



Groundwater Banking Subcommittee Meeting No. 4 | May 3, 2007

# Hydrologic Reconnaissance and Alternatives Selection



Paso Robles Groundwater Basin Water Banking Feasibility Study



# **Agenda Items**

- 1. Project Goal and Approach**
- 2. Groundwater Banking Operations**
- 3. Hydrogeology Reconnaissance Update**
- 4. Alternatives Descriptions**
- 5. Next Steps**



# Project Goal

**The goal of this project is to determine the feasibility of groundwater banking alternatives in the Paso Robles Groundwater Basin. This will be determined based on:**

- **Ability to utilize unallocated SWP supply**
- **Ability to store and recover water**
- **Ability to deliver banked water to end user**



# Project Approach

- **Evaluate Technical Feasibility**
  - **Hydrogeologic Feasibility**
  - **Engineering Feasibility**
- **Identify Other Considerations**
  - **Environmental Considerations**
  - **Institutional/Regulatory Considerations**
  - **Project Partners and Funding Opportunities**



# Groundwater Banking Operations (Put/Take Time Series)

- Needed to test the feasibility of recharge and recovery programs in the Paso Robles Basin
- Developed for a 17-year Simulation Period to evaluate groundwater impacts of water banking alternatives (representing 1981-1997 historical period)
- Put/Take time series will also be used to size needed facilities and estimate O&M costs

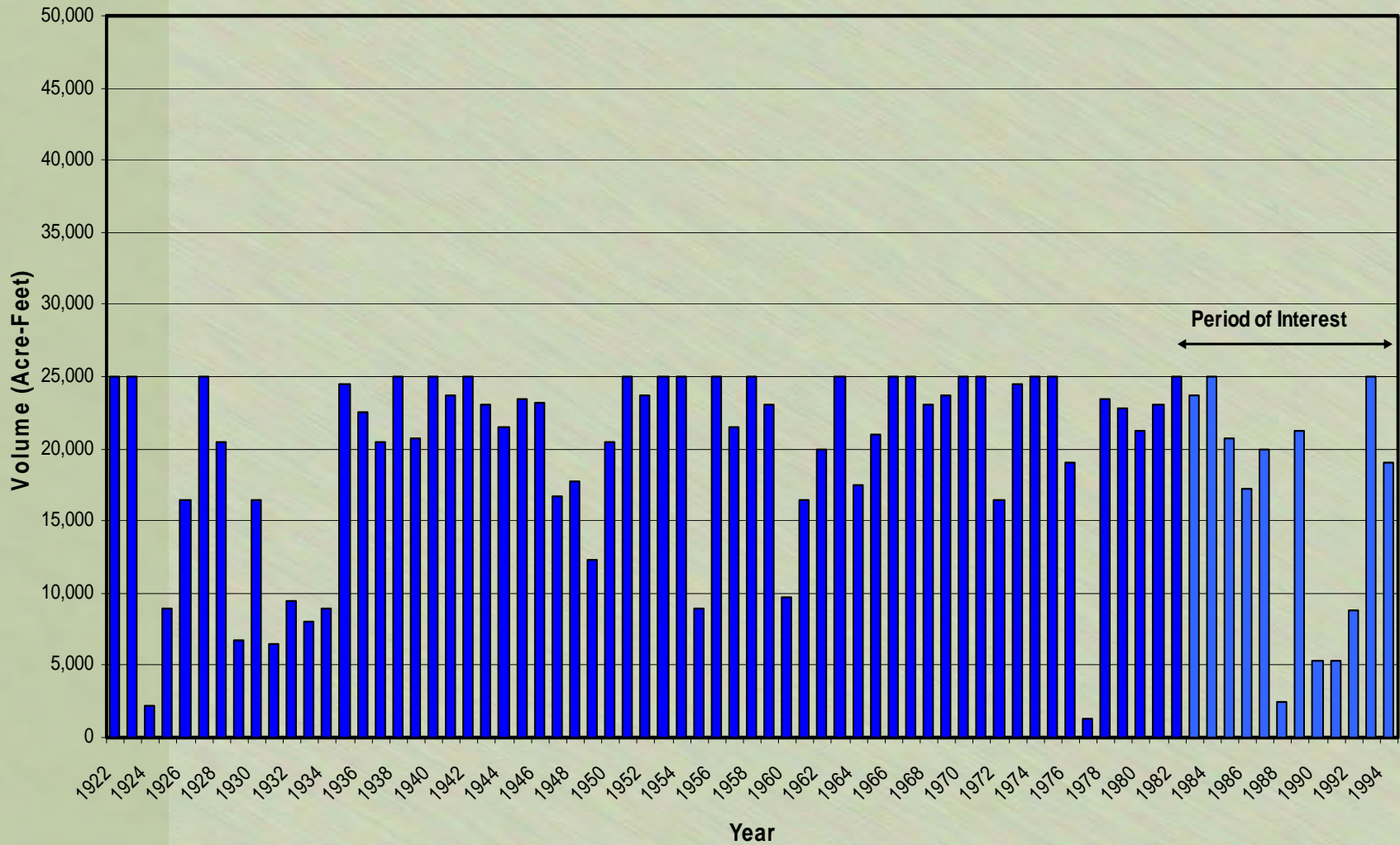


# **Groundwater Banking Operations – Recharge (Put)**

- **Based on SLOC Table A Allocation**
  - Accounts for existing SLOC M&I deliveries
  - Provides deliveries for water banking
  - Provides for direct deliveries to end user
- **Water banking operations could be modified to reflect other water management activities:**
  - Nacimiento Water Project available supplies
  - SBFCWCD excess supplies

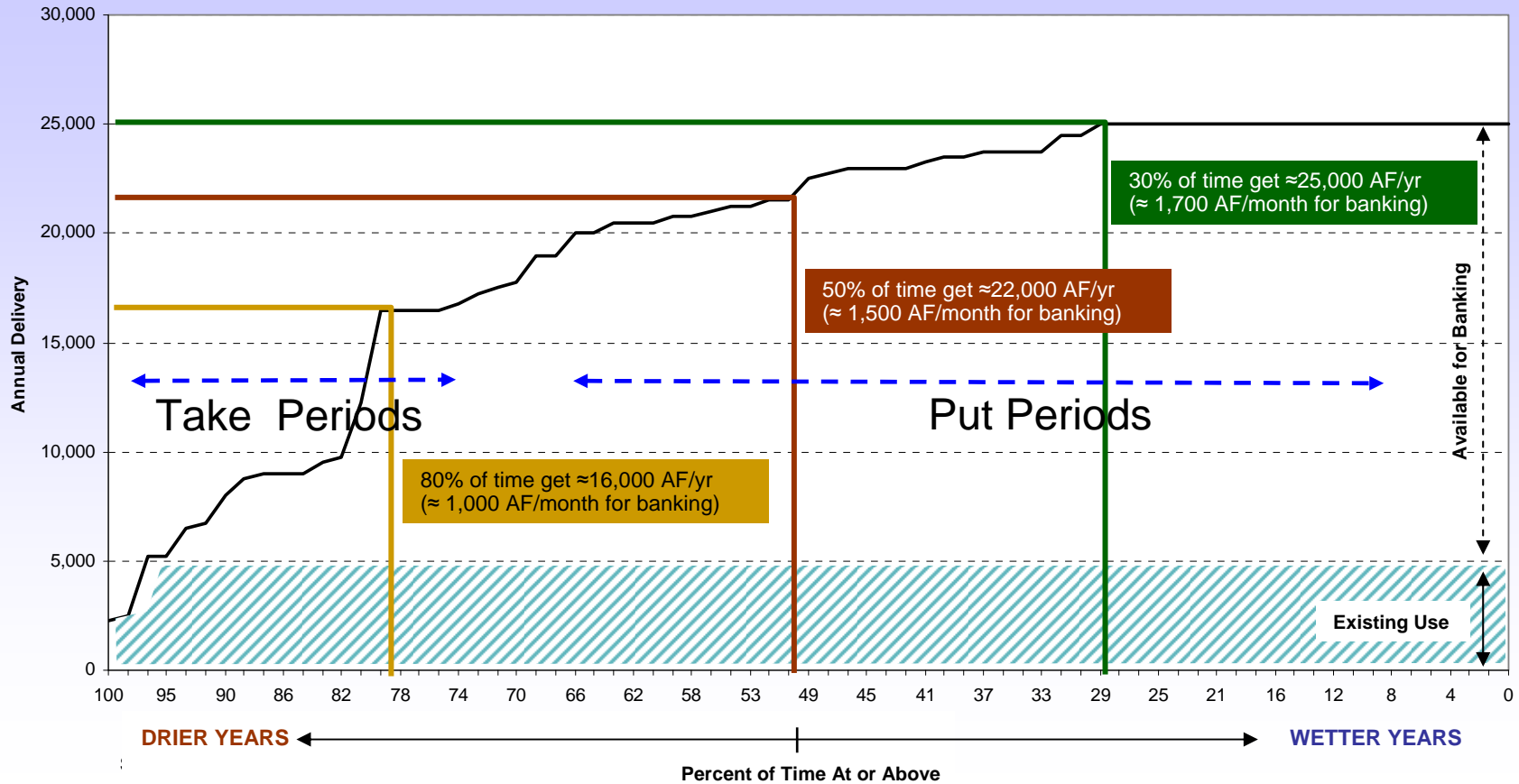


# Estimated SLOC SWP Table A Availability for the 1922 to 1994 Period



# Water Supply Availability

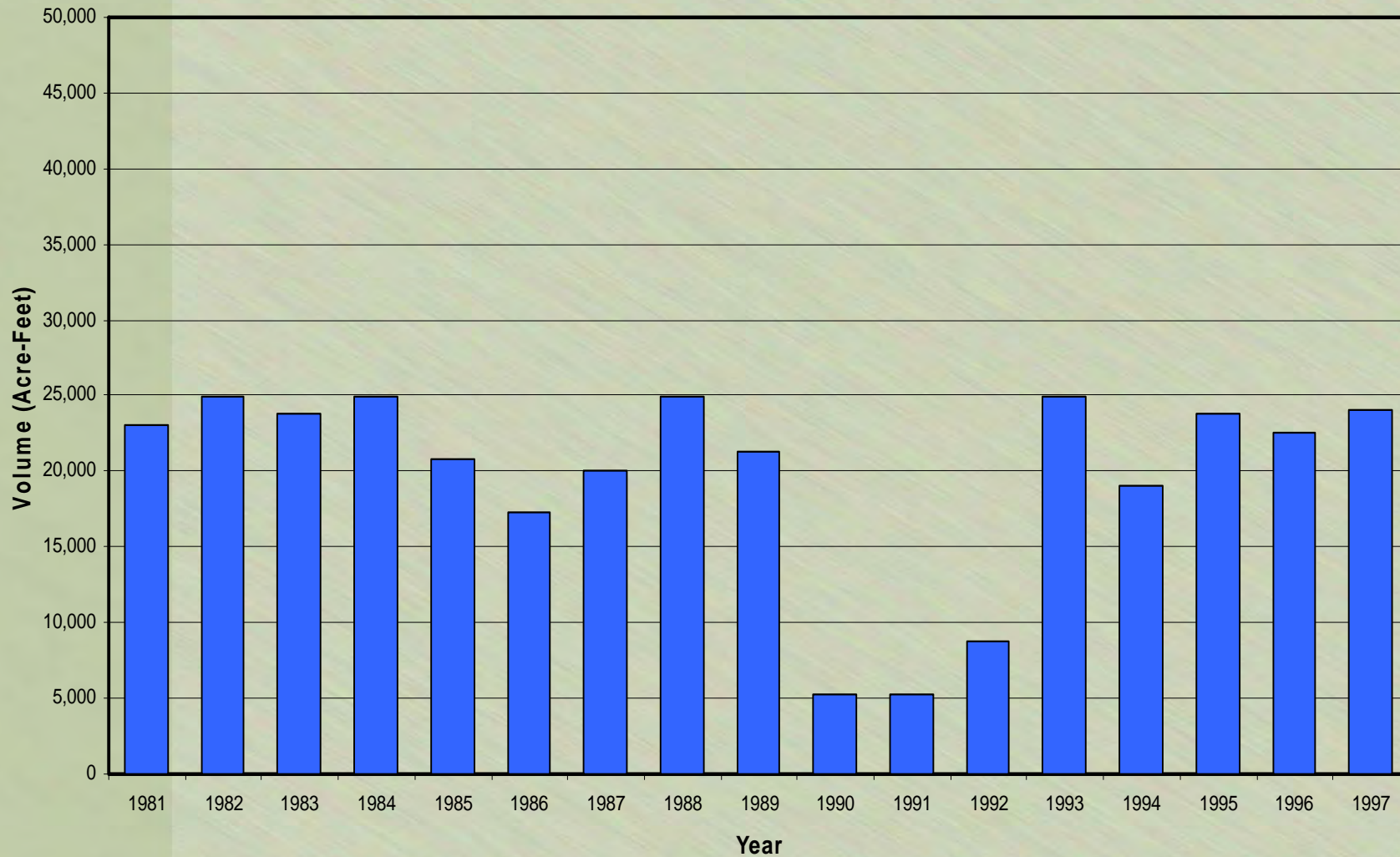
SWP Delta Table A Delivery Probability  
for San Luis Obispo County (25,000 acre-feet)





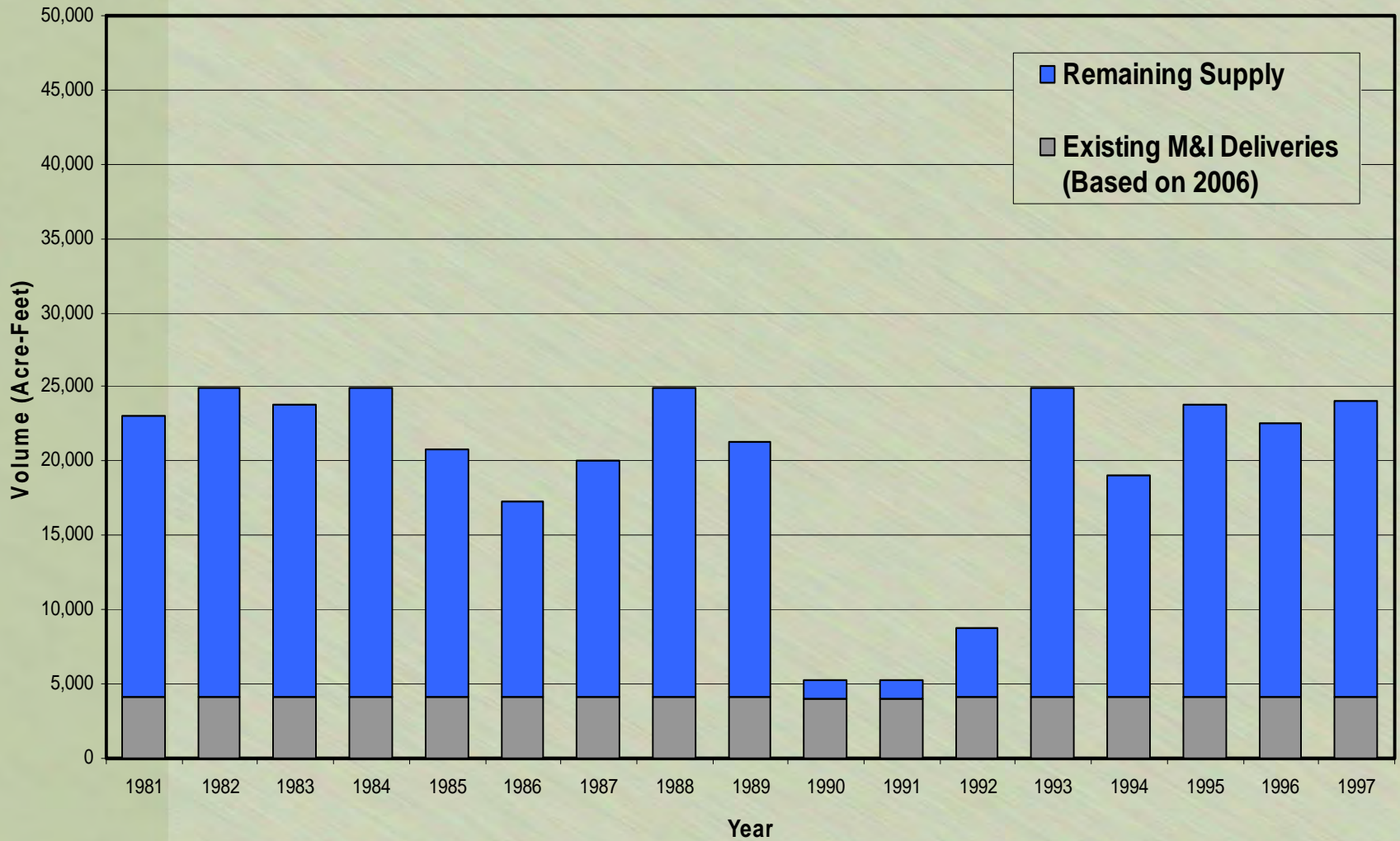


# SLOC SWP Table A Allocation for Simulation Period (1981 to 1997)



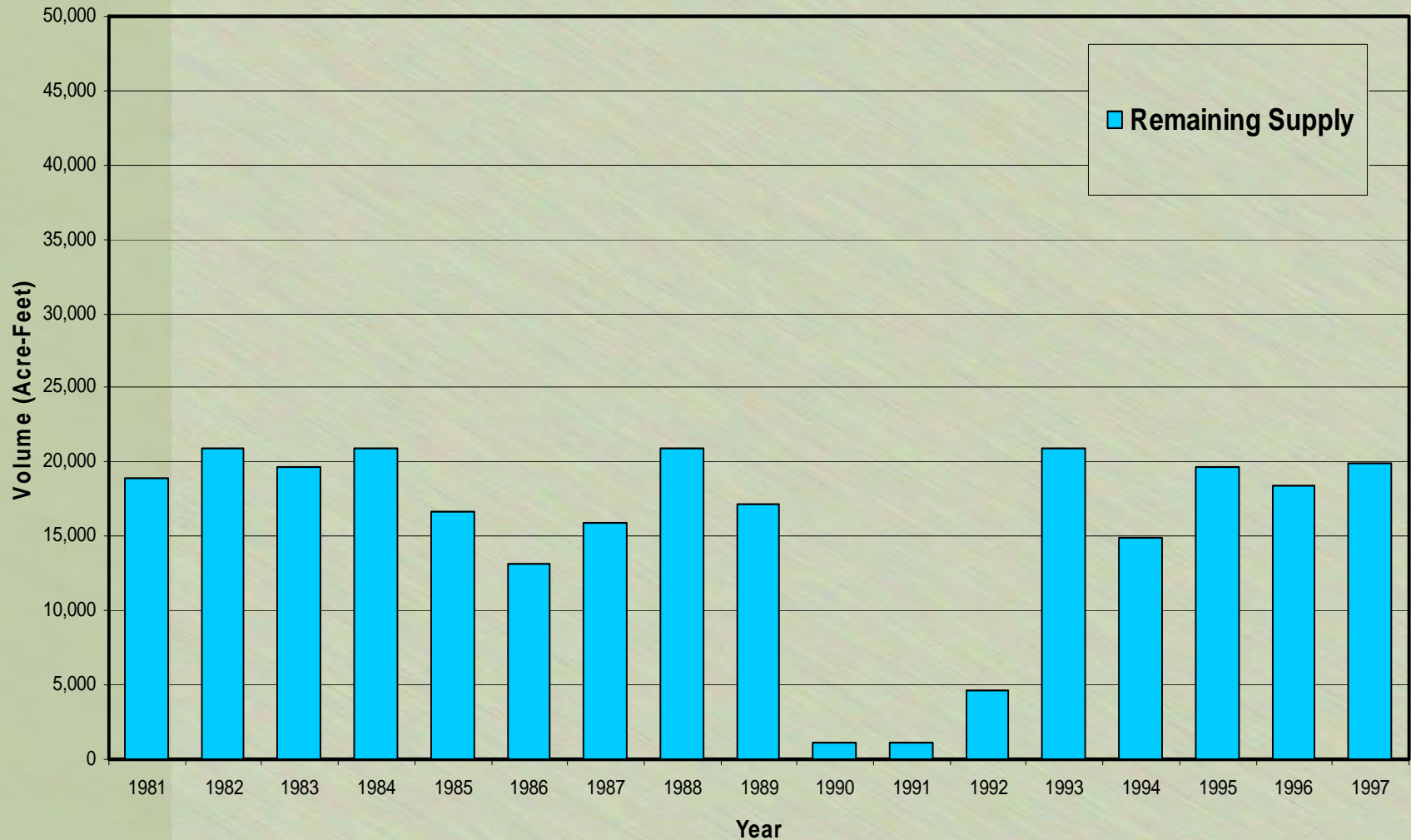


# Estimated Annual SLOC SWP Water Use for Simulation Period (1981 to 1997)





# Estimated Annual Unused SWP Allocation for Simulation Period (1981 to 1997)





# Groundwater Banking Operations- Recovery Goals (Take)

- **Recovery Goal No. 1 - Based on local agricultural demand** (under development based on recent land use data)
- **Recovery Goal No. 2 - Based on regional urban demand** (Santa Barbara Table A allocations)



# **Groundwater Banking Recovery Operations (Recovery Goal No. 1)**

- **Provide long-term water supply reliability for local agricultural water users**
- **Based on updated agricultural acreage mapping recently completed by San Luis Obispo County**



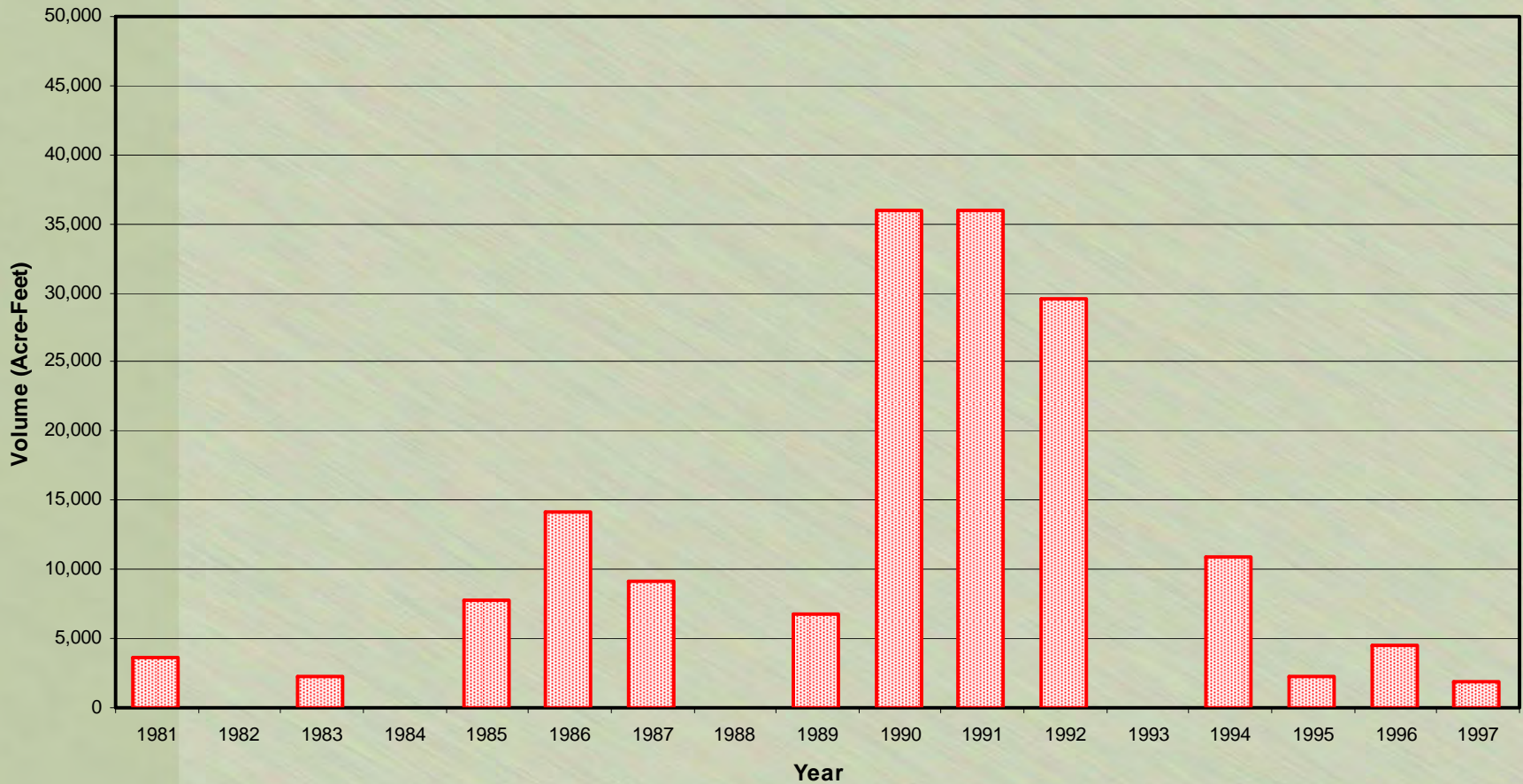
# **Groundwater Banking Recovery Operations (Recovery Goal No. 2)**

- **Provide critical year urban water supply reliability**
- **Based on meeting SBCFCWCD full SWP Table A allocation (described in following slides)**



# Recovery Goal No. 2

## SBCFCWCD Table A Shortage



Based on meeting full SBCFCWCD Table A Allocation for Simulation Period

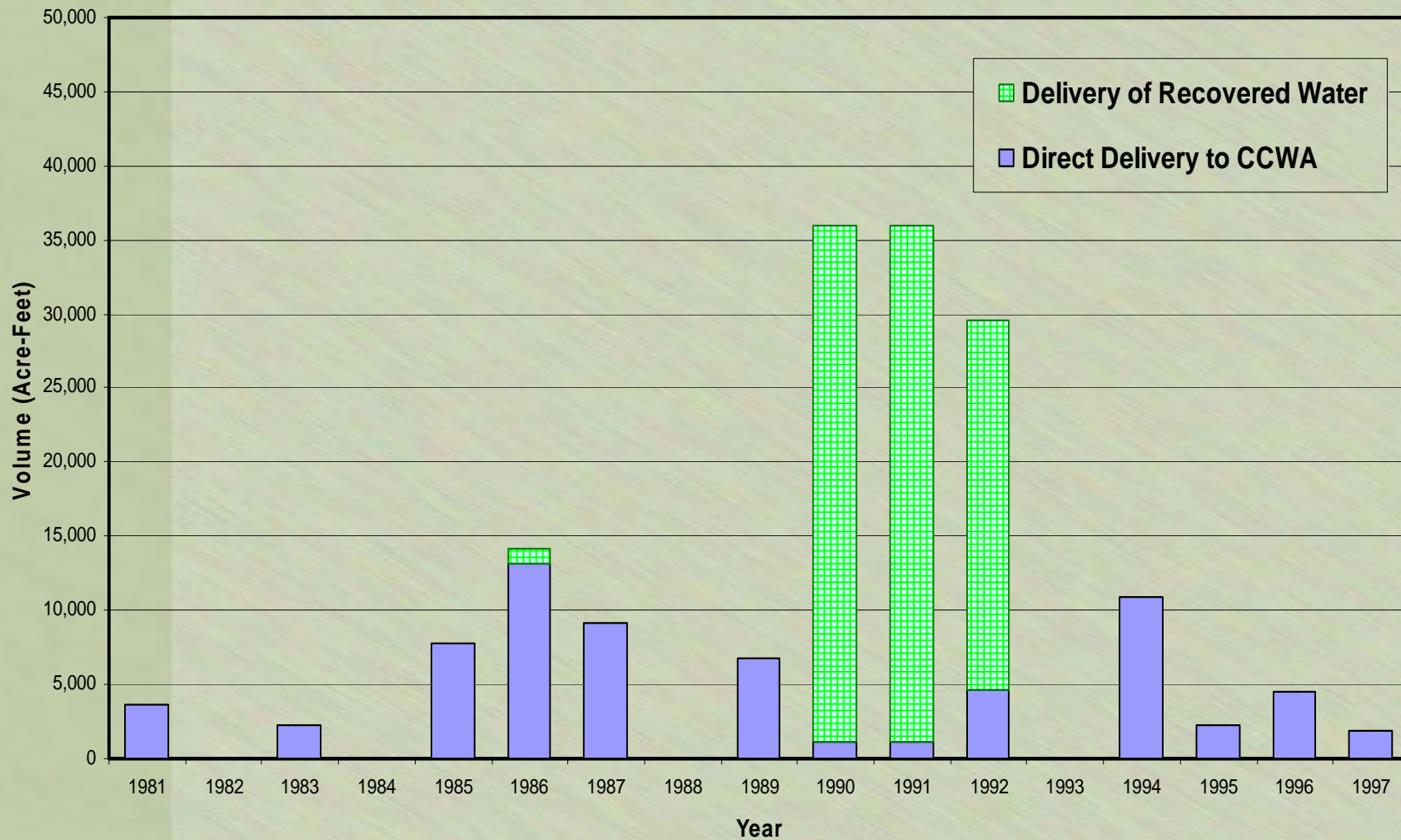






# Recovery Goal No. 2

## Estimated Annual Water Delivery Pattern





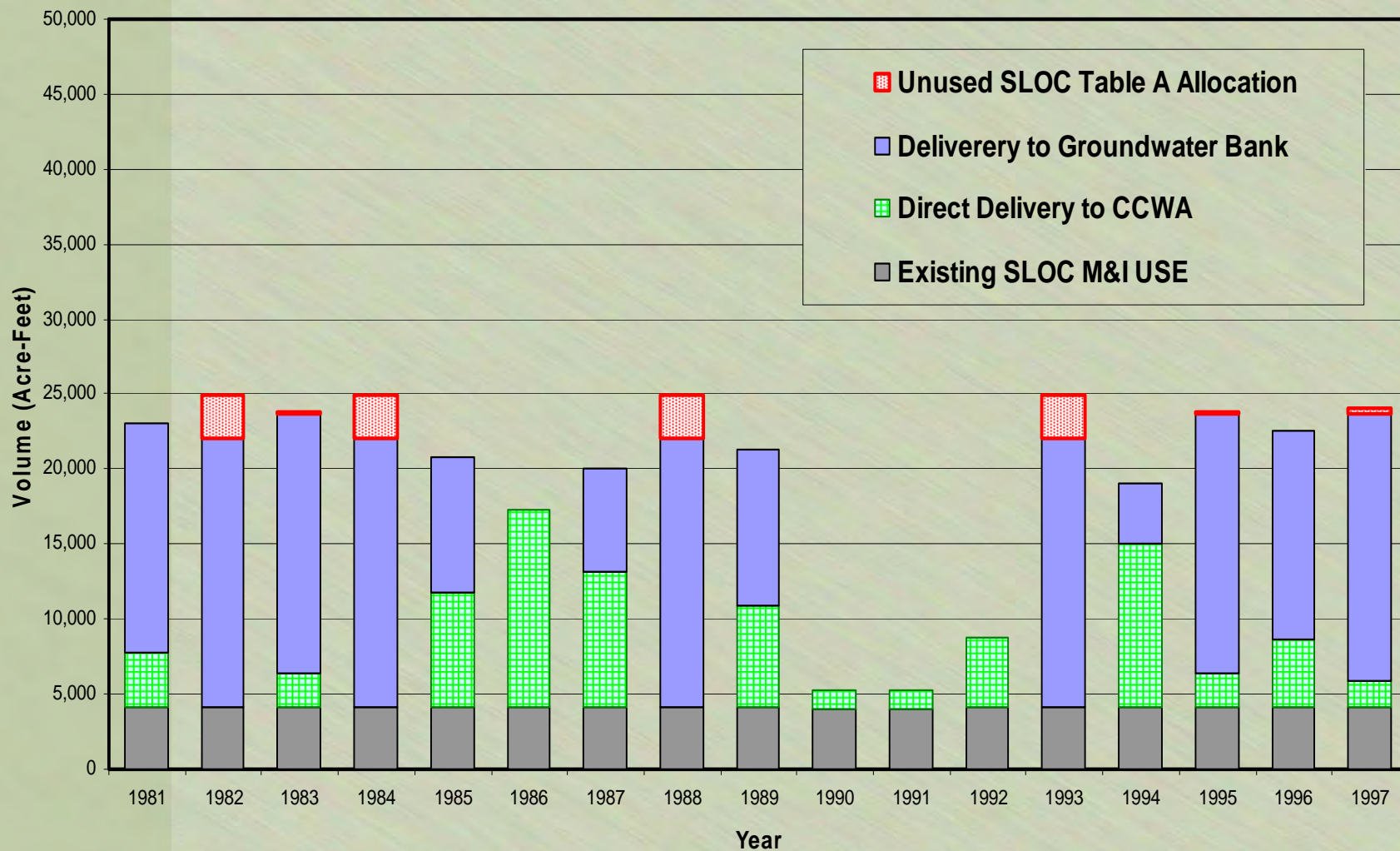
# **Groundwater Banking Operations Capacity Considerations**

**Limit groundwater banking recharge and recovery operations to 1,500 acre-feet per year:**

- Based upon SLOC Table A Allocation availability**
- Existing SLOC M&I Deliveries**
- Water exchange deliveries directly to CCWA (instead of banking)**
- Ability to Meet Recovery Goal No. 2**

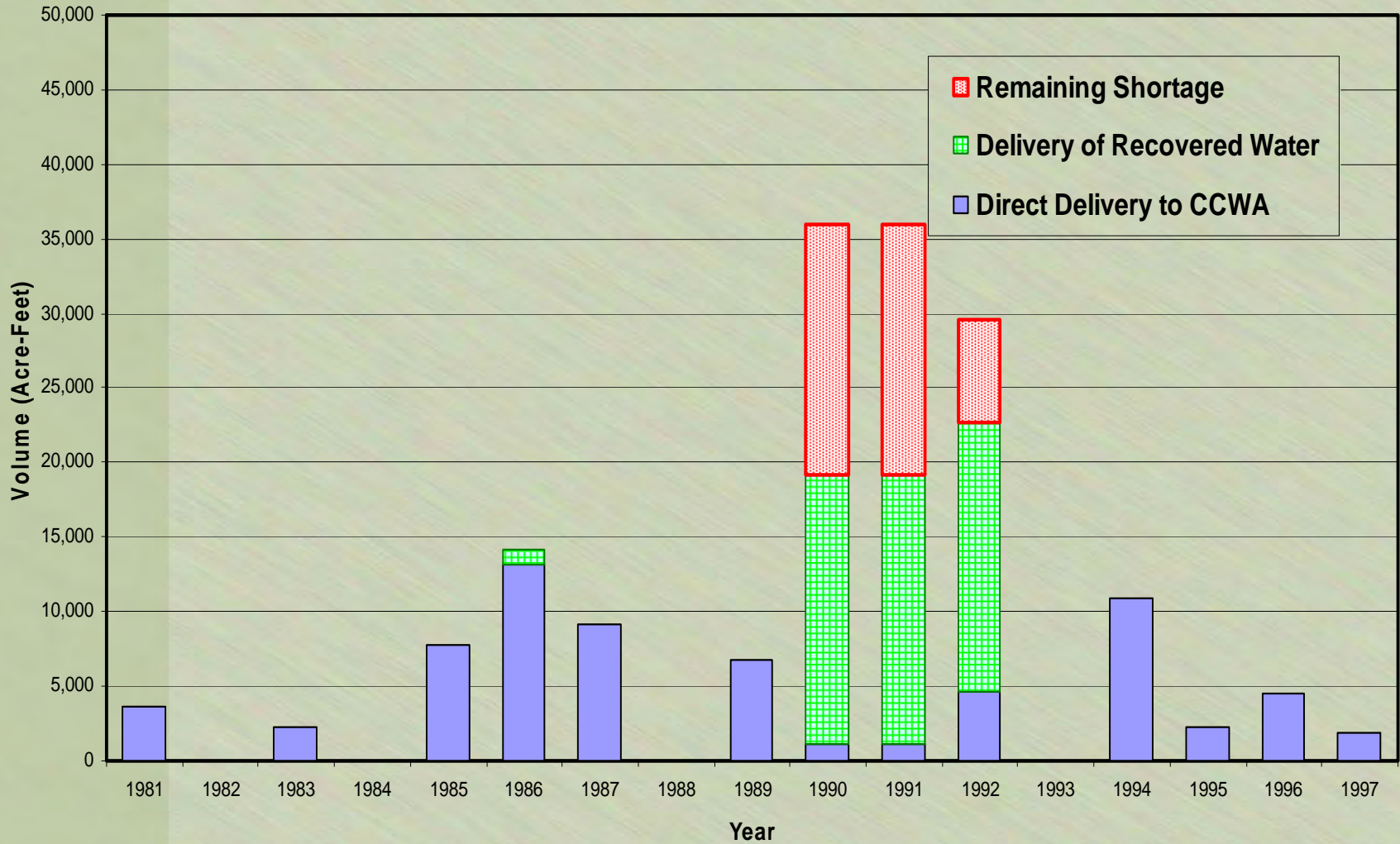


# Use of SLOC SWP Table A Allocation with 1,500 af/month Recharge Capacity Limitation





# Ability to Meet SBFCWCD Table A Allocation with 1,500 af/month Delivery Capacity Limitation





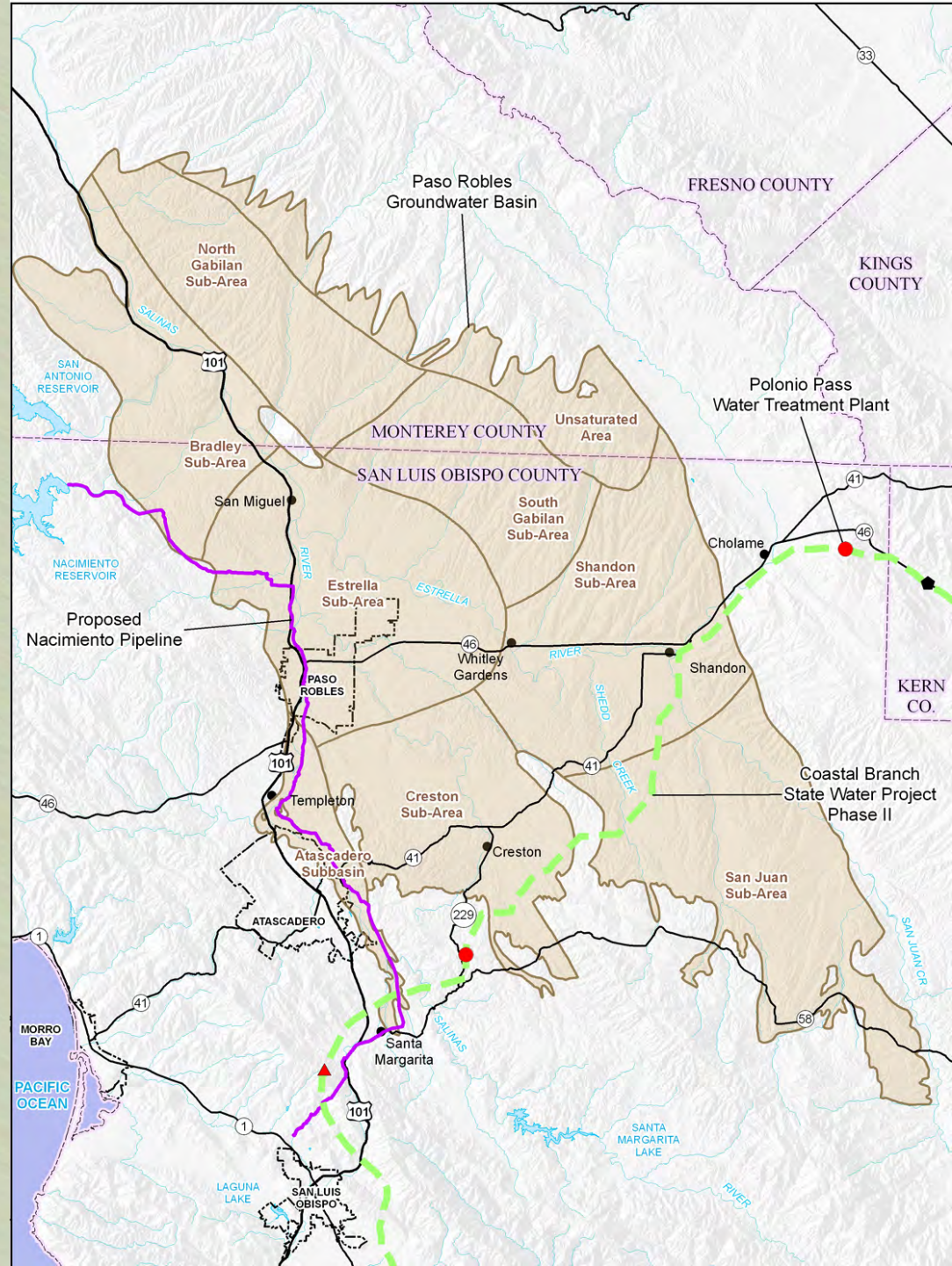
# Hydrogeologic Update

- **Groundwater Subareas**
- **Hydrogeologic Reconnaissance**
- **Identify Preferred Recharge Locations**



# Groundwater Sub-Areas

- Shandon
- San Juan
- Creston
- Estrella
- South Gabilan
- North Gabilan
- Bradley





# Generalized Surface Recharge Potential

Sub-Area	Groundwater Storage	Well Yield	Surface Recharge Potential
<b>Estrella</b>	<ul style="list-style-type: none"><li>• 8,800,000 af of storage</li><li>• 700 foot-thick aquifer</li><li>• 8% specific yield</li><li>• Groundwater levels declining</li></ul>	Wells yield up to 1,000 gpm	Potential recharge areas along Salinas River and near Estrella River
<b>San Juan</b>	<ul style="list-style-type: none"><li>• 4,200,000 af of storage</li><li>• 450 foot-thick aquifer</li><li>• 10% specific yield</li><li>• Small groundwater level decline</li></ul>	Wells yield 1,000 to 2,000 gpm	Potential stream recharge along Shedd Creek, and Shell Creek/Camatta Canyon
<b>Creston</b>	<ul style="list-style-type: none"><li>• 2,000,000 af of storage</li><li>• 450 foot-thick aquifer</li><li>• 9% specific yield</li><li>• Groundwater levels stable</li></ul>	Wells yield 300 to 400 gpm	Potential recharge along Huer Huero Creek
<b>Shandon</b>	<ul style="list-style-type: none"><li>• 7,600,000 af of storage</li><li>• 1000 foot-thick aquifer</li><li>• 9% specific yield</li><li>• Groundwater levels stable</li></ul>	Wells yield 350 to 900 gpm	Extensive clays restrict percolation of water Potential In-lieu recharge opportunity



# Generalized Surface Recharge Potential

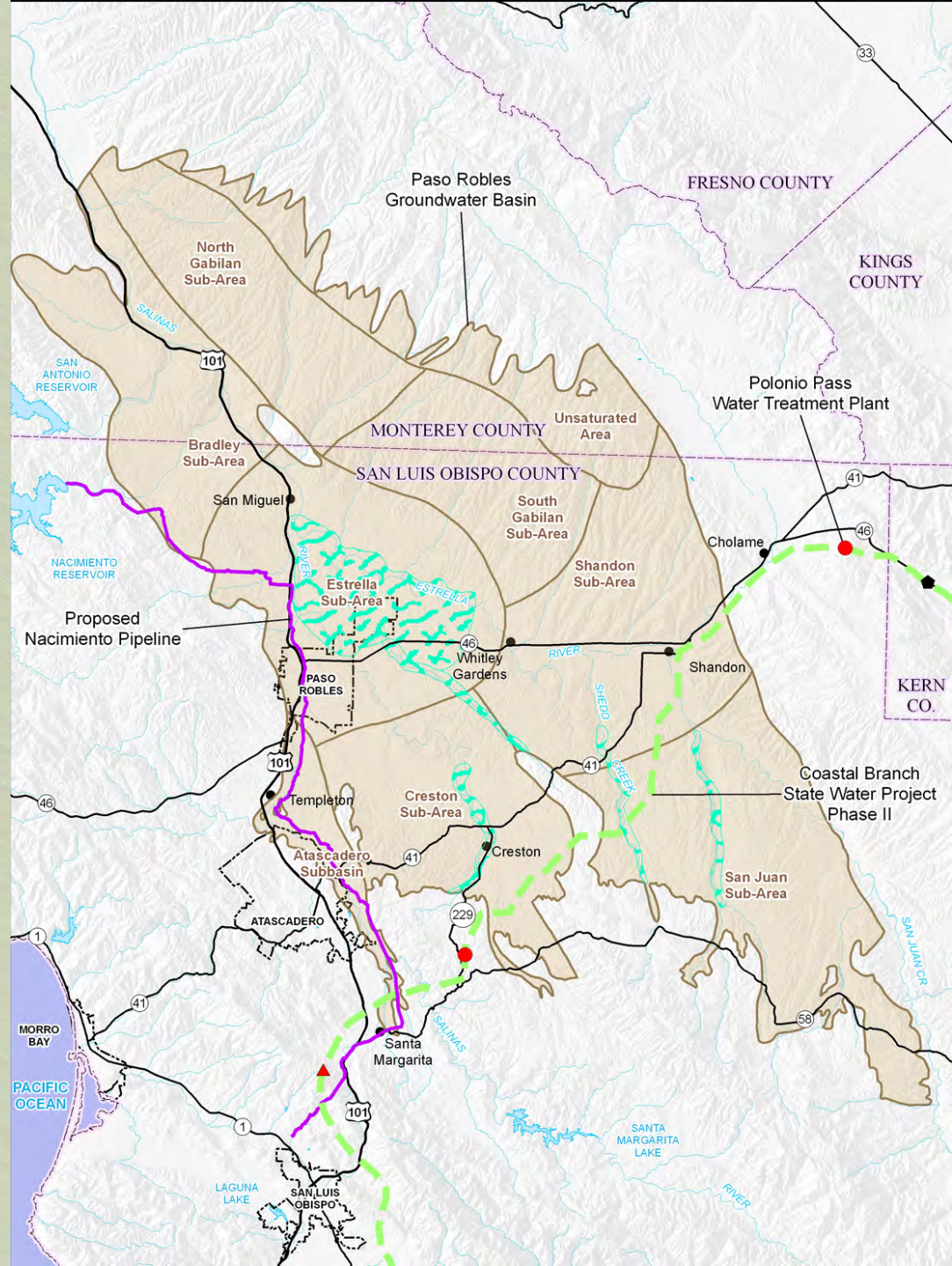
Sub-Area	Total Groundwater Storage	Well Yields	Surface Recharge Potential
<b>South Gabilan</b>	<ul style="list-style-type: none"><li>• 2,400,000 af of storage</li><li>• 800 foot-thick aquifer</li><li>• 9% specific yield</li><li>• Groundwater levels stable</li></ul>	Wells yield up 200 to 400 gpm Domestic wells yield less than 25 gpm	Clays compose 75 % of aquifer thickness, may reduce recharge potential
<b>North Gabilan</b>	<ul style="list-style-type: none"><li>• 3,500,000 af of storage</li><li>• 800 foot-thick aquifer</li><li>• 9% specific yield</li><li>• Groundwater levels stable</li></ul>	Wells yield up 200 to 400 gpm Domestic wells yield less than 25 gpm	Clays compose 75 % of aquifer thickness, may reduce recharge potential
<b>Bradley</b>	<ul style="list-style-type: none"><li>• 1,800,000 af of storage</li><li>• 700 foot-thick aquifer</li><li>• 7% specific yield</li><li>• Groundwater levels declining</li></ul>	Wells yield 300 to 400 gpm	Recharge potential is small due to limited hydraulic connection





## Potential Surface Recharge Areas

- **San Juan Sub-Area**
  - Shell Creek
  - Shedd Creek
- **Creston Sub-Area**
  - Huer Huero Creek
- **Estrella Sub-Area**





# Hydrogeologic Reconnaissance

- **San Juan Subarea**
  - **Camatta Canyon/Shell Creek**
    - Shell Creek Road
  - **San Juan Creek**
    - Truesdale Road/Shell Creek Road
    - Camatta-Shandon Road
  - **Upper San Juan Creek**



# Hydrogeologic Reconnaissance

- **Shandon Subarea**
  - **Lower San Juan Creek**
    - Truesdale Road
    - Confluence of San Juan Creek and Cholame Creek
  - **Estrella River**
    - Shandon to Whitley Gardens
    - Gruenhagen Flat
  - **Estrella River Tributaries**
    - McMillan Canyon
    - Shimmin Canyon
    - Pine Canyon



# Hydrogeologic Reconnaissance

- **Creston Subarea**
  - **West Branch Huer Huero Creek**
  - **Middle Branch Huer Huero Creek**
    - **Highway 229**
    - **Southeast of Creston**
  - **East Branch Huer Huero Creek**
    - **O'Donovan Road**
  - **La Panza Road to Wilson Corner**
    - **Stage Springs Road, Ryan Road**



# Hydrogeologic Reconnaissance

- **Estrella Subarea**
  - **Highway 46 Corridor**
    - Whitley Gardens to Paso Robles
  - **Estrella River**
    - Whitley Gardens to Airport Road
    - Freeman, Keyes, Hog, Ranchito Canyons
  - **Huer Huero Creek**
    - Paso Robles Airport area
    - Penman Springs
  - **Dry Canyon**
  - **Salinas River**
    - Highway 46 West to San Miguel



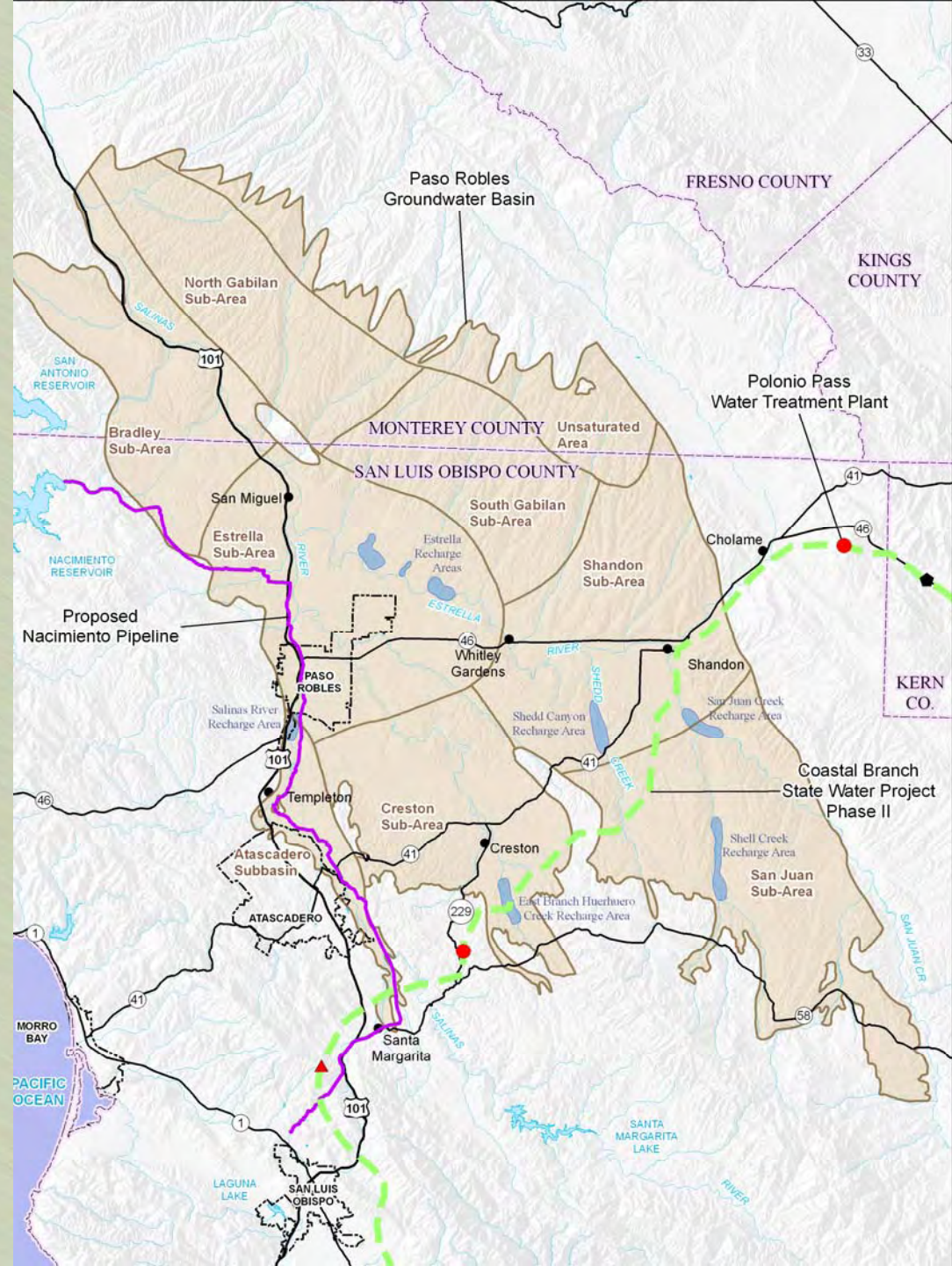
# **Hydrogeologic Reconnaissance – Preferred Recharge Sites**

- **East Branch Huer Huero Creek**
- **Shedd Canyon**
- **Camatta/Shell Creek**
- **Lower San Juan Creek**
- **Estrella River tributaries**
- **Salinas River**



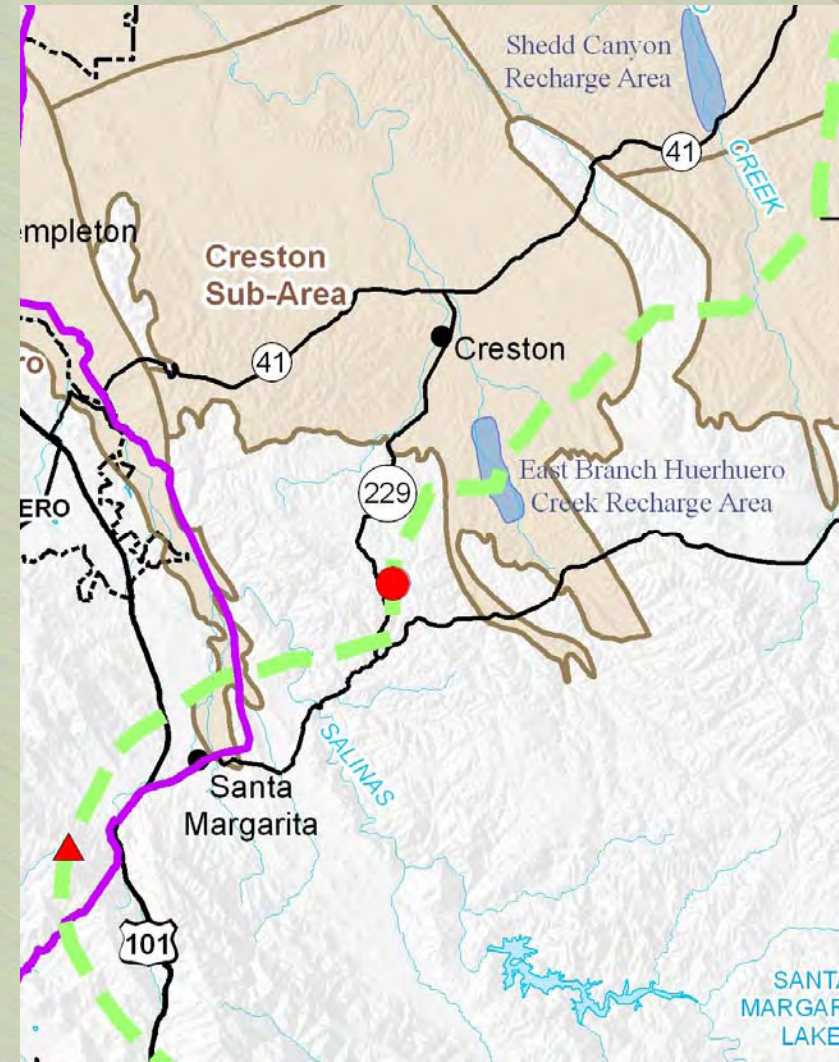
## Potential Surface Recharge Areas

- **San Juan Sub-Area**
  - Camatta Creek/Shell Creek
  - Shedd Canyon
- **Creston Sub-Area**
  - Huer Huero Creek
- **Estrella Sub-Area**
  - Estrella River
- **Atascadero Subbasin**
  - Salinas River



# Hydrogeologic Reconnaissance – Preferred Recharge Sites

- **East Branch Huer Huero Creek**
  - O'Donovan Road
  - Near SWP Pipeline
  - Broad and sandy stream channel
  - Downstream of La Panza Range granitics
    - Coarse-grained aquifer
    - Excellent water quality
  - Recharge area for Paso Robles Basin
  - Extensive new vineyard development
  - Potentially limited available aquifer storage capacity

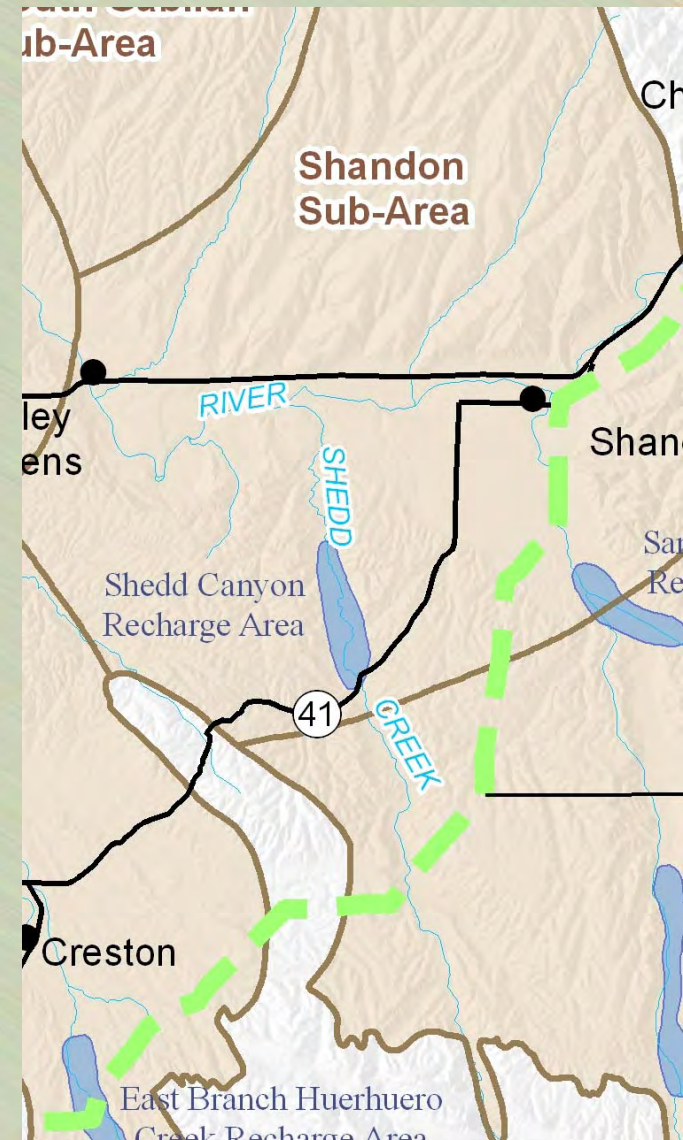




# Hydrogeologic Reconnaissance – Preferred Recharge Sites

- **Shedd Canyon**

- Likely best between Highways 41 and 46
- Potentially favorable alluvium recharge
- Potentially limited recharge into underlying Paso Robles Formation
- Limited subsurface information



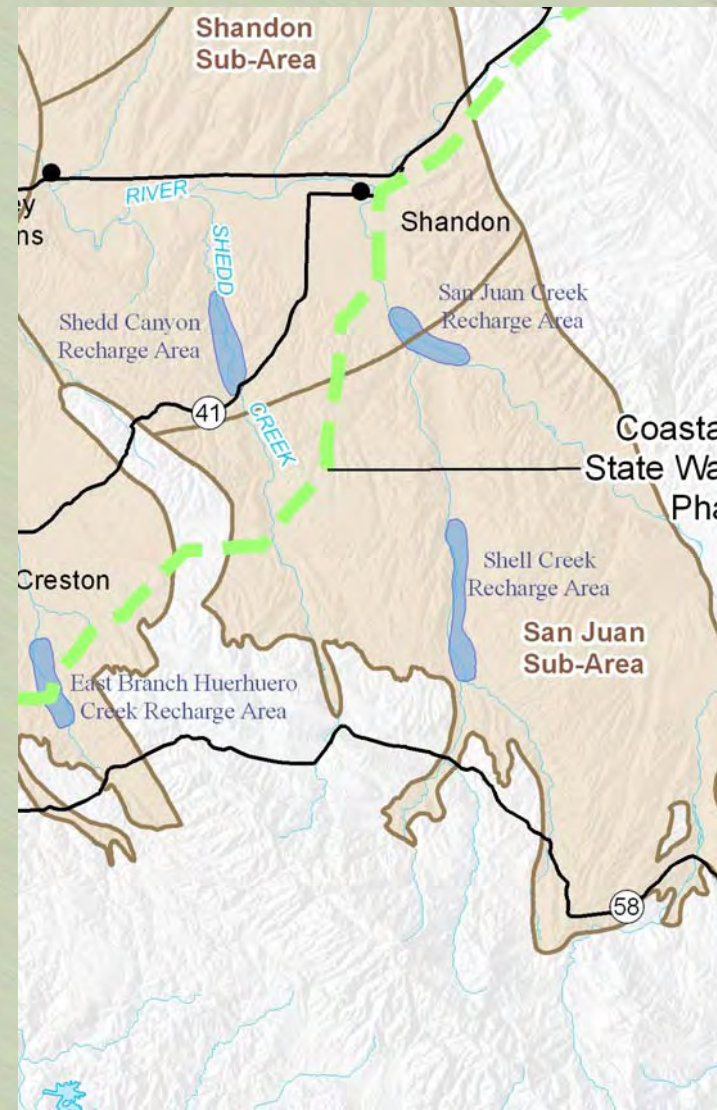
# Hydrogeologic Reconnaissance – Preferred Recharge Sites

- **Camatta/Shell Creek**
  - Sinton Ranch to confluence of Shell Creek and Camatta Canyon
  - Highly permeable alluvium with very high recharge potential
  - Broad and flat creek bed
  - Very good water quality
  - Considerable distance to SWP pipeline
  - Potentially limited available aquifer storage capacity



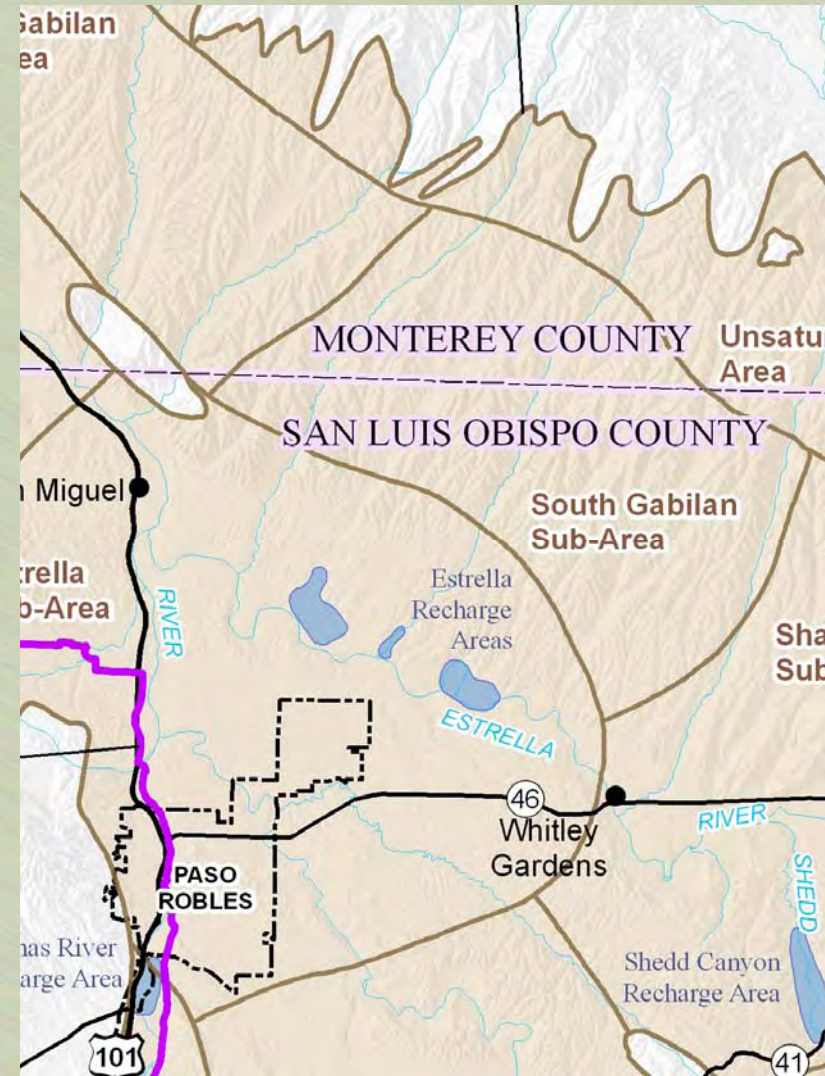
# Hydrogeologic Reconnaissance – Preferred Recharge Sites

- **Lower San Juan Creek**
  - Confluence of Camatta/Shell Creek with San Juan Creek, near Truesdale Road
  - Coarse-grained alluvium and Paso Robles Formation
  - Highly permeable alluvium
  - Close proximity to SWP pipeline and Shandon
  - Relatively good water quality



# Hydrogeologic Reconnaissance – Preferred Recharge Sites

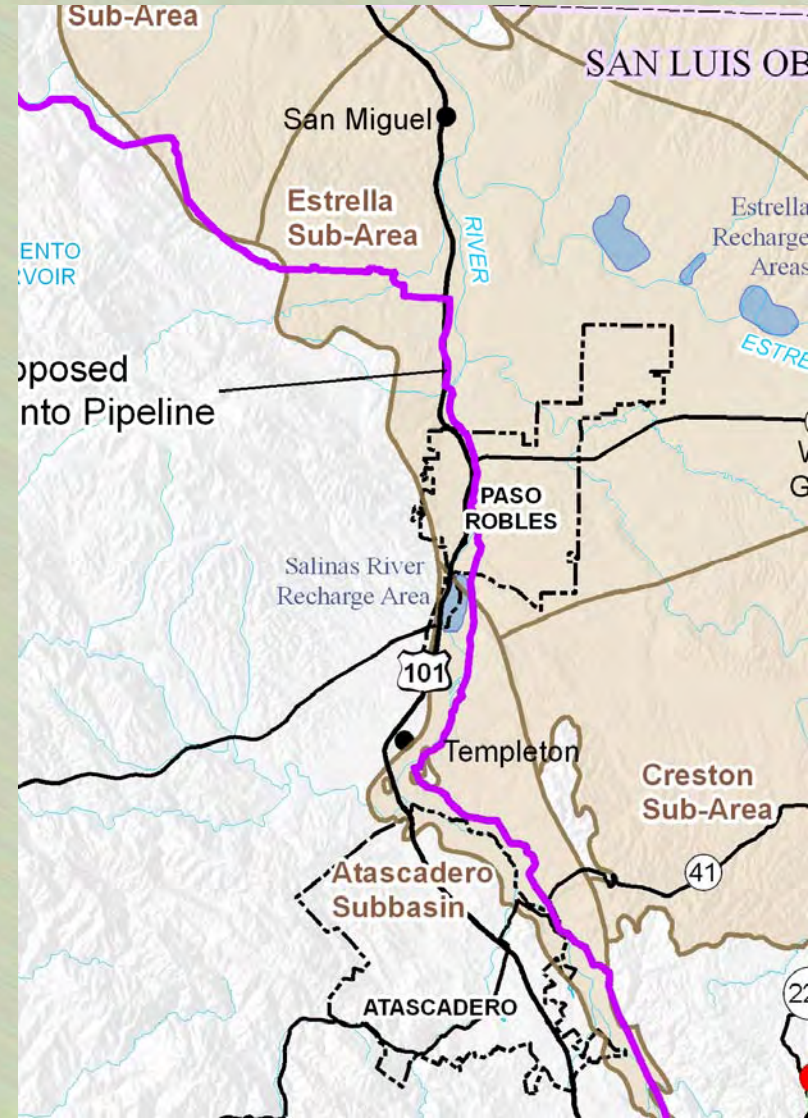
- **Estrella River Tributaries**
  - Estrella River loses surface flow between Jardine and Airport roads
  - Coarse-grained alluvium, but very fine-grained and lower permeability Paso Robles Formation
  - Minor gravel zones in Hog Canyon
  - Considerable distance to SWP pipeline



# Hydrogeologic Reconnaissance – Preferred Recharge Sites

- **Salinas River**

- Near intersection of Highway 46 West and Highway 101
- Coarse-grained alluvium
- Coarse gravels in underlying Paso Robles Formation
- Hydraulic continuity between alluvium and Paso Robles Formation
- Considerable distance to SWP pipeline
- Close proximity to Nacimiento pipeline





# **Groundwater Recharge Alternatives**

- **Stream Recharge Alternative**
- **In-Lieu and Direct Recharge Alternative**
- **Direct Recharge Alternative**



# Stream Recharge Alternative

- **Groundwater Recharge Alternative**
  - No organized groundwater recovery
- **Least Cost Alternative**
  - Fewest facilities and least O&M
- **Provide regional benefit**
  - Along stream corridors
- **May have environmental considerations**
  - May impact local stream habitat and riparian systems



# Stream Recharge Alternative

- **Option 1 - Estrella River at Basin Boundary**
  - About 27 miles of streambed
  - Adjacent to many agricultural areas
  
- **Option 2 - San Juan Creek at San Juan Creek Recharge Area**
  - About 28 miles of streambed
  - Adjacent to many agricultural areas
  - Provides recharge to San Juan Creek Recharge Area





# **In-Lieu Recharge Alternative (under development)**

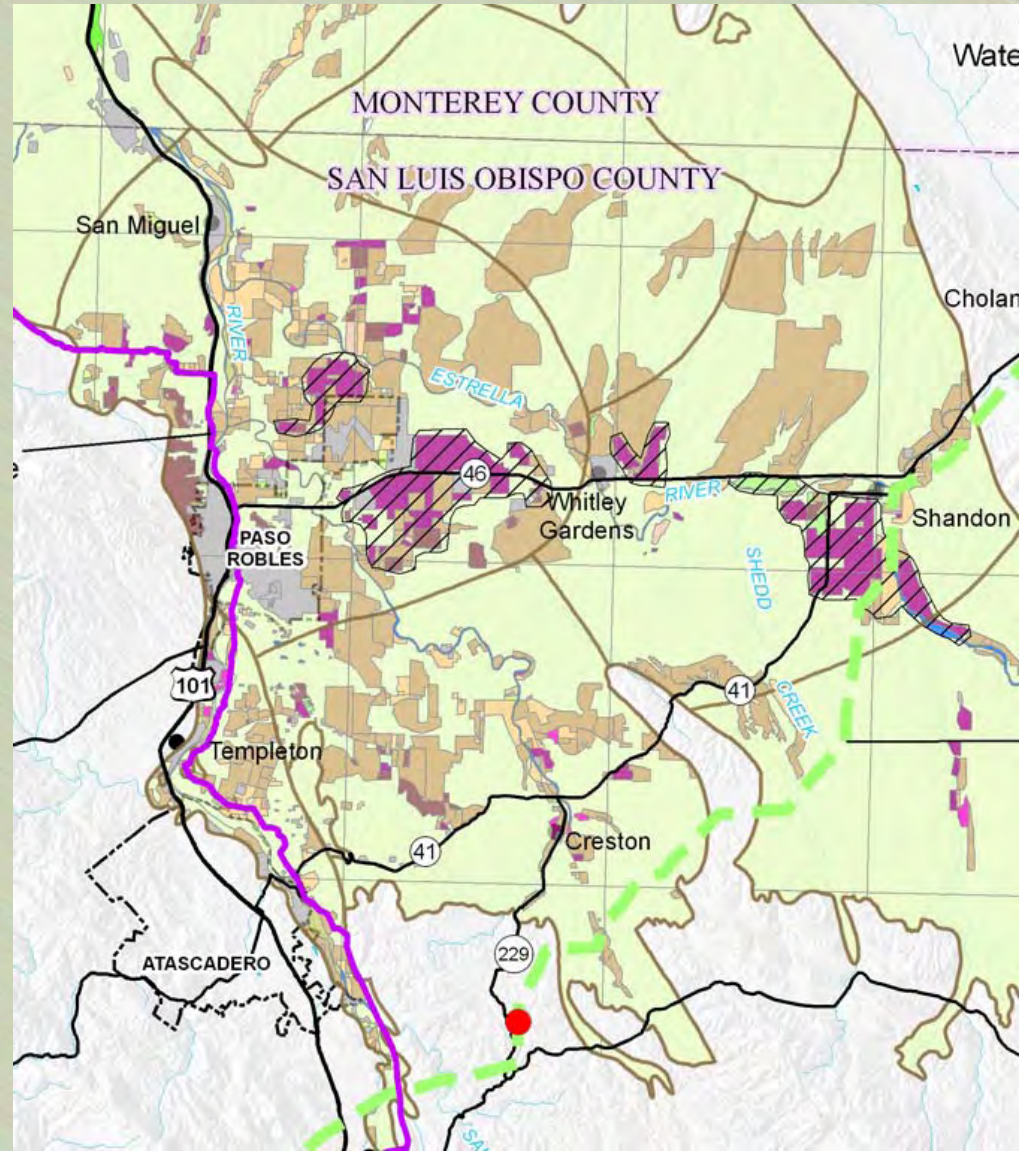
- **Maximize in-lieu recharge opportunity**
  - **Located near agricultural areas (greatest water use)**
- **Supplement with direct recharge**
  - **Sited near areas with favorable recharge potential**
- **May be designed for Recovery Goal No. 1 or Recovery Goal No. 2**



# Potential In-Lieu Recharge Areas

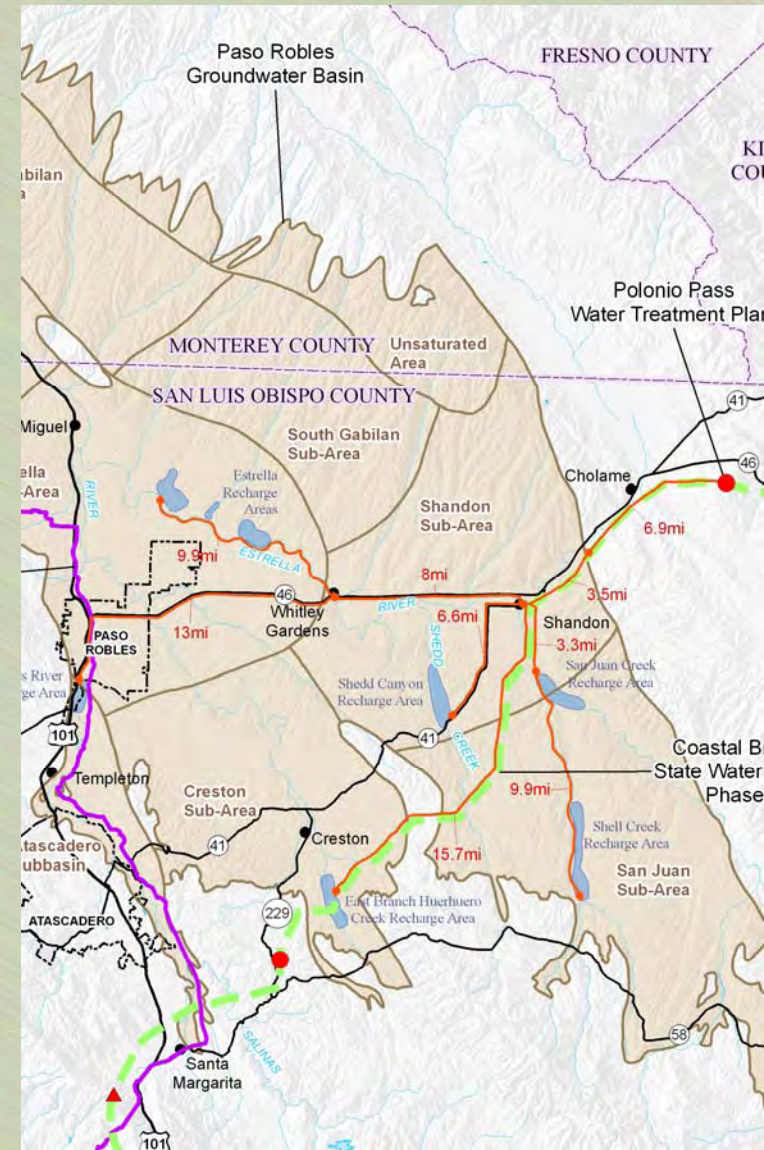
- Shandon Area
- Hwy 46 Corridor
- Whitley Gardens
- North Paso Robles

Based on DWR 1997 Land Use Survey



# Basin Recharge Alternative (under development)

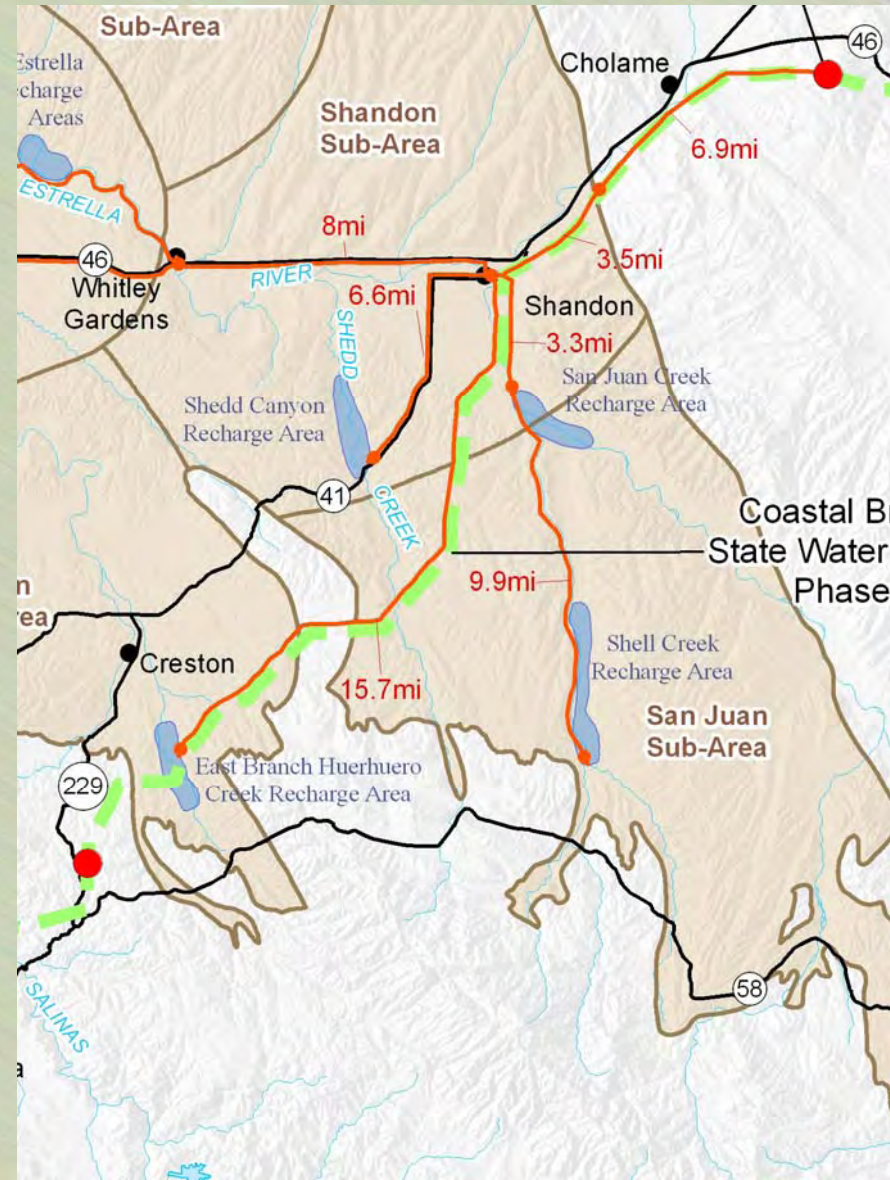
- Designed to meet Recovery Goal No.2
- Maximize direct recharge opportunities
  - Sited near areas with favorable recharge potential
- Supplement with in-lieu recharge
  - Located near agricultural areas
- Test other areas of groundwater basin





# Direct Recharge Alternative Options

- **Option 1 – San Juan and Cammati Creek/Shell Creek Recharge Area**
- **Option 2 - Creston Recharge Area**





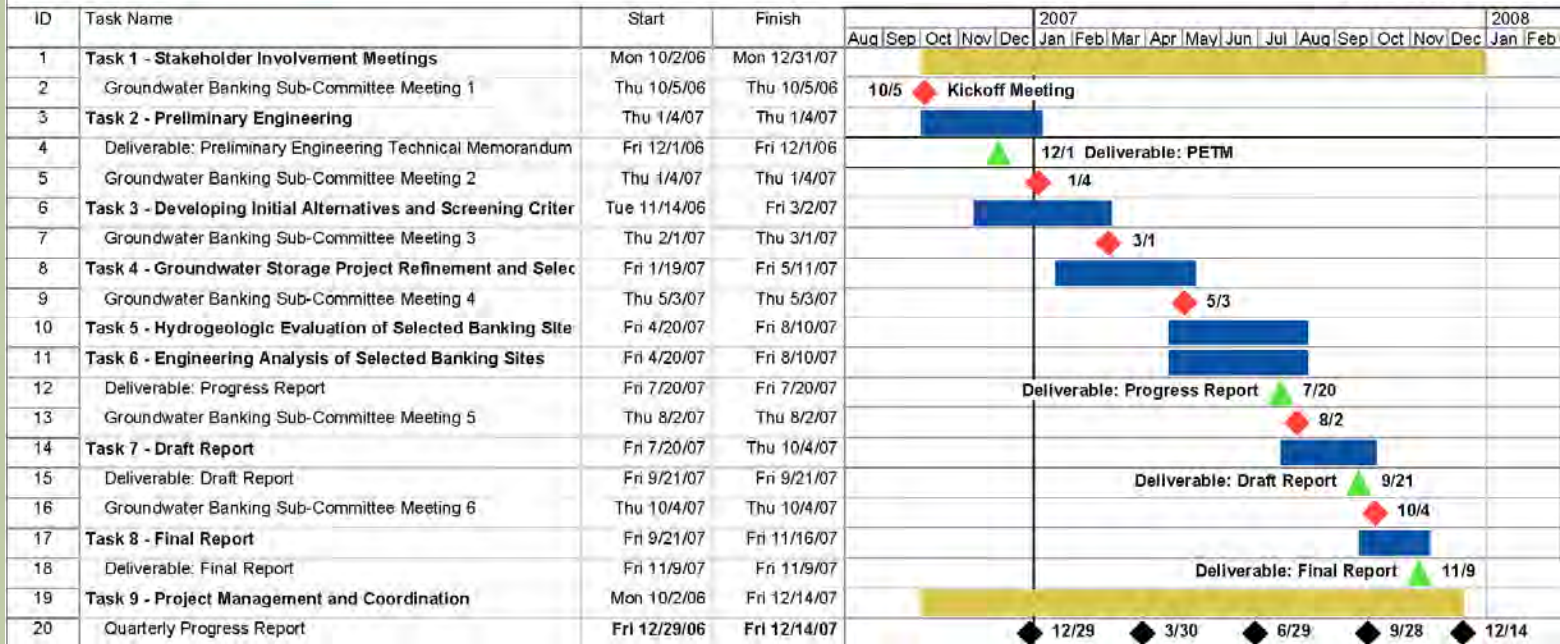
# Next Step

- **Finalize recharge locations based on recently available land use data**
- **Analyze the groundwater impacts of the three alternatives**
- **Evaluate the facility and O&M requirements for each alternative**
- **Document these results in the Progress Report for discussion at next GBSC Meeting (August, 2007)**

# Project Schedule

## UPDATED SCHEDULE

San Luis Obispo County Flood Control and Water Conservation District  
 Paso Robles Groundwater Basin Feasibility Study  
 Proposed Project Schedule



Project: Paso Robles.mpp  
 Date: Fri 8/4/06

Task Groundwater Banking Sub-Committee Meeting   
 Quarterly Progress Reports Deliverable



# **Next GBSC Meeting**

- **Scheduled for August 2, 2007**



**Questions ?**





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Paso Robles Groundwater Basin Water Banking Feasibility Study