Santa Cruz Water Commission
ASR Workshop

City of Santa Cruz Water Department

November 7, 2016

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Outline

1. **3-Phase ASR Project Implementation Plan**
2. **ASR Performance Measures**
3. **Current Phase 1 Project**
4. **Groundwater Modeling Status**
5. **Next Steps**
6. **Q & A / Discussion**

ASR Implementation Plan

- **Phase 1 – Technical Feasibility Analyses**
- **Phase 2 – Pilot Testing**
- **Phase 3 – Permanent Project Implementation**

Estimated time to complete all 3 phases is 6 – 12 years

Phase 1 Tasks and Performance Measures

Task	Potential Performance Measures
Existing Wells Screening	Suitable Existing Wells for Pilot Testing in Target Aquifers do not exist
Site-Specific Injection Capacity Analysis	Results show that avg. Injection Capacity of 250 gpm (+/- 10%) is unrealistic
Geochemical Interaction Modeling	Results show that undesirable geochemical interactions are likely
Groundwater Modeling	Results show that target aquifers cannot sustain needed injection or recovery rates or unacceptable hydraulic losses occur

Phase 2 Tasks and Performance Measures

Task	Potential Performance Measures
Injection Well Hydraulic Testing	Results show that avg. Injection Capacity of 250 gpm (+/- 10%) is unsustainable and/or unacceptable plugging rates are observed
Implement ISR Testing Program	Results show that long-term injection rates result in unacceptable water level "mounding" and/or water-quality of stored or recovered water does not meet drinking water standards
Refined Groundwater Modeling	Results show that target aquifers cannot sustain needed injection or recovery rates or unacceptable hydraulic losses occur
Develop Basis-of-Design for Permanent ASR Facilities	Projected program costs exceed some affordability threshold

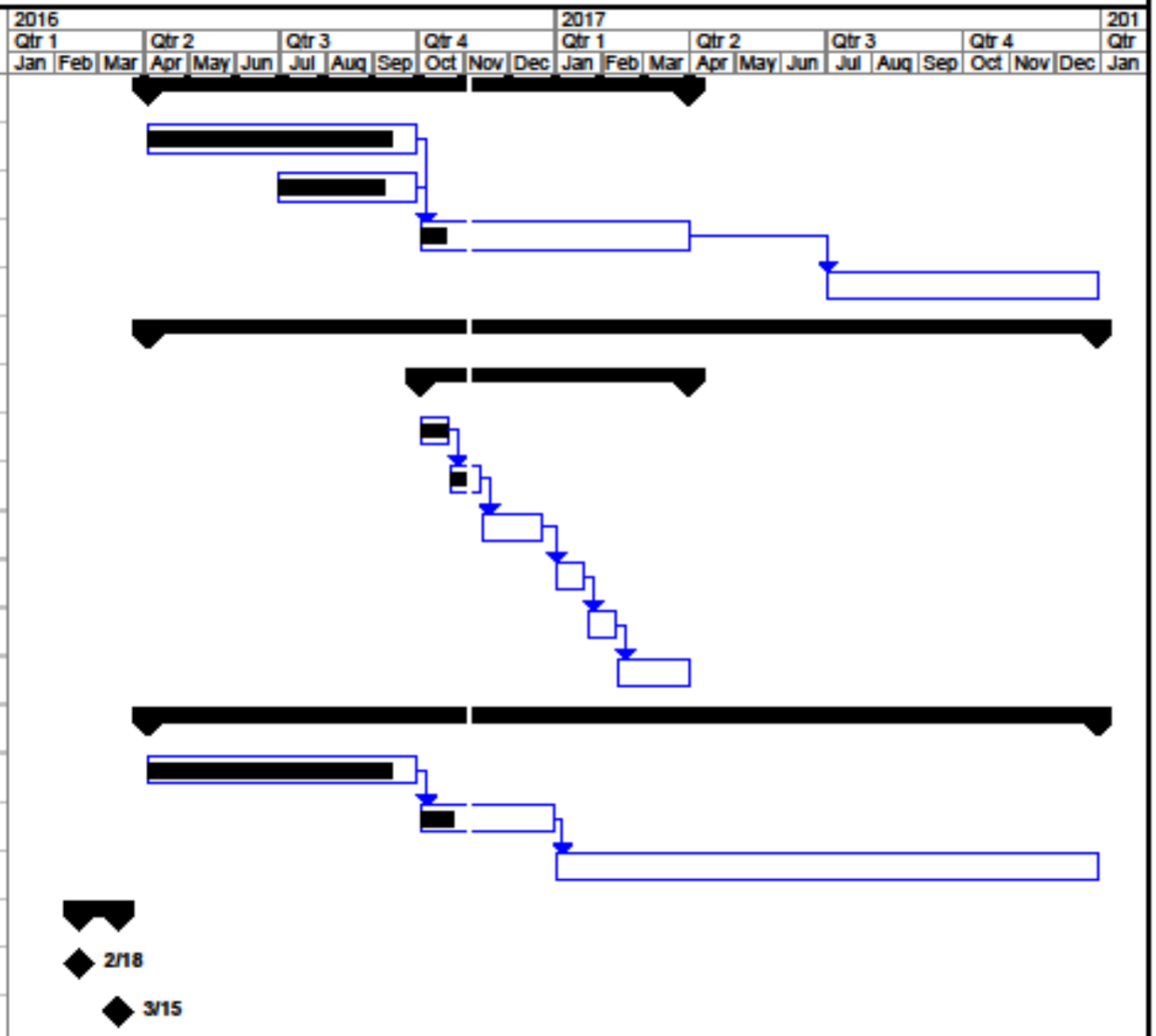
Phase 3 Tasks and Performance Measures

Task	Potential Performance Measures
Procurement of properties and ROW for ASR Facilities	Sufficient number of suitable ASR well sites cannot be acquired and/or costs exceed some affordability threshold
Engineering Design of ASR Facilities	Needed facilities can't be sited and/or exceed some affordability threshold
Complete CEQA and Project Permitting	CEQA process can't be completed without exceeding some affordability threshold for mitigation and/or litigation
Drill and Production Test New ASR Wells	Well performance for some portion of recharge system is insufficient
Perform site-specific ASR Testing and Develop O&M Procedures	Results produce new information about feasibility or productivity at specific sites

City of Santa Cruz Water Department
ASR Project - Phase 1 Feasibility Investigation
PWR Project No. 15-0111

PROJECT SCHEDULE

ID	Task Name
1	**Technical Feasibility Analyses**
2	T1.1 - Existing Wells Screening
3	T1.2 - Site-Specific Injection Capacity Analyses
4	T1.3 - Geochemical Interaction Analysis
5	T1.4 - Pilot ASR Testing Program Development
6	**Groundwater Modeling**
7	**T.5.1 - Well Siting Study**
8	T1.5.1.1 - Review Hydrogeologic Literature
9	T1.5.1.2 - Prepare Existing Well Database
10	T1.5.1.3 - Compile and Review GIS Databases
11	T1.5.1.4 - PCA Assessment
12	T1.5.1.5 - Field Surveys
13	T1.5.1.6 - Potential Well Site Ranking
14	**T1.5.2 - Groundwater Modeling Coordination**
15	T1.5.2.1 - Confluence Model Coordination
16	T1.5.2.2 - ASR Model Scenario Development
17	T1.5.2.3 - Modeling Coordination
18	**PM and Meetings**
19	NTP
20	Project KO Meeting



Project: 15-0111_SC_ASR_Ph_1_sch
Date: Fri 11/4/16

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

Findings To Date
Existing Wells Screening and Ranking

Evaluated 3 Primary Factors:

1. Target Aquifer Completion
2. Preliminary Injection Capacity Estimate
3. Well Construction Features

- Weighted Scoring System Maximum Score = 100 pts
- Findings:
  - SCWD Beltz 12 (score of 100)
  - SqCWD Tannery II (score of 81)
  - SVWD Well 10A (score of 98)

Findings To Date
Site Specific Injection Capacity Analysis

Evaluated 5 Primary Factors that affect Injection Capacity:

1. Well Response to Injection (unpressurized and pressurized)
2. Backflushing Capacity
3. Downhole Velocity
4. Hydrofracturing Potential
5. Offsite Impacts

Findings To Date
Site Specific Injection Capacity Analysis

- SCWD Beltz 12:
  - Injection Rate of ~450 gpm (0.65 mgd)
  - Constrained by "Hydrofracturing Potential" Criterion
- SqCWD Tannery II (score of xx)
  - Injection Rate of ~ 550 gpm (0.78 mgd)
  - Constrained by "Hydrofracturing Potential" Criterion
- SVWD Well 10A:
  - Injection Rate of ~ 200 gpm (0.29 mgd)
  - Constrained by "Backflushing Capacity" Criterion

Current Status of Groundwater Modeling

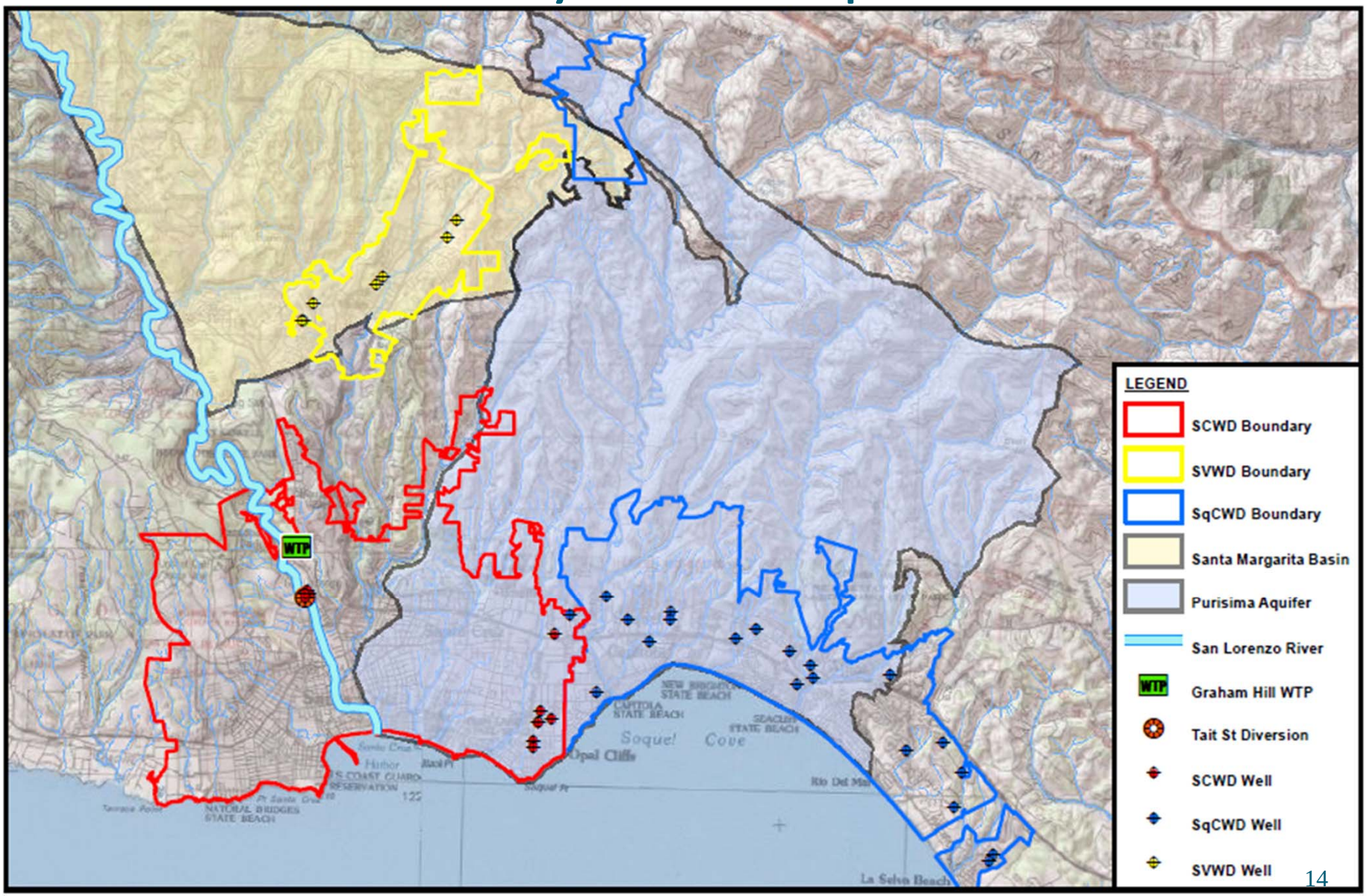
- Model Construction and Calibration:
  - SMGB Already Developed and Calibrated
  - SCMCGB Currently Under Development
    - Ready for Initial Simulations Early 2017
    - Seawater Interface Package Mid 2017
- Model Scenarios
  1. In-Lieu Only
  2. In-Lieu plus ASR
  3. ASR Only
- Historical and Future Climate Change Conditions

Next Steps

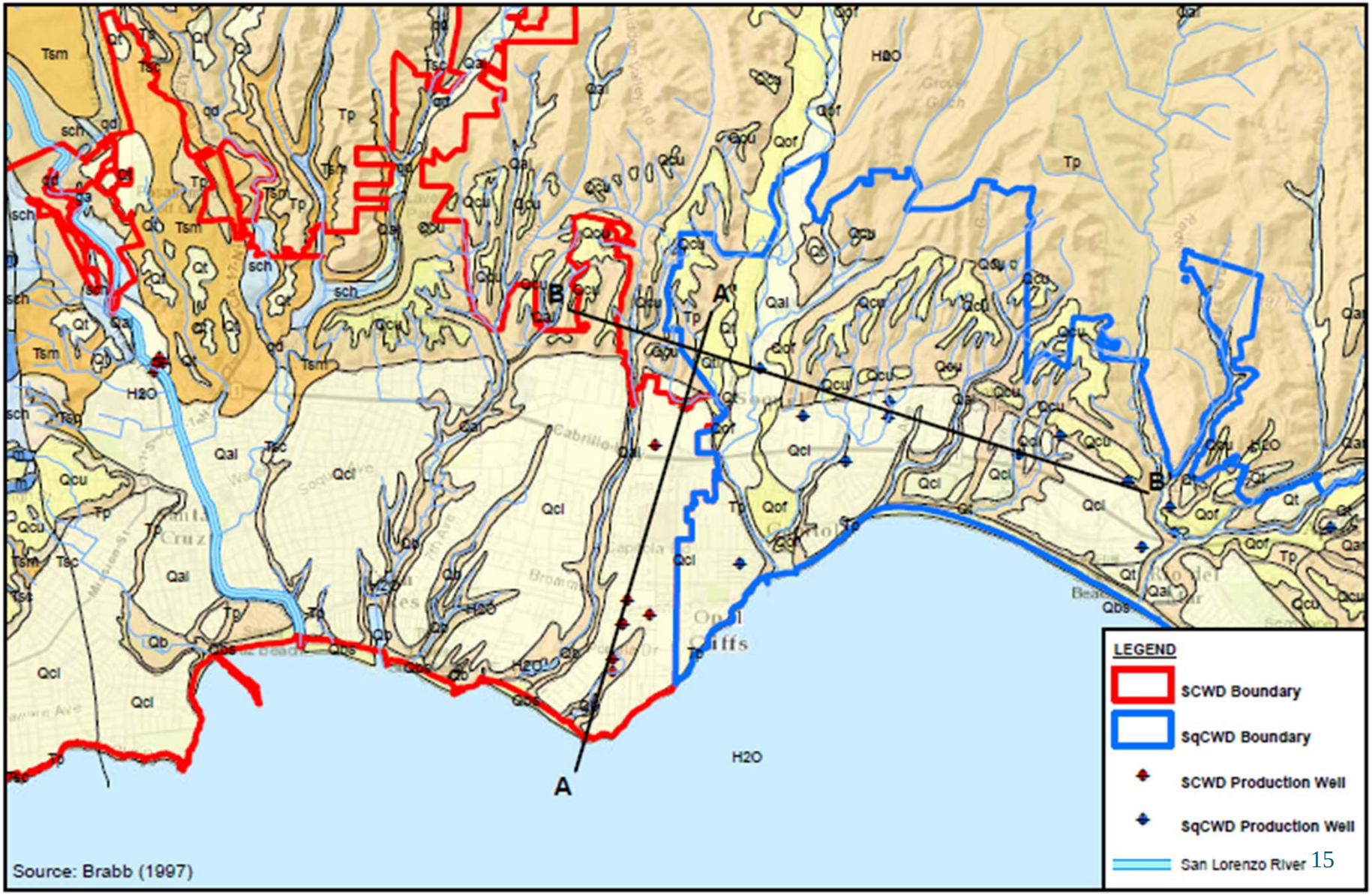
- T1.3 – Geochemical Interaction Modeling
  - Collect and Analyze WQ Samples
  - Receive Mineralogy Lab Results
  - Perform 3-component Geochemical Interaction Simulations
  - Schedule 2016 Q4 / 2017 Q1
- T1.4 – Develop Pilot Testing Programs
  - Define Site Prep Logistics
  - Develop ISR Testing Programs
  - Develop Water Level and Quality Monitoring Programs
  - Alternative Test Well Program May be Developed
  - Schedule 2017 Q3 – Q4
- T1.5 – Groundwater Modeling - Ongoing

Questions / Discussion

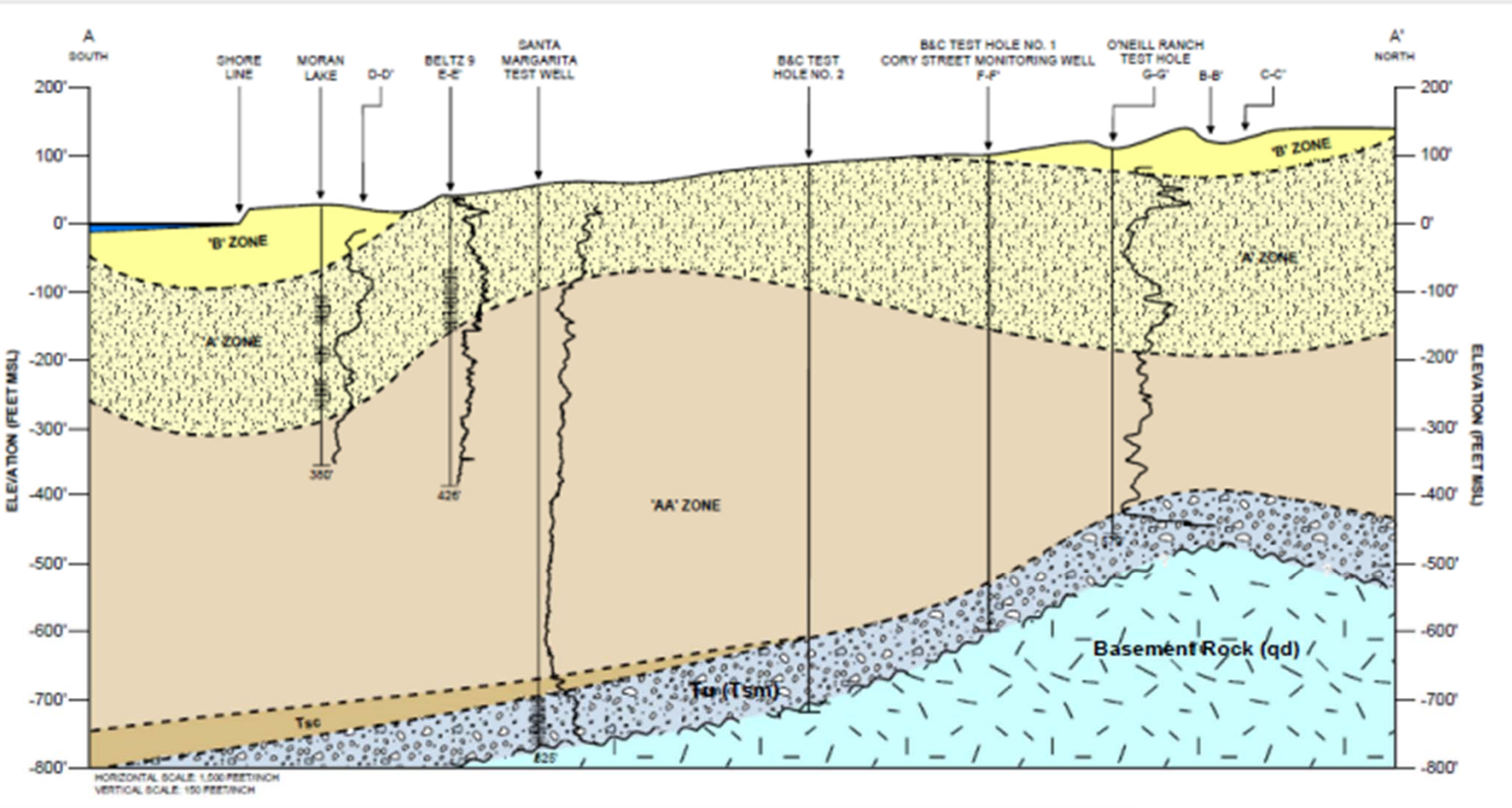
Study Area Map



Geologic Map – Purisima

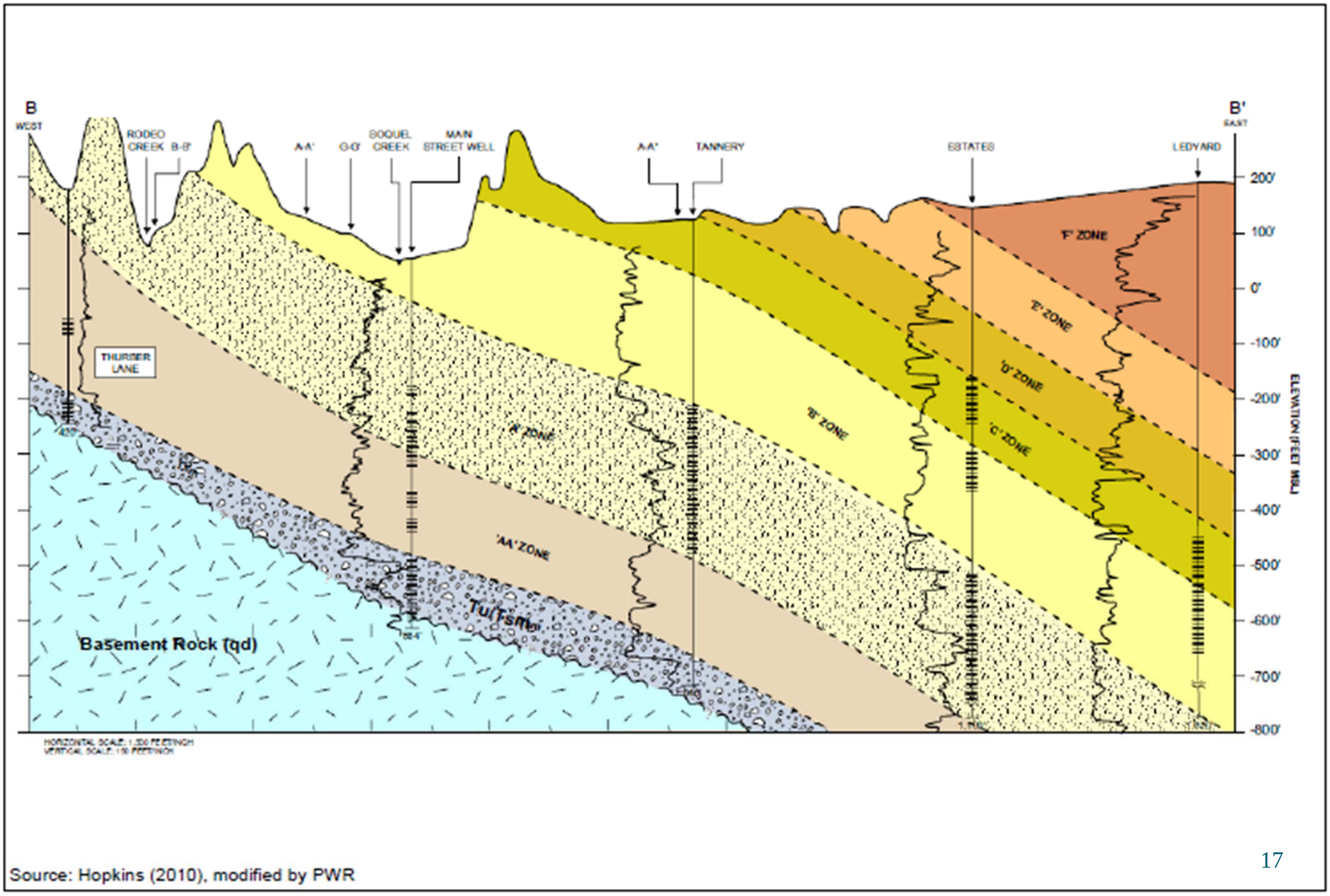


Purisima X-Section A-A’



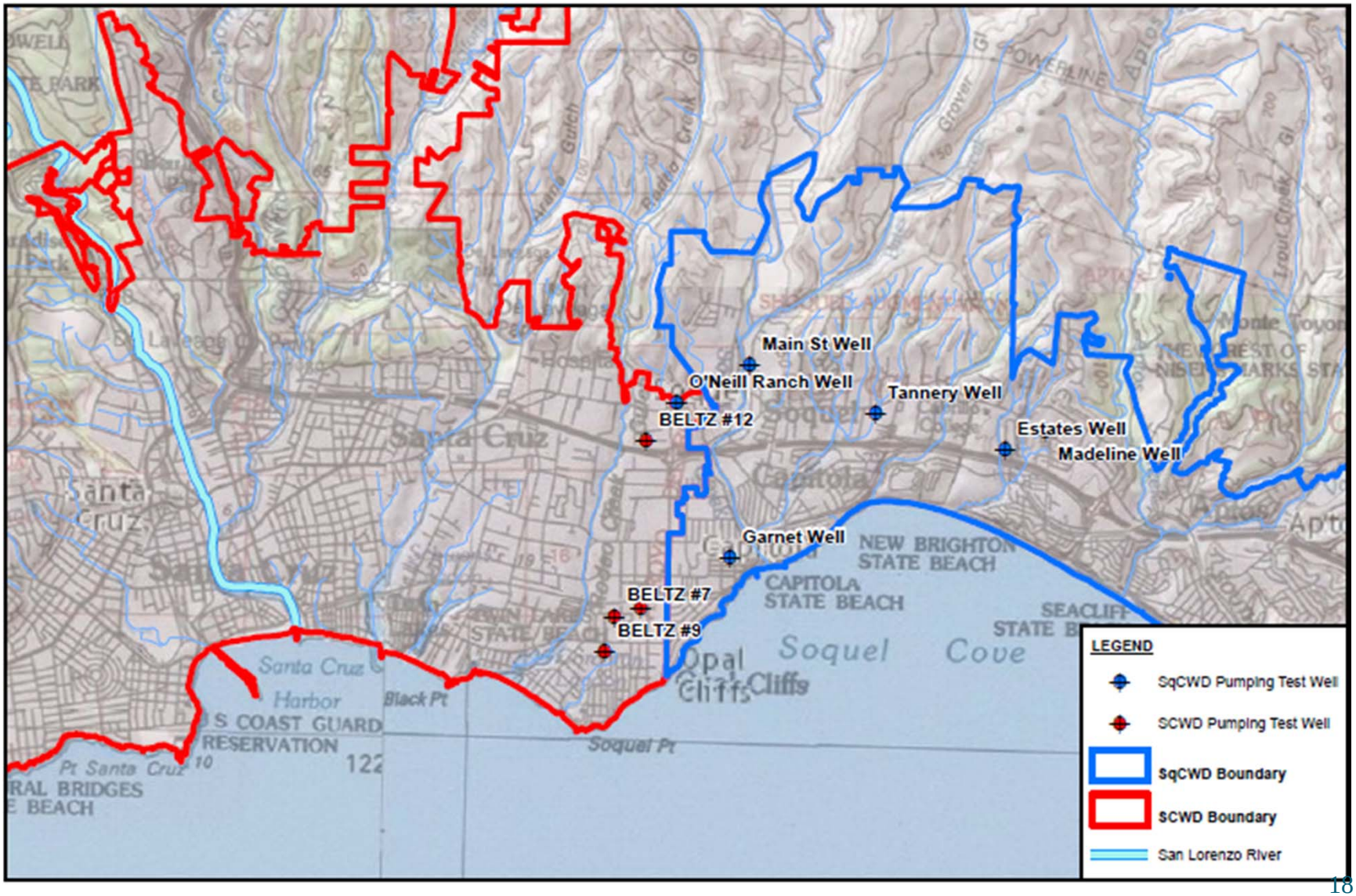
Source: Hopkins (2010), modified by PWR

Purisima X-Section B-B’

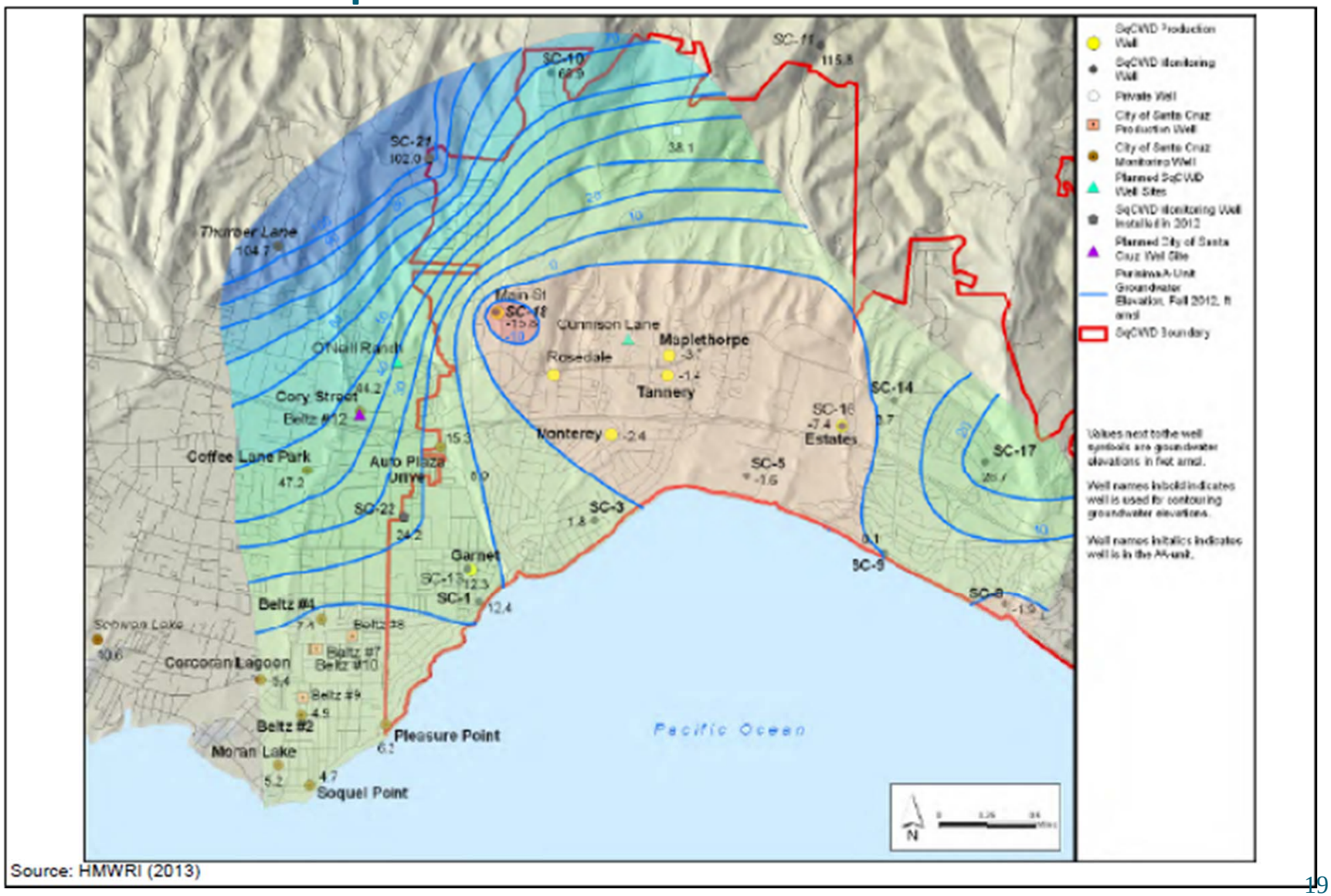


Source: Hopkins (2010), modified by PWR

Well Location Map – Purisima Aquifer

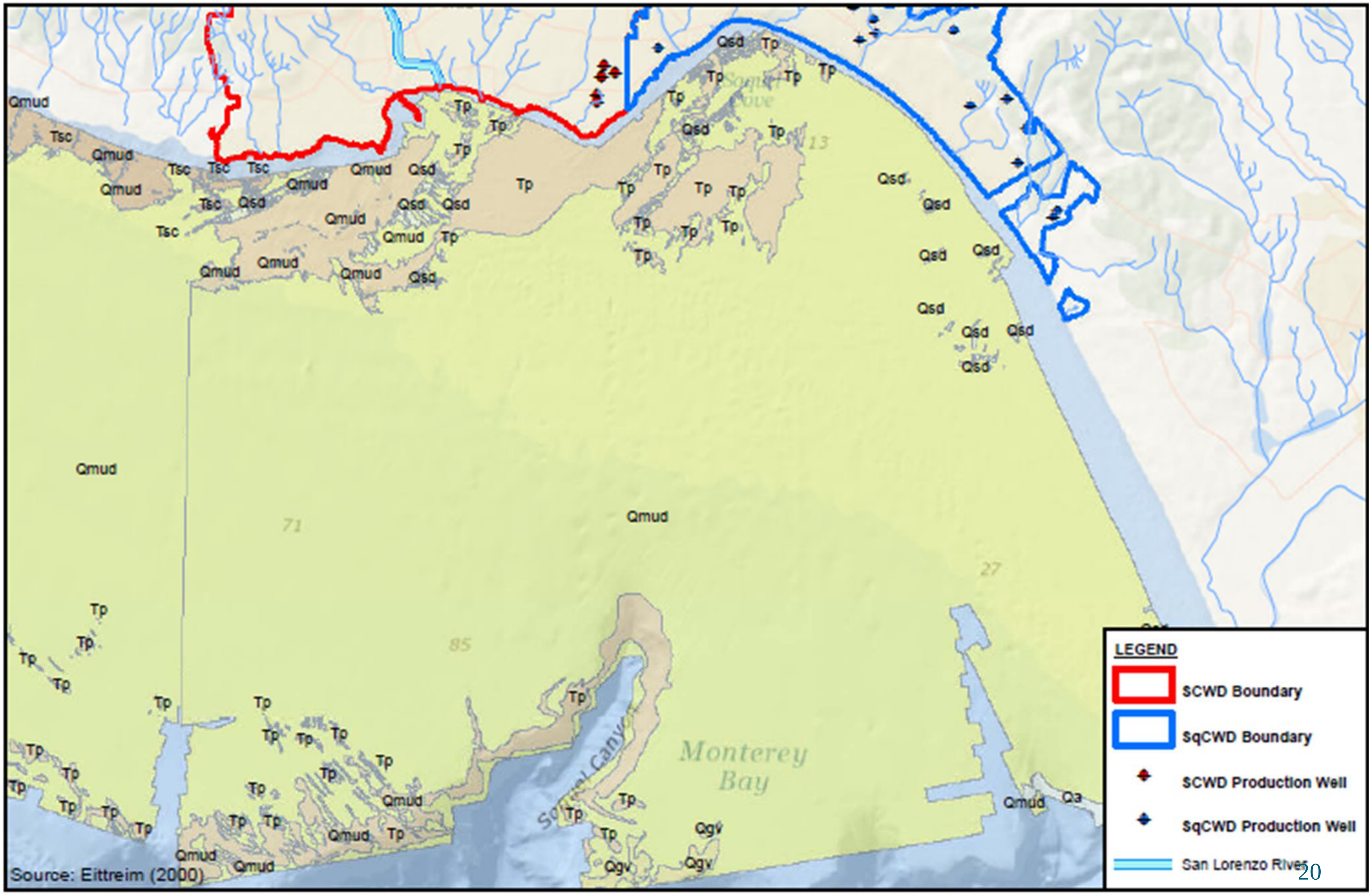


Purisima Aquifer Water Levels – Fall 2012

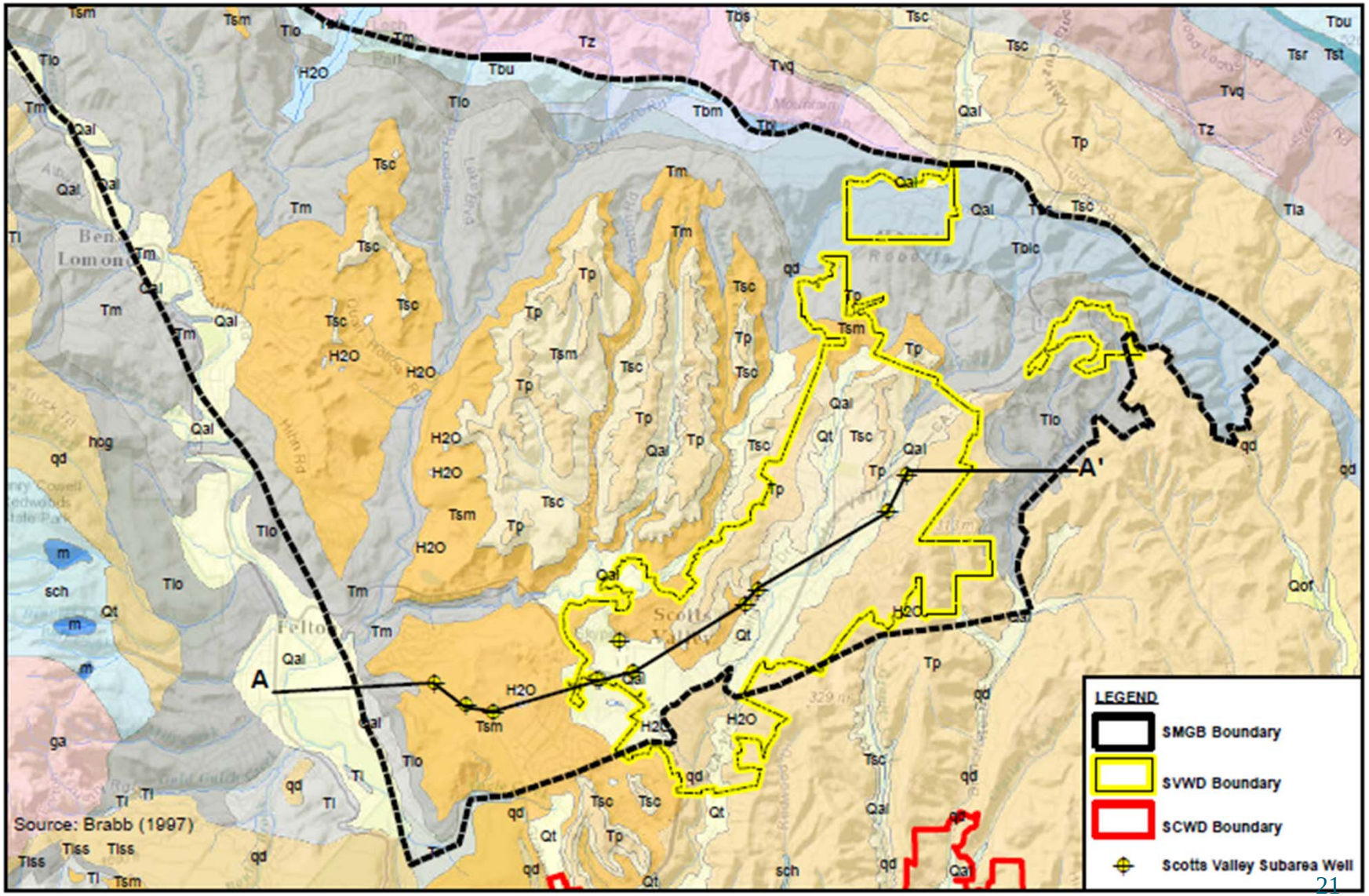


Source: HMWRI (2013)

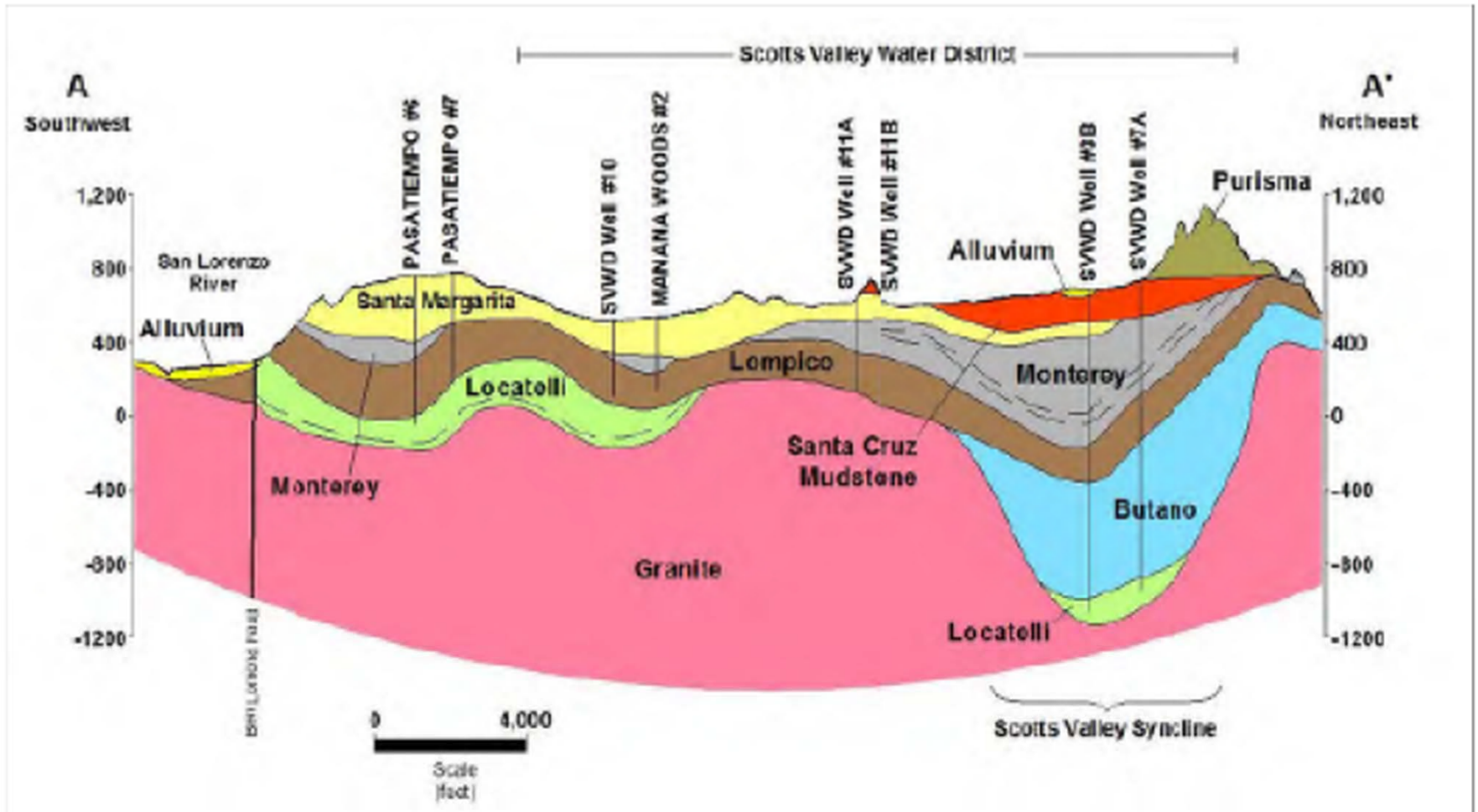
Offshore Geologic Map



Geologic Map – Santa Margarita Basin

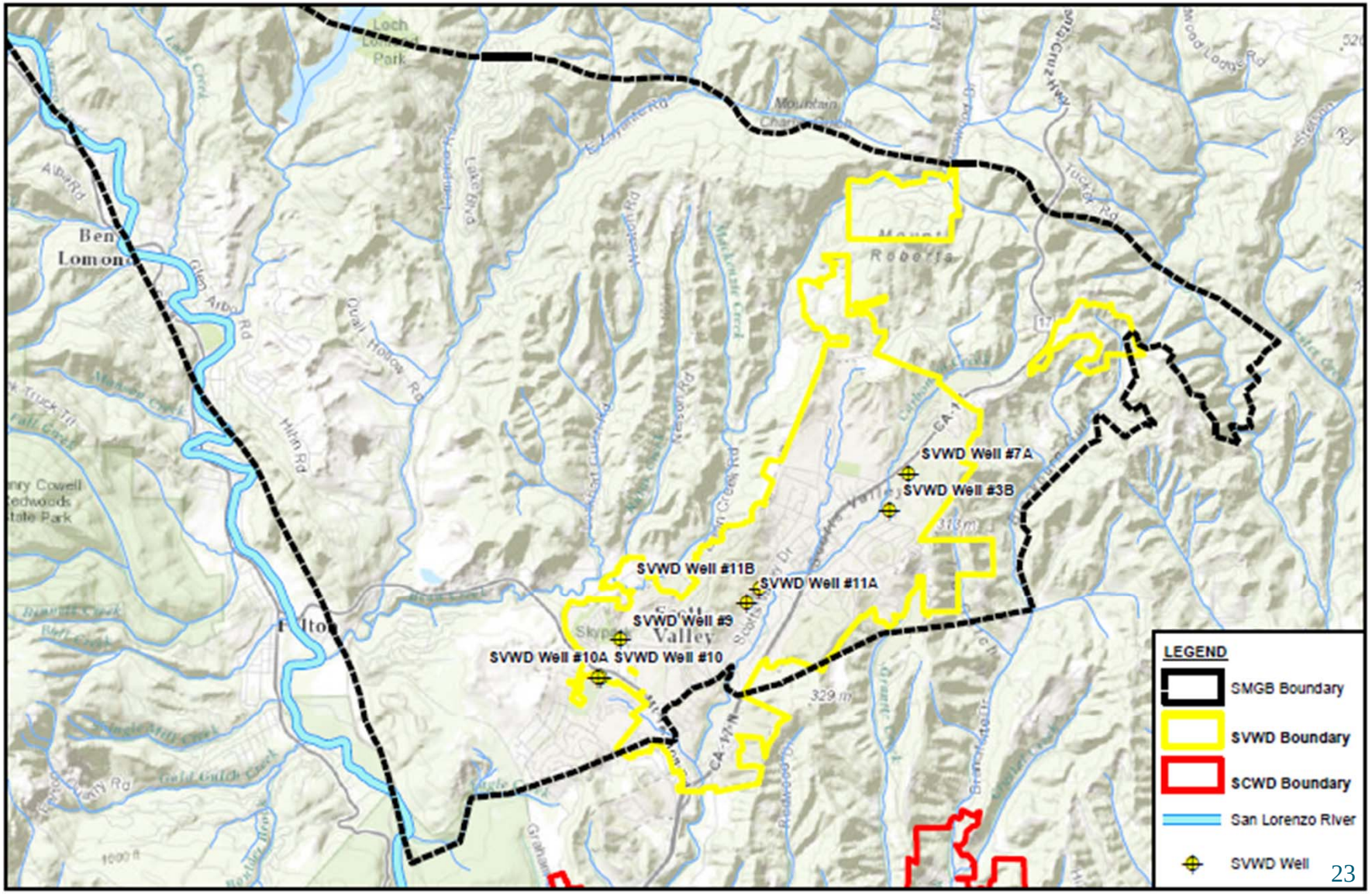


Scotts Valley Subarea X-Section A-A’

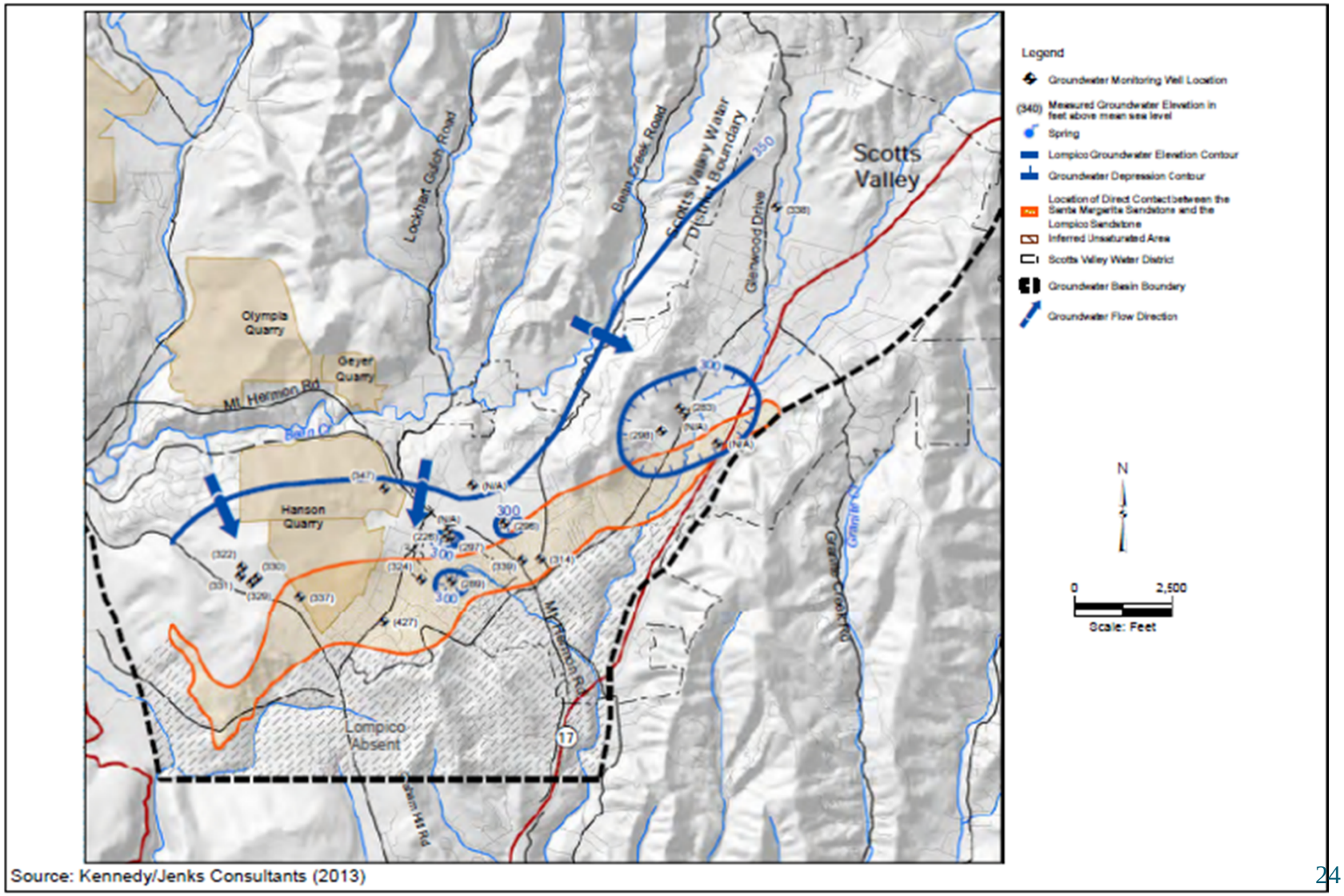


Source: Kennedy/Jenks Consultants (2011)

Well Location Map – SVWD



Scotts Valley Subarea (Tlo) Water Levels



Source: Kennedy/Jenks Consultants (2013)

Recon-Level Evaluation Findings
1 - Source Water Availability

- **Water Transfer Study - Confluence Modeling (Fiske 2013):**
  - **Current Tait/GHWTP Capacity = 145 mgy (445 afy)**
  - **Improved Tait/GHWTP Capacity = 558 mgy (1,712 afy)**

Recon-Level Evaluation Findings
2 - Infrastructure Capacity

- **Existing Tait/GHWTP Facilities = 10 mgd**
  - **2 mgd of Excess Capacity (145 mgy / 445 afy)**
- **Potential Improved Tait/GHWTP Facilities = 16 mgd**
  - **8 mgd** of Excess Capacity (558 mgy / 1,712 afy)

Recon-Level Evaluation Findings

3 - Available Groundwater Storage Capacities

First-Approximation Estimates

- **Based on Estimated Historical Storage Depletion**
  - Estimated Water Balances for Each Basin
  - Long-Term Overpumping = Cumulative Storage Loss
- **S-AGB (Purisima Aquifer)**
  - 3.3 bg (10,100 af) (HMWRI, 2012)
- **SMGB (Scotts Valley Subarea)**
  - 3.6 bg (10,990 af) (KJ, 2013)

❖ **9.9 bg (21,000 af) Combined**

Recon-Level Evaluation Findings
4 - Potential Well Injection Capacities

- **Two Main Factors Affect Injection Capacity:**
  1. **Available "Freeboard" in Water Levels**
  2. **Well Performance (Specific Capacity / Injectivity)**
- **Existing Wells in All 3 Water Service Areas Evaluated:**
  - **SCWD: 5 Wells (Purisima Aquifer)**
  - **SqCWD: 12 Wells (Purisima Aquifer)**
  - **SVWD: 6 Wells (Scotts Valley Subarea)**

Recon-Level Evaluation Findings
4 - Potential Well Injection Capacities

- **Purisima Aquifer (SCWD and SqCWD)**
  - **~ 0.5 mgd (350 gpm) per well**
- **SMGB (SVWD)**
  - **~ 0.35 mgd (250 gpm) per well**

Recon-Study Recommendations

1. **Perform Site-Specific ASR Well Analysis**
   a. Refined Injection Capacity Analysis
   b. Geochemical Interaction Modeling
2. **Implement Pilot ASR Testing at Existing Well**
   a. Confirm Injection / Recovery Capacity
   b. Well Plugging Rates
   c. Evaluate Water-Quality Interactions
   d. Monitor Aquifer Hydraulic Response to ASR
   e. Establish O&M Parameters
3. **Perform Hydraulic Modeling of SCWD Distribution System**
   a. Confirm Hydraulic Capacity to Convey Flows to/from ASR Sites
4. **Perform Groundwater Modeling of ASR / IPR Scenarios**
   a. Evaluate Potential for Hydraulic Losses
   b. Optimal ASR / IPR Well Spacing
   c. IPR in Conjunction With ASR