

Updating the Central Valley Groundwater Level Observation Dataset

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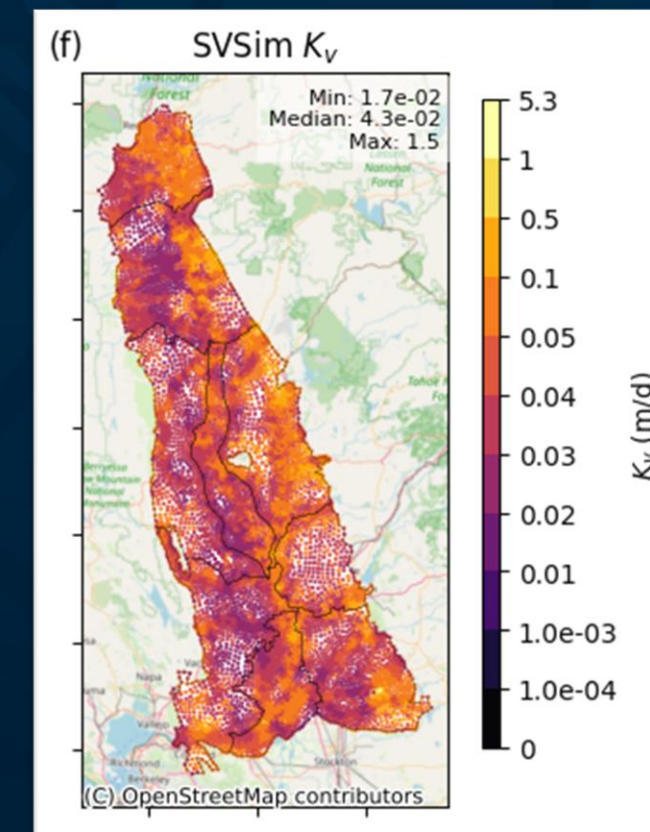
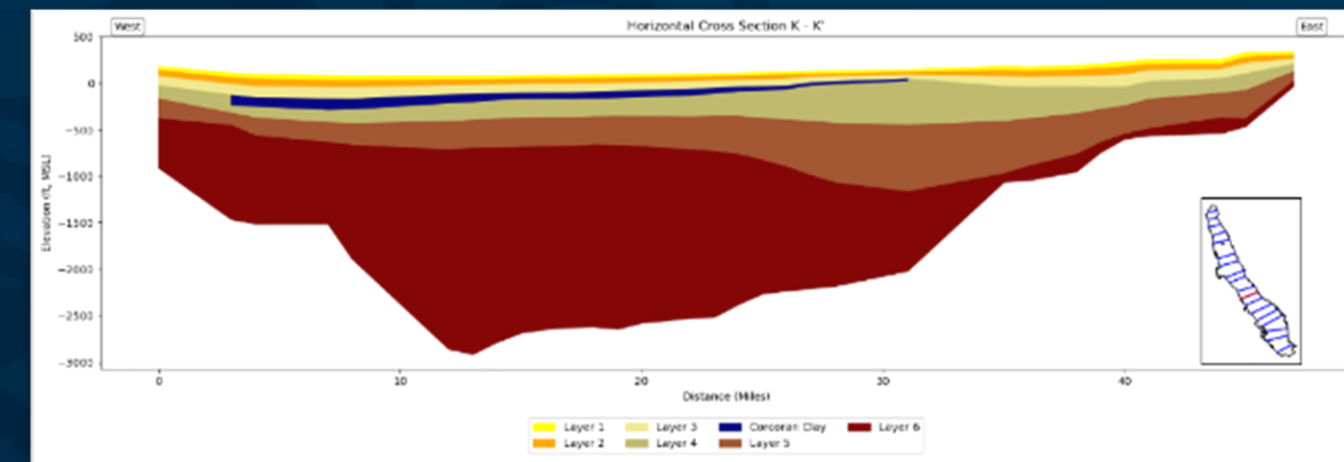


CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER
MANAGEMENT OFFICE

Introduction

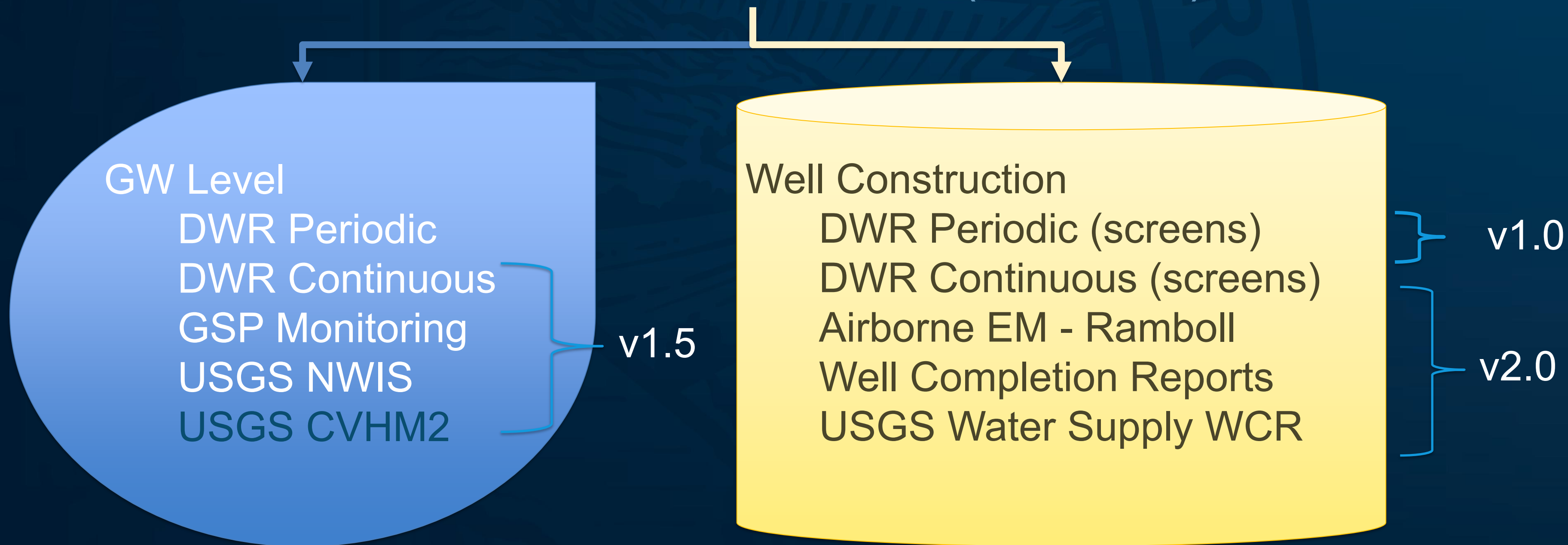
- **Problem**
 - Data Bottlenecks: Cleaning + model discretization
- **Objective**
 - Repeatable, script-based workflows
 - Handle multi-source data + iterative model changes
- **Key developments**
 - Automated QAQC of new data sources:
 - groundwater observations (GW Obs)
 - well construction
 - Standardize ID convention for nested wells
 - Automate well assignment to model layers for calibration
- **Example application**
 - vertical hydraulic conductivity

field_1	ramboll_1	usgs_ws_1
<chr>	<chr>	<chr>
1 id	WD6_1083	NA
2 wo	WD6	NA
3 aem_well_info_id	1083	NA
4 wcr_no	WCR1992-010477	WCR1992-010477
5 wcr_no_legacy	NA	579927
6 local_id1	Pelger MWC - Flopet	NA
7 local_id2	NA	NA
8 local_id3	NA	NA
9 swi	13N01E24K001M	13N01E24K001M
10 site_code	389605N1218103W001	NA
11 ew_id	NA	NA
12 usgs_id	NA	NA
13 well_type	NA	NA

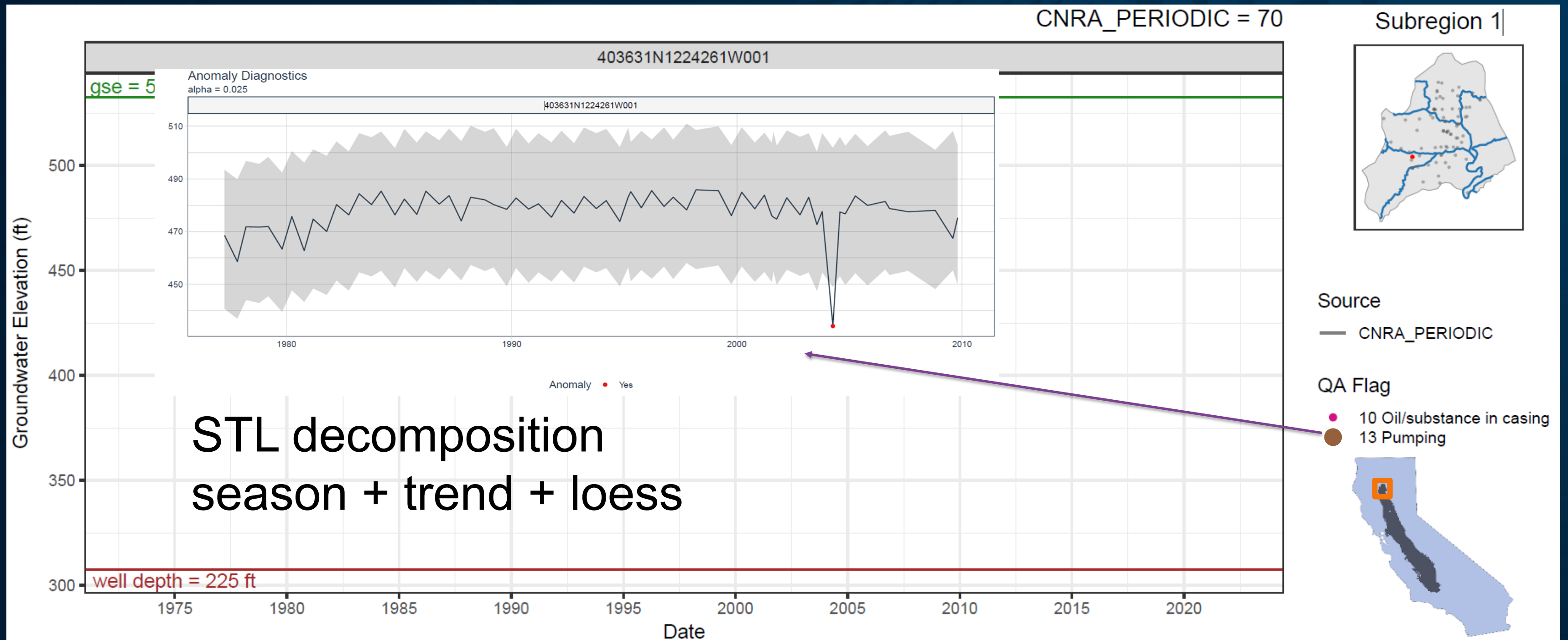


QAQC – New data sources

Groundwater Observations (GW Obs)

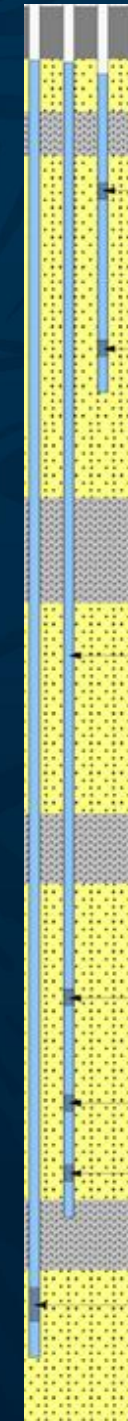
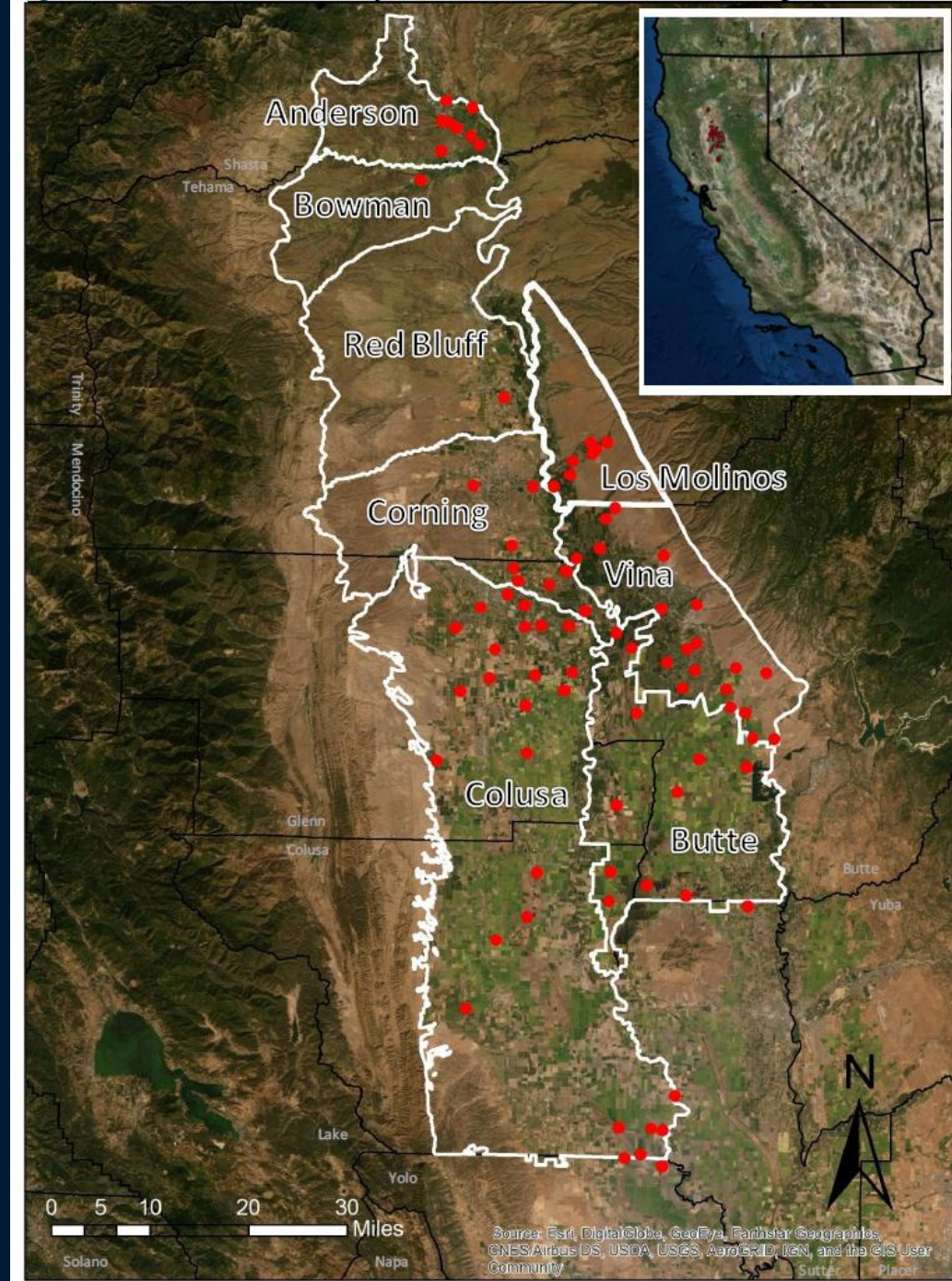


QAQC – GW Level Anomalies

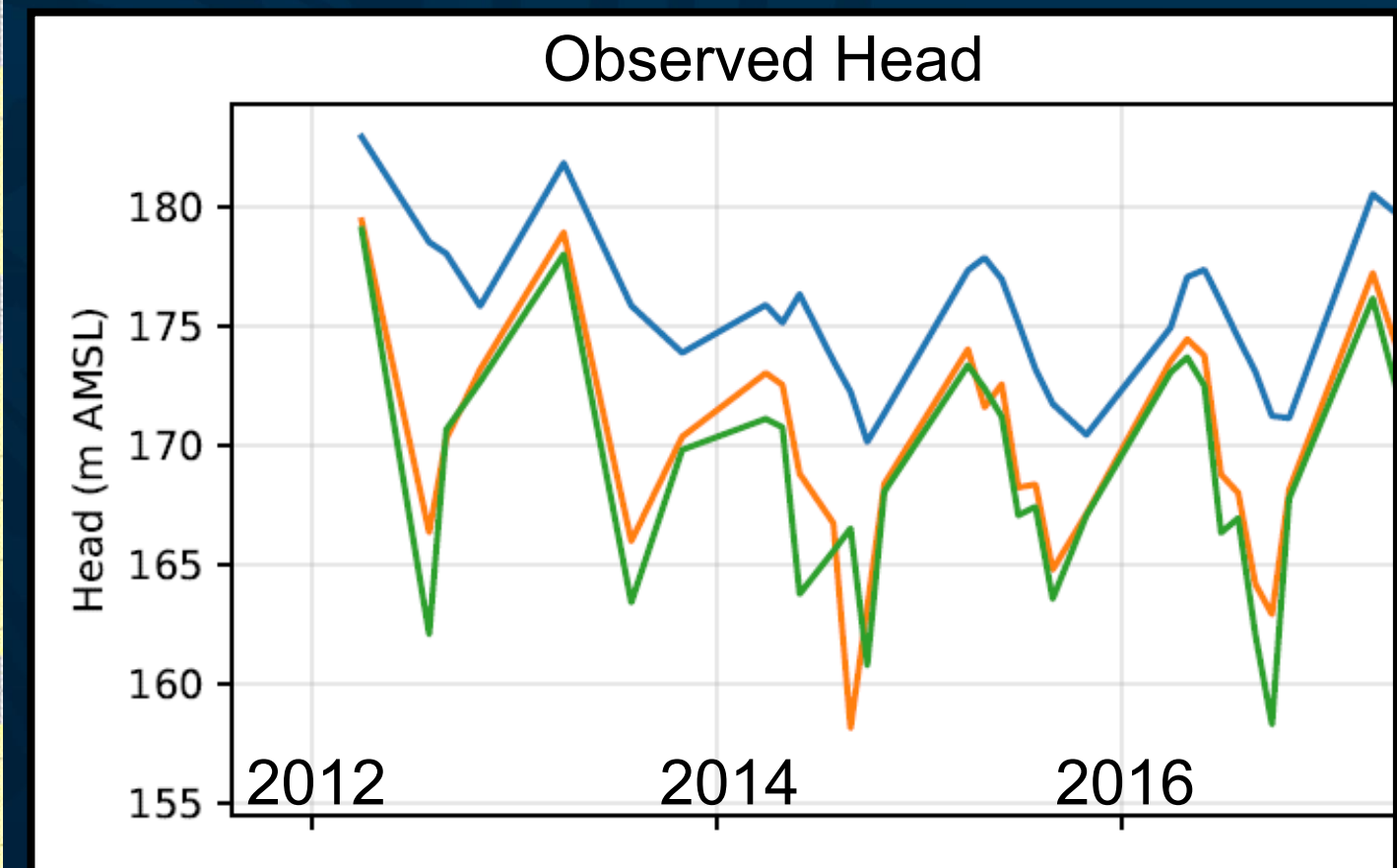


Standardize Nested Well ID

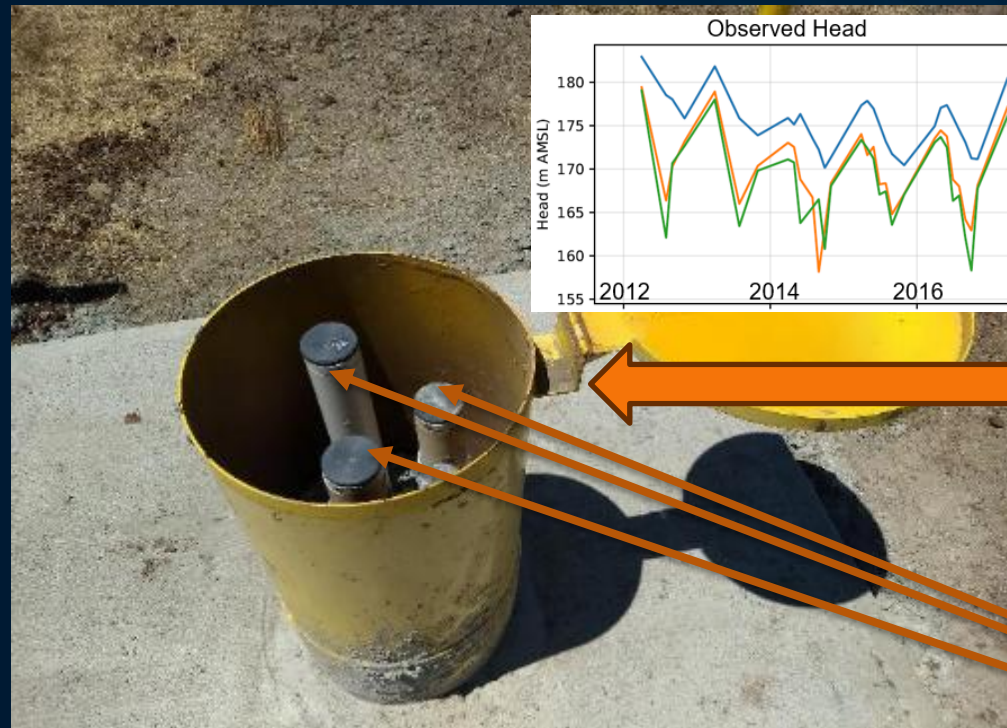
Figure 1 Northern Sacramento Valley Groundwater Subbasins and Monitoring Well Network



- Nested or multi-completion wells provide valuable vertical hydraulic data
- Challenge: not easily grouped



Standardize Nested Well ID



State of California
Well Completion Report
 Form DWR 188 Complete 7/20/2023
WCR2023-007525

Dec. Lat. 40.187439 Dec. Long. -122.198787
 Vertical Datum Horizontal Datum WGS84

DWR Use Only			
CSG #	State Well Number	Site Code	Local Well Number
2	27N03W15N004M	401874N1221988W002	27N03W15N004M
3	27N03W15N005M	401874N1221988W004	27N03W15N005M
4	27N03W15N006M	401874N1221988W006	27N03W15N006M
5	27N03W15N007M	401874N1221988W008	27N03W15N007M
6	27N03W15N008M	401874N1221988W010	27N03W15N008M

- Modern (~ 2015 +) nested well sets are tied to Well Completion Report Number
- Historical wells are less consistent

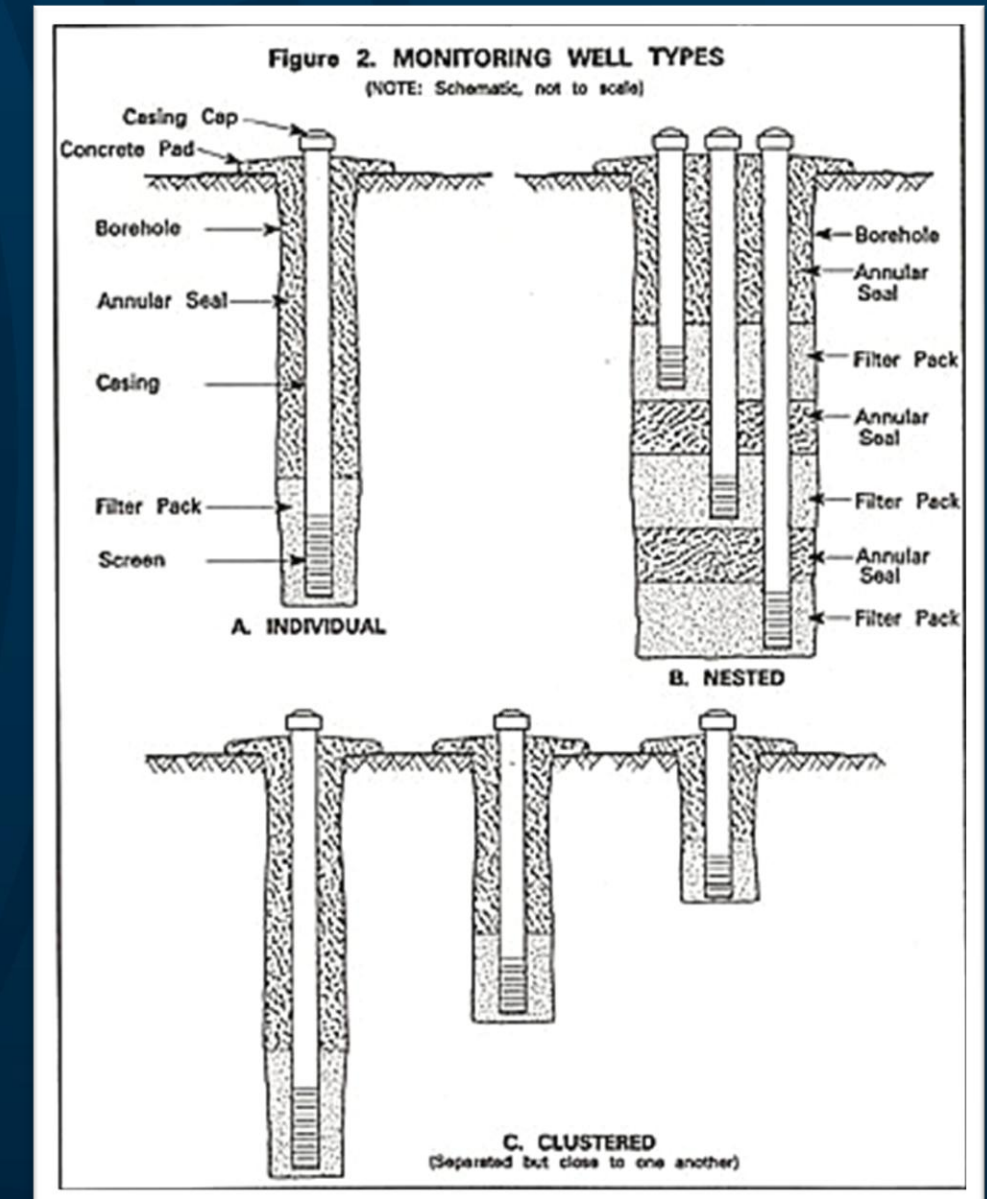
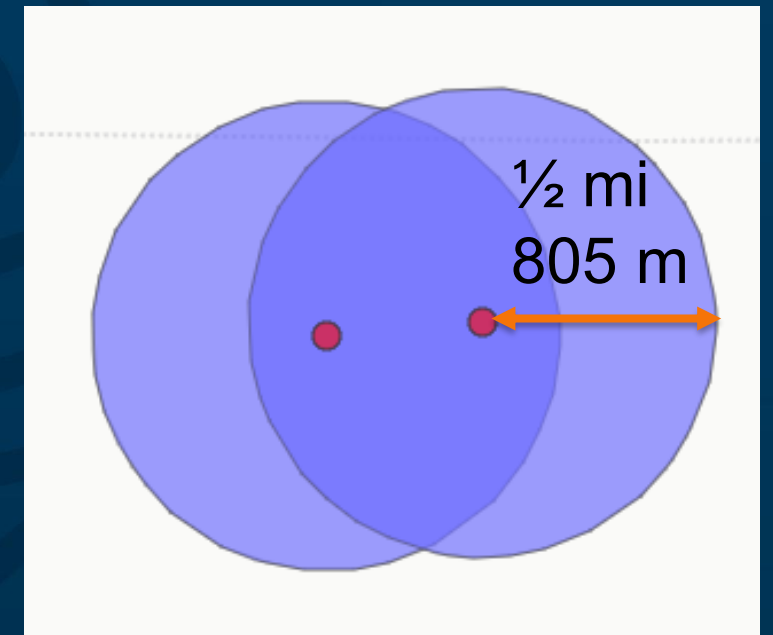


Figure 2 (Bulletin 74-90).
 DWR Monitoring Well
 Standards.

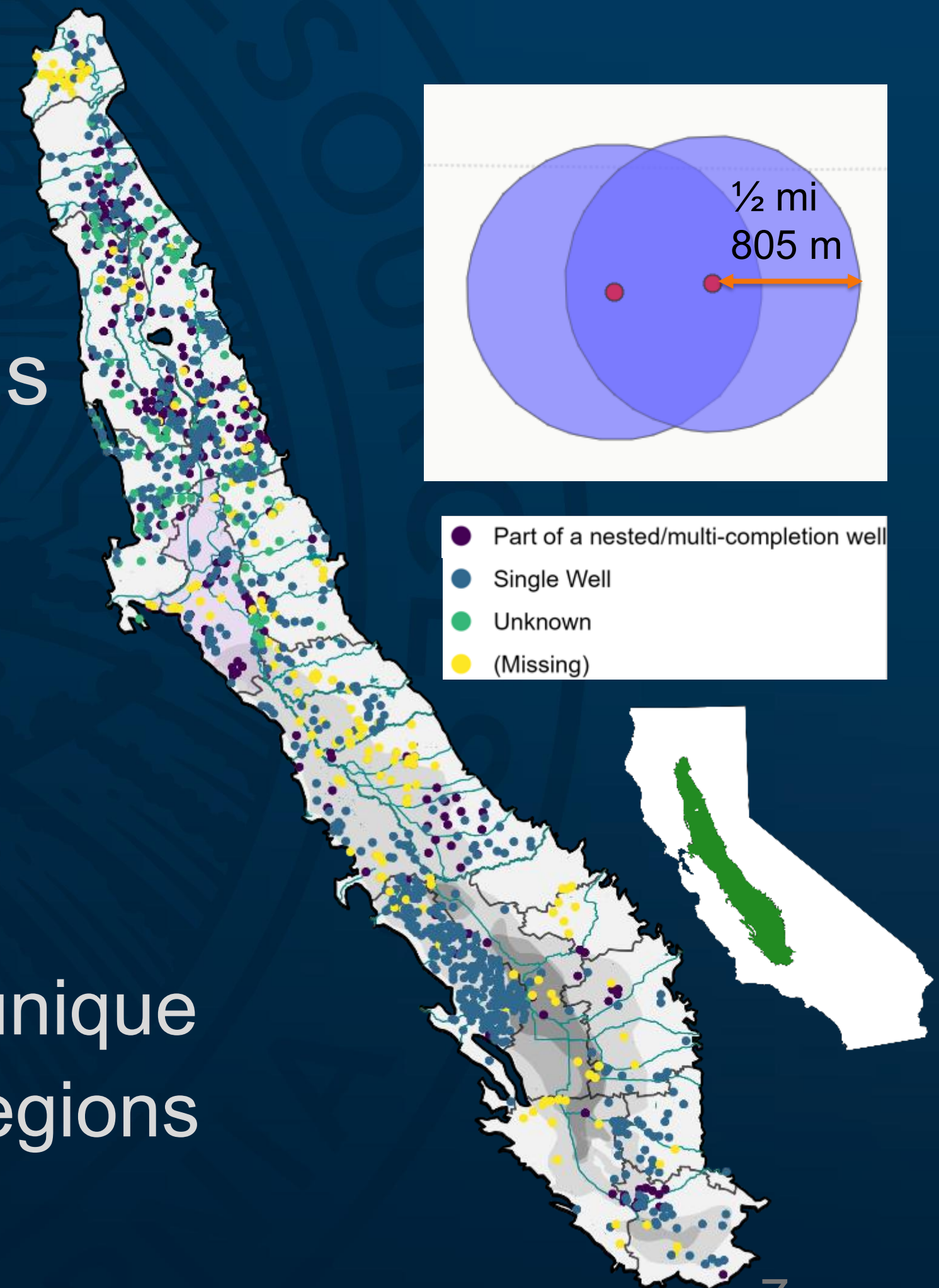
Wellgroup ID coverage

- Group wells within $\frac{1}{2}$ mile radius
 - Nested well
 - Clustered well
 - Single well
- County Code + sequential tag
 - Tag is unique per county
 - county code + tag is universally unique
 - Accommodates changes to subregions

wellgroup_id
BUT-A00
YOL-A0B



- Part of a nested/multi-completion well
- Single Well
- Unknown
- (Missing)

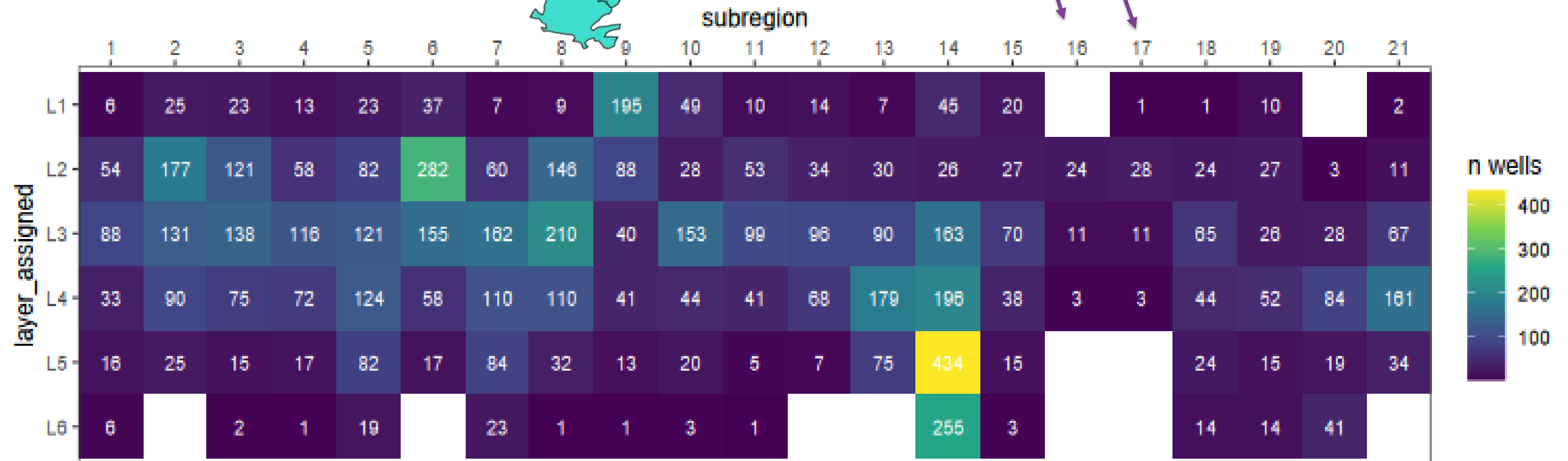


Automated Layer Assignment

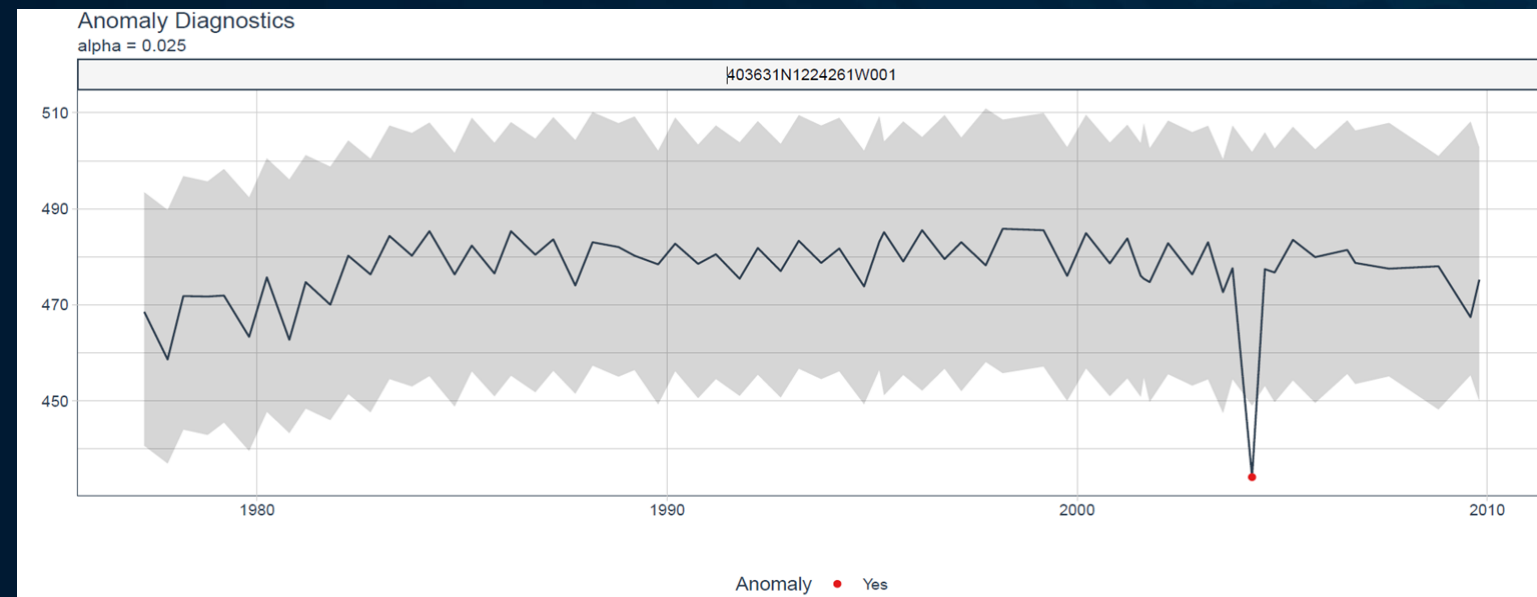
- Identify deepest value in descending hierarchy
 - 1) Bottom perforation depth
 - 2) Well depth
 - 3) Drill depth
- Compare to ordered stratigraphy
- Assign raw layer
- Adjust aquitards to 1 layer up
- Currently based on deepest layer
 - fuzzy / fractional assignment option is needed
 - Multi-perf wells = multi-productive zones



Automated Layer Assignment



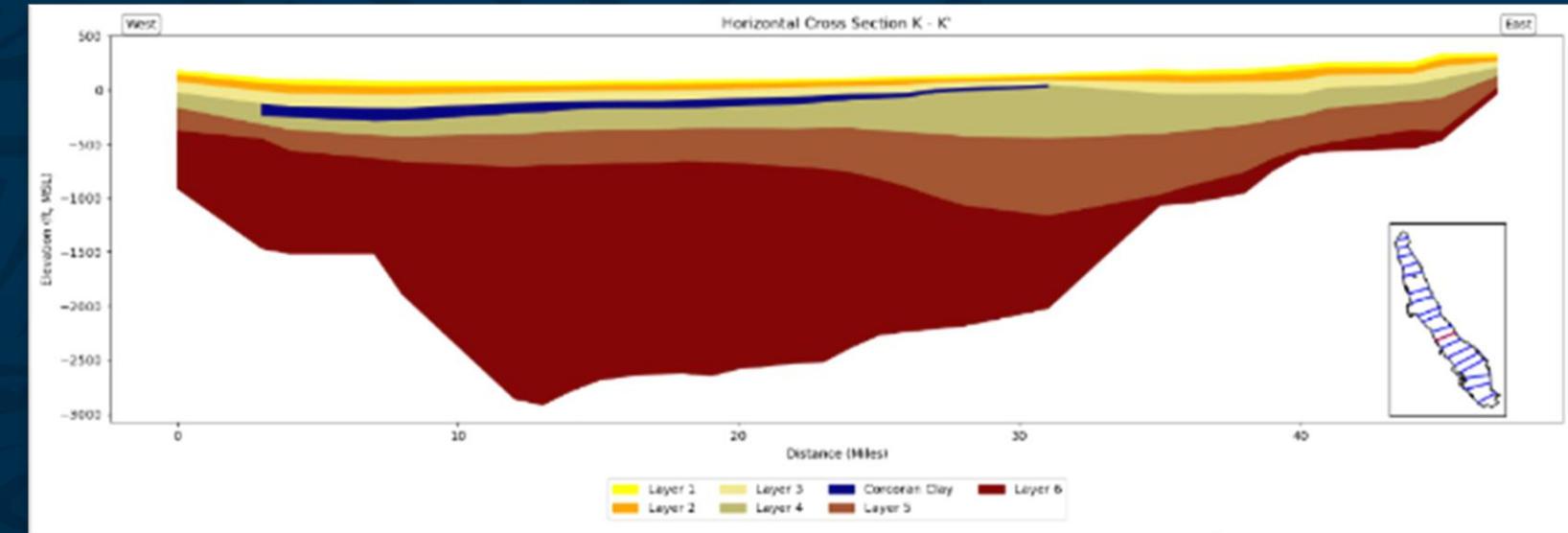
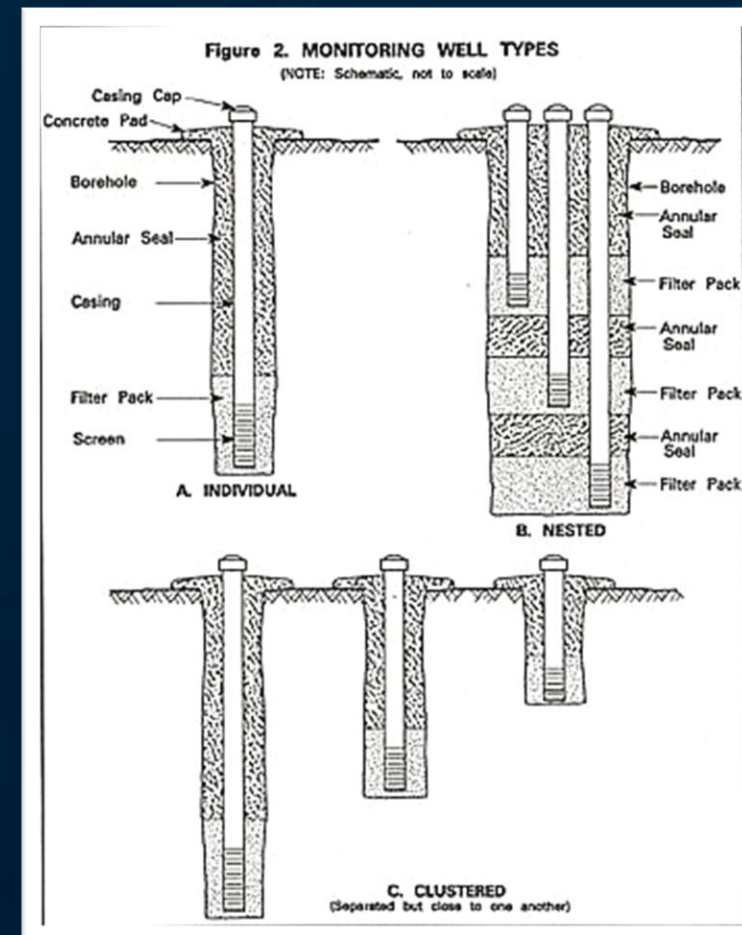
Summary: now with more numbers!



anomalies:
6,247 (2,544 wells)

total obs remaining:
693,051 (15,809 wells)

construction data:
6,879 wells



nested wellgroups: 274 (860 wells)

single/unknown: 974 (2,558 wells)

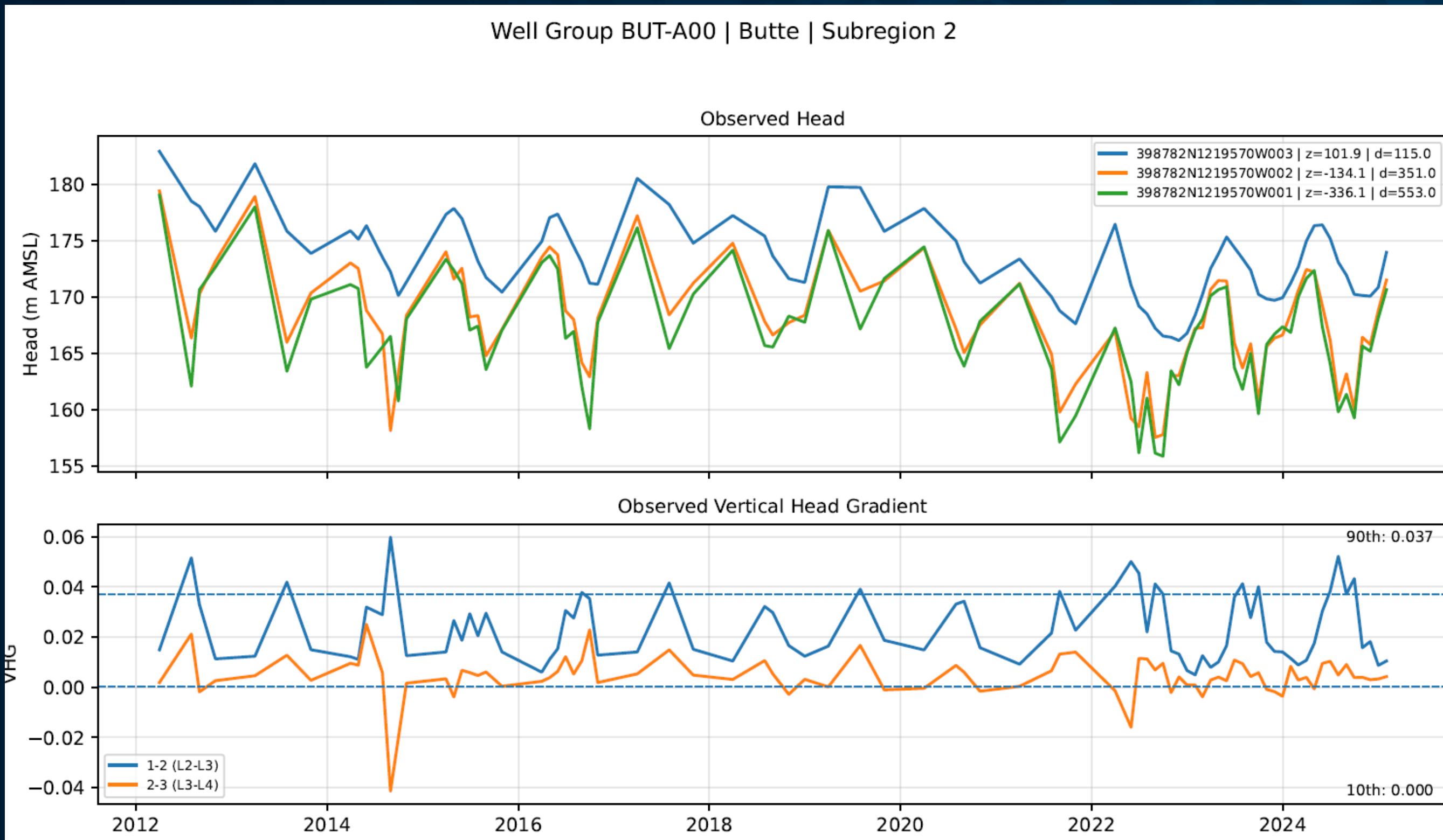
total wellgroups: 1,252

wellgroup obs: 199,177

wellgroups in single layer: 383

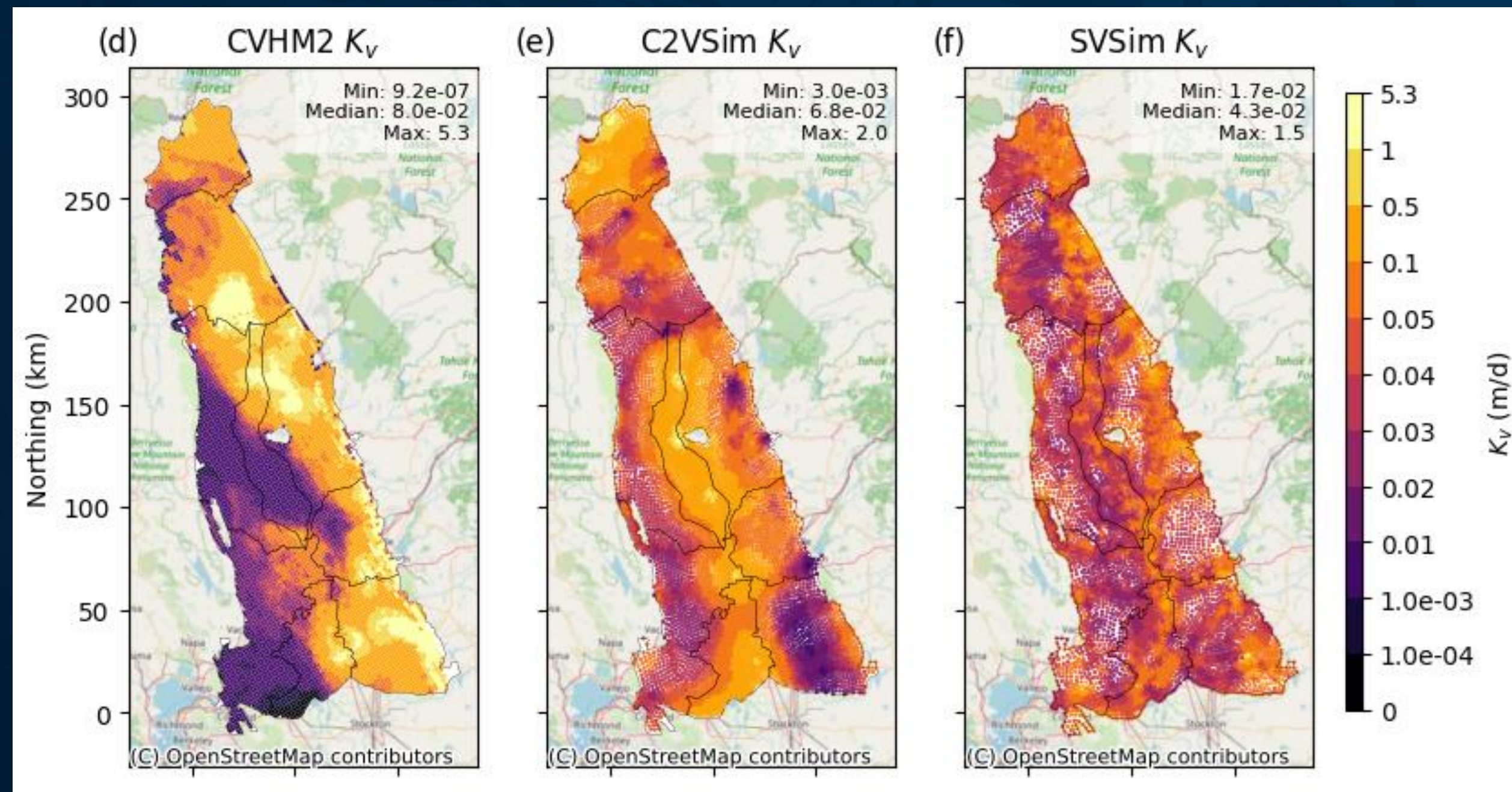
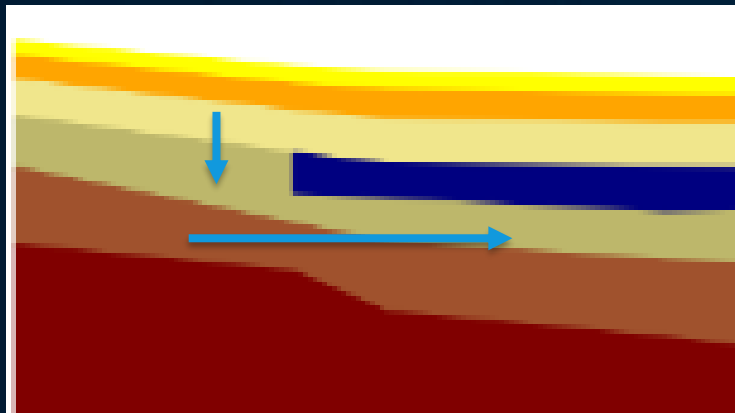
wellgroups with 2+ layers: 869

Why it matters – vertical hydraulic conductivity



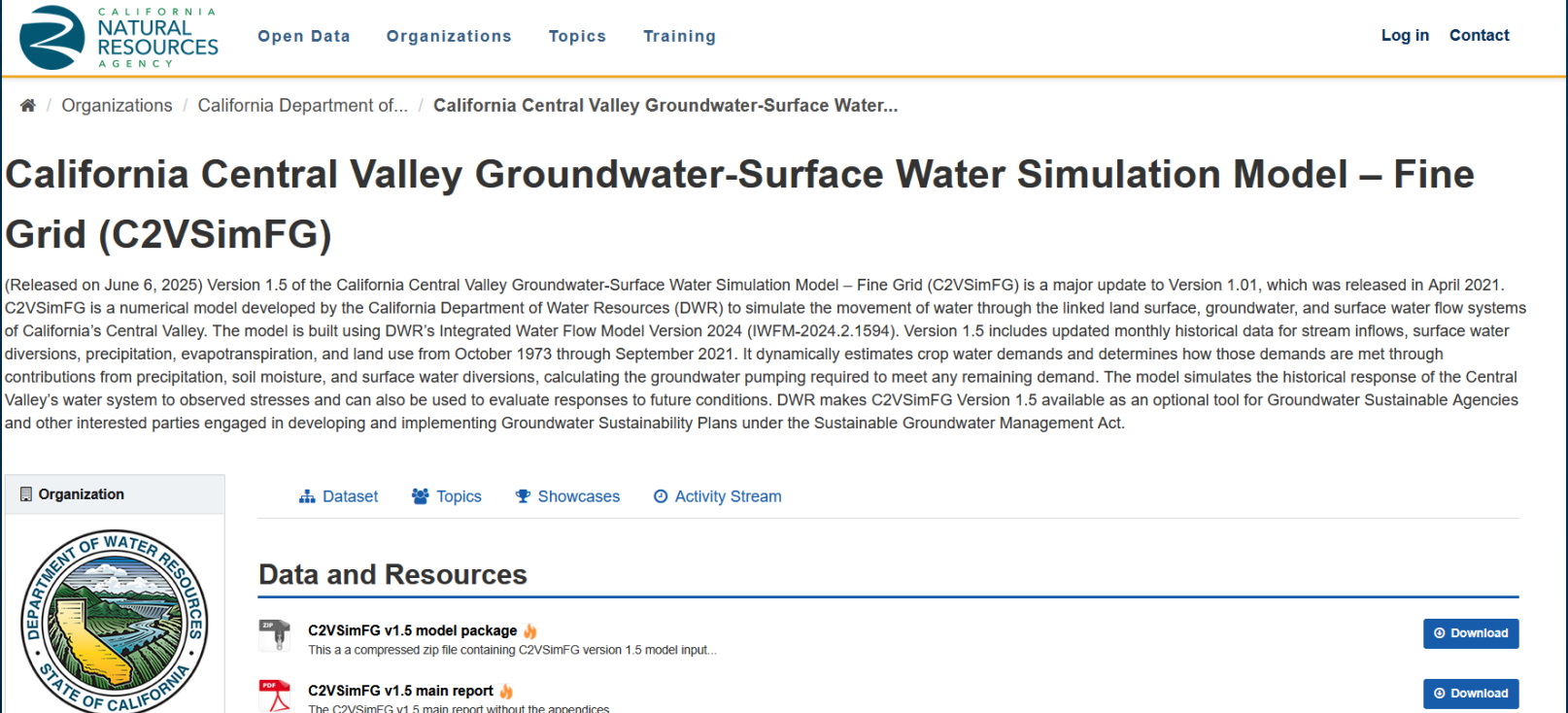
Why it matters – vertical hydraulic conductivity

- Need to calibrate against vertical hydraulic conductivity (5 orders of magnitude!)
- Yara Pasner (2025). Vertical Hydraulic Gradients: What They Mean and How to Use Them. UC Davis.
 - Figure B3. Map of K_h , **effective K_v** , and vertical anisotropy for CVHM2, C2VSim, and SVSim.



Conclusion

- Where can I access this data?
 - CNRA Open Data: C2VsimFG v1.5
 - Layer assignments: will be published with v2.0
 - Contact me for wellgroups (kyle.hardage@water.ca.gov)
 - Long term – unclear if updates to OSCWR or maintain C2VsimFG-specific dataset
 - Sustainable Groundwater Management Email list <https://water.ca.gov/Contact/Email-Subscriptions>
- Slides available: Appendix slides



The screenshot shows the California Department of Water Resources (DWR) Open Data portal. The page title is "California Central Valley Groundwater-Surface Water Simulation Model – Fine Grid (C2VSimFG)". The page content includes a detailed description of the model, its version history, and its purpose. Below the description, there is a "Data and Resources" section with two items: "C2VSimFG v1.5 model package" and "C2VSimFG v1.5 main report". Each item has a "Download" button.

California Central Valley Groundwater-Surface Water Simulation Model – Fine Grid (C2VSimFG)

(Released on June 6, 2025) Version 1.5 of the California Central Valley Groundwater-Surface Water Simulation Model – Fine Grid (C2VSimFG) is a major update to Version 1.01, which was released in April 2021. C2VSimFG is a numerical model developed by the California Department of Water Resources (DWR) to simulate the movement of water through the linked land surface, groundwater, and surface water flow systems of California's Central Valley. The model is built using DWR's Integrated Water Flow Model Version 2024 (IWFV-2024.2.1594). Version 1.5 includes updated monthly historical data for stream inflows, surface water diversions, precipitation, evapotranspiration, and land use from October 1973 through September 2021. It dynamically estimates crop water demands and determines how those demands are met through contributions from precipitation, soil moisture, and surface water diversions, calculating the groundwater pumping required to meet any remaining demand. The model simulates the historical response of the Central Valley's water system to observed stresses and can also be used to evaluate responses to future conditions. DWR makes C2VSimFG Version 1.5 available as an optional tool for Groundwater Sustainable Agencies and other interested parties engaged in developing and implementing Groundwater Sustainability Plans under the Sustainable Groundwater Management Act.

Data and Resources

- C2VSimFG v1.5 model package** 🔥
This is a compressed zip file containing C2VSimFG version 1.5 model input... [Download](#)
- C2VSimFG v1.5 main report** 🔥
The C2VSimFG v1.5 main report without the appendices... [Download](#)

Thank you

APPENDIX

Links

- DWR Periodic GW Data: <https://data.cnra.ca.gov/dataset/periodic-groundwater-level-measurements>
- DWR Continuous GW Data: <https://data.cnra.ca.gov/dataset/continuous-groundwater-level-measurements>
- DWR GSP Monitoring Data: <https://data.cnra.ca.gov/dataset/gspmd>
- USGS NWIS GW Data: <https://dashboard.waterdata.usgs.gov/app/nwd/en/>
- DWR AEM Ramboll Well Construction: <https://data.cnra.ca.gov/dataset/aem>
- DWR Well Completion Reports: <https://data.cnra.ca.gov/dataset/well-completion-reports>
- USGS Water Supply Study: <https://www.sciencebase.gov/catalog/item/64958d73d34ef77fcb01dc8f>



Data source priority for conflicting well construction

