DONALD BREN SCHOOL OF ENVIRONMENTAL SCIENCE & MANAGEMENT
UNIVERSITY OF CALIFORNIA, SANTA BARBARA

ANALYSIS OF WATER RESOURCES MANAGEMENT STRATEGIES FOR THE SANTA ANA RIVER WATERSHED: *WATER REUSE, RECHARGE, USE EFFICIENCY*

Project Members:
Nathan Adams, Heather Allen, Amy Burgard, Courtney Dietz, Po Chi Fung, Karl Rittger

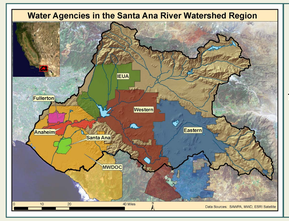
Project Advisors:
Dr. Arturo Keller & Dr. Robert Wilkinson

ON THE WEB AT HTTP://fiesta.bren.ucsb.edu/%7Esantaana/

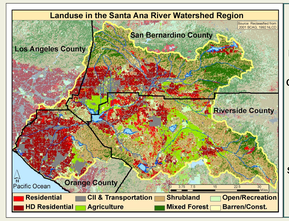
SPRING 2006

Overview of Santa Ana River Watershed

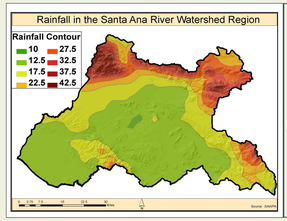
The Santa Ana River Watershed Region is located in four counties of Southern California, covers 2,650 square miles, and drains over 700 miles of the Santa Ana River and its tributaries.



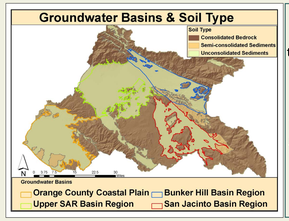
Water is distributed in the Santa Ana River Watershed Region through the regional water agencies shown here. Baseline demand and supply projections for the SARW Region are based on regional and local water agency 2005 Urban Water Management Plans (UWMP's). Imported water supplies into the region are delivered by the Metropolitan Water District of Southern California (MWD).



The SARW Region is experiencing rapid urbanization with much of Orange County already highly developed, while open space and agricultural areas of Riverside and San Bernardino Counties are increasingly becoming developed. Urbanization alters the natural environment and biophysical processes, such as natural recharge and water quality.

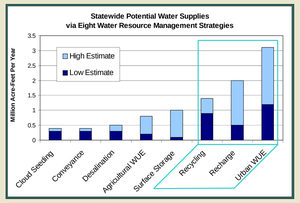


Average rainfall for the Santa Ana River Watershed Region is 20 inches. The orographic effect of the San Bernardino, San Gabriel and San Jacinto Mountains results in increased precipitation at higher elevations while the lower elevations receive considerably less rainfall.



Broad alluvial fans descend from the base of the mountains with alluvium and sediment deposits reaching up to 1000 feet in depth. These areas with unconsolidated sediments have excellent potential for water storage in groundwater aquifers. Groundwater is managed heavily by several agencies in the region (e.g. OCWD, IEUA).

Opportunity

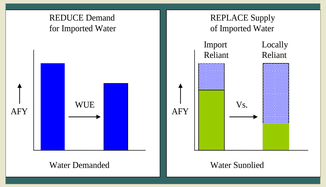


The Department of Water Resources (DWR) State Water Plan 2005 Update identified eight water management strategies to augment water supplies. The top three are:

- Water Use Efficiency (WUE)
- Groundwater Management and Recharge
- Water Recycling/Reuse

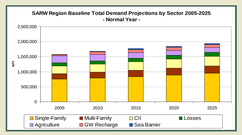
For the purposes of this research, we evaluate the potential for implementing these three management strategies for each water agency within the SARW Region by considering the interplay between plausible future water demand and supply scenarios.

Significance

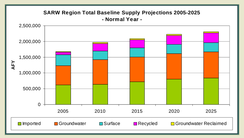


The significance of this project is to explore the interplay between alternative plausible future demand and supply scenarios. By contrasting the baseline demand and supply projections for the SARW region with alternative demand and supply scenarios, we demonstrate the potential to both REDUCE and REPLACE imported water supplies with locally-derived sources of water.

Baseline Demand & Supply Projections



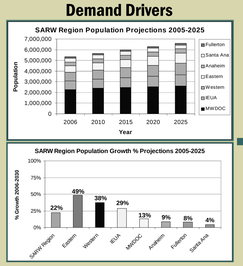
The baseline demand projection for the SARW Region is derived from MWD's 2005 Regional Urban Water Management Plan (UWMP) demand assessment for the region.

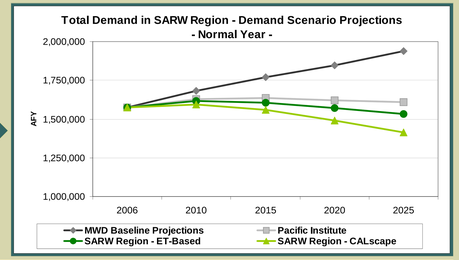


Baseline supply projections for the region were created by aggregating the seven individual water agency supply projections, reported in their UWMPs.

Alternative Plausible Future Demand & Supply Scenarios

Demand Drivers





DEMAND - The three demand scenarios we have developed differ in degree or intensity of WUE by sector and include the following:

Pacific Institute Efficiency Scenario:
Interior: Replacement of all inefficient appliances and fixtures.

Exterior: Improvement of landscape maintenance & install efficient irrigation technologies.

Commercial, Industrial & Institutional (CII): Use of cost-effective water use practices and technologies.

SARW Region ET Controller Scenario:
Interior: Pac. Inst. efficiency measures + dual-flush toilets.

Exterior: Pac. Inst. Efficiency + ET ("smart") irrigation controllers.

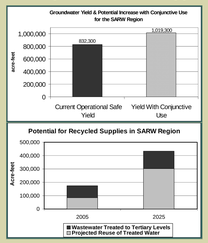
CII: Pac. Inst. efficiency + waterless urinals.

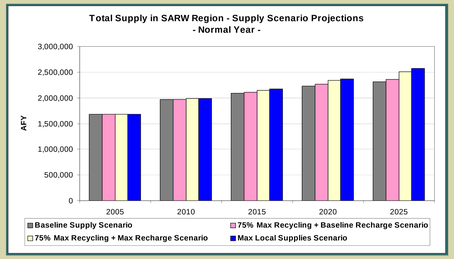
SARW Region CALscapes Scenario:
Interior: Pac. Inst. efficiency measures + dual-flush toilets.

Exterior: California Appropriate Landscapes (CALscapes) (similar to xeriscaping).

CII: Pac. Inst. efficiency + waterless urinals.

Development of Local Supplies





SUPPLY—Three alternative supply scenarios were created that feature increased levels of local resource development above and beyond what the SARW Region's water district UWMP project and plan for. The three supply strategies are:

- 75% Maximum Reuse + Baseline Recharge Scenario
- 75% Maximum Reuse + Maximum Recharge Scenario
- Maximum Local Supplies Scenario

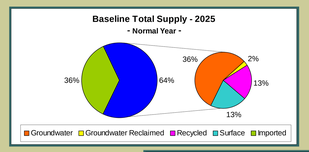
These alternative supply scenarios have been created such that they progressively develop additional local groundwater and municipal reuse supplies.

Alternative Plausible Future Scenario Evaluations

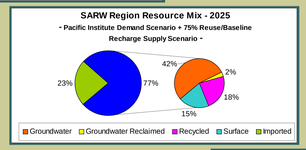
Potential Decrease of Imported Supplies by Scenario (TAF)

Scenarios	Baseline Demand	Pacific Institute	SARW Region - ET Controller	SARW Region - CALscapes
Baseline Supply	-	330	403	525
75% Max Reuse + Baseline Recharge	45	375	448	570
75% Max Reuse + Maximum Recharge	195	525	598	720
Maximum Local Supplies	260	590	663	785

By reducing imported supplies through demand management strategies and replacing imported water with developed local supplies, the SARW Region has the opportunity to significantly increase its local reliance with regards to water resources. By combining the various demand and supply scenarios, the potential exists to reduce imported supplies from 45-785 TAF, as shown in the table above. The potential reductions increase as one moves down the rows (Supply Scenarios) and across the columns to the right (Demand Scenarios). The reductions indicated in white result from progressively implementing more aggressive demand and supply scenarios to the baseline scenarios.

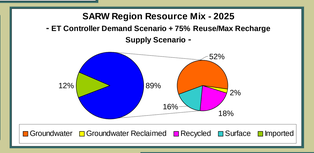


The baseline resource mix results in imported water making up 36% (indicated as the green slice of the resource pie) of the total supply in 2025. Groundwater supplies 36% while recycled water supplies 13%.

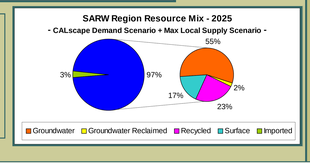


The Pacific Institute Efficiency Demand Scenario + 75% Reuse/Baseline Recharge Supply Scenario resource mix results in imported water making up 23% of the total supply in 2025. Groundwater resources increase to 42% of the total supply and recycled water supplies increase to 18% .

The SARW Region ET Controller Demand Scenario + 75% Reuse/Maximum Recharge Supply Scenario resource mix results in imported water making up 12% of the total supply in 2025. Groundwater resources increase to 52% of the total supply while recycled supplies remain at 18%.

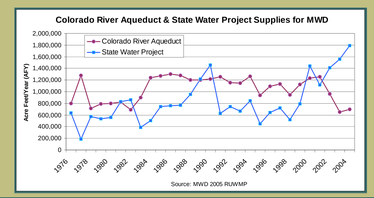


The SARW Region CALscape Demand Scenario + Maximum Supply Scenario resource mix results in imported water making up only 3% of the total supply in 2025. Groundwater resources increase to 55% of the total supply while recycled supplies increase to 23%.



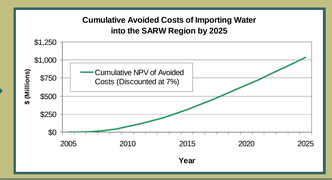
Environmental & Financial Benefits

Reliability of Deliveries



As a consequence of aggressively pursuing and developing local water management strategies the SARW Region would become less susceptible to water supply reliability issues related to limited and problematic imported water supplies. The increase in State Water Project imports into the Southern California region are particularly worrisome as uncertainties in climate, infrastructure integrity, and ecological viability may affect the reliability of future supplies.

Avoided Costs of Imported Water



The significant reduction in imported supplies in the CALscape Demand + Max Local Supplies scenario would result in an approximate $1 Billion dollar savings by 2025 in avoided costs associated with imported water.

The money saved by not having to purchase additional units of expensive imported supplies ($453/AF) can be redirected towards planning for and implementing water reuse, recharge and use efficiency policies, programs, and technologies. Of additional benefit is that expensive, limited, and uncertain water supplies can be swapped out for affordable, untapped, and locally-reliable water resources.

Environmental Benefits

Local ecosystems and riparian habitats would benefit from enhanced groundwater management and recharge as additional water would be present and available in the hydrologic system, raising in-stream water levels and protecting against seawater intrusion. Regional ecosystems, such as the San Francisco Bay Delta, would also benefit as the burden to supply water resources to the SARW region declines.