Lower Santa Cruz River Basin Study

Study Background and Process Overview

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Lower Santa Cruz River Basin Study Background

- Study area is the Tucson Active Management Area (TAMA) defined by the AZ Department of Water Resources
- Under state law, the goal of the TAMA is “safe-yield” by 2025 or earlier
- Safe-yield requires a long-term balance between the amount of water pumped and the amount recharged annually **over the entire TAMA**
- The safe-yield goal does not address the problem of imbalances within the TAMA
- Regulations do not address water for the environment
Impact of Central Arizona Project (CAP) Water

Tucson Basin Water Level Changes

Source: Tucson Water 2018 Status and Quality of the Aquifer Report
Water Management Challenges

• Climate Change
• Population and Economic Growth
LSCR Basin Study Summary

- Addresses the impacts of changing climate, population and other factors on water supplies and demands
- Focuses on spatial distribution of water resources within the Tucson Active Management Area
- Includes analysis of impacts on the environment (riparian areas)
- Estimates a range of possible futures through the use of scenario planning
Reclamation Basin Study Components

Step 1: Project future supply & demand imbalances (without adaptation measures)

Step 2: Evaluate risks to infrastructure and other systems

Step 3: Develop and investigate adaptation strategies (structural and non-structural)

Step 4: Perform trade-off analysis of strategies

Input: Scenarios and assumptions

Input: Adaptation Strategies

Input: Trade-off Analysis
Estimating future groundwater levels using ADWR’s TAMA Groundwater Model under a range of scenarios
Estimating future groundwater levels using ADWR’s TAMA Groundwater Model under a range of scenarios
2 climate scenarios based on future emissions levels

Tucson AMA Groundwater Model

3 socio-economic scenarios based on population and growth type

Climate Driving Forces (Precipitation, Temperature)

GLOBAL CLIMATE MODELS

SURFACE HYDROLOGY MODEL

Socio-Economic Driving Forces (Demographics, Economics, Technological, Regulatory)

CAP SERVICE AREA MODEL

RECLAMATION
Future Climate Scenarios

**Worse:** Based on **RCP 8.5** data

Dynamically Downscaled with the WRF Model from University of AZ

Weather Research and Forecasting Model
(https://www.mmm.ucar.edu/weather-research-and-forecasting-model)

**Best:** Based on **RCP 4.5** SD data

Statistically Downscaled (SD): LOCA

Localized Constructed Analogs (http://loca.ucsd.edu/)

DD not available for RCP 4.5

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RCP = Representative Concentration Pathways

From CMIP5 climate model intercomparison
Socio-Economic Forces - CAP Service Area Model

CAP Service Area Model (CAP: SAM)

- All Major Water Using Entities
  - 80 Municipal Providers
  - 23 Irrigation Districts
  - 12 Tribes and Districts
  - 20+ other user categories (CAGRD, AWBA, Industrial users, etc.)

- 16 Water Supply Types
  - Includes Surface Water, Effluent, CAP, LTSC, Groundwater, Recovered Water, etc.
  - Incorporates shortage scenarios from Colorado River Simulation model (CRSS)

- Models municipal, agricultural and industrial demands
- Demand estimated by water provider
- Matches each demand with supplies in order of preference
# Supply-Demand Scenarios

A. Official Projections: Medium, mixed-density growth and current climate

B. Slow, compact growth and Best Case climate

C. Rapid, outward growth and Best Case climate

D. Slow, compact growth and Worse Case climate

E. Official Projections and Worse Case climate

F. Rapid, outward growth and Worse Case climate

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<thead>
<tr>
<th>Climate Emissions</th>
<th>Growth</th>
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<tr>
<td>Current Climate</td>
<td>Slow, Compact</td>
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<td></td>
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Precipitation Variability in the Tucson Area

Seasonal precipitation at the University of Arizona Campbell Road Farms, 1900 - 2000

Incorporating Variability - Key Points

- Variability is a defining characteristic of the Tucson area climate
- Water managers need to understand future variability in addition to averages
- Climate models projections do not reproduce this variability
- The LSCR Basin Study used a computer program (weather generator) to simulate the local variability of precipitation and temperature
- The weather generator produces a set of 100 possible outcomes from one daily climate model projection
- This allows us to express the future in terms of **probabilities**