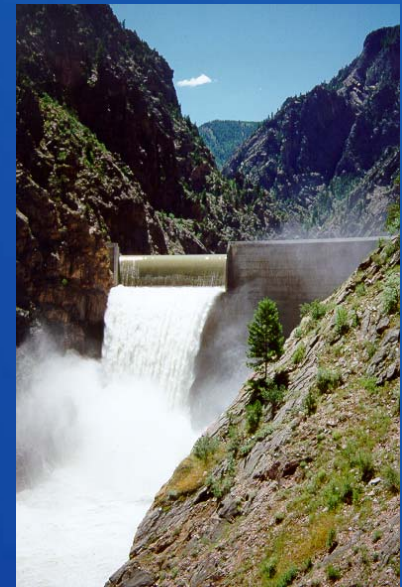
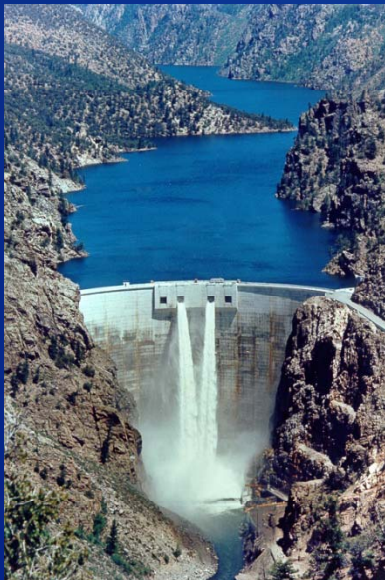


Aspinall Operations Meeting

August 18, 2011

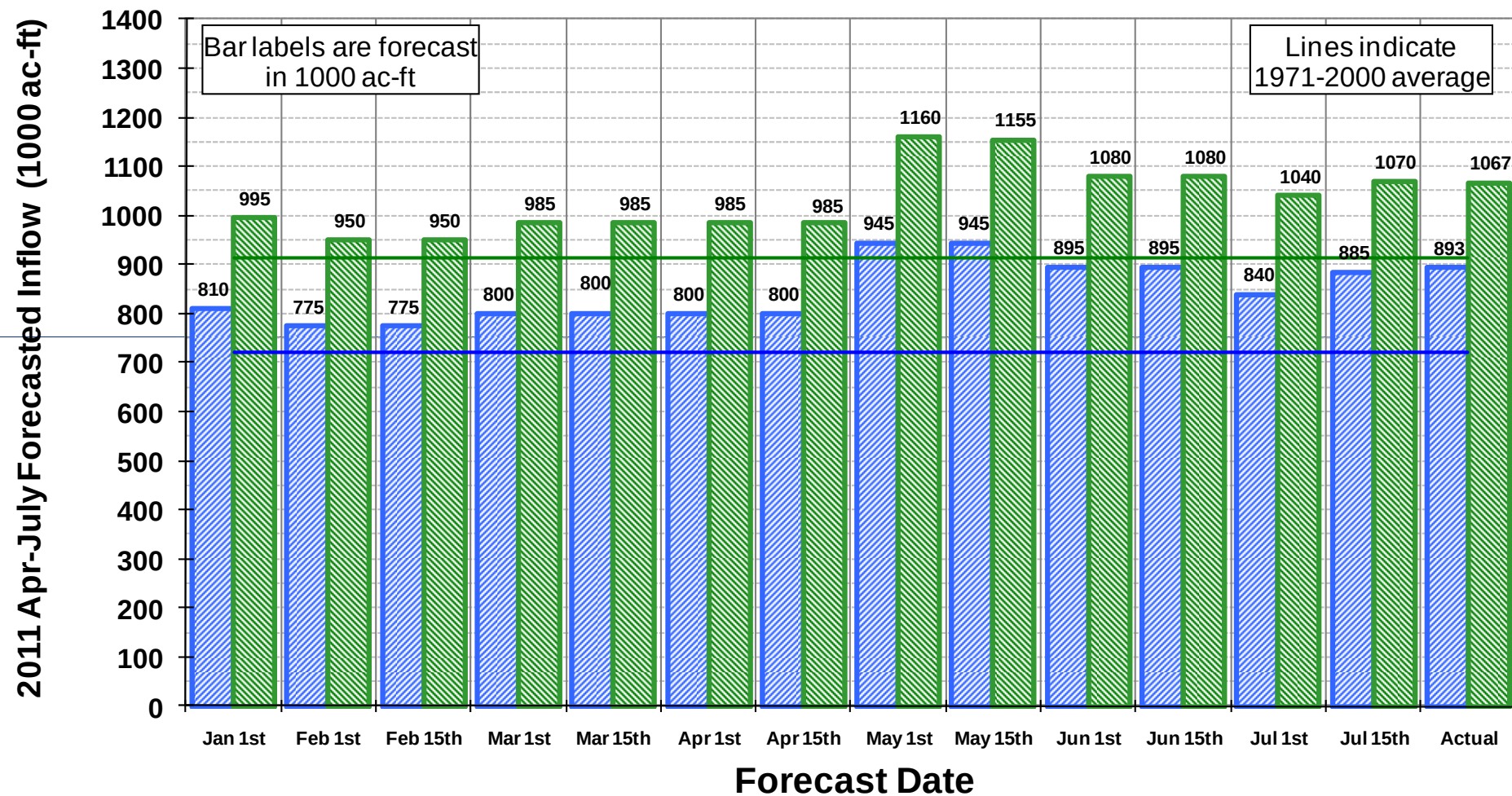


RECLAMATION

SPRING RUNOFF

RECLAMATION

Aspinall Unit Forecasted Unregulated Inflow



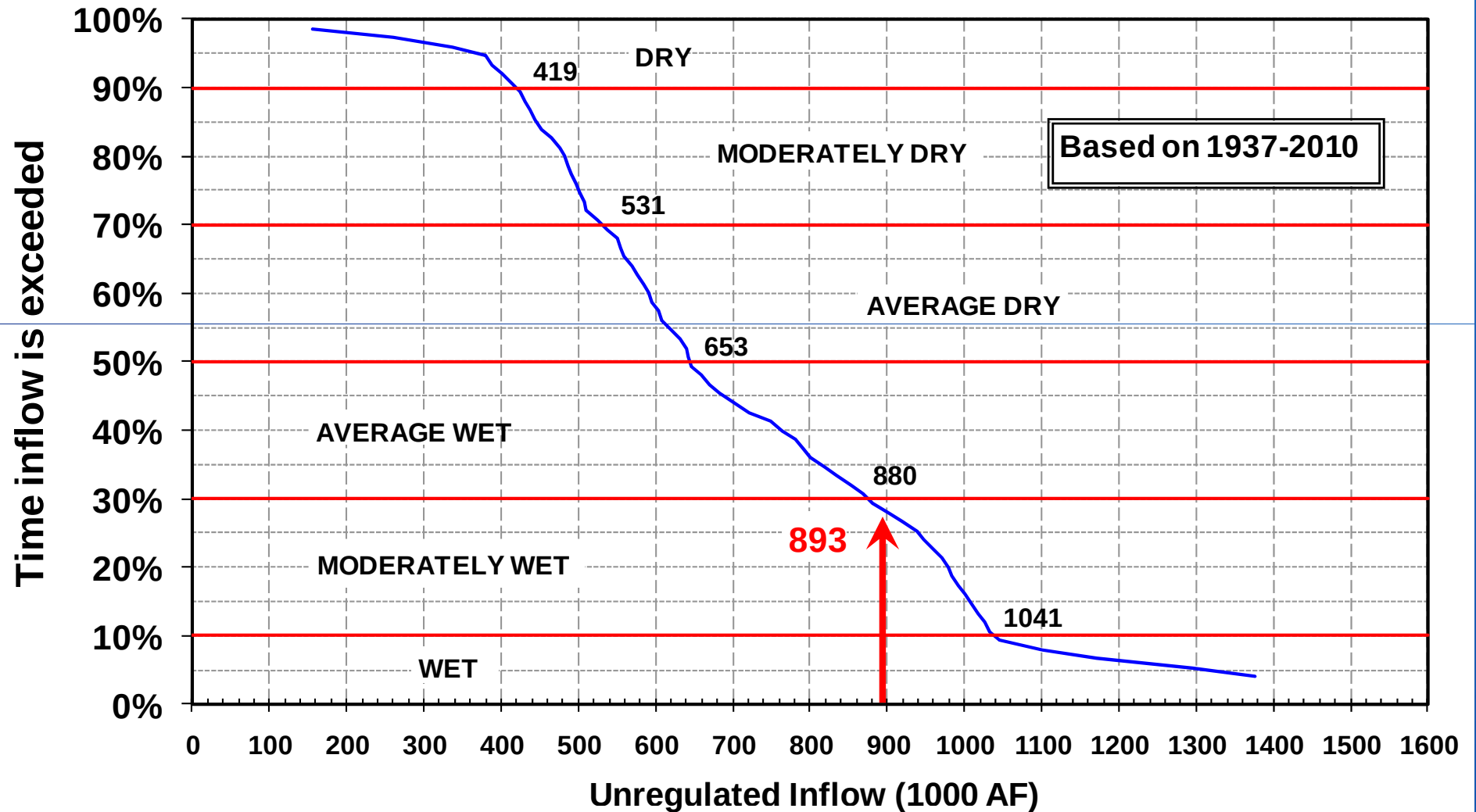
Blue Mesa Inflow

Crystal Inflow

RECLAMATION

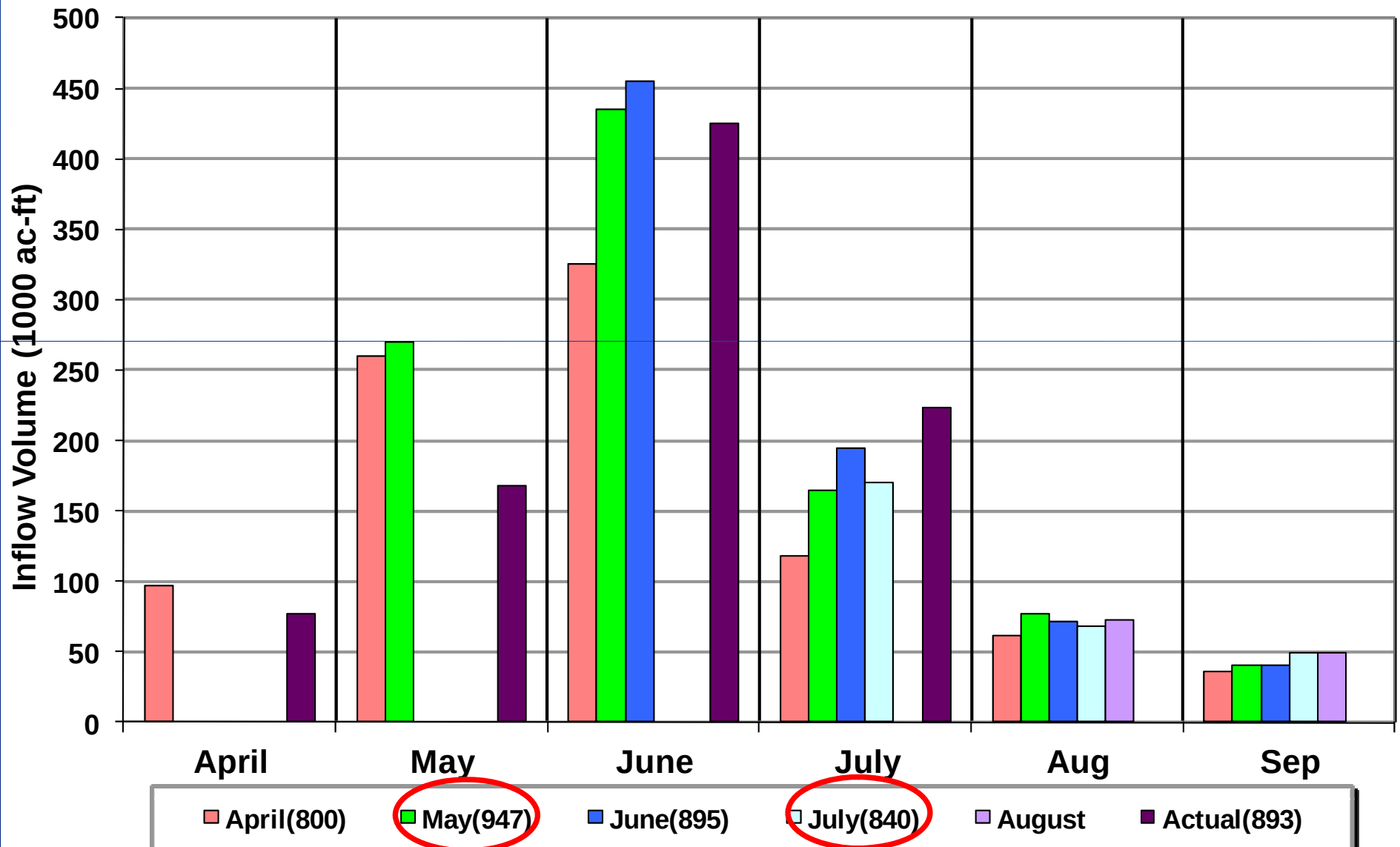
Blue Mesa Reservoir

April - July Unregulated Inflow



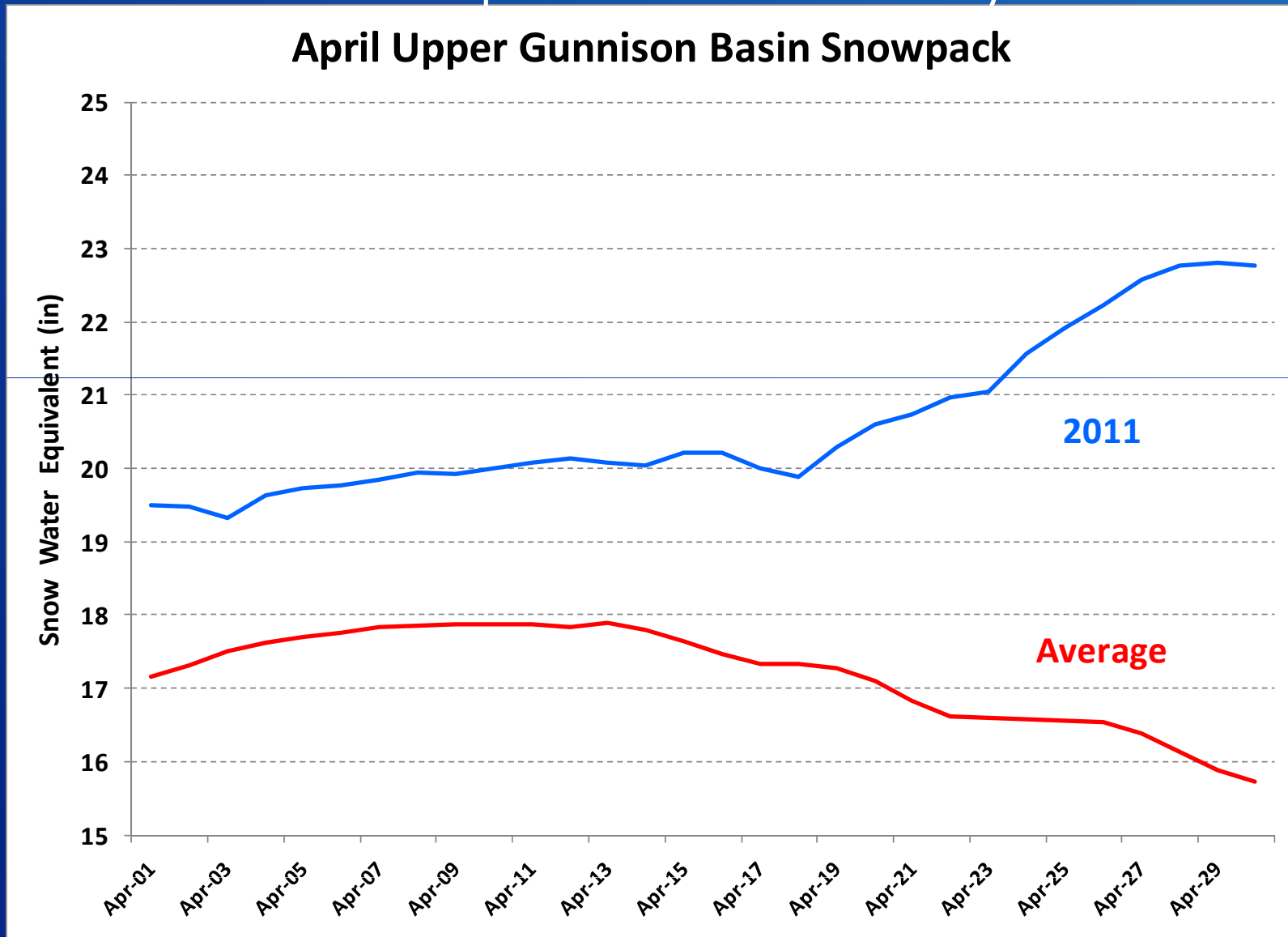
RECLAMATION

Blue Mesa Unregulated Monthly Inflow Forecasts (with actual Apr-July Blue Mesa inflow 1000 ac-ft)



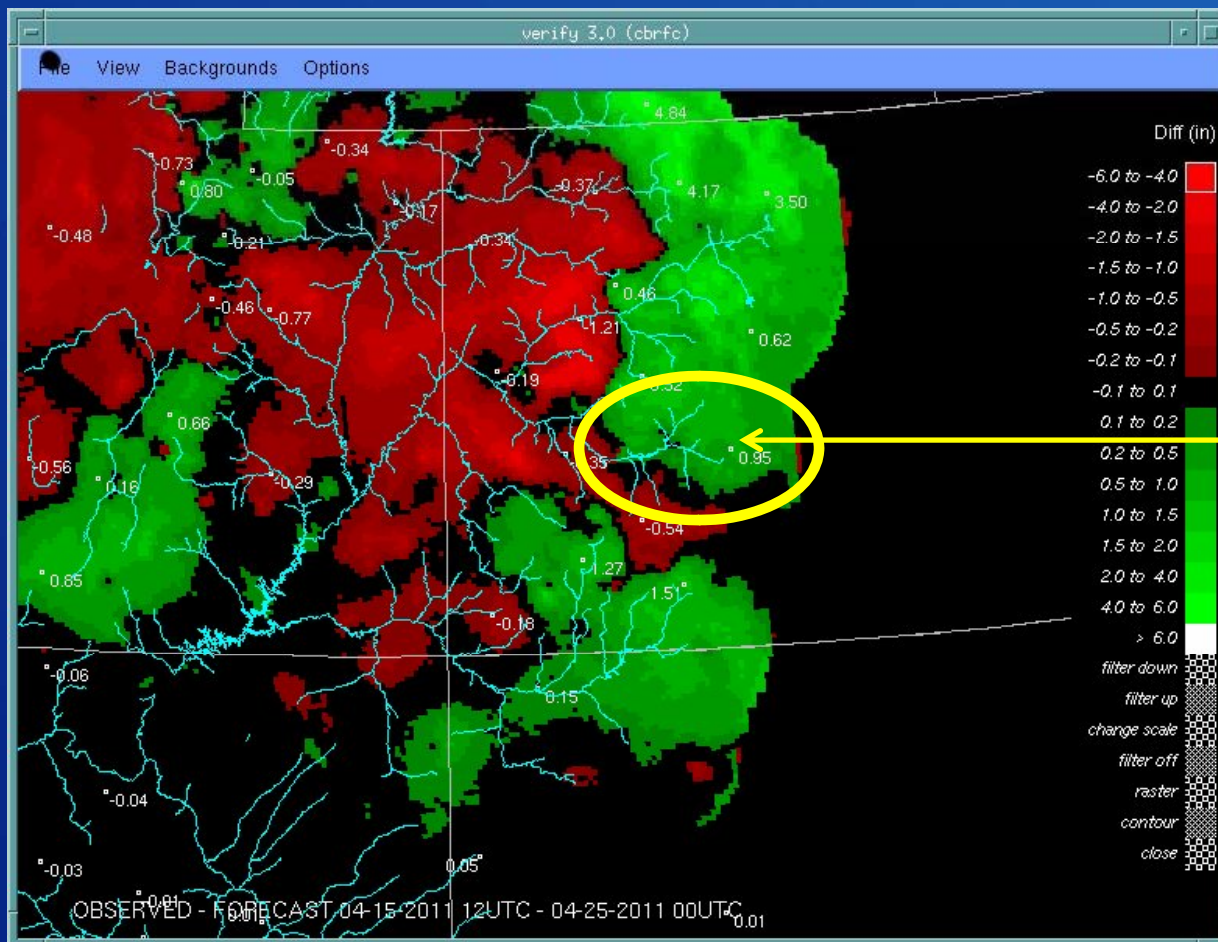
RECLAMATION

Why was there a jump in the forecast from
800 Kaf on April 15 to 945 Kaf on May 1?



RECLAMATION

Why was there a jump in the forecast from
800 Kaf on April 15 to 945 Kaf on May 1?



Forecast precipitation input
to the model on 4/15 ended
up being less than what was
observed (above Blue Mesa)

Red: Over-Forecast

Green: Under-Forecast

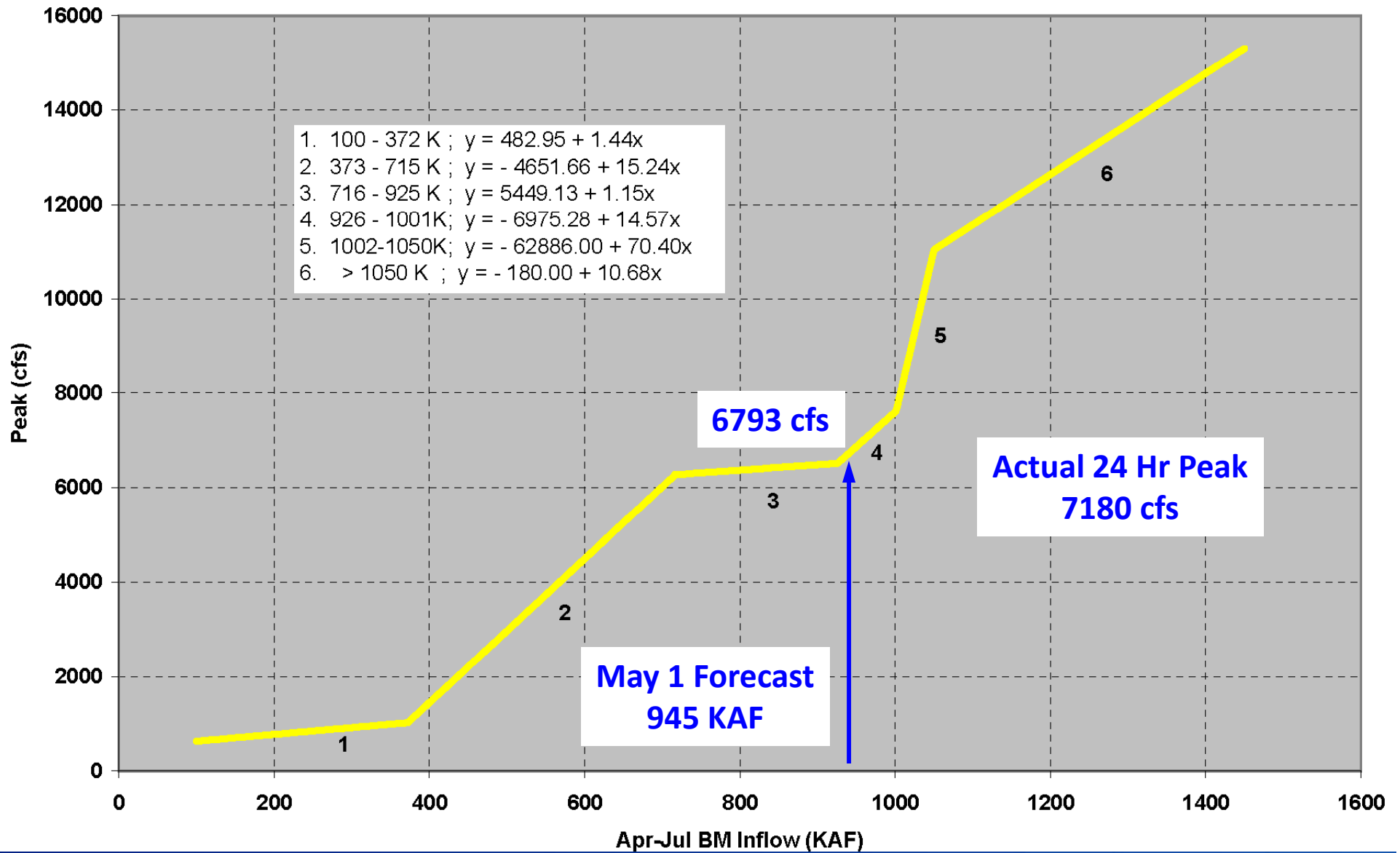
10 day precipitation 4/15-4/25, Observed – Forecast
(5 day forecast-model input- looked very similar)

RECLAMATION

BLACK CANYON PEAK OPERATION DISCUSSION

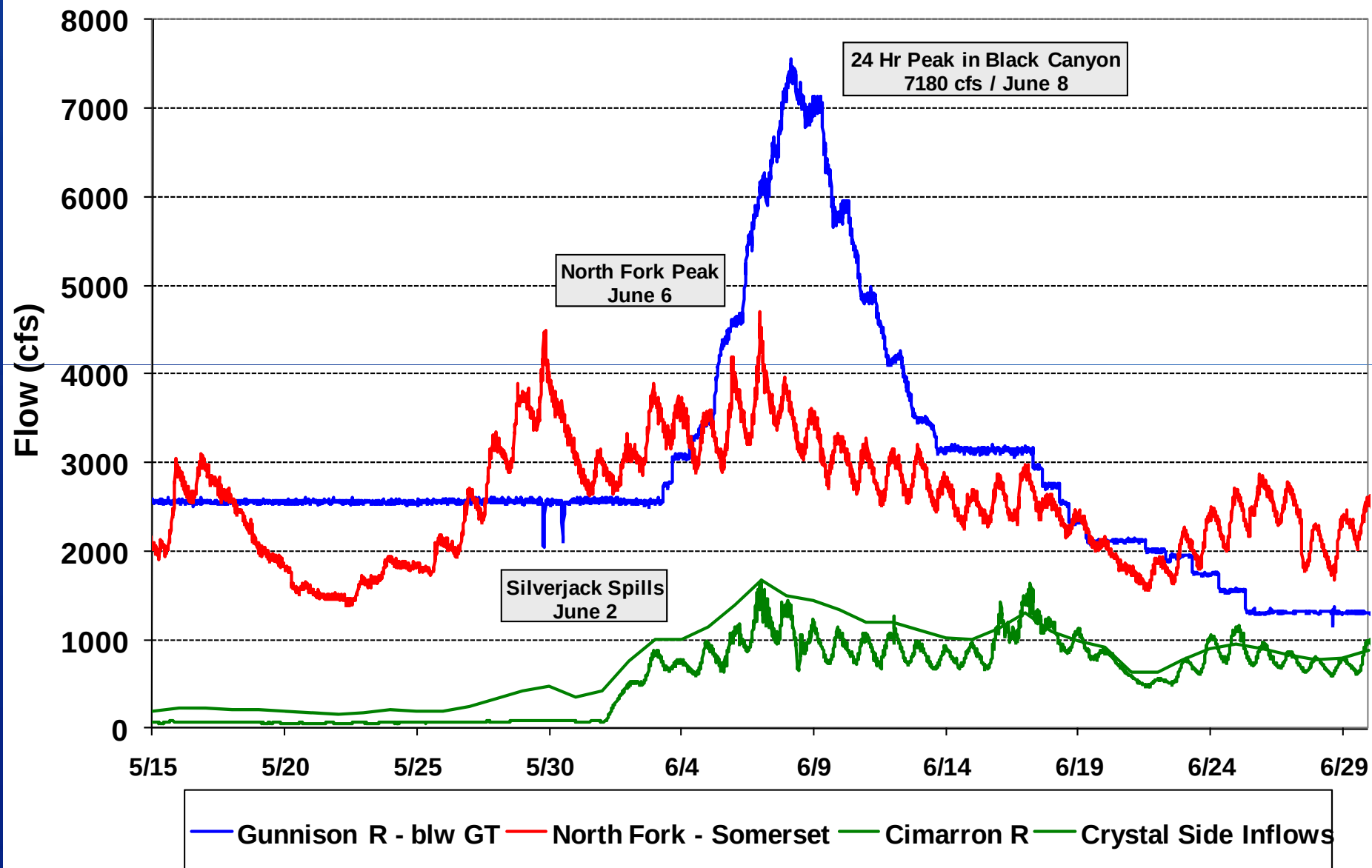
RECLAMATION

Black Canyon Peak Flow Determination based on Blue Mesa May 1 forecast



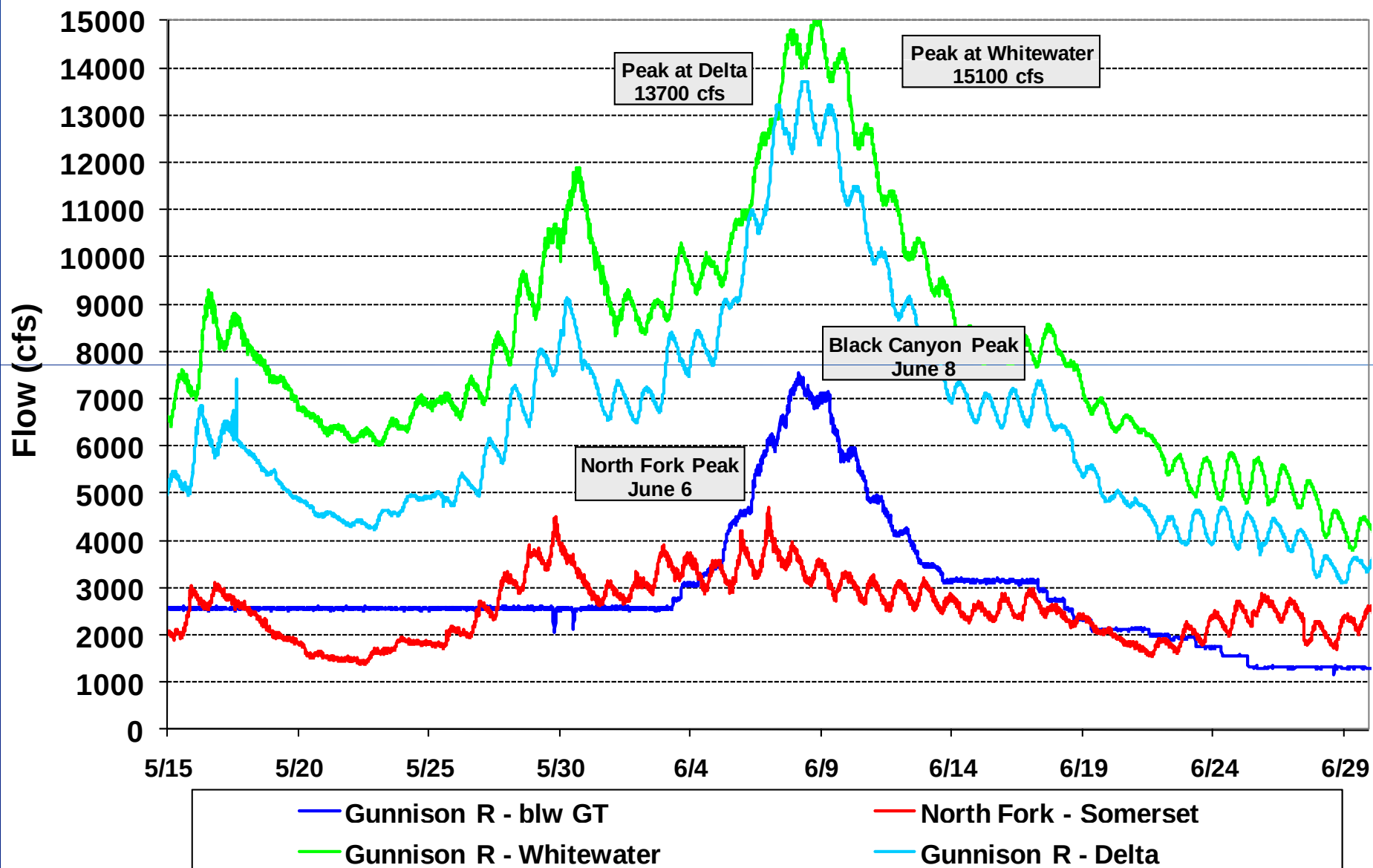
RECLAMATION

Gunnison River - Black Canyon



RECLAMATION

Gunnison River @ Whitewater



RECLAMATION



RECLAMATION



RECLAMATION



RECLAMATION



RECLAMATION

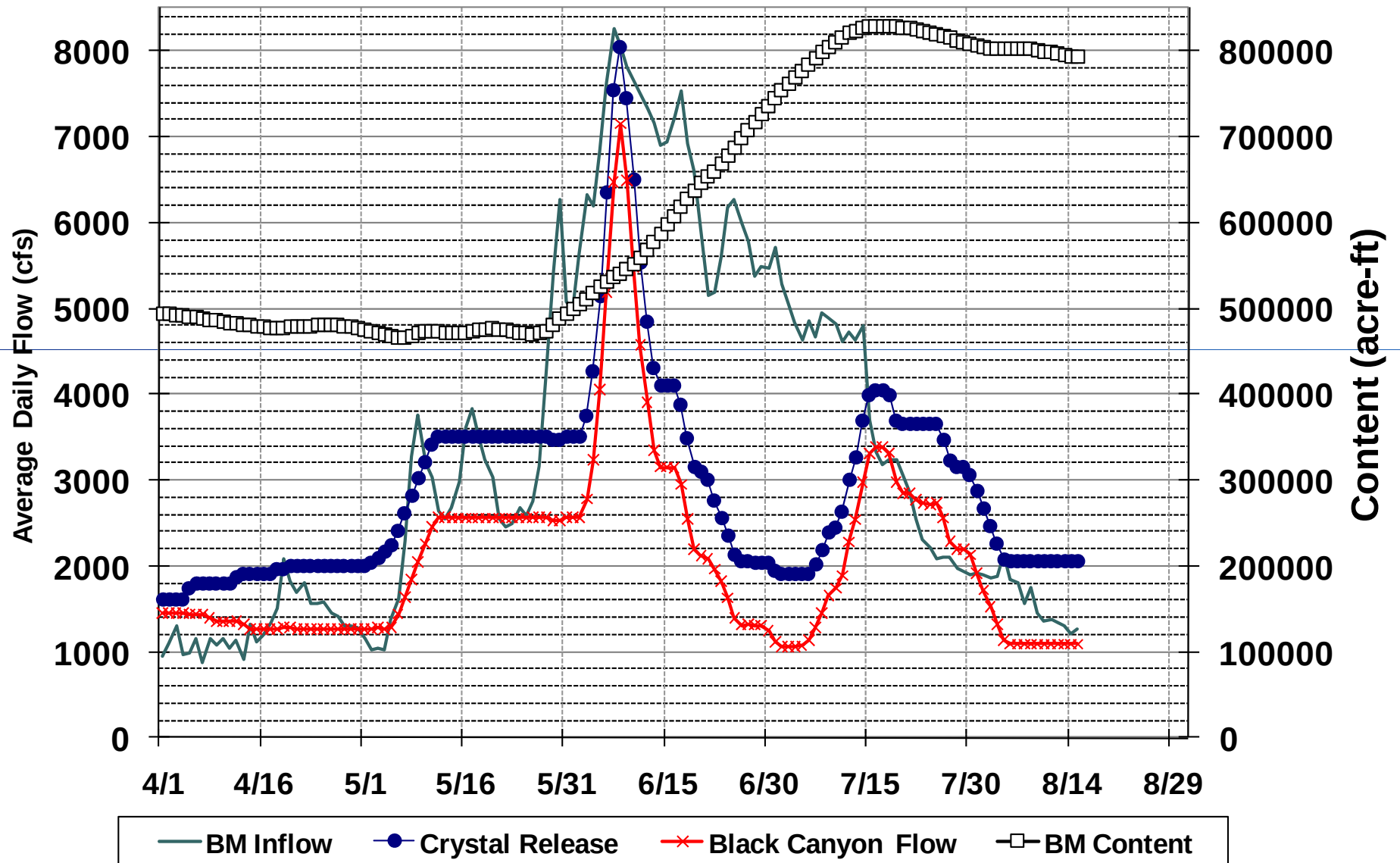


RECLAMATION

SPRING/SUMMER CONDITIONS

RECLAMATION

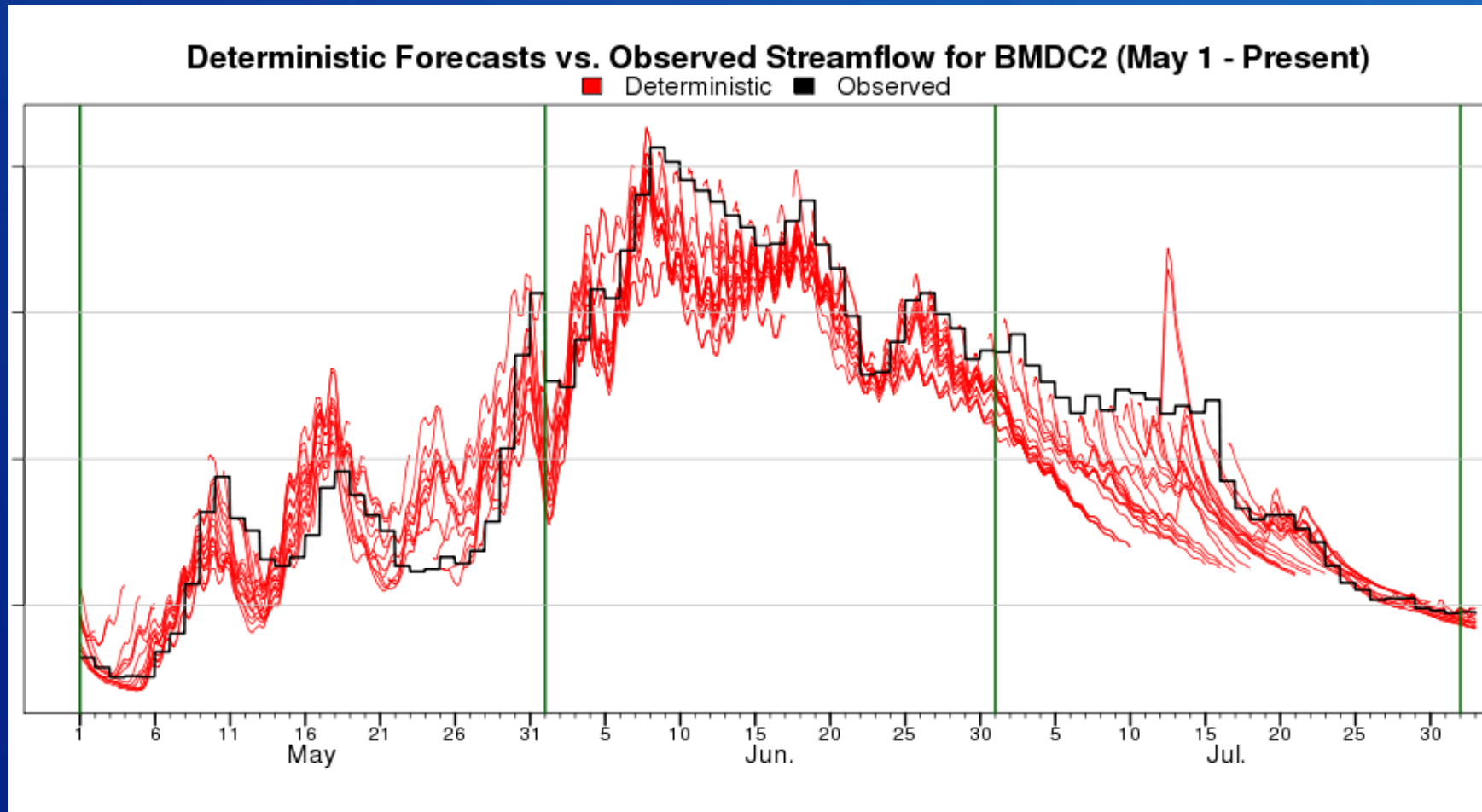
April - August



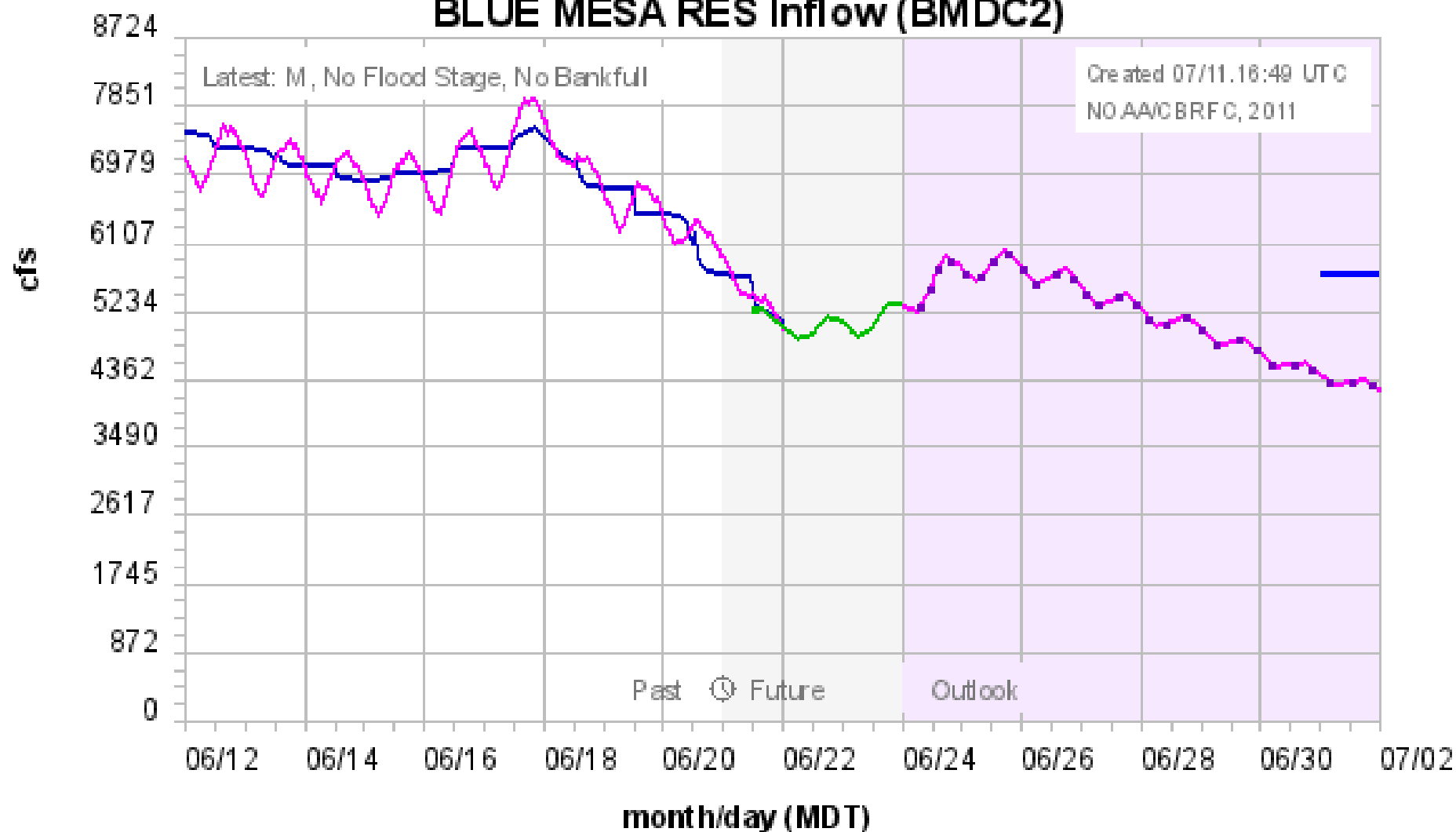
RECLAMATION

Given the amount of rainfall in the upper Gunnison Basin in early July , why did the CBRFC daily model under-forecast inflows to Blue Mesa Reservoir for the first 2 weeks of July?

Blue Mesa Inflow



Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

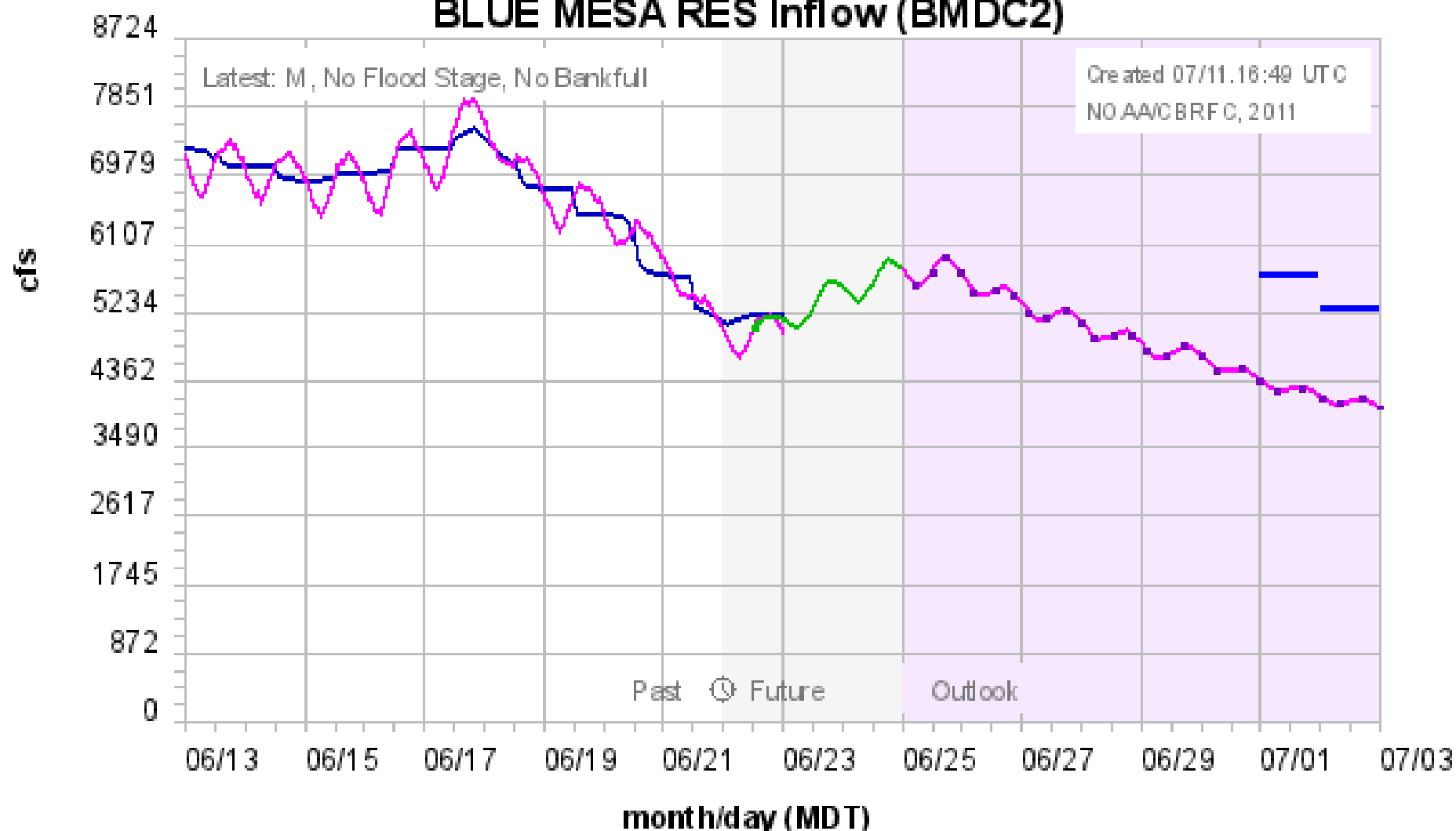


Observed — Simulated — Forecast (06/21.14:00) — Outlook (increasing uncertainty) —

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

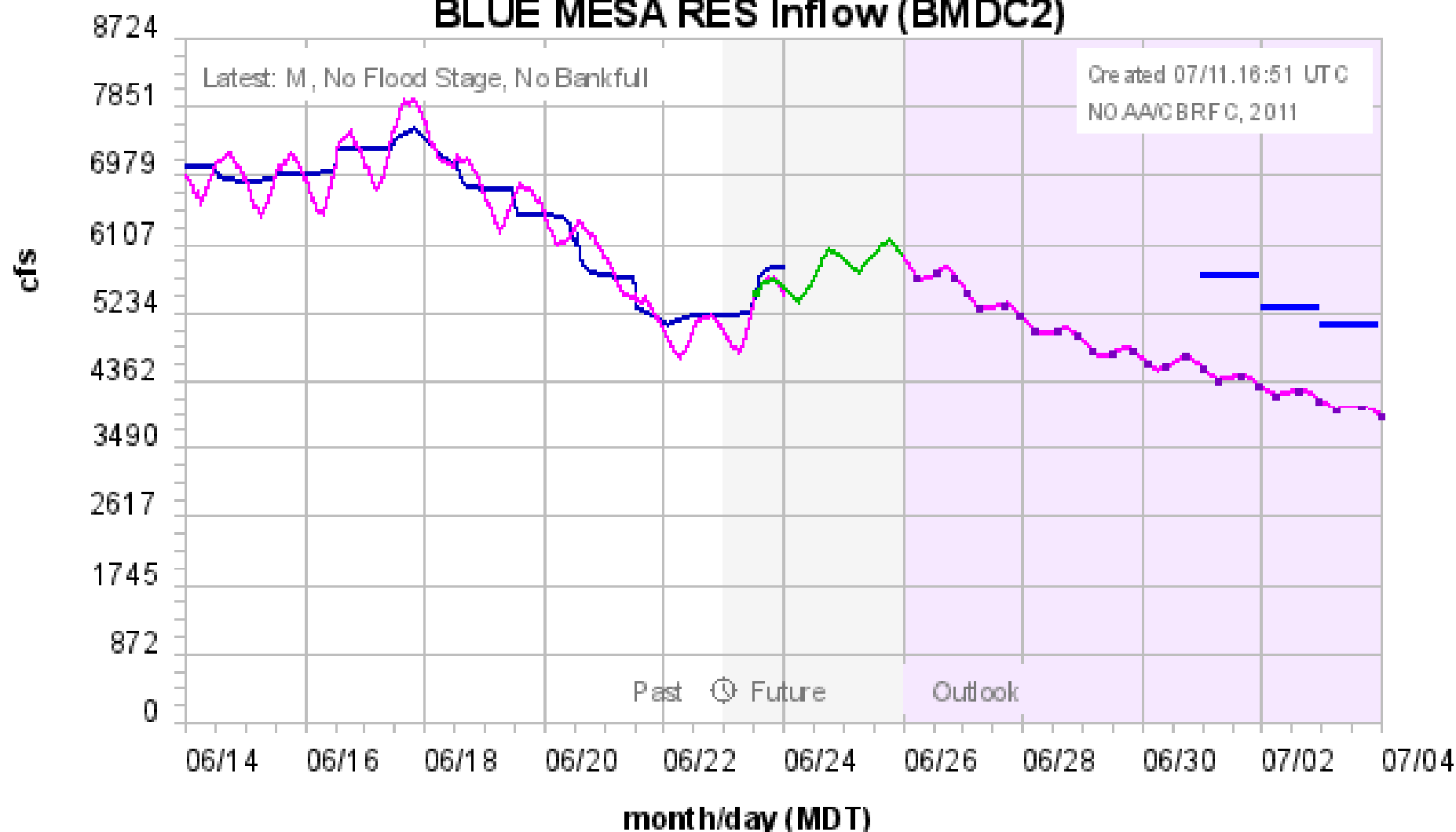


Observed — Simulated — Forecast (06/22.14:00) — Outlook (increasing uncertainty) ..

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

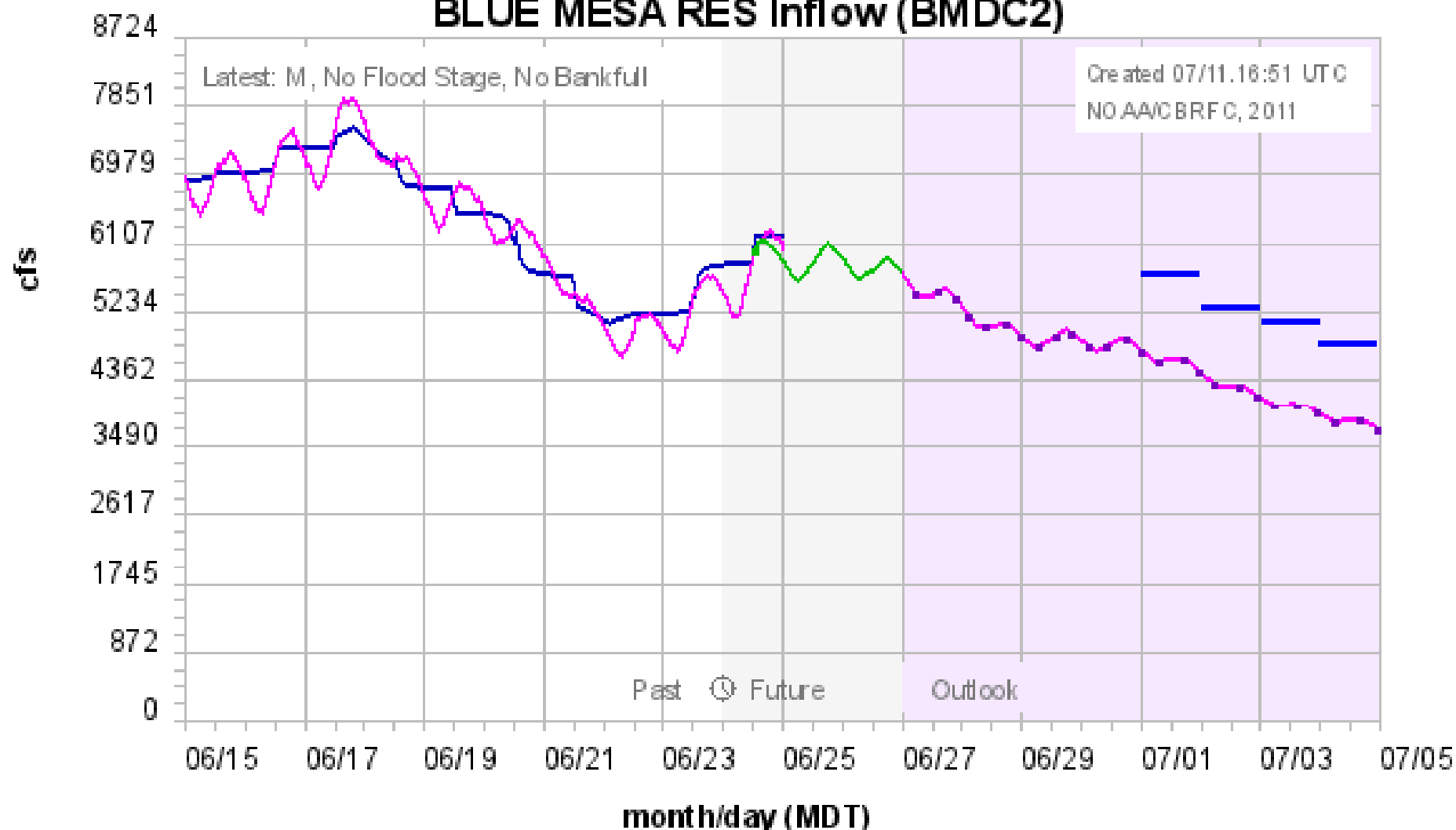


Observed — Simulated — Forecast (06/23.14:00) — Outlook (increasing uncertainty) - -

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

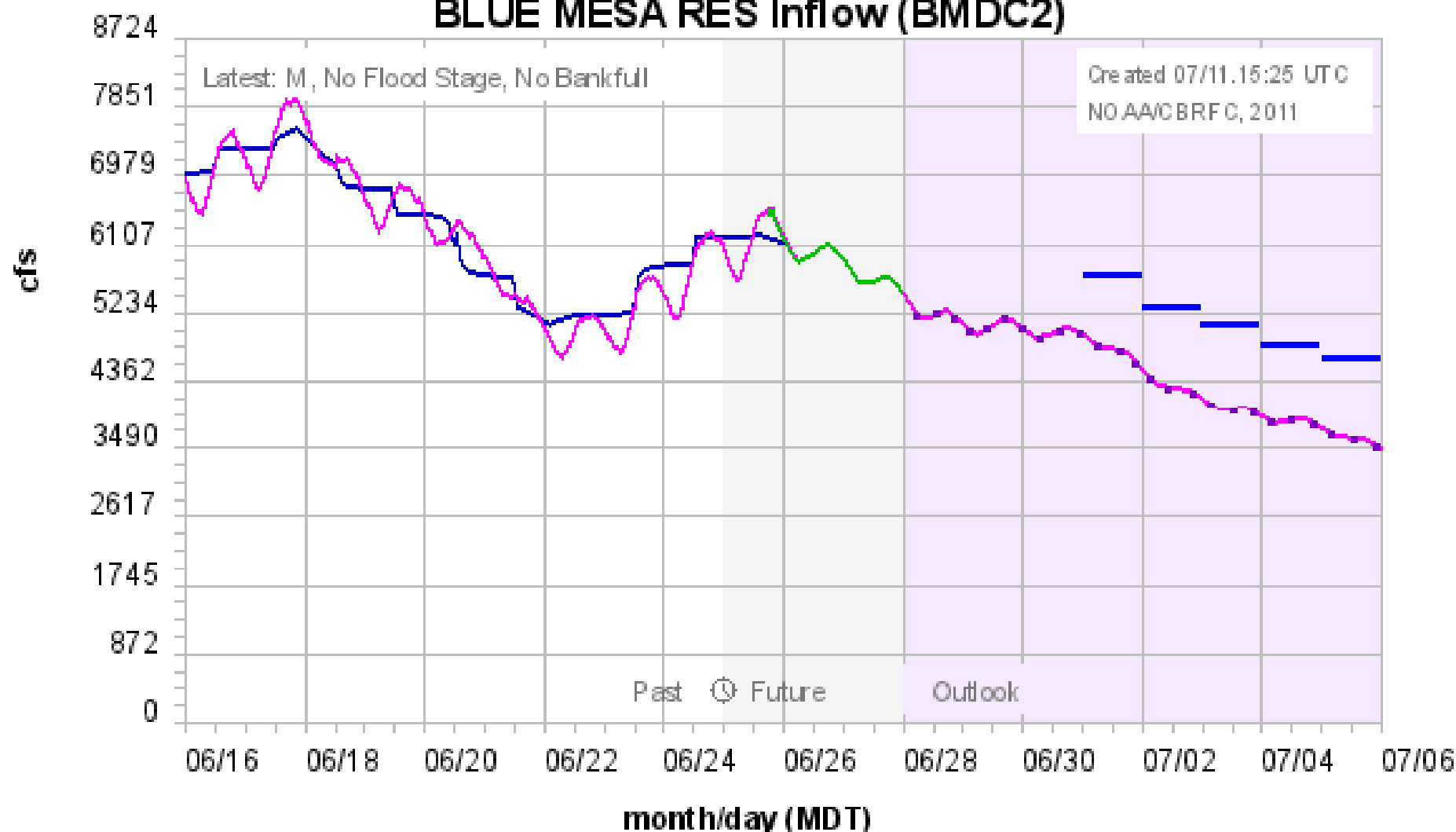


Observed — Simulated — Forecast (06/24.14:00) — Outlook (increasing uncertainty) ..

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

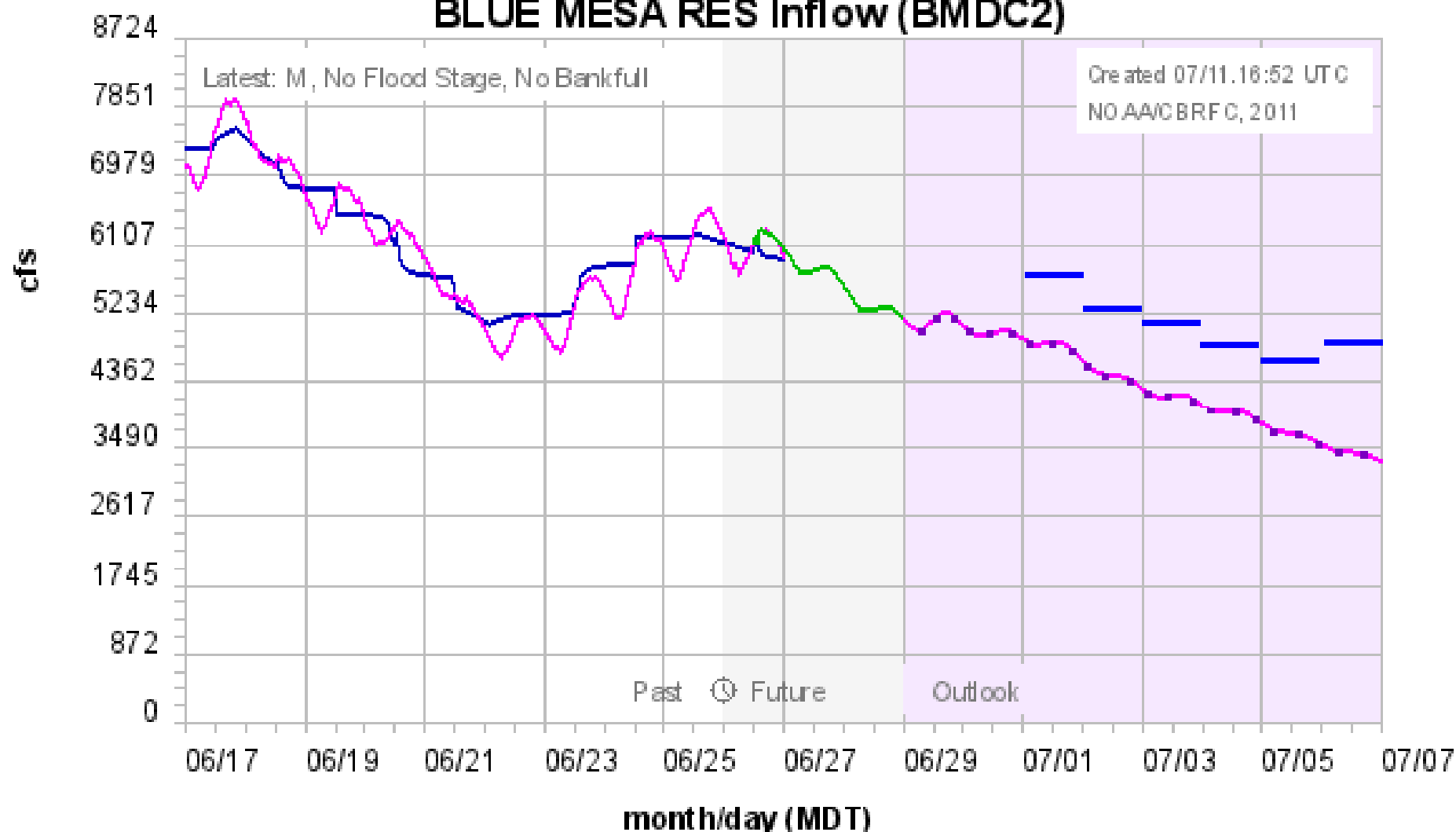
RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)



RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

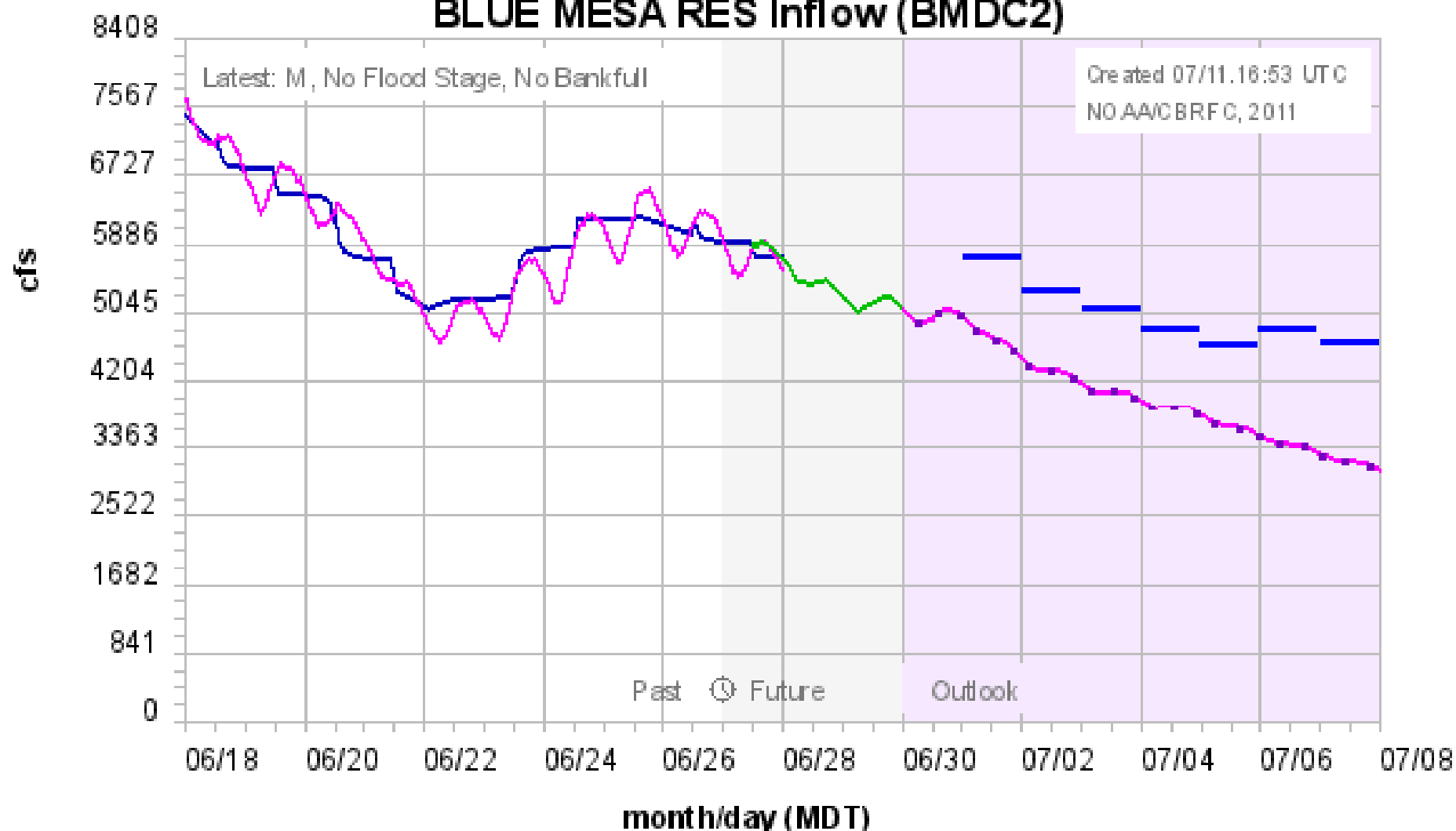


Observed — Simulated — Forecast (06/26.14:00) — Outlook (increasing uncertainty) ..

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

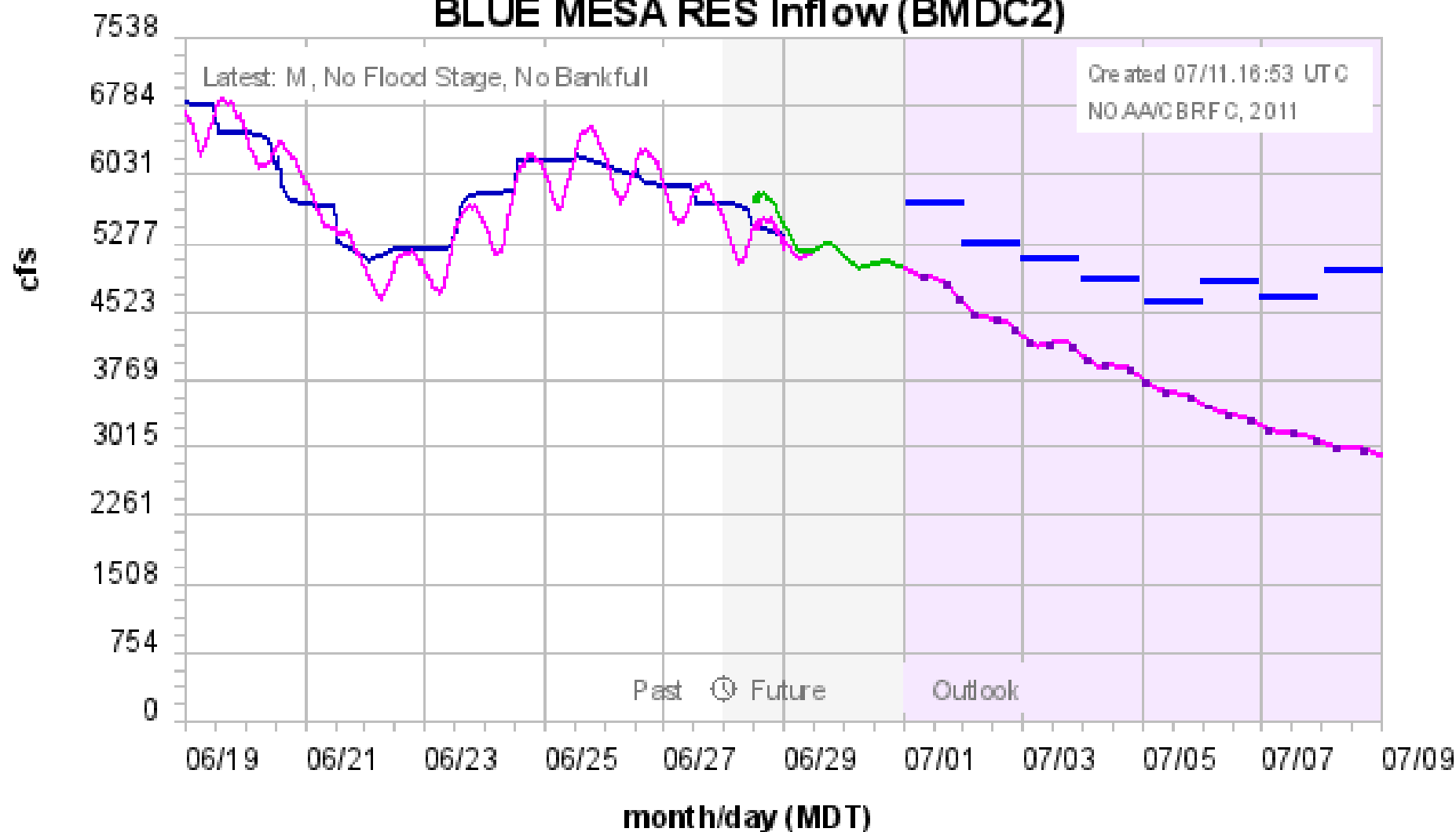


Observed — Simulated — Forecast (06/27.14:00) — Outlook (increasing uncertainty) ..

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

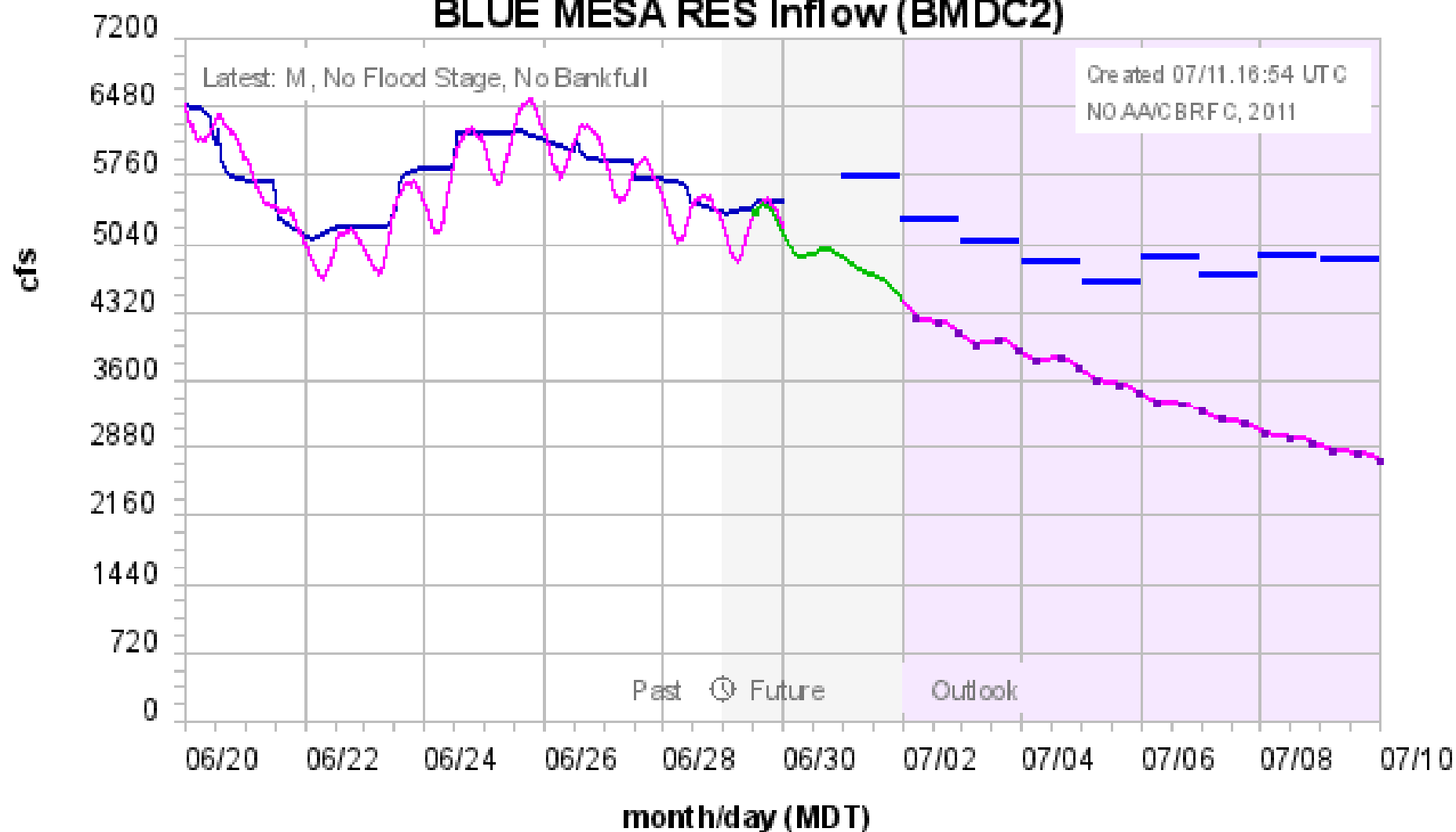
RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)



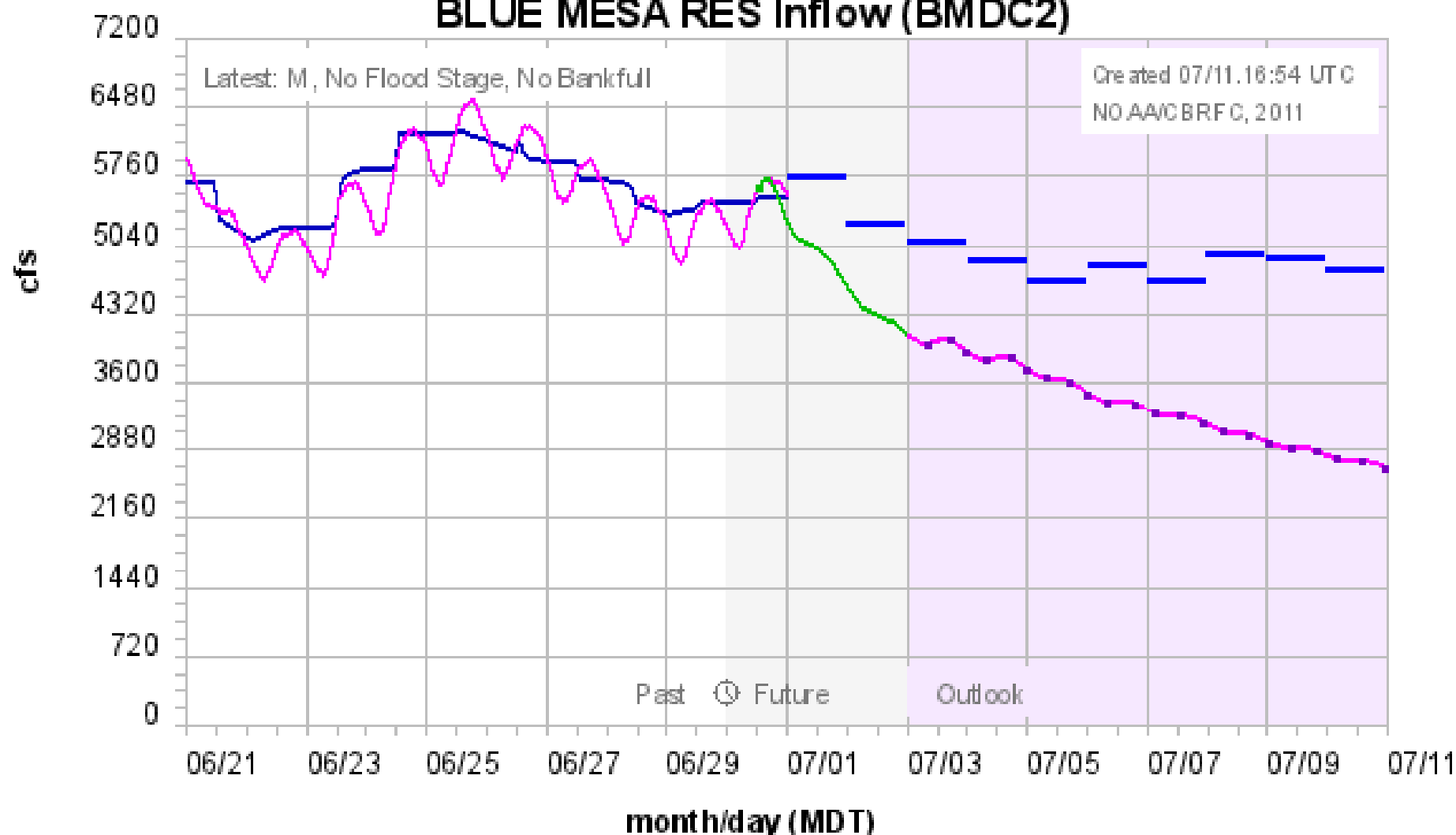
RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)



RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

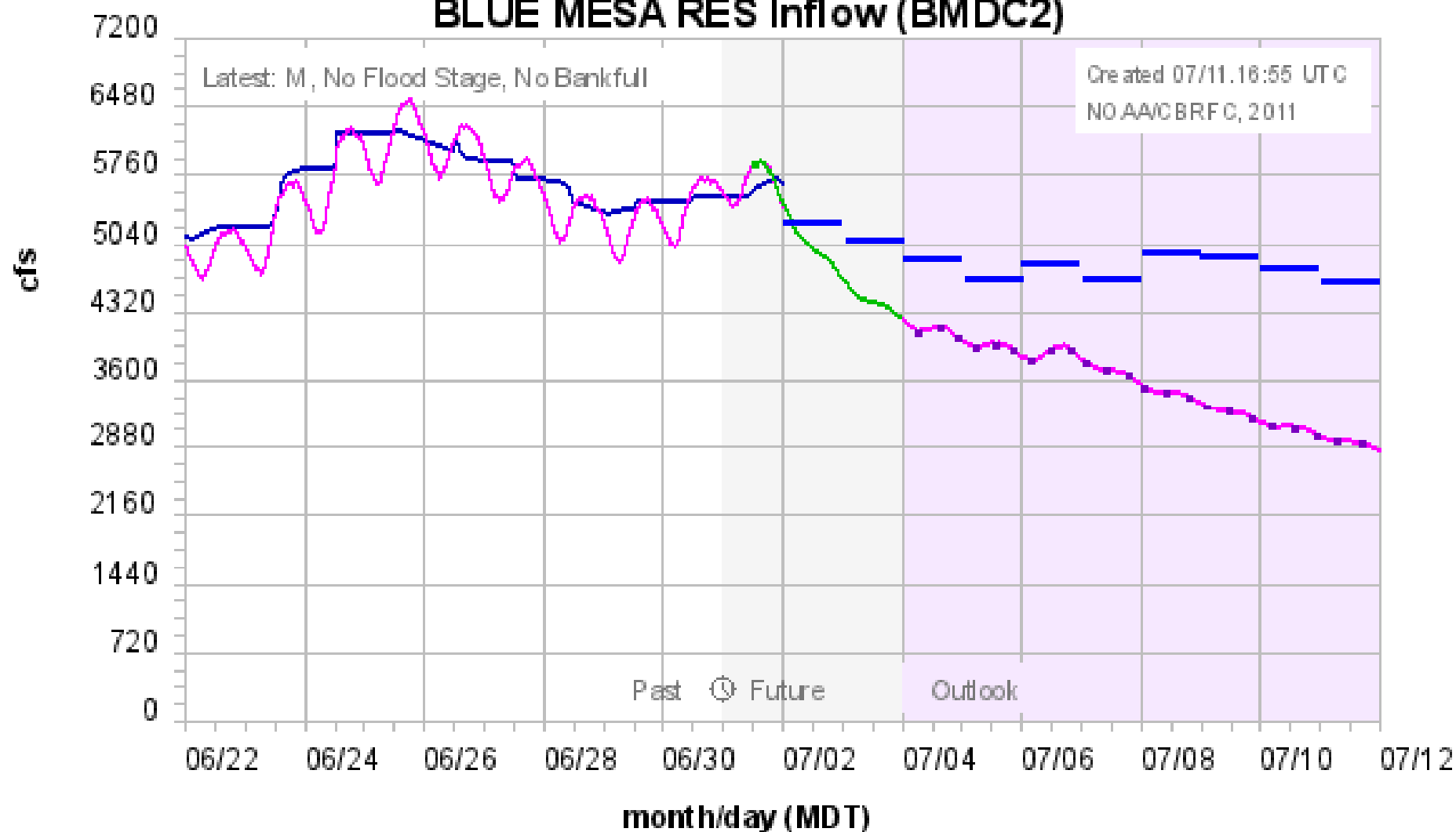


Observed — Simulated — Forecast (06/30.14:00) — Outlook (increasing uncertainty) ..

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

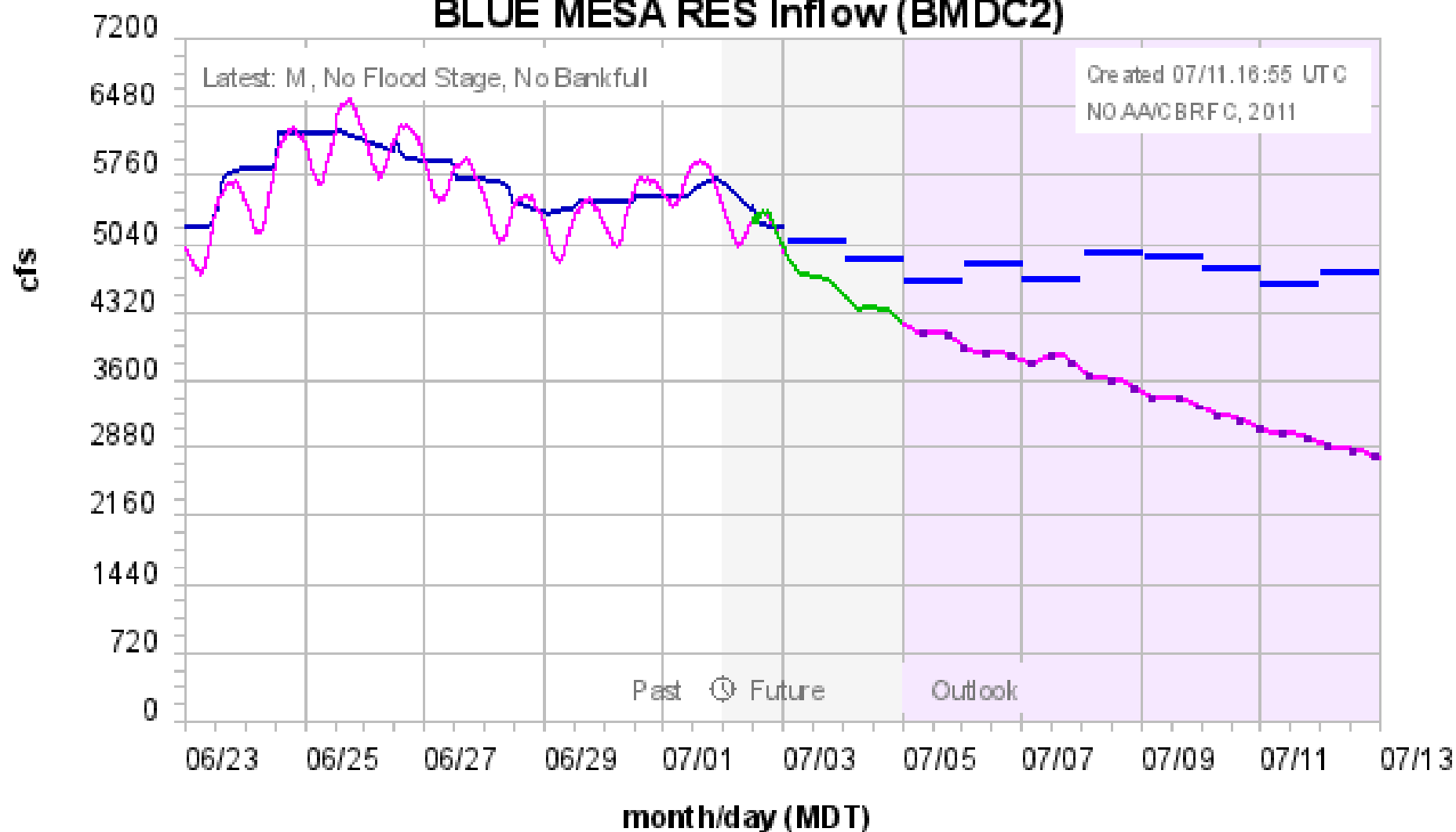


Observed — Simulated — Forecast (07/01.14:00) — Outlook (increasing uncertainty) - -

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

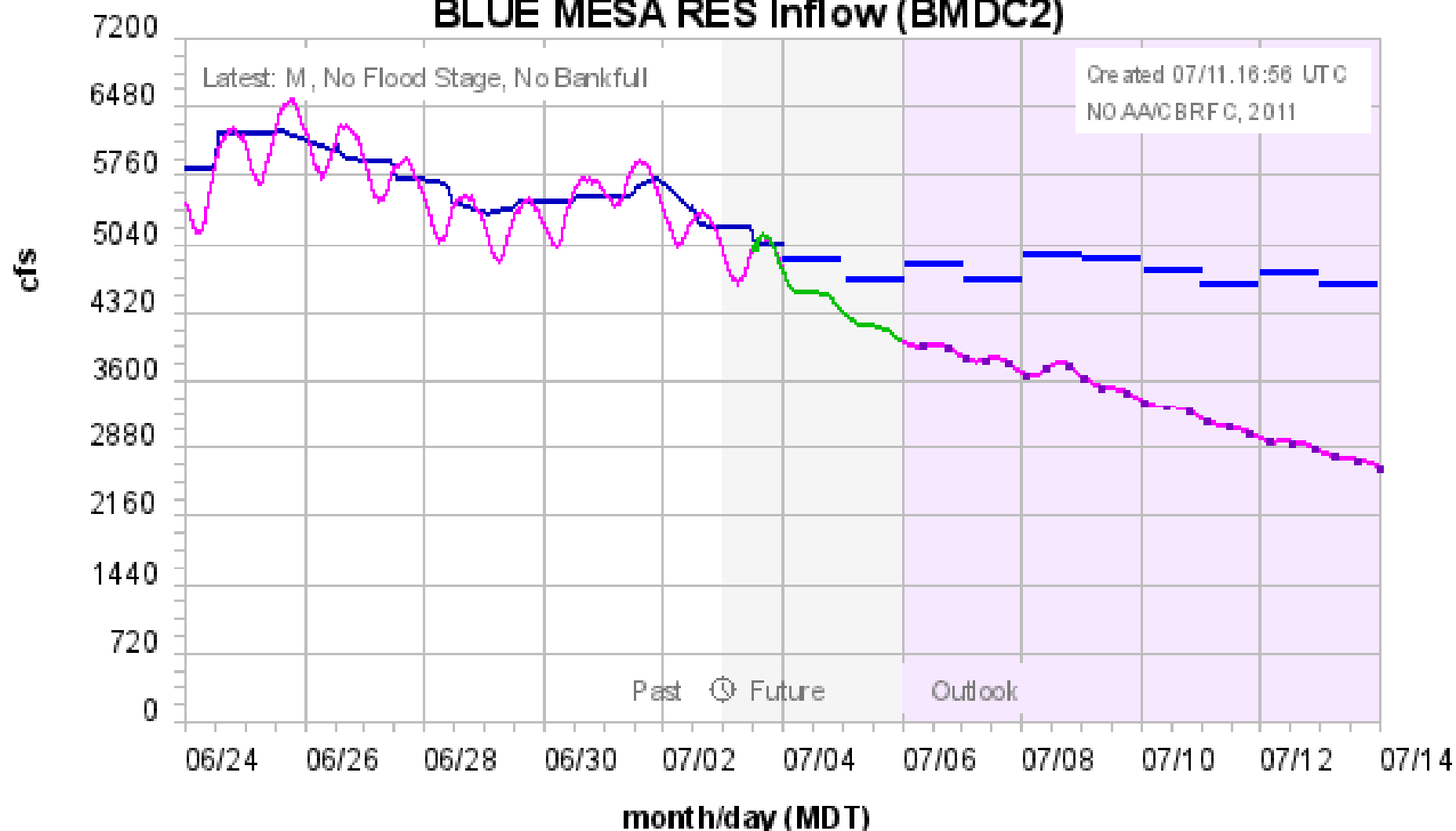


Observed — Simulated — Forecast (07/02.14:00) — Outlook (increasing uncertainty) ..

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

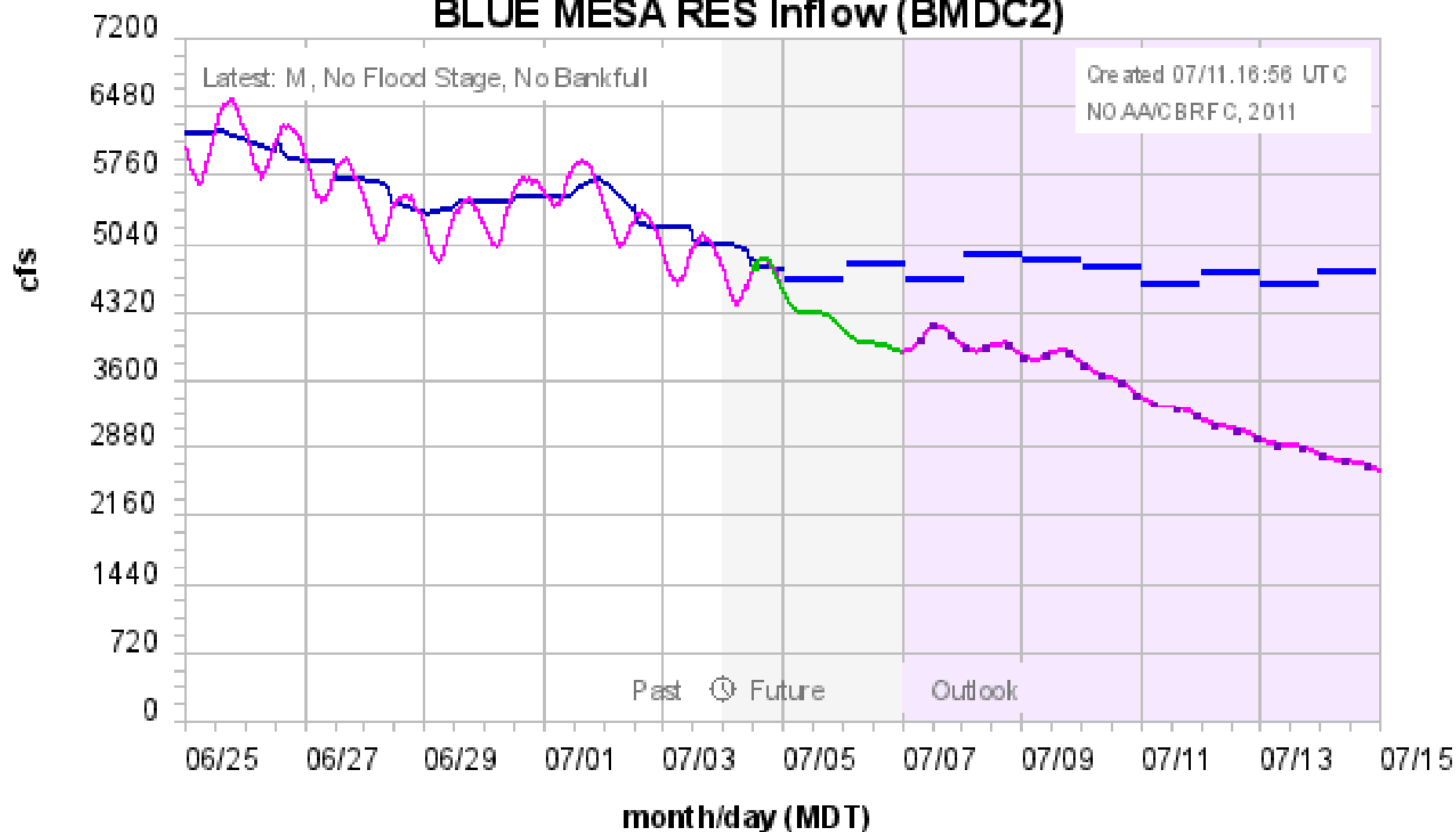


Observed — Simulated — Forecast (07/03.14:00) — Outlook (increasing uncertainty) - -

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

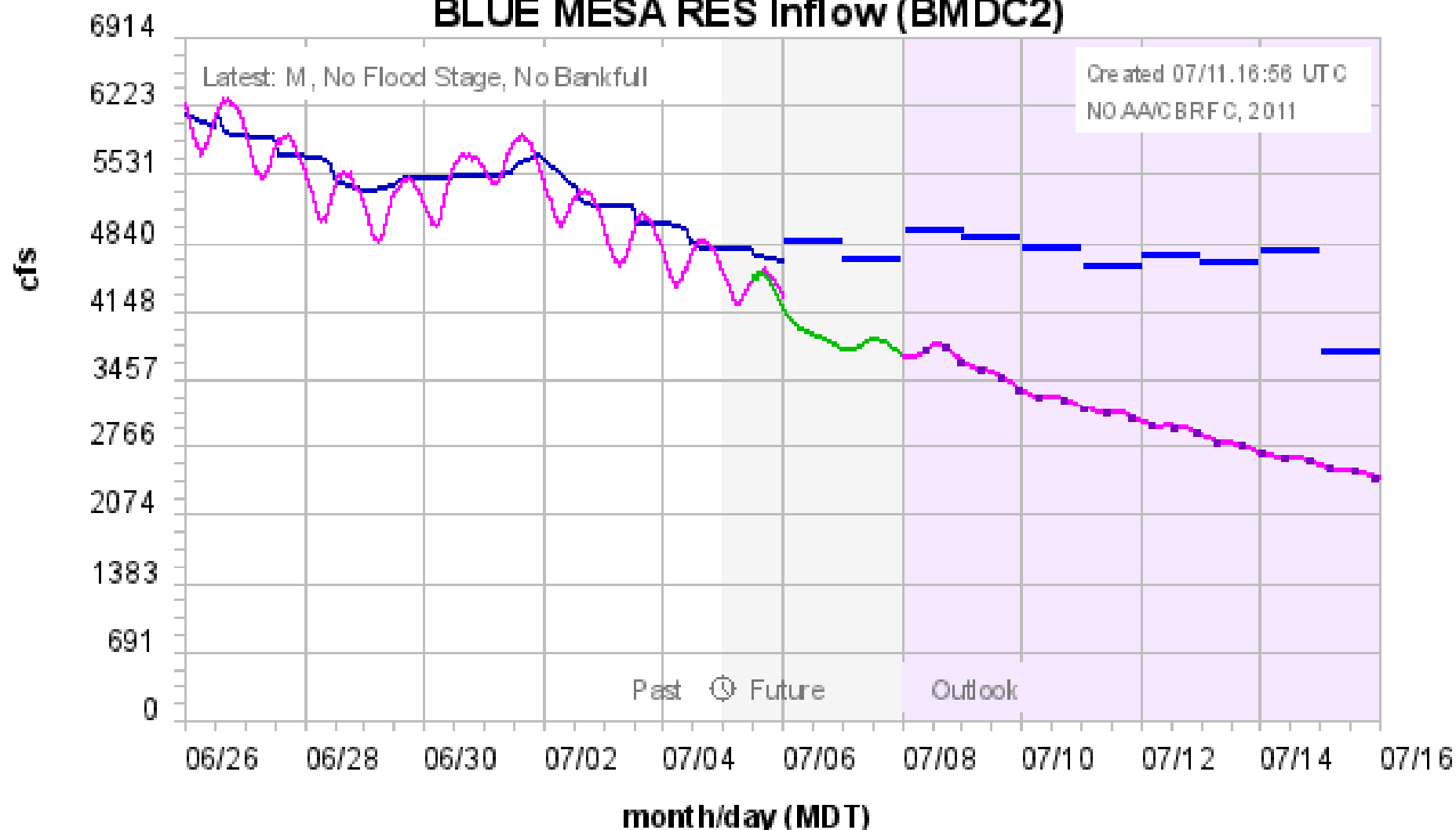


Observed — Simulated — Forecast (07/04.14:00) — Outlook (increasing uncertainty) —

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

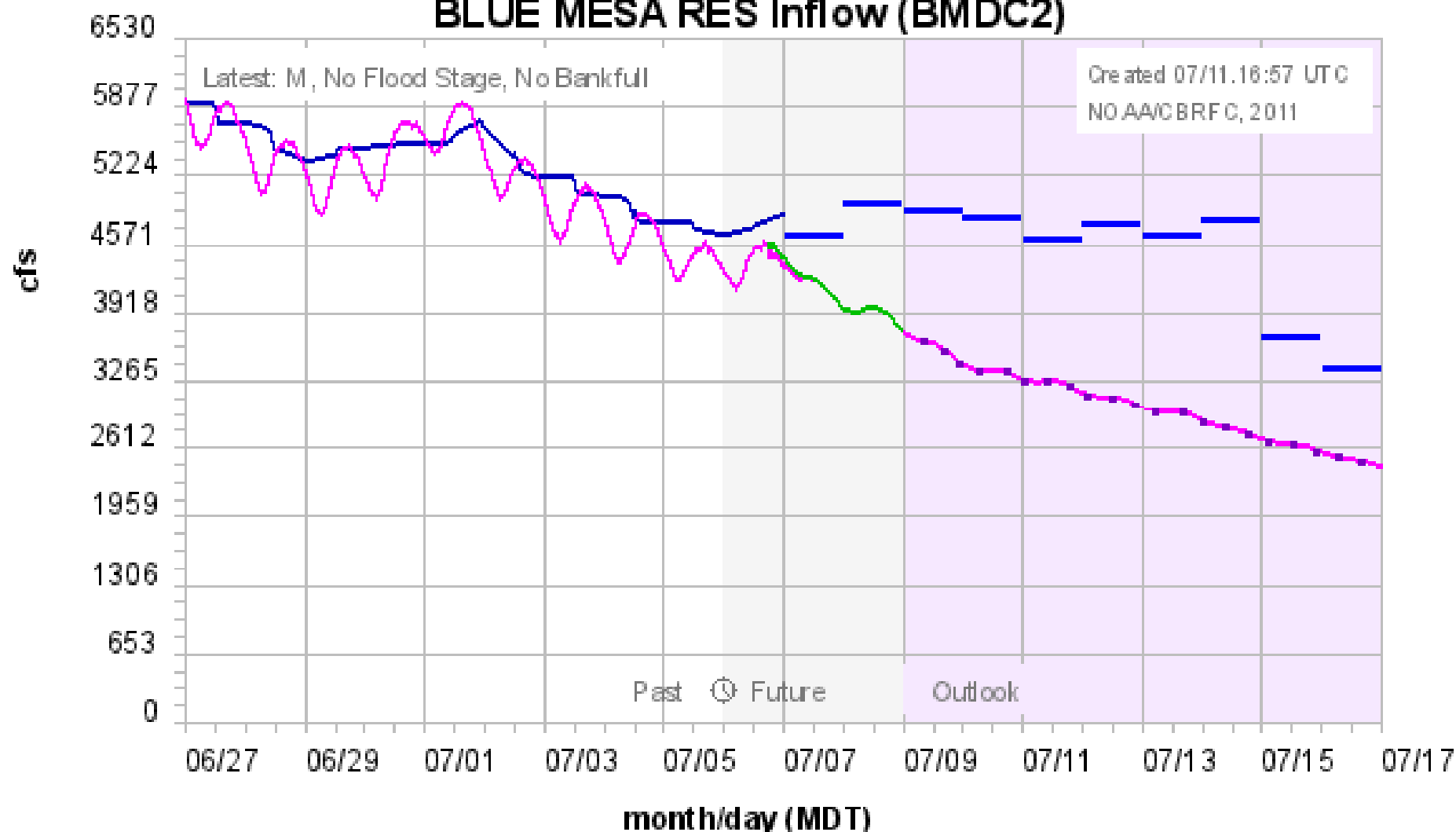


Observed — Simulated — Forecast (07/05.14:00) — Outlook (increasing uncertainty) - -

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

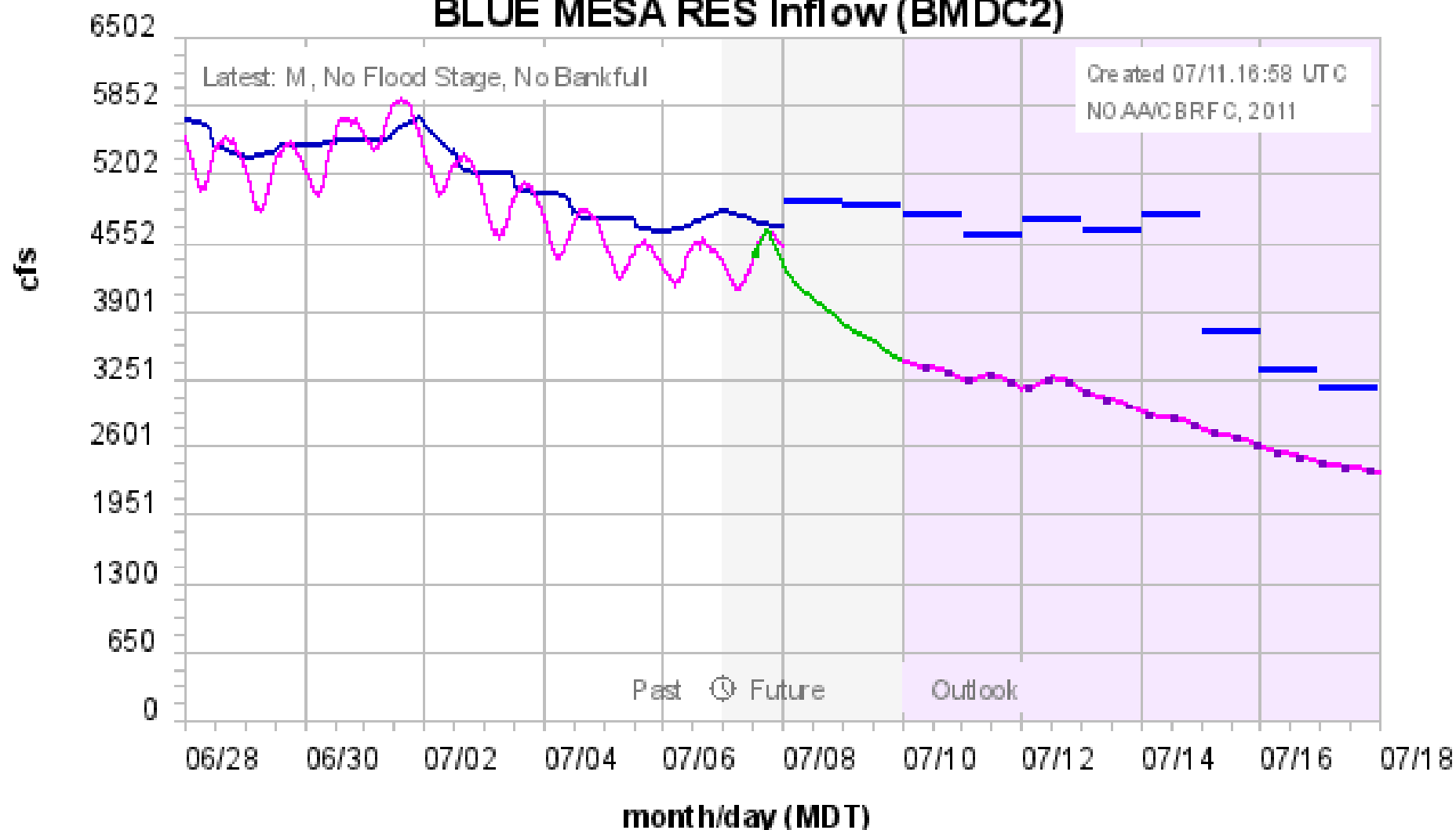


Observed — Simulated — Forecast (07/06.18:00) — Outlook (increasing uncertainty) - -

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)

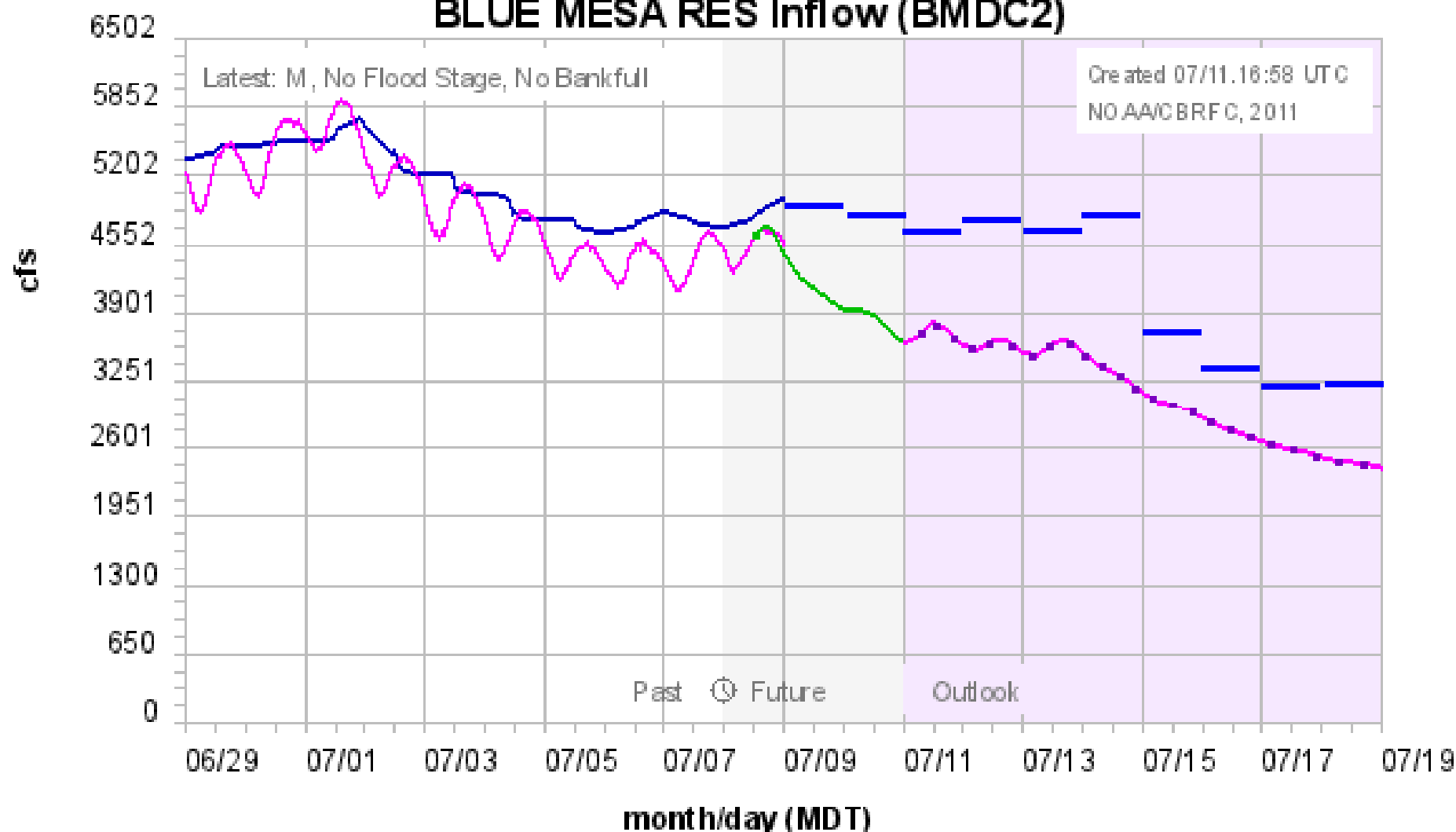


Observed — Simulated — Forecast (07/07.14:00) — Outlook (increasing uncertainty) - -

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION

Colorado Basin River Forecast Center BLUE MESA RES Inflow (BMDC2)



Observed — Simulated — Forecast (07/08.14:00) — Outlook (increasing uncertainty) - -

Historical Exceedance Probability (USGS): 90-75% 75-50% 50-25% 25-10%

RECLAMATION



RECLAMATION

Lots of Water!

Lots of Concerns..... Complaints?

Concerns from the fishing community

- Black Canyon peak is too high
- Black Canyon peak is occurring too late
- Don't increase flows during the rainbow trout emergence
- No high flows around the Stonefly hatch!

Concerns from the rafting community

- Timing with the Cimarron River causes the river to fluctuate
- More advanced notice when operation plans will change
- Operation plans change too often
- River flows are fluctuating too often, there needs to be more consistency
- There is no accountability with these operation plans, they can change at any time!
- If we can't tell our clients what the river conditions will be, we look bad

RECLAMATION

Sources of Forecast Error

- **Precipitation forecasts** (5 days into future) - Forecasting summertime convection is extremely challenging. Precip forecasts can be very generalized and may not specify locations of heavy rainfall.
- **Precipitation Estimation** – Precipitation observation network in Gunnison Basin probably underestimated July precip. Result of relatively sparse network of rain gauges and long distance from nearest weather radars.
- **EvapoTranspiration (ET)** - Cloud cover during monsoon also affects ET rates. ET modeled as a constant for some times of the year.
- **Snow** – Possibly more snow in higher parts of the basin than what was modeled. Difficult to accurately model snow at end of season. May have been easier to determine and correct without all the rain.

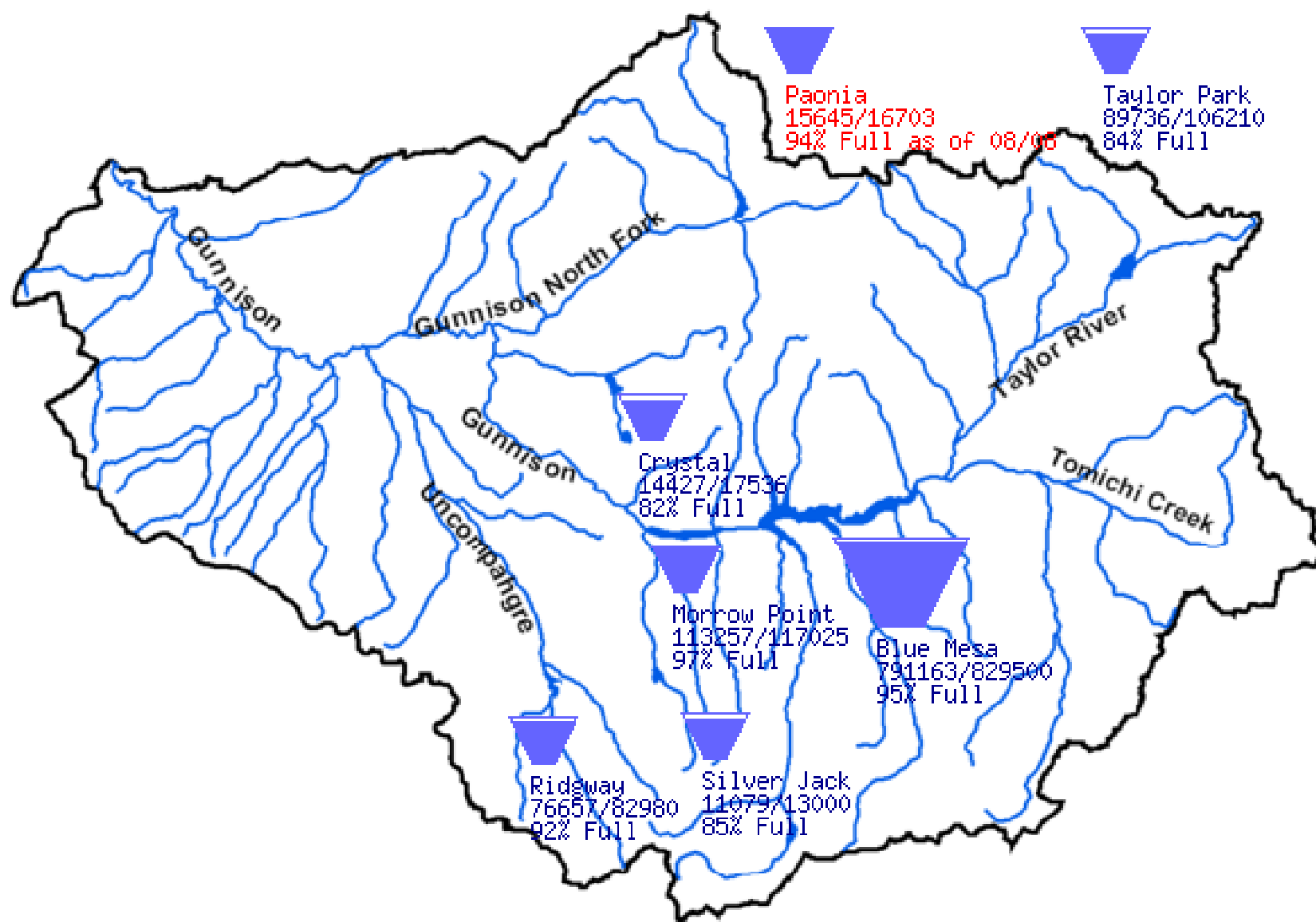
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- **What do we need?**
More Data! (snotels, rain gauges, snowcams, etc...we'll take anything)

RECLAMATION

Data Current as of:
08/16/2011

Gunnison River Basin, CO



RECLAMATION



RECLAMATION

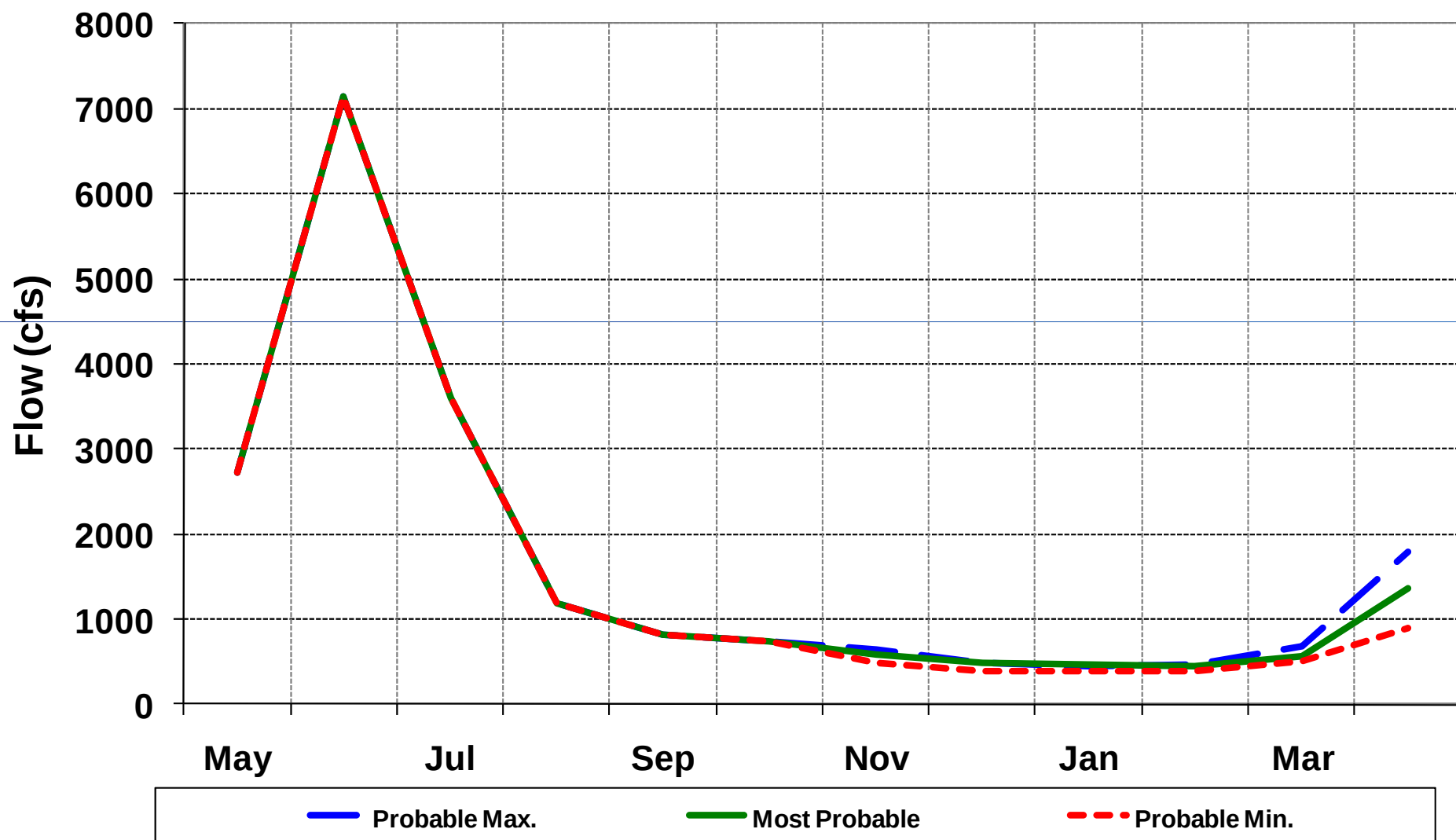


RECLAMATION

24 MONTH STUDY

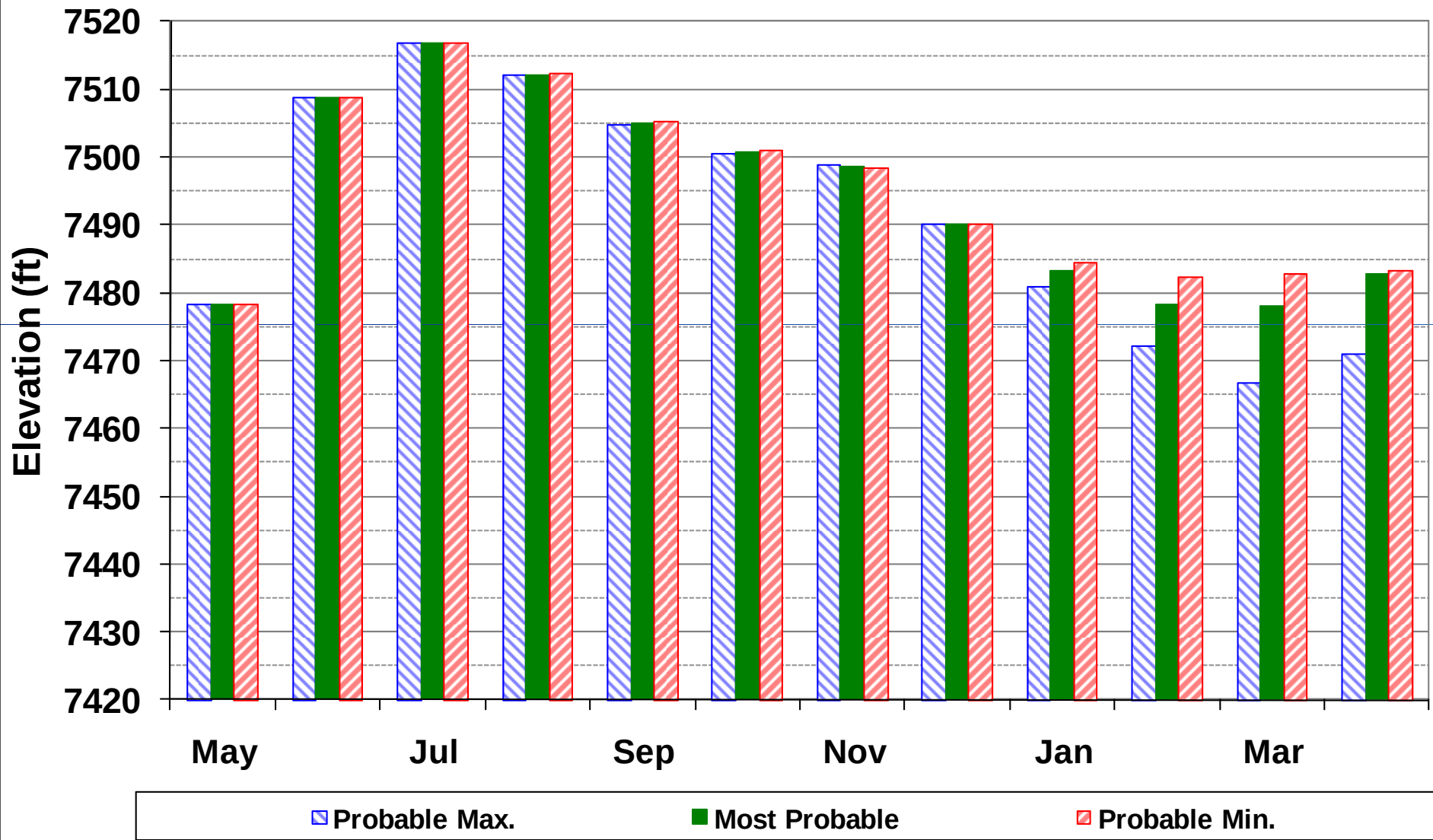
RECLAMATION

Unregulated Blue Mesa Inflow Monthly Average



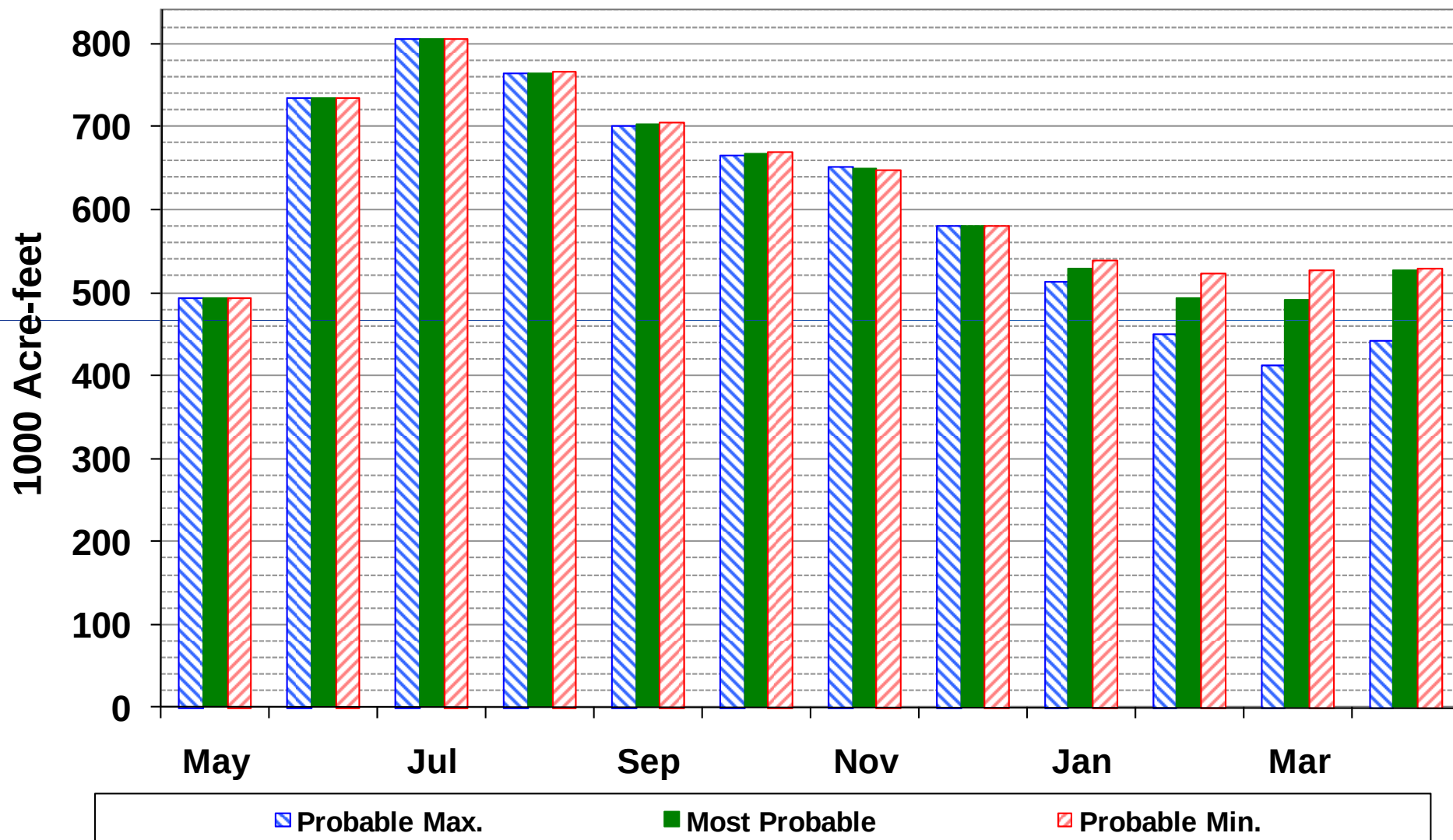
RECLAMATION

Blue Mesa Elevation End of Month



RECLAMATION

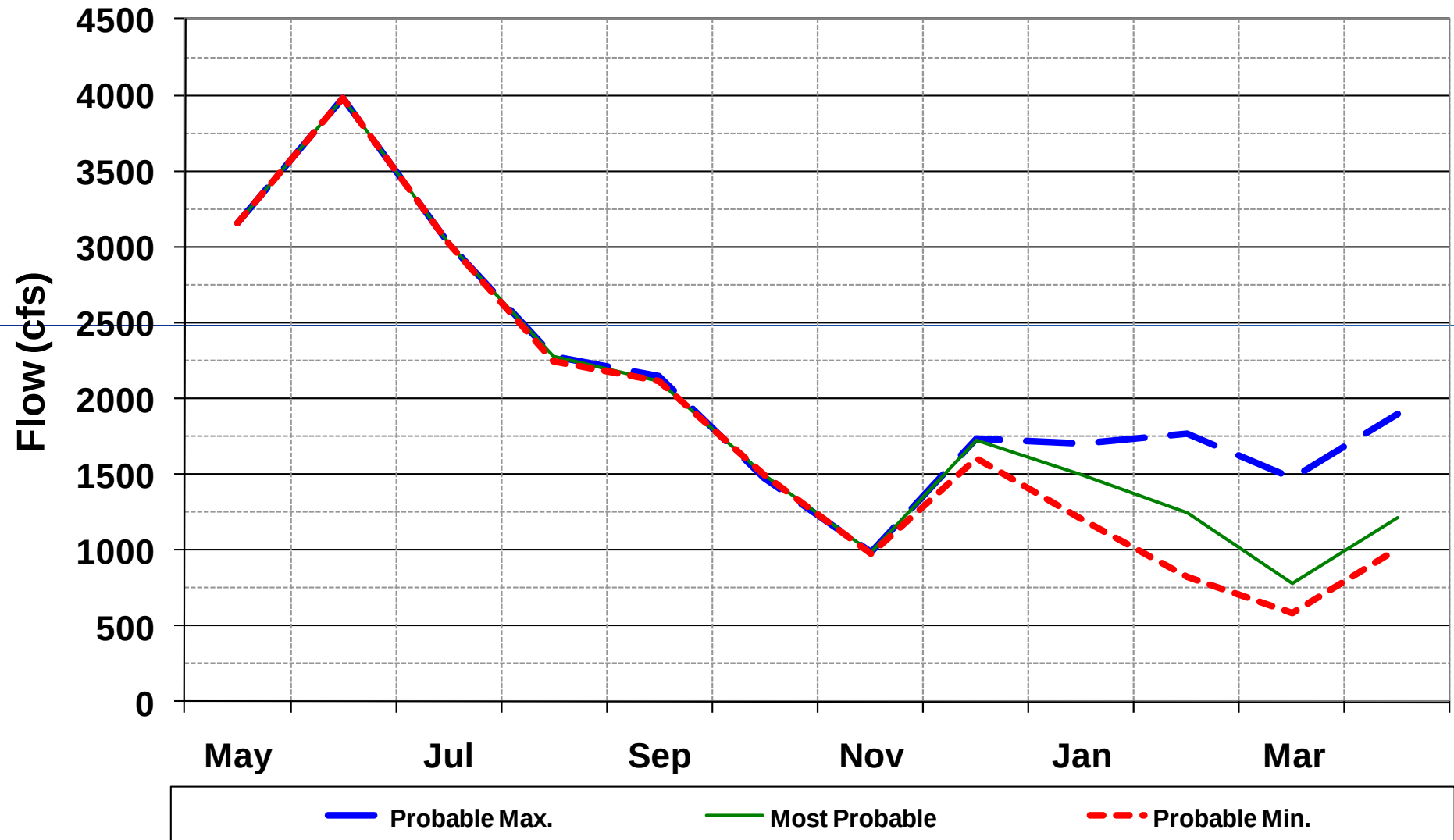
Blue Mesa Content End of Month



RECLAMATION

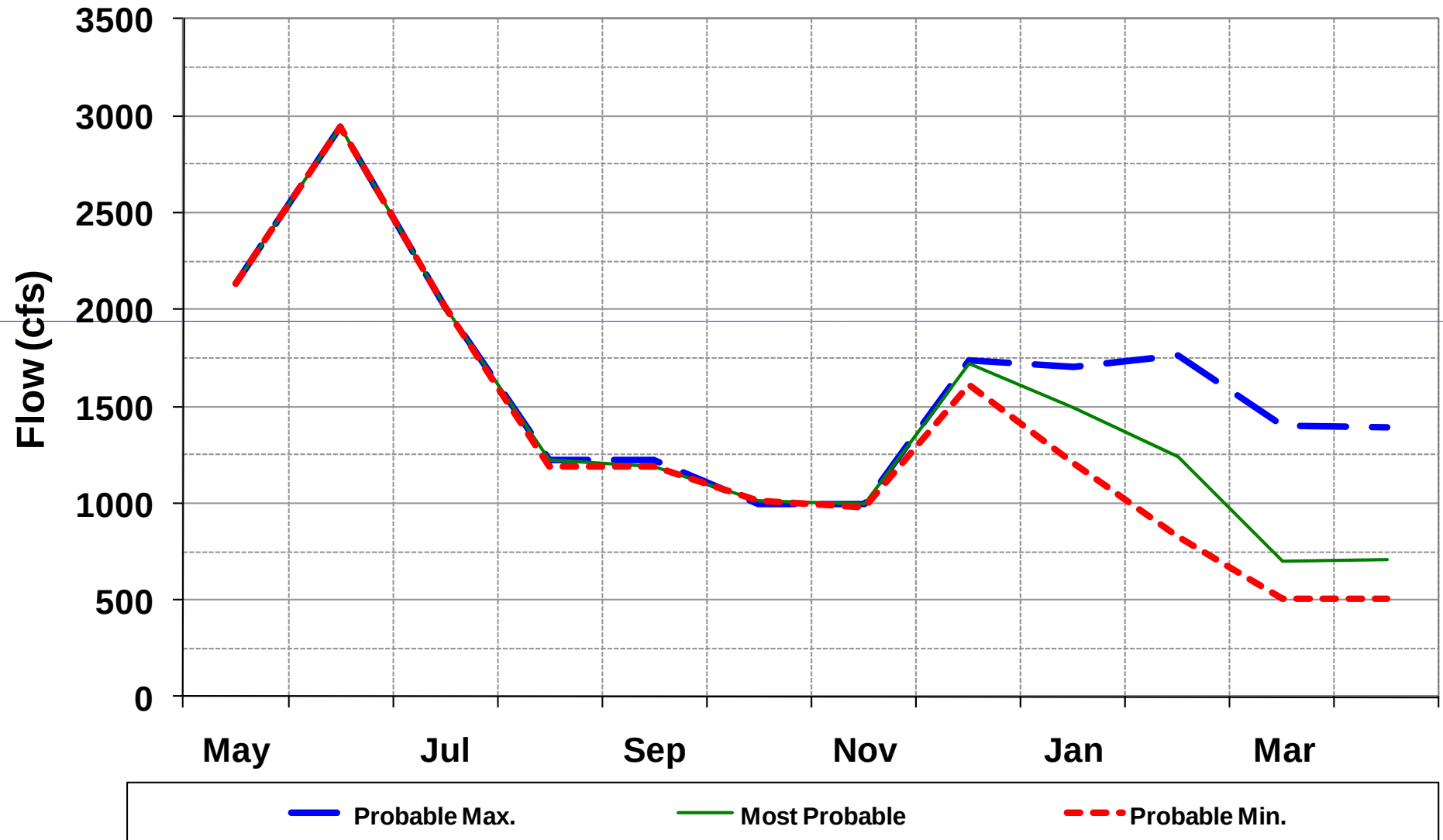
Crystal Release

Monthly Average



RECLAMATION

Black Canyon Monthly Average



RECLAMATION



May 15th

RECLAMATION



May 15th

RECLAMATION



<http://www.usbr.gov/uc/wcao/water/rsvrs/mtgs/amcurrnt.html>

RECLAMATION