SAN MATEO PLAIN GROUNDWATER BASIN ASSESSMENT

STAKEHOLDER WORKSHOP#2

SEPTEMBER 7, 2016

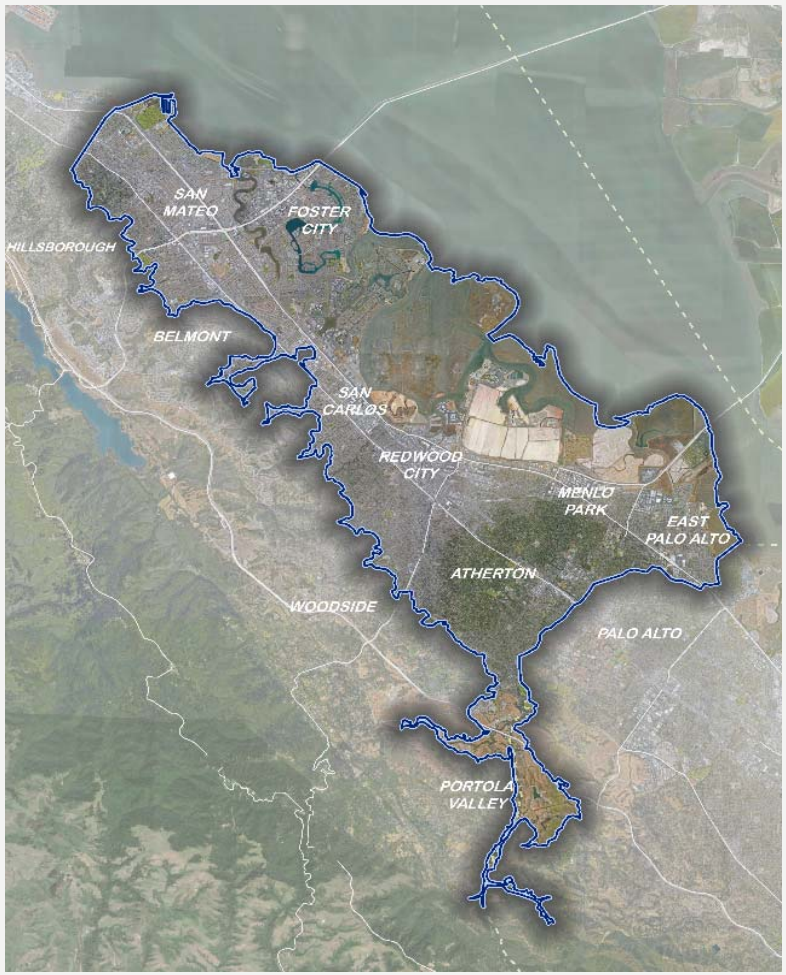
Erler & Kalinowski, Inc.

TODD GROUNDWATER

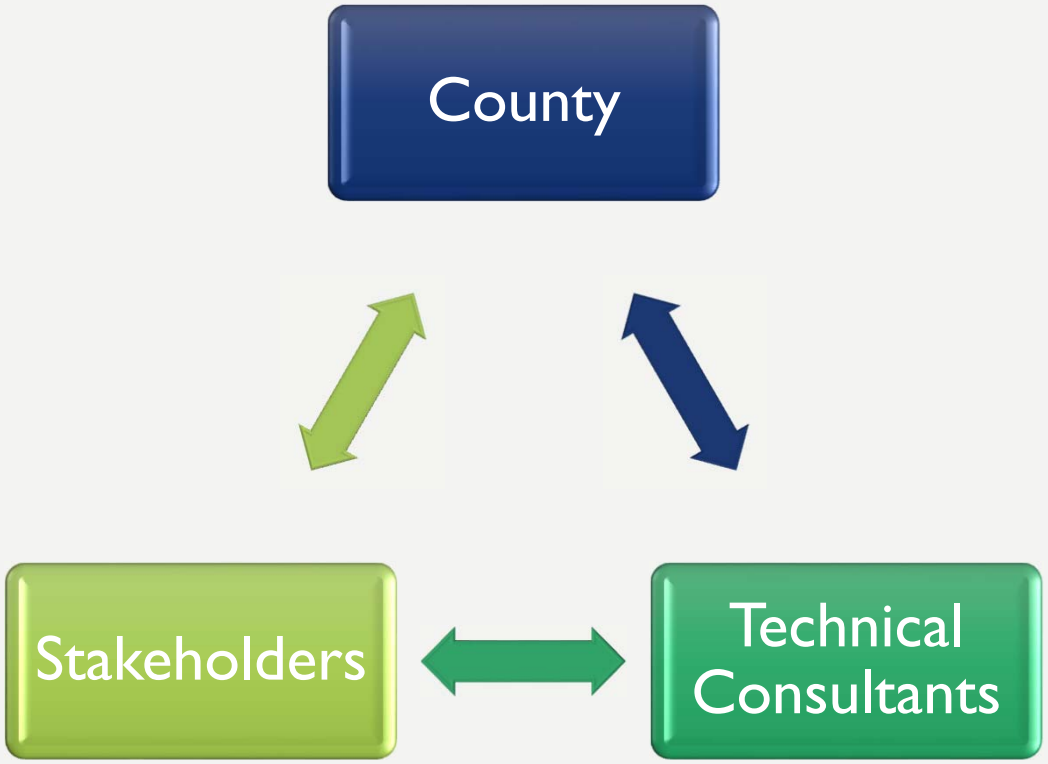
HYDROFOCUS INC.
Solutions for Land and Water Resources

PRESENTATION OVERVIEW

- Introductions
- Project Overview
- Summary of Stakeholder Meeting #1 Feedback
- “Snapshot” of Results to Date:
  - Data Compilation and Review
  - Hydrogeologic Conceptual Model
  - Basin Water Balance
  - Groundwater Quality
  - Evaluation of Potential Undesirable Results



INTRODUCTIONS



SAN MATEO PLAIN GROUNDWATER BASIN ASSESSMENT

- Funded through Measure A
- Project Objectives:
  - Increase Public Knowledge
  - Evaluate Hydrogeologic and Groundwater Conditions
  - Evaluate Risk of Undesirable Results
  - Develop Potential Groundwater Management Strategies
- http://green.smcgov.org/san-mateo-plain

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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

Jul 2016 – Dec 2017

Phase 3

- Public Outreach
- Conduct Scenario Evaluations
- Prepare Final Report

Sep 2017 – Apr 2018

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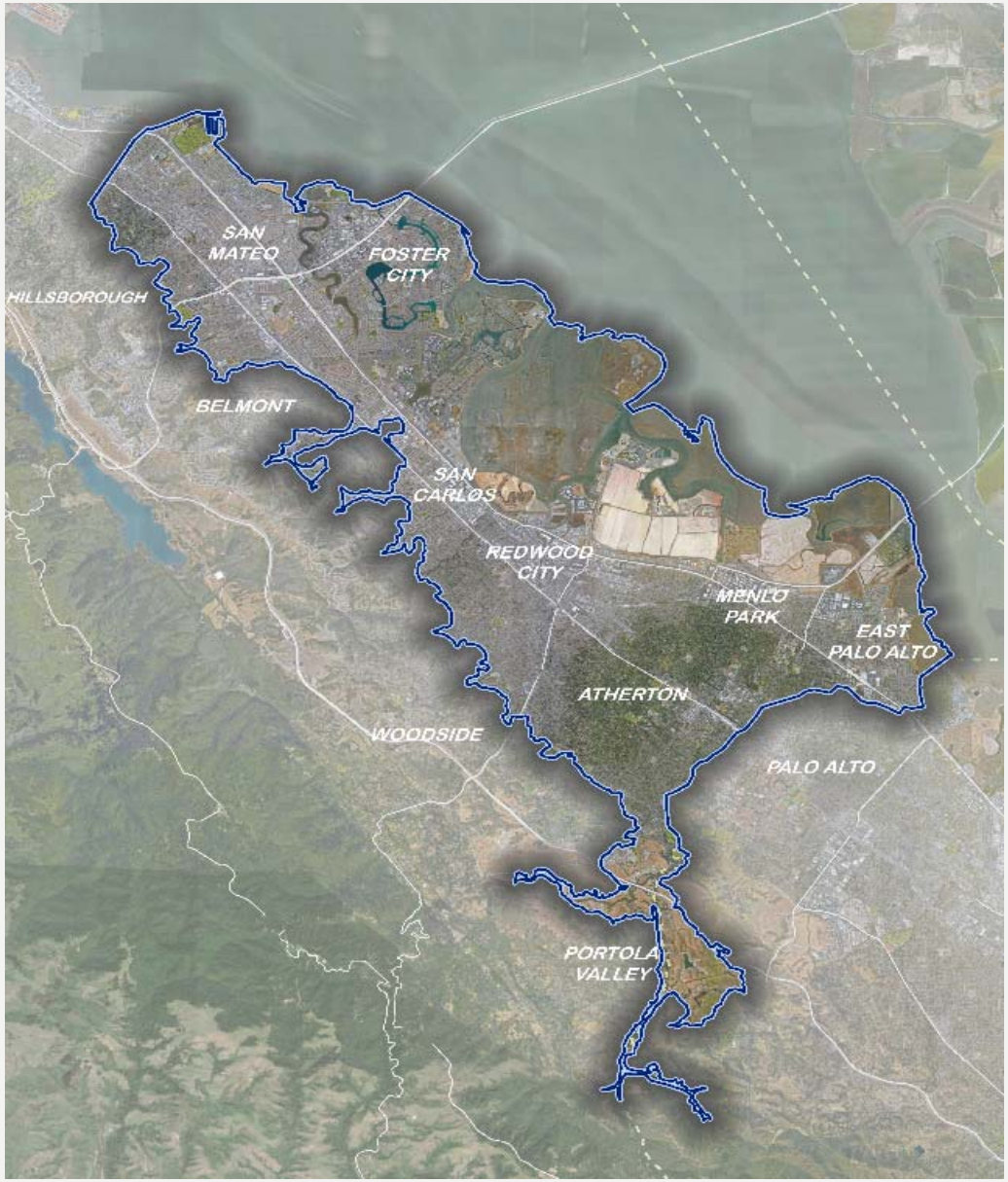


STAKEHOLDER OUTREACH

STAKEHOLDER WORKSHOP #1
MAY 17, 2016

- Project Overview
- Breakout Sessions on Three Topics

Potential Issues and Opportunities within the Basin

Objectives for the San Mateo Plain Groundwater Assessment Project

Data Gap Filling

TOPIC #1: POTENTIAL ISSUES AND OPPORTUNITIES

Potential Opportunity	Ways to Foster
Recharge with recycled water	• Encourage wastewater agency participation
Recharge with stormwater	• Dual-purpose projects / incentivize infiltration • "Unline" creeks
Conjunctive use of surface water and stormwater	• ASR, IPR
Funding partnerships and opportunities	• Private-Public Partnerships • IRWM funding
Public education	• Regional planning / solutions
Rethinking water infrastructure	• Distributed infrastructure (IPR / recharge)

TOPIC #1: POTENTIAL ISSUES AND OPPORTUNITIES

Potential Issue	Potential Mitigation
Lack of data / understanding	• Identify existing private wells and collect data
Climate change threats	• Leverage existing studies / data
Long-term sustainable management	• Establish sustainable yield • Different thresholds for different areas • Distinguish between short-term and long-term needs
Resource protection	• Multiple-benefit projects • Land use planning • Reuse / recycled water
Competition within and between basins	• Regional planning / solutions

TOPIC #2: RANKING PROJECT OBJECTIVES

1	**Evaluate the hydrogeologic and groundwater conditions of the entire Basin**
2	**Develop Basin water balance**
3	**Assess groundwater recharge areas**
4	**Develop a Basin hydrogeologic conceptual model**
5	**Evaluate interactions with adjacent basins and subbasins**
6	**Evaluate threats to the Basin groundwater quality and quantity**
7	**Identify long-term strategies to sustainably manage groundwater resources**
8	**Evaluate surface water and groundwater interactions in the Basin**
9	**Assess threats to water quality**
10	**Identify and position the Basin for funding opportunities**
11	**Increase public knowledge through data sharing and collaboration**
12	**Evaluate potential impacts of sea level rise and climate change**

Strong emphasis on establishing the scientific and technical foundation

Funding ranked lower because CASGEM ranking may limit competitiveness for funds

TOPIC #3: DATA GAP FILLING

- Established contacts for agencies and groups in the Basin and beyond
- Identified relevant studies
- General impressions:
  - Filling data gaps is high priority
  - Data should be shared across basin boundaries
- Prioritize coordination with entities with existing wells
  - Gather time-series water level / water quality data

RESOURCE USE AND ECOSYSTEM PROTECTION

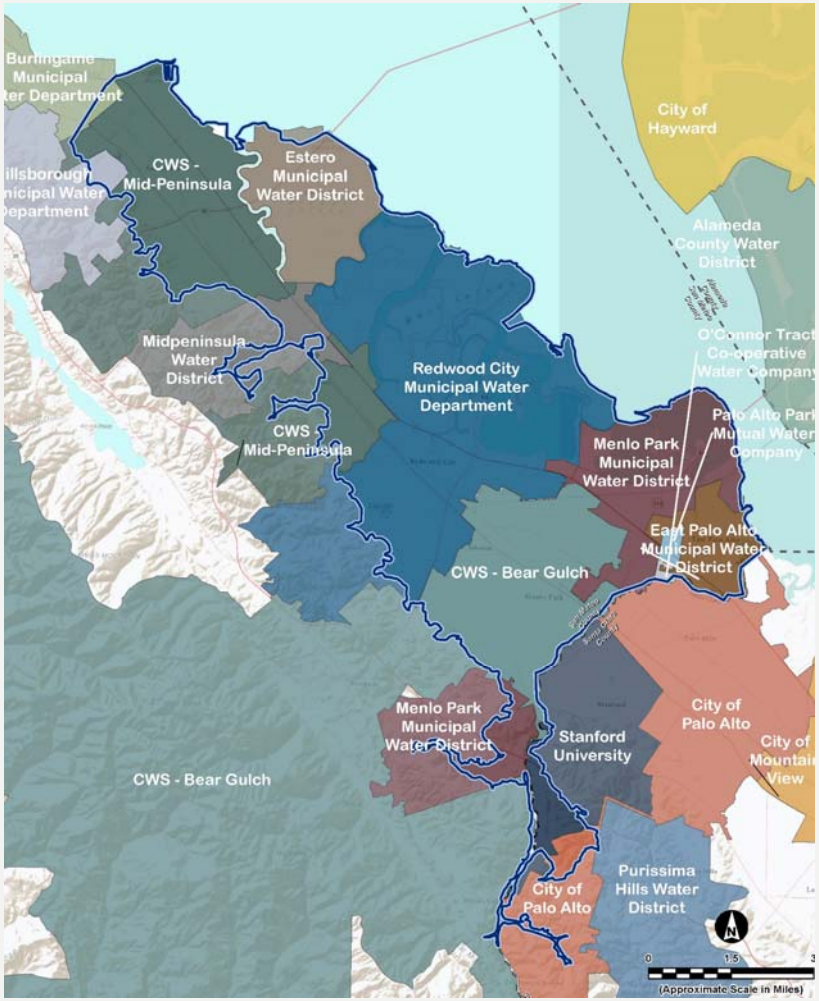
- "Project should emphasize the important role of groundwater in supporting ecosystems"

AND

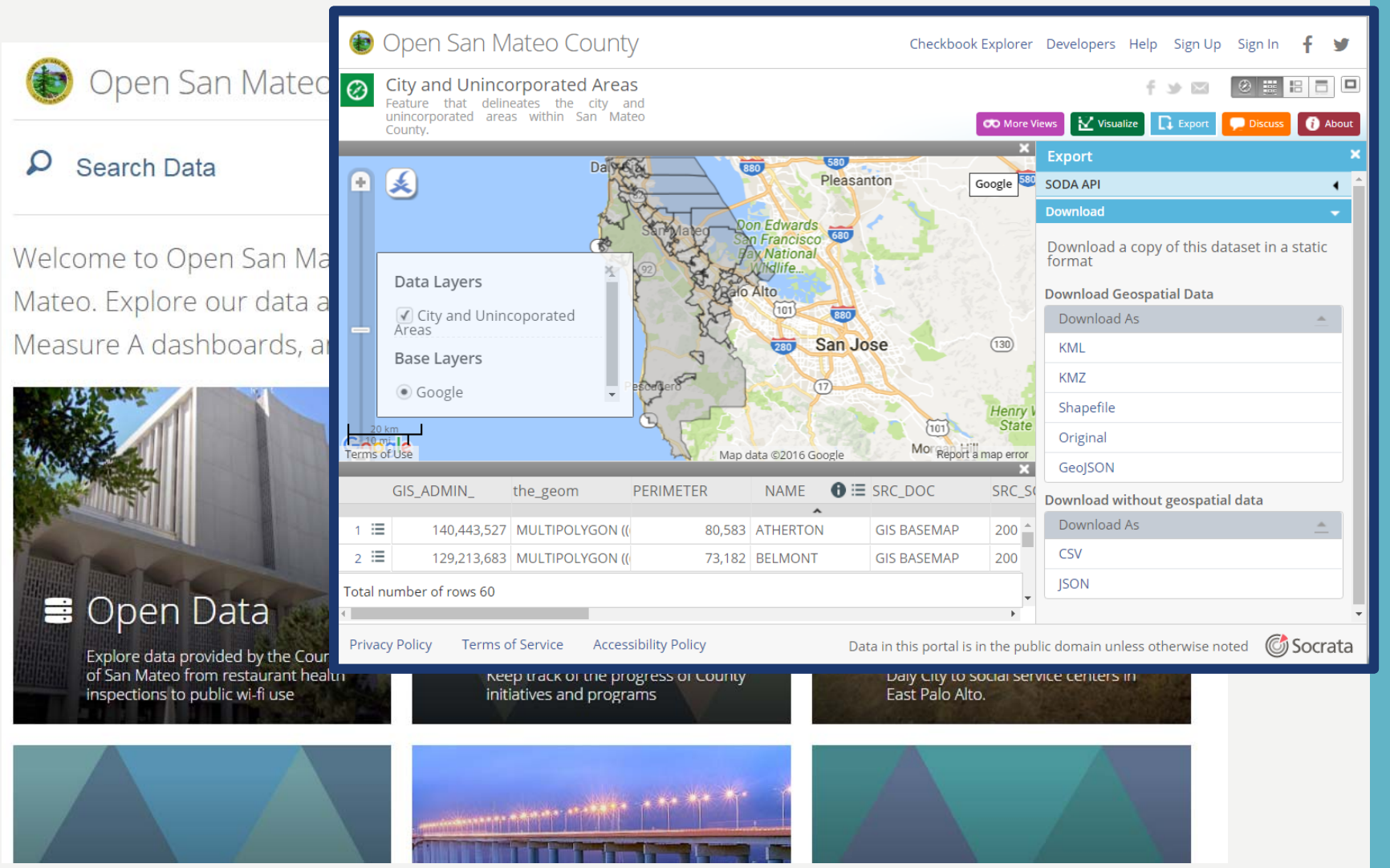
- Local groundwater is critical to ensuring a reliable emergency and supplemental water supply

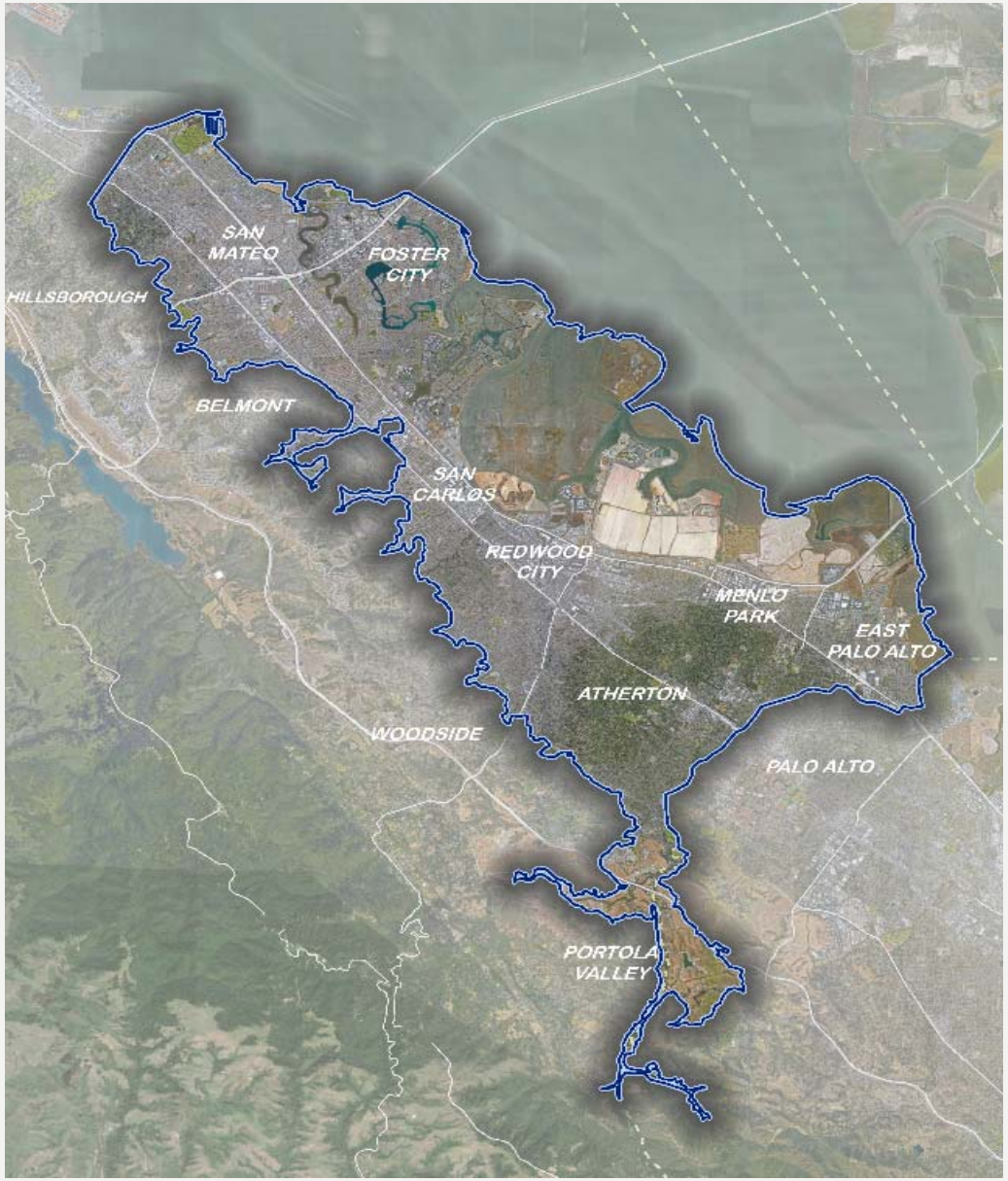
ON-GOING STAKEHOLDER OUTREACH

- Small group and one-on-one meetings
- Presentations to organizations and governing bodies
- Stakeholder workshops
- Website: http://green.smcgov.org/san-mateo-plain
- Open Data Portal



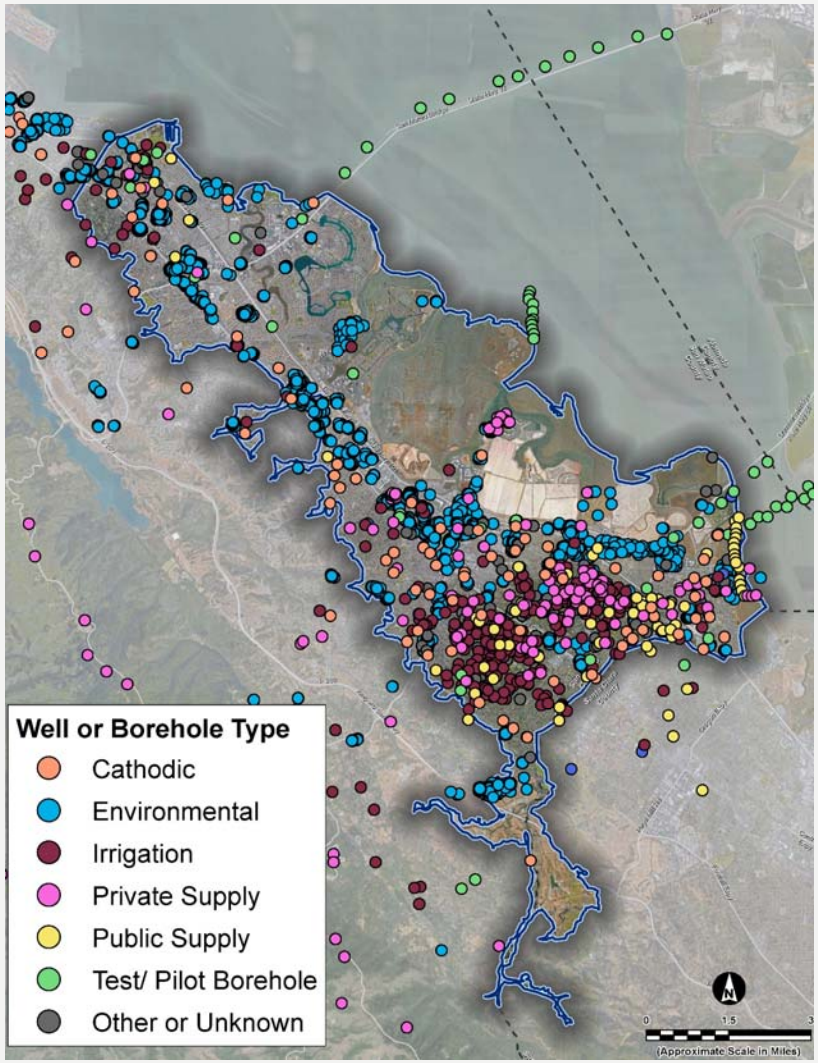
“OPEN SAN MATEO COUNTY” DATA PORTAL





DATA COMPILATION & REVIEW

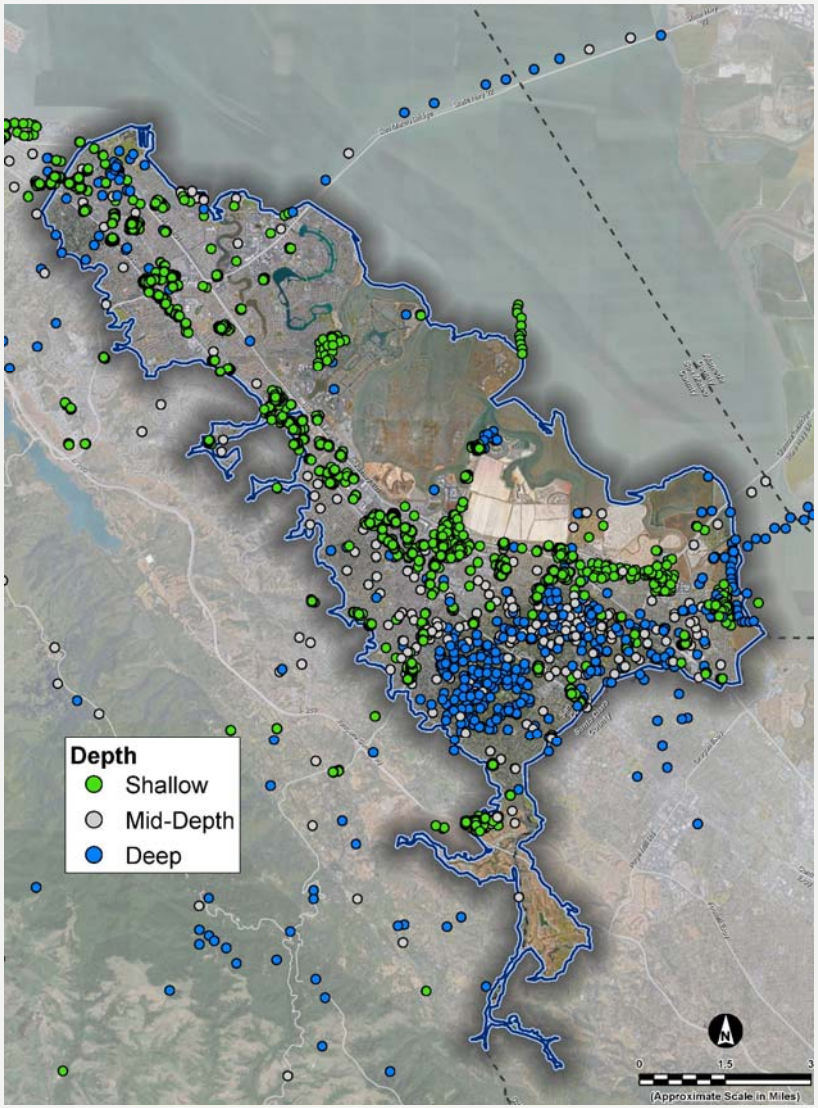
PROJECT DATABASE



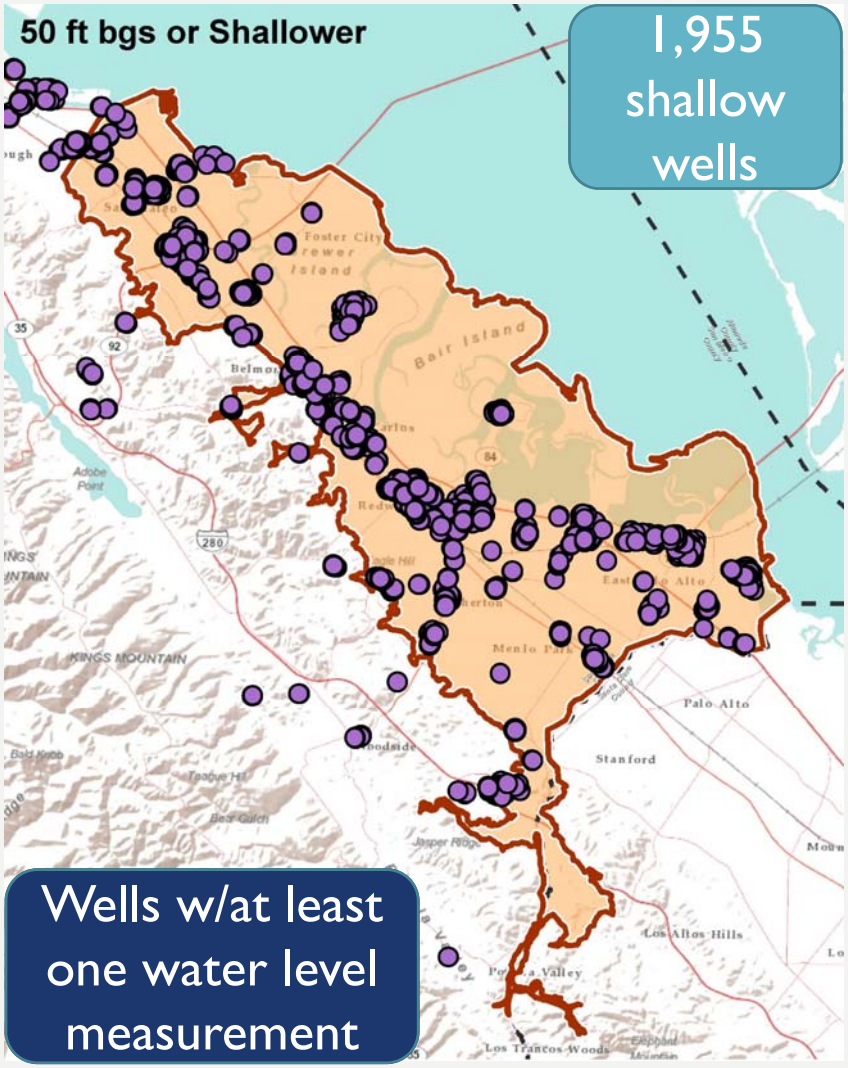
- Relational database in Microsoft Access
- ArcGIS geodatabase
- Information from ~3,000 wells and boreholes
- Data collected through 15 July 2016
- Data and GIS files will be publicly available

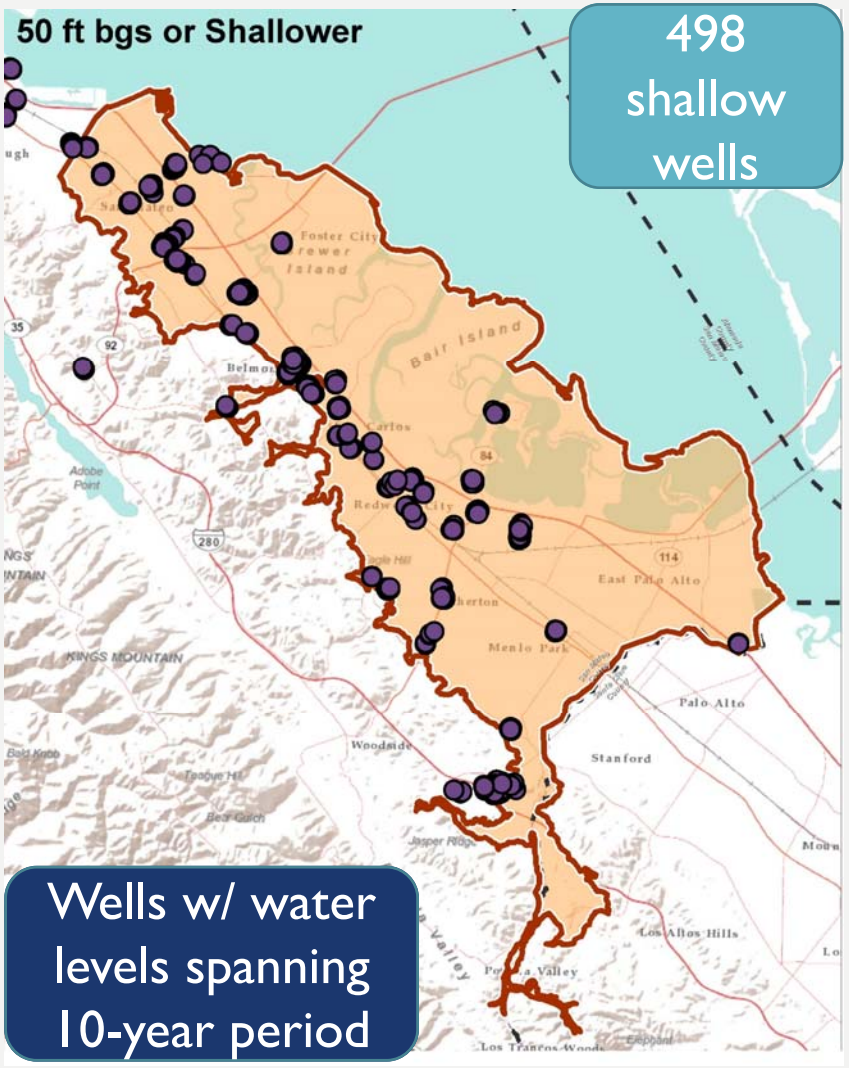
DATA WERE STRATIFIED BASED ON DEPTH

- Shallow wells (≤ 50 ft bgs) typically associated with remediation sites
- Deep wells (≥150 ft bgs) typically investigation or production wells

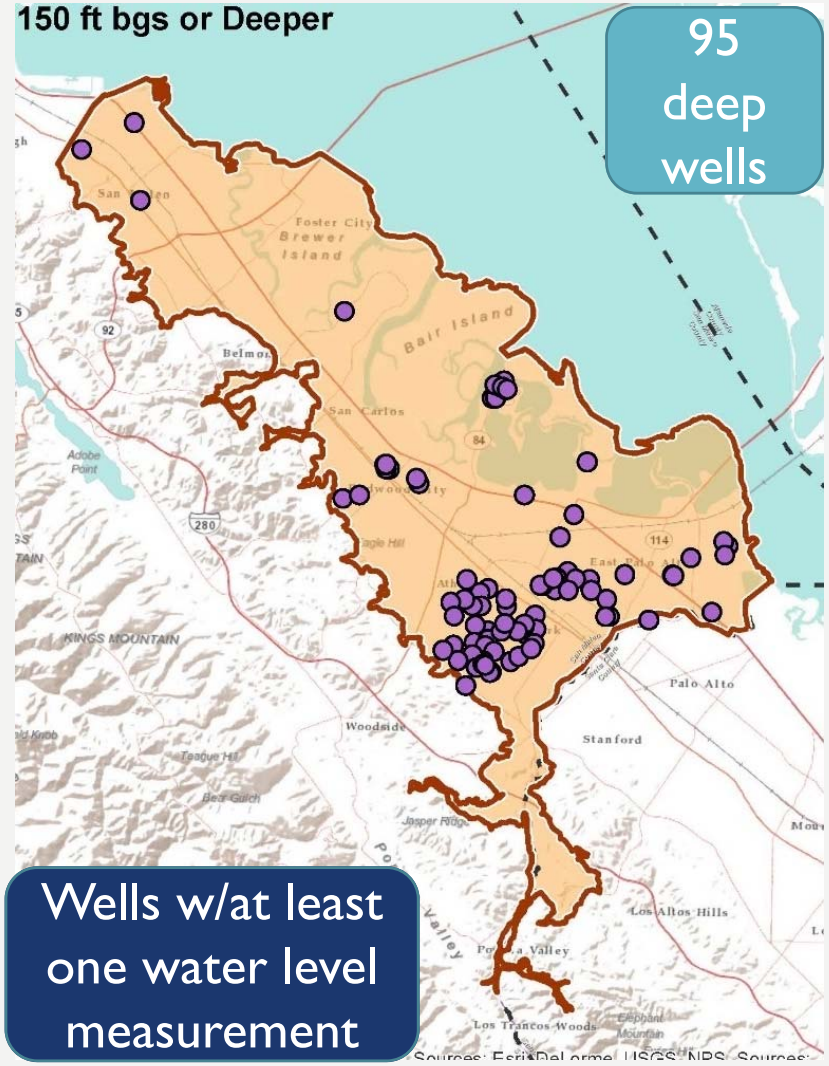


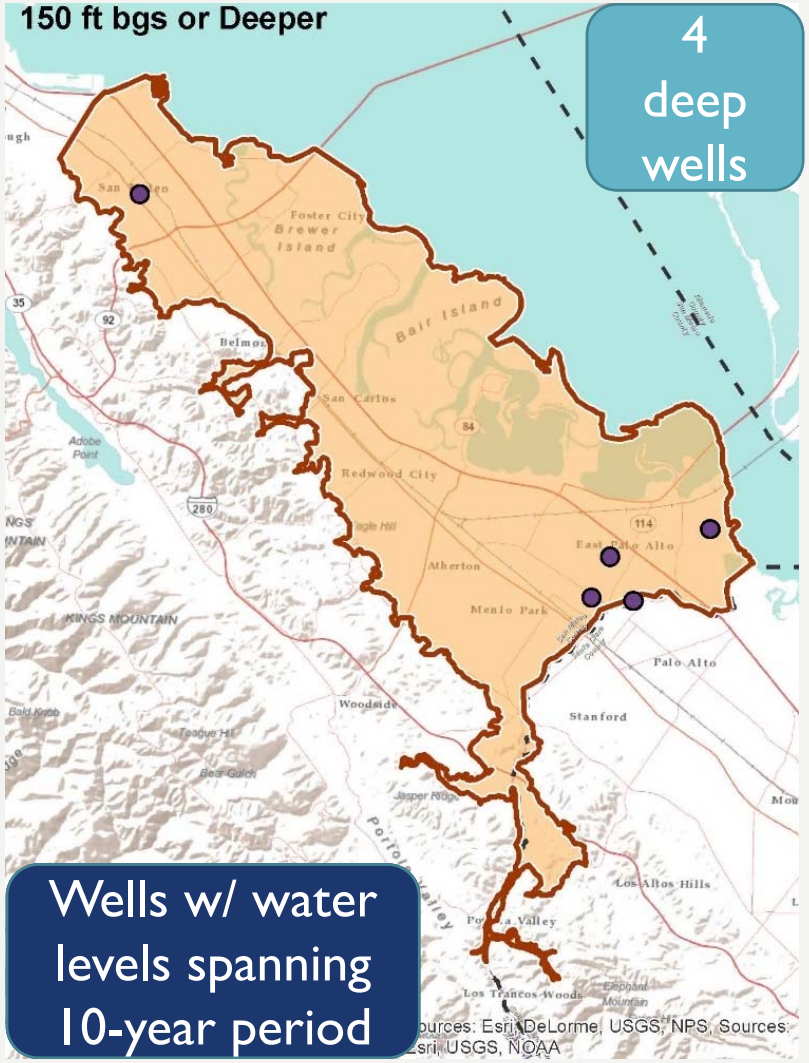
SHALLOW WELLS WITH WATER LEVEL MEASUREMENTS





DEEP WELLS WITH WATER LEVEL MEASUREMENTS





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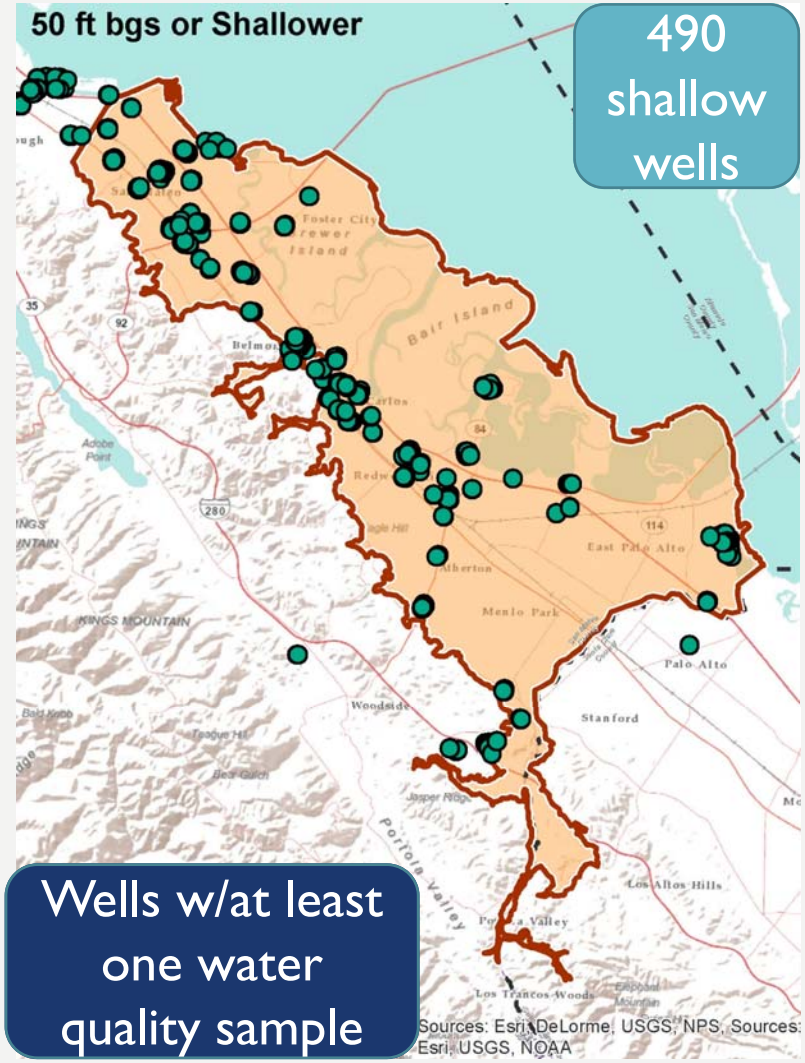
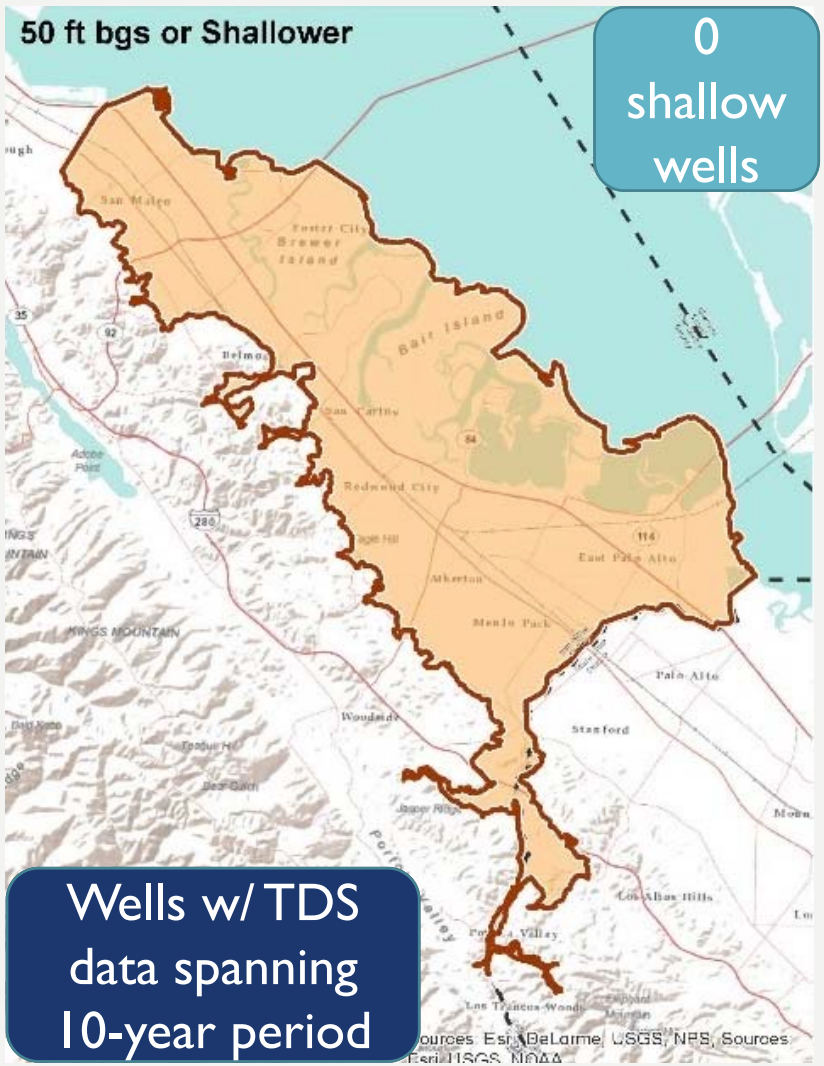
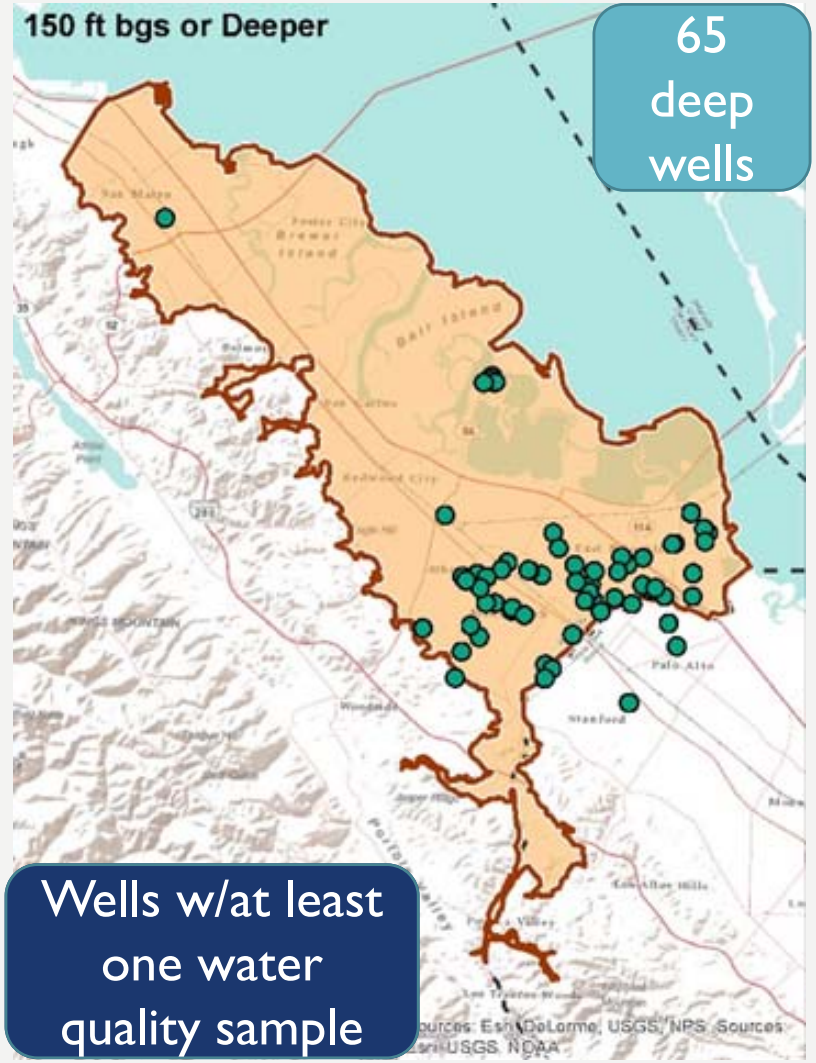
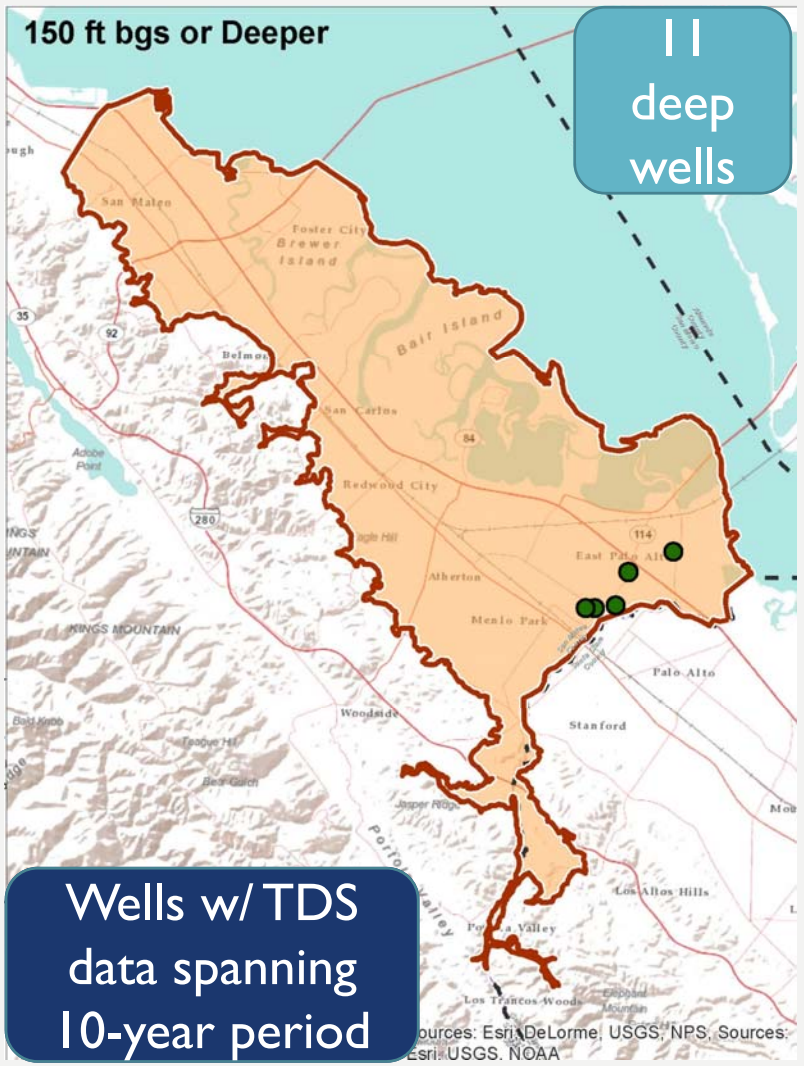
SHALLOW WELLS WITH WATER QUALITY DATA





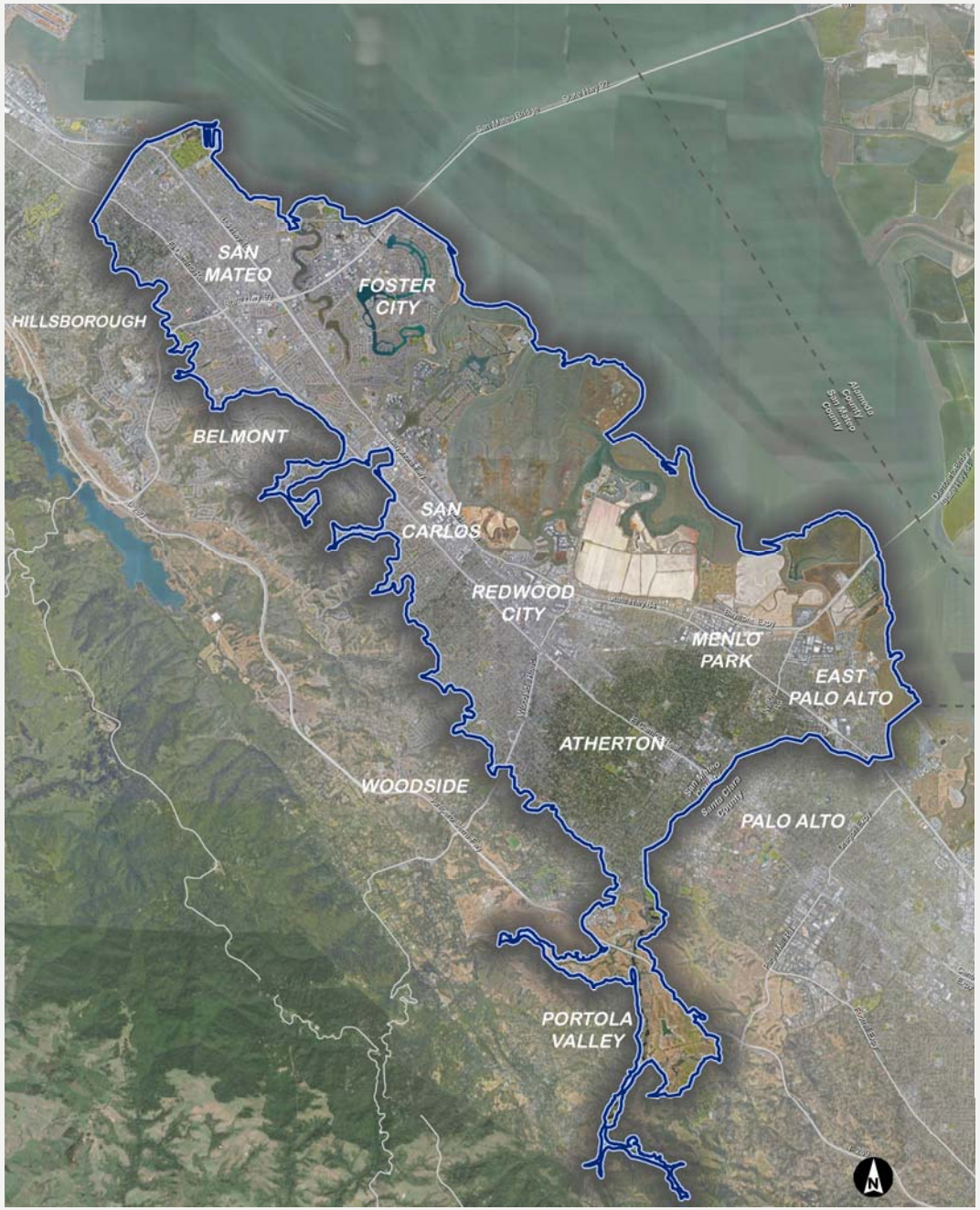
DEEP WELLS WITH WATER QUALITY DATA





DATA COMPILATION TAKE-AWAYS

- Reasonable spatial distribution of data
- Very limited temporal distribution
- Lack of time series data limit our ability to assess the relationships between key drivers such as precipitation, pumping rates, water levels, and water quality data
- Efforts in Phase 2 will focus on establishing a robust monitoring network to begin to develop key time-series data



HYDRO-GEOLOGIC CONCEPTUAL MODEL

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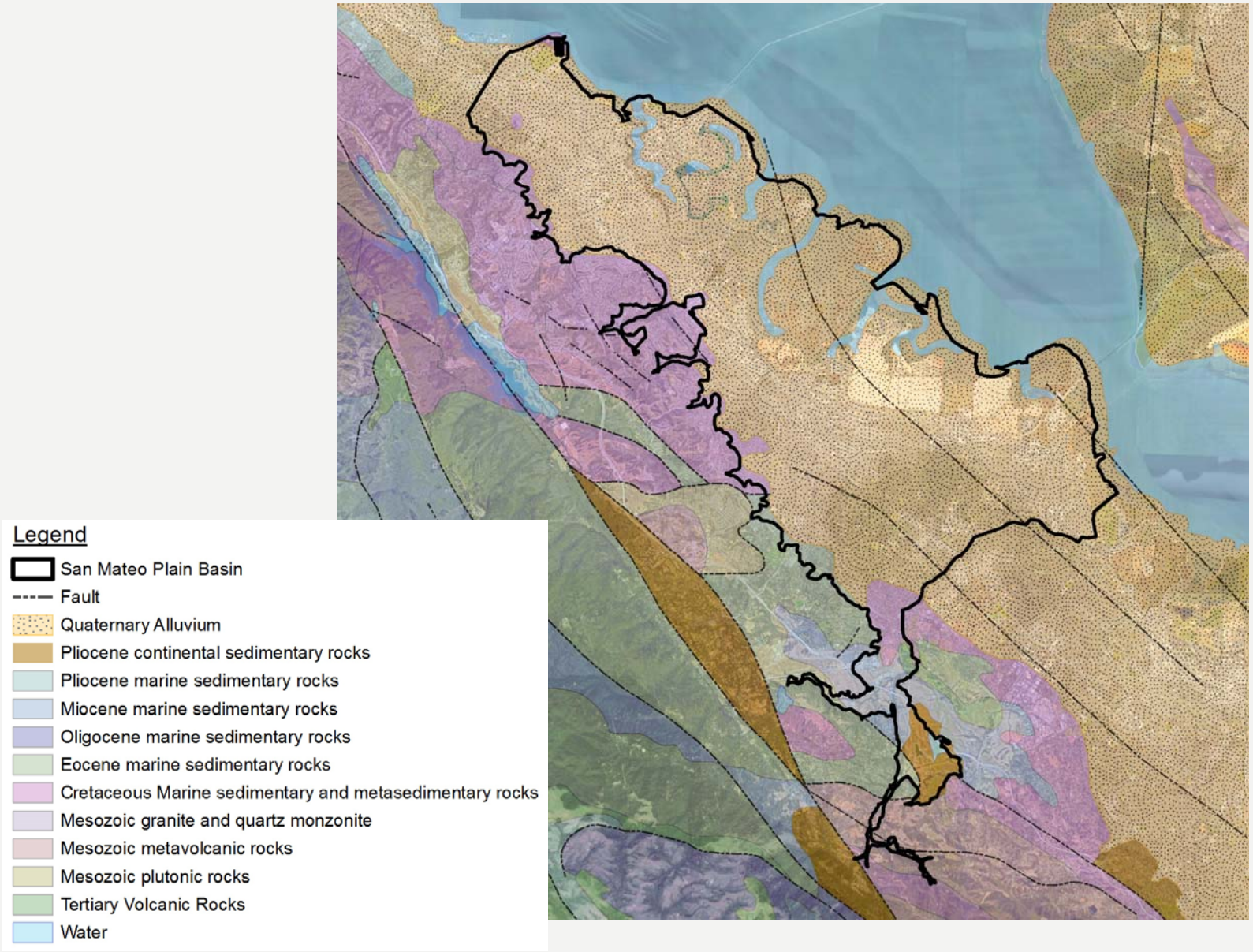
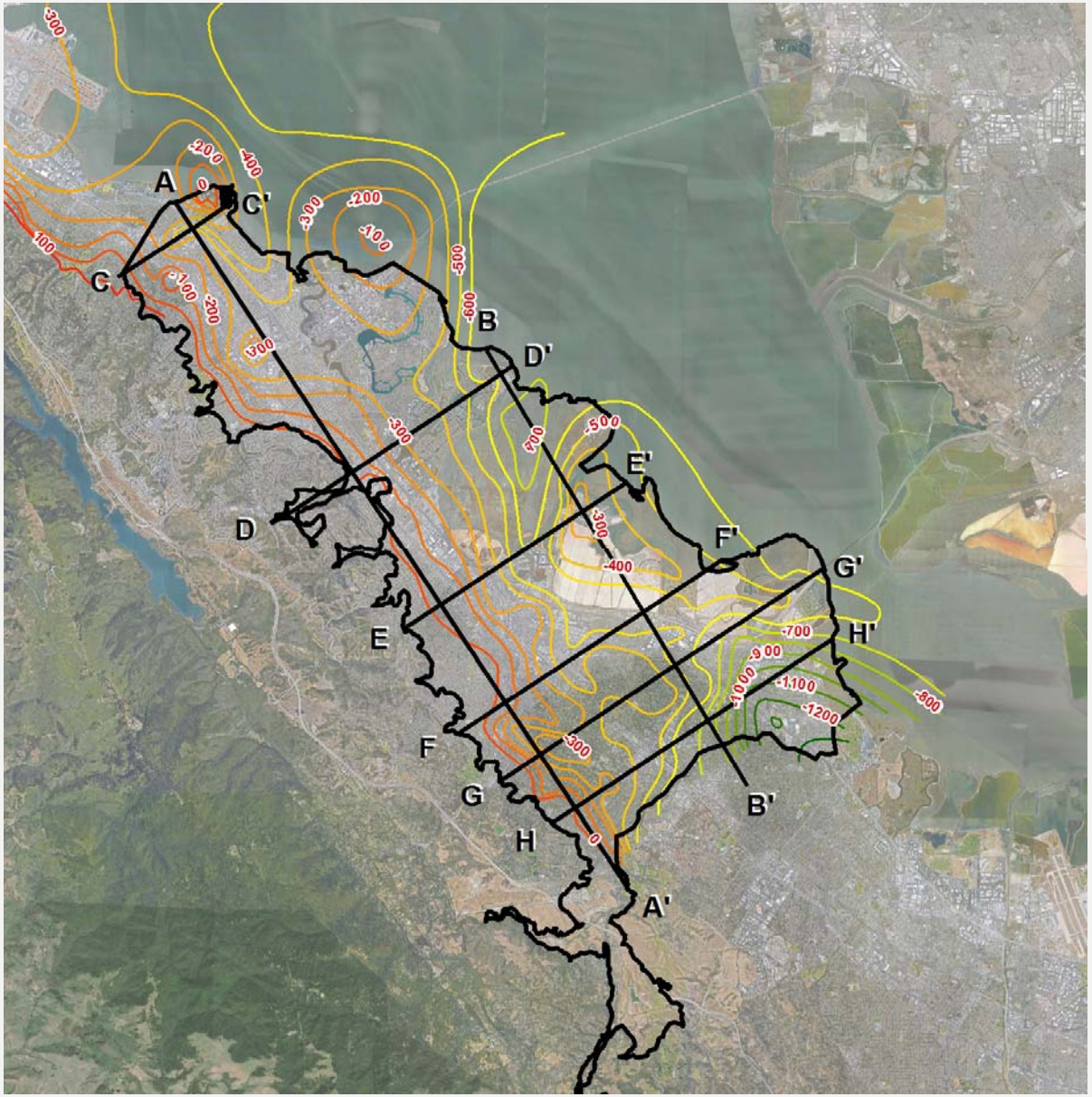
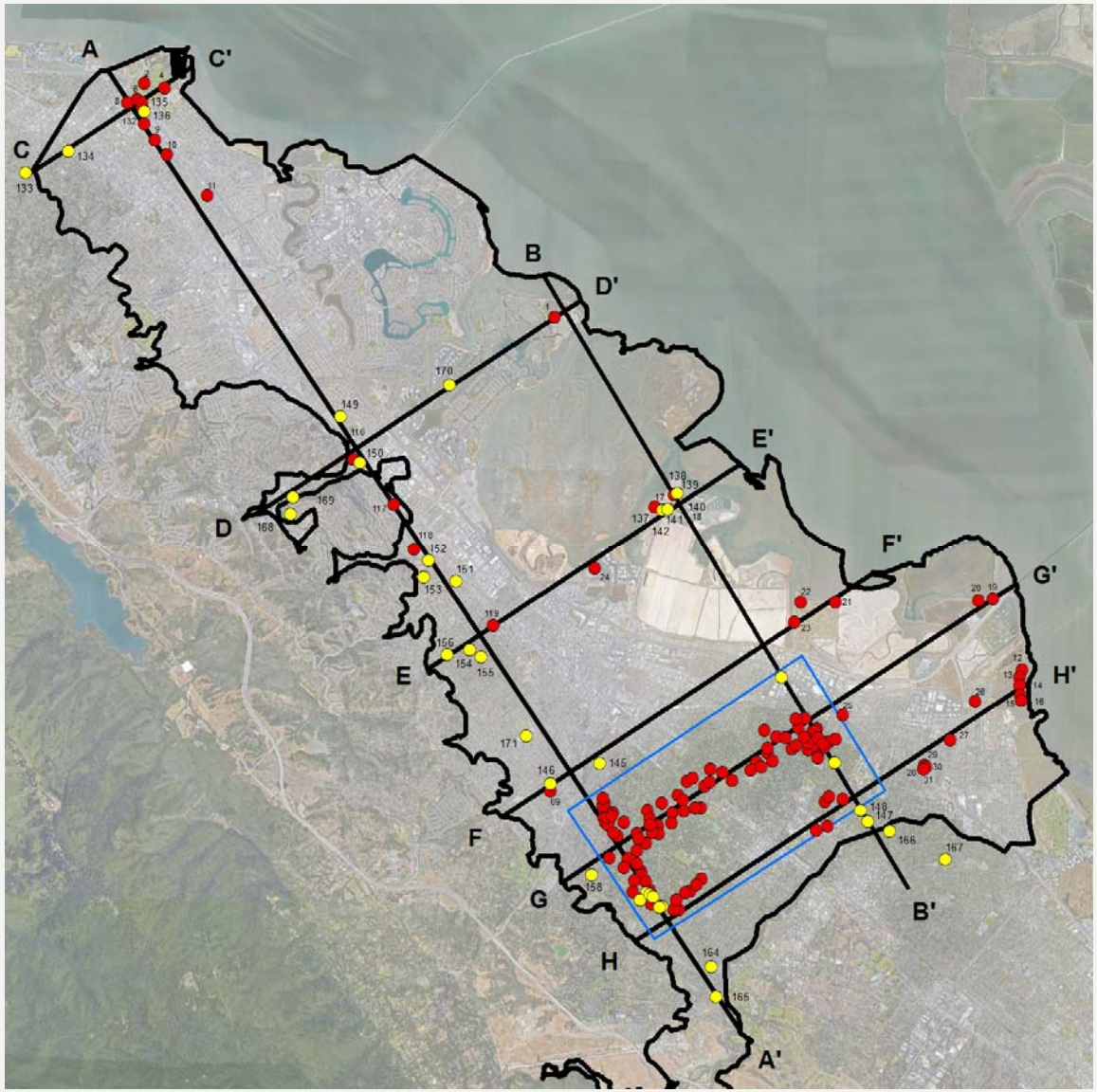
GEOLOGIC MAP



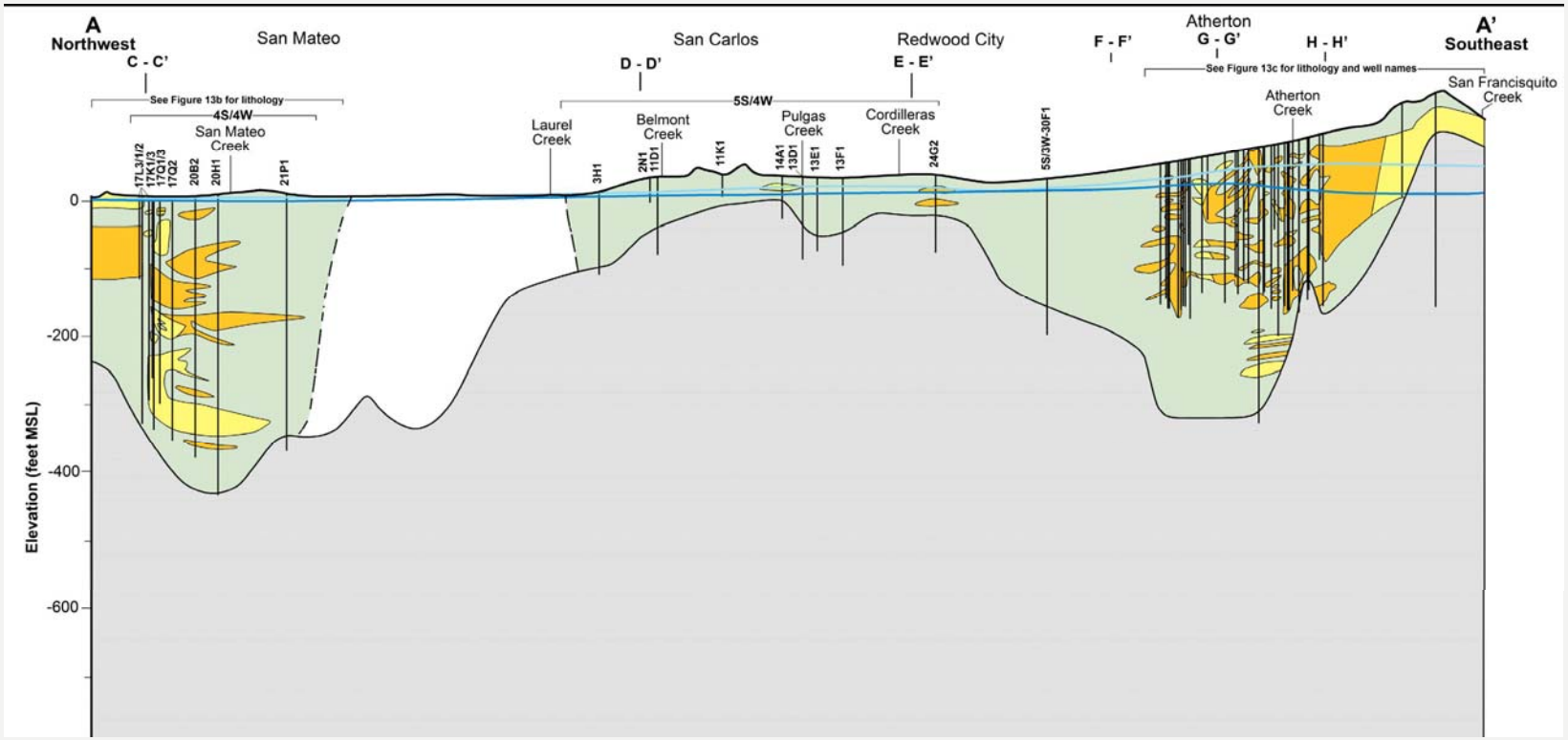
BEDROCK ELEVATION MAP



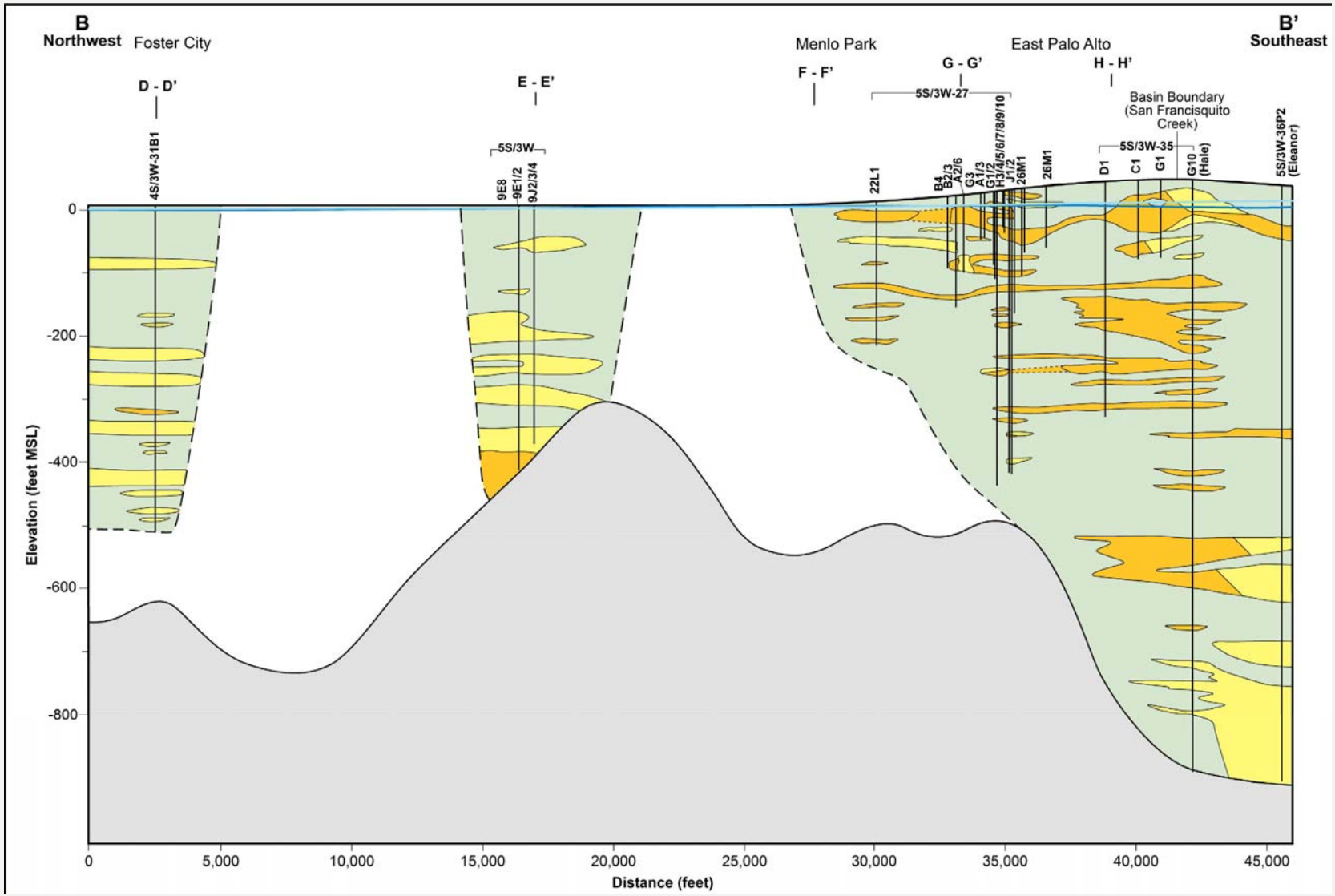
CROSS SECTION TRANSECTS



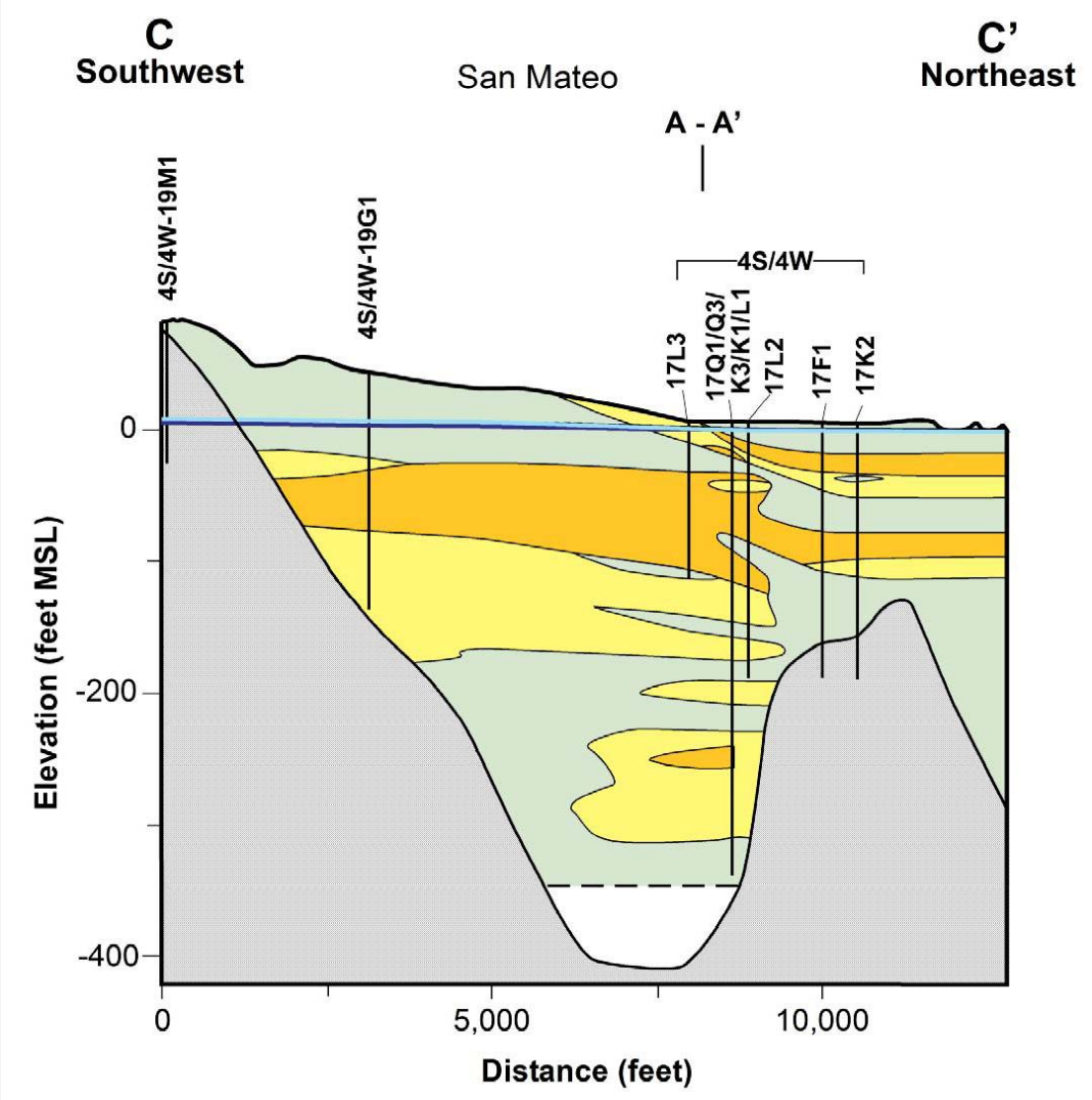
CROSS SECTION A-A’



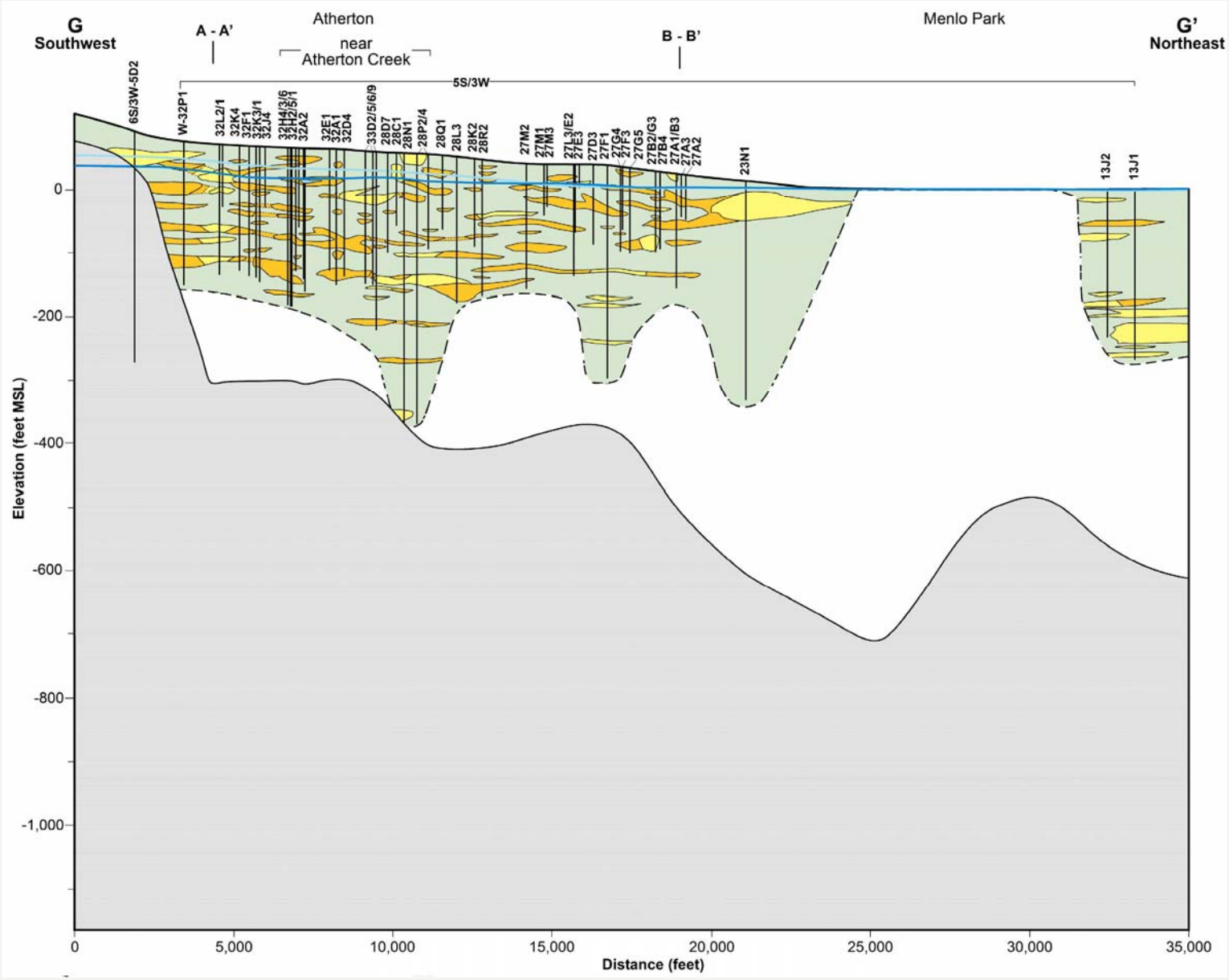
CROSS SECTION B-B’



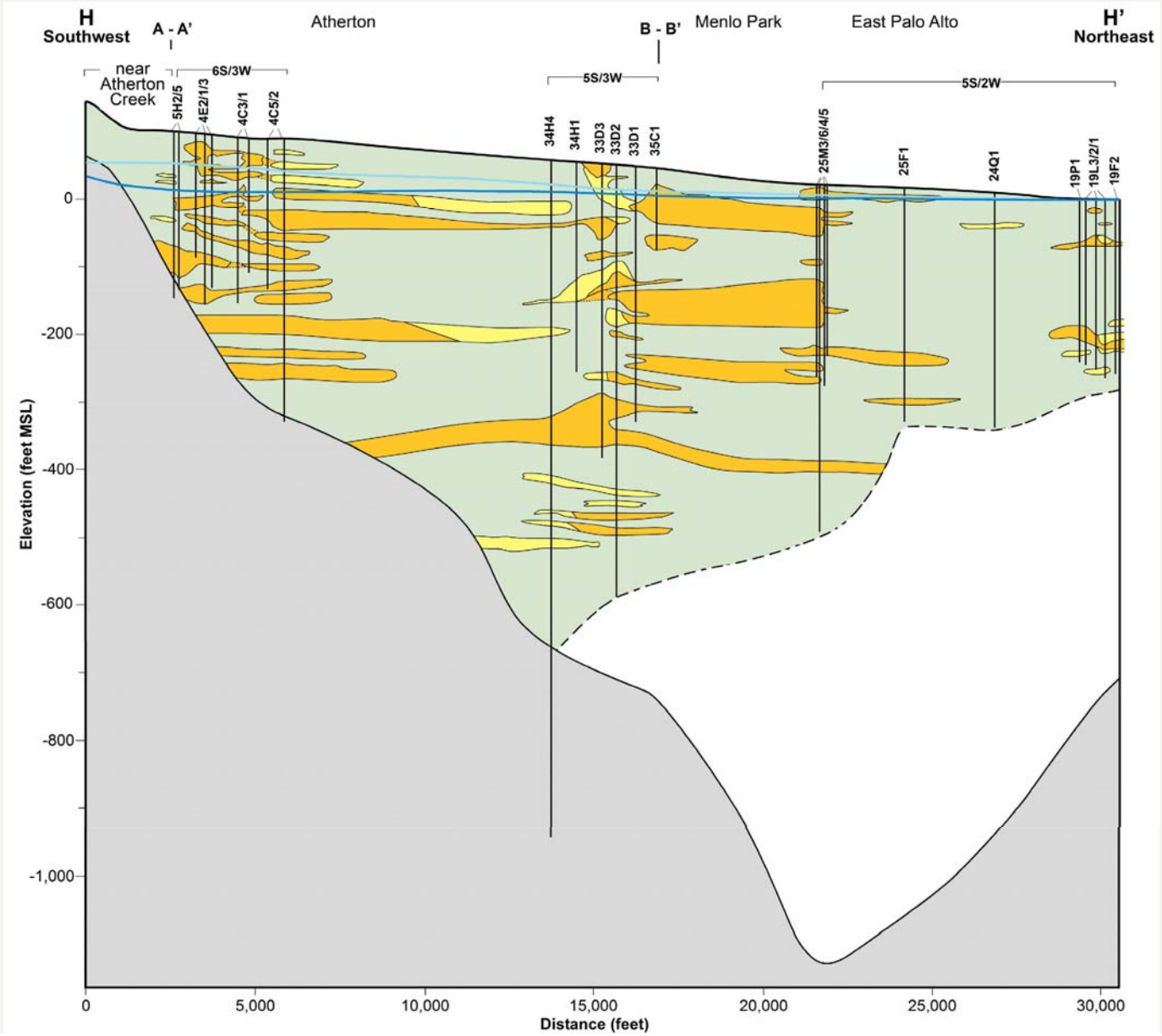
CROSS SECTION C-C’



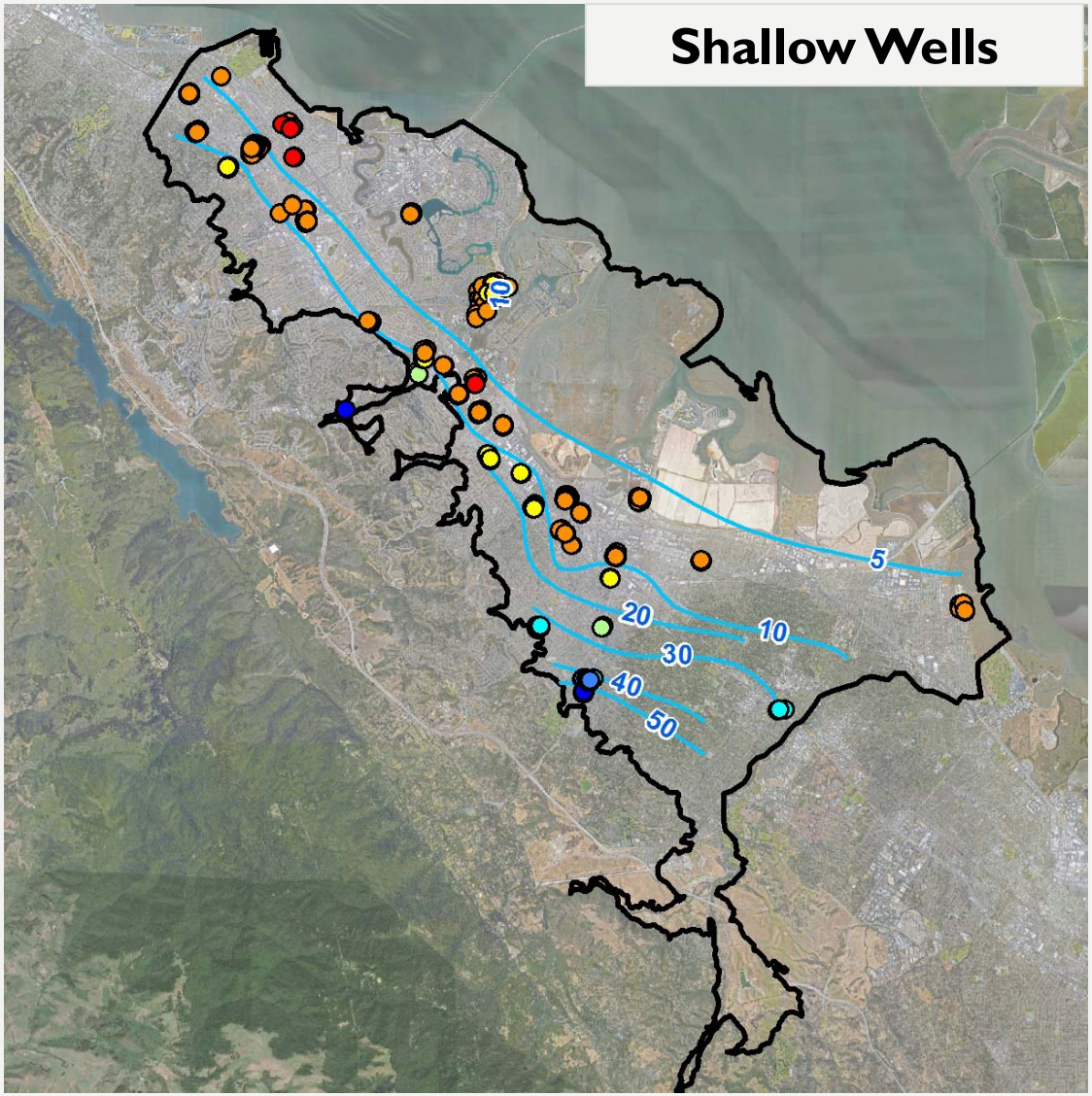
CROSS SECTION G-G’



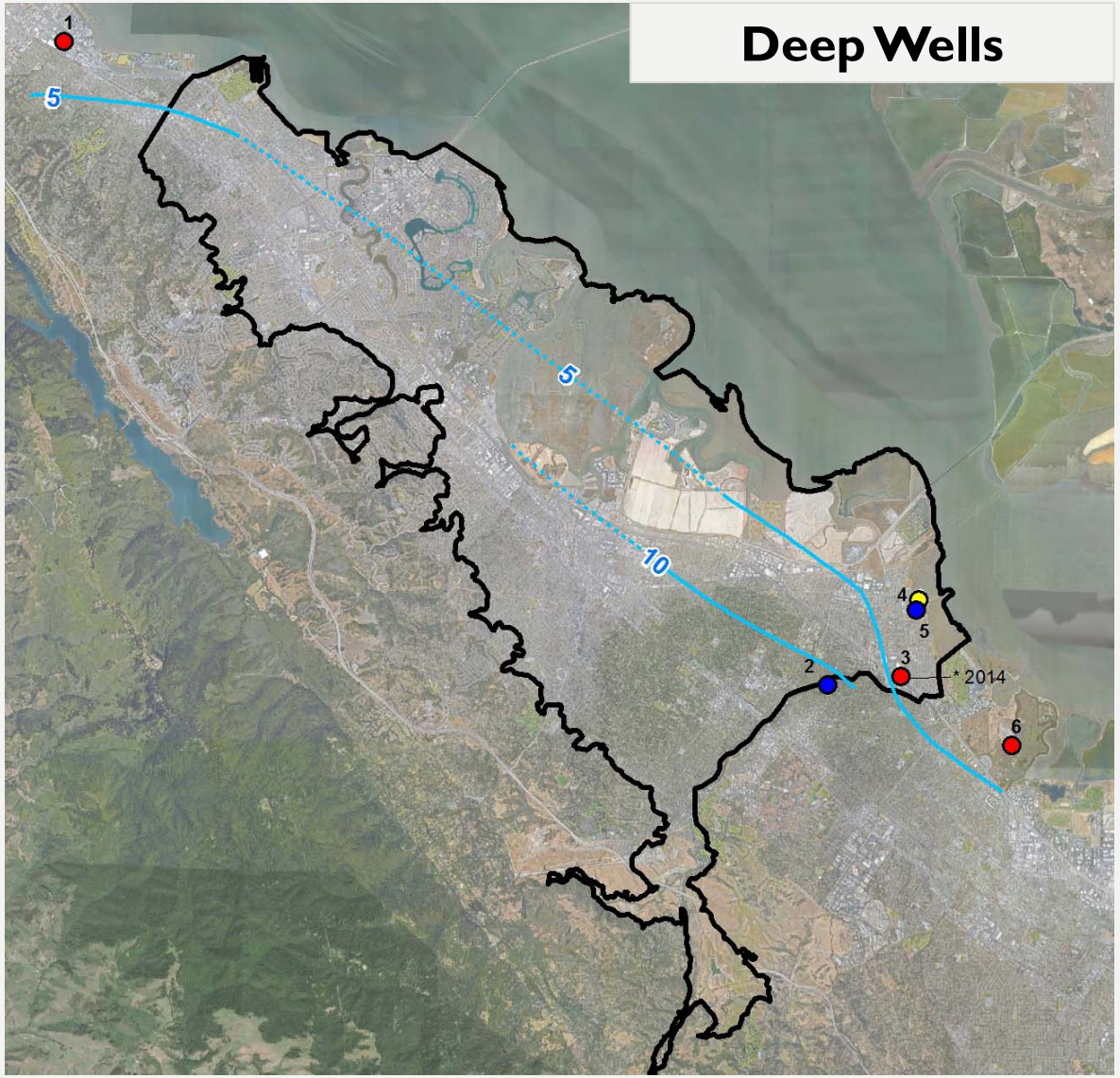
CROSS SECTION H-H’



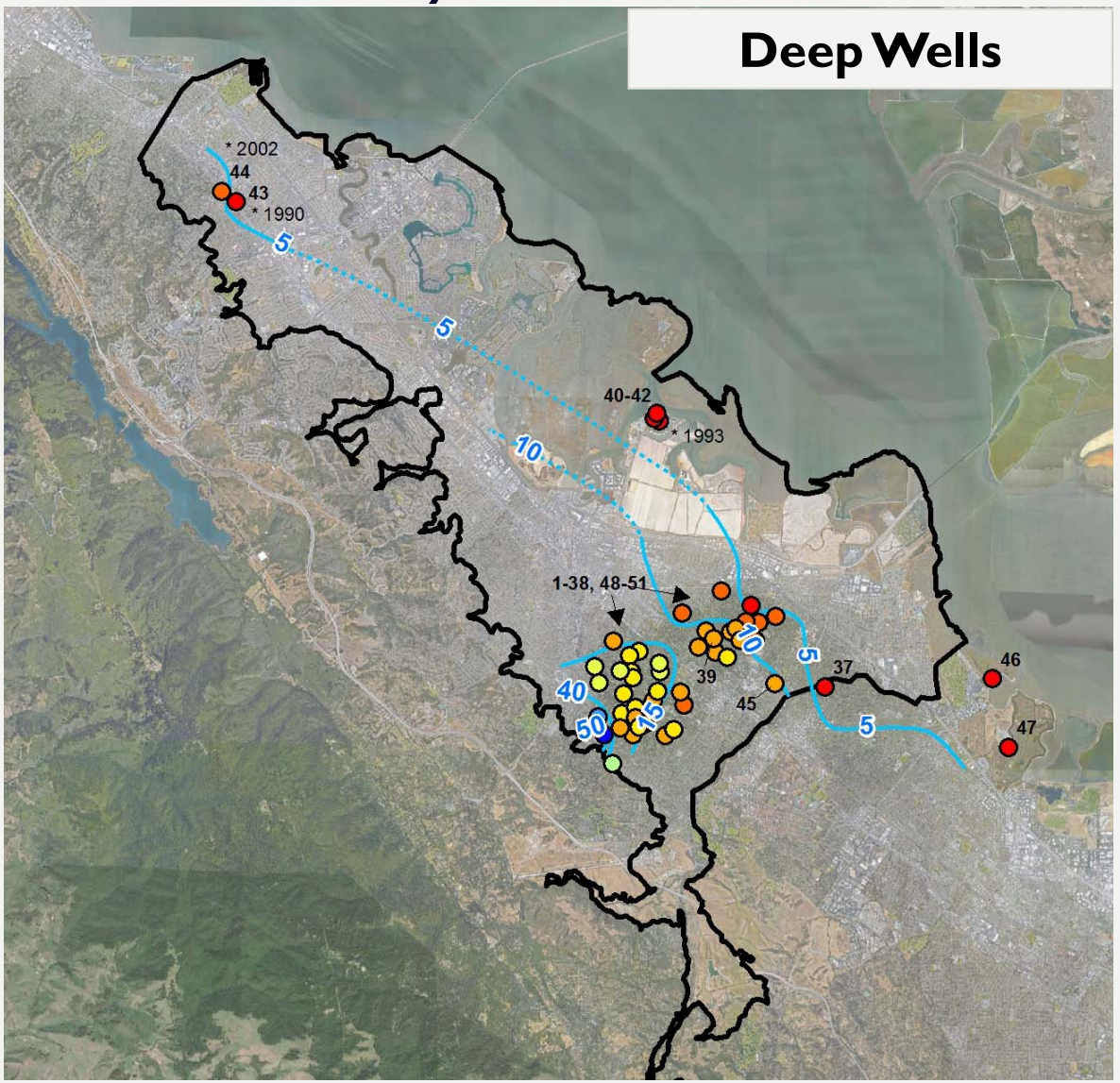
GROUNDWATER ELEVATION CONTOUR MAP, 2010



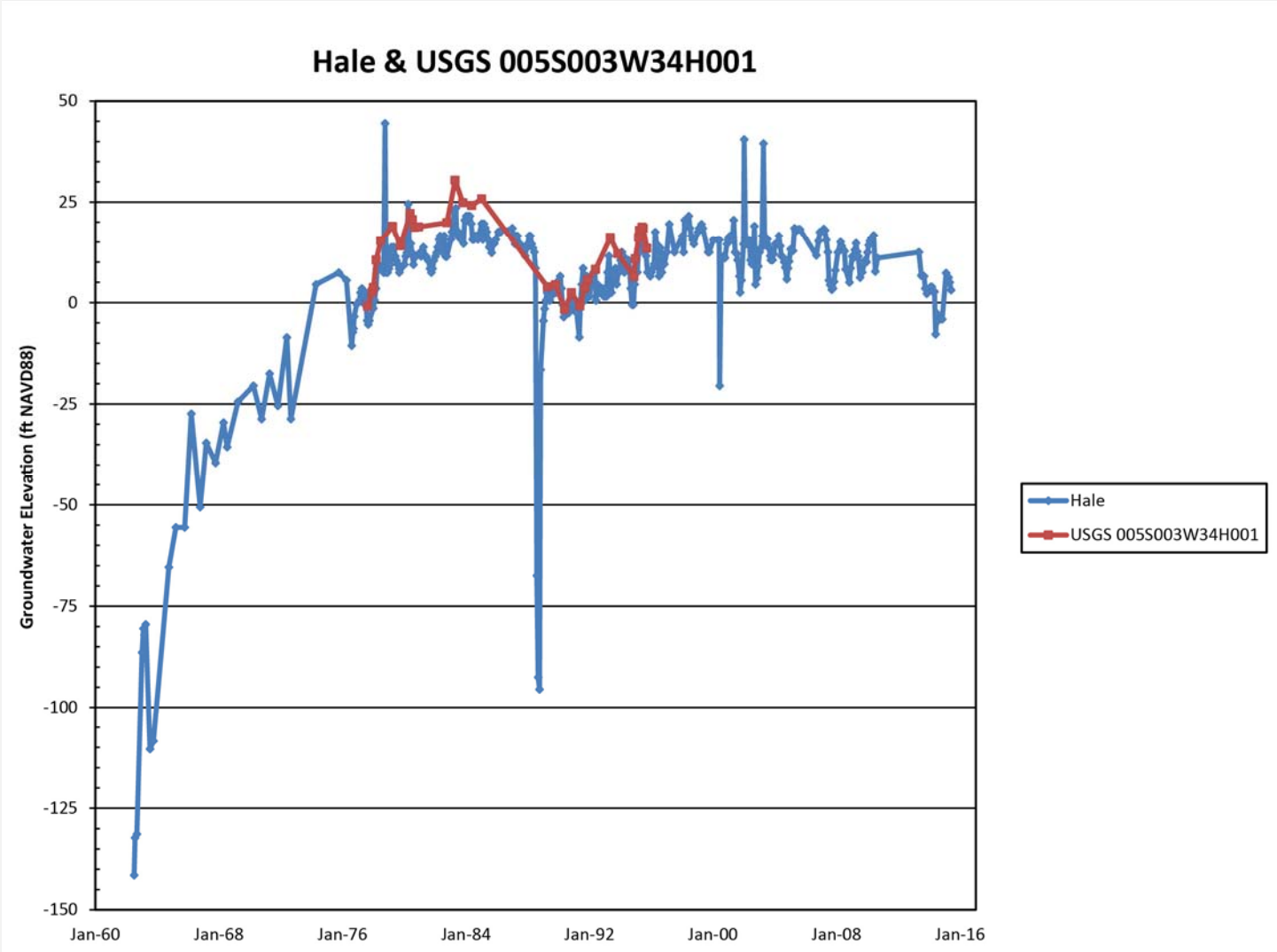
GROUNDWATER ELEVATION CONTOUR MAP, 2010



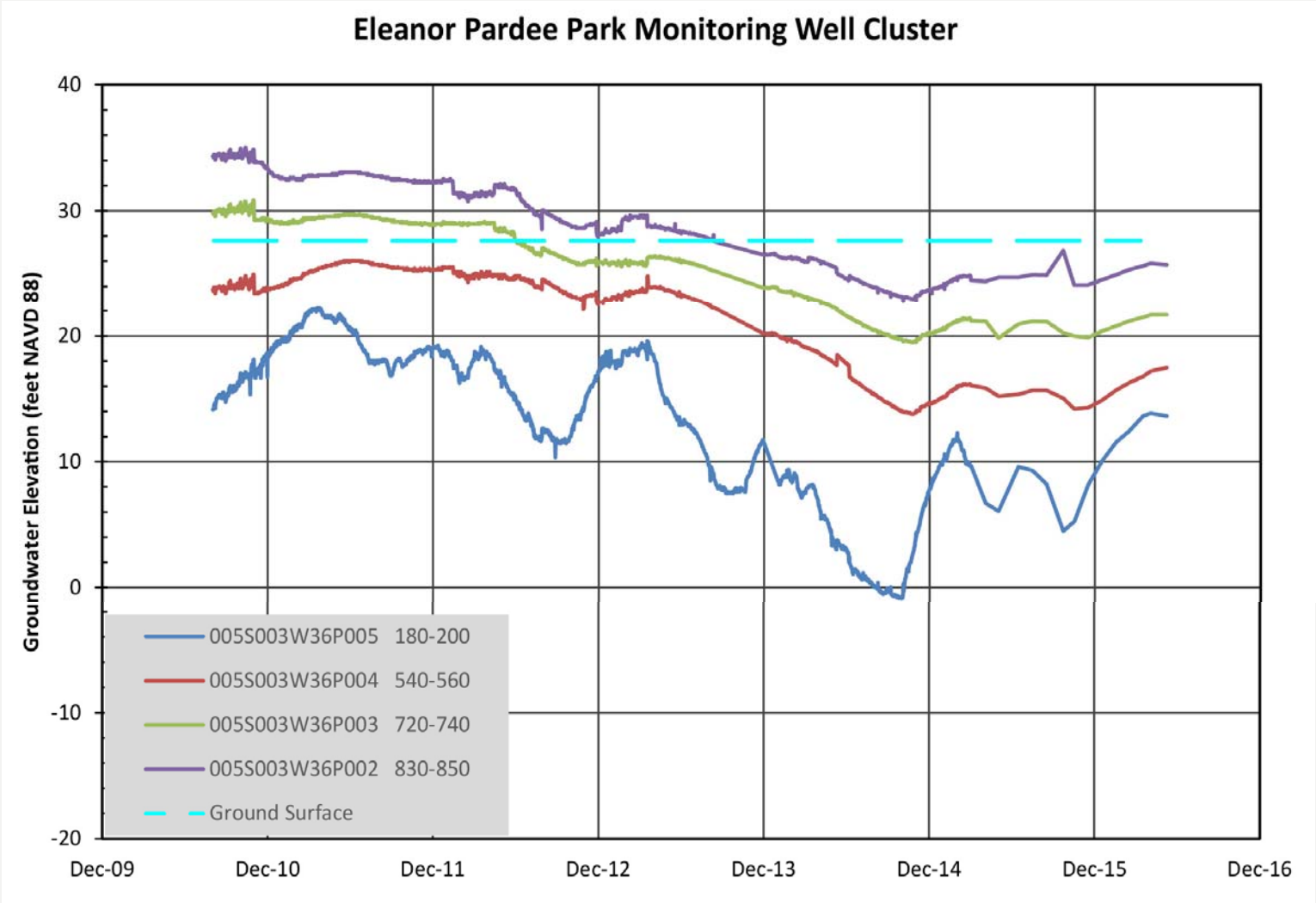
GROUNDWATER ELEVATION CONTOUR MAP, 1994



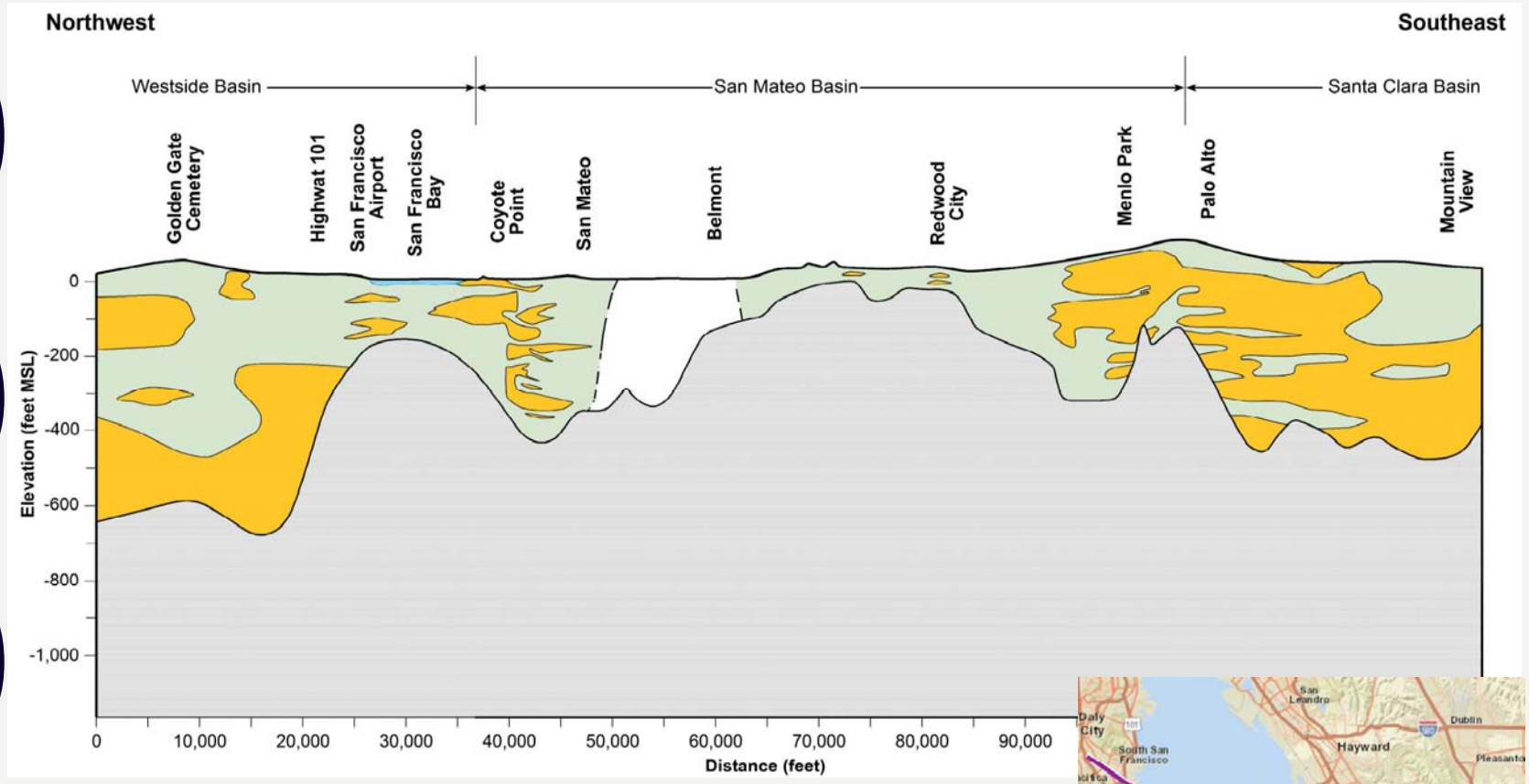
GROUNDWATER LEVEL HYDROGRAPHS, HALE AND 34H1

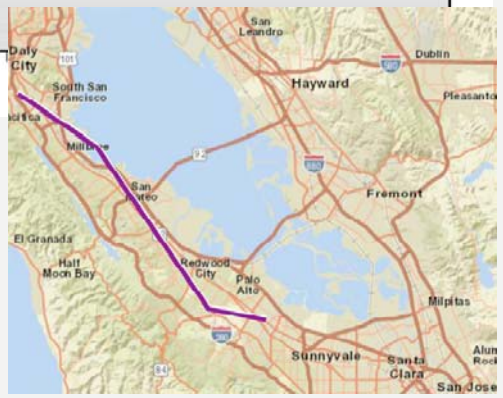


GROUNDWATER LEVEL HYDROGRAPHS, ELEANOR PARK

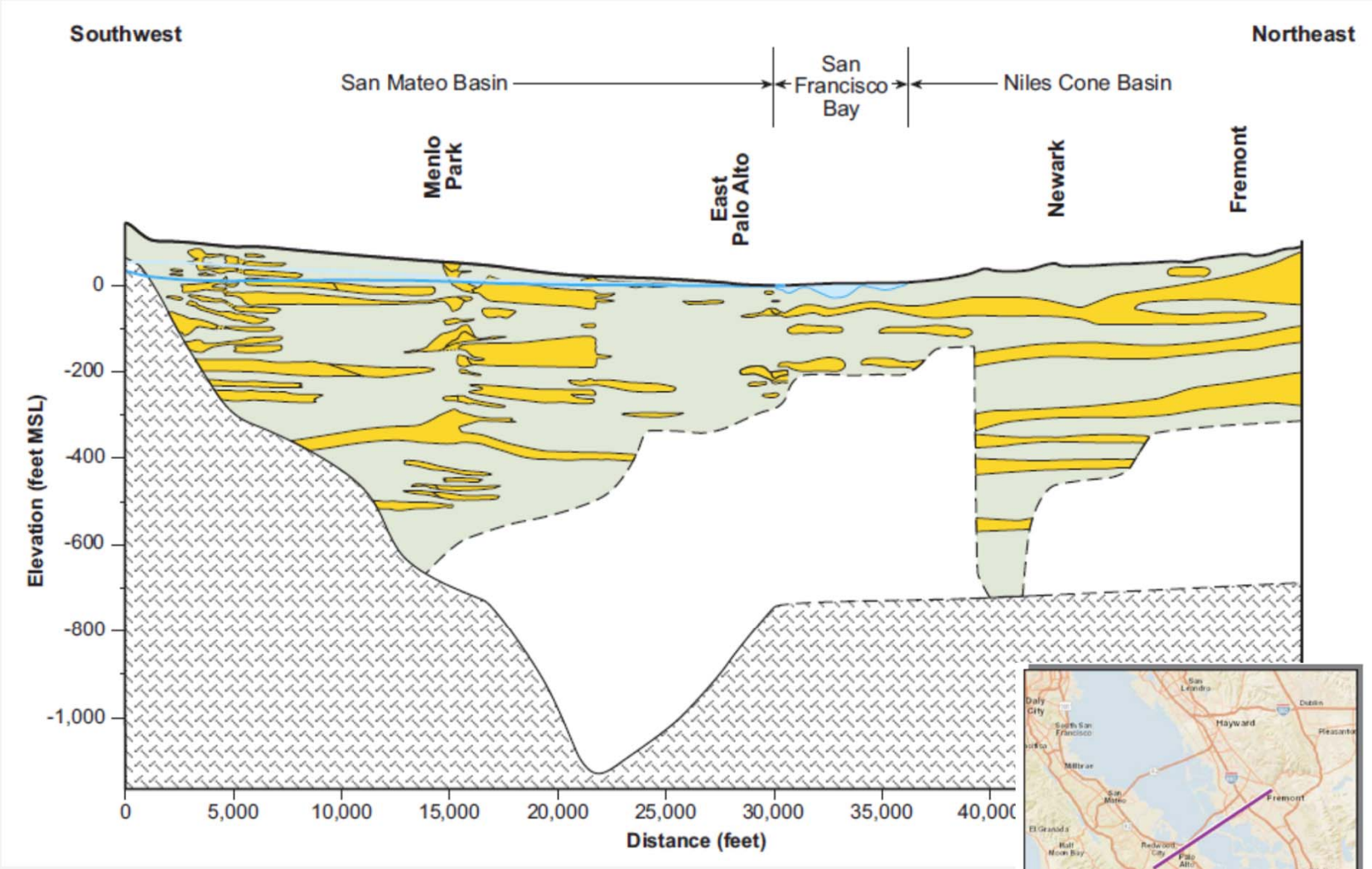


SCHEMATIC CROSS SECTION:
WESTSIDE, SAN MATEO AND SANTA CLARA BASINS





SCHEMATIC CROSS SECTION:
SAN MATEO TO NILES CONE BASINS



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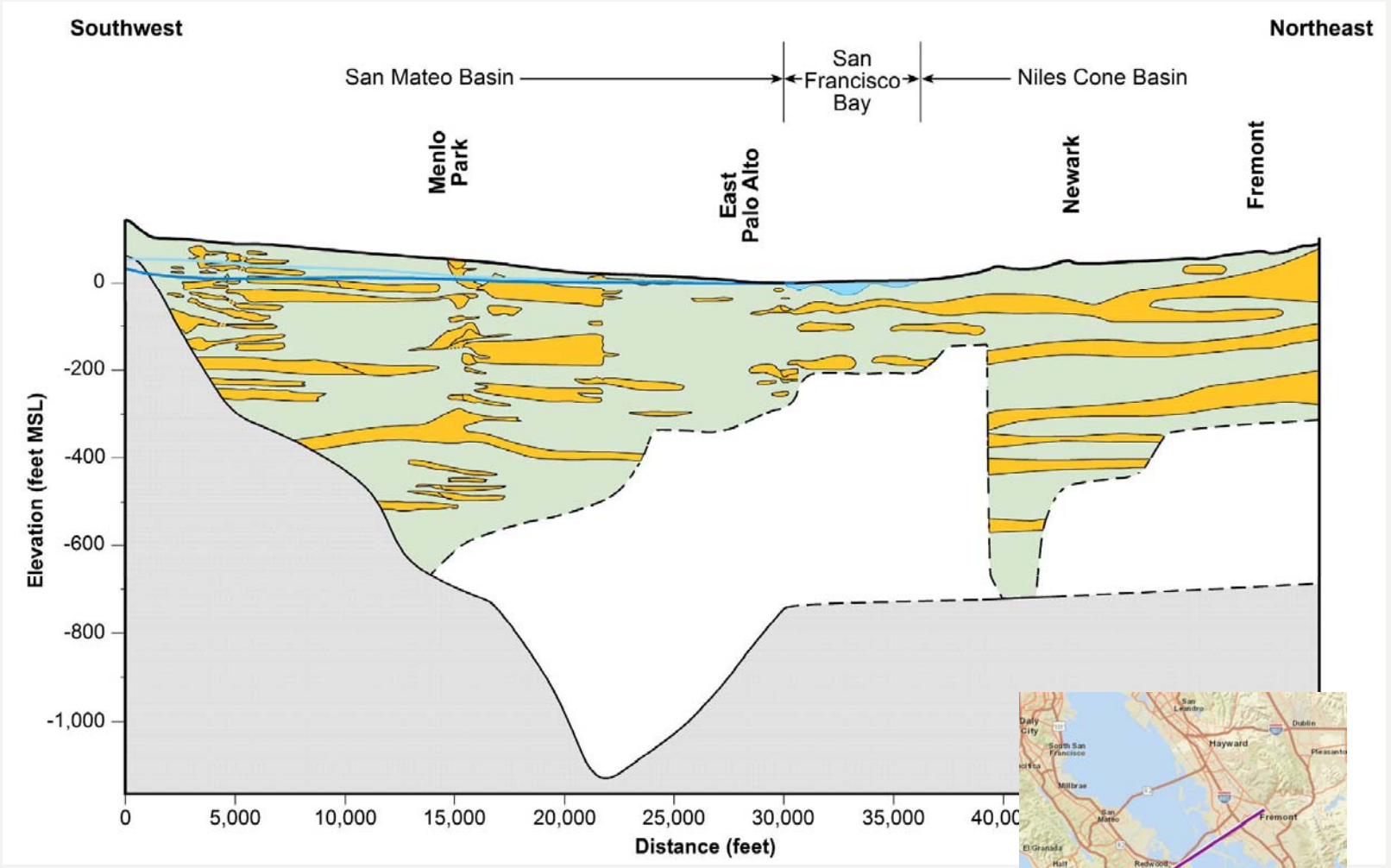

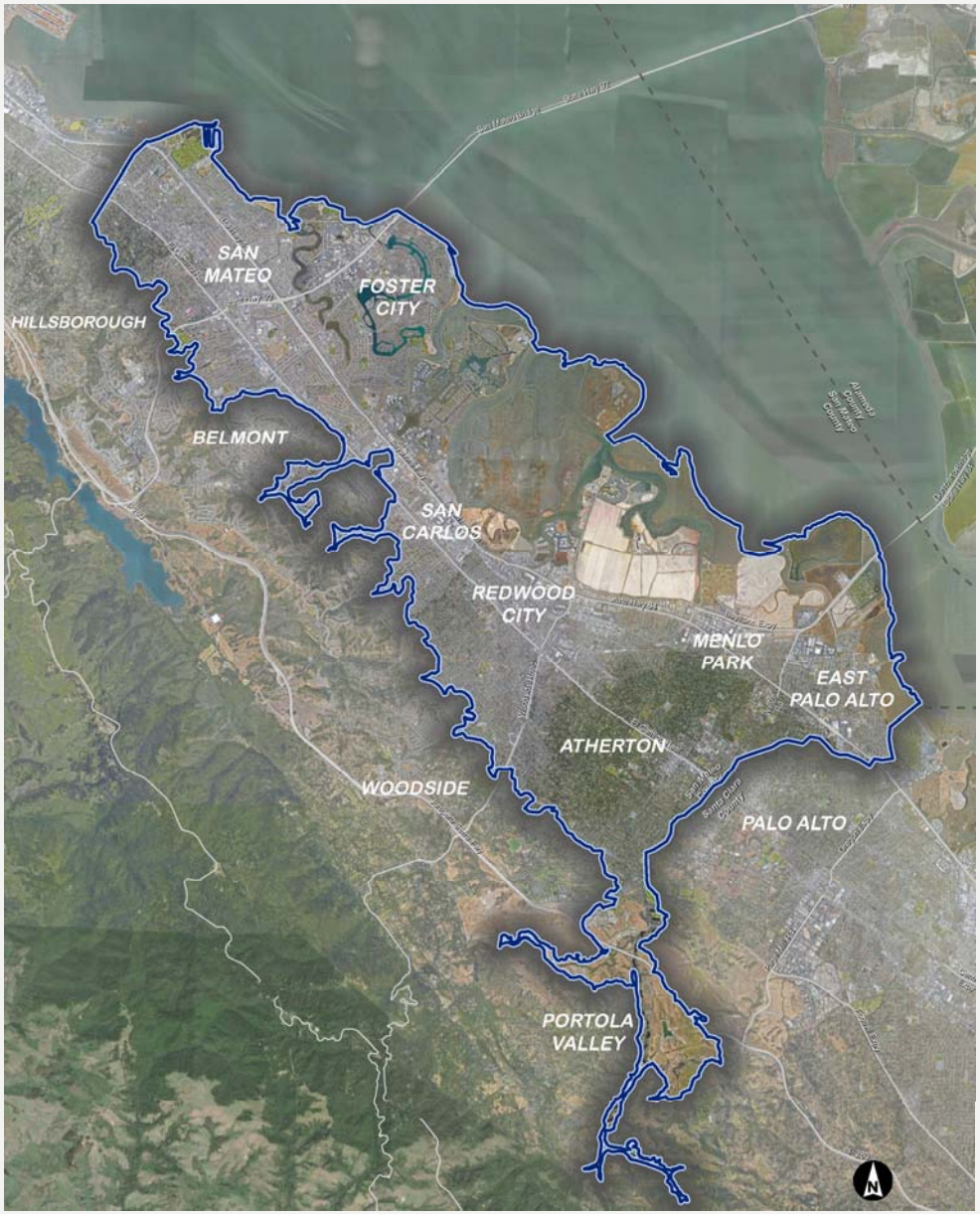

BASIN WATER BALANCE

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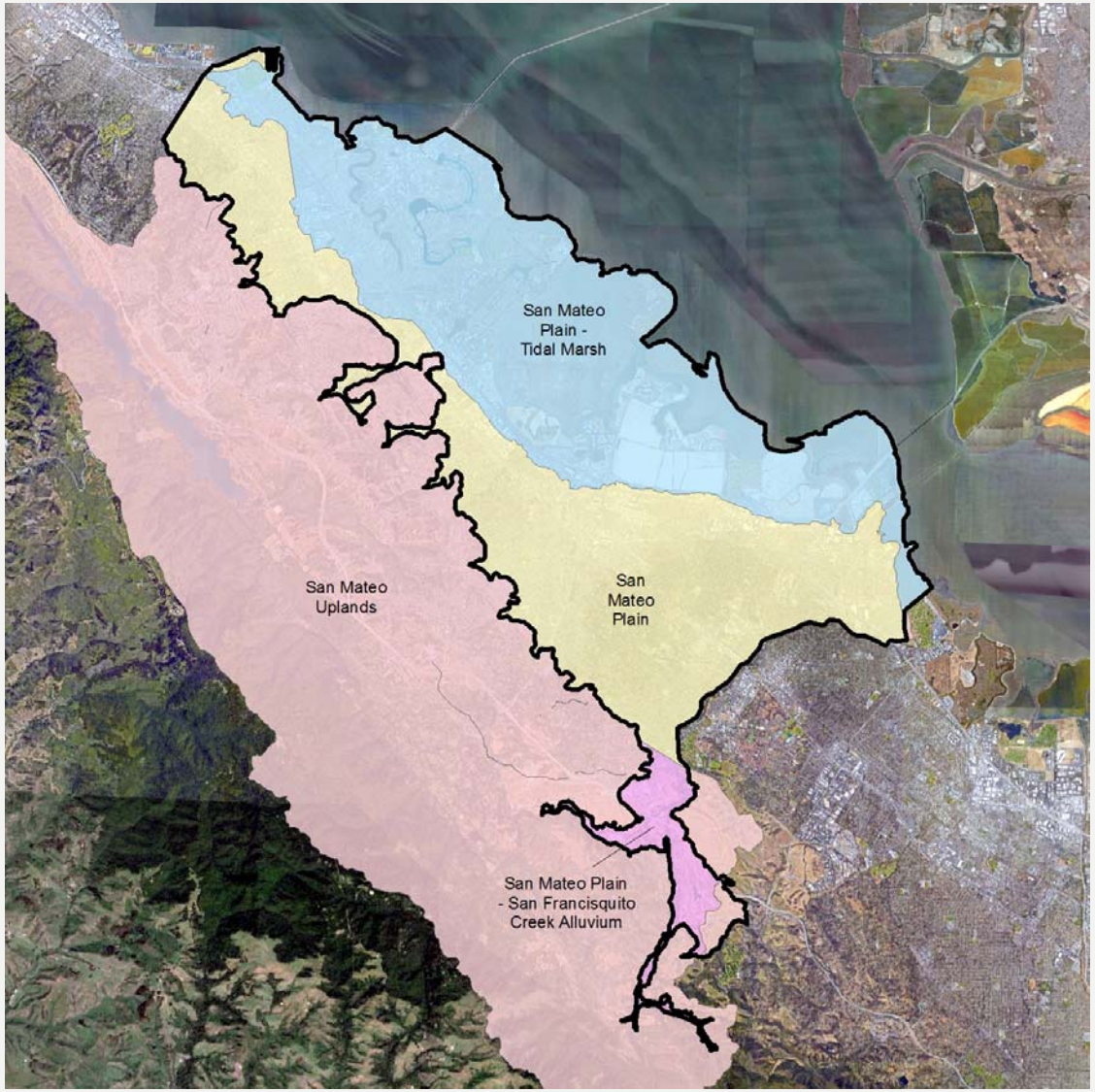
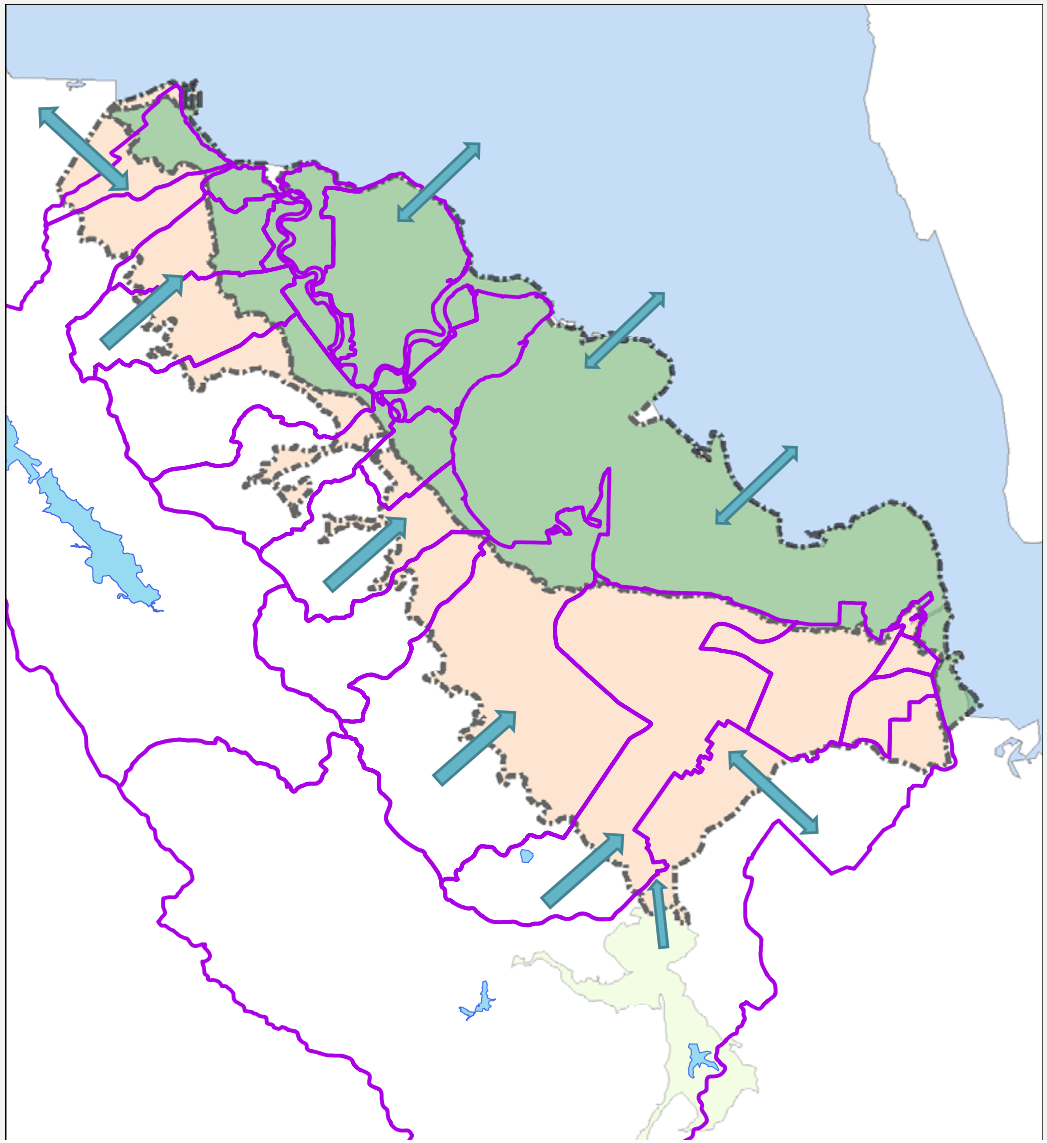
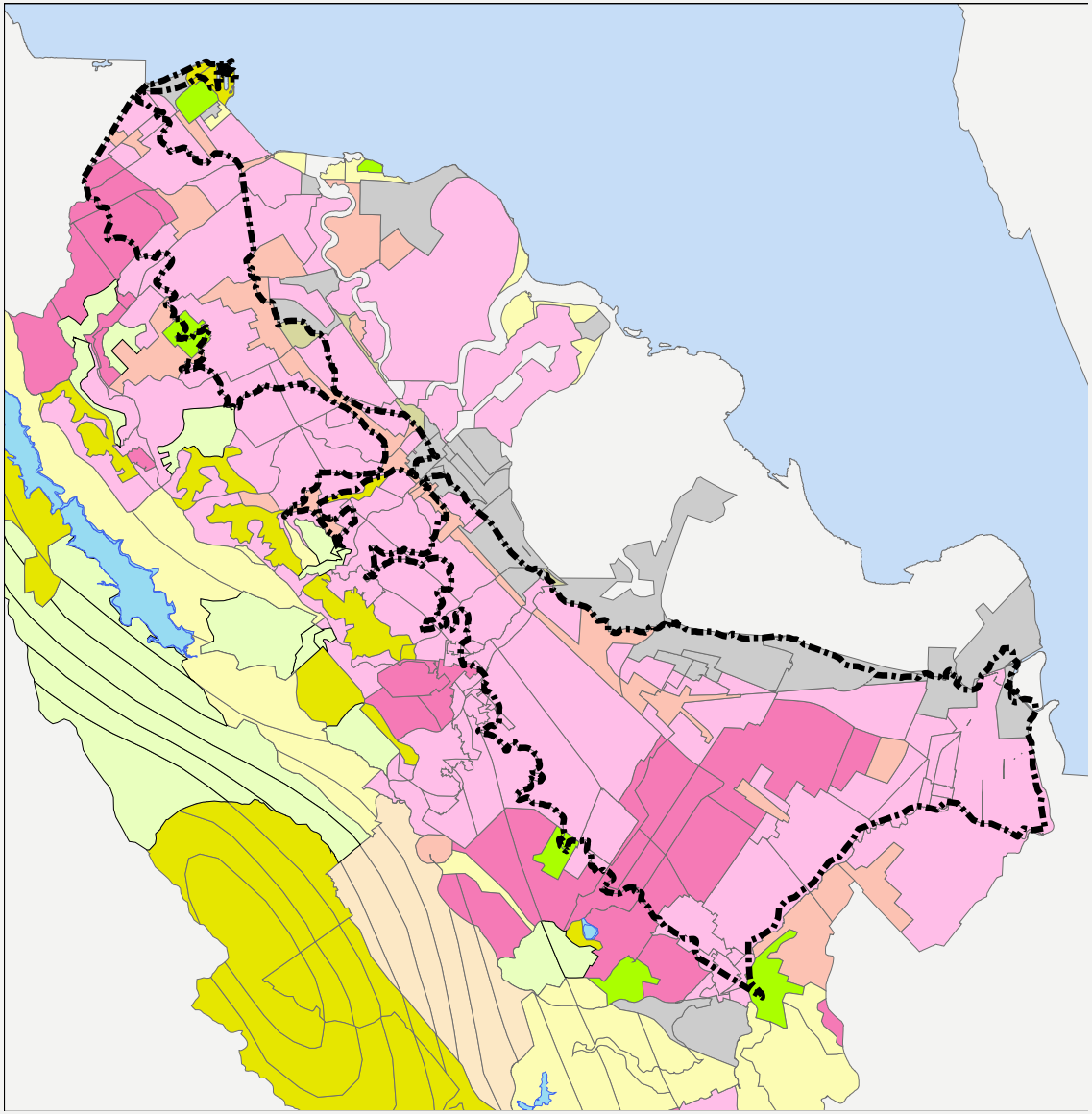
WATER BALANCE ANALYSIS REGIONS



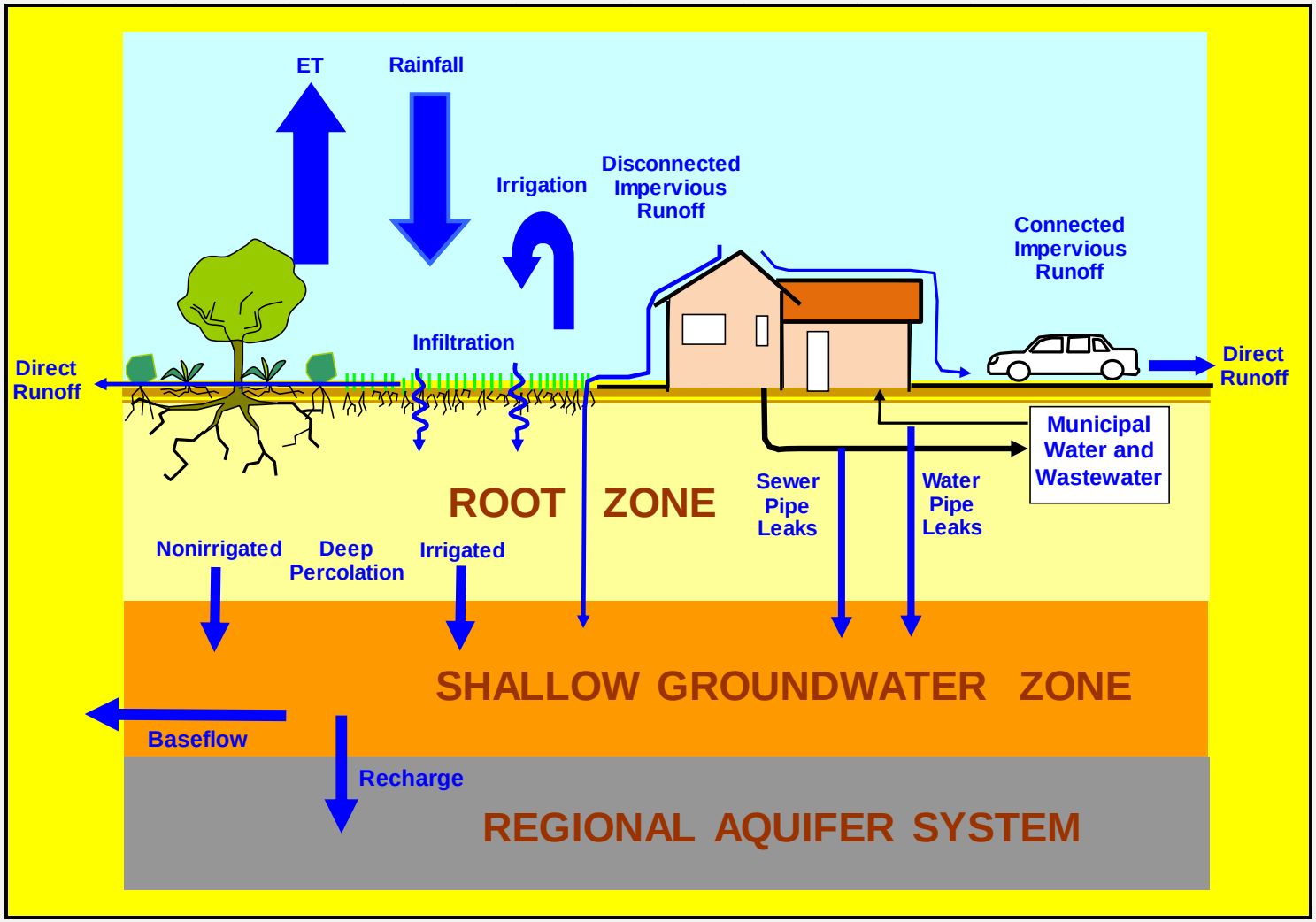
WATERSHEDS AND BASIN BOUNDARIES



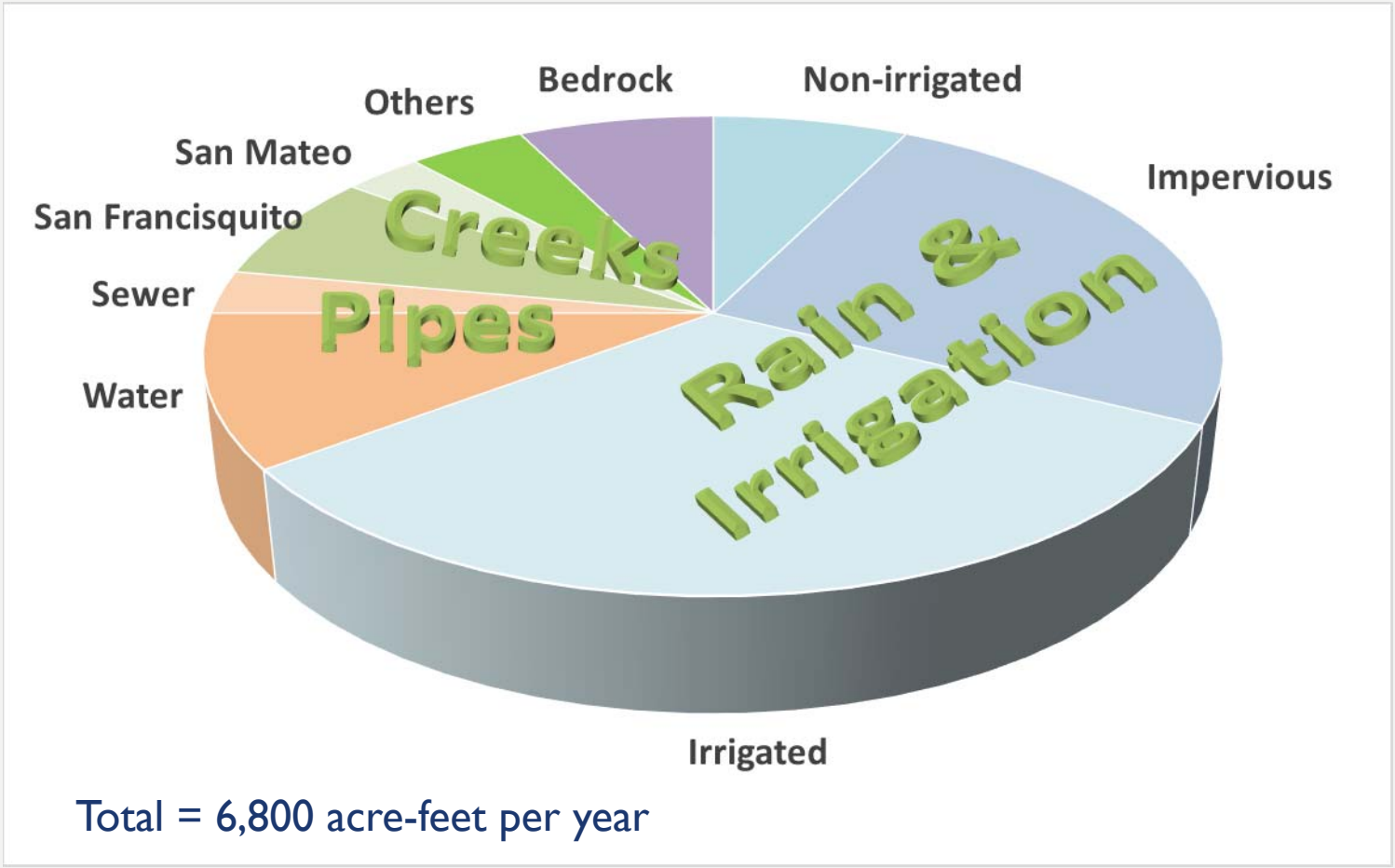
LAND USE



URBAN HYDROLOGY

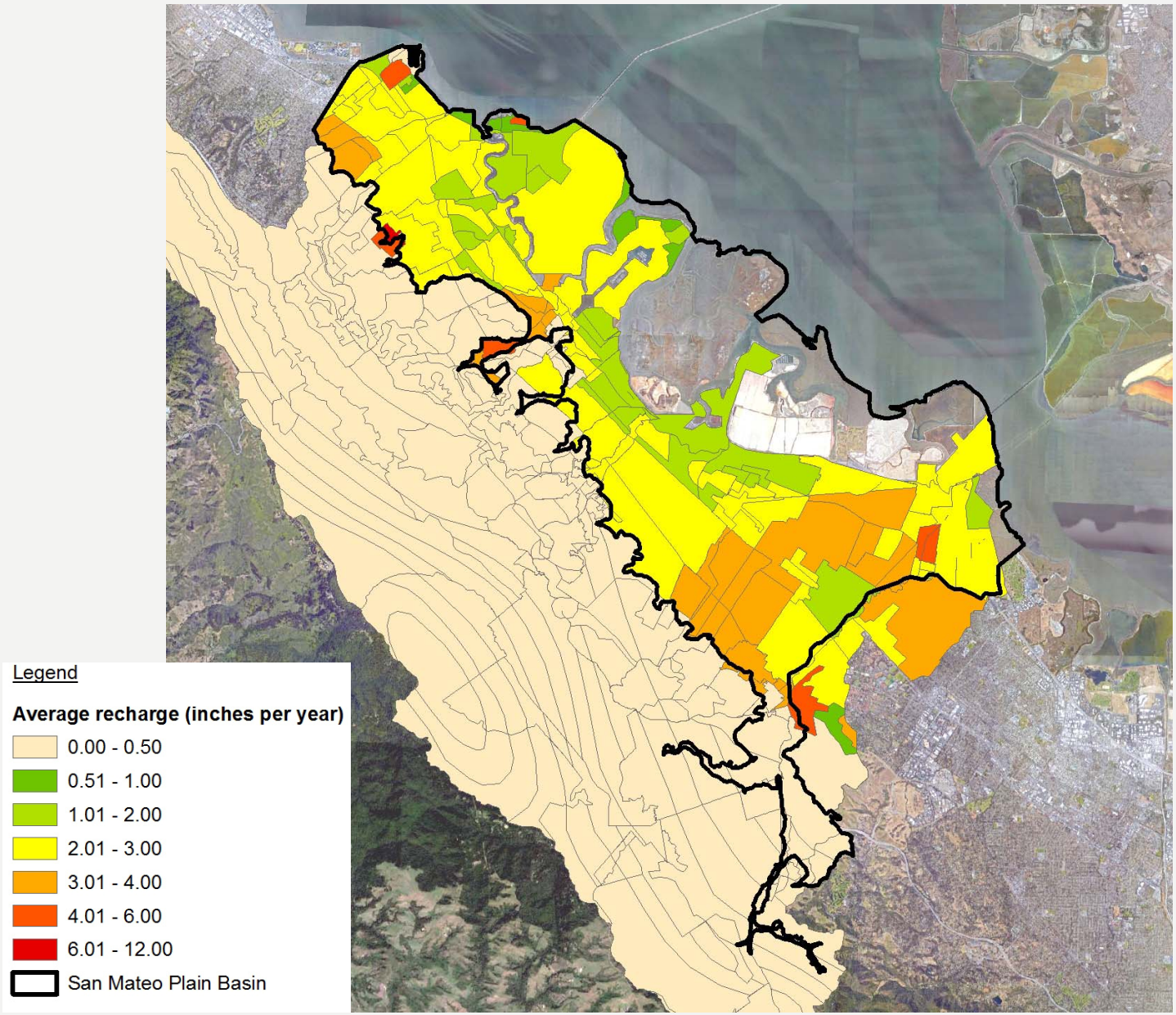


BASIN INFLOWS

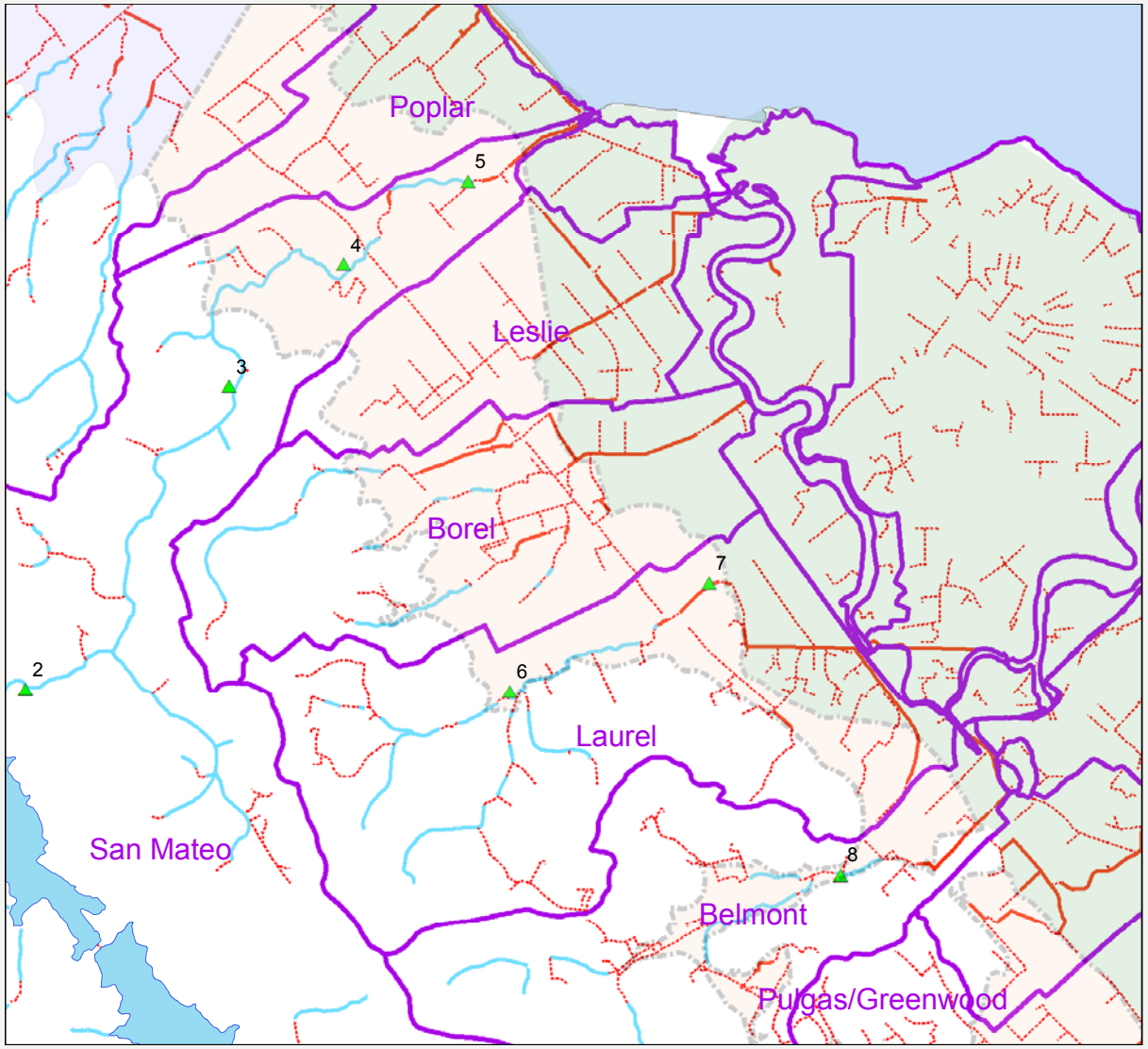


Total = 6,800 acre-feet per year

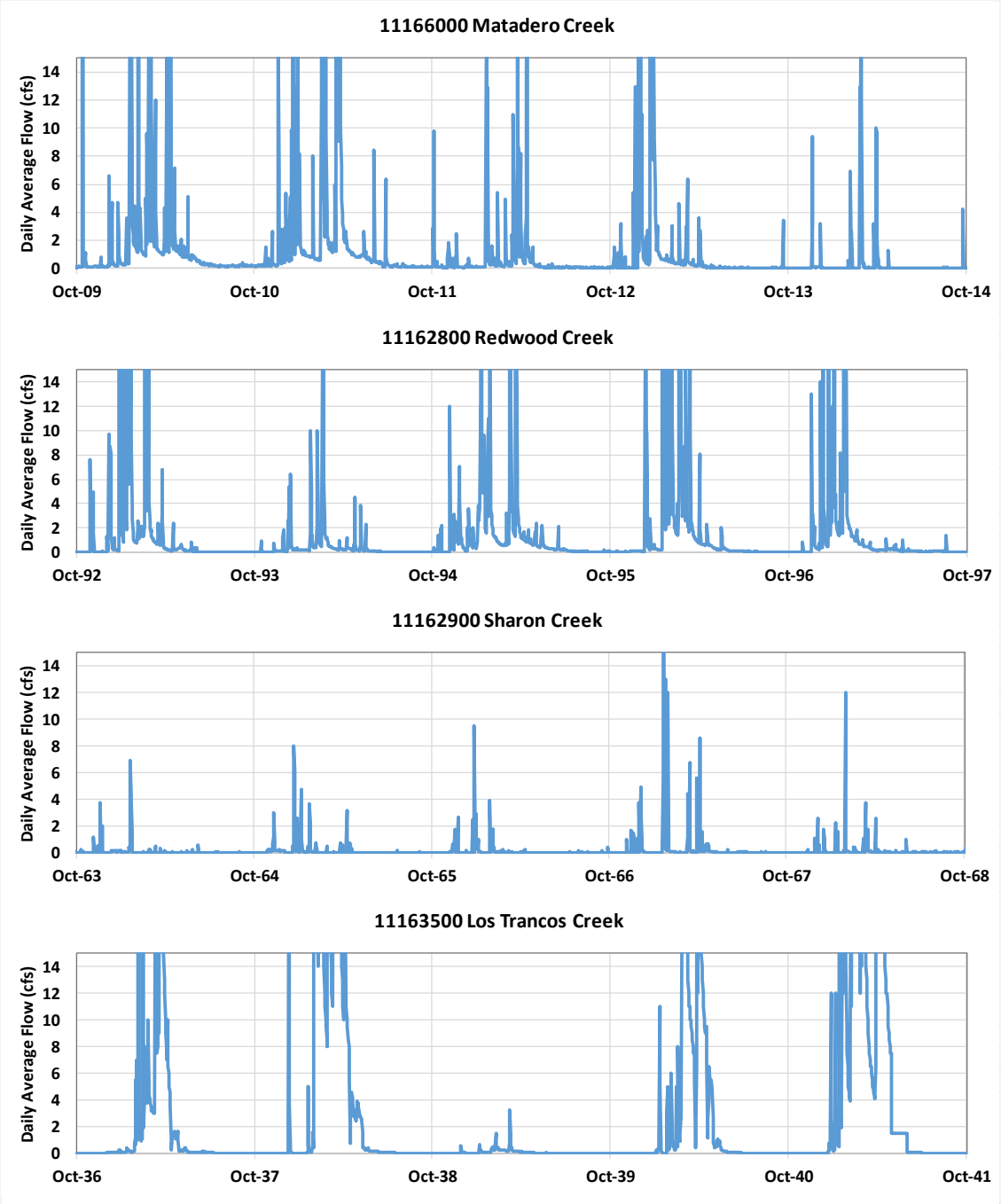
DISPERSED RECHARGE



WATERSHEDS AND CREEKS

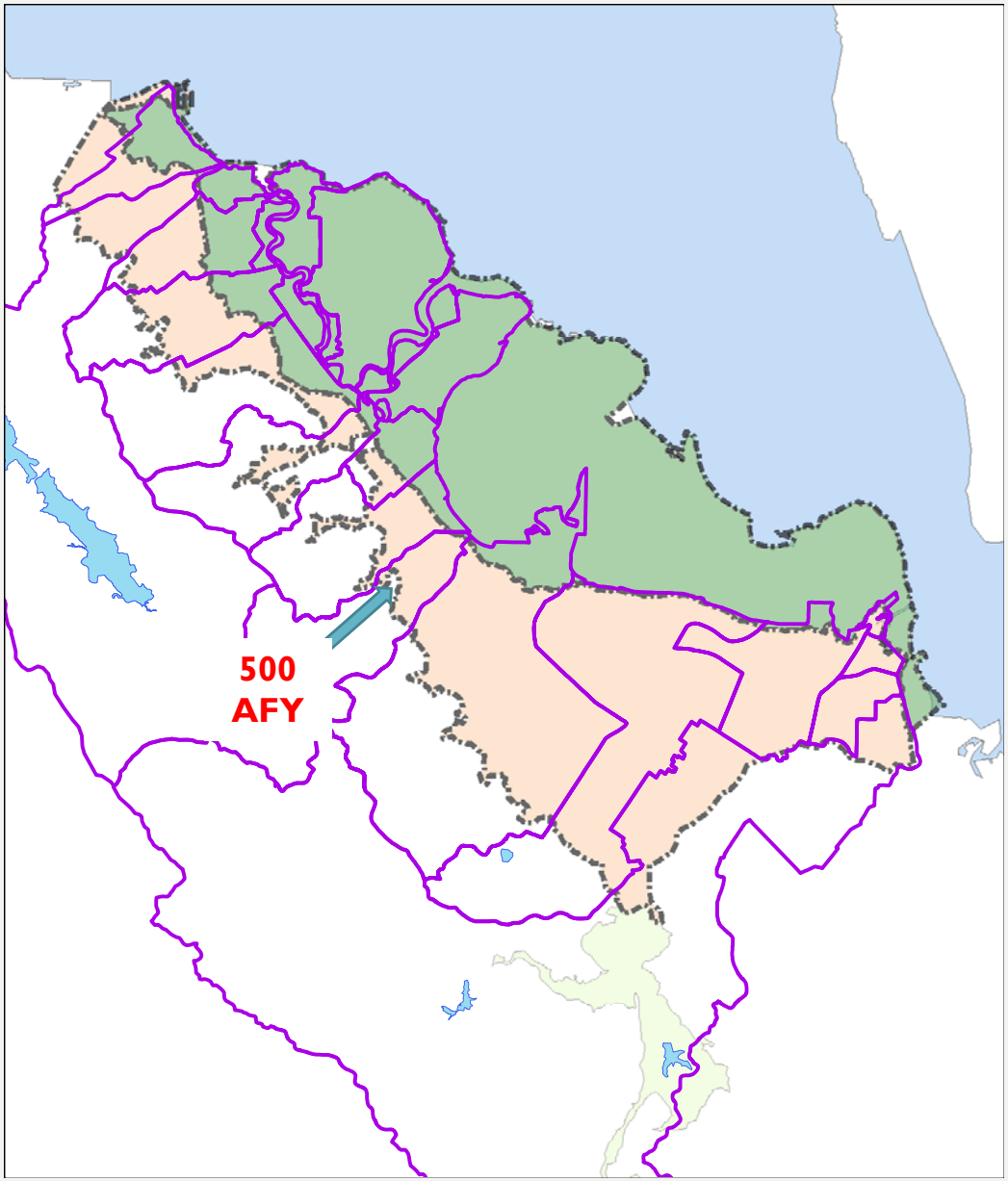


LOW FLOWS IN FOUR SMALL GAGED STREAMS

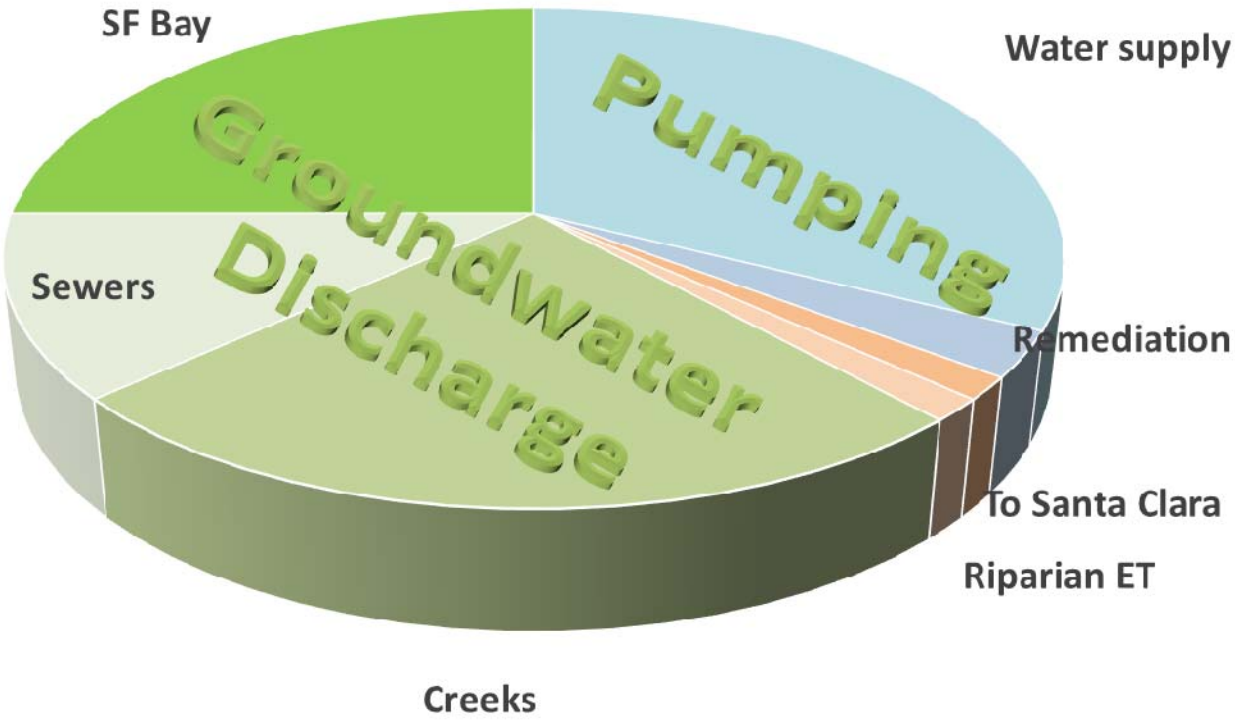


ENGINEERED CREEK CHANNELS

SUBSURFACE INFLOW

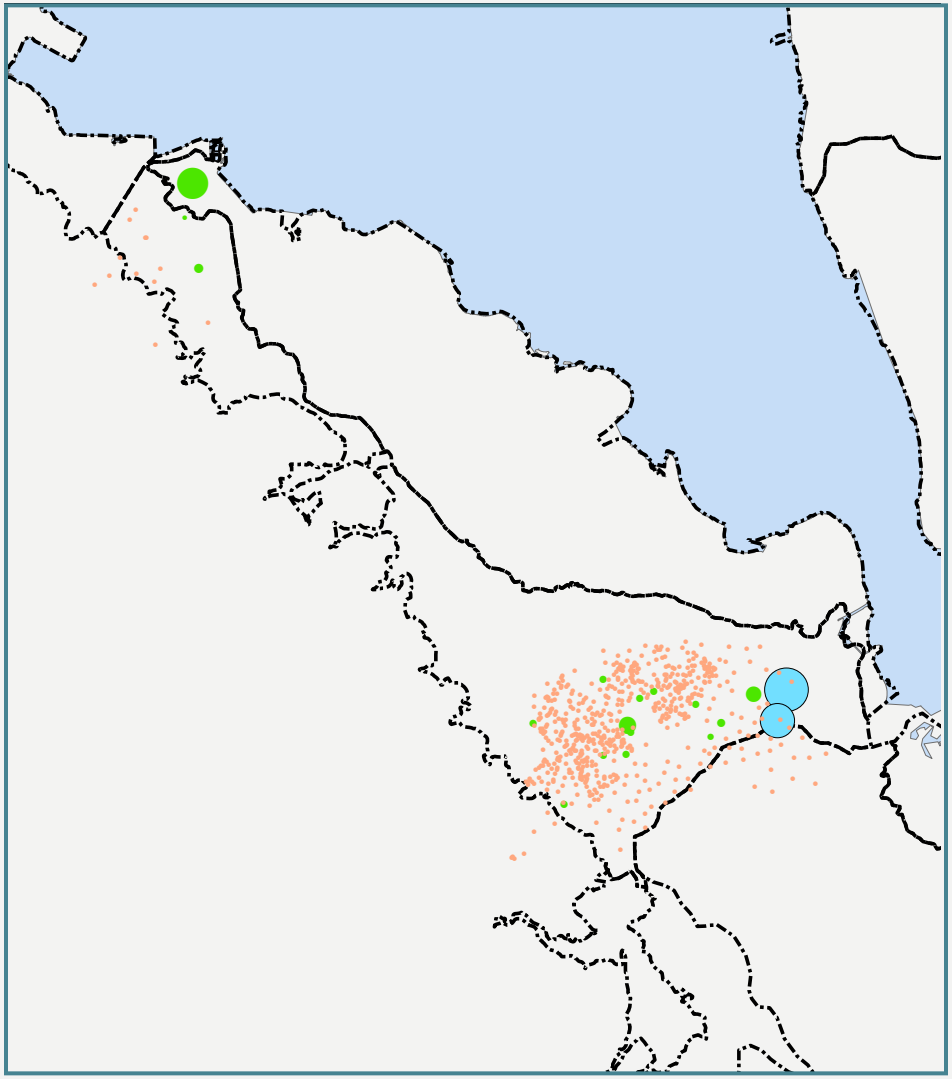


OUTFLOWS

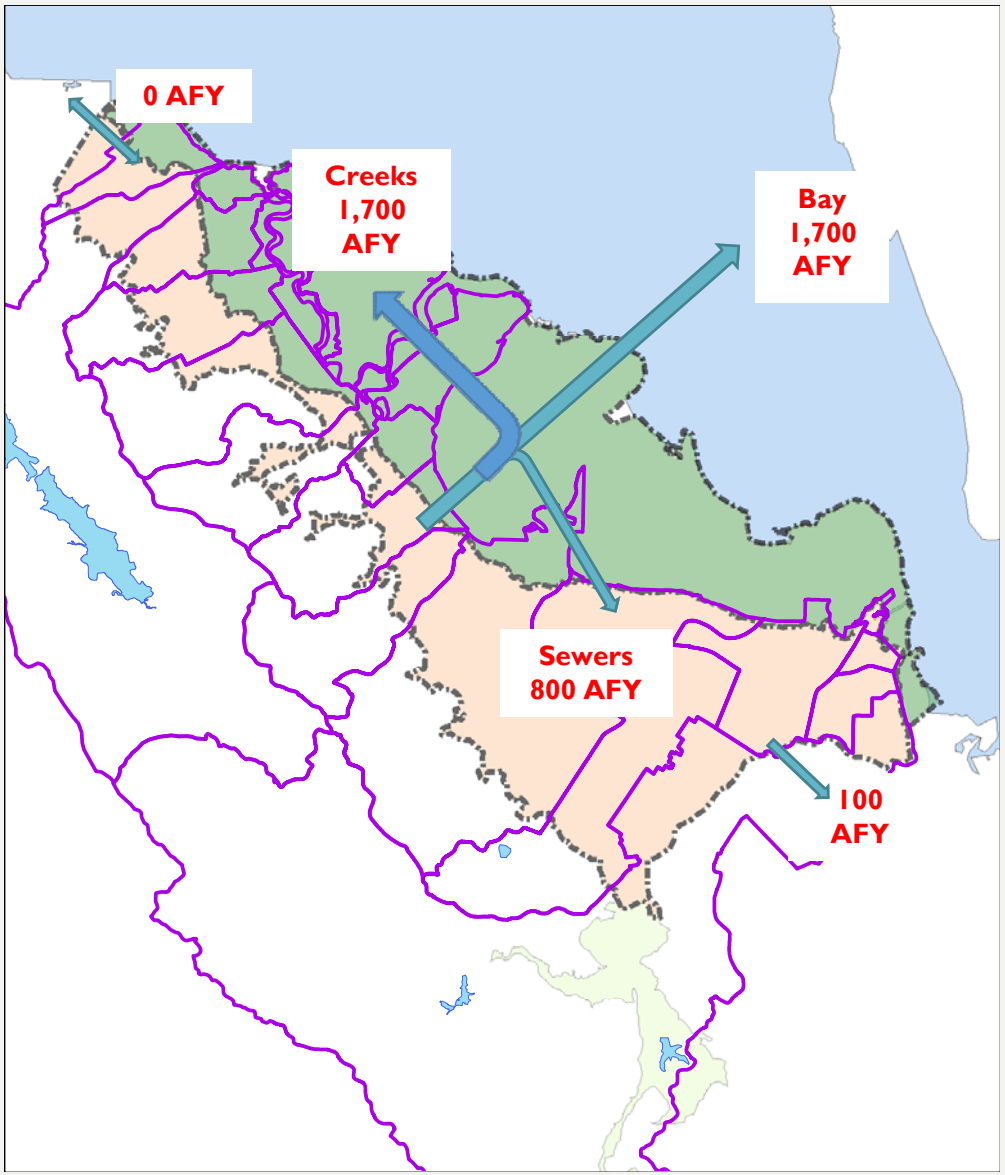


Total = 6,800 acre-feet per year

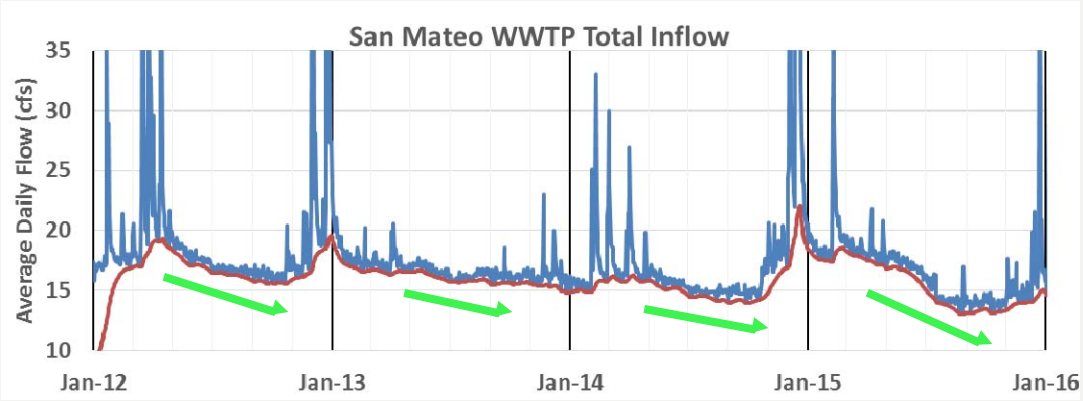
ESTIMATED WATER SUPPLY PUMPING

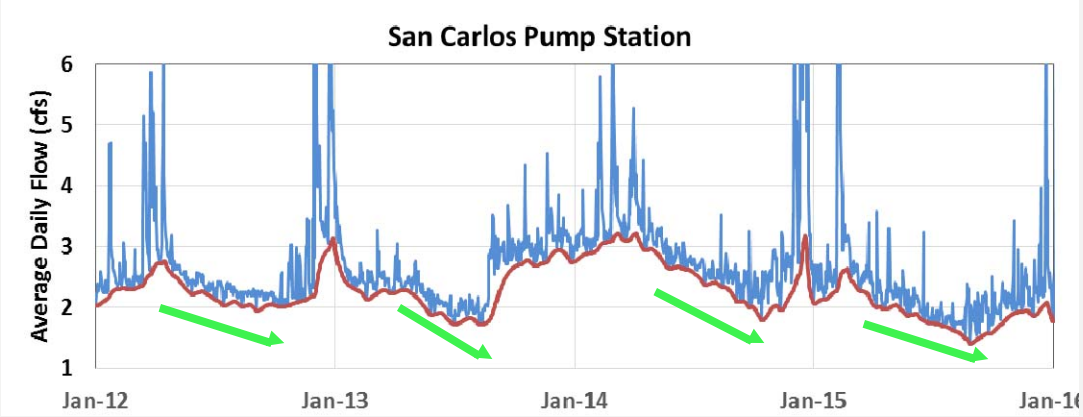


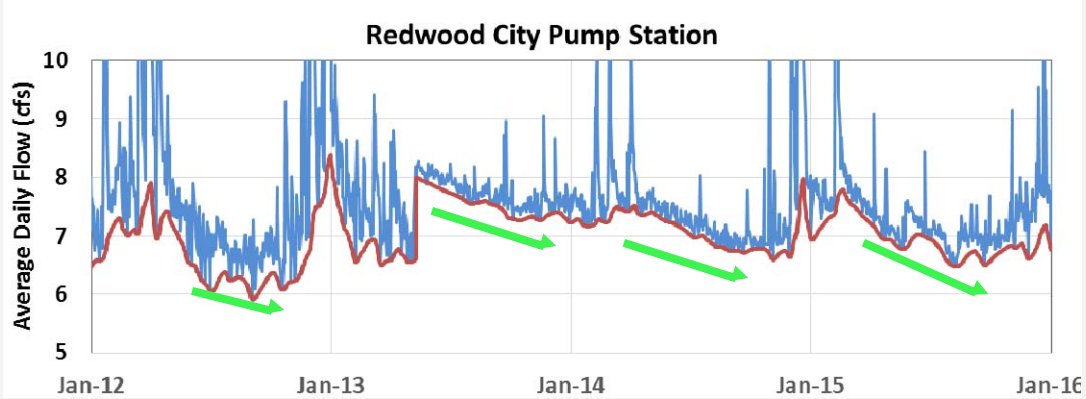
GROUNDWATER OUTFLOW TO CREEKS, SEWERS AND SF BAY



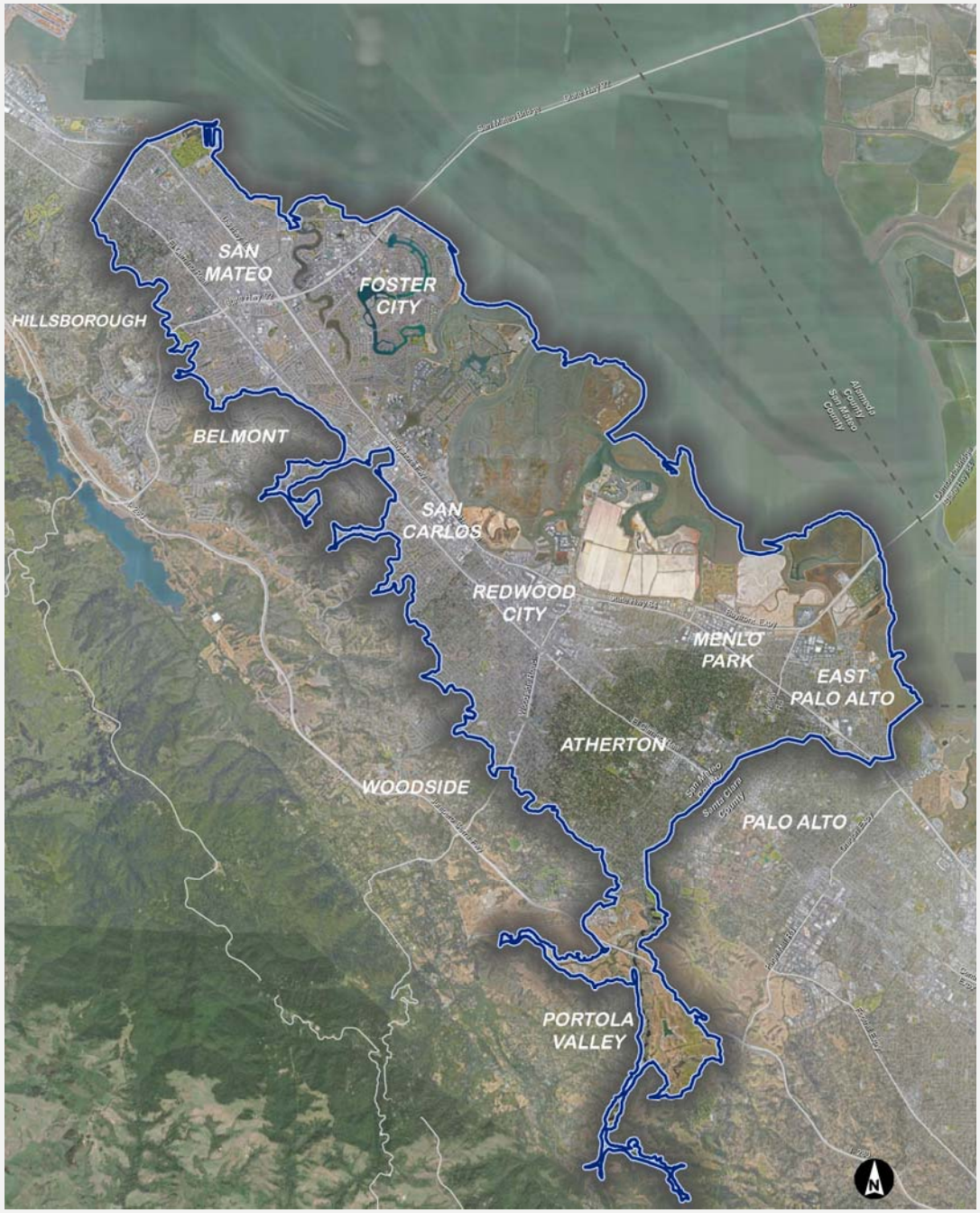
SEWER FLOW HYDRO-GRAPHS





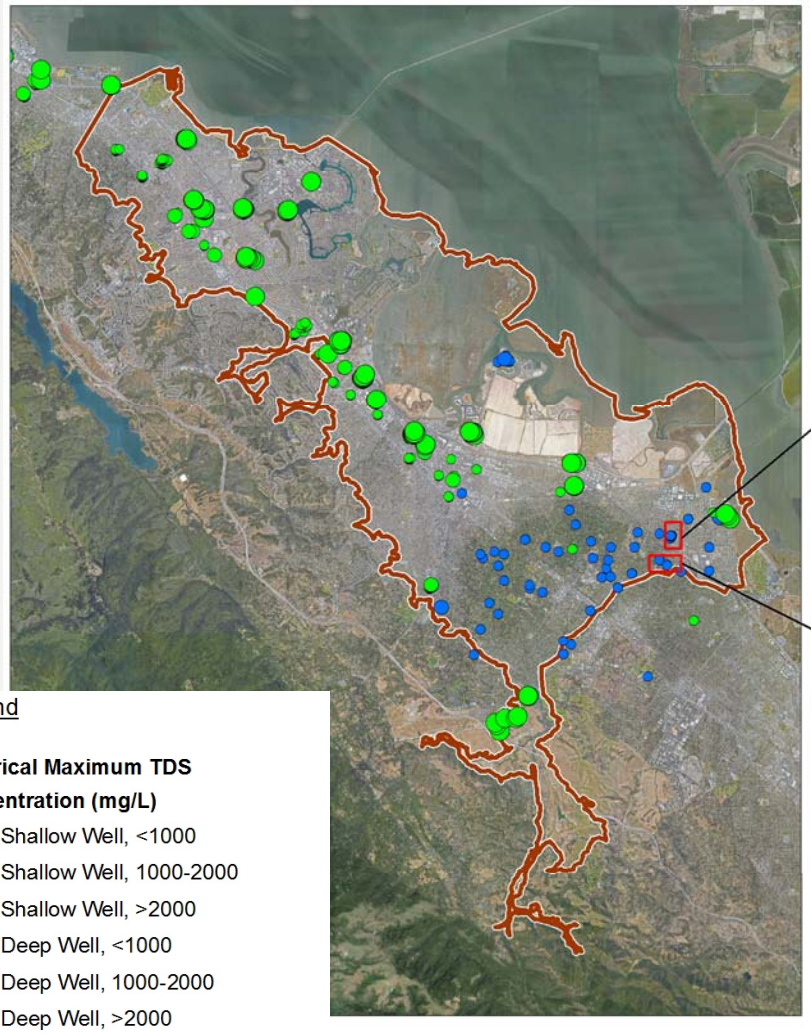


BALANCED WATER BUDGET



GROUND-WATER QUALITY

TOTAL DISSOLVED SOLIDS

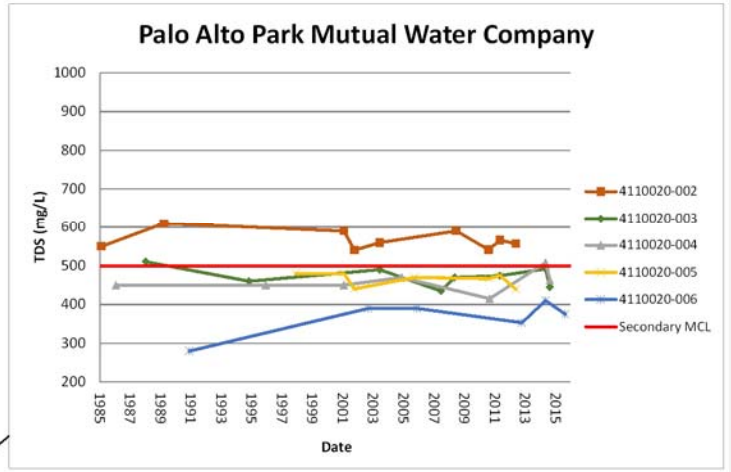


Legend

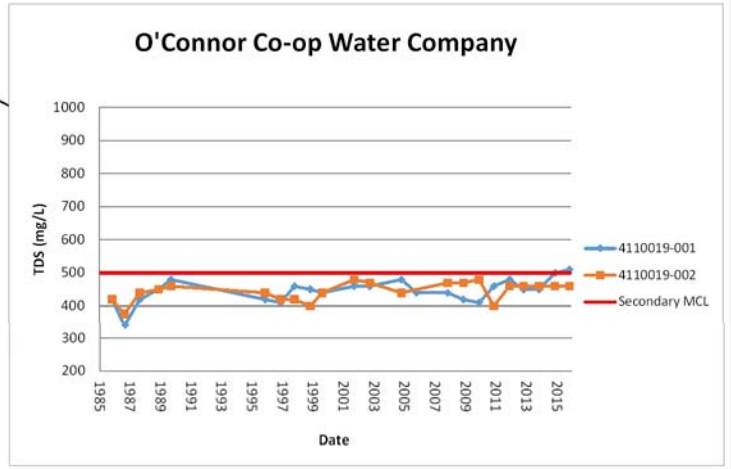
Historical Maximum TDS Concentration (mg/L)

- Shallow Well, <1000
- Shallow Well, 1000-2000
- Shallow Well, >2000
- Deep Well, <1000
- Deep Well, 1000-2000
- Deep Well, >2000
- San Mateo Plain Basin

Abbreviations:
TDS: Total Dissolved Solids
MCL: Maximum Contaminant Level
mg/L: milligrams per liter

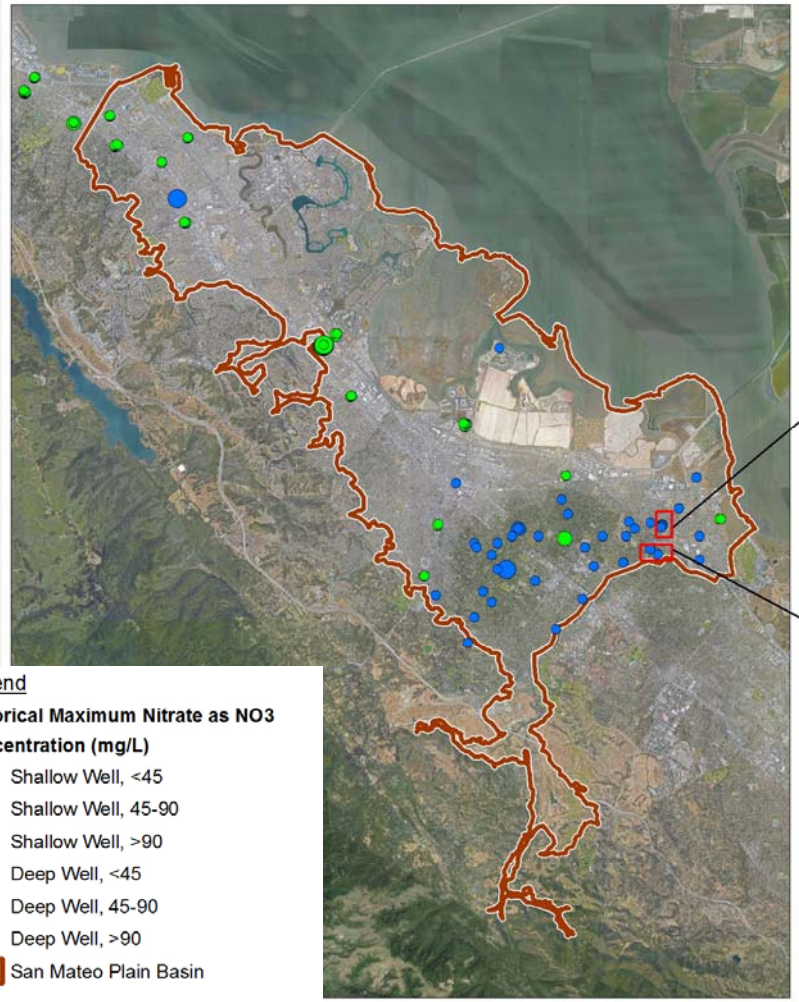


Palo Alto Park Mutual Screen Depths (ft bgs)
4110020-002: 60-67
4110020-003: 194-195, 219-235, 249-257, 269-285
4110020-004: 219-279
4110020-005: 247-251
4110020-006: 248-260, 290-300, 340-366, 378-388, 424-440



O'Connor Co-op Water Company Screen Depths (ft bgs)
4110019-001: 181-372, 396-489, 508-532
4110019-002: 72-90, 172-178, 184-200, 217-223, 233-237, 242-245, 252-265, 282-291

NITRATE



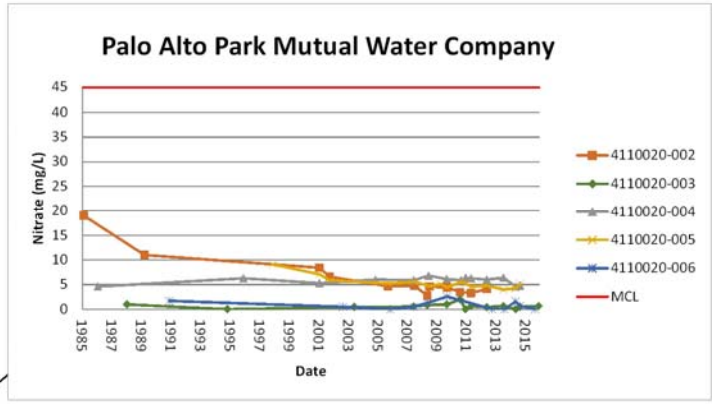
Legend

Historical Maximum Nitrate as NO3 Concentration (mg/L)

- Shallow Well, <45
- Shallow Well, 45-90
- Shallow Well, >90
- Deep Well, <45
- Deep Well, 45-90
- Deep Well, >90
- San Mateo Plain Basin

Abbreviations:
MCL: Maximum Contaminant Level
mg/L: milligrams per liter

*Non-Detect values plotted as 0 mg/L



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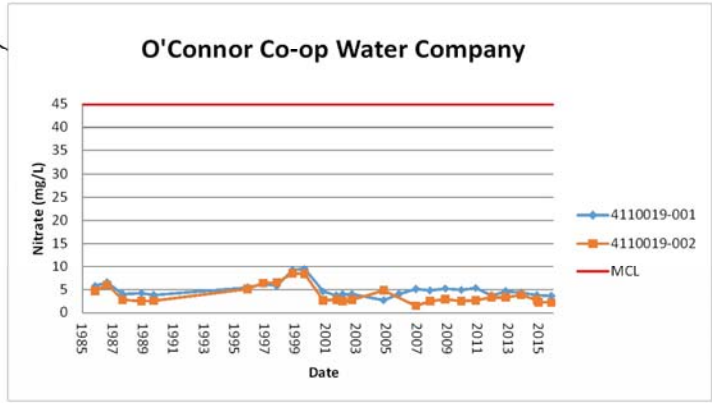

O'Connor Co-op Water Company Screen Depths (ft bgs)
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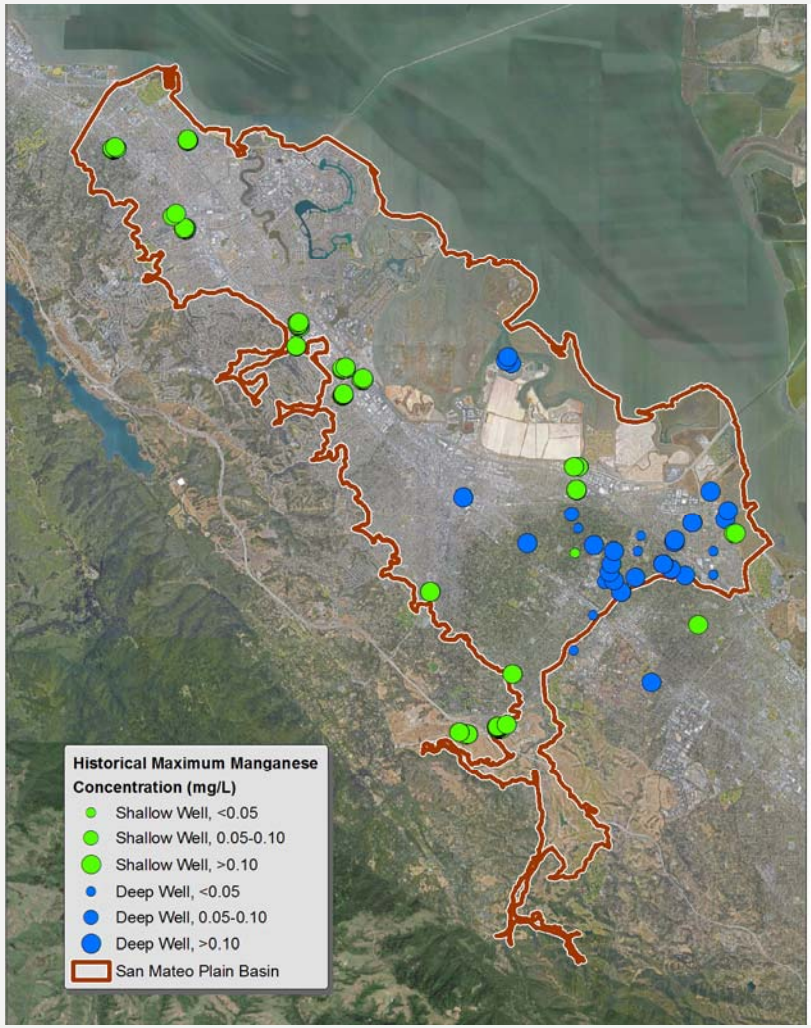
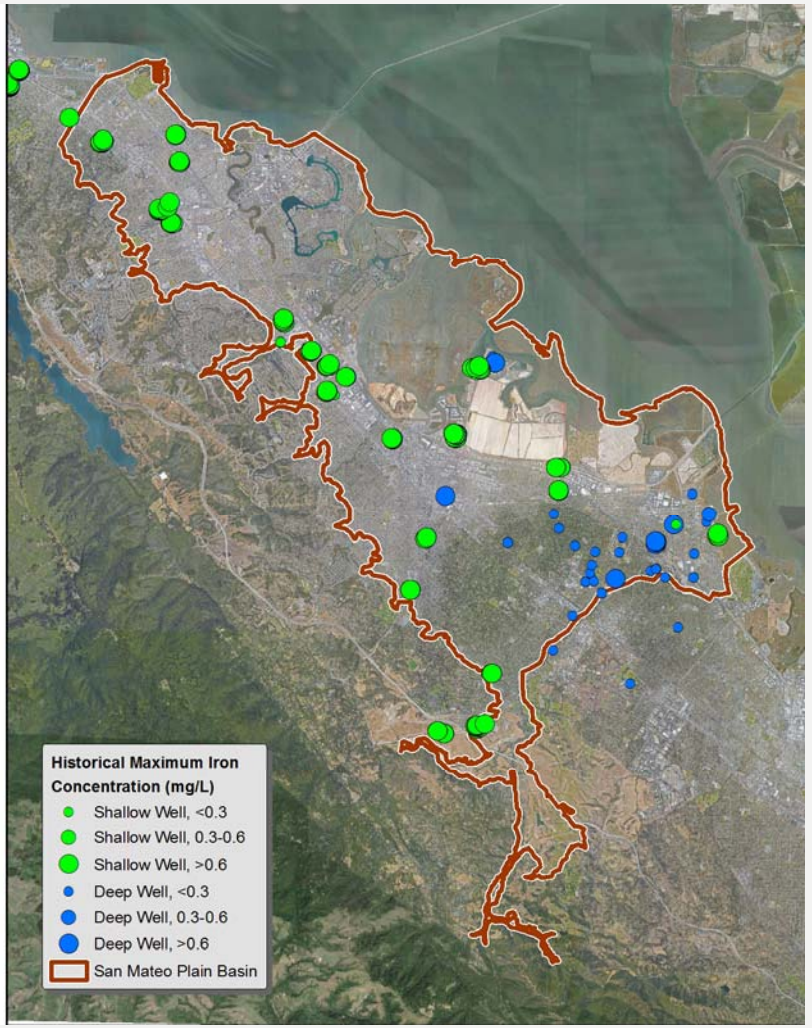
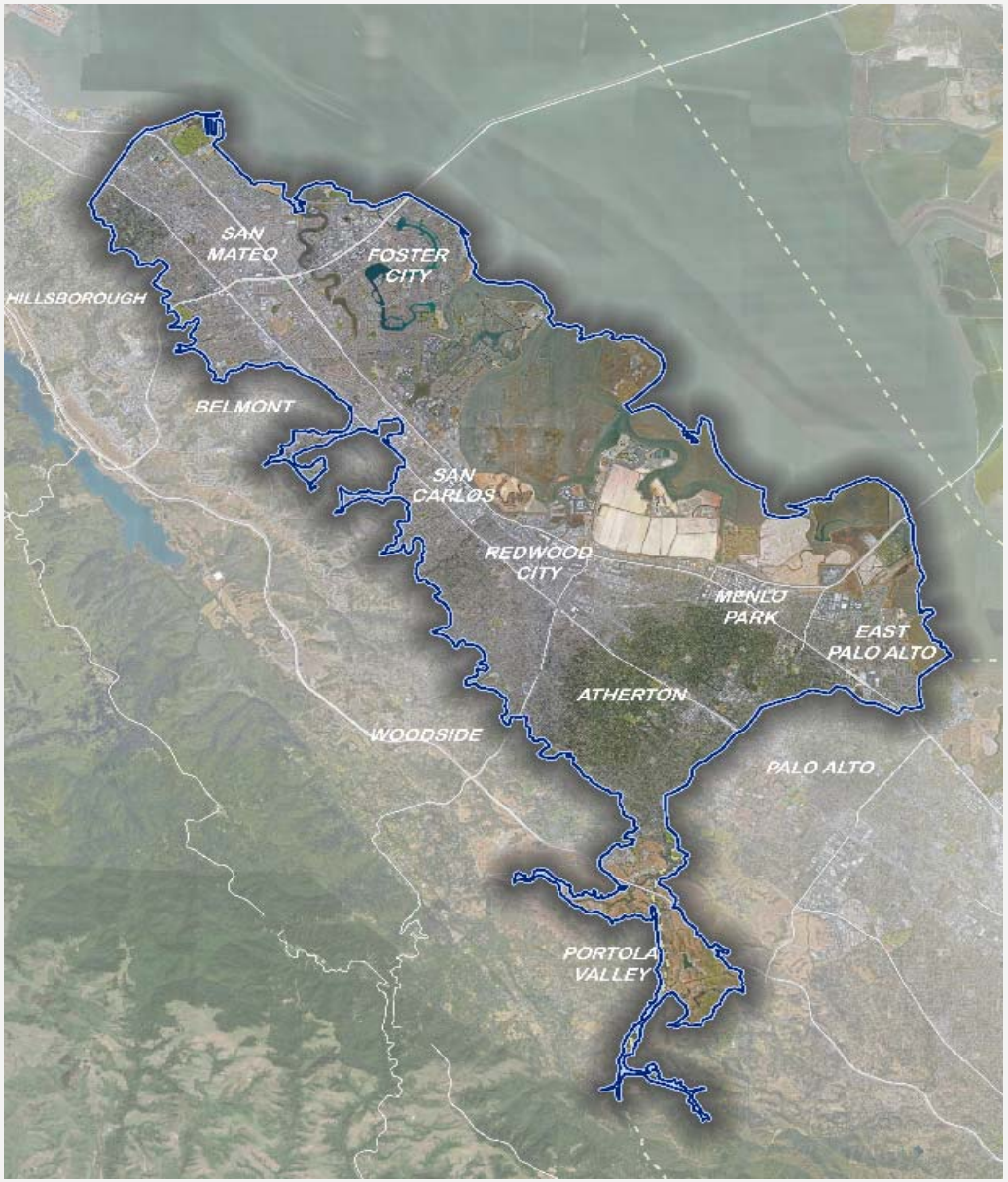
4110019-002: 72-90, 172-178, 184-200, 217-223, 233-237, 242-245, 252-265, 282-291

IRON AND MANGANESE







EVALUATION OF POTENTIAL UNDESIRABLE RESULTS

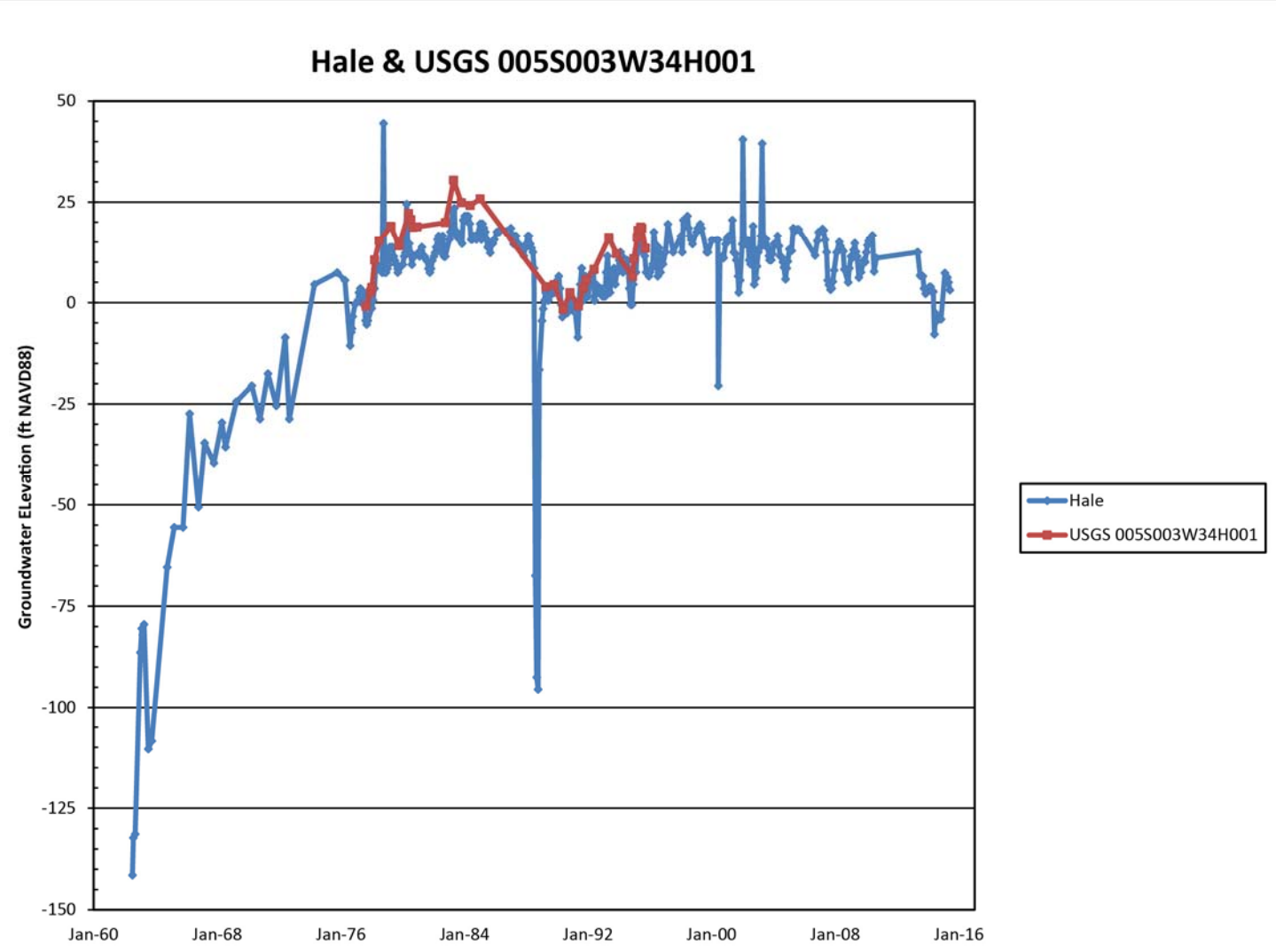
EVALUATION OF POTENTIAL "UNDESIRABLE RESULTS"

- Changes to the Basin Water Balance from Increased Pumping and/or Decreased Recharge
  - Declining groundwater levels
  - Decreased water in storage in basin
  - Land subsidence
  - Salt water intrusion
  - Impacts to interconnected surface water
- Other potential "Undesirable Results/Effects" to Basin Water Quality
  - Salt and nutrient loading
  - Point-source contamination sites
  - Cross-contamination between Shallow and Deep Aquifers
  - Sea level rise

EVIDENCE OF HISTORICAL UNDESIRABLE RESULTS

- Groundwater pumping from San Francisquito Cone & adjacent basins in first half of 20th century caused:
  - Lowering of water table
    - Average decline of 10 ft/yr between 1923 and 1926
    - Water level in the Hale Well in Palo Alto was about 150 ft lower in 1960 than in recent years
  - Up to 2 feet of subsidence measured in East Palo Alto (Poland and Ireland, 1988)
  - Saltwater intrusion
    - Chloride concentrations peaked in two Palo Alto wells in 1962 (Hale well) and 1972 (Rinconada well)
    - “Ravenswood Wells” in East Palo Alto

BASIN CONDITIONS HAVE IMPROVED AND STABILIZED



INTERCONNECTED SURFACE WATERS

- Unlined portions of creeks within the Basin provide habitat for flora and fauna
- Degree of connectivity to the groundwater system is variable and not well understood
- Proximity to surface streams an important consideration for future well siting

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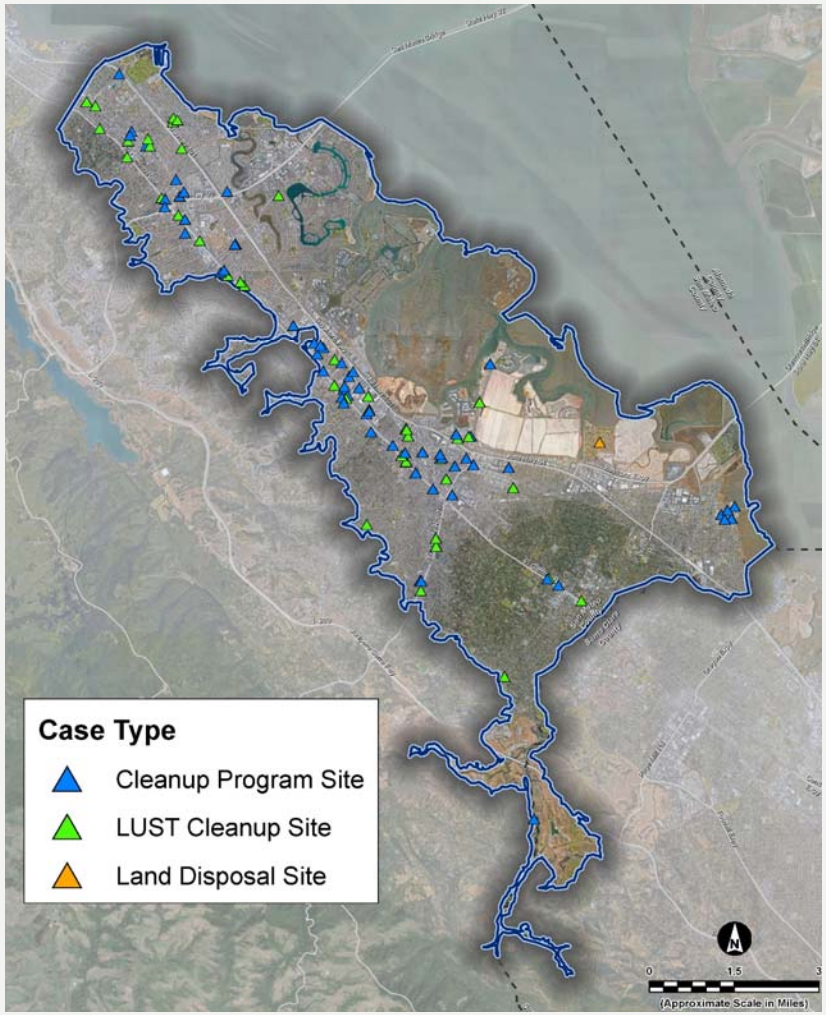
POINT SOURCE CONTAMINATION SITES AFFECTING GROUNDWATER

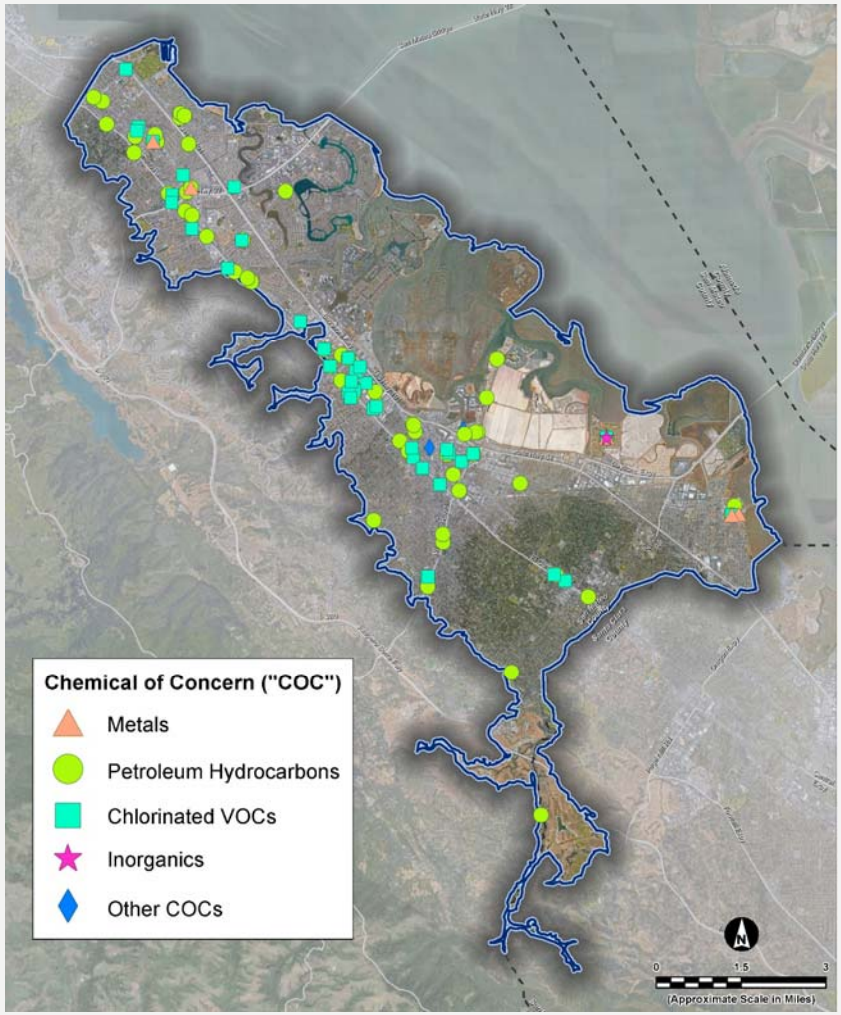
- Leaking Underground Storage Tank Sites (e.g., gas stations)
- Cleanup Program Sites (e.g., dry cleaners, other industrial facilities)
- Land Disposal Sites

Table 14. Summary of Point Source Contamination Sites by Type and Open/Closed Status

Site Type	Open Sites	Closed Sites	Total
Cleanup Program Sites	100	80	180
Leaking Underground Storage Tank ("LUST") Cleanup Sites	43	524	567
Land Disposal Sites	4	--	4
Total	**147**	**604**	**751**

LOCATIONS OF POINT SOURCE CONTAMINATION SITES

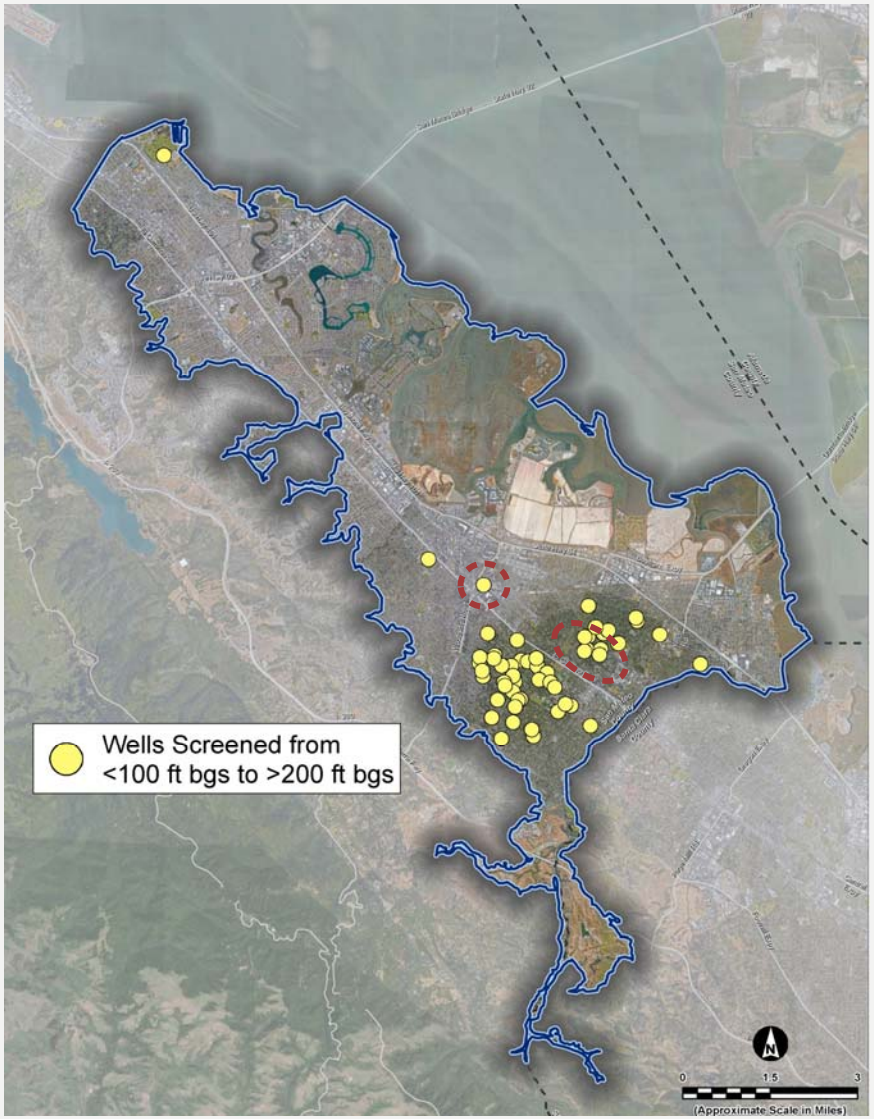




Geotracker sites with "active" status and groundwater listed as affected media.

LOCATIONS OF POTENTIALLY CROSS-CONNECTING WELLS

- Wells that screen over both shallow and deep zones have **potential to cross-connect** two aquifer zones
- Some wells are potentially downgradient of contamination sites
- Public water systems installing new wells must conduct Drinking Water Source Assessments to evaluate risk from contaminating activities



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OPTIONS FOR PREVENTING FUTURE UNDESIRABLE RESULTS

- Active groundwater monitoring (e.g., establishment of sentry well network, and a routine groundwater level and water quality monitoring program)
- Active subsidence monitoring (e.g., by repeated surveying of benchmarks, using Satellite Interferometric Synthetic Aperture Radar [InSAR] data)
- Support on-going and coordinated groundwater management efforts (e.g., East Palo Alto's Groundwater Management Plan)
- Increase efforts to prevent groundwater contamination (e.g., identify and destroy cross-connecting wells)
- Perform monitoring in creeks to better understand surface water / groundwater interactions

CONCLUSION

- To date we have initiated compilation and interpretation of substantial information about the Basin
- Foundational for future work to update numerical model, fill key data gaps, and evaluate groundwater management options
- Promoting public knowledge of the resource
- Positioning the Basin for funding and supporting sustainable groundwater development

NEXT STEPS

- TM#3: Numerical Model Update
  - Stakeholder Workshop #3 – October / November 2016
- TM#4: Potential Basin Management Options
  - Stakeholder Workshop #4 – November / December 2016
- Phase 1 Report
  - Stakeholder Workshop #5 – January 2017

QUESTIONS?

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