

DWR 2022 AEM Geophysical Survey Results: What Can we Learn?

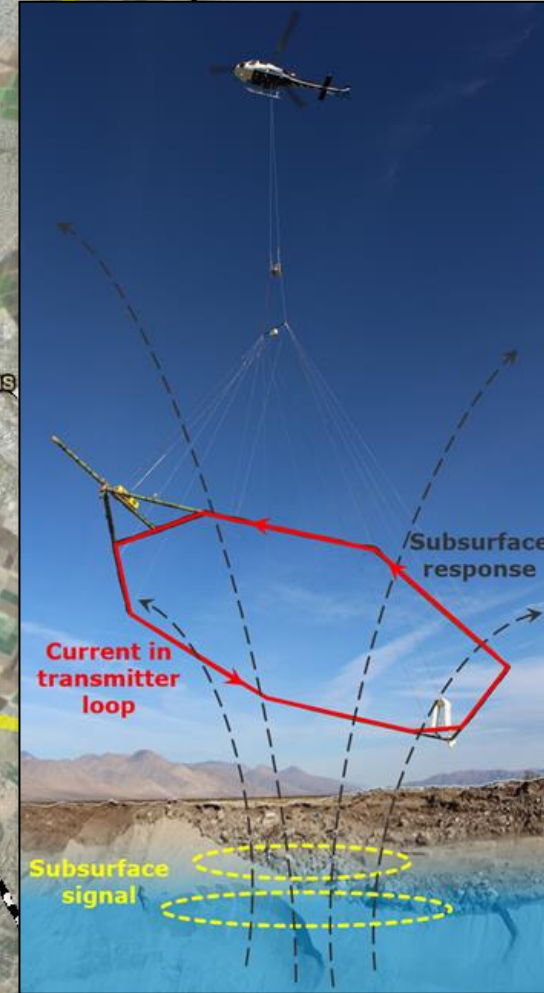
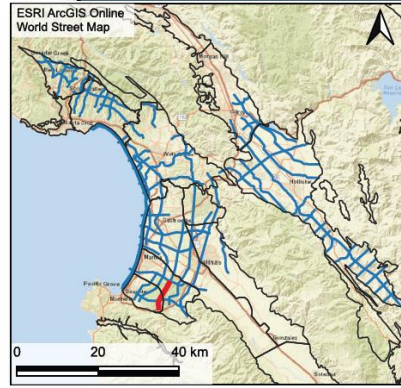


Pascual Benito, PhD

Seaside Watermaster TAC Meeting, 12/13/2023

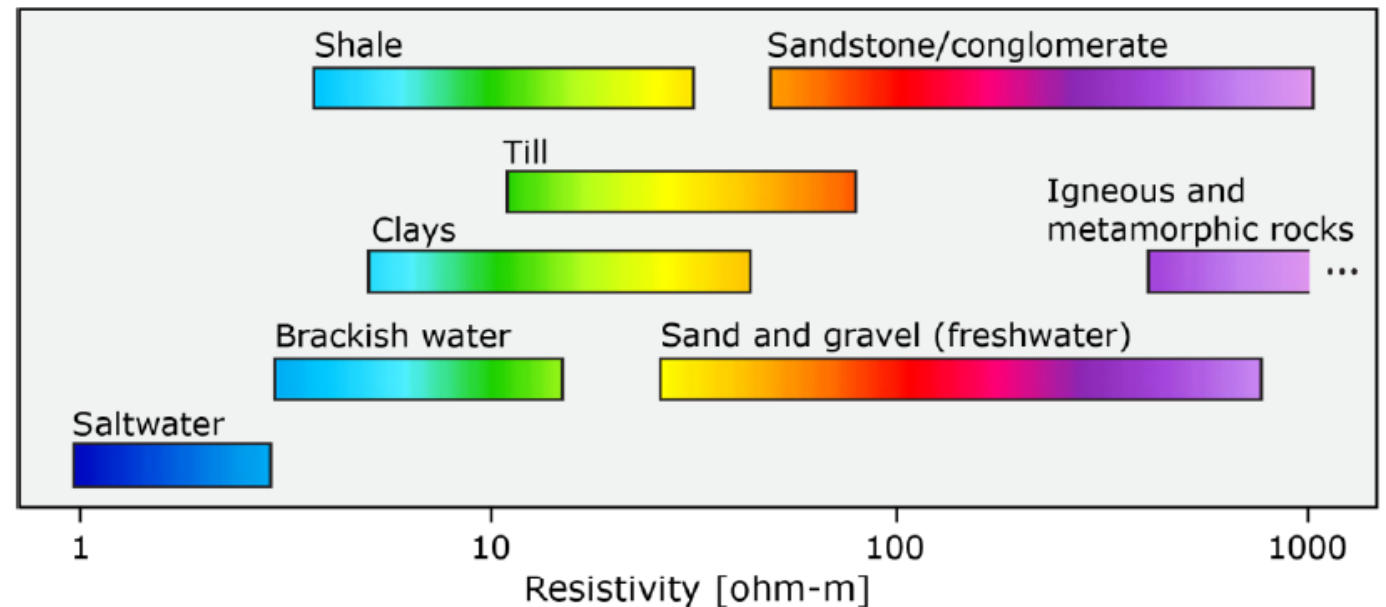
DWR AEM Flight Lines

- Flown November 2022
- Flight lines avoid built-up areas, highways, and other infrastructure for safety and signal interference reasons
- Coverage in Monterey and Seaside Subbasins mostly limited to inland areas within Fort Ord National Monument



How does Resistivity Relate to Subsurface Conditions?

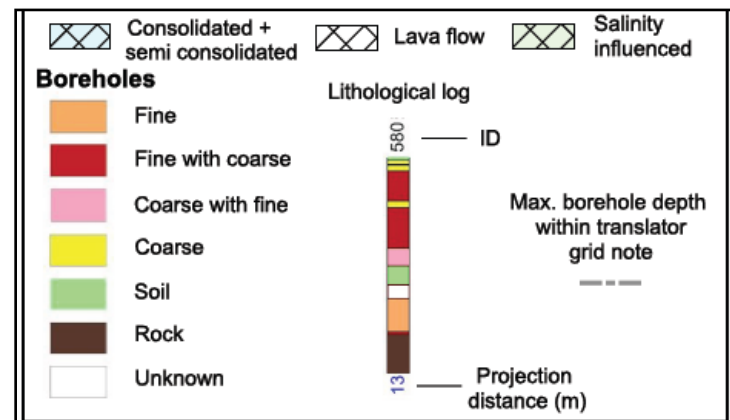
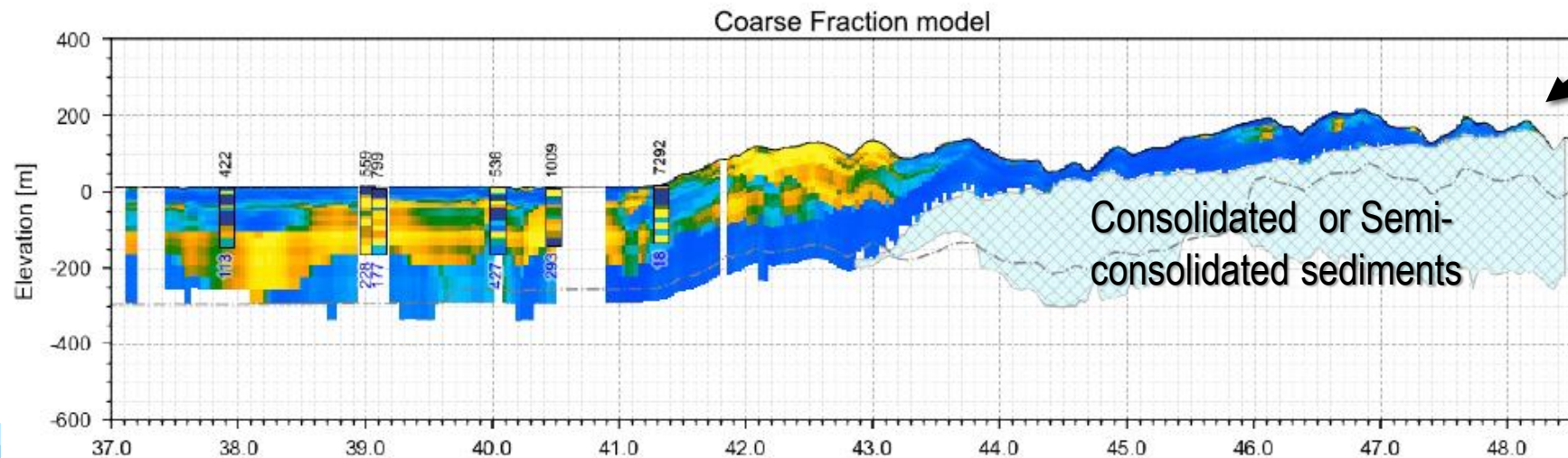
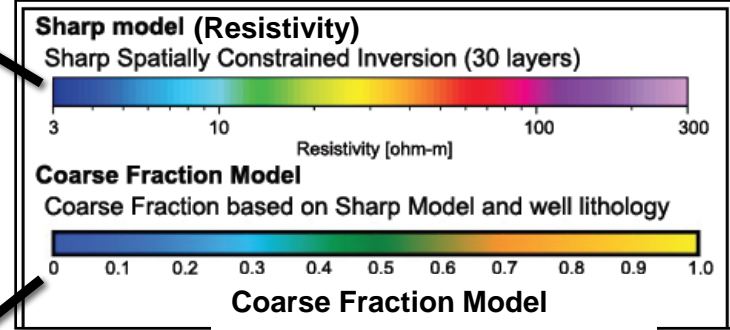
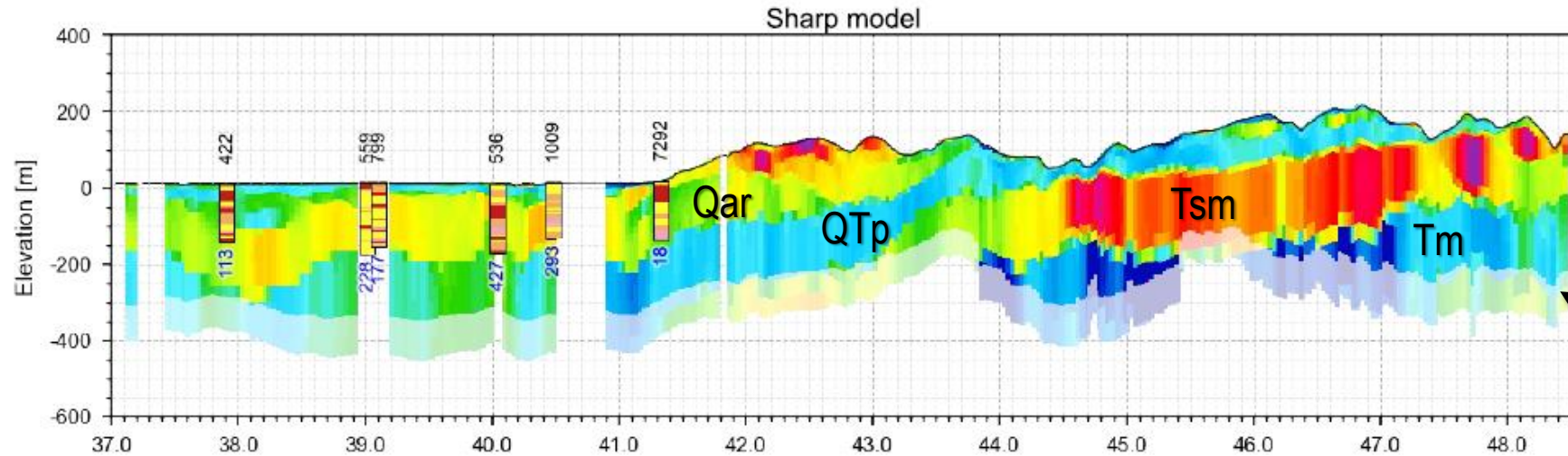
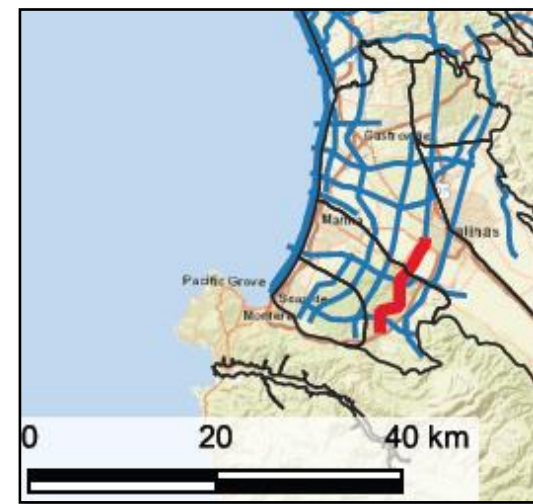
- Lower Resistivity (blues/green end of spectrum)
 - Finer Grained sediments, Shales
 - And/Or Higher Salinity/TDS Water
- Higher Resistivity (oranges/reds/pink end of spectrum)
 - Coarse sediments
 - Unsaturated (vadose zone)
 - Consolidated sediments
 - Igneous/Metamorphic

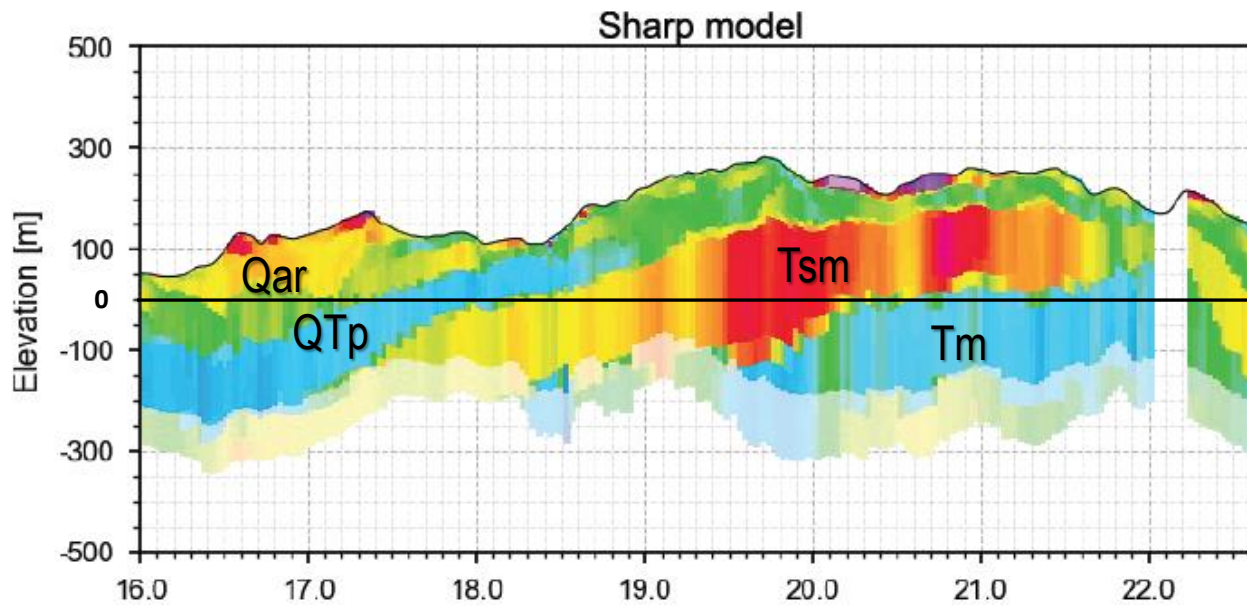


Structural Features & Hydrostratigraphy

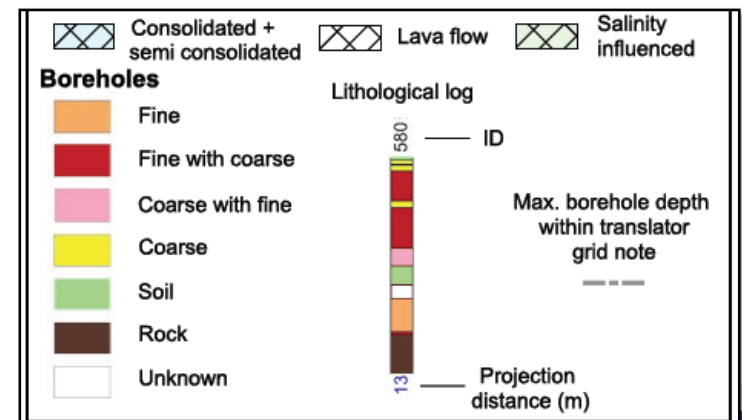
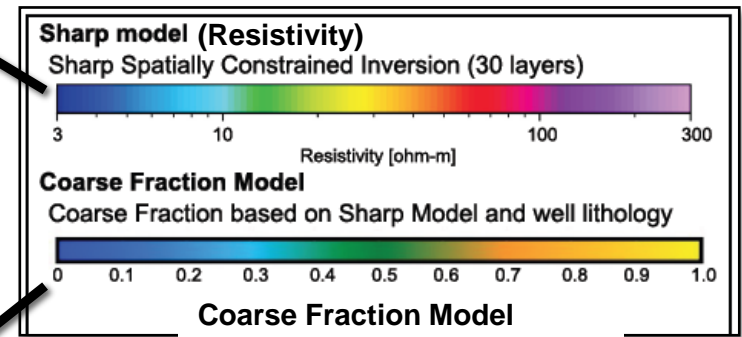
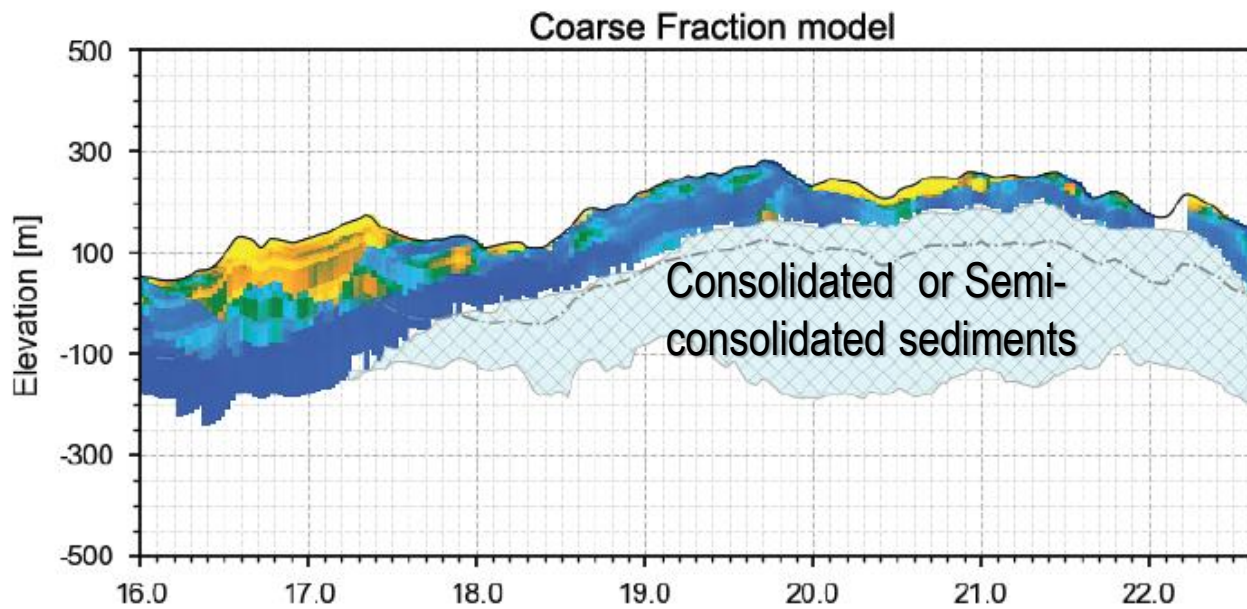
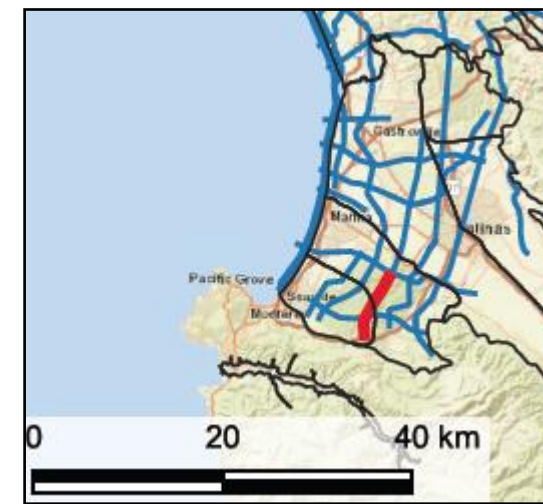
- The AEM derived resistivity results were combined with well lithology logs from nearby wells to create a relationship for converting resistivity to grain size texture (e.g. percent coarse or percent fine)
- This relationship was only developed for unconsolidated sediments and only applied for areas not impacted by seawater intrusion, and not known to have consolidated or semi-consolidated sediments

Linking Resistivity to Grain Size





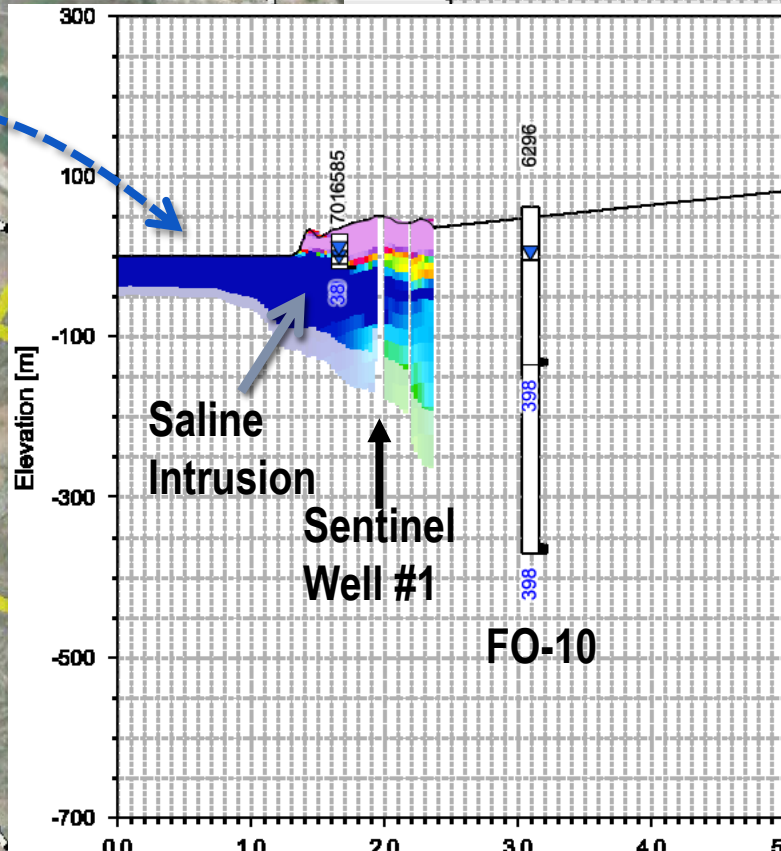
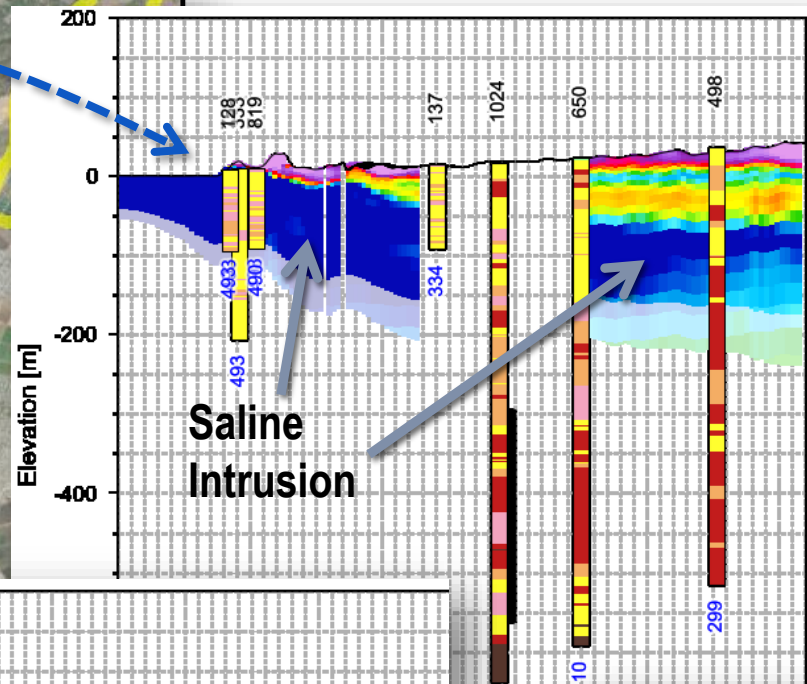
- Qal Alluvium
- Qar Aromas Sands
- QTp Paso Robles
- Tsm Santa Margarita
- Tm Monterey Formation



What can the AEM Data Tell us about the Extent of Seawater Intrusion?

Extent Lower 180-Foot, 400-Foot Aquifer Sea Water Intrusion¹

¹ Monterey Subbasin GSP 2022



Smooth model
Smooth spatially constrained inversion (30 layers)

Resistivity [ohm-m] *DOI = Depth of investigation

Boreholes

- Fine
- Fine with coarse
- Coarse with fine
- Coarse
- Soil
- Rock
- Unknown

Lithological log

- ID
- Water level
- Screen
- Same color scale as TDS**
- Projection distance (m)

Electrical log

- Electrical conductivity
- Water resistivity (ohm-m): same color scale as Smooth Model

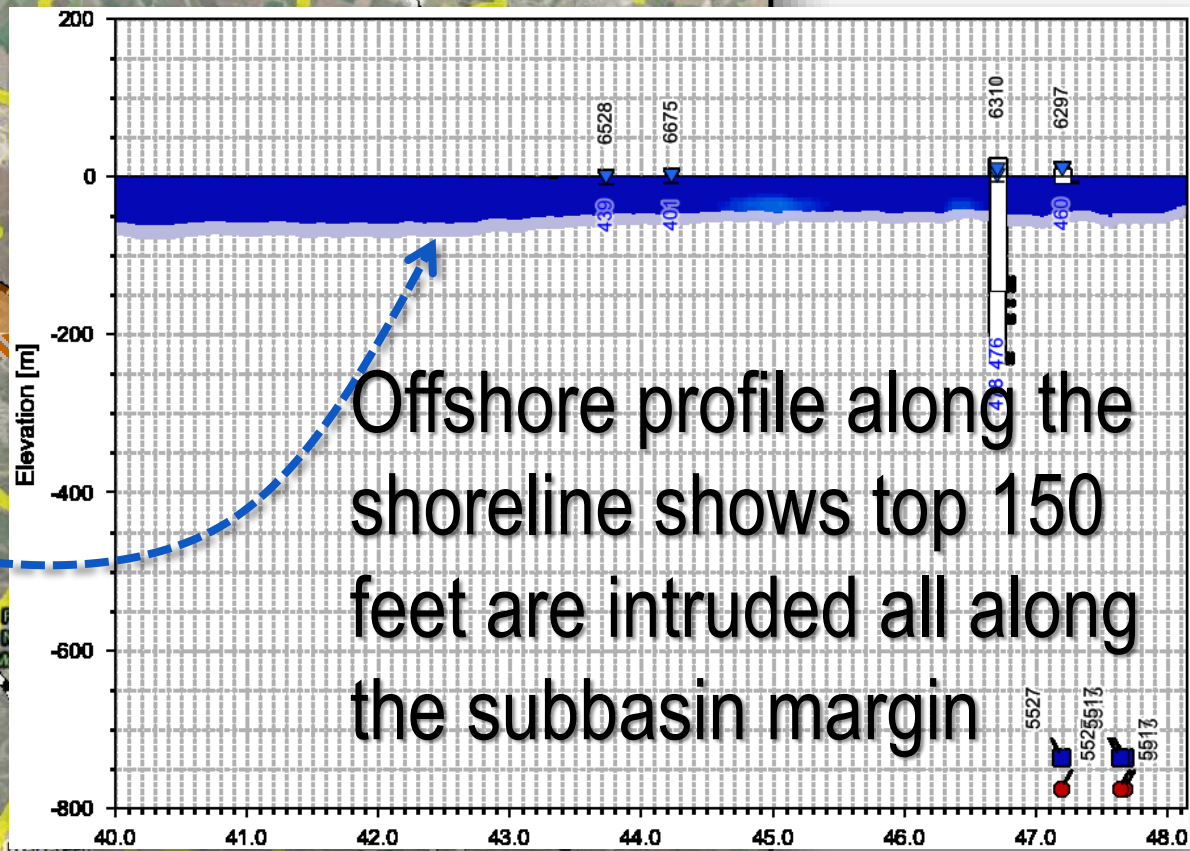
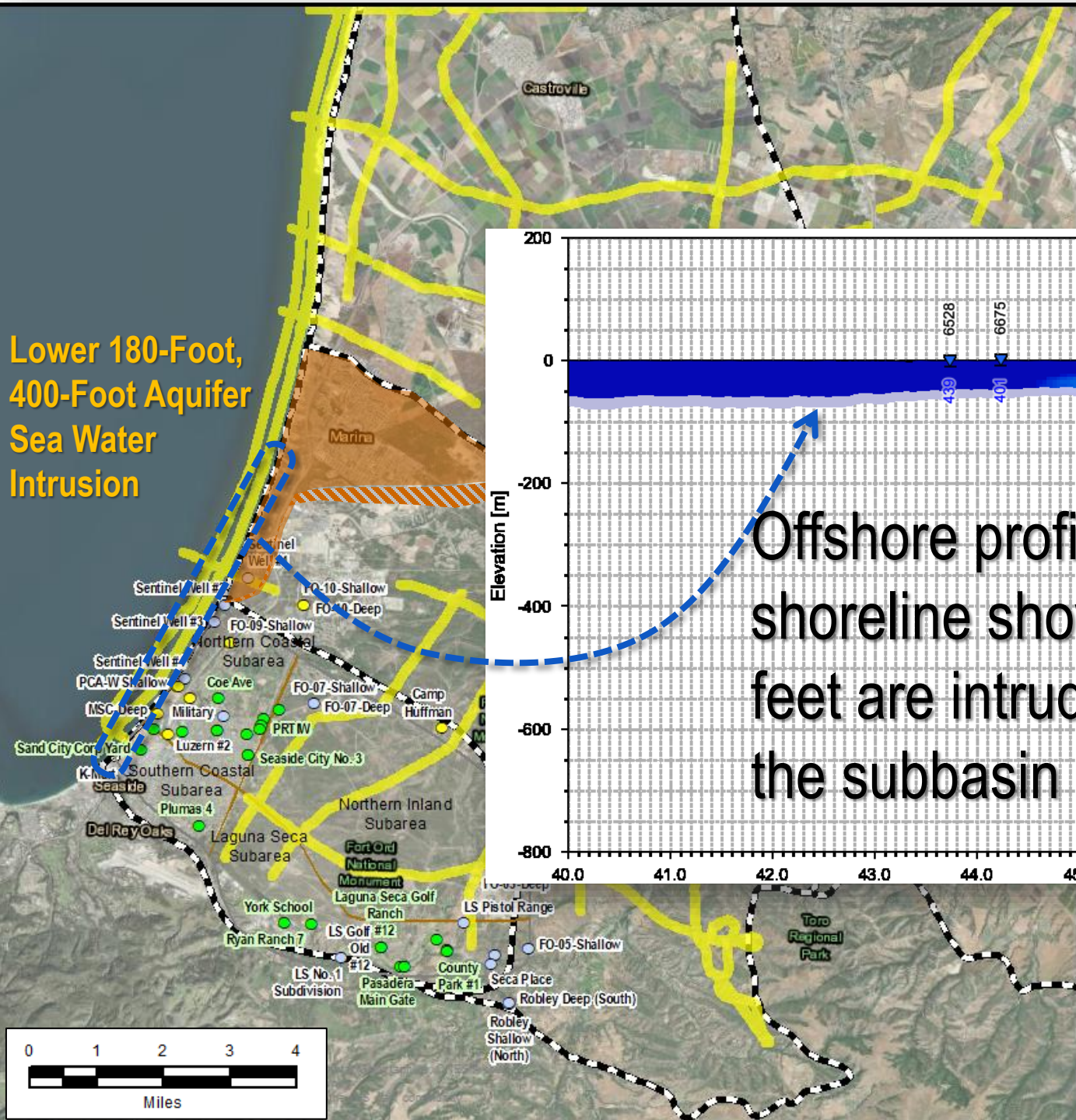
Magnetic Data

- Total magnetic intensity (TMI)
- First vertical derivative (1VD)

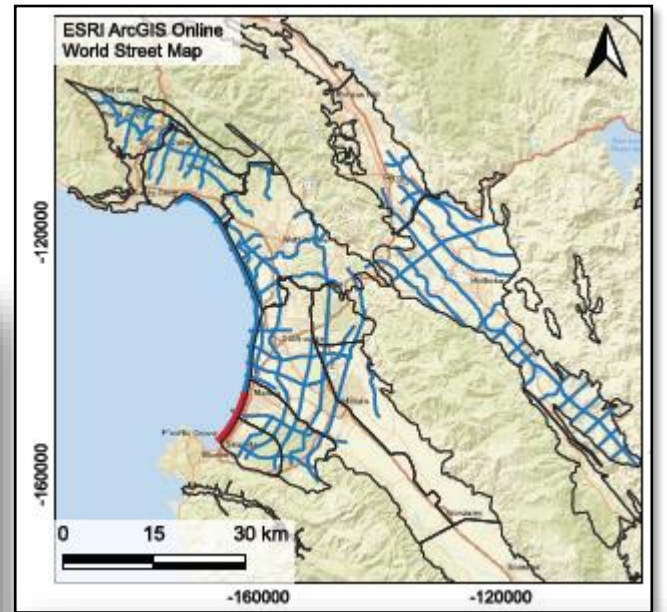
Total Dissolved Solids**

- ≤ 1000 mg/L
- 1000-3000 mg/L
- 3000-10000 mg/L
- >10000 mg/L

Lower 180-Foot, 400-Foot Aquifer Sea Water Intrusion



Offshore profile along the shoreline shows top 150 feet are intruded all along the subbasin margin



Smooth model
Smooth spatially constrained inversion (30 layers)

Resistivity [ohm-m] *DOI = Depth of investigation

Boreholes

- Fine
- Fine with coarse
- Coarse with fine
- Coarse
- Soil
- Rock
- Unknown

Lithological log

Electrical log

Total Dissolved Solids**

- ≤ 1000 mg/L
- 1000-3000 mg/L
- 3000-10000 mg/L
- >10000 mg/L

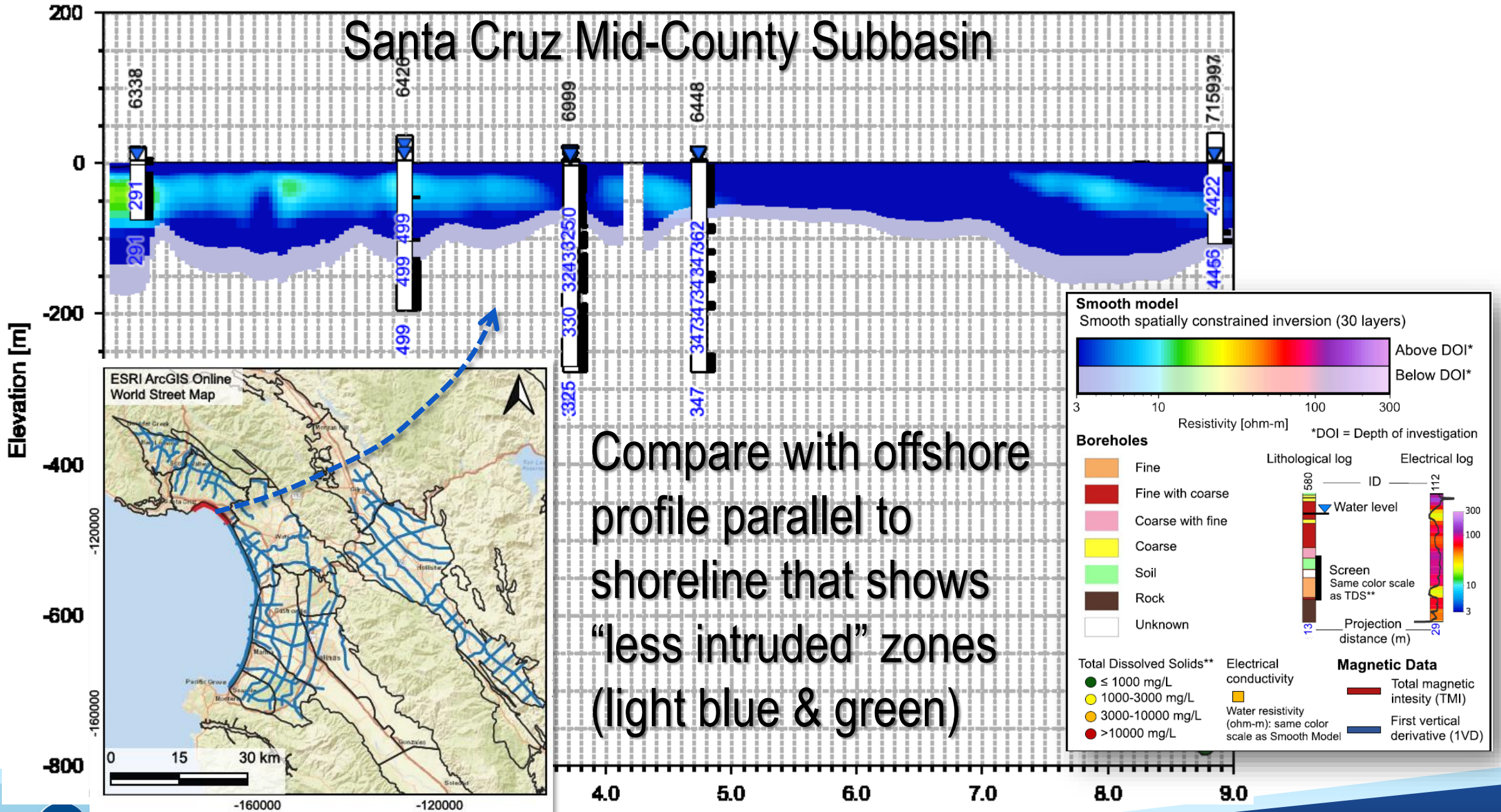
Electrical conductivity

- Water resistivity (ohm-m): same color scale as Smooth Model

Magnetic Data

- Total magnetic intensity (TMI)
- First vertical derivative (1VD)

Santa Cruz Mid-County Subbasin



Compare with offshore profile parallel to shoreline that shows “less intruded” zones (light blue & green)

Take Aways

- Survey coverage was mainly limited to inland areas
- Provides a 3-D view into structure and stratigraphy of the inland areas of the Monterey and Seaside Subbasins where data have previously been missing -- can be incorporated into future model updates
- Very clearly shows inland seawater intrusion extent in coastal areas of Monterey Subbasin that were surveyed
- Additional survey transects at Sentinel Wells #2, #3, and #4, and possibly Golf Courses should be considered to fill data gaps in the Coastal Subarea (can use TOWTEM instead of SkyTEM)

References

- CA DWR's Statewide Airborne Electromagnetic Survey Project: Data Report for Survey Area 10 Monterey Bay Area, October 15, 2023
<https://data.cnra.ca.gov/dataset/aem>

Questions



Pascual Benito, Ph.D.



pbenito@elmontgomery.com



510-485-9054



**MONTGOMERY
& ASSOCIATES**

Water Resource Consultants