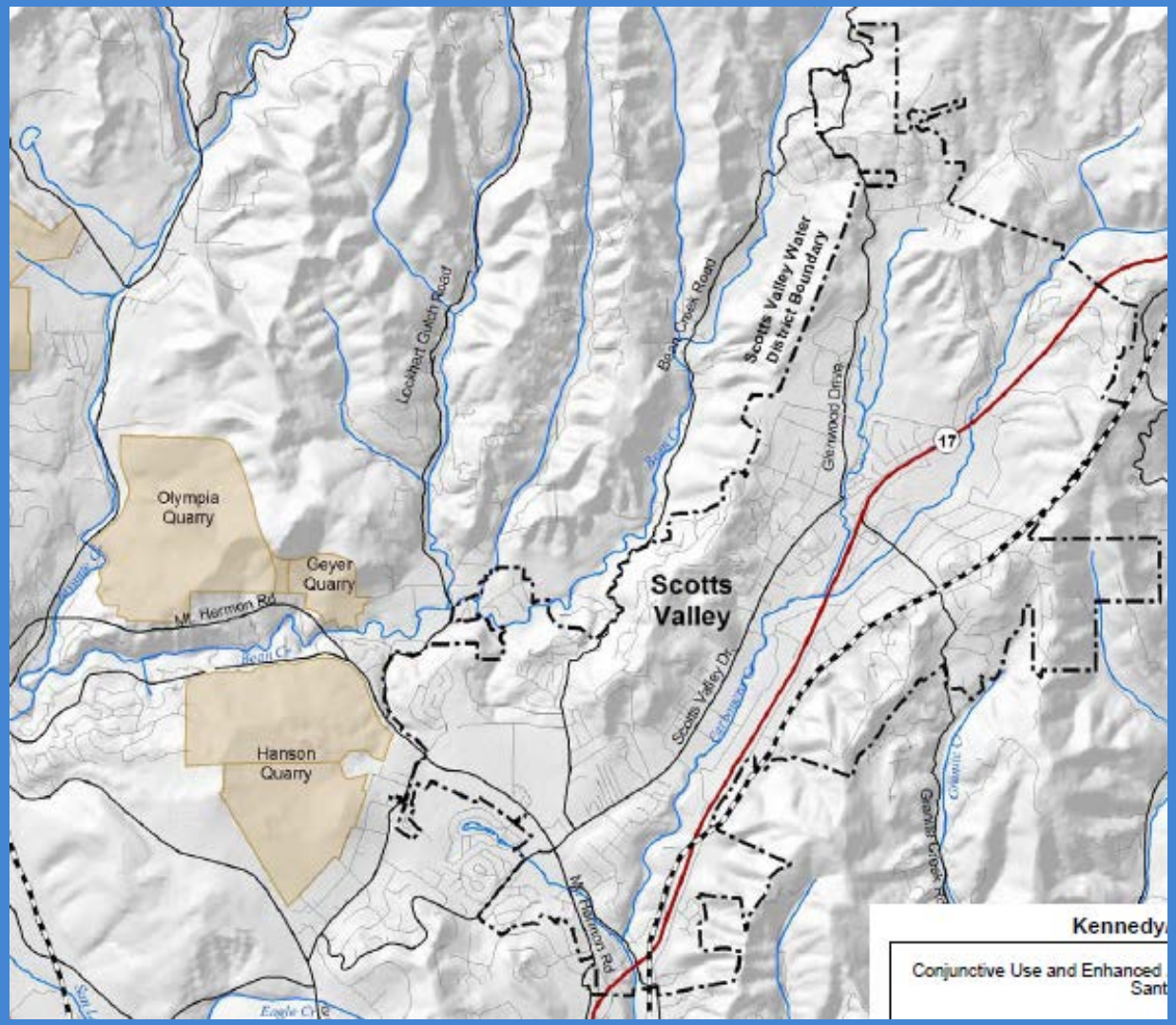

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Groundwater Modeling and Management Enrichment Session
City of Santa Cruz

26 August 2015

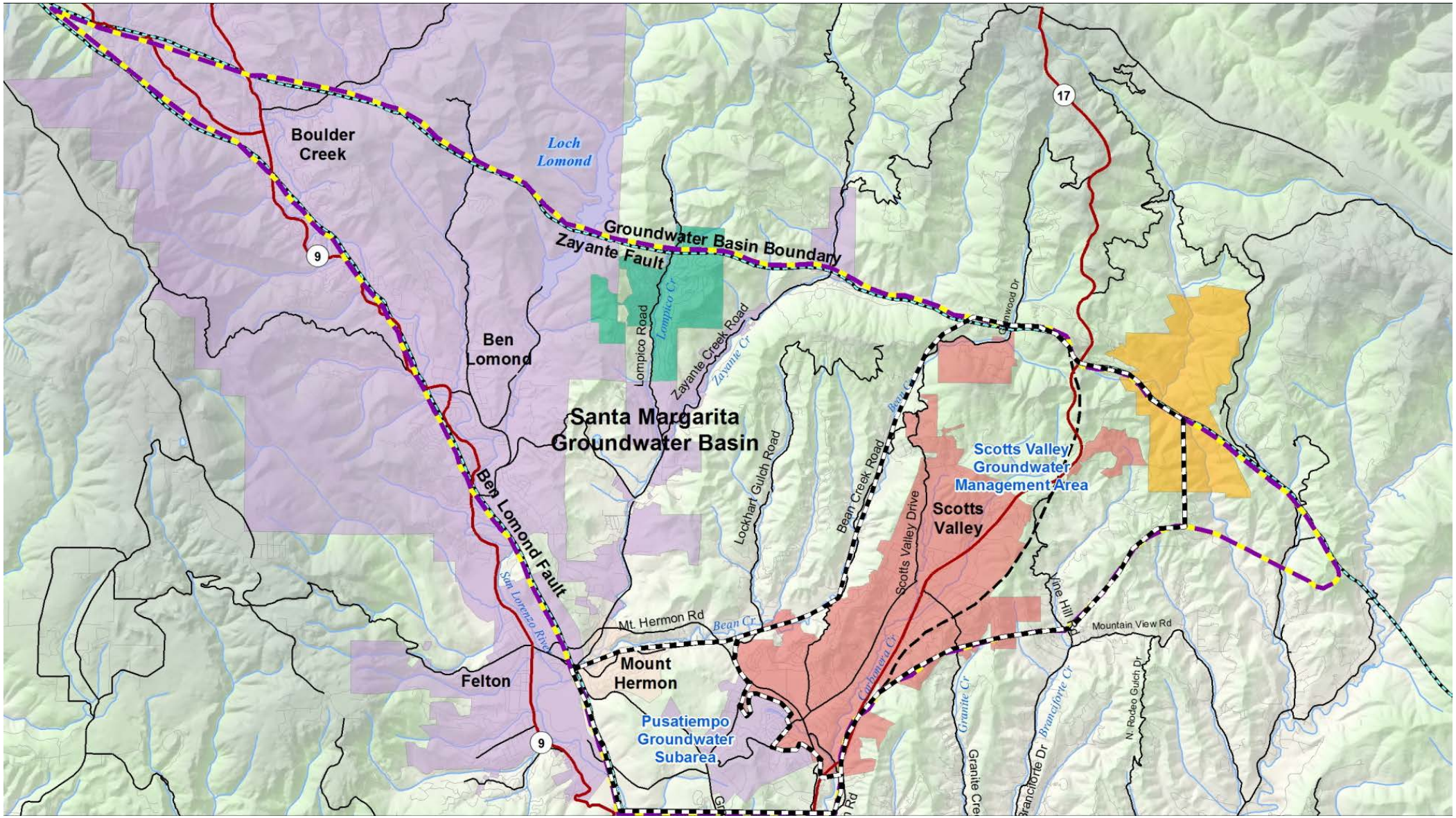
SCOTTS VALLEY WATER DISTRICT

Presentation Outline

- Groundwater Basin Understanding
  - Aquifers
  - Groundwater Issues
- Recent Groundwater Model Update
  - Setup
  - Results
- Modeling Applications
  - Groundwater Management
  - Potential Recharge Projects

Groundwater Basin Understanding

Several water districts overlie the Santa Margarita Groundwater Basin



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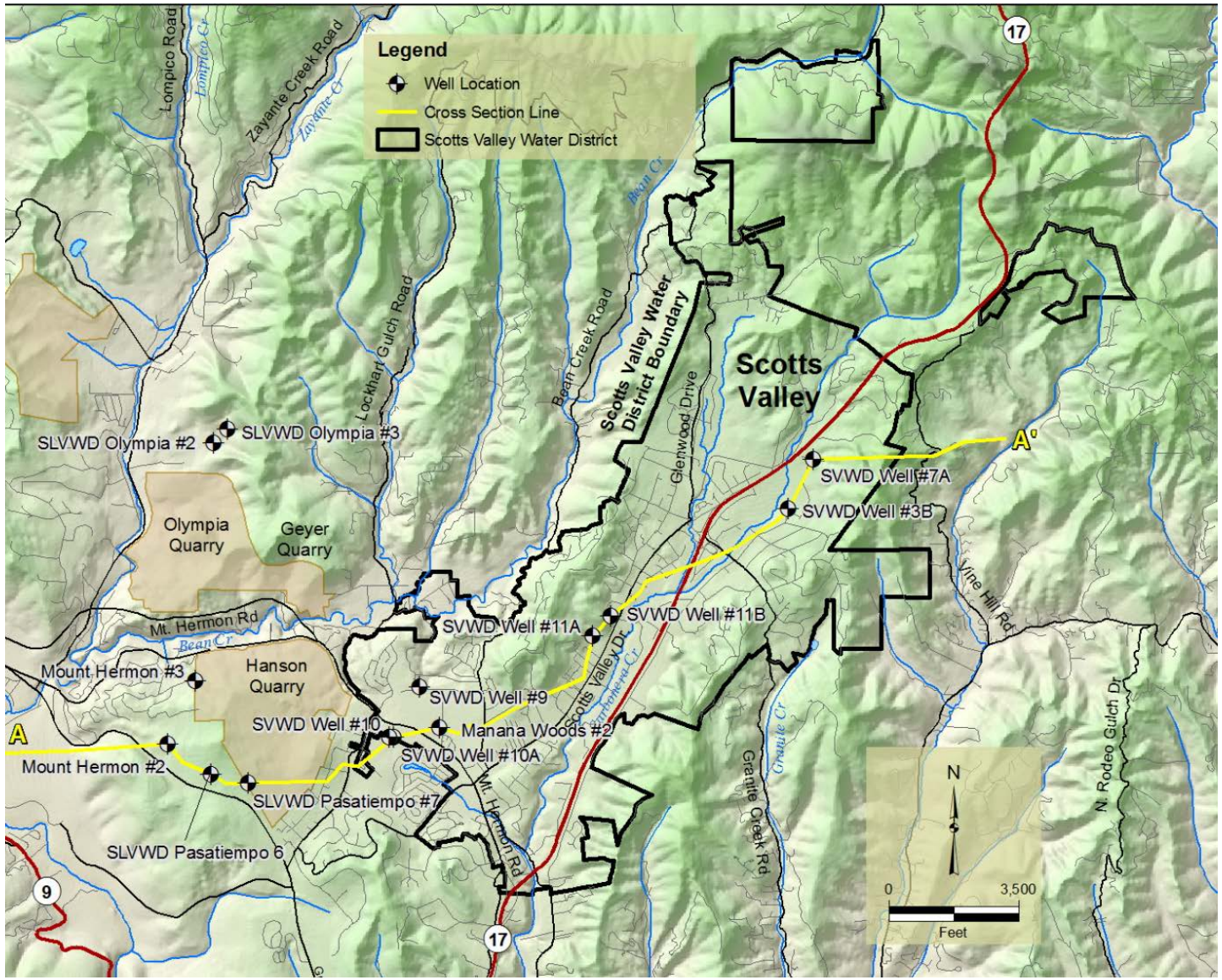
Groundwater pumping is concentrated in the Scotts Valley area



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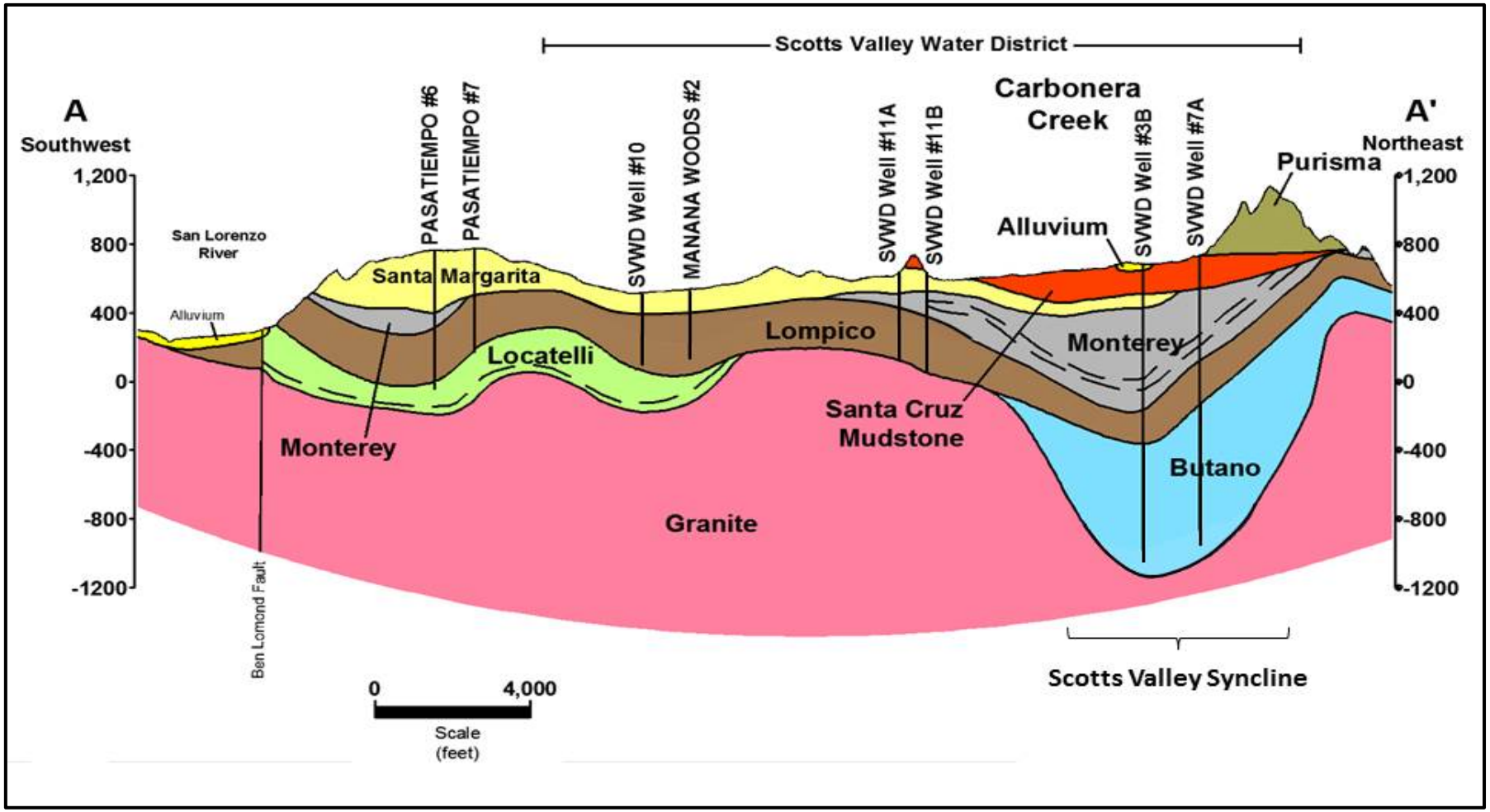
The Basin is underlain by complexly folded sandstones and shales



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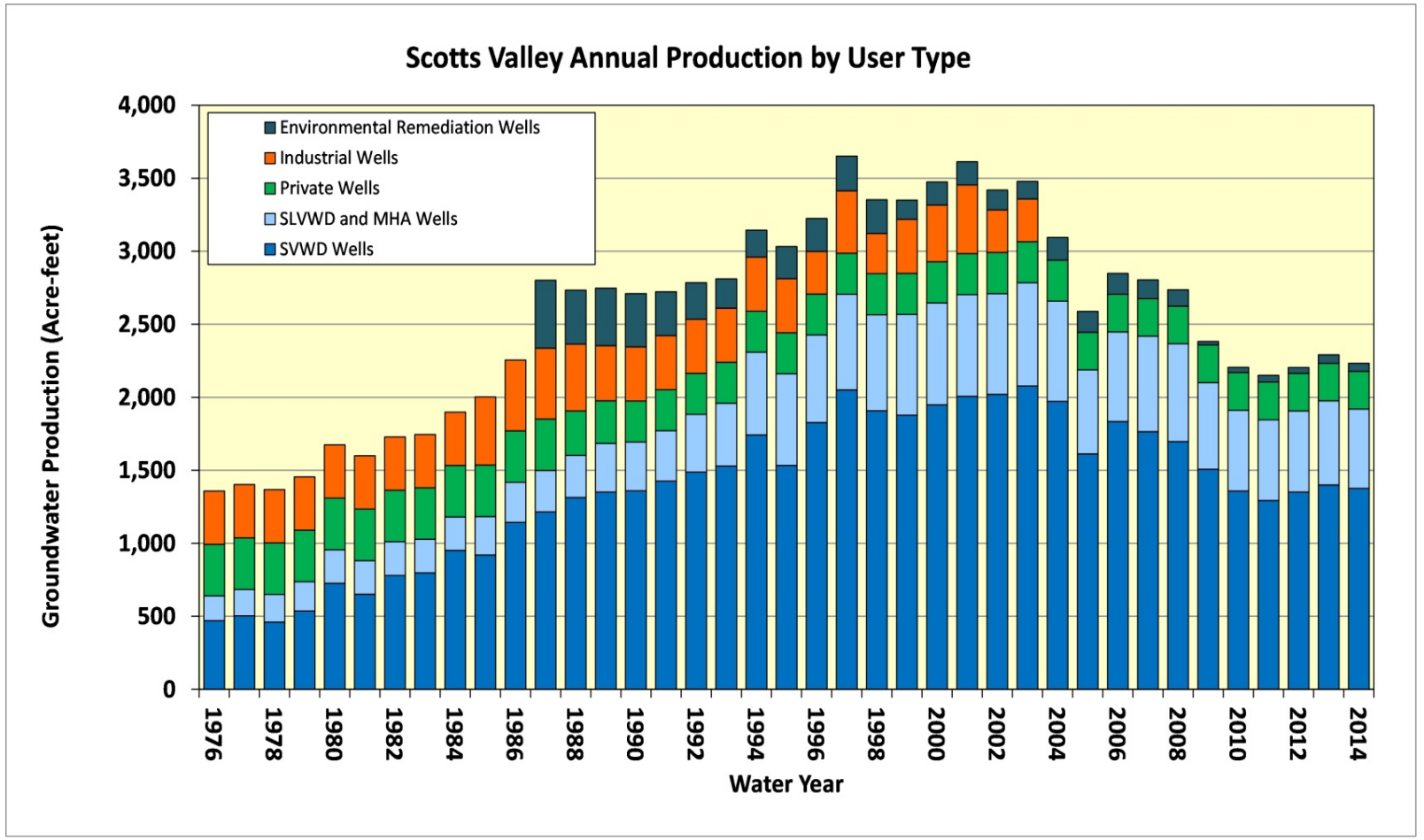
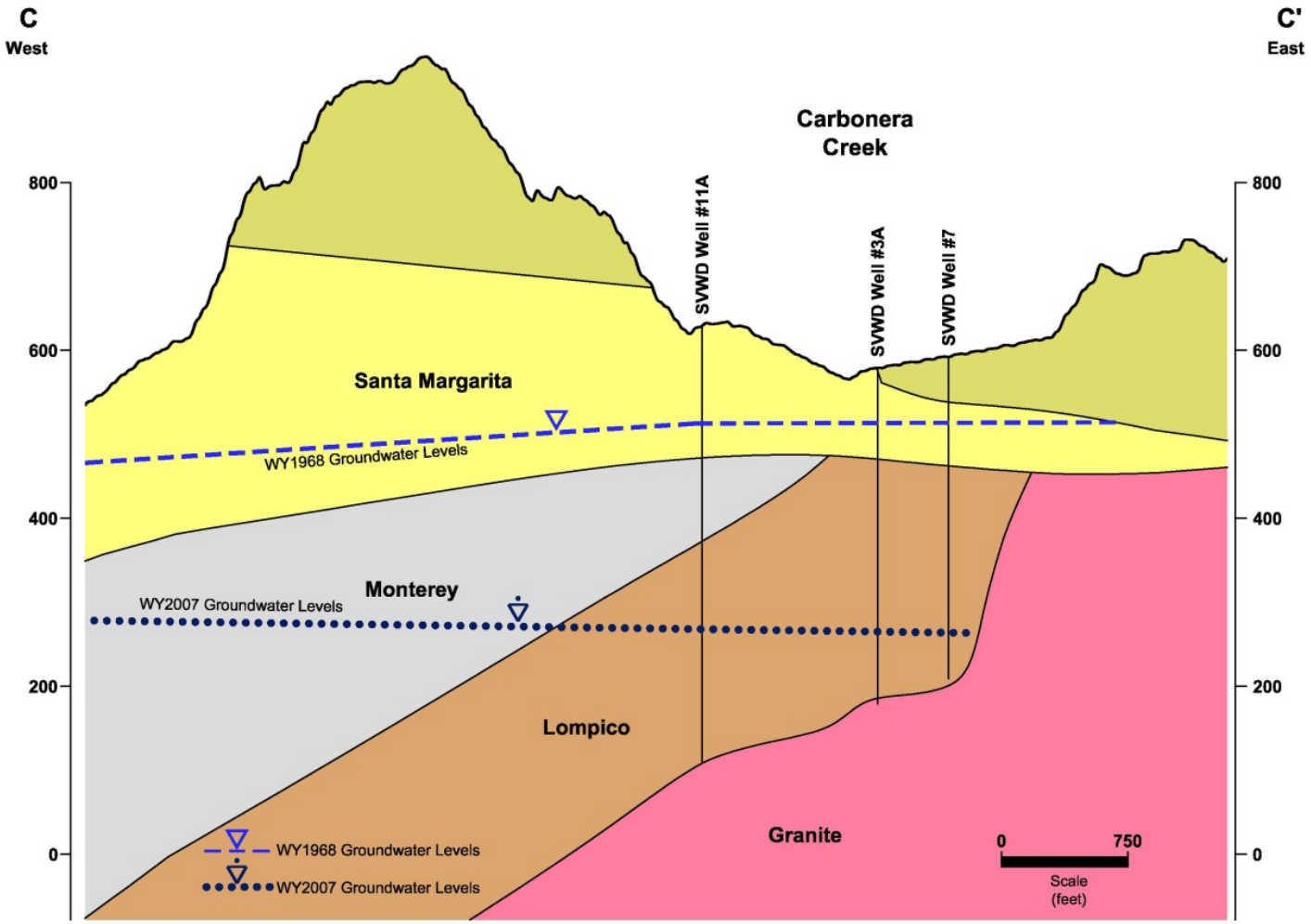
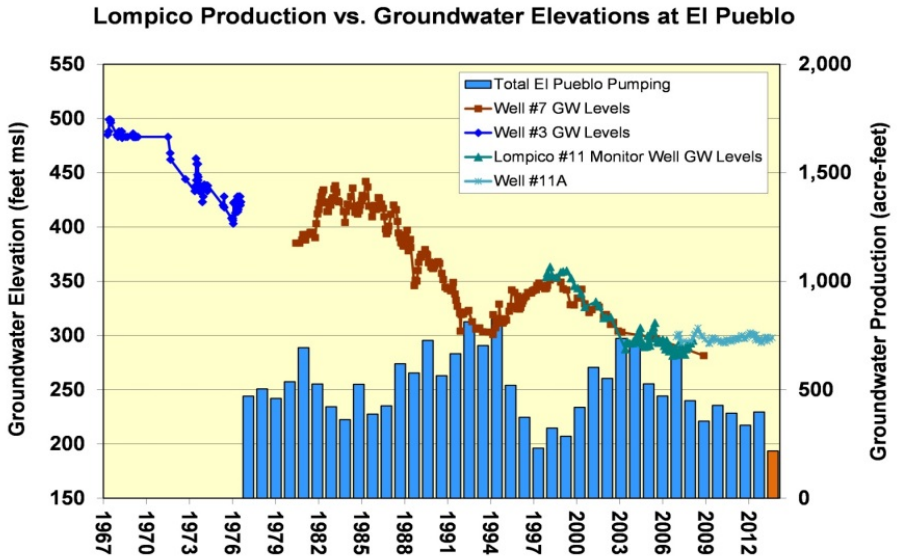
Groundwater pumping is done my many different types of users



	Regional Historic	Regional – 2014	SVWD - 2014
Santa Margarita	894 (1987)	72	0
Monterey	587 (1984)	69	23
Lompico	2,705 (2003)	1,752	989
Butano	738 (1997)	368	365

Historic drawdown of groundwater result of Pumping, Climate and Geology





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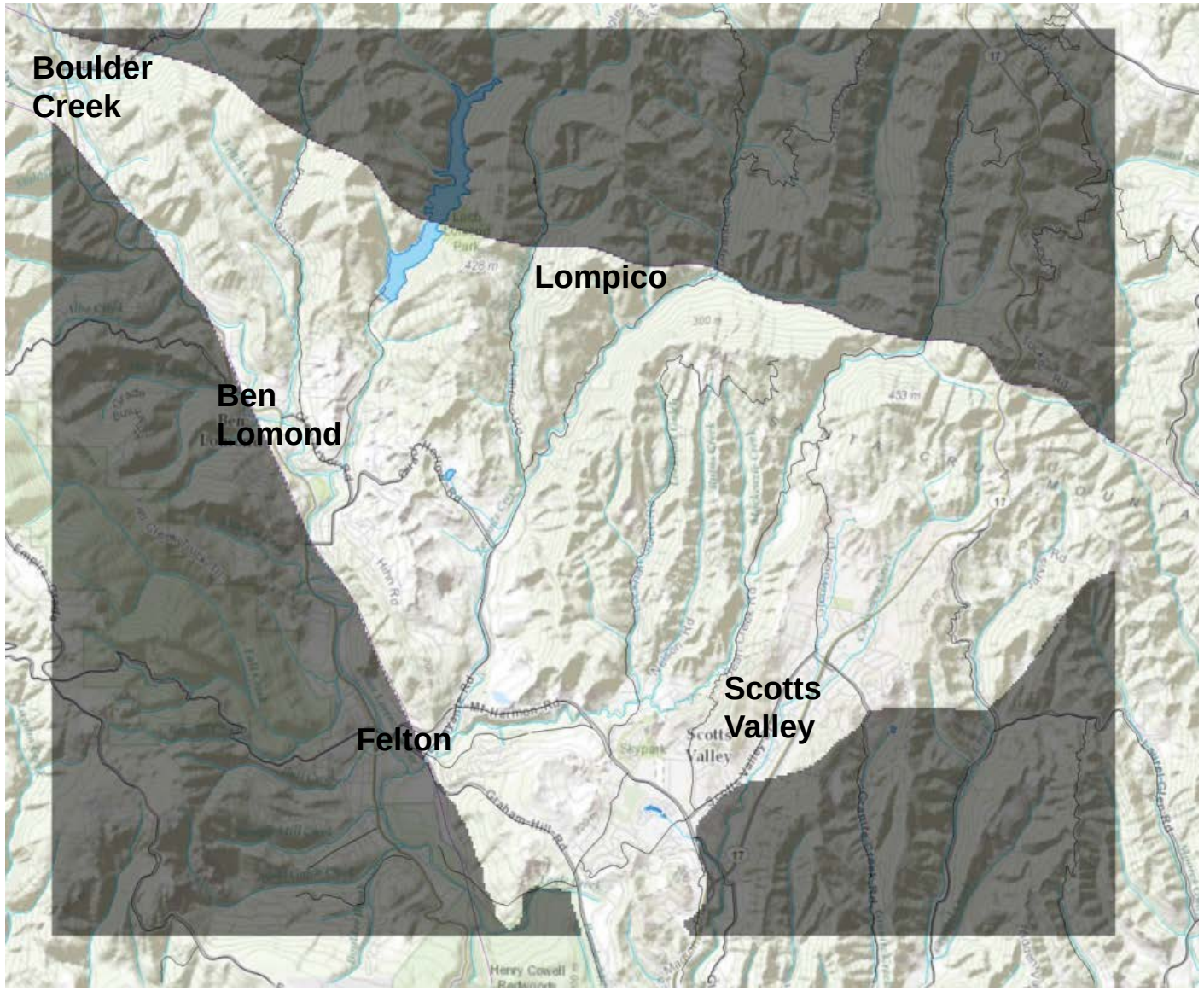
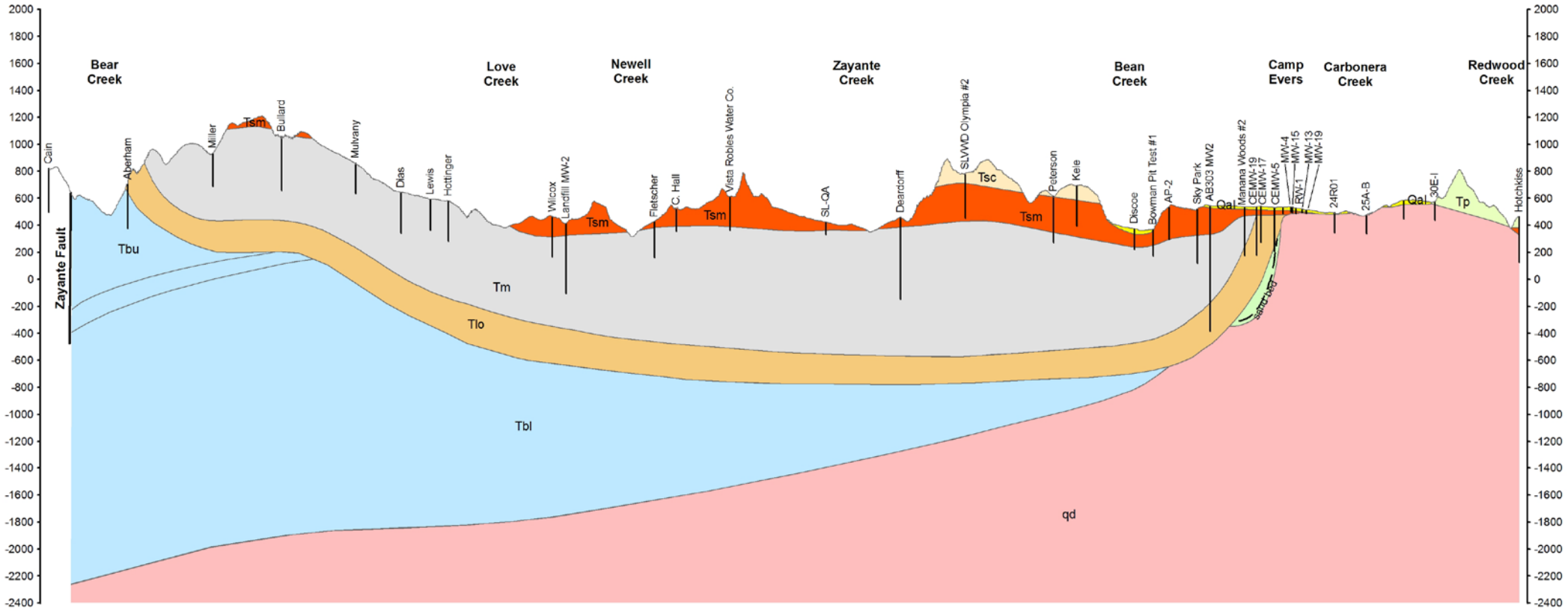
Recent Groundwater Model Update

Santa Margarita Groundwater Model



- Update the model with new geology data
- Update groundwater elevation, streamflow and other hydrologic 2006 - 2012 data
- Update model calibration with groundwater elevations and streamflows
- Run model scenarios of potential future conditions and aquifer recharge projects

The Basin Geology is Complex



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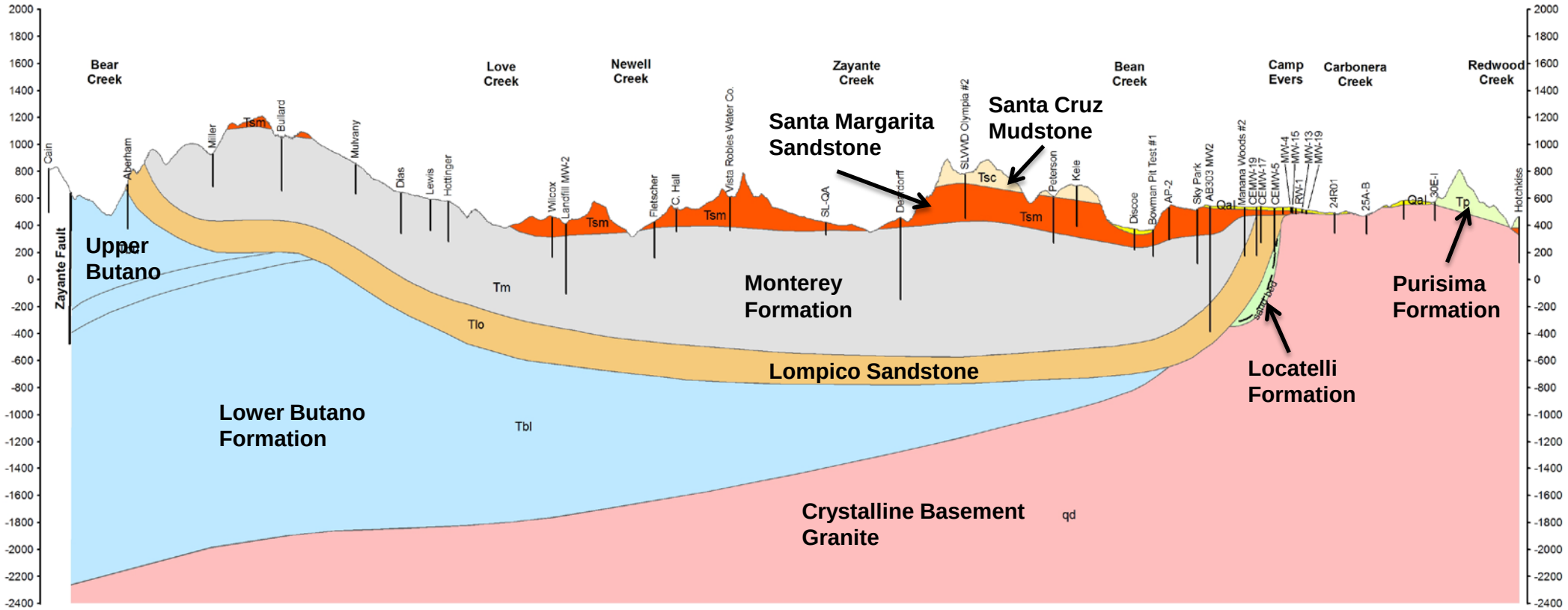
Key Units in the Santa Margarita Groundwater Basin



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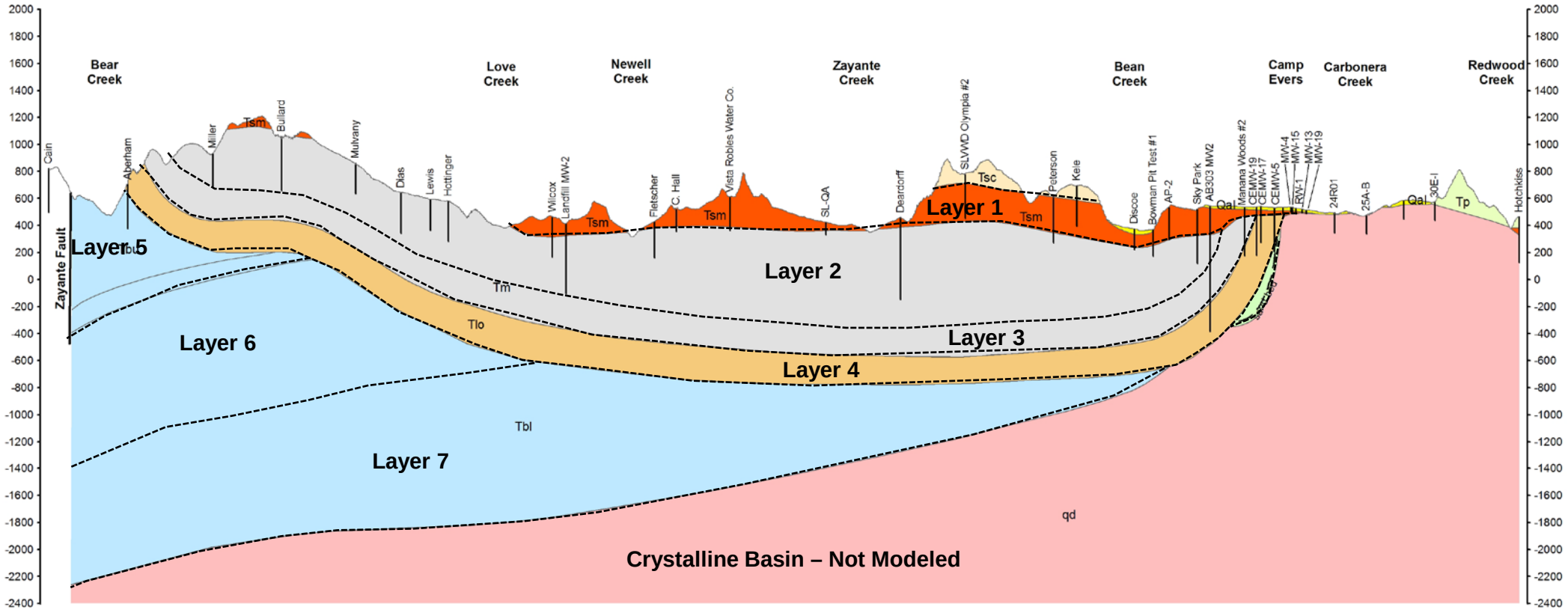
Model uses 7 layers to represent Basin geology



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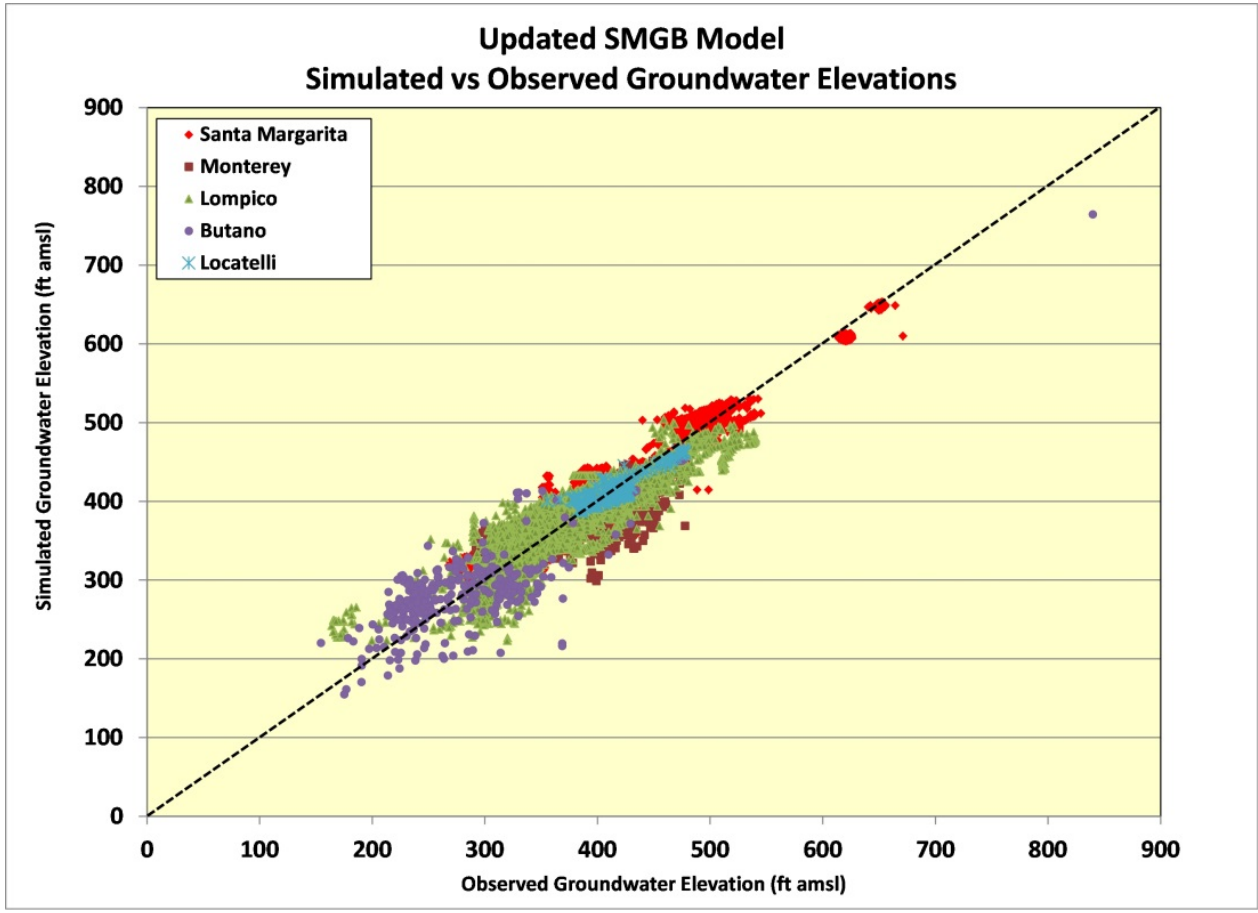
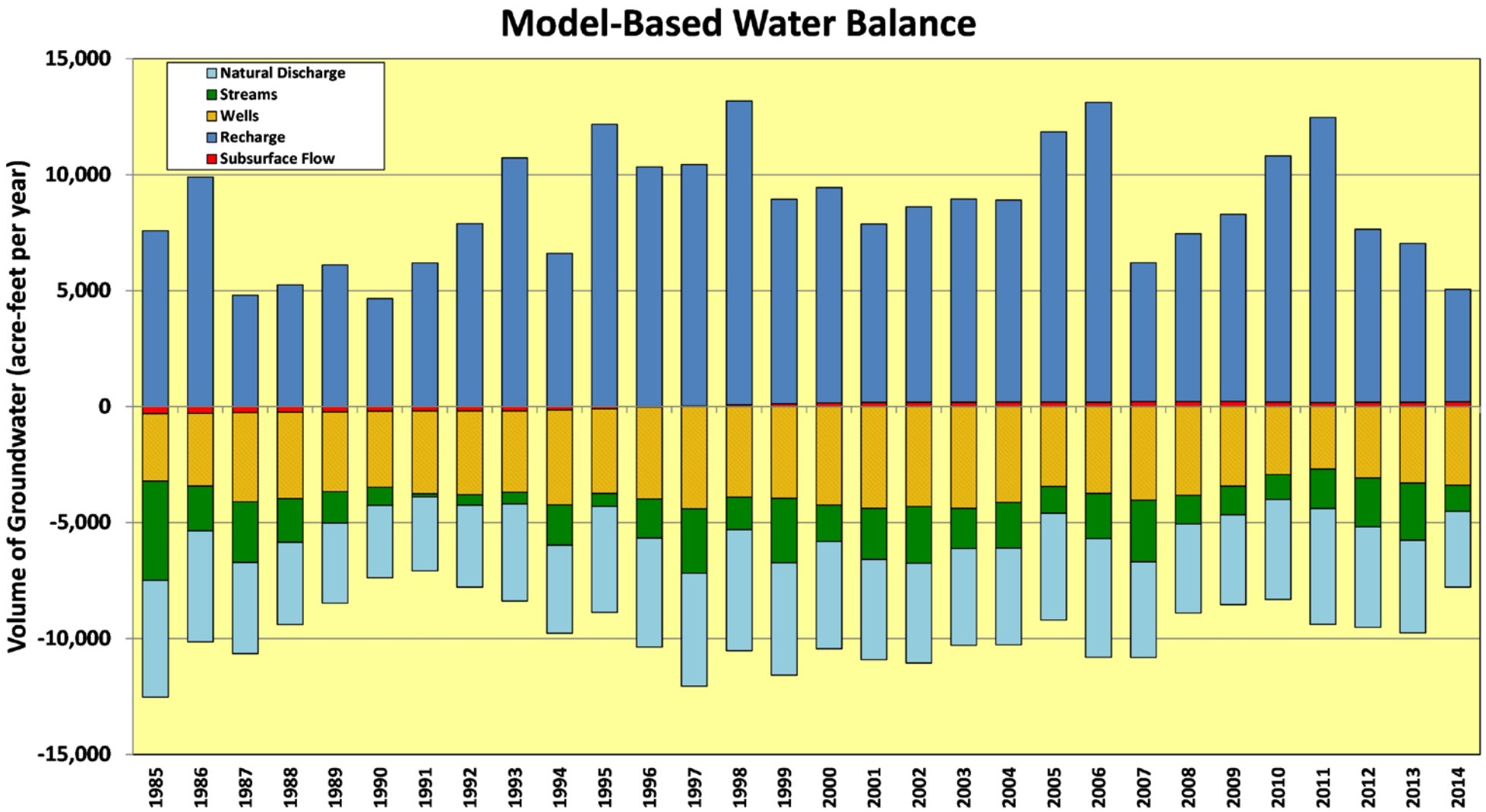
Model calibrated to available groundwater elevation data

- Model has been updated
  - Latest interpretations and data
  - New modeling methods improve simulations including resaturation
- Model calibration to groundwater levels improved by about 30% to 35%



Entire Model	Updated	Original	Difference
Residual Mean	0.72	-5.09	86%
Absolute Residual Mean	13.32	19.33	31%
Residual Std. Deviation	19.41	28.51	32%
RMS Error	19.42	28.96	33%
Scaled Absolute Residual Mean	0.0194	0.0282	31%
Correlation Coefficient	96%	92%	5%
Number of Observations	16344	16344	0%
Range in Observations	685.45	685.45	0%

Water balance provides summary of Basin inflows and outflows



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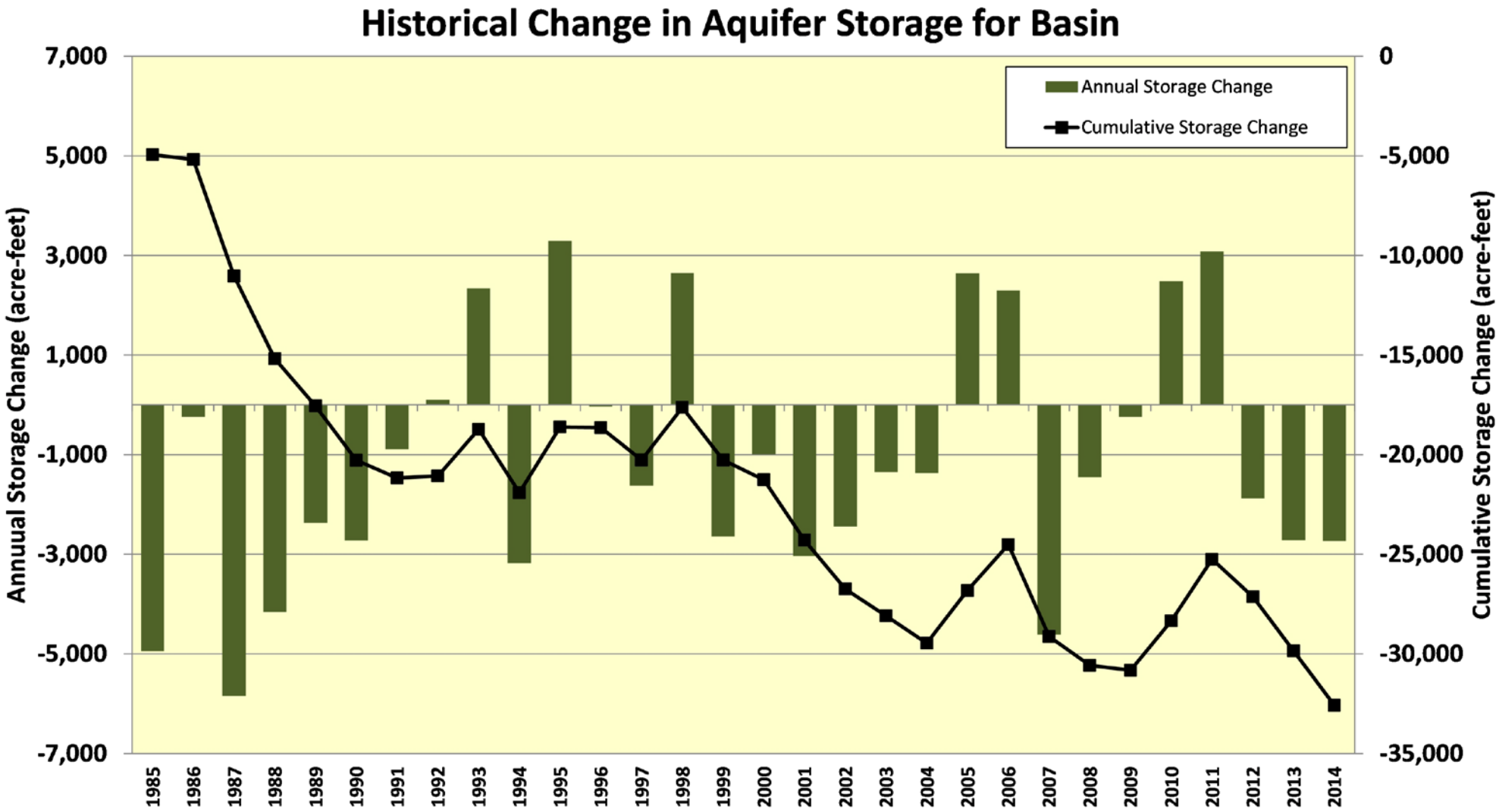
Model used to evaluate change in aquifer storage over time



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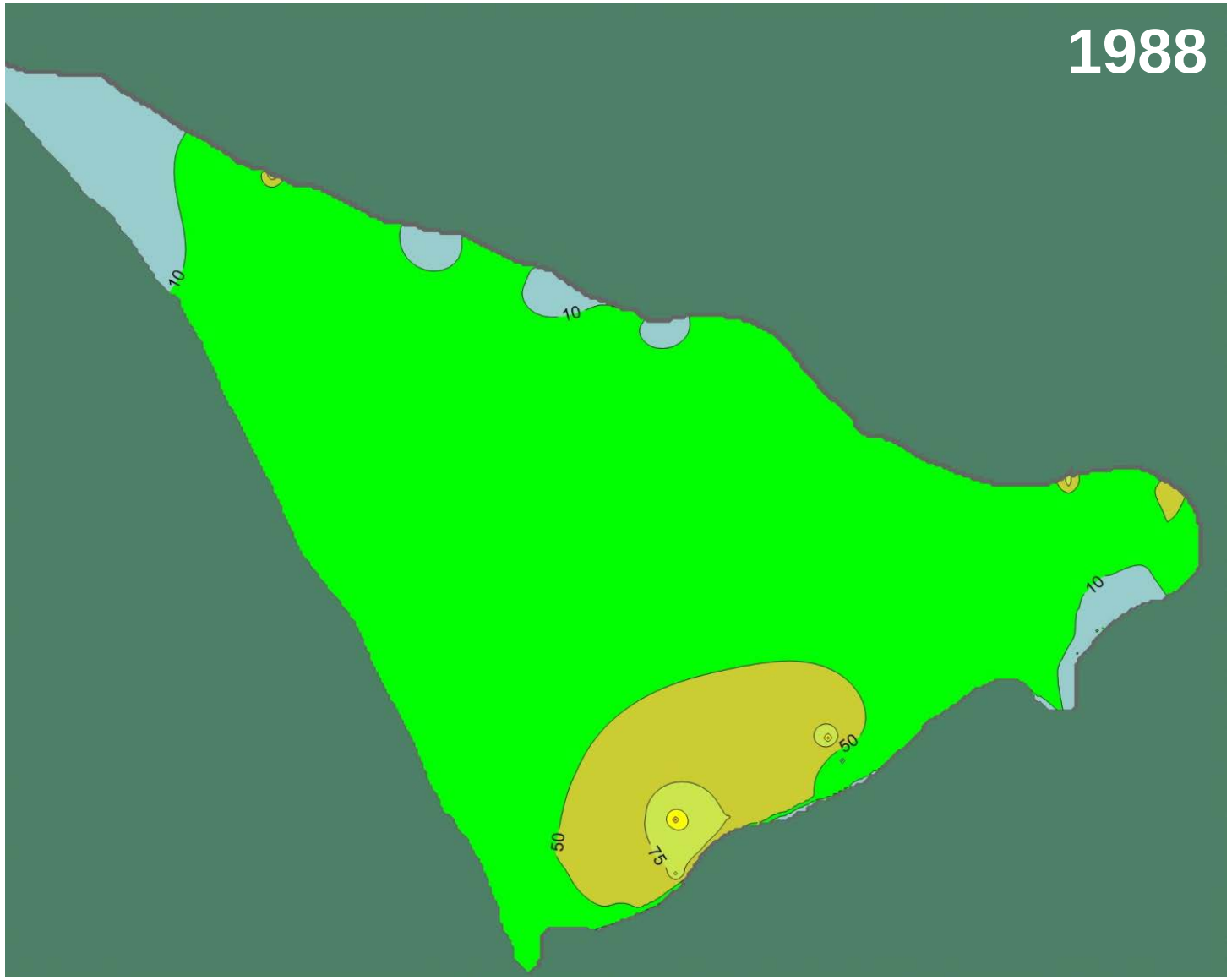
Estimate of Sustainable Pumping Using Existing Well Locations

- SMGB Sustainable Pumping
  - SMGB - 3,410 AFY
  - by Aquifer
    - Santa Margarita – 1,030 AFY
    - Monterey Aquifer – 170 AFY
    - Lompico Aquifer – 1,890 AFY
    - Butano Aquifer – 320 AFY
- Potential to maximize yield
  - Optimize pumping sites to limit “adverse affects”
  - Increase groundwater recharge
- Urbanization resulted in 15% decrease in Basin recharge

Time series of change in groundwater levels in Lompico over time



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Time series of change in groundwater levels in Lompico over time

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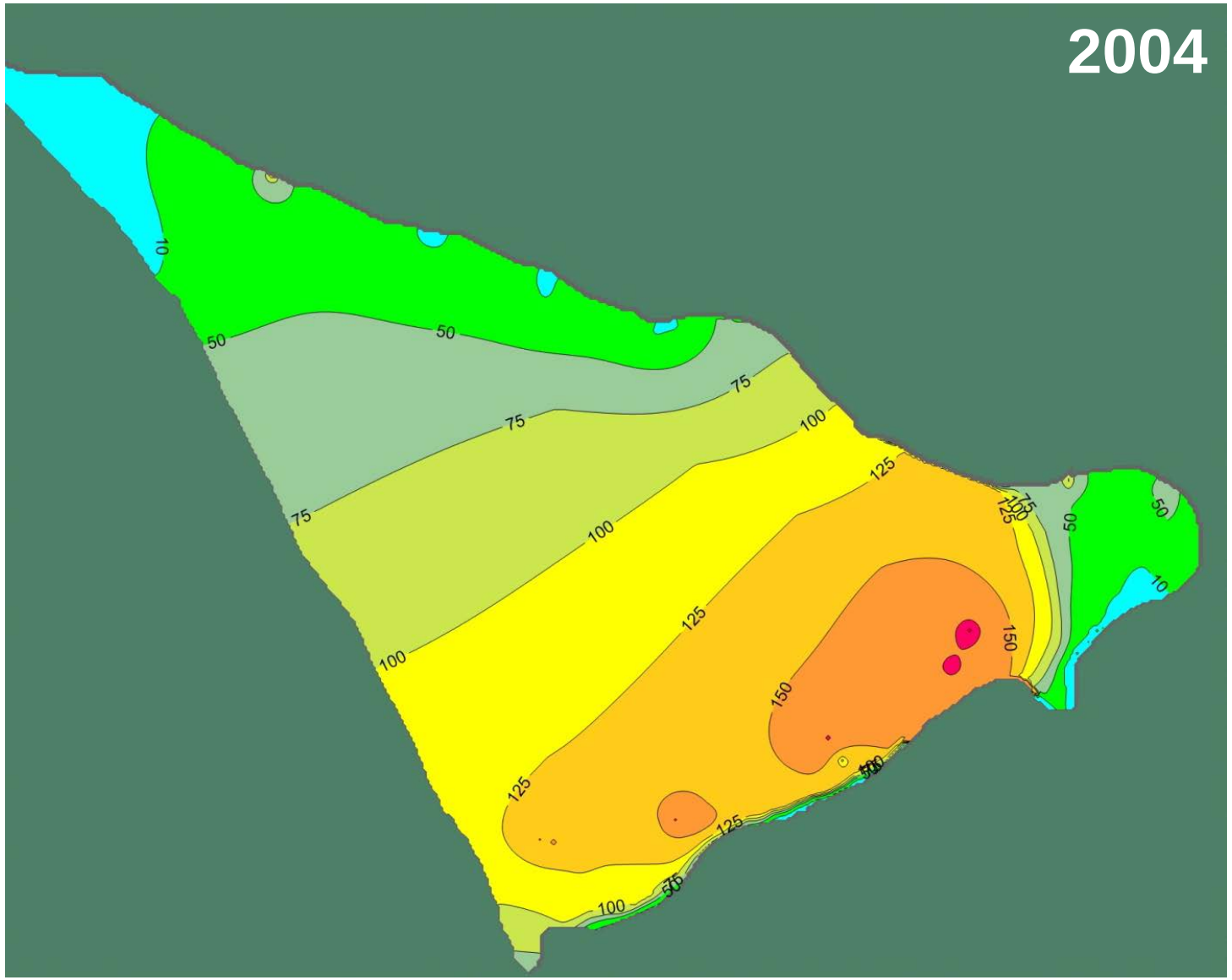
Time series of change in groundwater levels in Lompico over time



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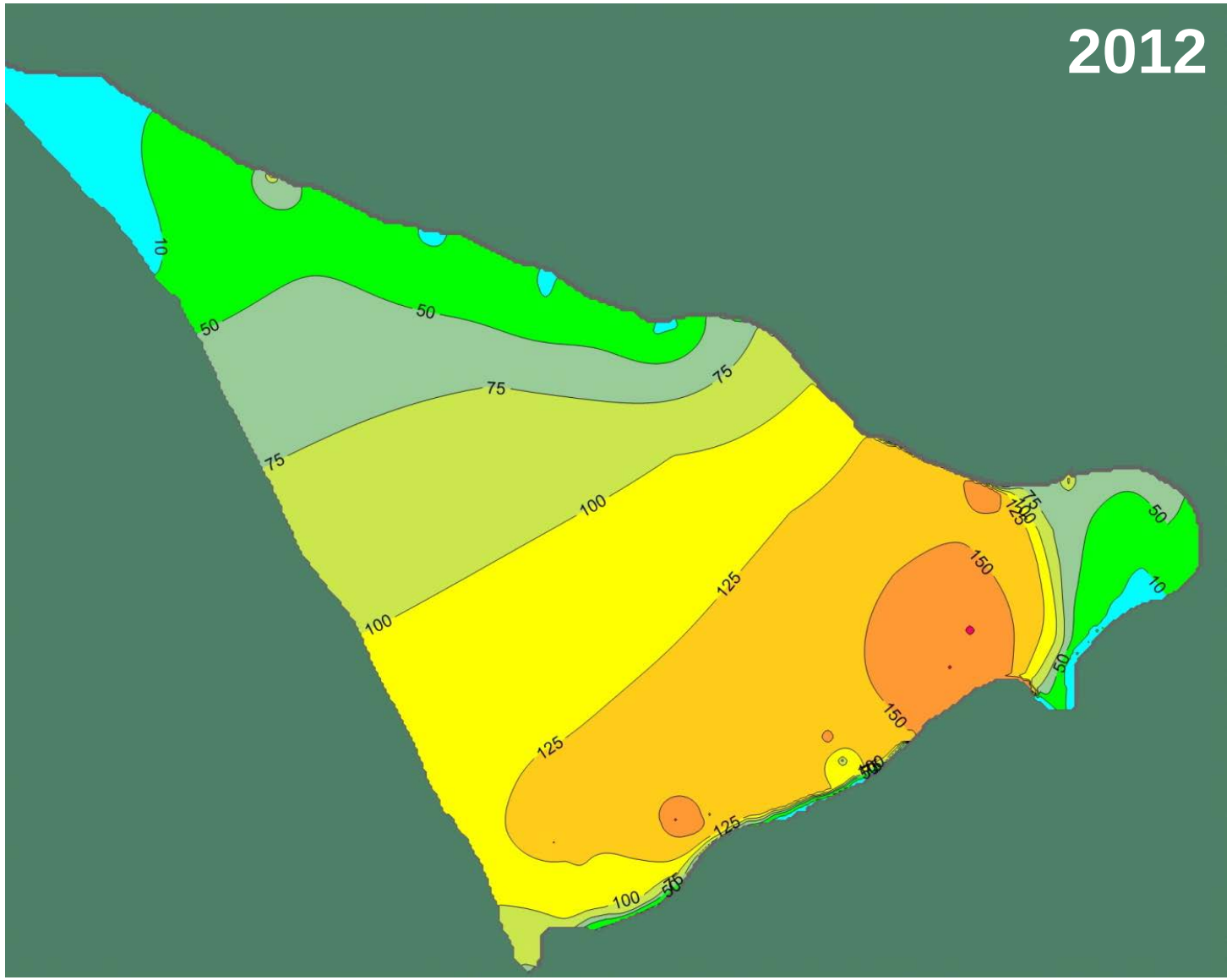
Time series of change in groundwater levels in Lompico over time



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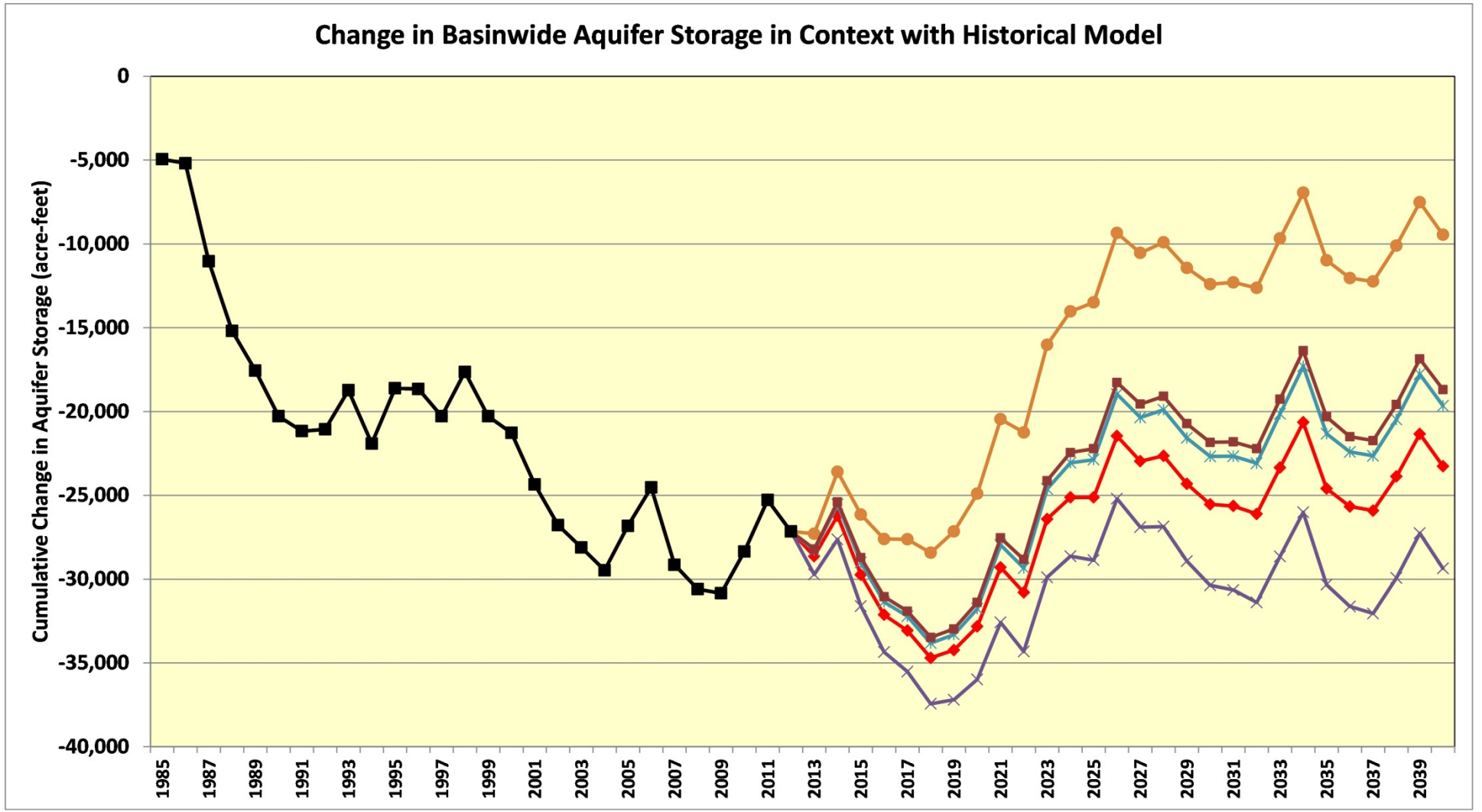
Modeling Applications

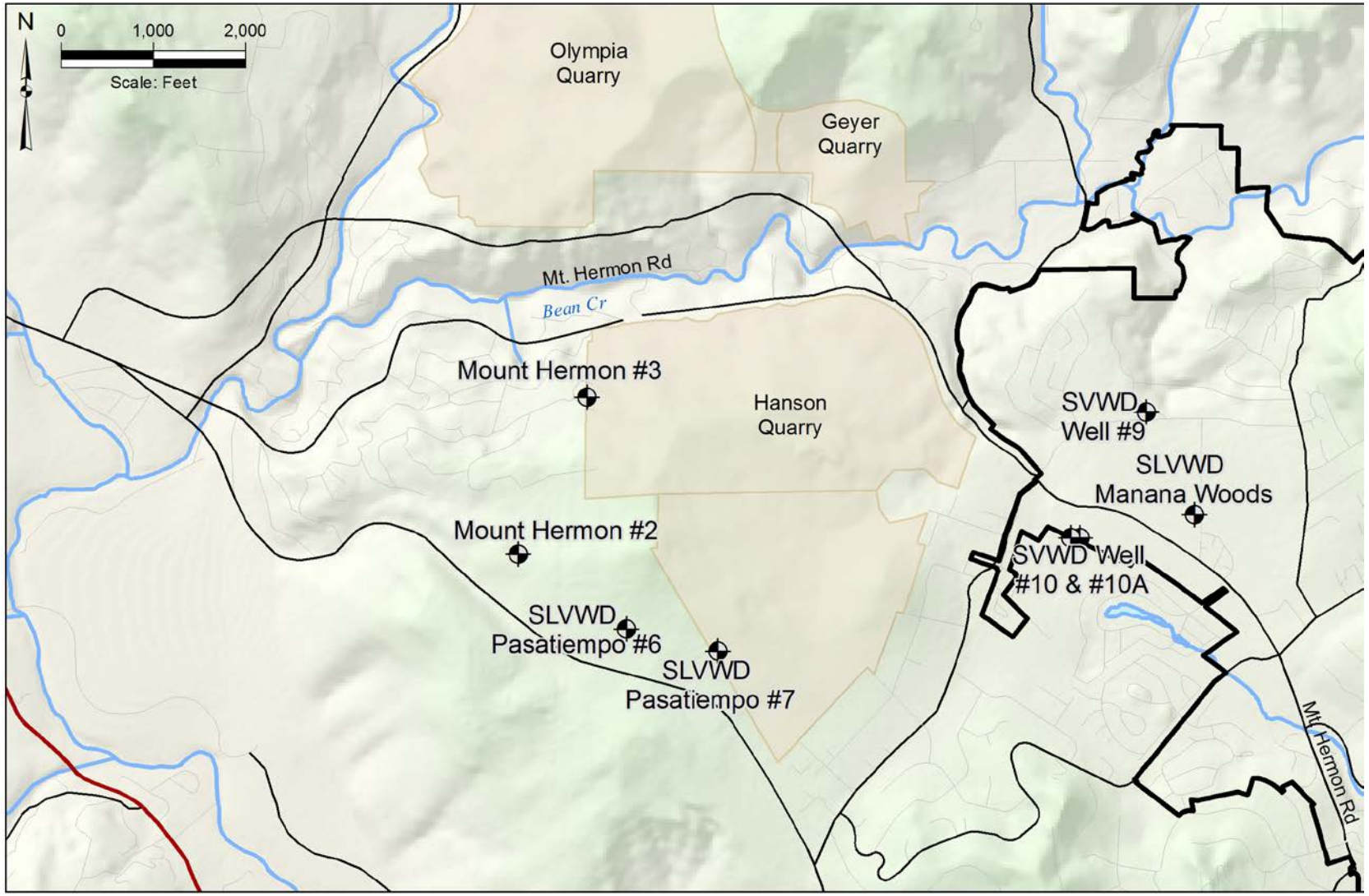
Initial scenarios to evaluate groundwater management and recharge

- Base Case
  - Assume Recent Pumping Volumes Remain Constant
  - Assume natural hydrology repeats of 1985-2012
- Groundwater Management #1
  - Future Water Demand Met by Groundwater Pumping
- Groundwater Management #2
  - Use Projected Future Water Demand Projections
- Enhanced Recharge #1
  - Assume 1,000 AFY injection into Lompico at Hanson Quarry
- Enhanced Recharge #2
  - Estimate Potential LID Recharge Projects

Results of initial groundwater management and recharge scenarios



Hanson Quarry is near water supply wells for SVWD, SLVWD and MHA.



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Hanson Quarry provide location for direct recharge to the Lompico Aquifer

- Existing Drinking Water Well
- Proposed Purified Water Injection Well

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Travel times to water supply wells are on the order of several years

Existing Drinking Water Well

Proposed Purified Water Injection Well

Extent of 5-year Underground Retention Time

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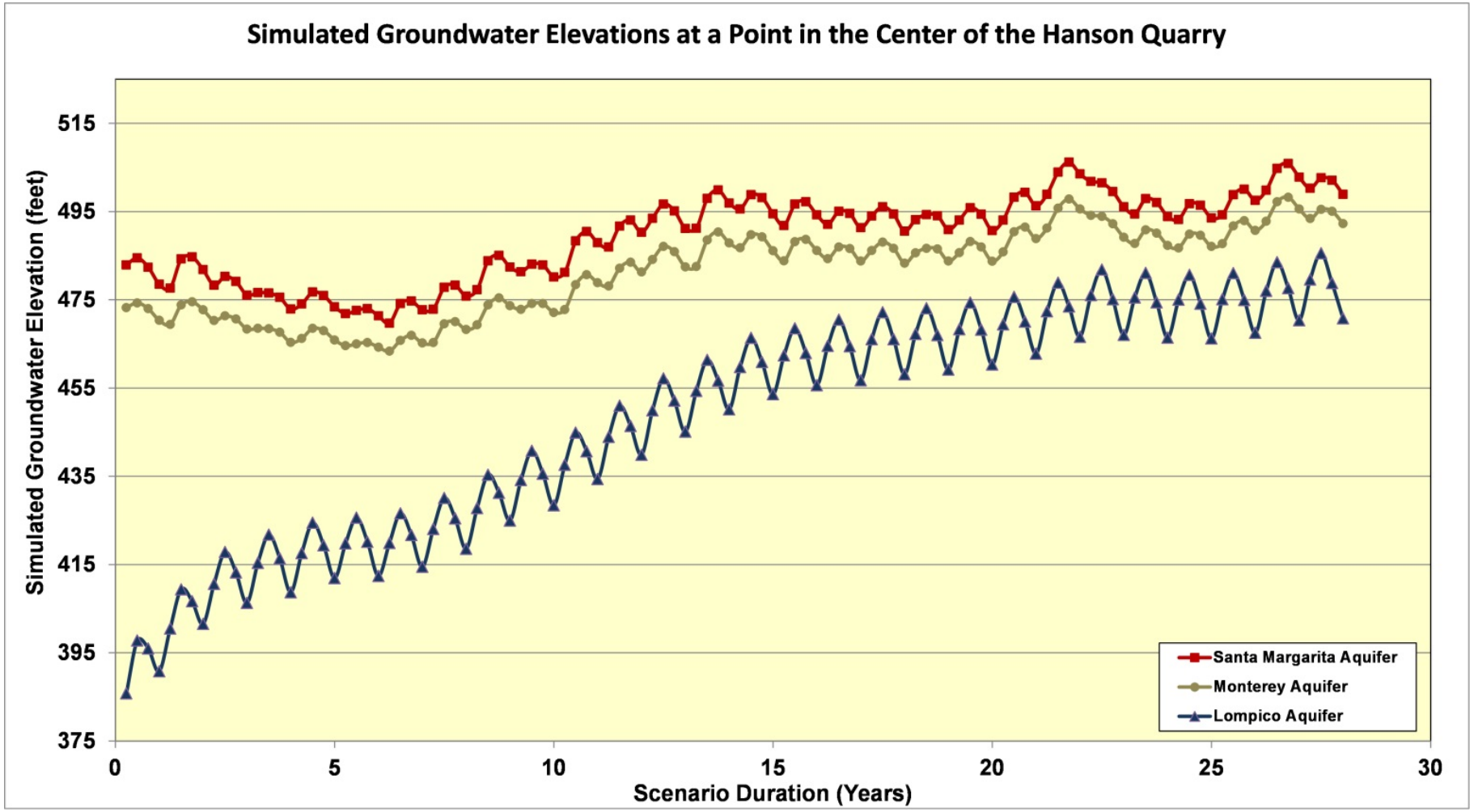
Active recharge produces significant increases in groundwater levels over time



Lowest Surface Elevation in Hanson Quarry - 554 feet

Elevation of SM/Lompico Contact - 480 feet

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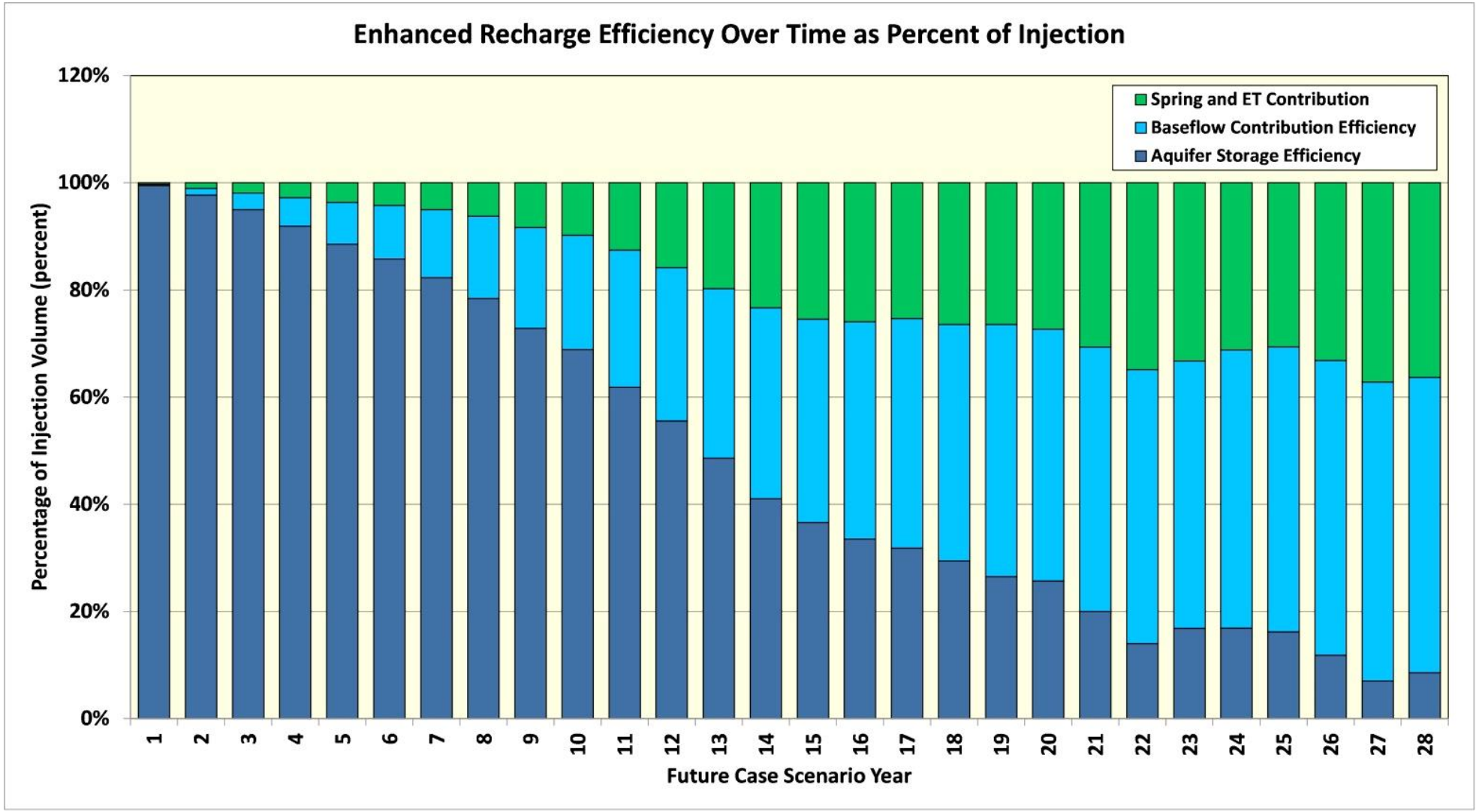
Over 28 year period, ~8,000 AF would go to groundwater storage and ~8,000 AF would go to environmental benefits for streams, springs and riparian habitat



Summary

- Santa Margarita Model has been updated
  - Latest interpretations and data
  - New modeling methods improve simulations including resaturation
- Model calibration has been improved
  - Groundwater levels
  - Streamflows
- Model applications
  - Evaluate groundwater management options
  - Planned measures help to stabilize aquifer storage
  - Provide assessment for potential active recharge projects

Questions