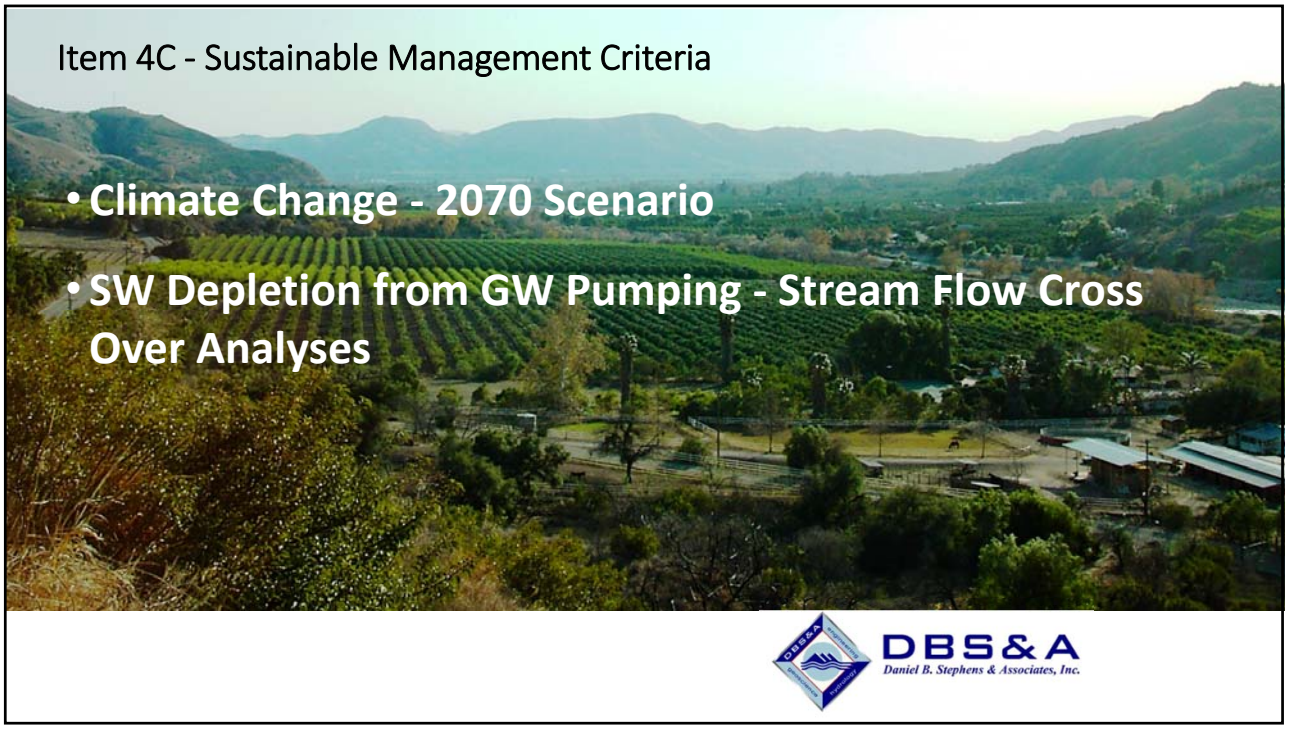
Item 4C - Sustainable Management Criteria
• Climate Change - 2070 Scenario
• SW Depletion from GW Pumping - Stream Flow Cross Over Analyses
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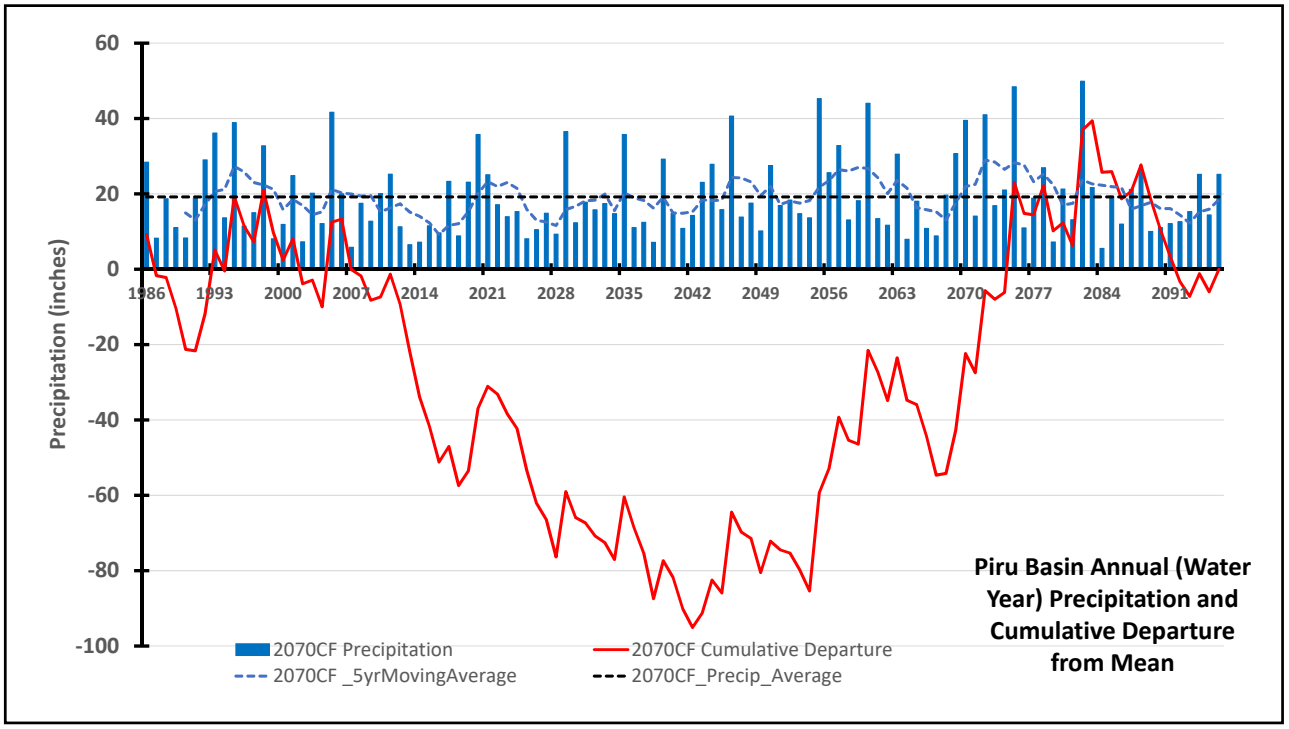
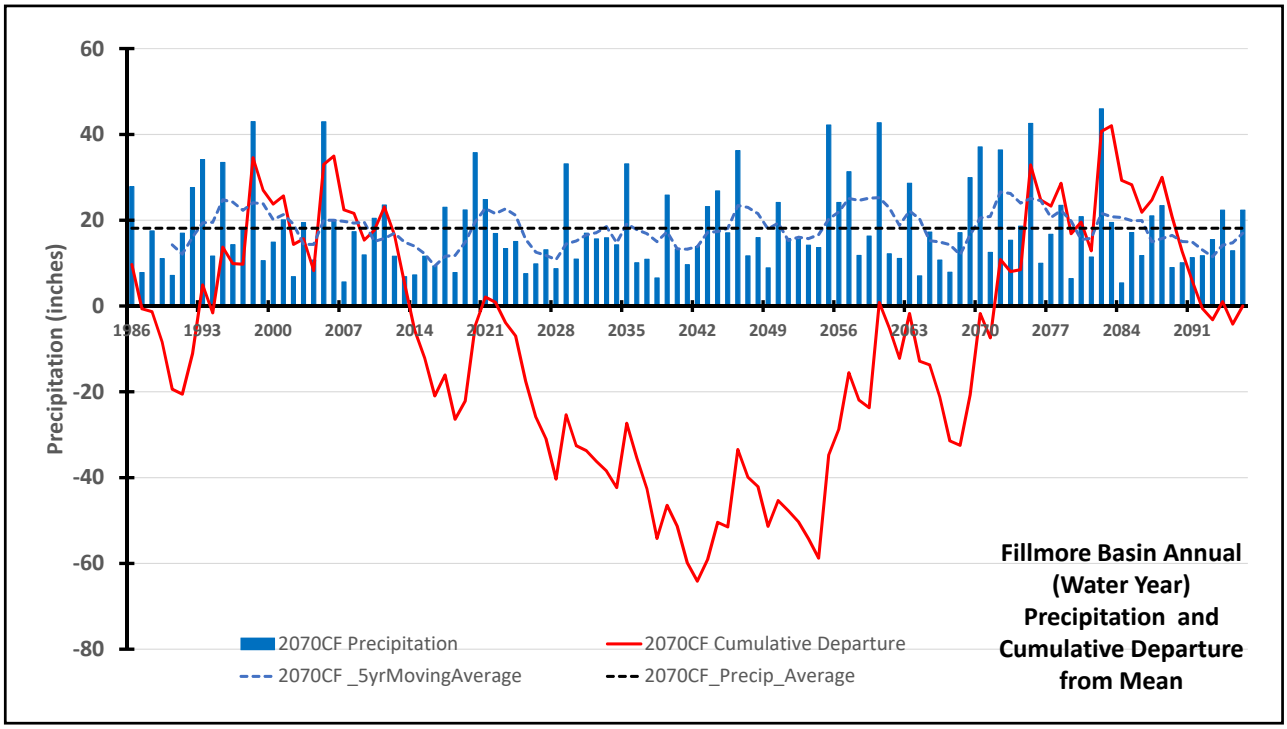

60
40
20
0
-20
-40
-60
-80
-100
Precipitation (inches)
1986
1993
2000
2007
2014
2021
2028
2035
2042
2049
2056
2063
2070
2077
2084
2091
2070CF Precipitation
2070CF Cumulative Departure
2070CF _5yrMovingAverage
2070CF_Precip_Average
Piru Basin Annual (Water Year) Precipitation and Cumulative Departure from Mean

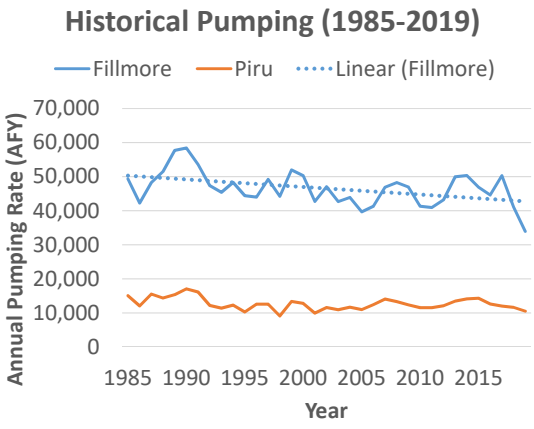


	Average Pumping (Acre-Feet/Year)	
Scenario	**Fillmore**	**Piru**
Historical	46,800	11,400
Baseline	44,800	12,600
2070CF	49,800	14,600

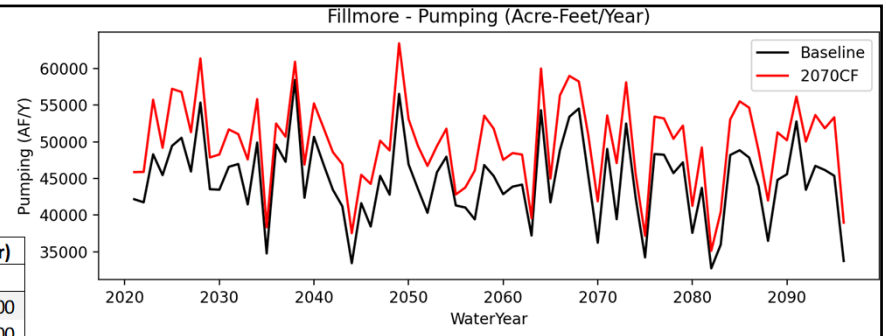
Time Period
(1985-2019)
(2020-2096)

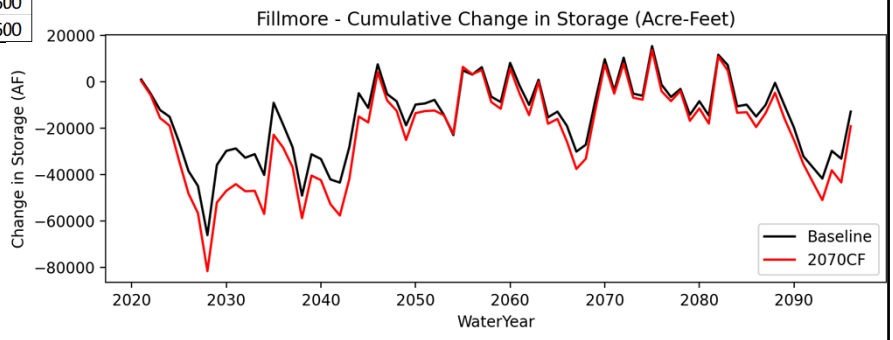
Future Scenarios

- We removed abandoned wells (~500 AFY on average) from Fillmore Basin.



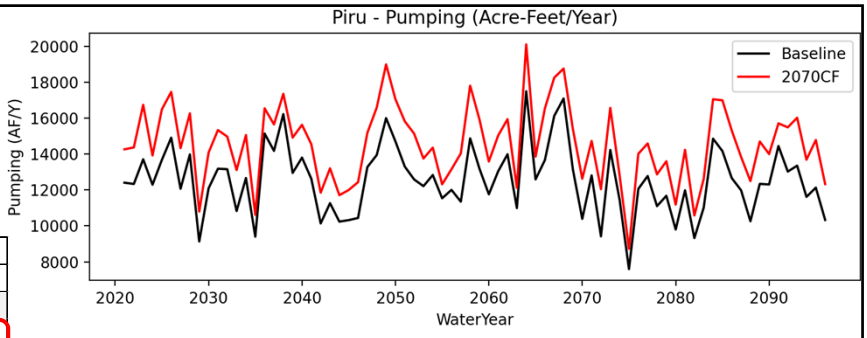
	Average Pumping (Acre-Feet/Year)	
Scenario	Fillmore	Piru
Historical	46,800	11,400
Baseline	44,800	12,600
2070CF	49,800	14,600

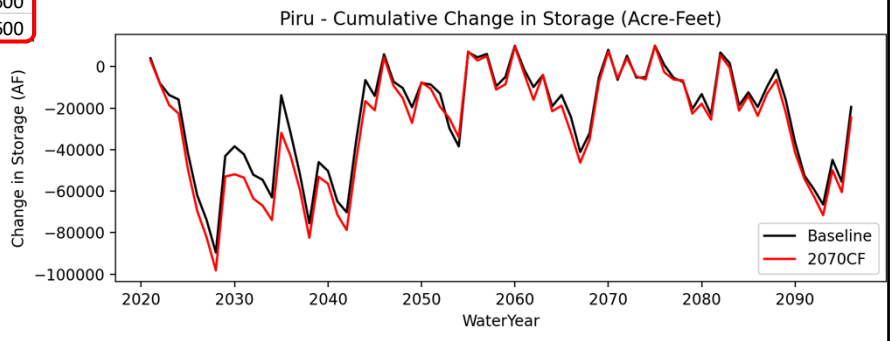




Preliminary Image - Subject to Revision - Do Not Cite or Reference

	Average Pumping (Acre-Feet/Year)	
Scenario	Fillmore	Piru
Historical	46,800	11,400
Baseline	44,800	12,600
2070CF	49,800	14,600

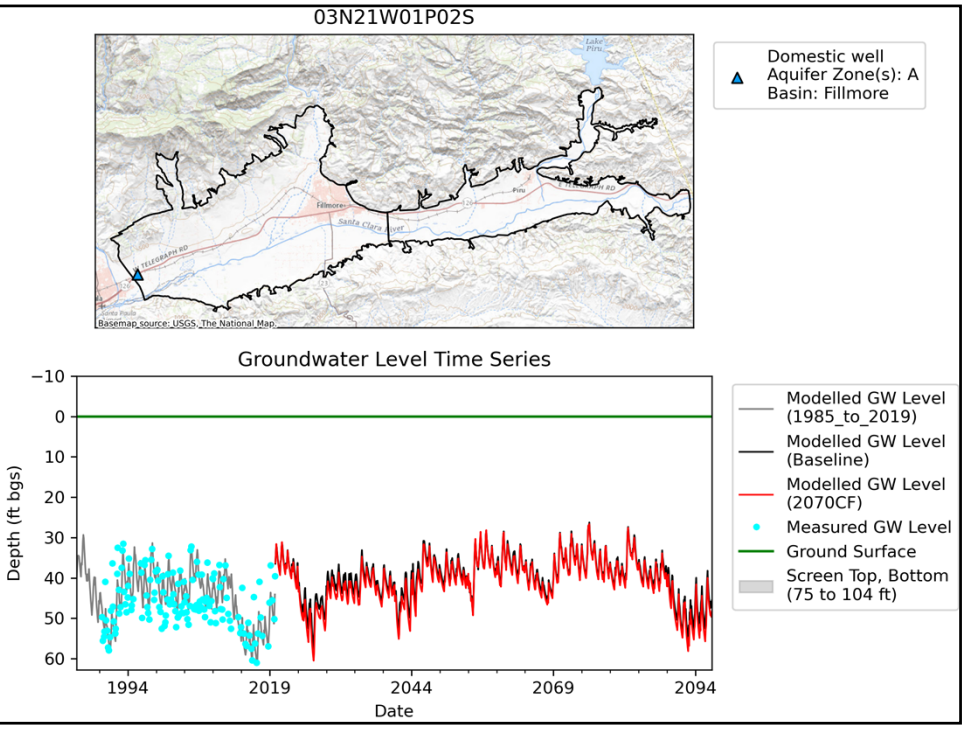




Preliminary Image - Subject to Revision - Do Not Cite or Reference

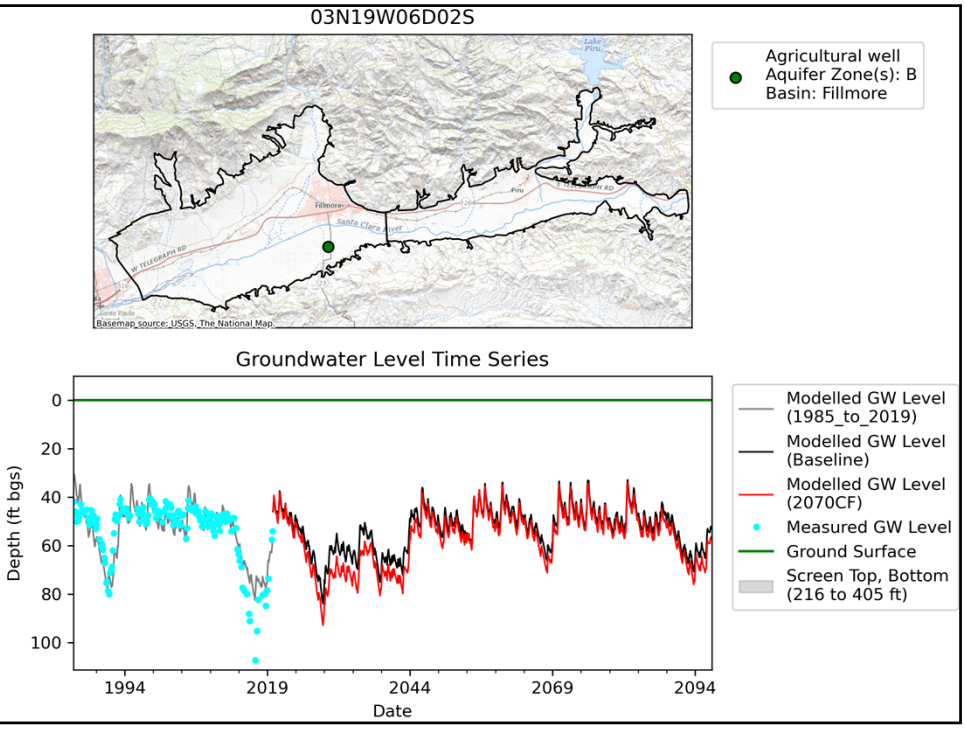
Conclusions

- No evidence of chronic decline in GW levels.
- GW level ranges are similar to the historic period.
- Difference in 2070CF scenario GW levels vs. Baseline scenario:
  - Wet periods: <5 ft
  - Droughts: <10 ft



Conclusions

- No evidence of chronic decline in GW levels.
- GW level ranges are similar to the historic period.
- Difference in 2070CF scenario GW levels vs. Baseline scenario:
  - Wet periods: <5 ft
  - Droughts: <20 ft



Conclusions

- No evidence of chronic decline in GW levels.
- GW level ranges are similar to the historic period.
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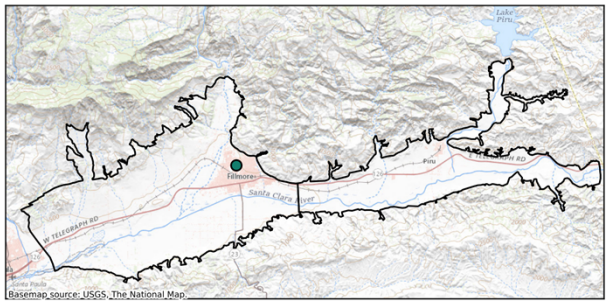
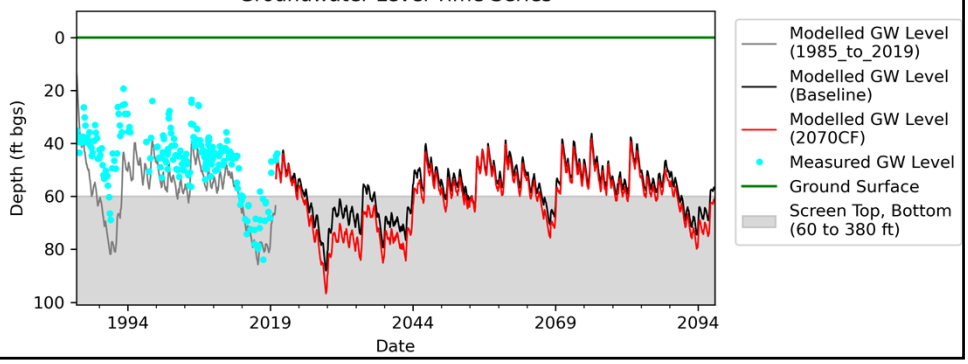
04N19W30D01S



Agricultural well
Aquifer Zone(s): A+B
Basin: Fillmore

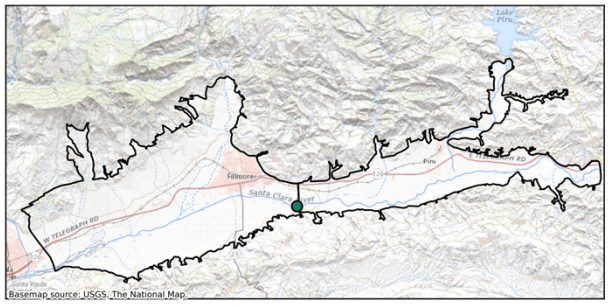
Groundwater Level Time Series



Conclusions

- No evidence of chronic decline in GW levels.
- GW level ranges are similar to the historic period.
- Difference in 2070CF scenario GW levels vs. Baseline scenario:
  - Wet periods: <5 ft
  - Droughts: <20 ft

04N19W33M05S



Agricultural well
Aquifer Zone(s): A+B
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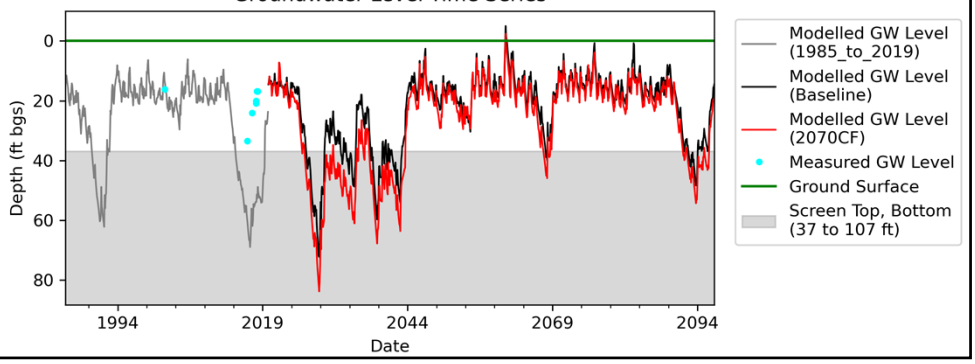
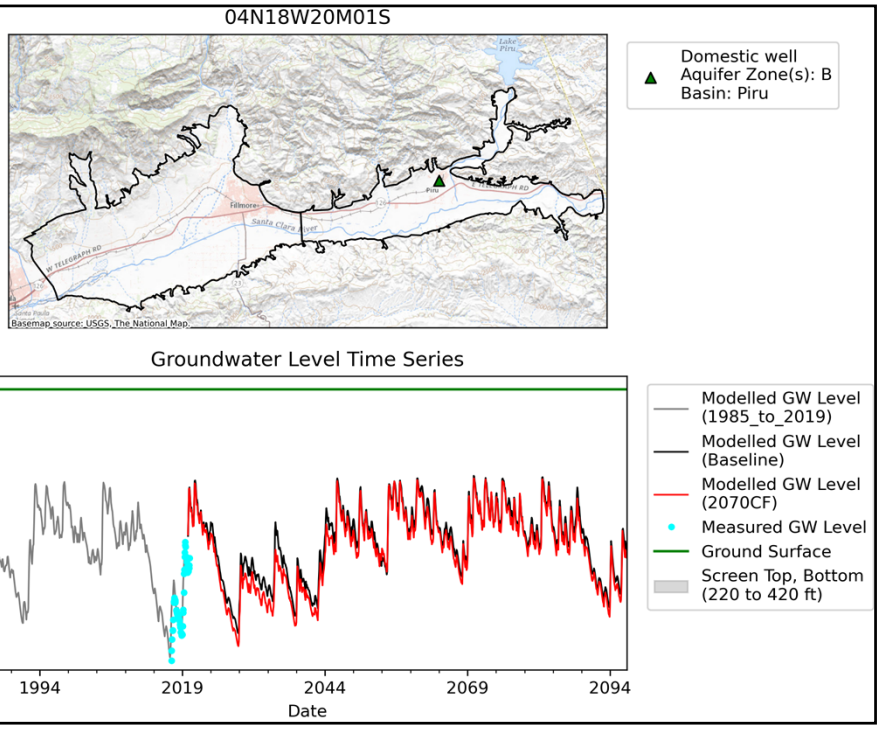
Groundwater Level Time Series



Conclusions

- No evidence of chronic decline in GW levels.
- GW level ranges are similar to the historic period.
- Difference in 2070CF scenario GW levels vs. Baseline scenario:
  - Wet periods: <5 ft
  - Droughts: <20 ft

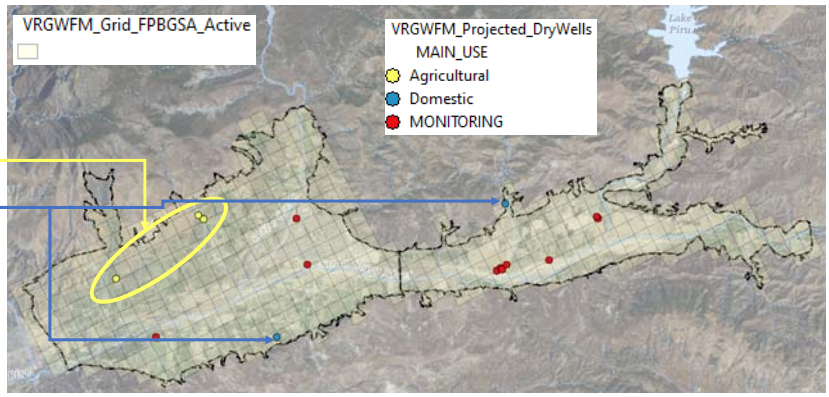


Dry Wells Evaluation (of 2070CF Future Scenario)

Bottom line: No production wells are predicted to go dry.

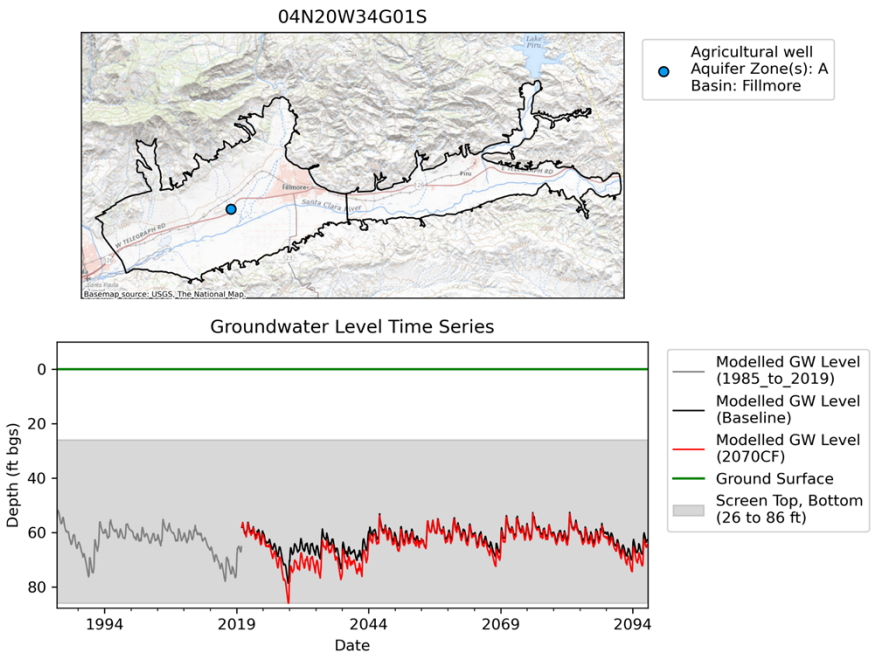
Notes:

- Based on comparison of modelled GW levels vs. bottom of screen...
- Some shallow monitoring wells (with screen <100 ft deep) will go dry during droughts.
- Manually inspected 3 agricultural wells and 2 domestic wells that modelled GW levels indicate would go dry:
  - Unlikely to go dry based on measured GW levels.
- Biases in modelled GW levels tends to underestimate measured GW levels - making this a cautious/conservative evaluation.



Dry Wells Evaluation

Example of a well with the highest risk of going dry (similar to Historical Baseline +20% from Dec. 2020 Board Meeting):



Item 4C - Sustainable Management Criteria

Water Level - Stream Flow Cross Over Analyses

- Updated relationship(s) between WLs in wells near rising GW areas and measured SW flow
- Impact of climate change on depth to water in drought
- Impact of climate change on SW flows

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Water Level - Stream Flow Cross Over Analyses

Results of the analyses done by United:

- cross over relationship between WLs and SW flow; and
- impact of pumping on SW flow

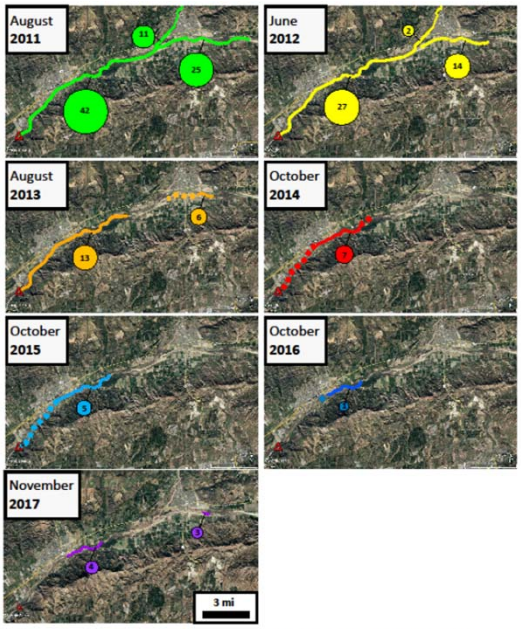
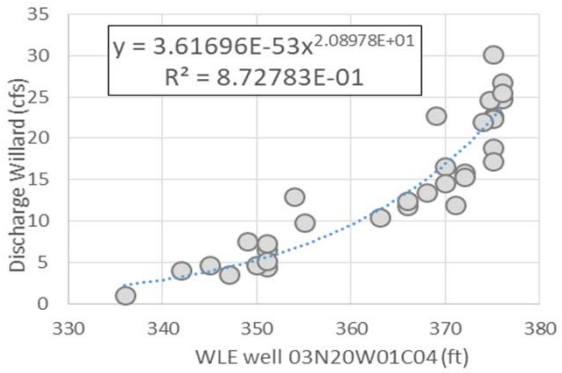


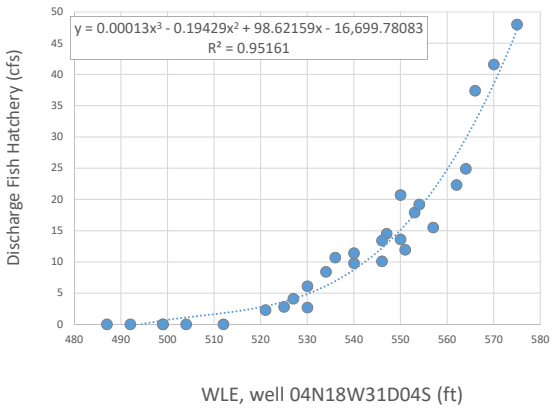
Figure 5.2-2. Length of wetted areas (colored lines) in the lower Santa Clara River, upstream of the Freeman Diversion (indicated by red triangle). Reaches where the end of the wetted area is uncertain are indicated by dotted lines. Flow rates (cfs) are indicated in circles, scaled according to magnitude.

Water Level - Stream Flow Cross Over Analyses

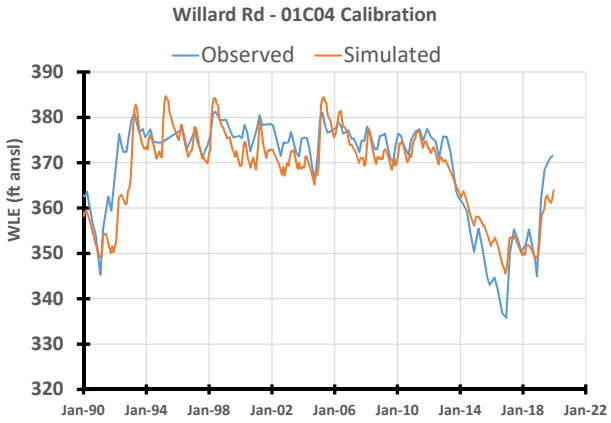
Willard Road

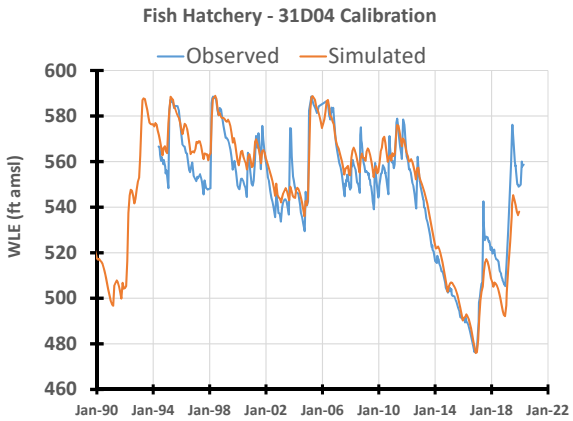


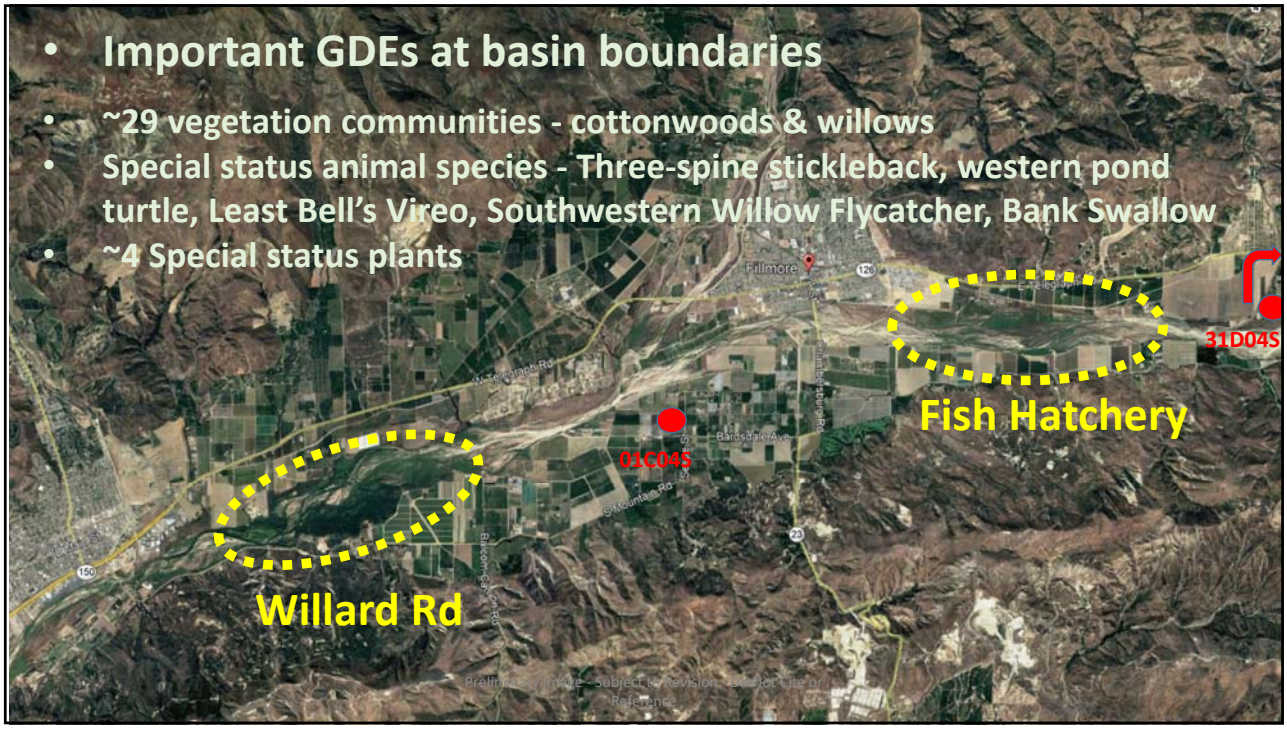
Fish Hatchery

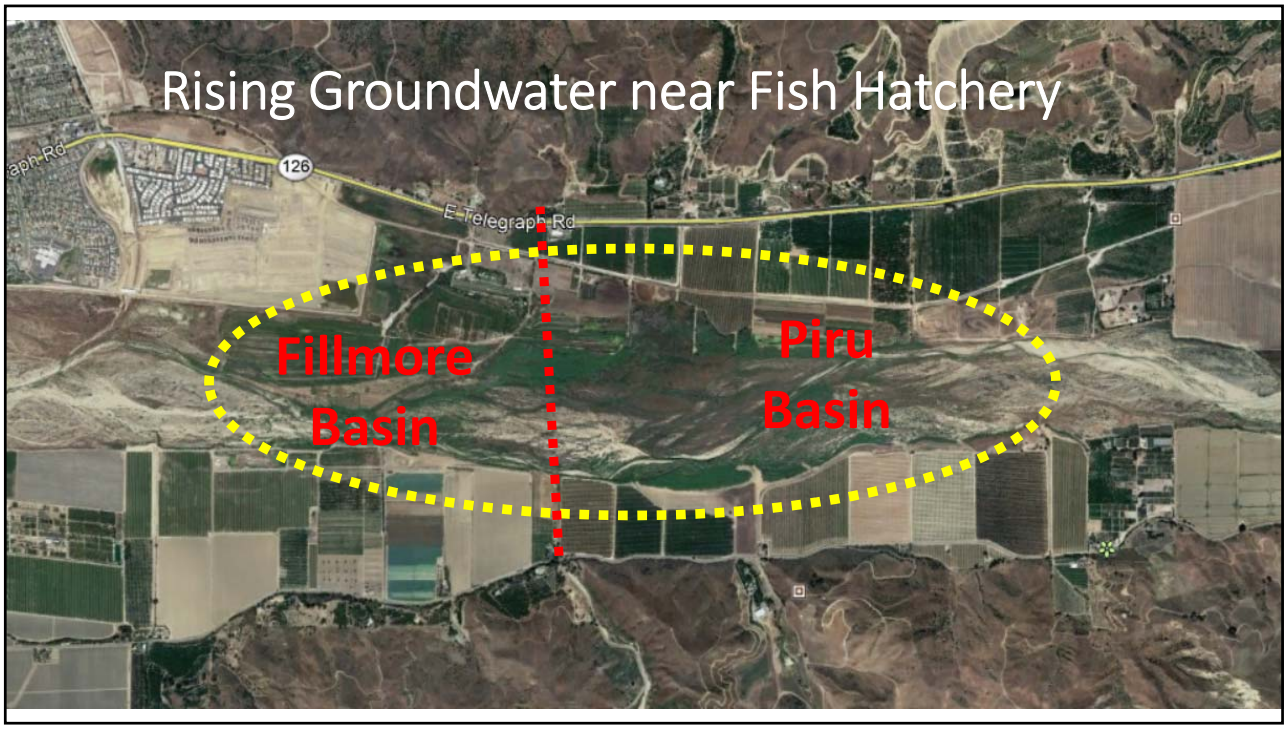


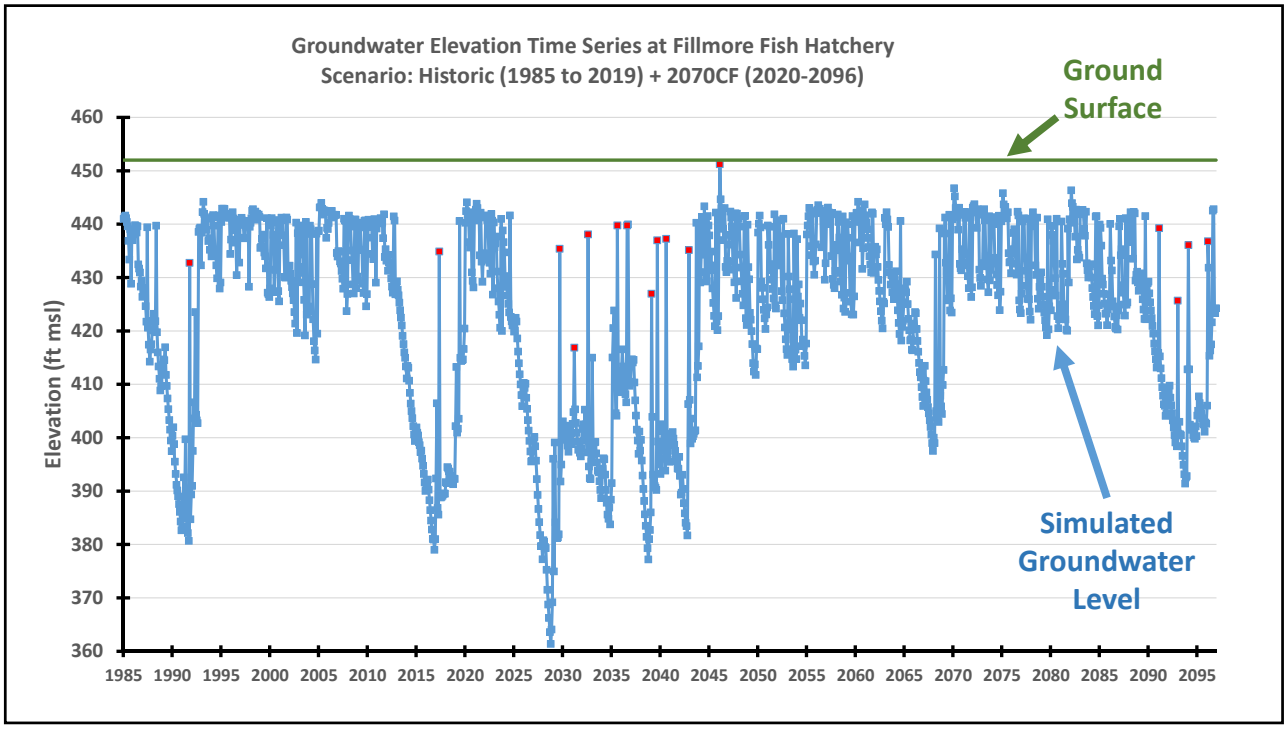
Groundwater Model Calibration

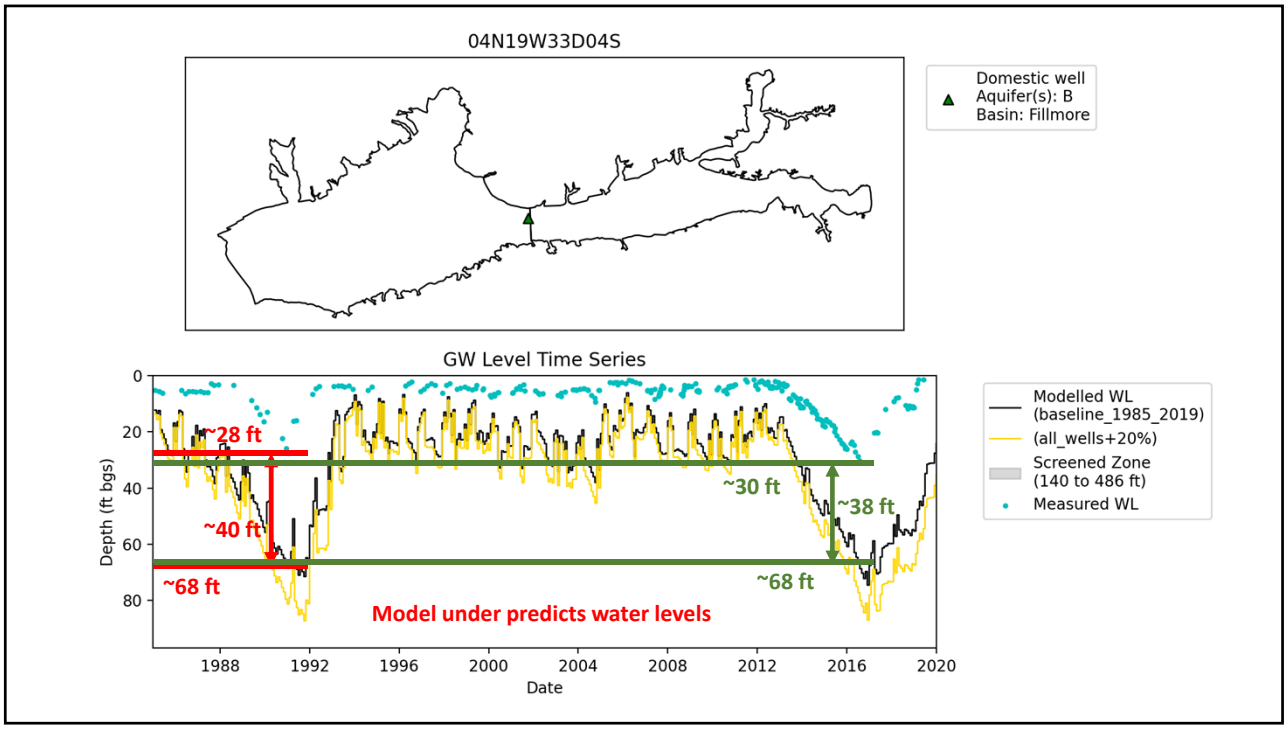


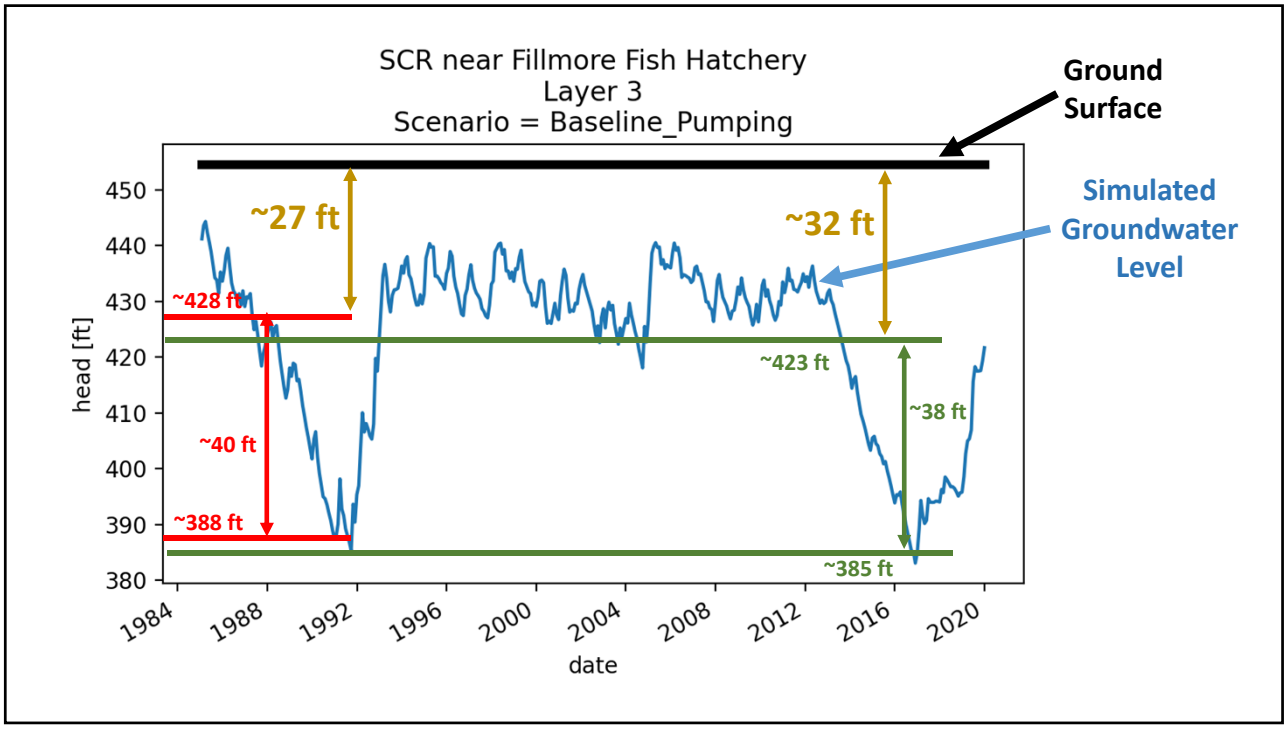


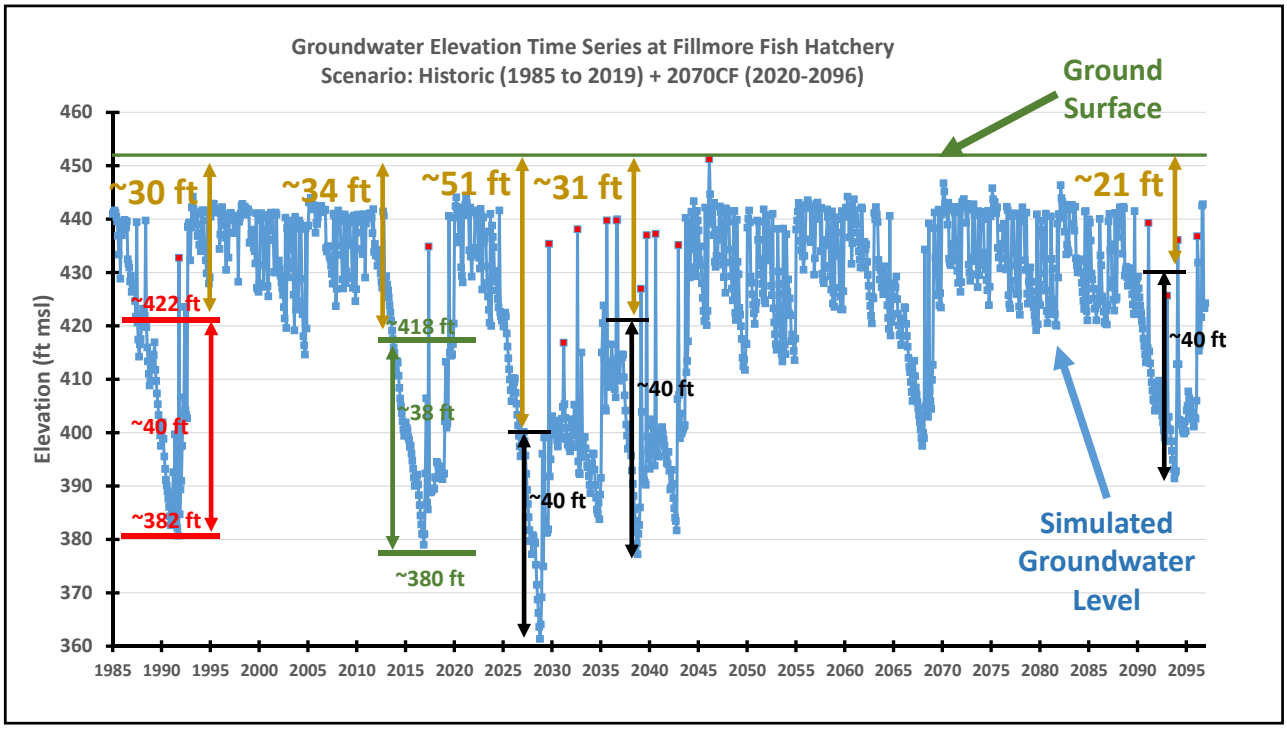


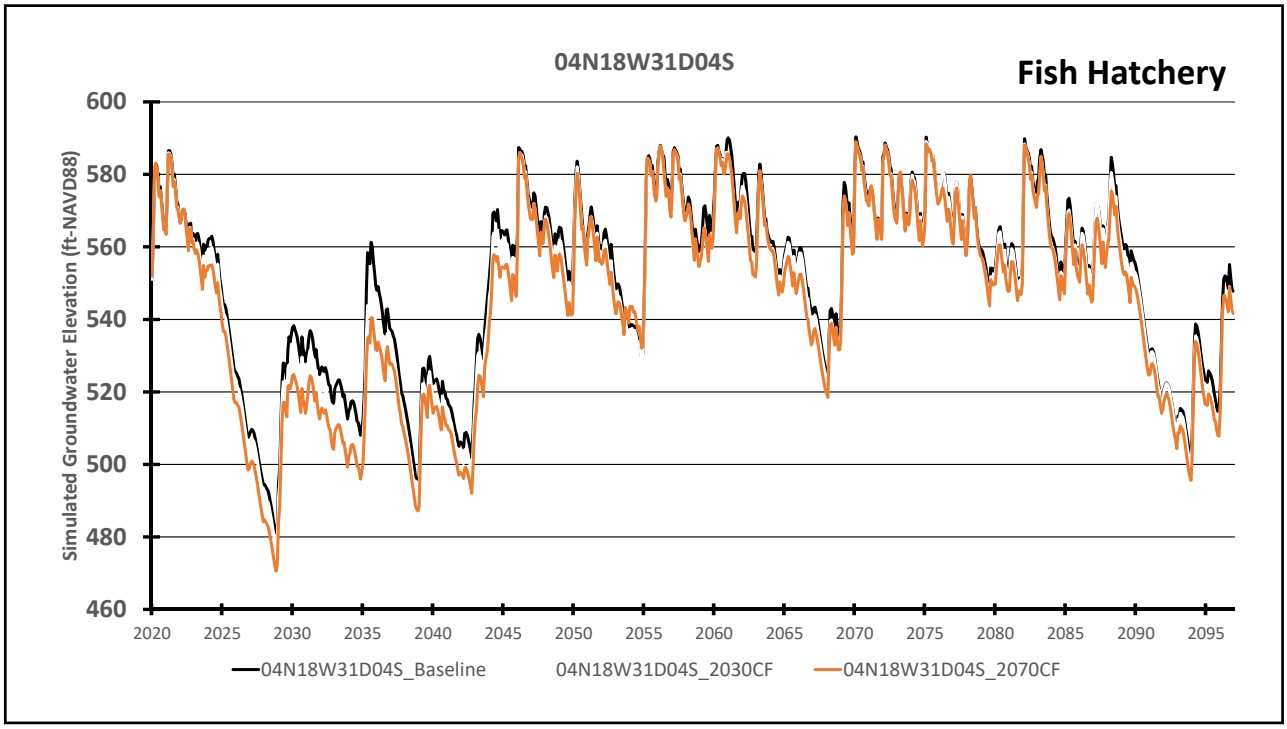

Rising Groundwater near Fish Hatchery
126
E Telegraph Rd
Fillmore Basin
Piru Basin

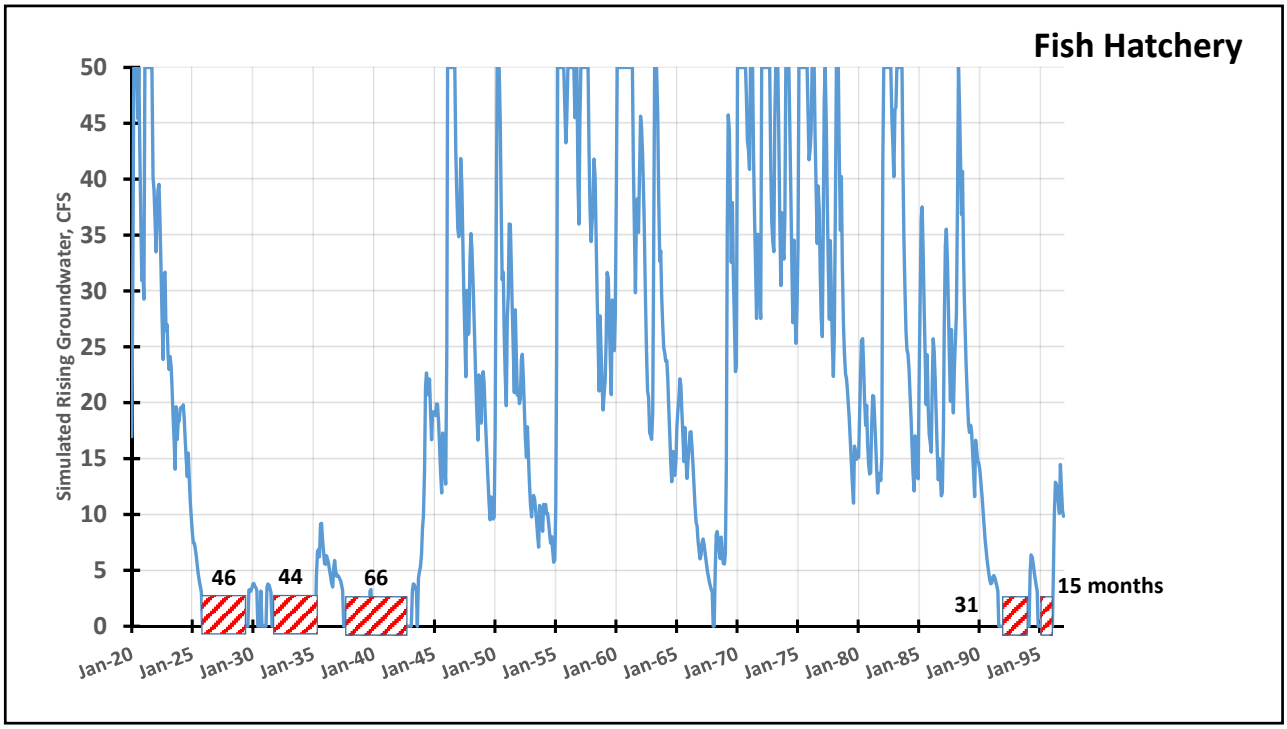

Groundwater Elevation Time Series at Fillmore Fish Hatchery
Scenario: Historic (1985 to 2019) + 2070CF (2020-2096)
Ground Surface
Simulated Groundwater Level
Elevation (ft msl)
460
450
440
430
420
410
400
390
380
370
360
1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095

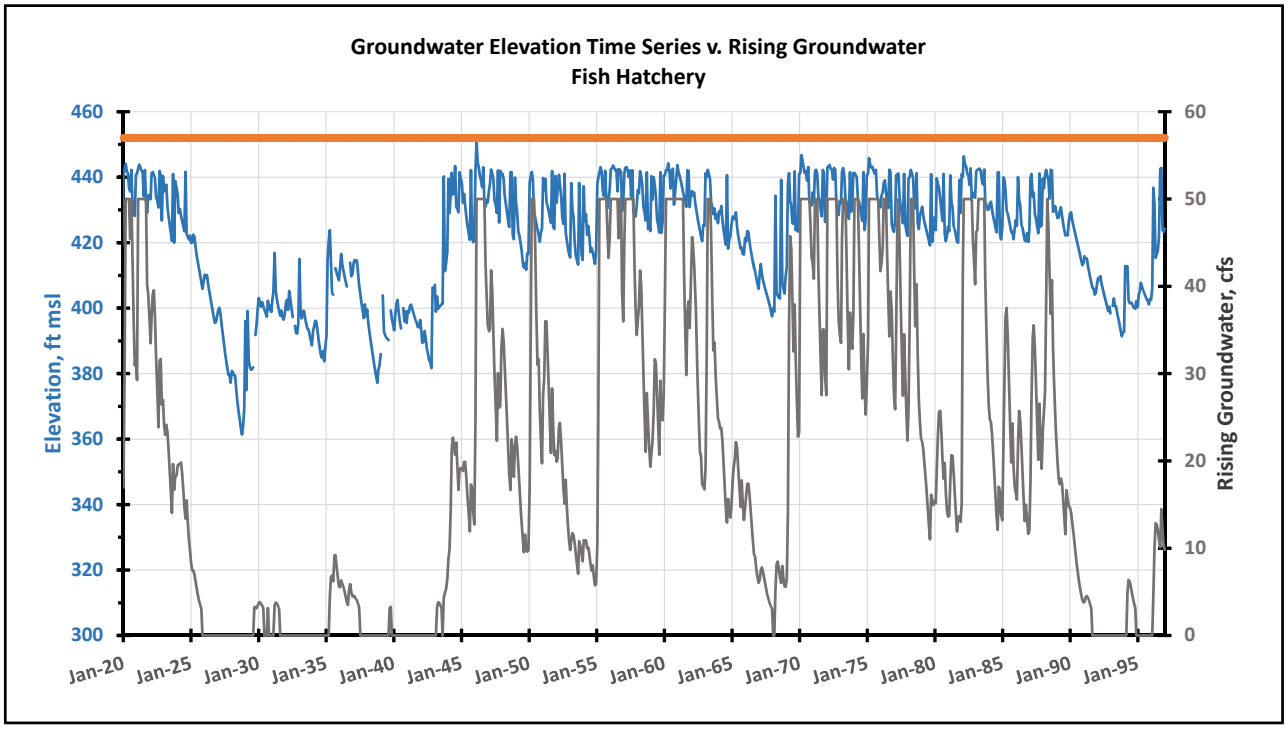

04N19W33D04S
Domestic well
Aquifer(s): B
Basin: Fillmore
GW Level Time Series
Depth (ft bgs)
Date
~28 ft
~40 ft
~68 ft
~30 ft
~38 ft
~68 ft
Model under predicts water levels
Modelled WL (baseline_1985_2019)
(all_wells+20%)
Screened Zone (140 to 486 ft)
Measured WL

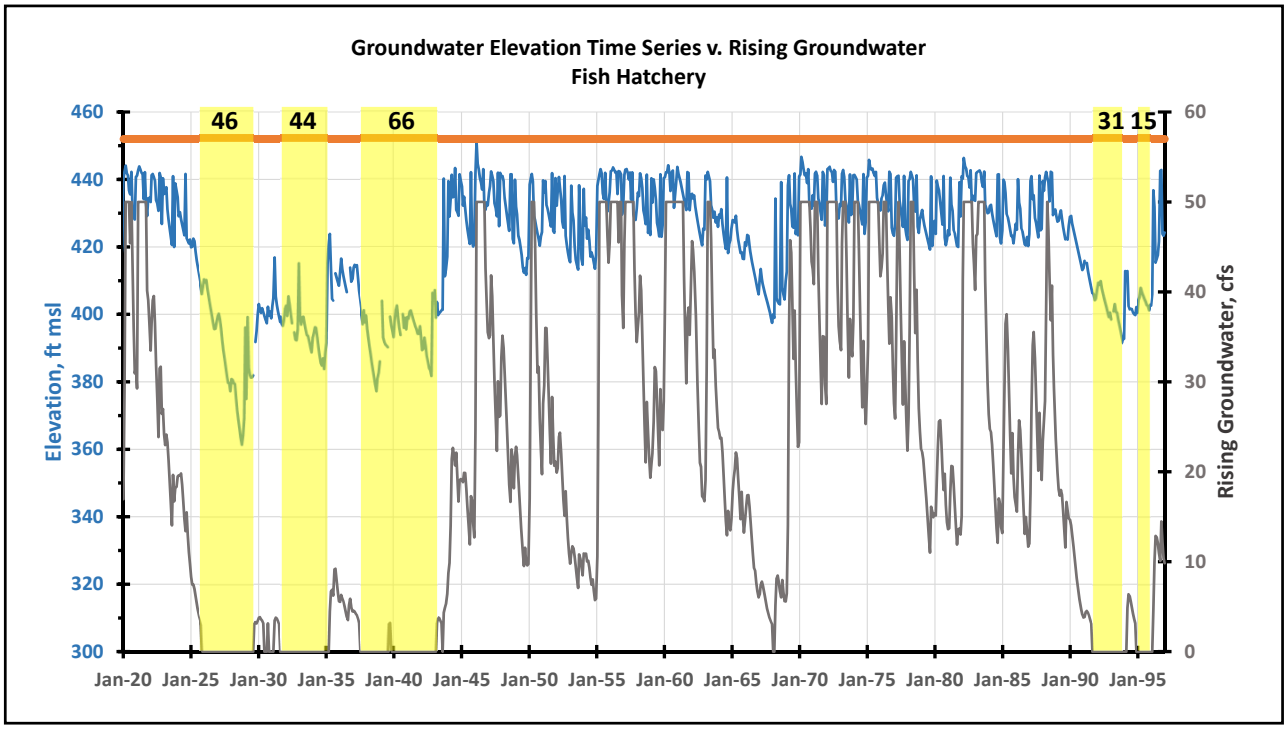

SCR near Fillmore Fish Hatchery
Layer 3
Scenario = Baseline_Pumping
Ground Surface
Simulated Groundwater Level
~27 ft
~32 ft
~428 ft
~40 ft
~388 ft
~423 ft
~38 ft
~385 ft
head [ft]
date


Groundwater Elevation Time Series at Fillmore Fish Hatchery
Scenario: Historic (1985 to 2019) + 2070CF (2020-2096)
Ground Surface
~30 ft
~34 ft
~51 ft
~31 ft
~21 ft
~422 ft
~40 ft
~382 ft
~418 ft
~38 ft
~380 ft
~40 ft
~40 ft
~40 ft
Simulated Groundwater Level
Elevation (ft msl)
460
450
440
430
420
410
400
390
380
370
360
1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095

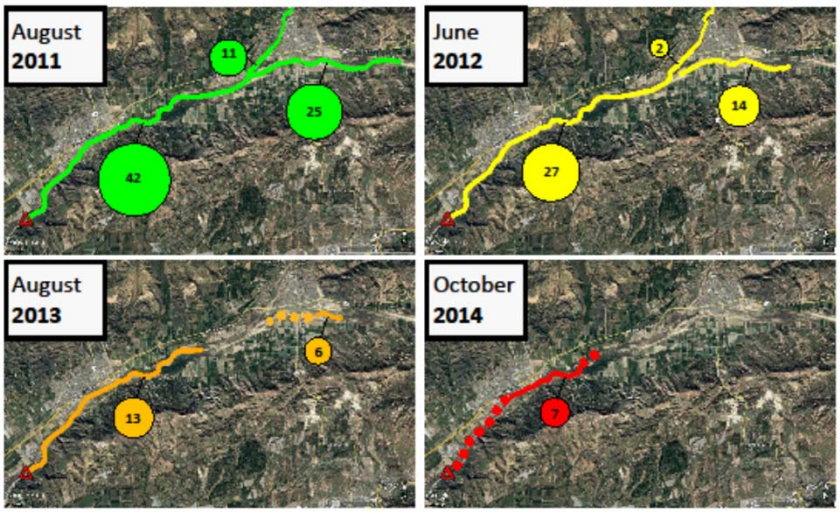

04N18W31D04S
Fish Hatchery
Simulated Groundwater Elevation (ft-NAVD88)
600
580
560
540
520
500
480
460
2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095
04N18W31D04S_Baseline
04N18W31D04S_2030CF
04N18W31D04S_2070CF


Fish Hatchery
Simulated Rising Groundwater, CFS
50
45
40
35
30
25
20
15
10
5
0
46
44
66
31
15 months
Jan-20
Jan-25
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95


Groundwater Elevation Time Series v. Rising Groundwater
Fish Hatchery
Elevation, ft msl
460
440
420
400
380
360
340
320
300
Rising Groundwater, cfs
60
50
40
30
20
10
0
Jan-20
Jan-25
Jan-30
Jan-35
Jan-40
Jan-45
Jan-50
Jan-55
Jan-60
Jan-65
Jan-70
Jan-75
Jan-80
Jan-85
Jan-90
Jan-95



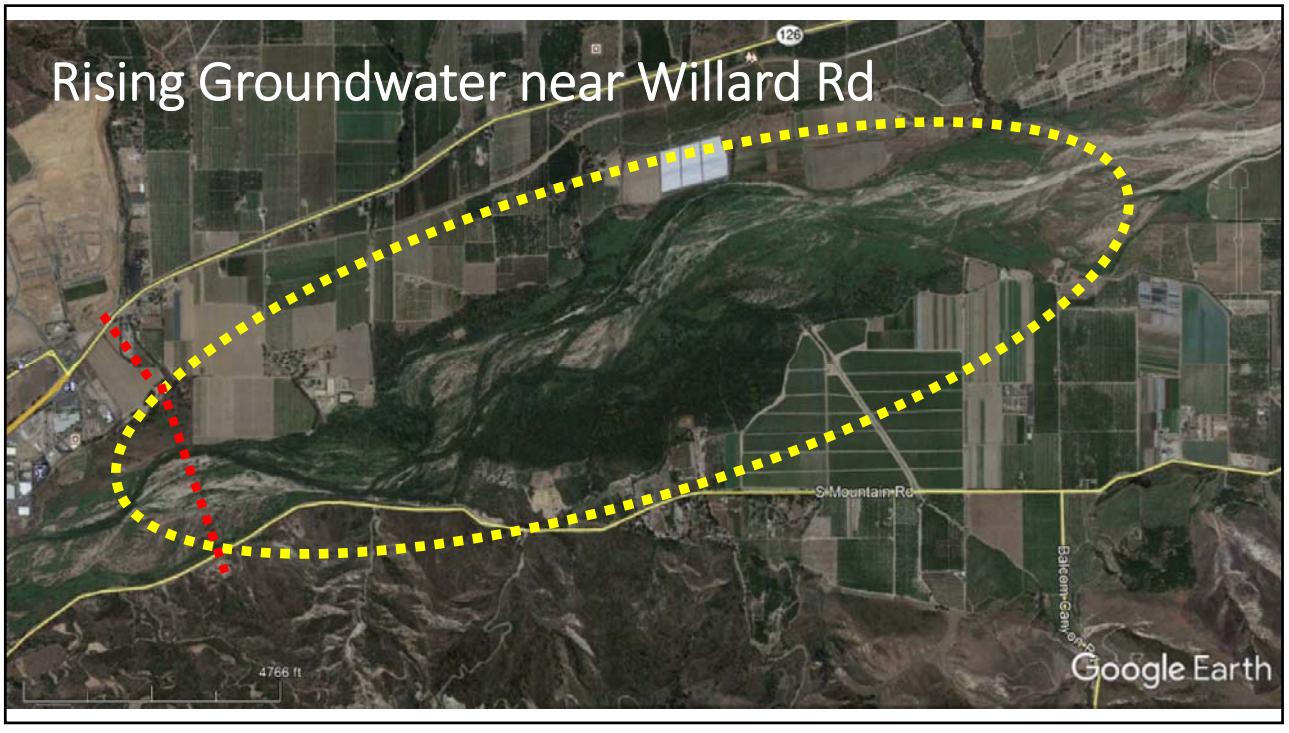
How quickly does Fish Hatchery reach of SCR go dry?

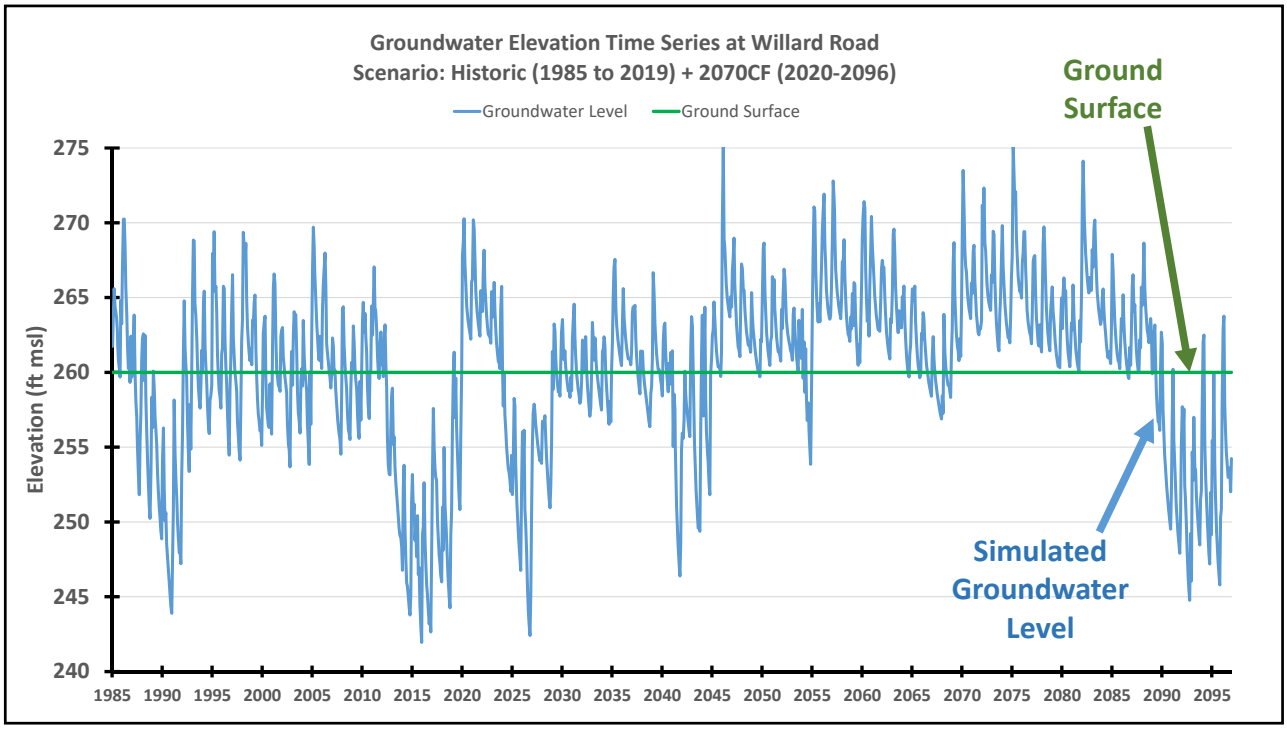


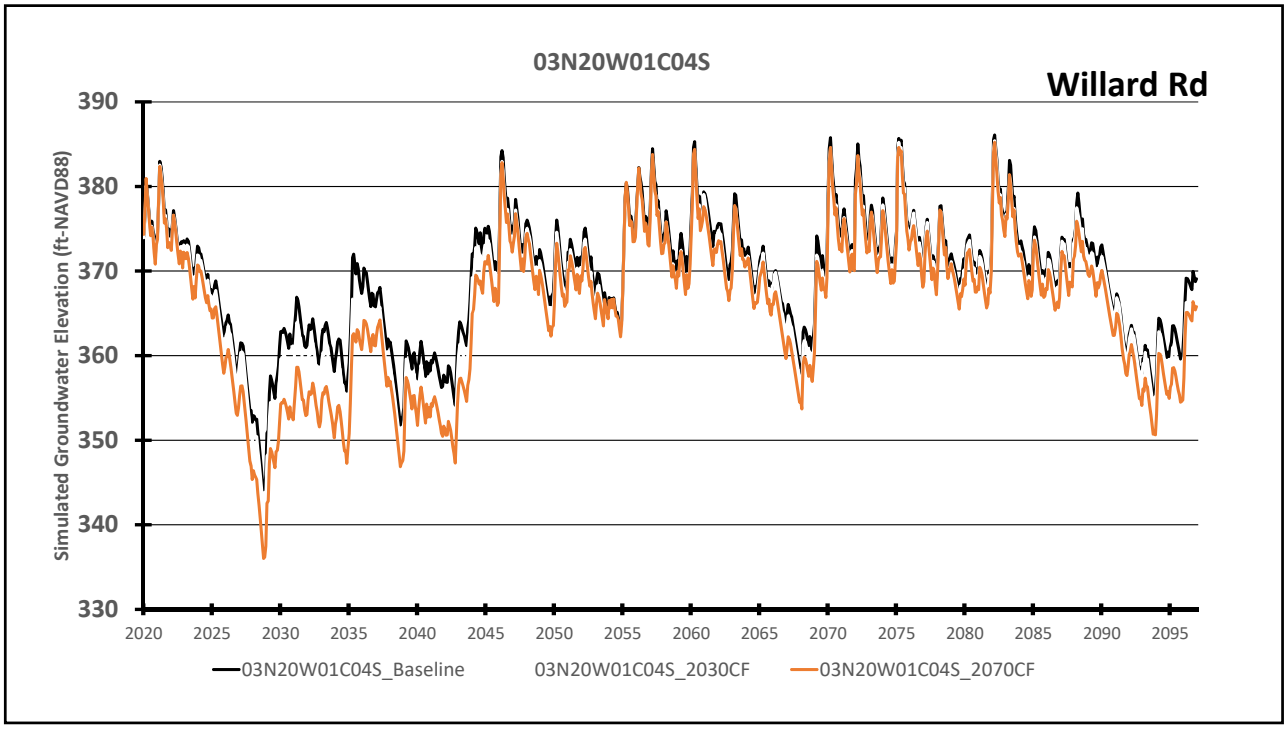
- **Wetted reach begins to shrink within a year**
- **Probably dry within 2 years**

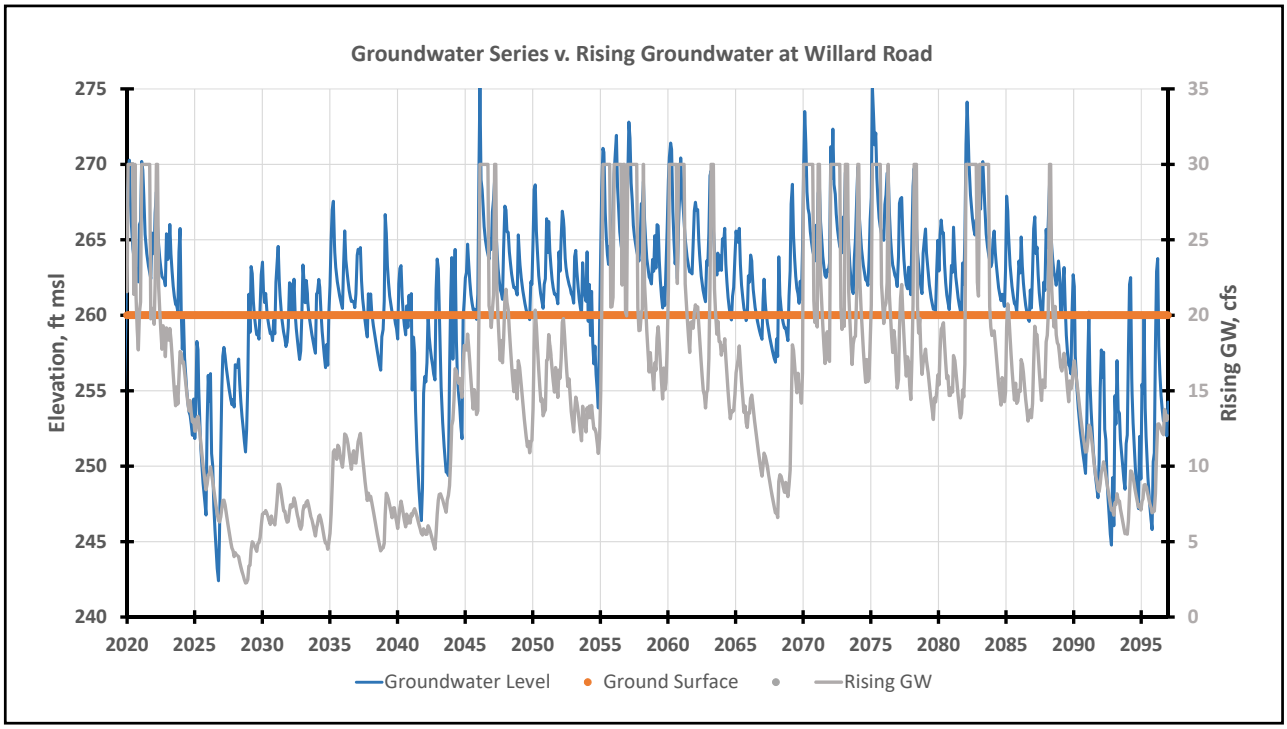
What did we learn?

- Extended periods of below normal precipitation are possible in the 2070 future conditions modeling scenario
- Drought WLs under 2070 future climate change conditions are estimated to be ~21-51 ft bgs with most in ~30-35 ft bgs range
- Rising groundwater may cease during moderate to severe drought conditions and remain that way for many months or even a few years
- The wetted reach of the SCR near the Fish Hatchery begins to shrink within a year of drought initiation and will probably be dry within 2 years if the drought lasts that long



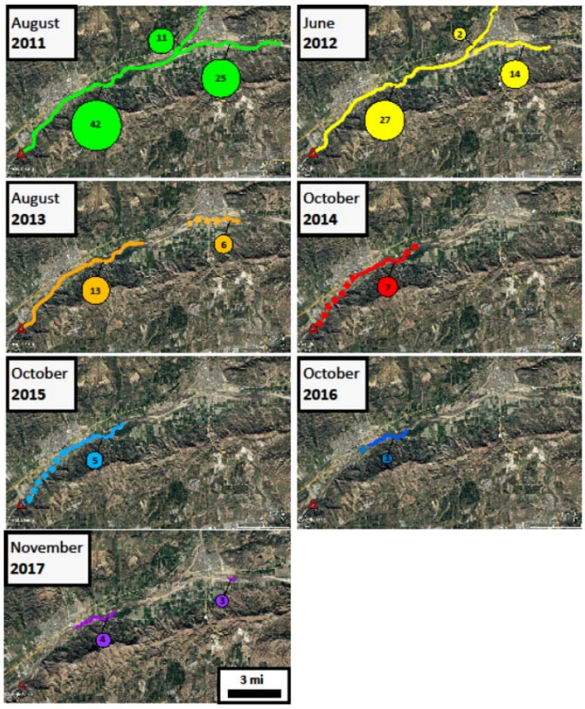

Groundwater Elevation Time Series at Willard Road
Scenario: Historic (1985 to 2019) + 2070CF (2020-2096)
Groundwater Level
Ground Surface
Ground Surface
Simulated Groundwater Level
Elevation (ft msl)
275
270
265
260
255
250
245
240
1985 1990 1995 2000 2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095


03N20W01C04S
Willard Rd
Simulated Groundwater Elevation (ft-NAVD88)
390
380
370
360
350
340
330
2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075 2080 2085 2090 2095
03N20W01C04S_Baseline
03N20W01C04S_2030CF
03N20W01C04S_2070CF



How quickly does Willard Road reach of SCR go dry?

- **Wetted reach begins to shrink within 2-3 years**
- **Probably dry within 5-6 years**

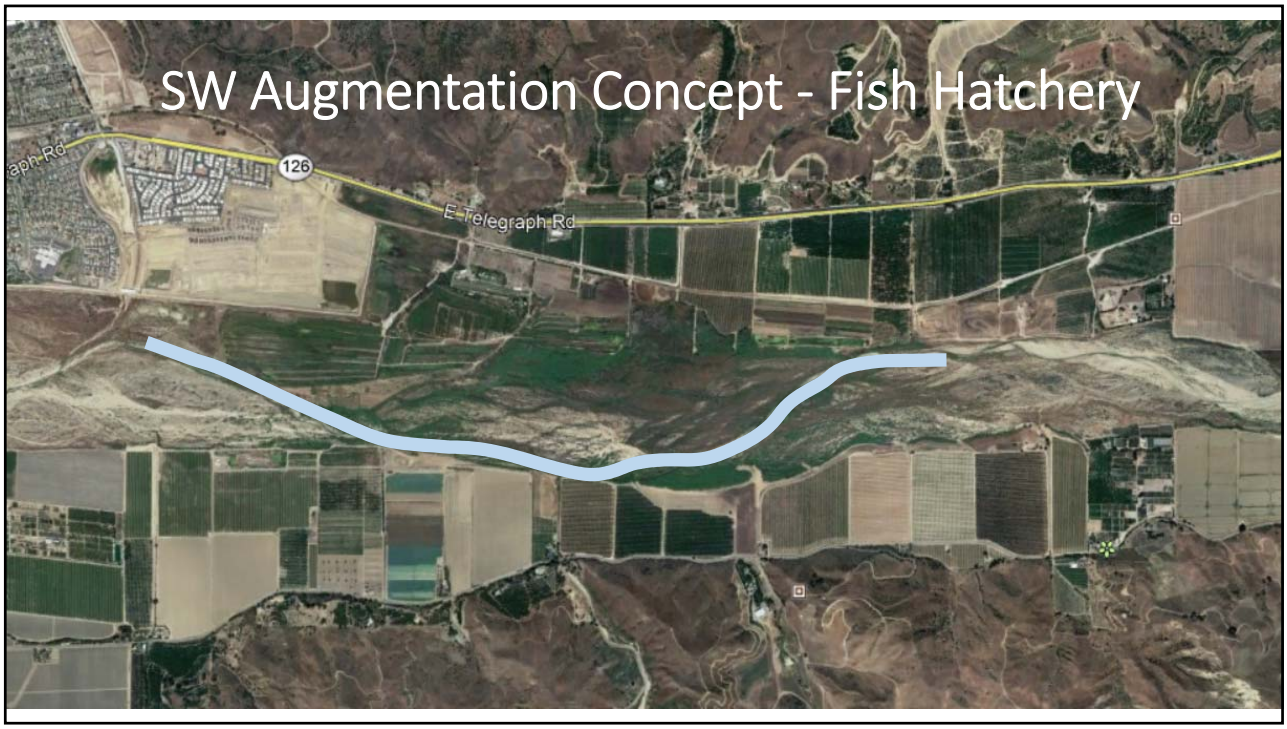


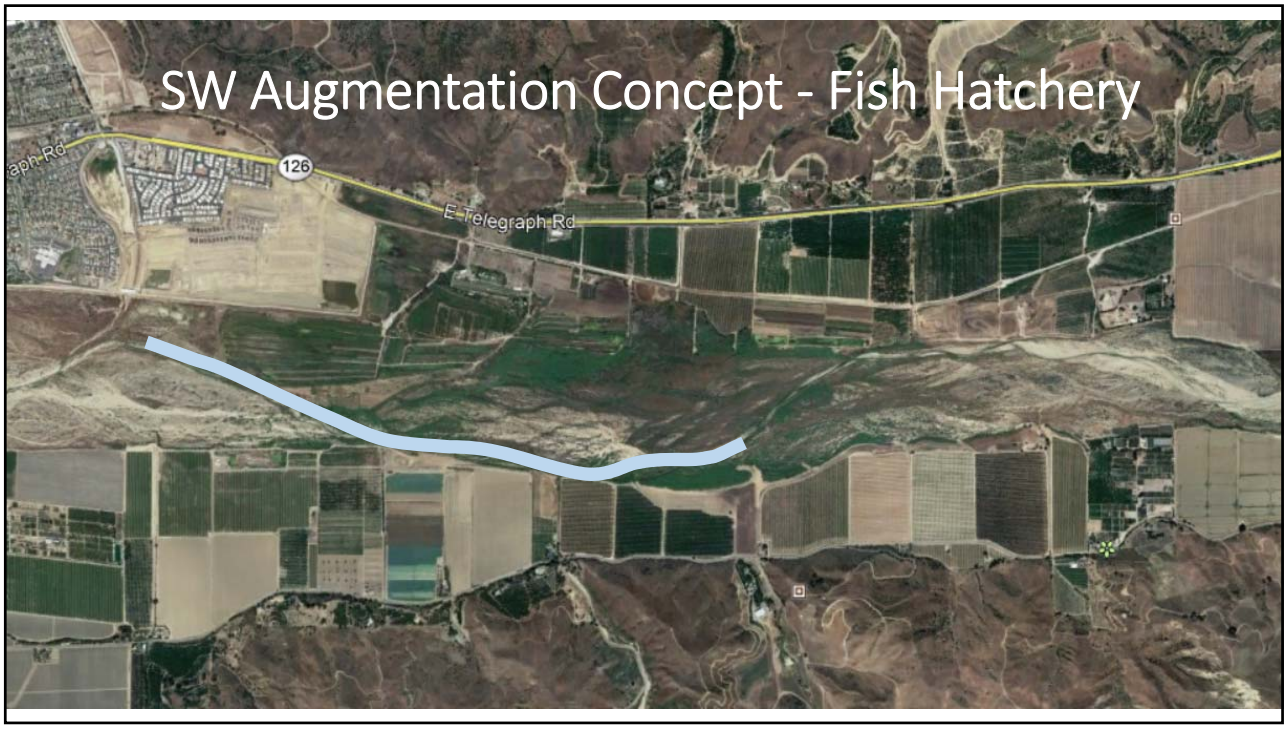
What did we learn?

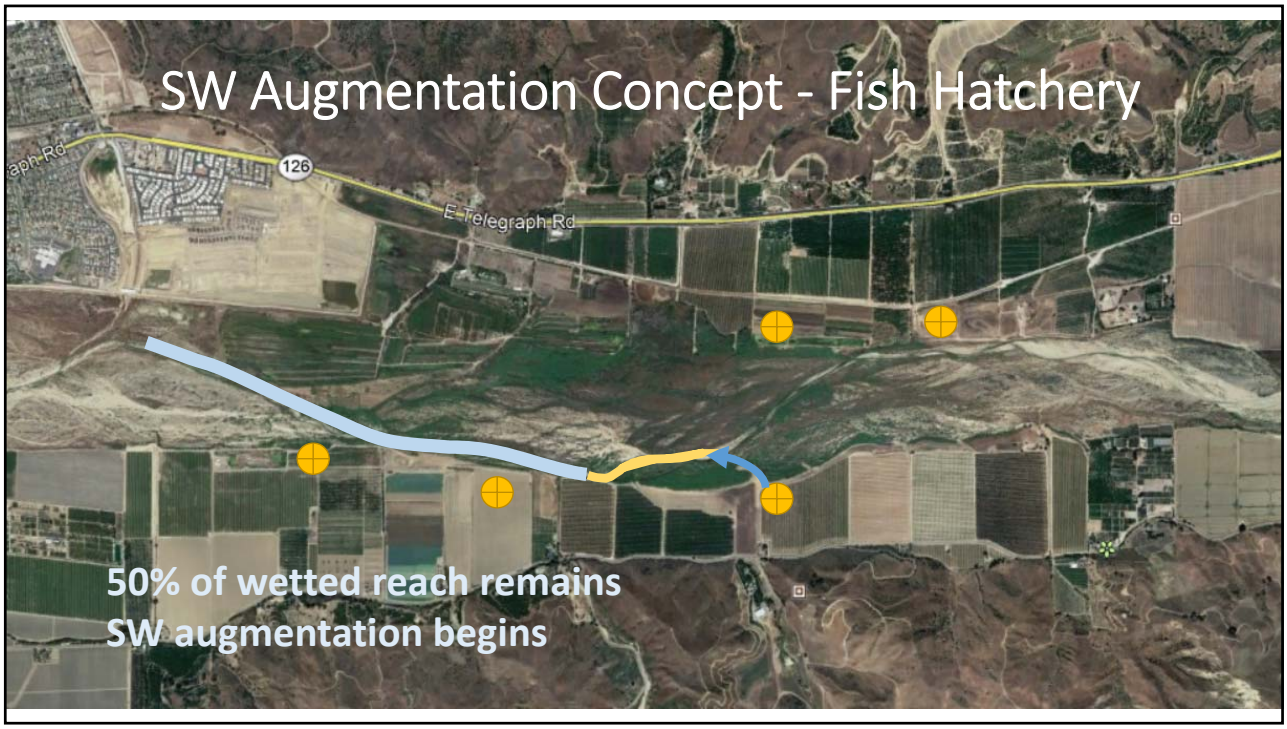
- Extended periods of below normal precipitation are possible in the 2070 future conditions modeling scenario
- Drought WLs under 2070 future climate change conditions are estimated to be 15 or less ft bgs
- Rising groundwater is expected to decrease to 5-10 cfs during droughts, but not cease near Willard Road
- The field observations of the SCR reach near the Willard Road records that the wetted reach begins to shrink within ~ 2 years of the beginning of a drought and could go dry within ~ 5 years

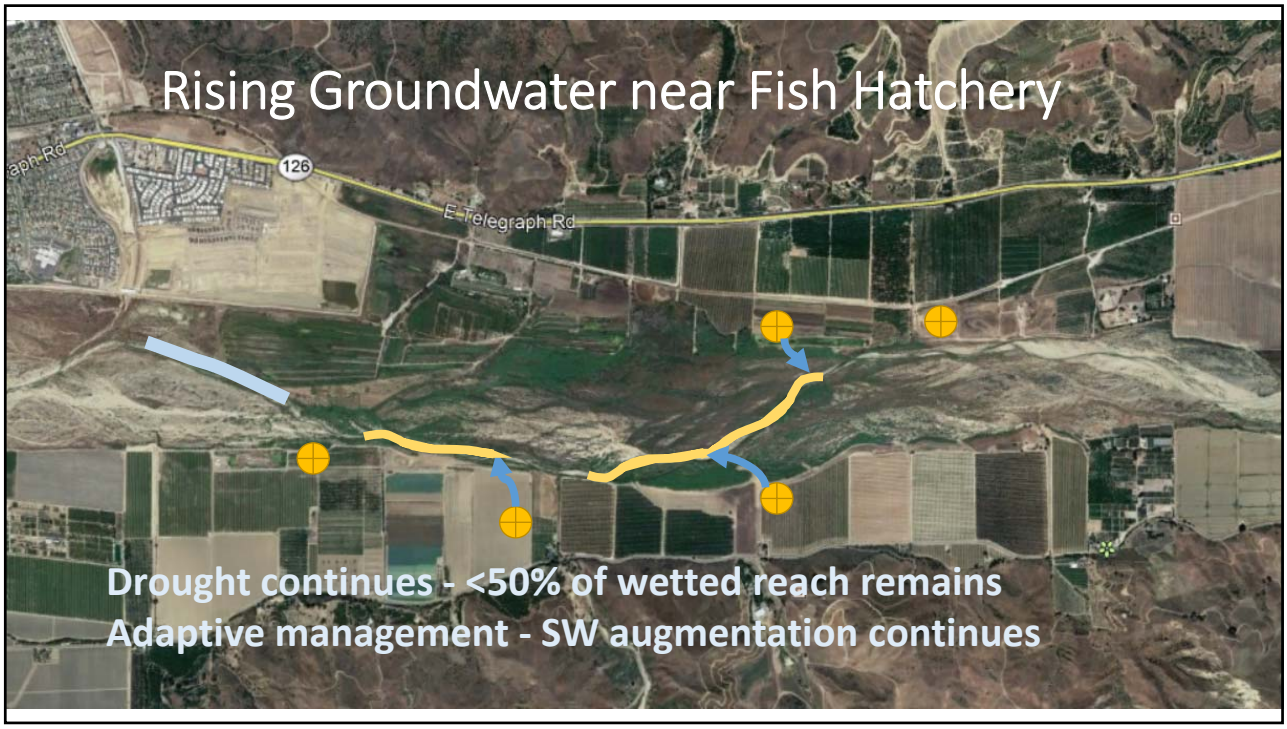
Summary

	Fish Hatchery	Willard Road	Comments
Rising GW (Surface Water Flows)	✓ GW extractions decrease SW flows by 5-10 cfs which creates periods of no flow that can last ~2-5 yrs ✓ Modeling suggests future flows during droughts could cease and remain that way for many months to a few yrs	✓ GW extractions decrease SW flows by 5-10 cfs ✓ Modeling suggests future flows will decrease 5-10 cfs but not go dry	✓ Are periods of no rising GW a *Significant and Unreasonable* impact to SW beneficial uses/users? ✓ Are modeled water levels of 30-35 ft bgs during a drought a *Significant and Unreasonable* impact? If so, what mitigation measures should/could be considered (e.g., reduce GW extractions near SCR? engineered solutions - Article 21 water, SW augmentation with GW, or ?)
Depth to GW during droughts	✓ Water levels during droughts modeled to be mostly in 30-35 ft bgs range, but could extend from 21-51 ft bgs	✓ Water levels during droughts modeled to be 15 ft bgs or less	


SW Augmentation Concept - Fish Hatchery
126
E Telegraph Rd


SW Augmentation Concept - Fish Hatchery
126
E Telegraph Rd


SW Augmentation Concept - Fish Hatchery
126
E Telegraph Rd
50% of wetted reach remains
SW augmentation begins


Rising Groundwater near Fish Hatchery
126
E Telegraph Rd
Drought continues - <50% of wetted reach remains
Adaptive management - SW augmentation continues

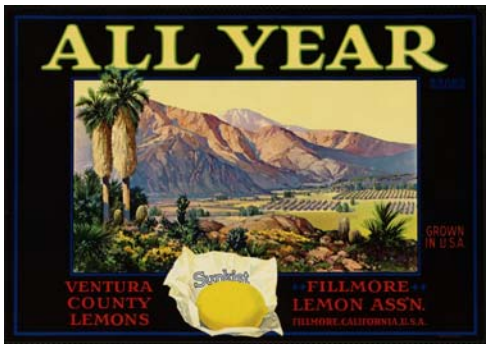
Key Elements SW Augmentation Concept

- *Goals: Use GW to support ecosystem survival through the drought. Water provides some water to the root zone for GW dependent vegetation and creates SW pools for amphibians, etc.*
- *The SW augmentation system would be implemented only during drought conditions when the length of the wetted reach declines below the trigger value.*
- *What is the minimum amount of wetted reach to maintain?* This length becomes a trigger value that, when exceeded, initiates the use of GW to augment SW flows.
- GW used for SW flow augmentation comes from wells perforated in deeper aquifers (not the shallow aquifer supplying the rising GW).
- If possible, no new wells would be drilled. Excess capacity from existing wells would be "crowd sourced" from multiple wells. Wells would likely be used sequentially to maintain the trigger length of wetted reach.

Key Elements SW Augmentation Concept

- FPBGSA would be responsible for any well retrofitting (e.g., discharge piping), metering, power costs for pumping the well, and a contribution towards maintenance costs of the well.
- The number of wells needed depends on the length of the wetted interval to be re-established, stream bed percolation rate, and quantity of water needed for re-establishment.
- What amount of water should be added for augmentation purposes?
  - ✓1 cfs = ~ 450 gal/min (1 well)
  - ✓5 cfs = ~ 2,250 gal/min (2-4 wells)
  - ✓10 cfs = ~4,500 gal/min (4-7 wells)
- The length of time the SW augmentation program could be in use might be *multiple years*. The amount of GW pumped could be extensive, for example:
  - ✓450 gal/min = 726 AFY

Questions?


ALL YEAR
GROWN IN U.S.A.
VENTURA COUNTY LEMONS
FILLMORE LEMON ASSN.
FILLMORE, CALIFORNIA, U.S.A.