Missouri River Mainstem Reservoir System

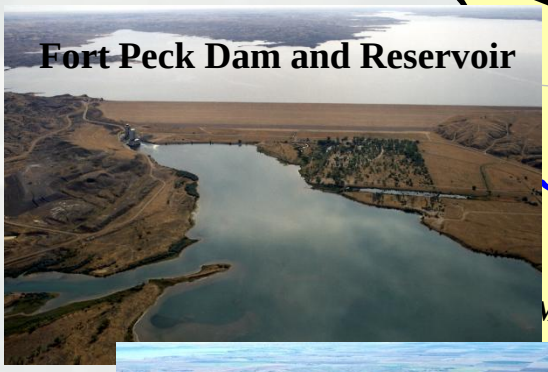
2011 Flood Regulation and 2011-2012 Draft AOP

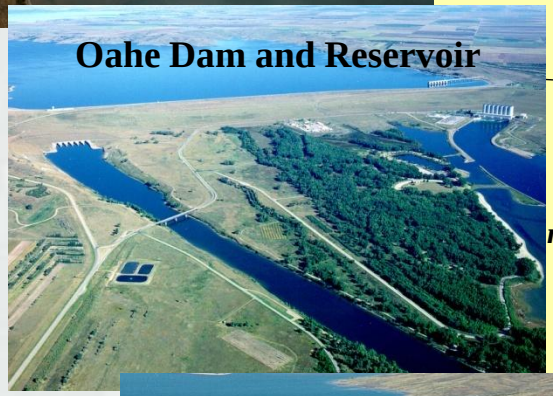
US Army Corps of Engineers

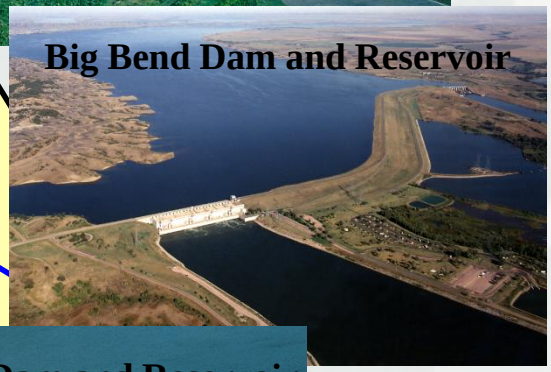
October 24th	7:00 p.m.	Omaha, NE
October 25th	7:00 p.m.	St. Joseph, MO
October 26th	7:00 p.m.	Overland Park, KS
October 27th	7:00 p.m.	Jefferson City, MO
October 31st	7:00 p.m.	Fort Peck, MT
November 1st	7:00 p.m.	Bismarck, ND
November 2nd	7:00 p.m.	Pierre, SD
November 3rd	7:00 p.m.	Sioux City, IA

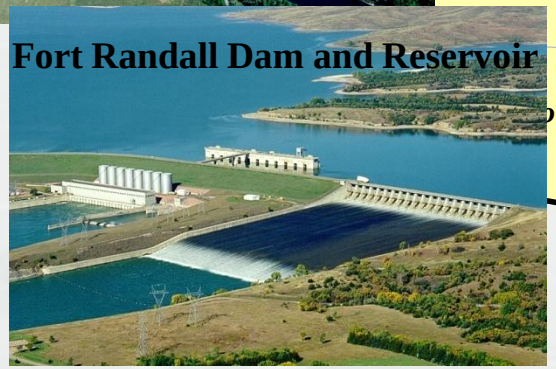
US Army Corps of Engineers
BUILDING STRONG®

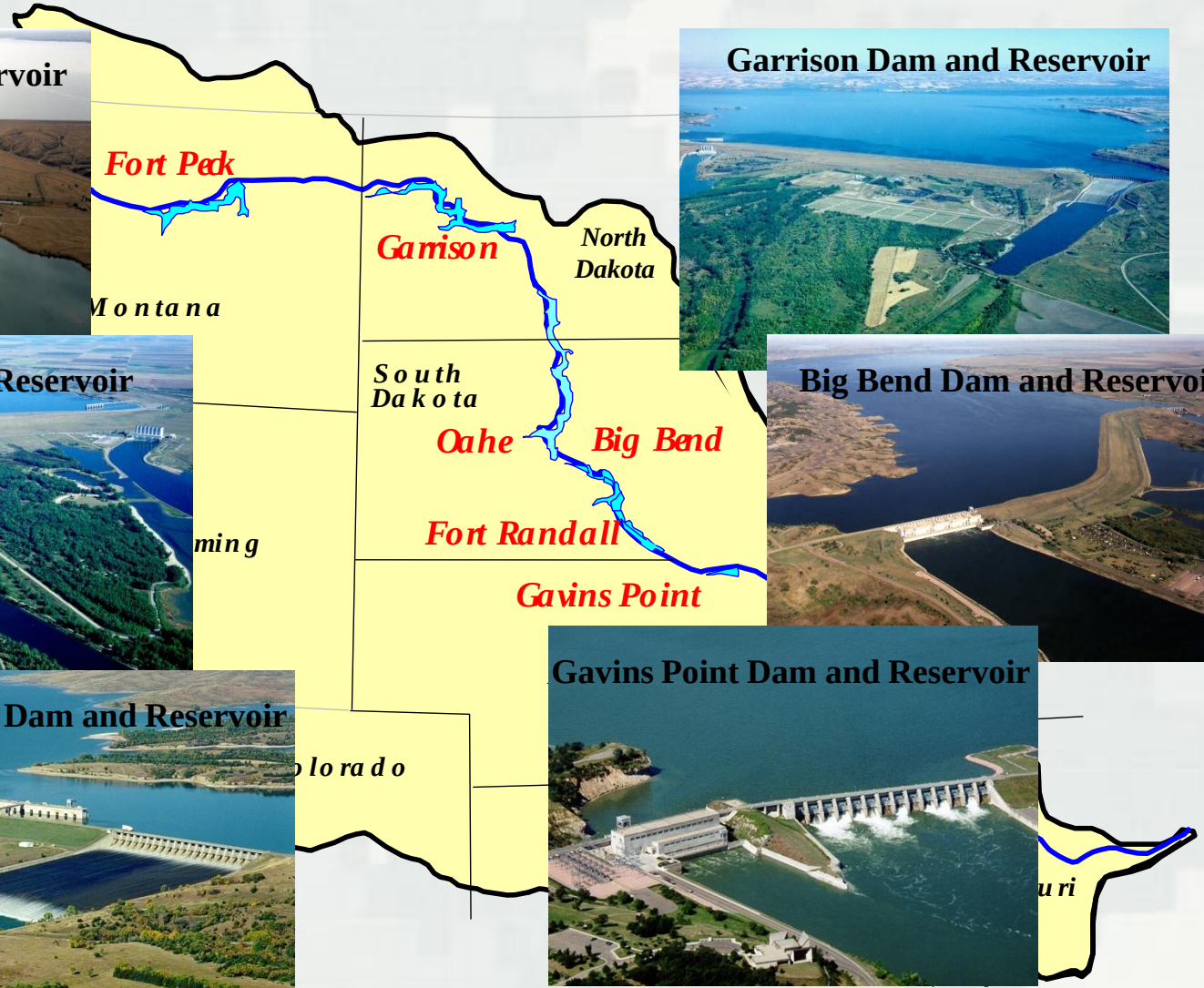
Missouri River Mainstem Reservoir System







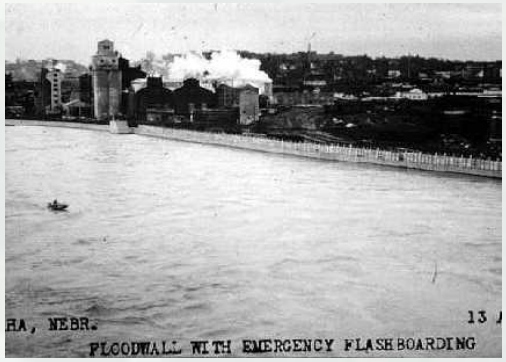




Our Mission

Regulate Missouri River Mainstem Reservoirs to Support Congressionally Authorized Purposes

Flood Control



Hydropower

Water Supply

Water Quality Control

Recreation

Navigation

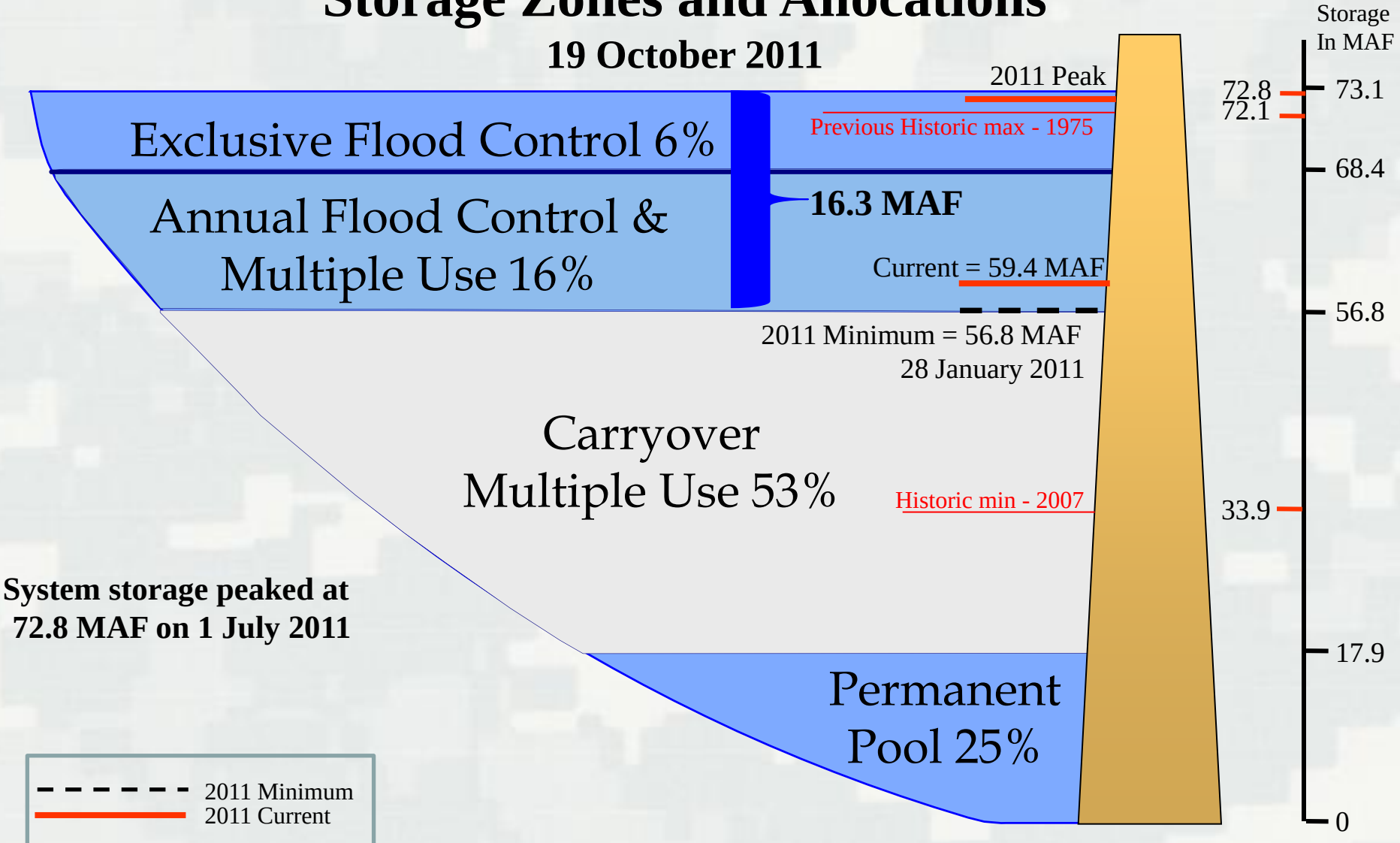
Fish and Wildlife

Including Threatened and Endangered Species

Irrigation

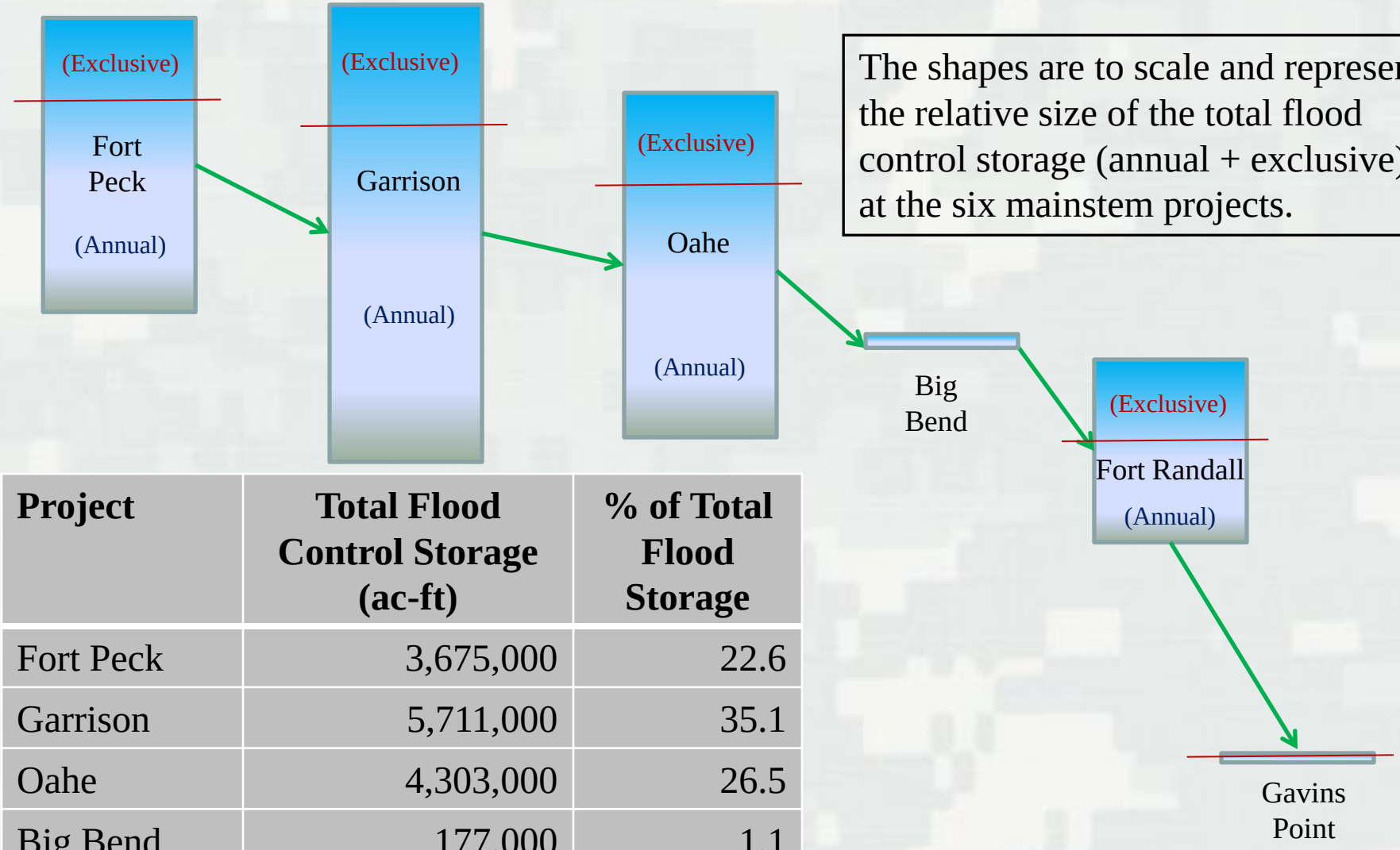
Missouri River Mainstem System Storage Zones and Allocations

19 October 2011



System storage peaked at 72.8 MAF on 1 July 2011

Flood Control Storage

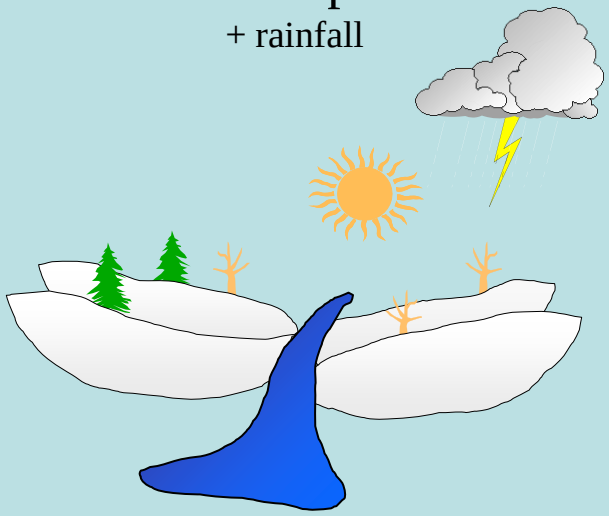


The shapes are to scale and represent the relative size of the total flood control storage (annual + exclusive) at the six mainstem projects.

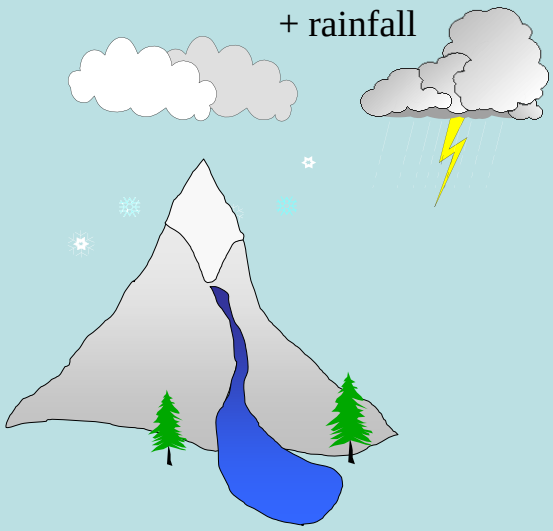
Project	Total Flood Control Storage (ac-ft)	% of Total Flood Storage
Fort Peck	3,675,000	22.6
Garrison	5,711,000	35.1
Oahe	4,303,000	26.5
Big Bend	177,000	1.1
Fort Randall	2,294,000	14.1
Gavins Point	108,000	0.7

Runoff Components

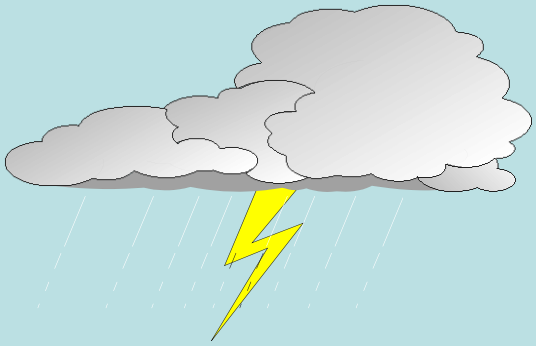
Plains Snowpack
+ rainfall



Mountain Snowpack
+ rainfall



Rainfall



March and April	May, June and July	March through October
~ 25% annual runoff	~ 50% annual runoff	

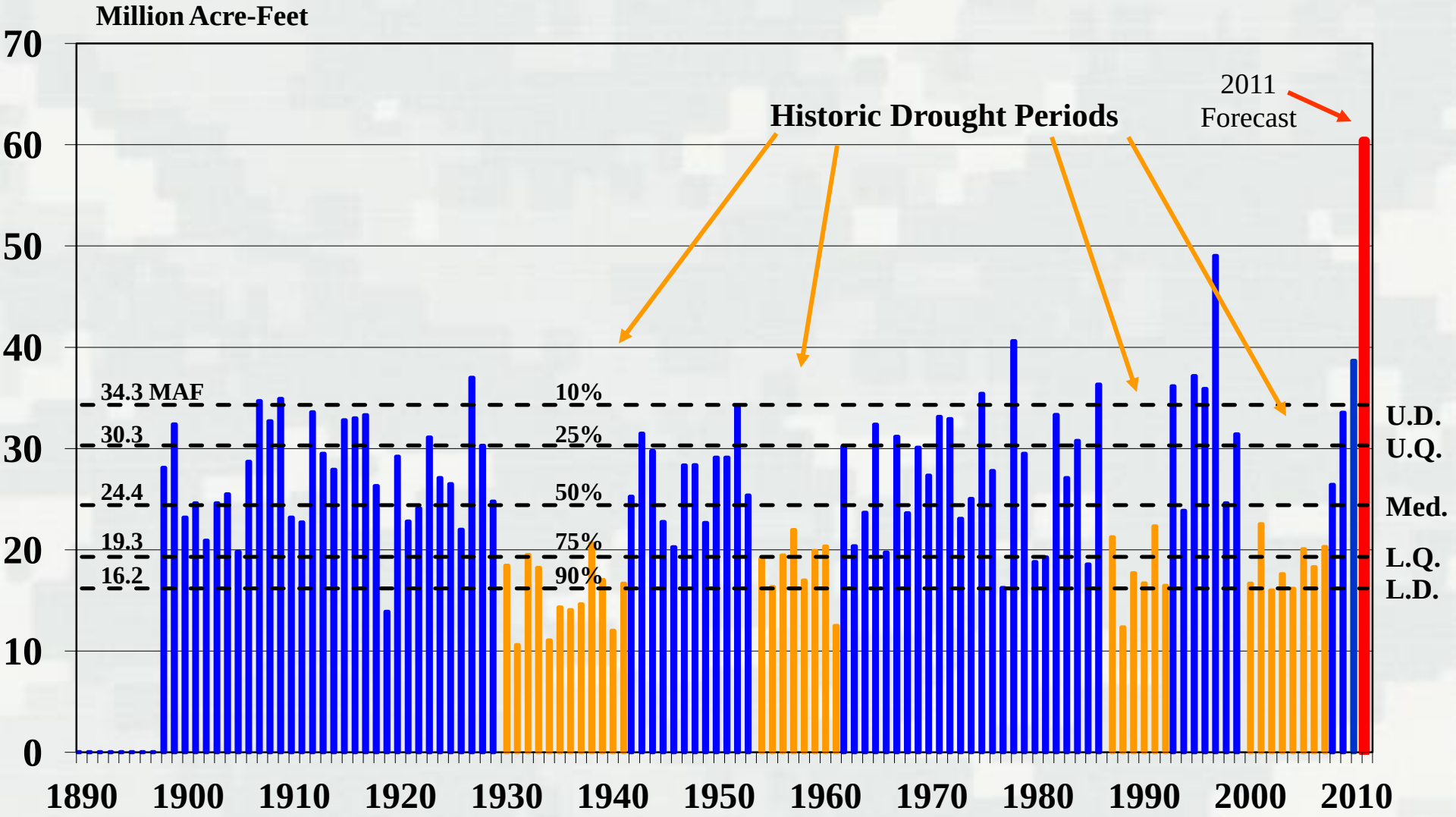
2011 Forecast* = 60.4 MAF

Highest runoff since 1898

Previous Record was 49.0 MAF in 1997

*October 1 Forecast

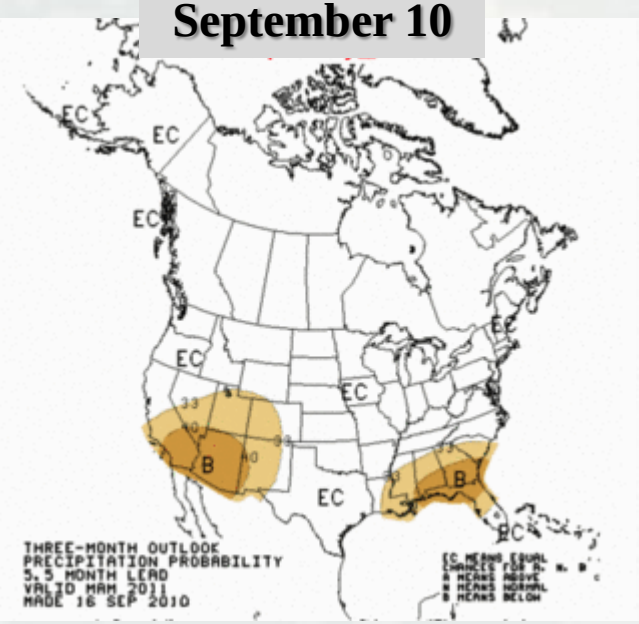
Missouri River Mainstem System
Annual Runoff above Sioux City, IA



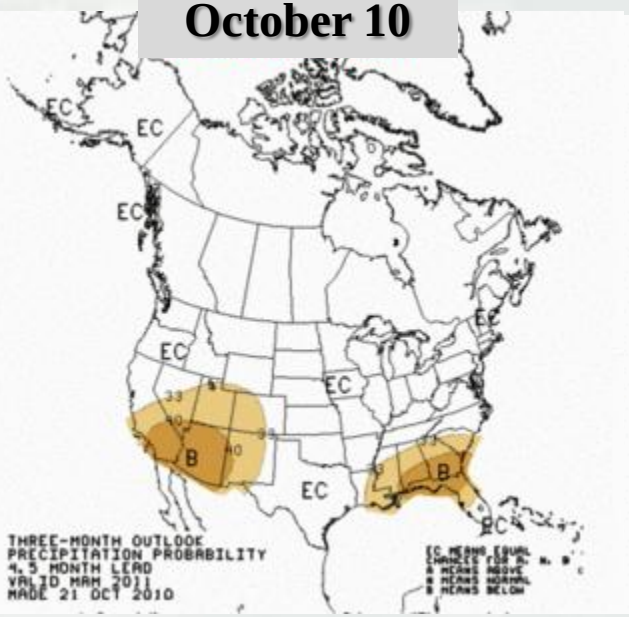
*October 1 Forecast

Long-Term Precipitation Forecast for Mar-Apr-May 2011

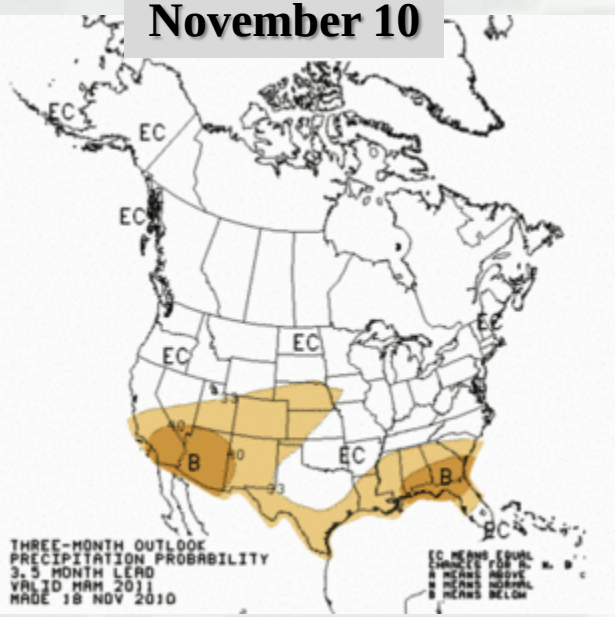
September 10



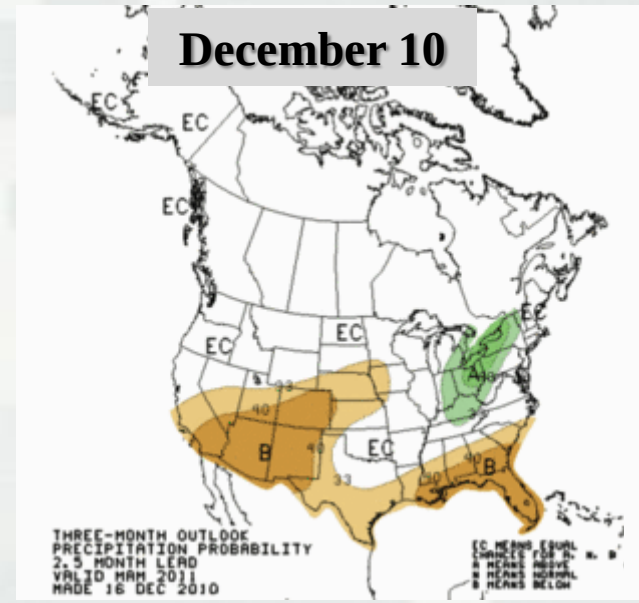
October 10



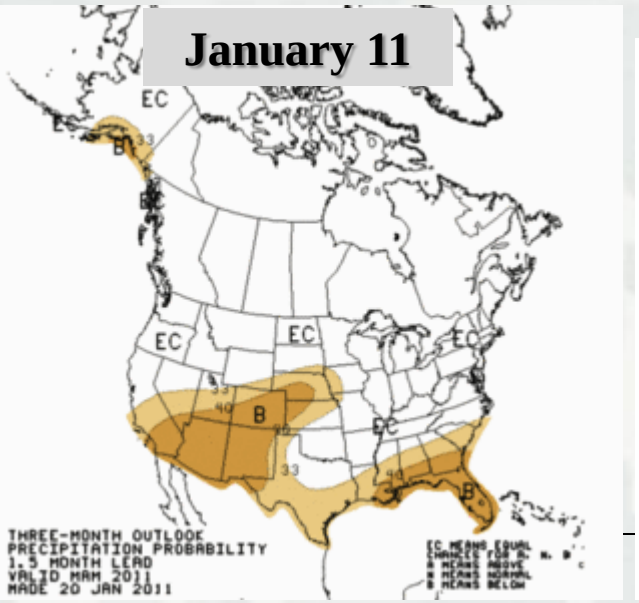
November 10



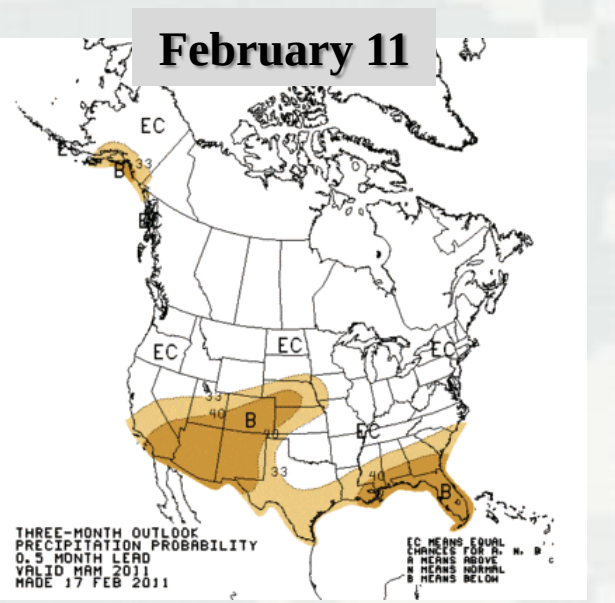
December 10



January 11

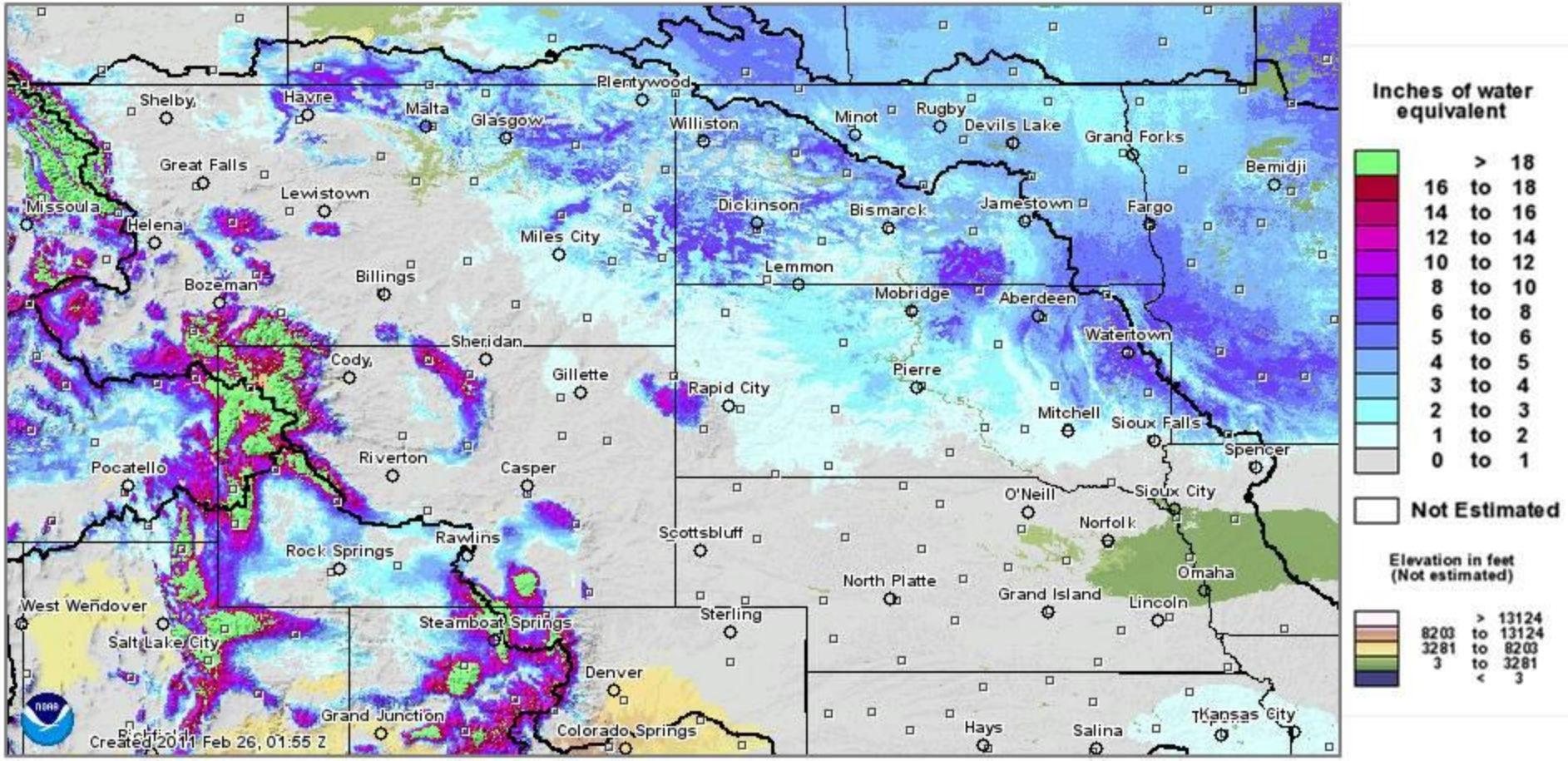


February 11

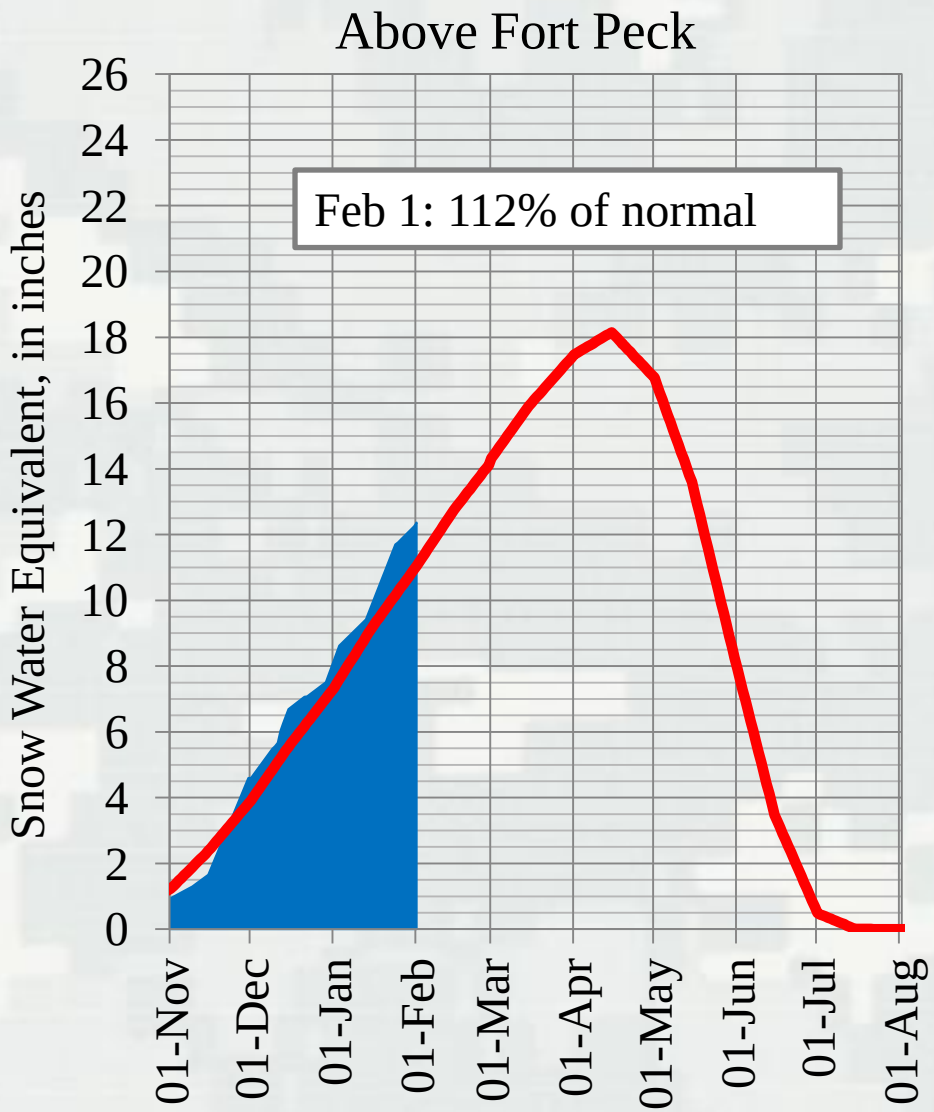


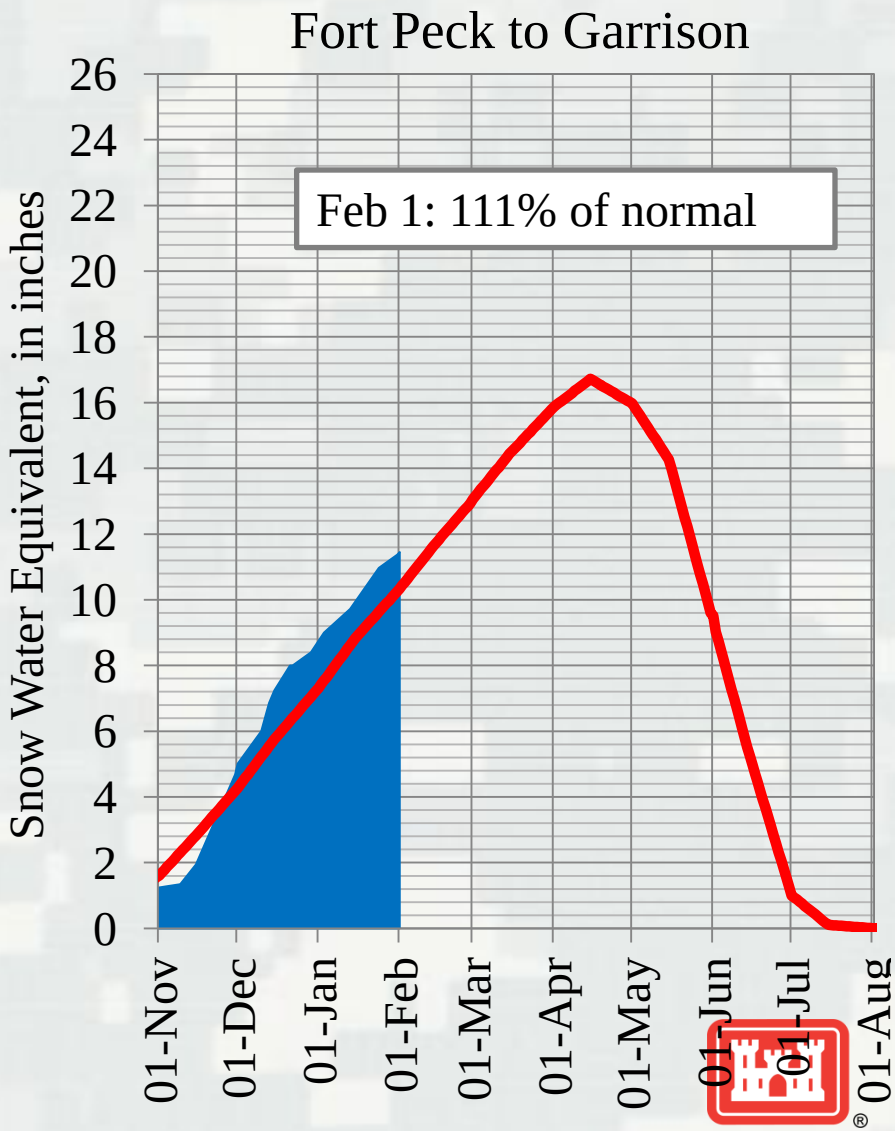
Peak - Plains Snowpack

25 February 2011



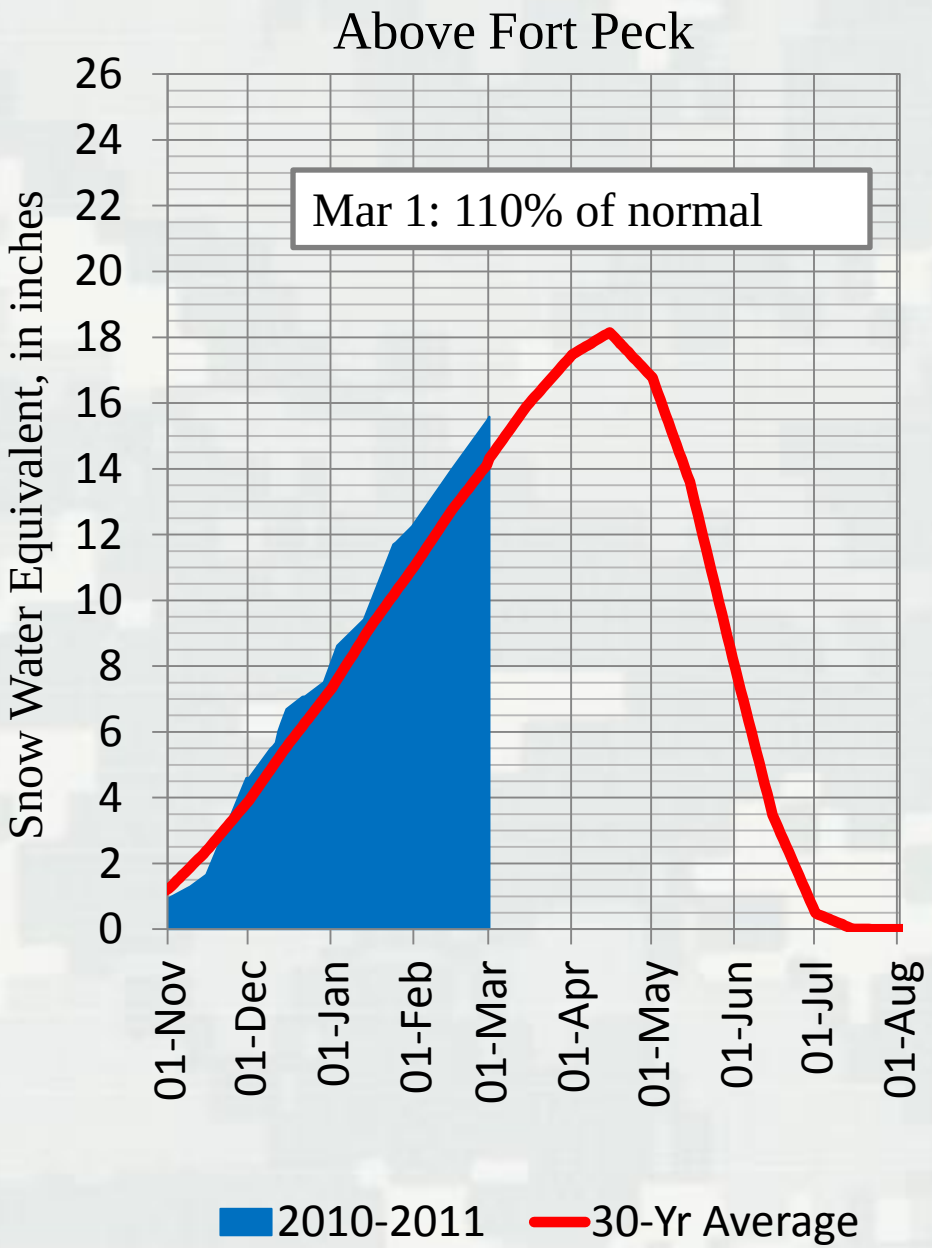
2010 – 2011 Mountain Snowpack

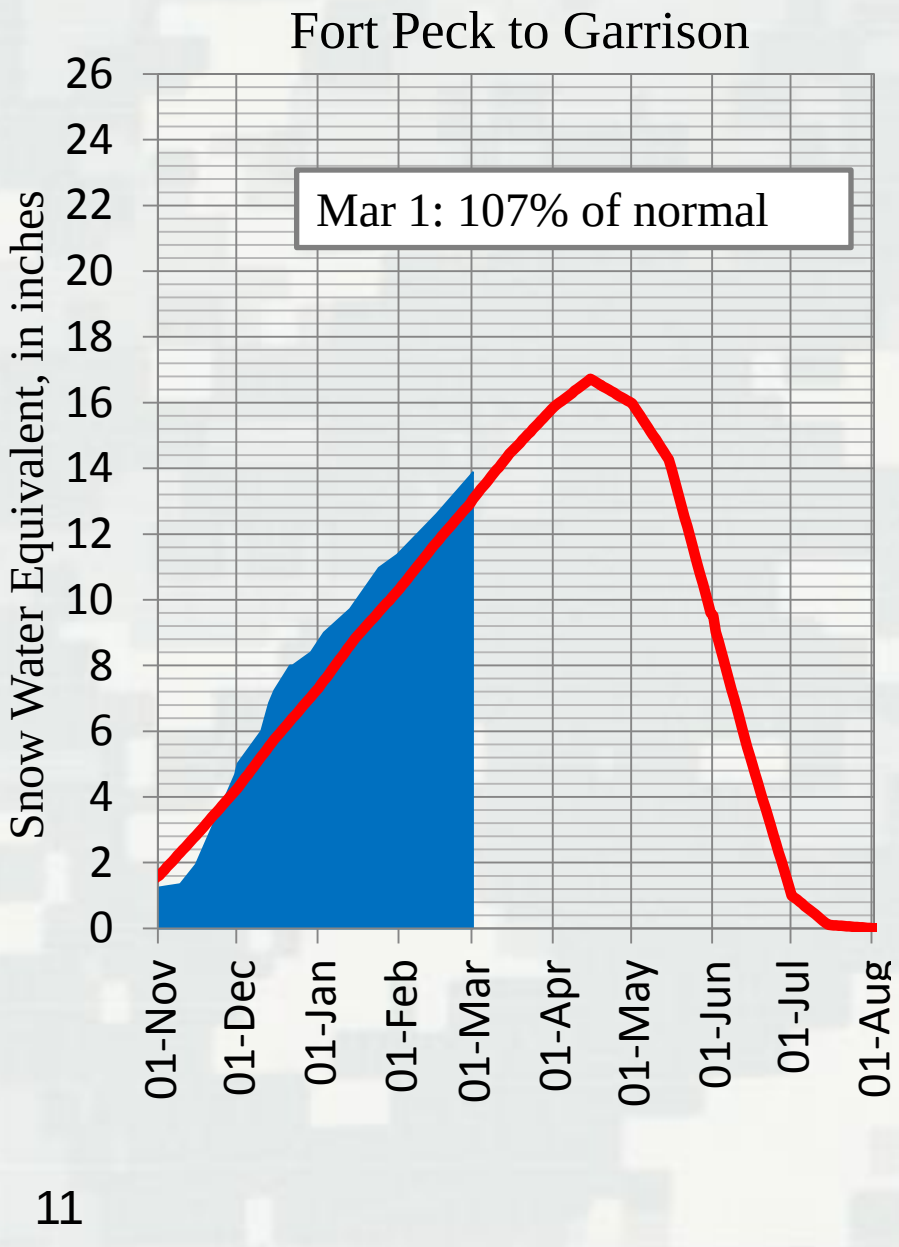




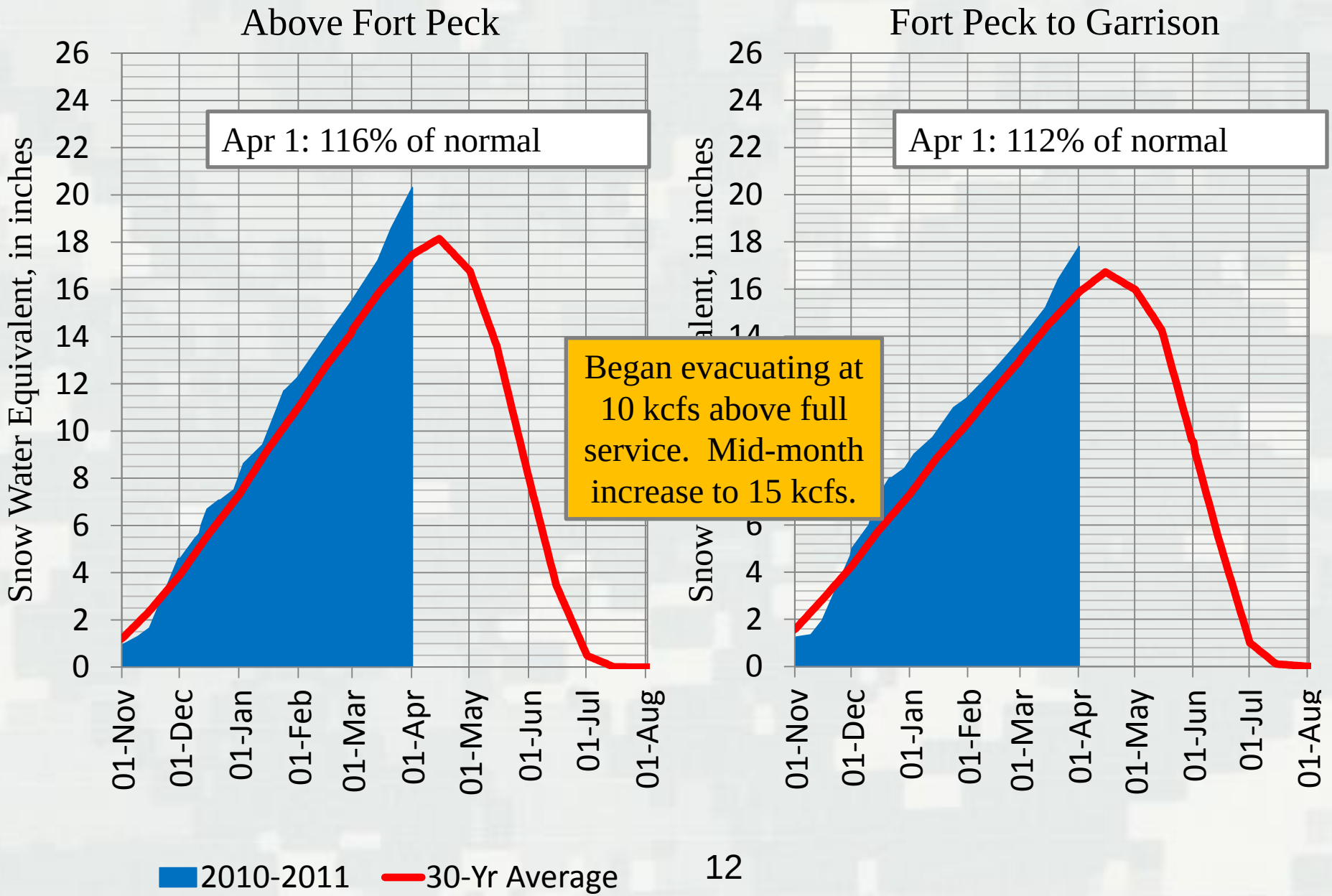
2010-2011 30-Yr Average

2010 – 2011 Mountain Snowpack

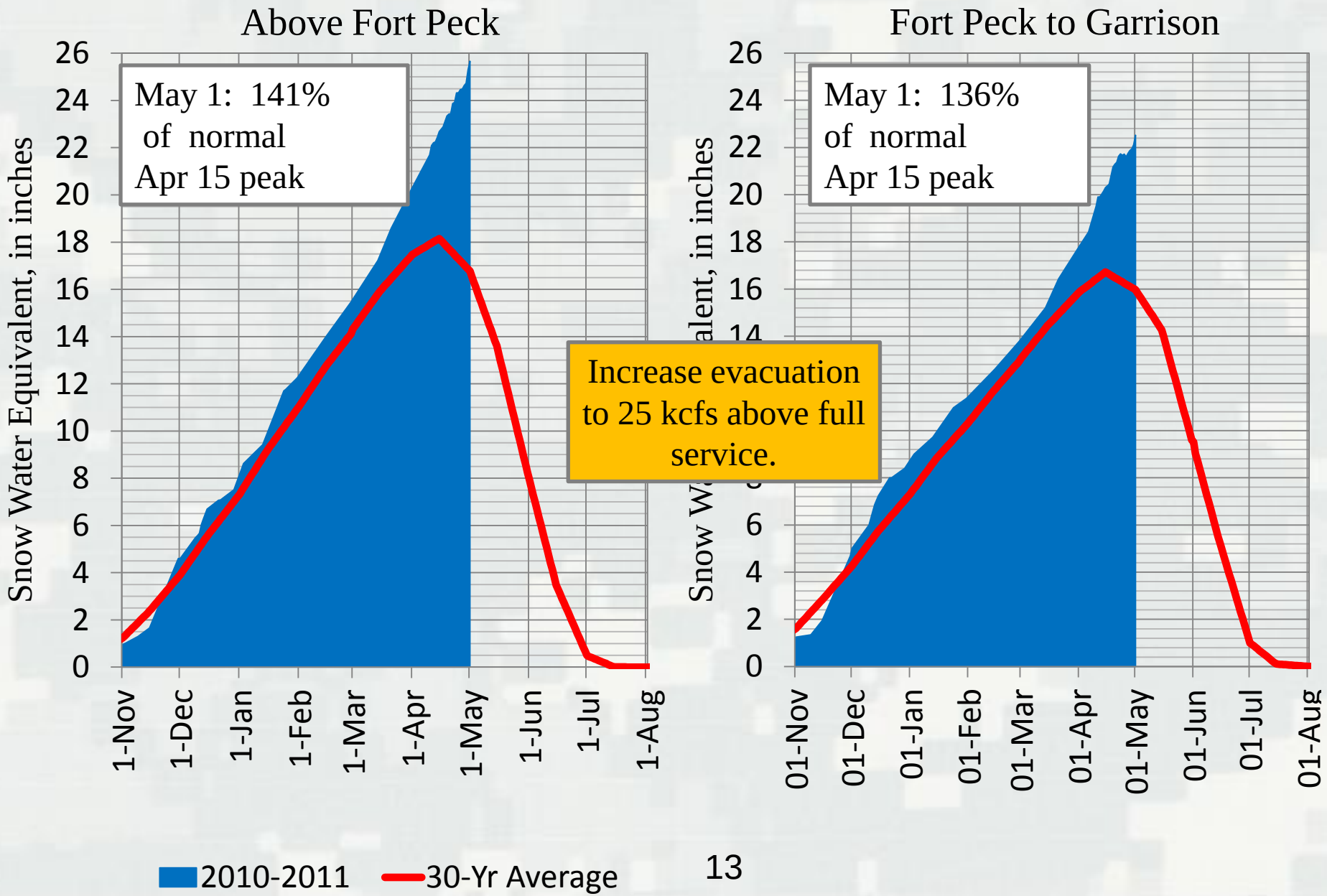




2010 – 2011 Mountain Snowpack

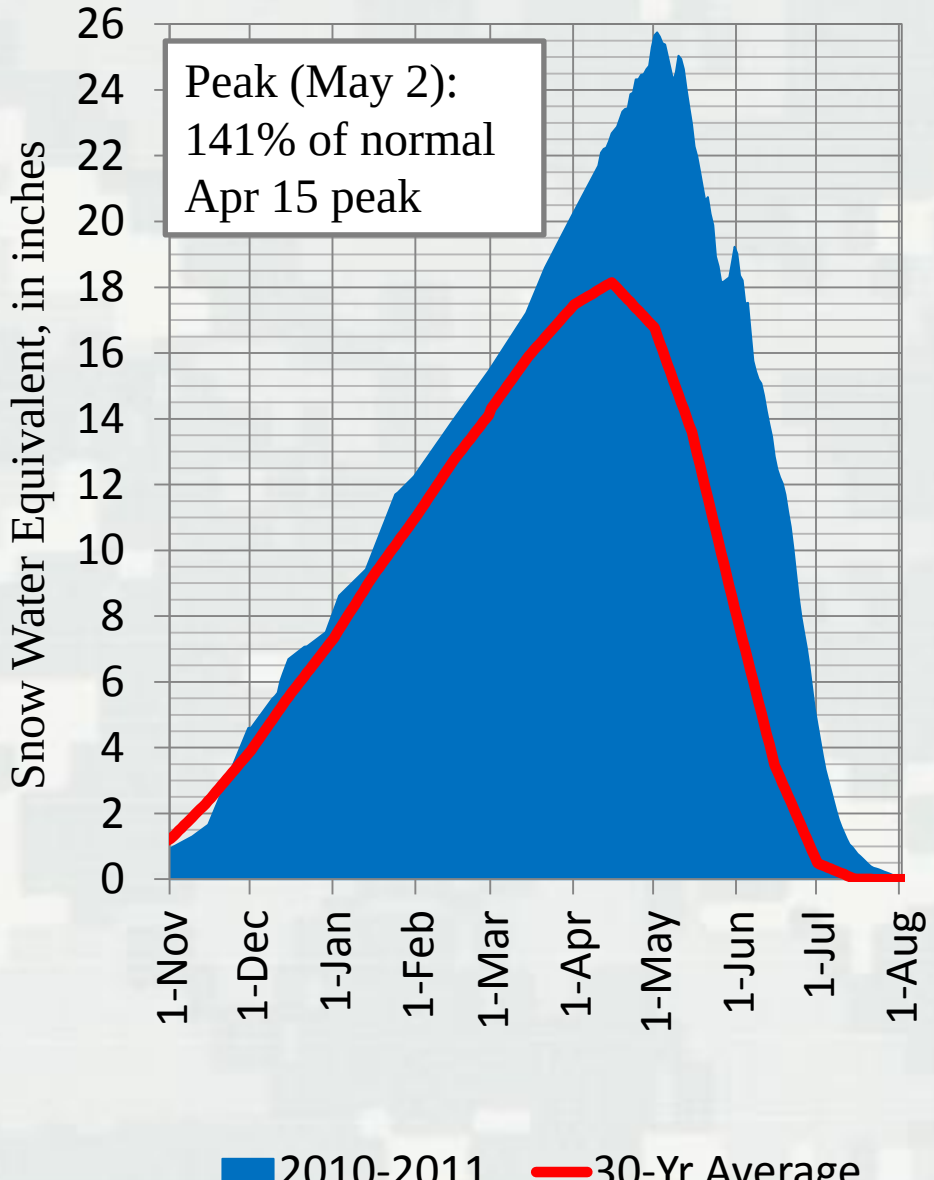


2010 – 2011 Mountain Snowpack

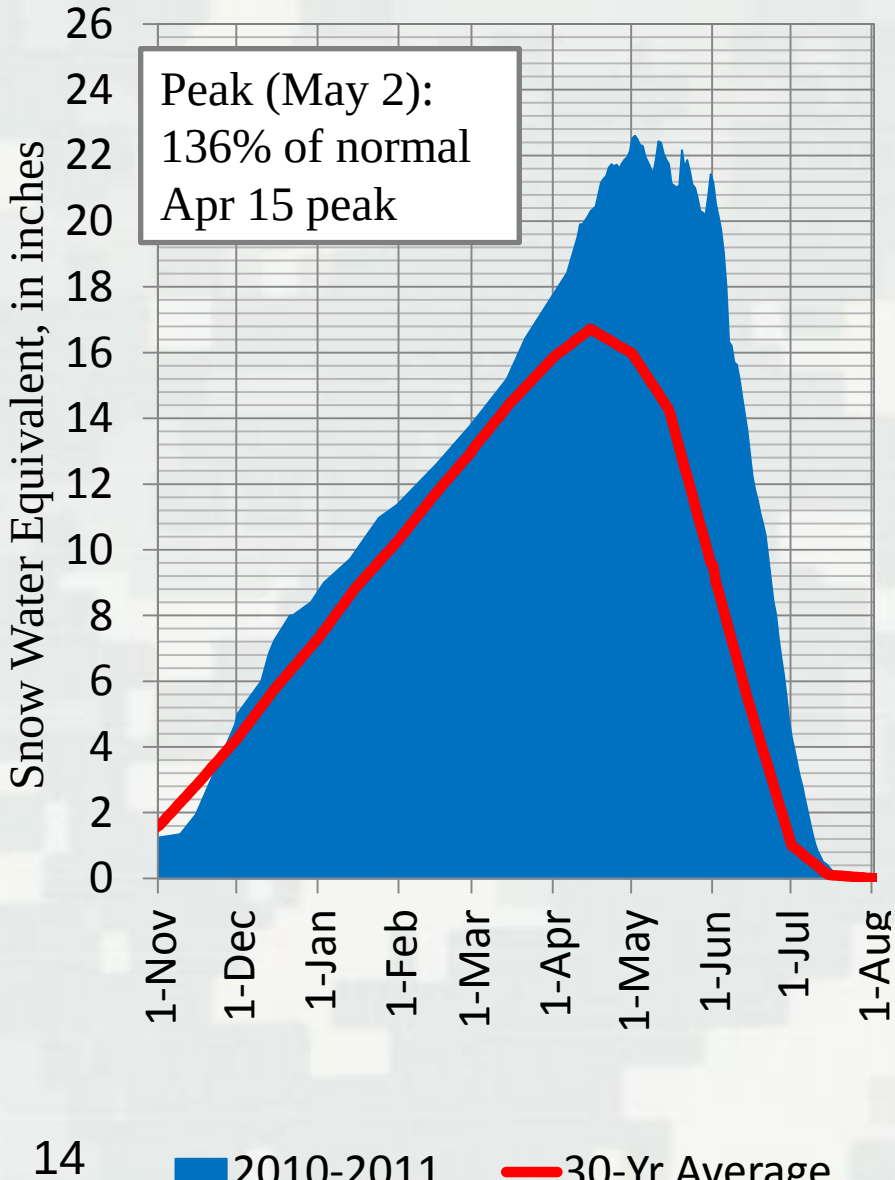


2010 – 2011 Mountain Snowpack

Above Fort Peck



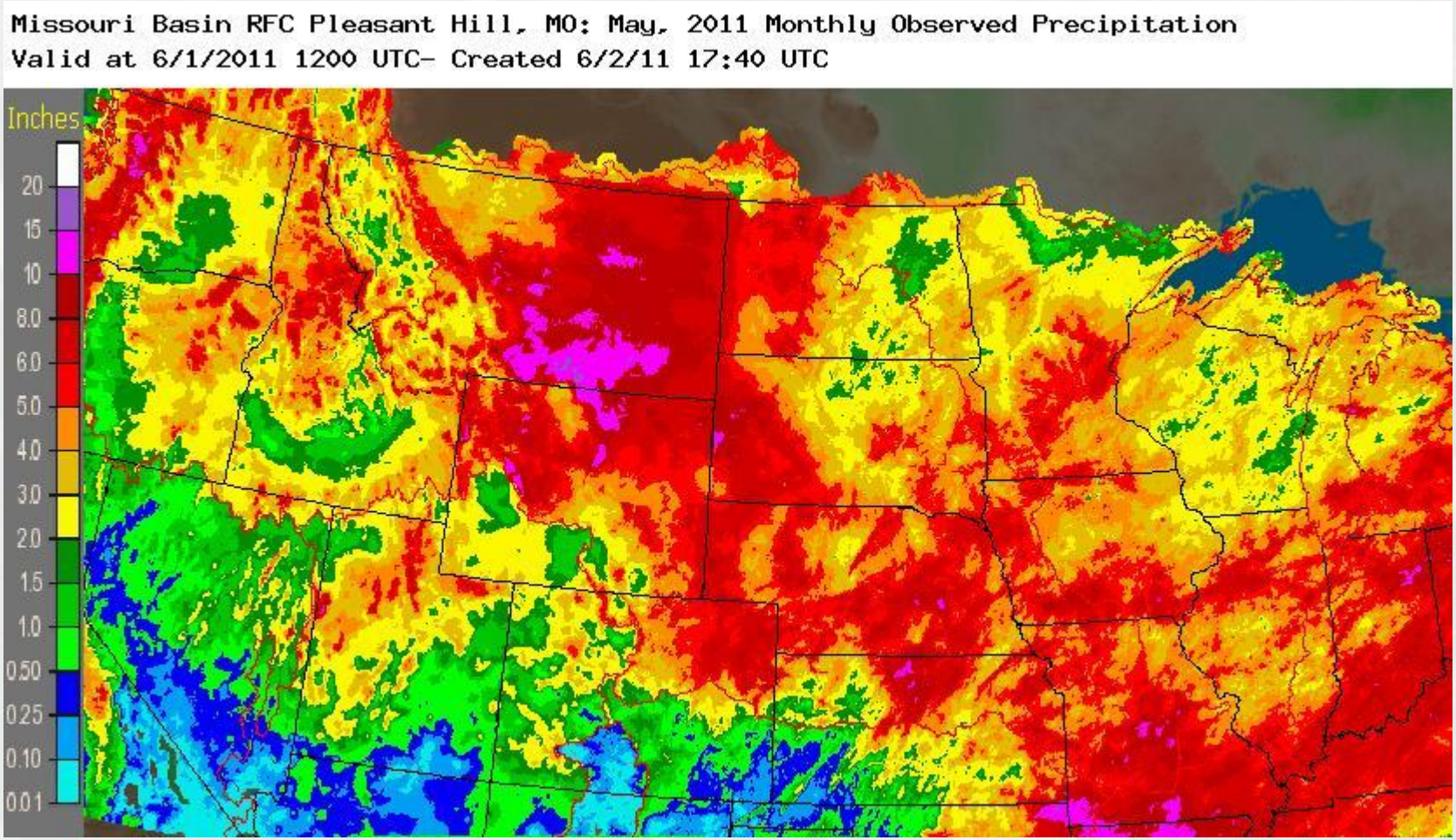
Fort Peck to Garrison



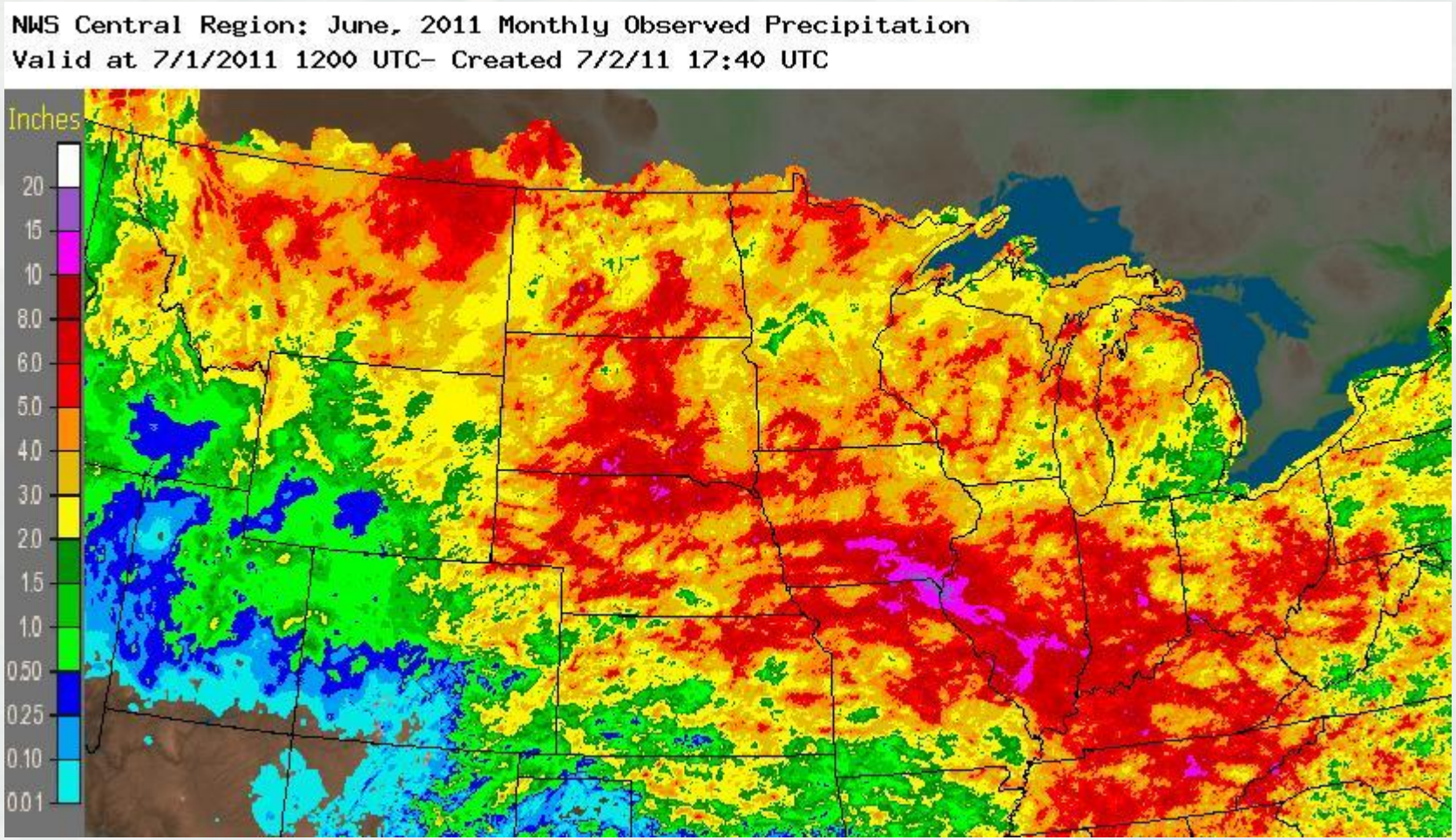
What We Forecast

- Full flood control capacity of the mainstem reservoir system was available at the start of the 2011 runoff season
  - 2010 was 3rd highest runoff year on record
  - All flood water was evacuated prior to start of runoff
- Until rain events in May, there was no need to evacuate water at historic levels
  - April 1 runoff forecast = 33.8 MAF
    - Runoff forecast near upper decile
    - Gavins Point peak releases = 39 to 45 kcfs
  - May 1 runoff forecast = 44.0 MAF
    - Forecast for second highest runoff on record
    - Gavins Point peak releases = 57.5 kcfs
  - June 1 runoff forecast = 54.6 MAF
    - Forecast for record runoff
    - Gavins Point peak releases = 150 kcfs

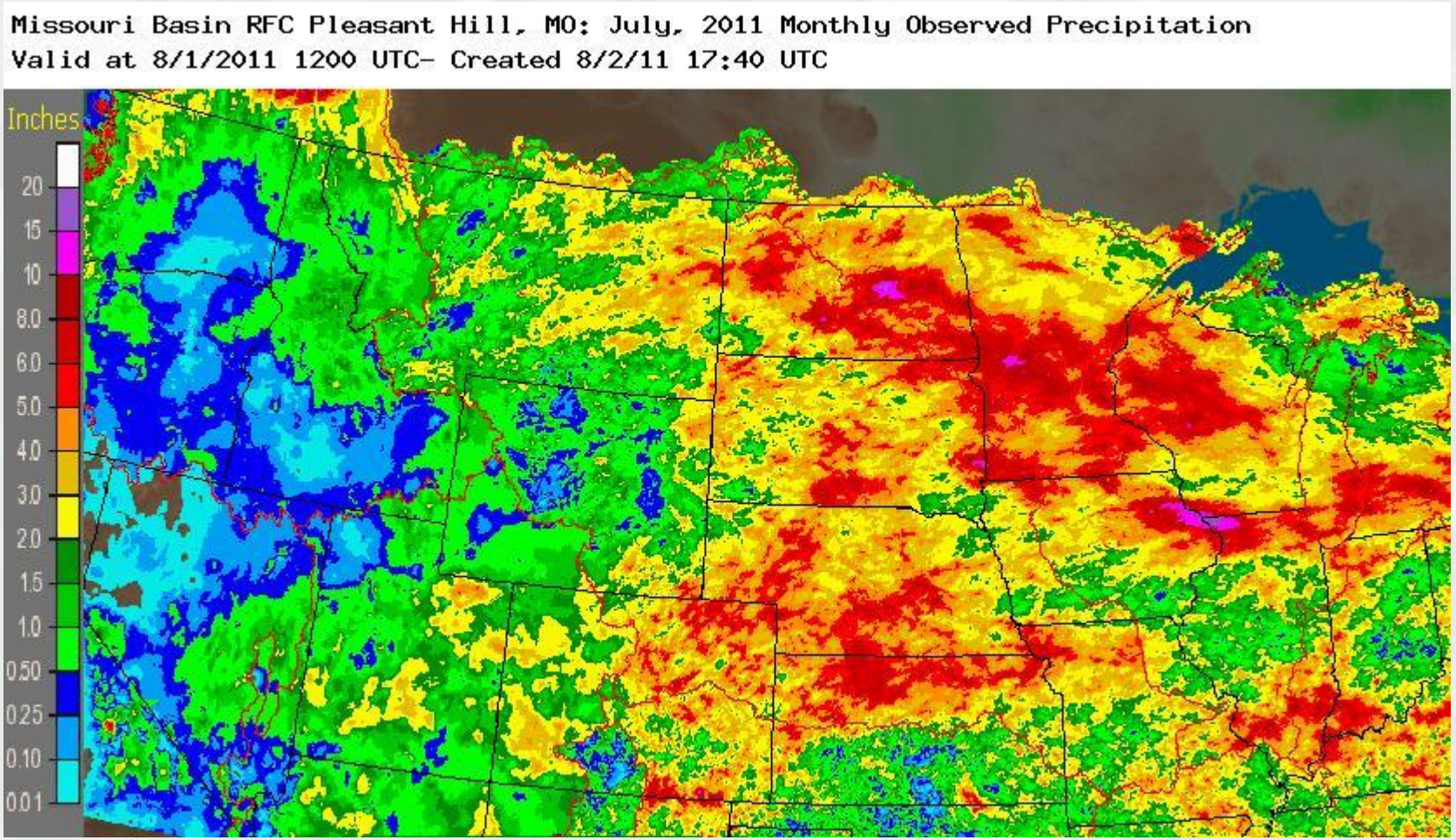
May 2011 Precipitation



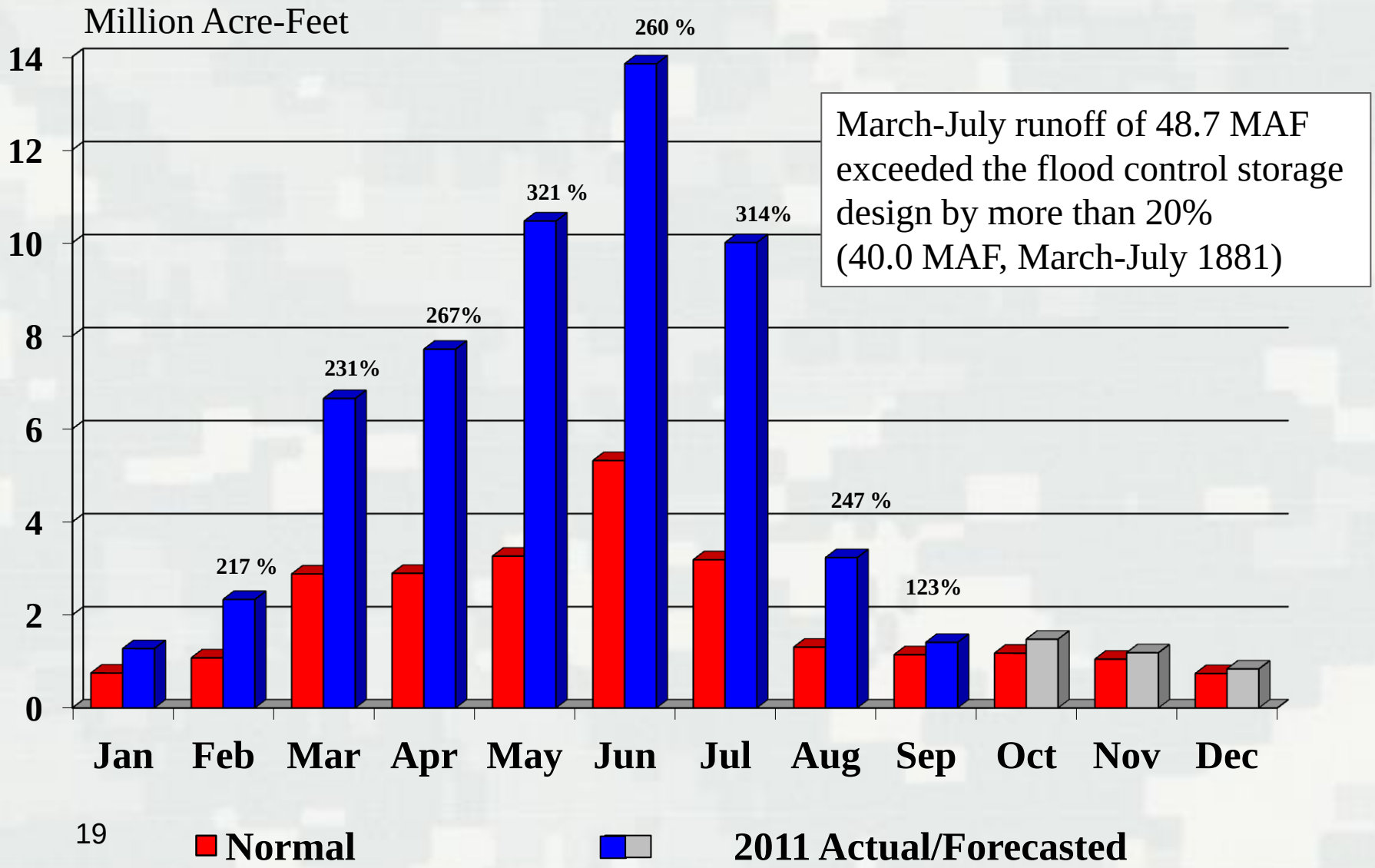
June 2011 Precipitation



July 2011 Precipitation



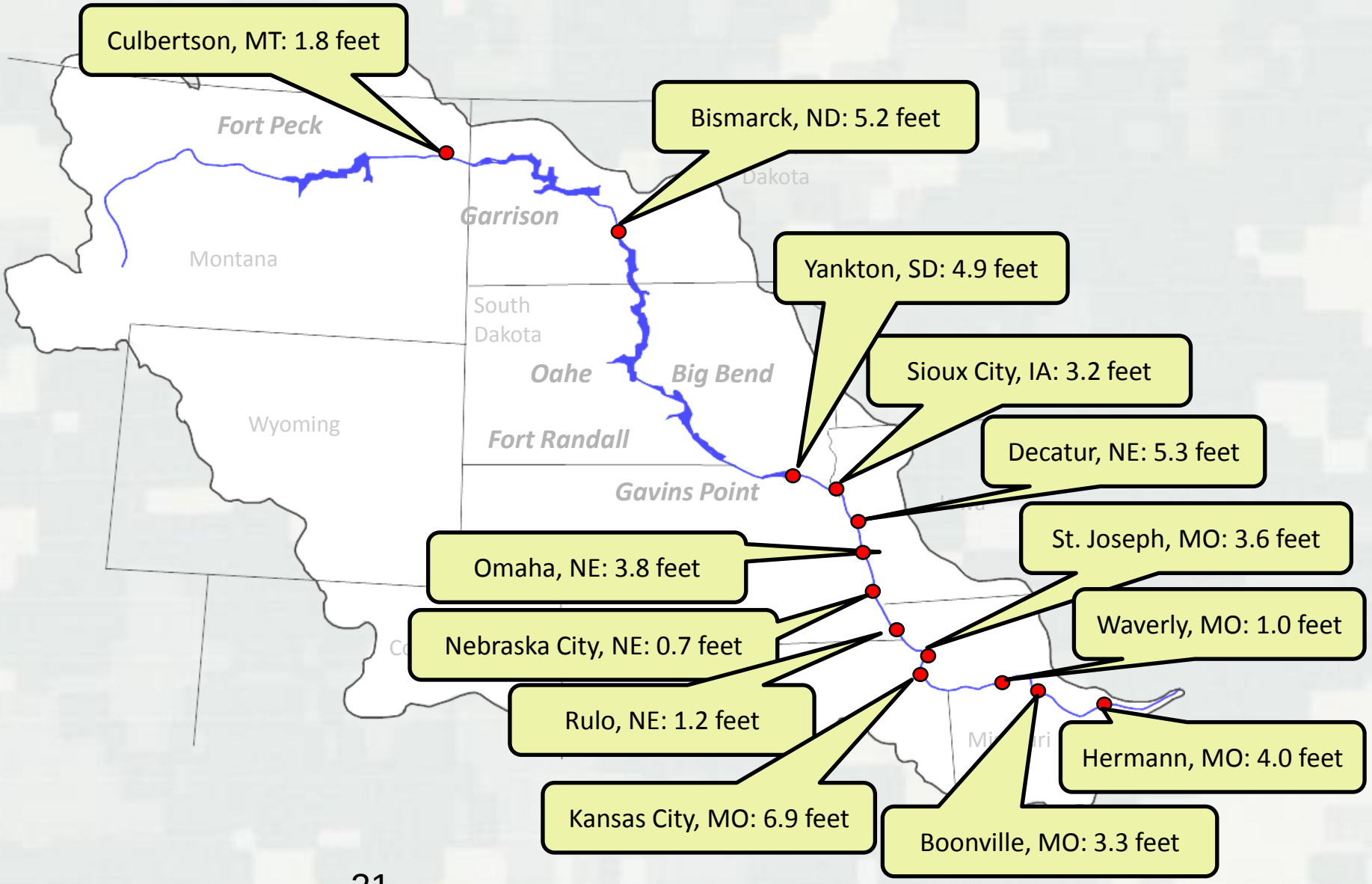
Missouri River Runoff above Sioux City
2011 Actual/Forecasted versus Normal



What Actually Happened

- Unprecedented runoff occurred in the Missouri River Basin above Sioux City, Iowa during May, June and July
  - June was the single wettest month on record with 13.8 MAF of runoff, surpassing the old record of 13.2 MAF set in April 1952.
  - May was the third wettest single month on record, with 10.5 MAF of runoff shattering the previous May record of 7.2 MAF set in May 1995
  - July was the fifth wettest single month on record with 10.0 MAF
  - **Combined May through July runoff of 34.3 MAF is higher than the total annual runoff in 102 of 113 years in the period of record**
  - 114 years of record (1898-2011)
    1. **June 2011 (13.8 MAF)**
    2. April 1952 (13.2 MAF)
    3. **May 2011 (10.5 MAF)**
    4. June 1909 (10.3 MAF)
    5. **July 2011 (10.0 MAF)**

Missouri River Stage Reduction Due to Reservoir Operations



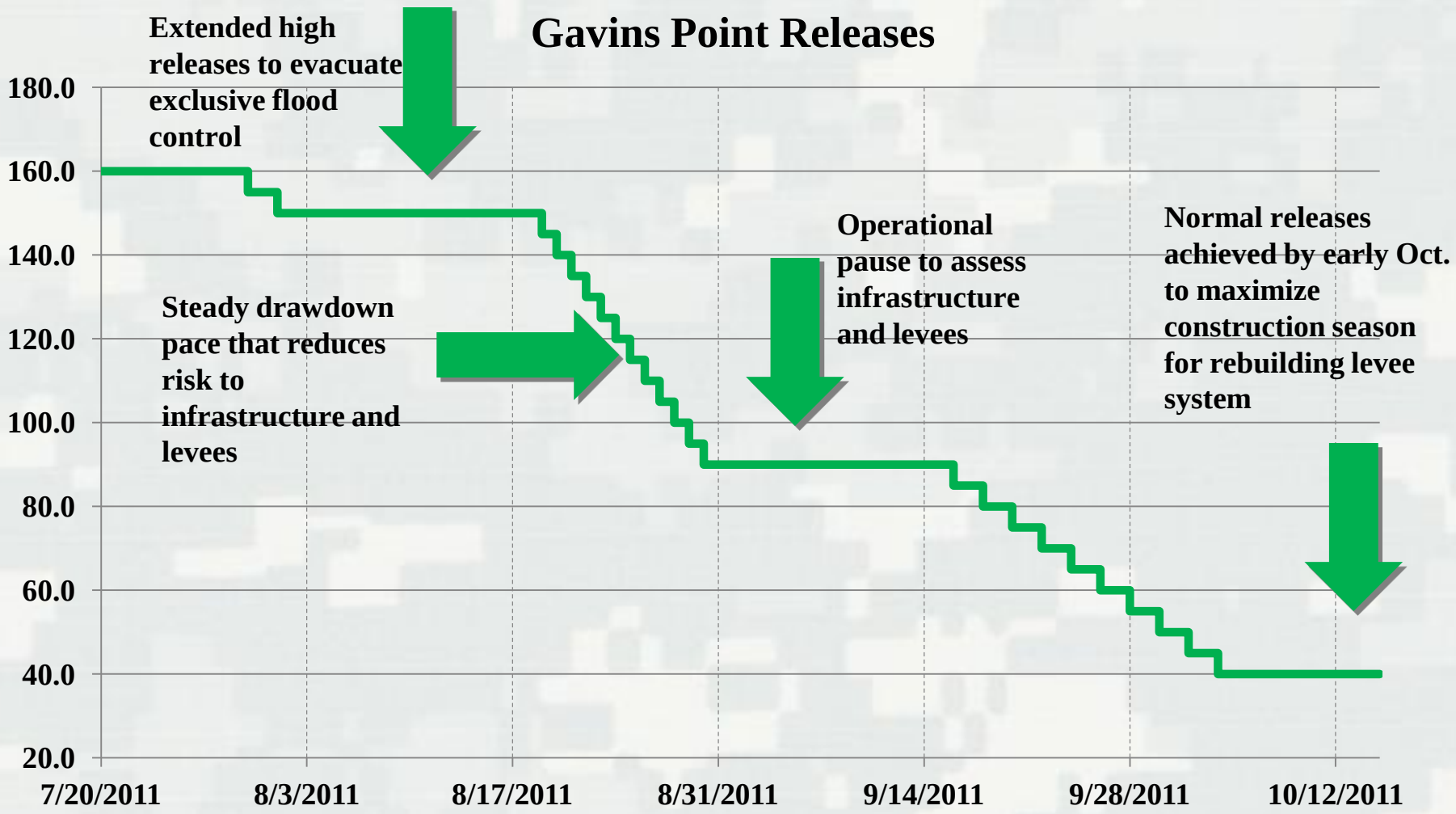
Preparing for 2012

- Determine best strategy to be ready for the 2012 runoff season
- Key Considerations
  - Return of citizens to homes, farms and businesses to begin recovery
  - Inspection, assessment and repair of infrastructure including dams and levees
- Primary Engineering Components
  - Flood control storage for 2012
  - Release rates – summer, fall and winter
  - Rates of change in releases

Why Still 16.3 MAF for Flood Control Storage?

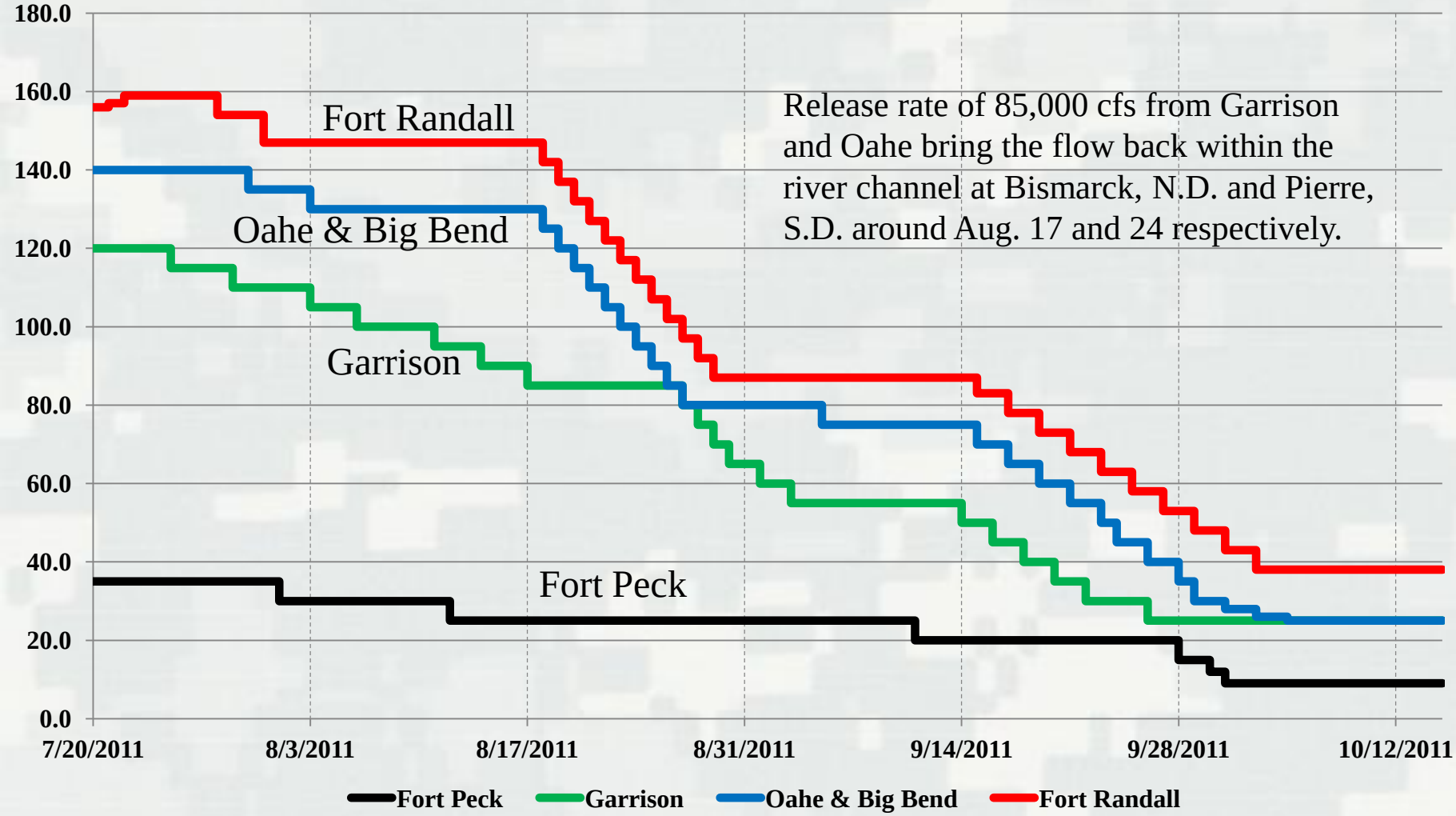
- Risk of levee failure with continued high releases
- Delay in flood recovery efforts for basin citizens and in the inspection and repair of infrastructure including dams and levees
- Low risk of repeat of 2011 runoff (0.2 percent)
- 16.3 MAF has been sufficient in 113 of the past 114 years to reduce flood risk without damaging releases

Drawdown Strategy



Drawdown Strategy

Fort Peck, Garrison, Oahe/Big Bend, and Fort Randall Releases



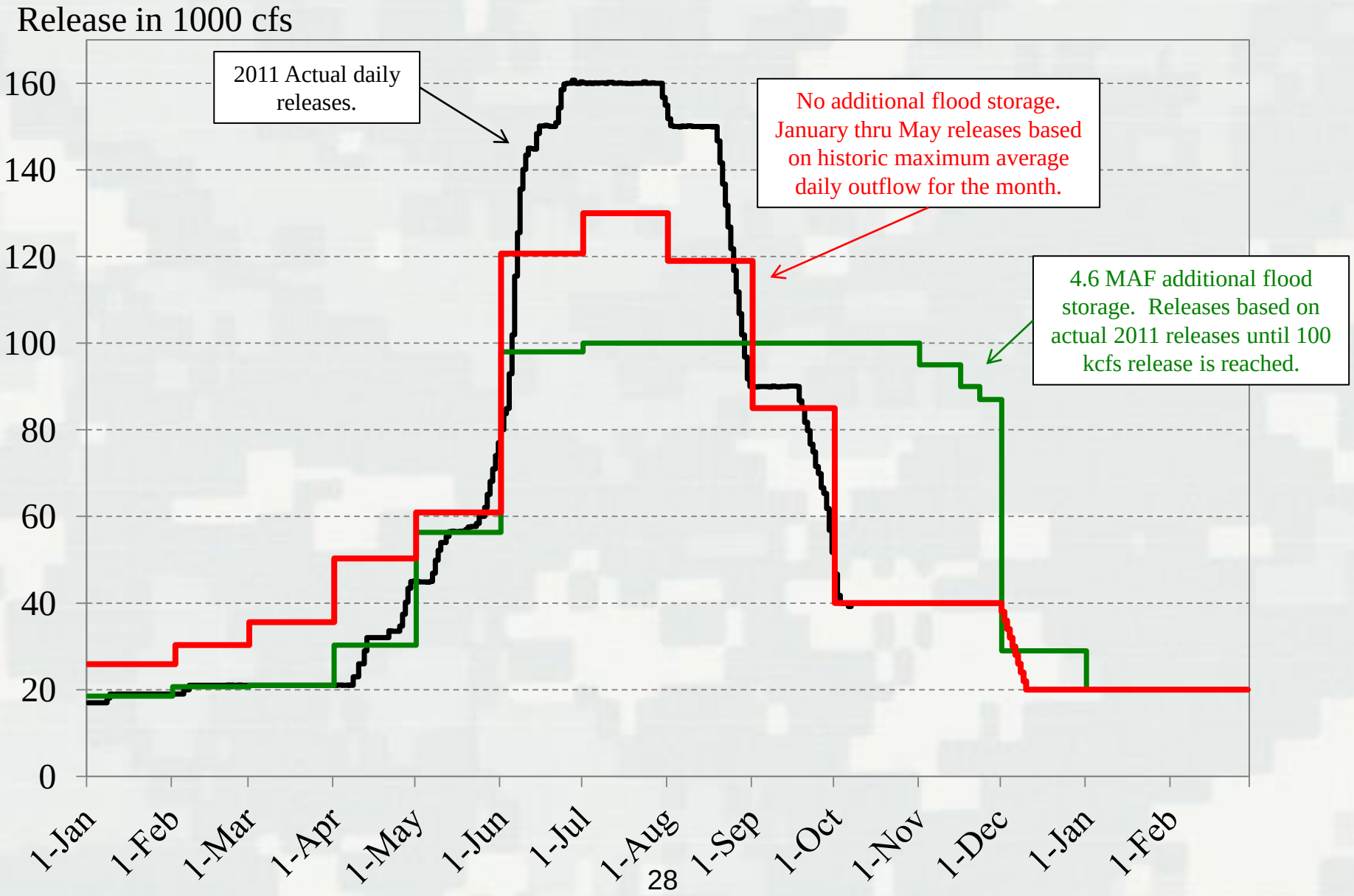
Post-Flood Assessment

- Missouri River Flood Task Force
- Water Management Technical Review
  - ► Independent External Peer Review
  - ► Internal Review - Post Flood Report
- Flood Fight Review
- Infrastructure Damage Assessment
- Basin Impact Assessment
- Repair and Restore Corps Infrastructure
- System Review and Recommendations

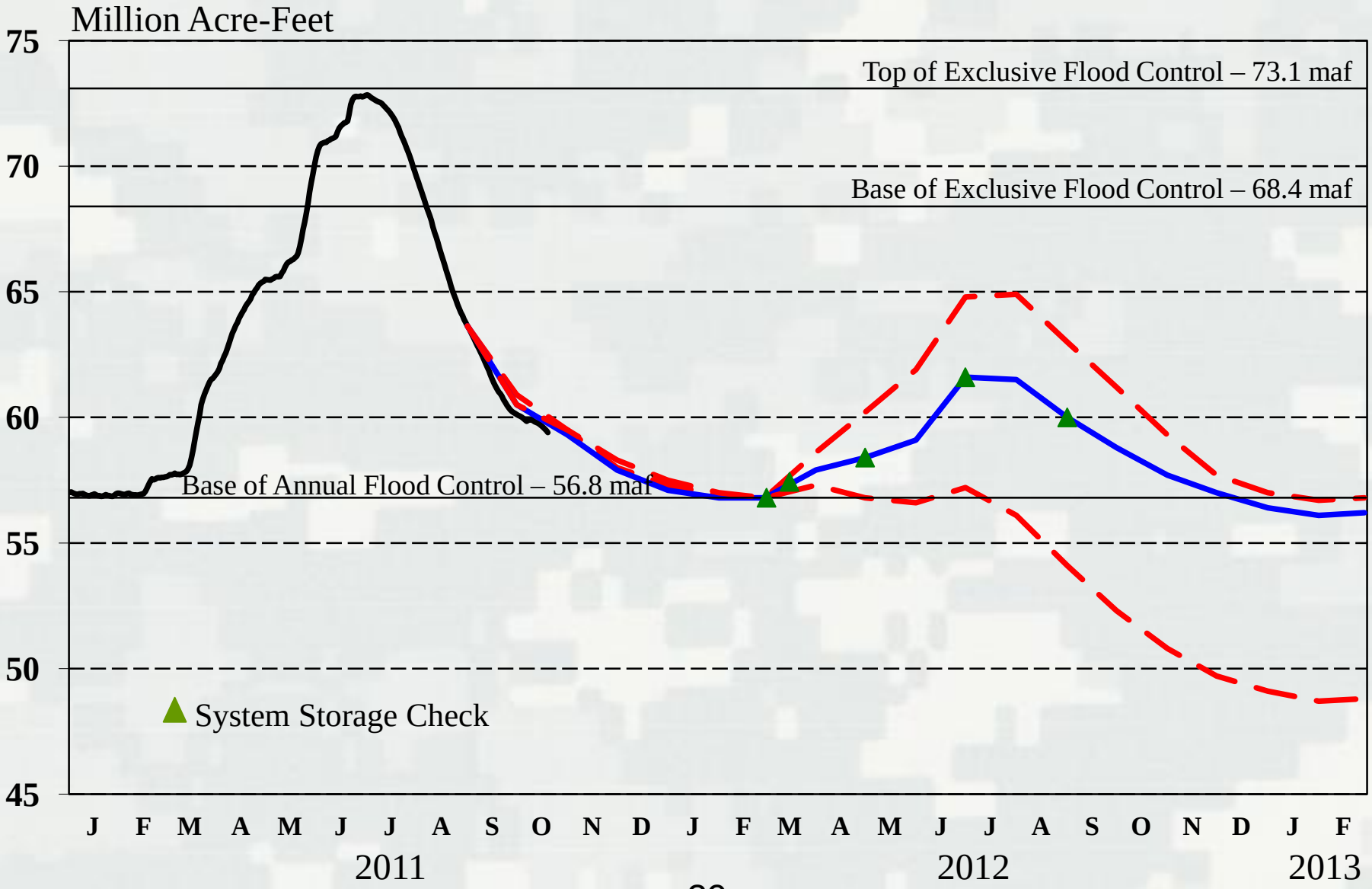
What If Questions

- What if releases had been higher earlier in the year?
- What if there had been additional flood storage?

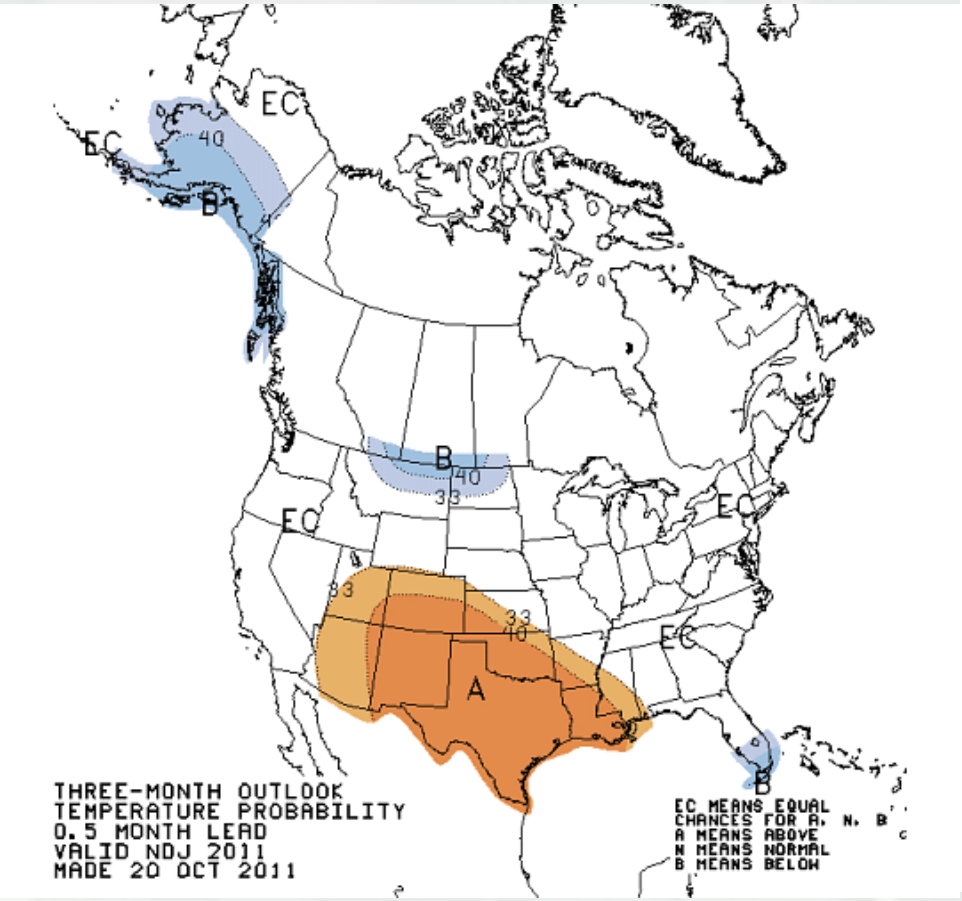
What If?
Gavins Point Releases

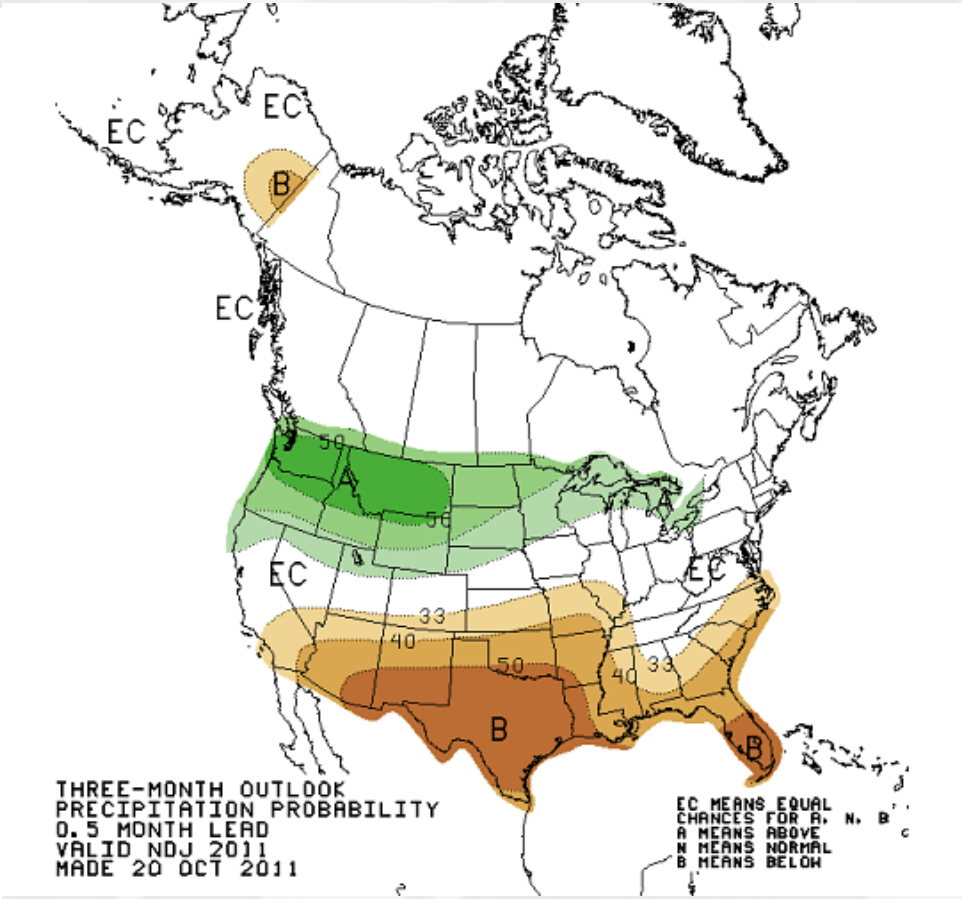


System Storage
2011-2012 Draft AOP



3-Month (NDJ) Temperature and Precipitation Forecast





Draft 2011-2012 Annual Operating Plan (AOP) Median Runoff Condition

- Flood Control
  - Entire flood control storage available in 2012 (16.3 MAF)
- Navigation
  - Full service flows to start season
  - Full service flows following July 1 storage check
  - Full length navigation season
- Hydropower
  - Annual Generation = 9.9 BkWh in 2012

Draft 2011-2012 Annual Operating Plan (AOP)
Median Runoff Condition

- Recreation, Water Supply, Water Quality and Irrigation
  - Near normal due to more normal reservoir levels and releases
  - Higher winter releases from Gavins Point
- Fish and Wildlife / Endangered Species
  - No spring pulses from Gavins Point
  - Favor Fort Peck and Oahe during forage fish spawn
  - No intrasystem unbalancing in 2012
  - No Fort Peck spring pulse pending results of modification of Intake Diversion Dam on the Yellowstone
  - Minimize zero releases at Fort Randall to the extent reasonably possible during the nesting season

Thank You!

Jody Farhat, P.E.	402.996.3840	jody.s.farhat@usace.army.mil
Kevin Grode, P.E.	402.996.3870	kevin.r.grode@usace.army.mil
Mike Swenson, P.E.	402.996.3860	michael.a.swenson@usace.army.mil

http://www.nwd-mr.usace.army.mil/rcc/