



# **NWS' Howard Hanson Dam decision support: new observations, services, and guidance**

---

**Brad Colman, Sc.D.**

**National Weather Service - Seattle/Tacoma**

**HMT-West 2010 Annual Meeting**

**7-8 October 2010**

**Santa Rosa, California**



# Howard Hanson Dam



*Green River*

*Landslide  
Debris*

*Eagle Gorge  
Reservoir*



# Key Planning Partners

- **USACE and FEMA**
- **Washington State Emergency Management Division (WSEMD)**
- **King County (Emergency Operations and Flood Warning Center)**
- **Cities (Auburn, Kent, Renton, and Tukwila)**
- **NWS (HDQTRS, WR, WFO Seattle and NWRFC)**



# National Weather Service Flood Bulletins



## Weather and Flood Bulletins



Time to onset of event (hours)



Increasing confidence event will occur



# An Urgent Community Need: Lead Time



- **Staging equipment and supplies (up to 10 days)**
- **Evacuation of facilities (up to 5 days)**
- **Minimum of 3 days for most activities**





# Request:



“We need Macro Level Trigger Points (Minimal, Low, Moderate concern) for **Long-Lead** Flood Response Activities for the Green River Basin.” **From a 2 November 2009, Trigger Point development meeting**

# Action:

The Northwest River Forecast Center, Seattle Weather Forecast Office, and USACE – Seattle District, initiated a collaborative project to establish **24-hour Forecast Precipitation Thresholds** with probability information that could be linked to three different long-lead Flood Concern Levels (Minimal, Low, Moderate) on the Green River.



# Analysis Method (NWRFC and USACE)



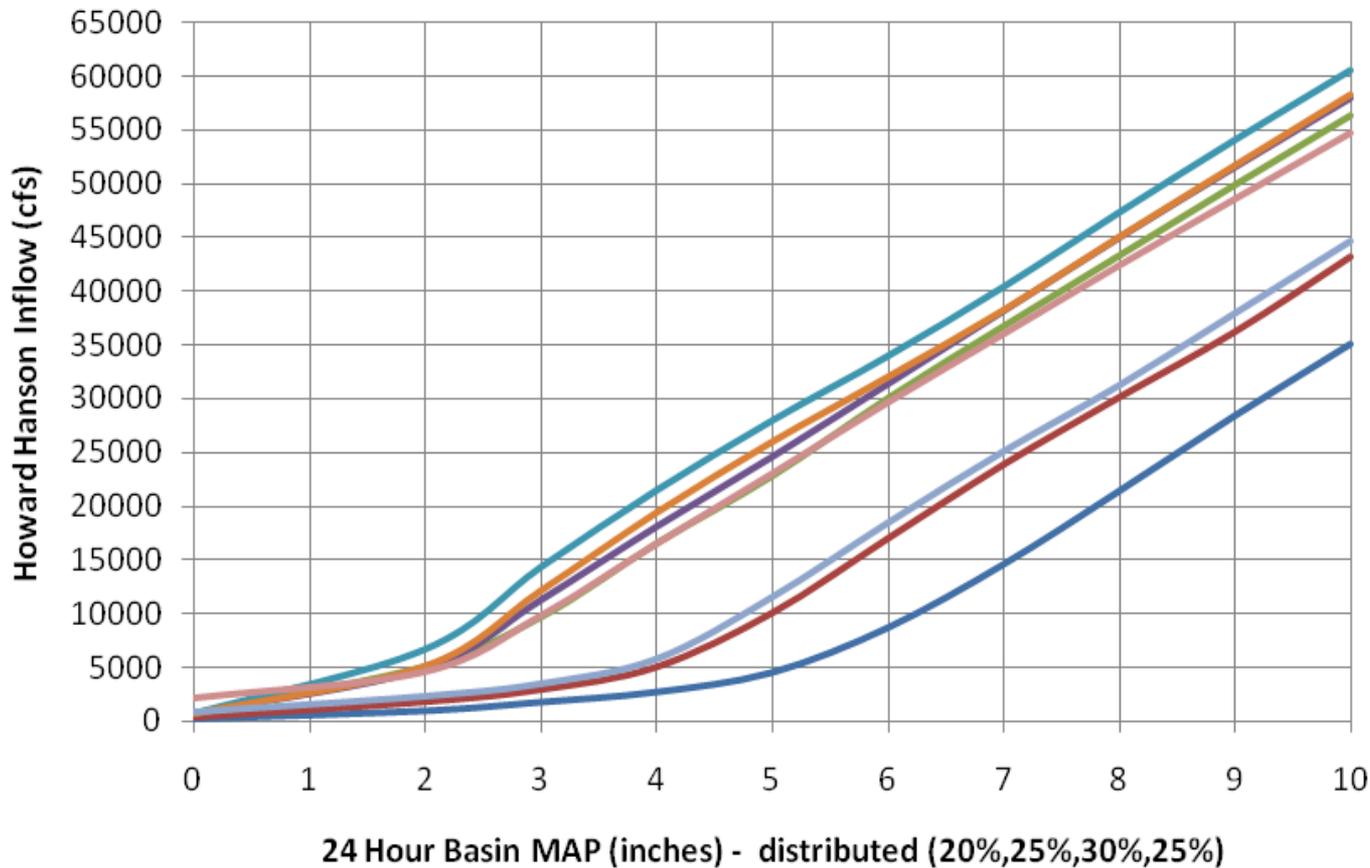
- Utilize the National Weather Service River Forecast System to simulate an ensemble of Howard Hanson Reservoir inflow peaks
  - Vary the 24-hour precipitation totals from 1 to 10 inches
  - Use average "1<sup>st</sup> of month" soil moisture and snow conditions from Oct-Mar
- Develop Peak Inflow versus 24 hour Precipitation Relationships for each set of model state conditions
- Extract Precipitation values corresponding to Peak Inflow Risk Thresholds provided by USACE-Seattle District (23,000 and 26,500 kfs)
- Link the Precipitation Thresholds to the corresponding Green River Emergency Response Activation Levels
- Provide information that would communicate probabilities of reaching the derived threshold levels for each day of the forecast



# Peak Inflow vs 24-hr Precipitation



Howard Hanson Reservoir Peak Inflow (Simulated)  
vs  
24 Hour Basin Mean Areal Precipitation (MAP)



**Note:** Peak Inflow simulations are very sensitive to antecedent state conditions (soil moisture and snow).

- oct\_mean
- nov\_mean
- dec\_mean
- jan\_mean
- feb\_mean
- mar\_mean
- 2009-Nov
- 2009-Jan



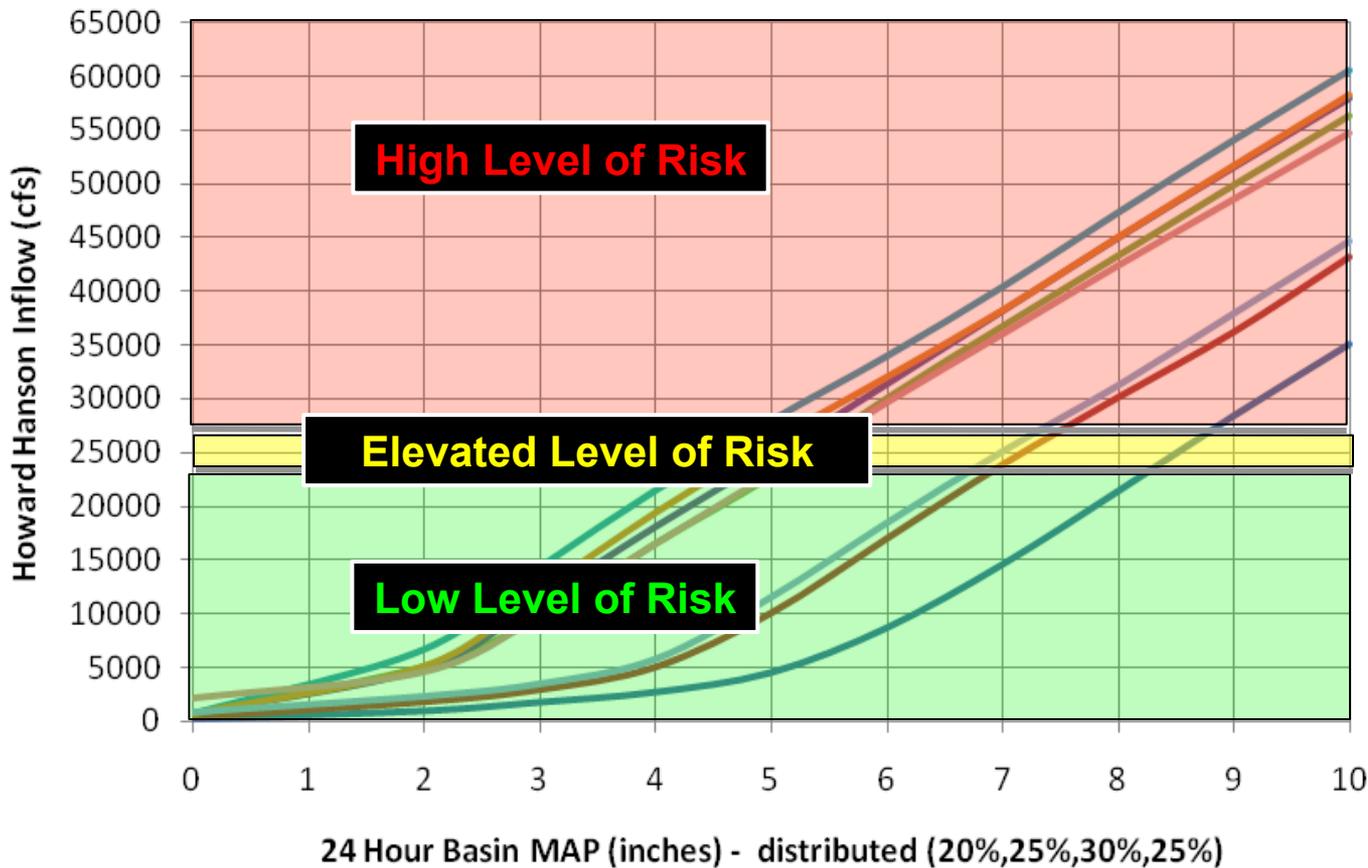
# Peak Inflow vs 24-hr Precipitation

(Shading denotes USACE-Seattle Derived Flood Risk Levels)



Howard Hanson Reservoir Peak Inflow (Simulated)  
vs  
24 Hour Basin Mean Areal Precipitation (MAP)

**Note:** 24-hr Precip Thresholds are extracted at the intersections of the peak inflow curves and the Corps provided inflow thresholds.

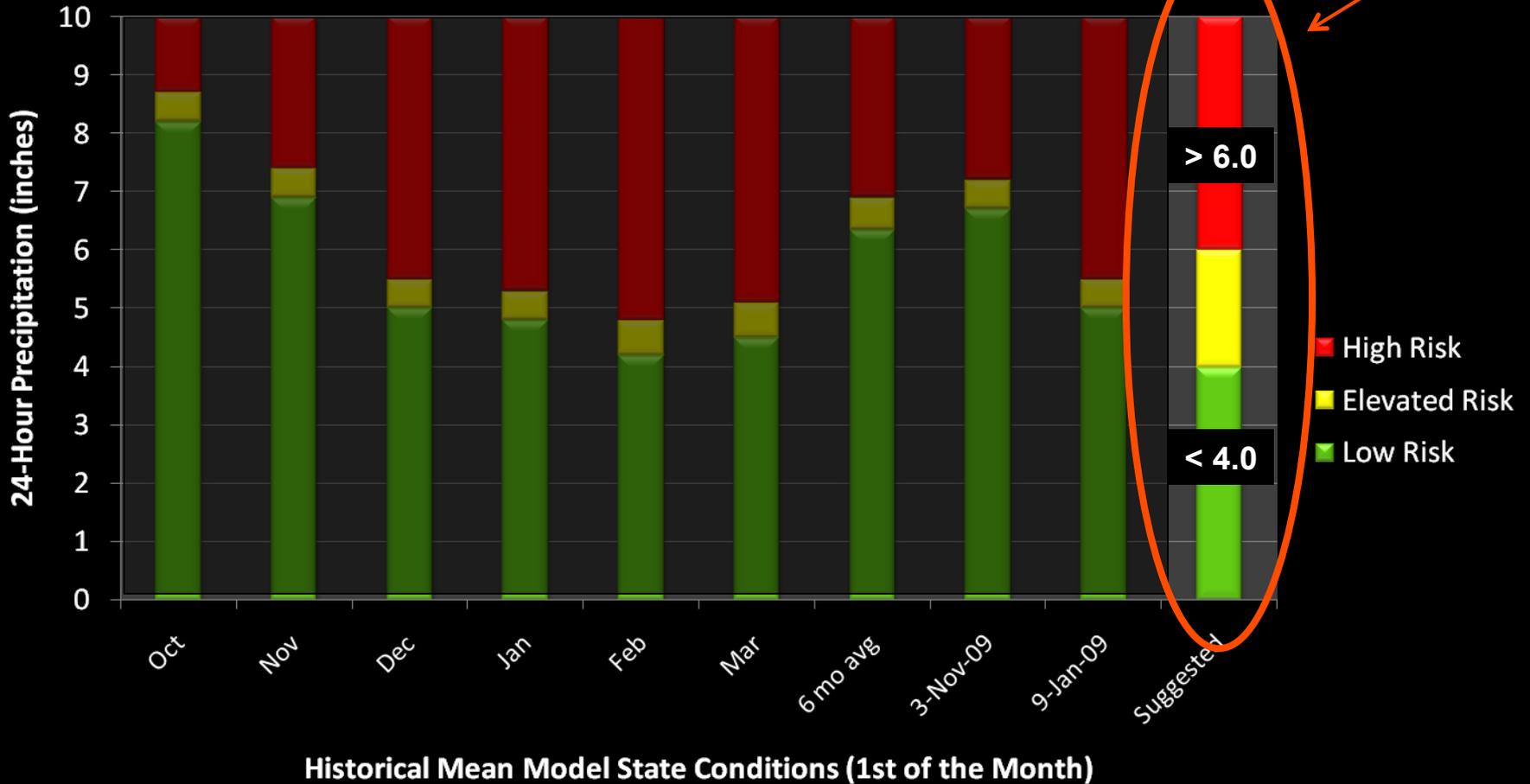




# Results and Recommendation



## Green River Flood Risk Levels [Based on Max 24 hour Precipitation Thresholds]





# AGREEMENT



- The joint analysis (USACE and NWS) supports using two thresholds for 24-hour rainfall on west slopes of the central Cascades:
  - *4 inches in 24 hours*
  - *6 inches in 24 hours*
- Level 1: No recognized risk of exceeding 4 inches in a 24-h period from day 3 through day 5
- Level 2: A perceived risk of having an event produce between 4 and 6 inches of rain in a 24-h period from day 3 through day 5
- Level 3: A perceived risk of having an event produce more than 6 inches of rain in a 24-h period from day 3 through day 5
- The alert level to be determined and provided by NWS Seattle to key partners - updated at least twice per day. General weather pattern will also play a factor.



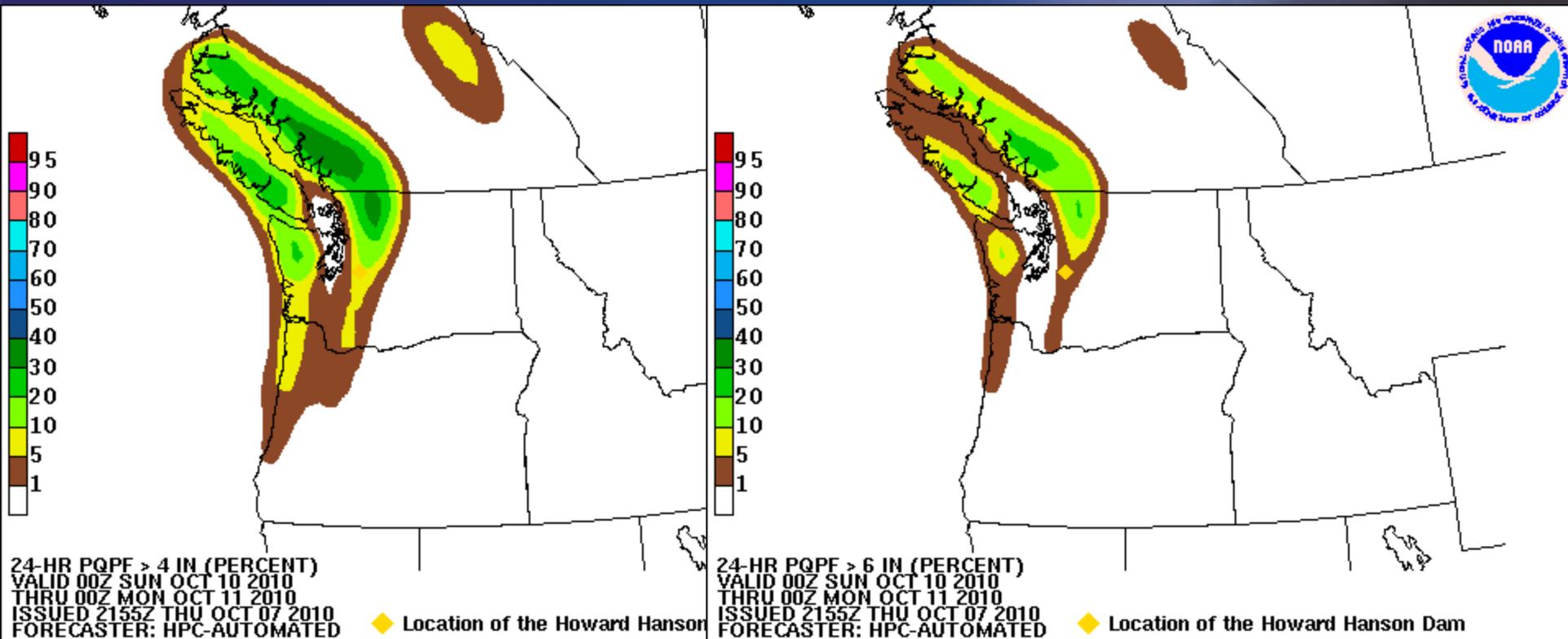
# NWS GUIDANCE AND IMPLEMENTATION

- *The objective thresholds allowed the NWS HPC and EMC to develop the specific guidance products in support of the forecast process*
- *A forecaster GUI was developed by local SOO to address forecaster workload*
- *Twice-daily email alerts were issued to EMs and partners alerting them to any developing risk in the 3 to 5 day period*
- *The alert levels were integrated into each involved agency's operation plan ensuring a coordinated response*



# HPC and EMC customized PQPF

- 24-h PQPF (4"/24h and 6"/24h, 0 to 7 d days)



- We also have GEFS guidance out to 15 days

# Howard Hanson Dam Extended Range Threat for Mon, Jan 18, through Wed, Jan 20

---

Issued Fri, Jan 15, 20:46Z

## Day 3-5 alert level: **Level 1**

### Comments:

No additional comments at this time, please see the hydrology section of the Area Forecast Discussion below for more information.

### Definitions:

**Level 1:** No perceived risk of exceeding 4 inches in a 24 hour period from day 3 through day 5.

**Level 2:** A perceived risk of having an event produce between 4 and 6 inches of rain in a 24 hour period from day 3 through day 5.

**Level 3:** A perceived risk of having an event produce more than 6 inches of rain in a 24 hour period from day 3 through day 5.

### Hydrology Section from latest Area Forecast Discussion:

FXUS66 KSEW 151708  
AFDSEW

AREA FORECAST DISCUSSION  
NATIONAL WEATHER SERVICE SEATTLE WA  
910 AM PST FRI JAN 15 2010

.HYDROLOGY. .BULK OF RAINFALL AMOUNTS REMAIN OVER THE OLYMPIC PENINSULA AND COAST. PER THE HOURLY PRECIP REPORTS AVAILABLE OFF OUR WEB PAGE FOR YOUR USE. A NUMBER OF LOCATIONS IN THESE REGIONS HAVE RECEIVED BETWEEN 2 AND 5 INCHES IN THE LAST 24 HOURS. FLOOD WARNING REMAINS FOR THE SKOKOMISH AND A FLOOD WATCH REMAINS FOR OTHER AREA STREAMS. WITH THE RAIN ANTICIPATED TO EASE AS THE FRONT MOVES INLAND TODAY..LOOKS LIKE MOST OTHER RIVERS SHOULD REMAIN BELOW FLOOD STAGE.

RAIN AMOUNTS FURTHER INLAND HAVE BEEN MUCH LIGHTER - FROM VERY LITTLE TO AN INCH OR SO IN THE LAST 24 HOURS. THERE WILL BE A BURST OF RAIN AS THE FRONT MOVES THROUGH TODAY BUT SHOULD EASE THIS AFTERNOON. SO LOOKS LIKE OTHER INTERIOR RIVERS SHOULD REMAIN BELOW FLOOD STAGE AS WELL.

BEYOND SUNDAY. EXPECT FAST-MOVING SYSTEMS TO BRING MODERATE RAINS. . BUT THE DURATION OF RAINFALL AND BREAKS BETWEEN SYSTEMS SHOULD PRECLUDE LARGE SCALE FLOODING CONCERNS ALTHOUGH SELECT EASY TO FLOOD RIVERS COULD THREATEN RENEWED FLOODING THROUGHOUT NEXT WEEK.

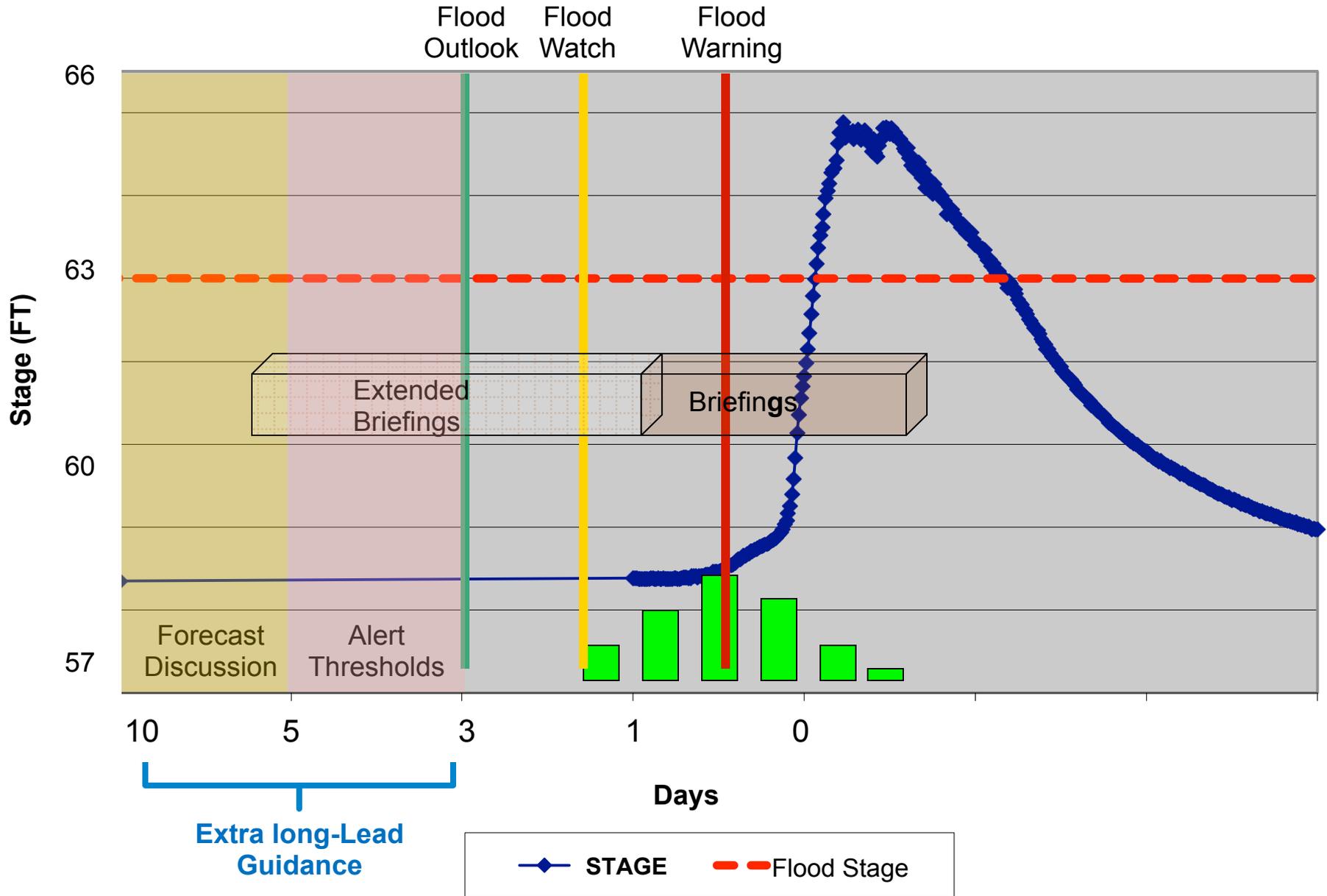
FLOODING IS NOT EXPECTED ON THE GREEN RIVER FOR THE NEXT 10 DAYS.

THE RECENT RAINFALL WILL MAINTAIN THE THREAT OF LOCAL LANDSLIDES. THE USGS LANDSLIDE INDEX INDICATED THAT THE GROUND IS SUFFICIENTLY WET. BUT 24-HR RAINFALL AMOUNTS WILL NOT BE ENOUGH TO TRIGGER WIDESPREAD LANDSLIDES. GIVEN THE CONDITIONS AND THE FORECAST FOR THE NEXT 7 DAYS. ISOLATED LANDSLIDES REMAIN A POSSIBILITY THROUGH NEXT WEEK. BUEHNER

### Statement of Caution:

This product is intended to serve as a "macro-level" indicator of any potential flood threat in the 3 to 5 day forecast time frame. The primary intent of this message is to provide an early notification of a potential flood event in the extended period. As such, this product is very conservative and will result in more false alarms than missed events. At this time range (3 to 5 days out) forecasts have a tendency to fluctuate and have inherently less skill. This product only has value for the 3 to 5 period. Other NWS products (Flood Potential Outlooks, Flood Watches, Flood Warnings) all supercede this product. If an event were to develop the National Weather Service will use these and other products, as well as web briefings, phone calls, etc., to inform all decision makers of the developing threat.

# NWS Flood Action Time Line for Green River





## Feedback from Dr. Dennis Hunsinger, Acting Regional Administrator, FEMA:

*"This work represents the very best of what can happen when we all work together collaboratively with our partners."*





# Summary



- A balance between the state of weather and water forecasting science and user needs
- Excellent collaboration -- A learning process
- The NWS needs an established mechanism to recognize similar, critical challenges. Some kind of Rapid Response process for DSS efforts.
- The system wasn't challenged last year...we were lucky. This year messaging will be critical.