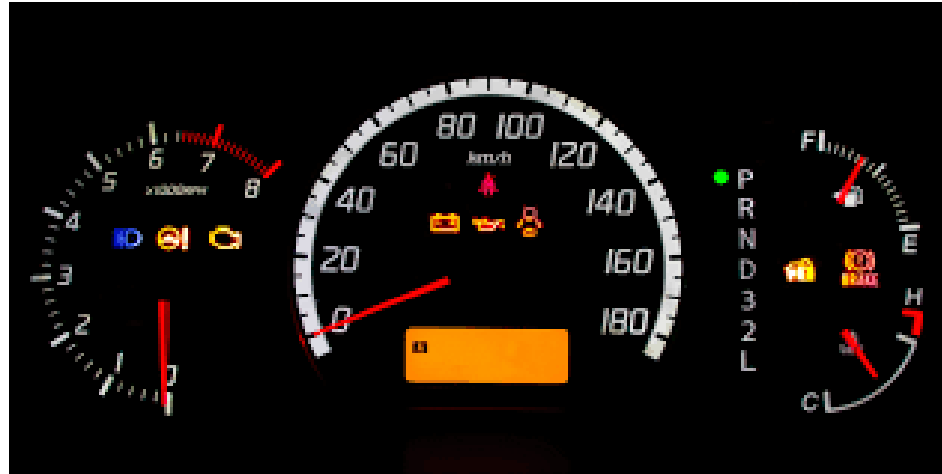


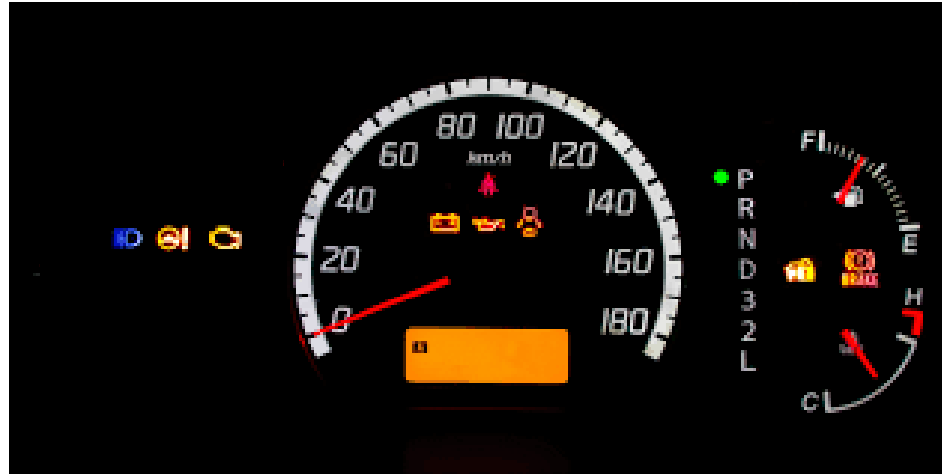


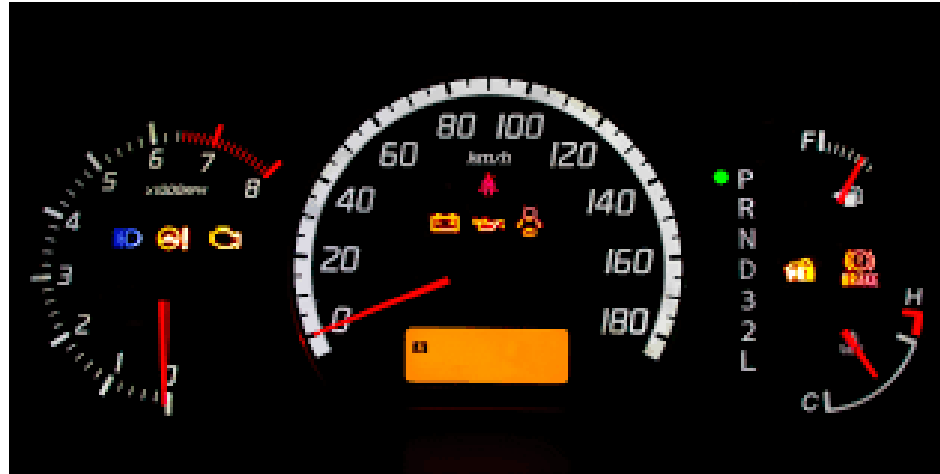
**GEOSCIENCE**

# Usable Groundwater in Storage Estimation for the San Bernardino, Rialto-Colton, Riverside, and Arlington Groundwater Basins

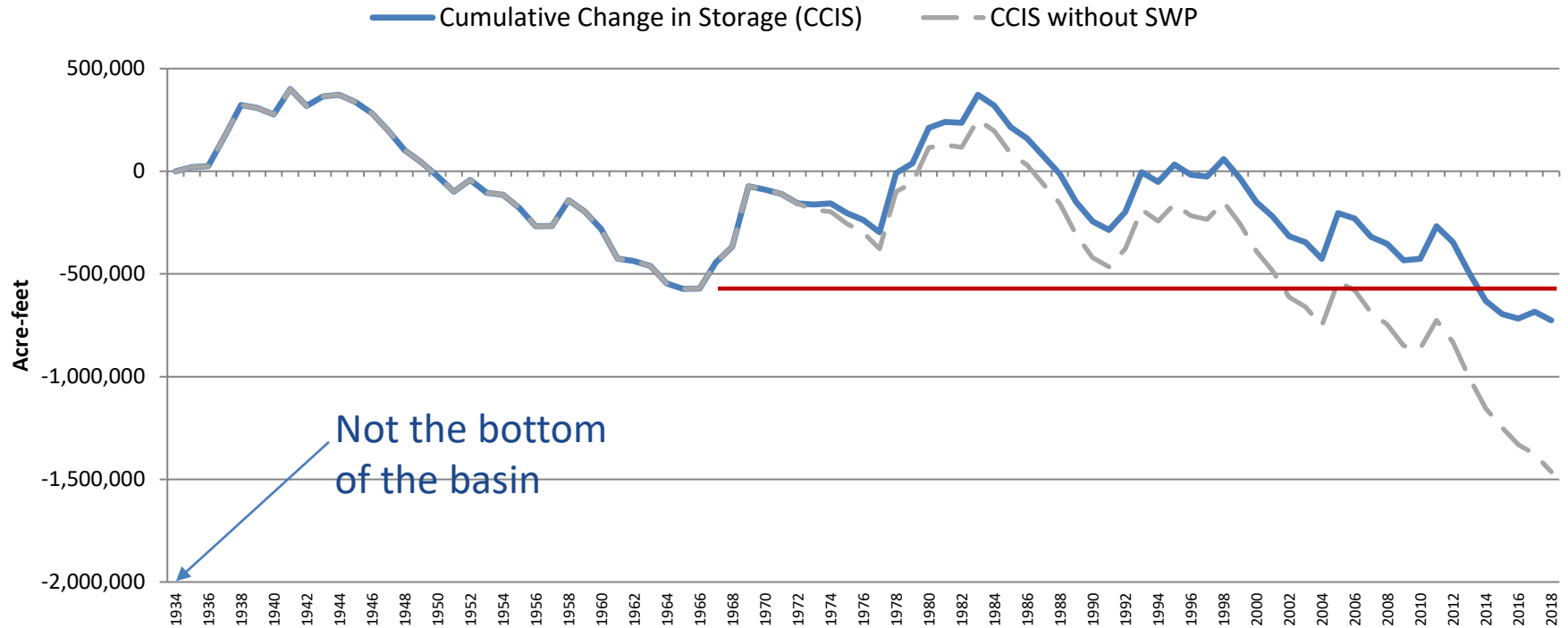








# Cumulative Change in Storage for the SBBA with and without SWP Water



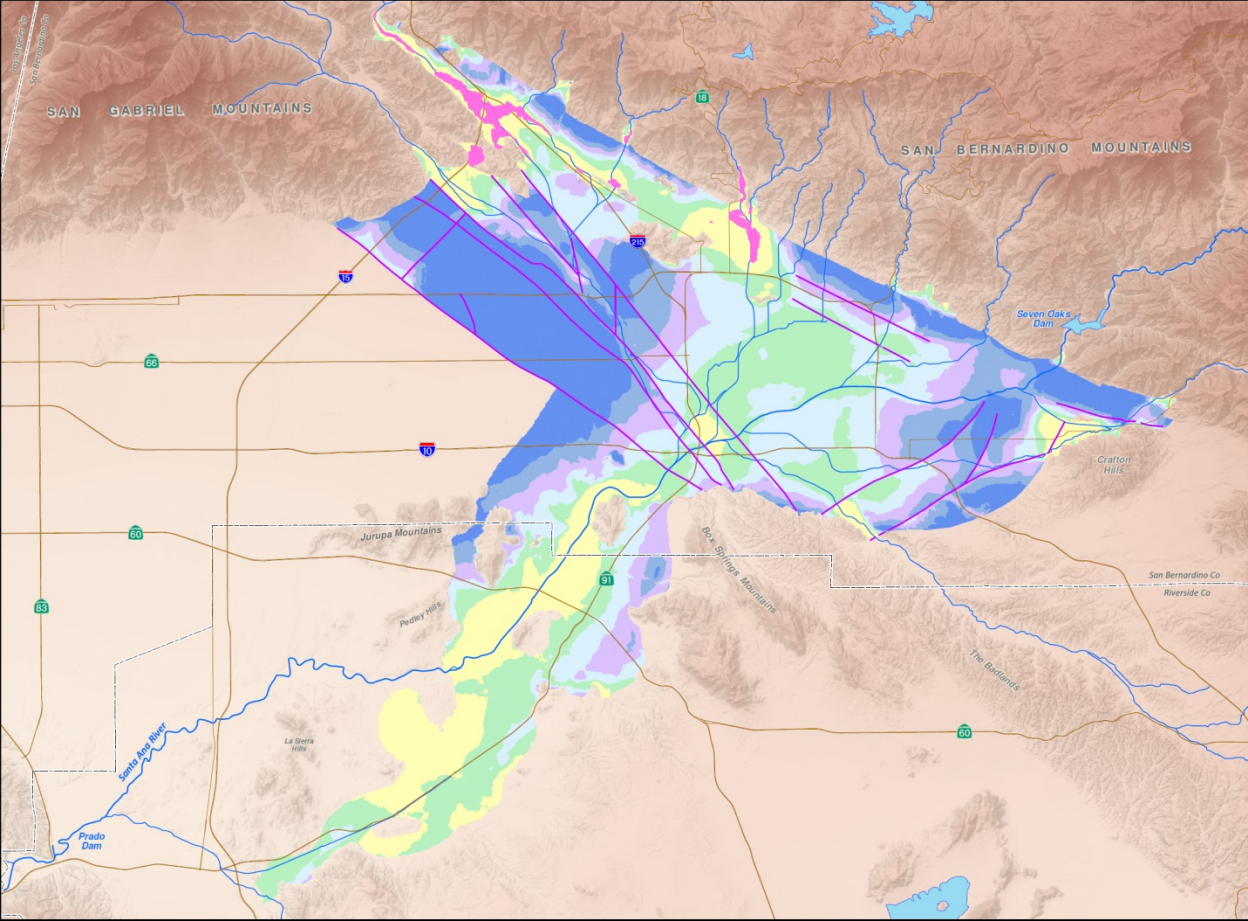
# Total Usable Storage Study

- Estimate the Total Amount of Usable Storage
- Identify impacts of decreasing storage in extended drought
- Estimate the Amount of Groundwater That Can Be Extracted
  - Using Existing Wells
  - Identify Facility Needs, if Any, to Access Groundwater if Water Levels Decline
- Estimate the Number of Years of Groundwater in Storage

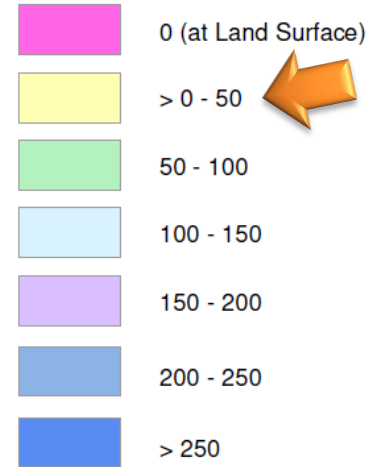
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# Depth to Water When Full



Depth to Water (ft, bgs)

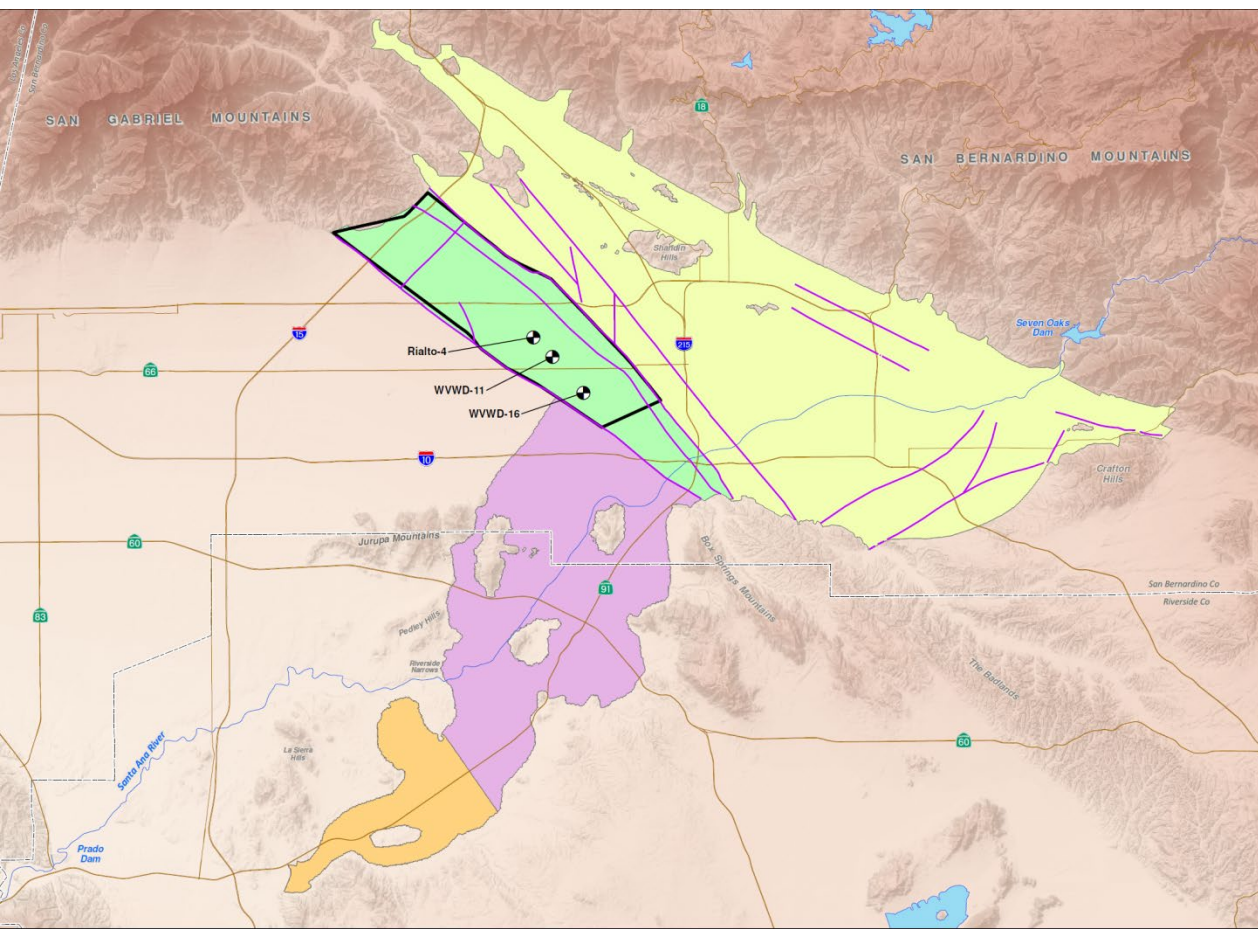






# Impacts of an Extended Drought

When Subsidence Risk Increases	When Low Yield Areas Stop Producing Water	When Wells Need to be Deepened	When Water for Habitat is Affected	When Water Levels Fall Below 1961 Decree Requirements	When Water Levels Fall Below 1969 Judgment Requirements
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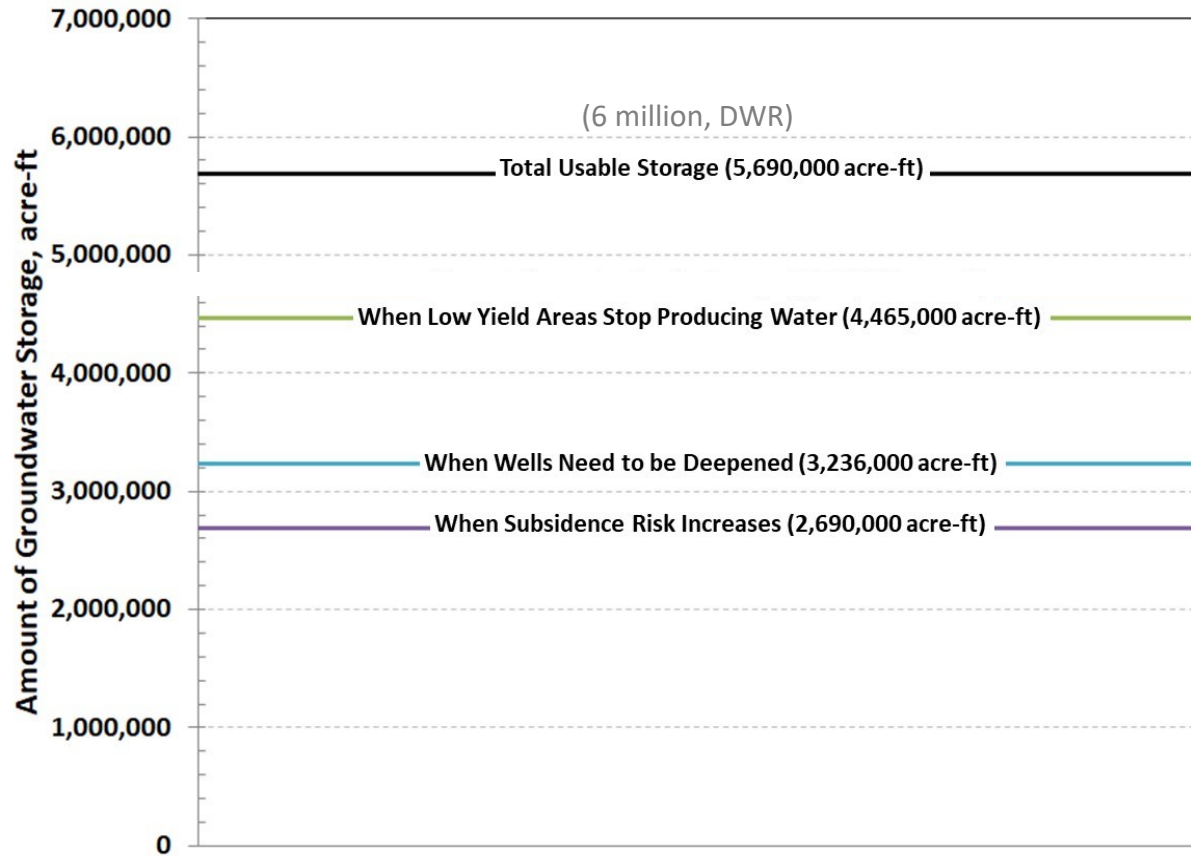
# Groundwater Basins



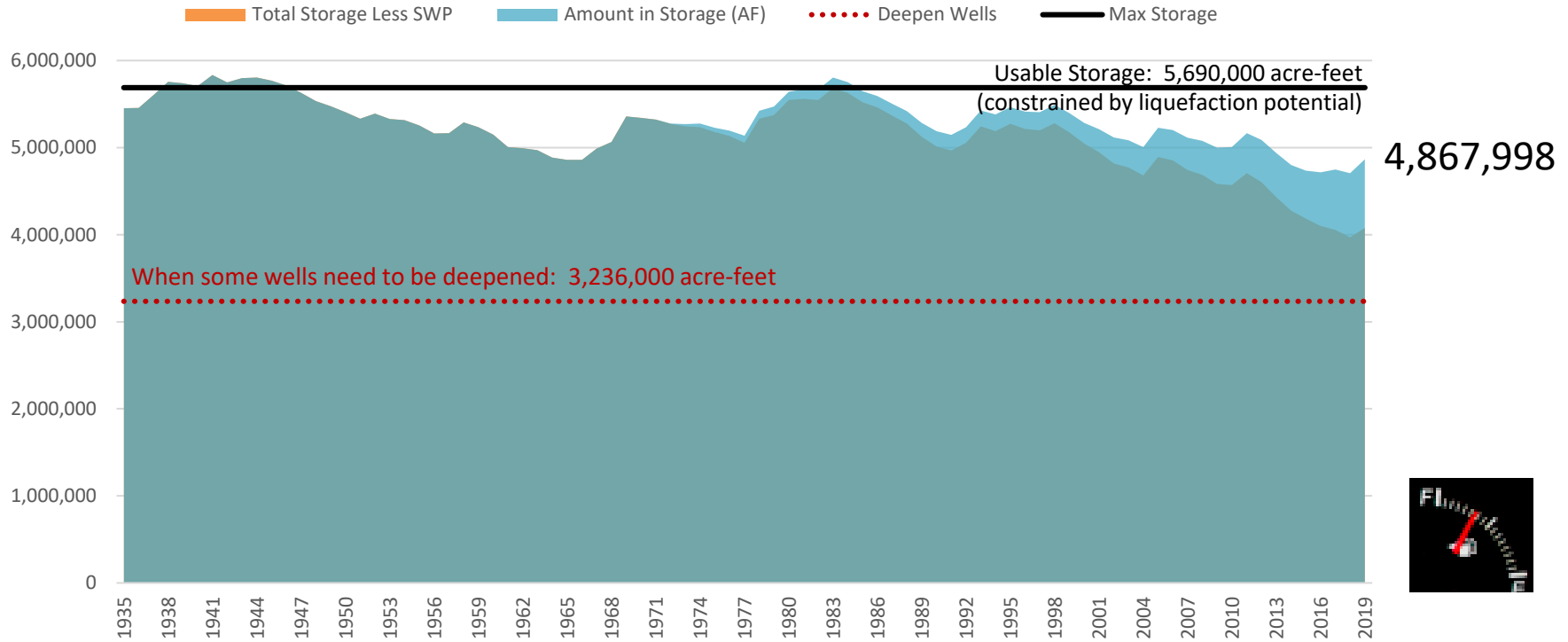
 1961 Rialto Basin Decree Index Well

 1961 Rialto Basin Decree Boundary

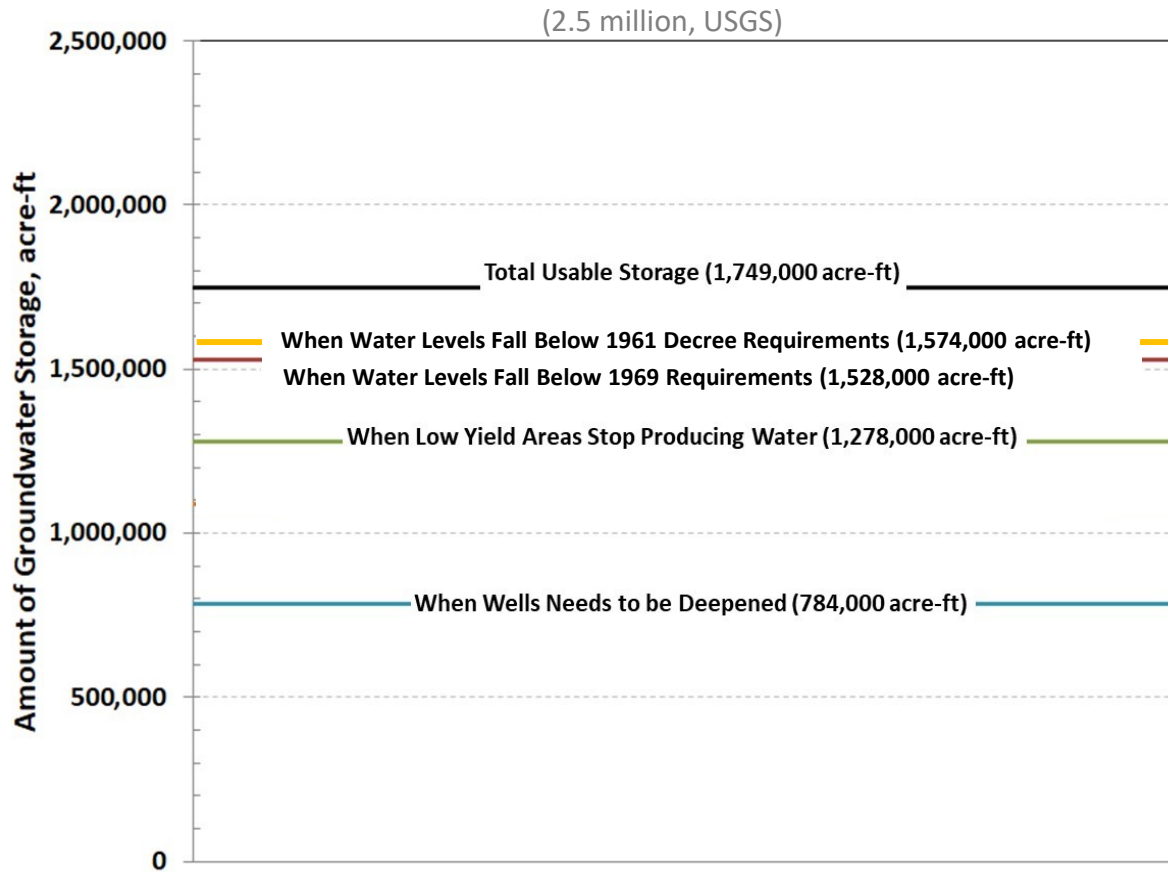
# San Bernardino Basin



# San Bernardino Basin Area Usable Storage (in acre-feet)

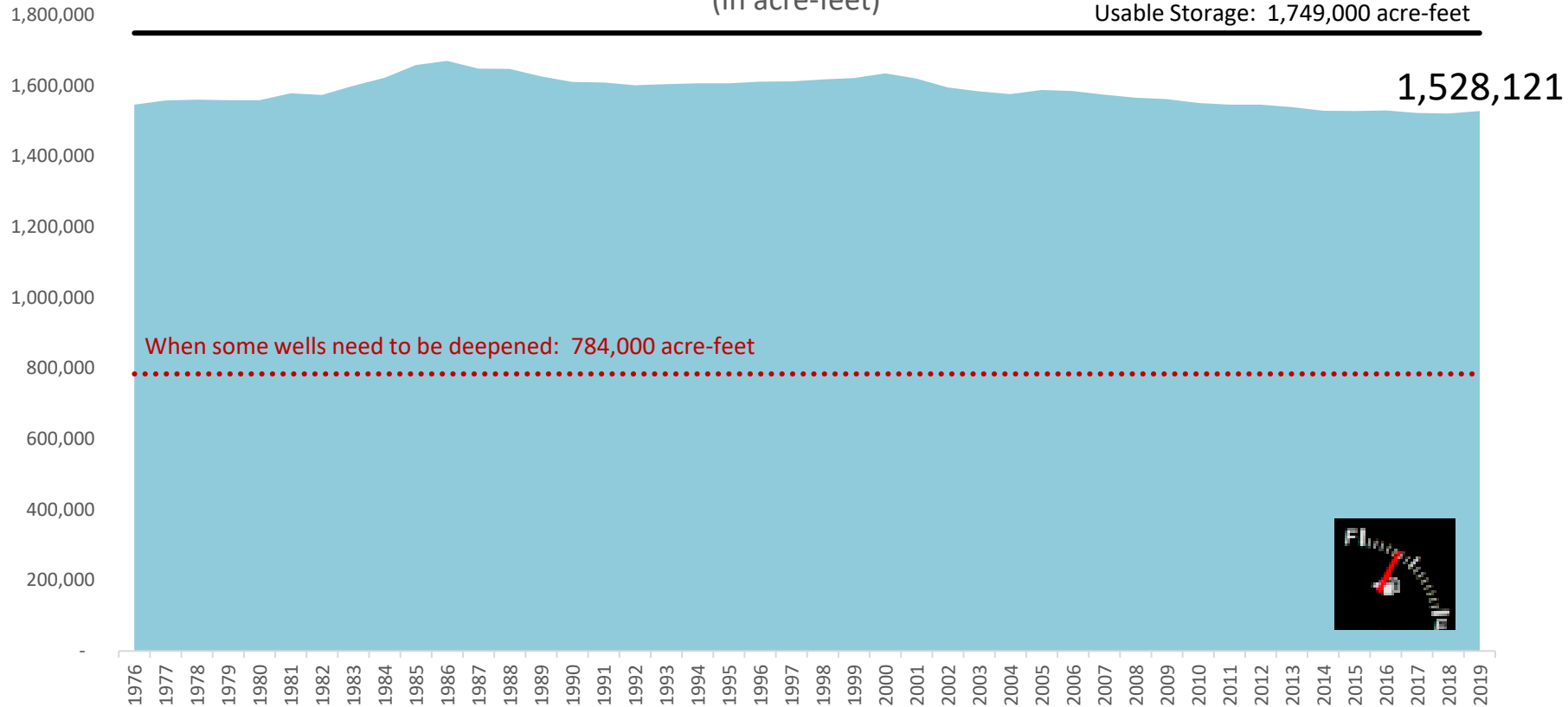


# Rialto-Colton Basin

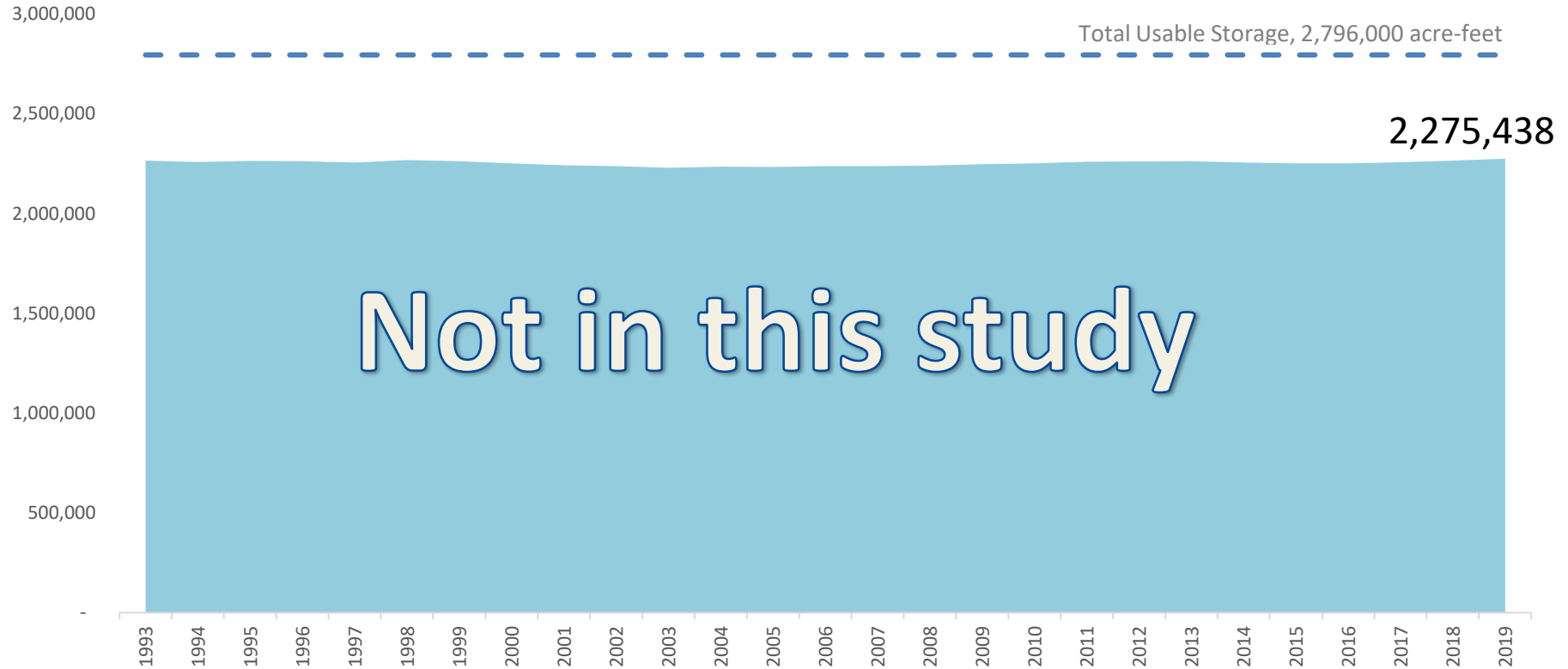


# Rialto-Colton Basin Storage (in acre-feet)

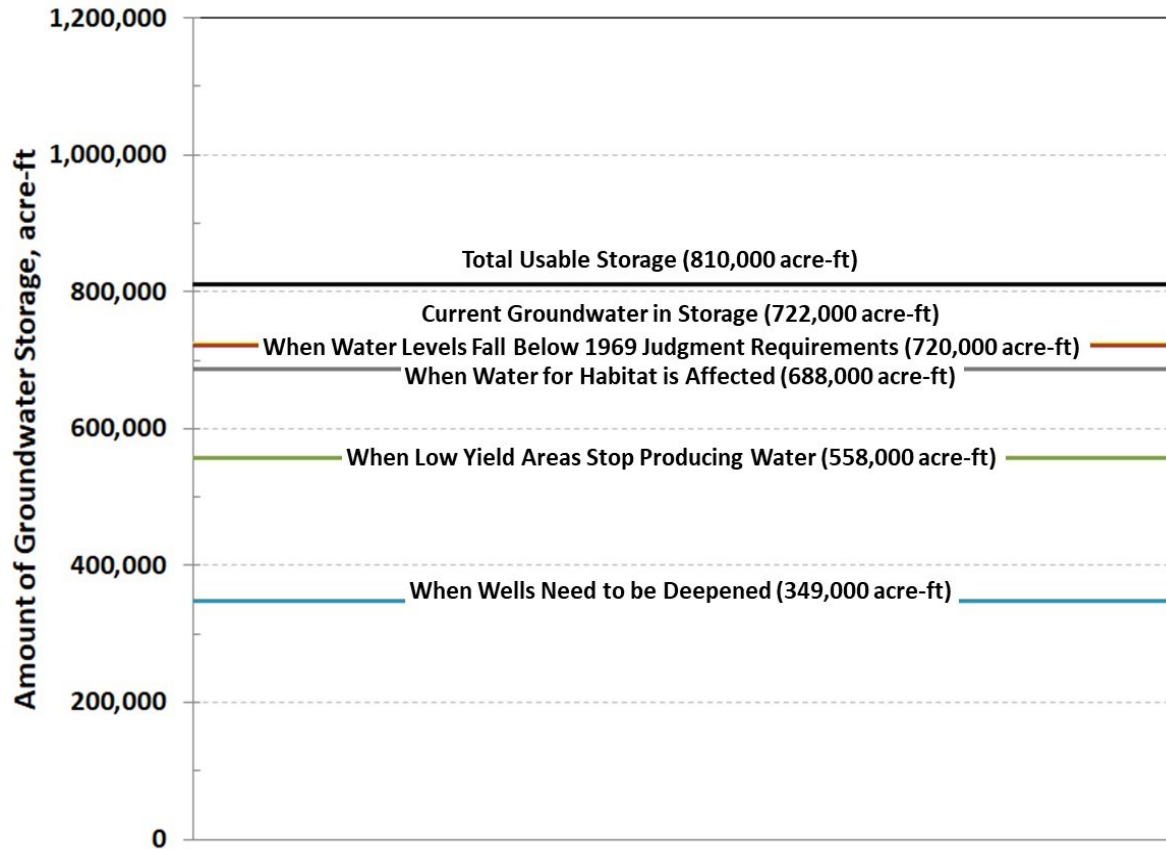
Usable Storage: 1,749,000 acre-feet



# Yucaipa Basin Storage (in acre-feet)

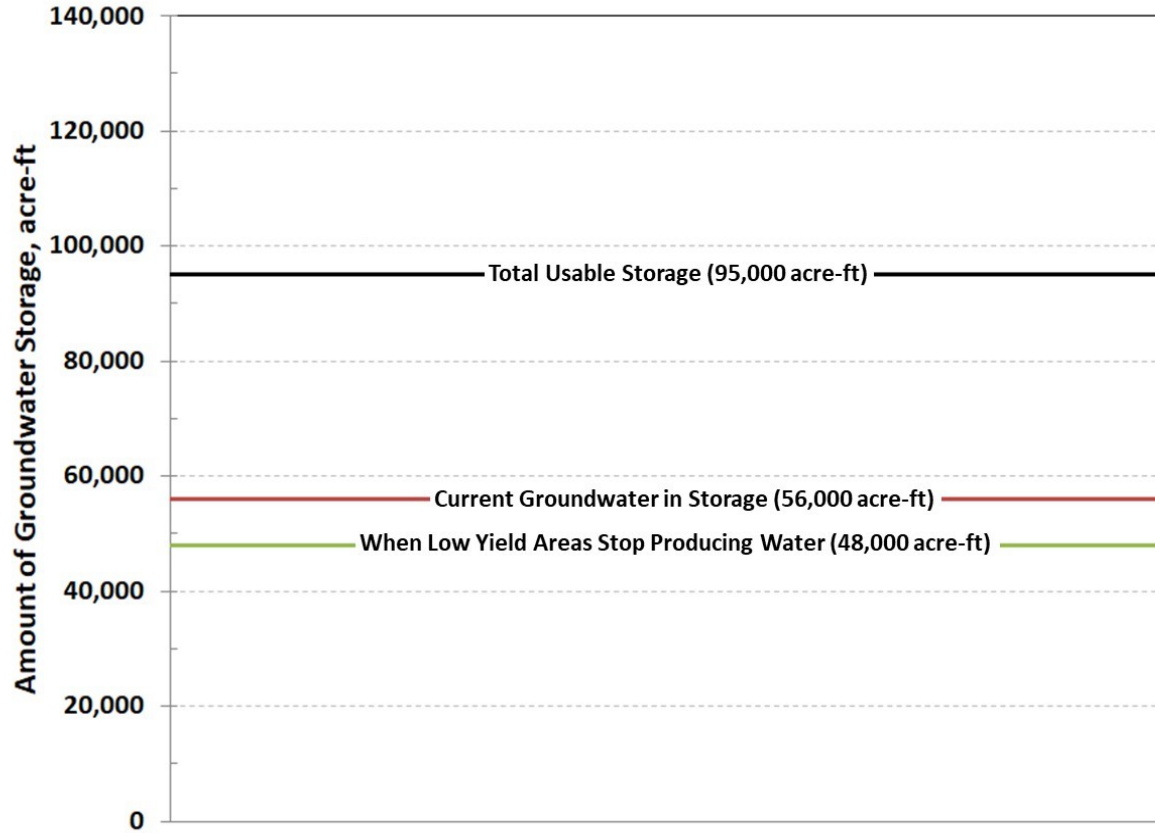


# Riverside Basin

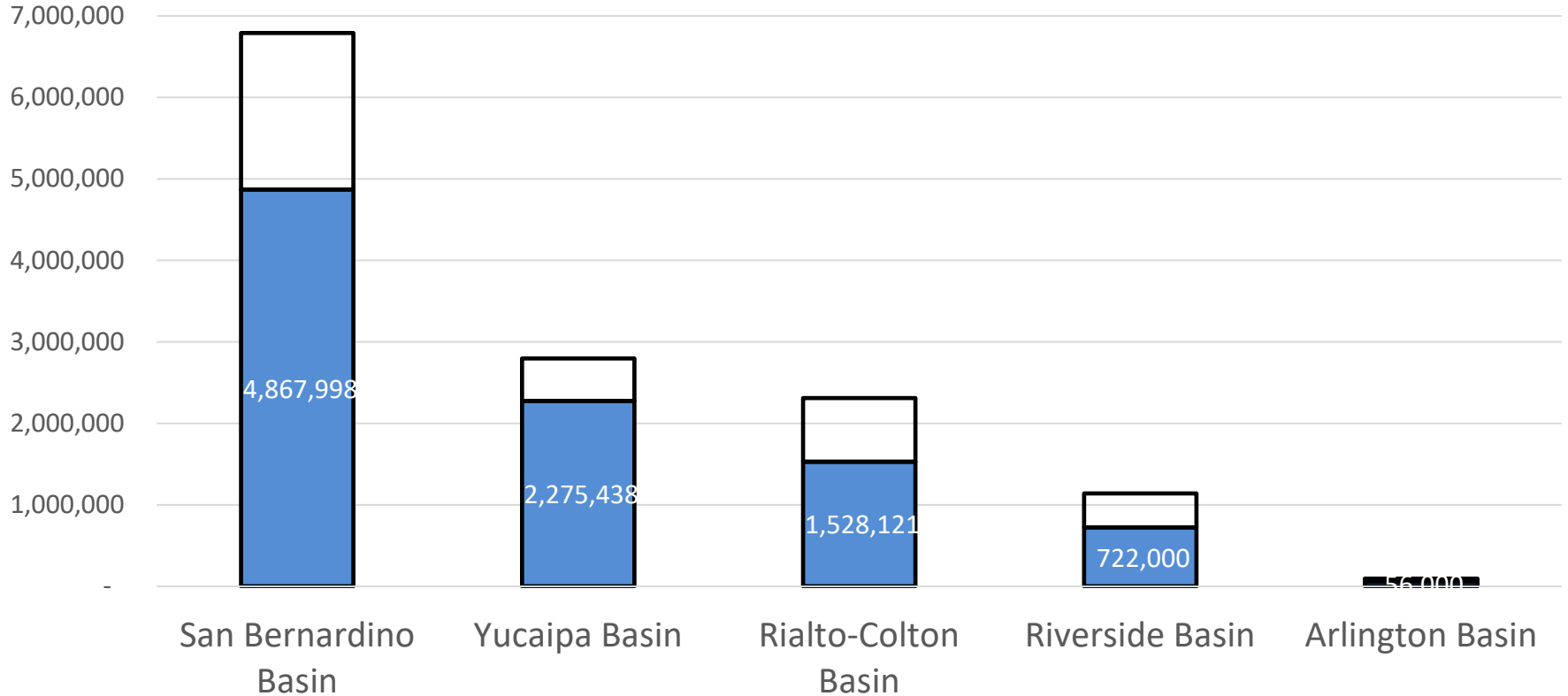




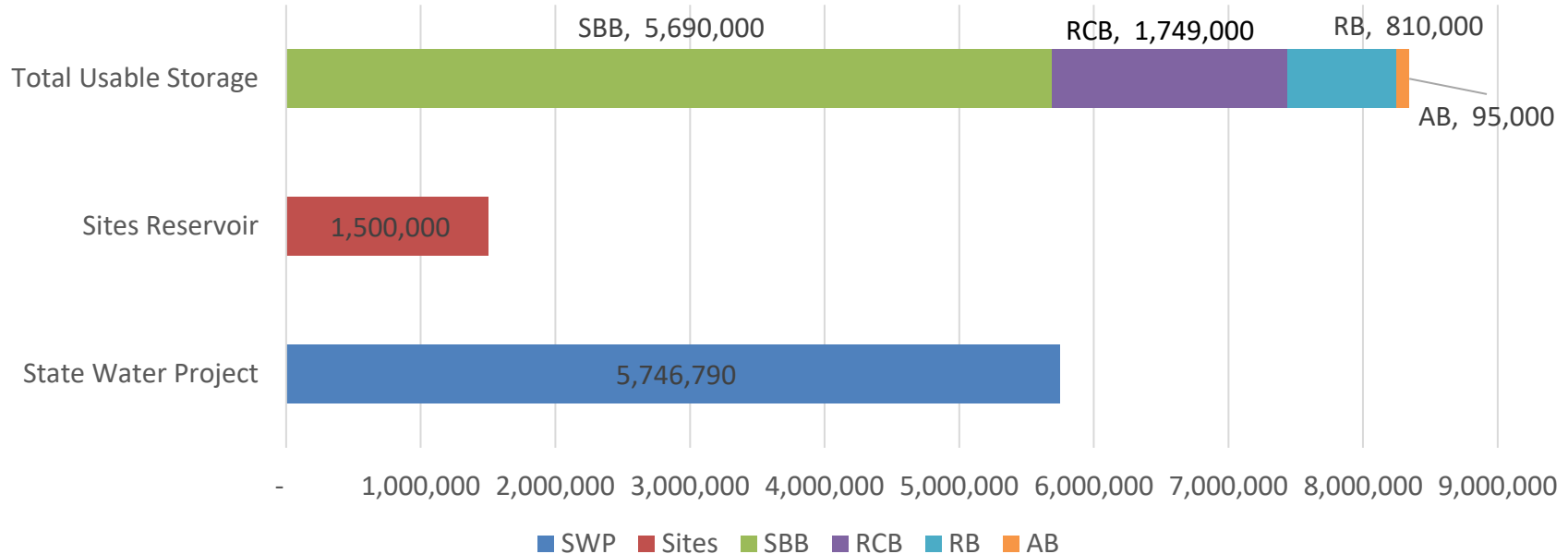
# Arlington Basin



# Total Usable Groundwater Storage



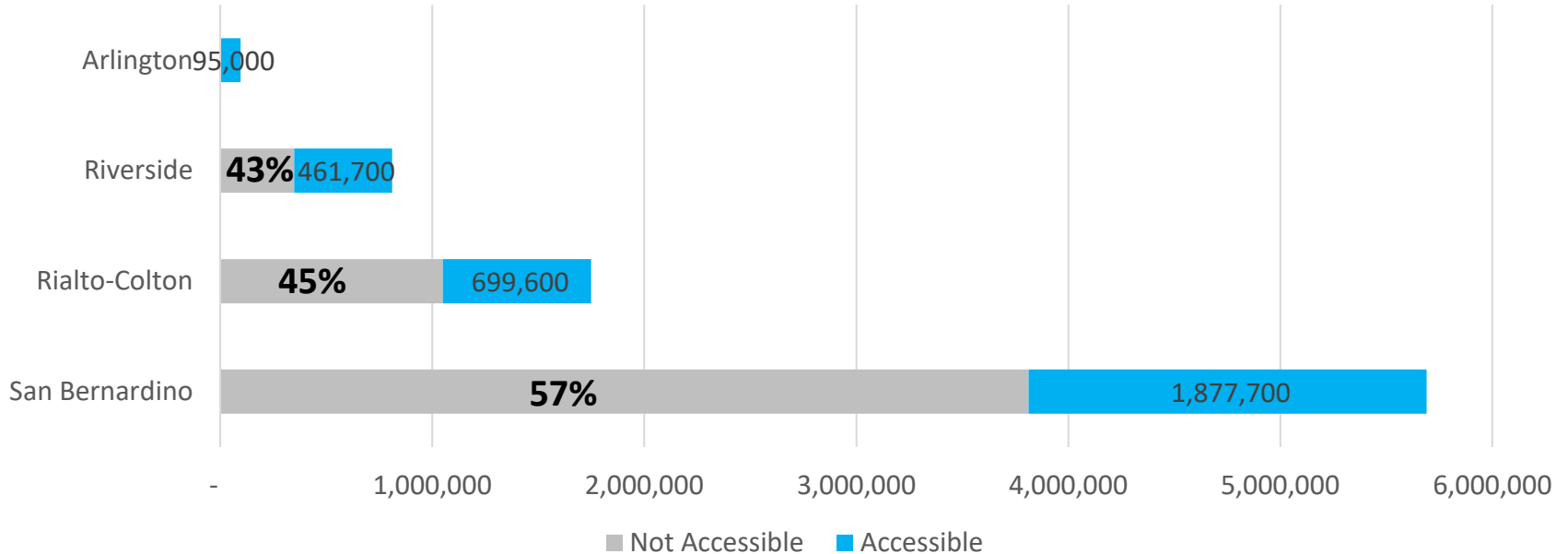
# More Usable Storage than the SWP!



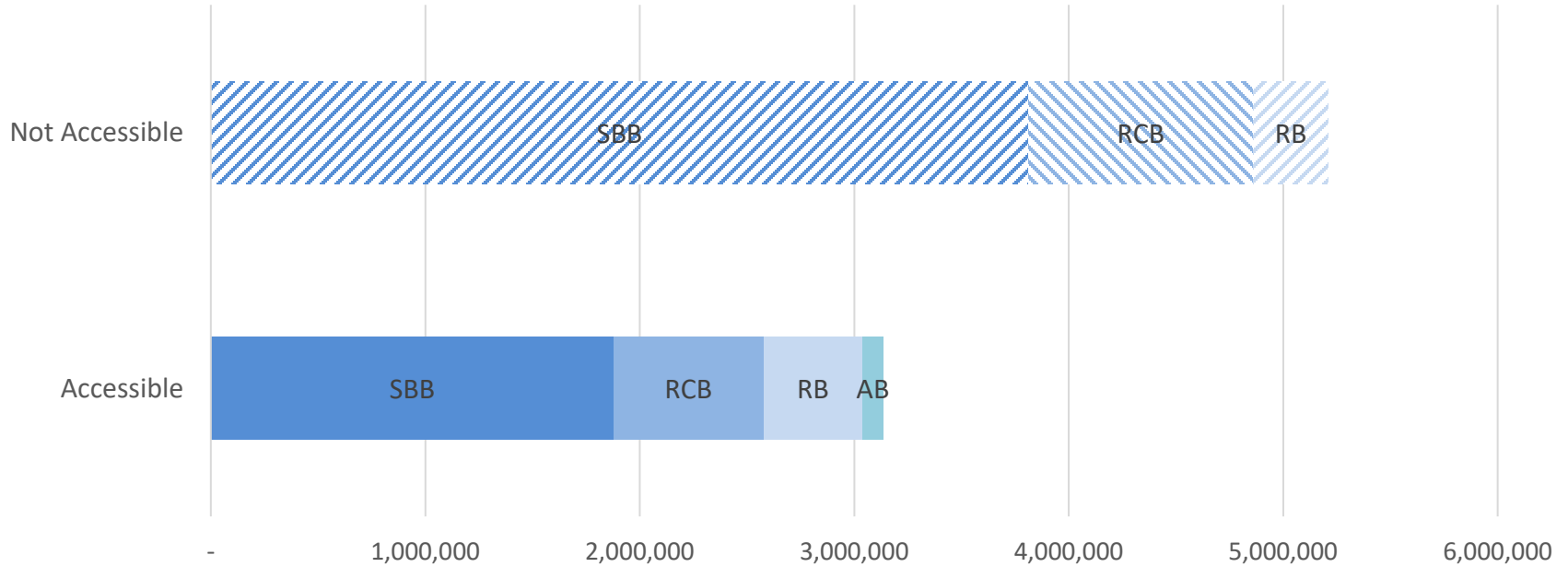
# Total Usable Storage Study

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- Estimate the Number of Years of Groundwater in Storage

# Groundwater Access Using Existing Wells



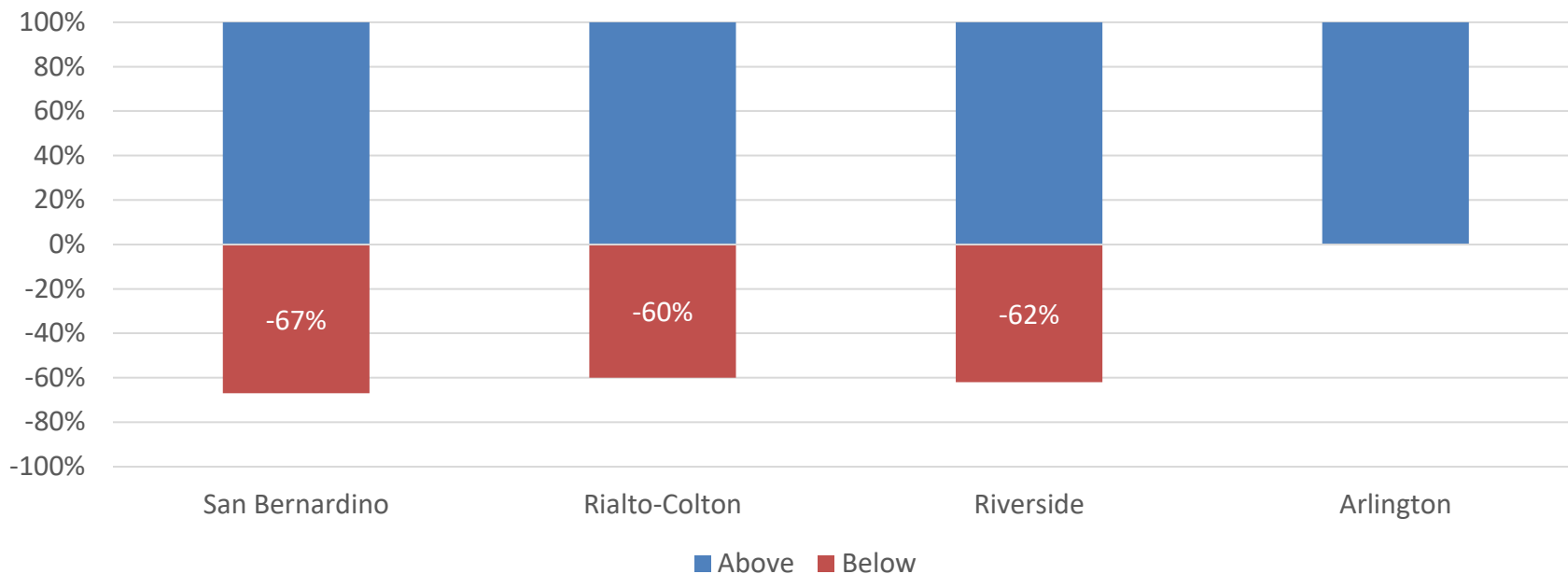
# Groundwater Access Using Existing Wells



# Total Usable Storage Study

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  - Identify Facility Needs, if Any, to Access Groundwater if Water Levels Decline
- Estimate the Number of Years of Groundwater in Storage

# Pumping Reduction When Shallower Existing Wells Go Dry

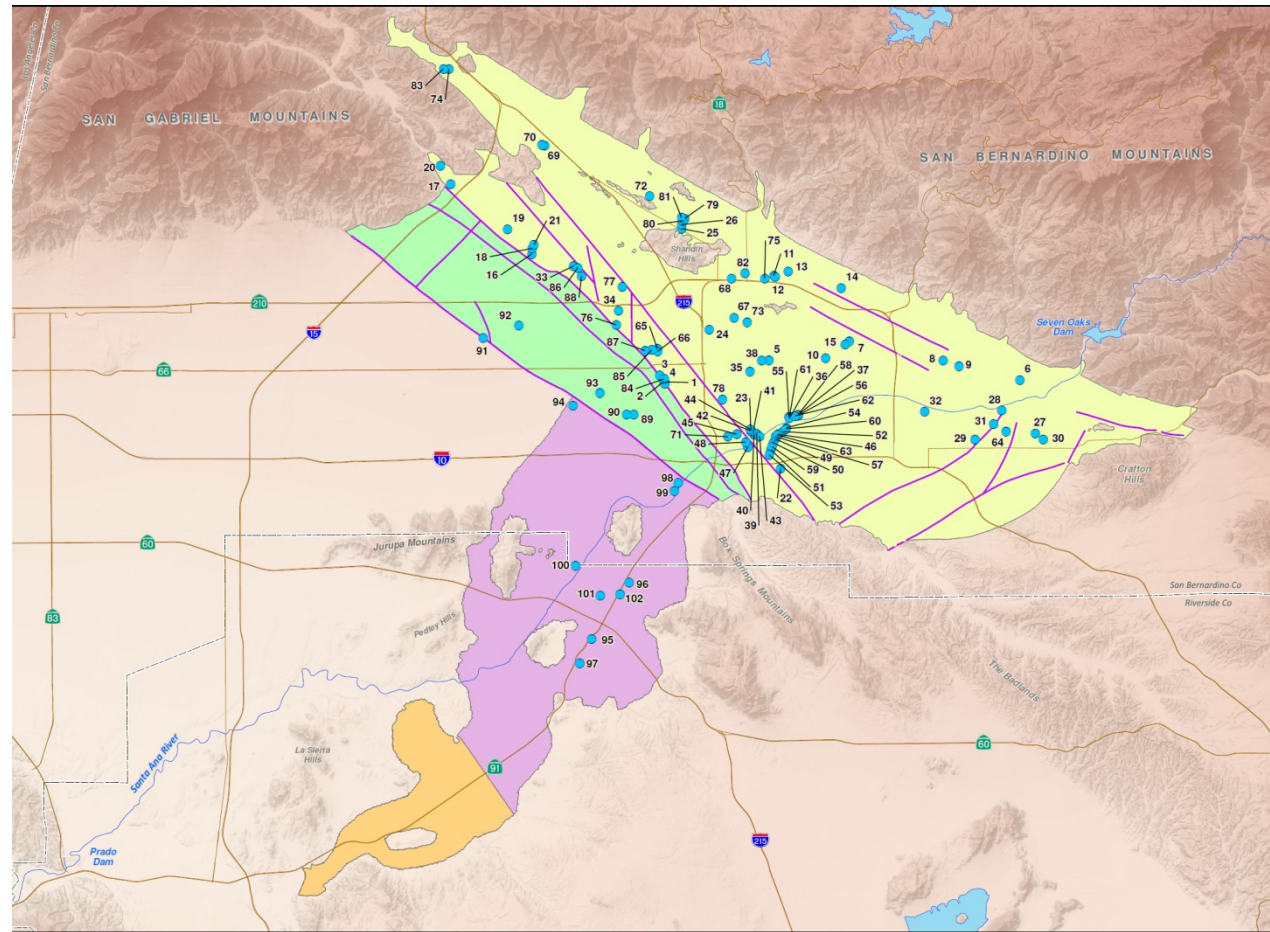




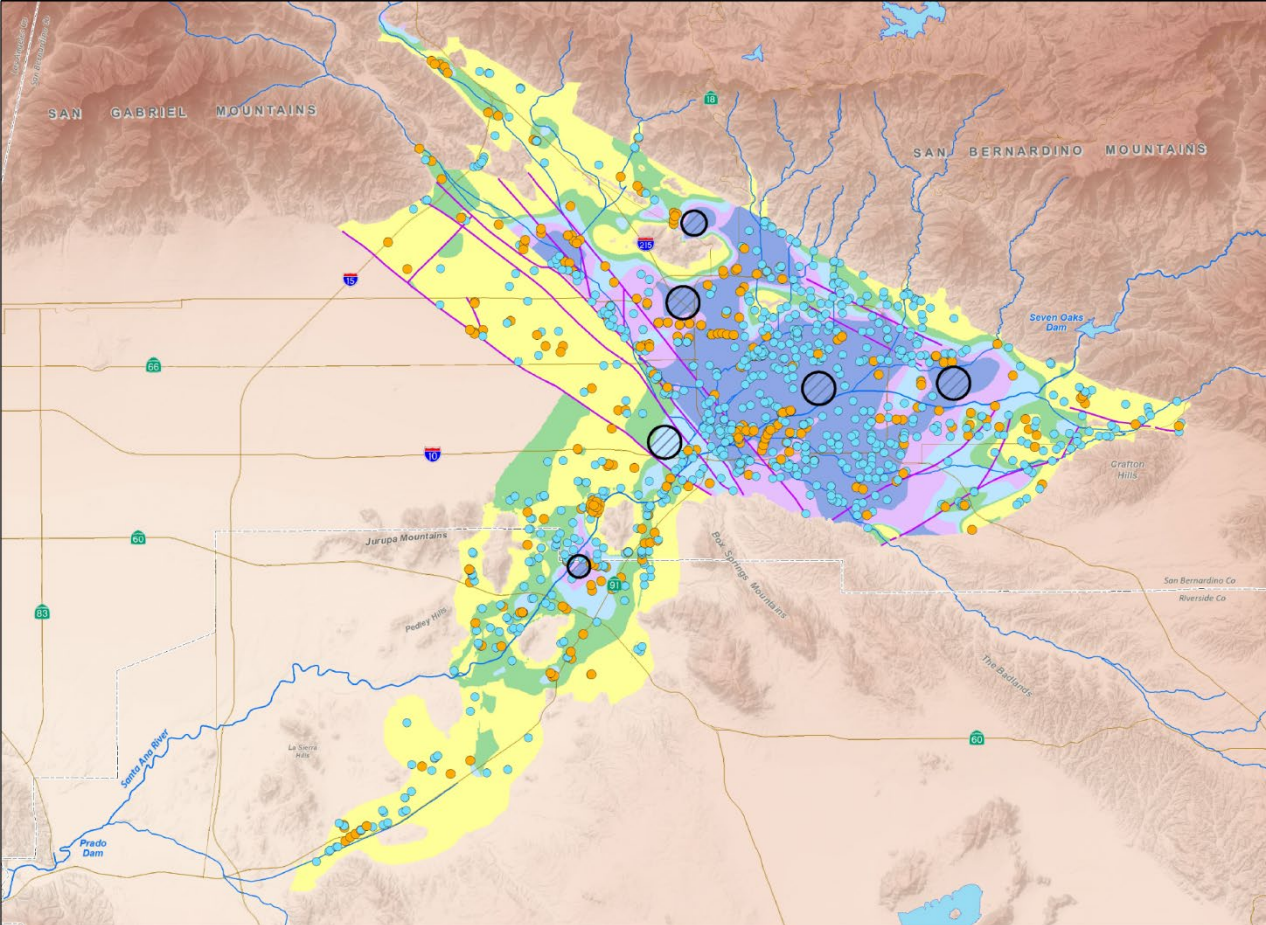
17  
●

Groundwater Flow Barrier

	San Bernardino Basin Area
	Rialto-Colton
	Riverside
	Arlington



# Areas for New Wells



Annual Average Pumping, acre-ft/yr  
(2012-2016)

- Production Below 100 acre-ft/yr
- Production Above 100 acre-ft/yr

○ Location for Additional Pumping

Saturated Thickness, ft

- < 100
- 100 - 200
- 200 - 300
- 300 - 400
- > 400

— Groundwater Flow Barrier

# Total Usable Storage Study

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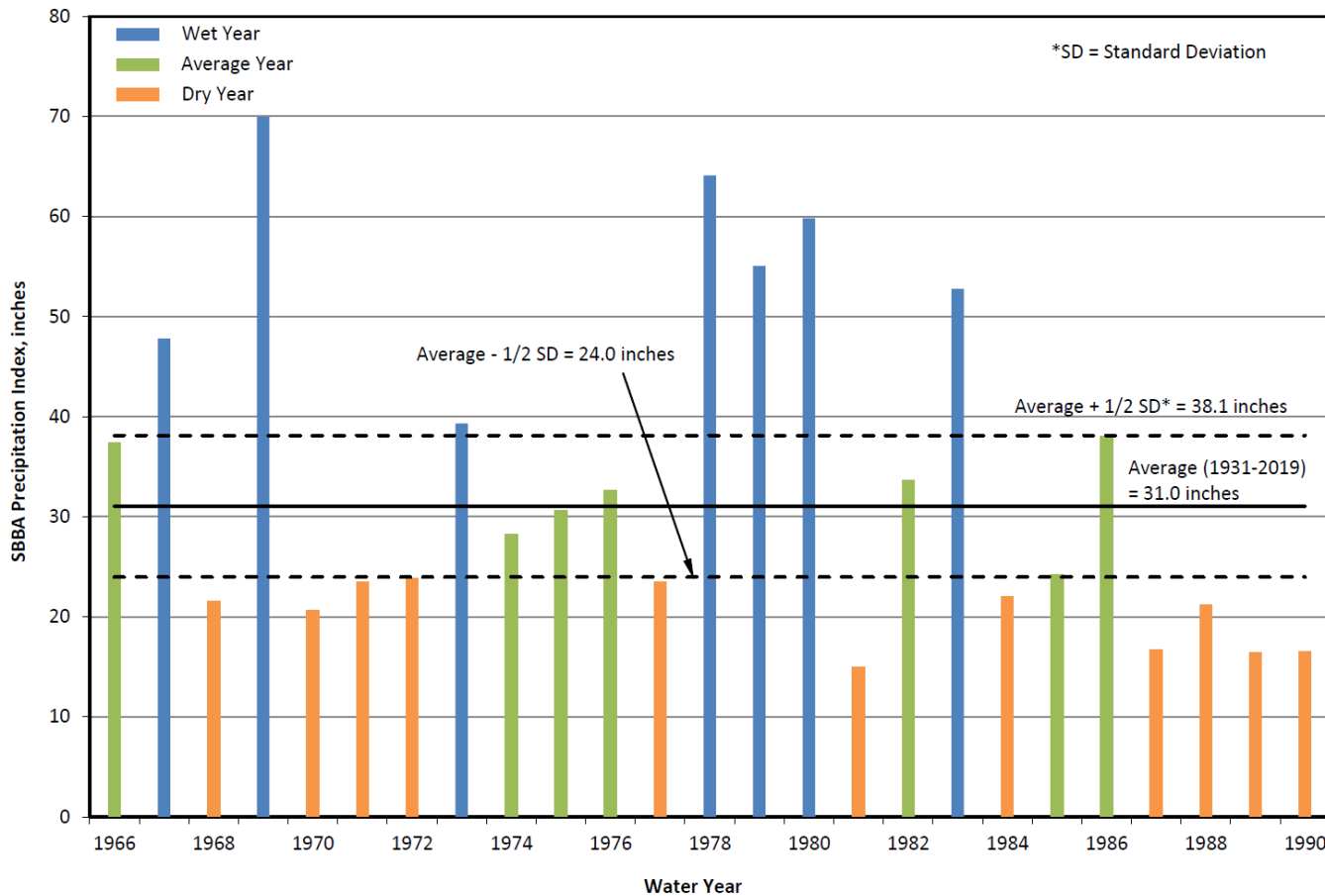
# Number of Years of Water in Storage Scenarios

Basin	Model Scenario	Hydrology	State Water Project	Stormwater Recharge	Recycled Water Recharge	Groundwater Pumping*	
SBBA Rialto-Colton Riverside Arlington	SAR-T3-1	Dry	Projected Table A Allocation	SAR SG diversion capacity of 500 cfs	None	2015 Pumping	plus a factor of 10% for dry years and an additional reliability factor of 10% on top of this
	SAR-T3-2	Dry	Projected Table A Allocation	SAR SG diversion capacity of 500 cfs	None	2040 Projected Pumping	plus a factor of 10% for dry years and an additional reliability factor of 10% on top of this
	SAR-T3-3	Average	Projected Table A Allocation	SAR SG diversion capacity of 500 cfs	None	2015 Pumping	plus a reliability factor of 10%
	SAR-T3-4	Average	Projected Table A Allocation	SAR SG diversion capacity of 500 cfs	None	2040 Projected Pumping	plus a reliability factor of 10%
	SAR-T3-5	HCP (1966-1990)	Projected Table A Allocation	SAR SG diversion capacity of 500 cfs	None	2015 Pumping	plus a reliability factor of 10%
Actual							

\*All model scenarios assume existing wells are drilled to bedrock.

# **SIMULATED HYDROLOGY**

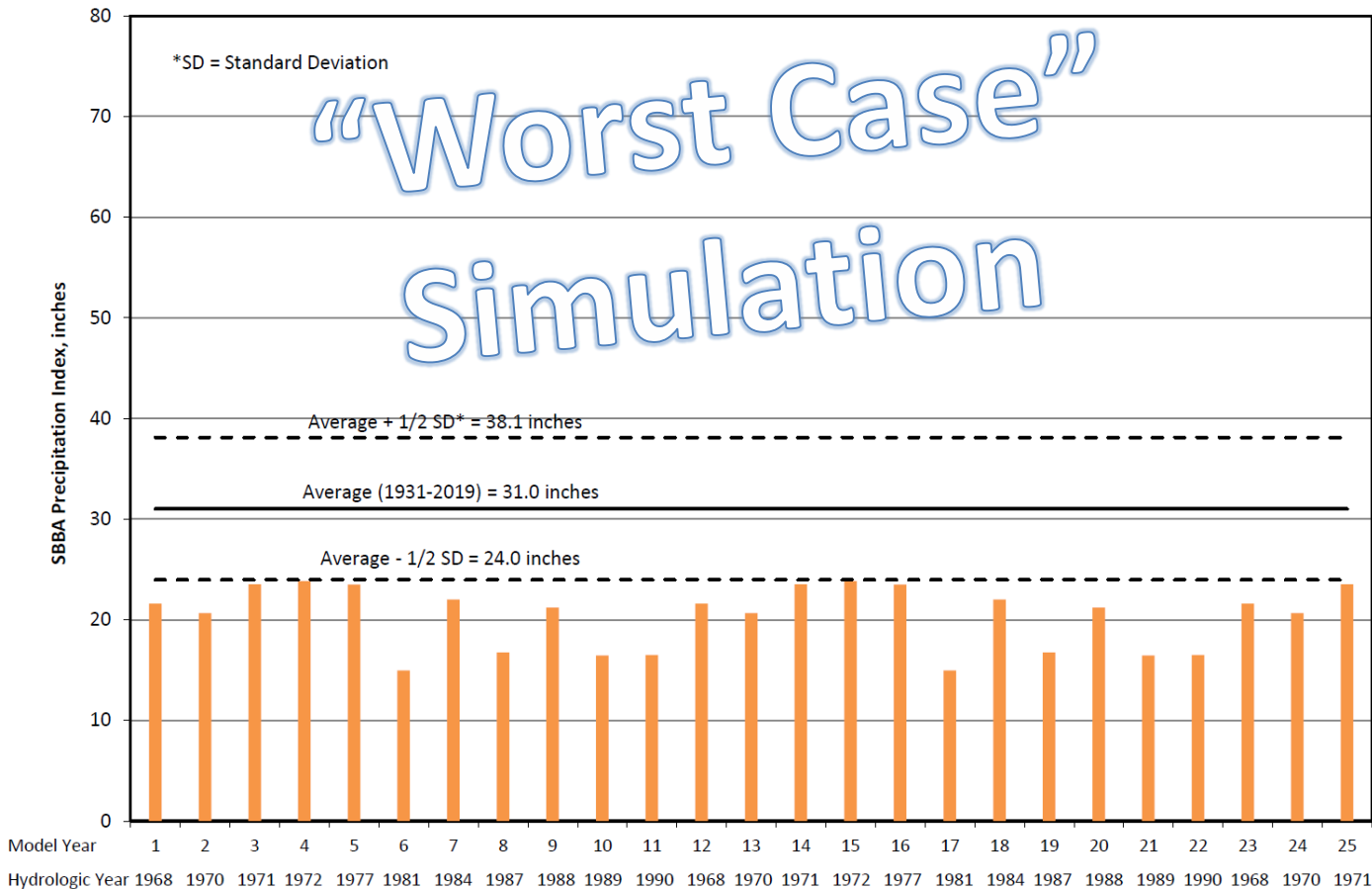
# Historical Showing Dry, Average, and Wet Years 1966-1990





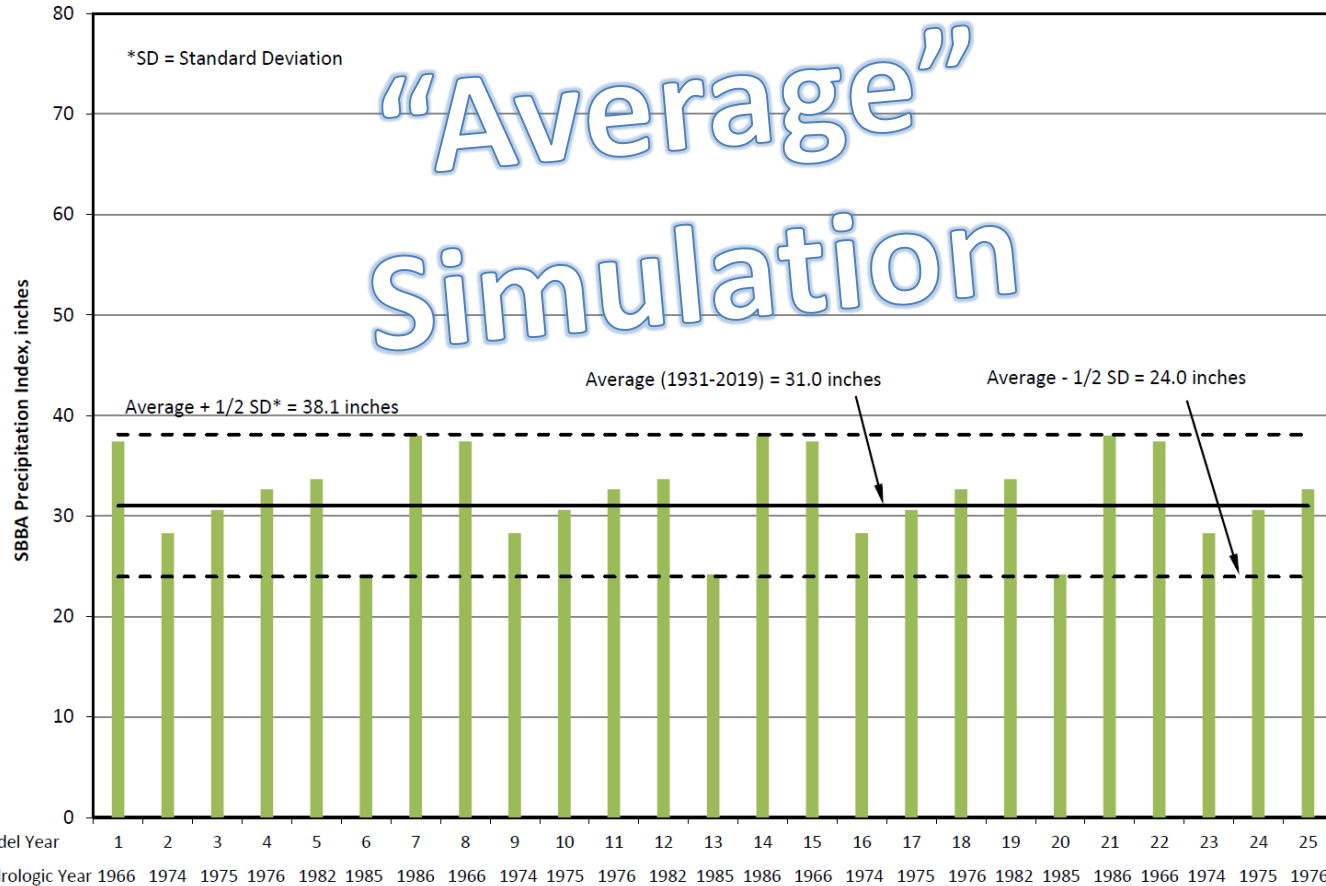
# "Worst Case" Simulation

Dry  
Repeat Cycle of  
Below Average  
Years



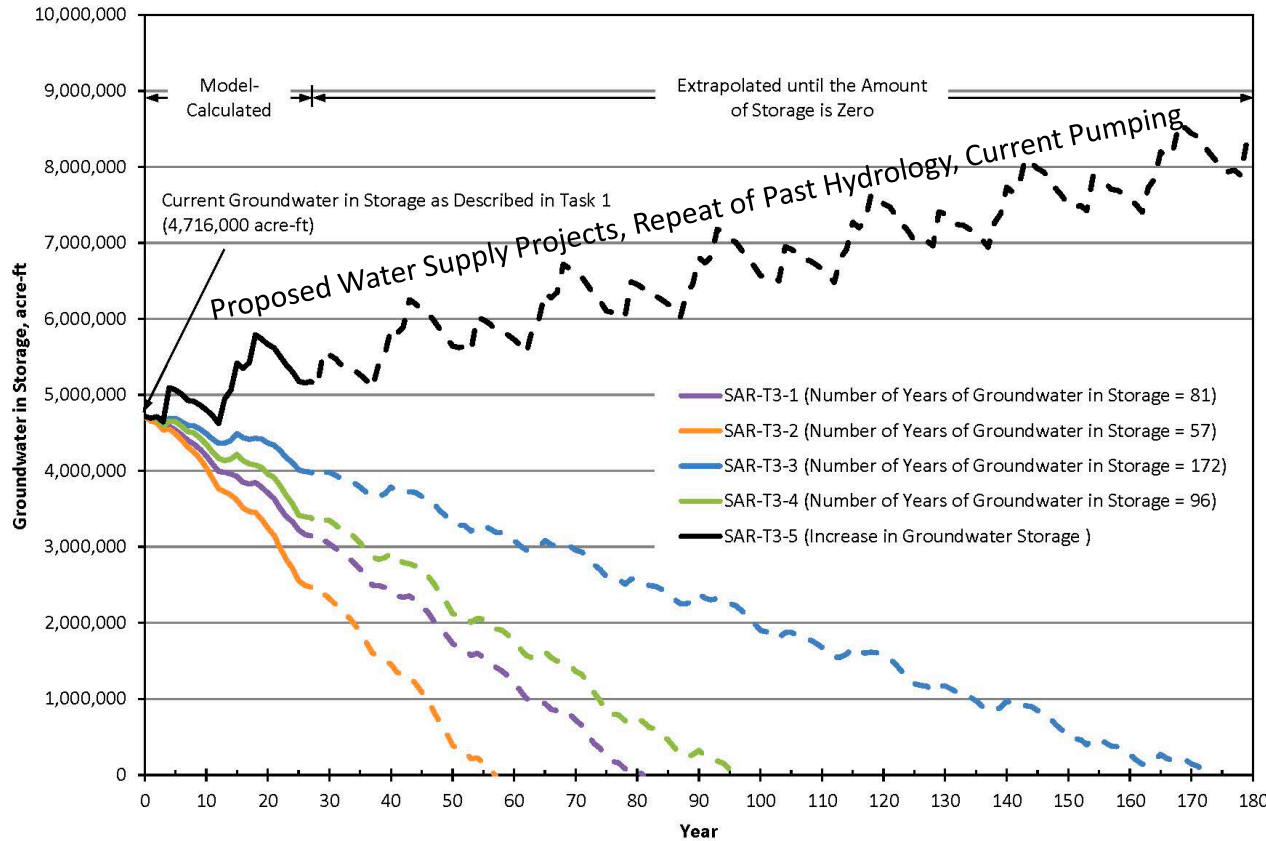
# "Average" Simulation

## Average Repeat Cycle of Average Years





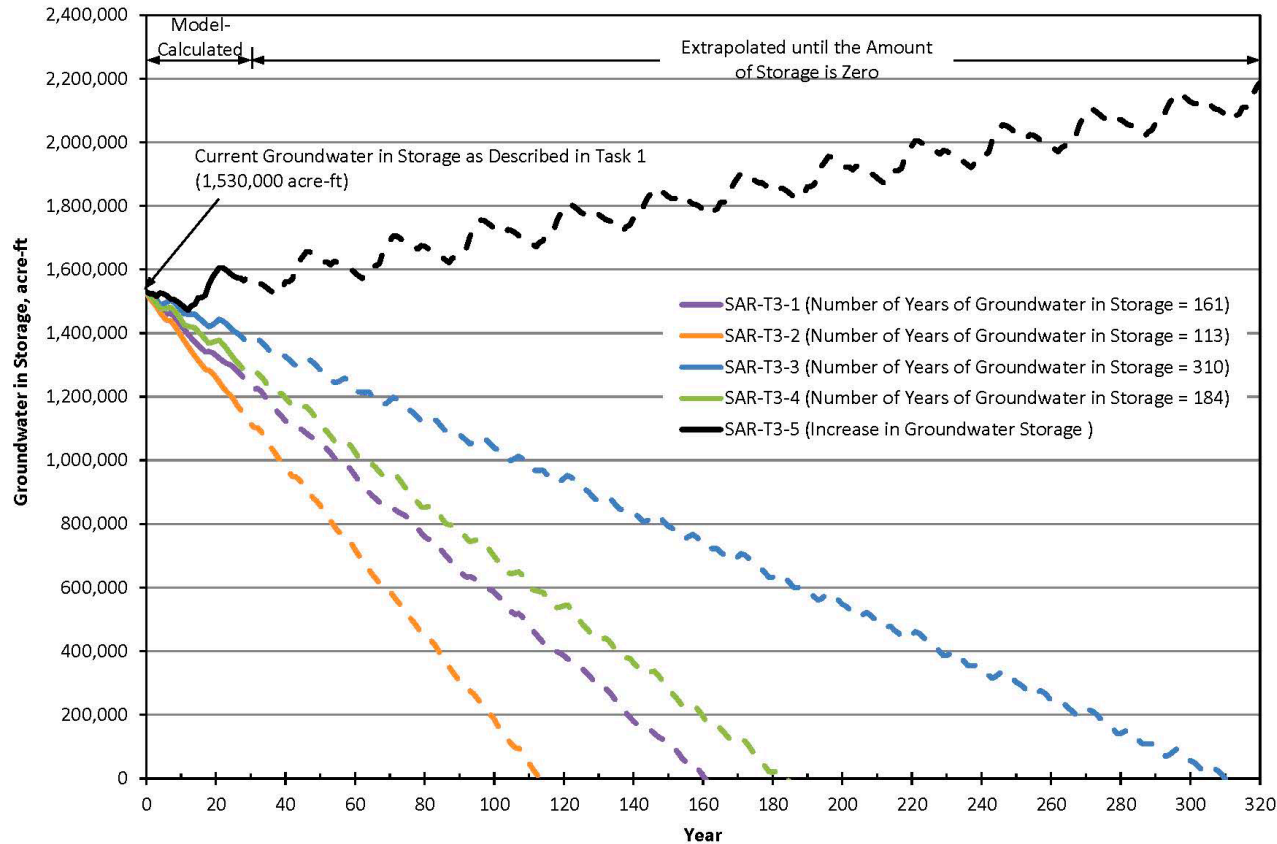
# SBB Years of Groundwater in Storage



Model Scenario	No. of Yrs of Groundwater in Storage
SAR-T3-1	81
SAR-T3-2	57
SAR-T3-3	172
SAR-T3-4	96
SAR-T3-5	Infinite

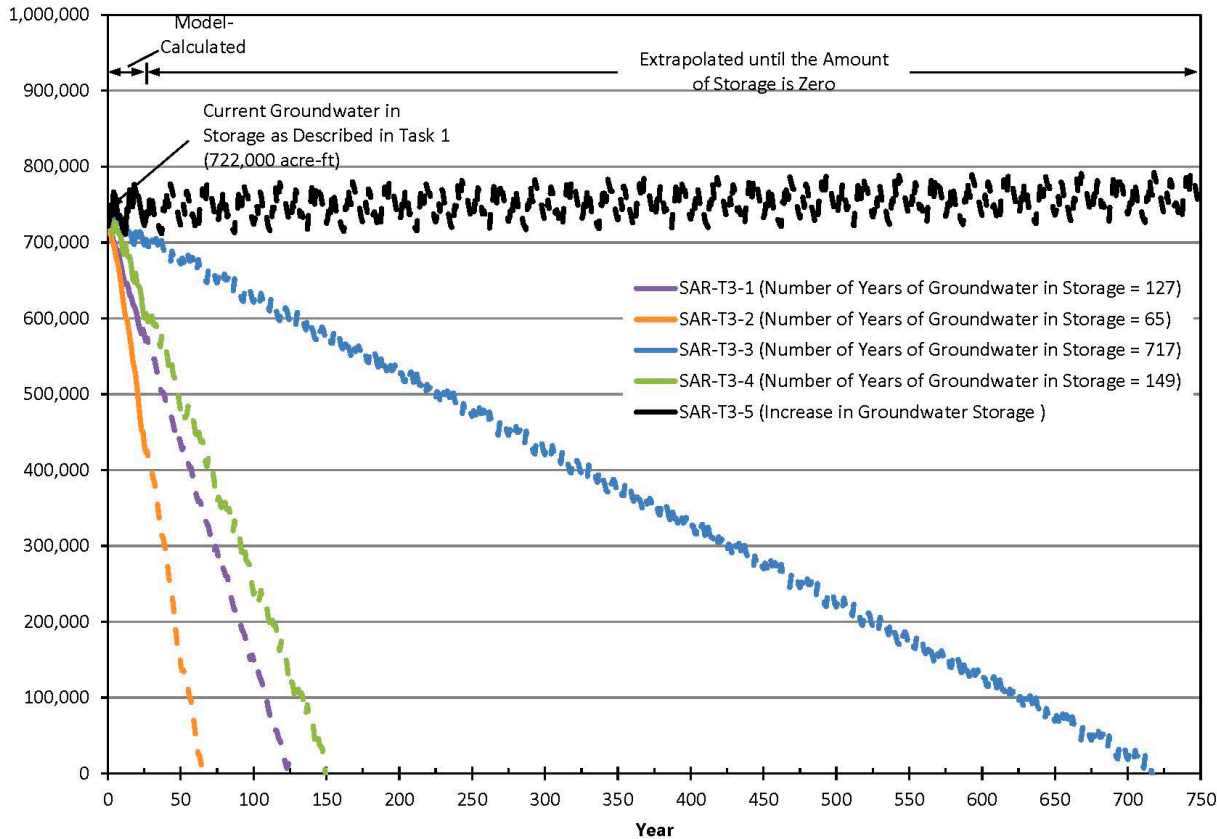
# Rialto-Colton Basin

## Years of Groundwater in Storage



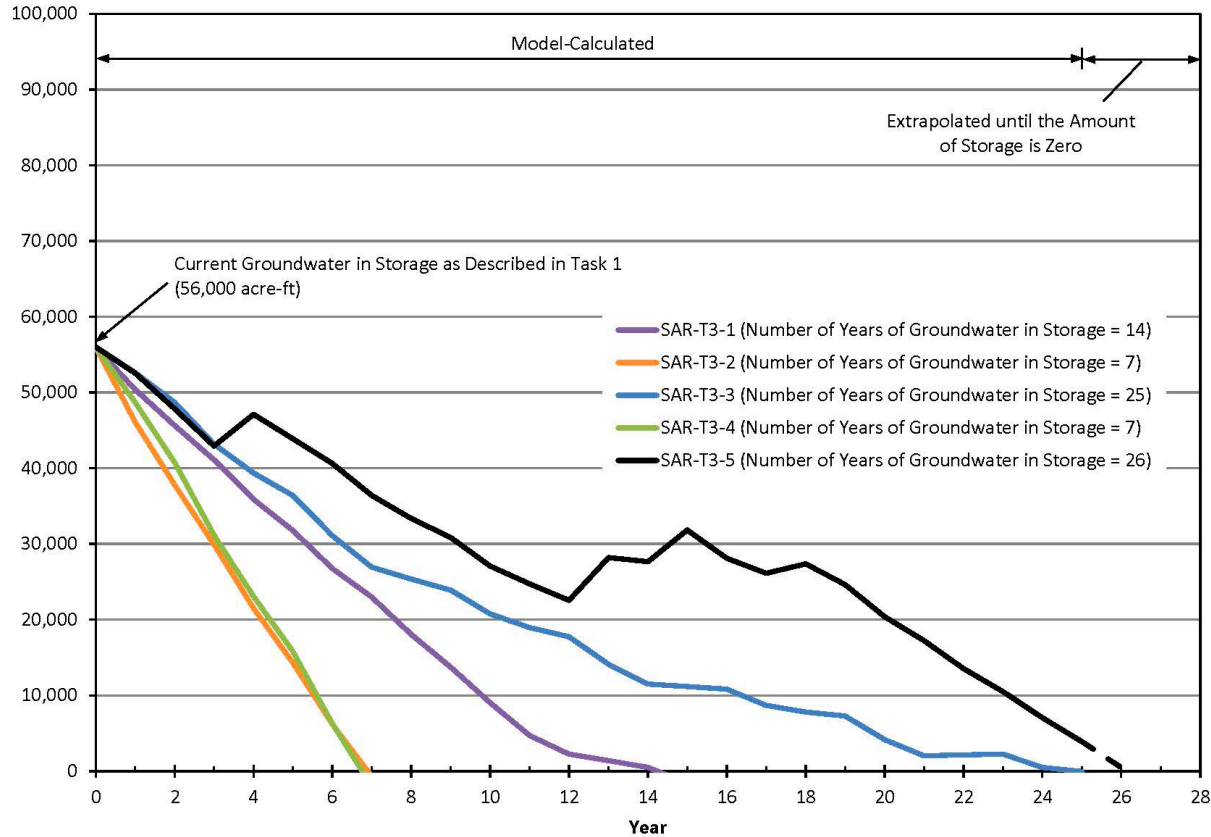
Model Scenario	No. of Yrs of Groundwater in Storage
SAR-T3-1	161
SAR-T3-2	113
SAR-T3-3	310
SAR-T3-4	184
SAR-T3-5	Infinite

# Riverside Basin Years of Groundwater in Storage



Model Scenario	No. of Yrs of Groundwater in Storage
SAR-T3-1	127
SAR-T3-2	65
SAR-T3-3	717
SAR-T3-4	149
SAR-T3-5	Infinite

# Arlington Basin Years of Groundwater in Storage



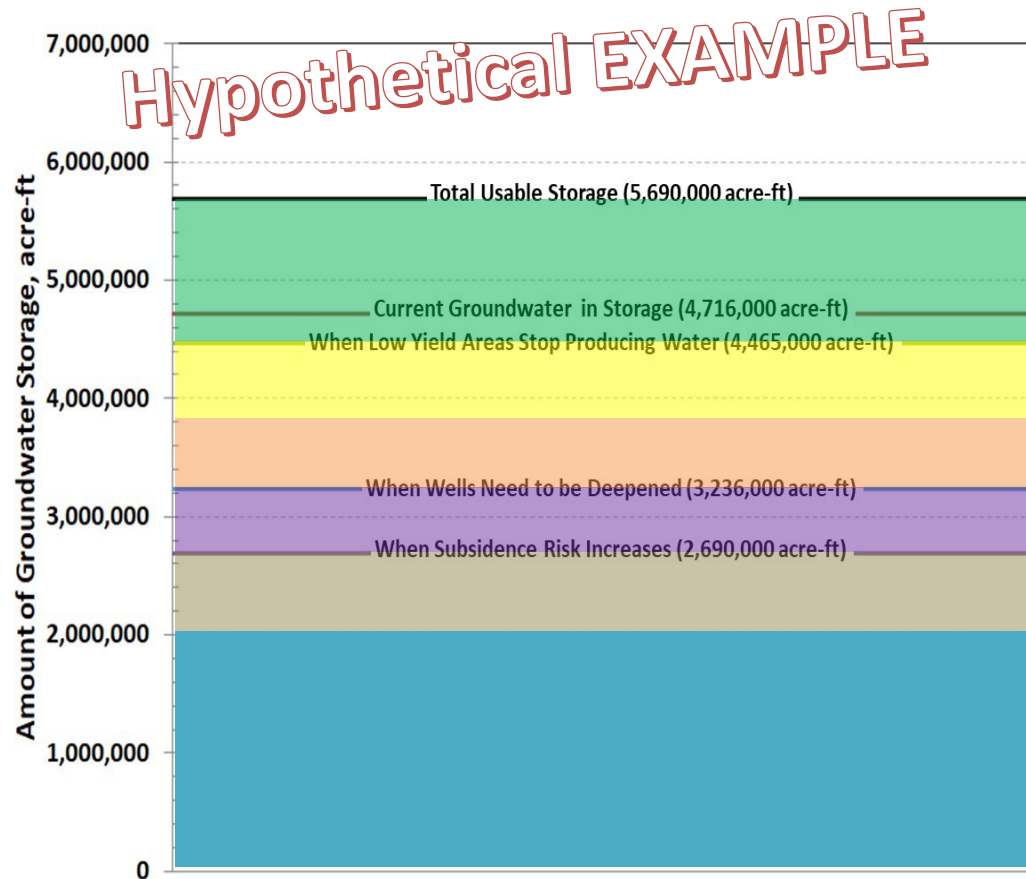
Model Scenario	No. of Yrs of Groundwater in Storage
SAR-T3-1	14
SAR-T3-2	7
SAR-T3-3	25
SAR-T3-4	7
SAR-T3-5	26

# Summary of Study Results

Basin	Usable Storage	Current Storage		% Groundwater Accessible		Storage (years)	
	(acre-ft)	(acre-ft)	%	(Existing)	(New)	Min	Max
San Bernardino (SBB)	5,690,000	4,867,998	86%	43%	57%	57	Infinite
Yucaipa Basin (Y)	2,796,000	2,275,438	81%	(not in this scope of work)			
Rialto-Colton (RCB)	1,749,000	1,528,121	87%	55%	45%	113	Infinite
Riverside (RB)	810,000	722,000	87%	57%	43%	65	Infinite
Arlington (AB)	95,000	56,000	59%	100%	0%	7	26

# Basin Technical Advisory Committee (BTAC)

- Directed the Engineering Subcommittee to develop draft management “zones” for each basin and present to the BTAC for consideration
- Future Work (if needed)
  - Explore plans for well deepening/new wells



## Management Zone Concept

Storage	% Full	Sample Action(s)
> 4.5	79 to 100%	<ol style="list-style-type: none"> <li>1. Maximize SWP Recharge</li> <li>2. Develop Water Supply Projects</li> <li>3. Store water in Central Valley</li> </ol>
4.5	79%	<ol style="list-style-type: none"> <li>1. Same as Green</li> <li>2. Plan to deepen wells</li> </ol>
3.8	67%	<ol style="list-style-type: none"> <li>1. Same as Green</li> <li>2. Deepen wells</li> <li>3. Plan additional recycling</li> <li>4. Reduce pumping 10%</li> </ol>
3.2	56%	<ol style="list-style-type: none"> <li>1. Reduce Pumping 20%</li> <li>2. Increase recycling</li> </ol>
2.7	47%	Continue to reduce pumping in 5% increments until storage levels increase to purple area

EXAMPLE

## Basin Management Zones Concept

