IMPACTS OF FORECAST LEAD TIMES ON RESERVOIR OPERATIONS

FIRO Workshop
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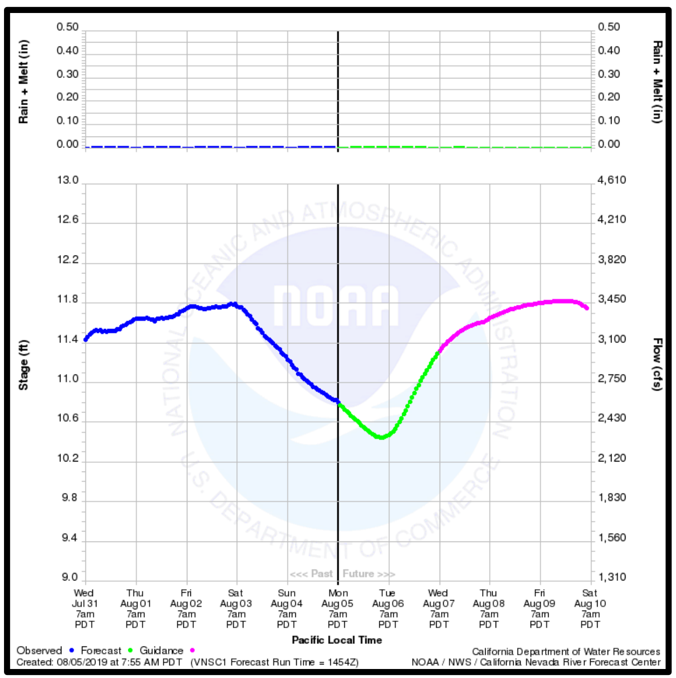
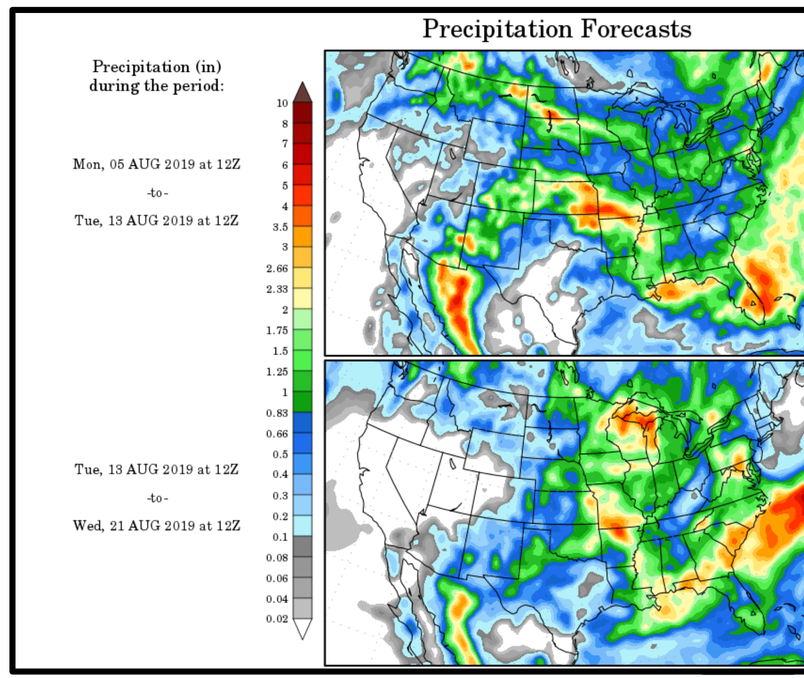
AGENDA

- Types of forecasts used in reservoir operations
- Variations in needs forecast lead times
- Examples of forecast information with varying lead times





TYPES OF FLOOD EVENTS

<u>Two basic types</u>

- Rainflood events
  - Higher peaks
  - Shorter durations

- Snowmelt events
  - Lower peaks
  - Longer durations

EXAMPLES OF FORECASTS USED

- Reservoir inflow forecasts from CNRFC
  - Deterministic
  - Ensemble

- Downstream flow forecasts from CNRFC
  - Deterministic
  - Ensemble

INFLOWS

- Snowmelt forecasts
  - Bulletin 120 (CA)
  - CBRFC spring runoff (CO/UT)

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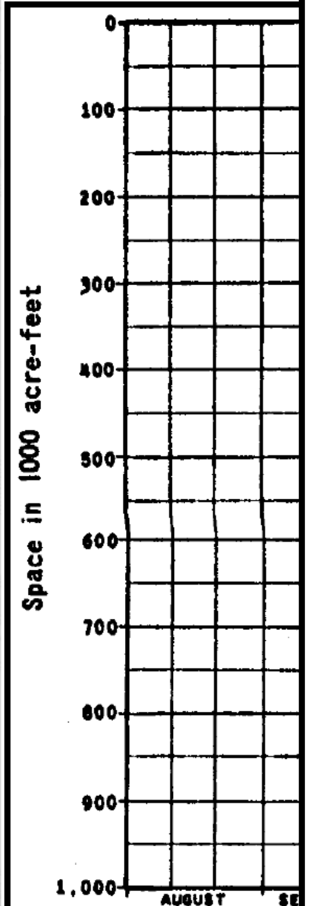
NEEDED FORECAST LEAD TIMES VARY

- Forecast products used in operations cover wide range of time windows

- Examples of factors of forecast lead time requirements:
  - Number of reservoirs in watershed
  - Reservoir release capacity
  - Channel capacity
  - Travel times
  - Downstream local flow contributions

EXAMPLE – PINE FLAT DAM



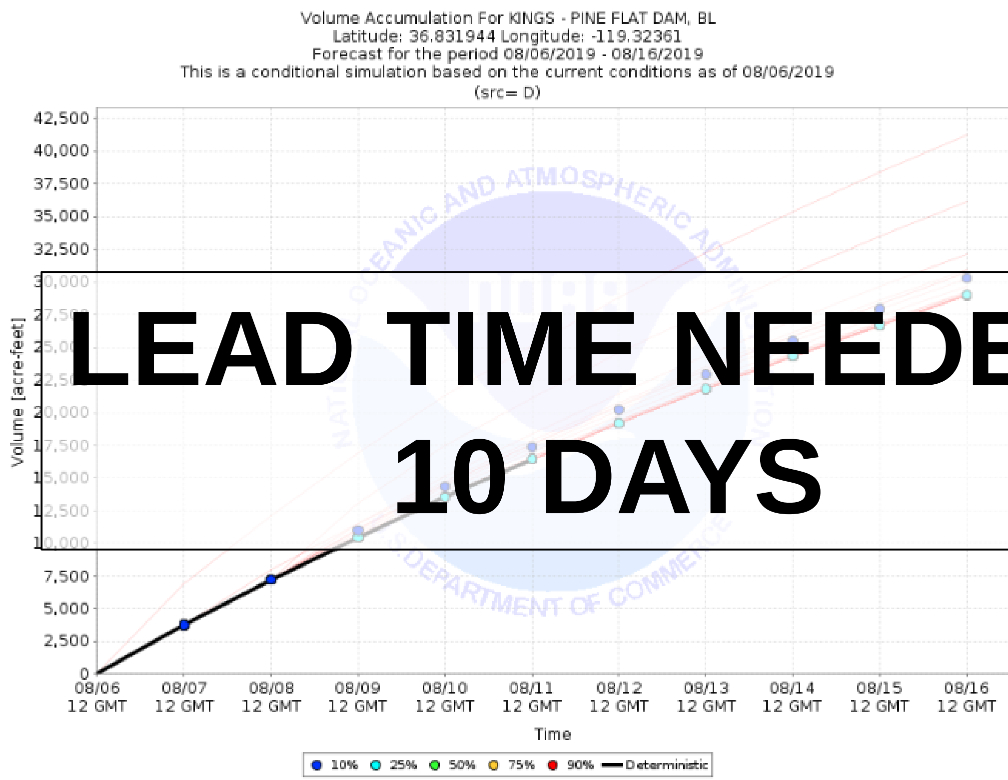
KINGS RIVER - PINE FLAT RESERVOIR (PFTC1)

Latitude: 36.82° N Longitude: 119.33° W Elevation: 615 Feet

Location: Fresno County in California River Group: San Joaquin

Issuance Time: Aug 06 2019 at 7:55 AM PDT

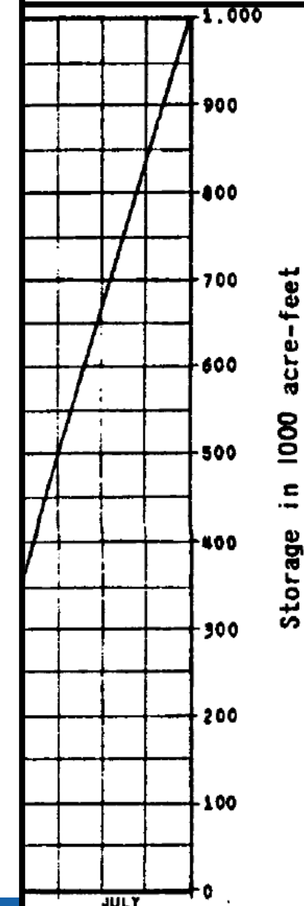
10-Day Accumulated Volume Plot



LEAD TIME NEEDED: 10 DAYS

Tabular 10-Day Streamflow Volume Accumulation (1000s of Acre-Feet)
Data Updated: Aug 06 2019 at 7:57 AM PDT

Probability	Aug 07	Aug 08	Aug 09	Aug 10	Aug 11	Aug 12	Aug 13	Aug 14	Aug 15	Aug 16
10% (Max)	3.8	7.2	11.0	14.3	17.4	20.2	22.9	25.5	27.9	30.3
25%	3.8	7.2	10.5	13.5	16.4	19.2	21.8	24.3	26.7	29.0
50% (Most Prob)	3.8	7.2	10.5	13.5	16.4	19.2	21.8	24.3	26.7	29.0
75%	3.8	7.2	10.5	13.5	16.4	19.2	21.8	24.3	26.7	29.0
90% (Min)	3.8	7.2	10.5	13.5	16.4	19.2	21.8	24.3	26.7	29.0



3. When wa… e increased
to maxi… maximum
channel… uate the
Rain Fl… ll not be
reduced…

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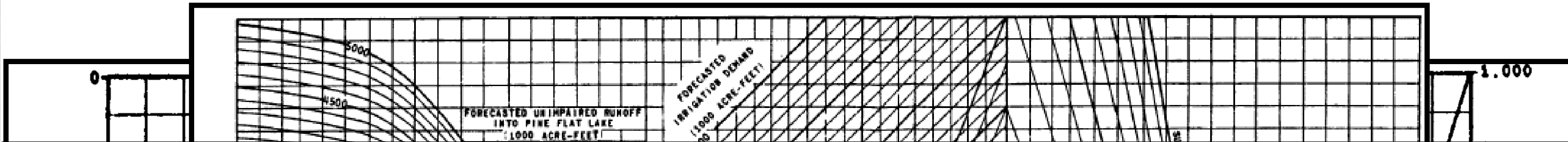
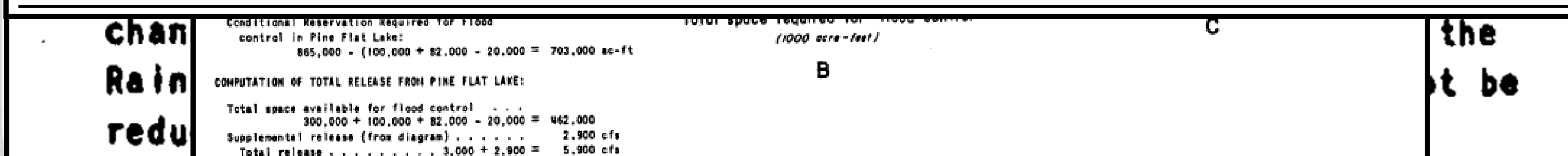


B-120 Water Supply Forecast Summary (continued)

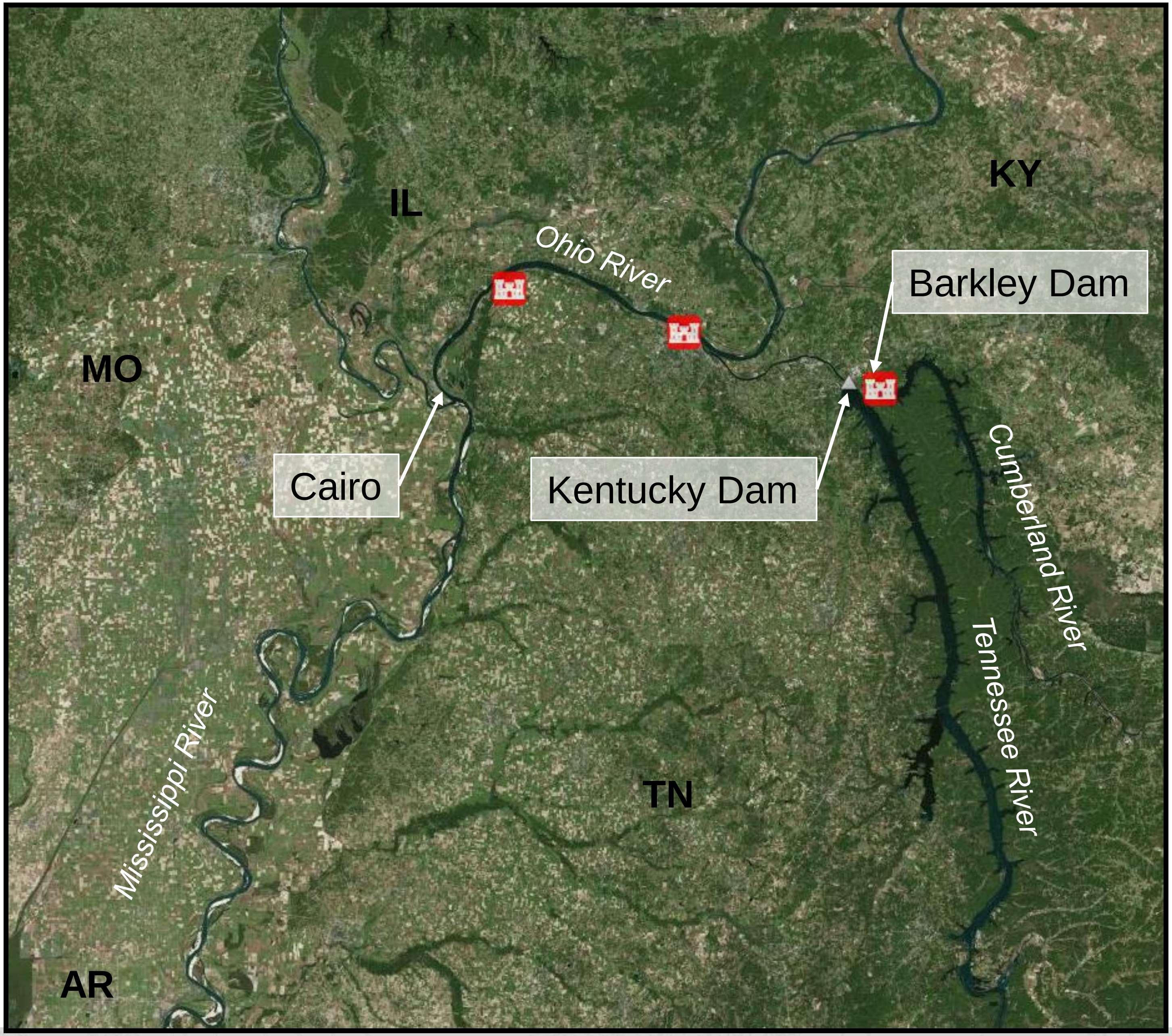
Water-Year (WY) Forecast Summary and Monthly Distribution (in thousands of acre-feet):

Watershed	Oct thru Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Water Year	80% Probability Range	WY % Avg
Trinity, Lewiston	224	177	225	455	315	190	50	15	9	1,660	1,475 - 1,835	123%
Inflow to Shasta	1,492	1,163	1,422	1,360	680	370	260	232	227	7,205	6,770 - 7,570	124%
Sacramento, Bend	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	355	[illegible]	295	[illegible]	10,410 - 11,860	130%
Feather, Oroville	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	104	[illegible]	5,745 - 6,710	142%
Yuba, Smartsville	381	496	563	533	580	370	87	33	27	3,070	2,795 - 3,360	135%
American, Folsom	425	702	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23	17	3,910	3,610 - 4,330	149%
Cosumnes, Mich. Bar	63	165	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	2	695	650 - 785	183%
Mokelumne, Pardee	70	128	165	235	260	195	40	7	5	1,105	990 - 1,240	148%
Stanislaus, Gdw.	144	217	278	356	390	255	79	17	8	1,745	1,610 - 1,945	152%
Tuolumne, La Grange	199	344	365	450	580	540	200	33	15	2,725	2,515 - 3,005	143%
Merced, McClure	95	226	183	255	320	240	55	15	6	1,395	1,280 - 1,555	141%
San Joaquin, Millerton	144	211	236	403	550	570	237	65	28	2,445	2,180 - 2,730	136%
Kings, Pine Flat	130	186	240	375	600	620	235	64	25	2,475	2,230 - 2,770	145%
Kaweah, Terminus	33	58	101	111	145	130	44	12	6	640	565 - 705	142%
Tule, Success	17	28	65	37	37	20	6	3	2	215	190 - 250	146%
Kern, Isabella	69	56	128	201	255	224	100	40	22	1,095	985 - 1,260	150%

LEAD TIME NEEDED: 6 MONTHS



EXAMPLE – MS/MO RIVERS FLOODING



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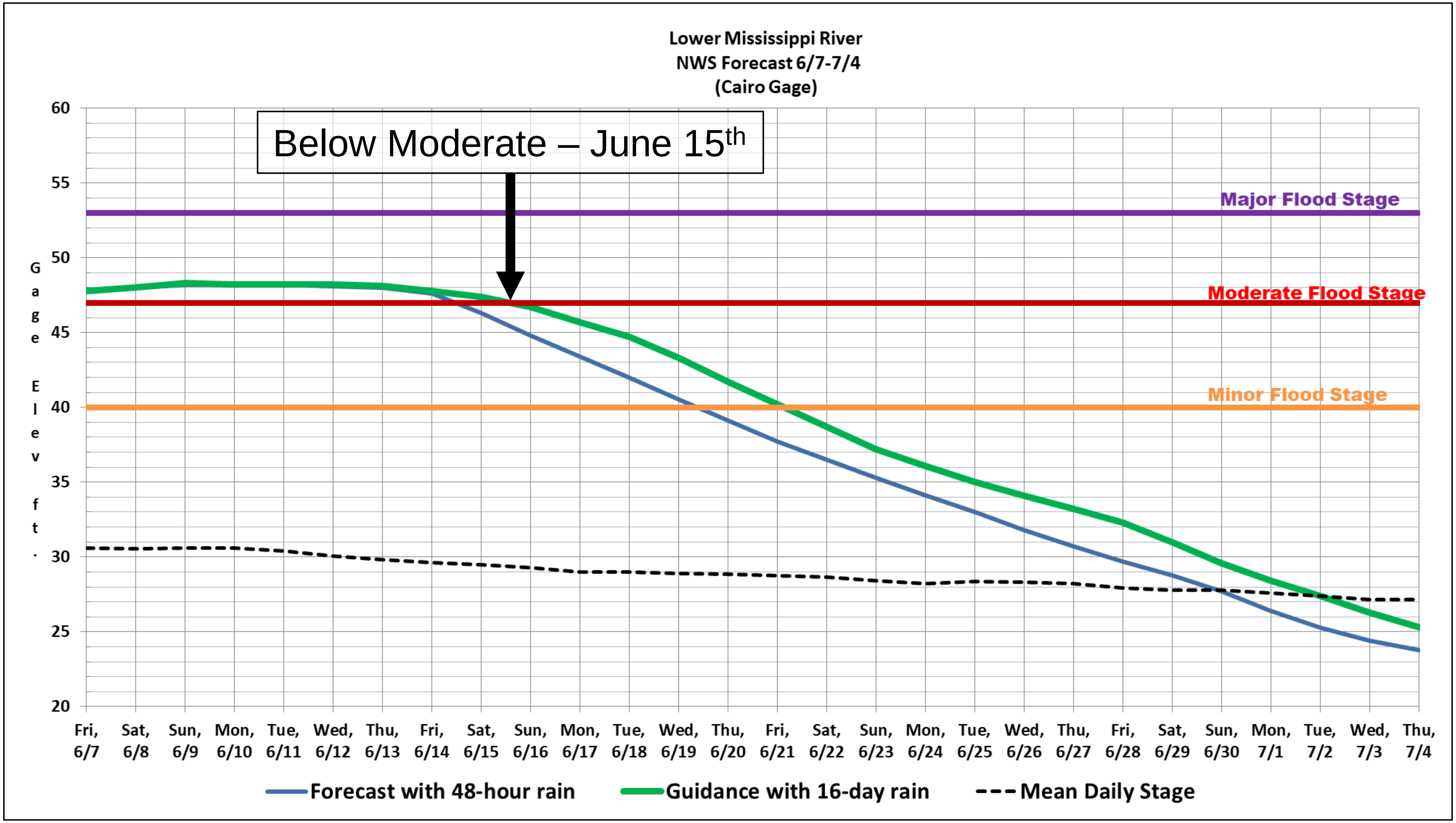

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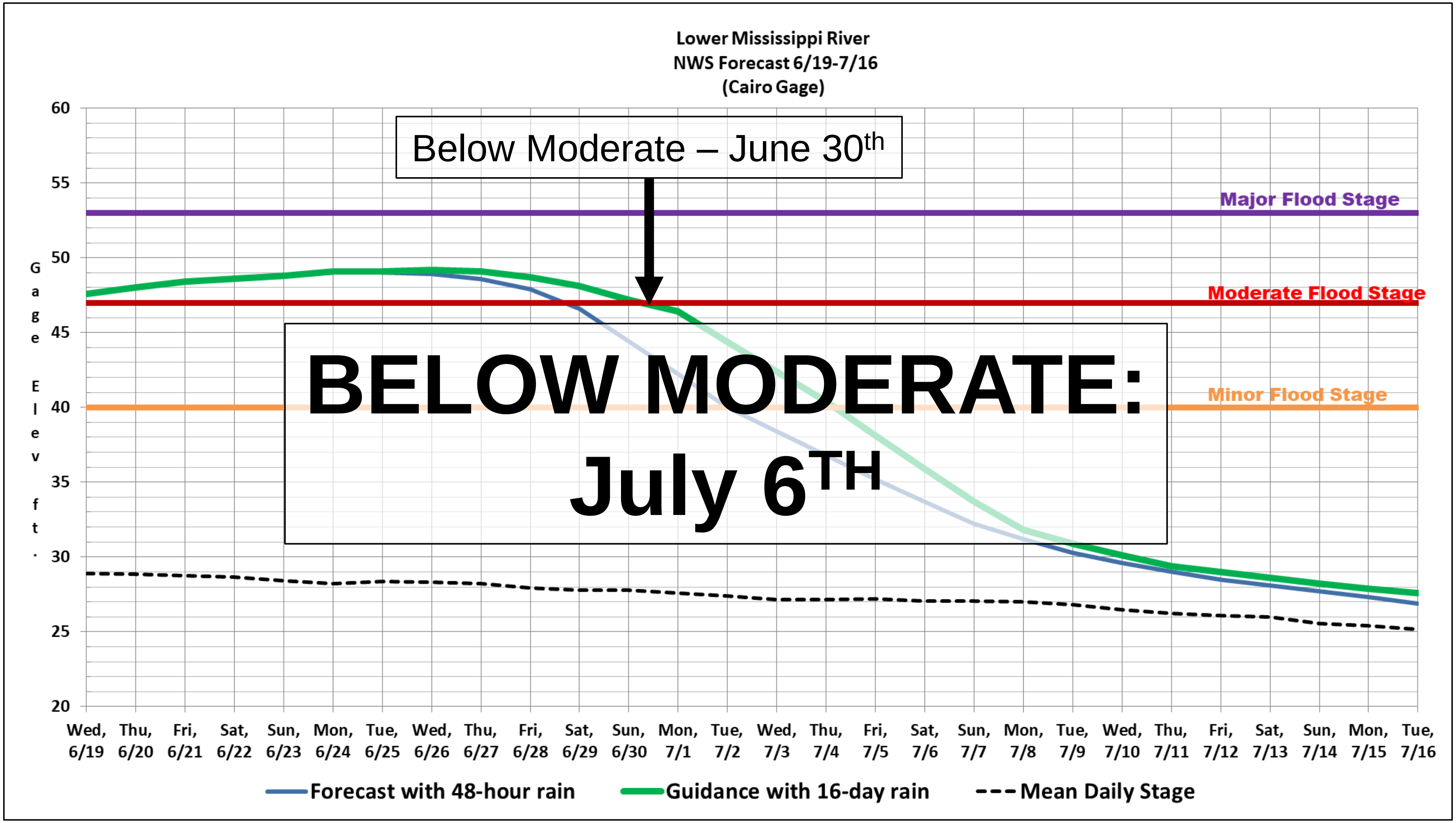

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IF LEAD TIMES ARE INSUFFICIENT

- Operational decisions are too conservative
  - Most common result
  - Many current WCMs designed around no forecast knowledge

- Operational decisions are not conservative enough
  - Less common (so far)
  - Older WCMs based on older hydrology
  - Climate change vs. stationarity

QUESTIONS?