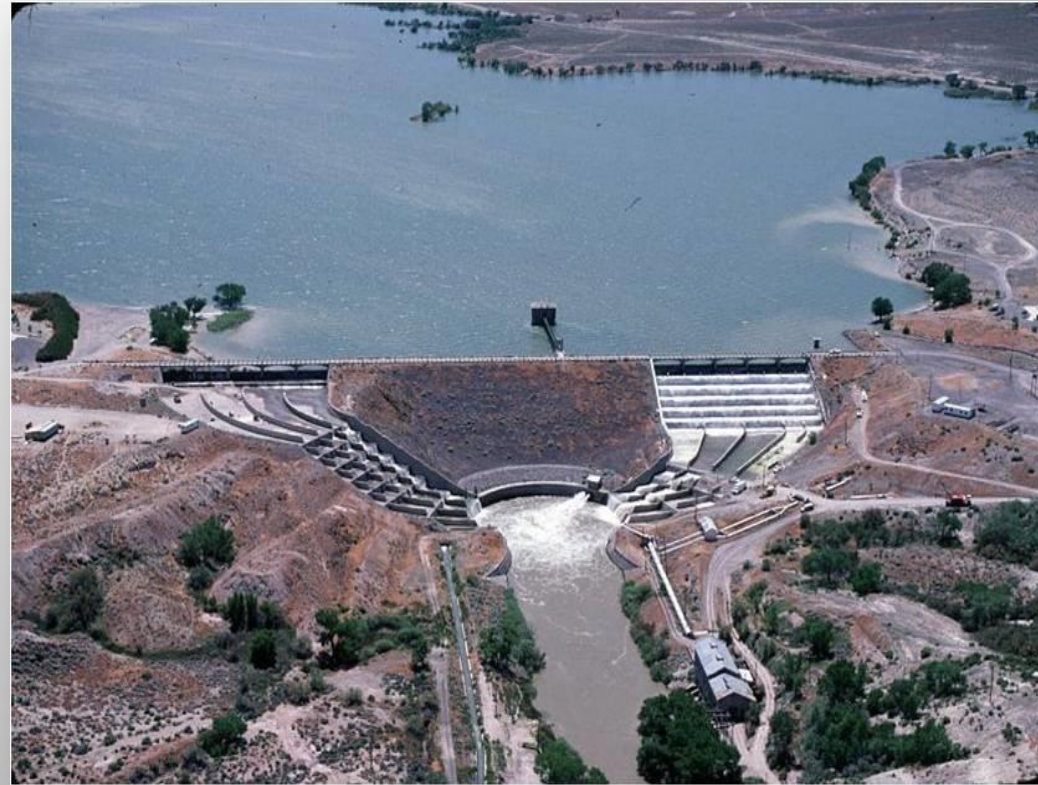


Lahontan Reservoir

2017 Operations Forecast and Discussion

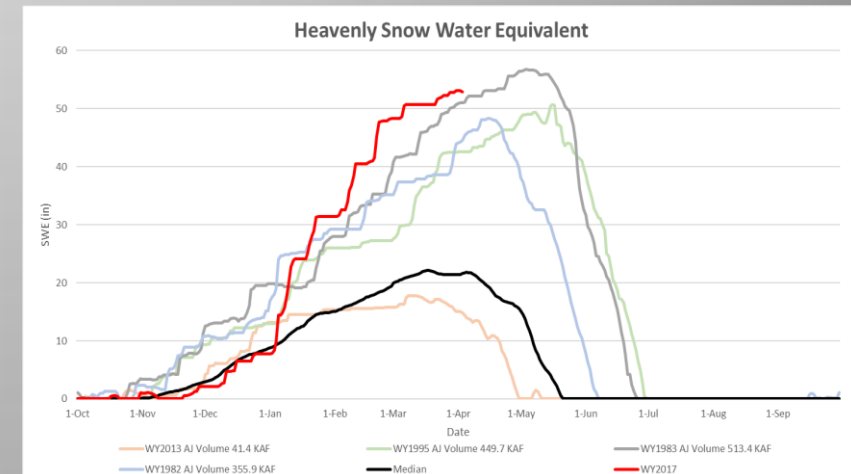
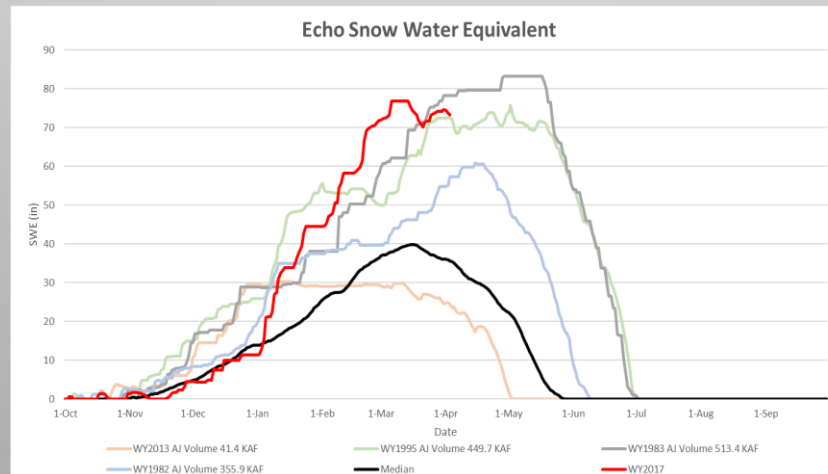
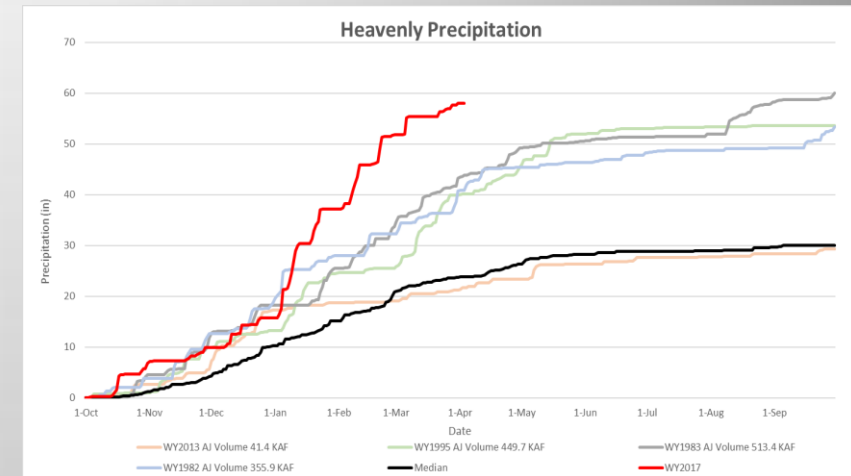
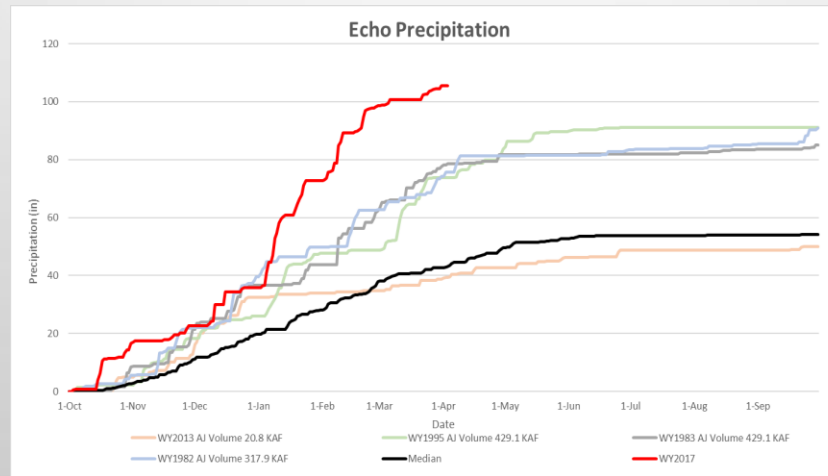
Phone Conference
April 4th, 2017

Shane Coors, PE
Precision Water Resources Engineering
www.precisionwre.com



Historical “Big Year” Comparison Current Snotels

- 2017 precipitation to date is largest on record for all snotels
- Approximately 1” of new precipitation in the upper basin over past 7 days
- April 3rd snowpack is at or near the largest in the snotel record (1979 – present)
- Composite basin snowpack held steady this week
- Precipitation/snow accumulation season is winding down. The big years’ snowpack has historically continued to grow through April into May
- Average precipitation at Lake Tahoe in April is ~2 in. Largest on record is ~8 in.

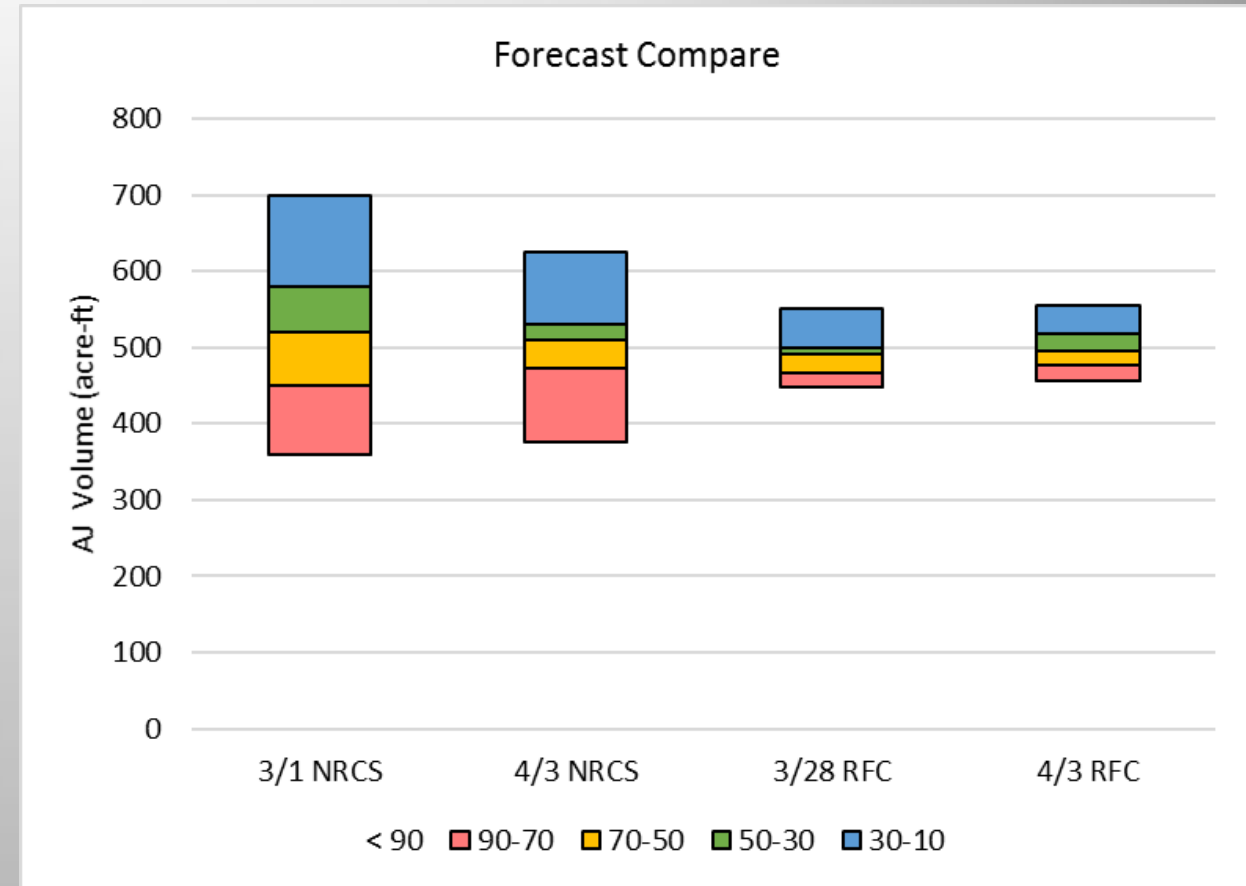


Ft Churchill April-July Volume Forecast Comparison

Last Week vs Current

- Most recent NRCS March 20th forecast is coordinated with the RFC. This is latest NRCS forecast
- Next NRCS/Coordinated forecast issued this week
- RFC is up slightly. Median has increased by 3 kaf. The spread decreased by 5 kaf
- NRCS median decreased by 10 kaf, spread decreased by 90 kaf, mostly from upper end

Forecast Comparison				
% exceedance	3/1 NRCS	4/3 NRCS	3/28 RFC	4/3 RFC
10%	700	625	551	555
30%	580	530	500	518
50%	520	510	492	495
70%	450	472	467	477
90%	360	375	448	457
Spread	340	250	103	98



Historic “Big Year” Comparison

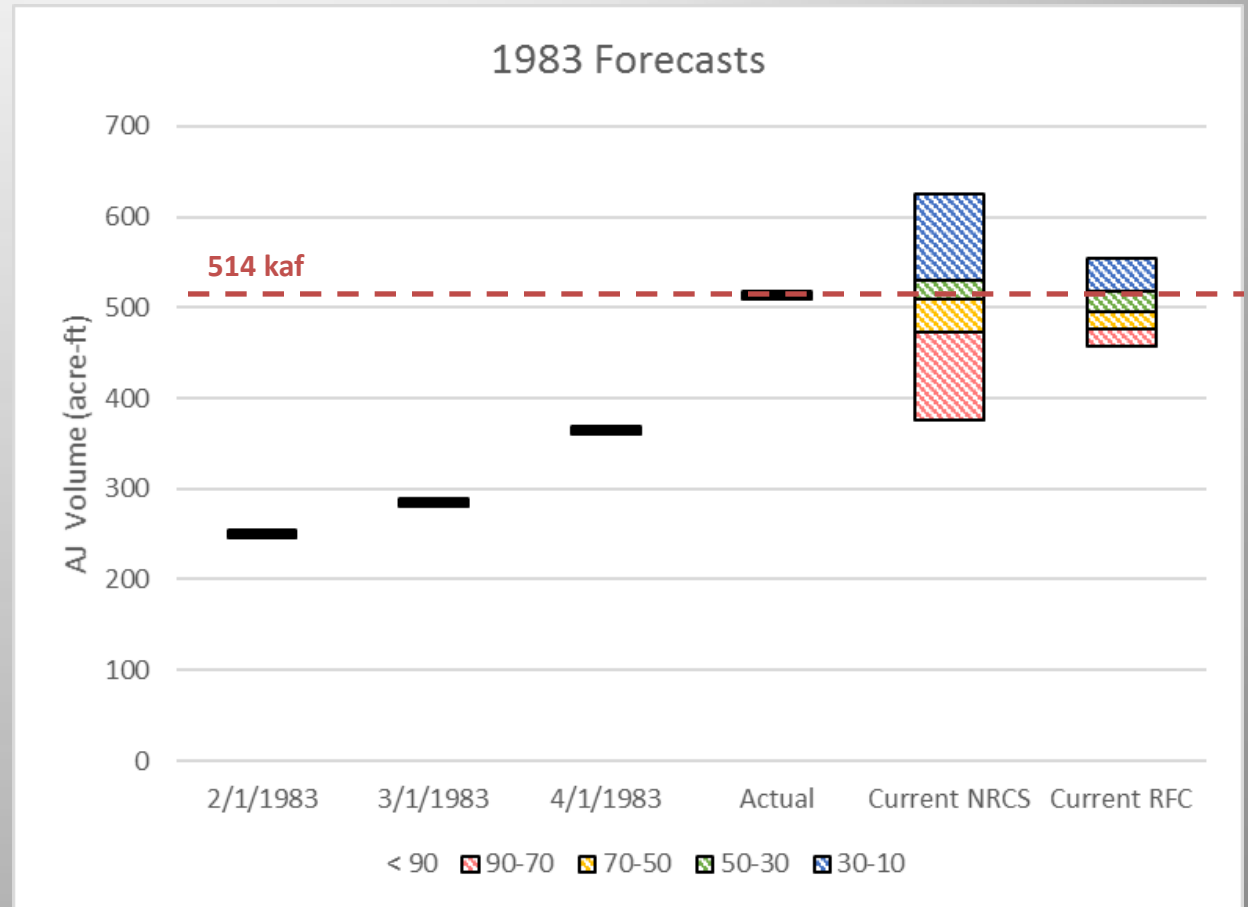
April – July Volume Forecast - 1983

1983 Forecasts

- February 1 Forecast – 250 kaf
- March 1 Forecast – 285 kaf
- April 1 Forecast – 365 kaf
- Actual AJ Volume – **514 kaf**

2017 Forecasts

- March 20th NRCS 50% - 510 kaf
- Current RFC 50% - 495 kaf



Historic “Big Year” Comparison

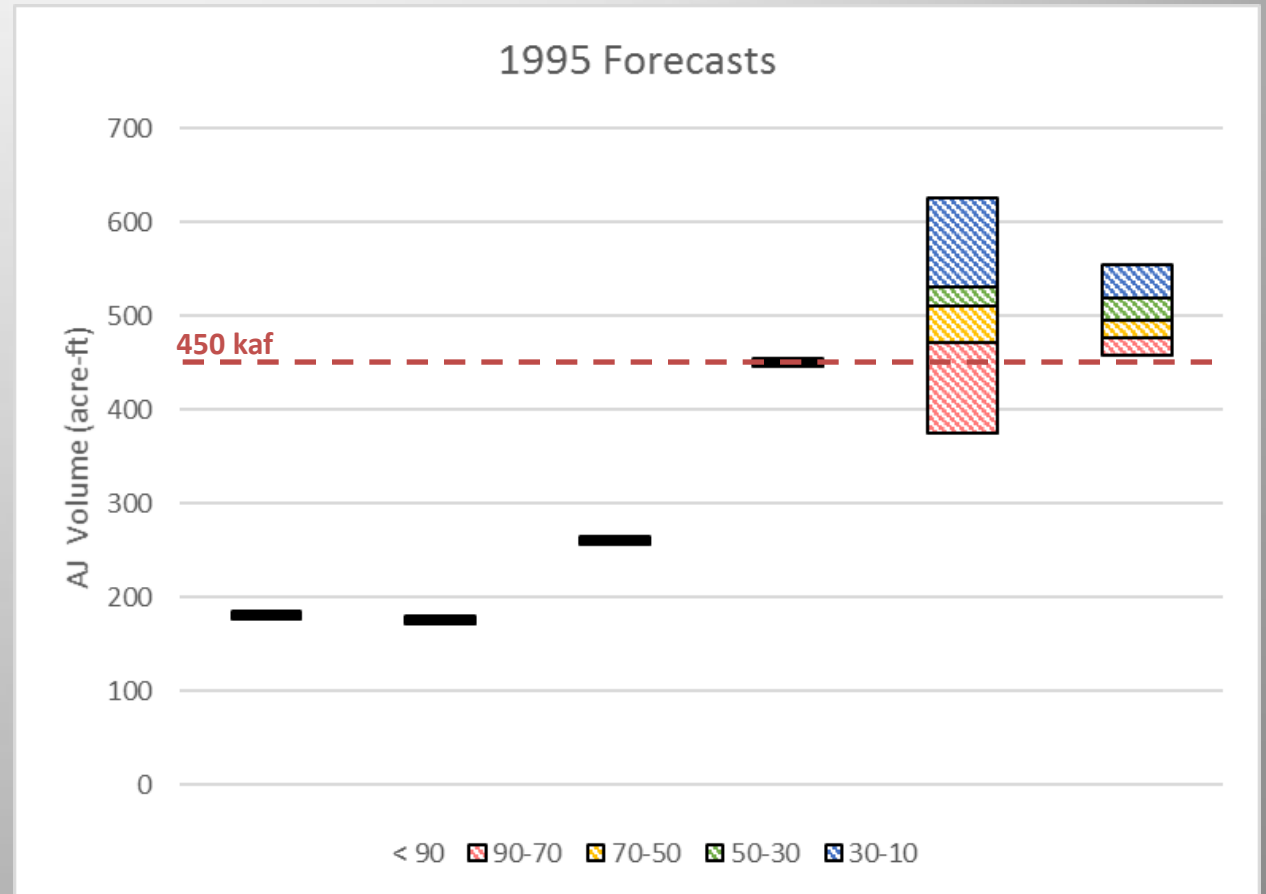
April – July Volume Forecast - 1995

1995 Forecasts

- February 1 Forecast – 180 kaf
- March 1 Forecast – 175 kaf
- April 1 Forecast – 260 kaf
- Actual AJ Volume – **450 kaf**

2017 Forecasts

- March 20th NRCS 50% - 510 kaf
- Current RFC 50% - 495 kaf



Historic “Big Year” Comparison

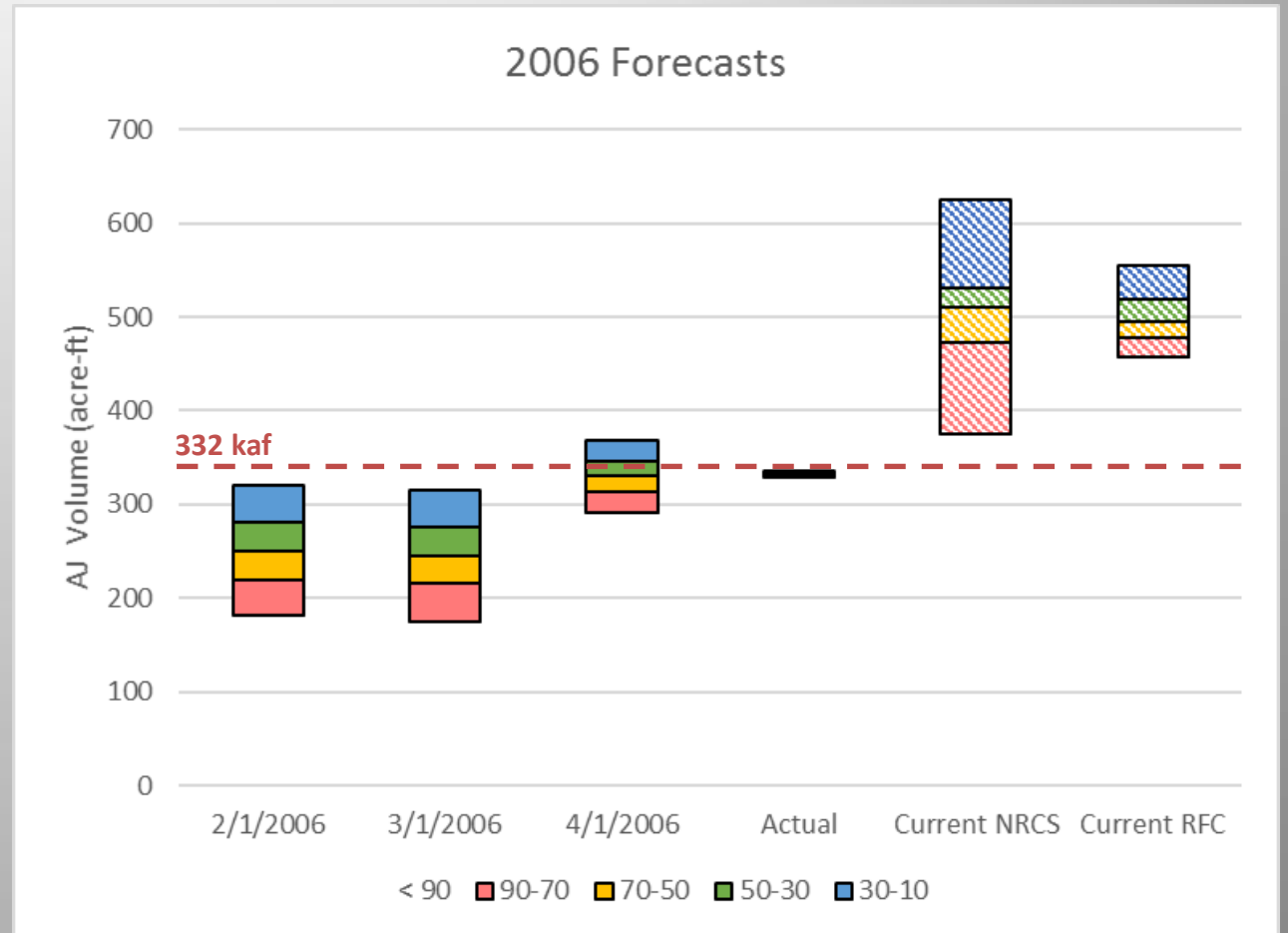
April – July Volume Forecast - 2006

2006 Forecasts

- February 1 Forecast – 250 kaf
- March 1 Forecast – 245 kaf
- April 1 Forecast – 330 kaf
- Actual AJ Volume – **332 kaf**

2017 Forecasts

- March 20th NRCS 50% - 510 kaf
- Current RFC 50% - 495 kaf



Historic “Big Year” Comparison

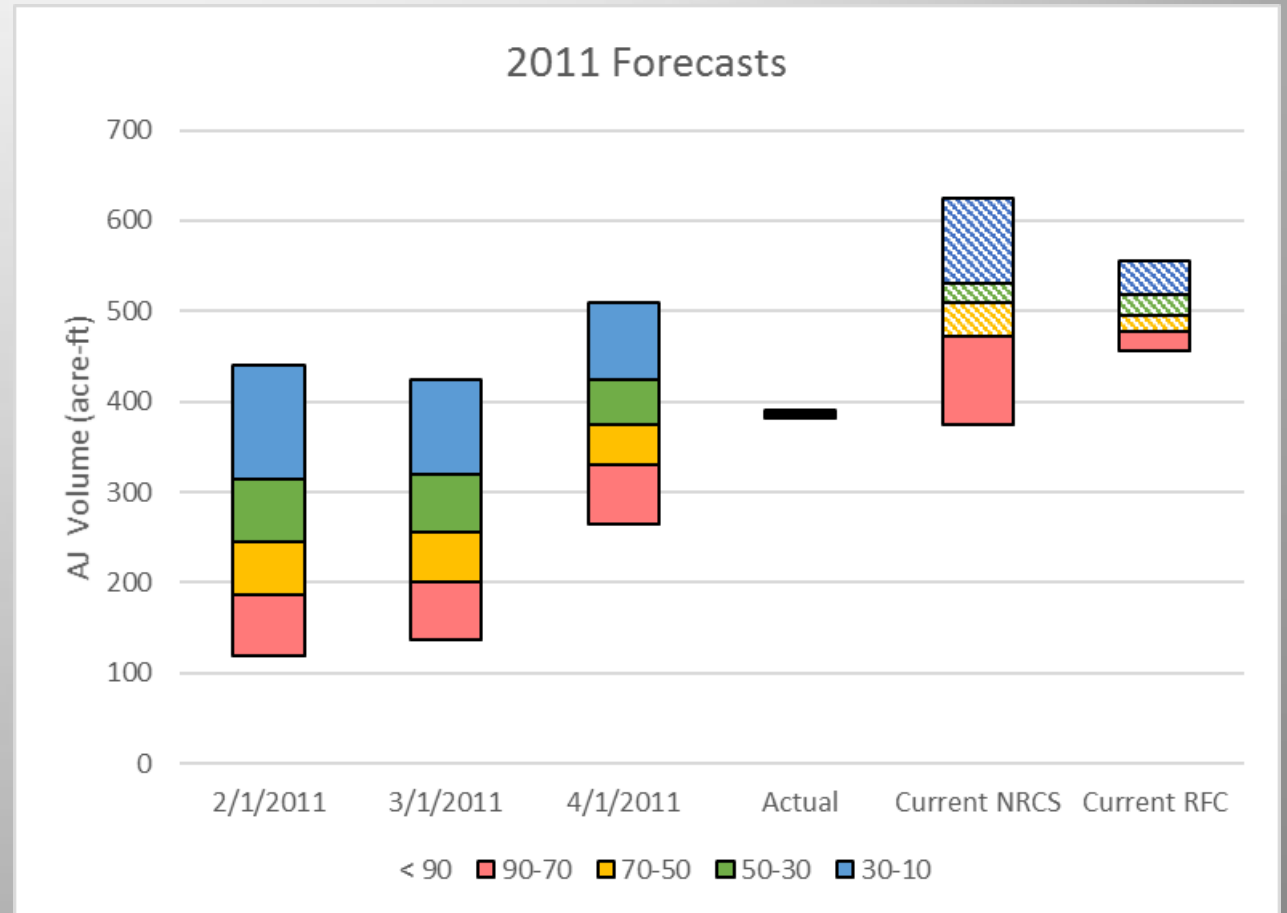
April – July Volume Forecast - 2011

2011 Forecasts

- February 1 Forecast – 245 kaf
- March 1 Forecast – 255 kaf
- April 1 Forecast – 375 kaf
- Actual AJ Volume – **386 kaf**

2017 Forecasts

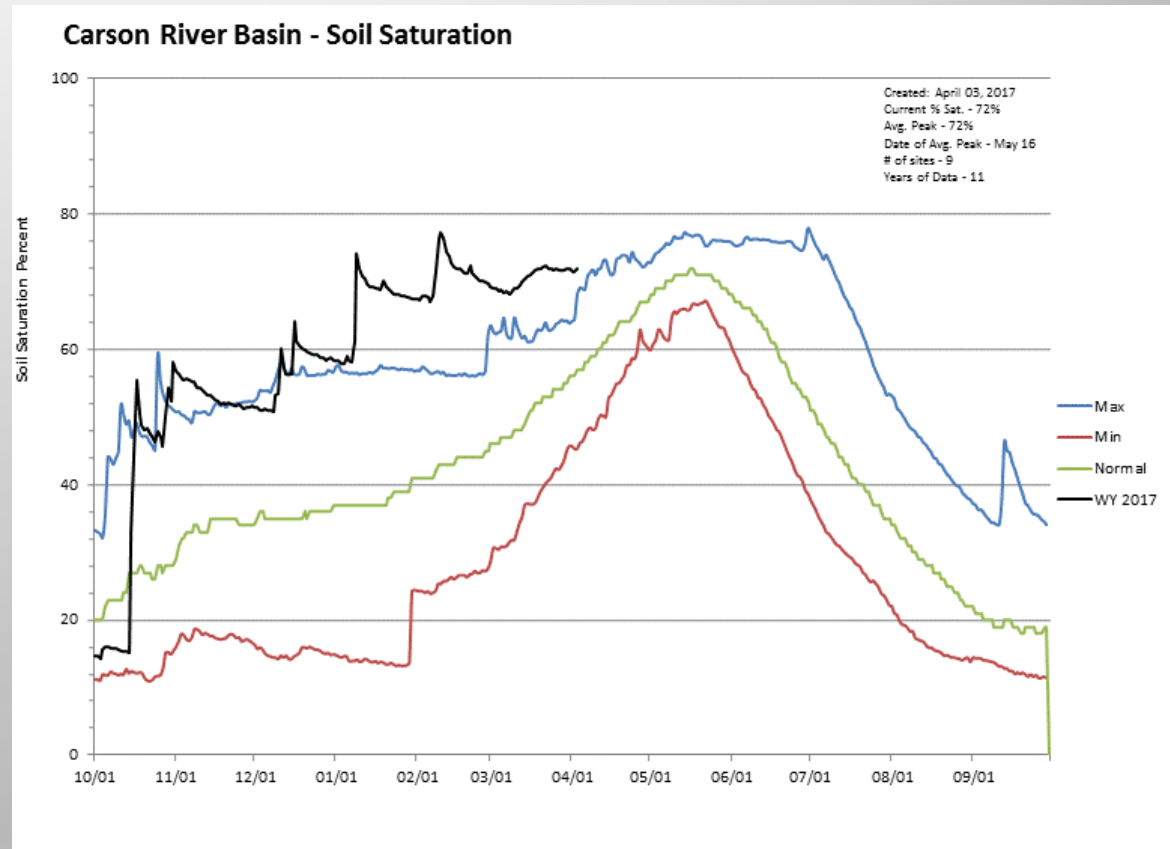
- March 20th NRCS 50% - 510 kaf
- Current RFC 50% - 495 kaf



Carson River Basin

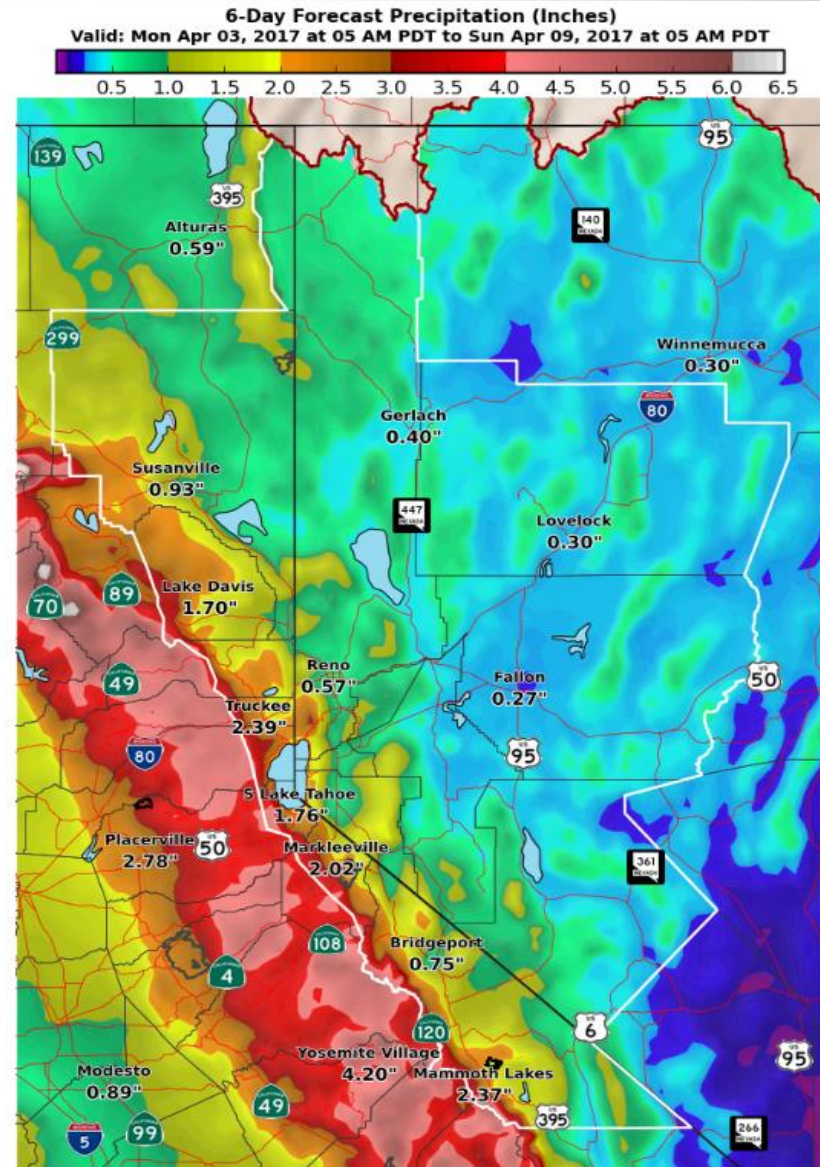
Current Soil Moisture Conditions

- Current soil moisture higher than any of the past 11 years at this date
- Current soil moisture is similar to typical conditions during peak runoff
- Soil moisture has decreased slightly due to colder temps
- The soil saturation remains at an elevated level such that an efficient runoff is to be expected



Short-term Precipitation Forecast

- Approximately 1" of precipitation in the upper basin over the past week
- Mix of rain and snow
- 2-5 inches of precipitation expected over the next 6 days. Per the NWS, this could go up between now and Friday
- This is a substantial storm for this time of year
- Expect volume forecasts to rise if this amount of precipitation is realized



Midterm Precipitation Forecasts

- Up to 6 inches of precipitation forecasted over the next 8 days
- Average precipitation (Tahoe City) for the month of April is ~2". Largest April on record is ~8"
- Little or no precipitation forecasted for the second 8 days. This forecast is more volatile
- Average precipitation is falling off quickly from now on through the rest of the season

Precipitation Outlook for the Conterminous U.S.

Related Maps: Climate outlook for [Temperature](#) and [Soil Moisture](#)

Precipitation Forecasts

Precipitation (in)
during the period:

Mon, 03 APR 2017 at 12Z

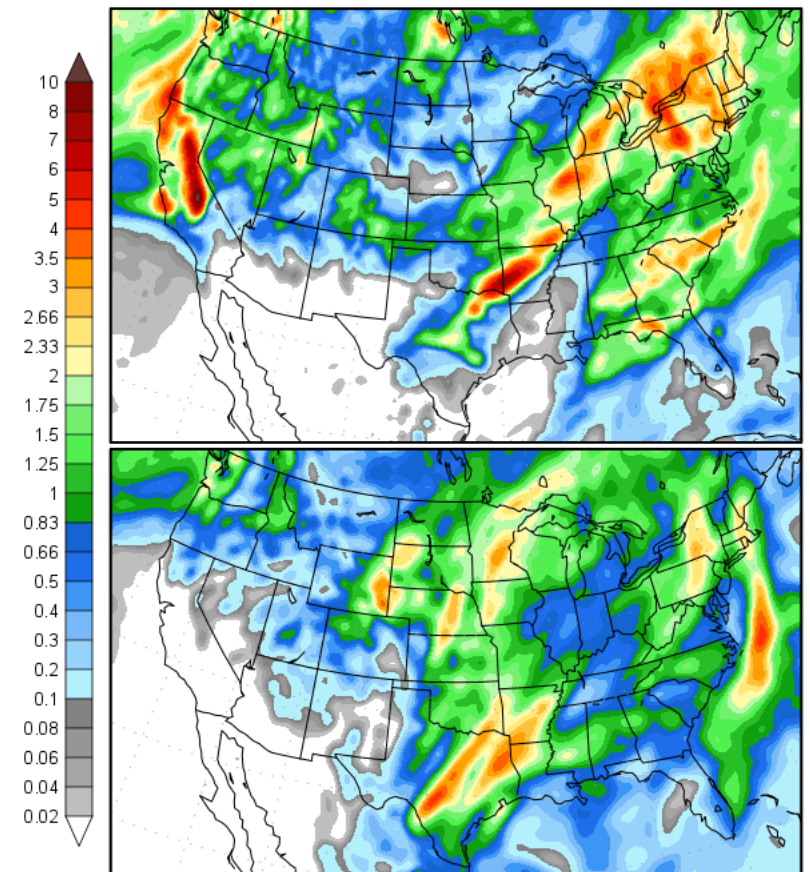
-to-

Tue, 11 APR 2017 at 12Z

Tue, 11 APR 2017 at 12Z

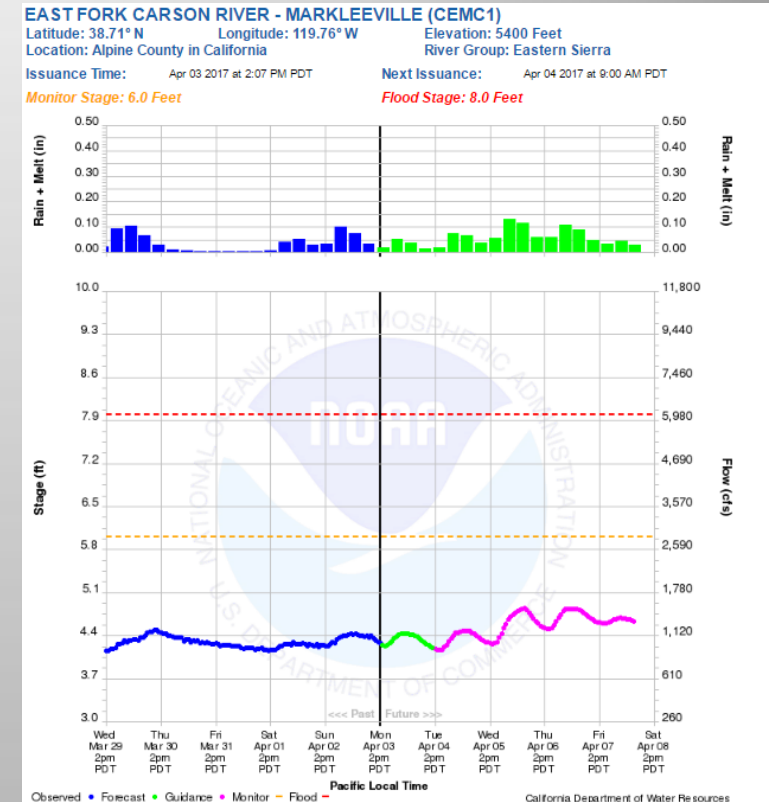
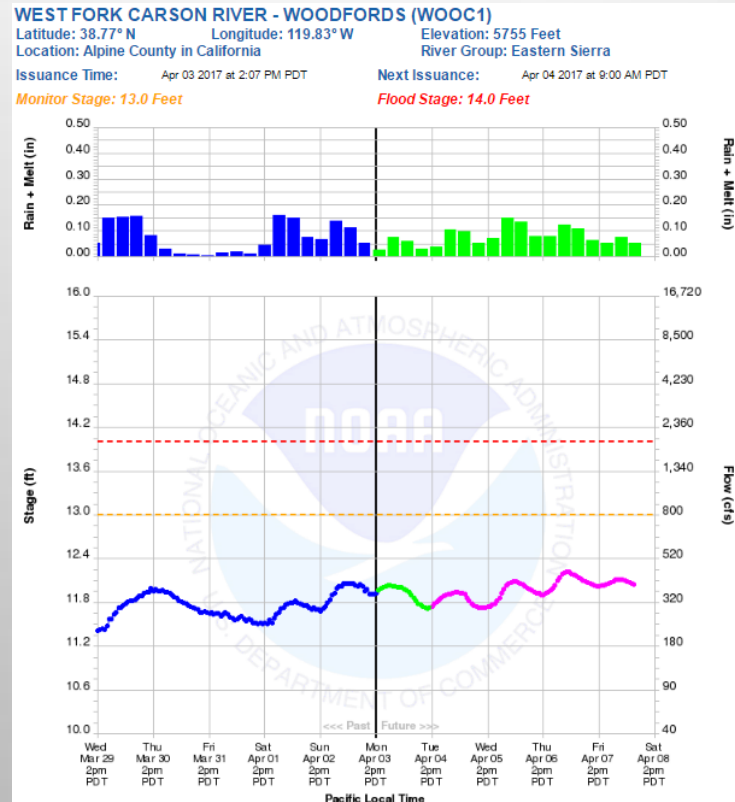
-to-

Wed, 19 APR 2017 at 12Z



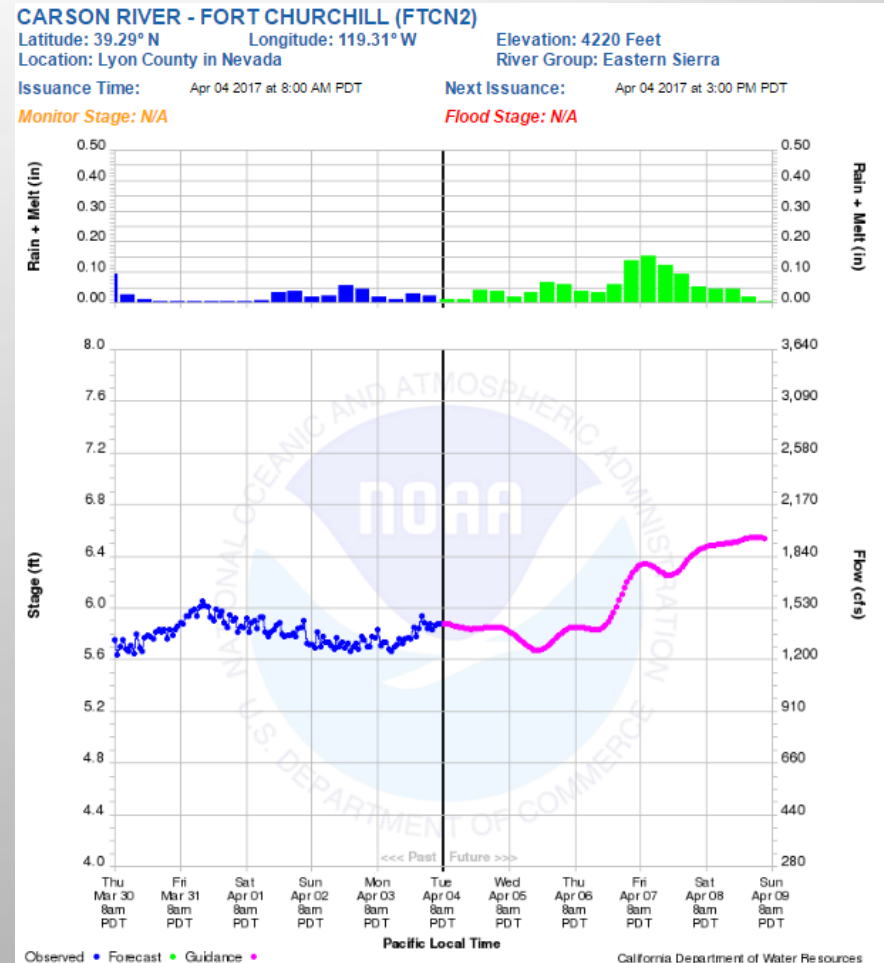
Carson River Short-Term Flow Forecasts Markleeville / Woodfords Gages

- Forecasted headwater flows rising slightly throughout the week
- Lots of uncertainty about snow levels associated with late week storm. Flows will come up more than indicated here if it is warm and precip comes as rain



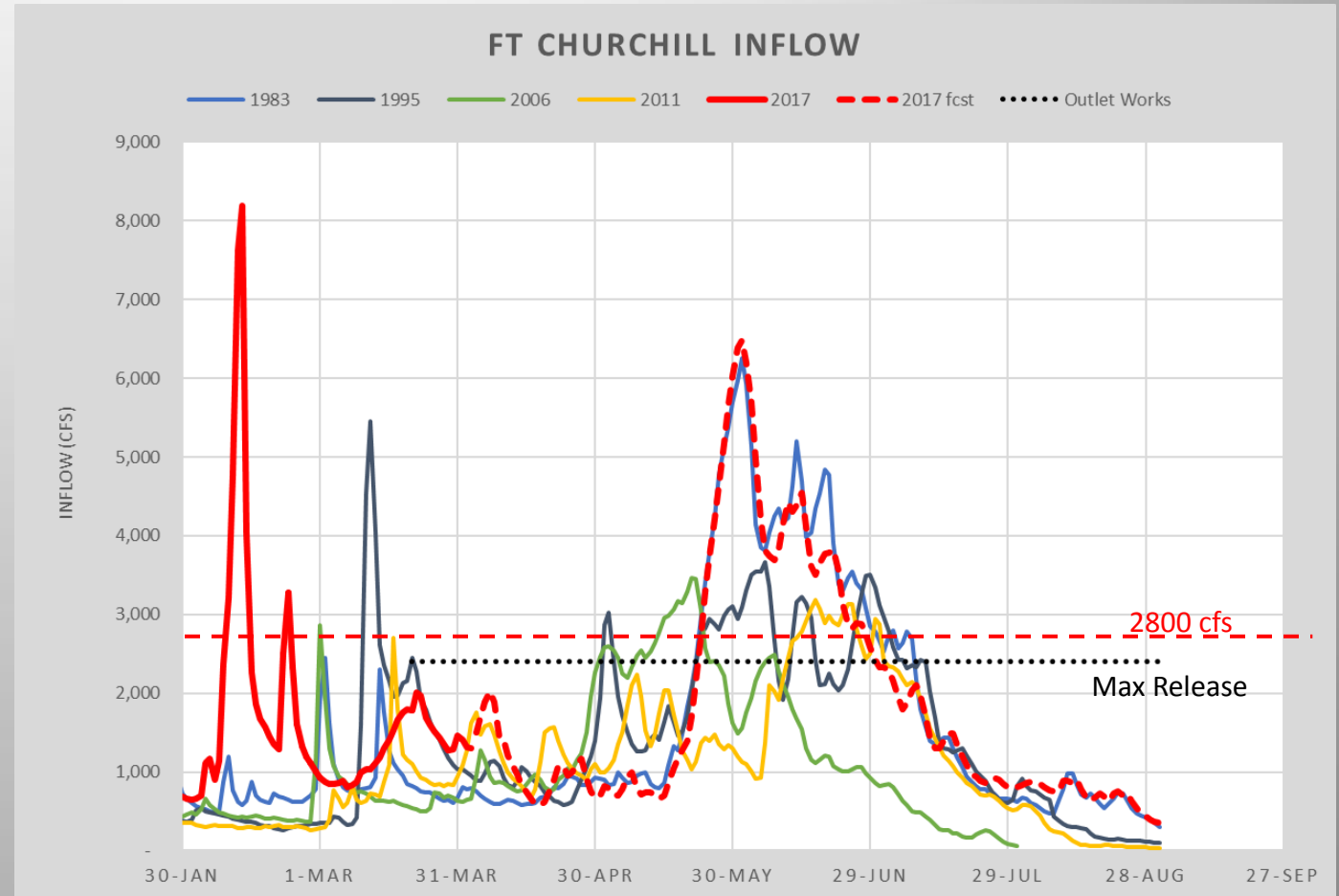
Carson River Short-Term Flow Forecasts Ft Churchill Gage

- RFC modeling error corrected this week
- Flows at Ft Churchill forecasted to rise substantially through the week.
- This increase is not seen in headwater forecasts where it is expected to snow
- PWRE is running a parallel short-term high-precision flow forecasting model to supplement the RFC model which has forecast inflow being a little higher
- Flows expected to get up near 2000 cfs by the end of the week
- Lahontan releases will exceed inflows all week and so the reservoir is expected to drawdown a little bit



Historic “Big Year” Comparison Carson River Inflow

- Historic big years all have inflows that go over maximum release capacity of the reservoir for extended periods
- Managing spills over the spillway at ~2800 cfs helps, but doesn't solve the problem, and can only be done when water surface is over the spillway
- Reservoir must have sufficient space available before inflows exceed release capacity of the reservoir
- If the reservoir fills to the top and the inflows are still high, then water surface rises and reservoir spills necessarily. Acts like a detention basin. Limited control over total outflow from reservoir
- At ~13" over the top of flashboards, the spill flows exceed 2800 cfs



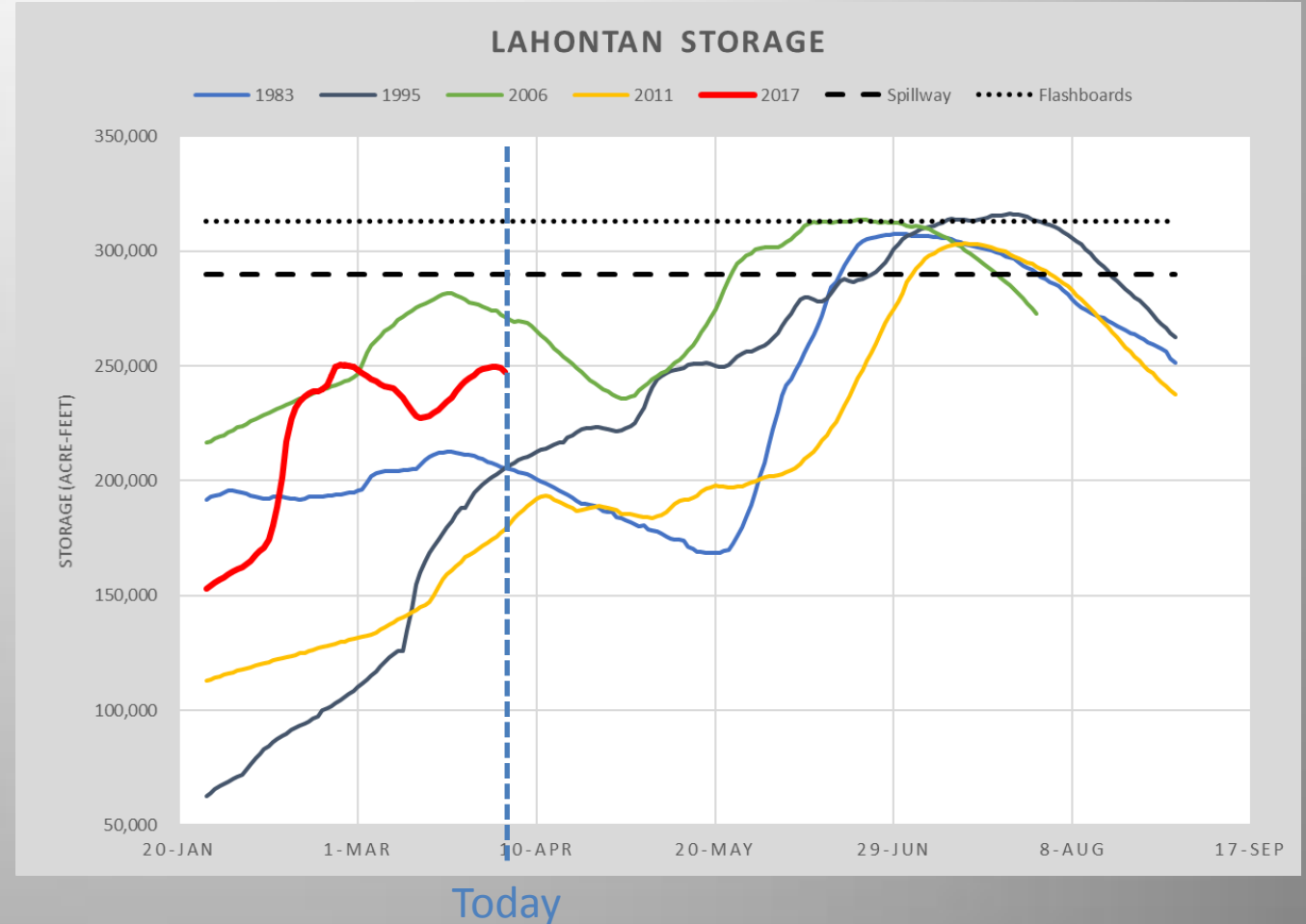
Historic “Big Year” Comparison

Current Lahontan Storage

Year	April 3 rd Storage (af)	March Volume (kaf)	AJ Volume (kaf)
1983	205,700	62.3	514
1995	205,700	102.9	450
2006	271,300	50.1	332
2011	178,800	53.9	386
2017	247,500	80	510/495*

* NRCS Mar 1st coordinated forecast / RFC ESP Forecast Median 4/3/17

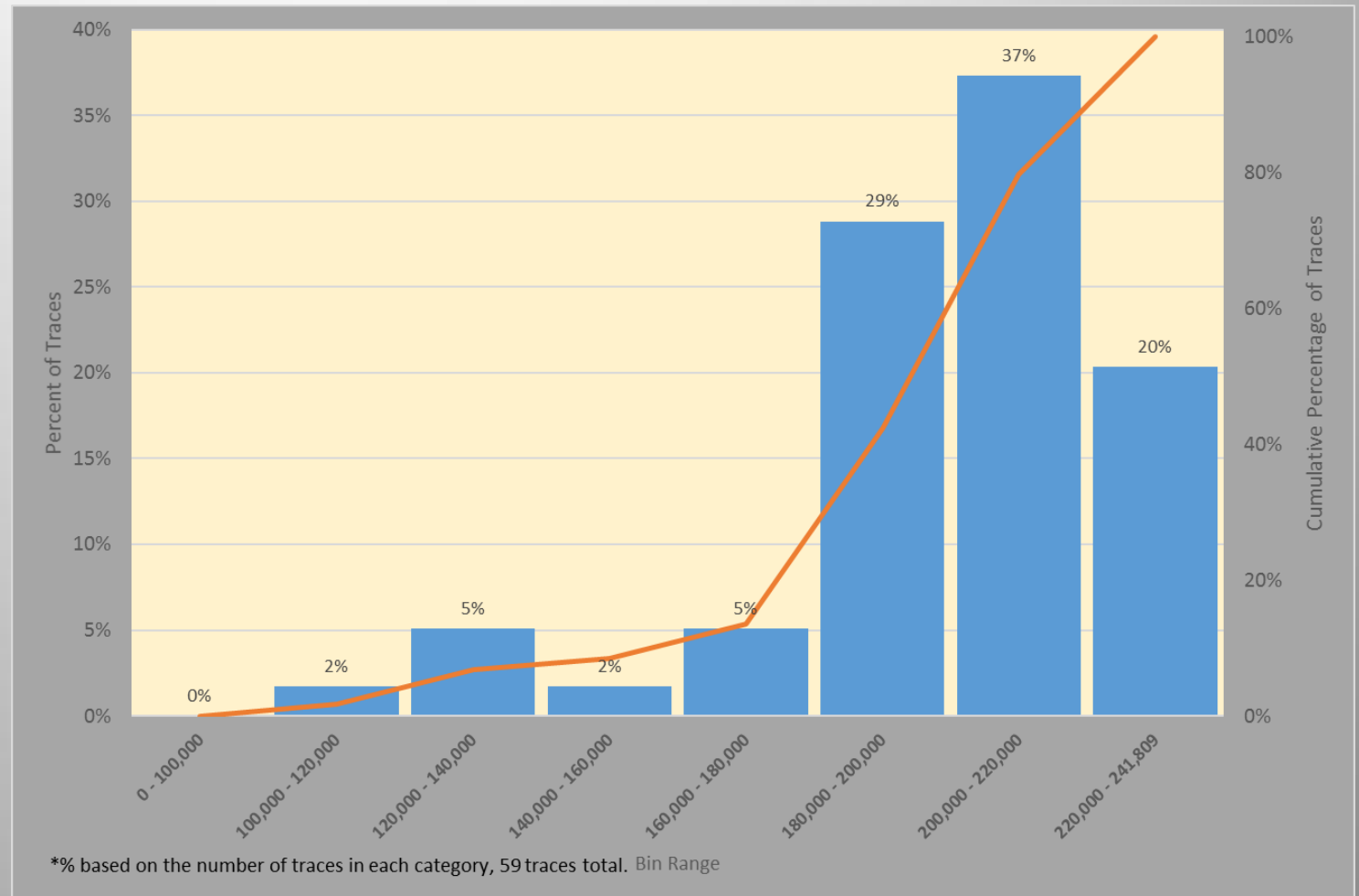
- Lahontan did not store or drawdown this week
- Lahontan is expected to drawdown to ~240,000 af by next week



Lahontan RiverWare Drawdown Storage Analysis

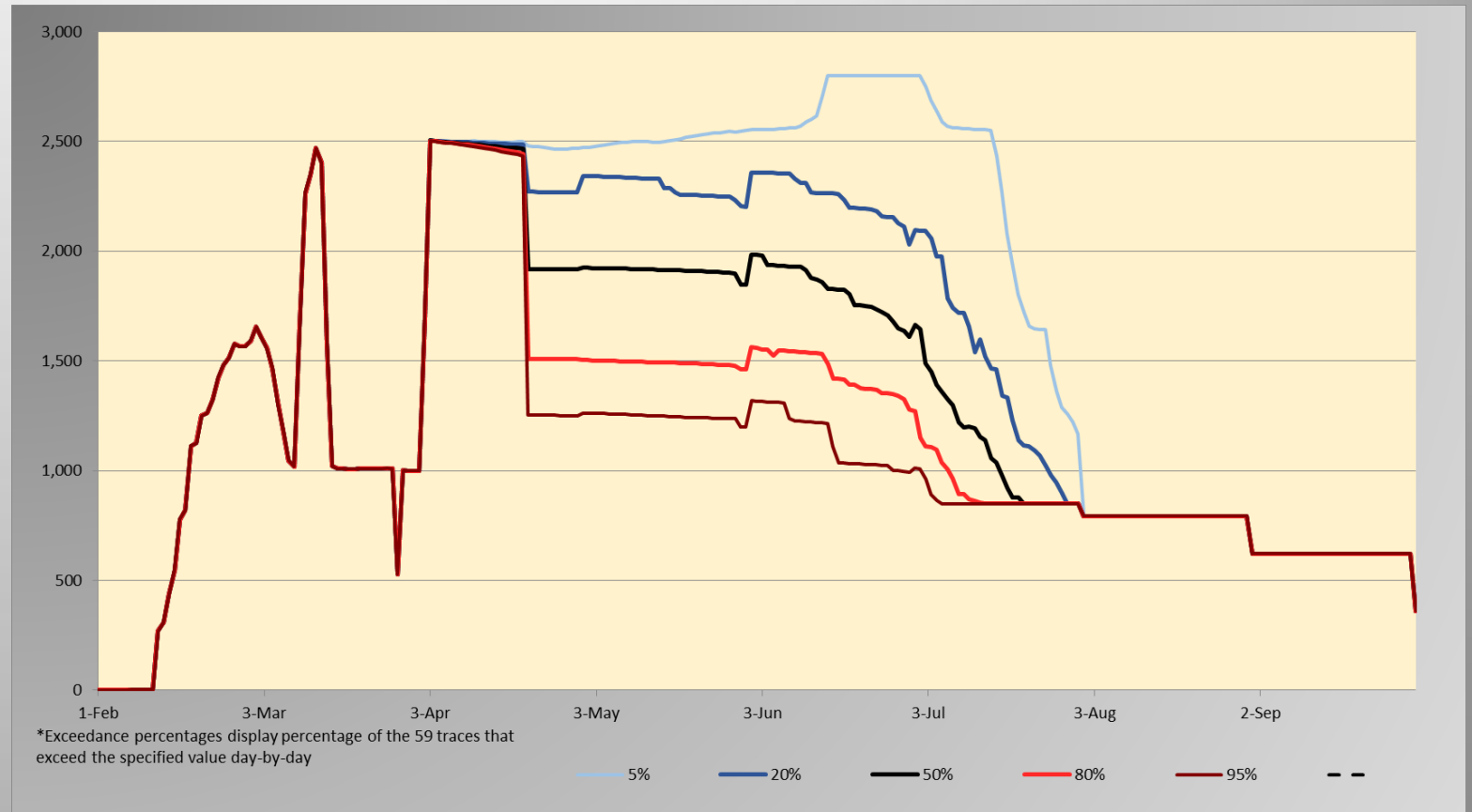
- All traces fill the reservoir
- The most extreme drawdown takes the reservoir to ~100 kaf mid-May
- One trace not managed below the spillway.
- The median drawdown level for the reservoir is 203 kaf. Last week it was 190 kaf
- We are seeing more overfilling than last week
- Both of these are due to extended maintenance period and slight forecast increase

Lahontan Minimum Storage (acre-ft)



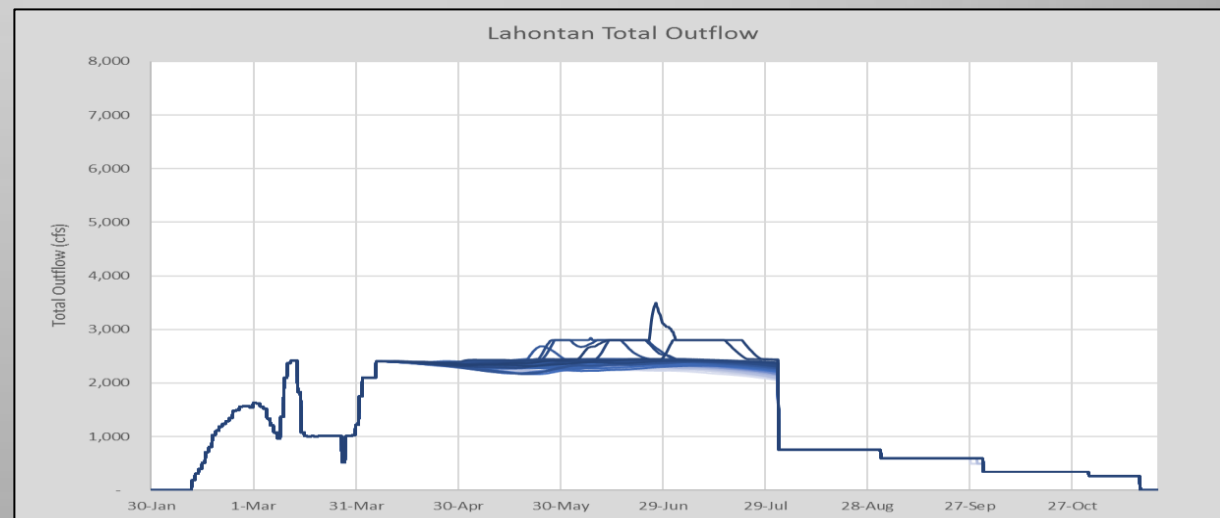
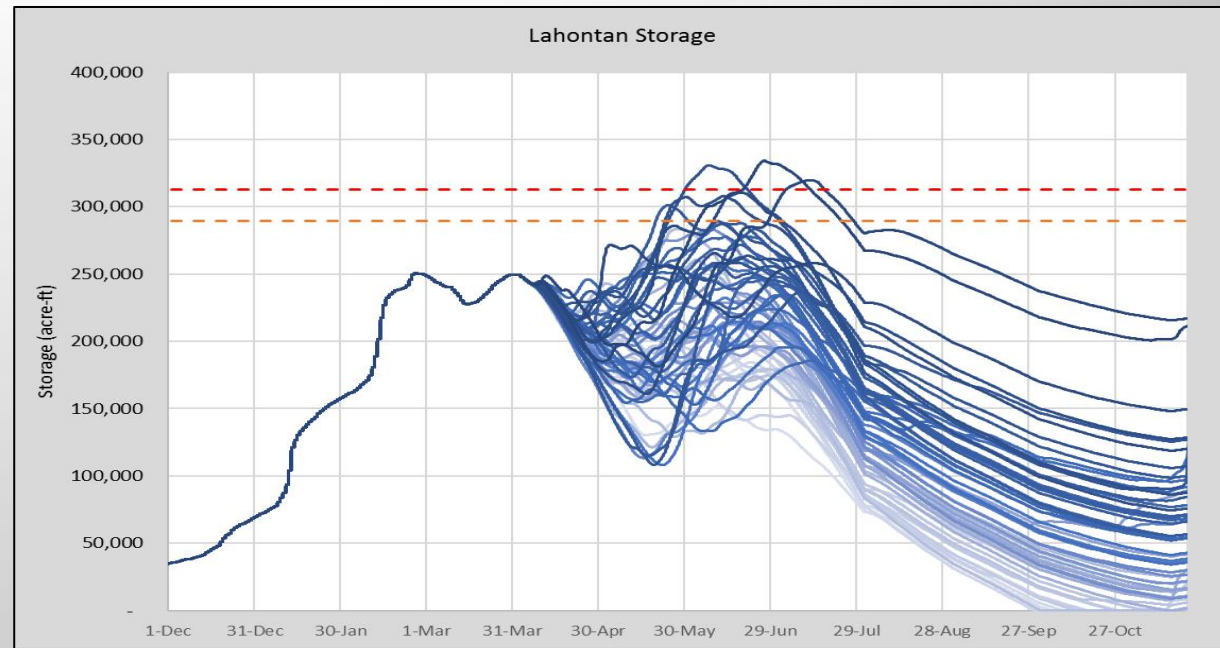
Lahontan RiverWare Release Analysis

- Most likely operational scenario will be to sustain maximum release until early May and then back off to 1500 cfs – 2300 cfs
- This is up from last week a couple hundred cfs due to extended maintenance period and slight forecast increase
- These numbers will change week to week, but should be a good indication of what range and timing to expect for release reductions



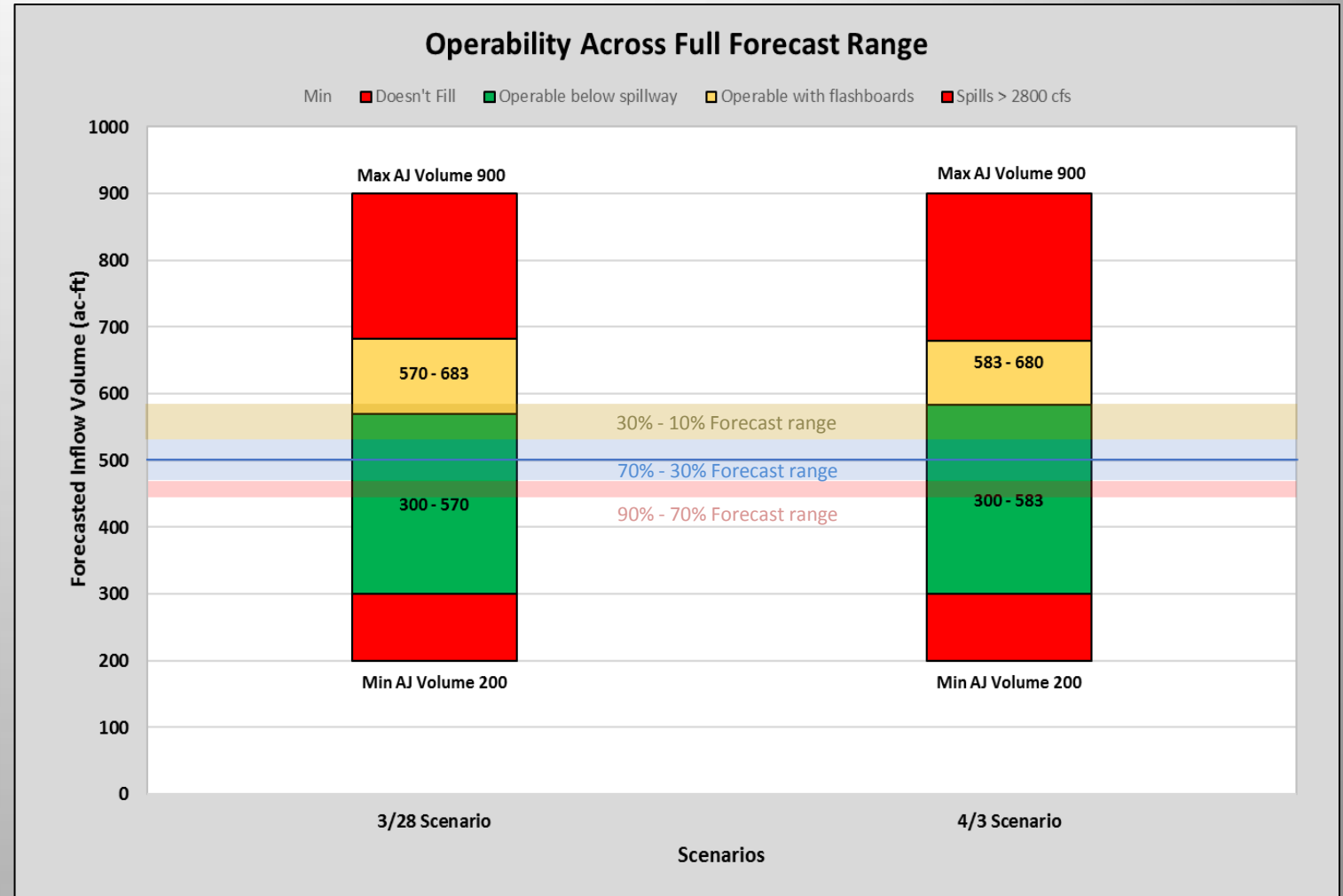
Probabilistic Operations Forecast Results

- Lahontan Release
 - Release 2100 cfs through tomorrow (4/5)
 - Max release beginning Thursday (4/6) and held at least until May 10th
- 8 bays of flashboards
 - 6 out of 59 (10%) traces overflow
 - 1 out of 59 (2%) traces release/spill >2800 cfs
 - Max spill 3500 cfs
 - 5% exceedance spill – 2800 cfs
 - 10% exceedance spill – 2800 cfs
 - Max elevation – 4165.05
 - All traces fill reservoir if flows reduced to historical demands if necessary by mid-May



Bottom Line

- Outflows returned to maximum by Sunday, April 1st. The maintenance resulted in an additional ~ 52 kaf of water in the reservoir
- Lost a little more operability on the high end of possible AJ volumes
- Range of operability is almost entirely within the 10%-90% exceedance forecast window because the forecast spread is shrinking
- Driest trace still fills reservoir if releases are backed off to historical demand on May 10th
- **Maintain max release until May and then reduce releases when appropriate**



Summary

- Snowpack is still very high, and large runoff volume is expected. Timing of runoff has a large degree of uncertainty
- Short term weather forecast indicates significant precipitation over the next week. Impacts of this storm could be substantial.
- Lahontan can be expected to drawdown over the next week
- Any reduction from maximum release is not expected to be necessary until May.
- Reservoir drawdown should be expected, but the actual minimum level has a large degree of uncertainty
- Actually operating the reservoir optimally will still be a challenge that requires ongoing monitoring and adjustments

Questions??

