# Colorado River Planning and Modeling

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Central Arizona Project

- Historical Information
  - Authorized by 1968 Basin Project Act
  - Substantially completed in 1993
  - Responsible for repaying reimbursable costs to the U.S.

- Physical Characteristics
  - 336 mile aqueduct
  - 15 pumping plants
  - Lake Pleasant (system storage/release)
  - Primarily powered through Navajo Generating Station (NGS)
  - Diverts remainder of Arizona's Colorado River Apportionment
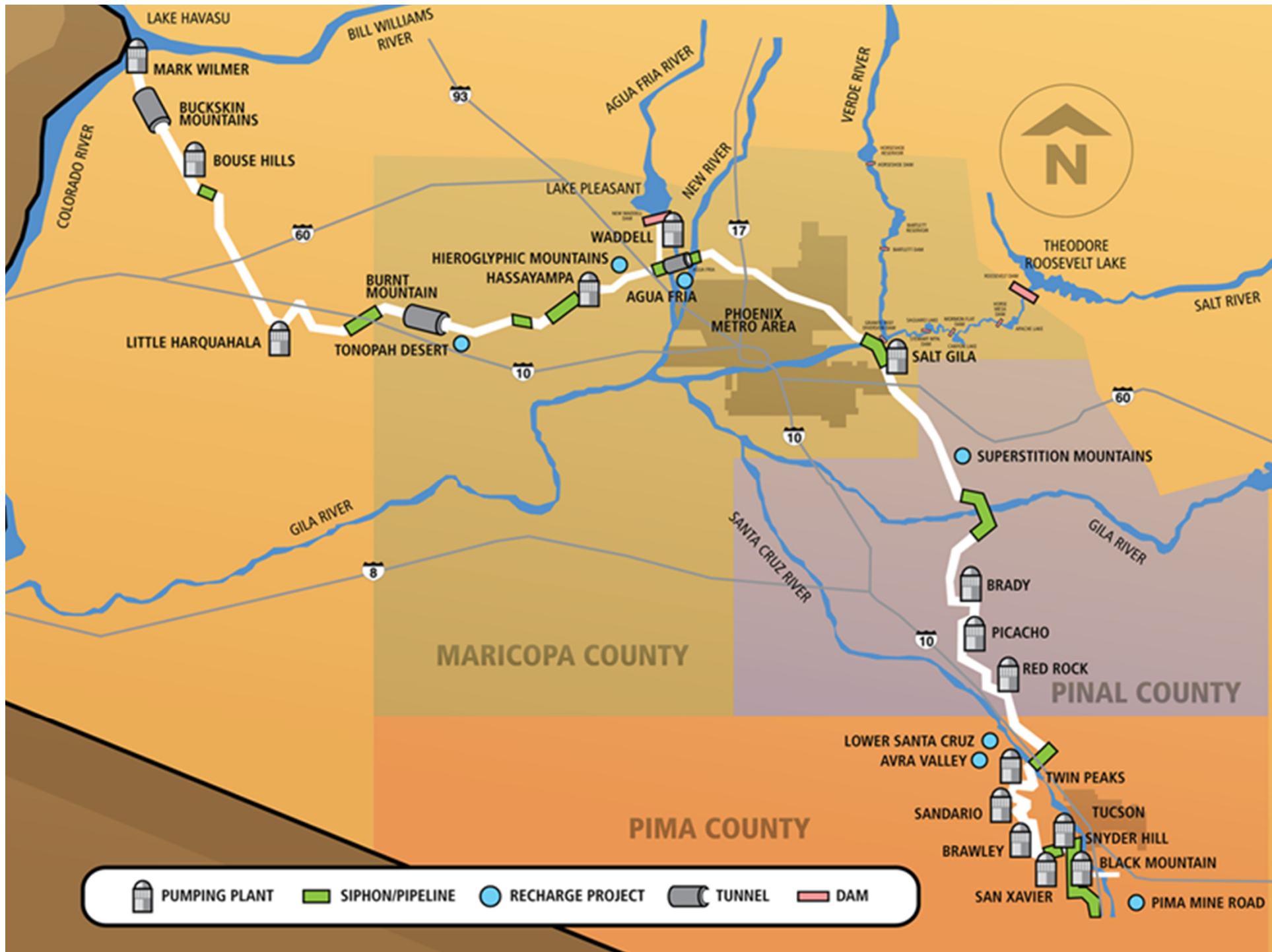
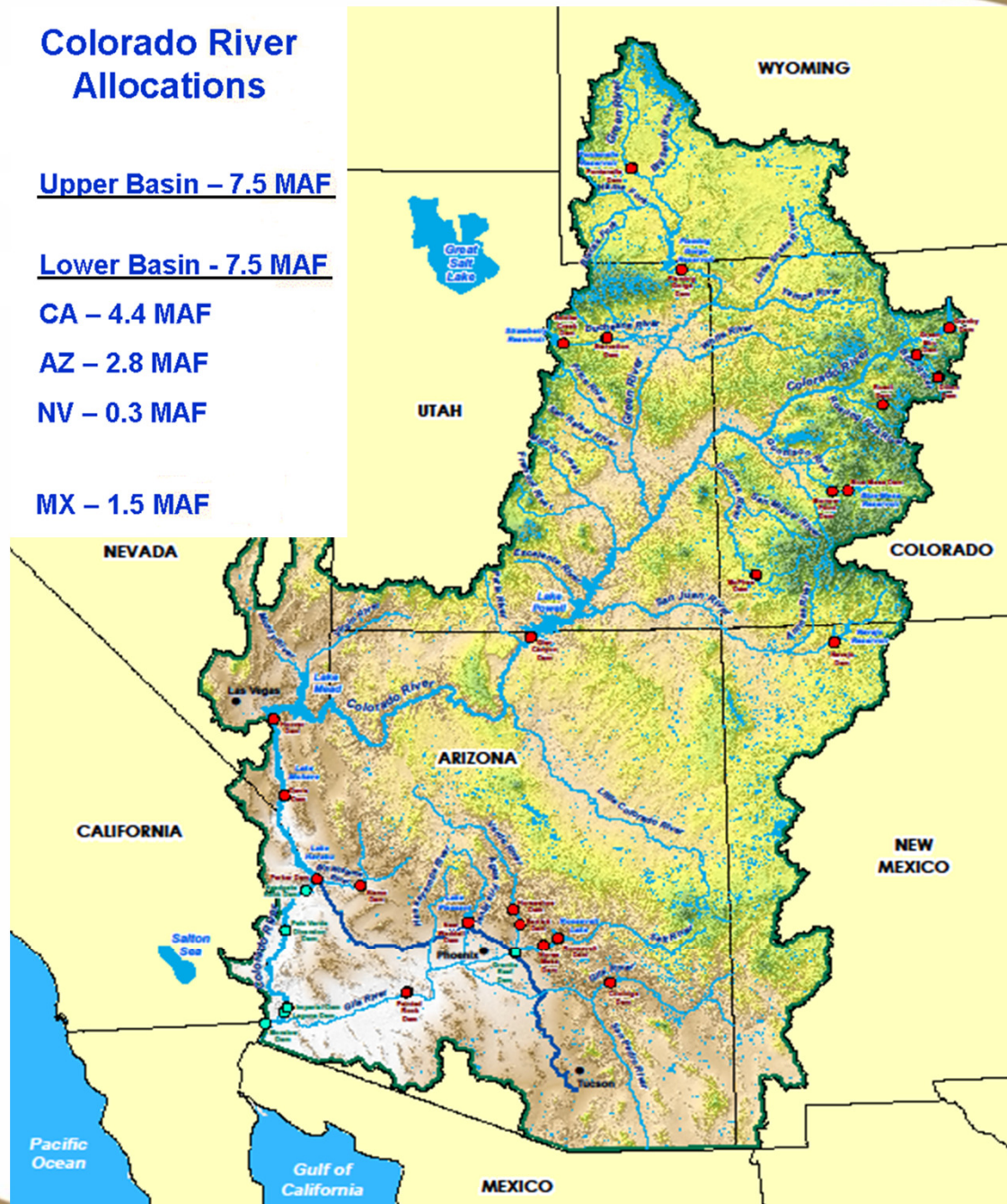**Colorado River Allocations**

Upper Basin – 7.5 MAF

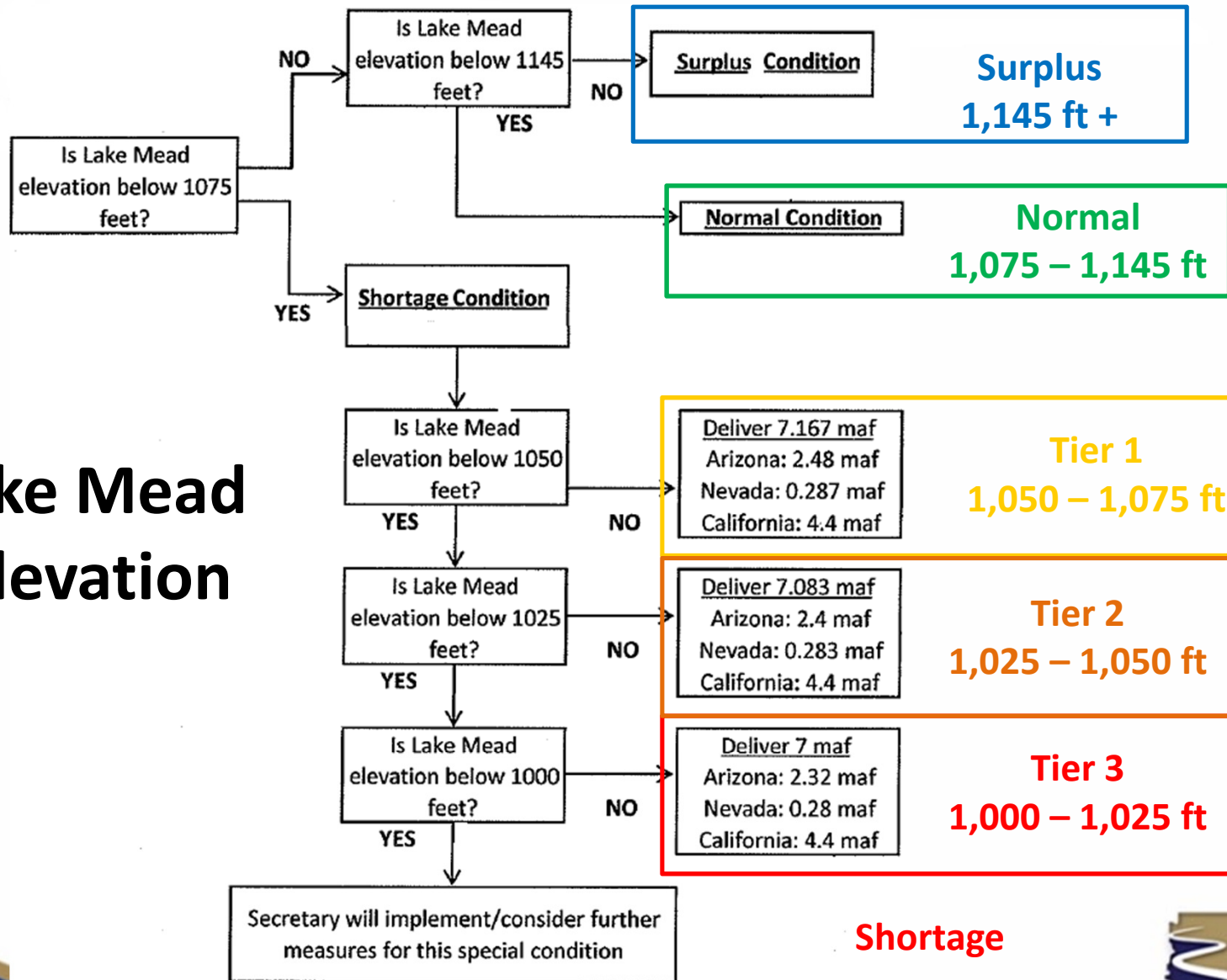Lower Basin - 7.5 MAF

CA – 4.4 MAF

AZ – 2.8 MAF

NV – 0.3 MAF

MX – 1.5 MAF

2007 Interim Guidelines

Lake Mead Elevation

Is Lake Mead elevation below 1075 feet?

Is Lake Mead elevation below 1145 feet? — NO → Surplus Condition

Surplus
1,145 ft +

YES → Normal Condition

Normal
1,075 – 1,145 ft

YES → Shortage Condition

Is Lake Mead elevation below 1050 feet? — NO →
Deliver 7.167 maf
Arizona: 2.48 maf
Nevada: 0.287 maf
California: 4.4 maf

Tier 1
1,050 – 1,075 ft

YES → Is Lake Mead elevation below 1025 feet? — NO →
Deliver 7.083 maf
Arizona: 2.4 maf
Nevada: 0.283 maf
California: 4.4 maf

Tier 2
1,025 – 1,050 ft

YES → Is Lake Mead elevation below 1000 feet? — NO →
Deliver 7 maf
Arizona: 2.32 maf
Nevada: 0.28 maf
California: 4.4 maf

Tier 3
1,000 – 1,025 ft

YES → Secretary will implement/consider further measures for this special condition

Shortage

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Colorado River Programs

- Primary Questions of Concern:
  - What factors influence the likelihood of shortage to CAP?
  - How do these factors influence the likelihood of shortage to CAP?
  - What is the magnitude of likely shortage to CAP?

- Planning Issues of Importance:
  - Climate change
  - Upper Basin consumptive use
  - Higher priority Arizona users (Colorado On-River users)
  - System capacity for water deliveries
  - Projected growth in water use

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Planning Models

- Colorado River Simulation System (CRSS)

  Addresses:
  - Climate change
  - Upper Basin uses
  - Projected growth in water use

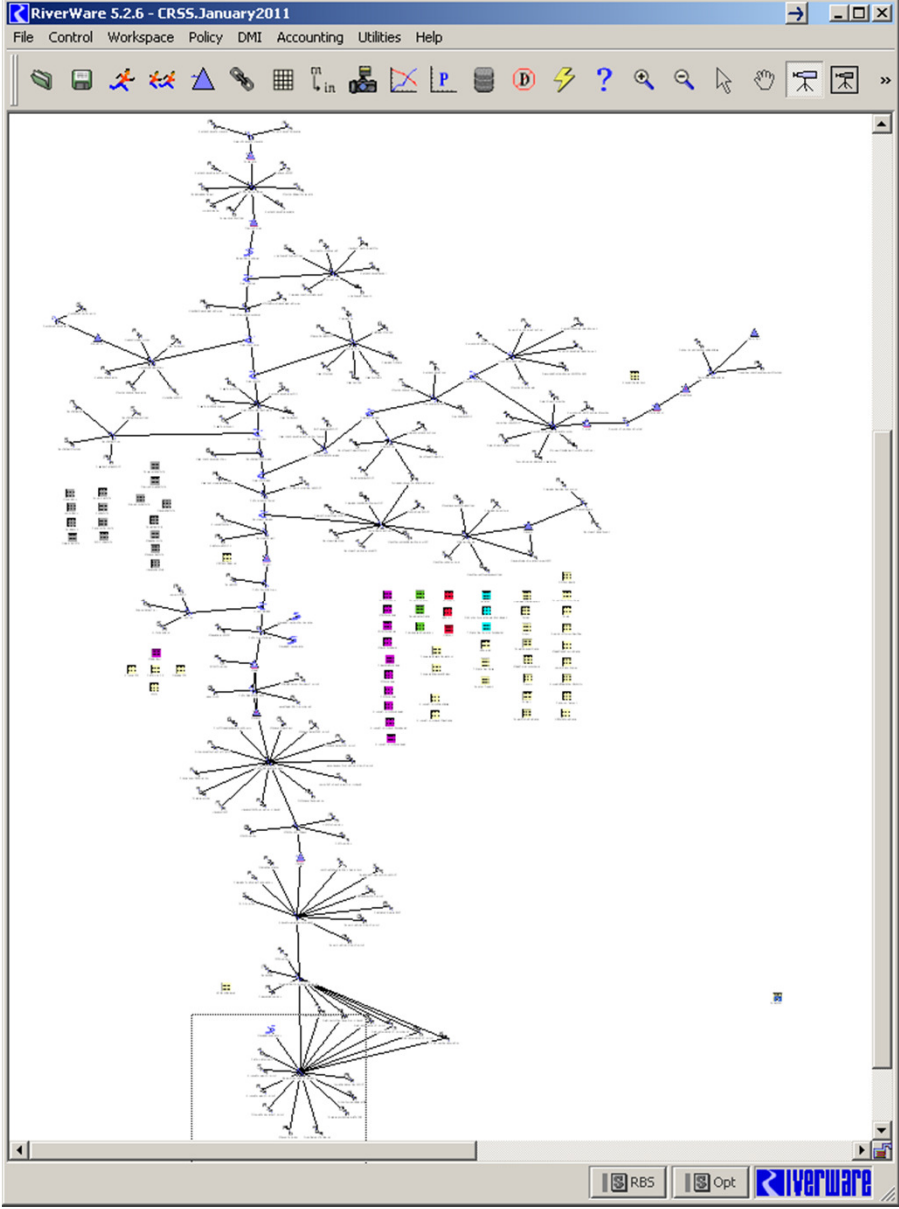- Arizona On-River Model

  Addresses:
  - Arizona higher priority uses
  - Projected growth in water use

- CAP System Model

  Addresses:
  - System capacity for deliveries

Colorado River Simulation System (CRSS)

CRSS: Model Features

- Constructed and operated in the RiverWare object-oriented platform

- Simulates the Colorado River Basin (Upper and Lower Basin):
  - User demand schedules
  - Diversion points from the river
  - Inflows into the river
  - Reservoirs and dams

- Official planning model for the Colorado River by the Bureau of Reclamation and the seven basin states

- Incorporates official policies and operation rules for the Colorado River

- Has provided the basis for policy negotiations, reservoir releases, and basin planning efforts (Basin Study)

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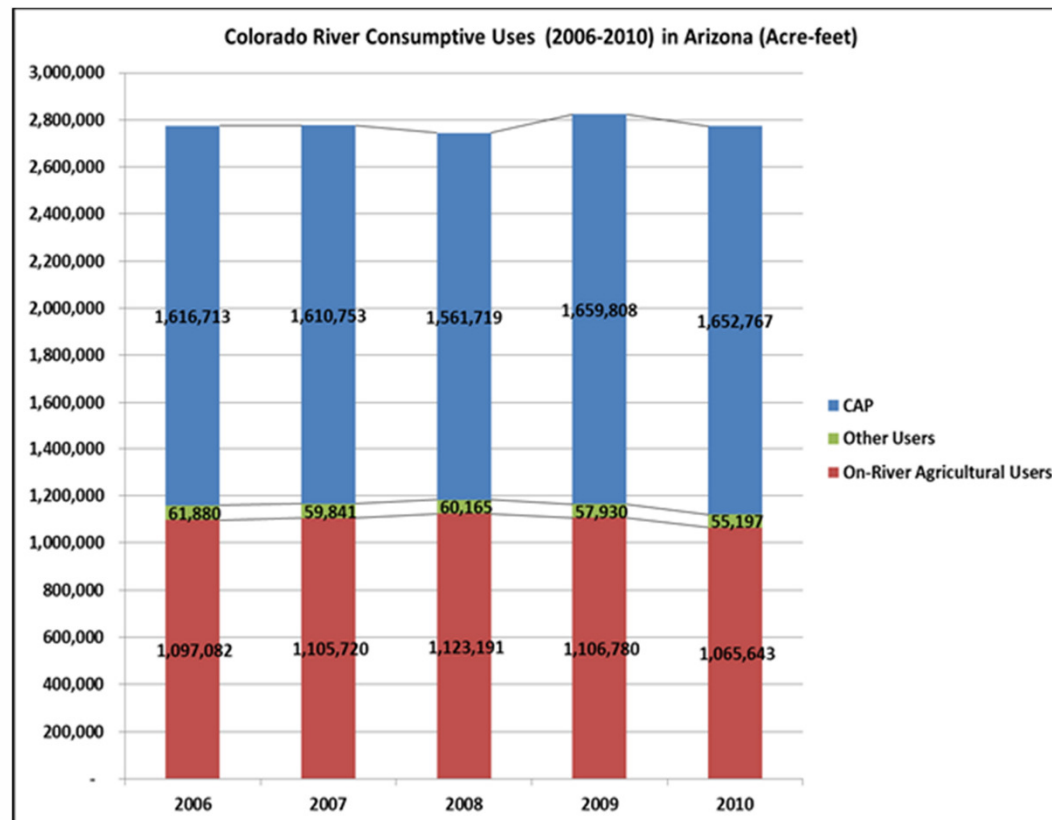
AZ On-River Users

- 22 Agricultural users

- 41 Municipal/Industrial users

- 8 Mixed Ag/M&I users

- 5 Indian tribes

- 3 Environmental/Wildlife Refuges

- Largest Users (Average > 100 KAF/yr)
  - *Colorado River Indian Reservation*
  - *Wellton-Mohawk Irrigation and Drainage District*
  - *Yuma County Water Users Association*
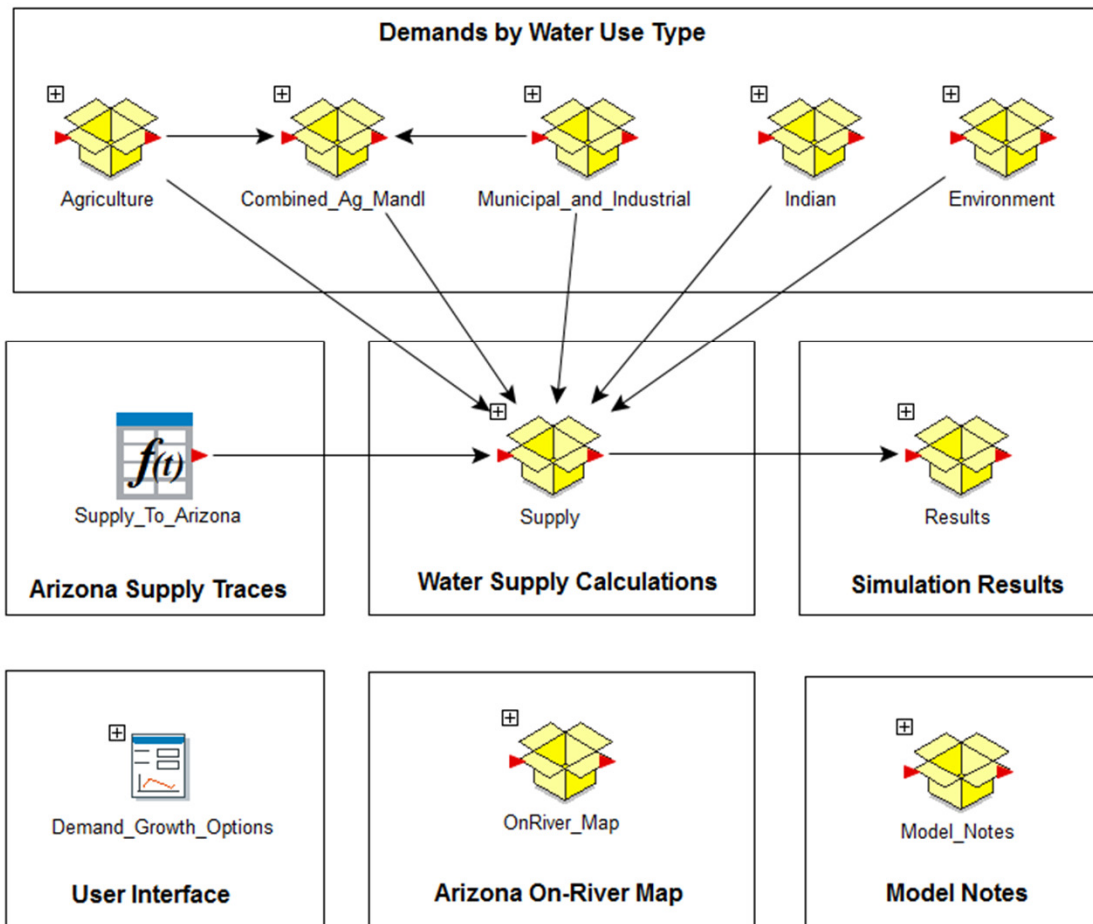
*Largest M&I – City of Yuma (16 KAF)
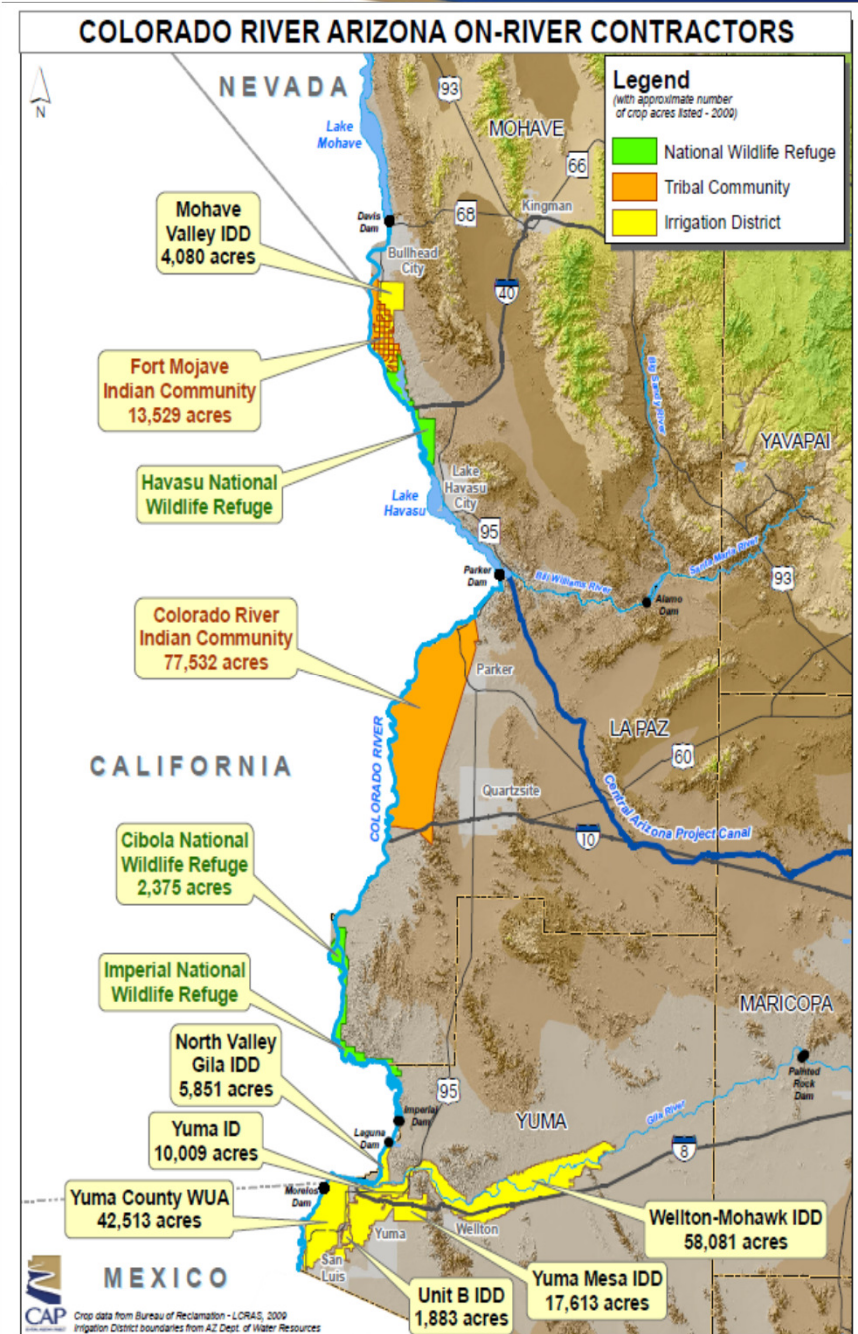
Arizona Priorities (Colorado River)

Priority Tier	Type of Contracts	Major Users
P1	Present Perfected Rights	Colorado River Indian Reservation
P2/P3	Equal Priority Contracts	Wellton-Mohawk Irrig. & Drainage District
P4	Post-1968 Contracts	Central Arizona Project
P5/P6	Unused/Surplus Water	Arizona Public Service

Colorado River Consumptive Uses (2006-2010) in Arizona (Acre-feet)

CAP values: 1,616,713 (2006), 1,610,753 (2007), 1,561,719 (2008), 1,659,808 (2009), 1,652,767 (2010)

Other Users: 61,880 (2006), 59,841 (2007), 60,165 (2008), 57,930 (2009), 55,197 (2010)

On-River Agricultural Users: 1,097,082 (2006), 1,105,720 (2007), 1,123,191 (2008), 1,106,780 (2009), 1,065,643 (2010)

Legend:
- CAP
- Other Users
- On-River Agricultural Users

CAP Arizona On-River Model

On-River Model: Model Features

- Constructed and operated in the GoldSim object-oriented platform

- Individual on-river users incorporated:
  - *User entitlements per priority*
  - *Initial use based on 2006-2010 average*

- Water use calculations based on consumptive use

- Projections are lumped according to water use type:
  - *Agricultural, Municipal/Industrial, Indian, Environmental*

- Calculates CAP available supply based on changes to P1 – P4 uses

CAP System Model
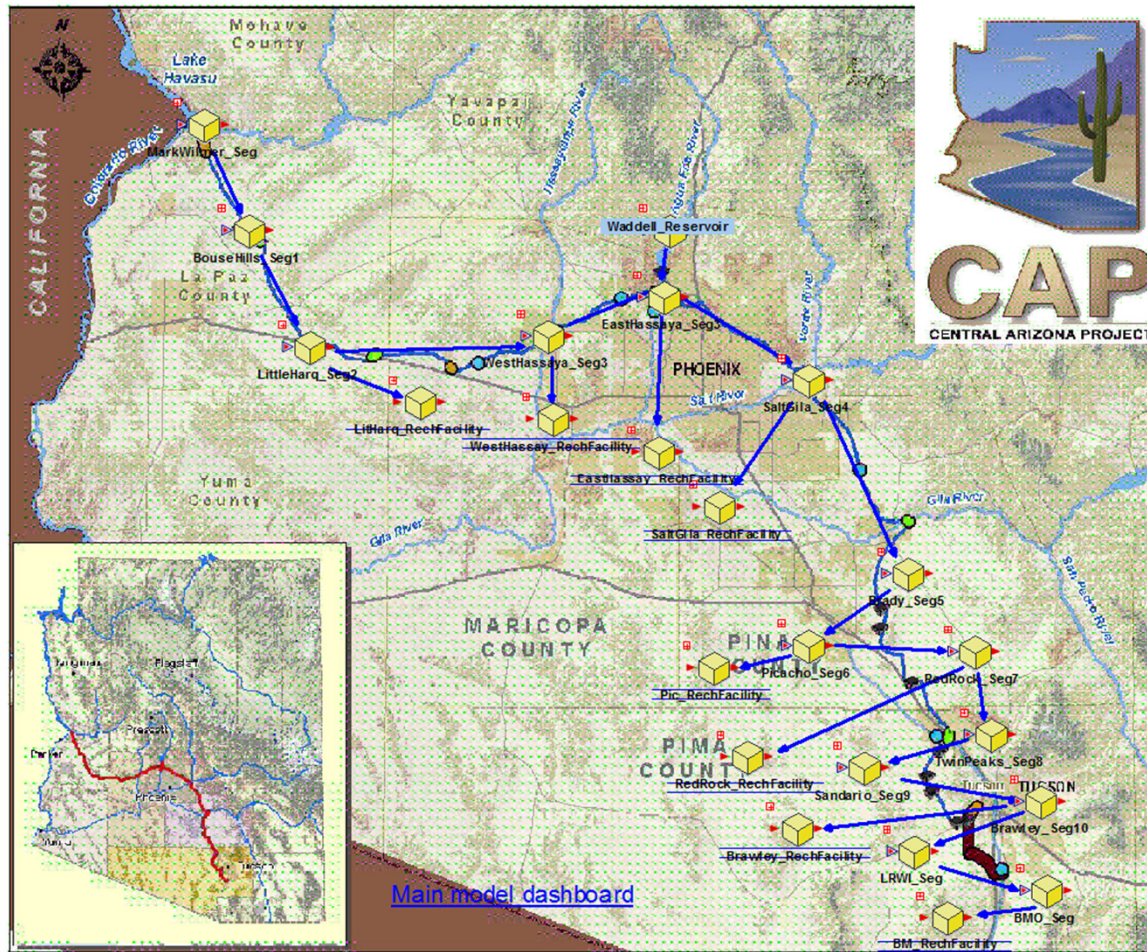
System Model: Model Features

- Constructed and operated in the GoldSim object-oriented platform

- Incorporates key infrastructure of the CAP system:
  - Canal segments
  - Pumping plants
  - Lake Pleasant reservoir (Waddell pumping plant)

- Utilizes mass balance equations for the canal and the reservoir

- Analyzes the system capacity in response to:
  - Seasonal variations in demand/deliveries
  - Canal and reservoir operation rules (maintenance outages)
  - Optimization of power consumption/generation

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Other Models/Planning Tools

- CAP Service Area Model
  – Service area demand and supply portfolios

- Bureau of Reclamation Support Data
  – Reservoir elevations/conditions (Lakes Powell and Mead)
  – Water accounting (Upper Basin/Lower Basin users)

- Colorado Basin River Forecast Center Data
  – Basin conditions (snowpack, soil moisture, runoff)
  – Forecasts (inflows, reservoir elevations, snowpack)

- Climate change information
  – Climate indices (ENSO, La Nina, PDO)
  – Synoptic storm patterns
  – Sea surface temperatures