Soquel-Aptos Basin Groundwater Modeling for Evaluating Water Supply Options

City of Santa Cruz Water Supply Alternatives Committee
Community Workshop
August 26, 2015

Hydro Metrics WRI

Outline

- Introduction to Basin Hydrogeology
- Seawater Intrusion Risk and Basin Overdraft
- Regional Groundwater Model Development
- Evaluating Water Supply Options with Regional Model

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Introduction to Basin Hydrogeology

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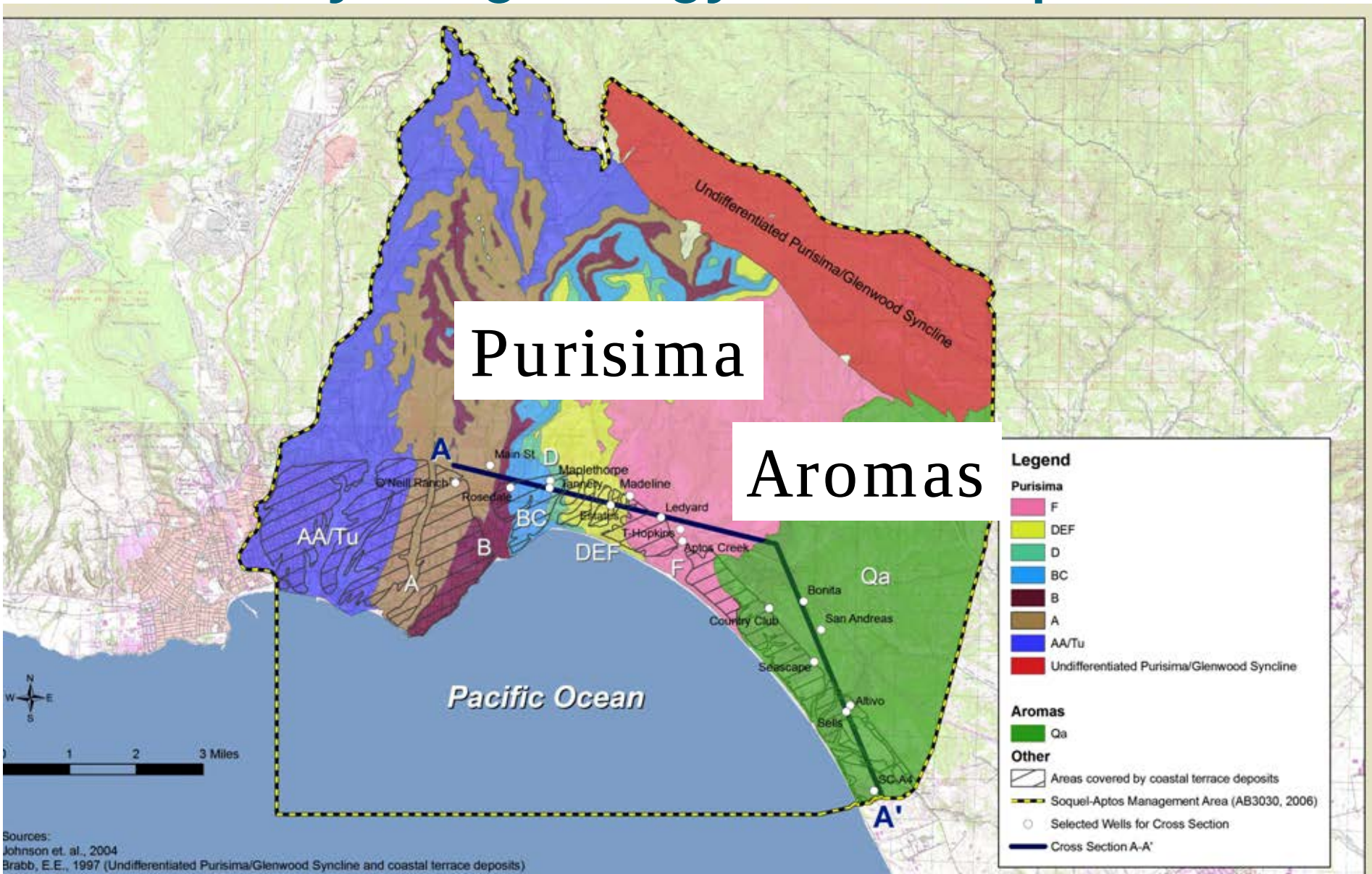
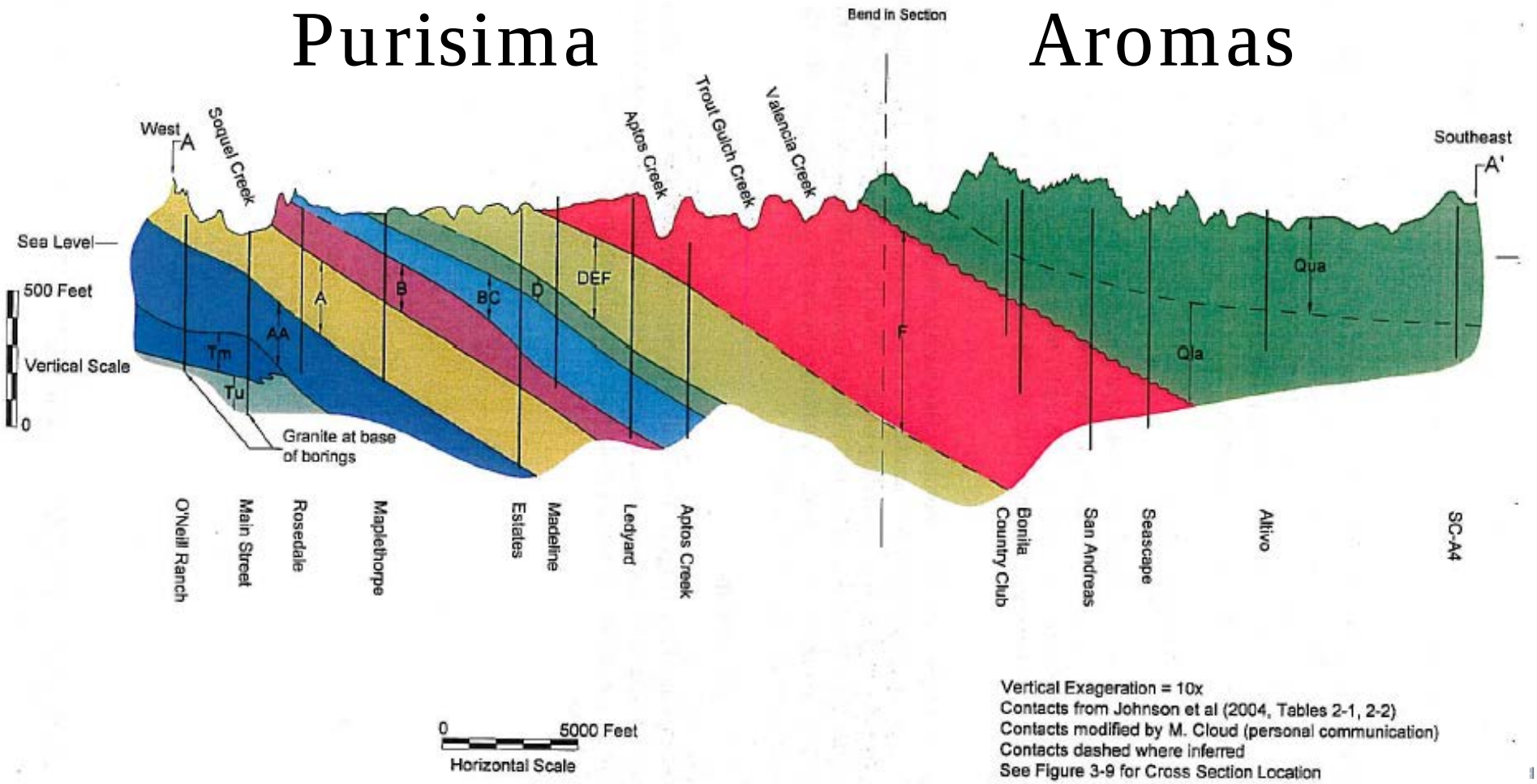
Basin Hydrogeology: Outcrops



Basin Hydrogeology: Cross-Section



Seawater Intrusion Risk and Basin Overdraft

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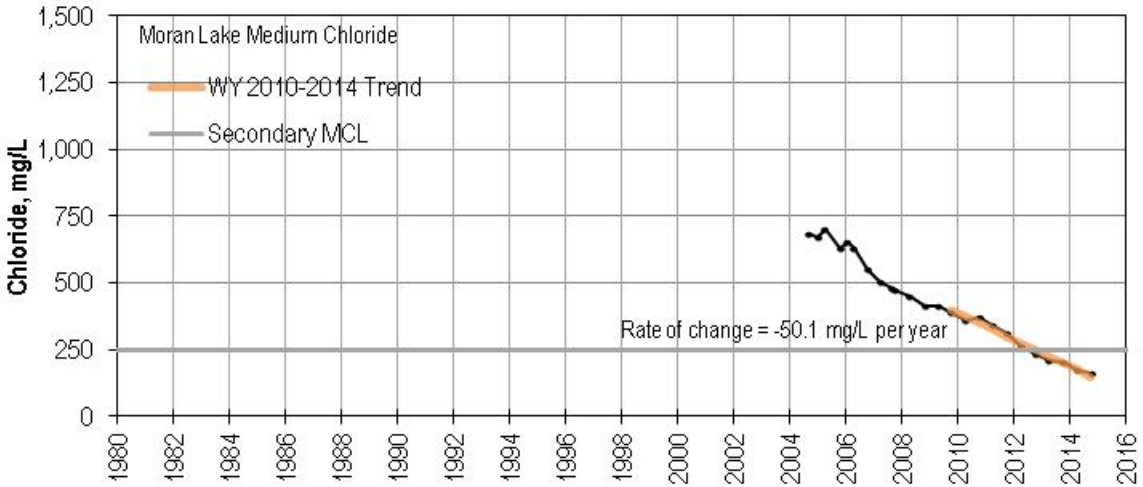
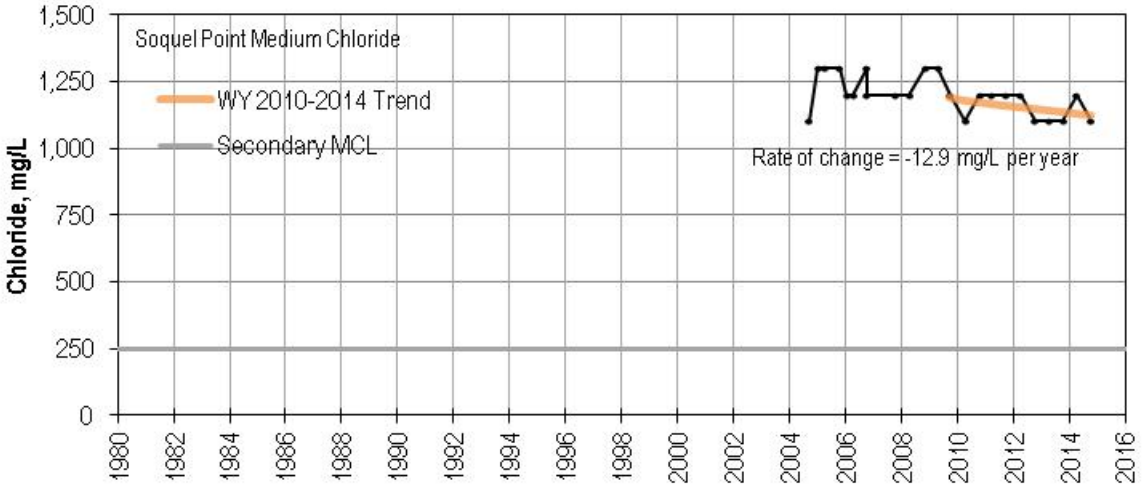
Coastal Well Chloride Concentrations

Historical Seawater Intrusion in City Purisima A Unit Monitoring Wells

Moran Lake

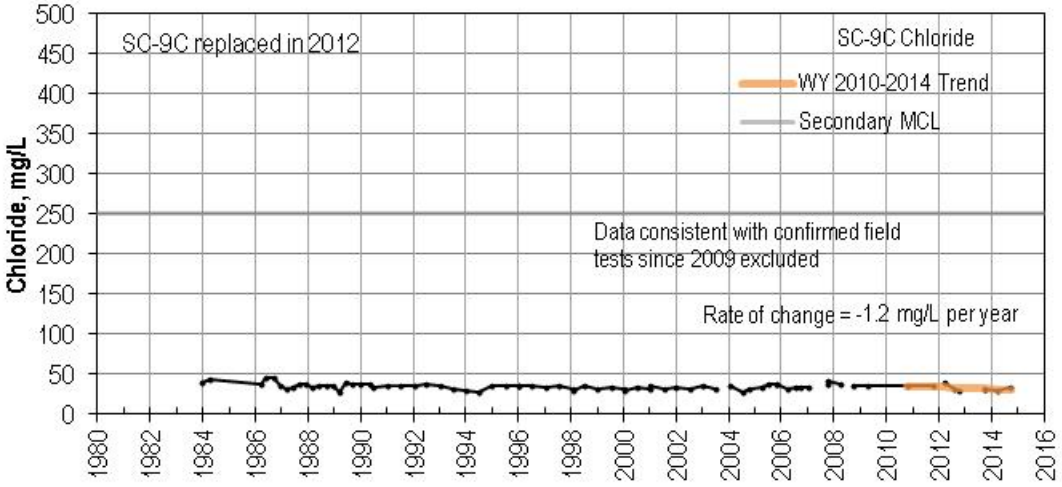


Soquel Point

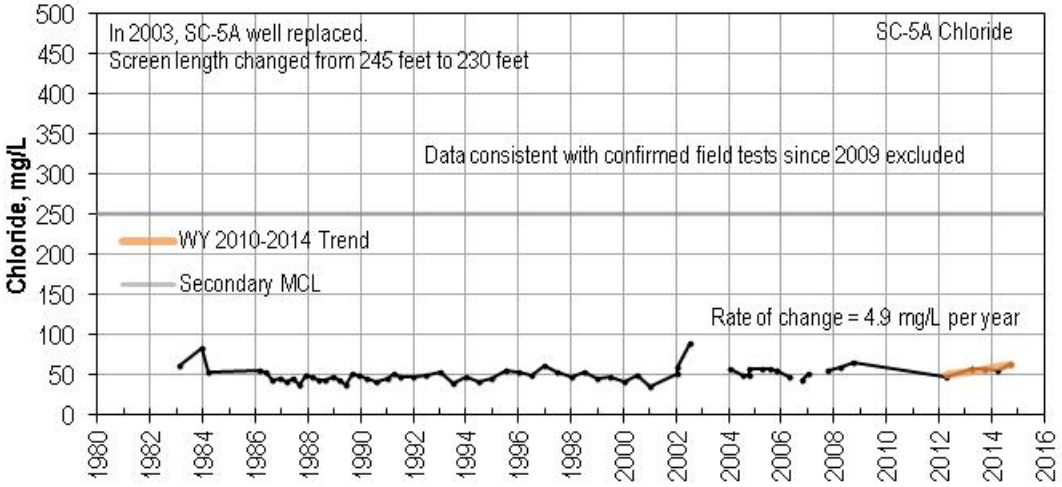


Seawater Intrusion Not Observed in SqCWD Purisima Monitoring Wells

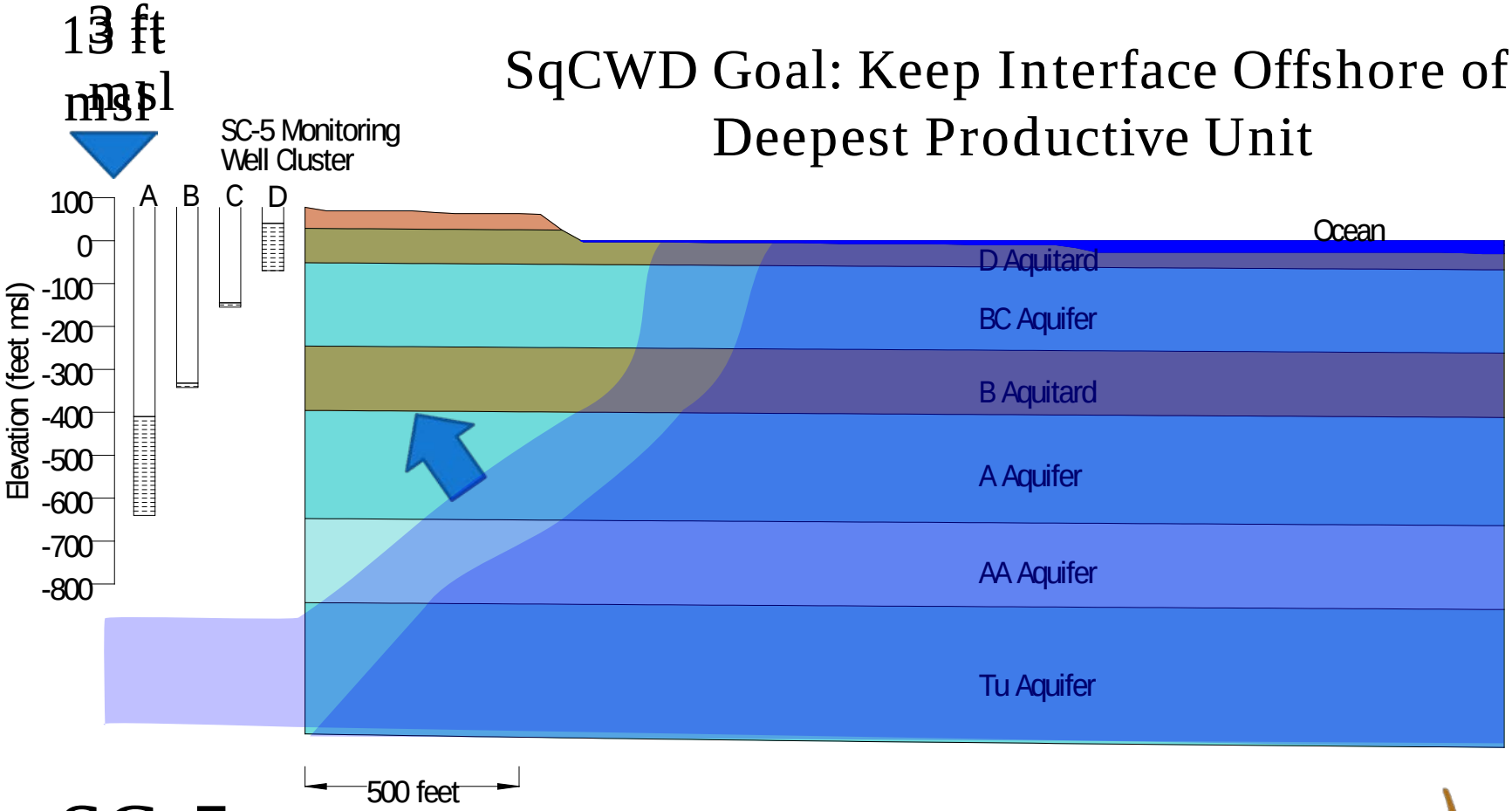
SC-9C
(Purisima BC)



SC-5A
(Purisima A)



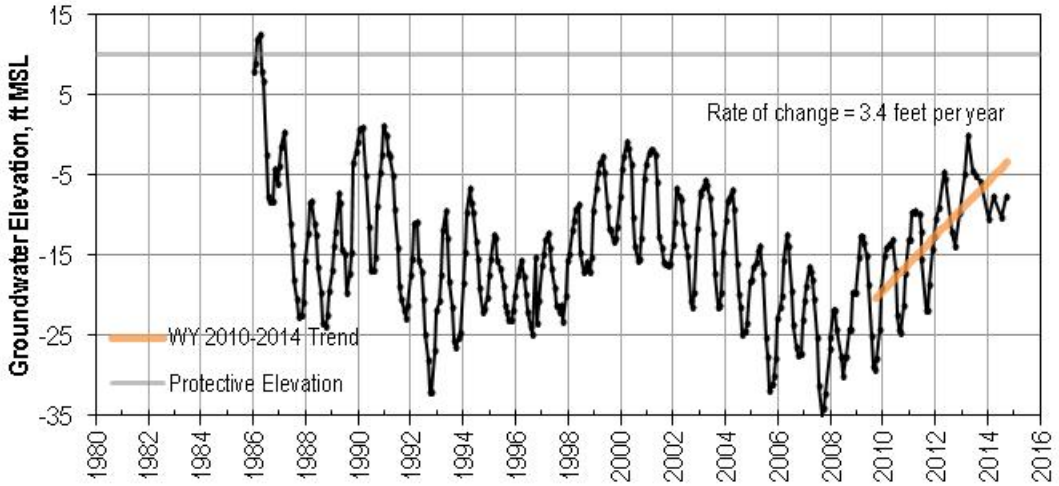
Protective Elevations to Prevent Seawater Intrusion in Purisima



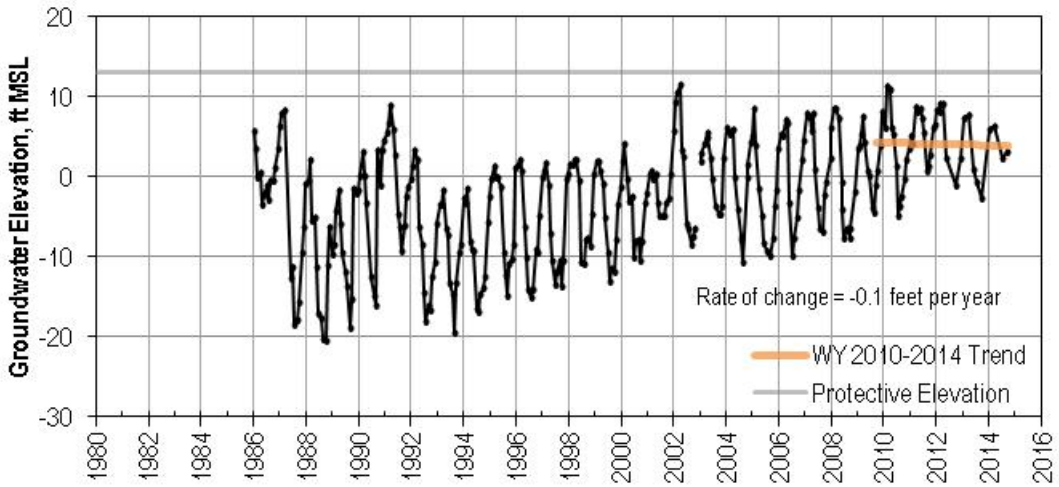
SC-5

SqCWD SC-5 and SC-9 Below Protective Elevations

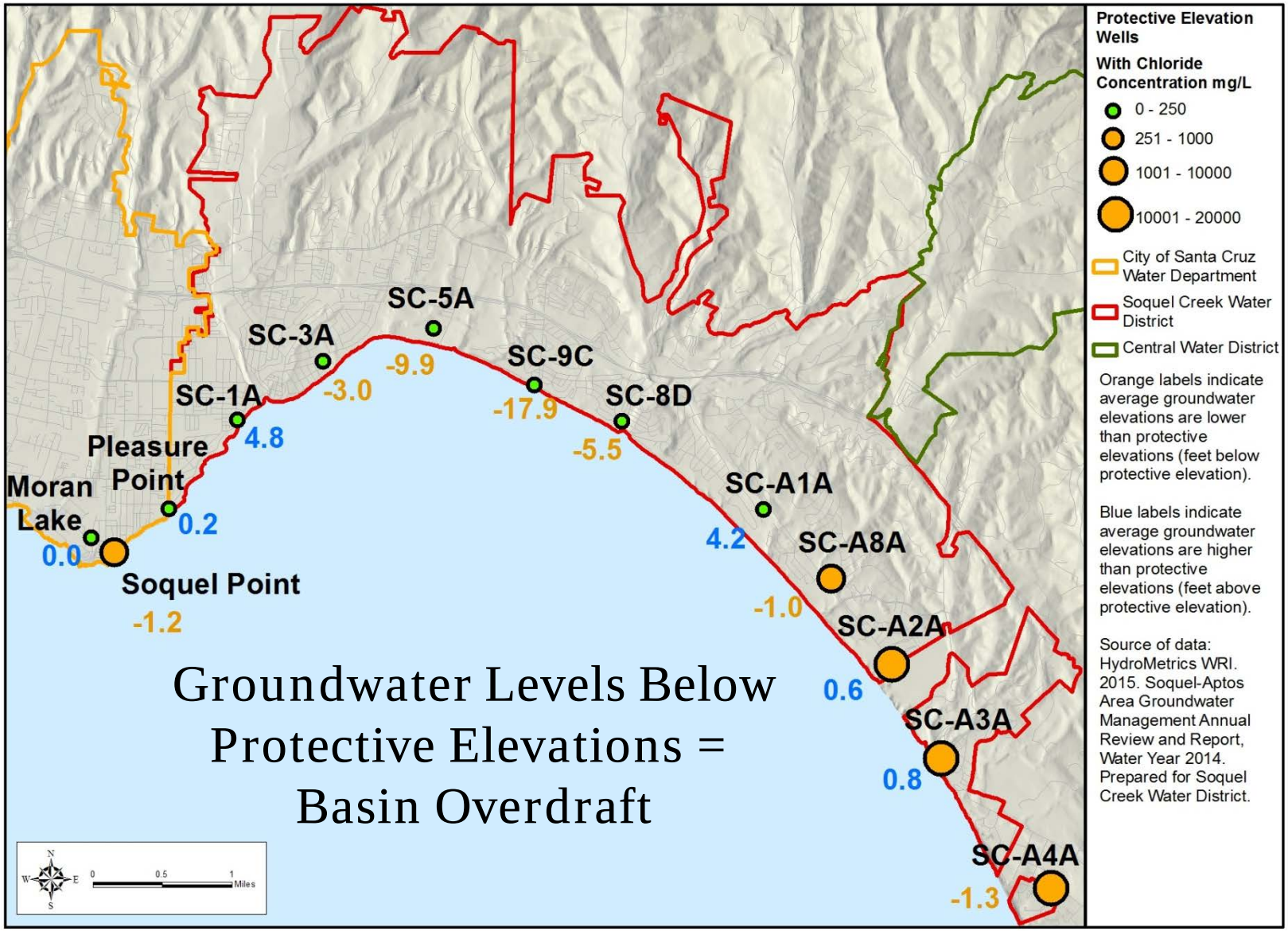
SC-9C
(Purisima BC)



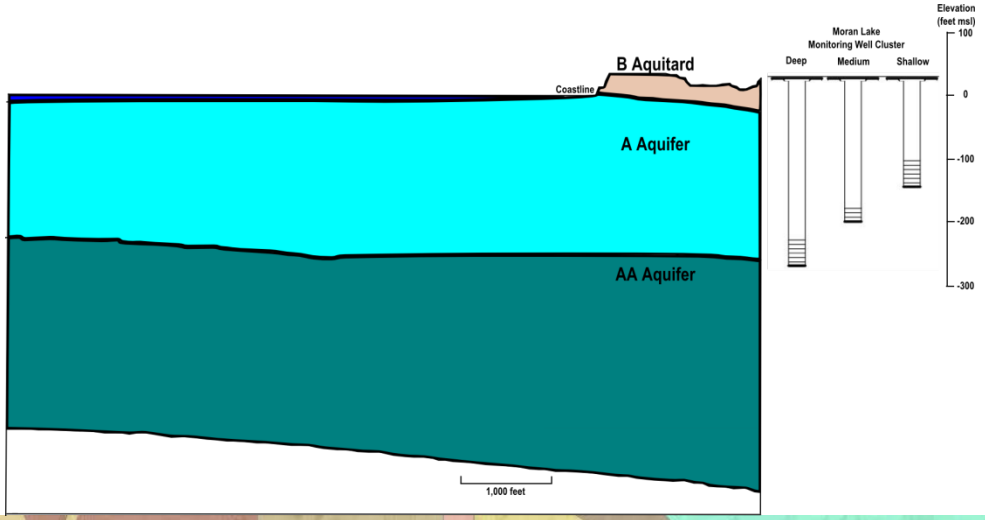
SC-5A
(Purisima A)

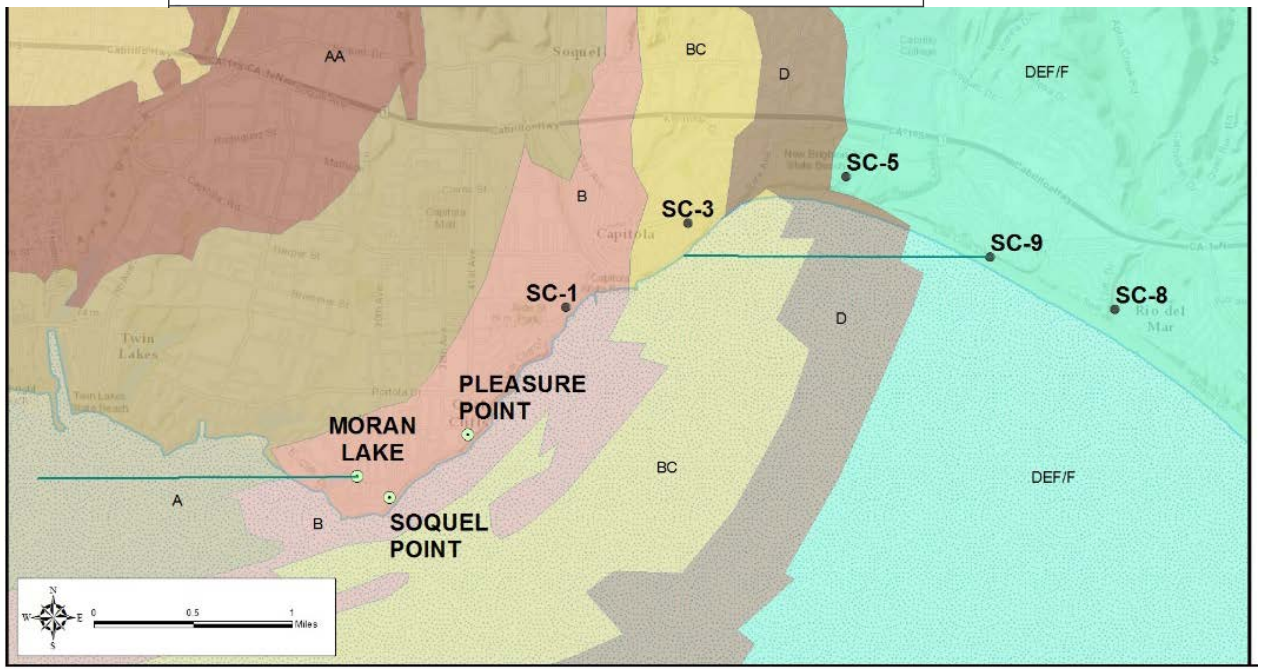


Current Levels vs. Protective Elevations



Modified Cross-Sectional Models





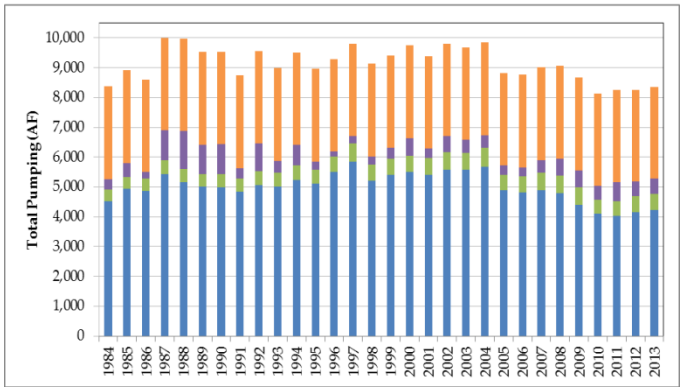
Regional Groundwater Model Development

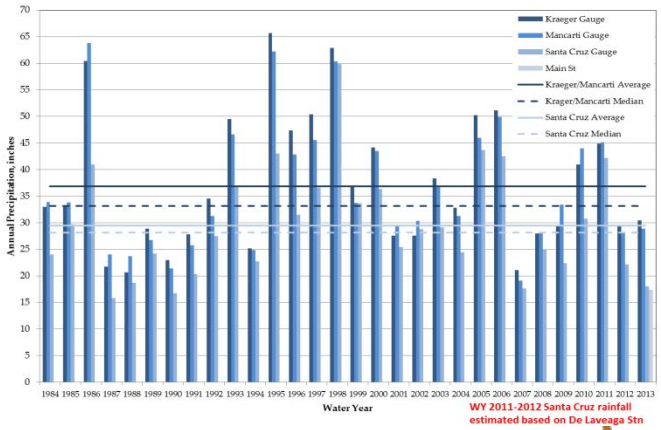
Model Use Priorities

- Consensus developed in scoping meetings
  - SqCWD, CWD, City of Santa Cruz, County, PVWMA, USGS, HydroMetrics WRI
- Model to be used to evaluate future condition of groundwater basin
  - Prioritize model inputs to change
  - Prioritize model outputs to evaluate

Priorities for Future Model Inputs

- Pumping
  - Overall quantities
  - Locations
  - Non-agency estimates
- Supplemental Supplies
  - Recharge or Injection
- Hydrologic Conditions
  - Climate Change





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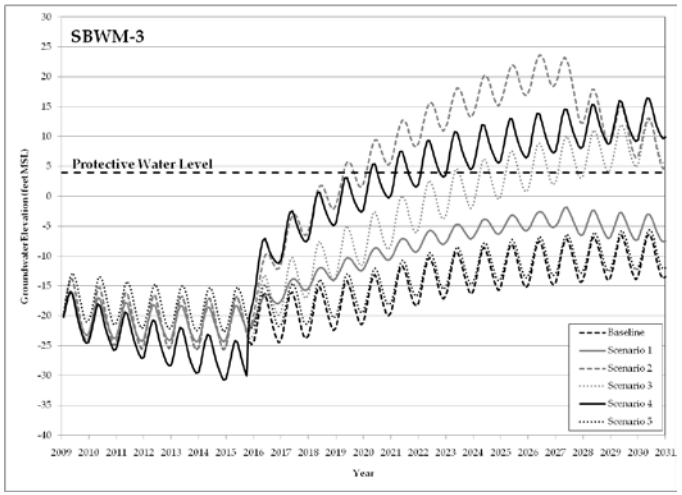
Priorities for Evaluating Model Outputs

- Comparing groundwater levels to protective elevations to prevent seawater intrusion
  - Time for basin recovery
- Effects on stream flow
- Movement of seawater interface

Seaside Model Example



Model Capabilities

- GSFLOW
  - USGS code integrating watershed and groundwater
  - PRMS for watershed surface flows
  - MODFLOW for groundwater flows
- Streamflow Routing (SFR2)
- Sharp Seawater Interface (SWI2)
  - USGS to incorporate into GSFLOW code
- Multi-Node Well (MNW2)
  - Production wells screened across multiple units

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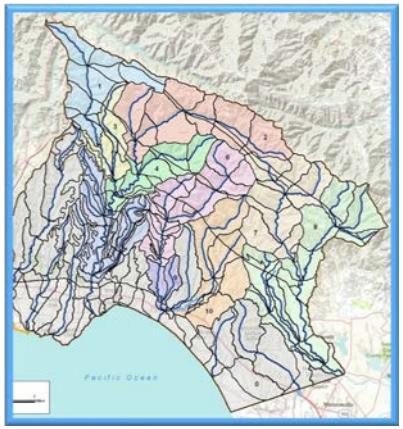
Work Plan Process

Existing PRMS

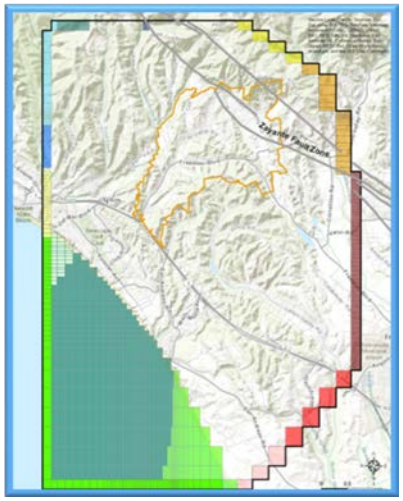


Task 2

Grid-Based PRMS

Surface

Sub-Surface



CWD Model

Task 3

MODFLOW

Task 4

GSFLOW

Task 5

Simulations

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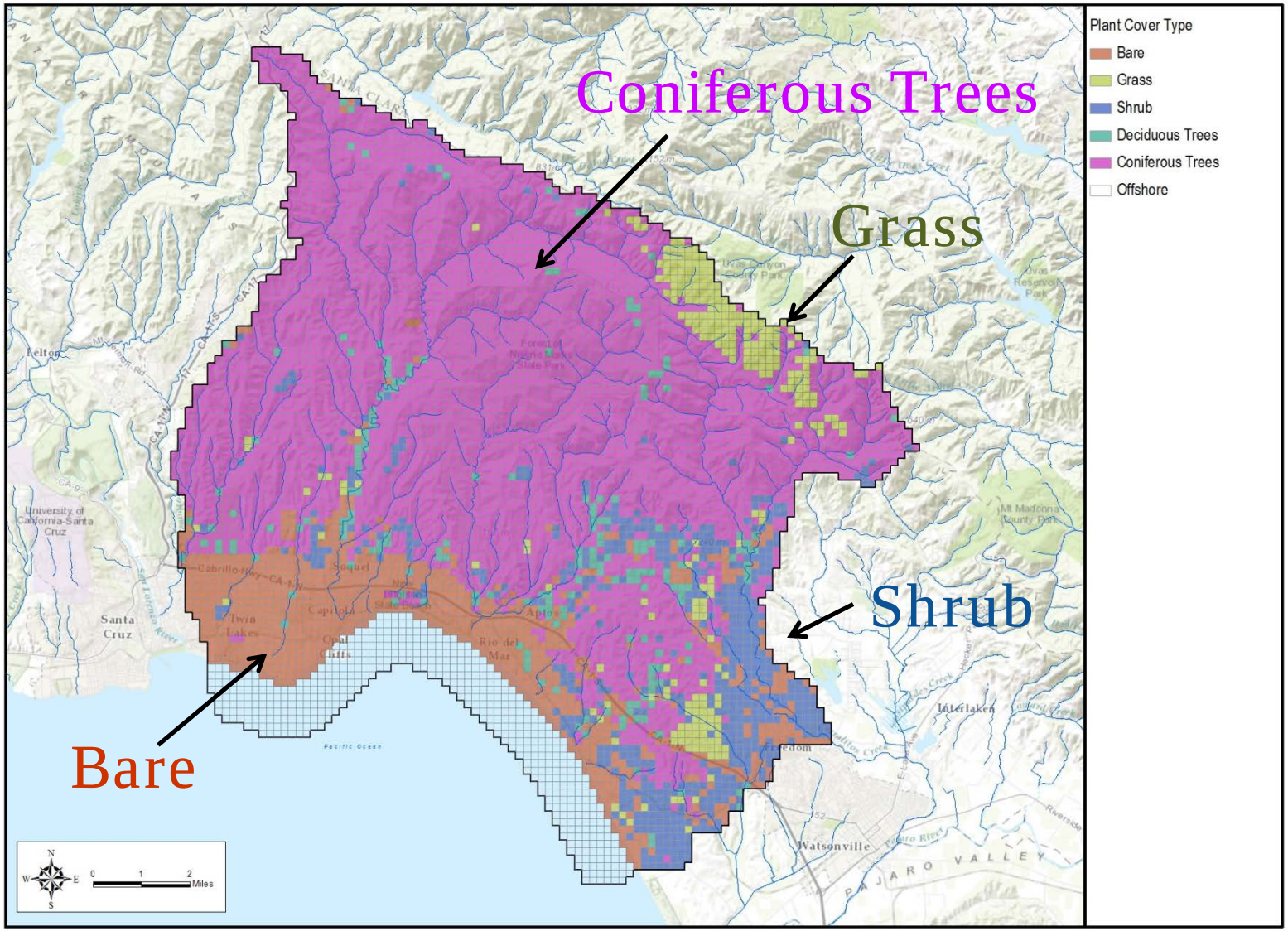
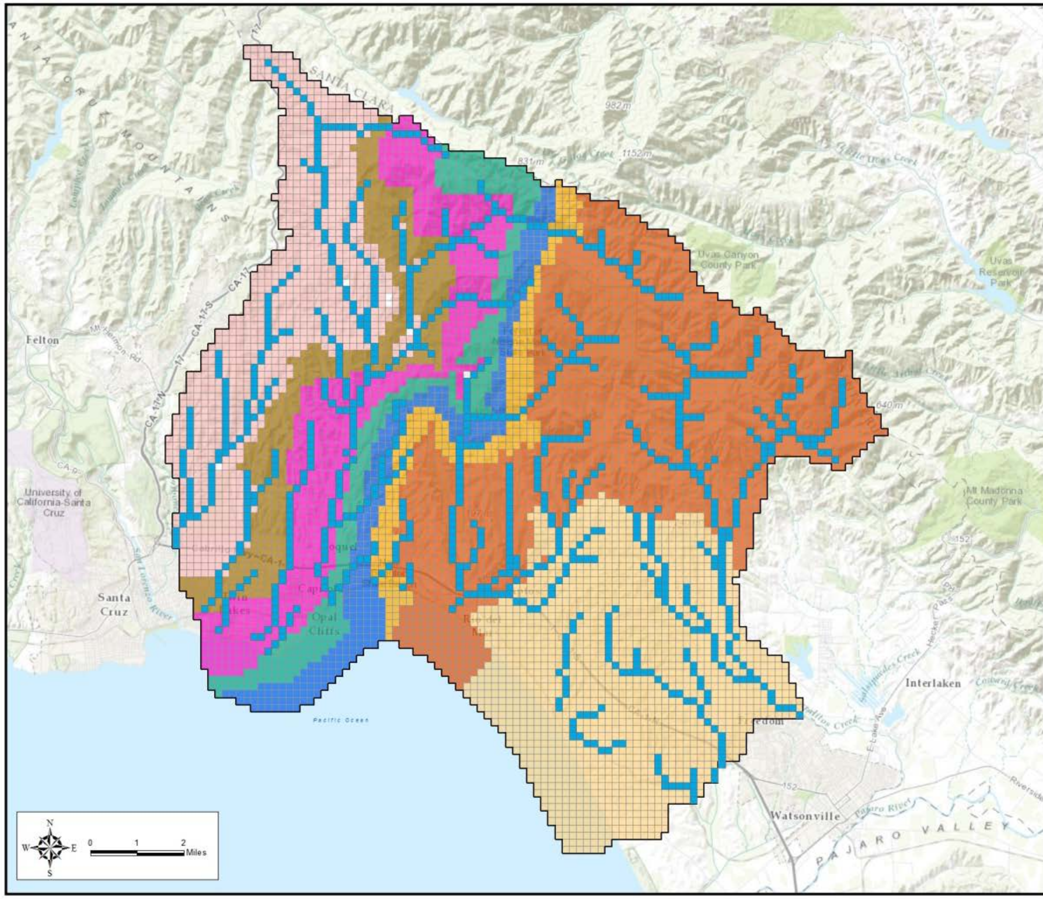
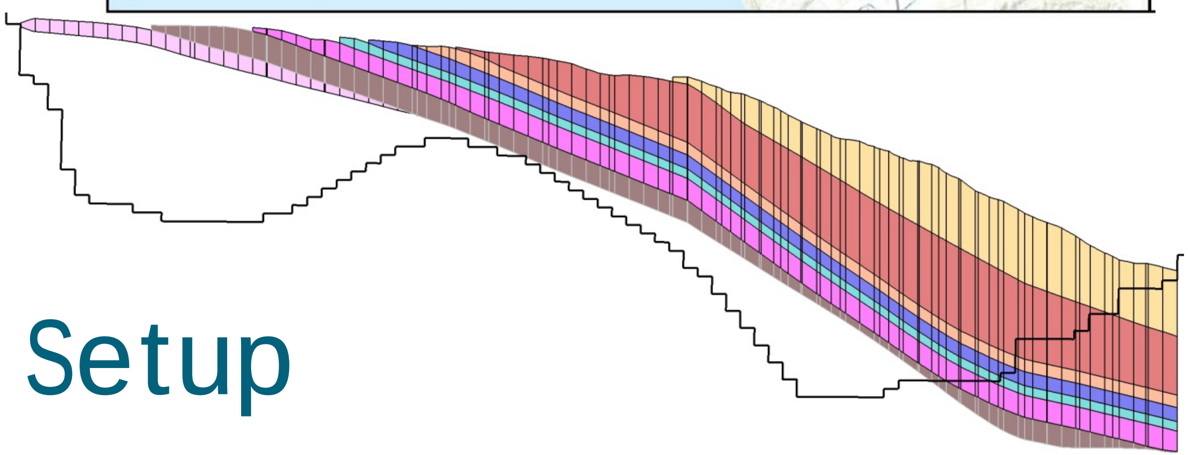
Watershed Model Plant Cover Type



Materials

- Aromas
- DEF-F
- D
- BC
- B
- A
- AA
- Tu inter
- Granite





Model Setup

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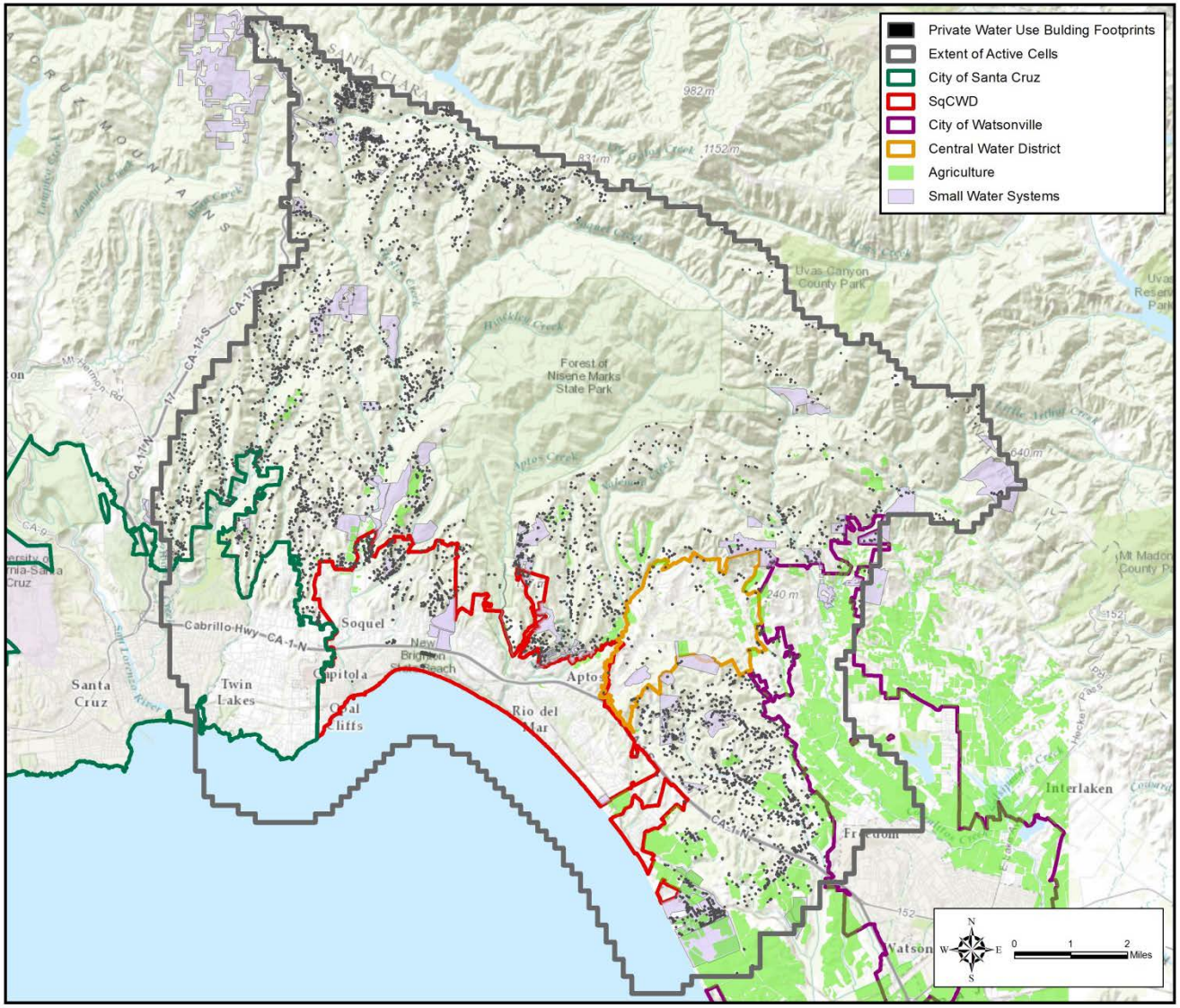
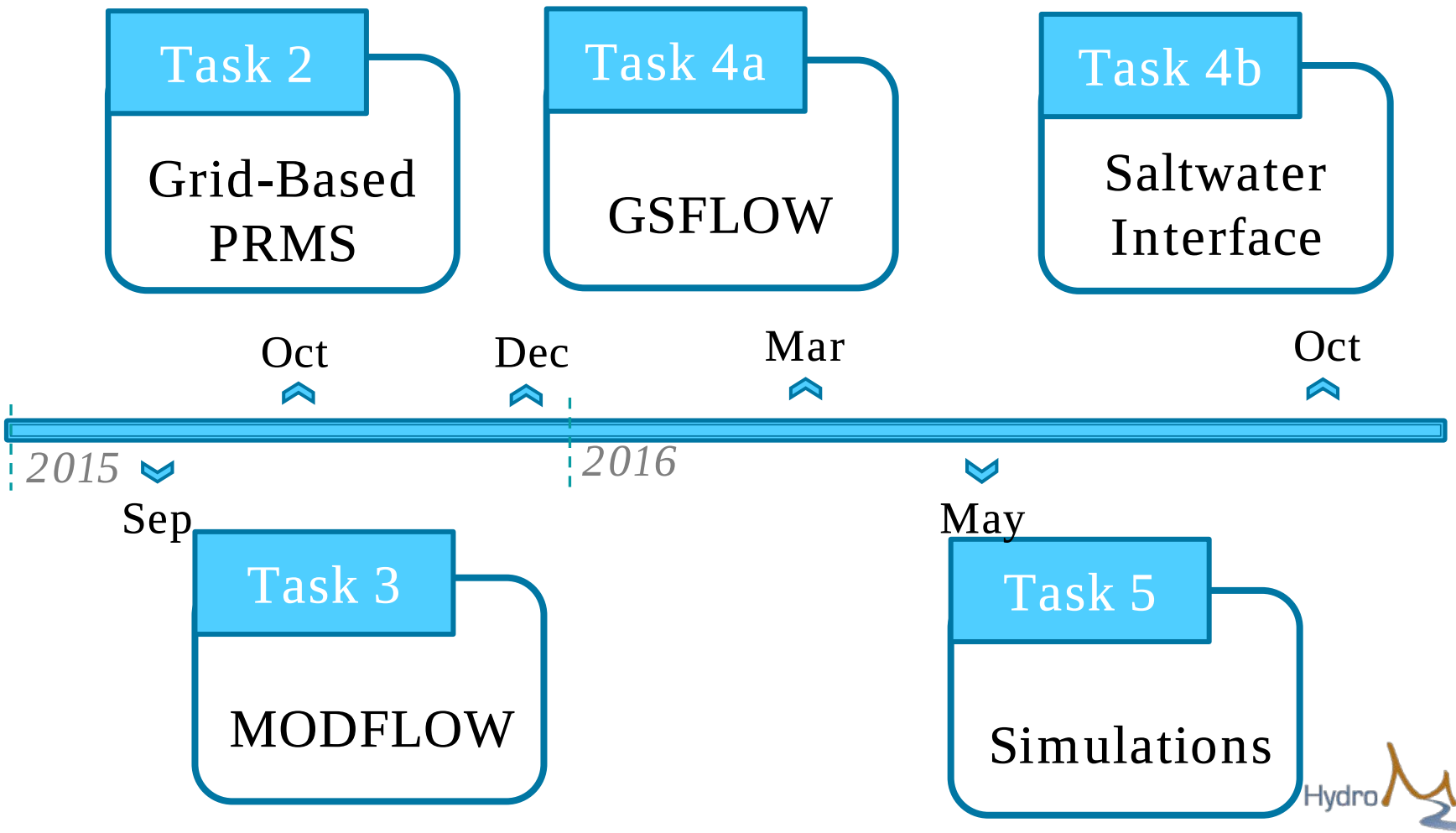
Pumping & Return Flow



Milestones

Interim draft tech memos for review by staff and Technical Review Committee



Evaluating Water Supply Options with Regional Model

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Model Simulations of Water Supply Options

Water Supply Option	Regional Model Input
Surface Water Transfer (and other in-lieu sources)	Reduce pumping and modify pumping distribution
Drought Supply	Increase and reduce pumping based on hydrology
Aquifer Storage and Recovery of Surface Water	Injection and pumping into Tu and/or Purisima A Units
Groundwater Replenishment by Recycled Water	Injection into Purisima A and/or BC Units
Distributed Stormwater Collection and Recharge	Injection, increase recharge, or add surface water at local sites identified

Evaluating Initial Simulations

- Groundwater levels
  - Do they recover to protective elevations?
  - How long is the recovery?
  - Are average groundwater levels maintained at protective elevations after recovery?
- Streamflow effects
  - What are relative effects on streamflow between different simulations?
  - Which streams are affected most?

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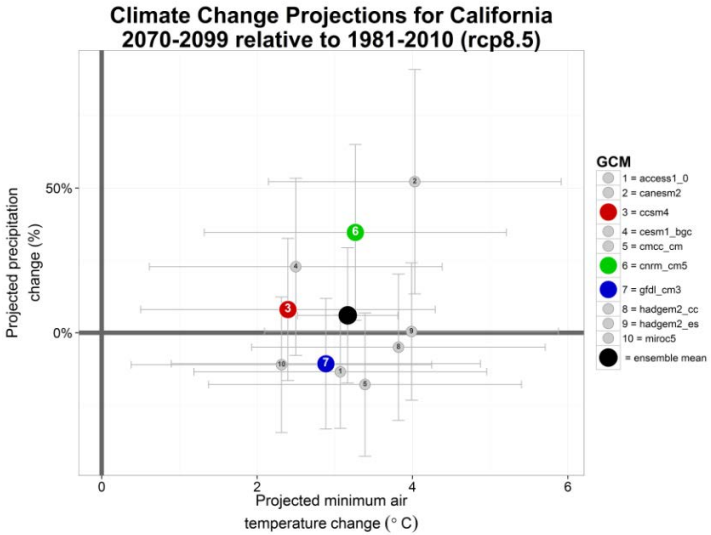
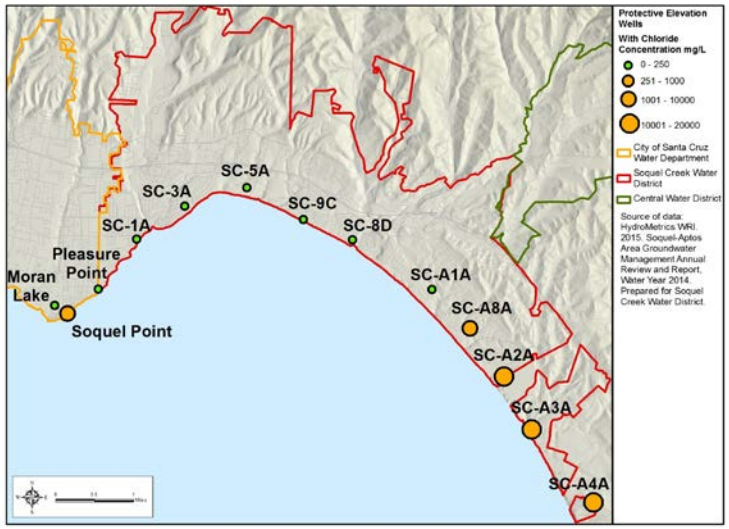
Evaluation of Recommended Alternative

- Evaluate Climate Change Scenarios
  - Downscaling by USGS
- Quantify model uncertainty
  - Based on calibration error
- Evaluate potential movement of seawater interface
  - Need assumption of location in Purisima





Questions

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