County of Lassen
Board of Supervisors

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April 13, 2021

CERTIFIED RETURN RECEIPT
7017 0660 0000 6271 3752 & 7017 0660 0000 6271 3745

Assembly Member Eduardo Garcia
Chair of the Water, Parks, and Wildlife Committee
Legislative Office Building
1020 N. Street, Room 160
Sacramento, CA 95814

Assembly Member Megan Dahle
Vice Chair of the Water, Parks, and Wildlife Committee
Legislative Office Building
1020 N. Street, Room 160
Sacramento, CA 95814

Dear Chair Garcia and Vice Chair Dahle:

This letter is in support of Assembly Bill 754, which was introduced by Assembly Member Devon Mathis. Said Assembly Bill was referred to the Water, Parks, and Wildlife Committee on March 15, 2021. In summary, this bill would extend the due date to January 31, 2023, for Groundwater Sustainability Agencies (GSA) in basins that are not critically over drafted to submit a Groundwater Sustainability Plan (GSP) to the Department of Water Resources.

Lassen County and Modoc County serve as the GSAs for the Big Valley Groundwater Basin, for the portion of the basin within their respective jurisdiction. Said GSAs have been working cooperatively (through a memorandum of understanding) to prepare a single GSP for the entire basin.

Preparation of said GSP has been negatively impacted by the Governor's Executive Orders. Specifically, the Governor's order has made it difficult to conduct the public outreach needed to prepare the plan. Over the last year, the public has been less inclined to meet physically because of the Executive Orders. We have attempted to accommodate by conducting more internet and phone-based meetings. However, internet connectivity in Big Valley is exceedingly poor and the basin is not well

situated to allow online type public meetings. We were very pleased to see proposed legislation to provide more time to submit the required GSP. In fact, on August 11, 2020, we sent a letter to the legislature requesting additional time (see attached) for this very reason (lack of ability to have meaningful public dialogue because of COVID-19). We have also sent multiple letters to the Governor, requesting an executive order allowing more time.

If adopted, this legislation will greatly improve upon the GSP that is ultimately adopted by ensuring the time needed for adequate public participation. The above said, please understand that we support this legislation only to the extent that it will provide more time to submit the required GSP. We are not supportive at all of the bill becoming a vehicle to legislate additional requirements. It is our position that the requirements of the Sustainable Groundwater Management Act are already too onerous, especially in basins like ours that were only designated a "medium priority basin" by half of one point.

Sincerely,

Aaron Albaugh

Aaron Albaugh, Chairman,
Lassen County Board of Supervisors
Big Valley Lassen Groundwater Sustainability Agency

AA:MLA:gfn
Enclosure

cc: Devon Mathis, Assembly Member, California State Assembly
Modoc County Board of Supervisors as the Big Valley Modoc GSA
Rural County Representatives of California (RCRC)
California State Association of Counties (CSAC)

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

Wednesday, April 7, 2021 4:00 PM Adin Community Center
605 Highway 299
Adin, CA 96006

BVAC Convene in Special Session.

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

Also in attendance: BVAC Secretary Maurice Anderson
BVAC staff Gaylon Norwood
BVAC staff Tiffany Martinez
BVAC Recorder Brooke Suarez
Modoc County Counsel Sean Cameron (via Zoom)
BVAC Alt. Board Representative Gary Bridges

BVAC Chairman Byrne called the meeting to order at 4:11 p.m.

Flag Salute: Chairman Byrne requested Duane Conner lead the Pledge of Allegiance.

General Update by Secretary: M. Anderson stated that everyone is working hard. He noted that the GEI Consultants contract was in the meeting packet. He also said that AB 754 was introduced and this bill would extend the deadline of groundwater sustainability plans to January 31, 2023, if passed.

Matters Initiated by Committee Members: Vice-Chairman Albaugh stated that DWR was out taking well measurements. They showed up in new 4X4 Dodge trucks with one person per truck. He was disappointed in seeing tax dollars being spent this way.

Correspondence (unrelated to a specific agenda item): None

Approval of Minutes (March 3, 2021) –

A motion was made by Vice-Chairman Albaugh to approve BVAC meeting minutes from March 3, 2021, with two changes. The motion was seconded by Representative Ohm. The motion was carried by the following vote:

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

Laura Snell facilitated the meeting and Gaylon Norwood reviewed GSP schedule and agenda for the meeting and slide presentation was handed out (Exhibit A).

SUBJECT #1:
Introduction of Draft Executive Summary for Chapters 1-6 of the Groundwater Sustainability Plan (GSP).

ACTION REQUESTED:

1. Receive report from the BVAC Secretary, Staff, and/or Consultant.
2. Receive public comment.
3. Provide direction to staff.

GEI consultant, D. Fairman led the discussion on the executive summary which was handed out (Exhibit B). The first three chapters give the background of GSP. The next three chapters are the science chapters. Chapters 7 through 9 are the planning chapters and the last three chapters are the implementation chapters. The executive summary is shortened down version of the GSP chapters. There is also a summary brochure in development.

Committee comment:

Vice-Chairman Albaugh asked if the summary will be updated as we move forward, can the summary be changed if needed, and if the committee could help with the brochure? The answer to all three was yes. L. Snell reviewed benefits of having an executive summary.

Public comment: None

SUBJECT #2:
Continued discussion on Revised Draft Chapter 7 (*Sustainable Management Criteria*) of the Groundwater Sustainability Plan (GSP) and discussion on groundwater monitoring networks in preparation for Draft Chapter 8 (*Monitoring Networks*) 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 7 for future inclusion into the Draft GSP.

Section 7.1 and 7.2

T. Martinez presented Sections 7.1 and 7.2 of the revised draft of Chapter 7. Prior to the written presentation of the sustainability goal, a written discussion of the uniqueness of the valley is captured.

Committee comment on sections 7.1 and 7.2:

Chairman Byrne said is pleased with Chapter 7. Vice-Chairman Albaugh recommended many changes to the verbiage of the chapter.

Section 7.3.1

G. Norwood presented Section 7.3.1. Thresholds were reviewed and Vice-Chairman Albaugh had changes to verbiage. Representative Conner reviewed pumping costs. The deeper the depth of water in the well the more it costs to pump. It depends on the crop if it is economically feasible to pump water. David Lile presented electric costs of pumping.

L. Snell presented a well depth analysis. She discussed the percentage of wells that would go dry at different lowering of water levels.

Committee comment on section 7.3.1:

Representative Mitchell stated that the analysis is presuming a "bath tub" effect. Vice-Chairman Albaugh concurred and stated that the plan is being forced to draw a line. D. Fairman said that domestic wells are concentrated in Adin and Bieber. Chairman Byrne stated that if agricultural wells go dry then domestic wells will not be needed because the agricultural industry drives the population of the valley.

Section 7.3.4

T. Martinez presented Section 7.3.4. She reviewed changes that were made to this section. All the water quality programs that are already in place in the valley are noted in this section. Water quality in the basin is excellent and will be monitored and criteria will be established in the 5-year update, if necessary.

Committee comment on section 7.3.4:

Chairman Albaugh reiterated the redundancy of the already established water quality programs.

Section 7.3.5

T. Martinez presented Section 7.3.5. Public outreach has identified some subsidence due to agricultural leveling. Subsidence is very minor in this basin and is natural and mostly due to tectonic plate movement. There are no issues, but subsidence will be monitored and criteria will be established in the 5-year update, if necessary.

Committee comment on section 7.3.5:

Chairman Albaugh requested change in verbiage in this section.

Section 7.3.6

T. Martinez presented Section 7.3.6. Interconnected surface water is difficult to understand due to data gaps. Once again there will be no criteria established at this time. As more science becomes available more management criteria will be established.

Committee comment on section 7.3.6:

Chairman Albaugh stated it is difficult to prove. DWR should prove there is an issue prior to the GSAs proving there isn't an issue. We shouldn't comment on requirements of the GSP that are not a problem. L. Snell's response stated we should comment or a general science will be applied to Big Valley which may or may not be realistic to the area.

Section 7.3.2 Groundwater storage

Committee comment on section 7.3.2:

Chairman Albaugh questioned the depth of the basin and how do we know how much water there is. Discussion was held regarding how the number was derived in previous chapters.

Public comment on all of Chapter 7:

Julie (online) commented that there is a data gap for Adin wells. She asked if we are writing off the possibility that the Bieber mill site will be revived for novel wood product uses that require significant water? She also asked if the cost per foot of deepening wells can be calculated?

Barbara Donahue wanted to bring up domestic wells. Four years ago, she had to drill her well 100 feet lower and neighbors are having to put in filters as they are hitting the bottom of their wells. Water quality has been going down and less recharge is happening. Mills and mining industry have declined, but recreation is increasing. There are people coming into the area impacting the water shed areas.

Doreen Powers would like to see thresholds defined better. She would like to see the number of wells by type and whether they are opened or closed. How do ditches and canals play in?

BVAC meeting recess: 5:54 to 6:10

Chapter 8 was present by D. Fairman. He stated that most of the well monitoring is already in place under existing programs. Water levels and groundwater storage will be monitored by 12 representative wells. The groundwater contour network will utilize 21 wells. The groundwater contours will capture highs and lows of water levels. These levels are required in the annual reporting. Seventeen wells will be used for measuring surface water depletion. D. Fairman explained what surface water depletion is. Ian Espinoza from DWR clarified the definition of the word depletion as used.

To monitor water quality, the thought is to use electrical conductivity transducers in the wells. D. Fairman stated that having no threshold on water quality in the GSP will probably not pass DWR review. DWR will probably say that omitting requirement in the GSP is inadequate and will be for the other items that thresholds are not set. Vice-Chairman Albaugh said that state agencies should talk to each other as they already have water quality reports from other programs rather that put the onus on the GSAs.

Subsidence is being measured by GPS and InSAR. Subsidence is minimal in the basin.

Streamflow and weather monitoring are also needed for the annual update of the water budget. Precipitation and evapotranspiration are measured by CIMIS Station in Fall River Valley and spatial CIMIS. Streamflow will be measured at Pit River at Canby, Ash Creek at Adin, Willow Creek, and Pit River at Muck Valley Diversion. A measurement at Pit River north of Lookout has been proposed.

Committee comment:

D. Fairman was asked when draft chapter 8 can be expected and he said he would have the draft done by April 14, 2021.

Public comment: Julie (online) asked if D. Fairman had any ideas on how to use this monitoring data in innovative ways to solve some of Big Valley's specific data gaps and questions that have arisen, beyond the reasons that DWR wants the data collected?

The committee decided to bring back Chapter 7 at the next meeting.

SUBJECT #3:
Discussion on projects and management actions, in preparation for Draft Chapter 9 (*Projects and Management Actions*) of the Groundwater Sustainability Plan (GSP).

ACTION REQUESTED:

1. Receive report from the BVAC Secretary, Staff, and/or Consultant.
2. Receive public comment.
3. Provide direction to staff.

Discussion was held on changing the BVAC meeting time. It is possible to present an action at the next meeting to change the time.

T. Martinez stated that there has been a lot of input regarding projects. There are three feasibility levels. Level I projects are things that can be done now, Level II are projects that the counties are committed to do but may not have the funding now, and Level III are projects in the concept stage. She reviewed the proposed projects in each level. There are regulatory requirements for each project.

Committee comment:

Vice-Chairman Albaugh wanted to know the delineation between a project and management action.

Public Comment: None

Matters Initiated by the General Public (regarding subjects not on the agenda**):** None

Establish next meeting date: May 5, 2021 at 4:00 pm. in Adin.

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

A motion was made by Vice-Chairman Albaugh to adjourn the meeting, which was seconded by Representative Ohm at 7:13 pm.

The motion was carried by the following vote:

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

Big Valley Groundwater Sustainability Plan GSP Regulations Checklist (Elements Guide) for Chapter 7

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
§ 354.20.			**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.	X	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:					
	(1)		The reason for the creation of each management area.	X	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.	X	7.4			No management areas were created for this GSP.
	(3)		The level of monitoring and analysis appropriate for each management area.	X	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.	X	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.	X	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**					

"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
			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.	X	7.2			
			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.	X	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.	X	7.3			
	(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.	X	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.	X	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.	X	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.	X	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**					

"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
(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.	X	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.	X	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.	X	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.	X	7.3			
	(4)		How minimum thresholds may affect the interests of beneficial uses and users of groundwater or land uses and property interests.	X	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.	X	7.3			
	(6)		How each minimum threshold will be quantitatively measured, consistent with the monitoring network requirements described in Subarticle 4.	X	7.3			
(c)			Minimum thresholds for each sustainability indicator shall be defined as follows:					
	(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.	X	7.3.1, 5.1.1			Also Appendix 5A
		(B)	Potential effects on other sustainability indicators.	X	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.	X	7.3.2			

"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
	(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
	(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

"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
(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.	X	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.	X	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.	X	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.	X	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.	X	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.	X	7.3			
(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.	X	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.	X	7.3			
			Note: Authority cited: Section 10733.2, Water Code.					
			Reference: Sections 10727.2, 10727.4, and 10733.2, Water Code.					

"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

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None

Figures

Appendices

Abbreviations and Acronyms

Basin	Big Valley Groundwater Basin
BVGB	Big Valley Groundwater Basin
BVAC	Big Valley Groundwater Basin Advisory Committee
DWR	Department of Water Resources
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IM	Interim Milestone
MO	Measurable Objective
MT	Minimum Threshold

NCWA	Northern California Water Association
NECWA	Northeastern California Water Association
Regs	DWR's GSP Emergency Regulations, California Code of Regulations Title 23, Section 350 et seq.
SGMA	Sustainable Groundwater Management Act of 2014, California Code of Regulations, Title 23, Section 350 et seq.
SMC	Sustainable Management Criteria
USFS	United States Forest Service

7. Sustainable Management Criteria (§ 354.22-30)

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 exceedances and are considered by the Department of Water Resources (DWR) ~~to~~when determining if the Basin is sustainable (i.e., in 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 are set for the same monitoring sites as the MTs.
- **Interim milestones (IMs):** Numeric values for every 5 years between the GSP adoption and sustainability (20 years) 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", ~~between~~applicable when levels are above the MT ~~and~~but below the MO, for each well to indicate where and when to focus projects and management actions.

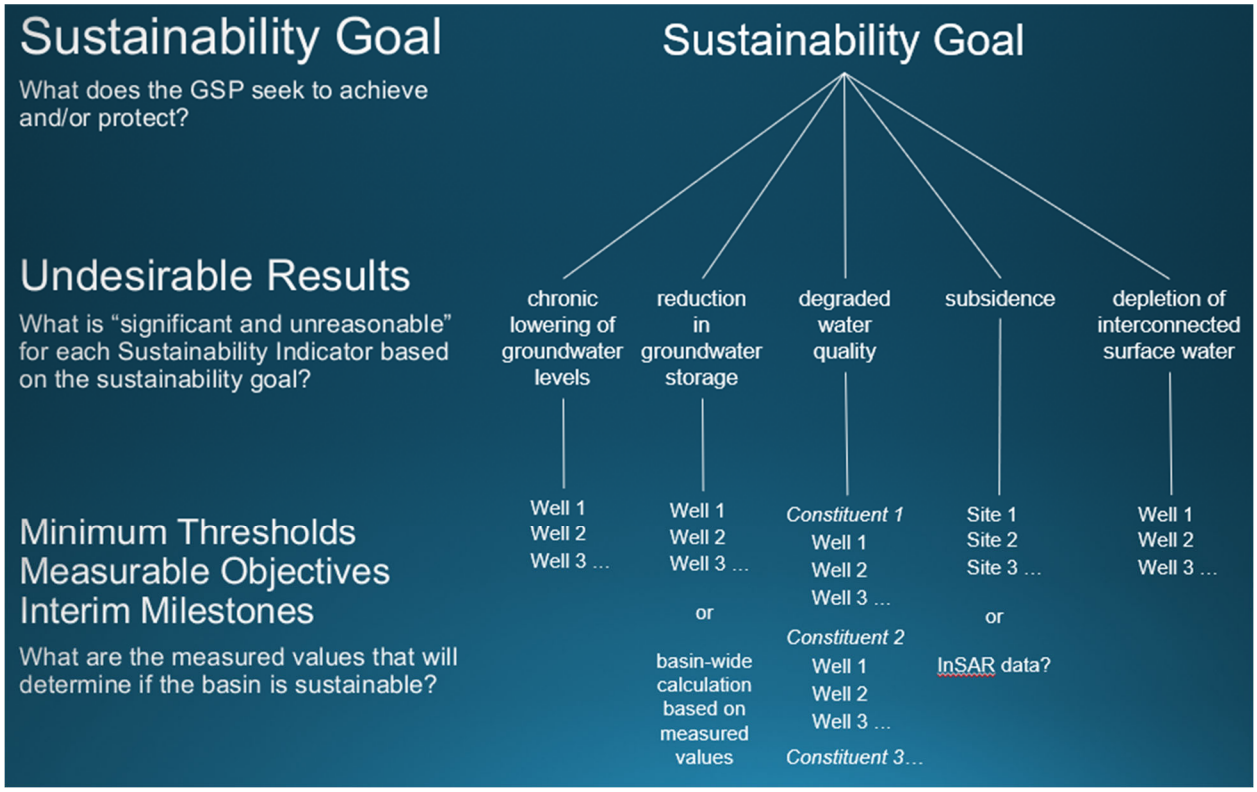

Figure 7-1 Illustration of the relationship among the sustainability indicators

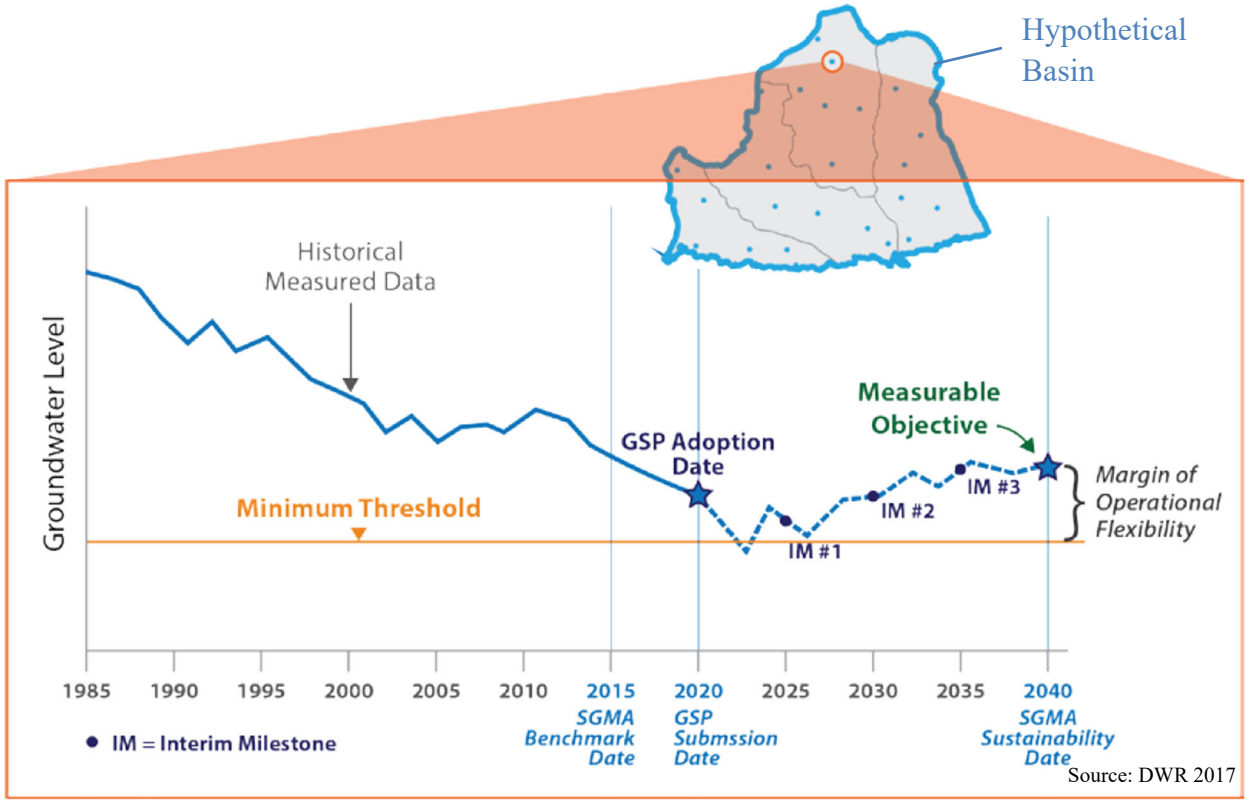

Figure 7-2 Illustration of the relationship among the MTs, MOs, and IMs for a hypothetical basin

7.1 Process for Establishing SMCs

These SMCs 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 Chapter 5 (groundwater conditions) and Chapter 6 (water budget). 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 by the ad hoc committees.

7.2 Sustainability Goal

Description

~~The sustainability goal was developed to reflect the unique culture of the basin. A large portion of the watershed is publicly owned, primarily at the higher elevations, while lower elevations are owned by predominantly private agricultural and residential full-time residents. The groundwater basin boundary is fundamentally biased toward the lower elevations instead of the United States Forest Service (USFS) and other agencies who are responsible for management of the higher elevations. Therefore, the focus and burden of the GSP lies with private citizens, many of whom have a multi-generational history in the valley.~~

~~The valley's beauty and open lands attract hunters, recreationists, tourists, and urban refugees who appreciate the rural nature of the area (less than 10 persons per square mile) and its strong culture of self-reliance and wariness of government. (NCWA 2017) Residents and visitors alike share the watershed with a diverse range of wildlife species whose habitat includes conifer forests, sagebrush, juniper, and chaparral in the higher elevations and grasslands, wet meadows, riparian vegetation, and aspen stands in the lower elevations. (NCWA 2017) The majority of the land that wildlife rely on in the lower elevations is privately owned lands irrigated to produce alfalfa, grass hay, and wild rice. (BVAC 2021) Agricultural uses in the basin provide the majority of the habitat used by birds and other species for feeding. The community has expressed concern that SGMA regulatory and financial burdens imposed by SGMA will result in the loss of agriculture within the BVGB.~~

~~As described in **Chapters 4** through **6**, agriculture is the largest land use within the groundwater basin and the primary driver of economic activity to support the community. Timber production has been reduced due to regulatory constraints, and tourism generates a relatively minor amount of economic activity. The entire basin has been identified by DWR as "disadvantaged", with the Modoc portion designated as "severely disadvantaged".~~

~~Based on the historic water budget developed in Chapter 6, the sustainable yield of the basin has been about 39,400 acre-feet per year since 1982. Average annual overdraft during this period~~

~~was about 5,200 acre-feet per year. In the absence of the actions detailed in this GSP, future water budget projections indicate an average annual overdraft of 2,100 acre-feet per year over the next 50 years.~~

~~Given this local and regional context, and through the public process described in **Section 7.1** above, the GSAs have developed the following sustainability goal:~~

The Big Valley Groundwater basin is in the remote mountain area of Modoc and Lassen counties. The two counties are in the extreme Northeastern portion of California, being bounded on the East by Nevada and on the North by Oregon. The Big Valley principal stream is the Pit River, a tributary of the Sacramento River. The upper reaches of the Pit River above Fall River Mills are a snow-fed high desert stream with a much more seasonal hydrograph. (Neasham 1985) The Pit River drains a sparsely populated volcanic highlands area in Modoc County's Warner Mountains, passing through the south end of the Cascade Range in a deep canyon northeast of Redding. The river is so named because of the pits, along with other bands of what is now the Pit River Tribe, the Achumawi dug to trap game that came to water at the river. The Basin is also fed by Ash Creek and many seasonal streams, and springs.

The Big Valley basin has a population of 1,046 residents and a projected slow growth of 1,086 by 2030, according to the Department of Water Resources Sustainable Groundwater Management Act basin prioritization dashboard. 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 are counties in California seeing a decline in population. (USCB 2021)

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 the central valley. The Basin ranges in elevation of 4200 feet and 4100 feet and can have deep freezes any time between September and May. 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, wild rice, and rangeland. The largest commodity surrounding the basin, managed primarily by the federal government, is the timber stands of conifer forests and juniper that make up the majority of the watershed feeding the Pit River and other tributaries entering the Basin. Timber management is subject to federal and state regulations and can change drastically over time, due to the inconsistent practices of land management in these areas this is a concern for the Big Valley groundwater basin.

Historically, the primary economic stimulus for the basin was a robust timber industry. Due to increased environmental regulations, the timber industry has been diminished over time which has caused a great economic hardship to the Big Valley communities. Stakeholders believe that SGMA will cause a similar decline to Agriculture. The loss of jobs and the reduction of timber

yield tax, which had historically 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 and is struggling to remain viable. The change in land management, has transformed a once thriving community to a "disadvantaged" and "severely disadvantaged" community 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 and is likely to intensify rural decline. With the increased cost for monitoring, annual reports, and GSP updates, land values will likely decline and lower the property tax base.

In addition to timber, agriculture has been a consistent economic industry in the Big Valley basin. Many of the families who ranch and farm the land today, have sustained multi-generational operations cultivating the land for over a century. 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 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 Refuge 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 Department of Fish and Wildlife has largely left the property unmanaged. However, farmers and ranchers are continuing to implement innovative science-based practices to improve the overall condition of the Basin.

Modoc and Lassen County Coordination

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 Lassen and Modoc County GSA's solicited for applicants from their county to serve on the committee. The application process was open to all residents of the Big Valley basin and after an extensive public outreach process for applicants, the GSA's appointed two (2) local members and one (1) GSA member for each county. The Big Valley Advisory Committee has dedicated countless hours to reviewing the data and content of the Groundwater Sustainability Plan.

After careful consideration of all the available data and community input from interested parties, the GSA's 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 ~~just and equitable to all water users and will be~~ conducted in context ~~to~~with the unique culture of the ~~BVGB~~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 ~~to support the human and natural community.~~.

~~As detailed in this GSP, the above goal will culminate in the absence of undesirable results by 2042 through the groundwater recharge opportunities and infrastructure projects, described in **Chapter 9,** that will augment water supplies by at least 2,100 acre-feet per year and maintain groundwater use within the sustainable yield for the basin. Future updates to this GSP will seek to better define the sustainable yield of the Basin.~~

The BVGB sustainability goal will be culminated through a better understanding of the surface water and groundwater conditions over time. 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 including 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 that may affect future beneficial uses of groundwater.

The implementation of projects such as winter recharge studies currently in progress will 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 at the top of the groundwater basin and will provide a more accurate reading 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 GSA's is that with proper management and coordination with and support from federal landowner partners, the Big Valley basin will remain sustainable for the benefit of all interested parties.

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.

7.3.1 ~~Chronic~~Lowering of 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. These cycles are naturally occurring. The BVGB, like all of California, is affected by drought periods. Of course, the GSAs do not have control over drought, but the GSAs can, and are, enacting various projects to improve management during the drought periods experienced in the Basin (see Chapter 9, Projects and Management Actions). Monitoring groundwater levels also helps the GSAs and DWR understand and recognize declining groundwater levels that may not be directly attributed to drought.

This section summarizes possible impacts from the lowering of groundwater levels, introduces the groundwater levels sustainability indicator adopted through this GSP and summarizes some of the public interaction and dialogue that went into development of said sustainability indicator. Chapter 11 (Notice and Communications) documents the GSP development process more thoroughly. Also pertinent to this section is Chapter 5 (Groundwater Conditions), which details the historic water level trends and conditions.

Over the 2000 to 2018 timeframe, a drought period with ~~below~~significantly lower than average precipitation, ~~there were~~ 21 wells were monitored and water levels in 12 wells rose ~~slightly~~ or remained stable (positive trend or negative trend of 1 ft/yr or less~~). During that period,~~) and 9 wells had declining water levels (downward / negative trend exceeding 1 ft/yr up to maximum of 3.1 ft/yr). Through public outreach ~~and~~, coordination with the Big Valley Groundwater Basin Advisory Committee (BVAC~~, the GSAs have~~), and development of this GSP, it has been determined that historic water levels have not lowered to a level that ~~would be~~is considered significant and unreasonable by the GSAs. In summary, there has not been widespread reports of wells becoming inoperable and agricultural producers have continued their longstanding practices. Again, this current and historic understanding of the Basin is discussed in other sections of this GSP.

As such, the measurable objective established in this section is set at the 2015 groundwater level for each well in the monitoring network (see chapter 8) because 2015 is the first year that SGMA became applicable. Moreover, 2015 is generally the lowest water level throughout the historic period of record, and, therefore, SGMA does not allow a higher (although potentially justifiable)

measurable objective. As such, it has been determined that the 2015 groundwater levels provide the most appropriate measurable objective because of the limited negative results experienced in the basin at this level. As detailed in chapter 5, there is insufficient justification for the establishment of a measurable objective at a higher groundwater level.

Through a coordinated online and in-person public outreach process performed with the BVAC, interested parties have determined that 140 feet below the Fall 2015 baseline level(s) is a conservative estimate of when pumping costs would exceed the value of the water for agricultural pursuits. It is recognized that there are currently data gaps that may necessitate adjustment of the minimum threshold at the five-year mandated update. A discussion regarding current data gaps can be found in Chapters 4 and 8 of this GSP. The 140-foot minimum threshold has been recommended by the BVAC through public participation because it has been determined that lowering of levels in excess of 140 feet below 2015 would negatively and severely affect agricultural production. Pumping costs at that depth would likely result in a significant percentage of the agricultural production in the Basin becoming unprofitable. Thus, lowering of levels in excess of 140 feet below the 2015 level has been determined to be "significant and unreasonable."

The other sections of this chapter will discuss impacts to other sustainability indicators that may result if groundwater levels go more than 140 feet below the 2015 level. However, this section will briefly discuss possible impacts to domestic water users if levels fell by that amount. It is recognized that domestic wells are typically not as deep as agriculture or production wells. Despite this understanding, the minimum threshold was nonetheless set at 140 feet because, if the minimum were set at a higher level, it is likely that agricultural production in the Basin would be severely impacted. Agricultural producers need the operational flexibility to operate in long drought periods experienced in California. Without agriculture, the community will be greatly diminished.

To identify potential effects to residential wells as early as possible that may result from groundwater levels falling below the measurable objective, many of the wells included in the monitoring network are located in close proximity to residential uses (as illustrated on **Figure 7-3**, which shows monitoring well location and density of domestic wells). As **Figure 7-3** shows, most of the residential wells located in the basin are in concentrated areas near communities. Because residential wells are concentrated, any cone of depression resulting from agricultural wells is less likely to impact residential wells (as most domestic wells are over ¼ mile away from agricultural wells). Further, not all the effect that may occur (if any) to residential users due to levels dropping below the MO will be a result of agricultural pumping. A portion of any reduction that may occur would be from the residential wells themselves.

As stated in the Sustainability Goal, effects to illegal activities (such as the illegal cultivation of marijuana) are not considered.

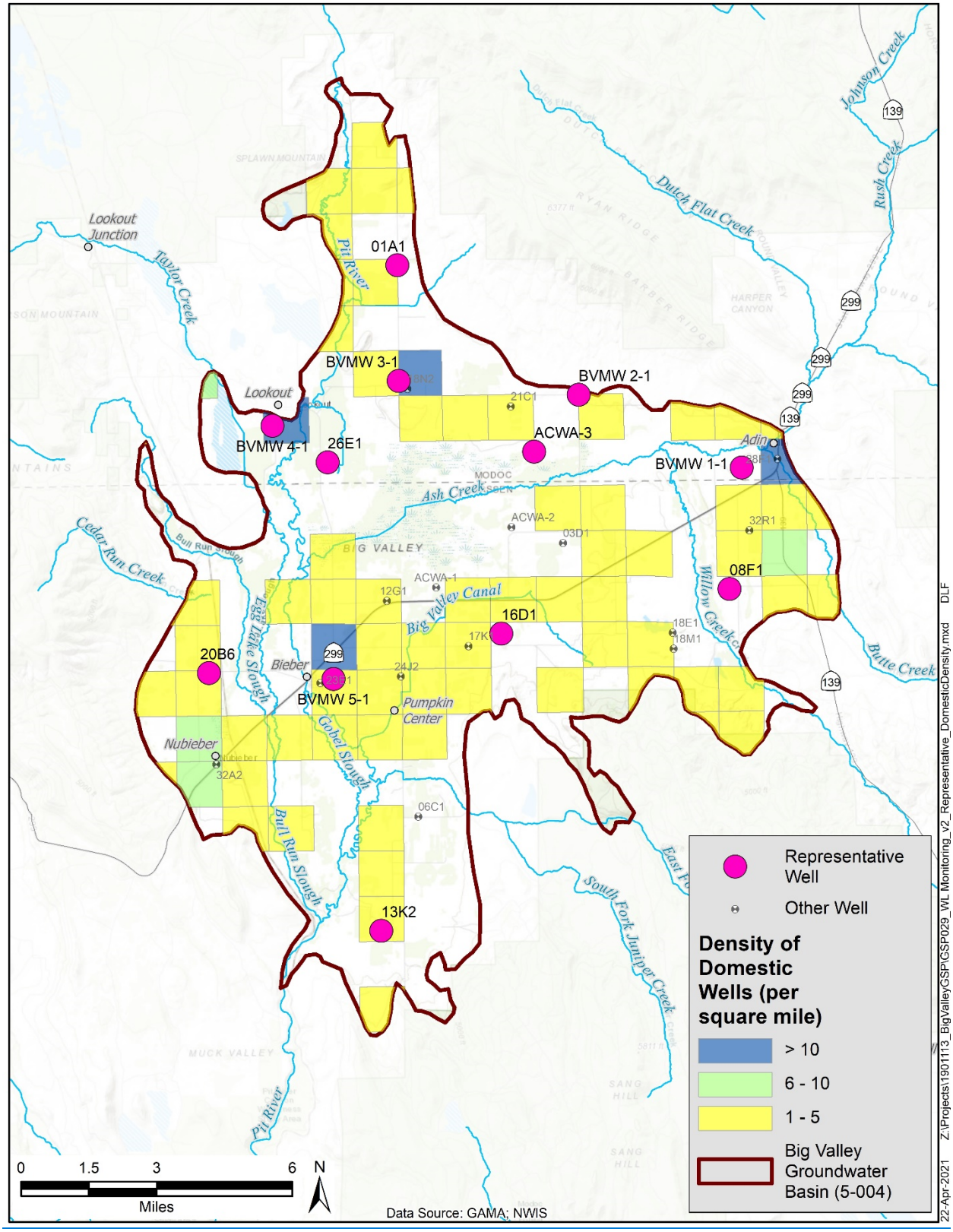

Figure 7-3 Domestic Well Density and Representative Groundwater Level Wells

Description

Agricultural production is the economic base of the community (see Chapter 1). If agricultural production were impacted to the degree expected if a higher minimum threshold were set, many of the residential wells would go into disuse because there would not be a need for those residences. The supporting agricultural economic base would not be present and a large part of the population would have to migrate out of the Basin. This disuse of said domestic wells would not be because the wells became inoperable. However, the beneficial use of the groundwater by many domestic users would still be impacted if the minimum threshold were set at a level that precluded successful agricultural production. A limited discussion regarding this dependency of the local economy on agriculture is found in Chapter 1 of this GSP (Introduction to Big Valley GSP).

Other plans, policies, and ordinances, not in the purview of this GSP, attempt, where feasible, to diversify the economic base of the community (e.g. County general plans). Again, the need and justification for such diversification is not the subject of this GSP. For this GSP, this interdependence is simply acknowledged. Accordingly, for this GSP, it has been determined that it is more effective to mitigate impacts (where feasible) to domestic users for the establishment of a 140-foot minimum threshold, than it is to attempt to mitigate the impacts to agricultural producers (and by default other beneficial users) if they are deprived of the operational flexibility required to operate.

The sustainability goal recognizes the above-described importance of agriculture and the economic, cultural, and environmental benefits derived from agriculture in Big Valley. The ~~need~~goal recognizes the importance to sustain agriculture for its own benefit, but also the importance of agriculture to support other users (e.g. domestic, municipal, etc.). It cannot be overstated that residential use of groundwater in the BVGB would be greatly diminished without the economic base provided to the community through agriculture. 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. ~~However, levels theoretically could fall low enough that the energy costs to pump the water result in agricultural pursuits becoming unviable. Therefore, significant~~Accordingly, and consistent with the goal, 140 feet below the 2015 groundwater level was established as the minimum threshold. 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.

The increase in horsepower required to pump from a well 140’ deeper than the current baseline 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 (Duane Connor personal communication). Calculated on a per ton basis, the increased cost of 140’ well 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 2015 baseline.

Causes

~~When~~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 ~~of~~ 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 ~~would~~, enhanced recharge, increased storage, and addressing data gaps will likely cause groundwater levels to experience a similar recovery and maintain balance within the basin.

Criteria

~~Through a coordinated online and in-person public outreach process performed with the Big Valley Advisory Committee (BVAC), interested parties have determined that 150 feet below the Fall 2015 baseline level(s) is a conservative estimate of when pumping costs would exceed the value of the water for agricultural pursuits. Minimum Thresholds are set at this water level. This criterium is based on 2015 as a baseline because 2015 is the first year that SGMA is applicable. Moreover, 2015 was generally the lowest water level throughout the historic period. The presumption is that interested parties have already determined that pumping costs from those 2015 levels are acceptable, but further lowering of levels in excess of 150 feet below 2015 would be significant and unreasonable.~~

~~The Undesirable Result for chronic lowering of groundwater levels occurs when greater than 1/3 of the representative wells drop below their minimum threshold for 5 consecutive years.~~

~~"Action Levels" are also defined for chronic lowering of groundwater levels. These Action Levels are independent of the GSP regulatory requirements. Groundwater projects and/or~~

~~management actions (described in Chapter 9) will be focused on areas that exhibit these conditions:~~

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 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 2015 baseline levels) for 5 consecutive years.
- Water ~~level declines~~levels at a representative well ~~in a year are greater than~~decline 3 times the average historic decline that well experienced between 2000 and 2018 as shown in **Appendix ~~7B~~5A**.
- Water ~~level declines~~levels at a representative well decline more than 5 feet in one year ~~at a representative well.~~.

Effects

As discussed above, if groundwater levels were to ~~reach Undesirable Results levels~~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. This 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 ~~Fall 2015 baseline.~~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 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.

~~If groundwater levels fell to 150 feet below the 2015 level, this could have an effect on groundwater dependent ecosystems. This use of water is addressed in the depletion of interconnected surface water section below.~~

7.3.2 *Groundwater storage*

The discussion and analysis regarding groundwater levels is directly related to groundwater storage. The groundwater levels for the fall 2015 measurement for each of the wells in the monitoring network (see chapter 8, Monitoring Network) is established as the measurable objective for groundwater storage (identical to the groundwater 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. ~~Through public outreach and coordination with the BVAC, the GSAs have determined that groundwater storage has not reached significant and unreasonable levels historically.~~While groundwater conditions are shown to have lowered based on the 20-year period being used, a local expert reviewed the hydrographs of wells throughout the Big Valley basin and found that over a thirty-seven-year period, the level of groundwater decline was less than 16.5 feet for fall measurements and 19.77 feet for spring measurements (Duane Conner personal communication, April 7, 2021). This further illustrates the possibility of data gaps. The data gaps discussed in the groundwater levels section also apply to groundwater storage. The GSAs will work to correct these data gaps where possible (dependent primarily on the availability of state and local funding).

Description

Like groundwater levels, significant and unreasonable reduction in groundwater storage is defined as ~~when~~a level that results in the energy cost to lift the groundwater ~~exceeds~~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

~~Use~~Again, the use of groundwater elevations as a ~~proxy~~substitute metric for groundwater storage is appropriate because change in storage is directly correlated to changes in groundwater elevation. ~~By setting minimum thresholds for levels, storage is also managed.~~

Causes

~~See causes of groundwater levels undesirable results above.~~

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

~~The criteria to define an Undesirable Result for reduction in groundwater storage is when storage is reduced to the volume associated with 1/3 of the representative wells dropping below their water level minimum threshold for 5 consecutive years.~~

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

~~If groundwater storage were~~Please refer to ~~reach Undesirable Results, pumping costs would make agricultural pursuits~~the "Effects" discussion in the ~~Basin unviable.~~

~~The water levels associated with this reduction in groundwater storage could cause many wells (e.g., shallow domestic) to go dry. This effect would be offset by a shallow well mitigation program described in the lowering of~~ groundwater levels section ~~above.~~

~~Lowering water levels by 150 feet could affect groundwater dependent ecosystems. Those areas would be protected by thresholds for depletion of interconnected surface water, described below~~of this chapter, as the content in both sections is the same.

~~7.3.1~~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.

~~7.3.2~~7.3.4 ~~*Degraded*~~ *Water quality*

The Big Valley groundwater basin is in one of the most remote and untouched areas of California. The sparsely populated valley has a rich biodiversity of wildlife and native species found on the privately-owned agriculture property throughout the basin. The Basin is predominantly used for low intensity and low value agriculture crops such as pasture, grass and alfalfa hay, and native rangelands. The selection of agricultural crops is due to the shorter growing season and colder temperatures which prevent the expansion of crop diversity within the basin. While this climate is considered a challenge to farmers and ranchers, it benefits the existence of excellent water quality within the Big Valley groundwater basin.

As described in Chapter 5 ~~details,~~ the groundwater quality conditions in the Basin ~~which overall~~ are over all excellent (DWR 1963, USBR 1979). ~~Although several~~After a review of the best available data on water quality in the Basin, it was discovered that all of the constituents ~~detailed in Section 5.4 are~~which were elevated above ~~drinking water suitability~~suitable thresholds~~, all~~ are naturally occurring ~~and the thresholds exceeded are secondary drinking water thresholds which are set for aesthetics such as taste, color and odor. None of the~~ . There has been no increase in the level of concentrations ~~have shown an increase~~ over time, and ~~some~~several constituents have indications of improvement in recent decades compared to concentrations in the 1950's and 1960's (e.g. Arsenic and Manganese ~~in~~ **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 basin and they are working in coordination to retain the existence of excellent water quality. 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 Big Valley groundwater basin.

Agricultural users have partnered 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.

Domestic water users are also assisting in improving water quality within the basin through the community action. Through the civic process, Big Valley residents were engaged in the development of the Modoc county ordinance 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 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.

The Sustainable Groundwater Management Act was not intended to regulate groundwater quality but to work in coordination with the many other programs and agencies who are tasked to maintain excellent water quality in the Basin. Below is a list of the many other programs currently being implemented to address water quality:

Irrigated Lands Program (ILRP) was 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 joined 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 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 - is 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.

Title 27 Program - 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.

Oil Field Program - The USGS California Water Science Center is working in partnership with state and federal agencies to answer questions about oil and gas development and groundwater resources.

Underground Storage Tank Site Cleanup Program (UTS) – 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.

In addition to the above, water quality samples are required when a property is sold and when a foster child is placed.

Section 5.4 also details the known groundwater contamination sites and plumes located in Bieber and Nubieber. These sites are currently being regulated by the Regional Water Quality Control Board (RWQCB) and contaminants associated with these sites have not been found in the main part of the aquifer, specifically the town of Bieber ~~town wells~~.

~~Therefore~~Due to the existence of excellent water quality in the basin, significant amount of existing water quality monitoring, and a robust effort to conduct conservation efforts by agricultural and domestic users, per §354.26(d), SMCs were not established for water quality degradation because Undesirable Results are not present and not likely to occur. At the 5-year ~~update~~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.

The impacts of high electrical conductivity (EC) in irrigation water are well documented (Bauder et al 2014). For alfalfa, yield reductions are not seen with EC reaching 1.3 dS/m. A 10% yield reduction occurs at 2.2 dS/m, 25% reduction 3.6 dS/m, and 50% reduction at 5.9 dS/m. Currently in the Big Valley Basin, groundwater EC levels are .2-.4 dS/m. The documented effects of EC on forage crop production will be used in the future to establish a SMC if needed.

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.

~~7.3.3~~7.3.5 *Land subsidence*

Local input provided at public outreach meetings identified areas of agricultural land leveling operations that were shown on the InSAR map as subsidence. 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. ~~Further, some~~Some subsidence ~~may be~~is natural and unavoidable due to the movement of Tectonic plates. Minor additional subsidence is acceptable in the absence of impacts on infrastructure (roadways, railroads, conveyance canals, and wells among others~~) or an increase in the flood risk.~~).

~~If water levels remain near the measurable objective (Fall 2015 baseline) or are reduced at their current rate for the next 5 years, only minor subsidence is expected. Even if the 3-inch ground surface decline, indicated by InSar on **Figure 5-17,** was indeed induced by groundwater pumping over the 4-year period (which is uncertain based on this single set of data), continued~~Continued groundwater operations would cause only an additional 3 inches of subsidence over the next five years, which would not be likely to have significant impacts on infrastructure~~ or flood risk. Further, if groundwater levels decline at a lesser rate, as expected, the potential for subsidence will be even lower.~~

. 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 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.

~~7.3.4~~7.3.6 *Depletion of interconnected surface water*

~~Chapter~~The Big Valley Groundwater basin has multiple streams which enter on the West and East portions of the basin. These streams are some of the most remote, least improved, and most pristine surface waters in all of California. All of the snow fed high desert streams entering into

the basin have a seasonal hydrograph and can experience natural periods of reduced flows or complete cessation of flows late in the summer season or during drought periods. The Upper Pit River enters on the North portion of the basin and is also considered a snow fed high desert river which has had documented periods of reduced flows or a complete cessation of flow during drought periods.

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 sustainably operated for over a century. Many of the surface water rights on farms and ranches are pre-1914 water rights. For all interested parties, there is need for a greater understanding of the possibility of the depletion of interconnected surface water in the Basin. 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.

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 2016~~). Conclusive~~), conclusive evidence of stream interconnection is not available~~, and therefore~~. Therefore, there is a lack of evidence for depletions 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 ~~will~~may partially be filled once adequate data from the five monitoring well clusters are collected. ~~Therefore, until more information is known about the interconnection of~~Scientific research related to groundwater and surface water~~, SMCs~~ will improve over time. As this science is made available, the GSA's will work to locate funding for ~~the depletion of interconnected surface water cannot be established.~~improved data depending on available staffing and financial resources.

Agricultural users have partnered with agencies such as the Natural Resource Conservation Services (NRCS) to implement on site programs which are designed to improve water

conservation in the riparian area. These projects are detailed in Chapter 9 – Projects and Management Actions.

Due to the absence of data supporting undesirable results in the basin, significant history of wet and dry periods of stream flow and an established effort to conduct conservation efforts, per §354.26(d), 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.

7.5 References

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Department of Water Resources (DWR), 1963. Northeastern Counties Ground Water Investigation. Bulletin 98.

DWR, 2016. Groundwater Sustainability Plan Emergency Regulations §351. Available at: ~~https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I74F39D13C76F497DB40E93C75FC716AA&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default)~~https://govt.westlaw.com/calregs/Browse/Home/California/CaliforniaCodeofRegulations?guid=I74F39D13C76F497DB40E93C75FC716AA&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default).

Neasham, Ernest, 1985. Fall River Valley: An Examination of Historical Sources: Fall River Valley and the intermountain area from the earliest times until 1890. Citadel Press, p.10.

Orloff. [Need reference]

United States Bureau of Reclamation (USBR), 1979. Ground-Water Geology and Resources Appendix, Allen Camp Unit, California, Central Valley Project, California, Pit River Division, Allen Camp Unit, Definite Plan. October 1979.

United States Census Bureau (USCB), 2021. State and County Quickfacts. Available at: https://www.census.gov/programs-surveys/sis/resources/data-tools/quickfacts.html.

Northeastern California Water Association (NCWA), 2017. Upper Pit River Watershed Integrated Regional Water Management Plan. Adopted December 5, 2013, updated review draft September 2017. Prepared by Burdick & Company, Auburn, California in collaboration with Upper Pit River Watershed Regional Water Management Group.

Appendix A 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)

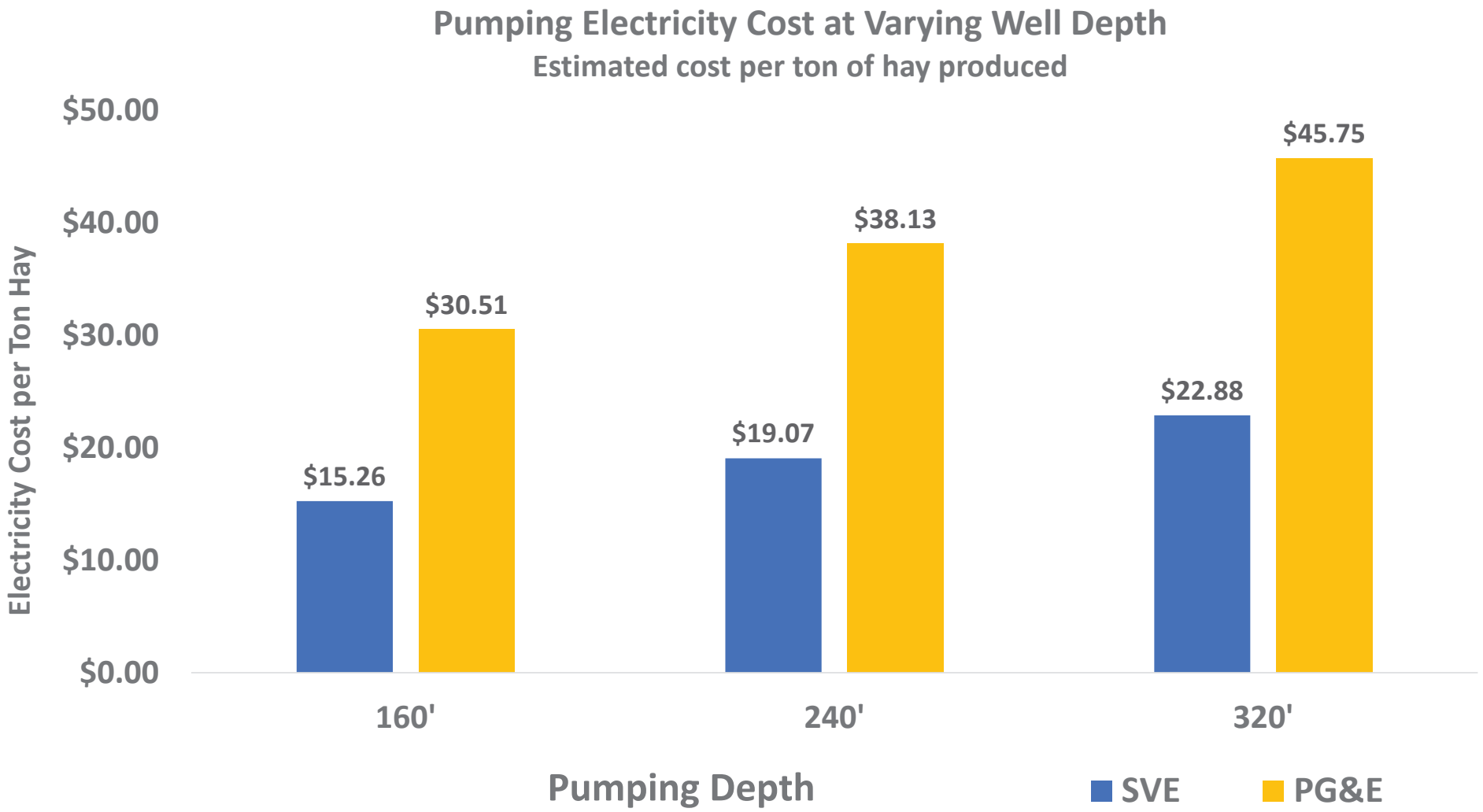
- For every 50 ft of drop in pumping level 16.66% increase in horsepower or cost. 150 ft drop = 50 HP increase in HP or cost

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
Electricity Cost per Ton Hay
$50.00
$40.00
$30.00
$20.00
$10.00
$0.00
$15.26
$30.51
$19.07
$38.13
$22.88
$45.75
160'
240'
320'
Pumping Depth
SVE
PG&E

Big Valley GSP Comment Matrix Chapter 7

Document	Packet Page	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chap 7 (4/1/2021)	45	5, 113	Deep freezes can occur from September to May	4/7/2021	Text changed
Public Draft Chap 7 (4/1/2021)	46	6, 125	Environmental regulations include SGMA	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	46	6, 133	Change "may" to "will"	4/7/2021	Text changed
Public Draft Chap 7 (4/1/2021)	46	6, 135	Change "may" to "is likely to"	4/7/2021	Text changed
Public Draft Chap 7 (4/1/2021)	46	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)	47	7, 197-199	The Basin needs the support of Federal management	4/7/2021	Text changed
Public Draft Chap 7 (4/1/2021)	48	8, 215	Monitoring also helps DWR	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	48	8, 224	Remove slightly	4/7/2021	Text changed
Public Draft Chap 7 (4/1/2021)	49	9, 261	If there is no Ag there is no community.	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	51	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)	51	11, 327	Add "and breeding grounds"	4/7/2021	Text added

Big Valley GSP Comment Matrix Chapter 7

Document	Packet Page	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chap 7 (4/1/2021)	51	11, 328	Add "develop" a new water source	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	51	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)	55	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)	45	5, 95-98	Add spring-fed streams verbiage	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	46	6, 127	Add "and roads"	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	46	6, 127	Add "reduction of timber yield tax"	4/7/2021	Text added
Public Draft Chap 7 (4/1/2021)	46	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)	48	8, 217	Remove "chronic"	4/7/2021	Text removed
Public Draft Chap 7 (4/1/2021)	51	11, 321	1/3 of representative wells	4/7/2021	Text altered
Public Draft Chap 7 (4/1/2021)	52	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)	55	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)	56	16, 508-510	Remove "Continued… flood risk" sentence	4/7/2021	Text removed

Big Valley GSP Comment Matrix Chapter 7

Document	Packet Page	Page & Line Number	Comment	Date	Notes and Responses
Public Draft Chap 7 (4/1/2021)	56	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.
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)	46	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)	56	16, 508-510	We don't know that subsidence will continue	4/7/2021	
Public Draft Chap 7 (4/1/2021)	56	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.

Big Valley Groundwater Sustainability Plan GSP Regulations Checklist (Elements Guide) for Chapter 8

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
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.	X	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.	X	8.1			
	(2)		Monitor impacts to the beneficial uses or users of groundwater.	X	8.1,8.2			
	(3)		Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds.	X	8.1,8.2			
	(4)		Quantify annual changes in water budget components.	X	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:					
		(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.	X	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.	X	8.2.1			
	(2)		Reduction of Groundwater Storage. Provide an estimate of the change in annual groundwater in storage.	X	8.2.1, 8.2.4			

"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
	(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.	X	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.	X	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.	X	8.2			
(e)			A Plan may utilize site information and monitoring data from existing sources as part of the monitoring network.	X	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.					
	(2)		Aquifer characteristics, including confined or unconfined aquifer conditions, or other physical characteristics that affect groundwater flow.					
	(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.	X	8.2			
	(4)		Whether the Agency has adequate long-term existing monitoring results or other technical information to demonstrate an understanding of aquifer response.	X	8.2			

"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
(g)			Each Plan shall describe the following information about the monitoring network:					
	(1)		Scientific rationale for the monitoring site selection process.	X	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.	X	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.	X	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.	X	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.	X	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.	X	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.	X	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.	X	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.	X	8.2.1			
(c)			The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area.	X	8.2.1			

"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
			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.	X	8.2.1.5, 8.2.2.2, 8.2.3.2		8-2, 8-4	
(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.	X	8.2.1.5, 8.2.2.2, 8.2.3.2		8-2, 8-4	
(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.	X	8.2.1.5, 8.2.2.2, 8.2.3.2		8-2, 8-4	
	(2)		Local issues and circumstances that limit or prevent monitoring.	X	8.2.1.5, 8.2.2.2, 8.2.3.2		8-2, 8-4	
(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.	X	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.	X	8.2		8-1	
	(2)		Highly variable spatial or temporal conditions.	X	8.2		8-1	
	(3)		Adverse impacts to beneficial uses and users of groundwater.	X	82			
	(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					

"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

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Abbreviations and Acronyms

ACWA	Ash Creek Wildlife Area
Basin	Big Valley Groundwater Basin
BVGB	Big Valley Groundwater Basin
BVAC	Big Valley Groundwater Basin Advisory Committee

36	CASGEM	California Statewide Groundwater Elevation Monitoring
37	DDW	Division of Drinking Water, State Water Resources Control Board
38	DWR	Department of Water Resources
39	EC	Electrical Conductivity
40	GAMA	Groundwater Ambient Monitoring and Assessment Program
41	GSA	Groundwater Sustainability Agency
42	GSP	Groundwater Sustainability Plan
43	SB	Senate Bill
44	SGMA	Sustainable Groundwater Management Act of 2014
45	SWRCB	California State Water Resources Control Board
46	USGS	United States Geologic Survey
47	SWRCB	State Water Resources Control Board

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[1].

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.

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 and groundwater storage sustainability indicators
- Groundwater contours required for annual reports
- Shallow groundwater monitoring to 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 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

[1] 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.

75 **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	298	4035	3885	X		biannual
03D1	Irrigation	280	50 - 280						X		biannual
06C1	Irrigation	400	20 - 400						X		biannual
08F1	Other	217	26 - 217	X	32	182	4222	4072	X		biannual
12G1	Residential	116	--								biannual
13K2	Irrigation	260	20 - 260	X	66	216	4062	3912	X		biannual
16D1	Irrigation	491	100 - 491	X	93	243	4079	3929	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	191	4085	3935	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	170	4114	3964	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	173	4136	3986	X	X	biannual
BVMW 1-1	Observation	265	175 - 265	X	53	203	4162	4012	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	172	4194	4044	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	168	4146	3996	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	215	4088	3938	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	197	4082	3932	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 150 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.

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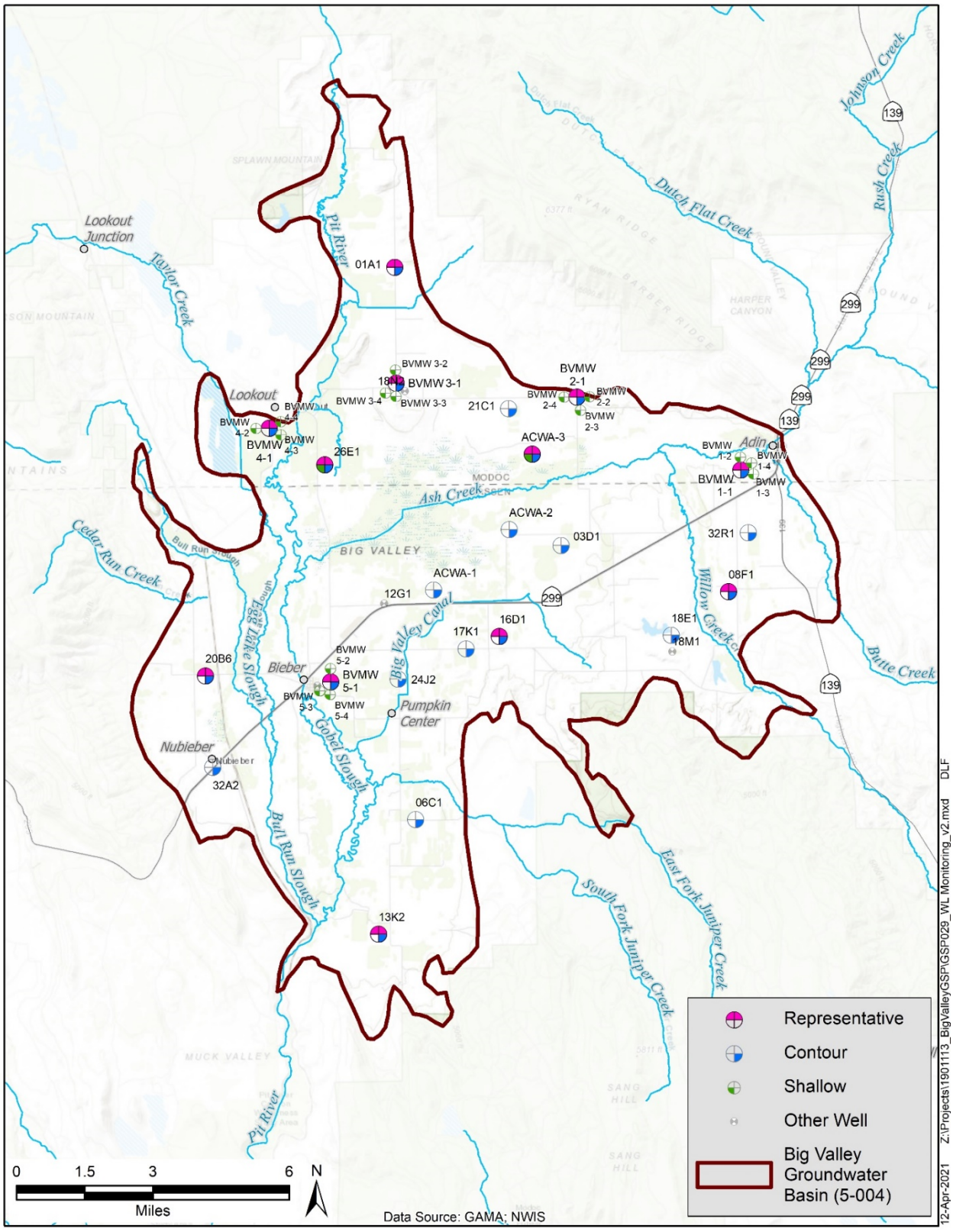

Figure 8-1 Water Level Monitoring Networks

level hydrographs are included in **Appendix 5A**. **Appendix 8B** contains the available well completion reports and **Appendix 8C** contains the well construction report 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 2016a) states that wells should be dedicated to groundwater monitoring. In addition, §354.34 indicates that wells in the monitoring network should have "depth-discrete[2] 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 typically have pumps in them and are used for irrigation, stockwatering, or domestic uses. The intent of groundwater level monitoring is to capture static (non-pumping) water levels. However, historic (and the proposed future) monitoring is performed before and after the irrigation season, March or April for spring measurements and October for fall measurements. 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[3], 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 aquifers have not been defined in the Basin and these long intervals therefore do not cross defined 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

[2] "Depth-discrete" means that the screens, perforations, or open hole is relatively short (typically less than about 20 feet).
[3] Screens in this context includes perforated casing, well screens, or open hole, all of which allow water to flow into the well.

square miles (DWR 2016a). Through consultation with the Big Valley Advisory Committee (BVAC), twelve wells were selected for representative monitoring of the 144 square mile Basin, a density of 8.3 wells per 100 square miles.

Considerations for selection of the wells included:

- Spatial distribution throughout the Basin to represent agricultural pumping areas and domestic well clusters
- An existing monitoring record (where available) to track long-term trends
- Access for long-term future monitoring
- Well depth (greater than 150 feet below fall 2015 levels[4])
- Wells dedicated to monitoring where available

Table 8-1 shows the measurable objectives and minimum thresholds for the twelve representative wells.

8.2.1.2 Groundwater Contour Monitoring Network

The GSP Regulations (§356.2) require that annual reports include groundwater contours for the previous year (spring and fall) as well as an estimate of change in groundwater storage. 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.

8.2.1.3 Shallow Groundwater Monitoring Network

Chapter 5 discusses interconnected surface water and describes the perennial streams in the BVGB which may be interconnected to the groundwater aquifer. As described in Chapter 7, there is currently no conclusive evidence for interconnection of perennial streams with the groundwater aquifer and the volume of depletions (if any) is unknown. Therefore, measurable objectives, minimum thresholds, and a representative monitoring network for depletion of interconnected surface water have not been established. 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

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

clusters were designed to measure the magnitude and direction of shallow groundwater flow and are equipped with water level transducers that collect continuous (15-minute interval) water level measurements so that potential correlations with streamflow gages can be assessed. Well 26E1 was also added to the shallow network due to its position between the two major streams (Pit River and Ash Creek), 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. **Table 8-1** lists the shallow groundwater monitoring network and **Figure 8-1** shows their locations.

8.2.1.4 Monitoring Protocols and Data Reporting Standards

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

8.2.1.5 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, 2016a). **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 infrequent DDW measurements. The

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

Best Management Practice (DWR, 2016a)	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

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EC transducers may be able to put anomalous 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" encompasses 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 2016b), 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 GeoTracker GAMA website. At the 5-year update, the GSAs will download 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.

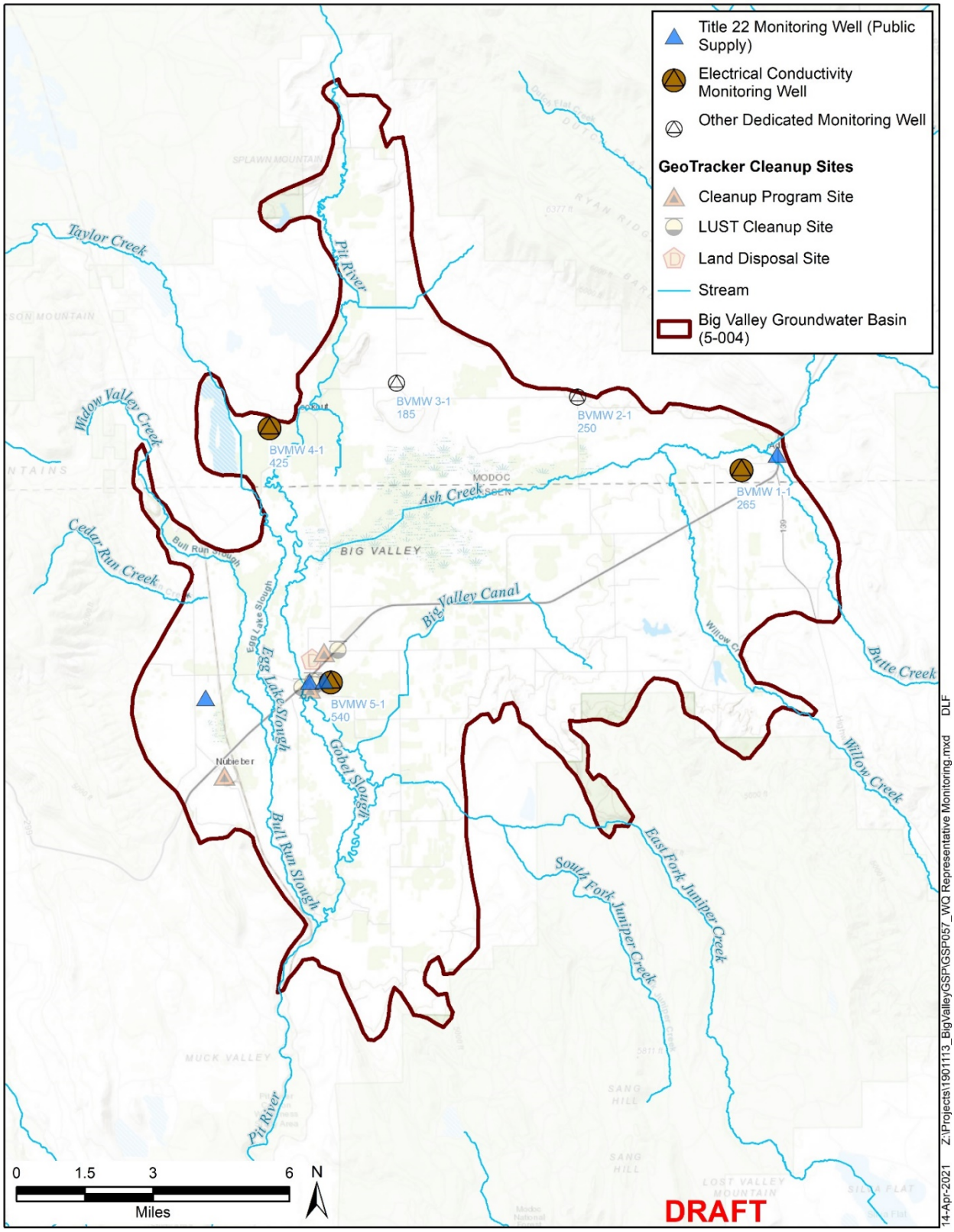

Figure 8-2 Water Quality Monitoring Network

204 **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.

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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, measurable objectives, minimum thresholds, 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.

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 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. 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**. 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.

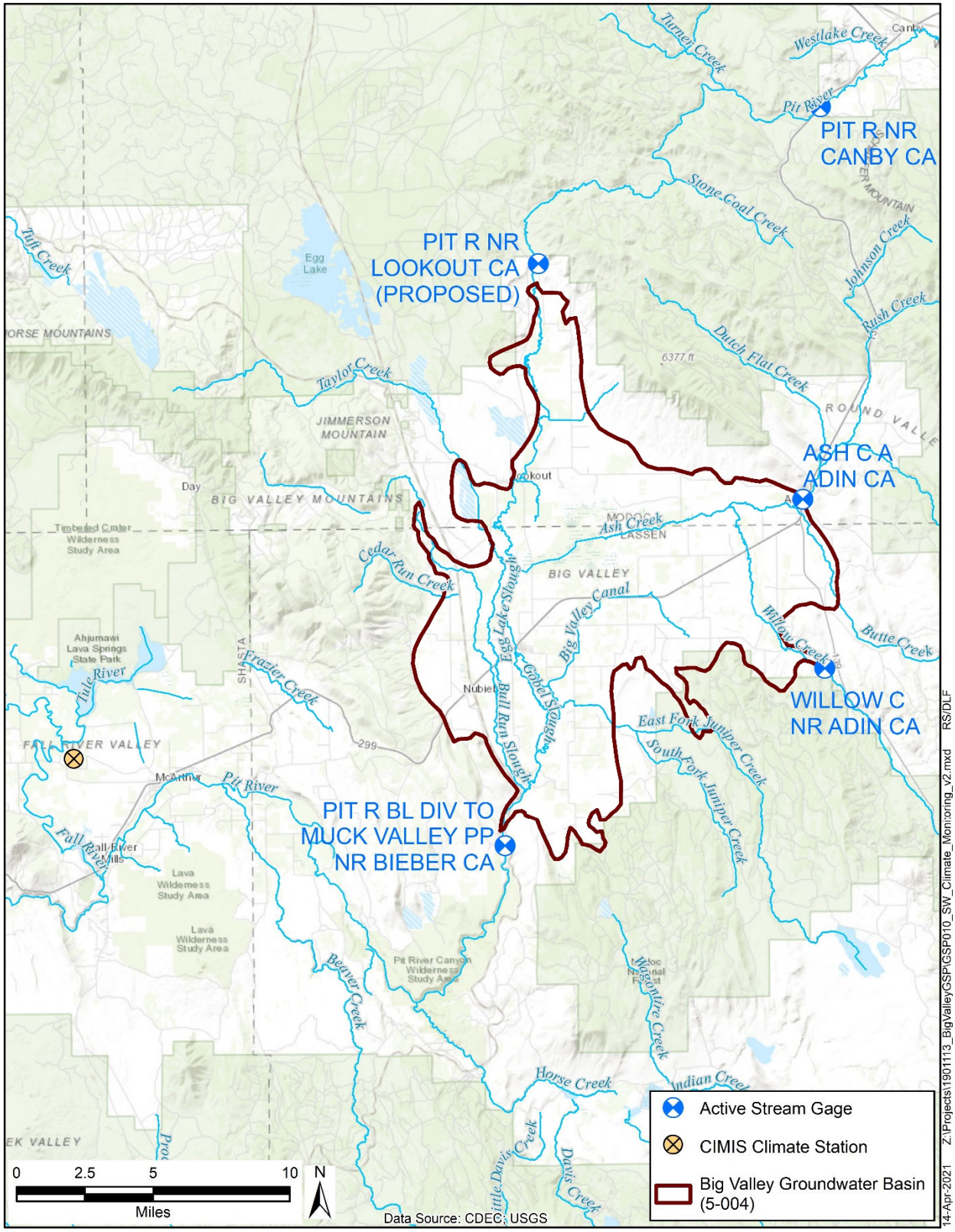


Figure 8-3 Surface Water and Climate Monitoring Network

8.3 References

Department of Water Resources (DWR), 2016a. Monitoring Networks and Identification of Data Gaps BMP. December 2016. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-2-Monitoring-Networks-and-Identification-of-Data-Gaps_ay_19.pdf.

DWR, 2016b. Monitoring Protocols, Standards and Sites BMP. December 2016. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Groundwater-Management/Sustainable-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents/Files/BMP-1-Monitoring-Protocols-Standards-and-Sites_ay_19.pdf.

Appendix 8A Water Level Monitoring Well Details

Well Name	State Well Number	DWR Site Code	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	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	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	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	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	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	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	Residential	4153.30	4154.30	TOC	180	yes	30 - 180	1957	2021	3.30	38.20	3 - 38	4150 - 4115	
18E1	38N09E18E001M	411356N1209900W001	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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	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 Monitoring Well Completion Reports

39N/7E-1

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 14565

Notice of Intent No._____

Permit No. or Date_____

State Well No._____

Other Well No._____

Address_____

City_____

(2) LOCATION OF WELL (See instructions):

County Modoc Owner's Well Number_____

Well address if different from above_____

Township 39 n Range 7 E Section 1

Distance from cities, roads, railroads, fences, etc. N.E.¼ of N.E.¼

WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☒
Municipal ☐
Other ☐

(5) EQUIPMENT:

Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☐ No ☒ Size_____
Diameter of bore_____
Packed from_____ to_____ ft.

(7) CASING INSTALLED:

Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0'	40	8"	188

(8) PERFORATIONS:

Type of perforation or size of screen

From ft.	To ft.	Slot size

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 40 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval_____ ft.
Method of sealing Casing & cement

(10) WATER LEVELS:

Depth of first water, if known_____ ft.
Standing level after well completion 40' ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Conners'
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test_____ ft. At end of test_____ ft.
Discharge 50 gal/min after 2 hours Water temperature cool
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?_____
Electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG:

Total depth 300 ft. Depth of completed well 300 ft.

from ft.	to ft.	Formation (Describe by color, character, size of material)
0'	1'	Top soil
1'	4'	cement gravel
4'	28'	Brown clay
28'	86'	Brown sandstone
86'	127'	Brown sandy clay
127'	168'	Blue sandstone
168'	204'	blue sandstone & pumic
204'	244'	Brown sandstone
244'	300'	Brown sandstone & pumic

CONFIDENTIAL LOG Water Code Sec. 13752

CONFIDENTIAL NOT FOR PUBLIC USE WATER CODE SEC. 13752

Work started August 19 77 Completed August 19 77

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED Roy A Conner (Well Driller)

NAME Conners' Well Drilling Inc. (Person, firm, or corporation) (Typed or printed)

Address P. O. Box 92

City Alturas, Calif. Zip 96101

License No. 250298 Date of this report Sept. 77

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 43816-950 7-76 50M QUAD ⓘT OSP

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

38N08E03W Do not fill in

No. 16564

Notice of Intent No.

Local Permit No. or Date

State Well No.

Other Well No.

(1

Addre

City

(2) LOCATION OF WELL (See instructions):

County Lassen Owner's Well Number

Well address if different from above

Township 38 N Range 8 E Section 3

Distance from cities, roads, railroads, fences, etc.

(3) TYPE OF WORK:

New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☐
Irrigation ☒
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

WELL LOCATION SKETCH

(5) EQUIPMENT:

Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☒ No ☐ Size 3/8 to 1/2
Diameter of bore 18
Packed from 0 to 280 ft.

(7) CASING INSTALLED:

Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot size
0	180	18"	188	50	280	3/16

(8) PERFORATIONS:

Type of perforation or size of screen

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☐ No ☒ If yes, to depth ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ft.
Method of sealing

(10) WATER LEVELS:

Depth of first water, if known 38 ft.
Standing level after well completion 35 ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Driller
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test ft. At end of test ft
Discharge 700 gal/min after 4 hours Water temperature Cool
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 300 ft. Depth of completed well 280 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	2	Top Soil
2	10	Hard Brown Sandstone
10	15	Brown Sandy Clay
15	25	Brown Clay
25	38	Brown Sandstone Some Clay
38	42	Coarse Brown Sand & Gravel
42	50	Brown Clay
50	70	Brown Sand & Gravel
70	75	Black Clay
75	83	Blue Sticky Clay
83	87	Coarse Gravel
87	95	Brown Sandy Clay
95	115	Blue Clay
115	145	Hard Rock Pumice
145	150	Brown Sandstone Some Pumice
150	160	Blue Clay
160	170	Black Sand & Pea Gravel
170	185	Grey Sandy Clay
185	200	Grey Clay & Some Gravel
200	215	Coarse Black Sand
215	220	Grey Clay
220	225	Black Sand & Pea Gravel
225	245	Grey Sandstone Some Clay
245	250	Black Sand Some Pumice
250	265	Grey Sandy Clay
265	275	Black Sandstone Some Pumice
275	300	Grey Clay

Work started July 19 81 Completed July 19 81

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED Roy A. Conners (Well Driller)

NAME Conners' Well Drilling, Inc. (Person, firm, or corporation) (Typed or printed)

Address P. O. Box 92

City Alturas, Calif. Zip 96101

License No. 250298 Date of this report Nov. 81

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 43816-950 7-76 50M QUAD 1T OSP

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

37N/8E -6 Do not fill in

No. 14580

Notice of Intent No.

Local Permit No. or Date

State Well No.

Other Well No. CONFIDENTIAL LOG
Water Code Sec. 13752

O'

Address

City

(2) LOCATION OF WELL (See instructions):
County Lassen Owner's Well Number # 4

Well address if different from above

Township 37 N. Range 8 E. Section 6

Distance from cities, roads, railroads, fences, etc. N.E. ¼ of N.W. ¼

WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☒
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) EQUIPMENT:
Rotary ☒ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☐ No ☒ Size
Diameter of bore
Packed from ft. to ft.

(7) CASING INSTALLED:
Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0'	20'	16"	188

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Slot size

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20' ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ft.
Method of sealing Casing

(10) WATER LEVELS:
Depth of first water, if known 50' ft.
Standing level after well completion 20' ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Conners'
Type of test Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test 20' ft. At end of test 137' ft.
Discharge 2840 gal/min after 16 hours Water temperature cool
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 440' ft. Depth of completed well 400 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0'	-2'	Top osil
2'	-20'	Brown clay
20'	-50'	Blue clay
50'	-55'	White pumic
55'	-70'	Brown sandstone
70'	-75'	White pumic
75'	-90'	Brown sandstone
90'	-105'	White pumic
105'	-135'	Brown sandstone
135'	-150'	White pumic
150'	-156'	Brown sandstone
156'	-174'	White pumic
174'	-210'	Brown sandstone
210'	-220'	Brown sandstone some white
220'	-230'	Red & brown cement gravel
230'	-240'	Brown, Red & white pumic
240'	-270'	Gray & white pumic
270'	-295'	Black cement gravel
295'	-310'	Brown sandstone
310'	-325'	Brown cement gravel
325'	-330'	Gray sandstone
330'	340'	Brown sandstone
340'	-350'	Gray cement gravel
350'	-380'	Gray sandstone
380'	-390'	Gray cement geavel
390'	440'	Gray sandstone some clay

Work started Aug. 19 76 Completed Aug. 19 76

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED Roy B Conner (Well Driller)

NAME Conners' Well Drilling, Inc. (Person, firm, or corporation) (Typed or printed)

Address P. O. Box 92

City Alturas, Calif. Zip 96101

License No. 250298 Date of this report Sept. 77

CONFIDENTIAL NOT FOR PUBLIC WATER USE

188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM 43816-950 7-76 50M QUAD OT OSP

WATER WELL DRILLERS REPORT

FIELD WORK SHEET

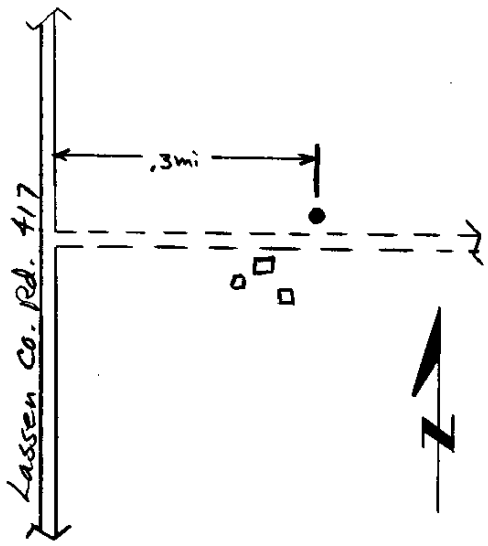
Report No. 14580

Owner _____

Pump No. TK15271

Meter No. 6395

P.G.&E. Loc. No. _____



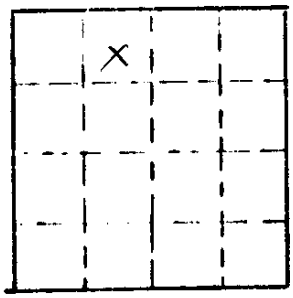
Elev. 4130

Section 6C

Township 37N

Range 8E

Location of Well in Section



Is well measurable?

No

4000 feet North,

3800 feet West from S. E. corner of Section

REMARKS

Owner gave permission to measure well but well is not measurable.

Tom Shoff
Field Checked by

8-8-79

38N/9E-8

ORIGINAL
File with DWR

WATER WELL DRILLERS REPORT

(Sections 7073, 7089, 7081, 7082, Water Code)

THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Do Not Fill In

No. 49934

State Well No.

Other Well No. CONFIDENTIAL LOG ~~Water Code Sec. 13752~~

(1) OWNER:

Name

Address

(2) LOCATION OF WELL:

County Lassen Owner's number, if any

Township, Range, and Section T 38N. R 9E. Sec. 8

Distance from cities, roads, railroads, etc. Center of the N.W.¼

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐

Irrigation ☐ Test Well ☐ Other ☒

(5) EQUIPMENT:

Rotary ☐

Cable ☒

Other ☐

(6) CASING INSTALLED:

STEEL: OTHER:

SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam	Gage or Wall
0	26	6"	¼

If gravel packed

Diameter of Bore	From ft.	To ft.

Type of shoe or ball ring: ½ x 4" Size of gravel:

Describe joint: weld

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☒ No ☐ To what depth 26 ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing

(9) WATER LEVELS:

Depth at which water was first found, if known 40 ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing 31' ft. 6" in.

(10) WELL TESTS: BAILER self

Was pump test made? Yes ☐ No ☐ If yes, by whom?

Yield: 6 gal./min. with 94 ft. drawdown after 1 hrs.

Temperature of water 56 Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth 217 ft. Depth of completed well 217 ft.

Formations: Describe by color, character, size of material, and structure

From ft.	To ft.	
0	½	soil and gravel
½	2	hard sandstone
2	4	course gravel and sand
4	22	gray clay and send
22	40	yellow chalk
40	58	gray clay
58	94	gray clay and layers of sand
94	105	gray clay
105	137	gray shale
137	183	gray clay
183	201	brown clay
201	211	black sand and layers of shale
211	217	green clay

~~CONFIDENTIAL LOG~~
~~Water Code Sec. 13752~~

Work started 6/9 19 70 Completed 6/11 19 70

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME John A. Van Meter
(Person, firm, or corporation) (Typed or printed)

Address Box 204 Malin, Oregon

[SIGNED] John A. Van Meter
(Well Driller)

License No. 194473 Dated 6/11 19 70

SKETCH LOCATION OF WELL ON REVERSE SIDE

37N/7E-13

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 090029

Notice of Intent No.

Local permit No. or Date

State Well No.

Other Well No.

(1) OWNER:

Address

City

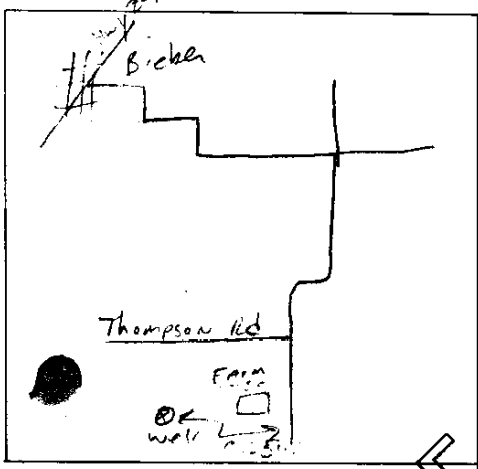
(2) LOCATION OF WELL (See instructions):

County LASSEN CO. Owner's Well Number

Well address if different from above

Township 37N Range 7E Section 13

Distance from cities, roads, railroads, fences, etc. Southern Alturas Center



WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well [X] Deepening [ ]
Reconstruction [ ]
Reconditioning [ ]
Horizontal Well [ ]
Destruction [ ] (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic
Irrigation [ ]
Industrial [ ]
Test Well [ ]
Stock [ ]
Municipal [ ]
Other [ ]

(5) EQUIPMENT:

Rotary [X] Reverse [ ]
Cable [ ] Air [X]
Other [ ] Bucket [ ]

(6) GRAVEL PACK:

Yes [ ] No [ ] Size

Diameter of bore

Packed from ft. to ft.

(7) CASING INSTALLED:

Steel [ ] Plastic [ ] Concrete [ ]

From ft.	To ft.	Dia. in.	Gage or Wall
0	20	16	

(8) PERFORATIONS:

Type of perforation or size of screen

From ft.	To ft.	Slot size

(9) WELL SEAL:

Was surface sanitary seal provided? Yes [ ] No [ ] If yes, to depth ft.

Were strata sealed against pollution? Yes [ ] No [ ] Interval ft.

Method of sealing

(10) WATER LEVELS:

Depth of first water, if known ft.

Standing level after well completion ft.

(11) WELL TESTS:

Was well test made? Yes [ ] No [ ] If yes, by whom?

Type of test Pump [ ] Bailer [ ] Air lift [ ]

Depth to water at start of test ft. At end of test ft

Discharge 2500 gal/min after 100 hours Water temperature

Chemical analysis made? Yes [ ] No [ ] If yes, by whom?

Was electric log made? Yes [ ] No [ ] If yes, attach copy to this report

(12) WELL LOG:

Total depth 260 ft. Depth of completed well ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	3'	Top Soil
3'	15'	Brown Sandy Clay
15'	60'	Blue Clay
60'	105'	Brown Clay
105'	118'	White Pumice Sandstone
118'	130'	Brown Sandstone
130'	160'	White Sandstone Pumice
160'	180'	Brown Sandstone
180'	210'	White Pumice Red Cinders
210'	240'	Brown Sandstone
240'	245'	Brown Clay
245'	260'	Brown Sandstone

Work started 19 Completed 19

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED Copied from Driller's Notes (Well Driller)

NAME Conners' Well Drilling, Inc. (Person, firm, or corporation) (Typed or printed)

Address P.O. Box 92

City Alturas, CA Zip 96101

License No. 250298 Date of this report August 17, 1981

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

38N/8E-16.

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 090143

Notice of Intent No.
Log Permit No. or Date

State Well No.
Other Well No.

(1) C

Address
City

(2) LOCATION OF WELL (See instructions):

County Lassen Owner's Well Number 1

Well address if different from above

Township 38 N. Range 8 E. Section 16

Distance from cities, roads, railroads, fences, etc. 1/4 Mile North from A 2, 1/4 Mile East from Finley Ln

Section 16

Finley Ln

well

A 2 Susanville Rd

WELL LOCATION SKETCH

(3) TYPE OF WORK:

New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☐
Irrigation ☒
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) EQUIPMENT:

Rotary ☒ Reverse ☐
Cable ☐ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☐ No ☒ Size
Diameter of bore
Packed from to ft.

(7) CASING INSTALLED:

Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	250	12¾	.188

(8) PERFORATIONS:

Type of perforation or size of screen

From ft.	To ft.	Slot size
100	250	

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 5 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ft.
Method of sealing Cement T

(10) WATER LEVELS:

Depth of first water, if known 43 ft.
Standing level after well completion 14 ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Self
Type of test Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test 14 ft. At end of test 14 ft
Discharge 450 gal/min after 10 hours Water temperature
Chemical analysis made? Yes ☒ No ☐ If yes, by whom? Cal Agway
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 491 ft. Depth of completed well 491 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	1	Top Soil
1	5	Hard Pan
5	9	Lava Rock, Black
9	11	Hard Soil
11	12	Lava Rock, Black
12	43	Clay, Light Brown
43	43.5	Rocks
43.5	76	Clay, Light Brown
76	127	Blue Clay
127	128	Rock
128	156	Sand Stone
156	176	White Chalk
176	235	Gravel & Sand
235	244	Rock & Clay
244	312	Sand Stone
312	327	Chalk
327	328	Rock
328	379	Sand Stone, Black
379	491	chalk

Work started 6-15 19 80 Completed 7-30 19 80

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED (Well Driller)

NAME J L Ranch
(Person, firm, or corporation) (Typed or printed)

Address
City Zip
License No. Date of this report

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

#090143
State No. _____

WELL DATA

DISTRICT _____

PAGE

Owner _____ State No. _____
Address _____ Other No. _____
Tenant _____
Address _____

Type of Well: Hydrograph ☐ Key ☐ Index ☐ Semiannual ☐
Location: County Modoc Basin Big Valley No. _____
U.S.G.S. Quad. Bieber Quad. No. _____
A ___ ¼ ___ ¼ Section 16, Twp. 38N, Rge. 8E MD SB Base & Meridian
Description ¼ mile North From AZ, ¼ mile east from Fuley Ln

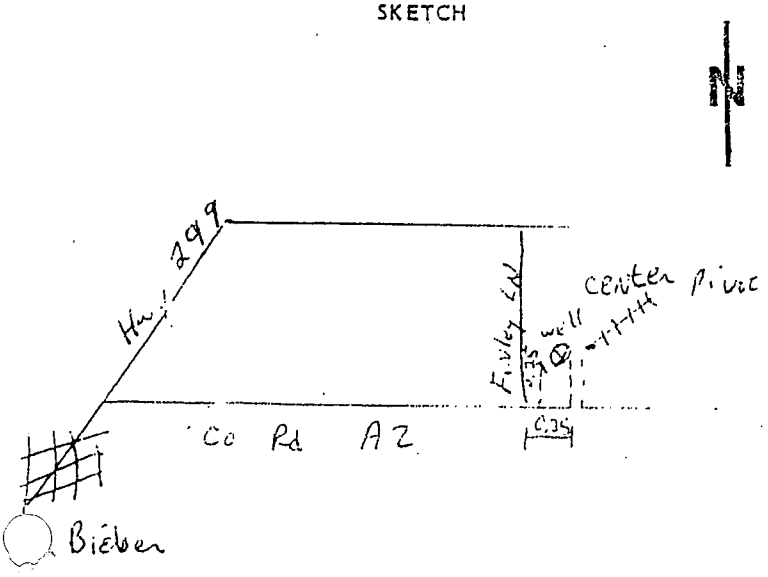
Reference Point description observation plug - South of Pump base

_____ ft. above / below land surface. Ground Elevation 4168 Ft.
Reference Point _____ ft. Determined from Quad
Well Location _____ Condition IN USE Depth 491 Ft.
_____ in., perforations _____

Measurements By: DWR ☐ USGS ☐ USBR ☐ County ☐ Irr. Dist. ☐ Water Dist. ☐ Cons. Dist. ☐
Chief Aquifer Name _____ Depth to Top Aq. _____ Depth to Bot. Aq. _____
Type of Material _____ Perm. Rating _____ Thickness _____
Gravel Packed? Yes ☐ No ☐ Depth to Top Gr. _____ Depth to Bot. Gr. _____
Supp. Aquifer _____ Depth to Top Aq. _____ Depth to Bot. Aq. _____
Driller Leroy Bett
Date drilled 7/80 Log, filed _____ open (1) _____ confidential (2) 090143
Equipment: Pump, type turbine make POMONA
Serial No. PK7930 Size of discharge pipe _____ in.
Power, Kind elect Make _____
H. P. 100 Motor Serial No. _____
Elec. Meter No. _____ Transformer No. _____
Yield 450 G.P.M. Pumping level _____ ft.

Water Analysis: Min. (1) _____ San. (2) _____ H.M. (3) _____
Water Levels available: Yes (1) _____ No _____
Period of Record: Begin _____ End _____
Collecting Agency: _____
Prod. Rec. (1) _____ Pump Test (2) _____ Yield (3) _____

SKETCH



REMARKS

measurable through observation plug
South of pump base
10/25/81 40.4 ft from ref pt

Recorded by: B Lewis
Date 11/81

DWR 429 (Rev. 4/70)

#218

REGION 5

COUNTY LASSEN

NEAR BIEBER #218

DIVISION OF WATER RESOURCES
DEPARTMENT OF PUBLIC WORKS
STATE OF CALIFORNIA

WELL LOG

BASIN BIG VALLEY

DWR No. 38N/8E-17K1 MDB & M

OTHER Nos. 17K1

CONFIDENTIAL LOG
Water Code Sec. 13752

LOCATION P.H., 100' W OF RANCH HOUSE. 25' SE OF PAVED RD., 1.1 MILE S HWY 299, 8.0 SW OF ADIN.

OWNER. ADDRESS.

DRILLED BY JACK CONNER ADDRESS BIEBER

DRILLING METHOD CABLE TOOL GRAVEL PACKED DATE COMPLETED 1948

SIZE OF CASING DEPTH 6" about 30' STRUCK WATER AT

PERFORATIONS NONE SIZE No.

WATER LEVEL BEFORE PERFORATING AFTER

TEST DATA: DISCHARGE G. P. M. DRAWDOWN FT. HOURS RUN

OTHER DATA AVAILABLE: WATER LEVEL RECORD ANALYSIS

SURFACE ELEV. DATUM SOURCE OF INFORMATION JACK CONNER

DEPTH	ELEV. OF BOTTOM OF STRATUM	MATERIAL	THICK-NESS	SP. YIELD %	
		Mostly clay – Jack Conner thinks there was "white sand in bottom of hole.			
		Supposedly 160 – 200' deep			
					CONFIDENTIAL LOG Water Code Sec. 13752

FOR FIELD COPIES USE ALTERNATE LINES

LOG OBTAINED BY D P Scott DATE 8-3-57 SHEET 1 OF 1

FORM 263. 8642 12-54 5M ② SPO

3SN/9E-18

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 138559 ✓

State Well No. ____

Other Well No. ____

(1) Owner

Address

City

(2) LOCATION OF WELL (See instructions):

County: Tulare Owner's Well Number

Well address if different from above

Township: 18 N. Range: 9 E. Section: 18

Distance from cities, roads, railroads, fences, etc.:

SW ¼ of NW ¼ near Wild Rd.

(3) TYPE OF WORK:

New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☐
Irrigation ☒
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

WELL LOCATION SKETCH

(5) EQUIPMENT:

Rotary ☒ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☐ No ☒ Size: ____
Diameter of bore: ____
Packed from ____ ft. to ____ ft.

(7) CASING INSTALLED:

Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	21	16	250

(8) PERFORATIONS:

Type of perforating or size of screen:

From ft.	To ft.	Slot Size

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 21 ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ____ ft.
Method of sealing: Puddling - Cement

(10) WATER LEVELS:

Depth of first water, if known: 20' ft.
Standing level after well completion: 10' ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Gerbell
Type of test: Pump ☒ Bailer ☐ Air lift ☐
Depth to water at start of test: 10' ft. At end of test ____ ft.
Discharge: 800 gal/min after ____ hours Water temperature ____
Chemical analysis made? Yes ☐ No ☒ If yes, by whom? ____
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth ____ ft. Depth of completed well ____ ft.

from ft.	to ft.	Formation (Describe by color, character, size of material)
0	3	Top soil
3	10	Brown clay
10	18	Cement gravel
18	85	Brown sandstone-pumice
85	100	Hard brown sandstone clay
100	110	Hard gray clay
110	120	Brown sandstone pumice
120	130	White pumice
130	140	Brown sandstone
140	150	Brown sandstone pumice
150	160	Gray sandstone
160	175	Brown sandstone--pea gravel
175	190	Light brown clay
190	210	Brown sandstone
210	260	Brown sandstone pumice
260	315	Brown clay pumice
315	330	Gray sand clay
330	355	Black sandstone pumice
355	380	Black sandstone
380	410	Gray sandstone
410	420	Black sandstone--pea gravel
420	440	Gray sandy clay
440	470	Gray sandstone pumice
470	485	Gray clay
485	490	Gray sandstone pumice
490	520	Gray sandy clay

Work started: May 19 80 Completed: Aug. 19 80

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief

Signed: Roy O. Conner (Well Driller)

Name: Layne-Western Well Drilling, Inc. (Person, firm, or corporation) (Typed or printed)

Address: P.O. Box 94

City: Tulare, Calif. Zip: 93274

License No.: 336498 Date of this report: Dec. 80

CONDITIONED WATER CODE

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

39N/9E-16

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 138563

Notice of Intent No. _____

Local permit No. or Date _____

State Well No. _____

Other Well No. _____

(1) Owner

Name _____

Address _____

City _____

(2) LOCATION OF WELL (See instructions):

County Glenn Owner's Well No. other _____

Well address if different from above _____

Township 18 N. Range 9 E. Section 16

Distance from cities, roads, railroads, fences, etc. NW ¼ of SW ¼

(3) TYPE OF WORK:

New Well ☒ Deepening ☐

Reconstruction ☐

Reconditioning ☐

Horizontal Well ☐

Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☐

Irrigation ☒

Industrial ☐

Test Well ☐

Stock ☐

Municipal ☐

Other ☐

WELL LOCATION SKETCH

(5) EQUIPMENT:

Rotary ☒ Reverse ☐

Cable ☐ Air ☒

Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☐ No ☒ Size _____

Quantity of lost _____

Packed from _____ ft. to _____ ft.

(7) CASING INSTALLED:

Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	500	10	188

(8) PERFORATIONS:

Type of perforation or size of screen _____

From ft.	To ft.	Slot size

(9) WELL SEAL:

Was surface seal or casing well provided? Yes ☒ No ☐ If yes, to depth 40 ft.

Were strata sealed against pollution? Yes ☐ No ☐ Interval _____ ft.

Method of sealing Casing

(10) WATER LEVELS:

Depth of first water, if known 90'

Standing level after well completed 125'

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Driller

Type of test Pump ☐ Bailer ☐ Air lift ☒

Depth to water at start of test _____ ft. At end of test _____ ft.

Discharge 150 gal/min after 2 hours Water temperature Cool

Chemical analysis made? Yes ☐ No ☒ If yes, by whom? _____

Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth _____ ft. Depth of completed well _____ ft.

from ft.	to ft.	Formation (Describe by color, character, size of material)
0	2	Top soil
2	18	Cement gravel
18	25	Brown sandstone
25	35	Brown clay
35	45	Brown sandstone pumice
45	60	Brown sandy clay
60	90	Gray sandy clay
90	115	Brown sandy clay
115	150	Brown clay
150	165	Brown sandstone-pumice
165	170	Brown sandy clay
170	185	Brown sandstone--pumice
185	190	Hard brown clay
190	195	White sandstone pumice
195	215	Brown sandstone and clay
215	250	White sandstone pumice
250	320	Brown sandstone pumice
320	370	Hard brown sandstone
370	390	Brown sandstone pumice
390	450	Gray sandstone pumice
450	465	Black sandstone--pea gravel
465	475	Grey sandstone some pumice
475	485	White and gray pumice
485	495	Gray sandstone
495	500	Red sandstone pumice
500	525	Gray sandstone

Work started June 19 50 Completed June 19 50

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed Ray C. Conner (Well Driller)

NAME Conner Well Drilling Inc. (Person, firm, or corporation) (Type or print)

Address P.O. Box 94

City Artois, Calif. Zip 95917

License No. 150-298 Date of this report Dec. 50

DWR 188 (REV. 9-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

39N-8E-18

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

№ 127457

State Well No. _____

Other Well No. _____

(1) C[illegible]

Name

Addre

(2) **LOCATION OF WELL:**

County Modoc Owner's number, if any

Township, Range, and Section T39 N - R 8 E Sec. # 18

Distance from cities, roads, railroads, etc. S.W. ¼ of S.W. ¼

(3) **TYPE OF WORK** *(check):*

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) **PROPOSED USE** *(check):*

Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) **EQUIPMENT:**

Rotary ☒
Cable ☐
Other ☐

(6) **CASING INSTALLED:**

STEEL: X OTHER:

SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
0'	40'	8"	188			

If gravel packed

Size of shoe or well ring: none Size of gravel:

Describe joint Welded

(7) **PERFORATIONS OR SCREEN:**

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
		NONE		

(8) **CONSTRUCTION:**

Was a surface sanitary seal provided? Yes ☒ No ☐ To what depth 40 ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing Casing & cement

(9) **WATER LEVELS:**

Depth at which water was first found, if known 200 ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing 20 ft.

(10) **WELL TESTS:** Air test

Was pump test made? Yes ☐ No ☐ If yes, by whom? Driller

Yield: 30 gal./min. with ft. drawdown after 2 hrs.

Temperature of water Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) **WELL LOG:**

Total depth 250' ft. Depth of completed well 250' ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to ft.

0'-2' Top soil

2'-60' White clay

60'-140' Gray clay

140'-200' Blue clay

200'-205' Black sand

205'-250' Gray clay

CONFIDENTIAL LOG
Water Code Sec. 13752

CONFIDENTIAL LOG
Water Code Sec. 13752

Work started July 1973, Completed July 1973

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Conners' Well Drilling, Inc.
(Person, firm, or corporation) *(Typed or printed)*

Address P. O. Box 92 Alturas, Calif. 96101

[SIGNED] Roy A. Conners
(Well Driller)

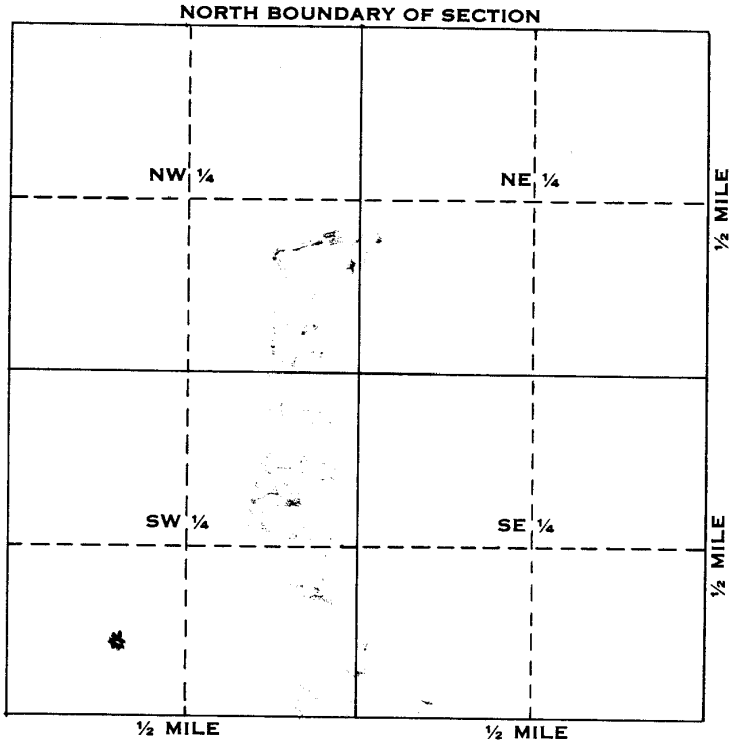
License No. 250298 Dated Feb. 1975

SKETCH LOCATION OF WELL ON REVERSE SIDE

DWR 188 (REV. 9-68)

67139-750 8-72 30M TRIP OT OSP

WELL LOCATION SKETCH

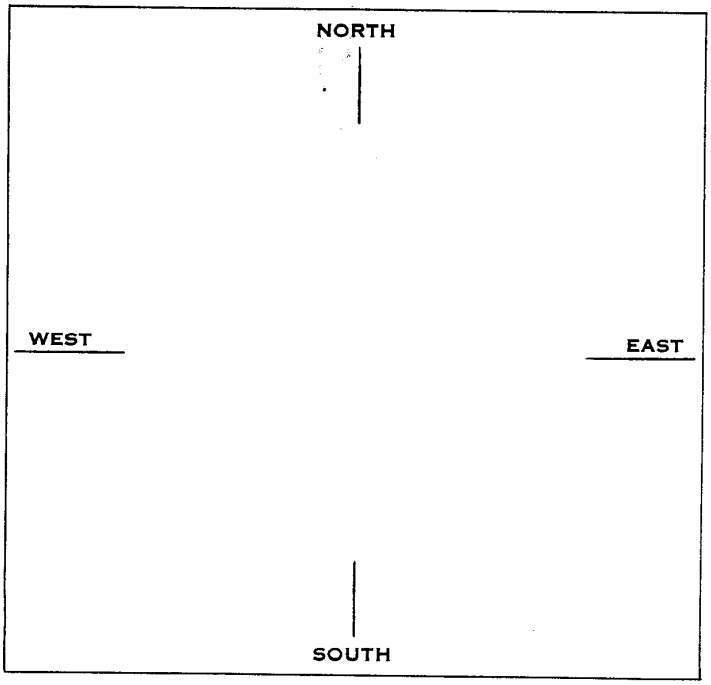


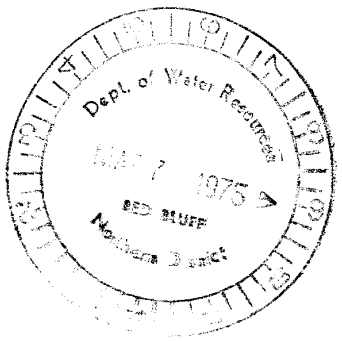
Township 39 N N/S

Range 8 E E/W

Section No. 18

A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.





B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.

38N/7E-20

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In
№ 128135
State Well No. 20 G8
Other Well No.
CONFIDENTIAL LOG
Water Code Sec. 13752

(1) OWNER:
N
A
—

(2) LOCATION OF WELL:
County Lassen Owner's number, if any
Township, Range, and Section T 38N R 7E Sec. 20
Distance from cities, roads, railroads, etc. N.E. ¼ of the N.E. ¼
M.D.B.M.

(3) TYPE OF WORK (check):
New Well X Deepening ☐ Reconditioning ☐ Destroying ☐
If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):
Domestic X Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:
Rotary ☐
Cable X
Other ☐

(6) CASING INSTALLED:
STEEL: OTHER:
SINGLE X DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
0	41	6"	.188			

If gravel packed

Size of casing or well pipe: 6"X6" X 5/8" Size of gravel:
Describe joint: welded

(7) PERFORATIONS OR SCREEN:
Type of perforation or name of screen: none

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.

(8) CONSTRUCTION:
Was a surface sanitary seal provided? Yes X No ☐ To what depth? 41 ft.
Were any strata sealed against pollution? Yes ☐ No ☐ If yes, note depth of strata
From 17 ft. to 23 ft.
From ft. to ft.
Method of sealing cased

(9) WATER LEVELS:
Depth at which water was first found, if known 17 ft.
Standing level before perforating, if known 17 ft.
Standing level after perforating and developing 17 ft.

(10) WELL TESTS: bailer
Was pump test made? Yes ☐ No X If yes, by whom?
Yield: 24 gal./min. with 5 ft. drawdown after 1 hr.
Temperature of water 54 Was a chemical analysis made? Yes ☐ No X
Was electric log made of well? Yes ☐ No X If yes, attach copy

(11) WELL LOG:
Total depth 183 ft. Depth of completed well 183 ft.
Formations: Describe by color, character, size of material, and structure

ft. to	ft.
0	1½ top soil
1½	3 hard pan
3	7 brown clay
7	14 brown sandstone
14	23 course sand, gravel & clay
23	154 gray clay
154	159 white pumice
159	183 layers of pumice and gray clay

CONFIDENTIAL LOG
Water Code Sec. 13752

Work started 6/1 19 76 Completed 6/3 19 76

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME John A. Van Meter
(Person, firm, or corporation) (Typed or printed)
Address P.O. Box 204 Malin, Oregon 97632
[Signed] John A. Van Meter
(As well driller)
License No. 194473 Dated 6/3 19 76

SKETCH LOCATION OF WELL ON REVERSE SIDE

39N-8E-21

Do Not Fill In

№ 127008

ORIGINAL
File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

CONFIDENTIAL LOG
Water Code Sec. 13752

State Well No.

(1) OWNER:

Name
Address

(2) LOCATION OF WELL:

County Modoc Owner's number, if any

Township, Range, and Section T 39 N - R 8 E Sec. # 21

Distance from cities, roads, railroads, etc. S.E ¼ of N.E.¼

(3) TYPE OF WORK *(check)*:

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE *(check)*:

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☒ Other ☐

(5) EQUIPMENT:

Rotary ☒
Cable ☐
Other ☐

(6) CASING INSTALLED:

STEEL X OTHER:
SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall
0'	40'	8"	188

If gravel packed

Diameter of Bore	From ft.	To ft.

Size of shoe or well ring: none

Size of gravel:

Describe joint Welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
30'	40'	8	2	1/8" X 3"

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☐ No ☒ To what depth ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing

(9) WATER LEVELS:

Depth at which water was first found, if known 25 ft.

Standing level before perforating, if known ft.

Standing level after perforating and developing 15 ft.

(10) WELL TESTS: Air test

Was pump test made? Yes ☐ No ☐ If yes, by whom? Driller

Yield: 150 gal./min. with ft. drawdown after 2 hrs.

Temperature of water cool Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth 300 ft. Depth of completed well 300 ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to	ft.	
0'	2'	Top soil
2'	25'	Brown clay some gravel
25'	30'	White sand some clay
30'	90'	Brown sandy clay
90'	100'	White sandstone
100'	130'	Brown & black sandstone
130'	140'	White & black sandstone
140'	190'	Brown sandy clay
190'	200'	Hard brown sandstone
200'	300'	Brown sandy clay

CONFIDENTIAL LOG
Water Code Sec. 13752

Work started Aug. 19 74 , Completed Aug. 19 74

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Conners' Well Drilling, Inc.
(Person, firm, or corporation) *(Typed or printed)*

Address P. O. Box 92 Alturas, Calif. 96101

[SIGNED] Roy C. Conners
(Well Driller)

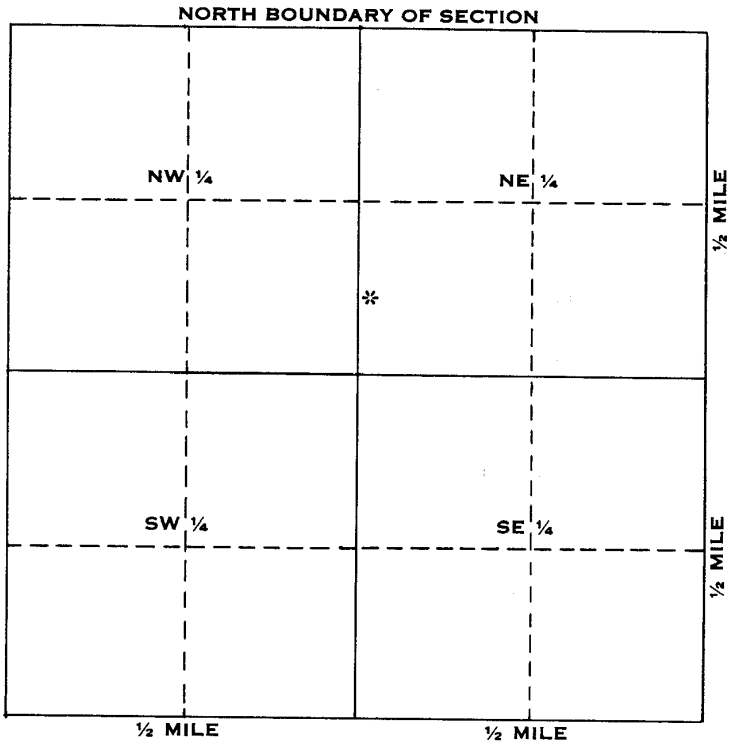
License No. 250298 Dated Feb. , 19 75

SKETCH LOCATION OF WELL ON REVERSE SIDE

DWR 188 (REV. 9-68)

67139-750 8-72 30M TRIP ①T OSP

WELL LOCATION SKETCH

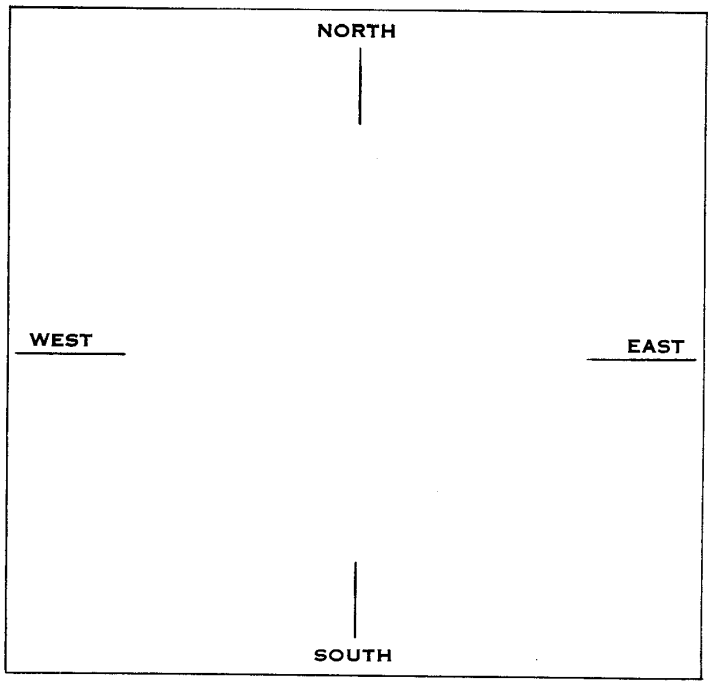


Township 39 N N/S

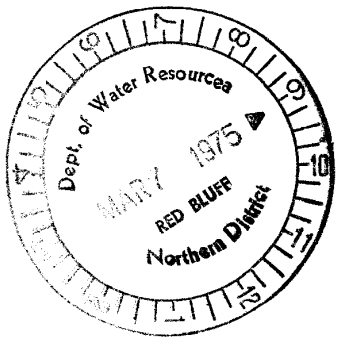
Range 8 E E/W

Section No. 21

A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.



B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.



ORIGINAL
File with DWR

WATER WELL DRILLERS REPORT

(Sections 7079, 7080, 7081, 7082, Water Code)

THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Do Not Fill In

No. 5322

CONFIDENTIAL LOG (Water Code Sec. 13752)

State Well No. T39N R7E-22G1

Other Well No.

(2) LOCATION OF WELL:

County Modoc Owner's number, if any

Township, Range, and Section T39N, R7E, Sec 22

Distance from cities, roads, railroads, etc. In Town of Lookout Calif

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☒ Industrial ☐ Municipal ☐

Irrigation ☐ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☐

Cable ☒

Other ☐

(6) CASING INSTALLED:

STEEL: OTHER:

SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall
0	115	8"	3/16

If gravel packed

Diameter of Bore	From ft.	To ft.

Size of shoe or well ring: 8" X 5"

Size of gravel:

Describe joint Welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☒ No ☐ To what depth ft.

Were any strata sealed against pollution? Yes ☒ No ☐ If yes, note depth of strata

From 25 ft. to 110 ft.

From 25 ft. to 110 ft.

Method of sealing Casing

(9) WATER LEVELS:

Depth at which water was first found, if known ft. 25

Standing level before perforating, if known ft.

Standing level ~~after perforating and developing~~ ft. 10

(10) WELL TESTS:

Was pump test made? Yes ☒ No ☐ If yes, by whom?

25 gal./min. with 60 ft. drawdown after 2 hrs.

Temperature of water Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth 260 ft. Depth of completed well 260 ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to	ft.	
0 — 3	soil	
3 - 15	Brown Clay	
15 - 30	Black sand	
30 — 110	Black sandy clay	
110 — 170	Blue sandy Clay	
170 — 190	Black Clay	
190 — 205	Blue clay	
205 — 260	Grey sandy clay	

Work started aug 14 19 66 Completed aug 21 19 66

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME JACK CONNER (Person, firm, or corporation) (*Typed or printed*)

Address Bieber Calif

[SIGNED] Jack Conner (Well Driller)

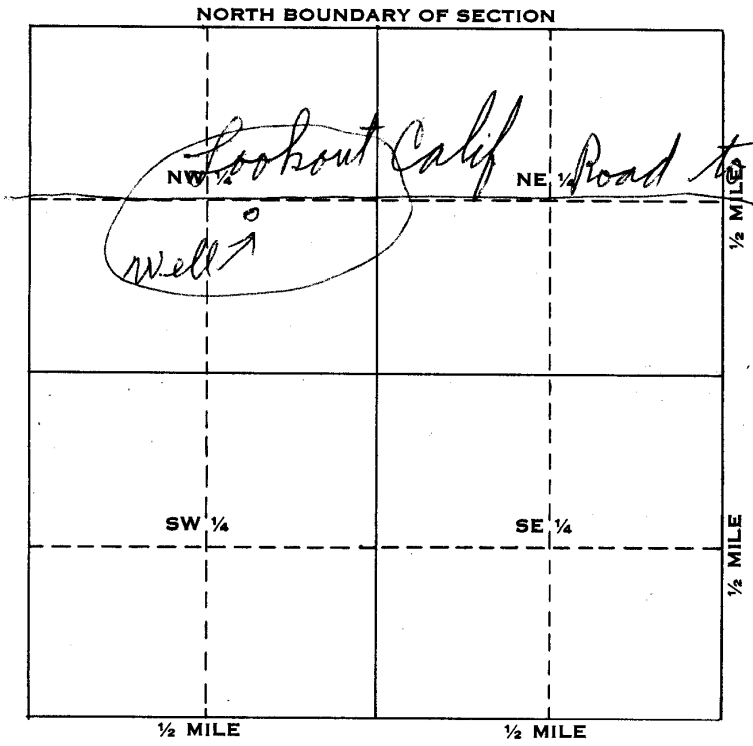
License No. 188934 Dated Sept 19, 1966

SKETCH LOCATION OF WELL ON REVERSE SIDE

DWR 188 (REV. 9-65)

56391-950 10-65 50M TRIP ① △ OSP

WELL LOCATION SKETCH



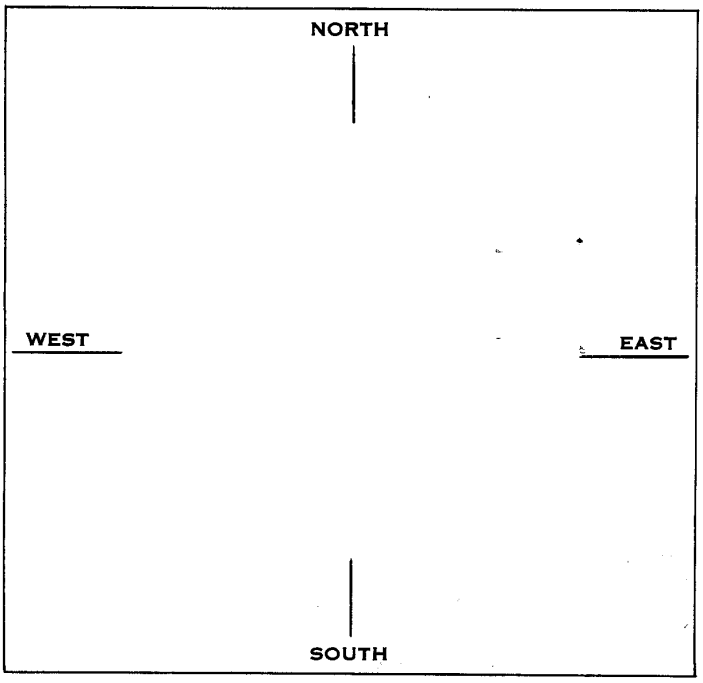
Township 39 N N/S

Range 7 E E/W

Section No. 22

SE ¼ of NW ¼

A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.



B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.

38N/7E-23

Do not fill in

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

No. 38108

Notice of Intent No.

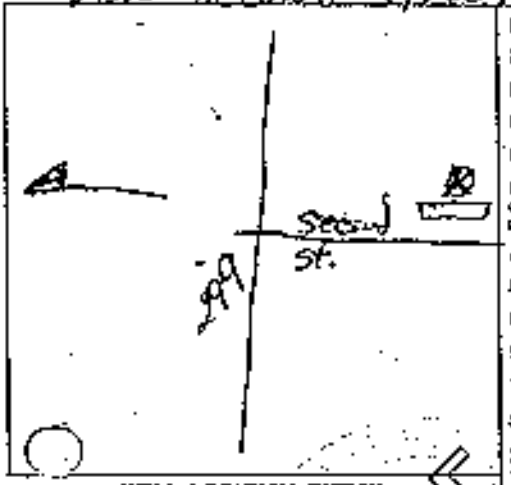
Local Permit No. or Date

State Well No. CONFIDENTIAL LOG

Other Well No. Water Code Sec. 13752

(1)
Address
City

(2) LOCATION OF WELL (See Instructions):
County Lassen Owner's Well Number 1
Well address if different from above same
Township 38 N Range 7 E Section 23
Distance from cities, roads, railroads, fences, etc.
Right Behind Green House, Last Second Street



WELL LOCATION SKETCH

(3) TYPE OF WORK:
New Well ☑ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:
Domestic ☐
Irrigation ☐
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) EQUIPMENT:
Rotary ☐ Reverse ☐
Cable ☑ Air ☐
Other ☐ Bucket ☐

(6) GRAVEL PACK:
Yes ☐ No ☑ Size
Diameter of bore
Packed from

(7) CASING INSTALLED:
Steel ☑ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0	23	8	12

(8) PERFORATIONS:
Type of perforation or size of screen

From ft.	To ft.	Slot size

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☑ No ☐ If yes, to depth 20 ft.
Were strata sealed against pollution? Yes ☐ No ☑ Interval ft.
Method of sealing Cement

(10) WATER LEVELS:
Depth of first water, if known 76 ft.
Standing level after well completion 50 ft.

(11) WELL TESTS:
Was well test made? Yes ☑ No ☐ If yes, by whom? me
Type of test Pump ☐ Bailer ☑ Air lift ☐
Depth to water at start of test 50 ft. At end of test 60 ft.
Discharge 30 gal/min after 1 hours Water temperature
Chemical analysis made? Yes ☐ No ☑ If yes, by whom?
Was electric log made? Yes ☐ No ☑ If yes, attach copy to this report

(12) WELL LOG: Total depth 84 ft. Depth of completed well 84 ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0	1	Top Soil
1	5	Hard pan
5	25	blue chalk
25	76	White chalk
76	84	white sand

Work started July 13, 19 77 Completed July 14, 19 77

WELL DRILLER'S STATEMENT:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

SIGNED Dean A. Davis (Well Driller)

NAME Dean A. Davis well drilling (Person, firm, or corporation) (Typed or printed)

Address P.O. Box 435

City Forestville, Calif. Zip 95436

License No. 316790 Date of this report July 14, 77

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

WATER WELL DRILLERS REPORT

(Sections 7079, 7080, 7081, 7082, Water Code)

THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Do Not Fill In

No. 5327

State Well No. T38N/R7E-24A1

Other Well No. CONFIDENTIAL LOG

Water Code Sec. 13752

(1) O'

Name

Address

(2) LOCATION OF WELL:

County Lassen Owner's number, if any

Township, Range, and Section 1 mile east of Bieber

Distance from cities, roads, railroads, etc. Calif T38N, R7E

Sec 24 NE¼ of NE¼

(3) TYPE OF WORK (check):

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE (check):

Domestic ☐ Industrial ☐ Municipal ☐

Irrigation ☒ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☐

Cable ☐

Other ☐

(6) CASING INSTALLED:

STEEL: OTHER:

SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall
0	102	14	3/16

If gravel packed

Diameter of Bore	From ft.	To ft.

Size of shoe or well ring: 10 X 5/8 Size of gravel:

Describe joint Welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
0	102	Machine Cut		1/8

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☐ No ☒ To what depth ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From ft. to ft.

From ft. to ft.

Method of sealing

(9) WATER LEVELS:

Depth at which water was first found, if known 9 ft.

Standing level before perforating, if known ft.

Standing level ~~after perforating and developing~~ 8 1/2 ft.

(10) WELL TESTS:

Was pump test made? Yes ☒ No ☐ If yes, by whom? Jack Conner

400 gal./min. with 120 ft. drawdown after 10 hrs.

Temperature of water Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth 192 ft. Depth of completed well 192 ft.

Formation: *Describe by color, character, size of material, and structure*

0 – 4	ft. to	soil ft.
4 – 12		gravel & clay
12 – 52		yellow clay
52 – 62		White Pumice sand
62 – 72		clay & sandstone
72 – 82		extra hard Black sandstone
82 – 92		grey gravel
92 – 95		Pumice sand
95 – 130		Cement sand
130 – 150		Black clay
150 – 155		green sandy clay
155 – 160		Black clay
160 – 180		Black sandstone
180 – 192		Grey sandstone

CONFIDENTIAL LOG

Water Code Sec. 13752

Work started Sept 25 19 66, Completed Oct 14 19 66

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME JACK CONNER

(Person, firm, or corporation) (Typed or printed)

Address Bieber Calif

[SIGNED] Jack Conner

(Well Driller)

License No. 188934 Dated Nov 11, 1966

SKETCH LOCATION OF WELL ON REVERSE SIDE

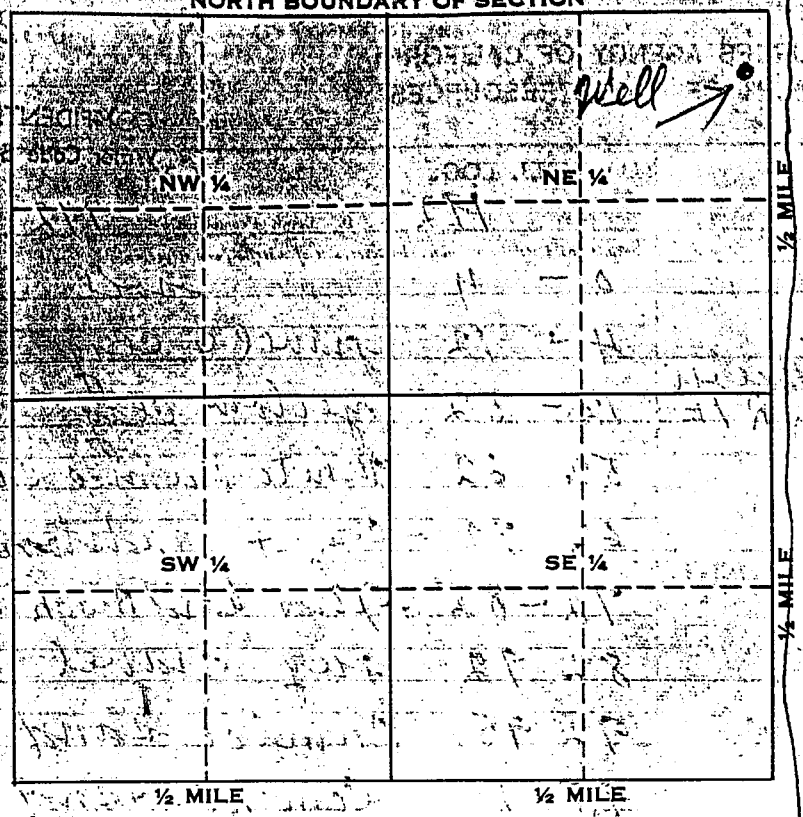
DWR 188 (REV. 9-65)

56391-950 10-66 TRIP ① △ OSP

86

A 2 Road

#5327



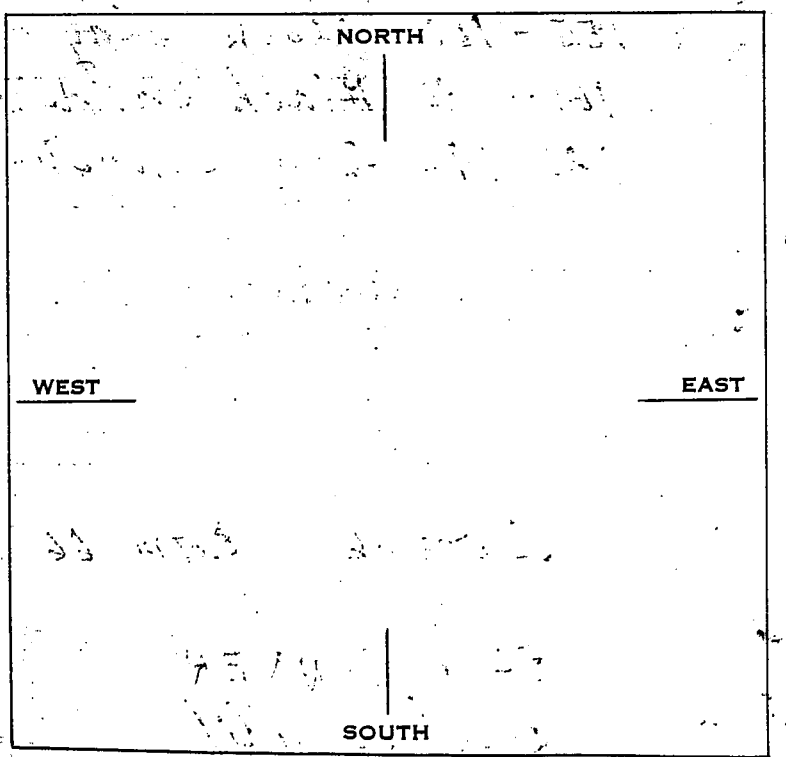
A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.

Township 38 N N/S

Range 7 E E/W

Section No. 24

NE ¼ of NE ¼



B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.

39N-7E-26

ORIGINAL
File with DWR

CONFIDENTIAL LOG
Water Code Sec. 13752

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do Not Fill In

№ 127484

State Well No. _____

Other Well No. _____

(1) OWNER:

Name _____

Address _____

(2) LOCATION OF WELL:

County Modoc Owner's number, if any

Township, Range, and Section T 39 N - R 7 E Sec # 26

Distance from cities, roads, railroads, etc. S E ¼ of N W ¼

(3) TYPE OF WORK *(check):*

New Well ☒ Deepening ☐ Reconditioning ☐ Destroying ☐

If destruction, describe material and procedure in Item 11.

(4) PROPOSED USE *(check):*

Domestic ☐ Industrial ☐ Municipal ☐
Irrigation ☒ Test Well ☐ Other ☐

(5) EQUIPMENT:

Rotary ☒
Cable ☐
Other ☐

(6) CASING INSTALLED:

STEEL ☒ OTHER:
SINGLE ☒ DOUBLE ☐

From ft.	To ft.	Diam.	Gage or Wall	Diameter of Bore	From ft.	To ft.
0'	400'	12"	188	20"	0'	400'

If gravel packed

Size of shoe or well ring: cone

Size of gravel: 3/8" to ½"

Describe joint Welded

(7) PERFORATIONS OR SCREEN:

Type of perforation or name of screen

From ft.	To ft.	Perf. per row	Rows per ft.	Size in. x in.
20'-60' & 114'	74'-84' 124'	12 Johnson screen	2	1/8" X 3" 100 slot
144-154' & 264-304' & 370'	184'-224' 328-370' 400'	12 Johnson screen	2	1/8" X 3" 100 slot

(8) CONSTRUCTION:

Was a surface sanitary seal provided? Yes ☐ No ☒ To what depth _____ ft.

Were any strata sealed against pollution? Yes ☐ No ☒ If yes, note depth of strata

From _____ ft. to _____ ft.

From _____ ft. to _____ ft.

Method of sealing _____

(9) WATER LEVELS:

Depth at which water was first found, if known 14' ft.

Standing level before perforating, if known _____ ft.

Standing level after perforating and developing 10' ft.

(10) WELL TESTS:

Was pump test made? Yes ☒ No ☐ If yes, by whom? Conners well

Yield: 1000 gal./min. with 170 ft. drawdown after 30 hrs.

Temperature of water cool Was a chemical analysis made? Yes ☐ No ☒

Was electric log made of well? Yes ☐ No ☒ If yes, attach copy

(11) WELL LOG:

Total depth 415 ft. Depth of completed well 400 ft.

Formation: *Describe by color, character, size of material, and structure*

ft. to ft.

0'-4' Top soil

4'-14' Brown clay

14'-25' Sand & gravel

25'-65' Gravel & boulders

65'-70' Gravel & some clay

70'-74' Brown clay

74'-82' Sand & gravel

82'-107' Blue clay

107'-114' Blue clay & some pumic

114'-120' Sand & pumic

120'-142' Blue clay

142'-150' Blue sand

150'-184' Blue sandy clay

184'-218' Sand & gravel

218'-265' Sandy clay

265'-298' Sand & gravel

298'-335' Sandy clay

335'-398' White pumic & black sand

398'-415' Black rock

Work started Aug. 1975, Completed Sept. 1975

CONFIDENTIAL LOG
Water Code Sec. 13752

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Conners' Well Drilling, Inc.
(Person, firm, or corporation) *(Typed or printed)*

Address P. O. Box 92 Alturas, Calif. 96101

[SIGNED] Roy O. Conner
(Well Driller)

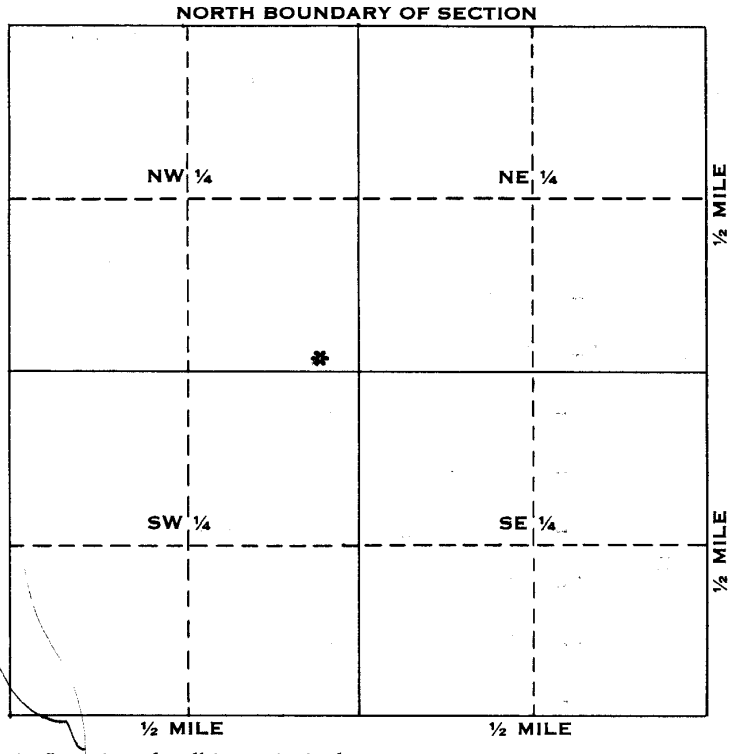
License No. 250298 Dated May, 1976

SKETCH LOCATION OF WELL ON REVERSE SIDE

DWR 188 (REV. 9-68)

67139-750 8-72 30M TRIP OT OSP

WELL LOCATION SKETCH

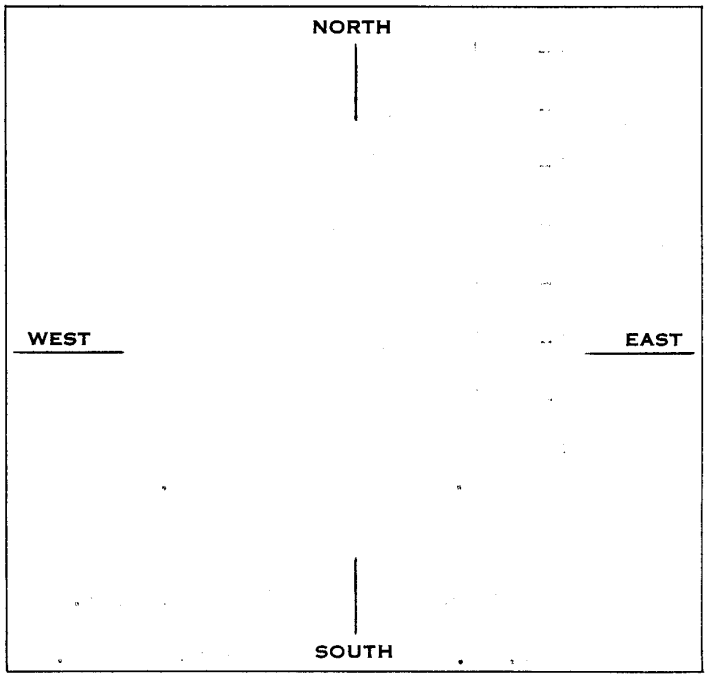


Township 39 N N/S

Range 7 E E/W

Section No. 26

A. Location of well in sectionized areas.
Sketch roads, railroads, streams, or other features as necessary.



B. Location of well in areas not sectionized.
Sketch roads, railroads, streams, or other features as necessary.
Indicate distances.

ORIGINAL
File with DWR

JAN 6 2011 RECD

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 0962825

DWR USE ONLY — DO NOT FILL IN
38N/08E-07
STATE WELL NO./STATION NO.
LATITUDE | LONGITUDE
APN/TRS/OTHER

Page ___ of ___
Owner's Well No. #1
Date Work Began July 2010, Ended July 2010
Local Permit Agency Lassen
Permit No. WE 2010-24 Permit Date 6/24/10

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Air

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	10'	Hard Brown Clay
10	15'	Brown Sandstone
15'	21'	Gravel & Sand
21	180'	Green Clay
180'	205'	Light Brown Clay
205'	220'	Hard Brown Clay
220'	238'	Porous White Sandstone
238'	255'	Brown Sandstone & Clay
255'	268'	Porous Brown Sandstone
268'	400'	Green Sandstone
400'	460'	Very Porous Sandstone & Red Gravel
460'	500'	Brown Clay
500'	580'	Grey & Green Clay
580'	670'	Green Clay & Pumice
670'	695'	Blue Sandstone (water)
695	720'	Grey Clay
720'	760'	Black Red Gravel (Big Water)
760	780'	Grey Sandstone

TOTAL DEPTH OF BORING 780' (Feet)
TOTAL DEPTH OF COMPLETED WELL 780' (Feet)

Name ___
Mailing Address ___
CITY ___ ZIP ___

WELL LOCATION

Address 654 655 Hwy 299E
City Bieber
County Lassen
APN Book 003 Page 050 Parcel 05
Township 38N Range 8E Section 7
Lat ___ DEG. ___ MIN. ___ SEC. N
Long ___ DEG. ___ MIN. ___ SEC. W

LOCATION SKETCH

NORTH
WEST: Office
EAST: Well, Well, Pivot
Hwy 299
SOUTH

*Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
✓ Irrigation ___ Industrial
___ MONITORING
___ TEST WELL
___ CATHODIC PROTECTION
___ HEAT EXCHANGE
___ DIRECT PUSH
___ INJECTION
___ VAPOR EXTRACTION
___ SPARGING
___ REMEDIATION
___ OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 15' (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 30' (Ft.) & DATE MEASURED July 2010
ESTIMATED YIELD * 1275 (GPM) & TEST TYPE Pump
TEST LENGTH 24 (Hrs.) TOTAL DRAWDOWN 217' (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60'	24"	✓				Steel	19.5"	250	NA
60'	320'	20"	✓	✓			Steel	15.5"	250	9/16
320	780	15"	✓	✓			Steel	12.25	250	5/11

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	60'		✓		3/8 Chips

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Conners Well Drilling
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS PO Box 92 CITY Alturas STATE Ca ZIP 96101
Signed Duane Conners C-57 LICENSED WATER WELL CONTRACTOR
DATE SIGNED 7/2010
C-57 LICENSE NUMBER 709156

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

90

OSP 03 78836

ORIGINAL
File with DWR

Page ___ of ___

Owner's Well No. ___

Date Work Began ___ Ended ___

Local Permit Agency ___

Permit No. 277-92 Permit Date ___

DEC 30 1992

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 484622

DWR USE ONLY — DO NOT FILL IN
39N/08E-33M
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DEPTH TO FIRST WATER ___ (Ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc*
0	18'	Brown Clay
18'	35'	Cemented Gravel
35	45'	Sticky Brown Clay
45'	48'	Pea Gravel Cemented
48'	110'	Brown Sand Stone
110'	135'	Sandy Grey Clay
135'	155'	Cemented Gravel
155'	170'	White Sand Stone
170'	190'	Black Sand Stone
190'	220'	Pink & White Pumice
220'	290'	Grey Clay
290'	298'	Black Sand Stone
298'	310'	Green Clay
310'	420'	Black Sand Stone
420'	470'	Grey Clay
470'	495'	Green & Black Sand Stone
495'	548'	Black Sand Stone & Pumice
548'	670'	Sticky Green Clay
670'	690'	Green Sand Stone & Clay Layers
690'	750'	Grey Sand Stone
750'	765'	Sticky Green Clay
765'	768'	Black Sand Stone
768'	800'	Green Clay & Sand Stone Layered

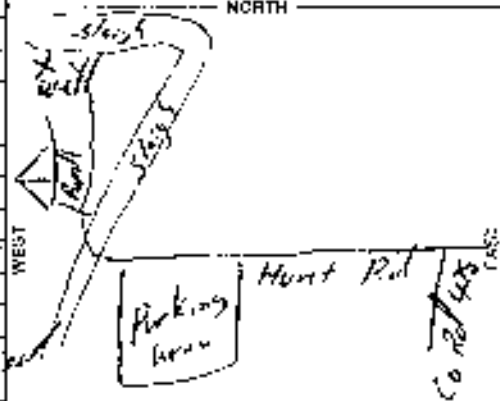
TOTAL DEPTH OF BORING 800' (Feet)
TOTAL DEPTH OF COMPLETED WELL 800 (Feet)

WELL LOCATION

Address ___
City Big Valley Lassen
County [redacted]
APN Book ___ Page ___ Parcel ___
or Township 34N Range 8E Section 33
or Latitude ___ DEG MIN SEC NORTH Longitude ___ DEG MIN SEC WEST

LOCATION SKETCH

NORTH



SOUTH
Illustrate or Describe Distance of Well from Landmarks such as Roads, Buildings, Fences, Rivers, etc.
PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

PLANNED USE(S) (✓)

___ MONITORING
WATER SUPPLY
___ Domestic
___ Public
✓ Irrigation
___ Industrial
___ "TEST WELL"
___ CATHODIC PROTECTION
___ OTHER (Specify)

DRILLING METHOD Rotary Air FLUID ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH OF STATIC WATER LEVEL 31 (Ft.) & DATE MEASURED 5/27/92
ESTIMATED YIELD* 2000 (GPM) & TEST TYPE Air
TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN ___ (Ft.)
* May not be representative of a well's long-term yield.

CASING(S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	STEEL	CONCRETE	FILL PIPE	MATERIAL/ GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	50'	28"			✓		Steel	24"	250	
50'	800'	24"	✓	✓			Steel	11"	250	3/11

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE: CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE-SIZE)
0	50'	✓			
0	800'			✓	¼-⅜

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Cannon's Well Drilling 466
(PERSON, FIRM OR CORPORATION) (TYPED OR PRINTED)

ADDRESS Po Box 92 CITY Gaitons STATE Calif ZIP 91101

Signed Duane Cannon
WELL OPERATOR/AUTHORIZED REPRESENTATIVE

DATE SIGNED 5/24/92 C-57 LICENSE NUM 760298

DWR 188 REV. 7-90 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

ORIGINAL
File with DWR

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 0951365

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.: 39N/08E-28
LATITUDE / LONGITUDE
APN/TRS/OTHER

Page ___ of ___
Owner's Well No. CA-281-10
Date Work Began 6/13 Ended 7/17
Local Permit Agency Modoc
Permit No. 2013-23 Permit Date 6/5/13

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Air

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	17'	Sticky Brown Clay
17'	30'	Loose Sand & Gravel
30	50'	Cemented Gravel & Sand
50'	65'	Hard Brown Sandstone
65'	100'	Cemented Gravel & Sandstone
100	140	Brown Sandstone
140'	160'	White & Yellow Pumice
160'	190'	Brown Sandstone & Clay
190'	200'	Very Porous White Pumice
200'	210'	Sticky Red Green Clay
210'	300'	Gray & Black Sandstone
300'	350'	Porous Brown Sandstone
350'	380'	Sticky Green & Brown Clay
380'	400'	Green Sandstone
400	575	Sticky Green Clay
575	670	Green Sandstone (Porous)
670	720	Porous Black Sandstone

TOTAL DEPTH OF BORING 720 (Feet)
TOTAL DEPTH OF COMPLETED WELL 720' (Feet)

WELL LOCATION

Address 659-695 Hwy 299 E Birch
City Big Valley
County Modoc
APN Book 012 Page 190 Parcel 08
Township 39N Range 08E Section 28
Lat ___ DEG. ___ MIN. ___ SEC. N Long ___ DEG. ___ MIN. ___ SEC. W

LOCATION SKETCH

NORTH
WEST
EAST
SOUTH
Eagle Ln
Birch Ln

*Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
✓ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 20' (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 25' (Ft.) & DATE MEASURED 7/13
ESTIMATED YIELD * 1600 (GPM) & TEST TYPE Pump
TEST LENGTH 24 (Hrs.) TOTAL DRAWDOWN 133' (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CONDUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60'	20"	✓				Steel	19.5	250	N/A
60'	720'	15.5"	✓	✓			Steel	12.25	250	9/16"

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	60'		✓		3/8 Chips
0	720			✓	3/8 Gravel Pac

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Conners Well Drilling (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS PO Box 92 CITY Alturas STATE Ca ZIP 96101
Signed Duane Conners C-57 LICENSED WATER WELL CONTRACTOR
DATE SIGNED 7/13 C-57 LICENSE NUMBER 709156

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

38 N07E 23M

ORIGINAL

File with DWR

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WATER WELL DRILLERS REPORT

Do not fill in

No. 090539

Notice of Intent No. _____

Local permit No. or Date _____

State Well No. _____

Other Well No. _____

(1

Add

City

(2) LOCATION OF WELL (See instructions):

County: Lassen Owner's Well Number _____

Well address if different from above _____

Township: 38 N. Range: 7 E. Section: 23

Distance from cities, roads, railroads, fences, etc. N.W. ¼ of N.W. ¼

(3) TYPE OF WORK:

New Well ☒ Deepening ☐

Reconstruction ☐

Reconditioning ☐

Horizontal Well ☐

Destruction ☐ (Describe destruction materials and procedures in Item 12)

(4) PROPOSED USE:

Domestic ☐

Irrigation ☐

Industrial ☐

Test Well ☐

Stock ☐

Municipal ☒

Other ☐

WELL LOCATION SKETCH

(5) EQUIPMENT:

Rotary ☒ Reverse ☐

Cable ☐ Air ☒

Other ☐ Bucket ☐

(6) GRAVEL PACK:

Yes ☐ No ☒ Size _____

Diameter of bore _____

Packed from _____ ft. to _____ ft.

(7) CASING INSTALLED:

Steel ☒ Plastic ☐ Concrete ☐

From ft.	To ft.	Dia. in.	Gage or Wall
0'	62'	12"	188

(8) PERFORATIONS:

Type of perforation or size of screen

From ft.	To ft.	Slot size

(9) WELL SEAL:

Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 62' ft.

Were strata sealed against pollution? Yes ☐ No ☒ Interval _____ ft.

Method of sealing Casing & cement

(10) WATER LEVELS:

Depth of first water, if known 65' ft.

Standing level after well completion 21' ft.

(11) WELL TESTS:

Was well test made? Yes ☒ No ☐ If yes, by whom? Modoc Pump

Type of test Pump ☒ Bailer ☐ Air lift ☐

Depth to water at start of test 21' ft. At end of test 150' ft.

Discharge 295 gal/min after 24 hours Water temperature _____

Chemical analysis made? Yes ☐ No ☒ If yes, by whom? _____

Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 200' Depth of completed well 200' ft.

from ft.	to ft.	Formation (Describe by color, character, size or material)
0'	1'	Top soil
1'	18'	Brown sandy clay
18'	65'	Blue clay
65'	72'	White sand & pumic
72'	77'	Blue clay
77'	90'	Black sandstone
90'	100'	Grey & red pumic
100'	110'	Red & gray sandstone pumic
110'	120'	Gray sandstone
120'	145'	Black sandstone
145'	150'	Blue clay
150'	175'	Hard gray sandy clay
175'	200'	Gray sandstone

Work started Sept 19 82 Completed Sept 19 82

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Signed Ray A Conners 466 (Well Driller)

NAME Conners' Well Drilling, Inc. (Person, firm, or corporation) (Typed or printed)

Address P. O. Box 92

City Alturas, Calif. Zip 96101

License No. 250298 Date of this report Oct 82

DWR 188 (REV. 7-76) IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

290 G.P.M. @ 87' 260 G.P.M. @ 65' 235 G.P.M. @ 50'

ORIGINAL
File with DWR FEB - 7 2013

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet

No. 0962842

DWR USE ONLY — DO NOT FILL IN
38N / 07E - 23
STATE WELL NO./STATION NO.
LATITUDE / LONGITUDE
APN/TRS/OTHER

Page ___ of ___
Owner's Well No. # 1-11
Date Work Began 6-11, Ended 6-11
Local Permit Agency Lassen County
Permit No. WE 2010-33 Permit Date 2010

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Air

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	2'	Gravel & Cindars
2'	10'	Cemented Gravel
10'	70'	Grey Clay
70'	80'	White Pumicy
80'	90'	Black Sandstone
90'	125'	White & Pink Pumicy
125'	145'	Green Sandstone
145'	155'	Green Clay
155'	240'	Green Sandstone & Clay Layered

TOTAL DEPTH OF BORING 240' (Feet)
TOTAL DEPTH OF COMPLETED WELL 240' (Feet)

WELL OWNER

WELL LOCATION

Address (Bike Path)
City
County Lassen
APN Book 001 Page 130 Parcel 55
Township 38N Range 07E Section 23
Lat ___ N Long ___ W
(DEG. MIN. SEC.) (DEG. MIN. SEC.)

LOCATION SKETCH

NORTH
CDF
WEST
well 11
Ball Park
EAST
SOUTH

*Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. **PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY *(Describe Procedures and Materials Under "GEOLOGIC LOG")*

USES (✓)

WATER SUPPLY
___ Domestic ✓ Public
___ Irrigation ___ Industrial
___ MONITORING
___ TEST WELL
___ CATHODIC PROTECTION
___ HEAT EXCHANGE
___ DIRECT PUSH
___ INJECTION
___ VAPOR EXTRACTION
___ SPARGING
___ REMEDIATION
___ OTHER (SPECIFY)

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 70' (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 25' (Ft.) & DATE MEASURED 6/11
ESTIMATED YIELD * 100 (GPM) & TEST TYPE Air
TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN 100' (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	60'	12"	✓				Steel	8 1/4	188	N/A
60'	240	8"	✓	✓			PVC	6"	40 Sch	10,000

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	TYPE CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	60'		✓		3/8 Chips

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Conners Well Drilling (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS Po Box 92 CITY Alturas STATE Ca ZIP 96101
Signed Duane Conners C-57 LICENSED WATER WELL CONTRACTOR
DATE SIGNED 6/11
C-57 LICENSE NUMBER 709156

DWR 188 REV. 05-03 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM OSP 03 78836

Appendix 8C New Monitoring Well Construction Report

Big Valley Monitoring Well Construction Report

Prepared for:
-North Cal-Neva Resource Conservation & Development Council
(on behalf of the Modoc County Groundwater Sustainability Agency)
-Lassen County Groundwater Sustainability Agency

Submitted by:
GEI Consultants, Inc.
2868 Prospect Park Drive, Suite 400
Rancho Cordova, CA 95670
916-631-4500

April 13, 2021
Projects 1901816 and 1901113

David Fairman, PG #9025, CHG #1000

Rodney A. Fricke, PG #4089, CHG #11

Table of Contents

Tables

Figures

Drawings

Attachments

Attachment A: Permits and CEQA
Attachment B: Field Lithologic Logs
Attachment C: Photos
Attachment D: Driller's DWR Well Completion Reports
Attachment E: Pump Test Data
Attachment F: Site 3 Retrofit Documentation
Attachment G: Water Quality Analyses
Attachment H: Transducer Data
Attachment I: Survey Report

1. Introduction

GEI Consultants, Inc. (GEI) prepared this well completion report for North Cal-Neva Resource Conservation & Development Council (North Cal-Neva) and the Lassen County Groundwater Sustainability Agency (GSA) to document the drilling, lithologic logging, and well installation activities associated with four monitoring well sites in Modoc County and one well site in Lassen County (**Figure 1**). The wells are located within the Big Valley Groundwater Basin (BVGB) in support of developing a Groundwater Sustainability Plan (GSP) to comply with the Sustainable Groundwater Management Act (SGMA). North Cal-Neva has participated on behalf of the Modoc County GSA.

The construction of these wells was funded through two grants obtained from the California Department of Water Resources (DWR) through the Proposition 1 Sustainable Groundwater Planning Grant Program. This program provided funds to support sustainable groundwater planning in severely disadvantaged communities (SDAC) (Category 1) and for the development of GSPs (Category 2). The Modoc County side of the BVGB is designated as a SDAC and the Lassen County side is designated as a disadvantaged community (DAC). North Cal-Neva obtained a Category 1 grant on behalf of the Modoc County SDAC for the construction of four well clusters and the development of a groundwater recharge feasibility study. North Cal-Neva has partnered with the University of California Cooperative Extension (UCCE) to lead the feasibility study and support GEI with the well drilling portion of the project. Lassen County obtained a Category 2 grant to develop a GSP for the BVGB and, as part of the scope, provided funding for the construction of one well cluster. Because the two grant projects are related and support one another toward the development of a GSP, GEI has provided a single report for the completion of the five well clusters.

2. Well Locations

Figure 1 shows the locations of new and existing monitoring wells from the California Statewide Groundwater Elevation Monitoring (CASGEM) program, which have been monitored for water levels by the Department of Water Resources (DWR) staff going as far back as the 1950's and are currently monitored under the county CASGEM plans. These existing CASGEM wells are typically production wells that are used for domestic and/or agricultural purposes.

The new wells are dedicated monitoring wells constructed as five clusters, including one deep well and three shallow wells in close proximity to each other. The three shallow wells are located in a triangular formation to allow the calculation of groundwater flow direction and gradient. Wells were sited, designed, and constructed to assist in future groundwater

monitoring and sampling efforts associated with development and implementation of the BVGB GSP. The well clusters were sited and drilled to achieve the following goals:

- Provide groundwater level data in the main (deep) portion of the aquifer at locations throughout the Basin using wells dedicated to monitoring (i.e. no pump)
- Provide shallow groundwater levels to determine the local direction and magnitude of flow (using the 3 shallow wells at each site) to inform the GSAs about the interaction of the groundwater aquifer with major streams and/or uplands recharge areas shown on **Figure 1**
- Provide lithologic information to the GSAs to use in developing hydrogeologic cross sections to support the hydrogeologic conceptual model (HCM) portion of the GSP
- Provide water quality information to establish the general quality of groundwater in main portion of the aquifer and potentially to inform the GSAs on the source of recharge to the Basin

The well cluster sites were located to achieve these goals and sited on county properties. Site 1 is located on the county-owned Adin Airport, Sites 2 and 3 are located on Modoc County road easements, Site 4 is located on the county-owned Lookout Cemetery, and Site 5 is located on Lassen County property in Bieber (roads maintenance station and county park ballfields). Site 3 was originally proposed for drilling closer to Ash Creek on the Ash Creek State Wildlife area, owned by the California Department of Fish and Wildlife (CDFW). However, after discussion about obtaining easements and permits needed to drill on the CDFW site, the length and cost of activities to drill on the site did not fit the schedule and budget for North Cal-Neva's grant.

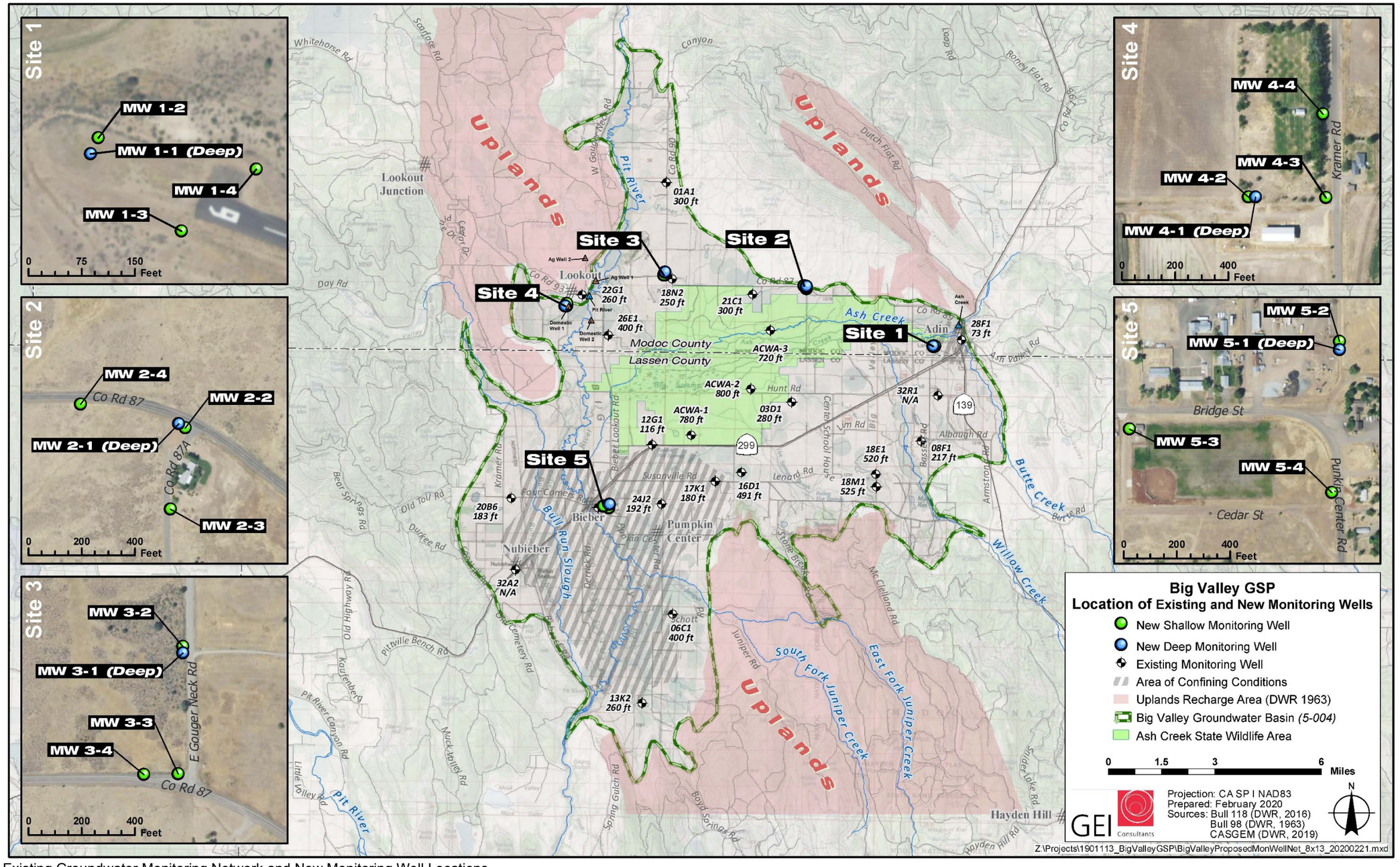


Figure 1: Existing Groundwater Monitoring Network and New Monitoring Well Locations

3. Pre-Field Activities

GEI prepared a Bid Package for the drilling and monitoring well construction activities and an optional site walk was performed on June 4, 2019. Bids were received from four drilling contractors. Maggiora Brothers Drilling, Inc., of Watsonville, California (Maggiora) was selected to perform the work as the lowest qualified bid to perform the drilling for both the North Cal-Neva and Lassen County projects.

Both projects were determined to qualify for categorical exemptions under Article 19 of the California Environmental Quality Act (CEQA) guidelines. Notices of these exemptions were posted by both counties and submitted to the state clearinghouse. Prior to the start of drilling activities, well drilling permits were obtained by Maggiora from the Lassen and Modoc County Departments of Environmental Health. Maggiora obtained an encroachment permit from the Modoc County Roads department for Sites 2 and 3. Copies of the permits and the CEQA exemption are included in **Attachment A.**

On September 4, 2019, site visits were made to all five sites. Staff from GEI, Maggiora, UCCE, Modoc County Roads, Modoc County, and Lassen County were present during the site visits where each proposed well location was marked. A Health and Safety Plan (HASP) for the field work was prepared by GEI prior to the start of field activities and the HASP was shared with all parties involved in the field portions of the projects.

4. Drilling and Lithologic Logging

All the well borings were drilled using the direct mud rotary drilling method. Each borehole was drilled with an 8-inch diameter bit and bentonite-based drilling mud. The deep monitoring wells were drilled to an approximate depth of 500 feet while boreholes for the shallow wells were drilled to depths between 50 and 100 feet. Potable water used during drilling for fluid and grouting was obtained from Lassen County roads maintenance yard in Bieber.

Samples of the drill cuttings were obtained every five feet for lithologic logging. Two sets of samples were prepared in resealable plastic bags and labeled with the sample depth, one set maintained by GEI and the other by UCCE. A GEI geologist performed lithologic logging of the deep borehole at each well site. The remaining three shallow boreholes at each well site were logged by UCCE staff who were trained on logging techniques by GEI. Lithologic logs included USCS Soil Classifications, Munsell color, percent gravel, sands, or fines, angularity, and mineralogy where it could be determined. The field lithologic logs are included in **Attachment B**.

5. Electric Logging and Well Design

Following the completion of drilling, Dewey Data, Inc. of Stockton, California performed down-hole electrical logging (e-logging). E-logs were only obtained for the deep wells. The e-logs are included on **Drawings 1** through **5** along with the corresponding well construction diagrams for all four wells at each well site and the lithologic log of the deepest boring at each well site. E-logs included measurements of temperature, spontaneous potential (SP), natural gamma radiation, and various resistivities, including the drilling fluid, lateral, single point, short normal (16-inch) and long normal (64-inch).

E-logs were used in conjunction with lithologic logs to produce a final design for each deep monitoring well, including the screen intervals, filter pack intervals, and annular seals. Shallow wells were designed using lithologic logs at each location to confirm that conditions were not substantially different than that observed at the deep well location. Variations in well construction were dependent on where coarse aquifer material was encountered.

6. Well Construction

Before installing the well screen and casing, reamed boreholes were backfilled (if necessary) to the design well depth using gravel pack or medium bentonite chips. The well screen and blank casings were then suspended in the borehole to the desired depth. The deepest monitoring well at each well site was constructed using flush-threaded, 2.5-inch diameter Schedule 80 polyvinyl chloride (PVC) blank casing and factory-slotted well screen. Shallow monitoring wells were completed in a similar manner using 2-inch diameter Schedule 40 PVC blank casing and well screens. Stainless steel centralizers were attached to the deep well casings at approximate 40-foot intervals with a centralizer above and below each screen interval to keep the casing centered in the borehole.

Filter pack (8x16 gradation) was then poured into the borehole via a tremie pipe. Medium bentonite chips were then placed in the boring to a depth of about 20 feet below ground surface (ft bgs) and allowed to hydrate. A neat cement sanitary seal was then poured to ground surface.

Following placement of the sanitary seal, the top of each monitoring well casing was cut down to about six inches below ground surface. An expansion well cap was installed on the top of each well casing. The surface completion at each well consists of an at-grade flush-mounted, traffic-rated steel vault set in a 4-foot by 4-foot wide concrete pad.

Well construction details for each monitoring well are provided in **Table 1** and the as-built diagrams for all the monitoring wells are shown in **Drawings 1** through **5**. **Attachment C** contains photos of the well drilling and construction. **Attachment D** contains the driller's well completion reports submitted to DWR.

7. Well Development

All monitoring wells were developed following construction to remove fine sediments and drilling mud from the gravel pack that may restrict flow into the well and/or affect water quality sampling results. The development also ensures that the filter pack settles into place. Development was performed by Maggiora and consisted of airlifting immediately after the well was constructed, followed by developmental pumping using a submersible pump. At the end of pump development, a groundwater sample was obtained from each deep well for laboratory analysis of water quality constituents.

A pumping test was also conducted for the deep well at each site. Wells were pumped at approximately 8 gallons per minute for an hour and depth to water was recorded throughout the test. The results from the pumping test are included in **Attachment E**.

8. Site 3 Retrofit

Following construction of monitoring wells at site MW-3, Modoc County roads staff observed that wells BVMW 3-1 and BVMW 3-2 were constructed on the county roadway in violation of the encroachment permit obtained from Modoc County Roads Department. The encroachment permit required the construction of both wells on the road shoulder. GEI contacted Maggiora to understand why the wells were drilled in the dirt roadway and was told that it was due to safety hazards of working on the shoulder. GEI informed Maggiora that this change in location was not approved and not acceptable. GEI discussed potential solutions with Maggiora, North Cal-Neva, Modoc County, Modoc County Roads, UCCE, and DWR. Potential solutions ranged from well modification to diverting the road slightly around the wells to re-drilling the wells.

After considering the options, their ability to meet the goals of the project, provide a safe roadway condition, and cost, the agencies agreed upon a solution to modify the well head to move it out of the roadway and onto the shoulder. Modification included excavating down 5 feet below the road base, cutting the PVC casing and installing a curved section of casing from the cut PVC to a traffic box located five feet west on the road shoulder. The excavated area was backfilled with a sand-cement slurry. Designs were sent to County of Modoc Roads Department for approval. Approved modifications were made to both BVMW 3-1 and BVMW 3-2. Construction details for the modified monitoring wells are shown in **Drawing 3**. Photos and correspondence regarding the retrofit are included in **Attachment F**.

Table 1: Well Construction Details

Well Name	Latitude, degrees (WGS84)	Longitude, degrees (WGS84)	Reference Point[1] Elevation (ft NAVD88)	Ground[2] Elevation (ft NAVD 88)	Drilling Start Date	Drilling End Date	Total Borehole Depth (ft bgs)	Total Well Depth (ft bgs)	Casing and Screen Type	Screen Slot Size (inches)	Screen Interval(s) (ft bgs)	Gravel Pack Interval (ft bgs)
Modoc County Wells												
BVMW 1-1	41.1880325	-120.9598526	4213.84	4214.17	11/18/2019	11/20/2019	470	265.5	2.5" Dia. SCH 80 PVC	0.030	175-185 195-215 245-265	170-279
BVMW 1-2	41.1881034	-120.9597792	4214.21	4214.54	12/6/2019	12/6/2019	60	52.5	2" Dia. SCH 40 PVC	0.032	32-52	25-57
BVMW 1-3	41.1877928	-120.9593371	4218.17	4218.50	12/7/2019	12/7/2019	59.5	50.5	2" Dia. SCH 40 PVC	0.032	30-50	24.5-55
BVMW 1-4	41.1880422	-120.9589947	4218.06	4218.39	12/8/2019	12/8/2019	59	49.5	2" Dia. SCH 40 PVC	0.032	29-49	24-54
BVMW 2-1	41.2118591	-121.0286214	4216.18	4216.51	2/12/2020	2/16/2020	505	250.5	2.5" Dia. SCH 80 PVC	0.030	210-250	182-505
BVMW 2-2	41.2118382	-121.0285515	4216.44	4216.77	2/18/2020	2/18/2020	75	70.5	2" Dia. SCH 40 PVC	0.032	50-70	40-75
BVMW 2-3	41.2109506	-121.0286823	4213.93	4214.26	2/19/2020	2/19/2020	75	70.5	2" Dia. SCH 40 PVC	0.032	50-70	40-75
BVMW 2-4	41.2119971	-121.0293786	4209.62	4209.95	2/20/2020	2/20/2020	65	60.5	2" Dia. SCH 40 PVC	0.032	40-60	30-65
BVMW 3-1	41.2169400	-121.1049557	4164.41[3] 4167.41[4]	4164.75	1/26/2020	1/28/2020	470	185.5	2.5" Dia. SCH 80 PVC	0.030	135-185	130-193
BVMW 3-2	41.2170083	-121.1049570	4164.58[3] 4167.58[4]	4164.92	1/31/2020	1/31/2020	45	40.5	2" Dia. SCH 40 PVC	0.032	25-40	22-45
BVMW 3-3	41.2157185	-121.1050902	4164.02	4164.36	2/1/2020	2/1/2020	55	50.5	2" Dia. SCH 40 PVC	0.032	25-50	22-53
BVMW 3-4	41.2157230	-121.1054095	4164.97	4165.31	2/2/2020	2/2/2020	100	50.5	2" Dia. SCH 40 PVC	0.032	25-50	22-55
BVMW 4-1	41.2029277	-121.1586996	4152.40	4152.73	11/1/2019	11/4/2019	500	425	2.5" Dia. SCH 80 PVC	0.020	385-415	370-429
BVMW 4-2	41.2029353	-121.1587904	4152.73	4153.06	11/12/2019	11/12/2019	79	74.5	2" Dia. SCH 40 PVC	0.032	54-74	44-79
BVMW 4-3	41.2029911	-121.1578593	4152.33	4152.66	11/14/2019	11/14/2019	101	80.5	2" Dia. SCH 40 PVC	0.032	60-80	45-90
BVMW 4-4	41.2035397	-121.1578433	4161.32	4161.65	11/15/2019	11/15/2019	100	93.5	2" Dia. SCH 40 PVC	0.032	73-93	55-100
Lassen County Wells												
BVMW 5-1	41.1218808	-121.1338666	4128.72	4129.05	12/13/2019	12/15/2019	555	540	2.5" Dia.SCH 80 PVC	0.030	485-535	457-544
BVMW 5-2	41.1219508	-121.1338622	4128.59	4128.92	1/8/2020	1/8/2020	120	115.5	2" Dia. SCH 40 PVC	0.032	65-115	57.5-117
BVMW 5-3	41.1211843	-121.1366445	4131.40	4131.73	1/10/2020	1/10/2020	100	85.5	2" Dia. SCH 40 PVC	0.032	65-85	55-94.5
BVMW 5-4	41.1205603	-121.1339942	4129.90	4130.23	1/12/2020	1/12/2020	95	90.5	2" Dia. SCH 40 PVC	0.032	70-90	60-93

[1] Reference Point is notch on top of PVC casing

[2] Ground elevation is the top of the well vault

[3] Actual elevation of Reference Point

[4] Corrected elevation of Reference Point (should be used for water level measurements to account for horizontal offset and curvature of casing)

ft = US survey feet

bgs = below ground surface

9. Water Quality Sampling and Results

Water quality samples were collected at each deep monitoring well following development. In addition, groundwater samples were collected from two domestic wells, two agricultural wells, and two surface water sites shown on **Figure 1**. All samples were collected by UCCE staff, cooled on ice, and transported under Chain-of-Custody (COC) to Basic Laboratory, Inc (Basic Lab) in Redding, CA. Basic Lab is an accredited lab under the State of California Environment Laboratory Accreditation Program (ELAP, #1677). The samples were analyzed for the following suite of constituents:

- General Mineral
- Inorganic Chemical (mostly dissolved metals)
- Volatile Organic Compounds

Results from sampling are shown in **Table 2** and laboratory reports can be found in **Attachment G**.

Water quality results showed generally good quality with a few constituents showing elevated concentrations at some locations. Total Dissolved Solids (TDS, a measure of the dissolved minerals (salts) in the water) concentrations were below the recommended secondary MCL established under state Title 22 drinking water standards and recommended agricultural thresholds.

Iron and Manganese were consistently elevated at all wells, which can be typical of volcanic terrains such as Big Valley. Iron and manganese concentrations in drinking water are subject to secondary standards for maximum contaminant levels (MCLs) due to aesthetics such as taste, color, and odor and are not regulated for human health concerns. These concentrations do not have negative impacts on agricultural uses according to recommended agricultural standards.

Elevated levels of Arsenic were observed in two wells, BVMW 2-1 and BVMW 4-1. Both wells are located in the northern portion of the basin, along the edges of the basin where the alluvial deposits meet the volcanic bedrock material. At both locations, arsenic levels exceeded the primary drinking water MCL of 10 µg/L which is intended to protect human health. Arsenic is a naturally occurring element and elevated concentrations are common in volcanic deposits.

Table 2: Water Quality Results

Constituent	Drinking Water Threshold [1]	Agricultural Threshold [5]	DLR	Unit	New Monitoring Well					Existing Domestic Well		Existing Ag Well		Surface Water	
					BVMW 1-1	BVMW 2-1	BVMW 3-1	BVMW 4-1	BVMW 5-1	DW2	DW3	AW5	AW6	Ash Ck	Pit R
Date Sampled:					12/16/2019	3/12/2020	3/12/2020	12/16/2019	3/12/2020	10/30/2019	10/30/2019	10/30/2019	10/30/2019	10/30/2019	10/30/2019
General Mineral															
Specific Conductance @25C	900 [2]	700	10	umhos/cm	334	341	313	249	215	367	212	611	385	165	366
Total Dissolved Solids	500 [2]	450	6	mg/l	251	479	377	201	169	248	171	389	261	122	239
pH	6.5-8.5 [3]	6.5-8.4	0.01	pH unit	7.63	7.92	8.30	8.17	8.43	7.95	7.69	7.58	7.96	8.07	8.33
Hardness-Total @CaCO3	--	--	5	mg/l	48	52	24	48	21	137	71	245	145	51	109
Alkalinity-Total @CaCO3	--	--	5	mg/l	155	125	140	111	91	171	101	250	151	82	155
Calcium	--	--	1	mg/l	8.8	13.1	7.4	10.4	2.9	27.5	17	52.1	30.1	10.7	25.2
Magnesium	--	--	1	mg/l	4.5	7.4	3.4	5.0	1.9	16.1	8.3	25.8	17.2	6.3	11.4
Sodium	--	69	1	mg/l	54.8	60.4	69.0	33.9	40.9	28.7	15.6	38.5	21.3	14.3	34.3
Potassium	--	--	1	mg/l	7.2	3.9	5.9	7.2	4.7	3.5	2.4	5.2	4.7	4.2	6.1
Bicarbonate	--	--	5	mg/l	189	153	171	135	111	209	123	305	184	100	189
Carbonate	--	--	5	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Hydroxide	--	--	5	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloride	250 [2]	106	1	mg/l	4.6	7.9	2.2	3.9	4.9	3.9	2.7	10.1	9.5	1.4	10.4
Sulfate	250 [2]	--	0.5	mg/l	0.77	28.3	14.6	7.01	4.95	15.1	3.71	48.1	19	1.23	17.2
Iron	300 [2]	5000	100	ug/l	592	11900	7640	336	120	101	ND	ND	147	179	740
Manganese	50 [2]	200	20	ug/l	181	244	309	56.6	28.2	189	ND	51.5	ND	ND	34.2
Copper	1000 [2] - 1300 [1]	200	50	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	5000	2000	50	ug/l	ND	ND	ND	ND	ND	67.3	ND	ND	ND	ND	ND
Inorganic Chemical (Dissolved)															
Aluminum	200 [2] - 1000 [1]	5000	5	ug/l	ND	43.3	87.6	ND	85.5	ND	ND	ND	ND	114	583
Antimony	6	--	0.5	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	10	100	2	ug/l	ND	12.0	3.78	10.5	3.60	ND	2.11	ND	ND	ND	4.14
Barium	1000	--	0.5	ug/l	34.9	41.1	6.87	36.8	15.4	ND	ND	ND	ND	ND	ND
Beryllium	4	100	0.5	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Boron	--	700	100	ug/l	16.6	13.6	50.6	17.5	55.7	ND	ND	ND	ND	ND	137
Cadmium	5	10	0.2	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium, Hexavalent (CrVI)	10 [4]	100	1	ug/l	ND	ND	ND	ND	ND	ND	3.29	ND	2.80	ND	ND
MBAS [6]	0.5	--	0.05	mg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	2	--	1	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	200	0.5	ug/l	0.63	0.67	ND	0.60	1.49	ND	ND	ND	ND	ND	ND
Selenium	50	20	2	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrate as N	10	--	0.45	mg/l	ND	ND	ND	ND	ND	ND	ND	1.32	1.87	ND	ND
Thallium	2	--	0.5	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Volitile Organic Compounds (VOCs)															
See Appendix D for list of VOCs teste	varies	varies	varies	varies	ND	ND	ND	ND	ND						
Miscellaneous															
Sodium Adsorption Ration (SAR)	--	13	N/A	N/A	3.7	3.3	5.3	2.2	4.6	1.1	0.8	1.1	0.8	0.9	1.4

Notes:

[1] Unless otherwise noted, the threshold is the California primary drinking water maximum contaminant level (MCL). (For more information on California MCLs, visit https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.html)

[2] California secondary drinking water MCL. Not a health hazard. MCL established based on consumer acceptance (aesthetics such as taste, color, and odor).

[3] USEPA Secondary MCL.

[4] This primary MCL is no longer in effect due to litigation. However, the State Water Resources Control Board is working to re-establish it.

[5] Unless otherwise noted, agricultural threshold based on guidelines by the Food and Agricultural Organization of the United Nations (Ayers and Westcot 1985)

[6] Methylene Blue Active Substances (MBAS) are a set of surfactants, foaming agents, and detergents.

DLR = Detection Limit for Reporting

ND = Not detected, concentration below the DLR

All samples analyzed by Basic Laboratory, Inc. in Redding, CA

-- Indicates no threshold has been identified

Measurement above Drinking Water or Agricultural threshold

10. Transducer Installation

Non-vented (absolute) pressure transducers were purchased and installed in each monitoring well following completion of construction and development. Two barometric transducers were installed to allow corrections for atmospheric pressure fluctuations. The transducers record water levels at frequent intervals to monitor changes in ground water levels and responses to changing ambient conditions such as storm events. **Attachment H** contains hydrographs for each well cluster, including groundwater elevations, directions and gradients of flow in each shallow zone, precipitation, and surface water stage.

11. Surveying

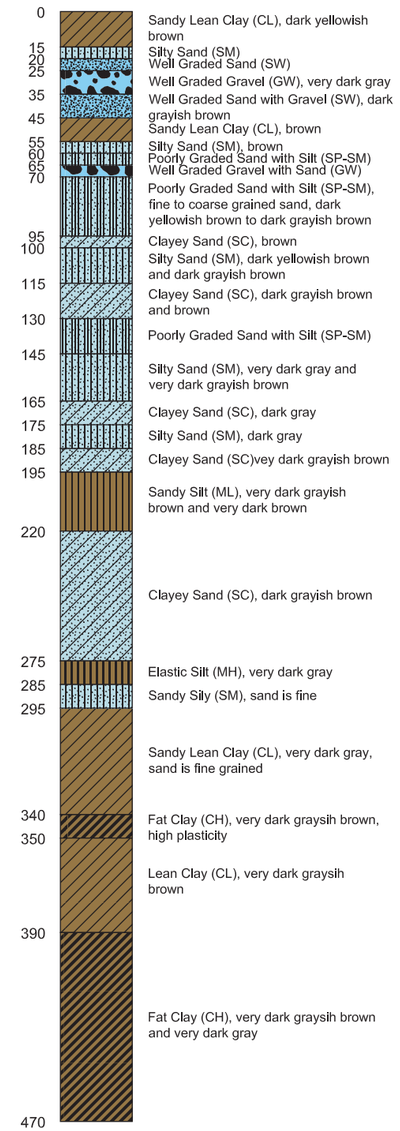
Following construction and development, each monitoring well was surveyed for horizontal location and elevation by Butler Engineering of Redding, CA using high-precision Global Positioning Survey (GPS) instruments. Horizontal control was established using two benchmarks, one located near the Adin Airport and one along Highway 299 approximately 2.5 miles northeast of Bieber. The latter horizontal control point was also used for vertical control.

At each well cluster, a precise site control point was established at one of the shallow wells (well ID ending in "-3") and was marked with a "PK nail" driven into the cement well pad. The PK nail was located with a horizontal accuracy of +/- 0.1 feet and a vertical accuracy of at least +/- 0.04 feet. From the site control point, horizontal locations and elevations of the reference point for each well were measured. The reference point was established as a notch in the top of the PVC well casing.

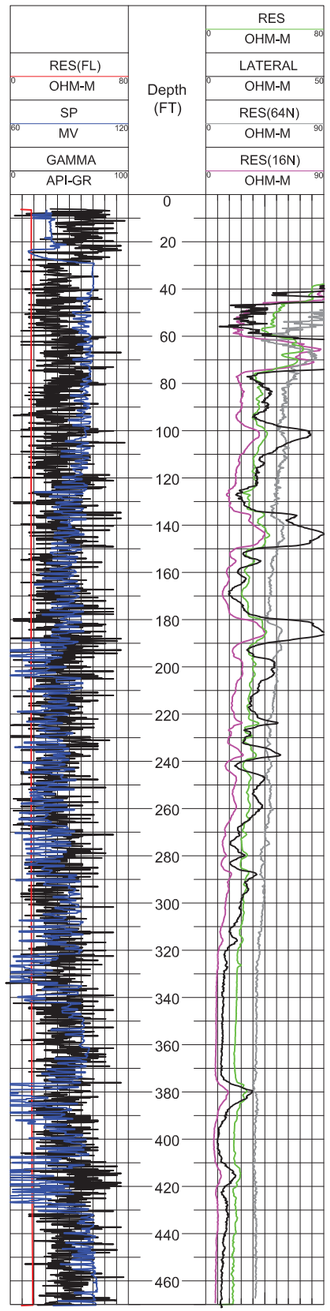
Survey data is included in **Table 1** and on **Drawings 1-5**, with the survey report included as **Attachment I**.

Drawings

LITHOLOGIC LOG

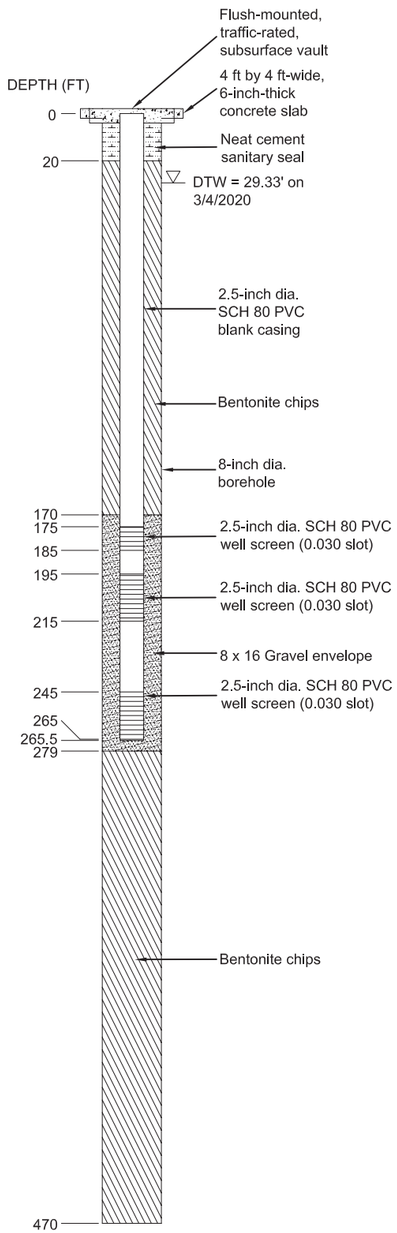


E-LOGS



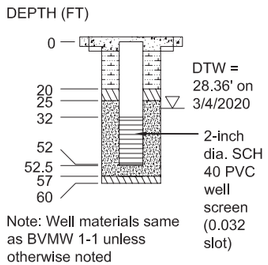
BVMW 1-1

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

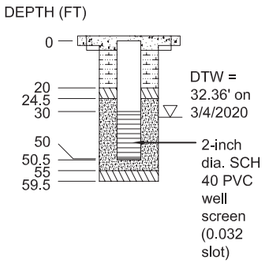
Latitude (WGS84): 41.1881034
Longitude (WGS84): -120.9597792
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4214.21
Top of Well Vault: 4214.54



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

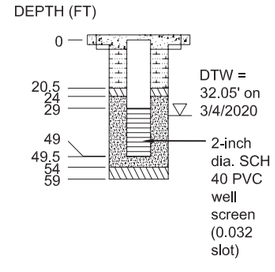
BVMW 1-3

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

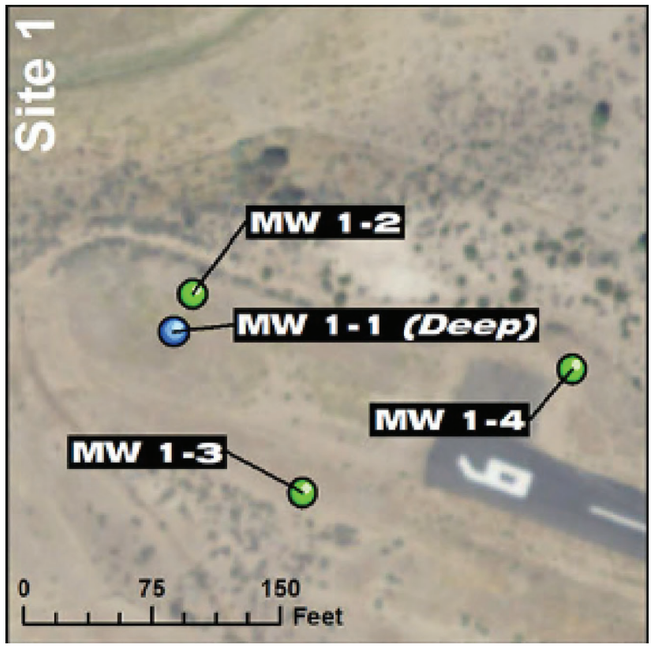


BVMW 1-4

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:

FUNDED BY:

PROJECT ENGINEER:

GEI Consultants
2868 PROSPECT PARK DRIVE
SUITE 400
RANCHO CORDOVA, CA 95670
(916)631-4500

DESIGNED:	CHECKED:
D. Fairman	J. Zumbro
DRAWN:	REVIEWED:
F. Olson / V. Yap	D. Fairman

PROFESSIONAL GEOLOGIST
DAVID FAIRMAN
No. 9025
STATE OF CALIFORNIA

Date: 4/13/2021

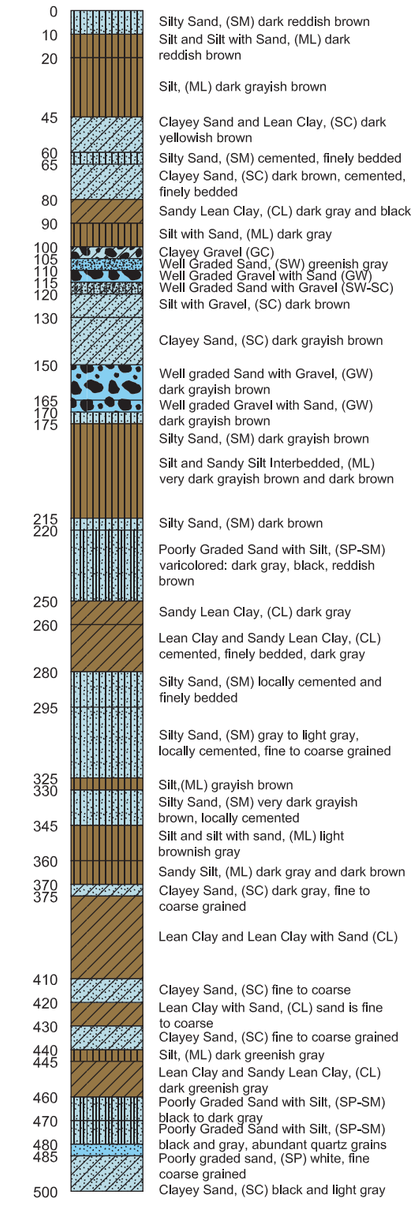
Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Nov-Dec 2019

BIG VALLEY
GROUNDWATER BASIN

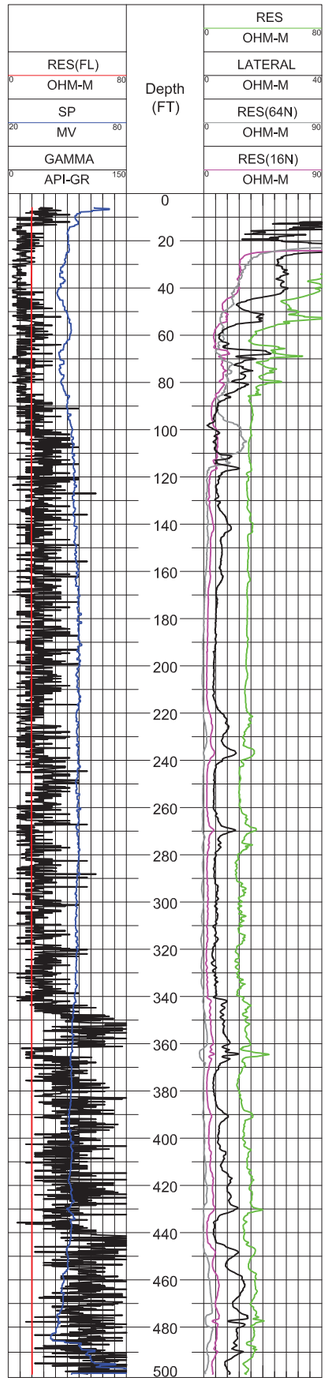
AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 1 ADIN AIRPORT

DRAWING 1

LITHOLOGIC LOG

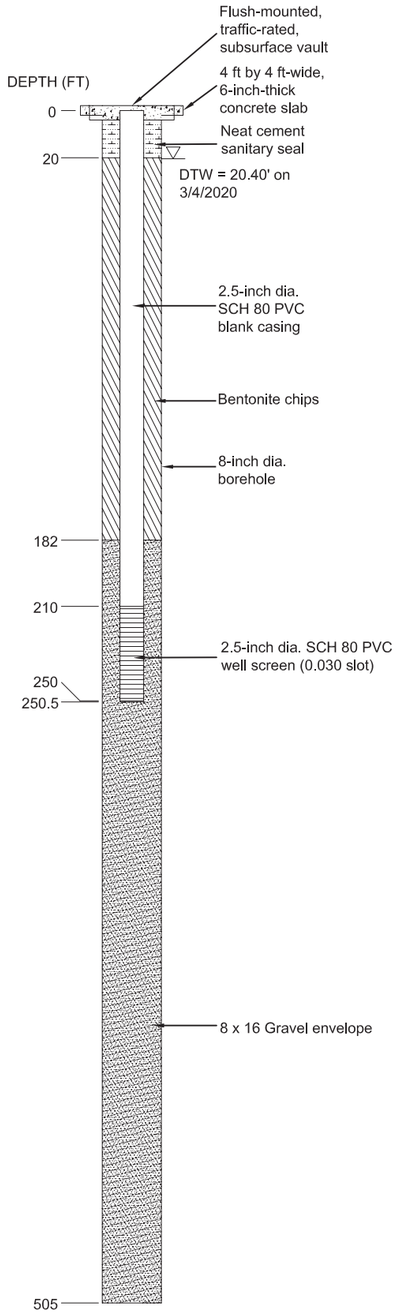


E-LOGS



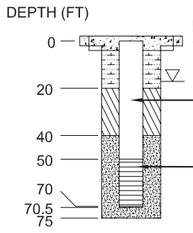
BVMW 2-1

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

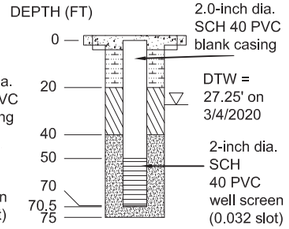
Latitude (WGS84): 41.2118382
Longitude (WGS84): -121.0285515
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4216.44
Top of Well Vault: 4216.77



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

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Longitude (WGS84): -121.0293786
Elevation in US Survey Feet (NAVD88)
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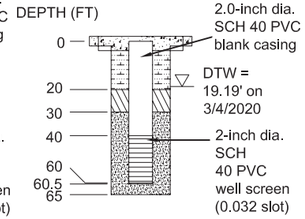
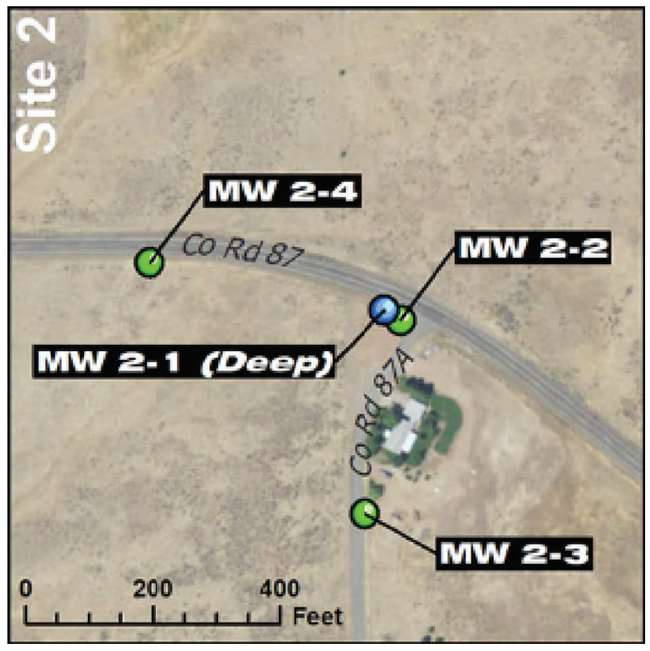
Top of Well Vault: 4209.95



SITE MAP



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PROFESSIONAL GEOLOGIST
DAVID FAIRMAN
No. 9025
STATE OF CALIFORNIA

Date: 4/13/2021

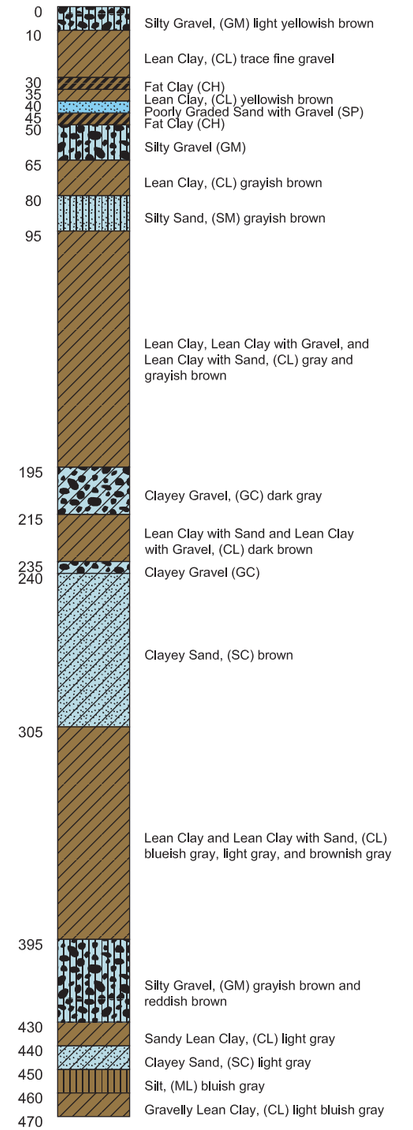
Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Feb 2020

BIG VALLEY
GROUNDWATER BASIN

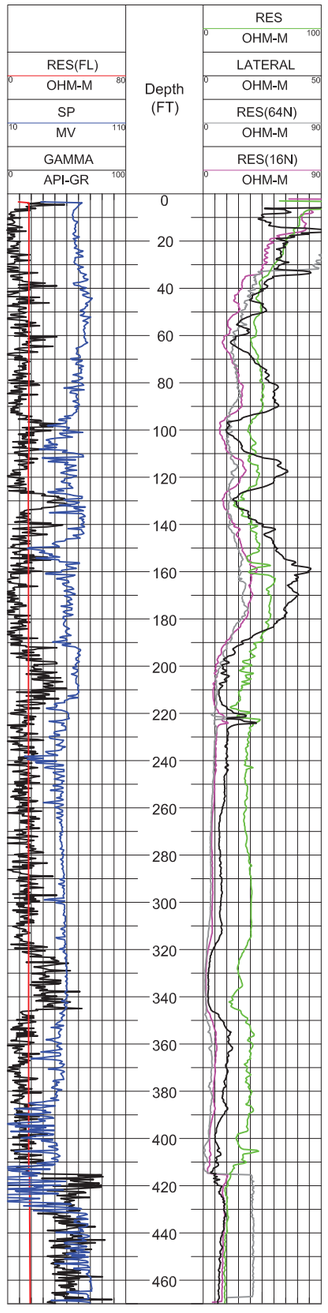
AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 2 ROADS 87 & 87A

DRAWING 2

LITHOLOGIC LOG

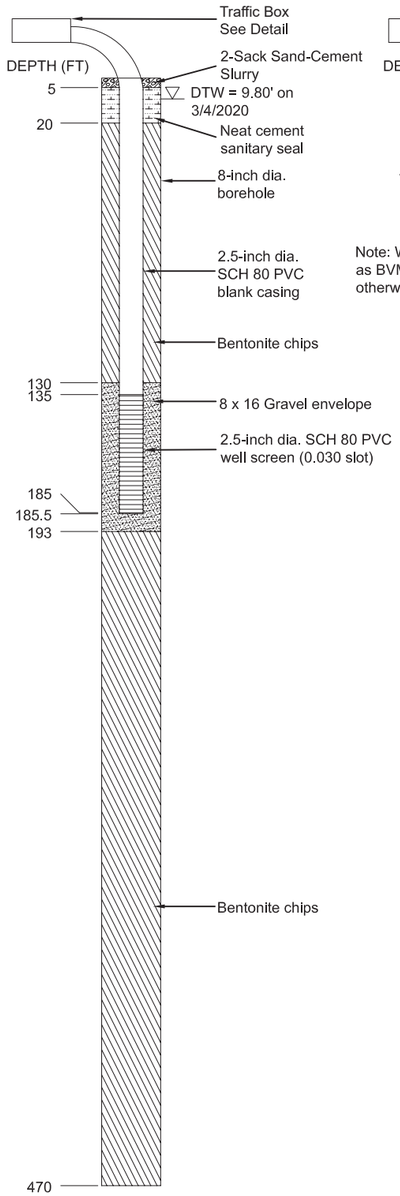


E-LOGS



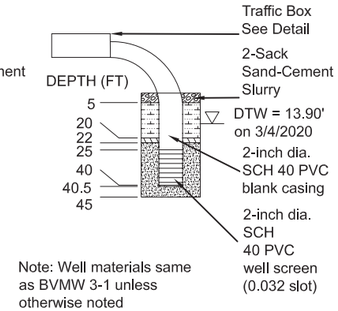
BVMW 3-1

Latitude (WGS84): 41.2169400
Longitude (WGS84): -121.1049557
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.41
Corrected Reference Pt.: 4167.41
Top of Well Vault: 4164.75



BVMW 3-2

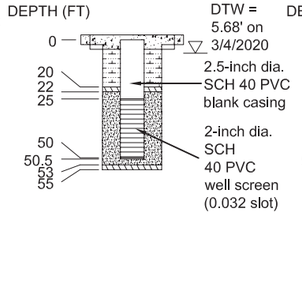
Latitude (WGS84): 41.2170083
Longitude (WGS84): -121.1049570
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.58
Corrected Reference Pt.: 4167.58
Top of Well Vault: 4164.92



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

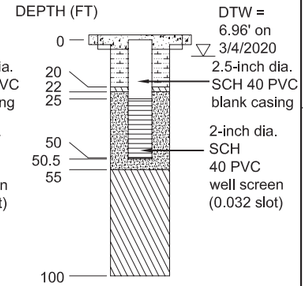
BVMW 3-3

Latitude (WGS84): 41.2157185
Longitude (WGS84): -121.1050902
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.02
Top of Well Vault: 4164.36

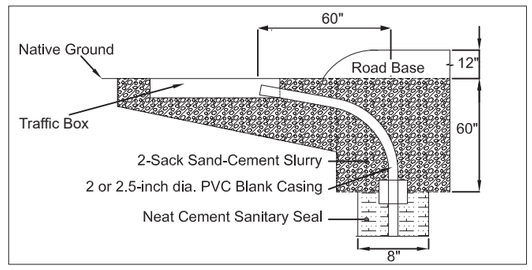


BVMW 3-4

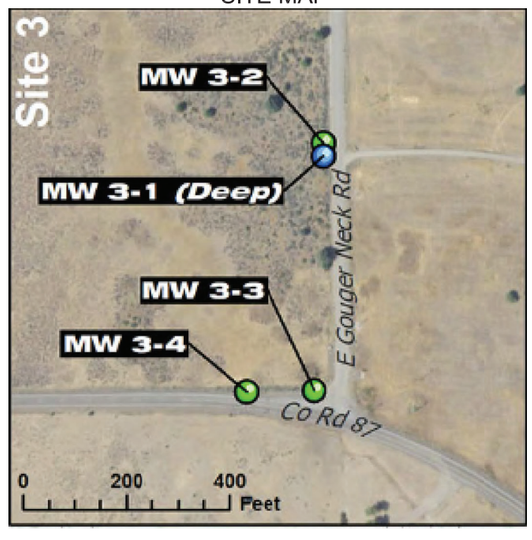
Latitude (WGS84): 41.2157230
Longitude (WGS84): -121.1054095
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4164.97
Top of Well Vault: 4165.31



Traffic Box Detail



SITE MAP



*Corrected reference point elevation should be used for water level measurements and accounts for horizontal offset and curvature of casing.

NORTH CAL-NEVA RESOURCE CONSERVATION AND DEVELOPMENT COUNCIL

ON BEHALF OF:

FUNDED BY:

PROJECT ENGINEER:

GEI Consultants
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(916)631-4500

DESIGNED:	CHECKED:
D. Fairman	J. Zumbro
DRAWN:	REVIEWED:
F. Olson / V. Yap	D. Fairman

PROFESSIONAL GEOLOGIST
DAVID FAIRMAN
No. 9025
STATE OF CALIFORNIA

Date: 4/13/2021

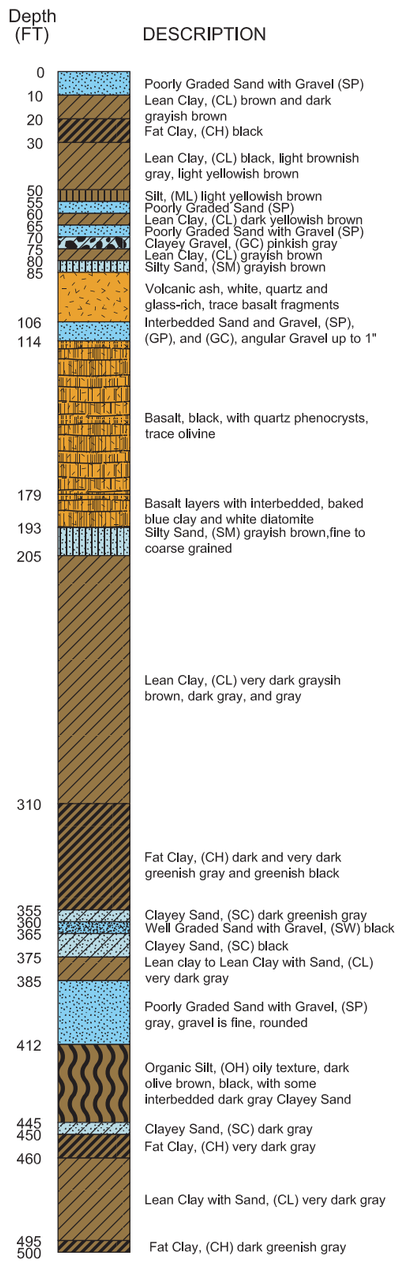
Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Jan-Feb 2020

BIG VALLEY
GROUNDWATER BASIN

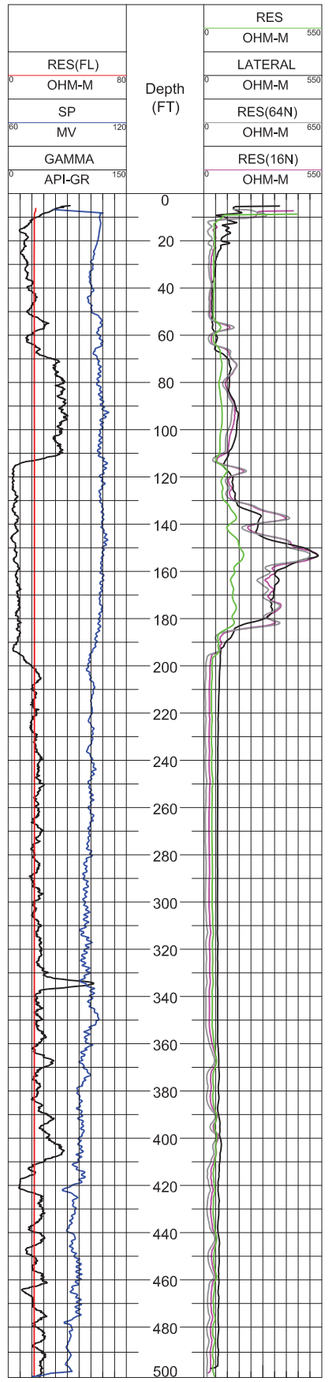
AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 3 ROADS 87 & 90

DRAWING 3

LITHOLOGIC LOG

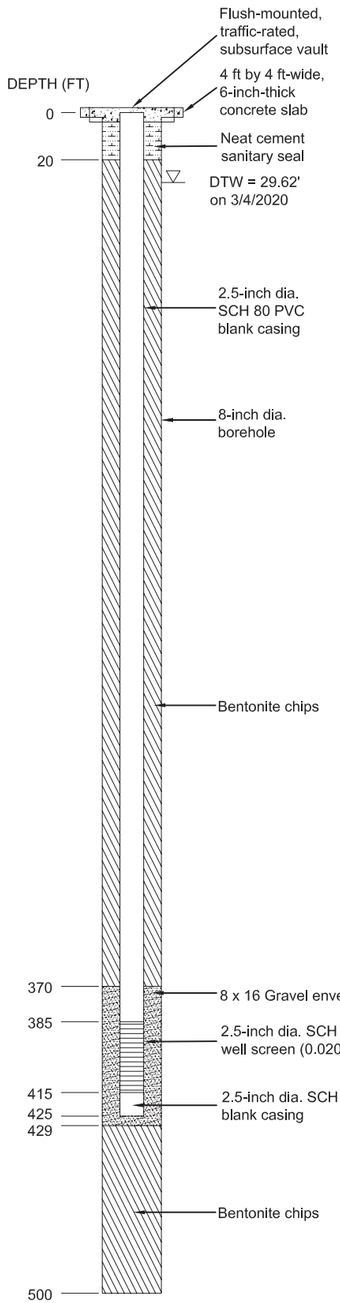


E-LOGS



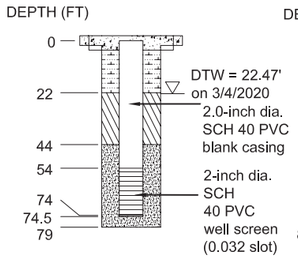
BVMW 4-1

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

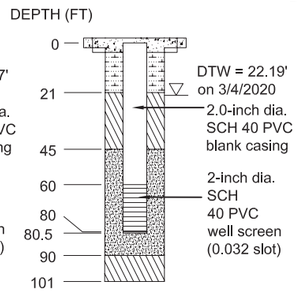
Latitude (WGS84): 41.2029353
Longitude (WGS84): -121.1587904
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4152.73
Top of Well Vault: 4153.06



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

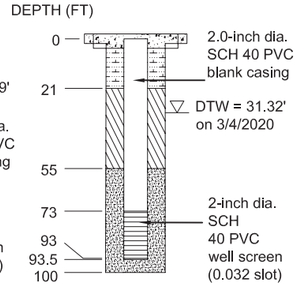
BVMW 4-3

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

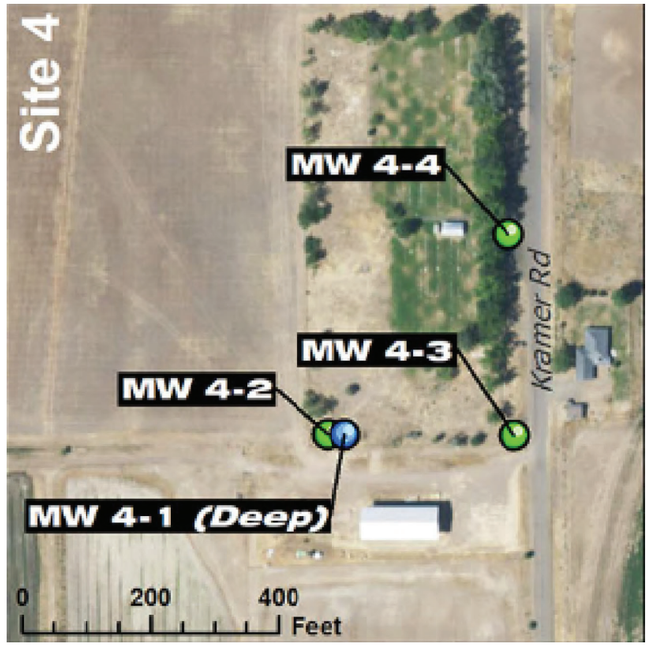


BVMW 4-4

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:

FUNDED BY:

PROJECT ENGINEER:

GEI Consultants
2868 PROSPECT PARK DRIVE
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DESIGNED:	CHECKED:
D. Fairman	J. Zumbro
DRAWN:	REVIEWED:
F. Olson / V. Yap	D. Fairman

PROFESSIONAL GEOLOGIST
DAVID FAIRMAN
No. 9025
STATE OF CALIFORNIA

Date: 4/13/2021

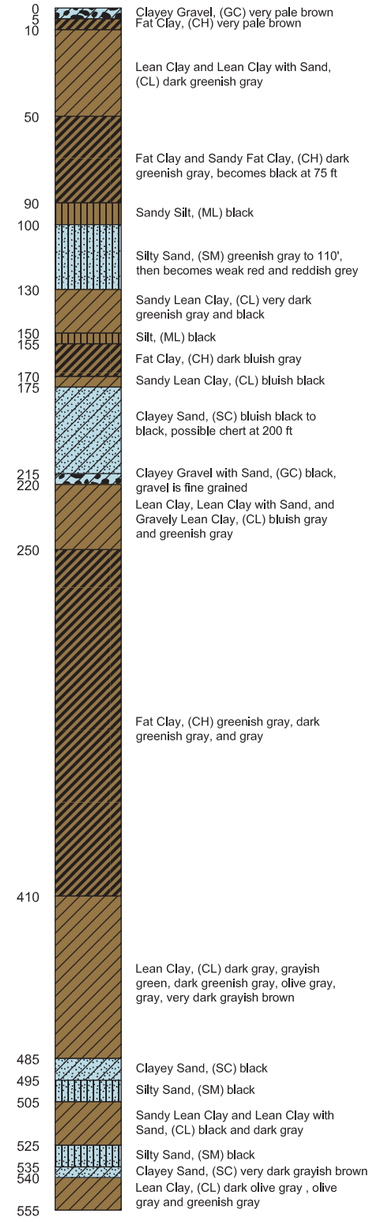
Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Nov 2019

BIG VALLEY
GROUNDWATER BASIN

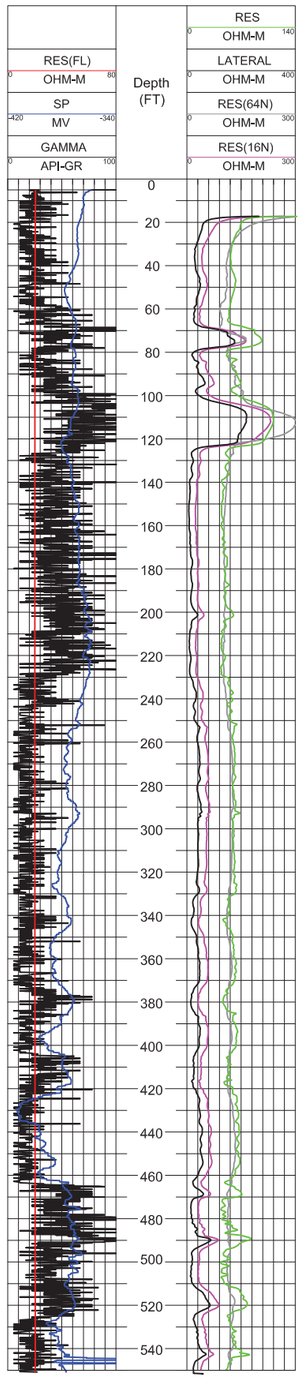
AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 4 LOOKOUT CEMETERY

DRAWING 4

LITHOLOGIC LOG

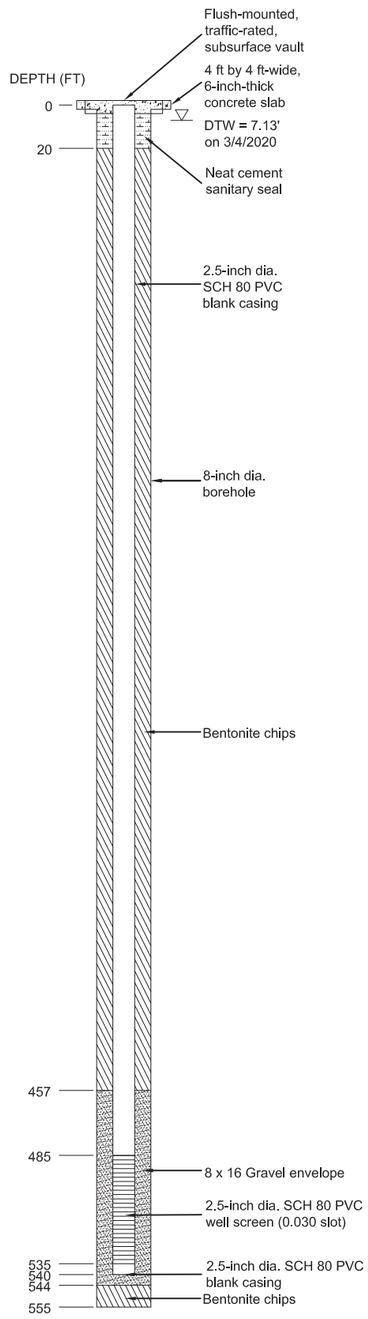


E-LOGS



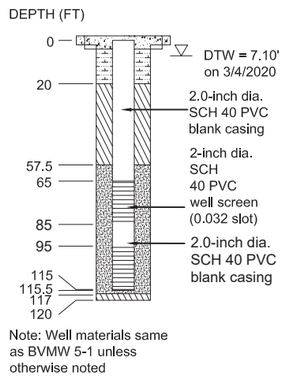
BVMW 5-1

Latitude (WGS84): 41.1218808
Longitude (WGS84): -121.1338666
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4128.72
Top of Well Vault: 4129.05



BVMW 5-2

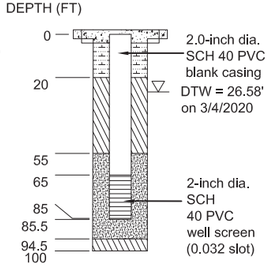
Latitude (WGS84): 41.1219508
Longitude (WGS84): -121.1338622
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4128.59
Top of Well Vault: 4128.92



Note: Well materials same as BVMW 5-1 unless otherwise noted

BVMW 5-3

Latitude (WGS84): 41.1211843
Longitude (WGS84): -121.1366445
Elevation in US Survey Feet (NAVD88)
Top of PVC Casing: 4131.40
Top of Well Vault: 4131.73



BVMW 5-4

Latitude (WGS84): 41.1205603
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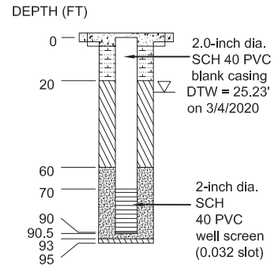
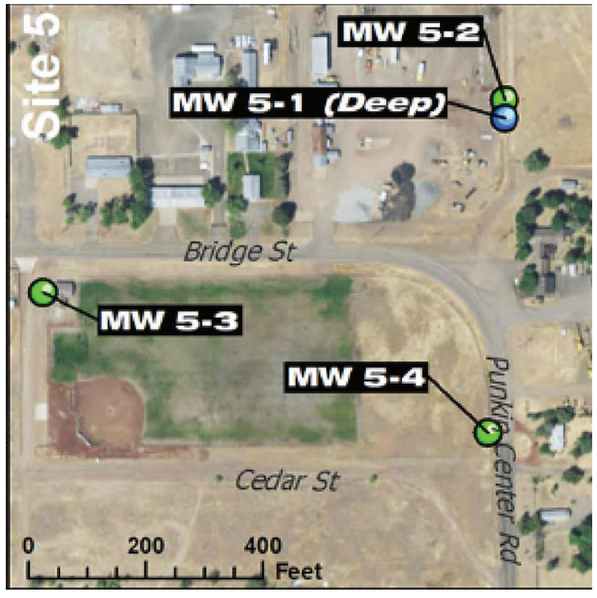
Top of Well Vault: 4130.23



SITE MAP



LASSEN COUNTY CALIFORNIA

FUNDED BY:

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

PROJECT ENGINEER:

GEI Consultants
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DESIGNED:	CHECKED:
D. Fairman	J. Zumbro
DRAWN:	REVIEWED:
F. Olson / V. Yap	D. Fairman

PROFESSIONAL GEOLOGIST
DAVID FAIRMAN
No. 9025
STATE OF CALIFORNIA

Date: 4/13/2021

Drilling Completed By:
Maggiora Brothers Drilling, Inc.
Dec 2019 - Jan 2020

BIG VALLEY
GROUNDWATER BASIN

AS-BUILT MONITORING WELL CONSTRUCTION DETAILS: SITE 5 BIEBER

DRAWING 5

Appendix 8D Selection from DWR Monitoring BMP

regulatory based requirements, there is flexibility among the various methodologies available to meet the DQOs based upon professional judgment (local conditions or project needs).

At a minimum, for each monitoring site, the following information or procedure should be collected and documented:

- Long-term access agreements. Access agreements should include year-round site access to allow for increased monitoring frequency.
- A unique identifier that includes a general written description of the site location, date established, access instructions and point of contact (if necessary), type of information to be collected, latitude, longitude, and elevation. Each monitoring location should also track all modifications to the site in a modification log.

PROTOCOLS FOR MEASURING GROUNDWATER LEVELS

This section presents considerations for the methodology of collection of groundwater level data such that it meets the requirements of the GSP Regulations and the DQOs of the specific GSP. Groundwater levels are a fundamental measure of the status of groundwater conditions within a basin. In many cases, relationships of the sustainability indicators may be able to be correlated with groundwater levels. The quality of this data must consider the specific aquifer being monitored and the methodology for collecting these levels.

The following considerations for groundwater level measuring protocols should ensure the following:

- Groundwater level data are taken from the correct location, well ID, and screen interval depth
- Groundwater level data are accurate and reproducible
- Groundwater level data represent conditions that inform appropriate basin management DQOs
- All salient information is recorded to correct, if necessary, and compare data
- Data are handled in a way that ensures data integrity

General Well Monitoring Information

The following presents considerations for collection of water level data that include regulatory required components as well as those which are recommended.

- Groundwater elevation data will form the basis of basin-wide water-table and piezometric maps, and should approximate conditions at a discrete period in time. Therefore, all groundwater levels in a basin should be collected within as short a time as possible, preferably within a 1 to 2 week period.
- Depth to groundwater must be measured relative to an established Reference Point (RP) on the well casing. The RP is usually identified with a permanent marker, paint spot, or a notch in the lip of the well casing. By convention in open casing monitoring wells, the RP reference point is located on the north side of the well casing. If no mark is apparent, the person performing the measurement should measure the depth to groundwater from the north side of the top of the well casing.
- The elevation of the RP of each well must be surveyed to the North American Vertical Datum of 1988 (NAVD88), or a local datum that can be converted to NAVD88. The elevation of the RP must be accurate to within 0.5 foot. It is preferable for the RP elevation to be accurate to 0.1 foot or less. Survey grade global navigation satellite system (GNSS) global positioning system (GPS) equipment can achieve similar vertical accuracy when corrected. Guidance for use of GPS can be found at USGS http://water.usgs.gov/osw/gps/. Hand-held GPS units likely will not produce reliable vertical elevation measurement accurate enough for the casing elevation consistent with the DQOs and regulatory requirements.
- The sampler should remove the appropriate cap, lid, or plug that covers the monitoring access point listening for pressure release. If a release is observed, the measurement should follow a period of time to allow the water level to equilibrate.
- Depth to groundwater must be measured to an accuracy of 0.1 foot below the RP. It is preferable to measure depth to groundwater to an accuracy of 0.01 foot. Air lines and acoustic sounders may not provide the required accuracy of 0.1 foot.
- The water level meter should be decontaminated after measuring each well.

Where existing wells do not meet the base standard as described in the GSP Regulations or the considerations provided above, new monitoring wells may need to be constructed to meet the DQOs of the GSP. The design, installation, and documentation of new monitoring wells must consider the following:

- Construction consistent with California Well Standards as described in Bulletins 74-81 and 74-90, and local permitting agency standards of practice.
- Logging of borehole cuttings under the supervision of a California Professional Geologist and described consistent with the Unified Soil Classification System methods according to ASTM standard D2487-11.
- Written criteria for logging of borehole cuttings for comparison to known geologic formations, principal aquifers and aquitards/aquicludes, or specific marker beds to aid in consistent stratigraphic correlation within and across basins.
- Geophysical surveys of boreholes to aid in consistency of logging practices. Methodologies should include resistivity, spontaneous potential, spectral gamma, or other methods as appropriate for the conditions. Selection of geophysical methods should be based upon the opinion of a professional geologist or professional engineer, and address the DQOs for the specific borehole and characterization needs.
- Prepare and submit State well completion reports according to the requirements of §13752. Well completion report documentation should include geophysical logs, detailed geologic log, and formation identification as attachments. An example well completion as-built log is illustrated in **Figure 2.** DWR well completion reports can be filed directly at the Online System for Well Completion Reports (OSWCR) http://water.ca.gov/oswcr/index.cfm.

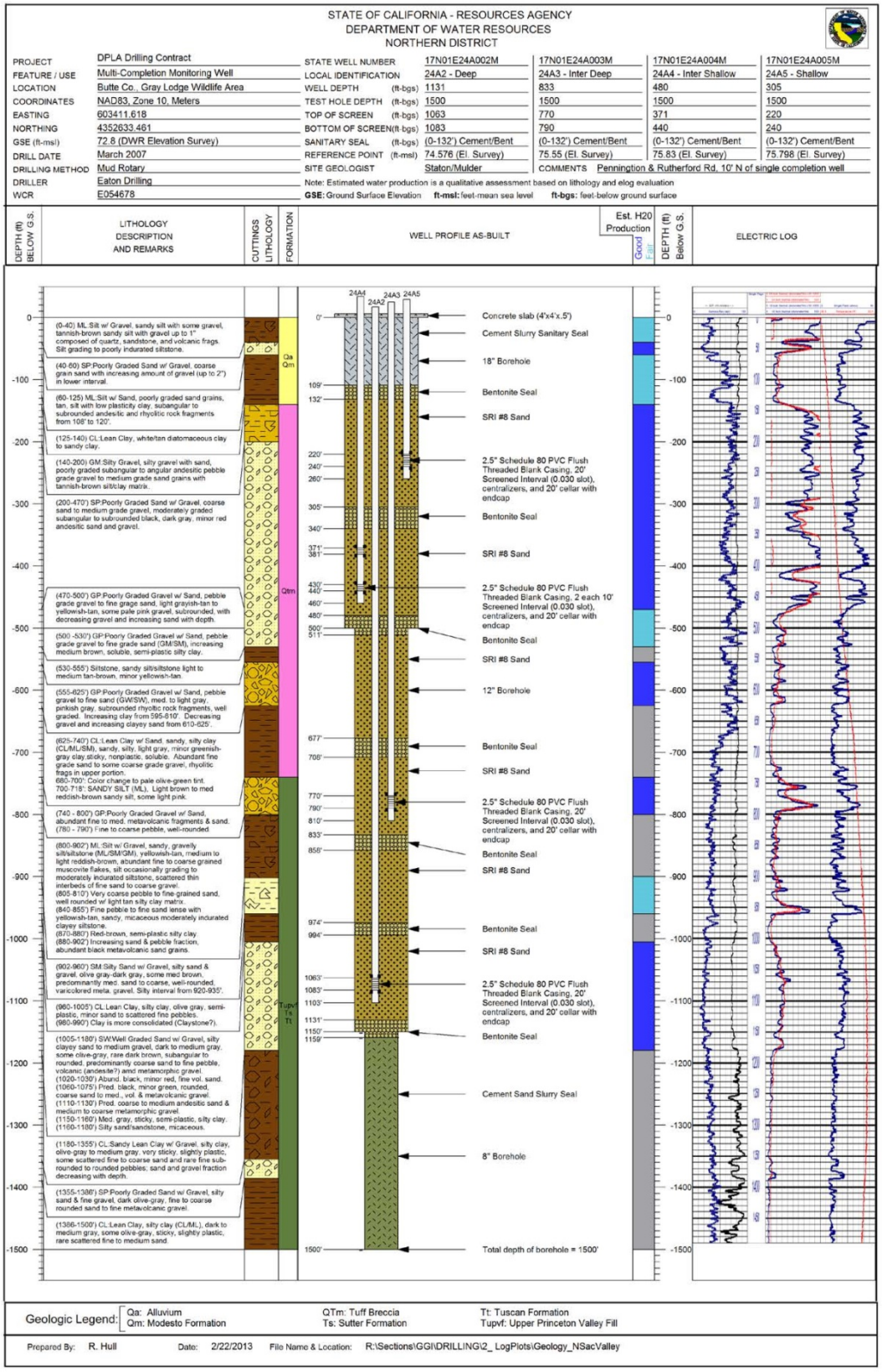

Figure 2 – Example As-Built Multi-Completion Monitoring Well Log

Measuring Groundwater Levels

Well construction, anticipated groundwater level, groundwater level measuring equipment, field conditions, and well operations should be considered prior collection of the groundwater level measurement. The USGS *Groundwater Technical Procedures* (Cunningham and Schalk, 2011) provide a thorough set of procedures which can be used to establish specific Standard Operating Procedures (SOPs) for a local agency. **Figure 3** illustrates a typical groundwater level measuring event and simultaneous pressure transducer download.

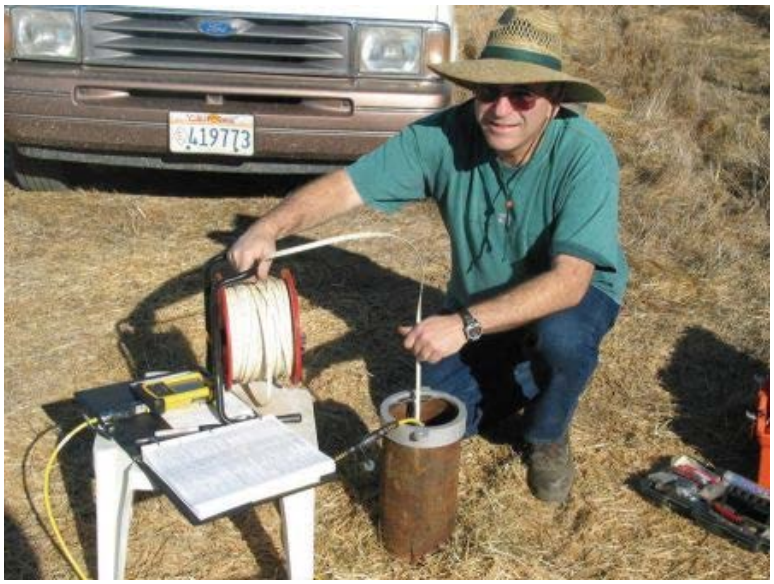

Figure 3 – Collection of Water Level Measurement and Pressure Transducer Download

The following points provide a general approach for collecting groundwater level measurements:

- Measure depth to water in the well using procedures appropriate for the measuring device. Equipment must be operated and maintained in accordance with manufacturer's instructions. Groundwater levels should be measured to the nearest 0.01 foot relative to the RP.
- For measuring wells that are under pressure, allow a period of time for the groundwater levels to stabilize. In these cases, multiple measurements should be collected to ensure the well has reached equilibrium such that no significant changes in water level are observed. Every effort should be made to ensure that a representative stable depth to groundwater is recorded. If a well does not stabilize, the quality of the value should be appropriately qualified as a

questionable measurement. In the event that a well is artesian, site specific procedures should be developed to collect accurate information and be protective of safety conditions associated with a pressurized well. In many cases, an extension pipe may be adequate to stabilize head in the well. Record the dimension of the extension and document measurements and configuration.

- The sampler should calculate the groundwater elevation as:

$$GWE = RPE - DTW$$

Where:

GWE = Groundwater Elevation
RPE = Reference Point Elevation
DTW = Depth to Water

The sampler must ensure that all measurements are in consistent units of feet, tenths of feet, and hundredths of feet. Measurements and RPEs should not be recorded in feet and inches.

Recording Groundwater Levels

- The sampler should record the well identifier, date, time (24-hour format), RPE, height of RP above or below ground surface, DTW, GWE, and comments regarding any factors that may influence the depth to water readings such as weather, nearby irrigation, flooding, potential for tidal influence, or well condition. If there is a questionable measurement or the measurement cannot be obtained, it should be noted. An example of a field sheet with the required information is shown in **Figure 4**. It includes questionable measurement and no measurement codes that should be noted. This field sheet is provided as an example. Standardized field forms should be used for all data collection. The aforementioned USGS *Groundwater Technical Procedures* offers a number of example forms.
- The sampler should replace any well caps or plugs, and lock any well buildings or covers.
- All data should be entered into the GSA data management system (DMS) as soon as possible. Care should be taken to avoid data entry mistakes and the entries should be checked by a second person for compliance with the DQOs.

STATE OF CALIFORNA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

WELL DATA

STATE WELL NUMBER	COUNTY	REFERENCE POINT ELEV.	MEASURING AGENCY
			DWR

NO MEASUREMENT

0. Measurement discontinued
1. Pumping
2. Pump house locked
3. Tape hung up
4. Can't get tape in casing
5. Unable to locate well
6. Well has been destroyed
7. Special
8. Casing leaky or wet
9. Temporarily inaccessible

QUESTIONABLE MEASUREMENT

0. Caved or deepened
1. Pumping
2. Nearby pump operating
3. Casing leaky or wet
4. Pumped recently
5. Air or pressure gauge measurement
6. Other
7. Recharge operation at or nearby well
8. Oil in casing

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

Tentative GSP and Meeting Schedule
Proposed to the Big Valley Groundwater Advisory Committee (BVAC) on May 5, 2021

The intent of this document is to outline the meeting schedule of the Big Valley Groundwater Basin Advisory Committee (BVAC) in their effort to recommend a Groundwater Sustainability Plan (GSP) to the two Groundwater Sustainability Agencies (GSAs). This schedule outlines the anticipated remaining meetings for this effort (starting with the June 2, 2021, meeting). As of this date, the BVAC has "set aside" GSP Chapters One through Six. These "set aside" chapters will be considered again by the BVAC at one or more future meetings (starting with the October 6, 2021, meeting), after the entire draft GSP has been prepared. These "set aside" chapters are available on the project website: https://bigvalleygsp.org

The meeting dates and content indicated below are subject to change. Please visit the project website for the most current meeting information. In addition to the meetings listed below, a "special meeting" of the BVAC may be scheduled at any time. The agenda for any such special meeting will be published on the project website and posted in accordance with the Brown Act.

This schedule does not introduce all of the content that will be presented for any particular BVAC meeting. The intent of this document is to list, as accurately as possible, specific dates when it is anticipated that the various chapters of the GSP will be presented to the BVAC and public. Again, this schedule will be updated/confirmed as necessary.

The meeting dates provided below are followed by a "notes" section that further explain the anticipated review process and schedule. Dates presented in italics, on the second page of this document, after the dashed line, describe the steps required after BVAC involvement (i.e. after the BVAC has made a recommendation to the two GSAs).

Big Valley Groundwater Basin (BVAC) meeting dates:

May 5, 2021 – Present Revised Draft Chapters 7 (*Sustainable Management Criteria*) to set aside; Introduce Public Draft Chapter 8 (*Monitoring Networks*)*;* Start comment period for Public Draft Chapter 8

June 2, 2021 – Discuss revisions to Chapter 8; Introduce Public Draft Chapters 9 and 10 (*Projects and Management Actions* and *Implementation Plan*); Start comment period for Public Draft Chapters 9 and 10

July 7, 2021 – Present Revised Draft Chapter 8 to set aside; Discuss revisions to Chapters 9 and 10; Introduce Public Draft Chapters 11-13 (*Notice and Communications*, *Interagency Agreements*, & *Reference List*); Start comment period for Public Draft Chapters 11-13

August 4, 2021 – Present Revised Draft Chapters 9 and 10 for BVAC to set aside; Discuss revisions to Chapters 11-13

September 1, 2021 – Present Revised Draft Chapters 11-13 for BVAC to set aside; Discuss additional revisions to all chapters previously set aside

October 6, 2021 – Present Revised Draft of Entire GSP; **BVAC vote to recommend approval of "Draft GSP" (all Revised Draft Chapters) to GSAs**

November 3, 2021 **–** ***special meeting if necessary***

December 1, 2021 **–** ***special meeting if necessary***

NOTES:

- The schedule above allows two months for each Chapter, including Chapters identified as requiring high input from stakeholders (i.e. *Sustainable Management Criteria*, *Projects and Management Actions*), to allow time for comments to be received and incorporated. This schedule references only the progression of the review of the individual Chapters of the GSP. In actuality, it is anticipated that some components of the GSP will be discussed at meetings prior to the date on which the associated Chapter is fully prepared and formally introduced. Discussion on additional information outside of the GSP chapters may also occur during the BVAC meetings. Those interested should consult the pertinent agenda.
- Meetings will be conducted at either the Adin Community Center (605 Highway 299, Adin, CA 96006) or at the Veterans Memorial Hall in Bieber (657-575 Bridge Street, Bieber, CA 96009). Please consult the appropriate agenda prior to any meeting.
- The meeting time for the above regularly scheduled meetings will be 2:00 p.m.

The GSA meeting dates proposed below are hypothetical, as they have not been approved by the GSAs. The dates are intended to present possible meeting dates, recognizing that the approved "Final GSP" must be submitted to the DWR by January 31, 2022.

October 19, 2021 – The Draft GSP will be presented to the two GSAs (Board packet to be available October 8, 2021); the two GSAs initiate a comment period for the "Public Draft GSP" and approve publication of a "Notice of Intent to Adopt the Big Valley Groundwater Basin Groundwater Sustainability Plan" no earlier than 90 days from Notice.

December 3, 2021 (45 days) – End of the comment period for the Public Draft GSP; potential Board agenda item for GSAs to discuss comments/edits; begin incorporation of comments for GSA approval of "Revised Draft GSP"

January 18, 2022 – Conduct public hearings for approval of the Final GSP by both GSAs (and direction to submit the Final GSP to the Department of Water Resources (DWR) by the ***January 31, 2022*** *deadline (public hearing)*