Topics

- Drought Monitor and Precipitation and Temperature Outlook
- Current stream flows and Rye Patch Reservoir Storage
- Stream flow forecast
- Q&A with Water Commissioners Kirk Owsley and Steve DelSoldato
- Capture Model Update
- In-House Capture Analysis
  - Methodology
  - Results
- Concluding Remarks
- Next Meeting
- Open Discussion
January 6, 2015
(Released Thursday, Jan. 8, 2015)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

<table>
<thead>
<tr>
<th>Current</th>
<th>None</th>
<th>D0-D4</th>
<th>D1-D4</th>
<th>D2-D4</th>
<th>D3-D4</th>
<th>D4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.00</td>
<td>100.00</td>
<td>96.96</td>
<td>63.25</td>
<td>43.33</td>
<td>11.89</td>
</tr>
<tr>
<td>Last Week</td>
<td>0.00</td>
<td>100.00</td>
<td>96.96</td>
<td>63.25</td>
<td>43.33</td>
<td>11.89</td>
</tr>
<tr>
<td>12/30/2014</td>
<td>0.00</td>
<td>100.00</td>
<td>97.07</td>
<td>69.99</td>
<td>43.33</td>
<td>11.89</td>
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<td>3 Months Ago</td>
<td>0.00</td>
<td>100.00</td>
<td>96.98</td>
<td>63.26</td>
<td>43.38</td>
<td>11.89</td>
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<tr>
<td>12/30/2014</td>
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<td>100.00</td>
<td>97.04</td>
<td>69.89</td>
<td>43.36</td>
<td>11.89</td>
</tr>
<tr>
<td>Start of Calendar Year</td>
<td>0.00</td>
<td>100.00</td>
<td>96.81</td>
<td>80.30</td>
<td>29.55</td>
<td>6.37</td>
</tr>
<tr>
<td>Start of Water Year</td>
<td>0.00</td>
<td>100.00</td>
<td>96.81</td>
<td>80.30</td>
<td>29.55</td>
<td>6.37</td>
</tr>
</tbody>
</table>

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Brad Rippey
U.S. Department of Agriculture

http://droughtmonitor.unl.edu/
Spring 2015 (Feb-Apr) Precipitation Outlook

Official outlook – favoring above normal precipitation overall; medium confidence
Temperature – favors continued above normal with medium to high confidence (higher than average snow levels).
Mean Annual Flow at Select Gages (WY 1946-2014)

Elko       170,000 af
Palisade   294,000 af
Battle Mountain 281,000 af*  
Comus      251,000 af
Imlay      205,000 af

## Current Stream Flows/Rye Patch Storage


### January 13, 2015

<table>
<thead>
<tr>
<th>Location</th>
<th>Long Term Average Flow (cfs)</th>
<th>Current Discharge (cfs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Humboldt River at Palisade</td>
<td>151</td>
<td>110</td>
</tr>
<tr>
<td>Humboldt River at Comus</td>
<td>118</td>
<td>22</td>
</tr>
<tr>
<td>Humboldt River at Imlay</td>
<td>108</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Capacity (KAF)</th>
<th>Current Storage (KAF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye Patch Reservoir</td>
<td>194.3</td>
<td>9.2</td>
</tr>
</tbody>
</table>
Stream Flow Forecasts for March - July

Humboldt River at Palisade

<table>
<thead>
<tr>
<th>Year</th>
<th>January 1 Forecast (KAF)</th>
<th>% of Average</th>
<th>March 1 Forecast (KAF)</th>
<th>Actual Flow (KAF)</th>
<th>Actual flow as a % of 30-yr average (270)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>460</td>
<td>170%</td>
<td>370</td>
<td>471</td>
<td>174%</td>
</tr>
<tr>
<td>2012</td>
<td>114</td>
<td>42%</td>
<td>108</td>
<td>58</td>
<td>21%</td>
</tr>
<tr>
<td>2013</td>
<td>235</td>
<td>87%</td>
<td>165</td>
<td>35</td>
<td>13%</td>
</tr>
<tr>
<td>2014</td>
<td>65</td>
<td>24%</td>
<td>120</td>
<td>57</td>
<td>21%</td>
</tr>
<tr>
<td>2015</td>
<td>230</td>
<td>85%</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Year</td>
<td>January 1 Forecast (KAF)</td>
<td>% of Average</td>
<td>March 1 Forecast (KAF)</td>
<td>Actual Flow (KAF)</td>
<td>Actual flow as a % of 30-yr average (255)</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------</td>
<td>--------------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>2011</td>
<td>410</td>
<td>161%</td>
<td>320</td>
<td>337</td>
<td>132%</td>
</tr>
<tr>
<td>2012</td>
<td>75</td>
<td>29%</td>
<td>67</td>
<td>45</td>
<td>18%</td>
</tr>
<tr>
<td>2013</td>
<td>200</td>
<td>78%</td>
<td>115</td>
<td>20</td>
<td>8%</td>
</tr>
<tr>
<td>2014</td>
<td>48</td>
<td>19%</td>
<td>59</td>
<td>32</td>
<td>13%</td>
</tr>
<tr>
<td>2015</td>
<td>185</td>
<td>73%</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
# Stream Flow Forecasts for March - July


## Humboldt River near Imlay

<table>
<thead>
<tr>
<th>Year</th>
<th>January 1 Forecast (KAF)</th>
<th>% of Average</th>
<th>March 1 Forecast (KAF)</th>
<th>Actual Flow (KAF)</th>
<th>Actual flow as a % of 30-yr average (222)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>355</td>
<td>160%</td>
<td>240</td>
<td>234</td>
<td>105%</td>
</tr>
<tr>
<td>2012</td>
<td>56</td>
<td>25%</td>
<td>40</td>
<td>24</td>
<td>11%</td>
</tr>
<tr>
<td>2013</td>
<td>160</td>
<td>72%</td>
<td>75</td>
<td>7</td>
<td>3%</td>
</tr>
<tr>
<td>2014</td>
<td>20</td>
<td>9%</td>
<td>24</td>
<td>5</td>
<td>2%</td>
</tr>
<tr>
<td>2015</td>
<td>140</td>
<td>63%</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
Water Commissioner Discussion
Capture Model Update

- In discussions with USGS and DRI
- Groundwater flow model to evaluate interaction between river and aquifer
- Uses existing data to ensure accuracy of model
- Looks at long term scenarios
- Final product includes estimate of river capture by groundwater wells over time
- Will be used in future management actions
- Estimated time to completion: 5 years
In-House Capture Analysis

- **Objectives**
  - Evaluate potential to increase 2015 streamflow by curtailing existing pumping
  - Evaluate effectiveness of different UG curtailment scenarios

- **Glover Analytical solution**
  - Commonly used in administering water rights to protect streamflows
  - Requires simplifying assumptions about aquifer and stream-aquifer connection

- **Requires**
  - Aquifer parameters: Transmissivity, Storativity
  - Distances between wells and stream
  - Pumping duration (irrigation season)
  - Pumping rates (typical pumping during drought; used 2013 pumpage data)
GLOVER'S SOLUTION

\[ \frac{q}{Q} = \text{erfc}(\sqrt{\frac{l^2 S}{4Tt}}) \]

- \( q/Q \) = Capture %
- \( l \) = distance
- \( S \) = Storage Coefficient
- \( T \) = Aquifer Transmissivity
- \( t \) = Time

Erfc is complementary error function
GLOVER'S SOLUTION

\[ \frac{q}{Q} = \text{erfc}\left(\sqrt{\frac{l^2 S}{4 T t}}\right) \]

- \( q/Q \): Capture %
- \( l \): distance
- \( S \): Storage Coefficient
- \( T \): Aquifer Transmissivity
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Erfc is complementary error function
GLOVER'S SOLUTION

\[ \frac{q}{Q} = \text{erfc}(\sqrt{\frac{l^2 S}{4Tt}}) \]

- \( q/Q \) = Capture %
- \( l \) = distance
- \( S \) = Storage Coefficient
- \( T \) = Aquifer Transmissivity
- \( t \) = Time

\text{Erfc is complementary error function}
Capture vs. Distance from Humboldt River or Tributary (180 day)
Mass Annual Flow at Select Gages (WY 1948-2014)

Elko: 170,000 af
Palisade: 254,600 af
Battle Mountain: 281,000 af
Carmen: 251,600 af
Imlay: 206,000 af

1852 Wells
1291 Groundwater Permits within 5 miles of Humboldt River and tributaries.
273 Permitted Wells with capture of 10% or more
## Results

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Groundwater <strong>Duty</strong> with &gt;10% Capture (AFS)</td>
<td>37,650</td>
</tr>
<tr>
<td>Estimated Groundwater <strong>Pumping</strong> during Irrigation Season (AF)*</td>
<td>7,480</td>
</tr>
<tr>
<td>Additional Flow in Humboldt River over 2015 Irrigation Season if all Pumping Ceased (AFS)</td>
<td>1,480</td>
</tr>
</tbody>
</table>

*Based on 2013 records*
Results

− Glover analysis shows that curtailment of pumping over one irrigation season will not cause an appreciable gain in Humboldt River flows

− Therefore it is anticipated that there will be NO groundwater curtailment in 2015
Concluding Remarks

- We’re committed to protecting senior water rights
- Need capture model as a long-term equitable management tool
- Augmentation, mitigation may be required in the future
- Uncharted territory
Next Meeting
February 11th and 12th

NRCS Snotel data and Streamflow Forecasts:

www.nv.nrcs.usda.gov/snow/

NWS Climate Forecasts:

www.cpc.ncep.noaa.gov/

United States Drought Monitor:

http://droughtmonitor.unl.edu/Home/StateDroughtMonitor
Questions