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the basin.		7.3			
	(3)		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.		7.3			
(c)			The Agency may need to evaluate multiple minimum thresholds to determine whether an undesirable result is occurring in the basin. The determination that undesirable results are occurring may depend upon measurements from multiple monitoring sites, rather than a single monitoring site.		7.3			
(d)			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.		7.3			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10721, 10723.2, 10727.2, 10733.2, and 10733.8, Water Code.					
§ 354.28.			**Minimum Thresholds**					
(a)			Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26.		7.3			
(b)			The description of minimum thresholds shall include the following:					
	(1)		The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting.		7.3			
	(2)		The relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators.		7.3			
	(3)		How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.		7.3			
	(4)		How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.		7.3			
	(5)		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 basis for the difference.		7.3			
	(6)		How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.		7.3			
(c)			Minimum thresholds for each sustainability indicator shall be defined as follows:					

Article 5.			Plan Contents for Big Valley Groundwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(1)		Chronic Lowering of Groundwater Levels. The minimum threshold for chronic lowering of groundwater levels shall be the groundwater elevation indicating a depletion of supply at a given location that may lead to undesirable results. Minimum thresholds for chronic lowering of groundwater levels shall be supported by the following:					
		(A)	The rate of groundwater elevation decline based on historical trends, water year type, and projected water use in the basin.		7.3.1, 5.1.1			Also Appendix 5A
		(B)	Potential effects on other sustainability indicators.		7.3.1			
	(2)		Reduction of Groundwater Storage. The minimum threshold for reduction of groundwater storage shall be a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results. Minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin, calculated based on historical trends, water year type, and projected water use in the basin.		7.3.2			
	(3)		Seawater Intrusion. The minimum threshold for seawater intrusion shall be defined by a chloride concentration isocontour for each principal aquifer where seawater intrusion may lead to undesirable results. Minimum thresholds for seawater intrusion shall be supported by the following:					
		(A)	Maps and cross-sections of the chloride concentration isocontour that defines the minimum threshold and measurable objective for each principal aquifer.	N/A	7.3.3			Seawater Intrusion is not applicable to the Basin and this section states that it does not and will not occur in the future.
		(B)	A description of how the seawater intrusion minimum threshold considers the effects of current and projected sea levels.	N/A	7.3.3			Seawater Intrusion is not applicable to the Basin and this section states that it does not and will not occur in the future.
	(4)		Degraded Water Quality. The minimum threshold for degraded water quality shall be the degradation of water quality, including the migration of contaminant plumes that impair water supplies or other indicator of water quality as determined by the Agency that may lead to undesirable results. The minimum threshold shall be based on the number of supply wells, a volume of water, or a location of an isocontour that exceeds concentrations of constituents determined by the Agency to be of concern for the basin. In setting minimum thresholds for degraded water quality, the Agency shall consider local, state, and federal water quality standards applicable to the basin.	N/A	7.3.4			No MT or MO established
	(5)		Land Subsidence. The minimum threshold for land subsidence shall be the rate and extent of subsidence that substantially interferes with surface land uses and may lead to undesirable results. Minimum thresholds for land subsidence shall be supported by the following:					
		(A)	Identification of land uses and property interests that have been affected or are likely to be affected by land subsidence in the basin, including an explanation of how the Agency has determined and considered those uses and interests, and the Agency's rationale for establishing minimum thresholds in light of those effects.	N/A	7.3.5			No MT or MO established
		(B)	Maps and graphs showing the extent and rate of land subsidence in the basin that defines the minimum threshold and measurable objectives.	N/A	7.3.5			No MT or MO established

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				GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(6)		Depletions of Interconnected Surface Water. 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. The minimum threshold established for depletions of interconnected surface water shall be supported by the following:					
		(A)	The location, quantity, and timing of depletions of interconnected surface water.	N/A	7.3.6			Not enough information available
		(B)	A description of the groundwater and surface water model used to quantify surface water depletion. If a numerical groundwater and surface water model is not used to quantify surface water depletion, the Plan shall identify and describe an equally effective method, tool, or analytical model to accomplish the requirements of this Paragraph.	N/A	7.3.6			Not enough information available
(d)			An Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence.	N/A	7.3.6			No MT or MO established
(e)			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 a basin, as described in Section 354.26, shall not be required to establish minimum thresholds related to those sustainability indicators.		7.3			Seawater Intrusion is not applicable to the Basin and this section states that it does not and will not occur in the future.
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10733, 10733.2, and 10733.8, Water Code.					
§ 354.30.			**Measurable Objectives**					
(a)			Each Agency shall establish measurable objectives, including interim milestones in increments of five years, to achieve the sustainability goal for the basin within 20 years of Plan implementation and to continue to sustainably manage the groundwater basin over the planning and implementation horizon.		7.3			
(b)			Measurable objectives shall be established for each sustainability indicator, based on quantitative values using the same metrics and monitoring sites as are used to define the minimum thresholds.		7.3			
(c)			Measurable objectives shall provide a reasonable margin of operational flexibility under adverse conditions which shall take into consideration components such as historical water budgets, seasonal and long-term trends, and periods of drought, and be commensurate with levels of uncertainty.		7.3			
(d)			An Agency may establish a representative measurable objective for groundwater elevation to serve as the value for multiple sustainability indicators where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual measurable objectives as supported by adequate evidence.		7.3			
(e)			Each Plan shall describe a reasonable path to achieve the sustainability goal for the basin within 20 years of Plan implementation, including a description of interim milestones for each relevant sustainability indicator, using the same metric as the measurable objective, in increments of five years. The description shall explain how the Plan is likely to maintain sustainable groundwater management over the planning and implementation horizon.		7.3			

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(f)			Each Plan may include measurable objectives and interim milestones for additional Plan elements described in Water Code Section 10727.4 where the Agency determines such measures are appropriate for sustainable groundwater management in the basin.		7.3			
(g)			An Agency may establish measurable objectives that exceed the reasonable margin of operational flexibility for the purpose of improving overall conditions in the basin, but failure to achieve those objectives shall not be grounds for a finding of inadequacy of the Plan.		7.3			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					
SubArticle 4.			**Monitoring Networks**					
§ 354.32.			**Introduction to Monitoring Networks**					
			This Subarticle describes the monitoring network that shall be developed for each basin, including monitoring objectives, monitoring protocols, and data reporting requirements. The monitoring network shall promote the collection of data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the basin and evaluate changing conditions that occur through implementation of the Plan.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.34.			**Monitoring Network**					
(a)			Each Agency shall develop a monitoring network capable of collecting sufficient data to demonstrate short-term, seasonal, and long-term trends in groundwater and related surface conditions, and yield representative information about groundwater conditions as necessary to evaluate Plan implementation.		8.2			
(b)			Each Plan shall include a description of the monitoring network objectives for the basin, including an explanation of how the network will be developed and implemented to monitor groundwater and related surface conditions, and the interconnection of surface water and groundwater, with sufficient temporal frequency and spatial density to evaluate the affects and effectiveness of Plan implementation. The monitoring network objectives shall be implemented to accomplish the following:					
	(1)		Demonstrate progress toward achieving measurable objectives described in the Plan.		8.1			
	(2)		Monitor impacts to the beneficial uses or users of groundwater.		8.1,8.2			
	(3)		Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.		8.1,8.2			
	(4)		Quantify annual changes in water budget components.		8.1,8.2			
(c)			Each monitoring network shall be designed to accomplish the following for each sustainability indicator:					
	(1)		Chronic Lowering of Groundwater Levels. Demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features by the following methods:					

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
		(A)	A sufficient density of monitoring wells to collect representative measurements through depth-discrete perforated intervals to characterize the groundwater table or potentiometric surface for each principal aquifer.		8.2.1			
		(B)	Static groundwater elevation measurements shall be collected at least two times per year, to represent seasonal low and seasonal high groundwater conditions.		8.2.1			
	(2)		Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage.		8.2.1, 8.2.4			
	(3)		Seawater Intrusion. Monitor seawater intrusion using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated.	N/A				Seawater intrusion not applicable to the BVGB
	(4)		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.		8.2.2			
	(5)		Land Subsidence. Identify the rate and extent of land subsidence, which may be measured by extensometers, surveying, remote sensing technology, or other appropriate method.		8.2.3			
	(6)		Depletions of Interconnected Surface Water. Monitor surface water and groundwater, where interconnected surface water conditions exist, to characterize the spatial and temporal exchanges between surface water and groundwater, and to calibrate and apply the tools and methods necessary to calculate depletions of surface water caused by groundwater extractions. The monitoring network shall be able to characterize the following:					
		(A)	Flow conditions including surface water discharge, surface water head, and baseflow contribution.	N/A				No SMCs established for interconnected surface water.
		(B)	Identifying the approximate date and location where ephemeral or intermittent flowing streams and rivers cease to flow, if applicable.	N/A				No SMCs established for interconnected surface water.
		(C)	Temporal change in conditions due to variations in stream discharge and regional groundwater extraction.	N/A				No SMCs established for interconnected surface water.
		(D)	Other factors that may be necessary to identify adverse impacts on beneficial uses of the surface water.	N/A				No SMCs established for interconnected surface water.
(d)			The monitoring network shall be designed to ensure adequate coverage of sustainability indicators. If management areas are established, the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the basin setting and sustainable management criteria specific to that area.		8.2			
(e)			A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.		8.2			
(f)			The Agency shall determine the density of monitoring sites and frequency of measurements required to demonstrate short-term, seasonal, and long-term trends based upon the following factors:					
	(1)		Amount of current and projected groundwater use.		6.2, 6.4			
	(2)		Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.		4.4			

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				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
	(3)		Impacts to beneficial uses and users of groundwater and land uses and property interests affected by groundwater production, and adjacent basins that could affect the ability of that basin to meet the sustainability goal.		8.2			
	(4)		Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.		8.2			
(g)			Each Plan shall describe the following information about the monitoring network:					
	(1)		Scientific rationale for the monitoring site selection process.		8.2			
	(2)		Consistency with data and reporting standards described in Section 352.4. If a site is not consistent with those standards, the Plan shall explain the necessity of the site to the monitoring network, and how any variation from the standards will not affect the usefulness of the results obtained.		8.2			
	(3)		For each sustainability indicator, the quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site or representative monitoring sites established pursuant to Section 354.36.		8.2			
(h)			The location and type of each monitoring site within the basin displayed on a map, and reported in tabular format, including information regarding the monitoring site type, frequency of measurement, and the purposes for which the monitoring site is being used.		8.2	8-1:8-3	8-1, 8-3	
(i)			The monitoring protocols developed by each Agency shall include a description of technical standards, data collection methods, and other procedures or protocols pursuant to Water Code Section 10727.2(f) for monitoring sites or other data collection facilities to ensure that the monitoring network utilizes comparable data and methodologies.		8.2.1.4, 8.2.2.1, 8.2.3.1			
(j)			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 a basin, as described in Section 354.26, shall not be required to establish a monitoring network related to those sustainability indicators.		8.2			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10727.4, 10728, 10733, 10733.2, and 10733.8, Water Code					
§ 354.36.			**Representative Monitoring**					
			Each Agency may designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin, as follows:					
(a)			Representative monitoring sites may be designated by the Agency as the point at which sustainability indicators are monitored, and for which quantitative values for minimum thresholds, measurable objectives, and interim milestones are defined.		8.2.1			
(b)			(b) Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following:					
	(1)		Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy.		8.2.1			
	(2)		Measurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy.		8.2.1			

Article 5.			Plan Contents for Big Valley Groundwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(c)			The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area.		8.2.1			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2 and 10733.2, Water Code					
§ 354.38.			**Assessment and Improvement of Monitoring Network**					
(a)			Each Agency shall review the monitoring network and include an evaluation in the Plan and each five-year assessment, including a determination of uncertainty and whether there are data gaps that could affect the ability of the Plan to achieve the sustainability goal for the basin.		8.2.1.5, 8.2.2.2, 8.2.3.2		8-2	
(b)			Each Agency shall identify data gaps wherever the basin does not contain a sufficient number of monitoring sites, does not monitor sites at a sufficient frequency, or utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the Agency.		8.2.1.5, 8.2.2.2, 8.2.3.2		8-2	
(c)			If the monitoring network contains data gaps, the Plan shall include a description of the following:					
	(1)		The location and reason for data gaps in the monitoring network.		8.2.1.5, 8.2.2.2, 8.2.3.2		8-2	
	(2)		Local issues and circumstances that limit or prevent monitoring.		8.2.1.5, 8.2.2.2, 8.2.3.2		8-2	
(d)			Each Agency shall describe steps that will be taken to fill data gaps before the next five-year assessment, including the location and purpose of newly added or installed monitoring sites.		8.2.1.5, 8.2.2.2, 8.2.3.2		8-2, 8-4	
(e)			Each Agency shall adjust the monitoring frequency and density of monitoring sites to provide an adequate level of detail about site-specific surface water and groundwater conditions and to assess the effectiveness of management actions under circumstances that include the following:					
	(1)		Minimum threshold exceedances.		8.2		8-1	
	(2)		Highly variable spatial or temporal conditions.		8.2		8-1	
	(3)		Adverse impacts to beneficial uses and users of groundwater.		8.2			
	(4)		The potential to adversely affect the ability of an adjacent basin to implement its Plan or impede achievement of sustainability goals in an adjacent basin.	N/A				No basins adjacent to Big Valley
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10723.2, 10727.2, 10728.2, 10733, 10733.2, and 10733.8, Water Code					
§ 354.40.			**Reporting Monitoring Data to the Department**					
			Monitoring data shall be stored in the data management system developed pursuant to Section 352.6. A copy of the monitoring data shall be included in the Annual Report and submitted electronically on forms provided by the Department.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10728, 10728.2, 10733.2, and 10733.8, Water Code.					
SubArticle 5.			**Projects and Management Actions**					
§ 354.42.			**Introduction to Projects and Management Actions**					

Article 5.			Plan Contents for Big Valley Groundwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
			This Subarticle describes the criteria for projects and management actions to be included in a Plan to meet the sustainability goal for the basin in a manner that can be maintained over the planning and implementation horizon.					
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Section 10733.2, Water Code.					
§ 354.44.			**Projects and Management Actions**					
(a)			Each Plan shall include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin.		9		9-3	
(b)			Each Plan shall include a description of the projects and management actions that include the following:					
	(1)		A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent. The Plan shall include the following:					
		(A)	A description of the circumstances under which projects or management actions shall be implemented, the criteria that would trigger implementation and termination of projects or management actions, and the process by which the Agency shall determine that conditions requiring the implementation of particular projects or management actions have occurred.		9		9-3	
		(B)	The process by which the Agency shall provide notice to the public and other agencies that the implementation of projects or management actions is being considered or has been implemented, including a description of the actions to be taken.		9		9-3	
	(2)		If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.				9-3	
	(3)		A summary of the permitting and regulatory process required for each project and management action.		9		9-3	
	(4)		The status of each project and management action, including a time-table for expected initiation and completion, and the accrual of expected benefits.				9-3	
	(5)		An explanation of the benefits that are expected to be realized from the project or management action, and how those benefits will be evaluated.		9		9-3	
	(6)		An explanation of how the project or management action will be accomplished. If the projects or management actions rely on water from outside the jurisdiction of the Agency, an explanation of the source and reliability of that water shall be included.		9		9-3	
	(7)		A description of the legal authority required for each project and management action, and the basis for that authority within the Agency.		9		9-3	
	(8)		A description of the estimated cost for each project and management action and a description of how the Agency plans to meet those costs.		9		9-3	
	(9)		A description of the management of groundwater extractions and recharge to ensure that chronic lowering of groundwater levels or depletion of supply during periods of drought is offset by increases in groundwater levels or storage during other periods.		9			

Article 5.			Plan Contents for Big Valley Groundwater Basin	GSP Document References				
				Page Numbers of Plan	Or Section Numbers	Or Figure Numbers	Or Table Numbers	Notes
(c)			Projects and management actions shall be supported by best available information and best available science.		9			
(d)			An Agency shall take into account the level of uncertainty associated with the basin setting when developing projects or management actions.		9			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					

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Big Valley Groundwater Basin
Groundwater Sustainability Plan

PUBLIC DRAFT

August 26, 2021

Prepared for:
Lassen County Groundwater Sustainability Agency
Modoc County Groundwater Sustainability Agency

PUBLIC DRAFT

Big Valley Groundwater Basin

Groundwater Sustainability Plan

Prepared for:

Lassen County Groundwater Sustainability Agency
Modoc County Groundwater Sustainability Agency

Prepared by:

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PUBLIC DRAFT August 26, 2021

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Acronyms and Abbreviations

ACWA	Ash Creek Wildlife Area
AFY	Acre-feet per year
AgMAR	Agriculture Managed Aquifer Recharge
ASR	Aquifer Storage and Recovery
Basin	Big Valley Groundwater Basin
bgs	below ground surface
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMO	Basin Management Objective
BVGB	Big Valley Groundwater Basin
BVAC	Big Valley Groundwater Basin Advisory Committee
BVWUA	Big Valley Water Users Association
CASGEM	California Statewide Groundwater Elevation Monitoring
CC	canopy cover
CCR	California Code of Regulations
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
CIMIS	California Irrigation Management Information System
CRP	conservation reserve project
CUP	Consumptive Use Program Model
CWC	California Water Code
DDW	Division of Drinking Water, State Water Resources Control Board
DMS	Data Management System
DOI	Department of the Interior
DWR	Department of Water Resources
EC	Electrical Conductivity
ET	Evapotranspiration
ETo	Reference Evapotranspiration
°F	degrees Fahrenheit

ft	feet
GAMA	Groundwater Ambient Monitoring and Assessment Program
GDE	Groundwater Dependent Ecosystem
GIS	Geographic Information System
GP	General Plan
GRA	Groundwater Resources Association of California
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IM	Interim Milestone
InSAR	Interferometric Synthetic Aperture Radar, a technology used to detect subsidence
IRWMP	Upper Pit Integrated Regional Water Management Plan
IWFM	Integrated Water Flow Model
LAMPs	Local Agency Management Programs
LESA	Low Energy Sprinkler Application
LMFCD	Lassen-Modoc Flood Control and Water Conservation District
LNAPL	Light non-aqueous phase liquid (found in petroleum hydrocarbons)
LUST	Leaking underground storage tank
MCL	Maximum Contaminant Level
Mn	manganese
MO	Measurable Objective
MODFLOW	USGS Modular Finite-Difference Ground-water Flow Model
MOU	Memorandum of Understanding
MT	Minimum Threshold
MTBE	Methyl tert-butyl ether
NCCAG	Natural Communities Commonly Associated with Groundwater
North Cal-Neva	North Cal-Neva Resource Conservation and Development Council
NCWA	Northern California Water Association
NECWA	Northeastern California Water Association
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System (USGS)
OWTS	Onsite Water Treatment System

PBO	Plate Boundary Observatory
PFAS	per/polyfluoroalkyl substances
PRISM	Parameter-elevation Regressions on Independent Slopes Model
Regs	DWR's GSP Emergency Regulations, California Code of Regulations Title 23, Section 350 et seq
RWMG	Regional Water Management Group
RWQCB	Regional Water Quality Control Board
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
SWC	Snow Water Content
SWQL	Secondary Water Quality Limits
SWRCB	State Water Resources Control Board
TBA	tert-Butyl alcohol
TDS	total dissolved solids
USBR	United States Bureau of Reclamation
USFS	United States Forest Service
USGS	United States Geologic Survey
WIFIA	Water Infrastructure Finance and Innovation Act
WIIN	Water Infrastructure Improvement for the Nation Act
WRP	wetland reserve project
WY	Water Year (October 1 – September 30)
yr	year

Executive Summary

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

The Big Valley Groundwater Basin (BVGB, Basin, or Big Valley), lies on border of Modoc and Lassen Counties in one of the most remote and untouched areas of California. The sparsely populated 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 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 bands that are now part of the Pit River Tribe, of digging pits to trap game that came to water at the river. Farming and ranching in Big Valley date back to the late 19^{th} and early 20^{th} century 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.

Historically, agriculture was supplemented by a robust timber industry which was 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 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 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 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) 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.

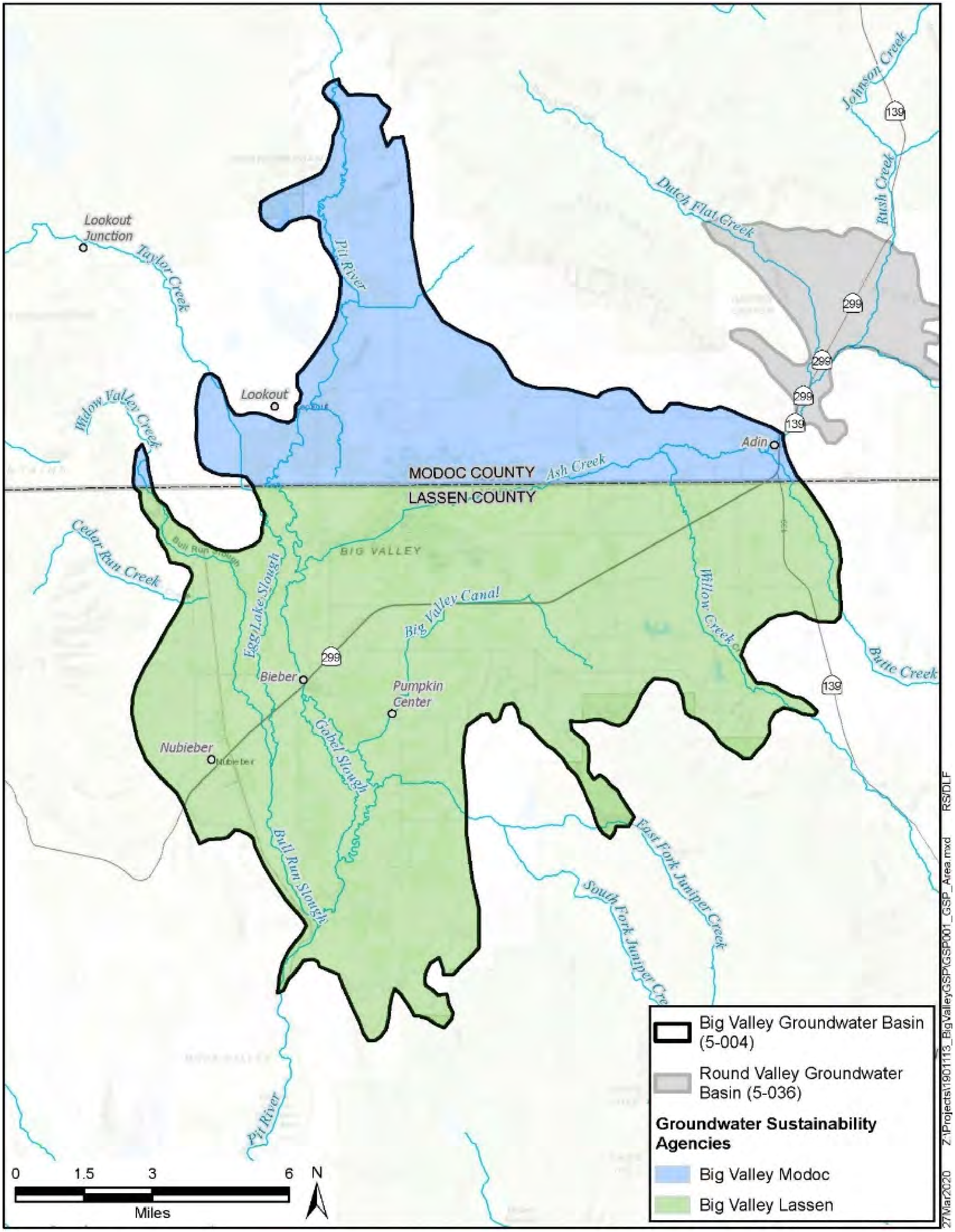


Figure ES-1 Groundwater Sustainability Agencies in Big Valley Groundwater Basin

The Basin, shown on **Figure ES-1**, encompasses an area of approximately 144 square miles (92,000 acres) with Modoc County 28% and Lassen County comprising 72%. The Basin includes the towns of Adin and Lookout in Modoc County and the towns of Bieber and Nubieber in Lassen County. The Ash Creek State Wildlife Area is located in both counties and occupies 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 2016 Land Use Summary by Water Use Sector

Water Use Sector	Acres	Percent of Total
Urban	250	<1%
Industrial	196	<1%
Agricultural	22,246	24%
Managed Wetlands	14,583	16%
Managed Recharge	-	0%
Native Vegetation and Domestic	54,792	60%
Total	**92,067**	**100%**

ES.2. Basin Setting (Chapters 4 – 6)

Hydrogeologic Setting

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. 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 can be described as 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 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) suggested that these mountains serve as "upland recharge areas" and provide subsurface recharge to BVGB via fractures in the rock and water bearing formations that may 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 a 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 Pliocene-Pleistocene age (5.3 million to 12 thousand years ago) Bieber Formation (TQb), shown in **Figure ES-2**, is the main formation of aquifer material defined within BVGB, extending to depths of 1,000 feet or more. 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 & 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 were not identified in the subsurface, which, if present, would create multiple aquifers.

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. 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 are composed of only soils with "slow" or "very slow" infiltration rates. While the soils are not highly permeable, some research has found that water can penetrate through these soils which means that managed aquifer recharge projects such as on-farm recharge may be viable.

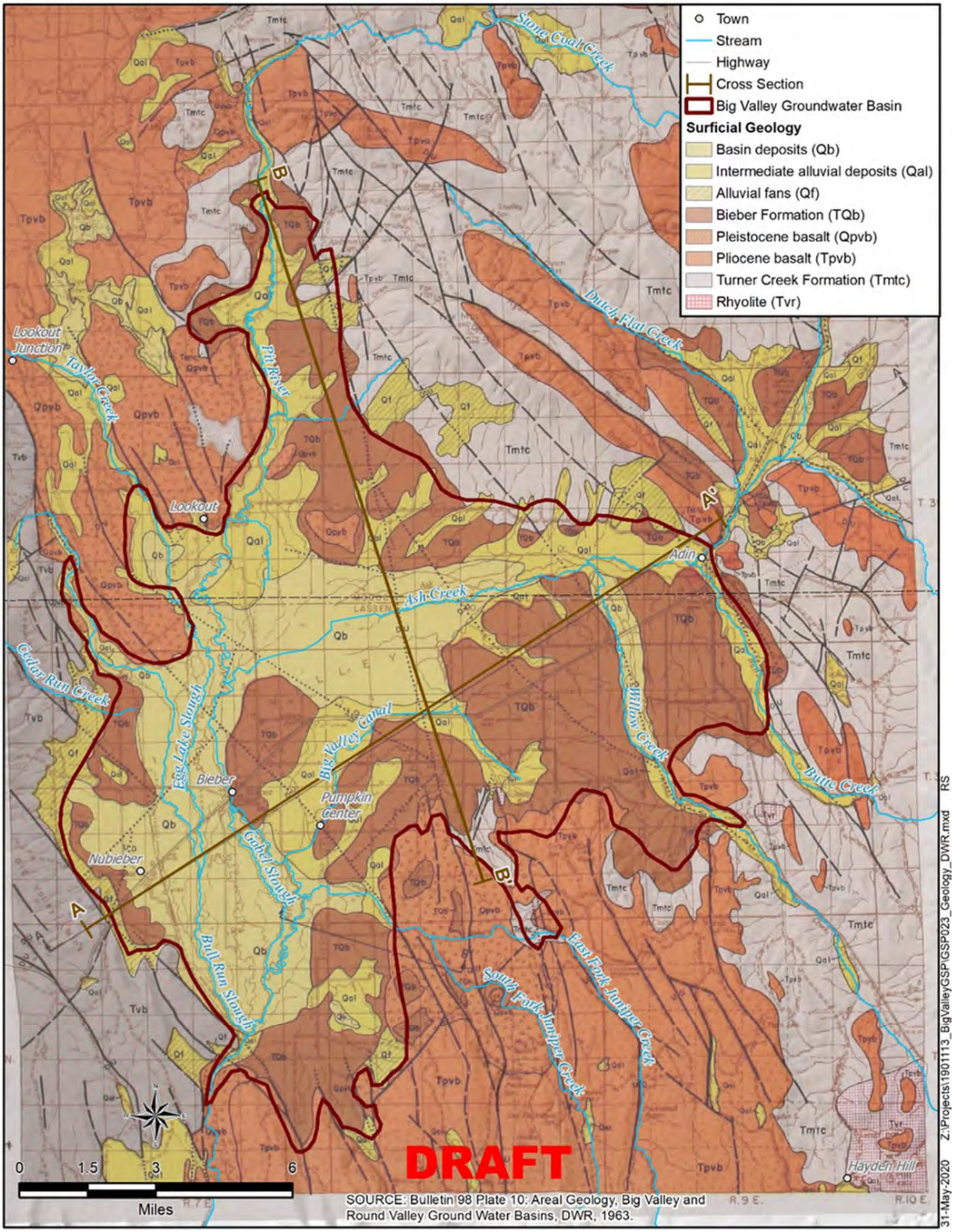
Groundwater Conditions

Historic groundwater elevations are available from a total of 22 wells in Big Valley, six located in Modoc County and sixteen 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 historic wells show that most areas of the basin have remained stable and a few areas have seen some decline of up to 1.3 feet per year between 1983 and 2018.

To determine the annual and seasonal change in groundwater storage, groundwater elevation surfaces[6] 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 1980's and early 1990's, then recovered during the wet period of the late 1990's. After 2000, while most wells are still stable, a few wells have generally declined resulting in a reduction in overall groundwater storage. The amount of decline represents a reduction in storage of less than 2% of groundwater storage.

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

[6] 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.



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95 **Figure ES-2 DWR 1963 Local Geologic Map**

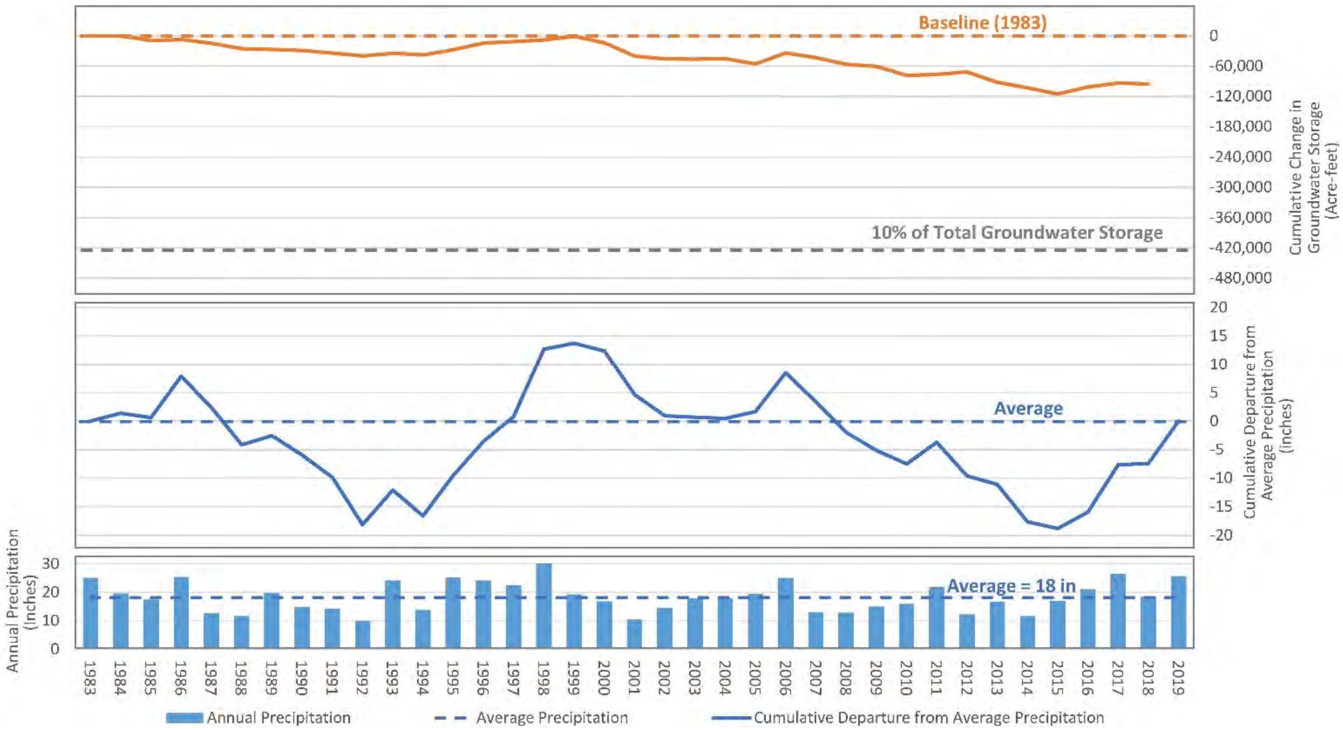

Figure ES-3 Cumulative Change in Groundwater Storage and Precipitation

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.

Water Budget

A historic 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 39,400 acre-feet per year, and average annual overdraft is 5,200 acre-feet per year.

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 energy cost to lift groundwater exceeds the economic value of the water for agriculture. A depth of 140 feet below fall 2021 groundwater level for each well in the monitoring network was determined to be the depth at which groundwater pumping becomes uneconomical for agricultural use.

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

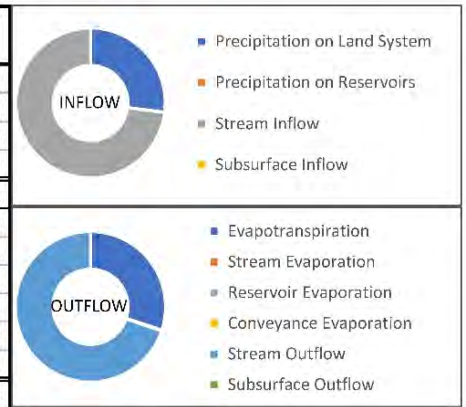

Figure ES-4 Average Total Basin Water Budget 1984-2018

- **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:** 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. At the 5-year update of this GSP, data from various existing programs, will be assessed to determine if degradation trends are occurring in the principal aquifer.
- **Land Subsidence:** Based on evaluation of subsidence data from a continuous GPS station and InSAR data 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:** There is currently insufficient data to establish whether undesirable results have occurred and whether they are likely to occur. At the five-year update, water level and streamflow data from newly constructed wells and proposed stream gages will be assessed. Thresholds will be considered if trends indicate that undesirable results have occurred or are likely to occur in the subsequent five years.

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 Big Valley Groundwater Basin. 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**.

Table ES-2 Projects and Potential Implementation Timeline

No.	Category	Description	Estimated Time for Potential Implementation (years)		
			0-2	2-8	>8
1	9.1 Recharge Projects	AgMAR	X	X	X
2		Drainage and Basin Recharge	X	X	X
3		Ag Injection Wells			X
4	9.2 Research and Data Development	Stream Gauges	X		
5		Refined Water Budget	X	X	
6		Agro-Climate Station	X		
7		Voluntary Installation of Well Meters	X	X	
8		Adaptive Management	X	X	X
9		Mapping and Land Use	X	X	
10	9.3 Increased Storage Capacity	Expanding Existing Reservoirs		X	
11		Allan Camp Dam			X
12	9.4 Improved Hydrologic Function	Forest Thinning and Management	X	X	X
13		Juniper Removal	X	X	X
14		Stream and Meadow Restoration	X	X	X
15	9.5 Water Conservation	Irrigation Efficiency	X	X	
16		Landscaping and Domestic Water Conservation	X	X	
17		Conservation Projects	X	X	
18	9.6 Education and Outreach	Public Communication	X		
19		Information and Data Sharing	X	X	
20		Fostering Relationships	X		
21		Compiling Efforts	X	X	
22		Educational Workshops	X		
22		Educational Workshops	X		

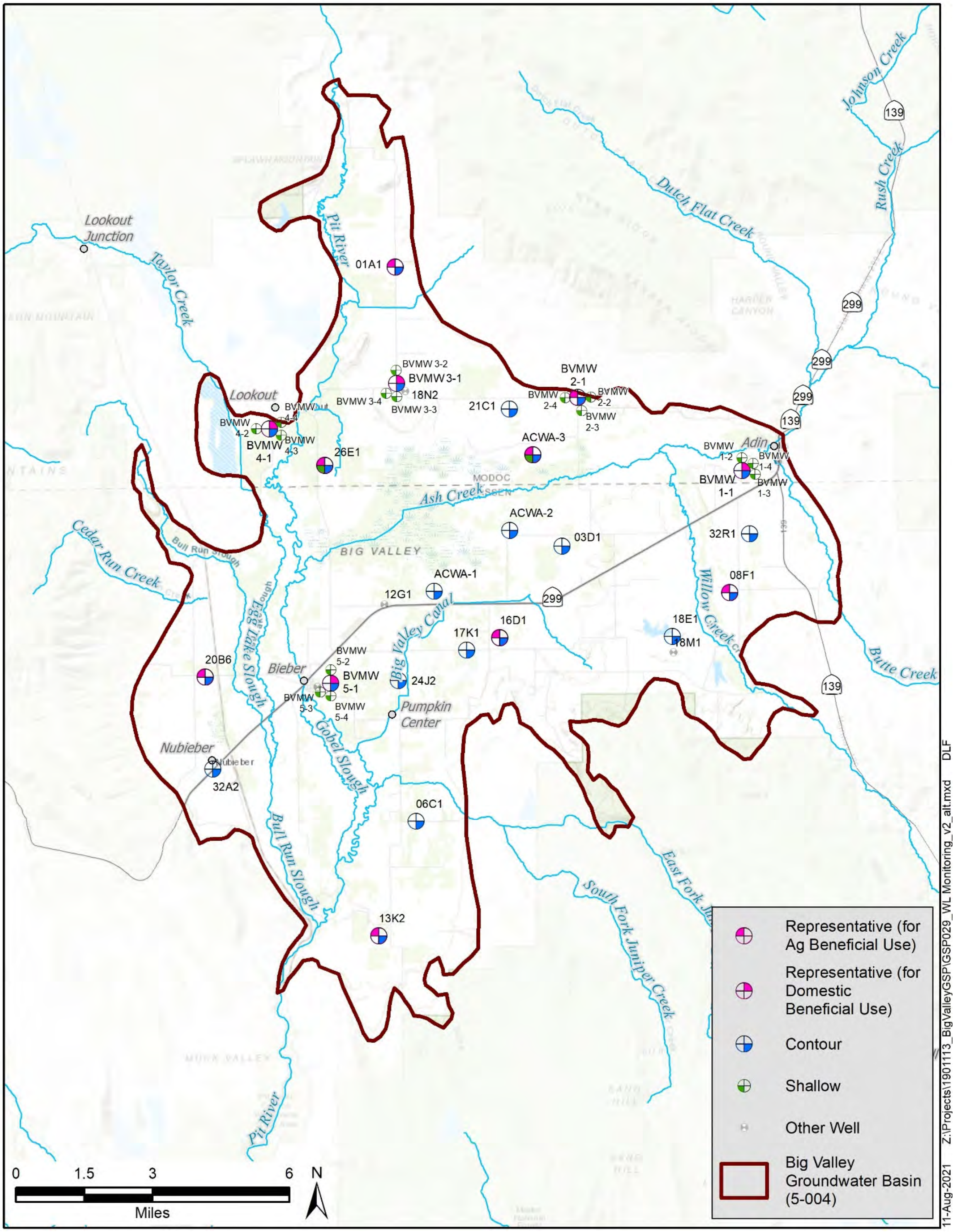

Figure ES-5 Groundwater Level Monitoring Networks

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

The GSP lays out a roadmap for addressing all of 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 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 Plan as required by §354.10(d)(4) of the Regs. Coordination activities would include ensuring monitoring is performed, developing and/or coordinate the development of annual reports and 5-year 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 Groundwater Sustainability Agencies (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 Water Year (WY), which will be WY 2021 (October 1, 2020 to September 30, 2021). The Annual Report will establish the current conditions of groundwater within the Big Valley Groundwater Basin (BVGB or Basin), the status of the Groundwater Sustainability Plan (GSP) implementation, and the trend towards maintaining sustainability.

- **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 and update and evaluation of the plan every five (5) years. (§356.4) While much of the content of the GSP will likely remain unchanged for these 5-year updates, the Regs require that most chapters of the plan be updated and supplemented with any new information obtained in the preceding five 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 little to no revenue generated in the counties to fund the state-mandated requirements of SGMA. Therefore, the GSAs will rely on outside funding to implement the plan.

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 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 bands that are now part of the Pit River Tribe, of digging pits to 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, Willow Creek, and many seasonal streams and springs.

Farming and ranching in Big Valley date back to the late 19th and early 20th century 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 sur names 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-nit community. These stores are some of the remaining evidence of a much more vibrant time in the 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 the Valley. The local driller, Conner's Well Drilling, has drilled the majority of wells in the 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).

Historically, agriculture was supplemented by a robust timber industry, ~~which was~~ 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 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 building 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 is struggling 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 the Department of Water Resources (DWR). The addition of the Sustainable

Groundwater Management Act (SGMA) will increase the severity of the disadvantaged and severely disadvantaged communities in the Basin due to increased regulatory costs <u>and potential actions that must be taken to comply with SGMA</u> and is likely to intensify rural decline in this area. With the increased cost 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 mandated role as the groundwater sustainability agencies (GSAs) since there is no other viable entity that can serve as GSA. Both counties have severe financial struggles as their populations and tax base are declining. The counties contend that not only do they not have 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 absence of a timber industry, agriculture has been the only viable industry 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 agencies such as the Natural Resources Conservation Service (NRCS) and the U.S. Fish and Wildlife Partners for Fish and Wildlife Program. 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 has largely left the property unmanaged. While the ACWA does offer refuge for waterfowl and other species, most species ~~feed~~ <u>graze</u> on the private lands around the Basin which are actively being cultivated because those lands offer better forage.

The BVGB differs from many of California's 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 <u>about</u> 4100 to 5000 feet and along with its northerly latitude in the state, 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 one hundred (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.

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

As detailed in this GSP, there are three major beneficial uses of groundwater: agriculture, municipal/domestic, and environmental. However, the importance of agriculture to Big Valley cannot be overstated, as it is the economic base of Big Valley upon which municipal/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 habitat. Other plans, policies, and ordinances unrelated to this GSP attempt to diversify the economic base of the community. Economic diversity of the Valley is not the purview of this GSP, but it is acknowledged that at present and for the foreseeable future, the Big Valley communities rely almost solely on farming and ranching to support residents of the Valley. The financial and regulatory impact of implementing SGMA will affect this disadvantaged community. Therefore, minimizing the GSP’s impact to agriculture while complying with SGMA and working to enhance water supply in the Valley is the thrust of this GSP.

1.2 Sustainability Goal

The GSAs are developing this GSP to comply with SGMA mandates, maintain local control, and preclude intervention by the State Water Resources Control Board (SWRCB). Satisfying the requirements of SGMA generally requires four activities:

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

The two GSAs established in the Basin; County of Modoc GSA and County of Lassen GSA; each cover 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 Big Valley Groundwater Basin, develops quantifiable management criteria that accounts for the interests of the Basin’s beneficial groundwater uses and users, and identifies projects and management actions to ensure sustainability.

The Lassen and Modoc Groundwater Sustainability Agencies (GSA’s) developed a Memorandum of Understanding (MOU) which detailed the coordination between the two GSA’s. The MOU stated a Big Valley Advisory Committee (BVAC) was to be established to provide local input and direction on the development of a Groundwater Sustainability Plan (GSP). The counties solicited applicants to be members of the BVAC through public noticing channels. Big Valley landowners and residents submitted applications to the county boards of supervisors, who then elected 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. 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, land subsidence, understanding upland recharge, and an improved estimate of crop water use will collectively provide the GSA's a better understanding of the basin water budget and timely information regarding any changes or trends.

The implementation of projects such as winter recharge studies currently in progress will help establish the feasibility of immediate actions the GSA~~’~~s can take to improve Basin conditions. A detailed off-season water budget 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 support an off-season and storage capacity water accounting to be conducted 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. In addition, a surface water assessment is being conducted to understand if there are additional gaging locations which will benefit data collection and improve the accuracy of the water budget.

The understanding that has been gained by the GSAs is that with proper management and coordination with and support from federal landowner partners, the Big Valley basin, which is not currently at risk of overdraft, will remain sustainable for the benefit of all interested parties.

1.3 Background of Basin Prioritization

The Big Valley Groundwater Sustainability Agencies (GSAs) are being forced to develop this GSP after exhausting its 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 16 feet of groundwater level decline on average in the last 30 years.~~.~~

Additionally, the GSAs recognize the adjustments made to Component 7.d, 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 Maximum Contamination Levels (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. 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.

The Basin boundary was drawn with a regional scale map (CGS 1958) and was not drawn with as much precision as subsequent geologic maps. 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 ~~also~~ submitted a request to DWR for basin boundary modifications, 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, necessarily requiring that groundwater levels be addressed primarily through demand restrictions. See **Appendix 1A** for communications with DWR regarding basin prioritization ranking and boundary modification. The GSAs may consider future basin boundary modification requests to DWR.

Development of this GSP by the GSAs, in partnership with the Big Valley Advisory Committee 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 the SGMA. This law requires medium- and high-priority groundwater basins in California to take actions to ensure they are managed sustainably. The California Department of Water Resources (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 state's 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 (DWR, 2019), groundwater basins with a score of 14 or greater (up to a score of 21) ranked as medium priority basins. Big Valley scored 13.5 and DWR chose to round the score up to put it in the Medium 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 some potentially erroneous data. They made a request to DWR for the raw data that was used, which they were eventually provided, and verified the error that would have put the BVGB into the Low 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 felt mis-led, as when the rankings originally came out SGMA did not exist and were told that the rankings were no big deal and in fact there was benefit in being medium. Once SGMA was passed and the onerous repercussions of being medium were better understood (and the counties identified erroneous data), DWR did not offer any recourse, simply saying they would remain medium and that the basins would soon be re-prioritized anyway.

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	
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**

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."

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 the SGMA mandate through a public process that established them as the Groundwater Sustainability Agencies (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 Big Valley Groundwater Basin is identified by DWR in Bulletin 118 as Basin No. 5-004 (DWR, 2016a). The 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, which is 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 north-eastern 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 approximately 144 square miles with Modoc County comprising 40 square miles (28%) on the north and Lassen County comprising 104 square miles (72%) 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 Ash Creek

State Wildlife Area is located along the boundary of both counties, occupying 22.5 square miles in the center of the basin in 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 by the way they have drawn the boundaries.

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.

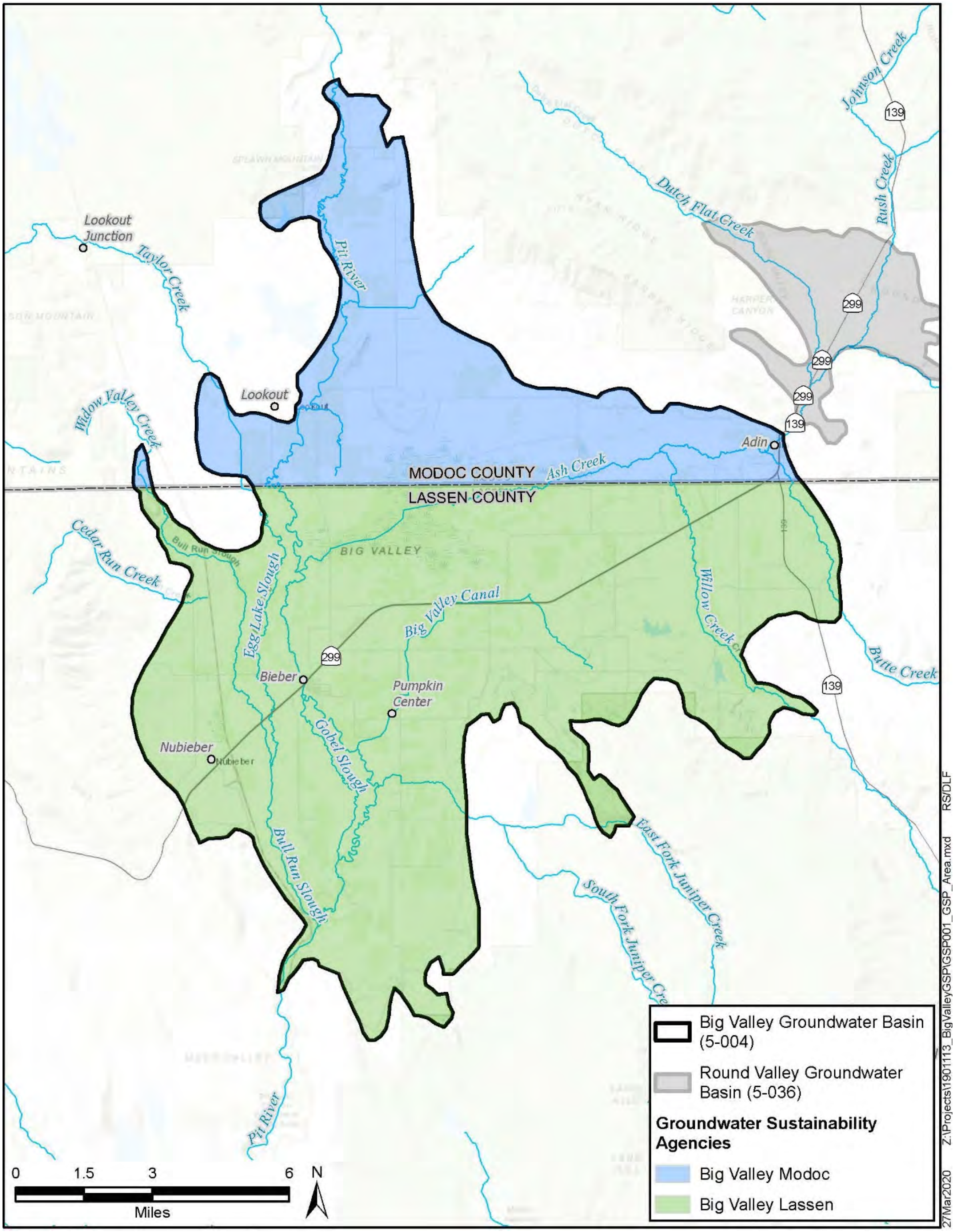

Figure 1-1 Big Valley Groundwater Basin, Surrounding Basins and GSA's

2. Agency Information § 354.6

The two Big Valley GSAs were established for the entire Big Valley Groundwater Basin 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 §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 SGMA, mandated legislation. **Appendix 2A** contains the resolutions forming the two agencies. Each GSA is governed by a five-member Board of Supervisors. In 2019, the two GSAs established the Big Valley Groundwater Basin Advisory Committee (BVAC) through a Memorandum of Understanding (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 Big Valley Groundwater Basin
- 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 Big Valley Groundwater Basin

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
Assistant 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 California Water Code §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 to enter into an agreement to jointly implement the GSP for the Basin. However, this agreement is not a requirement of the SGMA.

3. Plan Area § 354.8

3.1 Area of the Plan

This Groundwater Sustainability Plan (GSP) covers the Big Valley Groundwater Basin (BVGB or Basin), which is located within Modoc and Lassen Counties and is approximately 92,~~000~~ 057 acres (about 144 square miles). The Basin is a broad, flat plain extending about 13 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 California Department of Water Resources (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 disperse 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 Groundwater Sustainability Agencies (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 ½-mile wide gap of alluvium between the basins. The Ash Creek State Wildlife Area occupies 14,583 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.

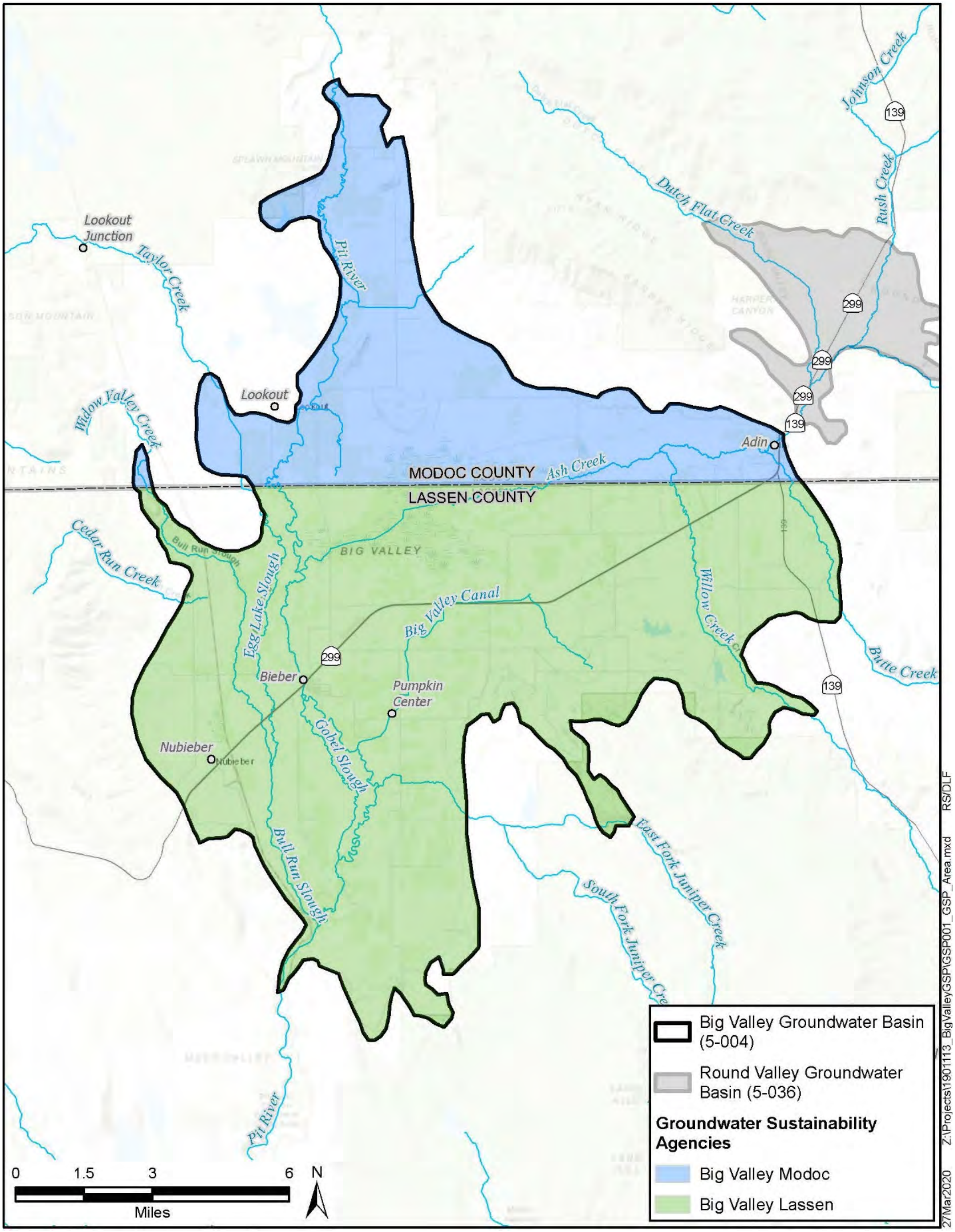

Figure 3-1 Area Covered by the GSP

3.2 Jurisdictional Areas

In addition to the GSAs, several other agencies 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 Federal Jurisdictions

The United States Bureau of Land Management (BLM) as well as the United States Forest Service (USFS or Forest Service) owns/manages land within the Basin, including 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 (Water System No. CA2500547, SWRBC Public Water Supply Listing).

3.2.2 Tribal Jurisdictions

The 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)

3.2.3 State Jurisdictions

The California Department of Fish and Wildlife (CDFW) owns and operates the Ash Creek Wildlife Area, shown on **Figure 3-2**.

3.2.4 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 3.8. Within the Basin, Modoc County includes the census-designated community of Adin and part of the community of Lookout. Within the Basin, Lassen County contains the census-designated communities of Bieber and Nubieber.

3.2.5 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) who is a member of the RWMG along with 27 other stakeholders, including community organizations; 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 three-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~~00~~ acres, the BVGB comprises about three percent of the IRWMP area at its center.

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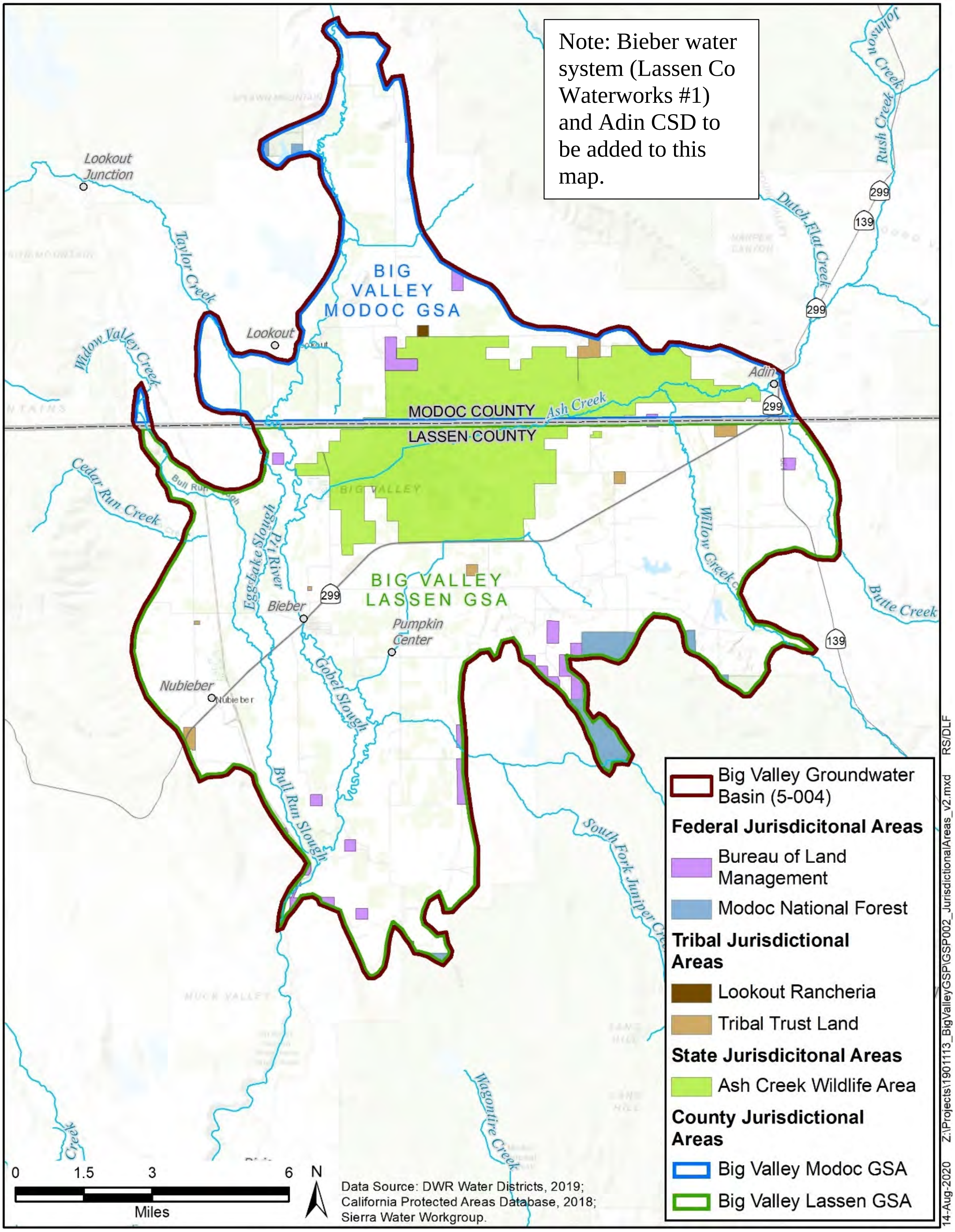


573 **Figure 3-2 Jurisdictional Areas**

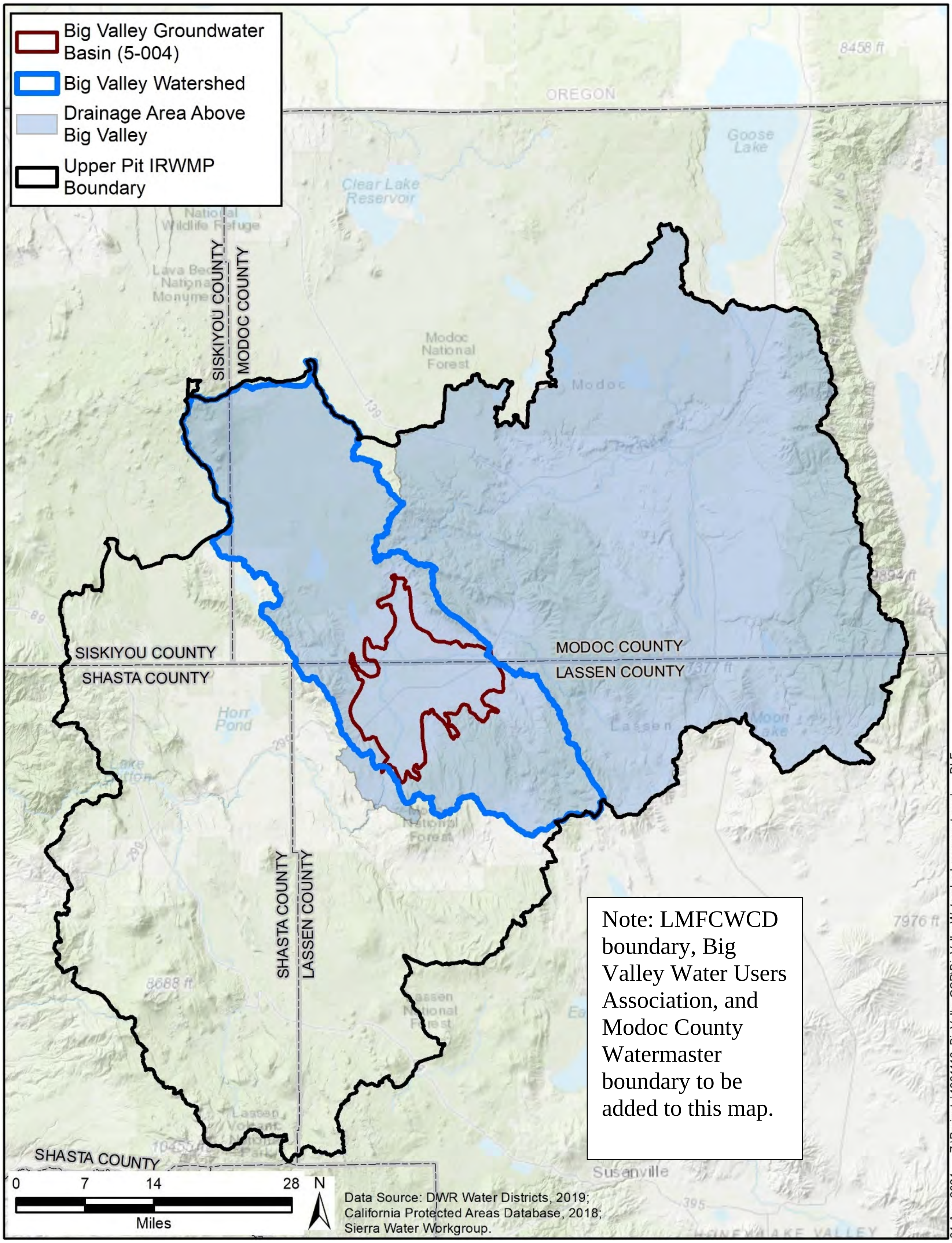


Figure 3-3 Upper Pit IRWMP, Watershed, and BVGB Boundaries

The IRWMP was established under the Integrated Regional Water Management Act (Senate Bill 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, a plan was developed for the Upper Pit River area and was adopted in late 2013. During 2017 and 2018, the plan 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 (LMFCD or District) was established in 1959 by the California Legislature and was activated in 1960 by the Lassen County Board of Supervisors (LAFCo, 2018). The District covers all the Lassen County portion of the Basin and a ~~significant portion~~entirety of the Modoc County portion, 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 and, in 1994, the District designated the same boundaries for Zone 2 as 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."

Lassen County Waterworks District #1

Lassen County Waterworks District #1 provides water and sewer services to Bieber. The district boundary is shown on **Figure 3-2**.

Adin Community Services District

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

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 ~~information~~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. Surveys performed prior to 2014 were developed by DWR using some aerial imagery with significant field verification. These 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]

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

Land use in the BVGB is organized into the ~~same~~ water use sectors ~~identified in Article 2 of the GSP emergency regulations (DWR 2016b)~~listed in **Table 3-2**. These sectors differ from DWR's ~~identified~~ water use sectors identified in Article 2 of the GSP regulations because DWR's sectors don't adequately describe the uses in Big Valley~~are detailed below with the addition of Domestic as an additional sector. Domestic is added~~ as a water use sector ~~because of of the wide-spread reliance on groundwater for domestic purposes in Big Valley~~. **Figure 3-4** 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.

Table 3-2 2016 Land Use Summary by Water Use Sector

Water Use Sector	Acres	Percent of Total
~~Urban~~Community[1]	250	<1%
Industrial	196	<1%
Agricultural	22,246	24%
~~Managed Wetlands~~State Wildlife Habitat[2]	14,583	16%
Managed Recharge	-	0%
Native Vegetation and Rural Domestic[3]	54,792	60%
Total	**92,067**	**100%**

[1] Includes the use in the communities of Bieber, Nubieber, and Adin
[2] Made up of a combination of wetlands and non-irrigated upland areas
[3] Includes the large areas of land in the Valley which have domestic wells interspersed

- **~~Urban~~ Community** ~~Urban water use~~This is non-agricultural, non-industrial water use in the census-designated places of Bieber, NuBieber and Adin, although~~.~~ ~~S~~some of these areas ~~designated as urban~~ may also have some minor industrial uses. These ~~urban~~ community areas were delineated using the areas designated as "urban" ~~data~~by ~~from~~ 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~~urban~~.

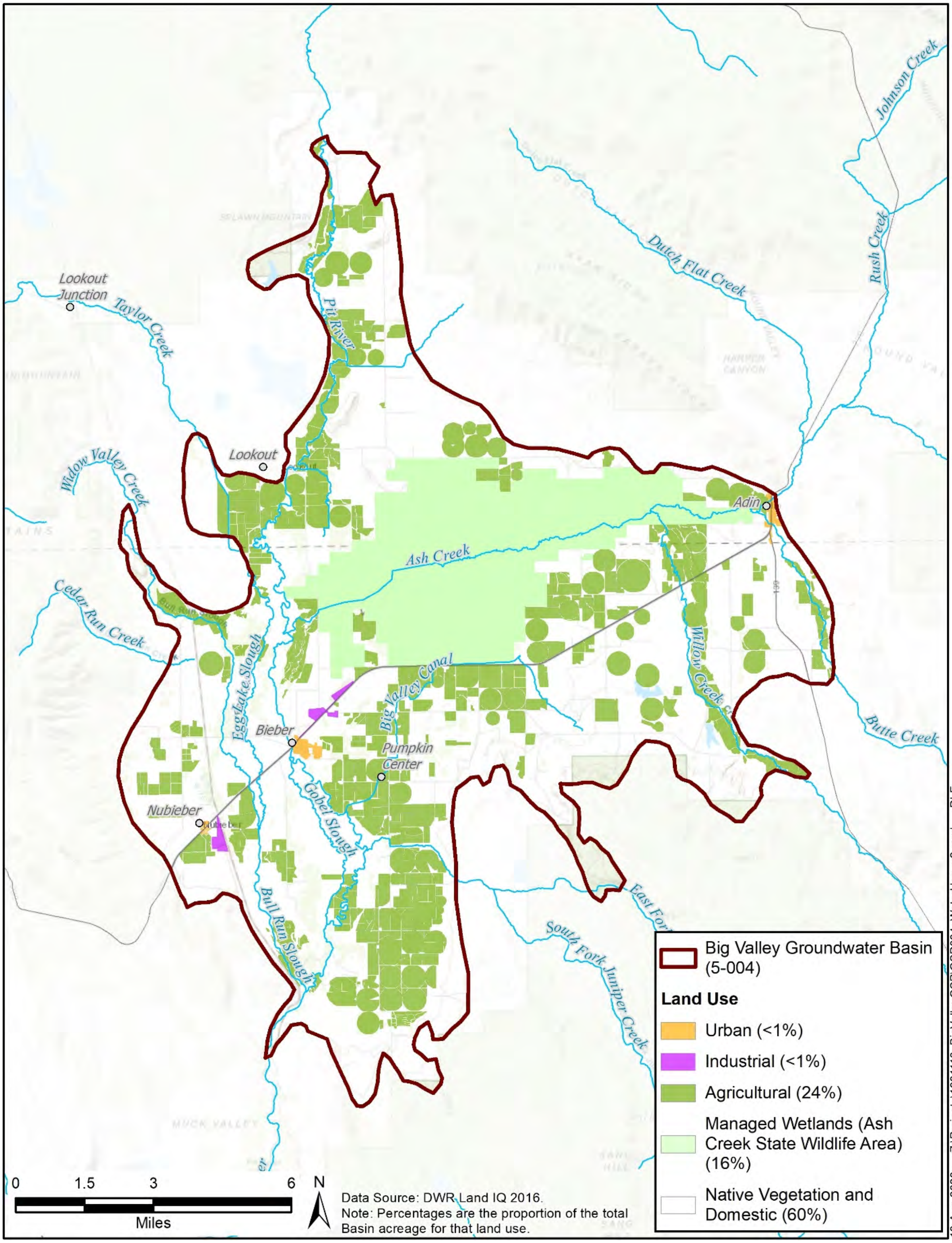


Figure 3-4 Land Use by Water Use Sector

- **Industrial** There is limited industrial use in the Basin. The DWR well log inventory shows six industrial wells, ~~with~~ all located at the inactive mill in Bieber~~, which is not active~~. 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[7].

- **State Wildlife Habitat** The area delineated in **Figure 3-4** is the boundary of the Ash Creek Wildlife Area (ACWA), located within the center of the Basin. The area includes ~~preserved freshwater~~ wetlands created by the seasonal flow of six streams, including Ash Creek.

- **Managed Recharge** ~~There is no formal managed recharge or recycled water discharged in the Basin. However, f~~Flood irrigation of some fields and natural flooding of lowland areas ~~does~~ 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. These two land uses are categorized together because it is not possible to distinguish between the two with readily available data.

- **Domestic** This sector ~~was added for the purposes of the BVGB GSP and~~ includes water use for domestic purposes, which aren't ~~supplied by~~located in a community~~ system~~. 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 field and does not include residences.

- **CRP and WRP** These land uses will be defined and described in future GSP draft.

3.3.1 Water Source Types

The Basin has two water source types: groundwater and surface water. Recycled water[8] and desalinated water are not formally utilized in the Basin~~,~~ nor is stormwater used as a formal 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 formal supplemental water source.

As detailed in **Table 3-1**, the most recent data for which water source is available are from 2011 and 2013 for Modoc and Lassen Counties, respectively. At the request of the GSAs, DWR staff provided a

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

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

hybrid dataset, where the water source estimated from 2011 and 2013 was superimposed onto the 2016 land uses. **Figure 3-5** and shows DWR's estimate of water source for agricultural lands in the Basin and indicates, in general, where surface water and groundwater are used in the Basin. This data does not distinguish lands that use a combination of surface and groundwater, which is a common practice in the Basin. Therefore, the data shown on **Figure 3-5** is assumed to provide an indication of the "primary" source of water. Chapter 6 (Water Budget) provides a further assessment of water sources and lands that use a combination of surface water and groundwater sources.

Three public water suppliers (as designated by the State Water Resources Control Board (SWRCB)) in the Basin use groundwater: Lassen County Waterworks District #1 in Bieber, the Forest Service Ranger Station in Adin, and the CalFire 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 up 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 Ash Creek Wildlife Area is fundamentally supported by surface water, but the CDFW does have three wells that are utilized in the fall to extend the length of time that wetland habitats are available.

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[9]. 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[10] under three categories: domestic, production, or public supply. **Table 3-3** shows the unverified number of wells in the BVGB for each county from this data. Many 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.

Prior to 2018, the counties had requested and received WCRs for their respective areas from DWR during 2015 and 2017, which also included an inventory of the wells. 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.

[9] 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.
[10] A section is defined through the public land survey system as a one mile by one mile square of land.

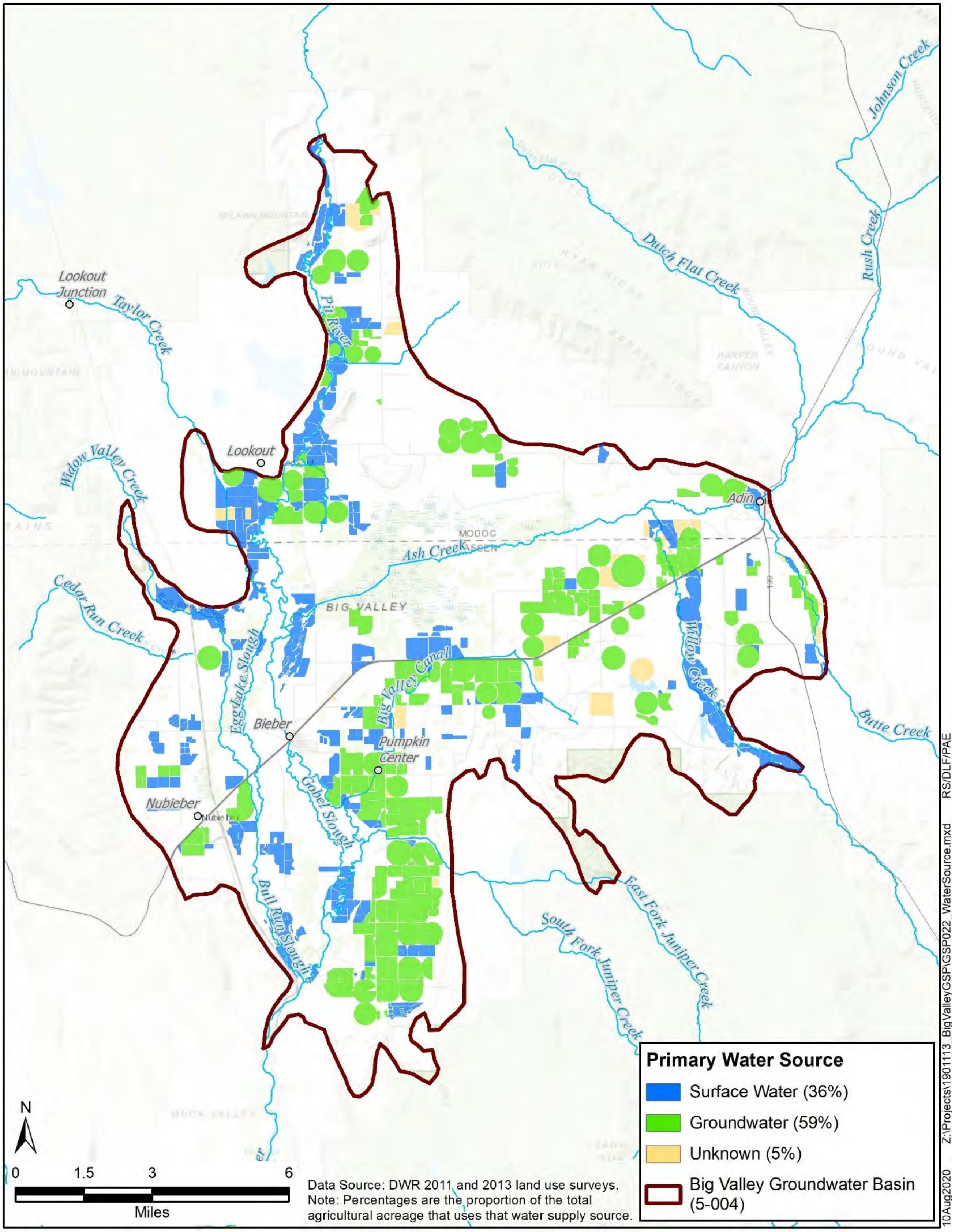


Figure 3-5 Agricultural Water Sources

Table 3-3 Well Inventory in the BVGB

WCR 2018 DWR Map Layer				DWR 2015/2017 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

The correlation between the 2018 WCR map layer categories and the categories in the 2015/2017 WCR inventory provided to the counties is indicated in **Table 3-3** by the grey shading. The table shows 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 about 475 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.

3.4.2 Well Density

Figure 3-6, **Figure 3-7**, and **Figure 3-8** 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 3-6 shows that domestic wells are located 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 2 wells per section and an average of 3 wells per section. The highest densities of domestic wells are located near Adin, Bieber, and Lookout and in a section to the east of Lookout and a section south of Adin. In addition, 22 wells are present in the four sections around Nubieber.

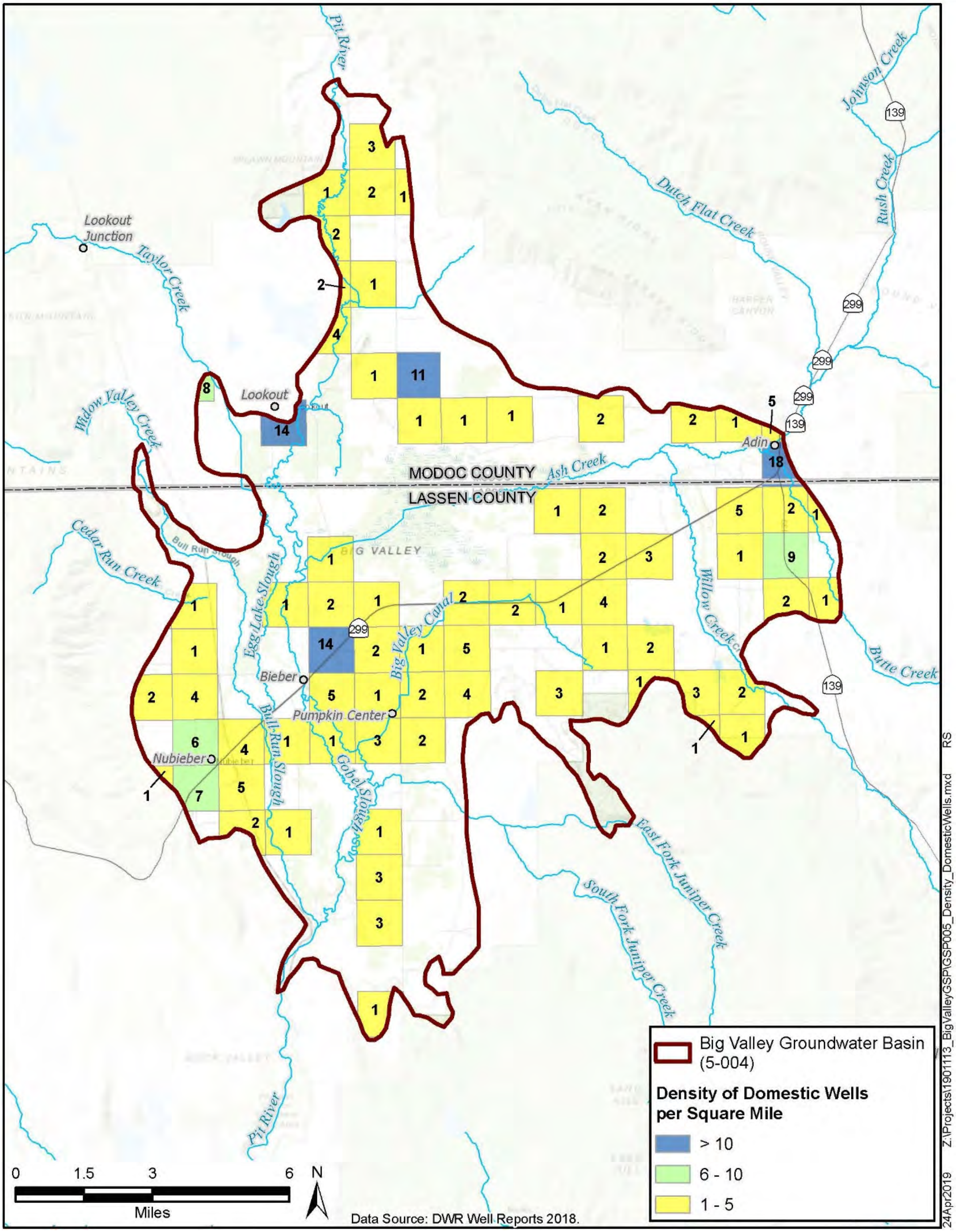


Figure 3-6 Density of Domestic Wells

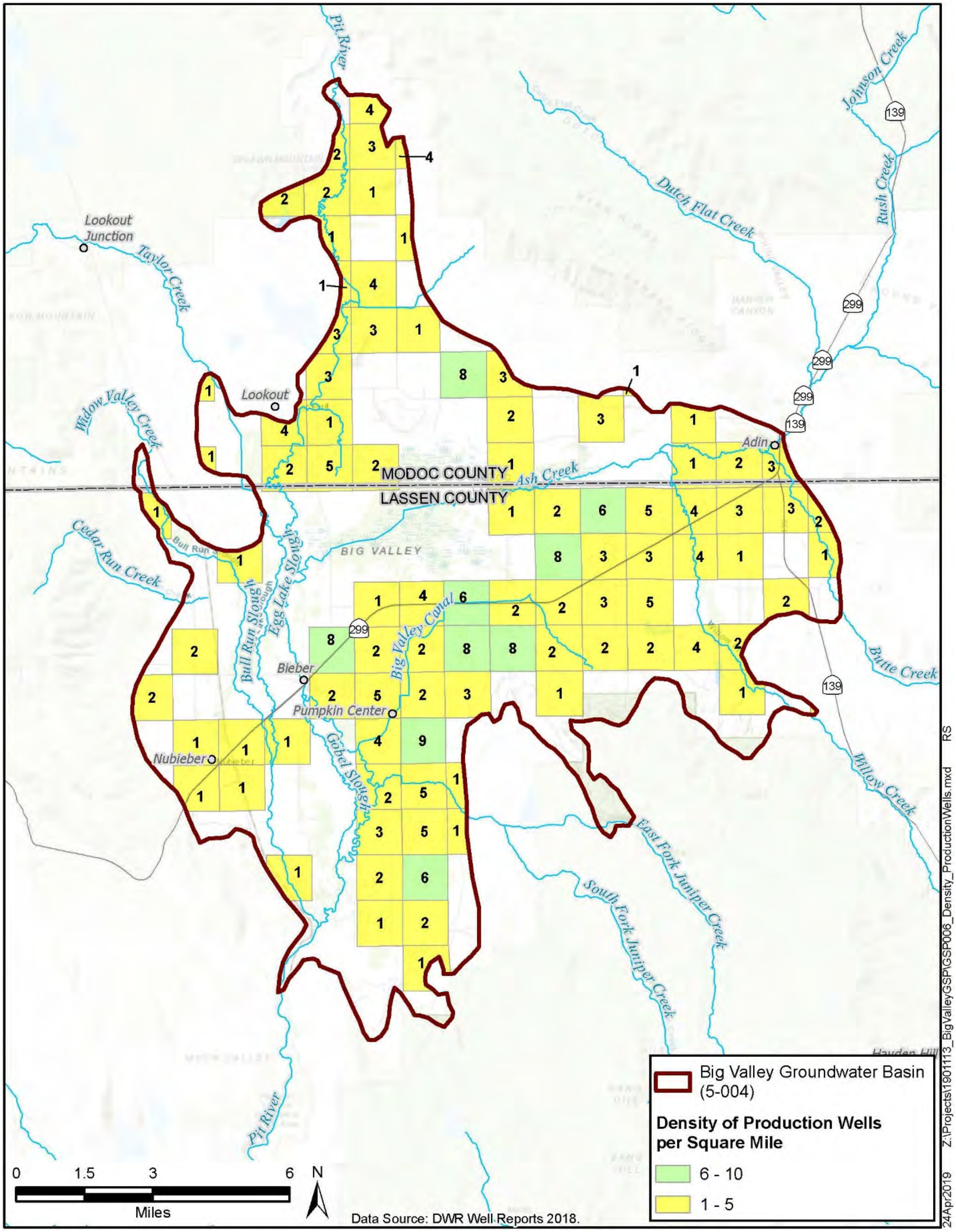


Figure 3-7 Density of Production Wells

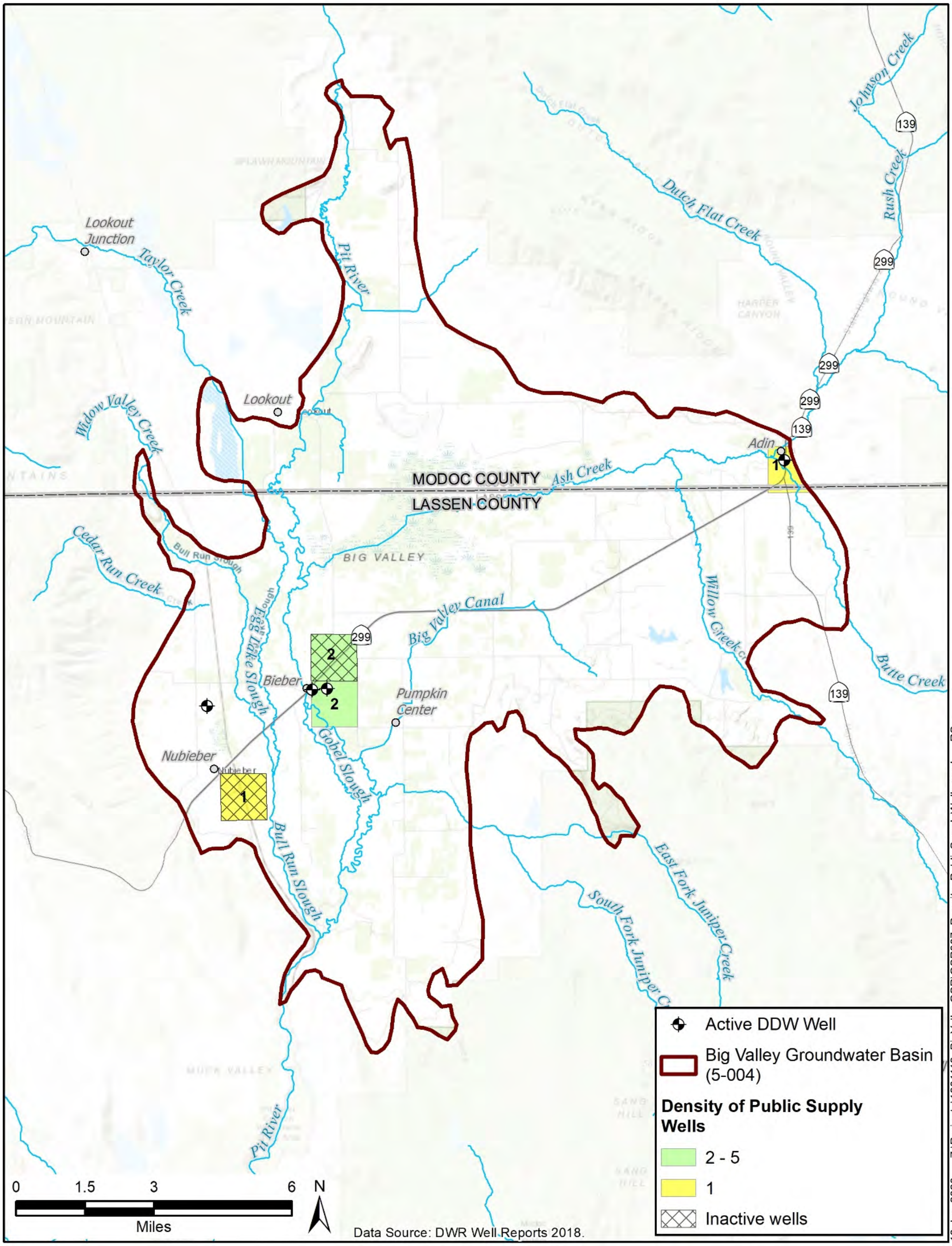


Figure 3-8 Density of Public Supply Wells

Figure 3-7 shows that production wells (primarily for irrigation) are located in 93 of the 180 sections with a maximum density of 9 wells per section (median: 2 wells per section, average: nearly 3 wells per section). The highest densities of production wells are located between Bieber and Adin, to the southeast of Bieber, and one section northeast of Lookout.

Figure 3-8 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 it was drilled. The SWRCB identifies three public water suppliers in the BVGB: Lassen County Waterworks District #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 CalFire conservation camp west of the Basin. These public suppliers account for 3 of the six public wells with WCRs. The other three are either inactive or aren't designated as SWRCB public supply. The CalFire conservation camp well does not show up as a public supply well in the WCR inventory, but its location is shown on **Figure 3-8**.

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 California Statewide Groundwater Elevation Monitoring (CASGEM) program. Each county has an approved CASGEM monitoring plan which provides for water level ~~monitoring~~ measurements twice a year (spring and fall) at 21 wells. The monitoring is performed by staff from DWR on behalf of the counties. 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.

Lassen and Modoc Counties drilled five monitoring well clusters in 2019-2020. 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 3-9**.

~~The LMFCD monitors biannual water levels throughout the basin. This information was not used in the GSP because the data was not available to the GSAs in a readily usable format.~~

[11] Wells depth indicates depth to where the wells are cased.

~~**Pumping**~~

~~The LMFCD installs and manages flow meters throughout the basin. This information was not used in the GSP because the data was not available to the GSAs in a readily usable format.~~

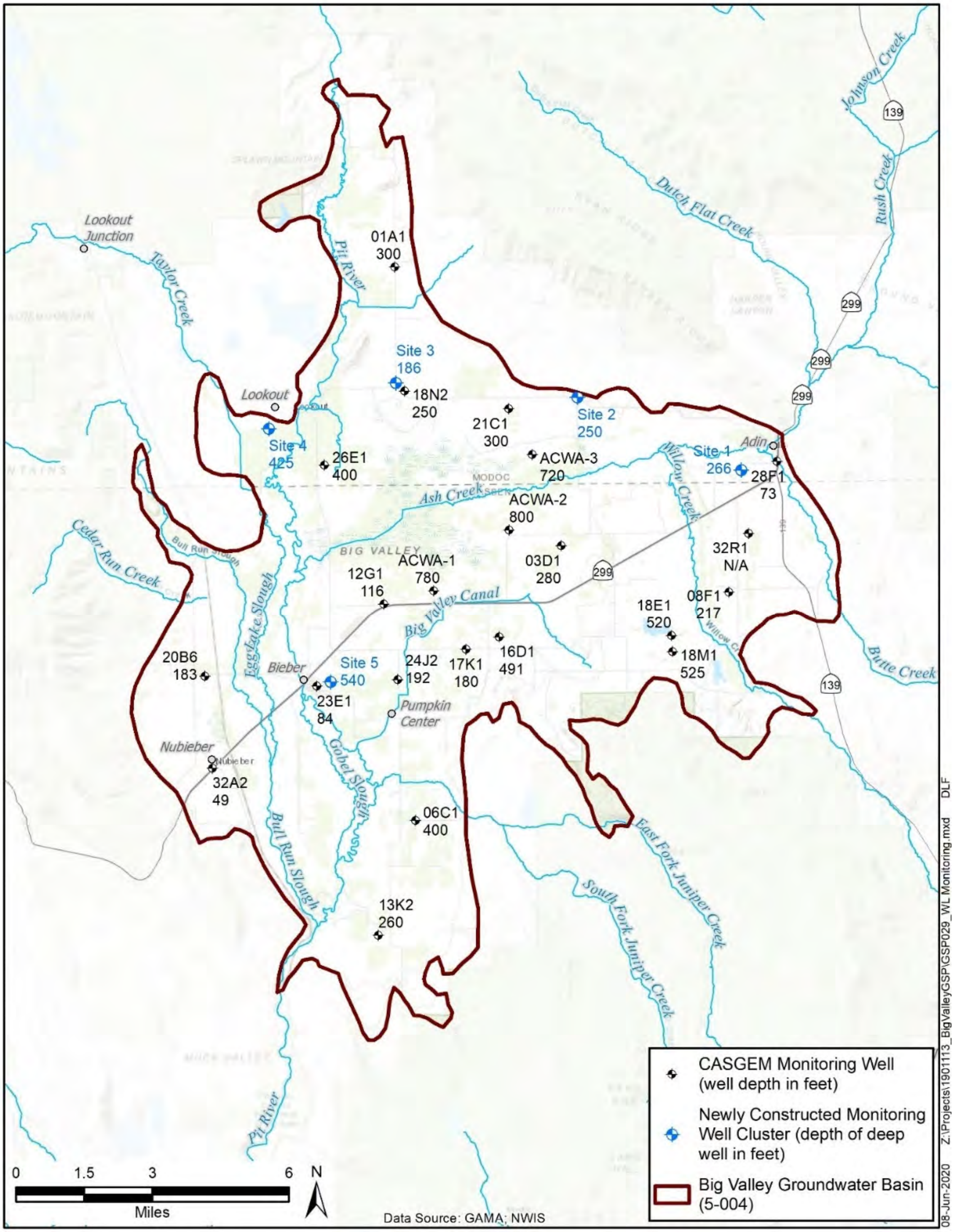
Quality

Water quality is regulated and monitored under a myriad of programs. **Table 3-4** describes the programs relevant to Big Valley. The SWRCB makes groundwater data from many of these programs available on their Groundwater Ambient Monitoring and Assessment (GAMA) Groundwater Information System (GAMA GIS) website (SWRCB 2019). **Table 3-5** lists and describes the groundwater programs from which historic data is available on GAMA GIS. The locations of wells with historic water quality data from GAMA GIS are shown on **Figure 3-10.**

~~While there are~~ Along with the many programs that monitor surface water quality, ~~the only current programs~~the following ~~that monitor groundwater quality on an ongoing basis~~ are currently in place to monitor groundwater quality on an ongoing basis:

- ~~the~~ Public Drinking Water Systems (SWRCB's Division of Drinking Water (DDW)) ~~and~~
- ~~m~~Monitoring associated with Underground Storage Tanks (USTs) and Waste Discharge Requirement (WDRs).

The BVGB contains three active public water suppliers regulated by the DDW: Lassen County Water District #1 in Bieber, and the Forest Service station in Adin, and the CalFire conservation camp west of the Basin. Water quality monitoring at their wells through the DDW can be used for ongoing monitoring in the basin and their locations are shown on **Figure 3-10**. The five newly constructed monitoring well clusters were sampled for water quality after construction and are shown on **Figure 3-10**.



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790 **Figure 3-9 Water Level Monitoring Network**

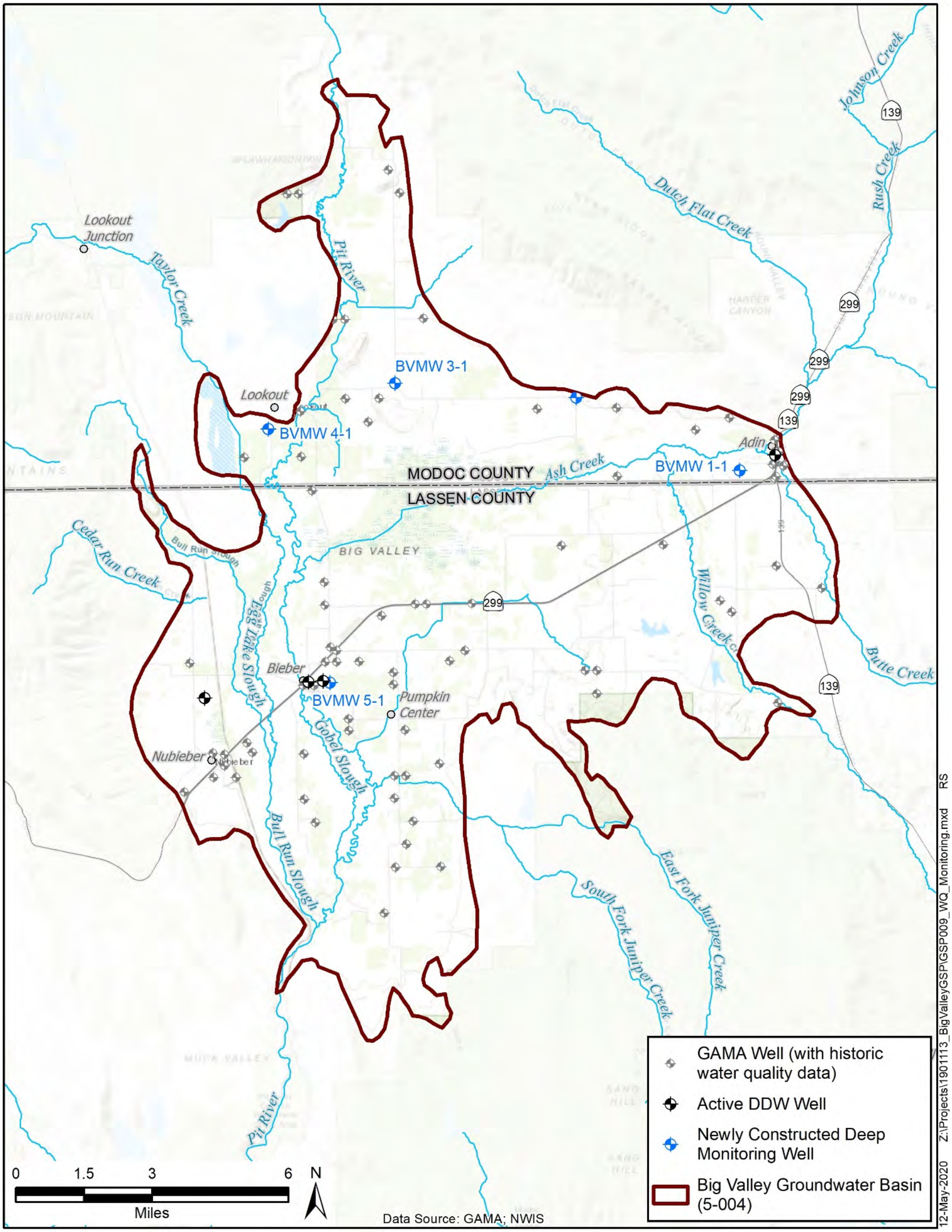


Figure 3-10 Water Quality Monitoring

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, and in 2012, groundwater regulations were added to the program. To comply with the ILRP, Big Valley growers ~~have~~ were forced to join~~ed~~ the Northeastern California Water Association (NECWA), which is a sub-watershed coalition of the Northern California Water Association (NCWA). 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, is a mandated program issuing WDRs to regulate the discharge of municipal, industrial, commercial and other wastes to land that will or have the potential to affect groundwater
Central Valley Salinity Coalition (CVSC)	represents the stakeholder groups working with the Board in the CV-SALTS collaborative basin planning process
Basin Plans	Adopted by the Regional Water Board and approved by the State Water Resources Control Board (State Board), and the Office of Administrative Law (OAL). The United State Environmental Protection Agency (USEPA) approves the water quality standards contained in the Basin Plan, as required by the Clean Water Act
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 (LAMPs)	These programs regulate Onsite Water Treatment Systems (OWTSs) and the programs is 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 Clean Water Act (CWA), helps address water pollution by regulating point sources that discharge pollutants to waters of the United States. 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 in order 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 SWRCB's GAMA Groundwater Information System

Name	Source
DDW	Division of Drinking Water
DPR	Department of Pesticide Regulation
DWR	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

The basin has five active groundwater cleanup sites in various stages of assessment and remediation, all located in Bieber. These sites are not appropriate for ongoing monitoring for groundwater resources in the basin, as 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 Irrigated Lands Regulatory Program (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 concern~~ed~~s with regulatory programs that involve costs, especially ongoing costs, particularly in light of the disadvantaged status of the Basin.~~.~~ The Goose Lake Basin has been exempted from the ILRP

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. ~~Streamflow data is not currently available from the Adin gage.~~ There is a gage where the Pit River exits the Basin in the south at the diversion for the Muck Valley Hydro Power Plant. ~~However, the data is not readily and publicly available.~~ Stream gauges are shown on **Figure 3-11**.

Diversions

Surface water diversions greater than 10 acre-feet per year must be reported to the SWRCB in compliance with state legislation (SB-88). The Big Valley Water Users Association (BVWUA) employs a watermaster service to measure diversions from the Pit River for submittal to the SWRCB. However, many claimants on the river do their own measurements and reporting. Ash Creek and Willow Creek diversions are monitored by the Modoc County watermaster department.~~, for claimants that don't do their own measurements and reporting.~~

3.5.1.3 Climate Monitoring

~~The Basin has limited climate monitoring.~~ The National Oceanic and Atmospheric Administration (NOAA) has two stations located in the Basin: Bieber 4 NW and Adin RS. Both of these stations are no longer active, thus only contain historic data. Annual precipitation at the Bieber station is shown for 1985 to 1995 in **Table 3-6**.

The closest California Irrigation Management Information System (CIMIS) station, number 43, is in McArthur, CA, and measures a number of 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 3-12** shows annual rainfall for 1984 through 2018. The locations of all climate monitoring stations are shown on **Figure 3-11**. Climate monitoring is a data gap that could be filled with a CIMIS station located in the Basin.

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 and can be reoccupied in the future to determine subsidence at those points if needed.

In addition, DWR has provided data processed from inferometric synthetic aperture radar (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.

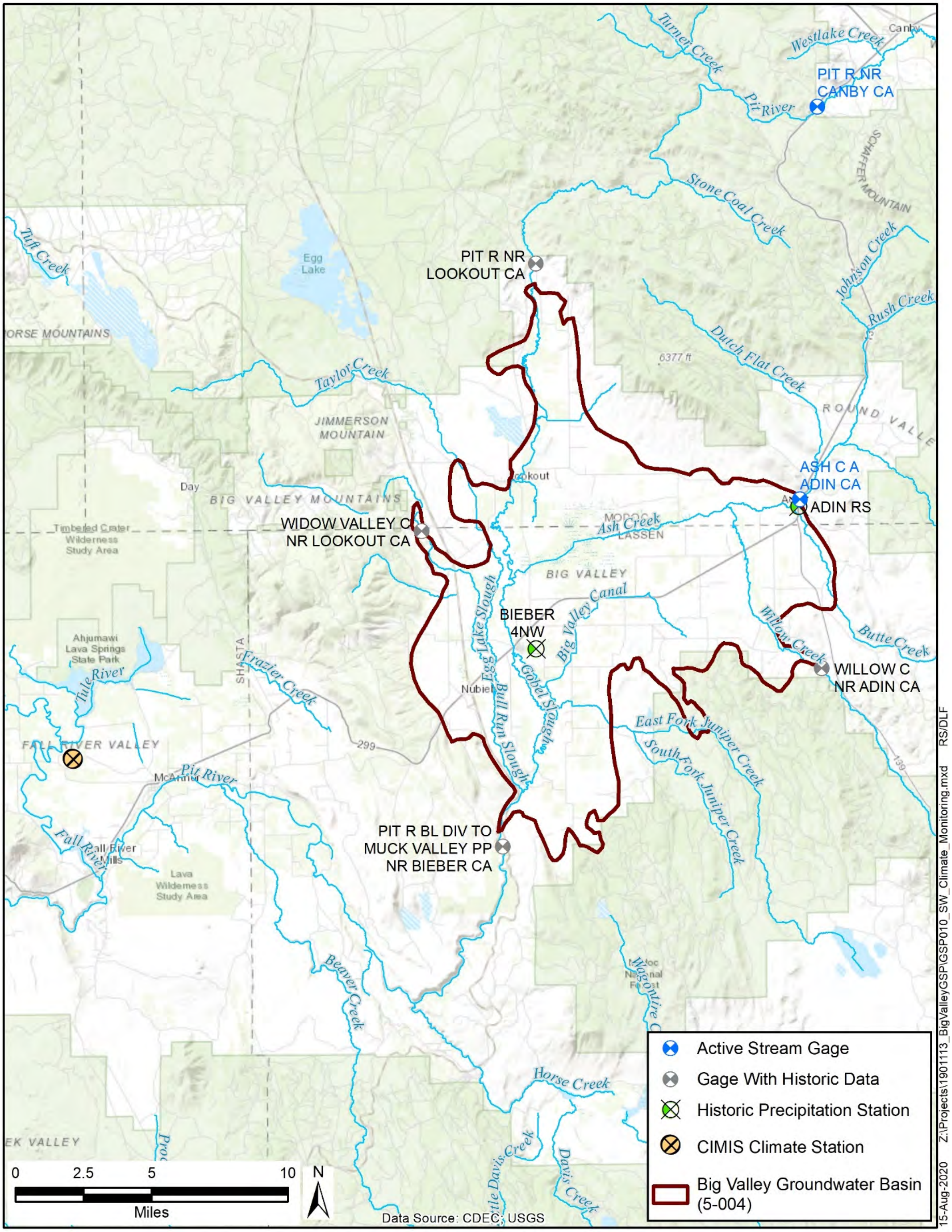


Figure 3-11 Surface Water and Climate Monitoring Network

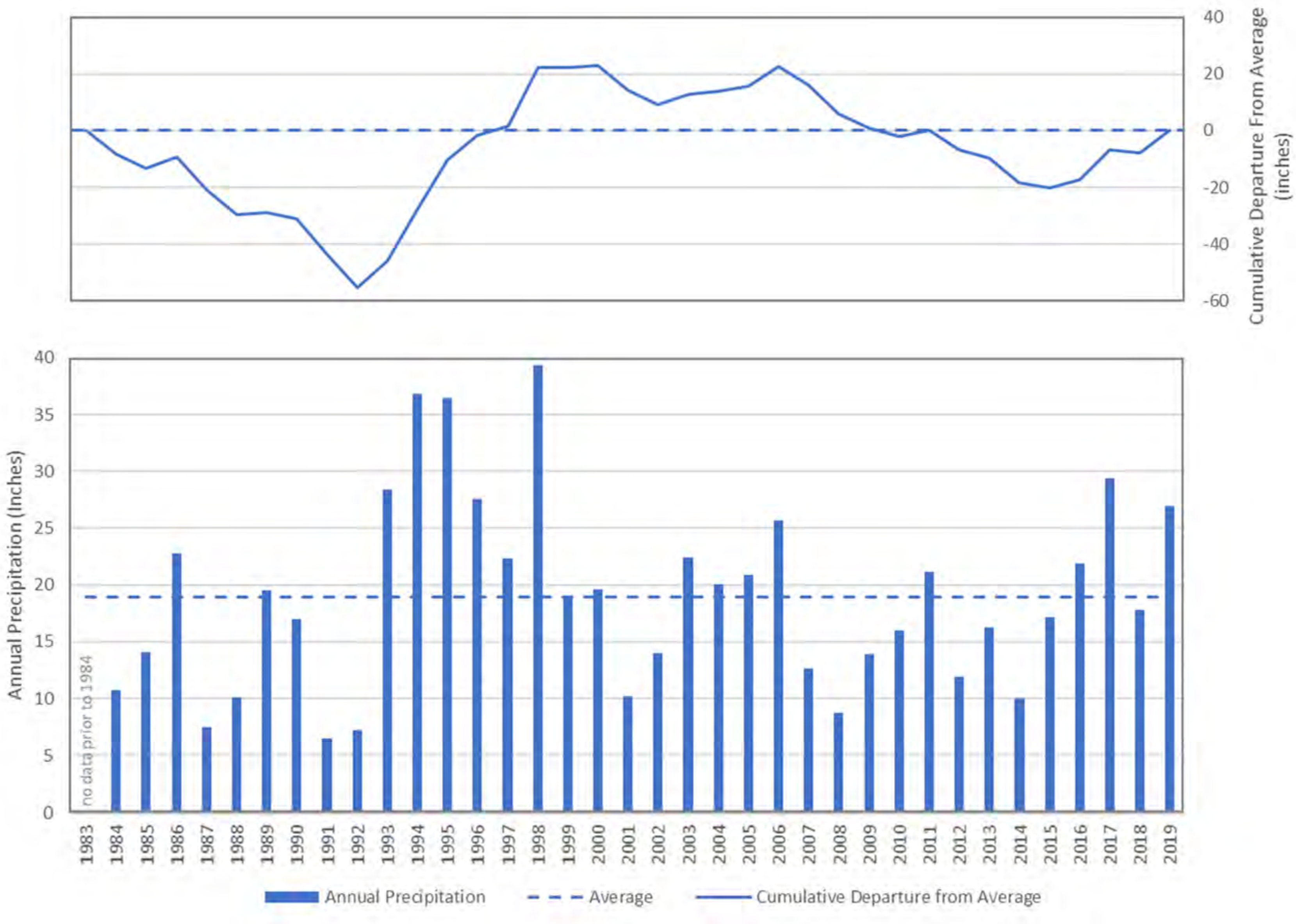


Figure 3-12 Annual Precipitation at the McArthur CIMIS Station

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

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

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 Integrated Regional Water Management Plan (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[12] (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 the Sustainable Groundwater Management Act (SGMA). A BMO ordinance was passed by Lassen County in 2011.

Upper Pit River Watershed IRWMP

The Upper Pit IRWMP was adopted by the Regional Water Management Group 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 the North Cal-Neva Resource Conservation and Development Council (NORTH CAL-NEVA) who has been working to update the Plan. 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."*

The Upper Pit IRWMP contains the entire Watershed above Burney and extends past Alturas to the northeast. The area includes the entire BVGB. This GSP has been identified as a Project in the IRWMP.

3.5.3 Groundwater Regulatory Programs

~~Water Quality Control Plan for the Sacramento River and San Joaquin River Basins~~

The Basin is located within the jurisdiction of the Regional Water Quality Control Board (RWQCB) Region 5 (R5) and subject to a Water Quality Control Plan (Basin Plan), which is required by the California Water Code (Section 13240) and supported by the Federal Clean Water Act. The Basin Plan

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

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. (SWRCB, 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 will not be contaminated or polluted, and 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 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 California Water Code (Section 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. (Title 20 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 in order to protect groundwater quality, as allowed by California Water Code Sections 13700 to 13806. DWR began this effort in 1949 and has published several versions of standards in Bulletin 74, beginning in 1962, and is working on a significant update for 2021. Current requirments are provided in Bulletin 74-81, Water Well Standards: State of California, and in Bulletin 74-90 (Supplement), California Well Standards. Cities, counties, and water agencies have regulatory authority over wells and can adopt local well ordinances that meet or exceed the state standards.

Title 22 Drinking Water Program

The SWRCB Division of Drinking Water (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 has 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 (Section 116275 (h). DDW further defines public water systems as:

- Community (C): Serves at least 15 service connections used by year-round residents or regularly serves 25 year-round residents. Lassen County Water District #1 ~~serves~~ provides residents with groundwater in Bieber.
- Non-Transient Non-Community (NTNC): Serves at least the same 25 non-residential individuals during 6 months of the year. The Adin Ranger Station utilizes a well for its water supply.
- Transient Non-Community (NC): Regularly serves at least 25 non-residential individuals (transient) during 60 or more days per year.

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

The SWRCB-DDW enforces the monitoring requirements established in Title 22 of the California Code of Regulations (CCR) for public water system wells, and all the data collected must be reported to the DDW. Title 22 designates the regulatory limits (e.g., maximum contaminant levels [MCLs]) for various constituents, including naturally-occuring inorganic chemicals and metals, and general characteristics; and also 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 may be incorporated into this GSP and used during the preparation of Sustainability Management Criteria (minimum thresholds, measurable objectives, interim milestones) and will be 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 requirements by Lassen County and Modoc County would be taken into account for any sustainable groundwater management 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 describes the jurisdictional areas within the BVGB and many of these entities have developed land use plans for their respective jurisdictions. This includes the Modoc and Lassen County general plans and the Modoc National Forest Land and Resource Management Plan.

3.7.1 Modoc County General Plan

The 1988 Modoc County General Plan was developed in order to meet a state requirement and to serve as the "constitution" for the community development and use of land. The plan discusses the mandatory elements of a general plan, 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 plan was intended to serve as a guide for growth and change in Modoc County~~ for the 15 years following its publication~~. 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 generally good to excellent within the numerous basins~~, although some basins contain groundwater with high natural concentrations of boron and/or arsenic (Big Valley)~~.

Policy items from the Modoc General Plan 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 county.
- 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 general plan amendment was adopted to update the housing element section.

3.7.2 Lassen County General Plan

The Lassen County General Plan 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 general plans. The General Plan (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.

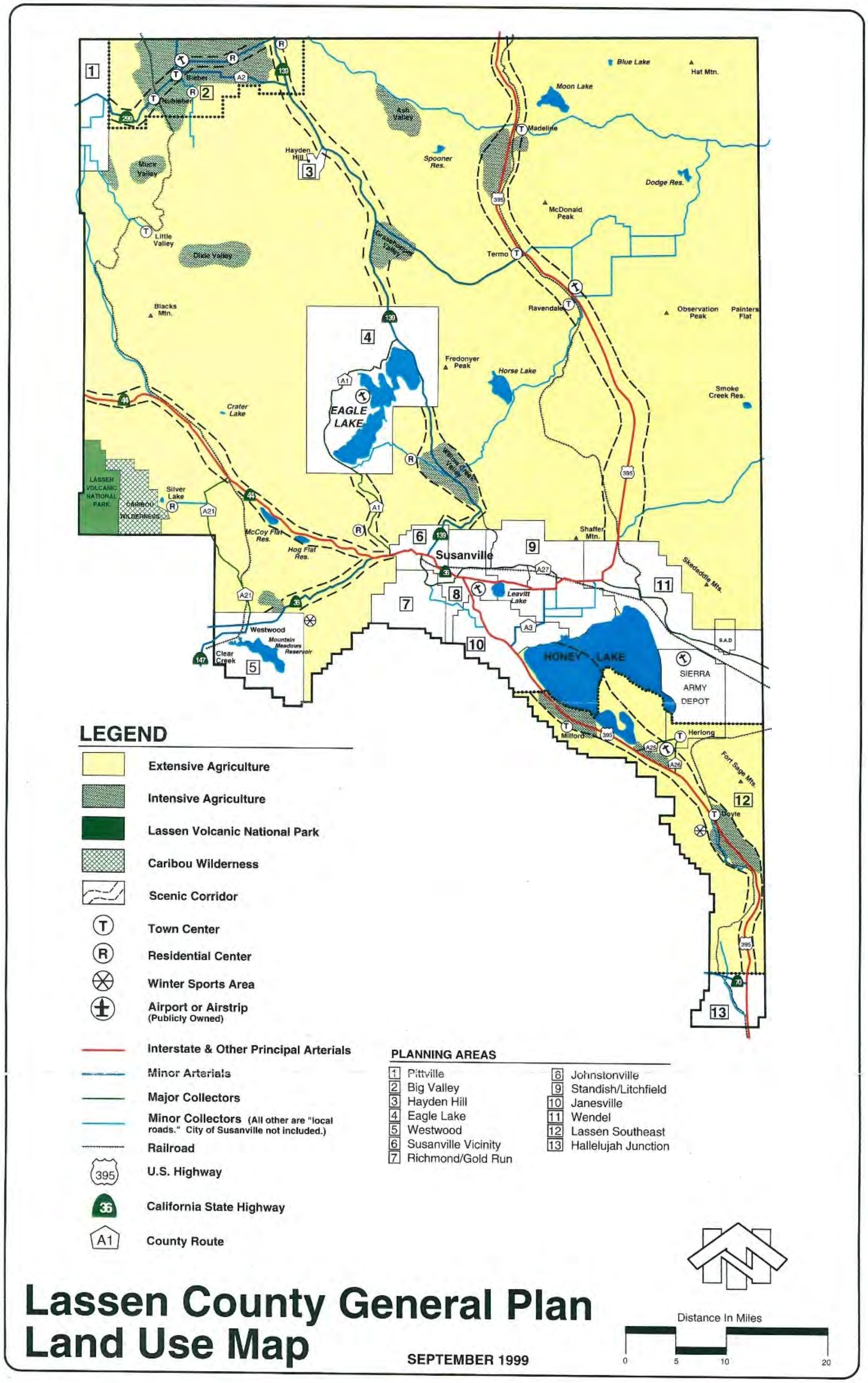
The goals of the plan are to:

- 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 plan 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 general plan, and correlates all land use issues into a set of coherent development policies. The Lassen County GP land use map from 1999 is shown in **Figure 3-13** 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. 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



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1035 **Figure 3-13 Lassen County General Plan Land Use Map**

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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 habitat 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: The County advocates the cooperation of state and Federal agencies, including the State Water Resources Control Board and its regional boards, in considering programs and actions to protect the quality of ground water and surface water resources.
- NR17 POLICY: The County supports measures to protect and insure 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: The County will maintain ground water ordinances and other forms of regulatory authority to protect the integrity of water supplies in Lassen County and regulate the exportation of water from ground water basins and aquifers in the county to areas outside those basins.
- NR19 POLICY: The 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: The County recognizes that its surface and ground water resources are especially valuable resources which deserve and are in need of appropriate measures to protect their quality and quantity.
- OS28 POLICY: The 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.) 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, the 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". With regard to water resources, the plan seeks to "maintain and improve the quality of surface water" through the implementation of Best Management Practices (BMPs) among other goals. ~~Little mention is made of groundwater in the plan.~~ 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 have an effect on Water Supply. Prior to the development of this plan, 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 as discussed above. The Lassen County Municipal Code (Section 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." Modoc County states that "a valid permit to drill, destroy, deepen, or recondition a water well is required in Modoc County. Permits are obtained from the Environmental Health Department after acceptance of a completed application, plot plan and fees."

3.7.7 Land Use Plans Outside of the Basin

The stakeholders submitting this GSP have not included information regarding the implementation of land use plans outside of the BVGB, as any nearby areas are also subject to the land use plan 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 Bureau of Land Management (BLM) also exist in the watershed.

3.8 Management Areas

Because the GSP is still under development, the GSAs have not defined management areas within the BVGB. 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. In deciding whether to implement management areas, the GSAs will need to weigh the added degree of complexity management areas bring to the GSP. For the final GSP, this section will be rewritten to reflect the GSAs decisions related to management areas.

3.9 Additional GSP Elements, if Applicable

The plan elements from California Water Code 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 will be 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 and defines the principal aquifer(s), based on the best available information. The HCM provides the context for the development of a water budget (Chapter 6), sustainable management criteria (Chapter 7), and monitoring network (Chapter 8).

This chapter presents the HCM for the Big Valley Groundwater Basin (BVGB or Basin, 5-004) and was developed by GEI Consultants for the Lassen County and Modoc County groundwater sustainability agencies (GSAs). This HCM supports the development of the monitoring network, water budget, and the sustainable management criteria of this Groundwater Sustainability Plan (GSP). The content of this HCM is defined by the regulations of the Sustainable Groundwater Management Act (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 prior to the 1980's. This HCM presents the best available information, data, and analyses and provides some limited new data and analyses that further the understanding. With that said, there are many data gaps in the HCM ~~are many and~~ 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~~. This includes not only hydrogeologic conditions, but also an evolving regulatory framework. The concern is that time, effort and funding could be invested in addressing data gaps and developing management strategies for regulatory priorities and requirements~~ that become less relevant in the future if the regulatory framework changes.

Recommendations and options for prioritizing and addressing the data gaps are part of this document. The stakeholders in the disadvantaged communities of the Big Valley Groundwater Basin (BVGB) have limited financial means to ~~fill~~ address data gaps, so the ~~filling of 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 (60%) with the remainder in Modoc County. At its widest points, the BVGB is approximately 21 miles long (north-south) in the vicinity of the Pit River and 15 miles wide (east-west) south of Ash Creek Wildlife area. The Basin has an irregular shape totaling 144 square miles or 92,000 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 4,090 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 and Roberts Buttes). The Pit River enters the BVGB at an elevation of 4,150 feet msl and leaves the Basin at 4,090 feet msl over the course of about 30 river miles, giving the Pit River a gradient of 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 4,100 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.

Topographic maps (7.5-minute) for the BVGB area include (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, a 1:250,000 scale map with an excerpt shown on **Figure 4-2**. (CGS 1958) The Big Valley Groundwater Basin 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, and is Miocene to Holocene age[13], which 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 provinces: block faulting of the Basin and Range and volcanism of the Cascade Range. This can be observed on **Figure 4-2** with the faults trending north-northwest surrounding Big Valley and the most recent center of volcanism (indicated by the numerous cinders centered around Medicine Lake, with several eruptions about 1000 years before present) about 30 miles northwest of Big Valley. Moreover, the historic 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[14] and basaltic andesite[15], while pyroclastic[16] ash deposits are rhyolitic[17] composition.

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

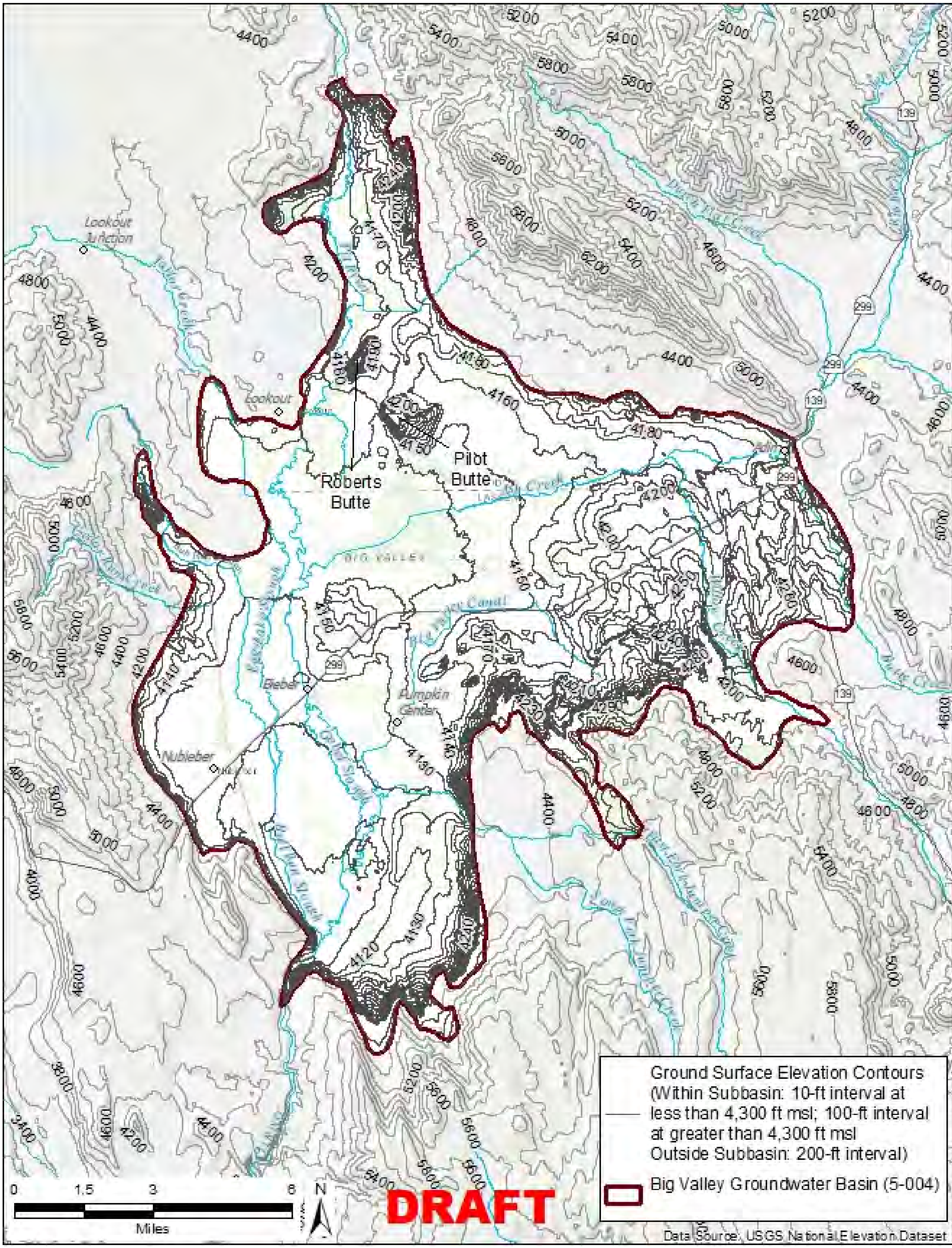

Figure 4-1 Topography

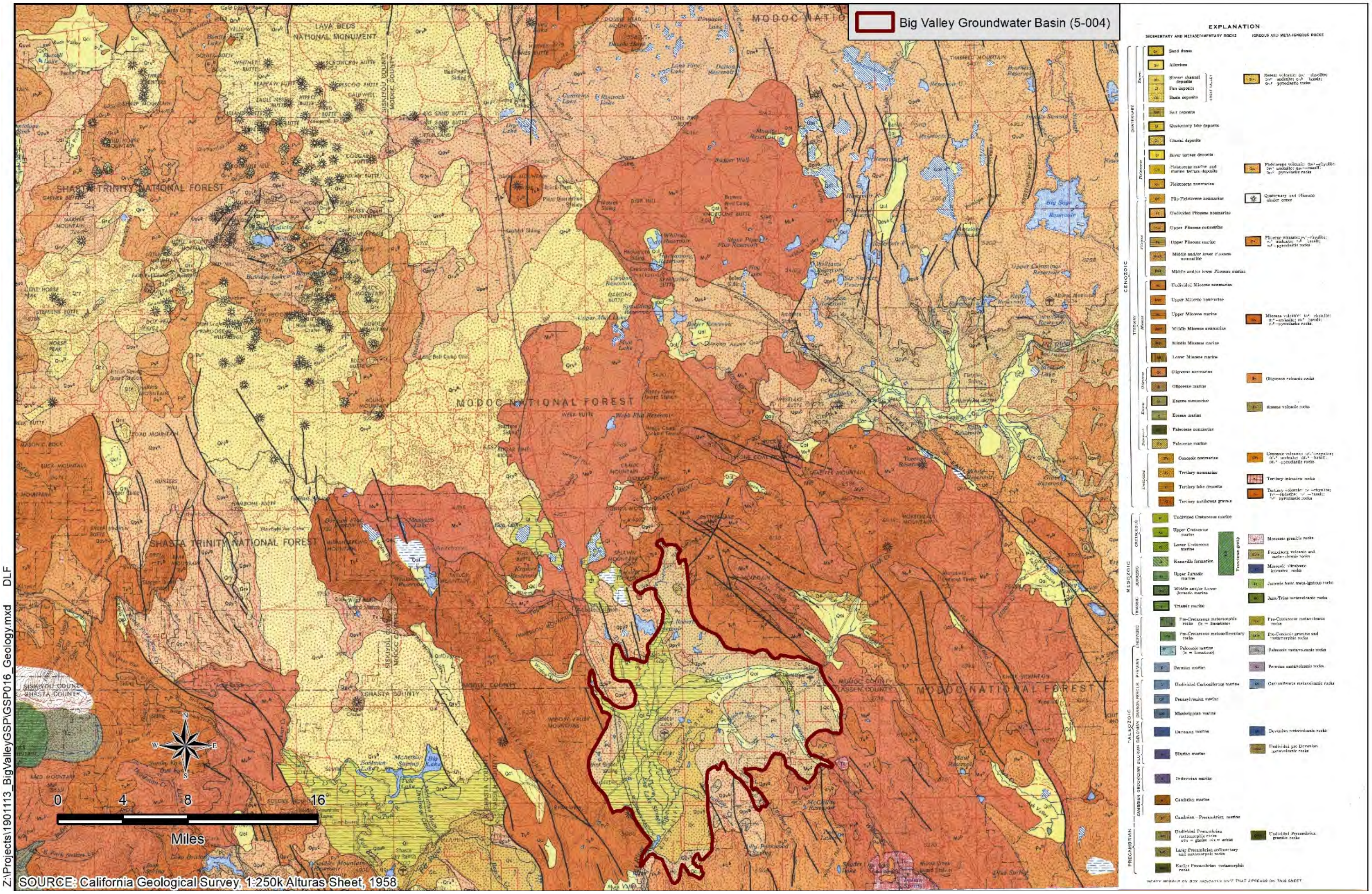

Figure 4-2 Regional Geologic Map

4.2.1 Lateral Basin Boundaries

The CGS (1958) map (**Figure 4-2**) was used by DWR to draw the BVGB boundary. 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 can be described as the contact between the valley alluvial deposits and the surrounding volcanic rocks. Because this boundary was drawn using a regional-scale map from 1958 drawn with the surface expression of geologic units, it may be necessary to modify the boundary at a future date with more precision in order to include the aquifer materials which may extend outside of the current boundary. This includes consideration of including the “upland recharge areas” described by DWR (1963).

Additionally, the basin boundary may be inaccurate in the southeastern portion of the Basin where two fingers extend into the uplands area. The narrower of the two fingers appears to extend 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**. A more thorough mapping of the elevations and geologic contacts in this area would help to refine the boundary between alluvium and upland volcanics.

In the northeastern portion of the Basin, the Basin 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 and geology (GeothermEx 1975) extends alluvium 1.5 miles further upslope as shown on **Figure 4-3**.

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 surficial geology and 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 of groundwater resources, and GeothermEx (1975) as an investigation specifically performed to evaluate 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, plus they capture and accumulate precipitation, which produces runoff that flows into BVGB. Moreover, DWR (1963) suggested that these mountains serve as “upland recharge areas” 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[18] basalts (Tpbv and Qpbv). These units are mapped by DWR (1963) outside the Basin to the northwest and southeast as well

[18] 5.3 million years to 11,700 years ago.

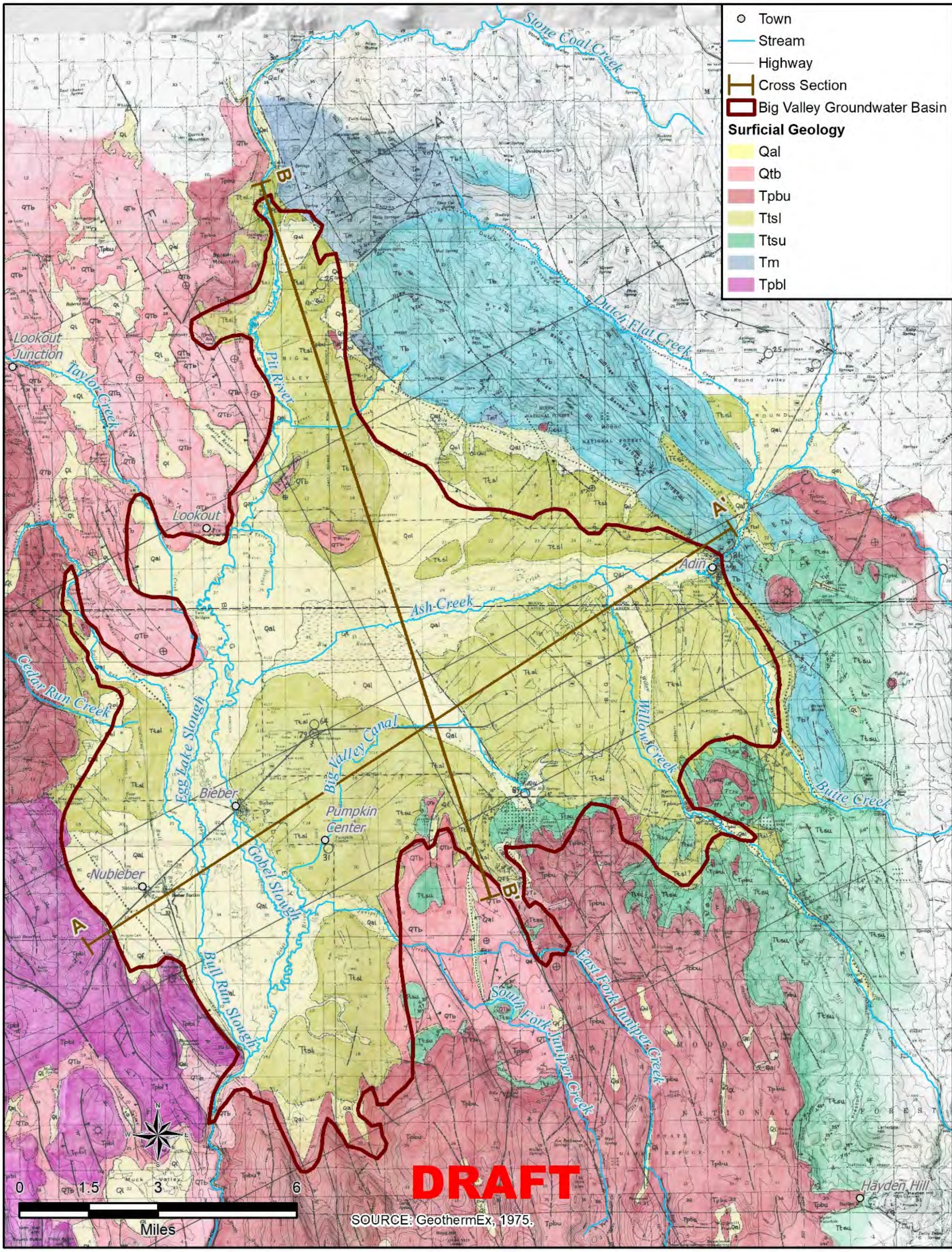

Figure 4-3 GeothermEx 1975 Local Geologic Map

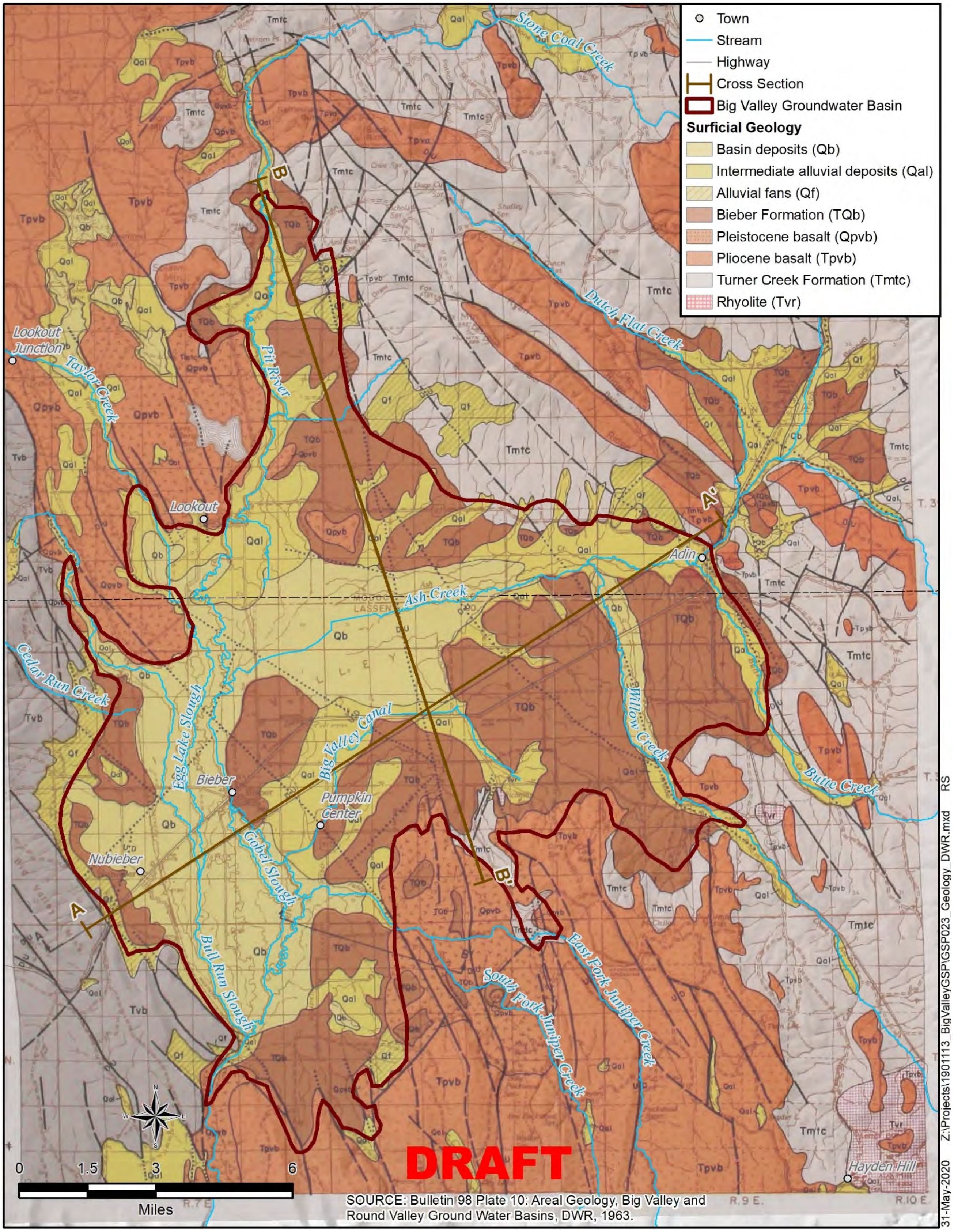

Figure 4-4 DWR 1963 Local Geologic Map

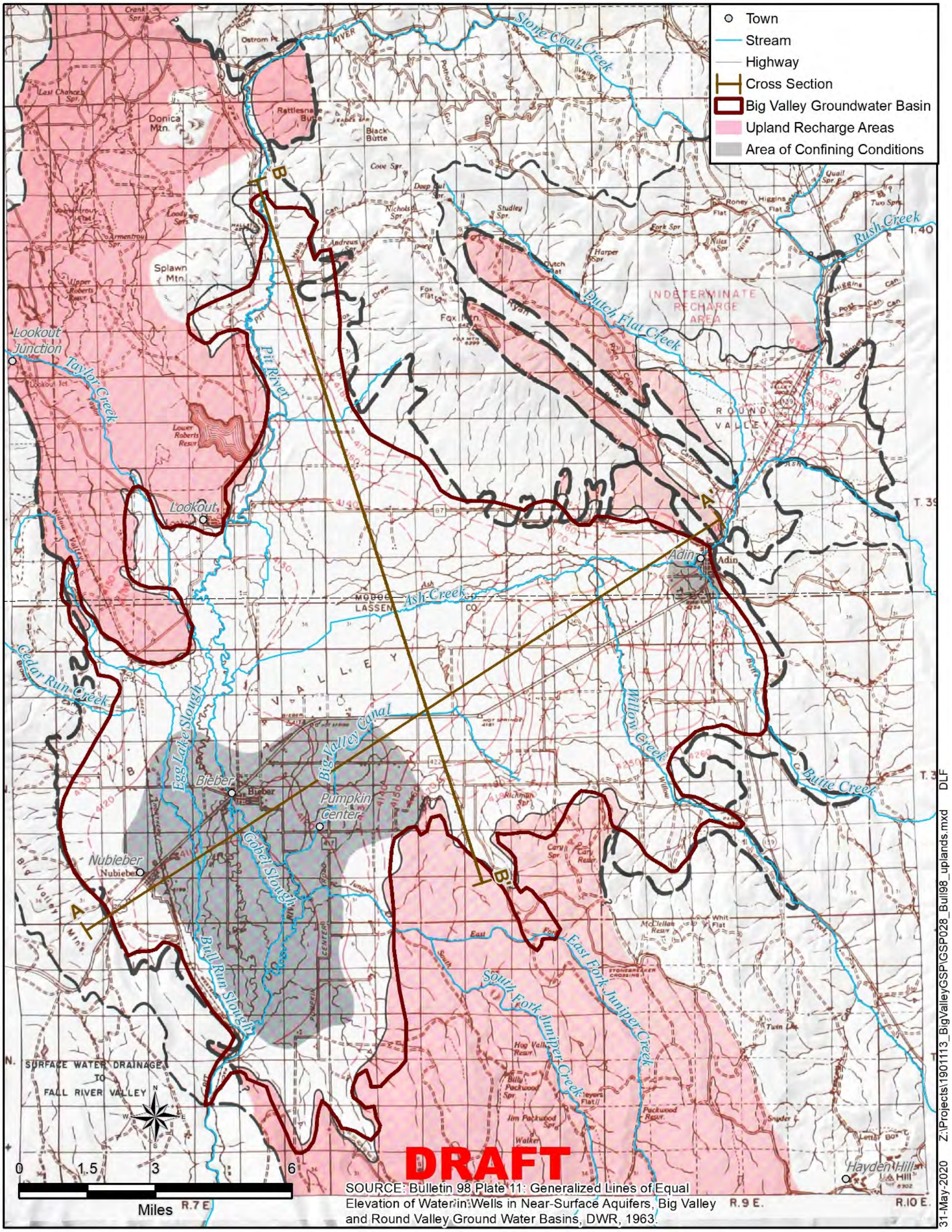

Figure 4-5 DWR 1963 Upland Recharge Areas and Areas of Confining Conditions

as along the crests of Barber and Ryan Ridges to the northeast of Big Valley.[19] 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) which is 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 less likely to be hydraulically connected to the BVGB. At the northwestern end of Barber Ridge, GeothermEx maps 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[20] age Bieber Formation (TQb) is the main formation of aquifer material defined within BVGB, extending to depths of 1,000 feet or more. It meets the 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[21]. 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[22] 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[23] 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) as well as undifferentiated alluvium (Qal). All these recent deposits are aquifer material[24] and are part of the Big Valley principal aquifer. ~~One area of~~There is discrepancy ~~is in mapping~~ between the two maps is 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.

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[19] 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**)

[20] 5.3 million to 12 thousand years old.

[21] Diatomite is a fine-grained sedimentary rock made primarily of silica. It is formed from the deposition of diatoms who make their microscopic shells from silica.

[22] Recent geologic period from 11,700 years old to present.

[23] 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).

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

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[25] is not currently available.

As described above and below, 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 of the water bearing units in the Basin will be defined as a single principal aquifer for this GSP. Future data collection and development of the groundwater resources could lead to the definition of additional aquifers.

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 ~~like~~ 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 valley. 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's GSP regulations do not provide clear guidance for what constitutes a "definable bottom" of a basin. However, DWR's (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 is 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 ft 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 probably flowed into Big Valley forming lava lenses that are now interlayered below, above and laterally 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 wells drilled in the Basin include two test borings by DWR to depths of 1843 and 1231 feet and two geothermal test wells near Bieber to depths of 2125 and 7000 feet. The deepest 7000 foot well is east of Bieber, but only has lithologic descriptions to a depth of 4100 feet. These descriptions indicate aquifer-type materials (sands) throughout. The other three deep well lithologies give similar indication of aquifer material to their total depth.

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

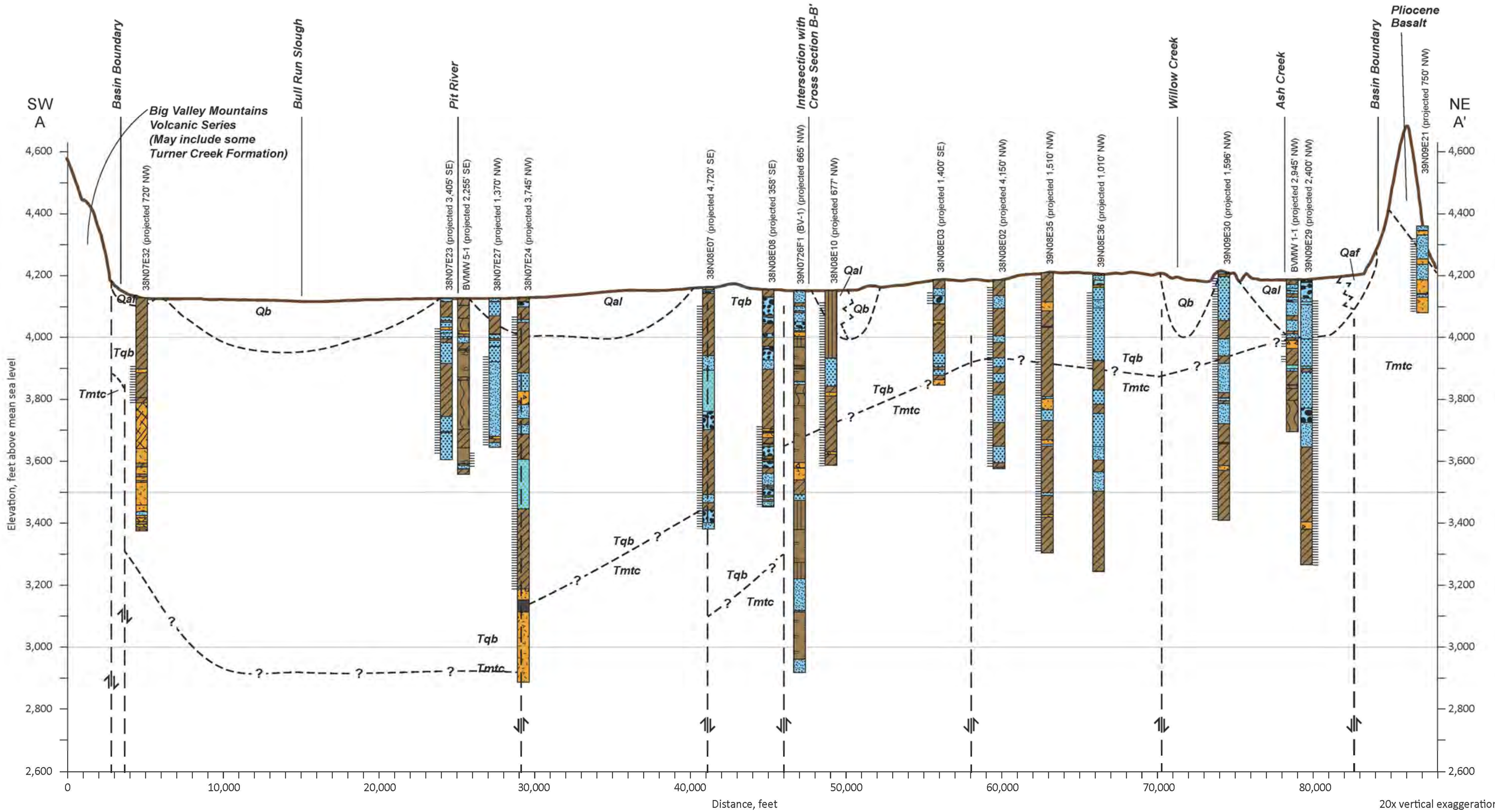


Figure 4-6 Geologic Cross Section A-A'

Note: Key to lithologic symbologies is in development and will be included in future draft(s)

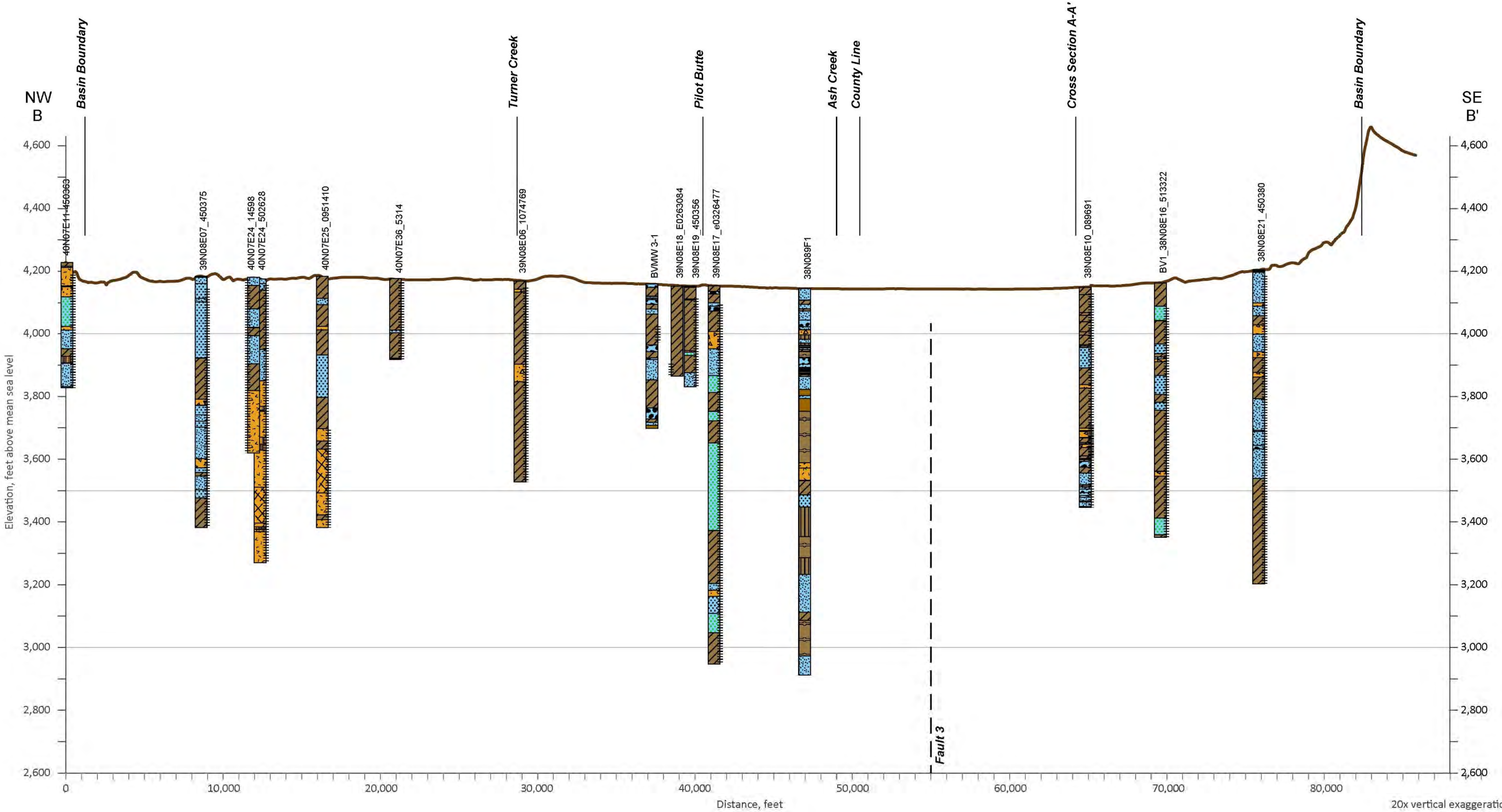


Figure 4-7 Geologic Cross Section B-B'

Note: Key to lithologic symbologies is in development and will be included in future draft(s)

The two geothermal wells also had temperature logs, and some water quality. Water temperatures increased to over 100°F beyond depths of about 2000 to 3000 feet. The Bieber School Well had water quality samples collected from the 1665 to 2000 foot interval and indicated water quality higher in total dissolved solids (632 mg/l) 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 no 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)).

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 ~~may~~ does not completely and precisely capture all the wells or the status of the wells (i.e. abandoned) ~~in the basin~~, it is the only readily available ~~inventory~~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 wells drilled deeper than 1,200 feet are the two DWR test borings and geothermal wells discussed above.

Table 4-1 Well Depths

Depth Interval (feet 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%

[a] 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 are only water wells drilled deeper than 1200 ft

For this GSP, the "practical bottom" of the aquifer is set at 1200 ~~feet, but~~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. 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 ~~[my]~~). Note that numerous faults to the west of BVGB were identified as later Quaternary to Holocene-age faults (displacement during the last 700,000 or within the last 11,700 years, respectively).

Some of the faults extend across the Basin, concealed beneath the alluvial materials. Two hot springs are located in the ~~valley~~ 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 given the limited number of widely spaced wells with groundwater level data 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[26], transmissivity[27], and storativity[28] 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 in late 2019 and early 2020.

The tests were performed by pumping each 2.5-inch diameter well for one hour at a rate of 8 gallons per minute (gpm) while measuring water level drawdown in the pumping well. A well efficiency[29] of 70% 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[30] solution that best matched the drawdown curve at each well. Storativity (S) ranged from highly confined ($3.0 \text{x} 10^{-6}$ at BVMW 3-1) to unconfined ($1.5 \text{x} 10^{-1}$ at BVMW 4-1). Hydraulic conductivity (K) ranged from 2 feet per day (ft/d) to 19 ft/d, although these K values likely range higher since pumping tests with larger pumps in larger wells for longer periods of time tend to give higher T and K. The results of these five pumping tests are documented further in **Appendix 4A.**

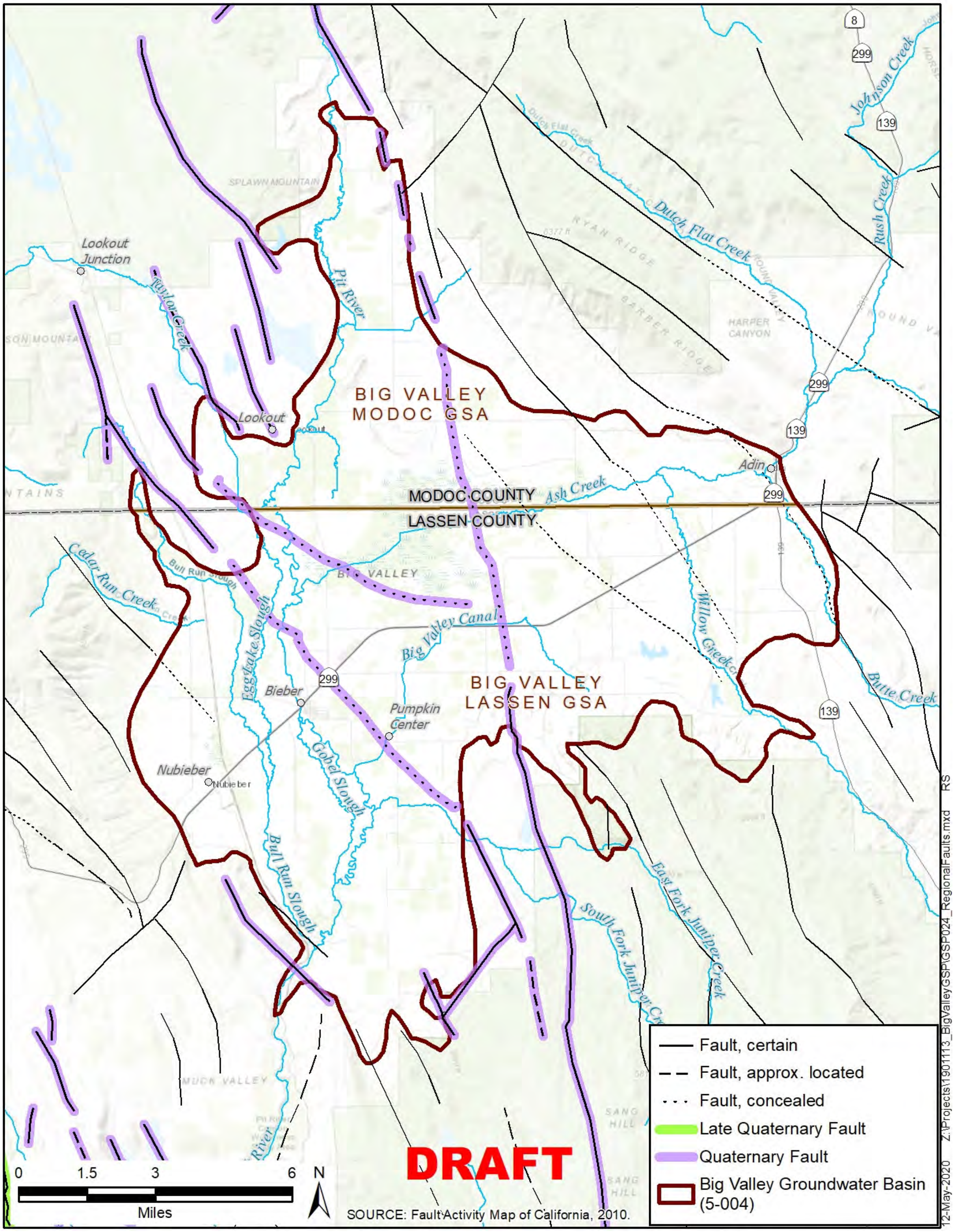
[26] Hydraulic conductivity (K) is defined as the volume of water that will move in a unit of time under a unit hydraulic gradient through a unit area. It is a measure of how easily water moves through a material and is usually given in gallons per day per square foot (gpd/ft^2) or feet per day (ft/day).

[27] 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).

[28] 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 aquifers, while low values indicate confined (pressurized) aquifers. S does not have units.

[29] Pumping tests with water levels measured in the pumping well will experience more drawdown than elsewhere in the aquifer. The predicted drawdown divided by the actual drawdown is well efficiency.

[30] Theis is a mathematical solution for predicting drawdown in a well and is commonly used to estimate K, T, and S.



1361 **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
Thickness (b)	ft	50	40	50	30	50
Flow (Q)	gpm	8	8	8	8	8
Drawdown after 1 hr	ft	4.3	16.0	27.5	2.0	3.0
Transmissivity (T)	gpd/ft	3000	750	700	4200	4500
Storativity (S)	unitless	1.5E-03	1.0E-03	3.0E-06	1.0E-01	2.0E-03
Hydraulic Conductivity (K)	ft/d	8	3	2	19	12

The 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. USBR (1979) discussed the SY in Big Valley and postulated that it varies with depth, at 7% for the first 100 feet below ground surface (bgs), 6% for the 100 to 200 feet bgs, and 5% from 200 to 1000 feet bgs. However, they don't give any supporting evidence for these percentages. SY in the Sacramento Valley has been estimated to vary between 5 to 10% (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%. This conservative percentage will be used for all depth intervals in this GSP.

4.5 Soils

Information on soils within the BVGB were obtained from the Soil Survey Geographic Database (SSURGO) of the Natural Resources Conservation Service (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 4-9**. 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.

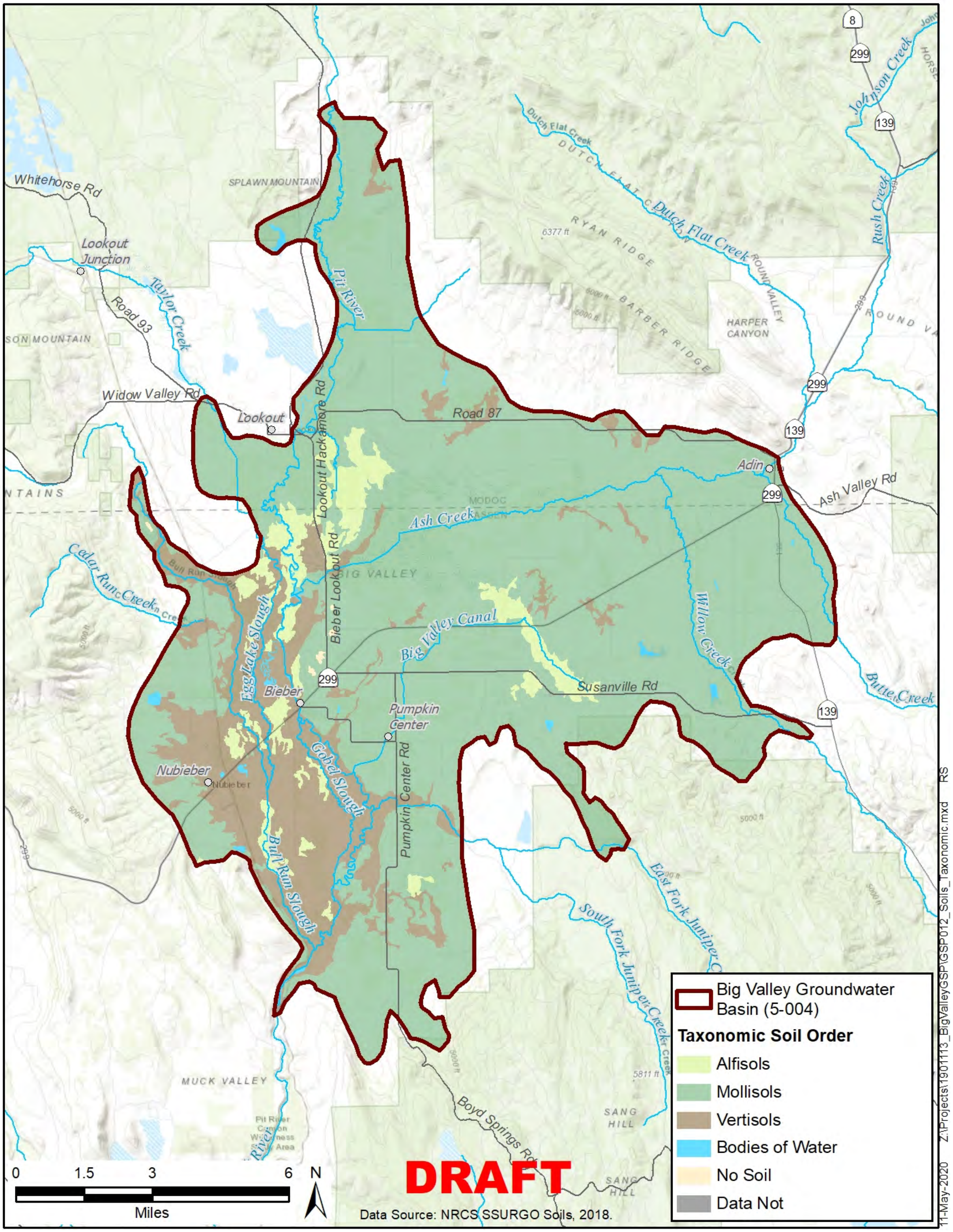


Figure 4-9 Taxonomic Soils Classifications

- Mollisol – Very dark-colored, naturally very fertile soils of grasslands. Mollisols develop from predominantly grasslands in temperate regions at midlatitudes 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. They 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% of the total area. Vertisols occupy over 16% 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% 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.

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 4-10** 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 percent clay and more than 90 percent 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[31], and the greatest recharge potential.

- 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 percent and 20 percent clay and 50 percent to 90 percent 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), a moderate infiltration rate[2], and a moderate potential for recharge.

[31] Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey

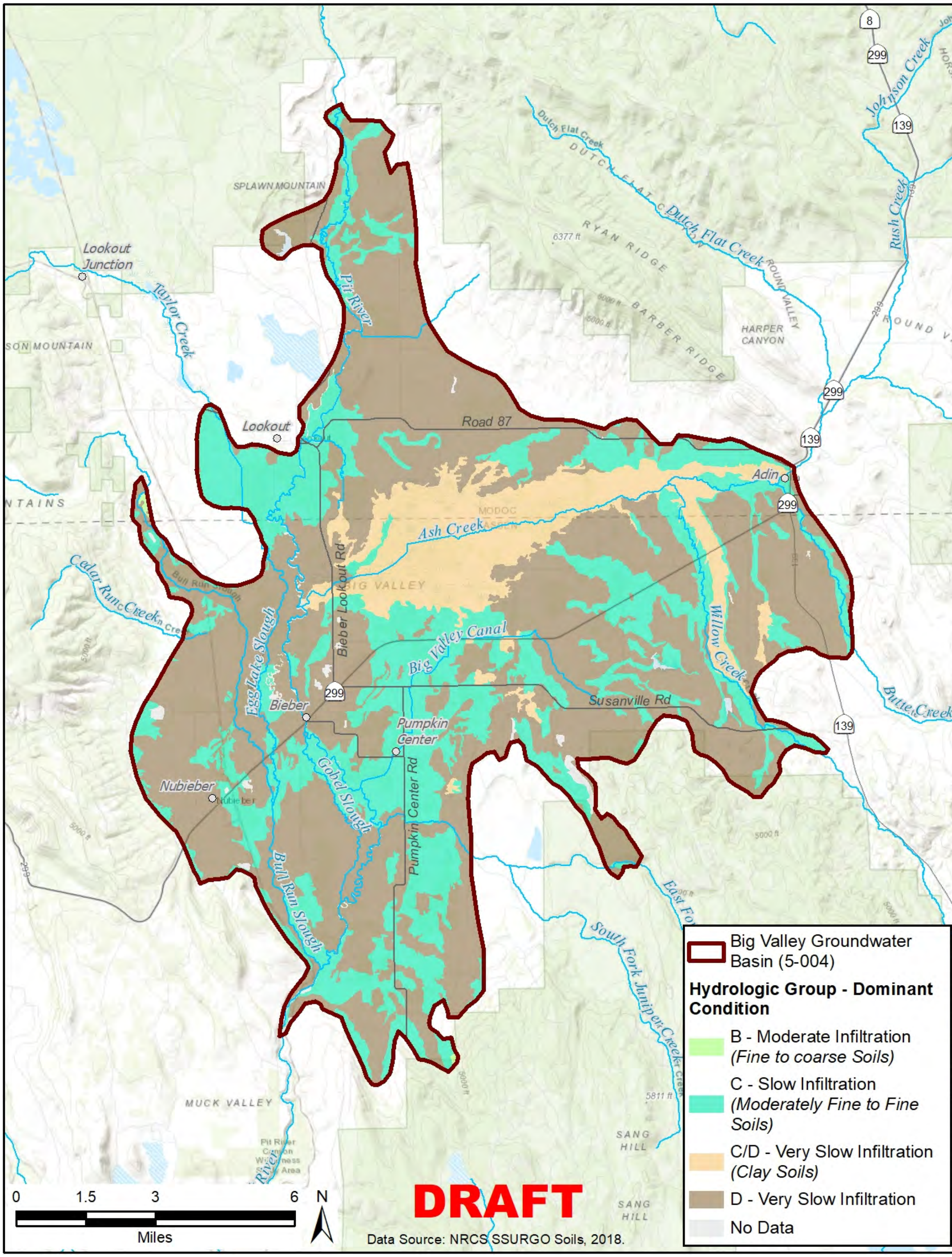


Figure 4-10 Hydrologic Soils Group Classifications

- 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 percent and 40 percent clay and less than 50 percent 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), a slow infiltration rate2, and limited potential for groundwater recharge due to their fine textures.

- 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 percent clay, less than 50 percent sand, and have clayey textures. In some areas, they also have high shrink-swell potential.” Group D soils have conductivity values less than 0.14 in/hr, a very slow infiltration rate2, and a very limited capacity to contribute to groundwater recharge.

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, no areas BVGB show high infiltration rates (Group A), and only a tiny area (<0.1%) of Group B soil (moderate infiltration) 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 Ash Creek Wildlife Area 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.

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 may still be 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. More research on soil permeability is being conducted through grant funding.

4.5.3 Soil Agricultural Groundwater Banking Index

The University of California at Davis (UCD) 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 to 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 4-11**, and the indices vary mostly

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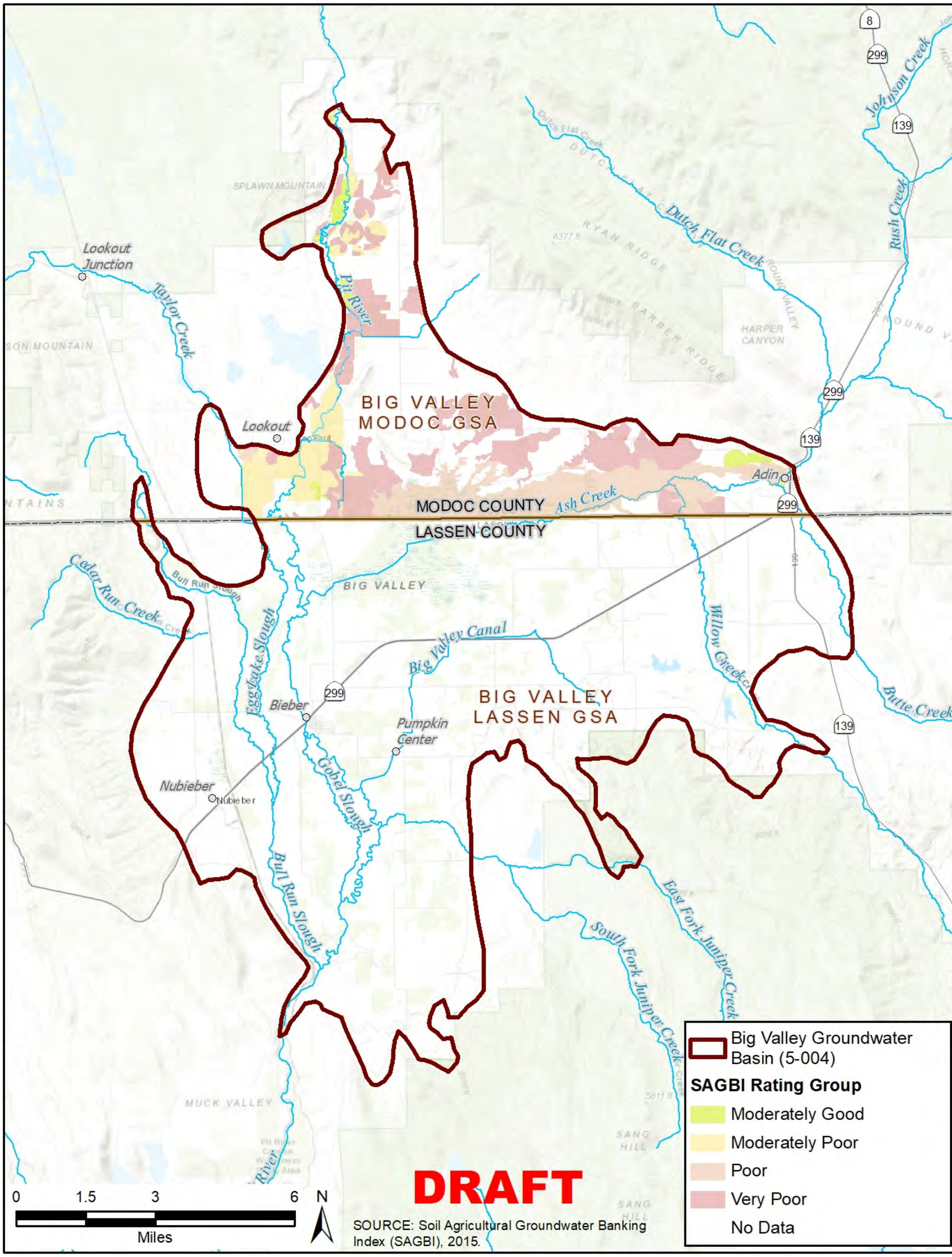


1468 **Figure 4-11 SAGBI Classifications** between moderately poor to very poor. Small areas of moderately good are present along the Pit River as it enters BVGB and to the west of Adin. It should be noted that the SAGBI is a large-scale, planning level tool and does not preclude local site conditions that are good for groundwater recharge.

4.6 Beneficial Uses of Principal Aquifers

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 3-5** 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.

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 3-4** 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 primarily within the Ash Creek Wildlife Area (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. **Figure 4-12** shows the wetlands delineated in the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset. (DWR 2018a) This dataset is a compilation of 48 publicly available State and Federal agency data sources, which have been screened to include the data most likely to be associated with groundwater. This dataset is a starting point in identifying groundwater dependent ecosystems (GDEs). Groundwater dependent ecosystems will be discussed further in Chapter 5.

Municipal

The State Water Resources Control Board (SWRCB) recognizes three public water systems that use groundwater under the purview of the Division of Drinking Water (DDW): Lassen County Waterworks District #1 (LCWWD#1) which serves the community of Bieber, the Forest Service Station in Adin which provides groundwater to a non-community, non-transient population, and the CalFire conservation camp west of the Basin whose well is located within the Basin boundary.

Domestic

Domestic users include residents that use their own well 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.

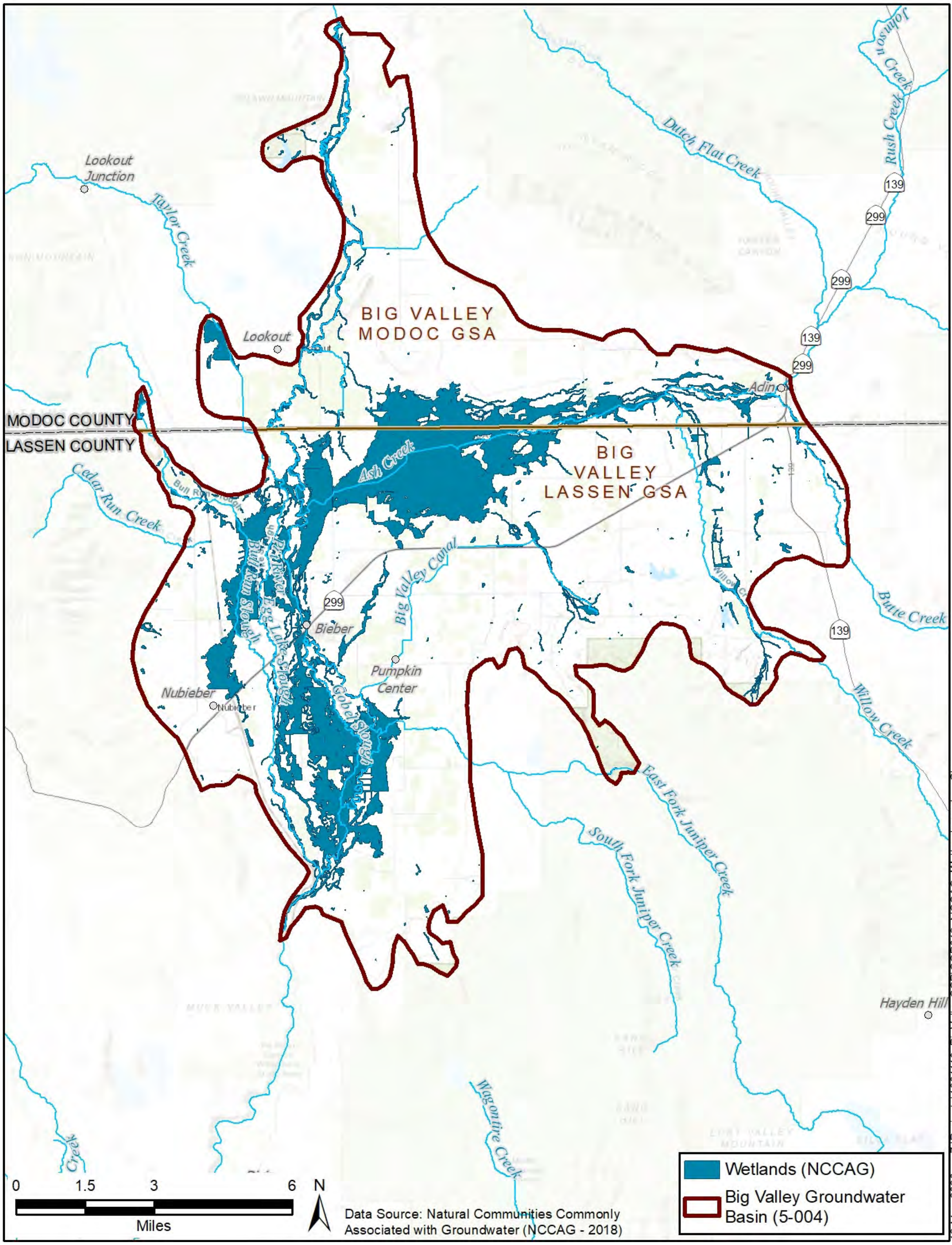


Figure 4-12 NCCAG Wetlands

4.7 General Water Quality

Previous reports have characterized the water quality as excellent. (DWR 1963, USBR 1979) The central area of the basin, where naturally occurring hot springs influence the chemistry, has elevated levels of sulfate, fluoride, boron, and arsenic. (USBR 1979) These localized areas with higher mineral content occur near the major faults that traverse the valley.

Figure 4-13 shows a Piper Diagram for water samples that were collected in late 2019 and early 2020 and characterizes the relative concentrations of the major cations (Ca, Mg, Na, K) and anions (SO4, Cl, HCO3). The dominant cations 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 indicates that the water is generally young in geologic terms.

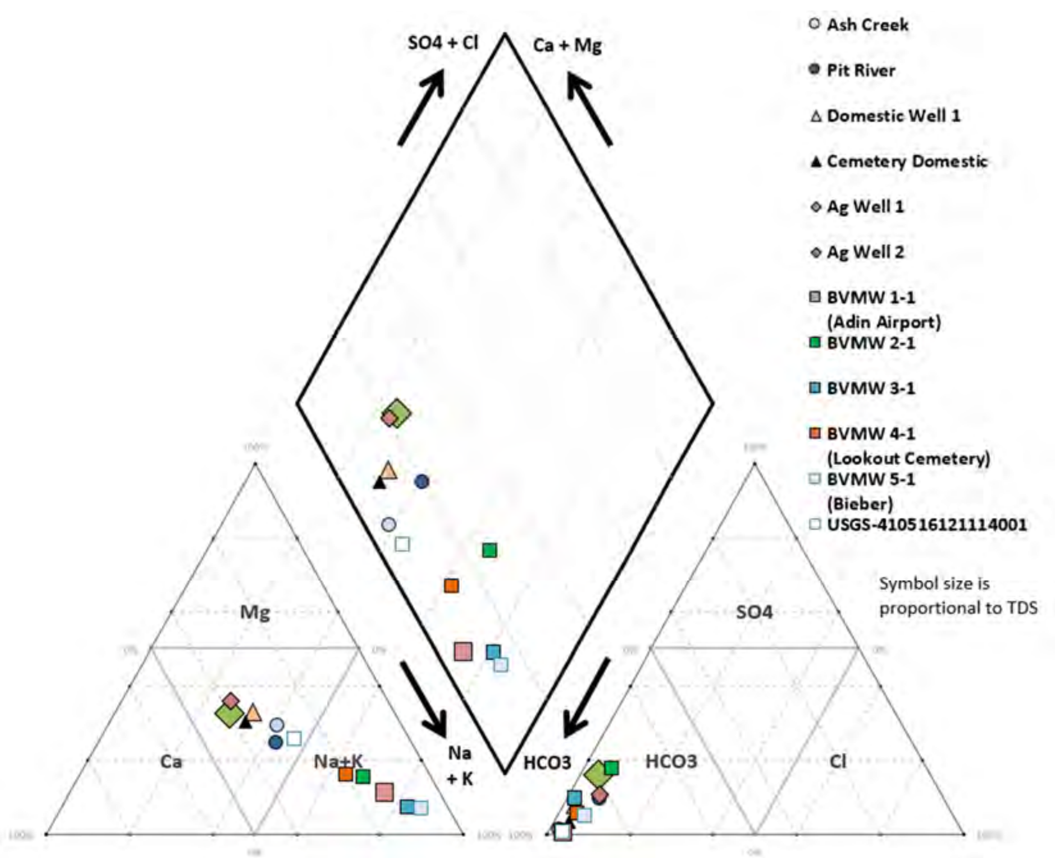


Figure 4-13 Piper Diagram showing major cations and anions

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.

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 hits 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 could enter the Basin where the Pit River and Ash Creek enter the Basin. A Basin boundary modification may be 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 likely 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 consumed through evapotranspiration. **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 California Department of Fish and Wildlife~~, who owns and operates that land~~ 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 still 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 ~~likely~~ occurs. Flood irrigation ~~tends~~ is an active~~to be~~ practice~~d~~ ~~adjacent to~~along the southern portions of the Pit River~~. But irrigation throughout the Basin may~~ and provides valuable recharge~~, depending on the amount of water applied~~.

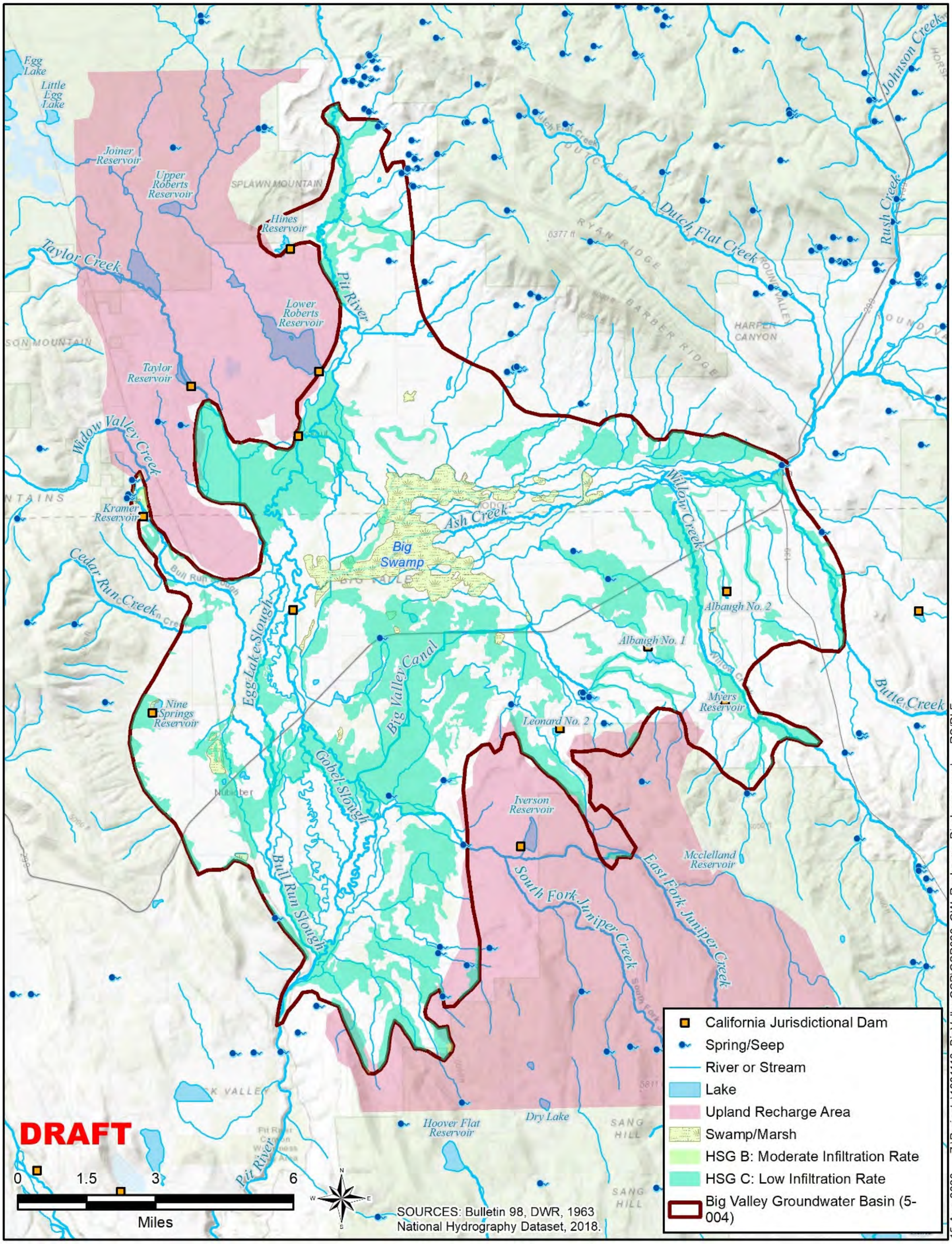


Figure 4-14 Recharge, Discharge, and Major Surface Water Bodies

4.8.2 Discharge

Flow out of the groundwater aquifer (and out of the Basin) most likely occurs at the southern portion of the Basin where groundwater flow is towards the Pit River. The gaining river[32] then transports the water out of the Basin. DWR (1963) indicates that artesian[33] conditions occurred in this southwestern area and therefore historically discharged some portion to the surface streams. Based on currently documented water levels, this area is no longer artesian. 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: the Pit River and Ash Creek. The figure also shows the many small ponds and several reservoirs that are in and around the Basin. The dams that are within the jurisdiction of DWR's 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, where the water originates in a watershed other than the one in which BVGB is located

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 Basin boundary was drawn 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~~ies may be~~ 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.

[32] Gaining rivers are where groundwater flows toward the river and contributes to surface water flow.
[33] Artesian aquifers are under pressure and wells screened in them flow from the surface.

Confining Conditions

Confining conditions exist throughout the Basin. Often the confinement is simply a result of depth and the fact that horizontal hydraulic conductivities are about 10 times greater than vertical. However, in the southwest portion of the Basin, DWR (1963) has documented an area of confining conditions. It is unknown whether the confinement is due to a single, coherent aquitard or is just a result of depth. It is also unknown whether the confinement is significant enough to warrant separate principal aquifers, which could have implications for the GSP.

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/or 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. On the Lassen County side of the Basin, this has bearing on understanding whether the eastern portions of the basin near Willow Creek are interconnected with the southwestern portions of the Basin near Pumpkin Center. 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 development of the water budget, estimates of the amount of recharge will be estimated using changes in water levels over a hydrologic base period.

- Effect of Ash Creek on recharge (incl. Big Swamp)
- Effect of Pit River on recharge (incl. overflow channels)
- Effect of smaller streams on recharge (incl.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

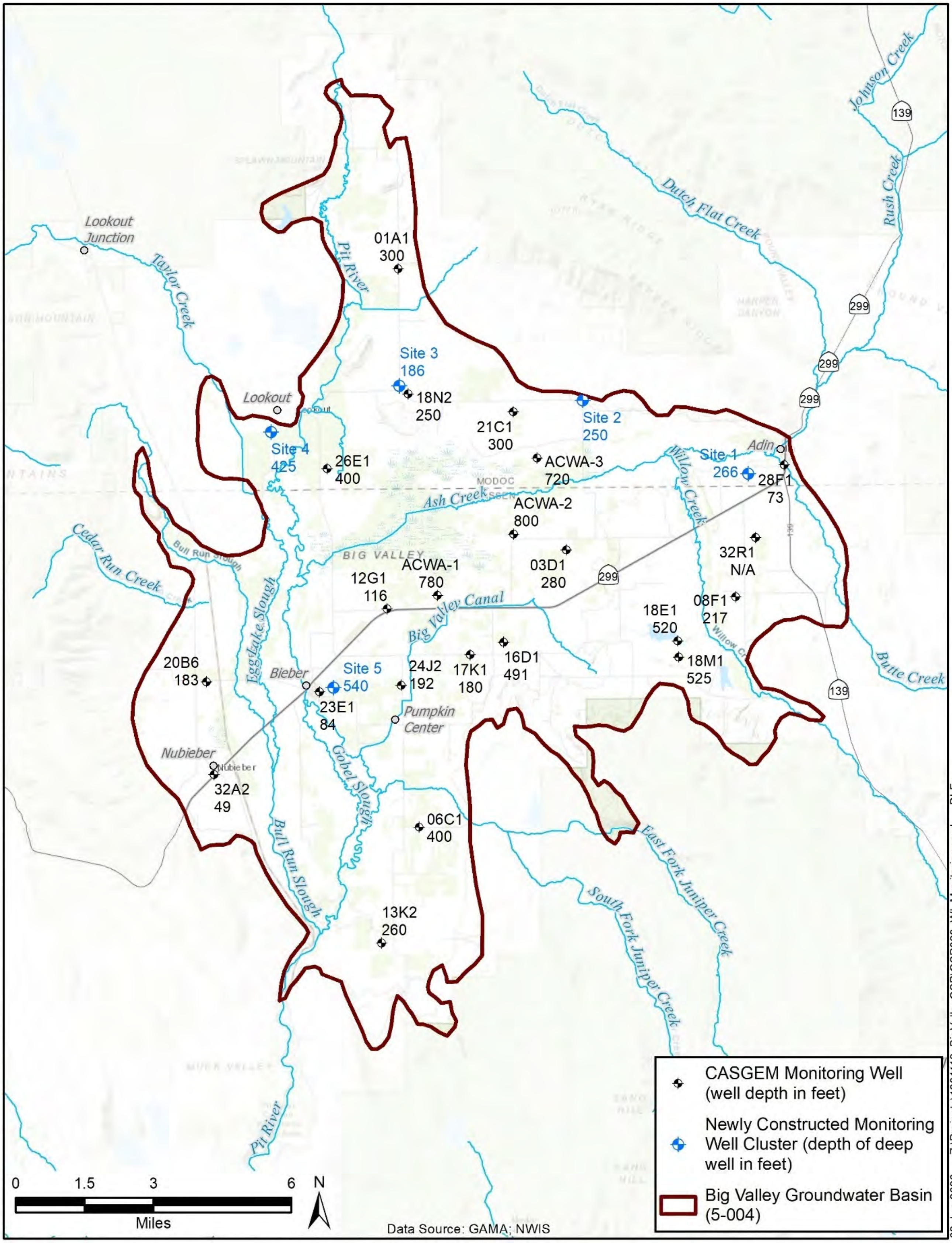
This chapter presents available information on ~~the G~~groundwater c~~C~~onditions for the Big Valley Groundwater Basin (BVGB or Basin, 5-004) developed by GEI Consultants for the Lassen County and Modoc County groundwater sustainability agencies (GSAs). This chapter provides some of the information needed for the development of the monitoring network and the sustainable management criteria of this Groundwater Sustainability Plan (GSP). The content of this chapter is defined by the regulations of the Sustainable Groundwater Management Act of 2014 (SGMA) – Chapter 1.5, Article 5, Subarticle 2: 354.16. GEI Certified Hydrogeologists 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.

5.1 Groundwater Elevations

Historic groundwater elevations are available from a total of 22 wells in Big Valley, six located in Modoc County and sixteen 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 California Statewide Groundwater Elevation Monitoring (CASGEM) program. The Department of Water Resources (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 sites 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.

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 Ash Creek Wildlife Area (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). Well 32R1 could benefit from '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 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 main portion of the aquifer ~~used~~ 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 of how groundwater interacts with surface water and possibly the location of groundwater recharge. Limited ~~W~~water level information is ~~not yet~~ available from these five clusters.



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1665 **Figure 5-1 Water Level Monitoring**

Table 5-1 Historic 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

source: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

bgs = below ground surface

msl = above mean sea level

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) varies between 3.1 and 15.3 (average: 8.1) and are divided into the f~~our~~ive WY categories.

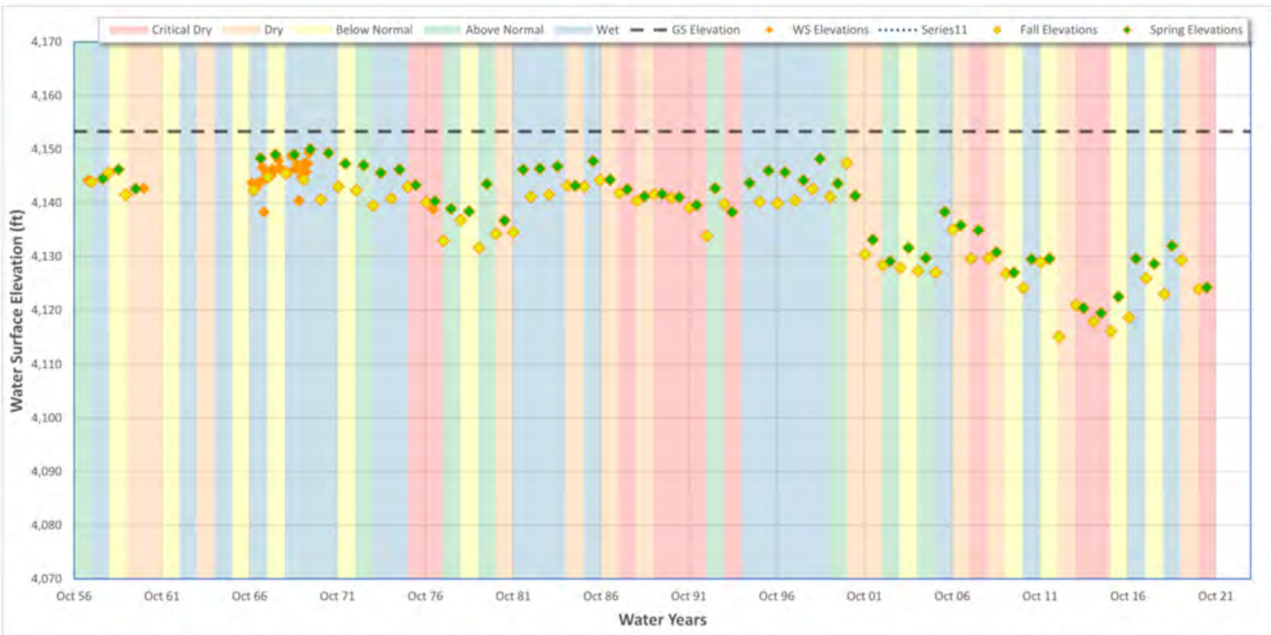


Figure 5-2 Hydrograph of Well 17K1

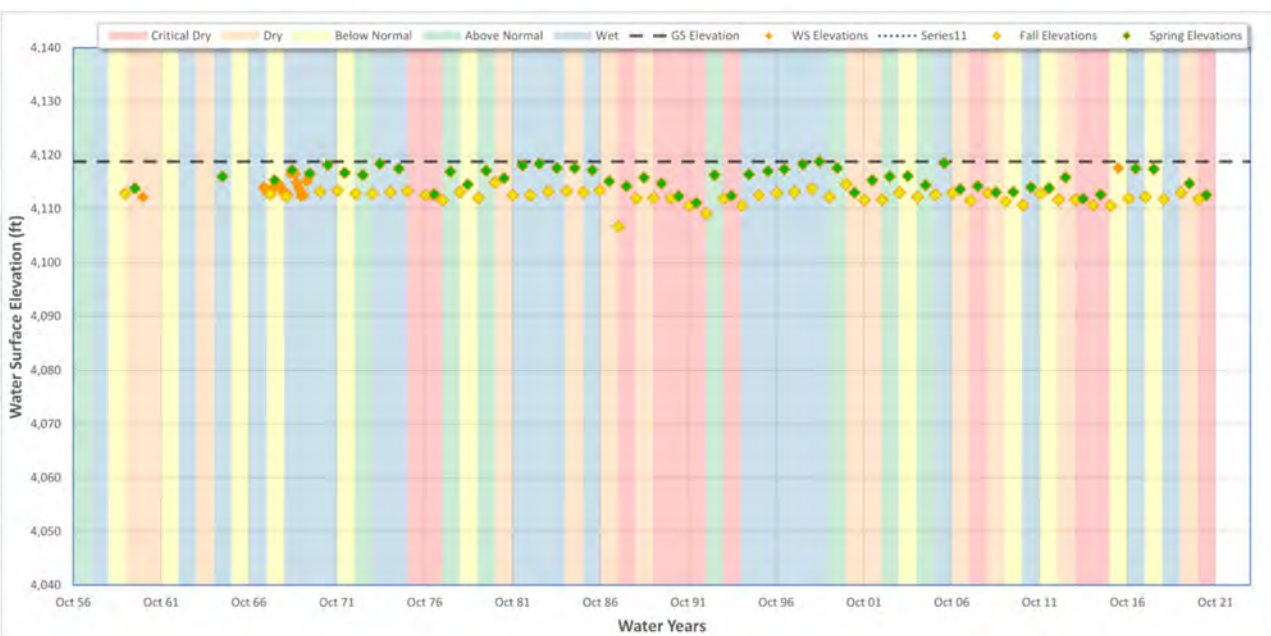


Figure 5-3 Hydrograph of Well 32A2

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. ~~more and have shown a measurable decline since about 2000~~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 hydrograph in the appendix an ~~red~~ orange trend line is shown, which is determined from a linear regression of the spring water level measurements between water year ~~2000~~1979 and ~~2019~~2021. The average water level change during that period, in feet per year, is also shown. ~~Twelve~~ Sixteen wells show relatively stable (less than -~~1~~ 1.0 ft/yr of decline) or rising water levels and ~~nine~~ six wells show declining water from -1 to -3.1 ft/yr. 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 in excess of -1 ft/yr in orange~~ and red~~.

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. Vertical gradients 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 contained the Hydrogeologic Conceptual Model which defined a single principal aquifer in the BVGB; therefore, there is no vertical gradient that needs to be described between principal aquifers. However, vertical gradients likely exist, and the five recently constructed well clusters will have data to describe these gradients once sufficient water level data is 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. 2018 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. 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.

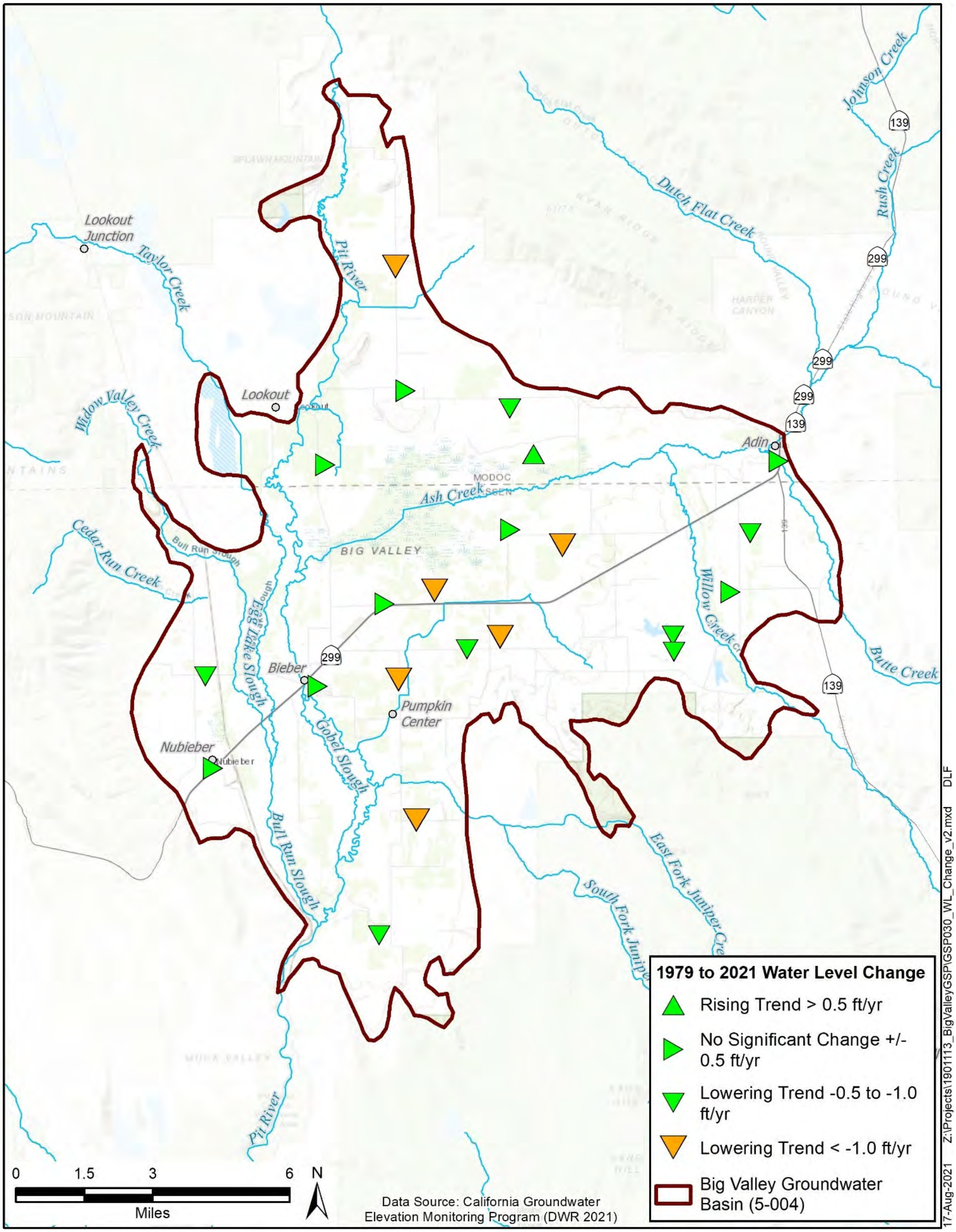
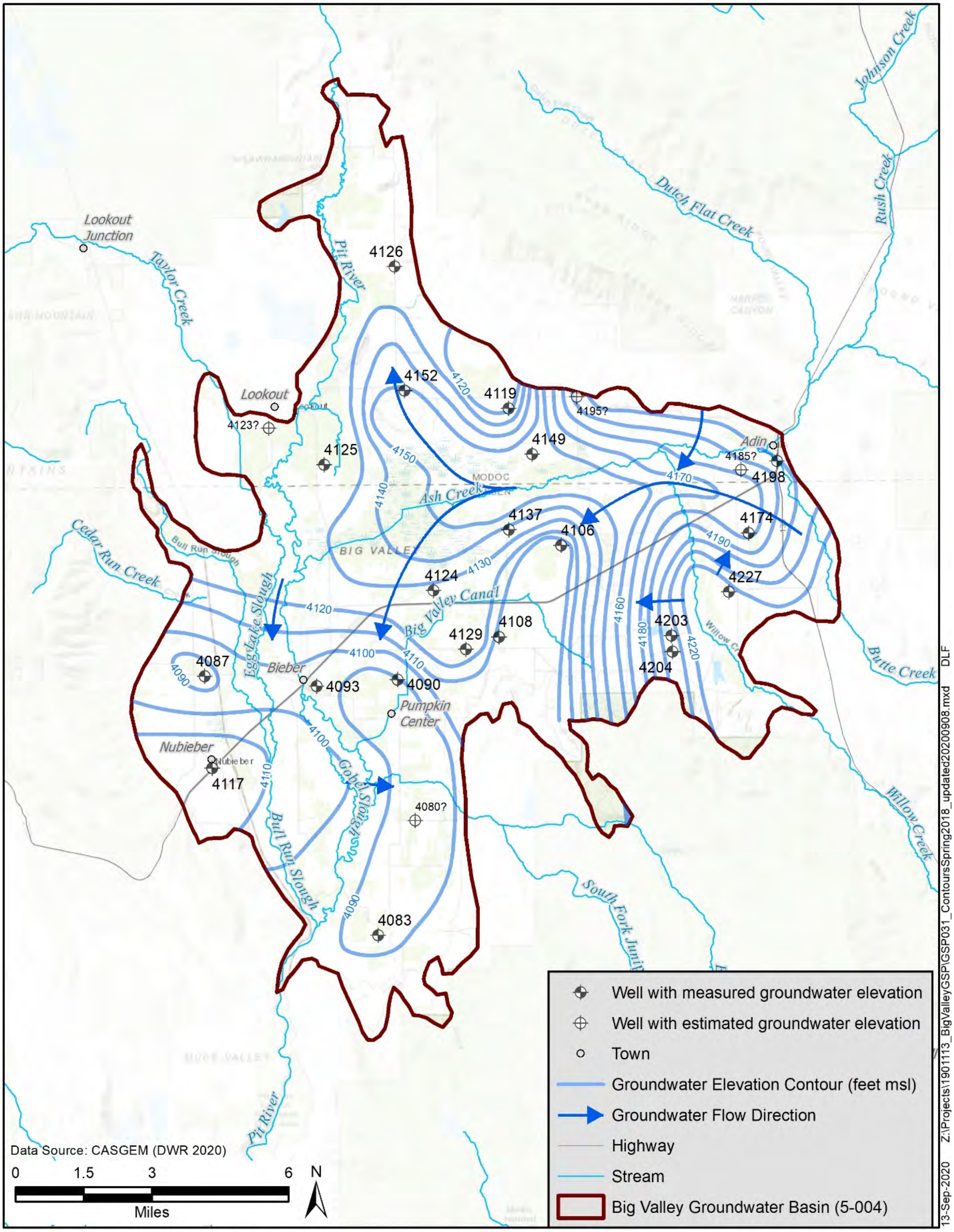


Figure 5-4 Average Water Level Change Since 2000 Using Spring Measurements

1716



1717 **Figure 5-5 Groundwater Elevation Contours and Flow Direction Spring 2018**

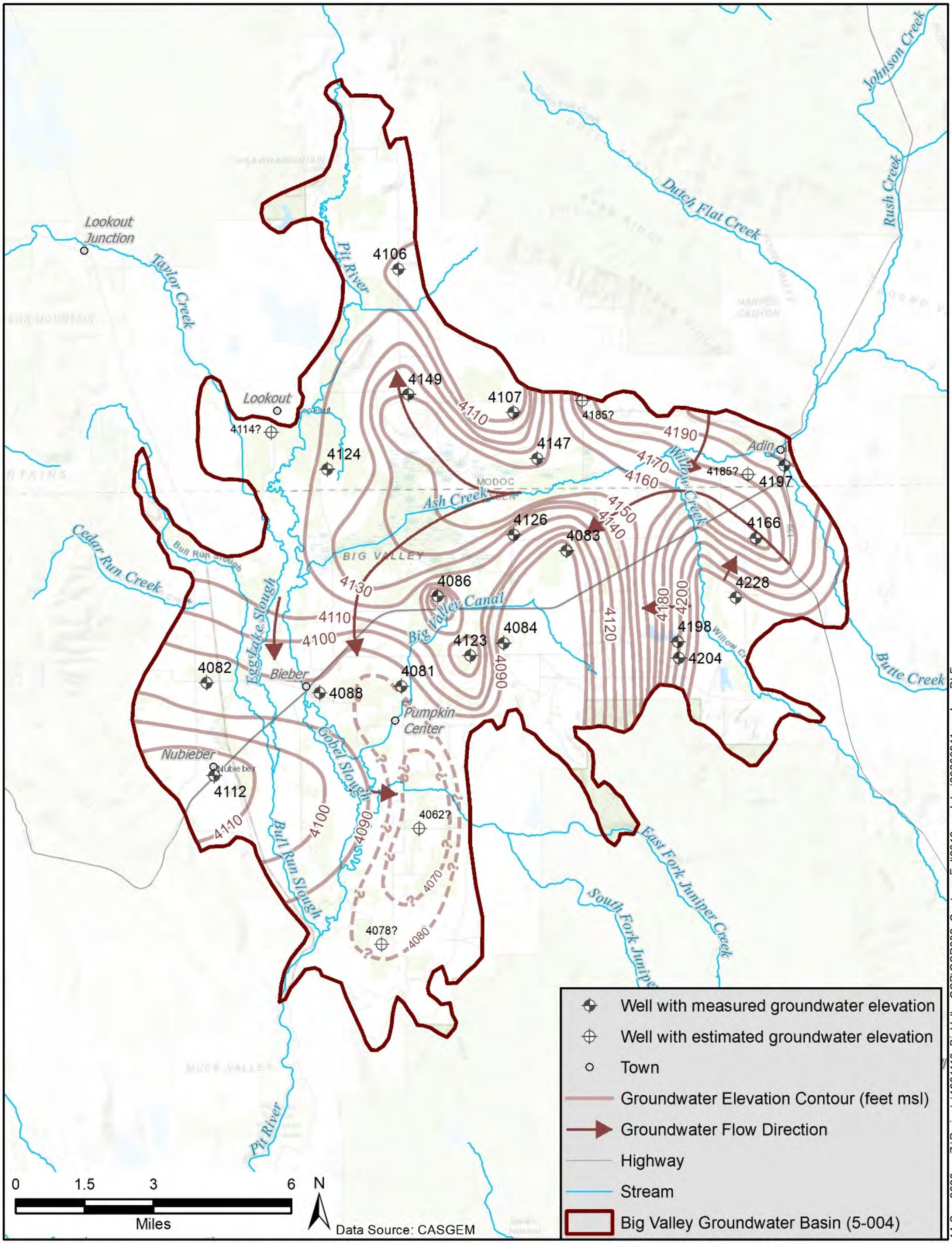


Figure 5-6 Groundwater Elevation Contours and Flow Direction Fall 2018

5.2 Change in Storage

~~In order to~~To determine the annual and seasonal change in groundwater storage, groundwater elevation surfaces[34] 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. This calculation was performed using ~~Geographic Information System (GIS)~~ software which can subtract the groundwater elevation surface from the ground elevation surface (using a digital elevation model) at each raster cell (pixel) and calculate the average depth to water (DTW) throughout the Basin. This average DTW was then subtracted from the definable bottom of the Basin (1,200 feet), multiplied by the area of the basin, and multiplied by 5%, which is used as the specific yield[35] ~~(the fraction of the aquifer material that contains recoverable water from Chapter 4)~~.

Table 5-2 shows, from 1983 to 2018, the total water in storage, the change in storage from the previous year, and the cumulative change in storage. **Figure 5-7** shows this information graphically, along with the annual precipitation from the McArthur station. This graph shows that groundwater storage generally declines during dry years and stays stable or increases slightly during normal or wet years. During the period from 1983 to 2000, groundwater levels dipped, then ~~returned~~ recovered~~to the same levels~~ to 1983 conditions by 1999 due to six consecutive years of above average precipitation. ~~After~~Since 2000, groundwater storage has generally declined by about 96,000 acre-feet (AF) (using spring measurements) which is a slight increase from the historic low of about 116,000 AF in spring 2015. During this same period (2000 to 2015), precipitation has gone through an average cycle of wet and dry years.

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).

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, ~~historic~~ reports have characterized the water quality in the BVGB as excellent (DWR 1963, USBR 1979). 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).

[34] Groundwater elevation surfaces are developed using the known groundwater elevations at wells throughout the Basin and using kriging. Kriging is a mathematical method that 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 grid cell.

[35] The fraction of the aquifer material that contains recoverable water. This is described in more detail in Chapter 4.

Table 5-2 Change in Storage ~~1998~~1983-2018

Year	Average Spring Depth to Water[1] (feet)	Spring Storage[2] (Acre-feet)	Spring Cumulative Change in Storage[3] (Acre-feet)
1983	29.3	5,390,192	-
1984	29.4	5,389,508	(684)
1985	31.4	5,380,526	(9,666)
1986	31.0	5,382,539	(7,653)
1987	32.6	5,375,135	(15,057)
1988	34.9	5,364,459	(25,733)
1989	35.2	5,363,150	(27,042)
1990	35.6	5,360,976	(29,216)
1991	36.8	5,355,677	(34,515)
1992	38.0	5,350,297	(39,895)
1993	36.9	5,355,293	(34,899)
1994	37.5	5,352,221	(37,971)
1995	35.3	5,362,737	(27,456)
1996	32.4	5,375,861	(14,332)
1997	31.8	5,378,600	(11,592)
1998	31.1	5,382,014	(8,179)
1999	29.5	5,389,070	(1,122)
2000	32.3	5,376,287	(13,905)
2001	38.0	5,350,015	(40,177)
2002	39.3	5,344,357	(45,835)
2003	39.4	5,343,881	(46,311)
2004	39.2	5,344,515	(45,677)
2005	41.5	5,334,164	(56,028)
2006	36.7	5,356,175	(34,017)
2007	38.8	5,346,641	(43,551)
2008	41.6	5,333,712	(56,480)
2009	42.5	5,329,337	(60,856)
2010	46.4	5,311,440	(78,752)
2011	45.9	5,313,710	(76,482)
2012	44.9	5,318,299	(71,893)
2013	49.3	5,298,013	(92,179)
2014	51.7	5,287,059	(103,133)
2015	54.4	5,274,644	(115,548)
2016	51.3	5,288,702	(101,490)
2017	49.7	5,296,127	(94,066)
2018	50.1	5,294,464	(95,728)

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 5%

[3] This is the total change in storage since the baseline, defined as Spring 1983.

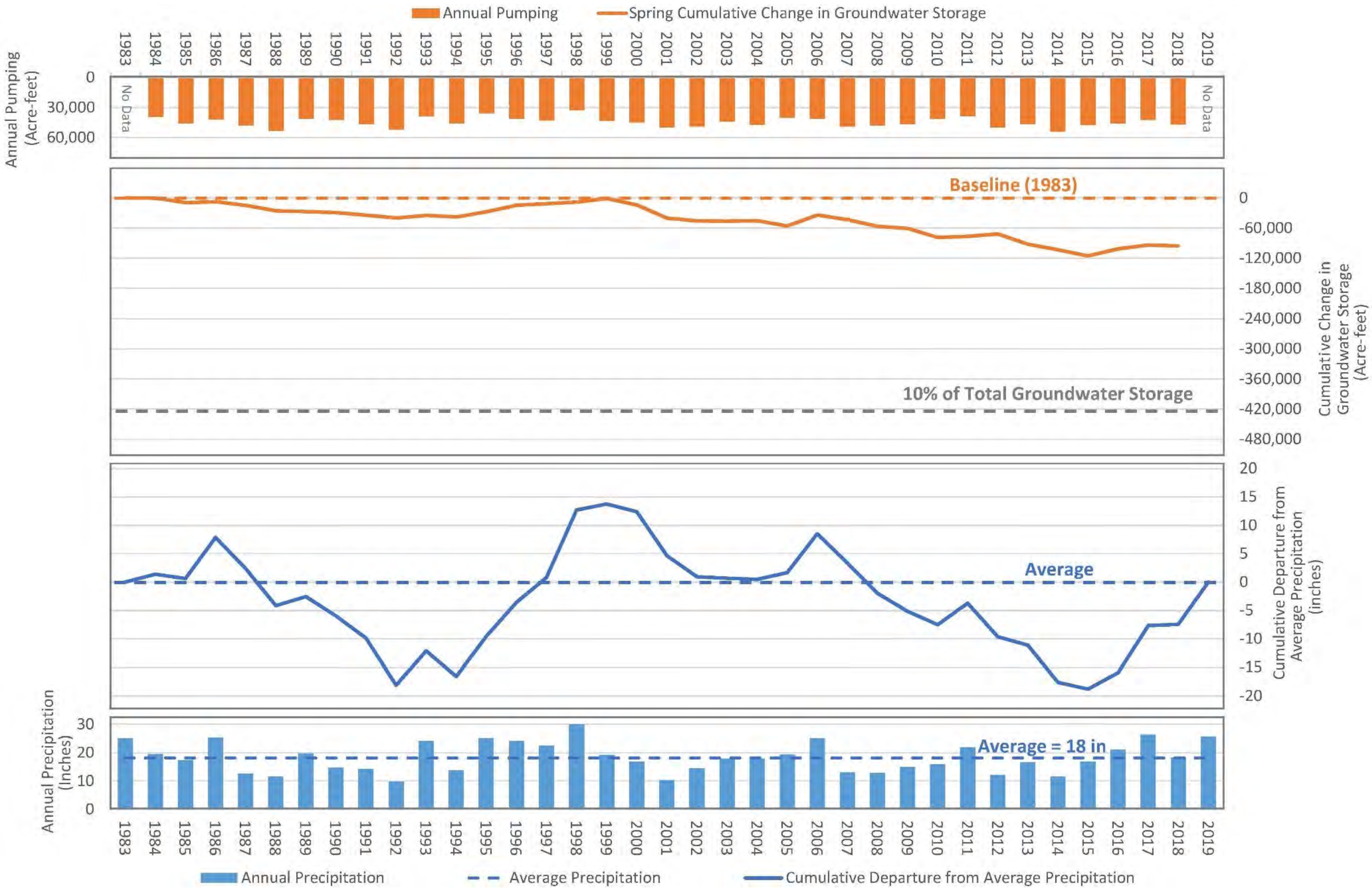


Figure 5-7 Precipitation, Pumping, and Change in Groundwater Storage

5.4.1 Naturally Occurring Constituents

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, USBR 1979) All of these constituents are naturally occurring and in these historic reports, they indicate that most of these constituents are associated with localized thermal waters found ~~in the area of~~near hot springs in the center of the Basin.

More recent conditions were analyzed using a statistical approach using data available from the state's Groundwater Ambient Monitoring and Assessment (GAMA) Groundwater Information System (SWRCB 2020a). The GAMA 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 (historic ambient monitoring)
- Environmental Monitoring Wells (regulated facilities and cleanup sites)
- United States Geological Survey (USGS) Groundwater Ambient Monitoring and Assessment (GAMA) program
- USGS National Water Information System (NWIS) data

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 1983 water year (WY) were eliminated from the statistical analysis of the data. WY 1983 was chosen because the bulk of the historic water level wells (**Figure 5-1**) came online by 1983. In addition, data from the Environmental Monitoring Wells programs were 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~~5.4.2~~.

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 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, since~~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 maximum contaminant level (MCL) or agricultural threshold, whichever was lower. ~~Because of their elevated concentrations, i~~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

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.

The subset of water quality data was analyzed to determine which constituents to investigate further. **Table 5-3** shows that most constituents have not had concentrations measured above their corresponding threshold since 1983 and were not investigated further. Sulfate, aluminum, and antimony only had one or two detections above their threshold, and none of these were recent, so these constituents were not investigated further. Arsenic (As), iron (Fe), manganese (Mn), specific conductance (SC), and total dissolved solids (TDS) were investigated further. All of these constituents are naturally occurring.

Arsenic, Iron, and Manganese

As, Fe, and Mn show elevated concentrations in over 10% of the wells. Although iron and manganese are regulated under secondary drinking water standards (for aesthetics such as color taste, and odor) and are not of concern for human health as drinking water, these constituents were still chosen for further investigation because they also have multiple detections above the agricultural suitability threshold. (Ayers and Westcot 1985) **Figure 5-8** through **Figure 5-10** show the trends over time. Wells with single measurements are shown as dots, where wells that had multiple measurements shown as lines. These figures indicate that the number of wells with highly elevated concentrations of arsenic and manganese concentrations may have decreased over the last 40 years of groundwater use. Iron concentrations are generally below the agricultural suitability threshold (Ayers and Westcot, 1985), with two recent elevated measurements from the monitoring wells constructed in support of the GSP.

Specific Conductance and Total Dissolved Solids

SC is a measure of the water's ability to conduct electricity. TDS is a measure of the total amount of dissolved materials (i.e. salts) in water. SC and TDS are related to one another (higher TDS results in higher SC) and SC is often used as a proxy for TDS. Although there was only one recent measurement over the MCL for SC, both SC and TDS were investigated further because they are important indicators of general water quality conditions.

Figure 5-11 and **Figure 5-12** show the distribution of elevated levels of SC and TDS around the Basin. **Figure 5-13** and **Figure 5-14** show the trends over time. Wells with single measurements are shown as dots, where wells that had multiple measurements 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.

5.4.2 Groundwater Contamination Sites and Plumes

To determine the location of potential groundwater contamination sites and plumes, the State Water Resources Control Board's (SWRCB's) GeoTracker website was consulted. GeoTracker catalogs known groundwater contamination sites and waste disposal sites. (SWRCB 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 5-4** and shown on **Figure 5-15**. The sites include leaking underground storage tanks (LUSTs), cleanup program sites, and land disposal sites. Half of the sites are open and subject to on-going regulatory requirements. The contaminants are listed in **Table 5-4**, which also gives a summary of the case history.

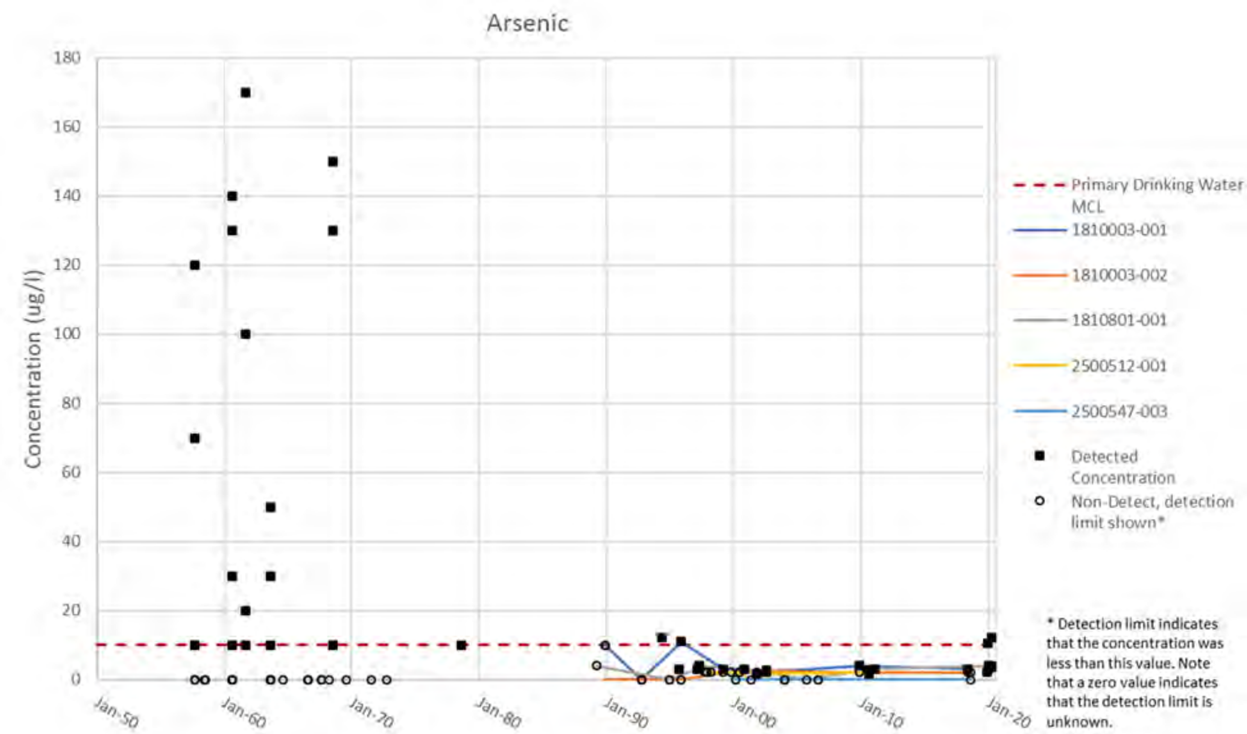


Figure 5-8 Arsenic Trends

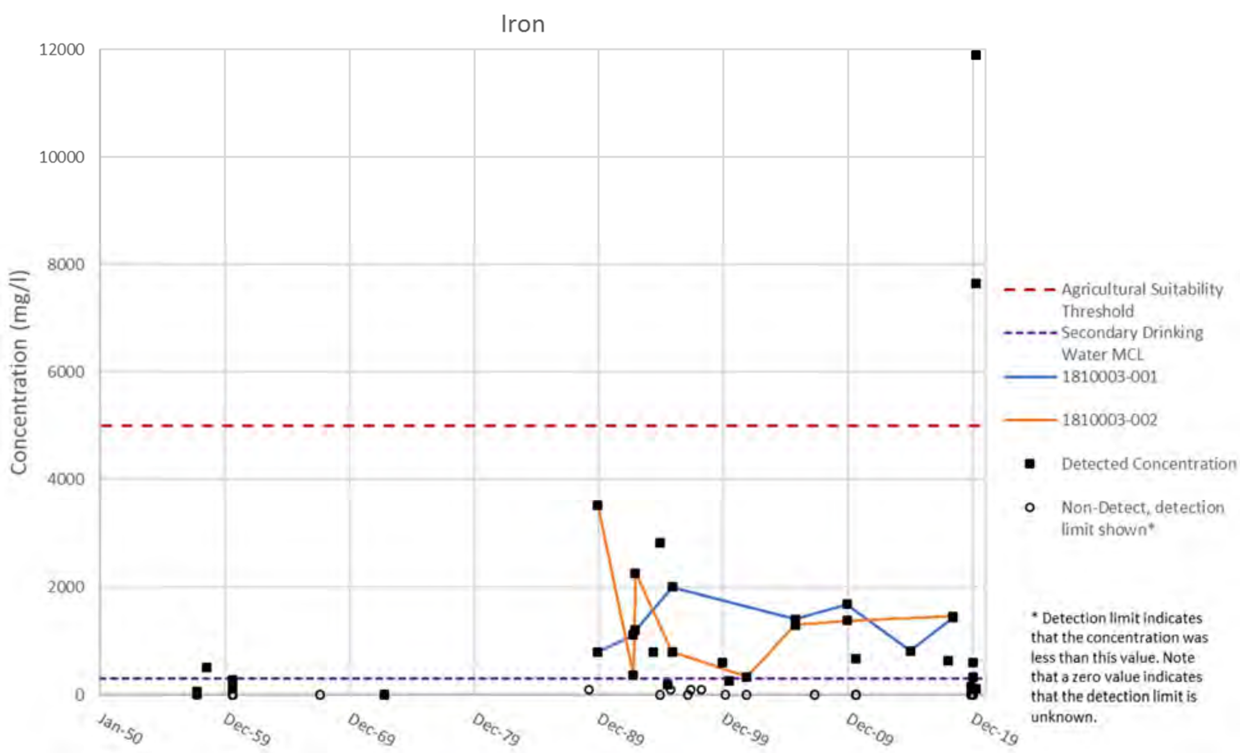


Figure 5-9 Iron Trends

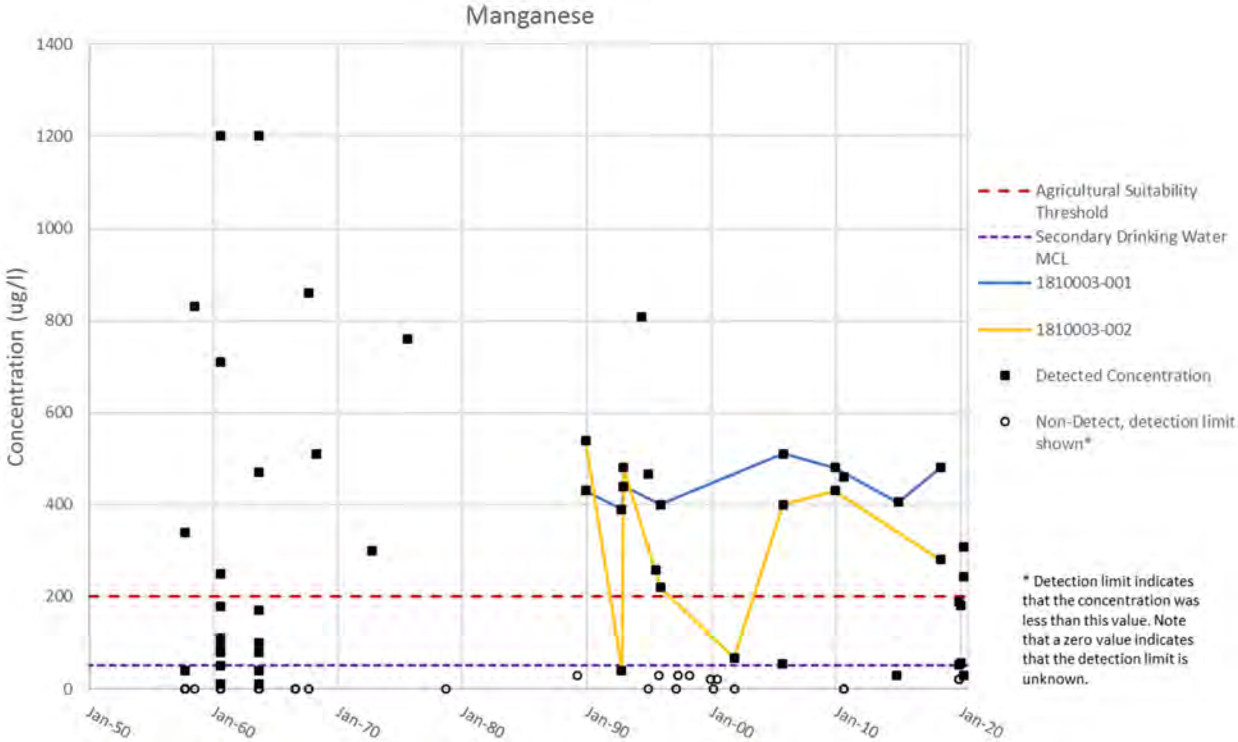
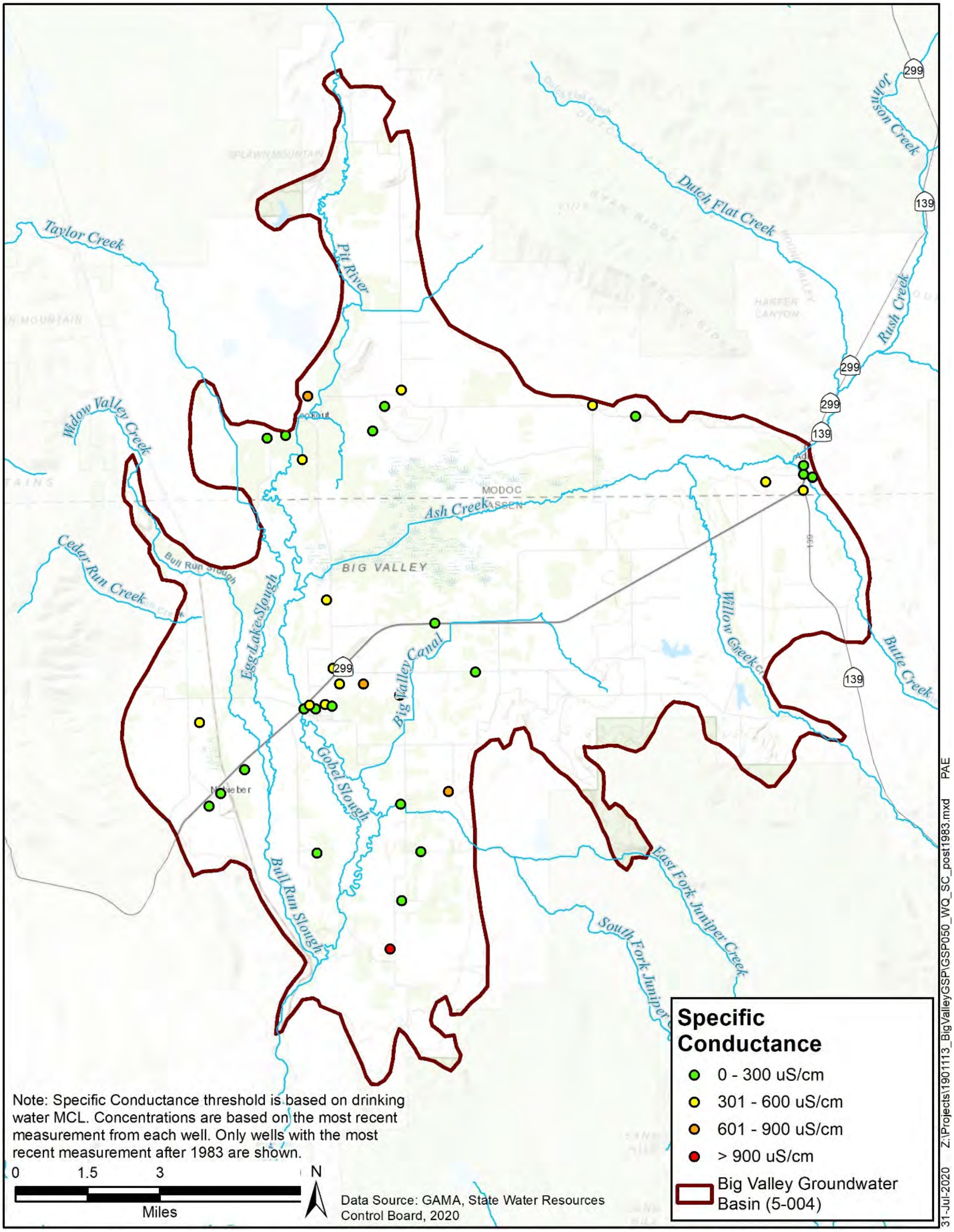


Figure 5-10 Manganese Trends

1834



1835 **Figure 5-11 Distribution of Elevated Specific Conductance**

1836

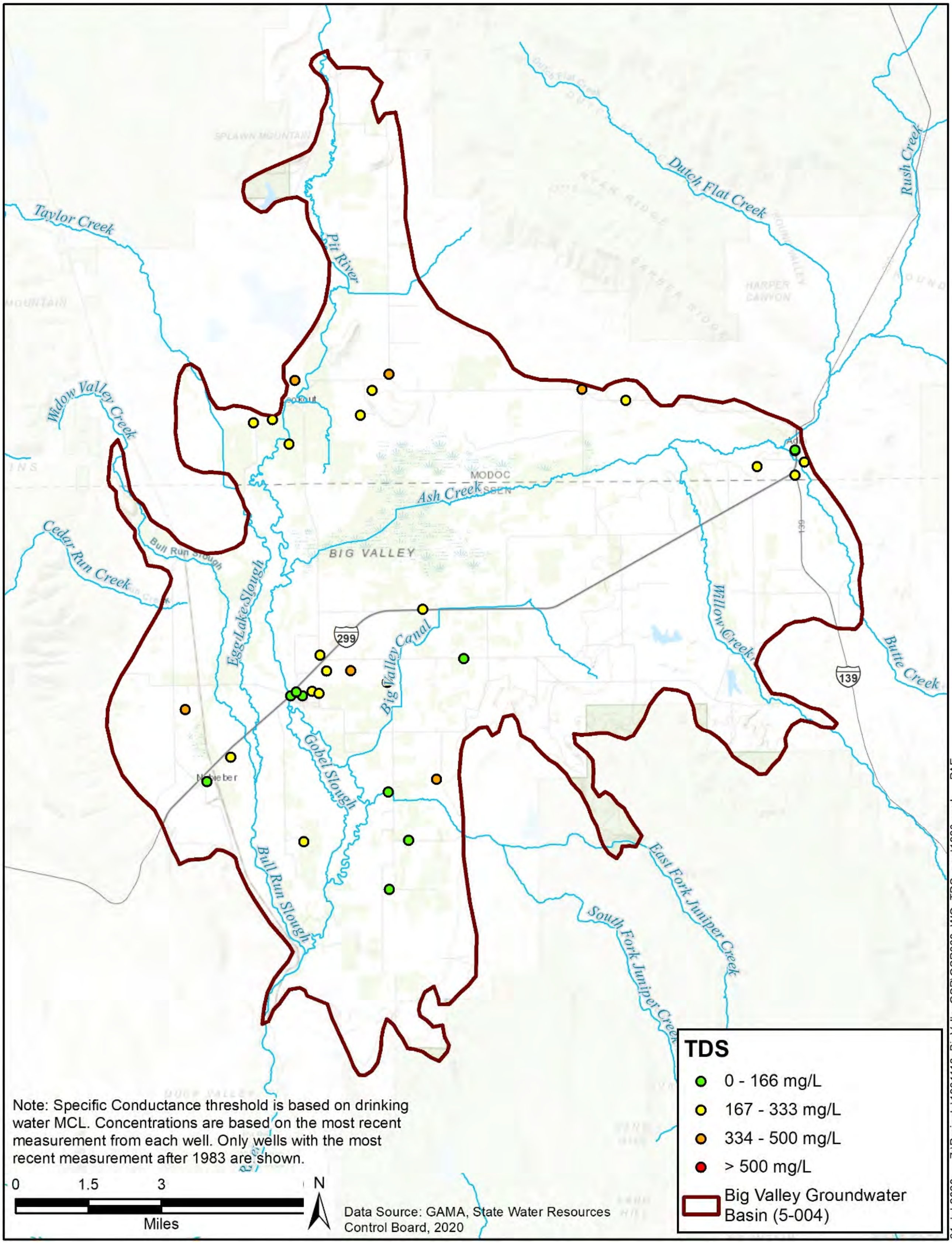


Figure 5-12 Distribution of Elevated TDS Concentrations

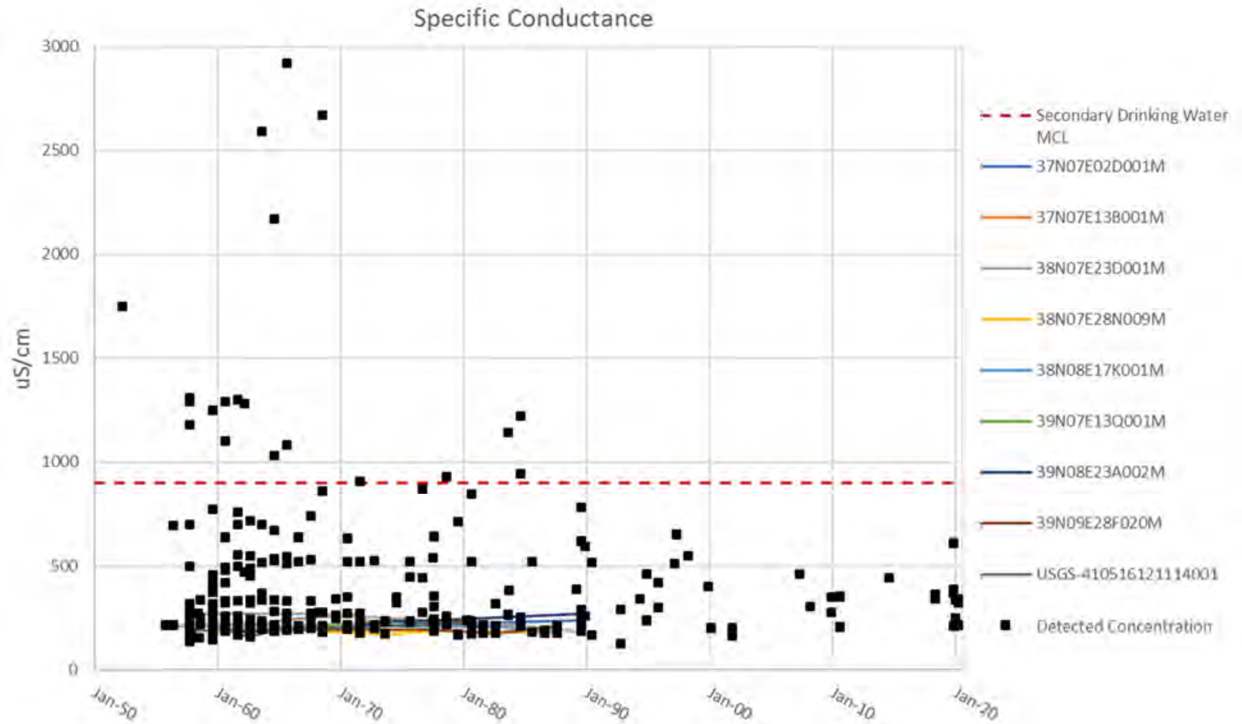


Figure 5-13 Specific Conductance Trends

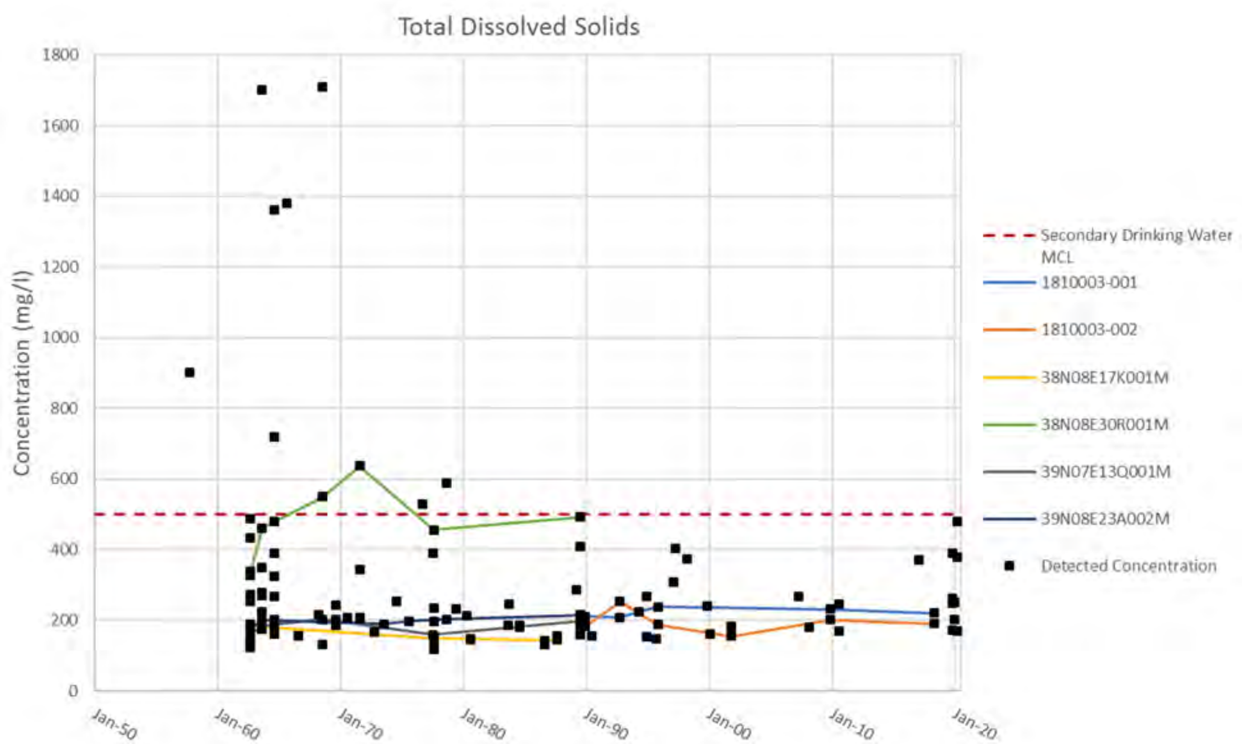


Figure 5-14 TDS Trends

Table 5-4 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 underground storage tank(s). Tank removal and further site assessment, including installation of eight 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 ug/L which exceeds the Low-Threat Closure Policy criteria. Additionally, high levels of TPHg and sheen/free product are present. A soil vapor extraction (SVE) 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, and risk modeling plus 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 underground storage tank 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 to 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 transporation of waste to another landfill. Groundwater levels and quality are monitored twice per year at four 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 underground storage tank was removed and contaminated soil was present beneath the tank, which led to installation of nine soils 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 initally found in one 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 underground storage tanks 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 underground storage tank 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 1930's 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 Central Valley 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 (SWRCB 2020b)

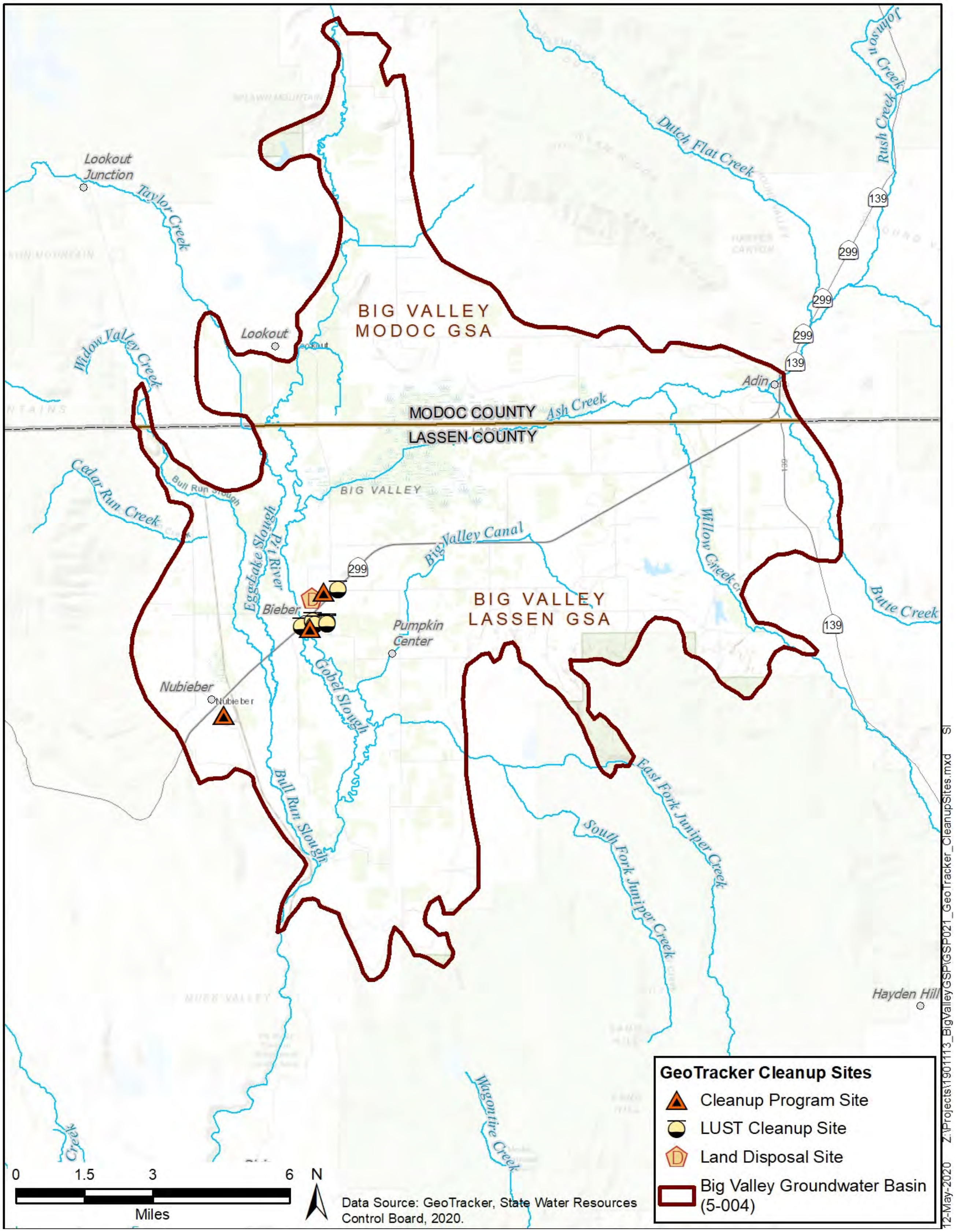


Figure 5-15 Location of Known Potential Groundwater Contamination Sites

Most of the contaminants originated at LUST sites 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[36], TBA[37], 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 on-going semi-annual monitoring of groundwater levels and groundwater quality at four shallow wells. This monitoring is required by the California Regional Water Quality Control Board (RWQCB Order No. R5-2007-0175), after the formal closure of the landfill in the early 2000s. Trace concentrations of several organic constituents[38] 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 SWRCB/RWQCB evaluation of these data is still pending.

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, including groundwater pumping. Lowering of groundwater levels can cause prolonged and/or extreme decrease in 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-caused processes such as mining and grading of land surfaces for agricultural use.

[36] 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.

[37] 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.

[38] 1,1-dichoroethane, 1,4-dichlorobenzene, cis-1,2-dichloroethylene, benzene, chlorobenzene, MTBE, 2,4,5-trichlorophenoxyacetic acid

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 groundwater 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~~continuously operating GPS (CGPS) station near Adin.
- Monitoring of specially constructed "extensometer" wells. There are no extensometers in the BVGB.
- Use of Interferometric Synthetic-Aperture Radar (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 Groundwater Management Plan (GMP) for Lassen County (Brown and Caldwell 2007) but was not identified as an issue for Big Valley specifically. The analysis in the GMP was based on indirect observations (groundwater levels) and anecdotal information. This section presents additional data that has become available since the development of the GMP.

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 (PBO) 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 5-16 is a plot of the vertical displacement at P347 and shows a slight decline (0.6 inches) 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 inches is an indication of inelastic displacement has occurred over an 11-year period, which equates to a rate of -0.05 inches per year at this location near Adin.

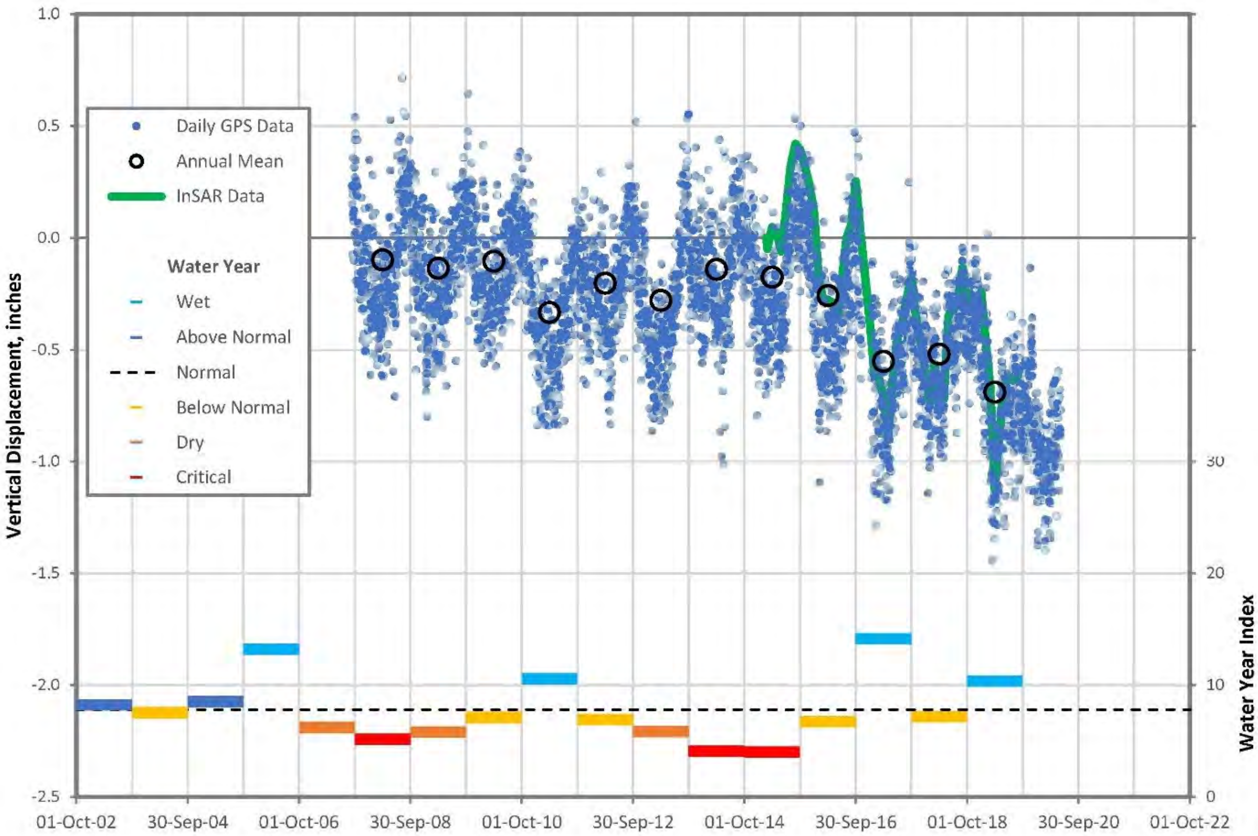


Figure 5-16 Vertical Displacement at CGPS P347

5.5.2 Interferometric Synthetic Aperture Radar (InSAR)

Figure 5-17 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 5-17**) including much of the Big Swamp/Ash Creek Wildlife Area, areas along the Pit River near Lookout, and south of Bieber. Most of the survey shows downward displacement (subsidence) between 0 and -1 inches throughout Big Valley. This widespread, small displacement is likely due to natural geologic activities.

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, or -0.77 inches per year over the 4.3-year period. It is unknown if the subsidence in these areas has been induced by groundwater extraction. Some of the downward displacement in the southern portion of the Basin near the Pit River may be due to re-grading of fields for production of wild rice.

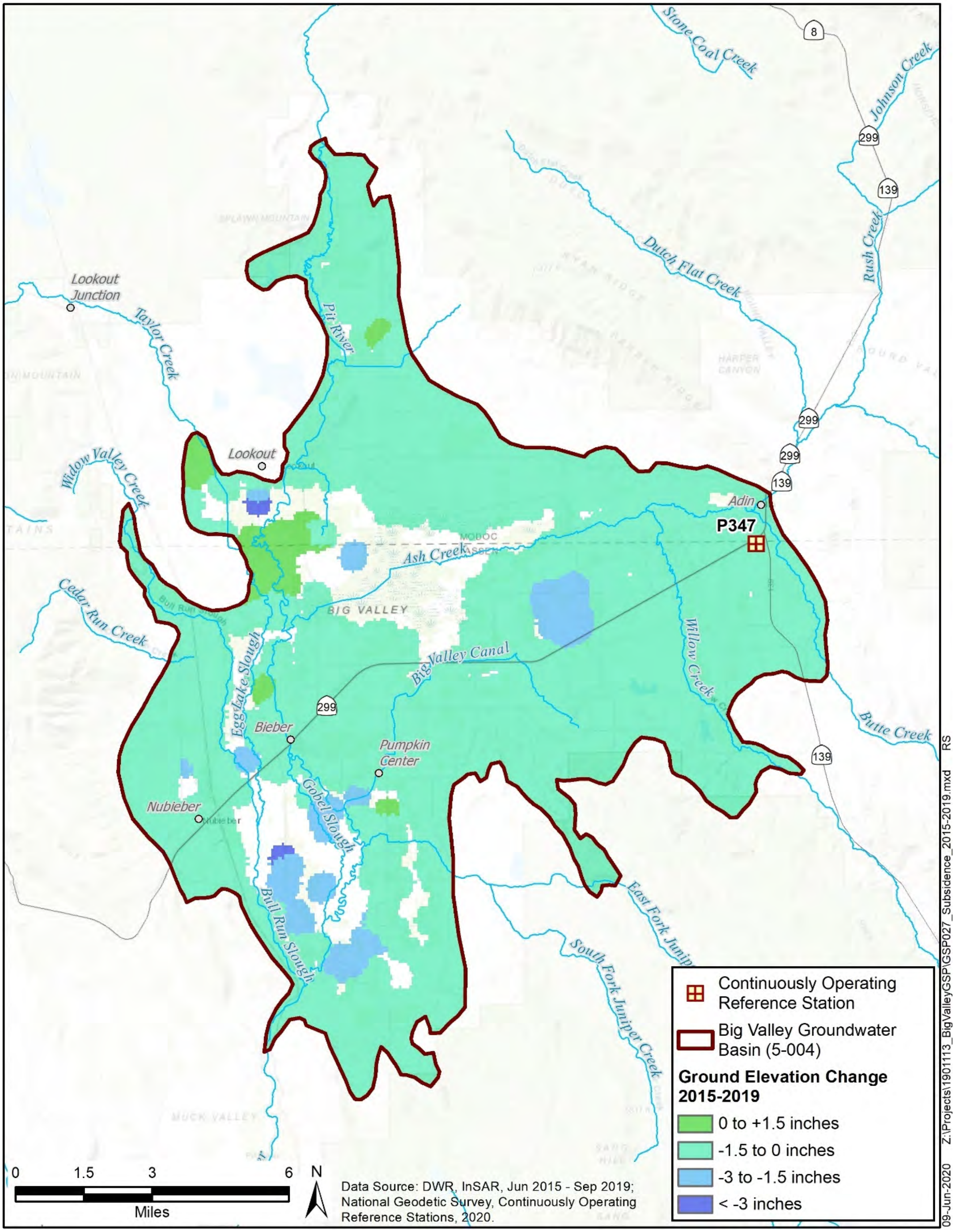


Figure 5-17 InSAR Change in Ground Elevation 2015 to 2019

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 purposes of this GSP, interconnected surface water includes major streams that are known to be perennial[39]. **Figure 5-18** shows all of the major (named) streams from the National Hydrography Dataset (NHD, USGS 2020), excluding several streams that are known to go dry.

Interconnected streams can be gaining (groundwater flowing toward the stream) or losing (groundwater flowing away from the stream). The flow directions from the groundwater contours can indicate whether the stream is gaining or losing, as are shown on **Figure 5-18**. In addition, shallow monitoring well clusters[40] give the direction of shallow groundwater flow as shown by the black arrows on **Figure 5-18**.

- **Reach 1 – Butte Creek**: Butte Creek enters the BVGB on the eastern fringe of the Basin, flowing north to the confluence with Ash Creek in Adin. Groundwater flow indicates that the stream is losing. Throughout its length in the Basin.

- **Reach 2 – Upper Ash Creek**: This reach includes Ash Creek from where it enters the Basin to the confluence with Willow Creek. Based on groundwater contours, groundwater flows toward the creek on the north, but away from the creek on the south side. Shallow groundwater flow indicated by the monitoring well cluster at the Adin Airport is to the south-southwest.

- **Reach 3 – Willow Creek**: Willow Creek enters the BVGB in the southeastern portion of the Basin and flows north into Ash Creek. Groundwater contours indicate that Reach 3 is a losing stream with flow away from the stream both westerly and northeasterly directions. In the lower portions of Reach 3, Willow Creek is fully appropriated and during summer months there is virtually no flow in the channel as most of the flow has been diverted into reservoirs and onto lands adjacent to the river.

- **Reach 4 – Lower Ash Creek**: This reach includes Ash Creek from Willow Creek to the confluence with the Pit River. In this reach surface water velocities slow considerably, and the surface water spreads out to occupy a large freshwater marsh. Groundwater flows away from Reach 4, with contours indicating both northerly and southerly flow away from the marsh.

- **Reach 5 – Hot Springs Slough:** This stream is spring-fed and flows into the marsh in the center of the Basin. Groundwater levels are considerably lower than ground surface in this area, and the upper portions of the slough may be disconnected from groundwater. The slough flows into the marsh area in the center of the basin where it may contribute to groundwater recharge.

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[39] With year-round flow, indicating it is not completely depleted.

[40] 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, two clusters have enough data to determine flow direction, one cluster near Adin and one near Lookout. **Appendix 5C** contains data collected at the two clusters and their flow directions

- **Reach 6 – Upper Pit River**: Reach 6 includes the Pit River from where it enters the BVGB (at an elevation of about 4160 (msl)) to its confluence with Ash Creek (at an elevation of about 4135 feet msl. The Pit River is generally losing in this portion of the Basin, with groundwater elevations less than 4130 feet msl throughout the reach, as shown in **Figure 5-5** and **Figure 5-6**. Just south of lookout, the stream may become gaining based on the well cluster at the Adin Cemetery. This location showed a thick hard-rock basalt layer, which may perch water on top and flow toward the stream. Groundwater beneath basalt may have a different flow direction.

- **Reach 7 – Taylor Creek / Egg Lake Slough**: Taylor Creek enters the BVGB west of Lookout and flows south, parallel to the Pit River and joins Bull Run Slough near the town of Nubieber. This reach may be losing near lookout, but is neither gaining nor losing as it crosses into Lassen County based on groundwater contours.

- **Reach 8 – Widow Valley Creek / Bull Run Slough**: Widow Valley Creek enters the BVGB on the western edge of the Basin and flows southerly into a broad, flat plain joining Egg Lake Slough at Nubieber and the Pit River at the southern edge of the Basin. Groundwater contours are Groundwater contours indicate that the stream is neither gaining, with losing conditions indicated south of Nubieber.

- **Reach 9 – Lower Pit River**: This reach extends from the confluence with Ash Creek to the where the Pit River exits at the southern tip of the Basin and includes Gobel Slough. Similar to Reach 8, conditions are neither gaining nor losing for much of the reach, until the Pit River passes the town of Bieber. South of Bieber groundwater flow is to the east, away from the river.

The descriptions above give a qualitative indication of interactions between surface water and groundwater. Quantitative estimates of flow between the two will be presented in Chapter 6.

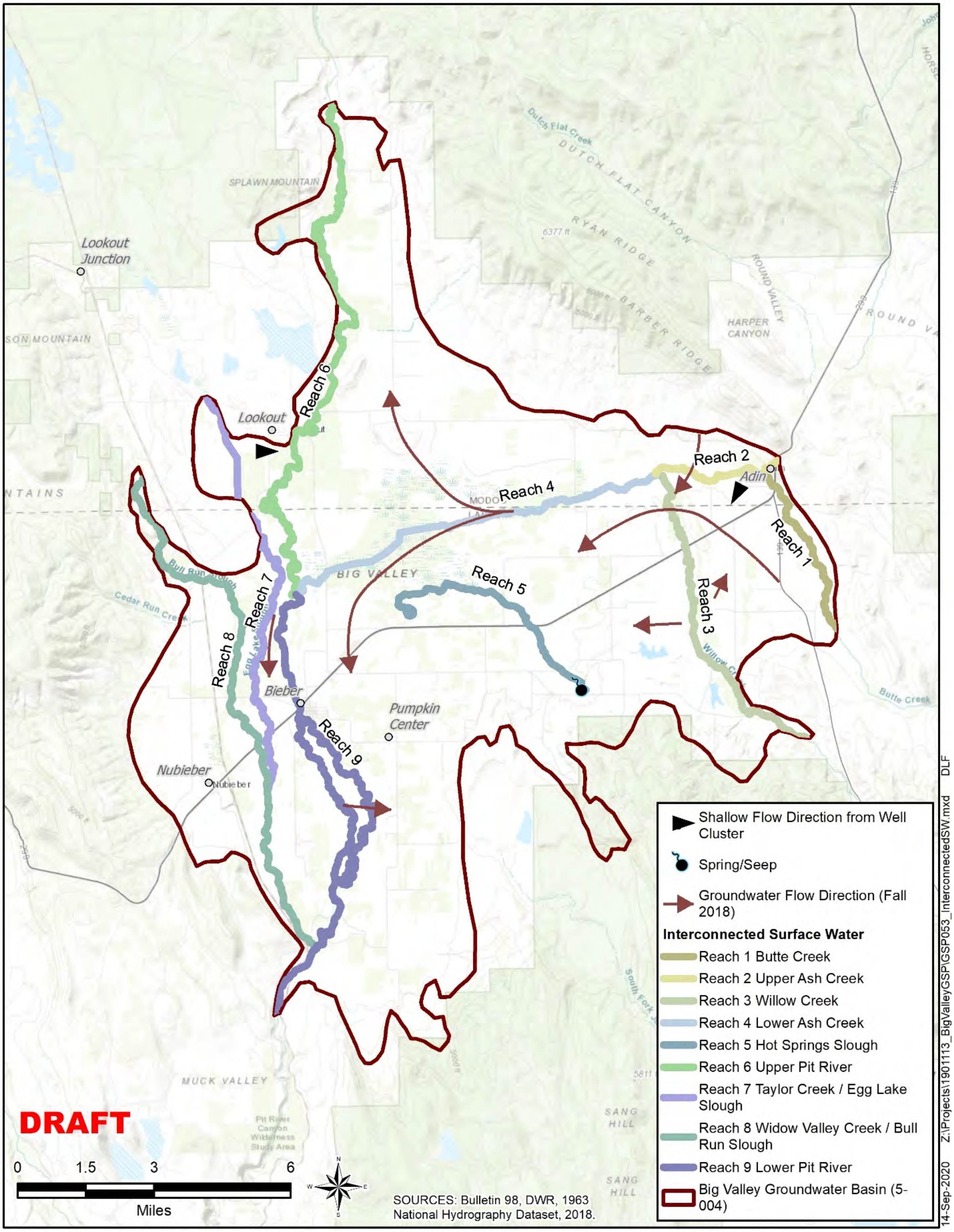


Figure 5-18 Interconnected Surface Water

5.7 Groundwater-Dependent Ecosystems

SGMA requires GSPs to identify Groundwater Dependent Ecosystems 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 Natural Communities Commonly Associated with Groundwater (NCCAG) dataset. 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 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 5-19 and **Figure 5-20** show the NCCAG geospatial data, which is separated into two categories: wetlands and vegetation, respectively.

The Wetlands area (12,800 total acres) is subdivided into two primary habitats, palustrine (or freshwater marsh) and riverine, based on setting. Palustrine is dominant at 96% of the total wetland area while riverine is present at 4% and can be seen along river courses. Sixteen springs account for a very small areal component. Most of the springs are in Lassen County (13) although numerous springs are located outside the BVGB boundary.

The Vegetation area (11,500 total acres) is subdivided further into two primary habitats, based on the plant species. Wet Meadows was the largest primary habitat at 59% of the vegetation area but did not include a dominant species. Willow was the second largest habitat at 41% of the vegetation area.

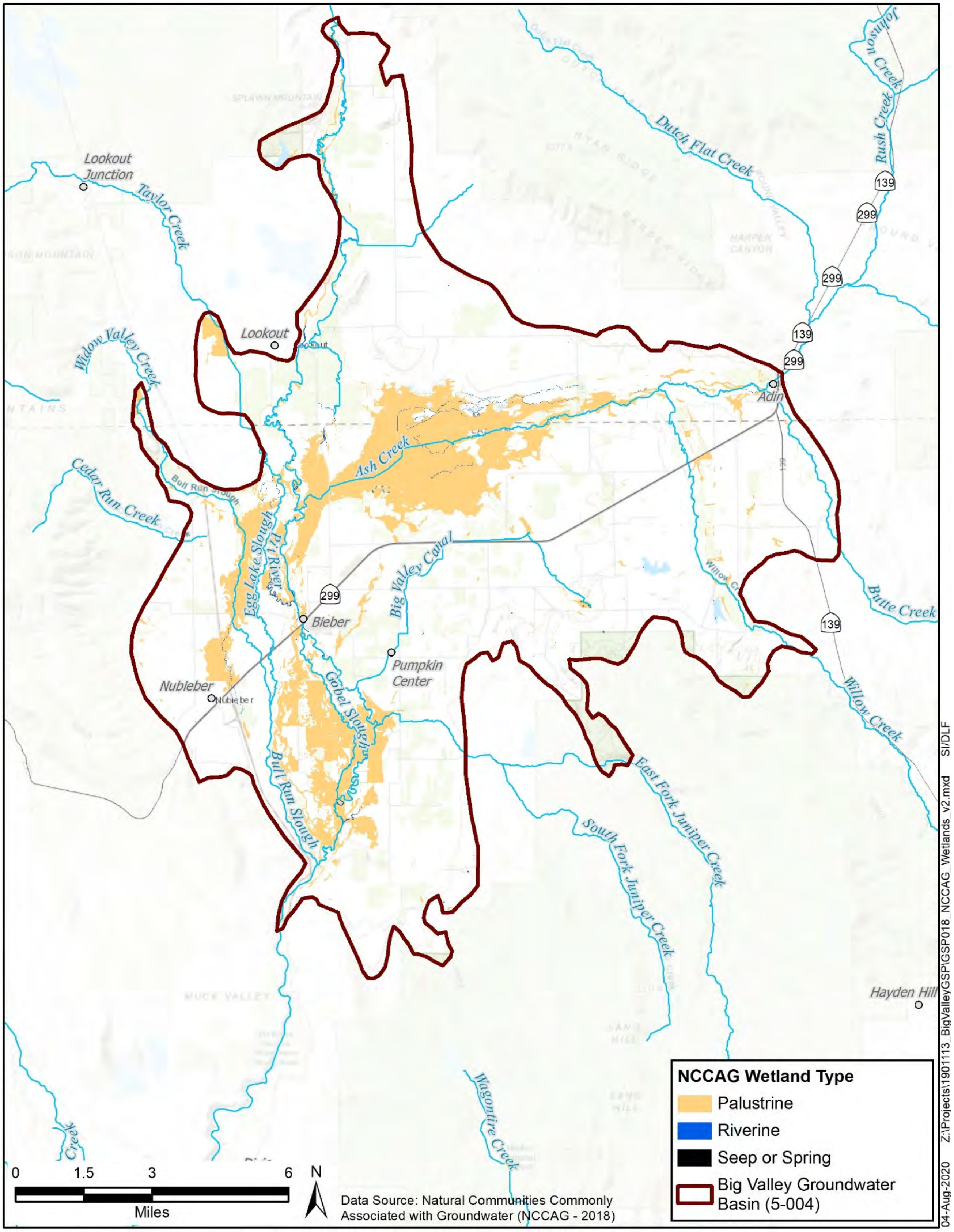


Figure 5-19 NCCAG Wetlands

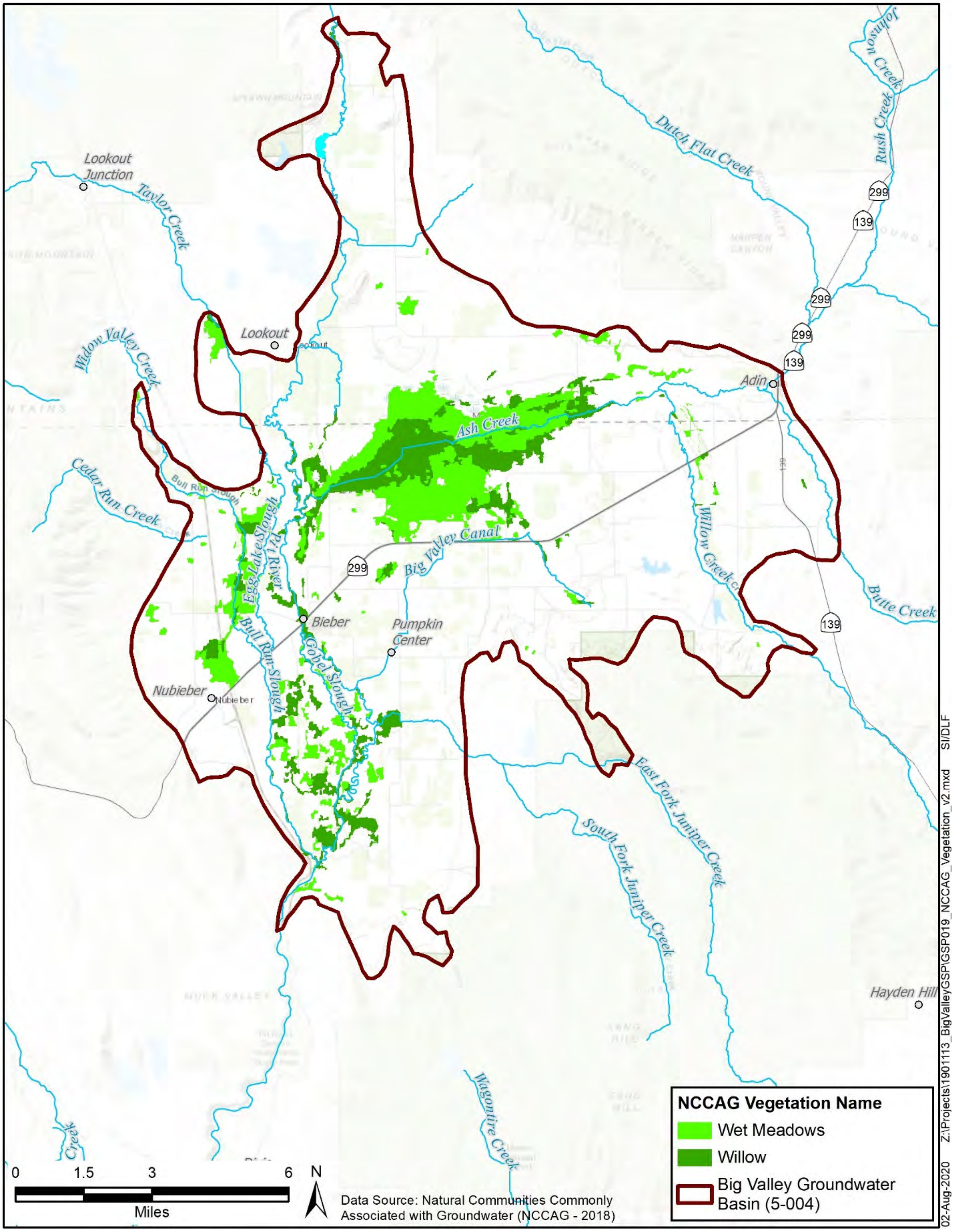


Figure 5-20 NCCAG Vegetation

These two maps identify potential GDEs as the NCCAG documentation acknowledges in its abstract. For these 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. **Figure 5-21** shows the depth to water for spring 2015. Spring 2015 is used because that is the SGMA baseline, and SGMA does not require that conditions be returned to a condition pre-2015. Spring is used, as that represents the highest water levels and thus the level that could be accessed by vegetation seasonally.

The depth to water that could potentially be accessed by GDEs depends on the rooting depth of the vegetation. Plant roots can extend up to 30 feet or more (TNC 2020), and 30 has been used by other GSPs as the threshold for GDEs. However, an assessment of native plants present in the Big Valley Groundwater Basin found that maximum rooting depths of species present is 10 feet as shown in **Table 5-5**. However, access to groundwater by plant roots extends above the water table as groundwater seeps upward to fill soil pores. This is known as the capillary fringe and can extend least a few feet or potentially much more depending on the soil type. As a conservative estimate, a capillary fringe of 10 feet is used. Therefore, for the purposes of delineating GDE's, only those areas in the NCCAG datasets that are in areas with groundwater less than 20 feet will be classified as GDEs. **Figure 5-22** shows the GDEs and was generated using the coverages from **Figure 5-19** and **Figure 5-20** that have a depth to groundwater less than 20 feet (**Figure 5-21**).

Table 5-5 Big Valley Common Plant Species Rooting Depths

Species	Rooting Depth
Carex spp.	Up to 5 ft
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

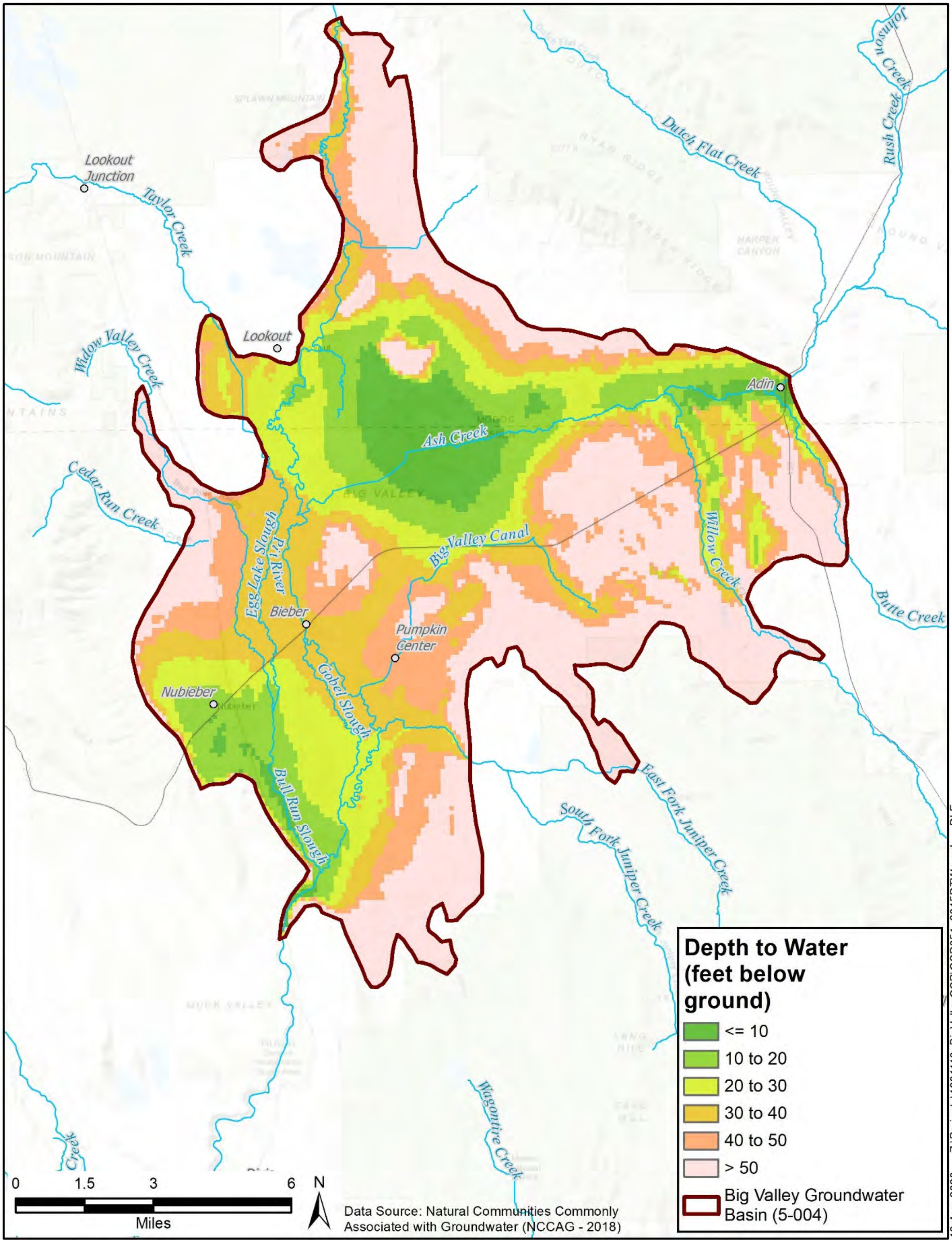


Figure 5-21 Depth to Groundwater Spring 2015

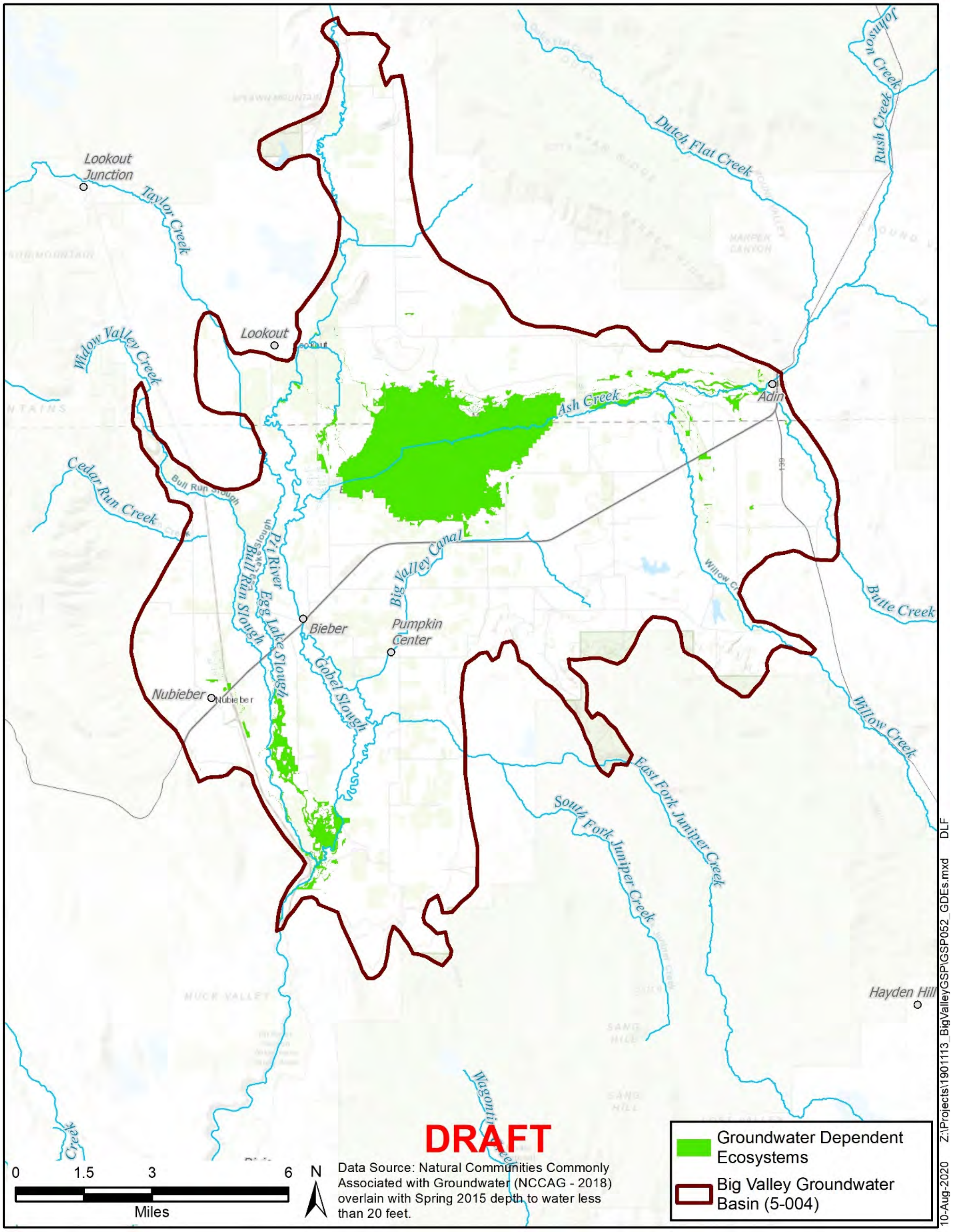


Figure 5-22 Groundwater Dependent Ecosystems

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** shows a depiction of the hydrologic cycle.

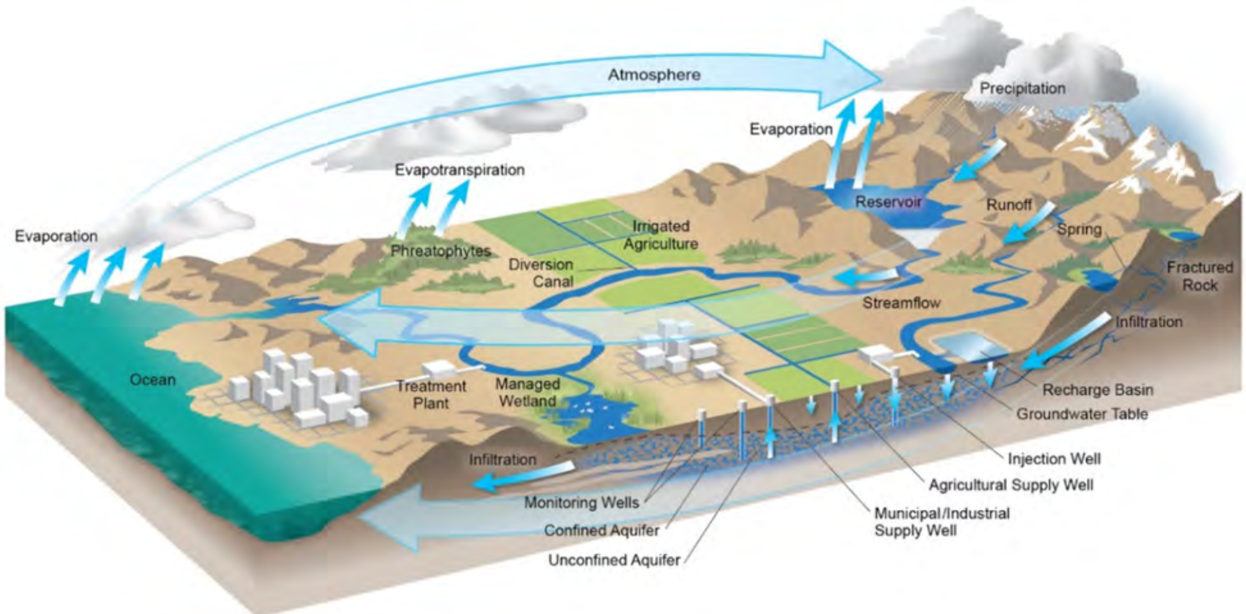


Figure 6-1 Hydrologic Cycle

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 Big Valley Groundwater Basin (BVGB) consists of the latter three (land surface, surface water, and groundwater) as shown by the black outline on **Figure 6-2**. This figure demonstrates the specific components of the water budget and exchange between the systems. 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 Groundwater Sustainability Agency (GSA) and stakeholders better understand the deposits and withdrawals and identify what conditions result in positive and negative balances. It should be noted that, while the development of a water budget is required by the Groundwater Sustainability Plan (GSP) regulations, 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.

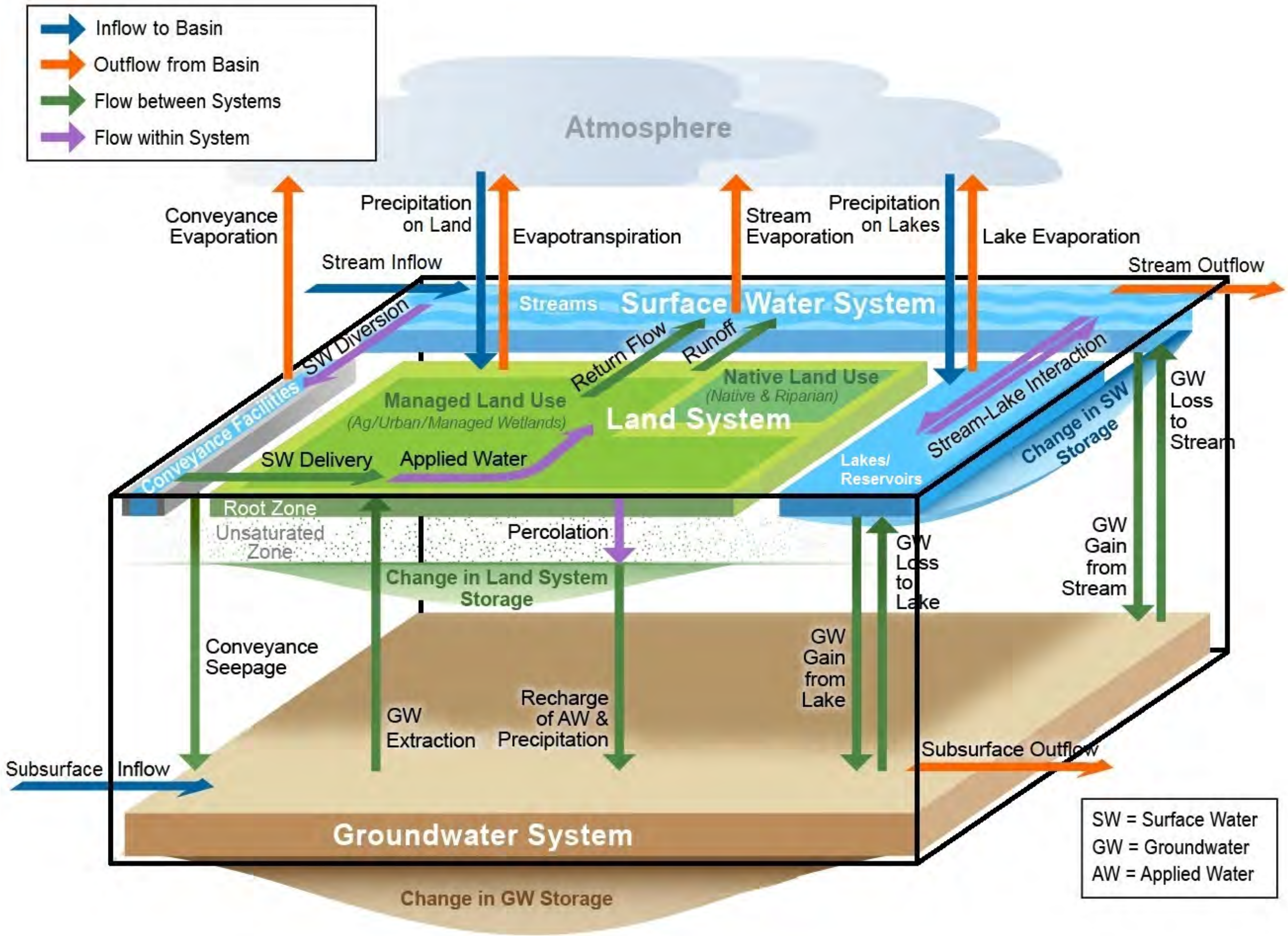


Figure 6-2 Water Budget Components and Systems

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 or IWFM 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 could be quantified precisely and accurately, and the budget could come out 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 roughly estimated parameters within acceptable ranges until the budget is balanced and all components of the budget are deemed reasonable.

As such, the water budget calculations presented here are not unique and the precision of the components estimated through the use of the water budget 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 that is obtained results 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[41] 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 historic water budget presented in this section covers 1984 to 2018. This period was chosen because it represents an average set of climatic conditions and water level, land use, and climate data were available in this time frame. **Figure 6-3** shows the annual precipitation and year type for the period. The criteria for year types were critical dry below 70% of average precipitation, dry between 70 and 85% of average precipitation, normal between 85 and 115% of average precipitation, and wet years greater than 115% of average precipitation.

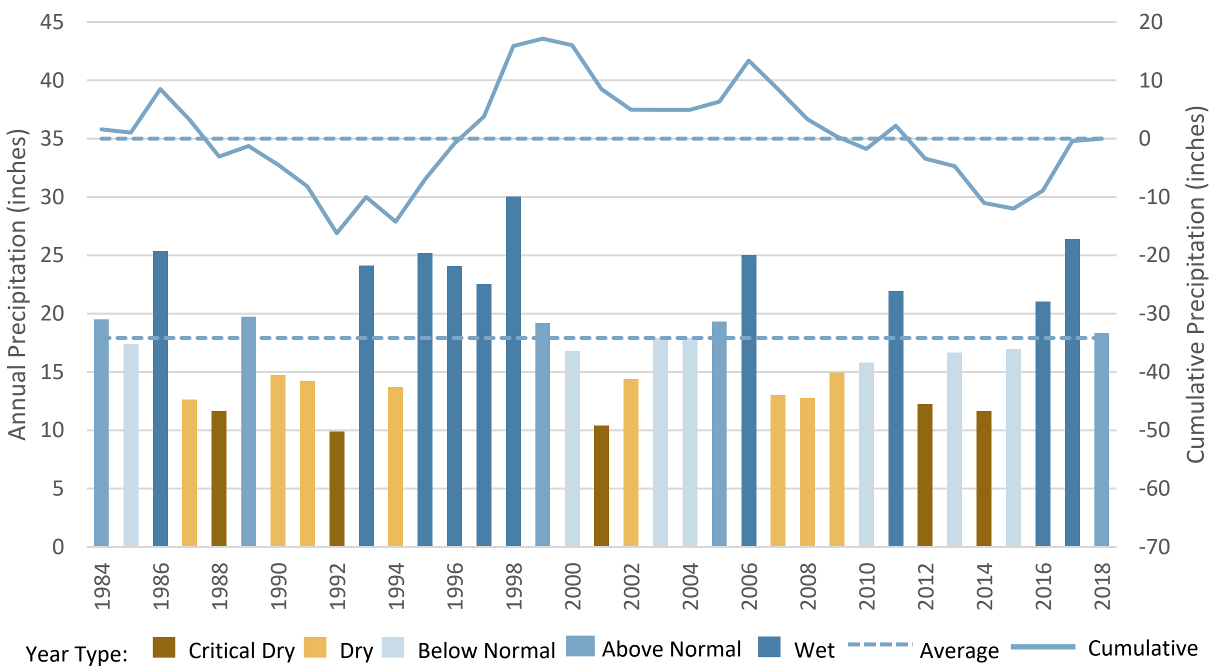


Figure 6-3 Annual and Cumulative Precipitation and Water Year Types 1984 to 2018

[41] 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.

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.

TOTAL BASIN WATER BUDGET — Acre-Feet

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

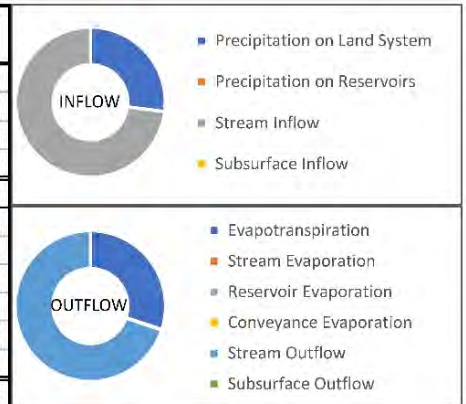


Figure 6-4 Average Total Basin Water Budget 1984-2018 (Historic)[42]

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% irrigation efficiency (NRCS 2020) and a respective 35%-65% 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% groundwater), well drilling records (areas without wells drilled were assumed to use 100% surface water), and an assessment of aerial imagery to see if water source could be determined. For the evapotranspiration associated with the Ash Creek Wildlife Area (ACWA), the habitat largely relies on surface water and very shallow subsurface[43] water that is interconnected with Ash Creek. This surface water delivery[44] 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 and is applied in portions of the habitat during dry months (Fall). These groundwater-enhanced habitat areas are indicated by the light blue areas within ACWA. Based on the limited area and time groundwater is used to support the habitat, 98% of the evapotranspiration for ACWA is estimated to come from surface water and 2% from groundwater. **Figure 6-5** shows the lands with applied water and their water source based on this assessment.

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

Stakeholders have noted that despite the efforts to improve estimates of water source and some input from local residents, **Figure 6-5** still contains significant inaccuracies and further refinement of this dataset is needed.

The water budget for the three systems (land, surface water, and groundwater) are shown on **Figure 6-6, Figure 6-7,** and **Figure 6-8**. The detailed water budget for each year is included in **Appendix 6B**. **Appendix 6C** shows graphically how the system water budgets vary over time.

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 6-9** and is analogous to the change in storage presented in Chapter 5 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 cumulative overdraft of about 120,000 acre-feet and the water budget indicating about 190,000 acre-feet. This difference may indicate that the water budget overdraft may be slightly over estimated or that the average specific yield of the basin is higher.

The GSP regulations require an estimate of the sustainable yield[45] 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 historic water budget is approximately 39,400 acre-feet, as indicated on item 28 of **Figure 6-8** (circled in green) for the groundwater system. The estimate of annual average groundwater use is approximately 44,600 acre-feet per year (AFY).

The regulations also require a quantification of overdraft[46]. (§354.18(b)(5)) For the water budget period of 1984 to 2018, overdraft is estimated at approximately 5,200 AFY, shown as the average groundwater system change in storage, circled in red on **Figure 6-8** (item 31).

6.3 Current Water Budget

The current water budget is demonstrated by looking at water year 2018, which is the most recent year of the historic water budget.

[45] 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." (California Water Code §10721(w))

[46] 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)

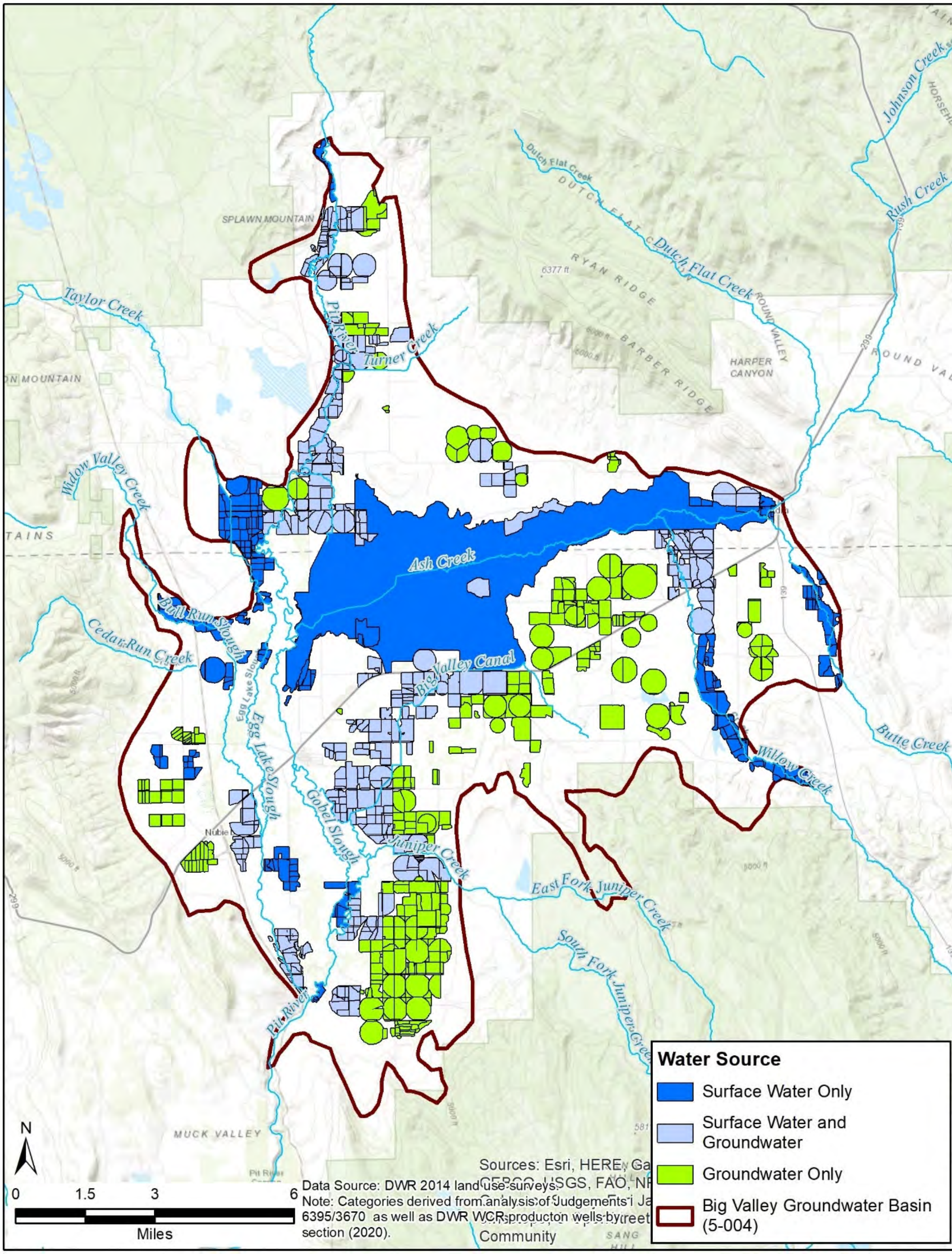


Figure 6-5 Primary Applied Water Sources

item	Flow Type	Origin/ Destination	Component	Acre-Feet
	LAND SYSTEM			
(1)	Inflow	Into Basin	Precipitation on Land System	136,801
(2)	Inflow	Between Systems	Surface Water Delivery	75,811
(3)	Inflow	Between Systems	Groundwater Extraction	44,622
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*257,234*
(5)	Outflow	Out of Basin	Evapotranspiration	154,040
(6)	Outflow	Between Systems	Runoff	83,449
(7)	Outflow	Between Systems	Return Flow	5,012
(8)	Outflow	Between Systems	Recharge of Applied Water	13,133
(9)	Outflow	Between Systems	Recharge of Precipitation	1,601
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*257,234*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	-

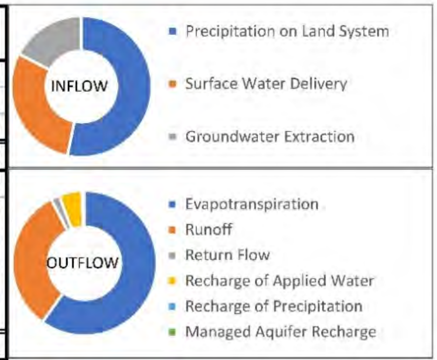


Figure 6-6 Average Land System Water Budget 1984-2018 (Historic

item	Flow Type	Origin/ Destination	Component	Acre-Feet
	SURFACE WATER SYSTEM			
(13)	Inflow	Into Basin	Stream Inflow	371,148
(14)	Inflow	Into Basin	Precipitation on Reservoirs	501
(6)	Inflow	Between Systems	Runoff	83,449
(7)	Inflow	Between Systems	Return Flow	5,012
(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*
(18)	Outflow	Out of Basin	Stream Outflow	358,486
(19)	Outflow	Out of Basin	Conveyance Evaporation	46
(20)	Outflow	Between Systems	Conveyance Seepage	27
(2)	Outflow	Between Systems	Surface Water Delivery	75,811
(21)	Outflow	Between Systems	Stream Loss to Groundwater	24,037
(22)	Outflow	Between Systems	Reservoir Loss to Groundwater	596
(23)	Outflow	Out of Basin	Reservoir Evaporation	722
(24)	Outflow	Out of Basin	Stream Evaporation	385
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*460,110*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-

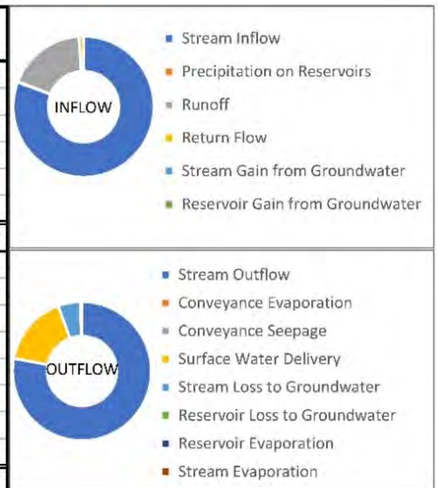


Figure 6-7 Average Surface Water System Water Budget 1984-2018 (Historic)

item	Flow Type	Origin/ Destination	Component	Acre-Feet
	GROUNDWATER SYSTEM			
(8)	Inflow	Between Systems	Recharge of Applied Water	13,133
(9)	Inflow	Between Systems	Recharge of Precipitation	1,601
(10)	Inflow	Between Systems	Managed Aquifer Recharge	-
(21)	Inflow	Between Systems	Groundwater Gain from Stream	24,037
(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*	*39,395*
(3)	Outflow	Between Systems	Groundwater Extraction	44,622
(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*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(5,227)

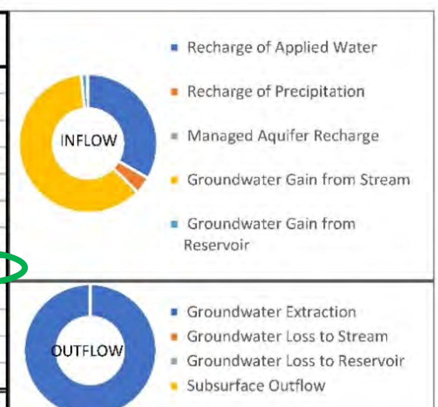


Figure 6-8 Average Groundwater System Water Budget 1984 to 2018 (Historic)

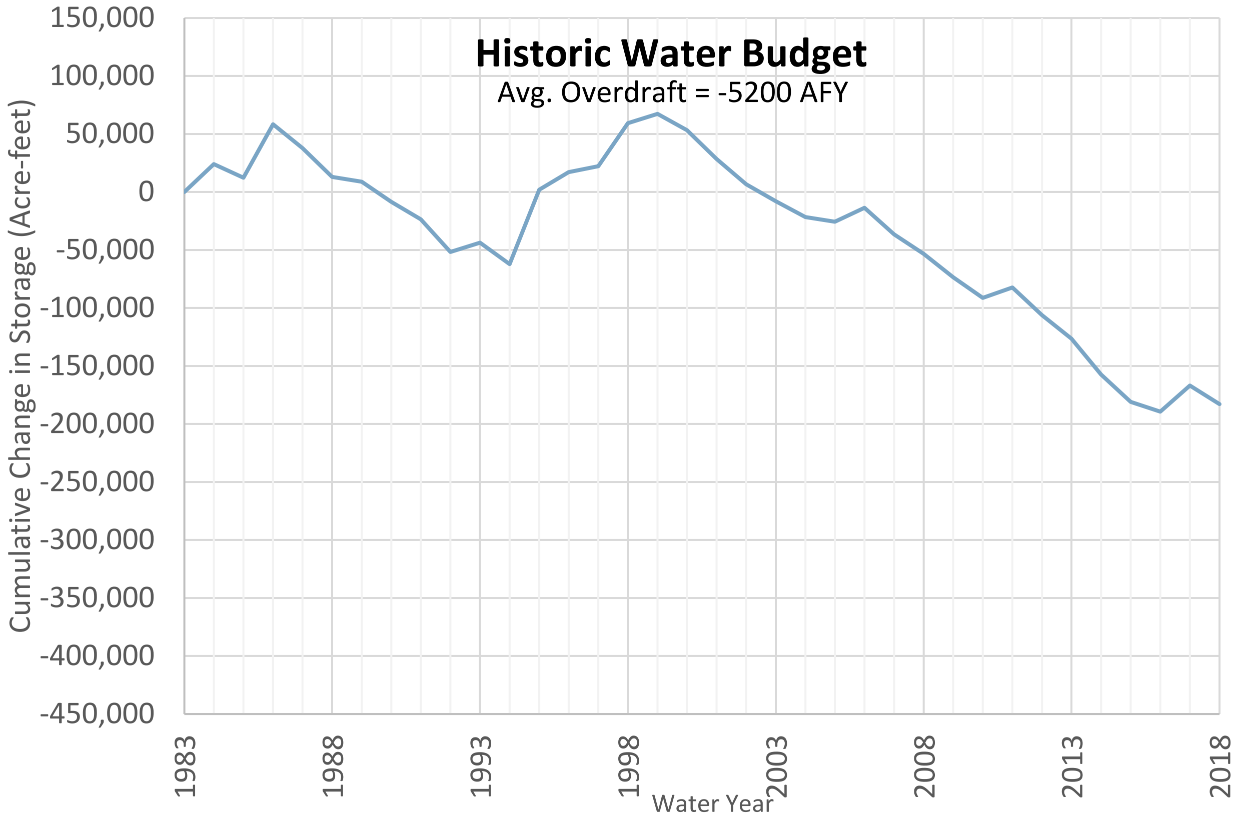


Figure 6-9 Cumulative Groundwater Change in Storage 1984 to 2018 (Historic)

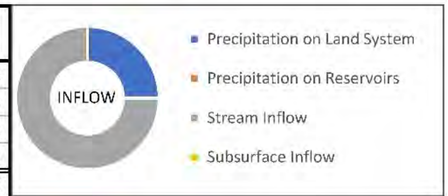
6.4 Projected Water Budget

As required by the GSP Regulations, the projected water budget is developed using at least 50 years of historic 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 6-10** shows the average annual future water budget. Long-term overdraft is projected to be about 2,100 acre-feet per year, which is less than the overdraft for the historic water budget because it uses a longer, wetter time-period for its projections. **Figure 6-11** shows the projected cumulative change in groundwater storage.

Item	Flow Type	Origin/ Destination	Component	Acre-Feet
	TOTAL BASIN WATER BUDGET			
(1)	Inflow	Into Basin	Precipitation on Land System	143,208
(14)	Inflow	Into Basin	Precipitation on Reservoirs	525
(13)	Inflow	Into Basin	Stream Inflow	430,242
(27)	Inflow	Into Basin	Subsurface Inflow	1
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*573,975*
(5)	Outflow	Out of Basin	Evapotranspiration	156,873
(24)	Outflow	Out of Basin	Stream Evaporation	393
(23)	Outflow	Out of Basin	Reservoir Evaporation	741
(19)	Outflow	Out of Basin	Conveyance Evaporation	47
(18)	Outflow	Out of Basin	Stream Outflow	418,003
(29)	Outflow	Out of Basin	Subsurface Outflow	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*576,056*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(2,080)



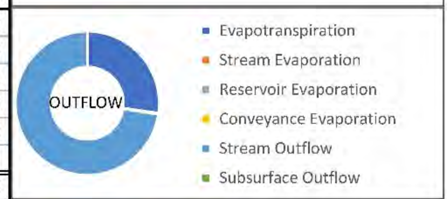


Figure 6-10 Projected Total Basin Water Budget 2019-2068 (Future Baseline)

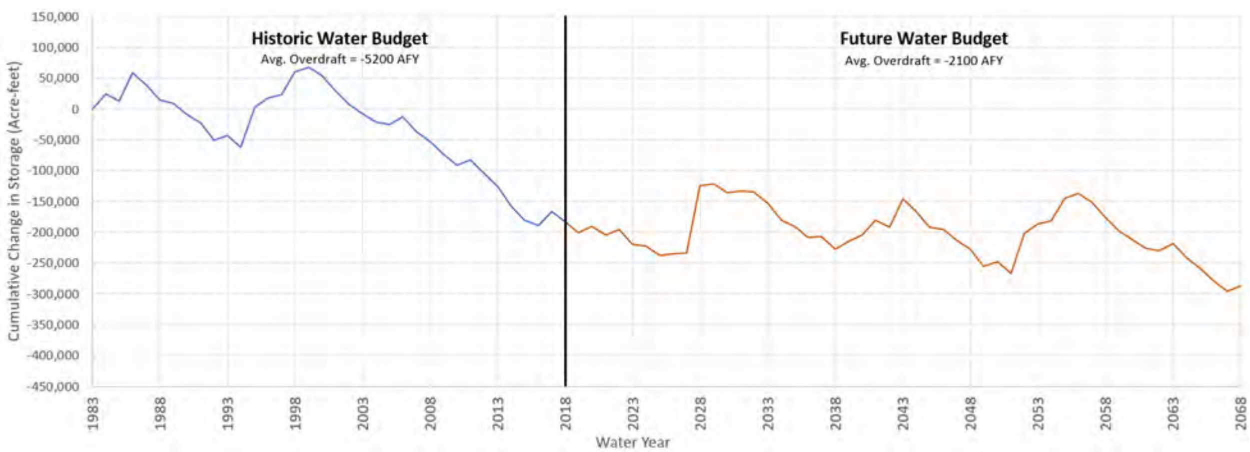
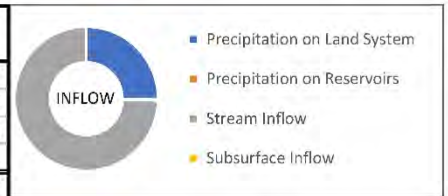


Figure 6-11 Cumulative Groundwater Change in Storage 1984 to 2068 (Future Baseline)

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 change factors for precipitation, evapotranspiration, and streamflow based on climate change models. While there is variability in the climate change models, if the models are correct, 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 in **Figure 6-12** and **Figure 6-13**. 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 600 AFY.

Item	Flow Type	Origin/ Destination	Component	TOTAL BASIN WATER BUDGET Acre-Feet
(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)



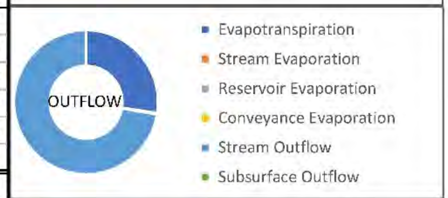


Figure 6-12 Projected Total Basin Water Budget 2019-2068 (Future with Climate Change)

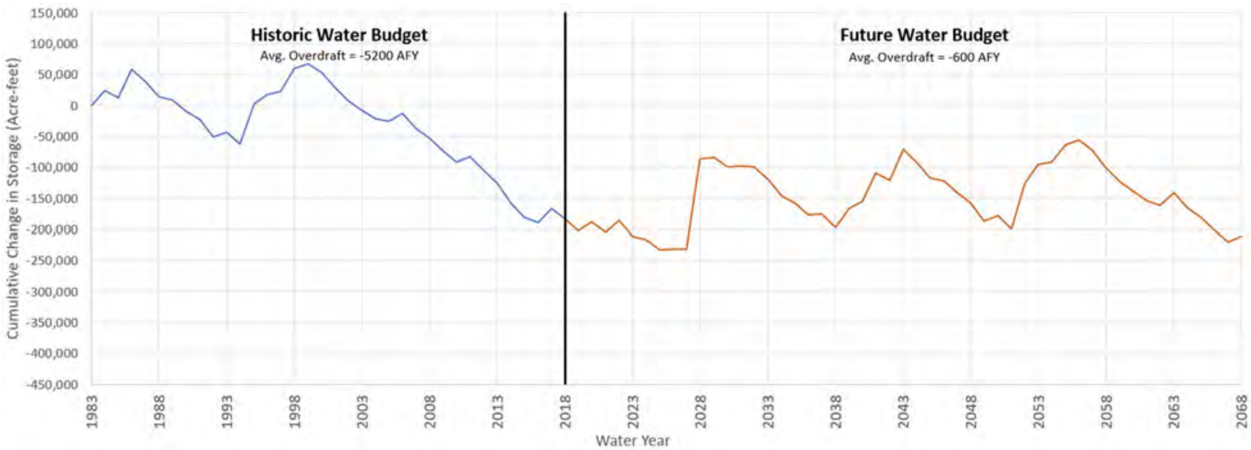


Figure 6-13 Cumulative Groundwater Change in Storage 1984 to 2068 (Future with Climate Change)

7. Sustainable Management Criteria § 354.20

This chapter describes criteria and conditions that constitute sustainable groundwater management for the Big Valley Groundwater Basin (BVGB or Basin), also known as sustainable management criteria (or SMCs). Below are descriptions of key terms used in the Groundwater Sustainability Plan (GSP) Regulations (Regs) 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 Regs 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 six 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 the Sustainable Groundwater Management Act (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 sustainability goal, undesirable results, and minimum thresholds. **Figure 7-2** shows the relationship of the MT, MO, and IMs. In addition to these regulatory requirements, some Groundwater Sustainability Agencies (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.

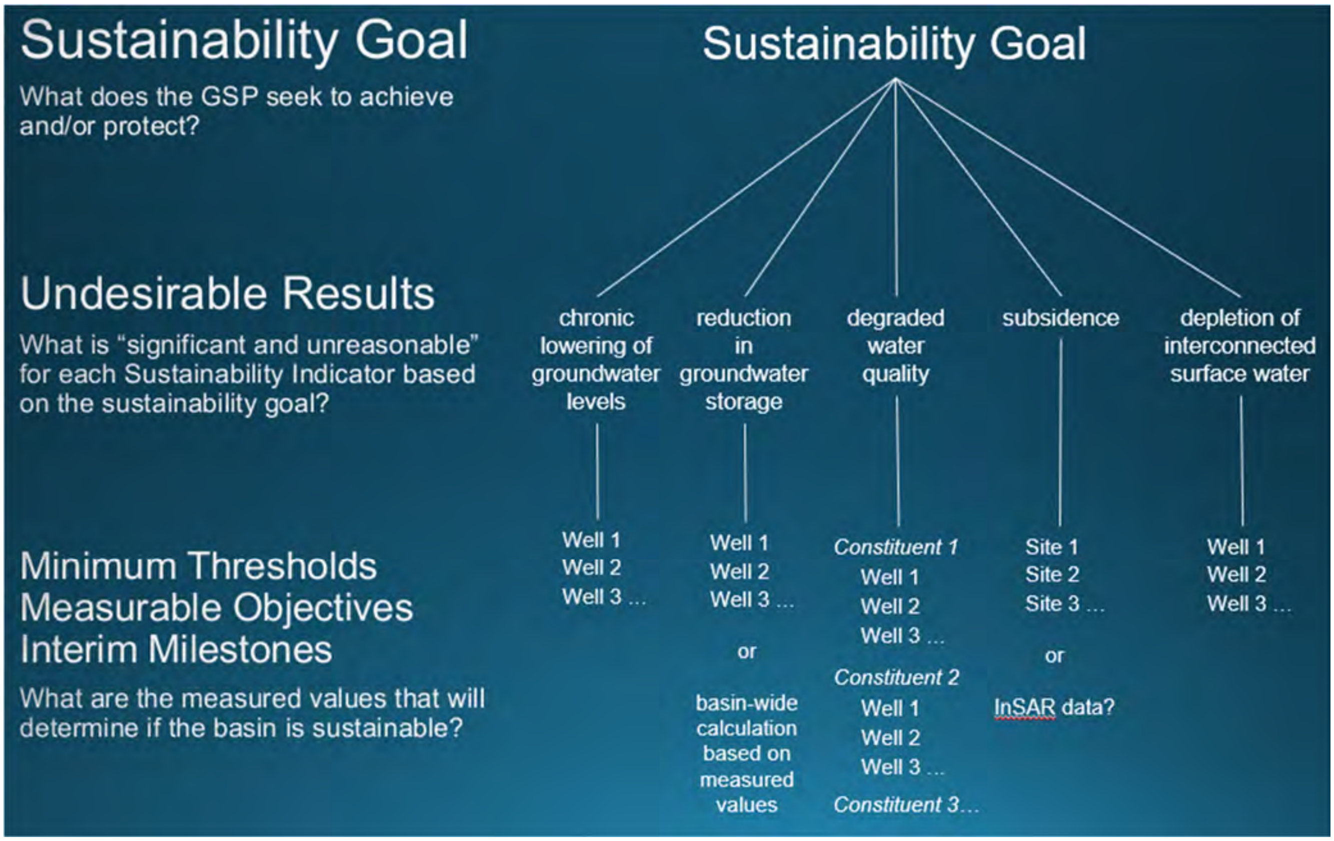


Figure 7-1 Illustration of the relationship among the sustainability indicators

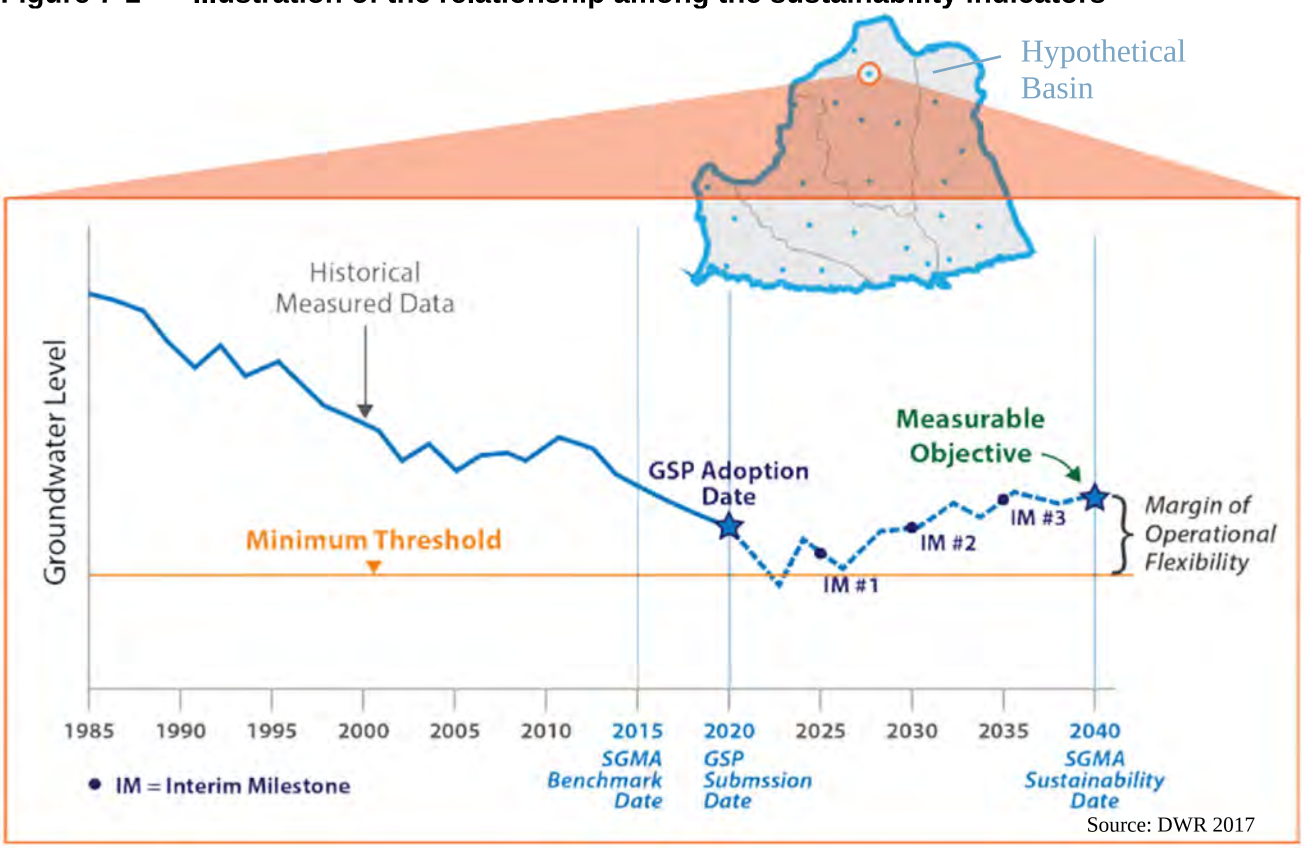


Figure 7-2 Relationship among the MTs, MOs, and IMs for a hypothetical basin

7.1 Process for Establishing SMCs

The SMCs detailed in this chapter were developed by the GSAs through consultation with the Big Valley Advisory Committee (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 (Introduction, Plan Area, and Basin Setting). 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 re-iterated 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 Regs, 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 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 SI.

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 1980's and early 1990's, recovery during the wet period of the late 1990's, 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 1 ft of change) or rising water levels and 9 wells have shown declining trends with only 3 of those wells declining by more than 2 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 ~~severely~~significantly. This re-emphasizes the point raised in Section 1.3 that the GSAs believe the Basin should be ranked as low priority and its ranking of medium priority is due in large part to the Department of Water Resources' (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 1990's) 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 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 ~~2021~~ 2015 groundwater level for each well in the monitoring network (see chapter 8). Fall ~~2021~~ 2015 is the most recent measurement prior to the adoption of this GSP and is generally the lowest groundwater level throughout the period of record. Since these levels are assumed to be economically feasible for agricultural 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. 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. For agricultural pursuits to be viable, growers need a large margin of operational flexibility (see **Figure 7-2**) so that crops can be irrigated even during dry years. Accordingly, and consistent with the goal, 140 feet below the 2015 groundwater level was established as the minimum threshold.

Consistent with the Sustainability Goal, significant and unreasonable lowering of groundwater levels is defined as the level where the energy cost to lift groundwater exceeds the economic value of the water for agriculture. Through discussions in BVAC ad hoc committee meetings among committee members, local well driller (Conner 2021), and farm advisors (Lile 2021) a depth of 140 feet below fall 2015 levels was determined to be the depth at which groundwater pumping becomes economically unfeasible for agricultural use.

The increase in horsepower required to pump from a well 140 feet deeper than the current 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). Calculated on a per ton basis, the increased cost of 140' water level decline translates to about $6.50 per ton using SVE power and $13 per ton with PG&E. (see **Appendix 7A**).

Total operating costs for a typical grass hay farm in the intermountain area are estimated to be $119 per ton. Total cash costs, not counting land and depreciation are estimated at $138 per ton of hay produced (Orloff et al 2016). Considering hay prices have been in the $200 per ton range (USDA, Agricultural

Marketing Service), the potential increase in required pumping power reduces return over cost by 10 to 20%.

To produce grain hay~~,~~ pumping costs are less because less water is required. But, because the relative value of grain hay, approximately $120 per ton, is also much less, the overall impact to economic returns is equal if not greater. Thus, the agricultural production economic threshold for well levels is determined to be 140 feet below the fall ~~2021~~ 2015 baseline.

While the viability of agriculture is of paramount importance, it is acknowledged that if agriculture use that utilizes the margin of operational flexibility (140 feet below fall 2015) described above may cause some wells in the Basin to go dry. **Figure 7-3** shows an assessment of the depths of wells throughout the Basin based on DWR well logs. While this dataset has inaccuracies, it gives a sense of the impact of lowering water levels on the different well types, and indicates that lowering of water levels throughout the Basin by 140 feet could result in a significant percentage of wells going dry. Many of the shallower wells are likely the oldest wells in the Basin and may be unused or abandoned.

Figure 7-4 shows that domestic well density is not evenly distributed throughout the Basin and that representative wells are located near the areas of highest domestic well density

It is also acknowledged that utilizing the margin of operational flexibility by agriculture to draw levels down by up to 140 feet could have impacts on users of interconnected surface water, including groundwater dependent ecosystems and surface water rights holders. Discussion of this effect is discussed in Section 7.3.6 below.

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 has resulted in declining groundwater levels in some parts of the Basin. A similar period of declining water levels occurred in the late 1980's through the middle of the 1990's. In the late 1990's, 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 levels to experience a similar recovery and maintain balance within the basin.

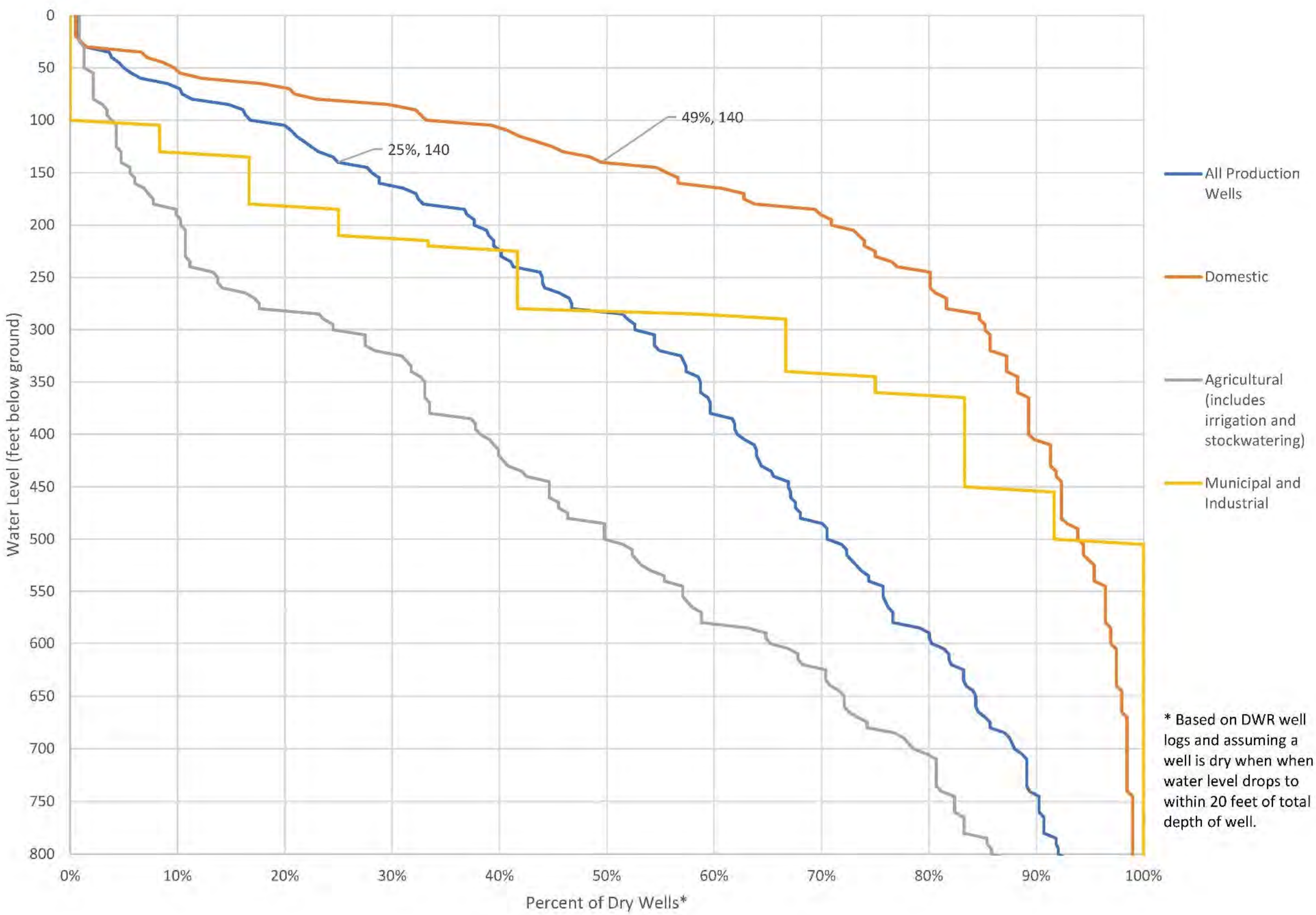


Figure 7-3 Analysis of Wells That Could Potentially Go Dry at Different Depths

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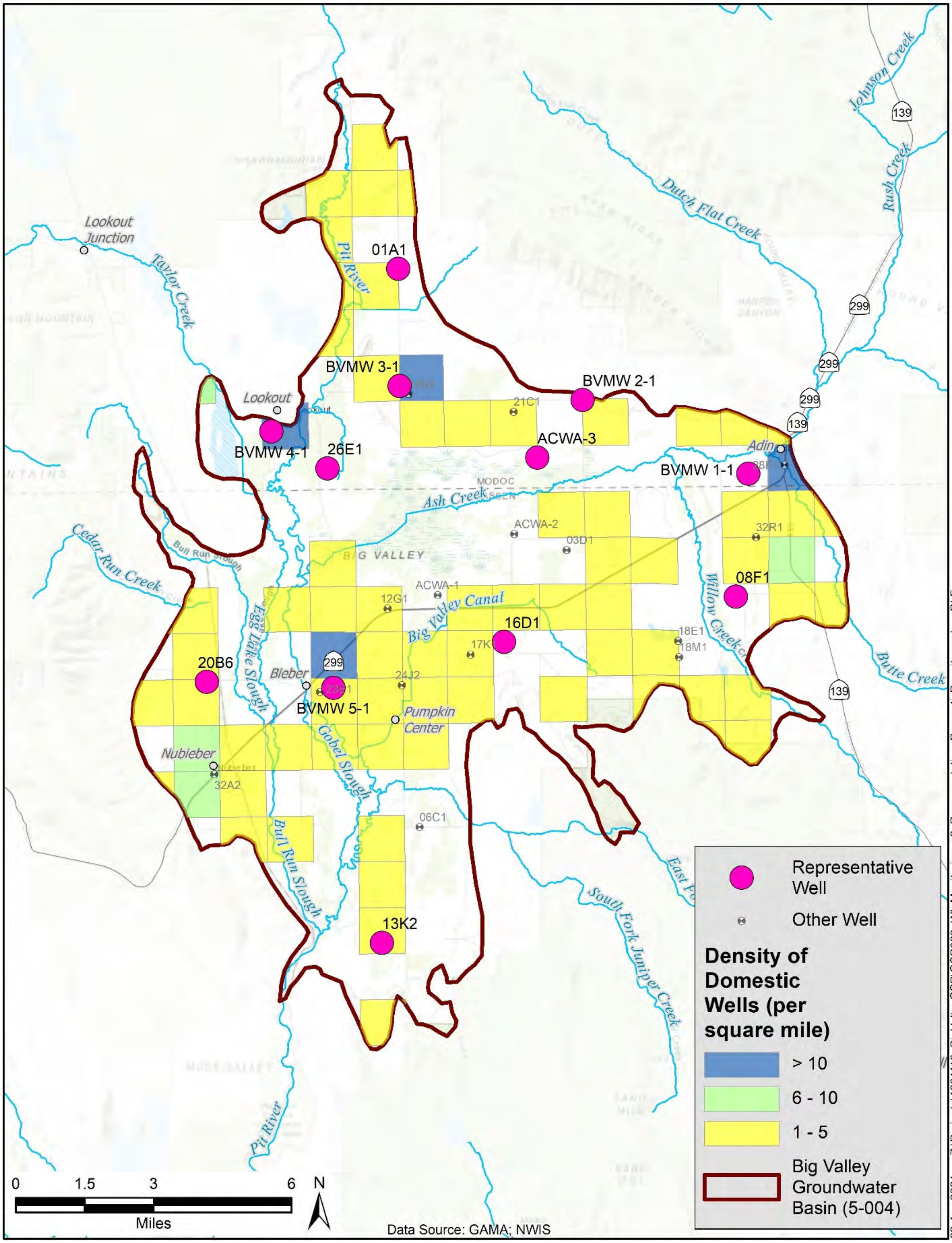


Lookout Junction
Taylor Creek
Pit River
01A1
BVMW 3-1
BVMW 2-1
Lookout
BVMW 4-1
26E1
21C1
ACWA-3
BVMW 1-1
Adin
Dutch Flat Creek
Johnson Creek
Rush Creek
139
299
MODOC
Ash Creek
ACWA-2
03D1
32R1
Cedar Run Creek
Bull Run Slough
BIG VALLEY
ACWA-1
08F1
12G1
Big Valley Canal
16D1
17K
18E1
18M1
Willow Creek
Butte Creek
20B6
Eagle Lake Slough
Bieber
24J2
BVMW 5-1
Pumpkin Center
Gobel Slough
Nubieber
32A2
06C1
Bull Run Slough
13K2
South Fork Juniper Creek
Pit River
0
1.5
3
6
Miles
N
Data Source: GAMA; NWIS
Representative Well
Other Well
Density of Domestic Wells (per square mile)
> 10
6 - 10
1 - 5
Big Valley Groundwater Basin (5-004)
Z:\Projects\1901113_BigValleyGSP\GSP029_WL Monitoring_v2_Representative_DomesticDensity.mxd
DLF
22-Apr-2021

Figure 7-4 Domestic Well Density and Representative Groundwater Level Wells

Criteria

The undesirable result criterion for the groundwater level sustainability indicator occurs when the groundwater level in one-third (1/3) of the representative monitoring wells drop below their minimum threshold (140 feet below the fall ~~2021~~ 2015 baseline) for five (5) consecutive years.

In addition to the above definition of undesirable result it is recognized that, although groundwater levels naturally fluctuate, some actions may be justified even before levels fall below the minimum threshold at a particular representative well. Thus, the GSAs are defining an "action level" to identify areas within the Basin where management actions and projects are needed (see chapter 9, Projects and Management Actions). The definition of the term "Action Level" is also at the discretion of the GSAs. "Action Levels" and the associated protocol are defined as follows:

"Action Level": When monitoring within the established monitoring network identifies the following ground water level trends, targeted projects or management actions may be considered, at the discretion of the GSAs when any of the following occur:

- One-third (1/3) of the representative monitoring wells in the Basin decline below the measurable objective (e.g. the fall ~~2021~~ 2015 baseline levels) for 5 consecutive years.
- Water levels at a 1/3 of the representative wells decline 3 times the average historic decline that well experienced between 2000 and 2018 as shown in **Appendix 5A**.
- Water levels at 1/3 of the representative wells decline more than 5 feet in one year.

Effects

As discussed above, if groundwater levels were to fall below the minimum threshold, pumping costs would render agricultural pursuits in the affected areas 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.

Low water levels could cause 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 would be offset by a shallow well mitigation program, which would apply to wells that have gone dry because water levels have fallen below the measurable objective. Substandard (e.g., hand-dug wells) would not qualify for mitigation. Mitigation would rely on a "good neighbor" practice already demonstrated in the Basin and would leverage any state or federal funding that may be secured. For example, the USDA Rural Development has offered low interest loans to drill new or replace existing wells. Additionally, prior to the first five-year update, a program will be developed (See Chapter 9) to cover a portion of the cost if new residential wells must be drilled because groundwater levels drop below the measurable objective. Any such program would apply to legally established wells and would be dependent on state and federal funding. Criteria will likely include well depth, screen interval, age of the well, distribution of declining any wells (e.g. is it isolated) and other factors.

7.3.2 Groundwater Storage

The discussion and analysis regarding groundwater levels is directly related to groundwater storage. The groundwater levels for the fall ~~2021~~ 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 levels measurable objective). The measurable objective is established at this level for storage for the same reasons discussed in the groundwater levels section. 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 established at 140 feet below the above measurable objective. The minimum threshold is set at this level for the same reasons discussed in the groundwater levels section.

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 1200 feet below ground surface. During this period, storage has fluctuated between a high of about 5,390,000 acre-feet in fall 1983 (and 1999) to a low of 5,214,000 acre-feet in Fall 2015.

Description

Like groundwater levels, significant and unreasonable reduction in groundwater storage is defined as a level that results in the energy cost to lift the groundwater exceeding the economic value of the water for agriculture or 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 has resulted in declining groundwater levels in some parts of the Basin. A similar period of declining water levels occurred in the late 1980's through the middle of the 1990's. In the late 1990's, 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 is the same. The monitoring network described in chapter 8 is also the same for both groundwater levels and storage. As such, the GSAs will use the voluntary and discretionary "Action Level" protocol described in the groundwater level section 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 Regs 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 mean sea level. 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, the groundwater quality conditions in the Basin are over all excellent (DWR 1963, USBR 1979). After a review of the best available data on water quality in the Basin, it was discovered 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 1950’s and 1960’s (e.g. Arsenic and Manganese **Figures 5-8** and **5-10**).

While the water quality is considered excellent in the Basin, water quality is an important issue to both agricultural and domestic users within the ~~b~~Basin and they are working in coordination to retain the existence of excellent water quality. ~~The SGMA is intended to work in coordination with the many other programs and agencies who are tasked to maintain excellent water quality in the Basin.~~ The multitude of programs is listed in Section 3.5 which regulate water quality.

In addition, Big Valley residents are voluntarily participating and coordinating in activities that will ensure continued excellent quality water in the Basin. In 2018, the Upper Pit River Watershed Integrated Regional Water Management Plan 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~~Agricultural users have~~ via partnerships~~ed~~ with agencies such as the Natural Resource Conservation Services (NRCS) to implement on site programs which are designed to improve water quality as detailed in Chapter 9 – Projects and Management Actions. As described in Section 1.1, 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 the community action. Through the civic process, Big Valley residents were engaged in the development of the Modoc and Lassen County ordinances to deter outdoor marijuana grows 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 ~~in~~ 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 (RRG) Used Oil and Filter Campaign to assist in maintaining excellent water quality. These outreach efforts are further discussed in Chapter 9 – Projects and Management Actions.

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. At the 5-year updates of this GSP, data from various existing programs, including the RWQCB sites, public supply wells (regulated by the Division of Drinking Water), and electrical conductivity transducers installed by the GSAs at three wells (BVMW 1-2, 4-1, and 5-1) will be assessed to determine if degradation trends are occurring in the principal aquifer. In addition, water quality impacts resulting from projects and management actions will be evaluated during their planning and implementation. At the five-year update, SMCs will be considered only if the trends indicate that undesirable results are likely to occur in the subsequent five years.

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 if identified through InSAR will be investigated. 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 inches 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 five 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 a greater understanding of interconnected surface water that may be present in the Basin and 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. Uncertainty in the amount of surface water entering the Basin has already been established and will continue to be a barrier. ~~in immediately determining if there is a depletion of interconnected surface water.~~ 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 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), conclusive evidence of stream interconnection is not available. Therefore, there is a lack of evidence for interconnection of streams. **Figure 5-18** overlays the general direction(s) of groundwater flow around the basin in relation to the major perennial 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 regarding the interconnection of surface water.

Chapter 4 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 GSA's will work to locate funding for improved data depending on available staffing and financial resources.

~~Given the data gaps identified above, there is currently insufficient data to establish whether undesirable results have occurred and whether they are likely to occur.~~ SMCs were not established for interconnected surface water because Undesirable Results are not present and not likely to occur. At the 5-year updates of this GSP, data from newly established well clusters, new and historic stream gages, and the monitoring network detailed in chapter 9 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 five years.

7.4 Management Areas

Management areas are not being established for this GSP.

8. Monitoring Networks § 354.34

8.1 Monitoring Objectives

This chapter describes the monitoring networks necessary to implement the Big Valley Groundwater Basin (BVGB or Basin) groundwater sustainability plan (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.
- to provide the information necessary for annual reports, including water levels and updates to the water budget[47].

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 groundwater sustainability agencies (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 along with the newly constructed dedicated monitoring wells. The table indicates which wells are used for each

[47] 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

					Depth to Water (feet bgs)		Groundwater Elevation (feet msl)				
Well Name	Well Use	Well Depth (feet bgs)	Screen[1] Interval (feet bgs)	Representative Well[2]	Measurable Objective[3]	Minimum Threshold[4]	Measurable Objective[3]	Minimum Threshold[4]	Contour Well	Shallow Well	Monitoring Frequency
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							X	continuous[5]
BVMW 1-3	Observation	50	30 - 50							X	continuous[5]
BVMW 1-4	Observation	49	29 - 49							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							X	continuous[5]
BVMW 2-3	Observation	70	50 - 70							X	continuous[5]
BVMW 2-4	Observation	60	40 - 60							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							X	continuous[5]
BVMW 3-3	Observation	50	25 - 50							X	continuous[5]
BVMW 3-4	Observation	50	25 - 50							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							X	continuous[5]
BVMW 4-3	Observation	80	60 - 80							X	continuous[5]
BVMW 4-4	Observation	93	73 - 93							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							X	continuous[5]
BVMW 5-3	Observation	85	65 - 85							X	continuous[5]
BVMW 5-4	Observation	90	70 - 90							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.

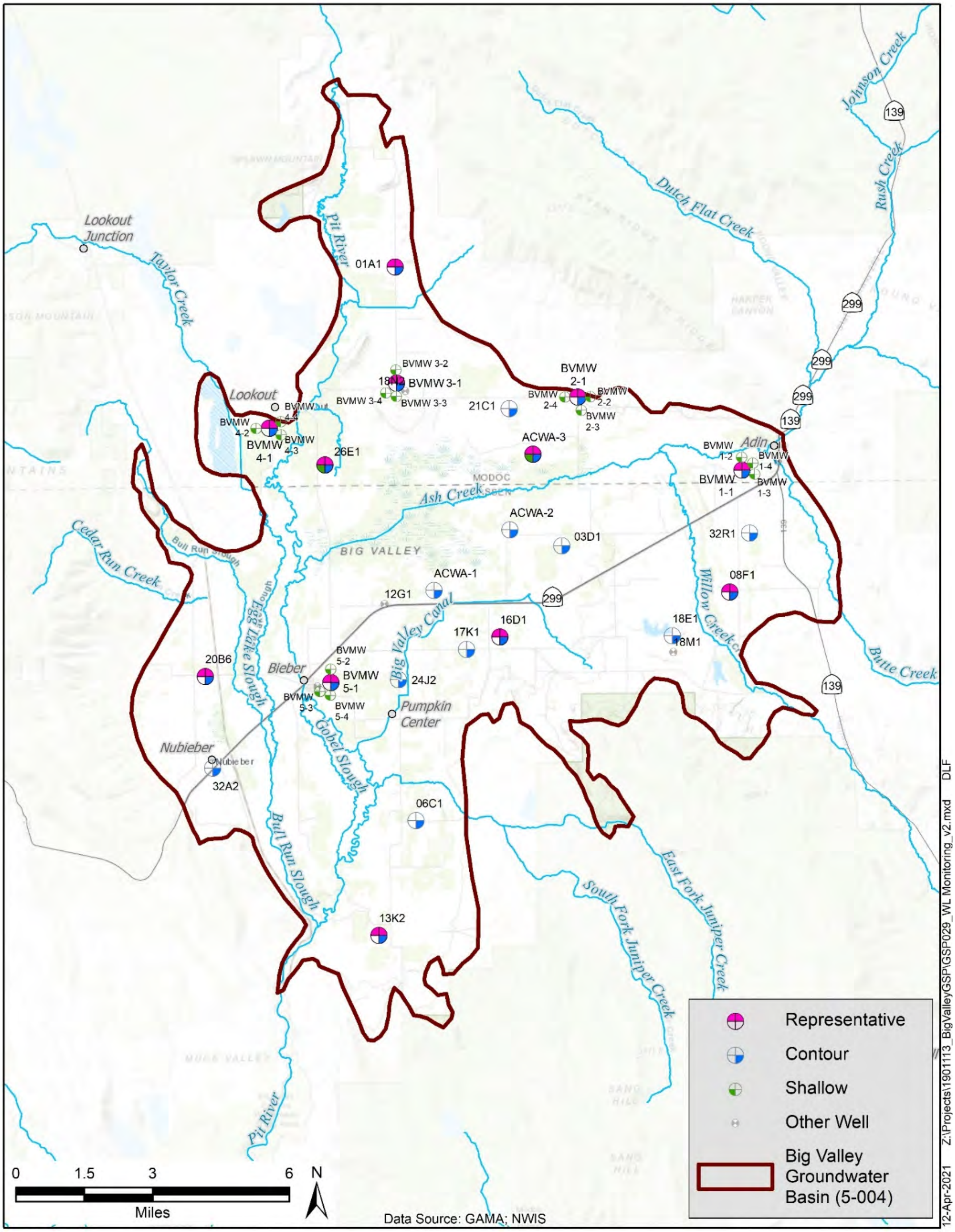


Figure 8-1 Water Level Monitoring Networks

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**.

GSP Regulation §352.4 states that monitoring sites that do not conform to Department of Water Resources (DWR) best management practices (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[48] perforated intervals". Many of the historic 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, stockwatering, or domestic uses. The intent of groundwater level monitoring is to capture static (non-pumping) water levels. However, historic monitoring is performed before and after the irrigation season, March or April for spring measurements and October for fall measurements[49]. 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 so that can be considered when assessing water level measurements.

In addition to the well use considerations, most of the historic wells do not have depth-discrete screen intervals[50], 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 30-40 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 these long intervals therefore 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. Their 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 Big Valley Advisory Committee (BVAC), twelve wells

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

[49] 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.

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

were selected for representative monitoring of the 144 square mile Basin, a density of 8.3 wells per 100 square miles.

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:

- Spatial distribution throughout the Basin to represent agricultural pumping areas
- ~~and~~ Areas with a high density of domestic wells ~~clusters~~
- An existing monitoring record (where available) to track long-term trends
- Access for long-term future monitoring
- Well depth (greater than ~~140 feet below fall 2015 levels~~the MT~~[51]~~)
- Wells dedicated to monitoring where available

Table 8-1 shows the measurable objectives (MOs) and minimum thresholds (MTs) for the twelve representative wells. As stated in Chapter 7, MOs are set at the fall 2015 water level. MTs in **Table 8-1** are set at 140 feet below the MO for wells to protect agricultural beneficial use 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. Historic groundwater storage changes were estimated in Chapter 5 using groundwater contours contained in **Appendix 5B**. Therefore, for annual reports to be comparable to historic conditions the wells used for groundwater contouring should be the same, or nearly the same as those used for the historic contours. Five wells that were used in the historic 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.

8.2.1.2 Shallow Groundwater Monitoring Network

Chapter 5 discusses interconnected surface water and describes the perennial streams in the BVGB. As described in Chapter 7, there is currently no conclusive evidence for interconnection of ~~perennial~~ streams with the groundwater aquifer and all summer flows are 100% 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 5-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

~~[51] These well depths are needed to ensure water levels can be measured if they approach the minimum threshold as defined in Chapter 8.~~

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), that it is screened up to a shallow depth (20 feet below ground surface), and it does not have a pump. Well ACWA-3 was also selected for the shallow network due to its location on the Ash Creek Wildlife Area (ACWA) within the northern portion of the Ash Creek wetlands associated with Big Swamp and the possible groundwater dependent ecosystems shown in **Figure 5-22**. **Table 8-1** lists the shallow groundwater monitoring network and **Figure 8-1** shows the well~~ir~~ locations.

8.2.1.3 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**.

8.2.1.4 Data Gaps in the Water Level Monitoring Network

Data gaps are identified in this section using guidelines in the 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 06C1, shown on **Figure 8-1**.

8.2.2 Groundwater Quality

Chapter 5 describes water quality conditions as overall excellent, and the few constituents that are infrequently elevated in Big Valley are all naturally occurring. Therefore, measurable objectives, minimum thresholds, and a representative monitoring network have not been established. Monitoring will be assessed at the 5-year update. To make such an assessment, the GSAs will rely on existing programs, described in Chapter 7. Focus will be on the water quality reported for wells regulated by the State Water Resources Control Board's (SWRCB's) Division of Drinking Water (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) 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 that may not be apparent from

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 water year 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 06D1 and 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

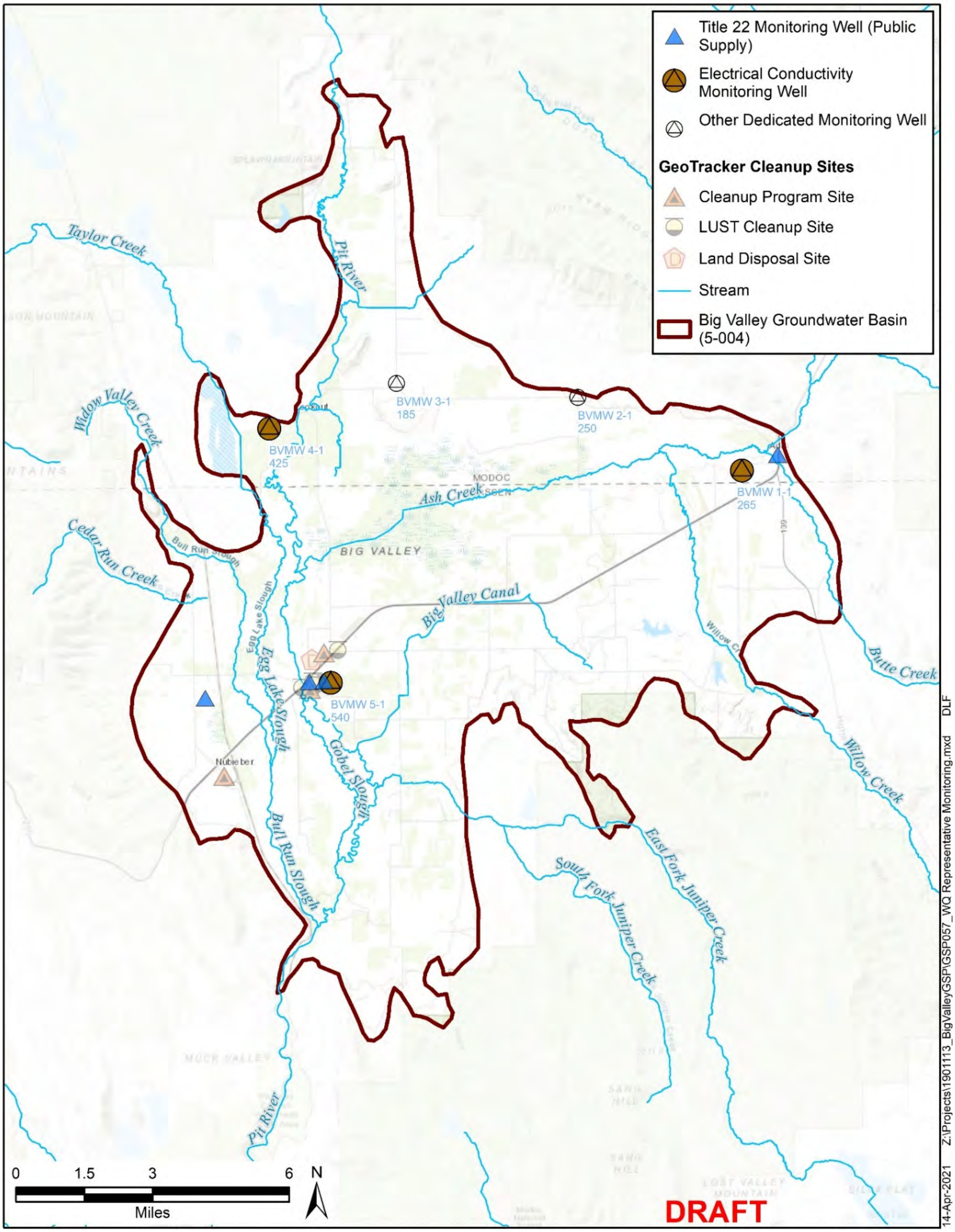


Figure 8-2 Water Quality Monitoring Network

infrequent DDW measurements. The EC transducers may be able to put anomalous[52] measurements from DDW into better context. **Table 8-3** lists the groundwater quality monitoring sites and their details.

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.

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 SWRCB is made available on their GAMA Groundwater Information System (GAMA GIS) website. At the 5-year update, the GSAs will ~~download~~ obtain and analyze the available data. For the EC transducers, measurements are made in situ with no samples collected or analyzed in a laboratory.

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 Chapters 5 and 7, no significant land subsidence has occurred in the BVGB and no subsidence is likely to occur that would have an impact on infrastructure or flood risk. Therefore, MOs, MTs, and a representative monitoring network have not been established. This assessment was made based on a continuous global positioning system (CGPS) station near Adin (P347) and interferometric synthetic aperture radar (InSAR) data provided by DWR. Future assessment of subsidence at the five-year GSP update will rely on data provided by the National Oceanic and Atmospheric Administration (NOAA) who operates 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.

[52] 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 8-4 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 and 3 monitoring wells with EC transducers	None. Most known contaminants are located in Bieber and Nubieber. Monitoring at Bieber Town wells and in BVMW 5-1 have not shown contaminants, but monitoring there would indicate if they become 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 and 3 monitoring wells with EC transducers	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.	No degraded water quality impacts are present	None.
Data should be adequate to evaluate whether management activities are contributing to water quality degradation.	None. Projects and management activities that are implemented will assess potential water quality impacts.	None.

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 ~~continuous~~ 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 SB88 stream diversion records submitted to the SWRCB.

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 LandIQ. DWR has provided these datasets for 2014, 2016, and 2018. 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 reference ETo by crop coefficients.

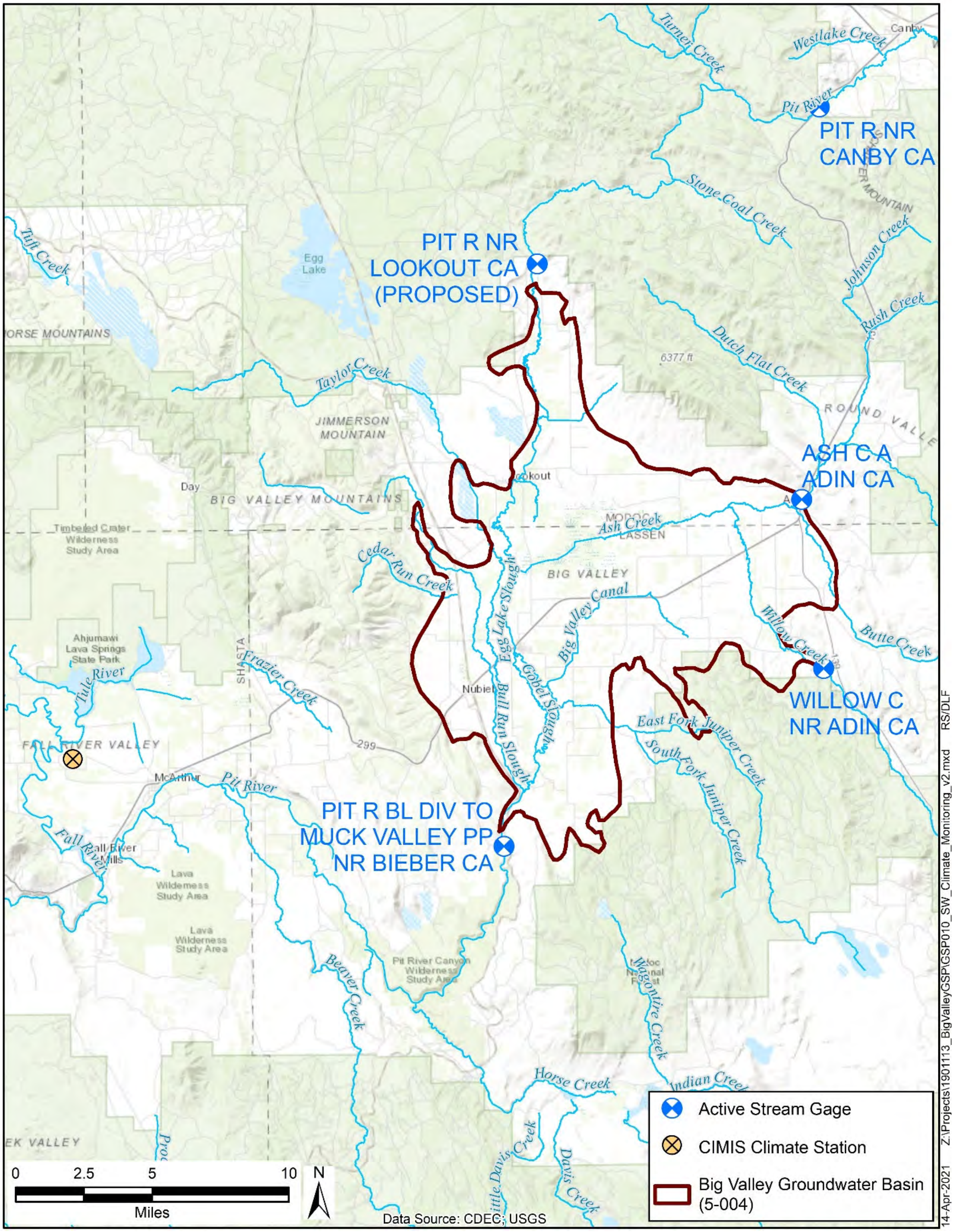


Figure 8-3 Surface Water and Climate Monitoring Network

9. Projects and Management Actions §354.44

Through an extensive planning and public outreach process, the GSA's have identified an array of projects and management measures that may be implemented to meet sustainability objectives in the Big Valley Groundwater Basin. 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 resource capacity is limited, there are a number of 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.

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. With the possible exception of a large surface water storage project such as Allen Camp Dam, the projects and management measures describe in this chapter are expected to work in combination and should be considered as a whole rather than dependent on any single strategy. Should sustainability not be realized, additional projects and management actions will be considered and developed as appropriate. A timeline for projects can be found in **Table 9-2** and additional details fulfilling state requirements can be found in **Table 9-3**.

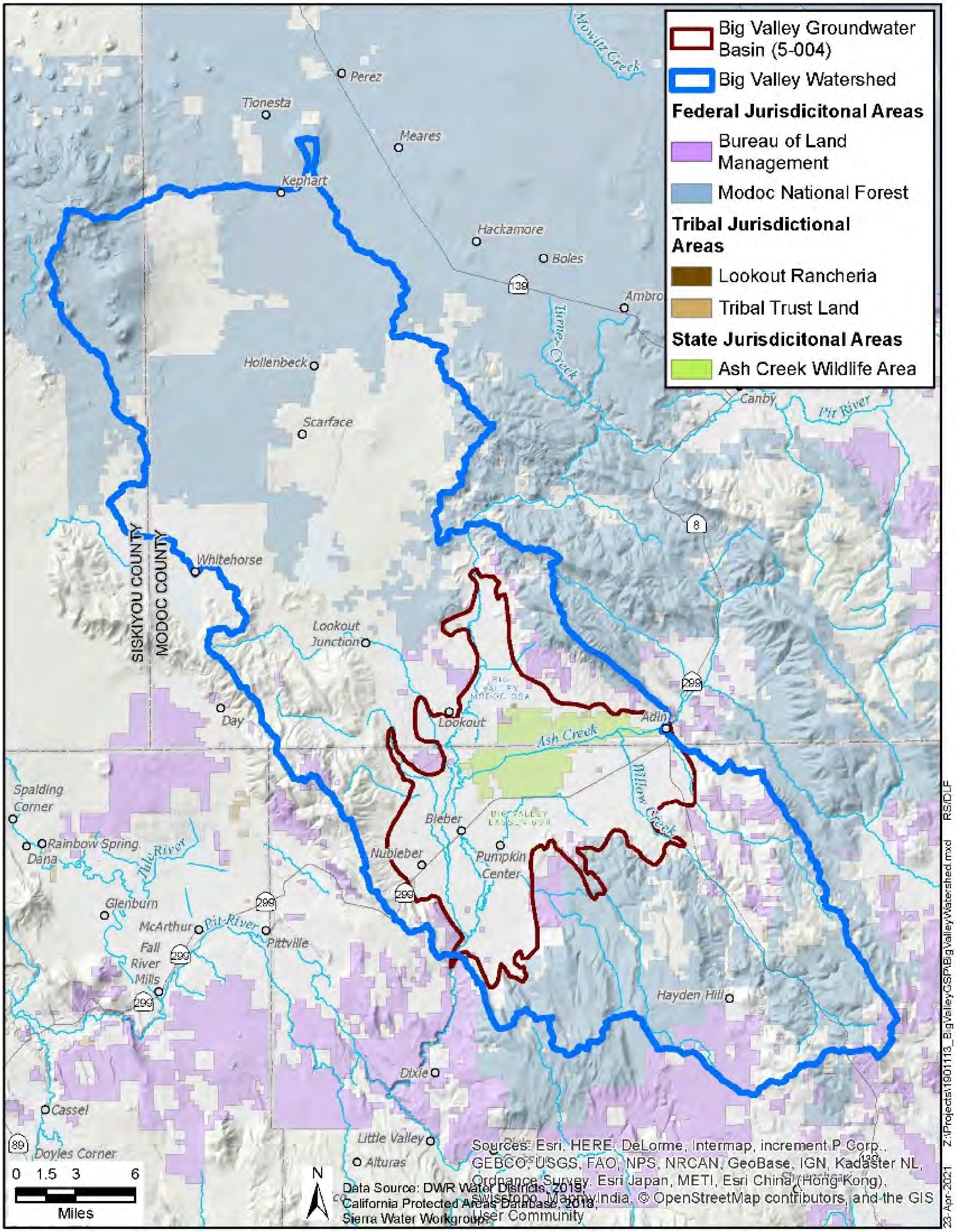


Figure 9-1 Big Valley Watershed Boundary

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 (WRP, CRP, EQIP)	Natural Resource Conservation Service (NRCS) (website)	Cost share funding for wide array of soil, water, and wildlife conservation practices. Funding priorities developed locally.
Conservation Innovation Grants (CIG)	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 (USFWS) (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 (HSP)	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 (Western SARE) (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 (SGM)	Dept of Water Resources (DWR) (website)	Planning and implementation grants supporting sustainable groundwater management. 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 Recharge Projects	AgMAR	X	X	X
2		Drainage and Basin Recharge	X	X	X
3		Ag Injection Wells			X
4	9.2 Research and Data Development	Stream Gauges	X		
5		Refined Water Budget	X	X	
6		Agro-Climate Station	X		
7		Voluntary Installation of Well Meters	X	X	
8		Adaptive Management	X	X	X
9		Mapping and Land Use	X	X	
10	9.3 Increased Storage Capacity	Expanding Existing Reservoirs		X	
11		Allan Camp Dam			X
12	9.4 Improved Hydrologic Function	Forest Thinning and Management	X	X	X
13		Juniper Removal	X	X	X
14		Stream and Meadow Restoration	X	X	X
15	9.5 Water Conservation	Irrigation Efficiency	X	X	
16		Landscaping and Domestic Water Conservation	X	X	
17		Conservation Projects	X	X	
18	9.6 Education and Outreach	Public Communication	X		
19		Information and Data Sharing	X	X	
20		Fostering Relationships	X		
21		Compiling Efforts	X	X	
22		Educational Workshops	X		

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	Legal authority
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).	Notification of available water and success of this projects will be communicated through the Big Valley Groundwater Advisory Committee. Agreements will be made between the GSAs and interested producers.	Following development of the WAA, an AgMAR permit for surface water diversions can be solicited from the State Water Resources Control 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.	Irrigating every 5-7 days for roughly 10 weeks in the winter/spring would benefit 2-5 acre-feet of water per acre. Previous research has quantified that over 90% of water is recharged to deep aquifers or available in the soil profile with AgMAR. The limitation to this project is available winter for recharge but a project goal of 1,000 acres per year could provide roughly 10,000 acre/feet of water per year benefit.	Water budget planning and permitting will take 6-18 months and possibly more depending on the case load at the department of water resources. After an off-season water budget is completed, permitting can be distributed to the GSAs for winter recharge location selection. AgMAR could start being used at productive scale by 2024 if all processes go smoothly.	The cost to develop the WAA is still being developed, but may be covered under existing grants from DWR. The cost of submitting a streamlined permit will also be developed, including fees.	[Need support here, potentially from council on the authority of the GSAs to coordinate this permitting]
9.2 Research and Data Development	Stream gages are scientific instruments used to collect streamflow and water quality data in order to decrease scientific uncertainty in order to inform water management decisions. Agri-climate/ CIMIS stations are helpful in monitoring for climactic 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.	In addition to the continued use of existing stream gages which monitor many of the seasonal streams that contribute inflow to the Big Valley Basin, stream gages may be installed if locations and need are determined. Presently, Modoc County is working to install an additional stream gage at the Shaw Pit. Data from agri-Climate/CIMIS stations may be utilized in order to make water management decisions with regard for climactic factors such as wind, rain etc. Adaptive management will be employed throughout the implementation process to allow for management decisions to reflect the best available data as more information comes available. Employing adaptive management strategies will expand our capacity to conduct research and data development, also. Refining the water budget will be done as more data becomes available through the combination of the data development projects described previously.	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 the Department of Water Resources 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.	Decreasing data gaps would decrease reliance on assumptions to govern groundwater management decisions. As more data becomes available, more accurate estimates of evapotranspiration would allow for more precise water budgeting estimates.	Gaging stations being installed where necessary early in the planning process in order to decrease uncertainty related to streamflow. They will be monitored throughout. Adaptive management strategies are anticipated to be employed throughout the GSP development and implementation phases. Refining the water budget is important early on in order to create a GSP that best reflects existing conditions in the basin, and which may be referenced in the future to perform adaptive management.	Funding is available through (DWR?) 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. 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.	

Continued

Project	Brief description	Circumstances under which the project will be implemented	Public notification process	Permitting and regulatory process	Benefits	Schedule	Estimated cost	Legal authority
9.3 Increased Surface Water Storage Capacity	Surface water storage may be used to reduce reliance on groundwater by providing an alternative water source. Presently, Robert's Reservoir and several others including the Inverson, Silva, and Bureau of Land Management reservoirs mitigate potential overdraft. As water levels in streams and other water courses diminish during the dry months, existing diversions may not adequately meet the needs of users. ~~Storing~~ Expanding the capacity of these reservoirs and possibly constructing new reservoirs such as the Allan Camp Project would allow additional water from snowmelt and storm events ~~could~~to be stored. This would help circumvent reliance on groundwater and would provide ~~a more~~ reliable ~~supply of water for these users. Several options related to~~ supplies of surface water ~~storage may be explored in order to meet ground water sustainability goals including expanding Robert's Reservoir and reassessing the Allan Camp Dam and Reservoir.~~ for users.	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 publically available whenever appropriate. Both NEPA and 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.	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.	Large infrastructure projects can be quite expensive. 1$ in May 1981 had the same buying power as $2.97 in April 2021. A ball park estimate of the capital costs for the Allan Camp Project in its entirety would amount to approximately $344,041,830, with the Dam and Reservoir component amounting to $174,487,500. These figures are 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 (SWC) and reducing dense forest canopy and associated evapotranspiration	Upland forest recharge will take place will be enhanced by implementation of forest health and fuels reduction projects within the Big Valley watershed. Such projects are on-going and in varying stages of planning and implantation. Support from GSA's 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 (National Environmental Policy Act).by the Modoc National Forest or Applegate BLM. State funded projects will follow CEQA public notification process. Opportunities on private land be communicated by GSA's, 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 run-off 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 acre-ft 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. Multiplied over a number of farms, water use savings could be significant.	Irrigation infrastructure and water use efficiency incentives are on-going. UC Cooperative Extension has submitted a grant proposal to SWEEP to initiate an outreach education program in 2022.	Costs vary widely. New irrigation infrastructure on a field scale can exceed $100,000. Soil moisture meters for irrigation scheduling can be in the $100's to $1,000's of dollars per farm. Landscaping and homeowner water efficiency projects in the $100's to $1000's per home.	Farmers and homeowners have legal authority to make upgrades to their own systems.
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, coordinating information sharing efforts and facilitating informational meetings with stakeholder groups.	As an essential part of sustainability, outreach and education will be conducted throughout the development of the GSP, with many opportunities for public engagement.	Public information is available through the Big Valley GSP communication portal, accessible at bigvalleygsp.org. Informational brochures will be distributed to interested parties in order 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 is 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 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 use efficiency and improved water quality.	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 ~~for~~throughout the ~~next 8 year window~~planning and implementation process of the GSP.	Costs may vary depending on program type.	

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 BV 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. For off-season diversion recharge projects to be widely available in the Big Valley Basin, an off-season water availability study must be completed for the Pit River watershed up-river of Big Valley such that growers could obtain a permit for winter flow diversion. This study would include a survey of potential water rights held for off-season use, storage, and hydroelectric power. A more detailed description of what is needed in this process can be found at:

(https://www.waterboards.ca.gov/waterrights/water_issues/programs/applications/groundwater_recharge/docs/streamlined_waa_guidance.pdf).

Once this survey is completed and approved by a licensed engineer, permits to divert for available surface water can be solicited from the Department of Water Resources. Currently this permitting process can take 6 to 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~~recharge is needed. More information about this streamlined process can be found here:

(https://www.waterboards.ca.gov/waterrights/water_issues/programs/applications/groundwater_recharge/streamlined_permits.html).

Along with permitting costs, there are also costs to the irrigator in electricity and labor costs to apply water.

9.1.1 Agriculture Managed Aquifer Recharge (AgMAR)

One approach to basin recharge currently being considered is the intentional recharge of groundwater aquifers by spreading water over agricultural fields at times when excess surface water is available, a concept called agricultural managed aquifer recharge, or AgMAR (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 ~~in~~on Big Valley ~~on~~ soils with slow to very slow infiltration rates ~~of slow to very slow~~ looks 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 ~~of~~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). 80-85% 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 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, H.E., 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 acre-feet per acre per irrigation in March and April have shown no damage to crops. Soil infiltration rates show 2-3.5 inches of infiltration over a 24 hour period to be feasible. Irrigating every 7-10 days for 6 irrigations in the winter/spring would benefit 1-2 acre-feet 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 best management practice (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 project (CRP) or NRCS wetland reserve project (WRP) land.

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 at a later date 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 on in **Table 9-3** also applies to this project. Unlined drainages, canals, and basins could recharge up to 90% of diverted surface water to the ~~shallow~~ aquifer.

9.1.3 Aquifer Storage and Recovery (ASR) and Injection Wells

~~ASR is the artificial method of storing water underground to be used for later dates by injecting surface water during wet periods to fill underground aquifers. It can be used as a more economical and practical alternative to reservoirs and other surface water storage techniques in some areas. There is significant concern about the quality of water for injection and whether treating water before it is injected into the wells will be required. It is unclear if this is solely in systems used for drinking water or whether~~

~~environmental regulation also requires this in agriculture applications, if so cost would be raised significantly and would eliminate practicality of ASR for many situations.~~

~~Before injection can be used, significant knowledge of the subsurface of the injection site is needed including but not limited to the types of minerals present, existing and potential sources of contamination, and soil water content. Structure and capacity of the well also needs to be analyzed. Agriculture production wells with high elevation screening may be applicable to this use. More research needs to be completed as to whether this option is applicable to Big Valley.~~

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 nearly 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 Regional Water Quality Control Board and the permitting method is usually the Statewide ASR General Order (General Order) adopted by the State Water Resources Control Board in 2012. More information on the ASR General order can be found at this link:

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 location due to the presence of impermeable soils at or new 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 and if outside funding assistance is available through either state or federal grant programs to 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 regional water quality control board. 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 Regional Water Quality Control Board. 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 for to stabilize or increase aquifer storage.

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

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 a necessity to ~~continue to work towards~~support sustainability using the best science available.

9.2.1 Additional Stream Gauges and Flow Measurement

Several seasonal streams contribute inflow to the Big Valley Basin (**Figure 9-2**). Many of these streams had historical stream gauges or have current gauges 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 gauge at the Shaw pit 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 gauges if locations of need can be determined. The current and proposed stream gauges are in **Figure 9-2**.

9.2.2 Refined Water Budget

Many assumptions were taken to create the Big Valley water budget in Chapter 6. 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.

There is currently no agri-climate or CIMIS station located in Big Valley. Nearby stations in other basins have helped to create models to determine averages but significant geologic features affecting elevation often make weather patterns unpredictable from nearby basins. These 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 evapotranspiration (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 need and promote water conversation especially early in the growing season.

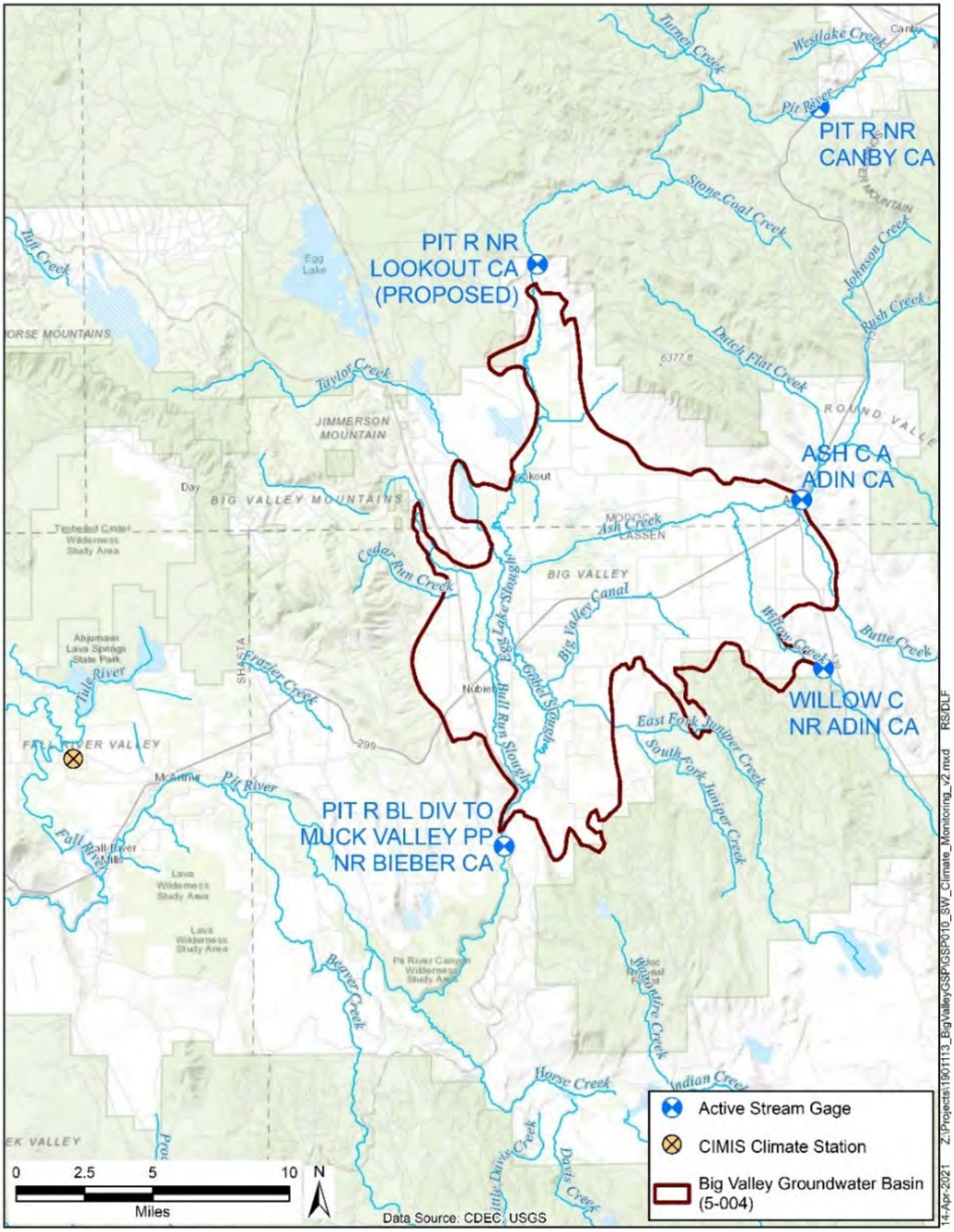


Figure 9-2 Current and Proposed Stream Gauges

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 bailing 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.

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 existing sources, many of which may need to be updated or expanded upon to reflect current conditions. DWR's LandIQ mapping resource has been a primary tool in estimating irrigated acres, although there is some ~~uncertainty~~inaccuracy related to~~ the accuracy of~~ the land classifications which field studies could address.

A voluntary well monitoring program has been available in Big Valley for upwards of two decades through the Lassen Modoc Flood Control Water Control District (LMFCD). 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 fills a data gap and ~~also ~~provides critical data to refine the water budget and pinpoint areas of concern. Meters are available for agricultural and domestic water users. Funding from DWR in a grant to Modoc County is currently available to provide well meters to voluntary applicants. Further, it would 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 monthly data across fifteen-minute intervals. Expanding on this existing program would further refine the water budget.

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 vs 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.

Collectively, the continuation of applied research efforts will help to better quantify the impacts from those actions and thus help refine the water budget. Some 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.

This describes an adaptive management strategy. 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 Big Valley Groundwater Basin and will serve as a bridge towards sustainability by providing current site-specific information to inform appropriate sustainable management criteria (SMCs) and thresholds as well as the ongoing assessment of projects and management actions in the basin.

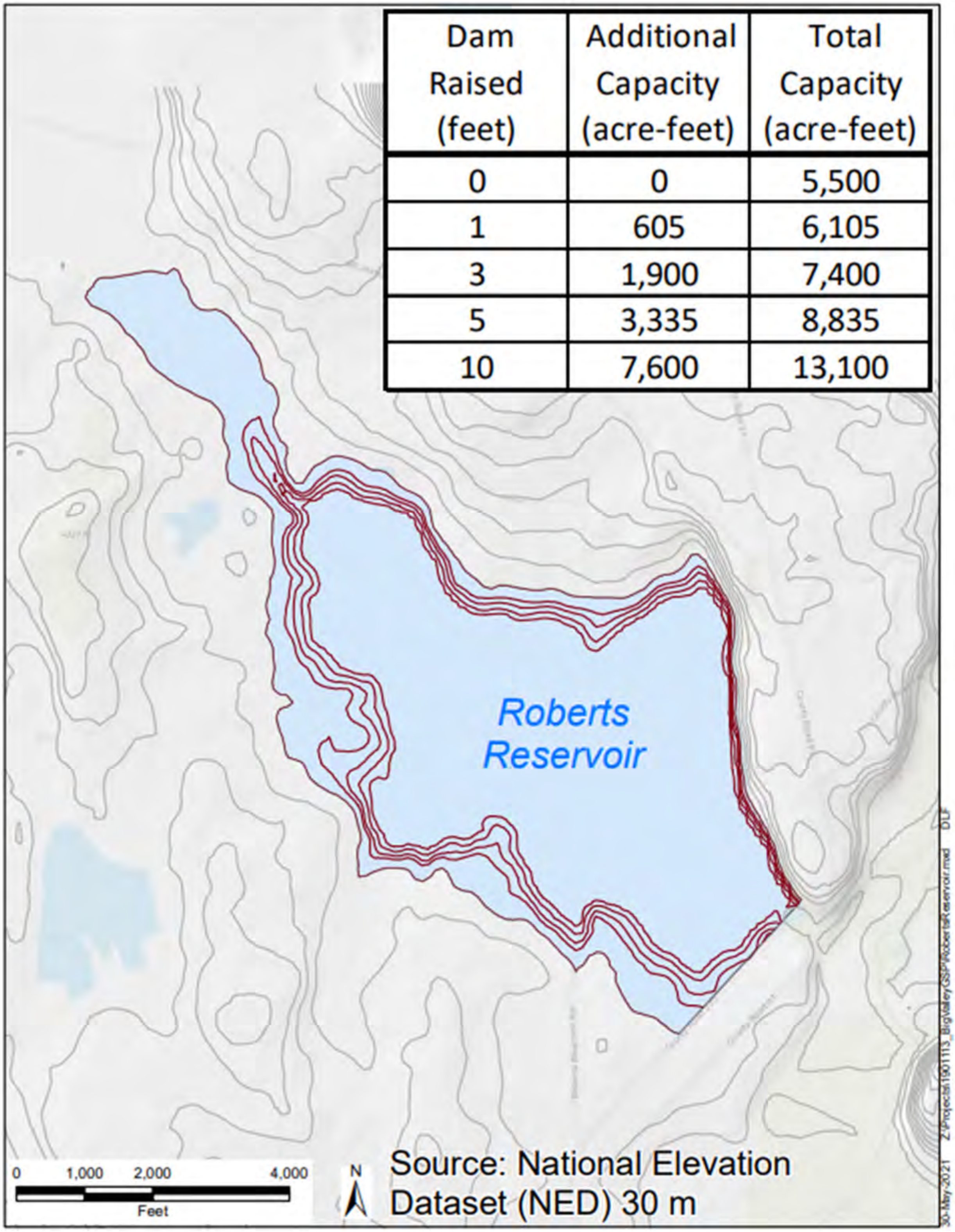
Although it is recognized and proven that the Big Valley Basin does not have the unsustainable conditions seen in other basins around the state, monitoring and filling data gaps from SMCs that were determined to not require thresholds helps us prepare for annual reports and five-year revisions and make 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 Groundwater Dependent Ecosystems (GDE).

9.3 Increased Surface Water Storage Capacity

Increasing the capacity to store surface water run-off during winter/spring high-flows 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 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 ~~to~~regarding climate variability and decreases in snowpack while also relieving pressure on groundwater for irrigation in Big Valley. One larger reservoir, Robert’s Reservoir, is located northeast of Lookout and has a current capacity of 5,500 acre-feet. Possible scenarios for raising this reservoir’s dam are shown in **Figure 9-3**. For example, raising Robert’s Reservoir three feet would increase capacity 1900 acre-feet, an increase of 35%.



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 Robert's Reservoir Scenarios

Other reservoirs include Iverson, Silva and Bureau of Land Management 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 ~~more~~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. The first phase examines the feasibility of the proposed project and planning. Engineering, permitting and project design take place during the second phase. Phase three covers implementation and construction of the proposed project. 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" (Lund 2014) and would be done very infrequently. 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.

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. Although the DOI's Report concluded that based on the existing criteria the proposed project was economically inadvisable, 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.

~~Located~~According to the original feasibility study (Allen Camp Reference, 19XX) the dam would be located around 11 miles north of the Modoc-Lassen County line, Allen Camp Reservoir would have a 90,000 acre-foot storage capacity, an 18,000 acre-foot surcharge, 2,350 acres of water surface area and a normal year yield of 22,400 acre-feet. 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~~ with~~. 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

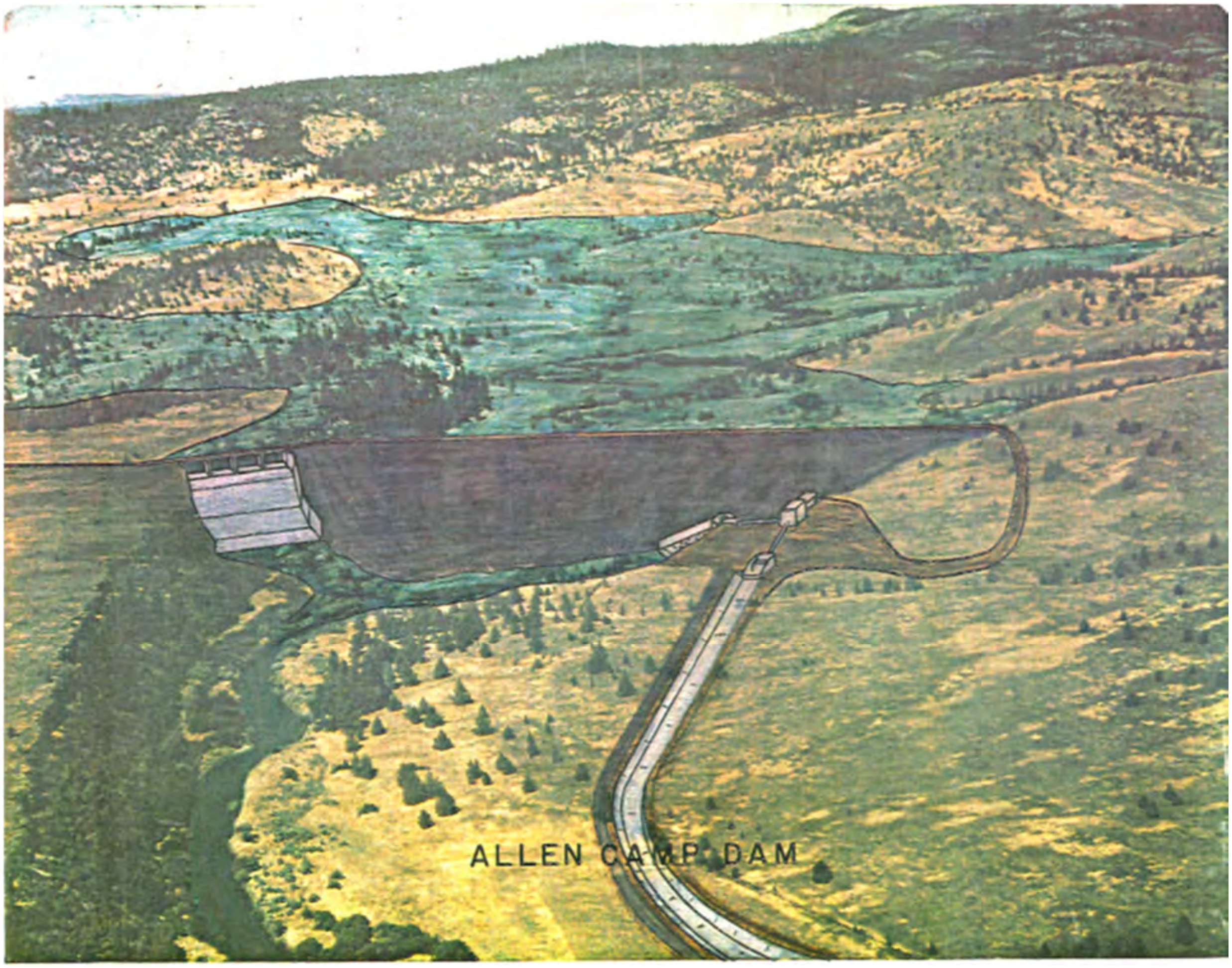


Figure 9-4 Allen Camp Dam Drawing

alternative for this proposed mitigation measure. The remaining land would be partitioned at 355 acres for the Hillside Canal, 148 acres for the ~~Lateral~~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 acre-feet with a safe yield of 7,000 acre-feet per year, with 5,000 acre-feet 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 Big Valley Groundwater Basin by providing a reliable source of surface water~~ and contributing to basin recharge. ~~, 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 of conifer forest and rangeland (**Figure 9-5**). Management policies have resulted in tree densities that are currently much higher than at the beginning of the 20th century. This includes ~~both mixed conifer forests and~~ western juniper and other mixed conifers (Stephens 2016) (Miller and Tausch 2001).

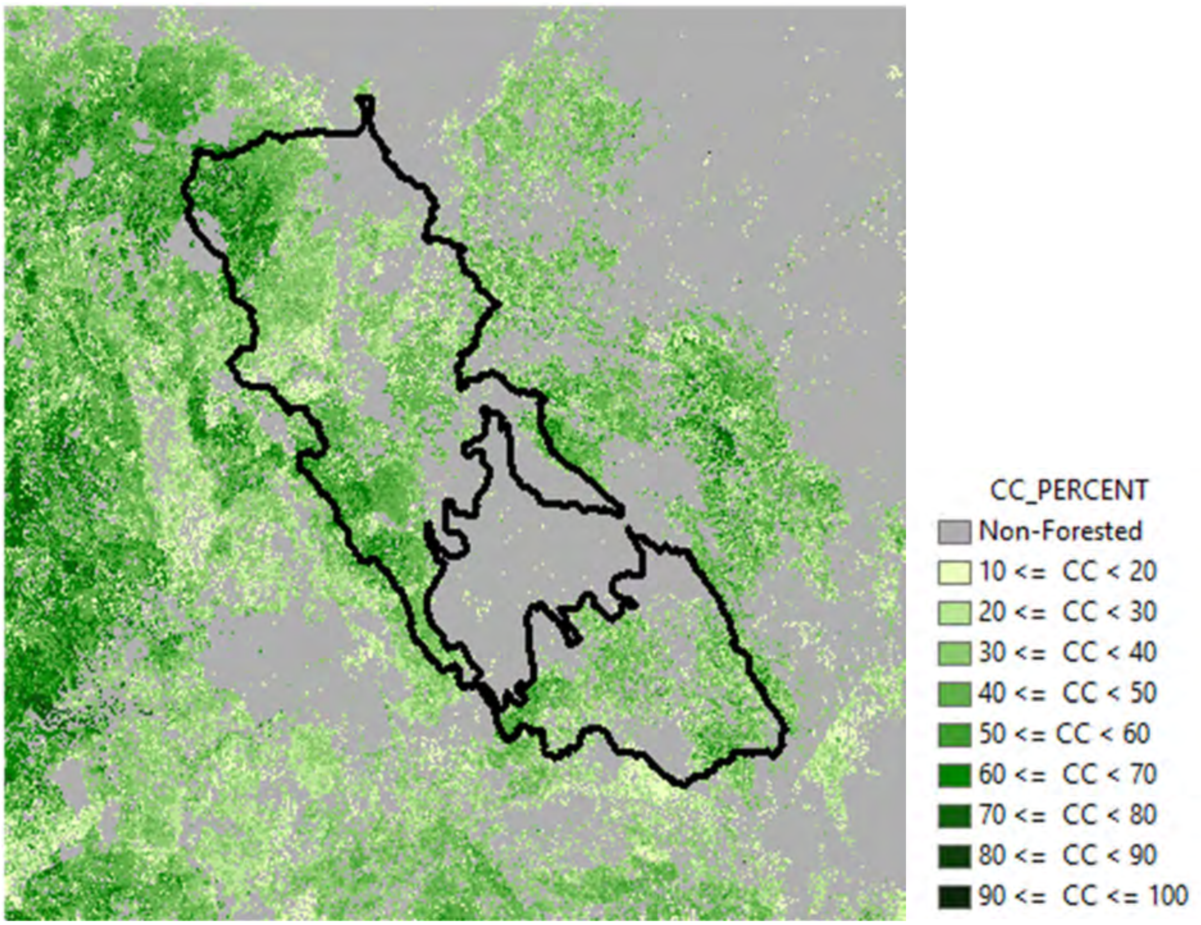


Figure 9-5 Canopy cover (CC) percentage of forested areas within the Big Valley watershed

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 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.

Spring snow water content (SWC) ranged from 33% to 44% higher in the aspen and an open meadow SNOTEL site vs adjacent juniper and conifer forest where interception of snowfall was much higher (LaMalfa 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% runoff increase, averaged over wet and dry years. Wildfire, with and without forest treatments, reduced vegetation by 38% and 50% and increased runoff by 55% and 67%, respectively. Forest fuel reduction in drier sites in the southern Sierra had less increase in run-off than wetter sites in the central Sierra Nevada Range. (Saska 2020).

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-yr period of juniper regrowth. (Mata-Gonzales 2021). Paired watershed studies in Oregon have demonstrated increased deep soil moisture, increased spring flow, and increased surface water run-off 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 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 ~~benefit~~benefits of forest health projects. Given the vast land area surrounding Big Valley, even a fraction of the land area is treated a significant amount of the current recharge deficit can be mitigated. Recently, controlled burns and fuels reductions have gained considerable traction as forest management tools and could be utilized for the purposes discussed.

9.4.2 Stream Channel Enhancement and Meadow Restoration

Several meadow restoration techniques exist for the purpose returning proper hydrologic function to montane and rangeland meadows. Two commonly 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 historic 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, 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 2018)

In mountains of the western United States, 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 to12 times. Before restoration, the total summer outflow from the meadow was 5% more than the total summer inflow.

After restoration, total summer outflow from the meadow was between 35% and 95% 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 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 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 season 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% of total operating costs (Wilson 2020) (Orloff 2016). Increasing the efficiency of crop water use is an economic as well conservation minded goal. Farmers in the Big Valley area have been adopting water conservation measures ~~and~~ 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 application will be neither effective nor economically viable, such as SGMA.

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%. Length of irrigation set should make full use of soil water holding capacity without incurring excessive run-off.

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 run-off. 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. While some of these have been applied in Big Valley some are relatively novel.

Genetic selection and the continued improvement of forage crop species as has resulted in the increased availability of drought tolerant, heat tolerant, or short-season forage grasses that may provide growers and viable alternatives in certain situations where water availability is otherwise limited. Crop selection is often based on the best fit for 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, on-going 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. is critical and promotes an efficient use of all resources including water. Finally, 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 together to fit on-farm conditions, is the most effective approach. To this end, education outreach via U.C. Cooperative Extension, technical support from Natural Resources Conservation Service, 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).

9.5.2 Landscaping and Domestic Water Conservation

While Big Valley is extremely rural, there are opportunities to enhance water conservation among domestic water users as well. Particularly with regarding domestic landscaping, use of native drought adapted plants, irrigation timers, effective mulch, and rainwater/snow water catchments can 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 2014) (California Native Plant Society, 2021).

9.6 Public Education and Outreach

The GSAs believe that public education and outreach are an important component of this plan. 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 grows, properly sealing abandoned wells, and best management practices. Continued outreach to support the coordination of efforts and information sharing, fostering relationships with relevant agencies and organizations, and attending meetings with local and region groups involved in water management is also important. This includes increasing public outreach about funding opportunities and programs that support water conservation methods, increased recharge, and mediation opportunities for decreasing water levels. A table of example funding opportunities is 9.1. More information on public outreach and communication can be found in Chapter 11.

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~~Plan revisions.

10. Implementation Plan

Groundwater Sustainability Plan (GSP) implementation generally consists of ~~four~~ five categories of activities:

- GSA Administration and Public Outreach
- Monitoring and Data Management
- Annual Reporting
- Plan Evaluation (5-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 groundwater sustainability agency (GSA) administration is not addressed explicitly in the GSP Emergency Regulations (Regs). Much of the work to implement portions of the GSP (e.g. monitoring and projects and management actions) ~~will~~ 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 GSA shoulders is public outreach. The level of effort needed from GSA staff depends greatly on the details of public outreach discussed in Chapter 11. In addition to the public outreach performed during GSP development, the Regs (§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 Regs are presented here for awareness by GSA staff to refine this chapter and understand the level of effort and expense that ~~may~~ will be required for this component of GSP implementation. Decisions will need to be made regarding whether the Big Valley Advisory Committee (BVAC) continues as a functioning body after completion of the GSP, and if the BVAC continues what role they take and how often they meet will determine the level of GSA staff effort to facilitate BVAC meetings and activities.

10.2 GSP Annual Reporting

According to §356.2 of the Regulations, the Big Valley Groundwater Sustainability Agencies (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 Water Year (WY), which will be WY 2021 (October 1, 2020 to September 30, 2021). 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 regulations. The Annual Report will establish the ~~current~~ historic conditions of groundwater within the Big Valley Groundwater Basin (BVGB or Basin), the status of the Groundwater Sustainability Plan (GSP) implementation, and the trend towards maintaining sustainability. ~~While~~ Unfortunately, while conditions won't differ significantly from when the GSP was developed, the GSAs ~~will~~ 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[53]
  - Run water budget for the water year and generate estimates of:
    - Groundwater extractions.
    - Surface water supply.
    - Total water use.

[53] This includes precipitation and reference evapotranspiration (ETo) from CIMIS and streamflow data from CDEC, BVWUA, Brookfield Energy, and other sources.

- ❖ Assemble and write annual report, of the estimates and assumptions.
- ❖ Upload report and data to state website, of the estimates and assumptions.

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 water year (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 ~~preceding~~ water year being reported along with a graphical representation of the conditions. A water year 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[54] pumping generated from the water budget
- Assumed Surface Water Supply – data from surface water supplies to irrigation demand[55], conveyance losses, and groundwater recharge, generated from the water budget
- 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 progress of the Plan since the previous report, including progress in maintaining measurable objectives and status of projects and management actions.

[54] This includes both in-basin industries as well as fire, wildlife, logging, and construction (which use both surface and groundwater).

[55] Summer flows in the BVGB are 100% allocated under existing water rights.

10.3 Data Management System

The Regs 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 Regs 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 data management system 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[56] and stored in an Excel hydrograph spreadsheet tool. This tool will store the well information, water level data, water year 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.

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.

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)	SWRCB	eWRIMS	Excel Water Budget Tool
GIS Base Data[1]	GSAs	various	GIS Database

[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.

[56] 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.

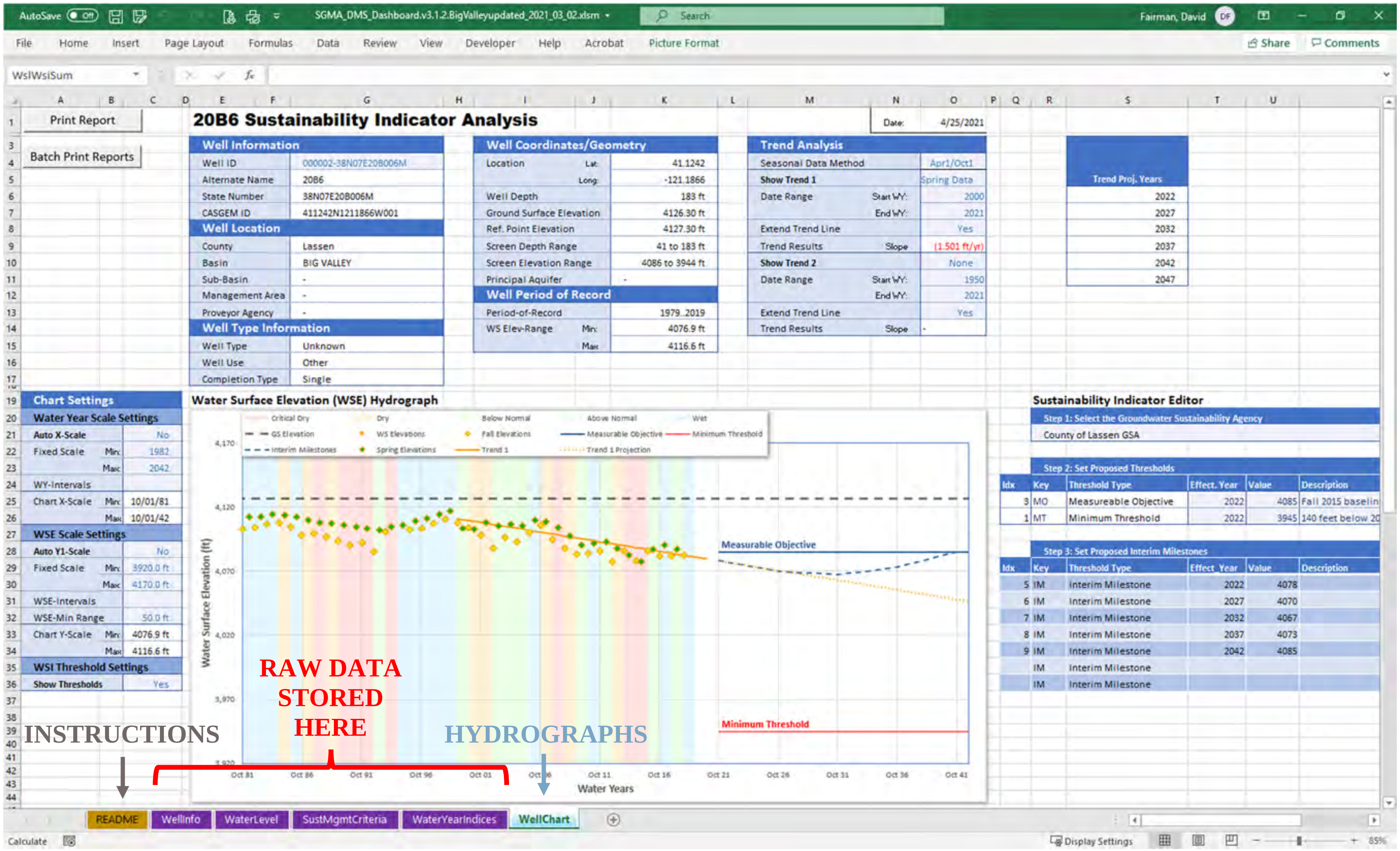
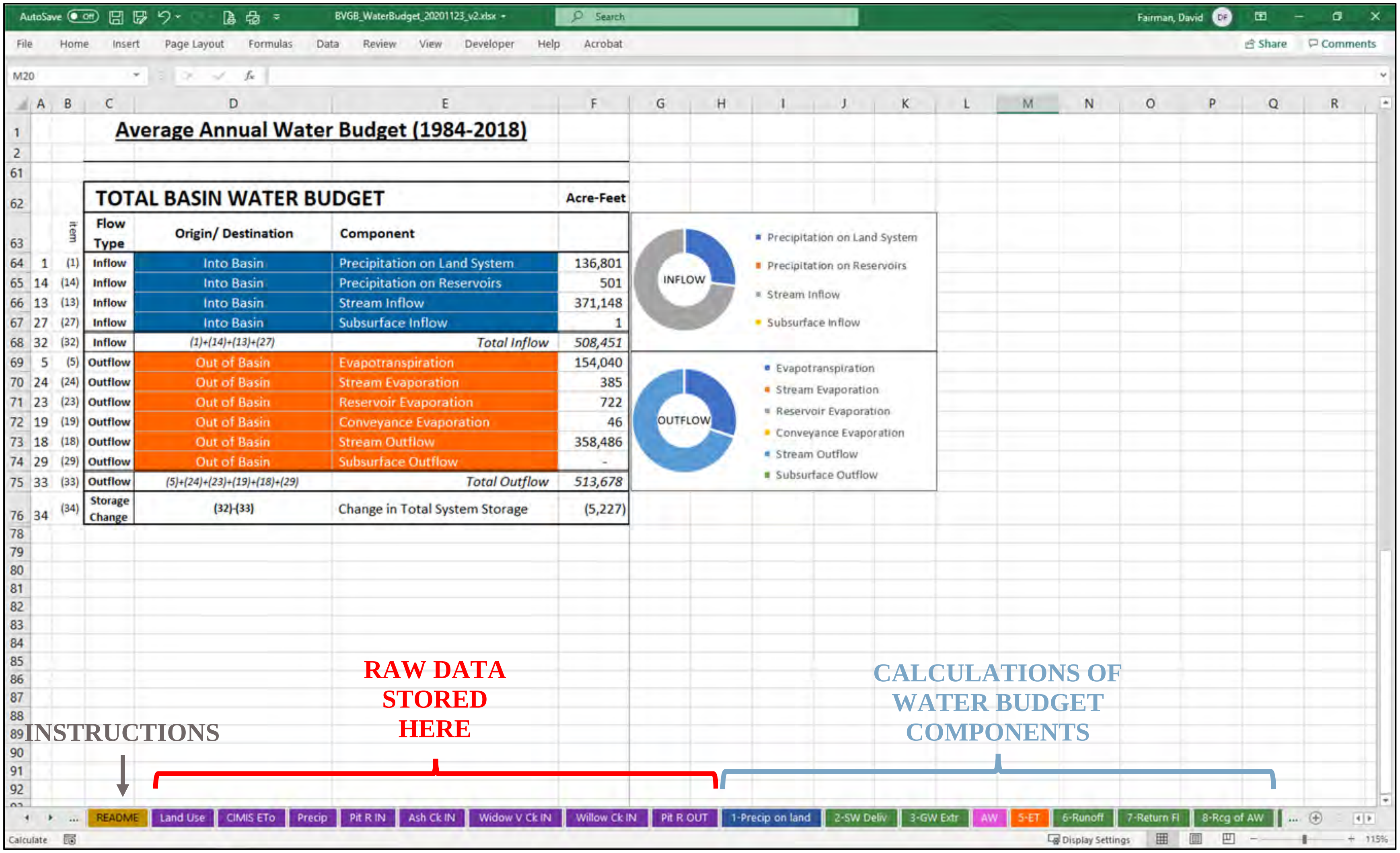


Figure 10-1 Excel Water Level Tool



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

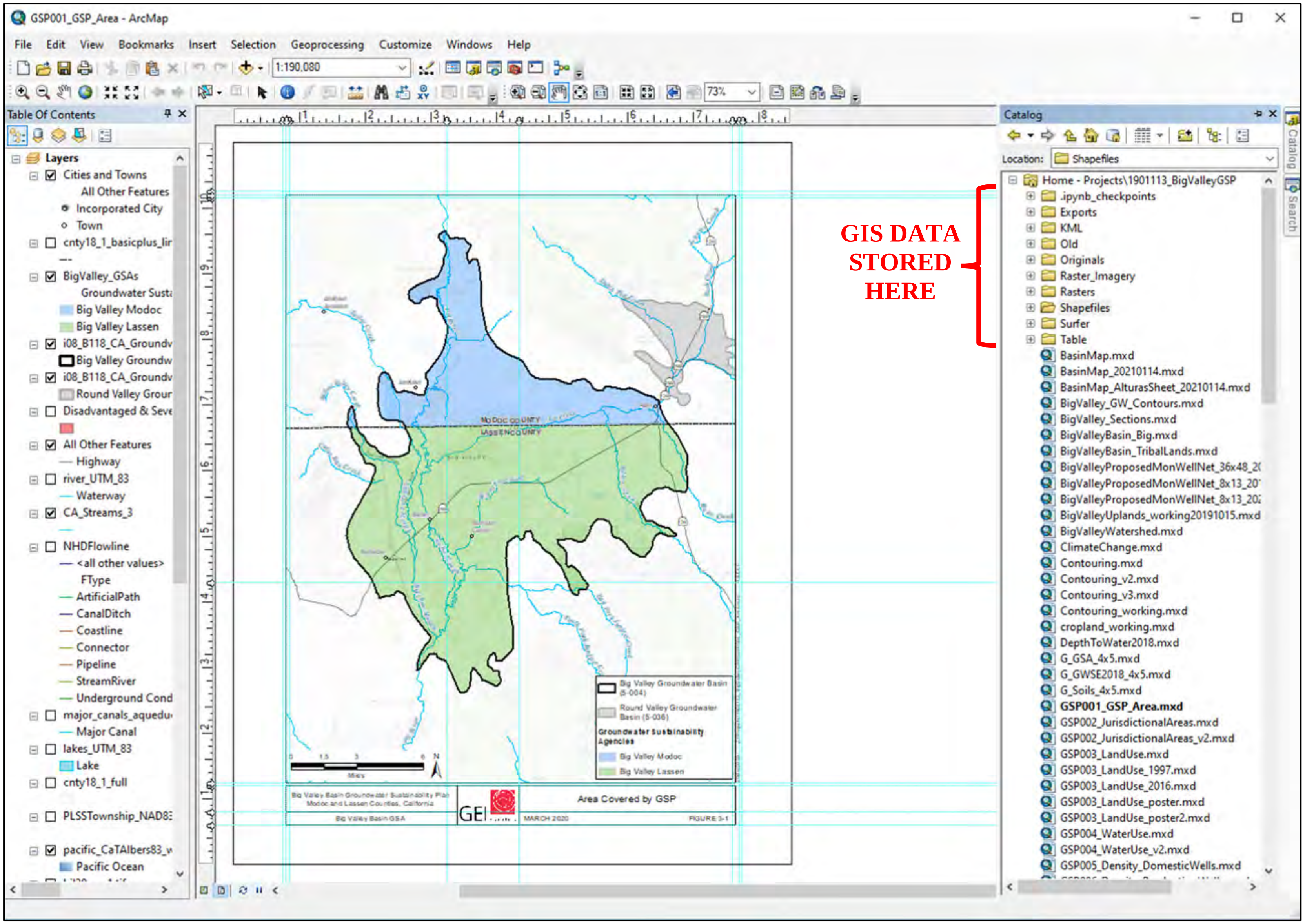


Figure 10-3 GIS Database

10.3.2 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 Resources Control Board's (SWRCB's) GAMA groundwater system in 2026 to support the 5-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)	SWRCB	eWRIMS	Excel Water Budget Tool
Water Quality	SWRCB	GAMA	Data to be downloaded for 5-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

[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.

10.4 Periodic Evaluations of GSP (5-Year Updates)

Updates and amendments to the GSP can be performed at any time, but at a minimum the GSAs must submit an~~d~~ update and evaluation of the plan every five (5) years. (§356.4) While much of the content of the GSP will likely remain unchanged for these 5-year updates, the Regs 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

Similar to this first version of the GSP, the Basin Setting (Chapters 4 through 6) will need to be signed and stamped by a California Professional Geologist or Engineer.

10.5 Implementation Schedule

Figure 10-5 shows the implementation schedule. Schedules for individual projects are still under development in Chapter 9.

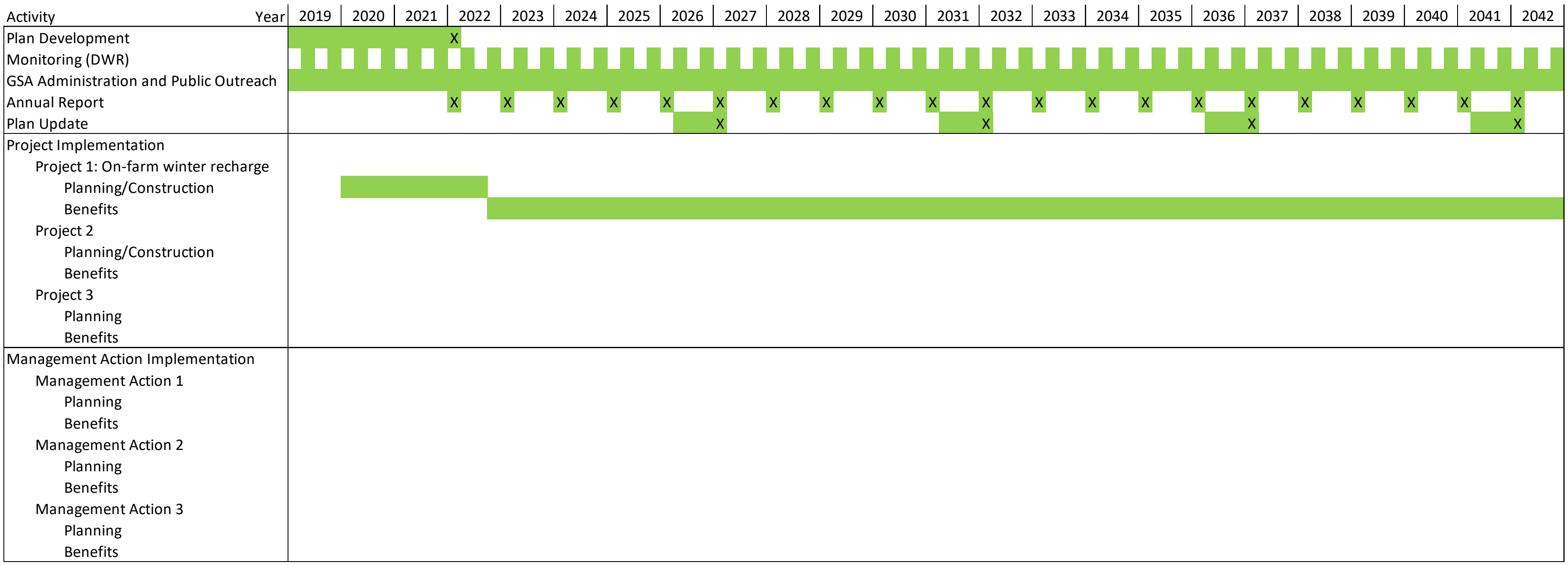


Figure 10-4 Implementation Schedule

10.6 Cost of Implementation

The legislation~~DWR gives~~ 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 (5-year updates)
- Projects and Management Actions

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~~ mandated~~ requirements 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. (See Section 10.6 below) For costs that must be borne by the GSAs, efficient implementation methods while still meeting the 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 this GSP.

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 Plan as required by

§354.10(d)(4) of the Regs. Coordination activities would include ensuring monitoring is performed, developing and/or coordinate the development of annual reports and 5-year updates, and coordinating projects and management actions. 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 (see Section 10.6).

In other GSPs already submitted, 21 itemized GSA administration and their estimates ranged in cost from $51,000 to over $1.5 million 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 more stakeholder groups. This cost for Big Valley could vary depending on the nature of public outreach written in the Plan.

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 $1 million 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 of $15,000.

DWR staff currently measures water levels in the Basin and posts them on their website and has indicated that they will continue to do so for the foreseeable future and 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 of $25,000. Annual reports have substantial requirements and assembling the data, processing, and generating the necessary charts, maps, and tables described in Section 10.2. 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. The level of effort and cost will be reduced over the course of the first few years, but an initial estimate of $25,000 for developing an annual report, then dropping to perhaps about $10,000, if the annual report is developed, written, and submitted by GSA staff, this would equate to about 200 staff-hours.

10.6.4 Plan Evaluation (5-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 $1.4 million with a median 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 3-6) is typically performed on a basin-wide basis. ~~Therefore, the basins that are estimating on the low end won't have to bear some of the cost the Big Valley will have to because Big Valley will have to update the basin setting.~~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.

10.6.5 Projects and Management Actions

Costs of projects and management actions are addressed in Chapter 9. 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 summarizes the cost estimates of annual and 5-year updates discussed above. When the GSAs seek outside funding, the costs will be put out to bid to ensure the reasonableness of the costs.

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, 5-year updates and particularly projects and management actions are good candidates for outside funding. Some of this outside funding that currently exists could through the DWR Prop 1 grants obtained by the North Cal-Neva Resource Conservation & Development Council (North Cal-Neva) and Modoc County could potentially be leveraged to support annual reporting in the next year or two. This depends on the degree that there is 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.

The entire BVGB is 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. 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 Resources Control 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 California Department of Fish and Wildlife 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 (WIFIA), Water Infrastructure Improvement for the Nation Act (WIIN), and the U.S. Department of the Interior, Bureau of 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).

Funding Mechanism		Description
	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

Sustainable Groundwater Management Act (SGMA) compliance, outreach, and communication efforts in the BVGB began before Groundwater Sustainability Plan (GSP) development. When SGMA was signed into law, local agencies in the Big Valley Groundwater Basin (BVGB or Basin) explored options for forming Groundwater Sustainability Agencies (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 Lassen-Modoc Flood Control and Water Conservation District (LMFCWCD) 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. 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** below.

Table 11-1 Pre-GSP Development Outreach Efforts

Date	Activity
Month 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
February 2019	GSP development started

11.2 Challenges of Developing GSP During COVID 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 Big Valley Advisory Committee (BVAC). Due to state ~~and county~~ 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 as well as 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 ~~a meaningful~~ the most effective way. However, the GSAs made the best of the circumstances and addressed all comments provided through the various means.

The GSAs identified the limitations of public participation due to COVID early on and wrote a letter to the governor (with copies to the leaders of state legislature) requesting an extension of the GSP submittal deadline. This initial letter was followed by 3 follow up letters requesting a response. Eventually, a response was received from the director of DWR stating that they had no latitude to move the January 31, 2022 deadline. No response was received directly from the Governor's office nor the legislature.

In February 2021, Assembly Member Devon Mathis introduced Assembly Bill 754 which would have extended the GSP deadline. The Lassen County Board of Supervisors sent a letter to Assembly committee leaders in support of the bill. The bill was passed by the State Assembly ~~and to date is still under consideration by the State Senate~~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 the Department of Fish and Wildlife which uses groundwater to supplement and maintain some habitat in the Ash Creek Wildlife Area 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 the county seats are distant from Big Valley. Both counties have engaged stakeholders through various processes and efforts, including Modoc County's groundwater committee, and Lassen County's GMP development and Basin Management Objectives program implementation, and the Big Valley Advisory Committee (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 (including Lassen County Waterworks District No. 1)
- California Department of Fish and Wildlife
- Surface Water User Groups (including Big Valley Water Users Association (BVWUA))
- Lassen-Modoc Flood Control and Water Conservation District (LMFCWCD)
- Modoc County Groundwater Advisory Committee

- Federal Agencies (including the U.S. Forest Service and Bureau of Land Management)
- Tribes (including the Pit River Tribe)
- California Department of Water Resources (DWR)
- North Cal-Neva Resource Conservation and Development Council (NCNRCDC)

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 Big Valley Advisory Committee 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 11C**.

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 on the GSP website. The survey is located at: https://www.surveymonkey.com/r/TQ9HCQK.

11.5.2 Website and Communication Portal

A website (https://bigvalleygsp.org) was deployed for GSP development to facilitate communication and track the communication in a database. The website was not meant to replace, but to enhance, outreach efforts. Tools of the website allowed the GSAs to communicate with interested parties. These tools include the following:

- **Calendar**. The website included 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 will be sent to interested parties using the e-blast tool. E-blasts helped 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 were available for public comment. A web form was available for anyone to submit comments on draft GSP documents. The form allowed the user to comment by page and line number stored the information for GSA review and response.

The web address was included on printed materials and announced at public meetings.

11.5.3 Community Flyers

Physical copies of flyers announcing upcoming public meetings were posted in heavily trafficked locations such as community centers, public buildings, local markets, and post offices.

11.5.4 Newspaper

All public meetings, including BVAC meetings were announced in the Lassen County Times, the Modoc Record, and the Mountain Echo.

11.5.5 Social Media

Information about GSP development and meeting announcements were made through Facebook social media, including informational posts on the County Farm Advisor's Devil's Garden Research and Education group and the Lassen County Information Group.

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 4-page informational brochure was developed, summarizing Chapters 1-6. This brochure was distributed on the website, through email, and at public meetings. The brochure is included as **Appendix 11D**.

11.5.7 Big Valley Advisory Committee

The GSAs established the BVAC through a memorandum of understanding (MOU) to advise both Lassen and Modoc counties on GSP preparation. The goals of the BVAC, as stated in the MOU (**Appendix 1C**), include the following:

- Advise the two GSAs on the preparation of a Groundwater Sustainability Plan (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 Big Valley Groundwater Basin be maintained by the two GSAs.
- Provide a recommendation to the GSA boards on whether to approve the GSP.

Membership of the BVAC was 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.
- 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 operated in compliance with the Ralph M. Brown Act (Brown Act). BVAC meetings were noticed and agendas posted according to the Brown Act. BVAC meetings were open to the public and allowed public comment, as much as possible given COVID 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 MOA 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.

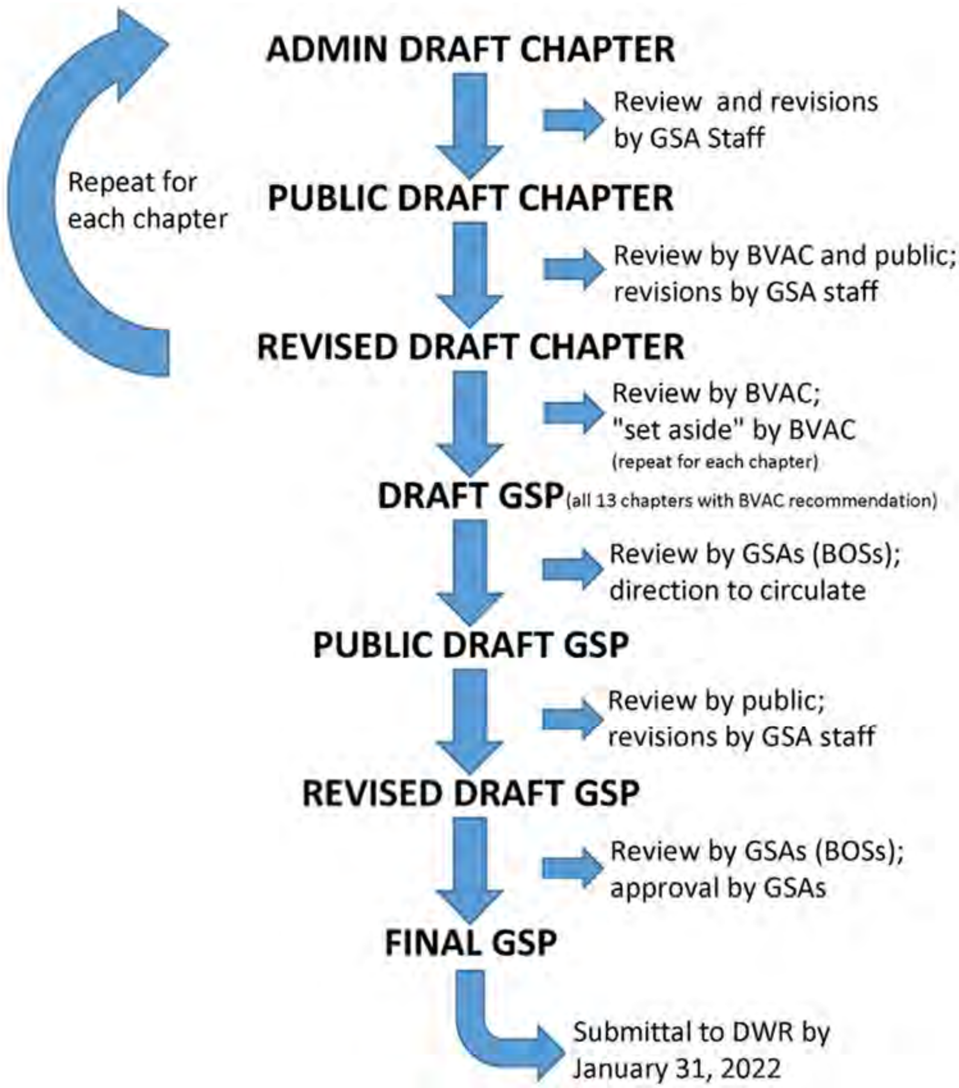


Figure 11-1 GSP Development Process

11.7 Comments and Incorporation of Feedback

All formal feedback on the GSP were documented both through the GSP website and from public meetings. The comments received, including how each comment was addressed is included in **Appendix 11E**.

11.8 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 making recommendations to the GSA boards on whether to approve the GSP. 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.

12. References

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Bauder, T.A., Waskom, R.M., Sutherland, P.L., and Davis, J.G., 2014. Irrigation Water Quality Criteria. Fact Sheet No. 0.506. Colorado State University Extension. Available at: https://extension.colostate.edu/topic-areas/agriculture/irrigation-water-quality-criteria-0-506/.

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Appendix 1A   Background Information

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,

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

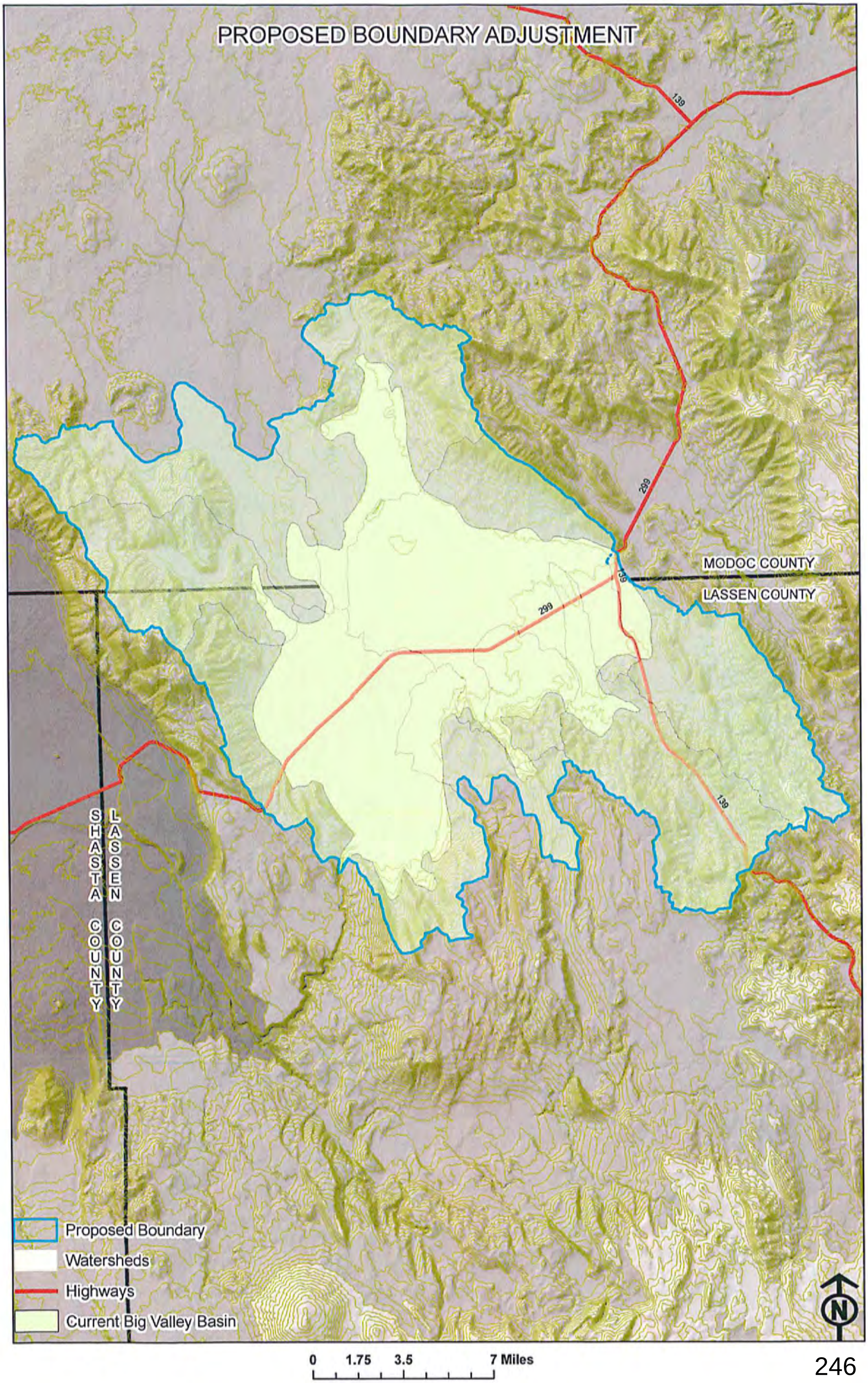
PROPOSED BOUNDARY ADJUSTMENT
139
299
MODOC COUNTY
LASSEN COUNTY
SHASTA COUNTY
LASSEN COUNTY
Proposed Boundary
Watersheds
Highways
Current Big Valley Basin
N
0 1.75 3.5 7 Miles

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

OFFICE OF COUNTY COUNSEL

ROBERT M. BURNS
Lassen County Counsel

221 SOUTH ROOP STREET, SUITE 2
SUSANVILLE, CA 96130-4339

☎ (530) 251-8334
FAX: (530) 251-2665

January 3, 2019

Trevor Joseph
Department of Water Resources
Sustainable Groundwater Management Office
P.O. Box 942836
Sacramento, CA 94236-0001

Re: 2018 SGMA Basin Prioritization Process and Results

Dear Mr. Joseph:

On August 8, 2018, a letter (attached) was sent to the Department of Water Resources (DWR) from both the Lassen County and Modoc County Board of Supervisors regarding the 2018 priority rankings for California groundwater basins. The letter was also submitted through the 2018 SGMA Basin Prioritization Public Comment Portal. The letter requested reconsideration of scores given to the Big Valley Groundwater Basin for Components 7 and 8, as well as further justification and clarification of the methodologies used.

In emails dated November 2, 2018 (attached), Ian Espinoza, DWR Engineering Geologist, informed Gaylon Norwood, Lassen County Assistant Planning Director, that all comments received would be considered and that he was not aware of any response to the Boards' comments prepared by DWR. Mr. Espinoza also informed Mr. Norwood that DWR is not obligated to respond to comments, but that an updated process will be applied to all basins if comments concerning the process used in the 2018 SGMA Basin Prioritization are determined to be appropriate.

If it has been determined as appropriate by DWR to apply any updated processes to basin rankings based on comments received, please inform Lassen County on how to obtain information on these changes and their results. However, regardless of any change to process, Lassen County is still requesting justification and/or clarification as to methods used to arrive at the priority rankings. As considerable time was spent evaluating the 2018 ranking system and preparing comments and questions for DWR, it is Lassen County's position that a response by DWR addressing said questions is warranted.

Therefore, in accordance with and pursuant to the California Public Records Act, please consider this letter as a request for all documents prepared by DWR related to the prioritization of the Big Valley Groundwater Basin as a medium priority basin, as well as any documents related to subsequent reconsideration or affirmation of this decision. We look forward to your response within the next ten days.

Sincerely,

Robert M. Burns
County Counsel

cc: Lassen County Board of Supervisors
Modoc County Board of Supervisors
Ian Espinoza, Department of Water Resources

County of Lassen
ADMINISTRATIVE SERVICES

CHRIS GALLAGHER
District 1
DAVID TEETER
District 2
JEFF HEMPHILL
District 3
AARON ALBAUGH
District 4
TOM HAMMOND
District 5

Richard Egan
County Administrative Officer
email: ...

Julie Morgan
Assistant to the CAO
email: jmorgan@co.lassen.ca.us

Regina Schaap
Executive Assistant to the CAO
email: ...

County Administration Office
221 S. Roop Street, Suite 4
Susanville, CA 96130
Phone: 530-251-8333
Fax: 530-251-2663

RECEIVED
AUG 15 2018
Lassen County Department of Planning and Building Services

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

Gaylon Norwood

From:	Espinoza, Ian@DWR <Ian.Espinoza@water.ca.gov>
Sent:	Friday, November 02, 2018 1:58 PM
To:	Gaylon Norwood
Cc:	Boyt, Jessica@DWR; Ehorn, Bill@DWR
Subject:	RE: comments on Big Valley prioritization

Hi Gaylon,

- DWR will consider all comments received, including comments submitted by Lassen County.
- I am not aware of a response from DWR regarding comments received on basin prioritization by Lassen County.

-Ian

From: Gaylon Norwood [mailto:GNorwood@co.lassen.ca.us]
Sent: Friday, November 2, 2018 1:13 PM
To: Espinoza, Ian@DWR <Ian.Espinoza@water.ca.gov>
Cc: Boyt, Jessica@DWR <Jessica.Boyt@water.ca.gov>; Ehorn, Bill@DWR <Bill.Ehorn@water.ca.gov>
Subject: RE: comments on Big Valley prioritization

Ian:

I want to confirm that I understand you correctly. I understand you to say that DWR did (is) consider(ing) all the comments, including the comments submitted by Lassen County. However, DWR is not obligated to respond to specific comments and did not prepare a specific written response to the comments submitted by Lassen County. Is this correct?

In simple language, I just need to know if there is a written response to our comments or not, I understand that you are not required to respond. If there is not a response, I will the Board know that. If there is a response, I would like to see it.

Thank you.

Sincerely,

Gaylon F. Norwood
Assistant Director of Planning
and Building Services
Lassen County
707 Nevada Street Suite 5
Susanville, CA 96130
(530) 251-8269
Fax: (530) 251-8373

From: Espinoza, Ian@DWR [mailto:Ian.Espinoza@water.ca.gov]
Sent: Friday, November 02, 2018 12:51 PM
To: Gaylon Norwood <GNorwood@co.lassen.ca.us>
Cc: Boyt, Jessica@DWR <Jessica.Boyt@water.ca.gov>; Ehorn, Bill@DWR <Bill.Ehorn@water.ca.gov>
Subject: RE: comments on Big Valley prioritization

Hello Gaylon,

DWR will consider comments received but is not obligated to respond to them. Please see the below excerpt from DWR's Basin Prioritization FAQ for more info on this process:

'DWR will consider all comments received during the public comment period while finalizing the 2018 SGMA Basin Prioritization results. DWR will evaluate any data provided during the public comment period to determine whether it is consistent with processes and datasets used in the evaluation, and may use the data received to enhance the prioritization analysis. Comments concerning the processes or scope of the datasets used in the 2018 SGMA Basin Prioritization will also be evaluated and if the suggested changes are determined to be appropriate, then the updated process or datasets will be applied to all basins."

Please let me know if you have any questions,

Best,
Ian

Ian Espinoza
Engineering Geologist
Groundwater & Geologic Investigations Section
Department of Water Resources
2440 Main St.
Red Bluff, CA 96080
Phone: (530) 529-7330
Email: ian.espinoza@water.ca.gov

From: Boyt, Jessica@DWR
Sent: Friday, November 2, 2018 11:36 AM
To: Gaylon Norwood <gnorwood@co.lassen.ca.us>
Cc: Espinoza, Ian@DWR <Ian.Espinoza@water.ca.gov>
Subject: Re: comments on Big Valley prioritization

Ian,

Can you direct or help Gaylon on this.

Thanks

Get Outlook for Android

From: Gaylon Norwood <GNorwood@co.lassen.ca.us>
Sent: Friday, November 2, 2018 10:46:04 AM
To: Boyt, Jessica@DWR
Subject: comments on Big Valley prioritization

Jessica:

I'm hoping that you can help me or direct me to the appropriate person. I am being asked about comments the Lassen County Board of Supervisors submitted on the recent basin prioritization for Big Valley (basically it was already and it stayed a medium priority basin). I am being asked if there has been a response from DWR to the comments that Lassen

County submitted on the ranking. It does not appear that DWR has commented. If DWR is not going to comment, I just need to confirm this so I can let the Board know.

Thanks you and I really appreciate it.

Sincerely,

Gaylon F. Norwood
Assistant Director of Planning
and Building Services
Lassen County
707 Nevada Street Suite 5
Susanville, CA 96130
(530) 251-8269
Fax: (530) 251-8373

R000019-011519 - Public Records Request

Message History (3)

On 2/6/2019 1:24:31 PM, CALIFORNIADWR Support wrote:

RE: PUBLIC RECORDS REQUEST of January 15, 2019, Reference # R000019-011519.

Dear Mr./Ms. Burns:

This is in response to your January 15, 2019 request, pursuant to the California Public Records Act, Government Code Section 6250 et seq. to the Department of Water Resources (DWR) regarding:

"Requesting all documents prepared by DWR related to the prioritization of Big Valley GW Basin as a medium priority basin, as well as any related to subsequent reconsideration or affirmation of this decision."

Please sign into the Public Records Request Portal to access your account. Use the reference number you were provided to retrieve the records which DWR has determined are fully responsive to your request.

Sincerely,

Public Records Act Team
Department of Water Resources

On 1/23/2019 2:14:59 PM, CALIFORNIADWR Support wrote:

RE: PUBLIC RECORDS REQUEST of January 15, 2019., Reference # R000019-011519.

Dear Mr./Ms. Burns,

This is in response to your January 15, 2019 request pursuant to the California Public Records Act, Government Code Section 6250 et seq. to the Department of Water Resources (DWR) regarding:

"Requesting all documents prepared by DWR related to the prioritization of Big Valley GW Basin as a medium priority basin, as well as any related to subsequent reconsideration or affirmation of this decision."

It has been determined that DWR maintains records responsive to your request, however, DWR anticipates these records may require a significant amount of time to locate, assemble and review. DWR is presently collecting and reviewing these records and estimates that these materials can be made available by February 22, 2019.

Please note that every effort will be made to provide you with responsive records as soon as feasible.

Sincerely,

Public Records Act Team
Department of Water Resources

Comment ID	Comment summary	Final Project Comments
60a	See the attached letter from the Lassen County Board of Supervisors, who serve as the GSA for the Lassen County portion of the basin, and the Modoc County Board of Supervisors, who serve as the GSA for the Modoc County portion of the basin.	No Action, Not an actionable sub-comment
60b	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.	Action - Used the same process used in the 2014 CASGEM BP; all declines are treated the same. No changes for basin.
60c	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.	No Action - Process already accounts for differences between basins. All MCL levels are calibrated by the Waterboard to be equal. The BP process used different scores or points to represent magnitude and unique public wells (distribution) and are totaled. Component 7.d points assigned to the basin are based on total For more detailed information, please see reference document "Process and Results Document ccovering the SGMA 2018 Basin Prioritization" covering component 7.d (WQ) See commnet 99b for more details on WQ
60d	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 Modac GSAs would like to request the points associated with this portion of the scoring criteria be reconsidered.	Action - Removed the comment and points. See also 99c
99a	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 comse 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 thet-efore we would like to request DWR reconsider the points associated with this portion of the scoring criteria.	Action - Used the same process used in the 2014 CASGEM BP; all declines are treated the same. No changes for basin.
99b	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.	Process 7.d was modified in Phase 1 to: 1) reduce the total WQ points a basin can earn from 5 down to 3 2) Must have GREATER THAN 3 points after adding 7.a + b + c + d to be assigned one component 7 priority point. 3) For those basin between 2,000 and 9,500 AF, WQ alone will not be enough to trigger document impacts and thus causing the basin to potentially be a medium or high priority. Other basins has the potential to reduce their component 7 priority points by one.
99c	While DWR did apply their methodologies consistently for Components I through 7, they were not consistent with Component 8 and provided little justification in applying five (5) points to Big Valley Basin	Action - Removed the comment and points.

[Response to Lassen County's 1/15/19 Public Records Request - Received from the California Department of Water Resources on 2/6/19 through the DWR "Public Records Request Portal"]

Comment ID	Comment summary	Final Project Comments
60a	See the attached letter from the Lassen County Board of Supervisors, who serve as the GSA for the Lassen County portion of the basin, and the Modoc County Board of Supervisors, who serve as the GSA for the Modoc County portion of the basin.	No Action, Not an actionable sub-comment
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60d	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 Modac GSAs would like to request the points associated with this portion of the scoring criteria be reconsidered.	Action - Removed the comment and points. See also 99c
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[Response to Lassen County's 1/15/19 Public Records Request - Received from the California Department of Water Resources on 2/6/19 through the DWR "Public Records Request Portal"]

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, Chair
Modoc County Board of Supervisors

ATTEST:

Tiffany Martinez
Deputy Clerk of the Board

Appendix 2B MOU Establishing the Big Valley Groundwater Advisory Committee

CONTRACT
19-09

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. <u>Administrative</u>: 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. <u>Groundwater Sustainability Planning/SGMA Advice and Recommendations</u>: 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: Geri Byrne Rhoads 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 8 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 D 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: ________________ 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 2_ 2019
Modoc County Counsel

204 S. Court St Alturas, CA, 96101 (530) 233-6201

Modoc County Board of Supervisors
MINUTE ORDER

The following action was taken by the Modoc County Board of Supervisors on May 14, 2019:

13.a. Consideration/Action: Requesting approval and authorization for the Chair of the Board to sign an agreement between the County of Modoc and the North Cal Neva Resource Conservation and Development Council, Inc. not to exceed $33,920, effective December 5, 2018 through April 30, 2022. (Administrative Services)

Motion by Supervisor Byrne, seconded by Supervisor Coe approve and authorize the Chair of the Board to sign an agreement between the County of Modoc and the North Cal Neva Resource Conservation and Development Council, Inc. not to exceed $33,920, effective December 5, 2018 through April 30, 2022 with approval to work with County Counsel on the amendment of the insurance provisions of the contract. (Administrative Services)

Motion Approved:
RESULT: **APPROVED [UNANIMOUS]**
MOVER: Geri Byrne, Supervisor District V
SECONDER: Ned Coe, Supervisor District I
AYES: Ned Coe, Supervisor District I, Patricia Cullins, Supervisor District II, Kathie Rhoads, Supervisor District III, Elizabeth Cavasso, Supervisor District IV, Geri Byrne, Supervisor District V

STATE OF CALIFORNIA

COUNTY OF MODOC

I, Tiffany Martinez, Clerk to the Board of Supervisors in and for the County of Modoc, State of California, do hereby certify that the above and foregoing is a full, true and correct copy of an ORDER as appears on the Minutes of said Board of Supervisors dated May 14, 2019 on file in my office.

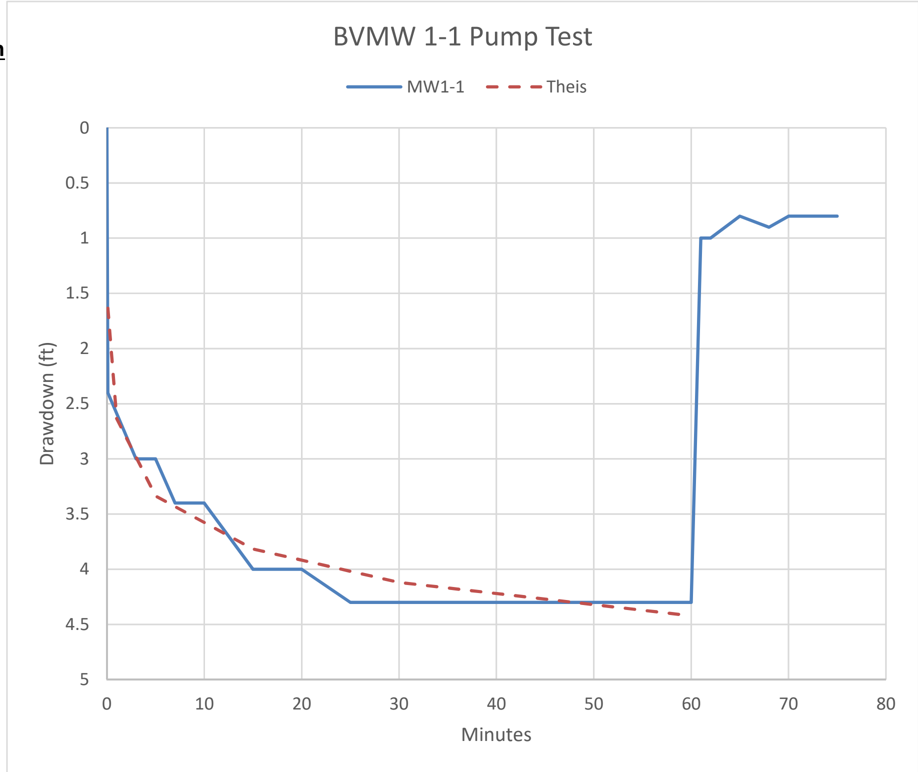
WITNESS my hand and the seal of the Board of Supervisors this 15th day of May 2019.

Tiffany A. Martinez
Clerk of the Board

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



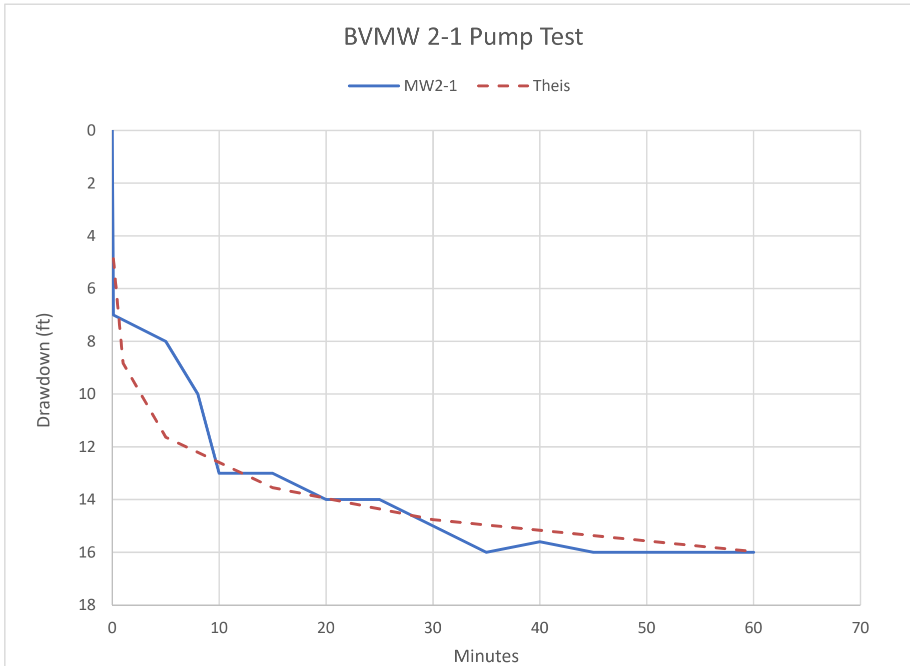
Theis Solution

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

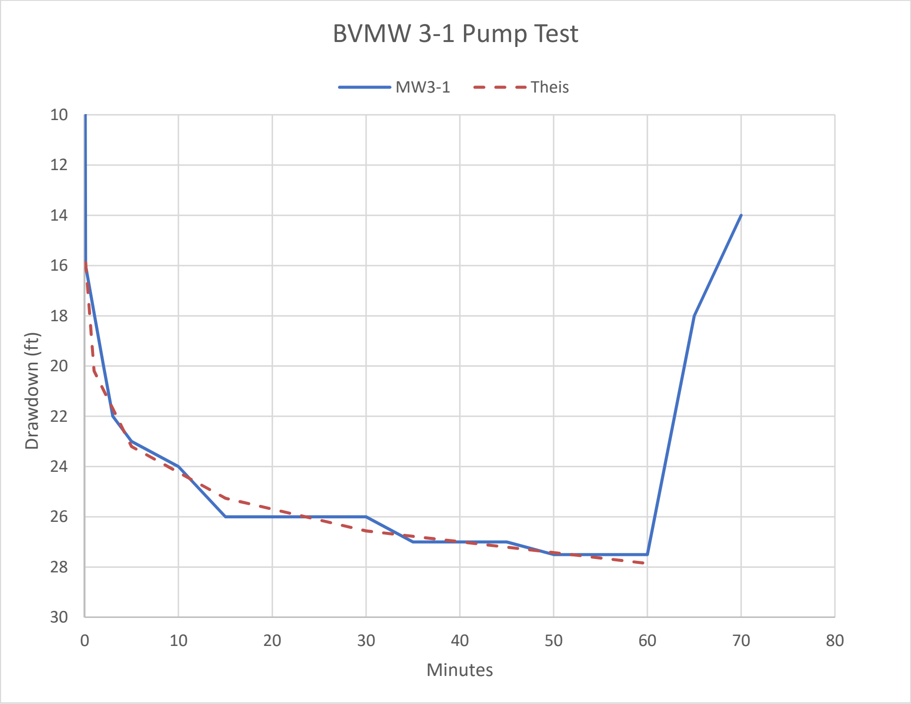


Theis Solution

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
10:15	55	45.5	27.5
10:20	60	45.5	27.5
10:25	65	36	18
10:30	70	32	14



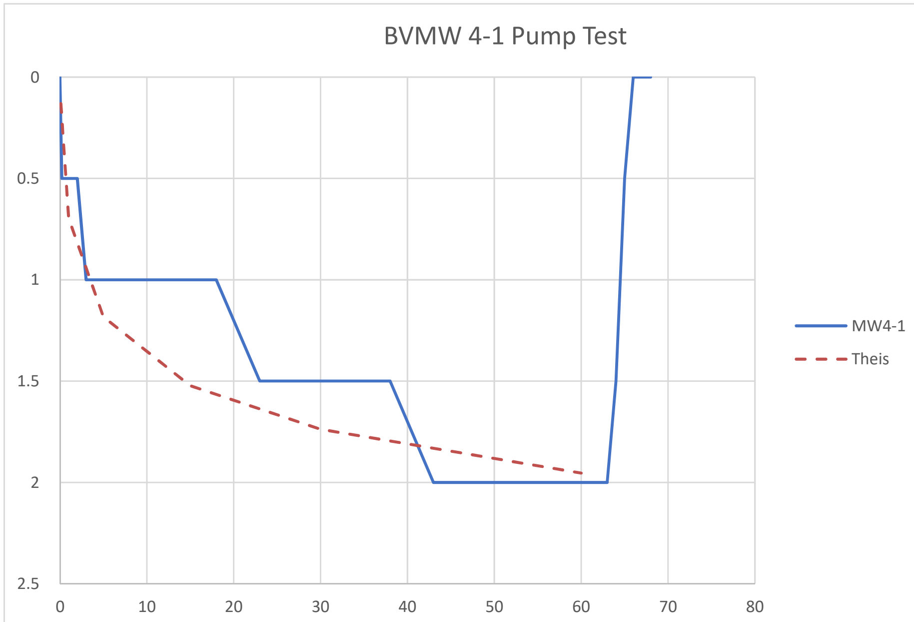
Theis Solution

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



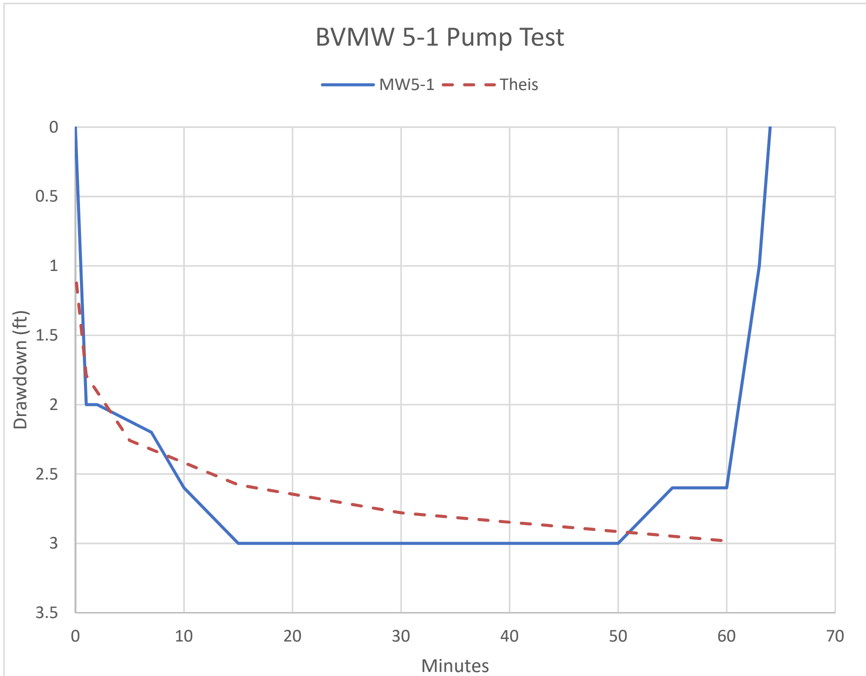
Theis Solution

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		-

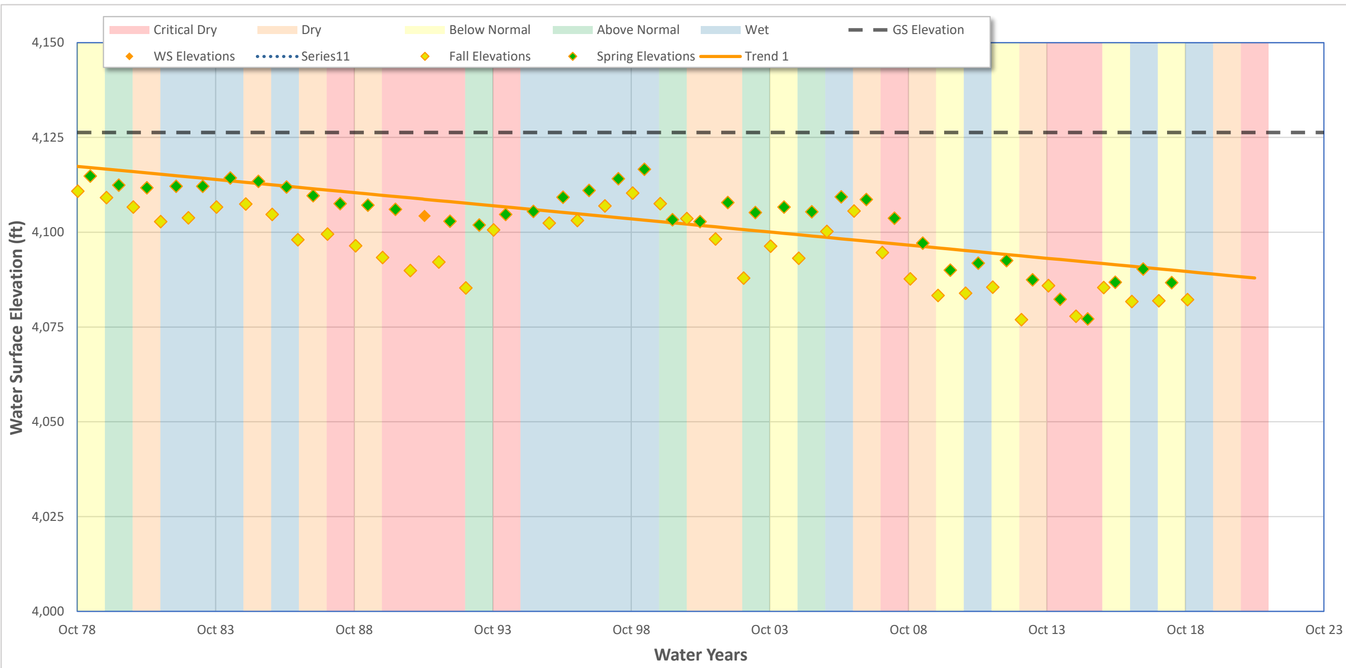
Well Period of Record

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

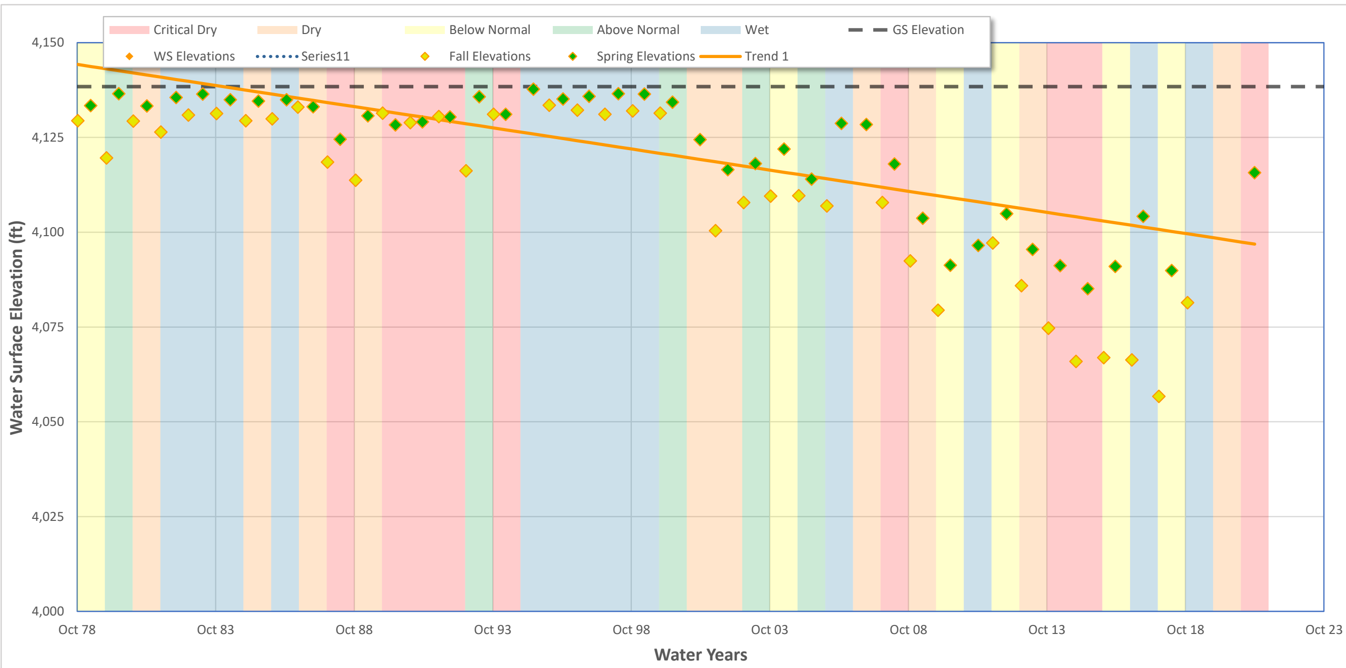
Well Period of Record

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

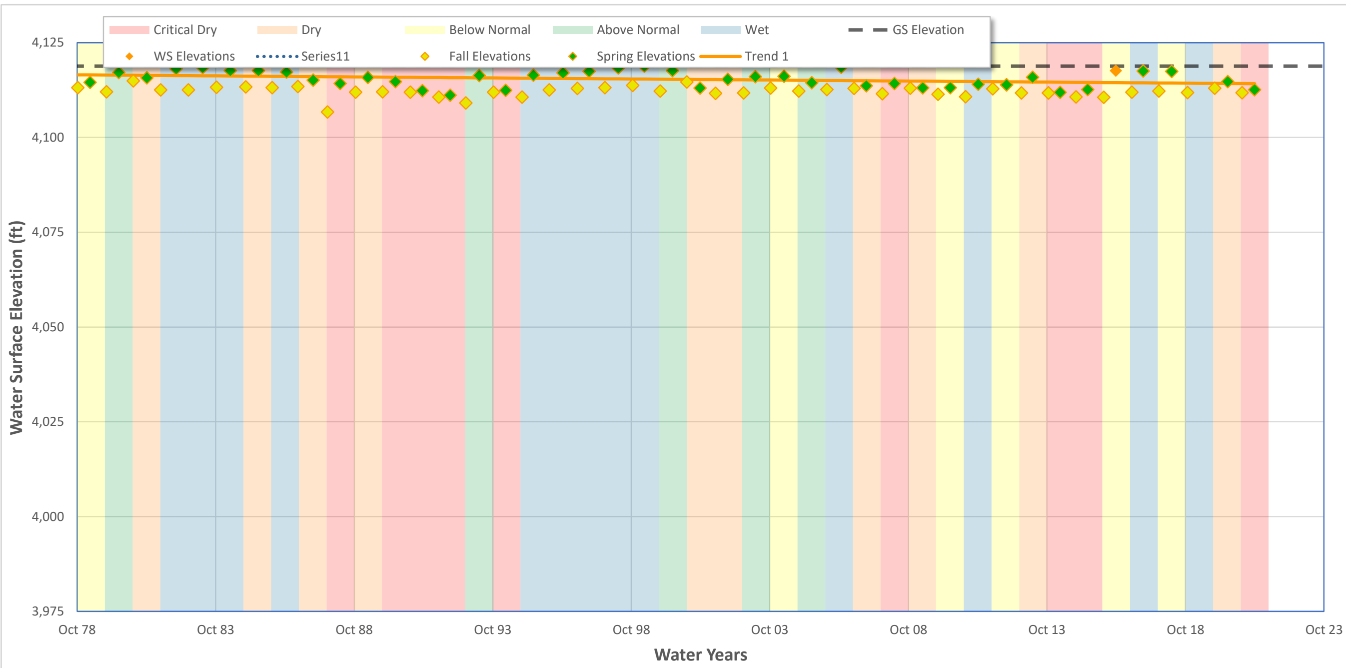
Date: 8/17/2021

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		-

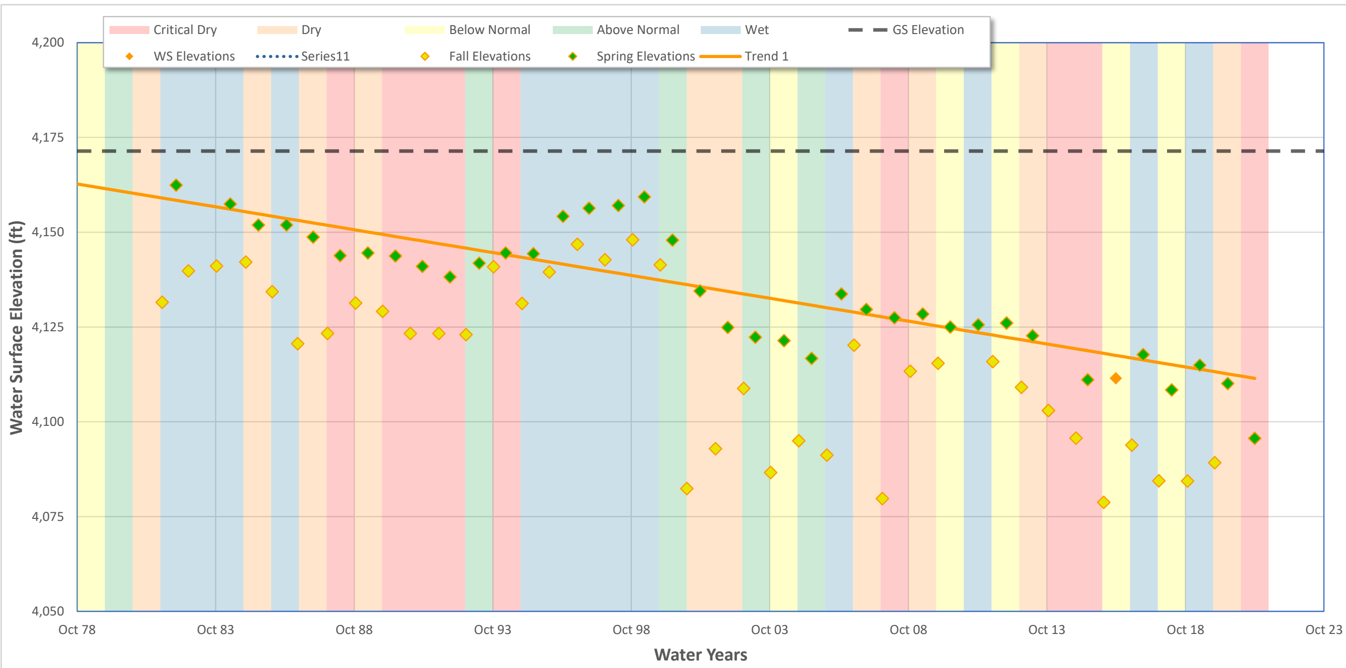
Well Period of Record

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

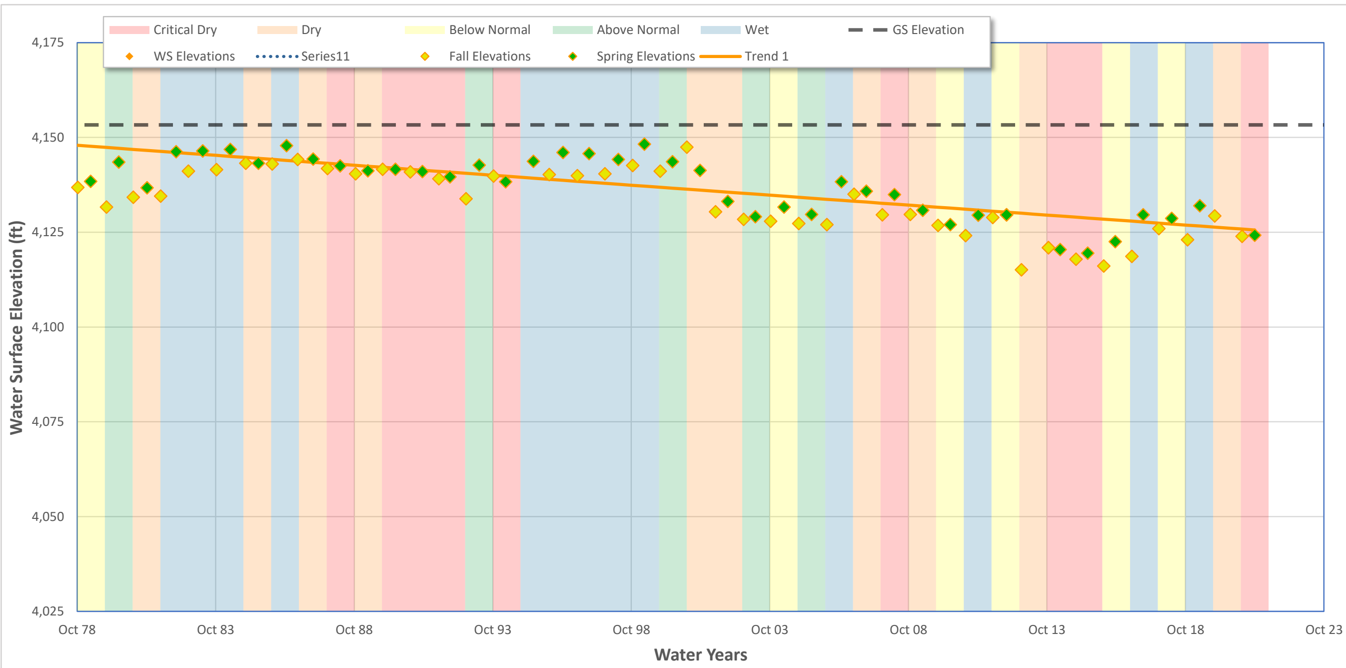
Date: 8/17/2021

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

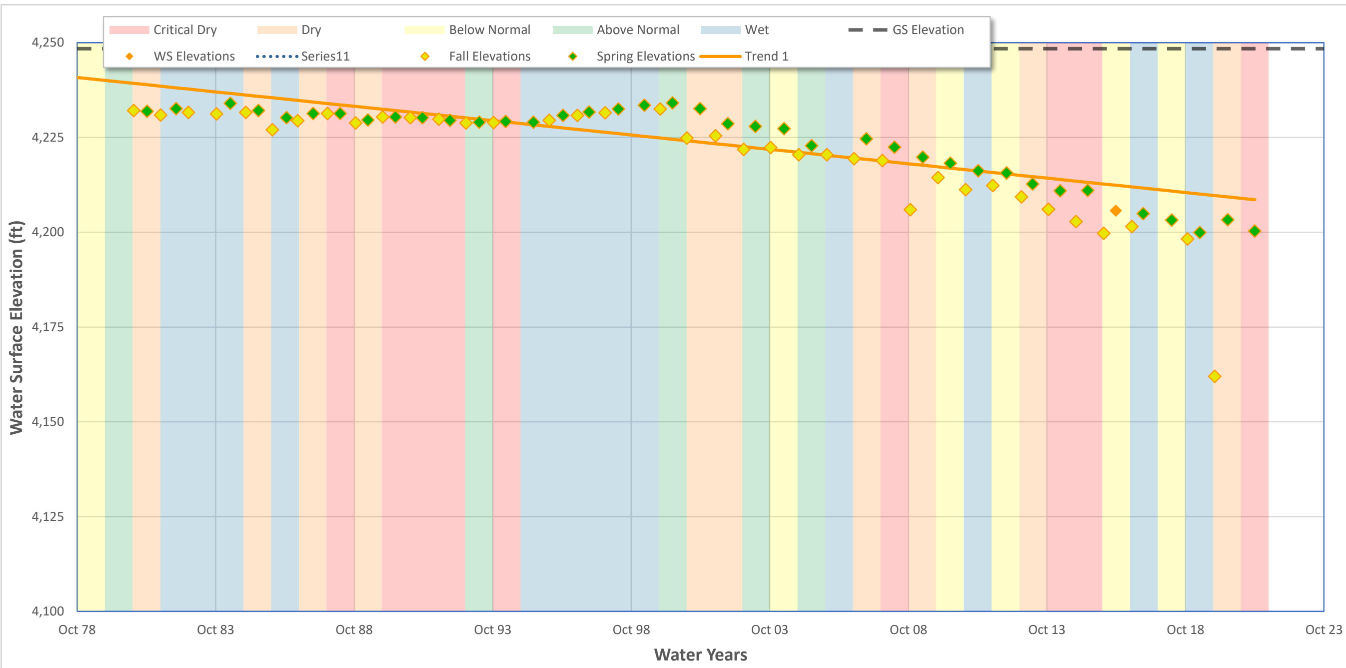
Date: 8/17/2021

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		-

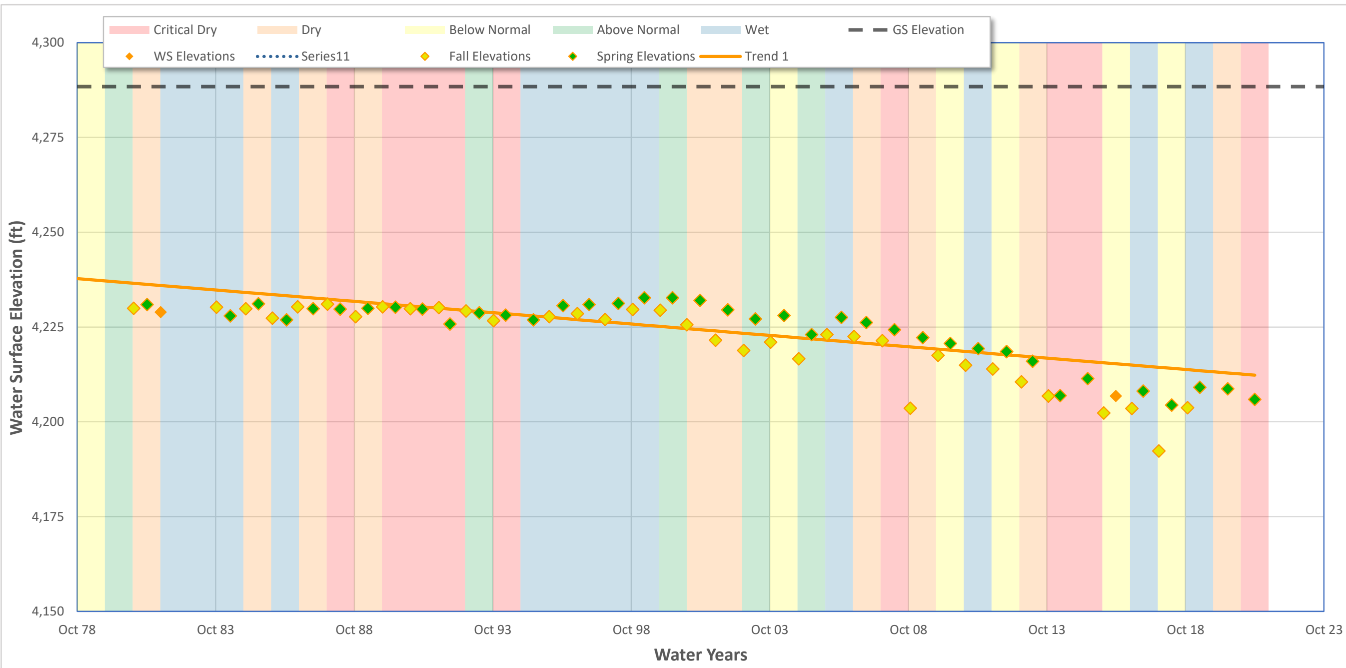
Well Period of Record

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

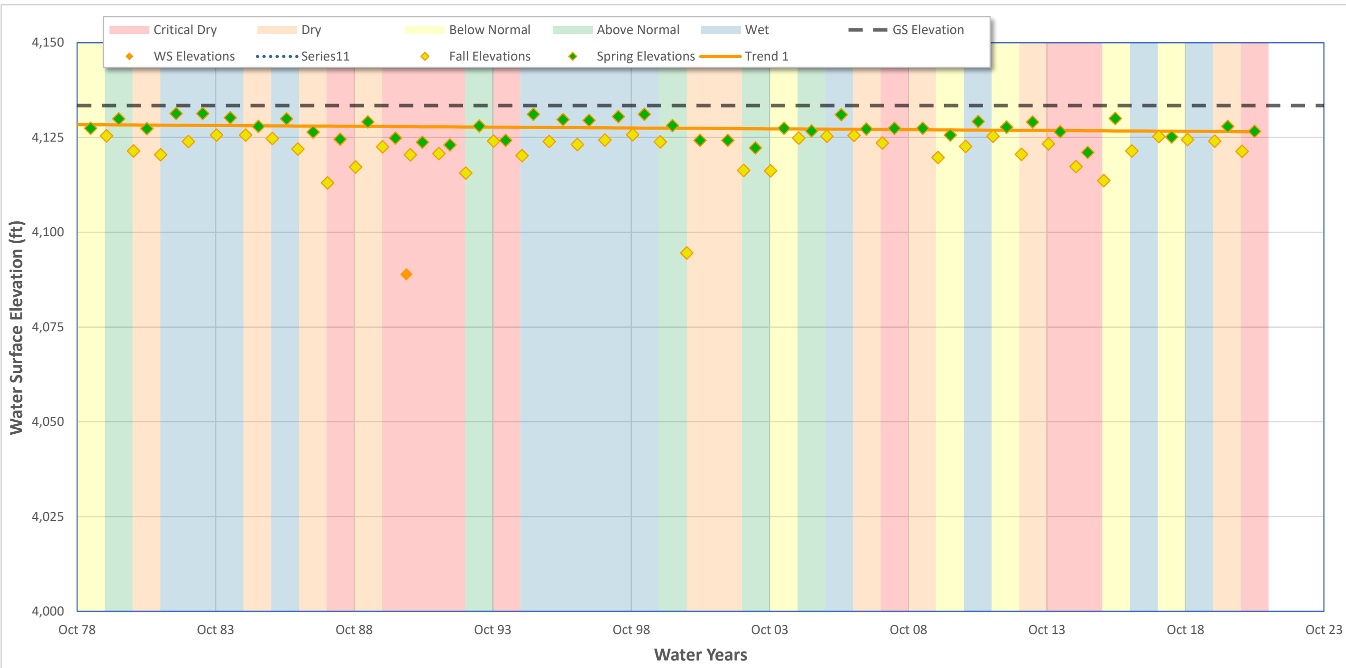
Date: 8/17/2021

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

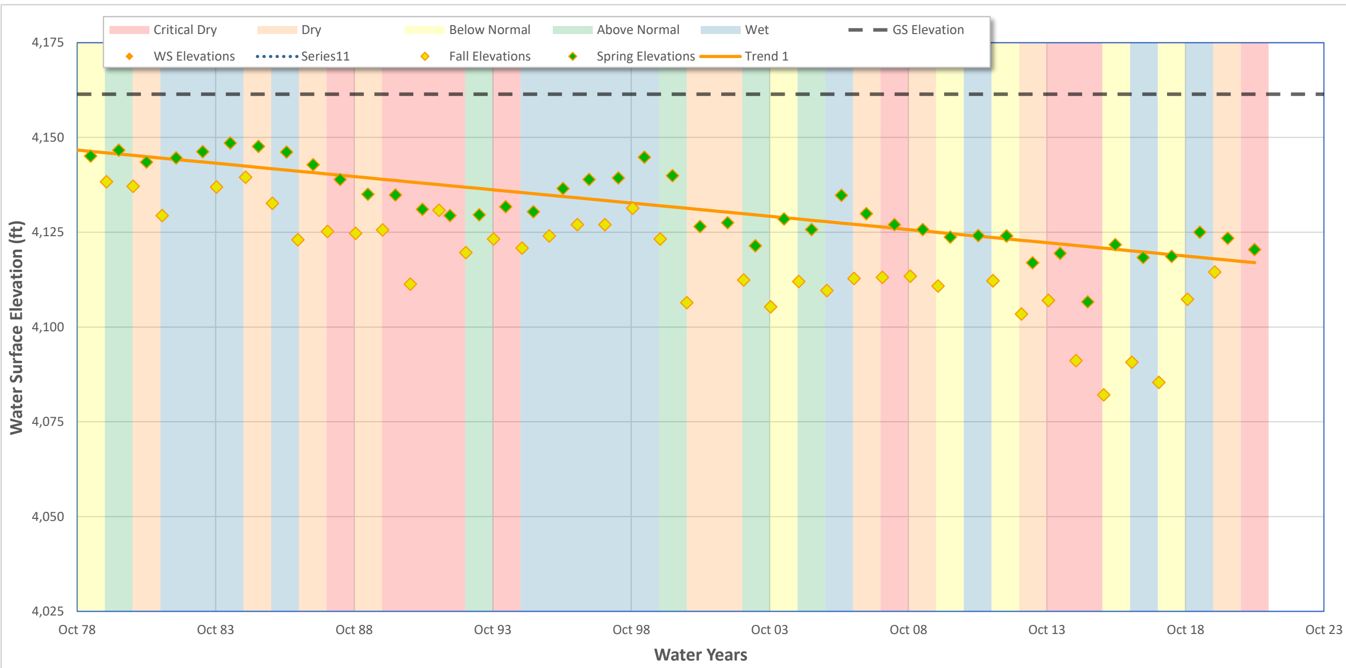
Well Period of Record

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

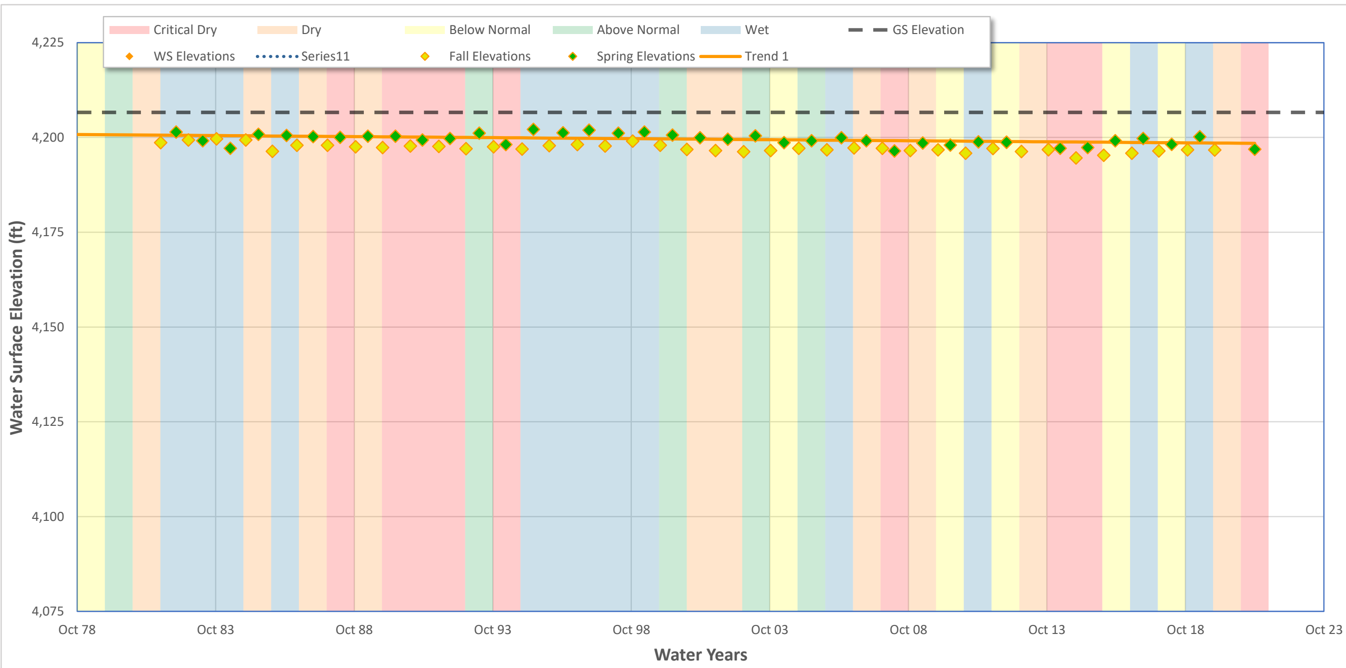
Date: 8/17/2021

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

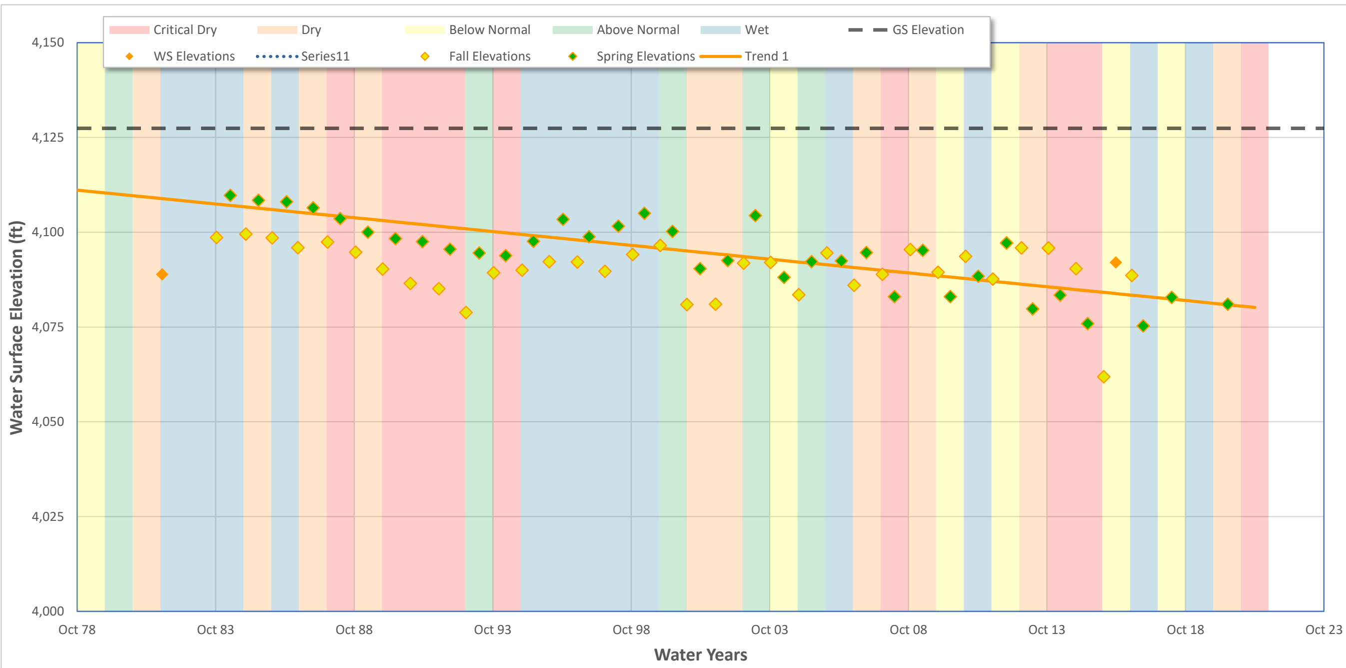
Date: 8/17/2021

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		-

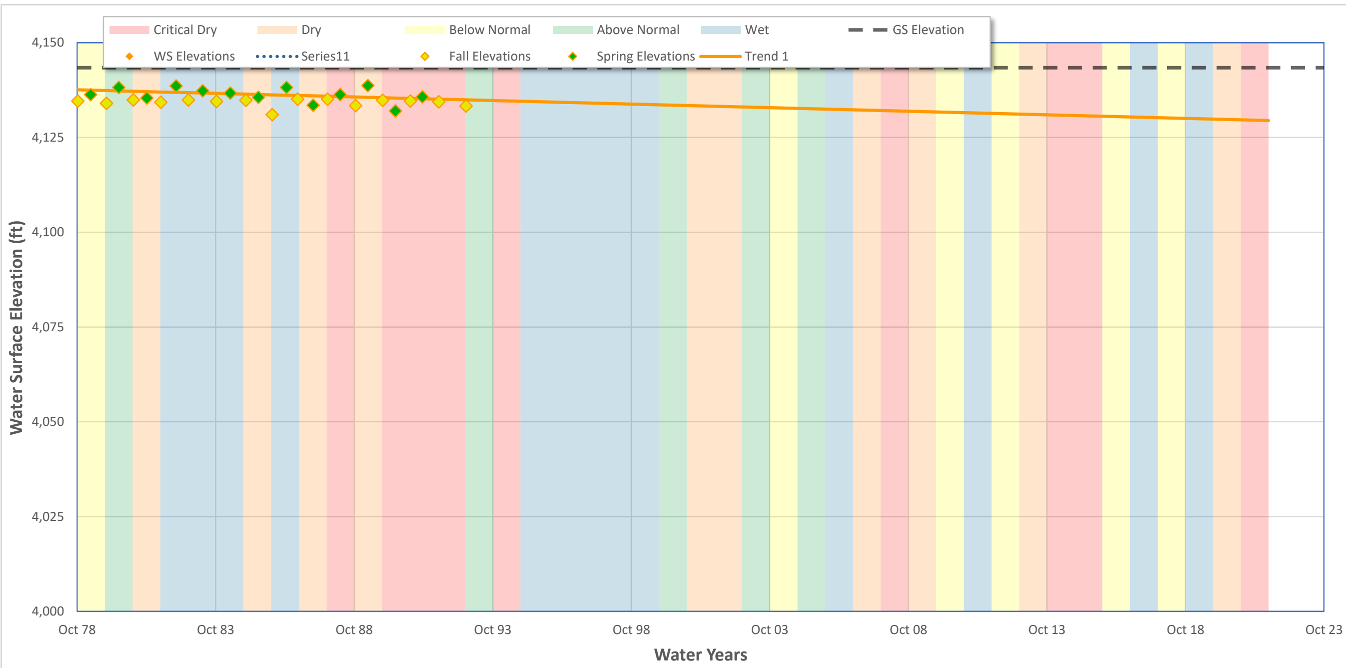
Well Period of Record

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		-

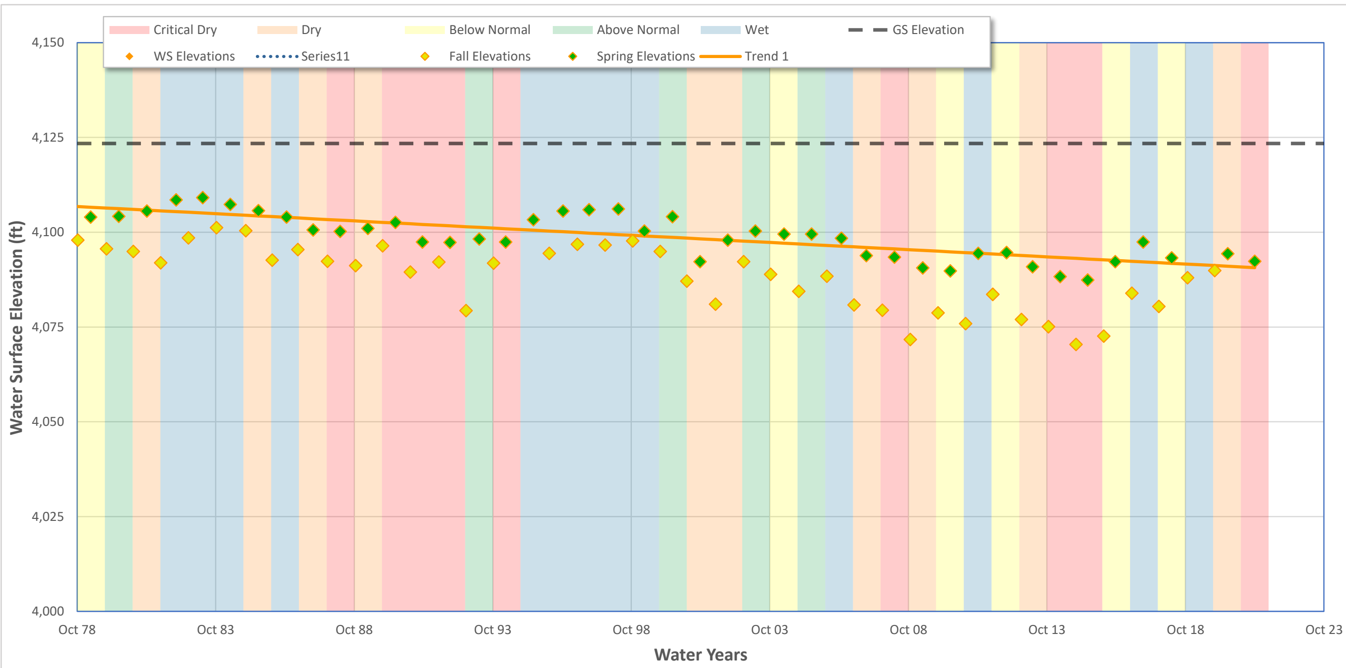
Well Period of Record

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

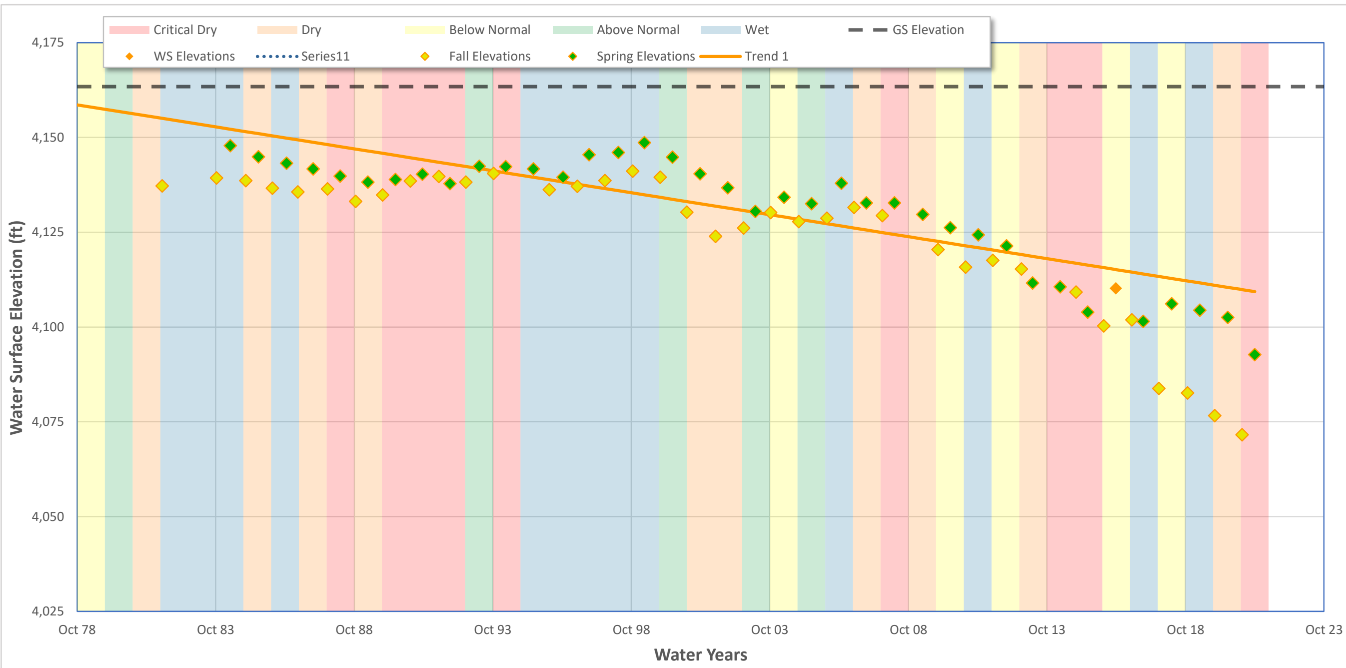
Date: 8/17/2021

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		-

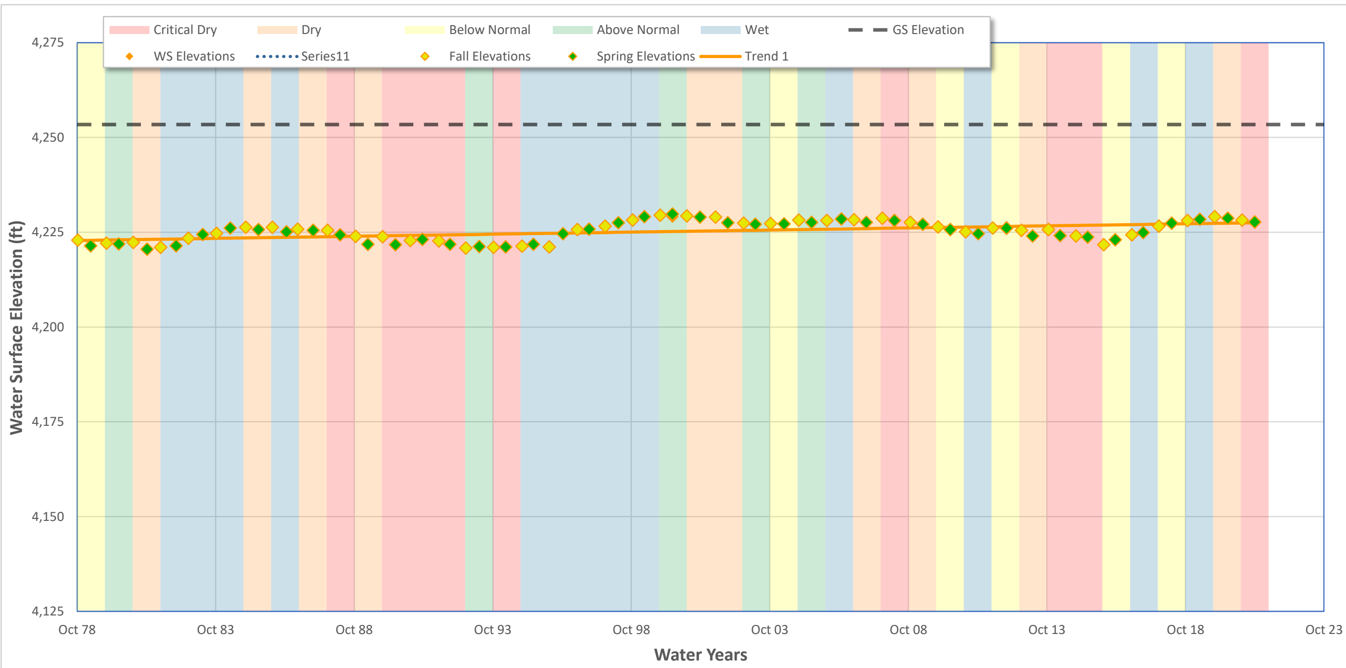
Well Period of Record

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		-

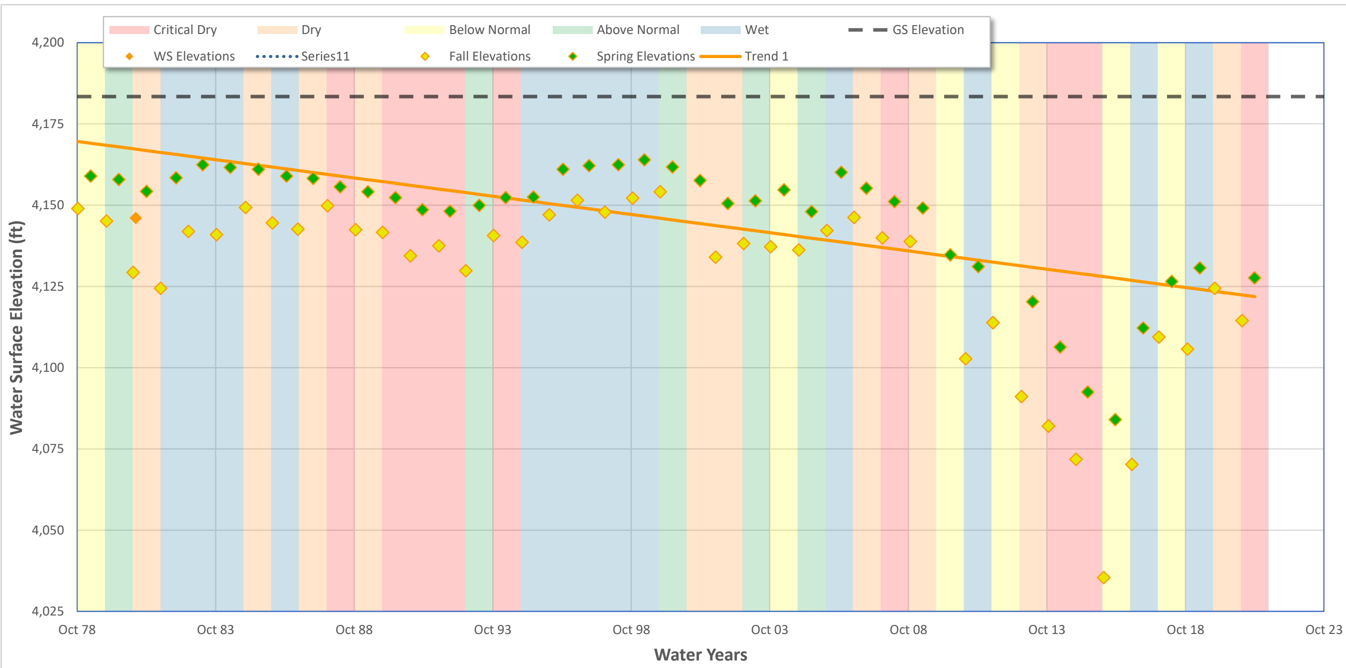
Well Period of Record

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

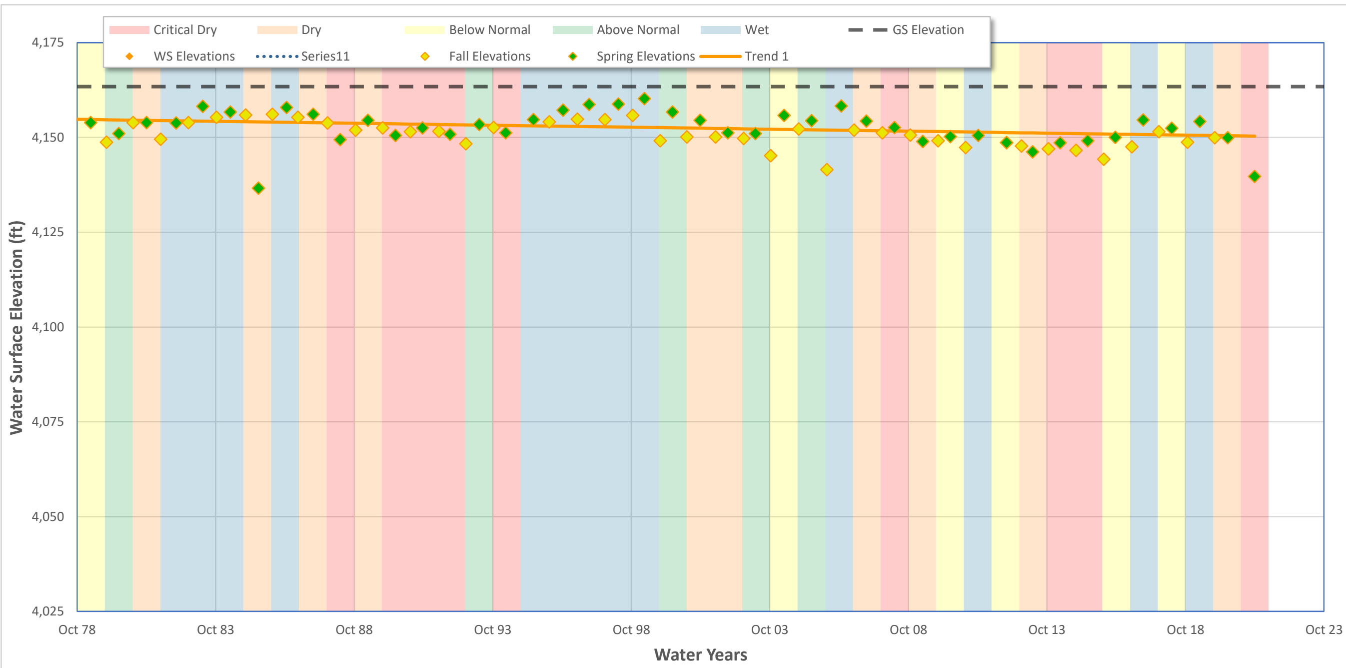
Date: 8/17/2021

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

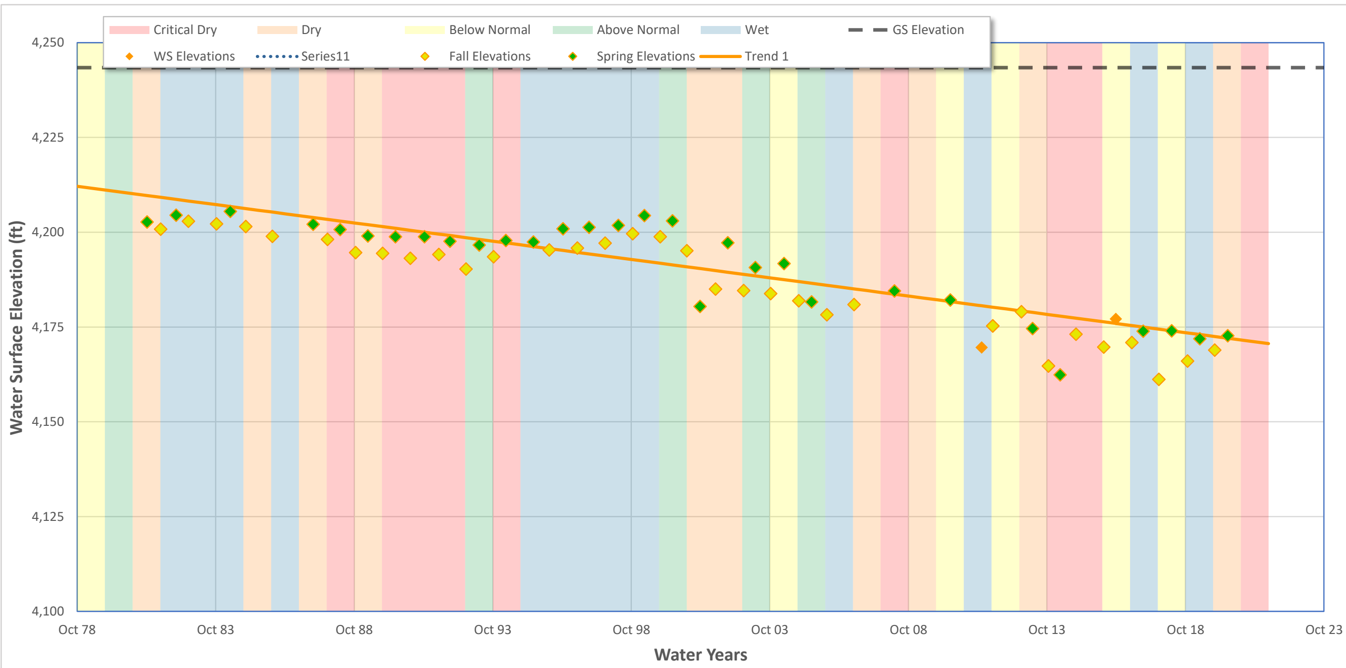
Date: 8/17/2021

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

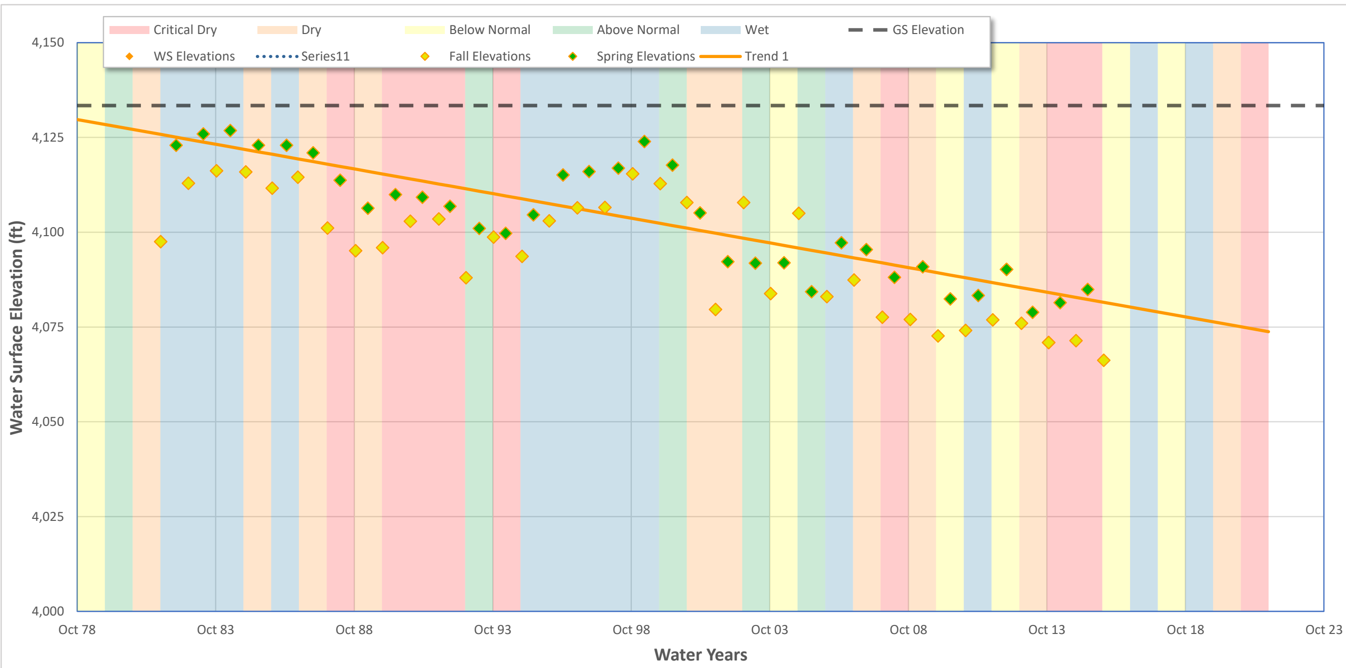
Date: 8/17/2021

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

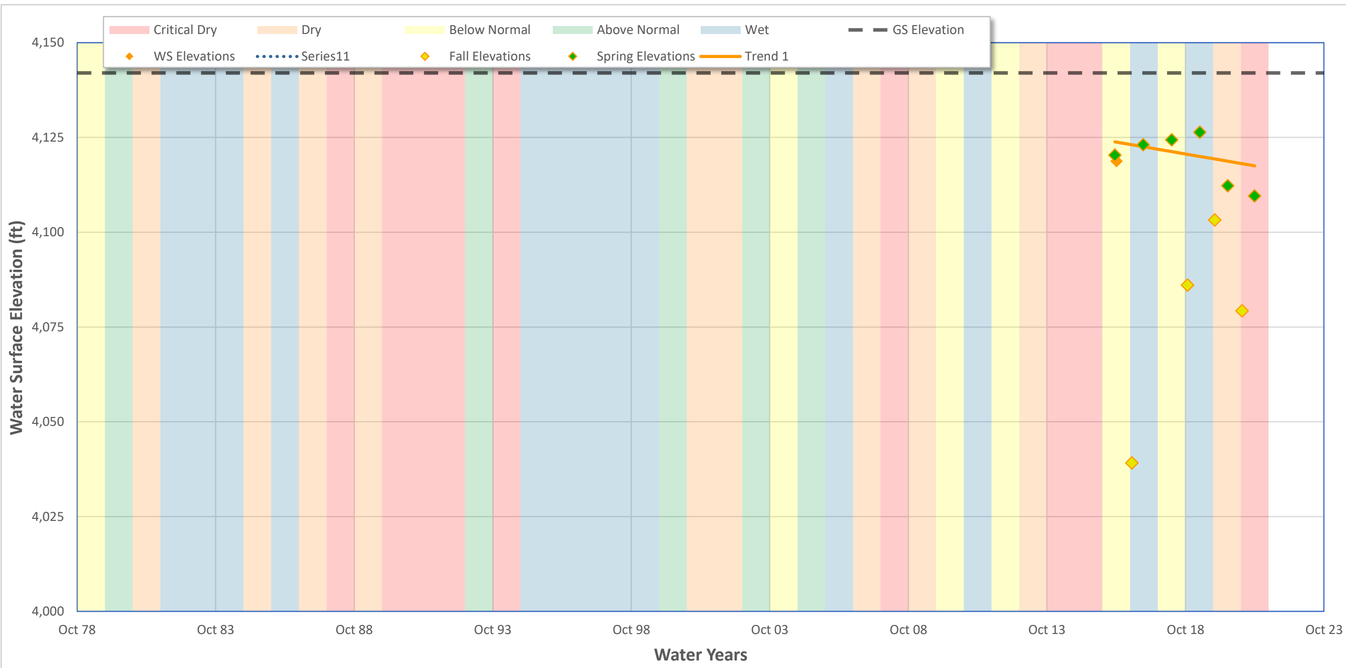
Date: 8/17/2021

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

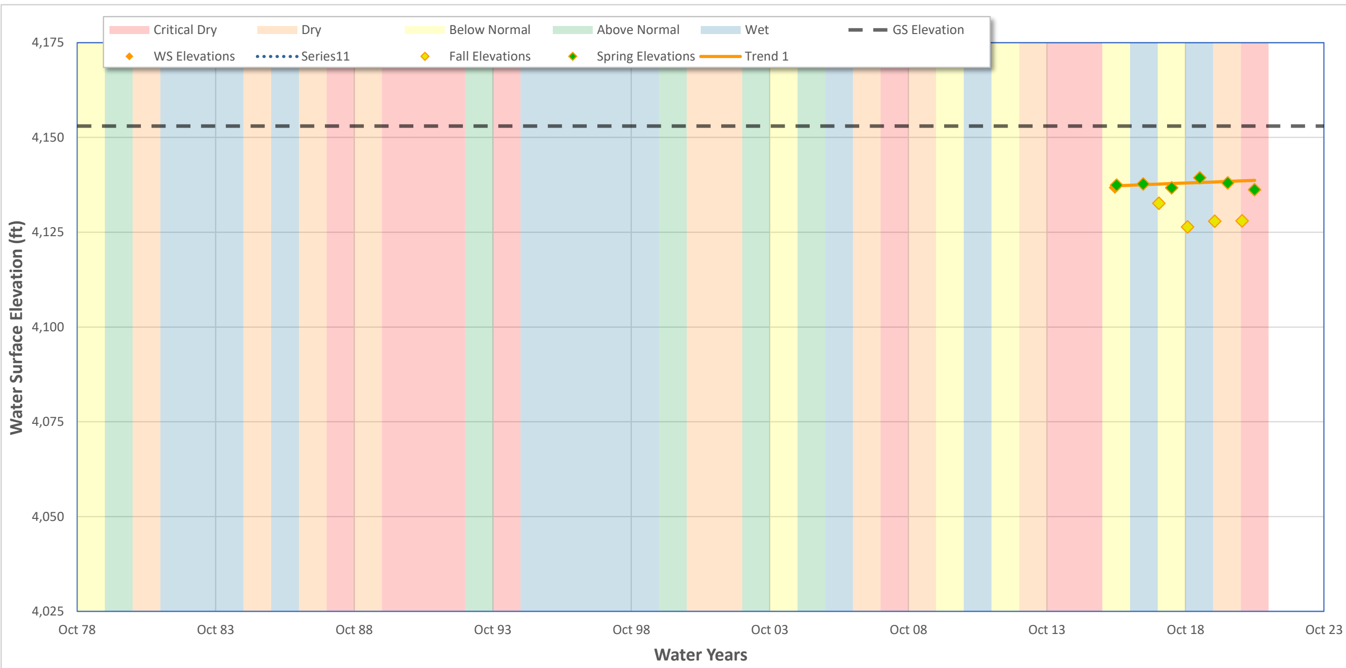
Date: 8/17/2021

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

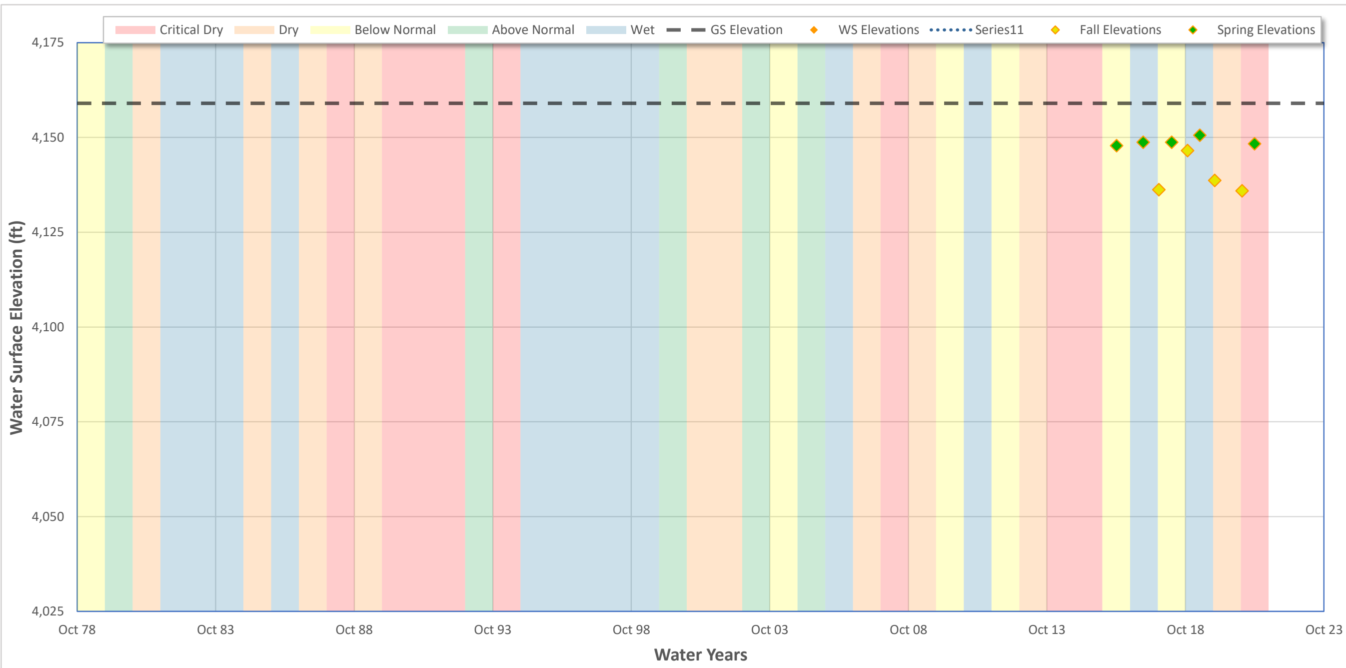
Well Period of Record

Period-of-Record		2016..2021
WS Elev-Range	Min:	4135.9 ft
	Max	4150.6 ft

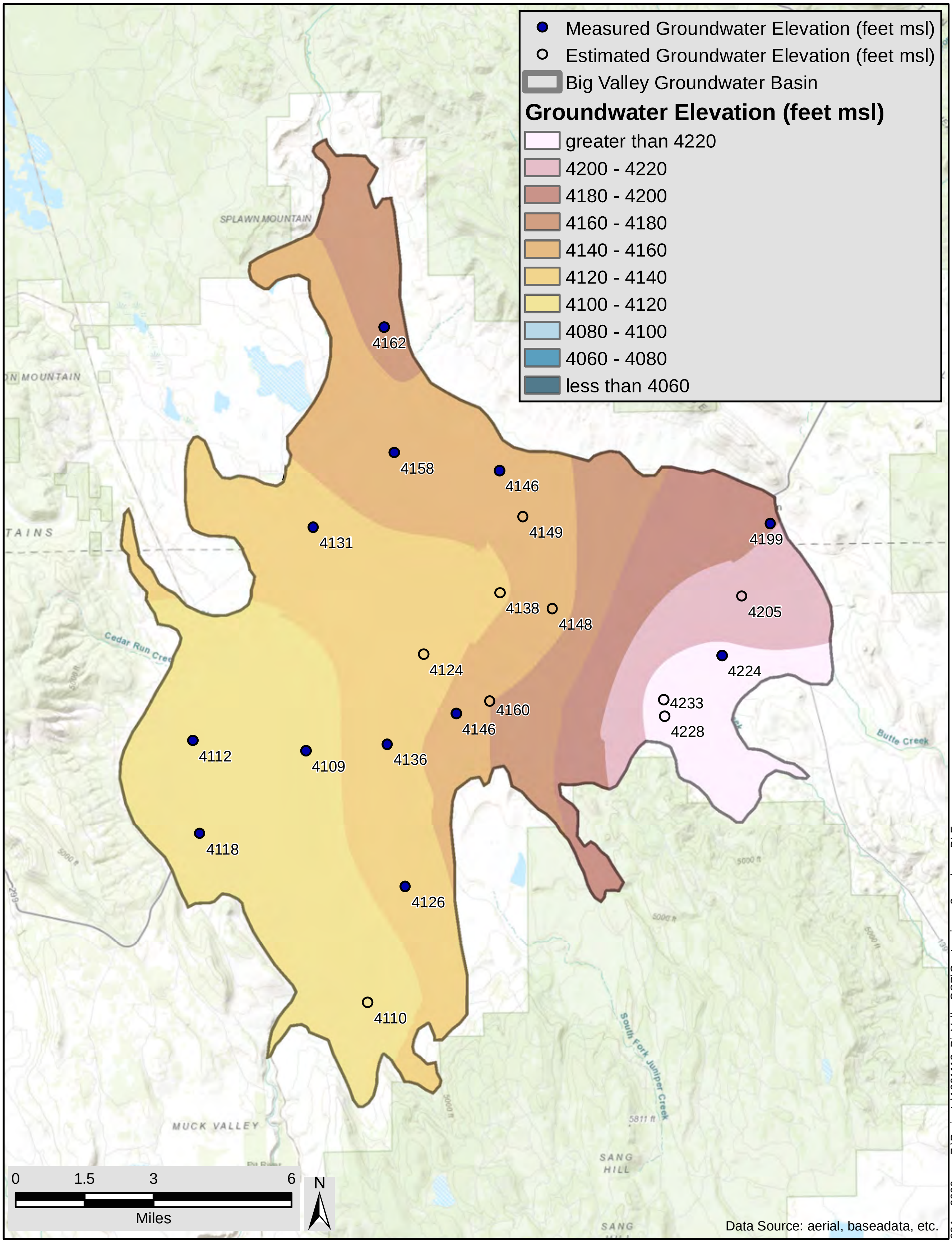
Trend Analysis

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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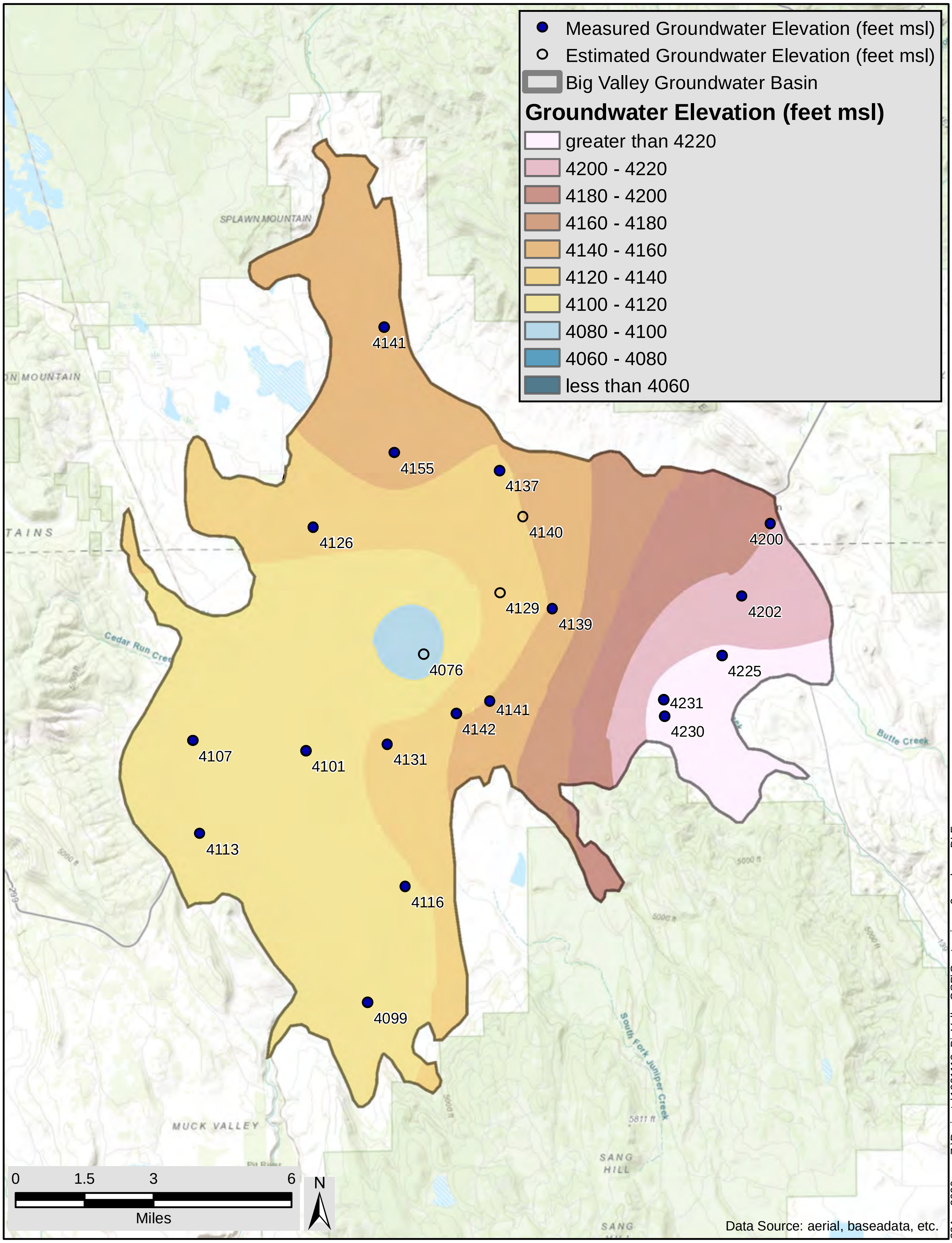
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1983
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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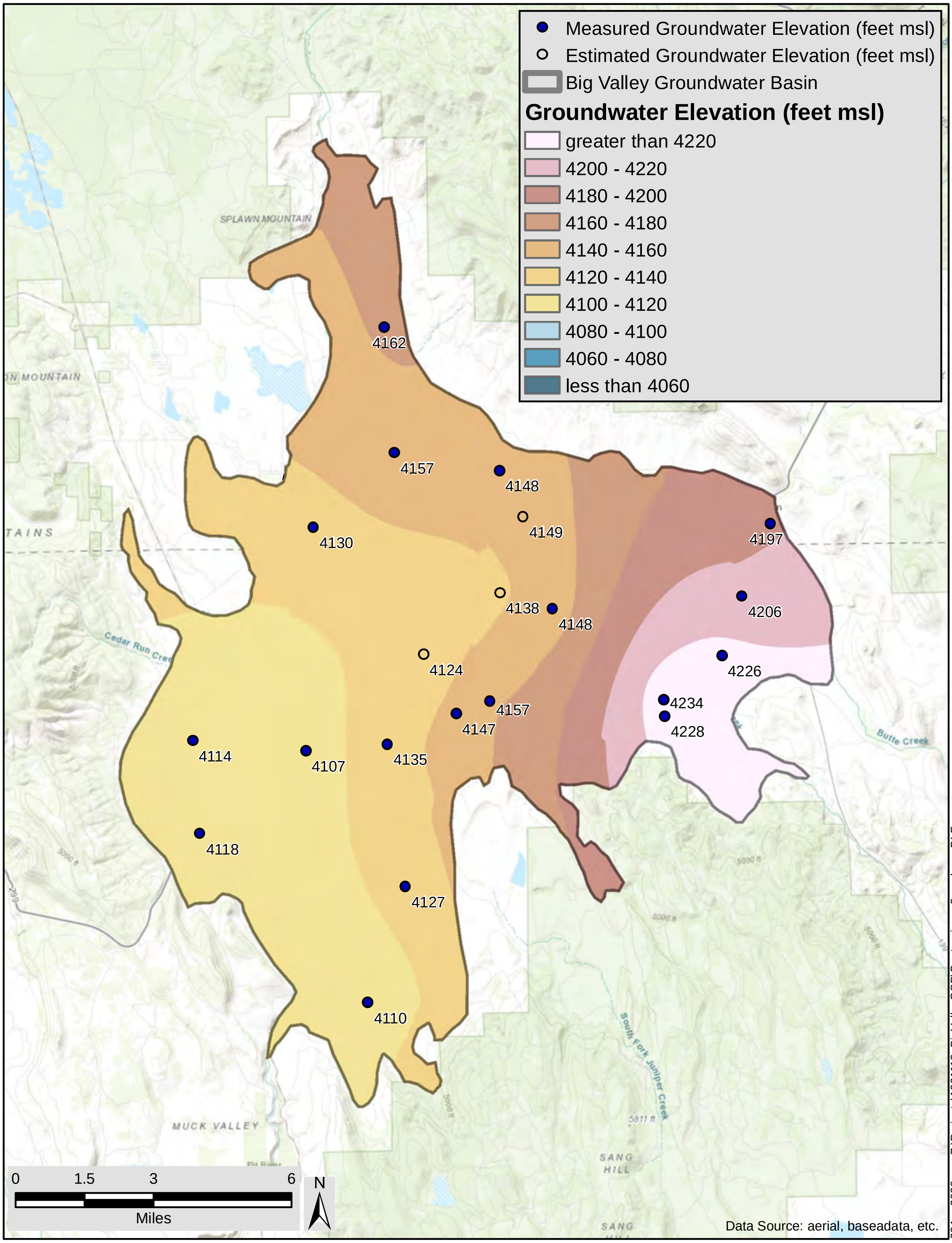
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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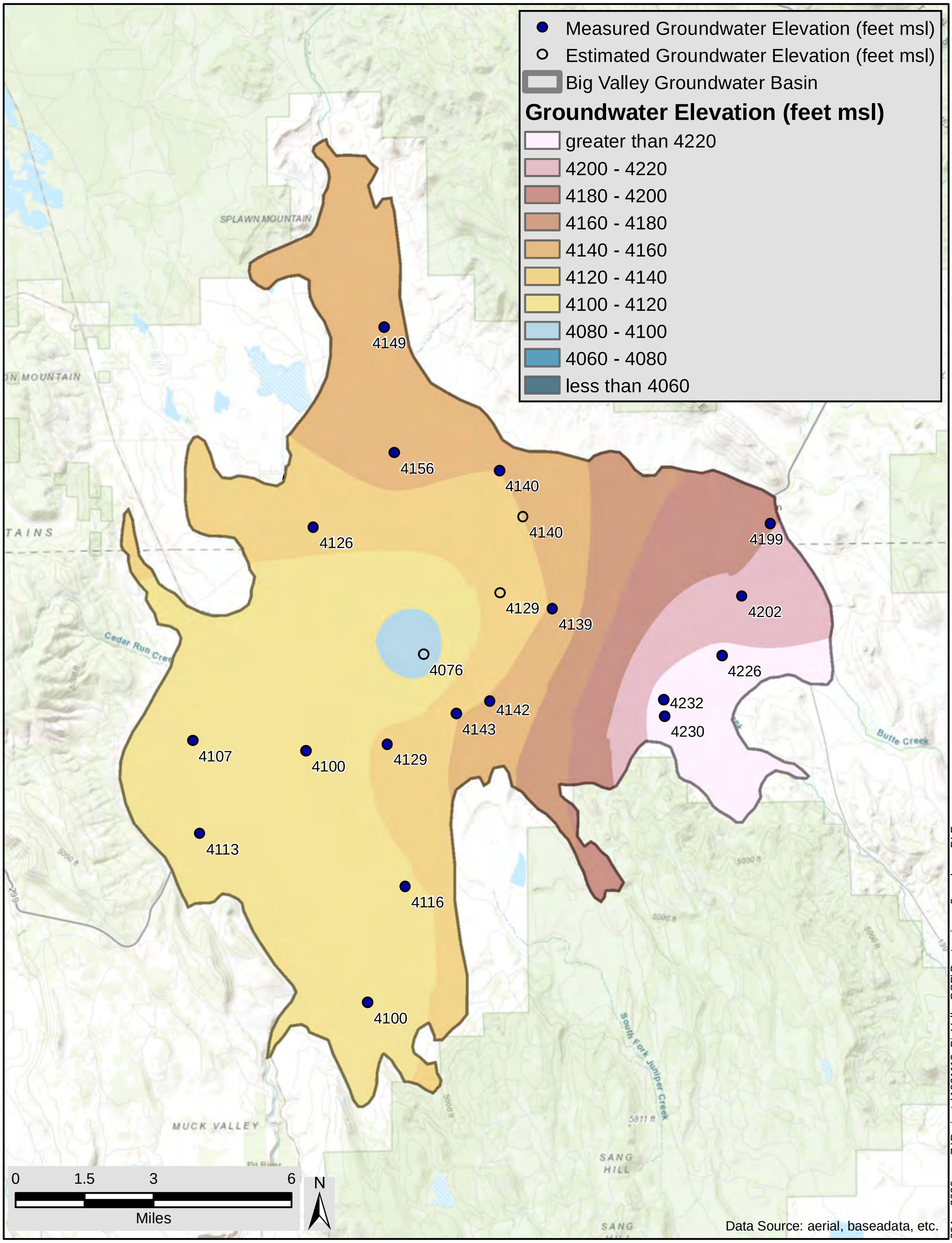

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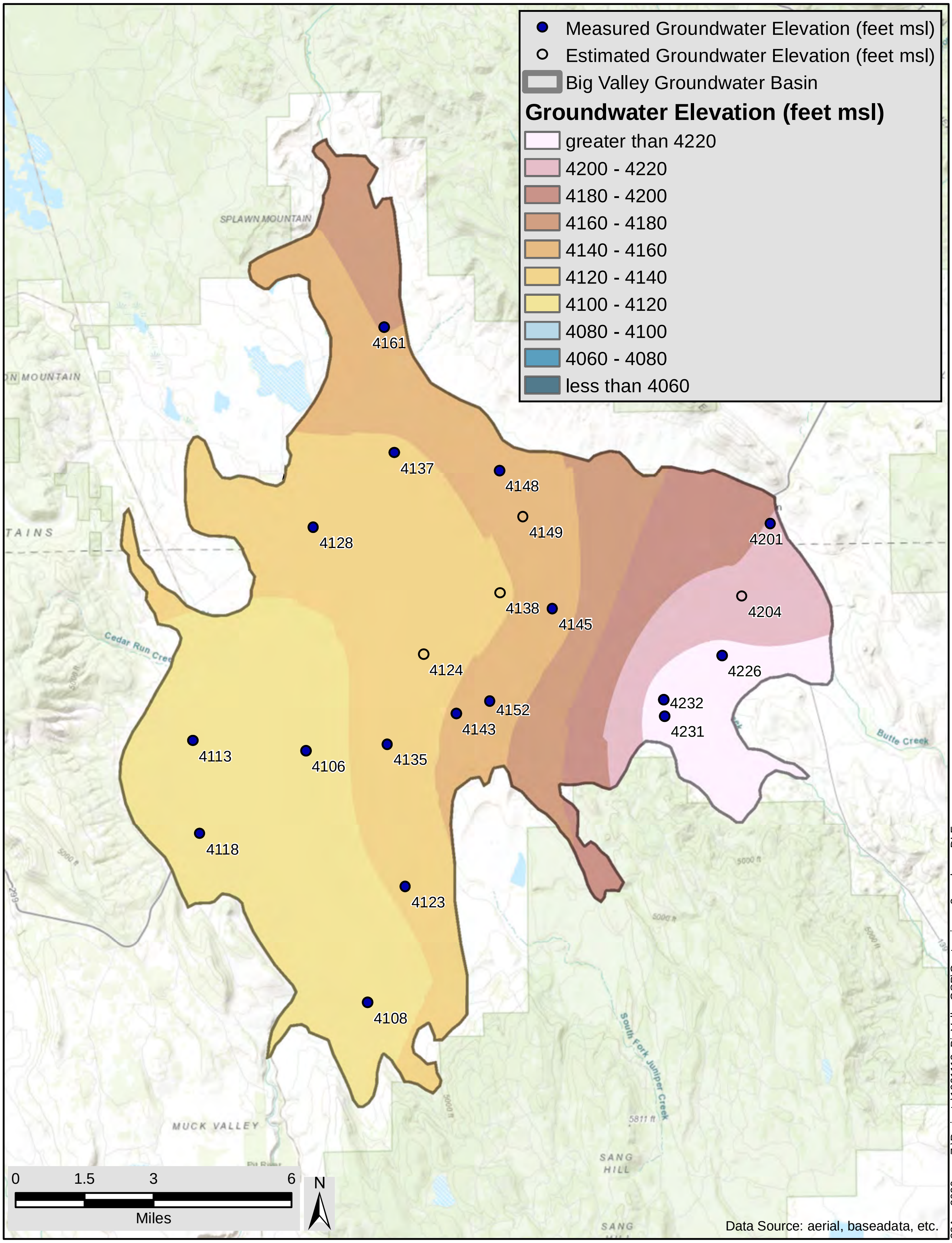
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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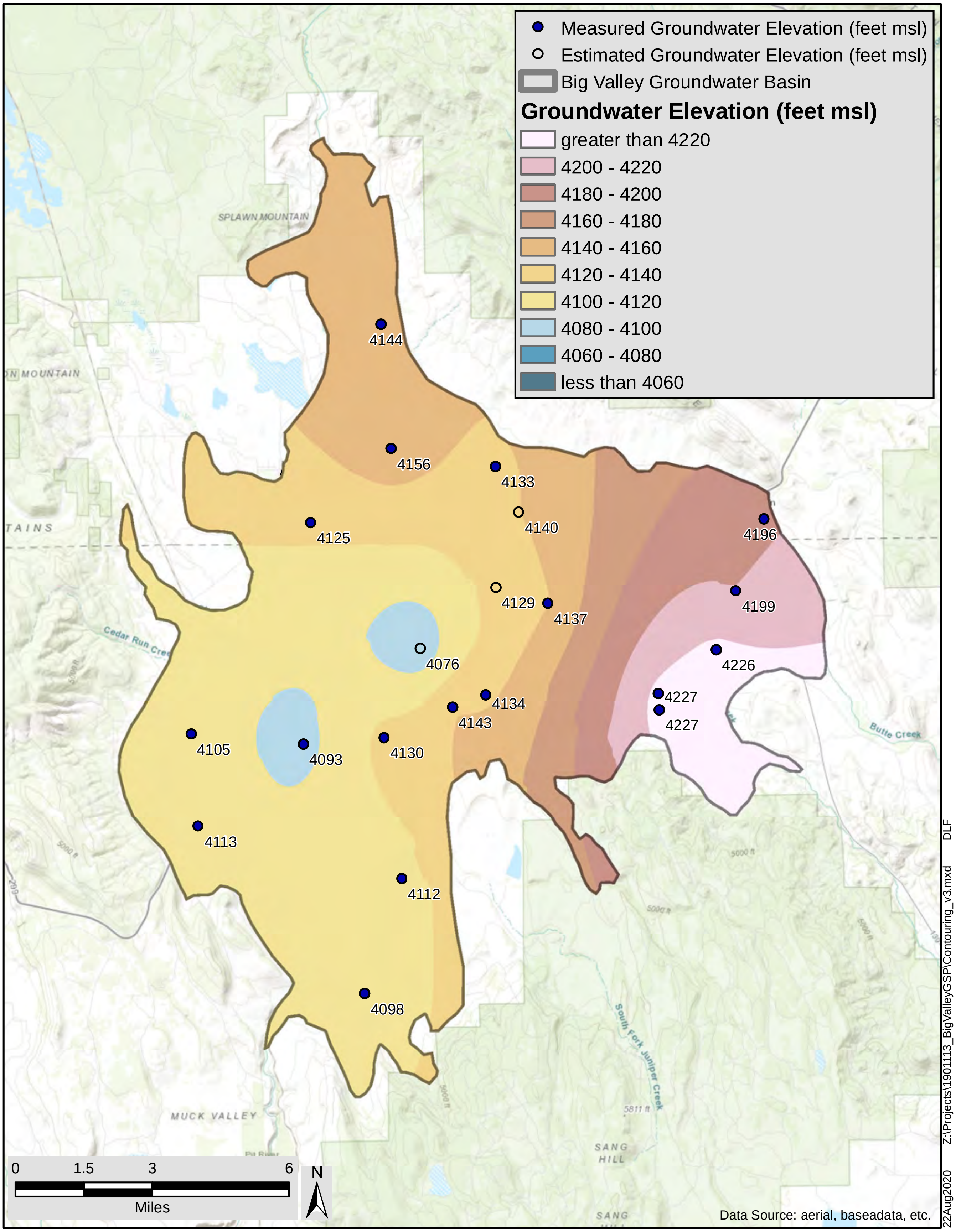
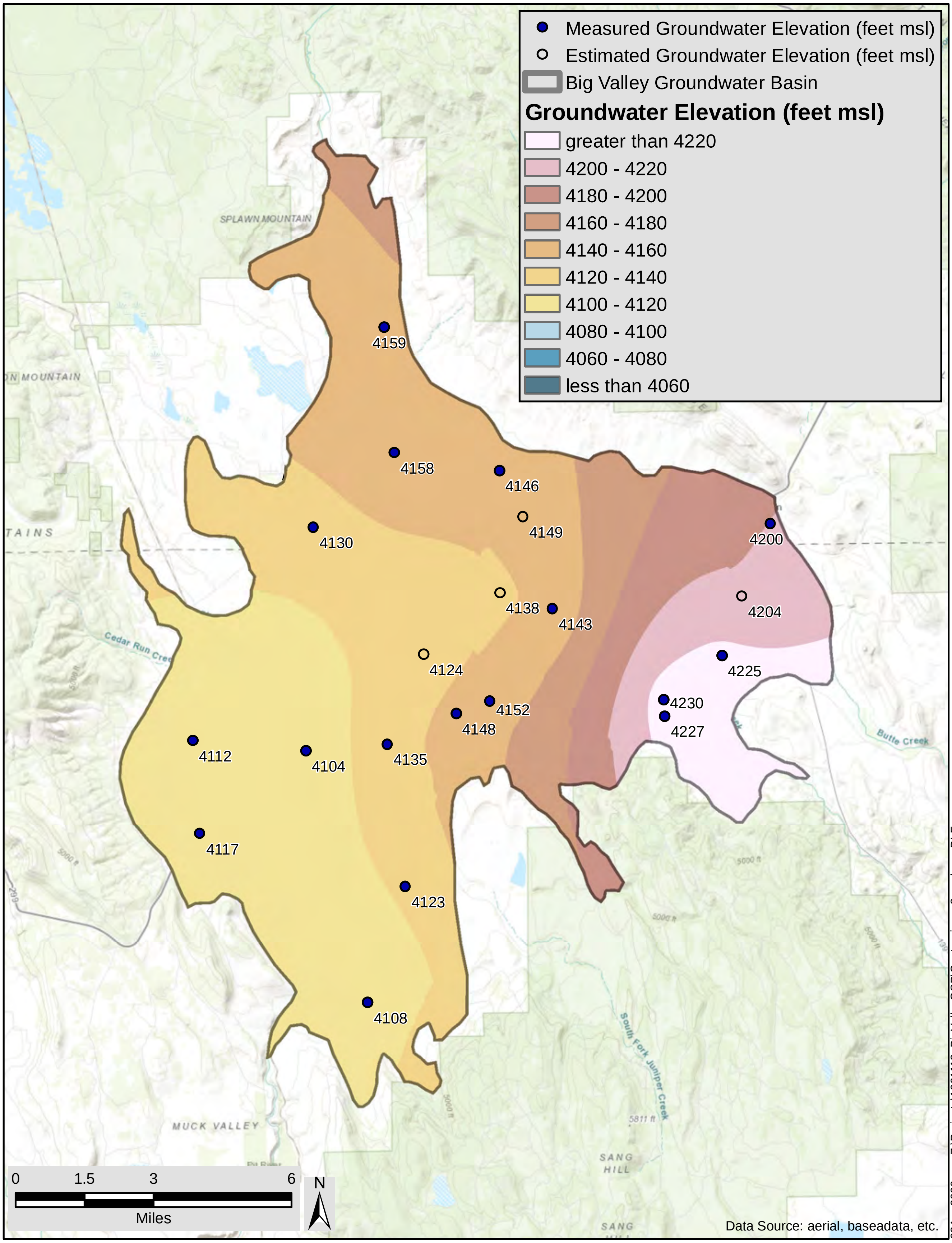
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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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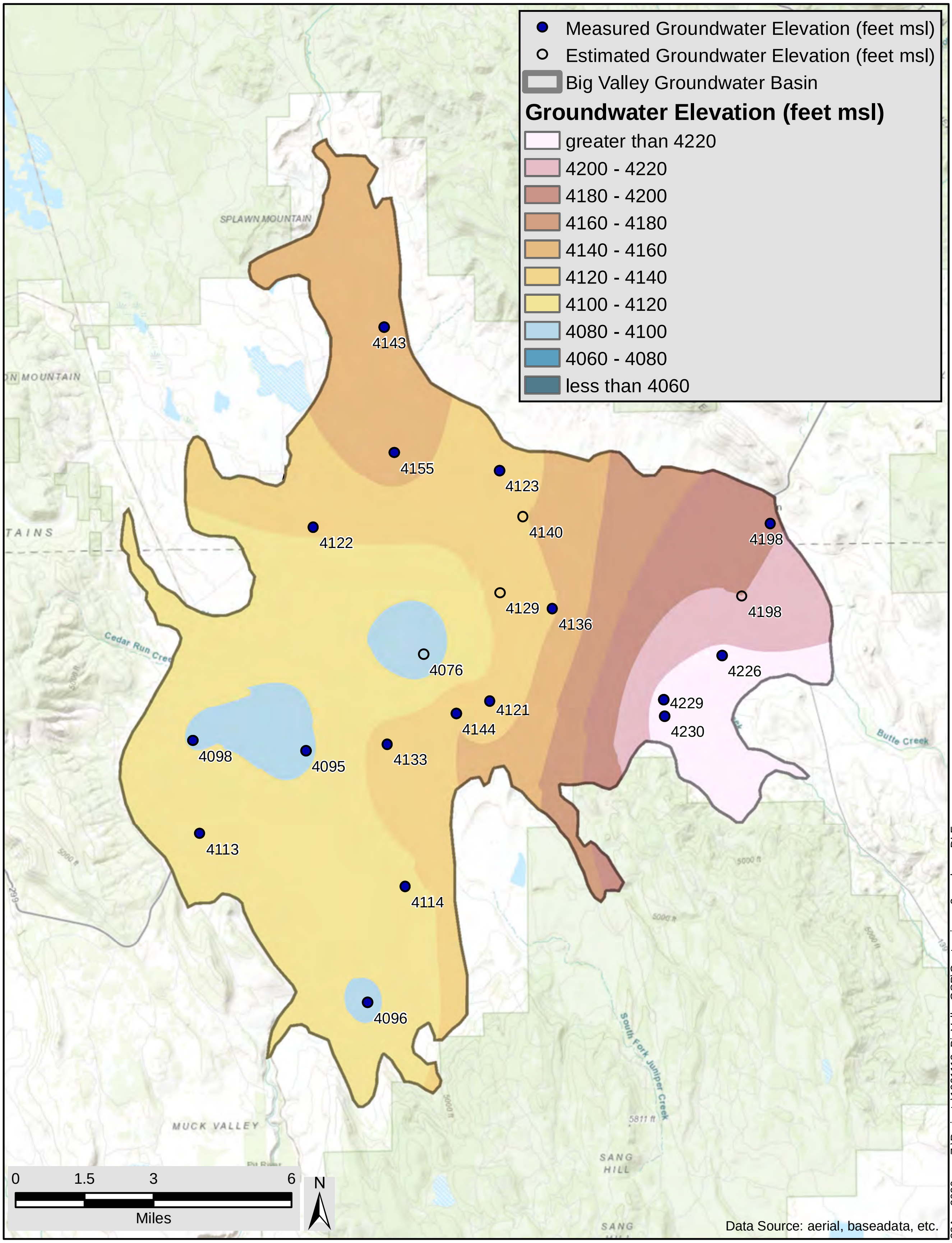
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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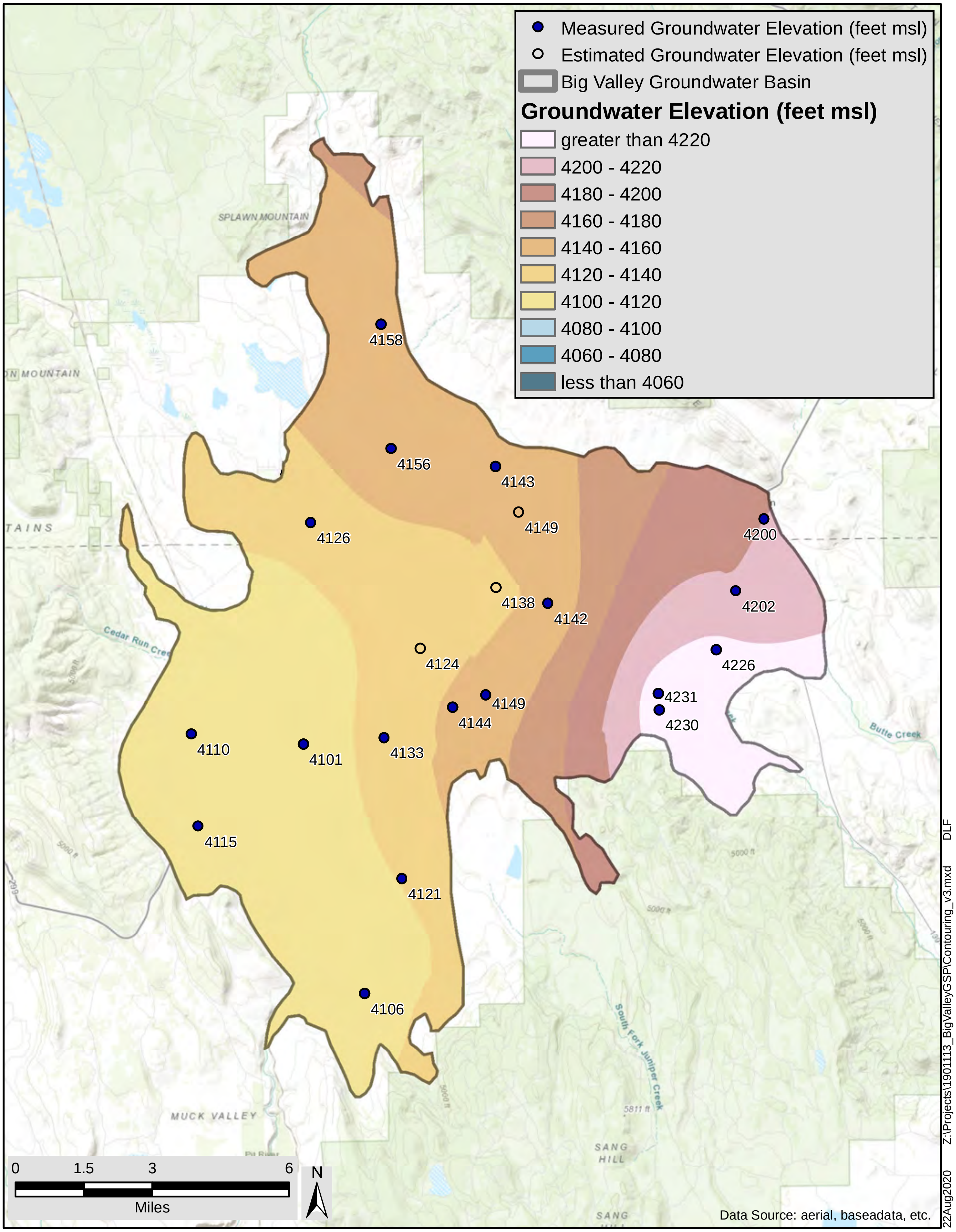
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



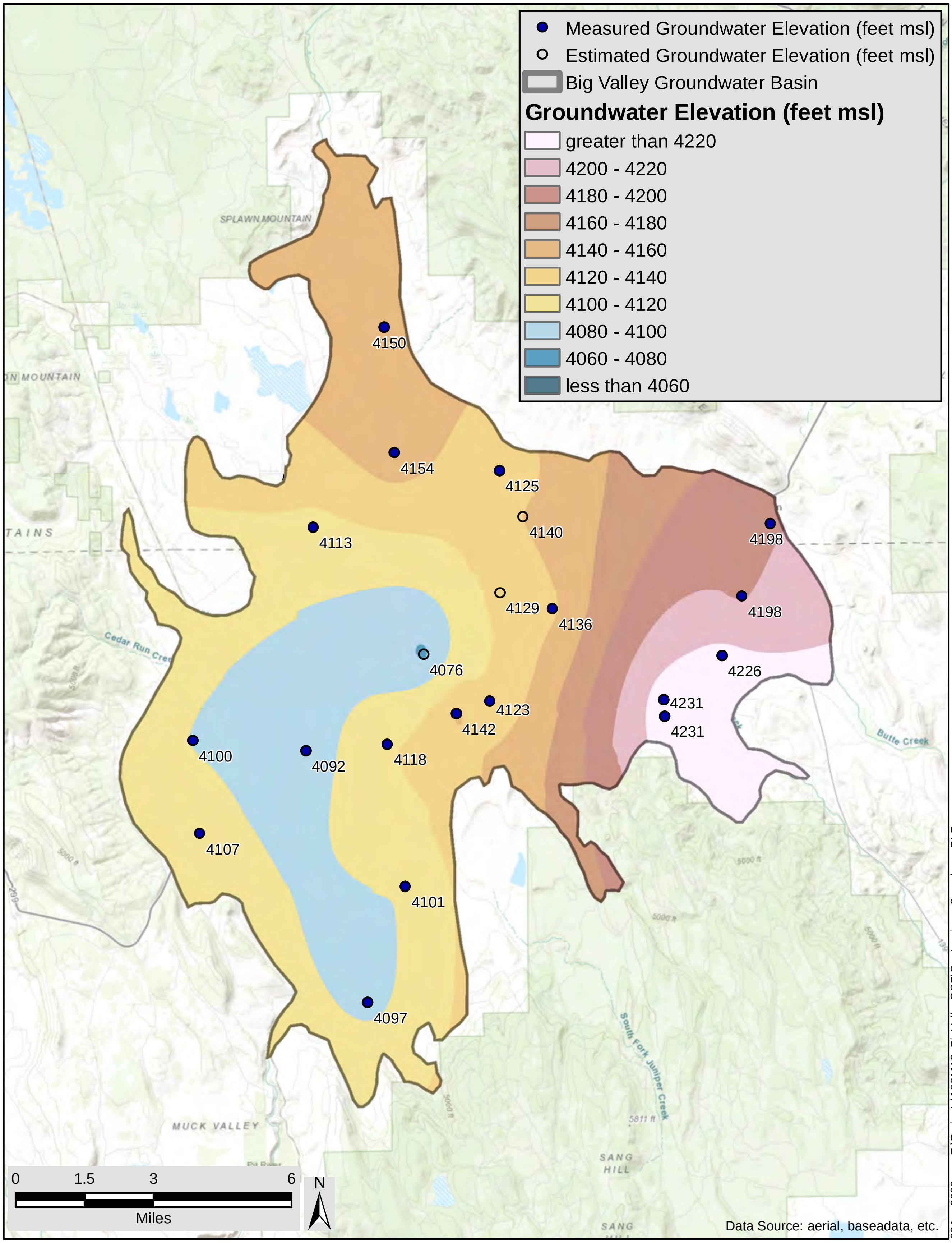
Big Valley Basin Groundwater Sustainability Plan
Modoc and Lassen Counties, California

Big Valley Groundwater Basin GSAs

GEI Consultants

Groundwater Elevations
Spring 1987

AUGUST 2020 DRAFT FIGURE



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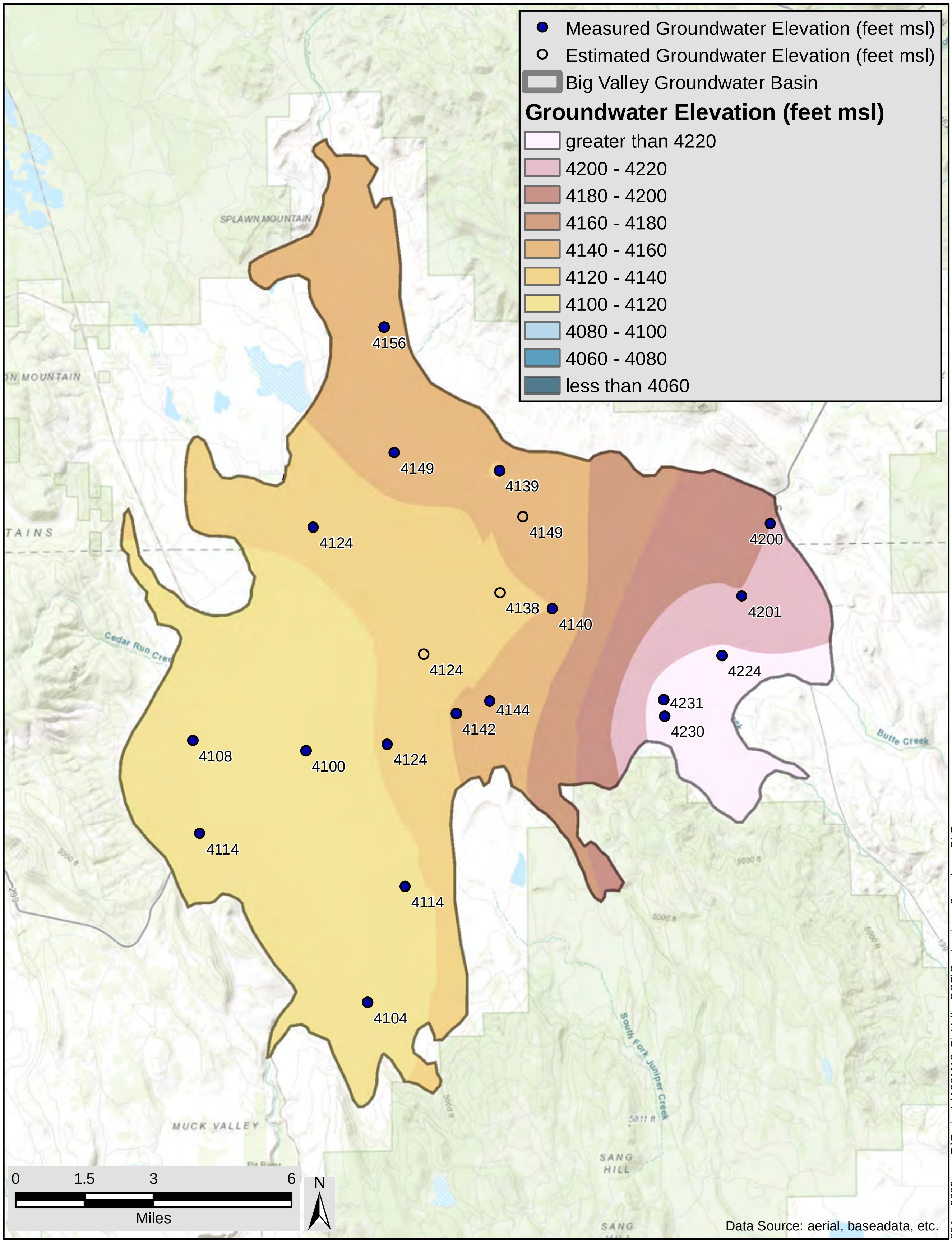
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 1987
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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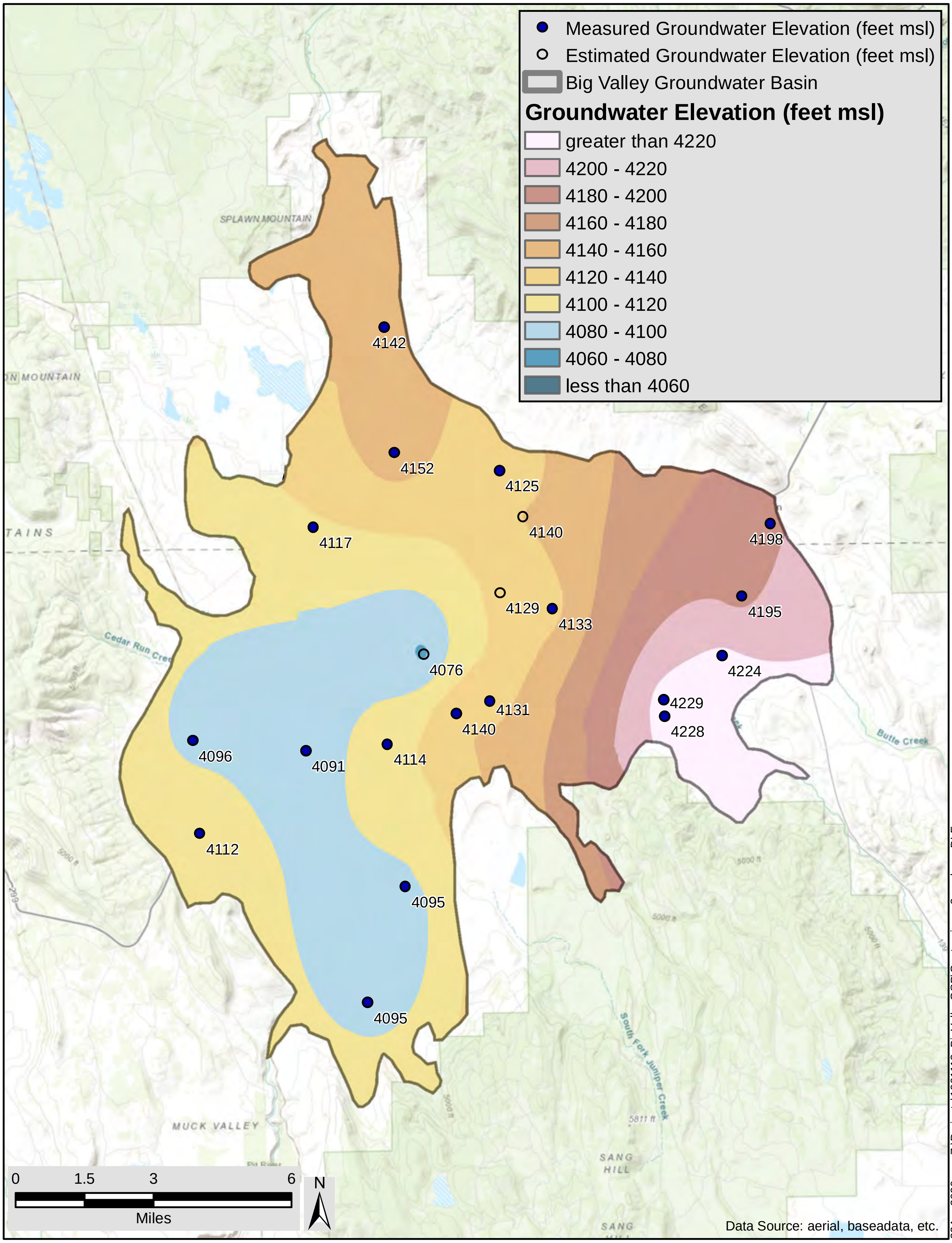
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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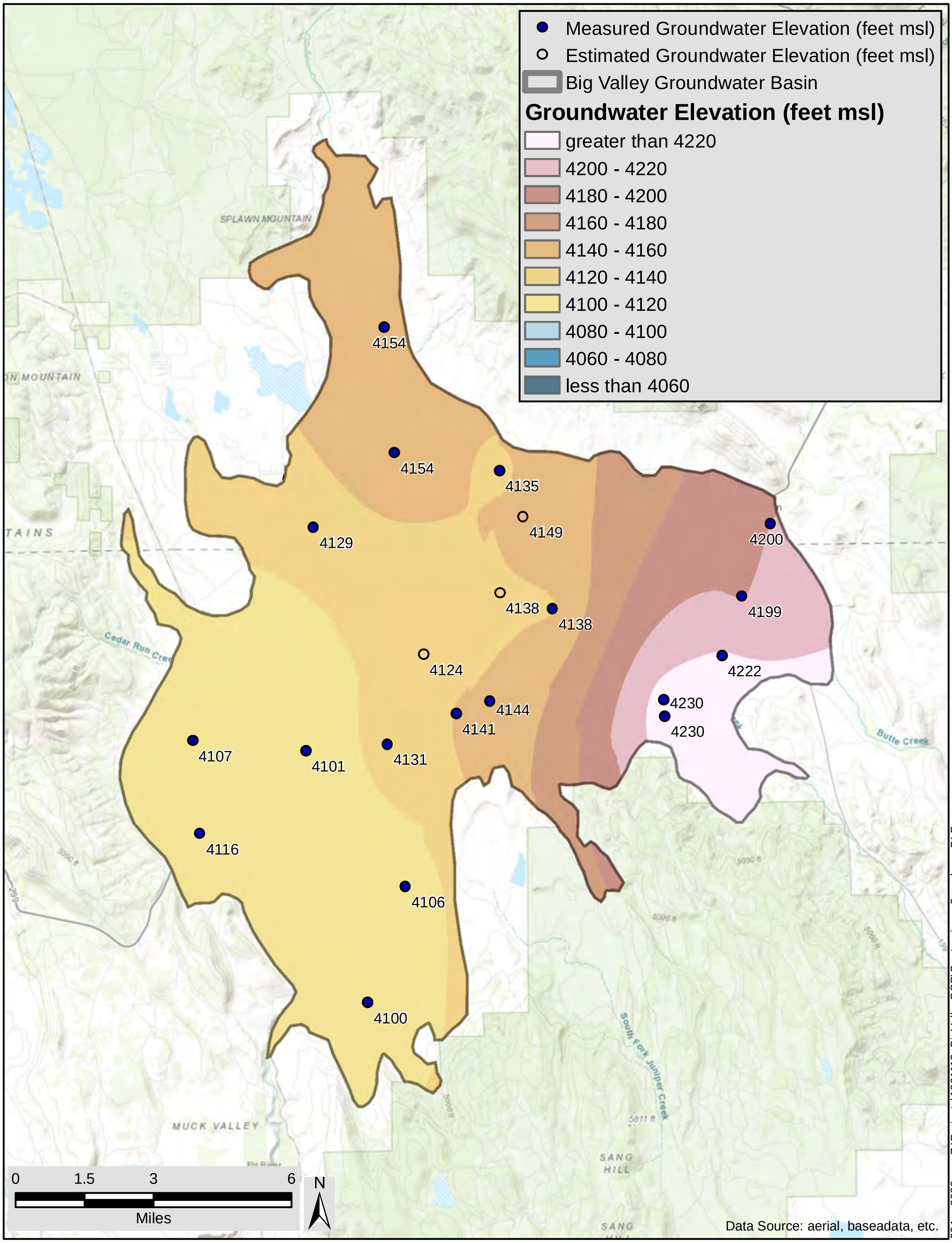

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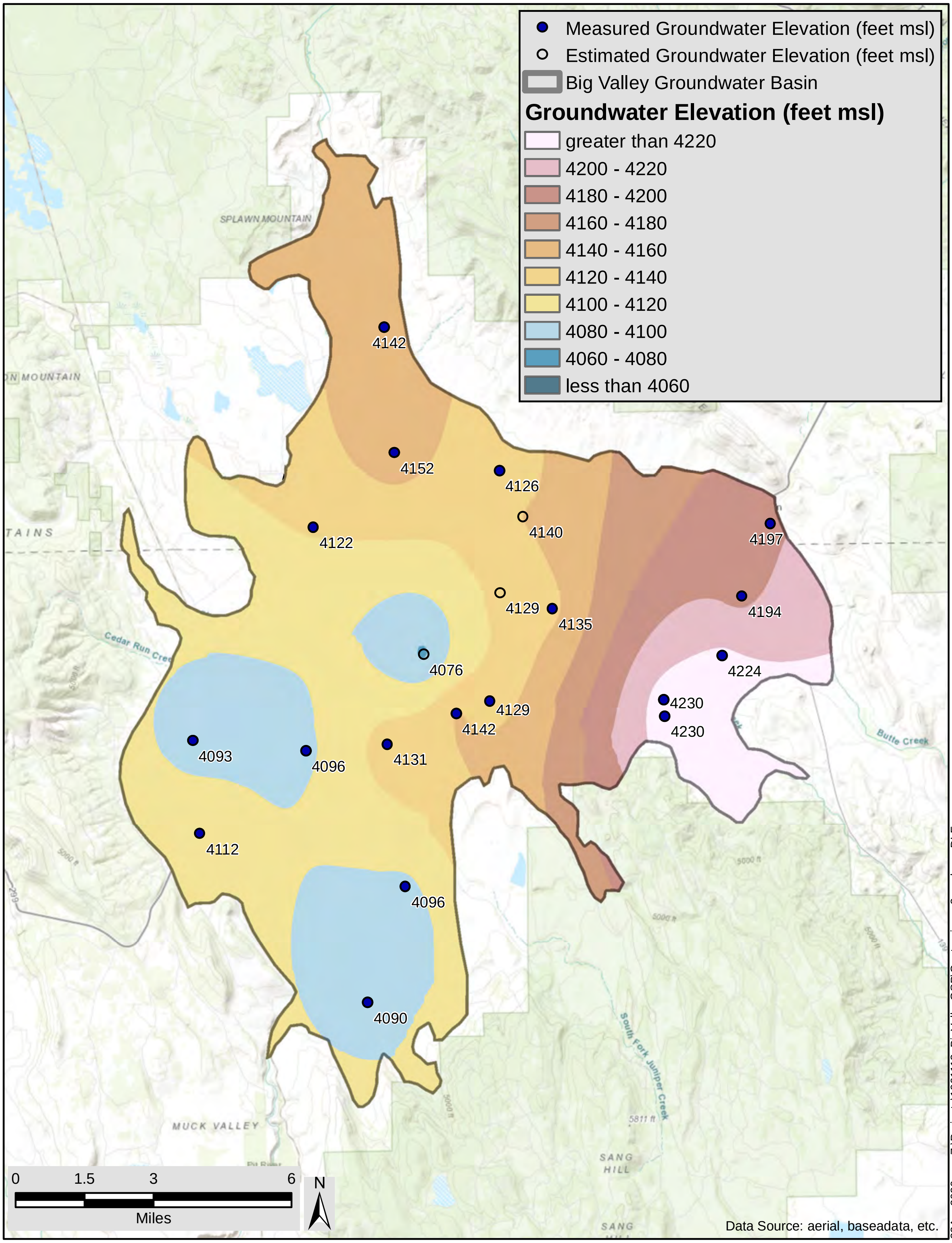
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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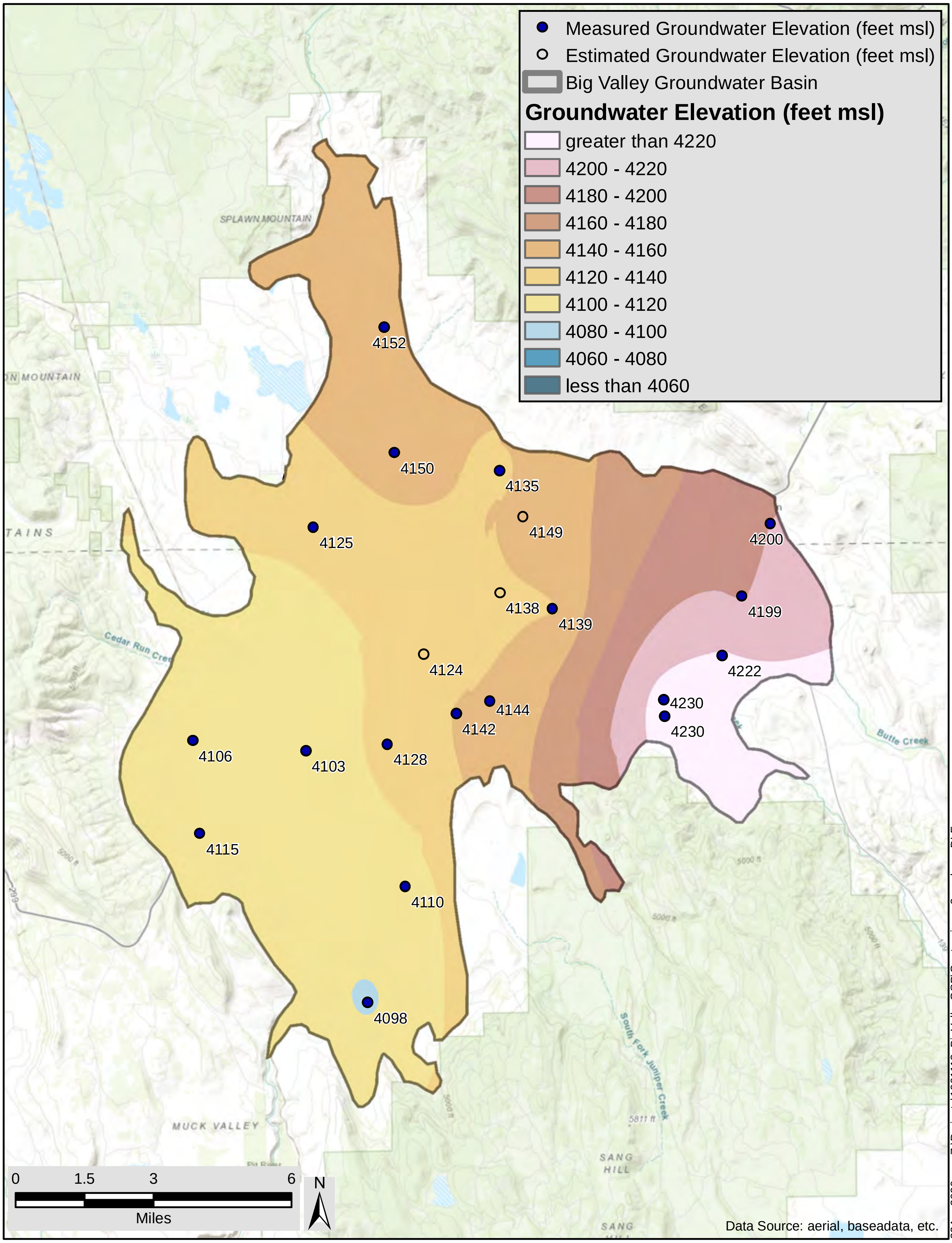

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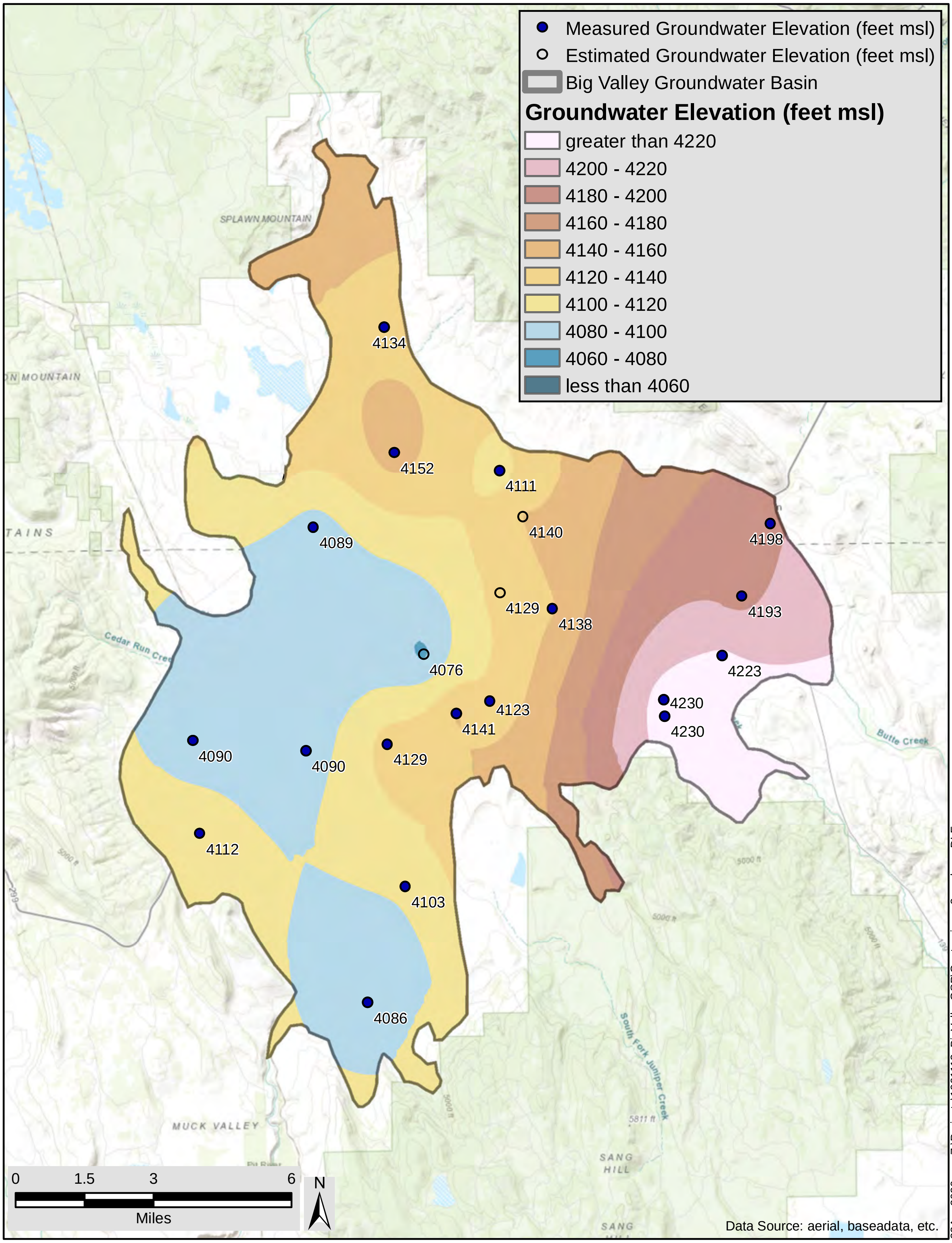

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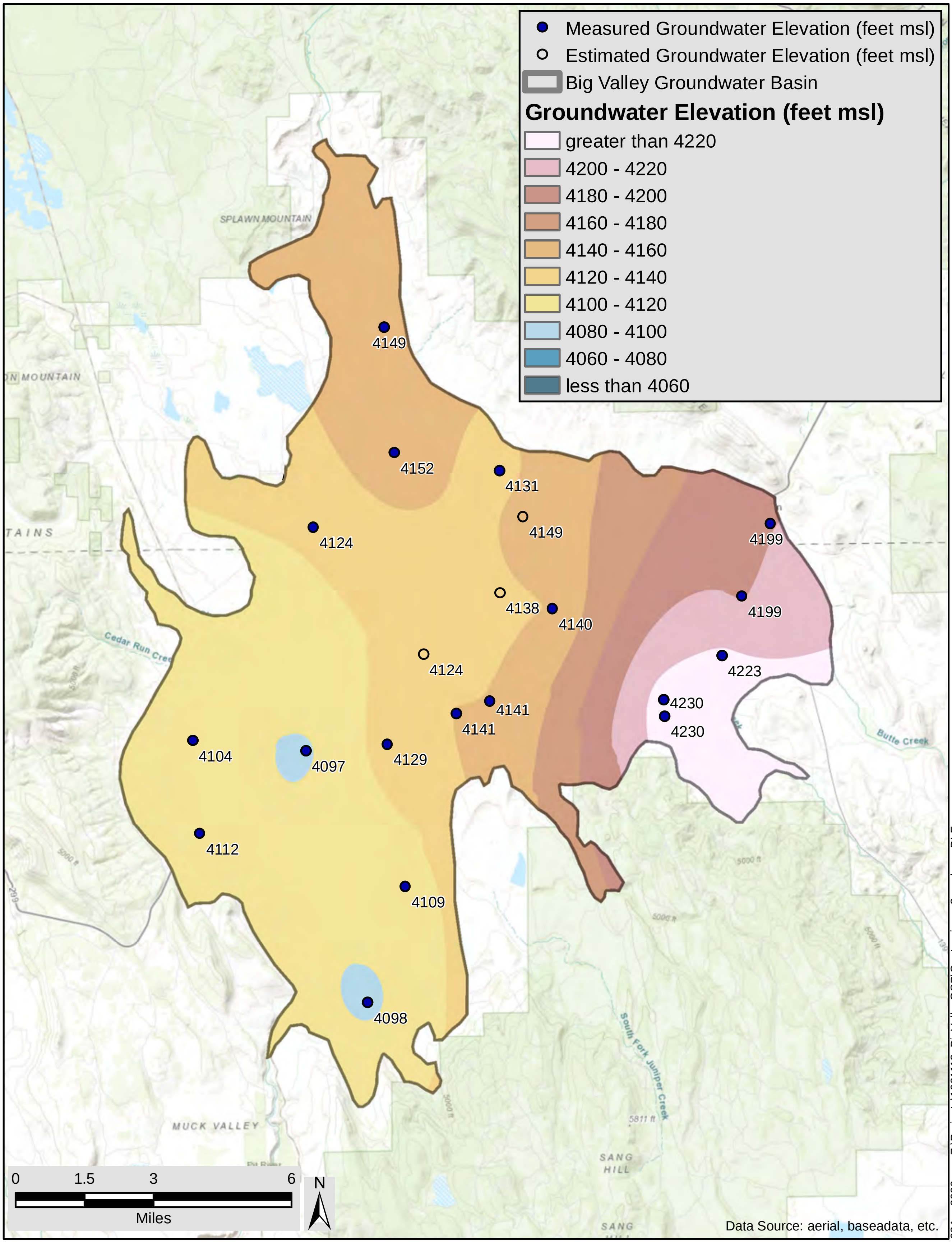

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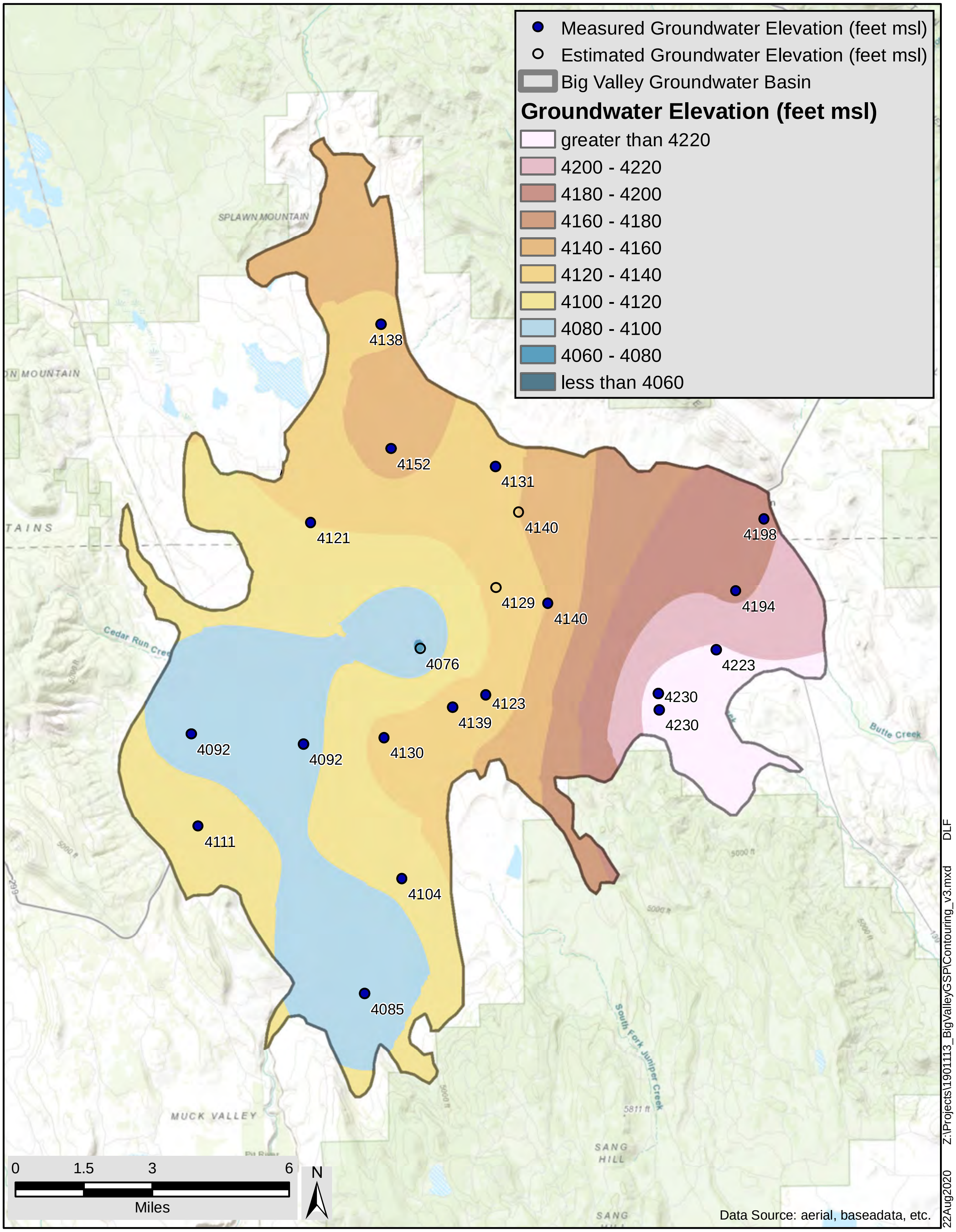
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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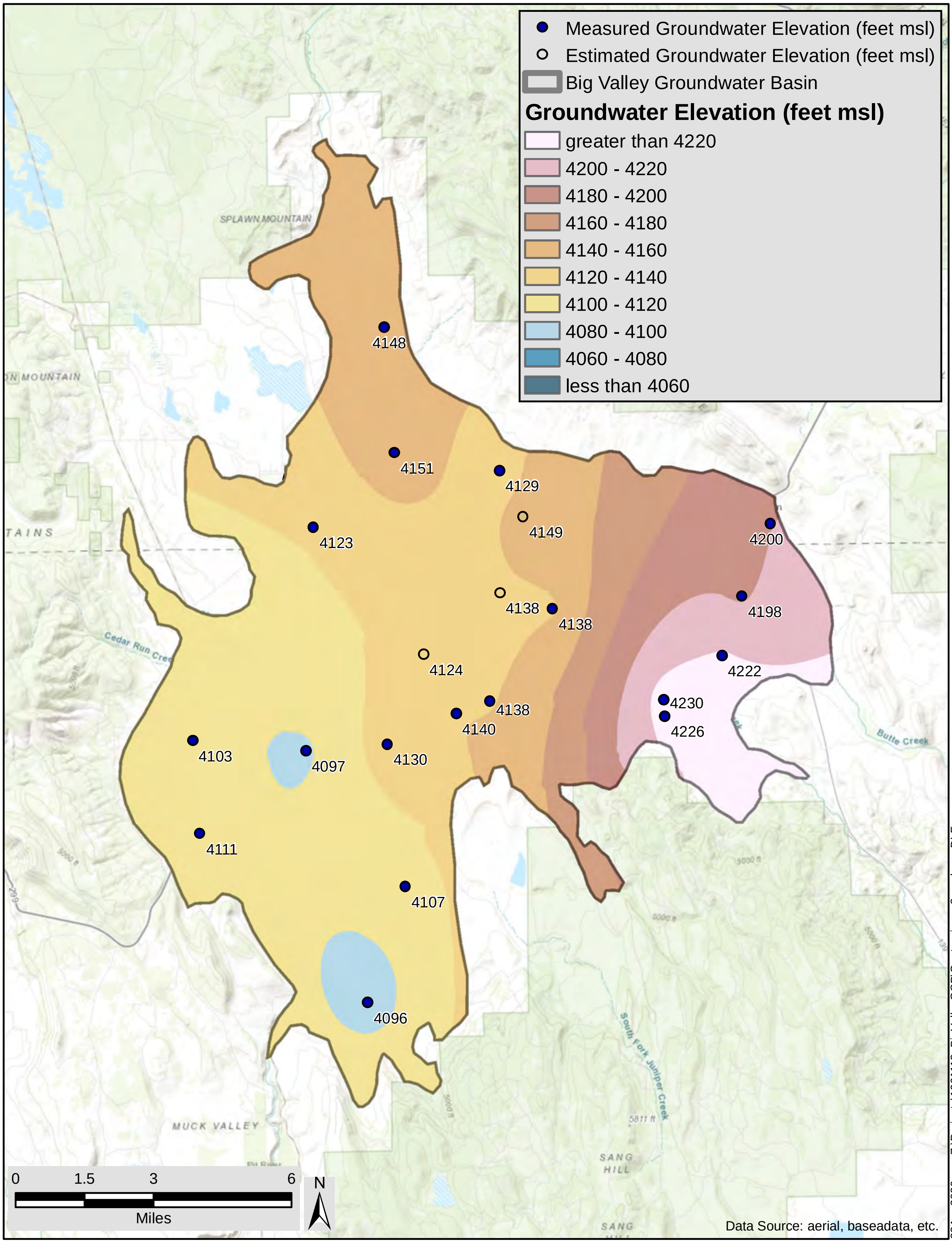

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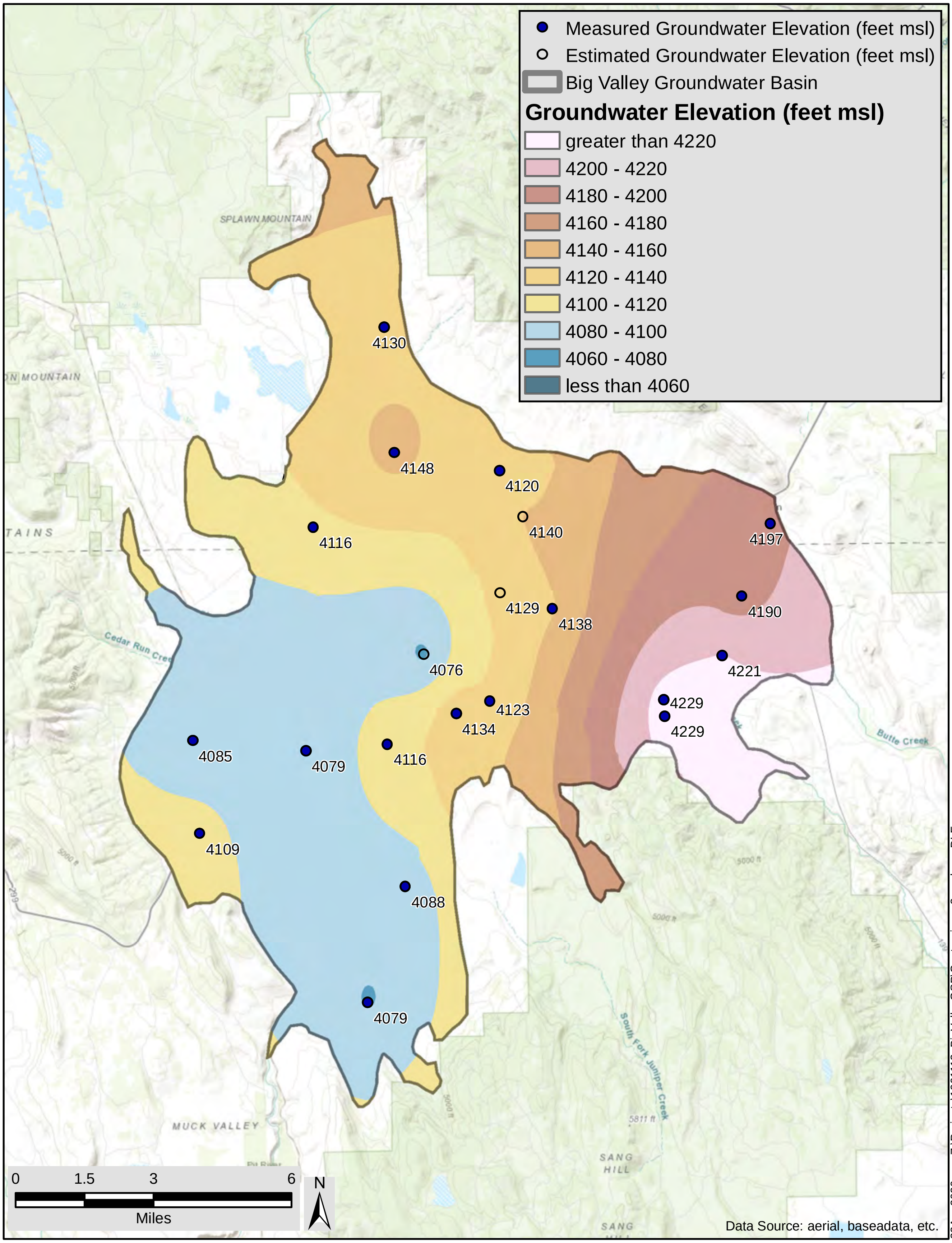
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT	FIGURE



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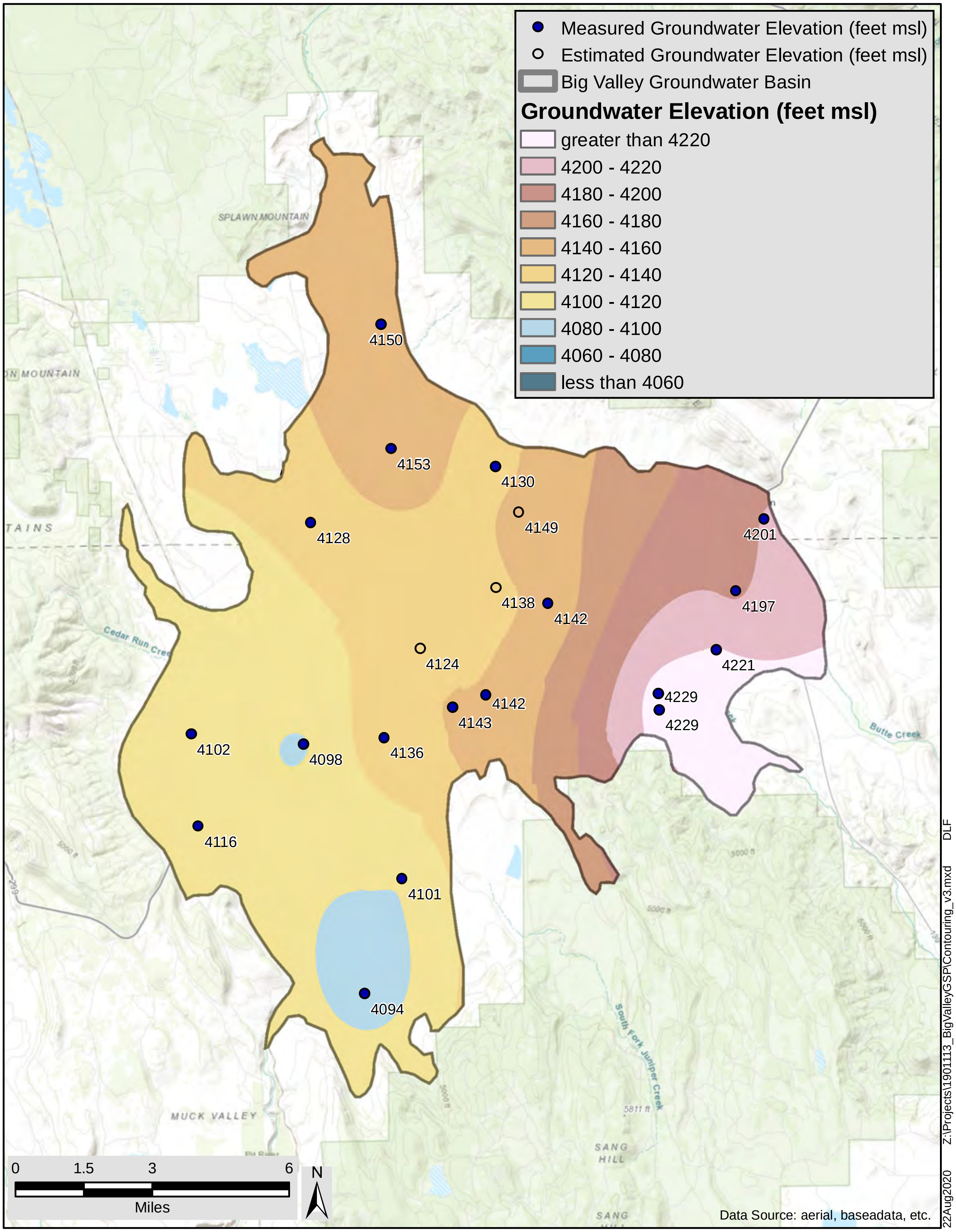

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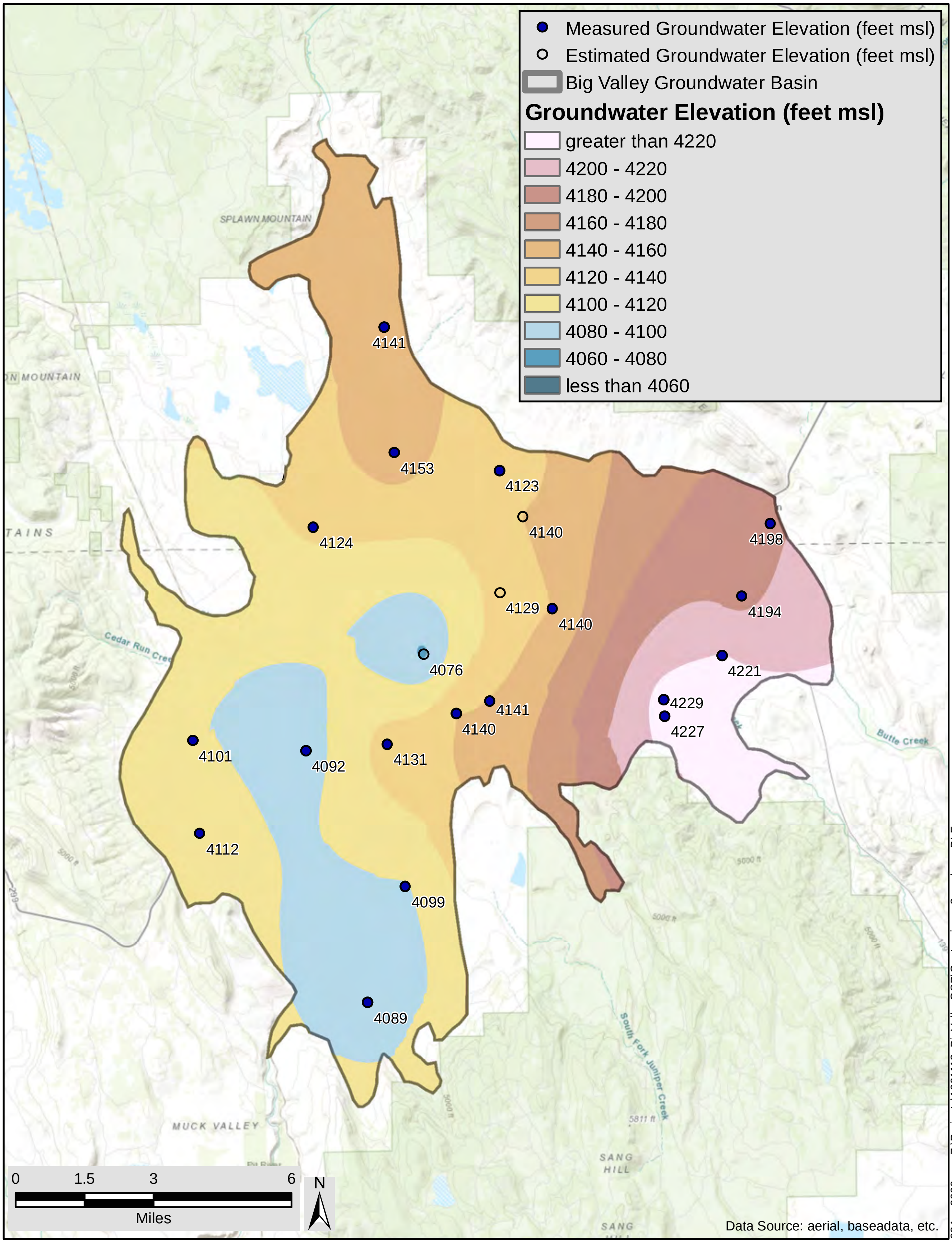
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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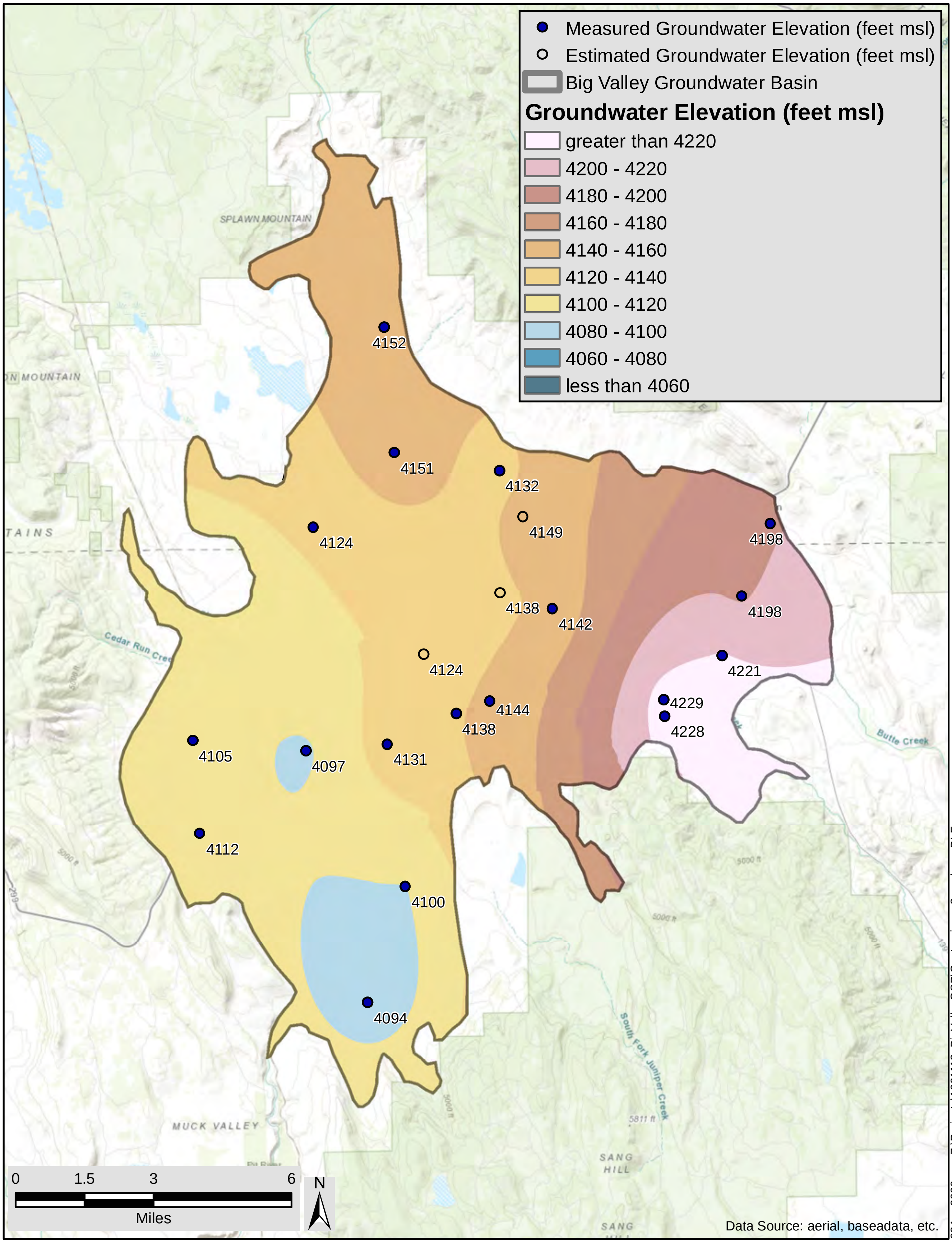

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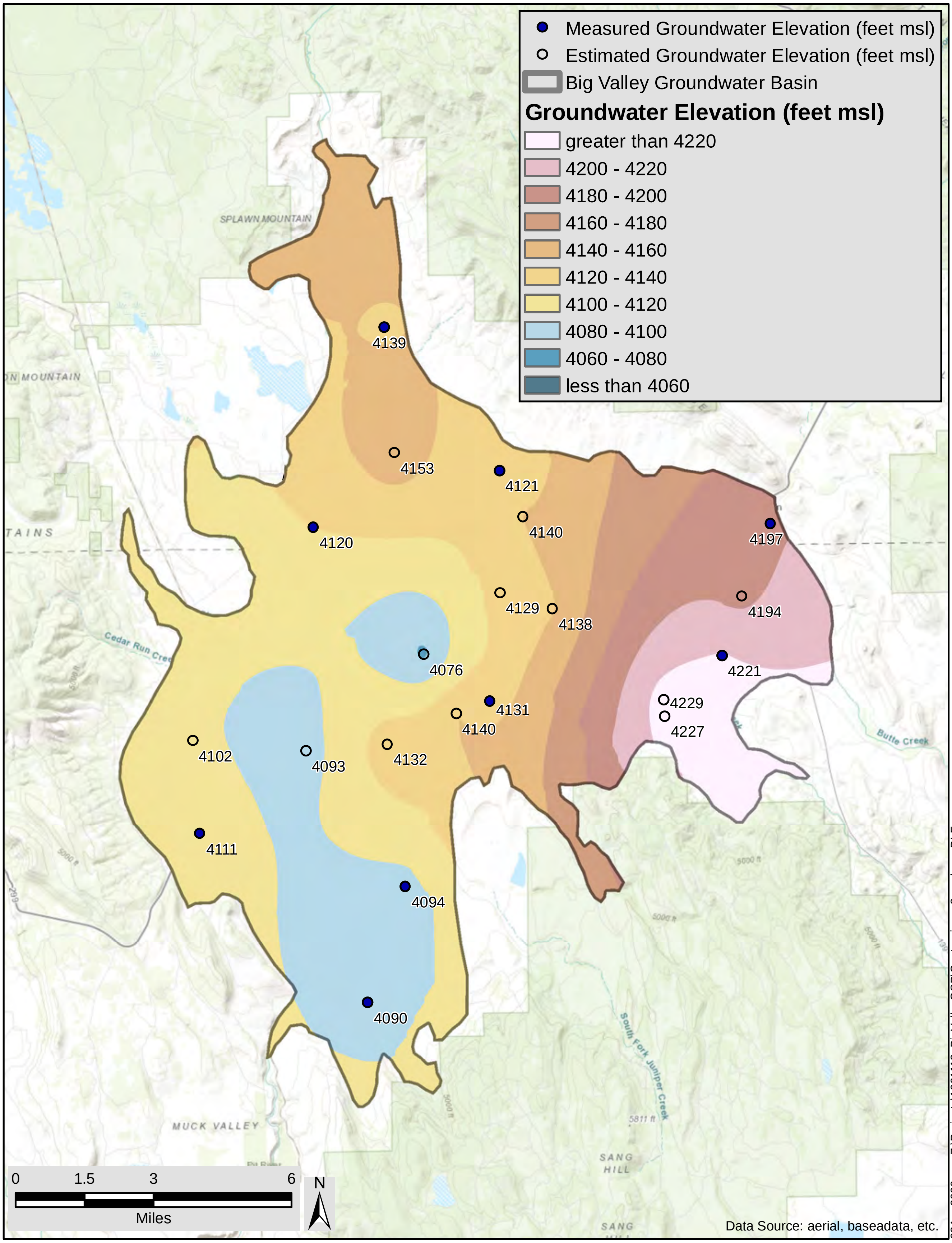
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Spring 1994
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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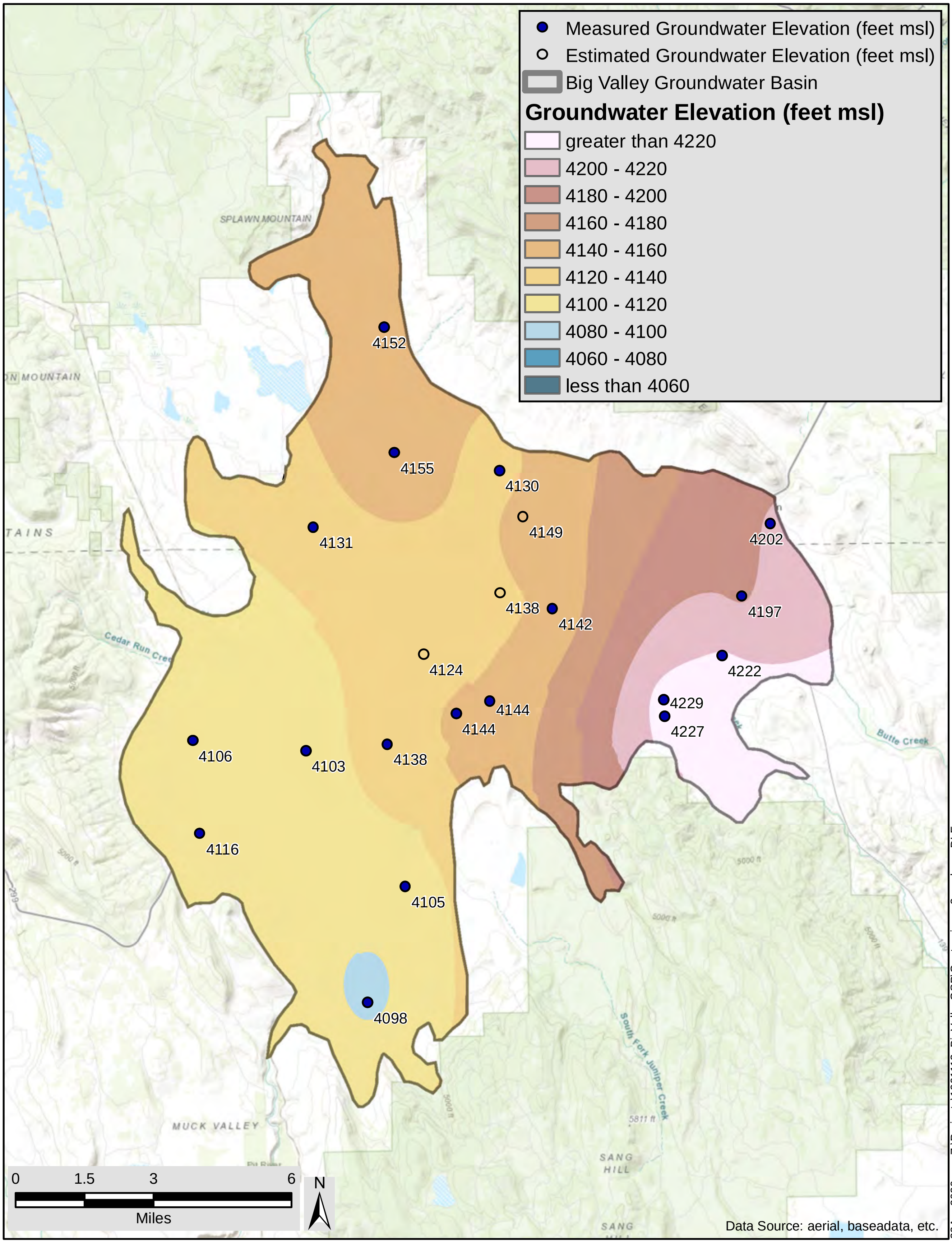
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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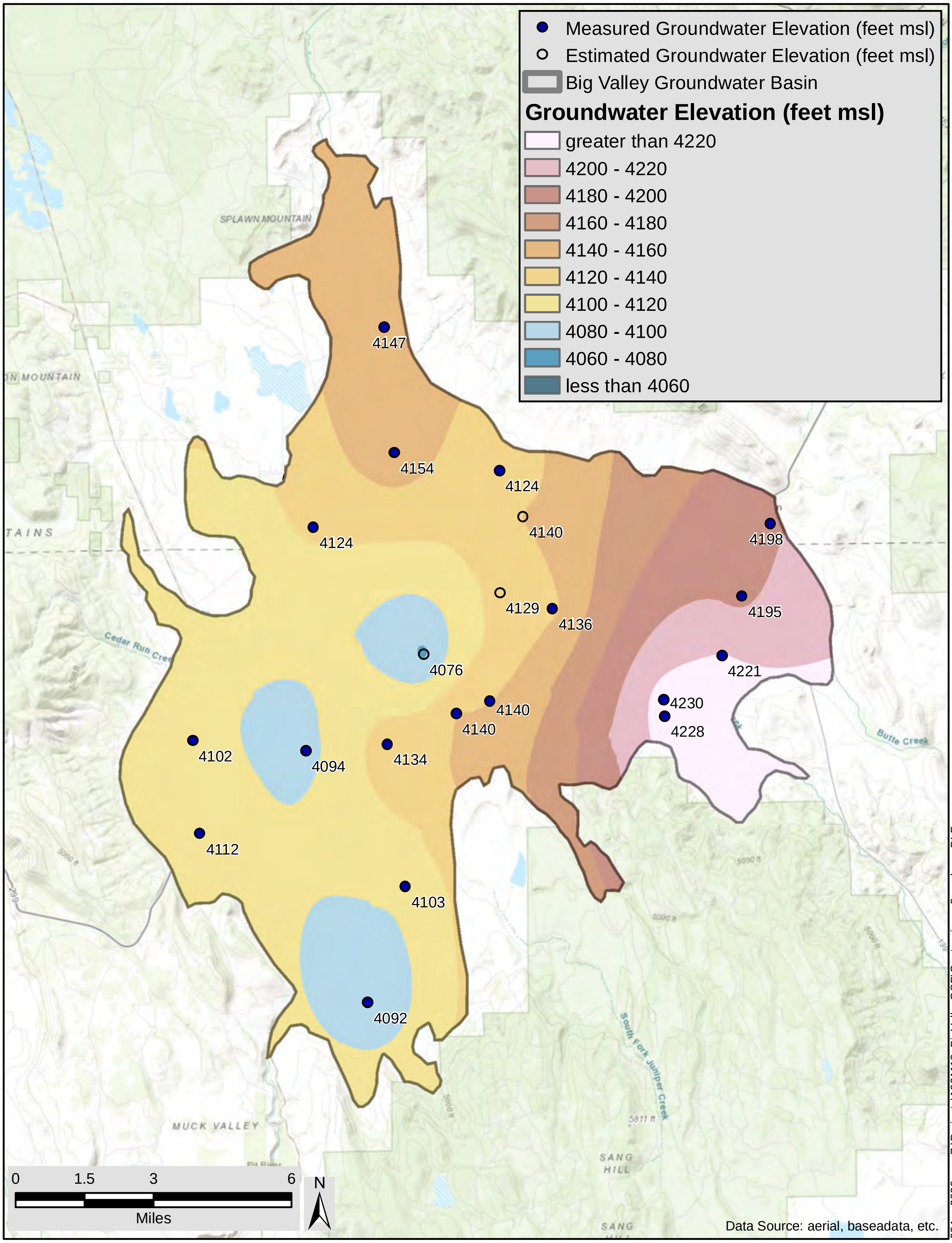

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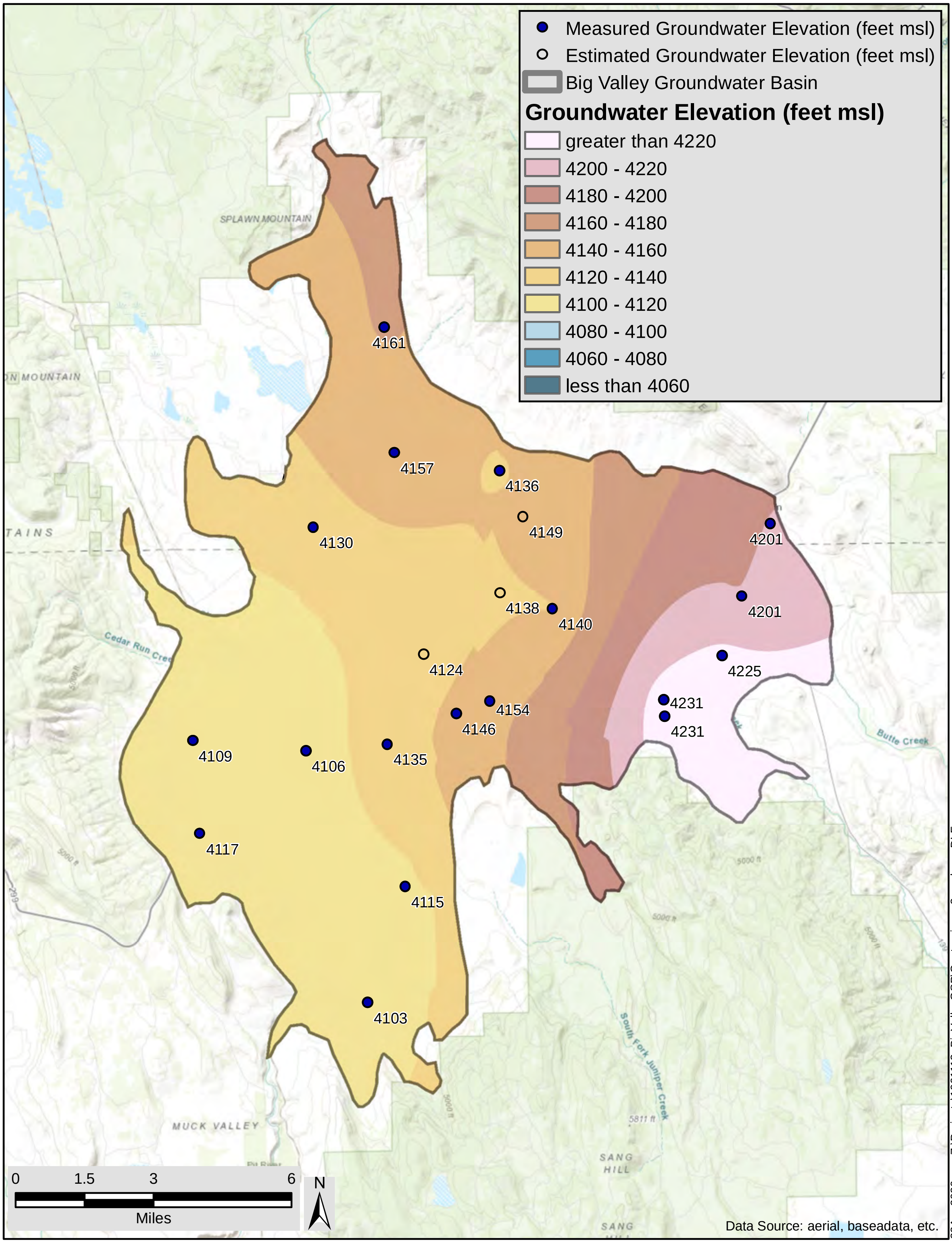
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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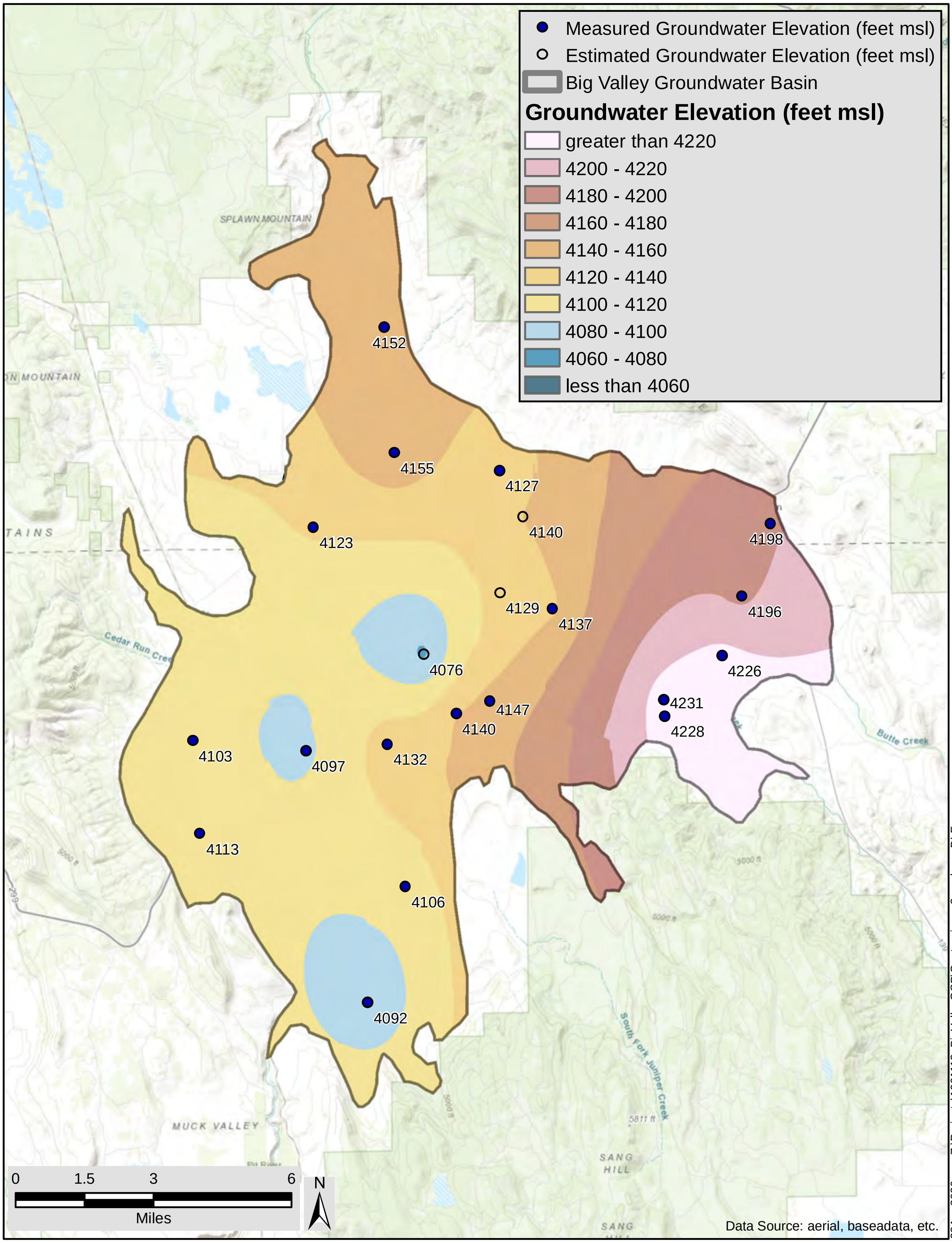
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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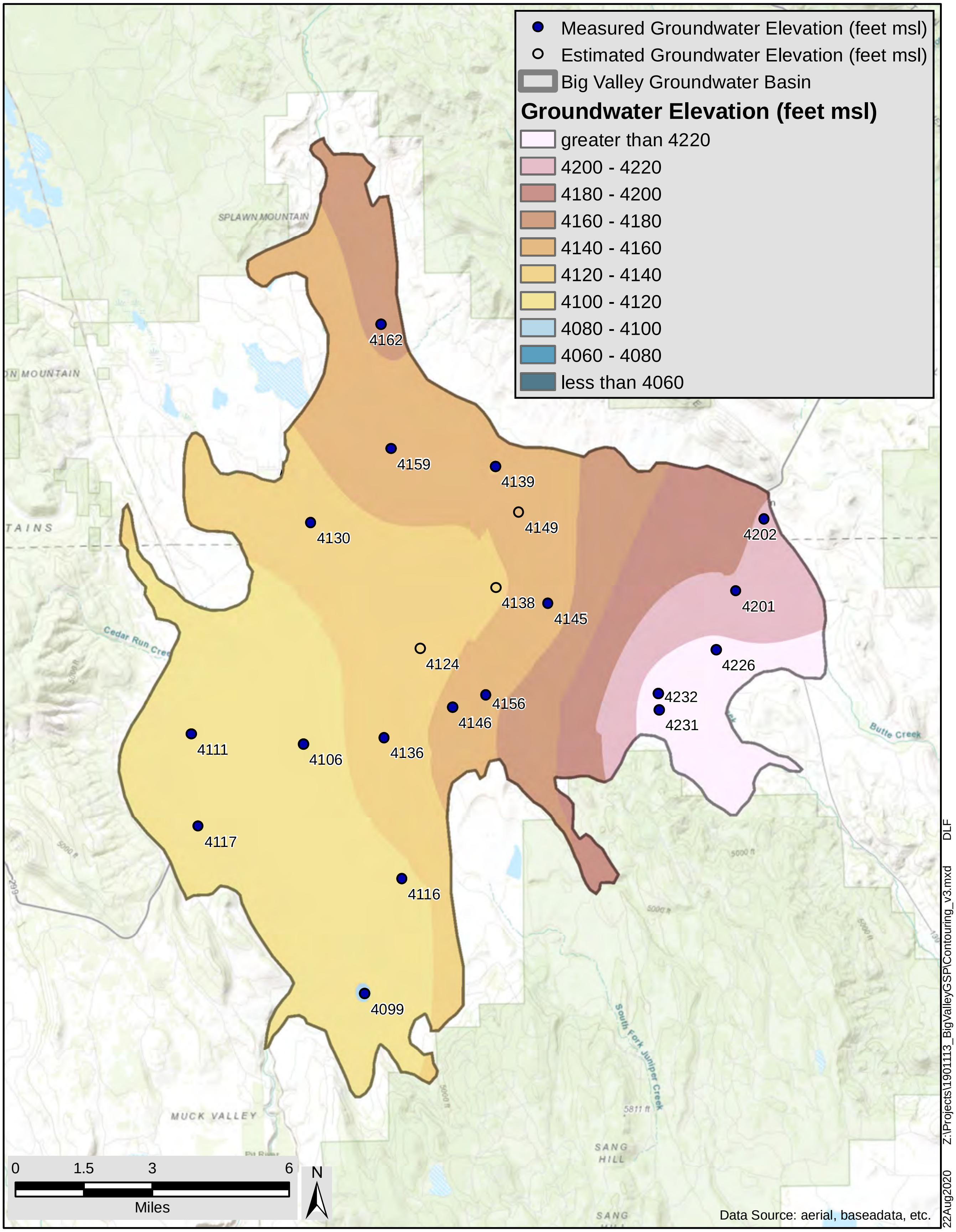

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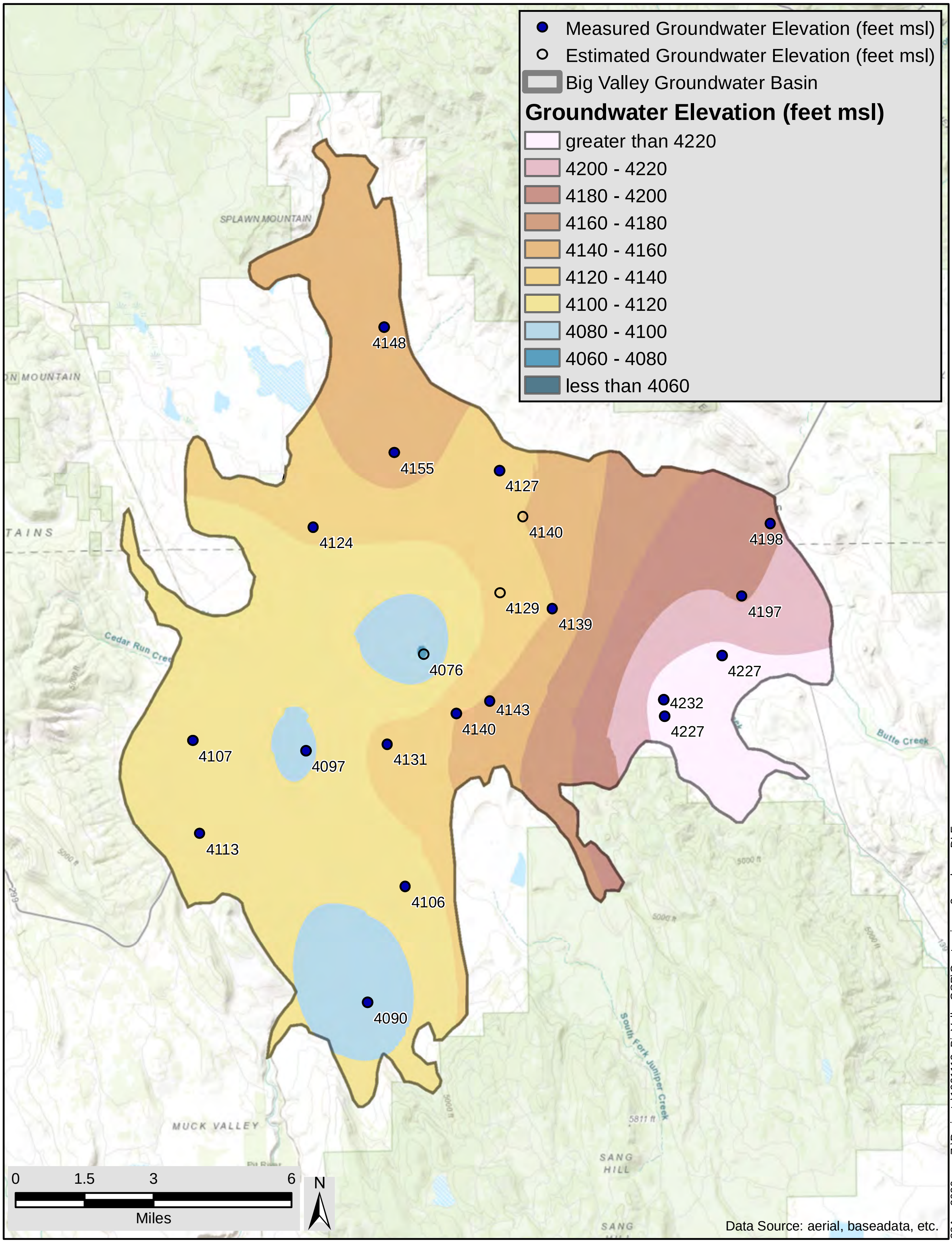

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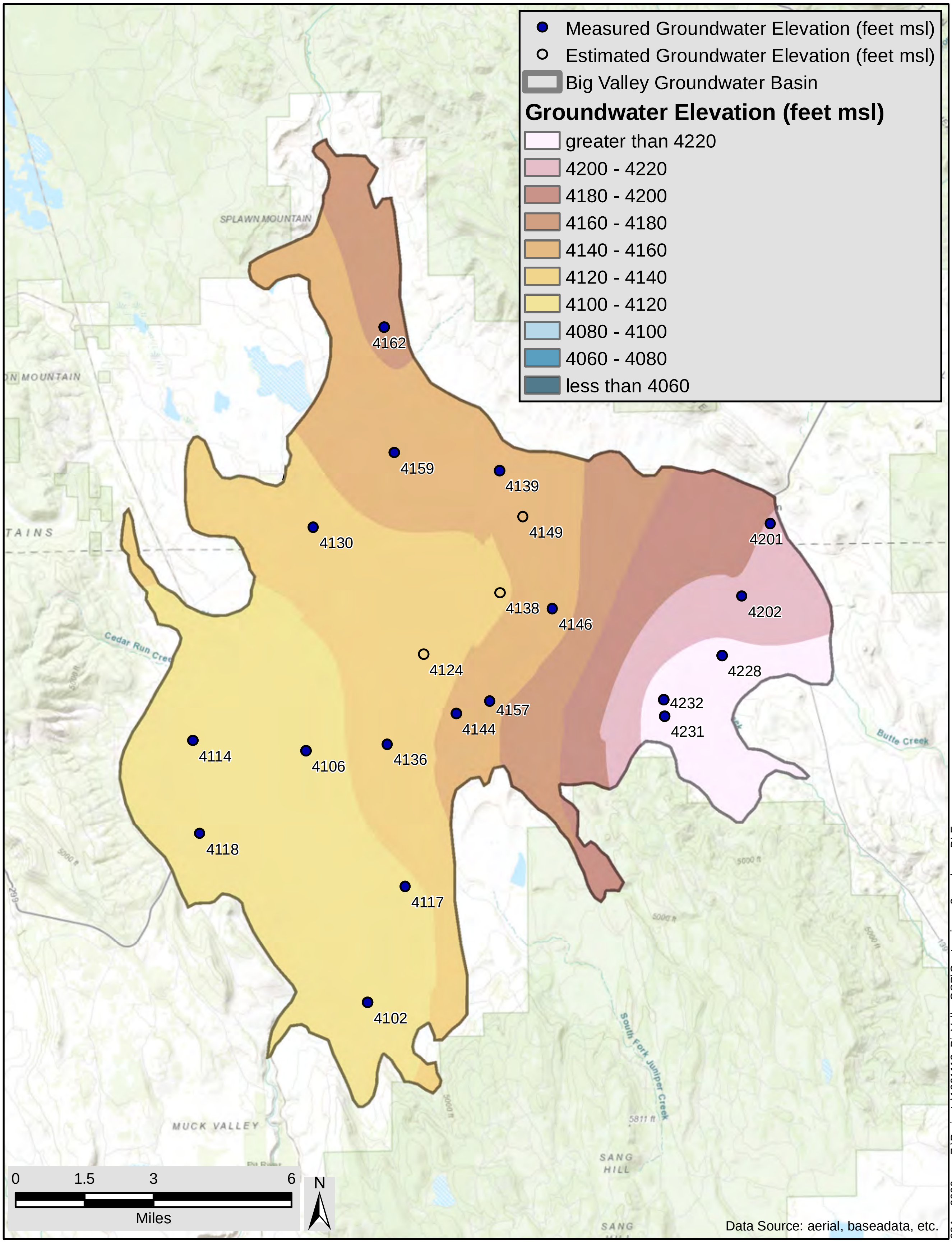
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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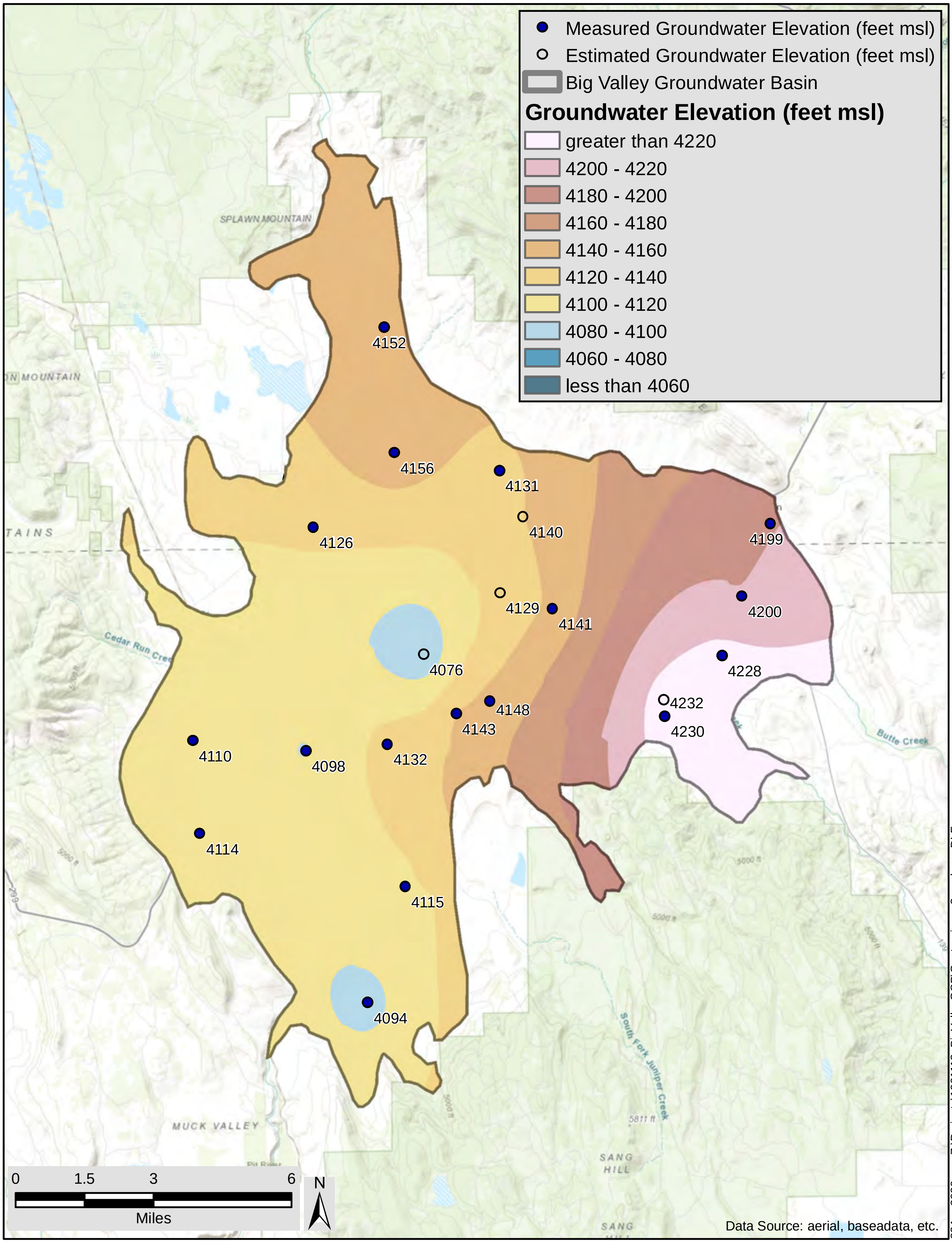
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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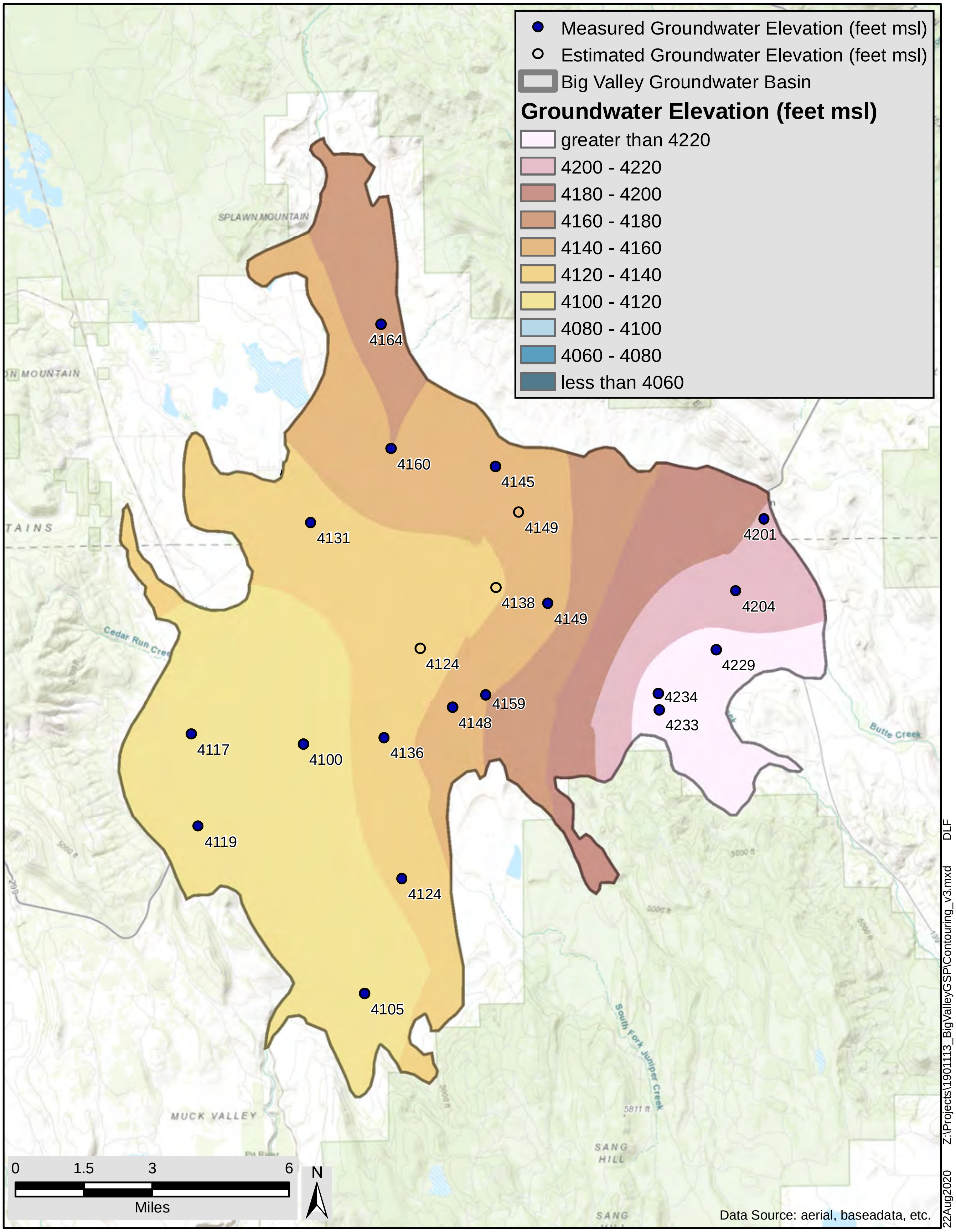
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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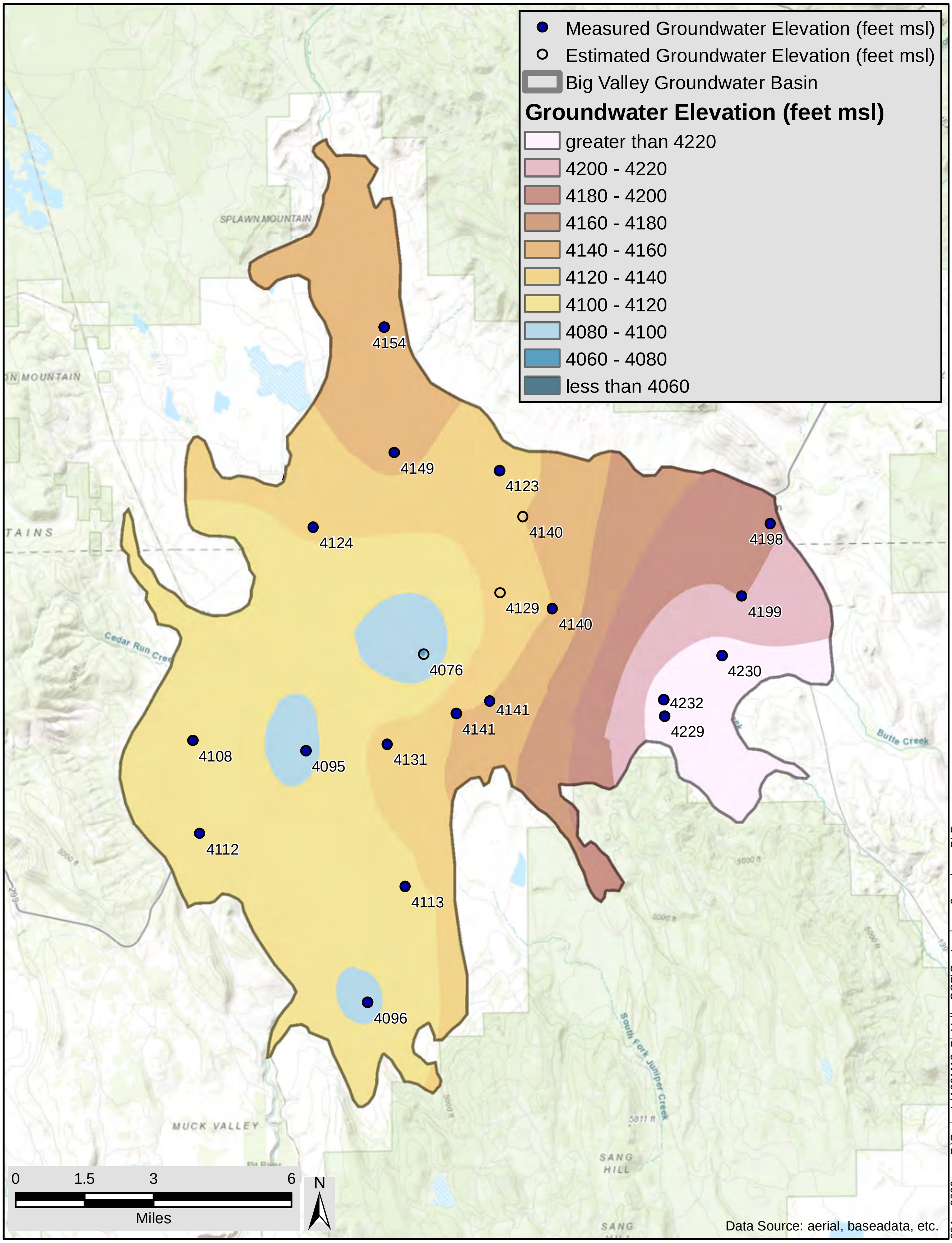

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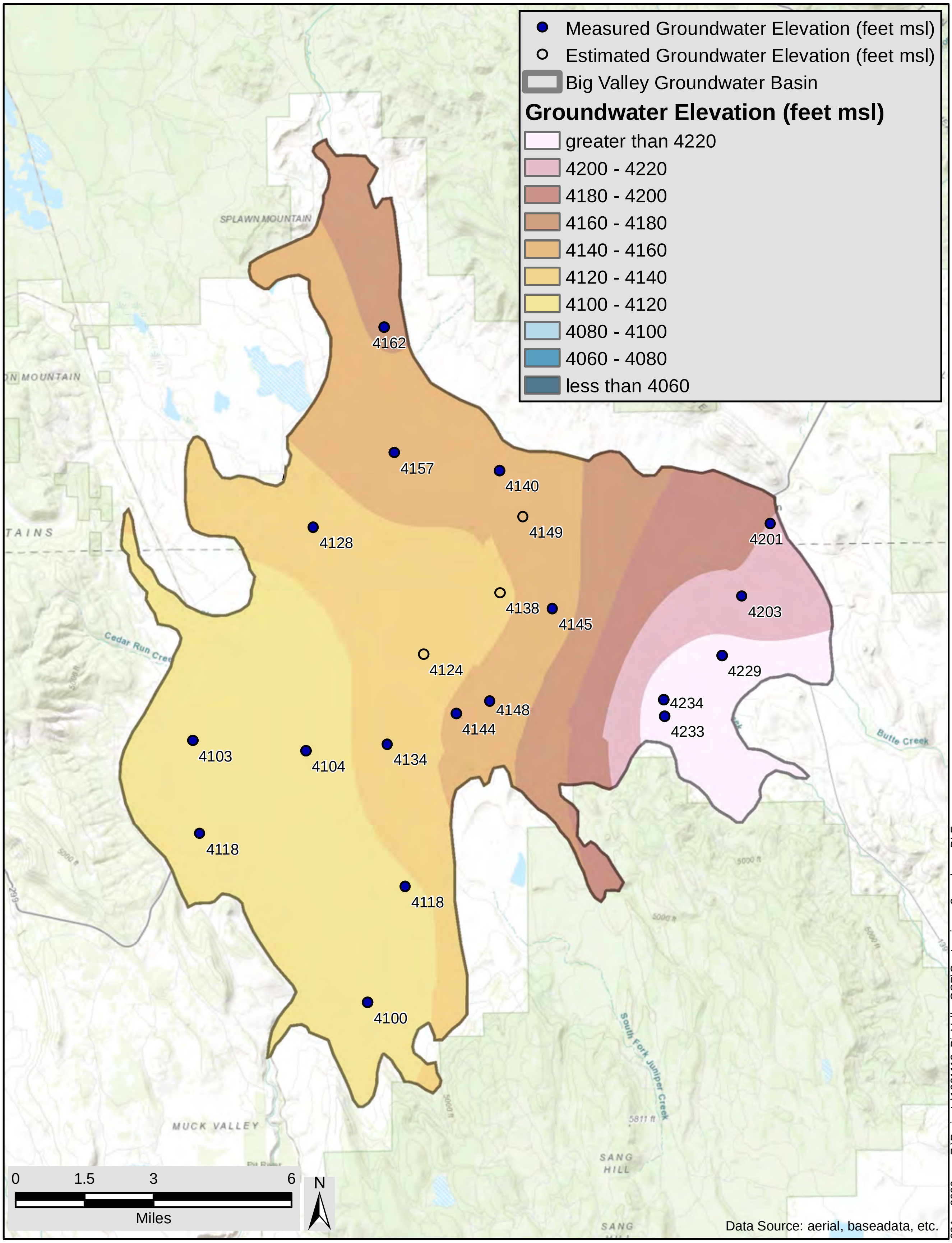
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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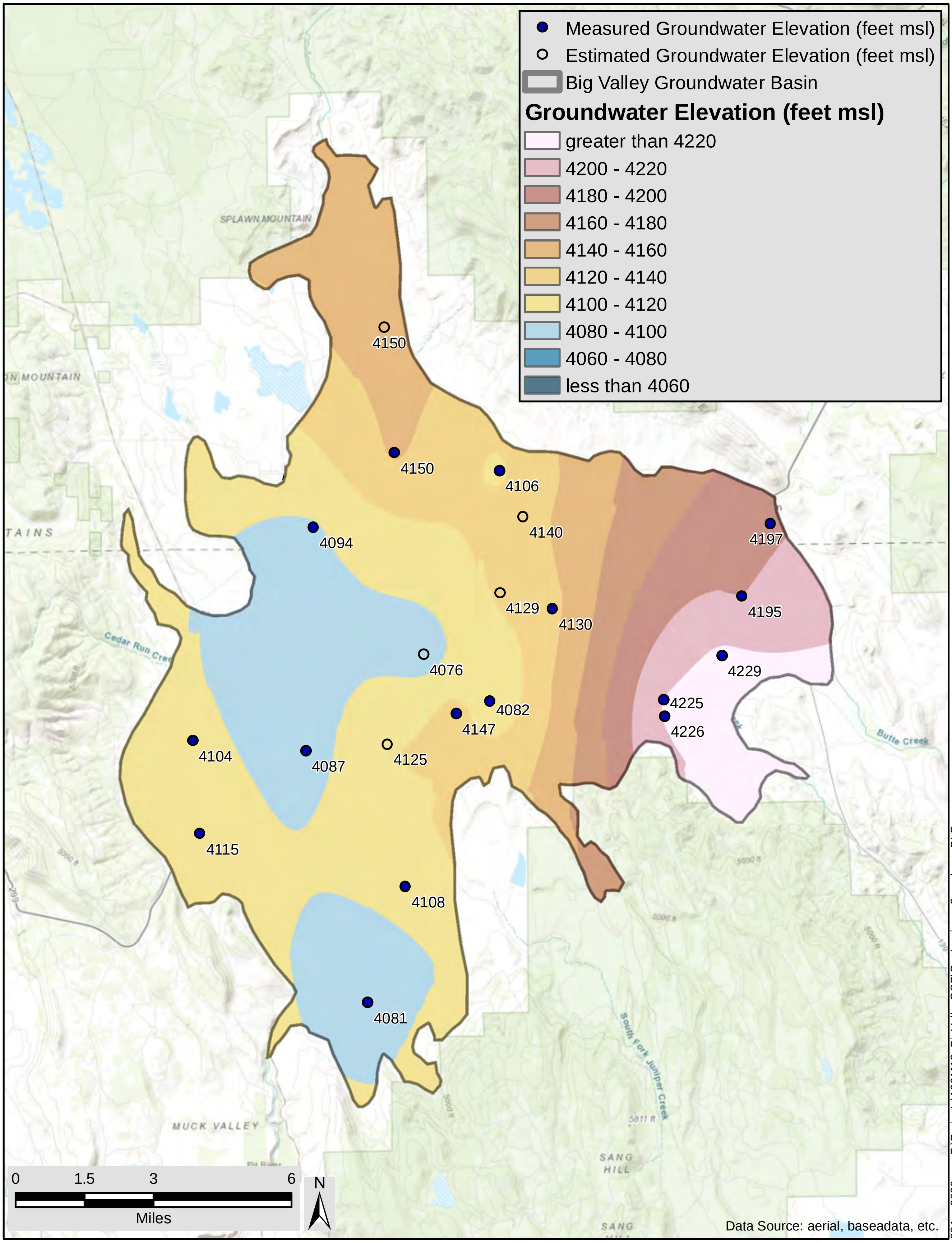

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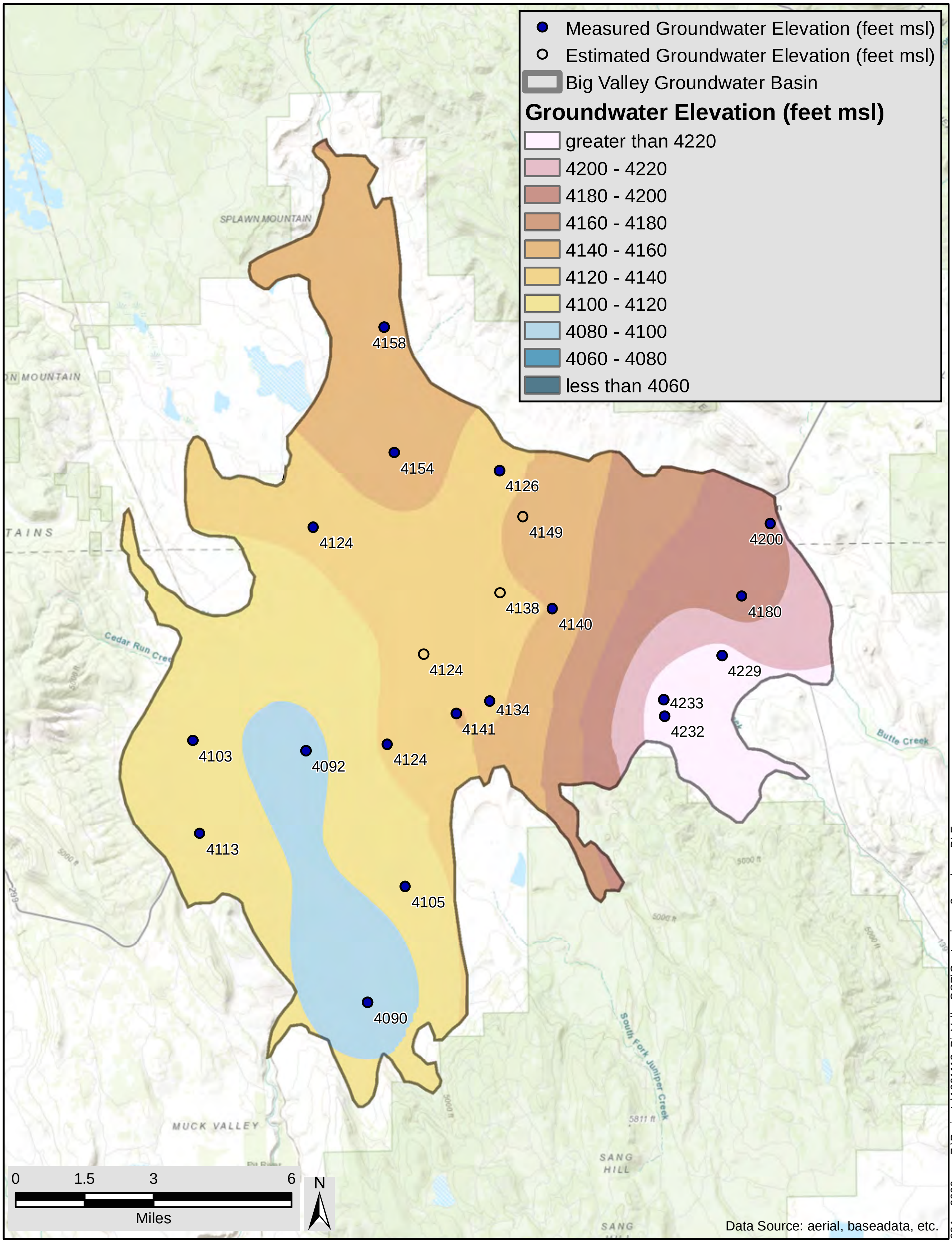
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 2000		
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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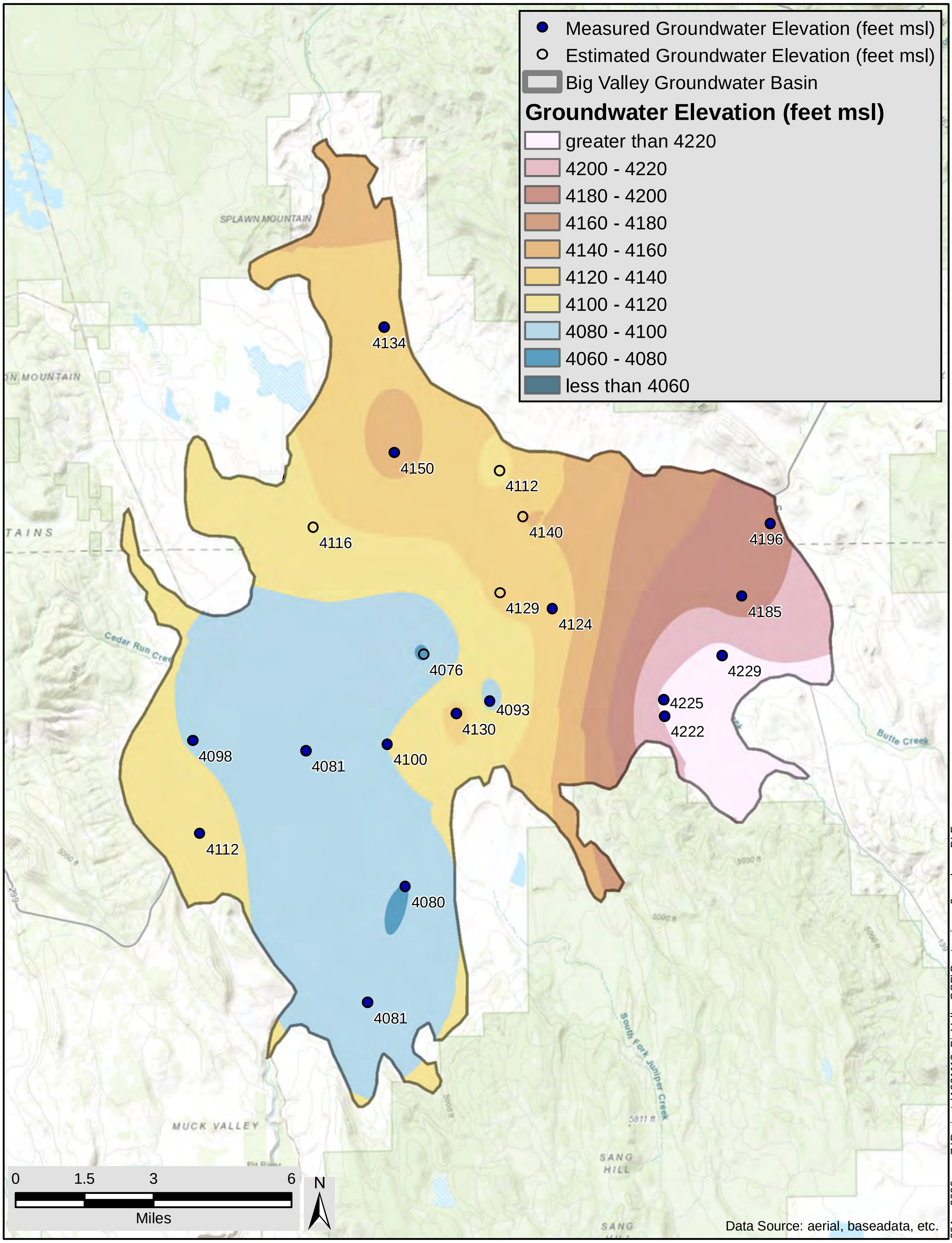
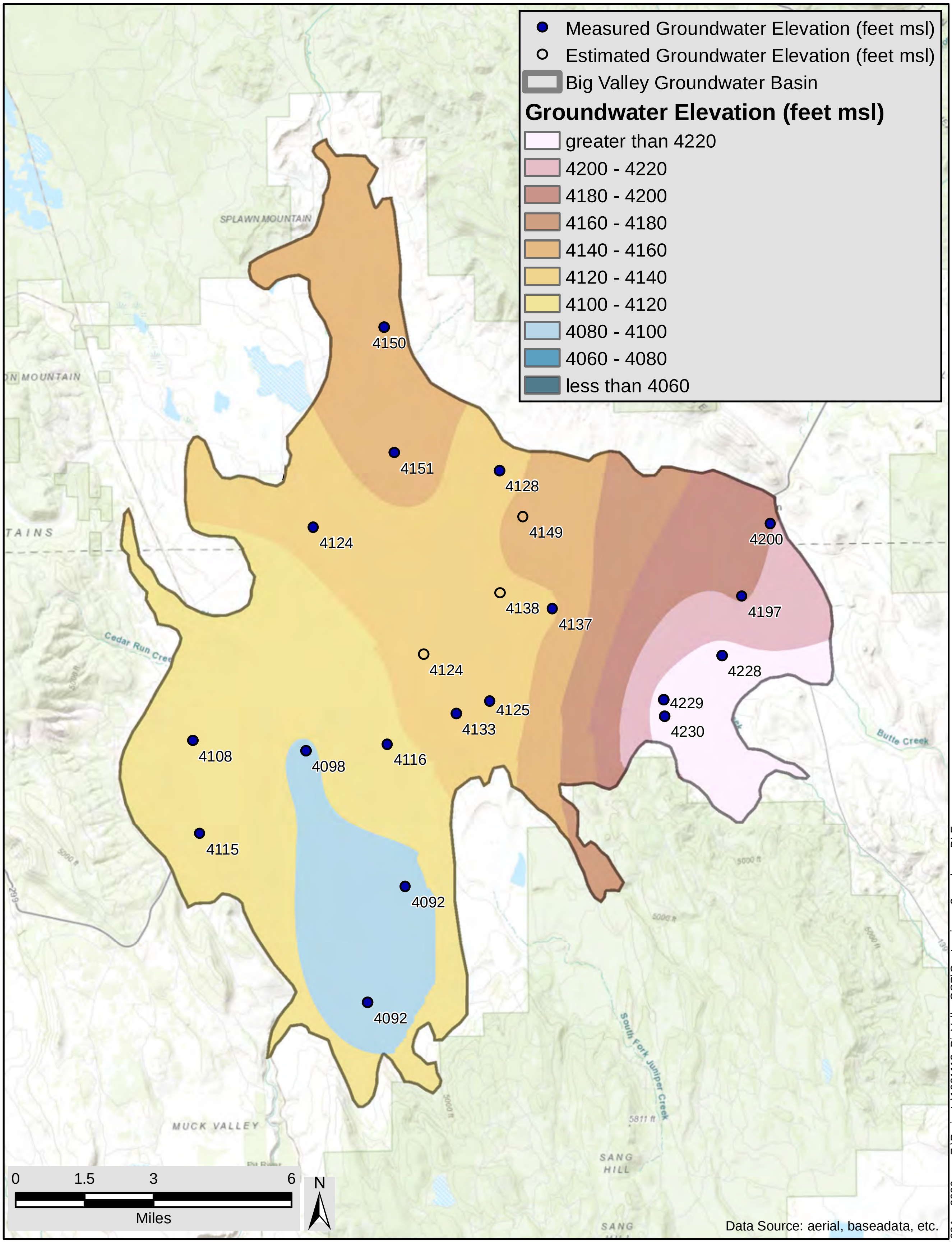
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 2001
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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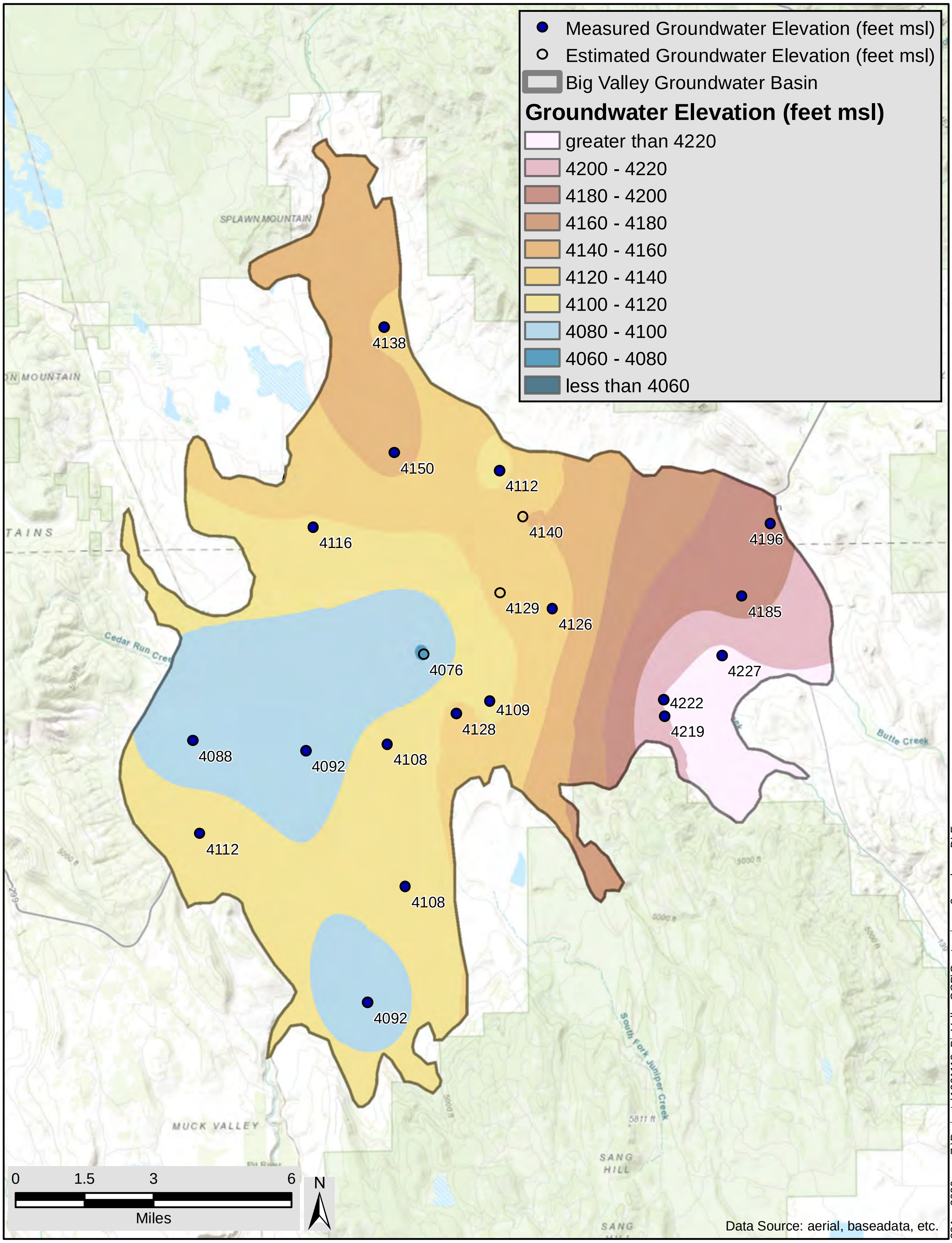
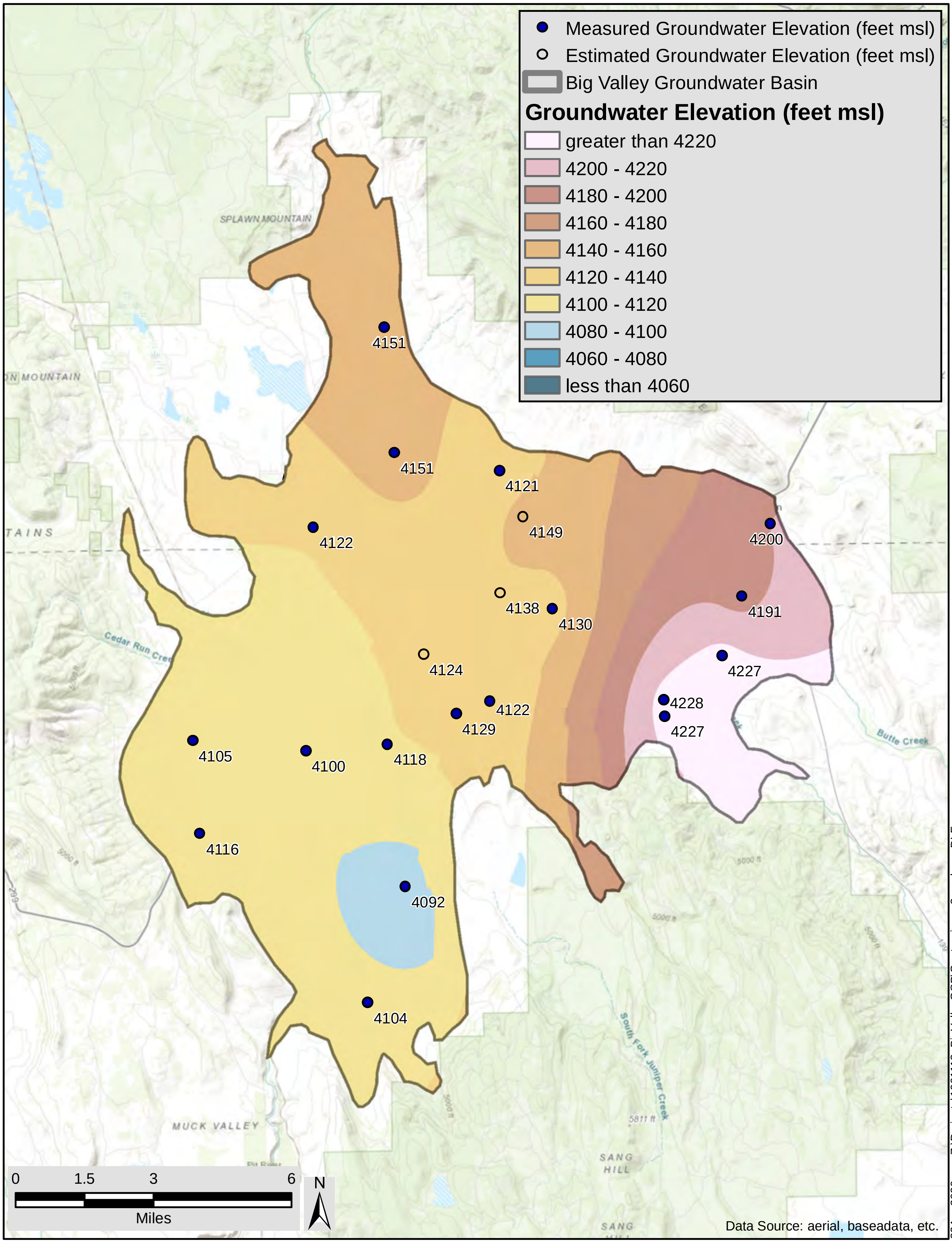


Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 2002
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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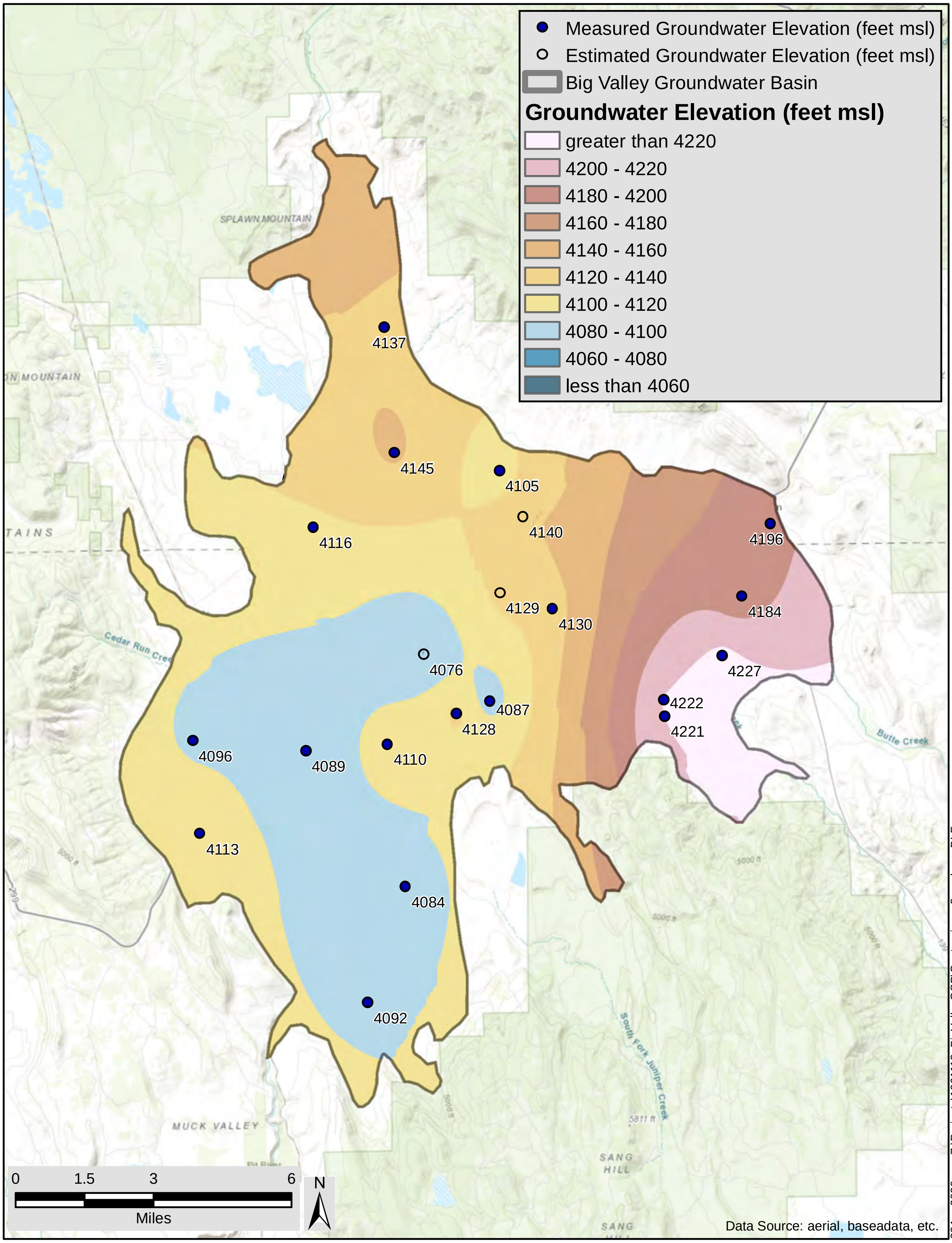

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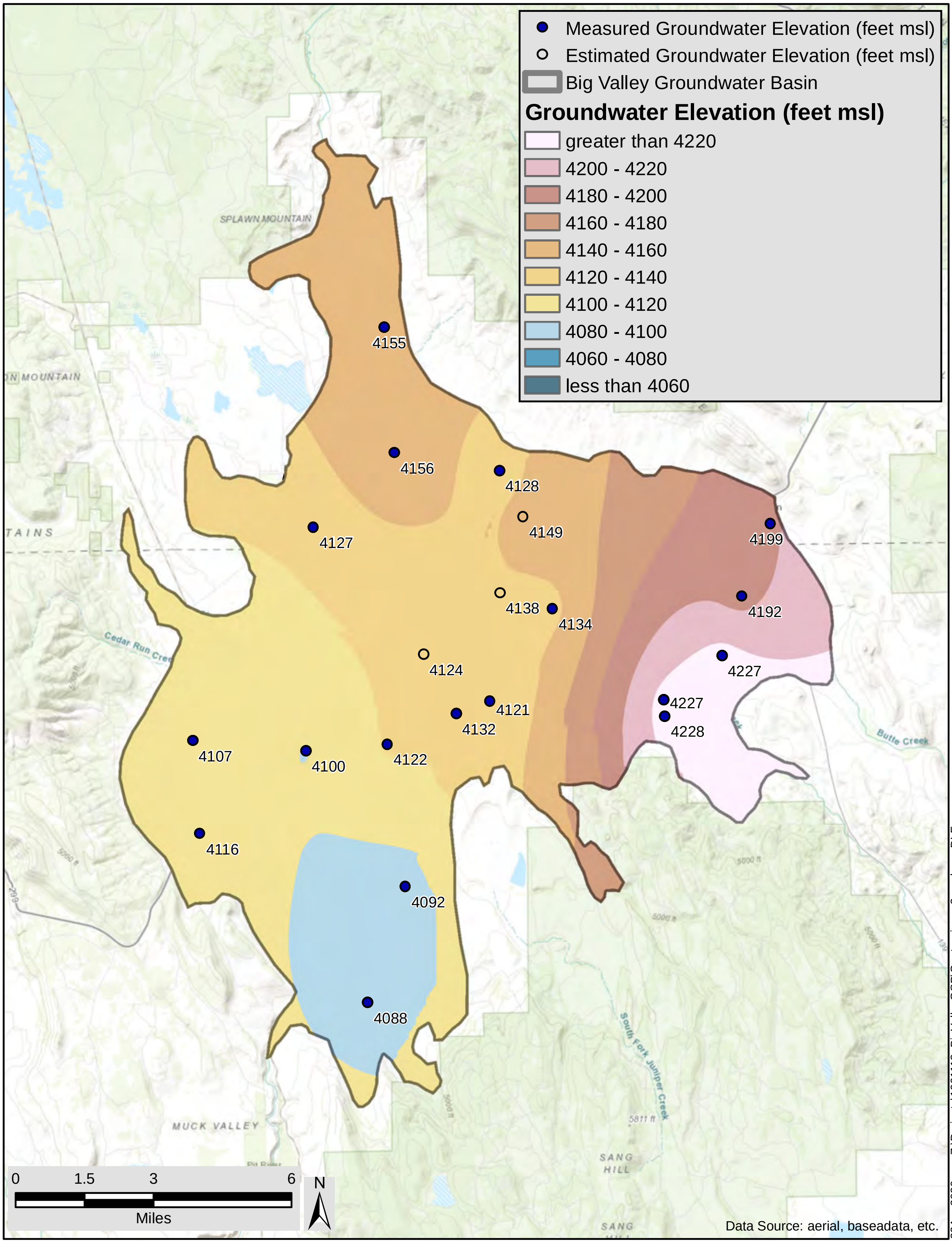

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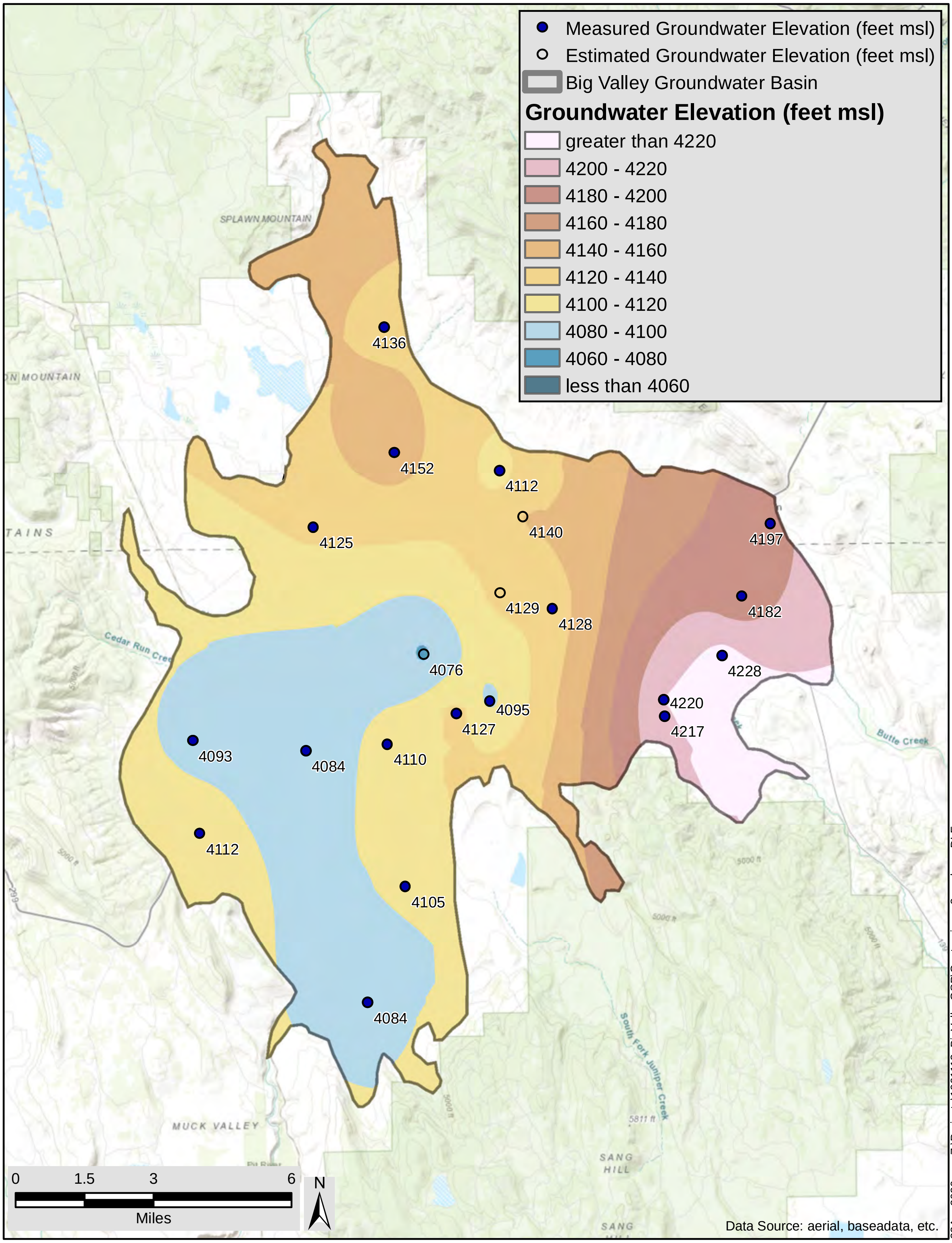

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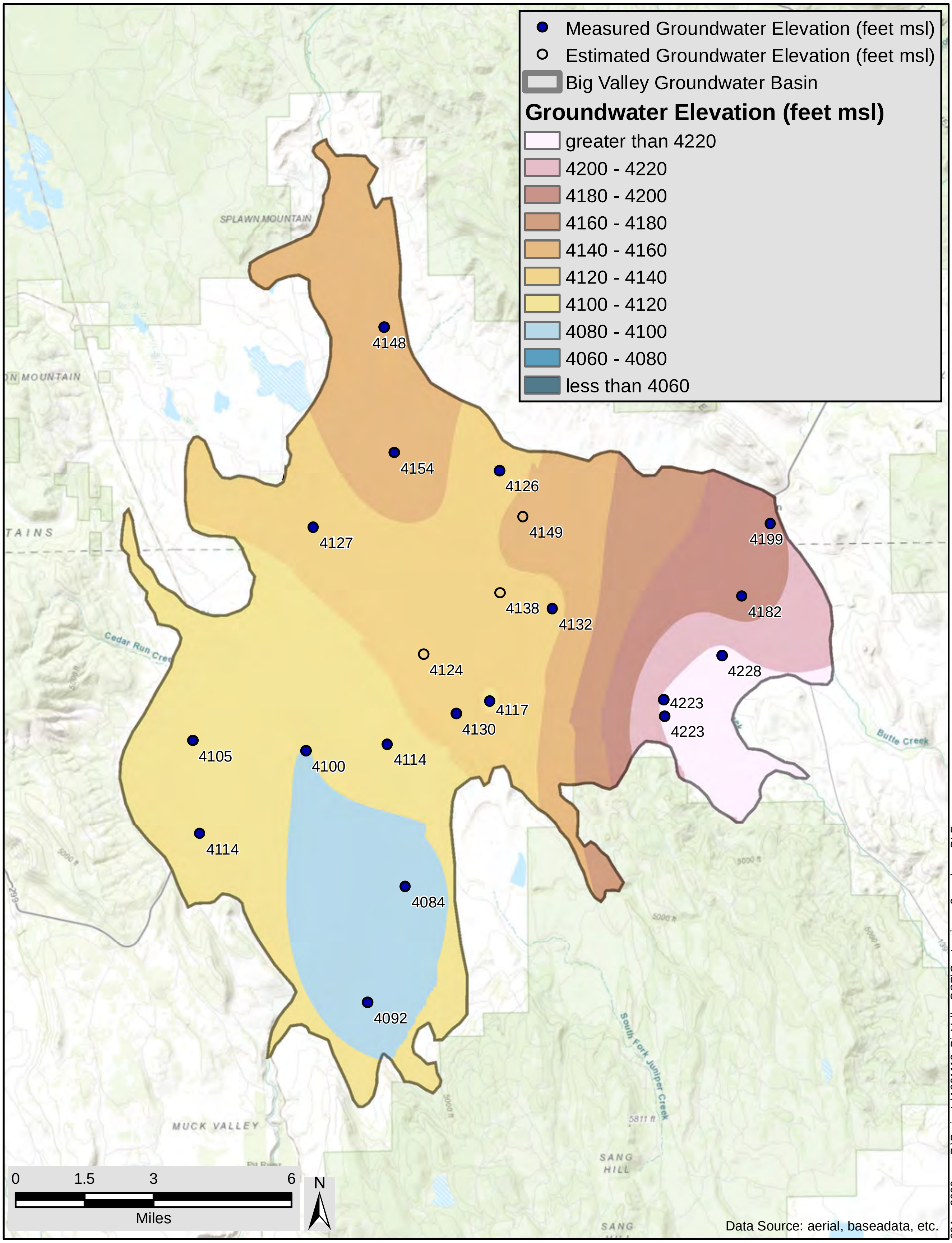

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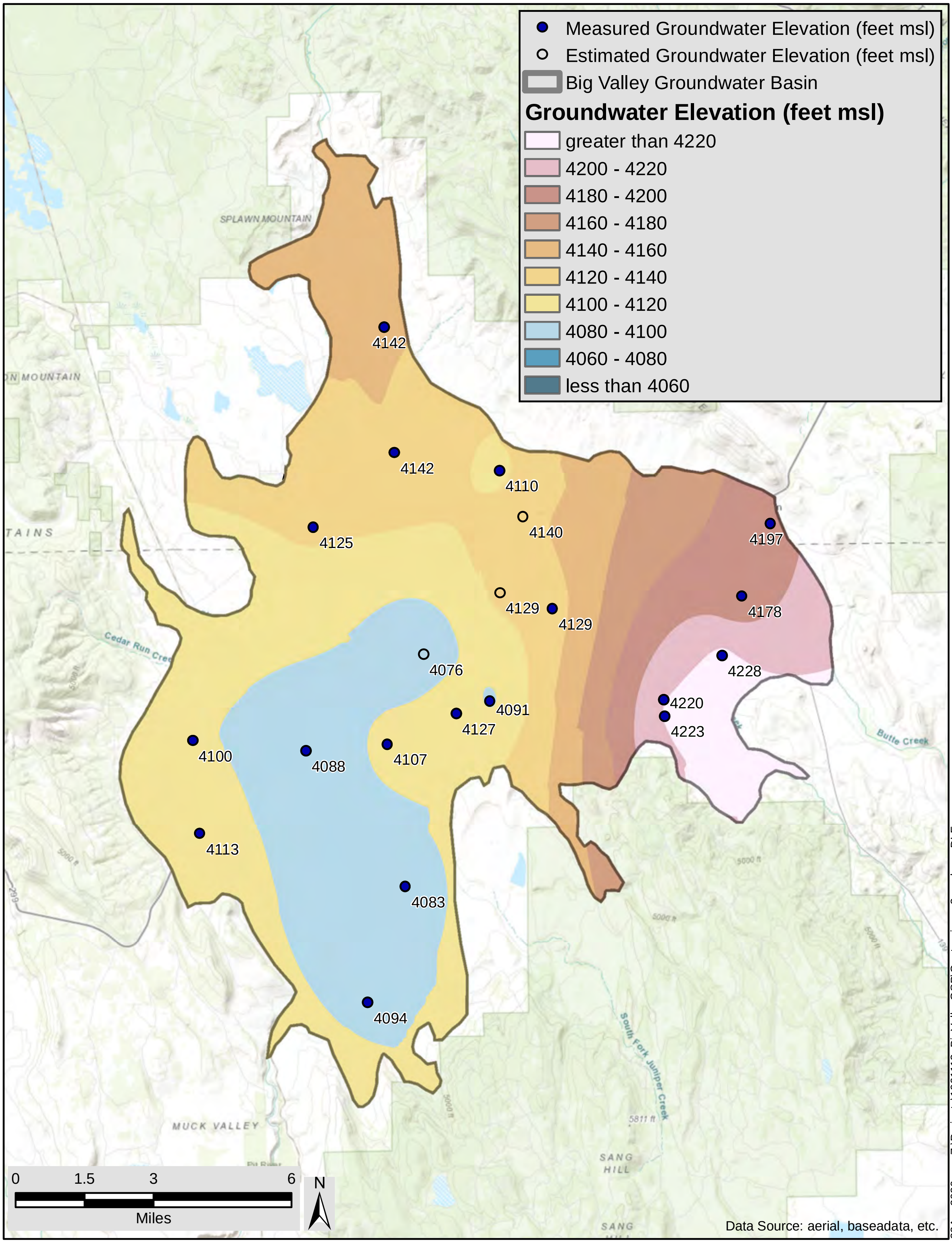

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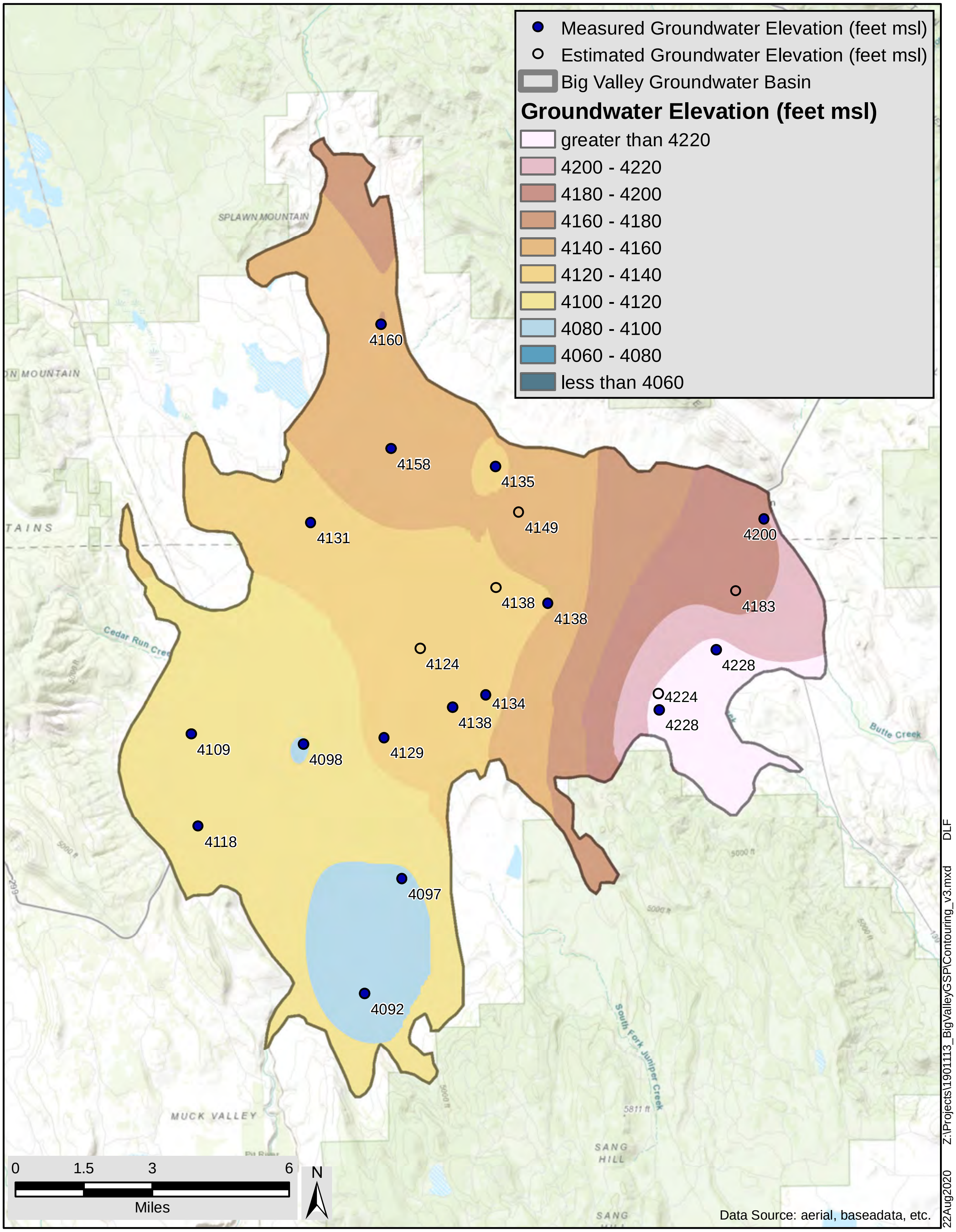

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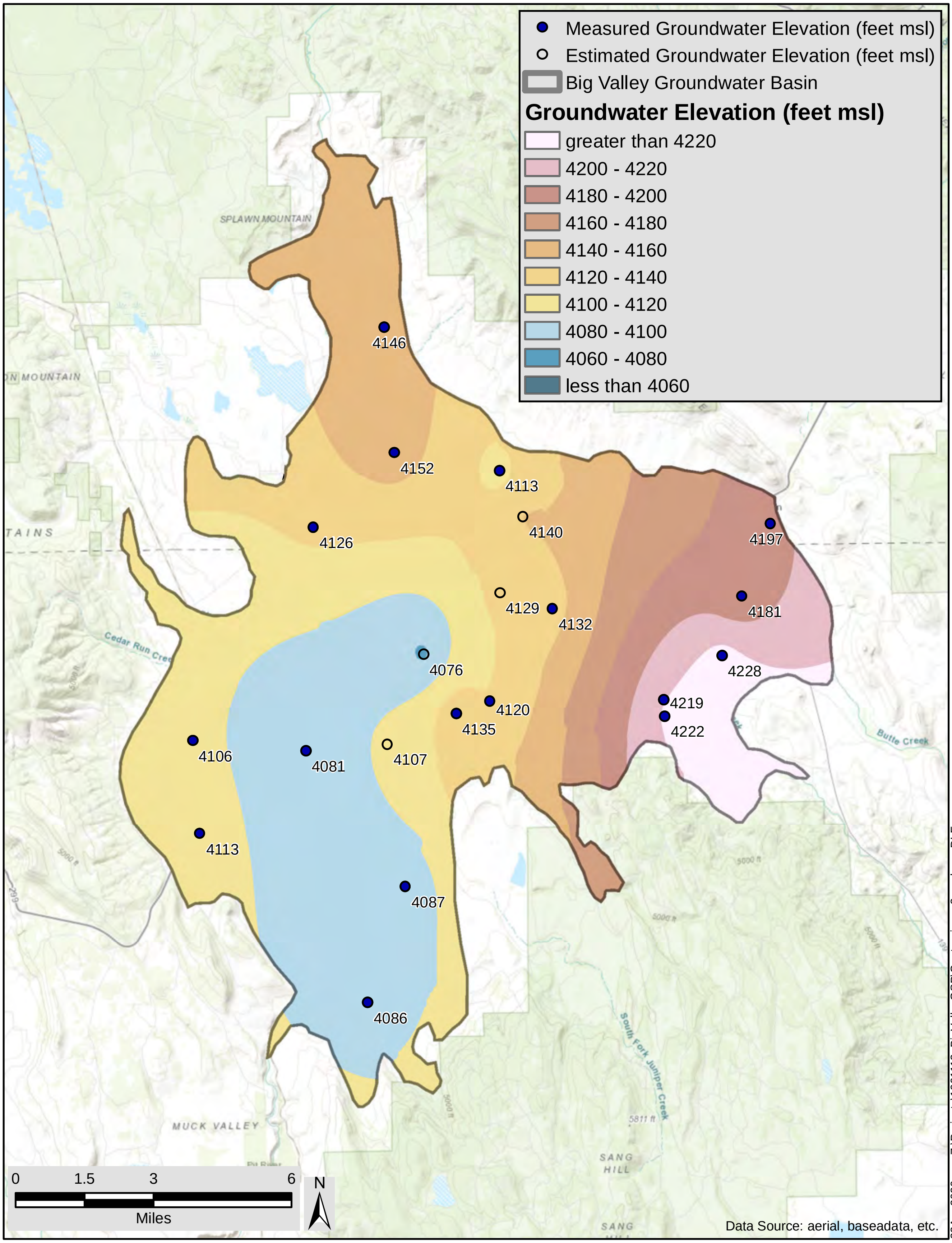

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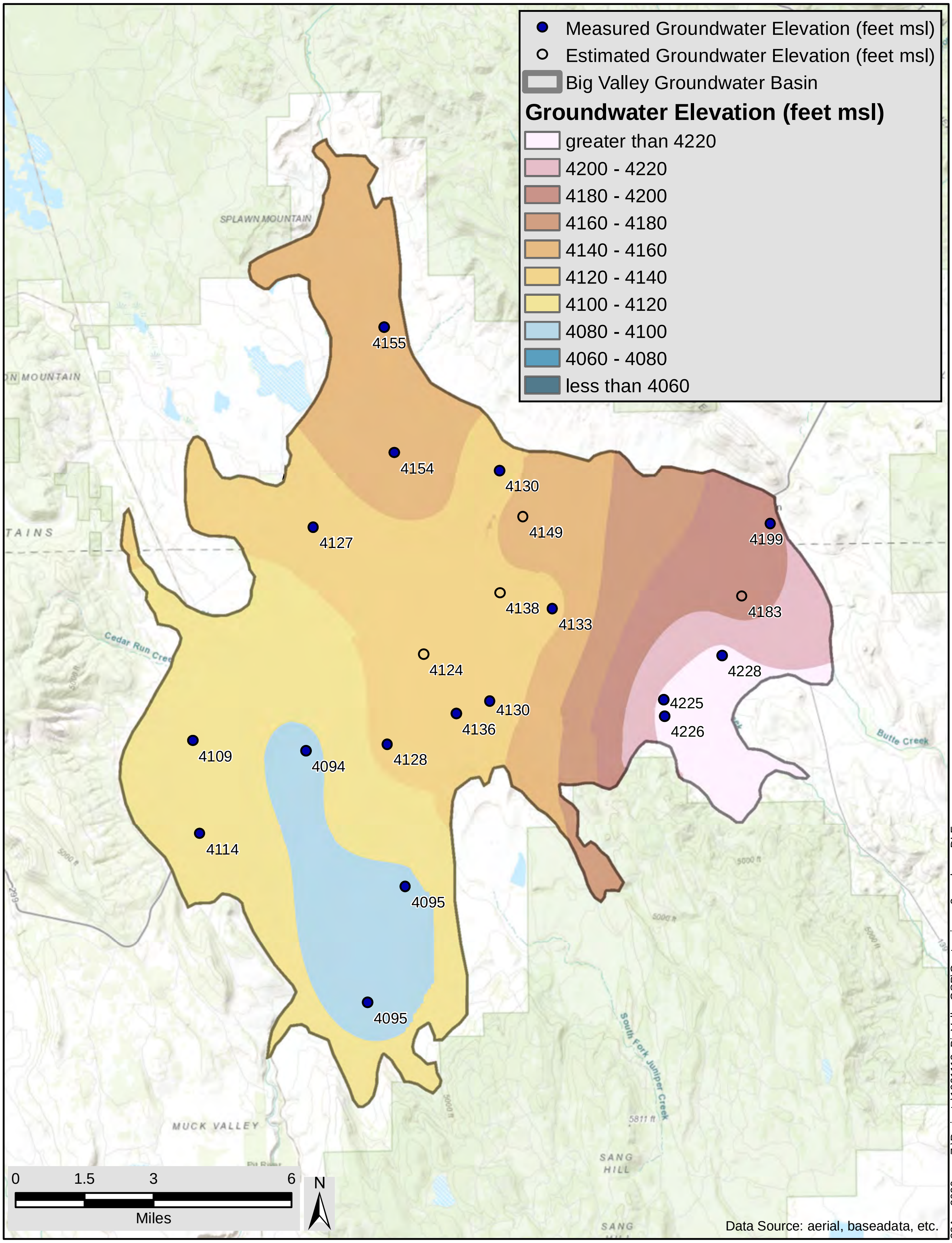
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE



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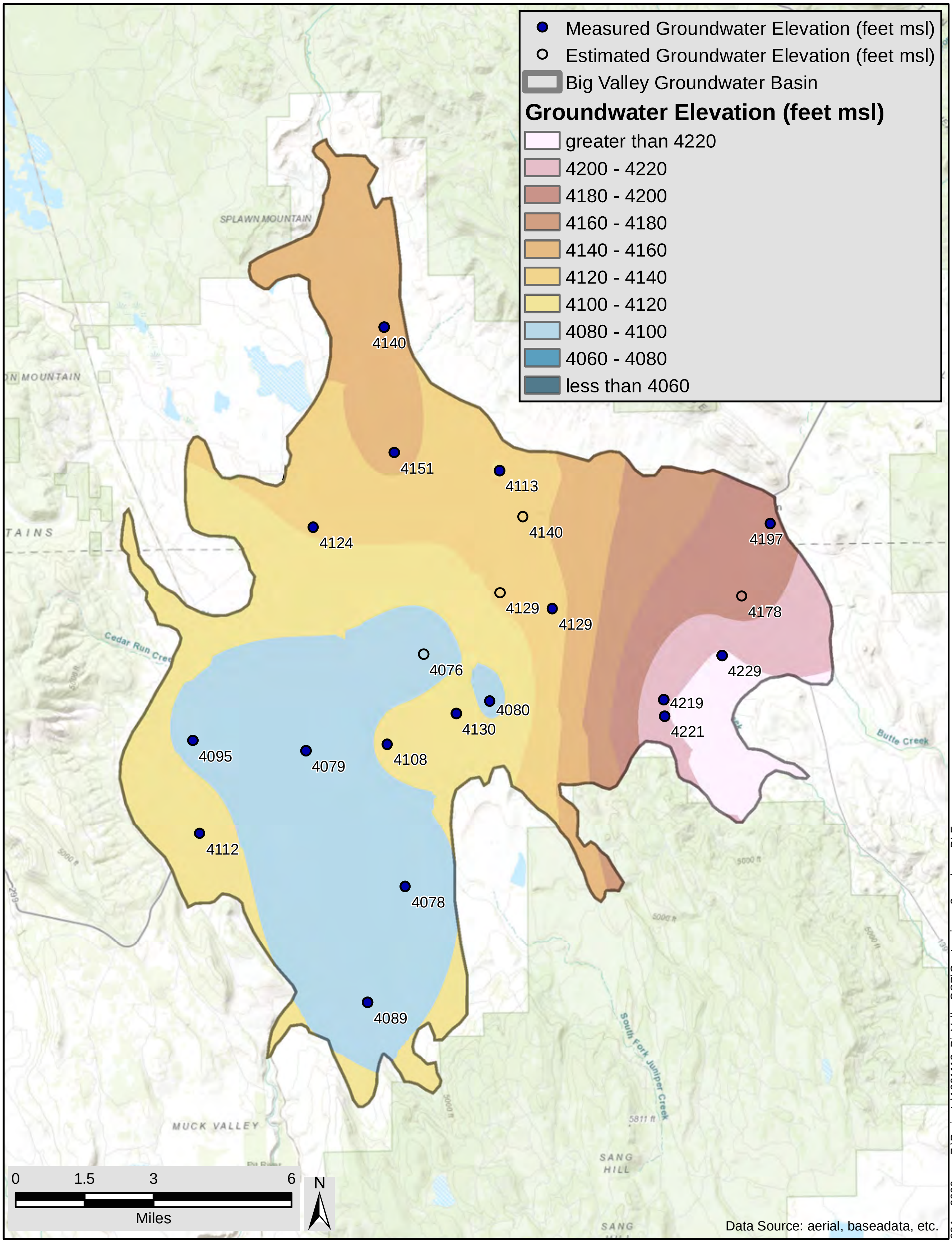

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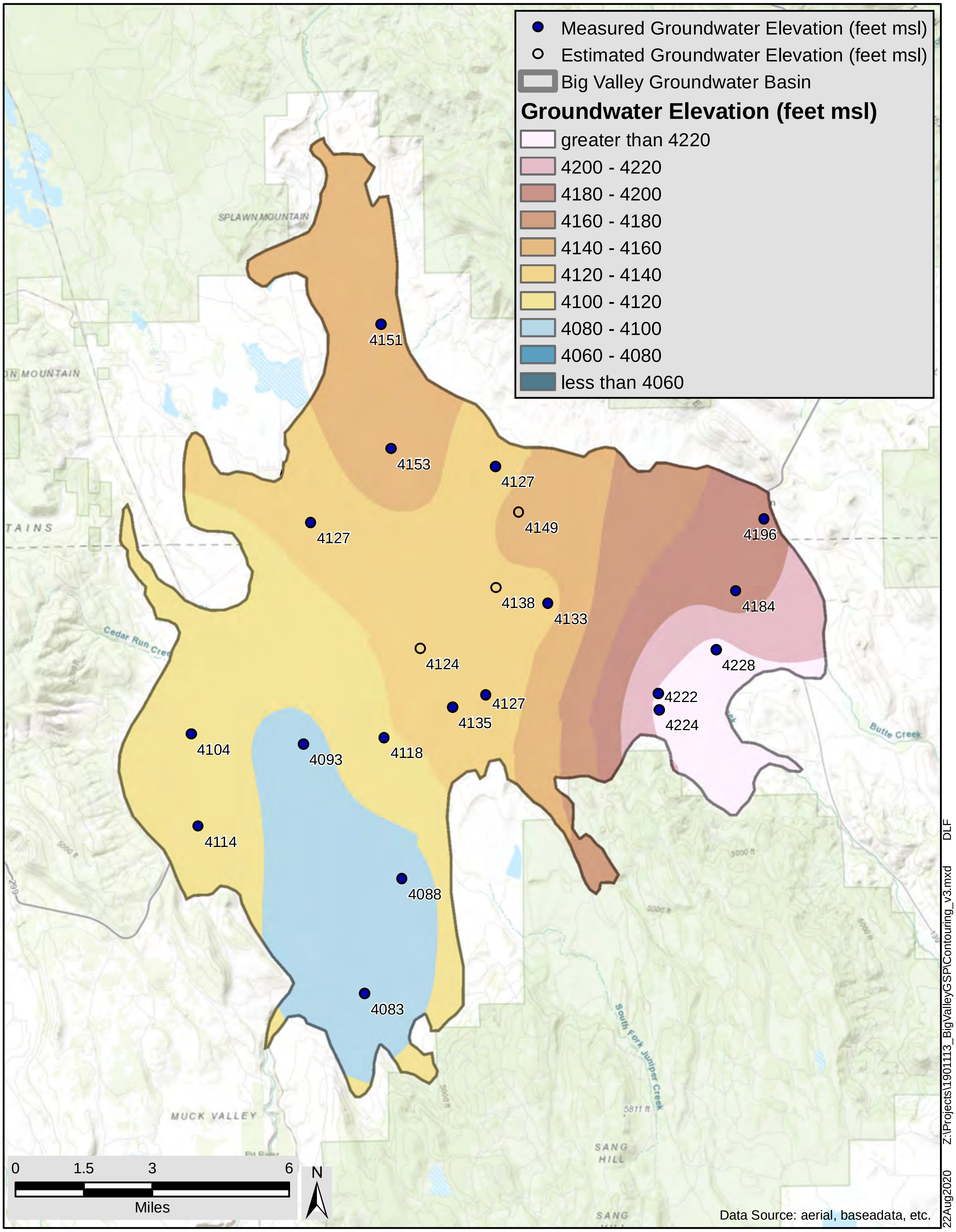

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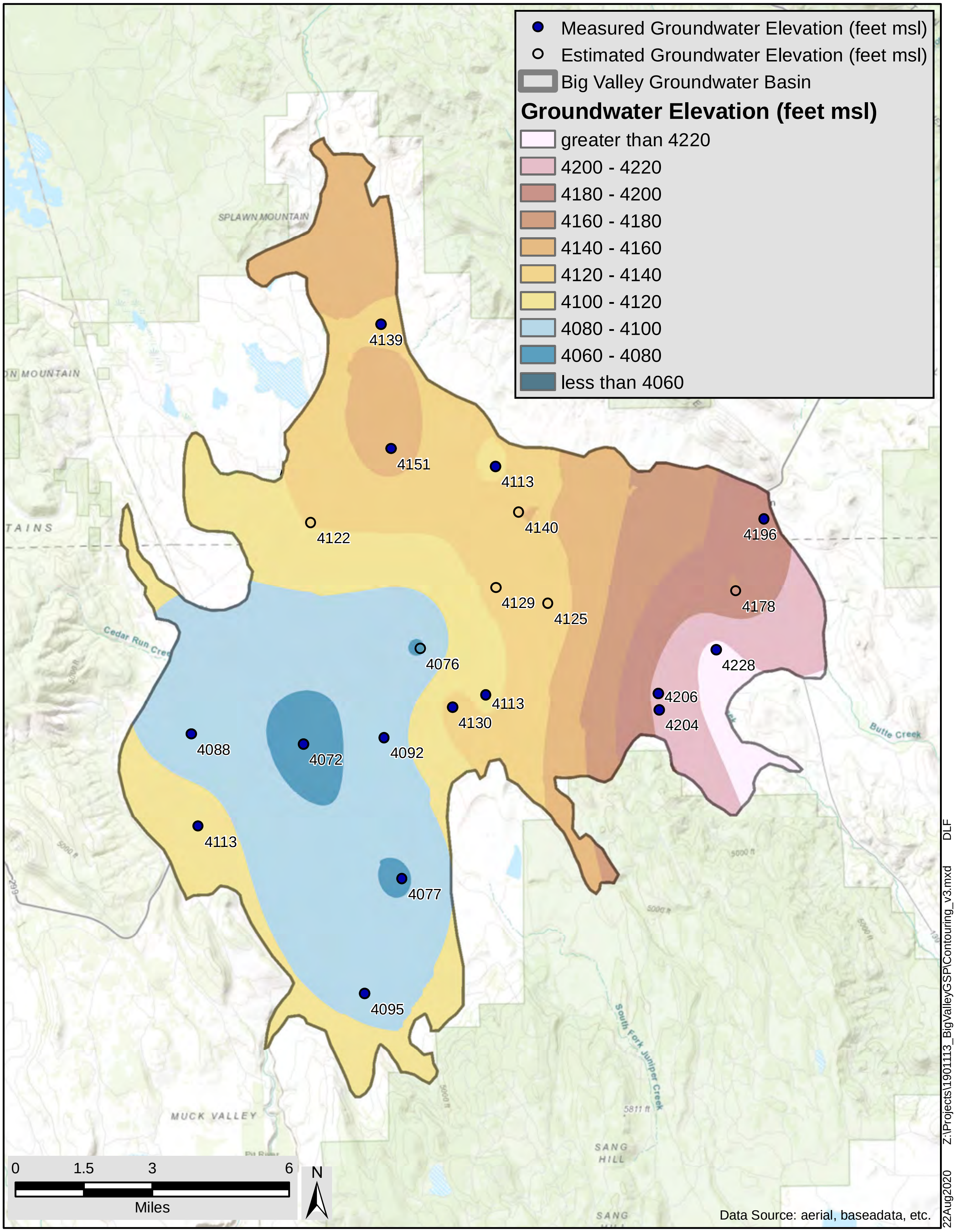

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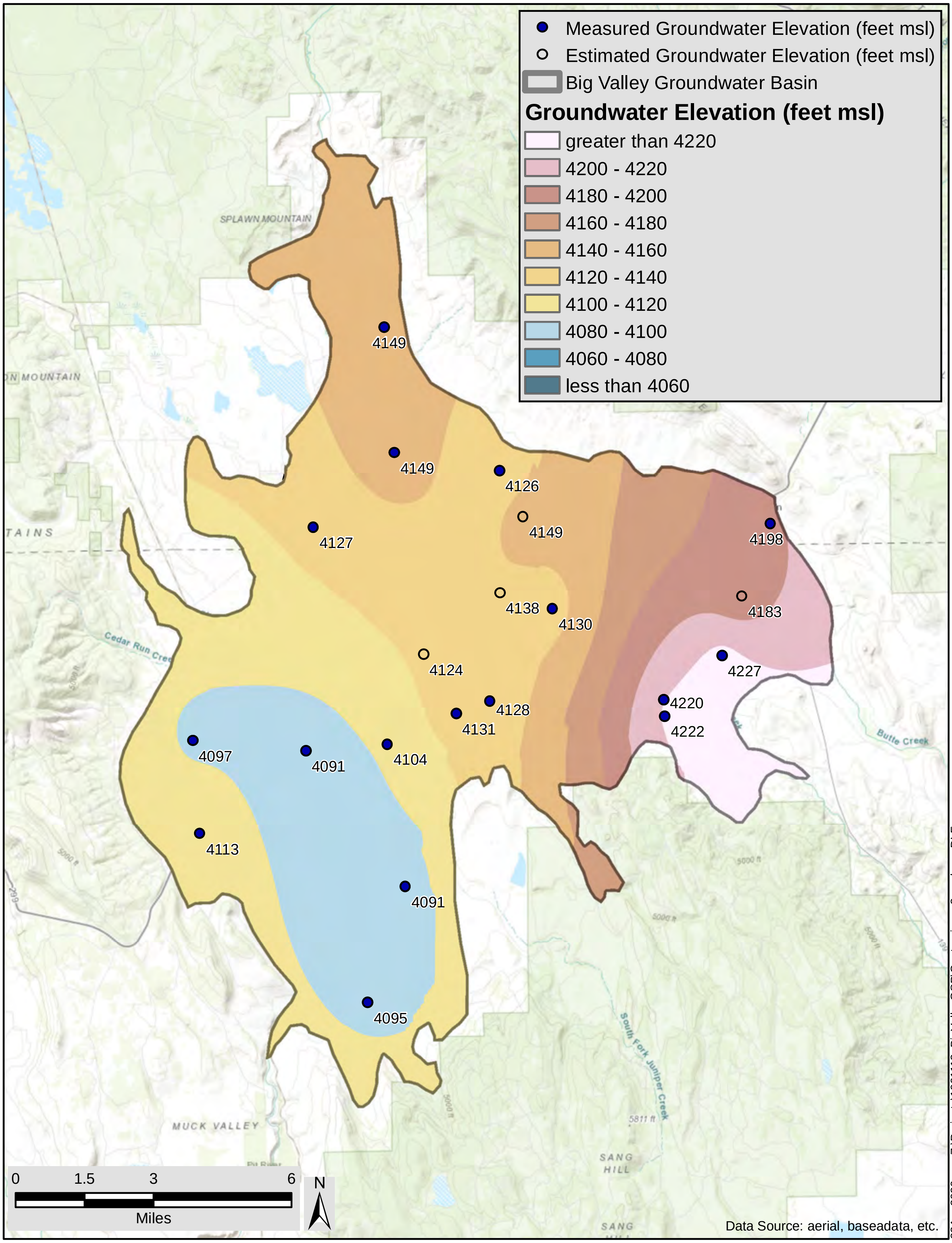
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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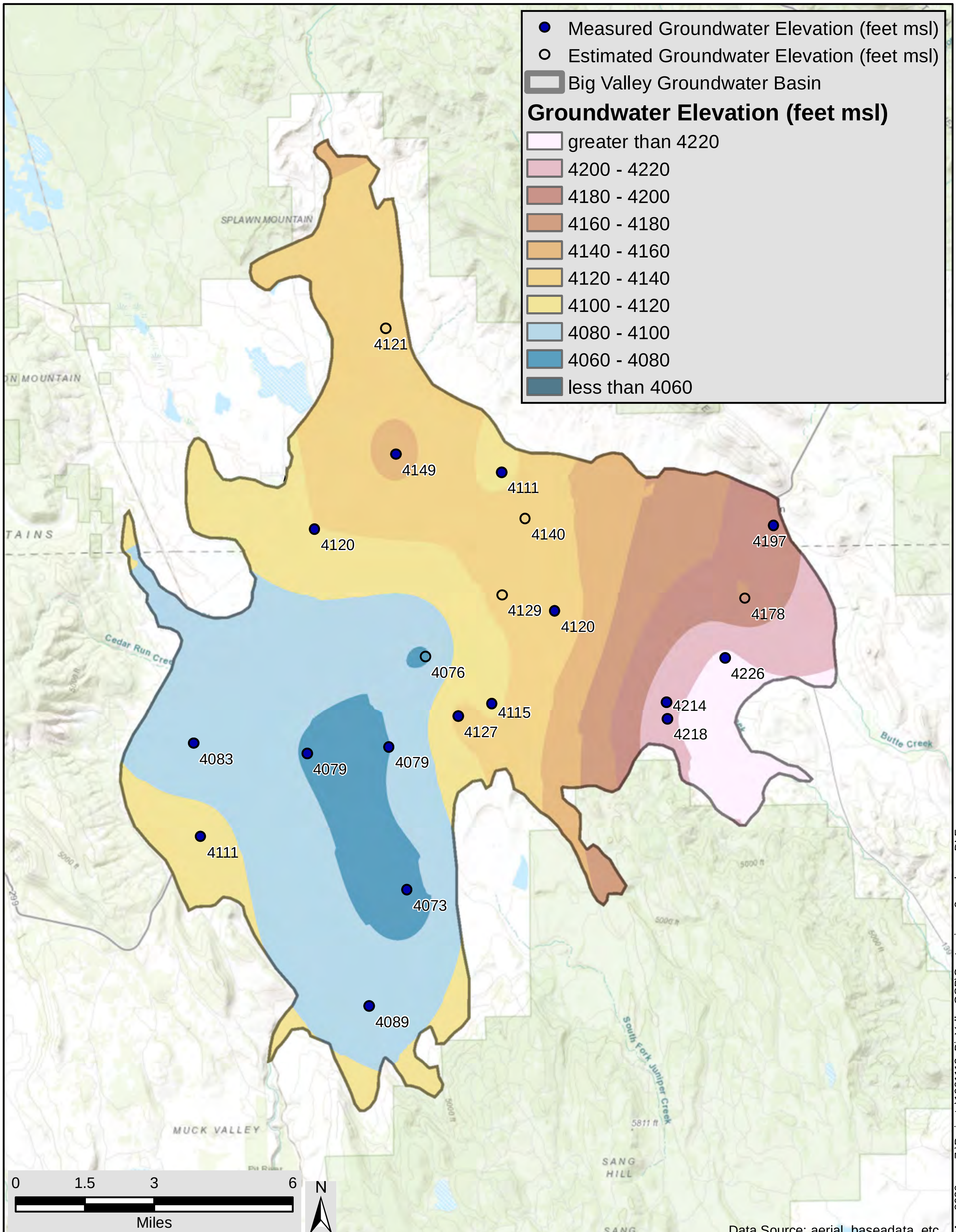

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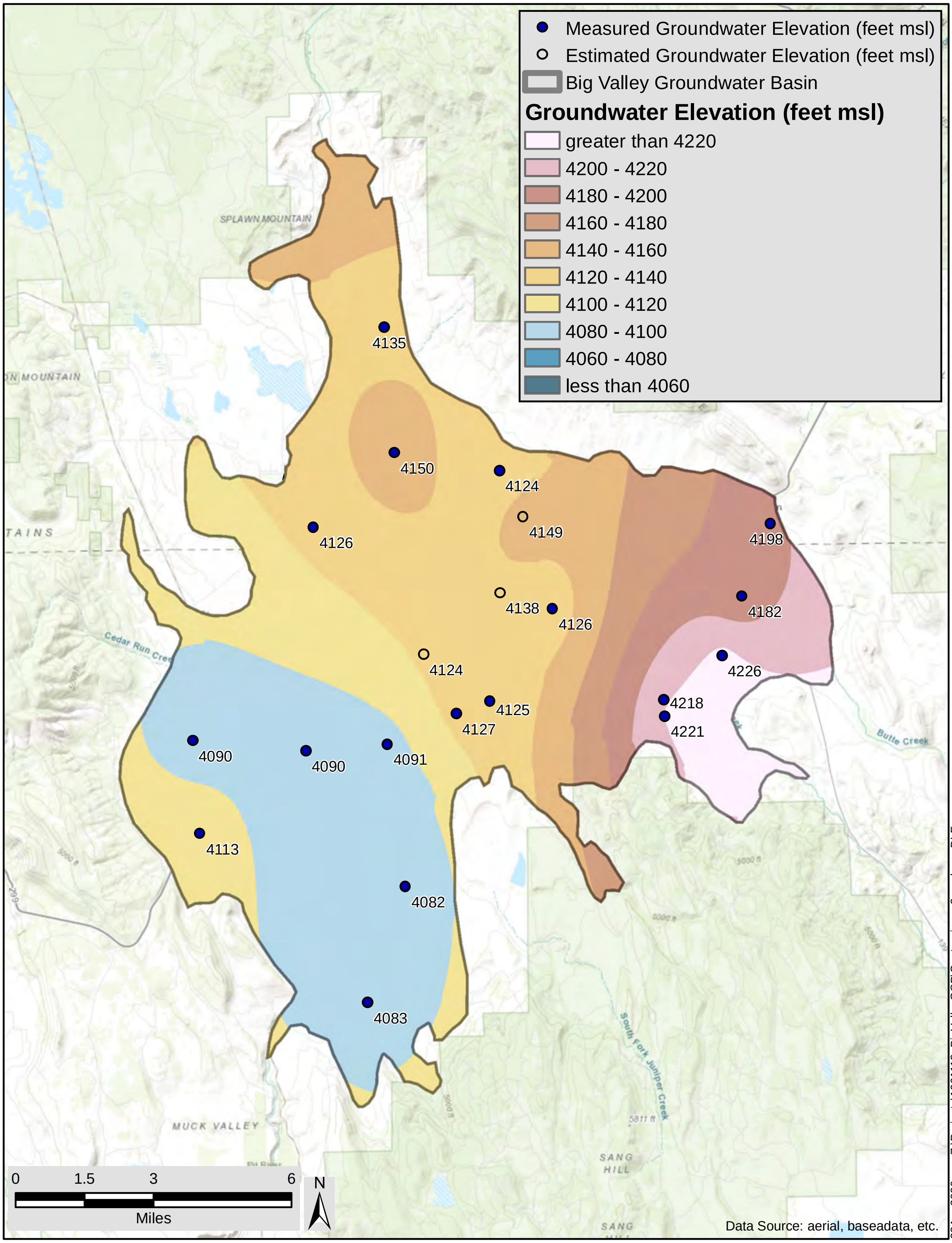

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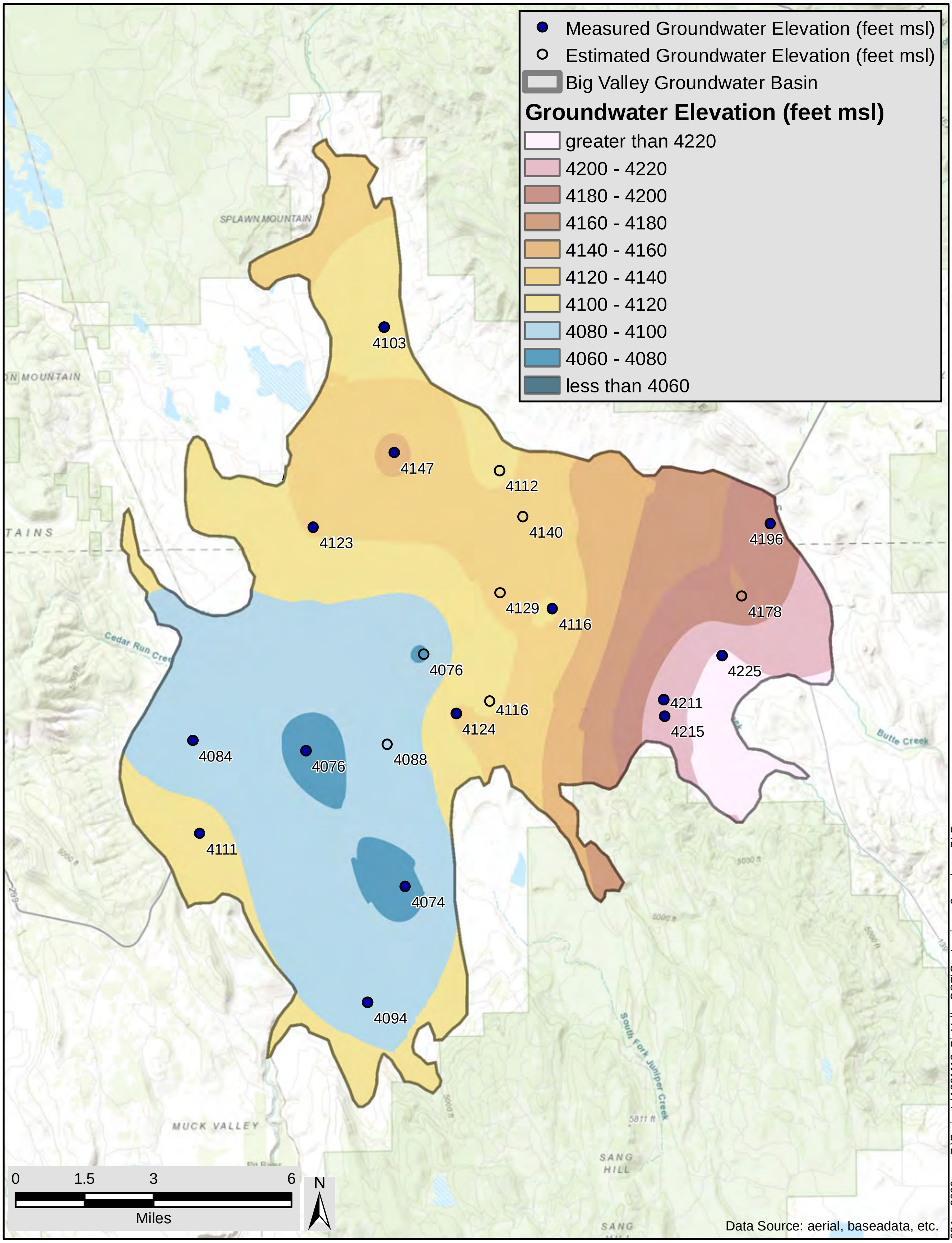

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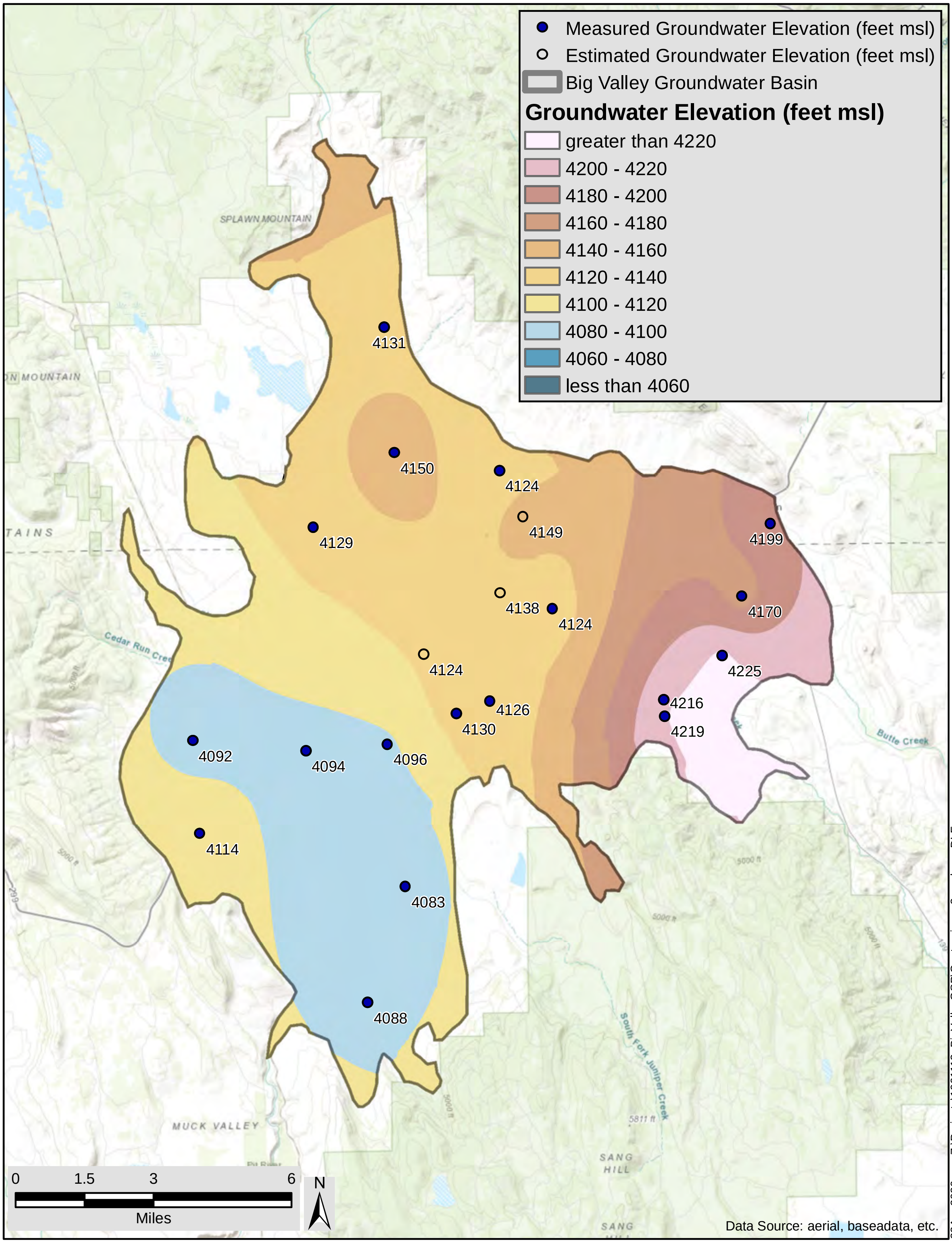

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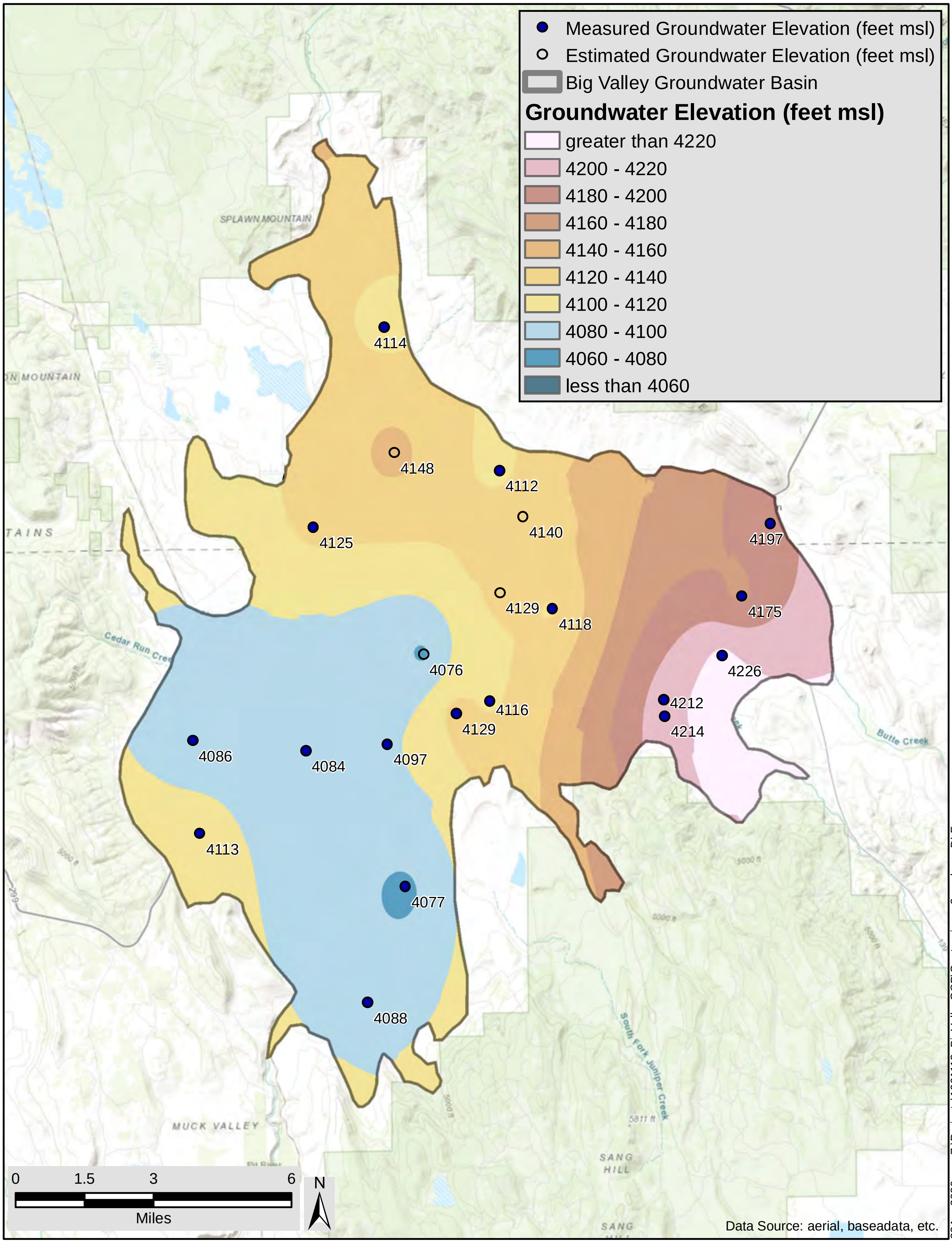

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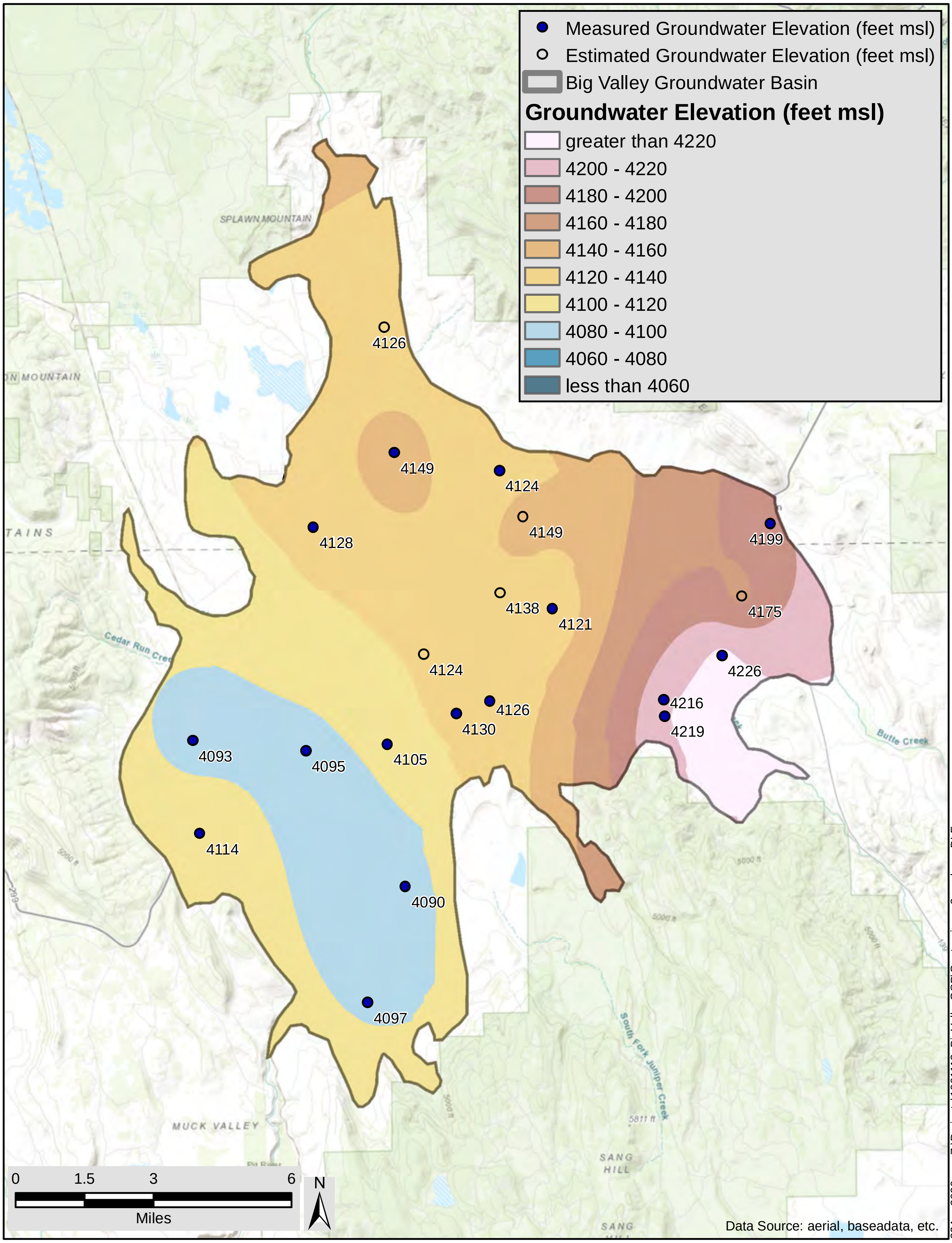

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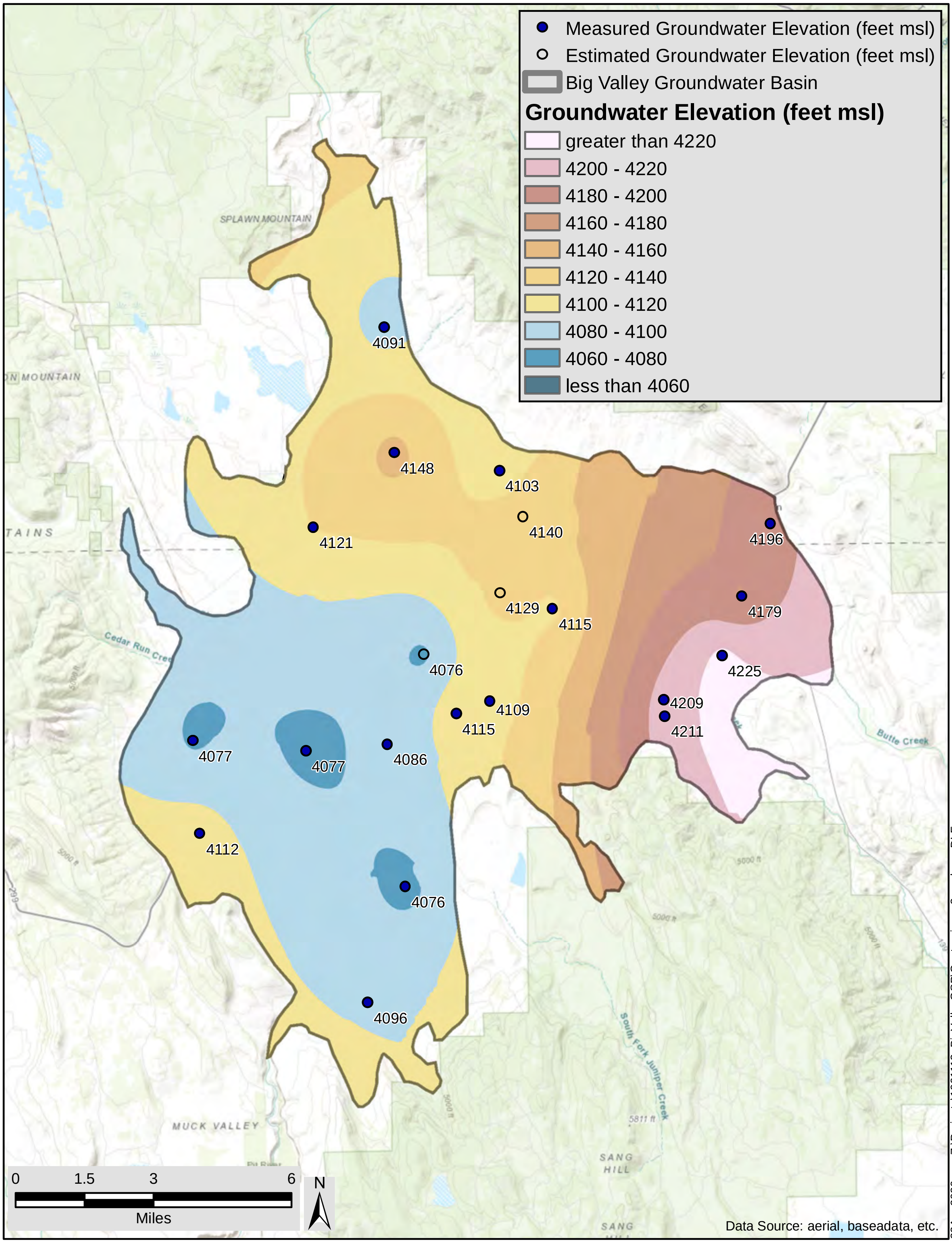

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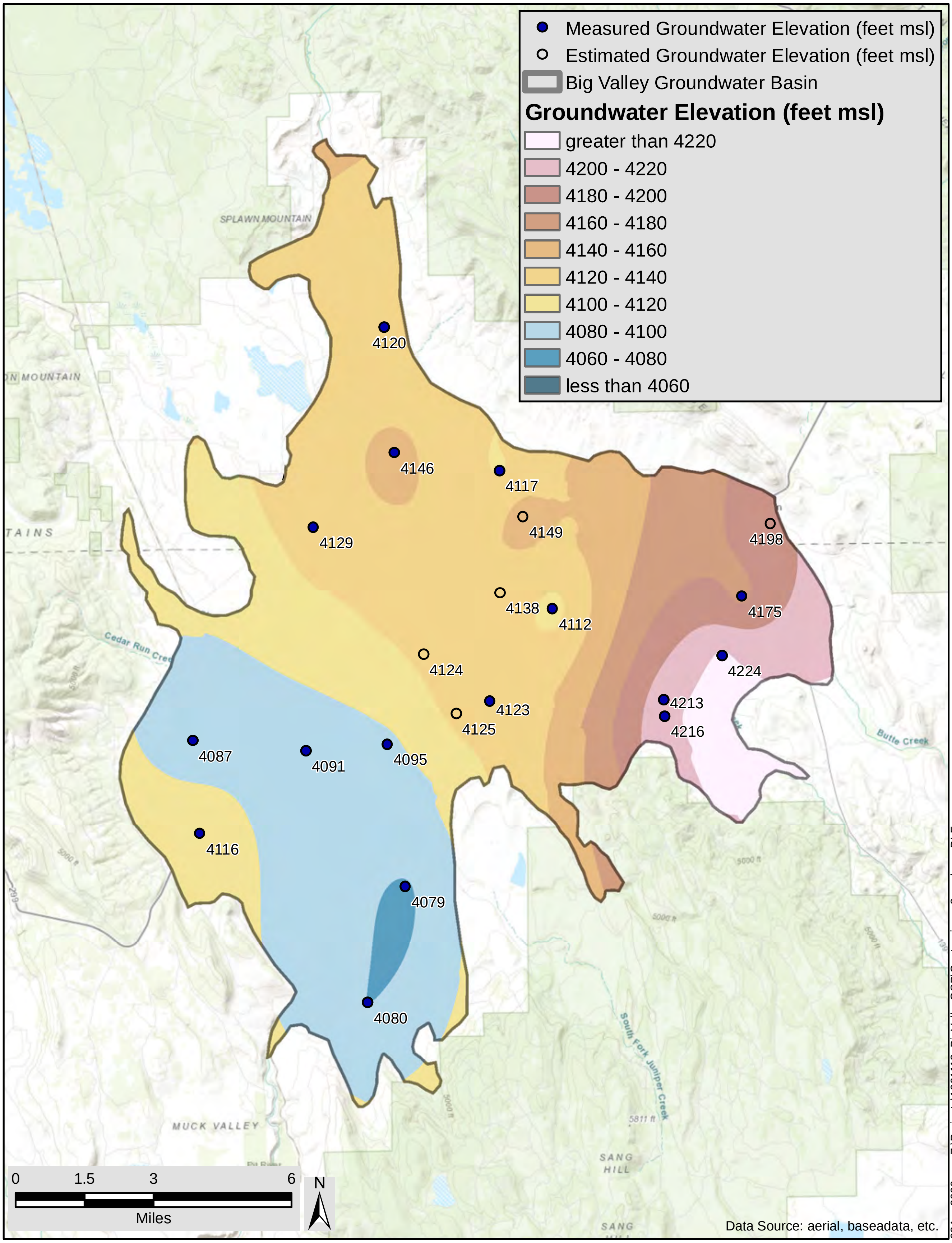

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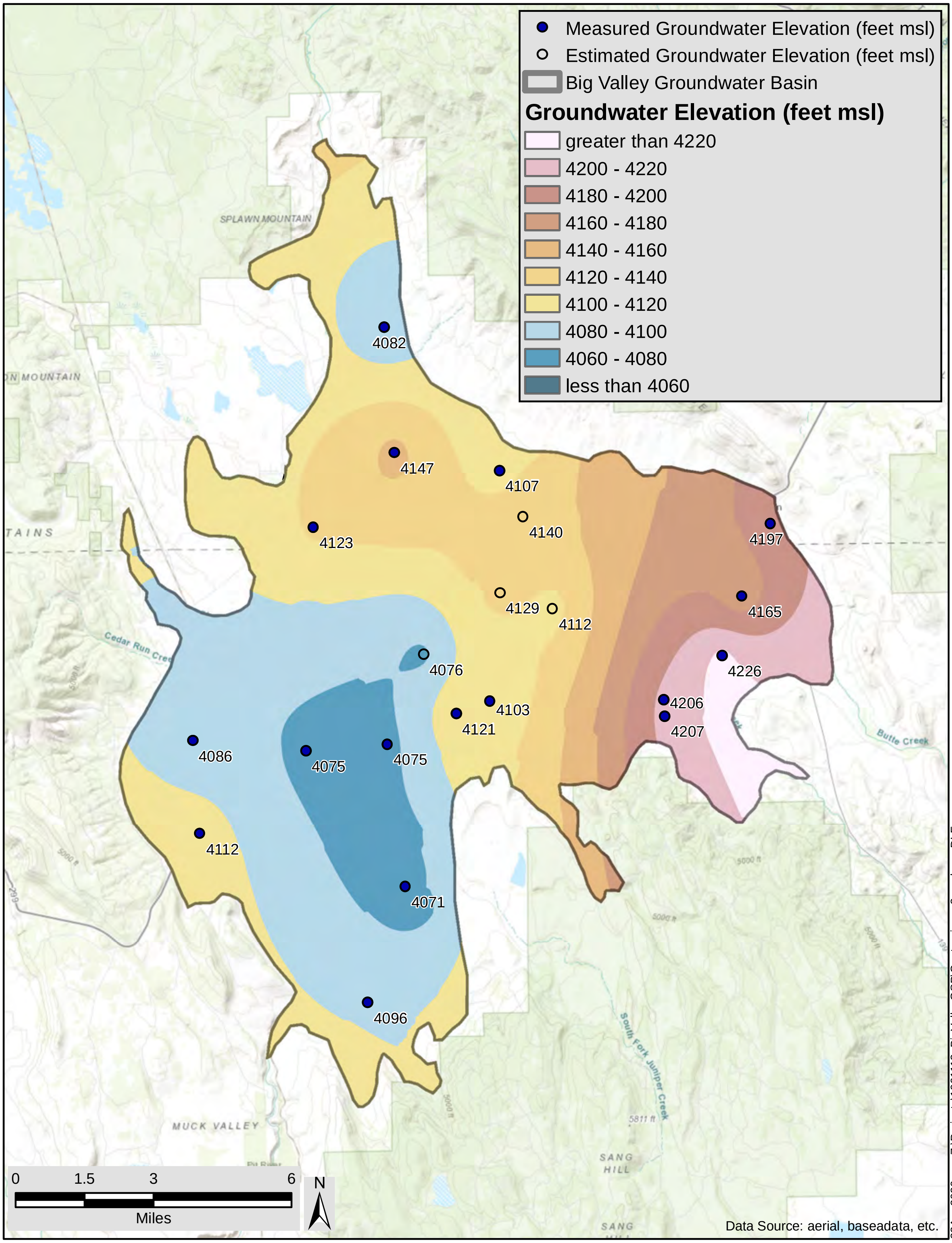

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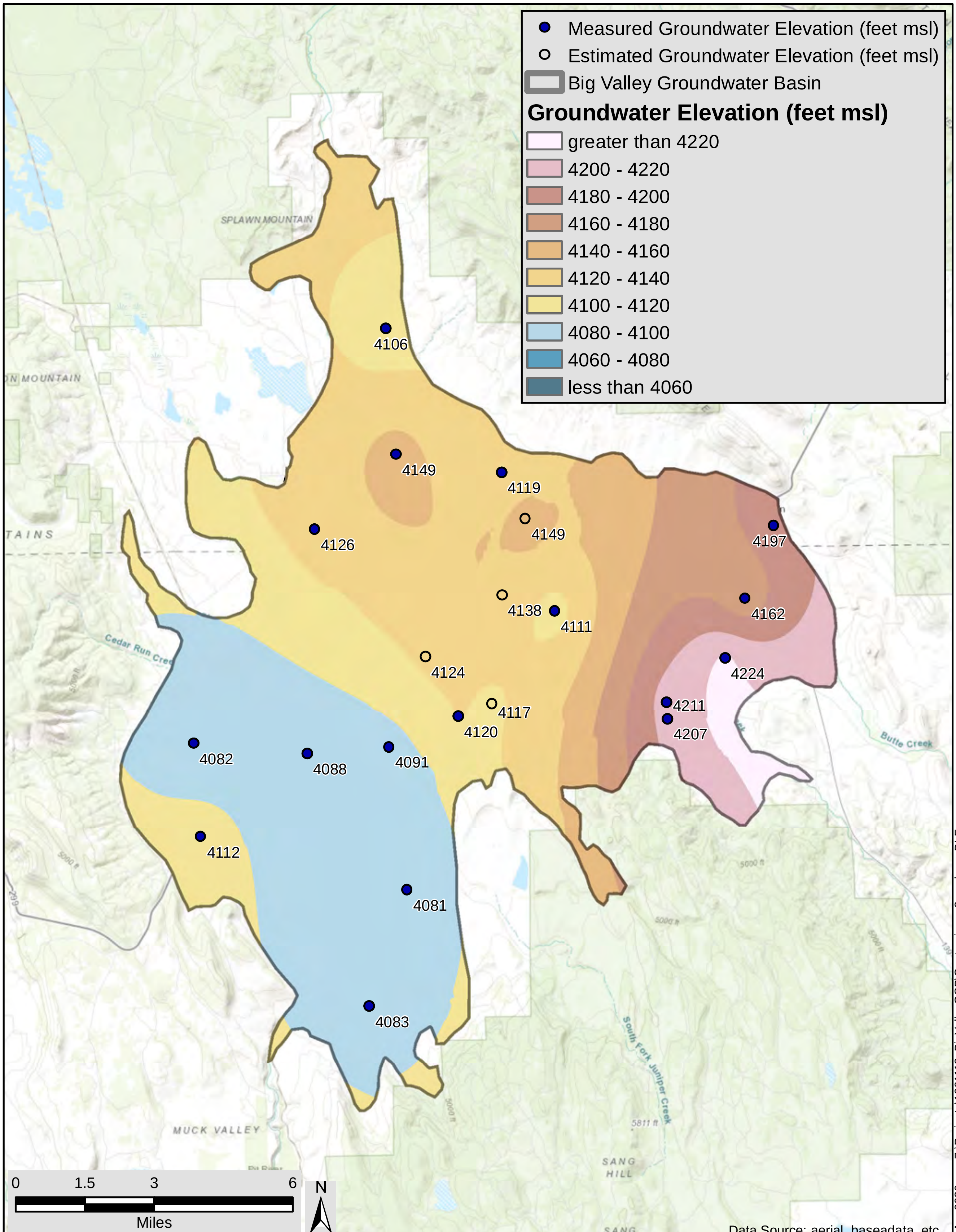
Big Valley Groundwater Basin GSAs		AUGUST 2020 DRAFT FIGURE



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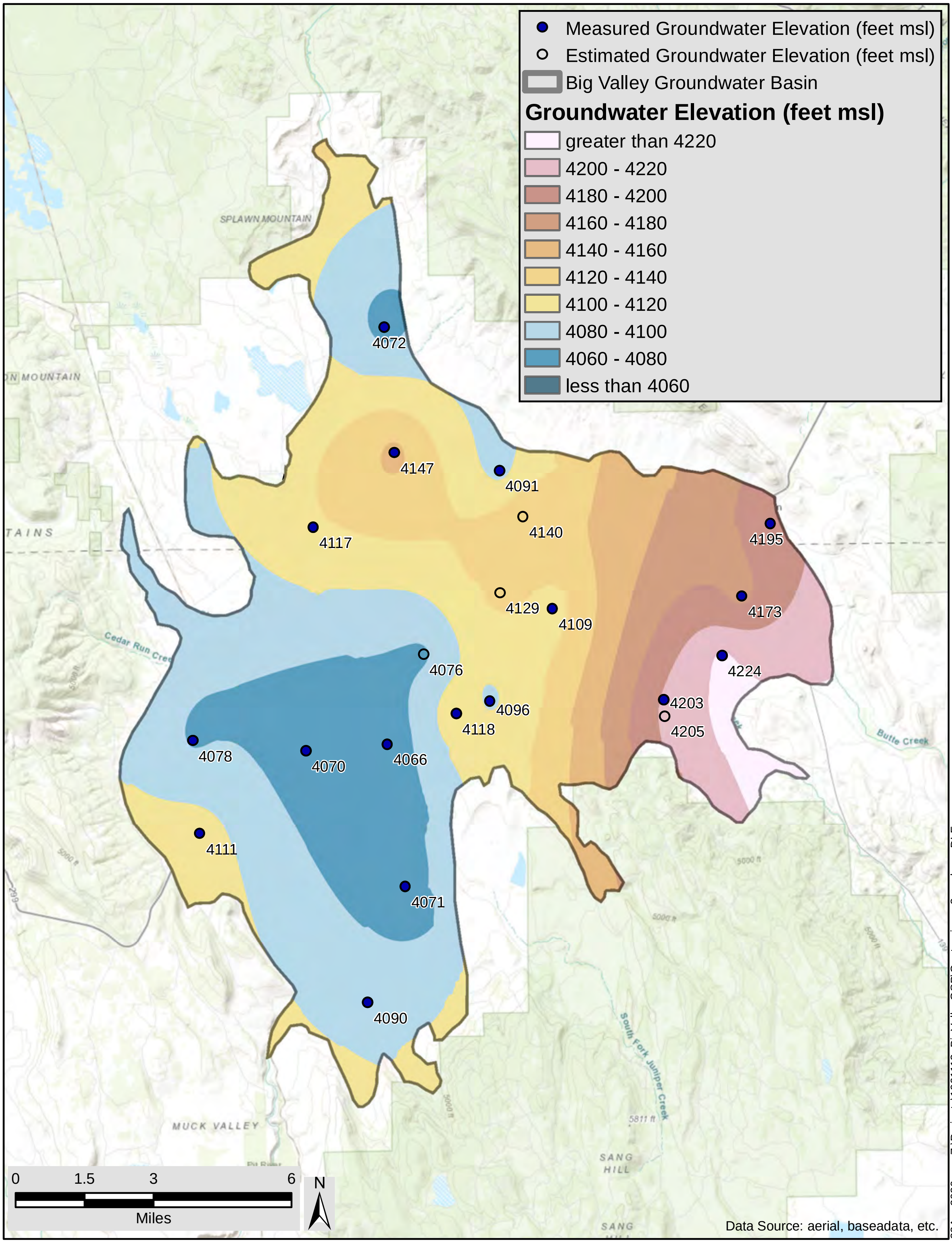

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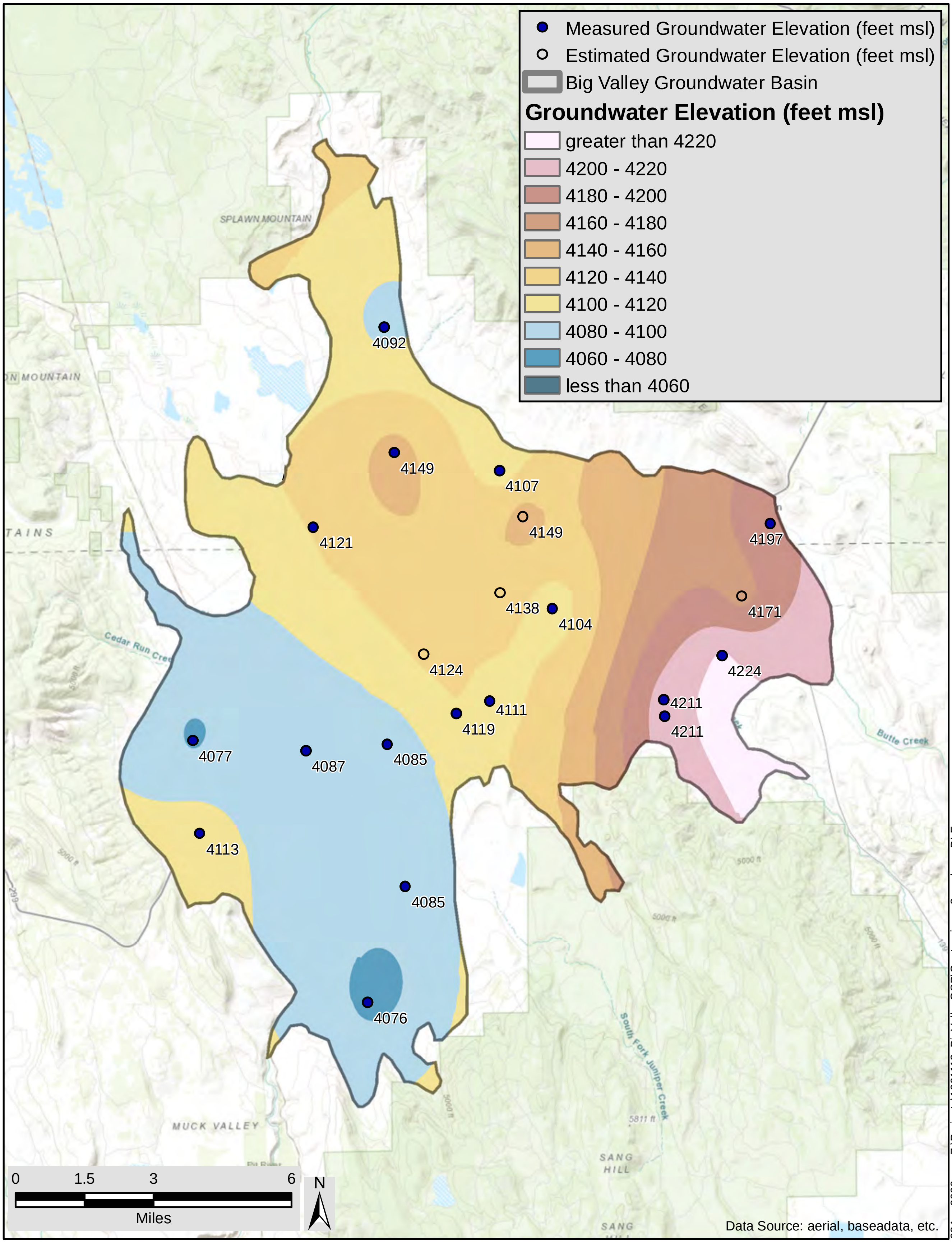

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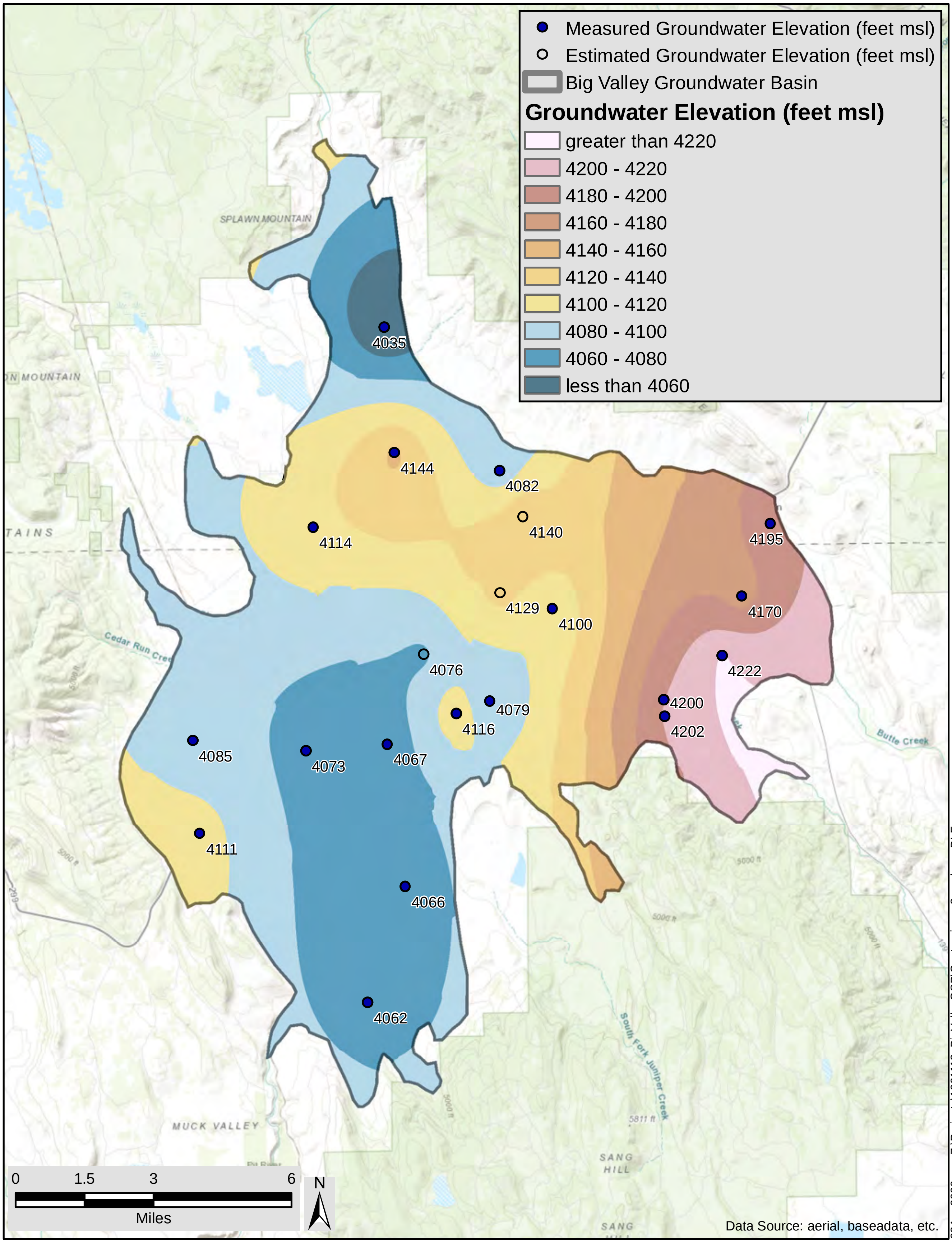

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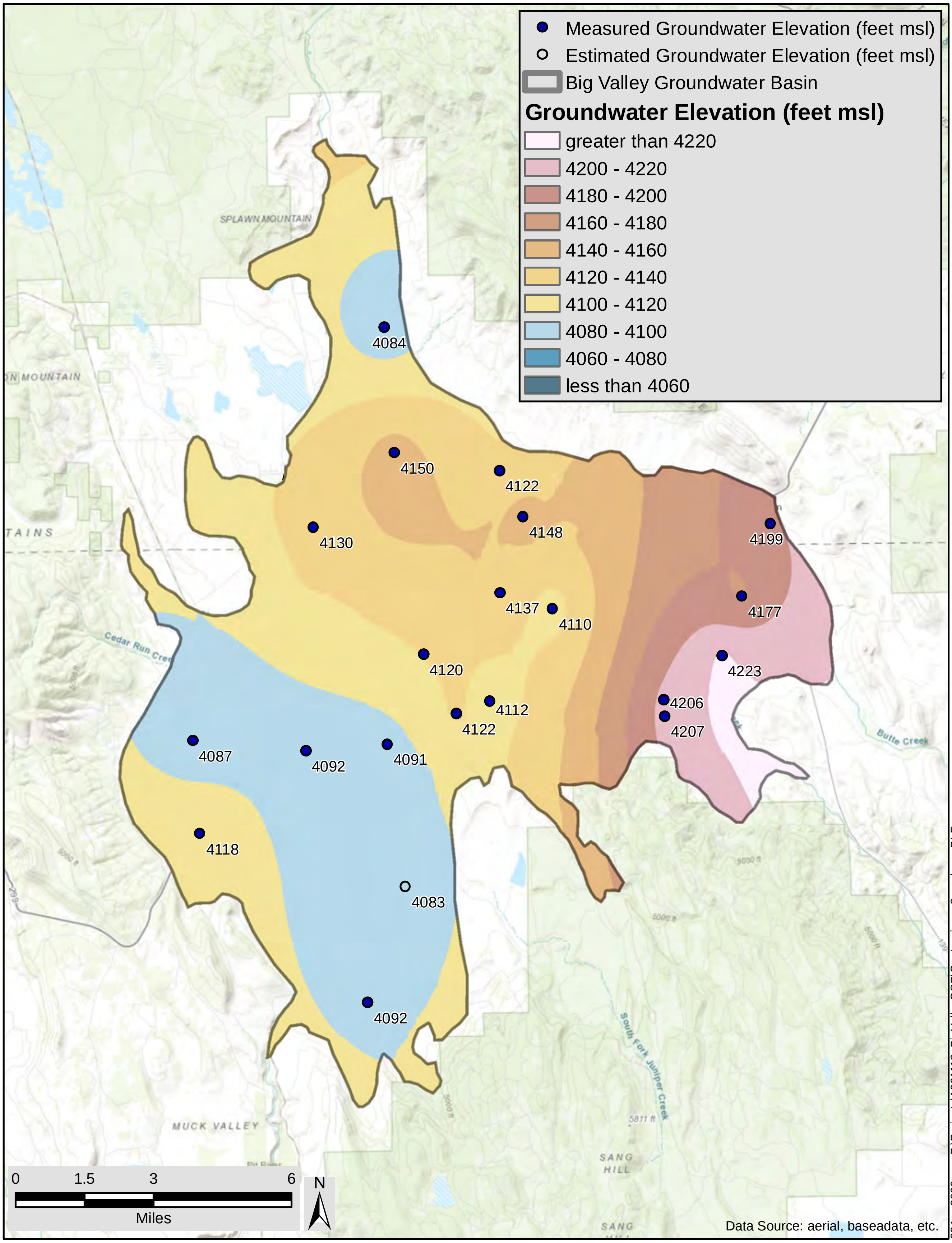

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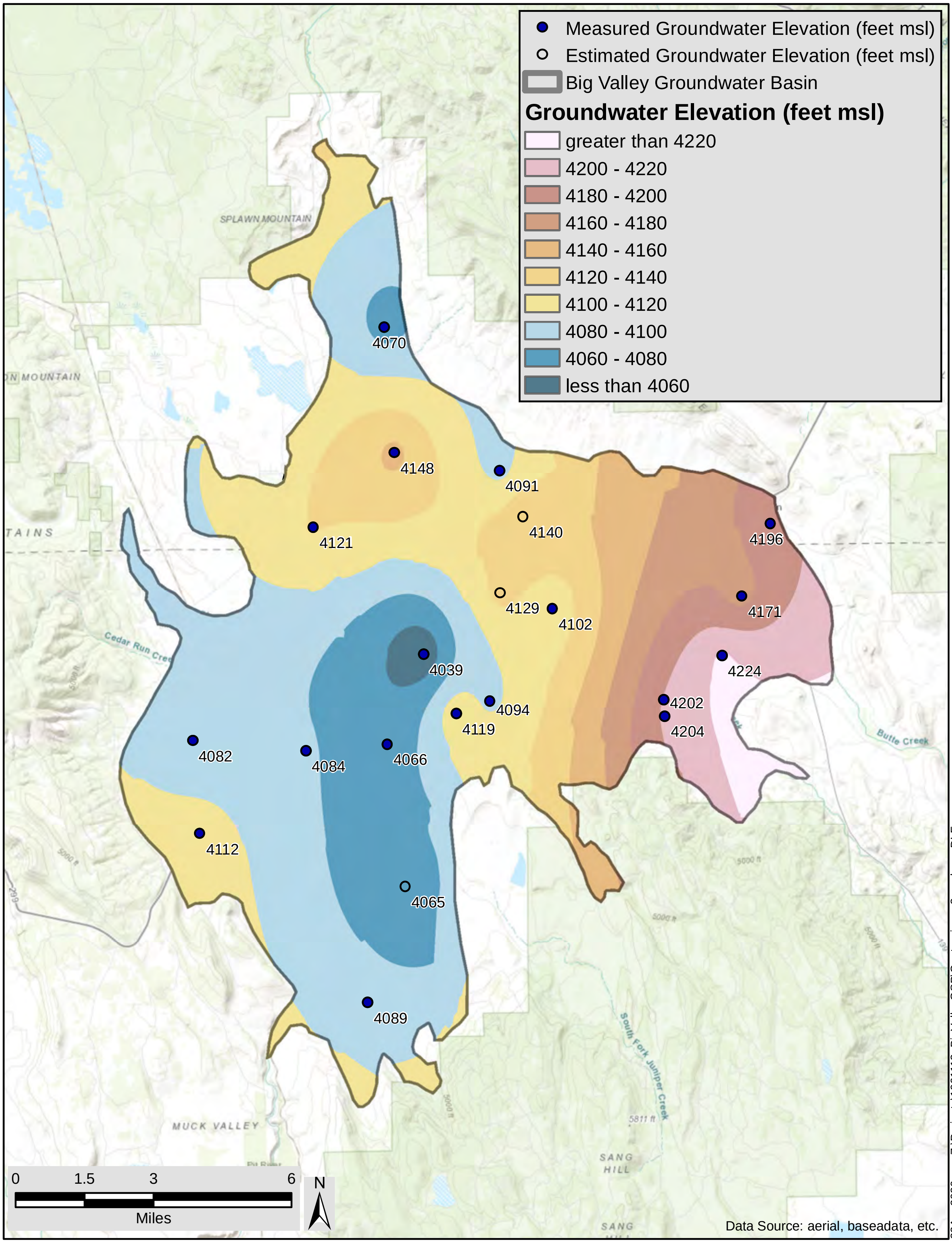

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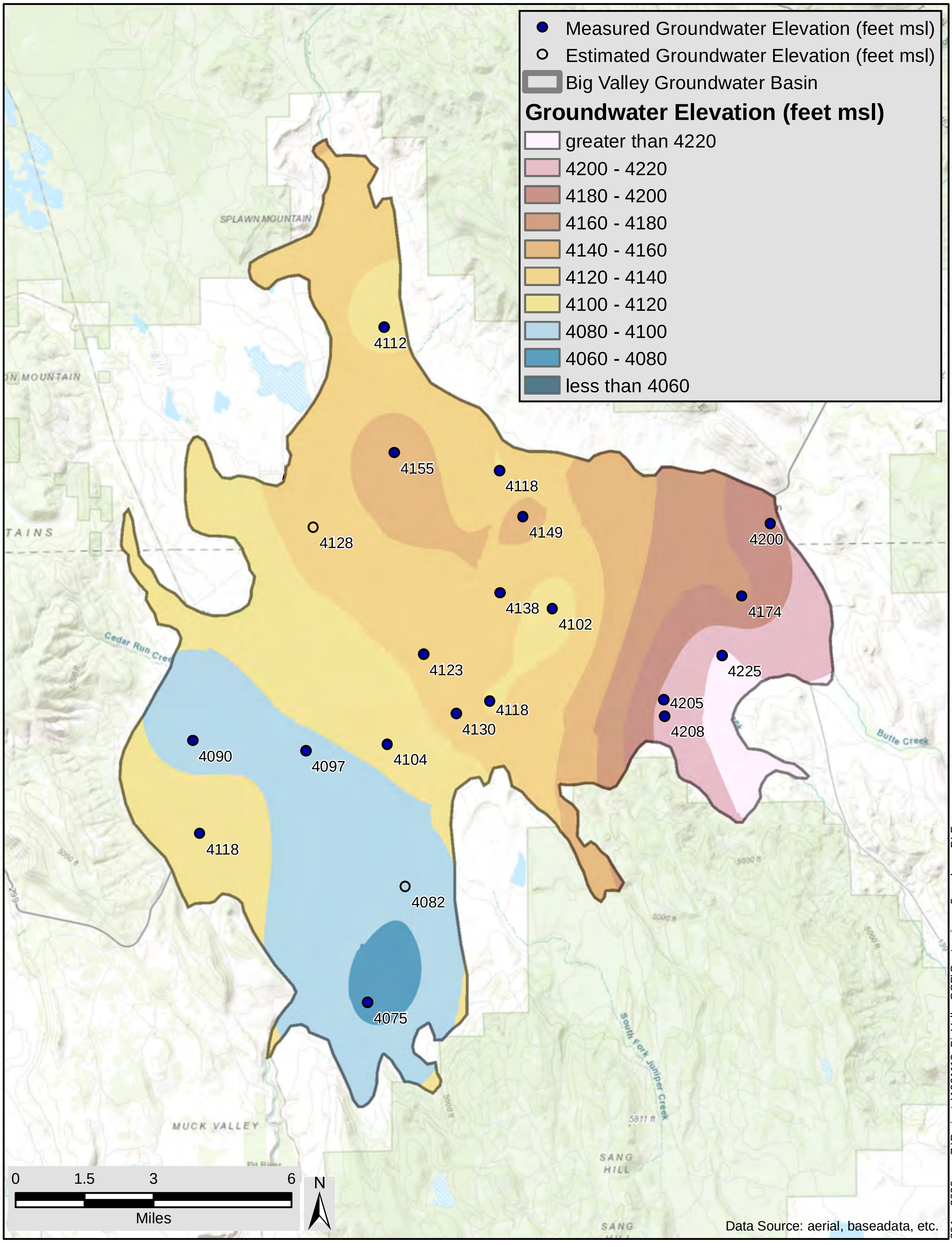

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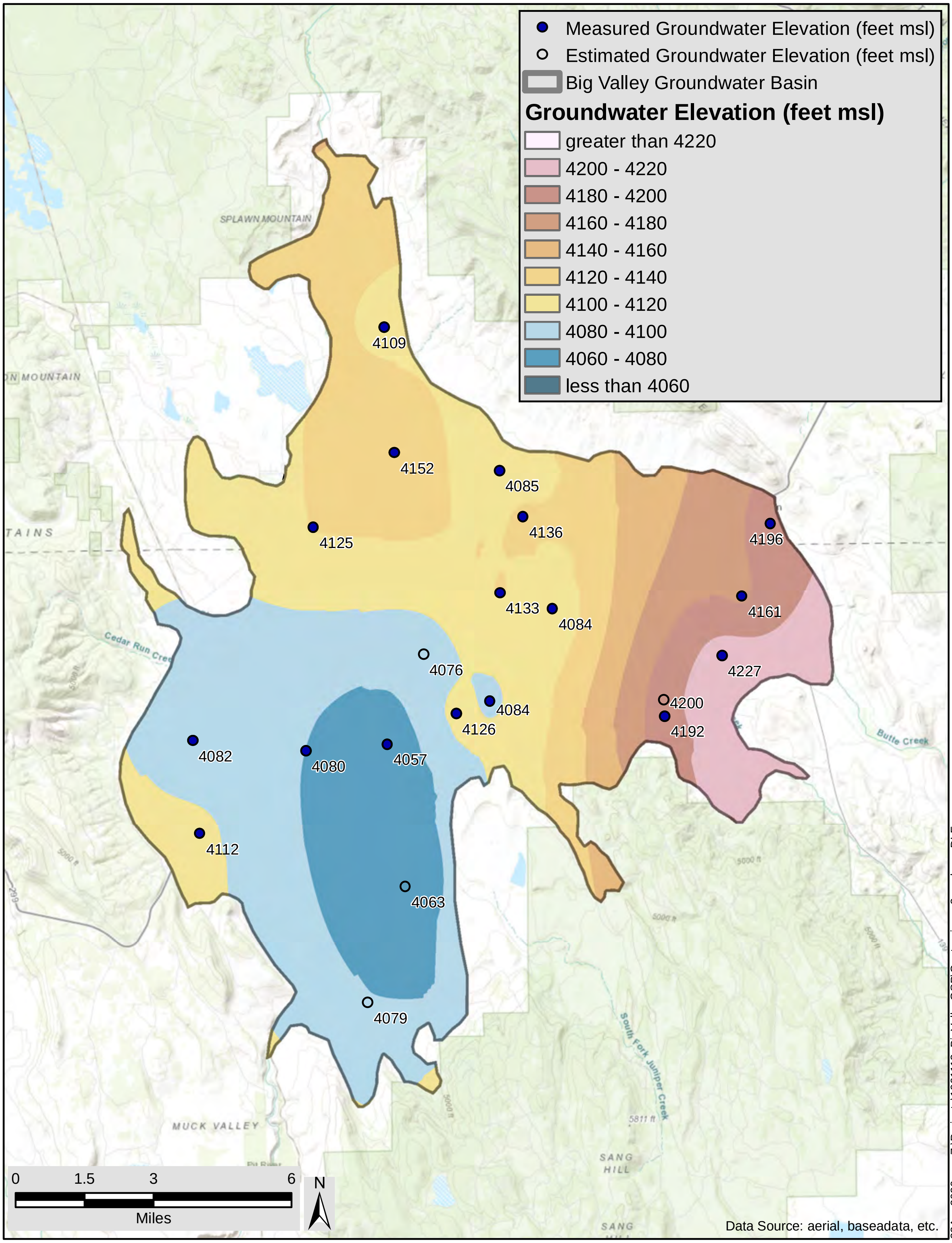

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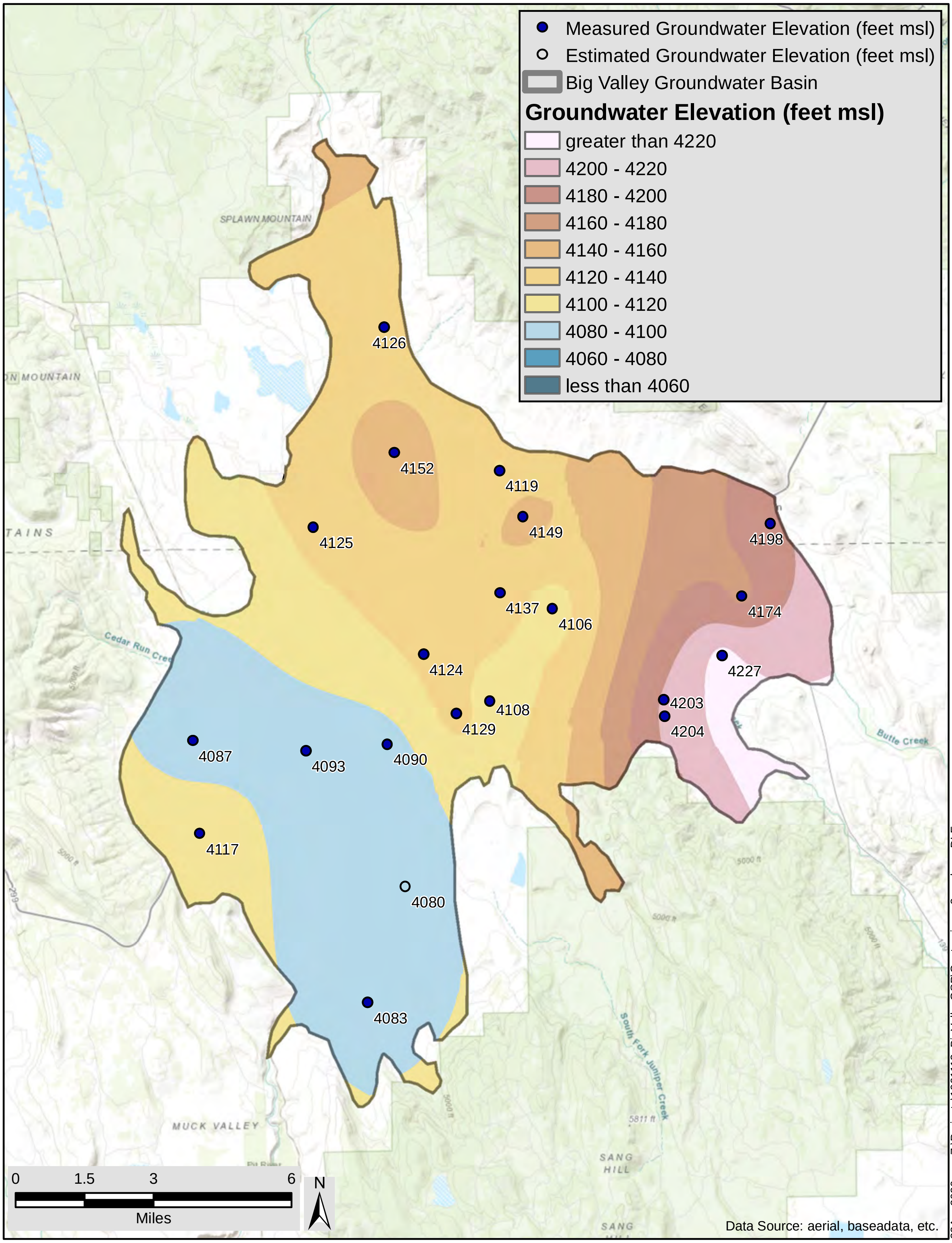

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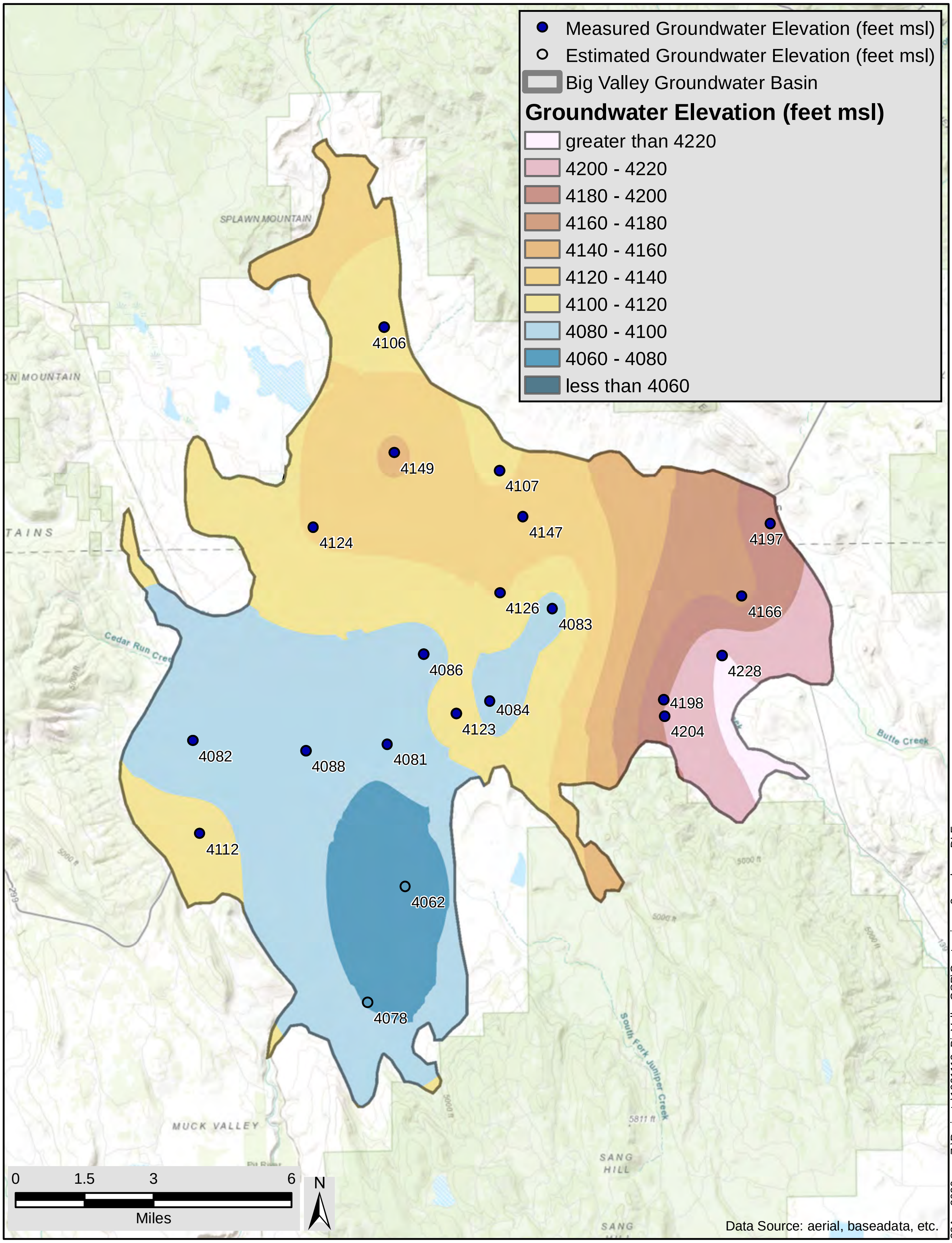

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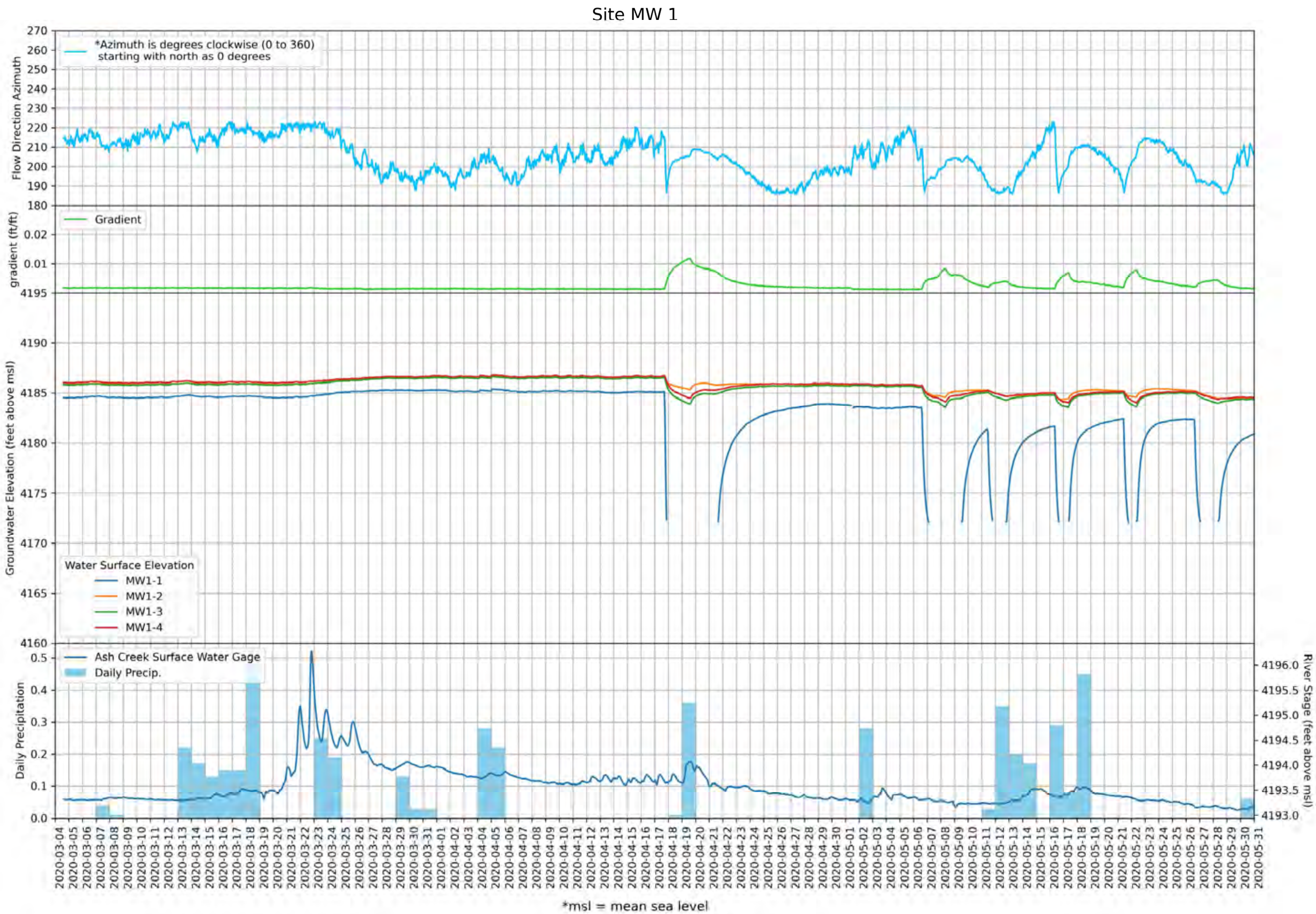
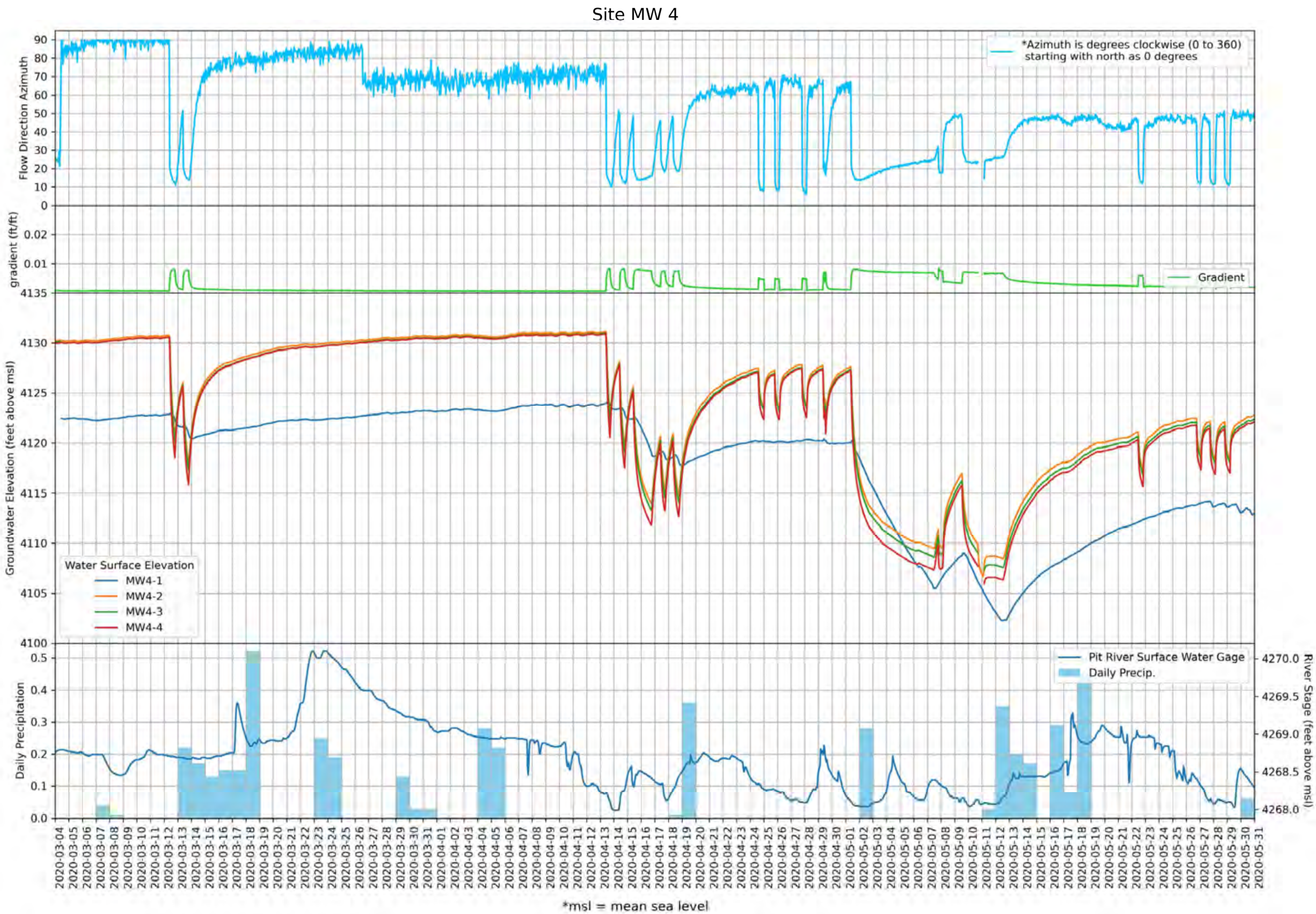
Big Valley Basin Groundwater Sustainability Plan Modoc and Lassen Counties, California	GEI Consultants	Groundwater Elevations Fall 2018		
Big Valley Groundwater Basin GSAs		AUGUST 2020	DRAFT	FIGURE

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


Site MW 4
*Azimuth is degrees clockwise (0 to 360) starting with north as 0 degrees
Flow Direction Azimuth
gradient (ft/ft)
Gradient
Groundwater Elevation (feet above msl)
Water Surface Elevation
MW4-1
MW4-2
MW4-3
MW4-4
Daily Precipitation
River Stage (feet above msl)
Pit River Surface Water Gage
Daily Precip.
*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	Data Needs and Refinements
(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	-No refinements planned for this component -Variations in precipitation throughout the basin could be estimated with an in-depth analysis of the PRISM model
(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) -Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber	-Agriculture is the only sector that uses surface water -Irrigation efficiency = 85% -40% of agricultural irrigation uses surface water -98% of riparian demands are met by surface water	Low	-More detailed information on irrigation practices and associated efficiencies More detailed information of agricultural surface water vs groundwater use More detailed information on amount of groundwater pumping to support riparian habitat at the Ash Creek Wildlife Area
(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) -Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber Population of Bieber from United States Census Bureau (2020) Population of Big Valley from DWR (2018)	-Irrigation efficiency = 85% -60% 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	-More detailed information on irrigation practices and associated efficiencies More detailed information of agricultural surface water vs groundwater use More detailed information on amount of groundwater pumping to support riparian habitat at the Ash Creek Wildlife Area
(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) -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	-Incorporate changes in crop acreages over time by using DWR land use surveys from 1997, 2011, 2013, and 2016
(6)	Outflow	Between Systems	Runoff	-	Equal to the *Runoff* term in Surface Water System*	-Precipitation from PRISM Model (NACSE 2020) evaluated at Bieber	-85% of precipitation results in runoff	Low	-More detailed runoff percentage from evaluation of basin using curve number method
(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	-More detailed information on irrigation practices and associated efficiencies
(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	-More detailed information on irrigation practices and associated efficiencies
(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 currently occurs 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	Data Needs and Refinements
(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	-Additional data from new gages
(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	-No refinements planned for this component
(6)	**Inflow**	Between Systems	Runoff	+	Equal to the *Runoff* term in land system (6)	-Precipitation from PRISM Model (NACSE 2020) evaluated at Bieber		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		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	-Analysis of transducer data from new monitoring wells and groundwater contours
(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	-No refinements planned for this component
(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	-No refinements planned for this component
(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	-No refinements planned for this component
(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	-No refinements planned for this component
(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) -Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber		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	-Additional data from new gages
(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	-No refinements planned for this component
(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	Data Needs and Refinements
(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		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		Low	
(10)	Inflow	Between Systems	Managed Aquifer Recharge	+	Equal to the *Managed Aquifer Recharge* term in the land system (10)	No managed recharge currently occurs 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.		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)		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)		Moderate	
(27)	Inflow	Into Basin	Subsurface Inflow	+			-No subsurface inflow occurs in the BVGB	Moderate	-Further analysis of transducer data from new monitoring wells -Analysis of potential inflow near Adin
(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) -Monthly precipitation from PRISM Model (NACSE 2020) evaluated at Bieber Population of Bieber from United States Census Bureau (2020) Population of Big Valley from DWR (2018)		Low	
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	Equal to the *Stream Gain from Groundwater* term in the surface water system (15)	-None		Low	
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-	Equal to the *Lake Gain from Groundwater* term in the surface water system (16)	-None		High	
(29)	Outflow	Out of Basin	Subsurface Outflow	-			-No subsurface outflow occurs in the BVGB	Moderate	-Will revisit this if additional information becomes available to indicated subsurface outflow
(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	Data Needs and Refinements
(1)	Inflow	Into Basin	Precipitation on Land System	+	Equal to the *Precipitation* term in the	-Monthly precipitation from PRISM Model (NACSE		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 -Area of rivers, conveyance, and lakes from USGS (2020).		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		Moderate	
(27)	Inflow	Into Basin	Subsurface Inflow	+	Equal to the *Subsurface Inflow* term in the groundwater system			Moderate	
(32)	Inflow		*Total Inflow*		*(1)+(14)+(13)+(27)*				
(5)	Outflow	Out of Basin	Evapotranspiration	-	Equal to the *Evapotranspiration*	-Reference Evapotranspiration (ETo) from CIMIS		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)		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)		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)		Low	
(29)	Outflow	Out of Basin	Subsurface Outflow	-	Equal to the *Subsurface Outflow* term in the groundwater system			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

item	LAND SYSTEM WATER BUDGET Flow Type	Origin/ Destination	Component	Average (1984-2018)	1984	1985	1986	1987	1988
(1)	Inflow	Into Basin	Precipitation on Land System	135,134	147,084	131,102	191,338	95,141	87,753
(2)	Inflow	Between Systems	Surface Water Delivery	83,368	73,276	83,420	80,966	86,167	93,463
(3)	Inflow	Between Systems	Groundwater Extraction	47,590	41,183	47,063	45,543	49,031	53,443
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*266,092*	*261,543*	*261,585*	*317,847*	*230,338*	*234,659*
(5)	Outflow	Out of Basin	Evapotranspiration	128,739	116,331	127,810	132,234	127,160	136,155
(6)	Outflow	Between Systems	Runoff	114,864	125,022	111,436	162,637	80,870	74,590
(7)	Outflow	Between Systems	Return Flow	5,800	5,014	5,733	5,547	5,976	6,516
(8)	Outflow	Between Systems	Recharge of Applied Water	13,923	12,234	13,919	13,509	14,384	15,600
(9)	Outflow	Between Systems	Recharge of Precipitation	2,703	2,942	2,622	3,827	1,903	1,755
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*266,029*	*261,543*	*261,521*	*317,754*	*230,292*	*234,616*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	64	-	64	93	46	43

item	SURFACE WATER SYSTEM WATER BUDGET 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 Lakes	998	573	756	1,219	402	545
(6)	Inflow	Between Systems	Runoff	114,864	125,022	111,436	162,637	80,870	74,590
(7)	Inflow	Between Systems	Return Flow	5,800	5,014	5,733	5,547	5,976	6,516
(15)	Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-
(16)	Inflow	Between Systems	Lake Gain from Groundwater	-	-	-	-	-	-
(17)	Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*492,811*	*939,071*	*428,885*	*1,047,968*	*249,054*	*244,631*
(18)	Outflow	Out of Basin	Stream Outflow	379,320	810,919	320,769	888,490	145,199	133,122
(19)	Outflow	Out of Basin	Conveyance Evaporation	821	783	827	813	815	900
(20)	Outflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(2)	Outflow	Between Systems	Surface Water Delivery	83,368	73,276	83,420	80,966	86,167	93,463
(21)	Outflow	Between Systems	Stream Loss to Groundwater	24,037	49,085	18,460	72,401	11,524	11,579
(22)	Outflow	Between Systems	Lake Loss to Groundwater	1,138	1,138	1,138	1,138	1,138	1,138
(23)	Outflow	Out of Basin	Lake Evaporation	1,553	1,439	1,643	1,564	1,588	1,668
(24)	Outflow	Out of Basin	Stream Evaporation	2,128	1,983	2,184	2,150	2,177	2,315
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*492,811*	*939,071*	*428,885*	*1,047,968*	*249,054*	*244,631*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-

item	GROUNDWATER SYSTEM WATER BUDGET Flow Type	Origin/ Destination	Component	Average (1984-2018)	1984	1985	1986	1987	1988
(8)	Inflow	Between Systems	Recharge of Applied Water	13,923	12,234	13,919	13,509	14,384	15,600
(9)	Inflow	Between Systems	Recharge of Precipitation	2,703	2,942	2,622	3,827	1,903	1,755
(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 Lake	1,138	1,138	1,138	1,138	1,138	1,138
(20)	Inflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*42,246*	*65,845*	*36,584*	*91,321*	*29,394*	*30,517*
(3)	Outflow	Between Systems	Groundwater Extraction	47,590	41,183	47,063	45,543	49,031	53,443
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*47,590*	*41,183*	*47,063*	*45,543*	*49,031*	*53,443*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	(5,344)	24,662	(10,478)	45,778	(19,636)	(22,925)

item	TOTAL BASIN WATER BUDGET Flow Type	Origin/ Destination	Component	Average (1984-2018)	1984	1985	1986	1987	1988
(1)	Inflow	Into Basin	Precipitation on Land System	135,134	147,084	131,102	191,338	95,141	87,753
(14)	Inflow	Into Basin	Precipitation on Lakes	998	573	756	1,219	402	545
(13)	Inflow	Into Basin	Stream Inflow	371,148	808,462	310,960	878,565	161,807	162,980
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*507,280*	*956,119*	*442,817*	*1,071,121*	*257,350*	*251,278*
(5)	Outflow	Out of Basin	Evapotranspiration	128,739	116,331	127,810	132,234	127,160	136,155
(24)	Outflow	Out of Basin	Stream Evaporation	2,128	1,983	2,184	2,150	2,177	2,315
(23)	Outflow	Out of Basin	Lake Evaporation	1,553	1,439	1,643	1,564	1,588	1,668
(19)	Outflow	Out of Basin	Conveyance Evaporation	821	783	827	813	815	900
(18)	Outflow	Out of Basin	Stream Outflow	379,320	810,919	320,769	888,490	145,199	133,122
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*512,561*	*931,457*	*453,232*	*1,025,251*	*276,940*	*274,161*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	(5,280)	24,662	(10,415)	45,871	(19,590)	(22,883)

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1989	1990	1991	1992	1993	1994
(1)	Inflow	Into Basin	Precipitation on Land System	148,818	111,048	107,203	74,635	181,839	103,208
(2)	Inflow	Between Systems	Surface Water Delivery	80,214	80,462	85,865	90,902	80,059	84,544
(3)	Inflow	Between Systems	Groundwater Extraction	46,379	45,973	49,539	52,304	46,333	48,114
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*275,411*	*237,484*	*242,607*	*217,841*	*308,231*	*235,866*
(5)	Outflow	Out of Basin	Evapotranspiration	126,799	121,773	128,898	131,311	130,905	126,046
(6)	Outflow	Between Systems	Runoff	126,495	94,391	91,123	63,440	154,563	87,727
(7)	Outflow	Between Systems	Return Flow	5,655	5,603	6,041	6,378	5,650	5,864
(8)	Outflow	Between Systems	Recharge of Applied Water	13,414	13,442	14,349	15,182	13,389	14,115
(9)	Outflow	Between Systems	Recharge of Precipitation	2,976	2,221	2,144	1,493	3,637	2,064
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*275,339*	*237,430*	*242,555*	*217,805*	*308,143*	*235,815*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	72	54	52	36	88	50

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 Lakes	1,044	911	348	386	1,518	2,017
(6)	Inflow	Between Systems	Runoff	126,495	94,391	91,123	63,440	154,563	87,727
(7)	Inflow	Between Systems	Return Flow	5,655	5,603	6,041	6,378	5,650	5,864
(15)	Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-
(16)	Inflow	Between Systems	Lake Gain from Groundwater	-	-	-	-	-	-
(17)	Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*524,048*	*234,499*	*361,174*	*146,458*	*764,729*	*263,000*
(18)	Outflow	Out of Basin	Stream Outflow	415,719	137,926	253,032	41,694	646,693	160,562
(19)	Outflow	Out of Basin	Conveyance Evaporation	799	785	838	860	816	830
(20)	Outflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(2)	Outflow	Between Systems	Surface Water Delivery	80,214	80,462	85,865	90,902	80,059	84,544
(21)	Outflow	Between Systems	Stream Loss to Groundwater	22,175	10,212	16,260	7,546	32,039	11,784
(22)	Outflow	Between Systems	Lake Loss to Groundwater	1,138	1,138	1,138	1,138	1,138	1,138
(23)	Outflow	Out of Basin	Lake Evaporation	1,503	1,493	1,488	1,626	1,492	1,562
(24)	Outflow	Out of Basin	Stream Evaporation	2,054	2,036	2,107	2,246	2,045	2,134
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*524,048*	*234,499*	*361,174*	*146,458*	*764,729*	*263,000*
(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	13,414	13,442	14,349	15,182	13,389	14,115
(9)	Inflow	Between Systems	Recharge of Precipitation	2,976	2,221	2,144	1,493	3,637	2,064
(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 Lake	1,138	1,138	1,138	1,138	1,138	1,138
(20)	Inflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*40,149*	*27,459*	*34,338*	*25,805*	*50,649*	*29,547*
(3)	Outflow	Between Systems	Groundwater Extraction	46,379	45,973	49,539	52,304	46,333	48,114
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*46,379*	*45,973*	*49,539*	*52,304*	*46,333*	*48,114*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	(6,231)	(18,514)	(15,201)	(26,499)	4,316	(18,567)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	1989	1990	1991	1992	1993	1994
(1)	Inflow	Into Basin	Precipitation on Land System	148,818	111,048	107,203	74,635	181,839	103,208
(14)	Inflow	Into Basin	Precipitation on Lakes	1,044	911	348	386	1,518	2,017
(13)	Inflow	Into Basin	Stream Inflow	390,854	133,594	263,663	76,254	602,999	167,393
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*540,716*	*245,553*	*371,214*	*151,275*	*786,355*	*272,617*
(5)	Outflow	Out of Basin	Evapotranspiration	126,799	121,773	128,898	131,311	130,905	126,046
(24)	Outflow	Out of Basin	Stream Evaporation	2,054	2,036	2,107	2,246	2,045	2,134
(23)	Outflow	Out of Basin	Lake Evaporation	1,503	1,493	1,488	1,626	1,492	1,562
(19)	Outflow	Out of Basin	Conveyance Evaporation	799	785	838	860	816	830
(18)	Outflow	Out of Basin	Stream Outflow	415,719	137,926	253,032	41,694	646,693	160,562
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*546,874*	*264,014*	*386,363*	*177,737*	*781,951*	*291,134*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	(6,158)	(18,460)	(15,149)	(26,462)	4,404	(18,517)

item	Flow Type	Origin/ Destination	Component	1995	1996	1997	1998	1999	2000
	LAND SYSTEM WATER BUDGET								
(1)	Inflow	Into Basin	Precipitation on Land System	189,905	181,537	169,776	226,318	144,747	126,578
(2)	Inflow	Between Systems	Surface Water Delivery	72,909	78,370	82,675	72,108	82,077	84,765
(3)	Inflow	Between Systems	Groundwater Extraction	42,025	44,842	46,927	41,431	47,198	48,547
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*304,839*	*304,750*	*299,378*	*339,857*	*274,022*	*259,890*
(5)	Outflow	Out of Basin	Evapotranspiration	122,209	128,163	132,070	125,740	128,551	129,629
(6)	Outflow	Between Systems	Runoff	161,420	154,307	144,310	192,371	123,035	107,592
(7)	Outflow	Between Systems	Return Flow	5,122	5,465	5,718	5,049	5,754	5,918
(8)	Outflow	Between Systems	Recharge of Applied Water	12,198	13,097	13,802	12,062	13,717	14,158
(9)	Outflow	Between Systems	Recharge of Precipitation	3,798	3,631	3,396	4,526	2,895	2,532
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*304,747*	*304,662*	*299,296*	*339,747*	*273,952*	*259,828*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	92	88	82	110	70	61

item	Flow Type	Origin/ Destination	Component	1995	1996	1997	1998	1999	2000
	SURFACE WATER SYSTEM WATER BUDGET								
(13)	Inflow	Into Basin	Stream Inflow	912,444	780,720	614,680	832,300	691,739	240,124
(14)	Inflow	Into Basin	Precipitation on Lakes	1,949	1,474	1,193	2,101	1,011	1,044
(6)	Inflow	Between Systems	Runoff	161,420	154,307	144,310	192,371	123,035	107,592
(7)	Inflow	Between Systems	Return Flow	5,122	5,465	5,718	5,049	5,754	5,918
(15)	Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-
(16)	Inflow	Between Systems	Lake Gain from Groundwater	-	-	-	-	-	-
(17)	Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*1,080,935*	*941,965*	*765,902*	*1,031,820*	*821,539*	*354,677*
(18)	Outflow	Out of Basin	Stream Outflow	916,329	816,120	644,515	897,886	697,247	248,582
(19)	Outflow	Out of Basin	Conveyance Evaporation	741	785	830	749	814	836
(20)	Outflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(2)	Outflow	Between Systems	Surface Water Delivery	72,909	78,370	82,675	72,108	82,077	84,765
(21)	Outflow	Between Systems	Stream Loss to Groundwater	86,149	41,575	32,583	56,285	36,166	15,166
(22)	Outflow	Between Systems	Lake Loss to Groundwater	1,138	1,138	1,138	1,138	1,138	1,138
(23)	Outflow	Out of Basin	Lake Evaporation	1,345	1,490	1,569	1,330	1,552	1,586
(24)	Outflow	Out of Basin	Stream Evaporation	1,878	2,040	2,146	1,878	2,100	2,159
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*1,080,935*	*941,965*	*765,902*	*1,031,820*	*821,539*	*354,677*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-

item	Flow Type	Origin/ Destination	Component	1995	1996	1997	1998	1999	2000
	GROUNDWATER SYSTEM WATER BUDGET								
(8)	Inflow	Between Systems	Recharge of Applied Water	12,198	13,097	13,802	12,062	13,717	14,158
(9)	Inflow	Between Systems	Recharge of Precipitation	3,798	3,631	3,396	4,526	2,895	2,532
(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 Lake	1,138	1,138	1,138	1,138	1,138	1,138
(20)	Inflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*103,728*	*59,886*	*51,364*	*74,457*	*54,362*	*33,440*
(3)	Outflow	Between Systems	Groundwater Extraction	42,025	44,842	46,927	41,431	47,198	48,547
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*42,025*	*44,842*	*46,927*	*41,431*	*47,198*	*48,547*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	61,703	15,044	4,437	33,026	7,163	(15,107)

item	Flow Type	Origin/ Destination	Component	1995	1996	1997	1998	1999	2000
	TOTAL BASIN WATER BUDGET								
(1)	Inflow	Into Basin	Precipitation on Land System	189,905	181,537	169,776	226,318	144,747	126,578
(14)	Inflow	Into Basin	Precipitation on Lakes	1,949	1,474	1,193	2,101	1,011	1,044
(13)	Inflow	Into Basin	Stream Inflow	912,444	780,720	614,680	832,300	691,739	240,124
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*1,104,299*	*963,730*	*785,650*	*1,060,719*	*837,497*	*367,746*
(5)	Outflow	Out of Basin	Evapotranspiration	122,209	128,163	132,070	125,740	128,551	129,629
(24)	Outflow	Out of Basin	Stream Evaporation	1,878	2,040	2,146	1,878	2,100	2,159
(23)	Outflow	Out of Basin	Lake Evaporation	1,345	1,490	1,569	1,330	1,552	1,586
(19)	Outflow	Out of Basin	Conveyance Evaporation	741	785	830	749	814	836
(18)	Outflow	Out of Basin	Stream Outflow	916,329	816,120	644,515	897,886	697,247	248,582
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*1,042,503*	*948,598*	*781,131*	*1,027,583*	*830,264*	*382,792*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	61,795	15,132	4,519	33,136	7,234	(15,046)

item	LAND SYSTEM WATER BUDGET								
item	Flow Type	Origin/ Destination	Component	2001	2002	2003	2004	2005	2006
(1)	Inflow	Into Basin	Precipitation on Land System	78,329	108,636	134,947	135,022	145,727	188,398
(2)	Inflow	Between Systems	Surface Water Delivery	88,557	87,835	82,497	85,444	77,755	79,668
(3)	Inflow	Between Systems	Groundwater Extraction	50,682	50,336	47,185	48,729	44,032	45,803
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*217,569*	*246,807*	*264,628*	*269,195*	*267,514*	*313,869*
(5)	Outflow	Out of Basin	Evapotranspiration	128,419	131,436	127,627	131,455	122,313	130,971
(6)	Outflow	Between Systems	Runoff	66,580	92,340	114,705	114,769	123,868	160,138
(7)	Outflow	Between Systems	Return Flow	6,179	6,137	5,751	5,939	5,364	5,583
(8)	Outflow	Between Systems	Recharge of Applied Water	14,787	14,669	13,781	14,266	12,984	13,317
(9)	Outflow	Between Systems	Recharge of Precipitation	1,567	2,173	2,699	2,700	2,915	3,768
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*217,531*	*246,754*	*264,562*	*269,129*	*267,443*	*313,778*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	38	53	66	66	71	92

item	SURFACE WATER SYSTEM WATER BUDGET								
item	Flow Type	Origin/ Destination	Component	2001	2002	2003	2004	2005	2006
(13)	Inflow	Into Basin	Stream Inflow	100,742	153,035	219,963	295,581	381,347	735,770
(14)	Inflow	Into Basin	Precipitation on Lakes	541	742	1,193	1,065	1,108	1,366
(6)	Inflow	Between Systems	Runoff	66,580	92,340	114,705	114,769	123,868	160,138
(7)	Inflow	Between Systems	Return Flow	6,179	6,137	5,751	5,939	5,364	5,583
(15)	Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-
(16)	Inflow	Between Systems	Lake Gain from Groundwater	-	-	-	-	-	-
(17)	Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*174,041*	*252,254*	*341,611*	*417,354*	*511,687*	*902,857*
(18)	Outflow	Out of Basin	Stream Outflow	70,489	147,020	238,861	307,951	406,267	778,989
(19)	Outflow	Out of Basin	Conveyance Evaporation	868	854	815	832	788	828
(20)	Outflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(2)	Outflow	Between Systems	Surface Water Delivery	88,557	87,835	82,497	85,444	77,755	79,668
(21)	Outflow	Between Systems	Stream Loss to Groundwater	8,684	11,116	14,228	17,745	21,733	38,213
(22)	Outflow	Between Systems	Lake Loss to Groundwater	1,138	1,138	1,138	1,138	1,138	1,138
(23)	Outflow	Out of Basin	Lake Evaporation	1,644	1,629	1,526	1,609	1,487	1,502
(24)	Outflow	Out of Basin	Stream Evaporation	2,214	2,215	2,100	2,189	2,073	2,072
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*174,041*	*252,254*	*341,611*	*417,354*	*511,687*	*902,857*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-

item	GROUNDWATER SYSTEM WATER BUDGET								
item	Flow Type	Origin/ Destination	Component	2001	2002	2003	2004	2005	2006
(8)	Inflow	Between Systems	Recharge of Applied Water	14,787	14,669	13,781	14,266	12,984	13,317
(9)	Inflow	Between Systems	Recharge of Precipitation	1,567	2,173	2,699	2,700	2,915	3,768
(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
(22)	Inflow	Between Systems	Groundwater Gain from Lake	1,138	1,138	1,138	1,138	1,138	1,138
(20)	Inflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*26,622*	*29,541*	*32,292*	*36,295*	*39,215*	*56,882*
(3)	Outflow	Between Systems	Groundwater Extraction	50,682	50,336	47,185	48,729	44,032	45,803
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*50,682*	*50,336*	*47,185*	*48,729*	*44,032*	*45,803*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	(24,060)	(20,795)	(14,893)	(12,433)	(4,817)	11,079

item	TOTAL BASIN WATER BUDGET								
item	Flow Type	Origin/ Destination	Component	2001	2002	2003	2004	2005	2006
(1)	Inflow	Into Basin	Precipitation on Land System	78,329	108,636	134,947	135,022	145,727	188,398
(14)	Inflow	Into Basin	Precipitation on Lakes	541	742	1,193	1,065	1,108	1,366
(13)	Inflow	Into Basin	Stream Inflow	100,742	153,035	219,963	295,581	381,347	735,770
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*179,612*	*262,413*	*356,102*	*431,668*	*528,182*	*925,534*
(5)	Outflow	Out of Basin	Evapotranspiration	128,419	131,436	127,627	131,455	122,313	130,971
(24)	Outflow	Out of Basin	Stream Evaporation	2,214	2,215	2,100	2,189	2,073	2,072
(23)	Outflow	Out of Basin	Lake Evaporation	1,644	1,629	1,526	1,609	1,487	1,502
(19)	Outflow	Out of Basin	Conveyance Evaporation	868	854	815	832	788	828
(18)	Outflow	Out of Basin	Stream Outflow	70,489	147,020	238,861	307,951	406,267	778,989
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*203,634*	*283,155*	*370,929*	*444,036*	*532,928*	*914,363*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	(24,022)	(20,742)	(14,827)	(12,368)	(4,746)	11,170

LAND SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2007	2008	2009	2010	2011	2012
(1)	Inflow	Into Basin	Precipitation on Land System	98,081	96,272	112,782	119,190	165,178	92,352
(2)	Inflow	Between Systems	Surface Water Delivery	87,225	85,939	85,918	79,962	76,188	88,131
(3)	Inflow	Between Systems	Groundwater Extraction	49,544	48,994	49,010	45,501	43,568	49,971
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*234,849*	*231,205*	*247,710*	*244,653*	*284,933*	*230,454*
(5)	Outflow	Out of Basin	Evapotranspiration	128,876	127,082	129,216	122,000	123,105	129,268
(6)	Outflow	Between Systems	Runoff	83,369	81,831	95,865	101,312	140,401	78,499
(7)	Outflow	Between Systems	Return Flow	6,038	5,972	5,974	5,544	5,309	6,090
(8)	Outflow	Between Systems	Recharge of Applied Water	14,557	14,348	14,345	13,355	12,734	14,705
(9)	Outflow	Between Systems	Recharge of Precipitation	1,962	1,925	2,256	2,384	3,304	1,847
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*234,802*	*231,158*	*247,656*	*244,595*	*284,853*	*230,409*
(12)	Storage Change	**(4)-(11)**	Change in Land System Storage	48	47	55	58	80	45

SURFACE WATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2007	2008	2009	2010	2011	2012
(13)	Inflow	Into Basin	Stream Inflow	127,762	240,456	143,169	103,605	629,359	125,535
(14)	Inflow	Into Basin	Precipitation on Lakes	669	462	739	845	1,122	628
(6)	Inflow	Between Systems	Runoff	83,369	81,831	95,865	101,312	140,401	78,499
(7)	Inflow	Between Systems	Return Flow	6,038	5,972	5,974	5,544	5,309	6,090
(15)	Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-
(16)	Inflow	Between Systems	Lake Gain from Groundwater	-	-	-	-	-	-
(17)	Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*217,838*	*328,720*	*245,746*	*211,306*	*776,191*	*210,752*
(18)	Outflow	Out of Basin	Stream Outflow	114,328	221,343	143,012	116,583	660,855	106,593
(19)	Outflow	Out of Basin	Conveyance Evaporation	855	837	817	805	798	832
(20)	Outflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(2)	Outflow	Between Systems	Surface Water Delivery	87,225	85,939	85,918	79,962	76,188	88,131
(21)	Outflow	Between Systems	Stream Loss to Groundwater	9,941	15,181	10,657	8,818	33,265	9,837
(22)	Outflow	Between Systems	Lake Loss to Groundwater	1,138	1,138	1,138	1,138	1,138	1,138
(23)	Outflow	Out of Basin	Lake Evaporation	1,660	1,628	1,589	1,492	1,461	1,582
(24)	Outflow	Out of Basin	Stream Evaporation	2,245	2,208	2,168	2,063	2,040	2,193
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*217,838*	*328,720*	*245,746*	*211,306*	*776,191*	*210,752*
(26)	Storage Change	**(17)-(25)**	Change in Surface Water Storage	-	-	-	-	-	-

GROUNDWATER SYSTEM WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2007	2008	2009	2010	2011	2012
(8)	Inflow	Between Systems	Recharge of Applied Water	14,557	14,348	14,345	13,355	12,734	14,705
(9)	Inflow	Between Systems	Recharge of Precipitation	1,962	1,925	2,256	2,384	3,304	1,847
(10)	Inflow	Between Systems	Managed Aquifer Recharge						
(21)	Inflow	Between Systems	Groundwater Gain from Stream	9,941	15,181	10,657	8,818	33,265	9,837
(22)	Inflow	Between Systems	Groundwater Gain from Lake	1,138	1,138	1,138	1,138	1,138	1,138
(20)	Inflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*28,044*	*33,039*	*28,842*	*26,140*	*50,887*	*27,974*
(3)	Outflow	Between Systems	Groundwater Extraction	49,544	48,994	49,010	45,501	43,568	49,971
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*49,544*	*48,994*	*49,010*	*45,501*	*43,568*	*49,971*
(31)	Storage Change	**(28)-(30)**	Change in Groundwater Storage	(21,500)	(15,955)	(20,168)	(19,361)	7,319	(21,997)

TOTAL BASIN WATER BUDGET

item	Flow Type	Origin/ Destination	Component	2007	2008	2009	2010	2011	2012
(1)	Inflow	Into Basin	Precipitation on Land System	98,081	96,272	112,782	119,190	165,178	92,352
(14)	Inflow	Into Basin	Precipitation on Lakes	669	462	739	845	1,122	628
(13)	Inflow	Into Basin	Stream Inflow	127,762	240,456	143,169	103,605	629,359	125,535
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*226,513*	*337,189*	*256,689*	*223,640*	*795,659*	*218,515*
(5)	Outflow	Out of Basin	Evapotranspiration	128,876	127,082	129,216	122,000	123,105	129,268
(24)	Outflow	Out of Basin	Stream Evaporation	2,245	2,208	2,168	2,063	2,040	2,193
(23)	Outflow	Out of Basin	Lake Evaporation	1,660	1,628	1,589	1,492	1,461	1,582
(19)	Outflow	Out of Basin	Conveyance Evaporation	855	837	817	805	798	832
(18)	Outflow	Out of Basin	Stream Outflow	114,328	221,343	143,012	116,583	660,855	106,593
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*247,965*	*353,098*	*276,802*	*242,943*	*788,260*	*240,467*
(34)	Storage Change	**(32)-(33)**	Change in Total System Storage	(21,452)	(15,908)	(20,113)	(19,303)	7,399	(21,952)

item	LAND SYSTEM WATER BUDGET								
item	Flow Type	Origin/ Destination	Component	2013	2014	2015	2016	2017	2018
(1)	Inflow	Into Basin	Precipitation on Land System	125,448	87,678	127,785	158,468	199,103	138,264
(2)	Inflow	Between Systems	Surface Water Delivery	86,791	92,729	87,371	85,368	82,968	85,294
(3)	Inflow	Between Systems	Groundwater Extraction	49,519	52,729	49,269	48,625	47,432	48,860
(4)	Inflow	*(1)+(2)+(3)*	*Total Inflow*	*261,757*	*233,135*	*264,425*	*292,462*	*329,502*	*272,418*
(5)	Outflow	Out of Basin	Evapotranspiration	132,031	134,914	132,614	134,339	136,547	131,859
(6)	Outflow	Between Systems	Runoff	106,630	74,526	108,617	134,698	169,237	117,524
(7)	Outflow	Between Systems	Return Flow	6,036	6,427	6,003	5,926	5,781	5,956
(8)	Outflow	Between Systems	Recharge of Applied Water	14,490	15,471	14,573	14,252	13,858	14,246
(9)	Outflow	Between Systems	Recharge of Precipitation	2,509	1,754	2,556	3,169	3,982	2,765
(10)	Outflow	Between Systems	Managed Aquifer Recharge	-	-	-	-	-	-
(11)	Outflow	*(5)+(6)+(7)+(8)+(9)+(10)*	*Total Outflow*	*261,696*	*233,092*	*264,363*	*292,385*	*329,406*	*272,351*
(12)	Storage Change	(4)-(11)	Change in Land System Storage	61	43	62	77	97	67

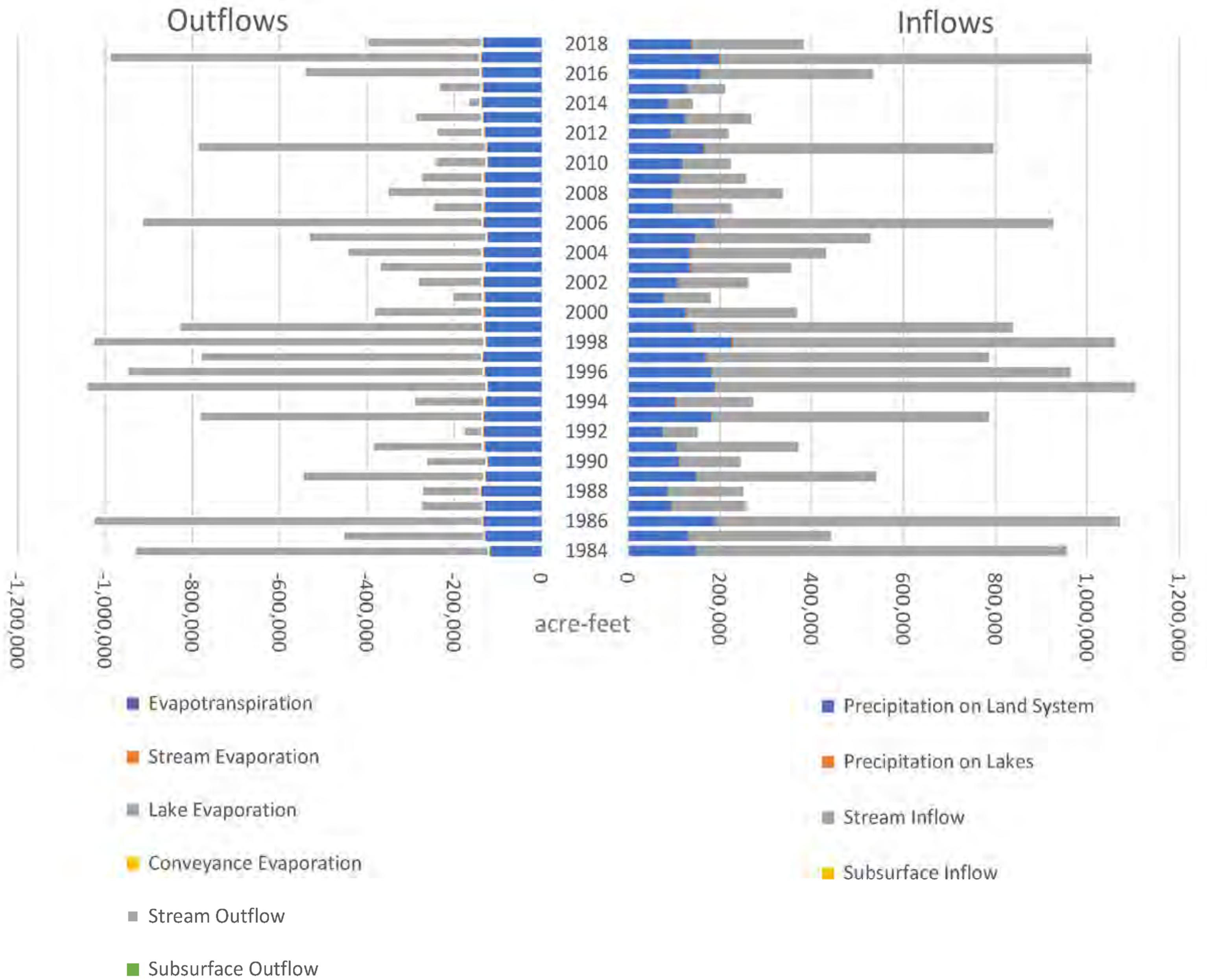
item	SURFACE WATER SYSTEM WATER BUDGET								
item	Flow Type	Origin/ Destination	Component	2013	2014	2015	2016	2017	2018
(13)	Inflow	Into Basin	Stream Inflow	142,221	52,739	82,881	374,311	809,028	243,145
(14)	Inflow	Into Basin	Precipitation on Lakes	864	527	910	1,163	1,563	945
(6)	Inflow	Between Systems	Runoff	106,630	74,526	108,617	134,698	169,237	117,524
(7)	Inflow	Between Systems	Return Flow	6,036	6,427	6,003	5,926	5,781	5,956
(15)	Inflow	Between Systems	Stream Gain from Groundwater	-	-	-	-	-	-
(16)	Inflow	Between Systems	Lake Gain from Groundwater	-	-	-	-	-	-
(17)	Inflow	*(13)+(14)+(6)+(7)+(15)+(16)*	*Total Inflow*	*255,751*	*134,220*	*198,411*	*516,099*	*985,609*	*367,570*
(18)	Outflow	Out of Basin	Stream Outflow	152,078	28,669	96,946	403,172	847,439	260,813
(19)	Outflow	Out of Basin	Conveyance Evaporation	834	846	806	832	822	844
(20)	Outflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(2)	Outflow	Between Systems	Surface Water Delivery	86,791	92,729	87,371	85,368	82,968	85,294
(21)	Outflow	Between Systems	Stream Loss to Groundwater	10,613	6,452	7,854	21,405	49,248	15,306
(22)	Outflow	Between Systems	Lake Loss to Groundwater	1,138	1,138	1,138	1,138	1,138	1,138
(23)	Outflow	Out of Basin	Lake Evaporation	1,642	1,672	1,640	1,575	1,500	1,568
(24)	Outflow	Out of Basin	Stream Evaporation	2,208	2,268	2,210	2,162	2,048	2,162
(25)	Outflow	*(18)+(19)+(20)+(2)+(21)+(22)+(23)+(24)*	*Total Outflow*	*255,751*	*134,220*	*198,411*	*516,099*	*985,609*	*367,570*
(26)	Storage Change	(17)-(25)	Change in Surface Water Storage	-	-	-	-	-	-

item	GROUNDWATER SYSTEM WATER BUDGET								
item	Flow Type	Origin/ Destination	Component	2013	2014	2015	2016	2017	2018
(8)	Inflow	Between Systems	Recharge of Applied Water	14,490	15,471	14,573	14,252	13,858	14,246
(9)	Inflow	Between Systems	Recharge of Precipitation	2,509	1,754	2,556	3,169	3,982	2,765
(10)	Inflow	Between Systems	Managed Aquifer Recharge						
(21)	Inflow	Between Systems	Groundwater Gain from Stream	10,613	6,452	7,854	21,405	49,248	15,306
(22)	Inflow	Between Systems	Groundwater Gain from Lake	1,138	1,138	1,138	1,138	1,138	1,138
(20)	Inflow	Between Systems	Conveyance Seepage	446	446	446	446	446	446
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(28)	Inflow	*(8)+(9)+(10)+(21)+(22)+(20)+(27)*	*Total Inflow*	*29,196*	*25,261*	*26,567*	*40,411*	*68,672*	*33,902*
(3)	Outflow	Between Systems	Groundwater Extraction	49,519	52,729	49,269	48,625	47,432	48,860
(15)	Outflow	Between Systems	Groundwater Loss to Stream	-	-	-	-	-	-
(16)	Outflow	Between Systems	Groundwater Loss to Lake	-	-	-	-	-	-
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(30)	Outflow	*(3)+(15)+(16)+(29)*	*Total Outflow*	*49,519*	*52,729*	*49,269*	*48,625*	*47,432*	*48,860*
(31)	Storage Change	(28)-(30)	Change in Groundwater Storage	(20,322)	(27,468)	(22,703)	(8,214)	21,240	(14,958)

item	TOTAL BASIN WATER BUDGET								
item	Flow Type	Origin/ Destination	Component	2013	2014	2015	2016	2017	2018
(1)	Inflow	Into Basin	Precipitation on Land System	125,448	87,678	127,785	158,468	199,103	138,264
(14)	Inflow	Into Basin	Precipitation on Lakes	864	527	910	1,163	1,563	945
(13)	Inflow	Into Basin	Stream Inflow	142,221	52,739	82,881	374,311	809,028	243,145
(27)	Inflow	Into Basin	Subsurface Inflow	-	-	-	-	-	-
(32)	Inflow	*(1)+(14)+(13)+(27)*	*Total Inflow*	*268,532*	*140,944*	*211,576*	*533,943*	*1,009,693*	*382,353*
(5)	Outflow	Out of Basin	Evapotranspiration	132,031	134,914	132,614	134,339	136,547	131,859
(24)	Outflow	Out of Basin	Stream Evaporation	2,208	2,268	2,210	2,162	2,048	2,162
(23)	Outflow	Out of Basin	Lake Evaporation	1,642	1,672	1,640	1,575	1,500	1,568
(19)	Outflow	Out of Basin	Conveyance Evaporation	834	846	806	832	822	844
(18)	Outflow	Out of Basin	Stream Outflow	152,078	28,669	96,946	403,172	847,439	260,813
(29)	Outflow	Out of Basin	Subsurface Outflow	-	-	-	-	-	-
(33)	Outflow	*(5)+(24)+(23)+(19)+(18)+(29)*	*Total Outflow*	*288,794*	*168,369*	*234,217*	*542,080*	*988,356*	*397,244*
(34)	Storage Change	(32)-(33)	Change in Total System Storage	(20,262)	(27,425)	(22,641)	(8,137)	21,337	(14,891)

Appendix 6C Water Budget Bar Charts

TOTAL BASIN

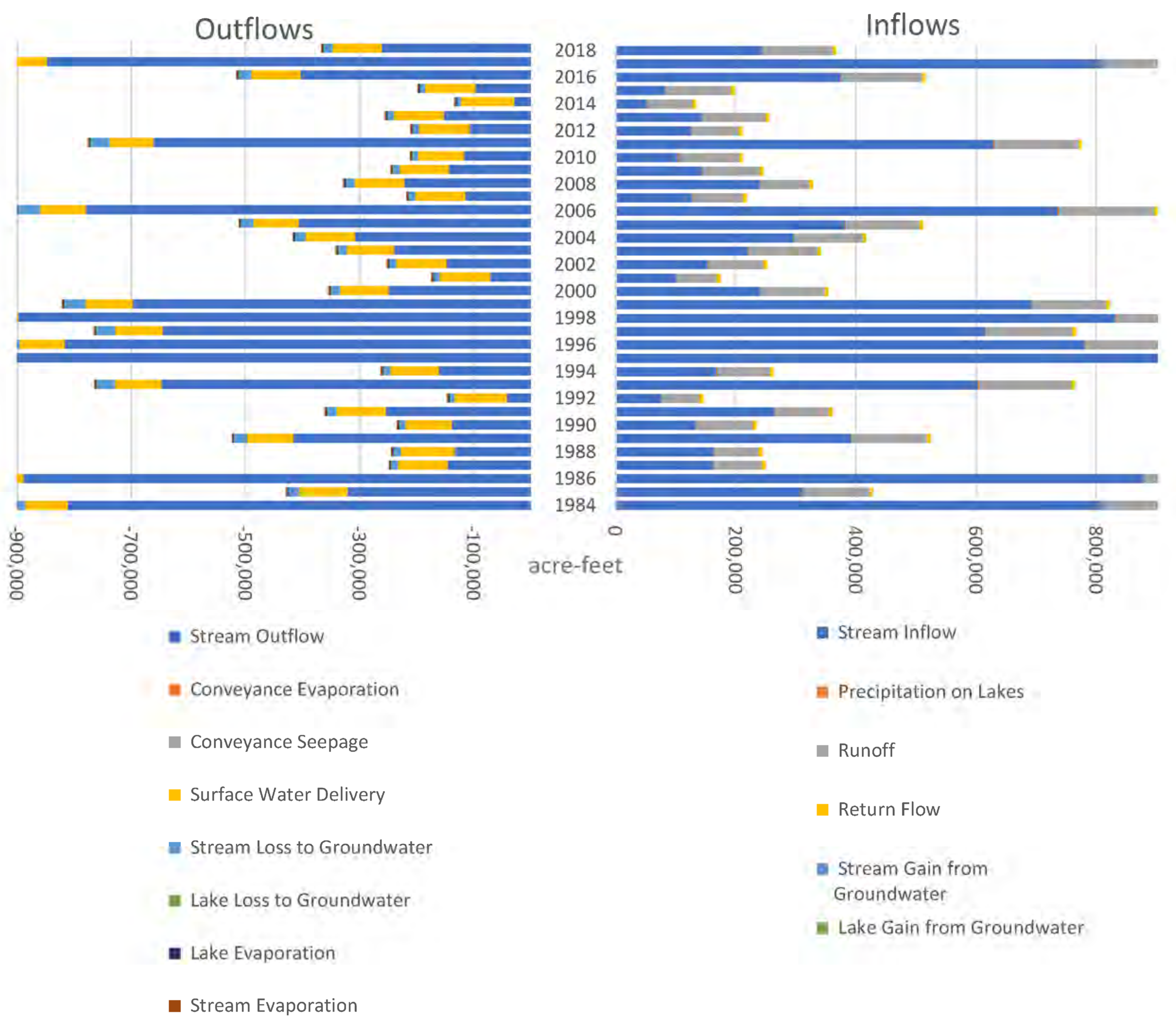


Outflows
Inflows
2018
2016
2014
2012
2010
2008
2006
2004
2002
2000
1998
1996
1994
1992
1990
1988
1986
1984
-1,200,000
-1,000,000
-800,000
-600,000
-400,000
-200,000
0
0
200,000
400,000
600,000
800,000
1,000,000
1,200,000
acre-feet
Evapotranspiration
Stream Evaporation
Lake Evaporation
Conveyance Evaporation
Stream Outflow
Subsurface Outflow
Precipitation on Land System
Precipitation on Lakes
Stream Inflow
Subsurface Inflow

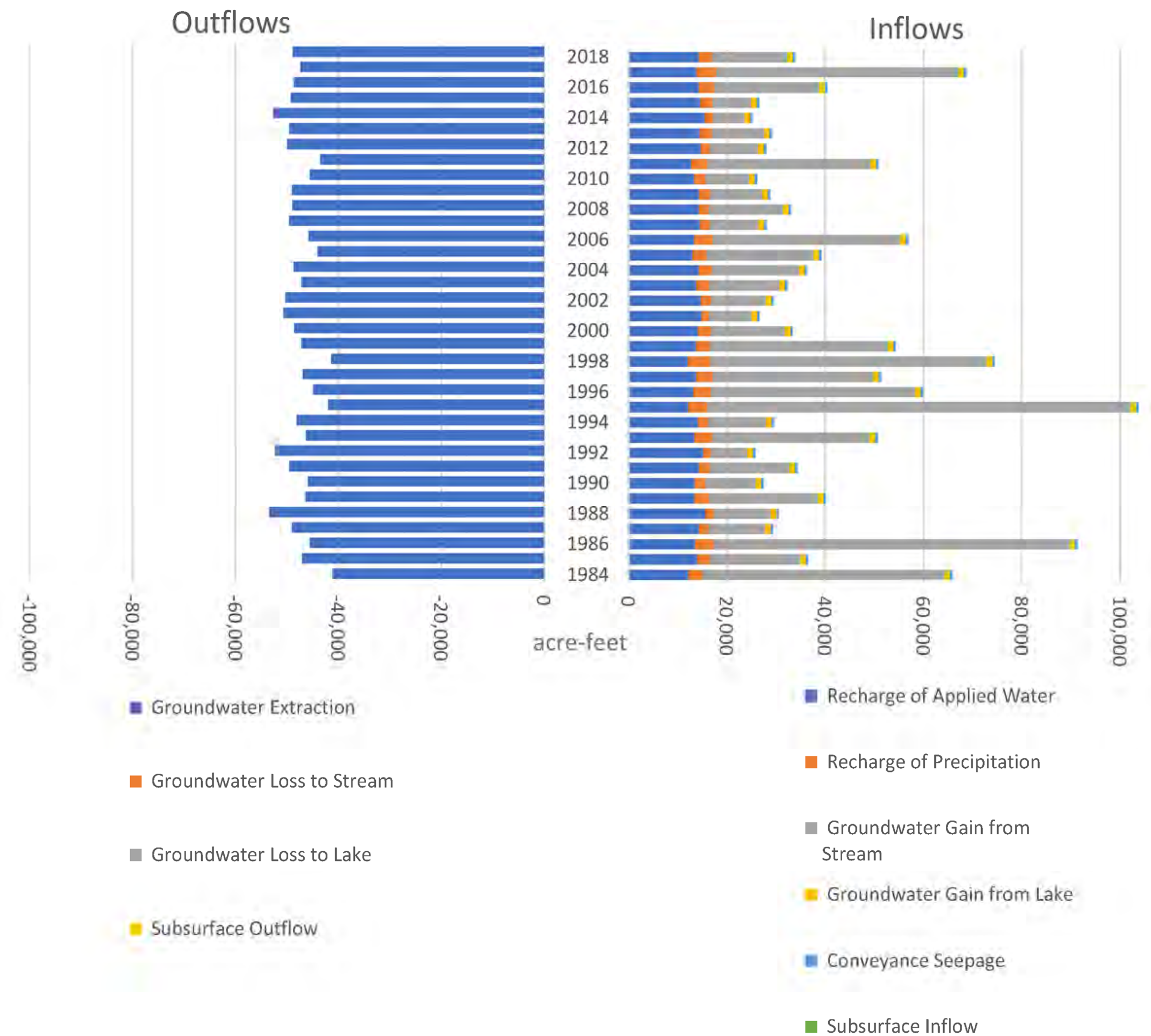
LAND SYSTEM


Outflows
Inflows
2018
2016
2014
2012
2010
2008
2006
2004
2002
2000
1998
1996
1994
1992
1990
1988
1986
1984
-350,000
-300,000
-250,000
-200,000
-150,000
-100,000
-50,000
0
acre-feet
0
50,000
100,000
150,000
200,000
250,000
300,000
350,000
Evapotranspiration
Runoff
Return Flow
Recharge of Applied Water
Recharge of Precipitation
Managed Aquifer Recharge
Precipitation on Land System
Surface Water Delivery
Groundwater Extraction

SURFACE WATER SYSTEM



GROUNDWATER SYSTEM



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)

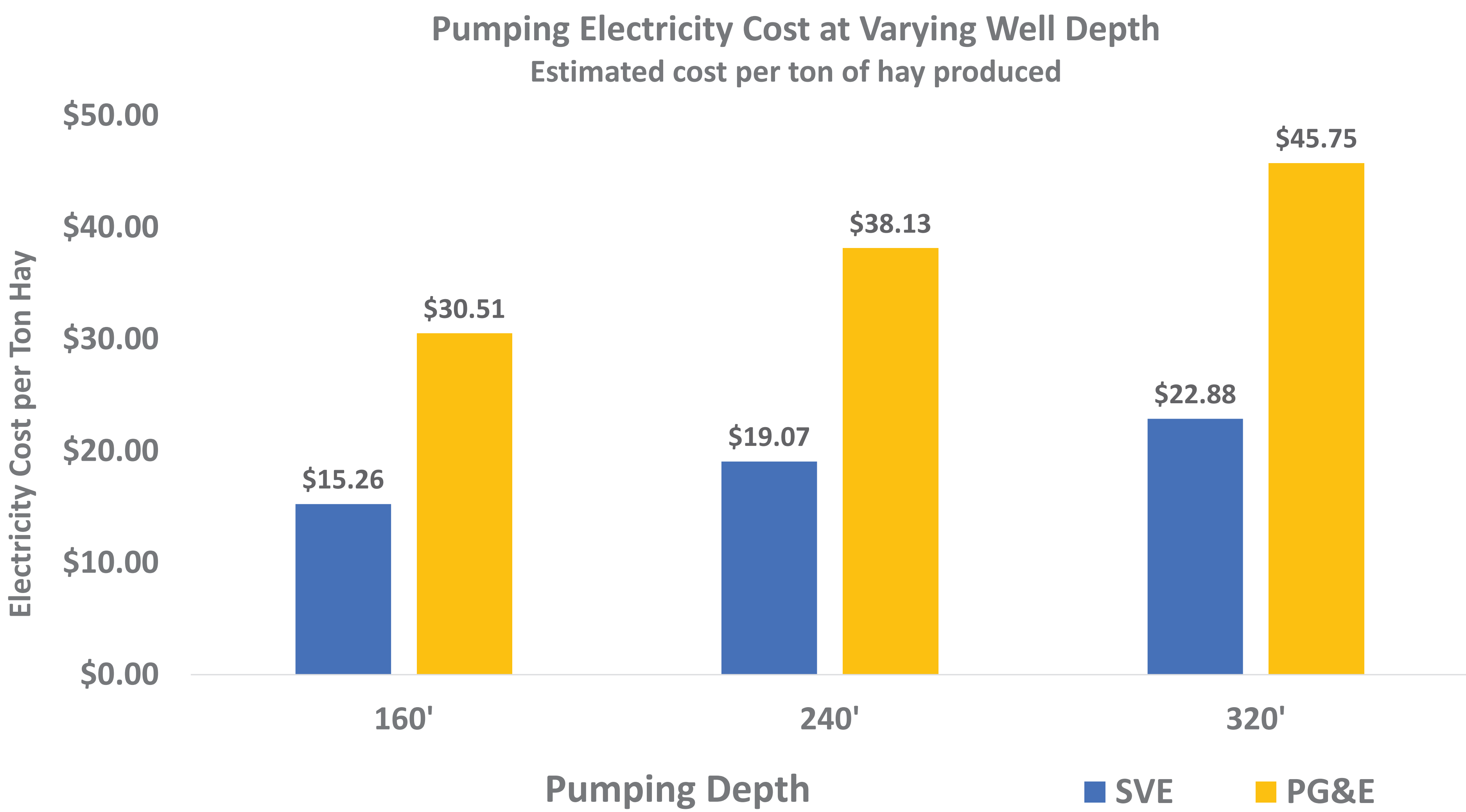
- For every 50 ft of drop in pumping level 16.66% increase in horsepower or cost. 150 ft drop = 50 HP increase in HP or cost

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)

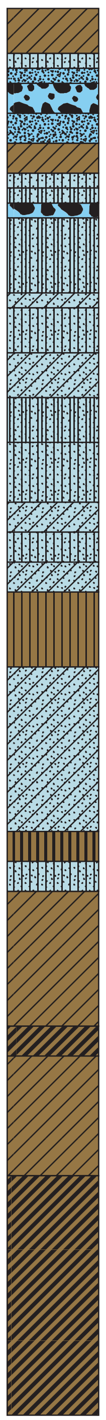
water year = October 1 to September 30

[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.

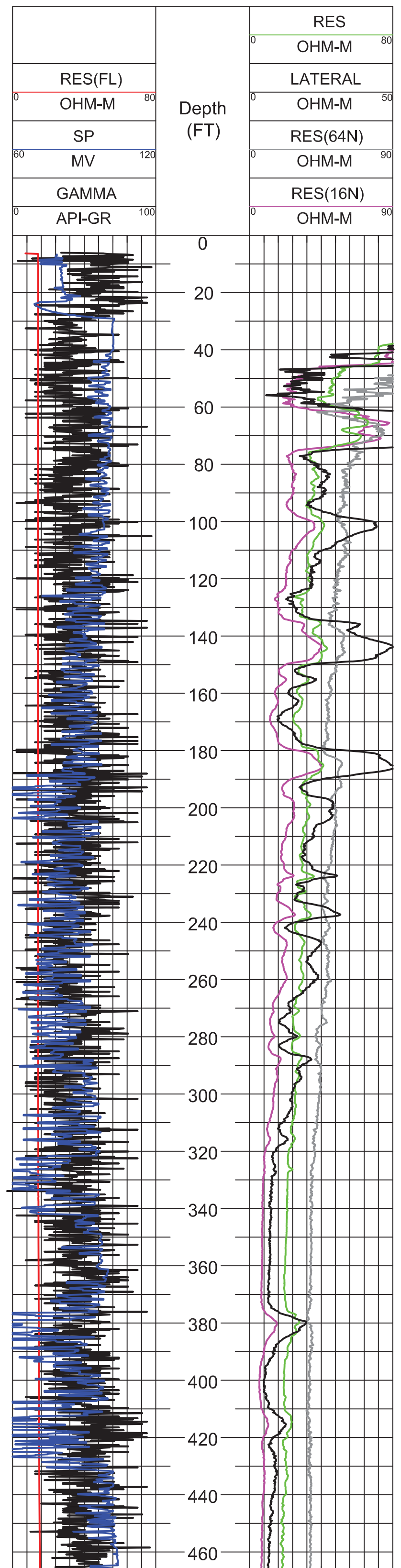
Appendix 8B New Monitoring Well As-Built Drawings

LITHOLOGIC LOG

Depth (FT)	DESCRIPTION
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	

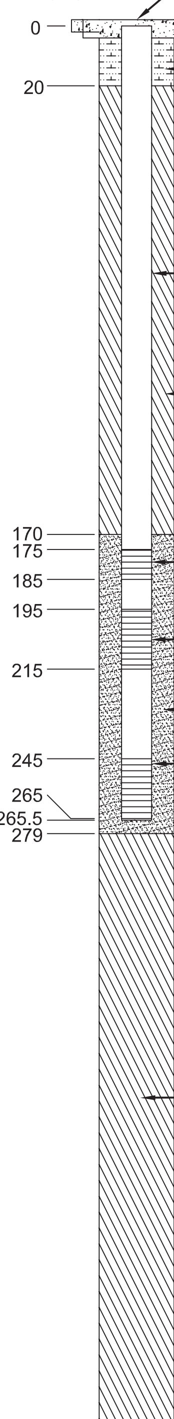


E-LOGS



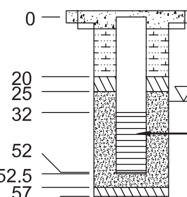
BVMW 1-1

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

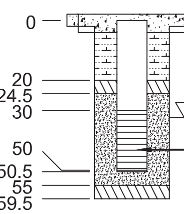
Latitude (WGS84): 41.1881034
Longitude (WGS84): -120.9597792
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4214.21
Top of Well Vault: 4214.54



Note: Well materials same as BVMW 1-1 unless otherwise noted

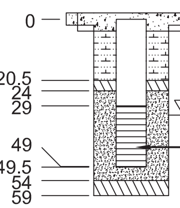
BVMW 1-3

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

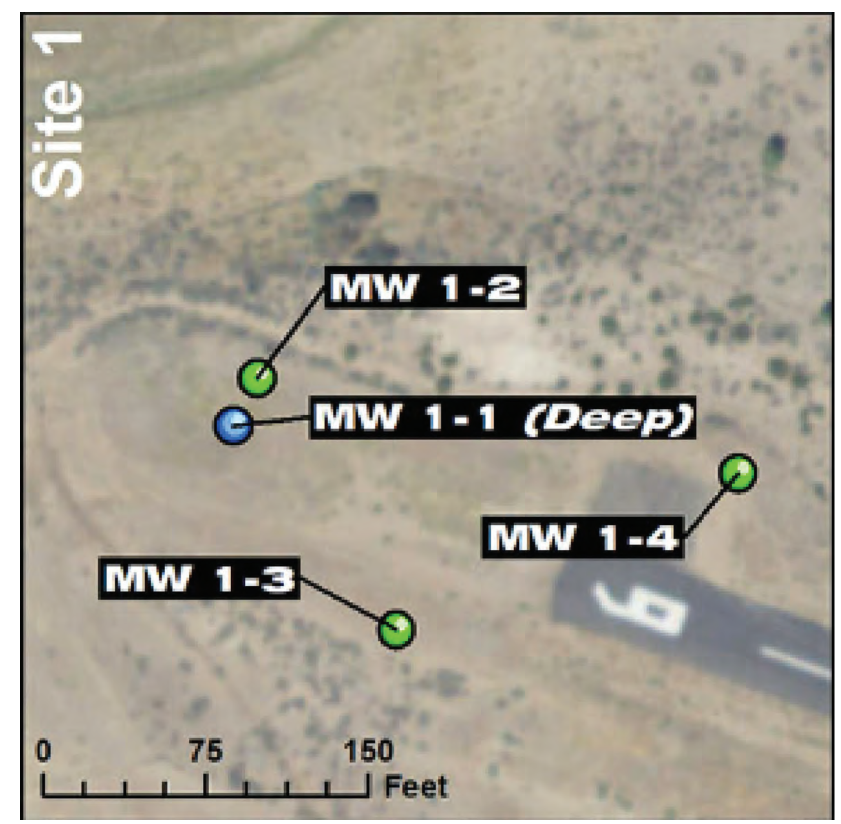


BVMW 1-4

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 1874 CALIFORNIA

FUNDED BY:

DEPARTMENT OF WATER RESOURCES STATE OF CALIFORNIA

PROJECT ENGINEER:

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(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

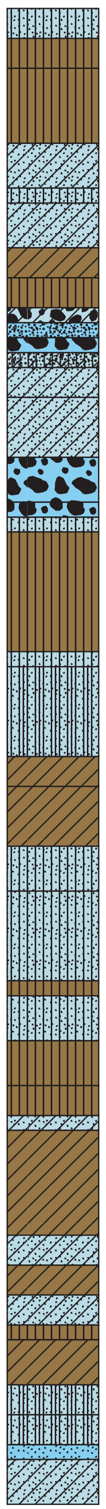
BIG VALLEY GROUNDWATER BASIN

AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 1 ADIN AIRPORT

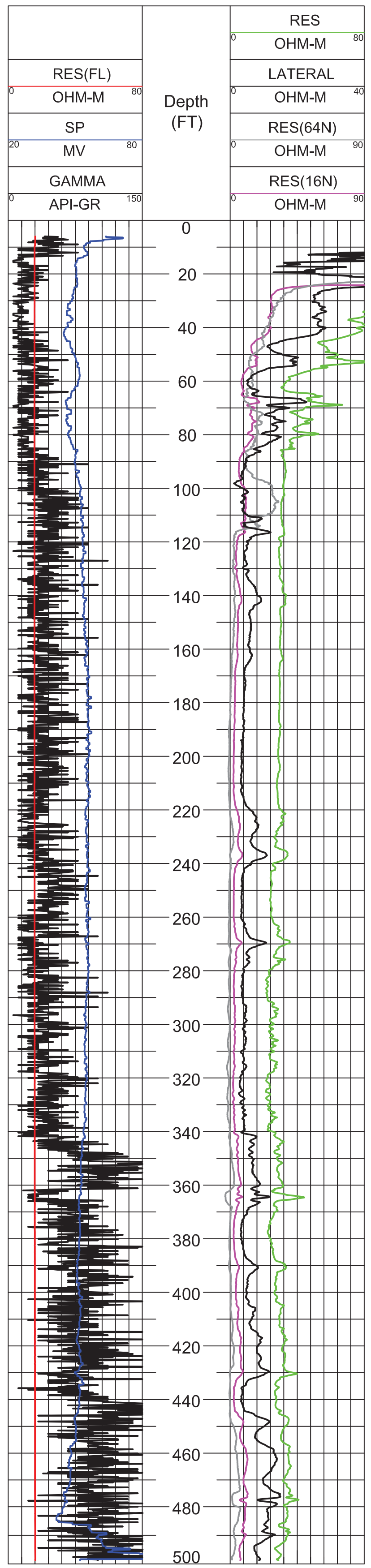
DRAWING 1

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	
175	Silty Sand, (SM) dark grayish brown
	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
485	coarse grained
500	Clayey Sand, (SC) black and light gray

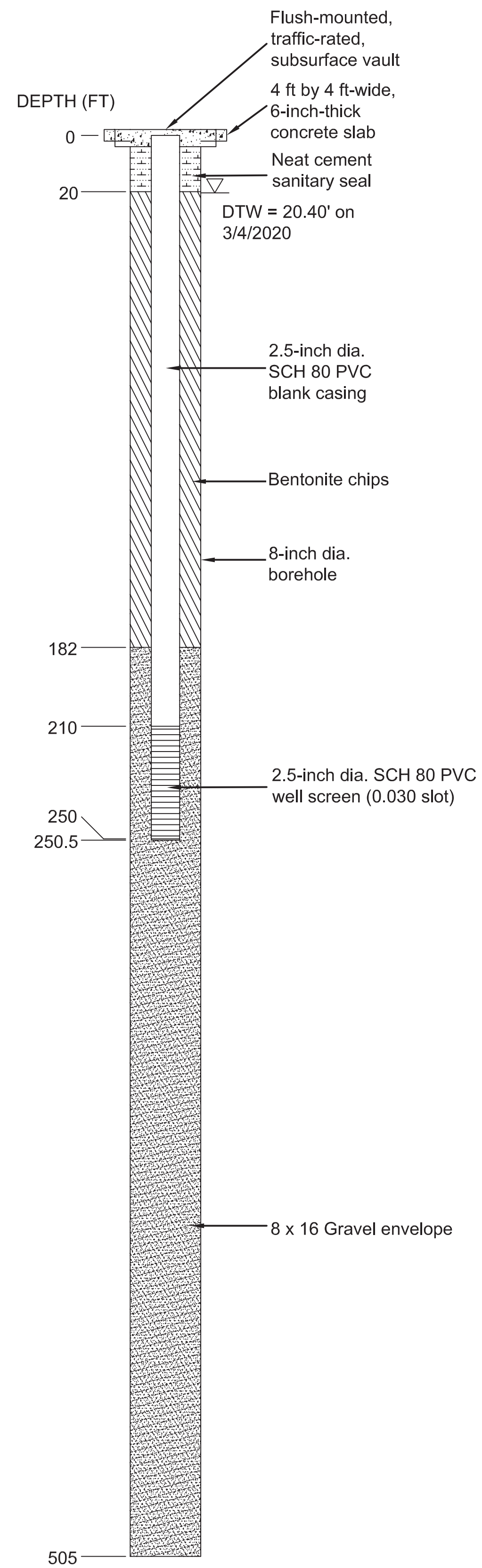


E-LOGS



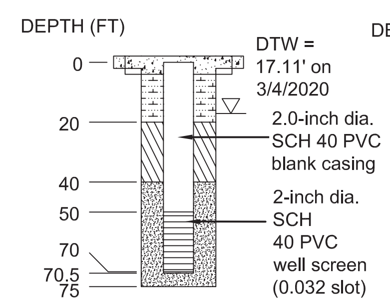
BVMW 2-1

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

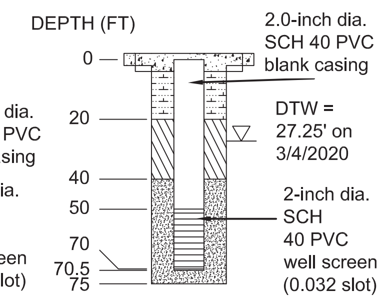
Latitude (WGS84): 41.2118382
Longitude (WGS84): -121.0285515
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4216.44
Top of Well Vault: 4216.77



Note: Well materials same as BVMW 2-1 unless otherwise noted

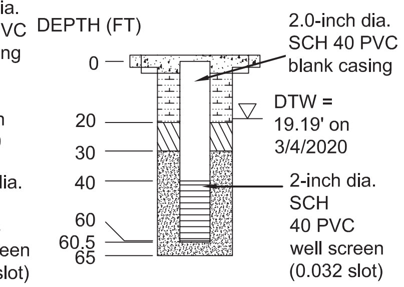
BVMW 2-3

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

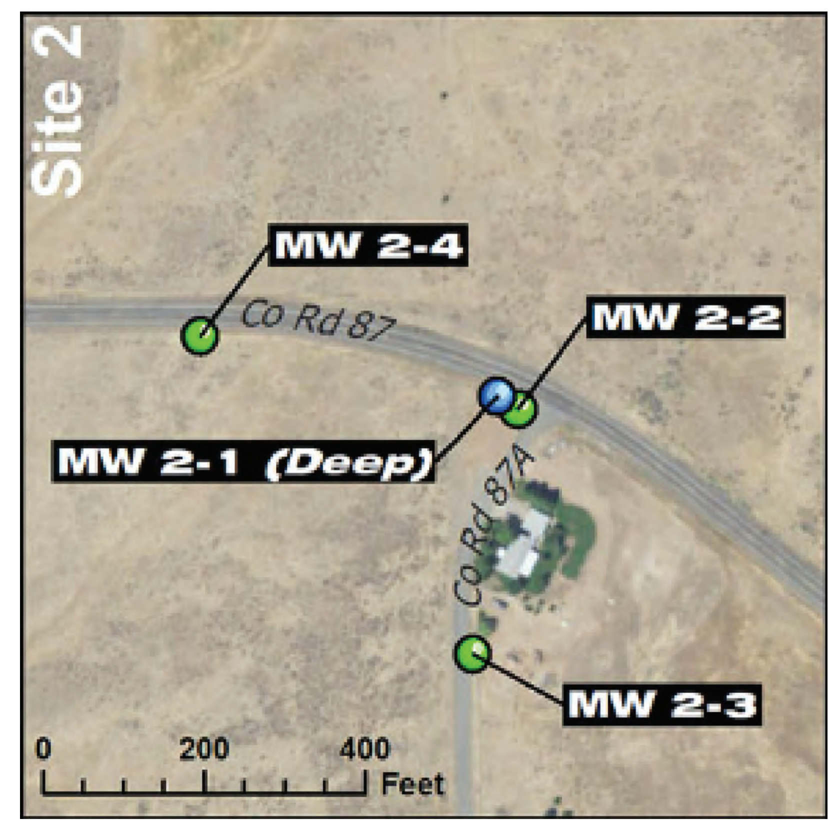


BVMW 2-4

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

ON BEHALF OF:

COUNTY OF MODOC CALIFORNIA 1874

FUNDED BY:

DEPARTMENT OF WATER RESOURCES STATE OF CALIFORNIA

PROJECT ENGINEER:

GEI Consultants
2868 PROSPECT PARK DRIVE
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(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

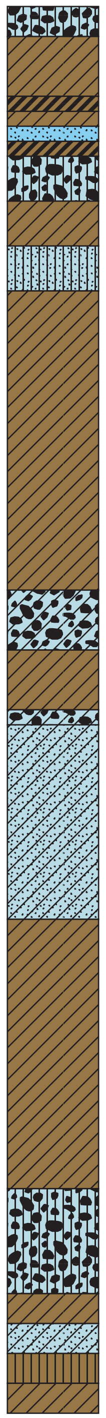
AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 2 ROADS 87 & 87A

DRAWING 2

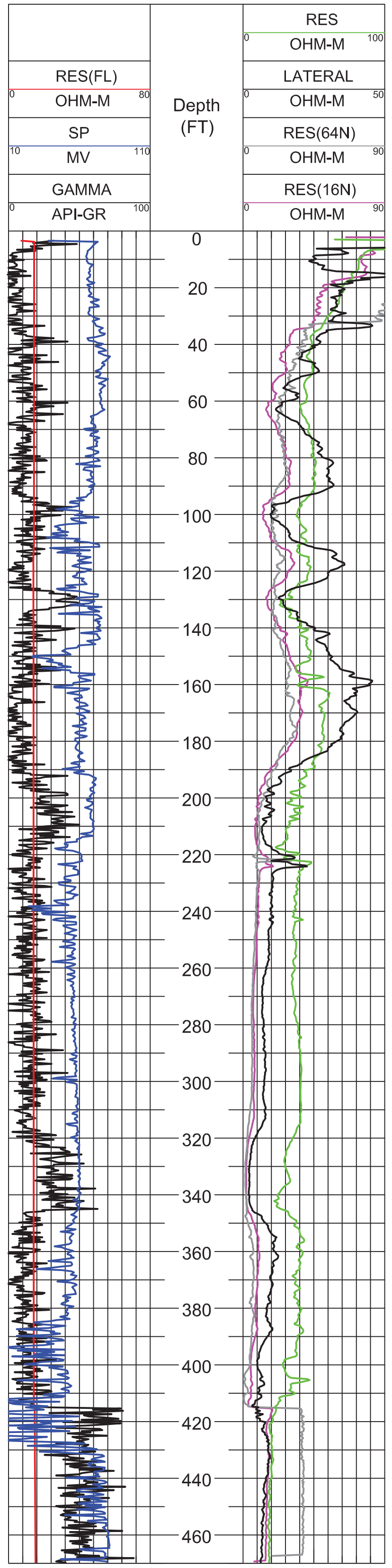
1 2 3 4 5 6 7 8

LITHOLOGIC LOG

Depth (FT)	DESCRIPTION
0	Silty Gravel, (GM) light yellowish brown
10	Lean Clay, (CL) trace fine gravel
30	Fat Clay (CH)
35	Lean Clay, (CL) yellowish brown
40	Poorly Graded Sand with Gravel (SP)
45	Fat Clay (CH)
50	Silty Gravel (GM)
65	Lean Clay, (CL) grayish brown
80	Silty Sand, (SM) grayish brown
95	Lean Clay, Lean Clay with Gravel, and Lean Clay with Sand, (CL) gray and grayish brown
195	Clayey Gravel, (GC) dark gray
215	Lean Clay with Sand and Lean Clay with Gravel, (CL) dark brown
235	Clayey Gravel (GC)
240	Clayey Sand, (SC) brown
305	Lean Clay and Lean Clay with Sand, (CL) bluebish gray, light gray, and brownish gray
395	Silty Gravel, (GM) grayish brown and reddish brown
430	Sandy Lean Clay, (CL) light gray
440	Clayey Sand, (SC) light gray
450	Silt, (ML) bluish gray
460	Gravelly Lean Clay, (CL) light bluish gray
470	

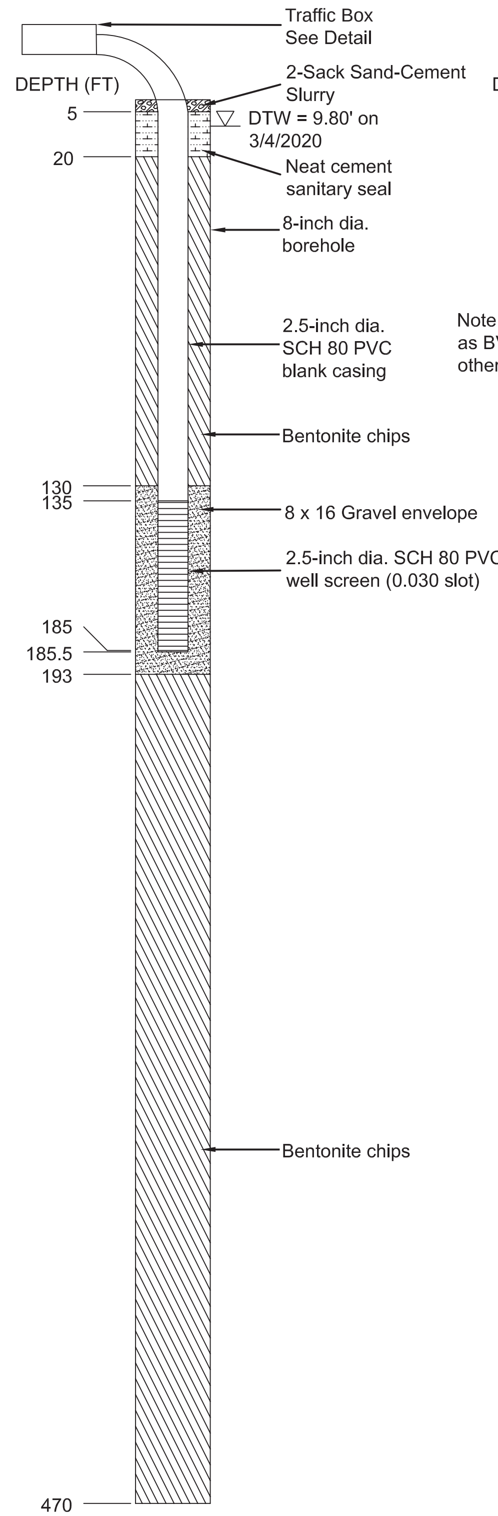


E-LOGS



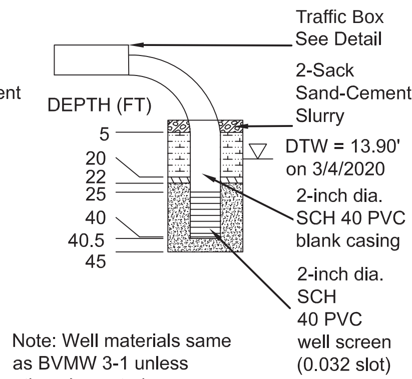
BVMW 3-1

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

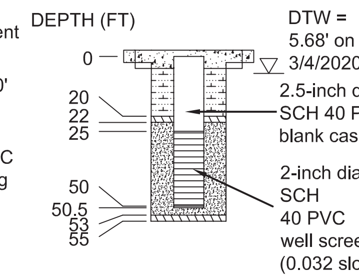
Latitude (WGS84): 41.2170083
Longitude (WGS84): -121.1049570
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.58
Corrected Reference Pt.: 4167.58
Top of Well Vault: 4164.92



Note: Well materials same as BVMW 3-1 unless otherwise noted

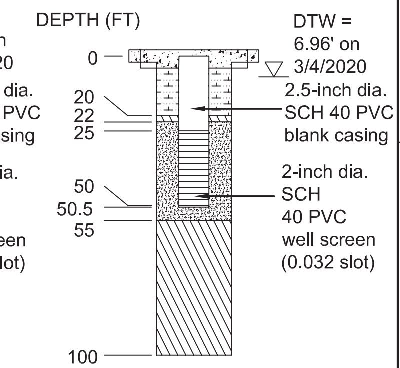
BVMW 3-3

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

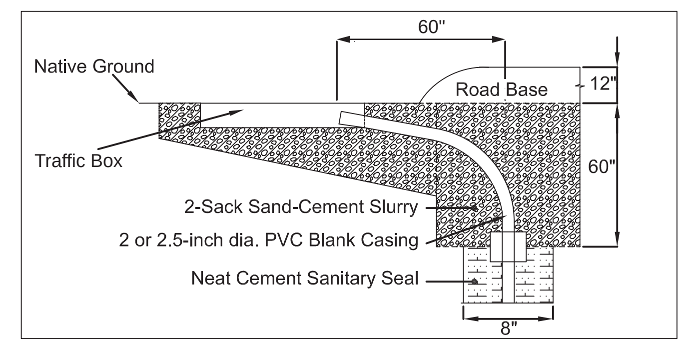


BVMW 3-4

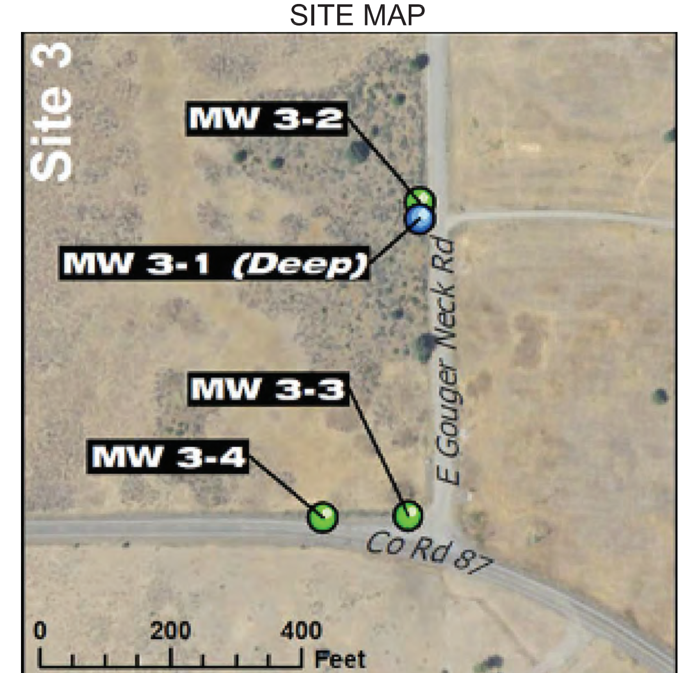
Latitude (WGS84): 41.2157230
Longitude (WGS84): -121.1054095
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.97
Top of Well Vault: 4165.31



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:

COUNTY OF MODOC CALIFORNIA 1874

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PROJECT ENGINEER:

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PROFESSIONAL GEOLOGIST DAVID FAIRMAN No. 9025 STATE OF CALIFORNIA

Date: 4/13/2021

Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Jan-Feb 2020

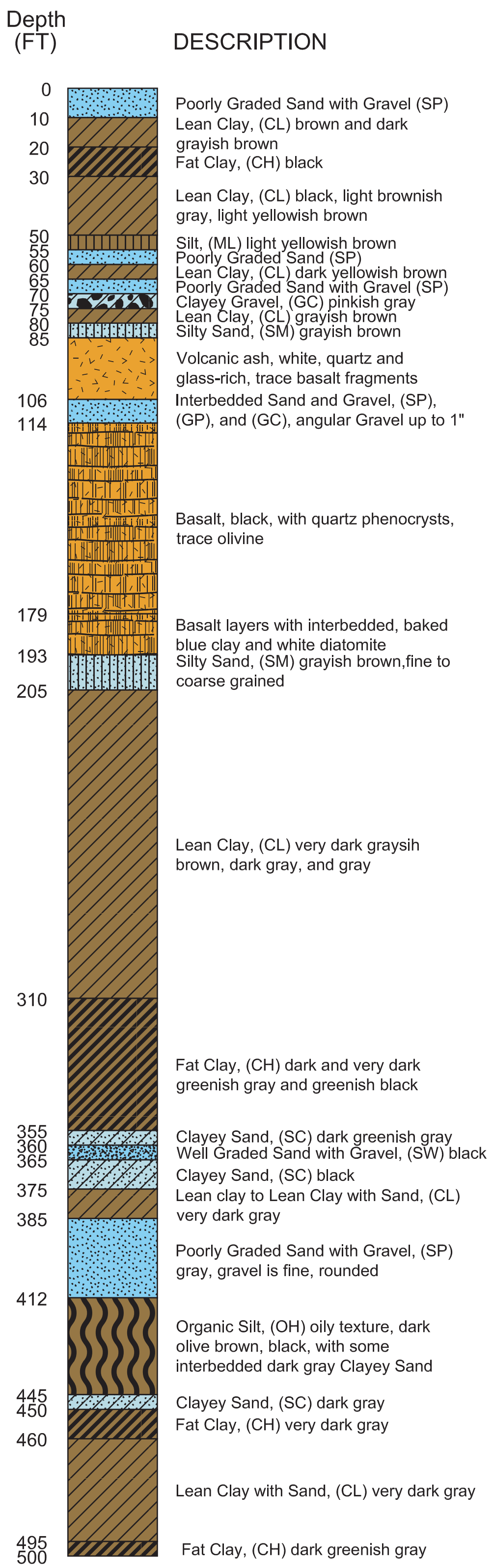
BIG VALLEY GROUNDWATER BASIN

AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 3 ROADS 87 & 90

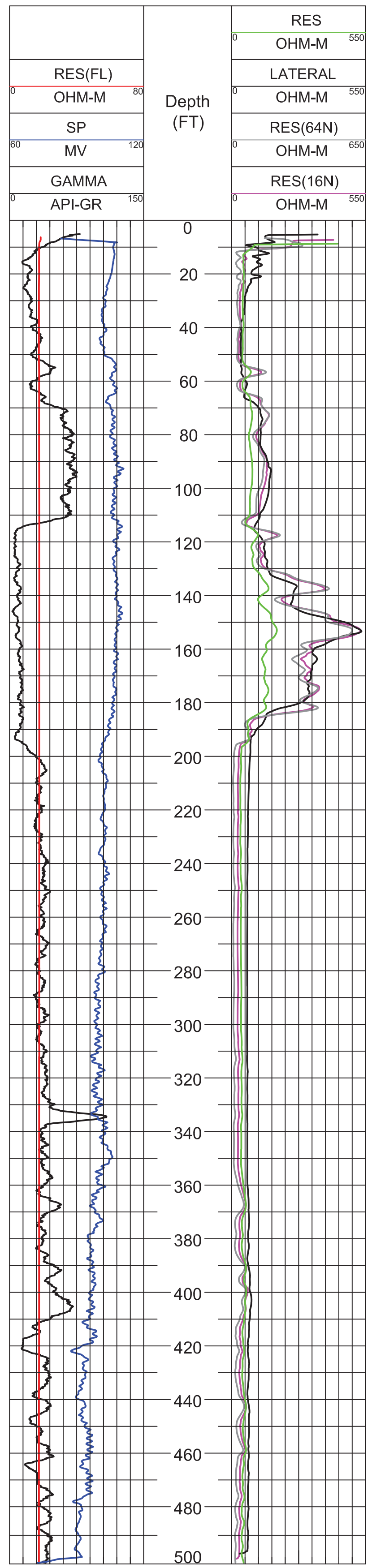
DRAWING 3

1 2 3 4 5 6 7 8

LITHOLOGIC LOG

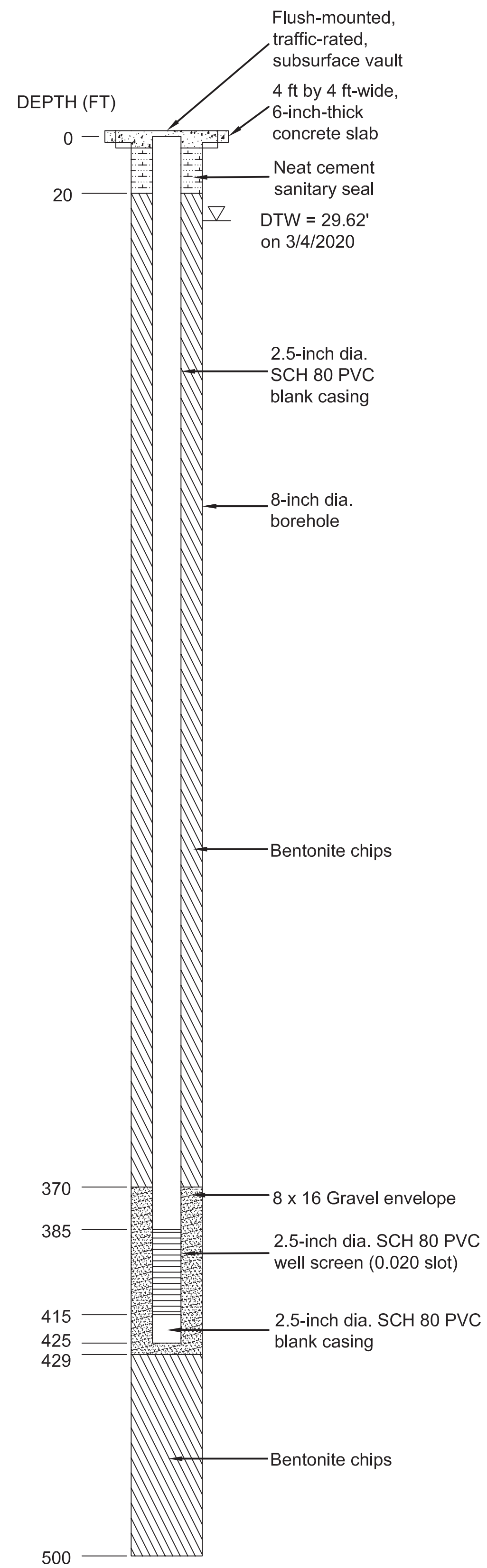


E-LOGS



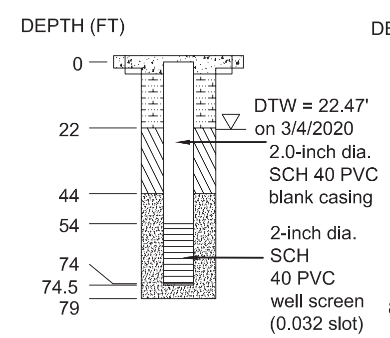
BVMW 4-1

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

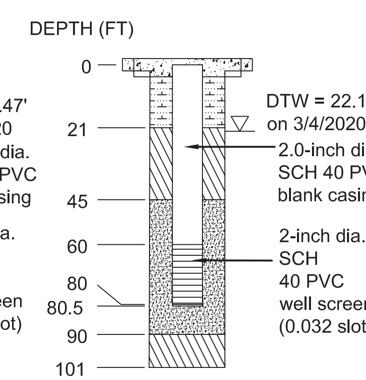
Latitude (WGS84): 41.2029353
Longitude (WGS84): -121.1587904
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4152.73
Top of Well Vault: 4153.06



Note: Well materials same as BVMW 4-1 unless otherwise noted

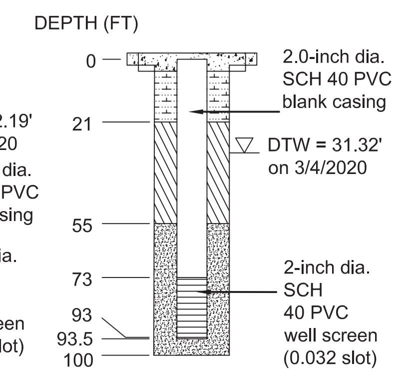
BVMW 4-3

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

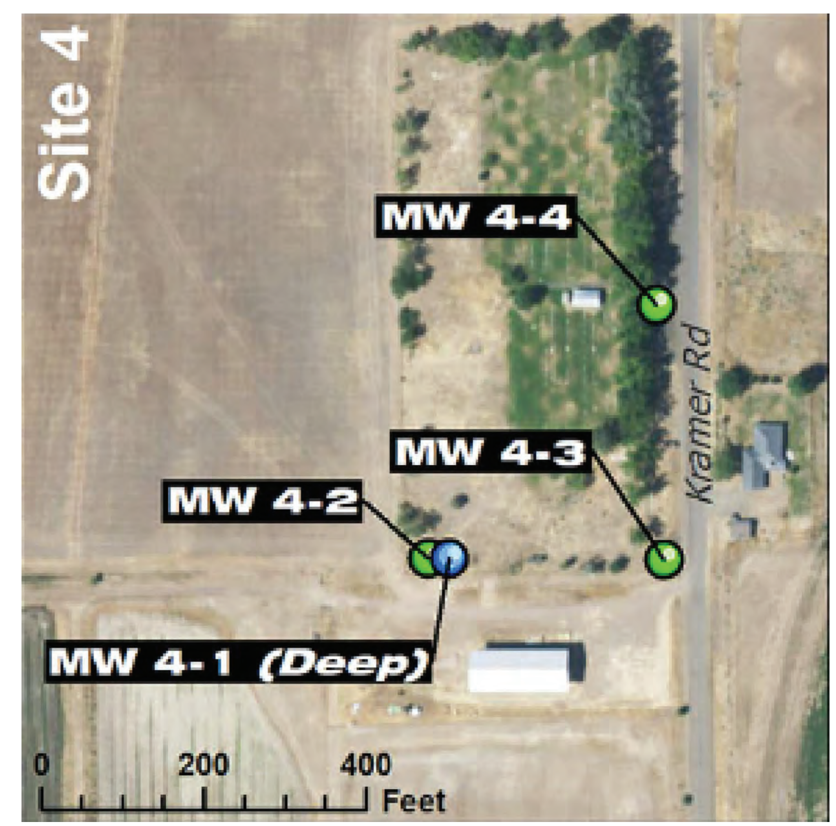


BVMW 4-4

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

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PROFESSIONAL GEOLOGIST DAVID FAIRMAN No. 9025 STATE OF CALIFORNIA

Date: 4/13/2021

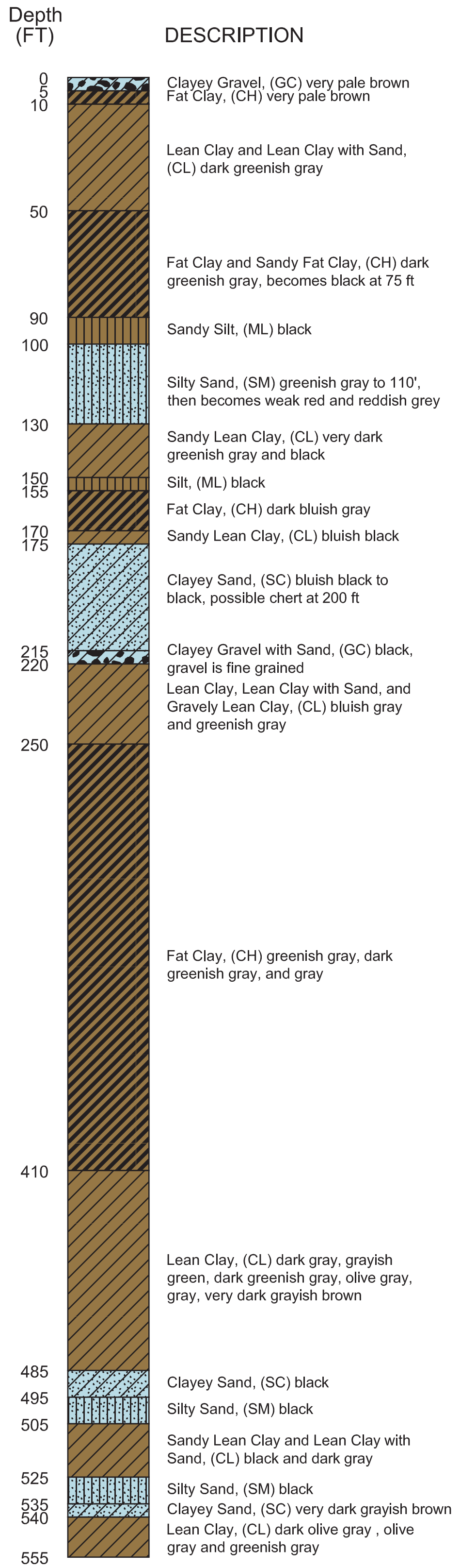
Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Nov 2019

BIG VALLEY GROUNDWATER BASIN

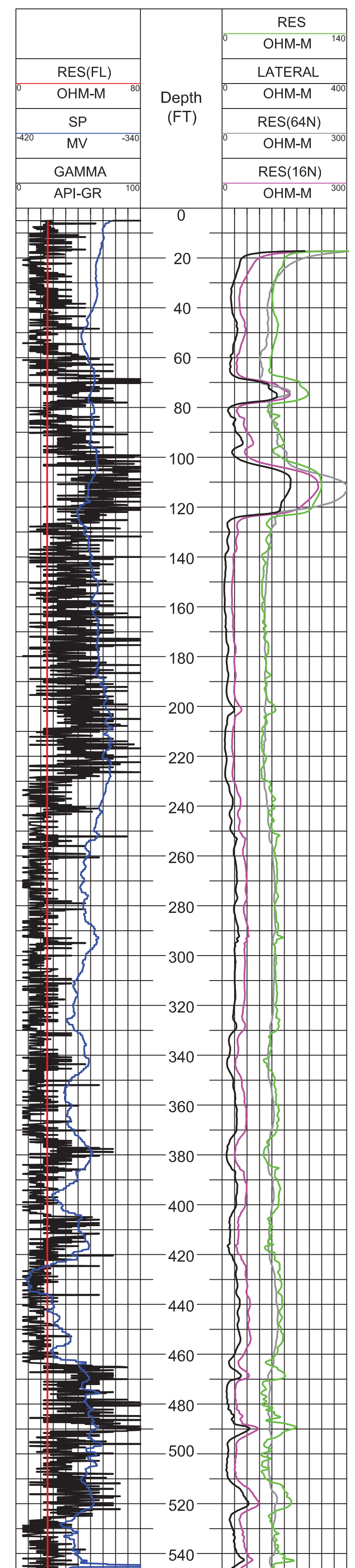
AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 4 LOOKOUT CEMETERY

DRAWING 4

LITHOLOGIC LOG

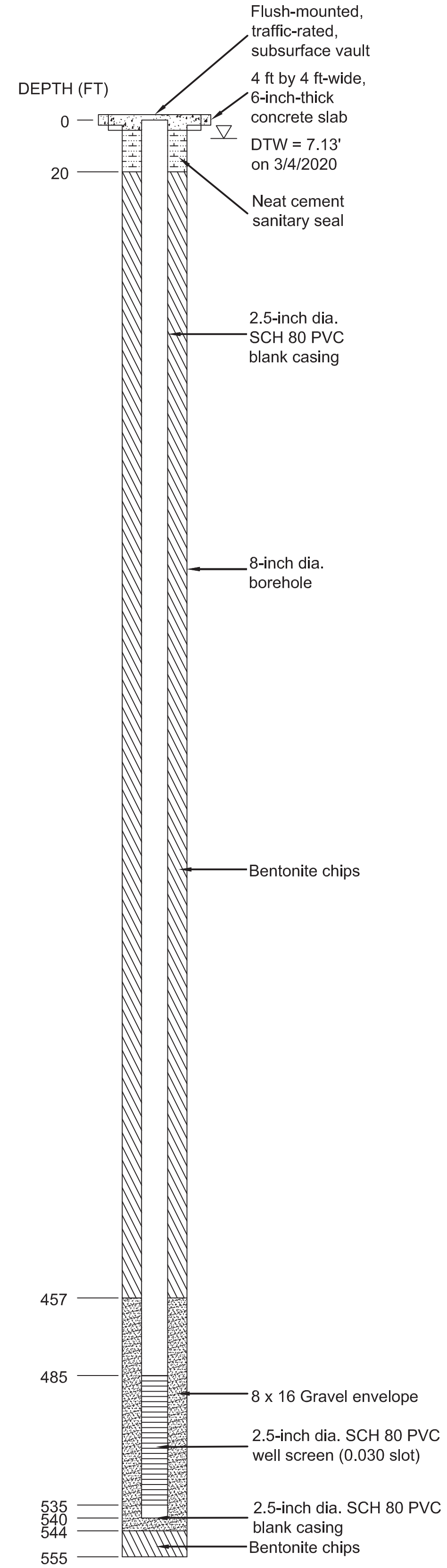


E-LOGS



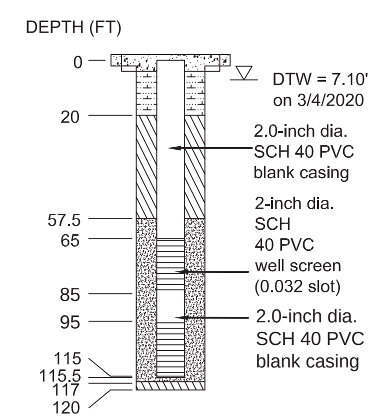
BVMW 5-1

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

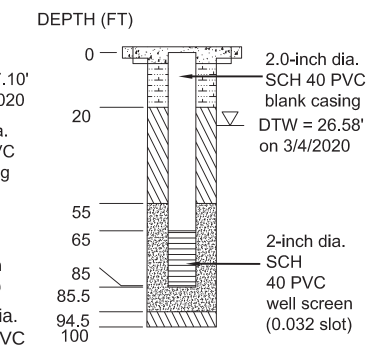
Latitude (WGS84): 41.1219508
Longitude (WGS84): -121.1338622
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4128.59
Top of Well Vault: 4128.92



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
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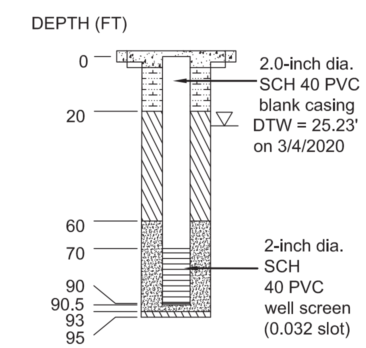
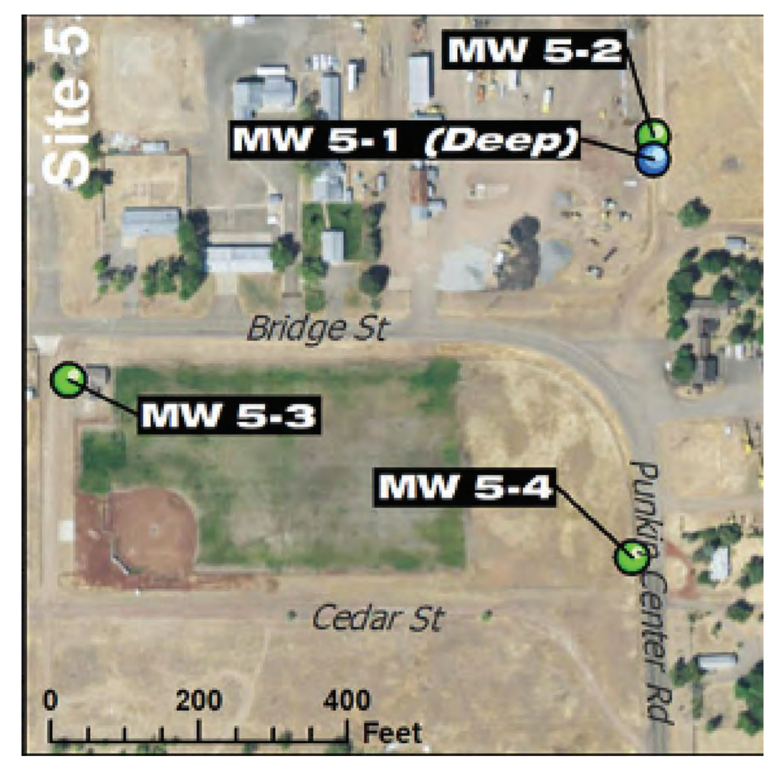
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4129.90
Top of Well Vault: 4130.23



SITE MAP



FUNDED BY:

PROJECT ENGINEER:

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DAVID FAIRMAN
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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.

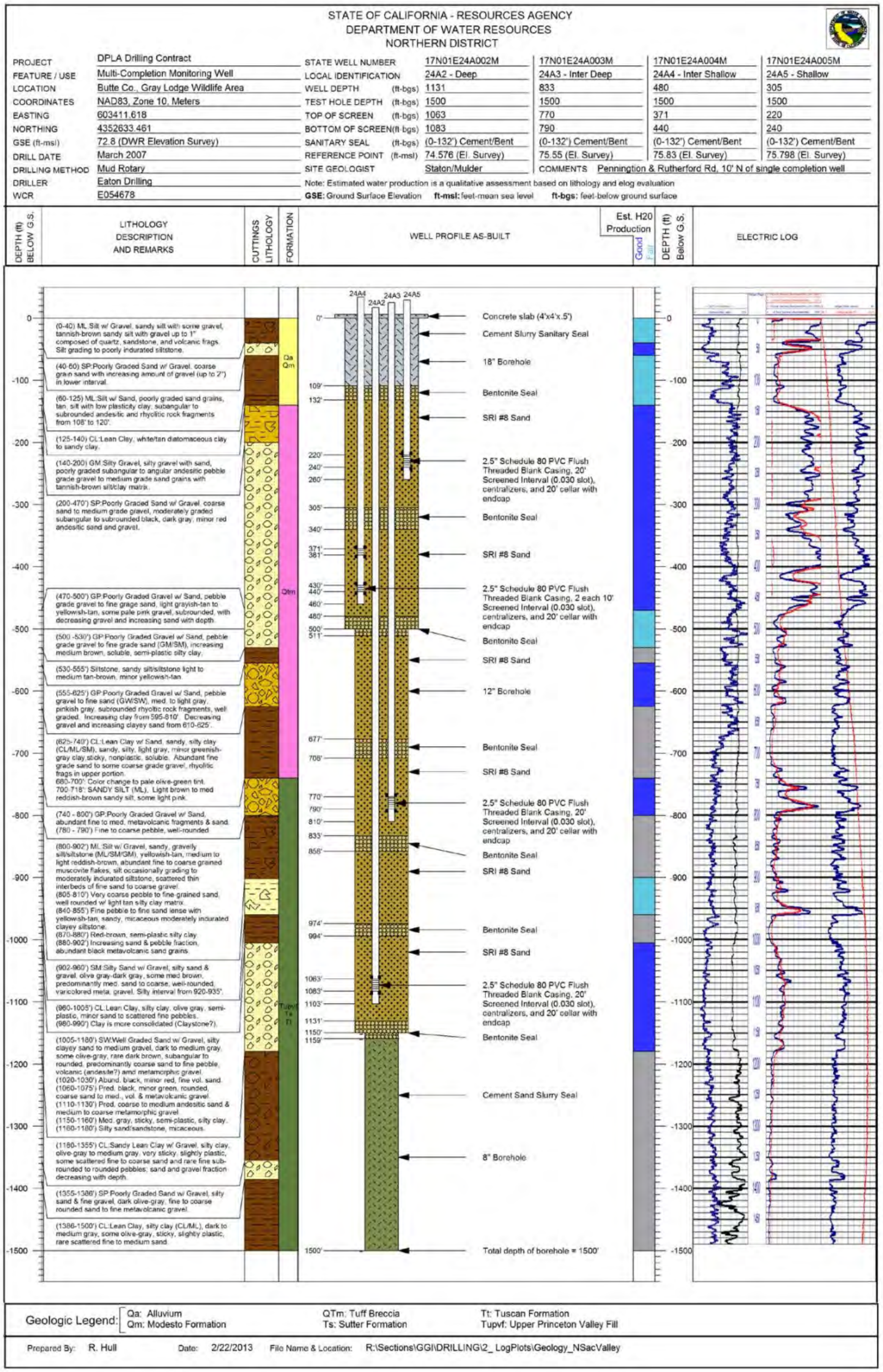

Figure 2 – Example As-Built Multi-Completion Monitoring Well Log

<u>Measuring Groundwater Levels</u>

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.

<u>Recording Groundwater Levels</u>

- 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

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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

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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

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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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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
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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

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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.

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 Tribal Outreach

From:	Tiffany Martinez
To:	David Lile; Laura Snell; Fairman, David; Petersen, Christian; Geri Byrne; Becky Albaugh; Gaylon Norwood; Nancy McAllister; Maurice Anderson
Subject:	[EXT] Tribal Outreach
Date:	Monday, August 16, 2021 11:01:59 AM

EXTERNAL EMAIL

David,
As promised, below is a log of the interaction for Modoc Counties' efforts to outreach to our tribal partners. FYI - Once the Pit River Tribe was added to the interested parties list they would have received notifications regarding BVAC meetings through the auto e-mail list. These are the dates of specific interactions I have had with the Pit River Tribe. I am sure there are more but this should show the timeline of our activities to outreach since 2016 regarding groundwater.

2/4/16 - Planning Director responded to e-mail regarding tribal position on the Modoc County Groundwater Resources Advisory Committee.
2/4/2016 - Pit River tribal members added to the interested parties list for Modoc County Groundwater Advisory Committee meetings (This list was provided to Lassen County and incorporated into the combined interested parties list which all BVAC meeting information has been sent to.) Pit River Tribe received all the agendas for the Modoc County Groundwater Advisory Committee meetings which detailed the notification for Modoc County to become the GSA and the details of groundwater planning in Big Valley. The Pit River Tribe should have also received all of the notices for the BVAC meetings.

2/23/16 - As requested, an application for the Modoc County Groundwater Advisory Committee was sent to Pit River tribal members
2/29/16 - Modoc County Groundwater Advisory Committee Meeting
4/28/16 - Modoc County Groundwater Advisory Committee Meeting
8/25/16 - Modoc County Groundwater Advisory Committee Meeting
10/6/16 - Video feed link for the upcoming SGMA (Sustainable Groundwater Management Agency) Outreach Workshop from DWR which will be held tomorrow, October 7, 2016 from 1:30 p.m. to 4:30 p.m. was sent to Pit River Tribe
10/27/16 - Modoc County Groundwater Advisory Committee Meeting
12/8/16 - Modoc County Groundwater Advisory Committee Meeting

3/23/17 - Modoc County Groundwater Advisory Committee Meeting
3/15/17 - Received call from a Pit River tribal member regarding questions on groundwater.
3/16/17 - Sent application for the Modoc County Groundwater Advisory Committee was sent to Pit River tribal members.
3/17/17 - Notice of public hearing for LassenCounty to be the GSA e-mailed to Pit River Tribe.
5/12/17 -Requested an application be sent to the Pit River Tribe for the tribal position on the Modoc County Groundwater Resources Advisory Committee
5/26/17 - Sent application for the tribal position on the Modoc County Groundwater Resources Advisory Committee
6/19/17 - Educational outreach meeting at Veterans Hall in Bieber

7/27/17 - Modoc County Groundwater Advisory Committee Meeting
9/28/17 - Modoc County Groundwater Advisory Committee Meeting
11/30/17 - Modoc County Groundwater Advisory Committee Meeting

2/22/18 - Modoc County Groundwater Advisory Committee Meeting
3/13/18 - Flyer of upcoming course in Adin to comply with SB 88. Farm Advisor, Laura Snell
6/28/18 - Modoc County Groundwater Advisory Committee Meeting
10/25/18 - Modoc County Groundwater Advisory Committee Meeting

1/24/19 - Modoc County Groundwater Advisory Committee Meeting
2/2/19 - Flyer for BVAC meeting sent with link to documents and information
4/25/19 - Modoc County Groundwater Advisory Committee Meeting
6/17/19 - Education Groundwater meeting information sent Pit River Tribe
6/3/19 - Flyer for BVAC meeting sent with link to documents and information
8/1/19 - Special notice of vacancy for the appointment of initial Lassen Modoc County Public members to the Big Valley Groundwater Basin Advisory Committee sent to tribal members.
9/26/19 - Modoc County Groundwater Advisory Committee Meeting

2/3/20 - Flyer for BVAC meeting sent with link to documents and information

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

Appendix 11D 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.

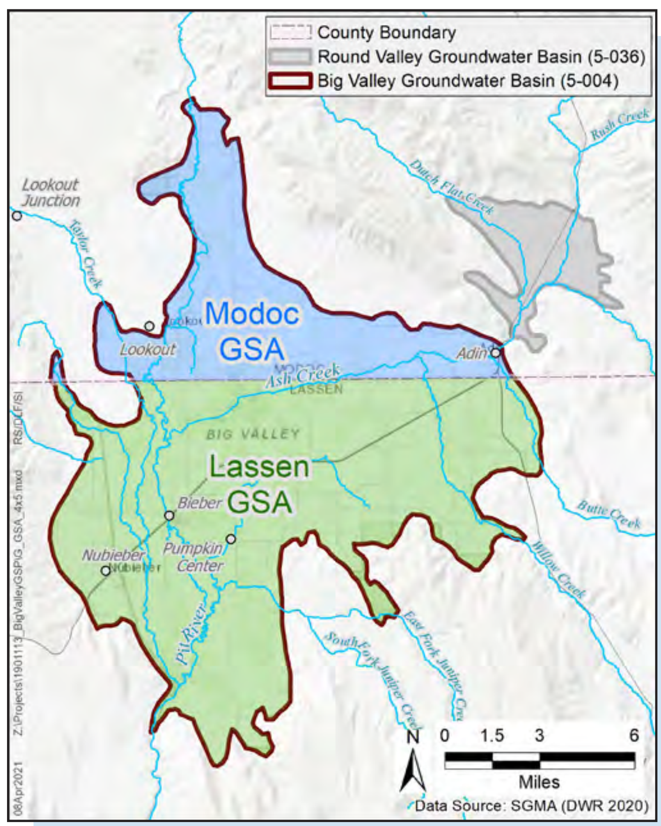

FIGURE 1: BIG VALLEY GROUNDWATER BASIN AND GSA BOUNDARIES

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.

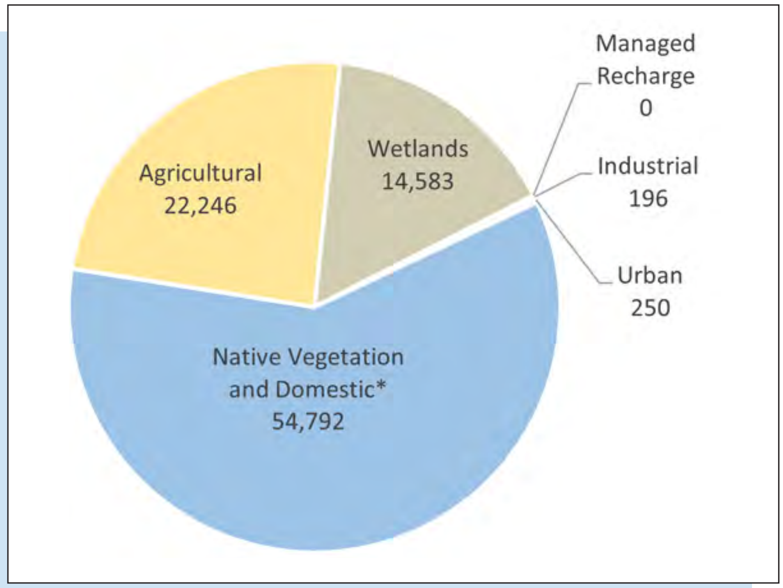

FIGURE 2: BIG VALLEY GROUNDWATER BASIN LAND USE

* 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.

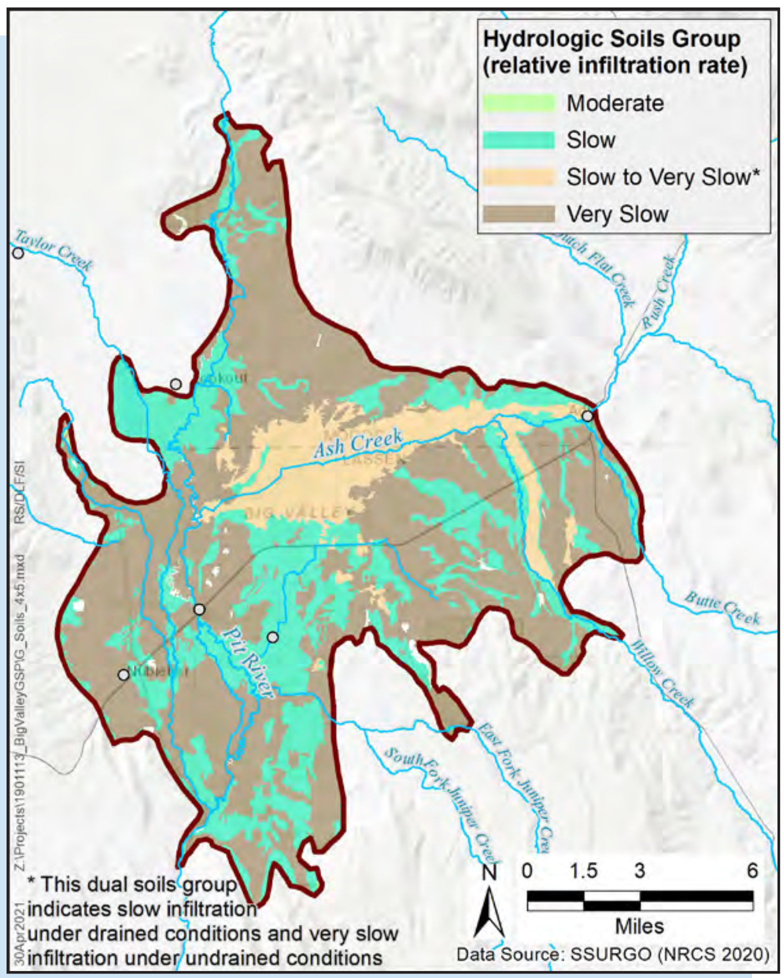

FIGURE 3: BIG VALLEY GROUNDWATER BASIN HYDROLOGIC SOILS GROUPS

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).

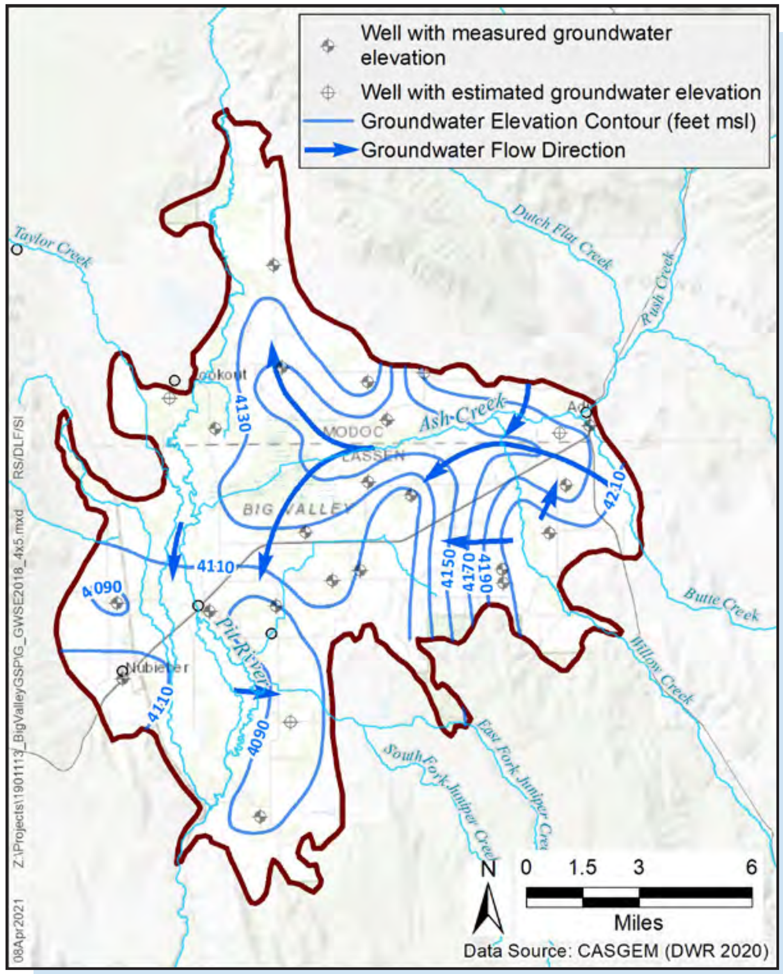

FIGURE 4: BIG VALLEY GROUNDWATER BASIN GROUNDWATER CONTOURS AND ESTIMATED FLOW DIRECTION

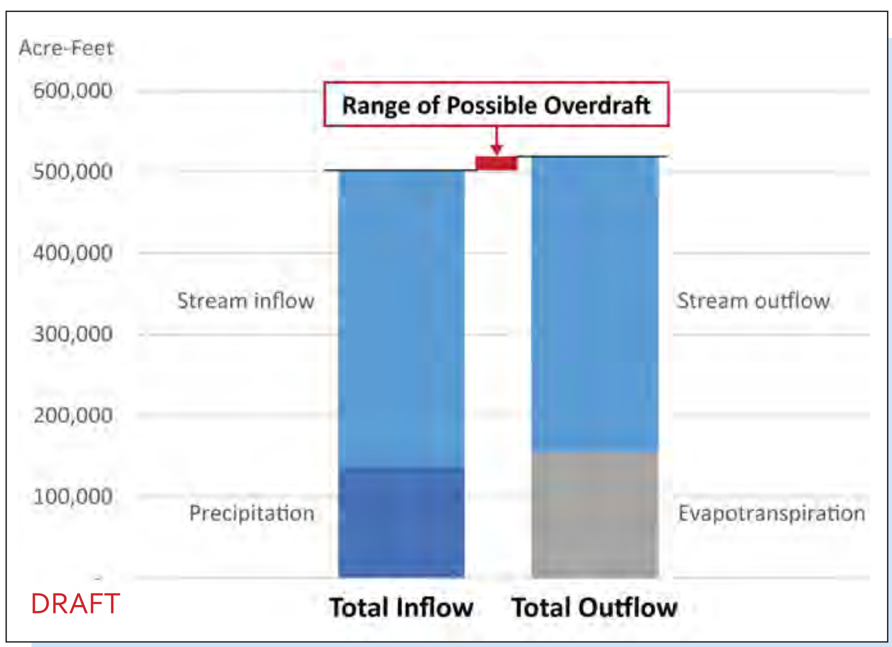

FIGURE 5: DRAFT AVERAGE ANNUAL WATER BUDGET (1984–2018)

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 11E Comment Matrix

Big Valley GSP Comment Matrix Chapters 1-3

Document	Page & Line Number	Comment	Date	Response
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.
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.
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.
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

Document	Page & Line Number	Comment	Date	Response
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¢Â€Â“ 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¢Â€Â¦ 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 will again accept requests for basin boundary modifications in 2023. 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.
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 may be investigated at a later time.
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
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.
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.
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 not yet been obtained
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	Noted, text will be updated to reflect this

Big Valley GSP Comment Matrix Chapters 1-3

Document	Page & Line Number	Comment	Date	Response
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	Checking with BLM.
Public Draft Chapter 3		There is significant new irrigated acreage in the basin since 2014.	7/1/2020	David: can you see if there are numbers available from 2015 or 2016?
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
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	Being discussed.
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	
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.
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.
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.
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.
Public Draft Chapter 3		Water bodies should be on the map, including lower Roberts Reservoir.	7/1/2020	Water bodies are shown on Map
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.
Public Draft Chapter 3	line 91	Remove language on LMFLWCD.	7/1/2020	Deleted.
Public Draft Chapter 3		Beneficial uses: reassess categories of municpal, 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
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	Be cautious about identifying data gaps - where DWR may require addressing data gaps without providing funding to do so.
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.

Big Valley GSP Comment Matrix Chapters 1-3

Document	Page & Line Number	Comment	Date	Response
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 futre.	7/1/2020	Other data sets may help increase accuracy - those will need to be looked at.
Ch. 3 Plan Area		The term managed wetlands should be changed to state wildlife habitat	9/24/2020	Change made in text
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 @ 2:30:00-2:35:00 Set aside with the condition that the language is revised.	9/24/2020	Changes made in text
Ch 3 Plan Area	Line 404	Ash Creek divergence is not measure past Modoc county line by water master @ 2:31:00-2:35:00	9/24/2020	Changes made in text
Revised Draft Chapters 1-2 v2	Page #:, Line #:	Currently BV Groundwater District mapping has defined groundwater zones within its boundaries.Â Will the district consider Â groundwater use similar to surface water use (CA riparian doctrine) in that beneficial use and waste or unreasonable use is firstÂ Â appliedÂ within zones to helpÂ alleviate projectedÂ over draft of groundwater reserves withinÂ zones?Â Does the SWRCB have guidance regarding this subject under the current groundwater lawÂ ?Â HasÂ this been applied in other groundwaterÂ management plans in California?Â Â	2/17/2021	
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	
BigValleyGSP_Ch3_RevisedDraft_2020_08_19.pdf	Page #: 3-21, Line #: 403	There is a great deal of precipiatation 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) 299-8444Â	3/15/2021	
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	

Big Valley GSP Comment Matrix Chapters 1-3

Document	Page & Line Number	Comment	Date	Response
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	

Big Valley GSP Comment Matrix Chapter 4

Document	Page & Line Number	Comment (NOTE: break from 02:19:30-02:28:00	Date	Response
Public Draft Chapter 4		How much UC Davis information is included in Chapter 4? Is preliminary information available from that Study.		Being looked at
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.		See conceptual language at the bottom of page 4-10 and at the top of page 4-13.
Public Draft Chapter 4		Data gaps include: basin boundary, confining conditions, definable bottom, faults as barriers to flow, soil permeability, recharge		See conceptual language on page 4-1
Public Draft Chapter 4	Page 1 line 13	Dimensions of basins do not match with Chapter 3.		Being looked at
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)		Riparian area is captured in Table 3-1
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?)		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 depteh from 800' to 50'-100'. It's hard to pin down details and distnintions 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. Somewhere in the report, say that the GSAs are being asked to make decisions with incomplete information and uncertainties.
Public Draft Chapter 4		Regardless of the complexity and cost of monitoring, it is important to accurately describe the aquifer. If there is variation across the basin, that should be described.		
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.		There will be an opportunity to mark up maps and revise presentation of waterbodies. (Map -14)

Big Valley GSP Comment Matrix Chapter 4

Document	Page & Line Number	Comment (NOTE: break from 02:19:30-02:28:00	Date	Response
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.		Imported water refers to surface water supplies that originate from outside the watershed where the supplies are used. This is clarified.
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 pursposes 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.		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.
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.		See suggested alternative language
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.		This will be the central discussion for creating Sustainable Management Criteria - this suggestion will be included when discussions are underway for developing the criteria
Public Draft Chapter 4		How can the GSP use remedial soils, outside of basin boundaries, to help support recharge to the basin?		This suggestion will be carreid forward for discussions on developing "Projects and Management Actions."
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	

Big Valley GSP Comment Matrix Chapter 4

Document	Page & Line Number	Comment (NOTE: break from 02:19:30-02:28:00	Date	Response
BigValleyGSP_Ch4_RevisedDraft_2020_08_19.pdf	Page #: 4-18, Line #: 303	Table 4.5.2 Hydrologic soil descriptions .... Again, the Hydrologic Soil DescriptionsÂ 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	
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.Â 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.Â Â You can access this information via the USGS website:Â https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/	3/19/2021	
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.Â There are little "lake" effects in the Valley.Â 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	

Big Valley GSP Comment Matrix Chapter 5

Document	Page & Line Number	Comment	Date	Notes and Responses
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. A key consideration is where groundlevel changes are due to groundwater pumping are undesirable.
Public Draft Chapter 5	Water Quality Section 5.4, pages 5-9 to 5-22.	There are concerns that providing quantifative measurements on water quality will encourage micro-analysis by the state.	9/24/2020	Elevated constituents are naturally occurring (iron, manganese, arsenic). Also good to watch specific conductants. 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.
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 reaons way 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.
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. <u>Table 5.5, page</u> **• 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, w.hich comes later 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.
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
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
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.

Big Valley GSP Comment Matrix Chapter 5

Document	Page & Line Number	Comment	Date	Notes and Responses
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	
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	
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	
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)Â be used for tree species that occur in these areas. There is rooting depth data available for both of these species.Â Wild rose (Rosa woodsii)Â is commonly found along Ash Creek and within the ACWR. We KNOW that Idaho fescueÂ (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.Â Â	3/19/2021	

Big Valley GSP Comment Matrix Chapter 6

Document	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Ch 6, Historic Wtr Budget	Figure 6-2, page 6-2	Why is the atmospheric system not incorporated into the water budget	Nov. 4	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.
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.	Nov. 4	Yes, which is why it's important to recharge groundwater during high flows - so that stored groundwater can be used during dry periods.
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.**	Nov. 4	**Change terms in text to "lakes/reservoirs" including bar charts and figures.**
Public Draft Ch 6, Historic Wtr Budget	Footnote 1, page 6-6	**What is the definition of long-term (e.g. long-term sustainability)?**	Nov. 4	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 it gets better.
Public Draft Ch 6, Historic Wtr Budget	Figure 6-8, page 6-6; and PPT slide #15	**Double-check the lines calculated by excel.**	Nov. 4	The results where checked to see if they were reasonable.
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.]**	Nov. 4	[David: Is this stream inflow to the basin?]
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?**	Nov. 4	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.
Public Draft Ch 6, Historic Wtr Budget	Appendix 6-B, (multiple locations)	**Why is Managed Aquifer Recharge set at zero?**	Nov. 4	Managed Aquifer Recharge refers to actions where the primary objective is recharge (e.g., as opposed to reservois, where surface water storage is the primary objective, with recharge is 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.
Public Draft Ch 6, Historic Wtr Budget	Figure 6-4, page 6-4	**Question from the public: ou 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 #)**	Nov. 4	
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.**	Nov. 4	There is no quantification of other surface water uses.
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.**	Nov. 4	Laura can work to coordinate data transfer.

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Document	Page & Line Number	Comment	Date	Notes and Responses
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.**	Nov. 4	Bieber has a munical system, which is different from domestic extractions. Adin will be added in as a public water supply which is a non-municipal use.
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.)**	Nov. 4	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.)
Public Draft Ch 6, Historic Wtr Budget	6-4 and 6-5, Section 6.2	How is it possible that inflow exceeds outflow?	Oct. 30	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.**
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.	Oct. 30	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**
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.	Oct. 30	Studies will be completed by December 2021 and information can be incorporated.
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".	Oct. 30	***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 will be corrected.**
Public Draft Ch 6, Historic Wtr Budget	Appendix 6A, GW System item 27	Is it true that no subsurface inflow occurs in the basin?	Oct. 30	Until it can be shown otherwise, it will be assumed that there are no inflows and no connection to Round Valley.
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	Oct. 30	***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**
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?	Oct. 30	
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	Oct. 30	***Subsurface Inflow will be removed from the bar chart key**

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Document	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Ch 6, Current Wtr Budget		**The Tables in Chapter 6 should say "ESTIMATED" or "ASSUMED" for Inflow, Outflow.**	Dec. 2	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.
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.**	Dec. 2	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.
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.**	Dec. 2	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.**
Public Draft Ch 6, Current Wtr Budget		**How were the percentages of 98% surface water and 2% groundwater derived for the wetlands?**	Dec. 2	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.**
Public Draft Ch 6, Current Wtr Budget		What are the options for determining runoff? Which way is best?		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.
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?	Dec. 2	**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.**

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Document	Page & Line Number	Comment	Date	Notes and Responses
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?	Dec. 2	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.
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?	Dec. 2	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.
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.	Dec. 2	Not sure, but there are certainly a lot other basins that are much worse off.
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.**	Dec. 2	The wetlands are alos 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.
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.**	Dec. 2	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.
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).**	Dec. 2	This information can be incorporated once the land is clearly identified. Such information will be solicited at future BVAC and/or public outreach meetings.
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.
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	Jan. 22	Changes will be made to next iteration of chapter.
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**	Jan. 22	Changes will be made to next iteration of chapter.
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**	Jan. 22	Wording will be adjusted in the next iteration to make the concept of "order of magnitude" estimates more clear.
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**	Jan. 22	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"
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)**	Jan. 22	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.

Big Valley GSP Comment Matrix Chapter 6

Document	Page & Line Number	Comment	Date	Notes and Responses
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	Jan. 22	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.
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)**	Jan. 22	Change will be made to next iteration of chapter.
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?)**	Jan. 22	We (GEI) have 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.
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.**	Jan. 22	Undesirable results are locally defined. This will be discussed in Chapter 7
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.
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.
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...	########	
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.	########	
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.Â 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 ...Â	########	

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Document	Page & Line Number	Comment	Date	Notes and Responses
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 toÂ 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. Climate change and a Ã¢Â€Âœthirsty atmosphereÃ¢Â€Âwill 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.Â According to their results, climate change projections show consistent future increases in atmospheric evaporative demand (or the Ã¢Â€Âœatmospheric thirstÃ¢Â€Â) 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.,Â 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	########	
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	

Big Valley GSP Comment Matrix Chapter 7

Document	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chap 7 (4/1/2021)	5, 113	Deep freezes can occur from September to May	4/7/2021	Text changed
Public Draft Chap 7 (4/1/2021)	6, 125	Environmental regulations include SGMA	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	6, 133	Change "may" to "will"	4/7/2021	Text changed
Public Draft Chap 7 (4/1/2021)	6, 135	Change "may" to "is likely to"	4/7/2021	Text changed
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
Public Draft Chap 7 (4/1/2021)	7, 197-199	The Basin needs the support of Federal management	4/7/2021	Text changed
Public Draft Chap 7 (4/1/2021)	8, 215	Monitoring also helps DWR	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	8, 224	Remove slightly	4/7/2021	Text changed
Public Draft Chap 7 (4/1/2021)	9, 261	If there is no Ag there is no community.	4/7/2021	Text added
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
Public Draft Chap 7 (4/1/2021)	11, 327	Add "and breeding grounds"	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	11, 328	Add "develop" a new water source	4/7/2021	Text added
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
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
Public Draft Chap 7 (4/1/2021)	5, 95-98	Add spring-fed streams verbiage	4/7/2021	Text added

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Document	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chap 7 (4/1/2021)	6, 127	Add "and roads"	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	6, 127	Add "reduction of timber yield tax"	4/7/2021	Text added
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
Public Draft Chap 7 (4/1/2021)	8, 217	Remove "chronic"	4/7/2021	Text removed
Public Draft Chap 7 (4/1/2021)	11, 321	1/3 of representative wells	4/7/2021	Text altered
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
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
Public Draft Chap 7 (4/1/2021)	16, 508-510	Remove "Continued… flood risk" sentence	4/7/2021	Text removed
Public Draft Chap 7 (4/1/2021)	16, 519 and 522	Add spring-fed streams verbiage	4/7/2021	Text added
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.
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	
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.
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

Document	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chap 7 (4/1/2021)		Of the GDEs, how much of it is springs?	4/7/2021	A map of GDE's can be found in Chapter 5 (Figure 5-20). A map of springs can be found in Chapter 4 (Figure 4-14).
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.
Public Draft Chap 7 (4/1/2021)	16, 508-510	We don't know that subsidence will continue	4/7/2021	
Public Draft Chap 7 (4/1/2021)	16	DWR induced additional walls because they required off-stream watering sources to have grazing away from streams due to water quality concerns	4/7/2021	This program is independent of the GSP
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.
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.
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.
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
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
Public Draft Chap 7 (4/22/2021)	7-6, 246	Insert "...enacting various projects to improve management during the drought periods <u>and wet periods</u> experienced in the Basin..."	5/4/2021	Text added
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
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."
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.
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.
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 8

Document	Page & Line Number	Comment	Date	Notes and Responses
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.
Chapter 8 Public Draft	1, 67	Add "The assumed" groundwater contours…	5/24/2021	Text added
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
Chapter 8 Public Draft	Table 8-1	Revise table to adjust to 140 feet below 2015 baseline	5/24/2021	Table replaced.
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	5/24/2021	This comment should be addressed in Chapter 5, when it is updated and compiled into the entire draft of the GSP.
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.
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"
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.
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
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	5/24/2021	Text modified.

Big Valley GSP Comment Matrix Chapter 8

Document	Page & Line Number	Comment	Date	Notes and Responses
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.
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
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."
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.
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.
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:"
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."
Chapter 8 Revised Draft 5/24/21	8-5, 137	Delete "which may be interconnected to the groundwater aquifer"	6/2/2021	Text removed
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.
Chapter 8 Revised Draft 5/24/21	8-8, 183	Please define "anomalous", perhaps in a footnote	6/2/2021	Footnote added.
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.

Big Valley GSP Comment Matrix Chapter 9

Document	Page & Line Number	Comment	Date	Notes and Responses
Chapter 9 Public Draft 5/24/21	1, 21	change "returning to" to "remaining"	6/2/2021	
Chapter 9 Public Draft 5/24/21	4, 95	What is meant by a "water storage basin"	6/2/2021	
Chapter 9 Public Draft 5/24/21	6, 120-121 7, 180-181	Change "towards sustainability" to "remain sustainable"	6/2/2021	
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	
Chapter 9 Public Draft 5/24/21	8, 195-196	change "achieve sustainability" to "maintain sustainability"	6/2/2021	
Chapter 9 Public Draft 5/24/21	8, 198	Insert "several" to discussion of reservoirs. Multiple reservoirs could be expanded.	6/2/2021	
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	
Chapter 9 Public Draft 5/24/21	9, 240 et seq	Add controlled burns to potential actions	6/2/2021	
Chapter 9 Public Draft 5/24/21	12, 329	add "as compared to SGMA". to end of sentence	6/2/2021	
Chapter 9 Public Draft 5/24/21	14, 375	Add text about illegal marijuana grows	6/2/2021	

Big Valley GSP Comment Matrix Chapter 10

Document	Page & Line Number	Comment	Date	Notes and Responses
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.
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
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.
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.
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
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.
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.
Chap 10 Public Draft 5/26/21	10-13, 234	Poor wording	6/2/2021	Wording changed
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
Chap 10 Public Draft 5/26/21	Appendix 10A	Don't like grant funding	6/2/2021	Wording changed