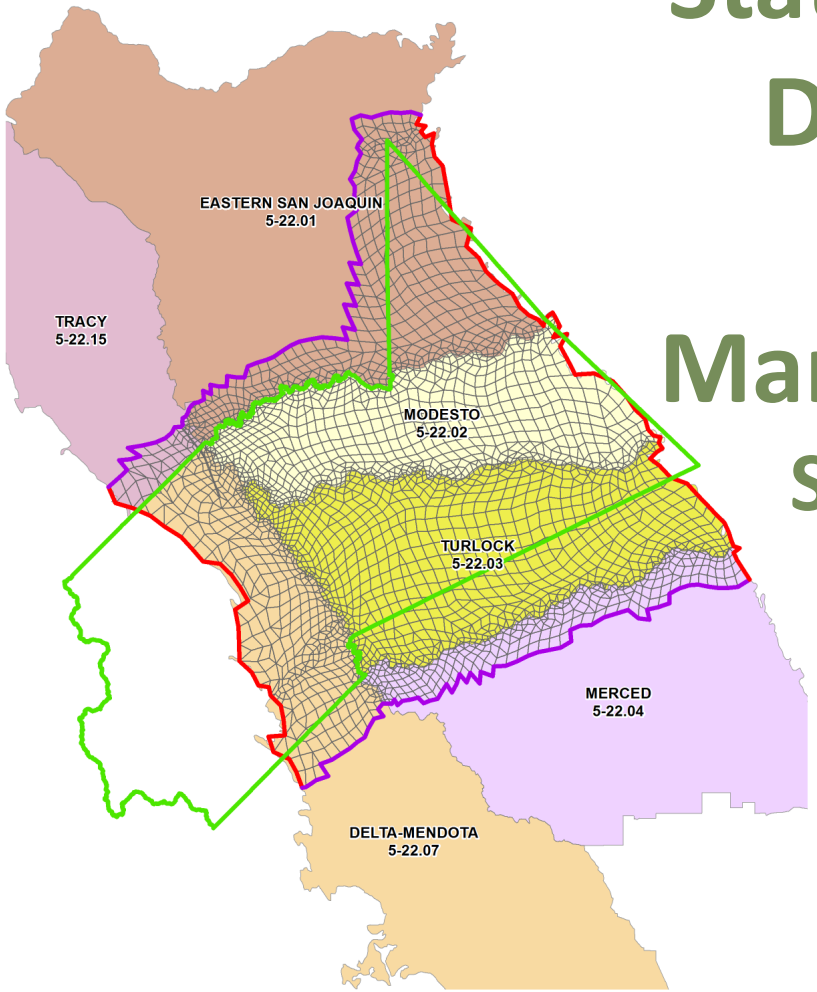
Status Report: PEIR for Discretionary Well Permitting and Management Program,

Stanislaus County, CA



JACOBSON | JAMES
& associates, inc

September 27, 2017

Acknowledgments

This workshop is part of a project that is financed under the Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Sustainable Groundwater Planning Grant Program), administered by State of California, Department of Water Resources

Local Contributors Include:			
Stanislaus County	City of Patterson	Oakdale ID	Rock Creek WD
City of Modesto	City of Newman	Eastside WD	Trinitas Farming
City of Turlock	City of Waterford	Del Puerto WD	MCCV
City of Ceres	City of Hughson	West Stanislaus ID	Agricultural Preservation Alliance, Inc.
City of Riverbank	Turlock ID	Central Calif. ID	
City of Oakdale	Modesto ID	Patterson ID	

Agenda

- ✓ **Information Available**
- ✓ **Stanislaus County Hydrologic Model Approach and Status**
- ✓ **Program Environmental Impact Report Status**
- ✓ **Questions**

Information Available

- ✓ **References, presentations and other files were recently migrated to a cloud-based share site and are currently available at the following link:**

  http://files.jacobsonjames.com/

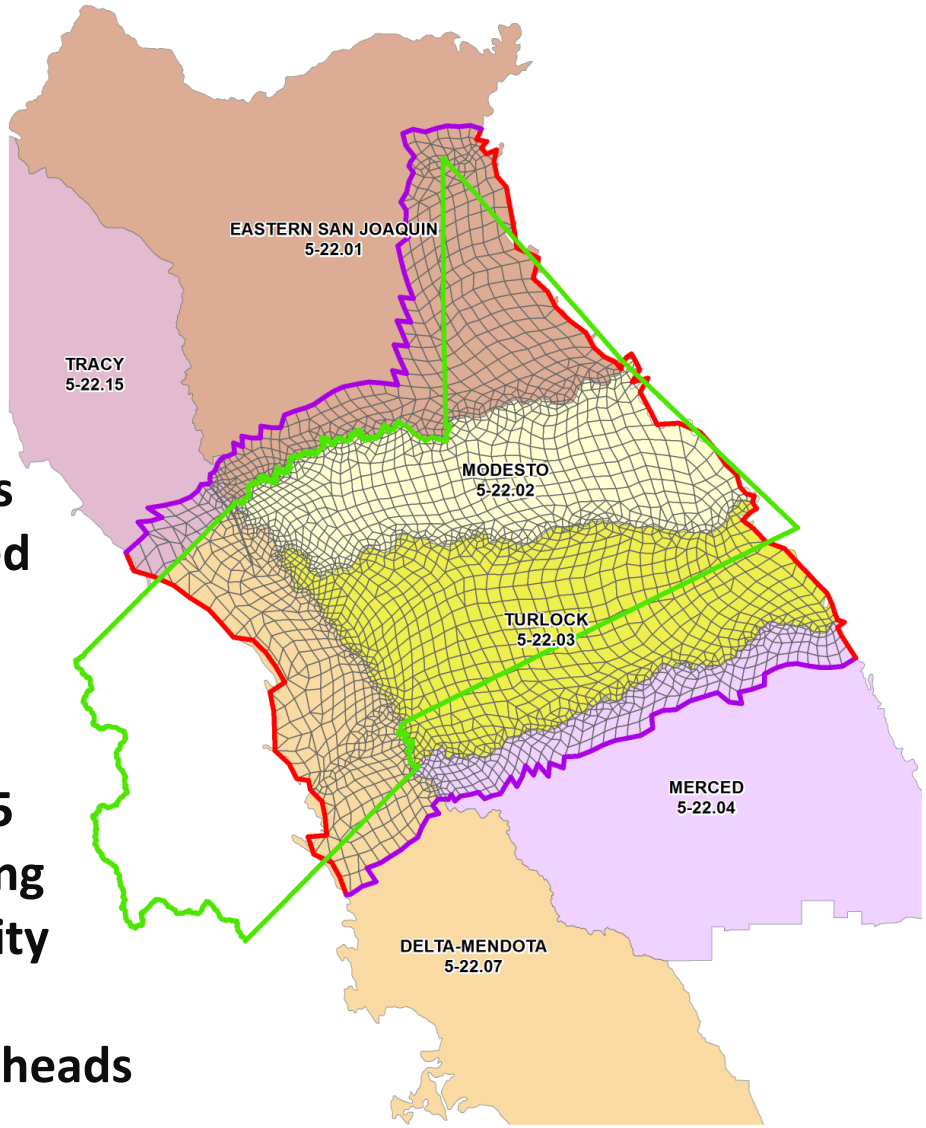
  User Name: StanCoL

  Password: LibraryJJA9083!

- ✓ **Site will be updated periodically, and additions posted in the "New" folder**
- ✓ **An indexed file that is searchable using the DocFetcher app is provided as a zip download**

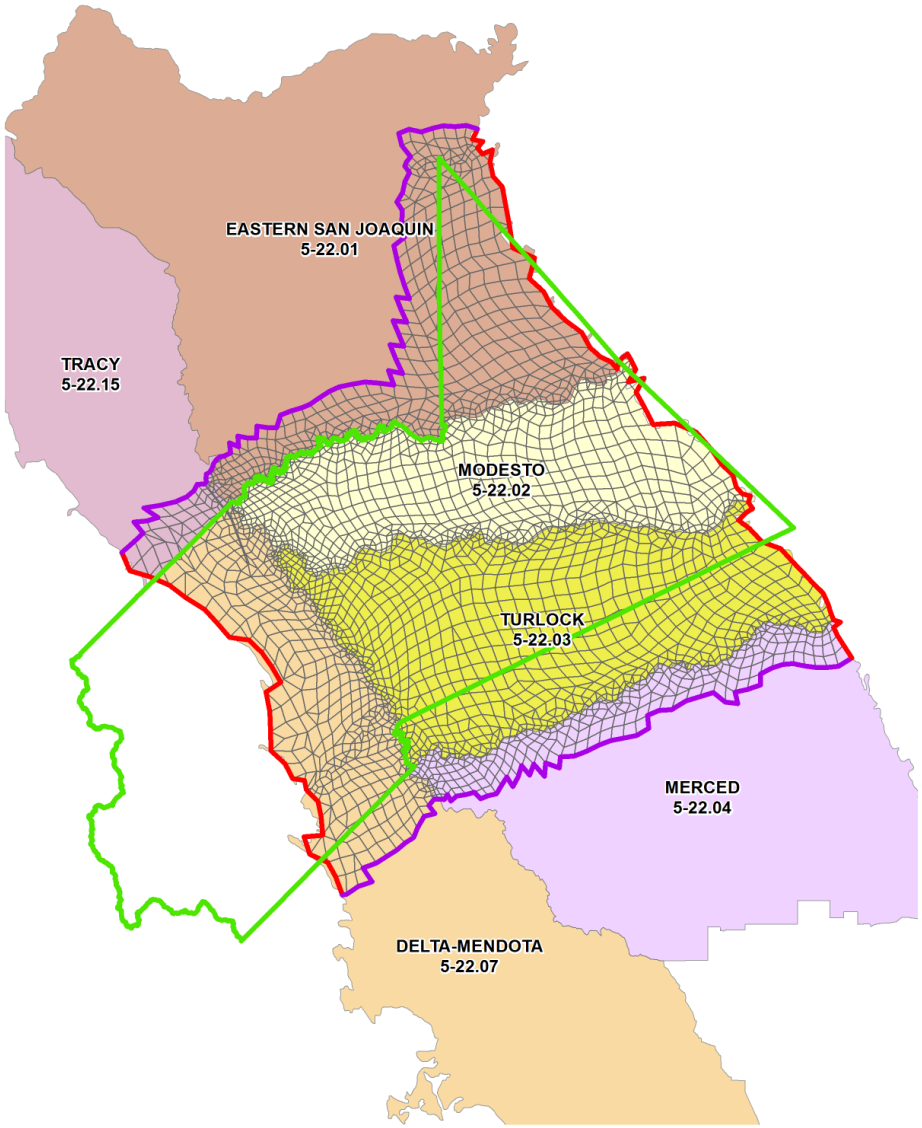
Basic Model Construction

- ✓ **Base model extracted from C2VSim-FG R374g, developed with IWFM 3.02**
- ✓ **Major modifications:**
  - **108 Water Budget Subregions**
  - **Scaled diversions and updated through 2015**
  - **Precipitation through 2015**
  - **Adjusted small watersheds**
  - **Updated crops WY 1990-2015**
  - **Added M&I wells and pumping**
  - **Updated hydraulic conductivity**
  - **Added reservoir leakage**
  - **Added time-series boundary heads**



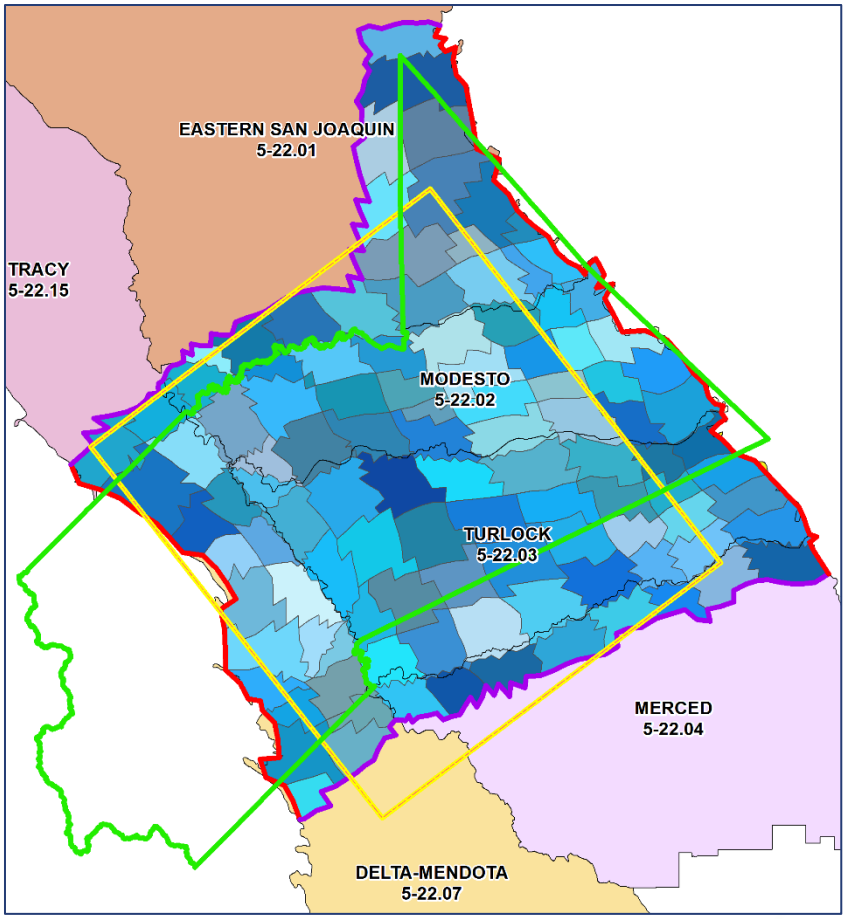
Basic Model Construction

- ✓ **SCHM Layering**
  - Three layers and impedance pseudo-layer
  - Thickness of Corcoran Clay from USGS, all other thickness values from C2VSim



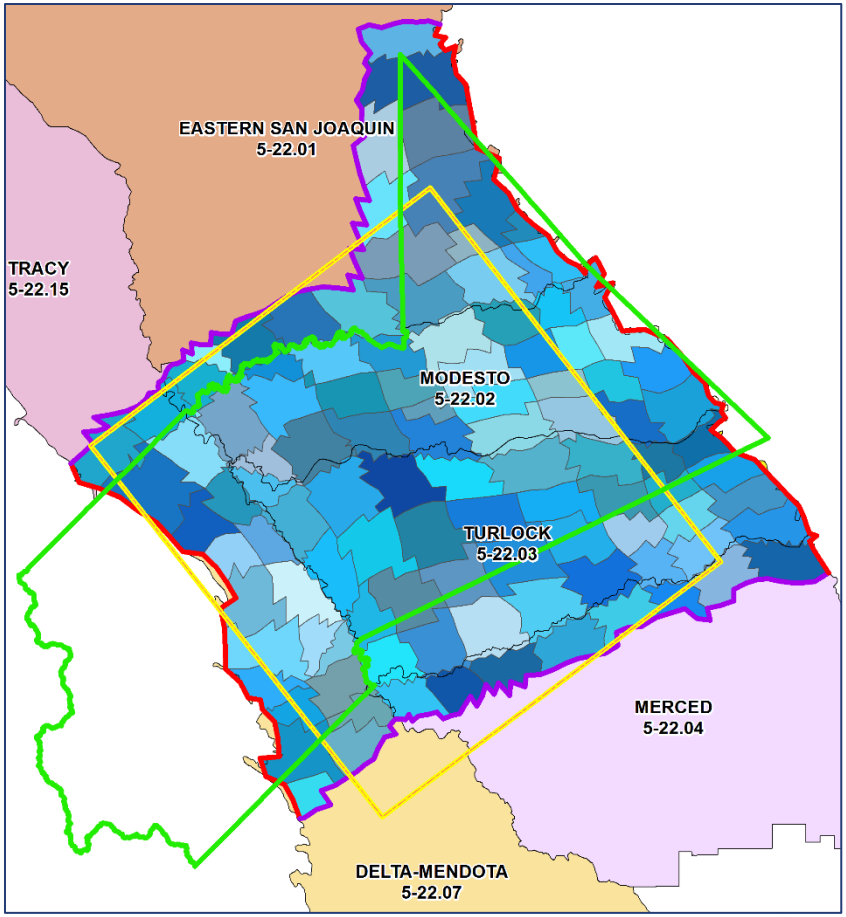
Water Budget Subregions

- ✓ **Preliminary land use data from DWR for yet to be released C2VSim 2015**
  - **Organized by CG elements**
  - **Based on county survey data, with interpolation/extrapolation for years without surveys.**
- ✓ **108 subregions set up to accommodate data**
  - **New crop categories combined into the old C2VSim categories**
  - **Crop demand and rooting depths from the old C2VSim**
- ✓ **Scaled diversions to subregions, adjusted small watersheds**



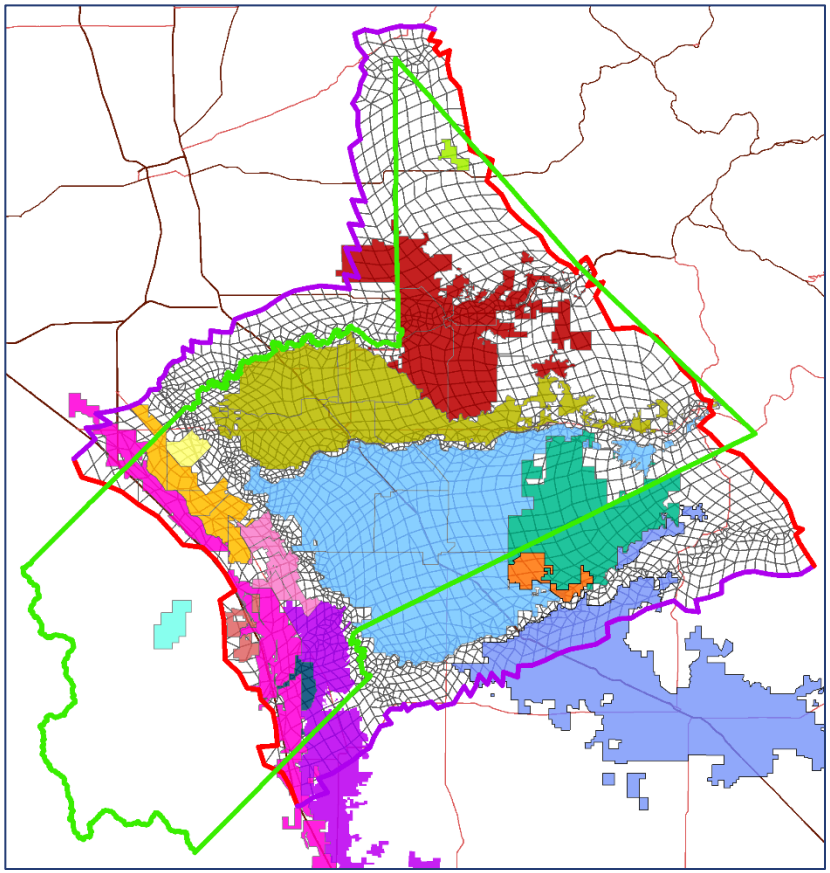
Water Budget Subregions

- ✓ **Initially scaled diversions using two-step process**
  - **Based on relative ag and urban acreages between original C2VSim subregions and trimmed-down SCHM subregions**
  - **Scaled between 108 subregions based on relative ag and urban acreages for trimmed-down SCHM subregions**
- ✓ **Adjusted small water-sheds to account for changes between C2VSim and SCHM subregions**



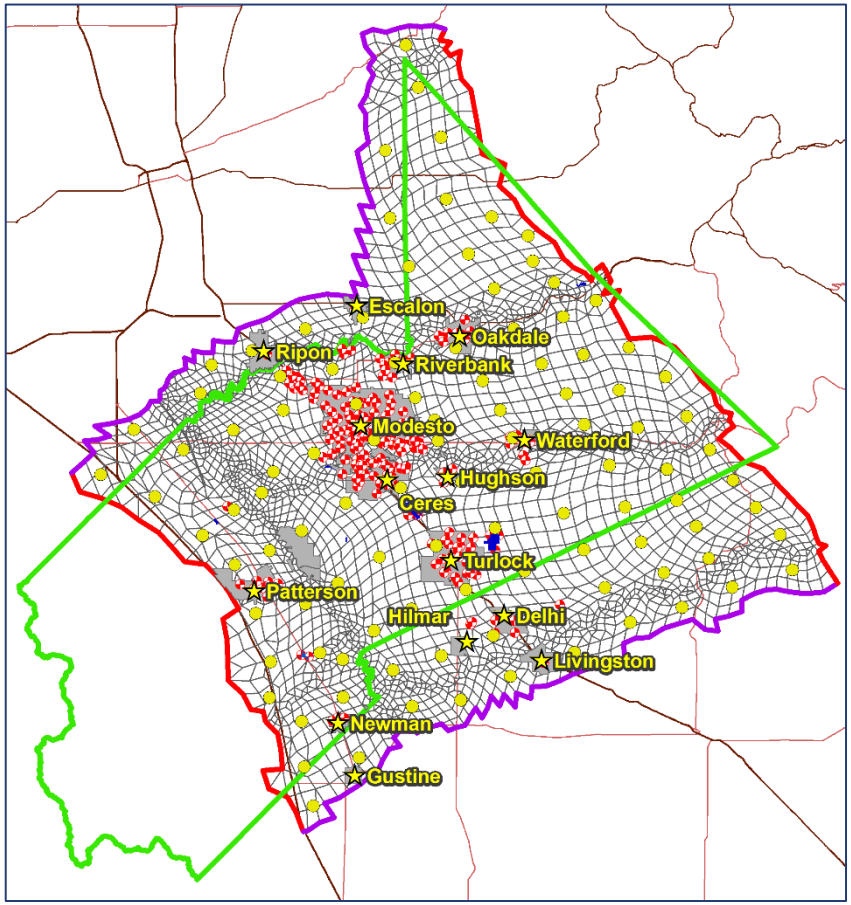
Agricultural Water Budget Adjustment

- ✓ **Compiled Data**
  - Water diversion, delivery, groundwater pumping, and cropping data
  - Data provided by districts was supplemented by AWMPs, MSRs, other plans and EWRIMS
- ✓ **Compared/Adjusted Data**
  - Compared data compiled for districts to data extracted from SCHM for district service areas
  - Adjusted diversion allocations and loss fractions to deliveries
  - Adjusted ag acreage and irrigation efficiency to match district-reported groundwater pumping



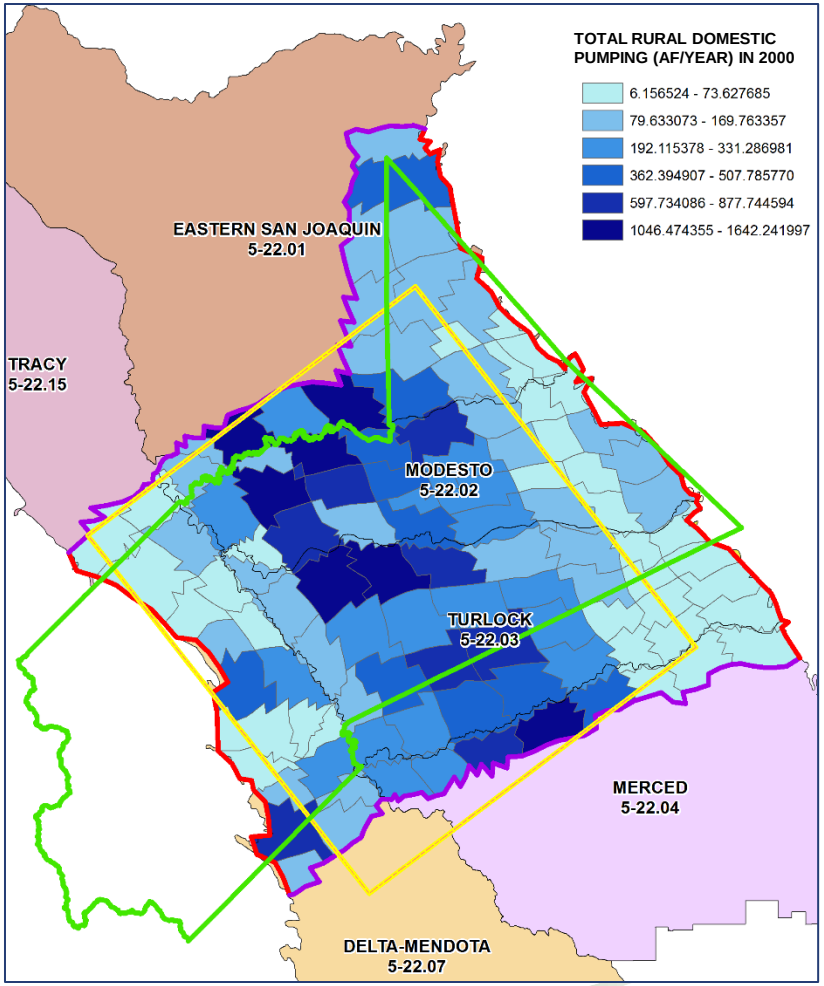
M&I Pumping

- ✓ **220 Municipal Wells**
  - Replaced 12 surrogate M&I wells in C2VSim
  - Data from Stakeholders, MSRs, UWMPs, and other plans/reports
  - Added locations, depths and screen intervals, where available
  - Added local surrogate wells where data were not available
- ✓ **Municipal Demand**
  - Data from stakeholders, UWMPs, MSRs, other plans
  - Interpolated as needed between data sources
  - Extrapolated as needed based on trends or population data



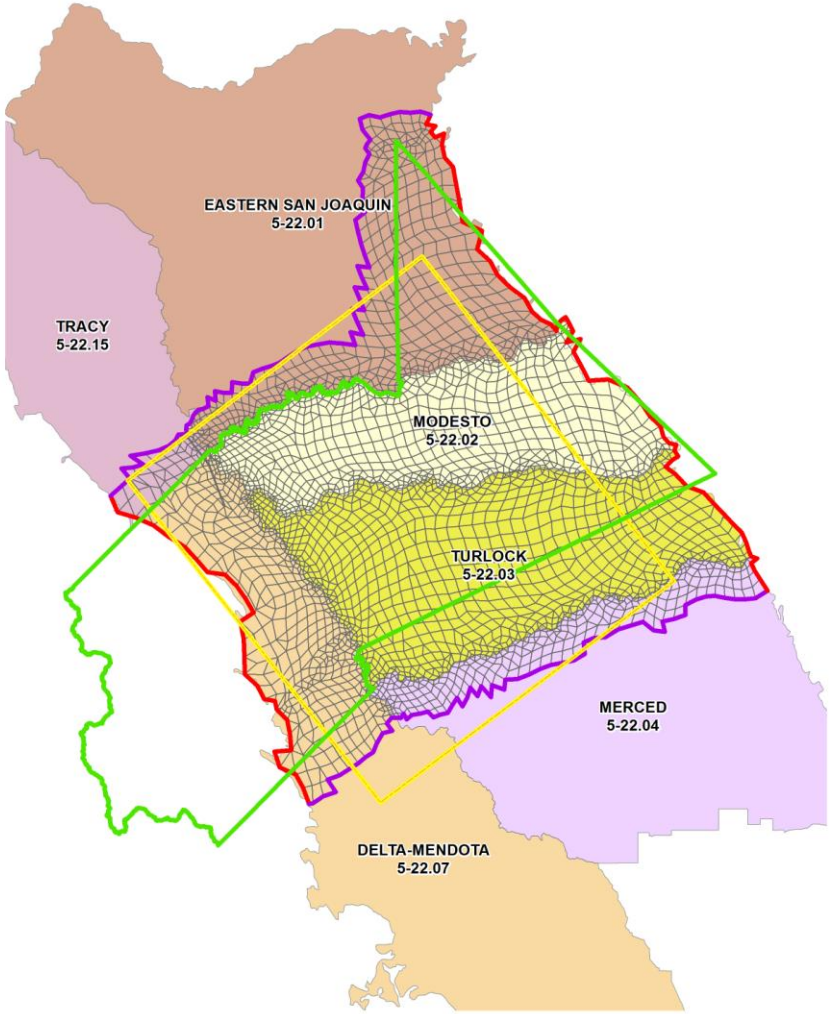
Rural Domestic Pumping

- ✓ **Rural Domestic Demand**
  - Used 2000 Census tract data outside municipal service areas to determine number of rural households not served by districts
  - Extrapolated through 2015 based on population trends
  - Assumed 0.5 AFY/household with 38% assumed return flow based on UWMP data and 2011 Water Use Efficiency Study
  - Surrogate wells added to each subregion to simulate rural domestic pumping

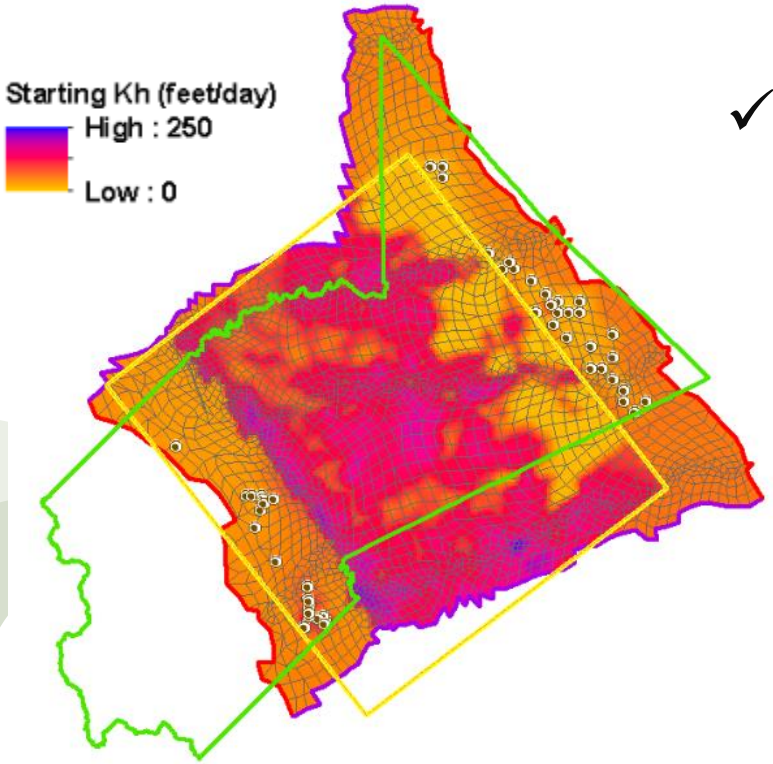


Hydraulic Conductivity Refinements

- ✓ **Added MERSTAN K**
  - Extracted 16-layer data and applied to three layer system
  - MERSTAN 1-7 = SCHM Layer 1
  - MERSTAN 8 = Aquitard
  - MERSTAN 9-13 = SCHM Layer 2
  - MERSTAN 14-16 = SCHM Layer 3
  - Removed data west of SJR and outside MERSTAN
- ✓ **Further Refinement**
  - Calculated K for 30 east side wells from County database
  - Calculated K for 23 west side wells from data and reports
  - Updated K based on modified nearest neighbor approach

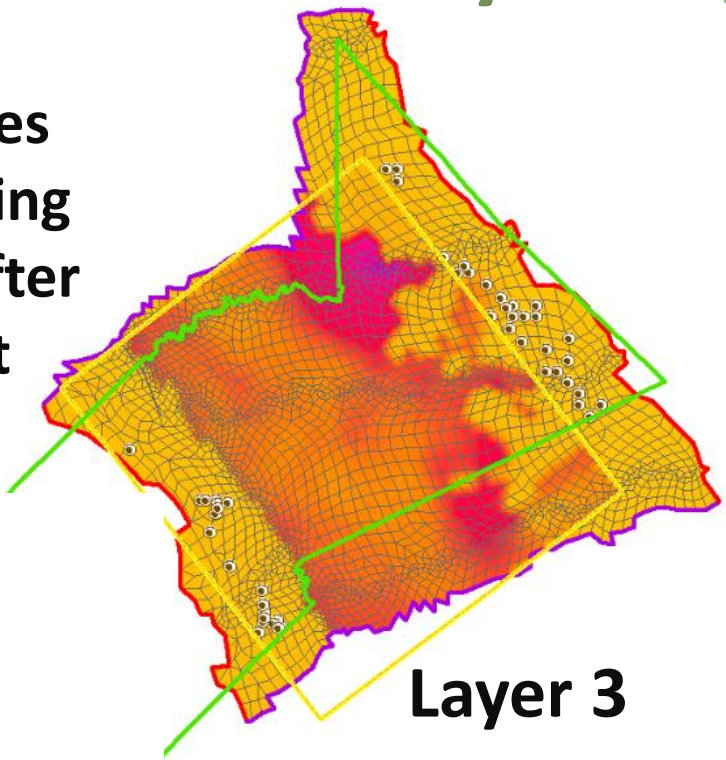


SCHM Starting Hydraulic Conductivity

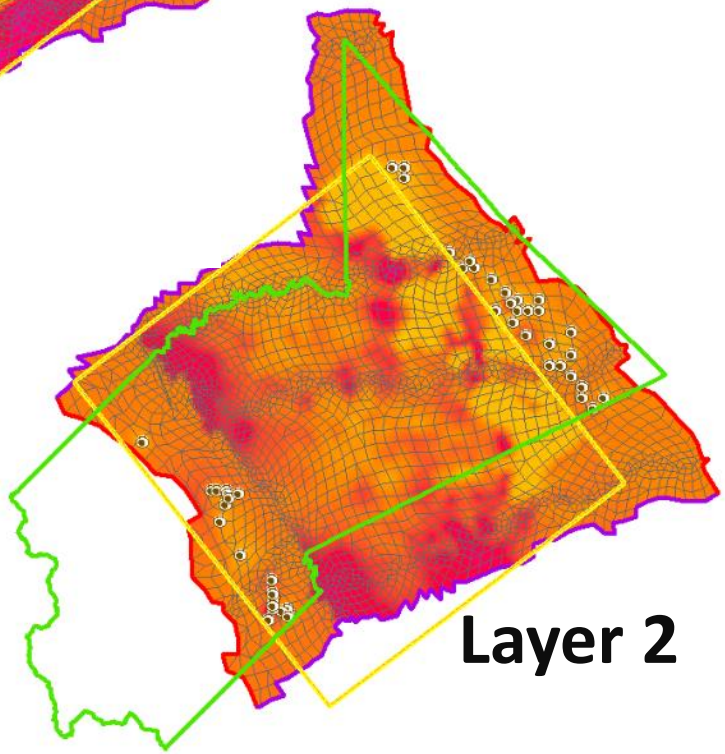


Layer 1

- ✓Starting values adjusted during calibration after water budget adjustments



Layer 3



Layer 2

Horizontal K:

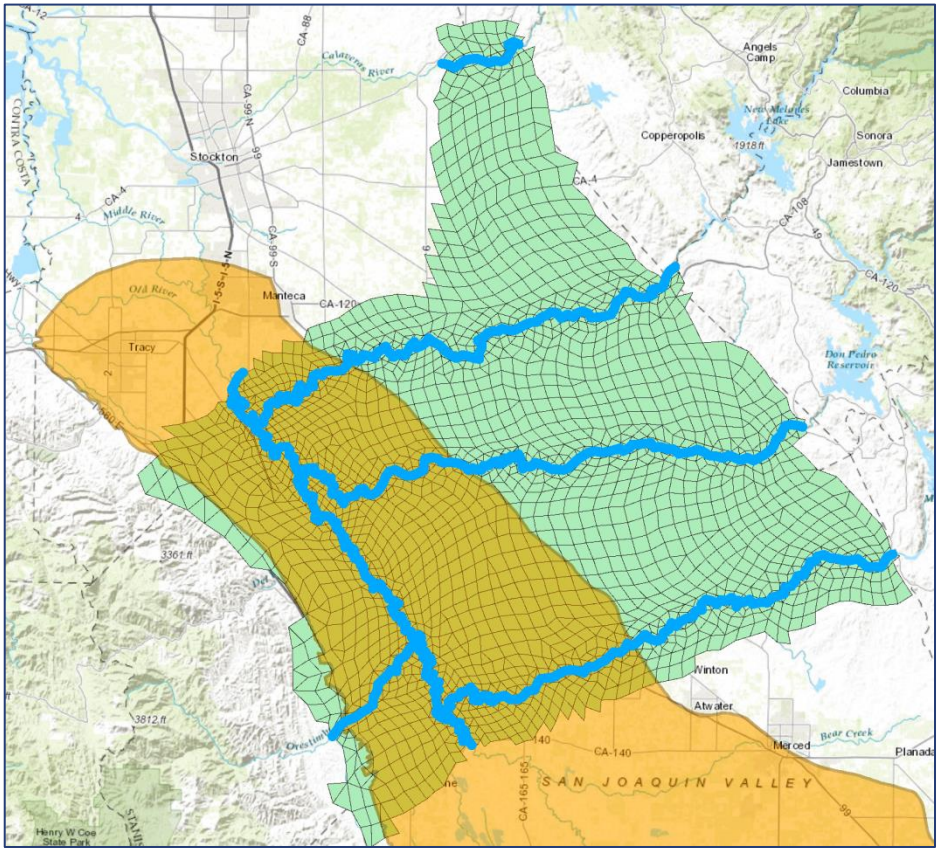
$$K_x = \sum_{i=1}^{n} \frac{k_i d_i}{d}$$

Vertical K:

$$K_z = \sum_{i=1}^{n} \frac{d}{\frac{d_i}{K_i}}$$

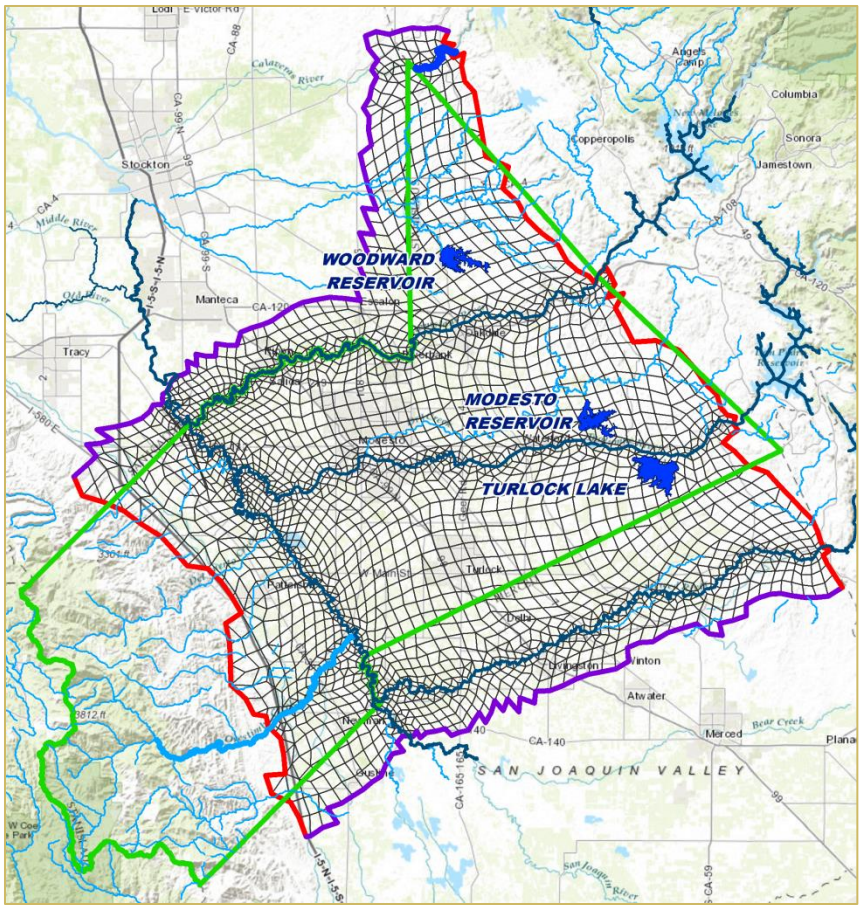
Corcoran Clay Kv

- ✓ **Aquitard Impedance Layer at Top of Layer 2**
  - **Thickness and extent based on USGS shapefile**
  - **Thickness = 0 outside Corcoran Clay subcrop area**
  - **Western extent allows mountain front recharge**
  - **Preliminary uniform Kv of 1 x E-05 ft/day selected based on literature values; adjusted during calibration**



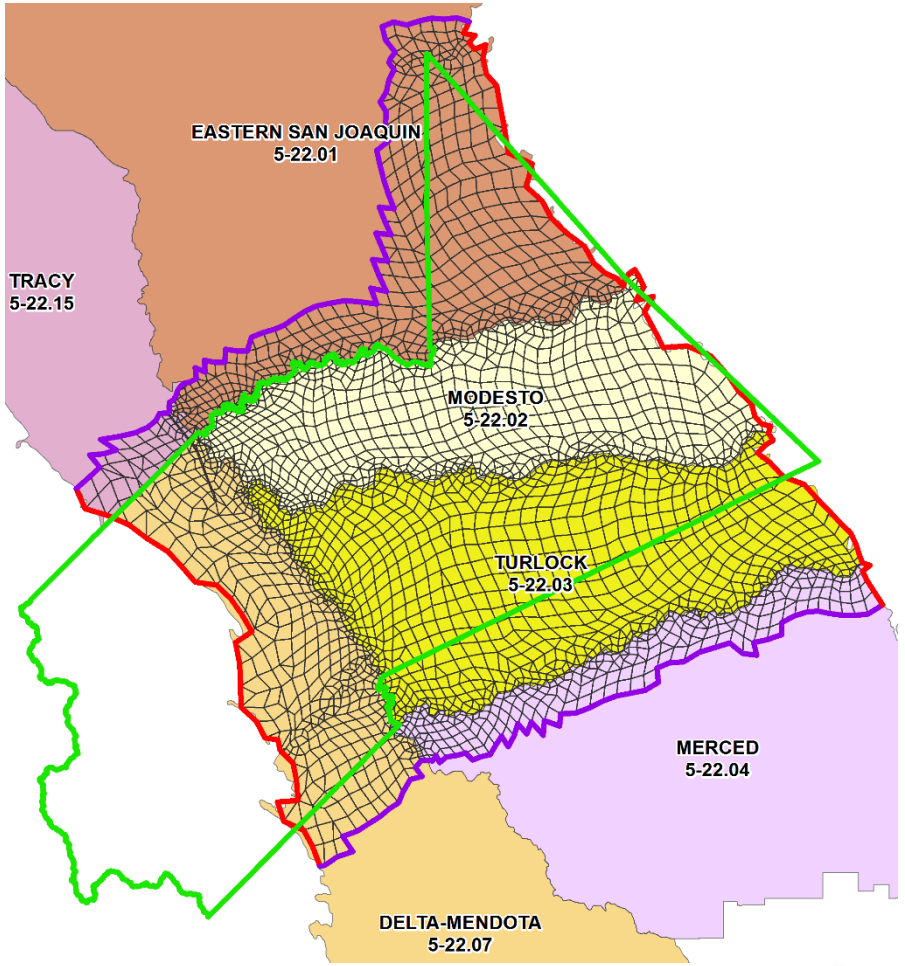
Surface Water

- ✓ **Reservoir Leakage**
  - Water balance data from AWMPs, CEDEC and/or districts
  - Distributed Turlock Lake and Modesto Res leakage seasonally based on monthly Et_o
  - Added three diversions with no deliveries and 100% recoverable losses to subregions
- ✓ **Streams**
  - Stream nodes and conductance values from C2VSim
  - Six major inflows through WY 2009 from C2VSim extended through 2015 using CalSim and gaging station data
  - 61 diversions, developed from CalSim and gaging station data using "wiring diagrams," allocated to 108 subregions



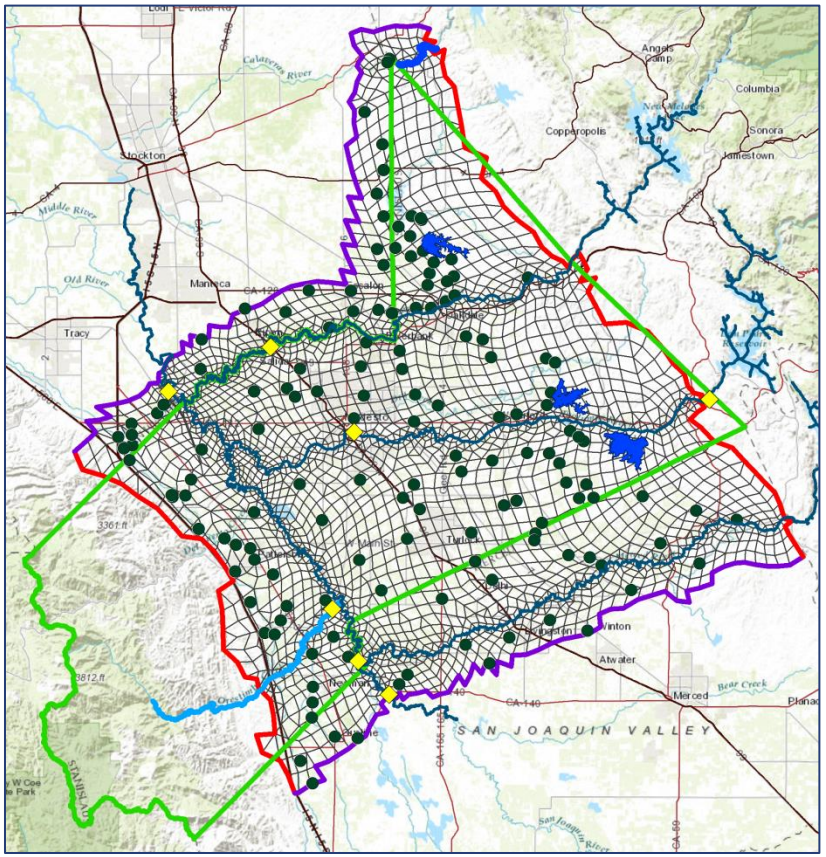
Boundary Conditions

- ✓ **No flow boundaries at mountain fronts**
- ✓ **Time-series general head boundaries across basin**
  - **Head data from C2VSim output through WY 2009**
  - **WY 2010-2015 heads derived using C2VSim WY 1985-1990 water level elevation changes to mimic drought**
  - **Adjusted boundary heads at selected locations during calibration being careful to maintain gradients**



Calibration Dataset

- ✓ **Calibration Period 2000 - 2015**
- ✓ **Calibration Wells**
  - **157 wells (some duplicates in two layers)**
  - **Hydrograph data compiled from C2VSim and/or DWR Water Data Library for WY 1990 - 2015**
- ✓ **Gaging Stations**
  - **Total of seven gaging stations covering each major river, and points entering and exiting the model**
  - **Data from NWIS for WY 1990 - 2015**



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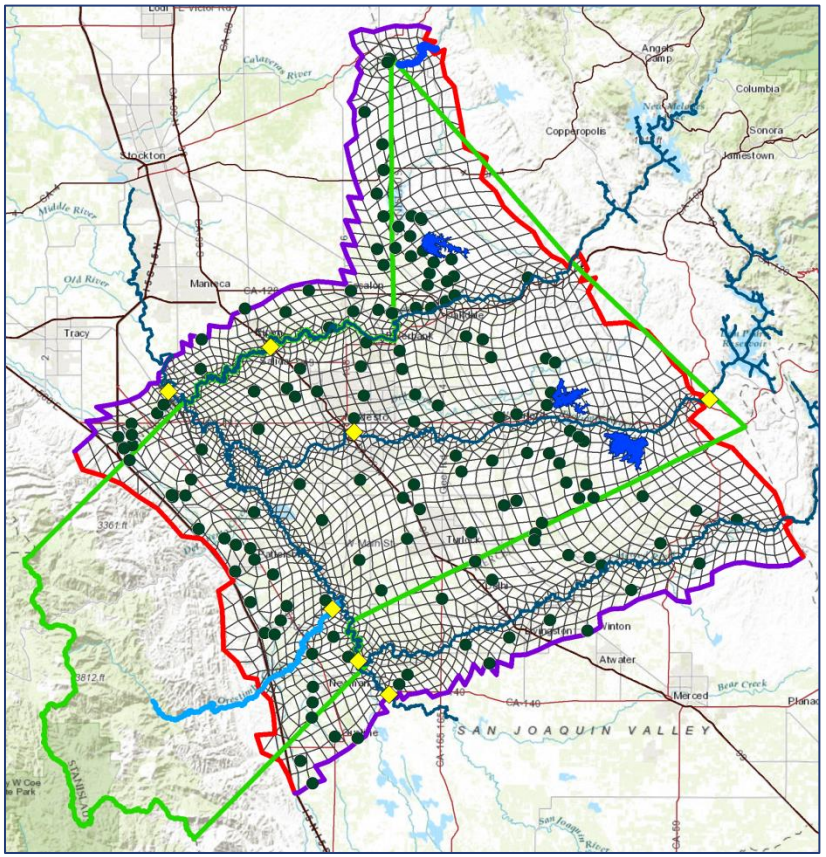
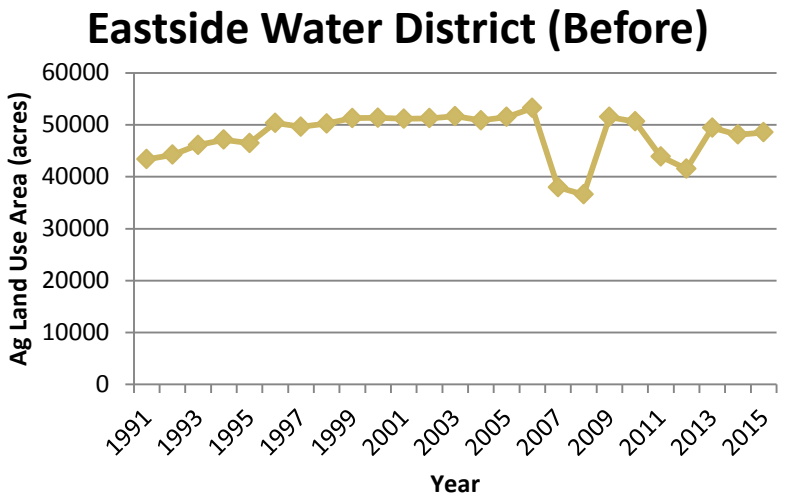
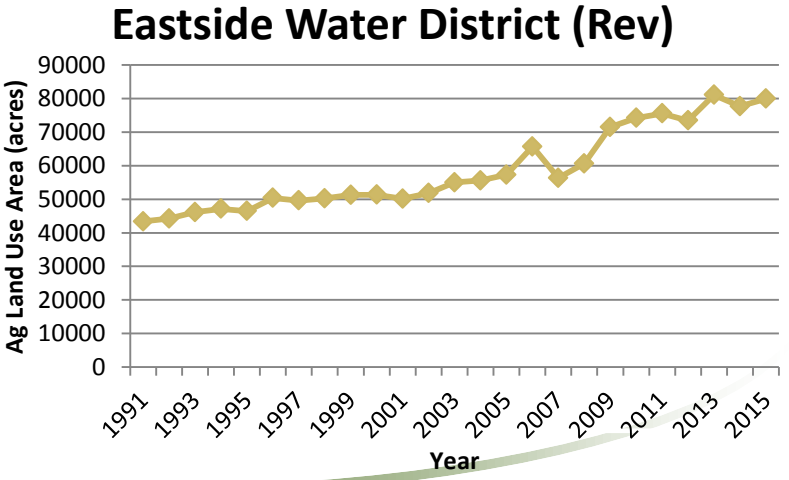


Calibration Gaging Stations
Calibration Wells

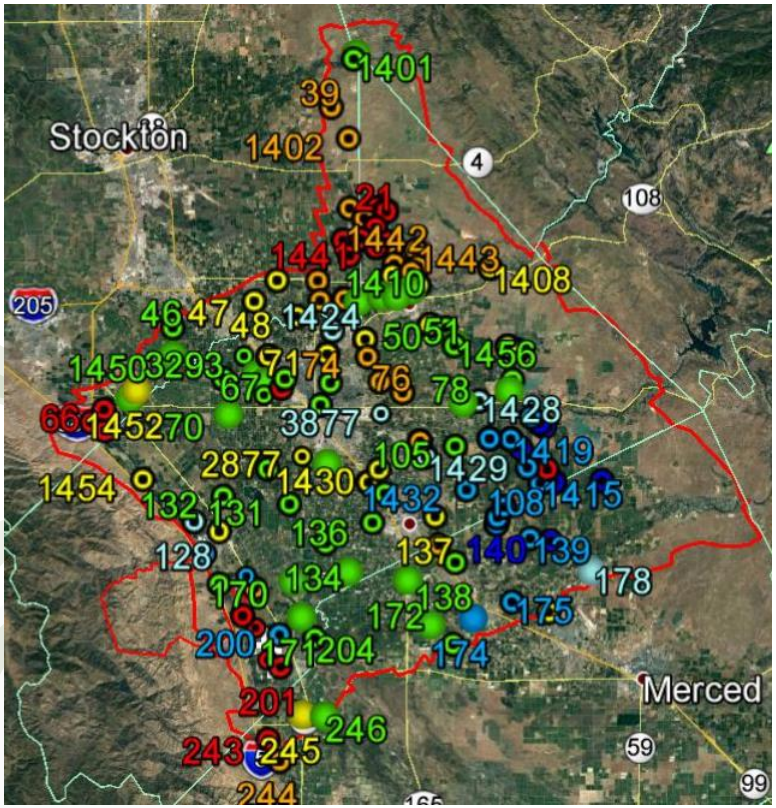
Calibration

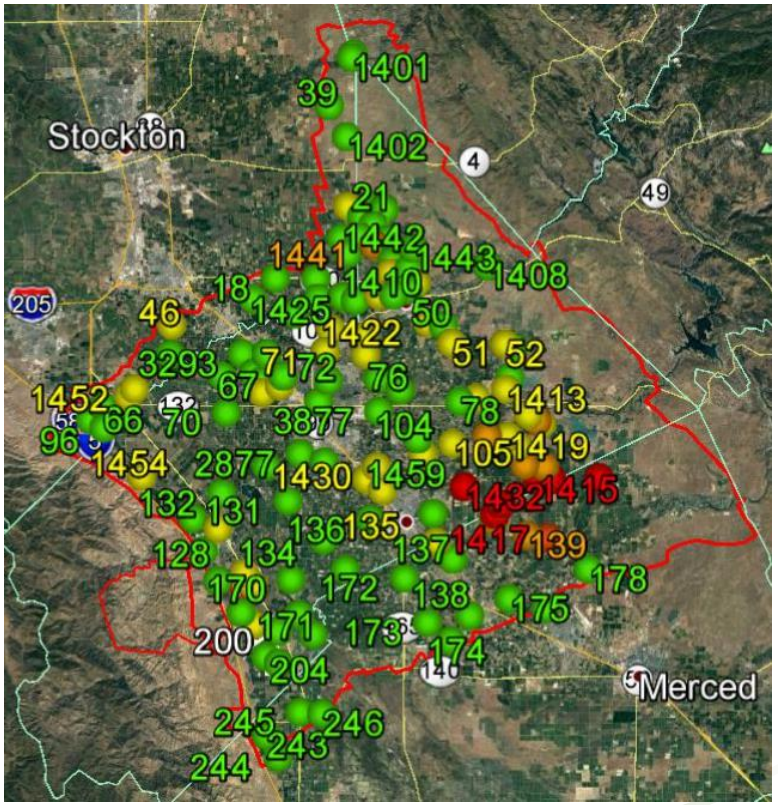
- ✓ **Water Budget Adjustment:**
  - Diversions/losses to match reported farm gate deliveries
  - Irrigation Efficiency to match reported pumping
  - Ag Acreage to match documented trends
  - Small watershed inflows
- ✓ **Boundary heads in areas that did not match boundary calibration wells**
- ✓ **Hydraulic conductivities**



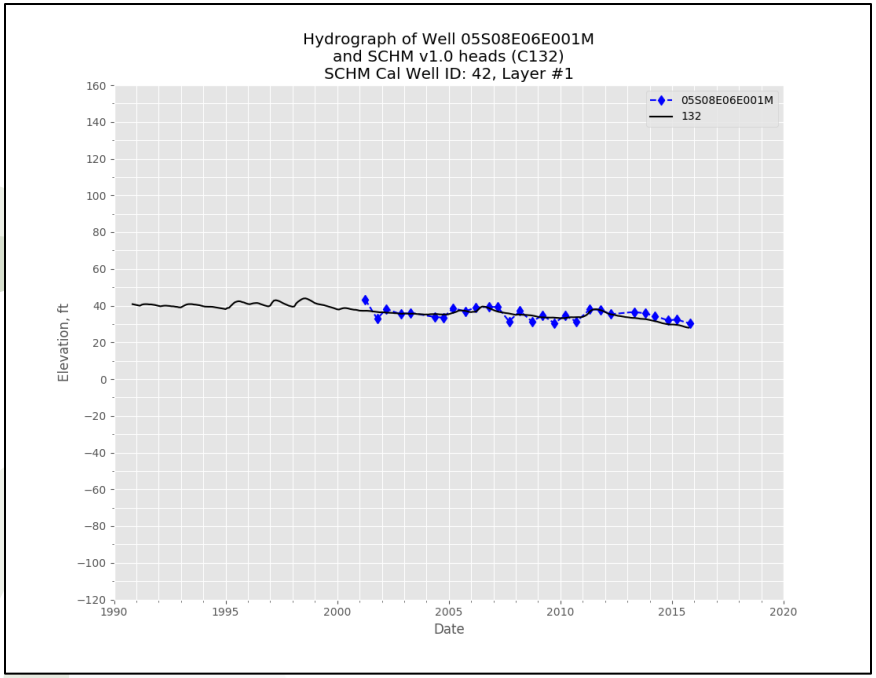


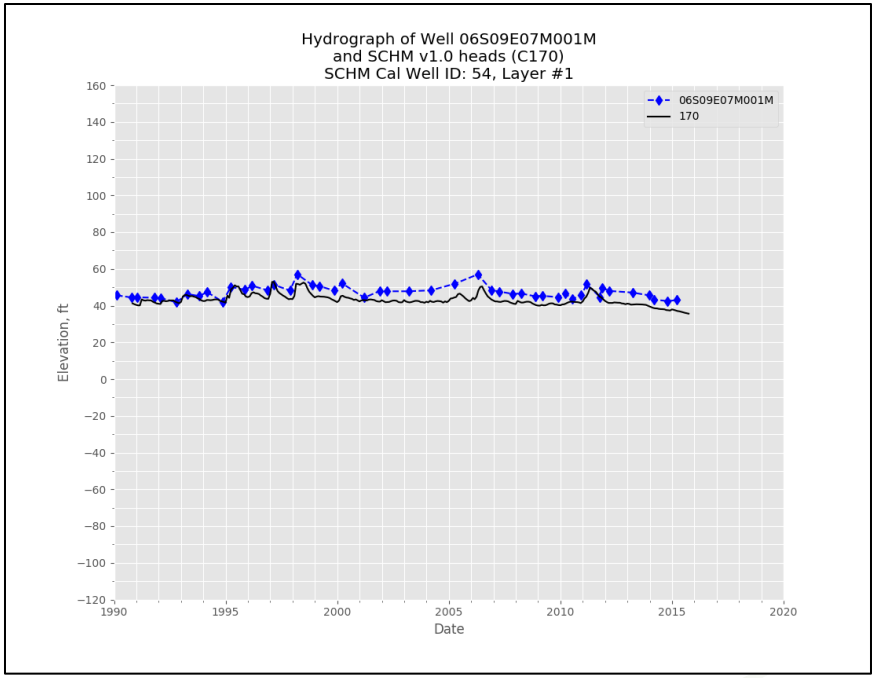
Example Calibration Maps



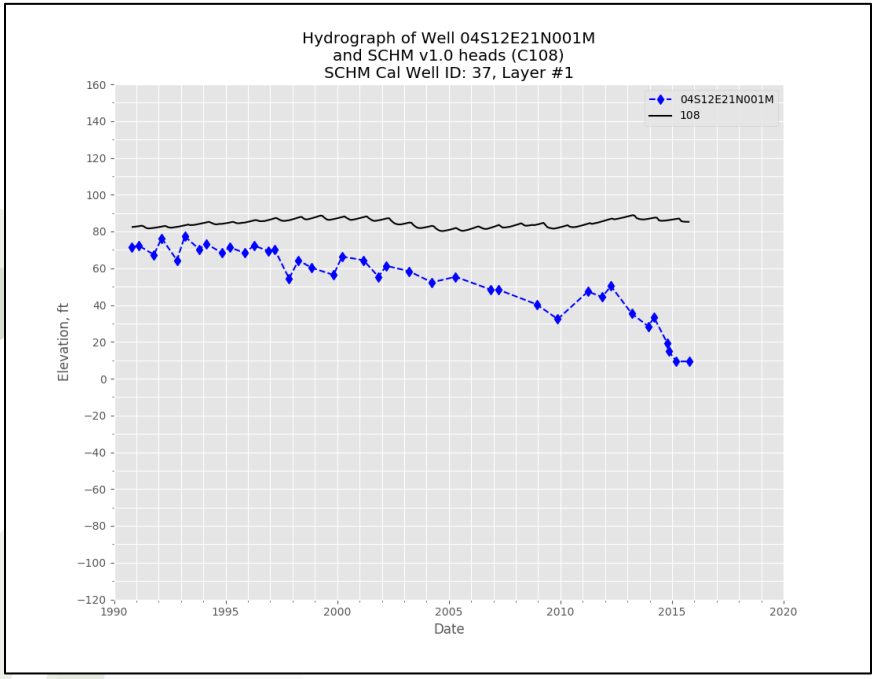


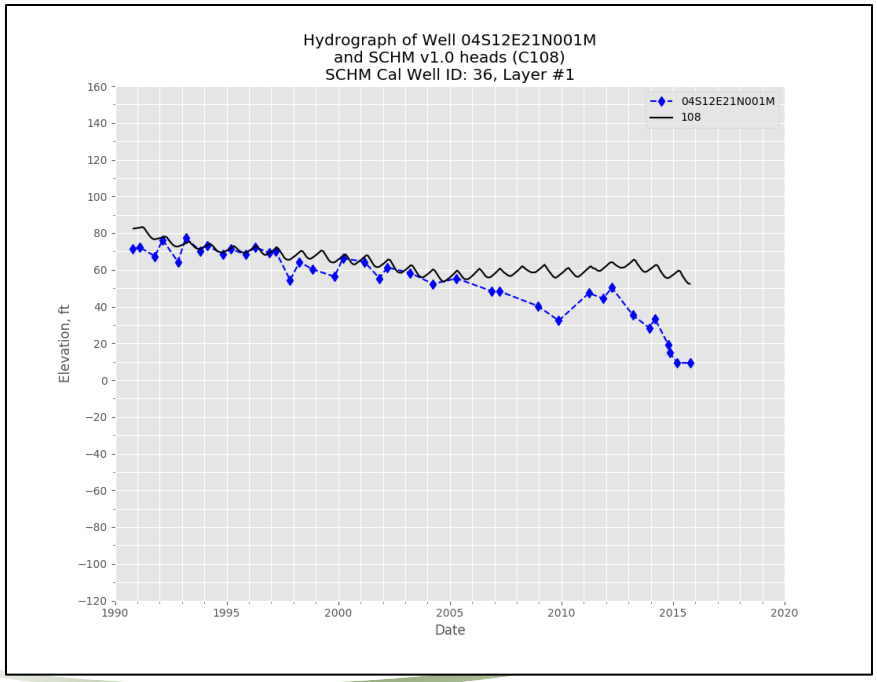
Example Calibration Hydrographs: The Good



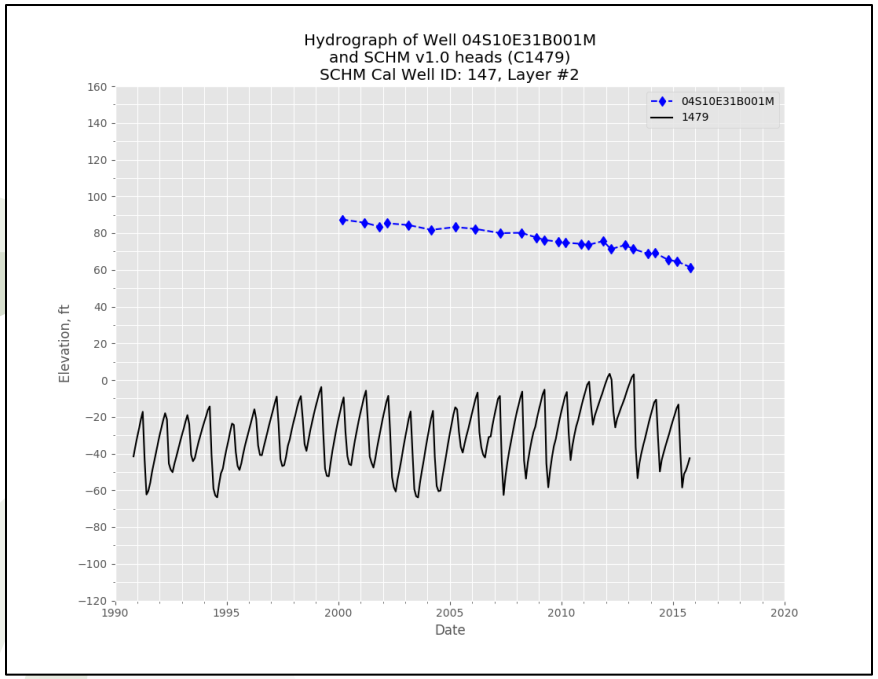


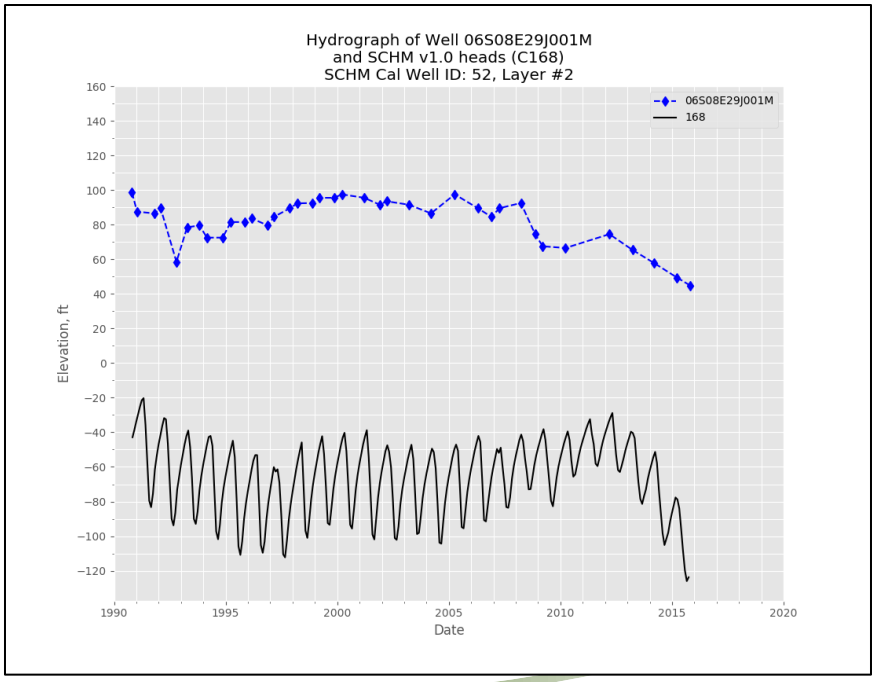
Example Calibration Hydrographs: The Bad



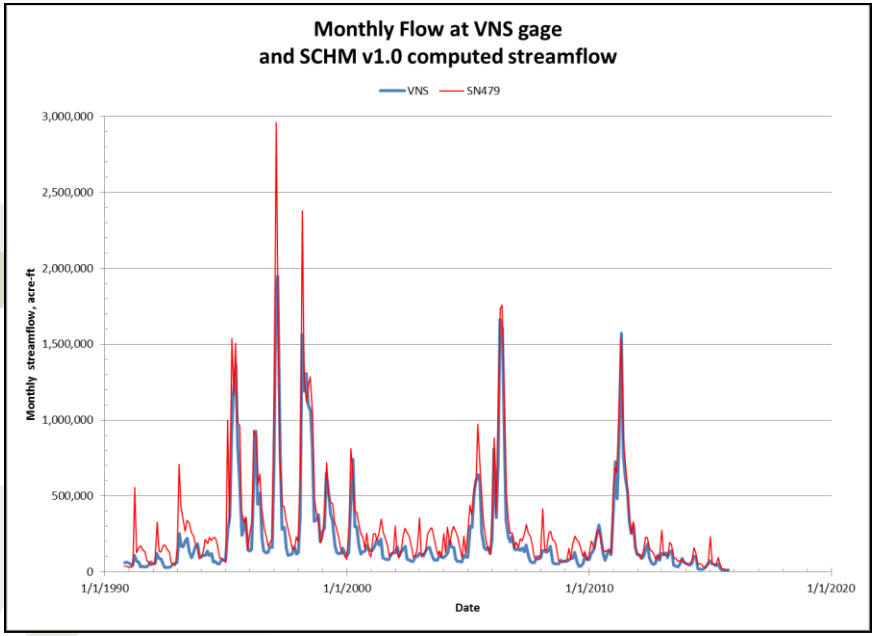


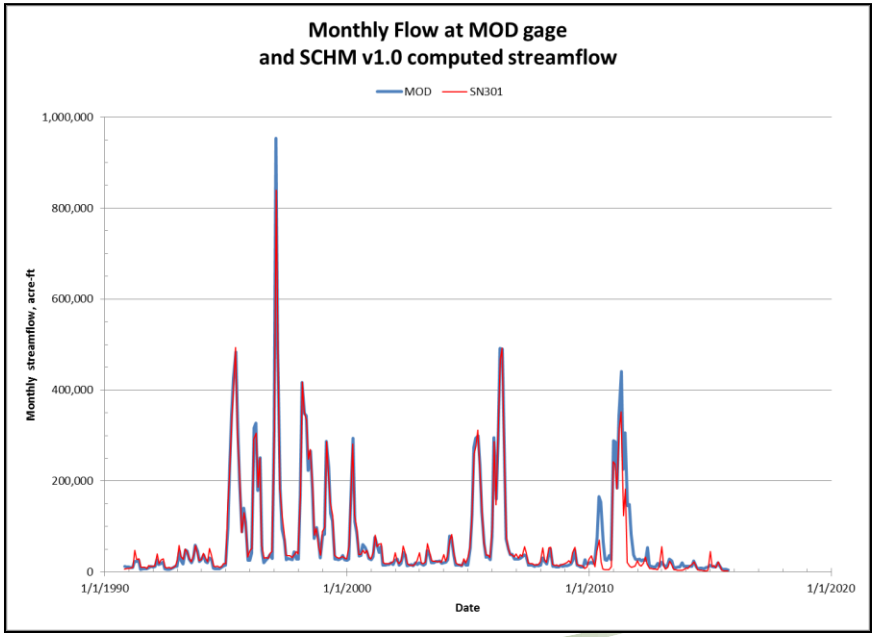
Example Calibration Hydrographs: The Ugly





Example Calibration Hydrographs: Stream Discharge





Findings: Water Budget

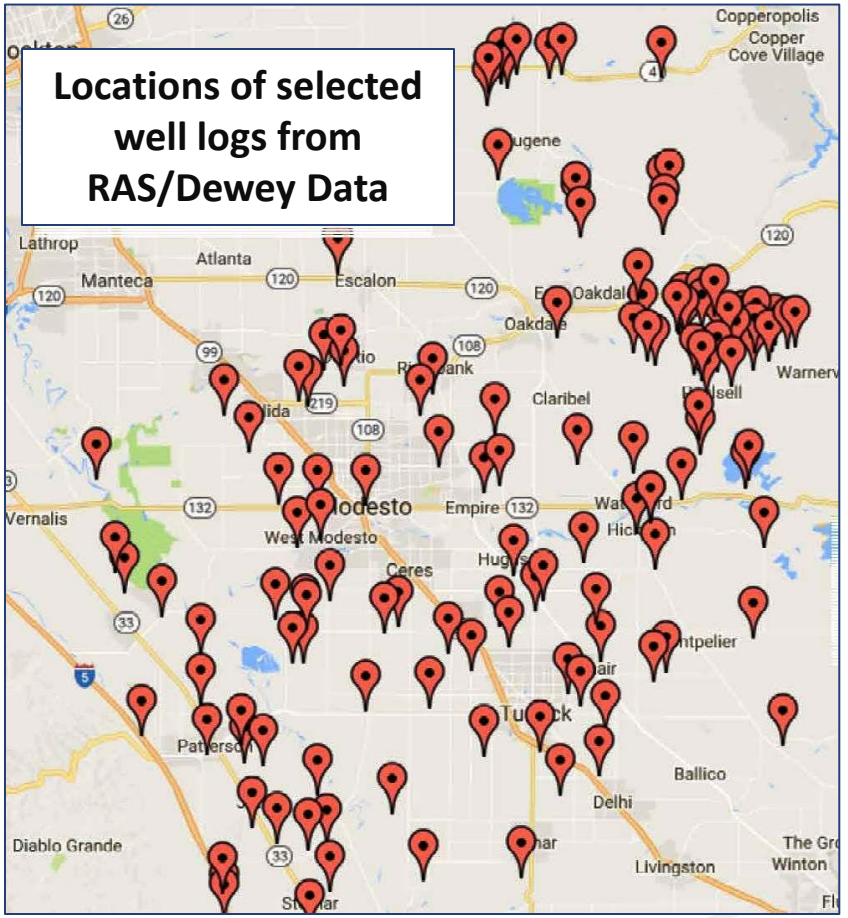
- ✓ **A solid water budget is step one!**
- ✓ **Ag water budget**
  - **C2VSim irrigated acreage was on average 79% of reported values by five irrigation districts for which data were available, yet model calculated groundwater pumping was on average 129% of reported values**
  - **C2VSim irrigated acreage averaged 95% of reported values by TID, yet model calculated pumping averaged 76% of reported values**
  - **High range in reported diversion to farm gate losses**
  - **Variability in cropping data and water demand must be resolved in future GSP level modeling**
- ✓ **Municipal pumping data a smaller fraction and generally more reliable**

Findings: Discretization

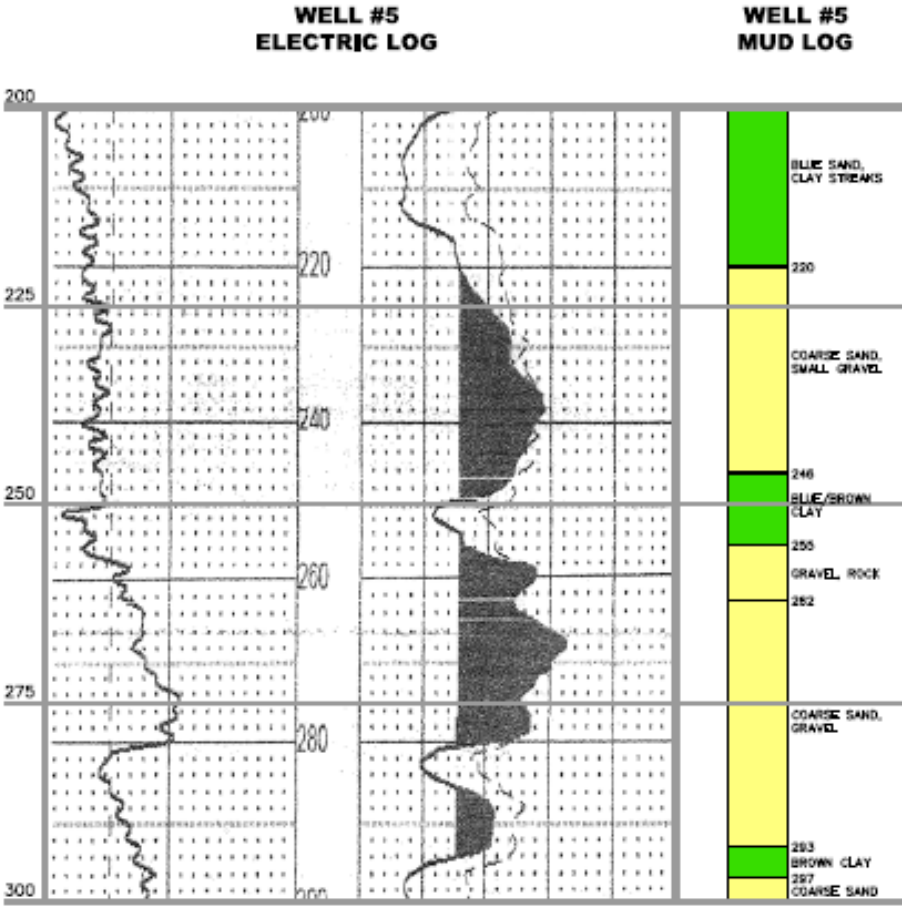
- ✓ Discretization affects model utility and ease of use
- ✓ GSP level models will likely require finer discretization
- ✓ Alignment of elemental land use and water budget subregions with district and municipal boundaries is important to utility and ease of use
  - Customizing C2VSim for local use with IWFM 3.02 requires manipulating multiple layers of intersecting shapefiles

Major Data Needs and Opportunities

- ✓ **Well data on east side**
  - **Growers associated with APA, EWD and BCWD are compiling specific capacity and water level data**
- ✓ **Geophysical data**
  - **Discussions with loggers indicate large datasets of geophysical logs may be avaialble**
  - **Potential to quantitatively analyze LAS or digitized logs and develop cost effective subsurface interpretation**



Geophysical Log Interpretation



Major Data Needs and Opportunities

- ✓ **Water budget data**
  - **Refine water budget and land use data for irrigation districts**
  - **Refine well and pumping data for municipal suppliers**
  - **Industrial pumping data**
- ✓ **Further development of county-wide well database**
  - **Fully populated for CASGEM data, partially for well completion reports**
  - **"Parking spaces" for pumping, geology at well, water quality, and specific capacity**
  - **Potential for phased development as regional needs develop**
    - **Phase I – Stanislaus County individual database – no web access (completed)**
    - **Phase II – Security upgrade to share database with other users – web access**
    - **Phase III – Data input/output upgrade access for users – web access**
    - **Phase IV – Web-based graphical Interface for creating maps and graphs – can also be used for data analysis**

Major Data Needs and Opportunities

- ✓ **Identification of regional monitoring well networks with representative hydrographs for specific hydrostratigraphic units**
- ✓ **Pending C2VSim Refinements**
- ✓ **Land Use and Climate Datasets**
- ✓ **Other Tools and Technical Assistance**

Questions?