### Agenda Item Information

**Basin Hydrology and Operations**

**Action Requested**

☑ Information item only.

**Presenters**

David Trueman, Resource Management Division Manager, Upper Colorado Region, Bureau of Reclamation

**Previous Action Taken**

N/A

**Relevant Science**

N/A

**Background Information**

The presentation is intended to provide pertinent information to AMWG members on current water supply and forecasted hydrologic conditions within the Upper Colorado River Basin. The presentation will focus on projected reservoir conditions and operations at Lake Powell/Glen Canyon Dam during water year 2011 and provide a general outlook for 2012.

The presentation will cover the implementation of the *Colorado River Interim Guidelines for Lower Basin Shortages and the Coordinated Operations of Lake Powell and Lake Mead* and equalization releases from Lake Powell in water year 2011. Such information is provided to assist the AMWG in developing recommendations to the Secretary on the operation of Glen Canyon Dam, particularly when such recommendations are near-term in nature.
Glen Canyon Dam Operation
Status WY2011/2012
Colorado River Basin Hydrology

AMWG Meeting
May 18, 2011
Colorado River Basin: Update on 2011 Coordinated Operations

- WY 2011 Hydrology Update
- Glen Canyon Dam Operations
  - Current status for the remainder of WY 2011
  - Projected water year release conditions for WY2012
Hydrologic Update
Upper Basin Hydrology Update

Upper Colorado River Basin Snotel Tracking
Aggregate of 115 Snotel Sites above Lake Powell

April 1 Snowpack
119% of average

April Forecast (Apr-Jul)
9.5 maf (120% of average)
Upper Basin Hydrology Update

Upper Colorado River Basin Snotel Tracking
Aggregate of 115 Snotel Sites above Lake Powell

May 10 Snowpack
147% of average

April Forecast (Apr-Jul)
11.5 maf (145% of average)
### CBRFC Unregulated Inflow Forecasts dated May 4, 2011

#### Projected 2011 April – July Inflow

<table>
<thead>
<tr>
<th>Period in 2011</th>
<th>Inflow (KAF)</th>
<th>Percent of Average¹</th>
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<tr>
<td>April (observed)</td>
<td>983</td>
<td>100</td>
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<tr>
<td>May</td>
<td>3,000</td>
<td>130</td>
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<tr>
<td>June</td>
<td>5,200</td>
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<tr>
<td>July</td>
<td>2,300</td>
<td>148</td>
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<td>April – July</td>
<td>11,500</td>
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<td>Water Year Projection</td>
<td>15,380</td>
<td>128</td>
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¹ Percentages and percent of average based on period of record from 1971-2000.
Projected Operations for the Remainder of WY 2011
Water Year 2011 Projections
April 2011 Most Probable Inflow Scenario

Projected Unregulated Inflow into Powell\(^1\) = 13.11 maf (109% of average)

Lake Powell
- 24.322 maf
- 16.2 maf
- 9.5 maf
- 0.0 maf (Dead Storage)
- 1.9 maf
- 3,638.2 feet (65% of capacity)

Lake Mead
- 25.877 maf
- 11.9 maf
- 9.4 maf
- 0.0 maf (Dead Storage)
- 1,105.0 feet (46% of capacity)

Water Year 2011 Projections
April 2011 Most Probable Inflow Scenario

Not to Scale

\(^1\) Projected elevations from the April 2011 24-Month Study which is based on the CBRFC inflow forecast dated April 4, 2011
Water Year 2011 Projections
May 2011 Most Probable Inflow Scenario

Projected Unregulated Inflow into Powell\(^1\) = 15.38 maf (128% of average)

Lake Powell
- 24.322 maf
- 3,643.0 feet
- 67% of capacity
- Dead Storage: 1.9 maf

Lake Mead
- 25.877 maf
- 1,123.4 feet
- 53% of capacity
- Dead Storage: 0.0 maf

---

\(^1\) Projected elevations from the May 2011 24-Month Study which is based on the CBRFC inflow forecast dated May 4, 2011

Not to Scale

RECLAMATION
Water Year 2011 Projections
May 2011 Most Probable Inflow Scenario

Projected Unregulated Inflow into Powell\(^1\) = 15.38 maf (128% of average)

Lake Powell

- 24.322 maf
- 16.2 maf
- 9.5 maf
- 0.0 maf
- 1.9 maf

3,649.7 feet
71% of capacity

Lake Mead

- 25.877 maf
- 11.9 maf
- 9.4 maf
- 0.0 maf
- 2.0 maf

1,114.9 feet
50% of capacity

Not to Scale

\(^1\) Projected elevations from the May 2011 24-Month Study which is based on the CBRFC inflow forecast dated May 4, 2011
Coordinated Operations of Lake Powell and Lake Mead

Annual Release Volume as a Function of Unregulated Inflow Volume
based on May 2011 Conditions

Potential Glen Canyon Annual Release Volume (maf)

Potential Water Year Unregulated Inflow Volume (maf)

With the Equalization Tier governing the operation of Lake Powell for the remainder of WY 2011, and a forecasted water year unregulated inflow into Lake Powell of 15.38 maf, the projected annual release in the most probable May 24-Month Study is 12.46 maf. This annual release volume represents the projected maximum amount of water than can be passed through Glen Canyon Powerplant in WY 2011. In the May 24-month study, the annual release volume to achieve Equalization by EOWY 2011 is projected to be 13.31 maf. Based on these conditions, a projected WY 2011 equalization volume of 0.85 maf will carry over to WY 2012, with Equalization being achieved by ECY 2011. This results in a Lake Powell projected EOWY elevation of 3,649.7 feet (nearly 7 feet above the 2011 Equalization Level of 3,643 feet) and a Lake Mead projected EOWY elevation of 1,114.9 feet.

Under the Equalization Tier, in years that are ultimately much drier than expected, the annual release from Lake Powell can be as low as 8.23 maf if the projected and actual EOWY elevation of Lake Powell is 20 feet or greater below the Equalization Level. In WY 2011, this elevation is 3,623 feet.

Equalization release volume controlled by Powell elevation of 3,623 ft at EOWY 2011

Equalization release volume controlled by Mead elevation of 1,105 ft at EOWY 2011

Equalization release volume controlled by equal volumes in Powell and Mead at EOWY 2011

Equalization release volume controlled by Powell elevation of 3,643 ft at EOWY 2011
Lake Powell End of Month Elevation

Projections from April 2011 24-Month Study Inflow Scenarios

- April 2011 Probable Minimum Inflow into Lake Powell (10.52 maf in WY 2011)
- April 2011 Most Probable Inflow into Lake Powell (13.11 maf in WY 2011)
- April 2011 Probable Maximum Inflow into Lake Powell (16.21 maf in WY 2011)

Historical Elevations
Lake Powell End of Month Elevation

Projections from April and May 2011 24-Month Study Inflow Scenarios

- May 2011 Most Probable Inflow into Lake Powell (15.38 maf in WY 2011)
- April 2011 Probable Minimum Inflow into Lake Powell (10.52 maf in WY 2011)
- April 2011 Most Probable Inflow into Lake Powell (13.11 maf in WY 2011)
- April 2011 Probable Maximum Inflow into Lake Powell (16.21 maf in WY 2011)
- Historical Elevations
Glen Canyon Dam Projected Operations for Remainder of WY2011
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<tr>
<th>Capacity (cfs)</th>
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<th>23,825</th>
<th>14,840</th>
<th>4.75</th>
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<td>Capacity (kaf/month)</td>
<td>990</td>
<td>1180</td>
<td>1350</td>
<td>1350</td>
<td>1080</td>
<td>1036</td>
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<td>1195</td>
<td>1369</td>
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Glen Canyon Power Plant Planned Unit Outage Schedule for Water Year 2011 (updated 5-9-2011)
Glen Canyon Dam Hourly Release Pattern MAY 2011

Power Plant Capacity (approximately 23,000 cfs)

Ramp-Up - 4000 cfs/hr
Ramp-Down - 1500 cfs/hr
May Volume = 1195 kaf

May 1-31, 2011

99 MW spinning and non-spinning reserves at GCD
CRSP Reserve Requirement is 99 MW.
40 MW Regulation at GCD

Scheduled Hourly Releases  Actual Hourly Releases  Lees Ferry Flow
Power Plant Capacity (approximately 23,000 cfs)

Ramp-Up - 4000 cfs/hr
Ramp-Down - 1500 cfs/hr
June Volume = 1369 kaf

June 1-30, 2011
99 MW spinning and non-spinning reserves at GCD
CRSP Reserve Requirement is 99 MW.
40 MW Regulation at GCD

Scheduled Hourly Releases  Actual Hourly Releases  Lees Ferry Flow
Power Plant Capacity (approximately 23,825 cfs)

Ramp-Up - 4000 cfs/hr
Ramp-Down - 1500 cfs/hr
July Volume = 1465 kaf

Date-Hour

July 1-31, 2011
99 MW spinning and non-spinning reserves at GCD
CRSP Reserve Requirement is 99 MW.
40 MW Regulation at GCD

Scheduled Hourly Releases  Actual Hourly Releases  Lees Ferry Flow
Glen Canyon Dam Hourly Release Pattern AUG 2011

Power Plant Capacity (approximately 23,825 cfs)

Ramp-Up - 4000 cfs/hr
Ramp-Down - 1500 cfs/hr
Aug Volume = 1465 kaf

August 1-31, 2011

99 MW spinning and non-spinning reserves at GCD

CRSP Reserve Requirement is 99 MW.

40 MW Regulation at GCD

Date-Hour

Scheduled Hourly Releases  Actual Hourly Releases  Lees Ferry Flow
Glen Canyon Dam Hourly Release Pattern SEP 2011

Power Plant Capacity (approximately 14,840 cfs)

- Steady Release Target: 14,840 cfs
- Sept. Volume = 883 kaf

September 1-30, 2011
- 99 MW spinning and non-spinning reserves at GCD
- CRSP Reserve Requirement is 99 MW.
- 40 MW Regulation at GCD

Scheduled Hourly Releases
Actual Hourly Releases
Lees Ferry Flow
May 24-Month Study Monthly Release Distribution

May 24-Month Study

WY2011 Release = 12.463 maf

WY2012 Release = 11.088 maf

Release Volume (kaf)

Month

Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

Traditional 8.23 MAF Release
Balancing or Equalization Release 2011
Balancing or Equalization Release 2012
Outlook to WY2012
## Glen Canyon Power Plant Planned Unit Outage Schedule for Water Year 2012

(updated 5-13-2011)

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<td>Capacity (cfs)</td>
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<tr>
<td>Max (kaf)</td>
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<td>900</td>
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<td>Most (kaf)</td>
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<td>Min (kaf)</td>
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<td>890</td>
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Coordinated Operations of Lake Powell and Lake Mead
Annual Release Volume as a Function of Unregulated Inflow Volume for 2012
based on May 2011 Conditions
## May 2011 Results from CRSS
Probabilities of occurrence, values in percent

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<tr>
<th>Event or System Condition</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
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<td><strong>Upper Basin</strong></td>
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<tr>
<td>Equalization release from Powell</td>
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<td>8.23 maf release from Powell</td>
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<td><strong>Lower Basin</strong></td>
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<td>Shortage – any amount (Mead ≤ 1,075)</td>
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<td>Shortage – 1\textsuperscript{st} level (Mead ≤ 1,075 and ≥ 1,050)</td>
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<td>Shortage – 3\textsuperscript{rd} level (Mead &lt; 1,025)</td>
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Questions/Discussion

Rick Clayton
rclayton@usbr.gov
801-524-3730