CUYAMA BASIN GROUNDWATER SUSTAINABILITY AGENCY

STANDING ADVISORY COMMITTEE

Committee Members

AGENDA

June 28, 2018

Agenda for a meeting of the Cuyama Basin Groundwater Sustainability Agency Standing Advisory Committee to be held on Thursday, June 28, 2018 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 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 4853 Primero Street, New Cuyama, California. 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 (Jaffe) (1 min)
2. Roll Call (Jaffe) (1 min)
3. Pledge of Allegiance (Jaffe) (2 min)
4. Approval of Minutes (Jaffe) (2 min)
5. Report of the General Counsel (Hughes) (2 min)
6. Groundwater Sustainability Agency
    a. Report of the Executive Director (Beck) (5 min)
    b. SGMA Educational Items: (Melton/Van Lienden) (25 min)
        i. What is a Management Area?
        ii. What Makes a Good Monitoring Network?
    c. Board of Directors Agenda Review (Beck) (5 min)
7. Groundwater Sustainability Plan
    a. Groundwater Sustainability Plan Update (Melton/Van Lienden) (25 min)
    b. Technical Forum Update (Melton) (5 min)
    c. **Action** – Description of the Plan Area (Van Lienden) (5 min)

d. Hydrogeologic Conceptual Model (Van Lienden) (20 min)

e. Stakeholder Engagement Update (Gardiner/Currie) (30 min)

i. Update on Workshops

ii. Discussion on Sustainability

8. Items for Upcoming Sessions (2 min)

9. Committee Forum (2 min)

10. 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.

11. Adjourn (6:12 p.m.)

Cuyama Basin Groundwater Sustainability Agency

Acronyms List

BOD	Board of Directors
CA	California
CASGEM	California Sustainable Groundwater Elevation Monitoring
CB	Cuyama Basin
CBGSA	Cuyama Basin Groundwater Sustainability Agency
CBWD	Cuyama Basin Water District
CCSD	Cuyama Community Services District
CDEC	California Data Exchange Center
CVCA	Cuyama Valley Community Association
CVRD	Cuyama Valley Recreation District
DMS	Data Management System
DWR	California Department of Water Resources
EKI	EKI Environment & Water, Inc.
ET	Evapotranspiration
FRC	Cuyama Valley Family Resource Center
FY	Fiscal Year
GAMA	Groundwater Ambient Monitoring and Assessment Program
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HG	Hallmark Group (Executive Director)
ITRC	Irrigation Training & Research Center
IWFM	Integrated Water Flow Model
JPA	Joint Exercise Powers Agreement
Kern	County of Kern
NOAA	National Oceanic and Atmospheric Administration
NWIS	National Water Information System
SAC	Standing Advisory Committee
Santa Barbara	County of Santa Barbara
SBCWA	Santa Barbara County Water Agency
SGMA	Sustainable Groundwater Management Act
SLO	San Luis Obispo County
SWCRB	State Water Resources Control Board
TO	Task Order
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
Ventura	County of Ventura
WC	Woodard & Curran (GSP Development Consultant)
WMA	Water Management Area

Cuyama Basin Groundwater Sustainability Agency Standing Advisory Committee Meeting

May 31, 2018

Draft Meetings Minutes

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

PRESENT:
Jaffe, Roberta – Chair
Kelly, Brenton – Vice Chair
Alvarado, Claudia
DeBranch, Brad
Draucker, Louise
Furstenfeld, Jake
Haslett, Joe
Post, Mike (*telephonic*)
Valenzuela, Hilda Leticia
Beck, Jim – Executive Director
Hughes, Joe – Legal Counsel

ABSENT:
None

1. **Call to order**
   Chair Roberta Jaffe called the Standing Advisory Committee (SAC) to order at 4:02 pm.

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

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

4. **Approval of minutes**
   Cuyama Basin Groundwater Sustainability Agency (CBGSA) Executive Director Jim Beck presented the April 26, 2018 SAC minutes. Minor editorial changes were suggested, and a motion was made by Committee Member Brenton Kelly to approve the revised minutes. The motion was seconded by Committee Member Brad DeBranch and passed by the Committee.

5. **Report of the General Counsel**
   Legal Counsel Joe Hughes provided an update on insurance items. Mr. Hughes stated that the SAC's insurance requirement is being met under the Cuyama Basin Groundwater Sustainability Agency's (CBGSA) policy. He also reported that a safety program is not required since the CBGSA does not have any employees.

6. Report of the Executive Director

a. Report of the Executive Director
Executive Director Jim Beck reported that he met with CBGSA Board of Directors Chairman Derek Yurosek and SAC Chair Roberta Jaffe to formalize how the SAC provides a report to the Board. Chair Yurosek suggested that a brief, summary-type written report, that presents both positions on possible contentious items, would be helpful to the CBGSA Board. Beginning this month and moving forward, Chair Jaffe and Vice Chair Brenton Kelly will prepare a written report that will distributed as an addendum to the Board packet following the SAC meeting. The purpose of this report is to provide the Board with SAC input on the various Groundwater Sustainability Plan (GSP) components/issues that will better equip the Board when making decisions on GSP-related issues.

Mr. Beck reported that he participated on a call regarding the Santa Barbara Integrate Regional Water Management program (IRWM). The IRWM group contacted GSAs in Santa Barbara County to explain the purpose of the IRWM group and to inform the GSAs of the grants that they will be applying for in 2019 for the upcoming implementation period. The initial fee to join the IRWM program is $1,500 to $2,000 per year with potential variance, depending on the size of the organization, quarterly meetings, and staff time to process document review and approval process. Costs to pursue possible implementation grants have not been budgeted within the Fiscal Year 2018-19 budget, but there are contingency funds that could be applied towards these.

Committee member Joe Haslett arrived at 4:15 p.m.

Mr. Beck reported that the Hallmark Group is in the process of submitting the necessary documentation to the California Department of Water Resources (DWR) to receive the grant funds awarded earlier this month.

Mr. Beck let the SAC know that the County of Kern reported that they will be paying their assessment and remaining as a voting member on the CBGSA. Mr. Beck also reported that Kern County will be going through a county-wide election due to a lawsuit. Due to the redistricting of County supervisorial districts, Supervisor David Couch no longer represents the Cuyama Valley and Supervisor Zack Scrivner is the new CBGSA Board member for Kern County. Mr. Scrivner will recommend to his Board that they pay their full assessment of $38,567.66.

Mr. Beck noted that the June assessments will be sent out soon and will be the last participant assessment since DWR reimbursements are expected to start in the 4th quarter of 2018.

Ms. Lynn Carlisle asked Mr. Beck if he is aware of the status of the IRWM grant issued to the Cuyama Community Services District (CCSD). Beck said that he is aware of this, and Ms. Carlisle offered to provide more information on that grant if needed.

Ms. Carlisle asked if the reports will be hosted on the website for public review and Mr. Beck confirmed they will.

b. SGMA Educational Item: What is Sustainability?
On June 6, 2018, GSP Consultant Woodard & Curran Project Manager Brian Van Lienden provided

an update on the educational item entitled "What is Sustainability?" to the joint meeting of CBGSA and SAC. His presentation included an overview of sustainability indicators and the metrics to assess these indicators as required under the Sustainable Groundwater Management Act (SGMA).

Chair Jaffe let attendees know that DWR re-assessed the Cuyama Basin from a medium-priority to a high-priority basin and one of the predominant reasons listed was subsidence issues. Mr. Van Lienden said that they will look closely at subsidence issues as they develop the GSP. Committee member Jake Furstenfeld asked if there is a baseline for these indicators. Mr. Van Lienden replied that SGMA requires a water budget for 10 recent years and this will be the baseline for water levels. Committee member Joe Haslett asked how the subsidence areas will be treated. Van Lienden replied that the SAC will have to determine the appropriate actions and goals for each Water Management Area (WMA). Mr. Van Lienden said that W&C can reach out to residents for goals at the upcoming workshop on June 6th, but the baseline is where we currently are. Mr. Beck commented that this is the stakeholder process and that the CBGSA gets to develop the objectives with stakeholder consensus.

Ms. Lynn Carlisle asked why the baseline is listed as January 1, 2015 and Mr. Beck replied that the baseline is the ending point for data collection that was provided by DWR.

Ms. Lynn Carlisle asked what the timeframe for deciding WMAs is, and Mr. Van Lienden stated by the end of summer. Mr. Back commented that the modelling results will assist in determining if WMAs exist. Committee member Brenton Kelly asked how a minimum threshold is set when there are different depths to groundwater levels occurring naturally across a basin. Mr. Van Lienden said that the CBGSA will need to develop a monitoring network and use representative wells to address the natural groundwater level contours.

Committee Member Draucker asked how the models account for the extreme variability in rainfall. Mr. Van Lienden said that they will be looking at broad hydrology that will allow us to see how the Basin responds to various conditions.

Ms. Carlisle asked who will determine the financial component of achieving measurable objectives. Mr. Beck said that this group will determine the financial component and he expects Woodard & Curran (W&C) to develop a portfolio of options to achieve the measurable objectives the group decides on. Mr. Van Lienden noted that they will be talking about potential programs for meeting measurable objectives in the near future. Vice Chair Kelly asked if this type of analysis is budgeted in the GSP and Mr. Van Lienden confirmed that it is.

Committee Member Draucker asked who enforces various entities to comply with measurable objectives, and Mr. Beck said the CBGSA will. He let the SAC know there are enforcement actions that GSAs are allowed to put into effect, but not police authority.

c. Board of Directors Agenda Review
Mr. Beck provided an overview of the June 6, 2018 CBGSA Board of Directors agenda.

7. Groundwater Sustainability Plan

a. Groundwater Sustainability Plan Update
Mr. Van Lienden provided an update on GSP activities, which is included in the SAC packet.

Chair Jaffe asked what the validation process is for data received and Mr. Van Lienden replied that W&C will look at the GSP activities in the context of the other data received. He also noted that this process is currently being implemented. Committee Member Joe Haslett asked if there is a requirement regarding the quality of well data received since well construction could significantly affect the quality of the data, and Mr. Van Lienden said that there are requirements, but W&C may need assistance in determining the level that specific wells are functioning at.

Ms. Carlisle asked why the SAC does not have data for pumping levels and Ms. Jaffe commented that landowners do not always like to provide pumping levels. Mr. Van Lienden mentioned that W&C can estimate pumping levels, and Mr. Beck noted that this could be a data gap we identify in the GSP and should formulate ways to improve this data going forward.

Committee Member Mike Post said that he is unaware of anything that precludes W&C from developing infrastructure to measure surface water flow.

Committee Member Haslett asked if W&C is taking the seasonability of crops into account. Mr. Van Lienden said they are looking at monthly time periods, which will capture the seasonability factor.

Ms. Carlisle asked if climate change will be factored in the plan. Mr. Van Lienden said yes, and DWR will provide climate data for this variable.

Committee Member DeBranch asked if the Irrigation Training & Research Center (ITRC) data will be publicly available, and Mr. Van Lienden replied that it will.

b. Technical Forum Update

Mr. Van Lienden provided an overview of the May 4, 2018 technical forum call. A summary of the issues discussed is provided in the Board packet.

c. Description of the Plan Area

Mr. Van Lienden provided an overview of the comments received on the Description of the Plan Area.

Ms. Carlisle asked if a red-line-strikeout version of the Description of the Plan Area could be distributed, and Mr. Van Lienden replied that they will distribute this.

Mr. Beck discussed sending out the comment matrix to those that provided comments to review responses to their comments, and then the Hallmark Group will send out a red-line strikeout version for review before a final draft is presented at the June 28, 2018 SAC meeting and July 11, 2018 Board meeting.

d. Stakeholder Engagement Update

GSP Outreach the Catalyst Group's Mary Currie provided an update on stakeholder engagement activity.

A discussion occurred regarding upcoming SAC educational items, and Mr. Van Lienden said that a groundwater monitoring network may be a potential discussion topic. Another education topic identified was a debrief of the upcoming public workshop. Lastly, Mr. Van Lienden said the updated land use and evapotranspiration data is another possible topic for discussion.

Ms. Currie reported that Ms. Carlisle distributed over 500 copies of the upcoming public workshop flyer to residents in the Cuyama Valley.

Committee Member Furstenfeld suggested developing a simple flyer that defines what each different water-related group in Cuyama is and does to clarify any confusion. Ms. Currie said she will work on drafting this.

8. Items for Upcoming Sessions
Nothing to report.

9. Committee Forum
Nothing to report.

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

11. Adjourn
Chair Jaffe adjourned the meeting at 6:04 pm.

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 Thursday, May 31, 2018, by the Cuyama Basing Groundwater Sustainability Agency Standing Advisory Committee.

Jim Beck
Dated: June 28, 2018

TO: Standing Advisory Committee
Agenda Item No. 6b

FROM: Jim Beck, Executive Director

DATE: June 28, 2018

SUBJECT: SGMA Educational Items: What is a Management Area? What Makes a Good Monitoring Network?

Issue

Educational presentation on what defines a Water Management Area and what makes a good monitoring network.

Recommended Motion

None – information only.

Discussion

An educational presentation on what defines a Water Management Area and what makes a good monitoring network is provided as Attachment 1.

Cuyama Basin Groundwater Sustainability Agency

SGMA Educational Items

June 28, 2018

What is a Management Area?

- A management area can be used to:
  - Set different minimum thresholds
  - Set different measurable objectives
  - Set up different density and frequency of monitoring
  - Vary implementation of projects and management actions
- Management areas are optional but may be established at GSA’s discretion
- Management areas increase GSP complexity
- Potential reasons to form one:
  - Jurisdictional boundaries
  - Physical conditions

WOODARD & CURRAN

Theoretical Example

- Basin W:
- Two jurisdictions
  - A (orange)
  - B (purple)

Theoretical Example

- Basin W:
- Two jurisdictions
  - A (orange)
  - B (purple)
- River (blue)

Theoretical Example

- Could have 1 management area (GSP) covering entire basin
  - Both jurisdictions agree upon and coordinate management

Theoretical Example

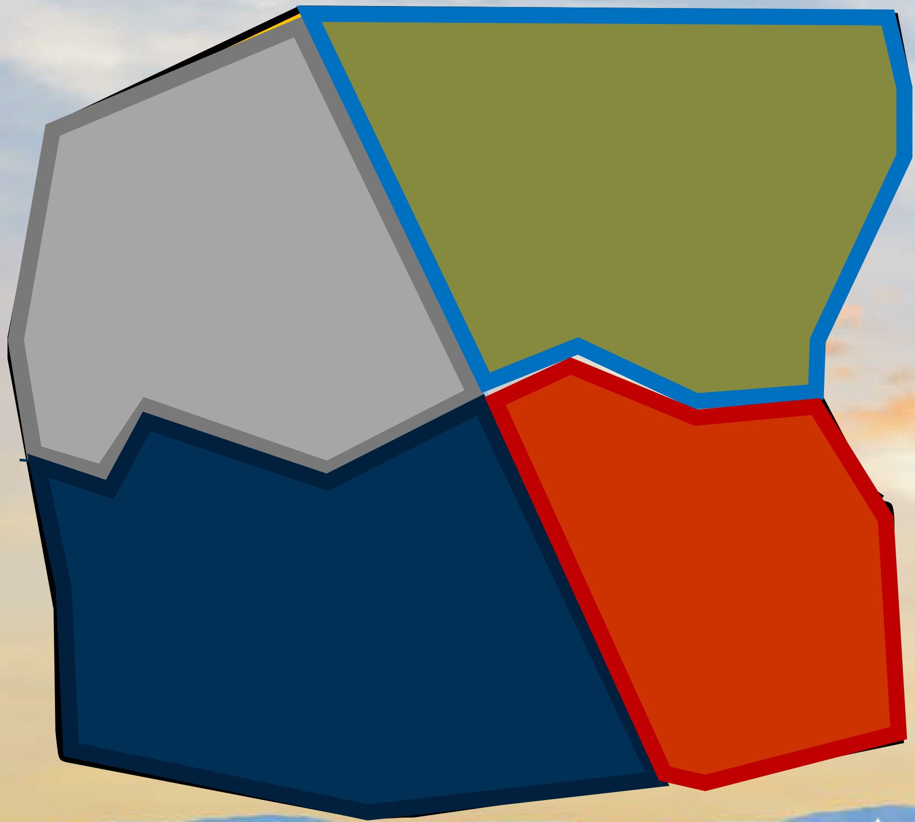
- Could have 2 management areas, one for each jurisdiction
  - Each jurisdiction sets its own management

Theoretical Example

- Could have 2 management areas, one north of the river, and one south of the river
  - jurisdictions would agree and collaborate on management in each area

Theoretical Example

- Could have 4 management areas
  - Each jurisdiction establishes management for each MA in their area



For the Cuyama Groundwater Basin

- Potential Jurisdictional Boundaries
  - Cuyama Community Services District
  - Cuyama Basin Water District
  - Areas Outside Both Districts
  - Four Counties

- Potential Physical Boundaries
  - Russell Fault
  - Santa Barbara Canyon Fault

WOODARD &CURRAN

What Makes a Good Monitoring Network?

- What is a monitoring network?
  - Established for each sustainability indicator:
    - Groundwater levels and quality
    - Subsidence
    - Surface water-groundwater interaction
  - Includes monitoring wells, stream gauges, subsidence measurements
  - Will have spatial and temporal components:
    - How many wells and how spread out are they?
    - How frequently are they measured?
  - Able to provide data relative to undesirable results

WOODARD & CURRAN

What Makes a Good Monitoring Network?

- Need to Consider Implementation cost
  - Cost for installation of equipment
  - Annual cost of data collection, analysis, and management
- Use Representative Monitoring
  - Can designate a subset of monitoring sites as representative of conditions in the basin or an area of the basin.

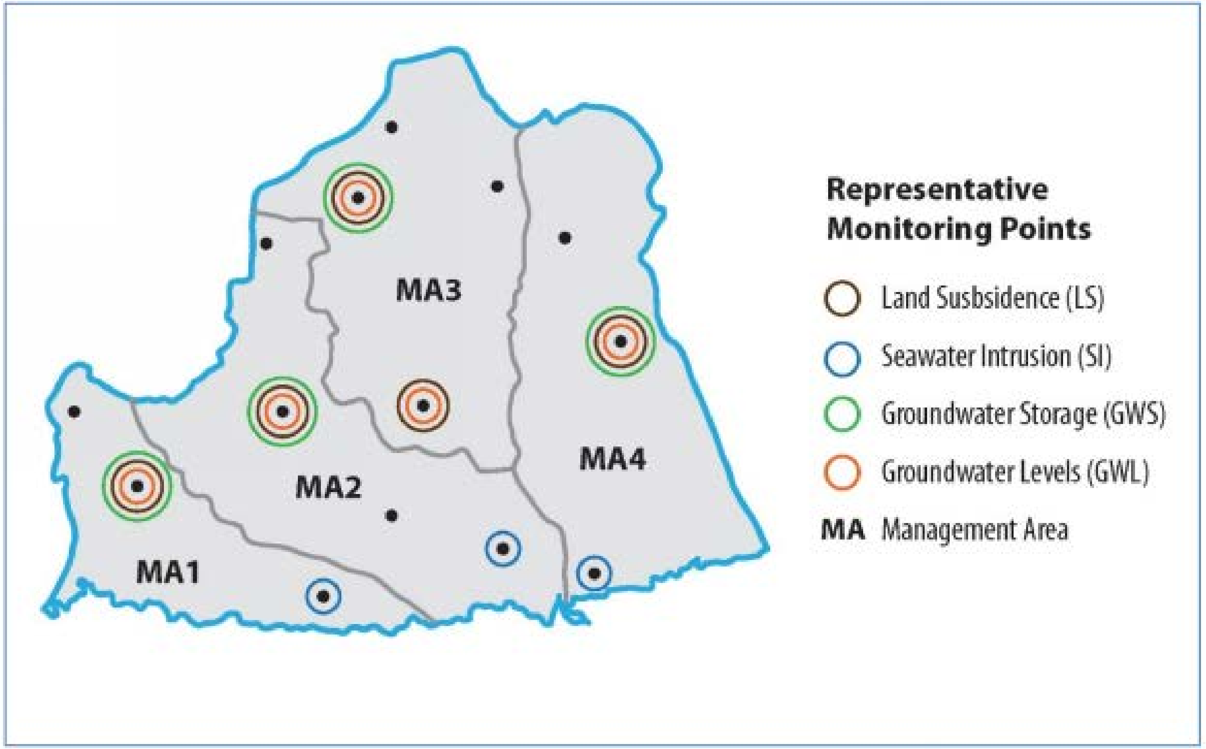


Figure 3: Representative Monitoring Points

What Makes a Good Monitoring Network?

- Characteristics of Good Monitoring Locations
  - Surface flow gauges:
    - Managed and maintained by USGS or CDEC
    - Longer and continuous periods of record
  - Groundwater wells (levels):
    - Have well construction info
    - Longer and continuous periods of record
    - More frequent measurements
    - Depths that are similar to where pumping occurs
  - Groundwater wells (quality):
    - Have well construction info
    - Longer and continuous periods of record
    - More frequent measurements
    - Measured where groundwater is used

WOODARD & CURRAN

What Makes a Good Monitoring Network?

- Spatial Coverage
  - Can differ by management area
  - May not be needed where no groundwater use occurs
- Temporal Coverage
  - Groundwater Levels: at least twice a year, preferably more
  - Groundwater Quality: at least once a year
  - Surface Flow: daily
  - Subsidence: annually

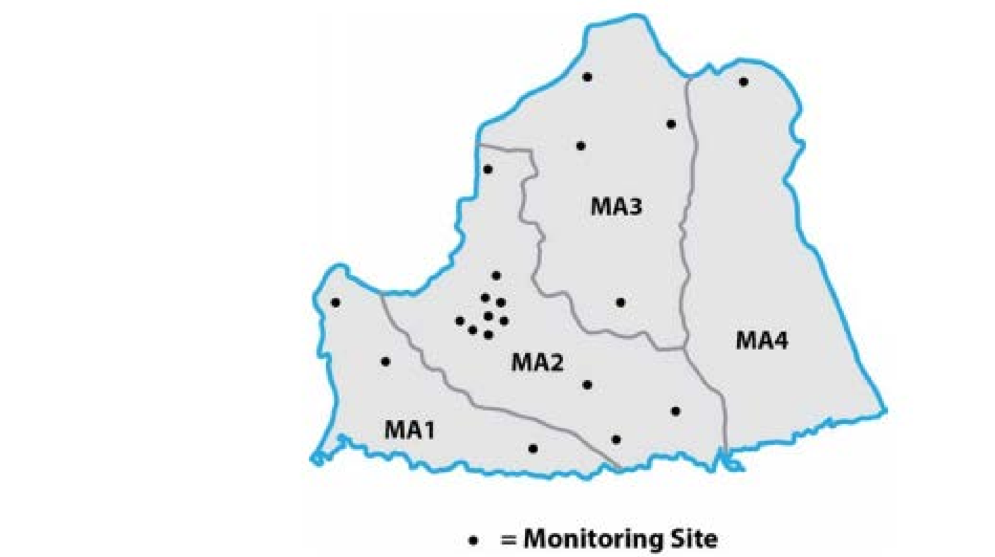


Figure 6. Example Monitoring Network with Spatial Data Gaps

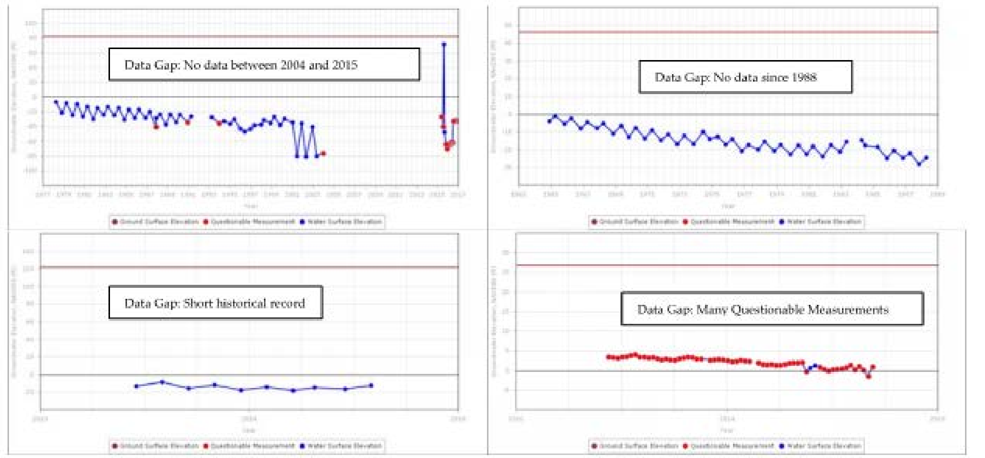


Figure 5. Examples of Hydrographs with Temporal Data Gaps

What Does SGMA Require for Groundwater Wuality?

- For Describing Current Groundwater Conditions:
  - In HCM: describe general water quality of principal aquifer
  - In Groundwater Conditions: describe GW quality issues that may affect supply and beneficial uses of groundwater (contaminated sites and plumes)
  - In Monitoring Networks: shall collect sufficient spatial and temporal data to determine water quality for water quality indicators
- How to Select which constituents to manage:
  - Determined by GSA board based on public discussion, data review
  - Consider ability of GSA management activities to influence constituent concentrations
  - Identify constituents considered to be of concern to GSA members that are near MCLs (maximum contaminant levels, set by the CalEPA)
- Establishing Minimal Thresholds for Future Sustainability:
  - Should be based on mapping of current and historical constituent concentrations

WOODARD & CURRAN

TO: Standing Advisory Committee
Agenda Item No. 6c

FROM: Jim Beck, Executive Director

DATE: June 28, 2018

SUBJECT: Board of Directors Agenda Review

Issue
Review of the July 11, 2018 Cuyama Basin Groundwater Sustainability Agency Board of Directors agenda.

Recommended Motion
None – information only.

Discussion
The July 11, 2018 Cuyama Basin Groundwater Sustainability Agency Board of Directors agenda is provided as Attachment 1 for review.

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

July 11, 2018

Agenda for a meeting of the Cuyama Basin Groundwater Sustainability Agency Board of Directors to be held on Wednesday, July 11, 2018 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

County Government Center
1055 Monterey Street, Room D430
San Luis Obispo, Ca 93408

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1. Call to Order
2. Roll Call
3. Pledge of Allegiance
4. Presentation from the California Department of Water Resources (Anita Regmi)
5. Approval of Minutes
   a. June 6, 2018
6. Report of the General Counsel
   a. Start of 45-Day Conflict of Interest Code Comment Period
7. Report of the Standing Advisory Committee

8. Groundwater Sustainability Agency
    a. Report of the Executive Director
    b. Progress & Next Steps
    c. DWR Grantee Resolution
9. Groundwater Sustainability Plan
    a. Groundwater Sustainability Plan Update
    b. Technical Forum Update
    c. Description of the Plan Area
    d. Hydrogeologic Conceptual Model
    e. Stakeholder Engagement Update
        i. Update on workshops
        ii. Discussion on Sustainability
10. Financial Report
    a. Financial Management Overview
    b. Financial Report
    c. Payment of Bills
11. Reports of the Ad Hoc Committees
12. Directors' Forum
13. Public comment for items not on the Agenda

    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.
14. Adjourn

TO: Standing Advisory Committee
Agenda Item No. 7a

FROM: Jim Beck, Executive Director

DATE: June 28, 2018

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 (GSP) consultant Woodard & Curran's GSP update is provided as Attachment 1. The update includes a discussion of the hydrogeologic conceptual model, and land and water use.

Attachment 1

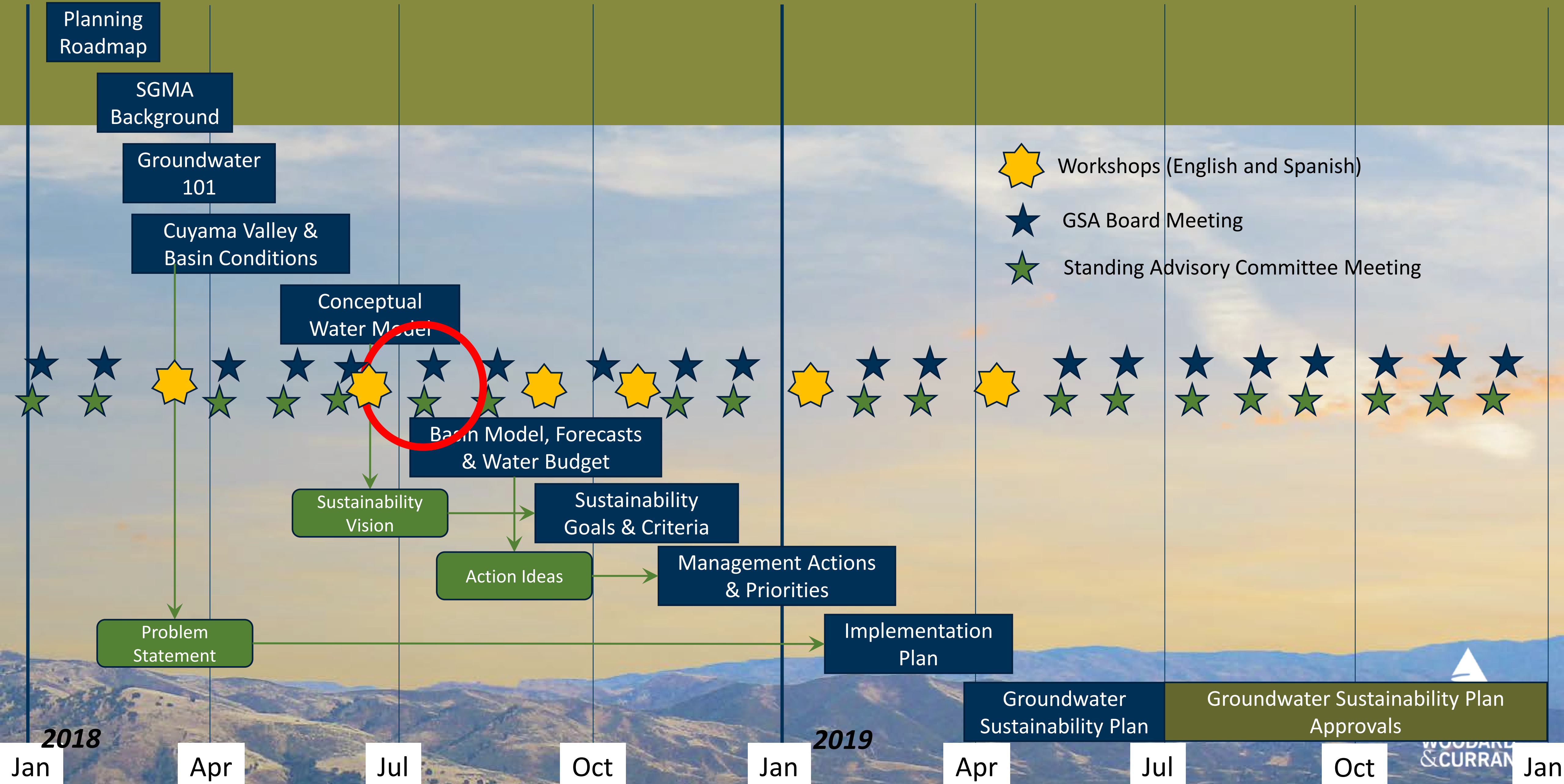
Cuyama Basin Groundwater Sustainability Agency

Groundwater Sustainability Plan Update

June 28, 2018

WOODARD & CURRAN

Cuyama Basin Groundwater Sustainability Plan – Planning Roadmap



June GSP Accomplishments

- ✓ Updated Description of Plan Area section in response to comments
- ✓ Distributed draft Hydrogeologic Conceptual Model GSP section
- ✓ Conducted Cuyama Basin GSP Workshops
- ✓ Continued data collection and processing
- ✓ Continued work on data management system
- ✓ Continued work on GSP numerical model

WOODARD & CURRAN

Update on Data Collection Efforts

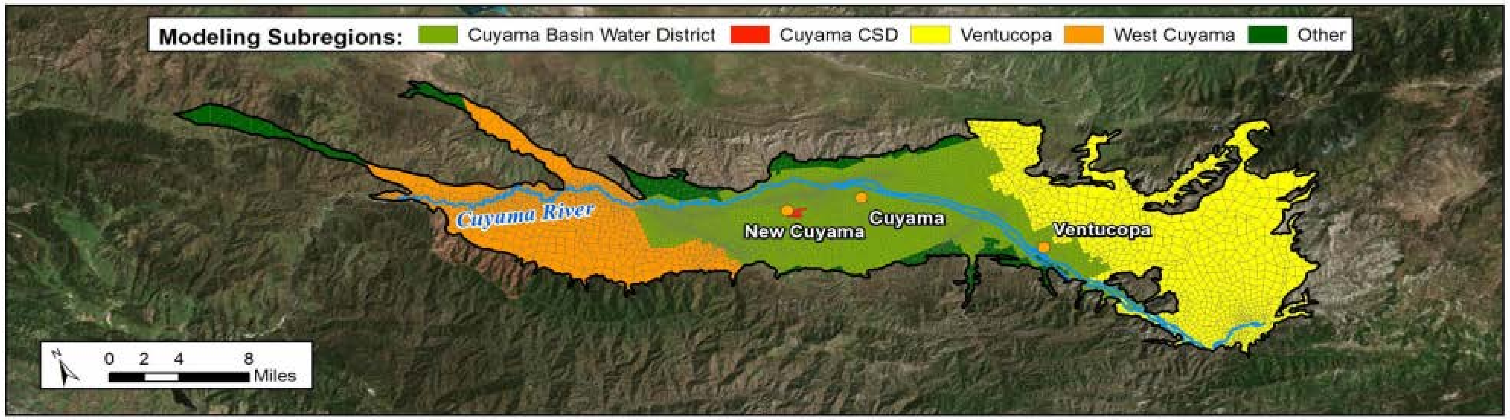
- Data/information received from:
  - Bolthouse and Grimmway
    - Groundwater well and elevation data
    - Historical cropping data
  - 16 additional land owners

Cuyama Basin Groundwater Sustainability Plan - Availability of Data by Modeling Subregion 6/22/2018

Data Type	Cuyama Basin WD	Cuyama CSD	Ventucopa	West Cuyama	Other
Geology	●	●	◖	●	○
GW Levels	●	●	○	◖	○
GW Well Locations	●	●	◖	◖	◖
GW Pumping	○	○	○	○	○
Land Use/Cropping	●	●	◖	◖	◖
Precipitation	◖	●	◖	◖	○
Subsidence	◖	◖	◖	○	○
Surface Water Flow	○	○	○	○	○
Water Quality	◖	◖	○	○	○

Key
- ● Robust data available
- ◖ Moderate data available
- ○ Little or no data available

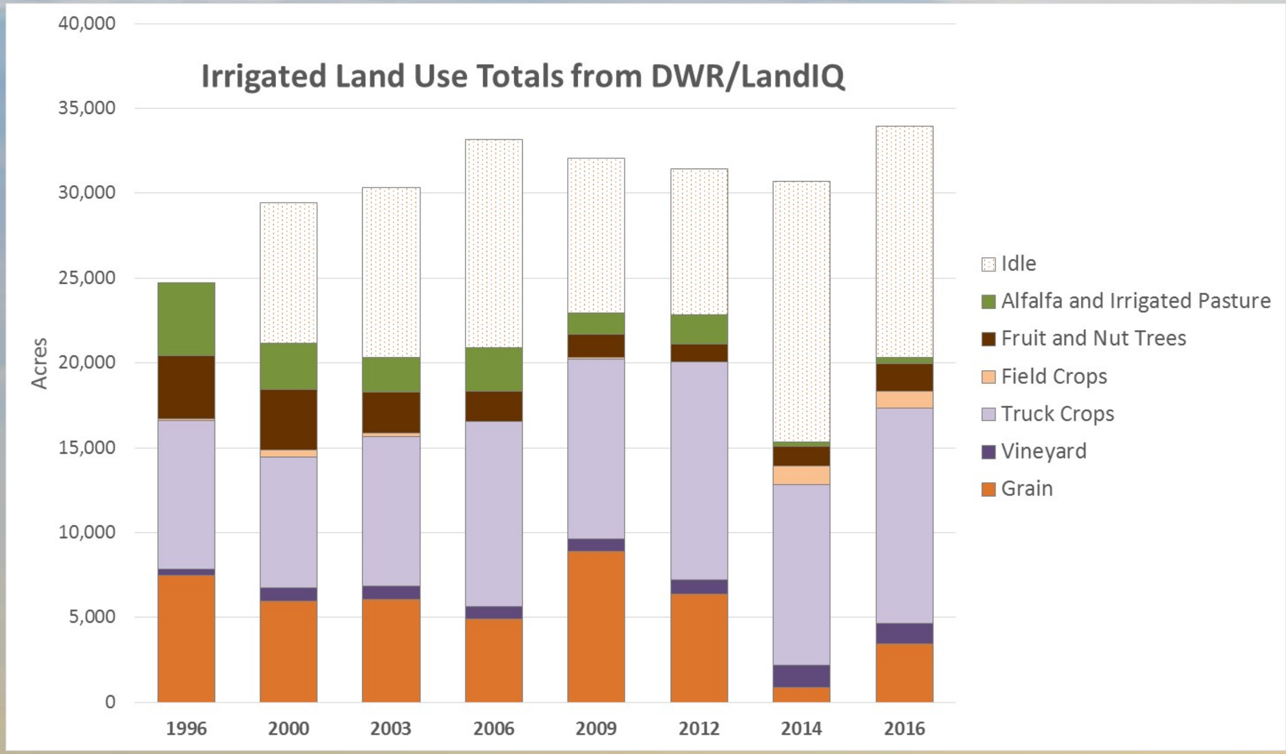
Note: Synthetic data will be developed where little or no data is available for groundwater pumping and surface water flows

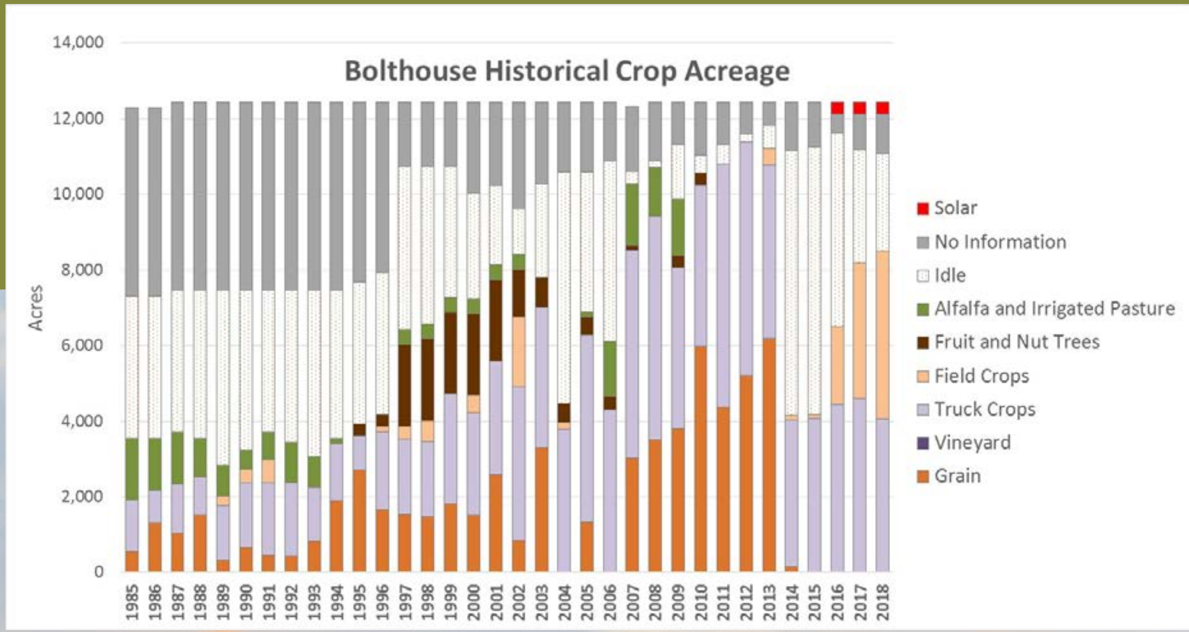


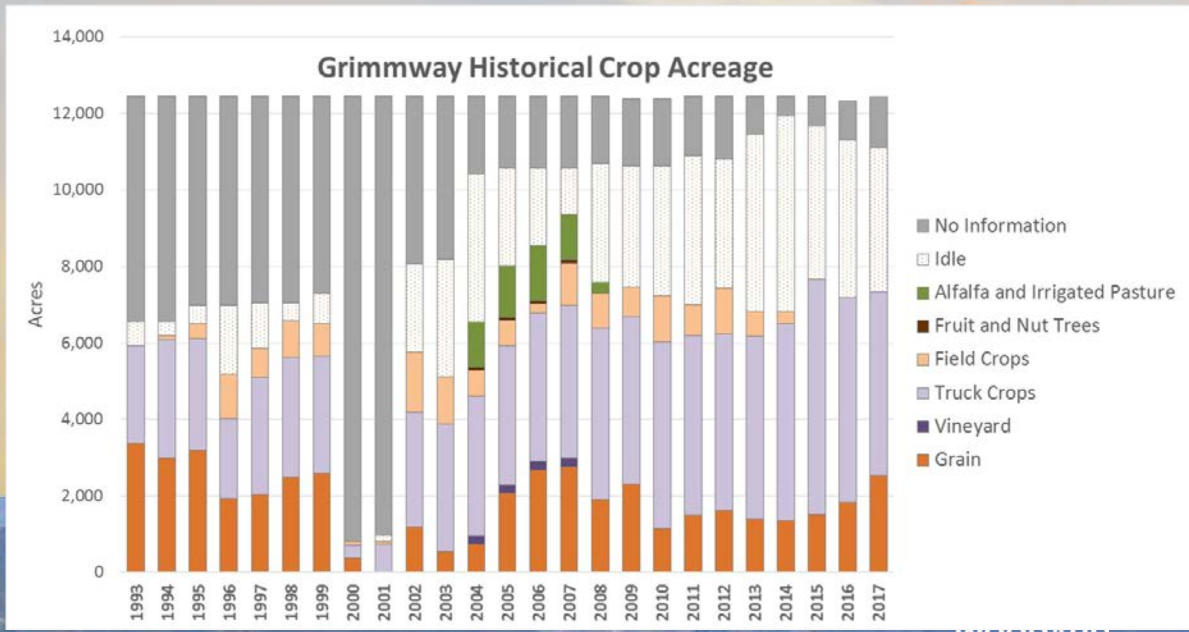
Land and Water Use

- Available Land Use Datasets
  - DWR/LandIQ:
    - 1996, 2000, 2003, 2006, 2009, 2012, 2014 and 2016
  - Grimmway: 1993-2017
  - Bolthouse: 1985-2018
- Available Evapotranspiration Data
  - LandIQ: 1996, 2016

Land Use –DWR/LandIQ vs Grimmway/Bolthouse Data

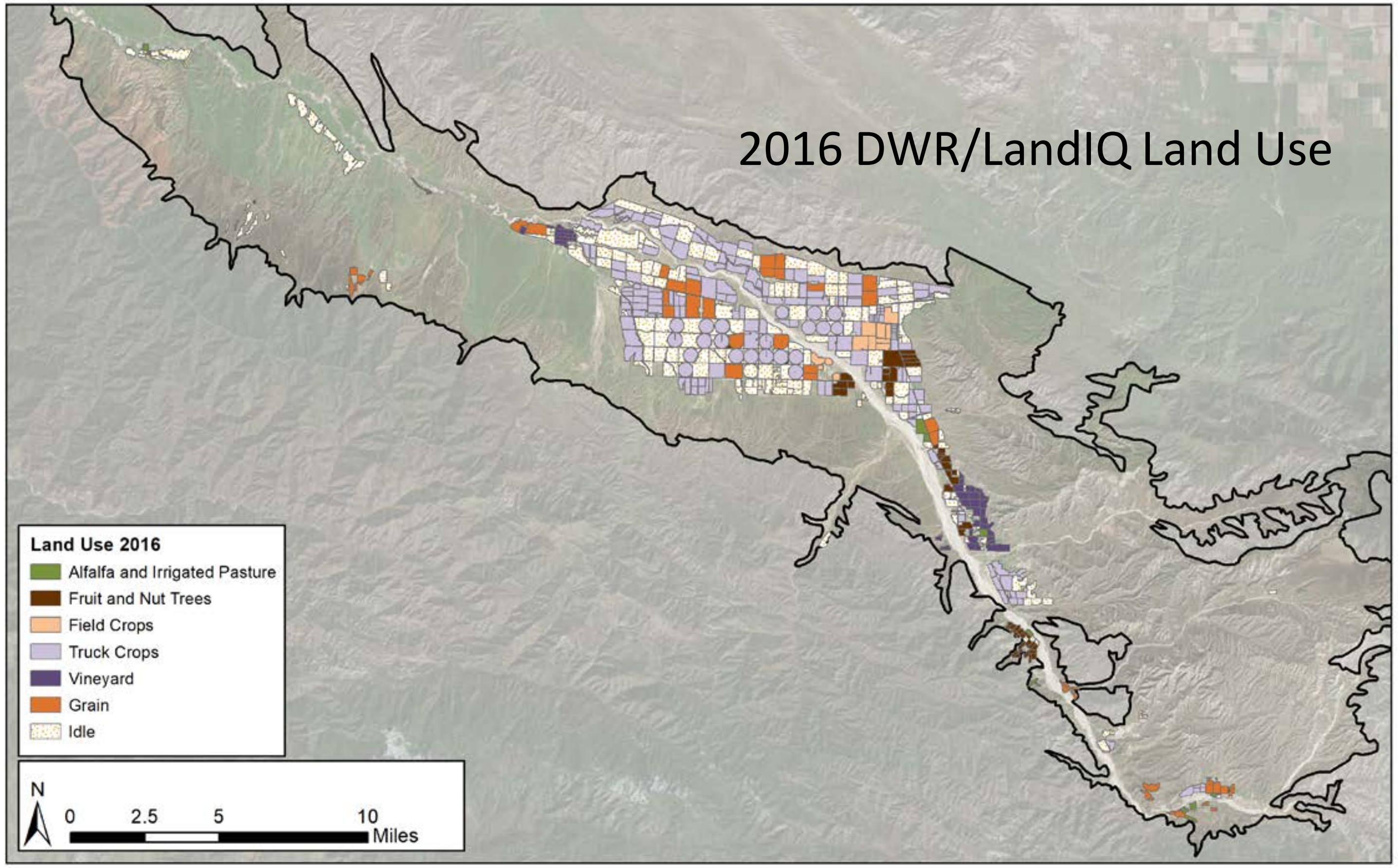


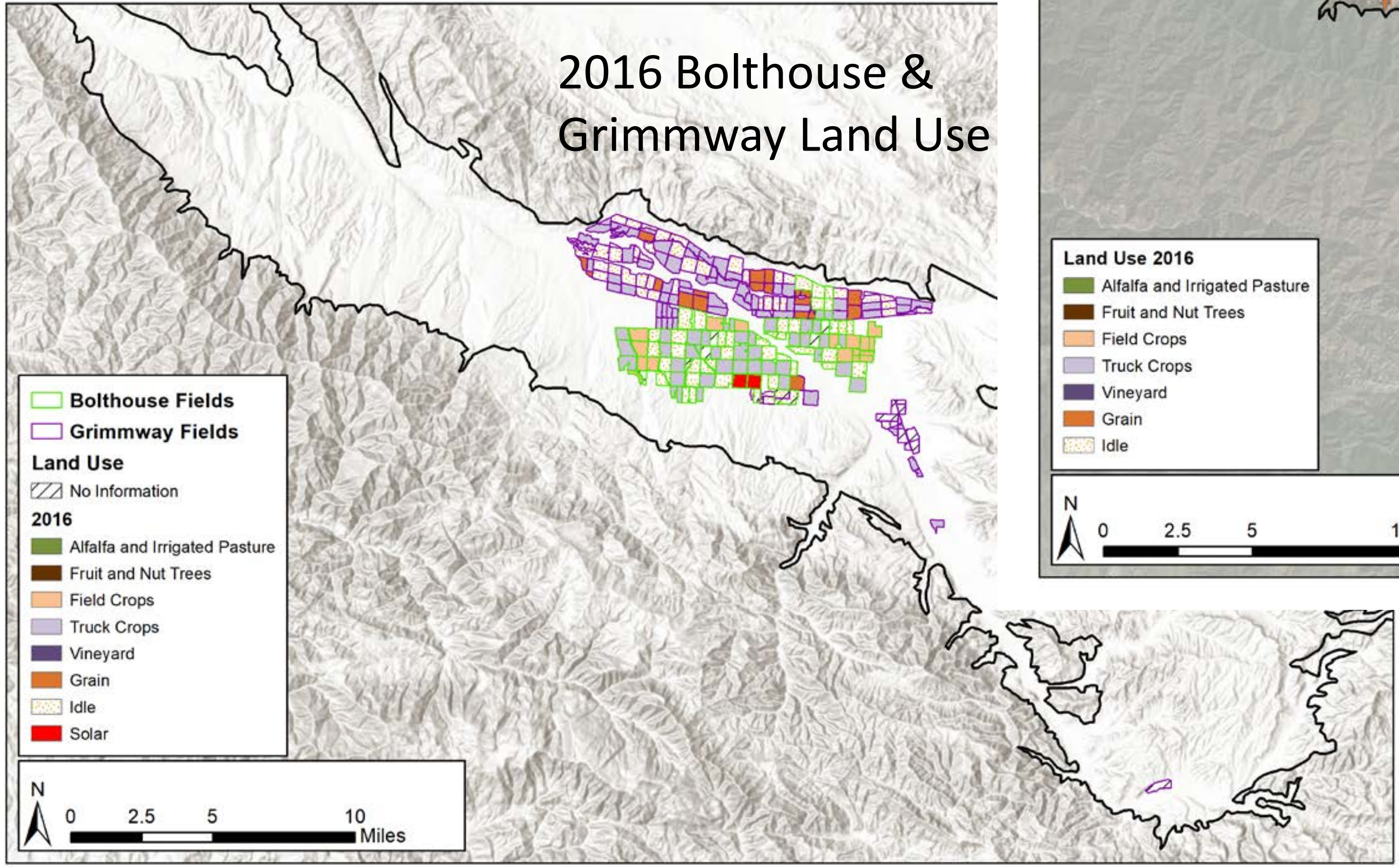




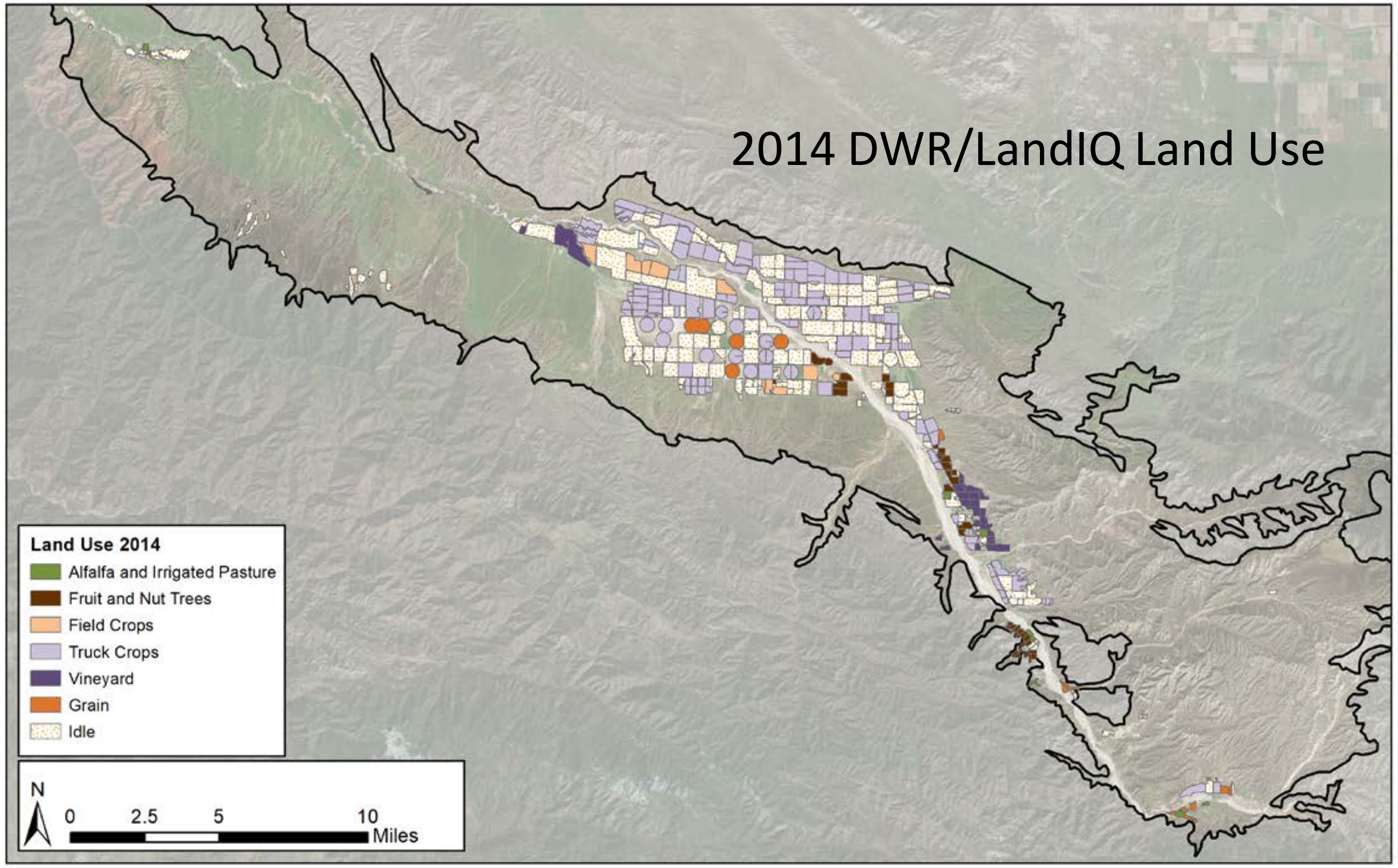
WOODARD &CURRAN

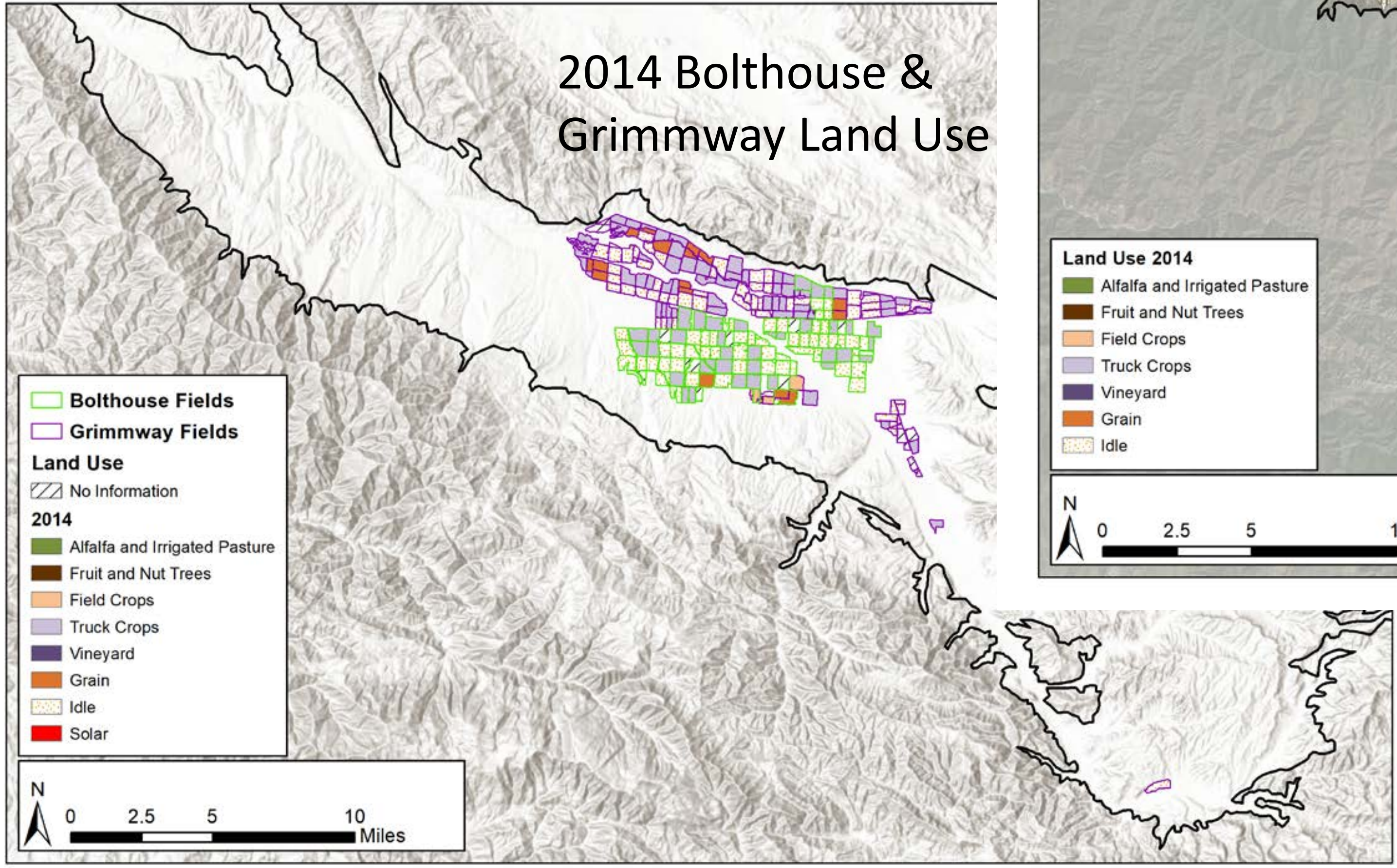
2016 Land Use –DWR/LandIQ vs Grimmway/Bolthouse



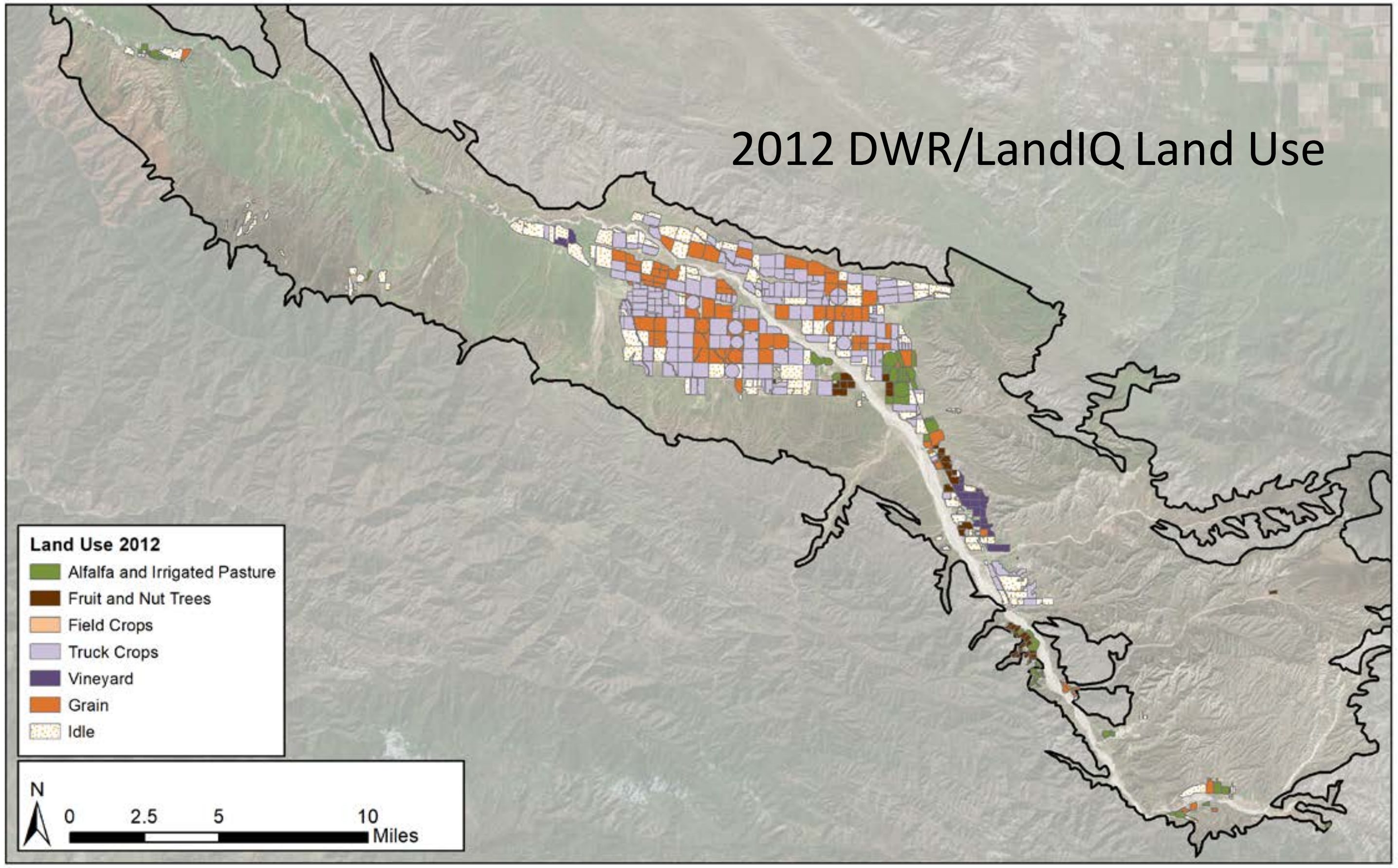


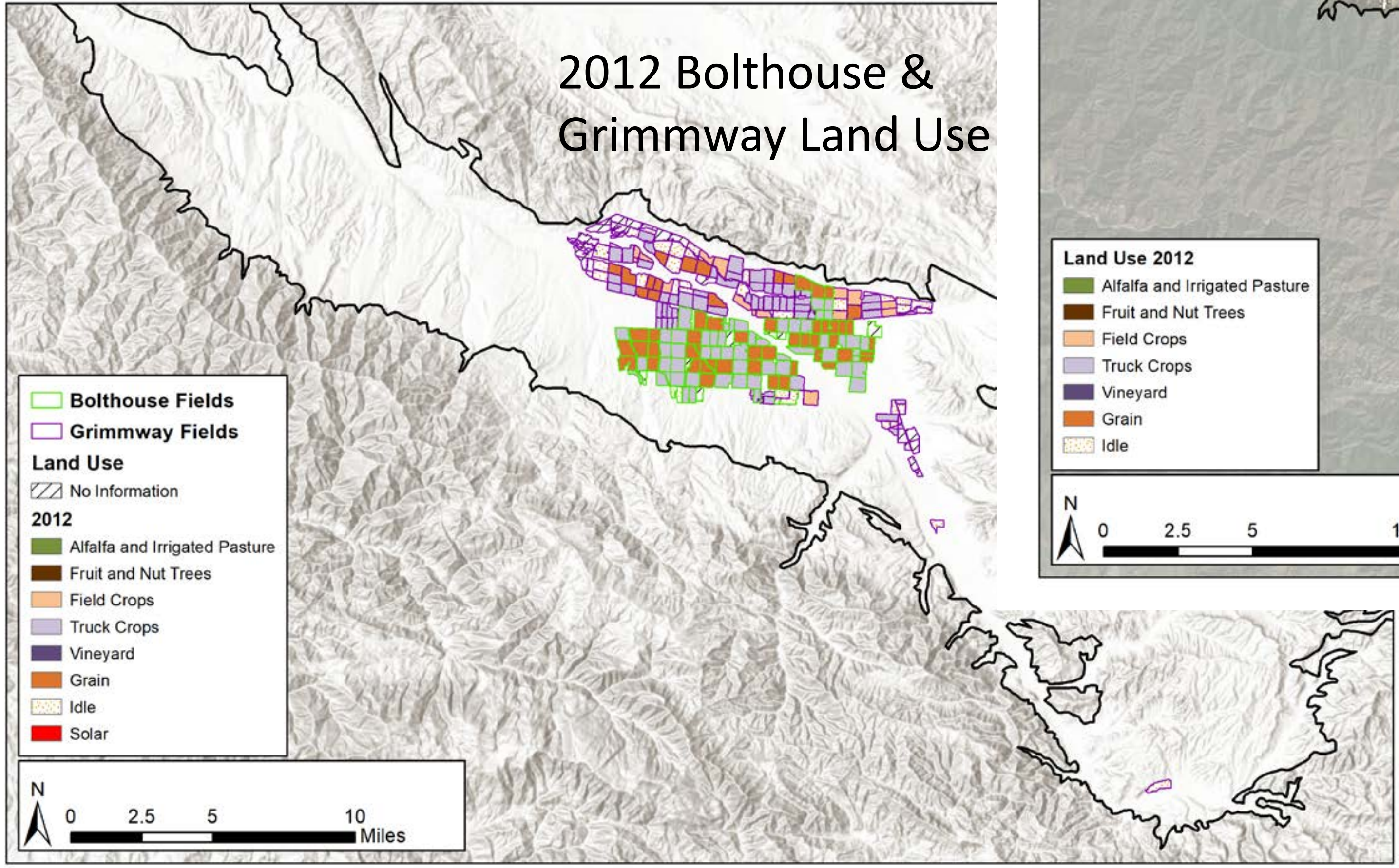
2014 Land Use –DWR/LandIQ vs Grimmway/Bolthouse





2012 Land Use –DWR/LandIQ vs Grimmway/Bolthouse

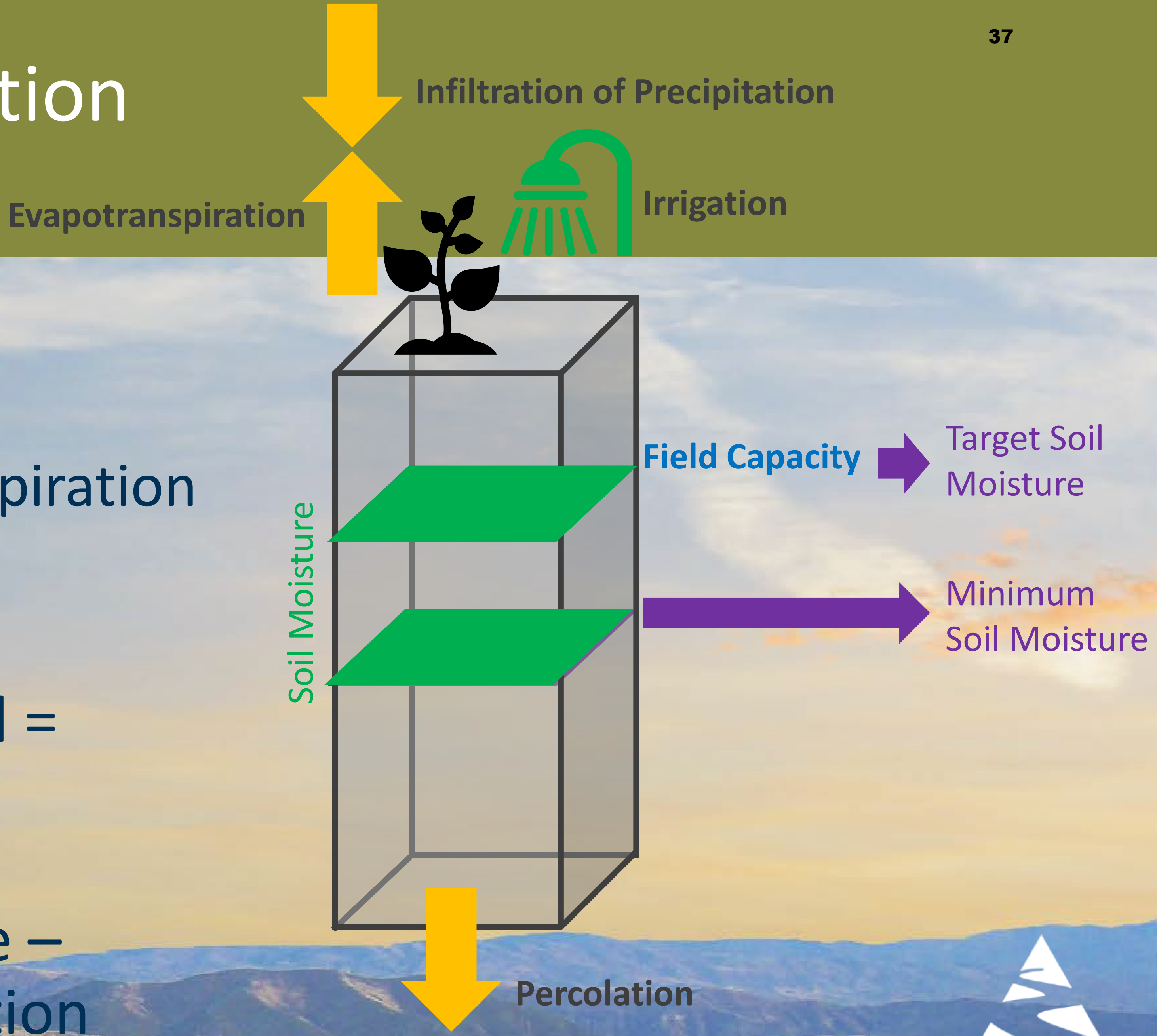




WOODARD & CURRAN

Crop Water Use Estimation

- Inputs:
  - Annual cropping data
  - Daily crop evapotranspiration
  - Daily precipitation
  - Soil parameters
- Crop Irrigation Demand = Evapotranspiration + Percolation + Change in Soil Moisture – Infiltration of Precipitation



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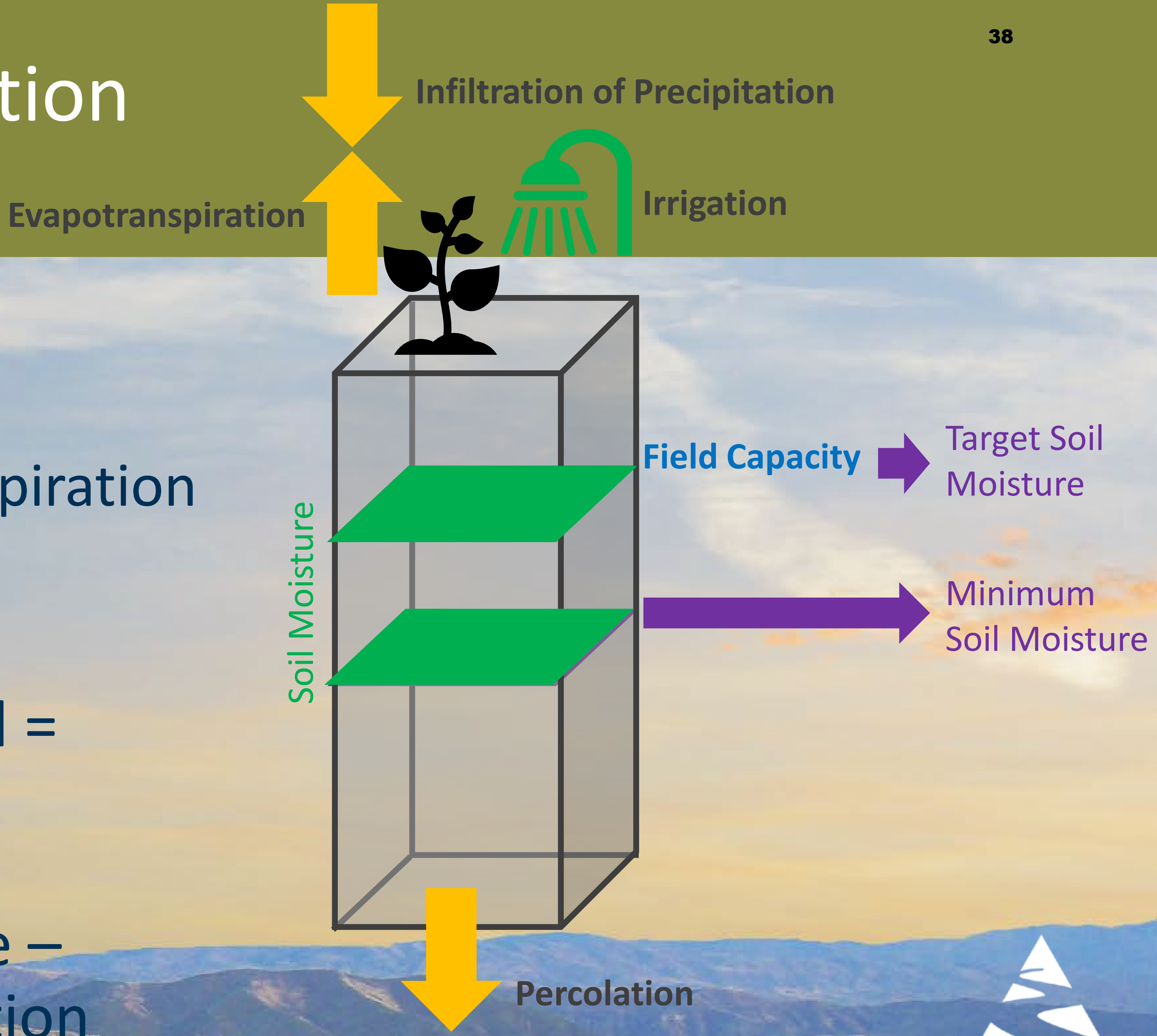

WOODARD &CURRAN

TO: Standing Advisory Committee
Agenda Item No. 7b

FROM: Jim Beck, Executive Director

DATE: June 28, 2018

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 June 8, 2018 technical forum meeting is provided as Attachment 1, and the next forum is scheduled for July 13, 2018.

COMMITMENT & INTEGRITY
DRIVE RESULTS

1545 River Park Drive | Suite 425
Sacramento, California 95815
www.woodardcurran.com

T 916.999.8700

MEETING MEMORANDUM

PROJECT: Cuyama Basin Groundwater Sustainability Plan Development

MEETING DATE: 6/8/2018

MEETING: Technical Forum Conference Call

ATTENDEES: Matt Young (Santa Barbara County Water Agency)
Matt Scrudato (Santa Barbara County Water Agency)
Matt Klinchuch (Cuyama Basin Water District)
Dennis Gibbs (Santa Barbara Pistachio Company)
Jeff Shaw (EKI)
Neil Currie (Cleath-Harris Geologists)
John Fio (HydroFocus)
Brian Van Lienden (Woodard & Curran)
Ali Taghavi (Woodard & Curran)
John Ayres (Woodard & Curran)
Sercan Ceyhan (Woodard & Curran)

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1. AGENDA

- Hydrogeologic Conceptual Model (HCM) Development Update
- Groundwater Level Monitoring
- Next steps

2. DISCUSSION ITEMS

The following table summarizes discussion items raised prior to and during the conference call and the plans for resolution identified for each item.

Item No.	Discussion Item	Plan for Resolution
1	The draft HCM GSP section is under development and will be provided to the Technical Forum members for review	A draft HCM document will be provided to the Forum members on Wed June 13, with comments due by Mon June 18.
2	What is the role of the Technical Forum in the GSP development process – is its purpose to provide an update on progress or a more robust "Technical Advisory Committee" that provides formal input?	The Technical Forum was formed to provide information and receive feedback on the development of technical products to technical experts representing different parties within the Basin. While the feedback provided by Technical Forum members is valuable and will be incorporated when possible, the Technical Forum does not have a formal role in the GSP development process.
3	We should show a cross-section along the Cuyama River that shows the Santa Barbara County fault.	This will be developed and considered for inclusion in the HCM document.

4	We should consider extending the model calibration period earlier than the mid-1990's so as to not exclude extensive dewatering in the 1970's and 1980's and to capture historic climatic cycles	The current calibration period of 1996-2015 was set based primarily on the availability of historical data, particularly related to land use and groundwater elevations. W&C will review the data and extend the calibration period further back if the data warrants it. For current and future level runs, the plan is to incorporate hydrology back to October 1959, corresponding with available data from USGS gage 11136800.
5	The figures of the model layering do not show the small outcrops in the vicinity of the Russell Fault.	Aquifer hydraulic conductivities at model nodes in these areas will be adjusted to account for outcrops as part of the development of the model.
6	Are there enough model nodes to adequately represent the White Rock and Rehoboth faults?	The model grid has been reviewed and the model nodes provide reasonable density to represent those faults, as necessary.
7	We should develop maps showing faults compared to monitoring points and to the model grid.	These figures will be considered during development of the model.
8	Is the SAGBI data shown during the presentation from the modified or unmodified dataset?	This figure has been modified to note that it is showing the modified dataset.
9	Questions raised regarding the modeling approach: (a) The model is planned to have large areas of very small model-element discretization (gridding). The model elements generally are on a much finer scale than the available input data. This presents an issue of false precision, where the model runs the risk of producing easily-misinterpreted output on a cell-by-cell basis. (b) The model is planned to run at a daily time-step, which contrasts with the available input data for pumping, streamflow, and other factors that will have nowhere near that level of detail. (c) The combination of fine grid dimensions and short time-steps will greatly increase the model run time, potentially adding significant time and expense to each iteration. This will limit the overall time available to calibrate the model and quantify its deficiencies, and generally reduce the usefulness of the model as a management tool.	The model grid elements have been developed so as to adequately represent important characteristics of the groundwater basin including the Cuyama River, irrigated areas and faults and to ensure a numerical representation of the physical system, to the extent that the data allows. Similarly, the daily time step was selected to adequately capture the hydrologic variability of Cuyama river streamflow and tributaries runoff within the Basin. While developing the spatial and temporal discretization, maintaining a reasonable model runtime was a criteria that was considered. Based on our experience developing and using IWFM models throughout the state, it is not anticipated that the spatial and/or temporal scales would be a barrier to successfully calibrating and applying the model for the GSP. When reporting model outputs, presentations of data will be developed to report data at appropriate spatial and temporal scales for understanding and interpreting the results.

June 8th Technical Forum Discussion

- Hydrogeologic Conceptual Model (HCM) Development Update
- Groundwater Level Monitoring
- Next steps

- Next Meeting – July 13th
- Monthly Meetings – first Friday after each Board meeting

WOODARD &CURRAN

TO: Standing Advisory Committee
Agenda Item No. 7c

FROM: Jim Beck, Executive Director

DATE: June 28, 2018

SUBJECT: Description of the Plan Area

Issue
Recommend adoption of the Description of the Plan Area.

Recommended Motion
Adopt the Description of the Plan Area.

Discussion
The final draft of the Description of the Plan Area is provided as Attachment 1.

Attachment 1

DRAFT GROUNDWATER SUSTAINABILITY PLAN SECTION

June 2018

CUYAMA VALLEY GROUNDWATER BASIN

GROUNDWATER SUSTAINABILITY PLAN

DESCRIPTION OF PLAN AREA - DRAFT

2175 North California Blvd., Suite 315
Walnut Creek, CA 94596
925-647-4100

TABLE OF CONTENTS

SECTION **PAGE**

List of Acronyms

BLM	Bureau of Land Management
CASGEM	California Statewide Groundwater Elevation Monitoring
CBGSA	Cuyama Basin Groundwater Sustainability Agency
CBWD	Cuyama Basin Water District
CCSD	Cuyama Community Services District
CDEC	California Data Exchange Center
CDFW	California Department of Fish and Wildlife
DDW	Division of Drinking Water, State Water Resources Control Board
DWR	California Department of Water Resources

GAMA	Groundwater Ambient Monitoring and Assessment
GICIMA	Groundwater Information Center Interactive Map
GSP	Groundwater Sustainability Plan
ILRP	Irrigated Lands Regulatory Program
IRWM	Integrated Regional Water Management
LID	Low Impact Development
NMFS	National Marine Fisheries Service
NWIS	National Water Information System
PBO	Plate Boundary Observatory
RCD	Resource Conservation District
RWQCB	Regional Water Quality Control Board
SBCFC&WCD	Santa Barbara County Flood Control and Water Conservation District
SBCWA	Santa Barbara County Water Agency
SGMA	Sustainable Groundwater Management Act
SLOCFC&WCD	San Luis Obispo County Flood Control & Water Conservation District
SR	State Route
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
UNAVCO	University NAVSTAR Consortium
USGS	United States Geological Survey
VCWPD	Ventura County Watershed Protection District
WDL	Water Data Library
WMP	Water Management Plan

1. PLAN AREA

1.1 Introduction

The Description of Plan Area document is a detailed description of the Cuyama Valley Groundwater Basin, including major streams and creeks, institutional entities, agricultural and urban land uses locations of groundwater production wells, locations of state lands and geographic boundaries of surface water runoff areas. The Plan Area document also describes existing surface water and groundwater monitoring programs, existing water management programs, and general plans in the Plan Area.

This document will be included as part of a report section in the Cuyama Basin Groundwater Sustainability Plan (GSP) that satisfies § 354.8 of the Sustainable Groundwater Management Act (SGMA) Regulations.

1.2 Plan Area Definition

The Cuyama Valley Groundwater Basin (Cuyama Basin, or Basin) is located in California's Central Coast Hydrologic Region. It is beneath the Cuyama Valley, which is bounded by the Caliente Range to the northwest and the Sierra Madre Mountains to the southeast. The Basin was defined by the California Department of Water Resources (DWR) in its report titled "California's Groundwater Bulletin 118 - Update 2003." The boundaries of the Cuyama Basin were delineated by DWR because they were the boundary between permeable sedimentary materials and impermeable bedrock. DWR defines this boundary as "*Impermeable bedrock with lower water yielding capacity. These include consolidated rocks of continental and marine origin and crystalline/or metamorphic rock.*"

1.3 Plan Area Setting

Figure 1-1 shows the Cuyama Basin and its key geographic features. The Basin encompasses an area of about 378 square miles and includes the communities of New Cuyama and Cuyama, which are located along State Route (SR) 166 and Ventucopa, which is located along SR 33. The Basin encompasses an approximately 55-mile stretch of the Cuyama River, which runs through the Basin for much of its extent before leaving the Basin to the northwest and flowing towards the Pacific Ocean. The Basin also encompasses stretches of Wells Creek in its north-central area, Santa Barbara Creek in the south-central area, the Quatal Canyon drainage and Cuyama Creek in the southern area of the Basin. Most of the agriculture in the Basin occurs in the central portion east of New Cuyama, and along the Cuyama River near SR 33 through Ventucopa.

Figure 1-2 shows the boundary of the Cuyama Basin Groundwater Sustainability Agency (CBGSA). The CBGSA boundary covers the entire Cuyama Basin. The CBGSA was created by a Joint Exercise of Powers Agreement (JPA) among the following agencies: Counties of Kern, San Luis Obispo, and Ventura; Santa Barbara County Water Agency (SBCWA) representing the County of Santa Barbara; Cuyama Basin Water District (CBWD); and, Cuyama Community Services District (CCSD).

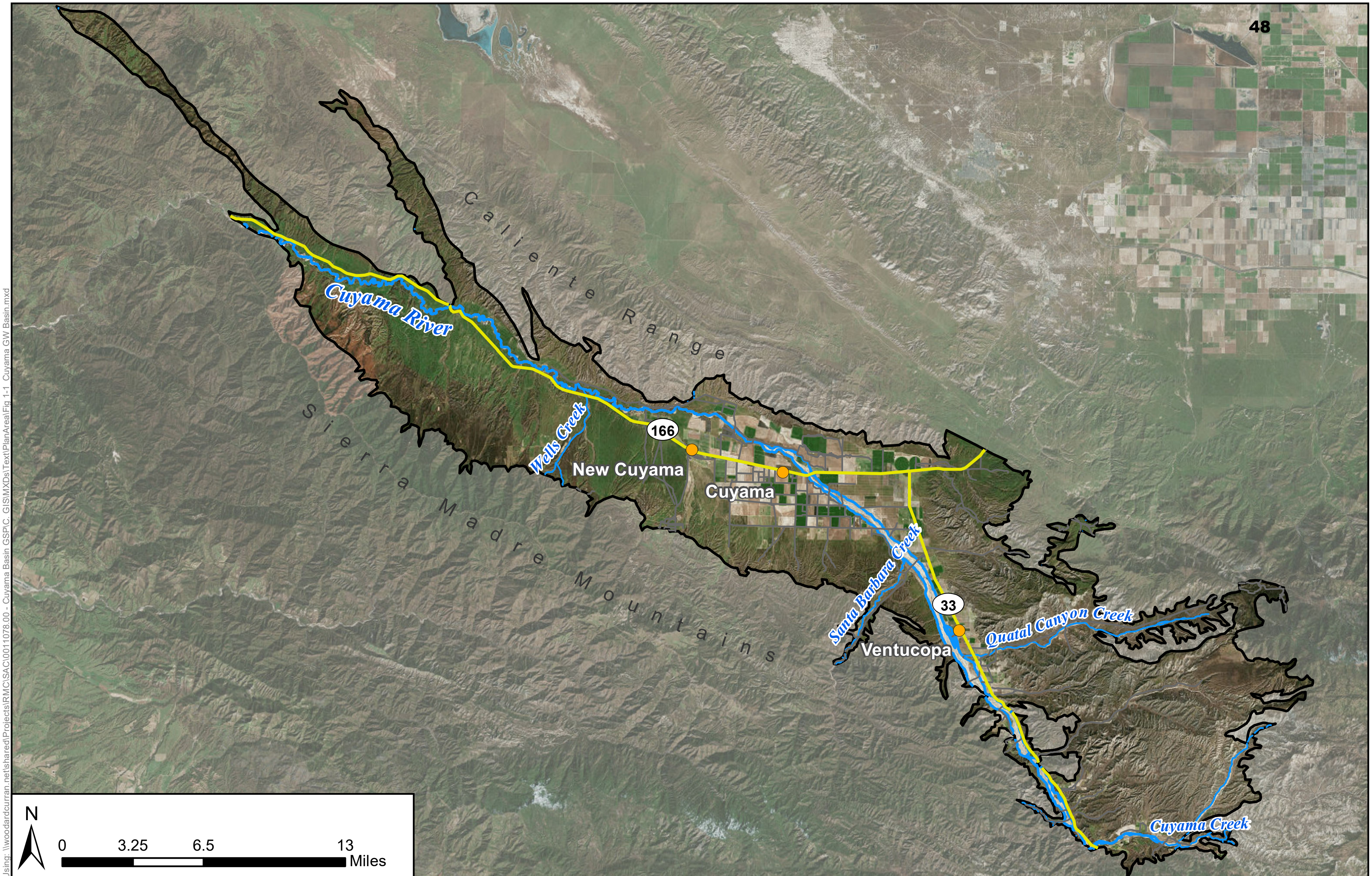

Figure 1-1 - Cuyama Valley Groundwater Basin

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

May 2018

WOODARD & CURRAN

Legend

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

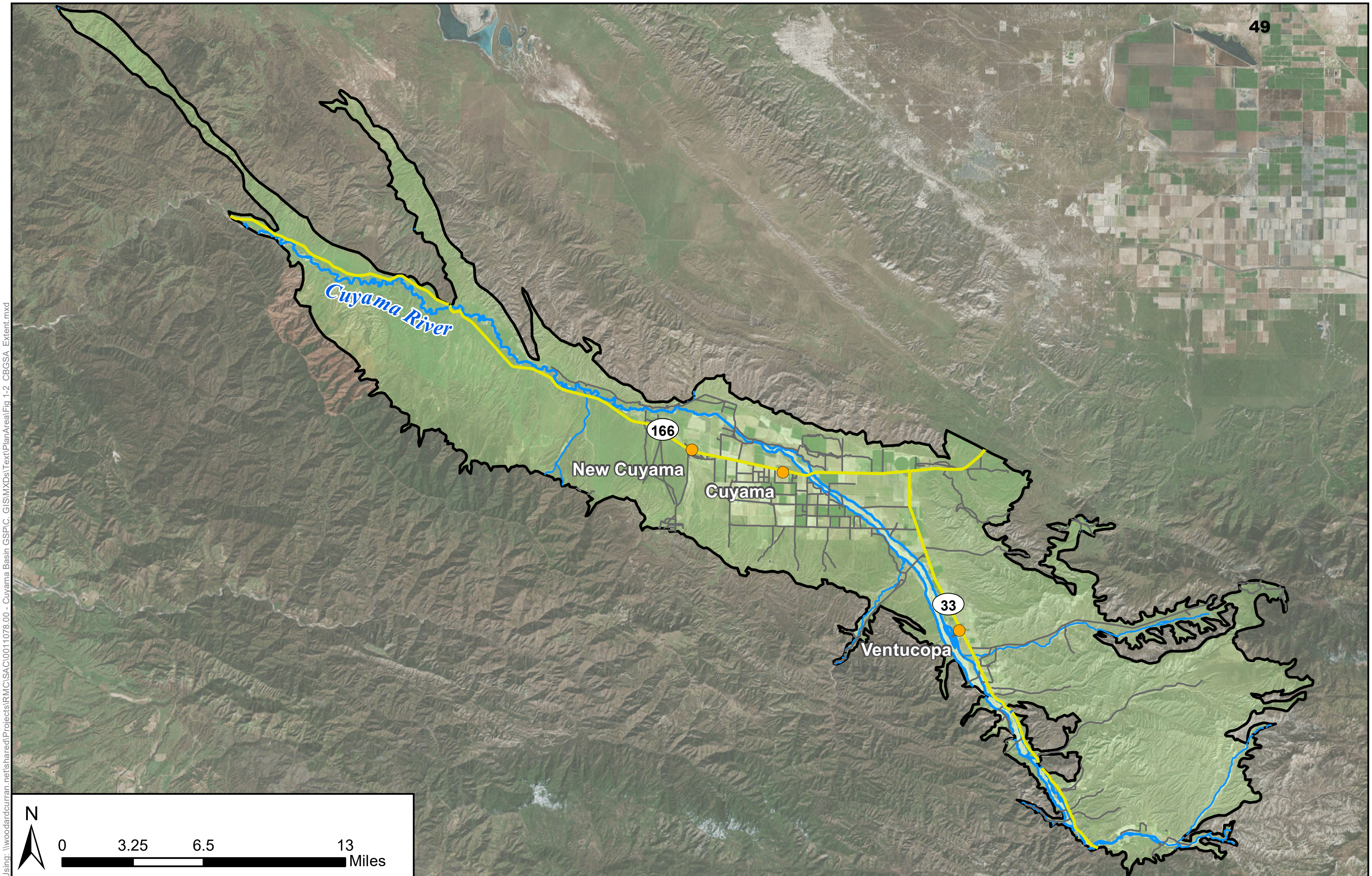

Figure 1-2 - Cuyama Valley Groundwater Sustainability Agency Boundary

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

May 2018

WOODARD & CURRAN

Legend

- Towns
- Cuyama Basin GSA
- Highways
- Local Roads
- Cuyama River
- Streams/Creeks

Figure 1-3 shows the Cuyama Basin and neighboring groundwater basins. The Carrizo Plain Basin is located immediately northeast of the Cuyama Basin and they share a boundary at a location about five miles east of the intersection of SR 166 and SR 133. The San Joaquin Valley Basin is located just east of the Carrizo Plain Basin. The Cuyama Basin also shares a boundary with the Mil Potrero Area Basin, which is located just east of one of the Cuyama Basin's southeastern tips, and the Lockwood Valley Basin is located close to the Cuyama Basin's southern area but does not share a boundary with it. To the southwest, and more distant from the Cuyama Basin, are the Santa Maria, San Antonio Creek Valley and Santa Ynez River Valley Basins, which are located about 30 to 40 miles southwest of the Cuyama Basin.

Figure 1-4 depicts the Cuyama Basin's extent relative to the boundaries of the various counties which overlie the Basin. Santa Barbara County has jurisdiction over the largest portion of the Basin (168 square miles), covering most of the area south of the Cuyama River, as well as Ventucopa and a small area to the north of that community. San Luis Obispo County has jurisdiction over areas north of the Cuyama River (covering 77 square miles). The Cuyama River marks the boundary between San Luis Obispo County and Santa Barbara County. Kern County has jurisdiction over the smallest extent of Cuyama Basin area compared to the other counties (13 square miles). Its jurisdictional coverage is located just east of the SR 166 and SR 33 intersection, as well as tips of the Basin in the Quatal Canyon area. Ventura County has jurisdiction over the southeastern area of the Basin (covering 120 square miles), including the area east of Ventucopa.

Figure 1-5 shows the non-County jurisdictional boundaries in the Basin. The CBWD was formed in 2016 and covers a large area of the Basin (about 130 square miles), from a location about five miles west of Wells Creek to two miles east of the intersection of SR 166 and SR 33, and south of Ventucopa along SR 33. The CCSD was formed in 1977 and covers a small area of the Basin (about 0.5 square miles) located along SR 166 in the community of New Cuyama.

Figures 1-6 through 1-13 show the agricultural and urban land uses in the Cuyama Basin for the years 1996, 2000, 2003, 2006, 2009, 2012, 2014 and 2016, respectively. The 1996 land use data is from historical DWR county land use surveys[1] while the 2014 and 2016 land use data was developed for DWR using remote sensing data.[2] Data for the remaining years was developed by the CBGSA using the same remote sensing method that DWR used for 2014 and 2016. Agricultural land is located primarily in the New Cuyama and Ventucopa areas, and along the SR 166 and SR 33 corridors between those communities. There is a regular rotation of crops with between 9,000 and 15,000 acres of agricultural area left idle each year between 2000 and 2016 (the 1996 dataset does not include records of idle land). Areas that are in active agricultural use primarily produce miscellaneous truck crops, carrots, potatoes and sweet potatoes, miscellaneous grains and hay, and grapes. Various other crop types are produced in the Basin as well, such as fruit and nut trees, though at smaller production scales.

Figure 1-14 shows the land use by water source in the Cuyama Basin. Almost all of the water use in the Basin is served by groundwater. There are 37 surface water rights permits in the Basin that allow up to

[1] https://www.water.ca.gov/Programs/Water-Use-And-Efficiency/Land-And-Water-Use/Land-Use-Surveys
[2] https://gis.water.ca.gov/app/CADWRLandUseViewer/

116 acre-feet per year. Much of the surface water use is for stockwatering of pasture land, which may not be included in the land use dataset shown in the figure.

Figure 1-15 shows the number of domestic wells per square mile and the average depth of domestic wells in each square mile in the Cuyama Basin. Figure 1-15 shows a grid pattern where each block on the grid is a section that covers one square mile of land. The number in each square represents the average depth of the well(s) in the section. Most of the sections in the Cuyama Basin that have domestic wells contain only one well, while twelve sections contain two wells each, three sections contain three wells each, four sections contain four wells each, and one section contains six wells. Wells range in depth broadly across the Basin, from as shallow as 120 feet below ground surface in the southeast portion of the Basin to 1,000 feet below ground surface in the central portion of the Basin.

Figure 1-16 shows the density and average depth of production wells in the Cuyama Basin per square mile. There is a wide distribution of production well density in the Basin; between 1 and 11 wells per square mile. Depths of production wells range from 50 feet below ground surface on the outer edges of the Basin, to over 1,200 feet in the central portion of the Basin.

Figure 1-17 shows the density and average depth of public wells in the Cuyama Basin. The Basin contains three public wells, one just south of New Cuyama, one east of Ventucopa and one at the southern tip of the Basin. These wells have depths of 855, 280 and 800 feet, respectively.

It should be noted that the information presented in Figures 1-15 through 1-17 reflect information contained in DWR's well completion report database, which contains information on the majority of wells drilled after 1947. However, some wells may not have been reported to DWR (potentially up to 30% of the total), and therefore are not included in the database or in these figures. Furthermore, designations of each well as a domestic, production, or public well were developed by DWR based on information contained in the well completion reports and have not been modified for this document.

Figure 1-18 shows the public lands in and around the Basin. Some portions of the land that overlies the Cuyama Basin, and most of the areas immediately surrounding the Basin, have a federal or State jurisdictional designation. The Los Padres National Forest covers most of the Basin's northwestern arm, then runs just outside the Basin's western boundary until the Forest boundary turns east at about Ventucopa where it covers the southern part of the basin. The balance of the northwestern arm consists of private holdings and the state-owned Carrizo Plains Ecological Reserve which extends into the basin to the Santa Barbara County-San Luis Obispo County line at the Cuyama River. A portion of the Basin north of Ventucopa, as well as an area nearby that is immediately outside the Basin, is designated as the Bitter Creek National Wildlife Refuge. The Bureau of Land Management (BLM) has jurisdiction over a large area outside the Basin, and along the Basin's northern boundary, including small parts of the Basin north of the Cuyama River. Most of the northeastern arm of the Basin is designated as State Lands.

Figure 1-19 shows that the Cuyama Basin is located within the Cuyama Watershed, which lies within the larger Santa Maria watershed, with the Cuyama Basin occupying roughly the entirety of the Santa Maria Basin's eastern contributing watershed, and a small part of the Cuyama Basin's northeastern arm that flows into the Estrella River Basin due to the topography present in this area. Figure 1-19 illustrates the Cuyama Watershed's location in the Santa Maria Basin, as well as the larger Basin's major receiving water bodies, which include the Santa Maria River, the Cuyama River, Wells Creek, Santa Barbara Creek, the Quatal Canyon drainage, and Cuyama Creek.

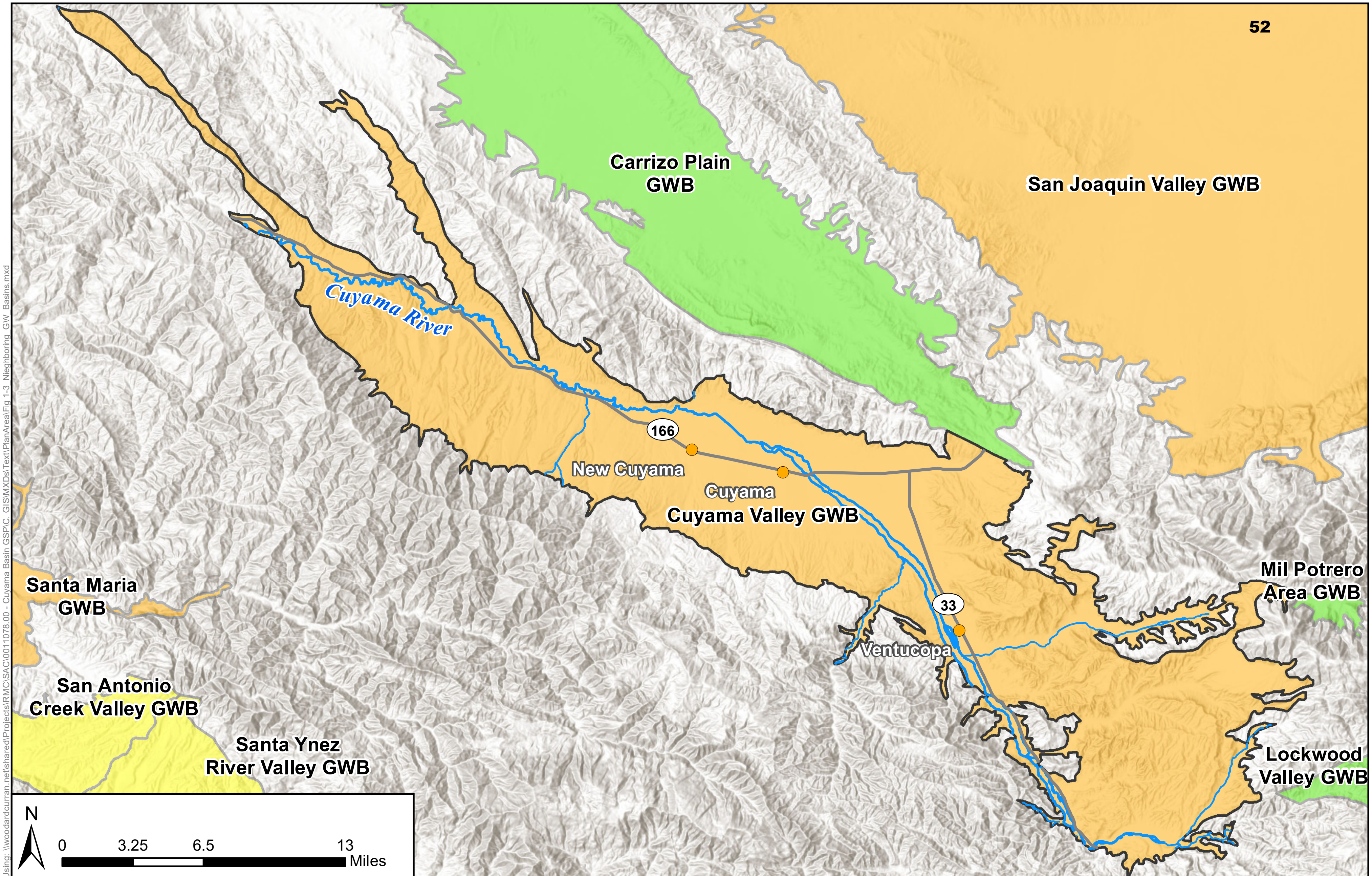

Figure 1-3 - Neighboring Groundwater Basins

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

May 2018

WOODARD & CURRAN

Legend

- Towns
- Cuyama Basin
- Highways
- Cuyama River
- Streams/Creeks

Basin Priority

- High Priority
- Medium Priority
- Low Priority
- Very Low Priority

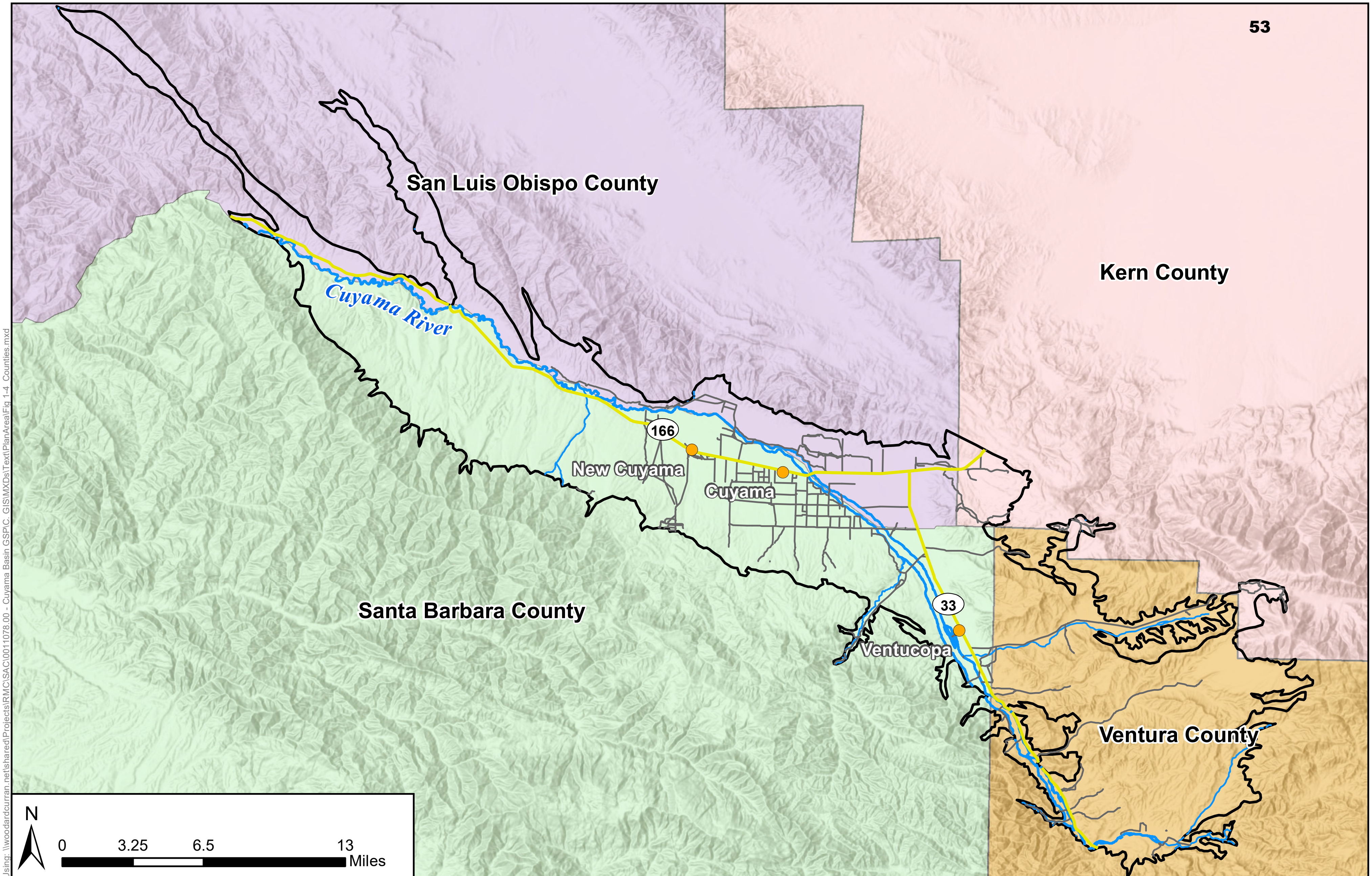

Figure 1-4 - Counties Overlying Cuyama Basin

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

May 2018

WOODARD & CURRAN

Legend

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

County

- Kern County
- San Luis Obispo County
- Santa Barbara County
- Ventura County

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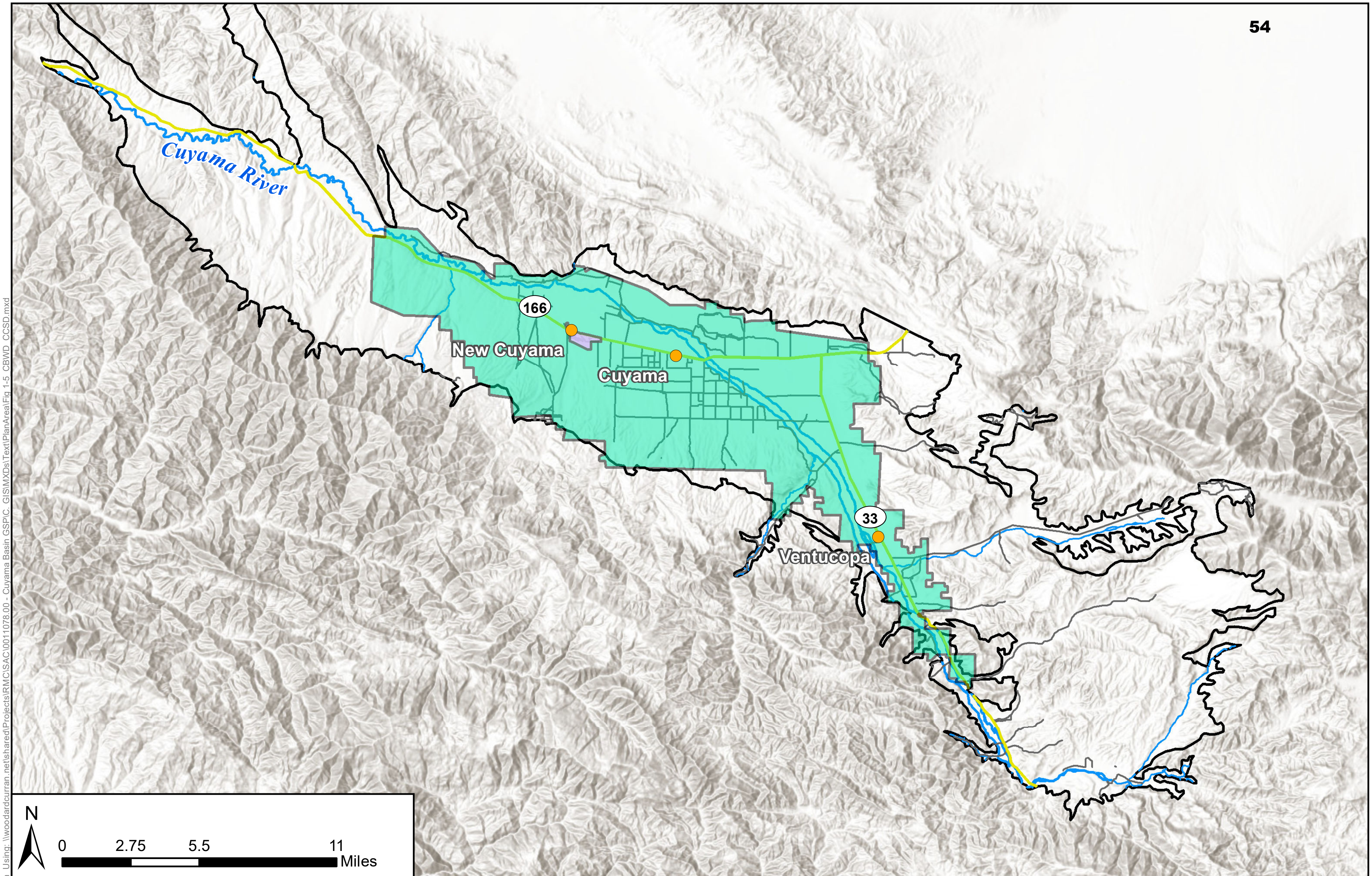

Figure 1-5 - Non-County Jurisdictional Boundaries

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

May 2018

WOODARD & CURRAN

Legend

- Cuyama Basin
- Towns
- Cuyama Community Service District
- Cuyama Basin Water District
- Highways
- Local Roads
- Cuyama River
- Streams/Creeks

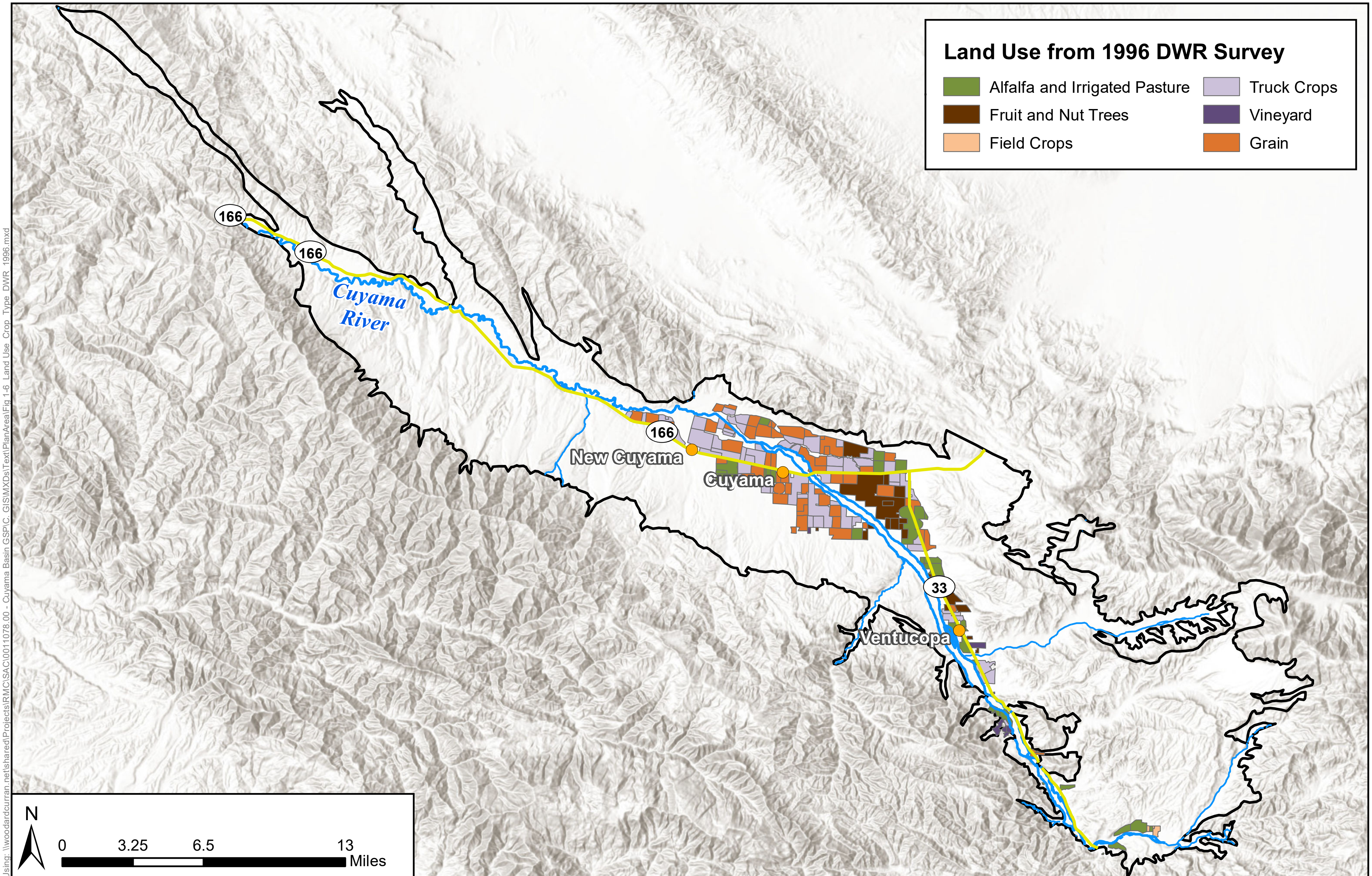

Figure 1-6 - 1996 Land Use

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams/Creeks

Source: California Department of Water Resources County Land Use Surveys, 1996 dataset.
https://www.water.ca.gov/Programs/Water-Use-And-Efficiency/Land-And-Water-Use/Land-Use-Surveys

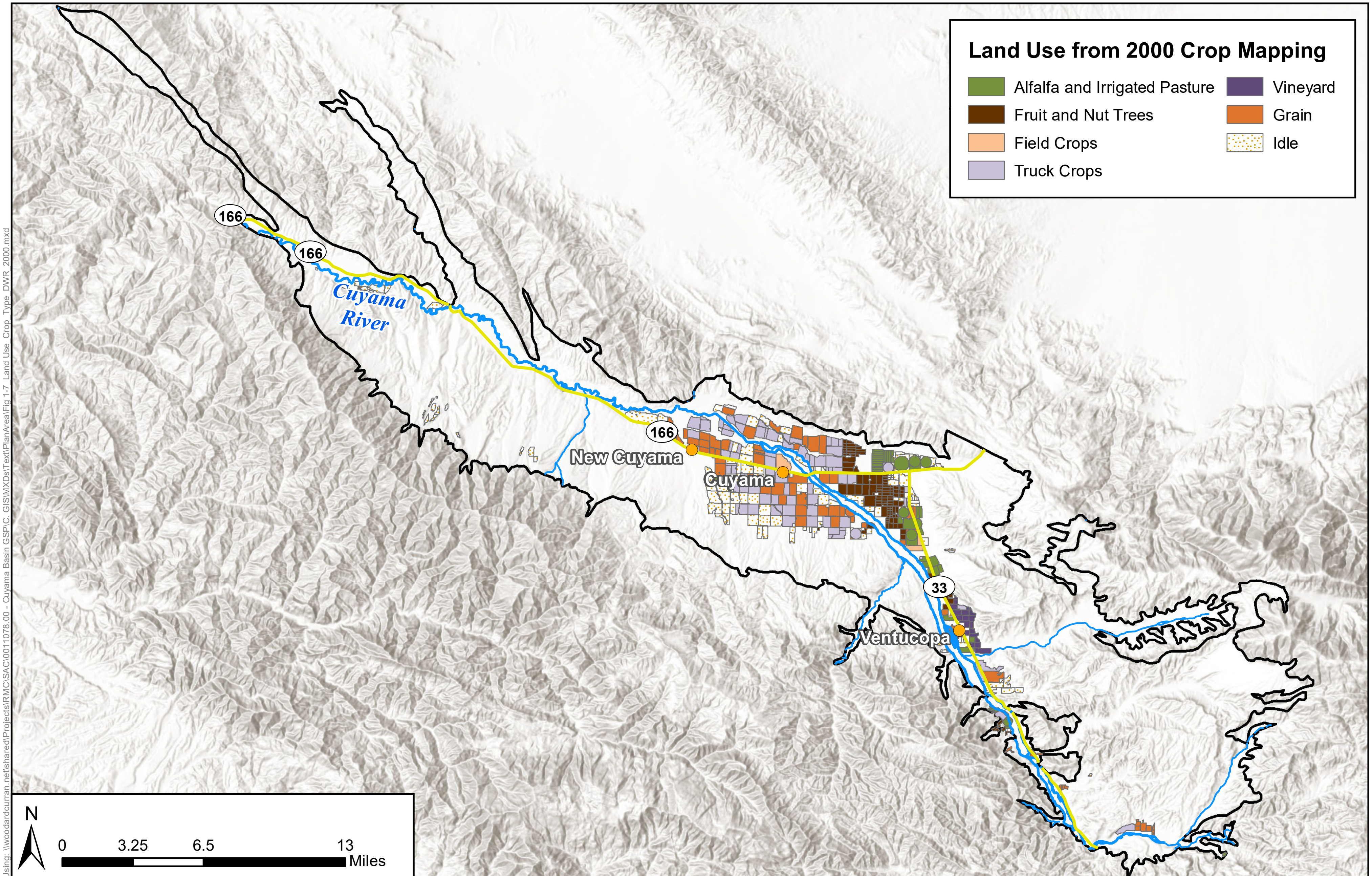

Figure 1-7 - 2000 Land Use

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams/Creeks

Source: Crop Mapping developed by LandIQ for the Cuyama Basin GSA, 2000 dataset

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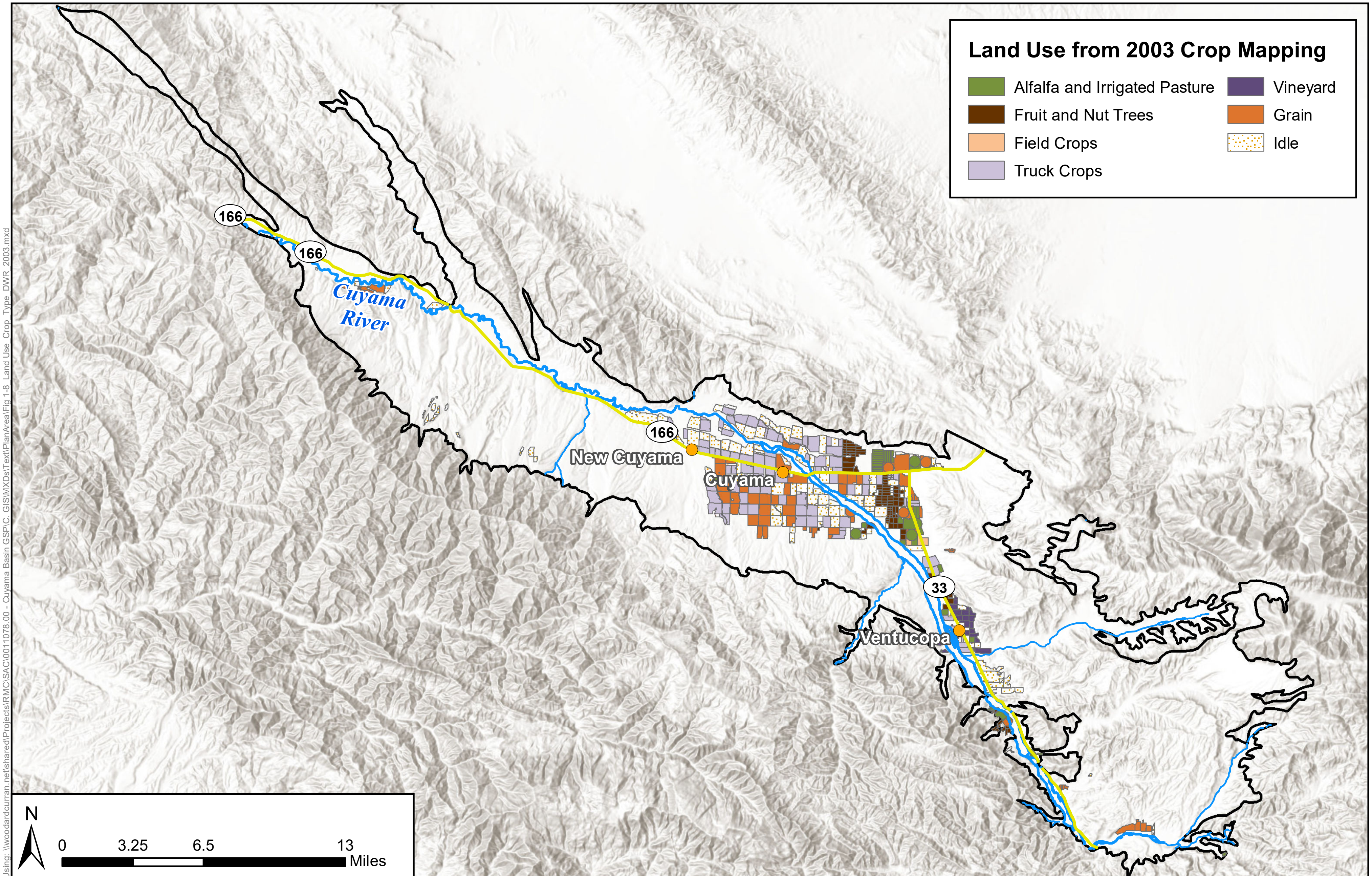

Figure 1-8 - 2003 Land Use

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD &CURRAN

Legend

Cuyama Basin
Towns
Highways
Cuyama River
Streams/Creeks

Source: Crop Mapping developed by LandIQ for the Cuyama Basin GSA, 2003 dataset.

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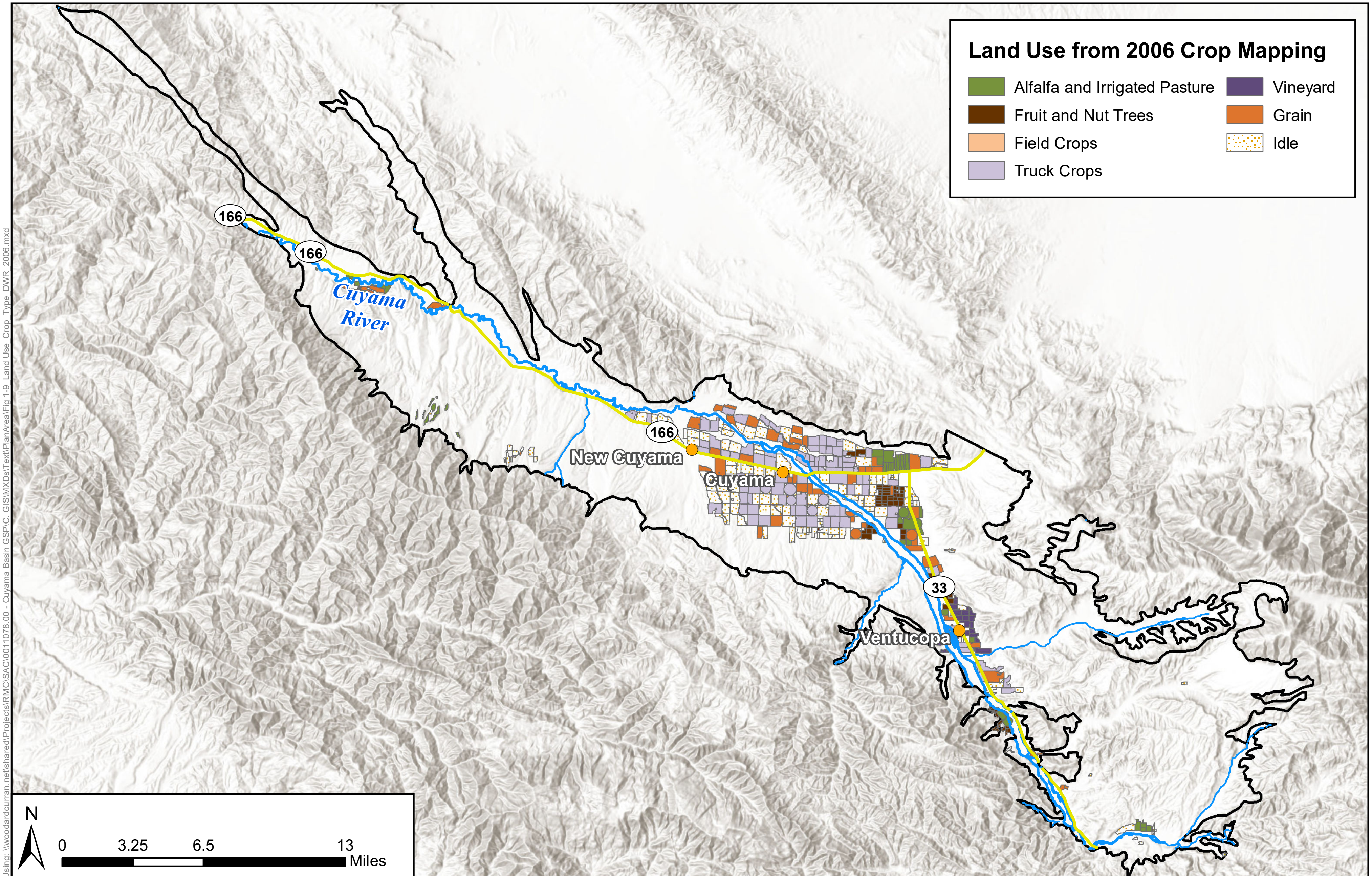

Figure 1-9 - 2006 Land Use

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

Cuyama Basin
Towns
Highways
Cuyama River
Streams/Creeks

Source: Crop Mapping developed by LandIQ for the Cuyama Basin GSA, 2006 dataset.

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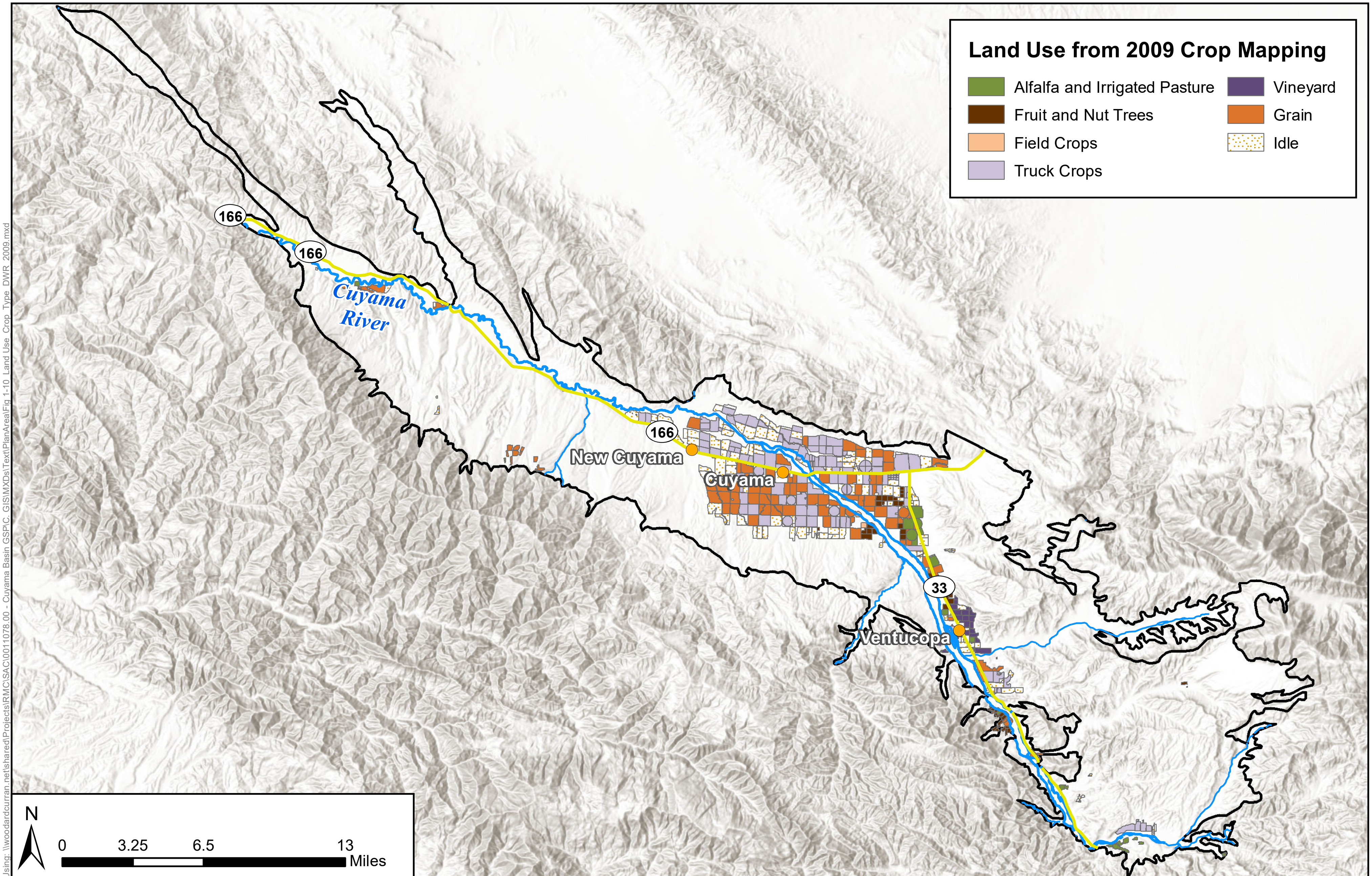

Figure 1-10 - 2009 Land Use

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

Cuyama Basin

Towns

Highways

Cuyama River

Streams/Creeks

Source: Crop Mapping developed by LandIQ for the Cuyama Basin GSA, 2009 dataset.

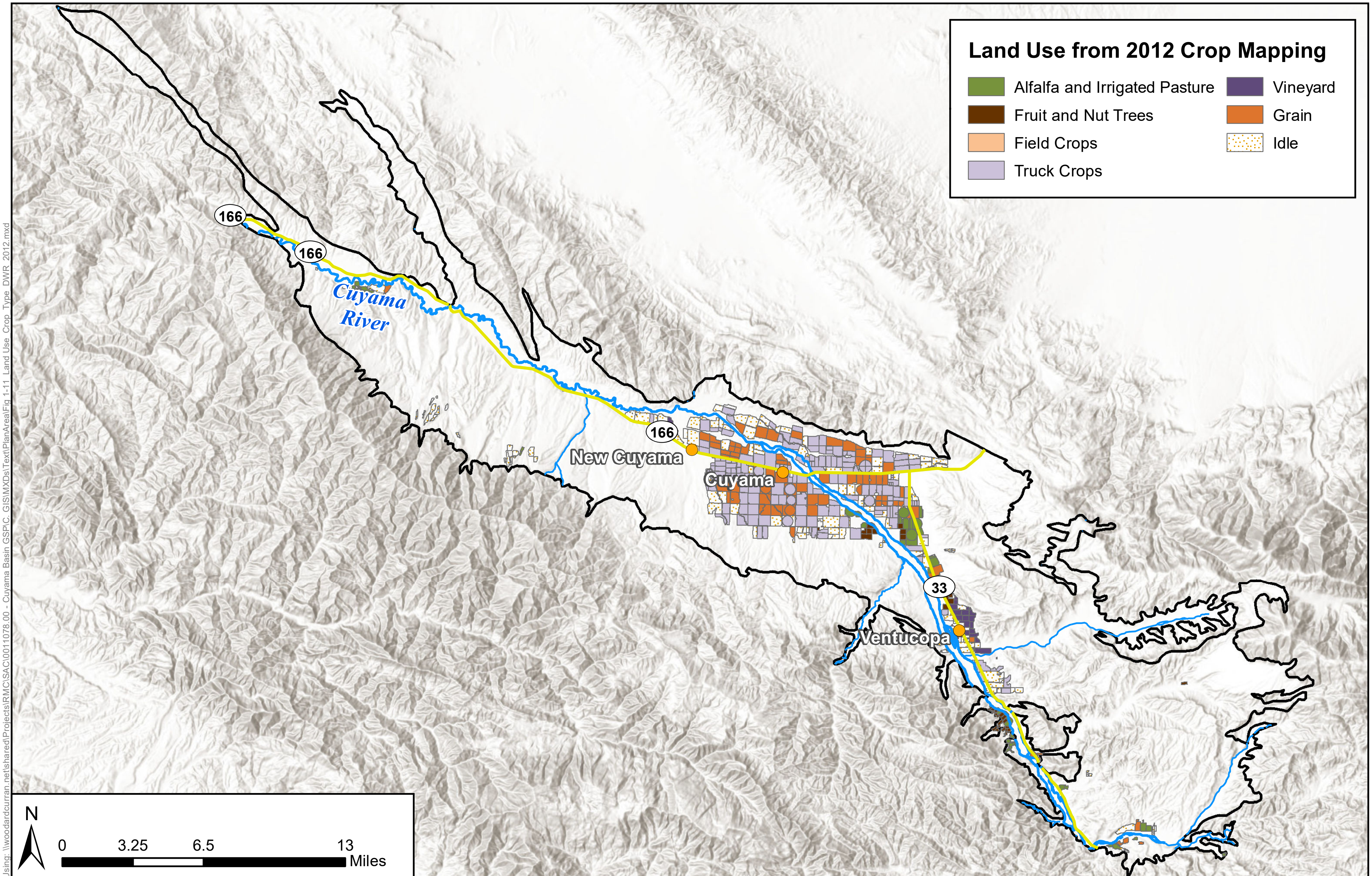

Figure 1-11 - 2012 Land Use

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Source: Crop Mapping developed by LandIQ for the Cuyama Basin GSA, 2012 dataset.

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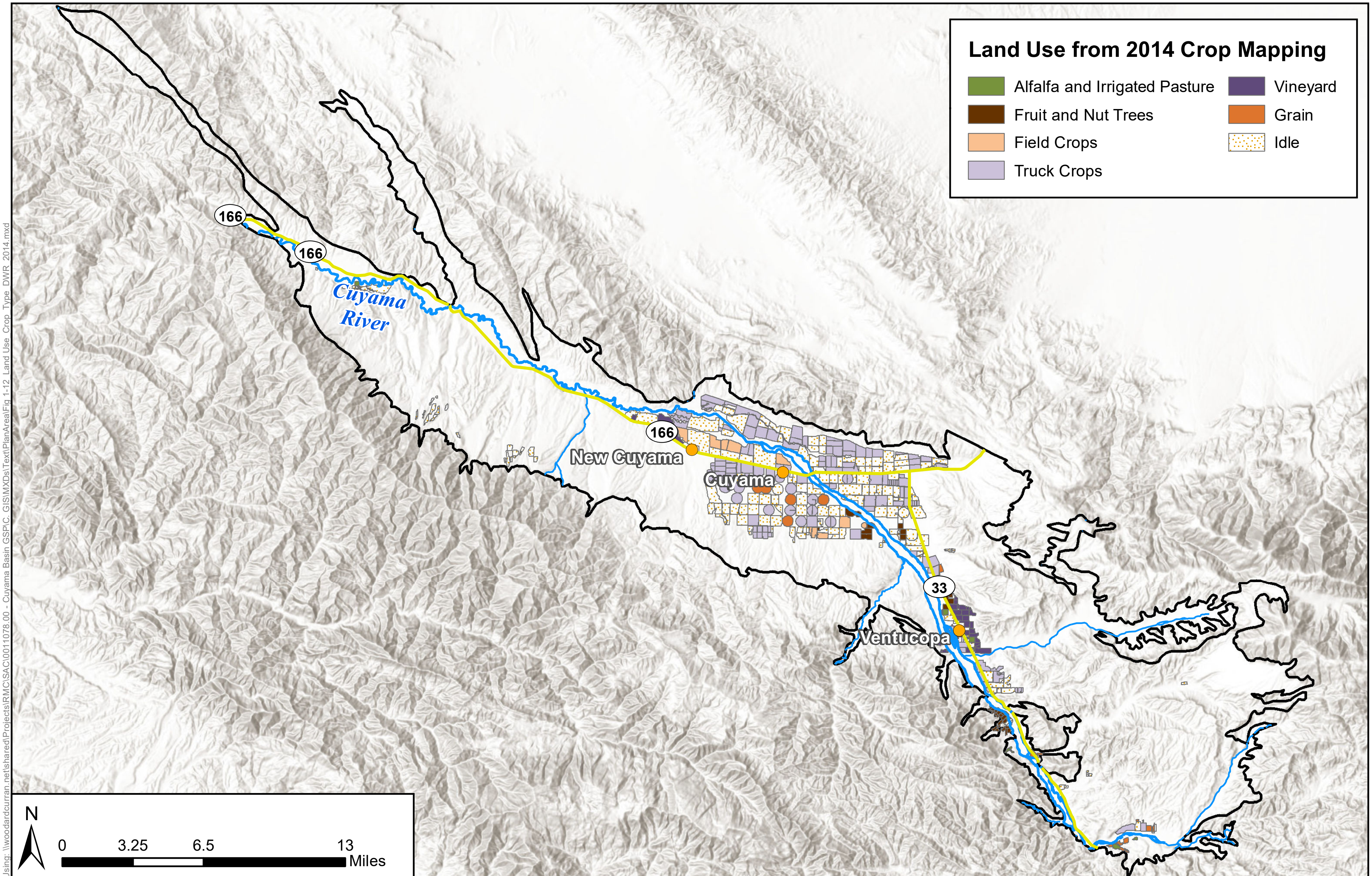

Figure 1-12 - 2014 Land Use

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams/Creeks

Source: California Department of Water Resources County Land Use Surveys, 2014 dataset. https://gis.water.ca.gov/app/CADWRLandUseViewer/

Figure Exported: 6/19/2018 By: mwicks Using: \\woodardcurran.net\shared\Projects\RMC\SAC\0011078.00 - Cuyama Basin GSP\C_GIS\MXDs\TextPlanArea\Fig 1-12_Land Use_Crop_Type_DWR_2014.mxd

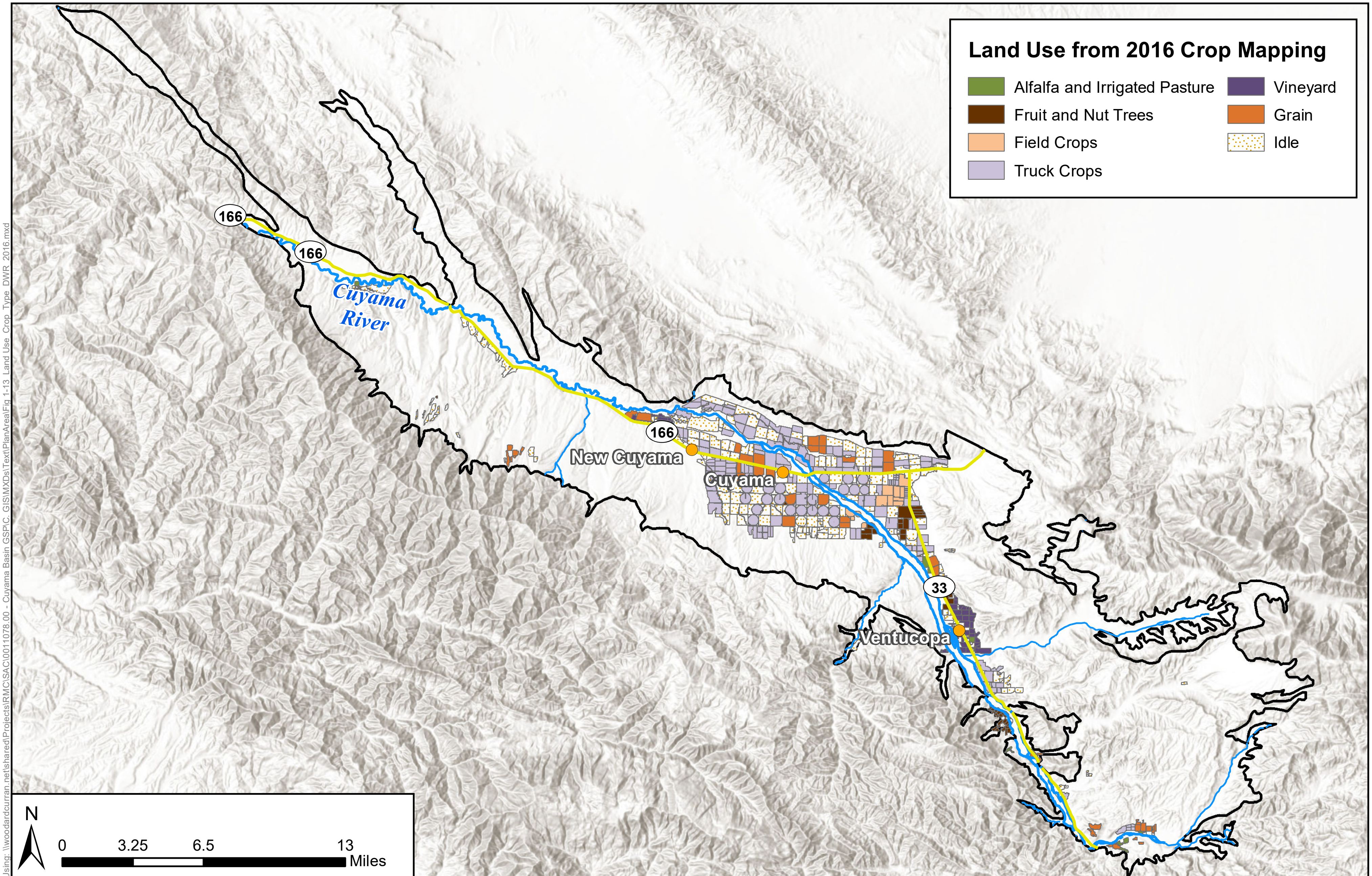

Figure 1-13 - 2016 Land Use

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams/Creeks

Source: California Department of Water Resources County Land Use Surveys, 2016 dataset. https://gis.water.ca.gov/app/CADWRLandUseViewer/

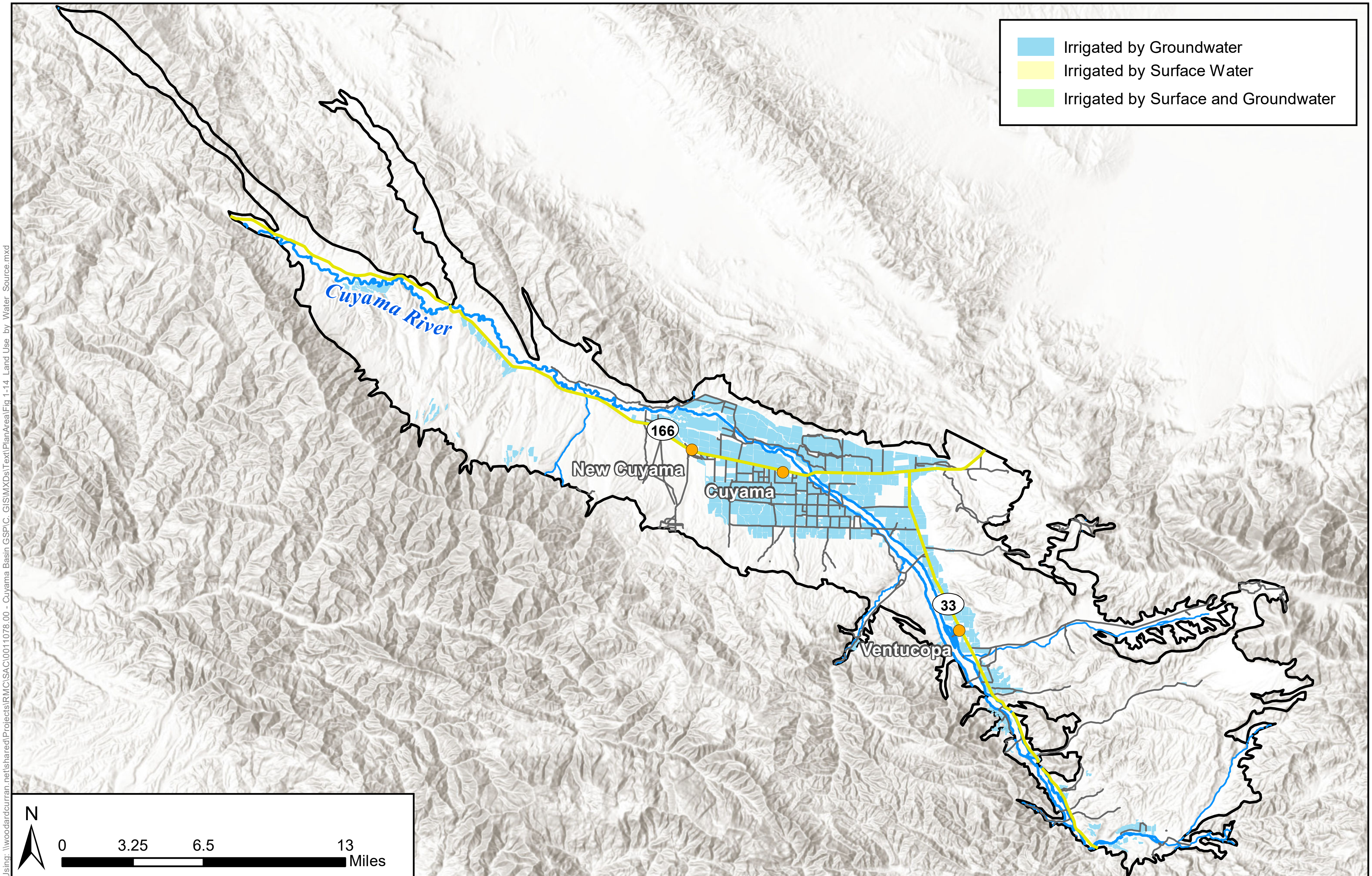

Figure 1-14 - Land Use by Water Source

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

Cuyama Basin
Towns
Highways
Local Roads
Cuyama River
Streams/Creeks

Source: California Department of Water Resources Statewide Crop Mapping, 2016 dataset.
https://gis.water.ca.gov/app/CADWRLandUseViewer/

Figure Exported: 6/19/2018 By: mwicks Using: \\woodardcurran.net\shared\Projects\RMC\SAC\0011078.00 - Cuyama Basin GSP\C. GIS\MXDs\Text\PlanArea\Fig 1-14 Land Use by Water Source.mxd

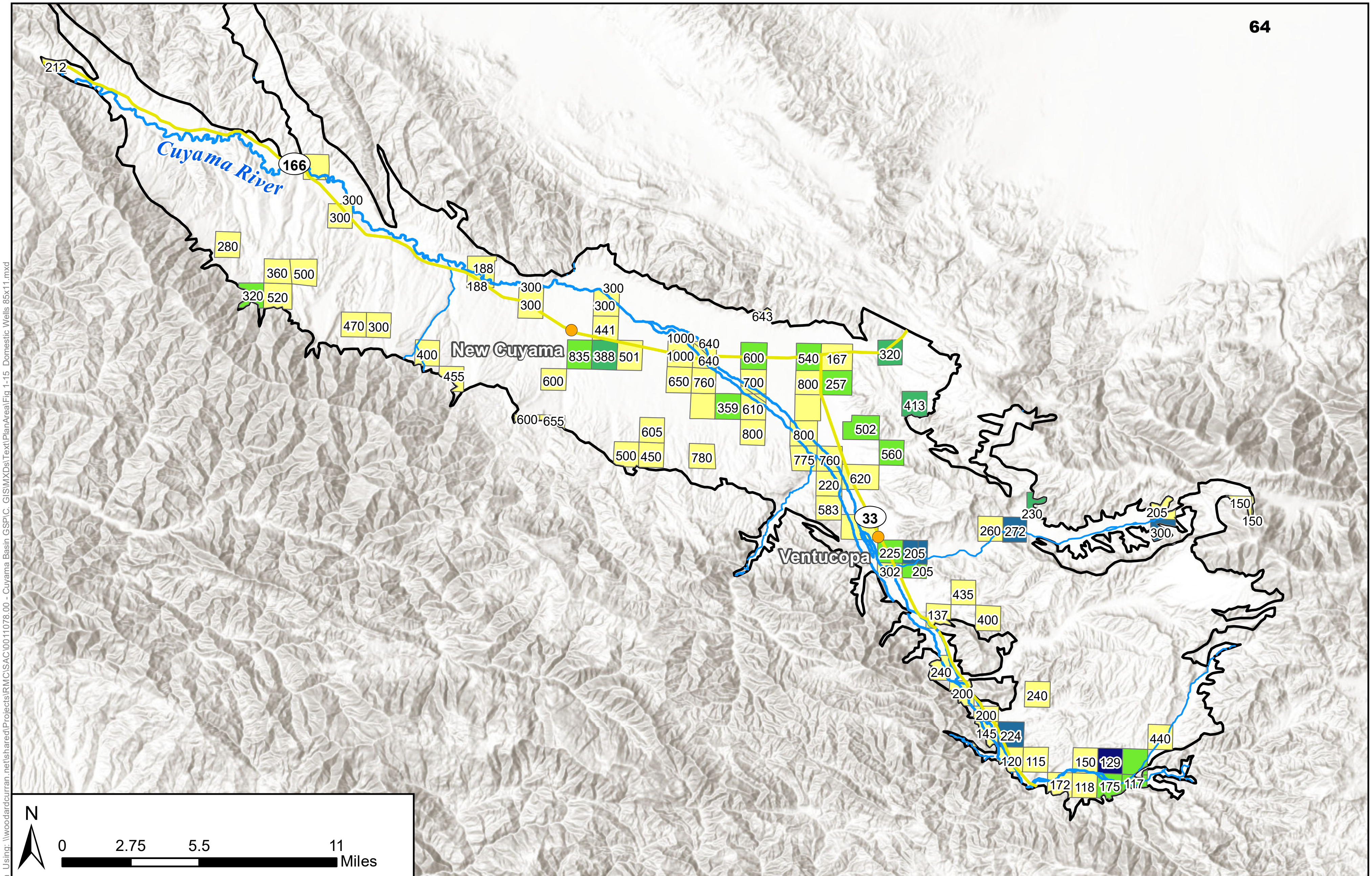

Figure Exported: 6/14/2018 By: ceggleton Using: \\woodardcurran.net\shared\Projects\RMC\SAC\0011078.00 - Cuyama Basin GSP\C. GIS\MXDs\Text\PlanArea\Fig 1-15 Domestic Wells 85x11.mxd

Figure 1-15 - Domestic Well Density and Average Depths

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams/Creeks

Number of Domestic Wells by Township & Range

- 1 Well
- 2 Wells
- 3 Wells
- 4 Wells
- 6 Wells

Numbers in the township and range grid correspond to the average depth of the wells within that grid. Grids with no number have no associated well depth data. Average well depth is given in feet below the ground surface.

Source: Department of Water Resources, Well Completion Report Map Application. Downloaded on February 6, 2018. <https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37>

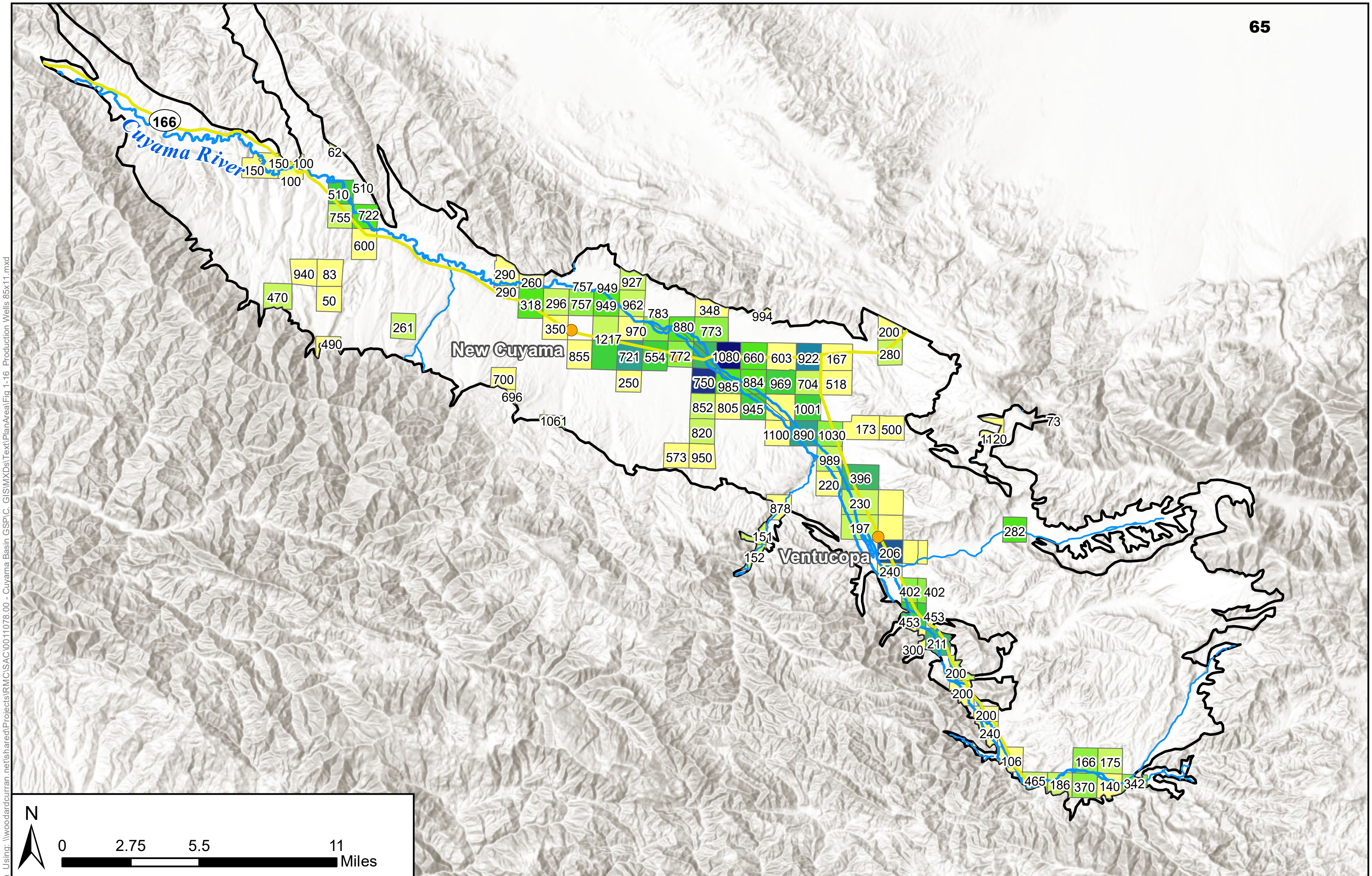

Figure 1-16 - Production Well Density and Average Depths

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams/Creeks

Number of Production Wells by Township & Range

- 1 Well
- 2 Wells
- 3 Wells
- 4 Wells
- 5 Wells
- 6 Wells
- 7 Wells
- 8 Wells
- 9 Wells
- 10 Wells
- 11 Wells

Numbers in the township and range grid correspond to the average depth of the wells within that grid. Grids with no number have no associated well depth data. Average well depth is given in feet below the ground surface.

Source: Department of Water Resources, Well Completion Report Map Application. Downloaded on February 6, 2018. <https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37>

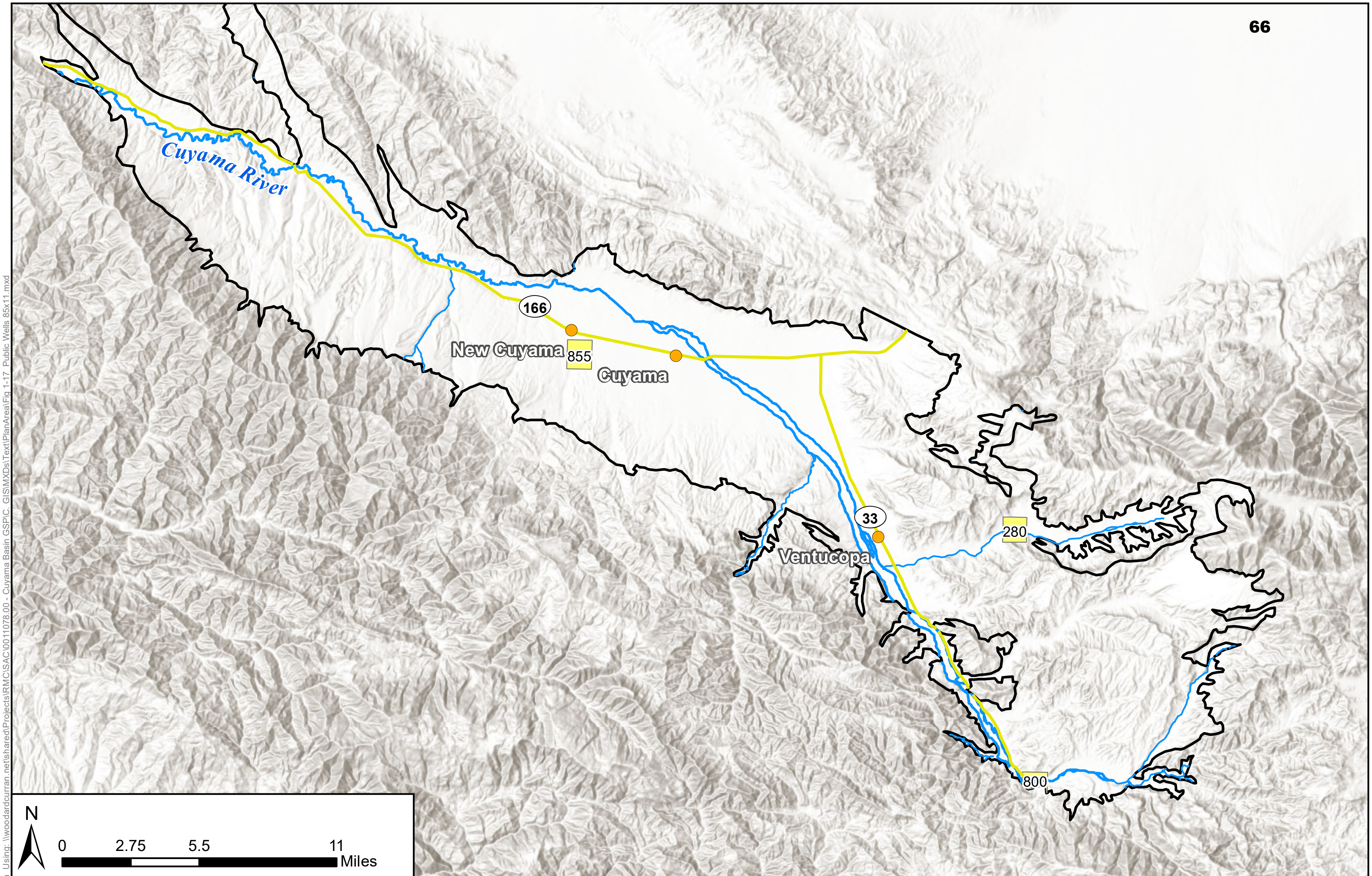

Figure 1-17 - Public Well Density and Average Depths

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

- Cuyama Basin
- Towns
- Highways
- Cuyama River
- Streams/Creeks

Number of Public Wells by Township & Range

- 1 Well

Numbers in the township and range grid correspond to the average depth of the wells within that grid. Grids with no number have no associated well depth data. Average well depth is given in feet below the ground surface.

Source: Department of Water Resources, Well Completion Report Map Application. Downloaded on February 6, 2018. <https://dwr.maps.arcgis.com/apps/webappviewer/index.html?id=181078580a214c0986e2da28f8623b37>

Figure Exported: 6/14/2018 By: ceggleton Using: \\woodardcurran.net\shared\Projects\RMC\SAC\0011078.00 - Cuyama Basin GSP\C_GIS\MXDs\Text\PlanArea\Fig 1-17_Public Wells 85x11.mxd

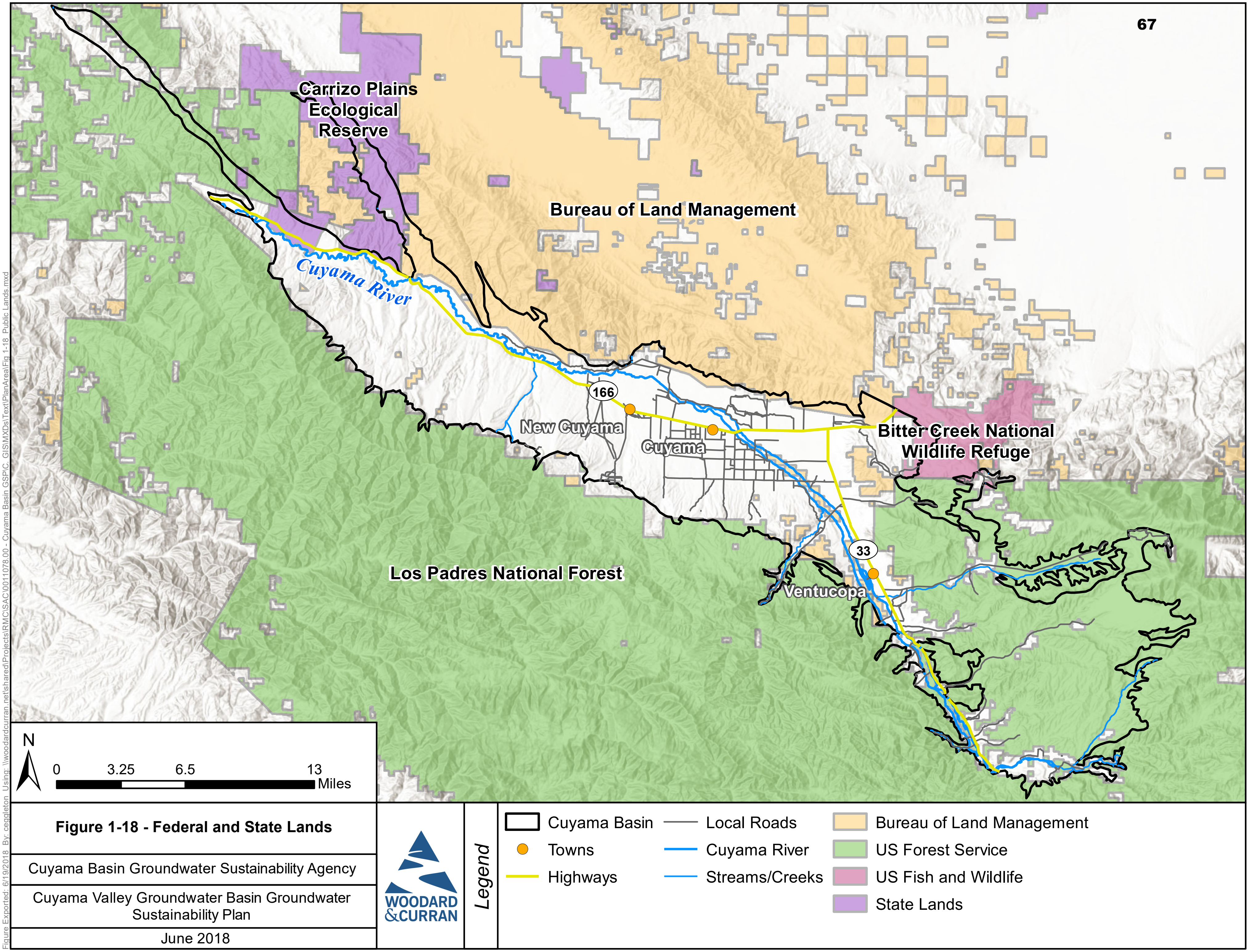

Figure 1-18 - Federal and State Lands

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

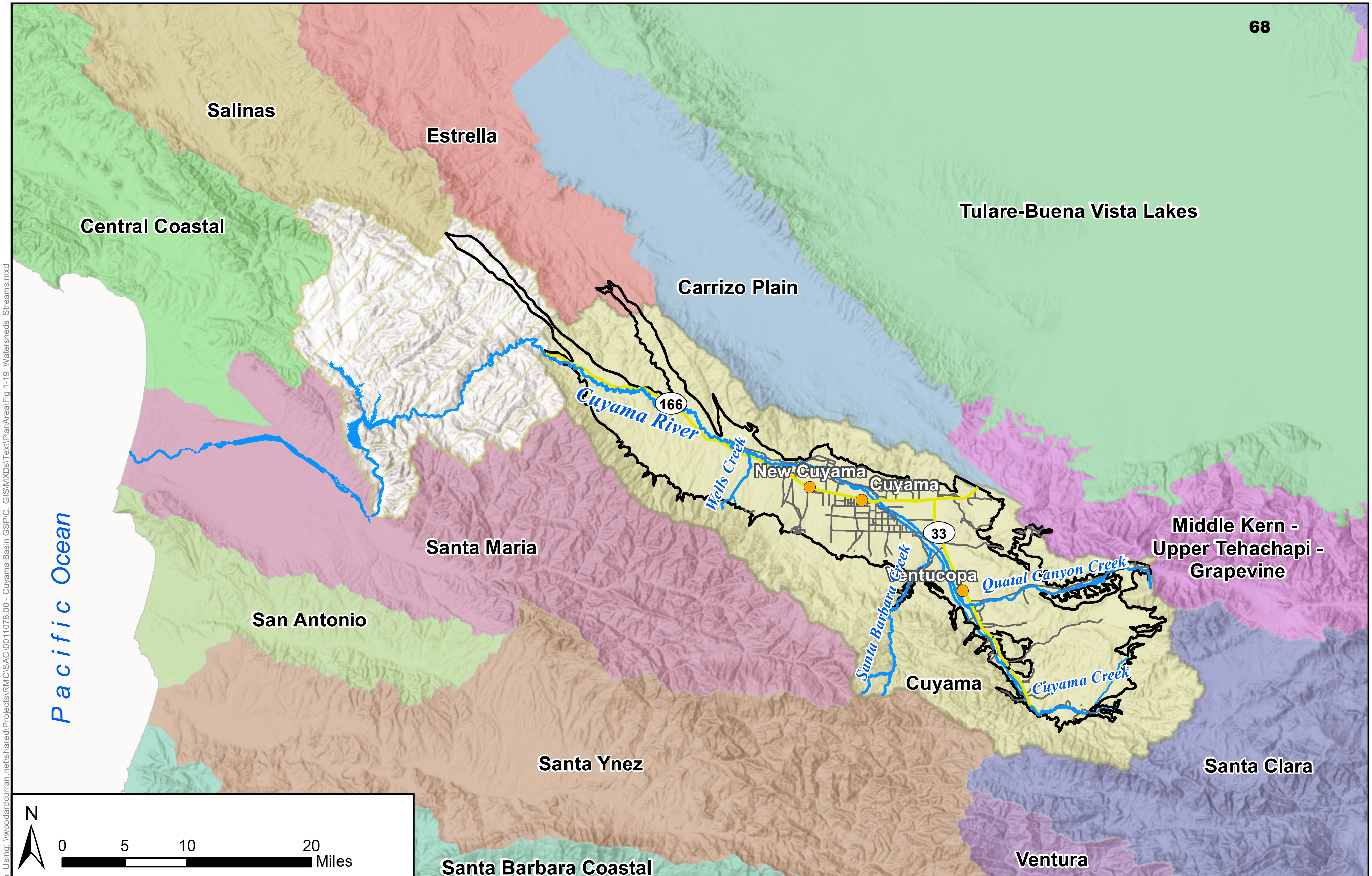

Figure 1-19 - Regional Watersheds

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

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

Cuyama Watershed

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

Watershed Data Source: USGS TNM Hydrography (WBD), U.S. Geological Survey - National Geospatial Program
Watersheds are 8-digit Hydrologic Units

1.4 Existing Surface Water Monitoring Programs

Existing surface water monitoring in the Cuyama Basin is extremely limited. Surface water monitoring in the basin is limited to DWR's California Data Exchange Center (CDEC) program, and monitoring performed by the United States Geological Survey (USGS). The only CDEC gage in the Cuyama River watershed is at Lake Twitchell, which is downstream of the Cuyama Basin. The USGS has two active gages that capture flows in the Cuyama River watershed upstream of Lake Twitchell, as well as four deactivated gages (Figure 1-20). The active and deactivated gages in the basin are summarized in Table 1-1.

Table 1-1. USGS Surface Flow Gages in the Cuyama Basin

Gage Number	Location	Status	Years of Record
11136800	Cuyama River below Buckhorn Canyon near Santa Maria CA	Active	1959-2017
11136650	Aliso Canyon Creek near New Cuyama CA	Deactivated	1963-1972
11136600	Santa Barbara Canyon Creek near Ventucopa CA	Active	2009-2017
11136500	Cuyama River near Ventucopa CA	Deactivated	1945-1958; 2009-2014
11136480	Reyes Creek near Ventucopa CA	Deactivated	1972-1978
11136400	Wagon Road Creek near Stauffer CA	Deactivated	1972-1978

The two active gages include one gage on the Cuyama River downstream of the Basin (ID #11136800), which is located just upstream of Lake Twitchell. This gage has 58 recorded years of streamflow measurements from 1959 to 2017. The other active gage is south of the city of Ventucopa along Santa Barbara Canyon Creek (ID #11136600) and has seven recorded years of streamflow measurements ranging from 2010 to 2017. Although neither of these stream gages provide a comprehensive picture of surface water flows in the Cuyama Basin, they can be used to help monitor the inflow and outflow of surface water through the Basin.

<< Description of how (and which) monitoring programs will be used in the GSP (fill in after monitoring network is prepared)>>

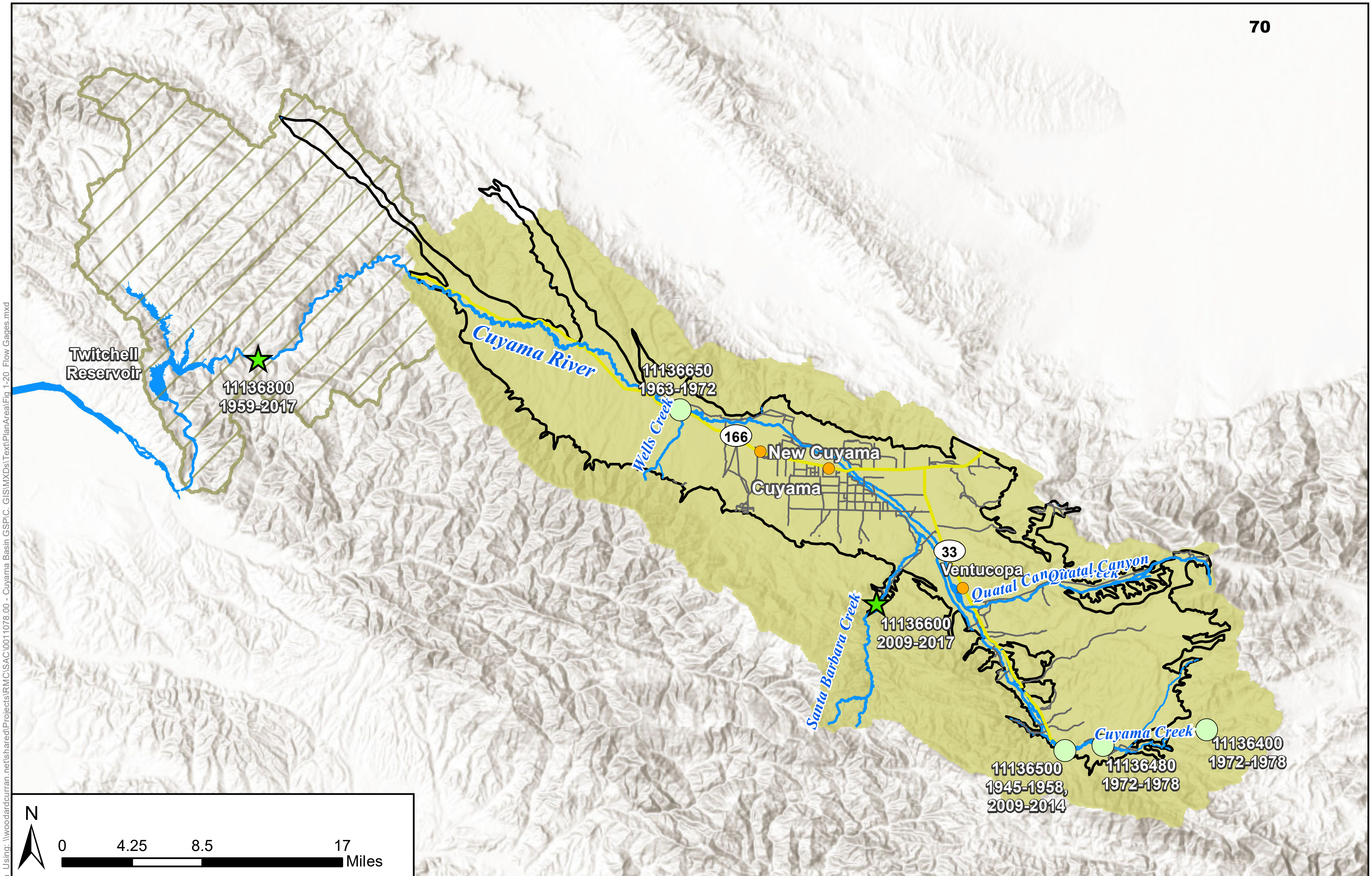

Figure 1-20 - Surface Stream Flow Gages

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

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

Cuyama Watershed

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

Figure Exported: 6/14/2018 By: ceggleton Using: \\woodardcurran.net\shared\Projects\RMC\SAC\0011078.00 - Cuyama Basin GSP\C GIS\MXDs\Text\PlanArea\Fig 1-20 Flow Gages.mxd

1.5 Existing Groundwater Monitoring Programs

Existing groundwater monitoring programs in the Cuyama Basin are primarily operated by regional, state and federal agencies. Local agencies such as the CCSD and CBWD do not conduct routine monitoring. Existing groundwater monitoring programs in the Basin collect data on groundwater elevation, groundwater quality and subsidence at varying temporal frequencies. A description of each groundwater monitoring program in the Basin is described in further detail below.

<< Description of how (and which) monitoring programs will be used in the GSP (fill in after monitoring network is prepared)>>

1.5.1 Groundwater Elevation Monitoring

Department of Water Resources Water Data Library

DWR's Water Data Library (WDL) is a database that stores groundwater elevation measurements from wells in the Cuyama Basin measured from 1946 through 2017. Data contained in the WDL is from several different monitoring entities, including the Ventura County Watershed Protection District (VCWPD), SBCWA, Santa Barbara County Flood Control and Water Conservation District (SBCFC&WCD), and San Luis Obispo County Flood Control and Water Conservation District (SLOCFC&WCD).

United States Geological Survey – National Water Information System

The USGS's National Water Information System (NWIS) contains extensive water data, including manual measurements of depth to water in wells throughout California. Wells are monitored by the USGS in SBCFC&WCD's jurisdictional area. Most of the wells that were monitored in 2017 have been monitored since 2008, although a few have measurements dating back to 1983. Groundwater level measurements at these wells are taken approximately once per quarter.

California Statewide Groundwater Elevation Monitoring

The California Statewide Groundwater Elevation Monitoring (CASGEM) Program monitors seasonal and long-term groundwater elevation trends in dedicated groundwater basins throughout California. Monitoring entities establish CASGEM dedicated monitoring wells and report seasonal groundwater levels to CASGEM's database. The information below describes sources where CASGEM data can be retrieved.

Department of Water Resources Groundwater Information Center Interactive Map

The Groundwater Information Center Interactive Map (GICIMA) is a database that collects and stores groundwater elevations and depth-to-water measurements. Groundwater elevations are measured biannually in the spring and fall by local monitoring agencies. Depth-to-water and groundwater elevation data is submitted to the GICIMA by the various monitoring entities including the SLOCFC&WCD, SBCWA, and VCWPD.

Santa Barbara County Water Agency California Statewide Groundwater Elevation Monitoring Plan

The SBCWA's CASGEM Monitoring Plan discusses the SBCWA's 19-well monitoring network, which includes 16 actively monitored wells and three inactive wells no longer monitored due to accessibility and permission issues. Initially, SBCWA was the sole monitoring entity for the entire Basin, but in 2014 SBCWA reapplied to CASGEM as a partial monitoring entity to reduce their monitoring activities and grant permission for neighboring counties (San Luis Obispo and Ventura) to monitor their portions of the Basin.

Of the 16 active wells in SBCWA's monitoring network, three are CASGEM dedicated monitoring wells and 13 are voluntary. Wells are monitored by either SBCWA staff or USGS staff. The three CASGEM dedicated monitoring wells are measured biannually in April and October, whereas the 13 voluntary wells are measured annually. All wells are single completion. CASGEM dedicated wells have known Well Completion Reports and perforated intervals.

San Luis Obispo County Flood Control and Water Conservation District California Statewide Groundwater Elevation Monitoring Plan

The SLOCFC&WCD's CASGEM Monitoring Plan identifies two wells in their CASGEM monitoring network. Upon recognition as a CASGEM monitoring entity in 2014, San Luis Obispo County Department of Public Works staff monitored these wells biannually. Static water level measurements are obtained biannually in April and October (corresponding to seasonal highs and low groundwater elevations).

Ventura County Watershed Protection District CASGEM Monitoring Plan

The VCWPD CASGEM Monitoring Plan identifies the two wells in their CASGEM monitoring network. Upon recognition as a CASGEM monitoring entity in 2014, VCWPD staff have monitored the two wells biannually. Static water level measurements are obtained biannually, due to the remoteness of the area, in April and October (corresponding to seasonal highs and low groundwater elevations). The two wells are located in the southernmost portion of the Basin.

VCWPD does not have information beyond location and water elevation measurements for the two wells. There are no well completion reports for either well and the perforation intervals are unknown. VCWPD identifies the southeastern portion of the Basin as a spatial data gap, given that the area contains no monitoring wells.

1.5.2 Groundwater Quality Monitoring

Water Data Library (WDL)

DWR's WDL monitors groundwater quality data. Samples are collected from a variety of well types including irrigation, stock, domestic, and some public supply wells. Wells are not regularly sampled, and most wells have only one or two days' worth of sampling measurements and large temporal gaps between the results. Constituents most frequently monitored include dissolved chloride, sodium, calcium, boron, magnesium, and sulfate. Measurements taken include conductance, pH, total alkalinity and hardness (more than 1,000 total samples per parameter). Additional dissolved nutrients, metals, and total dissolved solids (TDS) are also sampled but have fewer sample results available (one to 1,000 samples per parameter).

GeoTracker Groundwater Ambient Monitoring and Assessment Program

Established in 2000, the Groundwater Ambient Monitoring and Assessment (GAMA) Program monitors groundwater quality throughout the state of California. GAMA is intended to create a comprehensive groundwater monitoring program throughout California and increase public availability and access to groundwater quality and contamination information. GAMA receives data from a variety of monitoring entities including DWR, USGS, and the State Water Resources Control Board (SWRCB). In the Cuyama Groundwater Basin, three agencies submit data from monitoring wells for a suite of constituents including TDS, nitrates and nitrites, arsenic, and manganese.

National Water Information System

The USGS's NWIS monitors groundwater for chemical, physical, and biological properties in water supply wells throughout the Basin and data is updated to GeoTracker on a quarterly basis. The majority of wells with groundwater quality data were monitored prior to 2015.

Irrigated Lands Regulatory Program

The Irrigated Lands Regulatory Program (ILRP), established in 2003, regulates discharges from irrigated agriculture to surface and ground waters and establishes waste discharge orders for selected regions. The ILRP focuses on priority water quality issues, such as pesticides and toxicity, nutrients, and sediments. Wells are sampled biannually, once between March and June, and once between September and December.

Division of Drinking Water

The SWRCB's Division of Drinking Water (DDW, and formerly the Department of Health Services) monitors public water system wells for California Code of Regulations Title 22 requirements relative to levels of organic and inorganic compounds such as metals, microbial compounds and radiological analytes. Data is available for active and inactive drinking water sources, for water systems that serve the public, and wells defined as serving 15 or more connections, or more than 25 people per day. In the Cuyama Basin, DDW wells were monitored for Title 22 requirements, including pH, alkalinity, bicarbonate, calcium, magnesium, potassium, sulfate, barium, copper, iron, zinc, and nitrate.

1.5.3 Subsidence Monitoring

In the Cuyama Basin, subsidence monitoring is performed using continuous global positioning system (GPS) stations monitored by the University NAVSTAR Consortium's (UNAVCO) Plate Boundary Observatory (PBO) program. There are no known extensometers in the Cuyama Basin.

UNAVCO Plate Boundary Observatory

The UNAVCO PBO network consists of a network of about 1,100 continuous GPS and meteorology stations in the western U.S. used to monitor multiple pieces of information, including subsidence. There are two stations in the Cuyama Basin: (1) CUHS, located near the city of New Cuyama; and (2) VCST, located south of the city of Ventucopa. The CUHS station has subsidence data from 2000 through 2017, and the VCST station has subsidence data from 2001 through 2017.

Placeholder for other USGS Subsidence Monitoring

1.6 Existing Water Management Programs

1.6.1 Santa Barbara County Integrated Regional Water Management Plan 2013

The Santa Barbara County Integrated Regional Water Management Plan 2013 (IRWM Plan 2013) is the main integrated regional water management planning document for the Santa Barbara County IRWM Region (County of Santa Barbara, 2013). IRWM Plan 2013 emphasizes multi-agency collaboration, stakeholder involvement and collaboration, regional approaches to water management, water management involvement in land use decisions, and project monitoring to evaluate results of current practices. IRWM Plan 2013 identifies regionally and locally focused projects that help achieve regional objectives and targets while working to address water-related challenges in the region.

The following IRWM Plan 2013 objectives related to groundwater use would potentially influence implementation of the GSP:

- Protect, conserve, and augment water supplies
- Protect, manage, and increase groundwater supplies
- Practice balanced natural resource stewardship
- Protect and improve water quality
- Maintain and enhance water and wastewater infrastructure efficiency and reliability

IRWM Plan 2013 provides valuable resources related to potential concepts, projects and monitoring strategies that can be incorporated into the CBGSA GSP.

1.6.2 San Luis Obispo County 2014 Integrated Regional Water Management Plan

The San Luis Obispo 2014 IRWM Plan presents a comprehensive water resources management approach to managing the region's water resources, focusing on strategies to improve the sustainability of current and future needs of San Luis Obispo County (County of San Luis Obispo, 2014). Much of the IRWM Plan was based on the San Luis Obispo County Water Master Report (SLOCFC&WCD, 2012)

The following 2014 IRWM Plan goals related to groundwater use would potentially influence implementation of the GSP:

- **Water Supply Goal:** Maintain or improve water supply quantity and quality for potable water, fire protection, ecosystem health, and agricultural production needs; as well as to cooperatively address limitations, vulnerabilities, conjunctive-use, and water-use efficiency.
- **Ecosystem and Watershed Goal:** Maintain or improve the health of the Region's watersheds, ecosystems, and natural resources through collaborative and cooperative actions, with a focus on assessment, protection, and restoration/enhancement of ecosystem and resource needs and vulnerabilities.
- **Groundwater Monitoring and Management (Groundwater) Goal:** Achieve sustainable use of the region's water supply in groundwater basins through collaborative and cooperative actions.

- **Water Resources Management and Communications (Water Management) Goal:** Promote open communications and regional cooperation in the protection and management of water resources, including education and outreach related to water resources conditions, conservation/water use efficiency, water rights, water allocations, and other regional water resource management efforts.

The 2014 IRWM Plan provides valuable resources related to potential concepts, projects, and monitoring strategies that can be incorporated into the CBGSA GSP.

1.6.3 Ventura County 2014 Integrated Regional Water Management Plan

The Ventura County 2014 IRWM Plan reflects the unique needs of a diverse region in Ventura County, which encompasses three major watersheds, ten cities, portions of the Los Padres National Forest, a thriving agricultural economy, and is home to more than 823,000 people (County of Ventura, 2014). The Plan is a comprehensive document that primarily addresses region-wide water management and related issues.

The following 2014 IRWM Plan goals related to groundwater use would potentially influence implementation of the GSP:

- Reduce dependence on imported water and protect, conserve and augment water supplies.
- Protect and improve water quality.
- Protect and restore habitat and ecosystems in watersheds.

The 2014 IRWM Plan provides valuable resources related to potential concepts, projects and monitoring strategies that can be incorporated into the CBGSA GSP.

1.6.4 Kern County 2011 Integrated Regional Water Management Plan

The Kern County 2011 IRWM Plan covers most of Kern County but does not include the portion of the county that includes the Cuyama Basin (Kern County Water Agency, 2011). Therefore, the IRWM Plan is not relevant to the Cuyama GSP and is not addressed here.

1.7 General Plans in Plan Area

As illustrated in Figure 1-4, the Cuyama Basin is located within the geographic boundaries of four counties, including Kern, San Luis Obispo, Santa Barbara and Ventura. Implementation of the CBGSA GSP would be affected by the policies and regulations outlined in the General Plans of these counties, given that the Cuyama Basin, and long-term land use planning decisions that would affect the Basin, are under the jurisdiction of these counties.

This section describes how implementation of the various General Plans may change water demands in the Basin, for example due to population growth and development of the built environment, how the General Plans may influence the GSP's ability to achieve sustainable groundwater use, and how the GSP may affect implementation of General Plan land use policies.

1.7.1 Santa Barbara County Comprehensive Plan

The Santa Barbara County Comprehensive Plan is a means by which more orderly development and consistent decision making in the county can be accomplished. The Plan involves a continuing process of research, analysis, goal-setting and citizen participation, the major purpose of which is to enable the County Board of Supervisors and Planning Commission to more effectively determine matters of priority in the allocation of resources, and to achieve the physical, social and economic goals of the communities in the county (County of Santa Barbara, 2016).

Relevant Santa Barbara County Comprehensive Plan Principles and Policies

The following Santa Barbara County Comprehensive Plan Land Use Element policies related to groundwater use would potentially influence implementation of the GSP:

- **Land Use Development Policy 4:** Prior to issuance of a development permit, the County shall make the finding, based on information provided by environmental documents, staff analysis, and the applicant, that adequate public or private services and resources (i.e., water, sewer, roads, etc.) are available to serve the proposed development.
- **Hillside and Watershed Protection Policy 7:** Degradation of the water quality of groundwater basins, nearby streams, or wetlands shall not result from development of the site. Pollutants, such as chemicals, fuels, lubricants, raw sewage, and other harmful waste, shall not be discharged into or alongside coastal streams or wetlands either during or after construction.

The following Santa Barbara County Comprehensive Plan Conservation Element, Groundwater Resources Section goals and policies related to groundwater use would potentially influence implementation of the GSP:

- **Goal 1:** To ensure adequate quality and quantity of groundwater for present and future county residents, and to eliminate prolonged overdraft of any groundwater basins.
- **Policy 1.1:** The County shall encourage and assist all of the county's water purveyors and other groundwater users in the conservation and management, on a perennial yield basis, of all groundwater resources.
- **Policy 1.2:** The County shall encourage innovative and/or appropriate, voluntary water conservation activities for increasing the efficiency of agricultural water use in the county.
- **Policy 1.3:** The County shall act within its powers and financial abilities to promote and achieve the enhancement of groundwater basin yield.
- **Goal 2:** To improve existing groundwater quality, where feasible, and to preclude further permanent or long-term degradation in groundwater quality.
- **Policy 2.1:** Where feasible, in cooperation with local purveyors and other groundwater users, the County shall act to protect groundwater quality where quality is acceptable, improve quality where degraded, and discourage degradation of quality below acceptable levels.
- **Policy 2.2:** The County shall support the study of adverse groundwater quality effects which may be due to agricultural, domestic, environmental and industrial uses and practices.

- **Goal 3:** To coordinate County land use planning decisions and water resources planning and supply availability.
- **Policy 3.1:** The County shall support the efforts of the local water purveyors to adopt and implement groundwater management plans pursuant to the Groundwater Management Act and other applicable law.
- **Policy 3.2:** The County shall conduct its land use planning and permitting activities in a manner which promotes and encourages the cooperative management of groundwater resources by local agencies and other affected parties, consistent with the Groundwater Management Act and other applicable law.
- **Policy 3.3:** The County shall use groundwater management plans, as accepted by the Board of Supervisors, in its land use planning and permitting decisions and other relevant activities.
- **Policy 3.4:** The County's land use planning decisions shall be consistent with the ability of any affected water purveyor(s) to provide adequate services and resources to their existing customers, in coordination with any applicable groundwater management plan.
- **Policy 3.5:** In coordination with any applicable groundwater management plan(s), the County shall not allow, through its land use permitting decisions, any basin to become seriously over drafted on a prolonged basis.
- **Policy 3.6:** The County shall not make land use decisions which would lead to the substantial over commitment of any groundwater basin.
- **Policy 3.7:** New urban development shall maximize the use of effective and appropriate natural and engineered recharge measures in project design, as defined in design guidelines to be prepared by the Santa Barbara County Flood Control and Water Conservation District in cooperation with P&D.
- **Policy 3.8:** Water-conserving plumbing, as well as water-conserving landscaping, shall be incorporated into all new development projects, where appropriate, effective, and consistent with applicable law.
- **Policy 3.9:** The County shall support and encourage private and public efforts to maximize efficiency in the pre-existing consumptive M&I use of groundwater resources.
- **Policy 3.10:** The County, in consultation with the cities, affected water purveyors, and other interested parties, shall promote the use of consistent "significance thresholds" by all appropriate agencies with regard to groundwater resource impact analysis.
- **Goal 4:** To maintain accurate and current information on groundwater conditions throughout the county.
- **Policy 4.1:** The County shall act within its powers and financial abilities to collect, update, refine, and disseminate information on local groundwater conditions.

The following Santa Barbara County Comprehensive Plan Agricultural Element goal and policy related to groundwater use would potentially influence implementation of the GSP:

- **Goal 1:** Santa Barbara County shall assure and enhance the continuation of agriculture as a major viable production industry in Santa Barbara Country. Agriculture shall be encouraged. Where conditions allow, (taking into account environmental impacts) expansion and intensification shall be supported.
- **Policy 1F:** The quality and availability of water, air, and soil resources shall be protected through provisions including but not limited to, the stability of Urban/Rural Boundary Lines, maintenance of buffer areas around agricultural areas, and the promotion of conservation practices.

Santa Barbara County Comprehensive Plan's Influence on Water Demand and Groundwater Sustainability Plan's Goals

Review of relevant Santa Barbara County Comprehensive Plan goals and policies reveals that the County's goals and policies relative to future land use development and conservation complement the use and conservation of groundwater resources goals anticipated to be included in the CBGSA GSP. The Comprehensive Plan explicitly states as a goal ensuring that adequate quality and quantity of groundwater will be available for present and future county residents, as well as the elimination of prolonged overdraft of any groundwater basins through land use planning decisions and water resources planning.

The county is expected to grow from 428,600 to 520,000 residents between 2015 and 2040 (SBCAG, 2012). These growth estimates are County-wide and the General Plan does not specify how much growth, if any, is expected to occur within the Basin. Ensuring sustainable management of the Basin through implementation of the GSP will be critical in terms of supporting projected population growth in the county while maintaining sustainable groundwater levels in the Basin.

Groundwater Sustainability Plan's Influence on Santa Barbara County Comprehensive Plan's Goals and Policies

Successful implementation of the GSP will help to ensure that the Cuyama Basin's groundwater supply is managed in a sustainable manner. Given the amount of population growth projected in the county in the coming years, it is possible that changes in groundwater management by the GSP will result in changes to the pace, location and type of development that will occur in the county in the future. It is anticipated that GSP implementation will be consistent with the Comprehensive Plan's goals related to sustainable land use development in the county.

1.7.2 San Luis Obispo County General Plan

The San Luis Obispo County General Plan describes official County policy on the location of land uses and their orderly growth and development. It is the foundation upon which all land use decisions are based, guides action the County takes to assure a vital economy, ensures a sufficient and adequate housing supply, and protects agricultural and natural resources (County of San Luis Obispo, 2015).

Relevant San Luis Obispo General Plan Principles and Policies

The following San Luis Obispo General Plan Land Use Element principles and policies related to groundwater use would potentially influence implementation of the GSP:

- **Principle 1:** Preserve open space, scenic natural beauty and natural resources. Conserve energy resources. Protect agricultural land and resources.
- **Policy 1.2:** Keep the amount, location and rate of growth allowed by the Land Use Element within the sustainable capacity of resources, public services and facilities.
- **Policy 1.3:** Preserve and sustain important water resources, watersheds and riparian habitats.

The following San Luis Obispo General Plan Conservation and Open Space Element goals and policies related to groundwater use would potentially influence implementation of the GSP:

- **Goal WR 1:** The county will have a reliable and secure regional water supply.
- **Policy WR 1.2:** Conserve Water Resources. Water conservation is acknowledged to be the primary method to serve the county's increasing population. Water conservation programs should be implemented countywide before more expensive and environmentally costly forms of new water are secured.
- **Policy WR 1.3:** New Water Supply. Development of new water supplies should focus on efficient use of our existing resources. Use of reclaimed water, interagency cooperative projects, desalination of contaminated groundwater supplies, and groundwater recharge projects should be considered prior to using imported sources of water or seawater desalination, or dams and on-stream reservoirs.
- **Policy WR 1.7:** Agricultural Operations. Groundwater management strategies will give priority to agricultural operations. Protect agricultural water supplies from competition by incompatible development through land use controls.
- **Policy WR 1.12:** Impacts of New Development. Accurately assess and mitigate the impacts of new development on water supply. At a minimum, comply with the provisions of Senate Bills 610 and 221.
- **Policy WR 1.14:** Avoid Net Increase in Water Use. Avoid a net increase in non-agricultural water use in groundwater basins that are recommended or certified as Level of Severity II or III for water supply. Place limitations on further land divisions in these areas until plans are in place and funded to ensure that the safe yield will not be exceeded.
- **Goal WR 2:** The County will collaboratively manage groundwater resources to ensure sustainable supplies for all beneficial uses.
- **Policy WR 2.1:** Groundwater quality assessments Prepare groundwater quality assessments, including recommended monitoring, and management measures.
- **Policy WR 2.2:** Groundwater Basin Reporting Programs. Support monitoring and reporting programs for groundwater basins in the region.
- **Policy WR 2.3:** Well Permits. Require all well permits to be consistent with the adopted groundwater management plans.
- **Policy WR 2.4:** Groundwater Recharge. Where conditions are appropriate, promote groundwater recharge with high-quality water.
- **Policy WR 2.5:** Groundwater Banking Programs. Encourage groundwater-banking programs.

- **Goal WR 3:** Excellent water quality will be maintained for the health of the people and natural communities.
- **Policy WR 3.2:** Protect Watersheds. Protect watersheds, groundwater and aquifer recharge areas, and natural drainage systems from potential adverse impacts of development projects.
- **Policy WR 3.3:** Improve Groundwater Quality. Protect and improve groundwater quality from point and non-point source pollution, including nitrate contamination; MTBE and other industrial, agricultural, and commercial sources of contamination; naturally occurring mineralization, boron, radionuclides, geothermal contamination; and seawater intrusion and salts.
- **Policy WR 3.4:** Water Quality Restoration. Pursue opportunities to participate in programs or projects for water quality restoration and remediation with agencies and organizations such as the Regional Water Quality Control Board (RWQCB), California Department of Fish and Wildlife (CDFW), National Marine Fisheries Service (NMFS), and Resource Conservation Districts (RCDs) in areas where water quality is impaired.
- **Goal 4:** Per capita water use in the county will decline by 20% by 2020.
- **Policy WR 4.1:** Reduce Water Use. Employ water conservation programs to achieve an overall 20% reduction in per capita residential and commercial water use in the unincorporated area by 2020. Continue to improve agricultural water use efficiency consistent with Policy AGP 10 in the Agricultural Element.
- **Policy WR 4.2:** Water Pricing Structures. Support water-pricing structures to encourage conservation by individual water users and seek to expand the use of conservation rate structures in areas with Levels of Severity II and III for water supply.
- **Policy WR 4.3:** Water conservation The County will be a leader in water conservation efforts.
- **Policy WR 4.5:** Water for Recharge. Promote the use of supplemental water such as reclaimed sewage effluent and water from existing impoundments to prevent overdraft of groundwater. Consider new ways to recharge underground basins and to expand the use of reclaimed water. Encourage the eventual abandonment of ocean outfalls.
- **Policy WR 4.6:** Graywater. Encourage the use of graywater systems, rainwater catchments, and other water reuse methods in new development and renovation projects, consistent with state and local water quality regulations.
- **Policy WR 4.7:** Low Impact Development. Require Low Impact Development (LID) practices in all discretionary and land division projects and public projects to reduce, treat, infiltrate, and manage urban runoff.
- **Policy WR 4.8:** Efficient Irrigation. Support efforts of the resource conservation districts, California Polytechnic State University, the University of California Cooperative Extension, and others to research, develop, and implement more efficient irrigation techniques.
- **Goal 5:** The best possible tools and methods available will be used to manage water resources.

- **Policy WR 5.1:** Watershed Approach. The County will consider watersheds and groundwater basins in its approach to managing water resources in order to include ecological values and economic factors in water resources development.

The following San Luis Obispo General Plan Agriculture Element goals and policies related to groundwater use would potentially influence implementation of the GSP:

- **Policy AGP10a:** Encourage water conservation through feasible and appropriate "best management practices." Emphasize efficient water application techniques; the use of properly designed irrigation systems; and the control of runoff from croplands, rangelands, and agricultural roads.
- **Policy AGP10b:** Encourage the U.C. Cooperative Extension to continue its public information and research program describing water conservation techniques that may be appropriate for agricultural practices in this county. Encourage landowners to participate in programs that conserve water.
- **Policy AGP11b:** Do not approve proposed general plan amendments or re-zonings that result in increased residential density or urban expansion if the subsequent development would adversely affect: (1) water supplies and quality, or (2) groundwater recharge capability needed for agricultural use.
- **Policy AGP11c:** Do not approve facilities to move groundwater from areas of overdraft to any other area, as determined by the Resource Management System in the Land Use Element.

San Luis Obispo County General Plan's Influence on Water Demand and Groundwater Sustainability Plan

The semi-arid climate in the county is subject to limited amounts of rainfall and recharge of groundwater basins and surface reservoirs. A focus of the County General Plan is that future development should take place recognizing that the dependable supply of some county groundwater basins is already being exceeded. If mining of groundwater continues in those areas without allowing aquifers to recharge, water supply and water quality problems will eventually result, which may be costly to correct and could become irreversible.

The General Plan explicitly encourages preservation of the county's natural resources, and states that future growth should be accommodated only while ensuring that this growth occurs within the sustainable capacity of these resources.

The county was expected to grow between 0.44-1% per year from 2013 through 2018, an increase of approximately 12,000 persons over the five-year period and is expected to grow by over 41,000 from 2010 to 2030 (County of San Luis Obispo, 2014). These growth estimates are County-wide and the General Plan does not specify how much growth, if any, is expected to occur within the Basin. Ensuring sustainable management of the basin through implementation of the GSP will be critical in terms of supporting projected population growth in the county while maintaining sustainable groundwater levels in the basin.

Groundwater Sustainability Plan's Influence on San Luis Obispo County General Plan's Goals and Policies

Successful implementation of the GSP will help to ensure that the Cuyama Basin's groundwater supply is managed in a sustainable manner. Given the amount of population growth projected in the county in the coming years, it is possible that changes in groundwater management by the GSP will impact the location and type of development that will occur in the Basin in the future. It is anticipated that GSP implementation will reinforce the General Plan's goals related to sustainable land use development in the county.

1.7.3 Ventura County General Plan

The Ventura County General Plan consists of: (a) countywide Goals, Policies and Programs containing four chapters (Resources, Hazards, Land Use, and Public Facilities and Services), (b) four appendices (Resources, Hazards, Land Use, and Public Facilities and Services) which contain background information and data in support of the Countywide Goals, Policies and Programs, and (c) several Area Plans which contain specific goals, policies and programs for specific geographical areas of the county.

Relevant Ventura County General Plan Principles and Policies

The following Ventura County General Plan (Resources Chapter, Water Resources Section, 1.3.1 Goals, 1.3.2 Policies) goals and policies related to groundwater use would potentially influence implementation of the GSP:

- **Goal 1:** Inventory and monitor the quantity and quality of the county's water resources.
- **Goal 2:** Effectively manage the water resources of the county by adequately planning for the development, conservation and protection of water resources for present and future generations.
- **Goal 3:** Maintain and, where feasible, restore the chemical, physical and biological integrity of surface and groundwater resources.
- **Goal 4:** Ensure that the demand for water does not exceed available water resources.
- **Goal 5:** Protect and, where feasible, enhance watersheds and aquifer recharge areas.
- **Goal 6:** Promote reclamation and reuse of wastewater for recreation, irrigation and to recharge aquifers.
- **Goal 7:** Promote efficient use of water resources through water conservation.
- **Policy 1:** Discretionary development which is inconsistent with the goals and policies of the County's Water Management Plan (WMP) shall be prohibited, unless overriding considerations are cited by the decision-making body.
- **Policy 2:** Discretionary development shall comply with all applicable County and State water regulations.
- **Policy 3:** The installation of on-site septic systems shall meet all applicable State and County regulations.
- **Policy 4:** Discretionary development shall not significantly impact the quantity or quality of water resources in watersheds, groundwater recharge areas or groundwater basins.

- **Policy 5:** Landscape plans for discretionary development shall incorporate water conservation measures as prescribed by the County's Guide to Landscape Plans, including use of low water usage landscape plants and irrigation systems and/or low water usage plumbing fixtures and other measures designed to reduce water usage.
- **Policy 10:** All new golf courses shall be conditioned to prohibit landscape irrigation with water from groundwater basins or inland surface waters identified as Municipal and Domestic Supply or Agricultural Supply in the California Regional Water Quality Control Board's Water Quality Control Plan unless either: a) the existing and planned water supplies for a Hydrologic Area, including interrelated Hydrologic Areas and Subareas, are shown to be adequate to meet the projected demands for existing uses as well as reasonably foreseeable probable future uses in the area, or b) it is demonstrated that the total groundwater extraction/recharge for the golf course will be equal to or less than the historic groundwater extraction/recharge (as defined in the Ventura County Initial Study Assessment Guidelines) for the site. Where feasible, reclaimed water shall be utilized for new golf courses.

The following Ventura County General Plan (Land Use Chapter, 3.1.1 Goals) goal related to groundwater use would potentially influence implementation of the GSP:

- **Goal 1:** Ensure that the county can accommodate anticipated future growth and development while maintaining a safe and healthful environment by preserving valuable natural resources, guiding development away from hazardous areas, and planning for adequate public facilities and services. Promote planned, well-ordered and efficient land use and development patterns.

The following Ventura County General Plan (Public Facilities Chapter, Water Supply Facilities section 4.3.1 Goals and 4.3.2 Policies) goals and policies related to groundwater use would potentially influence implementation of the GSP:

- **Goal 1:** Ensure the provision of water in quantities sufficient to satisfy current and projected demand.
- **Goal 2:** Encourage the employment of water conservation measures in new and existing development.
- Encourage the continued cooperation among water suppliers in the county in meeting the water needs of the county as a whole.
- **Policy 1:** Development that requires potable water shall be provided a permanent potable water supply of adequate quantity and quality that complies with applicable County and State water regulations. Water systems operated by or receiving water from Casitas Municipal Water District, the Calleguas Municipal Water District or the United Water Conservation District will be considered permanent supplies unless an Urban Water Management Plan (prepared pursuant to Part 2.6 of Division 6 of the Water Code) or a water supply and demand assessment (prepared pursuant to Part 2.10 of Division 6 of the Water Code) demonstrates that there is insufficient water supply to serve cumulative development in the district's service area. When the proposed water supply is to be drawn exclusively from wells in areas where groundwater supplies have been determined by the Environmental Health Division or the

Public Works Agency to be questionable or inadequate, the developer shall be required to demonstrate the availability of a permanent potable water supply for the life of the project.

- **Policy 2:** Discretionary development as defined in section 10912 of the Water Code shall comply with the water supply and demand assessment requirements of Part 2.10 of Division 6 of the Water Code.
- **Policy 3:** Discretionary development shall be conditioned to incorporate water conservation techniques and the use of drought resistant native plants pursuant to the County's Guide to Landscape Plans.

Ventura County Plan's Influence on Water Demand and Groundwater Sustainability Plan's Goals

Review of relevant Ventura County General Plan goals and policies reveals that the County's goals and policies relative to future land use development and conservation complement the use and conservation of groundwater resources goals included in the CBGSA GSP. The General Plan explicitly states as a goal ensuring that adequate quality and quantity of groundwater will be available for present and future county residents, as well as accommodating anticipated future growth and development while maintaining a safe and healthful environment by preserving valuable natural resources, including groundwater.

The county is expected to grow from 865,090 to 969,271 residents between 2018 and 2040 (Caltrans, 2015). These growth estimates are County-wide and the General Plan does not specify how much growth, if any, is expected to occur within the Basin. Ensuring sustainable management of the basin through implementation of the GSP will be critical in terms of supporting projected population growth in the county while maintaining sustainable groundwater levels in the Basin.

Groundwater Sustainability Plan's Influence on Ventura County General Plan's Goals and Policies

Successful implementation of the GSP will help to ensure that the Cuyama Basin's groundwater supply is managed in a sustainable manner. Given the amount of population growth projected in the county in the coming years, it is possible that changes in groundwater management by the GSP will result in changes to the pace, location and type of development that will occur in the county in the future. It is anticipated that GSP implementation will reinforce the General Plan's goals related to sustainable land use development in the county.

1.7.4 Kern County General Plan

Because of the close interrelationship between water supplies, land use, conservation, and open space issues, the Land Use, Conservation, and Open Space Element sections of the Kern County General Plan are the most relevant elements for development of the GSP. These elements provide for a variety of land uses for future economic growth while also assuring the conservation of Kern County's agricultural, natural, and resource attributes (County of Kern, 2009).

Relevant Kern County General Plan Goals and Policies

The following Land Use, Conservation, and Open Space Element goals and policies related to groundwater use would potentially influence implementation of the GSP:

- **Goal 1.4.5:** Ensure that adequate supplies of quality water (appropriate for intended use) are available to residential, industrial, and agricultural users in Kern County.
- **Policy 1.4.2:** The efficient and cost-effective delivery of public services and facilities will be promoted by designating areas for urban development which occur in or adjacent to areas with adequate public service and facility capacity.
- **Policy 1.4.2.a:** Ensure that water quality standards are met for existing users and future development.
- **Goal 1.6.6:** Promote the conservation of water quantity and quality in Kern County.
- **Goal 1.6.7:** Minimize land use conflicts between residential and resource, commercial, and industrial land uses.
- **Policy 1.6.11:** Provide for an orderly outward expansion of new urban development so that it maintains continuity of existing development, allows for the incremental expansion of infrastructure and public service, minimizes impacts on natural environmental resources, and provides a high-quality environment for residents and businesses.
- **Policy 1.9.10:** To encourage effective groundwater resource management for the long-term economic benefit of the county, the following shall be considered:
- **Policy 1.9.10.a:** Promote groundwater recharge activities in various zone districts.
- **Policy 1.9.10.c:** Support the development of groundwater management plans.
- **Policy 1.9.10.d:** Support the development of future sources of additional surface water and groundwater, including conjunctive use, recycled water, conservation, additional storage of surface water and groundwater and desalination.
- **Goal 1.10.1:** Ensure that the county can accommodate anticipated future growth and development while maintaining a safe and healthful environment and a prosperous economy by preserving valuable natural resources, guiding development away from hazardous areas, and assuring the provision of adequate public services.
- **Policy 1.10.6.39:** Encourage the development of the county's groundwater supply to sustain and ensure water quality and quantity for existing users, planned growth, and maintenance of the natural environment.
- **Policy 1.10.6.40:** Encourage utilization of community water systems rather than the reliance on individual wells.
- **Policy 1.10.6.41:** Review development proposals to ensure adequate water is available to accommodate projected growth.

Kern County General Plan's Influence on Water Demand and Groundwater Sustainability Plan's Goals

Review of relevant Kern County General Plan goals and policies reveals that the County's goals and policies relative to future land use development and conservation complement the use and conservation of groundwater resources goals that are anticipated to be included in the CBGSA GSP. The General Plan explicitly encourages development of the county's groundwater supply to ensure that existing users have access to high quality water, and states that future growth should be accommodated only while ensuring that adequate high-quality water supplies are available to existing and future users.

Groundwater Sustainability Plan's Influence on Kern County General Plan's Goals and Policies

Successful implementation of the GSP will help to ensure that the Cuyama Basin's groundwater supply is managed in a sustainable manner. Given the small portion of the Cuyama Basin that lies in Kern County, it is anticipated that GSP implementation will have little to no effects on the General Plan's goals related to sustainable land use development in the county.

1.8 Plan Elements from CWC Section 10727.4

- To be filled in near end of GSP development. Will be used to address any component in the list below that was not addressed elsewhere in the GSP. If addressed in the GSP, a reference to where it's addressed will be provided.
    - (a) Control of saline water intrusion.
    - (b) Wellhead protection areas and recharge areas.
    - (c) Migration of contaminated groundwater.
    - (d) A well abandonment and well destruction program.
    - (e) Replenishment of groundwater extractions.
    - (f) Activities implementing, opportunities for, and removing impediments to, conjunctive use or underground storage.
    - (g) Well construction policies.
    - (h) Measures addressing groundwater contamination cleanup, groundwater recharge, in-lieu use, diversions to storage, conservation, water recycling, conveyance, and extraction projects.
    - (i) Efficient water management practices, as defined in Section 10902, for the delivery of water and water conservation methods to improve the efficiency of water use.
    - (j) Efforts to develop relationships with state and federal regulatory agencies.
    - (k) Processes to review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity.
    - (l) Impacts on groundwater dependent ecosystems.

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COMMITMENT & INTEGRITY DRIVE

Description of Plan Area

- Revised GSP Section provided to SAC and Board for review as part of Board Packet on June 22nd
- Revised section reflects responses to comments received on April Draft version
- Description of Plan Area describes:
  - Plan Area definition and setting
  - Existing surface water and groundwater monitoring programs
  - Existing water management programs
  - General Plans in the Plan Area

WOODARD &CURRAN

TO: Standing Advisory Committee
Agenda Item No. 7d

FROM: Jim Beck, Executive Director

DATE: June 28, 2018

SUBJECT: Hydrogeologic Conceptual Model

Issue
Report on the Hydrogeologic Conceptual Model.

Recommended Motion
None – information only.

Discussion
Cuyama Basin Groundwater Sustainability Agency Groundwater Sustainability Plan (GSP) consultant Woodard & Curran's summary of the Hydrogeologic Conceptual Model is provided as Attachment 1. The draft plan is provided as Attachment 2.

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan Hydrogeologic Conceptual Model Draft

Prepared by:

June 2018

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List of Figures

Chapter 2 Basin Setting

This document includes the Hydrogeologic Conceptual Model Section will be included as part of a report section in the Cuyama Basin Groundwater Sustainability Plan that satisfies § 354.8 of the Sustainable Groundwater Management Act Regulations. The Hydrogeologic Conceptual Model section is a portion of the Basin Settings portion of a Groundwater Sustainability Plan. The Basin Settings contains three main subsections:

- Hydrogeologic Conceptual Model – This section, presented here, provides the geologic information needed to understand the framework that water moves through in the basin. It focuses on geologic formations, aquifers, structural features, and topography.
- Groundwater Conditions - This section describes and presents groundwater trends, levels, hydrographs and level contour maps, estimates changes in groundwater storage, identifies groundwater quality issues, addresses subsidence and surface water interconnection.
- Water Budget – This section provides the data used in water budget development, discusses how the budget was calculated, and provides water budget estimates for historical conditions, current conditions and projected conditions.

Groundwater Conditions and the Water Budget section are currently under development and will be released for review when completed.

Acronyms

Basin	Cuyama Valley Groundwater Basin
bgs	below ground surface
CUVHM	Cuyama Valley Hydrologic Model
DWR	Department of Water Resources
ft.	feet
ft/d	feet per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
GSP	Groundwater Sustainability Plan
GRF	Graveyard Ridge Fault
HCM	Hydrogeological Conceptual Model
InSAR	interferometric synthetic-aperture radar
Ma	mega-annum (million years)
Morales	Morales Formation
MCL	maximum contaminant level
mg/L	milligrams per liter
NW	northwest
NRCS	National Resource Conservation Service
NWIS	National Water Information System
SAGBI	Soil Agricultural Groundwater Banking Index
SBCF	Santa Barbara Canyon Fault
SMCL	secondary maximum contaminant level
TDS	total dissolved solids
TTRF	Turkey Trap Ridge Fault
µg/L	microgram per liter
USGS	United States Geological Survey
USEPA	United States Environmental Protection Agency

2.1 Hydrogeologic Conceptual Model

This section describes the Hydrogeologic Conceptual Model (HCM) for the Cuyama Valley Groundwater Basin. (Basin).

As defined by the Groundwater Sustainability Plan (GSP) regulations promulgated by the Department of Water Resources (DWR), the HCM:

1. "Provides an understanding of the general physical characteristics related to regional hydrology, land use, geology geologic structure, water quality, *principal aquifers*, and principal aquitards of the *basin setting;*
2. Provides the context to develop water budgets, mathematical (analytical or numerical) models, and monitoring networks, and
3. Provides a tool for stakeholder outreach and communication."

The HCM is developed to understand and convey the physical conditions by which water moves through the basin, and is used elsewhere in the GSP to understand the distribution and movement of water within the basin to support the development of water budgets.

2.1.1 Regional Geologic and Structural Setting

The basin is located at the southeastern end of the California Coast Ranges and north of the Western Transverse Ranges (Figure 2-1) and is in an area of high tectonic activity. The basin is bounded on the north and south by faults and is located near major fault zones such as the San Andreas and Santa Maria River fault zones. Because the basin is located in a mountainous region with active tectonic activity, it has a number of structural features generated by tectonic activities. The basin has been deformed by this tectonic activity, and is generally a synclinal basin, with multiple synclines that are oriented to the northwest and a number of faults that cross the basin.

Tectonic activity from the northwest movement of the San Andreas fault system has led to the development of a fold and thrust belt which has driven the deformation of the Cuyama Valley for the past four million years (USGS, 2013c). The Cuyama Valley was formed by a downfaulted block of the earth's crust called a graben. This block is bordered on the north by the Morales and Whiterock faults and on the south by the South Cuyama and Ozena faults. Along these borders the faults have thrust older rocks of pre-Pliocene age over the rocks of Pliocene age and younger. In the eastern part of the valley the north-bordering faults approach the San Andreas fault zone and the south-bordering faults approach the Big Pine fault. (Singer and Swarzenski, 1970)

2.1.2 Geologic History

The Cuyama Basin has a long history of deformation and deposition, most influenced by tectonic activity and cycles of marine transgression and regression. Formations in the Basin reflect variable depositional environments, from the middle bathyal shales and siltstones to the nonmarine sandstone, conglomerate, and mudstones.

A major late Eocene/early Oligocene unconformity affected all regions south of the San Andreas fault, shown in the geologic record by nonmarine Oligocene rocks overlying a thick section (several kilometers) of upper Eocene marine rocks (Kellogg et al., 2008). The unconformity is a result of the Ynezian orogeny during which pre-Oligocene marine rocks were folded and uplifted above younger sediments (Kellogg et al., 2008).

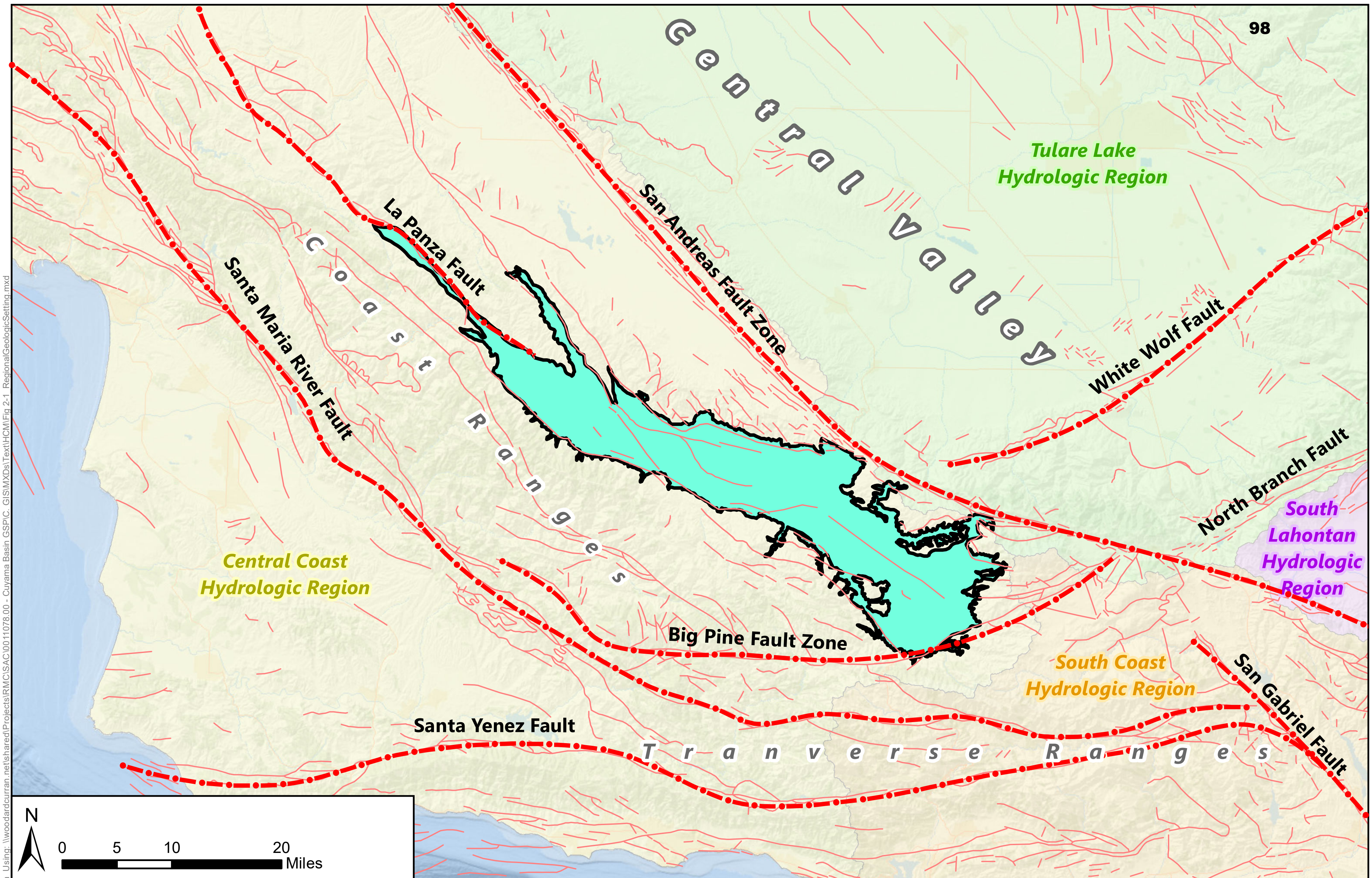


Figure 2-1: Regional Geologic Setting

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

WOODARD & CURRAN

Legend

Cuyama Basin

Faults

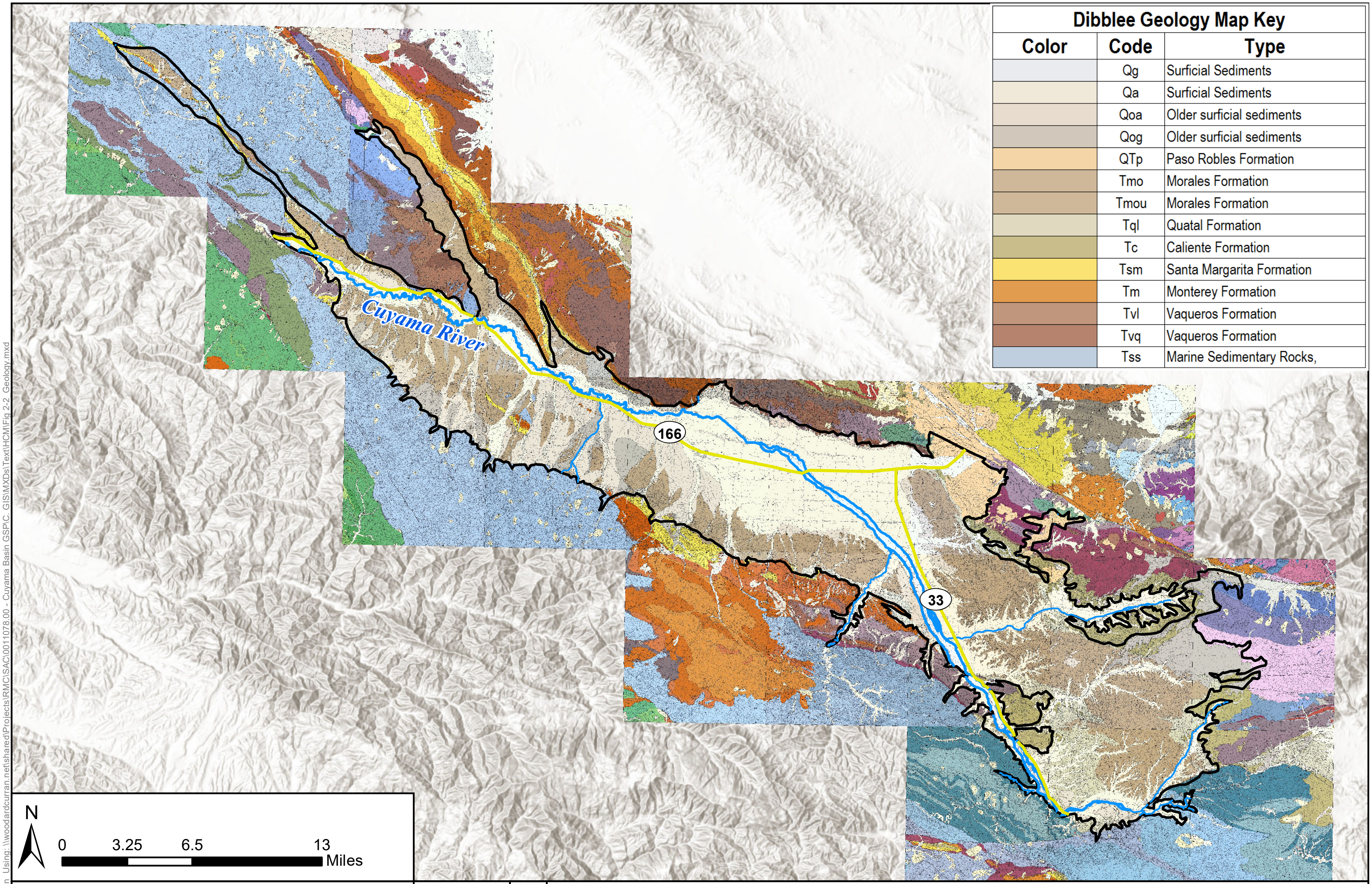
Fault locations and names use data from the Fault Activity Map of California (2010) from the California Department of Conservation. Retrieved 6/13/2018. <http://maps.conservation.ca.gov/cgs/fam/>

Following a period of orogeny, deformation changed to extension from the late Oligocene and early Miocene and the Cuyama Basin became a major extensional basin. This period also correlated with two transgressive-regressive cycles, where the sea advanced and retreated over geologic time over the sediments now in the basin. Sediments deposited during this period reflect the cyclical nature of sea level rise and are generally categorized by marine strata in the west and nonmarine strata to the east. Formations deposited during ocean transgression are thick marine sediments, including the Vaqueros Formation, Monterey Formation, Branch Canyon Sandstone, and Santa Margarita Sandstone (Kellogg et al., 2008; Lagoe, 1981). Many of the marine units interfinger with terrestrial units and eventually pinch out to zero thickness in the east. During the late Miocene, the sea regressed from the western part of the region, evident in the geologic record where the nonmarine Caliente Formation interfingers with the similarly aged marine Santa Margarita Sandstone and unconformably overlies the Branch Canyon Sandstone (Kellogg et al., 2008). By the middle Miocene, the eastern Cuyama Valley area was characterized by a shelf and nonmarine deposition. Deformation by the middle Miocene changed from extension to right-lateral strike slip motion, resulting in the development of the Russell fault.

Deformation from Oligocene extension and Miocene strike-slip faulting regimes was buried by the folding, uplift, and thrust faulting during the Pliocene through Pleistocene compression. Compression led to the uplift of the Coast and Transverse mountain ranges surrounding the current topographic valley and the converging thrust faults that surround the present day topographic basin, including the Whiterock, Morales, and South Cuyama faults (United States Geological Survey [USGS], 2013b). The transition to a predominantly compressional system led to the development of a thrust system across the older extensional basin and began thrusting older sediments above younger sediments through the Cuyama Valley (Davis et al., 1988). Older, inactive faults and rocks were buried by the deposition of the younger Morales Formation, older alluvium, and younger alluvium. Thrust and compression continued into the Quaternary and uplifted the Caliente Range and thrusted Miocene-aged rocks of the Caliente Range southward over Quaternary alluvium on the Morales fault (USGS, 2013b). The Morales Formation and older alluvium are folded into synclines along the north and south margins of the valley near the bounding thrust faults (USGS, 2013b). The Pliocene marks the complete withdrawal of the sea from the area and the final sea regression marks the change in deposition of marine sediments to the continental clay, silt, sand, and gravel of the Morales Formation and alluvium (Singer and Swarzenski, 1970). Fluvial deposits of claystone, sandstone, and conglomerate became the primary forms of sedimentation.

2.1.3 Geologic Formations/Stratigraphy

The Cuyama Valley Groundwater Basin is composed of a sequence of unconsolidated to partly consolidated nonmarine deposits of Pliocene to Pleistocene age unconformably overly consolidated marine and nonmarine sedimentary rocks of late Cretaceous to middle Cenozoic age on top of Mesozoic crystalline granitic and gneissic bedrock (Davis et al., 1988). The unconsolidated to partly consolidated nonmarine deposits are the primary water-bearing units in the Cuyama Basin and are described in further detail in Section 2.1.6. Individual geologic units found in the Cuyama Basin are described in detail below, in order of youngest to oldest in deposition. Geologic units mapped at the surface are shown in Figure 2-2. A generalized stratigraphic column of the Valley is shown in Figure 2-3.



Dibblee Geology Map Key

Color	Code	Type
	Qg	Surficial Sediments
	Qa	Surficial Sediments
	Qoa	Older surficial sediments
	Qog	Older surficial sediments
	QTp	Paso Robles Formation
	Tmo	Morales Formation
	Tmou	Morales Formation
	Tql	Quatal Formation
	Tc	Caliente Formation
	Tsm	Santa Margarita Formation
	Tm	Monterey Formation
	Tvl	Vaqueros Formation
	Tvq	Vaqueros Formation
	Tss	Marine Sedimentary Rocks,

Figure 2-2: Geologic Map

Cuyama Basin Groundwater Sustainability Agency

Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

June 2018

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Legend

- Cuyama Basin
- Highways
- Cuyama River
- Streams

Data Source: Thomas W. Dibblee, Jr., Dibblee Foundation Relased in June 2012, Purchased from AAPG as GeoTIF 28 March 2018.

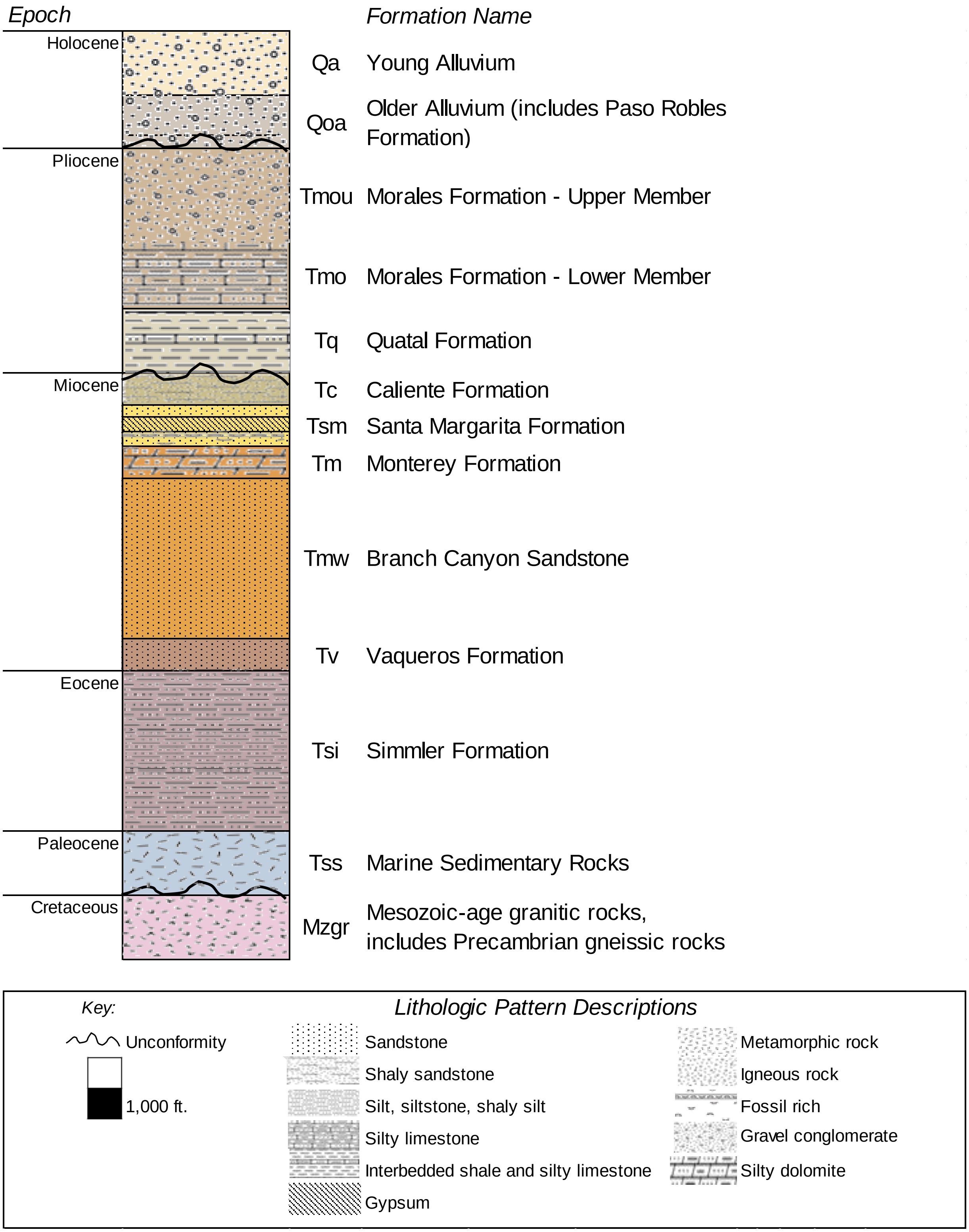


Figure 2-3: Generalized Stratigraphic Column of the Cuyama Valley

Recent and Younger Alluvium

The youngest deposit of the Cuyama Basin is the recent and young alluvium. Recent alluvium is made up of active fluvial channel deposits associated with the Cuyama River and other active channels. Deposits include river-bed gravels and grain sizes range from silt to boulder size and are found along active fluvial channels in the Basin. The younger alluvium is inactive fluvial deposits consisting of unconsolidated to partly consolidated sand, gravel, and boulders, with some clay deposited as part of stream channels, floodplains, alluvial fans, or stream terraces (USGS, 2013c). Younger alluvium is exposed throughout the central portion of the Valley and along the active channels and flood plains of the Cuyama River and other streams. The deposits thicken to the east; typically ranging from 5 to 50 feet (ft.) in the west and thicken up to 630-1,100 ft. in the east (Singer and Swarzenski, 1970). Recent and younger alluvium are primarily Holocene in age, but the younger alluvium can date back to the Pleistocene (USGS, 2013c). The younger and recent alluvium are the principal water-bearing formations in the Cuyama Basin.

Older studies do not distinguish the younger alluvium from the older alluvium (Upson and Worts, 1951; Singer and Swarzenski, 1970), but more recent studies (Kellogg et al., 2008) mapped the two alluvium units as distinguishable mappable units at the surface and the USGS identified differences in the two units using electric log signatures in 2013. A greater degree of consolidation, dissection, and local deformation distinguishes the older alluvium deposits from the younger alluvium.

Older Alluvium

Older alluvium is primarily Pleistocene in age and is composed of unconsolidated to partly consolidated sand, gravel, and boulders with some clay (USGS, 2013a). The percentage of clay increases in the western part of the valley. Older alluvium deposits are typically more consolidated and deformed than younger alluvium deposits and contain a higher clay content. The older alluvium is dissected alluvial fans, colluvial deposits and sediments on multiple terraces and alluvial surfaces and is found exposed on uplifted alluvial surfaces along the south side of the Cuyama Valley and on the caps of the Turkey Trap and Graveyard ridges (USGS, 2013a). Older alluvium is typically 400 to 600 ft. in thickness but increases in thickness up to 1,000 ft. near the axis of the Cuyama Valley (USGS, 2013a).

Paso Robles Formation

The Paso Robles Formation is part of the Quaternary alluvium series and is commonly grouped with the older alluvium. The Paso Robles Formation is a gray, crudely bedded alluvial gravel derived from Miocene rocks and basement rocks of western San Emigdio Mountains east of San Andreas Fault (Davis et al., 1988). The Formation is composed of pebbles, gravel, sand, and some cobbles. The Paso Robles Formation is sandwiched between two unconformities; it rests uncomformably below the older alluvium and with angular discordance above the Morales Formation (Davis et al., 1988). The Paso Robles Formation is present only in a small northeastern portion of the basin.

Morales Formation

The Pliocene to Pleistocene-aged Morales Formation (Morales) is divided into two members, the upper and lower. The upper member of the Morales is composed of partly consolidated, poorly sorted deposits of gravelly arkosic sand, pebbles, cobbles, siltstone, and clay of Pleistocene age (Davis et al., 1988). The lower member of the Morales consists of clay, shale, and limestone with lacustrine clay beds with distinct coarse-grained intervals, boulder trains, and gravelly channel deposits (USGS, 2013a). The contact between the upper and lower members of the Morales is used to define the base of water-bearing units of the Cuyama Basin (USGS, 2013a). The Morales is massively bedded and ranges from 1,000 to 5,000 ft. in thickness (USGS, 2013a). Thickness of the Morales Formation is disputed amongst published references. In 1970, Singer and Swarzenski reported the Morales Formation to be up to 10,000 feet in thickness along the northern margin of the Valley (Singer and Swarzenski, 1970). The Morales Formation is found throughout the Valley and is widely exposed to the east of the Cuyama River near Ventucopa and the Cuyama Badlands. Its lateral extent is generally limited by faults.

Quatal Formation

The Quatal Formation is a sequence of fluvial and lacustrine claystone, siltstone, and sandstone which unconformably underlies the Morales Formation. Near the Cuyama Badlands, the formation is up to 820 ft. of gypsiferous claystone while in other areas the unit is nonmarine sandstones interbedded with the claystone (USGS, 2013a). The Quatal Formation thins to the west and pinches out to zero in thickness near the town of Cuyama. In the eastern and central parts of the Basin, the Quatal Formation is a distinct stratigraphic marker that defines the bottom of the Morales Formation (USGS, 2013a). The Quatal Formation is not a water bearing unit and is not considered a part of the Cuyama Basin groundwater system.

Caliente Formation

The Caliente Formation is composed of nonmarine sandstones, claystones, and conglomerates of Miocene age (Davis et al., 1988). Layers of volcanic ash and basalt sills and dikes are commonly found in the formation and tertiary basalt is found interbedded with the formation in the Caliente Range (Davis, 1988; Dudek, 2016). The formation is exposed on the eastern half the Valley, along the basin edge in the Caliente Ranges and in a footwall block of the Pine Mountain fault (Kellogg et al., 2008). The Caliente Formation conformably overlies and interfingers with the marine sedimentary rocks of the Santa Margarita Formation and pinches out to zero thickness to the west (Kellogg et al., 2008; Davis et al., 1988).

Santa Margarita Formation

The Santa Margarita Formation is composed of shallow-marine, consolidated sandstones from the middle to late Miocene (USGS, 2013b). The formation contains a gypsum member and a sandstone-mudstone member. The gypsum member consists of a greenish-gray, medium to thin bedded gypsum, up to 82 ft. thick (Kellogg et al., 2008). The sandstone and mudstone member consists of interbedded layers of arkosic sandstone, mudstone, and siltstone, up to 400 ft. thick (Kellogg et al., 2008). The sandstone sequence is rich in shallow marine molluscan fossils. The formation underlies the Morales Formation in the northwest of the Valley and grades into the Caliente Formation to the east. Locally, the formation contains layers of volcanic ash, basalt sills, dikes and flow units (Davis et al., 1988). The Santa Margarita Formation is the youngest marine unit in the Cuyama Basin and marks the final phase of marine sedimentation and sea transgression (Lagoe, 1981).

Monterey Formation

The Monterey Formation consists of intervals of dolomitic marine shale, mudstone, and siltstone. The formation is subdivided into two members: the upper Whiterock Bluff Shale member and the lower Saltos Shale member (Davis et al., 1988). The Whiterock Bluff Shale is a calcareous to siliceous shale. The Saltos Shale member is a calcareous shale with turbiditic sandstones and was deposited at the same time as the fluvial Caliente Formation, but in the western, bathyal portion of the Basin (Davis et al., 1988; USGS, 2013b). The formation is middle Miocene in age and is cut with layers of volcanic ash and Miocene-age basalt sills (Davis et al., 1988). In the Caliente Mountain Range, tertiary basalt is found interbedded with the Monterey Formation (Davis et al., 1988). To the east, the Monterey Formation grades into the Branch Canyon Sandstone. The formation is conformably overlain by the Santa Margarita Formation.

Branch Canyon Sandstone

The Branch Canyon Sandstone is Middle Miocene in age and is a shallow marine sandstone (Davis et al., 1988). Like the Monterey and Santa Margarita formations, the Branch Canyon Sandstone contains layers of volcanic ash and is cut by basalt sills and dikes (Davis et al., 1988). The sandstone grades into the Caliente Formation to the east and is up to 2,500 ft. thick (Kellogg et al., 2008). The easternmost extent of the Branch Canyon Sandstone represents an early Miocene shoreline and is defined by the gradational change into the nonmarine Caliente Formation to the east (Davis et al., 1988).

Vaqueros Formation

Most of the oil produced in the Cuyama Basin comes from the Vaqueros Formation. The formation is late Oligocene to early Miocene in age and is a marine clastic unit that is subdivided into three members: the upper, shallow-marine Painted Rock Sandstone member, the middle, bathyal Soda Lake Shale member, and the lower, shallow-marine Quail Canyon Sandstone member (Davis et al., 1988). To the east, the Vaqueros Formation grades into the lower part of the nonmarine Caliente Formation. The Branch Canyon Sandstone and Monterey Formation are conformably above the Vaqueros Formation (Davis et al., 1988).

Simmler Formation

The Simmler Formation is a terrestrial sandstone, siltstone, and conglomerate of the Oligocene epoch (Davis et al., 1988). The Simmler Formation contains a shale member containing intervals of claystones and siltstones interbedded with coarse sandstones and a sandstone member containing sandstones interbedded with siltstones and claystones (Kellogg et al., 2008). The formation is as thick as 2,800 ft. and overlies the Eocene-Oligocene unconformity (Kellogg et al., 2008). To the east, the Simmler Formation interfingers with a thin section of the marine Vaqueros Formation, marking the beginning of marine regression in the early to middle Miocene (Kellogg et al., 2008).

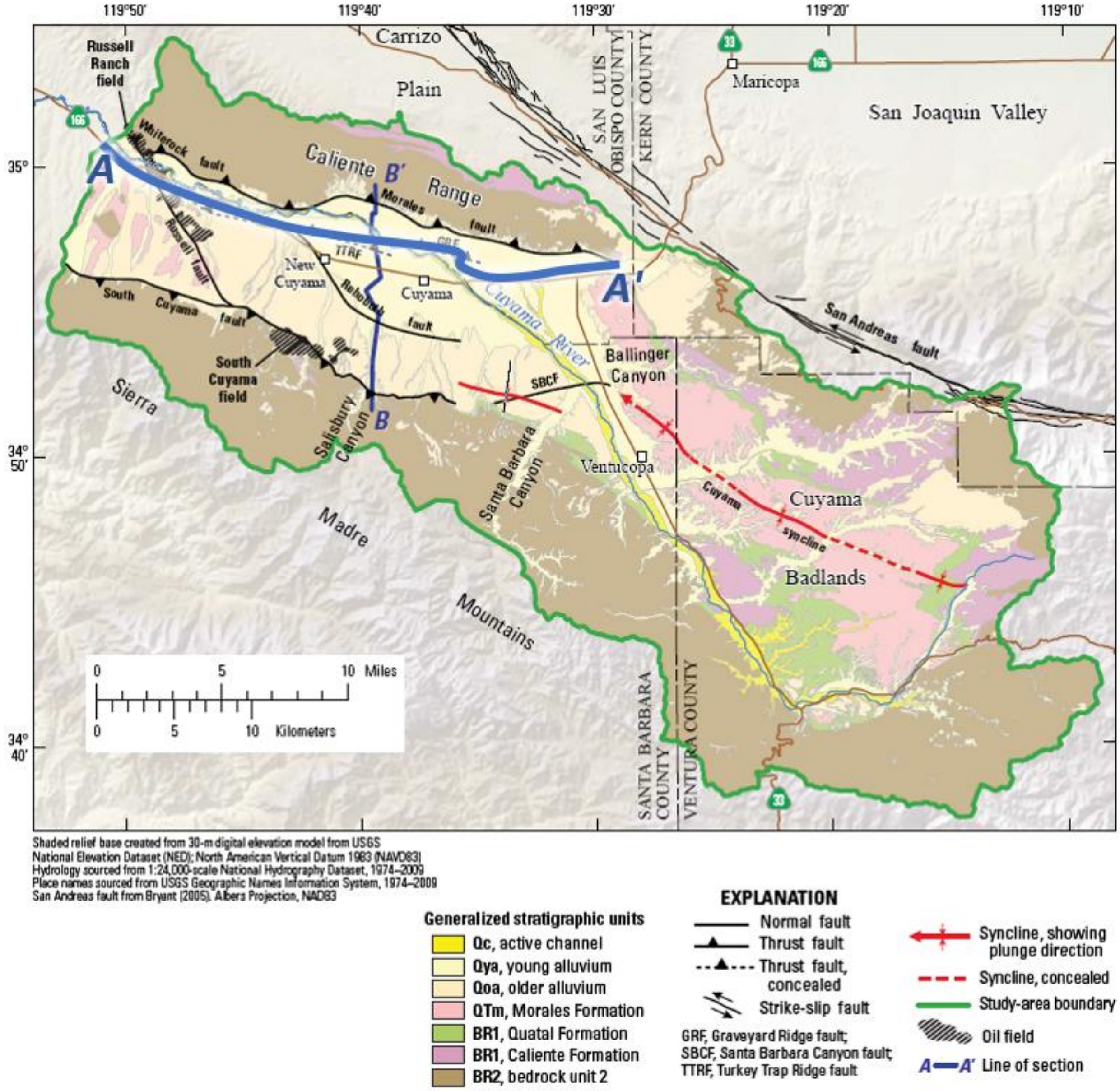
Marine Sedimentary Rocks

Late Cretaceous to Eocene marine rocks are unnamed but are part of the crystalline basement of the Cuyama Valley (Davis et al., 1988). The strata are unconformably overlain by a thick section of middle and upper Cenozoic rocks and are primarily exposed in the La Panza and Sierra Madres ranges and the hanging walls of the South Cuyama, La Panza, and Ozena faults (Davis et al., 1988).

Basement Rocks

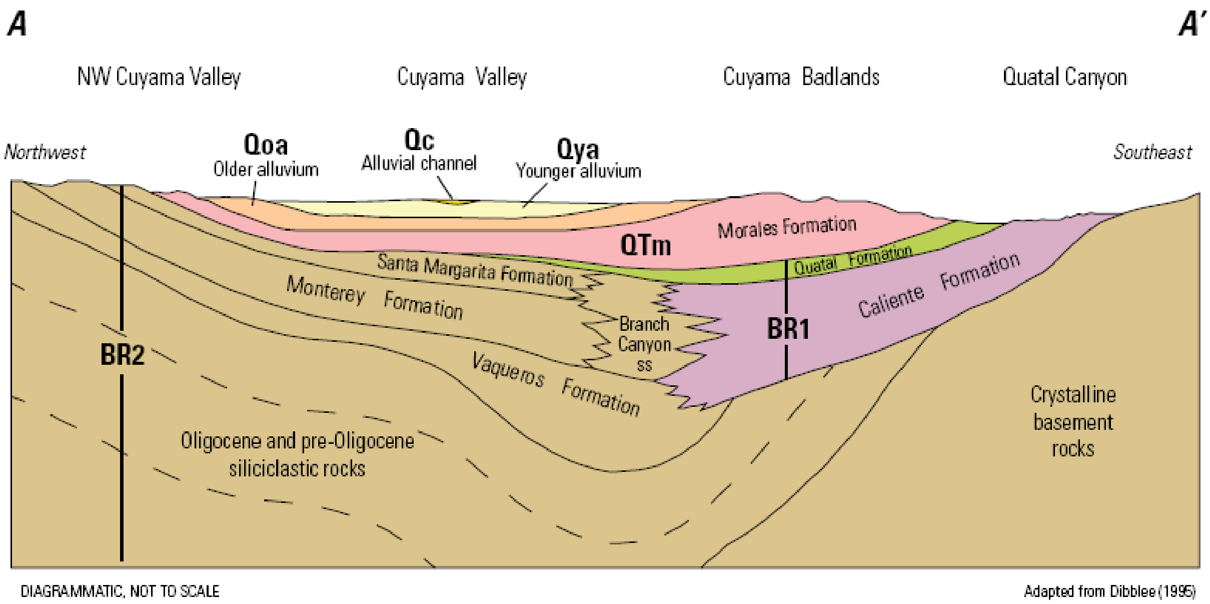
The crystalline basement rocks of the Cuyama Valley are composed of Mesozoic age granitic rocks and Precambrian age gneissic rocks (Davis et al., 1988). Cretaceous granitic rocks are exposed in the La Panza Range and near the San Andreas Fault, 12-18 miles southeast of the Cuyama Valley (USGS, 2013b). Precambrian granitic gneissic rocks outcrop east of the Cuyama Badlands and the La Panza Range (USGS, 2013b). Total thickness is unknown.

The USGS prepared a generalized stratigraphic diagram of the central portion of the basin in 2013. The location of the diagram is shown in Figure 2-4, and the diagram is shown in Figure 2-5. The diagram shows the relationship of the Young Alluvium, Older Alluvium, Morales Formation, and basement rocks in and near the basin. The diagram shows that the Morales formation is thicker to the east, and that the Caliente Formation is interfingered with a number of other basement rock formations (Santa Margarita, Monterey, Vaqueros) beneath the basin (USGS 2013a).



Source: USGS, 2013a.

Figure 2-4: Geologic Map and Location of Stratigraphic Diagram A-A'



Source: USGS, 2013a.

Figure 2-5: Generalized Stratigraphic Diagram

2.1.4 Faults and Structural Features

The basin is bounded by faults and contains a number of tectonic features including synclines, faults, and outcrops of basement rocks within the basin. Major faults and synclines are shown in Figure 2-6. Outcrops of basement rocks are shown on the geologic maps (Figure 2-2 and Figure 2-4).

Synclines

There are a number of synclines in the basin, they are generally oriented to the northwest/southeast consistent with how the majority of the basin is oriented.

Cuyama Syncline

The Cuyama Syncline is located in the southeastern portion of the basin. It stretches from the Ballinger Canyon south into the Cuyama Badlands, ending along the Cuyama River. The Cuyama Syncline plunges from the Ventucopa area northwestward to beneath the valley from the Ventucopa area to the southeast. The syncline is known from subsurface data from oil exploration wells beneath the valley and exposed near the town of Ventucopa and in the Cuyama Badlands. (USGS, 2013a). The axis of the syncline strikes roughly parallel to the San Andreas Fault and plunges to the northwest (Singer and Swarzenski, 1970). The syncline has folded water and non-water bearing formations and is favorable to the transmission of water from the southeast end of the valley but otherwise has no pronounced effect on the occurrence of groundwater (Upson and Worts, 1951).

Syncline Near the Santa Barbara Canyon Fault

Near the Santa Barbara Canyon Fault, A syncline is indicated by the USGS. The syncline runs generally east-west and is roughly five miles long. It ends near the southern edge of the South Cuyama fault (USGS, 2013a).

Syncline in the Northwestern Portion of the Basin

There is a syncline in the western portion of the basin, that roughly follows a west-northwest (WNW) direction near the southern border of the basin, located southwest of the Russel fault, near an outcrop of the Santa Margarita formation. (Cleath-Harris, 2016). The full extent of this syncline, and its length are not documented at this time, but likely extends 5 to 10 miles, which is the length of documented faults in the area, as mapped by Dibblee and Minch. (Dibblee and Minch, 2005)

Major Faults

There are a number of faults within the basin, many of which take the form of 'fault zones' where there are multiple individual faults close together oriented in the same direction. This section describes each major fault individually, with consideration that there are often additional small faults near each major fault. Major faults are shown in Figure 2-6.

Russell Fault

The Russell fault is a subsurface, right lateral, strike-slip fault that is seven miles long and runs roughly parallel to the Russell Ranch oil field in the center of the basin.

The Russell fault offsets the top of bedrock by as much as 1,500 feet (Nevins, 1982), and has had approximately 18 miles of right-lateral offset documented on the NW-striking Russell fault in the NW part of the Cuyama Valley have occurred between 23 and 4 million years (Ma) (USGS, 2013a). The fault is referred to as strike-slip by several authors, and normal fault by others, and is sometimes referred to as both strike slip and normal within the same document (USGS, 2013a). Water bearing units on the western (upthrown) side of the Russell fault are thinner than the water bearing units to the east of the Russell fault due to this uplift. Alluvium is generally limited to stream channels and the Cuyama River bed on the western side of the fault.

The Russell fault has been analyzed by a number of authors who have come to differing conclusions regarding the fault's potential to be a barrier to groundwater flow. The USGS in 2008 initially concluded that the fault was not a barrier to flow (USGS, 2013c). The USGS in 2013 studied the fault using interferometric synthetic-aperture radar (InSAR) data and concluded that the Russell fault did not appear to be acting as a barrier to groundwater flow (USGS, 2013a). In 2015 the USGS identified the Russell fault as a barrier to flow and used it as a no flow boundary in the CUVHM model (USGS, 2015). Based on the conclusions of the USGS, Dudek stated that the fault has indicators that it obstructs groundwater flow due to truncation of older geologic formations and standing moisture near the fault and prepared a basin boundary modification request based on the conclusion that the fault is a barrier to flow (Dudek, 2016). In addition, Cleath-Harris determined that the fault is a barrier to flow and prepared a technical memorandum to document their study of the fault's behavior (Cleath-Harris, 2016). EKI reviewed the USGS's work in 2017 and concluded the fault potential to be a barrier is not understood, and recommended additional study to refine the fault's properties (EKI, 2017).

Due to the lack of a consensus as to the impact of the Russell Fault on groundwater flow, we believe it is prudent to further evaluate the impacts of the fault on groundwater flow through additional monitoring, monitoring will be addressed in Section XX

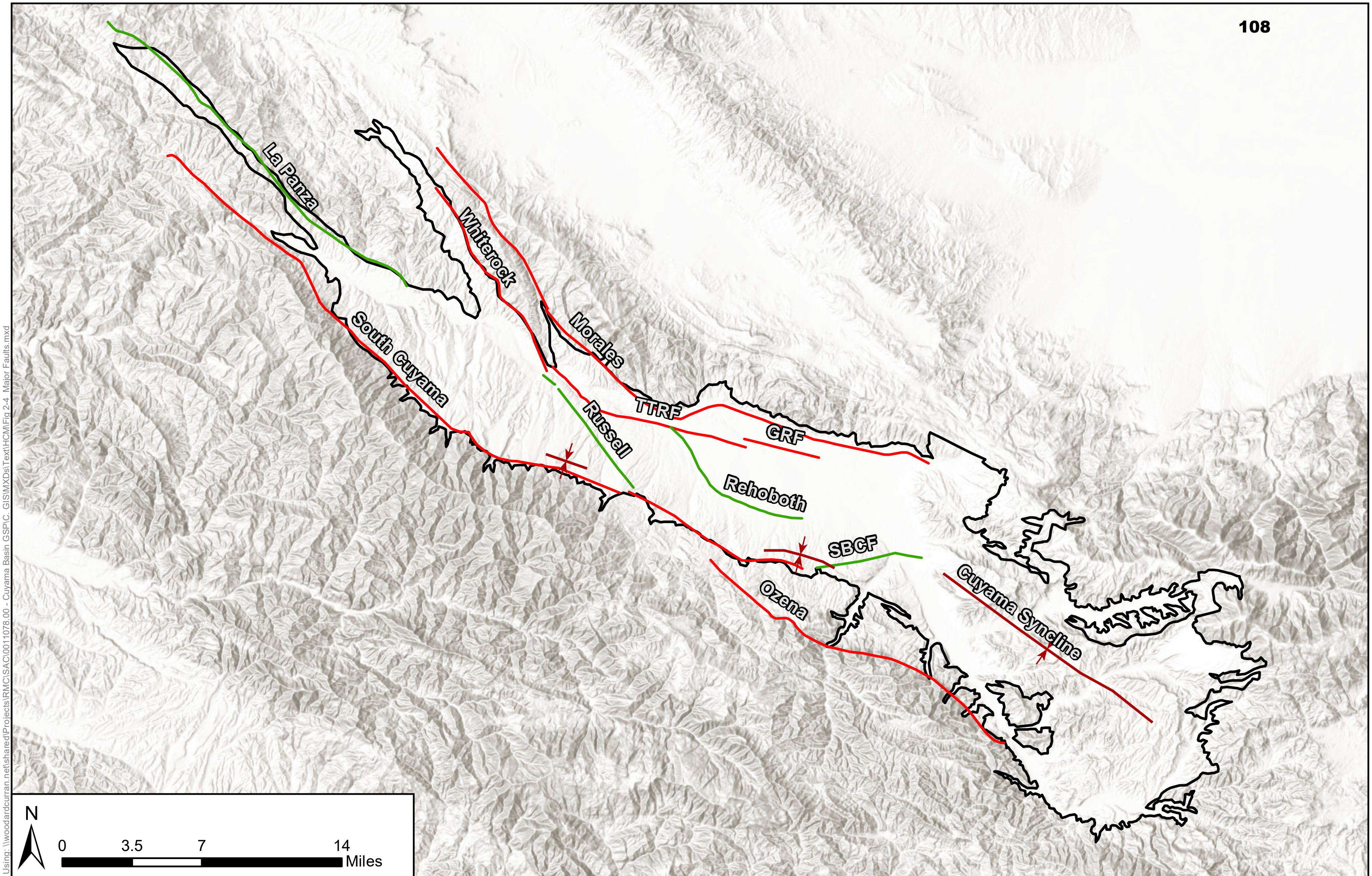


Figure 2-6: Major Faults

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Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

May 2018

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Legend

Cuyama Basin

Fault Types

Normal

Reverse Fault

Reverse Fault, Concealed

Syncline

Thrust

Thrust Fault, Concealed

Figure Exported: 6/5/2018 By: ceggleton Using: \\woodardcurran.net\shared\Projects\RMC\SAC\0011078.00 - Cuyama Basin GSP\C. GIS\MXDs\Text\HCM\Fig 2-4 Major Faults.mxd

Rehoboth Fault

The Rehoboth fault is a normal, subsurface fault that bisects the central portion of the basin. The fault is approximately eight miles long and trends to the southeast. The USGS concluded that evidence of the fault is inferred based on water level-changes in the west-central part of the valley (USGS, 2013b). The USGS determined the fault to be “not a significant barrier to groundwater flow” as symmetrical subsidence and uplift was observed on both sides of the fault (USGS, 2013b).

In 2013, the USGS concluded the fault only offsets formations older than the older alluvium. The top of the Morales Formation is offset by 160 feet on the northeast side of the fault and the offset increases with depth. Surface exposures of the older alluvium do not appear to be offset along the trace of the fault, indicating the motion of the Rehoboth fault ceased prior to the deposition of the older and younger alluvium (USGS, 2013c).

Whiterock Fault

The Whiterock fault is a surficial thrust fault that runs 11 miles along the northern finger of the Cuyama Basin. The fault dips northeast and is late Oligocene to early Miocene in age (Davis et al., 1988). The Whiterock fault is exposed at the surface where it thrusts the Monterey Formation over the Morales Formation (Davis et al., 1988). The Whiterock fault is a barrier to groundwater and is a defining feature of the lateral boundary of the Cuyama Basin.

Turkey Trap Ridge Fault and Graveyard Ridge Fault

The Turkey Trap Ridge fault (TTRF) and the Graveyard Ridge fault (GRF) are normal, subsurface faults that trend slightly north of west in the center of the Cuyama Valley (USGS, 2013a). The primary difference between the two faults is that the TTRF is 11 miles long and located southwest of the GRF and the GRF is four miles long. Both faults are located north of Highway 166 and are oriented in a “left-stepping, echelon pattern” (USGS, 2013a). Seismic reflection profiles collected along the ridges indicate they are bounded by north-dipping, south-directed, reverse faults along the south sides (USGS, 2013a). Both faults are considered to be barriers to groundwater. Evidence of the faults and their no-flow zones include springs and seeps along the base of the faults in the 1940-50s and water-level changes across the faults of 80 to 100 feet in the area near these ridges (Upson and Worts, 1951; Singer and Swarzenski, 1970).

In 1970, Singer and Swarzenski reported that water removed by pumping from this region was slow to replenish because faults restrict movement of water from neighboring areas. The impediment to flow could be related to the hydraulic properties of the faults themselves or fault juxtaposition of older, slightly less permeable older alluvium to the north against younger alluvium to the south of the faults (USGS, 2013a).

South Cuyama Fault

The South Cuyama fault is a surficial, thrust fault that defines a 39-mile stretch of the Cuyama Basin’s southwestern boundary. The fault thrusts the Eocene-Cretaceous aged marine sediments against the older alluvium and Morales Formation and impedes groundwater flow across the fault zone.

Ozena Fault

The Ozena fault is a 17-mile long surficial, thrust fault located three miles south of the Cuyama Basin and locally cuts through the southeastern canyons of the Basin. Less than one mile of the Ozena fault is within the Cuyama Basin boundary. The fault trends west to northwest and runs parallel to the Basin boundary.

Santa Barbara Canyon Fault

The Santa Barbara Canyon fault (SBCF) is a normal, subsurface fault that runs five miles perpendicular to the Santa Barbara Canyon. The fault is east-west striking and offsets basin deposits with impermeable Eocene-Cretaceous marine rocks. Evidence of the fault comes from reported seasonal springs, a steep hydraulic gradient in the southeastern part of the Cuyama Valley near the fault, and the truncation of distinct gravel beds (Singer and Swarzenski, 1970). Water levels in the Ventucopa area have been reported 98 feet higher than water levels to the north (Singer and Swarzenski, 1970). The fault is considered a barrier to groundwater flow as it prevents groundwater flow from moving across the boundary bounded by the marine rocks (USGS, 2015). The USGS in 2013 also concluded that the SBCF was a barrier to groundwater flow: “Relatively small amount of vertical offset in the SBCF indicates changes in water levels across the fault documented in previous studies are perhaps the result of distinct fault-zone properties rather than juxtaposition of units of differing water-transmitting ability” (USGS, 2013a).

La Panza Fault

The La Panza fault is a surficial thrust fault that trends west to northwest along 22 miles of the western margin of the Cuyama Basin (USGS, 2013b). The present day thrust fault is a reactivated Oligocene extensional fault (USGS, 2013b). The fault defines the west-central margin of the Cuyama Basin as it juxtaposes older non-water bearing Eocene to Cretaceous marine rocks and the Simmler Formation against the younger, water bearing alluvium and Morales Formation, impeding groundwater flow across the fault.

Morales Fault

The Morales fault is a 30-mile-long thrust fault that forms the boundary along the north central portion of the basin. The Morales thrust fault as a dip of approximately 30 (Davis et al., 1988).

Unnamed Fault Near Outcrop of Santa Margarita Formation

A fault located southwest of the Russell fault runs southeast to northwest and is located next to an outcrop of the Santa Margarita formation inside the basin. The fault runs parallel to the long side of the outcrop and bounds the syncline that is to the south of the outcrop. The fault’s extent is not well documented, and its surficial exposure is roughly five miles long.

Outcrops of Bedrock Inside the Cuyama Basin

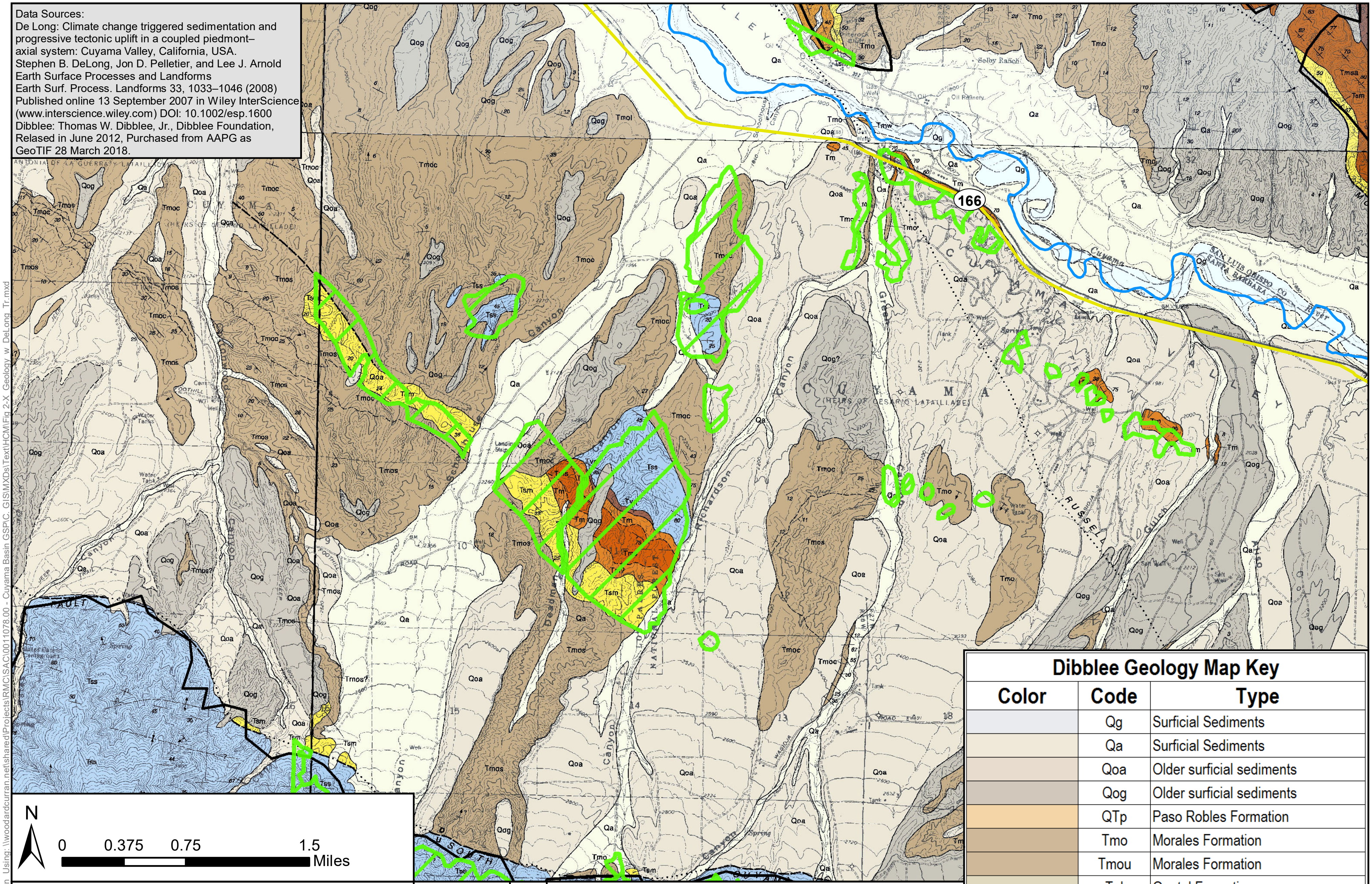
There are a number of outcrops of non-aquifer material within the basin. The outcrops occur primarily in the eastern upland portion of the basin and the western portion, near and to the west of the Russell Fault. Outcrops of basement rock in the western portion of the basin occur in a different manner than those in the eastern portion, outcrops in the eastern portion are likely depositional contacts with the Morales Formation that were missed during basin delineation by DWR. Outcrops in the western portion are likely tied to tectonic activity and faulting.

Outcrops of basement rock in the eastern upland portion of the basin are shown in Figure 2-4. The Quatal Formation, and the Caliente Formation are present within the basin boundary near the edges of the basin. The Quatal formation is exposed at the surface near the Cuyama River, and in the higher elevation portions of the basin, and in a band near the Quatal Canyon. The Caliente Formation is exposed at the surface within the basin in the northeast portion of the basin, near and along the Quatal Canyon. Another outcrop of Caliente Formation is present near the Cuyama River, but that outcrop has been excluded from the basin during the basin’s delineation by DWR and is visible in Figure 2-2.

Outcrops of basement rock in the western portion of the basin are exposed at the surface in limited areas and are tied to tectonic activity in the area.

Figure 2-7 shows the outcrops of bedrock near the Russell Fault with an overlay of areas identified by DeLong as “Tr”, or out of basin bedrock, overlain on the geologic mapping performed by Dibblee. In general, the outcrops identified by DeLong and Dibblee largely overlap and indicate that in separate field study efforts, the outcrops were identified independently by different geologists. As shown in Figure 2-7, outcrops of non-aquifer materials are present near the Russell Fault, next to the Cuyama River, as well as to the south of the Cuyama River, both in small outcrops that are partially linear in nature, and larger outcrops that are located next to faults, such as where the Santa Margarita, Monterey and Marine Sedimentary Formations are present. The presence of these non-aquifer materials in this area likely restricts groundwater movement by limiting the extent of permeable materials in this portion of the basin.

Data Sources:
De Long: Climate change triggered sedimentation and progressive tectonic uplift in a coupled piedmont–axial system: Cuyama Valley, California, USA.
Stephen B. DeLong, Jon D. Pelletier, and Lee J. Arnold
Earth Surface Processes and Landforms
Earth Surf. Process. Landforms 33, 1033–1046 (2008)
Published online 13 September 2007 in Wiley InterScience (www.interscience.wiley.com) DOI: 10.1002/esp.1600
Dibblee: Thomas W. Dibblee, Jr., Dibblee Foundation, Relased in June 2012, Purchased from AAPG as GeoTIFF 28 March 2018.



N
0 0.375 0.75 1.5 Miles

Figure 2-7: Geology with De Long "Tr" Overlay

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Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

May 2018

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Legend
- Cuyama Basin
- De Long Geology "Tr" - Out of Basin Bedrock
- Highways
- Cuyama River

Dibblee Geology Map Key

Color	Code	Type
	Qg	Surficial Sediments
	Qa	Surficial Sediments
	Qoa	Older surficial sediments
	Qog	Older surficial sediments
	QTp	Paso Robles Formation
	Tmo	Morales Formation
	Tmou	Morales Formation
	Tql	Quatal Formation
	Tc	Caliente Formation
	Tsm	Santa Margarita Formation
	Tm	Monterey Formation
	Tvl	Vaqueros Formation
	Tvq	Vaqueros Formation
	Tss	Marine Sedimentary Rocks,

Figure Exported: 6/5/2018 By: ceggleton Using: \\woodardcurran.net\shared\Projects\RMC\SAC\0011078.00 - Cuyama Basin GSP\GIS\MXDs\Text\HCM\Fig 2-X Geology w DeLong Tr.mxd

2.1.5 Basin Boundaries

The basin has multiple types of basin boundaries. The majority of the boundaries are in contact with impermeable bedrock and faults, and a small portion is bounded by a groundwater divide between this basin and the Carrizo Plain groundwater basin.

Lateral boundaries

The Cuyama Basin is geologically and topographically bounded; to the north by the Morales and Whiterock faults and the Caliente Range, to the west by the South Cuyama and Ozena faults and the Sierra Madre Range, to the east within the Los Padres National Forest and Caliente Range, and to the south by the surface outcrops of Pliocene and younger lithologies, which are surrounded by Miocene and older consolidated rocks (Dudek, 2016). The boundaries of the Cuyama Basin were delineated by DWR in Bulletin 118 because they were the boundary between permeable sedimentary materials and impermeable bedrock. DWR defines this type boundary as: "*Impermeable bedrock with lower water yielding capacity. These include consolidated rocks of continental and marine origin and crystalline/or metamorphic rock*" (DWR, 2003). The thrust faults bounding the Cuyama Basin juxtapose younger, water-bearing lithologies against older, impermeable rocks. The consolidated continental and marine rocks and shales of the bordering mountain ranges mark a transition from the permeable aquifer sediments to impermeable bedrock.

Boundaries with Neighboring Subbasins

The Cuyama Basin shares a boundary to the east with the Carrizo Plain Groundwater Basin (Carrizo Plain Basin) and the Mil Potrero Area Groundwater Basin, as shown in Figure 1-3. The Cuyama and Carrizo Plain basins share a four-mile boundary along Caliente Ranges, which is a groundwater divide basin boundary. DWR defines this type of boundary as: "*A groundwater divide is generally considered a barrier to groundwater movement from one basin to another for practical purposes. Groundwater divides have noticeably divergent groundwater flow directions on either side of the divide with the water table sloping away from the divide*" (DWR, 2003).

The Cuyama and Mil Potrero basins are share a less than one mile boundary along the San Emigdio Canyon. The division between the Cuyama and Mil Potrero basins is also a groundwater divide basin boundary.

Bottom of the Cuyama Basin

The bottom of the Cuyama Basin is generally defined by the base of the upper member of the Morales Formation. The lower member of the Morales Formation is composed of clay, shale, and limestone and is less permeable than the upper member of the Morales Formation (Cleath-Harris, 2016). The USGS describes the Morales Formation (both the upper and lower member combined) as up to 5,000 feet thick (USGS, 2013a). The top of the Morales Formation is generally encountered 750 feet below ground surface (bgs) but ranges up to 1,750 feet bgs in the Sierra Madre Foothills (USGS, 2013a).

2.1.6 Principal Aquifers and Aquitards

The DWR's *Groundwater Glossary* defines an aquifer as "a body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells and springs." Within the Cuyama Basin, there is one principal aquifer composed of the younger alluvium, older alluvium, and the Morales Formation. Most of the water pumped in the valley is contained in the younger and older alluviums. These two units are indistinguishable in the subsurface and are considered, hydrologically, one unit. There are no major stratigraphic aquitards or barriers to groundwater movement, amongst the alluvium and the Morales Formation. The aquifer is considered to be continuous and unconfined with the exception of locally perched aquifers resulting from clays in the formations.

Aquifer Formations

The formations making up the principal aquifer in the Cuyama Basin are

- younger alluvium,

- older alluvium, and the
- Upper Member of the Morales Formation.

These units consist of unconsolidated to partly consolidated sand, gravel, silt, clay, and cobbles within alluvial fan and fluvial deposits and in total range from 3,000 to 4,000 ft. in thickness (Upson and Worts, 1951). Rocks older than the upper Morales Formation are generally considered either non-water bearing or contain water, but the water is released too slowly or of quality that is too poor for domestic and irrigation uses. Historically, most of the water pumped in the Cuyama Valley has been extracted from the younger and older alluvium. Cross sections showing the extents and depths of the three formations making up the principal aquifer are shown in Figure 2-8 through Figure 2-11. Figure 2-8 shows the location of both aquifer cross sections. Cross sections were created using the layering of the Cuyama Basin groundwater model, which is described in Section 2.3 [Note: section to be added later]. Figure 2-9 shows a cross section of the three formations that make up the principal aquifer along A-A'. Figure 2-10 shows a cross section of the three formations that make up the principal aquifer along B-B'. Figure 2-11 shows a cross section of the three formations that make up the principal aquifer along C-C'. A detailed description of each formation that comprises the principal aquifer are provided below.

Recent and Younger Alluvium

Historically, most of the water pumped in the Cuyama Basin was sourced from the saturated portions of the younger and older alluvium (Singer and Swarzenski, 1970). Groundwater is found in the permeable Holocene alluvial fill and in the underlying, less permeable, Pliocene-Pleistocene continental deposits. Younger alluvium deposits thicken to the east, typically ranging from 5 to 50 ft. in the west and thicken up to 630-1,100 ft. in the east (Singer and Swarzenski, 1970).

The younger alluvium varies compositionally across the basin (Upson and Worts, 1951). The recent and younger alluvium is the primary source of groundwater on the western side of the Basin. In the west, younger alluvium consists of interbedded layers of sand and gravel and thick beds up clay (ranging from 1 to 36 ft. thick) (Upson and Worts, 1951). Clay beds, found 100 to 150 ft. bgs, define the base of the younger alluvium (Upson and Worts, 1951). Wells in the western part of the basin that are screened in the younger alluvium are shallow but have moderately large yields as the sands and gravels have high permeabilities (Singer and Swarzenski, 1970).

In the south-central part of the valley, the alluvium contains more gravel and is less fine grained compared to western alluvium. The alluvium is predominantly sand and silt with some beds of gravel and clay, though no continuous layers of any material exist (Upson and Worts, 1951).

Older Alluvium

Older alluvium consists of unconsolidated to partly consolidated sand, gravel, boulders, and some clay. Similar to the younger alluvium, clay content increases to the west (Upson and Worts, 1951). Like the younger alluvium, historically most of the water pumped in the Cuyama Basin was sourced from the saturated portions of the younger and older alluvium (Singer and Swarzenski, 1970). More wells are perforated in the older alluvium in the western portion of the basin than to the east (USGS, 2013c). In most regions of the basin, the top of the saturated zone is either deep in the alluvium or below its base (Upson and Worts, 1951).

Upper Morales Formation

The Pliocene to Pleistocene-aged Morales Formation is divided into two members, the upper and lower. The upper member of the Morales is composed of partly consolidated, poorly sorted deposits of gravelly arkosic sand, pebbles, cobbles, siltstone, and clay and is considered water bearing (USGS, 2013a). Water bearing properties of the Morales Formation are not well defined, but available data indicate that the hydraulic conductivity of the formation varies greatly laterally and with depth (USGS, 2013c). Permeabilities of the upper Morales Formation vary greatly laterally and with depth; the highest values occur in the syncline beneath the central part of the valley and decrease to the west (Singer and Swarzenski, 1970). In the east and southeastern parts of the valley where the Morales Formation outcrops, the formation is coarse grained and moderately permeable, but land is topographically unsuited to agricultural development and few wells have been installed.

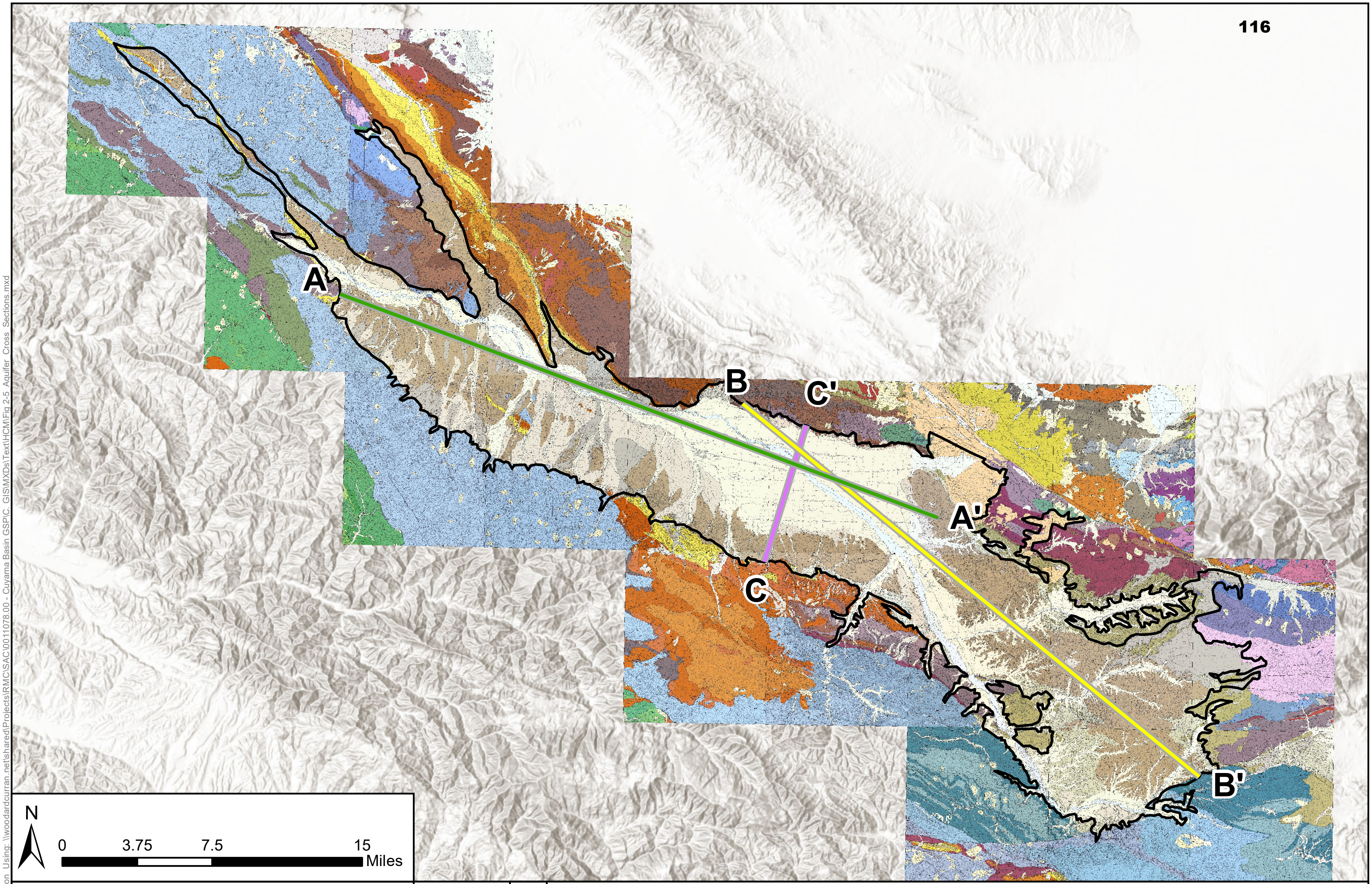

Figure 2-8: Aquifer Cross Sections

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Cuyama Valley Groundwater Basin Groundwater Sustainability Plan

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Legend

- Cuyama Basin
- Cross Section A-A'
- Cross Section B-B'
- Cross Section C-C'

Data Source: Thomas W. Dibblee, Jr., Dibblee Foundation Relased in June 2012, Purchased from AAPG as GeoTIF 28 March 2018.

Figure Exported: 6/12/2018 By: ceggleton Using: \\woodardcurran.net\shared\Projects\RMC\SAC\0011078.00 - Cuyama Basin GSP\C. GIS\MXDs\Text\HCM\Fig 2-5 Aquifer Cross Sections.mxd

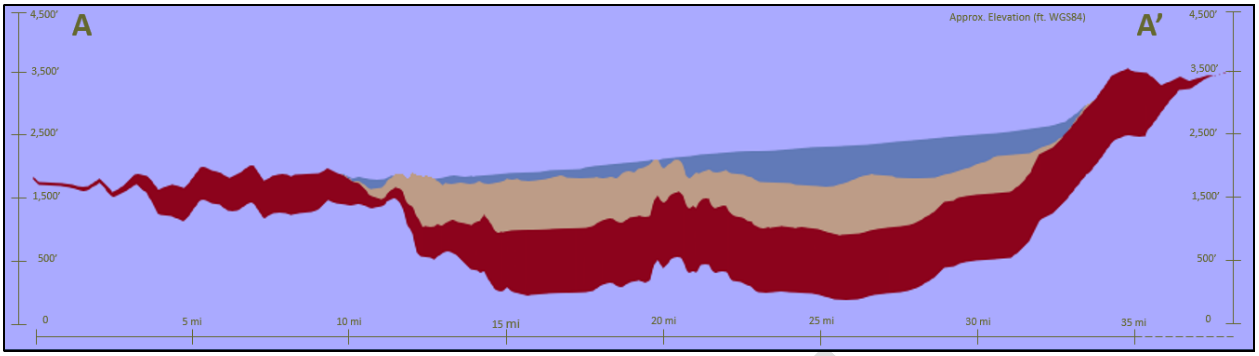


Figure 2-9:Cross Section A-A’

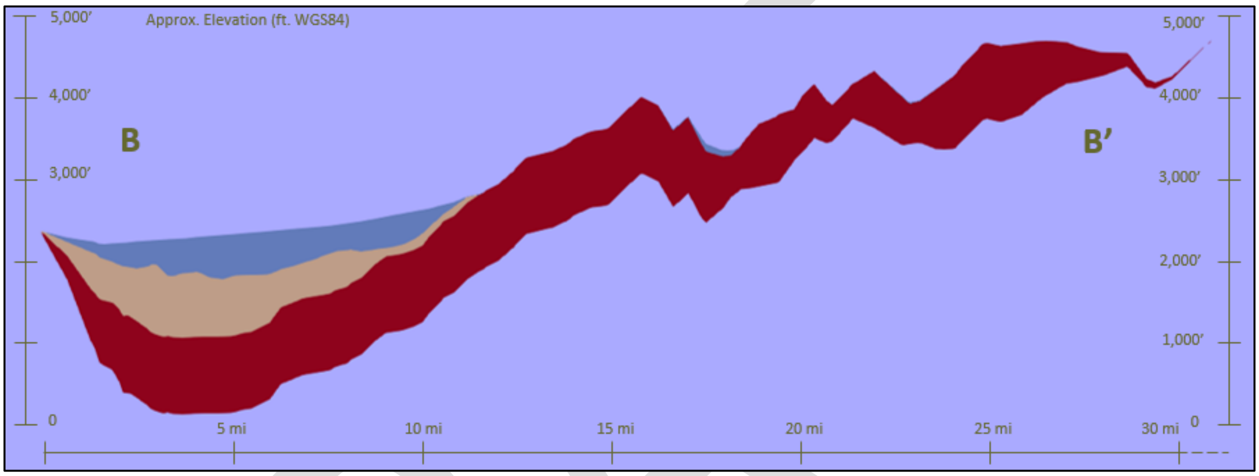


Figure 2-10: Cross Section B-B’

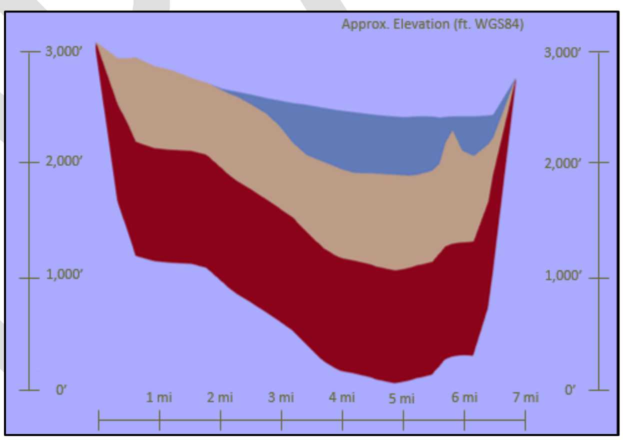


Figure 2-11: Cross Section C-C’

Aquifer Properties

The highest yielding wells are screened in the alluvium and located in the north-central portion of the basin. Pumping in the alluvium also occurs in the eastern part of the Cuyama Valley, along the Cuyama River and its tributary canyon as far as a few miles upstream from Ozena (Singer and Swarzenski, 1970).

Hydraulic Conductivity

The DWR defines hydraulic conductivity as the "measure of a rock or sediment's ability to transmit water" (DWR, 2003). The hydraulic conductivity is variable within the principal aquifer, varying laterally, vertically, and amongst the three aquifer formations. Using aquifer tests from 63 wells (Figure 2-12), estimates of horizontal hydraulic conductivity range from 1.5 to 28 feet per day (ft/d) and decrease with depth (USGS, 2013c). The younger alluvium generally has the highest hydraulic conductivity and the Morales Formation has the lowest. The median estimated hydraulic conductivity for the older alluvium (15 ft/d) is about five times the estimated value for the Morales Formation (3.1 ft/d) (USGS, 2013c). The hydraulic conductivity of the Morales Formation decreases with depth and the lower member of the formation (the clay and limestone unit) has a lower conductivity than the upper member (sandstone). The highest values in the Morales Formation occur in the central portion of the valley and decrease moving west (Singer and Swarzenski, 1970).

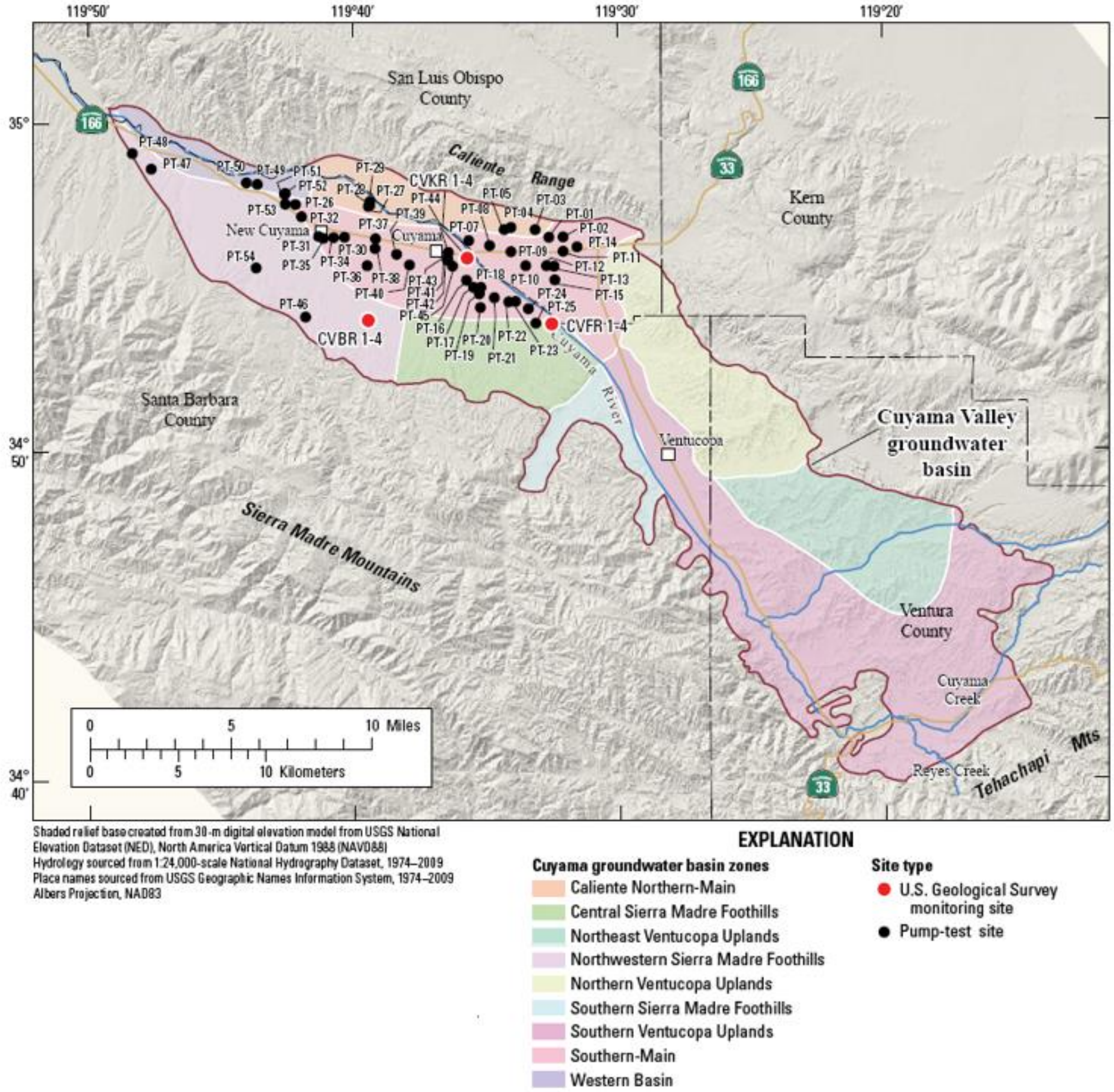
Specific Yield

The DWR defines specific yield as the "amount of water that would drain freely from rocks or sediments due to gravity and describes the portion of groundwater that could actually be available for extraction" (DWR, 2003). Specific yield is a measurement specific to unconfined aquifers, such as the primary aquifer in the Cuyama Basin[1]. The dewatered alluvium has an average specific yield of 15 percent (Singer and Swarzenski, 1970). The USGS estimated the specific yields of the three aquifer formations during the Cuyama Valley Hydrologic Model (CUVHM) calibration, calculating that the recent alluvium had the lowest specific yield ranging from 0.02 to 0.14, the older alluvium has a specific yield ranging from 0.05 to 0.19, and the Morales Formation has the highest specific yield ranging from 0.06 to 0.25 (USGS, 2015).

Specific Capacity

Specific capacity is defined as "the yield of the well, in gallons per minute, divided by the pumping drawdown, in feet" (Singer and Swarzenski, 1970). Specific capacity in the aquifer varies laterally and vertically but is typically highest in the younger alluvium and lowest in the Morales Formation. Wells perforated in the younger alluvium have a median specific capacity of 60 gallons per minute (gpm) per foot (USGS, 2013c). Wells perforated in both the younger and older alluvium have a median specific capacity of 40 gpm per foot (USGS, 2013c). Wells perforated in the older alluvium have a median specific capacity of 20 gpm per foot (USGS, 2013c). The silt and clay content of the older alluvium increases to the west and corresponds to a decrease in specific capacity in the alluvium; specific capacities are less on the western half of the valley compared to the eastern half. However, a greater percentage of wells in the western part are perforated in the older alluvium (USGS, 2013c). The specific capacity of the Morales Formation varies laterally but is generally less than the specific capacity of the younger and older alluvium. In the western part of the valley, the Morales Formation has a specific capacity ranging from 5 to 25 gpm per foot. In the north north-central portion of the basin the specific capacity increases to 25 to 50 gpm per foot (Singer and Swarzenski, 1970).

[1] For confined aquifers, the measurement of "storativity" is used instead of specific yield.



Source: USGS, 2013c.

Figure 2-12: Location of Aquifer Testing Well Sites

Transmissivity

The DWR defines transmissivity as the "aquifer's ability to transmit groundwater through its entire saturated thickness" (DWR, 2003). Using aquifer tests from 63 wells (shown in Figure 2-12), estimates of transmissivity ranged from 560 to 163,400 gallons per day per foot (gpd/ft) and decreased with depth (USGS, 2013c). Amongst the aquifer units, wells screened in the younger alluvium had the highest transmissivity, a median value of 15,700 gpd/ft (USGS, 2013c). Wells screened in older alluvium had a transmissivity three times less than the younger alluvium wells, at a median value of 5,000 gpd/ft (USGS, 2013c). Wells screened in both the younger and alluvium had a median transmissivity of 11,300 gpd/ft (USGS, 2013c). Data from the 61 wells were not available for the Morales Formation, but a transmissivity estimate from two wells screened in both the older alluvium and Morales Formation averaged 4,900 gpd/ft (USGS, 2013c). Using groundwater level contours, Singer and Swarzenski determined the range of transmissivity values in the Morales Formation to fluctuate much more than the transmissivity values of the younger and older alluvium; in general, values are highest in the central portion of the valley and decline to the west.

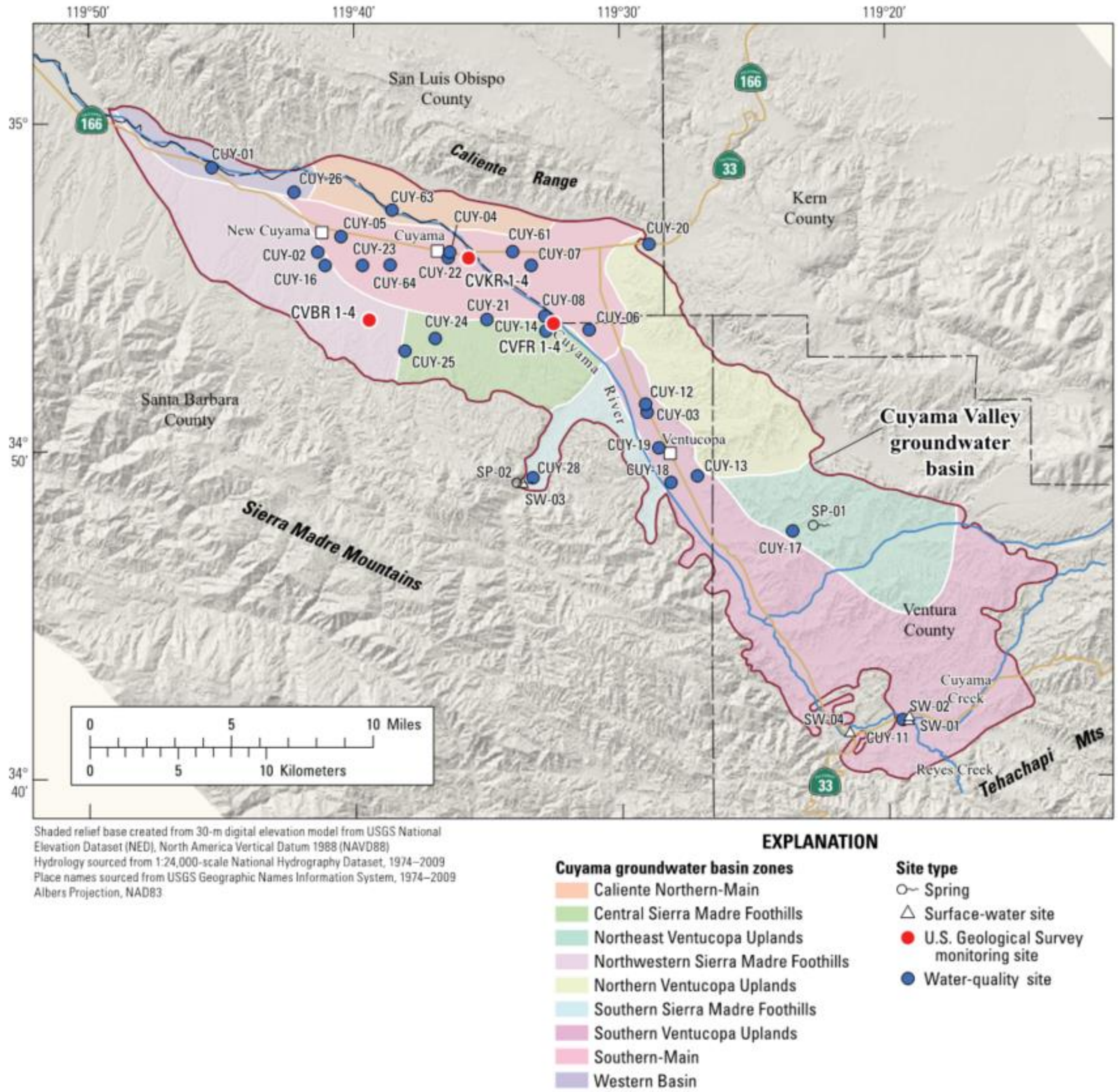
2.1.7 Water Quality

Historic Groundwater Quality

Water quality in the Cuyama Basin has historically had high total dissolved solids (TDS) and sulfates. High concentrations of other constituents, such as nitrate, arsenic, sodium, boron, and hexavalent chromium are localized (USGS, 2013c). Locations where water quality measurements were taken are shown in Figure 2-13.

Singer and Swarzenski studied groundwater in the basin in 1970. Groundwater ranges from hard to very hard and is predominately of the calcium-magnesium-sulfate type (Singer and Swarzenski, 1970). Averages of concentrations include 30 milligrams per liter (mg/L) chloride, 0.20 mg/L of boron, and 1,500 to 1,800 mg/L TDS (Singer and Swarzenski, 1970). Along the periphery of the basin, groundwater quality is variable. Along the southern boundary and near the eastern badlands, the groundwater quality reflects the recharge from springs and runoff from the Sierra Madre Mountains; TDS concentrations range from 400-700 mg/L and most of the water is sodium calcium bicarbonate (Singer and Swarzenski, 1970). Along the eastern edge of the valley, near the Caliente Range, water quality declines as concentrations of sodium, chloride, TDS, and boron increase. Concentrations of boron range up to 15 mg/L, concentrations of chloride increase up to 1,000 mg/L, and TDS concentrations range from 3,000 to 6,000 mg/L (Singer and Swarzenski, 1970).

Singer and Swarzenski in 1970 also concluded that the basin's water quality potentially results from the mixing of water from the marine rocks: *"This water quality presumably results from the mixing of water from the marine rocks of Miocene age with the more typical water from the alluvium and is characterized by increased sodium, chloride, and boron. Although chloride and boron concentrations commonly are less than 30 and 0.20 mg/1, respectively, in the central part of the valley, the water from many wells is close to the Caliente Range contains several hundred to nearly 1,000 mg/L of chloride and as much as 15 mg/1 of boron."* (Singer and Swarzenski, 1970). Singer and Swarzenski did not provide a map showing their sampling locations.



Source: USGS, 2013c.

Figure 2-13: Location of USGS 2013 Groundwater Quality Sites

Recent Groundwater Quality

In 2013, the USGS collected groundwater from 39 wells and two springs for 53 constituents including nitrate, major and minor ions, field parameters (dissolved oxygen, temperature, alkalinity, pH, and specific conductance), arsenic, iron, and chromium (USGS, 2013c). Concentrations of nitrates, sulfates, arsenic, TDS, and hexavalent chromium were compared to the United States Environmental Protection Agency (USEPA) secondary drinking-water standards (SMCL) and maximum contaminant levels (MCL) to identify samples that exceeded drinking water standards. Groundwater quality data indicated that the groundwater has high concentrations of TDS and sulfates Basin-wide and localized spikes in arsenic, nitrates, hexavalent chromium, boron, and chloride (USGS, 2013c). Results found that:

- TDS concentrations exceeding the SMCL (greater than 500 mg/L) were found in 97 percent of samples.
- Sulfate concentrations exceeding the SMCL (greater than 250 mg/L) were found in 95 percent of groundwater quality samples.
- Nitrate concentrations ranged from 0.02 mg/L up to 45.3 mg/L, exceeding the SMCL (10 mg/L) in 13 percent of samples. Wells along the edges of agricultural land-use areas reported the lowest nitrate levels and wells within agricultural land use areas reported the highest levels of nitrate. Nitrate concentrations decreased with depth, indicating the source was near the surface and likely a result of agricultural activities.
- Arsenic concentrations exceeding the MCL (greater than 10 micrograms per liter (µg/L)) were found in 12 percent of groundwater quality samples and ranged from 0.51 to 67.1 µg/L. High concentrations of arsenic correlated with groundwater older than 25,000 years.
- Hexavalent chromium concentrations exceeding the Public Health Goal[2] of 0.02 µg/L were observed in 95 percent of groundwater quality samples and ranged from below detection limit (0.1 µg/L) to 1.7 µg/L.

Aquifer Use

The Cuyama Valley is dependent on groundwater as its sole source of supply. Groundwater is used primarily for irrigation (USGS, 2013c). The majority of agricultural activity occurs between the New Cuyama and Ventucopa areas.

2.1.8 Topography, Surface Water and Recharge

This section describes the topography, surface water, soils, and groundwater recharge potential in the basin.

Topography

The basin is lowest in the northwest, and highest in the southeast. The lowest elevation in the Basin is located at the west edge where the Cuyama River exits at approximately 1,300 ft, while the highest point is approximately 7,250 ft on the eastern boundary. Figure 2-14 shows the topographic characteristics of the Cuyama Basin. The south facing northern slopes of the valley are generally steeper than the north facing south slopes. The eastern portion of the basin along the valley walls becomes steep, characterized by mountainous runoff-cut topography.

Surface Water Bodies

The Cuyama River is the primary surface water feature in the valley and flows from an elevation of 3,800 ft on the eastern side to the west of the basin to 1,300 ft at the western outlet of the basin. The Cuyama River travels approximately 55 miles through the basin and has a slope ratio of approximately 1:125. The river is perennial with most dry seasons seeing little to no flows. Large flows usually occur in flashes due

[2] The USEPA does not list a SMCL for hexavalent chromium. Public Health Goals are typically orders of magnitude lower than a SMCL.

to the small watershed and storms that provide precipitation onto the surrounding Coastal Range Mountains. Peak flows through the Cuyama River thus range from approximately 6,000 to the highest recorded flow of 15,500 cubic feet per second on February 18, 2017 (National Watershed Information System [NWIS], 2018). There are approximately four main perennial streams that feed the Cuyama River including Wells Creek, Santa Barbara Creek, Quatal Canyon Creek, and Cuyama Creek. However, during precipitation events many more smaller streams flow from the valley walls and surrounding mountains. Figure 2-15 shows the locations of surface water bodies in the basin.

No standing bodies of water such as lakes or ponds are present within Cuyama Valley. Downstream on the Cuyama River lies Twitchell Reservoir, however this is an artificial body of water outside of the Cuyama Groundwater Basin.

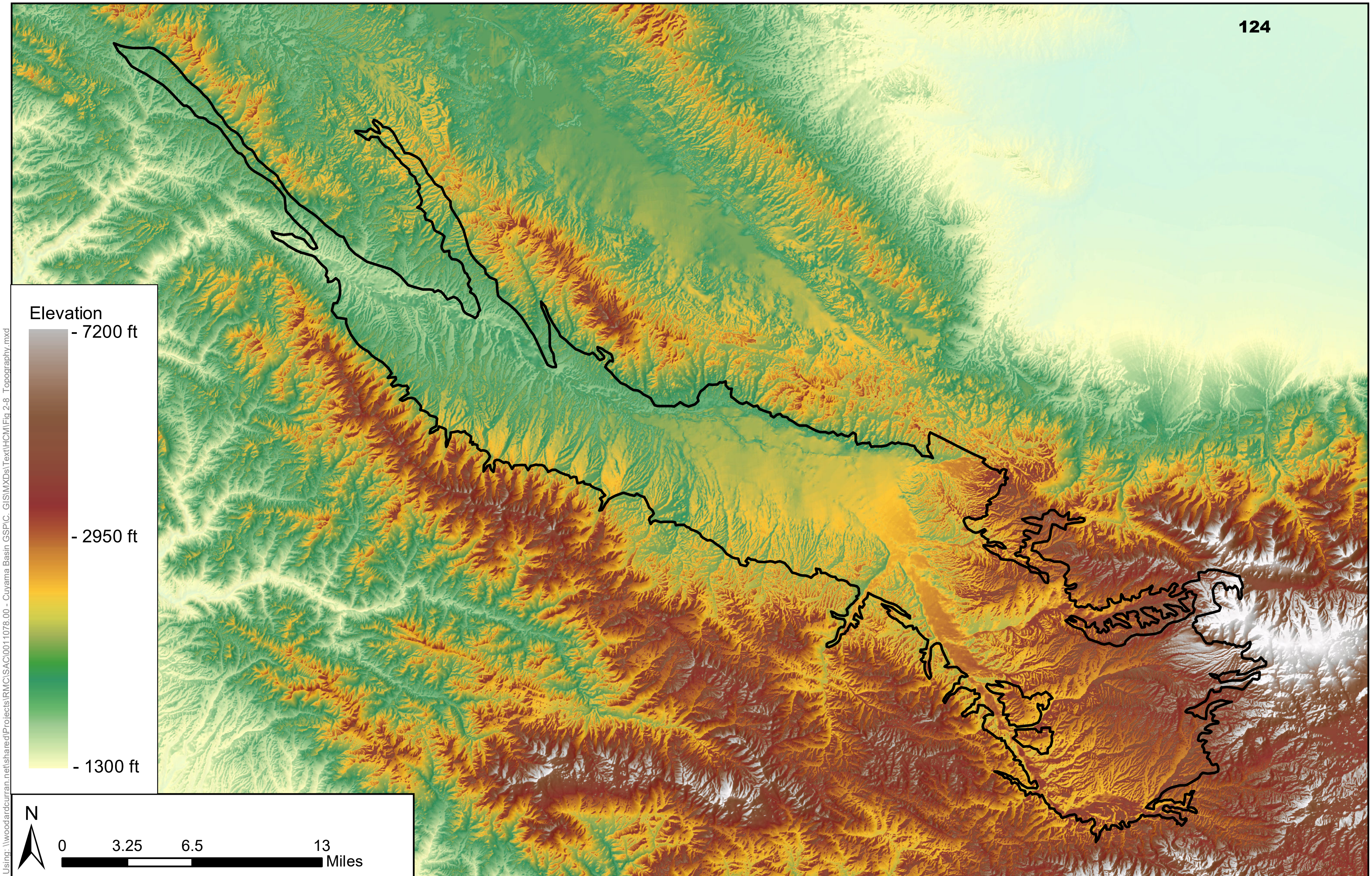


Figure 2-14: Topography

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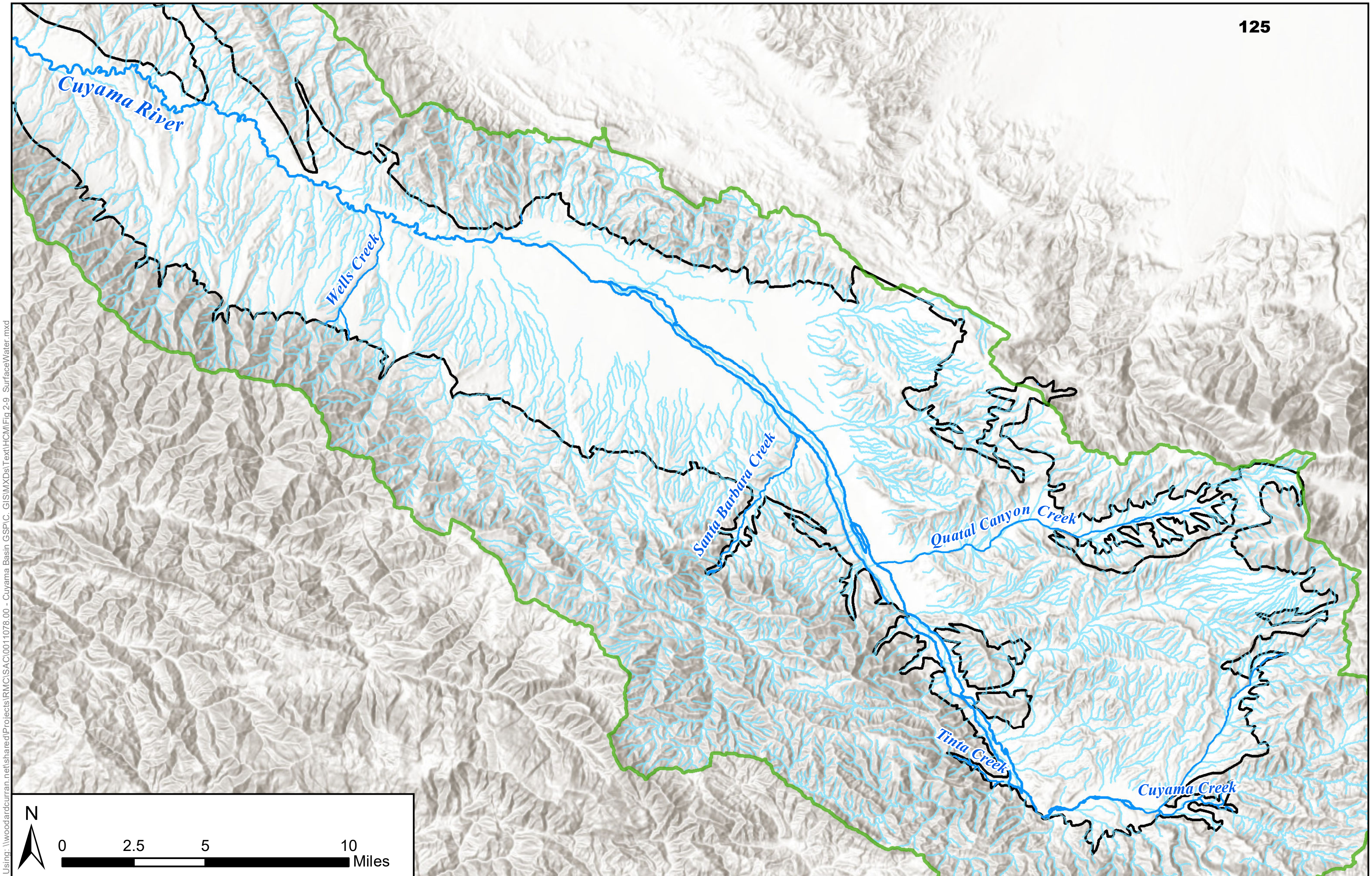

Figure 2-15: Surface Water

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Legend

- Cuyama Basin
- Cuyama Watershed
- Cuyama River
- Major Cuyama GW Basin Streams
- All Other NHD Flow Lines, Creeks, and Streams in the Cuyama Watershed

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Areas of Recharge, Potential Recharge, and Groundwater Discharge Areas

Areas of recharge and potential recharge lie primarily within the central and low-lying areas of the Cuyama Valley. Approximately 25 miles of the eastern portion of the Cuyama River is categorized as a wetland by the U.S. Fish & Wildlife Service's National Wetlands Inventory. These wetlands are considered areas of recharge during flow events due to precipitation within the basin.

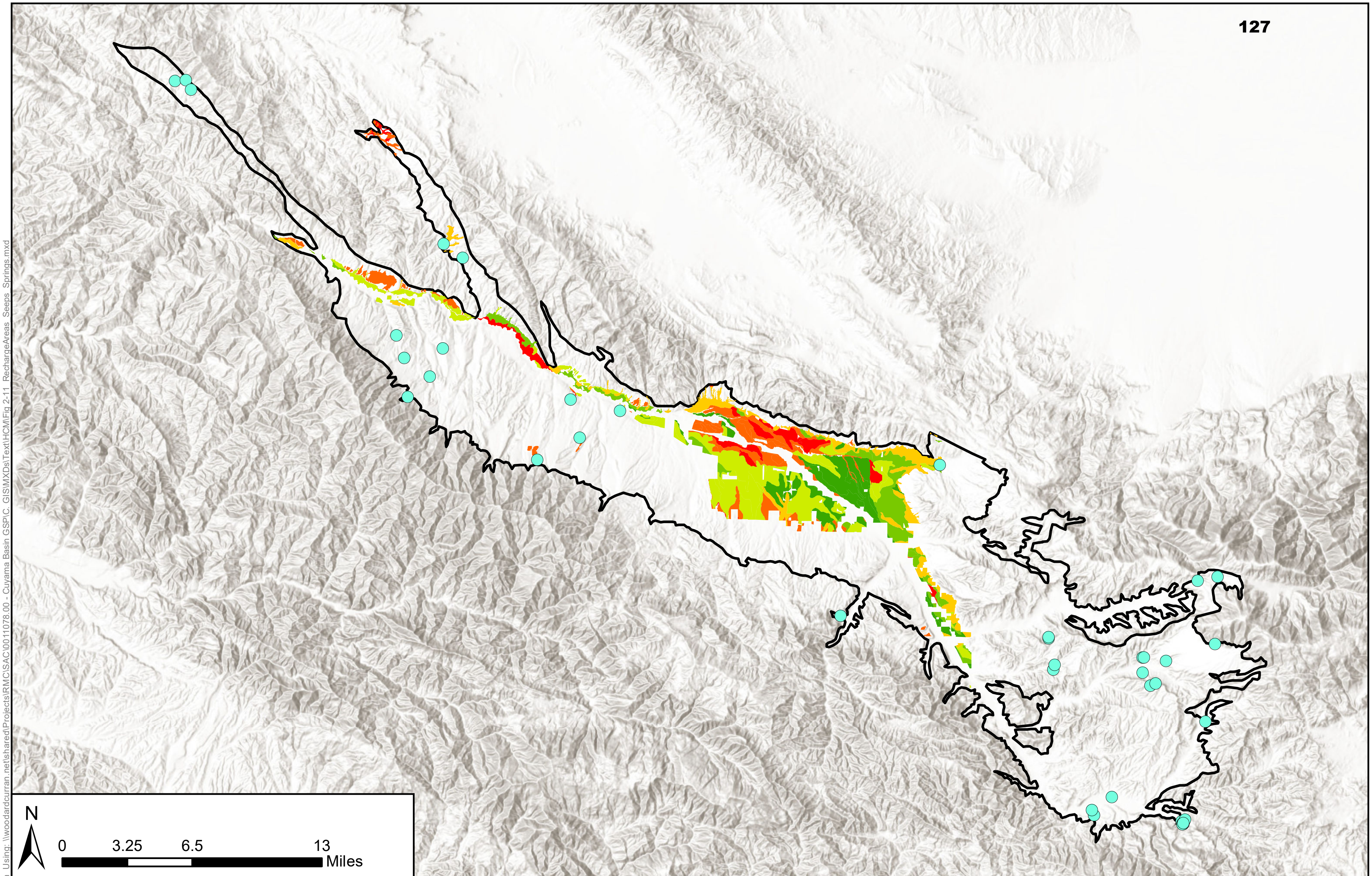
Agricultural and open space lands are also considered areas of potential recharge. Figure 2-16: Recharge Areas and Springs shows areas with their potential for groundwater recharge, as identified by the Soil Agricultural Groundwater Banking Index (SAGBI). SAGBI provides an index for the groundwater recharge for agricultural lands by considering deep percolation, root zone residence time, topography, chemical limitations, and soil surface condition. SAGBI data categorizes 22,675 acres out of 37,568 acres (60%) of agricultural and grazing land within the basin as moderately good, good, or excellent for groundwater recharge (University of California, Davis [UCD], 2018). SAGBI data shown in Figure 2-16 is "modified" SAGBI data. "Modified" SAGBI data shows higher potential for recharge than unmodified SAGBI data because the modified data assumes that the soils have been or will be ripped to a depth of six feet, which can break up fine grained materials at the surface to improve percolation.

Groundwater discharge areas are identified as springs located within the basin. Figure 2-16 shows the location of historic springs identified by the USGS (NWIS, 2018). The springs shown in represent a dataset collected by the USGS and are not a comprehensive map of springs in the basin.

Soils

Soils in the basin were categorized by the National Resource Conservation Service (NRCS). The basin is comprised mostly of fine- to coarse-loamy soils (NRCS STATSGO2, 2018). As shown in Figure 2-17, the valley bottom and primary soil surrounding the Cuyama River and its tributaries is primarily fine-loamy soils, while the northern boundary of the basin has coarse-loamy soils.

Figure 2-18 shows soils by hydrologic soil group. Hydrologic soil groups were calculated by the NRCS on a by-county basis. As shown in Figure 2-18, interpretations of soil groups varied by county in each study. In general, hydrologic soil groups are sorted by permeability, with class A being the most permeable and class D being the least permeable. Figure 2-18 shows that in general most of the soils in the basin have lower permeabilities and are listed as class C or D, with higher permeabilities being located near streams and rivers.



N

0 3.25 6.5 13 Miles

Figure 2-16: Recharge Areas, Seeps, and Springs

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Legend

Cuyama Basin

Spring/Seep

Modified SAGBI Soils of Cuyama Basin

Excellent (85-100)

Good (69-85)

Moderately Good (49-69)

Moderately Poor (29-49)

Poor (15-29)

Very Poor (0-15)

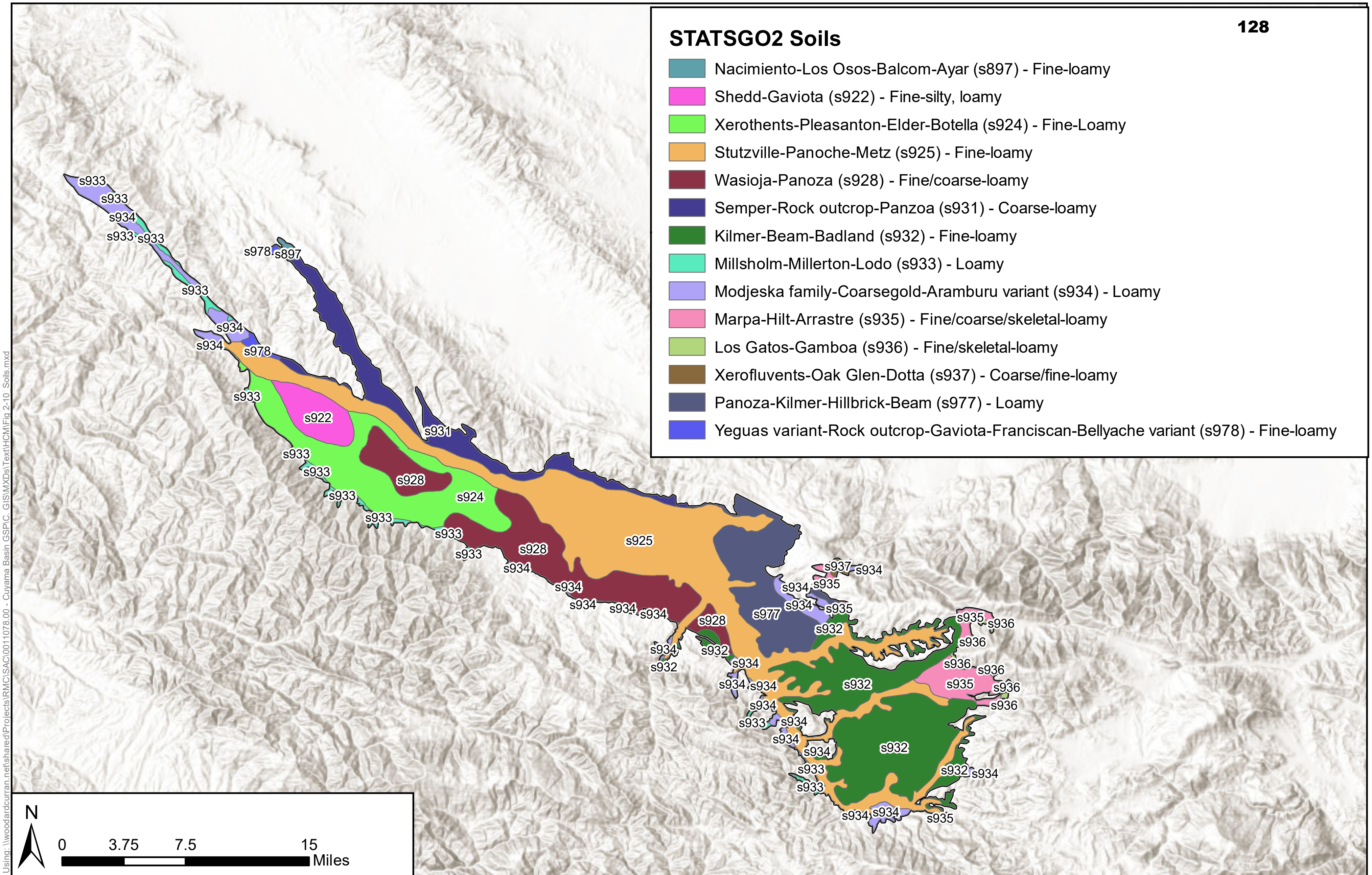

Figure 2-17: Soils

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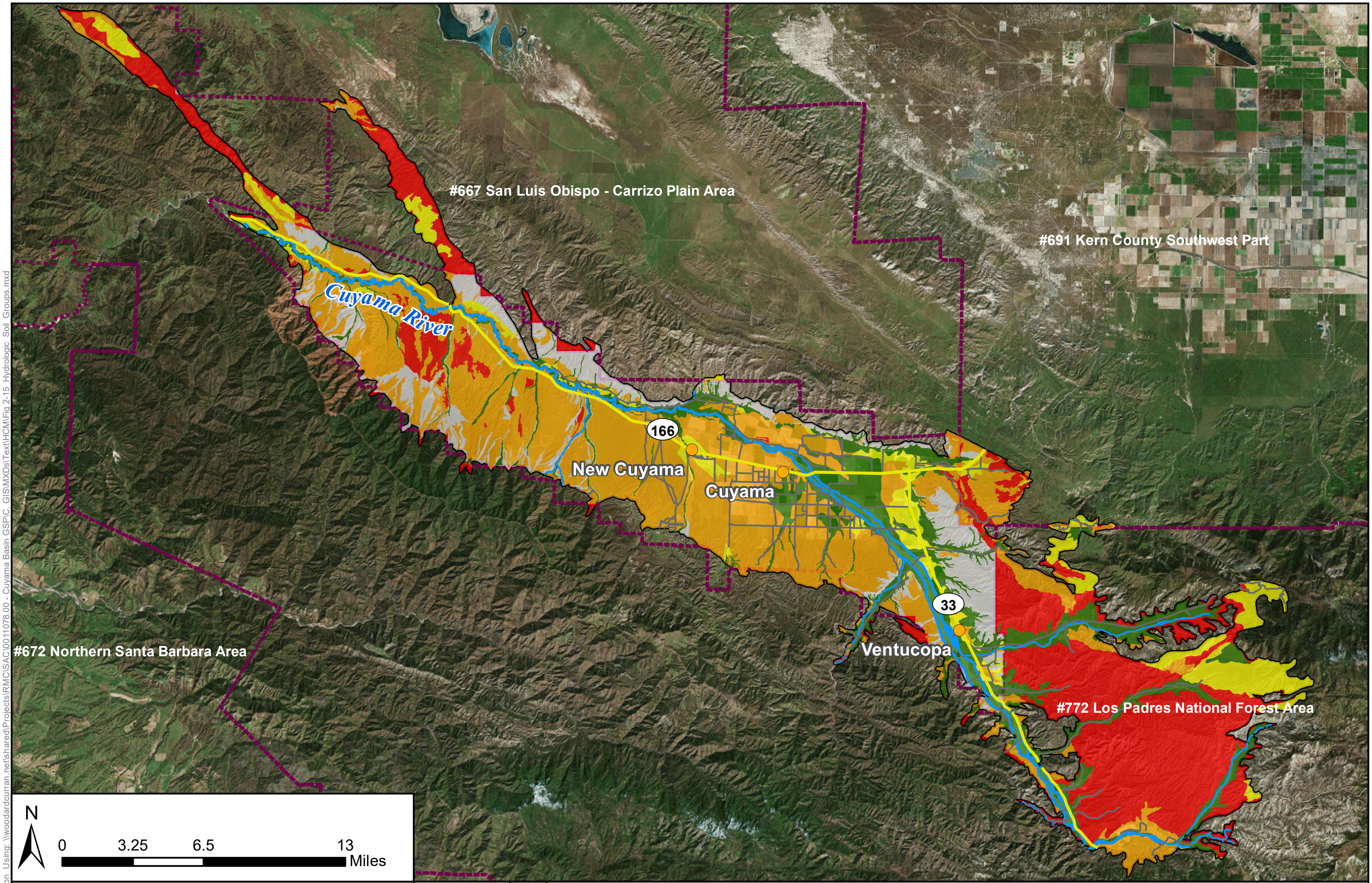

Figure 2-18: Hydrologic Soil Groups

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Legend

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

Hydrologic Soil Group

- A
- B
- C
- D
- Not classified

Soil Survey Boundary

Soil Survey Key:

#772 Los Padres National Forest Area

Soil Survey Number — Survey Name

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2.1.9 Hydrogeologic Conceptual Model Data Gaps

HCM data gaps are present in the understanding of the HCM presented in this GSP. Initial draft subjects considered data gaps are listed below, and will be refined and updated during the preparation of the rest of the GSP.

- Russell Fault
- Boundary of the Upper and Lower Units of the Morales Formation
- Groundwater Quality
- Portions of basin not well understood (far west and east portions)
- Plans to fill data gaps in understanding

To be completed after further research and GSP development

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Hydrogeologic Conceptual Model

- Draft GSP Section provided to SAC and Board for review as part of Board Packet on June 22nd
- Hydrogeologic Conceptual Model describes:
  - Regional Geologic and Structural Setting
  - Geologic History
  - Geologic Formations/Stratigraphy
  - Faults and Structural Features Basin Boundaries
  - Principal Aquifers and Aquitards Water Quality
  - Topography, Surface Water and Recharge
- Comments are due on Friday, July 20

WOODARD &CURRAN

TO: Standing Advisory Committee
Agenda Item No. 7e

FROM: Jim Beck, Executive Director

DATE: June 28, 2018

SUBJECT: Stakeholder Engagement Update

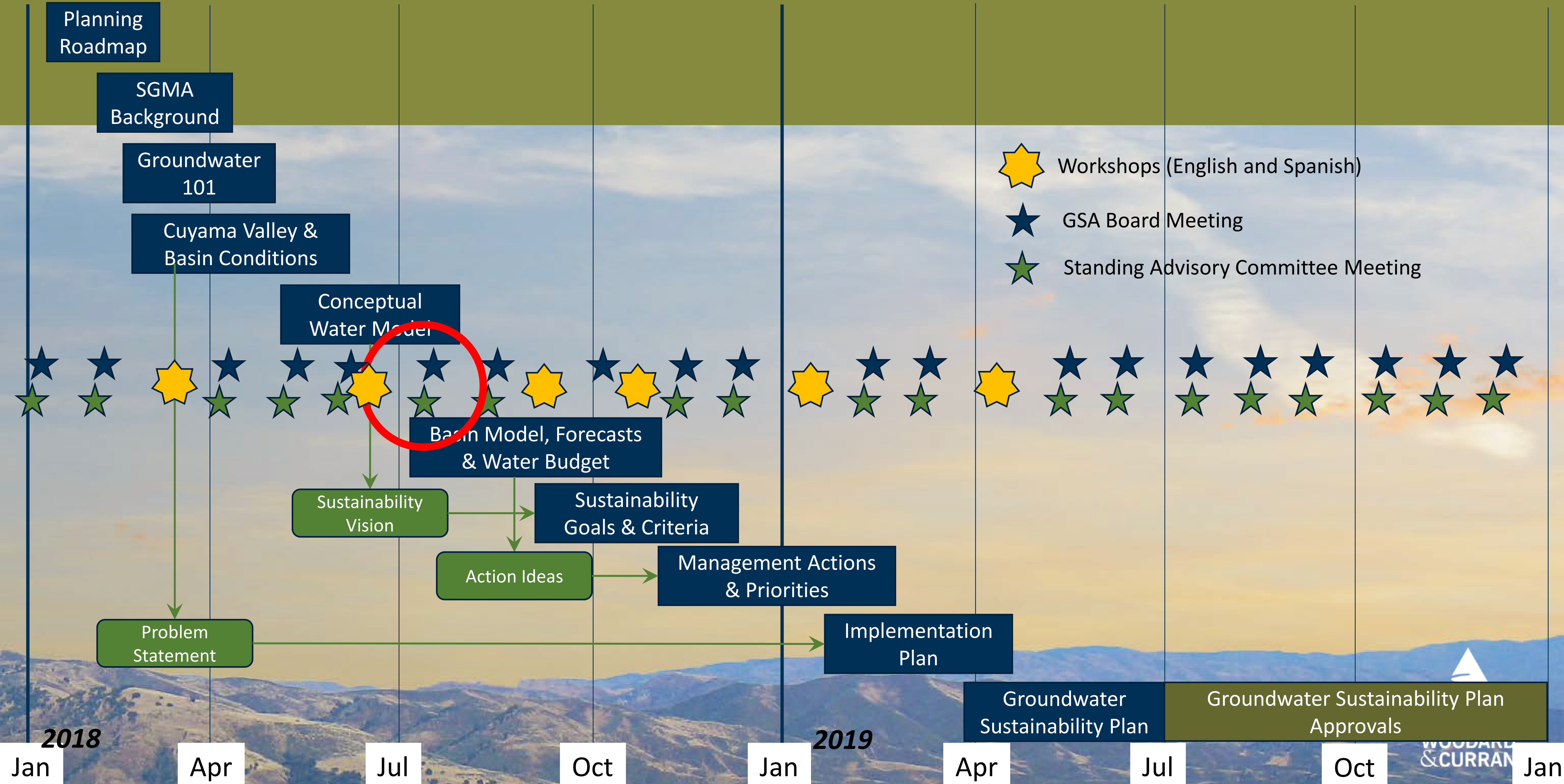
Issue
Update on the Cuyama Basin Groundwater Sustainability Agency Groundwater Sustainability Plan stakeholder engagement.

Recommended Motion
None – information only.

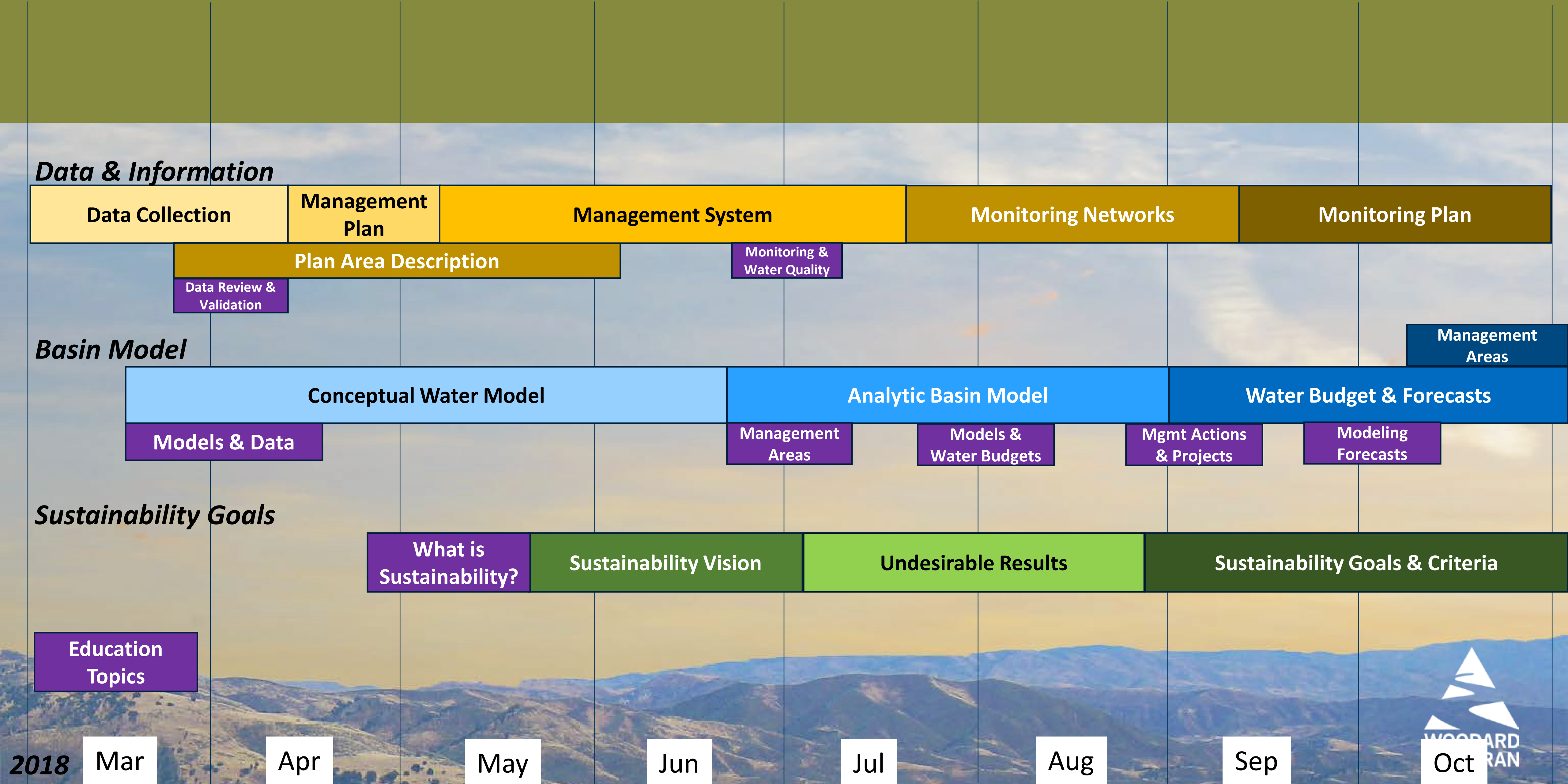
Discussion
Cuyama Basin Groundwater Sustainability Agency Groundwater Sustainability Plan (GSP) outreach consultant the Catalyst Group's stakeholder engagement update is provided as Attachment 1, the June 6, 2018 Workshop Summary is provided as Attachment 2, and a matrix that matches GSP sections with corresponding educational topics is provided as Attachment 3.

Attachment 1

Cuyama Basin Groundwater Sustainability Plan – Planning Roadmap



Cuyama Basin Groundwater Sustainability Plan – Discussion Topics



Outreach Activities

- June Activities
  - Prepared "Who's Talking about Water in Cuyama Valley?"
  - Conducted community workshops, June 6, and prepared workshop summary
  - Provided information materials for June/July outreach activities
- Next Steps
  - Expanding contact list with Assessor parcel address information to complement the email contact list
  - Develop outline for September 1 CBGSA newsletter
  - Continue developing educational topics

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Workshops Update – Physical Conditions of the Valley

- Topics of additional interest
  - Water use
  - Water quality – salinity and arsenic
  - Groundwater elevation contours
  - Management areas
  - Approach for addressing data gaps

Workshops Update – Sustainability

- The future has to be different – we are at a change point
- Balanced water use is critical for a sustainable Valley and Basin
  - How can we find and define balanced water use for the basin?
- Economics
  - Water and jobs are closely connected in the Valley
  - The Valley needs both economic productivity and quality of life
  - The Valley needs an economy that will keep people employed locally
  - Water affordability is critical for the community
  - Expanding housing will increase the economic base for the community

Workshops Update – Sustainability

- Local Ecology
  - Increase trees along the river and as windbreaks
  - Increase habitats for migratory birds and other fauna
- Water Quality
  - Address community water quality issues
  - Salinity is a problem for both homes and farms
- Farming Practices
  - Farming practices should change to use water more wisely

Sustainability Is:

- Returning to environmental and groundwater conditions before negative effects occurred
- Improving water quality, reversing land subsidence, and decreasing well depths
- People, animals, and crops must be able to survive without using more water than is replenished in an average year
- Survival of the community and wildlife through drought periods, mega-farming is not expanded beyond current levels, and no additional residential development

Discussion

- Are there additional elements or features to define Sustainability for water resources in the Cuyama Valley?

Undesirable Effects

- Economy
  - Loss of jobs
  - Drop in property values
  - Affordability of water and groundwater management actions
  - Lack of diversity of economy and jobs
  - Need for family housing and community reinvestment
- Community
  - Poor, unhealthy water quality for the community
  - Loss of community supply from declining groundwater levels
  - Land subsidence could affect infrastructure

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Undesirable Effects

- Small Farms
  - Loss of water supplies from lowering groundwater levels
  - Cost of drilling deeper for water supplies
  - Loss of small farms in the Valley
- Large Farms
  - Wells going dry from declining groundwater levels
  - Drilling deeper wells to maintain supplies
  - Declining water quality, increasing salinity
  - Impacts on environment and community
  - Crop choices

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Undesirable Effects

- Natural Resources
  - Loss of habitat and species
  - Reduced stream flows
  - Air quality problems from dust
  - Loss of organic matter in the soils
  - Contamination from chemical use

Discussion

- Are there any additional undesirable effects to consider in developing sustainability goals and criteria?

Actions

- Balance water use
- Address drinking water quality
- Improve community infrastructure
- Change crops and increase value-added processing
- Reduce farm irrigation
- Rebuild soils
- Maintain rangeland
- Volume-based water charges for agriculture
- Share community water costs
- Diversify the local economy
- Increase farm and residential housing to keep people and money in the Valley

Cuyama Basin Groundwater Sustainability Agency Board of Directors & Standing Advisory Committee Hosted Two Public Workshops

June 6, 2018

Summary of Comments and Questions

Background

On June 6, 2018, two community workshops were hosted by the Cuyama Basin Groundwater Sustainability Agency Board of Directors and the Standing Advisory Committee. They were held at the Cuyama Recreation District facility in New Cuyama, CA. The workshops were noticed through a number of methods. (See page 8, Appendix A: Workshop Notification). The workshop began at 6:15 pm and concluded at approximately 8:30 pm. The English workshop was attended by approximately 42 community members and landowners. The Spanish language workshop was attended by 8 community members. Both of the workshops had two discussion components: An overview of the Physical Conditions of the Cuyama Basin followed a question and answer session and a presentation about Sustainability and Role of Water in the Future of the Cuyama Basin followed by an interactive discussion.

The information gathered from the English and Spanish language workshops and six written comments is summarized below.

Workshops Part 1: Overview of Physical Conditions of the Cuyama Basin

Following a presentation on the Physical Conditions of the Cuyama Basin, workshop attendees asked the following questions and provided the following comments and observations. The questions are noted along with the answers.

GSP Plan

- What happens if the Cuyama Basin does not reach the minimum threshold by 2040?
  - The Cuyama Basin GSP will be reviewed every 5 years, from 2020 to 2040, and adjustments to the GSP can be made if progress toward the minimum threshold is not being made.

Water Use

- Farmers in the main portion of the Cuyama Basin are pumping too much water as fields are being irrigated 12 to 24 hours a day.

Water Quality

- There is water quality contamination, specifically from salinity and arsenic.
- Salinity is a problem specifically with the water in New Cuyama townsite as well as low water pressure. If you are in New Cuyama and you wash your car, there is a white film left on it from the salinity When you take a shower, your skin gets dry and irritated from the salinity. The salinity in the water causes build up in the pipes so the pipes need to get replaced more frequently.

- In the area toward where Hwy 166 and 33 intersect, there is a problem with salinity and low water pressure.
- How can water quality help understand the flows and barriers of groundwater and help with the geologic modelling?
    - Water quality can be significantly different on one side or another of a groundwater barrier that impedes or diverts groundwater flows, so water quality analyses can help identify barriers and how groundwater flows. However, water quality testing can be expensive so should be considered carefully.
- Can you define groundwater plumes?
    - Plumes are areas of contamination that can move through and spread in groundwater. Plume fronts determine the direction and speed of spreading contamination.

Hydrogeologic Model and Geology

- What is the depth to groundwater levels on the three Cuyama Basin hydrogeology layers?
    - In the center of the Cuyama Basin, the deepest groundwater level is at 1,000 feet; followed by the middle layer at 800 feet; followed by the top later 600 feet.
- Regarding the two faults (Russell Fault and Rehobeth Fault), why are they of such interest?
    - The two faults are of interest because there is less recorded data regarding the faults and how these faults generally affect groundwater flows. The published studies are not consistent regarding the impact of faults on water flow.
- Is more research going to be done on Santa Barbara Canyon fault and its effect on the aquifer?
    - The existing published data is consistent for that fault so it is a low priority for further research at this time.
- What is the significance of “basement” rock?
    - Basement rock is a catch-all term for rock formations that generally do not hold water and are a barrier to water movement. If you consider the basin a bathtub filled with sand and water, the basement rock is the porcelain bathtub. In some cases the rock can be fractured, which allows some movement of water through basement rock.
- Do we know if the “bathtub” or basement rock leaks?
    - Most basement rock in most basins does leak but that cannot be measured. It is included in the model as an estimate.
- On the ground surface and groundwater elevation profile, does it consider the sides of the river as opposed to just the river end-to-end? Have you done anything to look at the sides of the Cuyama Valley? Are you identifying water bearing layers of wells?
    - The groundwater conditions section of the GSP will also consider the sides of the river, i.e., how the groundwater levels change from the edges of the Cuyama Basin to the Cuyama River. The next phase of work will look at the data to estimate the elevation contours and use existing reports to understand groundwater movement. USGS looked at groundwater layers and determined that they are not consistent from well to well because, over time, the Cuyama River has deposited fine sand and coarse rocks in varied ways in the Cuyama Valley.

- Have you given thought to Water Management Areas based on the hydrology and geology?
  - Water management areas are a possible consideration, based on the hydrology and geology, however there is no decision at this time; there is more work to be done. We will start talking about water management areas at future meetings and more information about management areas will be provided for discussion as the GSP process continues.
- Are you looking at well logs to identify geologic layers?
  - If well logs are provided.
- When was the last USGS study done?
  - The latest data from the USGS study was 2014. We used previous studies from different geologists over the years, not only USGS. Geology does not change over time much. We are also using more recent data to understand current conditions.

Data Gaps

- How and when will data gaps be addressed? Before and after the draft plan?
  - While developing the plan, we will document the unknowns and how to address those gaps while moving forward. Activities to address data gaps and reduce uncertainty will be included in the plan and used to refine the plan at the 5-year updates.

Workshop Part 2: Sustainability and Role of Water in the Future of Cuyama Basin

After a general introduction about sustainability and what it means in SGMA, the first question asked of the attendees was "What does sustainability of the Cuyama Valley mean for you?" The responses are noted below:

Balanced Water Use

- Balance water use among all water users.
- Balanced water use by the people and by the farmers allows everyone to stay.
- How can we work together to find and maintain balance among water users for our future, for our children?
- Continue to do business and have a thriving community, but balance resources.
- The GSP that is chosen has to provide balance.
- Water needs to be balanced and water needs to be used wisely by all users.
- Water table is replenished and fills to levels that will not fall to dangerous levels even in drought.
- Water has to support residential, family and farm needs.

Economic Productivity and Stability

Current Perspectives

- Without water, how can we survive and maintain our livelihood?
- The community is already subject to greater impacts now with the high cost of water ($160 to $200 per household per month) and the water contamination (salinity and arsenic) that has come as a result of the increase in farming. The farmers/ranchers can pack up and leave the

area if they want to, leaving the community with no jobs and no community. Currently, the large agricultural businesses can leave the area and go somewhere else to grow, but the people in the community can't just pick up and leave.
- There were a lot more homes on the farms back in the day.

Future Perspectives

- Water and jobs are directly connected.
- The Cuyama economy should continue to grow.
- Economic productivity and quality of life are necessary.
- Solutions to the water issues have to be economical.
- Cuyama needs an economy that will keep people employed.
- Money generated in the Cuyama Valley should stay here.
- For the future, add 40 to 50 new homes to improve the economic base for the community.
- Adding more homes is not the right direction.
- Water use by homes is negligible compared to agriculture.
- Access to affordable quality water is the only thing that can support people and the economy in the Cuyama Valley.

Water Equality

- Need to fix the current water inequality in the future. (people have bad water with salinity and arsenic, and farmers pump all day)
- Regulate the amount of farming and irrigating so that residents can have clean water, affordable water.
- Water needs to be used wisely by all users.
- All water users must evaluate their use and determine where they can cut back – individuals must have enough water to maintain good health and large and small farms must evaluate their use and change their practices to be more conservation oriented.
-

Local Ecology

- We would like to see more plant growth along the riverbed and improvement to local ecology (specifically trees).
- Utilize trees for windbreaks, etc.
- Habitats are restored for migratory birds as well as insects and wild animals.

Farming Management Practices

- Farms have to change how they do business.
- Consider crop shift and value-added processing.
- Grow crops that are more permanent to reduce tilling and soil drying.
- Maintain the dry rangeland that is sustainable in parts of the valley.
- Farmers need to change what they are growing to use water more wisely.
- Use hedge-rows around fields.
- Rebuilding soil for moisture retention (no till and cover crop).

Water Delivery Infrastructure

- The community services district pumps break, the wells go down now. This didn't happen 5 to 10 years ago.

Water Quality

- The water has not been drinkable for at least 28 years (the number of years the speaker has lived in the Cuyama Valley near the intersect of 166 and 33). The water is better in Maricopa, so they go there to get water.
- 3 to 4 times per year the water is brown.
- Water quality has been bad for a long time, and the salinity has gotten worse.
- Salinity is bad for swamp coolers – lumps of salt get deposited, have to clean out 3 to 4 times a year when it used to be once a year.
- Water quality has been bad for a long time, and the salinity has gotten worse.
- The people need better water sources in the future, with no salinity.
- Better drinking water, some wells not drinkable, total dissolved solids, etc.
- Increased salinity from overdrafting on large farms leads to more overdrafting to remediate the problem which leads to dust and poor air quality.

Groundwater Depth

- 10 years ago, when there were fewer farms, the depth to water was okay. Now with more farms, the water depths are worse – have to drill deeper now to find water.
- Depth to water was bad during the drought but it is even worse now since even more farming (North Fork Vineyard) has come into the Valley.
- Stop wells from going dry.

Other

- Sustainability means the return of environmental and groundwater conditions to rates that were previous to the negative effects taking place.
- Sustainability means improving water quality, the reverse of land subsidence, and decreasing well depths.
- Sustainability is maximizing resources and increasing quality of life for members of community.
- Sustainability is not just water, rebuild soils in the area.
- Sustainability means survival of the community and wildlife through drought periods, that mega-farming is not expanded beyond current levels, and no additional residential development.
- Sustainability means people, animals, and crops must be able to survive without using more water than is replenished in an average year. This requires re-evaluation of current practices.
- The water connection to the natural and human environment is important – e.g., water retention can support natural and human communities.
- The future has to be different – we are at a change point.
- Consider that there will be longer cycles of wet and dry in the future.
- Re-establish reservoirs.

- Use a 60 year cycle to accommodate for a full wet and dry cycle of the Pacific Decadel Oscillation (we entered a wet cycle in 2014).
-

The next question asked of participants was, “Water is important for the future of the Cuyama Valley. What do you see as important challenges or undesirable effects for the future of water in the Cuyama Valley for the following?”

1. Water and Jobs
2. Water and Community/Households
3. Water and Small Farms
4. Water and Large Farms
5. Water and Natural Resources

While the workshop discussions did focus on these five topics, another topic of comment emerged: Water and Economy.

General Undesirable Results

- Everyone will be getting less water. It is a closed system.
- What if the Groundwater Sustainability Plan doesn’t get the outcomes we want?
- Well infrastructure is old and falling apart, which contributes to poor water quality.
- Groundwater pumping could limit access to water for the community.
- Land subsidence could be a problem that leads to infrastructure issues, less recharge for children to take on business and have a positive experience in Cuyama.

Water and Jobs

- The water used for farming is okay but the water for the community is still bad.
- Jobs go if the water goes.
- We want water for all – a balanced approach.
- We want to keep jobs in the Valley for people that live here.
- For homeowners, the value of the homes will drop drastically if there is no water and no jobs.
- With most farms, worker housing has been removed causing families with children to move away which has impacted the schools. Family housing needs to be addressed.
- Affordable, quality water supports jobs.
- The only jobs are farming jobs, so some people live here but don’t work here.
- Need increased population to work at both small and large farms – keep the money in the Valley.

Water and Community/Households

- Water of good quality must be available for people and animals at an affordable price.
- CCSD needs to provide safe and affordable water.
- Are the problems with the town water (low pressure, salinity, brown color at times, arsenic, unreliable delivery system) because of the nearby over-pumping? Can there be a way to not pump at all within a certain range to the town?
- We want good water quality for the community.

- We want water for the community pool, for community recreation.
- Grimmway should pay the CCSD water bills which are between $160 and $200 a month.
- Increasing arsenic, salinity, and carcinogens.
- The town well is drying, need functioning wells in town.
- Don't want to have to decide between washing clothes or taking a shower like it is now in New Cuyama.
- Need to educate children now about how to use water wisely, how to conserve water.
- With most farms, worker housing has been removed causing families with children to move away which has impacted the schools. Family housing needs to be addressed.
- Groundwater pumping could turn the Cuyama Basin into a desert, making homes impossible to sell, making it impossible to move elsewhere.

Water and Small Farms

- Many small farms are gone now.
- Generational farming is being phased out.
- Small farms have been and continue to be affected because as the water is deeper they can't afford to drill deeper like the big farms can.
- Deeper wells to reach water makes more expense for the small farmer, this is not sustainable.
- A bad impact would be that the community and small farms are unfairly punished for the negligence of the responsible parties of the negative effects. Small farms need to be protected.
- Wells going dry, crops going dry.

Water and Big Farms

- No Water = No Jobs.
- Bad water quality will impact the crops negatively – the crops will not be as good.
- Big farms should operate sustainably with the amount of water to keep water use balanced for everyone.
- Farming needs to reevaluate water use and crop choice.
- Can farmers grow crops that use less water?
- Regulate the water so farmers will change what they are growing.
- Big farms don't care about how much water they use, they don't care about the community, they don't care. They have the money to drill new wells. They have the money to pick up and leave but the people don't.
- Large farms operated by industrial ag-corporations appear to be blind to the damage that they do to the environment and the community.
- Shrink industrial ag by at least 50%.
- Wells going dry, crops going dry.
- Agriculture must pay for water based on the actual amount that they use.

Water and Natural Resources

- Chemicals are being sprayed onto the crops and then going into the groundwater.
- If there is no water, Big Ag will leave, and they will leave a polluted dust bowl full of the chemicals that have been sprayed.

- Air quality is bad because of Big Ag operations.
- Animals like deer and rabbits will be left with no water.
- There are fewer deer and rabbits now probably because they've been eating and drinking the sprayed chemicals.
- If there is no clean water for animals, then there will be no animals.
- Need diversity of species
- Build organic matter into the soil.
- 45 years ago, streams ran year round as not as torrents after rains. With a sustainable water table, the streams could run again.
- Over pumping has already destroyed much of the natural environment that drew people here years ago.
- Sustaining riparian areas, supporting wildlife habitat.

Water and Economy

- Cost of water needs to be affordable.
- Economic stability through boom and bust.
- We want water that is affordable.
- Affordability of well drilling to depth.
- Economic impact: agriculture and urban – need to connect with uses
- It will be undesirable for long-term management if the whole valley is treated the same.
- We need a diversified economy; we are over-reliant on certain industries.
- Changes in farming practices are important to the economy.
- If the GSP fails, there will be no economic stability.

Appendix A – Workshop Notification

Two CBGSA notices were prepared for the June 6, 2018 workshops – one in English and one in Spanish. The notices were distributed as follows:

1. May 19, 2018 - Posted to the CBGSA website.
2. May 31, 2018 - Emailed to the CBGSA email list.
3. June 4, 2018 - Emailed to the CBGSA email list as a reminder..
4. May 16 through June 5, the Cuyama Valley Family Resource Center (CVFRC) distributed the notices:
    a. 60 notices distributed at the Big Food Truck on May 16, 2018 and 30 notices distributed by the CVFRC at the Little Food Truck on May 23, 2018.
    b. 30 notices distributed via the CVFRC
    c. 140 notices were hand delivered in the Cuyama Valley on May 16, 2018 (40 notices were distributed to the U.S. Post Office, 20 notices were delivered to The Place restaurant in Ventucopa, 40 notices were delivered along Highway 33, 60 notices were delivered to one of the local churches.
5. From May 26 through June 5, 2018: CVFRC developed their own unique English and a Spanish flyer for the workshops and distributed approximately 500 copies (half English and half Spanish) by hand throughout New Cuyama. They were also emailed to the CVCA email list.

Plan for Meeting Topics and GSP Section Submittals
June 22, 2018

Key: GSA Board adoptions and approvals   Community Workshops

SAC/Board Mtg Dates	SAC Educational Topics	GSP Board/SAC Topics	Workshop Topics	GSP Section Submittals
June 28 July 11	• Monitoring of GW levels & quality, SW flows • What does SGMA require for water quality? • Management Areas	• Land and Water Use • Sustainability (workshop results)		• Plan Area (approval) • HCM (review)
July 26 August 1	• Calculating a Water Budget • How a Model Works – Baseline	• Current Basin Water Conditions (GW levels & quality, SW flows) • Sustainability (draft Undesirable Results narrative)		• GW Conditions (review) • Undesirable Results Narrative (review)
August 30 September 5 Workshop	• Management Actions & Projects	• Monitoring Networks	• Initial Model Results – Baseline • Conceptual Management Areas • Management Actions & Projects	• HCM (approval) • Monitoring Networks (review)
September 27 October 3	• How a Model Works – Future Conditions • Sustainability Refresher	• Management Areas (discussion) • Sustainability Thresholds (discussion)		• GW Conditions (approval) • Undesirable Results Narrative (approval) • Data Management (review)
November 1 November 7 Workshop	• Funding Sources and Mechanisms	• Management Areas (approval)	• Model Results – Current and Future Conditions • Sustainability Goals and Criteria	• Monitoring Networks (approval) • Sustainability Thresholds (review)
November 29 December 5	• Implementation Plan	• Sustainability Thresholds (proposed)		• Data Management (approval) • Water Budget (review)

SAC/Board Mtg Dates	SAC Educational Topics	GSP Board/SAC Topics	Workshop Topics	GSP Section Submittals
December 27? January 2		• Sustainability Thresholds (approval) • Implementation Plan (discussion)		• Sustainability Thresholds (approval) • Projects & Management Actions (draft)
January 31 February 6 Workshop		• Management Actions and Alternatives Evaluations	• Management Actions and Alternatives Evaluations	• Water Budget (approval) • Implementation Plan (draft)
February 28 March 6		• Management Actions & Projects (approval) • Implementation Plan (proposed)		• Management Actions & Projects (approval)
March 28 April 3 Workshop		• Implementation Plan (approval) • GSP Public Draft	• GSP Public Draft	• Implementation Plan (approval) • GSP Public Draft (review)
April 25 May 1		• GSP Public Draft response to comments		
May 30 June 5		• GSP Final Draft		• GSP Final Draft (approval)