Enhanced Recharge Studies:
Stormwater Management/Groundwater Recharge & Groundwater Banking Feasibility

Santa Rosa Plain Basin Advisory Panel
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SONOMA COUNTY WATER AGENCY

Water Resource Issues & Challenges

- Water Supply Reliability
- Operational Reliability
- Resilience Against Natural Hazards
- Adaption to Climate Change
- Balancing Surface Water & Groundwater

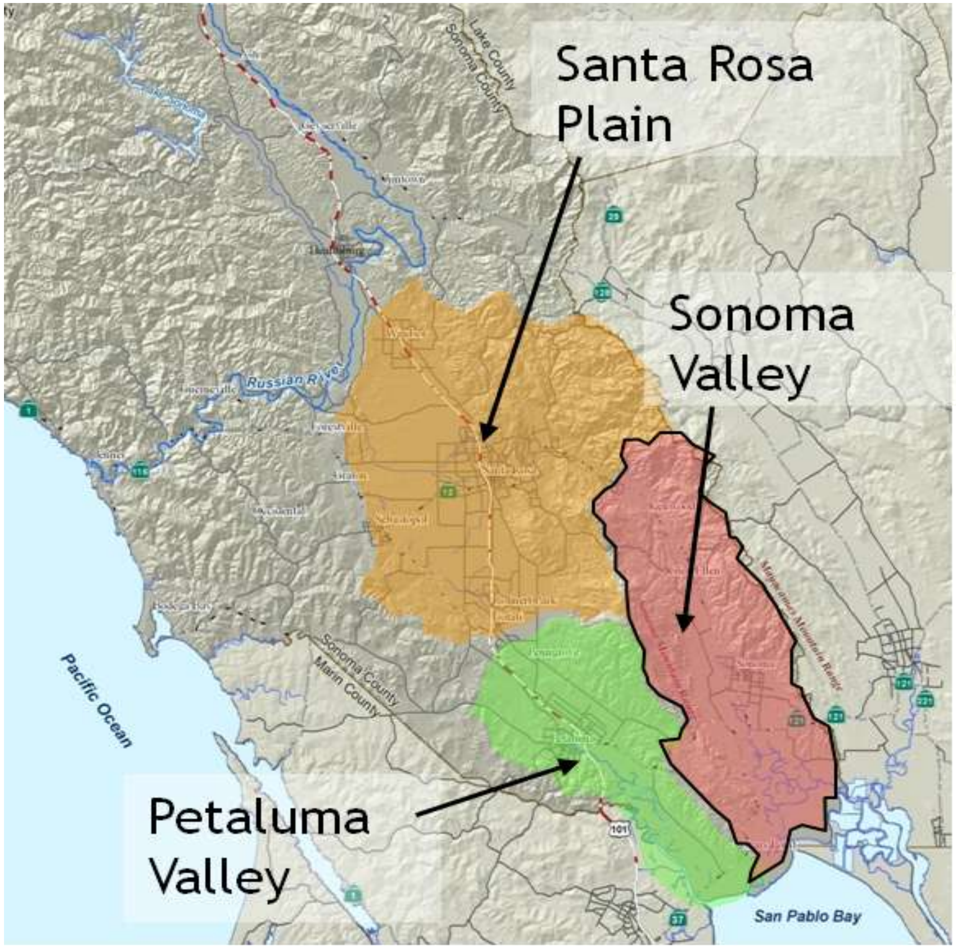
Management Strategies from Sonoma Valley GMP

- **CONSERVATION** of Urban, Non-Urban, & Agriculture
- **RECYCLED WATER** use to offset groundwater pumping
- **STORMWATER** to recharge of groundwater
- **BANKING** Russian River water to recharge groundwater basin

Combining Stormwater Management & Groundwater Recharge – Watershed Studies

<u>Goals and Objectives of Scoping Studies:</u>

- 3 Watersheds
- Strategically managing surface & groundwater improving flood protection & groundwater recharge
- Develop design strategies
- Grant funding opportunities
- Stakeholder Input



Core & Supporting Objectives

Flood Hazard Reduction

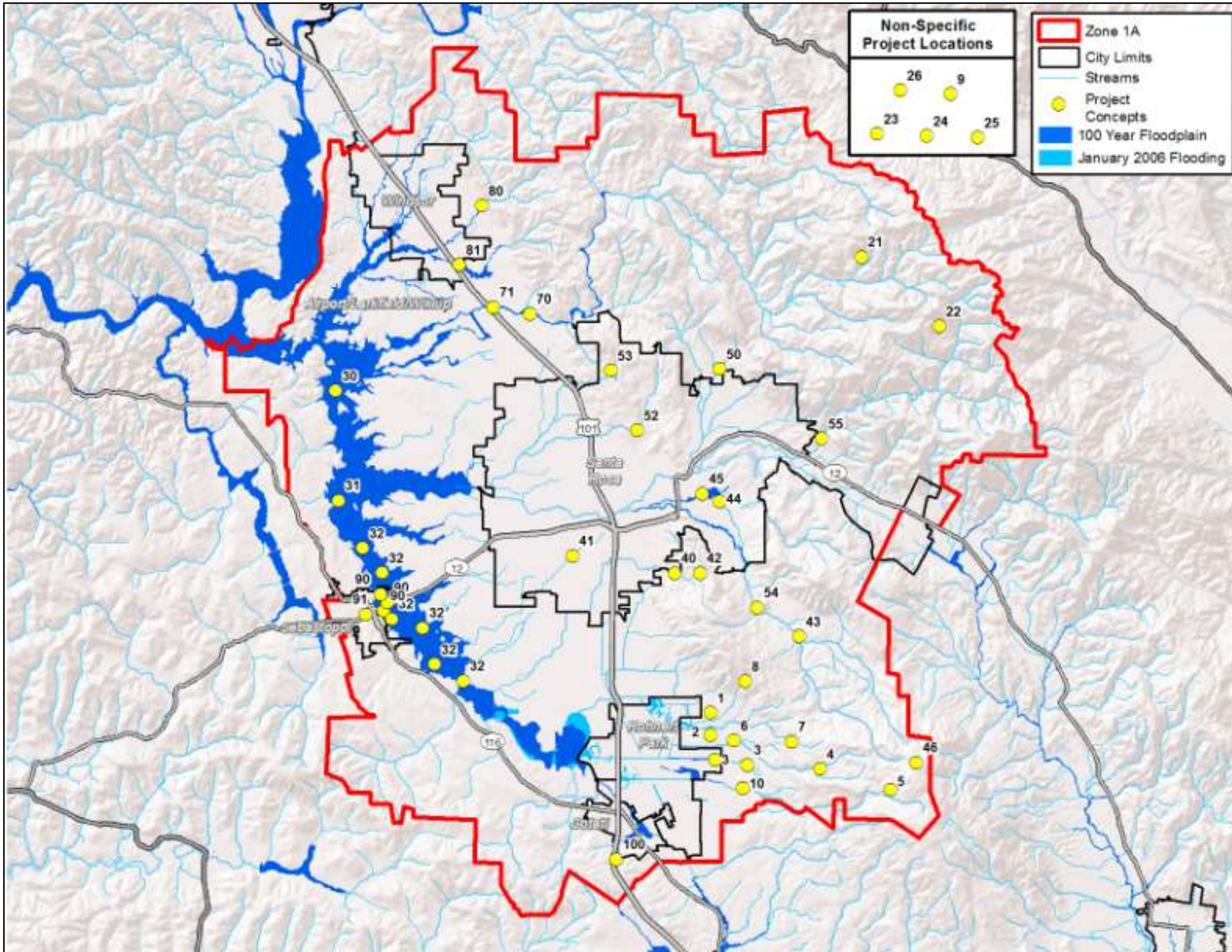
Groundwater Recharge

Water Quality	Water Supply	System Sustain-ability	Ecosystem	Ag-Land Preserv-ation	Open Space	Com-munity Benefits

Laguna-Mark West Watershed Project Concepts

- Floodplain Expansion
- Creek Daylighting
- Bypass Channel
- Detention Retention
- Channel Modification
- Sediment Reduction
- Reservoir Expansion
- Forest Restoration

Project Concepts



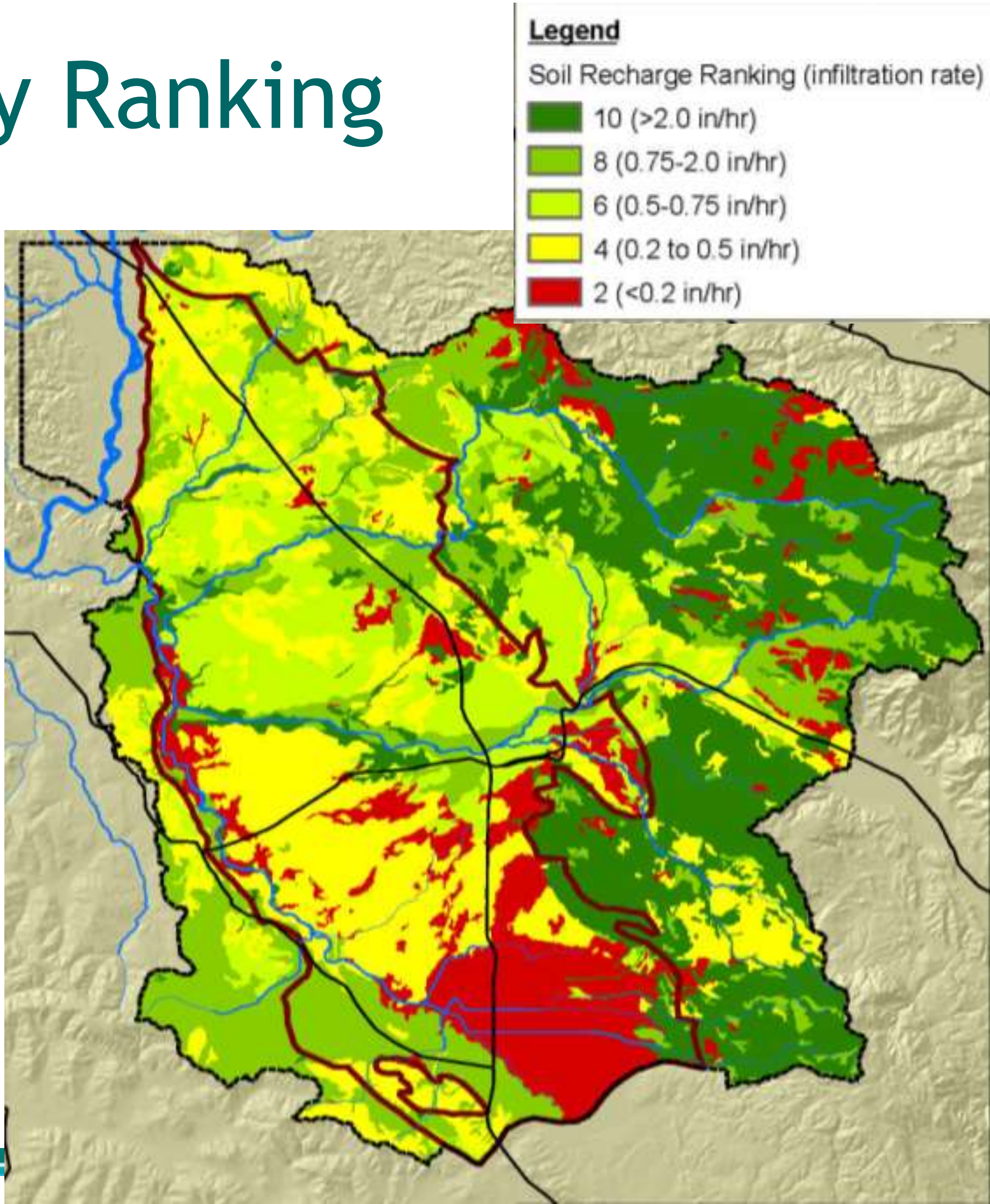
Recharge Potential Assessment

Recharge Maps

1. Natural Recharge: Soil/Slope/Geology
   - Assumes shallow soils remain in place
2. Engineered Recharge: Geology/Slope
   - Assumes shallow soils are excavated

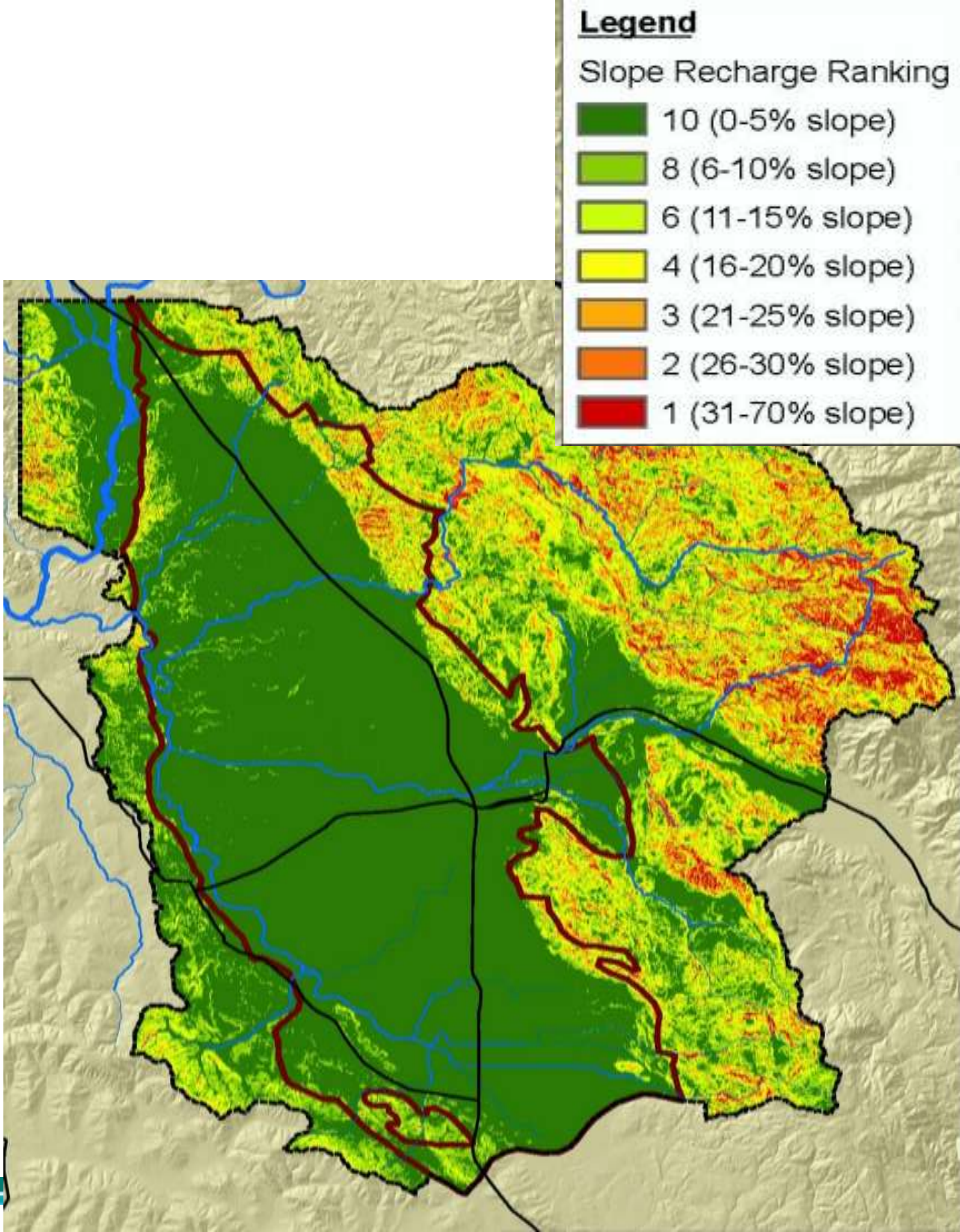
Soil Permeability Ranking

- Data from USDA Soil Survey
- Infiltration rate ranked from low to high
- Considerable variability in soil recharge ranking



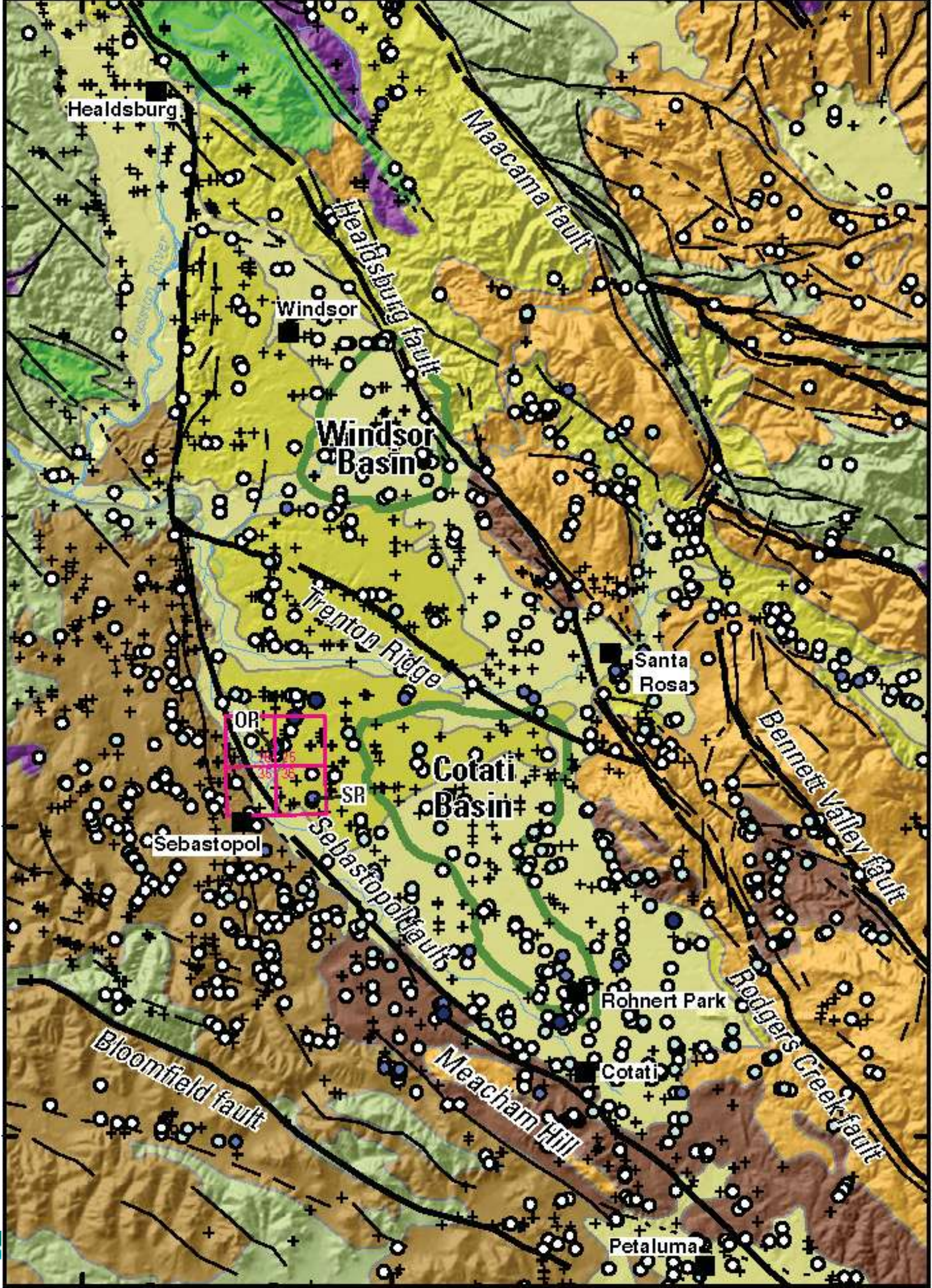
Slope Ranking

- Data from USGS topographic maps
- Steep slopes limit both natural and managed recharge potential
- Most of Santa Rosa Plain has high slope recharge ranking



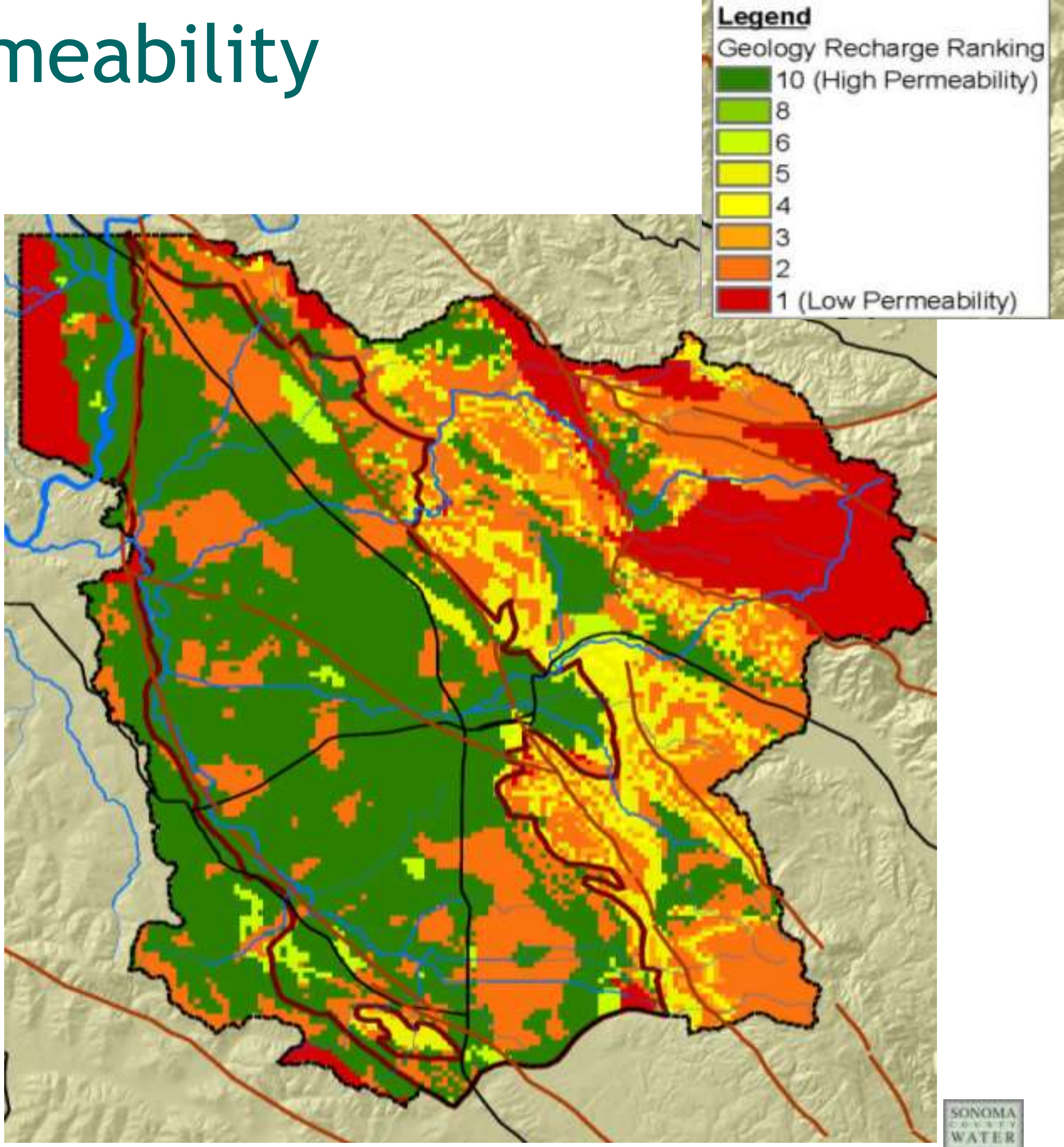
Recent Refined Geologic Data

- Data from USGS June 2010 publication on Lithologic Model of Santa Rosa Plain
- Data from 2,683 well logs interpreted
- Formation and texture interpretations used to rank permeability of geologic materials



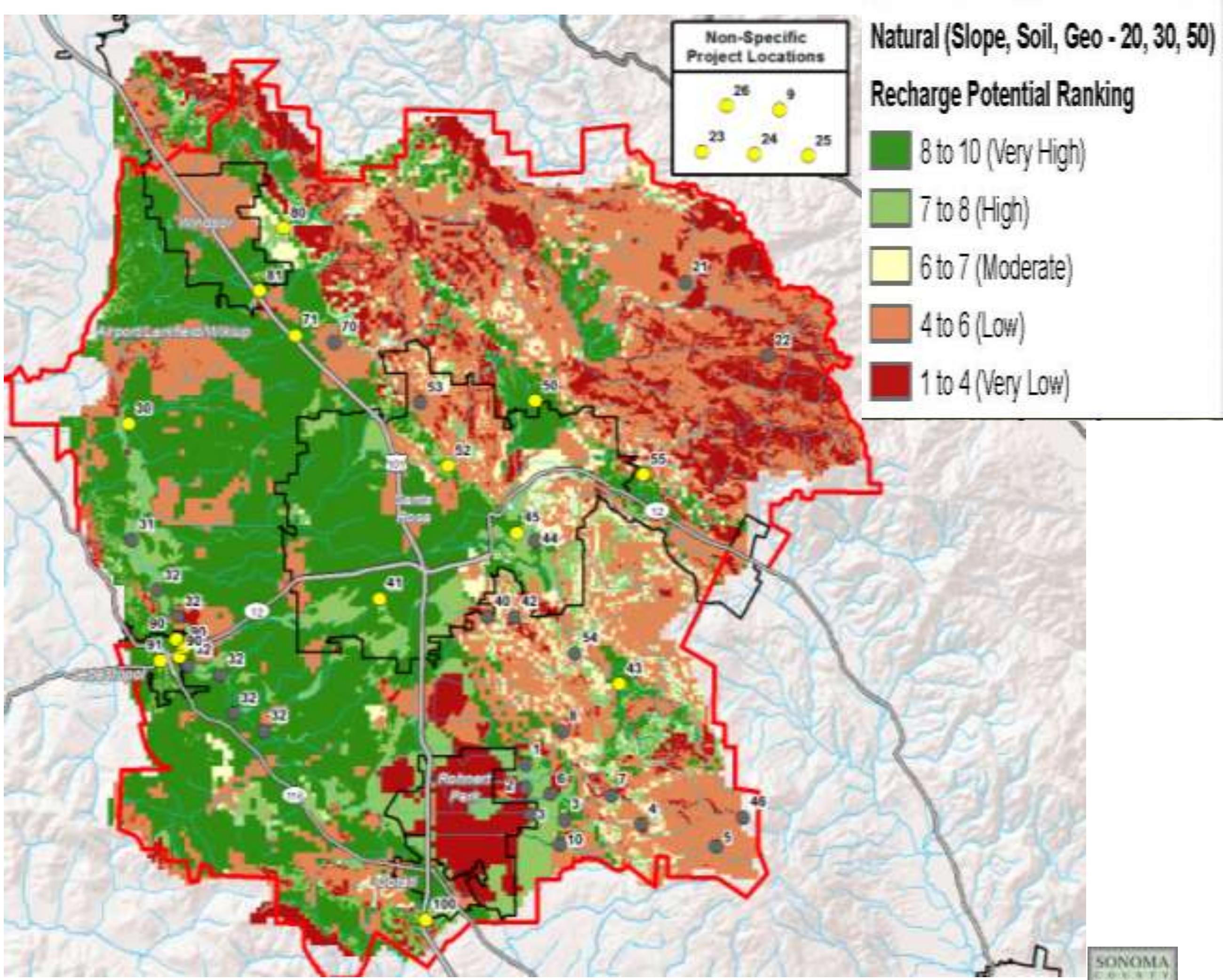
Geology Permeability Ranking

- Most heavily weighted factor
- Much of Santa Rosa Plain and low hills west of Plain suitable
- Highest variability in uplands to east of Plain



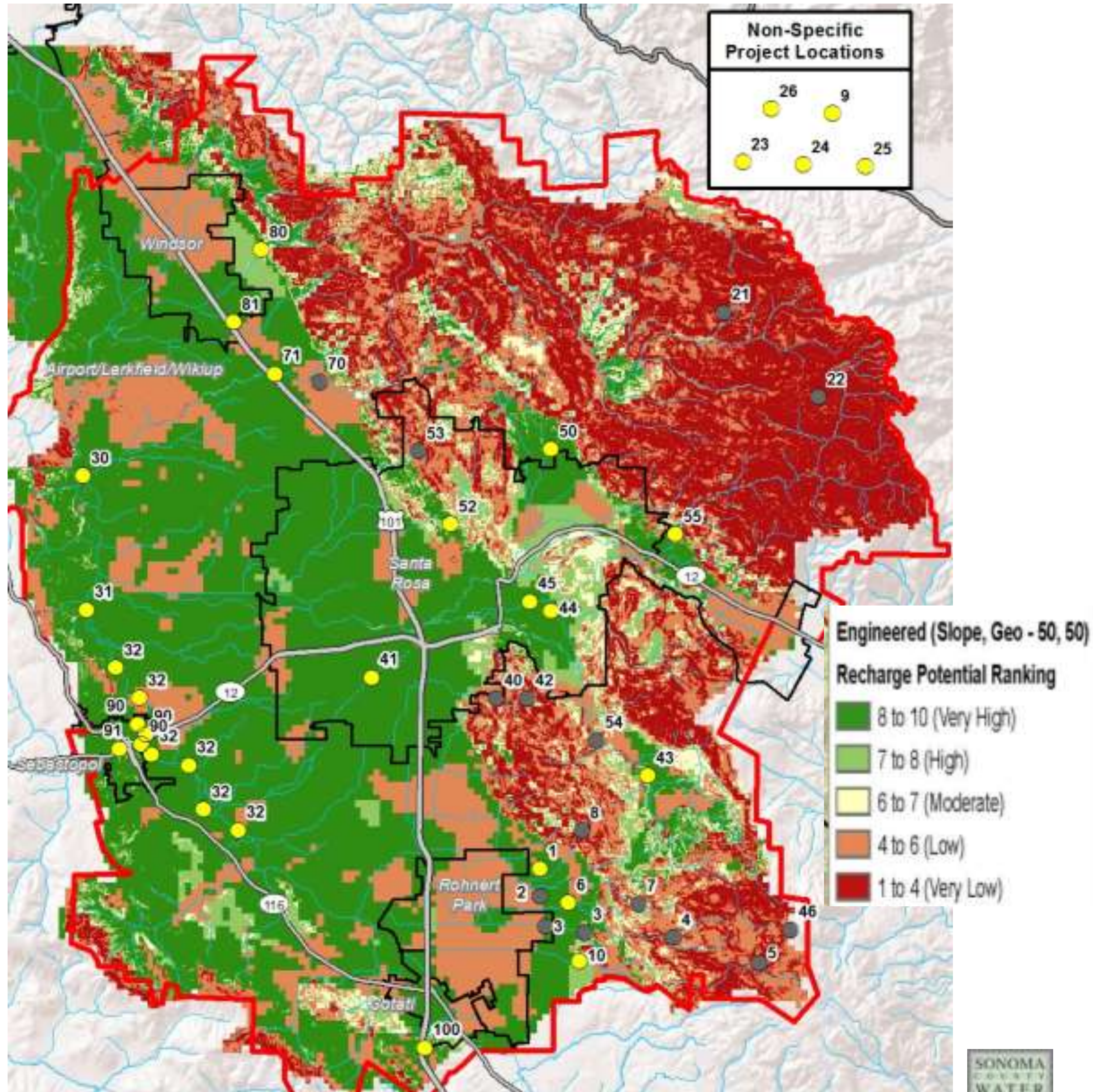
Natural Recharge Rating

- Project types
  - Minimal or no excavation of surface soils
  - Swales
  - Small diversions
  - Land spreading
- Combines and weights
  - Soil permeability – 30%
  - Slope – 20%
  - Geologic unit permeability – 50%

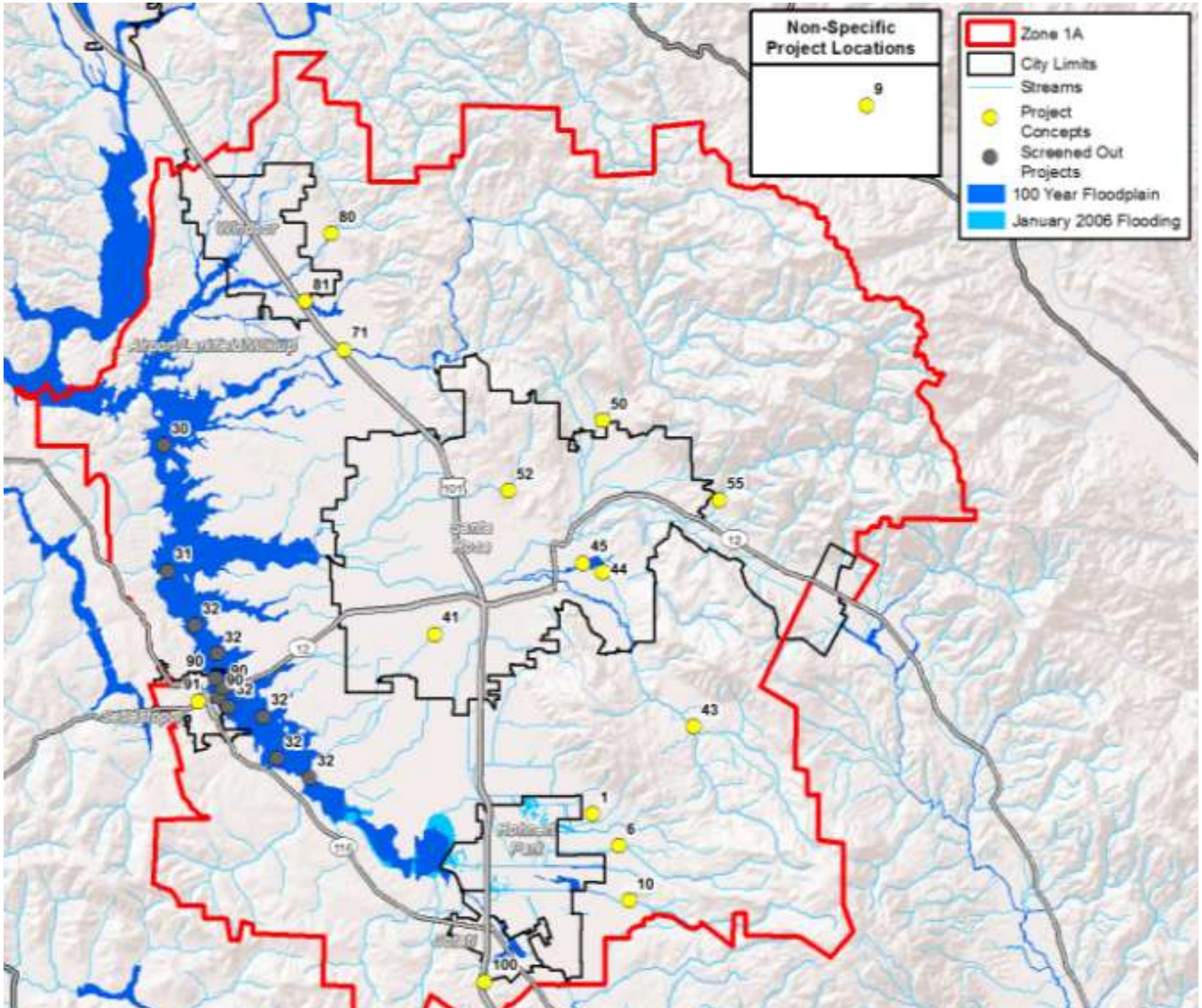


Engineered Recharge Ranking

- Combine and weight
  - ➢ Geology – 50%
  - ➢ Slope – 50%
- More area is suitable compared with natural recharge ranking



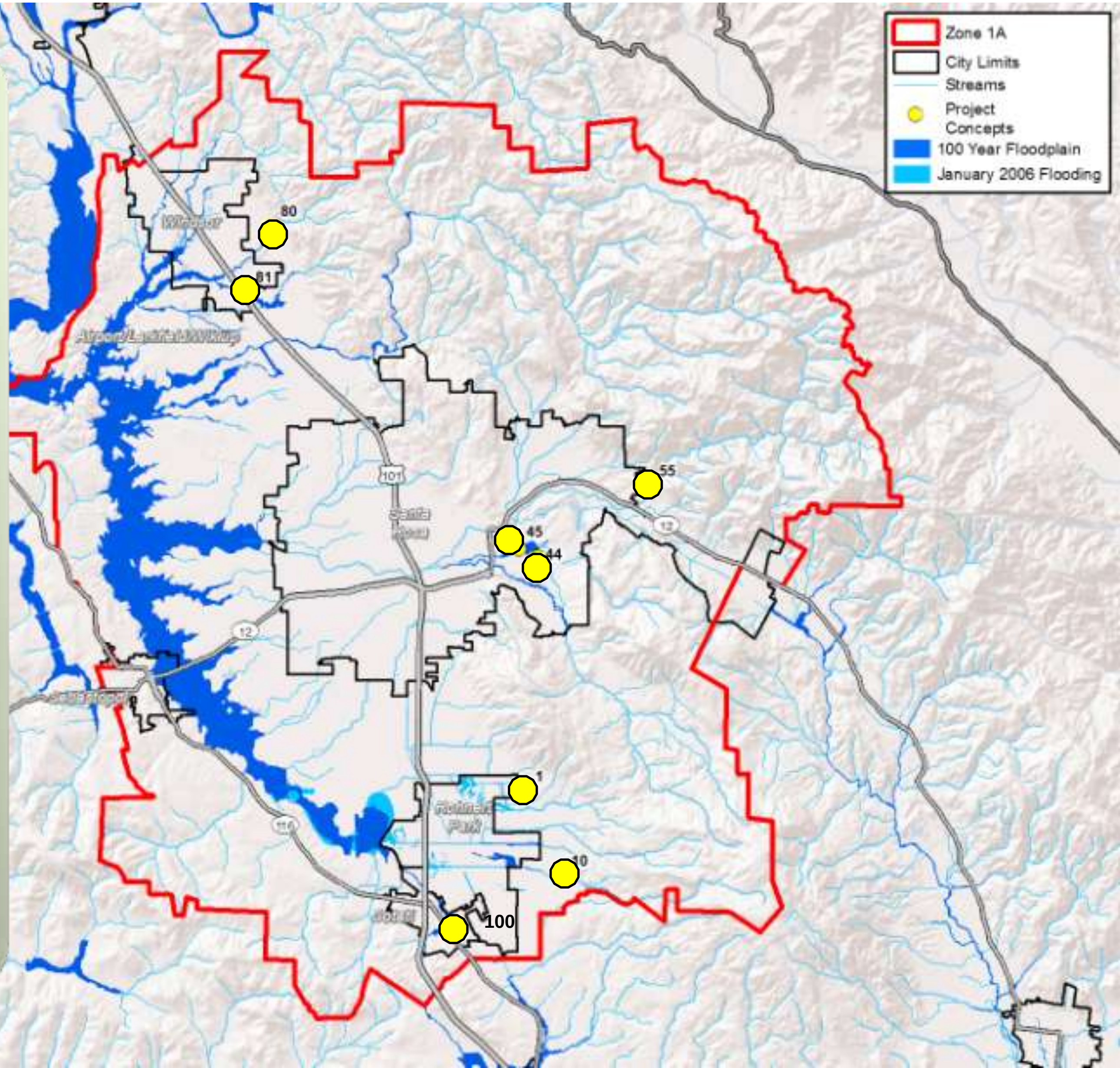
Project Concepts with Natural or Engineered Recharge Potential (Areas of Shallow Groundwater Screened out)



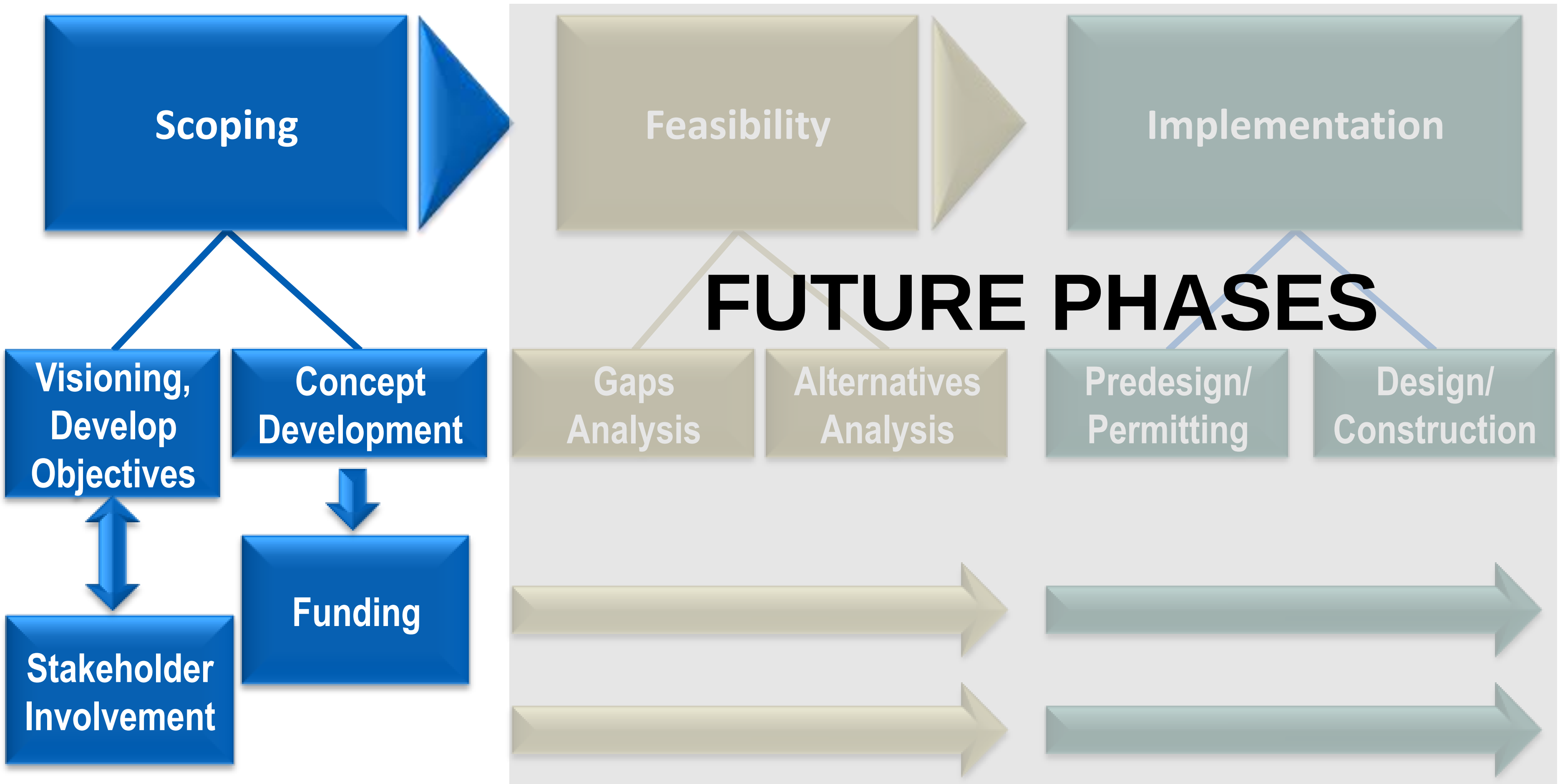
Remaining Projects Meet Both Core Objectives and Two or More Supporting Objectives

Proposed Project Concepts

- Project #1 on Coleman Creek
- Project #10 on Copeland Creek
- Project #44 Southeast Greenway
- Project #45 on Spring Creek
- Project #55 on Santa Rosa Creek
- Project #80 on Pool Creek
- Project #81 on Pruitt Creek
- Project #100 Laguna Headwaters



Planned Process – Phases of Work



Questions/Discussion

http://www.scwa.ca.gov/stormwater-groundwater/

Feasibility Study – Groundwater Banking

2 Groundwater Basins: Sonoma Valley & Santa Rosa Plain

➢ **Advantages/Benefits:**

- Decreased summer flows in Dry Creek – protective of salmonids
- Increased drought and natural hazard reliability
- Improve adaptability to climate variations/change
- Fewer SCWA water supply & transmission facilities needed
- Decrease competition for local groundwater

➢ **Challenges:**

- Technical issues (aquifer & water quality suitability)
- Permitting
- Coordination of end users (groundwater management)

➢ **Project Team:**

GEI Consultants

Pueblo Water Resources

Parker Groundwater

Groundwater Banking Study Overview

Regional Aspects

- Regional Hydrogeology
- Source Water
- Stakeholder Involvement
- Conceptual Alternatives
- Regulatory/Permitting

Local Aspects

- Identify Pilot Projects
- Groundwater Quality
- Recharge/Recovery Potential
- Water Quality Interaction
- Data Gaps
- Monitoring Approach

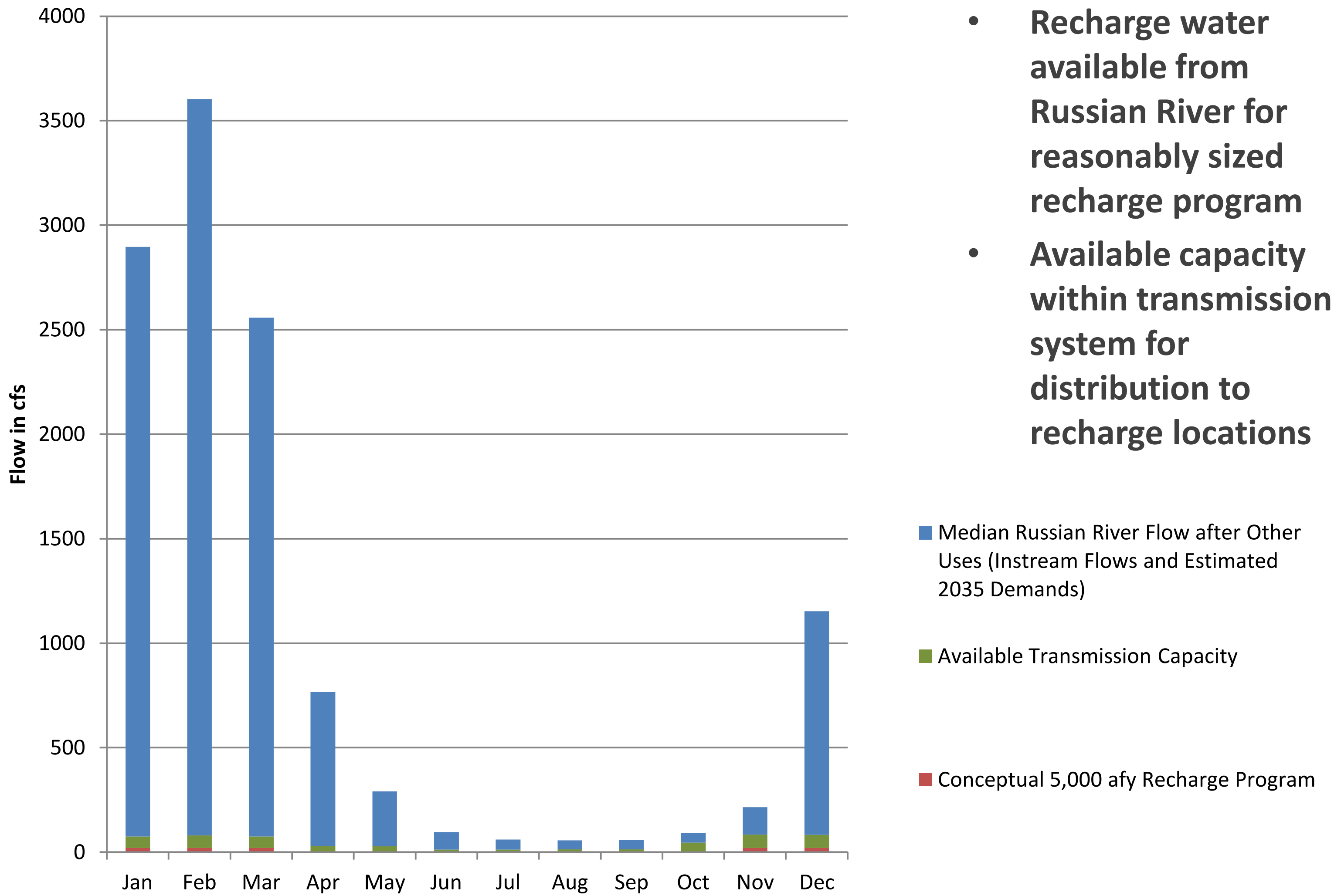
Demonstration Pilot Studies

- Work Plans
- Permitting
- Monitoring/Reporting
- Incremental Approach

Primary Components of Groundwater Banking Feasibility Study

- What's available to bank? – **Source Water Characterization**
- Where can it be banked? – **Hydrogeology/Conveyance**
- How? – **Technical Considerations**
  - Water Quality Testing & Modeling
  - Permitting
  - Incrementally phased pilot-scale testing

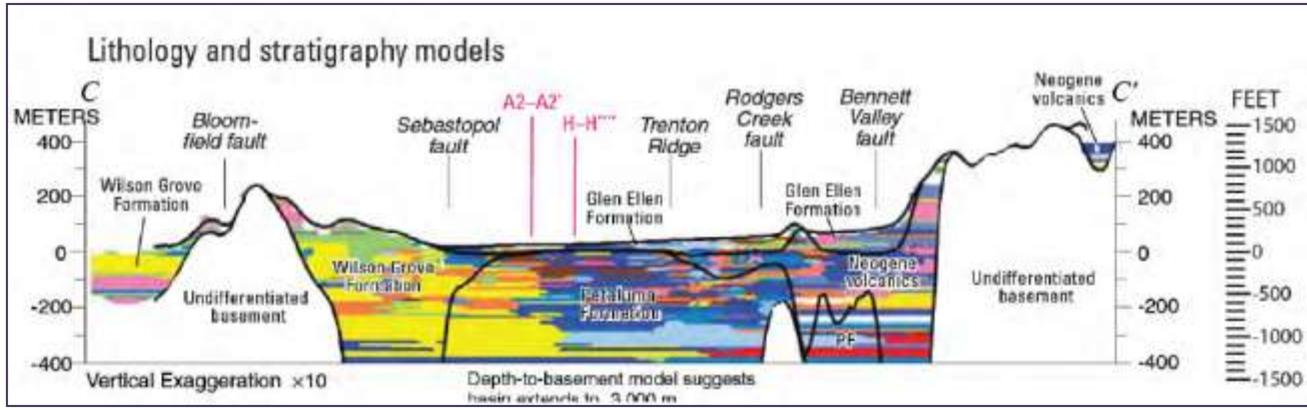
Recharge Water Availability
(at estimated 2035 demand levels)

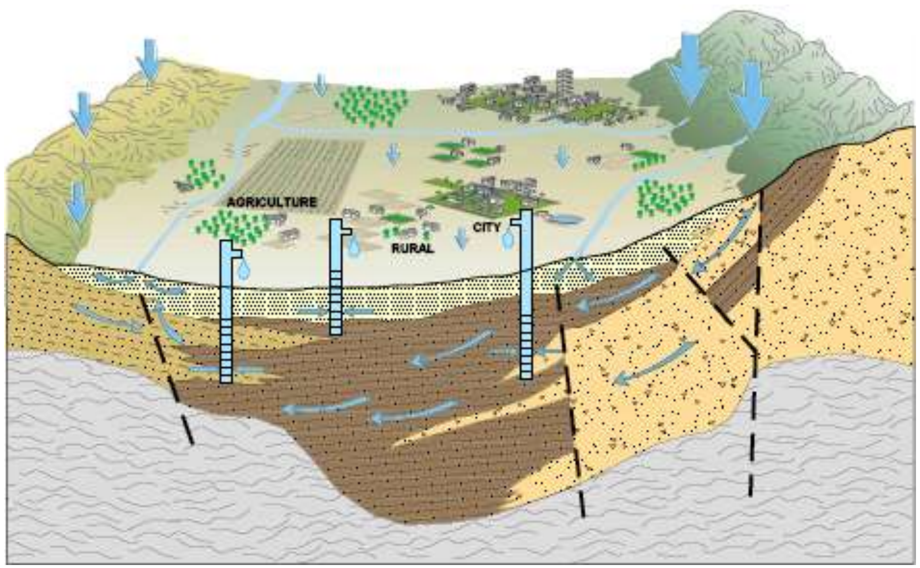


- **Recharge water available from Russian River for reasonably sized recharge program**
- **Available capacity within transmission system for distribution to recharge locations**

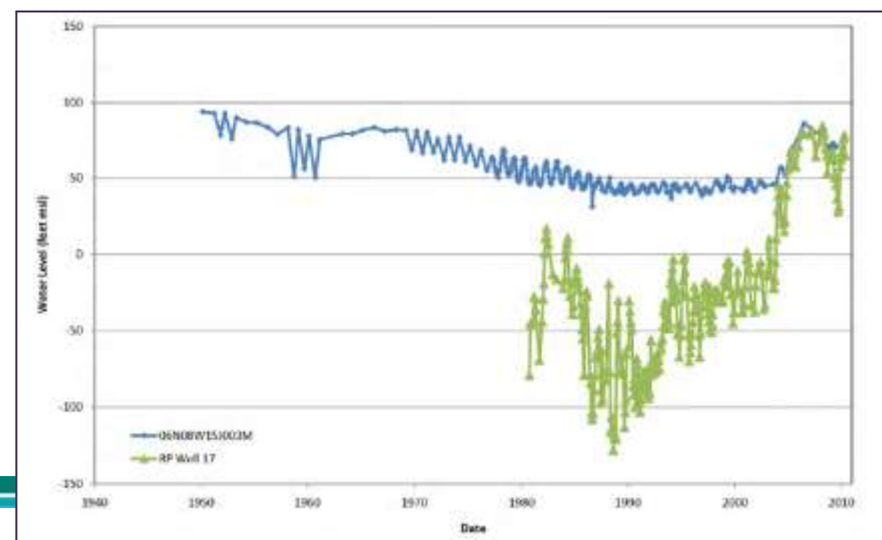
Hydrogeologic Analysis

- Most aquifers not laterally continuous
- Geology conducive to local ASR projects in deeper confined aquifers



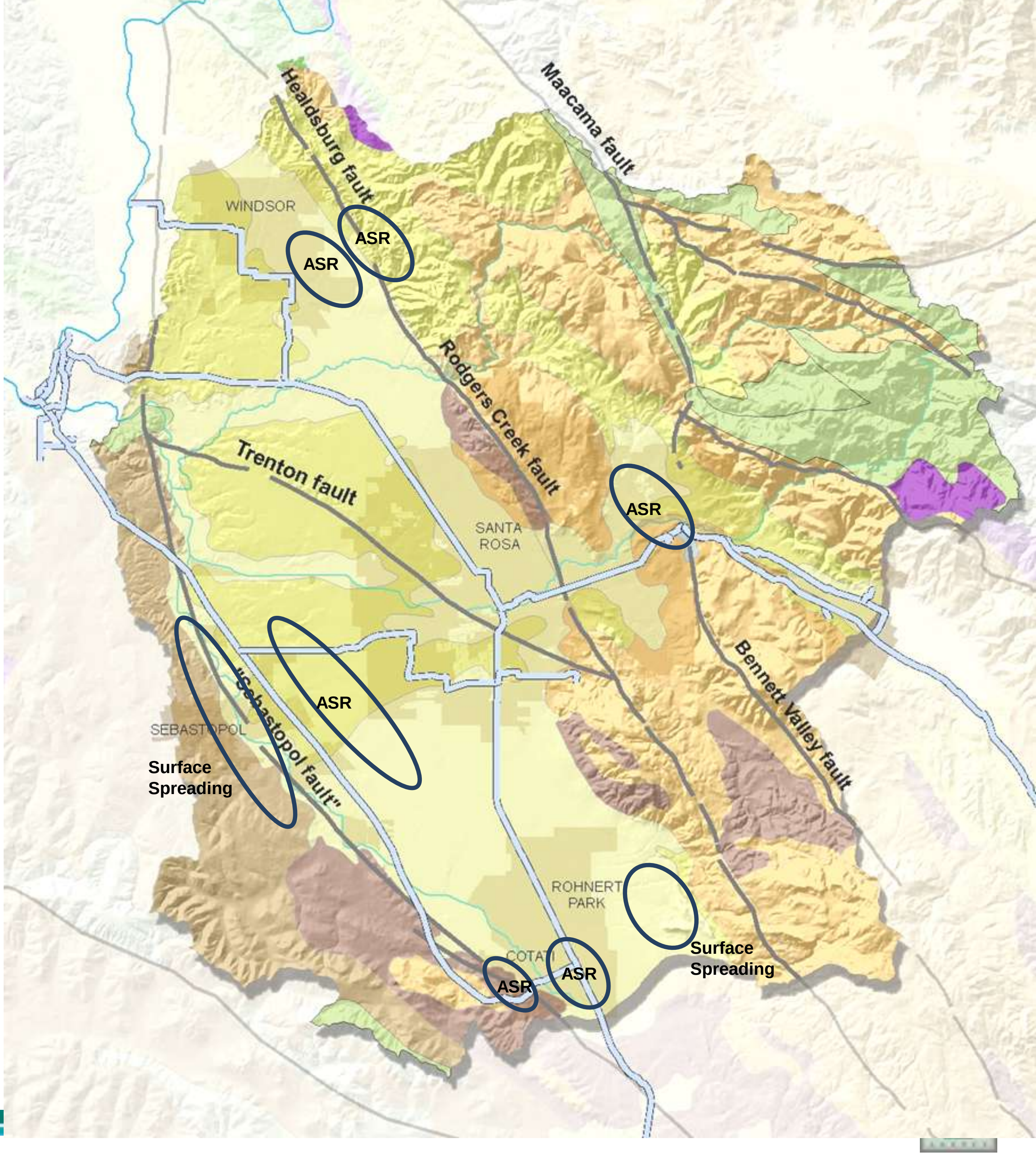


- Limited storage volume in some areas



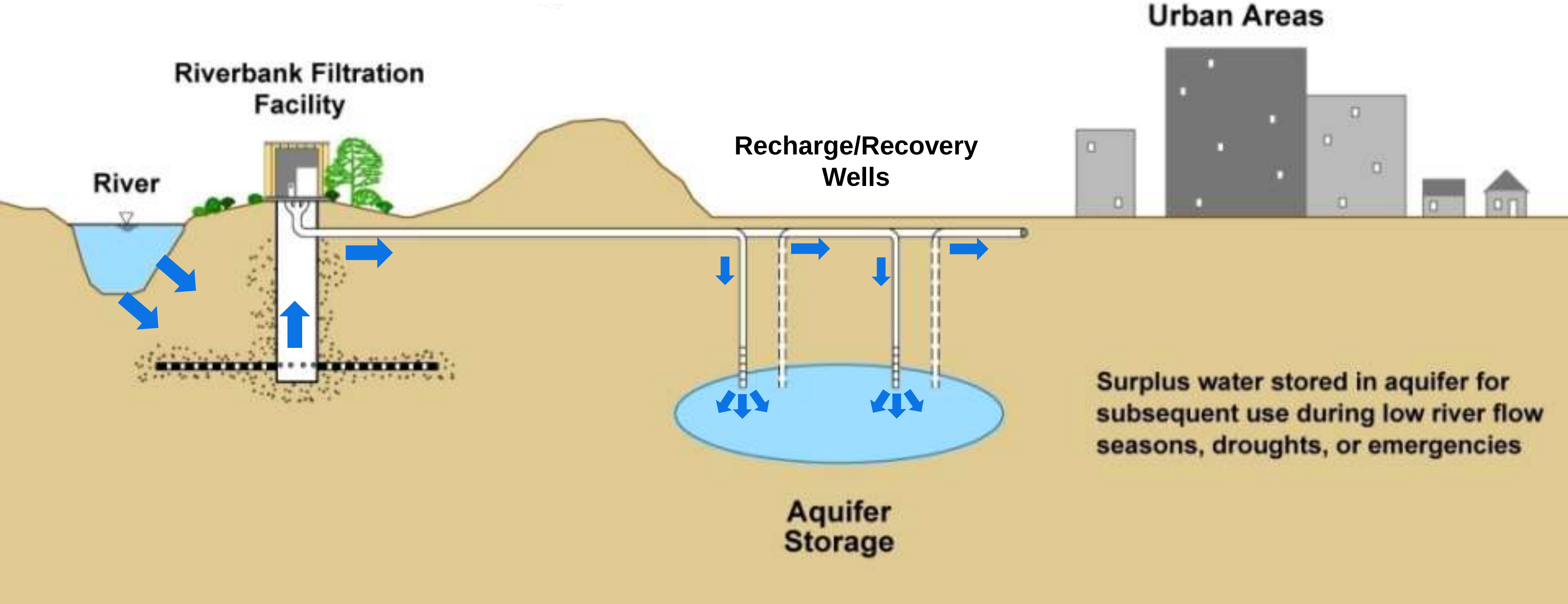
Santa Rosa Plain Conceptual Alternatives

- Aquifer Characteristics
  - Ability to move water in and out efficiently
  - Structurally sound aquifer formations
  - Confined aquifers with hydraulic gradients compatible for storage
- Available storage volume
- Proximity to conveyance of Russian River water



Conceptual Groundwater Banking Schematic
Aquifer Storage and Recovery

- Proceeding with Aquifer Storage and Recovery Concepts
- Geochemical compatibility assessment
  - Groundwater quality sampling and geochemical modeling
- Well Characterization and Design Assessment
- Scope and Design Pilot-Scale Demonstration Project(s)
- Explore funding options

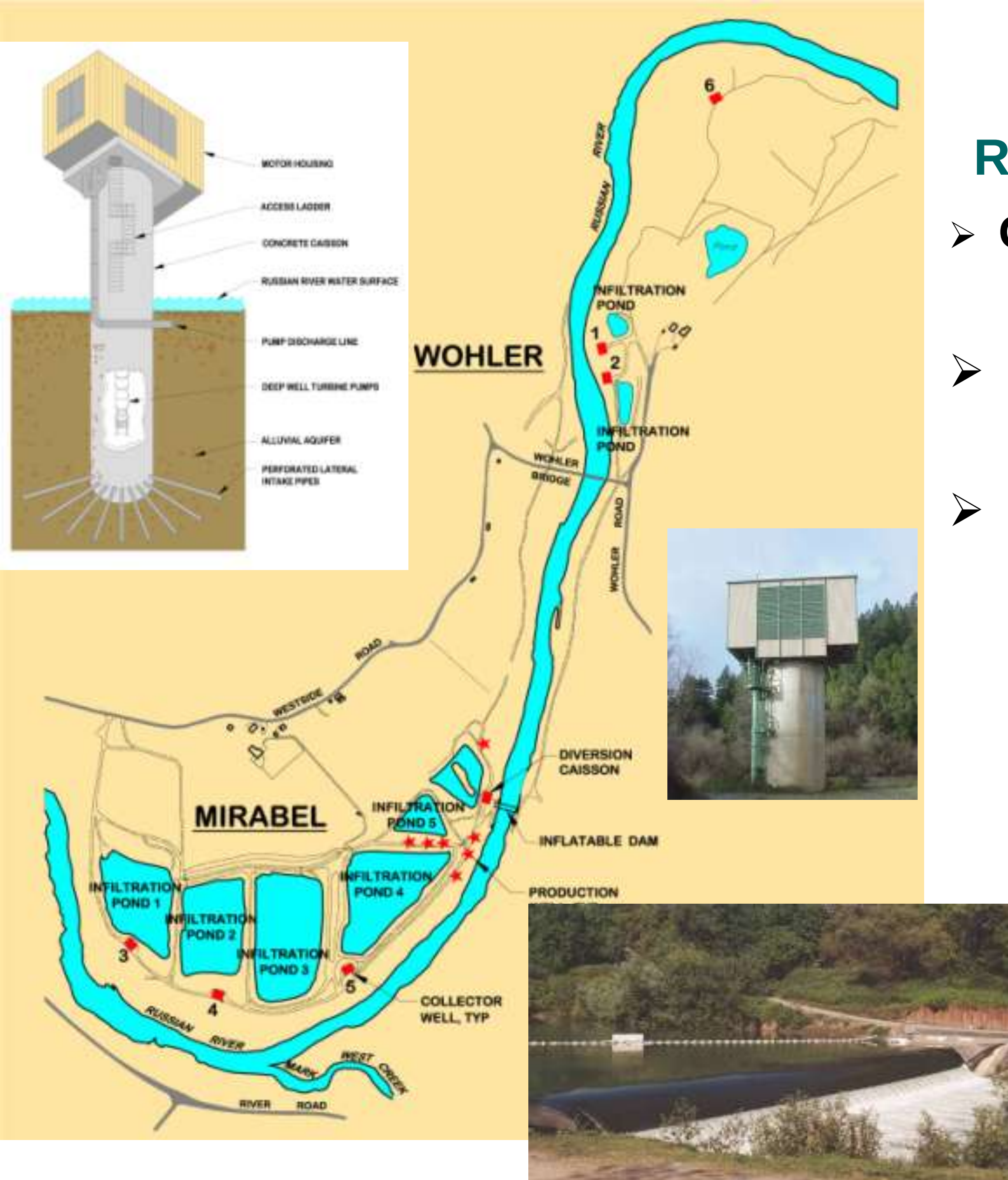


Water Quality Assessment

- Source Water Quality Characterization (Russian River) - **Complete**
  - Physical quality (particulates)
  - Mineral saturation (over/under equilibrium)
  - Redox condition
  - Disinfection by-products (e.g. THMs, HAAs)
  - Reactive compounds
  - ‘Fingerprint’ compounds
  - Title 22 potability
- Groundwater Quality Characterization - **Complete**
- Mixing of Source Water and Groundwater – Geochemical Modeling for Compatibility –**Ongoing**
  - Potential redox changes
  - Plugging potential

Russian River Riverbank Filtration System

- One of the largest riverbank filtration systems in the world
- Treatment accomplished via natural filtration.
- Only chlorine added as a disinfectant



- ❖6 Collector Wells
- ❖ 7 Vertical Wells
- ❖ 5 Infiltration Ponds
- ❖ Inflatable Dam

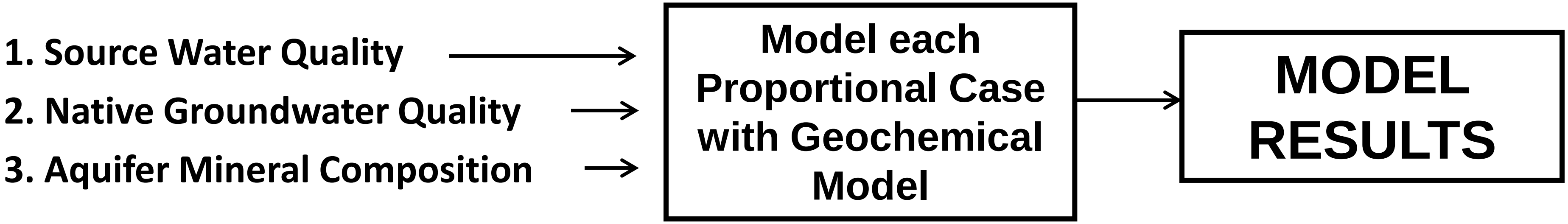
Source Water Quality Overview – Comparison with Other ASR Source Waters

	SCWA – Russian R. North Coast	Tracy – Stanislaus R. Central Valley	MPWMD – Carmel R. Central Coast	EBMUD – Mokelumne R. San Francisco Bay	Maximum Contaminant Level
Total Dissolved Solids	164	98	343	41	1,000**
Chloride	6.5	9	35	5	250**
Mercury (ug/L)	ND (<0.025)	--	--	--	2
Dissolved Organic Carbon	0.96	1.4	1.4	1.5	NA
pH	8.29	8.31	7.51	8.9	NA
Sulfate	17	11	91	15	500**
Haloacetic Acids (ug/L)	3.3	24	13	16	60
Total trihalomethanes (ug/L)	15.5	38	47	37	80
Dissolved Oxygen	6.0	5.0	3.0	6.0	NA
Silt Density Index	0.3	1.1	3.3	2.2	NA

•All values in mg/L except where noted otherwise.
•**Secondary MCL

- **Very high quality drinking water**
- **Low levels of disinfection byproducts**
- **Low potential for clogging**

Geochemical Characterization



Results:

- **Identify Potential Reactions**
- **Simulate Recovered Water Quality**
- **Identify Mitigation Measures to Avoid Adverse Reactions**

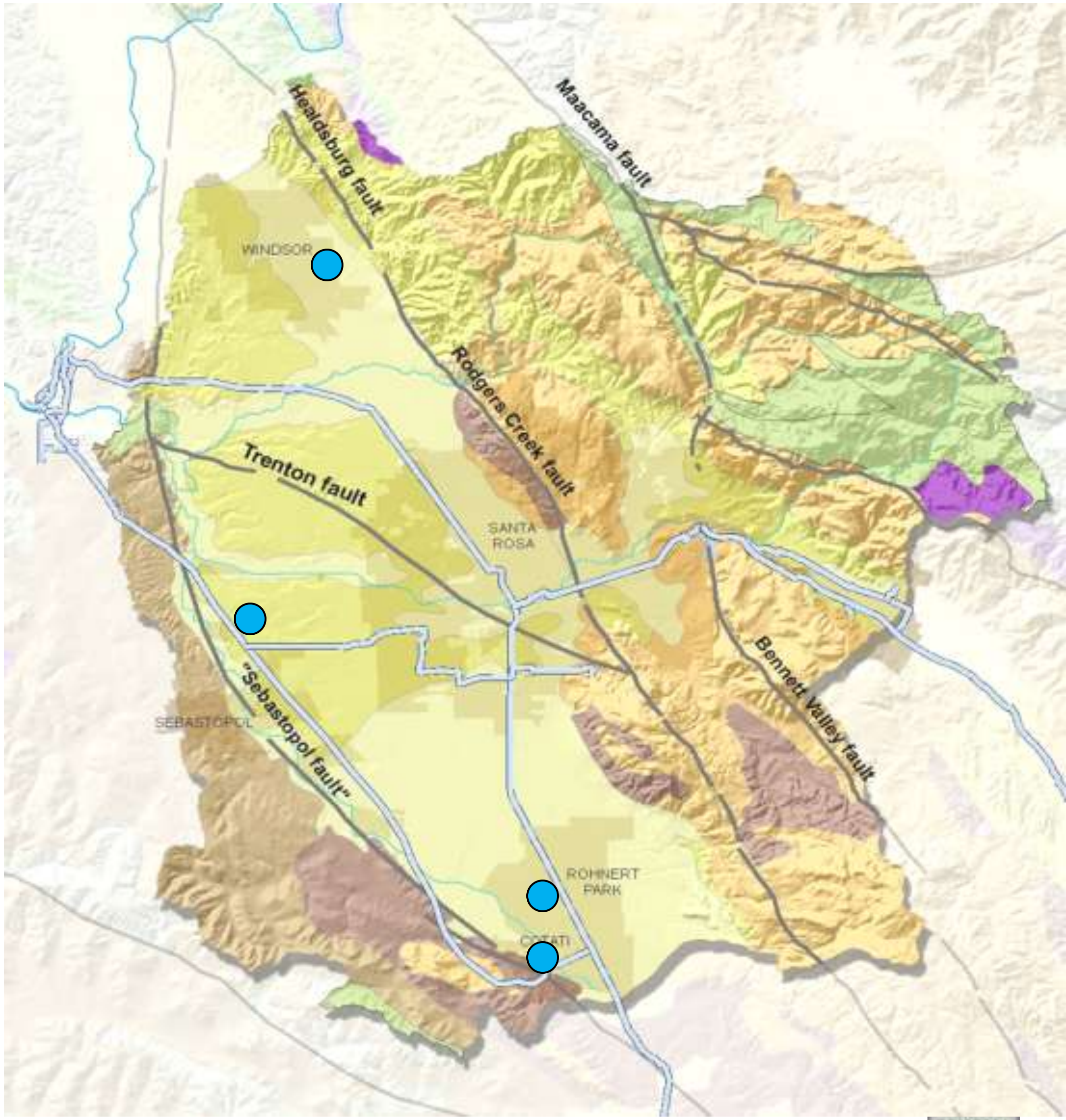
ASR Pilot-Scale Demonstration Testing Need & Purpose

- Assess aquifer capacity for recharge and recovery
- Evaluate water quality during and following testing
- Gather data needed to assess feasibility of and properly scope potential permanent/full-scale system
- Test ASR viability in incremental steps and costs

Pilot Project Screening

For each potential pilot evaluate:

- Well construction details
- Age/Condition of well
- Historical performance
- Water quality
- Proximity to contaminated groundwater sites
- Recharge/recovery constraints
- Nearby water wells
- Presence of existing monitoring wells
- Ability to backflush well
- Proximate system hydraulics



Approach for ASR Pilot-Scale Demonstration Testing

- Incremental, stepwise investigation allows ‘stop & pause’ progress
- Limited scale/duration of pilot programs
  - Duration dependant on water/well site availability
  - Short-term testing initially – 4-6 months minimum
  - Repeated cycles of recharge/storage/recovery
    - each cycle with longer duration and larger volumes
- Highly monitored
  - Extensive water level & water quality at pilot well and nearby wells (Background and through each cycle)
  - Recharge/Recovery efficiency
- Permitted through RWQCB
- CEQA compliance

Next Steps

- Design Pilot-Scale Demonstration Project(s)
  - Assess feasibility and gather data needed for potential permanent system
- Discuss permitting approach with regulatory agencies
- Briefings to Groundwater Management Stakeholder Groups
- Explore funding options

Potential Benefits of Enhanced Recharge

- Increased drought and natural hazard reliability
- Flood risk reduction
- Better maintain stream baseflows
- Improve adaptability climate variations/climate change
- Decrease competition for local groundwater
- May allow for reducing peak summer flows in Dry Creek – protective of salmonids

Potential Benefits of Enhanced Recharge

- May delay or eliminate need for future expensive capital projects by addressing peak summertime demands

- Further align with State policies on conjunctive management and integration of water supplies
  - **North Coast RWQCB Basin Plan:** Groundwater Recharge listed as Beneficial Use for surface water of the Russian River basin
  - **CA Dept of Water Resources:** Consistent with recommendations in State Water Plan and MOU between SCWA and DWR
  - **SWRCB:** Consistent with previous direction for conjunctive management and "replenishment of groundwater resources"

Discussion/Questions