RECLAMATION

Managing Water in the West

Yellowtail Dam & Bighorn Lake
Recap of Operations during WY-2012

Billings, Montana
October 3, 2012
Yellowtail Dam & Afterbay
BIGHORN LAKE CONDITIONS
November 1, 2011

Elevation
3639.30 ft – 0.7 ft below full pool

Storage
1,011,836 af – 99% full

Inflows = 2,600 cfs

Total Outflow = 3,500 cfs
  River = 3,500 cfs
  BIA Canal = 0 cfs
# Bighorn Lake Fall Operations

Operating Criteria Used for 2012 Plans

## November - March

**Bighorn Lake River Release Rate**

11/2/2011 9:18

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
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<tbody>
<tr>
<td>ENTER</td>
<td>CALCULATED</td>
<td>ENTER</td>
<td>ENTER</td>
<td>ENTER</td>
<td>End of March</td>
<td>CALCULATED</td>
<td>CALCULATED</td>
<td>31-Mar-10</td>
<td>Month</td>
<td>Gains</td>
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<tr>
<td>in Acre-feet</td>
<td>Storage AF</td>
<td>CFS</td>
<td>CFS</td>
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<tr>
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</tbody>
</table>

**Total** | 806.5

**Directions:** Enter appropriate values in the yellow cells: A10, C10, D10, & E10. Bighorn Lake River Release for Nov-Mar is calculated in cell H10 and the end of March target elevation is displayed in I10.

## Intermediate Calculations for River Release

<table>
<thead>
<tr>
<th>J</th>
<th>K</th>
<th>L</th>
<th>M</th>
<th>N</th>
<th>O</th>
<th>P</th>
<th>Q</th>
<th>R</th>
<th>S</th>
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<tbody>
<tr>
<td>CALCULATED</td>
<td>CALCULATED</td>
<td>CALCULATED</td>
<td>Check Results &amp;</td>
<td>End of March</td>
<td>End of March</td>
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<tr>
<td>Forecasts Gain</td>
<td>Step One</td>
<td>Step Two</td>
<td>Step Three</td>
<td>Adjust Release</td>
<td>Reservoir Elev.</td>
<td>Reservoir Storage</td>
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<tr>
<td>F = Desired end of March Storage</td>
<td>Release CFS</td>
<td>Release CFS</td>
<td>Release CFS</td>
<td>CFS</td>
<td>Target</td>
<td>Target</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>G is determined from calculations in J through L with Checks in M</td>
<td>&gt;2500</td>
<td>2000-2500</td>
<td>1500-2000</td>
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<tr>
<td>H = Dam Release (G) + 70 cfs</td>
<td>3137</td>
<td>3184</td>
<td>3228</td>
<td>3137</td>
<td>if J &gt; 2500 then set to J</td>
<td>3619.0</td>
<td>829,234</td>
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<tr>
<td></td>
<td>3137</td>
<td>2500</td>
<td>2000</td>
<td>3137</td>
<td>if K &lt; 2500 then set to K</td>
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<tr>
<td></td>
<td>3137</td>
<td>2500</td>
<td>2000</td>
<td>3137</td>
<td>if L &lt; 2000 then set to L</td>
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<tr>
<td>Forecasts Gain Adjustments</td>
<td>2000</td>
<td>1500</td>
<td>3137</td>
<td>if L &lt; 1500 then set to 1500</td>
<td>3619.0</td>
<td>829,234</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Elevation</th>
<th>Storage</th>
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<tbody>
<tr>
<td>1500-2000 cfs</td>
<td>3615</td>
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<tr>
<td>&gt; 2500 cfs</td>
<td>3619</td>
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</table>

**Reclamation**
BIGHORN LAKE FALL OPERATIONS
Operating Criteria Used for 2012 Plans

STEP 1

2011 April-October Gain = 806,500 acre-feet
2011 End-of-October Storage = 1,011,836 acre-feet
Upstream Reservoir Fall & Winter Releases =
   Boysen = 950 cfs
   Buffalo Bill = 350 cfs
Projected End-of-March Target Elevation = 3617
Calculated November-March Gain = 339,300 acre-feet
Calculated Fall & Winter Release for Yellowtail:
   River = 3,175 cfs
BIGHORN LAKE FALL CONDITIONS
Operating Criteria Used for 2012 Plans

STEP 2

Since Calculated Fall & Winter Release was > 2,500 cfs

Set End-of-March target elevation @ 3619

Calculated New Fall & Winter Release for Yellowtail:
River = 3,130 cfs
Recap of Water Year 2012

Bighorn Lake November-March Inflow 1967-2012

F.C. – 733 kaf
2012 – 726 kaf
Ave. – 696 kaf
Bighorn Lake 2012 Nov-Mar Operations

Lake Elevation feet

1-Nov  1-Dec  1-Jan  1-Feb  1-Mar

2012
Top of Joint Use
# November-March River Release

<table>
<thead>
<tr>
<th></th>
<th>Target</th>
<th>Actual</th>
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<tbody>
<tr>
<td>Oct 31 Lake Elev.</td>
<td>3635-3640</td>
<td>3639.30</td>
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<tr>
<td>Nov-Mar Release</td>
<td>3,130</td>
<td>3,100 cfs</td>
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<td>Mar 31 Lake Elev.</td>
<td>3619</td>
<td>3619.58</td>
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</tbody>
</table>
Spring Runoff Season
Recap of Water Year 2012

2012 Valley Precipitation

- **Average Valley Precipitation**
- **Actual Valley Precipitation**

Month: Oct, Nov, Dec, Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sept

Precipitation (Inches):

- Oct: Approx. 2.0 inches
- Nov: Approx. 0.5 inches
- Dec: Approx. 0.5 inches
- Jan: Approx. 0.0 inches
- Feb: Approx. 0.0 inches
- Mar: Approx. 0.5 inches
- Apr: Approx. 1.0 inch
- May: Approx. 2.0 inches
- Jun: Approx. 1.5 inches
- Jul: Approx. 1.0 inch
- Aug: Approx. 0.5 inches
- Sept: Approx. 0.5 inches

RECLAMATION
Recap of Water Year 2012

April-July Forecast = 1,131.4 kaf (99%)
Recap of Water Year 2012

Mountain Snowpack Conditions on February 1

- SE = 96% of average
- April-July Forecast = 1,212.2 kaf (102%)

Graph showing snow water equivalent from October 11 to October 12.
Recap of Water Year 2012

SE = 116% of average
April-July Forecast = 1,344.3 kaf (118%)
Recap of Water Year 2012

Mountain Snowpack Conditions on April 1

SE = 86% of average
April-July Forecast = 1,064.0 kaf (93%)
Recap of Water Year 2012

SE = 63% of average
April-July Forecast = 749.7 kaf (66%).
Recap of Water Year 2012

Mountain Snowpack Conditions on June 1

SE = 55% of average
April-July Forecast = 690.4 kaf (61%).
Recap of Water Year 2012

Mountain Snowpack Conditions - 2012

- Peaked on 3/22 @ 102% of average
- 1.6” below average peak on 4/15
Recap of Water Year 2012

Peaked on 3/22 @ 102% of average
1.6” below average peak on 4/15
Recap of Water Year 2012
5-17-2012
Recap of Water Year 2012
6-15-2012
Recap of Water Year 2012
6-20-2012
Recap of Water Year 2011
6-30-2011
Rule Curve Operations April-July
<table>
<thead>
<tr>
<th>Date</th>
<th>Forecast</th>
<th>% of Avg</th>
<th>Min Elev.</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan. 1</td>
<td>1,131,400</td>
<td>99%</td>
<td>3613.4</td>
<td>5/03</td>
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<tr>
<td>Feb. 1</td>
<td>1,212,200</td>
<td>102%</td>
<td>3612.6</td>
<td>5/08</td>
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<td>Mar. 1</td>
<td>1,344,300</td>
<td>118%</td>
<td>3611.1</td>
<td>5/13</td>
</tr>
<tr>
<td>April 1</td>
<td>1,064,000</td>
<td>93%</td>
<td>3614.4</td>
<td>5/02</td>
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<tr>
<td>April 15</td>
<td>903,900</td>
<td>79%</td>
<td>3616.6</td>
<td>4/26</td>
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<tr>
<td>May 1</td>
<td>749,700</td>
<td>77%</td>
<td>3619.0</td>
<td>5/01</td>
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<tr>
<td>May 15</td>
<td>641,800</td>
<td>56%</td>
<td>3622.1</td>
<td>5/16</td>
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<tr>
<td>June 1</td>
<td>690,500</td>
<td>61%</td>
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<td>6/01</td>
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<tr>
<td>Actual</td>
<td>693,100</td>
<td>61%</td>
<td>3623.6</td>
<td>6/01</td>
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</table>
Bighorn Lake Rule Curve Operation 2012

Elevation (feet) vs. Discharge (cfs)

- Elevation
- Rule Curve
- Top of Joint Use
- Inflow
- River Release
Recap of Water Year 2012

Peaked Inflow = 6,527 cfs on 6/7
13,826 cfs lower than in 2011
Recap of Water Year 2012

Bighorn Lake Cumulative Inflow
October 1 - September 30

- WY-2011 Total Inflow – 3,817.0 kaf (162% of average)
- WY-2012 Total Inflow – 1,850.0 kaf (78% of average)
- 30-Yr Average Total Inflow – 2,337.4 kaf
Recap of Water Year 2012

Bighorn Lake April-July Inflow
1967-2012

2012 – 693 kaf
Ave. – 1,138 kaf
Recap of Water Year 2012

Peak River Release = 15,461 cfs on 6/15
5,468 cfs higher than in 2010
Recap of Water Year 2012

Bighorn Lake Storage

Peaked on 6/25 at 3635.58 feet
4.42 feet below full pool
19.45 feet lower than in 2011
<table>
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<tr>
<th>A</th>
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<tr>
<td>ENTER</td>
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<td>End of March</td>
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<td>Acre-feet</td>
<td>Storage AF</td>
<td>CFS</td>
<td>CFS</td>
<td>acre-feet</td>
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<td></td>
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<td></td>
<td>To Afterbay</td>
<td>Target</td>
<td>May</td>
<td>184.0</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>From Afterbay</td>
<td></td>
<td>Jun</td>
<td>390.7</td>
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<td>Jul</td>
<td>88.4</td>
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<td>Aug</td>
<td>-11.6</td>
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<td>Max Probable</td>
<td>374,348</td>
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**NOVEMBER - MARCH**

**Bighorn Lake River Release Rate**

**11/2/2011 9:18**

**Intermediate Calculations for River Release**

- **B** = 145.1*A + 222402, \( R^2 = 0.8756 \)
- **F** = Desired end of March Storage
- **G** is determined from calculations in J through L with Checks in M
- **H** = Dam Release (G) + 70 cfs

**Forecasted Gain Adjustments**

- Elevation Storage
- 1500-2000 cfs: 3619, 821,949
- 2000-2500 cfs: 3137, 3184
- 2500 cfs: 3137, 3184
- > 2500 cfs: 3615, 794,613

**Directions:** Enter appropriate values in the yellow cells: A10, C10, D10, & E10.

Bighorn Lake River Release for Nov - Mar is calculated in cell H10 and the end of March target elevation is displayed in I10.
Questions??

Open Discussion