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

Is Lake Mead elevation below 1145 feet?

- **Surplus Condition**
  - Surplus
  - 1,145 ft +

- **Normal Condition**
  - Normal
  - 1,075 – 1,145 ft

Is Lake Mead elevation below 1075 feet?

- **Shortage Condition**

Is Lake Mead elevation below 1050 feet?

- **Tier 1**
  - 1,050 – 1,075 ft
  - Deliver 7.167 maf
  - Arizona: 2.48 maf
  - Nevada: 0.287 maf
  - California: 4.4 maf

Is Lake Mead elevation below 1025 feet?

- **Tier 2**
  - 1,025 – 1,050 ft
  - Deliver 7.083 maf
  - Arizona: 2.4 maf
  - Nevada: 0.283 maf
  - California: 4.4 maf

Is Lake Mead elevation below 1000 feet?

- **Tier 3**
  - 1,000 – 1,025 ft
  - Deliver 7 maf
  - Arizona: 2.32 maf
  - Nevada: 0.28 maf
  - California: 4.4 maf

Secretary will implement/consider further measures for this special condition

Shortage

Lake Mead Elevation
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
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)
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)

<table>
<thead>
<tr>
<th>Priority Tier</th>
<th>Type of Contracts</th>
<th>Major Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Present Perfected Rights</td>
<td>Colorado River Indian Reservation</td>
</tr>
<tr>
<td>P2/P3</td>
<td>Equal Priority Contracts</td>
<td>Wellton-Mohawk Irrig. &amp; Drainage District</td>
</tr>
<tr>
<td>P4</td>
<td>Post-1968 Contracts</td>
<td>Central Arizona Project</td>
</tr>
<tr>
<td>P5/P6</td>
<td>Unused/Surplus Water</td>
<td>Arizona Public Service</td>
</tr>
</tbody>
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### Colorado River Consumptive Uses (2006-2010) in Arizona (Acre-feet)

<table>
<thead>
<tr>
<th>Year</th>
<th>CAP</th>
<th>Other Users</th>
<th>On-River Agricultural Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1,816,713</td>
<td>61,880</td>
<td>1,097,082</td>
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<tr>
<td>2007</td>
<td>1,810,753</td>
<td>59,841</td>
<td>1,105,720</td>
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<tr>
<td>2008</td>
<td>1,561,719</td>
<td>60,165</td>
<td>1,123,191</td>
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<tr>
<td>2009</td>
<td>1,659,808</td>
<td>57,930</td>
<td>1,106,780</td>
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<tr>
<td>2010</td>
<td>1,852,767</td>
<td>55,197</td>
<td>1,065,643</td>
</tr>
</tbody>
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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
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