San Mateo Plain Groundwater Basin Assessment

Stakeholder Workshop #7

9 NOVEMBER 2017

COUNTY OF SAN MATEO
HEALTH SYSTEM

TODD GROUNDWATER

eki environment & water

HYDROFOCUS INC.
Solutions for Land and Water Resources

PRESENTATION OVERVIEW

- Introductions
- Project Overview
- Stakeholder Outreach Summary
- Phase 2 Updates
- Modeling Activities
- Updates on SGMA

SAN MATEO PLAIN GROUNDWATER BASIN ASSESSMENT

- Funded through Measure K and Office of Sustainability
- Project Objectives:
  - Increase Public Knowledge
  - Evaluate Hydrogeologic and Groundwater Conditions
  - Evaluate Risk of Undesirable Results
  - Potential Groundwater Management Strategies

SUPPORTED BY MEASURE K
LOCALFUNDS LOCALNEEDS
WWW.SMCGOV.ORG

OFFICE OF SUSTAINABILITY
COUNTY OF SAN MATEO

http://www.smcsustainability.org/smplain

THE PROJECT IS BEING EXECUTED IN THREE PHASES

Phase 1

- Stakeholder Coordination and Public Outreach
- Data Compilation, Unification, and Sharing
- Develop Initial Basin Conceptual Model
- Develop Basin Groundwater Numerical Model
- Evaluate Potential Basin Management Strategies
- Prepare Phase I Report

Apr 2016 – Jan 2017

Phase 2

- Public Outreach
- Fill Selected Data Gaps
- Update Database
- Update and Refine Conceptual and Numerical Models

Feb 2017– Dec 2017

Phase 3

- Public Outreach
- Conduct Scenario Evaluations
- Prepare Final Report

Aug 2017 – Jun 2018

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ON-GOING STAKEHOLDER OUTREACH

- Small group and one-on-one meetings
- Presentations to organizations and governing bodies
- Stakeholder workshops
- New website address:
  http://www.smcsustainability.org/smplain
- Open Data Portal:
  http://data-smcmaps.opendata.arcgis.com/datasets?q=Groundwater&sort_by=relevance
- Preliminary Report:
  http://www.smcsustainability.org/download/energy-water/groundwater/Final-Phase-1-Report.pdf

Workshop #1
May 17, 2016
Project Introduction and Overview

Workshop #2
September 7, 2016
Basin Conceptual Model

Workshop #3
November 21, 2016
Groundwater Flow Model

Workshop #4
December 6, 2016
Basin Management Options

Workshop #5
January 31, 2017
Phase 1 Results and Report

Workshop #6
August 17, 2017
Phase 2 Progress and Phase 3 Planning

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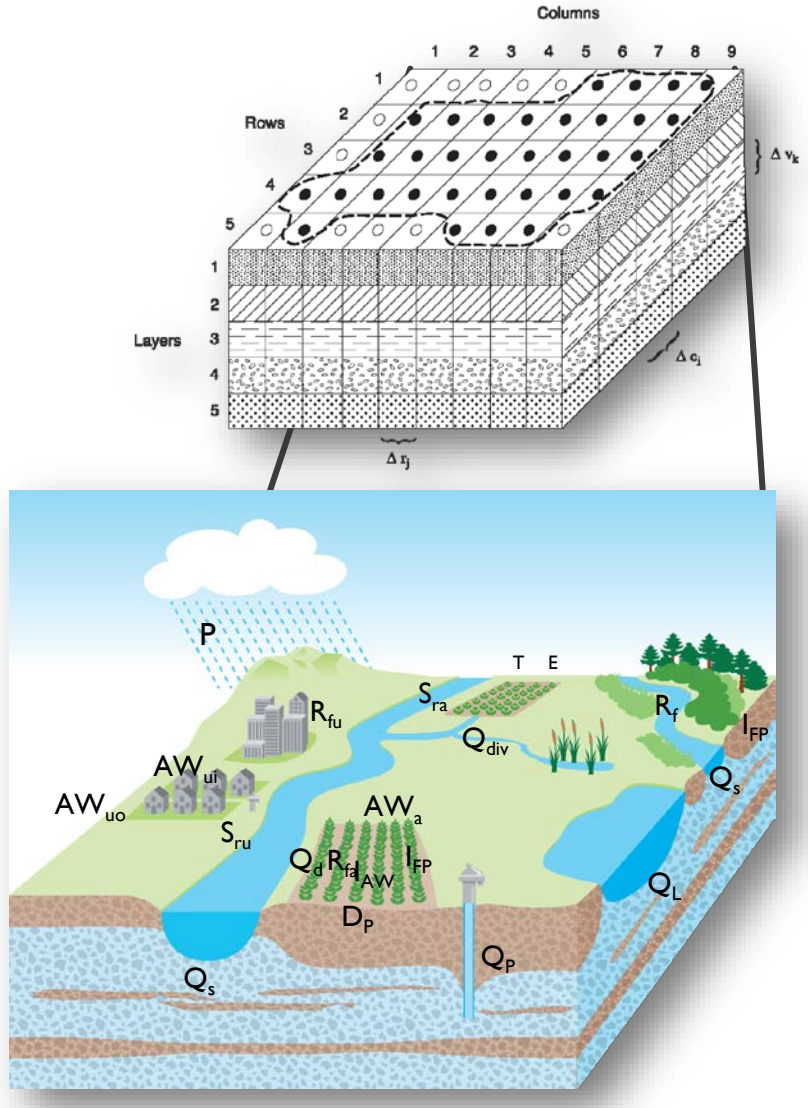
MODEL LIMITATIONS & CONSIDERATIONS FOR PHASE 3

- Goal is to understand the Basin's sensitivity to changed conditions or management
- The more complex the scenarios, the fewer that can be completed for Phase 3
- Focused on changes <u>within</u> the San Mateo Plain Basin only
- <u>Not</u> intended to analyze the impact of any single project or collection of projects (within or outside of Basin)*



*Model will be available to others to use for this purpose, as desired

WORKSHOP #6 BREAKOUT SESSION RESULTS

- Topic 1 – Groups asked to identify and prioritize potential scenarios to model within the Basin and identify basis for prioritization
- Top 3 ranked Scenarios:
  - Increased groundwater pumping
  - Stormwater recharge projects
  - Climate change
- Basis for prioritization include:
  - Timeframe of implementation of currently planned projects and policy changes
  - Determine if factors will affect sustainability of the Basin


San Mateo Plain Groundwater Basin Assessment Stakeholder Workshop #6

STAKEHOLDER DISCUSSION TOPIC 1: Model Scenarios & Priority

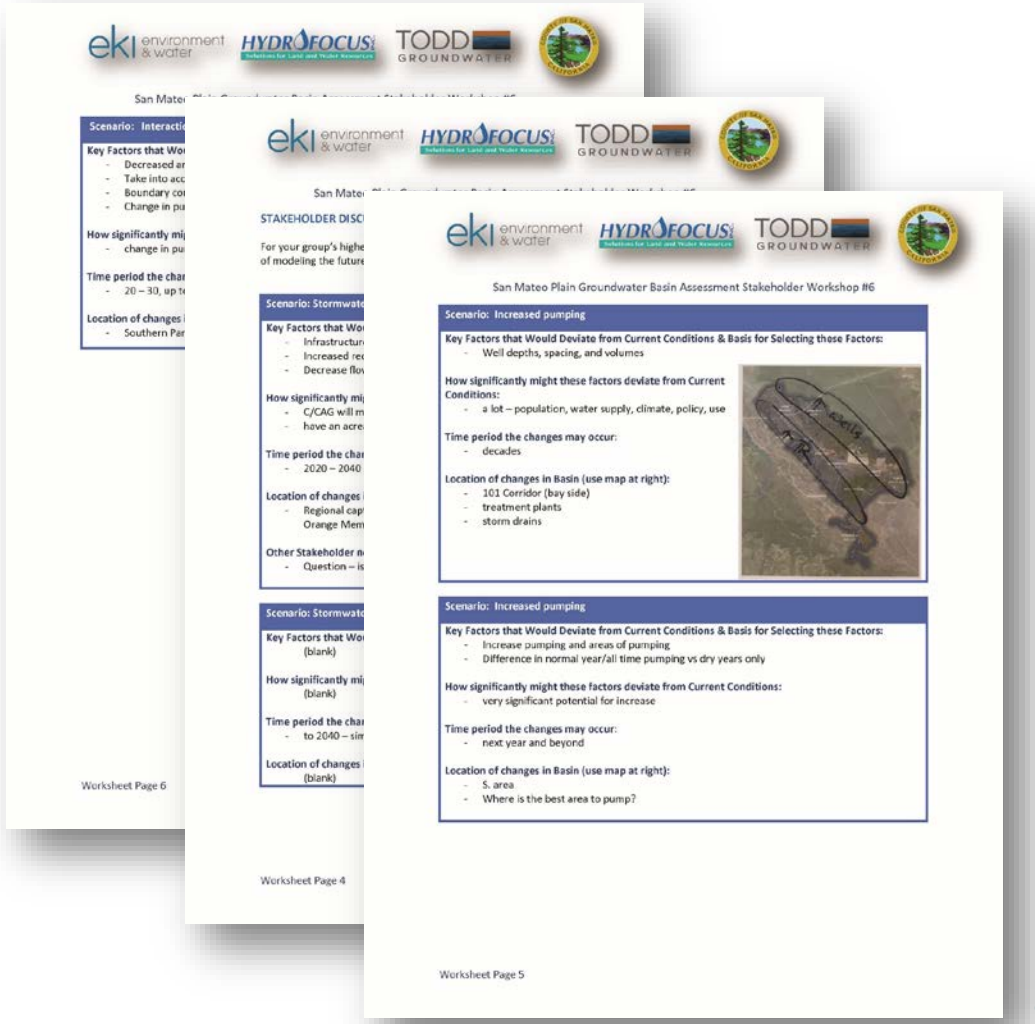
Identify model scenarios for the future that you would like to see be modeled as part of the Phase 3 work. Think about the specifics of the scenarios and then rank the these in order of importance, with 1 being of the highest importance. Note the basis for ranking values.

Priority	Potential Model Scenarios	Basis for Priority Ranking
Group A		
1	Stormwater recharge - Subsurface detention basins - Green Street, LID	Timeframe – within 5 years to inform projects and policy
2	IDR and recycled water and how it changes yield	Slightly later timeframe than 1
1'	Increased pumping - Normal vs. dry year/emergency	Same as for stormwater recharge
3	Rainfall changes - Temporal and amount shifts	Can't change rainfall itself, can only react – less planning of specific projects
5	Sea level rise	Least certainty with respect to groundwater impacts (water balance of outflows)
Group B		
All	Drought effects	
Top 2	Increase groundwater pumping – shallow/deep, time patterns	Widespread and shallow; localized and deep
Top 2	Climate change - Rain intensity - Increase drought pumping - Annual rain and evapotranspiration	Sea level rise; two time periods
4	Pipe leak repairs - water - sewer	
All	Include Palo Alto	
All	Pumping depletion of streamflow	
3	Increase stormwater recharge	
Calibration	Simulate 1950s – 1960s recovery	

Worksheet Page 1

WORKSHOP #6 BREAKOUT SESSION RESULTS

- Topic 2 – Groups asked to identify assumptions for their top ranked modeling scenarios
  - Locations – western portions of Basin for stormwater recharge, southern and eastern portions of Basin for groundwater pumping
  - Time period – generally over next ~20 years (2040)



FOUR SELECTED SCENARIOS

Baseline

Baseline + Climate Change

Baseline + Climate Change + Urban Demand Pumping Increase

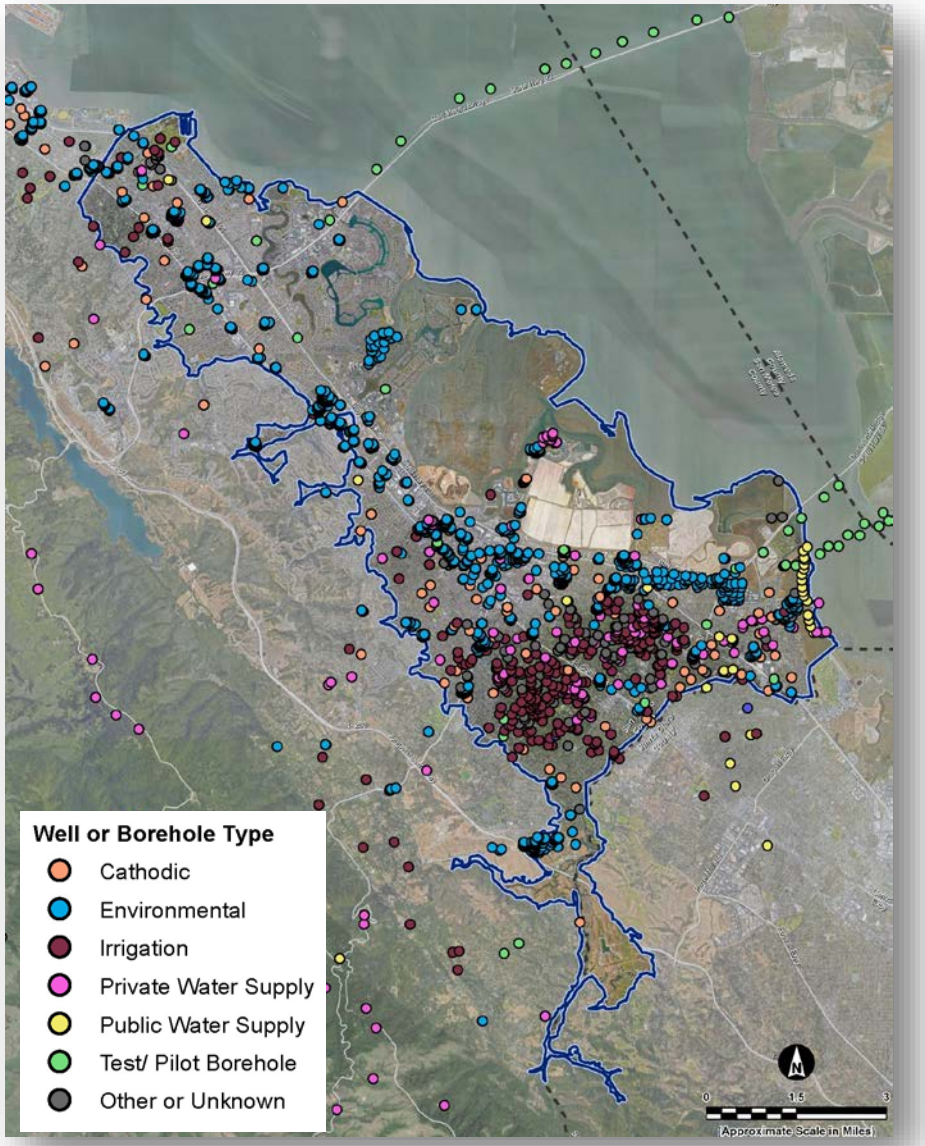
Baseline + Climate Change + Urban Demand Pumping Increase + Implementation of Recharge Projects

- Stepwise approach allows for measurement of incremental effects
- Reflects progression of natural effects and potential local changes to address those effects

PHASE 2 UPDATES

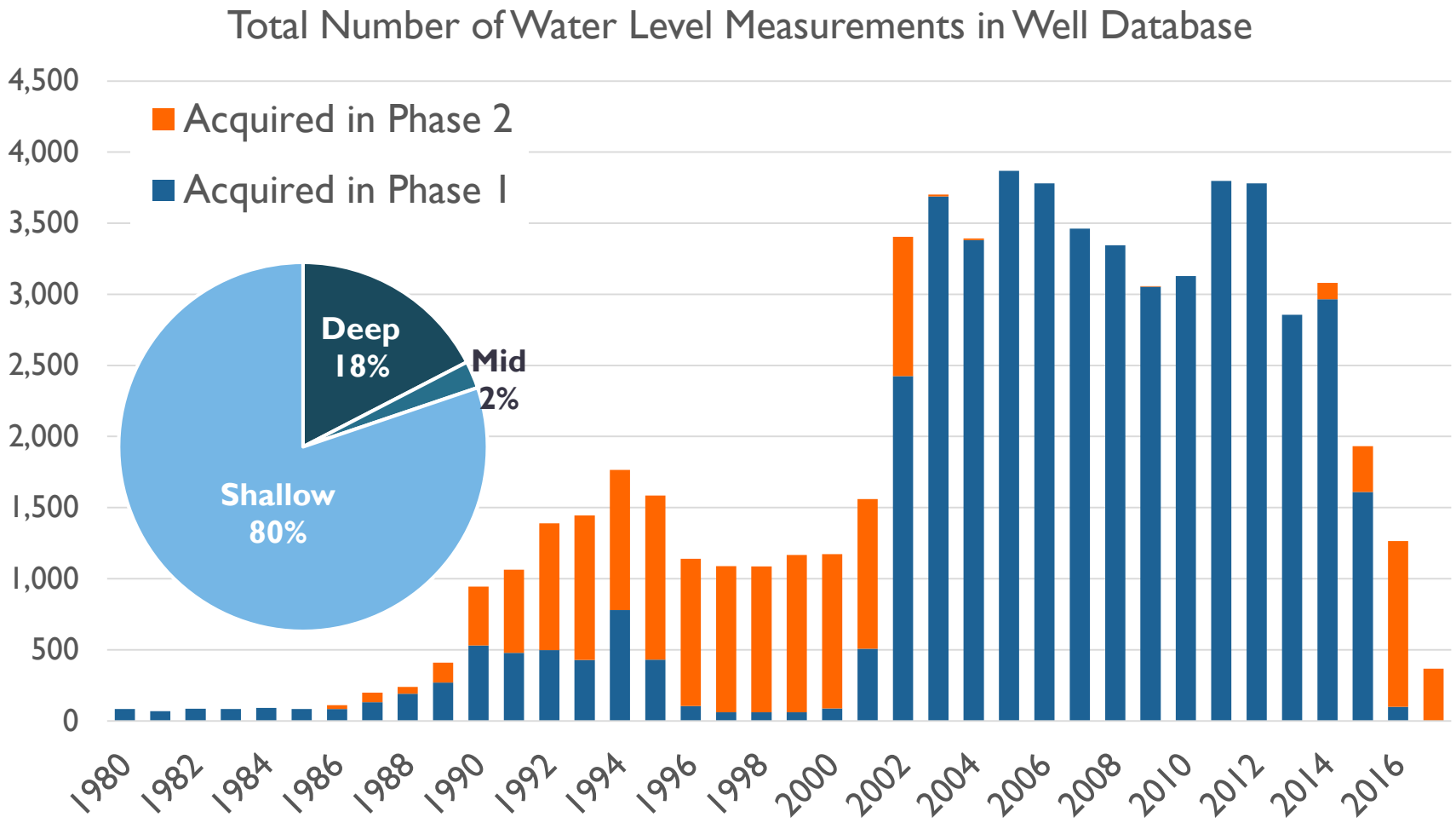
ADDITIONAL WORK TO REFINE AND RECONCILE WELL RECORDS

- Incorporating DWR tabulated Well Construction Records, made available this summer 2017
  - Significantly more well construction records tabulated than were provided by DWR in Phase 1
- Additional cross referencing to County well records



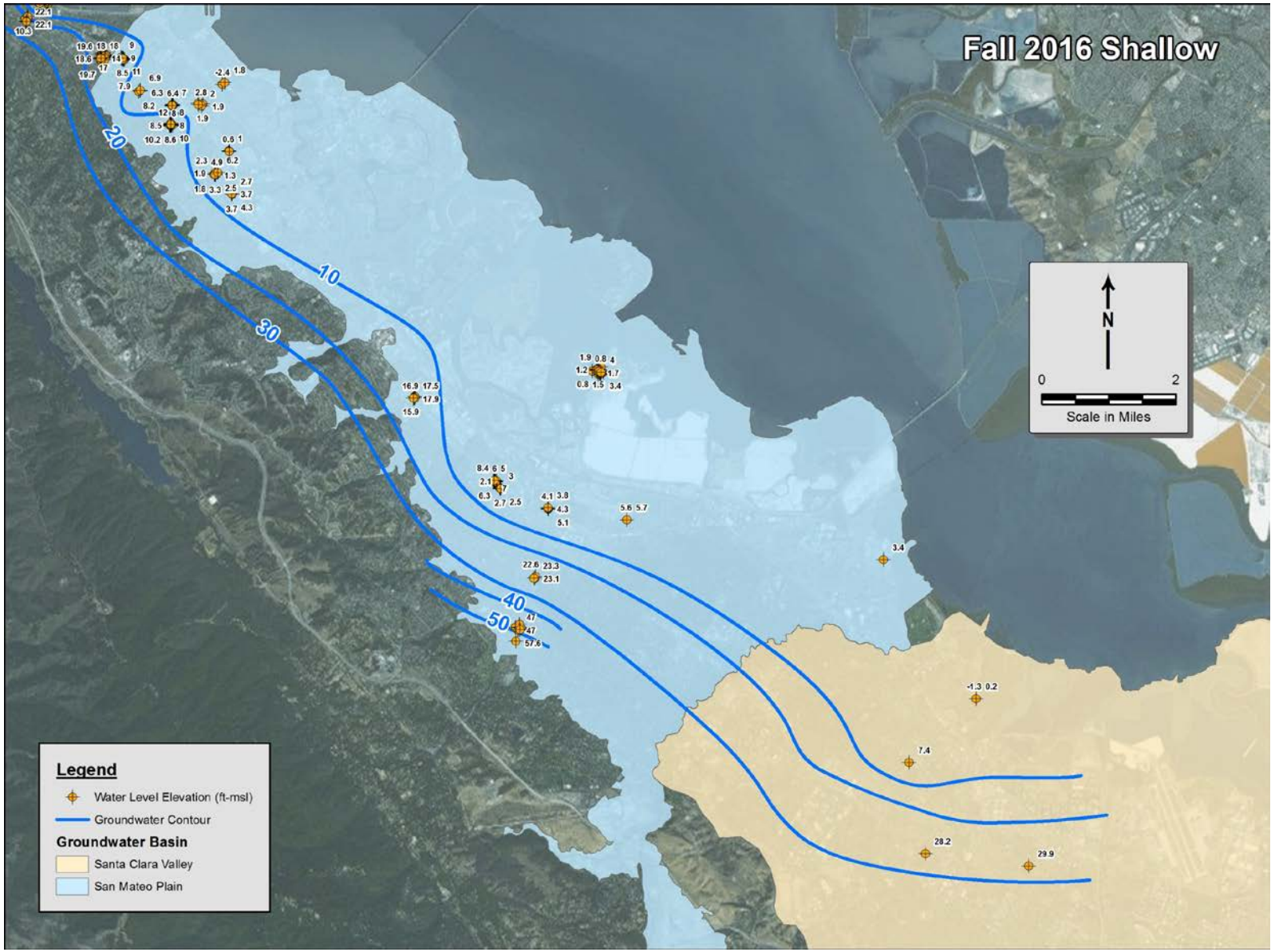
NEW WATER LEVEL MEASUREMENTS

- Added ~15,000 new water level measurements
  - Hand-entered data from Pre-Geotracker/pre-2004
  - Newly added Geotracker measurements
  - Deep wells measured by the County
- Increased dataset by 30%
- Significantly more data for the 1990s
- Data predominantly for shallow wells



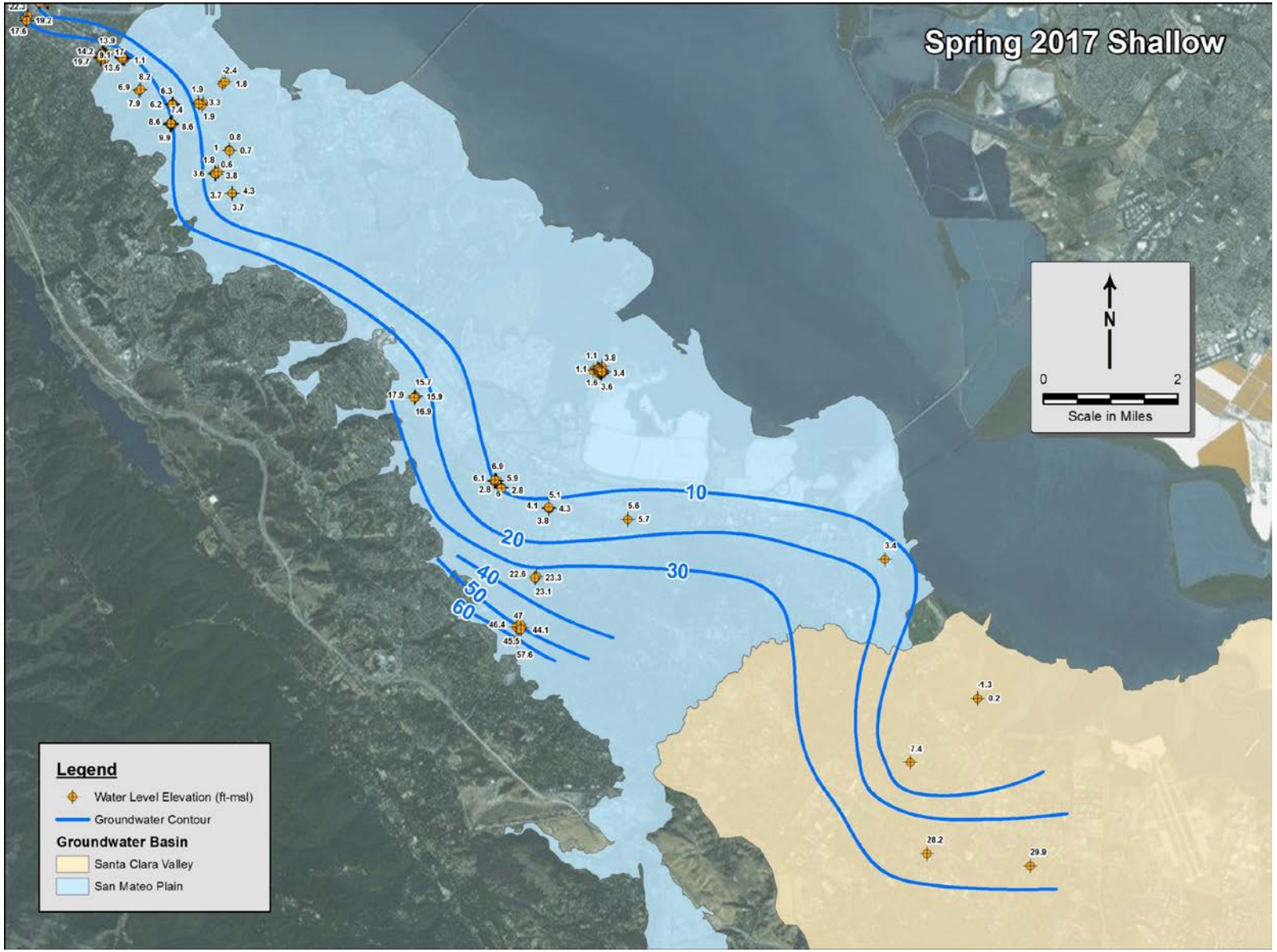
NEW WATER LEVEL CONTOUR MAPS (1 OF 4)

Shallow Wells
Fall 2016



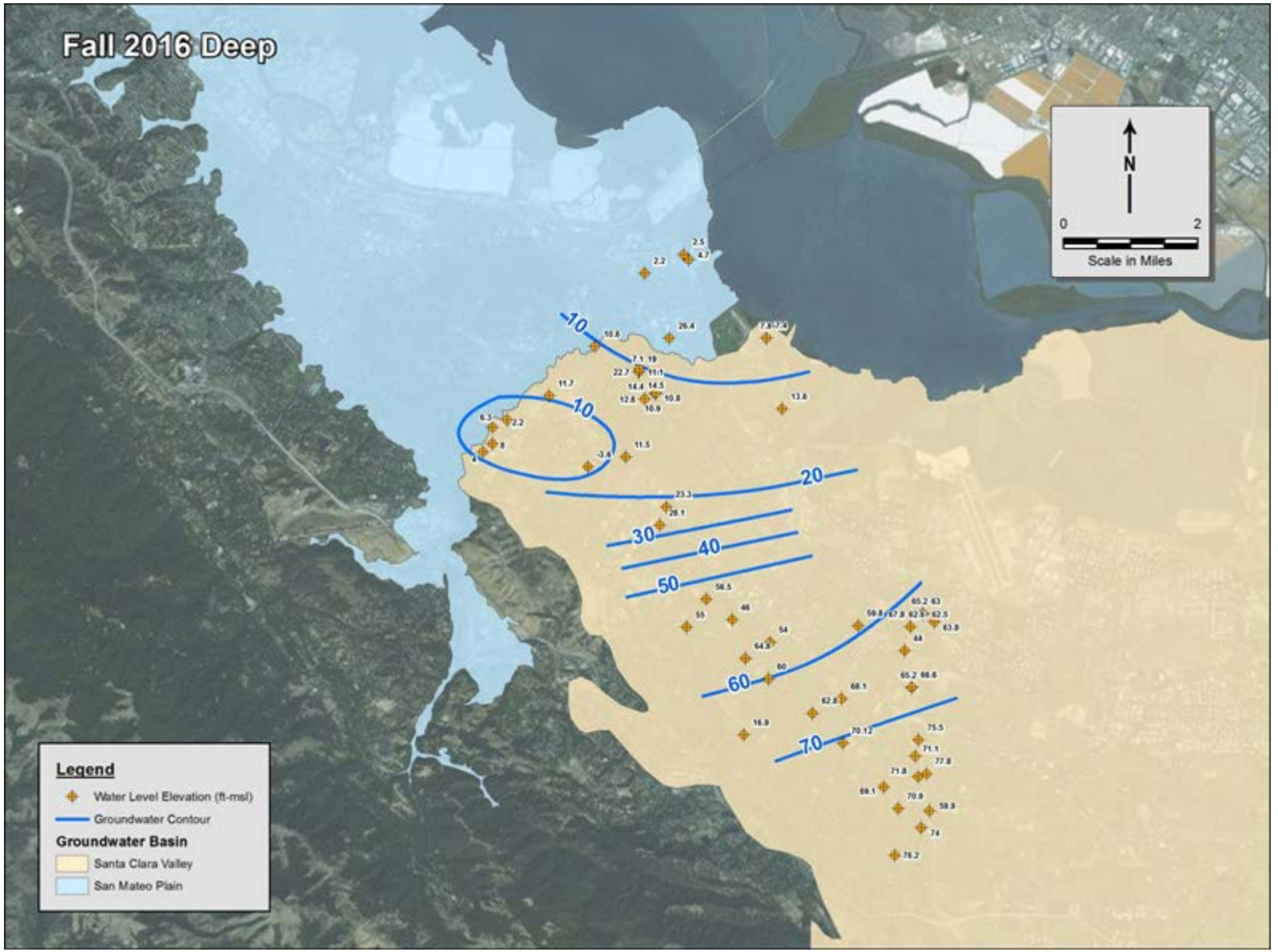
NEW WATER LEVEL CONTOUR MAPS (2 OF 4)

Shallow Wells
Spring 2017



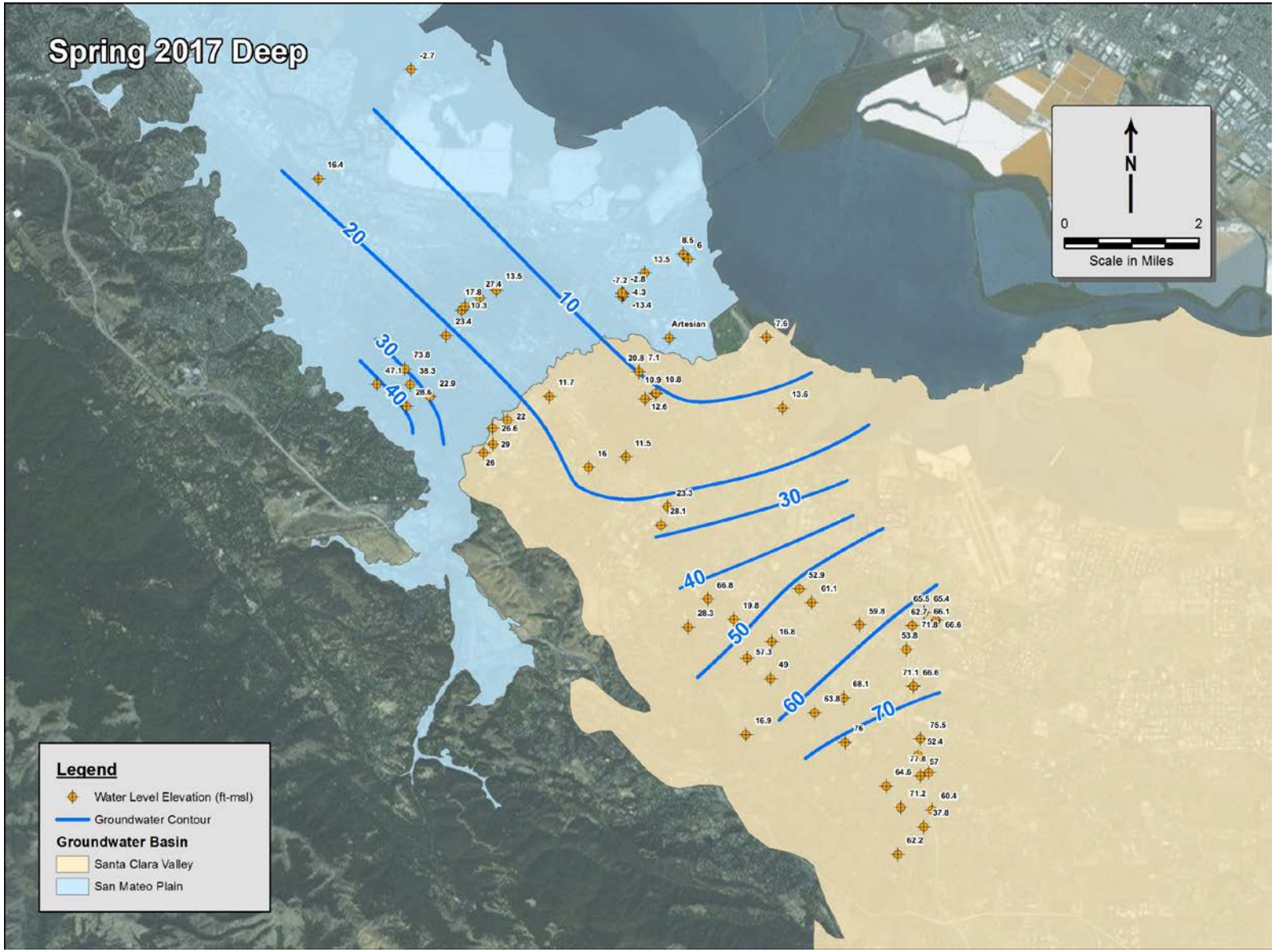
NEW WATER LEVEL CONTOUR MAPS (3 OF 4)

Deep Wells
Fall 2016



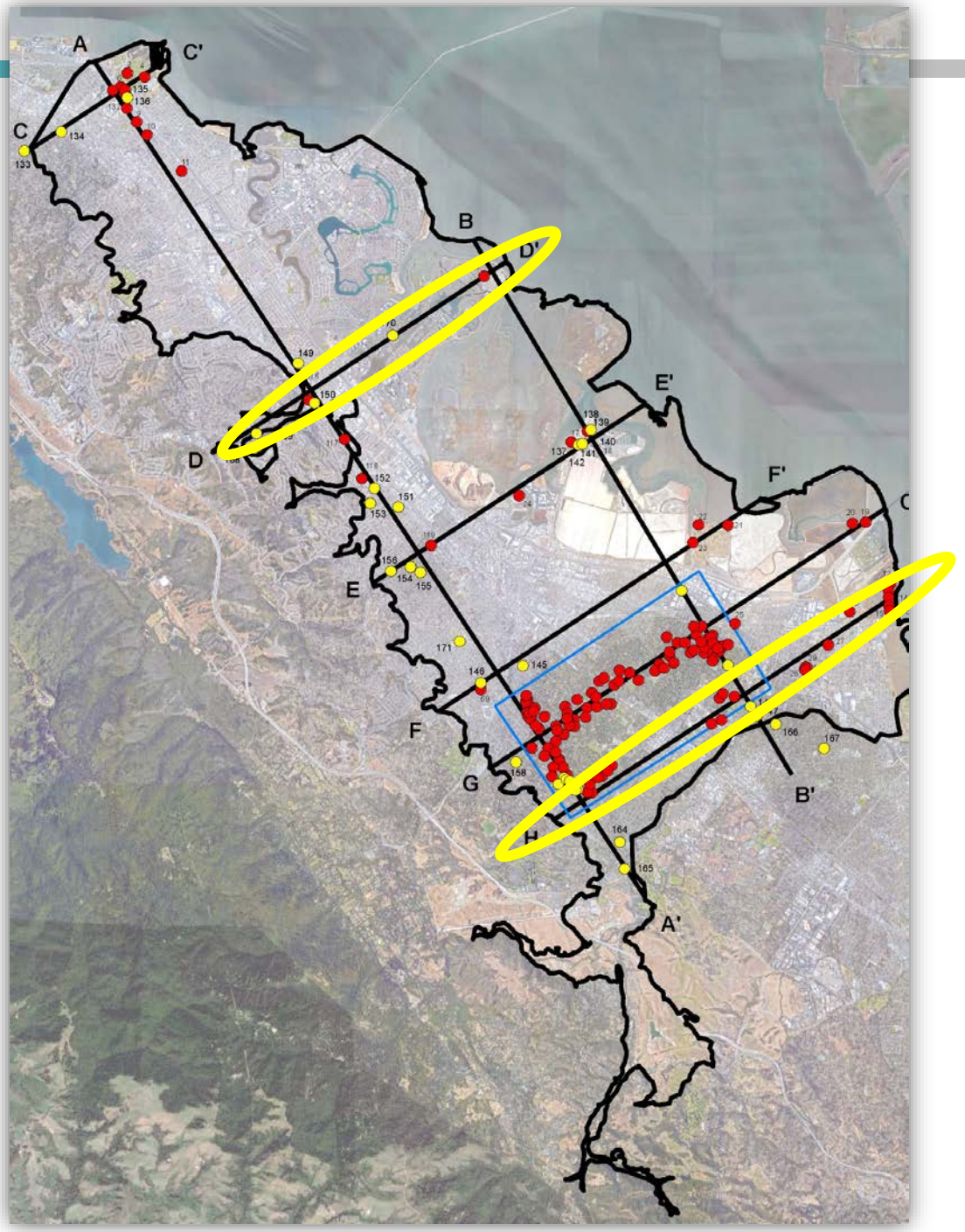
NEW WATER LEVEL CONTOUR MAPS (4 OF 4)

Deep Wells
Spring 2017



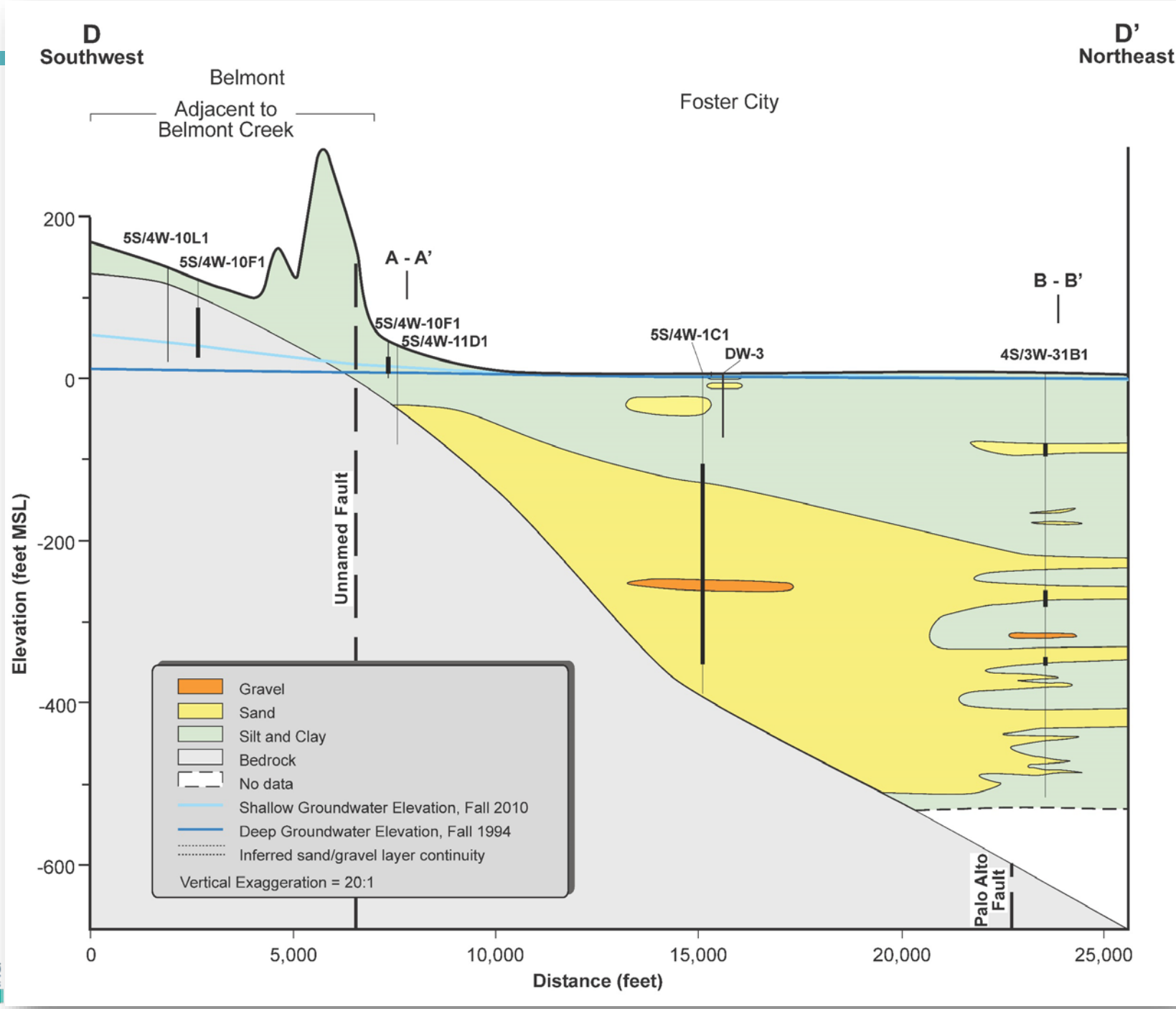
CROSS SECTION LOCATION MAP

- Updated to include:
  - Additional wells
  - Well screen depths
  - Further refinement of lithology



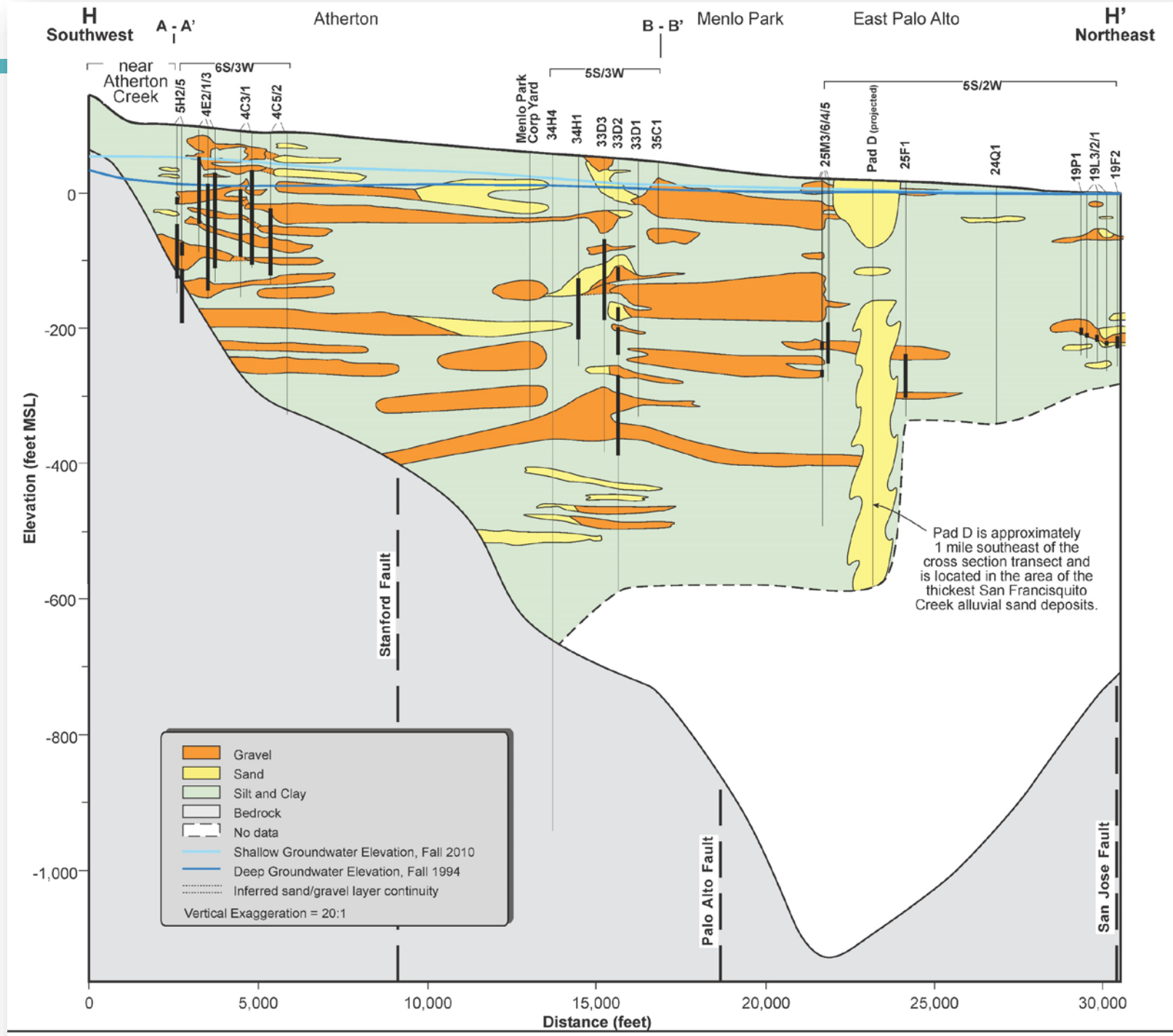
UPDATED CROSS SECTION (D-D')

- Updated to include:
  - Additional wells
  - Well screen depths
  - Further refinement of lithology



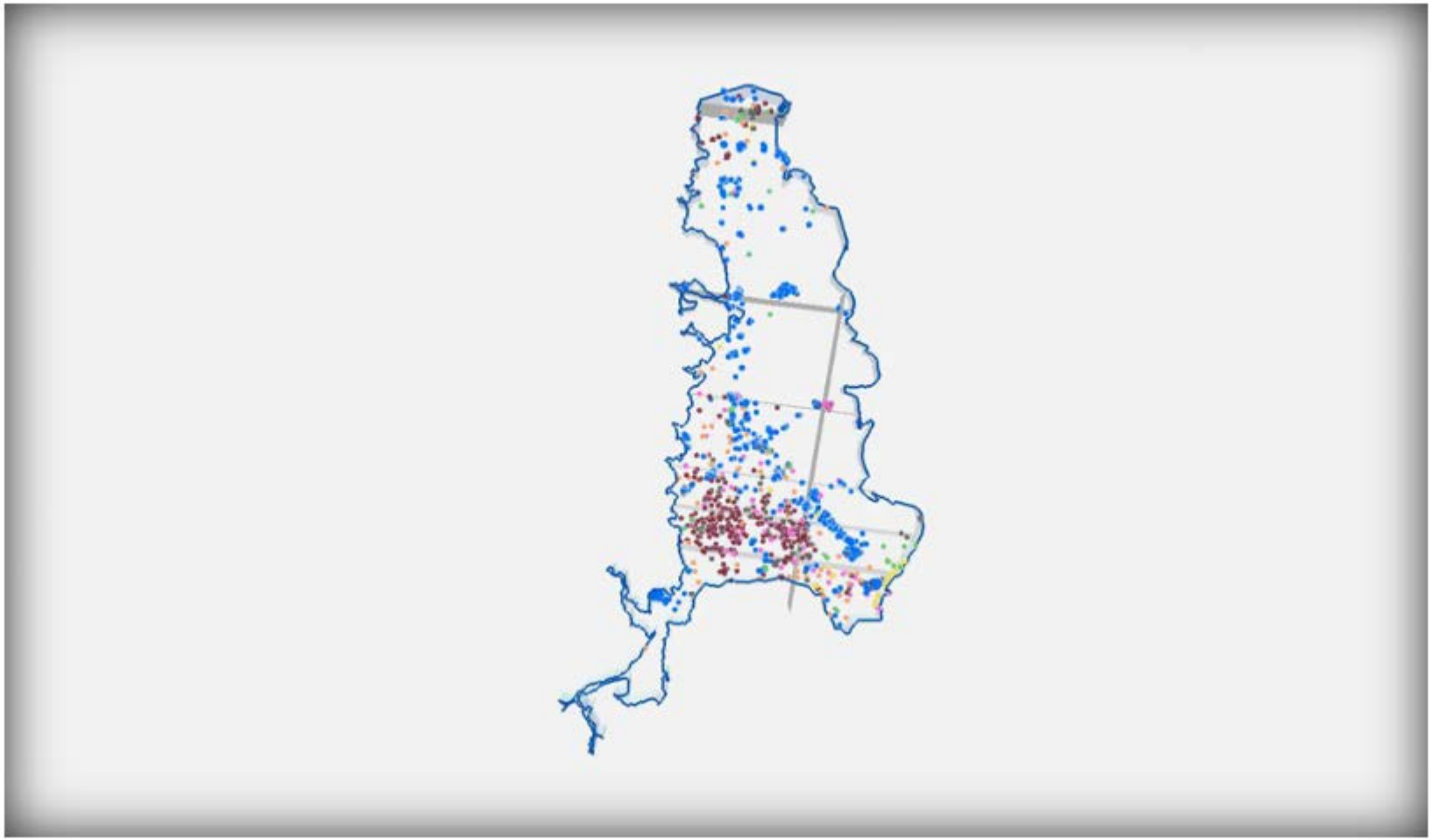
UPDATED CROSS SECTION (H-H')

- Updated to include:
  - Additional wells
  - Well screen depths
  - Further refinement of lithology

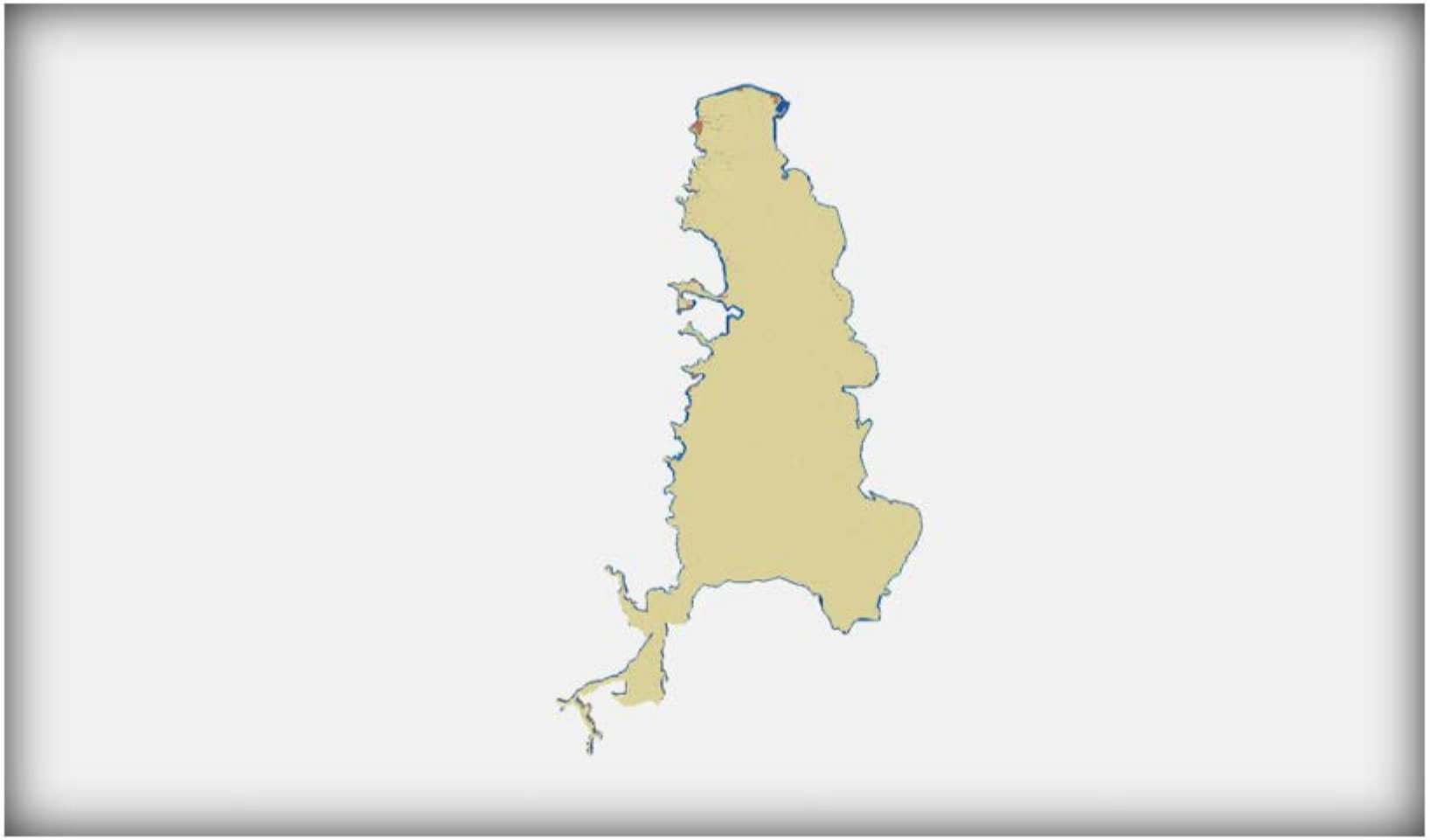


DEVELOPING 3D VISUALIZATIONS

3D - WELLS AND TRANSECTS



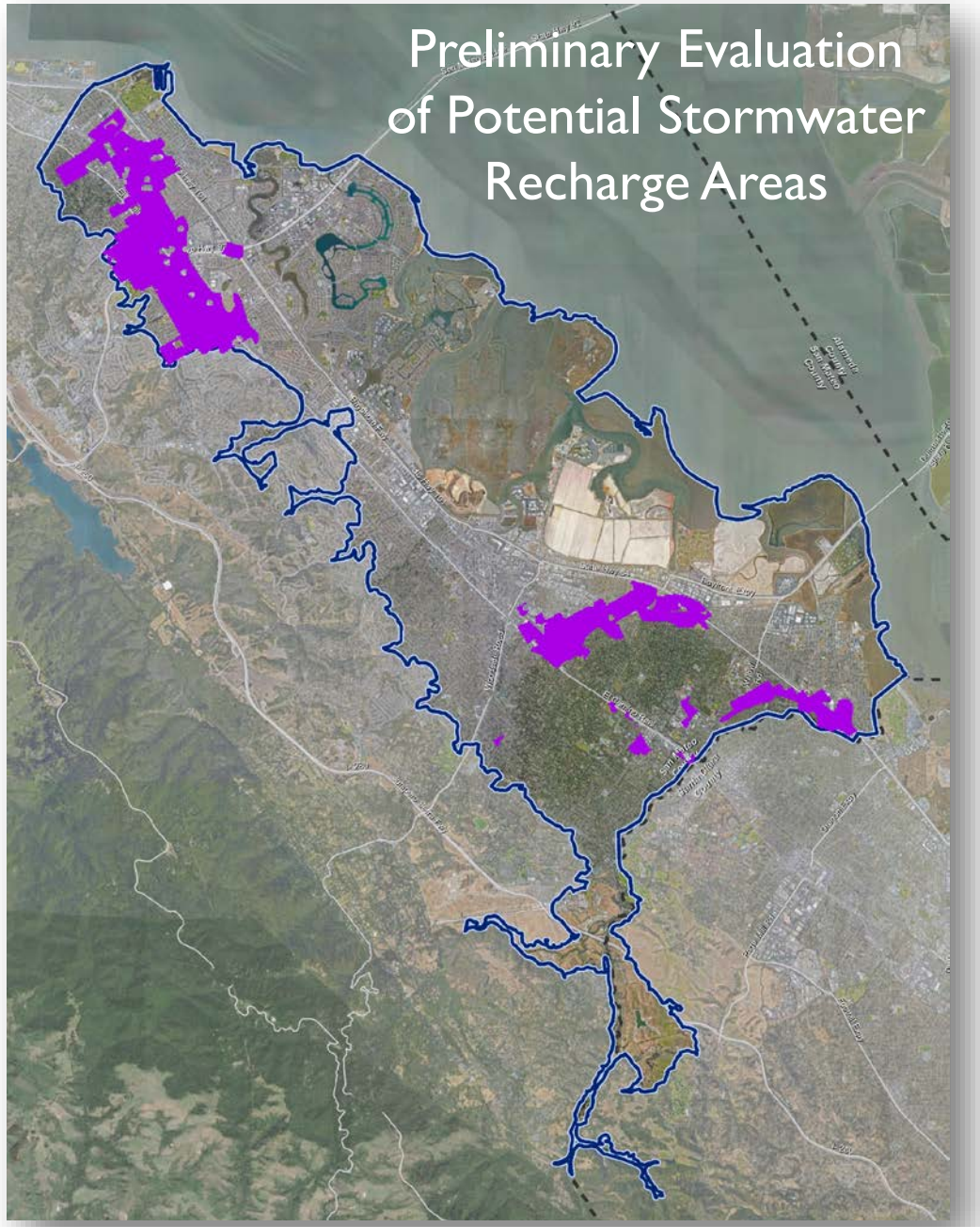
3D - GEOLOGIC LAYERING



POTENTIAL STORMWATER RECHARGE (LID) AREAS

Areas where Stormwater Recharge are likely to be most effective:

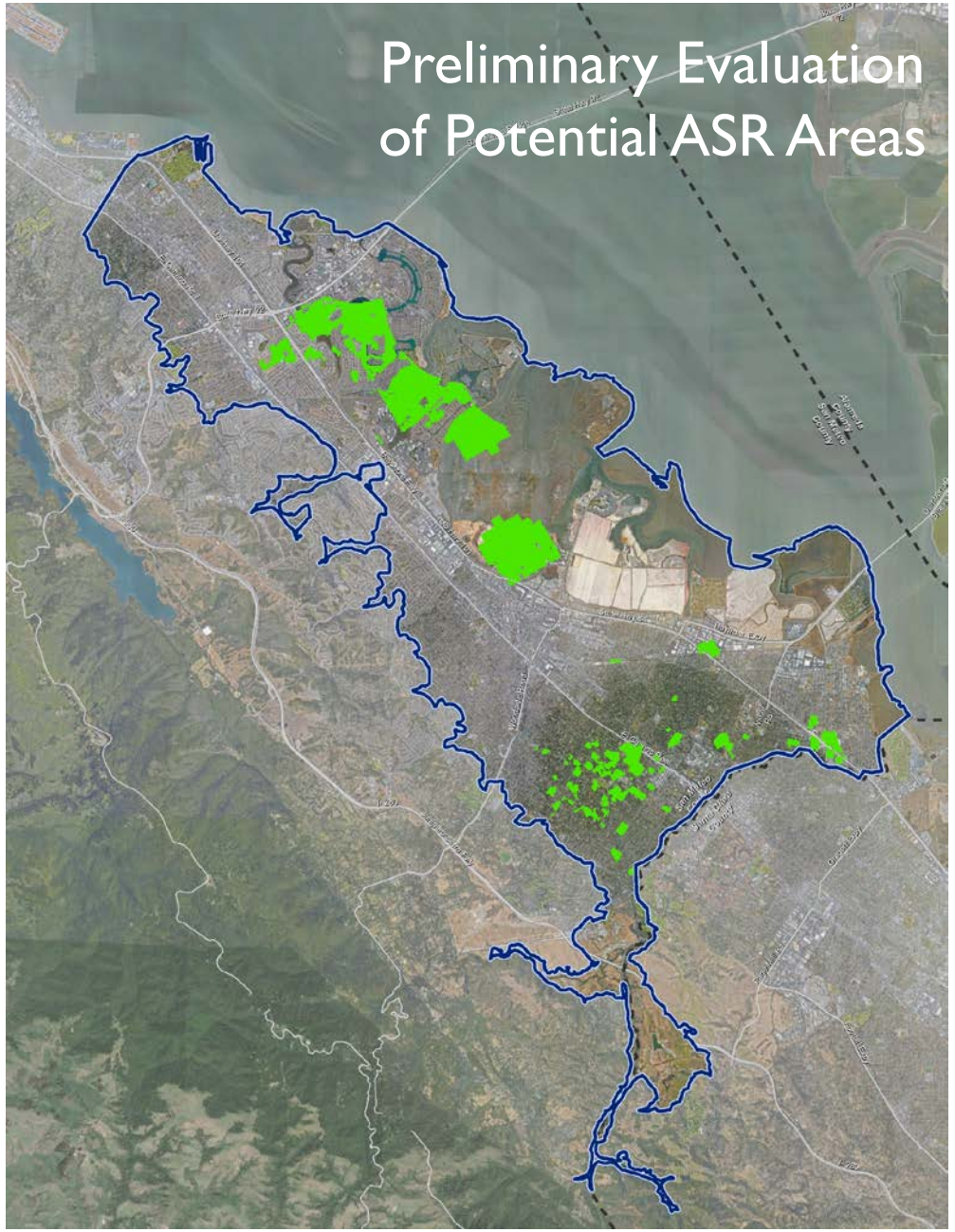
- High permeability surface soils
- Low surface slope
- Low permeability confining layer (Bay Mud) not present or weak
- Not located near known, active contamination sites



POTENTIAL AQUIFER STORAGE AND RECOVERY (ASR) AREAS

Areas where ASR is likely to be most effective:

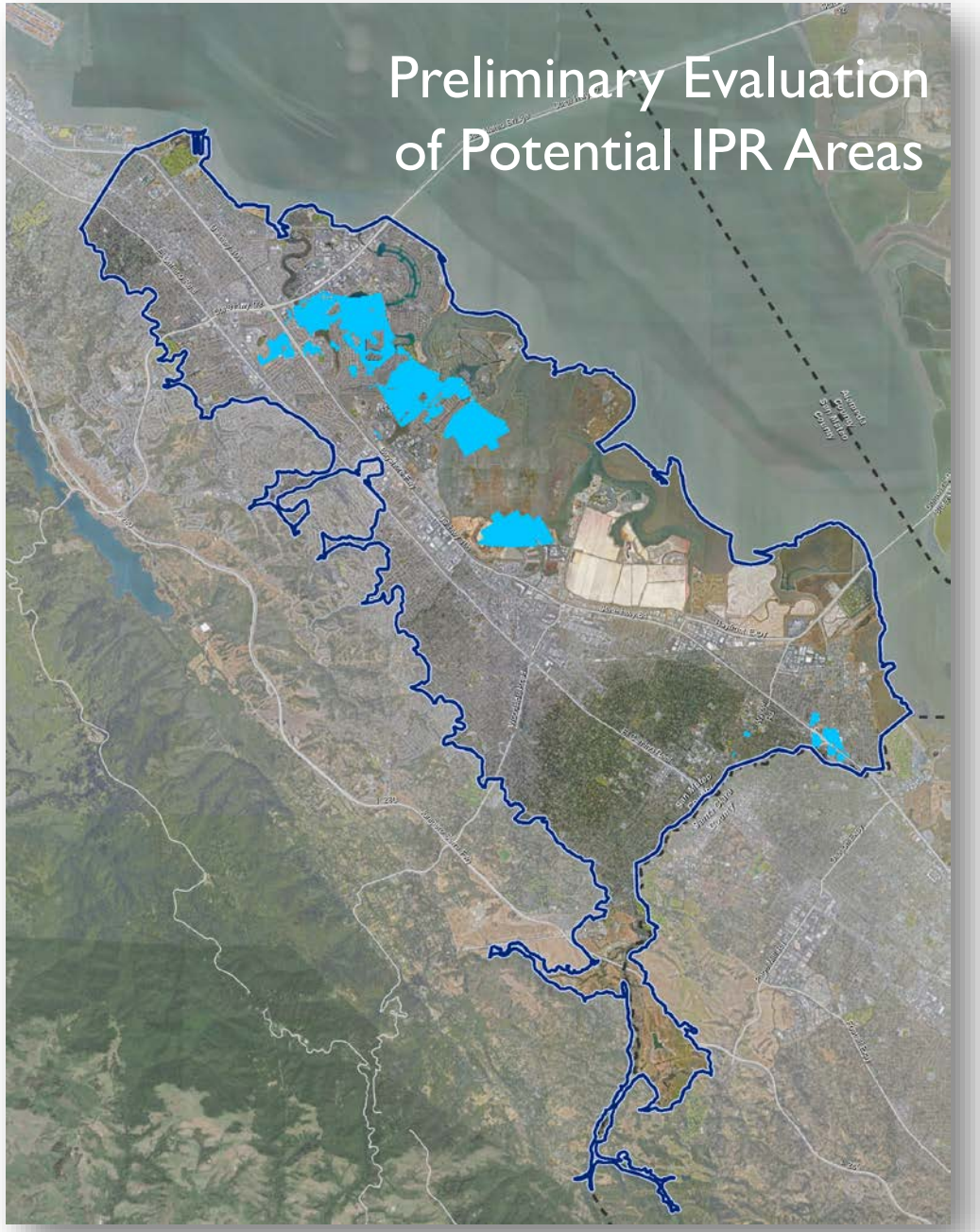
- Significantly thick high permeability zone in the aquifer
- Large properties
- Not located near known, active contamination sites
- Not adjacent to the Bay



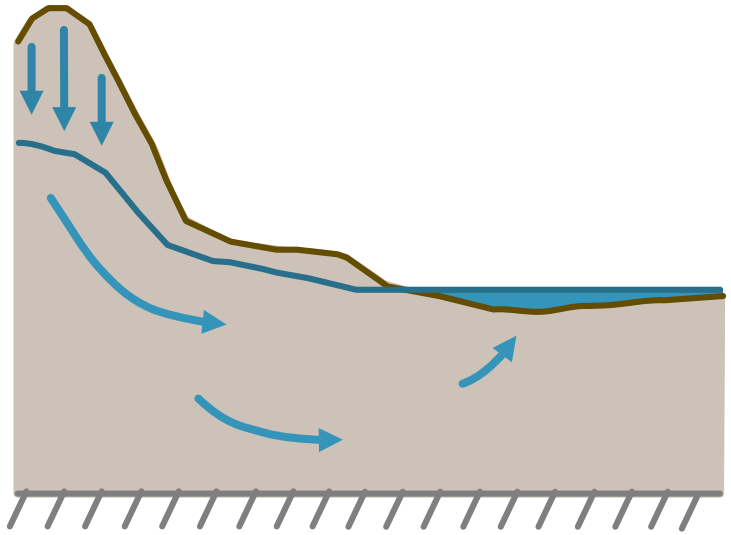
POTENTIAL INDIRECT POTABLE REUSE (IPR) AREAS

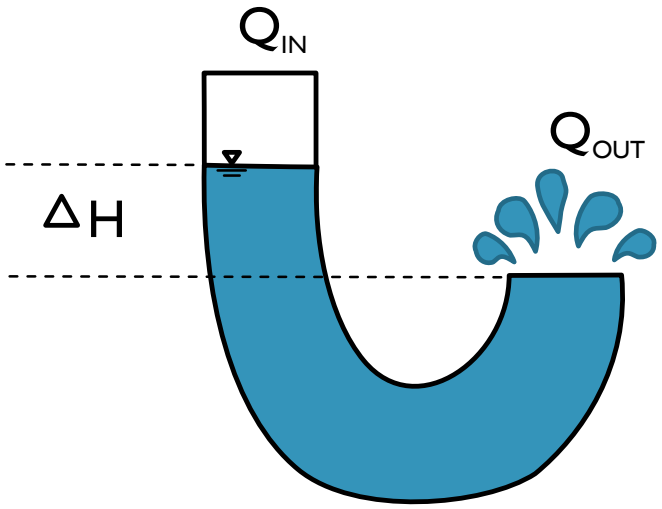
Areas where IPR is likely to be most effective:

- Same criteria as ASR
- Within 3 miles of an existing wastewater treatment plant
- Not located near existing municipal water supply wells

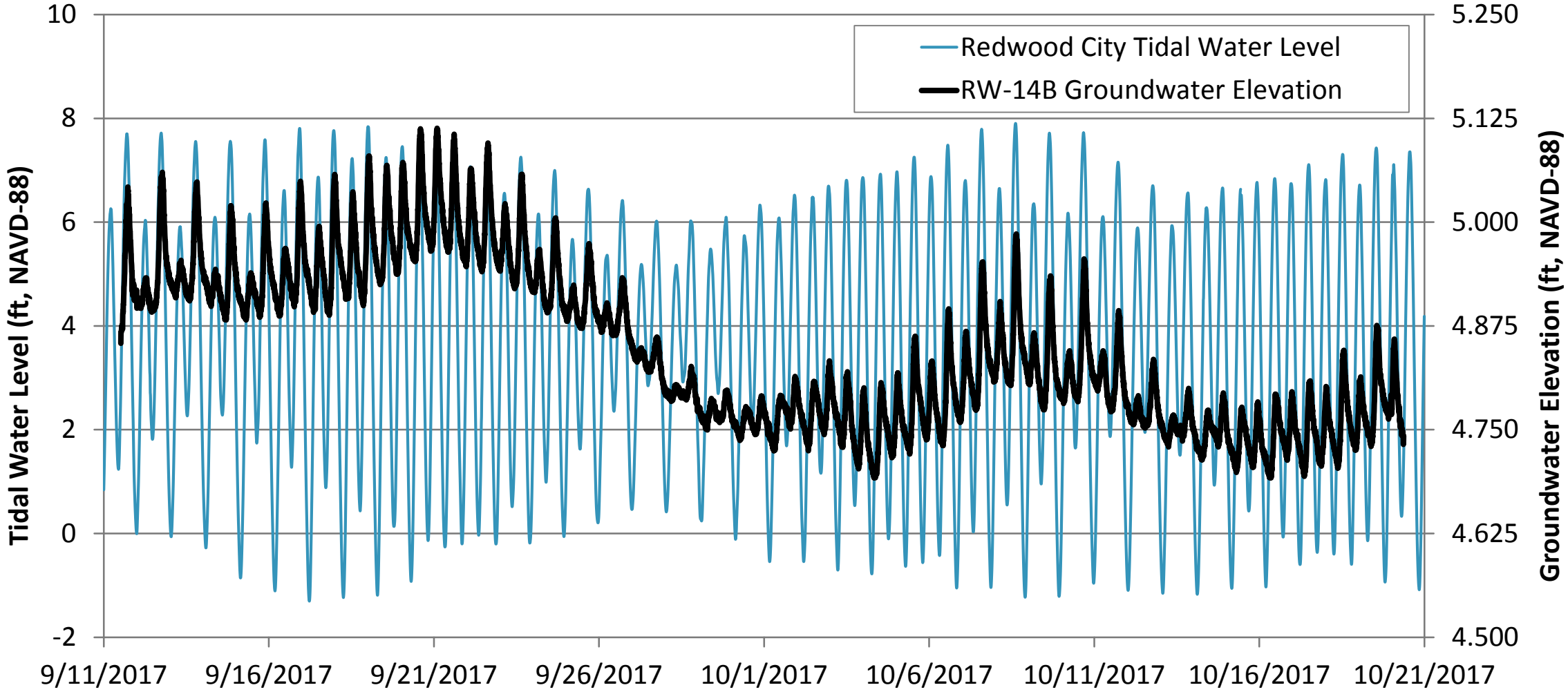


BAY MUD INVESTIGATION





TIDE AND MONITORING WELL DATA



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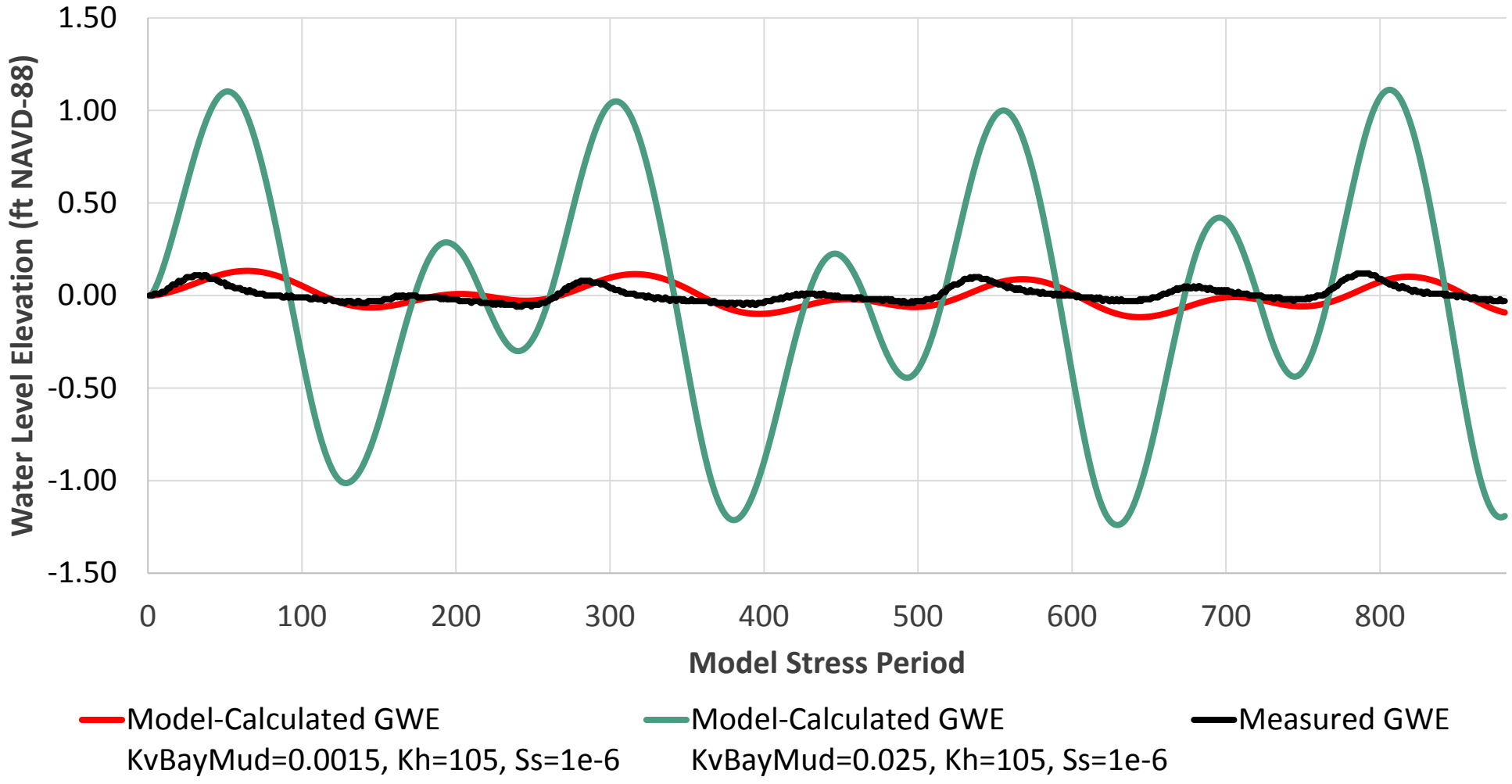
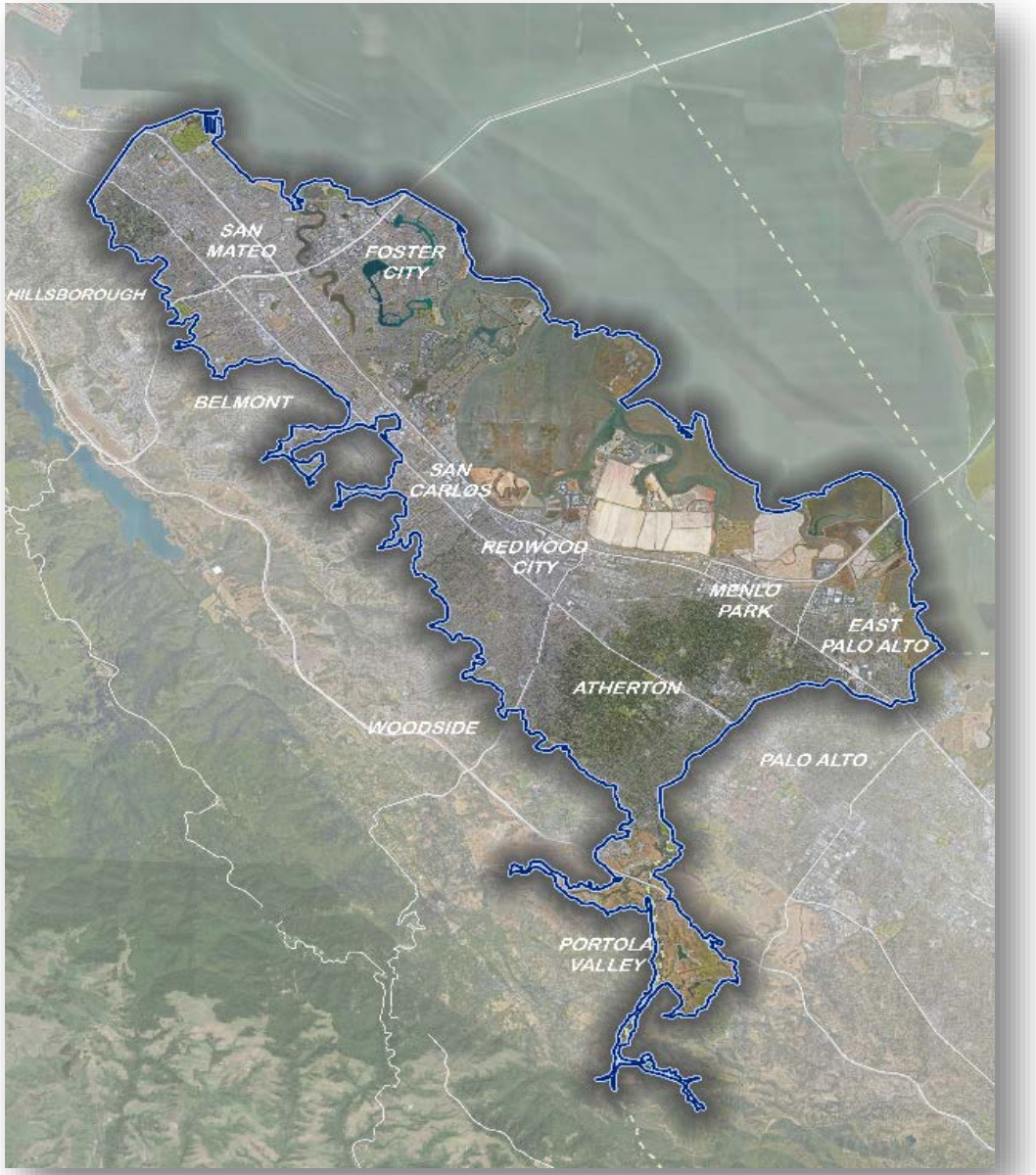
MEASURED AND MODEL-CALCULATED TIDAL RESPONSE

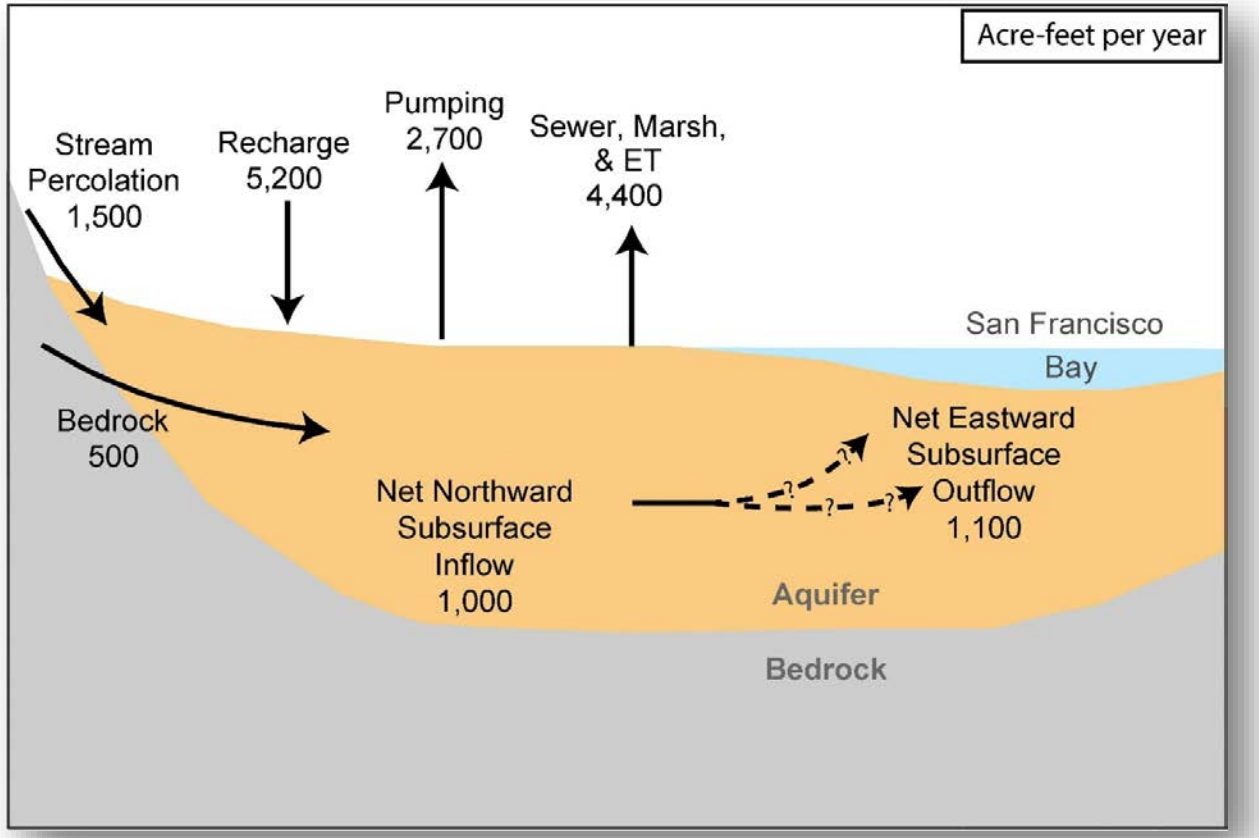


MODELING ACTIVITIES



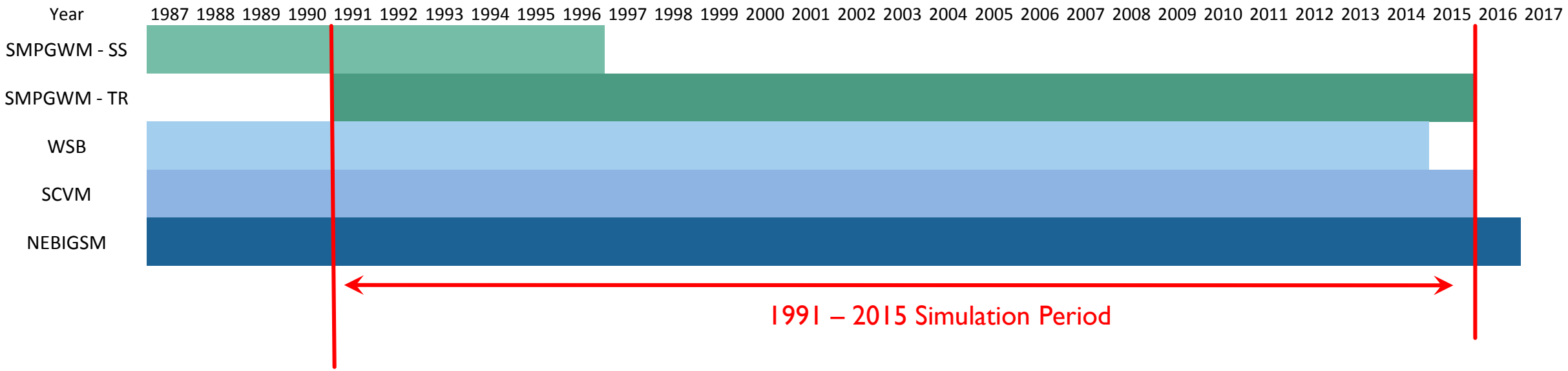
MODELING SCENARIO DEVELOPMENT

- Use Transient model to assess Basin sensitivity to changing hydrologic conditions and potential management decisions
- Quantify Basin changes in each scenario relative to the historical baseline
- Baseline
  - 24-year calibration period (1991-2015)
  - Represents current (2015) conditions



Phase 1 Water Budget Based on Steady-State Model

SIMULATION TIMELINE

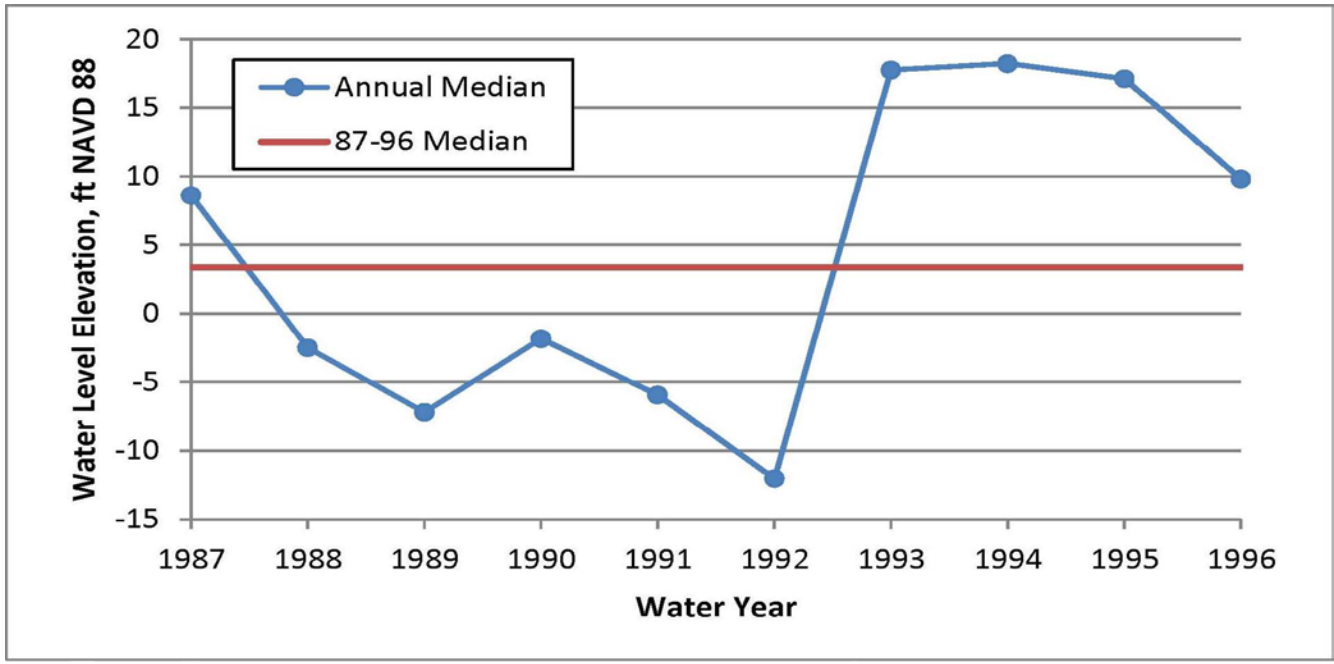


- SMPGWM – SS — San Mateo Plain Groundwater Model – Steady State
- SMPGWM – TR — San Mateo Plain Groundwater Model - Transient
- WSB — Westside Basin Model
- SCVM — Santa Clara Valley Water District Model
- NEBIGSM — Niles Cones and South East Bay Plain IGSM

TEMPORAL MODELING APPROACH (AVERAGE 1987-1996 CONDITIONS)

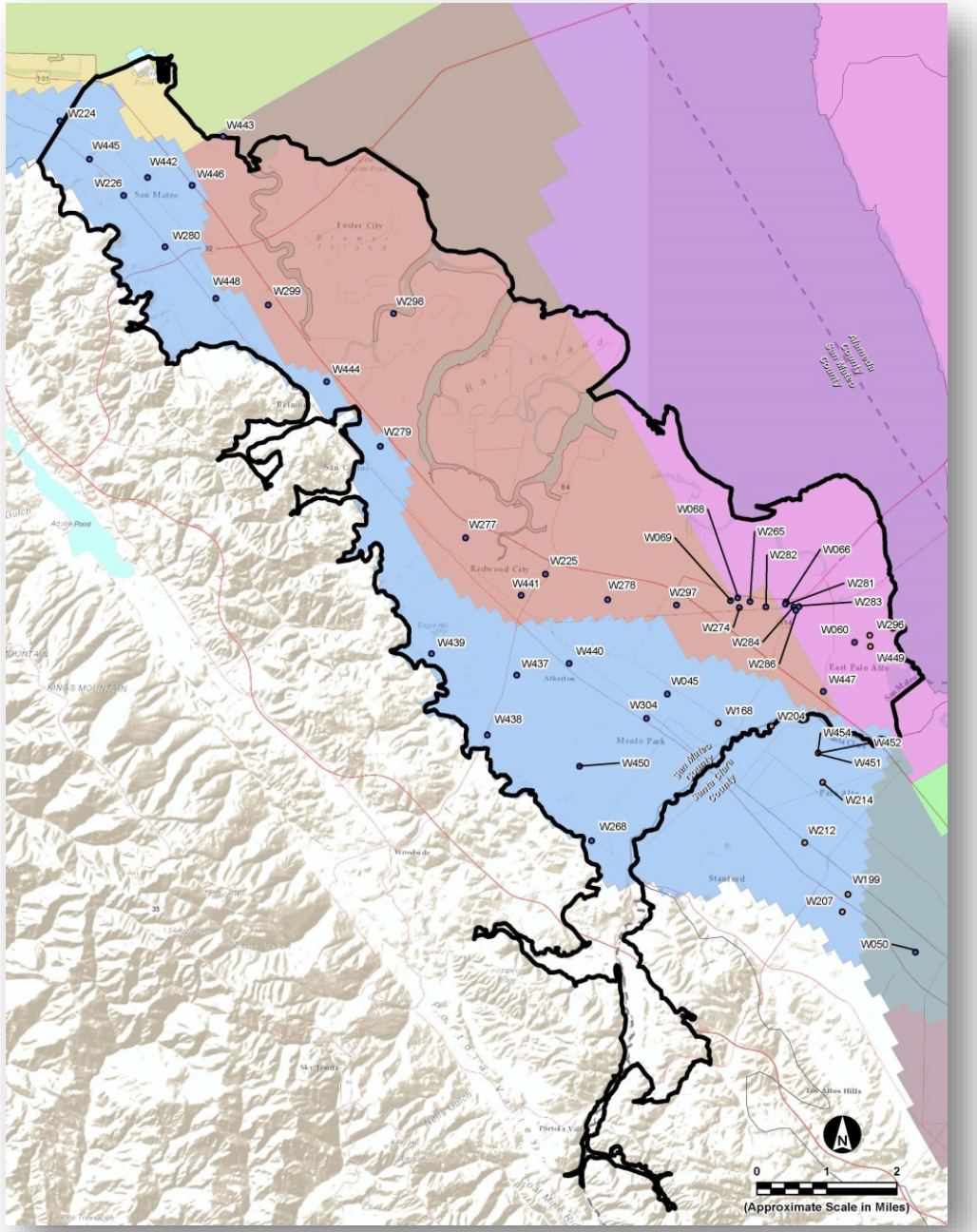
Employed Steady-State approximation:

- Average groundwater conditions represented by median measured water levels in wells.
- Calibrate hydraulic conductivity
- Assess hydraulic consistency of the Basin conceptual model
- Evaluate average annual water balance

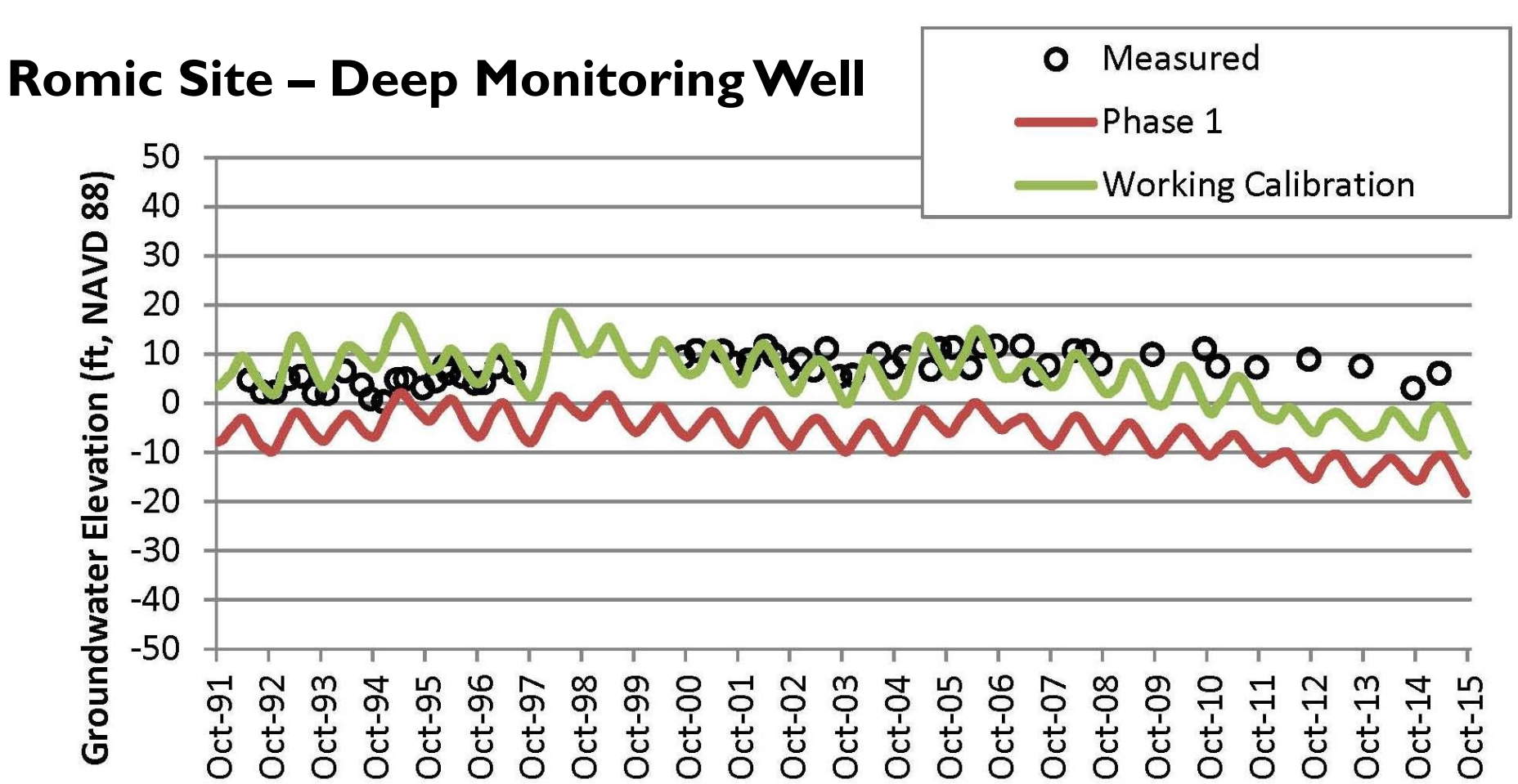


CONVERSION OF MODEL TO TRANSIENT

- Calibration wells used for conversion to transient model



EXAMPLE MODEL-CALCULATED HYDROGRAPH (PHASE 1 VS. PRELIMINARY PHASE 2)



FOUR SELECTED SCENARIOS

Baseline

Baseline + Climate Change

Baseline + Climate Change + Urban Demand Pumping Increase

Baseline + Climate Change + Urban Demand Pumping Increase + Implementation of Recharge Projects

- Stepwise approach allows for measurement of incremental effects
- Reflects progression of natural effects and potential local changes to address those effects

MAJOR SCENARIO ASSUMPTIONS

Baseline

Hydrology	1991 – 2015
Land and Water Use	2015
Average Pumping	3,749 AFY
Average Recharge	6,767 AFY

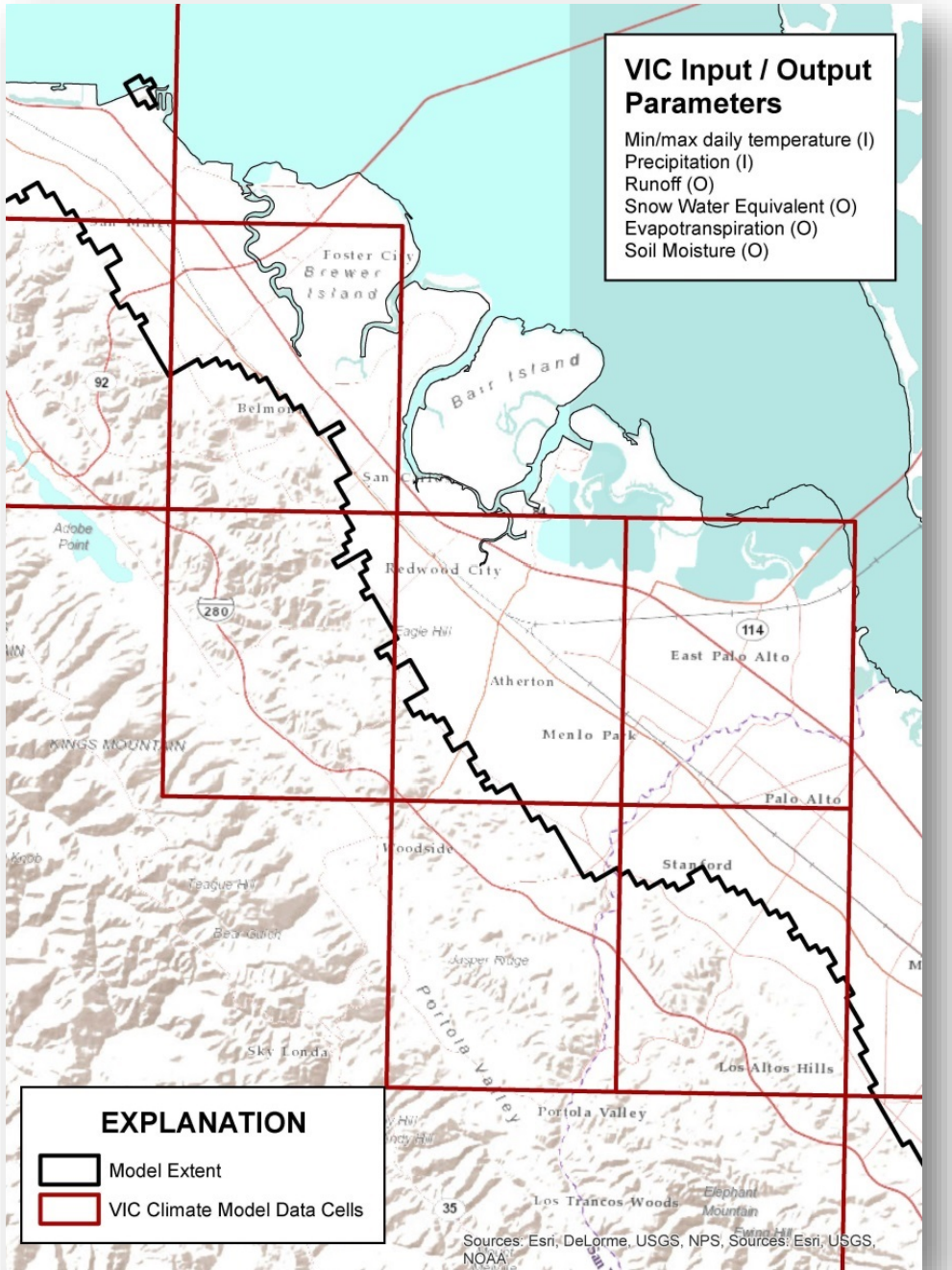
MAJOR SCENARIO ASSUMPTIONS

Baseline + Climate Change

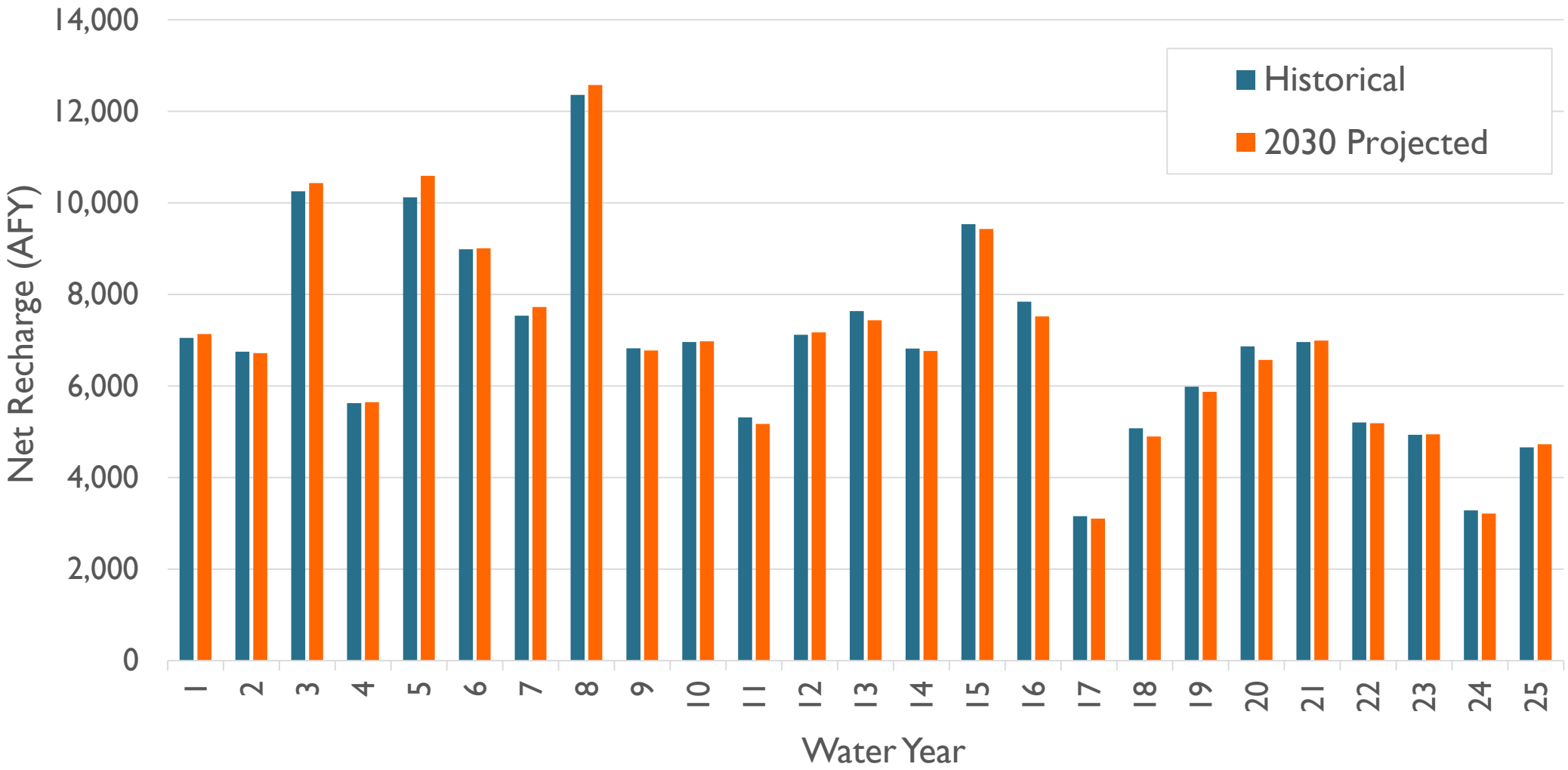
Hydrology	1991 - 2015 (modified to 2026 - 2050) • Rainfall (+6%) • ETo (+3%) • Stream flow runoff (-0.4%) Sea Level Rise estimated by Coastal Commission (8.5 ± 3 in. by 2040)
Land and Water Use	2015
Average Pumping	3,746 AFY Revised irrigation water demand using modified rainfall and ETo
Average Recharge	6,760 AFY Revised using updated rainfall, ET_0, and runoff

CLIMATE CHANGE MODEL GRID

- Climate change model grid, results reported from California Department of Water Resources, Water Storage Investment Program (WSIP)



HISTORICAL AND PROJECTED RECHARGE



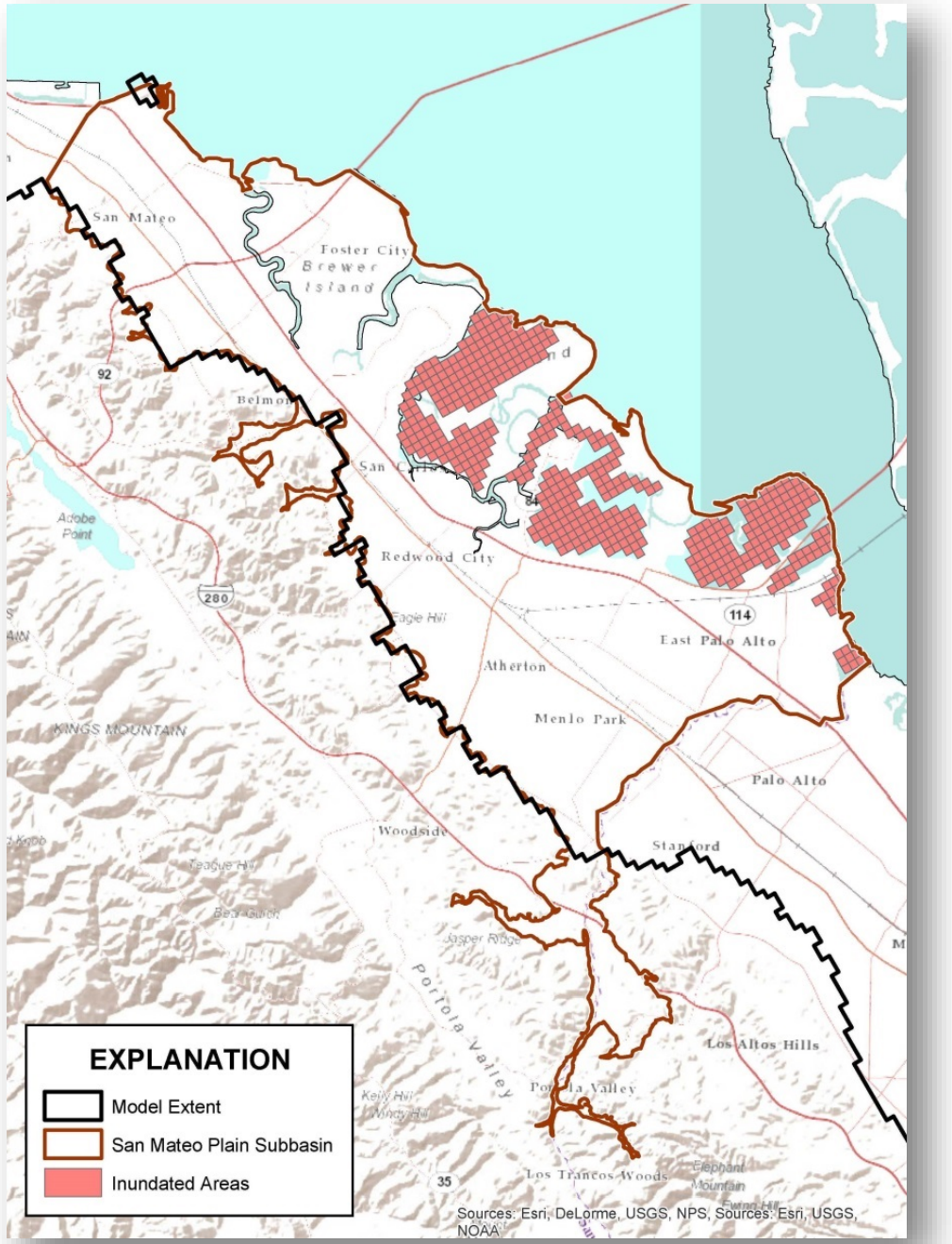
SEA LEVEL RISE ESTIMATES

Year	Projection	Range
2030	6 ± 2“	2–12”
2040 (inferred)	8.5 ± 3” (~0.7 feet)	3.5–18”
2050	11 ± 4“	5–24”
2100	36 ± 10“	17–66”

California State Coastal Conservancy and County of San Mateo (2017). “County of San Mateo Sea Level Rise Vulnerability Assessment - Draft Report. Appendix G - Selection of Inundation Scenarios for San Mateo County Sea Level Rise Vulnerability Assessment Memo.”

SEA LEVEL RISE (2040)

- Estimated model areas inundated by projected 0.7 ft sea level rise by 2040



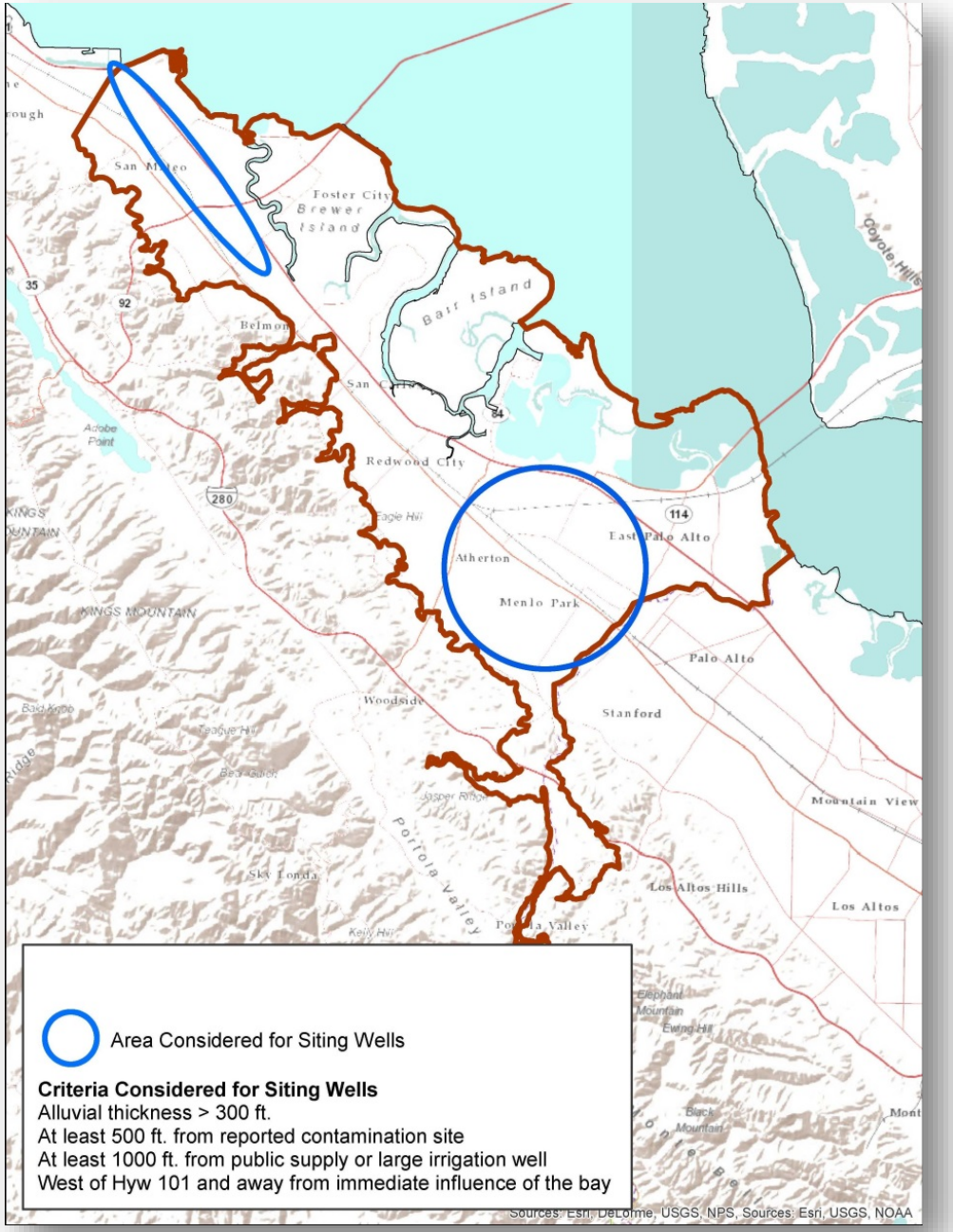
MAJOR SCENARIO ASSUMPTIONS

Baseline + Climate Change + Urban Demand Pumping Increase

Hydrology	1991 - 2015 (modified to 2026 - 2050) • Rainfall (+6%) • ETo (+3%), • Stream flow runoff (-0.4%) Sea Level Rise estimated by Coastal Commission (8.5 ±3 in. by 2040)
Land and Water Use	2040
Average Pumping	5,746 AFY Deep zone pumping increased to meet 2040 demand (+2,000 AFY)
Average Recharge	6,760 AFY Revised using updated rainfall, ETo, and 2040 muni water use

POTENTIAL GROUNDWATER DEVELOPMENT AREAS

- Criteria:
  - Alluvial thickness > 300 ft
  - At least 500 ft from reported contamination site
  - At least 1,000 ft from public supply or large irrigation well
  - West of US 101, and away from immediate influence of the Bay



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MAJOR SCENARIO ASSUMPTIONS

Baseline + Climate Change + Urban Demand Pumping Increase + Implementation of Recharge Projects

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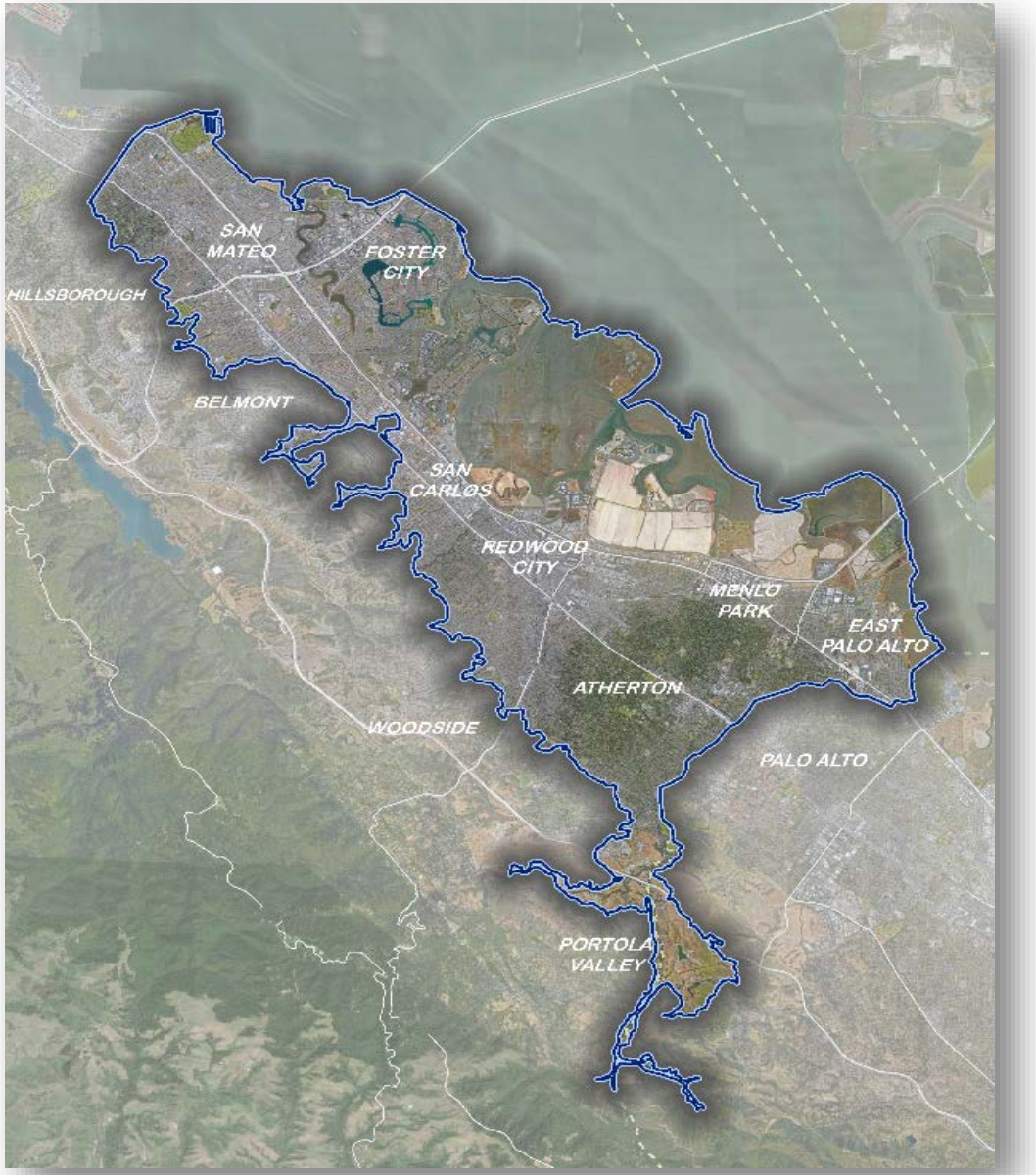
Land and Water Use	2040
Average Pumping	5,746 AFY Deep zone pumping increased to meet 2040 demand (+2,000 AFY)
Average Recharge	6,760 AFY Revised using updated rainfall, ETo, and 2040 muni water use Enhanced recharge (LID & IPR)

POTENTIAL INDIRECT POTABLE RE-USE PROJECTS

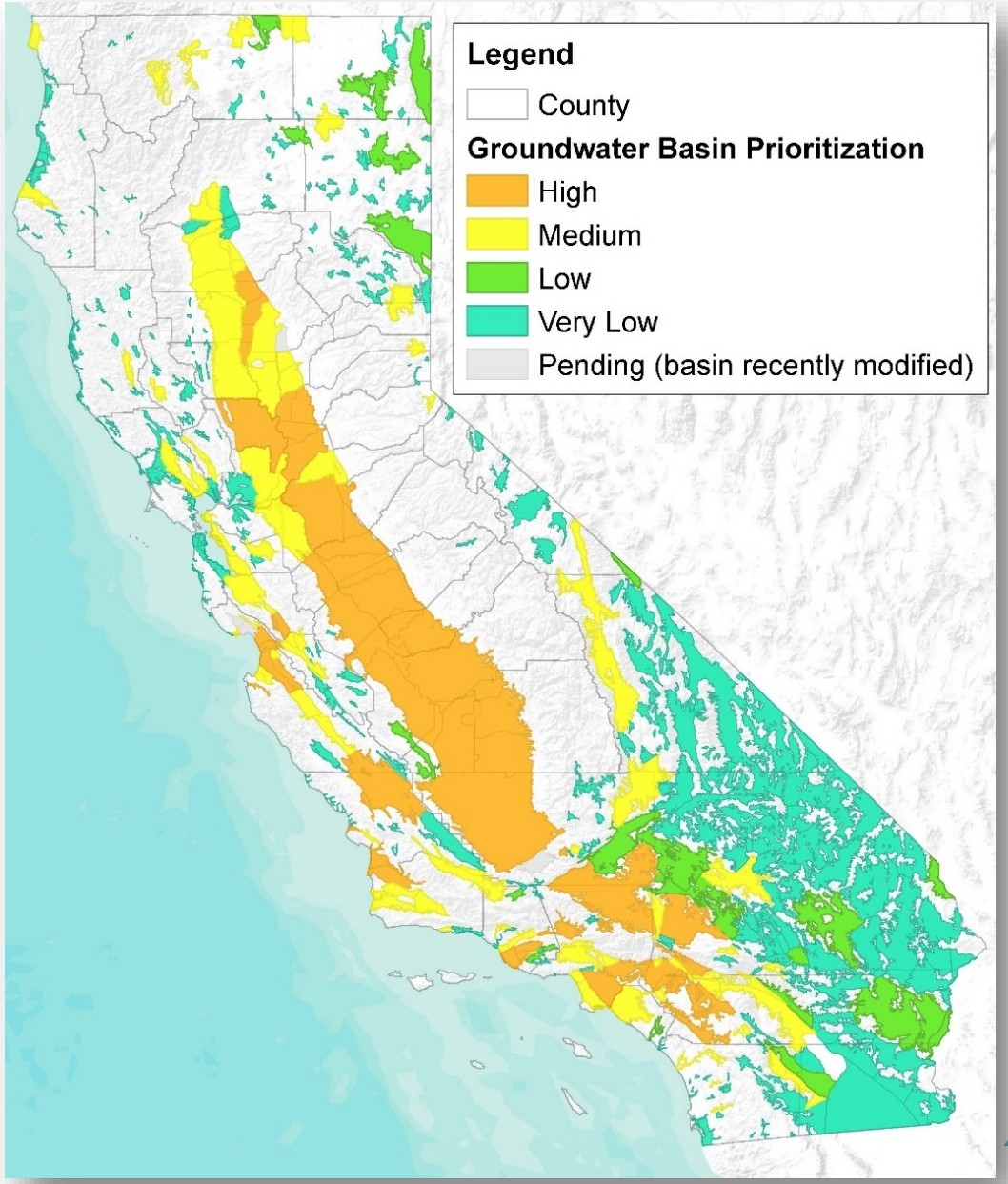
Silicon Valley Clean Water Facility Recycled Water – Redwood City	AFY
Recycled Water Used in 2014	750
Recycled Water Used in 2015	708
Recycled Water Used in 2016	654
Phase 1 Capacity (current)	2,000
Potential Total System Capacity	3,238

SGMA UPDATES



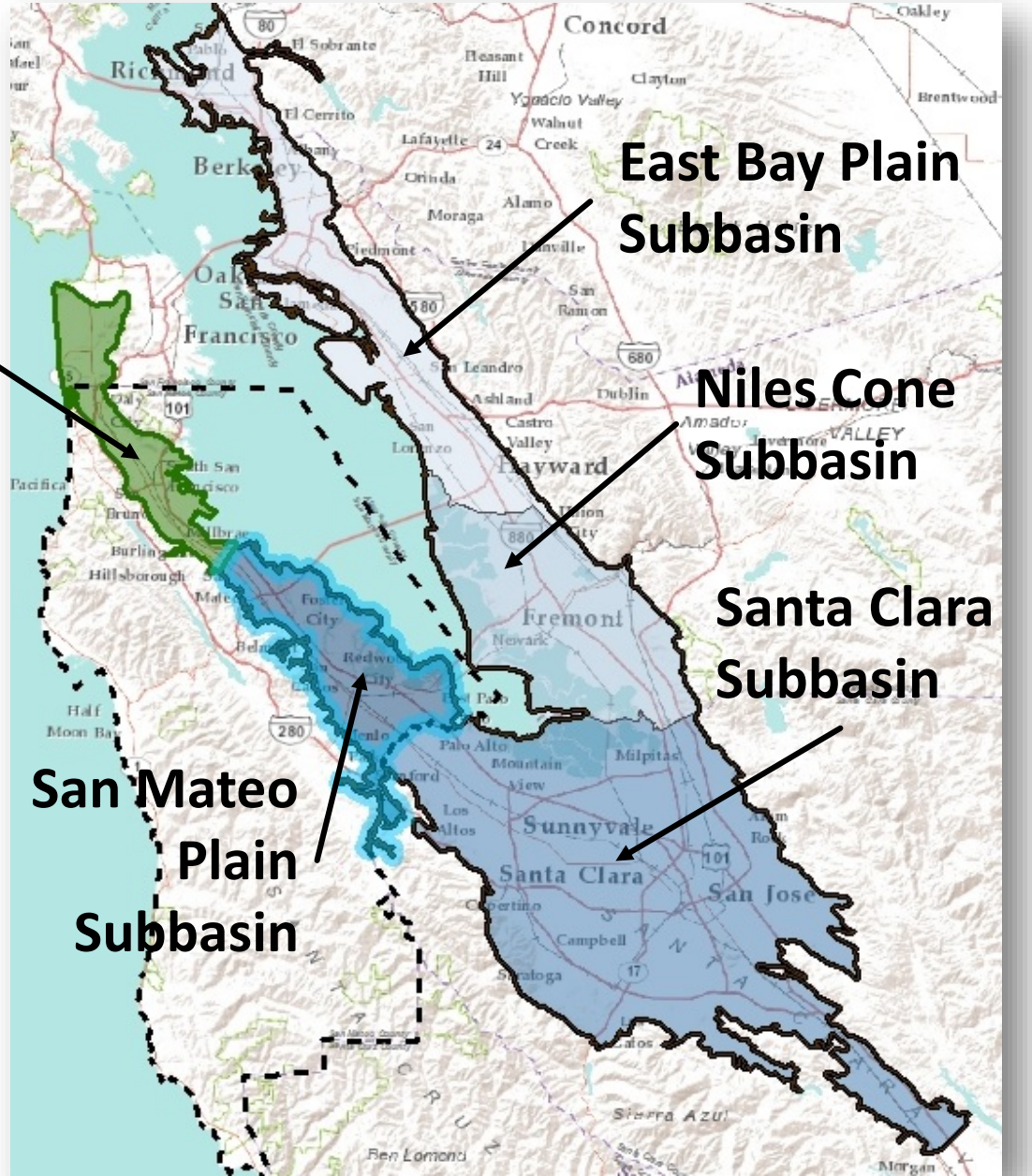
STATEWIDE SGMA UPDATE

- Anticipated late 2017/early 2018:
  - DWR status update on evaluation of Alternative Plans
  - DWR Basin Reprioritization
- Opportunity for more Basin Boundary Modifications (request submission January to March 2018)
- Proposition 1 SGWP Grant applications due November 13th
- Additional DWR guidance and Best Management Practices being developed



SGMA ACTIVITIES IN ADJACENT BASINS

- Westside Basin
- Santa Clara Valley Subbasin
- Niles Cone Basin
- East Bay Plain Subbasin



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UPCOMING ACTIVITIES

- Working with BAWSCA and other agencies to explore development of CASGEM-compliant groundwater monitoring well network
- Potentially collect another round of groundwater level measurements
- Prepare Phase 3, Final Report based on new data
  - Report will reflect data collected and aggregated by January 2018
- Next Stakeholder Workshop – Anticipated January 2018

QUESTIONS?

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