CUYAMA BASIN GROUNDWATER SUSTAINABILITY AGENCY

STANDING ADVISORY COMMITTEE

Committee Members

Roberta Jaffe (Chair)	Brad DeBranch	Joe Haslett
Brenton Kelly (Vice Chair)	Louise Draucker	Mike Post
Claudia Alvarado	Jake Furstenfeld	Hilda Leticia Valenzuela

AGENDA

January 31, 2019

Agenda for a meeting of the Cuyama Basin Groundwater Sustainability Agency Standing Advisory Committee to be held on Thursday, January 31, 2019 at 4:00 PM, at the Cuyama Valley Family Resource Center, 4689 CA-166, New Cuyama, CA 93254. To hear the session live, call (888) 222-0475, code: 6375195#.

Teleconference Locations:

Cuyama Valley Family Resource Center 4689 CA-166 New Cuyama, CA 93254	7870 Fairchild Ave Winnetka, CA 91306

The order in which agenda items are discussed may be changed to accommodate scheduling or other needs of the Committee, the public or meeting participants. Members of the public are encouraged to arrive at the commencement of the meeting to ensure that they are present for Committee discussion of all items in which they are interested.

In compliance with the Americans with Disabilities Act, if you need disability-related modifications or accommodations, including auxiliary aids or services, to participate in this meeting, please contact Taylor Blakslee at (661) 477-3385 by 4:00 p.m. on the Friday prior to this meeting. Agenda backup information and any public records provided to the Committee after the posting of the agenda for this meeting will be available for public review at 4689 CA-166, New Cuyama, CA 93254. The Cuyama Basin Groundwater Sustainability Agency reserves the right to limit each speaker to three (3) minutes per subject or topic.

1. Call to Order
2. Roll Call
3. Pledge of Allegiance
4. Approval of Minutes
5. Groundwater Sustainability Plan
    a. Groundwater Sustainability Plan Update
        i. Water Budget Update
        ii. Preliminary Discussion on Project and Management Actions
        iii. Presentation on Groundwater Dependent Ecosystems
    b. Technical Forum Update

   c. Monitoring Networks Adoption
   d. Data Management Adoption
   e. Stakeholder Engagement Update

6. Groundwater Sustainability Agency
   a. Report of the Executive Director
   b. Board of Directors Agenda Review
   c. Report of the General Counsel

7. Items for Upcoming Sessions

8. Committee Forum

9. Public comment for items not on the Agenda

   At this time, the public may address the Committee on any item not appearing on the agenda that is within the subject matter jurisdiction of the Committee. Persons wishing to address the Committee should fill out a comment card and submit it to the Executive Director prior to the meeting.

10. Adjourn

Cuyama Basin Groundwater Sustainability Agency Standing Advisory Committee Meeting

January 8, 2019

Draft Meetings Minutes

Cuyama Valley Family Resource Center, 4689 CA-166, New Cuyama, CA 93254

PRESENT:
Kelly, Brenton – Vice Chair – Acting Chair
DeBranch, Brad
Draucker, Louise
Furstenfeld, Jake
Haslett, Joe
Post, Mike – *via teleconference*
Valenzuela, Hilda Leticia
Beck, Jim – Executive Director
Hughes, Joe – Legal Counsel – *via teleconference*

ABSENT:
Jaffe, Roberta – Chair
Alvarado, Claudia

1. **Call to Order**
Acting Chair Brenton Kelly called the Standing Advisory Committee (SAC) to order at 4:01 p.m.

2. **Roll Call**
Hallmark Group Project Coordinator Taylor Blakslee called roll of the Committee (shown above).

   CBGSA Board Chair Derek Yurosek and Director Bryon Albano participated in the SAC meeting via teleconference and Director Jane Wooster attended in-person.

3. **Pledge of Allegiance**
The pledge of allegiance was led by Acting Chair Kelly.

4. **Approval of Minutes**
Cuyama Basin Groundwater Sustainability Agency (CBGSA) Executive Director Jim Beck presented the November 29, 2018 SAC minutes.

   MOTION
   Committee Member Brad Debranch made a motion to adopt the November 29, 2018 CBGSA SAC minutes pending several editorial changes. The motion was seconded by Committee Member Joe Haslett, a roll call vote was made, and the motion passed.

   AYES: Committee Members DeBranch, Draucker, Furstenfeld, Haslett, Post,

Valenzuela, and Acting Chair Kelly
NOES: None
ABSTAIN: None
ABSENT: Committee Member Jaffe

Mr. Blakslee informed the SAC that later in the meeting legal counsel Joe Hughes would be providing an update on the Brown Act. He said as general guidance for CBGSA Directors attending the SAC meetings, they have been advised that they can participate, however they should only ask factual questions or provide factual information, and avoid advocating for a particular position.

Woodard & Curran Project Manager Brian Van Lienden informed the group that W&C's Senior Hydrogeologist John Ayres was planning on attending the meeting in-person but had to participate via teleconference due to sickness.

5. Groundwater Sustainability Plan

a. Groundwater Sustainability Plan Update

Mr. Van Lienden provided an update on Groundwater Sustainability Plan (GSP) activities, which is included in the SAC packet. He reported on W&C's progress for November 2018, notably including refinements to the historical calibration and future conditions scenario of the GSP numerical model.

Mr. Van Lienden briefed the group on two potential options for the GSP schedule which would determine the release sequence for the remaining chapters/sections. Option 1 would allow a round of review for each section and then a final review as part of the public draft; however, this option would push the adoption process of the public draft back a month and Board decisions would need to be set at a more aggressive pace. Option 2 would keep the current schedule for the public draft release but does not allow an initial review of the remaining sections prior to being released in the public draft.

Mr. Beck commented that we will seeking the Board's direction regarding the GSP schedule tomorrow. He let the SAC know that neither schedule results in more work for W&C and this decision is primarily to identify how the remaining GSP sections should be sequenced.

Committee member Draucker said she favored the option where there is more time for making decisions.

Committee member DeBranch asked Mr. Van Lienden what option he is more comfortable with. Mr. Van Lienden said Option 2 (the current schedule).

Mr. Beck noted that with Option 2, the SAC and Board may see the water budget section comments prior to the project and management actions being drafted.

Committee member Haslett said that it would make more sense to use Option 2.

Acting Chair Kelly stated that he preferred Option 1 because it would allow more review time for each document.

Acting Chair Kelly took a poll from the SAC to determine which option would be more favorable for the GSP Schedule.

Poll
Option 1: Allows a round of review for each GSP section and a final review as part of the public draft but will postpone the release of the public draft by a month.

Option 2: Keeps the current schedule for the public draft release but does not allow initial review of several GSP sections before being released in the public draft.

Option 1:	Acting Chair Kelly
Option 2:	Committee Members DeBranch, Draucker, Furstenfeld, Haslett, Post, and Valenzuela
Majority:	Option 2

Mr. Van Lienden reported that W&C Principle Lyndel Melton had mentioned at the December 3, 2018 Board meeting that W&C would be discussing how to address the document placeholders. He said they had originally planned to include the placeholders in the public draft, however another option is to include all of the placeholders in a separate document. If all the placeholders were included in a separate document, there would only be about a week to review those placeholders before going into the public draft.

There are two options for the release of the placeholders. Option 1 is to issue the GSP chapters/sections at the time of the GSP public draft release. Option 2 is to issue the newly developed subsections as a single package in March 2019 with a 1-week review and comment period. There will be discussions regarding the subsections at the SAC and Board meetings prior to the document sections being released for review.

Mr. Beck asked Mr. Van Lienden to address the budget implications with each option. Mr. Van Lienden said their budget is very tight and Option 1 would be less of a financial burden and more feasible for W&C staff.

Acting Chair Kelly said his personal preference is to review the GSP sections initially as complete documents and then review the public draft.

Acting Chair Kelly took a poll from the SAC to determine which option would be more favorable for the placeholder strategy.

Poll
Option 1: Issue subsections for review at time of GSP public draft.

Option 2: Issue the newly developed subsections as a single package in March with a 1-week review and comment period.

Option 1:	Committee Members DeBranch, Haslett, Post
Option 2:	Committee Members Draucker, Furstenfeld, Valenzuela, and Acting Chair Kelly
Majority:	Option 2

b. Technical Forum Update
Mr. Van Lienden provided an overview of the December 14, 2018 technical forum call. A summary

of the issues discussed is provided in the SAC packet.

c. Groundwater Conditions Chapter Adoption
Mr. Van Lienden provided an overview of Groundwater Conditions chapter.

Mr. Beck read SAC Chair Robbie Jaffe's following comments regarding the Groundwater Conditions chapter:

"To the members of the SAC and stakeholders present:
Happy New Year. This will be a very important year for the Cuyama Basin. This is when we put forward our plan for the sustainability of the Cuyama Valley groundwater basin. I hope this plan will ensure that there is enough groundwater for future generations to thrive. Thank you for your participation. I am sorry to miss this important meeting. Unfortunately, it coincides with long-term plans I have had to be away. I've reviewed the packet, focusing on the thresholds and I appreciate Jim sharing my comments with you when appropriate in the agenda.

5c. Groundwater Conditions Chapter:
I reviewed the comments and actions taken. This is an important chapter in laying the baseline for our plan. In the comments there were extensive comments from the County hydrologists with concerns that there were inaccuracies about:

- *the characterization of the wells and the lumping of the categories*
- *groundwater trends*

It seems that it is important to have these characterizations accurately reported for our baseline. And I'd want the Counties to sign off that their comments and concerns have been resolved based on scientific feedback before approving this section.
In addition, there were a few comments regarding Groundwater Quality that raised questions related to CCSD data. Woodard and Curran's response were that they did not receive water quality data from CCSD. CCSD is required to collect and report this data and it seems every effort needs to be made to include this data in the Groundwater Conditions Chapter."

Acting Chair Kelly said he had discussed the lack of data from the Cuyama Community Services District (CCSD) with Vivian Vickery and Paul Chounet, and they had informed him that there is a lot of information available online. CBGSA alternate Board Director John Coates said water quality data is public and has to be posted annually. Mr. Van Lienden said water deliveries is all the data W&C received from the CCSD. Mr. Beck suggested Mr. Van Lienden speak with the rest of the W&C team regarding the CCSD water quality data and report back. He said this data should be added if available.

Mr. Ayres let the SAC know that Mr. Ayres said a number of wells were mischaracterized as California Department of Water Resources' (DWR) wells when they were actually from DWR's data set and belonged to different entities.

Acting Chair Kelly provided the following personal comments in regard to the Groundwater Conditions chapter public responses:

"General Comments:

The quality and integrity of this Chapter follows the trend of the developing Plan, that is, with consistently unsatisfactory representation of the actual conditions of the Cuyama Groundwater Basin. The chosen Representative Monitoring Sites are insufficient to provide true science based, data driven interpretations of the groundwater conditions.

However, Considerable effort by many stakeholders have contributed an enormous amount of constructive editorial input (13 stakeholders with 183 Comments) which do not seem to have been incorporated into the text, even when the response from W&C was favorably. This Chapter should along with the HCM, describe the general groundwater conditions but the text is poorly written and does not accurately reflect the Basin. The general disregard for the considered comments from stakeholders, including the SB & SLO County's, is most discouraging. Woodard & Curran should use & value this regional knowledge and experience to a much greater extent. It is a waste of everyone's time if this process does not legitimately contribute to a quality end product.

And, I continue to repeat my comment that the missing components of this chapter are significant and disturbing. Groundwater Storage, Surface Water Interactions, and GDE are the groundwater conditions of greatest concern to most every stakeholder with the possible exception of those mining the groundwater. When will we see & approve whatever W&C has for these Sustainability Indicators? Also, Data Gaps, which have begun to be developed for the other chapters of this GSP, are an inexcusably omission in this Chapter. Why can't this subsection be written? We already know which parts we don't have the data points for. They should be described now not wait any later.

Specific Comments to Responses:

Comment # 5; Ventucopa Badlands is now a significant part of the text as a Threshold Region in the GSP and should be included in fig. 2.2-1.

Comment # 11,12, 56 & 63; What data would be sufficient to be definitively conclusive regarding the relationship between groundwater extraction and water quality? The best science indicates a strong relationship. This should be in the missing Data Gap section.

Comment # 13; Age dating and other anthropogenic tracers must be used to find where and how much recharge is percolating down to the main zone of extraction. All the best local science indicates an impaired recharge rate due to complex hydro stratigraphy in the Morales Formation. (see comments # 171 & 181)

Comment # 20; Reference to the HCM and the effects of hydro stratigraphy must be considered in the discussions of "vertical gradients, hydrograph comparisons, and groundwater elevation contours" A change in the text is required for the document to be descriptive, accurate and a true representation of the groundwater conditions in the Cuyama Basin.

Comment # 24 & 25; These unsupported statements do require a change to the document. Include the data that suggests this conclusion. What hydrograph is available to support this statement?

Comment # 40; The text was not revised for clarity as to any difference between loss of the aquifer due to subsidence and storage loss capacity. This is a significant sustainability Indicator *that needs full consideration and a clear description. The Appendix Z (Subsidence White Paper) requires further explanation and clarification. The Cuyama Basin is not the same as the San Joaquin and should not be looked at the same. Where in the San Joaquin do GW elevations plummet >500' over such a short horizontal distance?*

Comment # 58; Any accurate description of the condition of the Groundwater in Cuyama must more fully address the historic trends of 500+ feet of elevation declines over 6+ decades of chronic overdraft. This level of detail and accuracy is very much called for in this Section and understating the chronic conditions is not going to help solve it.

Comment # 63; If you recognize that the relationship between depth to groundwater and constituent concentrations is not yet well known, then what data gap needs to be filled and how.
Cathy Martin, SLO county, 40 comments

Comments # 99,101, 104, 105, 106 & 108; The water quality section is unreadable, inaccurate and unnecessarily confusing. Explanations are needed in the text for the justification of constituent choices and the MCL standards chosen from the various options. Why just these three indicators, and why have you chosen these MCL standards over any other? Explanatory text was asked for, the response was that "text has been revised for clarity", yet the explanation is not given, and clarity was not achieved.
SBCWA, 3 staff members, 75 Comments

Comment # 109; This section as a whole requires significant revision...and contains minimal analysis, with little explanation or interpretation. This does not accurately describe the groundwater conditions of the Cuyama basin. A technical editor or senior W&C staff should review these sections prior to distribution.

Comments # 116, 119, 120, 121, 122; Data accuracy section is needed Not entirely True...confusing...mostly accurate, but missing...not entirely true…missing a few. The accuracy and completeness of this document is called into question when so many errors and omissions are of concern.

Comment #131-135; There needs to be a separate data validation section that addresses QC/QA amongst different data sources. This data comparison between private and public data sets is mostly irrelevant, misleading and illustrates nothing informative at all.

Comment # 151; The discussion on west end hydrographs and the related Figure 2.2-15 is misleading. The trends indicate the yearly hydrologic minimum continues to drop, yet the text does not adequately or accurately describe this trend.

Comment #170; A summary of the conclusions drawn about water quality conditions is needed. No interpretive conclusions are presented about the groundwater quality conditions. No good explanation of why constituents were or weren't selected.

Comment #171; Age dating does provide information on groundwater water quality and its movement within the aquifer. The best science indicates it is very relevant, especially in a basin as stratigraphically challenging as Cuyama.

Comment # 176; Include a line showing MCL on the water quality hydrographs. This was favorably responded to as "MCL lines have been added to the figure". Yet no revised lines appear in the Figure. A good suggestion well received and then thoroughly ignored.

Comment # 181; This quote from the USGS Literature makes the determination "that groundwater movement favors movement of brackish water from the north of the Cuyama River towards areas of groundwater depletion, and that return of some water applied during irrigation and needed for leaching the soil carries dissolved salts with it to the water table (Singer and Swarzensky, 1970)." This more than suggests that irrigation activities contribute to the movement and concentrations of constituents and can directly impact groundwater quality over time.

I continue to believe that we are all working with a goal to make this Groundwater Sustainability Plan as accurate and representative a document as is possible under the legislative time restraints. I also believe it is the job and duty of the Standing Advisory Committee to make recommendations to the GSA to affect those goals. This compilation of unsatisfactory responses to stakeholder comments is an effort to that effect. There is no reason not to produce a good product, but this is not yet a good product."

Mr. Melton asked Mr. Van Lienden if we delaying the adoption of the Groundwater Conditions section by a month would that affect the current schedule. Mr. Van Lienden said it would not. Mr. Melton suggested delaying the section approval to next month and working with Acting Chair Kelly on his comments. Acting Chair Kelly said he would appreciate this and would like to work these things out.

Landowner Sue Blackshear said it sounded like Santa Barbara County Water Agency and San Luis Obispo County are accustomed to using redline strikeout versions and cannot understand why we are not doing this. Mr. Van Lienden commented that W&C is currently providing more services than other GSP consultants. Mr. Beck said we have not been using red line strikeout because it becomes expensive and cumbersome when commenters provide comments on the same items.

Cuyama Valley Family Resource Center's Executive Director Lynn Carlisle suggested creating a detailed feedback loop so that if commenters feel as though their comments were not addressed, they know what to do.

Committee member Post said he believes Acting Chair Kelly should not report his personal comments regarding the Groundwater Conditions chapter to the Board tomorrow and Acting Chair Kelly agreed.

d. Adoption of Threshold Numbers for Representative Wells

Mr. Ayres let the SAC know that they are looking for approval of preliminary threshold numbers that have been applied to representative wells. He reported that W&C used the Board-directed rationales for the thresholds and 5-years of storage for setting the measure of operational flexibility. He reported that three wells were removed because there was not a method that was available to set a reasonable measurable objective and they were near other wells.

Acting Chair Kelly asked if there will be an impact on the water budget after we generate the preliminary numbers and thresholds. Mr. Ayres said the water budget is a separate technical evaluation and does not interface directly with thresholds.

Mr. Beck said once you have the water budget you will have to adjust the model with management actions and potentially adjust threshold levels.

Mr. Ayres suggested addressing the thresholds as 'proposed' rather than 'preliminary'.

Mr. Beck read SAC Chair Robbie Jaffe's following comments regarding the "proposed" threshold numbers:

"5d. Minimum Thresholds and Measurable Objectives.

I want to thank and acknowledge Woodard and Curran for working over the holidays to develop this important data where we can look at what we are setting as operational goals for the representative wells in the Basin.
I am very pleased to see the addition of representative wells in the Western and Northwestern region. I think these additions will provide a much better data set to analyze the progress and impact of water use in these areas.

In looking through the table and hydrographs sent to us on 1/4/19 I have several comments:

According to the DWR we are a high priority, critically over drafted Basin. Thus, overall, we are extracting more water than is being replenished and our plan needs to stop this trend in order to have a sustainable Basin. In general, the Minimum Thresholds for representative wells

throughout the regions are set below or at the lowest groundwater level of these wells. In many instances the Measurable Objective is below the average groundwater level of the well and sometimes below the lowest point on the graph.
Will MTs that in general are below the lowest groundwater level of wells meet the criteria of a GSP and SGMA?

Is that what we as stakeholders, especially those of us on the SAC who are here to represent the community and advise the GSA, want to put forth as the guidelines and goals for our GSP? Personally, I would like to see Minimum Thresholds not be below the lowest points of wells and Measurable Objectives set to reach a goal that will really replenish wells to before the 2015 drought.

Specifically:
Southeast region:
Is it possible to add more wells?
 # 2 continues to be problematic as previously discussed
 # 89 the MT is below the lowest graph point and the MO is below the average high

Eastern region:
#62- MT is below the lowest this well has ever been
MO is below the level at the end of 2015 drought…and the well has gone consistently down from there

Central region:
#422- this is one of the shallowest representative wells in the region. The MT is slightly below the

lowest point the GW level has ever been (and its current reading) and it is less than 20 feet from the bottom of the well. Is this a problem?

Western region:
Many of the wells in the western region have steady graph lines, yet the MTs are set below where these well levels have been. This would ideally be adjusted so that they maintain their stability, rather than allowing them to drop below where they have been.

Northwest region:
Wells #119, 121, 830, 832, 835 all MTs are lower than well depth
Wells #831, 833, 834, 836, 840, 841, 843, 845, 849 all have Measurable Objectives (i.e. the goal of where we are setting the optimal level of these representative wells) at 100 feet or more below the current level of these wells. Why wouldn't we set a MO that maintains a steady state for these water levels? It is especially concerning in that there is no recharge or pumping data available. It does not seem the intention of SGMA that groundwater levels be further reduced in a critically over drafted basin. I urge the SAC to recommend MOs to be set at a level within the current water level measurements of these wells.

Thank you."

Acting Chair Kelly asked if staff would like to respond to her comments.

Mr. Beck said some of comments go against the viability of the threshold rationales and are not strictly related to the question "do the thresholds appropriately reflect application of the rationales."

Acting Chair Kelly asked what staff thinks about her specific well threshold issues.

Mr. Ayres said he reviewed the wells thresholds that she presented in the northwestern region and agreed that the threshold levels may need to be adjusted for that region.

Mr. Melton said one of Chair Jaffe's questions was if we could add additional wells. He said we cannot at this point because we have added all the wells in the monitoring network as representative wells, unless private landowners would like to come forward and offer the use of their wells.

Mr. Melton said in the eastern region, well #62's levels are only 1-2 feet below the groundwater elevation. He stated that regarding the drop in Central region well #422, this well is a monitoring well and does not reflect production in that area.

Acting Chair Kelly asked for clarity on what type of input we are looking for. Mr. Beck said input for any wells that they do not feel the results make sense, and Mr. Ayres added he is looking for input on the potential update schedule for changing thresholds. Committee member Haslett said Mr. Ayres has said for months that there is not enough data, but over the next years we will understand more as we monitor 65 wells on a monthly basis and will paint a much more detailed picture of what is going on.

Committee member Haslett said he disagreed with one statement that Chair Jaffe had made in regard to regions outside the central basin being in critical overdraft.

Committee member Draucker said the reason Cuyama is being more conservative than other areas is because groundwater is all they have.

Ms. Carlisle said she is concerned that with 20-30 thousand acre-feet of water, if there is no will or budget to review these minimum thresholds, will this be business as usual. Mr. Beck replied that Ms. Carlisle's question relates to determining the glide path to reach sustainability, which is an iterative process. Mr. Beck said a basin can continue to overdraft for five years as they decide on management actions but at some point, you need to flatten out and DWR will be monitoring this for compliance.

Mr. Van Lienden said thresholds have been set by the Board where they have determined if levels fall below the minimum thresholds it is an undesirable result.

Ms. Blackshear commented that thresholds in the western area are reasonable for business, but not necessarily appropriate for others.

Committee member Post said wells in the northwestern region are relatively shallow because they have never needed to be deeper and we do not know where the bottom of the basin is.

Mr. Beck asked if we need resolution on the five wells in question now or can they push decisions on these five wells back a month.

Mr. Van Lienden and Mr. Ayres discussed moving these wells into the western region and applying the thresholds used in that area since thresholds on those wells are below the well depth.

Mr. Melton said if you set the minimum threshold at current water levels, that means you are going to reduce pumping de facto, but setting the levels a little lower allows the opportunity to adjust pumping overtime to obtain a balanced basin.

Mr. Ayres said they missed the minimum threshold being below the well depth for these five wells and they should be adjusted.

Acting Chair Kelly took a poll from the SAC to approve the proposed threshold numbers for representative wells; however, in the Northwestern Region, 2 wells should be removed due to inappropriate threshold results and 3 wells should have the Western Region rationale applied.

<u>Poll</u>

AYES:	Committee Members DeBranch, Draucker, Furstenfeld, Haslett, Post, Valenzuela, and Acting Chair Kelly
NOES:	None

The SAC reached general consensus to review thresholds numbers the first year and implement changes in the second year.

e. Stakeholder Engagement Update

GSP Outreach the Catalyst Group's Charles Gardiner provided an update on stakeholder engagement activity.

Acting Chair Kelly said he prefers the workshops at the Recreation Center.

Committee Member Post left the meeting at 6:17 pm
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6. Groundwater Sustainability Agency

a. Report of the Executive Director
Nothing to report.

b. Board of Directors Agenda Review
Mr. Beck provided an overview of the January 9, 2019 CBGSA Board of Directors agenda.

c. Report of the General Counsel
Legal Counsel Joe Hughes addressed the SAC regarding Brown Act and SGMA issues arising from CBGSA Board members, SAC members and Cuyama Water District Board members attending the meetings of one another. An important conclusion was that CBGSA Board members may attend SAC meetings, but should not advocate to the SAC regarding the advice and input the SAC gives to the CBGSA Board.

Ms. Wooster asked when she would be able to have her opinions expressed as a major stakeholder in the Cuyama Basin, and Mr. Hughes said she would express those opinions at the CBGSA Board meeting.

7. Items for Upcoming Sessions
Nothing to report.

8. Committee Forum
Nothing to report.

9. Public comment for items not on the Agenda
Nothing to report.

10. Adjourn
Acting Chair Kelly adjourned the meeting at 6:39 p.m.

I, Jim Beck, Executive Director of the Cuyama Basin Groundwater Sustainability Agency, do hereby certify that the foregoing is a fair statement of the proceedings of the meeting held on Tuesday, January 8, 2019, by the Cuyama Basing Groundwater Sustainability Agency Standing Advisory Committee.

Jim Beck
Dated: January 31, 2019

TO: Standing Advisory Committee
Agenda Item No. 5a

FROM: Brian Van Lienden, Woodard & Curran (W&C)

DATE: January 31, 2019

SUBJECT: Groundwater Sustainability Plan Update

Issue
Update on the Cuyama Basin Groundwater Sustainability Agency Groundwater Sustainability Plan.

Recommended Motion
None – information only.

Discussion
Cuyama Basin Groundwater Sustainability Agency Groundwater Sustainability Plan consultant Woodard & Curran's GSP updates are provided as the following attachments:

Attachment 1 – GSP Update
Attachment 2 – Water Budget Update
Attachment 3 – Preliminary Discussion on Project and Management Actions
Attachment 4 – Presentation on Groundwater Dependent Ecosystems

Attachment 1

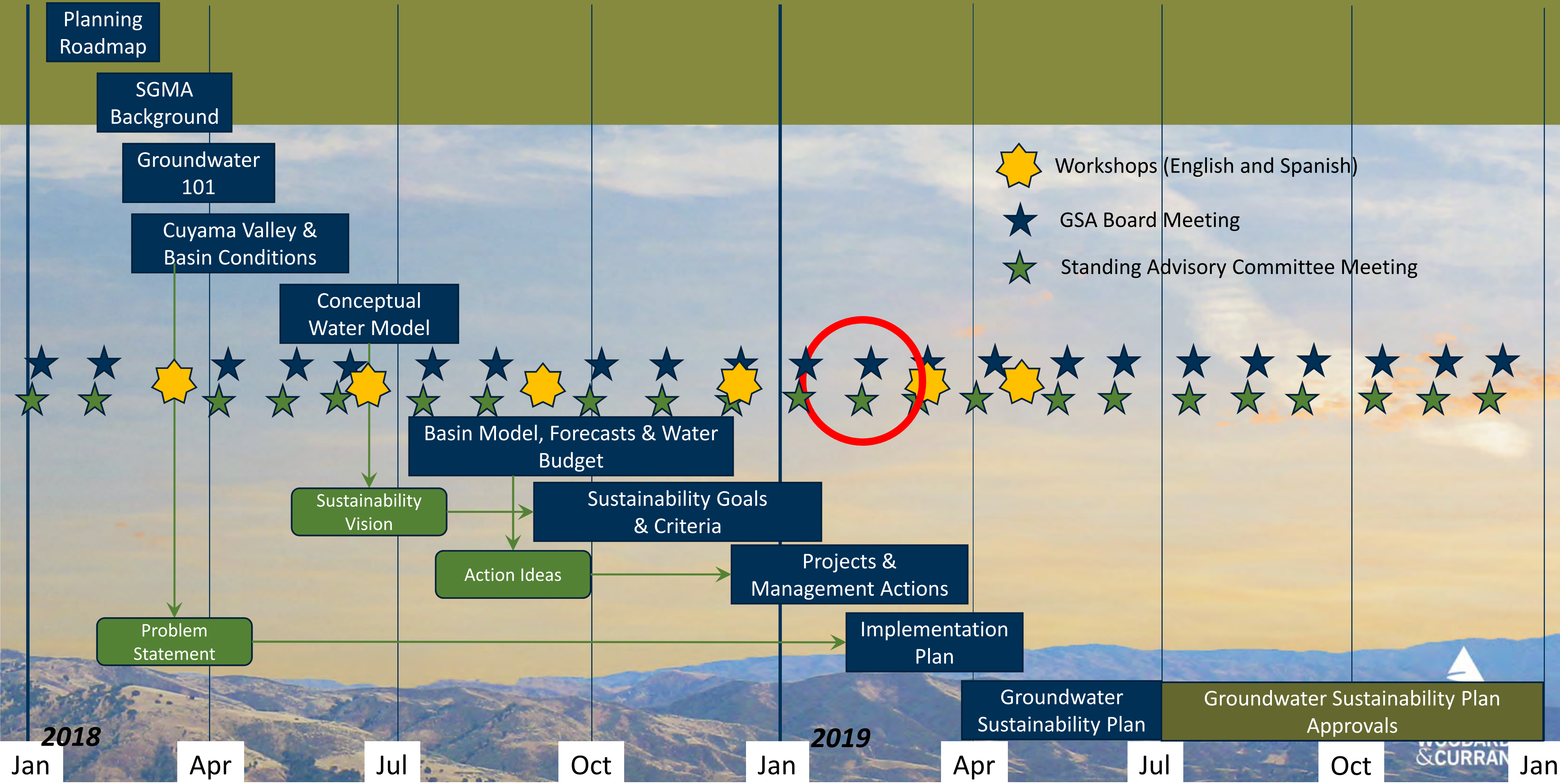
Cuyama Basin Groundwater Sustainability Agency

Groundwater Sustainability Plan Update

January 31, 2019

WOODARD & CURRAN

Cuyama Basin Groundwater Sustainability Plan – Planning Roadmap



January GSP Accomplishments

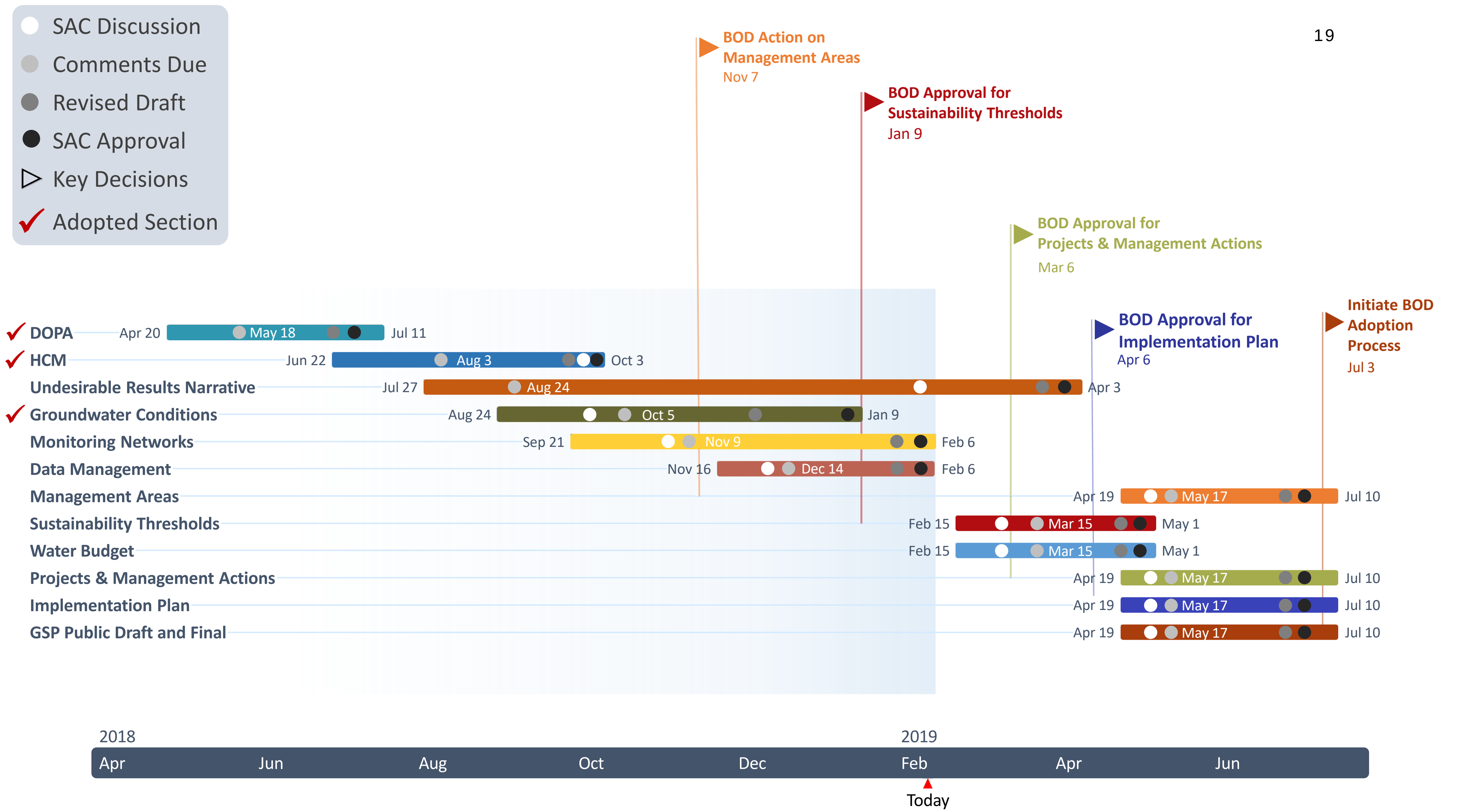
- ✓ Developed revised threshold numbers per Board direction
- ✓ Facilitated discussion on thresholds at SAC/Board meetings
- ✓ Updated Data Management GSP chapter in response to comments
- ✓ Updated Monitoring Networks GSP chapter in response to comments
- ✓ Refined historical calibration and future conditions scenario of numerical model based on comments from Technical Forum

WOODARD & CURRAN

GSP Sections

1. Introduction
   - 1.1 GSA Authority & Structure
   - 1.2 Plan Area
   - 1.3 Outreach Documentation
2. Basin Settings
   - 2.1. HCM
   - 2.2 GW Conditions
   - 2.3 Water Budget
     - *Appendix:* Numerical GW Model Documentation
3. Undesirable Results
   - 3.1 Sustainability Goal
   - 3.2 Narrative/Effects
   - 3.2 ID Current Occurrence
4. Monitoring Networks
   - 4.1 Data Collection/Processing
   - 4.2 GSP Monitoring Networks
5. Sustainability Thresholds
   - 5.1 Threshold Regions
   - 5.2 Minimum Thresholds, Measurable Objectives, Margin of Operational Flexibility, Interim Milestones
6. Data Management System
   - *Appendix:* DMS User Guide
7. Projects & Management Actions
8. GSP Implementation

WOODARD & CURRAN


SAC Discussion
Comments Due
Revised Draft
SAC Approval
Key Decisions
Adopted Section
BOD Action on Management Areas Nov 7
BOD Approval for Sustainability Thresholds Jan 9
BOD Approval for Projects & Management Actions Mar 6
BOD Approval for Implementation Plan Apr 6
Initiate BOD Adoption Process Jul 3
DOPA Apr 20 May 18 Jul 11
HCM Jun 22 Aug 3 Oct 3
Undesirable Results Narrative Jul 27 Aug 24 Apr 3
Groundwater Conditions Aug 24 Oct 5 Jan 9
Monitoring Networks Sep 21 Nov 9 Feb 6
Data Management Nov 16 Dec 14 Feb 6
Management Areas Apr 19 May 17 Jul 10
Sustainability Thresholds Feb 15 Mar 15 May 1
Water Budget Feb 15 Mar 15 May 1
Projects & Management Actions Apr 19 May 17 Jul 10
Implementation Plan Apr 19 May 17 Jul 10
GSP Public Draft and Final Apr 19 May 17 Jul 10
2018
2019
Apr
Jun
Aug
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Dec
Feb
Apr
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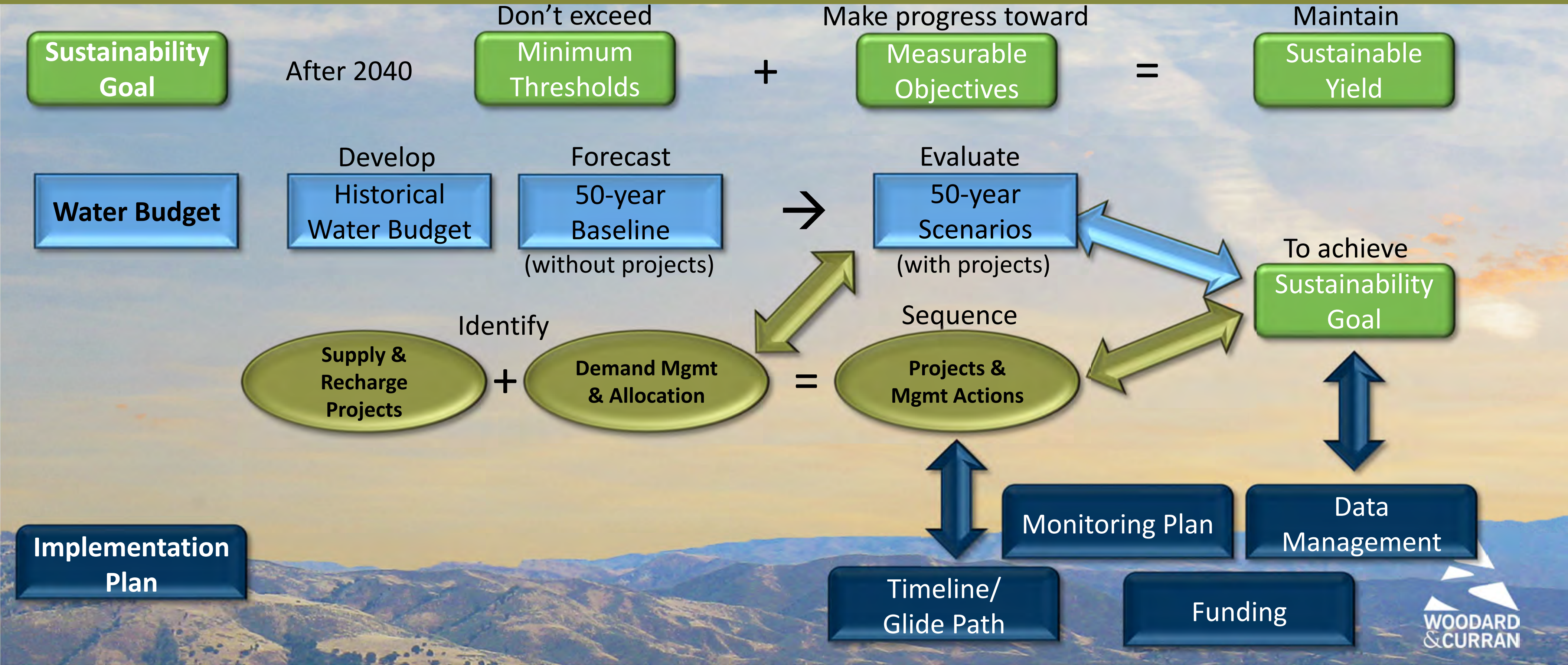
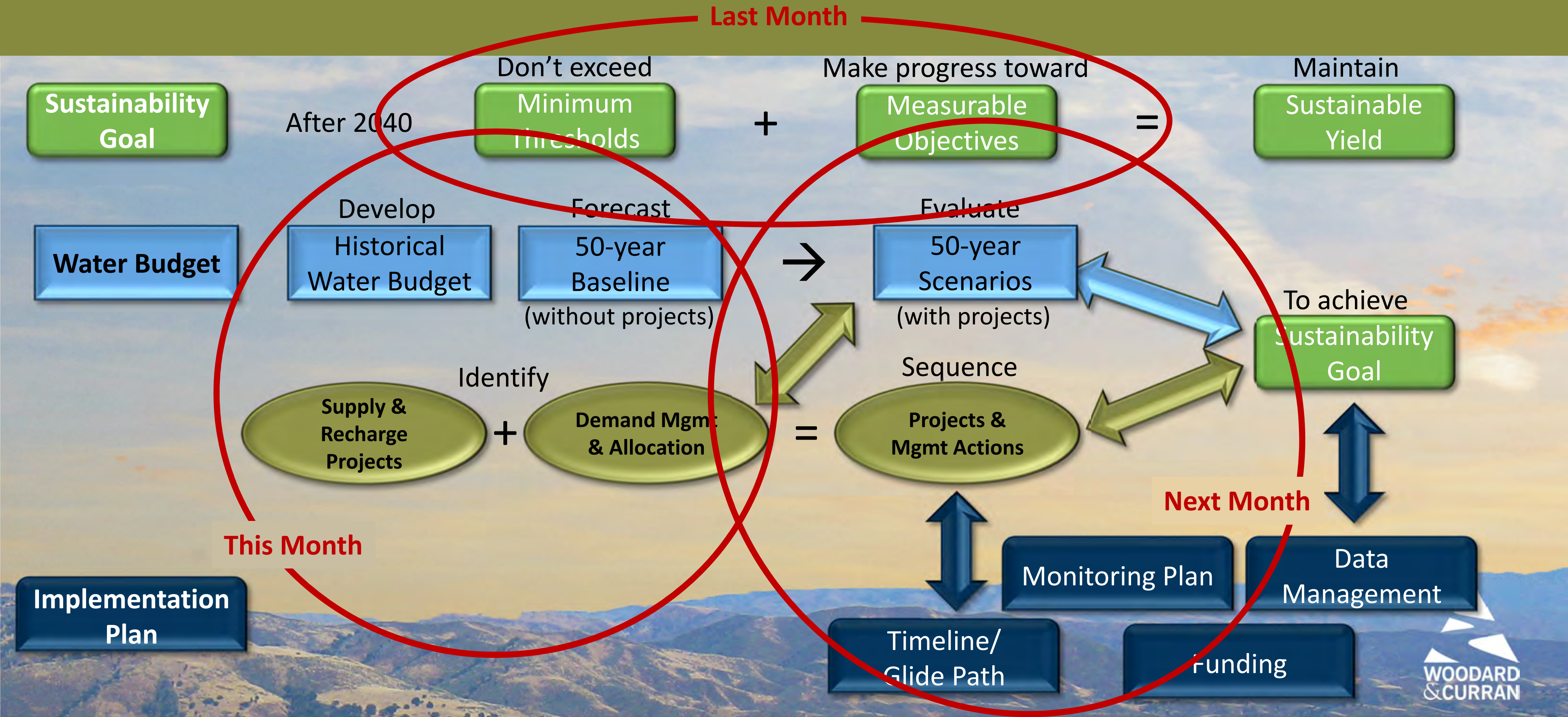
Today

GSP Discussion Approach & Terminology



GSP Discussion Approach & Terminology



Attachment 2

Cuyama Basin Groundwater Sustainability Agency

Water Budget Update

January 31, 2019

WOODARD & CURRAN

Water Budgets - Time Frames

Historical Conditions

Historical hydrology, land use and population (1995-2015)

Current Conditions

2017 land use and population

1967 - 2017 historical hydrology

Future Conditions

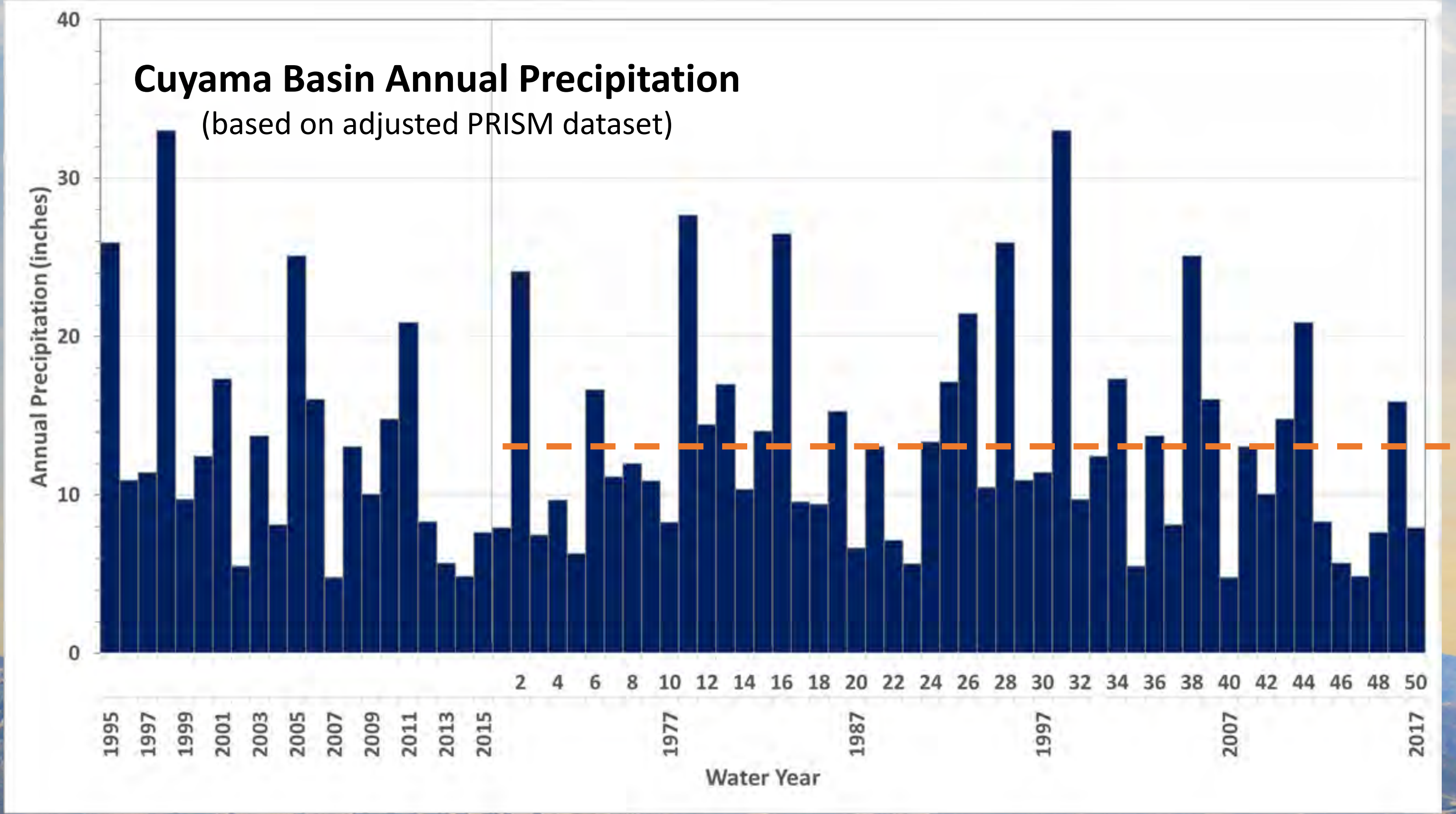
Year 2040 land use and population

- Assumed to be the same as Current Conditions

1967- 2017 historical hydrology

With and without climate change

Future Conditions
Cuyama Basin Adjusted PRISM Precipitation



Average Annual Precipitation (50 years)

- Entire Basin: 13.1 inches
- Valley Floor: 11.5 inches
- Foothills: 14.8 inches

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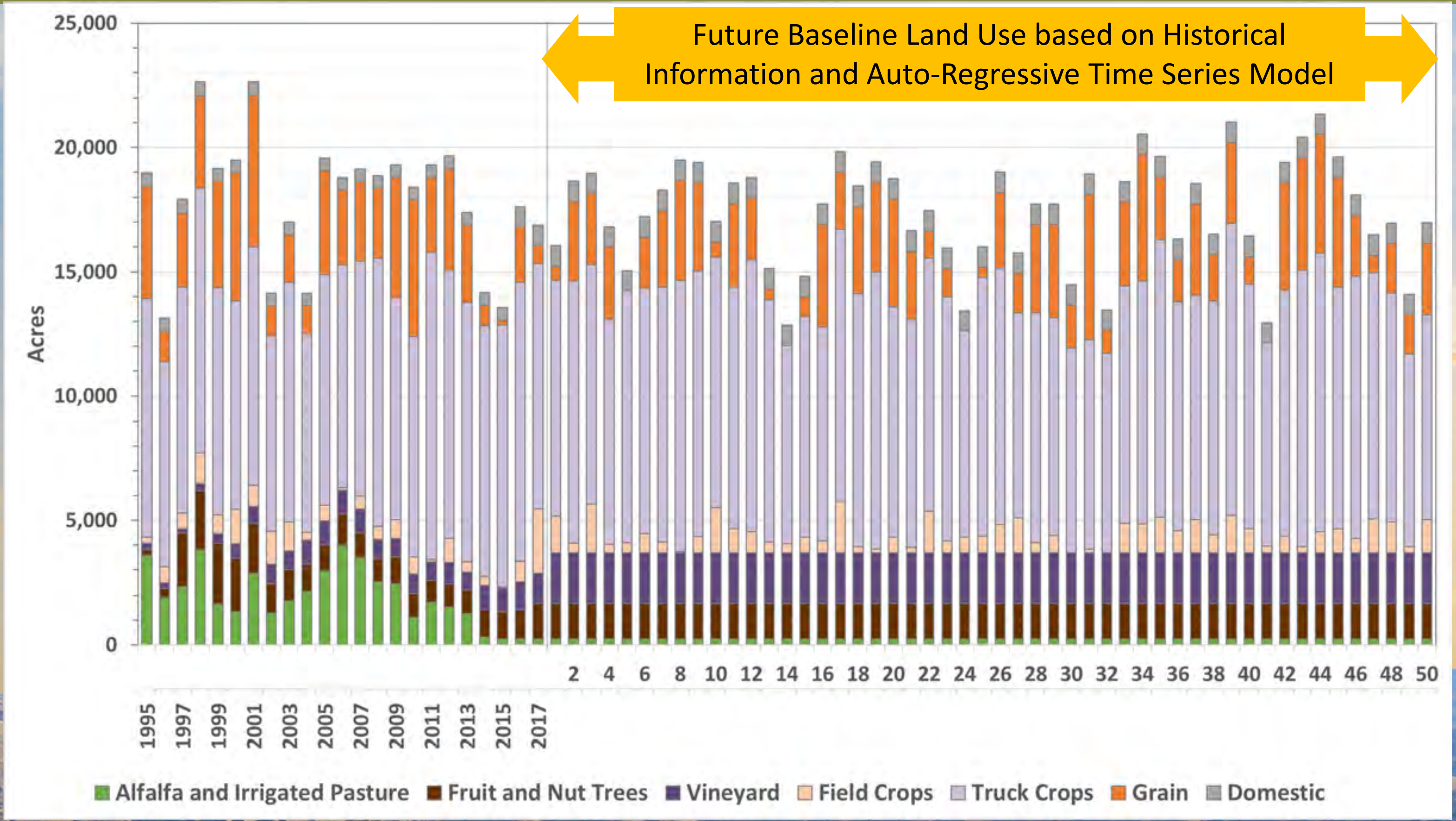
Future Conditions
Cuyama Basin Land Use



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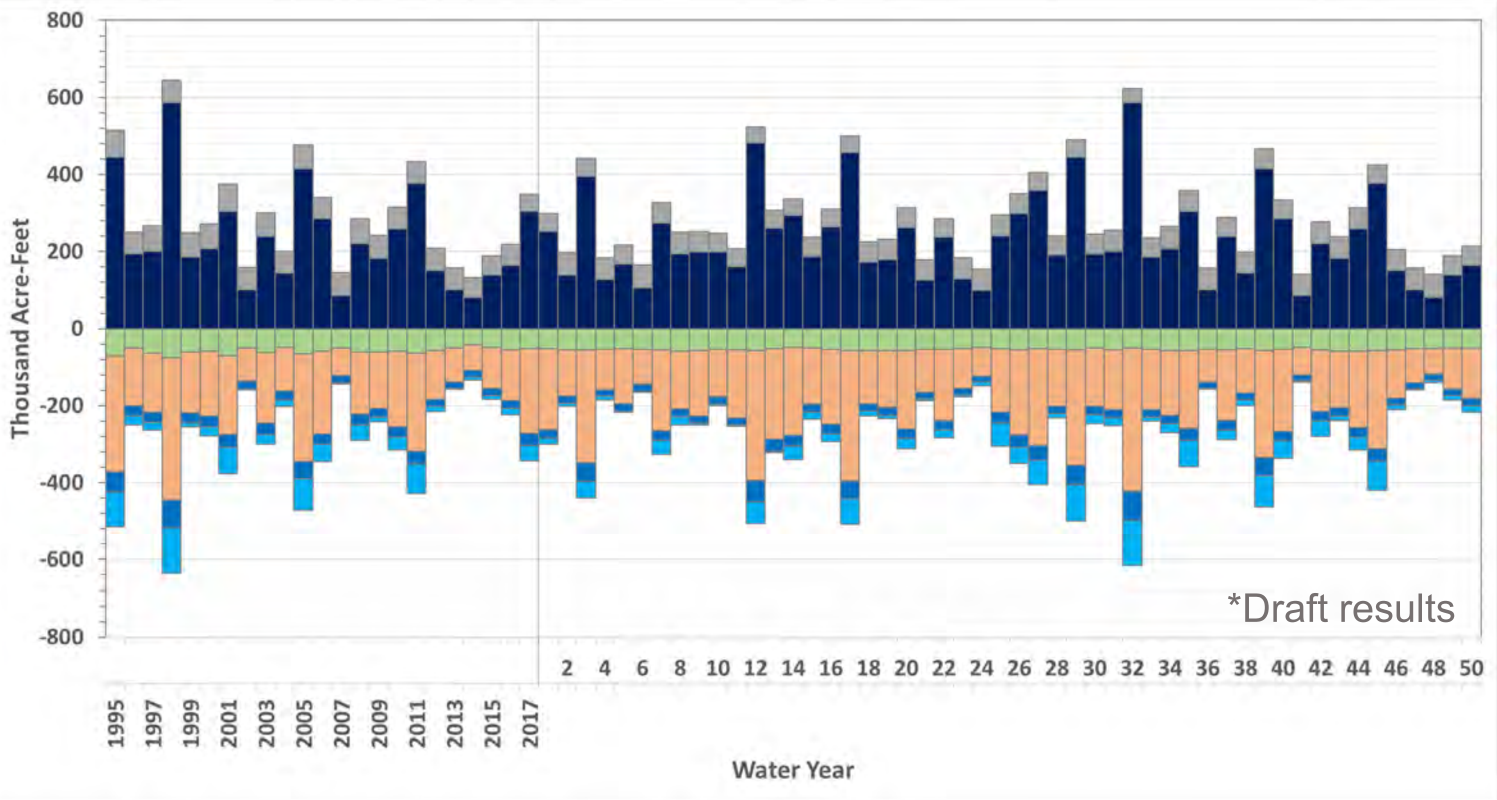
Future Conditions Land Surface Water Budget: Basin-Wide

DRAFT



Average Annual (50 years)

Inflows

- Precipitation: 230 TAF (~11.4 in)
- Applied Water 60 TAF

Outflows

- Ag. Actual ET 57 TAF
- NV Actual ET 182 TAF
- Dom. Act. ET <0.1 TAF
- Deep Perc. 24 TAF
- Runoff 27 TAF

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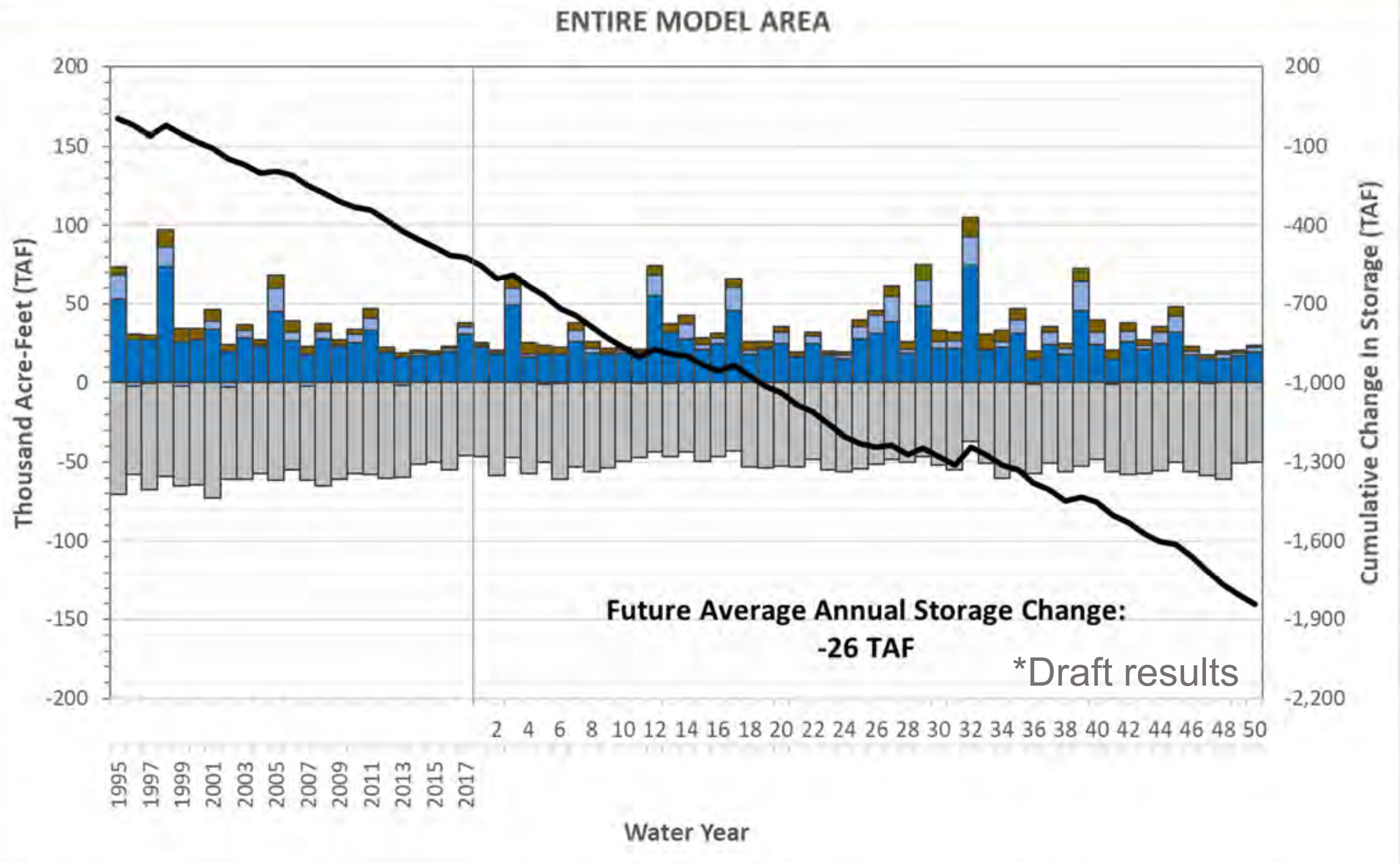
Future Conditions Groundwater Budget: Basin-Wide

DRAFT



Average Annual (50 years)

Inflows:

Deep Percolation	24 TAF
Stream Seepage	5 TAF
Boundary Flow	5 TAF

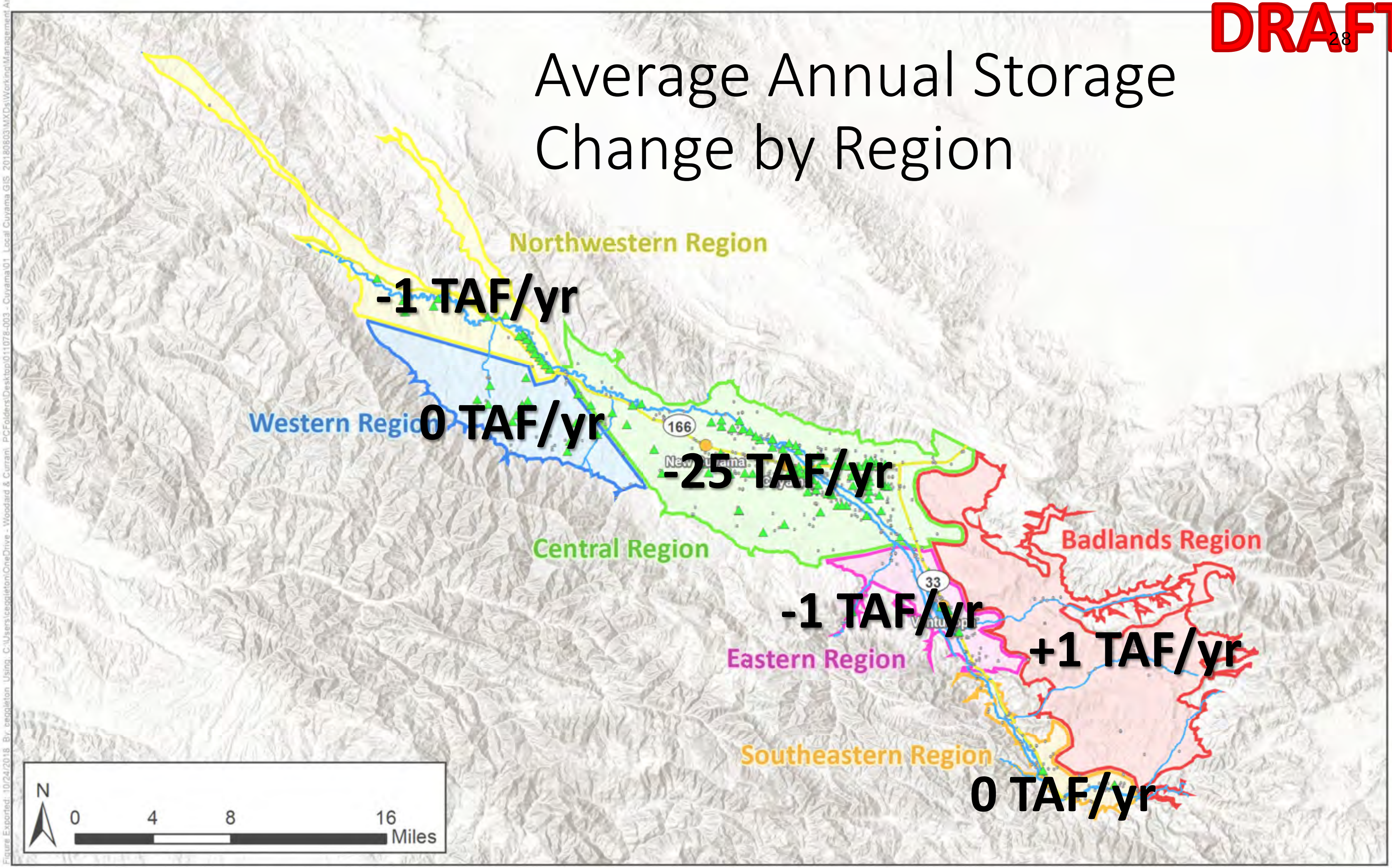
Outflows:

GW Pumping	60 TAF

WOODARD & CURRAN

Average Annual Storage Change by Region

DRAFT



Northwestern Region

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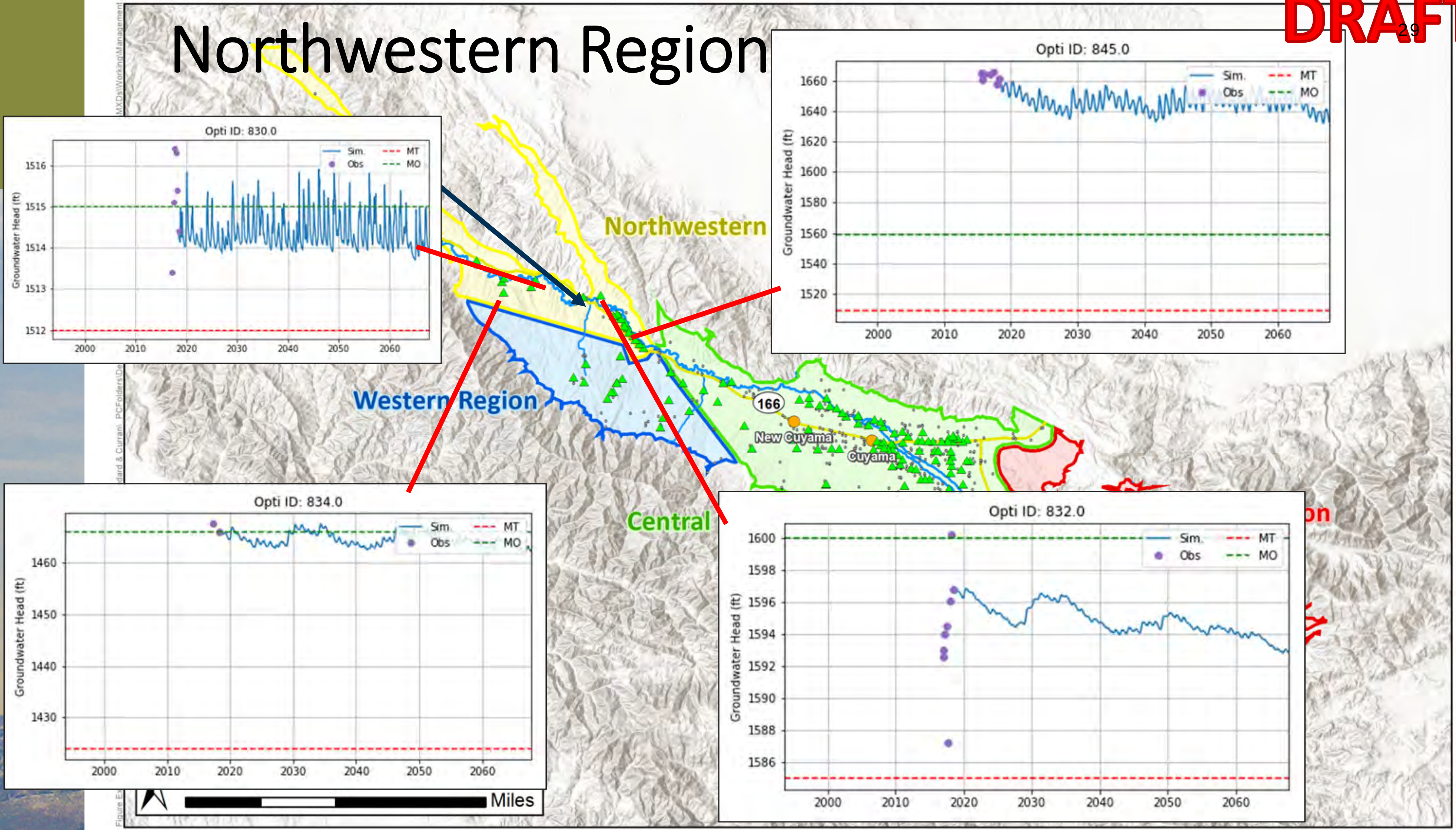

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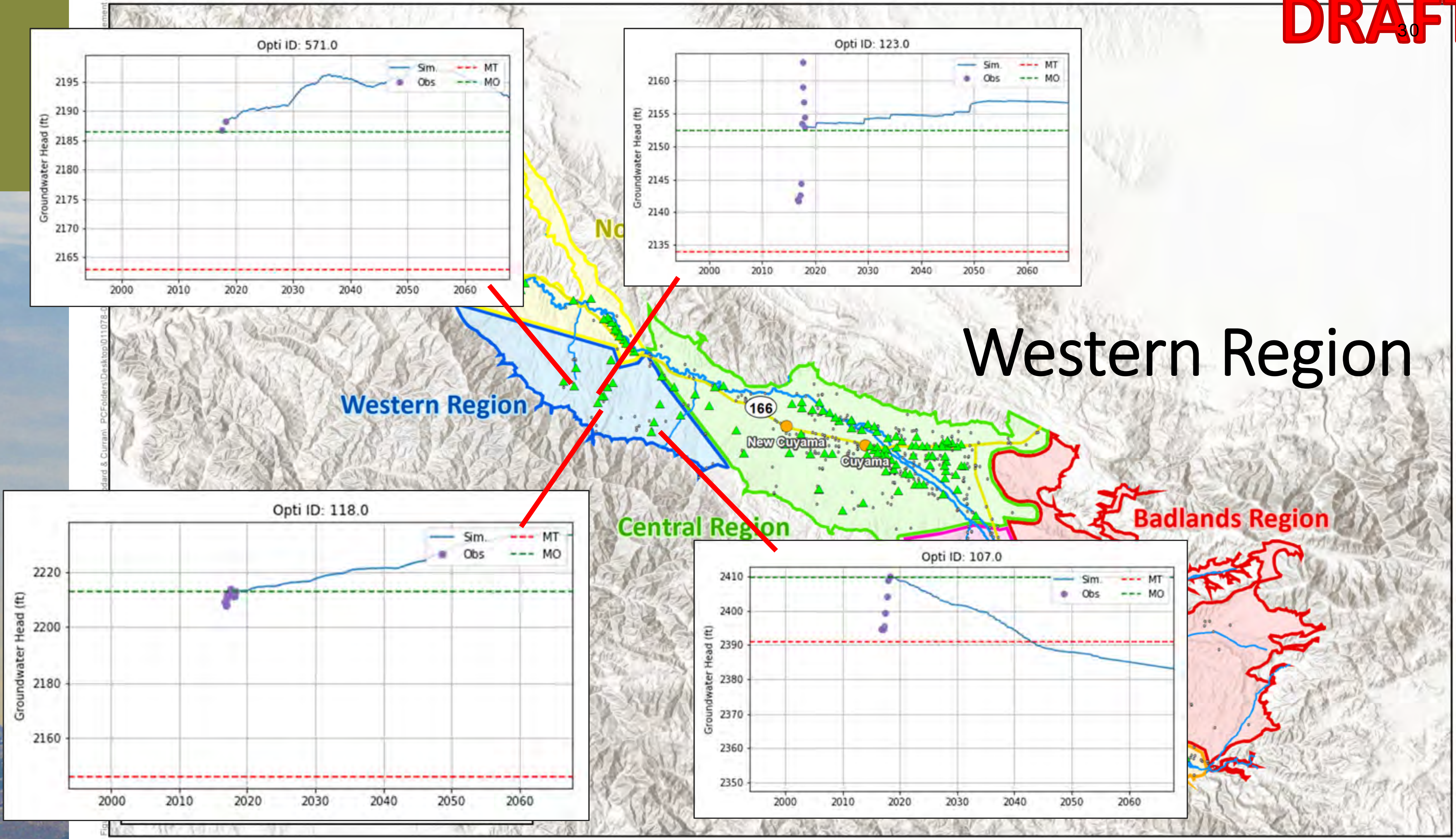
Western Region



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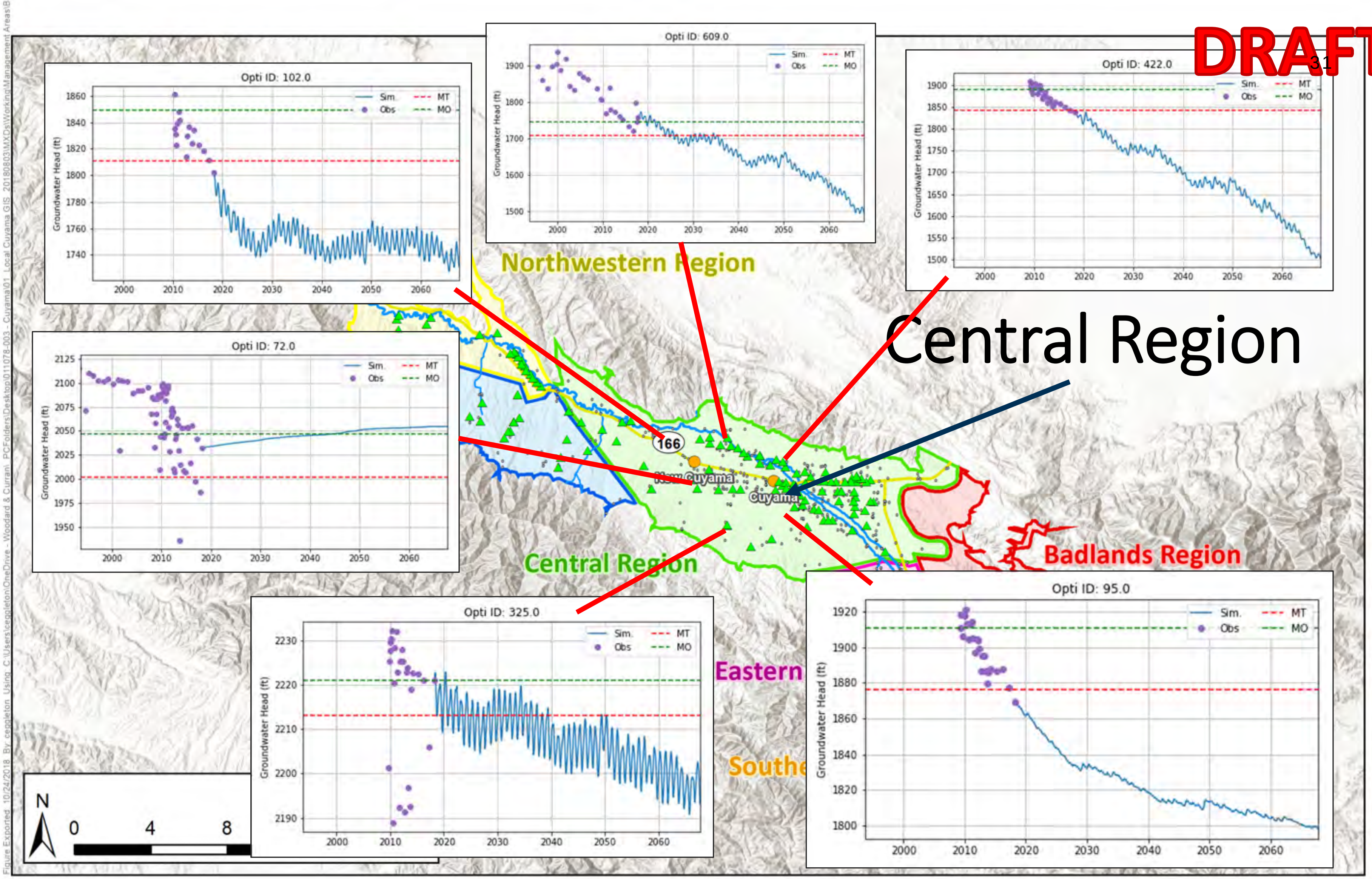
Central Region



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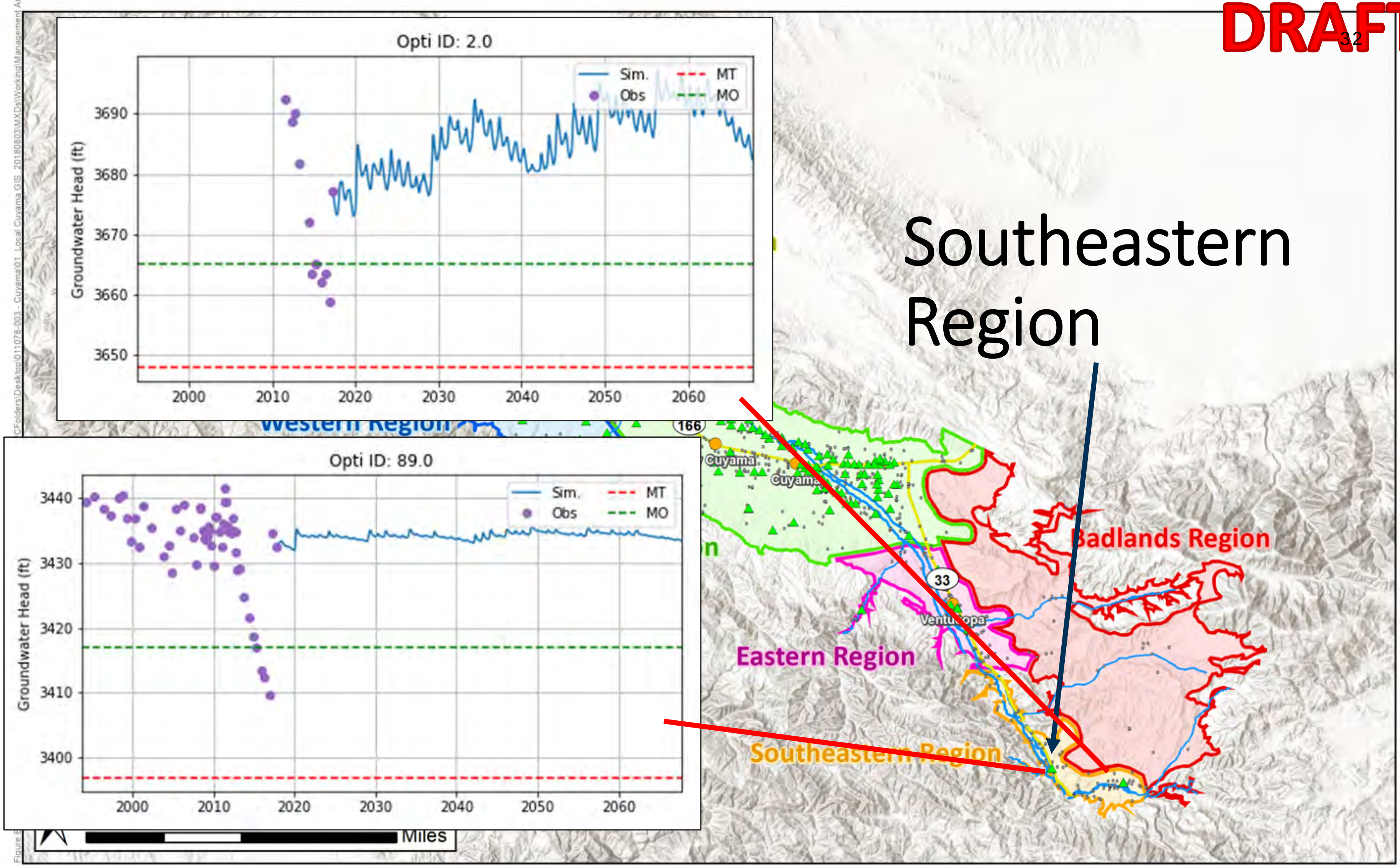
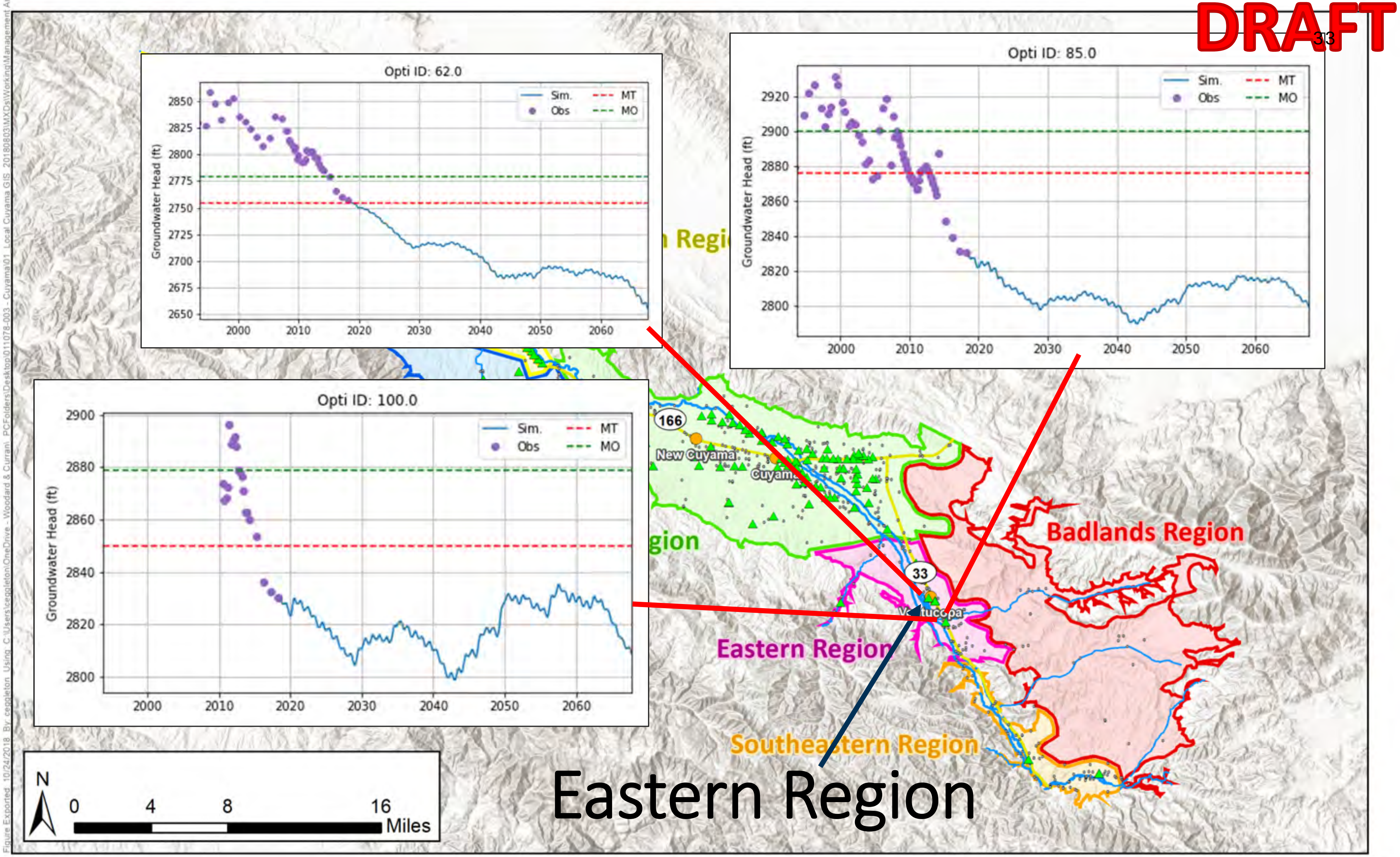
Southeastern Region





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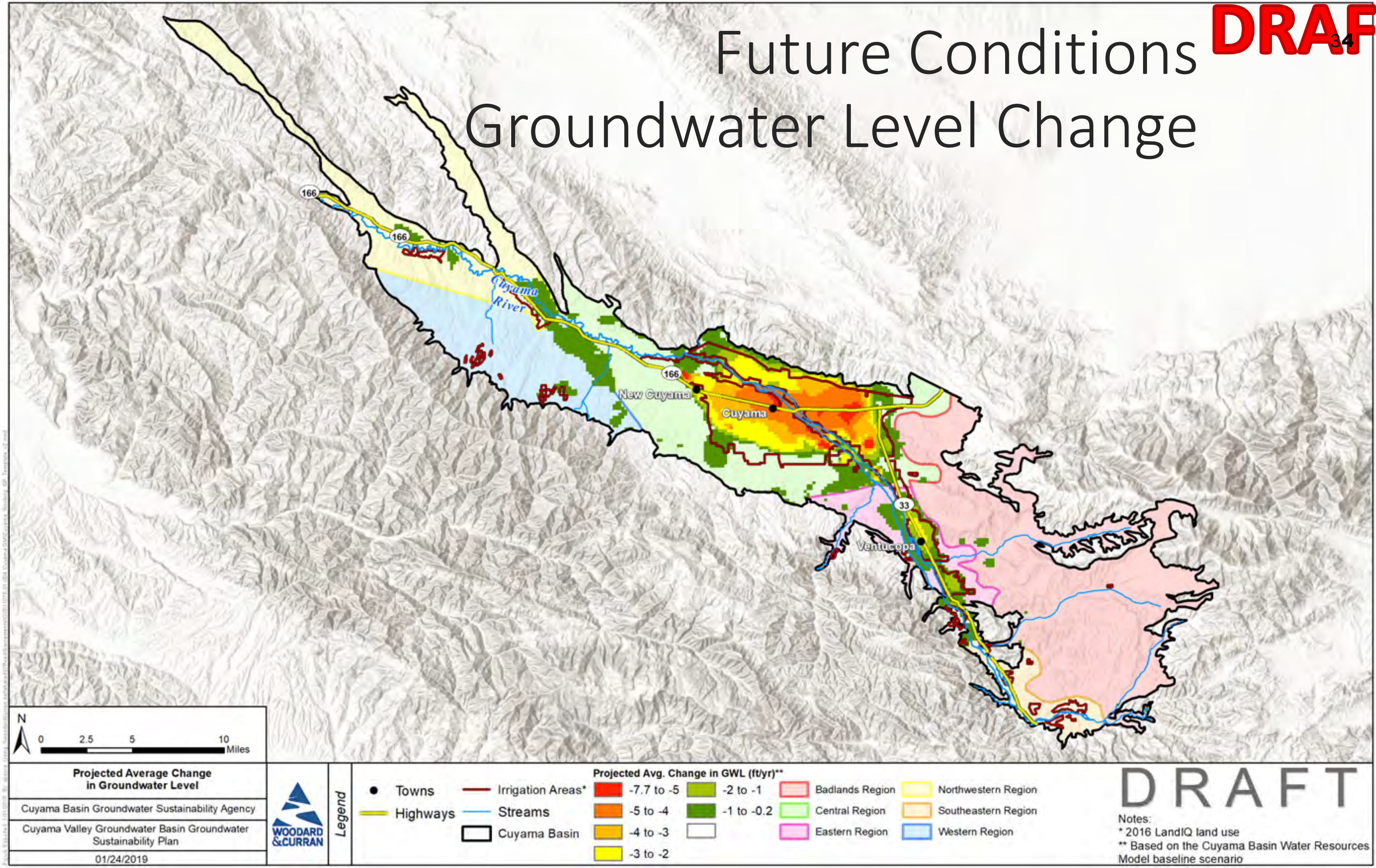
33
Opti ID: 62.0
Groundwater Head (ft)
Sim.
Obs
MT
MO
Opti ID: 85.0
Groundwater Head (ft)
Sim.
Obs
MT
MO
Opti ID: 100.0
Groundwater Head (ft)
Sim.
Obs
MT
MO
166
New Cuyama
Cuyama
33
Badlands Region
Eastern Region
Southeastern Region
N
0 4 8 16
Miles
Eastern Region

Future Conditions Groundwater Level Change

DRAFT



Cuyama Basin Groundwater Sustainability Agency

Projects and Management Actions

January 31, 2019

Process for Identifying and Analyzing Management Actions and Projects

- Solicit public input on potential actions and projects (Sep)
- Evaluation and characterization of actions and projects (Sep-Jan)
- **Discuss potential actions with SAC and Board (Jan-Feb)**
- Numerical modeling of management action alternatives (Feb)
- Present numerical modeling results to SAC and Board (Feb-Mar)

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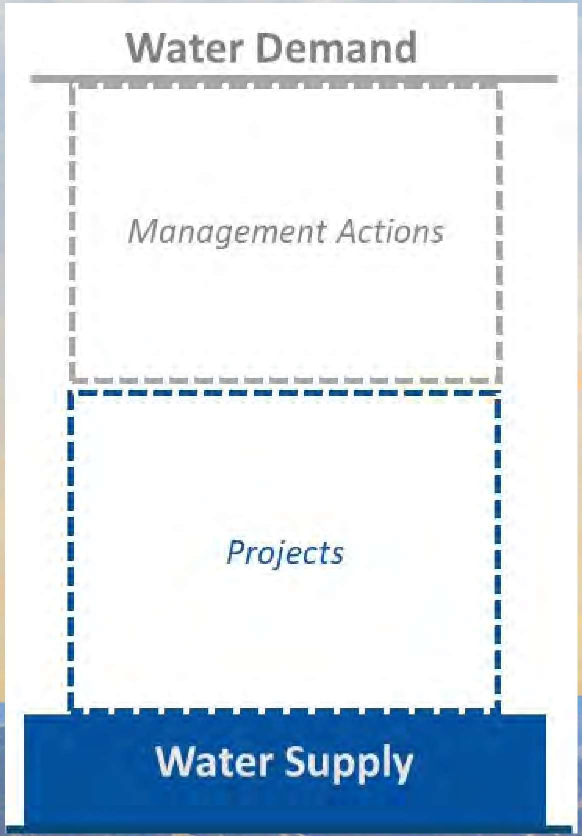
Projects and Management Actions to Close the Gap Between Water Supplies and Demands

- Water supply projects to increase available supplies
- Management actions to reduce groundwater pumping
- Adaptive management to respond to changes in supplies and demands over time



Projects and Management Actions Considered

- New pumping wells for local communities
  - Cuyama CSD & Ventucopa
- Projects to increase net Basin water supply
  - Flood/Stormwater Capture
  - Municipal Area Rainwater Capture
  - Rangeland Management
  - Water Supply Imports via Pipeline
  - Water Supply Imports via Transfer/Exchange
  - Precipitation Enhancement
- Demand management/allocation approaches

New Pumping Well for Cuyama CSD & Ventucopa

- Potential Yield: up to 460 gpm (CCSD) or 55 gpm (Ventucopa)
- Estimated Cost: ~$1,175,000
- Planning Horizon: 0-5 years
- Description: Addresses issues with access to reliable water supplies. Drill a replacement well for CSD well #2, which has been abandoned. Construct a new water supply pump, pipeline and meters for Ventucopa's existing well.
- Potential Implementation Issues: How to finance
- Recommendation: Include in GSP portfolio of projects

Sources: *Cuyama Community Services District Well No. 4 Drilling and Equipping Project*, February 2018
Ventucopa Water Supply Company Water System Evaluation Report, February 2007

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Flood/Stormwater Capture

- Potential Yield: 4,400 AF/year
- Estimated Cost: $600-800/acre-foot
- Planning Horizon: 0-5 years
- Description: The addition of surface water into a groundwater aquifer through surface infiltration. Recharge locations would be determined based on soil properties, current groundwater conditions and projected surface flow conditions.
- Potential Implementation Issues: Water available for recharge may be limited by downstream water rights; requires acquisition of land for spreading grounds
- Recommendation: Include as an option in the GSP and perform detailed studies to refine potential yield and cost

Source: Santa Barbara County, *Long Term Supplemental Water Supply Alternatives Report*, December 2015

WOODARD & CURRAN

Municipal Area Rainwater Capture

- Potential Yield: 1-2 AF/year
- Estimated Cost: $5,500/acre-foot
- Planning Horizon: 0-5 years
- Description: The capture and storage of rainwater or overland flow in residential areas using rain barrels or cisterns prior to the water reaching surface water bodies.
- Potential Implementation Issues: Requires significant public outreach; may require subsidized incentive plan
- Recommendation: Do not include in GSP portfolio of projects due to high cost and low potential yield

Source: Santa Barbara County, *Long Term Supplemental Water Supply Alternatives Report*, December 2015

WOODARD & CURRAN

Rangeland and Forest Management

- Potential Yield: undetermined
- Estimated Cost: $500/acre-foot
- Planning Horizon: 0-5 years
- Description: Removal of native vegetation in forest or rangeland areas through controlled burning could reduce water consumption through decreased evapotranspiration
- Potential Implementation Issues: potential adverse effects on wildlife habitat; air quality concerns from smoke and dust; potential increase in flood flows due to reduced water interception
- Recommendation: Do not include in GSP portfolio of projects due to uncertain benefits and potential wildlife and air quality impacts

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Water Supply Imports via Pipeline

- Potential Yield: undetermined
- Estimated Cost: $5,000-10,000/acre-foot
- Planning Horizon: 10-20 years
- Description: Purchase water transfer or excess SWP water and import into Cuyama Basin via a new pipeline
- Potential Implementation Issues: High cost and reliability of potnetial supplies
- Recommendation: Do not include in GSP portfolio of projects due to cost

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Water Supply Imports via Exchange

- Potential Yield: undetermined
- Estimated Cost: $600-$2,800/acre-foot
- Planning Horizon: 10-20 years
- Description: Purchase water transfer or excess SWP water and exchange with water users downstream of Lake Twitchell to allow for greater floodwater capture upstream
- Potential Implementation Issues: High cost, willingness of downstream users to enter exchange program
- Recommendation: Include for consideration for future study as part of stormwater capture analysis during GSP implementation phase

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Precipitation Enhancement

- Potential Yield: 1,000-5,000 AF/year
- Estimated Cost: $20-30/acre-foot
- Planning Horizon: 0-5 years
- Description: The introduction of atmospheric silver iodide to serve as condensation nuclei that would increase snowfall over mountain regions; rainfall could potentially increase by 5-15% in the Cuyama Basin
- Potential Implementation Issues: operational precision; potential concerns about silver toxicity
- Recommendation: Include as an option in the GSP and perform detailed studies to refine potential yield and cost

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Summary of Potential Projects

- Are there any clarifying questions on the potential projects?
- Are there any comments on the proposed recommendations?

Option	Recommendation
New Pumping Well for Cuyama CSD & Ventucopa	Include in GSP portfolio of projects
Flood/Stormwater Capture	Include in GSP portfolio of projects and in GSP modeling analysis and perform detailed study going forward
Municipal Area Rainwater Capture	Do not include in GSP portfolio of projects
Rangeland and Forest Management	Do not include in GSP portfolio of projects
Water Supply Imports via Pipeline	Do not include in GSP portfolio of projects
Water Supply Imports via Pipeline	Do not include in GSP portfolio of projects; include in future analyses of flood/stormwater capture
Precipitation Enhancement	Include in GSP portfolio of projects and in GSP modeling analysis and perform detailed study going forward

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Demand Management/Allocation Approach

- Under SGMA, GSAs have authority to establish groundwater extraction allocations
- SGMA and GSPs adopted under SGMA cannot alter water rights
- Potential components of a demand management approach:
  - Pumping restrictions/allocations
    - Water accounting
    - Water metering
  - Water market
  - Fees
    - By pumping amount or acreage
  - Glide path

Examples of Allocation Methods

Method	Description	Advantages	Disadvantages
Pro Rata Allocation per Overlying Acre	Divides available groundwater proportional to property size	● Recognizes correlative nature of groundwater rights ● Simple approach in calculation	● Creates inequities for those who have invested in use of groundwater ● Ignores legal limitations on use
Pro Rata Allocation per Irrigated Overlying Acre	Allocates each irrigated acre a specific quantity of groundwater	● Acknowledges existing pumping ● Simple approach in calculation	● Does not consider unexercised groundwater rights ● Does not recognize historic use ● Ignores legal limitations on use
Allocation Based on Fraction of Historic Pumping	Allocates water based on historic groundwater use	● Potential to reduce conflict among existing pumpers	● Requires data re historic use ● Ignores correlative nature of groundwater rights
Hybrid	Applies above methods differently in different parts of the Basin	● Provides greatest flexibility	● Additional complexity due to lack of consistency across Basin

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Example Application of Allocation Methods – Pro Rata

- Example Basin:
  - 300 AF sustainable yield
  - 300 irrigated acres out of 600 total acres
- Computation: Take 300 AF (sustainable yield) divided by total basin acreage (600 acres) ~ 0.5 AF/ac
- GSAs can modify implementation and allocation within GSA, but establishes basis for basin-wide management

Advantages	Disadvantages
• Simple • Recognizes correlative nature of GW rights	• Does not explicitly account for appropriators / prescriptive rights • Allocates same amount to irrigated and unirrigated acres

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Example Application of Allocation Methods – Pro Rata (Irrigated Acres)

- Example Basin:
  - 300 AF sustainable yield
  - 300 irrigated acres out of 600 total acres
- Take 300 AF (sustainable yield) divided irrigated acres (300 acres) (~18,000 acres) ~ 1.0 AF/irrigated ac
- GSAs can modify implementation and allocation within GSA, but establishes basis for basin-wide management

Advantages	Disadvantages
• Simple • Acknowledges existing pumping	• Does not explicitly account for appropriators / prescriptive rights • Does not account for unexercised GW rights

Example Application of Allocation Methods – Historic Pumping

- Review historic pumping data for agricultural users (if available)
- Overlying users could be allocated on a per-acre basis OR based on historic use if that information is available
- GSAs can modify implementation and allocation within GSA, but establishes basis for basin-wide management

Advantages	Disadvantages
• Less likely to result in conflict among users • Explicitly accounts for appropriative use / prescriptive rights	• Requires more data • If unirrigated acres are excluded, does not account for unexercised GW rights

***Numbers presented are preliminary draft estimates for discussion purposes only and require additional review and vetting*

WOODARD & CURRAN

Recommendation for Next Steps on Projects and Actions

- Perform modeling analysis to determine action needed to achieve sustainable yield under the following scenarios:
  - Pumping reductions only
  - With water supply projects and pumping reductions
- Report on updated water budgets and sustainable yield results with implemented actions at next Tech Forum/SAC/Board meetings

Key Implementation Plan Components

- Establishment of Monitoring Program
  - Coordination with monitoring entities
  - Agreements with local landowners
- Data Collection and Analysis
  - Water levels, water quality, subsidence
- Annual reporting
- GSP Five-year Update
  - Re-evaluation of thresholds
  - Review/update of numerical model
  - More detailed analysis of potential projects/actions
- Ongoing GSA Administration
  - Maintenance of DMS, website
  - Board/SAC meetings and other stakeholder outreach
- Financing Plan

Attachment 4

Cuyama Basin Groundwater Sustainability Agency

Groundwater Dependent Ecosystems

January 31, 2019

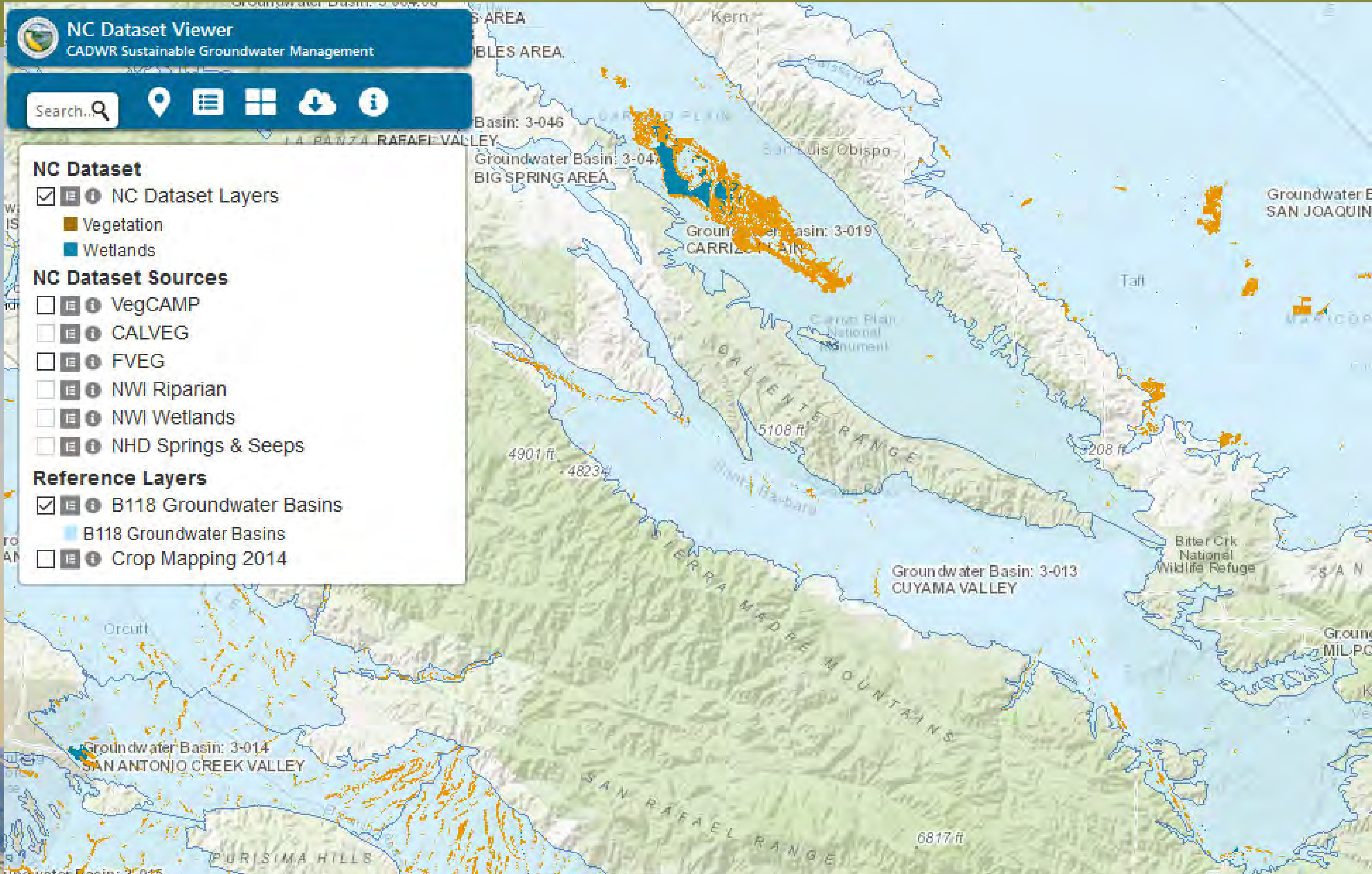
WOODARD & CURRAN

Groundwater Dependent Ecosystems (GDEs)

- SGMA requirements:
  - Identification of GDEs (10727.2(a))
  - Describe impacts of management actions on GDEs (10727.4)
    - But no specific management actions are required to protect identified GDEs
- Summary of W&C Analysis:
  - Used Nature Conservancy dataset
  - Verified polygons by licensed biologist
  - Reviewed relationship between GDEs and monitoring
  - Verified GDEs

Groundwater Dependent Ecosystems (GDEs)

- Nature Conservancy (NC) Dataset
- Identifies potential vegetation and wetlands dependent on groundwater
- DWR recommends verification

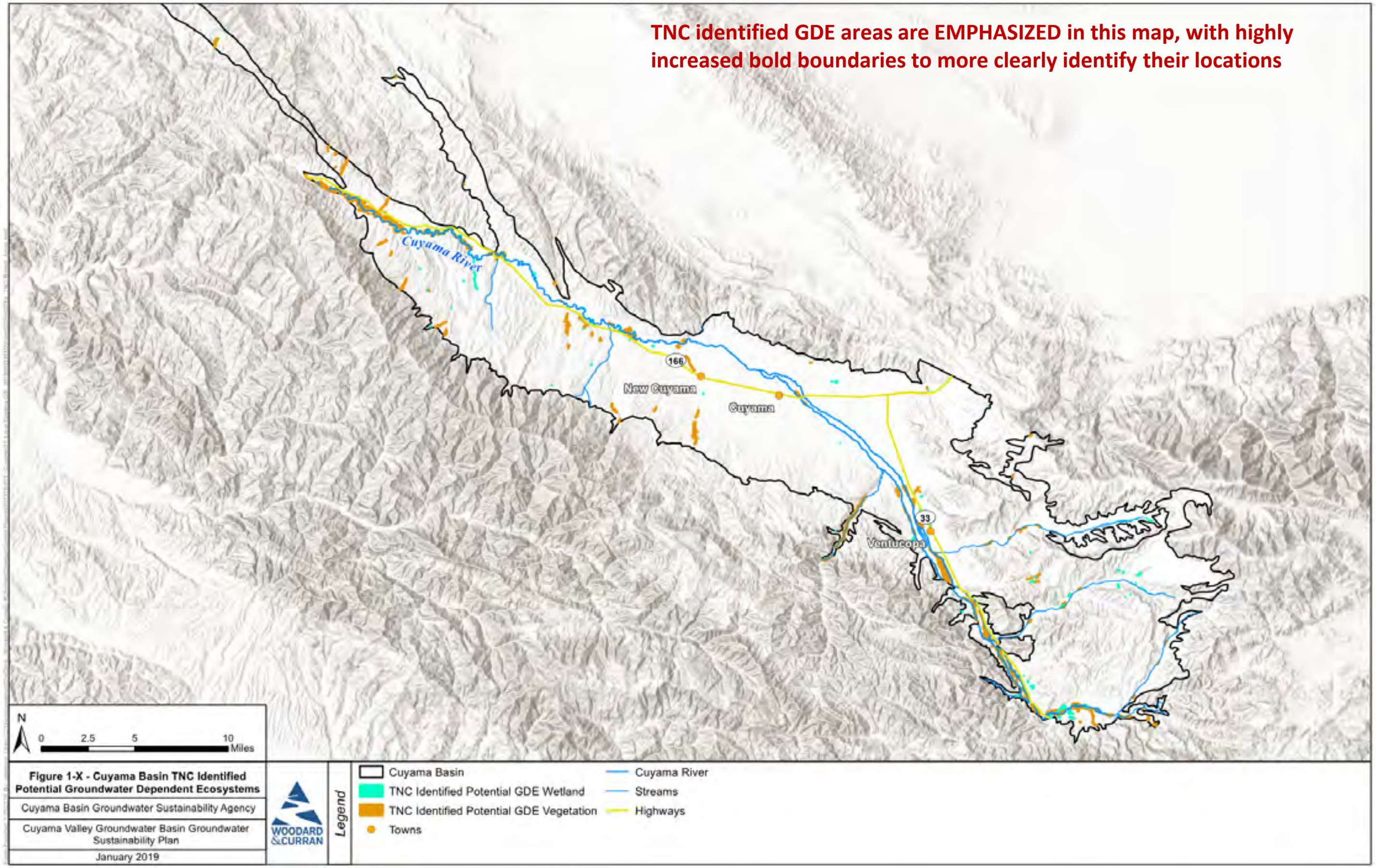


GDEs – Biologist Field Verification

- Remote Sensing
- Field Verification
- Updated NC Dataset

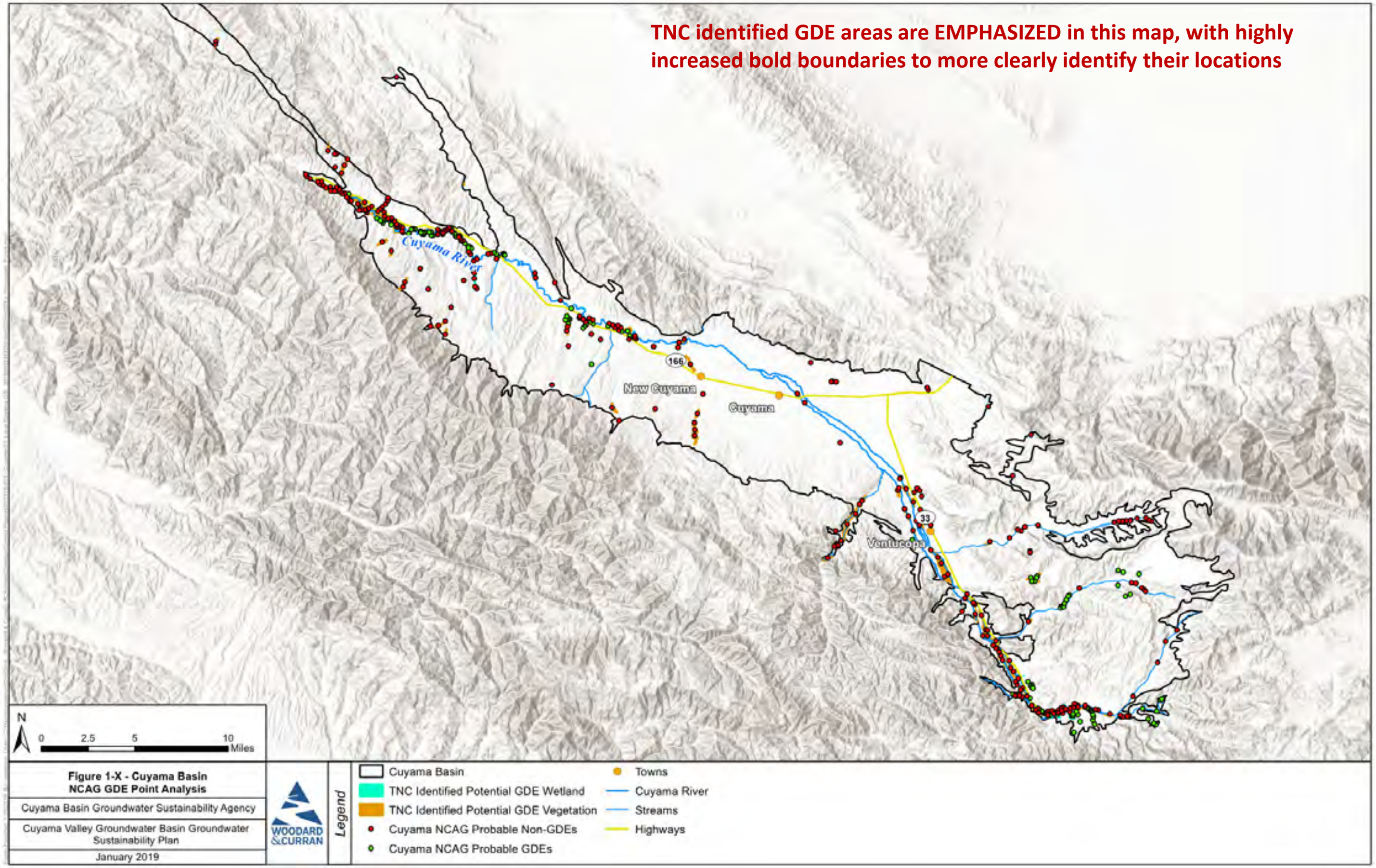
GDEs Identified by Nature Conservancy - Emphasized for Visibility

- Emphasized boundaries to show locations of GDEs
- 2,700 acres
- Primarily along canyons, washes, and near Cuyama River



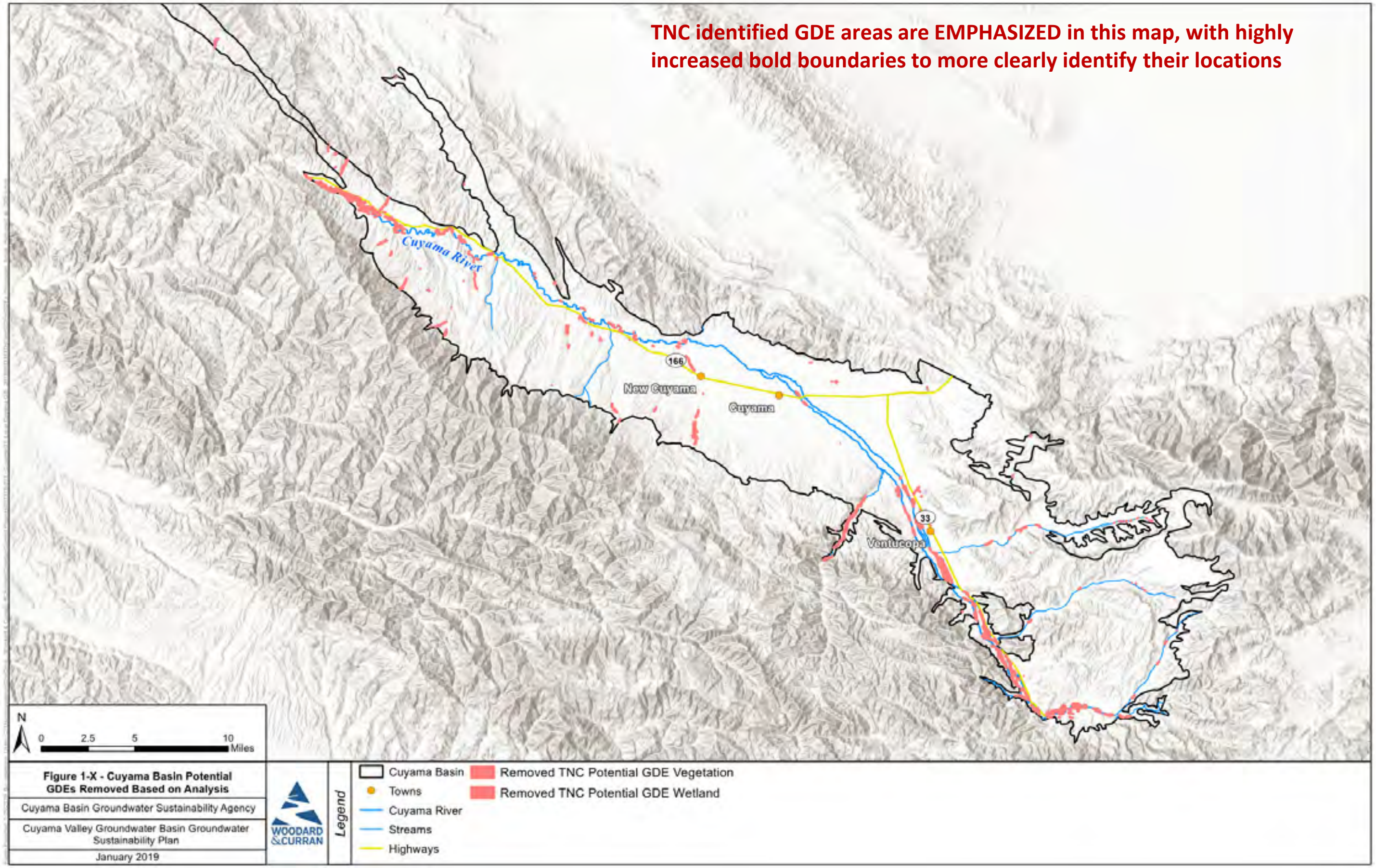
GDEs – Biologist Field Verification

- Points indicate analyzed points in the NC dataset



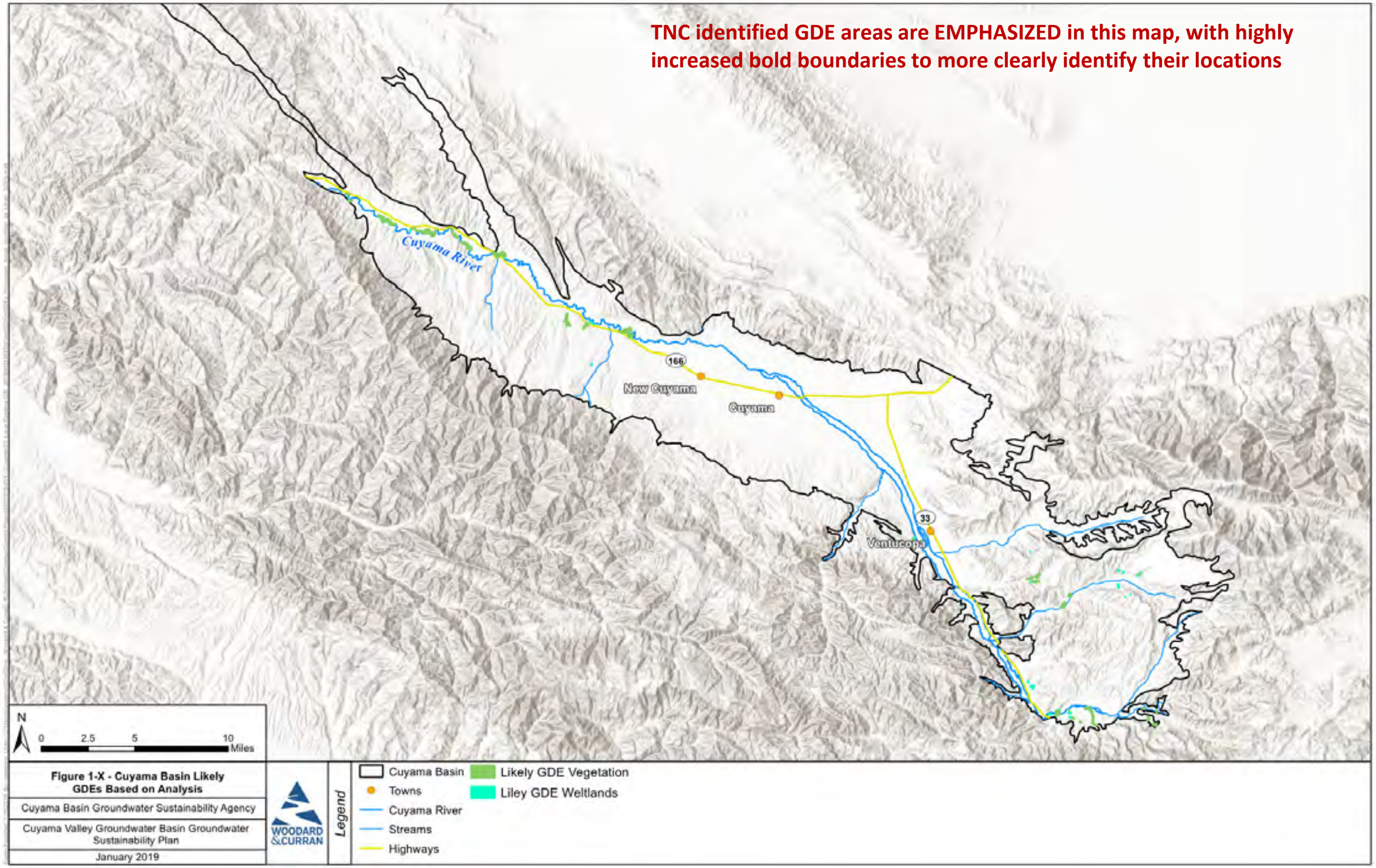
GDEs – Biologist Field Verification

- 2200 Acres removed
- 497 Acres of remaining verified GDEs



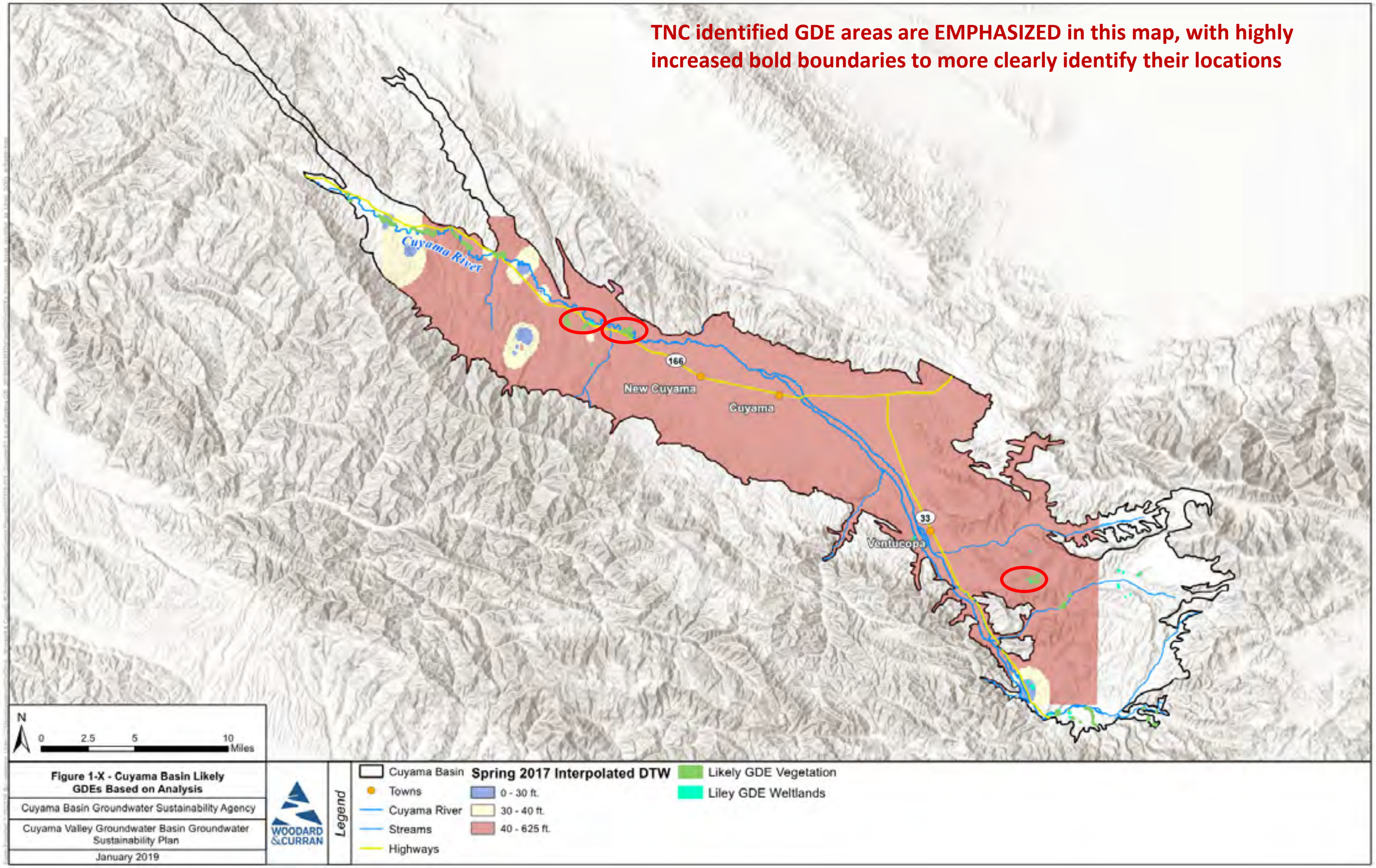
GDEs – Verified

- 497 Acres of verified GDEs
- GDEs occur near the river, and near faults and canyons



GDEs – Comparison to Regional Monitoring

- Areas where regional monitoring and contouring indicate Depth to Water is over 40 feet



GDEs – Conclusions

- Nature Conservancy dataset is recommended by DWR as basis for evaluation
- Biologist field verified 497 Acres of GDEs
- GDEs occur in canyons and along faults and waterways
- Regional monitoring is not suitable for GDEs
- Recommend installing piezometers as part of monitoring network at representative GDE sites

TO: Standing Advisory Committee
Agenda Item No. 5b

FROM: Brian Van Lienden, Woodard & Curran (W&C)

DATE: January 31, 2019

SUBJECT: Technical Forum Update

Issue
Update on the Technical Forum.

Recommended Motion
None – information only.

Discussion
At the request of Cuyama Valley landowners, Cuyama Basin Groundwater Sustainability Agency Groundwater Sustainability Plan (GSP) consultant Woodard & Curran (W&C) has been meeting monthly with technical consultants representing landowners to discuss W&C's approach and to provide input where appropriate.

A summary of the topics discussed at the January 25, 2019 technical forum meeting is provided as Attachment 1, and the next forum date is February 22, 2019.

COMMITMENT & INTEGRITY
DRIVE RESULTS

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MEETING MEMORANDUM

PROJECT: Cuyama Basin Groundwater Sustainability Plan Development

MEETING DATE: 1/25/2019

MEETING: Technical Forum Conference Call

ATTENDEES: Matt Young (Santa Barbara County Water Agency)
Matt Scrudato (Santa Barbara County Water Agency)
Catherine Martin (San Luis Obispo County)
Neil Currie (Cleath-Harris Geologists)
John Fio (EKI)
Jeff Shaw (EKI)
Dave Leighton (EKI)
Dennis Gibbs (Santa Barbara Pistachio Company)
Brian Van Lienden (Woodard & Curran)
Sercan Ceyhan (Woodard & Curran)
Micah Eggleton (Woodard & Curran)
John Ayres (Woodard & Curran)
Ali Taghavi (Woodard & Curran)
Sebastien Poore (Woodard & Curran)

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1. AGENDA

- Numerical Model and Water Budget Update
- Projects and Management Actions
- Groundwater Dependent Ecosystems

2. DISCUSSION ITEMS

The following table summarizes comments raised during the conference call and the response and plan for resolution (if appropriate) identified for each item.

Item No.	Comment	Commenter	Response/Plan for Resolution
1	When will you release the model input and output files?	Jeff Shaw	Model files will be released subsequent to the release of the draft Water Budgets GSP section.
2	It may make sense to subdivide the Central Basin into developed and undeveloped areas. I can provide input on where it makes sense to draw a line.	Dennis Gibbs	Dennis can mark up the pdf map provided to the Tech Forum and send it back to us with his ideas.
3	The rationale for separating the two areas in CB for water budget accounting is not clear.	John Fio	Comment noted. This separation has not been included in material to be presented to the SAC and Board

4	There was discussion about potentially drawing a different line between the Northwest and Western boundaries for purposes of water budgets. The new boundary would better reflect geology in that part of the Basin.	Multiple	Technical Forum members responded that these changes could be reasonable, for purposes of discussing water budgets. However, we would need to be careful that we are still adequately reflecting the relationship between the regions and the threshold wells. The original boundary has been retained for the SAC/Board presentations.
5	What was the modeling assumption for pumping going forward?	Jeff Shaw	W&C took the 2017 land use conditions, and assumed a variable pattern going forward that approximated recent agricultural land use.
6	There are localized pumping depressions in the Ventucopa corridor.	Dennis Gibbs	Comment noted. This may need to be considered when looking at model performance in the Ventucopa region.
7	I can give you some ideas for good locations for monitoring wells in the Ventucopa area.	Dennis Gibbs	W&C will contact Dennis and others fior ideas for where new wells can be added in the Category 1 task.
8	What iss the largest avg annual decline in the Basin?	Dennis Gibbs	The largest decline in the Basin is about 10 feet/year.
9	Twitchell Reservoir has a sedimentation problem – the GSA should engage Twitchell operators when considering a potential stormwater capture project.	Dennis Gibbs	Comment noted. This should be considered if the GSA does a more detailed study during the implementation phase.
10	Controlled burning would be a hard sell. If you ran a burn on areas where there is a flat slope it could work, but it often doesn't go according to plan.	Jeff Shaw	Comment noted. The pros and cons of this option will need to be considered by the Board.
11	Through controlled prescription burning, you don't necessarily increase sedimentation. A program that runs appropriately will reduce ET and sediment won't necessarily go down the valley	Dennis Gibbs	Comment noted. The pros and cons of this option will need to be considered by the Board.
12	You should consider cloud seeding as a potential action. A study has been performed for this action in the Cuyama Basin.	Matt Scrudato	Matt will provide W&C with the study report. This action will be added to the SAC/Board presentation for consideration.
13	Materials developed for Paso Robles GSP development may be useful for Cuyama Basin discussions with the SAC/Board.	Cathy Martin	Cathy will provide W&C with the materials and these will be taken into consideration for future SAC/Board presentations.

14	It would be better to use example numbers rather than actual numbers when discussing the potential pumping allocation options.	Multiple	This change has been made to the SAC/Board presentations.

Cuyama Basin Groundwater Sustainability Agency

Technical Forum Update

January 31, 2019

January 25th Technical Forum Discussion

- Water Budget Update
- Preliminary Discussion on Projects and Management actions
- Presentation on Groundwater Dependent Ecosystsms
- Next Steps

- Next Meeting – Friday, February 22

Technical Forum Members

- Catherine Martin, San Luis Obispo County
- Matt Young, Santa Barbara County Water Agency
- Matt Scrudato, Santa Barbara County Water Agency
- Matt Klinchuch, Cuyama Basin Water District
- Jeff Shaw, EKI
- Anona Dutton, EKI
- John Fio, EKI
- Dennis Gibbs, Santa Barbara Pistachio Company
- Neil Currie, Cleath-Harris Geologists
- Matt Naftaly, Dudek

TO: Standing Advisory Committee
Agenda Item No. 5c

FROM: Brian Van Lienden, Woodard & Curran (W&C)

DATE: January 31, 2019

SUBJECT: Monitoring Networks Adoption

Issue
Recommend adoption of the Monitoring Networks section.

Recommended Motion
Adopt the Monitoring Networks section.

Discussion
An overview of the revised Monitoring Networks section is provided as Attachment 1. The comments and responses matrix is provided as Attachment 2, the redline strikeout is provided as Attachment 3, and the revised Monitoring Networks section is provided as Attachment 4.

Cuyama Basin Groundwater Sustainability Agency

Monitoring Networks Chapter Adoption

January 31, 2019

WOODARD & CURRAN

Monitoring Networks GSP Chapter

- Revised GSP Section provided to SAC and Board for review as part of Board Packet on January 25th
- Revised section reflects responses to comments received on September Draft version
- Monitoring Networks section includes:
  - Existing monitoring used
  - Groundwater level and storage monitoring network
  - Degraded water quality monitoring network
  - Land subsidence monitoring network
  - Depletions of interconnected surface water monitoring network (placeholder)
- Seeking recommendation from the SAC for approval by CBGSA Board

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Cuyama Basin Monitoring Networks Chapter
Summary of Public Comments and Responses
January 25, 2019

Comment #	Commenter	Commenter Organization	Section	Section Paragraph #	Paragraph's Sentence #	Sentence Starts with, "...	Comment	Response to Comment
1	Brenton Kelly	Quail Springs Permaculture	General				The Monitoring Networks spatial density around the faults of interest is insufficient.	Comment noted. These areas have been included in the groundwater level data gaps.
2	Brenton Kelly	QSP	General - Well Data with Completion reports				The insufficient Quality Control / Quality Assurance compounds the uncertainty due to the scarcity of data.	Comment noted. Monitoring protocols will be set up to ensure consistent QA/QC for monitoring in the future.
3	Brenton Kelly	QSP	General (Well ID #)				Will any cross reference table for well ID#s be made available?	This can be provided separate from the document.
4	Brenton Kelly	QSP	Global (Salinity)				Please use the term TDS	The text has been changed to note at first usage that salinity is measured in TDS
5	Brenton Kelly	QSP	General				The MN must asses all causal nexus between groundwater quality and groundwater extraction, such as constituents migrating into areas with lower pressure heads due to heavy groundwater extraction.	Comment noted. This can be accomplished in the implementation phase by filling in the monitoring data gaps.
6	Brenton Kelly	QSP	4.2 Basin Conditions (Pg. 4-11)			Fig 4-2 Combined Hydrograph	The text should clearly articulate that groundwater elevations have declined consistently over 500' since pumping started in 1947.	The text has been revised for clarity.
7	Brenton Kelly	QSP	4.3 Existing Monitoring Used (Pg. 4-13)				Other wells that have been monitored by DWR - CASGEM, USGS and/or The Ventura County Watershed Protection District (VCWPD) in the Ventucopa Uplands river corridor should be reconcidered for selection as a monitoring site for the GSP.	Comment noted. Additional wells can be added during the GSP implementation phase.
8	Brenton Kelly	QSP	Table 4-5: Cuyama Basin VCWPD Wells (Pg. 4-22)				Table is mislabeled as; Number of SLOCFC&WCD wells	The table has been corrected.
9	Brenton Kelly	QSP	Table 4-9: Cuyama Basin NWQMC, USGS, IRLP Water Quality Monitoring Sites (Pg. 4-29)				The texts suggests "The NWQMC database provides data on 47 water quality monitoring sites", but the table indicated there are 176 sites.	The text has been revised for clarity.
10	Brenton Kelly	QSP	GAMA / DWR (Pg. 4-31)			age dating and groundwater movement trending	If freshwater recharge is assumed to be happening, then where is it going if not into the productive wells of the area?	Comment noted. This is not relevant to the Monitoring Network section.
11	Brenton Kelly	QSP	4.3.5 Surface Water Monitoring (Pg. 4-37)			Fig 4-14	Not one stream gauge exists on the Cuyama River within the basin. Can we get a Plan to fill this Data Gap? Flow Gauges at the 3 bridges over the Cuyama?	This will be discussed in Section 4.10 when it is developed.
12	Brenton Kelly	QSP	4.5.5 Representative Monitoring (Fig 4-16 thru Fig 4-18)				The major Data Gaps area in Fig 4-18 are also the fault zones of interest and the likely boundaries to proposed Management Areas (or Threshold Regions). What is the plan to solve this uncertainty?	This will need to be addressed during the GSP implementation phase.
13	Brenton Kelly	QSP	4.6 Groundwater Storage Monitoring Network (Pg. 4-53)				All of the data gaps for the groundwater level monitoring network will now compound the uncertainty of the Groundwater Storage calculations. How will calculations made from uncertain data be verfied for QA/QC?	Monitoring protocols will be set up to ensure consistent procedures for monitoring in the future.
14	Brenton Kelly	QSP	4.8 Degraded Groundwater Quality Monitoring Network (Pg. 4-53)				The best available science suggests a causal nexus between SGMA related activities like groundwater extraction and the migrations of constituents into areas with lower pressure heads due to unsustainable extraction.(See Appendix A, page 21-29) Boron, Arsenic & Nitrites should be monitored along with age dating to determine the movement of bodies of groundwater and the rates of any freshwater recharge.	The text has been revised to describe the rationale for establishing the monitoring network only for salinity.
15	Brenton Kelly	QSP	4.9 Land Subsidence Monitoring Network (Pg. 4-60)				Is it possible to use other avaliable technologies (like InSAR to match the USGS data set) while we wait for more CGPS installations to come online?	The can be explored by the GSA during the GSP implementation phase.
16	Brenton Kelly	QSP	4.9.5 Monitoring Protocols (Pg. 4-62)			"New stations will require downloading the data as equipment storage..."	Garbled english!	The text has been revised for clarity.
17	Brenton Kelly	QSP	4.10 Depletions of Interconnected Surface Water Monitoring Network (Pg. 4-64)				The last of the Cuyama River Cottonwood trees stand as testament to the depletion of interconnected surface waters. Try to count them before their dead limbs crack and fall to the dry sands of their former wetlands.	Comment noted. No change needed in the Monitoring Network section.
18	Arne Anselm	Ventura County Watershed Protection District	Pg. 4-22				On page 4-22 the first line of the table is incorrect (not SLOCFC&WCD)). It should read VCWPD wells.	The table has been corrected.
19	Arne Anselm	VCWPD	Figure 4-7				The map in Figure 4-7 the title for VC wells in the legend for VCWPD should be more descriptive - Ventura County Watershed Protection District database wells to be consistent with the other maps.	The figure title has been changed.

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20	Cathy Martin	County of San Luis Obispo	Intro			This section was prepared to meet the requirements	Consider listing the GSP regulations for this chapter	The regulation has been added.
21	Cathy Martin	SLO County	4.2 Monitoring Networks Obj.	1	1	This section describes the Cuyama	Consider adding a comment or footnote on seawater intrusion to reinforce why it is not being monitored.	This is discussed in the Undesirable Results GSP Section.
22	Cathy Martin	SLO County	4.2.1 Basin Conditions Relevant	2	3	There are no major stratigraphic aquitards or	Suggest clarifying this sentence. The basin has faults, maybe adding a figure of the Morales Formation.	The text has been revised for clarity. A figure of the Morales Formation is shown in the HCM Section.
23	Cathy Martin	SLO County	4.2.1 Basin Conditions Relevant	2	4	The aquifer ranges from	Consider adding the top and bottom basin range.	The text has been revised for clarity.
24	Cathy Martin	SLO County	4.2.1 Basin Conditions Relevant	3	1	The largest groundwater	Suggest adding a table of the entire basin for land use, square miles, and percentage, such urban, rural, open space, and etc.	This is discussed in the Plan Area section.
25	Cathy Martin	SLO County	4.2.1 Basin Conditions Relevant	4	2	Generally, groundwater elevations	Consider quantifying the decrease in years, such as … decreasing by approximately XX ft from the 1940s and 1950s to the present	The text has been revised for clarity.
26	Cathy Martin	SLO County	4.2.1 Basin Conditions Relevant	4	2	Generally, groundwater elevations	Suggest verifying if the figure is missing.	The figure is included in the GSP section.
27	Cathy Martin	SLO County	4.3.1 Groundwater Level Monitoring	4	1	CASGEM allows locally	Editorial: "CASGEM allows ~~locally~~ local agencies to be designated"	The text has been revised for clarity.
28	Cathy Martin	SLO County	4.3.1 Groundwater Level Monitoring			There are currently six CASGEM	Clarification - The two SLO County CASGEM wells are volunteer wells (County agreement with private owner)	The text has been revised for clarity.
29	Cathy Martin	SLO County	Figure 4-3			Cuyama Basin DWR/CASGEM Wells	Suggest adding the Federal and State areas to the monitoring network to help show why groundwater wells are not located in several basin areas.	These are shown in the Plan Area section and are not needed in this section.
30	Cathy Martin	SLO County	Table 4-2			Cuyama Basin USGS Well Statistics	Suggest verifying if duplicate wells exist between all agencies, such as County, DWR, and USGS.	This is addressed in Section 4.3.2
31	Cathy Martin	SLO County	Figure 4-4			Cuyama Basin USGS Wells	Suggest adding the Federal and State areas to the monitoring network to help show why groundwater wells are not located in several basin areas.	These are shown in the Plan Area section and are not needed in this section.
32	Cathy Martin	SLO County	Table 4-3			Cuyama Basin SBCWA Well Statistics	Suggest verifying if duplicate wells exist between all agencies, such as County, DWR, and USGS.	This is addressed in Section 4.3.2
33	Cathy Martin	SLO County	Figure 4-5			Cuyama Basin SBCWA Managed Wells	Suggest adding the Federal and State areas to the monitoring network to help show why groundwater wells are not located in several basin areas.	These are shown in the Plan Area section and are not needed in this section.
34	Cathy Martin	SLO County	4.3.1 GW Level Monitoring - SLO	1	2	SLOCFC&WCD also reports the data for	SLO County – the two CASGEM wells are in the County's volunteer program (agreement between the County and owner). If using these 2 wells in the GSP, the CBGSA will need agreements with the owners.	Comment noted. Agreements can be sought during the GSP implementation phase.
35	Cathy Martin	SLO County	Figure 4-6			Cuyama Basin SLOCFC&WCD Wells	Suggest adding the Federal and State areas to the monitoring network to help show why groundwater wells are not located in several basin areas.	This is addressed in Section 4.3.2
36	Cathy Martin	SLO County	Figure 4-7			Cuyama Basin VCWPD Wells	Suggest adding the Federal and State areas to the monitoring network to help show why groundwater wells are not located in several basin areas.	This is addressed in Section 4.3.2
37	Cathy Martin	SLO County	Figure 4-8			Cuyama Basin Community Services District Wells	Suggest adding the Federal and State areas to the monitoring network to help show why groundwater wells are not located in several basin areas.	This is addressed in Section 4.3.2
38	Cathy Martin	SLO County	Figure 4-9			Cuyama Basin Private Landowner Wells	Suggest adding the Federal and State areas to the monitoring network to help show why groundwater wells are not located in several basin areas.	This is addressed in Section 4.3.2
39	Cathy Martin	SLO County	4.3.3 GW Quality Monitoring - NWQMC	2	3	Initial water quality data for the Cuyama	Could this data be leveraged for the GSP? If so, please add the regulations pertaining to the IIRLP, such as water quality sampling.	This is included in the monitoring network. Regulations for IRLP progam can be found here: https://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/
40	Cathy Martin	SLO County	Multiple figures			Cuyama Basin NWQMC, USGS, IRLP Water Quality Monitoring Sites	Suggest adding the Federal and State areas to the monitoring network to help show why groundwater wells are not located in several basin areas.	These are shown in the Plan Area section and are not needed in this section.
41	Cathy Martin	SLO County	4.3.3 GW Quality Monitoring - Private Landowners	1	1	Private landowners within the	Consider verifying if these owners are in the IRLP, included in GAMA?	Comment noted. This can be done during the GSP implementation phase.

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42	Cathy Martin	SLO County	4.4 Monitoring Rationales	1	2	Monitoring networks in the Cuyama GSP	Suggest adding – "Cuyama Basin GSP"	The text has been revised for clarity.
43	Cathy Martin	SLO County	4.4 Monitoring Rationales	3	2	The schedule and costs associated	Suggest adding –a period "GSP."	The text has been revised for clarity.
44	Cathy Martin	SLO County	Table 4.13			Number of Wells Selected for Monitoring Network	SBCWA - Suggesting verifying that well are not being counted twice between agencies and verifying that the programs are continuing, if leverage existing programs	The table has been updated to note that the total does not equal the sum of the rows due to wells being duplicated in multiple databases.
45	Cathy Martin	SLO County	Table 4.13			Number of Wells Selected for Monitoring Network	SLOCFC&WCD - Clarification - The two SLO County CASGEM wells are volunteer wells (County agreement with owner), not monitoring wells. The CBGSA will need agreements with the well owners for additional sampling beyond CASGEM	Comment noted. No change needed to text.
46	Cathy Martin	SLO County	4.5.3 Monitoring Frequency	5	1	The Basin is an unconfined aquifer	Where did the 5 inches per year come from?	"5-inches" is based on values provided in Table 4-14, which is from the *Monitoring Networks and Identification of Data Gaps Best Mangement Practices.* " 5-inches" refers to the quantitative value of annual recharge. This value is output from the model, which currently models an annual recharge of # inches. Although this value is subject to change based on model calibration efforts, it is not expect to increase above 5-inches per year.
47	Cathy Martin	SLO County	4.5.3 Monitoring Frequency	5	2	Based on the data in Table 4-14	Suggest that the CBGSA Board review the consultant economic benefit cost analysis on monthly, quarterly, and semi-annual groundwater sampling to determine what is feasible? Suggest the Consultant reviews the sampling timeframe with the CBGSA Board.	Comment noted. The specific time frame will need to be selected by the CBGSA Board going forward.
48	Cathy Martin	SLO County	4.5.4 Spatial Density	3		Based on Hopkins well density	Suggest adding reference	The reference has been added to the text.
49	Cathy Martin	SLO County	4.5.4 Spatial Density	3		Based on Heath	Suggest adding reference	The reference has been added to the text in the section and to the references at the end of the section.
50	Cathy Martin	SLO County	4.5.6 GW Level Monitoring Network	1	1	The Groundwater Level Monitoring Network	Suggesting verifying that well are not being counted twice between agencies and verifying that the programs are continuing, if leverage existing programs.	Entities with current monitoring programs were attempted to be contacted. Of those that responded to our inqueries, most were non-committal with the continuation of their programs, however, this non-committal response was a result of not knowing specifics about the wells in Cuyama and not wanting to be responsible for missinformation. This is also why criteria for inclusion in the monitoring network is so broad. In the event some wells are discontinued, it is the hope that other wells will be able to provide sufficient data. If this is not the case, the GSA will have to determine if additional wells will need to be constructed. A review of the monitoirng network was conducted and no duplicates were found. Wells that appear in Figure 4-17: Cuyama GW Basin Groundwater level and Storage Monitoring Network Wells that have multiple labels for what appears to be the same site are actually multi-completion (aka multi-depth) wells. Each individual casing is considered an independent well due to the output of GWL measurements. Note: Due to revisions to the Monitoring Network and Representative Wells through Board direction, the Table and List of wells has been updated.
51	Cathy Martin	SLO County	4.5.6 GW Level Monitoring Network	1	1	The Groundwater Level Monitoring Network	Does the CBGSA have to form agreements with the well owners for volunteer programs?	Yes, this will need to be done going forward during the GSP implementation phase.
52	Cathy Martin	SLO County	4.5.6 GW Level Monitoring Network	3	1	The proposed monitoring frequency	Suggest that the CBGSA Board review the consultant economic benefit cost analysis on monthly, quarterly, and semi-annual groundwater sampling to determine what is feasible? Suggest the Consultant reviews the sampling timeframe with the CBGSA Board.	Comment noted. The specific time frame will need to be selected by the CBGSA Board going forward.
53	Cathy Martin	SLO County	Appendix K	1	1	General	Suggesting verifying that this follows SGMA GSP protocols.	Appendix K is *Best Management Practices for the Sustainable Management of Groundwater Monitoring Protocols, Standards, and Sites* published by DWR and provided on the SGMA website.

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54	Cathy Martin	SLO County	4.5.8 Data Gaps	3	1	Well construction information is not	Suggesting verifying if there is a SGMA GSP standard for well construction. If so, does this monitoring network meet these standards?	Article 3, Section 352.4, (c) describes the standards to apply to the wells. Although it outlines the information that should be included under Part (1), Part (2) states that either the GSA create a schedule for acquiring the necessary information, or describe why the information is not necessary to undersand and manage groundwater in the basin. Due to the extremely limited amount of data within the Cuyama Basin, an attempt to use all valuable data was made. To understand the limitations of the data, the Tiering System was utlized and discussed within the section. Additionally, within Project and Management Actions, there will be additional information about pursuing projects to obtain additional well information.
55	Cathy Martin	SLO County	4.5.9 Plan to fill data gaps	3	3	New wells drilled by DWR's	Suggest updating this section when DWR approves the TSS for new wells	Comment noted. This will be considered if DWR approves the TSS before completion of the GSP.
56	Cathy Martin	SLO County	4.8 Degraded GW Quality	1	1	Due to the relationship of undesirable	This needs to be vetted by the CBGSA Board for any constituent to be monitored and sampled. Is sampling for salinity meeting SGMA GSP regulations? Suggest providing a discuss of why other constituent are not being monitored	The text has been revised to describe the rationale for establishing the monitoring network only for salinity.
57	Cathy Martin	SLO County	4.8.2 Monitoring Sites Selected	1	4	Note that due to duplication of wells	Consider updating the table (4-17) with the correct values.	The table has been updated.
58	Cathy Martin	SLO County	4.8.3 Monitoring Frequency	2	3	The Basin, in coordination	This needs to be vetted by the CBGSA Board for any constituent to be monitored, sampled, and frequency of sampling.	Comment noted. The specific time frame will need to be selected by the CBGSA Board going forward.
59	Cathy Martin	SLO County	4.8.6 GW Quality Monitoring Network	1	3	All 64 wells are representative	Suggest verifying if these are duplicate wells and if leveraging data from existing programs to verify that the program is continuing.	Comment noted. This will be done during the implementation phase going forward.
60	Cathy Martin	SLO County	4.8.8 Data Gaps	4	3	All management entities are	Suggest verifying that this assumption is true	The text has been revised for clarity.
61	Cathy Martin	SLO County	4.8.9 Plan to fill data gaps	3	2	Downhole video logging	Suggest verifying that you can perform downhole video logging in existing wells with casings.	This will be verified as specific wells are identified for video logging by the DWR TSS.
62	Cathy Martin	SLO County	4.9.7 Plan to fill data gaps	1	3	Although there are multiple	Suggest reviewing the pros/cons and cost associated with recommendation	The rationale for this recommendation is provided in the text.
63	Matt Y., Matt S., & Fray C.	Santa Barbara County Water Agency	General				It is quite difficult to determine the appropriateness of the proposed monitoring network without know what the management areas will be. Suggest revising/recirculating once they have been identified.	Comment noted. This can be considered by the GSA Board.
64	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4.1			Well completion diagram	Depth to Bottom of Well should/could be reworded to match the what is written under useful terms - Total Well Depth	Updated Figure
65	Matt Y., Matt S., & Fray C.	SBCWA	4.1 Useful Terms			Subsidence (refer to appendix Z	Suggest deleting appendix Z for reasons described in comments to Groundwater Conditions Section	Comment noted. The appendix is included because some readers are interested in this content.
66	Matt Y., Matt S., & Fray C.	SBCWA	4.2.1 Basin Conditions Relevant	2	3	There are no major stratigraphic aquitards	Fault lines?	The text has been revised for clarity.
67	Matt Y., Matt S., & Fray C.	SBCWA	4.2.1 Basin Conditions Relevant	2		The aquifer ranges from 10's to 100's of feet	Not a very useful, give #s.	Specific values are unavailble in this summary sentence. Therefore, numbers have been removed. For details on aquifer thickness, refer to the HCM section.
68	Matt Y., Matt S., & Fray C.	SBCWA	4.2.1 Basin Conditions Relevant	2		Median reported hydraulic	Median or a range?	Median, as shown in Table 2.1-1.
69	Matt Y., Matt S., & Fray C.	SBCWA	4.2.1 Basin Conditions Relevant	2		Figure 2.1-2 shows the extent	Do we have that?	This figure is in the HCM section.
70	Matt Y., Matt S., & Fray C.	SBCWA	4.2.1 Basin Conditions Relevant	3		Based on the most recent data from 2016,	Sentence is somewhat confusing.	The text has been revised for clarity.
71	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4-2			Central Basin with Combined	Label wells on map	The figure has too many wells to effectively label them.
72	Matt Y., Matt S., & Fray C.	SBCWA	4.3 Existing Monitoring Used	1	1	This section discusses current groundwater	As mentioned in comments to the groundwater conditions section, this is a list of databases from which W&C pulled data, it is not a list of monitoring programs.	The text has been revised for clarity.
73	Matt Y., Matt S., & Fray C.	SBCWA	4.3.1 Groundwater Level Monitoring				I like how each monitoring entity is mentioned in a separate section below. A general summary of how these data were collected should be included for each entitry to include information such as: 1-protocols 2-accuracy 3-equipment used 4-QA/QC	Users can refer to the metadata provided by each data source for this information. This level of detail is not needed in this GSP section.

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74	Matt Y., Matt S., & Fray C.	SBCWA	4.3.1 Groundwater Level Monitoring - DWR, Statewide...			CASGEM Wells – Wells with well	Many of the voluntary wells have publically available well construction info. This distinction is not correct.	The text has been revised for clarity.
75	Matt Y., Matt S., & Fray C.	SBCWA	4.3.1 Groundwater Level Monitoring - DWR, Statewide...			Most wells were measured on a semi-annual	This is not correct, most wells are measured annually. Some were measured semi-annually during the USGS study.	The text has been revised for clarity.
76	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-1			Summary Statistics for CASGEM Wells	No CASGEM program in 1946. It started in 2000. No big deal. These wells are now CASGEM.	The table header has been revised for clarity.
77	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4-3			Cuyama Basin DWR/CASGEM	As commented on the groundwater conditions section, these are not DWR wells.	The figure title has been changed.
78	Matt Y., Matt S., & Fray C.	SBCWA	4.3.1 Groundwater Level Monitoring - USGS	5	1	USGS has approximately 25 approved	Needs to be much clearer. USGS doesn't "have" these wells. They happen to appear in the USGS database.	The text has been revised for clarity.
79	Matt Y., Matt S., & Fray C.	SBCWA	Table 4.2			Cuyama Basin USGS Well Statistics	# of provisional wells - This is unclear. There may be some provisional data from the last few months that re currently not approved. Standard to approve data within 150 days. This statement leads one to believe that these data are not useable.	The distinction between provisional and approved USGS wells has been removed.
80	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4-4			Cuyama Basin USGS Wells	These are not USGS wells. They are wells that are in the USGS database.	The text has been revised for clarity.
81	Matt Y., Matt S., & Fray C.	SBCWA	4.3.1 Groundwater Level Monitoring - SBCWA	1	1	The Santa Barbara County Water Agency (SBCWA) manages	Summary of SBCWA monitoring programs: USGS network for entire basin was 32 wells. •About 14 of these 32 wells are overlapped on the west-end with our quarterly network. •Our quarterly network is 36 wells but could be considered as large as 47 if we want to count the Harvard production wells which they self-monitor and we periodically verify. •Mandatory CASGEM is 3 and Voluntary CASGEM is 13. These are also part of the USGS total of 32 wells. • The USGS has stopped monitoring wells in the basin.The entire network we will start to monitor will be about 52 in total (or 63 if we want to consider the 11 Harvard production wells).	Text and Table has been updated
82	Matt Y., Matt S., & Fray C.	SBCWA	4.3.1 Groundwater Level Monitoring - SBCWA	1	3	Many of these wells are included in the DWR	I didn't see any in the DWR database. Some are in NWIS. Important to clarify that wells may be in database and maps, but our data for the last couple of years is not located in the database.	Unecessary detail removed from document
83	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-3			Number of SBCWA-wells	29 should be 55	Numbers reflect data provided by SBCWA. Numbers have been updated to reflect this.
84	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-3			Number of SBCWA wells included in the Monitoring Network	30 is ?	Numbers have been updated.
85	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4-5			Cuyama Basin SBCWA	As mentioned, this does not include all the wells monitored by SBCWA	Figure has been updated
86	Matt Y., Matt S., & Fray C.	SBCWA	4.3.1 Groundwater Level Monitoring - Private Landowners	1	1	Private landowners within the Basin	Nearly all the wells mentioned previously are owned and "managed" by private landowners. The terminology is very confusing.	The text has been revised for clarity.
87	Matt Y., Matt S., & Fray C.	SBCWA	4.3.1 Groundwater Level Monitoring - Private Landowners	1	3	Summary statistics for these	Are these private wells that are measured by USGS, Ventura, SLO, and SBCWA? Or are these overlap wells found in separate databases? Hard to tell without shapefiles. If there are 99 wells measured by private landowners, there would a serious issue with data quality and accuracy and should not be the foundation of the model.	The text has been clarified to note that these are additional wells beyond those included in the previously described datasets.
88	Matt Y., Matt S., & Fray C.	SBCWA	4.3.2 Overlapping and Duplicate Data	2	1	Duplicates were identified and then	Were similar MP elevations, accuracy standards, and methodology used?	Well data was not altered during this duplicate identification processing. Sources were either combined (i.e. one source had GSE and another had RPE) or the source with the more accurate information was utilized (i.e. once dsource only had ID and general coordinates whereas another may have had well construction info and general coordinates). Sources where there were conflicting data, such as Well Depth, were addressed one by one and researched and professional determination was made. All elevation values were ultimately corrected using a singular DEM dataset to standardize all elevation values.

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89	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-8			MSC column	Explain how Local Name is different from Name? Explain how is USGS ID different from MSC?	Some wells had two names. For example, OPTI Well 834 has a state well number, a well name of "Mustang Production" and local well name of "Spanish WM-1". In an effort to include as much well information as possible "two" well name categories were included. The USGS ID and MSC are two unique identification serial numbers. For example, OPTI well 134 has a SWN of 07N23W20M001S and a USGS Site Code of 344115119202001.
90	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-8			SBCWA row	The table needs to include all SBCWA-monitored wells, which includes all of the CASGEM Wells in the basin within SB County.	Data provided by the SBCWA in indivudal spreadsheets did not include CASGEM ID, and thus a check mark was not included in the CASGEM ID column for the SBCWA row in Table 4-8. Table 4-8 is intended to show what information was included in the orginal data provided to W&C to illistrate the necessity of finding duplicates and data processing. Although those wells may have CASGEM IDs, these were associated with the wells during data processing.
91	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-8			Managing Entity column	Change heading to Database	The heading has been changed to "Data Maintaining Entity"
92	Matt Y., Matt S., & Fray C.	SBCWA	4.3.3 GW Quality Monitoring	1	1	This section discusses existing groundwater	Confusingly worded – the programs were "collected"?	The text has been revised for clarity.
93	Matt Y., Matt S., & Fray C.	SBCWA	4.3.3 GW Quality Monitoring - NWQMC				Why is NWIS not mentioned?extensive water quality data available.	The data downloaded form the NWQMC includes NWIS data. The text has been revised for clarification.
94	Matt Y., Matt S., & Fray C.	SBCWA	4.3.3 GW Quality Monitoring - NWQMC				What sample constituents and parameters?	Text has been editted for clarity.
95	Matt Y., Matt S., & Fray C.	SBCWA	4.3.3 GW Quality Monitoring - NWQMC	2	3	IRLP was initiated in 2003	Are these data collected by the landowner? Explain in text who does this data collection?	Who collects this data is unknown and not included in the data provided by the management enetities
96	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-9			Median period of record	Is this accurate?	Yes. A considereable number of sites only took 1-2 samples during a single year.
97	Matt Y., Matt S., & Fray C.	SBCWA	4.3.3 GW Quality Monitoring - GAMA/DWR				Explain in text what sample constituents and parameters.	Clarification has been added to the text, detail about consituents was not added due to nexus of causality in water qualty result.
98	Matt Y., Matt S., & Fray C.	SBCWA	4.3.3 GW Quality Monitoring - GAMA/DWR			Earliest measurement date year	GAMA started in 2000 Many of these data are historic USGS data from NWIS. The database W&C pulled the data from is not indicative of what program or agency collected the data.	While this comment is correct, the intent of this section is to summarize the data that is available, and was downloaded, and could be downloaded, from each of these sources and to show the processes W&C took to processes and collect data for the Cuyama Basin.
99	Matt Y., Matt S., & Fray C.	SBCWA	4.3.3 GW Quality Monitoring - Ventura County Watershed				Need to add a section on the CSD.	A new section has been added to include data provided by the CSD.
100	Matt Y., Matt S., & Fray C.	SBCWA	4.3.3 GW Quality Monitoring - Ventura County Watershed				What sample constituents and parameters?	Clarification has been added to the text, detail about consituents was not added due to nexus of causality in water qualty result.
101	Matt Y., Matt S., & Fray C.	SBCWA	4.3.3 GW Quality Monitoring - Private Landowners				What sample constituents and parameters?	The text addresses that only TDS is utlized by this data source.
102	Matt Y., Matt S., & Fray C.	SBCWA	4.3.4 Subsidence Monitoring			Appendix Z, a subsidence white	As commented on groundwater conditions section, suggest deleting this white paper.	Comment noted. The appendix is included because some readers are interested in this content.
103	Matt Y., Matt S., & Fray C.	SBCWA	4.3.5 Surface Water Monitoring				Perhaps assess whether there is more needed? Where?	This will be addressed in Section 4.10
104	Matt Y., Matt S., & Fray C.	SBCWA	4.4 Monitoring Rationales	2	1	The monitoring networks were	Be specific - levels? Storage?	The text has been revised for clarity.
105	Matt Y., Matt S., & Fray C.	SBCWA	4.5.2 Monitoring Wells Selected for Monitoring Network				SBCWA knows of currently available wells to fill these data gaps for monitoring. Also, a few wells, which are also currently available, should be monitored in the Ventucopa Uplands and east uplands. We don't need the network density here, but maintaining a baseline dataset is important. It is unwise to completely overlook these areas because there's currently little to no and use. Please contact Matt Scrudato for information on wells available	Comment noted. In the GSP implementation phase, the GSA should coordinate with SBCWA staff to identify appropriate wells to fill data gaps.

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106	Matt Y., Matt S., & Fray C.	SBCWA	4.5.2 Monitoring Wells Selected for Monitoring Network	2	1	Tier 1 encompasses wells with the most	Are there any in the Basin? None show up on the figure	No, there are no Tier 1 wells in the Basin.
107	Matt Y., Matt S., & Fray C.	SBCWA	4.5.2 Monitoring Wells Selected for Monitoring Network			Table 4-13 & following paragraph	This is not useful and unnecessarily confusing due to the overlap between the top three monitoring groups. The database that W&C found the well in is irrelevant.	The paragraph has been removed.
108	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4-16			Cuyama Basin Groundwater Level and Storage Monitoring	No Tier 1 Wells?	No, there are no Tier 1 wells in the Basin.
109	Matt Y., Matt S., & Fray C.	SBCWA	4.5.3 Monitoring Frequency	5	1	The Basin is an unconfined aquifer	Large withdrawals are not consistent across the basin. Mention where the large withdrawals occur.	The text has been revised for clarity.
110	Matt Y., Matt S., & Fray C.	SBCWA	4.5.3 Monitoring Frequency	5	2	Based on the data in Table 4-14	If there are management areas, may not need monthly monitoring this across all areas. A good reason to wait until MAs jave been decided.	Comment noted. This can potentially be updated in the Public Draft if the GSA Board provides direction on management areas.
111	Matt Y., Matt S., & Fray C.	SBCWA	4.5.4 Spatial Density				Should be done by management area.	The monitoring wells correspond to the wells used to develop threholds, which have been selected by threshold region.
112	Matt Y., Matt S., & Fray C.	SBCWA	4.5.4 Spatial Density	1	5	Monitoring wells in close proximity	Many of the wells in the basin are themselves pumped. There are very few dedicated monitoring wells.	Comment noted. No change needed to text.
113	Matt Y., Matt S., & Fray C.	SBCWA	4.5.5 Representative Monitoring				The GSA will need access agreements with private landowners to monitor nearly all of these wells. These ability to get these agreements may drastically alter which wells are selected.	Comment noted. No change needed to text.
114	Matt Y., Matt S., & Fray C.	SBCWA	4.5.5 Representative Monitoring			Monitoring Well – Other wells are	"Supplemental wells" may be a less confusing description.	The text has been changed accordingly.
115	Matt Y., Matt S., & Fray C.	SBCWA	4.5.5 Representative Monitoring			Adequate Spatial Distribution – Representative monitoring	Awkward phrasing, please restate for clarity	The text has been revised for clarity.
116	Matt Y., Matt S., & Fray C.	SBCWA	4.5.6 GW Level Monitoring Network	1	1	The Groundwater Level Monitoring Network is comprised	Sum of Table 4.13 is 151 wells. Not useful.	Paragraph was removed.
117	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-16			Column: Managing Agency as of 2018	These are not the managing agency. This is the database W&C pulled the data from	The column has been renamed "Data Mantaining Agency"
118	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-16			OPTI ID	Add Bittercreek. Appears to be a discrepancy between managing agency mentioned here and monitoring agency mentioned on the OPTI webpage.	We are unclear what "Add Bittercreek" means. With more clarification, we can make a change in the Public Draft.
119	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-16			2* SB County	This well appears to be located in Ventura in OPTI	Table has been updated
120	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-16			105 - confidential	This data is published in NWIS. Not confidential. Depth of well 600 feet. Depth of hole 750 feet.	The table has been updated.
121	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-16			109	Plots in the ocean near Channel Islands.	Data provided to W&C was plotted in the Ocean. This well has been removed, and and the correct well/lat/long was added to the network as OPTI Well 833
122	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-16			120	Collapsed well. Not a good choice.	Data provided to W&C did not indicate the well was collapsed. Instances like recent collapses that happened after data collection will be addressed in the GSP implementation phase.
123	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4-17			Groundwater Level and Storage Representative	Big data gaps in this map. SBCWA can assist in providing better spatial coverage.	Comment noted. In the GSP implementation phase, the GSA should coordinate with SBCWA staff to identify appropriate wells to fill data gaps.
124	Matt Y., Matt S., & Fray C.	SBCWA	4.5.7 Monitoring Protocols	1	1		LSD accuracy standard? What is the required accuracy for the WL data? May want to refer to USGS publication Groundwater Technical Procedures of the USGS if this is the required standard. https://pubs.er.usgs.gov/publication/tm1A1	As mentioned before about Appendix K (*Best Management Practices for the Sustainable Management of Groundwater Monitoring Protocols, Standards, and Sites)* the GSP cites DWRs published material for sampling protocols.
125	Matt Y., Matt S., & Fray C.	SBCWA	4.5.7 Monitoring Protocols	1	1	Monitoring protocols for the groundwater	The attached appendix is titled Appendix A.	The text has been revised for clarity.
126	Matt Y., Matt S., & Fray C.	SBCWA	4.5.8 Data Gaps	1	1	Groundwater levels monitoring data gaps	awk - delete sentence and 2 bullet points below	The text has been revised for clarity.
127	Matt Y., Matt S., & Fray C.	SBCWA	4.5.9 Plan to fill data gaps	2	1	The CBGSA has already been	Provide context (Proposition 1, etc)	The text has been revised for clarity.

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Comment #	Commenter	Commenter Organization	Section	Section Paragraph #	Paragraph's Sentence #	Sentence Starts with, "…	Comment	Response to Comment
128	Matt Y., Matt S., & Fray C.	SBCWA	4.5.9 Plan to fill data gaps	2	2	This task includes identification	Explain where? Why? What will this illustrate and how will it help? Better than discrete monthly measurements?	The text has been revised for clarity.
129	Matt Y., Matt S., & Fray C.	SBCWA	4.5.9 Plan to fill data gaps	3	1	DWR provides Technical Support Services (TSS) to	This needs context and has no basin-specific info.	The text has been revised for clarity.
130	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4-18			Groundwater Levels Monitoring Network	See Figures 4.10 and 4-4. There appear to be wells available to fill data gaps. CVCR6 RRU1 and 2	Comment noted. W&C will coordinate with SBCWA staff to identify appropriate wells to fill data gaps.
131	Matt Y., Matt S., & Fray C.	SBCWA	4.8 Degraded GW Quality	1	1	Due to the relationship of undesirable	Elaborate. This need a lot more justification. Why only salinity? What is the standard? What would cause this to change? No other parameters needed at all?	The text has been revised to describe the rationale for establishing the monitoring network only for salinity.
132	Matt Y., Matt S., & Fray C.	SBCWA	4.8.2 Monitoring Sites Selected				Too many in North Fork. Large data gaps. No west end monitoring? Poor distribution when other wells are available.	The monitoring network identified in the document only includes wells that are currently being monitored for salinity. Wells for filling the data gaps identified in the document will be idenfied in the future during GSP implementation.
133	Matt Y., Matt S., & Fray C.	SBCWA	4.8.2 Monitoring Sites Selected	1	4	Note that due to duplication of wells	Why show this if there are overlaps? What value does it add?	It identifies the role that these entities currently play in managing and maintaining water quality data in the Basin.
134	Matt Y., Matt S., & Fray C.	SBCWA	4.8.3 Monitoring Frequency	1	1	Monitoring agencies such the USGS	USGS always in July, except during the recent basin study. They collect these samples for the SBCWA. The SBCWA will likely discontinue this program once the GSP is submitted.	Text has been editted for clarity. Text reflects the conversation with USGS staff and W&C.
135	Matt Y., Matt S., & Fray C.	SBCWA	4.8.3 Monitoring Frequency	1		Monitoring agencies such the USGS (entire paragraph)	This is irrelevant. Explain what the GSA is going to do first, then explain how it will leverage samples collected by other agencies.	The text has been revised for clarity.
136	Matt Y., Matt S., & Fray C.	SBCWA	4.8.3 Monitoring Frequency	2	2	The Basin, in coordination with partnering	This should come first	The text has been revised for clarity.
137	Matt Y., Matt S., & Fray C.	SBCWA	4.8.3 Monitoring Frequency	2	2	Representative wells, those with sufficient	Not necessary, it was already stated that all are representative wells.	The text has been revised for clarity.
138	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-18			Managing Agency as of 2018	See previous comment.	The text has been revised for clarity.
139	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-18			Department of Water Resources	Wells 710-758 are DWR. This managing agency should stay consistent and use DWR.	The table has been revised for clarity.
140	Matt Y., Matt S., & Fray C.	SBCWA	Table 4-18			Last Measurement Date	Many of these are from the USGS Study, not part of a regular monitoring program. There is no "managing entity as of 2018".	"Managing entity" has been changed to "Data Maintaining Agency"
141	Matt Y., Matt S., & Fray C.	SBCWA	4.8.7 Monitoring Protocols			Existing groundwater quality monitoring	Irrelevant. GSA will be establishing its own network and using its own protocols. Existing programs may not continue.	The text has been revised for clarity.
142	Matt Y., Matt S., & Fray C.	SBCWA	4.8.8 Data Gaps	3		Additional information about how	Use the three wells completed at different depths.	Comment noted. This can be considered during the GSP implementation phase.
143	Matt Y., Matt S., & Fray C.	SBCWA	4.8.8 Data Gaps	4	1	The entire Basin is identified as	??? The basin is the data gap?? Please restate to explain what data is missing.	The text has been revised for clarity.
144	Matt Y., Matt S., & Fray C.	SBCWA	4.8.9 Plan to fill data gaps	1	1	The CBGSA will fill the temporal	Explain (DWR's TSS program. to perform downhole logging....)	The text has been revised for clarity.
145	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4-20				Wells are available. SBCWA can help find them. SBCWA are actually measuring them and collecting water quality samples.	Comment noted. The GSA can coordinate with SBCWA to incorporate these wells during the GSP implementation phase.
146	Matt Y., Matt S., & Fray C.	SBCWA	4.9.3 Monitoring Frequency	1	1	Subsidence monitoring frequencies should capture	State clearly in the beginning of the section what the GSA will do.	The text has been revised for clarity.
147	Matt Y., Matt S., & Fray C.	SBCWA	4.9.4 Spatial Density	1	1	The current spatial density of subsidence	With 2 stations within the basin as mentioned in 4.9-2?	Yes, this is based on the 2 stations currently in the Basin.
148	Matt Y., Matt S., & Fray C.	SBCWA	Figure 4-21			Current Subsidence Monitoring	Legend does not include symbols for the sites.	Stations are labeled on map, and thus are not needed in the legend.

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149	Matt Y., Matt S., & Fray C.	SBCWA	4.9.5 Monitoring Protocols				Is there equipment calibration needed? There needs to be a written standard. This needs to be elaborated on. There are some standards already developed which may be useful as a guide and reference. These are as follows: (for GNSS surveys) USGS- https://pubs.usgs.gov/tm/11d1/tm11-D1.pdf NOAA https://www.ngs.noaa.gov/PUBS_LIB/NGS-58.html https://www.ngs.noaa.gov/PUBS_LIB/NGS592008069FINAL2.pdf USGS reports have information about "future monitoring" which may be a useful reference when establishing the standards and protocols. Here's an example: https://pubs.usgs.gov/sir/2014/5075/pdf/sir2014-5075.pdf	Comment noted. This can be considered during the GSP implementation phase.
150	Matt Y., Matt S., & Fray C.	SBCWA	4.9.5 Monitoring Protocols	2	1	Data should be saved on	Where? Central databse?	The text has been revised for clarity.
151	Matt Y., Matt S., & Fray C.	SBCWA	4.9.7 Plan to fill data gaps				Should we create a baseline dataset set now since it may take time to establish permanent sites? DGPS biannually?	Comment noted. This can be considered during the GSP implementation phase.
152	Matt Y., Matt S., & Fray C.	SBCWA	4.9.7 Plan to fill data gaps	2	1	Theses stations can be managed	Why USGS? Are they running the current stations or have we determined that they will do this monitoring? If so, M Sneed (USGS) should elaborate on the protocols and methodology.	Comment noted. This can be considered during the GSP implementation phase.
153	EKI	Cuyama Basin Water District	General				Representativeness of wells for water level monitoring. Wells used within a monitoring network must not only meet standards for sufficient well construction and monitoring data, they also must be representative of local hydrogeologic conditions. "The designation of a representative monitoring site shall be supported by adequate evidence demonstrating that the site reflects general conditions in the area." [§ 354.36(c)]. The process for selecting candidate wells for the water level Monitoring Network is explained based on well construction and monitoring frequency criteria, but the chapter is unclear on how selected wells were determined to be representative of certain areas of the basin.	Comment noted. These factors can be considered when the monitoring network is finalized during the GSP implementation phase.
154	EKI	CBWD	General				Representativeness of wells for water quality monitoring. The process used to select wells as representative for water quality monitoring also is not transparent. All available wells apparently were included in the water quality Monitoring Network, but this section (e.g., Page 4-54) lacks discussion of basin groundwater quality characteristics. A Piper diagram with data from all wells, or maps with well-by-well Stiff diagrams could highlight spatial differences (and redundancies) in water quality. If only TDS data are available, a figure showing side-by-side historical TDS data boxplots for all wells would allow identification of wells with statistically-distinct (or redundant) historical data.	Comment noted. The available water quality data is discussed in the Groundwater Conditions chapter. This level of detail is not needed in this chapter.
155	EKI	CBWD	General				General determination process. In general, a systematic process for selecting representative wells is not discussed. The basis used to identify the various wells as representative is not clear.	The criteria used to select representative monitoring wells are given in Section 4.5.5
156	EKI	CBWD	General				Optimization. It also is unclear whether an effort was made to simplify the network to increase efficiency, and reduce cost (i.e., have the same wells be used for water levels, water quality monitoring, etc). The chapter needs a discussion of network optimization, including (a) coordination of monitoring with other agencies or entities to potentially share costs and eliminate redundant monitoring, and (b) identification of clustering and spatial redundancy within the network, via comparison of water level, well construction, and water quality data (see preceding comment #2), to eliminate wells that are not both unique and representative.	Comment noted. This can be addressed when the monitoring network is finalized during the GSP implementation phase.

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157	EKI	CBWD	General				Clustering effects. The potential effect of data clustering on conclusions drawn from parts of the network with very high well densities also is not discussed. The well density discussion needs to consider the potential effects of data clustering on conclusions drawn from aggregation of water level data. For example, if Undesirable Results are defined as a certain percentage of monitoring network wells experiencing water levels below their Minimum Thresholds, clustering of wells through intentional "selection of additional wells in heavily pumped areas" may artificially magnify the apparent portion of the basin affected, increasing the likelihood of it being judged as out of compliance with sustainability criteria.	Comment noted. This can be addressed when the monitoring network is finalized during the GSP implementation phase.
158	EKI	CBWD	General				Sustainability Criteria. The Monitoring Network section does not include "quantitative values for the minimum threshold, measurable objective, and interim milestones that will be measured at each monitoring site", as required [§354.34 (g)(3)]. We understand that these sustainability criteria are currently under development, and anticipate that, when final, the appropriate values will be incorporated into this chapter.	This will be provided in the Sustainability Thresholds GSP chapter.
159	EKI	CBWD	General				Data gaps. Discussion of plans to fill data gaps is very general, with no description of "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." [§354.38 (d)]. Regulations specify that each GSA identify data gaps wherever the basin does not contain (a) a sufficient number of monitoring sites, (b) does not monitor sites at a sufficient frequency, or (c) utilizes monitoring sites that are unreliable, including those that do not satisfy minimum standards of the monitoring network adopted by the agency. There is no reason therefore to create minimum well acceptance standards to match what is currently available, and instead criteria should emphasize the capacity to reliably monitor and track basin efforts to maintain sustainability.	Comment noted. The specific plan to fill data gaps will be developed during the GSP implementation phase.
160	EKI	CBWD	General				Acquisition of wells to meet network deficiencies. Regulations regarding minimum requirements for monitoring network wells state "If an Agency relies on wells that lack casing perforations, borehole depth, or total well depth information to monitor groundwater conditions as part of a Plan, the Agency shall describe a schedule for acquiring monitoring wells with the necessary information, or demonstrate to the Department that such information is not necessary to understand and manage groundwater in the basin." [§352.4]. Additionally, DWR's Best Management Practices #2 – Monitoring Networks & Identification of Data Gaps states that agricultural or municipal wells may be used in place of monitoring wells, but that "If not using a dedicated monitoring well, the GSA must provide a rationale and a schedule for acquiring one." The Monitoring Network section does not assert that the information available for existing wells is adequate to understand the basin, nor does it support or refute the need for a rationale and schedule for acquiring monitoring wells.	Comment noted. This can be addressed when the monitoring network is finalized during the GSP implementation phase.
161	EKI	CBWD	General				Access for future monitoring. DWR's Best Management Practices #2 – Monitoring Networks & Identification of Data Gaps also states, "Monitoring wells should be secured by a long-term access agreement to ensure year-round site access." No discussion is provided in the Monitoring Network section regarding negotiation goals or procedures to ensure access to wells on private property for monitoring in the future.	Comment noted. This can be addressed when the monitoring network is finalized during the GSP implementation phase.
162	EKI	CBWD	General				Implementation. Explanation of how the Monitoring Network will be developed and implemented is deferred to a later GSP section (Projects and Management Actions), although it is required in the Monitoring Network section [§354.34(b)].	This can be revisited for the Public Draft version of this section when the implentation section is available

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163	EKI	CBWD	General				Areas with known data gaps. Very few wells were selected for the Monitoring Network within the southeastern part of the basin (near and upstream of Ventucopa). Ventura County Watershed Protection District maintains 51 wells in the area (Table 4-11, Figure 4-12), and private landowners have indicated they provided data to WC for additional wells in this area. It may be useful to reconsider inclusion of some of these wells into the network, to obtain better representation in this area of the basin. A pre-existing well with known construction data and some measurements is preferable to nothing, as long as the well is in acceptable condition.	Additional wells have been added to the monitoring network in these region.
164	EKI	CBWD	General				Field confirmation of selected Network wells. Anecdotally, some older historically gauged wells under consideration for inclusion within the network may have failed, allowing annular or aquifer materials into the casing, and altering their effective screened intervals. We recommend field-confirmation of total depths and general condition of wells selected for the network, particularly in areas of sparse well data density where each well represents large areas of the basin.	Comment noted. This can be addressed when the monitoring network is finalized during the GSP implementation phase.
165	EKI	CBWD	General				Surface water monitoring. Discussion of interconnected surface water monitoring is deferred until after numerical modeling is complete.	Comment noted.
166	EKI	CBWD	Pg. 4-14				Places where the relationships between sets of wells and databases is confusing: The distinction between California State Groundwater Elevation Monitoring (CASGEM) and other Department of Water Resources (DWR) wells is confusing. The text refers to Figure 4-3 as CASGEM wells, but the map labels say "DWR Database Wells." There appear to be 222 wells on the map, not 113. Terminology between text, table, and figure is inconsistent.	The text has been revised for clarity.
167	EKI	CBWD	Pg. 4-28				Places where the relationships between sets of wells and databases is confusing: "IRLP [sic] water quality measurements are sampled from surface locations." Why are Irrigated Lands Regulatory Program (ILRP) sites included in the groundwater quality database (see label and caption for Figure 4-10)? It is unclear whether all the sites in Table 4-9 are groundwater sites.	ILRP stations were utlized in the quality monitoring because surface flows within the basin, except during signifincantly high flow events, percolate into the groundwater system. These water qulaity measurements may be useful to provide information to the GSA as to the quality of water that enters the groundwater system.
168	EKI	CBWD	Pg. 4-29				Places where the relationships between sets of wells and databases is confusing: The relationship between databases from ILRP, California Environmental Data Exchange Network (CEDEN), U.S. Geological Survey (USGS), and National Water Quality Monitoring Council (NWQMC) is confusing. We suggest clarifying this point, perhaps using a Venn diagram or a similar graphic.	The text has been revised for clarity.
169	EKI	CBWD	Pg. 4-40				Monitoring network selection issues: Proposed Monitoring Network tiers reflect priorities in the following order: (i) recent data, (ii) frequent data, (iii) known construction information. This is reasonable if monitoring is limited only to acquisition of data from existing programs. However, if the network is selected to meet SGMA requirements and monitor specifically for the GSA, then construction information and future well access is more important than frequency of past measurements and (to an extent) more important than the date of the most recent measurement. Additionally, no discussion was provided of data by which the wells were determined to be representative of the basin.	There is not adequate information on well construction and well access to base well selection on these criteria. These will need to be considered as the monitoring program is developed during the GSP implementation phase.
170	EKI	CBWD	Pg. 4-35				Monitoring network selection issues: How were private landowner TDS values obtained? What was the context of the monitoring? Will landowners be enlisted to continue monitoring? How will this be accomplished if so?	Comment noted. This can be addressed when the monitoring network is finalized during the GSP implementation phase.
171	EKI	CBWD	Pg. 4-45				Monitoring network selection issues: "Wells with multiple depths…" The vertical distribution of representative wells is not discussed. It appears here as a goal, but there is no indication of the depth distribution of the representative network.	Criteria Updated.
172	EKI	CBWD	Pg. 4-53				Monitoring network selection issues: "…Established to monitor for salinity." What about other constituents from the groundwater conditions GSP chapter?	The text has been revised to describe the rationale for establishing the monitoring network only for salinity.

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173	EKI	CBWD	Pg. 4-53				Monitoring network selection issues: "…Unlikely to be monitored again by that monitoring agency." Will the GSA rely on the agencies to continue monitoring? Will the GSA attempt to share monitoring activity with the agency, ensure the network is monitored through their own funding?	Comment noted. This can be addressed when the monitoring network is finalized during the GSP implementation phase.
174	EKI	CBWD	Pg. 4-58				Monitoring network selection issues: "Well/measurement depths for three-dimensional constituent mapping." Was this considered in the section discussing groundwater level data gaps?	Not directly. We anticipate that the GSA will first need to focus on filling spatial data gaps in the monitoring network.
175	EKI	CBWD	Pg. 4-37				Text issues: Section 4.3.4 discusses CGPS stations on Figure 2.2-22. The Monitoring Networks section needs its own figure showing subsidence monitoring stations, including CGPS stations. Also, on the same page an unreferenced "subsidence white paper" is attributed to Appendix Z, which likely is a placeholder. The paper needs a complete reference.	The figure in Chapter 2 is sufficient. The white paper is an appendix to the Groundwater Conditions chapter - the reference has been revised for clarity.
176	EKI	CBWD	Pg. 4-39				Text issues: Section 4.5.1, discussing Management Areas, may be out of date. Several other sections discussing Management Areas also may no longer be accurate.	This section will be developed when the Board provides direction on management areas in the Basin.
177	EKI	CBWD	Pg. 4-62				Text issues: The subsidence monitoring network section should at least mention critical or subcritical infrastructure likely to be affected by subsidence. If none exists, it may be helpful to state this and cite as the reason that limited subsidence monitoring will be required.	The data gaps section identifies areas that may be critically affected by subsidence.
178	EKI	CBWD	Pg. 4-18				Table issues: Shouldn't "Number of SBCWA wells included in the Monitoring Network" be less than "Number of SBCWA wells"? The distinction between these categories is unclear. There is no discussion of why some are included, and others are not.	The text has been revised for clarity.
179	EKI	CBWD	Pg. 4-24				Table issues: CCSD well table shows two wells with longest period of record 37 years and median 11 years. This is not possible given only two wells.	Table has been updated
180	EKI	CBWD	Pg. 4-47 - 4-49				Table issues: Suggest adding a table number and identification on each page of the multi-page table.	The table format has been revised
181	EKI	CBWD	General				Figure issues: When map figure discussions in the text name geographic features, those features should be shown and labeled on the map (e.g., Pages 4-14, 4-18).	The text has been revised for clarity.
182	EKI	CBWD	Figure 4-2				Figure issues: Are all the hydrograph wells within this oval? Why focus on such a small part of the basin? This cannot be the extent of agriculture. Wells shown on hydrographs should be labeled on the map.	Yes. A single area was selected for presentation purposes as using all wells within the central basin would create a hydrograph that would not be useful or legible.
183	EKI	CBWD	Figure 4-15				Figure issues: As discussed above, the selection scheme values a monthly monitoring record over knowledge of critical well construction data (screened or perforated interval). We rather suggest swapping the criteria for Tier 2 and Tier 3. Also, text explaining the criteria for each tier needs to be increased in size for readability.	Suggestion noted but not included. Every well with data from 2017-2018 was included in the montioring network regaurdless of well construciton information or frequency of measurement.
184	EKI	CBWD	Figure 4-17				Figure issues: Faults should be included on this figure (and on most if not all water level monitoring network figures), especially since they were discussed in the monitoring well selection rationale.	Faults have been added to 4-16 and 4-17
185	EKI	CBWD	Figure 4-19				Figure issues: What are "Non-Groundwater Quality Monitoring Network Wells"? This should be explained in the text.	Wells have been removed from figure.
186	EKI	CBWD	Figure 4-20				Figure issues: This map distinguishes between Representative Wells and Active Groundwater Quality Monitoring Network Wells. The text says that all water quality network wells are representative wells.	Figurue and text has been updated.
187	EKI	CBWD	Pg. 4-20				Misc/Minor: "East of Highway 33" should be "west of Highway 33."	This has been fixed.
188	EKI	CBWD	Figure 4-2				Misc/Minor: Data series labels on the plot should be clearer or larger.	This has been fixed.
189	EKI	CBWD	Pg. 4-26				Misc/Minor: "Landowners have provided data on 99 wells." Needs discussion of how the data were requested and obtained.	The text has been revised for clarity.
190	EKI	CBWD	Pg. 4-28				Misc/Minor: Throughout the document, Irrigated Lands Regulatory Program is abbreviated as "IRLP" rather than "ILRP."	This has been fixed.
191	EKI	CBWD	Pg. 4-44				Misc/Minor: "Proximity to other prominent features such as faults…" Based on this statement it is unclear - should monitoring wells be near or far from faults?	The text has been revised for clarity.

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan Monitoring Networks Draft

Prepared by:

September January 20198

Chapter 4 Monitoring Networks

This section of the Cuyama Basin Groundwater Sustainability Plan (GSP) discusses the planned monitoring networks needed to guide the GSP's path to sustainability. Monitoring networks need to be established for each sustainability indicator either directly or through monitoring through a proxy. This ~~section was prepared to meet the requirements of DWR's GSP regulations~~section satisfies Subarticle 4 of the Sustainable Groundwater Management Act Regulations. This section discusses the objectives of the monitoring networks, existing monitoring networks used in the development of each network, and establishes a monitoring network for each sustainability indicator. Data gaps and a plan to fill data gaps if they are present are provided for each monitoring network.

This section does not include information about basin settings, undesirable results, sustainability thresholds, water budget information, or projects and management actions.

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Acronyms

ACWI	Advisory Committee on Water Information
AFY	Acre feet per year
ARS	Agricultural Research Service
Basin	Cuyama Valley Groundwater Basin
BMP	Best Management Practices
CA	California
CASGEM	California Statewide Groundwater Elevation Monitoring
CBGSA	Cuyama Basin Groundwater Sustainability Agency
CBWD	Cuyama Basin Water District
CCSD	Cuyama Community Services District
CEDEN	California Environmental Data Exchange Network
CGPS	CGPS
DWR	California Department of Water Resources
EPA	Environmental Protection Agency
GAMA	Groundwater Ambient Monitoring and Assessment
GICIMA	Groundwater Information Center Interactive Map
GSA	Groundwater Sustainability Agency
ILRRLP	Irrigated Lands Regulatory Program
MSC	Master Site Code
msl	mean sea level
NWIS	National Water Information System
NGWMN	National Ground-Water Monitoring Network
NWQMC	National Water Quality Monitoring Council
SBCWA	Santa Barbara County Water Agency
SLOCFC&WCD	San Luis Obispo County Flood Control & Water Conservation District
SWN	State Well Number
TSS	Technical Services Support
USGS	United States Geological Survey
VCWPD	Ventura County Water Protection District

WDL	Water Data Library

4.1 Useful Terms

The monitoring networks section includes descriptions of groundwater wells, water quality measurements, subsidence stations, and other related components. A list of technical terms and a description of the terms are listed below. Figure 4-1 shows a diagram of a monitoring well with well related terms identified on the diagram. The terms and their descriptions are identified here to guide readers through the section and are not a definitive definition of each term:

- Well related terms:
    - **Ground Surface Elevation –** The elevation in feet above mean sea level (msl) at the well's location.
    - **Total Well Depth** – The depth that a well is installed to. This is often deeper than the bottom of the screened interval.
    - **Screened interval** – The portion of a well casing that is screened to allow water from the surrounding soil into the well pipe. There can be several screened intervals within the same well. Screened interval is usually reported in feet below ground surface elevation for both the upper most limit and lower most limit of the screen.
    - **Top Perforation –** The distance to the top of the perforation from the ground surface elevation.
    - **Bottom Perforation –** The distance to the bottom of the perforation from the ground surface elevation.
    - **Water Surface Elevation –** The elevation above mean sea level (msl) that water is encountered inside the well
    - **Depth to Water –** The distance from the ground surface or the well' to where water is encountered inside the well
- **Historical high groundwater elevations** – This is the highest measurement of static groundwater elevation (closest to the ground surface) in a monitoring well that was recorded. Measurements of groundwater elevation are used to indicate the elevation of groundwater levels in the area near the monitored well.
- **Historical low groundwater elevations** – This is the lowest measurement of static groundwater elevation (furthest from the ground surface) in a monitoring well that was recorded. Measurements of groundwater elevation are used to indicate the elevation of groundwater levels in the area near the monitored well.
- **Depth to Groundwater –** This is the distance from the ground surface to groundwater, typically reported at a well.
- **Hydrograph –** A hydrograph is a graph that shows the changes in groundwater elevation over time for each monitoring well. Hydrographs show how groundwater elevations change over the years and indicate whether groundwater is rising or descending over time.

Figure 4-14-1: Well Completion Diagram

- **Constituent** – Refers to a water quality parameter measured to assess groundwater quality.
- **Subsidence** (refer to appendix Z which was included with Groundwater Conditions) – Refers to the sinking or downward settling of the earth's surface, not restricted in rate, magnitude, or area involved, and is often the result of over-extraction of subsurface water.
- **Best Management Practice** – Refers to a practice, or combination of practices, that are designed to achieve sustainable groundwater management and have been determined to be technologically and economically effective, practicable, and based on best available science (California (CA) Code of Regulations, Title 23, Article 2).
- **Data Gap** – Refers to a lack of information that significantly affects the understanding of the basin setting or evaluation of the efficacy of Plan implementation and could limit the ability to assess whether a basin is being sustainablye managed (CA Code of Regulations, Title 23, Article 2).
- **Representative Monitoring** – Refers to a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin (CA Code of Regulations, Title 23, Article 2).

4.2 Monitoring Network Objectives

This section describes the Cuyama Valley Groundwater Basin (Basin) Monitoring Networks for the five sustainability indicators that apply to the Basin. The objective of these monitoring networks is to detect undesirable results in the basin as described in Section 3 of this Groundwater Sustainability Plan (GSP) using the sustainability thresholds described in Section 5 of this GSP. Other, related objectives of the monitoring network were defined by the GSP regulations promulgated by the Department of Water Resources (DWR):

- Demonstrate progress toward achieving measurable objectives described in the Plan
- Monitor impacts to the beneficial uses or users of groundwater
- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds
- Quantify annual changes in water budget components

The monitoring network plan provided to the Basin is intended to monitor:

- Chronic lowering of groundwater levels

- Reduction in groundwater storage
- Degraded water quality
- Land subsidence
- Depletions of interconnected surface water

The monitoring networks described in this section were designed by evaluating data provided by DWR, USGS, participating counties, and private landowners. Wells currently used for such activity are included and considered based on criteria further described below.

4.2.1 Basin Conditions Relevant to Measurement Density and Frequency

This section summarizes key basin conditions that influence the development of monitoring networks. The key conditions include hydrogeologic considerations, land use considerations, and historical groundwater conditions considerations.

The Basin, as described in the Section 2.1, is composed of one principal aquifer comprised of three geologic groups: Younger Alluvium, Older Alluvium, and Morales Formation. The majority of groundwater in the aquifer is stored in the younger and older alluvium. While there are many faults in the Basin, t~~T~~here are no major stratigraphic aquitards or barriers to vertical groundwater movement amongst the alluvium and Morales Formation. The aquifer has a wide range of thicknesses that vary spatially, with median reported hydraulic conductivity ranges from 1.22 – 72.1 ft/day (see Table 2.1-1 for detailed values). Figure 2.1-2 shows the extent of these formations throughout the basin.

The largest groundwater use within the Basin is for agriculture and irrigation. Figures 1-6 through 1-13 show the extent of land used for irrigated agriculture within the Basin. Based on the most recent data from 2016, there is approximately 53 square miles of agricultural land~~e~~ in the Basin out of a total of ~~overlies~~ approximately 378 square miles, or ~~of the Basin totaling~~ roughly 14%.

Data provided in Section 2.2 shows the historical declining trend of groundwater levels within the central portion of the basin. ~~Generally, g~~Groundwater elevations in this portion of the basin have ~~been decreasing~~decreased by more than 400 feet from the 1940s ~~and 1950s~~ to the present, as shown in Figure 4~~-~~2.

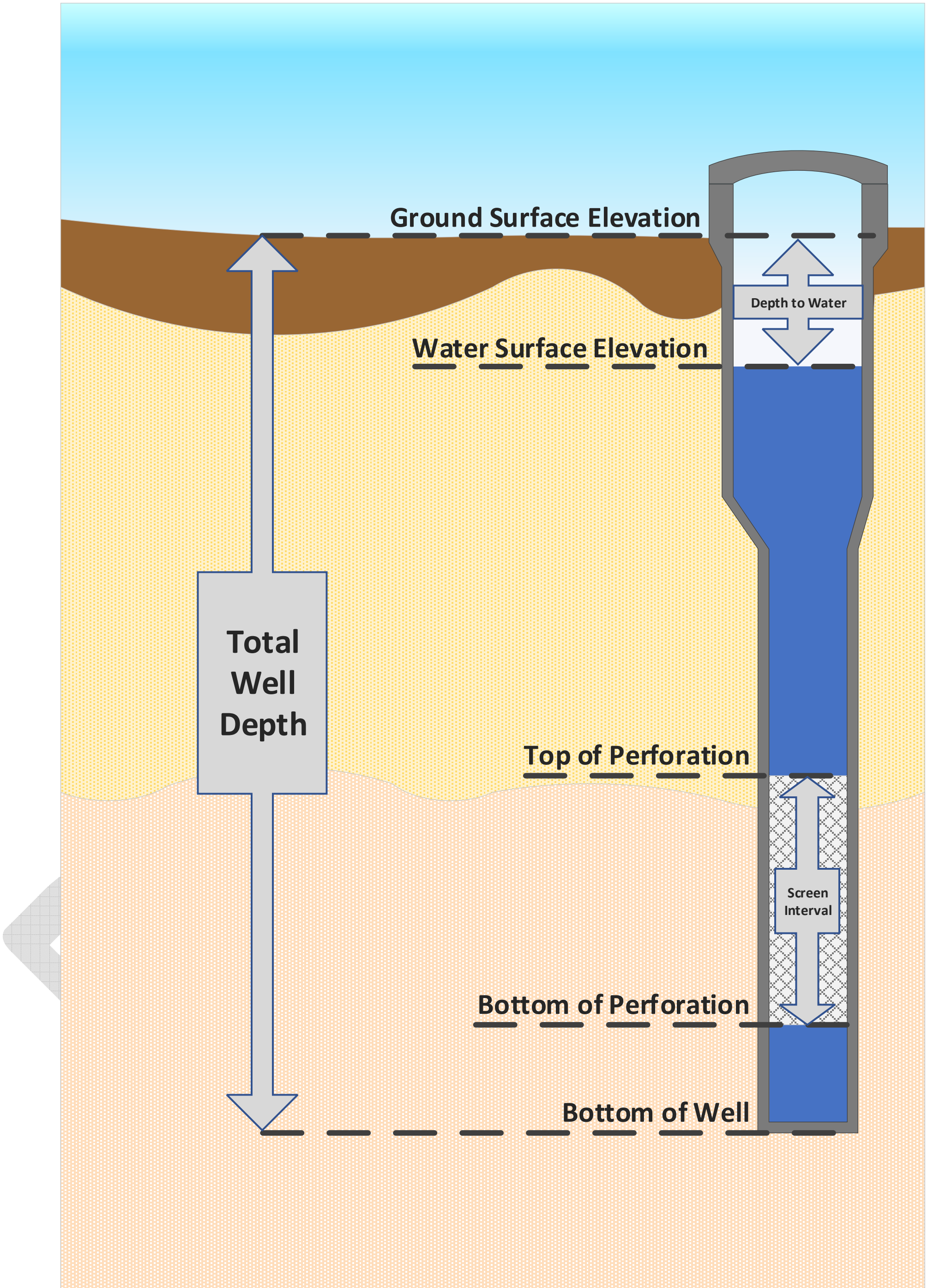

Figure 4-24-2: Central Basin with Combined Hydrograph

4.3 Existing Monitoring Used

This section discusses current groundwater level monitoring with the Basin.

4.3.1 Groundwater Level Monitoring

This section describes the groundwater level monitoring that has been conducted by agencies and private land owners in the Basin.

Department of Water Resources, Statewide Dataset / CASGEM

The State of California has several water-related database portals accessible online. These include, but are not limited to, the California Statewide Groundwater Elevation Monitoring (CASGEM) Program, Water Data Library (WDL), and the Groundwater Information Center Interactive Map Application (GICIMA). The data for these portals is organized and saved in one master database, where each portal accesses and displays the intended data dependent on the search criteria and portal being used.

In an attempt to include all available data related to the Basin, DWR was contacted directly and they provided a link ~~to~~ for Groundwater Sustainability Agency (GSA) representatives to download the entire State's database. Cuyama Basin data was then extracted from this dataset.

Although the master dataset was used to collect the initial data, the CASGEM portal was utilized throughout the planning process to verify data (DWR CASGEM Online System, 2018). CASGEM is tasked with tracking seasonal and long-term groundwater elevation trends in groundwater basins throughout the state. CASGEM was initialized by Senate Bill x7-6 passed by the legislature in 2009 to establish collaboration between local monitoring parties and DWR to collect groundwater elevations (DWR Groundwater Monitoring [CASGEM] 2018).

CASGEM allows local~~ly~~ agencies to be designated as CASGEM monitoring entities for groundwater basins throughout the state (CASGEM Brochure 2018). CASGEM monitoring entities can measure groundwater elevation or compile data from other agencies to fulfill a monitoring plan and each is responsible for submitting that data to DWR. Three monitoring entities operate as CASGEM monitoring entities in the Cuyama Basin; the Santa Barbara County Water Agency (SBCWA), Ventura County Watershed Protection District (VCWPD), and San Luis Obispo Flood Control & Water Conservation District (SLOFC&WCD).

CASGEM includes two kinds of wells in its database:

- CASGEM Wells – All of these w~~W~~ells ~~with~~ include well construction information
- Voluntary Wells – Wells included in the CASGEM database on a volunteer basis where the well construction ~~has~~ may not be~~en~~ identified or made public

There are currently six CASGEM wells and 107 voluntary wells in the Basin. Figure 4-3 shows the locations of these wells.

Most wells were measured on either a semi-annual or annual schedule. Summary data about the wells reported through CASGEM can be seen in Table 4-1.

CASGEM Wells	
Number of CASGEM wells	6
Number of voluntary wells	107
Total number of DWR and CASGEM wells	222
Earliest measurement year	1946
Longest period of record	68 years
Median period of record	12 years
Median number of records for a single well	19

Table 4-14-1: Cuyama Basin Monitoring Well Information Provided by CASGEMSummary Statistics for CASGEM Wells within Cuyama Basin

Spatial distribution of the wells is best suited to capture groundwater trends in the central portion of the Basin, and around the Ventucopa area. There are also several monitoring wells in the south eastern portion of the Basin near the junction of Highway 33 and Lockwood Valley Roadupstream of Ventucopa. CASGEM data is sparser along the north facing slopes of the main Cuyama Valley and the western portion of the Basin, as can be seen in Figure 4-3.

Figure 4-34-3: Cuyama GW Basin Wells with Monitoring Data Provided by DWR/CASGEM Wells

United States Geological Survey

The United States Geological Survey (USGS) has the most groundwater elevation monitoring locations within the Basin. Many of these wells were installed for a 1966 groundwater study and have since been retired.

It should be noted that there are significant overlaps between the DWR provided datasets and the USGS provided datasets. Approximately 106 wells appeared in both downloaded datasets. Discussion about overlapping data is provided in Section 4.3.2 below.

USGS data may be accessed through their online portals for the National Ground-Water Monitoring Network (NGWMN), Groundwater Watch, and National Water Information System (NWIS).

The USGS online data portals provide "Approved" data which has been quality-assured and fit to be published, and "Provisional" data which is unverified and subject to revision. The USGS was contacted directly and coordinated download of their monitoring records in the Basin, and to obtain all available data, the USGS URL Generation tool was used to download all provisional and approved data within the Basin.

USGS has approximately 25 approved476 wells within the basin, but many more that have data that is provisional. Summary statistics of this data may be found in Table 4-2 below.

USGS Wells	
Number of Approved wells	25
Number of Provisional wells	451
Total number of USGS wells	476
Earliest measurement date	1946
Longest period of record	68 years
Median period of record	2 years
Median number of records for a single well	2 years

Table 4-24-2: Cuyama Basin Monitoring Well Information Provided by USGS Cuyama Basin USGS Well Statistics

A significant portion of the wells included in the USGS wells dataset are located near the Cuyama River and in the central portion of the Basin. Wells are also found along many of the tributaries that feed the Cuyama River during large precipitation events. Well locations are included in the USGS dataset are shown in Figure 4-4.

Figure 4-44-4: Cuyama GW Basin Wells with Monitoring Data Provided byCuyama Basin USGS Wells

Santa Barbara County Water Agency

The Santa Barbara County Water Agency (SBCWA) manages maintains data for 3629 wells within the Cuyama Basin. Some of those wells are owned by private land owners, while others owned by local agencies such as Caltrans and the California Department of Fish and Wildlife. Many of these wells are included in the DWR statewide dataset. Summary statistics for these wells are included in Table 4-3 below.

SBCWA Wells	
Number of SBCWA-monitored wells	3629
Earliest measurement date year	19501988
Longest period of record	6830 years
Median period of record	21.4 years
Median number of records for a single well	89
Number of SBCWA wells included in the Monitoring Network	230

Table 4-34-3: Cuyama Basin Monitoring Well Information Provided by SBCWA Cuyama Basin SBCWA Well Statistics

Wells managed byincluded in the SBCWA dataset are located within Santa Barbara County near the Cuyama River and Miranda Canyon, as well as between Cottonwood Canyon and Aliso Canyonin the hills to the south of the river. Figure 4-5 shows the locations of these wellsthe SBCWA managed wells.

Figure 4-54-5: Cuyama GW Basin Wells with Monitoring Data Provided by Cuyama Basin SBCWA Managed Wells

San Luis Obispo County Flood Control & Water Conservation District

San Luis Obispo County Flood Control & Water Conservation District (SLOCFC&WCD) ~~manages~~ maintains data for two wells within the Basin. SLOCFC&WCD also reports the data for the two wells to DWR, thus all data is for the wells is incorporated through the DWR dataset.

The wells are located in the central portion of the Basin, north of the Cuyama River and ~~east~~ west of Highway 33. Both wells meet the minimum requirements to be included in the monitoring network, and summary statistics are provided in Table 4-4 below.

~~SLOCFC&WCD Wells~~	
Number of SLOCFC&WCD-monitored -wells	2
Earliest measurement date year	1990
Longest period of record	28 years
Median period of record	18 years
Median number of records for a single well	35

Table 4-4~~4-4~~: Cuyama Basin Monitoring Well Information Provided by SLOCFC&WCD ~~Cuyama Basin SLOCFC&WCD Wells Statistics~~

Locations for the two wells included in the SLOCFC&WCD ~~managed wells are provided~~dataset are shown in Figure 4-6.

Figure 4-64-6: Cuyama GW Basin Wells with Monitoring Data Provided by Cuyama Basin SLOCFC&WCD Wells

Ventura County Watershed Protection District

The Ventura County Watershed Protection District (VCWPD) manages 22 groundwater elevation monitoring wells within the Basin. Twenty of those wells are incorporated in the DWR dataset.

The majority of wells managed by VCWPD are discontinued and no longer measure groundwater elevations. Five of the 22 wells have measured elevation data within the last decade are currently active. A summary of the wells statistics is provided in Table 4-5 below.

VCWPD Wells	
Number of SLOCFC&WCDVCWPD-monitored wells	22
Earliest measurement date year	1971
Longest period of record	46 years
Median period of record	5.8 years
Median number of records for a single well	21.5

Table 4-54-5: Cuyama Basin Monitoring Well Information Provided by VCWPD Cuyama Basin VCWPD Wells

The wells included in the VCWPD wells dataset are located in the south eastern portion of the Basin that intersects with Ventura County. The wells are primarily found near the Cuyama River close to agricultural lands. Locations for the wells are provided in Figure 4-7.

Figure 4-74-7: Cuyama GW Basin Wells with Monitoring Data Provided by Cuyama Basin VCWPD Wells

Cuyama Community Services District

The Cuyama Community Services District (CCSD) manages performs monitoring on its two production wells, one of which has been retired. The CCSD wells are located just south of the CCSD. Data for these wells is included in the SBCWA dataset, as well as the DWR and USGS datasets. Summary statistic for the wells is included in Table 4-6. Locations for these wells can be found in Figure 4-8.

CCSD Wells	
Number of CCSD-monitoring wells	2
Earliest measurement date year	1981
Longest period of record	37 years
Median period of record	26.511 years
Median number of records for a single well	79

Table 4-64-6: Cuyama Basin Monitoring Well Provided Information by CCSD Cuyama Basin CCSD Well Statistics

Figure 4-84-8: Cuyama GW Basin Wells with Monitoring Data Provided by CCSDCuyama Basin Community Services District Wells

Private Landowners

Private landowners within the Basin own and operate large numbers of wells, primarily for irrigation and domestic use. Many wells owned by private landowners are included in the databases described above. In addition, these lLandowners have provided additional monitoring data on 99 wells at the request of theto the GSA. Summary statistics for these wellsthis additional data is provided in Table 4-7.

Private Landowner Wells	
Number of Private Landowner wells with monitoring data	99
Earliest measurement date year	1975
Longest period of record	42 years
Median period of record	15 years
Median number of records for a single well	16

Table 4-74-7: Cuyama Basin Monitoring Well Information Provided by Private Landowners Cuyama Basin Private Landowner Well Statistics

The private landowner wells with for which provided monitoring information was provided are distributed throughout the Basin. The majority of wells are located within the central portion of the Basin near the Cuyama River and Highway 166. There is an additional cluster towards the western portion of the basin that runs along the Cuyama River. Private landowner wells are shown in Figure 4-9.

Figure 4-94-9: Cuyama GW Basin Wells with Monitoring Data Provided byCuyama Basin Private Landowners Wells

4.3.2 Overlapping and Duplicate Data

Many of the data sources used to compile and create the Cuyama Basin Database contain duplicate entries for wells, metadata, groundwater level measurements, and groundwater quality measurements. Much of the well information managed by the counties within the Basin is also provided and incorporated into the DWR dataset. Many of the USGS wells and DWR wells overlap between datasets.

To avoid duplicate entries when compiling the Cuyama Basin Database, wells were organized by their State Well Number (SWN), Master Site Code (MSC), USGS ID, Local Name, and Name. Duplicates were identified and then removed or combined as necessary. Each unique well was then assigned an OPTI ID which was used as the primary identification number for all other processes and mapping exercises.

OPTI IDs were used to identify wells in the database within the Basin because not all data sources use similar identification methods, as shown in Table 4-8 below.

~~Managing Entity~~Data Maintaining Entity	SWN	CASGEM ID	USGS ID	MSC	Local Name	Name
DWR	✔ (green)	✔ (green)		✔ (green)		
USGS	✔ (black)		✔ (green)		✔ (red)	
SLOCFC&WCD	✔ (green)					
SBCWA	✔ (black)		✔ (red)		✔ (black)	
VCWPD	✔ (green)					
Private Landowners					✔ (black)	✔ (green)

✔ (green) = All wells had this information, ✔ (black) = Some wells had the information, ✔ (red) = Few wells had the information

Table 4-8~~4-8~~: Well Identification Matrix

4.3.3 Groundwater Quality Monitoring (Combine Existing Programs)

This section discusses existing groundwater quality monitoring programs ~~collected for GSP development~~in the Cuyama Basin.

NWQMC / USGS / ~~IRL~~PILRP

The National Water Quality Monitoring Council (NWQMC) was created in 1997 to provide a collaborative, comparable, and cost-effective approach for monitoring and assessing the United State's water quality. Several organizations contribute to the database including the Advisory Committee on Water Information (ACWI), the Agricultural Research Service (ARS), the Environmental Protection Agency (EPA), and USGS (NWQMC, 2018).

A single online portal provides access to data from the contributing agencies. Data is included from the USGS national Water Information System (NWIS) the EPA STOrage and RETrieval (STORET) Data Warehouse, and the USDA ARS Sustaining The Earth's Watersheds – Agricultural Research Database System (STEWARDS). Data incorporates hundreds of different water quality constituents from the different contributing agencies. Initial water quality data for the Cuyama Basin was downloaded through NWQMC and included data for USGS monitoring sites and Irrigated Land Regulatory Program (~~IRLP~~ILRP) monitoring sites. ~~IRLP~~ ILRP was initiated in 2003 to prevent agricultural runoff from impairing surface waters, and in 2012, groundwater regulations were added to the program. ~~IRLP~~ ILRP water quality measurements are sampled from surface locations (DWR ~~IRLP~~ILRP, 2018). There are currently five ~~IRLP~~ ILRP measurement sites within the Cuyama Basin. ~~IRLP~~ ILRP uses the California Environmental Data Exchange Network (CEDEN) to manage the data associated with the program. CEDEN data is then incorporated with USGS data, and thus included in the NWQMC database (DWR CEDEN, 2018).

The NWQMC database provides TDS data on 180~~47~~ water quality monitoring sites. This database also provided data for a wide variety of constituents not included here.

~~-~~Summary statistics for ~~this~~ the NWQMC, USGS and ILRP monitoring sites~~information~~ is shown in Table 4-9.

NWQMC, USGS, and ~~IRLP~~ ILRP Water Quality Monitoring Sites	
Number of measurement sites	~~176~~180
Earliest measurement date year	1940
Longest period of record	53 years
Median period of record	<1 year
Median number of records for a single site	2

Table 4-9~~4-9~~: Cuyama Basin NWQMC, USGS, ~~IRLP~~ ILRP Water Quality Monitoring Sites Summary Statistics

The majority of the water quality monitoring sites included in the NWQMC database are located in the central portion of the basin and along the Cuyama River as it follows Highway 33. These monitoring sites can be seen in Figure 4-10.

Figure 4-10~~4-10~~: Cuyama Basin NWQMC, USGS, ~~IRLP~~ ILRP Water Quality Monitoring Sites

GAMA / DWR

The Groundwater Ambient Monitoring and Assessment (GAMA) Program is the State of California's groundwater quality monitoring program created by the State Water Resources Control Board in 2000, and later expanded by Assembly Bill 599, the Groundwater Quality Monitoring Act of 2001 (DWR GAMA 2018). The purpose of GAMA is to improve statewide comprehensive groundwater monitoring and increase the availability of information to the general public about groundwater quality and contamination information. Additionally, GAMA aims to establish groundwater quality on basin wide scales, continue with groundwater quality sampling and studies, and centralize the information and data for the public and decision makers to enhance groundwater resource protection.

DWR also publishes statewide water quality data via the California Natural Resources Agency. Access to DWR and GAMA information and data is accessible through separate online portals.

There are 213 GAMA and DWR groundwater quality monitoring sites within the Basin. Summary statistics for these sites is included in Table 4-10.

GAMA / DWR Water Quality Monitoring Sites	
Number of measurement sites	213
Earliest measurement date year	1942
Longest period of record	41 years
Median period of record	<1 year
Median number of records for a single site	2

Table 4-10~~4-10~~: Cuyama Basin GAMA / DWR Groundwater Quality Monitoring Sites Summary Statistics

The GAMA / DWR groundwater quality monitoring locations are spread throughout the Basin, loosely following the Cuyama River. There are currently 60 water quality monitoring sites per 100 miles^2 within the Basin. These locations can be seen in Figure 4-11.

Figure 4-11~~4-11~~: Cuyama Basin GAMA / DWR Groundwater Quality Monitoring Sites

Cuyama Community Services District

The Cuyama Community Services District (CCSD) currently operates one production well for residential distribution within the Basin. Although some data for this well is included in the NWQMC dataset, annual Consumer Confidence Reports from 2011 to 2017 were processed for additional water quality data measurements. Summary Statistics for the CCSD well are included in Table 4-11 and the location is shown in Figure 4-12.

CCSD~~VCWPD~~ Water Quality Monitoring Sites	
Number of measurement sites	1
Earliest measurement date	2008
Period of record	10 years
Number of records	21

Table 4-11: Cuyama Basin CCSD Water Quality Site Summary Data

Figure 4-12: Cuyama Basin CCSD Water Quality Monitoring Site

Ventura County Watershed Protection District

VCWPD has 51 groundwater wells that have been utilized for groundwater quality monitoring within the Basin. All of the wells are incorporated into the DWR, GeoTracker, or USGS datasets. Sampling data includes numerous water quality constituents, however, this GSP only addresses TDS. Summary statistics for the wells are included in Table 4-12, and locations of these wells are included in Figure 4-13.

VCWPD Water Quality Monitoring Sites	
Number of measurement sites	51
Earliest measurement date	1957
Longest period of record	45
Median period of record	7
Median number of records for a single site	5

Table 4-124-11: Cuyama Basin VCWPD Water Quality Sites Summary Data

Figure 4-13~~4-12~~: Cuyama Basin VCWPD Water Quality Sites

Private Landowners

Private landowners within the Basin conducted groundwater quality testing, which has been incorporated into this document and associated analysis. Eleven wells measured Total Dissolved Solids in 2015. Summary statistics for these sites can are included in Table 4-13 and locations are included in Figure 4-14.

Private Landowner Water Quality Monitoring Sites	
Number of measurement sites	11
Earliest measurement date	1/12/2015
Longest period of record	N/A
Median period of record	N/A
Median number of records for a single site	1

Table 4-134-12: Cuyama Basin Landowner Water Quality Sites Summary Data

Figure 4-14~~4-13~~: Cuyama Basin Landowner Water Quality Sites

4.3.4 Subsidence Monitoring

Subsidence is the sinking or downward settling of the earth's surface and is often the result of over-extraction of subsurface water. Subsidence can be directly measured in a few different methods such as with LiDAR or InSAR, Continuous Geographic Positioning System (CGPS), Extensometers, and Spirit Leveling. For more information, see Appendix Z in the Groundwater Conditions chapter, ~~Appendix Z,~~ which ~~is a subsidence white paper~~ contains further information about these methods and the physics behind land subsidence. The subsidence monitoring network currently described below for the Cuyama Basin assumes the use of extensometers to monitor subsidence in the Basin. However, the GSA should evaluate other methods, including LiDAR and InSAR as well during the implementation phase to identify the optimal approach.

The Basin hosts two CGPS stations with three others just outside the Basin's boundary, as shown in Figure 2.2-22. CGPS stations measure surface movement in all three axis directions; up/down, east/west, and north/south. CGPS stations are placed in the center of the Cuyama Valley to measure subsidence, while other are placed on ridges around the valley to also measure tectonic movements.

4.3.5 Surface Water Monitoring

Surface water monitoring within the Basin is conducted through stream and river gages placed along the Cuyama River or one of its tributaries. USGS manages most flow gages in California, and currently operates one active stream gage along Santa Barbara Creek. There is an additional gage (ID 11136800) along the Cuyama River downstream of the Basin before Twitchell Reservoir, however, this gage also receives water from non-Cuyama Basin watershed areas. Data for surface flow gages is obtained through the NWIS Mapping portal (USGS NWIS 2017). Existing and discontinued gages are included in Figure 4-15.

USGS has operated three additional gages within the Basin, however, two of those gages were discontinued in the 1970's. Gage ID 11136500 operated from 1945 to 1958 and was brought back into service from 2009 to 2014.

Figure 4-15~~4-14~~: Cuyama Basin Streams and Rivers with Existing Gages

4.4 Monitoring Rationales

This section discusses the reasoning behind monitoring network selection. Monitoring networks in the Cuyama Basin GSP were developed to ensure that they were able to detect changes in basin conditions so that the Cuyama Basin Groundwater Sustainability Agency (CBGSA) can manage the basin to ensure the basin's sustainability goal is met, and that no undesirable results are present after 20 years of sustainable management.

The monitoring networks were selected specifically to detect short term, seasonal, and long term trends in groundwater levels and storage. The monitoring networks have been selected to include an adequate amount of temporal frequency and spatial density to evaluate information about groundwater conditions that are necessary to evaluate the effectiveness of projects and management actions undertaken by the GSA.

Explanations of how each monitoring network will be developed and implemented will be described in the projects and management actions section of the GSP as individual projects that the GSA will undertake as part of GSP implementation. The schedule and costs associated with developing and implementing each network will be discussed in the Implementation Section of the GSP.

4.5 Groundwater Level Monitoring Network

Groundwater level monitoring is conducted through a groundwater well monitoring network. This section will provide information on how the level monitoring network was developed, criteria for selecting representative wells, monitoring frequency, spatial density, summary protocols, and identification and strategies to fill data gaps.

4.5.1 Management Areas

Management Areas have not been selected at the time of writing this GSP section. Management Areas allow flexibility in establishing monitoring networks both spatially and temporally to match conditions and use in the management area. At this time, it is recommended due to the sparsity of monitored wells to use the same monitoring network selection criteria across all management areas in the basin.

4.5.2 Monitoring Wells Selected for Monitoring Network

A set of well tiering criteria were created to rank existing groundwater level measuring sites within the basin into six different tiers, shown in Figure 4-16.

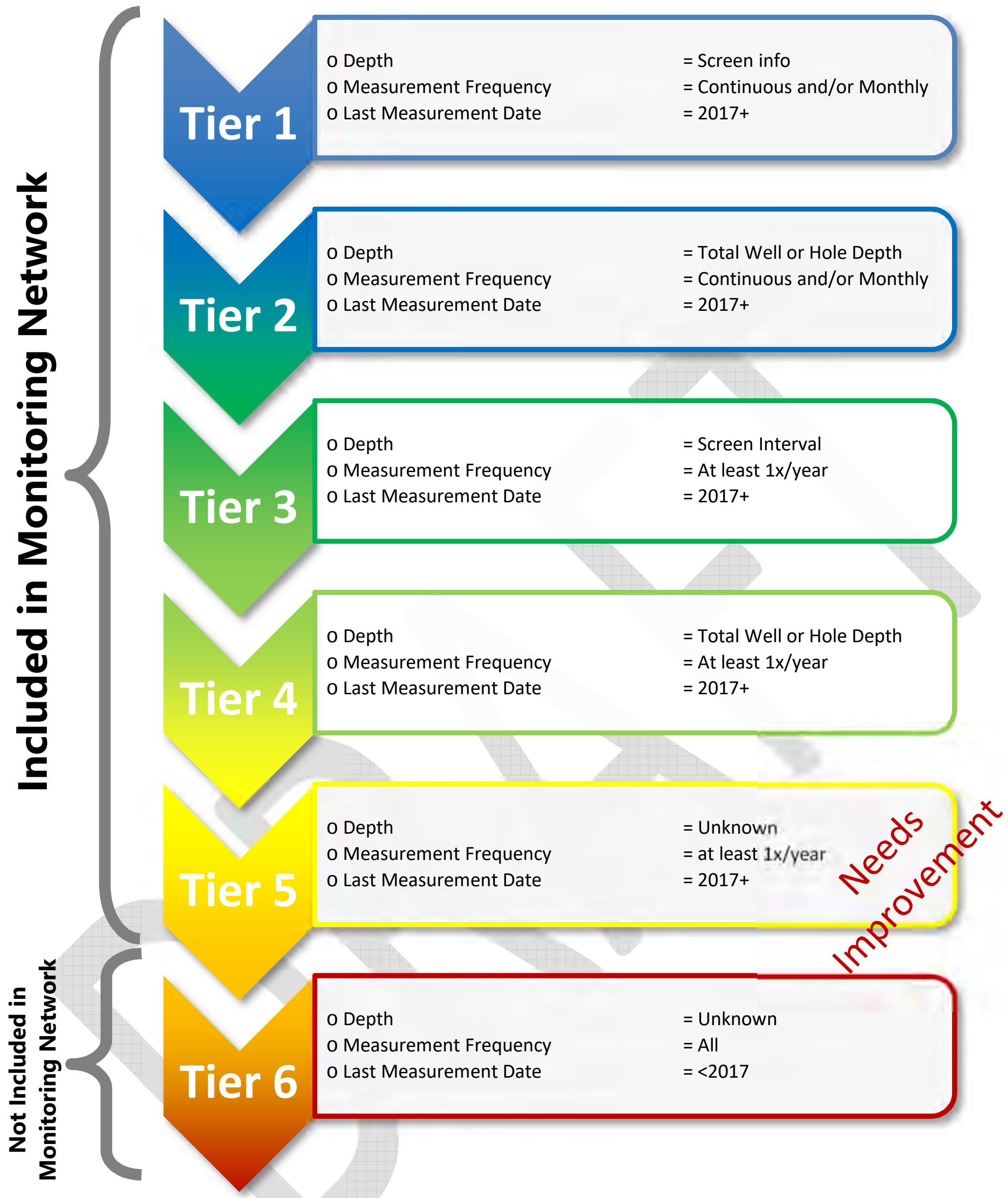

Figure 4-164-15: Cuyama Well Tiering Criteria

Tier 1 encompasses wells with the most amount of metadata as well as consistent water elevation data that are still operating and functional. As tiering levels increase, requirements around well metadata and frequency of monitoring decrease, but all the wells are still active and functioning. Tier 5 captures the remaining “active” wells, but the metadata and/or frequency of monitoring would benefit from improvement.

Tier 6 includes all other wells that are no longer operational, which are categorized as those who do not have recorded data from January 1, 2017 to August 1, 2018 This approximate two-year cut off was determined as being a reasonable amount of time for a monitoring agency or organization to obtain, log, and report well information and measurements, and as an indicator of whether a well was currently monitored or not.

Table 4-13 shows the number of monitoring wells selected from each existing monitoring ~~program~~data maintaining entity.

Monitoring ~~Group~~Data Maintaining Entity	Number of Wells Selected for Monitoring Network
CASGEM	28
USGS	43
SBCWA	30
SLOCFC&WCD	2
VCWPD	5
CCSD	1
Private Landowner	43
~~Private Landowner~~Total	~~43~~89

Note: Total does not equal sum of rows due to duplicate entries in multiple databases

Table 4-14: Number of Wells Selected for Monitoring Network

~~Thirteen percent of the CASGEM wells meet the minimum requirements for inclusion in the Cuyama Basin Monitoring Network (monitoring network) based on the metadata and the groundwater elevation measurements available for each well. Nine percent of the USGS wells meet the minimum requirements for inclusion in the Monitoring Network based on the metadata and the groundwater elevation measurements available for each well. Ninety six percent of the SBCWA wells meet the minimum requirements for inclusion in the Monitoring Network based on the metadata and the groundwater elevation measurements available for each well. included in the Monitoring Network, as can be seen in Figure 4-16. Forty-three percent of the private landowner operated wells are active and included in the monitoring network.~~Figure 4-17 shows the Monitoring Network wells by their Tier level.

Figure 4-17~~4-16~~: Cuyama Basin Groundwater Level and Storage Monitoring Network Wells by Tier

4.5.3 Monitoring Frequency

A successful monitoring frequency and schedule should allow the monitoring network to adequately interpret the fluctuations over time of the groundwater system based on shorter-term and long-term trends and conditions. These changes may be the result of storm events, droughts or other climatic variations, seasons, and anthropogenic activities such as pumping.

Monitoring frequency must, at a minimum, occur within the same designated time-period for all wells to ensure that measurements represent the same condition for the aquifer.

The *Monitoring Networks and Identification of Data Gaps Best Management Practices (BMP)* published by DWR provides guidance for the monitoring frequency based on the discussion presented in the *National Framework for Ground-water Monitoring in the United States* (ACWI, 2013). This analysis and discussion provide guidance on monitoring frequency based on aquifer properties and degree of use, as shown in Table 4-15.

The guidance recommends that initial characterization of monitoring locations use frequent measurements to establish the dynamic range at each monitoring site and to identify external stresses affecting groundwater levels. An understanding of these conditions based on professional judgement should be reached before normal monitoring frequencies are followed.

Aquifer Type	Nearby Long-Term Aquifer Withdrawals		
	Small Withdrawals	***Moderate Withdrawals***	***Large Withdrawals***
Unconfined Aquifer			
“low” recharge (<5 inches/year)	Quarterly	Quarterly	Monthly
“high” recharge (>5 inches/year)	Quarterly	Monthly	Daily
Confined Aquifer			
“low” hydraulic conductivity (<200 feet/day)	Quarterly	Quarterly	Monthly
“high” hydraulic conductivity (>200 feet/day)	Quarterly	Monthly	Daily

Table 4-154-14: Monitoring frequency Based on Aquifer Properties and Degree of Use

The Basin is an unconfined aquifer with large withdrawals, with a “low” recharge rate of less than 5-inches per year. Based on the data in Table 4-15 provided by DWR, the Basin’s groundwater monitoring frequency should be on a monthly basis. This GSP recommends monitoring the groundwater level network monthly for the first three years of GSP implementation and consideration of reducing the monitoring frequency to quarterly measurements after that. Ideally, the monitoring network would be monitored simultaneously to gain a ‘snapshot’ of groundwater conditions. Since that is not practical monitoring of the level network should be conducted within one week for each measurement period.

4.5.4 Spatial Density

Spatial density of the monitoring network was considered both for the selection of the entire monitoring network, and for the selection of representative wells (Section 4.5.5) The goal of the groundwater level monitoring network is to provide adequate coverage of the entire aquifer within the Basin. This includes the ability to monitor and identify groundwater changes across the basin through time. Consideration of the spatial location of monitoring wells should include proximity to other monitoring wells and proximity ensuring adequate coverage near~~to~~ other prominent features such as faults or production wells. Monitoring wells in close proximity to active pumping wells could be influenced by groundwater withdrawals, thus skewing static level monitoring.

The *Monitoring Networks and Identification of Data Gaps BMP* published by DWR provides different sources and condition dependent densities to guide monitoring network implementation (Table 4-16). This information was adapted from the *CASGEM Groundwater Elevation Monitoring Guidelines* (DWR, 2010). While these estimates provide guidance to monitoring well site spatial densities, monitoring points should primarily be influence by local geology, groundwater use, and GSP defined undesirable rates. Professional judgement is essential to determine final locations.

Reference	Monitoring Well Density (wells per 100 miles^2)
Heath (1976)	0.2-10
Sophocleous (1983)	6.3
Hopkins (1994)	
Basins pumping more than 10,000 AFY per 100 miles^2	4.0
Basins pumping between 1,000 and 10,000 AFY per 100 miles^2	2.0
Basins pumping between 250 and 1,000 AFY per 100 miles^2	1.0
Basins pumping between 100 and 250 AFY per 100 miles^2	0.7

Table 4-16~~4-15~~: Monitoring Well Density Considerations

PRELIMINARY AND WILL BE UPDATED WHEN WATER BUDGET INFORMATION IS COMPLETE, it is estimated that the basin pumps approximately over 10,000 AFY per 100 square miles. The basin has 378 square miles of area. Based on Hopkins (1994), well density estimate guidelines, the Basin should have 4 monitoring wells per 100 square miles~~,~~. Sophocleous (1983) recommends~~,~~ 6.3 monitoring wells per 100 square miles. Based on Heath ~~(????),~~(1976), the basin should have between 0.2 and 10 monitoring wells per 100 square miles. Due to the geologic and topographic variability within the basin, as well as the severity of groundwater declines and hydrogeologic uncertainty in various portions of the basin, this GSP recommends a density greater than the most conservative estimate of 10 wells per 100 square miles, which is over 38 monitoring wells.

4.5.5 Representative Monitoring

There are two categories of wells were identified within the monitoring network:

- **Representative Wells** – These wells will be used to monitor sustainability in the basin. Minimum thresholds and measurable objectives will also be calculated for these wells.
- **~~Monitoring~~ Supplemental Wells** – Other wells are included in the monitoring network to provide redundancy for representative wells, and to maintain a robust network for evaluation as part of five-year GSP updates.

Representative monitoring wells were selected as part of monitoring network development. Representative monitoring wells are wells that represent conditions in the basin, and in locations that allow monitoring on the well to indicate the long term, regional changes in its vicinity.

Representative groundwater level and groundwater storage sites within each management area were selected by several different criteria. These include:

1. **Adequate Spatial Distribution –** Representative monitoring does not ~~usually~~ require the use of all wells ~~to be~~that are spatially “clumped” together within ~~the~~ a portion of the Basin. Adequately spaced wells will provide greater Basin coverage with fewer monitoring sites.
2. **Robust and Extensive Historical Data –** representative monitoring sites with longer and more robust historical data provide insight into long-term trends that can provide information about groundwater conditions through varying climatic periods such as droughts and wet periods. Historical data may also show changes in groundwater conditions through anthropogenic effects as well. While some sites chosen may not have extensive historical data, they may still be selected because there are no wells nearby with longer records.
3. **Increased Density in Heavily Pumped Areas –** Selection of additional wells in heavily pumped areas such as in the central portion of the Basin and other agriculturally intensive areas will provide additional data where the most groundwater change occurs.
4. **Increased Density near Areas of Geologic, Hydrologic, or Topologic Uncertainty** – Having a greater density of representative wells in areas of uncertainty, such as around faults or large elevation gradients may provide insightful information about groundwater dynamics to improve management practices and strategies.
5. **Wells with Multiple Depths** – The utilization of wells with different screen intervals is important to collect data on the groundwater conditions at different elevations within the aquifer. This can be achieved by using wells with different screen depths that are close to one another, or by using multi-completion wells.
6. **Consistency with BMPs –** Using published Best Management Practices (BMPs) provided by DWR will ensure consistency across all basins and ensure compliance with established regulations.
7. **Adequate Well Construction Information –** Well information such as perforation depths, construction date, and well depth should be considered and encouraged when considering wells to be included.
8. **Professional Judgement** – Professional judgement is used to make the final decision about each well, particularly when more than one suitable well exists in an area of interest.

~~8.~~9. **Maximum Coverage** – Any monitoring network well that was suitable for use in the representative network was used to maximize spatial and vertical density of monitoring.

4.5.6 Groundwater Level Monitoring Network

The Groundwater Level Monitoring Network is comprised of 88 of wells within the Basin. Forty-nine of those wells are representative wells. Overall well density is 23.3 wells per 100 square miles. Figure 4-18 shows the locations of the groundwater level monitoring network monitoring wells and representative wells.

Table 4-17 includes the wells in the Groundwater Level Monitoring Network. Representative wells, those with sufficient data and representative trends within the Basin, are identified with the asterisk (*) next to the OPTI ID and are sorted first. Metadata for the wells is also included.

The proposed monitoring frequency is monthly for the first three years of GSP implementation with an option to reduce to quarterly monitoring if the CBGSA Board decides that it is appropriate. This monitoring frequency captures short term, seasonal, and long-term trends in groundwater levels. The well density of 23.3 wells per 100 square miles in the monitoring network provides a spatial density that adequately covers the primary aquifer in the Basin, and is useful for determining flow directions and hydraulic gradients as well as change in storage calculations for use in future water budgeting efforts in portions of the basin with significant land use.

OPTI ID	~~Managing Agency~~Data Maintaining Entity as of 2018	Well Construction Date	Well Depth (ft.)	Hole Depth (ft.)	Screen Interval	Well Elevation (ft. above MSL)	Reference Point Elevation (ft. above MSL	First Measurement Year	Last Measurement Year	Measurement Period (yrs)	Measurement Count
2*	County of Ventura		73.0			3720		2011	2017	6	17
62*	SBCWA		212			2921		1966	2018	52	65
72*	SBCWA	1/1/1980	790	820	350 - 340 ft.	2171		1981	2018	37	114
74*	SBCWA					2193		2008	2018	10	45
77*	SBCWA	12/4/2008	980	1003.5	980 - 960 ft.	2286		2009	2018	9	47
84	SBCWA		200			2923		2008	2018	10	28
85*	SBCWA		233			3047		1950	2018	68	282
89*	VWPD	1/1/1965	125			3461		1965	2017	52	68
91*	SBCWA	9/29/2009	980	1000	980 - 960 ft.	2474		2009	2018	9	47
93*	SBCWA	10/18/1967	151	165		2928		1971	2018	47	36
95*	SBCWA	4/9/2009	805.	825.		2449		2009	2018	9	32
96*	SBCWA	2/1/1980	500			2606		1983	2018	35	61
98*	SBCWA		750.			2688		2008	2018	10	32
99*	SBCWA	9/10/2009	750	906	750 - 730 ft.	2513		2009	2018	9	43
100*	SBCWA	11/1/1988	284.	302.		3004		2010	2018	8	28
101*	SBCWA		200	220		2741		2008	2018	10	42
102*	SBCWA					2046		2010	2018	8	22
103*	SBCWA	7/23/2010	1030.	1040.		2289		2012	2018	6	25
104	Unknown		640		638.64 - 478.64 ft.	2299	2301	2008	2017	9	32
105	SLOCFCWC		~~Confidential~~750			2374	2375	1990	2017	27	38
106*	Unknown		227.5			2327	2327	2016	2018	2	9
107*	Unknown	1/1/1950	200			2482		1950	2018	68	12
108*	Private Landowner		328.75			2629	2630	2016	2018	2	8
110	Unknown	1/1/1948	603			2046		1950	2018	68	17
112*	Unknown		441			2139		1966	2018	52	10
114*	DWR	1/1/1947	58.0			1925		1967	2017	50	9
115	Private Landowner		1200			2276	2278	2016	2018	2	4
116	Private Landowner	10/1/1980	700		700 - 240 ft.	2329	2329	1980	2018	38	6
117*	Private Landowner		212			2098	2095	2016	2018	2	10
118*	Private Landowner		500			2270	2271	2016	2018	2	11
119	DWR		92.0			1713		1955	2017	62	10
120	Private Landowner		15.4			1705	1707	2016	2017	1	2
121	Private Landowner		98.25			1984	1985	2016	2018	2	16
122	Private Landowner		63.2			2129	2131	2016	2018	2	16
123*	Private Landowner		138			2165	2167	2016	2018	2	14
124*	Private Landowner		160.55			2287	2288	1988	2018	30	22
125	Private Landowner		26			2283	2284	2016	2018	2	9
127*	Private Landowner		100.25			2364	2365	2016	2018	2	14

OPTI ID	~~Managing Agency~~Data Maintaining Entity as of 2018	Well Construction Date	Well Depth (ft.)	Hole Depth (ft.)	Screen Interval	Well Elevation (ft. above MSL)	Reference Point Elevation (ft. above MSL	First Measurement Year	Last Measurement Year	Measurement Period (yrs)	Measurement Count
128	Unknown	3/15/1990	140.	150.		3721		2014	2017	3	8
316*	Unknown	9/29/2009	830	1000		2474		2009	2018	9	27
317*	Unknown	9/29/2009	700	1000		2474		2009	2018	9	28
322*	Unknown	4/9/2009	850	906		2513		2009	2018	9	27
324*	Unknown	9/10/2009	560	906		2513		2009	2018	9	26
325*	Unknown	9/10/2009	380	906		2513		2009	2018	9	26
420*	Unknown	12/4/2008	780	1003.5		2286		2009	2018	9	29
421*	Unknown	12/4/2008	620	1003.5		2286		2009	2018	9	29
422*	Unknown	12/4/2008	460	1003.5		2286		2009	2018	9	28
467	Unknown	1/1/1963	1140.	1215.		2224					
474*	Unknown		213			2369		1955	2017	62	6
564	Unknown	1/1/1920				2172		2017	2017	0	1
566	Unknown		500	520		2263					
568*	Unknown	1/1/1948	188	188		1905		1967	2018	51	22
571*	Private Landowner	1/1/1951	280			2307		2016	2018	3	14
573*	Unknown		404			2084		1950	2018	68	12
584	Unknown		450	606		1753		2018	2018	0	1
586	Unknown		620	622		1761					
587	Unknown	12/29/2014	900	960		1713		2018	2018	0	1
591	Unknown		720	740		1715		2017	2018	1	2
597	Unknown		390	670		1694		2017	2018	1	2
601	Private Landowner	6/14/1905	723		723 - 338 ft.	2074		1993	2017	24	32
602	Private Landowner	6/12/1905	725		725 - 325 ft.	2114		1992	2017	25	29
603	Private Landowner	6/15/1905	800		800 - 398 ft.	2097		1994	2017	23	33
604*	Private Landowner		924		924 - 454 ft.	2125		1995	2017	22	28
608*	Private Landowner	6/10/1905	745		745 - 440 ft.	2224		1995	2017	22	26
609*	Private Landowner	6/15/1905	970		970 - 476 ft.	2167		1995	2017	22	31
610*	Private Landowner		780		780 - 428 ft.	2442		1995	2017	22	27
612*	Private Landowner		1070		1070 - 657 ft.	2266		1995	2017	22	24
613*	Private Landowner		830		830 - 330 ft.	2330		1995	2017	22	24
614	Private Landowner		745		745 - 405 ft.	2337		1995	2017	22	25
615*	Private Landowner		865		865 - 480 ft.	2327		1995	2017	22	22
618	Private Landowner	6/18/1905	927		927 - 496 ft.	2163		1996	2017	21	31
619	Private Landowner	6/19/1905	1040		1040 - 569 ft.	2307		1997	2017	20	28
620*	Private Landowner	6/19/1905	1035		1035 - 550 ft.	2432		1997	2017	20	25
621	Private Landowner	6/19/1905	974		974 - 540 ft.	2126		1998	2017	19	30
623	Private Landowner	6/21/1905	1040		1040 - 530 ft.	2288		1999	2017	18	29
627	Private Landowner	6/23/1905	960		960 - 460 ft.	2279		2001	2017	16	19
628	Private Landowner	5/31/1905	941		941 - 593 ft.	2388		1978	2017	39	32

OPTI ID	~~Managing Agency~~Data Maintaining Entity as of 2018	Well Construction Date	Well Depth (ft.)	Hole Depth (ft.)	Screen Interval	Well Elevation (ft. above MSL)	Reference Point Elevation (ft. above MSL	First Measurement Year	Last Measurement Year	Measurement Period (yrs)	Measurement Count
629*	Private Landowner		1000		1000 - 500 ft.	2379		2005	2017	12	13
630	Private Landowner		900		900 - 360 ft.	2371		1991	2017	26	22
631	Private Landowner	5/31/1905	960		960 - 600 ft.	2367		1986	2017	31	22
633*	Private Landowner		1000		1000 - 500 ft.	2364		1998	2017	19	23
635	Private Landowner		1050		1050 - 549 ft.	2356		2003	2017	14	10
636	Private Landowner	5/27/1905	924		924 - 474 ft.	2348		1975	2017	42	15
637	Private Landowner	6/30/1905	980		980 - 540 ft.	2110		2009	2017	8	10
638	Private Landowner	6/30/1905	1006		1006 - 526 ft.	2437		2008	2017	9	9
640	Private Landowner	6/30/1905	840		840 - 400 ft.	2239		2008	2017	9	16
641	Private Landowner	7/2/1905	800		800 - 360 ft.	2204		2010	2017	7	7
642	Private Landowner	7/2/1905	1000		1000 - 550 ft.	2232		2010	2017	7	8
644	Private Landowner	7/5/1905	950		950 - 490 ft.	2143		2013	2017	4	10

Table 4-17~~4-16~~: Wells included in the Groundwater Levels and Storage Monitoring Network

Figure 4-184-17: Groundwater Level and Storage Representative Wells and other Monitoring Network Wells

4.5.7 Monitoring Protocols

Monitoring protocols for the groundwater level monitoring network are included in Appendix K.

4.5.8 Data Gaps

Groundwater levels monitoring data gaps ~~are~~ result from poor ~~the result of two monitoring characteristics:~~s

~~S~~patial distribution of ~~the~~ available wells and a lack of w

~~W~~ell construction information.

The spatial distribution of the groundwater levels monitoring network provides coverage of the majority of the Basin. However, ~~T~~th~~h~~ere are several areas, identified by the red ovals in Figure 4-19, that do not have adequate monitoring. Additional monitoring wells added in these areas would~~ill~~ provide more information that can be used to detect changes in conditions in the basin.

Well construction information is not available for many wells within the Basin. Monitoring wells with construction information featuring total depth and screened interval are preferred, because that information is useful in understanding what monitoring measurements mean in terms of basin conditions at different depths.

4.5.9 Plan to fill data gaps

This GSP ~~has identified~~identifies a number of activities to increase the robustness of the groundwater level monitoring network.

The CBGSA has ~~already~~ been awarded a Proposition 1 Category 1 Grant ~~Fund~~, which includes a task to expand the groundwater level monitoring network. This task includes identification of additional monitoring wells for hand measurements as well as installation of continuous monitoring equipment into ten existing wells, which can be used to augment the existing monitoring network. This task will both increase the spatial coverage of the monitoring network and the temporal coverage in the wells with additional continuous monitoring.

The Cuyama Basin GSA has applied for assistance from DWR's ~~provides~~ Technical Support Services (TSS), which provides ~~to~~ support GSAs as they develop GSPs. Opportunities within the TSS include the installation of new monitoring wells and downhole video logging. New wells drilled by DWR's TSS will improve the density and sampling frequency for level monitoring within the Basin. Downhole video logging will provide more well construction information to better utilize well data within the Basin. As of this writing, the DWR TSS program has not provided any TSS services for the Cuyama Basin.

Figure 4-194-18: Groundwater Levels Monitoring Network Data Gap Areas

4.6 Groundwater Storage Monitoring Network

Groundwater in storage is monitored through the measurement of groundwater levels. Therefore, the Groundwater groundwater storage monitoring network will use the groundwater level monitoring network. Thresholds for groundwater storage will be discussed in Section 5.

4.7 Seawater Intrusion Monitoring Network

The Cuyama Groundwater Basin is geographically and geologically isolated from the Pacific Ocean and any other large source of saline water. Thus, the Basin is not at risk for seawater intrusion. salinity Salinity is monitored as part of the groundwater quality network, but seawater intrusion is not a concern for the Basin.

4.8 Degraded Groundwater Quality Monitoring Network

Salinity (measured as TDS), arsenic, and nitrates have all been identified by local stakeholders as potentially being of concern for water quality in the Basin. However, as noted in the Groundwater Conditions section, there have only been two nitrate measurements and threefewer than ten arsenic measurements in recent years that exceeded MCLs. In the case of arsenic, all of the high concentration measurements have been taken either at CCSD Well #2 (which is no longer in operation) or at groundwater depths of greater than 700 feet, outside of the range of pumping for drinking water. Furthermore, unlike with salinity, there is no evidence to suggest a causal nexus between potential GSP actions under the GSA's authority and arsenic or salinity. ThereforeDue to the relationship of undesirable results for water quality and the causal nexus of groundwater quality and GSP actions, the groundwater quality network is has been established to monitor for salinity (measured as TDS) but does not include arsenic or nitrates at this time.

4.8.1 Management Areas

Management Areas have not been selected at the time of writing this GSP section. Management Areas allow flexibility in establishing monitoring networks both spatially and temporally to match conditions and use in the management area. At this time, it is recommended due to the sparsity of monitored sites to use the same monitoring network selection criteria across all management areas in the basin.

4.8.2 Monitoring Sites Selected for Monitoring Network

Table 4-17 lists the monitoring sites selected for the groundwater quality monitoring network by monitoring group. Monitoring sites selected for inclusion into the network were monitored within the years of 2008-2018. Many additional monitoring sites have been monitored for salinity, however, they were not monitored in the last 10 years, indicating that they are unlikely to be monitored again by that monitoring agency. Note that due to duplication of wells being in both USGS and DWR's networks, the total number of selected groundwater quality networks wells (64) is less than the sum of wells shown in Note: Total does not equal sum of rows due to duplicate entries in multiple databases

Table 4-18.

Monitoring Data Maintaining EntityGroup	Number of Wells Selected for Monitoring Network
NWQC, USGS, IRLPILRP	43
GAMA, DWR	20
BCWPD	7
Private Landowner	11
Total	**64**

Note: Total does not equal sum of rows due to duplicate entries in multiple databases

Table 4-18: Groundwater Quality Monitoring Sites by Source

4.8.3 Monitoring Frequency

The Basin, in coordination with partnering agencies, will compile salinity samples once a year,. as is consistently practiced by USGS.

Monitoring agencies such as the USGS and DWR were contacted to inquire about when they would next monitor their sites for groundwater quality, including salinity. The agencies communicated that they 'usually' monitor annually, but the timing of that monitoring is not set and changes from year to year. Additionally, depending on funding and staff availability, there may be years where no groundwater quality monitoring is conducted by an agency.

Although DWR does not provide specific recommendations on the frequency of monitoring in relationship to aforementioned groundwater characteristics, however, concentrations of groundwater quality, especially salinity, do not fluctuate significantly throughout a year to require multiple samples per year. The Basin, in coordination with partnering agencies, will compile salinity samples once a year, as is consistently practiced by USGS.

4.8.4 Spatial Density

DWR's *Monitoring Networks and Identification of Data Gaps BMP* states "The spatial distribution must be adequate to map or supplement mapping of known contaminants." Using this guidance, professional judgement was used to identify representative wells within each management area. Heavily pumped areas, such as the central portion of the Basin, require additional monitoring sites, while areas of lower pumping or less agricultural or municipal groundwater use need less monitoring.

Any well measured sincefrom -2008 to June 2018 was included in the Monitoring Network. The entire Monitoring Network was selected as representative monitoring. The selected groundwater quality representative and monitoring wells provide adequate coverage of the Basin's aquifer. The groundwater quality monitoring network is composed of 64 of wells within the Basin. Providing a monitoring site density of 17 sites per 100 square miles. This significantly exceeds the density recommended by reference materials for groundwater level density shown in Table 4-16.

4.8.5 Representative Monitoring

Representative monitoring sites were selected for groundwater quality using the considerations used to select representative groundwater level monitoring wells (Section 4.5.5). Due to the uncertainty of the monitoring frequency, all monitoring network wells were selected to be representative wells in the Groundwater Quality Monitoring Network.

4.8.6 Groundwater Quality Monitoring Network

Figure 4-20 shows the groundwater quality monitoring network and representative and monitoring sites. The Groundwater Quality Monitoring Network is comprised of 64 wells within the Basin, all of which are representative wells.

Table 4-19 shows the wells in the groundwater quality monitoring network. Metadata for the wells is also included.

OPTI ID	Managing Agency as of 2018	Well Construction Date	Well Depth	Hole Depth	Screen Interval	Well Elevation	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count
61*	Department of Water Resources		357.		Unknown	3681	2008-09-25	2008-09-25	0	3
72*	Santa Barbara County Water Agency	1/1/1980	790	820	340 to 350 ft.	2171	2008-09-15	2017-07-14	9	13
73*	Santa Barbara County Water Agency	8/26/1982	880.	1021.	Unknown	2252	2010-08-03	2011-07-12	1	2
74*	Santa Barbara County Water Agency				Unknown	2193	2008-09-17	2017-07-13	9	11
76*	USGS	9/1/1960	720		Unknown	2277	1960-09-22	2008-09-17	48	10
77*	Santa Barbara County Water Agency	12/4/2008	980	1003.5	960 to 980 ft.	2286	2009-04-08	2009-04-08	0	1
79*	USGS		600	750	Unknown	2374	2008-07-08	2011-08-11	3	7
81*	USGS		155.		Unknown	2698	2011-08-16	2011-08-16	0	1
83*	Santa Barbara County Water Agency	1/1/1972	198.		Unknown	2858	2011-08-16	2011-08-16	0	1
85*	Santa Barbara County Water Agency		233		Unknown	3047	1964-02-07	2011-07-12	47	46
86*	USGS	1/1/1995	230.		Unknown	3141				0
87*	USGS		232.		Unknown	3546				0
88*	USGS	9/4/2007	400	400.	Unknown	3549	2011-08-18	2011-08-18	0	1
90*	Santa Barbara County Water Agency	8/8/2006	800	800	Unknown	2552	2008-09-17	2012-09-20	4	6
91*	Santa Barbara County Water Agency	9/29/2009	980	1000	960 to 980 ft.	2474	2009-11-05	2009-11-05	0	1
94*	USGS		550	720	Unknown	2456	2008-07-29	2010-07-29	2	6
95*	Santa Barbara County Water Agency	4/9/2009	805.	825.	Unknown	2449	2011-08-19	2011-08-19	0	1
96*	Santa Barbara County Water Agency	2/1/1980	500		Unknown	2606	2011-08-19	2011-08-19	0	1
98*	Santa Barbara County Water Agency		750.		Unknown	2688	2011-08-16	2011-08-16	0	1
99*	Santa Barbara County Water Agency	9/10/2009	750	906	730 to 750 ft.	2513	2009-11-04	2009-11-04	0	1
101*	Santa Barbara County Water Agency		200	220	Unknown	2741	2008-09-25	2008-09-25	0	3
102*	Santa Barbara County Water Agency				Unknown	2046	2011-08-15	2017-07-13	6	7
130*	USGS				Unknown	3536	2011-08-19	2011-08-19	0	1
131*	USGS				Unknown	2990	2011-08-17	2011-08-17	0	1
157*	USGS		71.0		Unknown	3755				0
196*	USGS		741	755	Unknown	3117				
204*	USGS	1/1/1935			Unknown	3693	2011-08-18	2011-08-18	0	1
226*	USGS	1/1/1971		220.	Unknown	2945	2011-08-18	2011-08-18	0	1
227*	USGS				Unknown	3002	1966-07-01	2011-08-17	45	2
242*	USGS		155	187	Unknown	2933	2012-07-18	2012-07-18	0	1
269*	USGS	1/1/1951			Unknown	2756	2008-09-16	2008-09-16	0	3
309*	USGS	2/2/1980	1100	1100	Unknown	2513	2011-08-11	2011-08-11	0	1
316*	USGS	9/29/2009	830	1000	Unknown	2474	2009-11-05	2009-11-05	0	1
317*	USGS	9/29/2009	700	1000	Unknown	2474	2009-11-05	2009-11-05	0	1
318*	USGS	9/29/2009	610	1000	Unknown	2474	2009-11-04	2009-11-04	0	1
322*	USGS	4/9/2009	850	906	Unknown	2513	2009-11-03	2009-11-03	0	1
324*	USGS	9/10/2009	560	906	Unknown	2513	2009-11-04	2009-11-04	0	1
325*	USGS	9/10/2009	380	906	Unknown	2513	2009-11-04	2009-11-04	0	1
400*	USGS		2120.	2200.	Unknown	2298	1958-05-26	2011-08-15	53	8
420*	USGS	12/4/2008	780	1003.5	Unknown	2286	2009-04-07	2009-04-07	0	1
421*	USGS	12/4/2008	620	1003.5	Unknown	2286	2009-04-07	2009-04-07	0	1
422*	USGS	12/4/2008	460	1003.5	Unknown	2286	2009-04-08	2009-04-08	0	1
424*	USGS		1000.	1020.	Unknown	2291	2011-08-15	2011-08-15	0	1
467*	USGS	1/1/1963	1140.	1215.	Unknown	2224	2012-07-18	2017-07-13	5	6
568*	USGS	1/1/1948	188	188	Unknown	1905	2008-09-15	2008-09-15	0	3

OPTI ID	Managing Agency as of 2018	Well Construction Date	Well Depth	Hole Depth	Screen Interval	Well Elevation	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count
702*	USGS				Unknown	3539				
703*	USGS				Unknown	1613				
710*	DWR				Unknown	2942				
711*	DWR				Unknown	1905				
712*	DWR				Unknown	2171				
713*	DWR				Unknown	2456				
721*	DWR				Unknown	2374				
758*	DWR				Unknown	3537				
840*	Private Landowner	11/21/2014	900		200 to 880 ft.	1713				
841*	Private Landowner	12/12/2014	600		170 to 580 ft.	1761				
842*	Private Landowner	12/19/2014	450		60 to 430 ft.	1759				
843*	Private Landowner	1/5/2015	620		60 to 600 ft.	1761				
844*	Private Landowner	7/17/2015	730		100 to 720 ft.	1713				
845*	Private Landowner	7/12/2015	380		100 to 360 ft.	1712				
846*	Private Landowner	6/15/2015	610		130 to 590 ft.	1715				
847*	Private Landowner	7/26/2015	600		180 to 580 ft.	1733				
848*	Private Landowner	6/30/2015	390		110 to 370 ft.	1694				
849*	Private Landowner	6/23/2015	570		150 to 550 ft.	1713				
850*	Private Landowner	8/13/2015	790		180 to 780 ft.	1759				

Table 4-194-18: Wells Included in the Groundwater Quality Monitoring Network

Figure 4-204-19: Cuyama Basin Groundwater Quality Monitoring Network Wells

4.8.7 Monitoring Protocols

~~Existing groundwater quality monitoring programs use their agency's specific monitoring protocols.~~

For recommended additional monitoring recommended in Section 4.8.9, the monitoring protocols will use DWR's *Monitoring Networks and Identification of Data Gaps BMP* which sites the USGS's 1995 publication *Ground-Water Data-Collection Protocols and Procedures for the National Water-Quality Assessment Program: Collection and Documentation of Water-Quality Samples and Related Data* (Appendix A) for the groundwater quality sampling protocols. This publication includes protocols for equipment selection, setup, use, field evaluation, sample collection techniques, sample handling, and sample testing, and is included in Appendix L.

4.8.8 Data Gaps

Groundwater quality monitoring data gaps have three components:

- Spatial distribution of the wells
- Well/measurement depths for three-dimensional constituent mapping
- Temporal sampling

The spatial distribution of the groundwater quality monitoring network provides coverage of several portions of the Basin. There are several areas, identified by the red ovals in Figure 4-21, that do not have adequate monitoring. Additional sampling taken within these identified areas will provide more information about salinity in the indicated locations.

Well construction of wells used in existing salinity sampling efforts is mostly unknown, and the depth of the water used for sampling is not known at most monitoring sites. Additional information about how salinity may change at different depths in the aquifer would be valuable, and requires samples from wells with construction information.

Water quality sampling is currently performed at an insufficient time interval throughout t~~T~~he entire Basin, and therefore the entire Basin is identified as a groundwater quality monitoring temporal data gap. Management entities within the Basin responsible for groundwater quality sampling were contacted by a GSA representative in September 2018, to understand the timing of current monitoring schedules, and whether those management entities were intending to continue quality monitoring in the future. The GSP assumes that a~~A~~ll management entities are anticipating continuing with groundwater quality sampling within the Basin, but this will need to be confirmed, as well as the anticipated schedule of ~~the~~ sampling ~~was unknown~~by each entity.

4.8.9 Plan to fill data gaps

The CBGSA will fill the temporal and spatial data gaps by implementing its own salinity sampling program, and will fill the well construction knowledge gap at least partially by using DWR's TSS program to perform downhole logging of a subset of wells.

The CBGSA will develop and perform a project to perform annual monitoring of salinity in the basin. This new monitoring program will focus on using wells that have both construction information and pumps installed. Details of the new monitoring program, such as the targeted number and distribution of sampling sites will be detailed as a project in the projects and management actions section of this GSP (Section 6).

DWR provides Technical Support Services (TSS) to support GSAs as they develop GSPs. Downhole video logging performed by the TSS program in existing salinity monitoring wells ~~will~~ could provide more well construction information to better utilize well data within the Basin.

Figure 4-214-20: Identification of Groundwater Quality Monitoring Data Gaps

4.9 Land Subsidence Monitoring Network

4.9.1 Management Areas

Management Areas have not been selected at the time of writing this GSP section. Management Areas allow flexibility in establishing monitoring networks both spatially and temporally to match conditions and use in the management area. At this time, it is recommended due to the sparsity of monitored sites to use the same monitoring network selection criteria across all management areas in the basin.

4.9.2 Monitoring Sites Selected for Monitoring Network

There are currently two subsidence monitoring stations within the Basin, and three outside of the Basin. Figure 4-22 shows the locations of existing subsidence monitoring stations, which make up the current subsidence monitoring network. The two stations within the Basin, Sites CUHS and VCST are both include in the monitoring network because they are active and provide Basin specific data. The three stations located outside of the Basin, Sites P521, BCWR, and OZST, are also included in the monitoring network. These stations are important to understand the general dynamic movement trends of the Basin because they detect tectonic movement in the area of the Basin.

4.9.3 Monitoring Frequency

Subsidence monitoring frequencies should capture long-term and seasonal fluctuations in ground level changes. DWR's *Monitoring Networks and Identification of Data Gaps BMP* does not provide specific monitoring frequency or interval guidance. However, CGPS stations allow for data sampling to be taken several times a minute, more than enough for seasonal fluctuations to captured in the data. Long-term trends are easily compiled from continuous data. Therefore, the GSA will utilize the same monitoring frequency currently used by the CGPS stations.

4.9.4 Spatial Density

Because there are currently only two monitoring stations, t~~T~~he current spatial density of subsidence monitoring ~~stations~~ within the basin is 0.5 stations per 100 miles^2. These stations are included in Figure 4-22. DWR's *Monitoring Networks and Identification of Data Gaps BMP* does not provide specific spatial density guidelines for subsidence monitoring networks, and thus relies on professional judgment on site identification. Current stations, in and outside of the basin, do not adequately cover the Basin to capture subsidence variations. Potential areas for new stations are discussed further in the following sections.

Figure 4-22~~4-21~~: Current Subsidence Monitoring Stations In and Around the Cuyama Basin

4.9.5 Monitoring Protocols

DWR's provided *Monitoring Networks and Identification of Data Gaps GMP* does not provide specific monitoring protocols for subsidence monitoring networks. CGPS station measurements are logged digitally, and depending on the station and network setup, either require downloading at the physical station site or are uploaded automatically to a server. Data management will also depend on the monitoring agency. Current operating stations will continue to be managed by their current entity, and the GSA will be responsible for downloading data on a fixed schedule. The additional of nNew stations will require procedures for downloading and storing the data as ~~equipment storage or need requires and~~and for providing quality assurance review of the data.

Data should be saved in the Cuyama Basin data management system on a regular annual schedule. All data should be reviewed for quality and logged appropriately.

4.9.6 Data Gaps

New subsidence monitoring sites should be chosen to provide data on areas most at risk for land subsidence. Six potential new site locations were identified within the Basin, as shown in Figure 4-23. These locations were identified by focusing on the areas with significant or new groundwater pumping that did not currently have subsidence monitoring nearby.

A. Identified as an area with relatively new and increased agricultural activity and pumping with no nearby stations.
B. Identified because there are currently no nearby stations and the Russell Fault bisects this area.
C. Identified because of the CCSD and proximity to the heavily pumped central portion of the Basin.
D. Identified because this is the most heavily pumped portion of the Basin and there are currently no nearby stations.
E. Identified because of its proximity to the heavily pumped portion of the Basin, on the north facing slop of the valley. Additionally, there are currently no stations nearby.
F. Identified because this is the transition into the heavily pumped central portion of the Basin near current agricultural pumping. This is also an area with faults.

4.9.7 Plan to fill data gaps

New monitoring sites should be located near areas with the greatest groundwater pumping, or where pumping is new. This is because pumping is the primary driving force for subsidence with the Basin. Although there are multiple ways to measure subsidence, CGPS stations are likely the best option for the Basin. CGPS stations are relatively low cost when compared to labor intensive land surveys, construction of borehole extensometers, and frequent satellite data processing. CGPS stations require comparatively little maintenance and provide continuous information allowing detailed land subsidence analysis.

Increasing data collection on subsidence for the Basin requires the addition of several new CGPS stations. Theses stations can be managed solely by the GSA or can be incorporated into CORS via coronation with USGS. Site selection, equipment, and management will require coordination with USGS

Figure 4-234-22: Subsidence Monitoring Location Data Gap Areas

4.10 Depletions of Interconnected Surface Water Monitoring Network

Monitoring Networks for depletions of surface water cannot be developed until the numerical modeling effort can inform the GSP about the amounts and locations of depletions. This section will be added prior to plan completion.

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Appendix A - Monitoring Protocols BMP

Appendix B - Water Quality Monitoring Standards From USGS

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan Monitoring Networks Draft

Prepared by:

January 2019

Chapter 4 Monitoring Networks

This section of the Cuyama Basin Groundwater Sustainability Plan (GSP) discusses the planned monitoring networks needed to guide the GSP's path to sustainability. Monitoring networks need to be established for each sustainability indicator either directly or through monitoring through a proxy. This section satisfies Subarticle 4 of the Sustainable Groundwater Management Act Regulations. This section discusses the objectives of the monitoring networks, existing monitoring networks used in the development of each network, and establishes a monitoring network for each sustainability indicator. Data gaps and a plan to fill data gaps if they are present are provided for each monitoring network.

This section does not include information about basin settings, undesirable results, sustainability thresholds, water budget information, or projects and management actions.

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Acronyms

ACWI	Advisory Committee on Water Information
AFY	Acre feet per year
ARS	Agricultural Research Service
Basin	Cuyama Valley Groundwater Basin
BMP	Best Management Practices
CA	California
CASGEM	California Statewide Groundwater Elevation Monitoring
CBGSA	Cuyama Basin Groundwater Sustainability Agency
CBWD	Cuyama Basin Water District
CCSD	Cuyama Community Services District
CEDEN	California Environmental Data Exchange Network
CGPS	CGPS
DWR	California Department of Water Resources
EPA	Environmental Protection Agency
GAMA	Groundwater Ambient Monitoring and Assessment
GICIMA	Groundwater Information Center Interactive Map
GSA	Groundwater Sustainability Agency
ILRP	Irrigated Lands Regulatory Program
MSC	Master Site Code
msl	mean sea level
NWIS	National Water Information System
NGWMN	National Ground-Water Monitoring Network
NWQMC	National Water Quality Monitoring Council
SBCWA	Santa Barbara County Water Agency
SLOCFC&WCD	San Luis Obispo County Flood Control & Water Conservation District
SWN	State Well Number
TSS	Technical Services Support
USGS	United States Geological Survey
VCWPD	Ventura County Water Protection District

WDL	Water Data Library

4.1 Useful Terms

The monitoring networks section includes descriptions of groundwater wells, water quality measurements, subsidence stations, and other related components. A list of technical terms and a description of the terms are listed below. Figure 4-1 shows a diagram of a monitoring well with well related terms identified on the diagram. The terms and their descriptions are identified here to guide readers through the section and are not a definitive definition of each term:

- Well related terms:
    - **Ground Surface Elevation –** The elevation in feet above mean sea level (msl) at the well's location.
    - **Total Well Depth** – The depth that a well is installed to. This is often deeper than the bottom of the screened interval.
    - **Screened interval** – The portion of a well casing that is screened to allow water from the surrounding soil into the well pipe. There can be several screened intervals within the same well. Screened interval is usually reported in feet below ground surface elevation for both the upper most limit and lower most limit of the screen.
    - **Top Perforation –** The distance to the top of the perforation from the ground surface elevation.
    - **Bottom Perforation –** The distance to the bottom of the perforation from the ground surface elevation.
    - **Water Surface Elevation –** The elevation above mean sea level (msl) that water is encountered inside the well
    - **Depth to Water –** The distance from the ground surface or the well' to where water is encountered inside the well
- **Historical high groundwater elevations** – This is the highest measurement of static groundwater elevation (closest to the ground surface) in a monitoring well that was recorded. Measurements of groundwater elevation are used to indicate the elevation of groundwater levels in the area near the monitored well.
- **Historical low groundwater elevations** – This is the lowest measurement of static groundwater elevation (furthest from the ground surface) in a monitoring well that was recorded. Measurements of groundwater elevation are used to indicate the elevation of groundwater levels in the area near the monitored well.
- **Depth to Groundwater –** This is the distance from the ground surface to groundwater, typically reported at a well.
- **Hydrograph –** A hydrograph is a graph that shows the changes in groundwater elevation over time for each monitoring well. Hydrographs show how groundwater elevations change over the years and indicate whether groundwater is rising or descending over time.

Figure 4-1: Well Completion Diagram

- **Constituent** – Refers to a water quality parameter measured to assess groundwater quality.
- **Subsidence** (refer to appendix Z which was included with Groundwater Conditions) – Refers to the sinking or downward settling of the earth's surface, not restricted in rate, magnitude, or area involved, and is often the result of over-extraction of subsurface water.
- **Best Management Practice** – Refers to a practice, or combination of practices, that are designed to achieve sustainable groundwater management and have been determined to be technologically and economically effective, practicable, and based on best available science (California (CA) Code of Regulations, Title 23, Article 2).
- **Data Gap** – Refers to a lack of information that significantly affects the understanding of the basin setting or evaluation of the efficacy of Plan implementation and could limit the ability to assess whether a basin is being sustainably managed (CA Code of Regulations, Title 23, Article 2).
- **Representative Monitoring** – Refers to a monitoring site within a broader network of sites that typifies one or more conditions within the basin or an area of the basin (CA Code of Regulations, Title 23, Article 2).

4.2 Monitoring Network Objectives

This section describes the Cuyama Valley Groundwater Basin (Basin) Monitoring Networks for the five sustainability indicators that apply to the Basin. The objective of these monitoring networks is to detect undesirable results in the basin as described in Section 3 of this Groundwater Sustainability Plan (GSP) using the sustainability thresholds described in Section 5 of this GSP. Other, related objectives of the monitoring network were defined by the GSP regulations promulgated by the Department of Water Resources (DWR):

- Demonstrate progress toward achieving measurable objectives described in the Plan
- Monitor impacts to the beneficial uses or users of groundwater
- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds
- Quantify annual changes in water budget components

The monitoring network plan provided to the Basin is intended to monitor:

- Chronic lowering of groundwater levels

- Reduction in groundwater storage
- Degraded water quality
- Land subsidence
- Depletions of interconnected surface water

The monitoring networks described in this section were designed by evaluating data provided by DWR, USGS, participating counties, and private landowners. Wells currently used for such activity are included and considered based on criteria further described below.

4.2.1 Basin Conditions Relevant to Measurement Density and Frequency

This section summarizes key basin conditions that influence the development of monitoring networks. The key conditions include hydrogeologic considerations, land use considerations, and historical groundwater conditions considerations.

The Basin, as described in the Section 2.1, is composed of one principal aquifer comprised of three geologic groups: Younger Alluvium, Older Alluvium, and Morales Formation. The majority of groundwater in the aquifer is stored in the younger and older alluvium. While there are many faults in the Basin, there are no major stratigraphic aquitards or barriers to vertical groundwater movement amongst the alluvium and Morales Formation. The aquifer has a wide range of thicknesses that vary spatially, with median reported hydraulic conductivity ranges from 1.22 – 72.1 ft/day (see Table 2.1-1 for detailed values). Figure 2.1-2 shows the extent of these formations throughout the basin.

The largest groundwater use within the Basin is for agriculture and irrigation. Figures 1-6 through 1-13 show the extent of land used for irrigated agriculture within the Basin. Based on the most recent data from 2016, there is approximately 53 square miles of agricultural land in the Basin out of a total of approximately 378 square miles, or roughly 14%.

Data provided in Section 2.2 shows the historical declining trend of groundwater levels within the central portion of the basin. Groundwater elevations in this portion of the basin have decreased by more than 400 feet from the 1940sto the present, as shown in Figure 4-2.

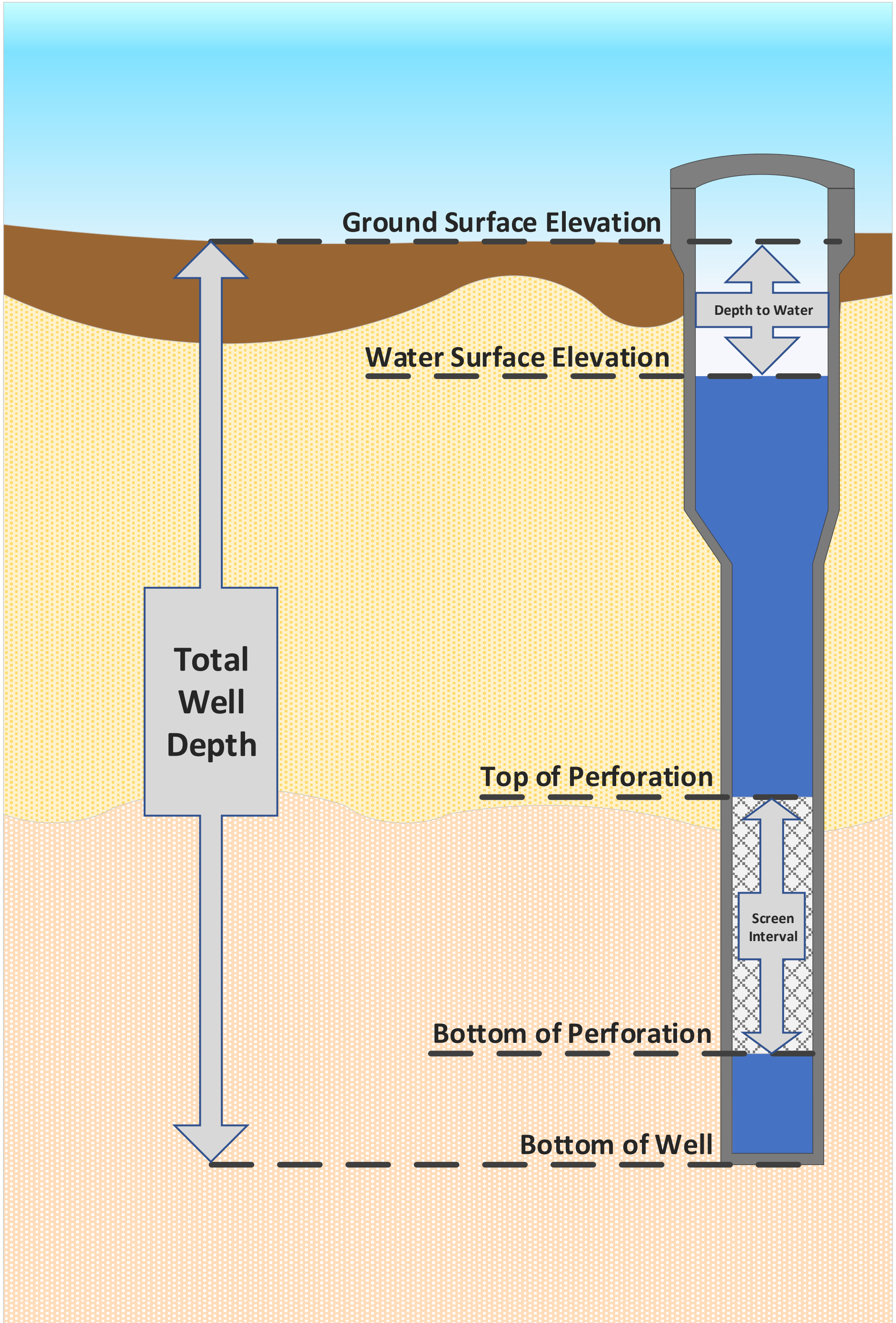

Figure 4-2: Central Basin with Combined Hydrograph

4.3 Existing Monitoring Used

This section discusses current groundwater level monitoring with the Basin.

4.3.1 Groundwater Level Monitoring

This section describes the groundwater level monitoring that has been conducted by agencies and private land owners in the Basin.

Department of Water Resources, Statewide Dataset / CASGEM

The State of California has several water-related database portals accessible online. These include, but are not limited to, the California Statewide Groundwater Elevation Monitoring (CASGEM) Program, Water Data Library (WDL), and the Groundwater Information Center Interactive Map Application (GICIMA). The data for these portals is organized and saved in one master database, where each portal accesses and displays the intended data dependent on the search criteria and portal being used.

In an attempt to include all available data related to the Basin, DWR was contacted directly and they provided a link for Groundwater Sustainability Agency (GSA) representatives to download the entire State's database. Cuyama Basin data was then extracted from this dataset.

Although the master dataset was used to collect the initial data, the CASGEM portal was utilized throughout the planning process to verify data (DWR CASGEM Online System, 2018). CASGEM is tasked with tracking seasonal and long-term groundwater elevation trends in groundwater basins throughout the state. CASGEM was initialized by Senate Bill x7-6 passed by the legislature in 2009 to establish collaboration between local monitoring parties and DWR to collect groundwater elevations (DWR Groundwater Monitoring [CASGEM] 2018).

CASGEM allows local agencies to be designated as CASGEM monitoring entities for groundwater basins throughout the state (CASGEM Brochure 2018). CASGEM monitoring entities can measure groundwater elevation or compile data from other agencies to fulfill a monitoring plan and each is responsible for submitting that data to DWR. Three monitoring entities operate as CASGEM monitoring entities in the Cuyama Basin; the Santa Barbara County Water Agency (SBCWA), Ventura County Watershed Protection District (VCWPD), and San Luis Obispo Flood Control & Water Conservation District (SLOFC&WCD).

CASGEM includes two kinds of wells in its database:

- CASGEM Wells – All of these wells include well construction information
- Voluntary Wells – Wells included in the CASGEM database on a volunteer basis where the well construction may not be identified or made public

There are currently six CASGEM wells and 107 voluntary wells in the Basin. Figure 4-3 shows the locations of these wells.

Most wells were measured on either a semi-annual or annual schedule. Summary data about the wells reported through CASGEM can be seen in Table 4-1.

Number of CASGEM wells	6
Number of voluntary wells	107
Total number of DWR and CASGEM wells	222
Earliest measurement year	1946
Longest period of record	68 years
Median period of record	12 years
Median number of records for a single well	19

Table 4-1: Cuyama Basin Monitoring Well Information Provided by CASGEM

Spatial distribution of the wells is best suited to capture groundwater trends in the central portion of the Basin, and around the Ventucopa area. There are also several monitoring wells in the south eastern portion of the Basin upstream of Ventucopa. CASGEM data is sparser along the north facing slopes of the main Cuyama Valley and the western portion of the Basin, as can be seen in Figure 4-3.

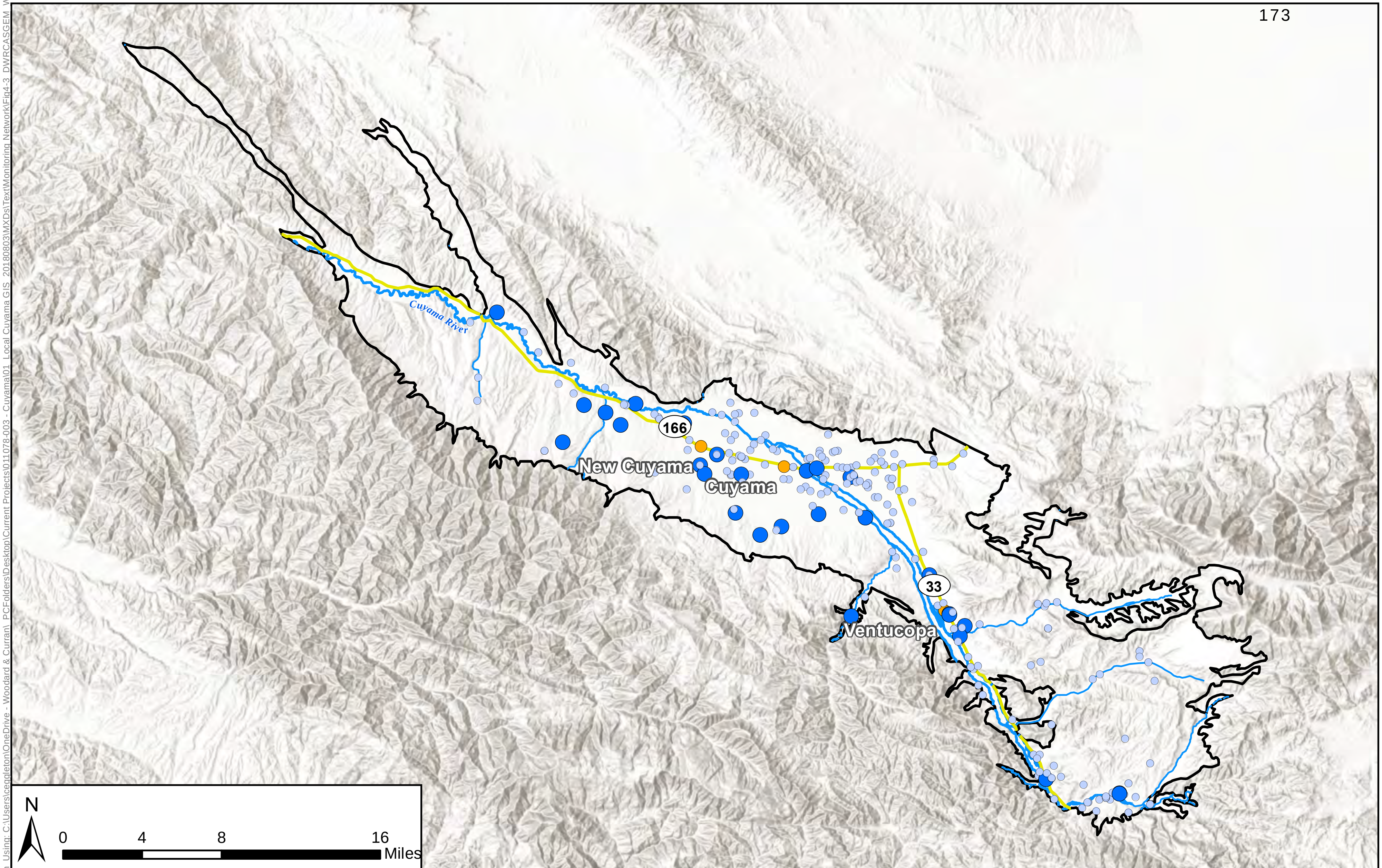

Figure 4-3: Cuyama GW Basin Wells with Monitoring Data Provided by DWR

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

January 2019

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Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams
- DWR Database Wells Last Measured in 2017-2018
- DWR Database Wells Last Measured 2016 and Earlier

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United States Geological Survey

The United States Geological Survey (USGS) has the most groundwater elevation monitoring locations within the Basin. Many of these wells were installed for a 1966 groundwater study and have since been retired.

It should be noted that there are significant overlaps between the DWR provided datasets and the USGS provided datasets. Approximately 106 wells appeared in both downloaded datasets. Discussion about overlapping data is provided in Section 4.3.2 below.

USGS data may be accessed through their online portals for the National Ground-Water Monitoring Network (NGWMN), Groundwater Watch, and National Water Information System (NWIS).

The USGS online data portals provide "Approved" data which has been quality-assured and fit to be published, and "Provisional" data which is unverified and subject to revision. The USGS was contacted directly and coordinated download of their monitoring records in the Basin, and to obtain all available data, the USGS URL Generation tool was used to download all provisional and approved data within the Basin.

USGS has approximately 476 wells within the basin. Summary statistics of this data may be found in Table 4-2 below.

Total number of USGS wells	476
Earliest measurement date	1946
Longest period of record	68 years
Median period of record	2 years
Median number of records for a single well	2 years

Table 4-2: Cuyama Basin Monitoring Well Information Provided by USGS

A significant portion of the wells included in the USGS dataset are located near the Cuyama River and in the central portion of the Basin. Wells are also found along many of the tributaries that feed the Cuyama River during large precipitation events. Well locations included in the USGS dataset are shown in Figure 4-4.

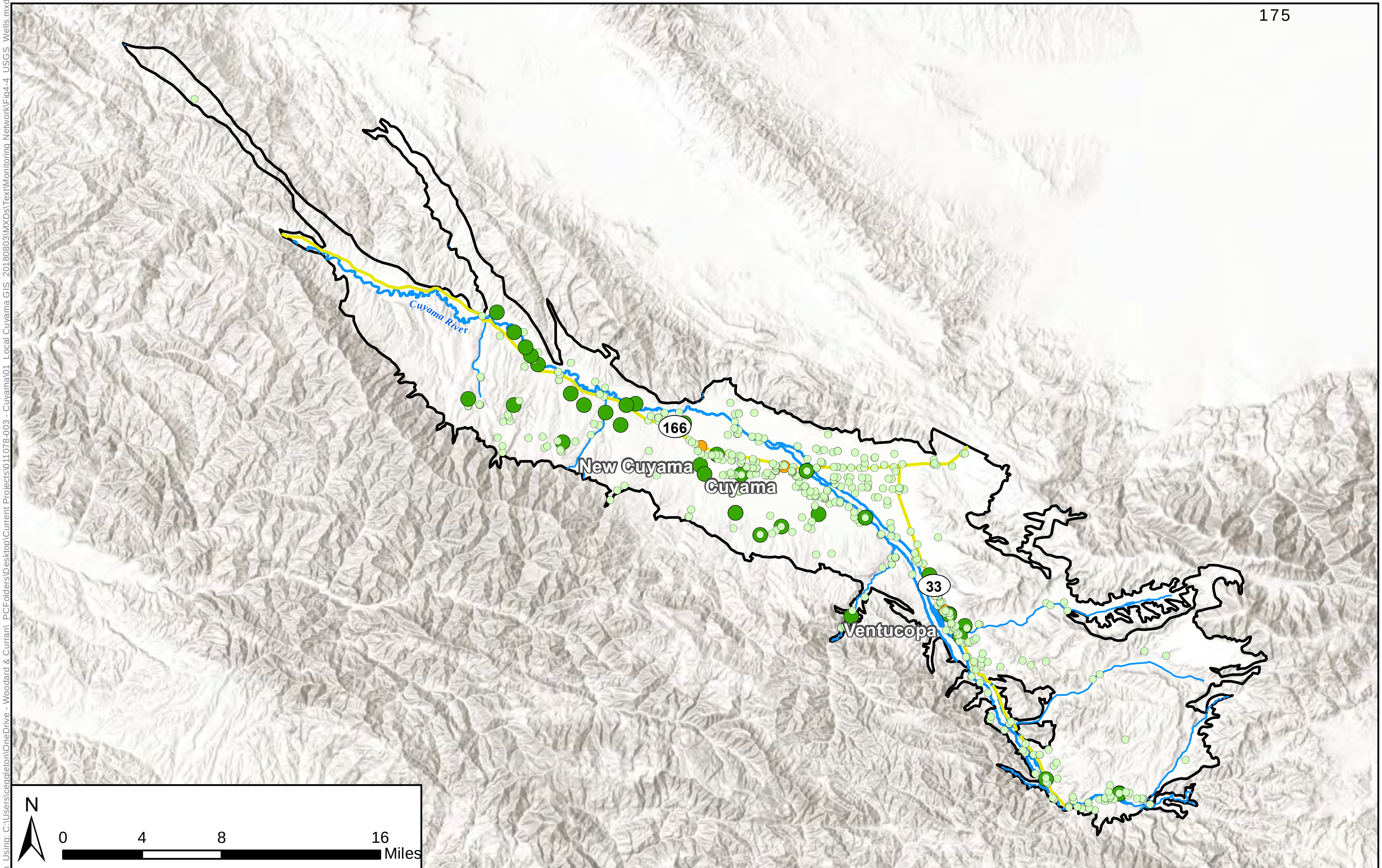

Figure 4-4: Cuyama GW Basin Wells with Monitoring Data Provided by USGS

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

September 2018

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Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams
- USGS Database Wells Last Measured in 2017-2018
- USGS Database Wells Last Measured 2016 or Earlier

Santa Barbara County Water Agency

The Santa Barbara County Water Agency (SBCWA) maintains data for 36 wells within the Cuyama Basin. Some of those wells are owned by private land owners, while others owned by local agencies such as Caltrans and the California Department of Fish and Wildlife. Summary statistics for these wells are included in Table 4-3 below.

Number of SBCWA-monitored wells	36
Earliest measurement date year	1950
Longest period of record	68 years
Median period of record	2 years
Median number of records for a single well	8
Number of SBCWA wells included in the Monitoring Network	20

Table 4-3: Cuyama Basin Monitoring Well Information Provided by SBCWA

Wells included in the SBCWA dataset are located within Santa Barbara County near the Cuyama River and in the hills to the south of the river. Figure 4-5 shows the locations of these wells.

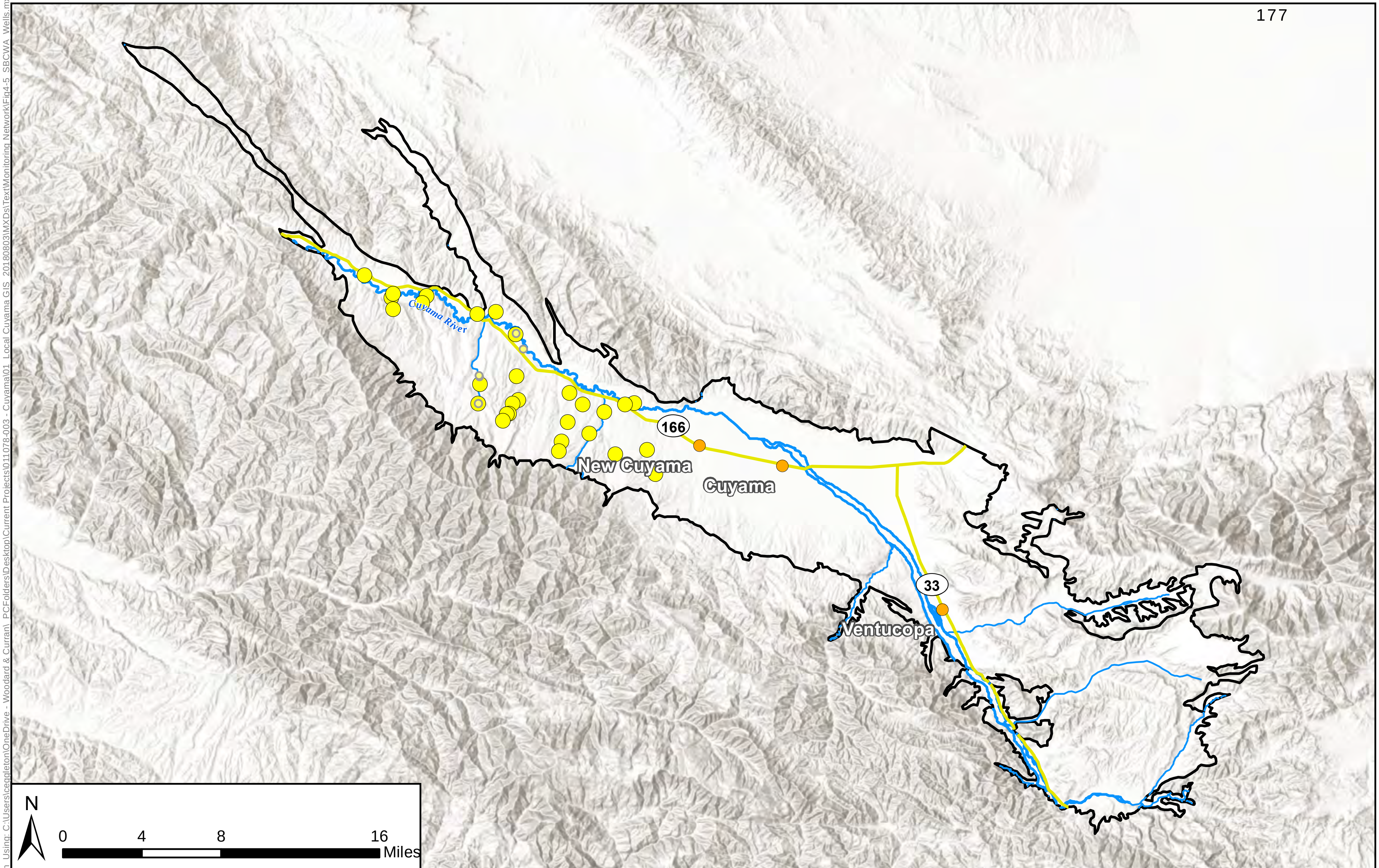

Figure 4-5: Cuyama GW Basin Wells with Monitoring Data Provided by SBCWA

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

January 2019

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Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams
- Santa Barbara County Database Wells Last Measured in 2017-2018
- Santa Barbara County Database Wells Last Measured 2016 or Earlier

San Luis Obispo County Flood Control & Water Conservation District

San Luis Obispo County Flood Control & Water Conservation District (SLOCFC&WCD) maintains data for two wells within the Basin. SLOCFC&WCD also reports the data for the two wells to DWR, thus all data is for the wells is incorporated through the DWR dataset.

The wells are located in the central portion of the Basin, north of the Cuyama River and west of Highway 33. Both wells meet the minimum requirements to be included in the monitoring network, and summary statistics are provided in Table 4-4 below.

Number of SLOCFC&WCD-monitored wells	2
Earliest measurement date year	1990
Longest period of record	28 years
Median period of record	18 years
Median number of records for a single well	35

Table 4-4: Cuyama Basin Monitoring Well Information Provided by SLOCFC&WCD

Locations for the two wells included in the SLOCFC&WCD dataset are shown in Figure 4-6.

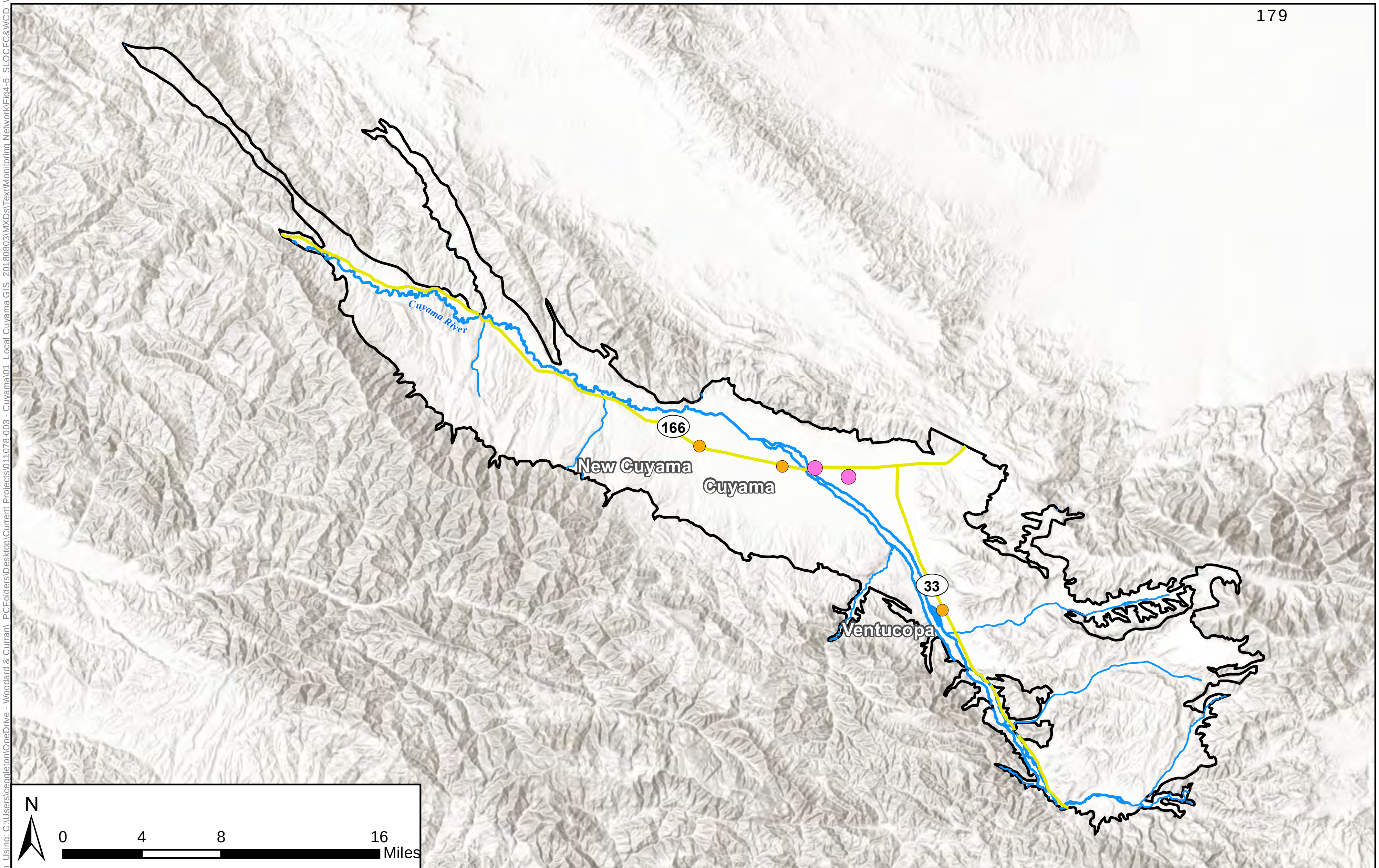

Figure 4-6: Cuyama GW Basin Wells with Monitoring Data Provided by SLOCFC&WCD

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

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Legend

- Cuyama Basin
- San Luis Obispo County Wells Last Measured in 2017-2018
- Towns
- Highways
- Cuyama River
- Streams

Ventura County Watershed Protection District

The Ventura County Watershed Protection District (VCWPD) manages 22 groundwater elevation monitoring wells within the Basin. Twenty of those wells are incorporated in the DWR dataset.

The majority of wells managed by VCWPD are discontinued and no longer measure groundwater elevations. Five of the 22 wells have measured elevation data within the last decade are currently active. A summary of the wells statistics is provided in Table 4-5 below.

Number of VCWPD-monitored wells	22
Earliest measurement date year	1971
Longest period of record	46 years
Median period of record	5.8 years
Median number of records for a single well	21.5

Table 4-5: Cuyama Basin Monitoring Well Information Provided by VCWPD

The wells included in the VCWPD dataset are located in the south eastern portion of the Basin that intersects with Ventura County. The wells are primarily found near the Cuyama River close to agricultural lands. Locations for the wells are provided in Figure 4-7.

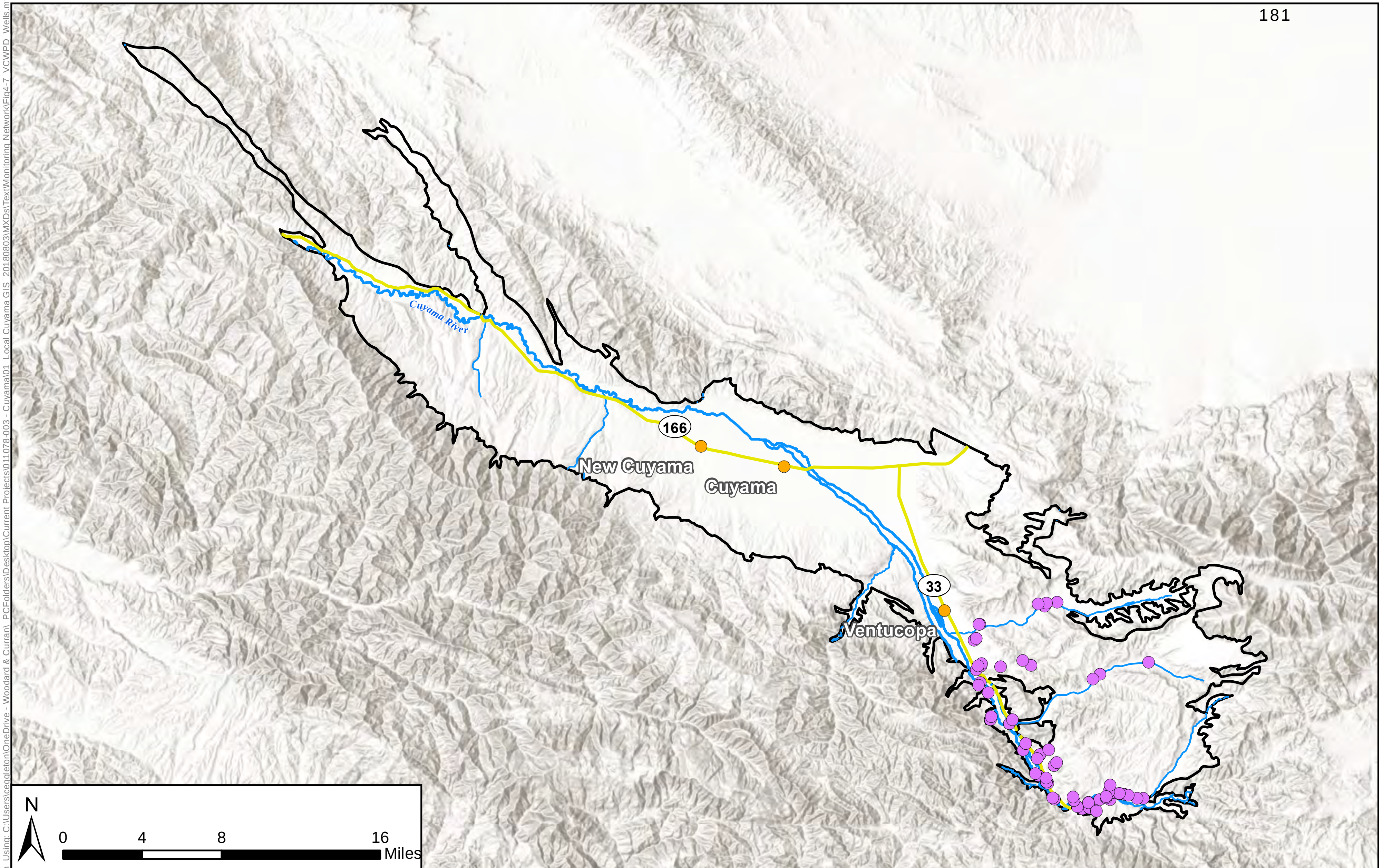

Figure 4-7: Cuyama GW Basin Wells with Monitoring Data Provided by VCWPD

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Legend

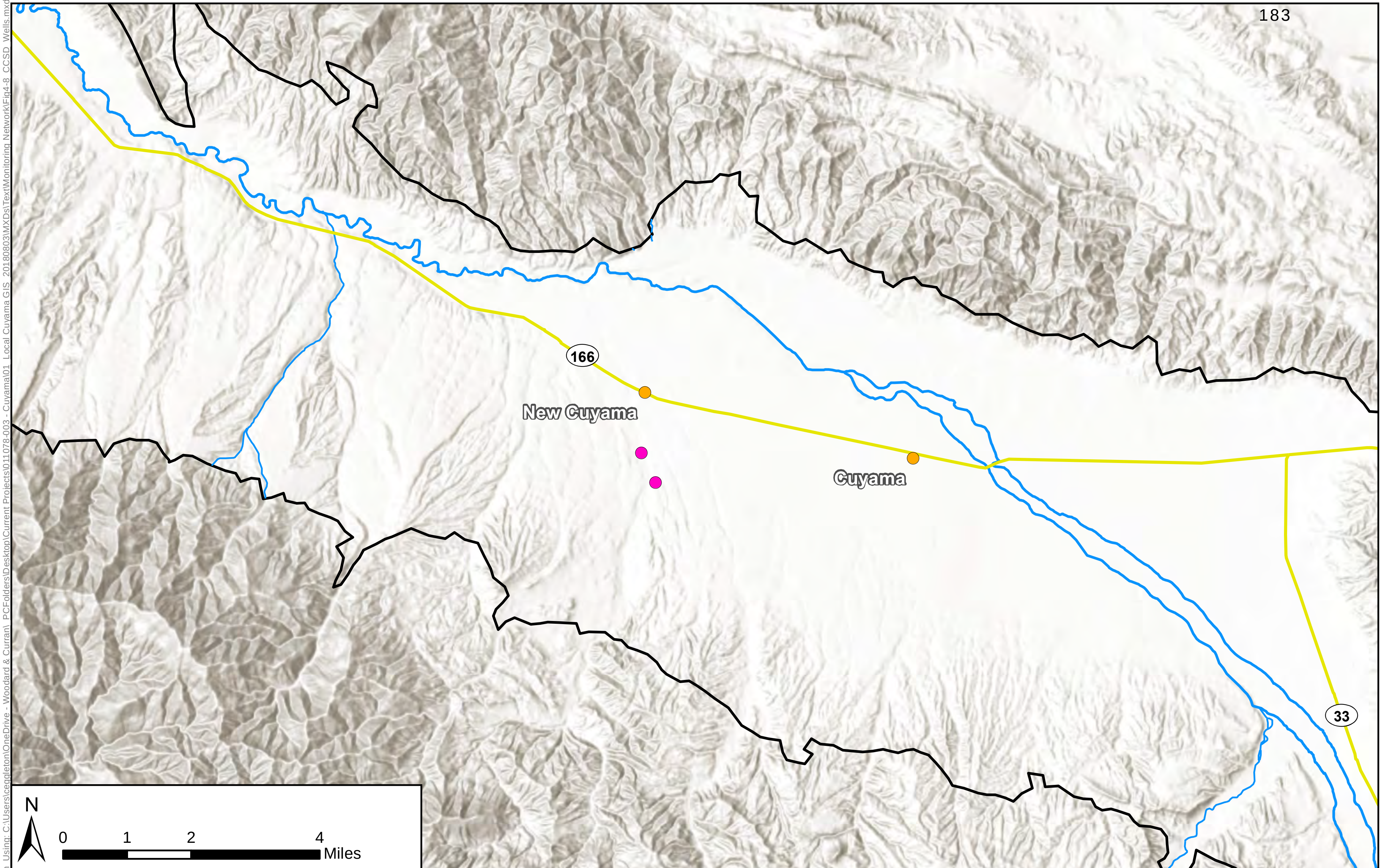
- Cuyama Basin
- Ventura County Watershed Protection District
- Towns
- Highways
- Cuyama River
- Streams

Cuyama Community Services District

The Cuyama Community Services District (CCSD) performs monitoring on its two production wells, one of which has been retired. The CCSD wells are located just south of the CCSD. Data for these wells is included in the SBCWA dataset, as well as the DWR and USGS datasets. Summary statistic for the wells is included in Table 4-6. Locations for these wells can be found in Figure 4-8.

Number of CCSD-monitoring wells	2
Earliest measurement date year	1981
Longest period of record	37 years
Median period of record	26.5 years
Median number of records for a single well	79

Table 4-6: Cuyama Basin Monitoring Well Provided Information by CCSD



Legend

- Cuyama Basin
- CCSD Wells
- Towns
- Highways
- Cuyama River
- Streams

Figure 4-8: Cuyama GW Basin Wells with Data Provided by CCSD

Cuyama Basin Groundwater Sustainability Agency

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Private Landowners

Private landowners within the Basin own and operate large numbers of wells, primarily for irrigation and domestic use. Many wells owned by private landowners are included in the databases described above. In addition, these landowners have provided additional monitoring data on 99 wells at the request of the GSA. Summary statistics for this additional data is provided in Table 4-7.

Number of Private Landowner wells with monitoring data	99
Earliest measurement date year	1975
Longest period of record	42 years
Median period of record	15 years
Median number of records for a single well	16

Table 4-7: Cuyama Basin Monitoring Well Information Provided by Private Landowners

The private landowner wells for which monitoring information was provided are distributed throughout the Basin. The majority of wells are located within the central portion of the Basin near the Cuyama River and Highway 166. There is an additional cluster towards the western portion of the basin that runs along the Cuyama River. Private landowner wells are shown in Figure 4-9.

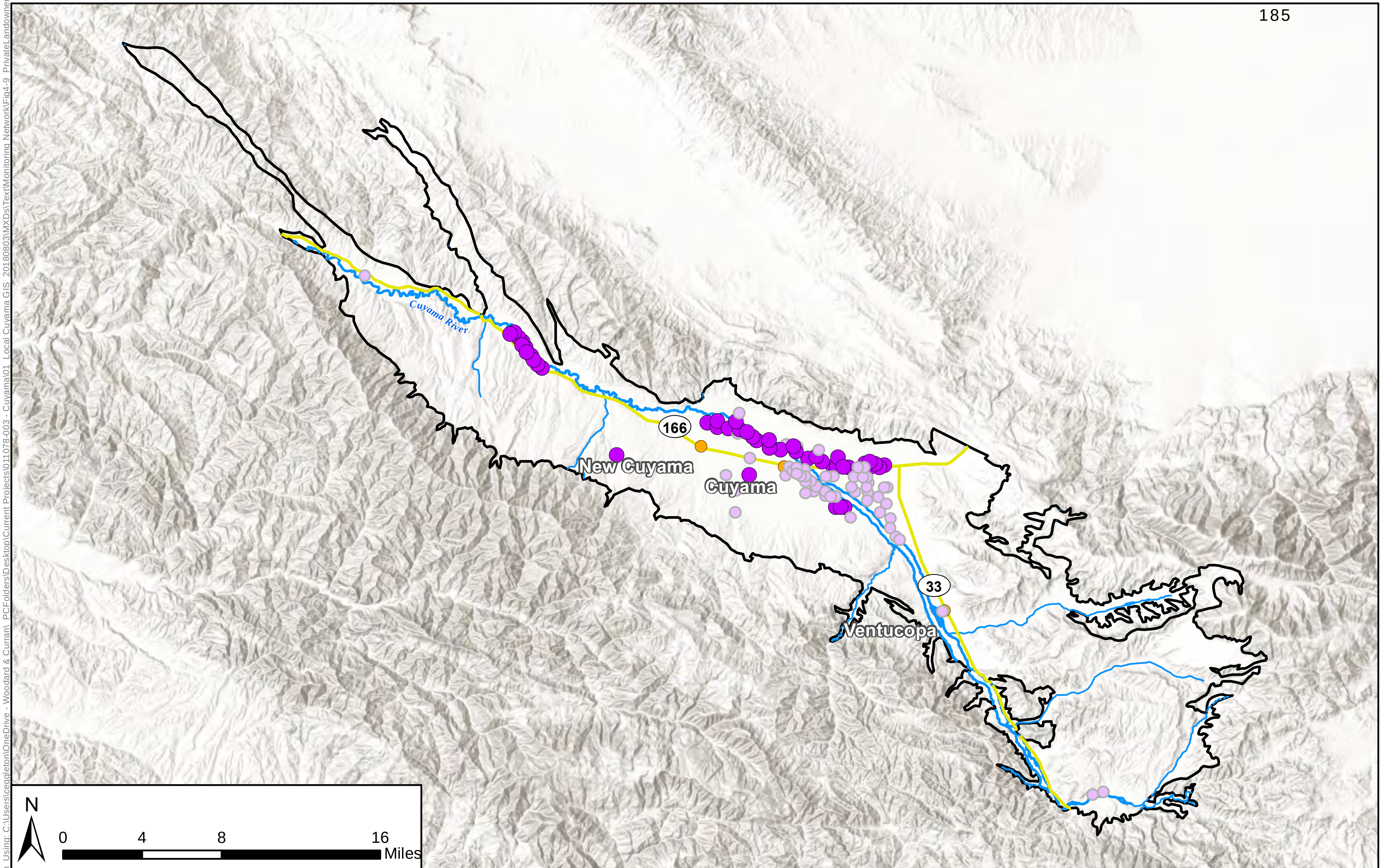

Figure 4-9: Cuyama GW Basin Wells with Monitoring Data Provided by Private Landowners

Cuyama Basin Groundwater Sustainability Agency

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Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams
- Private Landowner Reported Wells Last Measured in 2017-2018
- Private Landowner Reported Wells Last Measured 2016 and Earlier

4.3.2 Overlapping and Duplicate Data

Many of the data sources used to compile and create the Cuyama Basin Database contain duplicate entries for wells, metadata, groundwater level measurements, and groundwater quality measurements. Much of the well information managed by the counties within the Basin is also provided and incorporated into the DWR dataset. Many of the USGS wells and DWR wells overlap between datasets.

To avoid duplicate entries when compiling the Cuyama Basin Database, wells were organized by their State Well Number (SWN), Master Site Code (MSC), USGS ID, Local Name, and Name. Duplicates were identified and then removed or combined as necessary. Each unique well was then assigned an OPTI ID which was used as the primary identification number for all other processes and mapping exercises.

OPTI IDs were used to identify wells in the database within the Basin because not all data sources use similar identification methods, as shown in Table 4-8 below.

Data Maintaining Entity	SWN	CASGEM ID	USGS ID	MSC	Local Name	Name
DWR	✓ (green)	✓ (green)		✓ (green)		
USGS	✓ (black)		✓ (green)		✓ (red)	
SLOCFC&WCD	✓ (green)					
SBCWA	✓ (black)		✓ (red)		✓ (black)	
VCWPD	✓ (green)					
Private Landowners					✓ (black)	✓ (green)

✓ (green) = All wells had this information, ✓ (black) = Some wells had the information, ✓ (red) = Few wells had the information

Table 4-8: Well Identification Matrix

4.3.3 Groundwater Quality Monitoring (Combine Existing Programs)

This section discusses existing groundwater quality monitoring programs in the Cuyama Basin.

NWQMC / USGS / ILRP

The National Water Quality Monitoring Council (NWQMC) was created in 1997 to provide a collaborative, comparable, and cost-effective approach for monitoring and assessing the United State's water quality. Several organizations contribute to the database including the Advisory Committee on Water Information (ACWI), the Agricultural Research Service (ARS), the Environmental Protection Agency (EPA), and USGS (NWQMC, 2018).

A single online portal provides access to data from the contributing agencies. Data is included from the USGS national Water Information System (NWIS) the EPA STOrage and RETrieval (STORET) Data Warehouse, and the USDA ARS Sustaining The Earth's Watersheds – Agricultural Research Database System (STEWARDS). Data incorporates hundreds of different water quality constituents from the different contributing agencies. Initial water quality data for the Cuyama Basin was downloaded through

NWQMC and included data for USGS monitoring sites and Irrigated Land Regulatory Program (ILRP) monitoring sites. ILRP was initiated in 2003 to prevent agricultural runoff from impairing surface waters, and in 2012, groundwater regulations were added to the program. ILRP water quality measurements are sampled from surface locations (DWR ILRP, 2018). There are currently five ILRP measurement sites within the Cuyama Basin. ILRP uses the California Environmental Data Exchange Network (CEDEN) to manage the data associated with the program. CEDEN data is then incorporated with USGS data, and thus included in the NWQMC database (DWR CEDEN, 2018).

The NWQMC database provides TDS data on 180 water quality monitoring sites. This database also provided data for a wide variety of constituents not included here.

Summary statistics for the NWQMC, USGS and ILRP monitoring sites is shown in Table 4-9.

NWQMC, USGS, and ILRP Water Quality Monitoring Sites	
Number of measurement sites	180
Earliest measurement date year	1940
Longest period of record	53 years
Median period of record	<1 year
Median number of records for a single site	2

Table 4-9: Cuyama Basin NWQMC, USGS, ILRP Water Quality Monitoring Sites Summary Statistics

The majority of the water quality monitoring sites included in the NWQMC database are located in the central portion of the basin and along the Cuyama River as it follows Highway 33. These monitoring sites can be seen in Figure 4-10.

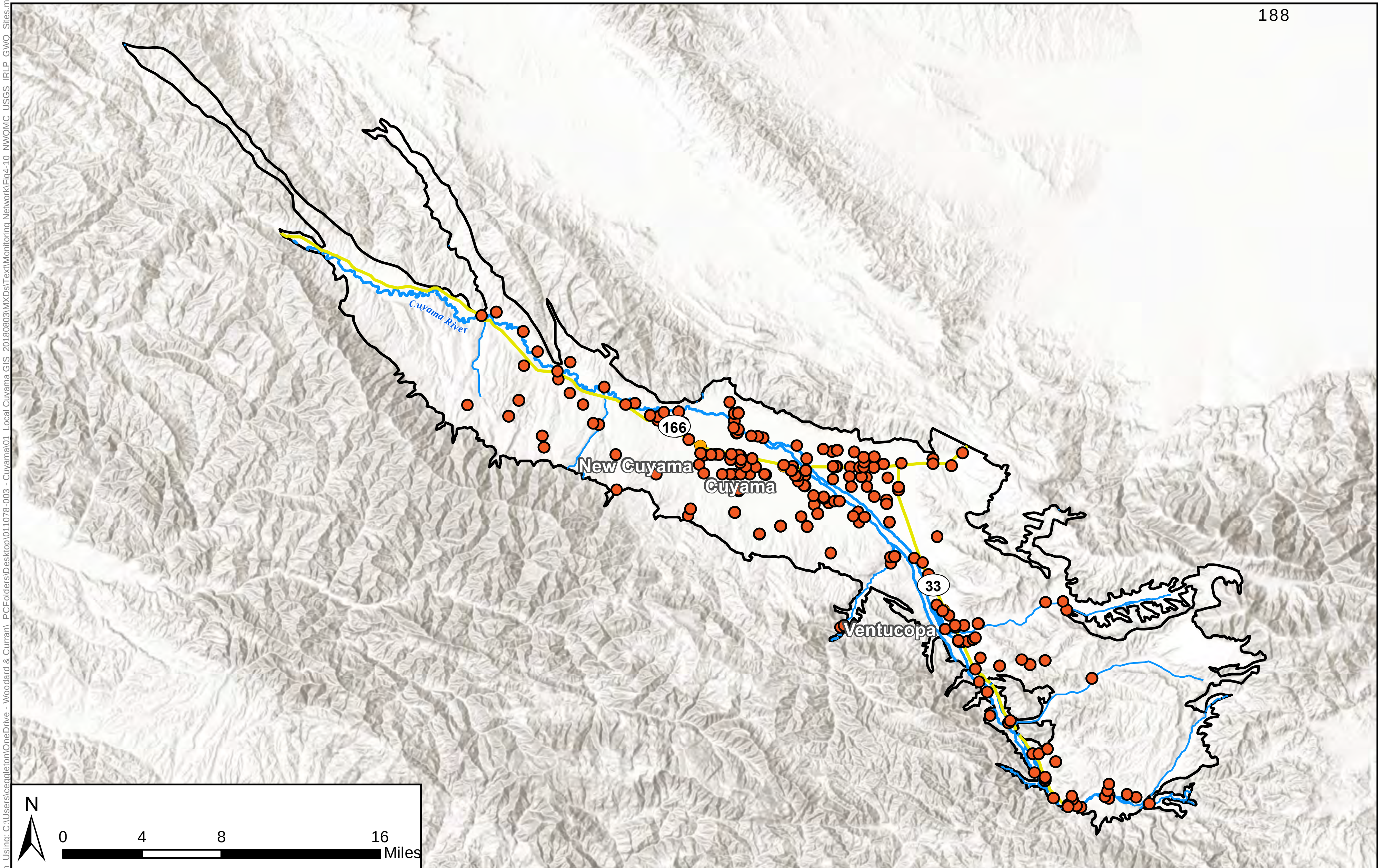

Figure 4-10: Cuyama GW Basin USGS/NWQMC/ IRLP Groundwater Quality Monitoring Sites

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

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Legend

- Cuyama Basin
- USGS/NWQMC/IRLP Groundwater Quality Sites
- Towns
- Highways
- Cuyama River
- Streams

GAMA / DWR

The Groundwater Ambient Monitoring and Assessment (GAMA) Program is the State of California's groundwater quality monitoring program created by the State Water Resources Control Board in 2000, and later expanded by Assembly Bill 599, the Groundwater Quality Monitoring Act of 2001 (DWR GAMA 2018). The purpose of GAMA is to improve statewide comprehensive groundwater monitoring and increase the availability of information to the general public about groundwater quality and contamination information. Additionally, GAMA aims to establish groundwater quality on basin wide scales, continue with groundwater quality sampling and studies, and centralize the information and data for the public and decision makers to enhance groundwater resource protection.

DWR also publishes statewide water quality data via the California Natural Resources Agency. Access to DWR and GAMA information and data is accessible through separate online portals.

There are 213 GAMA and DWR groundwater quality monitoring sites within the Basin. Summary statistics for these sites is included in Table 4-10.

GAMA / DWR Water Quality Monitoring Sites	
Number of measurement sites	213
Earliest measurement date year	1942
Longest period of record	41 years
Median period of record	<1 year
Median number of records for a single site	2

Table 4-10: Cuyama Basin GAMA / DWR Groundwater Quality Monitoring Sites Summary Statistics

The GAMA / DWR groundwater quality monitoring locations are spread throughout the Basin, loosely following the Cuyama River. There are currently 60 water quality monitoring sites per 100 miles^2 within the Basin. These locations can be seen in Figure 4-11.

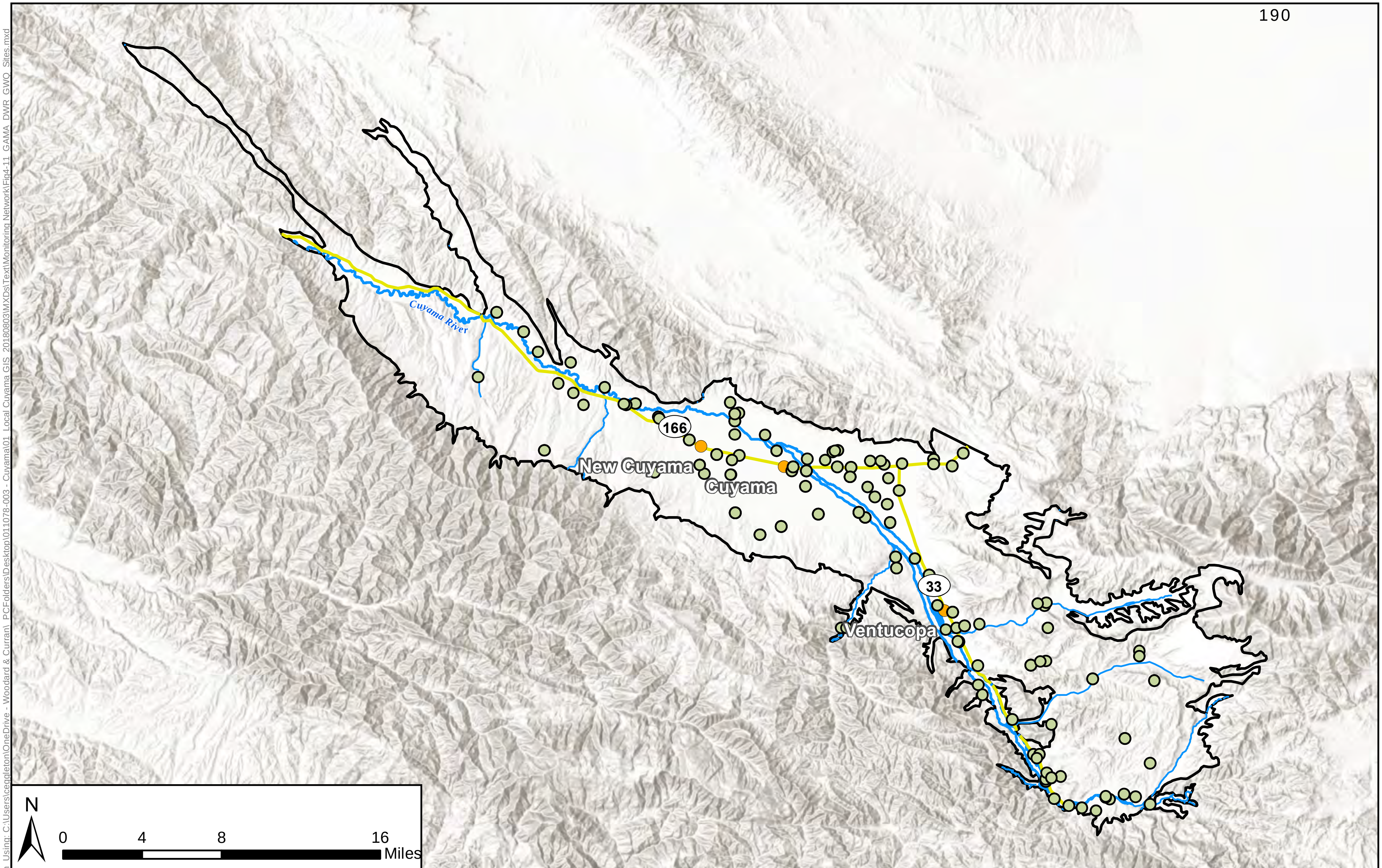

Figure 4-11: Cuyama GW Basin GAMA/DWR Groundwater Quality Monitoring Sites

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Legend

- Cuyama Basin
- GAMA/DWR Groundwater Quality Sites
- Towns
- Highways
- Cuyama River
- Streams

Cuyama Community Services District

The Cuyama Community Services District (CCSD) currently operates one production well for residential distribution within the Basin. Although some data for this well is included in the NWQMC dataset, annual Consumer Confidence Reports from 2011 to 2017 were processed for additional water quality data measurements. Summary Statistics for the CCSD well are included in Table 4-11 and the location is shown in Figure 4-12.

CCSD Water Quality Monitoring Site	
Number of measurement sites	1
Earliest measurement date	2008
Period of record	10 years
Number of records	21

Table 4-11: Cuyama Basin CCSD Water Quality Site Summary Data

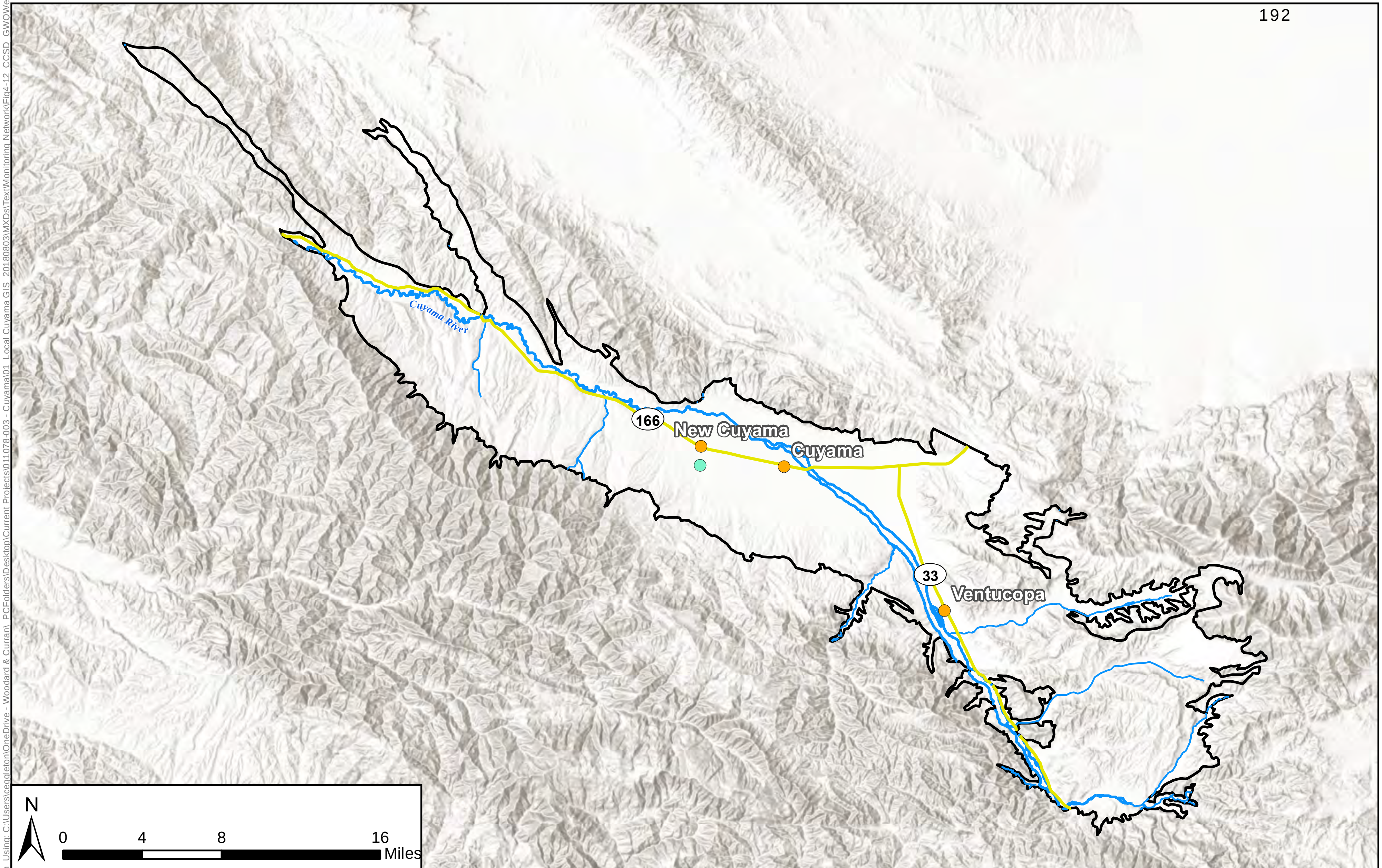

Figure 4-12: Cuyama GW Basin
CCSD Groundwater Quality Well

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

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Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams
- Cumaya Community Services District Water Quality Monitoring Well

Ventura County Watershed Protection District

VCWPD has 51 groundwater wells that have been utilized for groundwater quality monitoring within the Basin. All of the wells are incorporated into the DWR, GeoTracker, or USGS datasets. Sampling data includes numerous water quality constituents, however, this GSP only addresses TDS. Summary statistics for the wells are included in Table 4-12, and locations of these wells are included in Figure 4-13.

VCWPD Water Quality Monitoring Sites	
Number of measurement sites	51
Earliest measurement date	1957
Longest period of record	45
Median period of record	7
Median number of records for a single site	5

Table 4-12: Cuyama Basin VCWPD Water Quality Sites Summary Data

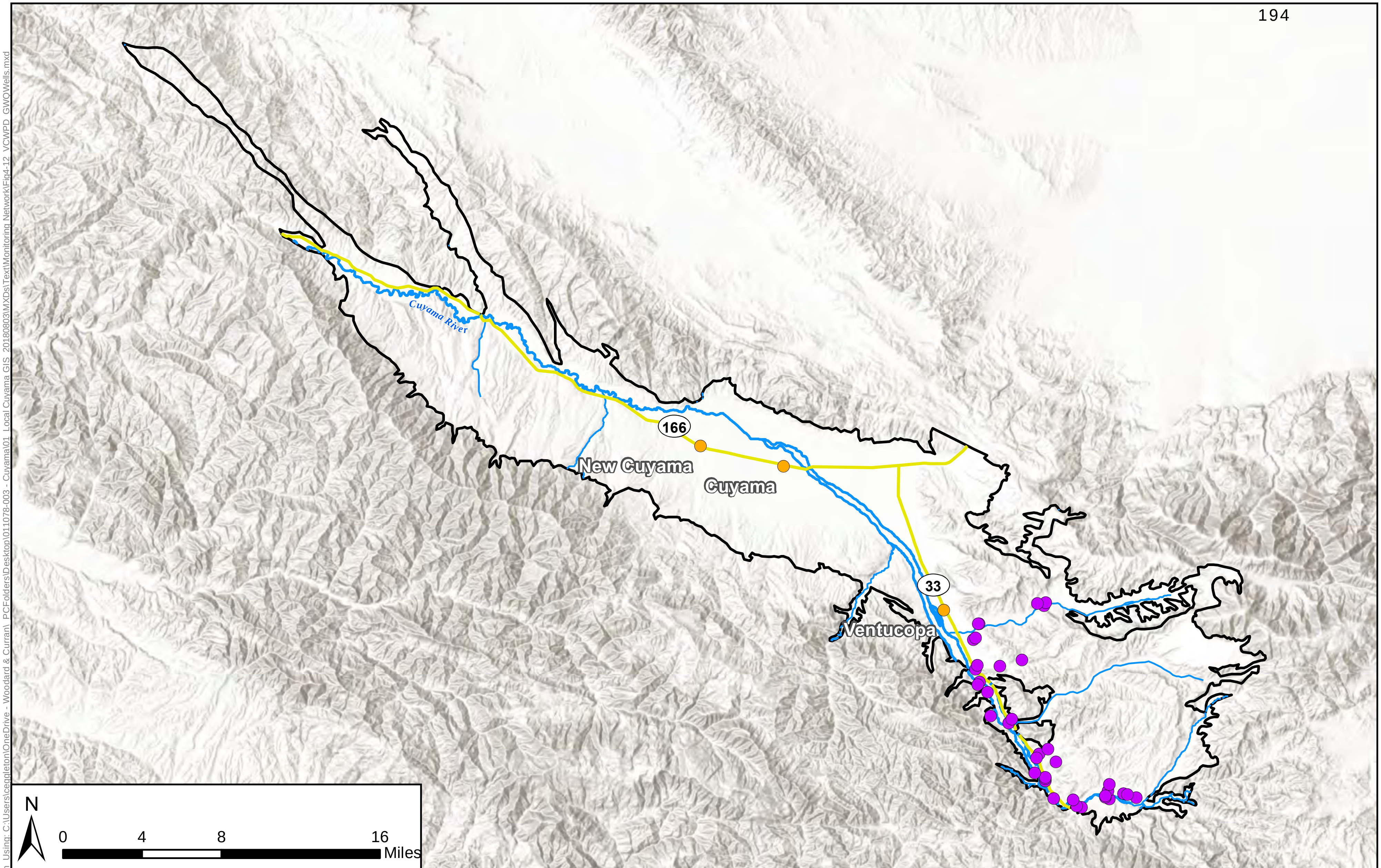

Figure 4-13: Cuyama GW Basin
VCWPD Groundwater Quality Wells

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

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Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams
- Ventura County Watershed Protection District Groundwater Quality Monitoring Wells

Figure Exported: 9/14/2018 By: ceggleton Using: C:\Users\ceggleton\OneDrive - Woodard & Curran_PCFolders\Desktop\011078-003 - Cuyama\01_Local Cuyama GIS_20180803\MXDs\Text\Monitoring Network\Fig4-12_VCWPD_GWQWells.mxd

Private Landowners

Private landowners within the Basin conducted groundwater quality testing, which has been incorporated into this document and associated analysis. Eleven wells measured Total Dissolved Solids in 2015. Summary statistics for these sites can are included in Table 4-13 and locations are included in Figure 4-14.

Private Landowner Water Quality Monitoring Sites	
Number of measurement sites	11
Earliest measurement date	1/12/2015
Longest period of record	N/A
Median period of record	N/A
Median number of records for a single site	1

Table 4-13: Cuyama Basin Landowner Water Quality Sites Summary Data

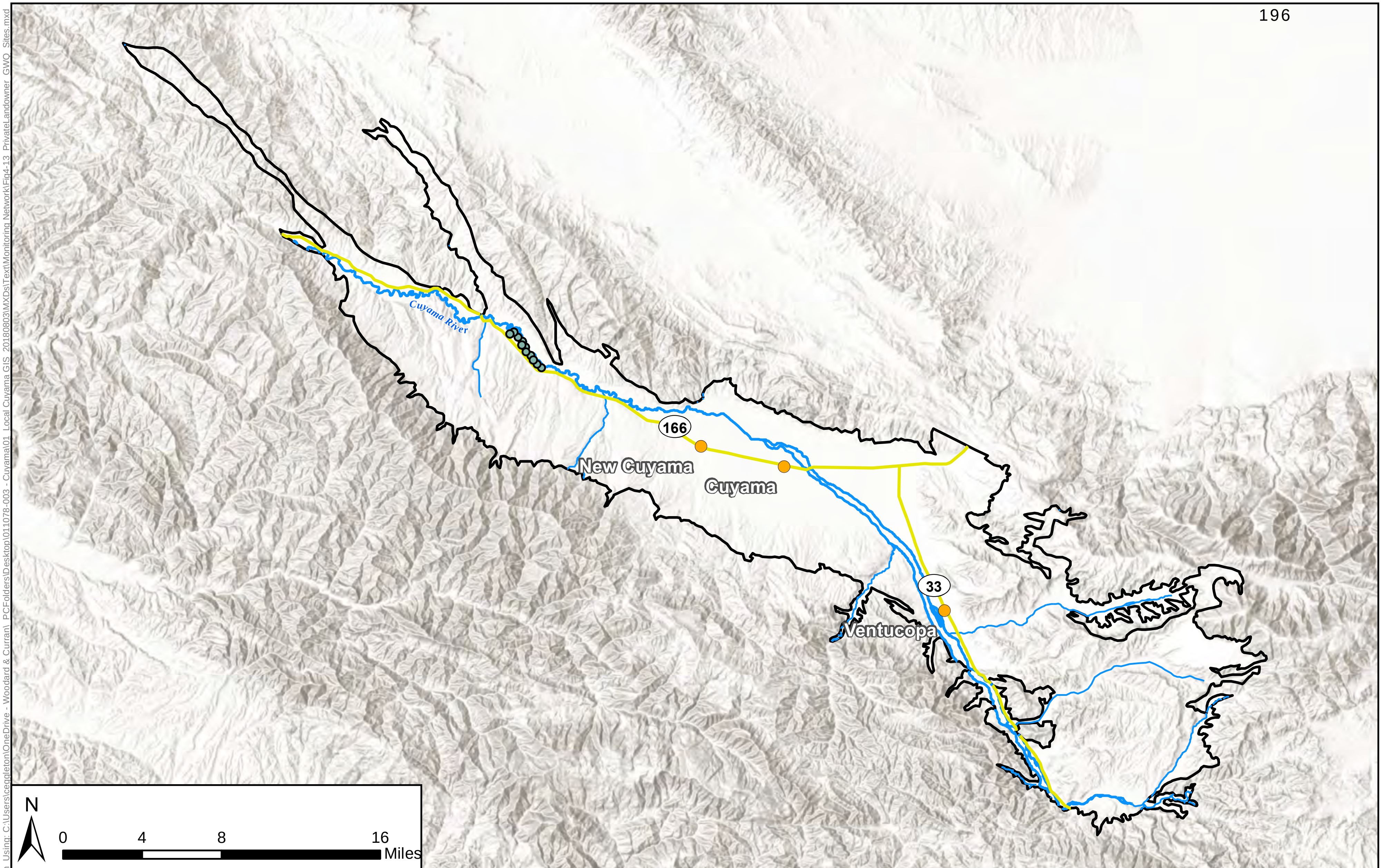

Figure 4-14: Cuyama GW Basin Private Landowner Groundwater Quality Monitoring Sites

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Figure Exported: 9/14/2018 By: ceggleton Using: C:\Users\ceggleton\OneDrive - Woodard & Curran_PCFolders\Desktop\011078-003 - Cuyama\01_Local Cuyama GIS_20180803\MXDs\Text\Monitoring Network\Fig4-13_PrivateLandowner_GWQ_Sites.mxd

4.3.4 Subsidence Monitoring

Subsidence is the sinking or downward settling of the earth's surface and is often the result of over-extraction of subsurface water. Subsidence can be directly measured in a few different methods such as with LiDAR or InSAR, Continuous Geographic Positioning System (CGPS), Extensometers, and Spirit Leveling. For more information, see Appendix Z in the Groundwater Conditions chapter, which contains further information about these methods and the physics behind land subsidence. The subsidence monitoring network currently described below for the Cuyama Basin assumes the use of extensometers to monitor subsidence in the Basin. However, the GSA should evaluate other methods, including LiDAR and InSAR as well during the implementation phase to identify the optimal approach.

The Basin hosts two CGPS stations with three others just outside the Basin's boundary, as shown in Figure 2.2-22. CGPS stations measure surface movement in all three axis directions; up/down, east/west, and north/south. CGPS stations are placed in the center of the Cuyama Valley to measure subsidence, while other are placed on ridges around the valley to also measure tectonic movements.

4.3.5 Surface Water Monitoring

Surface water monitoring within the Basin is conducted through stream and river gages placed along the Cuyama River or one of its tributaries. USGS manages most flow gages in California, and currently operates one active stream gage along Santa Barbara Creek. There is an additional gage (ID 11136800) along the Cuyama River downstream of the Basin before Twitchell Reservoir, however, this gage also receives water from non-Cuyama Basin watershed areas. Data for surface flow gages is obtained through the NWIS Mapping portal (USGS NWIS 2017). Existing and discontinued gages are included in Figure 4-15.

USGS has operated three additional gages within the Basin, however, two of those gages were discontinued in the 1970's. Gage ID 11136500 operated from 1945 to 1958 and was brought back into service from 2009 to 2014.

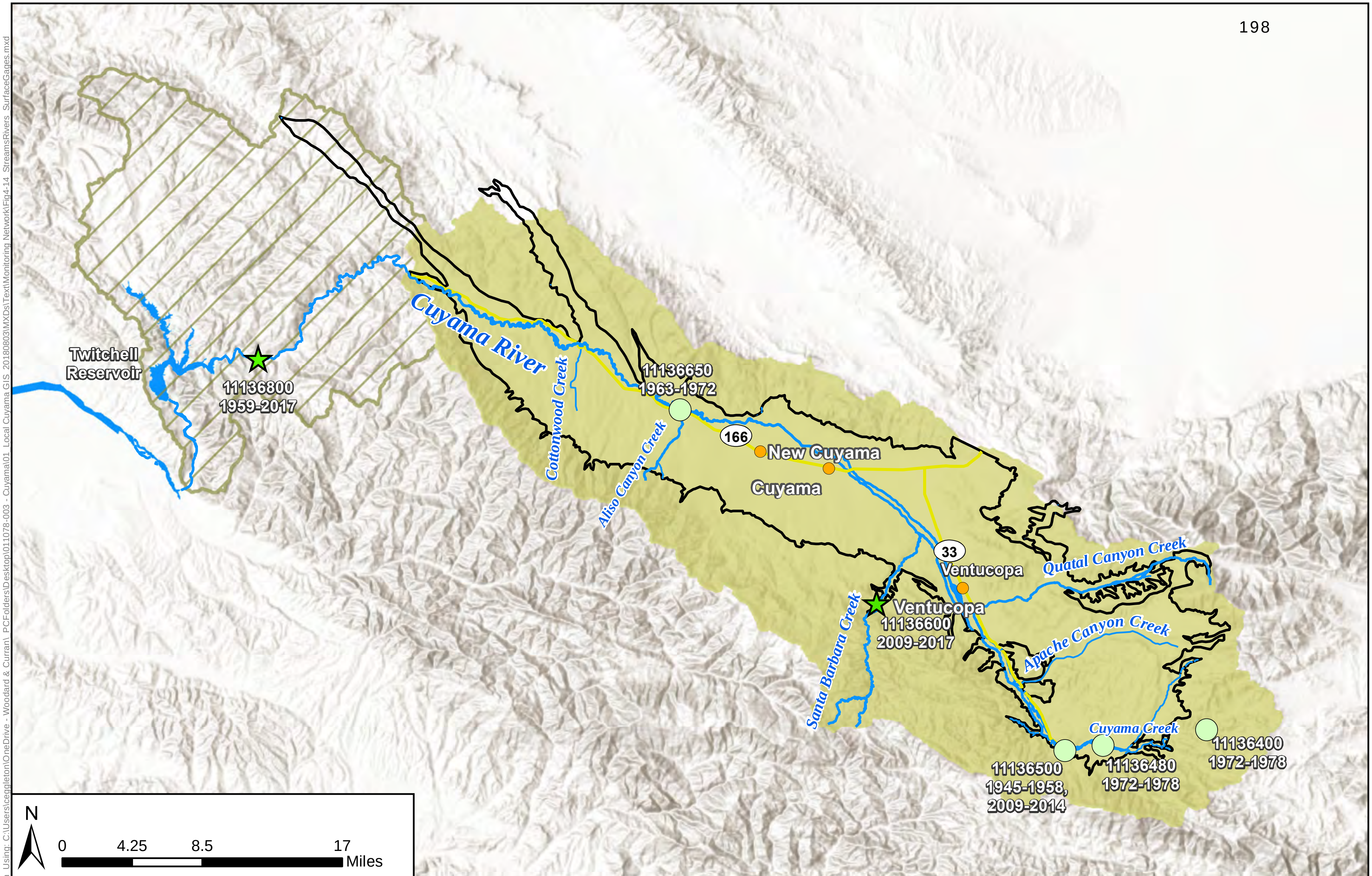

Figure 4-15: Rivers, Streams, and Surface Flow Gages

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

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Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Inactive Flow Gages
- Active Flow Gages

Cuyama Watershed

- Contributes to Cuyama GW Basin
- Does Not Contribute to Cuyama GW Basin

Figure Exported: 9/14/2018 By: ceggleton Using: C:\Users\ceggleton\OneDrive - Woodard & Curran\PCFolders\Desktop\011078-003 - Cuyama\01_Local Cuyama GIS_20180803\MXDs\TextMonitoring Network\Fig4-14_StreamsRivers_SurfaceGages.mxd

4.4 Monitoring Rationales

This section discusses the reasoning behind monitoring network selection. Monitoring networks in the Cuyama Basin GSP were developed to ensure that they were able to detect changes in basin conditions so that the Cuyama Basin Groundwater Sustainability Agency (CBGSA) can manage the basin to ensure the basin's sustainability goal is met, and that no undesirable results are present after 20 years of sustainable management.

The monitoring networks were selected specifically to detect short term, seasonal, and long term trends in groundwater levels and storage. The monitoring networks have been selected to include an adequate amount of temporal frequency and spatial density to evaluate information about groundwater conditions that are necessary to evaluate the effectiveness of projects and management actions undertaken by the GSA.

Explanations of how each monitoring network will be developed and implemented will be described in the projects and management actions section of the GSP as individual projects that the GSA will undertake as part of GSP implementation. The schedule and costs associated with developing and implementing each network will be discussed in the Implementation Section of the GSP.

4.5 Groundwater Level Monitoring Network

Groundwater level monitoring is conducted through a groundwater well monitoring network. This section will provide information on how the level monitoring network was developed, criteria for selecting representative wells, monitoring frequency, spatial density, summary protocols, and identification and strategies to fill data gaps.

4.5.1 Management Areas

Management Areas have not been selected at the time of writing this GSP section. Management Areas allow flexibility in establishing monitoring networks both spatially and temporally to match conditions and use in the management area. At this time, it is recommended due to the sparsity of monitored wells to use the same monitoring network selection criteria across all management areas in the basin.

4.5.2 Monitoring Wells Selected for Monitoring Network

A set of well tiering criteria were created to rank existing groundwater level measuring sites within the basin into six different tiers, shown in Figure 4-16.

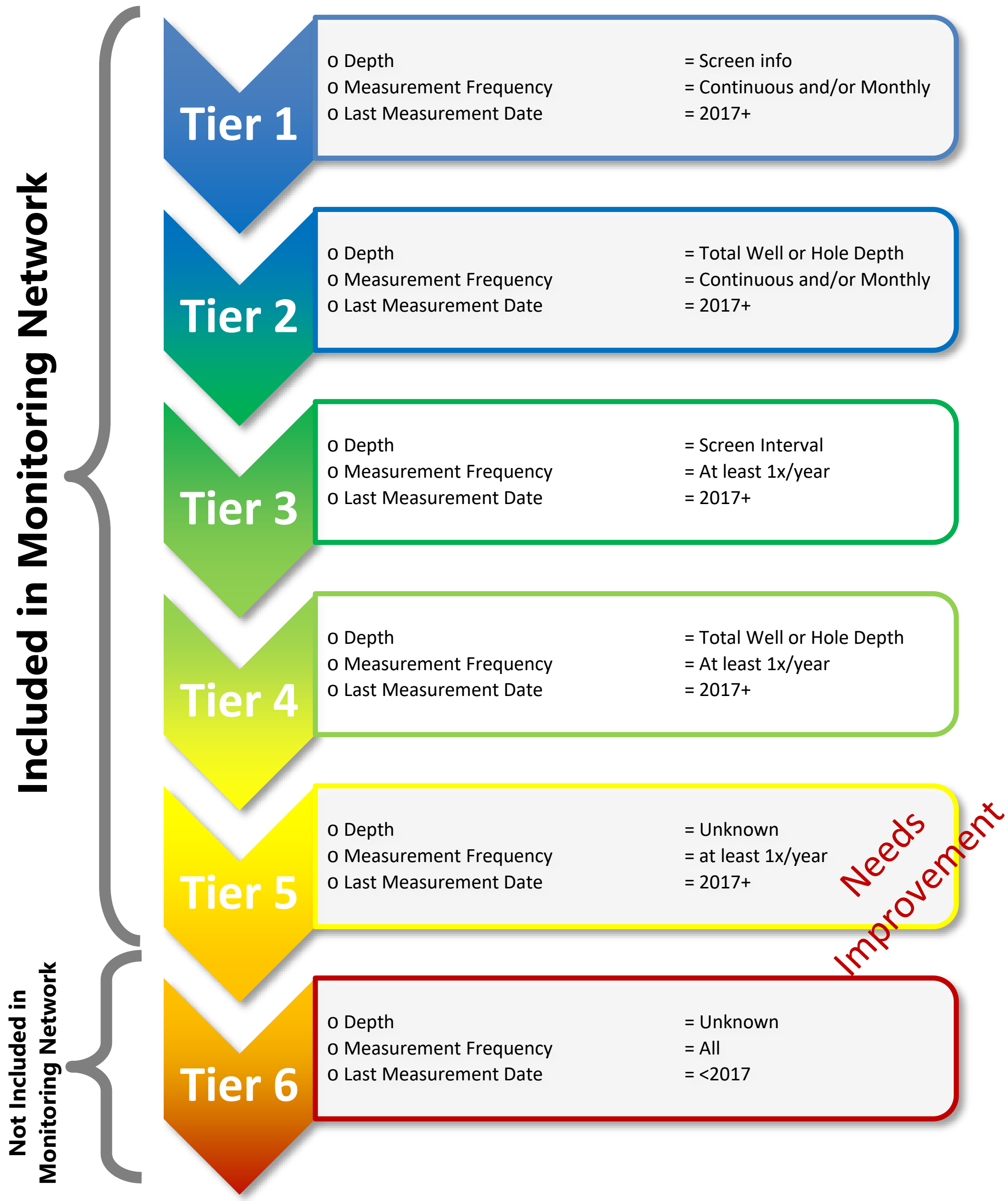

Figure 4-16: Cuyama Well Tiering Criteria

Tier 1 encompasses wells with the most amount of metadata as well as consistent water elevation data that are still operating and functional. As tiering levels increase, requirements around well metadata and frequency of monitoring decrease, but all the wells are still active and functioning. Tier 5 captures the remaining "active" wells, but the metadata and/or frequency of monitoring would benefit from improvement.

Tier 6 includes all other wells that are no longer operational, which are categorized as those who do not have recorded data from January 1, 2017 to August 1, 2018 This approximate two-year cut off was determined as being a reasonable amount of time for a monitoring agency or organization to obtain, log, and report well information and measurements, and as an indicator of whether a well was currently monitored or not.

Table 4-13 shows the number of monitoring wells selected from each existing monitoring data maintaining entity.

Monitoring Data Maintaining Entity	Number of Wells Selected for Monitoring Network
CASGEM	28
USGS	43
SBCWA	30
SLOCFC&WCD	2
VCWPD	5
CCSD	1
Private Landowner	43
Total	**89**

Note: Total does not equal sum of rows due to duplicate entries in multiple databases

Table 4-14: Number of Wells Selected for Monitoring Network

Figure 4-17 shows the Monitoring Network wells by their Tier level.

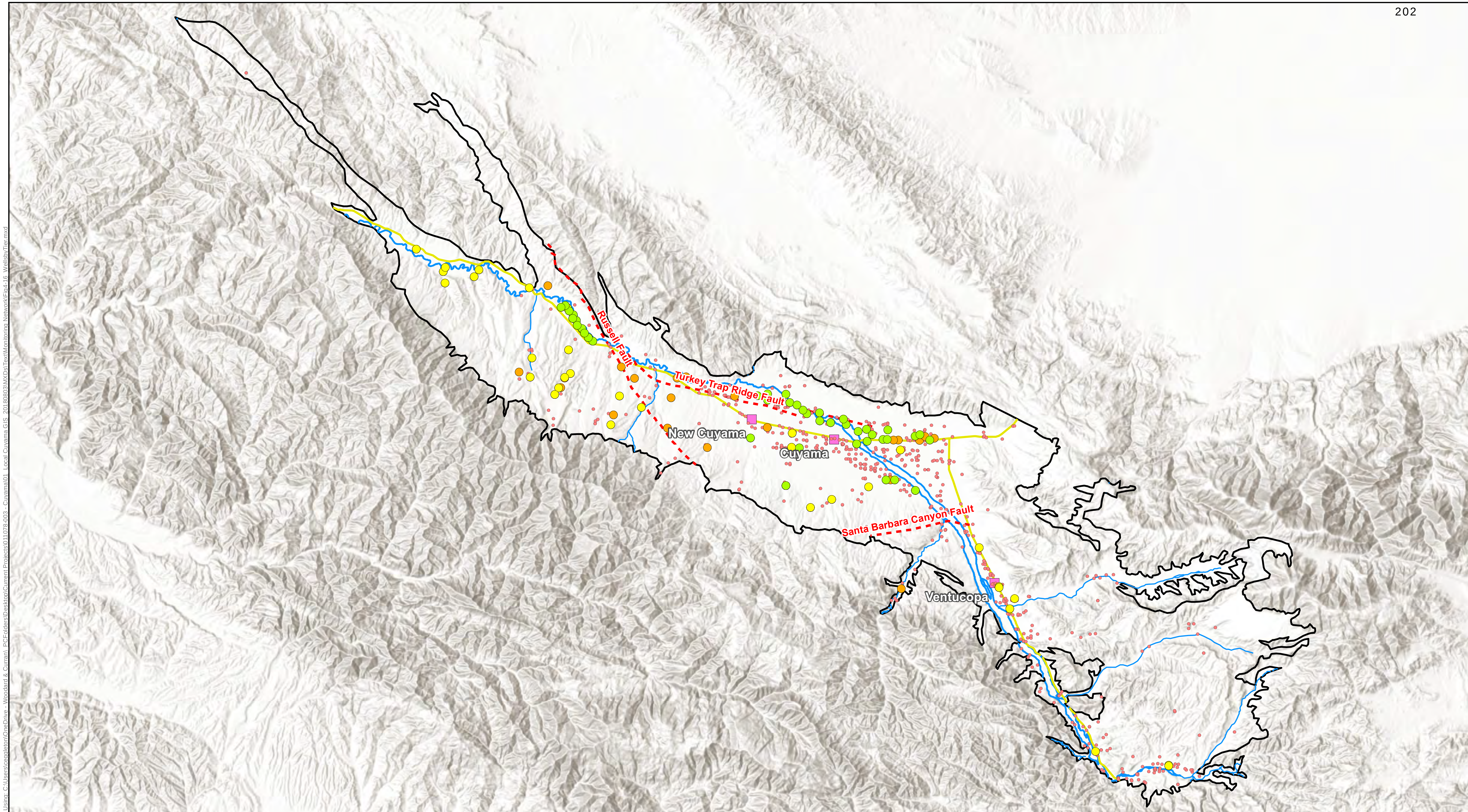

Figure 4-17: Cuyama GW Basin Groundwater Level Wells by Tier

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

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Legend

- Cuyama Basin
- Towns
- Faults
- Highways
- Cuyama River
- Streams

Monitoring Network Wells

- Tier 1
- Tier 2
- Tier 3
- Tier 4
- Tier 5
- Tier 6

N

0 2.5 5 10 Miles

4.5.3 Monitoring Frequency

A successful monitoring frequency and schedule should allow the monitoring network to adequately interpret the fluctuations over time of the groundwater system based on shorter-term and long-term trends and conditions. These changes may be the result of storm events, droughts or other climatic variations, seasons, and anthropogenic activities such as pumping.

Monitoring frequency must, at a minimum, occur within the same designated time-period for all wells to ensure that measurements represent the same condition for the aquifer.

The *Monitoring Networks and Identification of Data Gaps Best Management Practices (BMP)* published by DWR provides guidance for the monitoring frequency based on the discussion presented in the *National Framework for Ground-water Monitoring in the United States* (ACWI, 2013). This analysis and discussion provide guidance on monitoring frequency based on aquifer properties and degree of use, as shown in Table 4-15.

The guidance recommends that initial characterization of monitoring locations use frequent measurements to establish the dynamic range at each monitoring site and to identify external stresses affecting groundwater levels. An understanding of these conditions based on professional judgement should be reached before normal monitoring frequencies are followed.

Aquifer Type	**Nearby Long-Term Aquifer Withdrawals**		
	Small Withdrawals	***Moderate Withdrawals***	***Large Withdrawals***
Unconfined Aquifer			
“low” recharge (<5 inches/year)	Quarterly	Quarterly	Monthly
“high” recharge (>5 inches/year)	Quarterly	Monthly	Daily
Confined Aquifer			
“low” hydraulic conductivity (<200 feet/day)	Quarterly	Quarterly	Monthly
“high” hydraulic conductivity (>200 feet/day)	Quarterly	Monthly	Daily

Table 4-15: Monitoring frequency Based on Aquifer Properties and Degree of Use

The Basin is an unconfined aquifer with large withdrawals, with a “low” recharge rate of less than 5-inches per year. Based on the data in Table 4-15 provided by DWR, the Basin’s groundwater monitoring frequency should be on a monthly basis. This GSP recommends monitoring the groundwater level network monthly for the first three years of GSP implementation and consideration of reducing the monitoring frequency to quarterly measurements after that. Ideally, the monitoring network would be monitored simultaneously to gain a ‘snapshot’ of groundwater conditions. Since that is not practical monitoring of the level network should be conducted within one week for each measurement period.

4.5.4 Spatial Density

Spatial density of the monitoring network was considered both for the selection of the entire monitoring network, and for the selection of representative wells (Section 4.5.5) The goal of the groundwater level monitoring network is to provide adequate coverage of the entire aquifer within the Basin. This includes the ability to monitor and identify groundwater changes across the basin through time. Consideration of the spatial location of monitoring wells should include proximity to other monitoring wells and ensuring adequate coverage near other prominent features such as faults or production wells. Monitoring wells in close proximity to active pumping wells could be influenced by groundwater withdrawals, thus skewing static level monitoring.

The *Monitoring Networks and Identification of Data Gaps BMP* published by DWR provides different sources and condition dependent densities to guide monitoring network implementation (Table 4-16). This information was adapted from the *CASGEM Groundwater Elevation Monitoring Guidelines* (DWR, 2010). While these estimates provide guidance to monitoring well site spatial densities, monitoring points should primarily be influence by local geology, groundwater use, and GSP defined undesirable rates. Professional judgement is essential to determine final locations.

Reference	Monitoring Well Density (wells per 100 miles^2)
Heath (1976)	0.2-10
Sophocleous (1983)	6.3
Hopkins (1994)	
Basins pumping more than 10,000 AFY per 100 miles^2	4.0
Basins pumping between 1,000 and 10,000 AFY per 100 miles^2	2.0
Basins pumping between 250 and 1,000 AFY per 100 miles^2	1.0
Basins pumping between 100 and 250 AFY per 100 miles^2	0.7

Table 4-16: Monitoring Well Density Considerations

PRELIMINARY AND WILL BE UPDATED WHEN WATER BUDGET INFORMATION IS COMPLETE, it is estimated that the basin pumps approximately over 10,000 AFY per 100 square miles. The basin has 378 square miles of area. Based on Hopkins (1994), well density estimate guidelines, the Basin should have 4 monitoring wells per 100 square miles. Sophocleous (1983) recommends 6.3 monitoring wells per 100 square miles. Based on Heath (1976), the basin should have between 0.2 and 10 monitoring wells per 100 square miles. Due to the geologic and topographic variability within the basin, as well as the severity of groundwater declines and hydrogeologic uncertainty in various portions of the basin, this GSP recommends a density greater than the most conservative estimate of 10 wells per 100 square miles, which is over 38 monitoring wells.

4.5.5 Representative Monitoring

There are two categories of wells were identified within the monitoring network:

- **Representative Wells** – These wells will be used to monitor sustainability in the basin. Minimum thresholds and measurable objectives will also be calculated for these wells.
- **Supplemental Wells** – Other wells are included in the monitoring network to provide redundancy for representative wells, and to maintain a robust network for evaluation as part of five-year GSP updates.

Representative monitoring wells were selected as part of monitoring network development. Representative monitoring wells are wells that represent conditions in the basin, and in locations that allow monitoring on the well to indicate the long term, regional changes in its vicinity.

Representative groundwater level and groundwater storage sites within each management area were selected by several different criteria. These include:

1. **Adequate Spatial Distribution –** Representative monitoring does not require the use of all wells that are spatially "clumped" together within a portion of the Basin. Adequately spaced wells will provide greater Basin coverage with fewer monitoring sites.
2. **Robust and Extensive Historical Data –** representative monitoring sites with longer and more robust historical data provide insight into long-term trends that can provide information about groundwater conditions through varying climatic periods such as droughts and wet periods. Historical data may also show changes in groundwater conditions through anthropogenic effects as well. While some sites chosen may not have extensive historical data, they may still be selected because there are no wells nearby with longer records.
3. **Increased Density in Heavily Pumped Areas –** Selection of additional wells in heavily pumped areas such as in the central portion of the Basin and other agriculturally intensive areas will provide additional data where the most groundwater change occurs.
4. **Increased Density near Areas of Geologic, Hydrologic, or Topologic Uncertainty** – Having a greater density of representative wells in areas of uncertainty, such as around faults or large elevation gradients may provide insightful information about groundwater dynamics to improve management practices and strategies.
5. **Wells with Multiple Depths** – The utilization of wells with different screen intervals is important to collect data on the groundwater conditions at different elevations within the aquifer. This can be achieved by using wells with different screen depths that are close to one another, or by using multi-completion wells.
6. **Consistency with BMPs –** Using published Best Management Practices (BMPs) provided by DWR will ensure consistency across all basins and ensure compliance with established regulations.
7. **Adequate Well Construction Information –** Well information such as perforation depths, construction date, and well depth should be considered and encouraged when considering wells to be included.
8. **Professional Judgement** – Professional judgement is used to make the final decision about each well, particularly when more than one suitable well exists in an area of interest.
9. **Maximum Coverage** – Any monitoring network well that was suitable for use in the representative network was used to maximize spatial and vertical density of monitoring.

4.5.6 Groundwater Level Monitoring Network

The Groundwater Level Monitoring Network is comprised of 88 of wells within the Basin. Forty-nine of those wells are representative wells. Overall well density is 23.3 wells per 100 square miles. Figure 4-18 shows the locations of the groundwater level monitoring network monitoring wells and representative wells.

Table 4-17 includes the wells in the Groundwater Level Monitoring Network. Representative wells, those with sufficient data and representative trends within the Basin, are identified with the asterisk (*) next to the OPTI ID and are sorted first. Metadata for the wells is also included.

The proposed monitoring frequency is monthly for the first three years of GSP implementation with an option to reduce to quarterly monitoring if the CBGSA Board decides that it is appropriate. This monitoring frequency captures short term, seasonal, and long-term trends in groundwater levels. The well density of 23.3 wells per 100 square miles in the monitoring network provides a spatial density that adequately covers the primary aquifer in the Basin, and is useful for determining flow directions and hydraulic gradients as well as change in storage calculations for use in future water budgeting efforts in portions of the basin with significant land use.

OPTI ID	Data Maintaining Entity as of 2018	Well Construction Date	Well Depth (ft.)	Hole Depth (ft.)	Screen Interval	Well Elevation (ft. above MSL)	Reference Point Elevation (ft. above MSL	First Measurement Year	Last Measurement Year	Measurement Period (yrs)	Measurement Count
2*	County of Ventura		73.0			3720		2011	2017	6	17
62*	SBCWA		212			2921		1966	2018	52	65
72*	SBCWA	1/1/1980	790	820	350 - 340 ft.	2171		1981	2018	37	114
74*	SBCWA					2193		2008	2018	10	45
77*	SBCWA	12/4/2008	980	1003.5	980 - 960 ft.	2286		2009	2018	9	47
84	SBCWA		200			2923		2008	2018	10	28
85*	SBCWA		233			3047		1950	2018	68	282
89*	VWPD	1/1/1965	125			3461		1965	2017	52	68
91*	SBCWA	9/29/2009	980	1000	980 - 960 ft.	2474		2009	2018	9	47
93*	SBCWA	10/18/1967	151	165		2928		1971	2018	47	36
95*	SBCWA	4/9/2009	805.	825.		2449		2009	2018	9	32
96*	SBCWA	2/1/1980	500			2606		1983	2018	35	61
98*	SBCWA		750.			2688		2008	2018	10	32
99*	SBCWA	9/10/2009	750	906	750 - 730 ft.	2513		2009	2018	9	43
100*	SBCWA	11/1/1988	284.	302.		3004		2010	2018	8	28
101*	SBCWA		200	220		2741		2008	2018	10	42
102*	SBCWA					2046		2010	2018	8	22
103*	SBCWA	7/23/2010	1030.	1040.		2289		2012	2018	6	25
104	Unknown		640		638.64 - 478.64 ft.	2299	2301	2008	2017	9	32
105	SLOCFCWC		750			2374	2375	1990	2017	27	38
106*	Unknown		227.5			2327	2327	2016	2018	2	9
107*	Unknown	1/1/1950	200			2482		1950	2018	68	12
108*	Private Landowner		328.75			2629	2630	2016	2018	2	8
110	Unknown	1/1/1948	603			2046		1950	2018	68	17
112*	Unknown		441			2139		1966	2018	52	10
114*	DWR	1/1/1947	58.0			1925		1967	2017	50	9
115	Private Landowner		1200			2276	2278	2016	2018	2	4
116	Private Landowner	10/1/1980	700		700 - 240 ft.	2329	2329	1980	2018	38	6
117*	Private Landowner		212			2098	2095	2016	2018	2	10
118*	Private Landowner		500			2270	2271	2016	2018	2	11
119	DWR		92.0			1713		1955	2017	62	10
120	Private Landowner		15.4			1705	1707	2016	2017	1	2
121	Private Landowner		98.25			1984	1985	2016	2018	2	16
122	Private Landowner		63.2			2129	2131	2016	2018	2	16
123*	Private Landowner		138			2165	2167	2016	2018	2	14
124*	Private Landowner		160.55			2287	2288	1988	2018	30	22
125	Private Landowner		26			2283	2284	2016	2018	2	9
127*	Private Landowner		100.25			2364	2365	2016	2018	2	14

OPTI ID	Data Maintaining Entity as of 2018	Well Construction Date	Well Depth (ft.)	Hole Depth (ft.)	Screen Interval	Well Elevation (ft. above MSL)	Reference Point Elevation (ft. above MSL	First Measurement Year	Last Measurement Year	Measurement Period (yrs)	Measurement Count
128	Unknown	3/15/1990	140.	150.		3721		2014	2017	3	8
316*	Unknown	9/29/2009	830	1000		2474		2009	2018	9	27
317*	Unknown	9/29/2009	700	1000		2474		2009	2018	9	28
322*	Unknown	4/9/2009	850	906		2513		2009	2018	9	27
324*	Unknown	9/10/2009	560	906		2513		2009	2018	9	26
325*	Unknown	9/10/2009	380	906		2513		2009	2018	9	26
420*	Unknown	12/4/2008	780	1003.5		2286		2009	2018	9	29
421*	Unknown	12/4/2008	620	1003.5		2286		2009	2018	9	29
422*	Unknown	12/4/2008	460	1003.5		2286		2009	2018	9	28
467	Unknown	1/1/1963	1140.	1215.		2224					
474*	Unknown		213			2369		1955	2017	62	6
564	Unknown	1/1/1920				2172		2017	2017	0	1
566	Unknown		500	520		2263					
568*	Unknown	1/1/1948	188	188		1905		1967	2018	51	22
571*	Private Landowner	1/1/1951	280			2307		2016	2018	3	14
573*	Unknown		404			2084		1950	2018	68	12
584	Unknown		450	606		1753		2018	2018	0	1
586	Unknown		620	622		1761					
587	Unknown	12/29/2014	900	960		1713		2018	2018	0	1
591	Unknown		720	740		1715		2017	2018	1	2
597	Unknown		390	670		1694		2017	2018	1	2
601	Private Landowner	6/14/1905	723		723 - 338 ft.	2074		1993	2017	24	32
602	Private Landowner	6/12/1905	725		725 - 325 ft.	2114		1992	2017	25	29
603	Private Landowner	6/15/1905	800		800 - 398 ft.	2097		1994	2017	23	33
604*	Private Landowner		924		924 - 454 ft.	2125		1995	2017	22	28
608*	Private Landowner	6/10/1905	745		745 - 440 ft.	2224		1995	2017	22	26
609*	Private Landowner	6/15/1905	970		970 - 476 ft.	2167		1995	2017	22	31
610*	Private Landowner		780		780 - 428 ft.	2442		1995	2017	22	27
612*	Private Landowner		1070		1070 - 657 ft.	2266		1995	2017	22	24
613*	Private Landowner		830		830 - 330 ft.	2330		1995	2017	22	24
614	Private Landowner		745		745 - 405 ft.	2337		1995	2017	22	25
615*	Private Landowner		865		865 - 480 ft.	2327		1995	2017	22	22
618	Private Landowner	6/18/1905	927		927 - 496 ft.	2163		1996	2017	21	31
619	Private Landowner	6/19/1905	1040		1040 - 569 ft.	2307		1997	2017	20	28
620*	Private Landowner	6/19/1905	1035		1035 - 550 ft.	2432		1997	2017	20	25
621	Private Landowner	6/19/1905	974		974 - 540 ft.	2126		1998	2017	19	30
623	Private Landowner	6/21/1905	1040		1040 - 530 ft.	2288		1999	2017	18	29
627	Private Landowner	6/23/1905	960		960 - 460 ft.	2279		2001	2017	16	19
628	Private Landowner	5/31/1905	941		941 - 593 ft.	2388		1978	2017	39	32

OPTI ID	Data Maintaining Entity as of 2018	Well Construction Date	Well Depth (ft.)	Hole Depth (ft.)	Screen Interval	Well Elevation (ft. above MSL)	Reference Point Elevation (ft. above MSL	First Measurement Year	Last Measurement Year	Measurement Period (yrs)	Measurement Count
629*	Private Landowner		1000		1000 - 500 ft.	2379		2005	2017	12	13
630	Private Landowner		900		900 - 360 ft.	2371		1991	2017	26	22
631	Private Landowner	5/31/1905	960		960 - 600 ft.	2367		1986	2017	31	22
633*	Private Landowner		1000		1000 - 500 ft.	2364		1998	2017	19	23
635	Private Landowner		1050		1050 - 549 ft.	2356		2003	2017	14	10
636	Private Landowner	5/27/1905	924		924 - 474 ft.	2348		1975	2017	42	15
637	Private Landowner	6/30/1905	980		980 - 540 ft.	2110		2009	2017	8	10
638	Private Landowner	6/30/1905	1006		1006 - 526 ft.	2437		2008	2017	9	9
640	Private Landowner	6/30/1905	840		840 - 400 ft.	2239		2008	2017	9	16
641	Private Landowner	7/2/1905	800		800 - 360 ft.	2204		2010	2017	7	7
642	Private Landowner	7/2/1905	1000		1000 - 550 ft.	2232		2010	2017	7	8
644	Private Landowner	7/5/1905	950		950 - 490 ft.	2143		2013	2017	4	10

Table 4-17: Wells included in the Groundwater Levels and Storage Monitoring Network

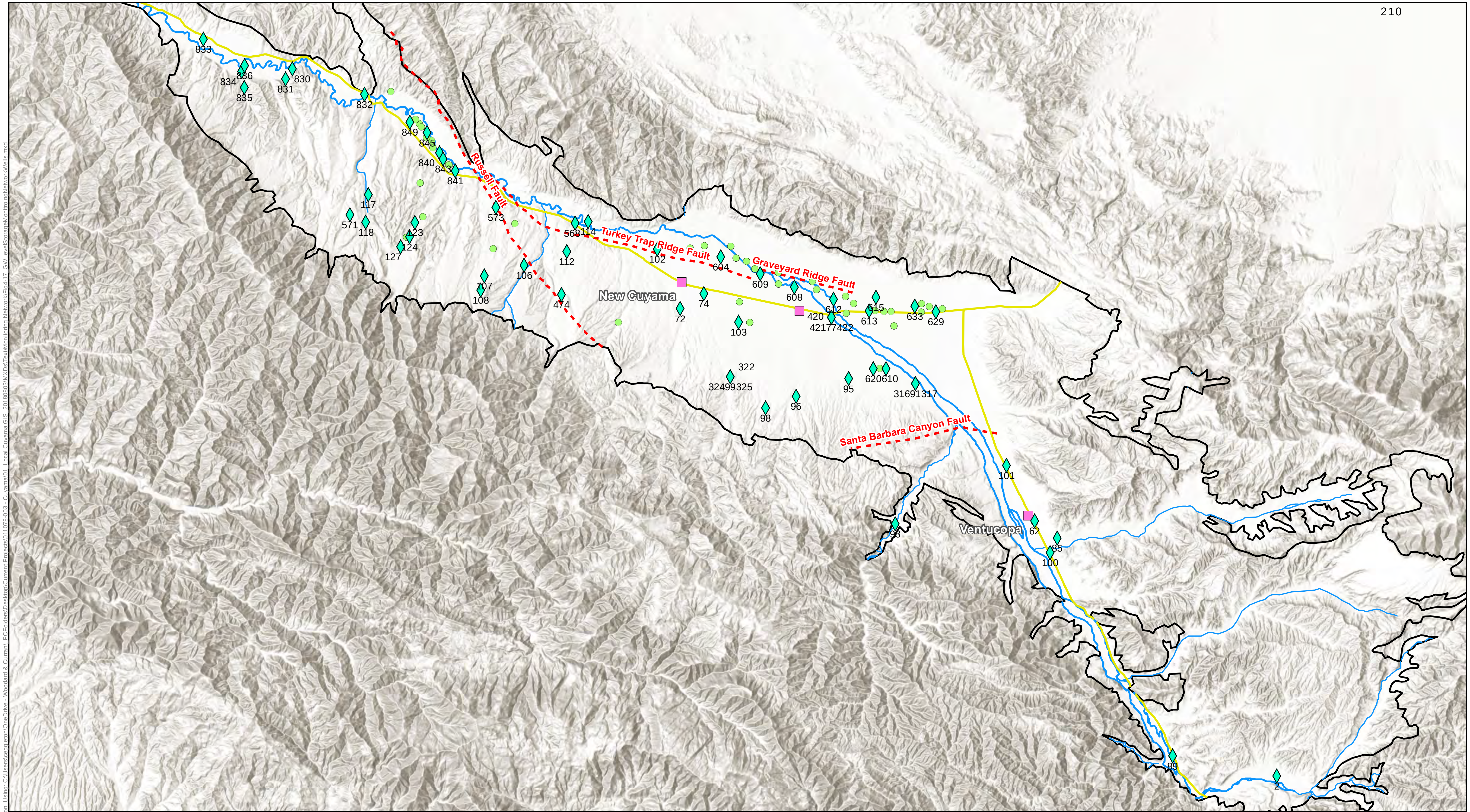

Figure 4-18: Cuyama GW Basin Groundwater Level & Storage Monitoring Network Wells

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4.5.7 Monitoring Protocols

Monitoring protocols for the groundwater level monitoring network are included in Appendix K.

4.5.8 Data Gaps

Groundwater levels monitoring data gaps result from poor spatial distribution of available wells and a lack of well construction information.

The spatial distribution of the groundwater levels monitoring network provides coverage of the majority of the Basin. However, there are several areas, identified by the red ovals in Figure 4-19, that do not have adequate monitoring. Additional monitoring wells added in these areas would provide more information that can be used to detect changes in conditions in the basin.

Well construction information is not available for many wells within the Basin. Monitoring wells with construction information featuring total depth and screened interval are preferred, because that information is useful in understanding what monitoring measurements mean in terms of basin conditions at different depths.

4.5.9 Plan to fill data gaps

This GSP identifies a number of activities to increase the robustness of the groundwater level monitoring network.

The CBGSA has been awarded a Proposition 1 Category 1 Grant, which includes a task to expand the groundwater level monitoring network. This task includes identification of additional monitoring wells for hand measurements as well as installation of continuous monitoring equipment into ten existing wells, which can be used to augment the existing monitoring network. This task will both increase the spatial coverage of the monitoring network and the temporal coverage in the wells with additional continuous monitoring.

The Cuyama Basin GSA has applied for assistance from DWR's Technical Support Services (TSS), which provides support GSAs as they develop GSPs. Opportunities within the TSS include the installation of new monitoring wells and downhole video logging. New wells drilled by DWR's TSS will improve the density and sampling frequency for level monitoring within the Basin. Downhole video logging will provide more well construction information to better utilize well data within the Basin. As of this writing, the DWR TSS program has not provided any TSS services for the Cuyama Basin.

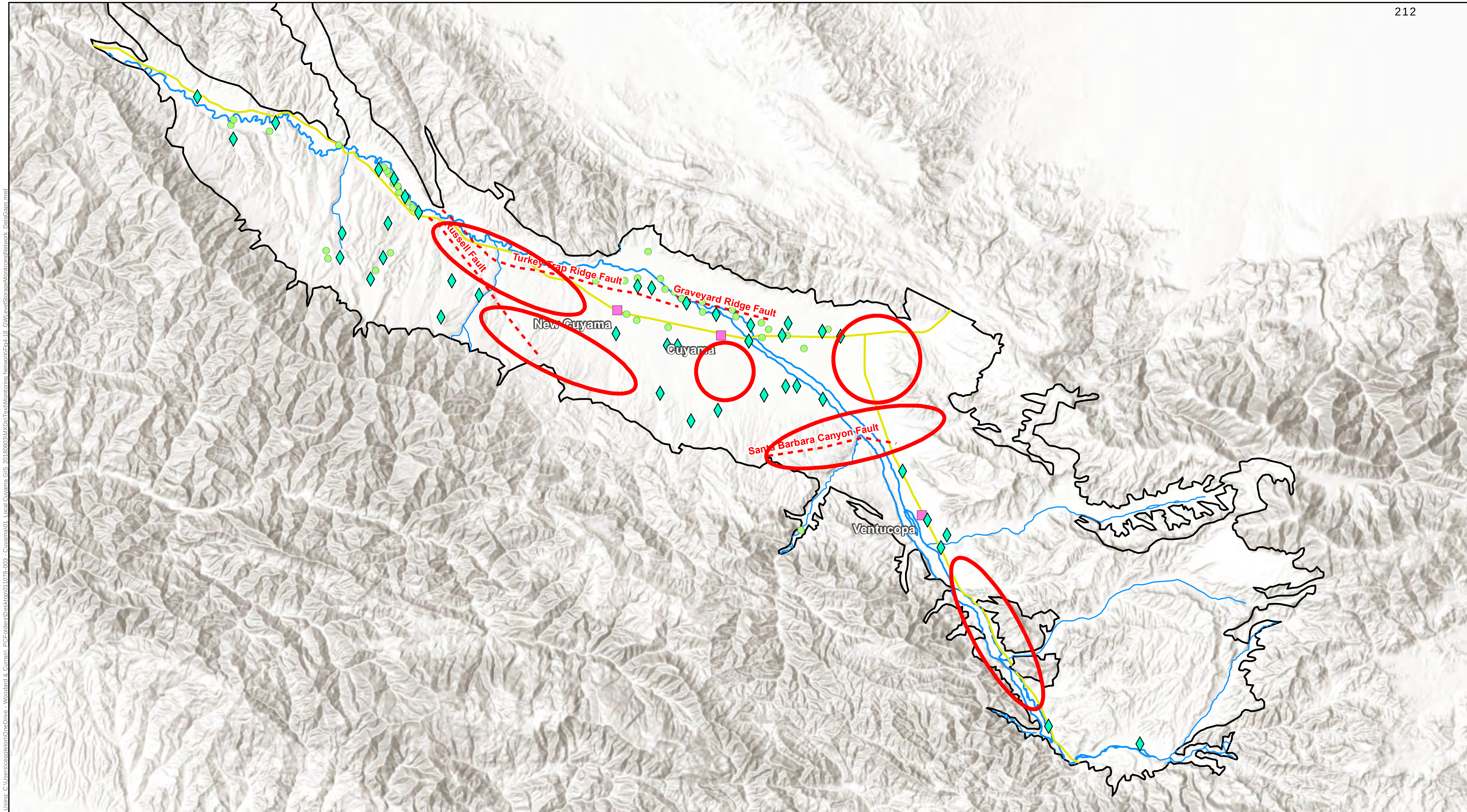

Figure 4-19: Cuyama GW Basin Groundwater Level & Storage Monitoring Network Data Gaps

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- Cuyama Basin
- Towns
- Faults
- Highways
- Cuyama River
- Streams

Monitoring Network Wells

- Representative Wells
- Monitoring Network Wells

4.6 Groundwater Storage Monitoring Network

Groundwater in storage is monitored through the measurement of groundwater levels. Therefore, the groundwater storage monitoring network will use the groundwater level monitoring network. Thresholds for groundwater storage will be discussed in Section 5.

4.7 Seawater Intrusion Monitoring Network

The Cuyama Groundwater Basin is geographically and geologically isolated from the Pacific Ocean and any other large source of saline water. Thus, the Basin is not at risk for seawater intrusion. Salinity is monitored as part of the groundwater quality network, but seawater intrusion is not a concern for the Basin.

4.8 Degraded Groundwater Quality Monitoring Network

Salinity (measured as TDS), arsenic, and nitrates have all been identified by local stakeholders as potentially being of concern for water quality in the Basin. However, as noted in the Groundwater Conditions section, there have only been two nitrate measurements and fewer than ten arsenic measurements in recent years that exceeded MCLs. In the case of arsenic, the high concentration measurements have been taken either at CCSD Well #2 (which is no longer in operation) or at groundwater depths of greater than 700 feet, outside of the range of pumping for drinking water. Furthermore, unlike with salinity, there is no evidence to suggest a causal nexus between potential actions under the GSA's authority and arsenic or salinity. Therefore, the groundwater quality network has been established to monitor for salinity but does not include arsenic or nitrates at this time.

4.8.1 Management Areas

Management Areas have not been selected at the time of writing this GSP section. Management Areas allow flexibility in establishing monitoring networks both spatially and temporally to match conditions and use in the management area. At this time, it is recommended due to the sparsity of monitored sites to use the same monitoring network selection criteria across all management areas in the basin.

4.8.2 Monitoring Sites Selected for Monitoring Network

Table 4-17 lists the monitoring sites selected for the groundwater quality monitoring network by monitoring group. Monitoring sites selected for inclusion into the network were monitored within the years of 2008-2018. Many additional monitoring sites have been monitored for salinity, however, they were not monitored in the last 10 years, indicating that they are unlikely to be monitored again by that monitoring agency. Note that due to duplication of wells being in both USGS and DWR's networks, the total number of selected groundwater quality networks wells (64) is less than the sum of wells shown in Table 4-18.

Monitoring Data Maintaining Entity	Number of Wells Selected for Monitoring Network
NWQC, USGS, ILRP	43
GAMA, DWR	20
BCWPD	7
Private Landowner	11
Total	**64**

Note: Total does not equal sum of rows due to duplicate entries in multiple databases

Table 4-18: Groundwater Quality Monitoring Sites by Source

4.8.3 Monitoring Frequency

The Basin, in coordination with partnering agencies, will compile salinity samples once a year,.

Monitoring agencies such as the USGS and DWR were contacted to inquire about when they would next monitor their sites for groundwater quality, including salinity. The agencies communicated that they 'usually' monitor annually, but the timing of that monitoring is not set and changes from year to year. Additionally, depending on funding and staff availability, there may be years where no groundwater quality monitoring is conducted by an agency.

Although DWR does not provide specific recommendations on the frequency of monitoring in relationship to aforementioned groundwater characteristics, however, concentrations of groundwater quality, especially salinity, do not fluctuate significantly throughout a year to require multiple samples per year.

4.8.4 Spatial Density

DWR's *Monitoring Networks and Identification of Data Gaps BMP* states "The spatial distribution must be adequate to map or supplement mapping of known contaminants." Using this guidance, professional judgement was used to identify representative wells within each management area. Heavily pumped areas, such as the central portion of the Basin, require additional monitoring sites, while areas of lower pumping or less agricultural or municipal groundwater use need less monitoring.

Any well measured from 2008 to June 2018 was included in the Monitoring Network. The entire Monitoring Network was selected as representative monitoring. The selected groundwater quality representative and monitoring wells provide adequate coverage of the Basin's aquifer. The groundwater quality monitoring network is composed of 64 of wells within the Basin. Providing a monitoring site density of 17 sites per 100 square miles. This significantly exceeds the density recommended by reference materials for groundwater level density shown in Table 4-16.

4.8.5 Representative Monitoring

Representative monitoring sites were selected for groundwater quality using the considerations used to select representative groundwater level monitoring wells (Section 4.5.5). Due to the uncertainty of the monitoring frequency, all monitoring network wells were selected to be representative wells in the Groundwater Quality Monitoring Network.

4.8.6 Groundwater Quality Monitoring Network

Figure 4-20 shows the groundwater quality monitoring network and representative and monitoring sites. The Groundwater Quality Monitoring Network is comprised of 64 wells within the Basin, all of which are representative wells.

Table 4-19 shows the wells in the groundwater quality monitoring network. Metadata for the wells is also included.

OPTI ID	Managing Agency as of 2018	Well Construction Date	Well Depth	Hole Depth	Screen Interval	Well Elevation	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count
61*	Department of Water Resources		357.		Unknown	3681	2008-09-25	2008-09-25	0	3
72*	Santa Barbara County Water Agency	1/1/1980	790	820	340 to 350 ft.	2171	2008-09-15	2017-07-14	9	13
73*	Santa Barbara County Water Agency	8/26/1982	880.	1021.	Unknown	2252	2010-08-03	2011-07-12	1	2
74*	Santa Barbara County Water Agency				Unknown	2193	2008-09-17	2017-07-13	9	11
76*	USGS	9/1/1960	720		Unknown	2277	1960-09-22	2008-09-17	48	10
77*	Santa Barbara County Water Agency	12/4/2008	980	1003.5	960 to 980 ft.	2286	2009-04-08	2009-04-08	0	1
79*	USGS		600	750	Unknown	2374	2008-07-08	2011-08-11	3	7
81*	USGS		155.		Unknown	2698	2011-08-16	2011-08-16	0	1
83*	Santa Barbara County Water Agency	1/1/1972	198.		Unknown	2858	2011-08-16	2011-08-16	0	1
85*	Santa Barbara County Water Agency		233		Unknown	3047	1964-02-07	2011-07-12	47	46
86*	USGS	1/1/1995	230.		Unknown	3141				0
87*	USGS		232.		Unknown	3546				0
88*	USGS	9/4/2007	400	400.	Unknown	3549	2011-08-18	2011-08-18	0	1
90*	Santa Barbara County Water Agency	8/8/2006	800	800	Unknown	2552	2008-09-17	2012-09-20	4	6
91*	Santa Barbara County Water Agency	9/29/2009	980	1000	960 to 980 ft.	2474	2009-11-05	2009-11-05	0	1
94*	USGS		550	720	Unknown	2456	2008-07-29	2010-07-29	2	6
95*	Santa Barbara County Water Agency	4/9/2009	805.	825.	Unknown	2449	2011-08-19	2011-08-19	0	1
96*	Santa Barbara County Water Agency	2/1/1980	500		Unknown	2606	2011-08-19	2011-08-19	0	1
98*	Santa Barbara County Water Agency		750.		Unknown	2688	2011-08-16	2011-08-16	0	1
99*	Santa Barbara County Water Agency	9/10/2009	750	906	730 to 750 ft.	2513	2009-11-04	2009-11-04	0	1
101*	Santa Barbara County Water Agency		200	220	Unknown	2741	2008-09-25	2008-09-25	0	3
102*	Santa Barbara County Water Agency				Unknown	2046	2011-08-15	2017-07-13	6	7
130*	USGS				Unknown	3536	2011-08-19	2011-08-19	0	1
131*	USGS				Unknown	2990	2011-08-17	2011-08-17	0	1
157*	USGS		71.0		Unknown	3755				0
196*	USGS		741	755	Unknown	3117				
204*	USGS	1/1/1935			Unknown	3693	2011-08-18	2011-08-18	0	1
226*	USGS	1/1/1971		220.	Unknown	2945	2011-08-18	2011-08-18	0	1
227*	USGS				Unknown	3002	1966-07-01	2011-08-17	45	2
242*	USGS		155	187	Unknown	2933	2012-07-18	2012-07-18	0	1
269*	USGS	1/1/1951			Unknown	2756	2008-09-16	2008-09-16	0	3
309*	USGS	2/2/1980	1100	1100	Unknown	2513	2011-08-11	2011-08-11	0	1
316*	USGS	9/29/2009	830	1000	Unknown	2474	2009-11-05	2009-11-05	0	1
317*	USGS	9/29/2009	700	1000	Unknown	2474	2009-11-05	2009-11-05	0	1
318*	USGS	9/29/2009	610	1000	Unknown	2474	2009-11-04	2009-11-04	0	1
322*	USGS	4/9/2009	850	906	Unknown	2513	2009-11-03	2009-11-03	0	1
324*	USGS	9/10/2009	560	906	Unknown	2513	2009-11-04	2009-11-04	0	1
325*	USGS	9/10/2009	380	906	Unknown	2513	2009-11-04	2009-11-04	0	1
400*	USGS		2120.	2200.	Unknown	2298	1958-05-26	2011-08-15	53	8
420*	USGS	12/4/2008	780	1003.5	Unknown	2286	2009-04-07	2009-04-07	0	1
421*	USGS	12/4/2008	620	1003.5	Unknown	2286	2009-04-07	2009-04-07	0	1
422*	USGS	12/4/2008	460	1003.5	Unknown	2286	2009-04-08	2009-04-08	0	1
424*	USGS		1000.	1020.	Unknown	2291	2011-08-15	2011-08-15	0	1
467*	USGS	1/1/1963	1140.	1215.	Unknown	2224	2012-07-18	2017-07-13	5	6
568*	USGS	1/1/1948	188	188	Unknown	1905	2008-09-15	2008-09-15	0	3

OPTI ID	Managing Agency as of 2018	Well Construction Date	Well Depth	Hole Depth	Screen Interval	Well Elevation	First Measurement Date	Last Measurement Date	Measurement Period (years)	Measurement Count
702*	USGS				Unknown	3539				
703*	USGS				Unknown	1613				
710*	DWR				Unknown	2942				
711*	DWR				Unknown	1905				
712*	DWR				Unknown	2171				
713*	DWR				Unknown	2456				
721*	DWR				Unknown	2374				
758*	DWR				Unknown	3537				
840*	Private Landowner	11/21/2014	900		200 to 880 ft.	1713				
841*	Private Landowner	12/12/2014	600		170 to 580 ft.	1761				
842*	Private Landowner	12/19/2014	450		60 to 430 ft.	1759				
843*	Private Landowner	1/5/2015	620		60 to 600 ft.	1761				
844*	Private Landowner	7/17/2015	730		100 to 720 ft.	1713				
845*	Private Landowner	7/12/2015	380		100 to 360 ft.	1712				
846*	Private Landowner	6/15/2015	610		130 to 590 ft.	1715				
847*	Private Landowner	7/26/2015	600		180 to 580 ft.	1733				
848*	Private Landowner	6/30/2015	390		110 to 370 ft.	1694				
849*	Private Landowner	6/23/2015	570		150 to 550 ft.	1713				
850*	Private Landowner	8/13/2015	790		180 to 780 ft.	1759				

Table 4-19: Wells Included in the Groundwater Quality Monitoring Network

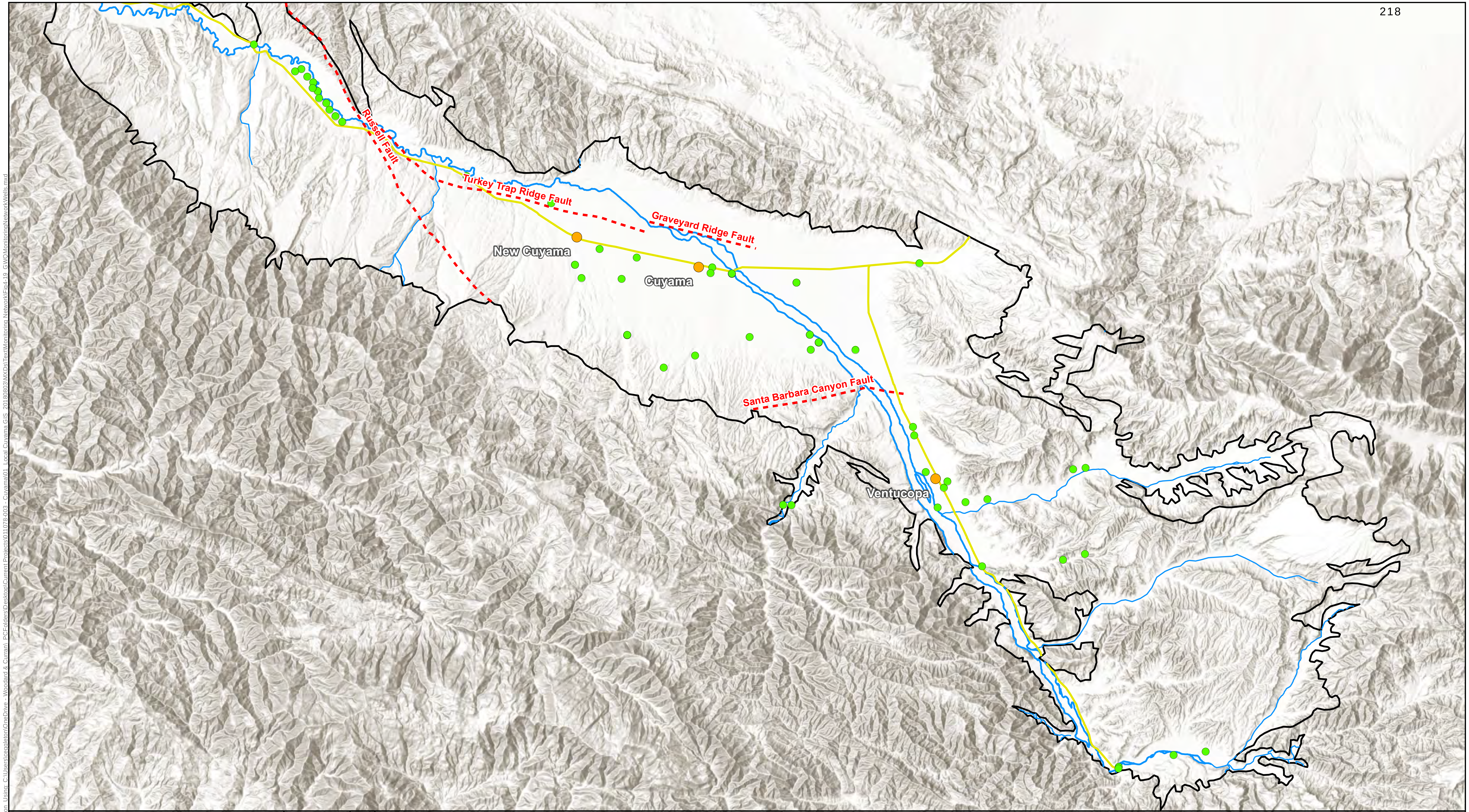

Figure 4-20: Cuyama GW Basin Groundwater Quality Monitoring Network Wells

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- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams
- Faults
- Representative Wells and Groundwater Quality Monitoring Network Wells

All wells included in the Groundwater Quality Monitoiring Network have been measured since 1/1/2008. Wells measured prior to 2008 are not included.

N

0 1.75 3.5 7 Miles

4.8.7 Monitoring Protocols

For recommended additional monitoring recommended in Section 4.8.9, the monitoring protocols will use DWR's *Monitoring Networks and Identification of Data Gaps BMP* which sites the USGS's 1995 publication *Ground-Water Data-Collection Protocols and Procedures for the National Water-Quality Assessment Program: Collection and Documentation of Water-Quality Samples and Related Data* (Appendix A) for the groundwater quality sampling protocols. This publication includes protocols for equipment selection, setup, use, field evaluation, sample collection techniques, sample handling, and sample testing, and is included in Appendix L.

4.8.8 Data Gaps

Groundwater quality monitoring data gaps have three components:

- Spatial distribution of the wells
- Well/measurement depths for three-dimensional constituent mapping
- Temporal sampling

The spatial distribution of the groundwater quality monitoring network provides coverage of several portions of the Basin. There are several areas, identified by the red ovals in Figure 4-21, that do not have adequate monitoring. Additional sampling taken within these identified areas will provide more information about salinity in the indicated locations.

Well construction of wells used in existing salinity sampling efforts is mostly unknown, and the depth of the water used for sampling is not known at most monitoring sites. Additional information about how salinity may change at different depths in the aquifer would be valuable, and requires samples from wells with construction information.

Water quality sampling is currently performed at an insufficient time interval throughout the entire Basin, and therefore the entire Basin is identified as a groundwater quality monitoring temporal data gap. Management entities within the Basin responsible for groundwater quality sampling were contacted by a GSA representative in September 2018, to understand the timing of current monitoring schedules, and whether those management entities were intending to continue quality monitoring in the future. The GSP assumes that all management entities are anticipating continuing with groundwater quality sampling within the Basin, but this will need to be confirmed, as well as the anticipated schedule of sampling by each entity.

4.8.9 Plan to fill data gaps

The CBGSA will fill the temporal and spatial data gaps by implementing its own salinity sampling program, and will fill the well construction knowledge gap at least partially by using DWR's TSS program to perform downhole logging of a subset of wells.

The CBGSA will develop and perform a project to perform annual monitoring of salinity in the basin. This new monitoring program will focus on using wells that have both construction information and pumps installed. Details of the new monitoring program, such as the targeted number and distribution of sampling sites will be detailed as a project in the projects and management actions section of this GSP (Section 6).

DWR provides Technical Support Services (TSS) to support GSAs as they develop GSPs. Downhole video logging performed by the TSS program in existing salinity monitoring wells could provide more well construction information to better utilize well data within the Basin.

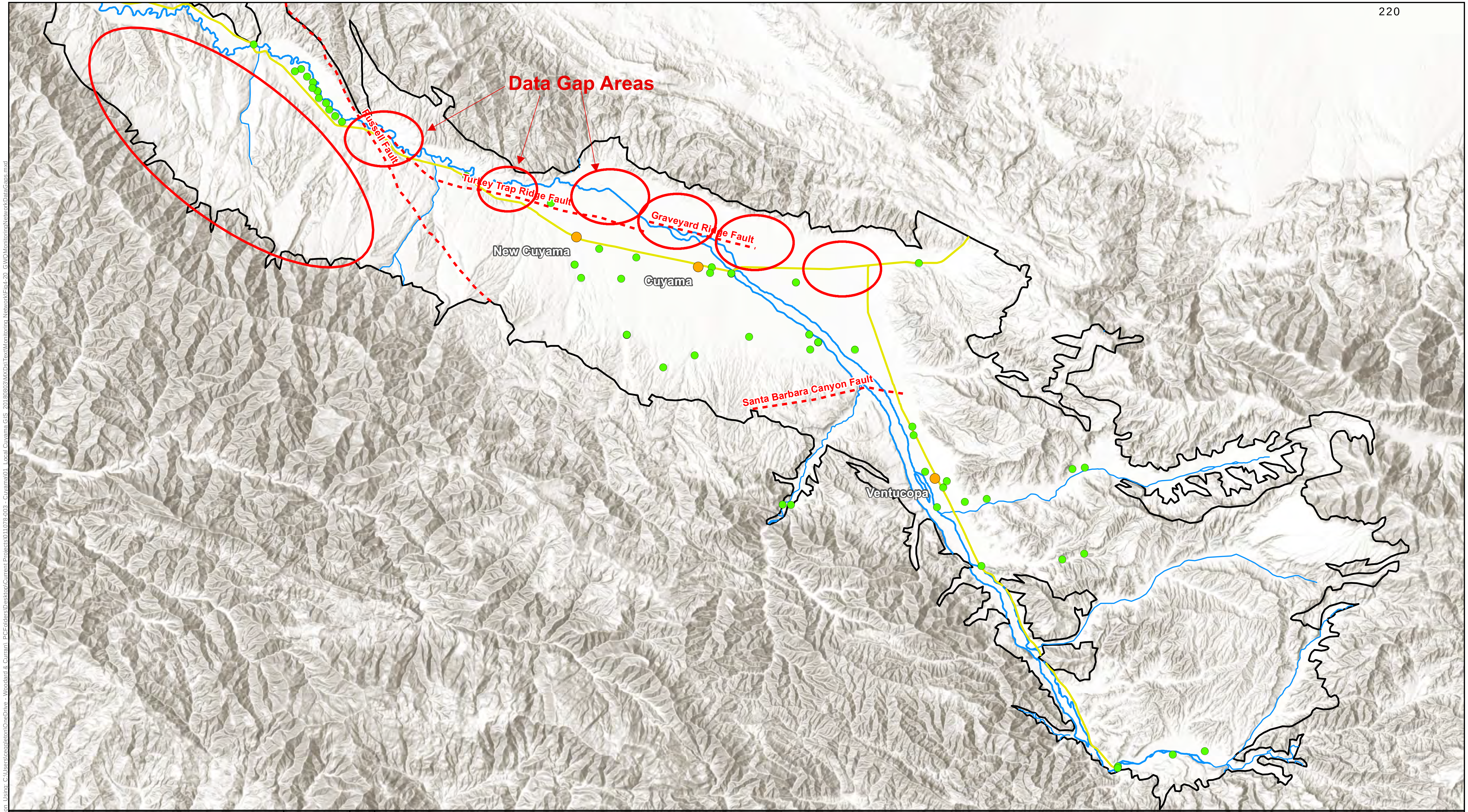

Figure 4-21: Cuyama GW Basin Groundwater Quality Monitoring Network Data Gaps

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Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

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4.9 Land Subsidence Monitoring Network

4.9.1 Management Areas

Management Areas have not been selected at the time of writing this GSP section. Management Areas allow flexibility in establishing monitoring networks both spatially and temporally to match conditions and use in the management area. At this time, it is recommended due to the sparsity of monitored sites to use the same monitoring network selection criteria across all management areas in the basin.

4.9.2 Monitoring Sites Selected for Monitoring Network

There are currently two subsidence monitoring stations within the Basin, and three outside of the Basin. Figure 4-22 shows the locations of existing subsidence monitoring stations, which make up the current subsidence monitoring network. The two stations within the Basin, Sites CUHS and VCST are both include in the monitoring network because they are active and provide Basin specific data. The three stations located outside of the Basin, Sites P521, BCWR, and OZST, are also included in the monitoring network. These stations are important to understand the general dynamic movement trends of the Basin because they detect tectonic movement in the area of the Basin.

4.9.3 Monitoring Frequency

Subsidence monitoring frequencies should capture long-term and seasonal fluctuations in ground level changes. DWR's *Monitoring Networks and Identification of Data Gaps BMP* does not provide specific monitoring frequency or interval guidance. However, CGPS stations allow for data sampling to be taken several times a minute, more than enough for seasonal fluctuations to captured in the data. Long-term trends are easily compiled from continuous data. Therefore, the GSA will utilize the same monitoring frequency currently used by the CGPS stations.

4.9.4 Spatial Density

Because there are currently only two monitoring stations, the current spatial density of subsidence monitoring within the basin is 0.5 stations per 100 miles. These stations are included in Figure 4-22. DWR's *Monitoring Networks and Identification of Data Gaps BMP* does not provide specific spatial density guidelines for subsidence monitoring networks, and thus relies on professional judgment on site identification. Current stations, in and outside of the basin, do not adequately cover the Basin to capture subsidence variations. Potential areas for new stations are discussed further in the following sections.

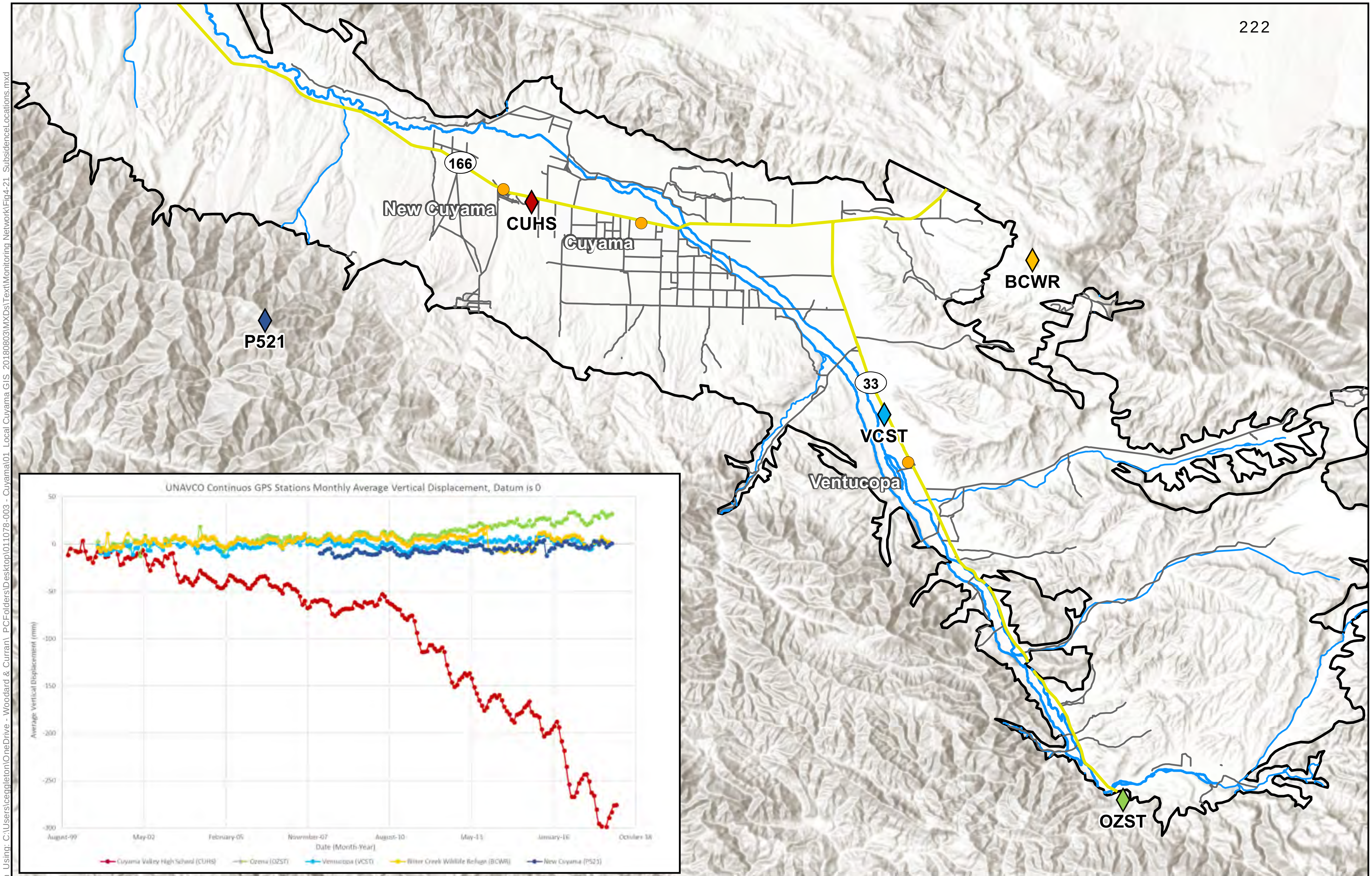

Figure 4-22: Currently Active Subsidence Monitoring Locations

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Legend

- Cuyama Basin
- Towns
- Highways
- Local Roads
- Cuyama River
- Streams

0 2 4 8 Miles

N

Figure Exported: 9/18/2018 By: ceggleton Using: C:\Users\ceggleton\OneDrive - Woodard & Curran\PCFolders\Desktop\011078-003 - Cuyama\01 Local Cuyama GIS 20180803\MXDs\Text\Monitoring Network\Fig4-21 SubsidenceLocations.mxd

4.9.5 Monitoring Protocols

DWR's provided *Monitoring Networks and Identification of Data Gaps GMP* does not provide specific monitoring protocols for subsidence monitoring networks. CGPS station measurements are logged digitally, and depending on the station and network setup, either require downloading at the physical station site or are uploaded automatically to a server. Data management will also depend on the monitoring agency. Current operating stations will continue to be managed by their current entity, and the GSA will be responsible for downloading data on a fixed schedule. The additional of new stations will require procedures for downloading and storing the data as and for providing quality assurance review of the data.

Data should be saved in the Cuyama Basin data management system on a regular annual schedule. All data should be reviewed for quality and logged appropriately.

4.9.6 Data Gaps

New subsidence monitoring sites should be chosen to provide data on areas most at risk for land subsidence. Six potential new site locations were identified within the Basin, as shown in Figure 4-23. These locations were identified by focusing on the areas with significant or new groundwater pumping that did not currently have subsidence monitoring nearby.

A. Identified as an area with relatively new and increased agricultural activity and pumping with no nearby stations.
B. Identified because there are currently no nearby stations and the Russell Fault bisects this area.
C. Identified because of the CCSD and proximity to the heavily pumped central portion of the Basin.
D. Identified because this is the most heavily pumped portion of the Basin and there are currently no nearby stations.
E. Identified because of its proximity to the heavily pumped portion of the Basin, on the north facing slop of the valley. Additionally, there are currently no stations nearby.
F. Identified because this is the transition into the heavily pumped central portion of the Basin near current agricultural pumping. This is also an area with faults.

4.9.7 Plan to fill data gaps

New monitoring sites should be located near areas with the greatest groundwater pumping, or where pumping is new. This is because pumping is the primary driving force for subsidence with the Basin. Although there are multiple ways to measure subsidence, CGPS stations are likely the best option for the Basin. CGPS stations are relatively low cost when compared to labor intensive land surveys, construction of borehole extensometers, and frequent satellite data processing. CGPS stations require comparatively little maintenance and provide continuous information allowing detailed land subsidence analysis.

Increasing data collection on subsidence for the Basin requires the addition of several new CGPS stations. Theses stations can be managed solely by the GSA or can be incorporated into CORS via coronation with USGS. Site selection, equipment, and management will require coordination with USGS

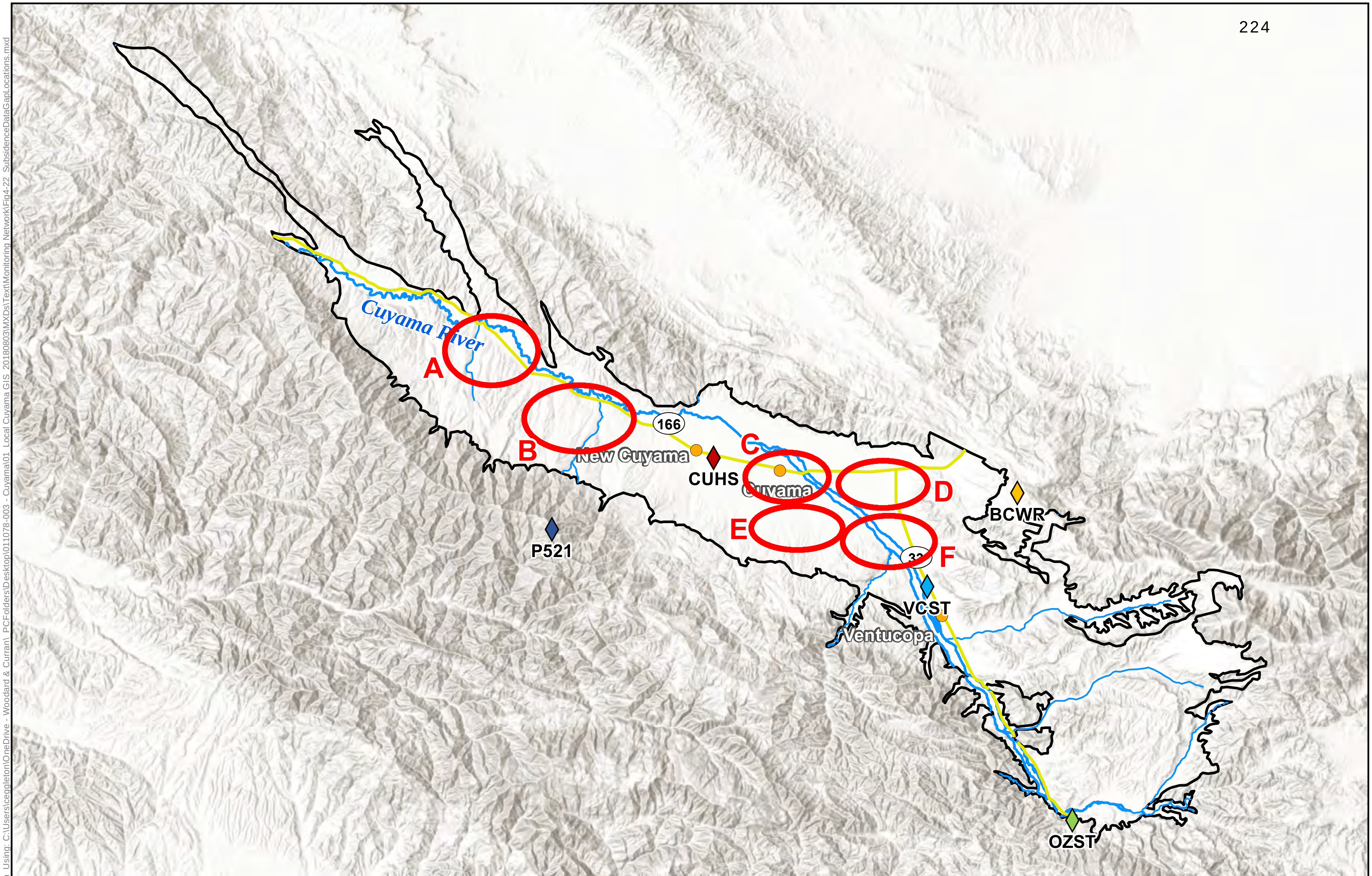

Figure 4-23: Subsidence Monitoring Location Data Gap Areas

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Figure Exported: 9/18/2018 By: ceggleton Using: C:\Users\ceggleton\OneDrive - Woodard & Curran\ PCFolders\Desktop\011078-003 - Cuyama\01_Local Cuyama GIS_20180803\MXDs\Text\Monitoring Network\Fig4-22_SubsidenceDataGapLocations.mxd

4.10 Depletions of Interconnected Surface Water Monitoring Network

Monitoring Networks for depletions of surface water cannot be developed until the numerical modeling effort can inform the GSP about the amounts and locations of depletions. This section will be added prior to plan completion.

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Appendix A - Monitoring Protocols BMP

Appendix B - Water Quality Monitoring Standards From USGS

TO: Standing Advisory Committee
Agenda Item No. 5d

FROM: Brian Van Lienden, Woodard & Curran (W&C)

DATE: January 31, 2019

SUBJECT: Data Management Adoption

Issue
Recommend adoption of the Data Management section.

Recommended Motion
Adopt the Data Management section.

Discussion
An overview of the revised Data Management section is provided as Attachment 1. The comments and responses matrix is provided as Attachment 2, the redline strikeout is provided as Attachment 3, and the revised Monitoring Networks section is provided as Attachment 4.

Cuyama Basin Groundwater Sustainability Agency

Data Management Chapter Adoption

January 31, 2019

Data Management GSP Chapter

- Revised GSP Section provided to SAC and Board for review as part of Board Packet on January 25th
- Revised section reflects responses to comments received on November Draft version
- Data Management System GSP section describes:
  - Overview of the data management system
  - Functionality of the data management system
  - Data included in the data management system
- Seeking recommendation from the SAC for approval by CBGSA Board

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Cuyama Basin DMS
Summary of Public Comments and Responses
January 25, 2019

Comment #	Commenter	Commenter Organization	Section	Section Paragraph #	Paragraph's Sentence #	Sentence Starts with, "…	Comment	Response to Comment
		Comments on DMS Section						
1	Matt Klinchuch	Cuyama Basin Water District	General				The GSP chapter and DMS appear to fulfill the basic requirements of GSP Regulation § 352.6 - Data Management System.	Comment noted. No change required in document.
2	Matt Klinchuch	Cuyama Basin Water District	Table 6-2				All data types within the DMS are listed in Table 6-2, but it is unclear which data are minimum required information (e.g., latitude and longitude) and which are optional parameters (e.g., casing perforations).	The table and text have been revised to indicate required fields.
3	Matt Klinchuch	Cuyama Basin Water District	6.3	3	2	In many cases …	The chapter states "In many cases, there were discrepancies between ground surface elevation (GSE) of the well from different sources. In these cases, the ground surface elevation of the well was updated using the USGS digital elevation model." This might cause problems with calculation of water-level elevations, as the USGS DEM is less precise than surveyed GSE values, and based on a 30 meter by 30 meter horizontal resolution. DEM elevation values are interpolated and averaged within each model element. The use of DEM elevation data could affect assumed groundwater flow directions in areas with shallow groundwater gradients. More information should be provided to demonstrate the adequacy of this approach over evaluating and selecting the most likely of the elevations published in original data sources for the wells. At the least, wells with groundwater elevations calculated using DEM values should be flagged clearly in hydrographs, piezometric surface maps, and other interpretations.	Comment noted. The data used in the model can be re-evaulated in the future as the monitoring network is implemented and more data is available.
4	Matt Klinchuch	Cuyama Basin Water District	General				For "more detailed" instructions on DMS use, the user is referred to a sparse one-page user guide. Some pertinent details of user interaction and function limits could be provided, for example restrictions on data downloads for review of well construction details.	Comment noted. The Opti User Guide is a 17 page user manual for data managers and is provided separately from the 1 page Opti Quick Start Guide. The User Guide will be linked to the DMS Section upon finalization.
5	Catherine Martin	SLO County	6.2.1 User and Data Access…			Private data is monitoring data…	Please clarify, it is unclear if private data can be edited by ANY private user. Also, how is this performed? For example, is the private data associated to the user type with parcel/well id	The text has been revised for clarity. Sites (wells, gages, etc.) and their associated data (whether private, shared, or published) may only be edited by Administrators and Power Users associated with the Managing Entity.
6	Catherine Martin	SLO County	6.2.2 Data Entry and Validation	1	3	The data is validated using…	Please clarify -Who is performing and verifying the quality control checks?	The text has been revised for clarity. The system runs some validation checks to alert users to potential data quality issues. The data is validated by the Managing Entity's Administrators or Power Users.
7	Catherine Martin	SLO County	6.2.2 Data Entry and Validation - Data Collection…	1	2	In the Data Entry tool, new sites may be added by…	Please explain who is verify the data entry? Is the data being flagged as new, so it can be reviewed later by the GSA Board?	The text has been revised for clarity to match the existing conditions. If process changes are required for GSA Board review, the DMS can be configured to meet those needs during the implementation phase.
8	Catherine Martin	SLO County	6.2.2 Data Entry and Validation - Monitoring Data…			Quality Flag	Please explain the term "Quality Flag" and how is it used and by whom	The text has been revised for clarity. Quality flags are associated with individual measurements and include quality assurance descriptions (e.g., "Pumping", "Can't get tape in casing", etc.). The quality flags should be documented by the person taking the measurement.
9	Catherine Martin	SLO County	6.2.2 Data Entry and Validation - Data Validation	3	2	Users may access partially completed…	Consider adding a note to the bottom of the page to reference that this is a partially completed import validation, in case of data discrepancies.	The text has been revised for clarity. Partially completed logs are currently identified as incomplete in the DMS import logs.
10	Catherine Martin	SLO County	6.3 Data Included in the Data…	2		Groundwater Elevation (2 parameters)…	Please list these parameters. The GSA Board may need this information to resolve any data discrepancies. Can the list of parameters grow?	The text has been revised to list parameters. The list of parameters can grow as the needs of the GSA change over time.
11	Matthew Scrudato	SBCWA	6.2 Functionality of the Data…	2	3	For more detailed instructions on …	Provide a hyperlink to the user's guide here	Comment noted. Hyperlink will be included upon finalizing and posting the User Guide.
12	Matthew Scrudato	SBCWA	6.2.2 Data Entry and Validation	1	1	To encourage agency and user participation…	This possibly helps maintain consistency but how do these tools improve data quality? Data quality is a function of training, following protocols, and equipment calibrations combined to create defensible data. It even mentions below in Data Validation that these data may not be accurate.	Comment noted. The text has been revised for clarity.
		Comments on topics separate from the DMS Section						
13	Matt Klinchuch	Cuyama Basin Water District	General				Clustering effects. The potential effect of data clustering on conclusions drawn from parts of the network with very high well densities also is not discussed. The well density discussion needs to consider the potential effects of data clustering on conclusions drawn from aggregation of water level data. For example, if Undesirable Results are defined as a certain percentage of monitoring network wells experiencing water levels below their Minimum Thresholds, clustering of wells through intentional "selection of additional wells in heavily pumped areas" may artificially magnify the apparent portion of the basin affected, increasing the likelihood of it being judged as out of compliance with sustainability criteria.	This was accounted for in the selection of wells included in the Representative Monitoring Network, and will be addressed in the Sustainability Thresholds GSP section.
14	Matt Klinchuch	Cuyama Basin Water District	General				A number of properties including well construction details and measuring-point (MP) and ground surface (GS) elevations cannot be queried in the public "Opti" interface. Some of the data can be viewed on a well-by-well basis, but the use of tables and queries is very limited. This lack of transparency makes quantitative evaluation by outside parties difficult.	Comment noted. No change required in document. Will evaluate as enhancements to Opti query tool during implementation phase.
15	Matt Klinchuch	Cuyama Basin Water District	General				Queries seem to hang without producing consistent results depending on the browser used to access the website. For example, the Opti system seems to produce better results using Google Chrome than Mozilla Firefox, and Microsoft Internet Explorer is stated as not compatible at all.	Comment noted. No change required in document. Will evaluate Opti query tool performance.
16	Matt Klinchuch	Cuyama Basin Water District	General				A few queries to test the site's functions revealed some potential structural problems with the DMS. In one example, a query for all wells with Managing Agency = Cuyama Basin GSA returns an extensive list of wells but when the data are downloaded to an Excel format file, only subsidence data for two sites (not wells, apparently) are produced. In another example, a query for Reference ET > 0 appears to be coded into the menu system but running the query produces no records.	Could not reproduce results described. A query for all wells with Managing Entity = "Cuyama Basin GSA" and subsequent Excel export produced expected results. More information is needed to try and identify the issue described. The system is coded for more data types (e.g., Reference ET) than are currently collected for future expansion of data efforts.
17	Catherine Martin	SLO County	6.2 Functionality of the Data…				Please clarify - Does the GSA need agreements with well owner for the information they are supplying? For example, if someone is adding a new well to the DMS, can the board use the well data in their monitoring network? What is the GSA process to approve a new groundwater well for the DMS?	These issues will be addressed during the GSP implementation phase.
18	Catherine Martin	SLO County	6.2.1 User and Data Access…				Please clarify - Does the DMS track what data was changed and by what user?	The data record and user associated with measurement data entry/modification is stored in the DMS but not currently viewable in the tabular data output.

Cuyama Basin DMS
Summary of Public Comments and Responses
January 25, 2019

Comment #	Commenter	Commenter Organization	Section	Section Paragraph #	Paragraph's Sentence #	Sentence Starts with, "...	Comment	Response to Comment
19	Catherine Martin	SLO County	6.2.1 User and Data Access...			System Administrator users manage,,,	Please clarify - Who is the system administrator? Does the GSA need to designate someone?	Currently, the Consultant team is the System Administrator. The GSA can designate a System Administrator as desired.
20	Catherine Martin	SLO County	6.2.1 User and Data Access...			The Cuyama Basin GSA is...	Please clarify term "Cuyama Basin GSA" – Do you mean GSA Board members, Executive Director, or both? Do you need the Board to address this and list who is the managing entity(ies)?	It is currently the Executive Director and GSA consultants. The GSA Board will decide on the appropriate party for managing the DMS in the future.
21	Catherine Martin	SLO County	Table 6-2			Data Collection Site Information	Is there a way to rank the groundwater well locations/elevations on accuracy? For example, rank (1) – accurate with little risk to location/ elevation to rank 3 – not as accurate, considering surveying the groundwater well to verify location/elevation	That ranking does not currently exist in the DMS, but can be added is needed during the implementation phase.
22	Ray Dienzo	SLO County	6.2.2 Data Entry and Validation - Monitoring Data...	1	1	Monitoring data including but not limited to...	Would Land Use data be included in this data set?	Land use is currently not included in this dataset. Additional data needs can be evaluated and potentially included during the implementation phase.
23	Catherine Martin	SLO County	6.2.2 Data Entry and Validation - Data Validation				To help address data questions, is there a column to note who revised or entered the data?	The data record and user associated with measurement data entry/modification is stored in the DMS but not currently viewable in the tabular data output.
24	Catherine Martin	SLO County	6.2.2 Data Entry and Validation - Data Validation	1	2	The entities that maintain the monitoring data...	Who will keep the DMS maintained and updated?	DMS maintenance and update will be determined by the Cuyama Subbasin GSA Board.
25	Catherine Martin	SLO County	6.2.2 Data Entry and Validation - Data Validation	1	2	The entities that maintain the monitoring data...	Please list all assumptions made for the database, such as locations of each well and how they were verified, such as by a GPS survey, lats/logs, google maps, and etc. Consider approaching the GSA Board with a disclaimer on the DMS for data and accuracy.	Comment noted. A disclaimer window has been added upon logging into the DMS.
26	Catherine Martin	SLO County	6.2.2 Data Entry and Validation - Data Validation	2	1	Upon saving the data in the data entry interface...	Can the GSA Board increase the list of data validation checks?	Comment noted. No change required in document. Will work with Cuyama Subbasin GSA to evaluate need for additional data validation checks during implementation phase.
27	Ray Dienzo	SLO County	6.2.3 Visualization and Analysis	1	1	Transparent visualization and analysis	Can it be incorporated into their own DMS system?	There are many options for integrating different DMS systems and functionalities. These options and the exact requirement would need to be identified and evaluated for inclusion during the implementation phase.
28	Catherine Martin	SLO County	6.3 Data Included in the Data...	5	2	Using the DMS data viewing capabilities...	Consider asking the GSA Board, if they would like a list of recommendations to this chapter, such as below. 6.4 RECOMMENDATIONS Recommendation to survey each groundwater well, as discussed on Page 7 of the DWR BMP Groundwater Monitoring Protocols, Standards, and Sites Best Management Practice, December 2016. • The elevation of the Reference Point (RP) on the well casing 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.	Comment noted. This can be addressed by the GSA Board during the implementation phase.
29	Brenon Kelly	Quail Springs Permaculture	General				The Data Management System has been developing with steady improvements being made over time. However, several issues with functionality and the need for more complete data inputs still persist. The wells in the Monitoring Network are not in a viewable layer. And a search by State ID #s is not cross referenced with the Opti ID #s, challenging the users ability to find a particular well.	Comment noted. The DMS will be updated to display wells in the Monitoring Network once the Monitoring Network has been finalized. State Well Numbers and Opti IDs (Site Name) are cross referenced in the Site List. Consultant team will evaluate updating the Query tool to reflect the cross reference and update functionality as needed during the implementation phase.
30	Brenon Kelly	Quail Springs Permaculture	6.2.2 Data Entry and Validation, page 6-2				Although some of the critically important data has be entered, many of the data parameters on table 6-2 are completely blank throughout the DMS. The fields that are most important to understanding the aquifer a particular well might represent is the depth and casing perforation intervals. None of this is available in Opti, yet. I'm told much of this data is in W&C's hands, but are not able to be input due to time & budget. Why can't the wells selected for the Groundwater Level Monitoring Network be viewed as a subset or a seperate layer? Same for any of the other sites in the Monitoring Network? Which wells are the representative Groundwater Quality Monitoring wells? If "The data is validated using a number of quality control checks prior to inclusion in the DMS." What are the QC/QA checks? As we move forward, in order to help promote user confidence in the data stored and published in the DMS, some ground truthing and well site canvassing will be required by a licensed hydrogeologist to verify and complete the understanding of the Monitoring Network wells and their data.	Comments noted. Additional data may be added during the implementation phase. The DMS will be updated to display wells in the Monitoring Network once the Monitoring Network has been finalized. The QC/QA checks performed by the DMS are listed in Section 6.2.2 and include: • Duplicate measurements: The database checks for duplicate entries based on the unique combination of site, data type, date, and measurement value. • Inaccurate measurements: The database compares data measurements against historical data for the site and flags entries that are outside the historical minimum and maximum values. • Incorrect data entry: Data field entries are checked for correct data type, e.g., number fields do not include text, date fields contain dates, etc.
31	Brenon Kelly	Quail Springs Permaculture	6.2.4 Query and Reporting, page 6-5				The query tool does not allow a well to be searched by the various other ID#s like the State Well ID, USGS Code, or CASGEM ID, even when this data is present. This is unnecessarily cumbersome. A cross reference table should be made available if the DMS can't search for it. The Analysis Tools and the toolbox mentioned sounds very helpful but it is not part of the DMS. Will the DMS ever actually offer any of these analysis tools, including contouring, total water budget visualization, and management area tracking?	Enhancements to the Query tool will be evaluated and implemented as needed during the plan implementation phase. The tools discussed in the DMS section of the GSP are currently available for non-public users. Access will be granted for Monitoring Entities and their associated users to these tools. Additional tools will be made available as needed during the implementation phase.
32	Matthew Scrudato	SBCWA	6.1 Overview of the Cuyama Basin....	2	3	The site may be accessed here:	Where will this site ultimately reside? It shouldn't be in the system of W&C, nor should their name be part of this URL. Does the GSA own the DMS and will it have access once W&C's contract ends?	To be determined by the Cuyama Subbasin GSA Board. W&C can direct the DMS to a domain of the GSA's choosing.
33	Matthew Scrudato	SBCWA	6.2.2 Data Entry and Validation - Data Collection...	1	2	In the Data Entry tool, new sites may be added by...	May not want to provide access to create new sites to too many users. This could create issues with overlap.	Comment noted. Access will be determined by Cuyama Subbasin GSA Board.
34	Matthew Scrudato	SBCWA	6.2.2 Data Entry and Validation - Data Collection...	1	3	Existing sites may be updated using the Edit Site...	A feature should be added (similar to the CASGEM portal) which automatically tracks ALL edits to data and site information to include date/time/user/edit.	Comment noted. Will evaluate feasibility and address during implementation phase.

Cuyama Basin DMS
Summary of Public Comments and Responses
January 25, 2019

Comment #	Commenter	Commenter Organization	Section	Section Paragraph #	Paragraph's Sentence #	Sentence Starts with, "...	Comment	Response to Comment
35	Matthew Scrudato	SBCWA	6.2.2 Data Entry and Validation - Data Collection…	2	1	The information that is collected for sites…	Many of these items could use additional clarification for the user and entity inputting these data. Examples include………. 1)-Lat/Long-accuracy and how was the information obtained. Cell phone, GPS, DGPS, etc. NAD27 or NAD83, or…….? 2)-Accuracy of GSE and how was the information obtained? NAVD29 or NAVD88 or….?	Comment noted. Will evaluate feasibility and address during implementation phase.
36	Matthew Scrudato	SBCWA	6.2.2 Data Entry and Validation - Monitoring Data…				Can we add a function to upload photos and measurement field notes? Storing this original data and viewing changes to the well head over many years will be useful. I can't tell if these are options, but additional things to add to this list are…… 1)-Time of measurement. 2)-Status (pumping, nearby pumping, dry, flowing, etc) 3)-Accuracy of measurement 4)-Equipment used to make the measurement (steel tape, electric tape, etc.) and was this equipment calibrated? Calibration paperwork should be loaded to this data portal for reference. 5)-Things noted in Supplemental Info are mentioned in Table 6.2 and linked to the well. These shouldn't be changed during measurements unless the reference point changed as a result of breaking or modification.	Comment noted. Will evaluate feasibility and address during implementation phase.
37	Matthew Scrudato	SBCWA	6.2.2 Data Entry and Validation - Data Validation	1	1	Quality control helps ensure the integrity….	Data validation is a huge issue in the basin, but we understand this section is strictly related to the DMS. Possibly a footnote explaining this issue with data quality should be provided to the user. Possibly verification/statement that certain protocols were followed when making the measurement? Additionally, data quality can be better verified by adding entries which……… 1)-indicate data accuracy (0.01 ft, 0.1 ft, 0.5 ft, to the nearest foot, etc). 2)-equipment calibration 3)-where two consecutive measurements completed? 4)-availability of field notes	Comment noted. Will evaluate feasibility and address during implementation phase.
38	Unknown	SBCWA	6.2.2 Data Entry and Validation - Data Validation	2		Inaccurate measurements: The database…	Many of the historical data were collected by private entities with no QA/Q processes in place. In addition, in a declining basin, one would expect to continually see entries outside the historical minimum values.	Comment noted. No change required in document.
39	Matthew Scrudato	SBCWA	6.2.2 Data Entry and Validation - Data Validation	3	3	This allows a second person to also access the…	There should be confirmation that 2 individuals reviewed these data. Possibly an option for a second user to login and initial that the data have been visually confirmed.	Comment noted. Will evaluate feasibility and address during implementation phase.
40	Mike Post		General				Where there are multiple data sources for one site that the most negative data be assumed as the most accurate pending implementation of the monitoring system	Comment noted. Will evaluate feasibility and address during implementation phase.

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan Data Management System Draft

Prepared by:

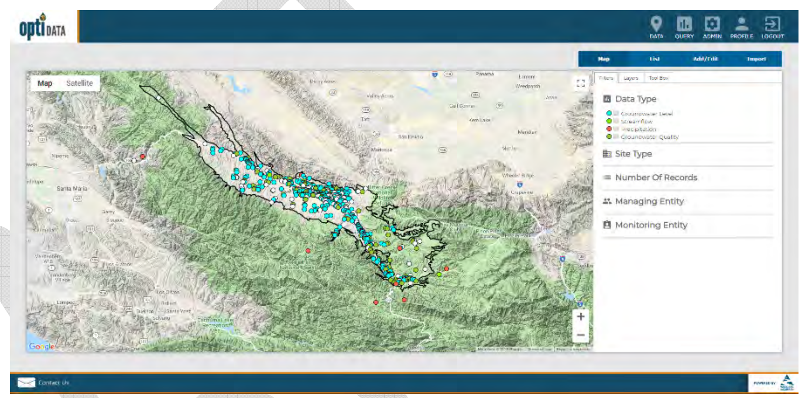
~~November 2018~~January 2019

Chapter 6 Data Management System

This chapter includes the Data Management System Section that satisfies § 352.6 of the Sustainable Groundwater Management Act Regulations. This section contains three main subsections:

- Overview of the Cuyama Basin Data Management System
- Functionality of the Data Management System
- Data Included in the Data Management System

6.1 Overview of the Cuyama Basin Data Management System



The Cuyama Basin Data Management System (DMS) is implemented using the Opti platform. The DMS serves as a data sharing portal to enable utilization of the same data and tools for visualization and analysis to support sustainable groundwater management and transparent reporting of data and results.

The DMS is web-based and publicly accessible using common web browsers including Google Chrome, Firefox, and Microsoft Edge. It is a flexible and open software platform that utilizes familiar Google maps and charting tools for analysis and visualization. The site may be accessed here: http://opti.woodardcurran.com/cuyama

6.2 Functionality of the Data Management System

The DMS is a modular system that includes numerous tools to support GSP development and ongoing implementation, including:

- User and Data Access Permissions
- Data Entry and Validation
- Visualization and Analysis
- Query and Reporting

The DMS can be configured for additional tools and functionality as the needs of the GSA change over time. The following sections briefly describe the currently configured tools. For more detailed instructions on the usage of the DMS, please refer to the Opti User Guide.

6.2.1 User and Data Access Permissions

User access permissions are controlled through several user types that have different roles in the DMS as summarized in Table 6-1 below. These user types are broken into three high-level categories:

- System Administrator users manage information at a system-wide level, with access to all user accounts and entity information. System Administrators can set and modify user access permissions when an entity is unable to do so.

- Managing Entity (Administrator, Power User, User) users are responsible for managing their entity's site/monitoring data and can independently control access to this data. Entity users can view and edit their entity's data and view (not edit) shared or published data of other entities. An entity's site information (wells, gages, etc.) and associated data may only be edited by Administrators and Power Users associated with the entity. Note: *The Cuyama Basin GSA is currently configured as the Managing Entity for all datasets.*
- Public users may view data that is published but may not edit any information. These users may access the DMS using the Guest Login feature on the login screen.

Monitoring sites and their associated datasets are added to the DMS by Managing Entity Administrators or Power Users. In addition to the user permissions, ~~data~~ access to the monitoring datasets is ~~also~~ controlled through three options:

- Private data is monitoring data that is only available for viewing ~~and editing~~, depending on user type, by the entity's- associated users ~~that is managing the data~~ in the DMS.
- Shared data is monitoring data that is available for viewing by all users in the DMS (excludes Public Users).
- Public data is monitoring data that is available publicly and can be viewed by all user types in the DMS and may be published to other sites or DMSs as needed.

The Managing Entity Administrators have the ability to set and maintain the data access options for each dataset associated with their entity.

Modules/Submodules	System Administrators	Entity			Public
		Admin	Power User	User	
Data: Map	●	●	●	●	○
Data: List	●	●	●	●	○
Data: Add/Edit	●	●	●		
Data: Import	●	●	●		
Query	●	●	●	●	○
Admin	●				
Profile	●	●	○	○	○

● Indicates access to all functionality, ○ Indicates access to partial functionality (see explanations in following sections)

Table 6-1: Data Management System User Types

6.2.2 Data Entry and Validation

To encourage agency and user participation in the DMS, data entry and import tools are easy-to-use, accessible over the web, and help maintain data ~~quality~~ consistency and standardization. The DMS allows Entity Administrators and Power Users to enter data either manually via easy-to-use interfaces, or through an import tool utilizing Excel templates, ensuring data may be entered into the DMS as soon as possible after collection. The data is validated by Managing Entity's Administrators or Power Users using a number of quality control checks prior to inclusion in the DMS.

Data Collection Sites

Site information is input for groundwater wells, stream gages, and precipitation meters manually either through the Data Entry tool or when prompted in the Import tool. In the Data Entry tool, new sites may be added by clicking on New Site. Existing sites may be updated using the Edit Site tool. During data import, the sites associated with imported data are checked by the system against the existing site list in the DMS. If the site is not in the existing site list, the user is prompted to enter the information via the New Site tool before the data import can proceed.

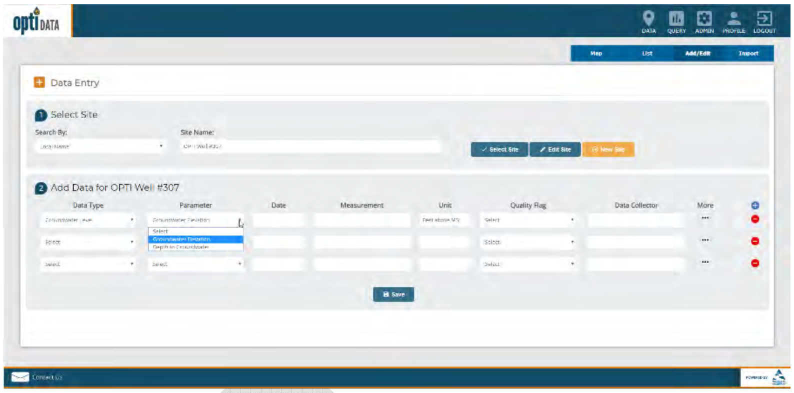
The information that is collected for sites is shown in Table 6-2. Required fields are indicated with an asterisk.

Basic Info	Well Info	Construction Info
Site Type* ~~Local~~ Opti Site Name* Local Site Name~~ID~~* Additional Name Latitude/Longitude* Description County Managing Entity* Monitoring Entity* Type of Monitoring Type of Measurement Monitoring Frequency	State Well ID MSC (Master State Well Code) USGS Code CASGEM ID Ground Surface Elevation (ft) Reference Point Elevation (ft) Reference Point Location Reference Point Description Well Use Well Status Well Type Aquifers Monitored Groundwater Basin Name/Code Groundwater Elevation ~~Start~~Begin/~~/~~End Date Groundwater Elevation Measurement Count Water Level Measurement Method Groundwater Quality ~~Start~~Begin/~~/~~End Date Groundwater Quality Measurement Count Comments	Total Well Depth Borehole Depth Casing Perforations Top/Bottom Elevation Casing Diameter Casing Modifications Well Capacity Well Completion Report Number Comments

*** Required fields; all other fields are optional**

Table 6-2: Data Collection Site Information

Monitoring Data Entry



Monitoring data including but not limited to groundwater elevation, groundwater quality, streamflow, and precipitation, may be input either manually through the Data Entry tool or using templates in the Import tool. The Data Entry tool allows users to select a site and add data for the site using a web-based tool. The following information is collected:

- Data Type (e.g. groundwater elevation, groundwater quality, streamflow, or precipitation)
- Parameter for selected Data Type, units populate based on selection
- Date of Measurement
- Measurement Value
- Quality Flag (e.g. quality assurance description for the measurement such as "Pumping", "Can't get tape in casing", etc. as documented by the Data Collector)
- Data Collector
- Supplemental Information based on Data Type (e.g. Reference Point Elevation, Ground Surface Elevation, etc.)

Data import templates include the same data entry fields and are available for download from the DMS. The Excel-based templates contain drop down options and field validation similar to the data entry interface.

Data Validation

Quality control helps ensure the integrity of the data added to the DMS. The entities that maintain the monitoring data that were loaded into the DMS may have performed previous validation of that data; no effort was made to check or correct that previous validation and it was assumed that all data provided was valid. While it is nearly impossible to determine complete accuracy of the data added to the DMS since the DMS cannot detect incorrect measurements due to human error or mechanical failure, it is possible to verify that the data input into the DMS meets some data quality standards. This helps promote user confidence in the data stored and published for visualization and analysis.

Upon saving the data in the data entry interface or importing the data using the Excel templates, the following data validation checks are performed by the DMS:

- Duplicate measurements: The database checks for duplicate entries based on the unique combination of site, data type, date, and measurement value.
- Inaccurate measurements: The database compares data measurements against historical data for the site and flags entries that are outside the historical minimum and maximum values.
- Incorrect data entry: Data field entries are checked for correct data type, e.g., number fields do not include text, date fields contain dates, etc.

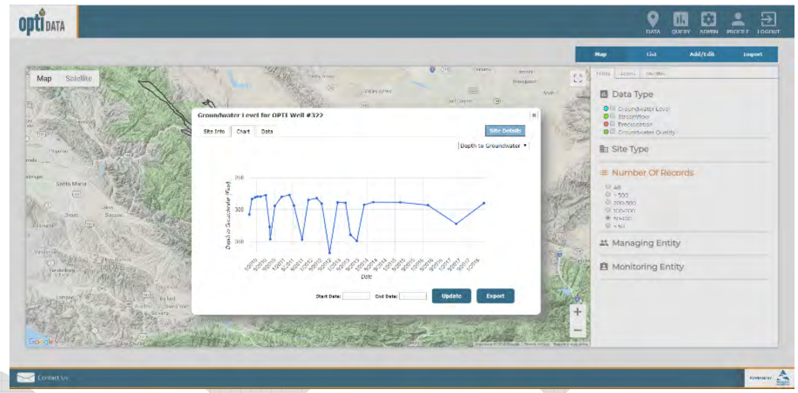
Users are alerted to any validation issues and may either update the data entries or accept the values and continue with the entry/import. Users may access partially completed import validation through the import logs that are saved for each data import. The partially imported data are identified in the Import

Log with an incomplete icon under the Status field. This allows a second person to also access the imported data and review prior to inclusion in the DMS.

6.2.3 Visualization and Analysis

Transparent visualization and analysis tools enable utilization of the same data and methodologies, allowing stakeholders and neighboring GSAs to use the same data and methods for tracking and analysis. In the Cuyama DMS, data visualization and analysis are performed in both Map and List views.

Map View



The Map view displays all sites (groundwater wells, stream gages, precipitation meters, etc.) in a map-based interface. The sites are color coded based on associated data type and may be filtered by different criteria such as number of records or monitoring entity. Users may click on a site to view the site detail information and associated data. The monitoring data is displayed in both chart and table formats. In these views, the user may select to view different parameters for the data type. The chart and table may be updated to display selected date ranges, and the data may be exported to Excel.

List View

The List view displays all sites (groundwater wells, stream gages, precipitation meters, etc.) in a tabular interface. The sites are listed according to site names and associated entities. The list can be sorted and filtered by different criteria such as number of records or monitoring entity. Similar to the Map view, users may click on a site to view the site detail information and associated data. The monitoring data is displayed in both chart and table formats. In these views, the user may select to view different parameters for the data type. The chart and table may be updated to display selected date ranges, and the data may be exported to Excel.

Analysis Tools

The Toolbox is available in the Map view and offers Administrative and Entity users access to the Well Tiering tool to support monitoring plan development. The flexibility of the DMS platform allows for future analysis tools, including contouring, total water budget visualization, and management area tracking.

6.2.4 Query and Reporting

The DMS has the ability to format and export data and analysis at different levels of aggregation, and in different formats, to support local decision making and for submission to various statewide and local programs (i.e., SGMA, CASGEM, GAMA, etc.).

Ad-hoc Query

The data in the DMS can be queried and reported using the Query Tool. The Query Tool includes the ability to build ad-hoc queries using simple options. The data can be queried by:

- Monitoring or Managing Entity
- Site Name
- Data Type

Once the type of option is selected, the specific criteria may be selected, e.g., groundwater elevation greater than 100 ft. Additionally, users may include time periods as part of the query. The query options can build upon each other to create reports that meet specific needs. Queries may be saved and will display in the saved query drop-down for future use.

The query results are displayed in a map format and a list format. In both the map and list views, the user may click on a well to view the associated data. The resulting data of the query may be exported to Excel.

Standard Reports

The DMS can be configured to support wide-ranging reporting needs through the Reports Tool. Standard report formats may be generated based on a predetermined format and may be created at the click of a button. These report formats may be configured to match state agency requirements for submittals, including annual reporting of monitoring data that must be submitted electronically on forms provided by the Department of Water Resources.

6.3 Data Included in the Data Management System

Many monitoring programs exist at both the local and state/federal levels. A cross-sectional analysis was conducted within the basin to document and assess the availability of data within the basin, as well as statewide or federal databases that provide data relevant to Basin.

The DMS can be configured to include a wide variety of data types and associated parameters. Based on the analysis of existing datasets within the basin and the GSP needs, the ~~following~~ data types shown in the table below were identified and are currently ~~included~~ configured in the DMS.~~:~~

~~Groundwater Quality (17 parameters)~~
~~Streamflow (1 parameter)~~
~~Precipitation (1 parameter)~~
~~Subsidence (1 parameter)~~

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Elevation	Depth to Groundwater	feet	Yes
	Groundwater Elevation	feet	Yes
Groundwater Quality	Total Dissolved Solids (TDS)	MG/L	Yes
	Nitrate (NO3)	MG/L	Yes
	Arsenic	UG/L	Yes
	Benzene	UG/L	
	Chloride	MG/L	
	Hexavalaent Chromium (CR6)	UG/L	
	Dibromochloropropane (DBCP)	UG/L	
	Methyl Tertiary Butyl Ether (MTBE)	UG/L	
	Perchlorate	UG/L	
	Tetrachloroethylene (PCE)	UG/L	
	Specific Electrical Conductivity (SC)	UMHOS/CM	
	1,1,1-Trichloroethane (111-TCA)	UG/L	
	Trichloroethylene (TCE)	UG/L	
	1,2,3-Trichloropropane (123-TCP)	UG/L	
	CL	PPM	

	EC	Mmhos	
	TDS	PPM	
Streamflow	Streamflow	CFS	Yes
Precipitation	Precipitation	inches	Yes
	Reference Evapotranspiration (ETo)		
	Average Air Temperature		
Subsidence	Subsidence	Vertical (mm)	Yes

Table 6-3: Data ~~Collection Site Information~~Types and Their Associated Parameters Configured in the DMS

Additional data types and parameters can be added and modified as the DMS grows over time.

The data was collected from a variety of sources, as shown in Table 6-3 below. Each dataset was reviewed for overall quality and consistency prior to consolidation and inclusion in the database. In many cases, there were discrepancies between the ground surface elevation (GSE) of the well from different sources. In these cases, the ground surface elevation of the well was updated using the USGS digital elevation model (DEM).

The groundwater wells shown in the DMS are those that are included data sets provided by the monitoring data sources shown below for groundwater elevation and quality. These do not include all wells currently used for production and may include wells historically used for monitoring that do not currently exist. Care was taken to minimize duplicative wells in the DMS. As datasets were consolidated, sites were evaluated based on different criteria (e.g., naming conventions, location, etc.) to determine if the well was included in a different dataset. Datasets for the wells were then associated with the same well, where necessary.

After the data was consolidated and reviewed for consistency, it was loaded into the DMS. Using the DMS data viewing capabilities, the data was reviewed for completeness and consistency to ensure the imports were successful.

Data Source	Datasets Collected	Date Collected	Activities Performed
US Geological Survey (USGS)	• Groundwater Elevation • Streamflow • Precipitation	5/4/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
Department of Water Resources (DWR) CASGEM/Water Data Library (WDL)	• Groundwater Elevation	4/18/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
San Luis Obispo County	• Groundwater Elevation • Groundwater Quality	4/2/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
Santa Barbara County Water Agency	• Groundwater Elevation • Precipitation	3/27/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
Ventura County	• Groundwater Elevation • Groundwater Quality • Precipitation	3/8/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
DWR Natural Resources Agency	• Groundwater Quality	6/14/2018	• Removed duplicate records
GeoTracker	• Groundwater Quality	6/5/2018	• Removed duplicate records
California Environmental Data Exchange Network (CEDEN)	• Groundwater Quality	8/29/2018	• Removed duplicate records
National Water Quality Monitoring Council	• Groundwater Quality	6/1/2018	• Removed duplicate records
UNAVCO	• Ground Surface Elevation	3/12/2018	• None
Local Data	• Groundwater Elevation • Groundwater Quality • Other	Various	• Removed duplicate records • Recalculated GSE based on DEM on select wells

Table 6-3: Sources of Data Included in the Data Management System

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan Data Management System Draft

Prepared by:

January 2019

Chapter 6 Data Management System

This chapter includes the Data Management System Section that satisfies § 352.6 of the Sustainable Groundwater Management Act Regulations. This section contains three main subsections:

- Overview of the Cuyama Basin Data Management System
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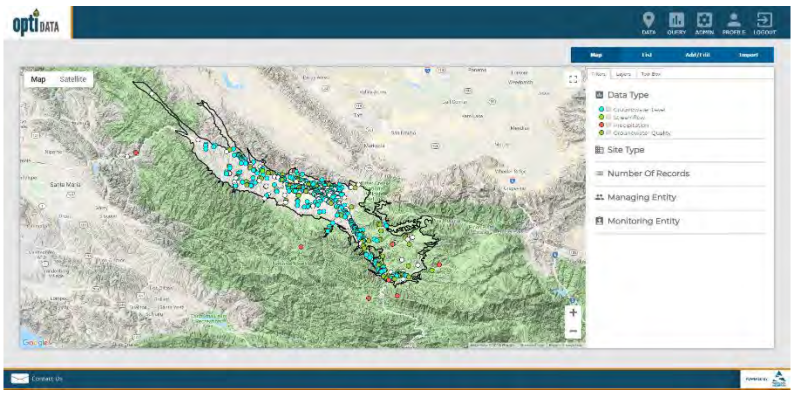
6.1 Overview of the Cuyama Basin Data Management System

The Cuyama Basin Data Management System (DMS) is implemented using the Opti platform. The DMS serves as a data sharing portal to enable utilization of the same data and tools for visualization and analysis to support sustainable groundwater management and transparent reporting of data and results.



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Data: List	●	●	●	●	○
Data: Add/Edit	●	●	●		
Data: Import	●	●	●		
Query	●	●	●	●	○
Admin	●				
Profile	●	●	○	○	○

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6.2.2 Data Entry and Validation

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The information that is collected for sites is shown in Table 6-2. Required fields are indicated with an asterisk.

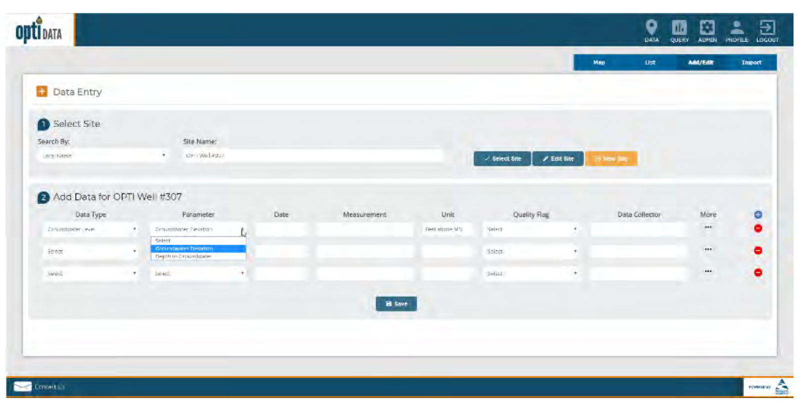
Basic Info	Well Info	Construction Info
Site Type*	State Well ID	Total Well Depth
Opti Site Name*	MSC (Master State Well Code)	Borehole Depth
Local Site Name*	USGS Code	Casing Perforations Top/Bottom Elevation
Additional Name	CASGEM ID	Casing Diameter
Latitude/Longitude*	Ground Surface Elevation (ft)	Casing Modifications
Description	Reference Point Elevation (ft)	Well Capacity
County	Reference Point Location	Well Completion Report Number
Managing Entity*	Reference Point Description	Comments
Monitoring Entity*	Well Use	
Type of Monitoring	Well Status	
Type of Measurement	Well Type	
Monitoring Frequency	Aquifers Monitored	
	Groundwater Basin Name/Code	
	Groundwater Elevation Begin/End Date	
	Groundwater Elevation Measurement Count	
	Water Level Measurement Method	
	Groundwater Quality Begin/End Date	
	Groundwater Quality Measurement Count	
	Comments	

*** Required fields; all other fields are optional**

Table 6-2: Data Collection Site Information

Monitoring Data Entry

Monitoring data including but not limited to groundwater elevation, groundwater quality, streamflow, and precipitation, may be input either manually through the Data Entry tool or using templates in the Import tool. The Data Entry tool allows users to select a site and add data for the site using a web-based tool. The following information is collected:



- Data Type (e.g. groundwater elevation, groundwater quality, streamflow, or precipitation)
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- Measurement Value
- Quality Flag (e.g. quality assurance description for the measurement such as “Pumping”, “Can’t get tape in casing”, etc. as documented by the Data Collector)
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- Supplemental Information based on Data Type (e.g. Reference Point Elevation, Ground Surface Elevation, etc.)

Data import templates include the same data entry fields and are available for download from the DMS. The Excel-based templates contain drop down options and field validation similar to the data entry interface.

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- Duplicate measurements: The database checks for duplicate entries based on the unique combination of site, data type, date, and measurement value.
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- Incorrect data entry: Data field entries are checked for correct data type, e.g., number fields do not include text, date fields contain dates, etc.

Users are alerted to any validation issues and may either update the data entries or accept the values and continue with the entry/import. Users may access partially completed import validation through the import logs that are saved for each data import. The partially imported data are identified in the Import Log with an incomplete icon under the Status field. This allows a second person to also access the imported data and review prior to inclusion in the DMS.

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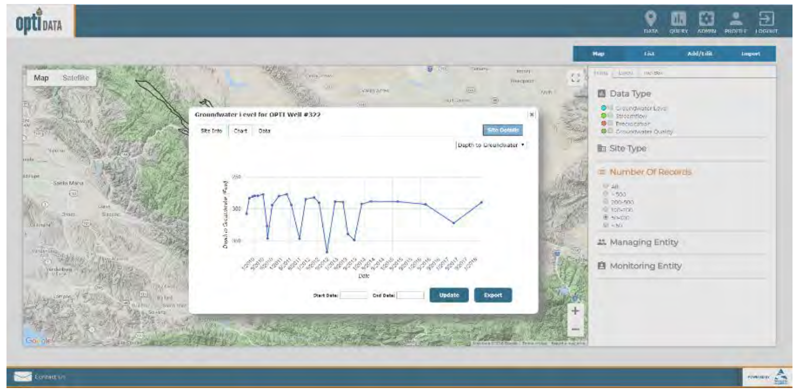
Transparent visualization and analysis tools enable utilization of the same data and methodologies, allowing stakeholders and neighboring GSAs to use the same data and methods for tracking and analysis. In the Cuyama DMS, data visualization and analysis are performed in both Map and List views.

Map View



The Map view displays all sites (groundwater wells, stream gages, precipitation meters, etc.) in a map-based interface. The sites are color coded based on associated data type and may be filtered by different criteria such as number of records or monitoring entity. Users may click on a site to view the site detail information and associated data. The monitoring data is displayed in both chart and table formats. In these views, the user may select to view different parameters for the data type. The chart and table may be updated to display selected date ranges, and the data may be exported to Excel.

List View

The List view displays all sites (groundwater wells, stream gages, precipitation meters, etc.) in a tabular interface. The sites are listed according to site names and associated entities. The list can be sorted and filtered by different criteria such as number of records or monitoring entity. Similar to the Map view, users may click on a site to view the site detail information and associated data. The monitoring data is displayed in both chart and table formats. In these views, the user may select to view different parameters for the data type. The chart and table may be updated to display selected date ranges, and the data may be exported to Excel.

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The Toolbox is available in the Map view and offers Administrative and Entity users access to the Well Tiering tool to support monitoring plan development. The flexibility of the DMS platform allows for future analysis tools, including contouring, total water budget visualization, and management area tracking.

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The DMS has the ability to format and export data and analysis at different levels of aggregation, and in different formats, to support local decision making and for submission to various statewide and local programs (i.e., SGMA, CASGEM, GAMA, etc.).

Ad-hoc Query

The data in the DMS can be queried and reported using the Query Tool. The Query Tool includes the ability to build ad-hoc queries using simple options. The data can be queried by:

- Monitoring or Managing Entity
- Site Name
- Data Type

Once the type of option is selected, the specific criteria may be selected, e.g., groundwater elevation greater than 100 ft. Additionally, users may include time periods as part of the query. The query options can build upon each other to create reports that meet specific needs. Queries may be saved and will display in the saved query drop-down for future use.

The query results are displayed in a map format and a list format. In both the map and list views, the user may click on a well to view the associated data. The resulting data of the query may be exported to Excel.

Standard Reports

The DMS can be configured to support wide-ranging reporting needs through the Reports Tool. Standard report formats may be generated based on a predetermined format and may be created at the click of a button. These report formats may be configured to match state agency requirements for submittals, including annual reporting of monitoring data that must be submitted electronically on forms provided by the Department of Water Resources.

6.3 Data Included in the Data Management System

Many monitoring programs exist at both the local and state/federal levels. A cross-sectional analysis was conducted within the basin to document and assess the availability of data within the basin, as well as statewide or federal databases that provide data relevant to Basin.

The DMS can be configured to include a wide variety of data types and associated parameters. Based on the analysis of existing datasets within the basin and the GSP needs, the data types shown in the table below were identified and are currently configured in the DMS.

Data Type	Parameter	Units	Currently Has Data in DMS
Groundwater Elevation	Depth to Groundwater	feet	Yes
	Groundwater Elevation	feet	Yes
Groundwater Quality	Total Dissolved Solids (TDS)	MG/L	Yes
	Nitrate (NO3)	MG/L	Yes
	Arsenic	UG/L	Yes
	Benzene	UG/L	
	Chloride	MG/L	
	Hexavalaent Chromium (CR6)	UG/L	
	Dibromochloropropane (DBCP)	UG/L	
	Methyl Tertiary Butyl Ether (MTBE)	UG/L	
	Perchlorate	UG/L	
	Tetrachloroethylene (PCE)	UG/L	
	Specific Electrical Conductivity (SC)	UMHOS/CM	
	1,1,1-Trichloroethane (111-TCA)	UG/L	
	Trichloroethylene (TCE)	UG/L	
	1,2,3-Trichloropropane (123-TCP)	UG/L	
	CL	PPM	
	EC	Mmhos	
	TDS	PPM	
Streamflow	Streamflow	CFS	Yes
Precipitation	Precipitation	inches	Yes
	Reference Evapotranspiration (ETo)		
	Average Air Temperature		
Subsidence	Subsidence	Vertical (mm)	Yes

Table 6-3: Data Types and Their Associated Parameters Configured in the DMS

Additional data types and parameters can be added and modified as the DMS grows over time.

The data was collected from a variety of sources, as shown in Table 6-3 below. Each dataset was reviewed for overall quality and consistency prior to consolidation and inclusion in the database. In many cases, there were discrepancies between the ground surface elevation (GSE) of the well from different sources. In these cases, the ground surface elevation of the well was updated using the USGS digital elevation model (DEM).

The groundwater wells shown in the DMS are those that are included data sets provided by the monitoring data sources shown below for groundwater elevation and quality. These do not include all wells currently used for production and may include wells historically used for monitoring that do not currently exist. Care was taken to minimize duplicative wells in the DMS. As datasets were consolidated, sites were evaluated based on different criteria (e.g., naming conventions, location, etc.) to determine if the well was included in a different dataset. Datasets for the wells were then associated with the same well, where necessary.

After the data was consolidated and reviewed for consistency, it was loaded into the DMS. Using the DMS data viewing capabilities, the data was reviewed for completeness and consistency to ensure the imports were successful.

Data Source	Datasets Collected	Date Collected	Activities Performed
US Geological Survey (USGS)	• Groundwater Elevation • Streamflow • Precipitation	5/4/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
Department of Water Resources (DWR) CASGEM/Water Data Library (WDL)	• Groundwater Elevation	4/18/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
San Luis Obispo County	• Groundwater Elevation • Groundwater Quality	4/2/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
Santa Barbara County Water Agency	• Groundwater Elevation • Precipitation	3/27/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
Ventura County	• Groundwater Elevation • Groundwater Quality • Precipitation	3/8/2018	• Removed duplicate records • Recalculated GSE based on DEM on select wells
DWR Natural Resources Agency	• Groundwater Quality	6/14/2018	• Removed duplicate records
GeoTracker	• Groundwater Quality	6/5/2018	• Removed duplicate records
California Environmental Data Exchange Network (CEDEN)	• Groundwater Quality	8/29/2018	• Removed duplicate records
National Water Quality Monitoring Council	• Groundwater Quality	6/1/2018	• Removed duplicate records
UNAVCO	• Ground Surface Elevation	3/12/2018	• None
Local Data	• Groundwater Elevation • Groundwater Quality • Other	Various	• Removed duplicate records • Recalculated GSE based on DEM on select wells

Table 6-3: Sources of Data Included in the Data Management System

TO: Standing Advisory Committee
Agenda Item No. 5e

FROM: Mary Currie, Catalyst Group

DATE: January 31, 2019

SUBJECT: Stakeholder Engagement Update

Issue
Update on the Cuyama Basin Groundwater Sustainability Agency Groundwater Sustainability Plan stakeholder engagement.

Recommended Motion
None – information only.

Discussion
Cuyama Basin Groundwater Sustainability Agency (CBGSA) Groundwater Sustainability Plan (GSP) outreach consultant the Catalyst Group's stakeholder engagement update is provided as Attachment 1.

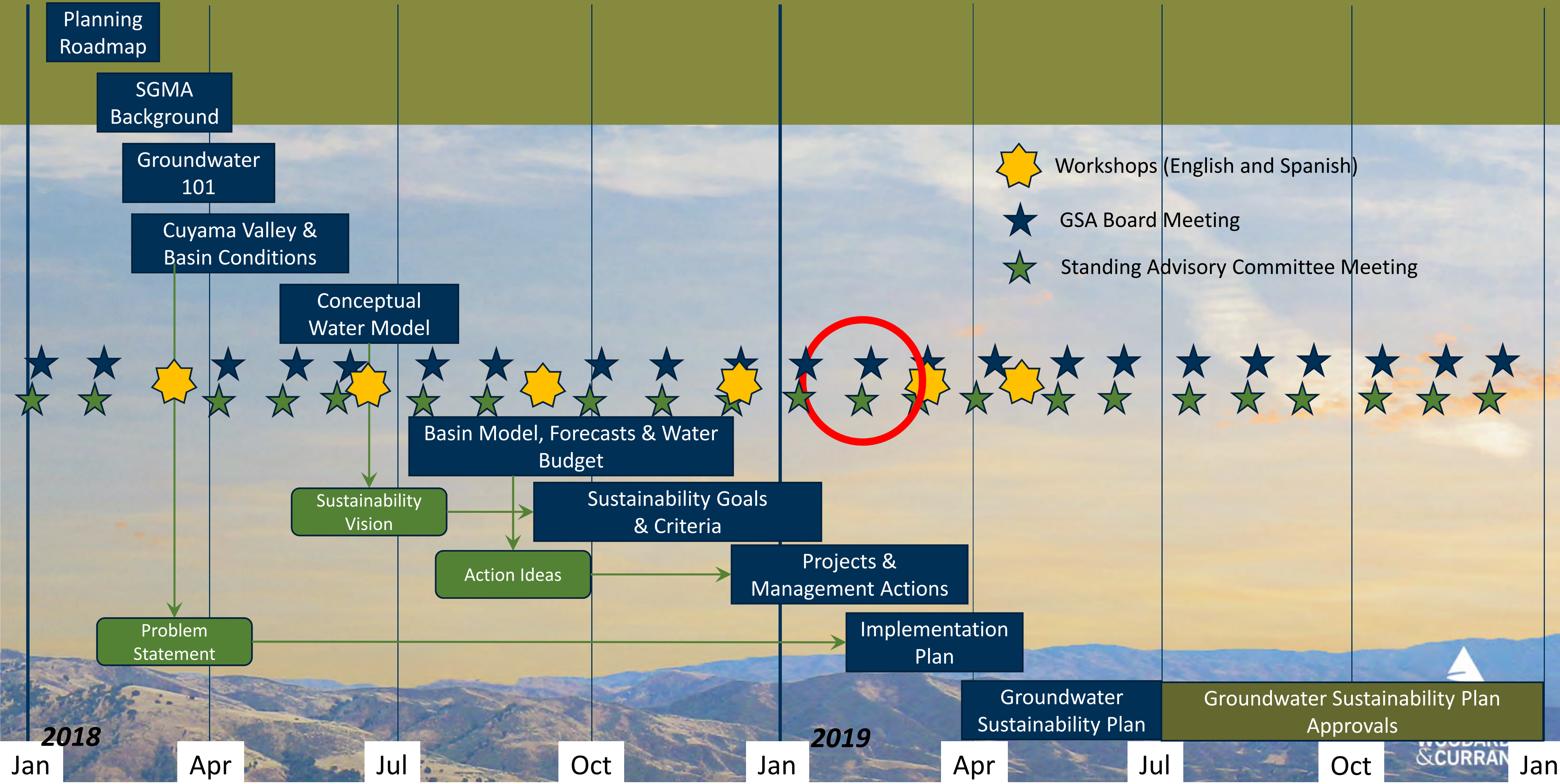
Cuyama Basin Groundwater Sustainability Agency

Groundwater Sustainability Plan Stakeholder Engagement Update

January 31, 2019

WOODARD & CURRAN

Cuyama Basin Groundwater Sustainability Plan – Planning Roadmap



Update on Outreach Activities

- Community Workshops Wednesday, March 6, 2019
  - Update on Water Budget and Numerical Model
  - Projects and Management Actions
  - Implementation Plan

- GSA Newsletter Distributed February 1
  - Email to GSA contact list
  - With February-April 2019 Cuyama Recreation Center Newsletter

WOODARD & CURRAN

TO: Standing Advisory Committee
Agenda Item No. 6b

FROM: Jim Beck, Executive Director

DATE: January 31, 2019

SUBJECT: Board of Directors Agenda Review

Issue
Review of the February 6, 2019 Cuyama Basin Groundwater Sustainability Agency Board of Directors agenda.

Recommended Motion
None – information only.

Discussion
The February 6, 2019 Cuyama Basin Groundwater Sustainability Agency Board of Directors agenda is provided as Attachment 1 for review.

Attachment 1

CUYAMA BASIN GROUNDWATER SUSTAINABILITY AGENCY BOARD OF DIRECTORS

Board of Directors

Derek Yurosek Chairperson, Cuyama Basin Water District
Lynn Compton Vice Chairperson, County of San Luis Obispo
Das Williams Santa Barbara County Water Agency
Cory Bantilan Santa Barbara County Water Agency
Glenn Shephard County of Ventura
Zack Scrivner County of Kern
Paul Chounet Cuyama Community Services District
George Cappello Cuyama Basin Water District
Byron Albano Cuyama Basin Water District
Jane Wooster Cuyama Basin Water District
Tom Bracken Cuyama Basin Water District

AGENDA

February 6, 2019

Agenda for a meeting of the Cuyama Basin Groundwater Sustainability Agency Board of Directors to be held on Wednesday, February 6, 2019 at 4:00 PM, at the Cuyama Valley Family Resource Center, 4689 CA-166, New Cuyama, CA 93254. To hear the session live call (888) 222-0475, code: 6375195#.

The order in which agenda items are discussed may be changed to accommodate scheduling or other needs of the Board or Committee, the public, or meeting participants. Members of the public are encouraged to arrive at the commencement of the meeting to ensure that they are present for discussion of all items in which they are interested.

In compliance with the Americans with Disabilities Act, if you need disability-related modifications or accommodations, including auxiliary aids or services, to participate in this meeting, please contact Taylor Blakslee at (661) 477-3385 by 4:00 p.m. on the Friday prior to this meeting. Agenda backup information and any public records provided to the Board after the posting of the agenda for this meeting will be available for public review at 4689 CA-166, New Cuyama, CA 93254. The Cuyama Basin Groundwater Sustainability Agency reserves the right to limit each speaker to three (3) minutes per subject or topic.

	1.	Call to Order (Compton) (1 min)
	2.	Roll Call (Blakslee) (1 min)
	3.	Pledge of Allegiance (Compton) (1 min)
	4.	Approval of Minutes (Compton) (3 min)
Motion		a. January 9, 2019
Memo	5.	Report of the Standing Advisory Committee (Jaffe) (3 min)
Memo	6.	Technical Forum Update (Melton) (3 min)
	7.	Groundwater Sustainability Plan
Memo		a. Groundwater Sustainability Plan Update (Melton) (60 min)
		i. Water Budget Update
		ii. Preliminary Discussion on Project and Management Actions
		iii. Presentation on Groundwater Dependent Ecosystems

M/M		b. Monitoring Networks Adoption (Melton) (5 min)
M/M		c. Data Management Adoption (Melton) (5 min)
Memo		d. Stakeholder Engagement Update (Gardiner) (5 min)
	8.	Groundwater Sustainability Agency
Verbal		a. Report of the Executive Director (Beck) (3 min)
Memo		b. Progress & Next Steps (Beck) (3 min)
Verbal		c. Report of the General Counsel (Hughes) (2 min)
Motion		i. Election of Officers (Hughes) (5 min)
	9.	Financial Report
Memo		a. Financial Management Overview (Blakslee/Beck) (3 min)
Memo		b. Financial Report (Blakslee) (3 min)
M/M		c. Annual Insurance Coverage (Blakslee) (3 min)
Memo		d. Annual Audit (Blakslee) (3 min)
M/M		e. Payment of Bills (Blakslee) (3 min)
	10.	Reports of the Ad Hoc Committees (3 min)
	11.	Directors' Forum (3 min)
	12.	Public comment for items not on the Agenda (5 min)

At this time, the public may address the Board on any item not appearing on the agenda that is within the subject matter jurisdiction of the Board. Persons wishing to address the Board should fill out a comment card and submit it to the Board Chair prior to the meeting.

13. Adjourn (6:06 pm)