

# WY 2021 Report for Fillmore and Piru Subbasins

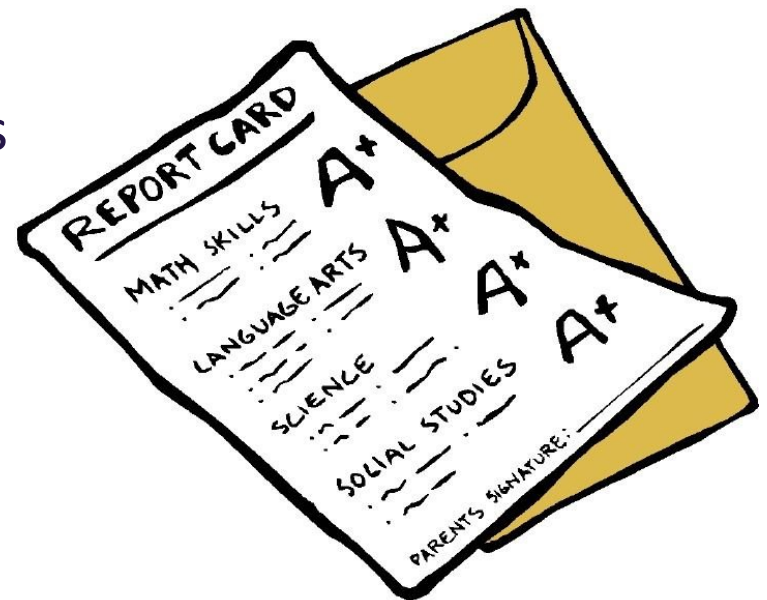


Fillmore and Piru Basins  
Groundwater Sustainability Agency  
Board Meeting  
March 17th, 2022



# Annual Reports (23 CCR § 356.2)

- Due to DWR April 1 every year
- Summarizes hydrologic conditions and storage changes over the preceding water year
- Describes progress towards plan implementation



**Annual Report WY 2021: Oct 1, 2020 - Sep 30, 2021**



# Automated Workflow

```
1 # GSP Annual Report Variables
2 writeOutput = 1 # IF TRUE, output files (shapefiles, excel files, etc.) are written. T/F
3 basinName = 'Fillmore' # Fillmore
4 DMS_siteID = 20 # site_id
5 WY = 2021
6 WY_type = 'critical' # DWR water year
7 out_eps = 26911 # desin
8 crs_units = 'm' # crs
9 interPres = 20 # spatia
10 reportDir = paste0('C:/Users/500/Docu
11 basinBoundary = paste0(reportDir, 'GIS
12 Pumping_Areas = paste0(reportDir, 'GIS
13 measAccFile = paste0(reportDir, 'Meas
14 waterBudgetFile = paste0('C:/Users/50
15 WY_idx_4_Plots = paste0(reportDir, 'S
16 Avg_S_Coeffs = paste0('GIS/Shapefiles
17 budgetRange = c(-80,80) # Range
18 budgetInterval = 20 # Tickma
19 dateBuffer = 14 # Number
20 WL_centr_int = 20
21 WL_change_centr_int = 2
22 interp_method = 'UK' # TPS = This p
23 variogram_model = 'Sph' # Sph = Spher
24 SW_fill_WaterYears = c(2020, 2016:20
25 dbName = 'FillmoreP1ru'
```

```
157 # Groundwater Elevations, include = F
158 Mps.tbl = sqlFetch(DB, 'wells')
159
160 Prior_Spring_WLS.sf = WLSsnapshot_sf(refdate =
161
162 Spring_WLS.sf = WLSsnapshot_sf(refdate = as.Date
163 left_join(Prior_Spring_WLS.sf %>%
164 st_drop_geometry() %>%
165 rename(prv_WLE_ft = WLE_ft, prv_
166 dbyr = select(well_id, well_name
167 mutate(WL_diff_ft = WLE_ft - prv_WLE_ft)
168
169 Spring_WLS_upper.sf = Spring_WLS.sf %>%
170 filter(grep(x = aquifer, pattern = 'Lower
171
172 Spring_WLS_lower.sf = Spring_WLS.sf %>%
173 filter(grep(x = aquifer, pattern = 'Upper
174
175 Prior_Fall_WLS.sf = WLSsnapshot_sf(refdate = as
176
177 Fall_WLS.sf = WLSsnapshot_sf(refdate = as.Date
178 left_join(Prior_Fall_WLS.sf %>%
179 st_drop_geometry() %>%
180 rename(prv_WLE_ft = WLE_ft, prv_
181 dbyr = select(well_id, well_name
182 mutate(WL_diff_ft = WLE_ft - prv_WLE_ft)
183
184 Fall_WLS_upper.sf = Fall_WLS.sf %>%
185 filter(grep(x = aquifer, pattern = 'Lower
186
187 Fall_WLS_lower.sf = Fall_WLS.sf %>%
188 filter(grep(x = aquifer, pattern = 'Upper
189
190 basinBoundary.sf = st_read(basinBoundary, quiet
191 st_transform(out_eps)
192 modeToCrst.sf = cr_nead(modeToCrst)
193
```

```
1 # Groundwater Extractions
2 Groundwater pumps that produce groundwater from the Basin pay United Water Conservation District (UWCD) an extraction fee based on the number of acre-ft they pump. Prior to 2022, this was reported on a 6-month basis (reporting to UWCD twice per calendar year). Period 1 covered January through June and period 2 covered July through December of each year. A description of the historical groundwater extraction monitoring in Fillmore Basin is provided in Section 3.5.1.4 of the Fillmore Subbasin GSP. In order to better comply with SGMA reporting requirements, pumping will be reported to the Agency on a quarterly (3-month) basis from 2022 onwards.
3
4 Groundwater pumps are required to self-report groundwater extractions by well to UWCD using of three methods: domestic multiplier, electrical meter (based on Southern California Edison efficiency testing), or water flow meter. For non-reporters, an estimate from historical usage is entered in the groundwater production database for accounting and basin volume calculation purposes. For wells with water meters, reporting typically involves filling out a form and submitting an accompanying photograph of the digital totalizer reading. The extent to which "smart meters" or automated (advanced) metering infrastructure (AMI) technology is used by individual well owners to quantify their groundwater production is unknown in the Fillmore Basin. There is not currently a mechanism by which well owners can automatically report groundwater production from their water meters to UWCD or the Agency. De minimis domestic pumping can be reported to UWCD using a multiplier of 0.2 AF per person per 6-month period with a minimum of 0.5 AF (e.g., if there are 1 or 2 people reporting domestic usage on a well, then 0.5 AF minimum is assessed). De minimis pumpers (extractors) that have a meter on their well discharge have the option of calculating their usage based on the meter reading which may show less than 0.5 AF usage, and are billed based on actual usage.
5
6 Estimated groundwater extractions for WY 'r WY' grouped by water use sector and measurement method are shown in Table 1. Due to the timing of the 6-month measurement and billing cycle described above, reported extractions for period 2 (July - December) of 'r WY' were not available at the time this annual report was developed. Since this is the only annual report that will have this issue as the billing cycle is now quarterly, development of a detailed approach for filling this data gap was deemed unnecessary. Instead, a simple approach that assumed groundwater extractions for period 2 of 'r WY' were equal to those in period 1 of 'r WY' was used. Groundwater pumping within each public land survey (PLSS) section (1 mi^2) shows the spatial distribution of agricultural (Figure 5), municipal & industrial (Figure 6) and total (Figure 7) groundwater extractions within the Basin. Groundwater pumping totaled approximately 'r formatC(totalGroundwaterAF, format = 'f', big.mark = ',', digits = 0) AF for agricultural beneficial uses accounted for about 'r AgPumpingPct % round(0) % of total groundwater extractions for WY 'r WY'.
```

Database  
Management  
System



Data and word  
processing  
scripts



Maps, plots,  
and tables

Updated in-text  
calculations



# Fillmore Subbasin Summary: WY 2021

- Water levels changed by -10.45 to +14.02 ft (average of -4.1 ft)
- Only 1 RMP (04N20W36MW104) is approaching minimum threshold
- Groundwater extractions: 56,800 AF (estimated)
- Estimated change in storage: -14,100 AF



# Piru Subbasin Summary: WY 2021

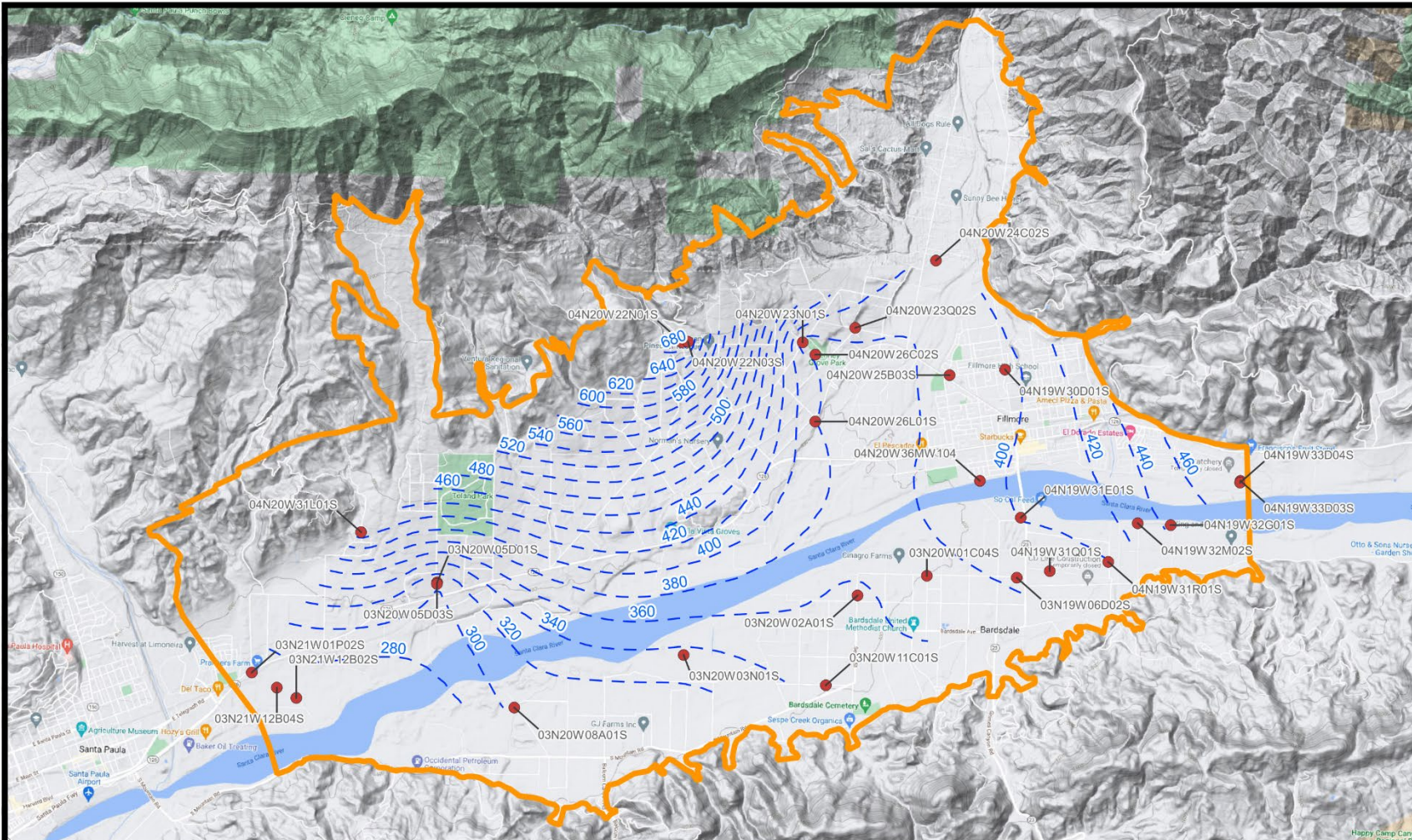
- Water levels changed by -2.55 to -47.25 ft (average of -34.60 ft)
- RMP 04N19W36D01S is approaching minimum threshold - projected to exceed in summer 2022 if trend continues
- Groundwater extractions: 13,361 AF (estimated)
- Estimated change in storage: -38,500 AF



# Fillmore Basin







### Explanation

- Monitoring Well
- Water Level Contour (ft amsl)
- Groundwater Basin Boundary



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03/15/2022

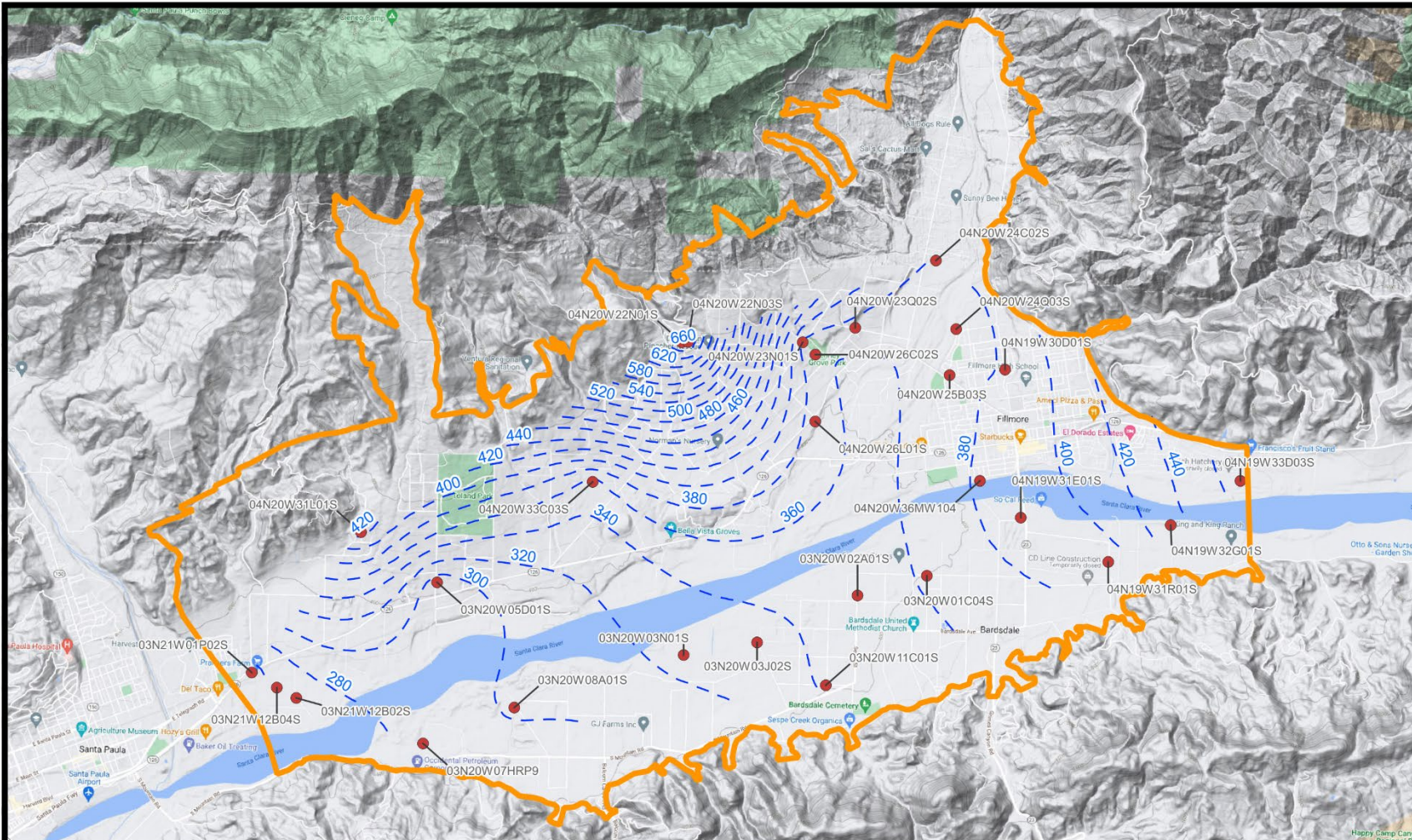
a Geo-Logic Company

0 2,500 5,000 ft



Fillmore Subbasin Annual Report  
Groundwater Elevations  
Spring 2021





### Explanation

- Monitoring Well
- - - Water Level Contour (ft amsl)
- Groundwater Basin Boundary



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0 2,500 5,000 ft



Fillmore Subbasin Annual Report  
Groundwater Elevation Contours  
Fall 2021



D:\2021\1412.00 C:\Users\SGO\Documents\Local\_Project\_Files\Fillmore-Drill\Annual Reports\Fillmore\WY2021\GIS\GZs\Fillmore Annual Report WY2021.gpz

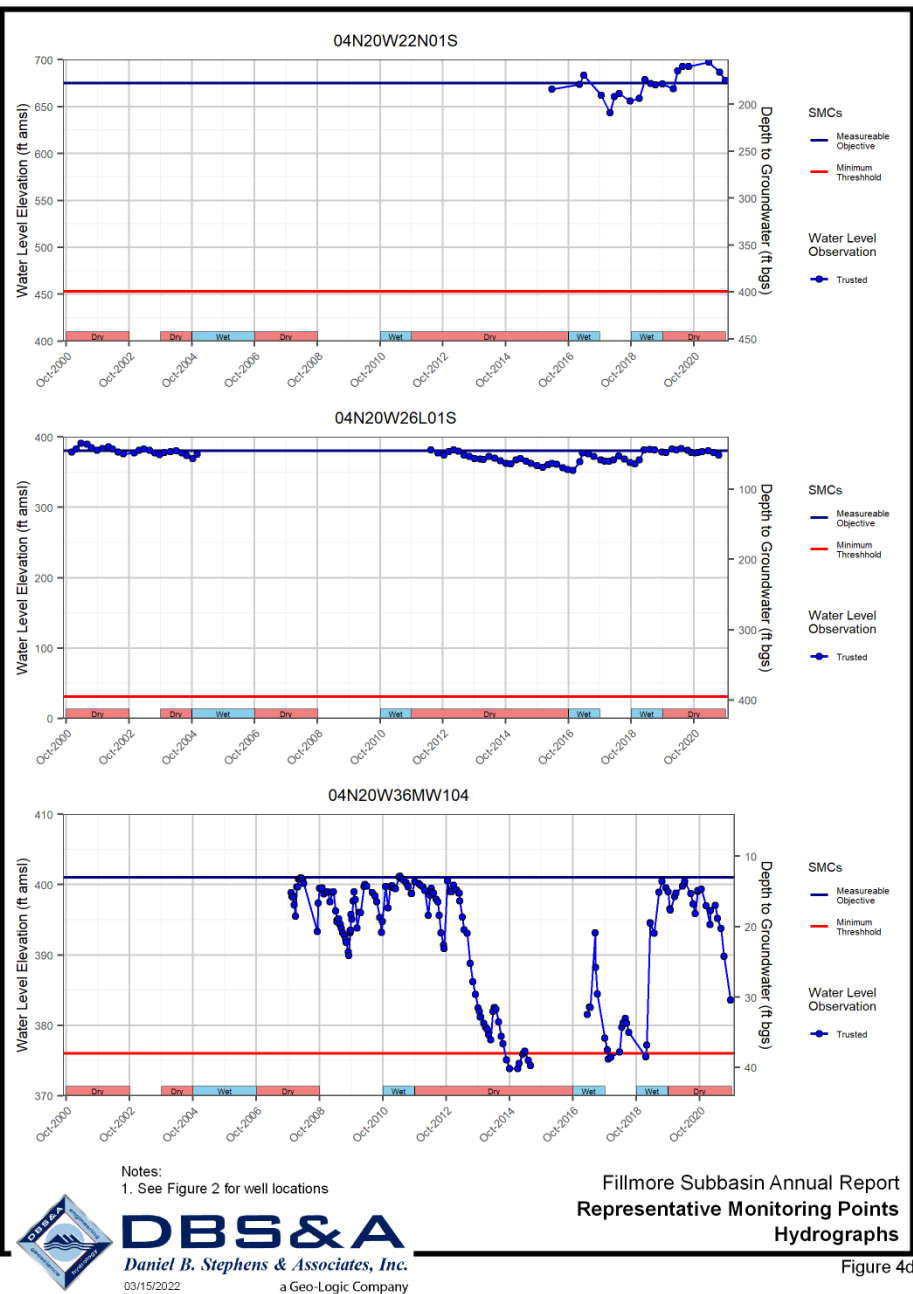
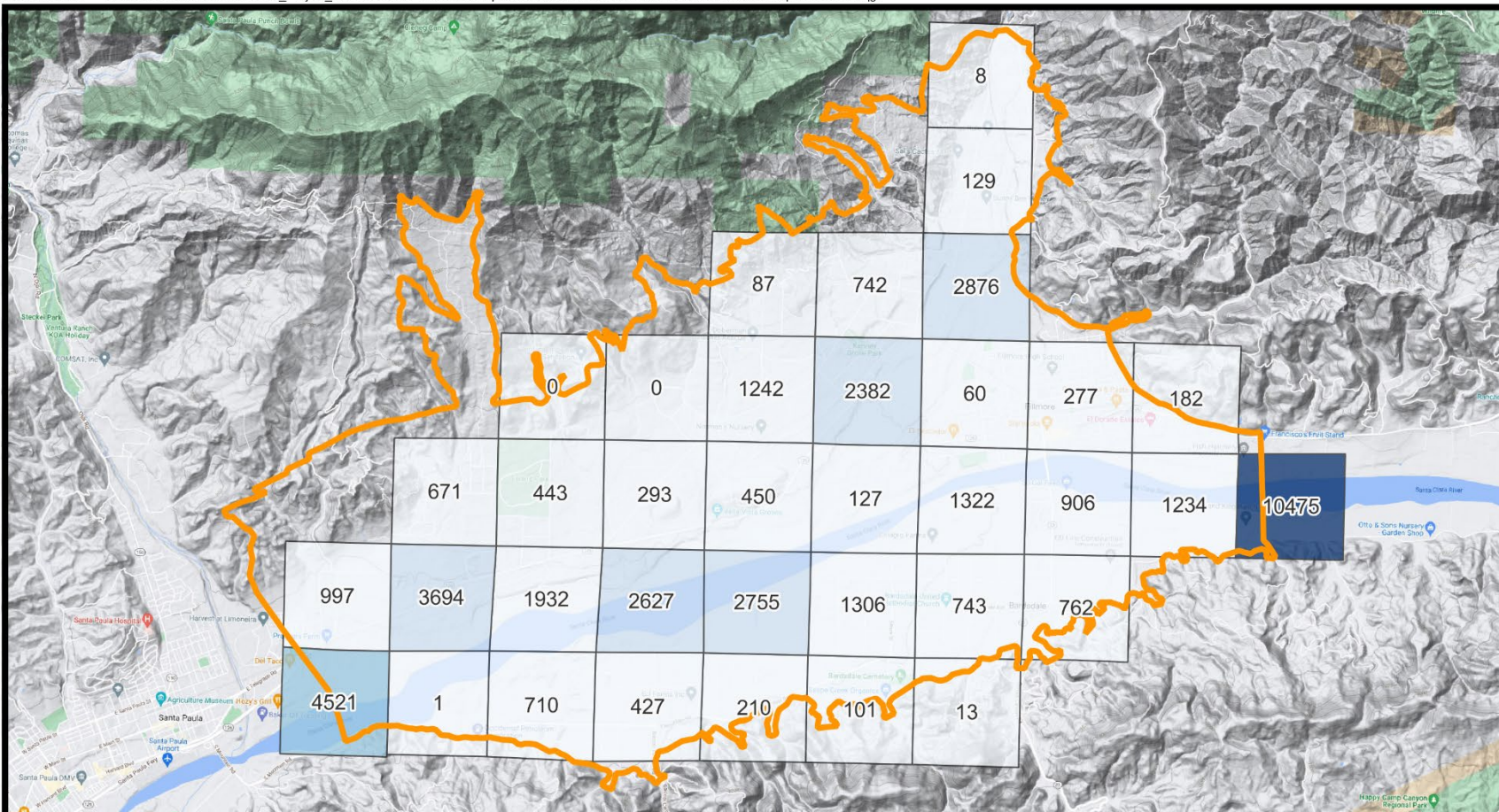
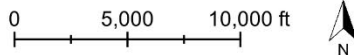


Figure 4d



### Explanation

|                        |                |                 |                            |
|------------------------|----------------|-----------------|----------------------------|
| Extraction Volume (AF) | 4,000 - 6,000  | 10,000 - 12,000 | Groundwater Basin Boundary |
| 0 - 2,000              | 6,000 - 8,000  |                 |                            |
| 2,000 - 4,000          | 8,000 - 10,000 |                 |                            |



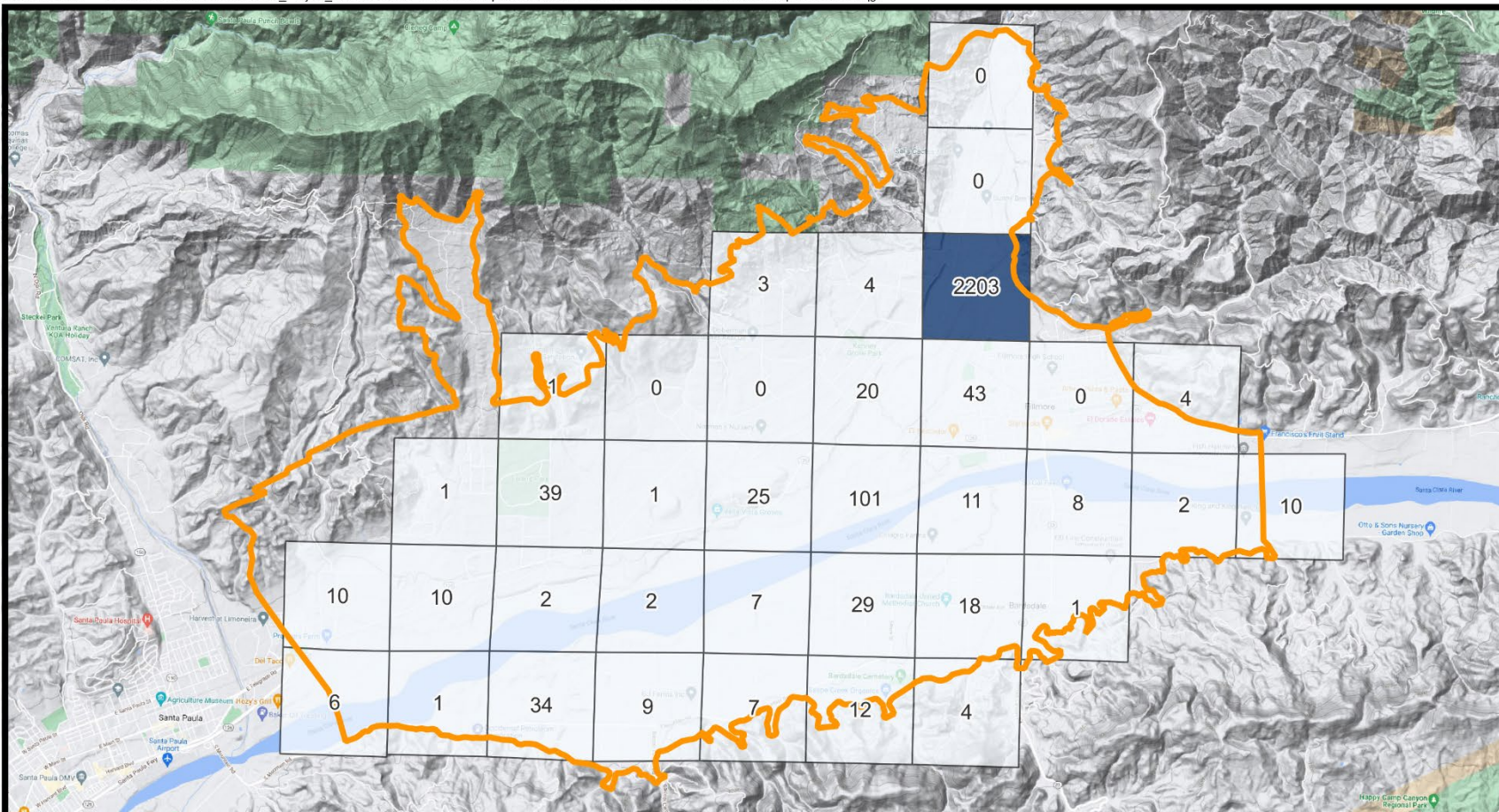
### Notes:

1. Estimated extraction volumes aggregated by public land survey system section.
2. Labels indicate estimated extraction volume in acre-ft (AF).
3. Values estimated from January - July 2021 pumping records.

Fillmore Subbasin Annual Report  
Estimated Agricultural Groundwater Extractions  
WY 2021







### Explanation

Extraction Volume (AF)

|  |               |  |               |  |                            |
|--|---------------|--|---------------|--|----------------------------|
|  | 0 - 500       |  | 1,500 - 2,000 |  | Groundwater Basin Boundary |
|  | 500 - 1,000   |  | 2,000 - 3,000 |  |                            |
|  | 1,000 - 1,500 |  |               |  |                            |

0 5,000 10,000 ft

N

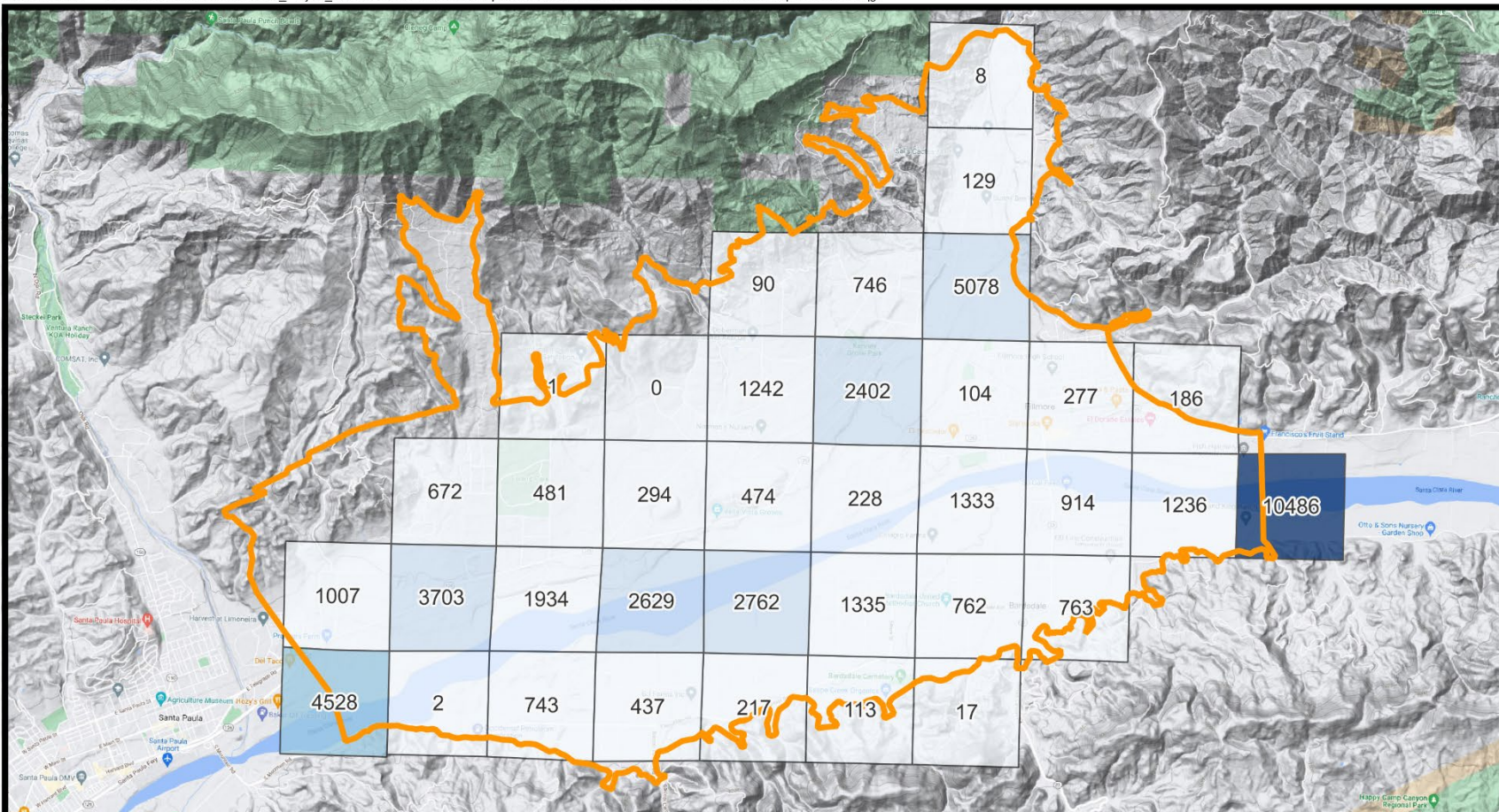
### Notes:

1. Estimated extraction volumes aggregated by public land survey system section.
2. Labels indicate estimated extraction volume in acre-ft (AF).
3. Values estimated from January - July 2021 pumping records.

Fillmore Subbasin Annual Report  
Estimated Municipal and Industrial Groundwater Extractions  
WY 2021





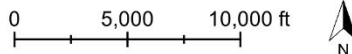


### Explanation

|                        |                |                 |                            |
|------------------------|----------------|-----------------|----------------------------|
| Extraction Volume (AF) | 4,000 - 6,000  | 10,000 - 12,000 | Groundwater Basin Boundary |
| 0 - 2,000              | 6,000 - 8,000  |                 |                            |
| 2,000 - 4,000          | 8,000 - 10,000 |                 |                            |

### Notes:

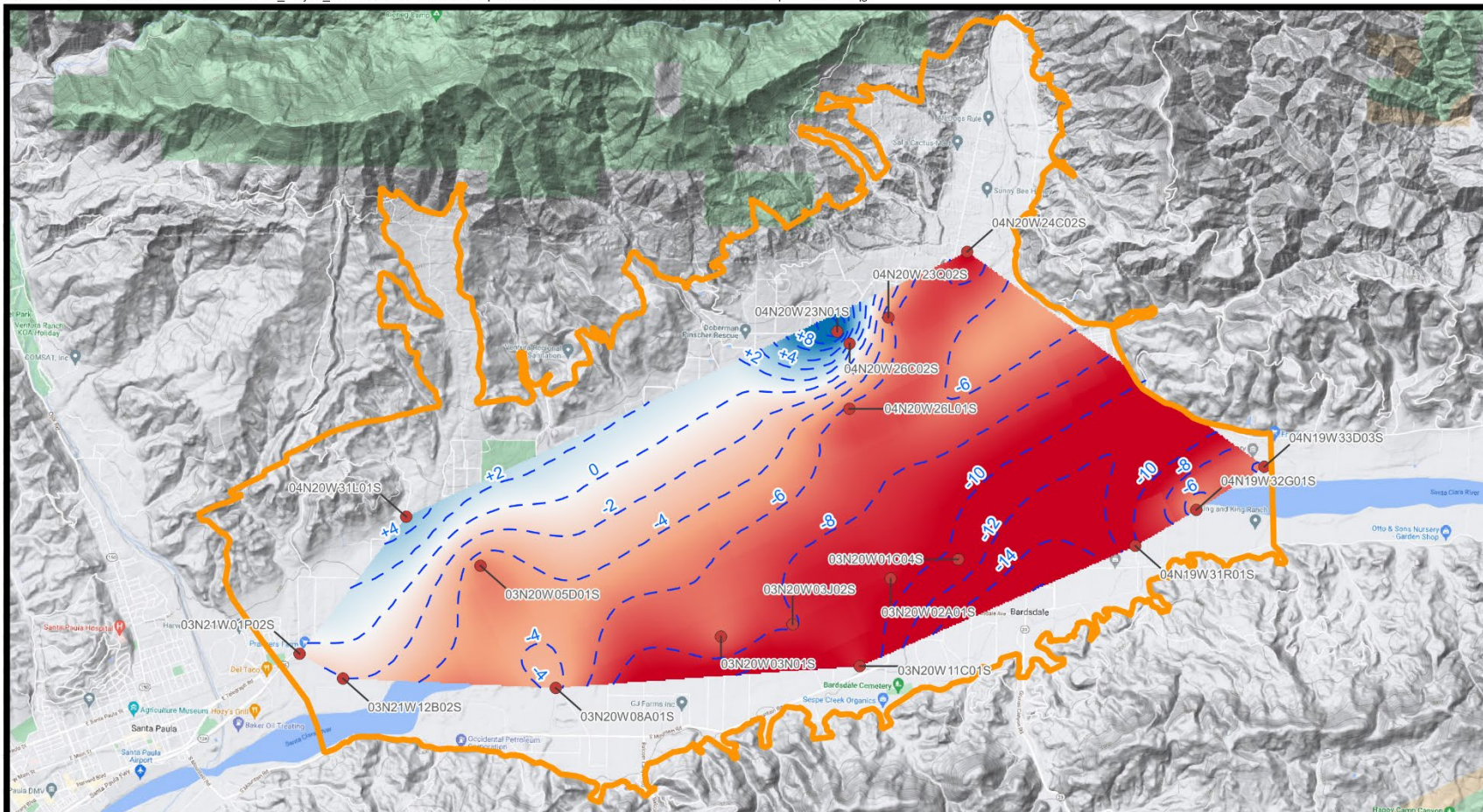
1. Estimated extraction volumes aggregated by public land survey system section.
2. Labels indicate estimated extraction volume in acre-ft (AF).
3. Values estimated from January - July 2021 pumping records.



Fillmore Subbasin Annual Report  
Estimated Total Groundwater Extractions  
WY 2021

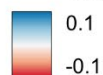






## Explanation

Estimated Groundwater Storage Change (AF)



Monitoring Well  
Water Level Elevation Change Contour (ft)

Groundwater Basin Boundary

0 5,000 10,000 ft



## Notes:

1. Storage change estimated by interpolating changes in observed water levels to a 65 x 65 ft grid and multiplying by the vertically integrated aquifer storage coefficient for each grid cell.
2. Vertically integrated aquifer storage coefficient calculated as the thickness weighted average of aquifer storage coefficients for each model layer used in the UWCD groundwater model.
3. Estimated WY 2021 total groundwater storage change is -14,100 AF.

Fillmore Subbasin Annual Report  
Change in Groundwater Storage  
WY 2021

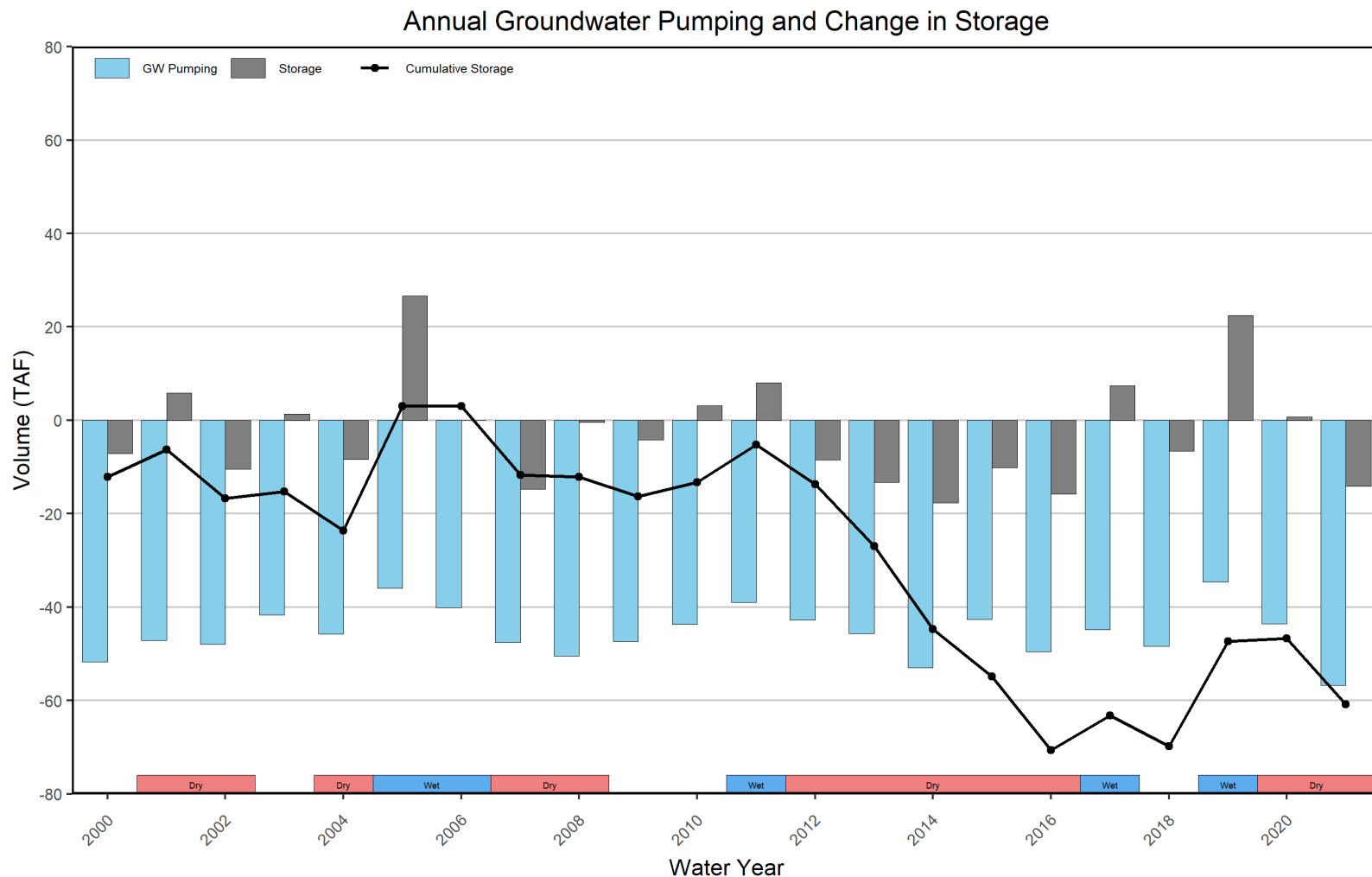


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**Notes:**

1. Negative GW pumping values indicate extractions from groundwater aquifer.
2. Positive storage values indicate increasing groundwater levels.
3. GW pumping volume estimated for WY 2021.

Fillmore Subbasin Annual Report  
Groundwater Pumping and Change in Storage  
WY 2000-2021

Figure 9

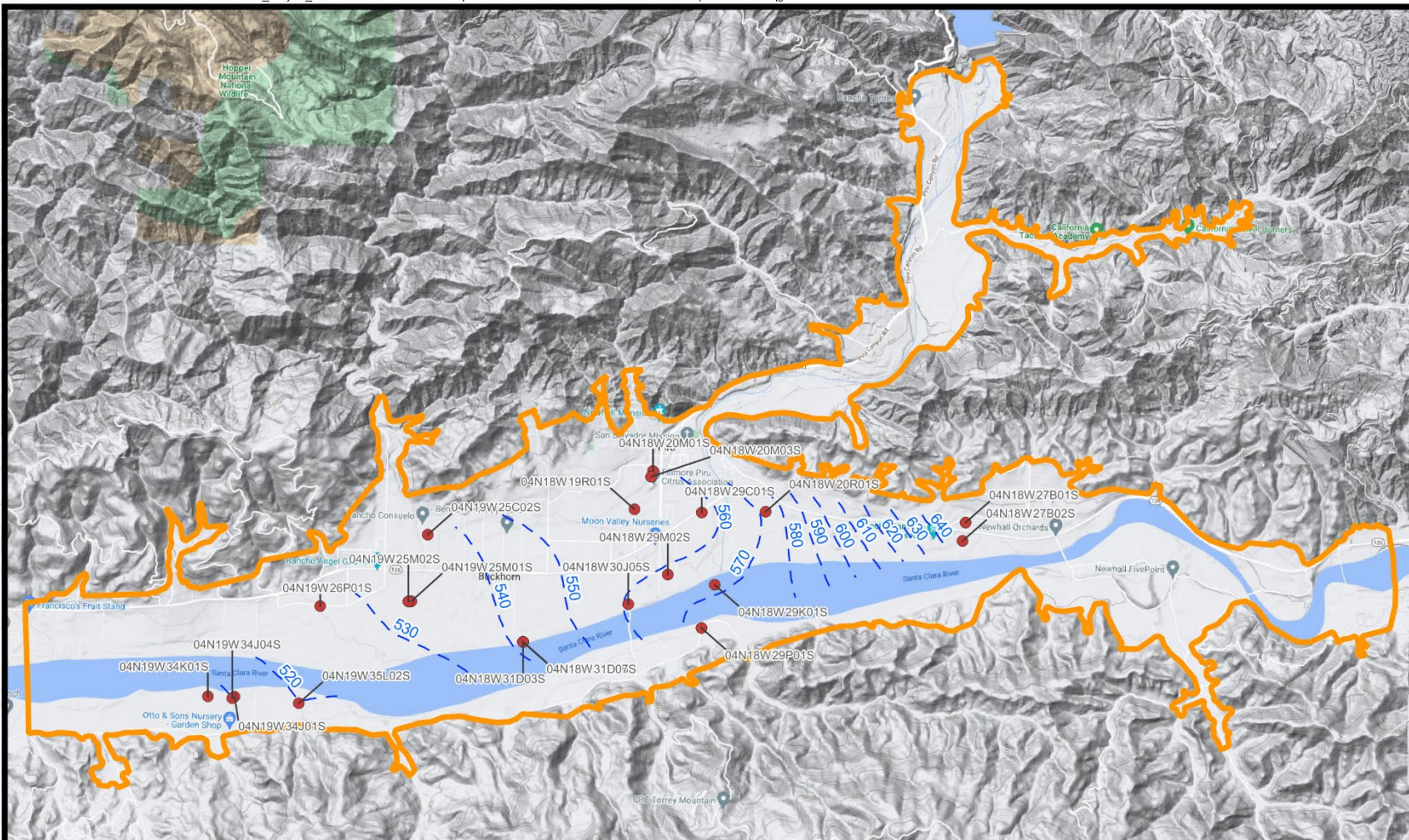


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# Piru Basin







### Explanation

- Monitoring Well
- Water Level Contour (ft amsl)
- Groundwater Basin Boundary



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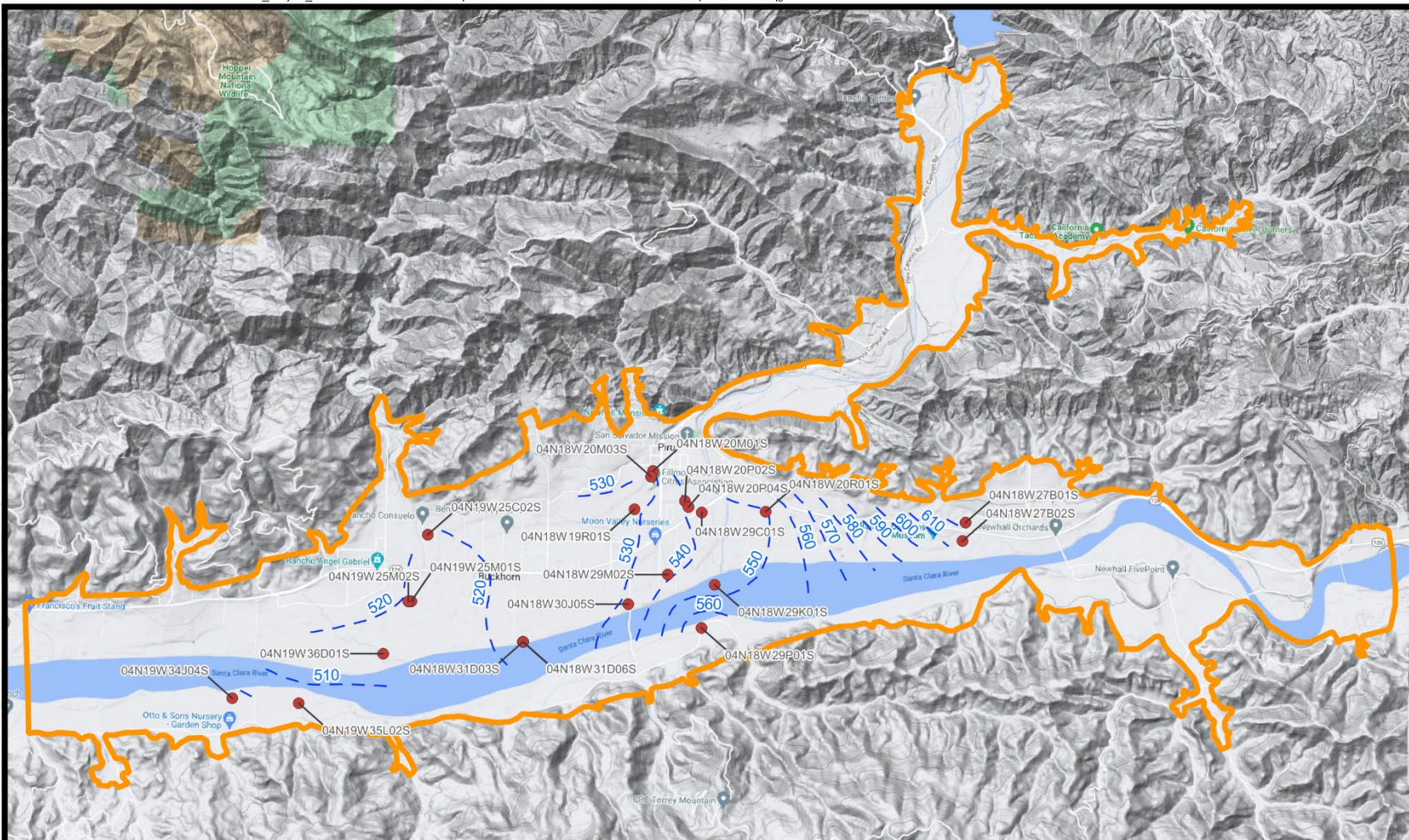
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0 2,500 5,000 ft



Piru Subbasin Annual Report  
Groundwater Elevations  
Spring 2021





### Explanation

- Monitoring Well
- Water Level Contour (ft amsl)
- Groundwater Basin Boundary

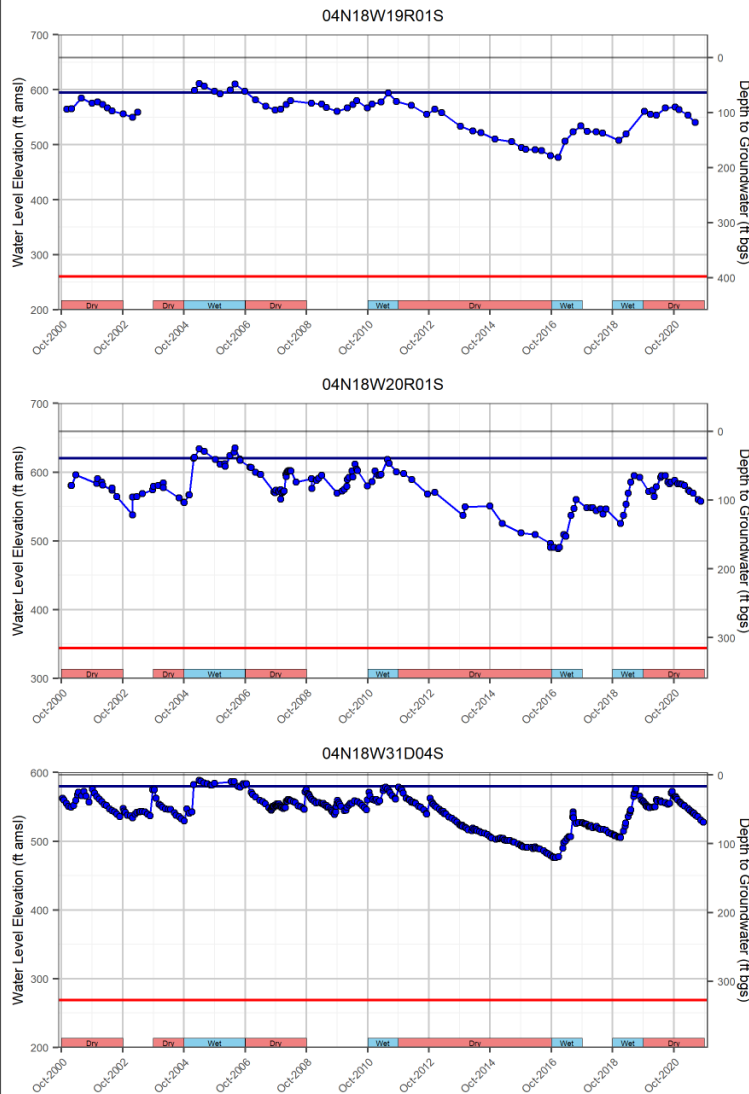


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0 2,500 5,000 ft



Piru Subbasin Annual Report  
 Groundwater Elevation Contours  
 Fall 2021



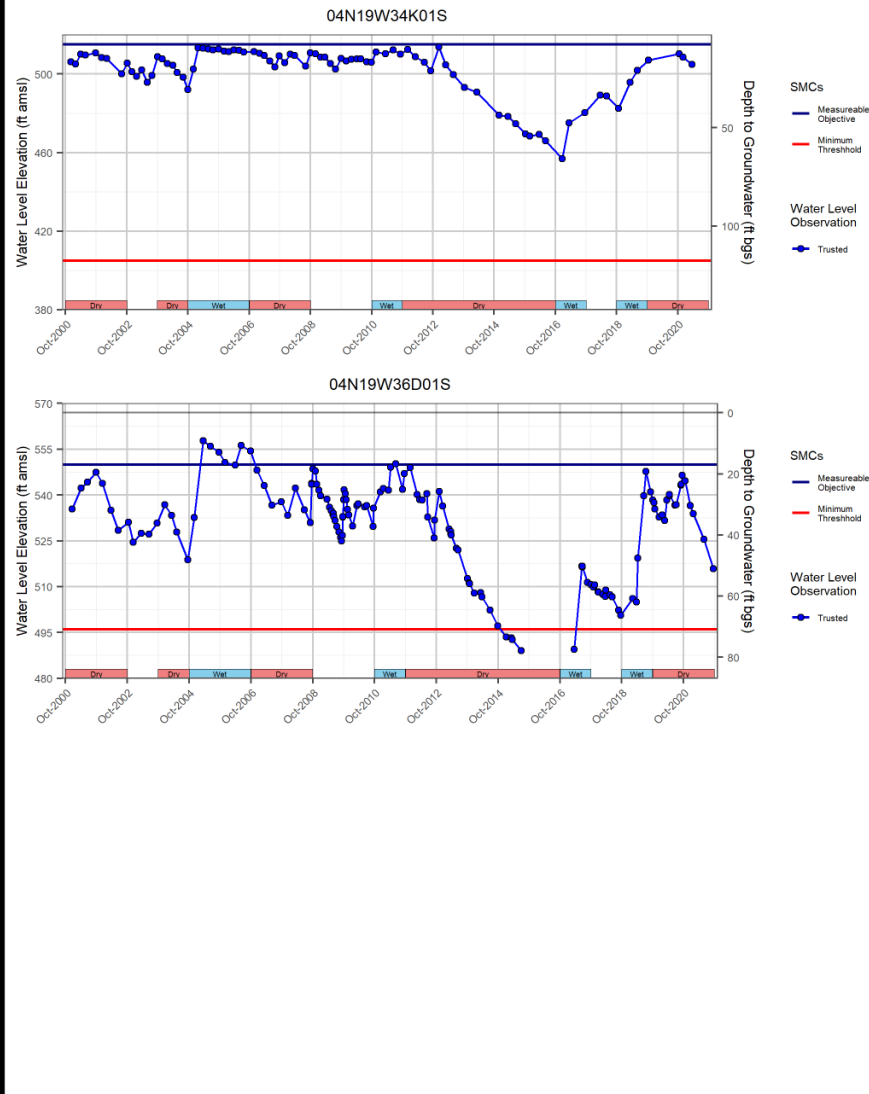
Notes:  
1. See Figure 2 for well locations

### Piru Subbasin Annual Report Representative Monitoring Points Hydrographs

Figure 4a



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Notes:  
1. See Figure 2 for well locations

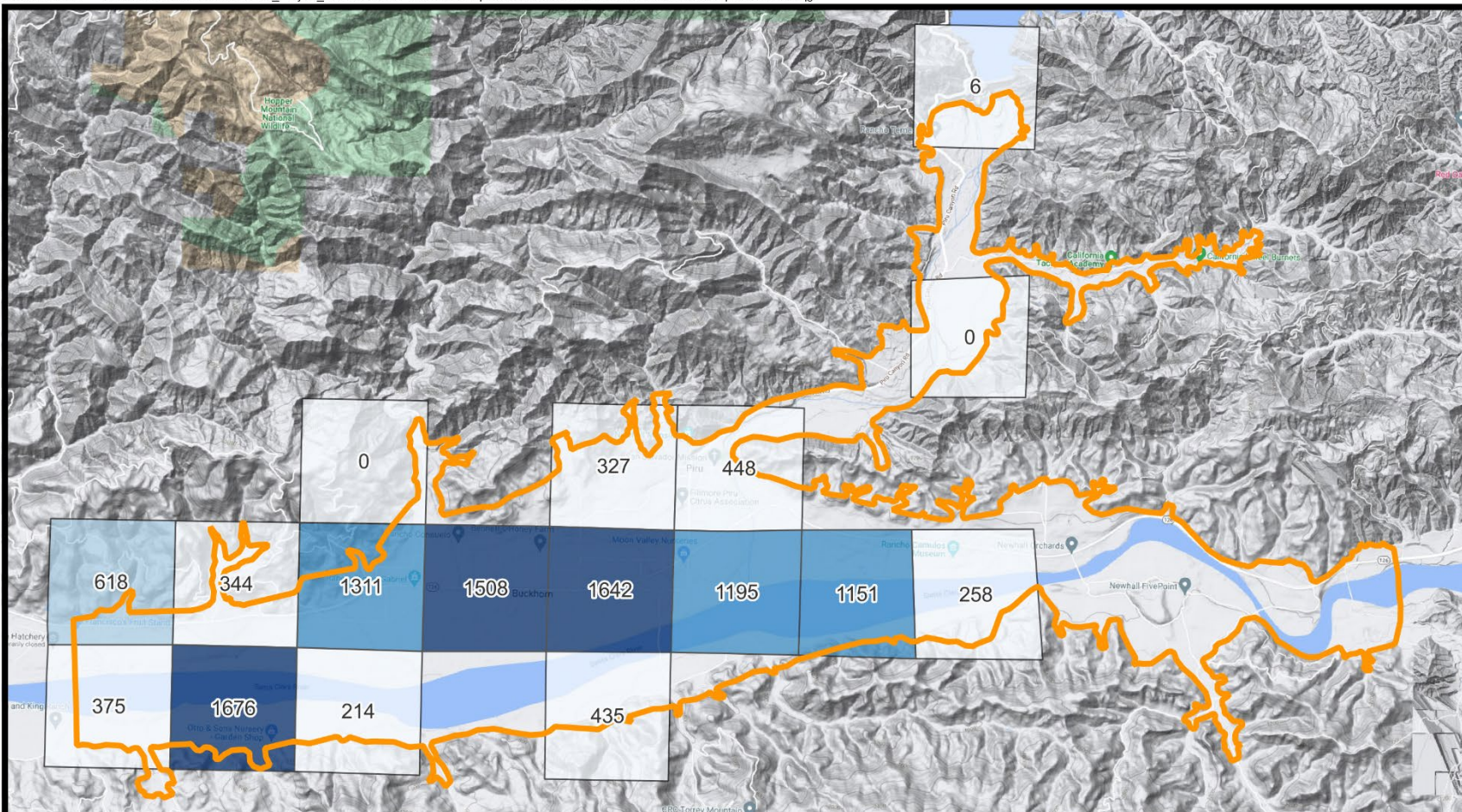
### Piru Subbasin Annual Report Representative Monitoring Points Hydrographs

Figure 4c



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### Explanation

Extraction Volume (AF)

|             |               |                            |
|-------------|---------------|----------------------------|
| 0 - 500     | 1,000 - 1,500 | Groundwater Basin Boundary |
| 500 - 1,000 | 1,500 - 2,000 |                            |

### Notes:

1. Estimated extraction volumes aggregated by public land survey system section.
2. Labels indicate estimated extraction volume in acre-ft (AF).
3. Values estimated from January - July 2021 pumping records.

0 2,500 5,000 ft



Piru Subbasin Annual Report  
Estimated Agricultural Groundwater Extractions  
WY 2021







0 - 100

100 - 200

300 - 400

■ 400 - 500

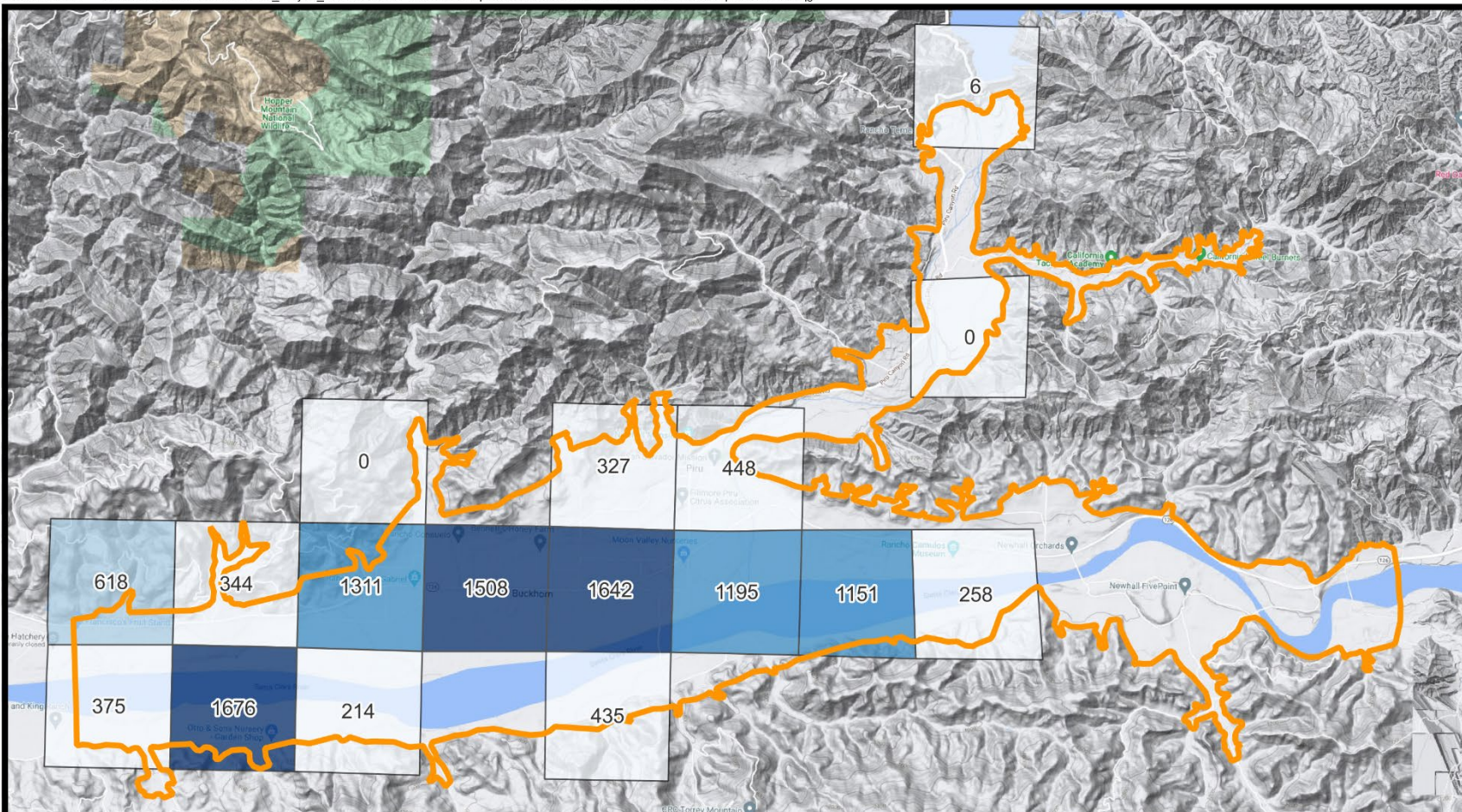
A horizontal number line with tick marks at 0, 2,500, and 5,000 ft.



1. Estimated extraction volumes aggregated by public land survey system section.
2. Labels indicate estimated extraction volume in acre-ft (AF).
3. Values estimated from January - July 2021 pumping records.

Piru Subbasin Annual Report  
Estimated Municipal and Industrial Groundwater Extractions  
WY 2021





### Explanation

Extraction Volume (AF)

|             |               |                            |
|-------------|---------------|----------------------------|
| 0 - 500     | 1,000 - 1,500 | Groundwater Basin Boundary |
| 500 - 1,000 | 1,500 - 2,000 |                            |

0 2,500 5,000 ft



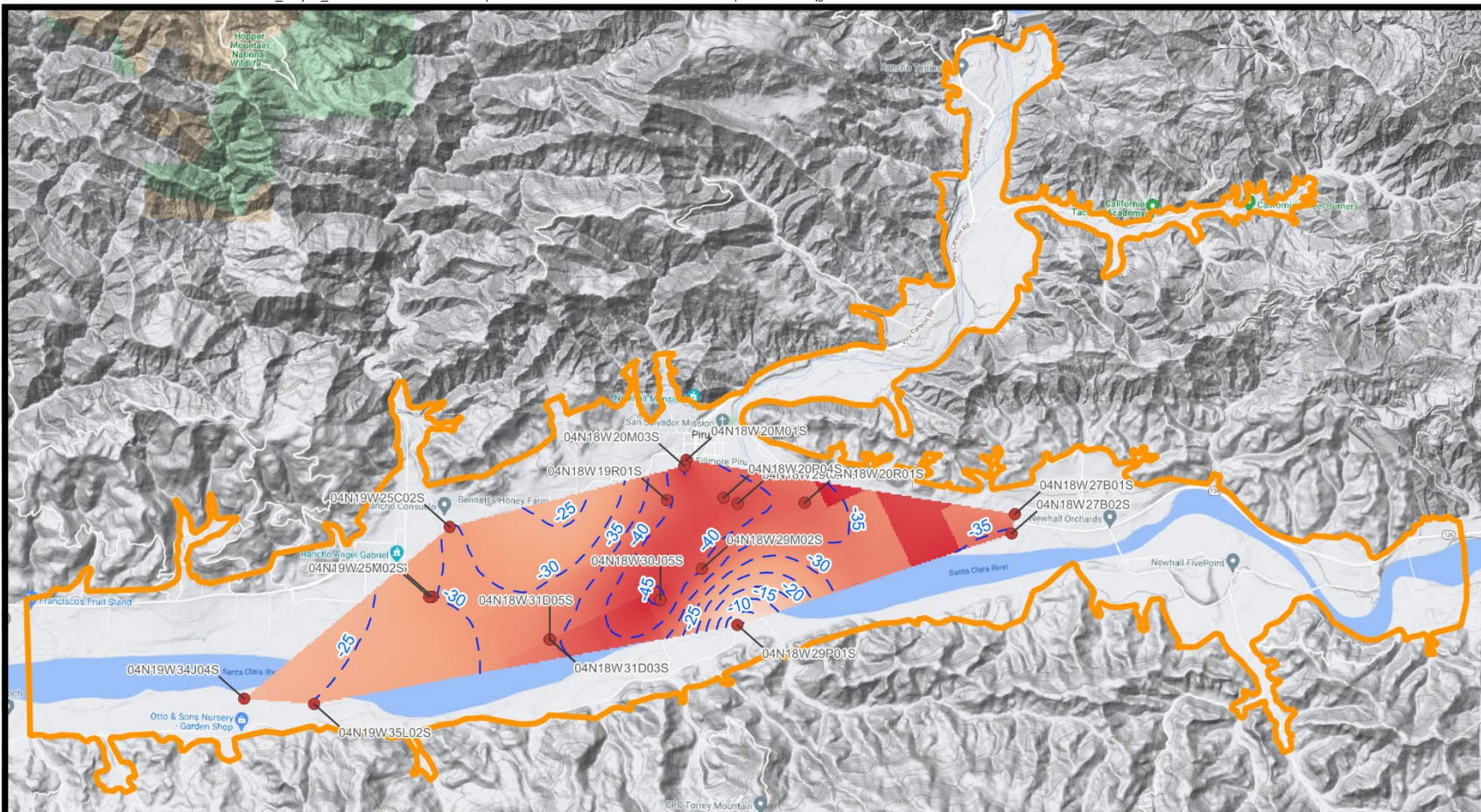
### Notes:

1. Estimated extraction volumes aggregated by public land survey system section.
2. Labels indicate estimated extraction volume in acre-ft (AF).
3. Values estimated from January - July 2021 pumping records.

Piru Subbasin Annual Report  
Estimated Total Groundwater Extractions  
WY 2021







## Explanation

Estimated Groundwater Storage Change (AF)



Monitoring Well

Water Level Elevation Change Contour (ft)

Groundwater Basin Boundary

## Notes:

1. Storage change estimated by interpolating changes in observed water levels to a 65 x 65 ft grid and multiplying by the vertically integrated aquifer storage coefficient for each grid cell.
2. Vertically integrated aquifer storage coefficient calculated as the thickness weighted average of aquifer storage coefficients for each model layer used in the UWCD groundwater model.
3. Estimated WY 2021 total groundwater storage change is -38,500 AF.

0 2,500 5,000 ft



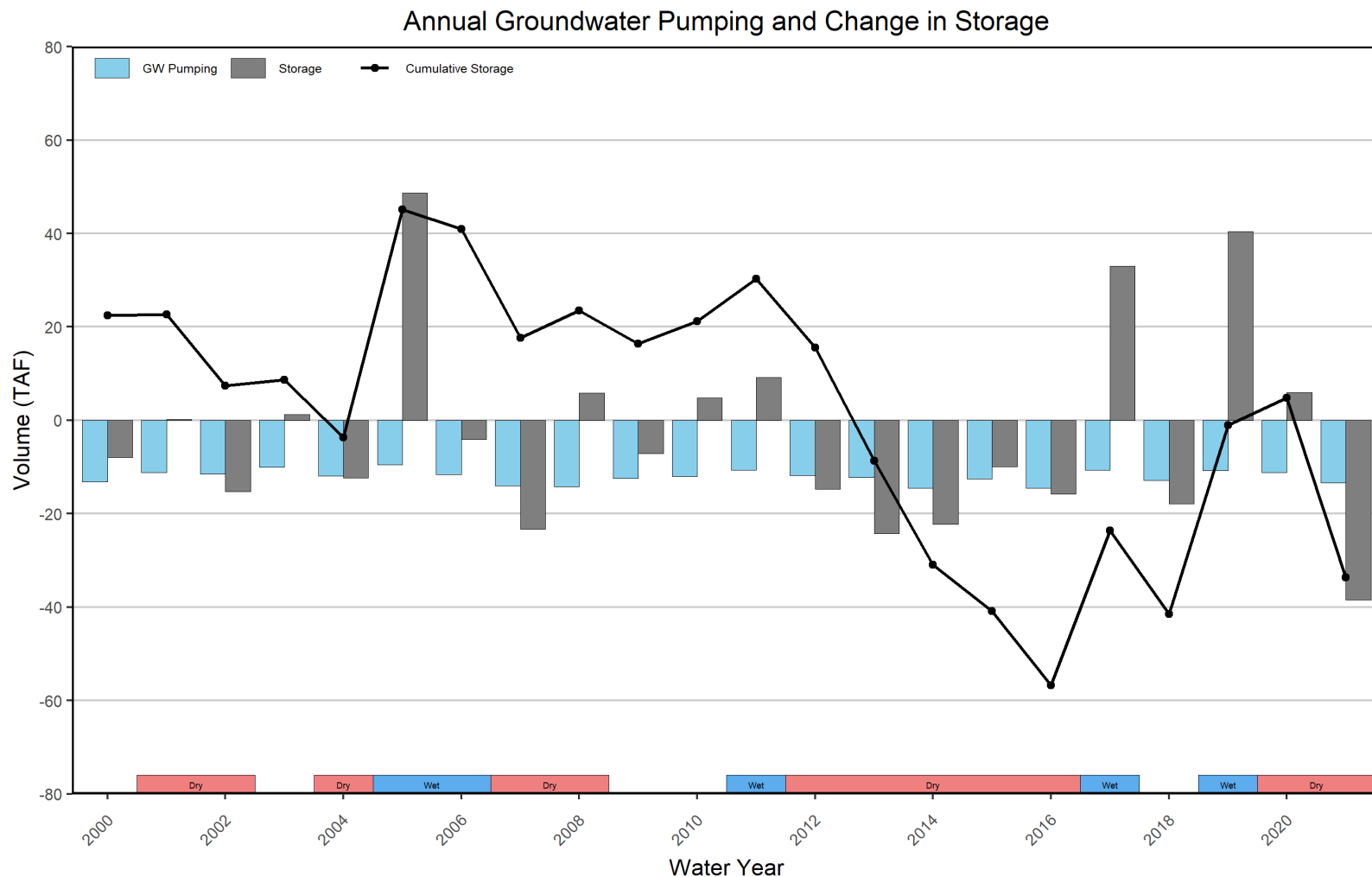
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Piru Subbasin Annual Report  
Change in Groundwater Storage  
WY 2021



**Notes:**

1. Negative GW pumping values indicate extractions from groundwater aquifer.
2. Positive storage values indicate increasing groundwater levels.
3. GW pumping volume estimated for WY 2021.

Fillmore Subbasin Annual Report  
Groundwater Pumping and Change in Storage  
WY 2000-2021

Figure 9



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# QUESTIONS?





# Table 1. Fillmore Subbasin Groundwater Extractions

| Sector                            | Method      | GW<br>Extraction<br>Volume<br>(AF) | Accuracy<br>(%) | Range<br>(AF)          |
|-----------------------------------|-------------|------------------------------------|-----------------|------------------------|
| Agriculture                       | Domestic    | 8                                  | ± 20            | 7 - 10                 |
|                                   | Electrical  |                                    |                 |                        |
|                                   | Efficiency  | 18,046                             | ± 20            | 14,437 - 21,655        |
|                                   | Water Meter | 36,107                             | ± 5             | 34,302 - 37,912        |
| Agriculture Subtotal              |             | 54,161                             |                 | 48,746 - 59,577        |
| Municipal and Industrial          | Domestic    | 102                                | ± 20            | 81 - 122               |
|                                   | Electrical  |                                    |                 |                        |
|                                   | Efficiency  | 88                                 | ± 20            | 70 - 105               |
|                                   | Water Meter | 2,436                              | ± 5             | 2,314 - 2,557          |
| Municipal and Industrial Subtotal |             | 2,626                              |                 | 2,465 - 2,784          |
| <b>Total</b>                      |             | <b>56,787</b>                      |                 | <b>51,211 - 62,361</b> |



## Table 2. Fillmore Subbasin Surface Water Use

| Surface Water Source | Method                                        | Annual Volume Used (AF) | Accuracy (%) | Range (AF)           |
|----------------------|-----------------------------------------------|-------------------------|--------------|----------------------|
| Local Supplies       | Estimated from previously reported diversions | 1,794                   | ± 33         | 1,202 - 2,386        |
|                      | Water Meter                                   | 988                     | ± 5          | 939 - 1,037          |
|                      | Weir                                          | 494                     | ± 5          | 469 - 519            |
| <b>Total</b>         |                                               | <b>3,276</b>            |              | <b>2,610 - 3,942</b> |



## Table 3. Fillmore Subbasin Total Water Use

| Sector                            | Method                                        | Total Annual Volume (AF) | Accuracy (%) | Range (AF)             |
|-----------------------------------|-----------------------------------------------|--------------------------|--------------|------------------------|
| Agriculture                       | Domestic                                      | 8                        | ± 20 %       | 7 - 10                 |
|                                   | Electrical Efficiency                         | 18,046                   | ± 20 %       | 14,437 - 21,655        |
|                                   | Estimated from previously reported diversions | 1794                     | ± 33 %       | 1,202 - 2,386          |
|                                   | Water Meter                                   | 37,095                   | ± 5 %        | 35,241 - 38,949        |
|                                   | Weir                                          | 494                      | ± 5 %        | 469 - 519              |
| Agriculture Subtotal              |                                               | 57,437                   | -            | 51,356 - 63,519        |
| Municipal and Industrial          | Domestic                                      | 102                      | ± 20 %       | 81 - 122               |
|                                   | Electrical Efficiency                         | 88                       | ± 20 %       | 70 - 105               |
|                                   | Water Meter                                   | 2,436                    | ± 5 %        | 2,314 - 2,557          |
| Municipal and Industrial Subtotal |                                               | 2,626                    | -            | 2,465 - 2,784          |
| <b>Total</b>                      |                                               | <b>60,063</b>            |              | <b>53,821 - 66,303</b> |





# Table 1. Piru Subbasin Groundwater Extractions

| Sector                            | Method                | GW Extraction<br>Volume<br>(AF) | Accuracy<br>(%) | Range<br>(AF)          |
|-----------------------------------|-----------------------|---------------------------------|-----------------|------------------------|
| Agriculture                       | Domestic              | -                               | ± 20            | 0 - 0                  |
|                                   | Electrical Efficiency | 3,057                           | ± 20            | 2,446 - 3,668          |
|                                   | Water Meter           | 9,847                           | ± 5             | 9,355 - 10,340         |
| Agriculture Subtotal              |                       | 12,904                          |                 | 11,801 - 14,008        |
| Municipal and Industrial          | Domestic              | 21                              | ± 20            | 17 - 25                |
|                                   | Electrical Efficiency | 11                              | ± 20            | 9 - 13                 |
|                                   | Water Meter           | 425                             | ± 5             | 404 - 447              |
| Municipal and Industrial Subtotal |                       | 457                             |                 | 430 - 485              |
| <b>Total</b>                      |                       | <b>13,361</b>                   |                 | <b>12,231 - 14,493</b> |



## Table 2. Piru Subbasin Surface Water Use

| Surface Water Source | Method                                        | Annual Volume Used (AF) | Accuracy (%) | Range (AF)           |
|----------------------|-----------------------------------------------|-------------------------|--------------|----------------------|
| Local Supplies       | Estimated from previously reported diversions | 1,794                   | ± 33         | 1,202 - 2,386        |
|                      | Water Meter                                   | 988                     | ± 5          | 939 - 1,037          |
|                      | Weir                                          | 494                     | ± 5          | 469 - 519            |
| <b>Total</b>         |                                               | <b>3,276</b>            |              | <b>2,610 - 3,942</b> |





# Table 3. Piru Subbasin Total Water Use

| Sector                            | Method                                        | Total Annual Volume (AF) | Accuracy (%) | Range (AF)           |
|-----------------------------------|-----------------------------------------------|--------------------------|--------------|----------------------|
| Agriculture                       | Domestic                                      | 0                        | ± 20 %       | 0 - 0                |
|                                   | Electrical Efficiency                         | 3,057                    | ± 20 %       | 2,446 - 3,668        |
|                                   | Estimated from previously reported diversions | 1,794                    | ± 33 %       | 1,202 - 2,386        |
|                                   | Water Meter                                   | 10,835                   | ± 5 %        | 10,294 - 11,377      |
|                                   | Weir                                          | 494                      | ± 5 %        | 469 - 519            |
| Agriculture Subtotal              |                                               | 16,180                   | -            | 14411 - 17950        |
| Municipal and Industrial          | Domestic                                      | 21                       | ± 20 %       | 17 - 25              |
|                                   | Electrical Efficiency                         | 11                       | ± 20 %       | 9 - 13               |
|                                   | Water Meter                                   | 425                      | ± 5 %        | 404 - 447            |
| Municipal and Industrial Subtotal |                                               | 457                      | -            | 430 - 485            |
| <b>Total</b>                      |                                               | <b>16,637</b>            |              | <b>14841 - 18435</b> |

