EBP Subbasin GSP Progress Update

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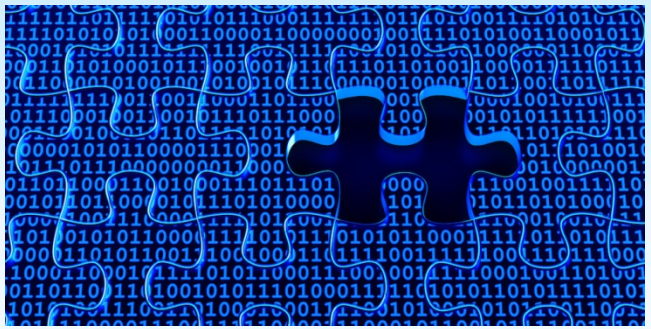
East Bay Plain Subbasin – Groundwater Sustainability Plan
Technical Advisory Committee Meeting

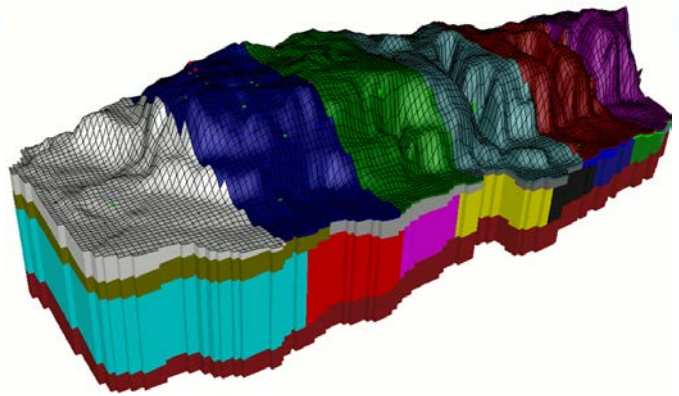
May 4, 2020

Completed Tasks

- Subtask 4.1: Data Compilation and Data Gap Analysis

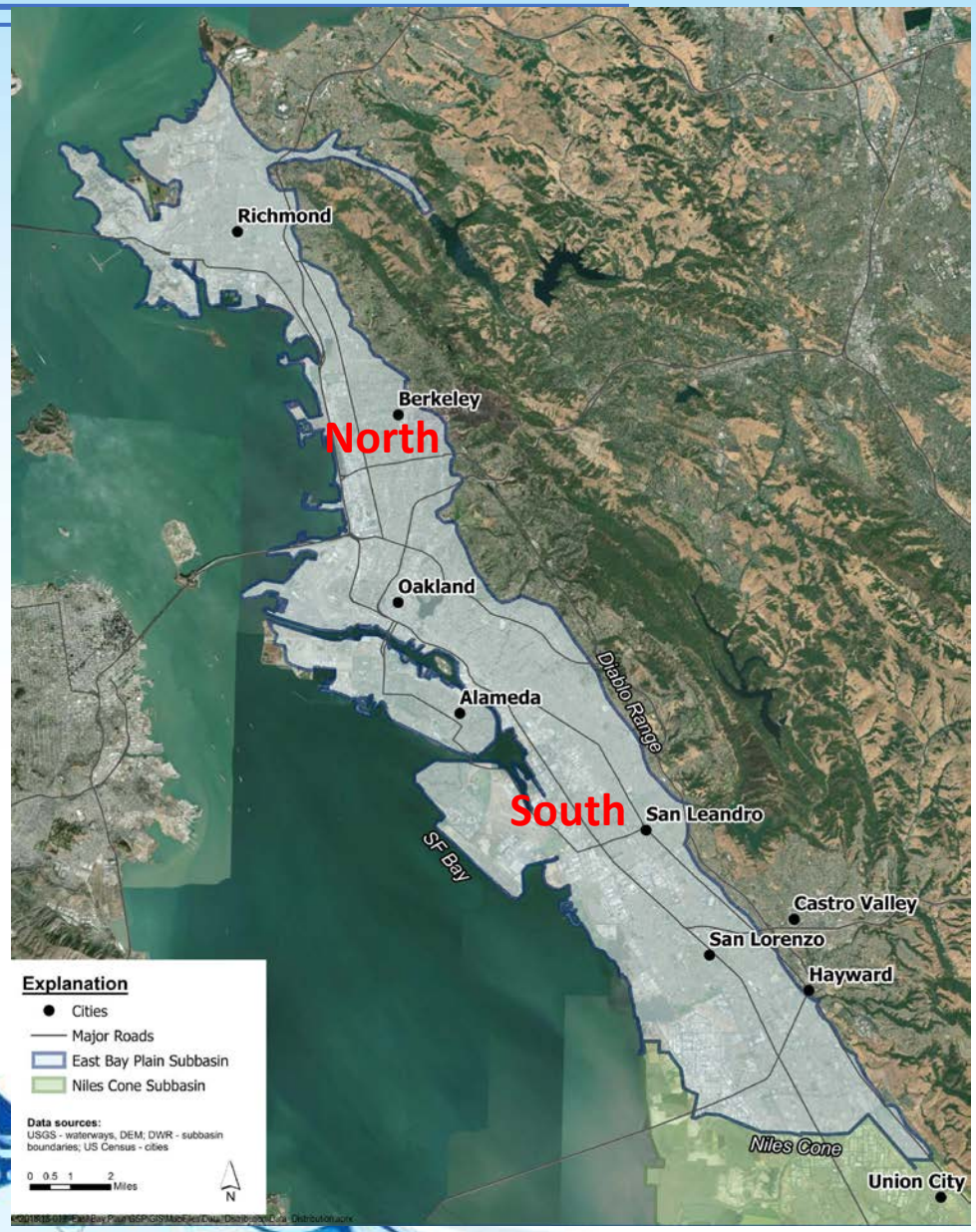


- Subtask 4.3: Model Objectives and Model Selection



Subtask 4.1 Data Compilation/Data Gaps

- Compiled available data including: well logs, water levels, water quality, water budget components, and other data types
- Mapped spatial distribution of data and evaluated temporal coverage of data
- Current status: Draft TM review by TAC recently completed (April 24, 2020)



Subtask 4.1 Well Completion Reports (WCRs)

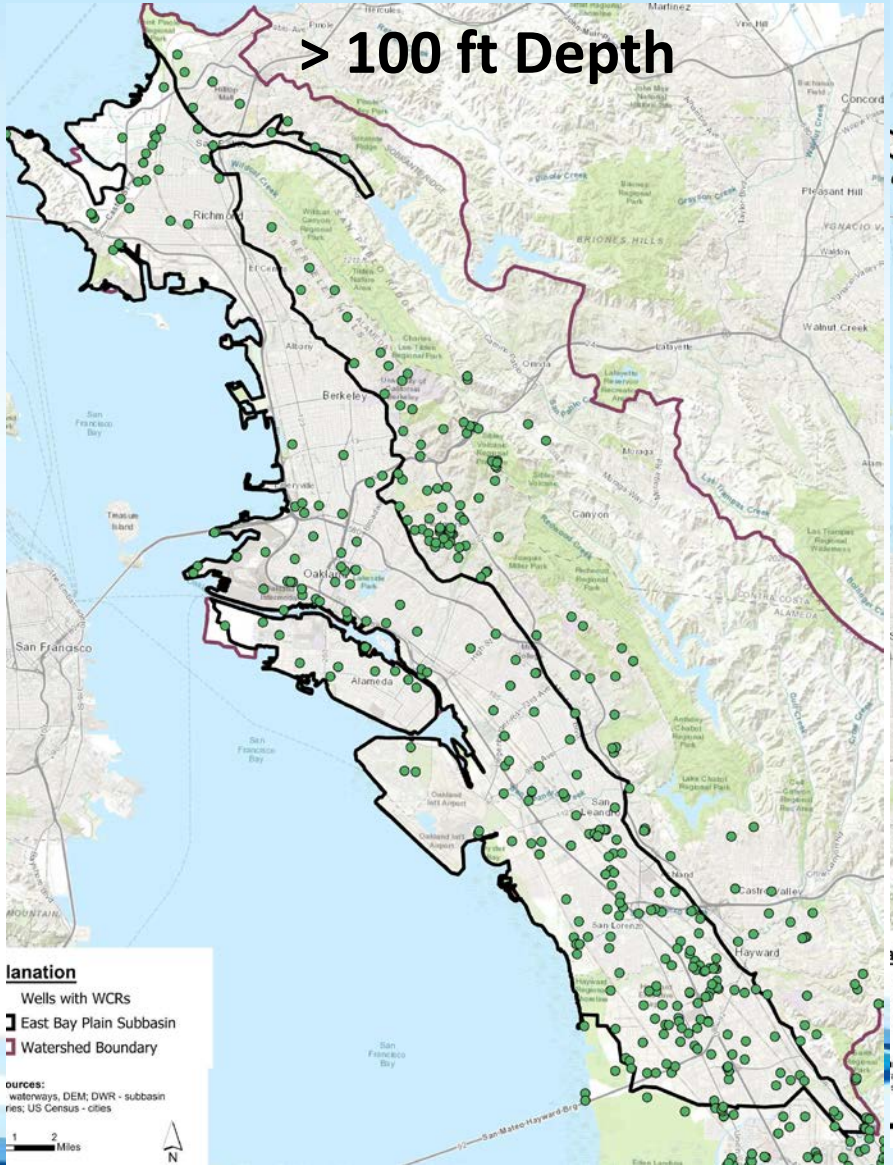
- Used to define aquifer/aquitard units and develop model layering
- 22,433 WCRs received from DWR
- Screening of WCRs by depth/quality of record – 642 records for further processing

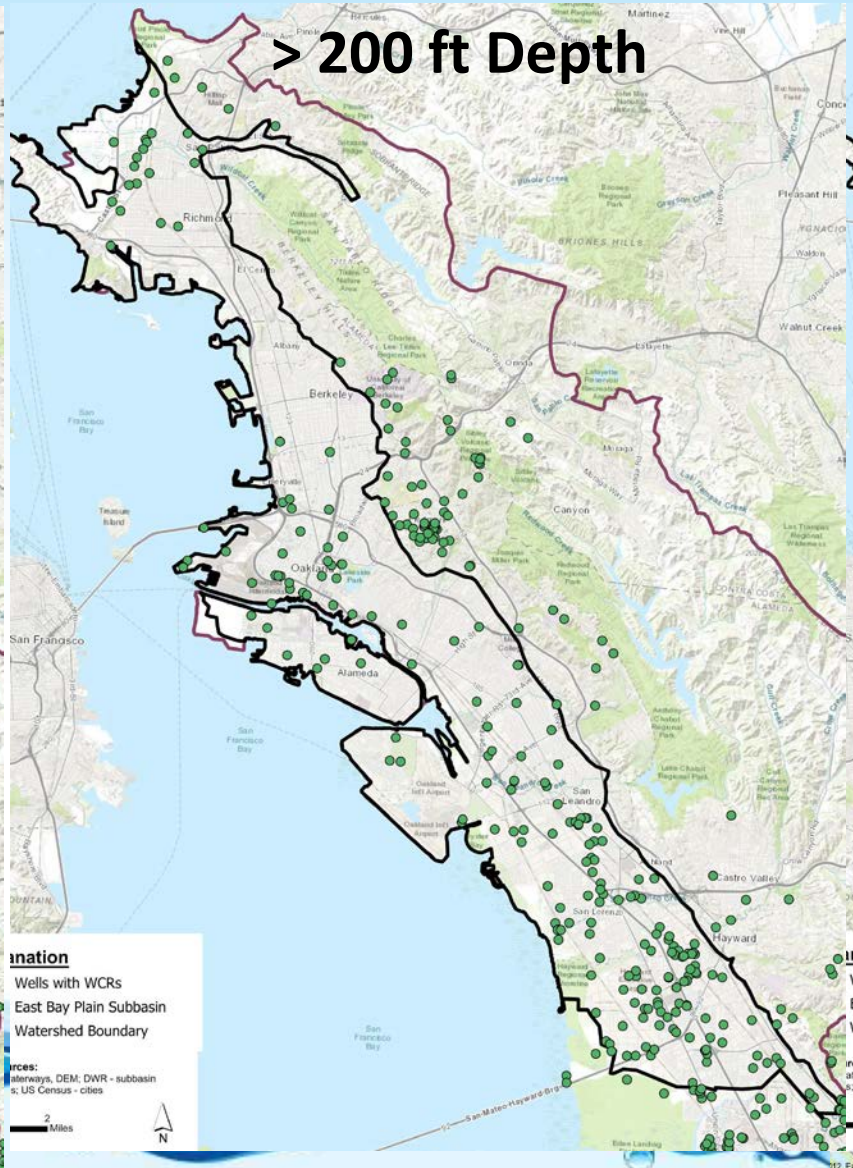
Table 3-1: WCR Summary By Depth

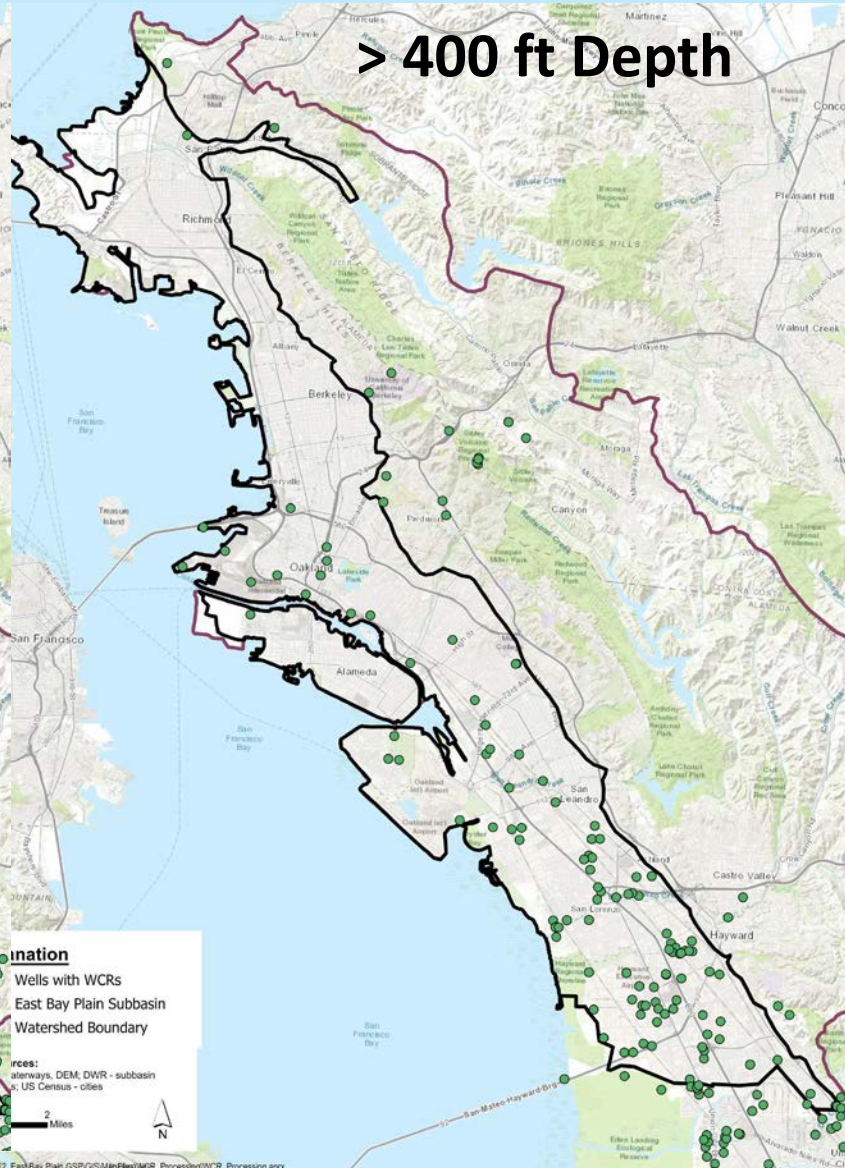
Number of WCRs	
100 ft or greater	642
200 ft or greater	557
400 ft or greater	232

- 86% are located as precisely as possible, and
  14% located at centroid of Township/Range/Section (T/R/S)
- Deep Aquifer (greater than 400 ft deep) of primary interest in southern portion of subbasin

Subtask 4.1 Well Completion Reports

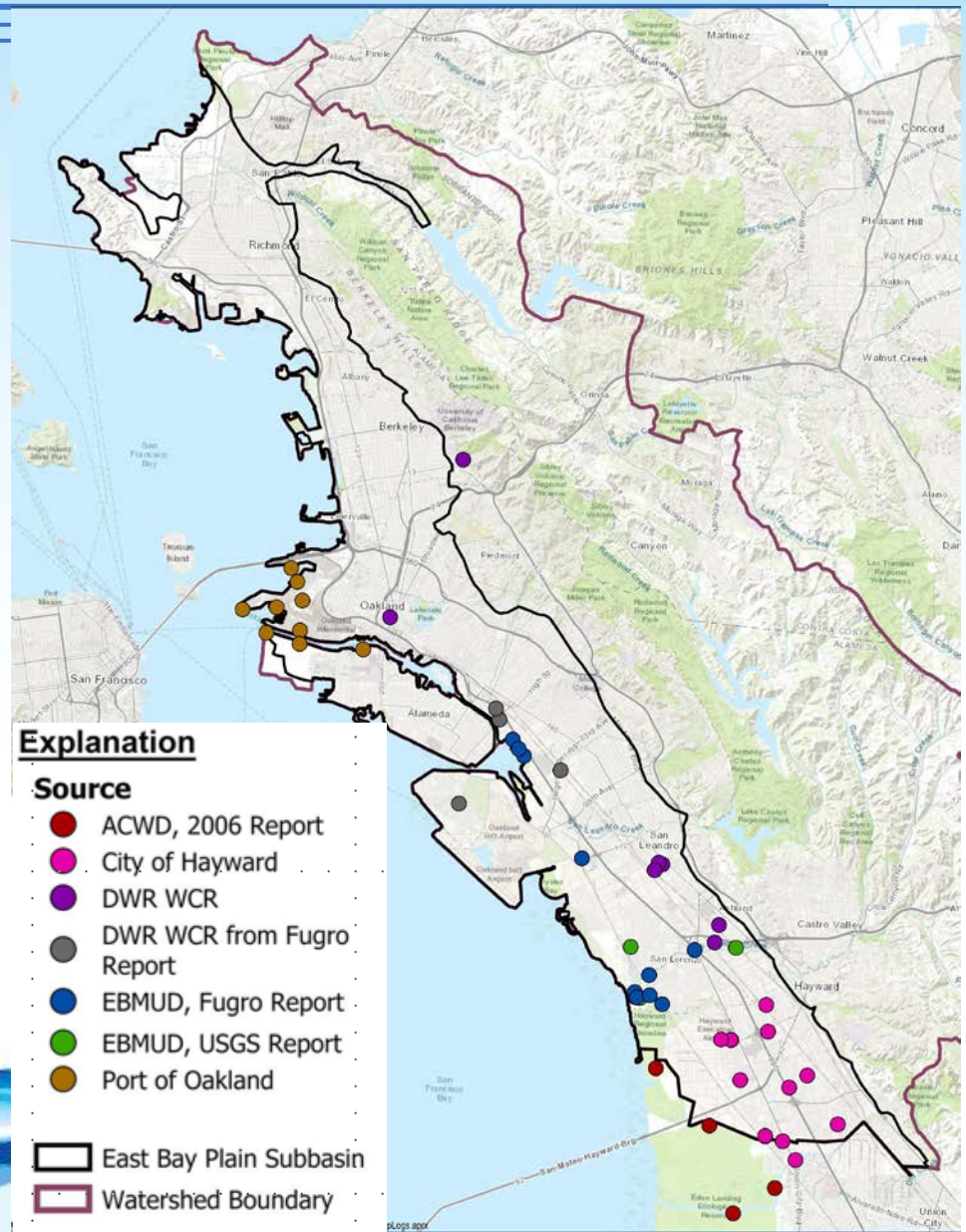






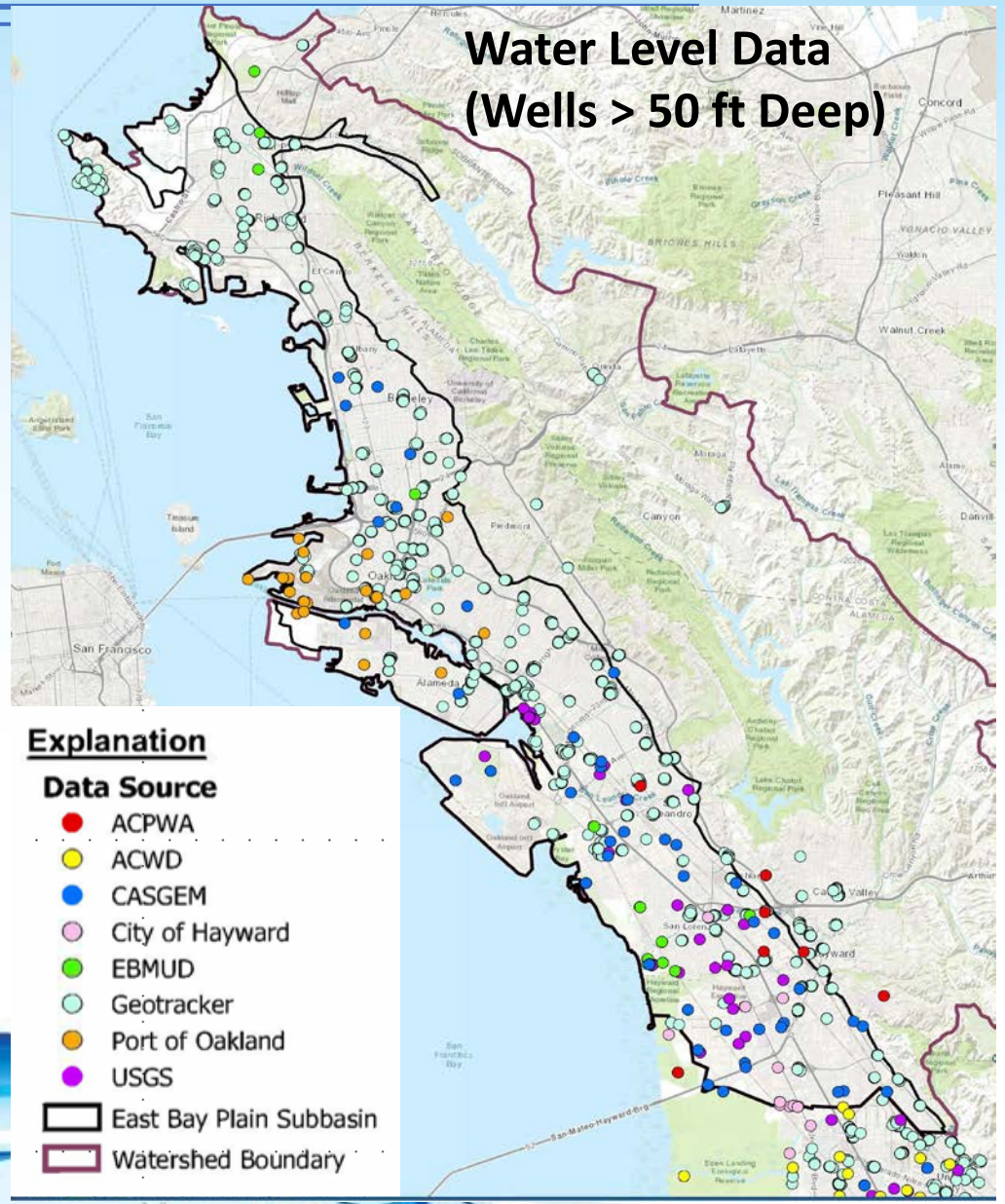
Subtask 4.1 Geophysical Logs

- Used to define aquifer/aquitard units and develop model layering
- More precise definition of fine and coarse-grained sediments than WCRs
- Compilation of geophysical logs from Department of Water Resources (DWR) ; EBMUD; Hayward; Port of Oakland

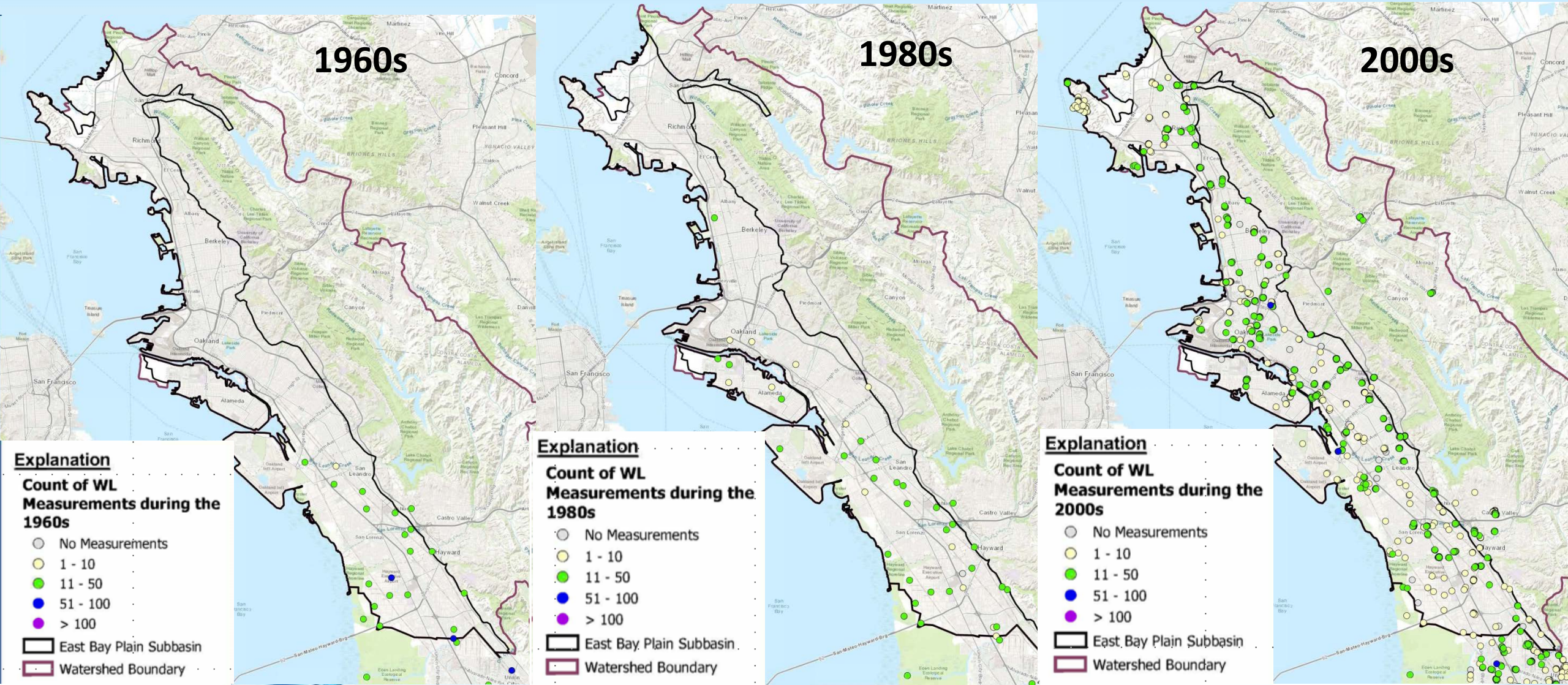


Subtask 4.1 Groundwater Level/Quality Data

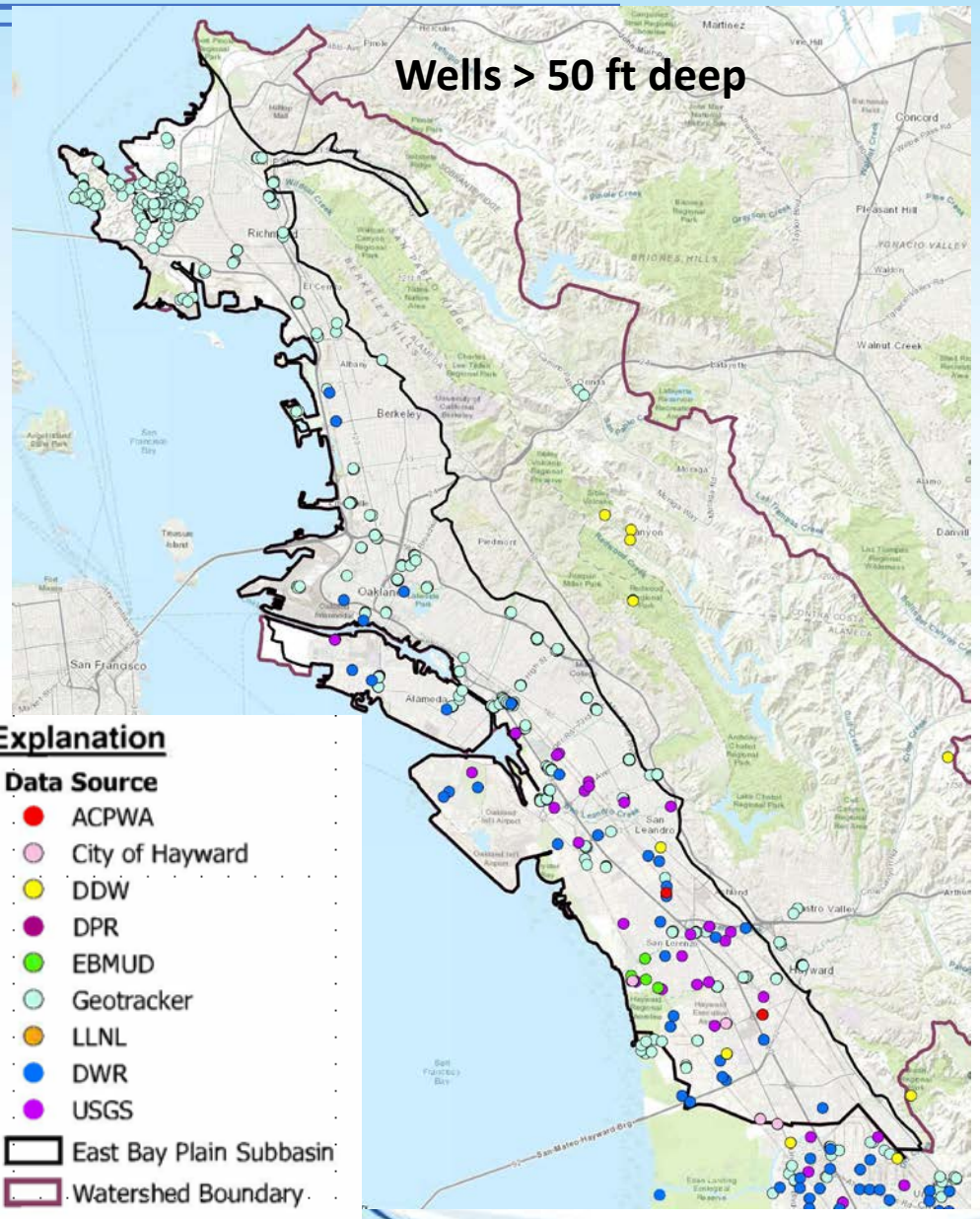
- Data compiled from various sources: EBMUD, Hayward, County, DWR United States Geological Survey (USGS), Geotracker/GAMA, Basin Reports
- Evaluated by well depth zones: < 50 ft, 50-200 ft, 200-400 ft, > 400 ft
- Majority of wells with water level data represent shallow zone (< 200 ft) e.g., Geotracker Sites.
- Evaluated by time periods: 1950s, 1960s, 1970s, 1980s, 1990s etc.



Subtask 4.1 Groundwater Level Data

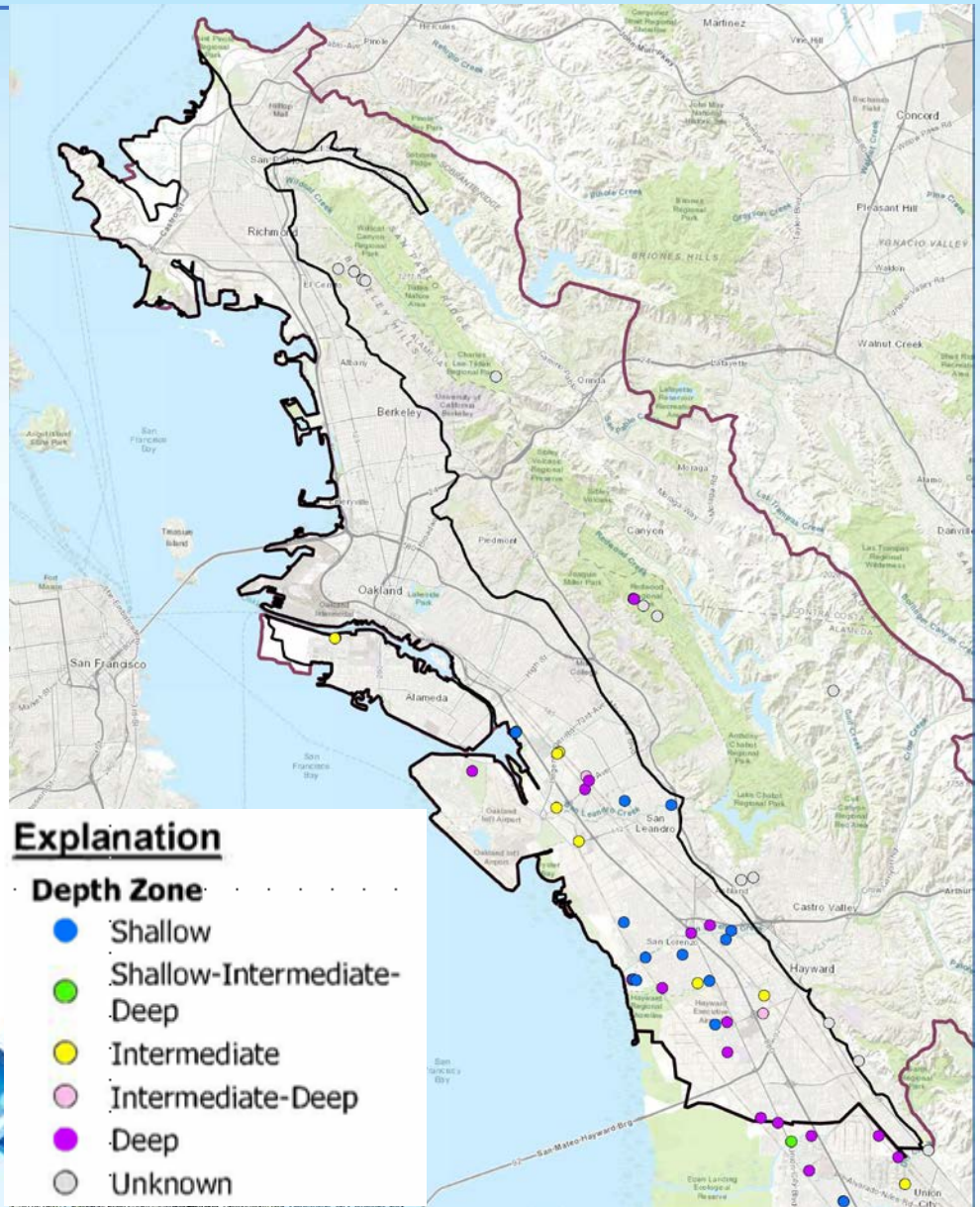


Subtask 4.1 Groundwater Quality Data



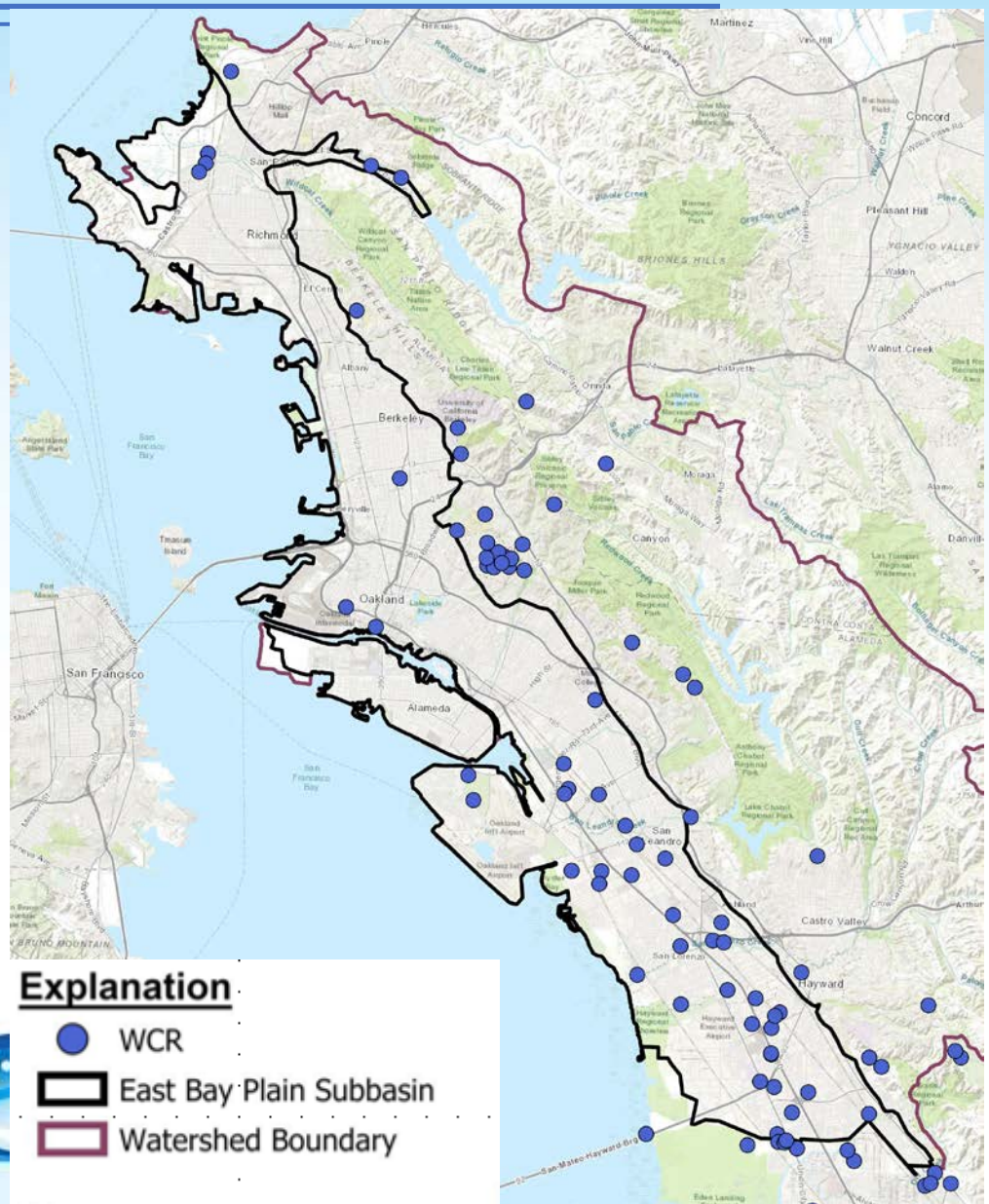
Subtask 4.1 Isotope Data

- Dr. Jean Moran compiled from various sources
- Isotope data available included:
  - Deuterium/Hydrogen ratio
  - Tritium
  - Carbon-13/Carbon-12 ratio
  - Oxygen-18/Oxygen-16 ratio



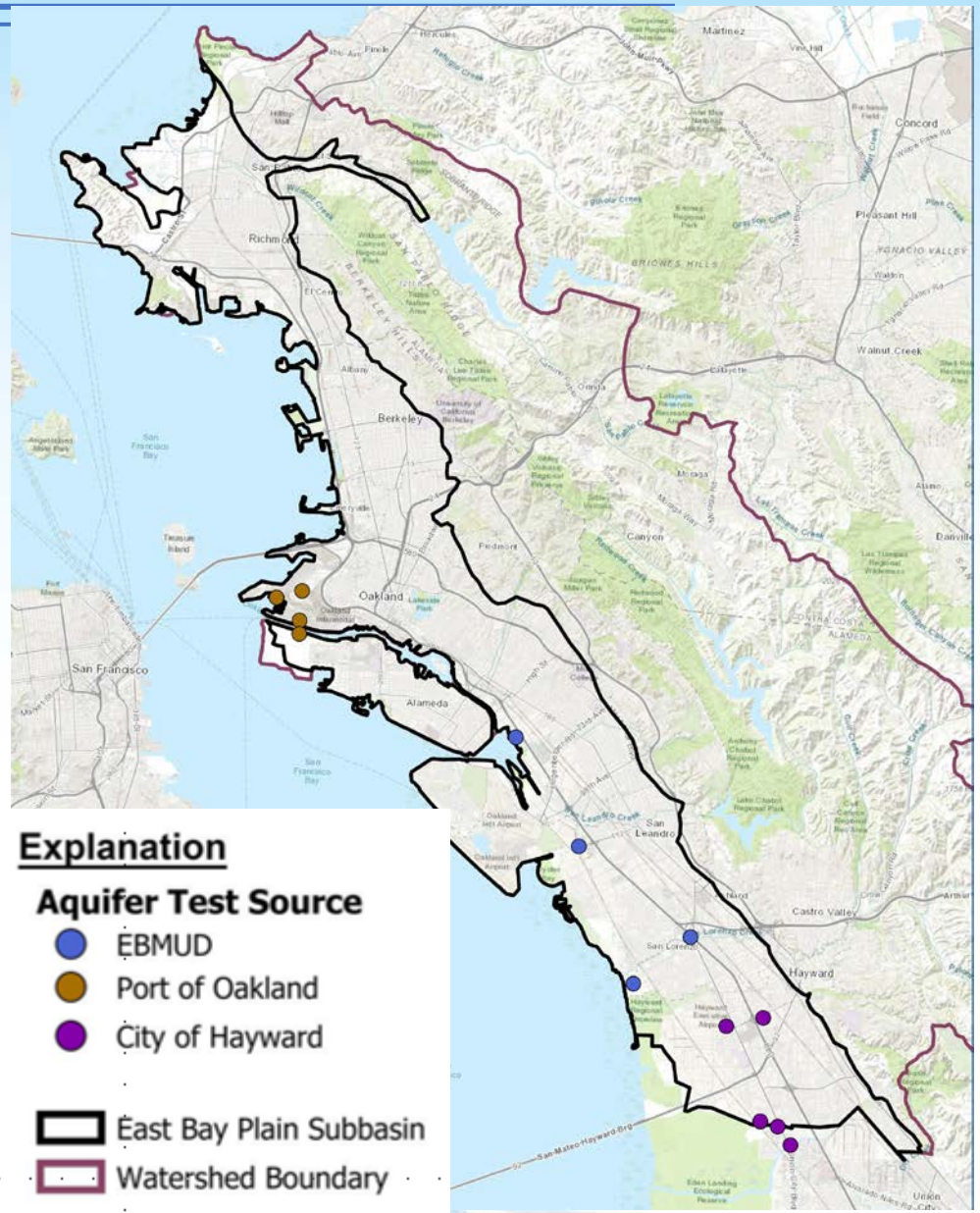
Subtask 4.1 Specific Capacity Data

- Compiled from DWR WCRs
- Specific capacity = pumping rate/ drawdown (gallons per minute/ft or gpm)
- Indication of aquifer permeability or transmissivity



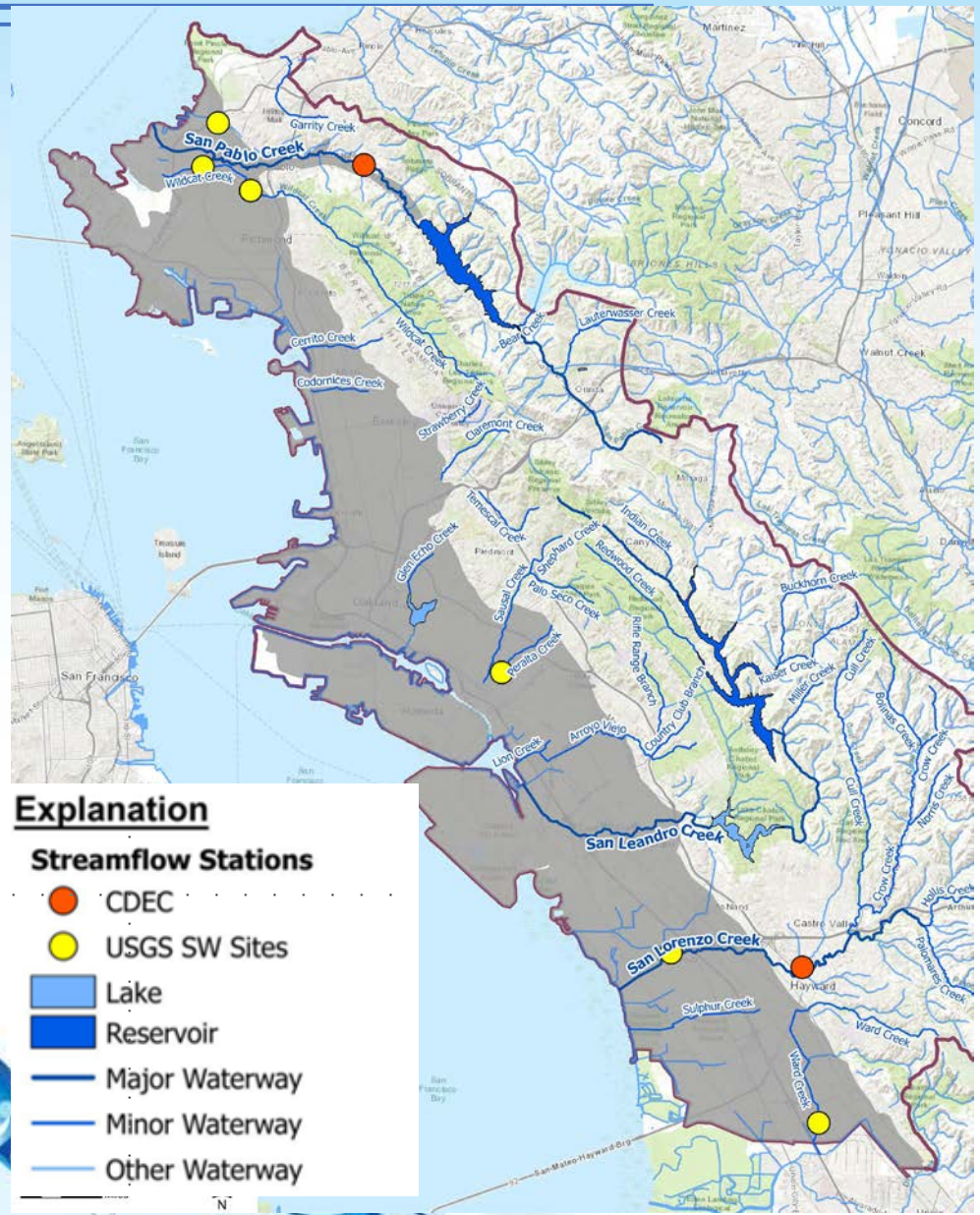
Subtask 4.1 Aquifer Test Data

- Compiled from EBMUD, Hayward, and Port of Oakland studies
- Map shows pumped wells, but not observation wells
- Provides aquifer parameters: transmissivity, hydraulic conductivity, and storativity
- Long-term regional tests provide model calibration data, indication of leakage from shallower aquifer zones



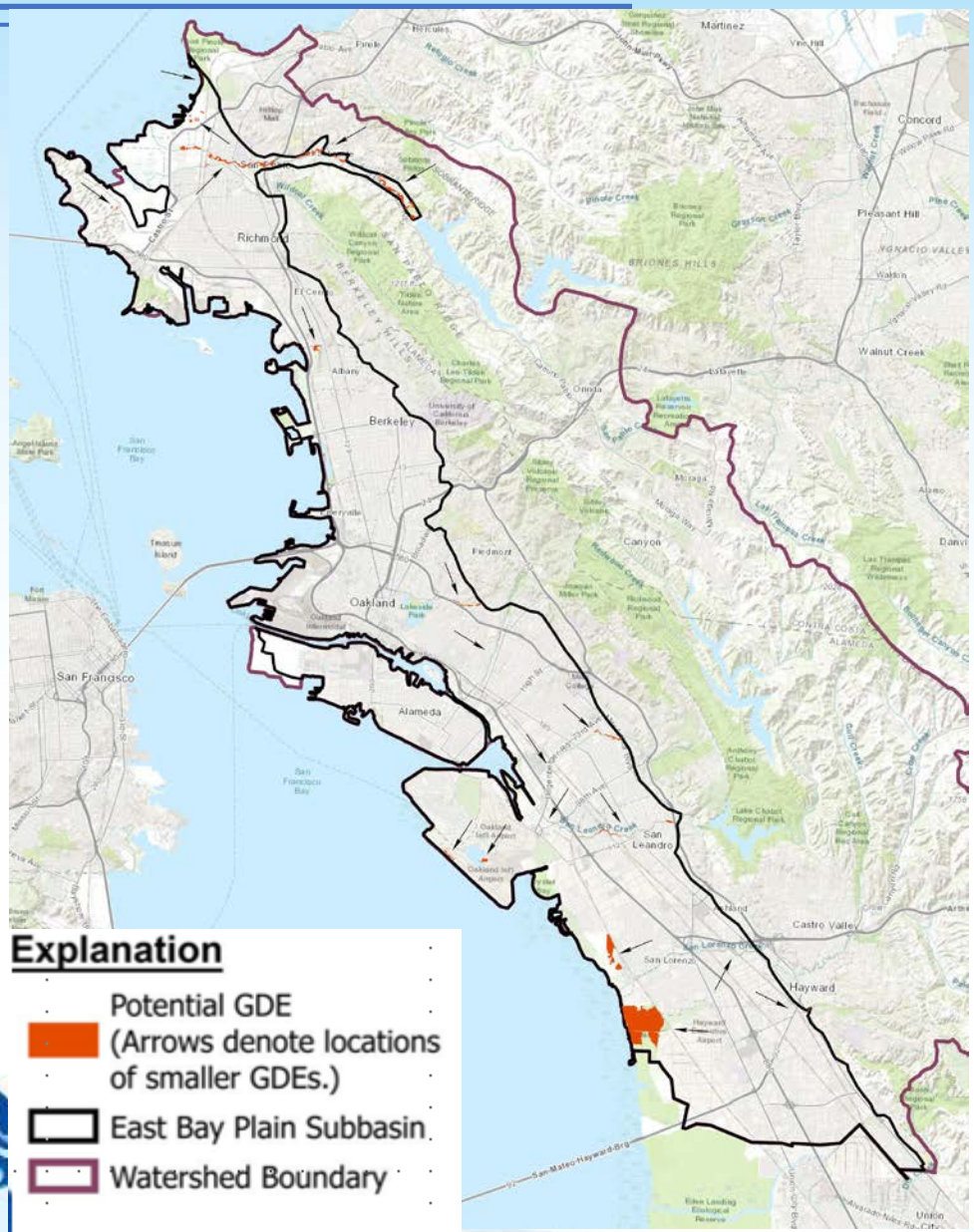
Subtask 4.1 Streamflow Data

- Compiled data from USGS and DWR
- Limited or no data available for most streams



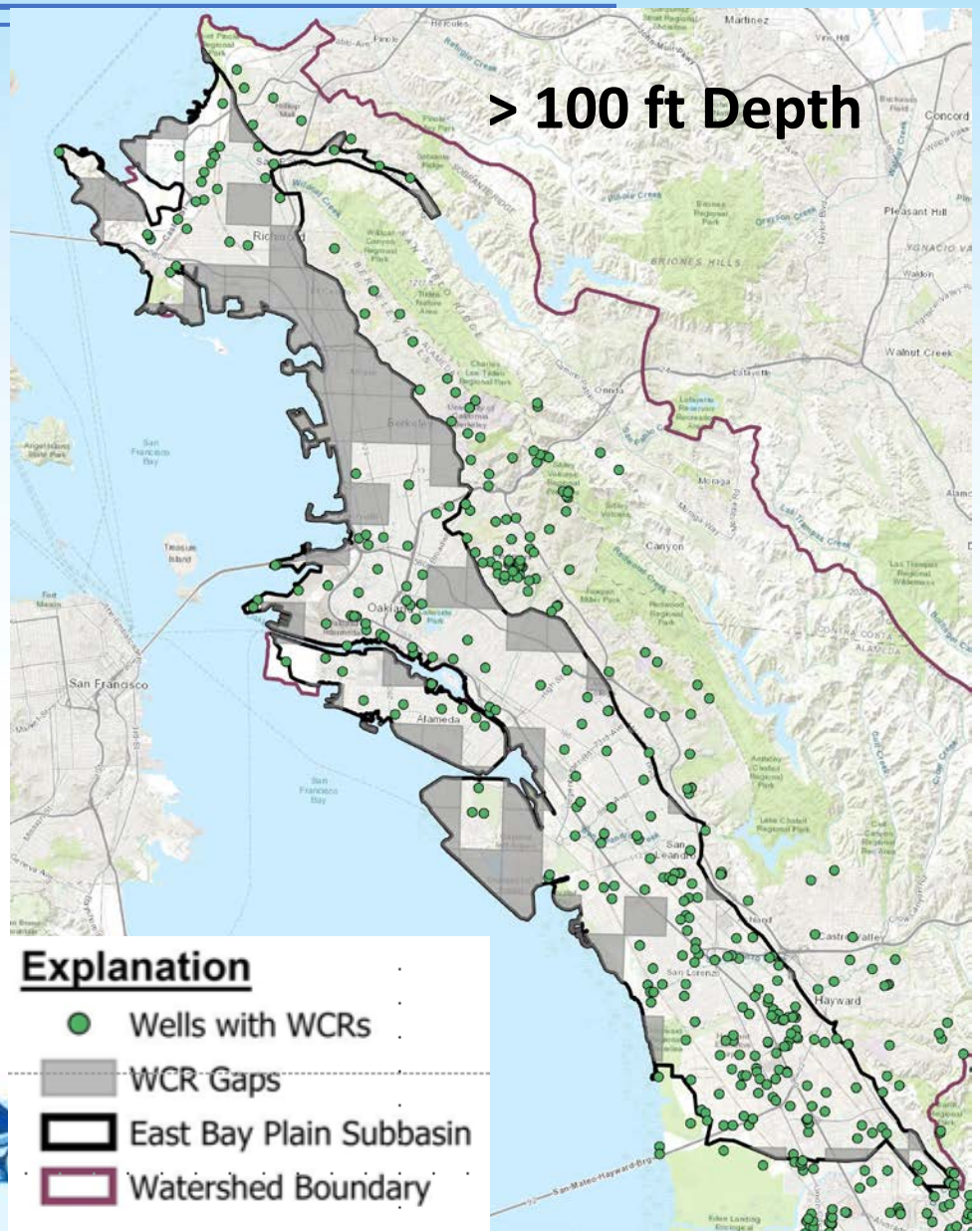
Subtask 4.1 Groundwater Dependent Ecosystems (GDEs)

- Compiled data from The Nature Conservancy (TNC), California Dept. Fish and Wildlife (CDFW), and DWR
- Generally occur along stream/creek channels (indicated by arrows on map)
- Largest GDE along the bay in the southern portion of the EBP is Don Edwards National Wildlife Refuge

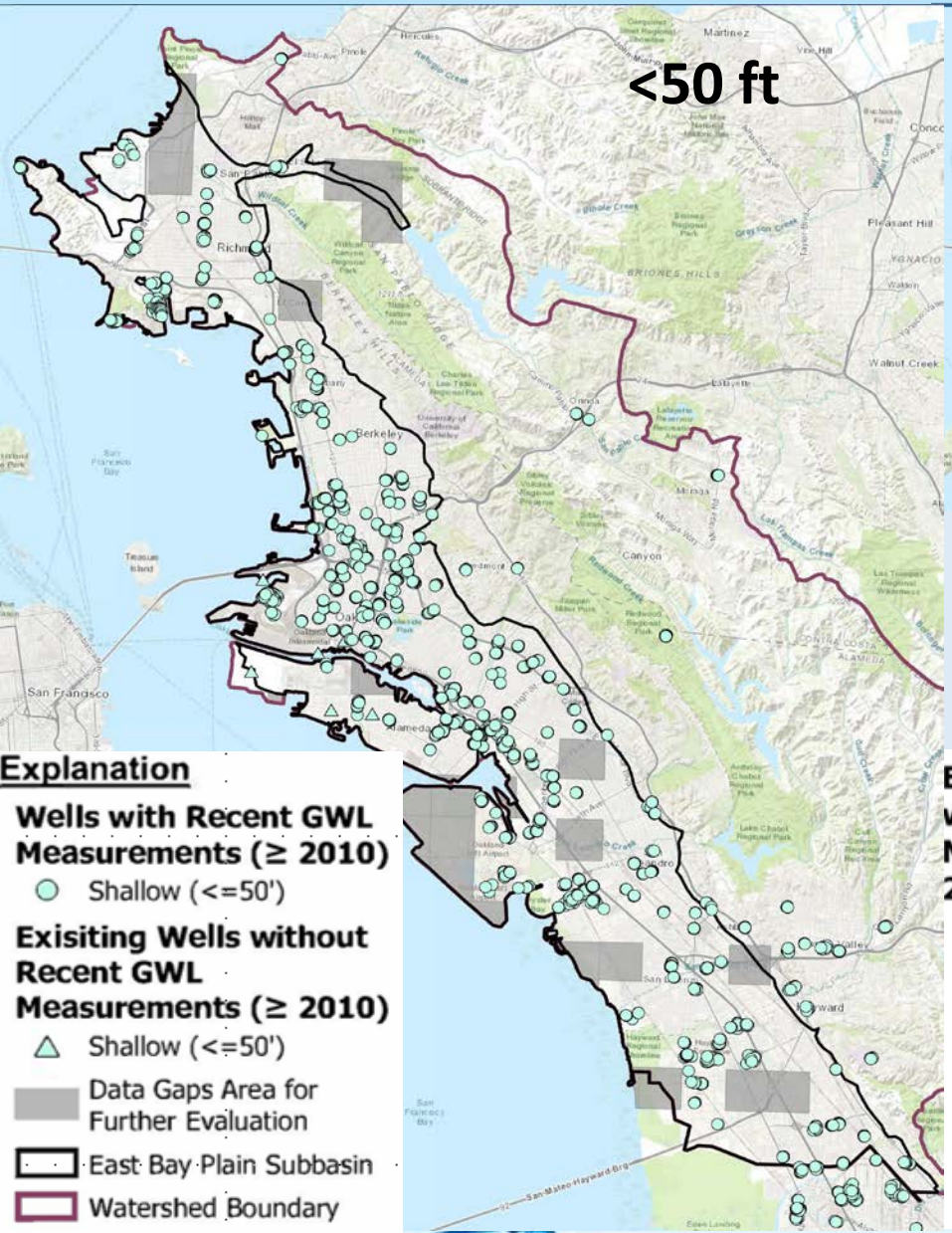


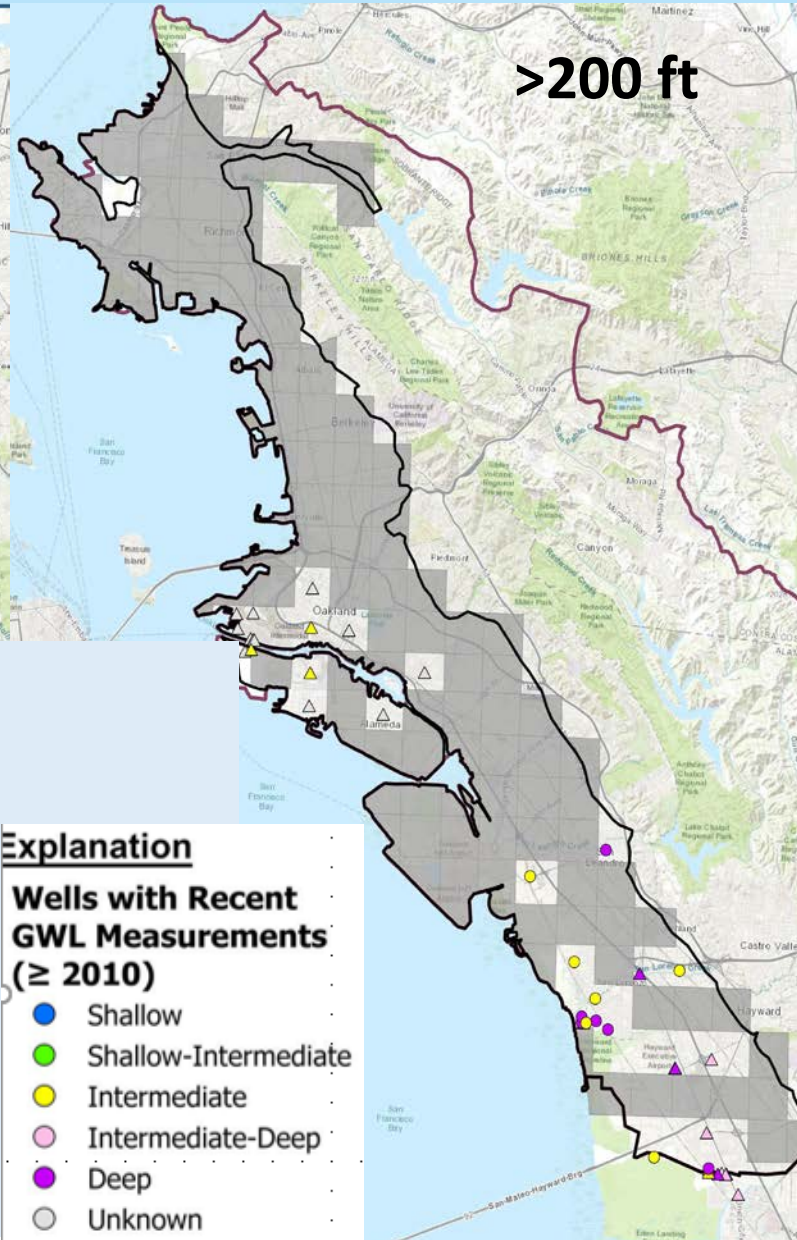
Subtask 4.1 Data Gaps Analysis (WCRs)

- Available data for various datasets evaluated by T/R/S
- Sections without data highlighted in gray

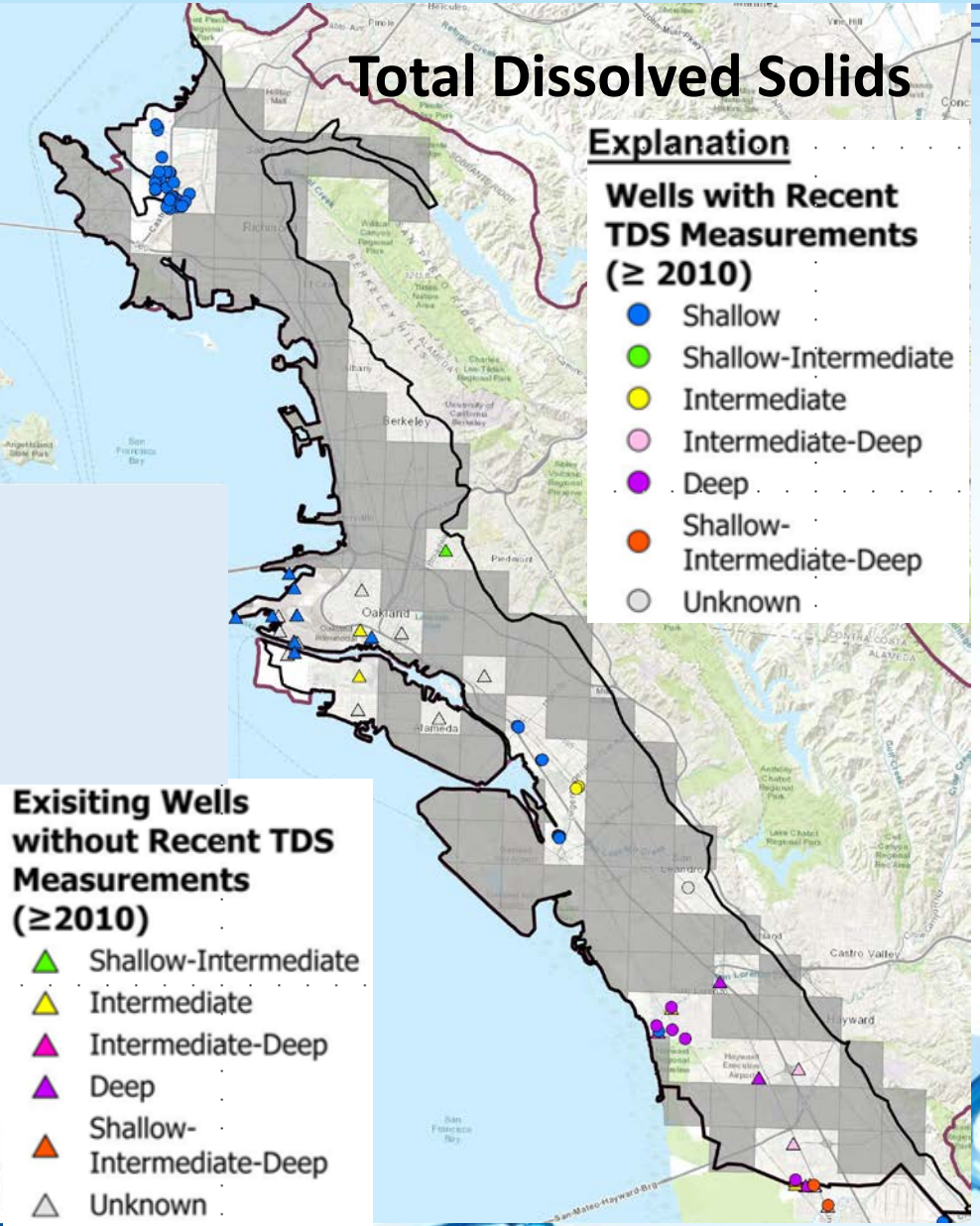


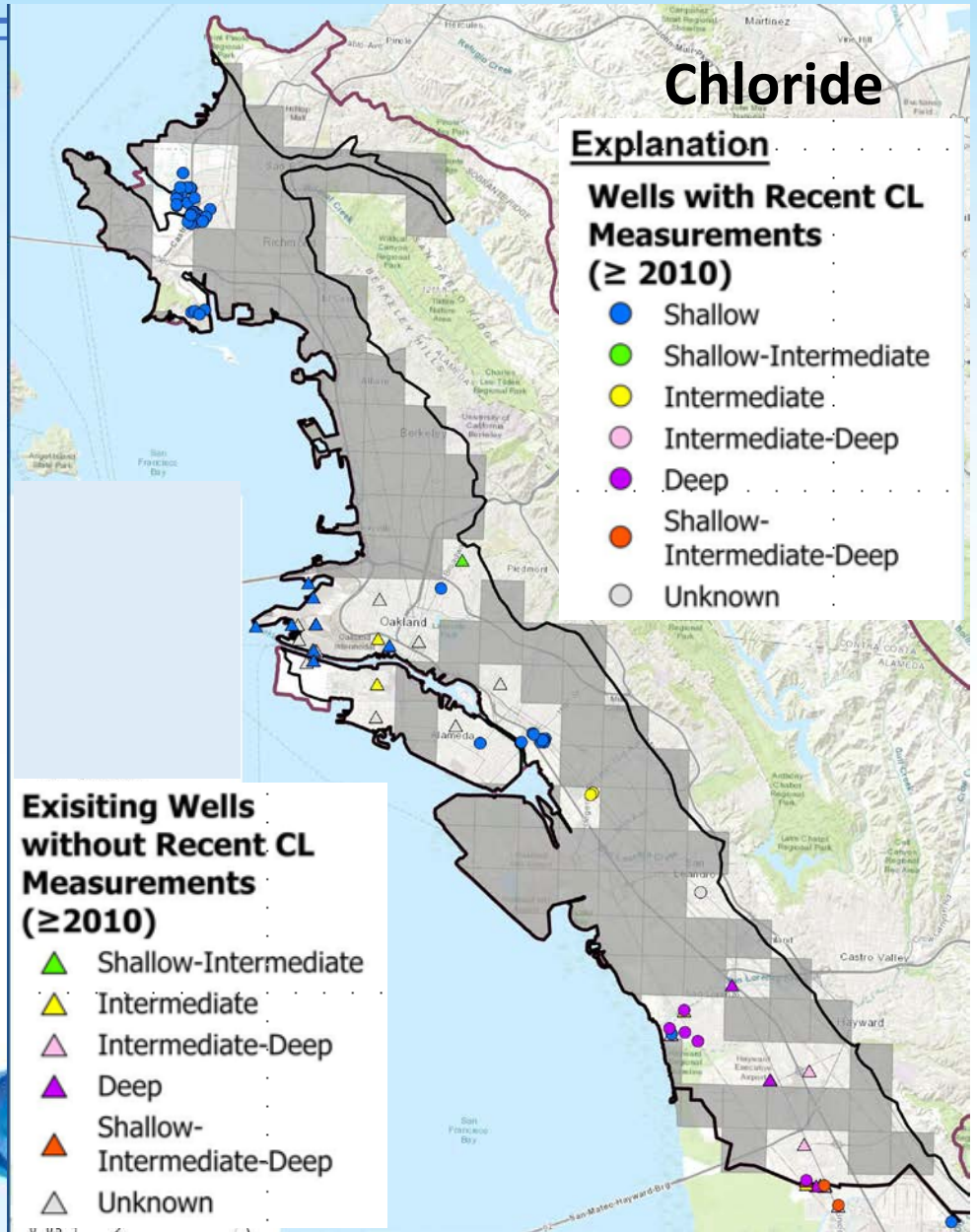
Subtask 4.1 Data Gaps (Groundwater Levels)





Subtask 4.1 Data Gaps (Groundwater Quality)





Subtask 4.1 Data Gaps Summary

- **Geologic Conditions:** Primary data gaps areas north of Oakland and eastern central portion of subbasin
- **Groundwater Conditions:** Same data gap areas as for geologic conditions; plus some added data gap areas in southern portion of subbasin; also, increasing data gaps with depth
- **Water Budget:** Several data gaps including streamflow data, groundwater pumping data, and evapotranspiration data

Subtask 4.1

Data Gaps Analysis (Summary)

Data Need		Area of EBP Subbasin	
		North	South
Geologic/Hydrogeologic Characterization	Well Completion Reports	Poor	Good
	Geophysical Logs	Poor	Fair to Good
	Aquifer Properties	Poor	Fair to Good
Groundwater Conditions	Levels	Poor; except for recent time period in upper 50 feet	Poor to Fair; varies by aquifer/time period
	Quality	Poor; except for recent time period in upper 50 feet	Poor to Fair; varies by aquifer/time period
	Isotopes	Poor	Fair
	Subsidence	Poor	Poor to Fair
	SW-GW Interactions	Poor	Poor
Water Budget	Precipitation	Good	Fair
	Evapotranspiration	Poor to Fair	Poor to Fair
	Streamflow	Poor	Poor
	Land Use	Good	Good
	Surficial Soils	Fair	Fair
	Groundwater Pumping	Poor to Fair	Poor to Fair
	Surface & Recycled Water Deliveries	Fair to Good	Fair to Good

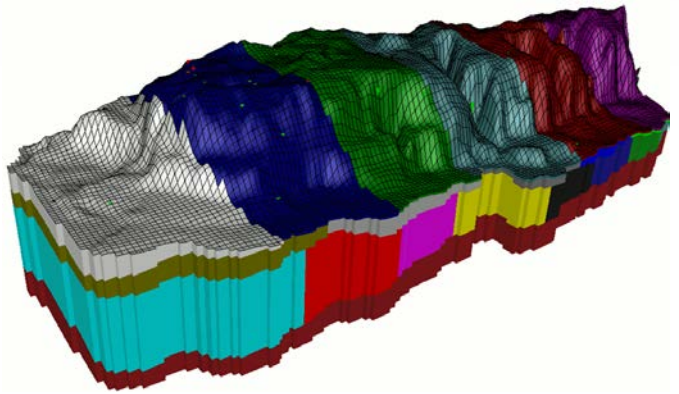
Notes: Excellent: No further data needed; Good: Small data gap areas with limited data needs; Fair: One or two major data gap areas; Poor: Large areas with no data

Subtask 4.1 Addressing Data Gaps

- Existing data represent the starting point for the GSP effort
- Additional data will be collected moving forward, including:
  - Development of a monitoring network for the GSP
  - Additional wells in the future as funding becomes available
- This GSP provides the initial foundation. Required future reports will incorporate additional data and groundwater model revisions/updates:
  - Annual Reports
  - 5-Year Update Reports

End of Task 4.1 (Data Gaps) Section

Review of Task 4.3 (Model Objectives and Selection) follows



Status of Subtask 4.3 Model Objectives/Selection

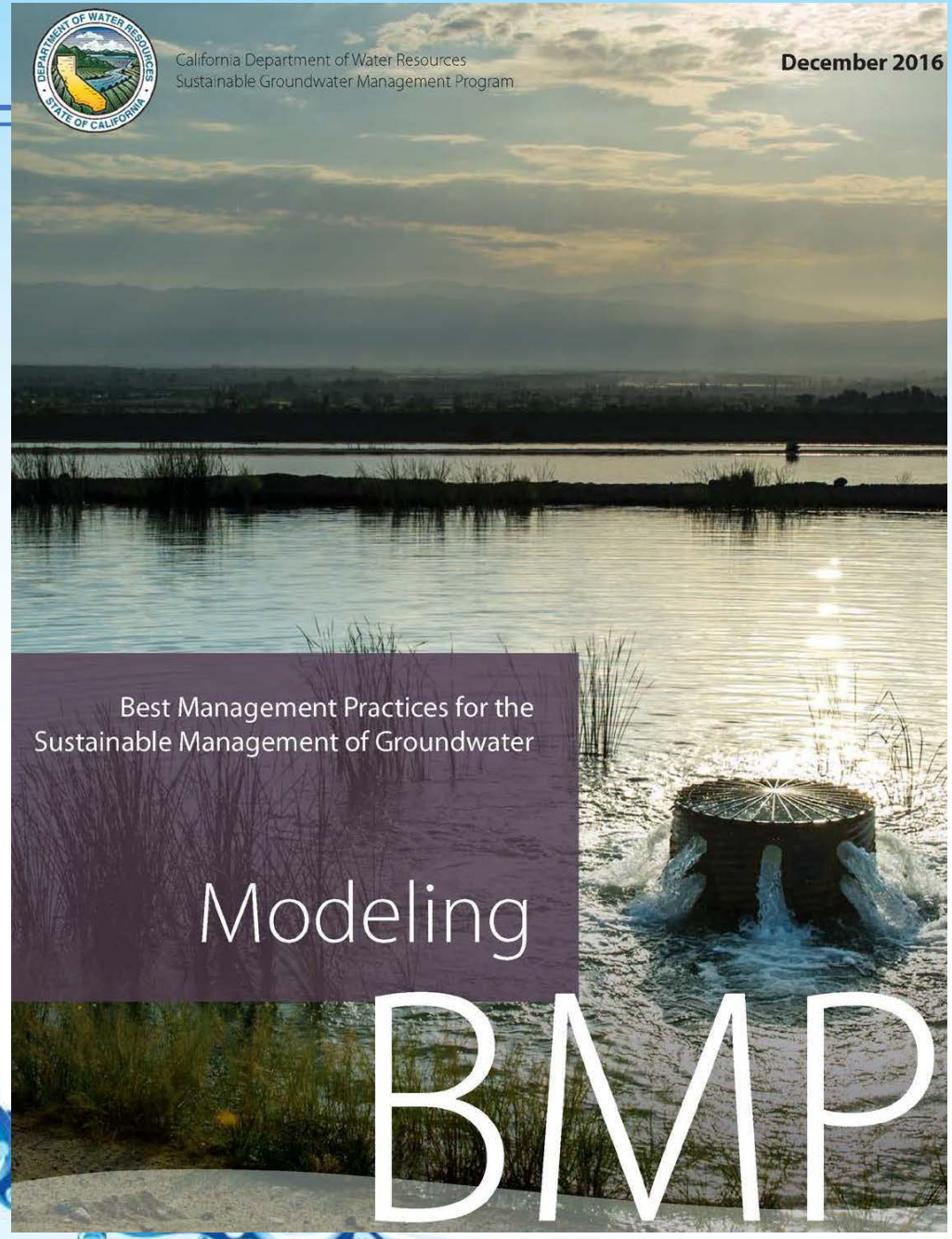
- Review of presentation at TAC meeting Oct 2019
- Technical memo submitted to the TAC March 2020
- Review by TAC completed April 25, 2020
- Discuss comments and questions

Purpose of Task 4.3

- Define key objectives for the groundwater basin model
- Identify model code requirements to meet key objectives
- Make recommendation for model selection

DWR SGMA Requirements

- A numerical GW - SW flow model required for the GSP
- Framework for conceptual hydrogeology, available data, and hydrologic processes over varying time periods
- Public domain software with established credibility



GSP Numerical Model

Important tool to:

- Estimate sustainable yield
- Quantify water budget
- Analyze GW – SW interaction
- Evaluate and Protect GDEs
- Develop monitoring criteria for sustainable management
- Plan groundwater resources development projects
- Guide management actions

Necessary Software Capabilities

- 3-D GW flow
- Heterogeneity/anisotropy of porous media in 3-D
- Confined and unconfined aquifers
- Aquifer storage
- GW pumping and injection
- Fault structures and other hydraulic barriers

Necessary Software Capabilities (continued)

- GW – SW interaction (e.g., streams, lakes, springs, etc.)
- Recharge and evapotranspiration
- GW fluxes and water budget
- Potential changes in GW quality, including salt water intrusion (SWI)
- Potential subsidence with declining GW levels
- Comparison between modeled and observed data to facilitate model calibration

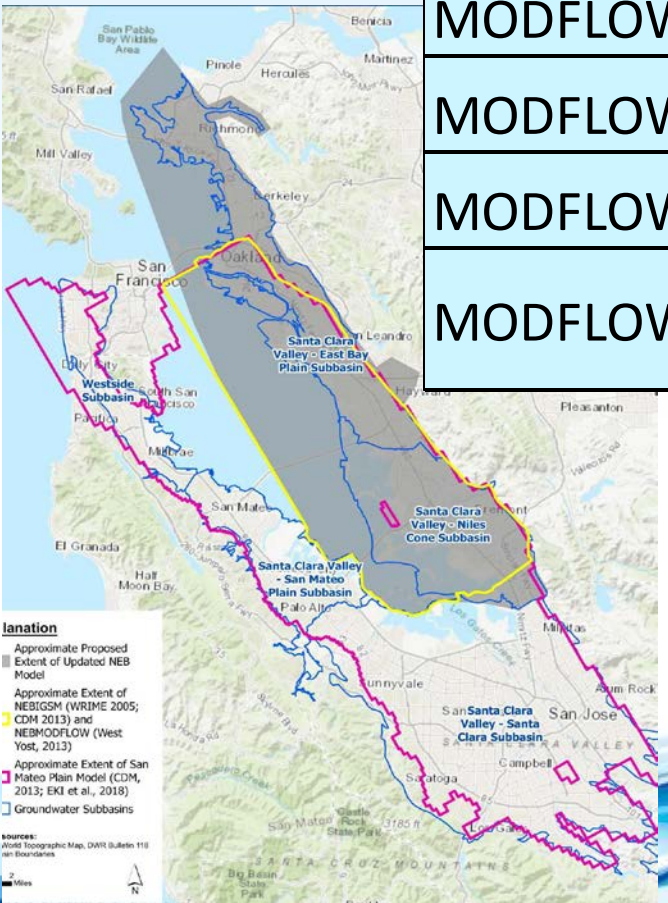
Groundwater Modeling Software Considered

- MODFLOW – USGS - 3D finite difference, saturated flow, subsidence
- SEAWAT – USGS - 3D finite difference, variable density, multi-species transport and heat transport (similar to MODFLOW)
- IWFM –DWR - 3D finite element groundwater & surface water flow model (improvement on IGSM)
- SUTRA – USGS - 2D/3D finite element, sat/unsat, variable density fluid flow, transport, heat flow

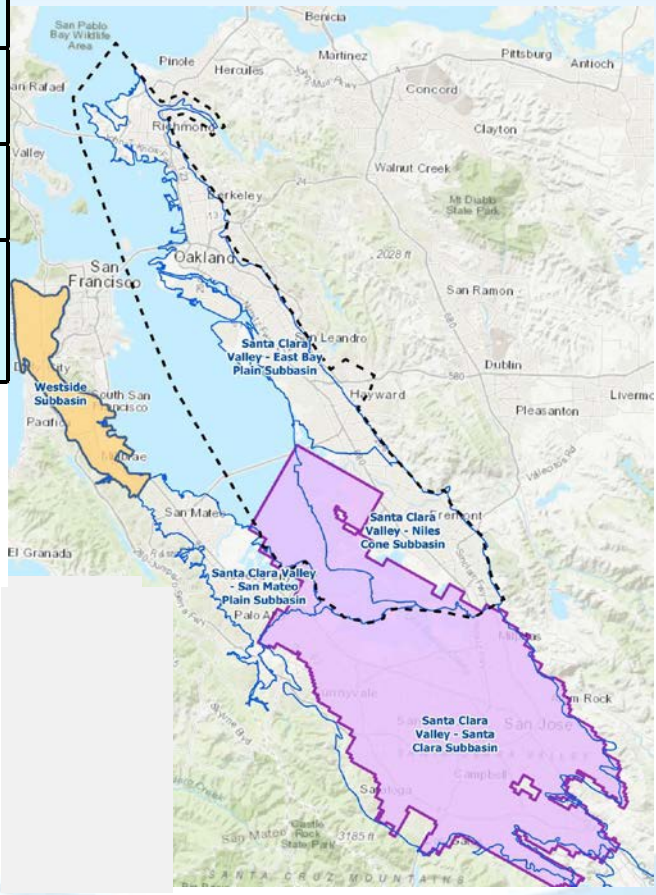
SF Bay Regional GW Models *Nearly All MODFLOW*

Software	Location	Year	Key Objective
IGSM	Niles Cone	1991	Niles Cone GW Mgmt
	Southern EPB	2005	EBMUD Bayside ASR
MODFLOW	Southern EPB	2013	EBMUD GWMP
MODFLOW	San Mateo Plain	2018	General Basin Mgmt
MODFLOW	Santa Clara Valley	1990s+	General Basin Mgmt
MODFLOW	Westside Basin (SF & San Mateo Co)	2007+	General Basin Mgmt

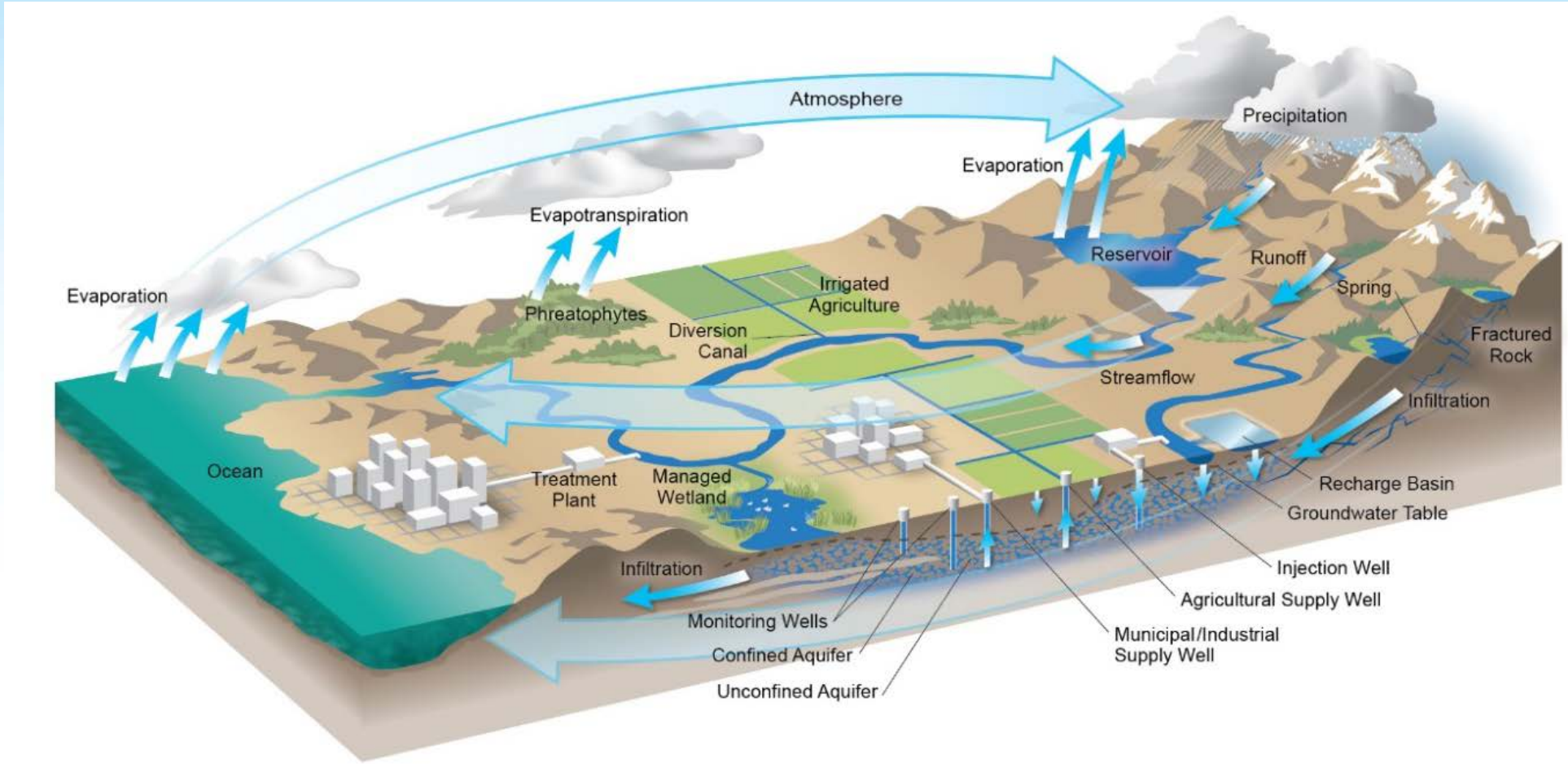
Major Overlap with EBP



Other Regional Models



Discuss Questions and Comments



The Hydrologic Cycle, DWR Water Budget BMP, 2016

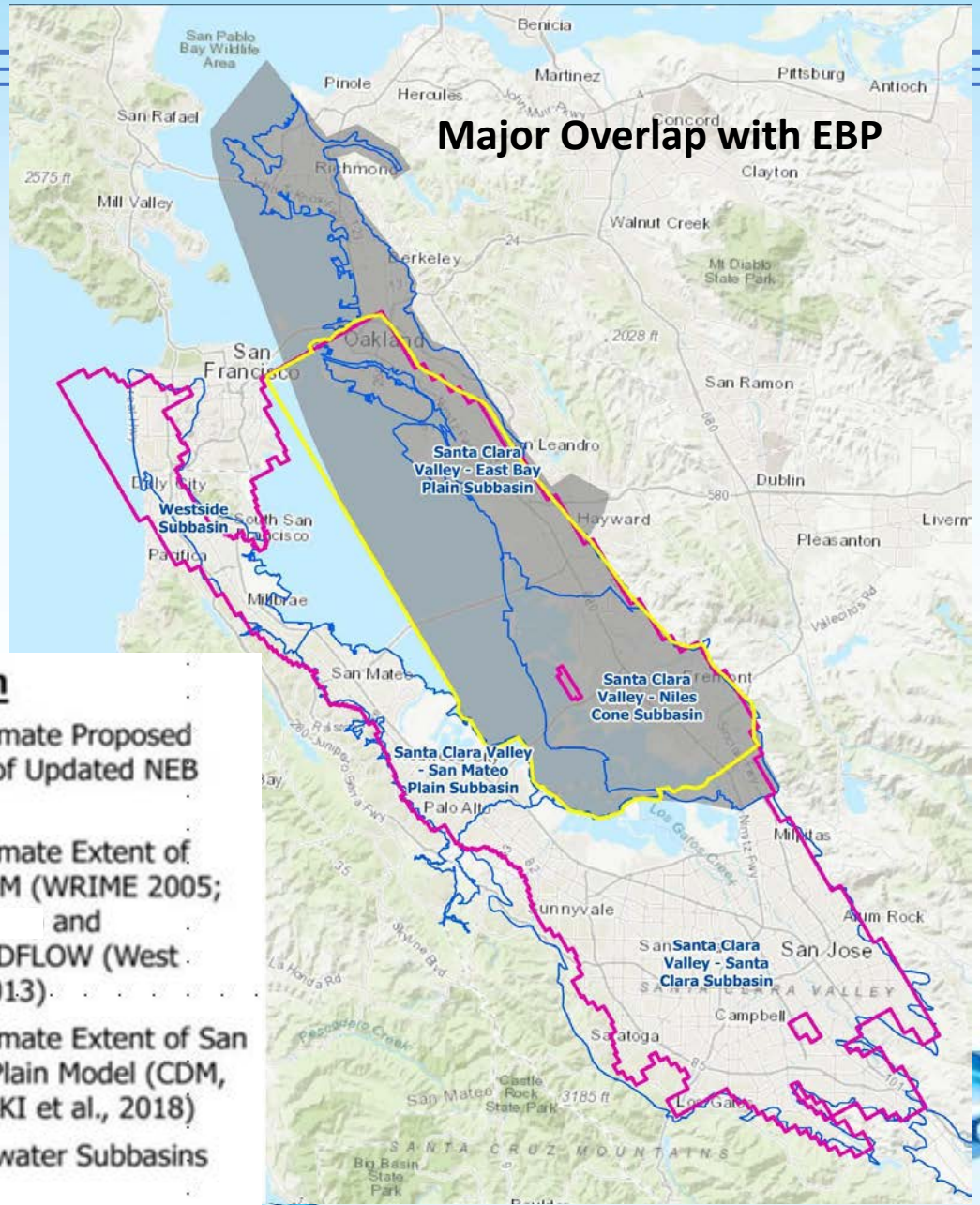
Extra Slides

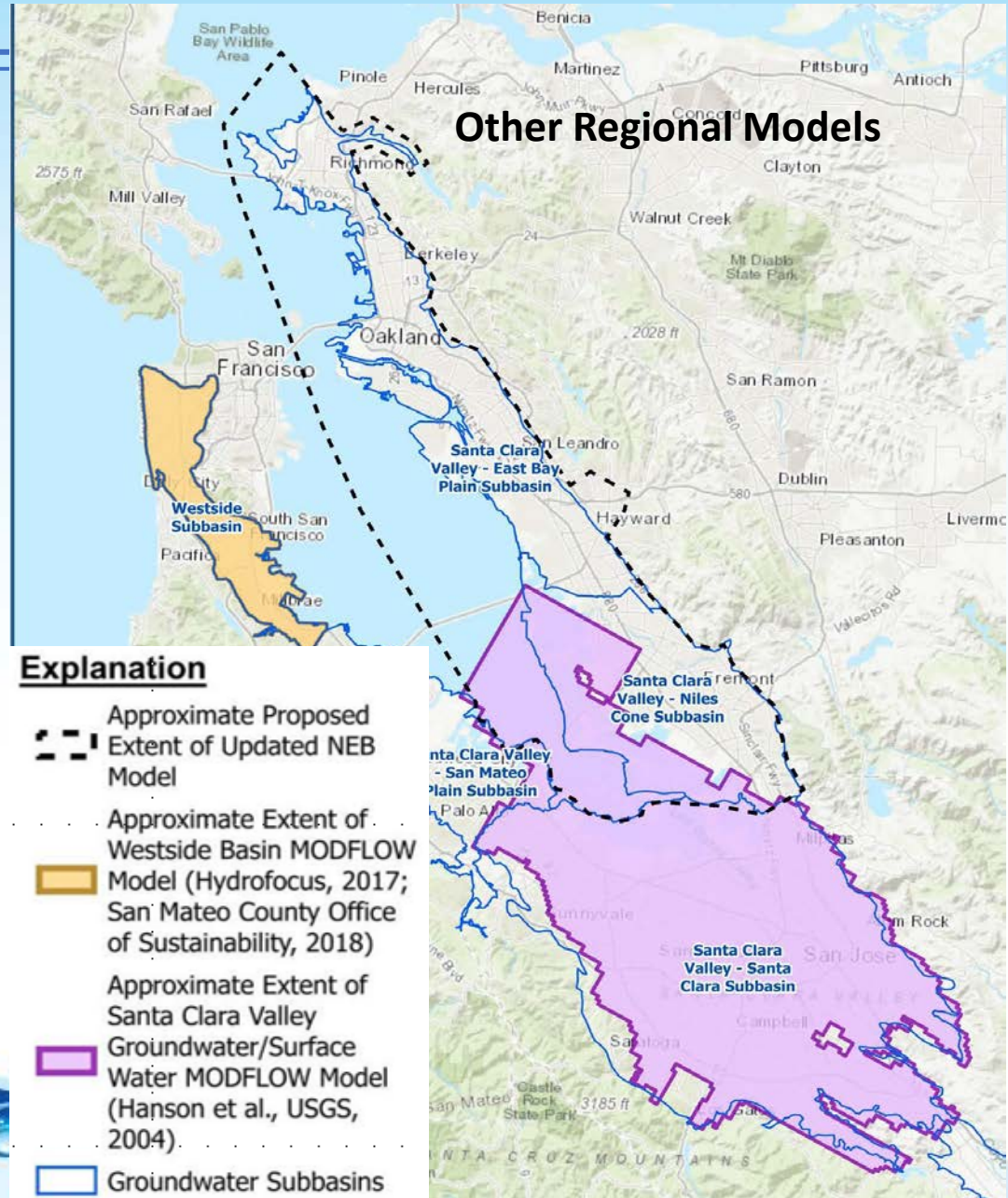
Subtask 4.1 Data Compilation (Contaminant Sites)

- Geotracker database was queried for contaminant sites
- Data compiled for nine primary contaminants of concern
- Emphasis on most common and potentially impactful constituents
- Vast majority of sites had fuel-related contaminants
- Denser compounds considered of greater concern for water supply

- Perchloroethene (PCE)
- Trichloroethene (TCE)
- Total petroleum hydrocarbons (TPH)
- Benzene (B)
- Toluene (T)
- Ethylbenzene (E)
- Xylenes (X)
- Methyl tert-butyl ether (MTBE)
- Hexavalent Chromium (CrVI)

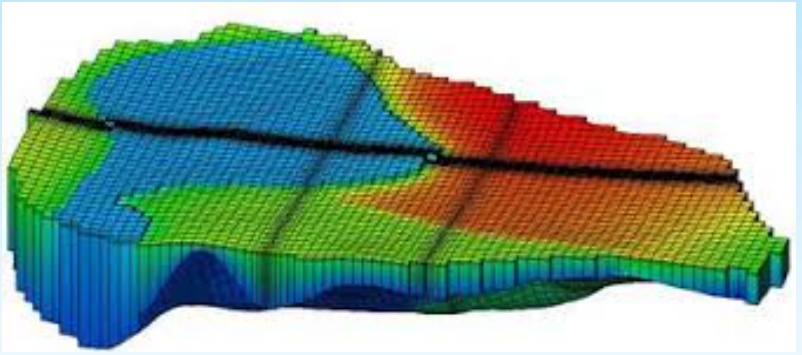
Existing Regional GW Models in SF Bay Area





Logical Choices for the Updated EBP GW Model

- Groundwater Flow and Storage
- Fate and Transport of Contaminants
- Seawater Intrusion
- Subsidence



MODFLOW ⟷ **GMS** ⟷ **ArcGIS**
Arc Hydro Groundwater

USGS Modular Finite-Difference Flow Model

MODPATH
MT3DMS
SEAWAT

(Groundwater Modeling System)
Graphical User Interface (GUI)