

# Spring 2024 Peak Flow Outlook

March 20, 2024  
Ashley Nielson-Hydrologist



Colorado Basin  
River Forecast Center  
National Weather Service

# Presentation Overview

- Peak Flow Forecast Products Overview
  - Map View
  - List View
  - Peak Flow Dashboard Page
- Current Conditions
  - Snow conditions
  - Mid-March Peak Flow Forecasts
- Spring Weather Impacts
- Summary

**Participants will be muted during the webinar.**

**If you have a question please type it in or raise your hand and questions will be answered at the end of the webinar.**

**Webinar recording & slides will be available on the CBRFC webpage.**

# Peak Flow Forecasts - Map View



Rivers ▾ Snow ▾ Water Supply ▾ Peak Flow ▾ Reservoirs ▾ Weather ▾ Climate ▾ Help ▾ About ▾ News ▾

Forecast Map

Forecast List

Special Forecast Map


Special Forecast List

Map view of peak flow forecast points that are issued daily.

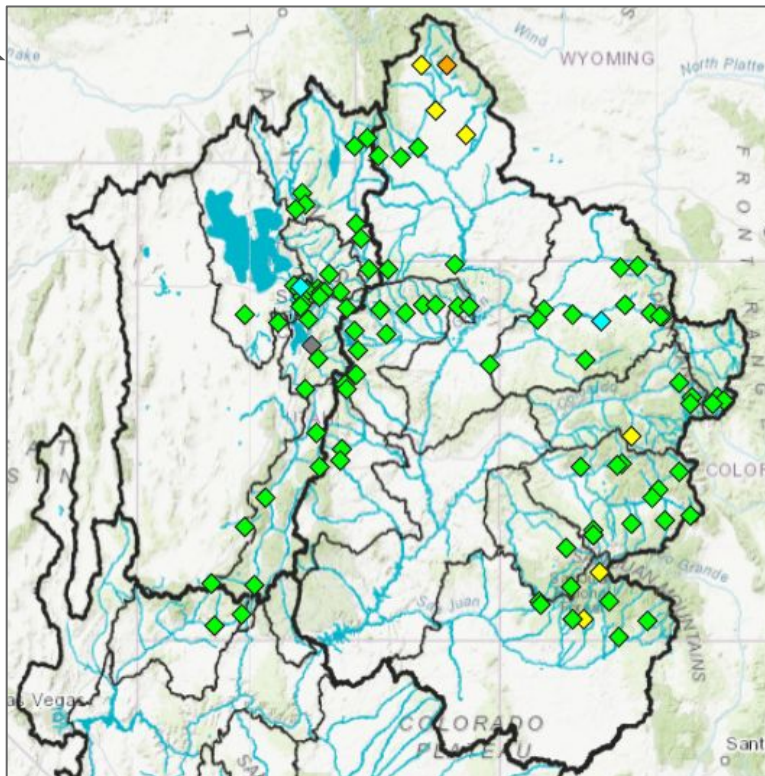
Locations with minimal upstream regulation.

### 3 Map Layers/Variables:

- Percentile
- Percent Average
- NWS Flood Stage Exceedance Probability

Help and documentation available through  buttons.



Clicking on a point takes you to the site's peak flow dashboard page.





## Peak Flow Forecasts

Show Hide Other

Data Label ▾










- Percentile 
- Percent Average 

NWS Flood Stage Exceedance Probability

- Mean Daily 
- Instantaneous 

Peak Flow Help

### Percentile

-  No Forecast
-  No Stats
-  Low
-  <10
-  10-25
-  25-75
-  75-90
-  >90
-  High

# Peak Flow Forecasts - List View



## Daily Peak Flow Forecasts - Colorado - Latest - Sorted by Area

Choose Area Sort By Show/Hide Forecast Month Forecast Year Legend CSV Data


- CBRFC
- Green ←
- Colorado
- San Juan
- Great
- Sevier
- Virgin
- Lower Colorado

- Forecast Map
- Forecast List
- Special Forecast Map
- Special Forecast List

Data filter/sorting options available.  
Clicking on a point → site's peak flow dashboard page.

Sub Area	NWS ID	River	Location	Forecast Created	Forecast 50	Forecast 25	Forecast 10	Percentile Cond	Percentile	Rank	Total Years	Percent		Average Peak	Flood Cond	Flood Flow	Observed Peak to Date	Observed Date	Historic Peak	Hist Peak Date	Forecast Earliest Date	Forecast 50 Date	Forecast Latest Date	Normal Earliest Date	Normal Latest Date
												Average Cond	Percent Average												
Upper	<a href="#">WBRW4</a>	Green	Daniel; Nr; Warren Bridge; At	2024-03-18	2110	2555	2847	◆	20	73	91	◆	72	2891	◆	8609			5620	1997-06-12	05-16	06-10	07-07	05-27	06-24
Upper	<a href="#">FRAW4</a>	Pine Ck	Fremont Lk; Abv	2024-03-18	1120	1285	1636	◆	7	59	63	◆	71	1558	◆			2300	2017-06-23	05-15	06-10	07-04	05-29	06-27	
Upper	<a href="#">RPNW4</a>	New Fork	Big Piney; Nr	2024-03-18	3702	4376	4959	◆	24	53	69	◆	75	4898	◆	8813		9110	1986-06-08	05-17	06-10	07-07	05-25	06-23	
Upper	<a href="#">BSRW4</a>	Big Sandy	Farson; Nr	2024-03-18	555	769	949	◆	24	62	81	◆	74	741	◆			1690	1986-06-05	05-09	06-06	07-02	05-21	06-18	
Upper	<a href="#">LABW4</a>	Green	La Barge; Nr	2024-03-18	6730	8148	8792	◆	30	43	60	◆	79	8415	◆	10933		18800	1986-06-10	05-23	06-14	07-08	05-26	06-22	
Upper	<a href="#">HMFV4</a>	Hams Fork	Frontier; Nr; Pole Ck; Blo	2024-03-18	569	770	907	◆	36	46	71	◆	85	667	◆	1889		2000	1986-06-06	04-23	05-27	06-15	05-10	06-05	
Upper	<a href="#">BNRU1</a>	Blacks Fork	Robertson; Nr	2024-03-18	1164	1340	1651	◆	27	38	51	◆	82	1416	◆	1938		2860	2011-07-01	05-14	06-02	06-25	05-21	06-16	
Upper	<a href="#">HEMW4</a>	Henrys Fork	Manila; Nr	2024-03-18	692	1047	1368	◆	52	43	88	◆	90	762	◆	2815		3780	1965-06-14	04-26	06-09	07-09	05-08	06-20	
Yampa/White	<a href="#">STMK2</a>	Yampa	Steamboat Springs	2024-03-18	3277	3663	4682	◆	51	57	116	◆	105	3093	◆	5922		5870	1921-06-15	05-12	05-31	06-24	05-16	06-07	
Yampa/White	<a href="#">ENMC2</a>	Elk	Milner; Nr	2024-03-18	3872	4572	5870	◆	51	27	54	◆	98	3946	◆	5535		7000	2011-06-08	04-28	05-23	06-22	05-16	06-06	
Yampa/White	<a href="#">ELHC2</a>	Elkhead Ck	Long Gulch; Abv; Hayden; Nr	2024-03-18	1196	1351	1702	◆	56	12	25	◆	100	1195	◆	2753		2120	2011-05-17	04-25	05-13	06-06	04-20	05-17	
Yampa/White	<a href="#">WIKC2</a>	Williams Fork	Mouth; At; Hamilton; Nr	2024-03-18	1736	2079	2527	◆	76	5	17	◆	106	1632	◆			3620	2008-05-21	04-26	05-22	06-27	05-07	06-01	
Yampa/White	<a href="#">MBLC2</a>	Yampa	Maybell; Nr	2024-03-18	10926	12118	15597	◆	62	42	108	◆	107	10155	◆	22799		24400	1984-05-18	04-29	05-23	06-25	05-11	06-06	
Yampa/White	<a href="#">LILC2</a>	Little Snake	Lily; Nr	2024-03-18	4374	5119	6277	◆	51	50	102	◆	111	3924	◆	18522		13400	1984-05-19	04-28	05-23	06-20	05-07	06-05	
Yampa/White	<a href="#">YDLC2</a>	Yampa	Deerlodge Park	2024-03-18	15304	17959	20009	◆	66	14	39	◆	119	12758	◆	20744		32300	1984-05-19	04-29	05-23	06-24	05-13	06-06	
Yampa/White	<a href="#">WRMC2</a>	White	Meeker; Nr	2024-03-18	2536	2997	3514	◆	34	79	119	◆	90	2811	◆	8929		6320	1984-05-26	05-12	05-29	06-27	05-15	06-09	
Yampa/White	<a href="#">WATU1</a>	White	Watson; Nr	2024-03-18	2528	3027	3538	◆	36	61	95	◆	91	2756	◆	9568		8160	1929-07-16	05-10	05-29	06-28	05-16	06-11	

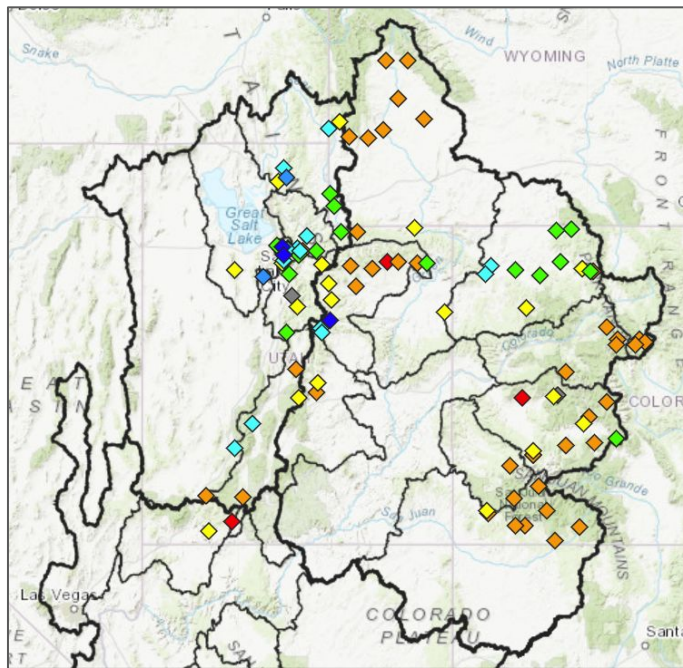
# Peak Flow Forecasts - Daily Points vs. Special Points

 Colorado Basin  
River Forecast Center  
National Weather Service

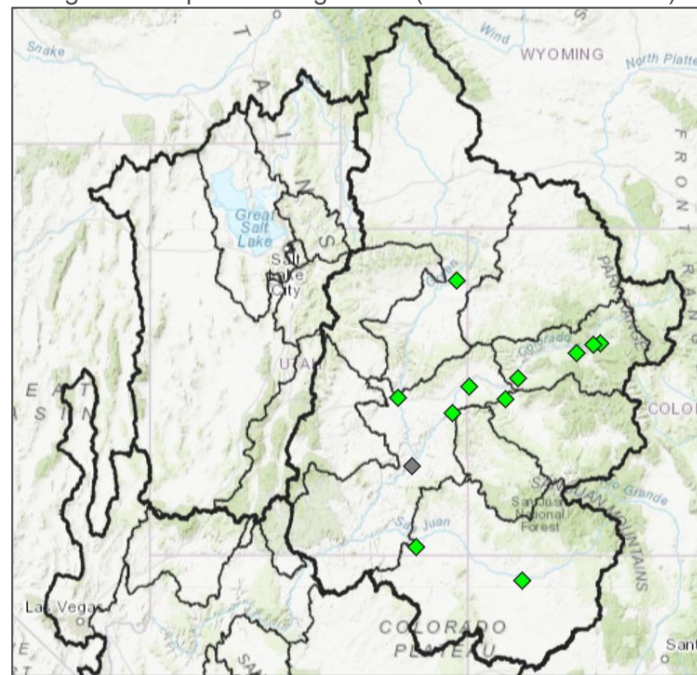
Rivers ▾ Snow ▾ Water Supply ▾ **Peak Flow ▾** Reservoirs ▾ Weather ▾ Climate ▾ Help ▾ About ▾ News ▾

- Forecast Map
- Forecast List
- Special Forecast Map
- Special Forecast List

Issued Daily  
Minimal upstream regulation

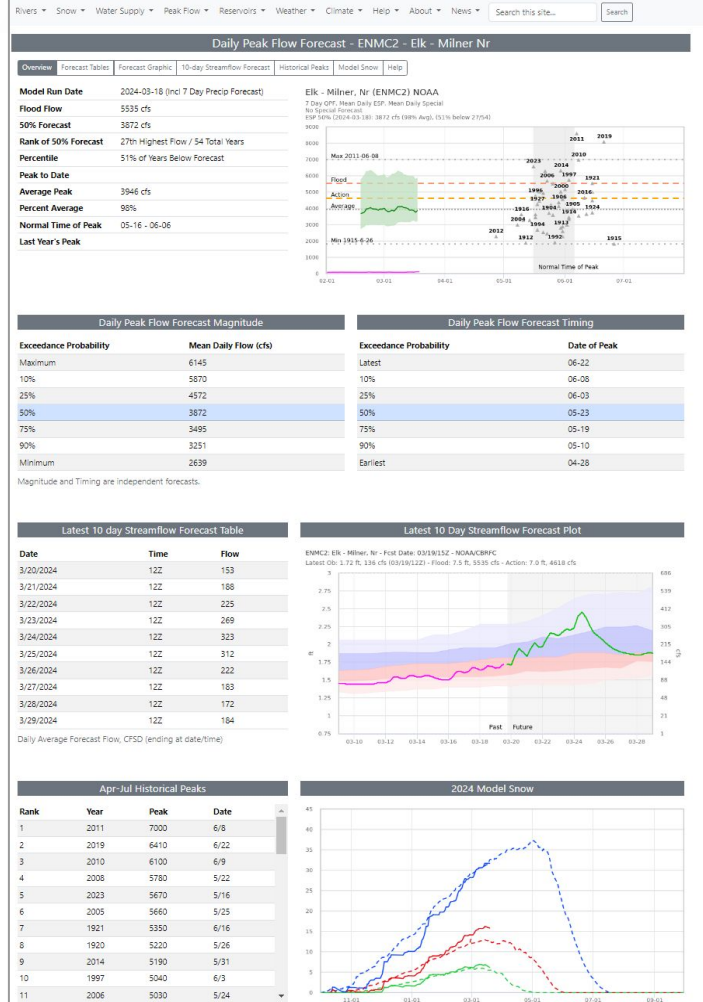


Issued ~2 times/month  
Significant upstream regulation (reservoirs/diversions)





# Peak Flow Dashboard Page



## Long Range Probabilistic Peak Flow Forecast: **Planning Tool**

- Peak forecast evolution plot
- Tabular forecasts
- Probabilistic Forcings
  - 30 years of historical precipitation and temperature (1991-2020)

## Daily Deterministic Streamflow Forecast: **Use as time of peak nears**

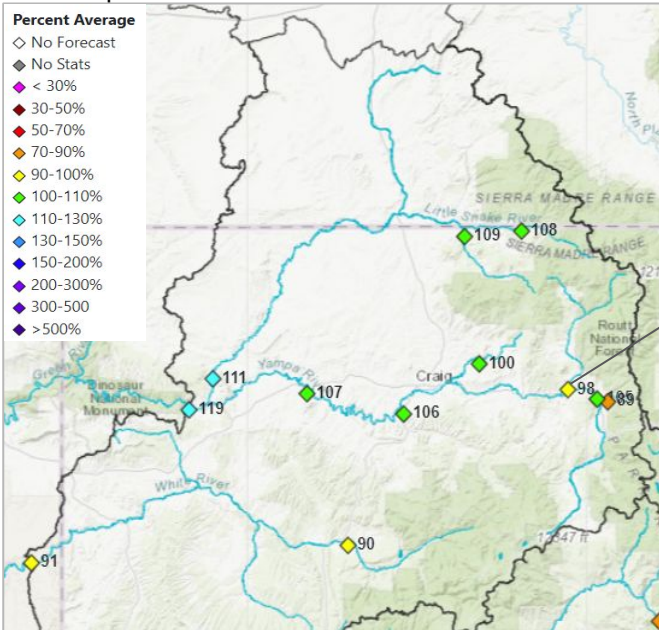
- 10-day streamflow forecast hydrograph
- Tabular 10-day streamflow forecast table
- Deterministic Forcings
  - 10 days of future temperature
  - 7 days of future precipitation

## Supplemental Information:

- Model snow: driving peak flow forecasts
- Historical April-July observed peak flows

# Peak Flow Dashboard Page

## Yampa River Peak Flow Forecasts: March 19

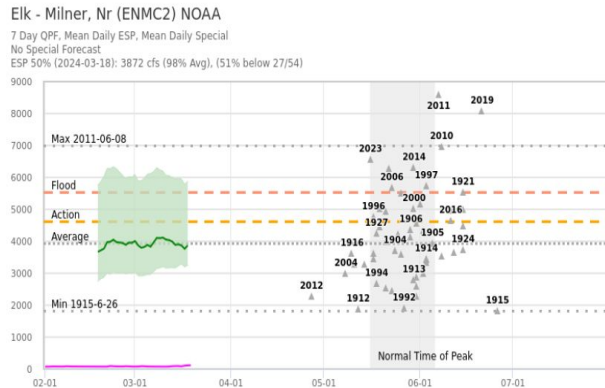


Clicking on a point takes you to the site's peak flow dashboard page.

## Daily Peak Flow Forecast - ENMC2 - Elk - Milner Nr

- Overview
- Forecast Tables
- Forecast Graphic
- 10-day Streamflow Forecast
- Historical Peaks
- Model Snow
- Help

**Model Run Date** 2024-03-18 (Incl 7 Day Precip Forecast)  
**Flood Flow** 5535 cfs  
**50% Forecast** 3872 cfs  
**Rank of 50% Forecast** 27th Highest Flow / 54 Total Years  
**Percentile** 51% of Years Below Forecast  
**Peak to Date**  
**Average Peak** 3946 cfs  
**Percent Average** 98%  
**Normal Time of Peak** 05-16 - 06-06  
**Last Year's Peak**



### Daily Peak Flow Forecast Magnitude

Exceedance Probability	Mean Daily Flow (cfs)
Maximum	6145
10%	5870
25%	4572
50%	3872
75%	3495
90%	3251
Minimum	2639

### Daily Peak Flow Forecast Timing

Exceedance Probability	Date of Peak
Latest	06-22
10%	06-08
25%	06-03
50%	05-23
75%	05-19
90%	05-10
Earliest	04-28

Magnitude and Timing are independent forecasts.

# Peak Flow Dashboard Page: Forecast Overview and Peak Flow Evolution Plot

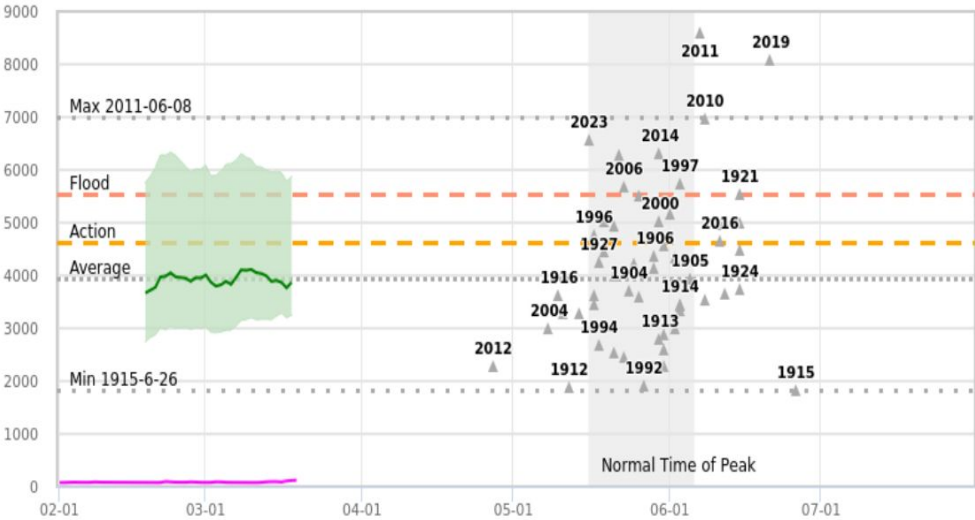
## Daily Peak Flow Forecast - ENMC2 - Elk - Milner Nr

- Overview
- Forecast Tables
- Forecast Graphic
- 10-day Streamflow Forecast
- Historical Peaks
- Model Snow
- Help

<b>Model Run Date</b>	2024-03-18 (Incl 7 Day Precip Forecast)
<b>Flood Flow</b>	5535 cfs
<b>50% Forecast</b>	3872 cfs
<b>Rank of 50% Forecast</b>	27th Highest Flow / 54 Total Years
<b>Percentile</b>	51% of Years Below Forecast
<b>Peak to Date</b>	
<b>Average Peak</b>	3946 cfs
<b>Percent Average</b>	98%
<b>Normal Time of Peak</b>	05-16 - 06-06
<b>Last Year's Peak</b>	

### Elk - Milner, Nr (ENMC2) NOAA

7 Day QPF, Mean Daily ESP, Mean Daily Special  
No Special Forecast  
ESP 50% (2024-03-18): 3872 cfs (98% Avg), (51% below 27/54)



Clicking on the plot will take you to an interactive evolution plot.

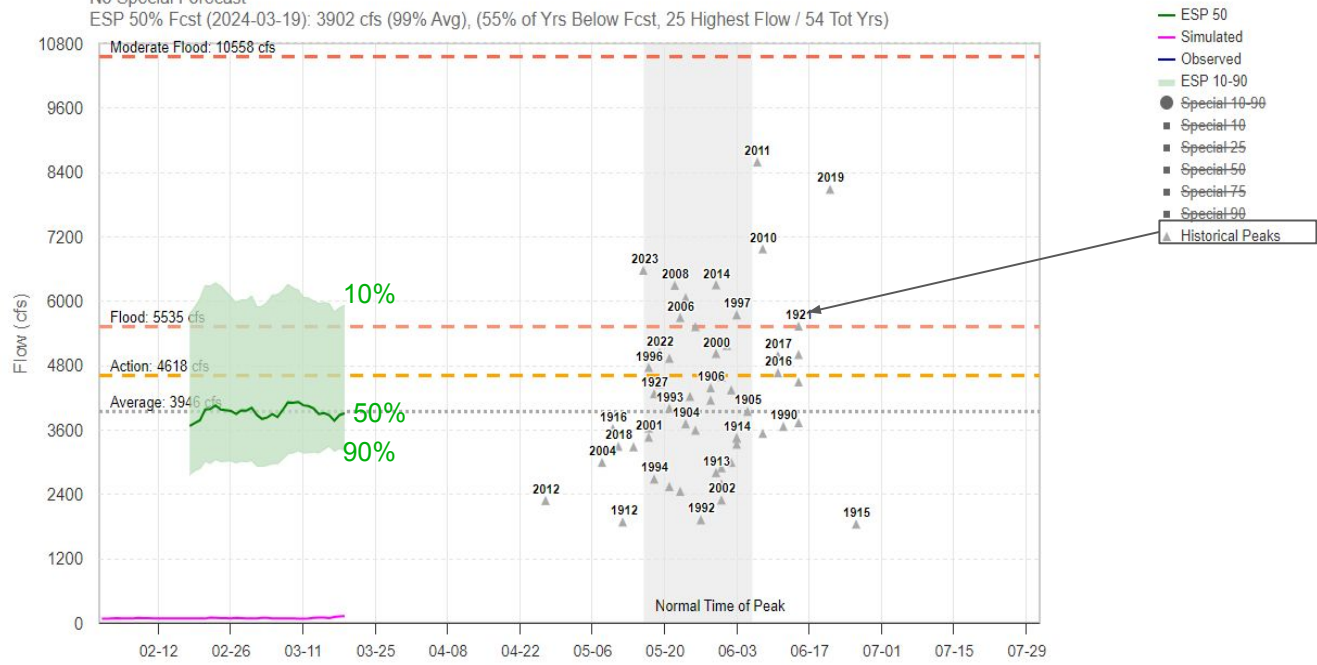


# Peak Flow Dashboard Page: Peak Flow Evolution Plot

Water Year ▾ Options ▾ Scale To ▾ Image ▾ Data ▾ Help ▾

- QPF
- ESP
- Special Forecasts
- Instantaneous
- Average
- Observations
- Historical Max/Min
- Historical Max
- Historical Min
- Critical Flows
- Probability Traces
- Data Table

**2024 Peak Flow ESP Forecast - Elk - Milner, Nr (ENMC2)**  
 Includes 7 Day Precipitation Forecast, Mean Daily E:  
 No Special Forecast  
 ESP 50% Fcst (2024-03-19): 3902 cfs (99% Avg), (55% of Yrs Below Fcst, 25 Highest Flow / 54 Tot Yrs)



Green shading: Daily Raw Model Guidance 90% - 10% exceedance range  
 Green line: Daily Raw Model Guidance 50% exceedance  
 Blue line: Observed data  
 Pink line: Model simulation  
 Grey Shaded Area: Normal Time of Peak based on historical peaks

# Peak Flow Dashboard Page: Daily Peak Flow Forecast Tables

## Daily Peak Flow Forecast Tables

- Probability of peak flow magnitude
- Probability of peak date
  - Forecast peak flow timing generally points to the 'normal time of peak' until the actual time of peak is near.
- Magnitude and timing are independent forecasts

Daily Peak Flow Forecast Magnitude

Exceedance Probability	Mean Daily Flow (cfs)
Maximum	6145
10%	5870
25%	4572
50%	3872
75%	3495
90%	3251
Minimum	2639

Daily Peak Flow Forecast Timing

Exceedance Probability	Date of Peak
Latest	06-22
10%	06-08
25%	06-03
50%	05-23
75%	05-19
90%	05-10
Earliest	04-28

Magnitude and Timing are independent forecasts.

# Peak Flow Dashboard Page: 10-Day Streamflow Forecasts

## Latest 10 day Streamflow Forecast Table

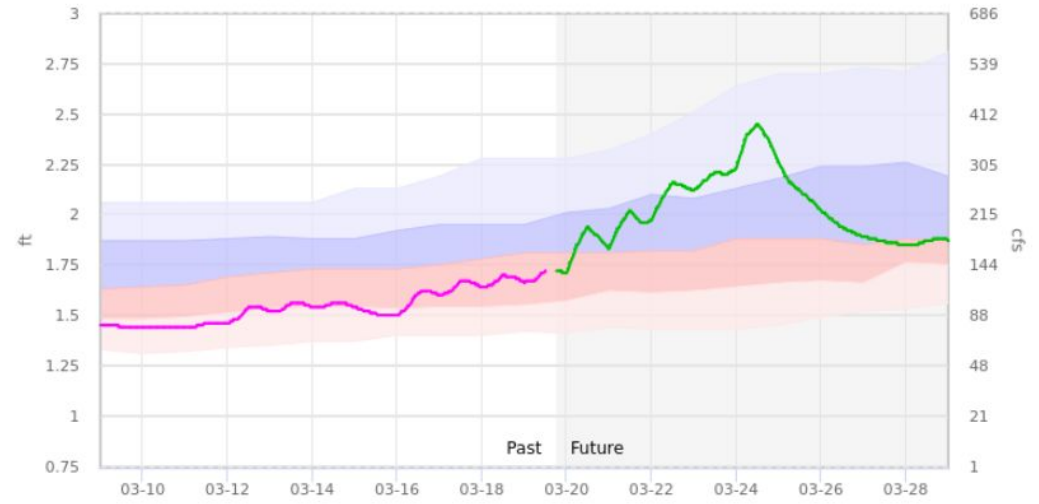
Date	Time	Flow
3/20/2024	12Z	153
3/21/2024	12Z	188
3/22/2024	12Z	225
3/23/2024	12Z	269
3/24/2024	12Z	323
3/25/2024	12Z	312
3/26/2024	12Z	222
3/27/2024	12Z	183
3/28/2024	12Z	172
3/29/2024	12Z	184

Daily Average Forecast Flow, CFSD (ending at date/time)

## Latest 10 Day Streamflow Forecast Plot

ENMC2: Elk - Milner, Nr - Fcst Date: 03/19/15Z - NOAA/CBRFC

Latest Ob: 1.72 ft, 136 cfs (03/19/12Z) - Flood: 7.5 ft, 5535 cfs - Action: 7.0 ft, 4618 cfs



# Peak Flow Dashboard Page: Supplemental Information

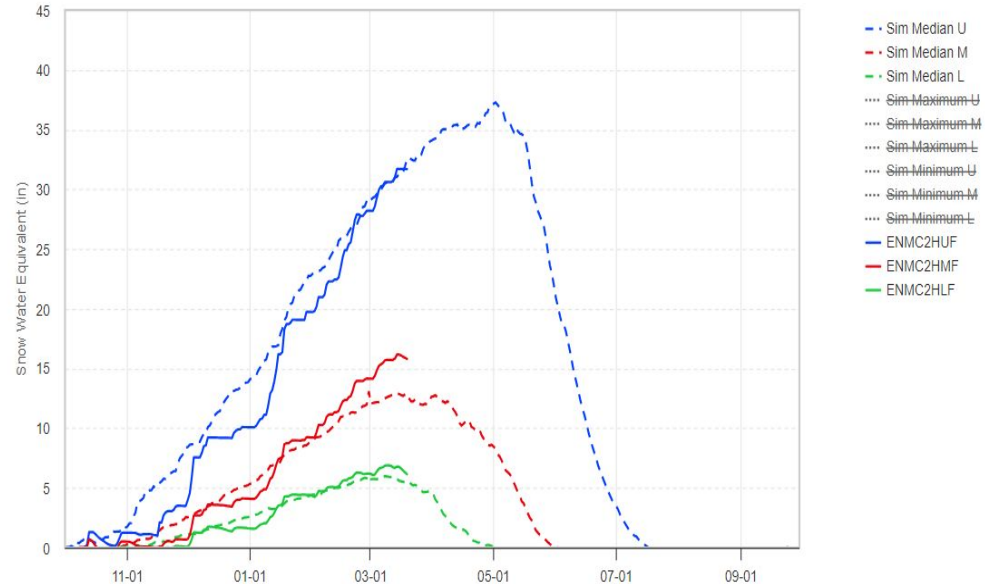
## Apr-Jul Historical Peaks

Rank	Year	Peak	Date
1	2011	7000	6/8
2	2019	6410	6/22
3	2010	6100	6/9
4	2008	5780	5/22
5	2023	5670	5/16
6	2005	5660	5/25
7	1921	5350	6/16
8	1920	5220	5/26
9	2014	5190	5/31
10	1997	5040	6/3
11	2006	5030	5/24

[CSV file](#)

## Model Snow Plot - Elk - Milner, Nr (ENMC2) - NOAA/CBRFC

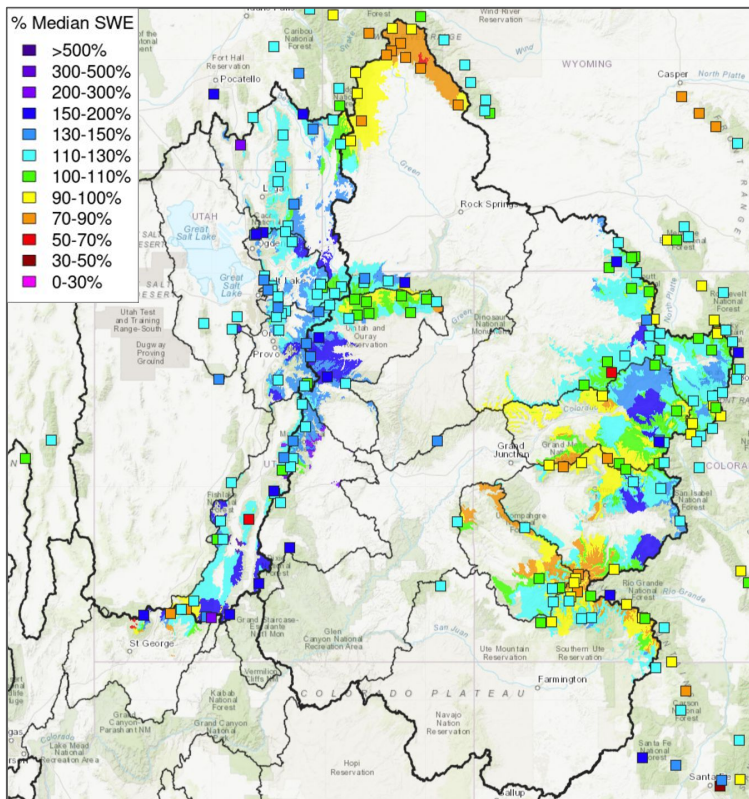
Created: 2024-03-19 18:55Z



# Current Snowpack Conditions

## March 19 SWE Conditions

NRCS SNOTEL Observed (Squares)  
CBRFC Model (Significant Areas)



**SWE** = Snow Water Equivalent  
The amount of water in snow.

Snow above and below SNOTEL stations is modeled in CBRFC's hydrologic model.

Water Year 2024 CBRFC Model SWE (Major Contributing Areas) Percent of 1991-2020 Median			
UPPER COLORADO RIVER BASIN			
	Mar1	Mar19	Change
Above Lake Powell	97	107	10
<b>Green River Basin</b>			
Above Fontenelle	81	85	4
Above Flaming Gorge	91	97	6
Yampa/White	108	113	5
Duchesne	110	111	1
Price/San Rafael/Dirty Devil	116	130	14
<b>Colorado River Headwaters</b>			
Above Kremmling	100	112	12
Eagle	98	105	7
Roaring Fork	92	102	10
Above Cameo	96	106	10
<b>Southwest Colorado</b>			
Gunnison	95	103	8
Dolores	84	102	18
San Juan	84	101	17
<b>GREAT BASIN</b>			
Bear	111	118	7
Weber	115	122	7
Six Creeks	113	121	8
Provo/Utah Lake	119	123	4
Sevier	98	122	24

Upper Colorado  
85-130%

Great Basin  
120-125%



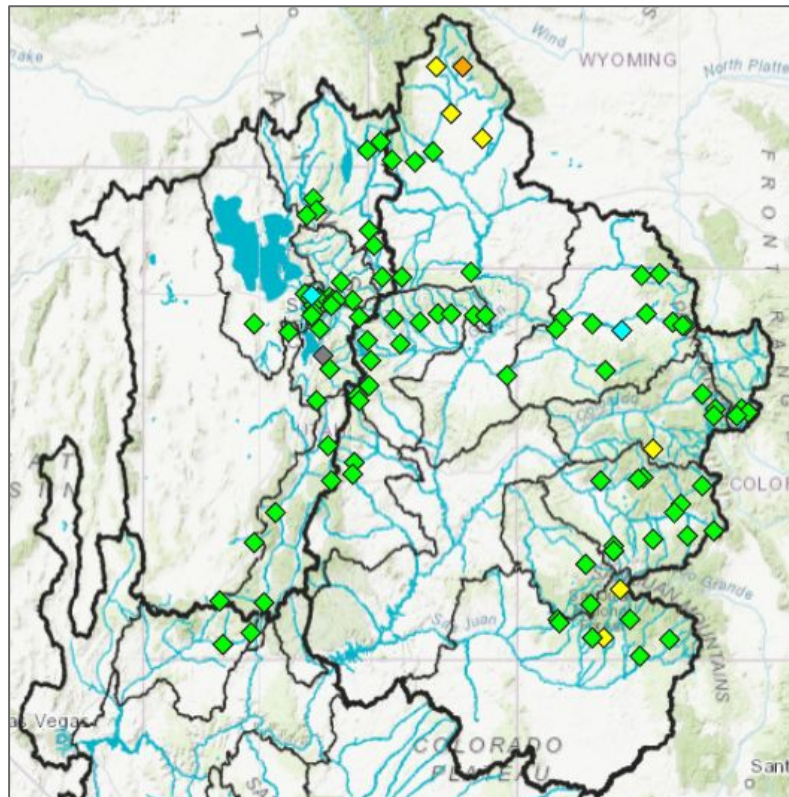
# Mid-March Peak Flow Forecast - Percentile

**Percentile:** the percent of historical annual peak flow values that are below the current peak flow forecast.

## Legend: Percentile Categories

Peak flow forecasts with a higher percentile correspond to locations with better snowpack conditions.

Peak flow forecasts >90<sup>th</sup> percentile:  
None as of mid-March



## Peak Flow Forecasts

Show Hide Other

Data Label

- Percentile ?  
 Percent Average ?

NWS Flood Stage Exceedance Probability

- Mean Daily ?  
 Instantaneous ?

Peak Flow Help

## Percentile

- ◇ No Forecast
- ◆ No Stats
- ◆ Low
- ◆ <10
- ◆ 10-25
- ◆ 25-75
- ◆ 75-90
- ◆ >90
- ◆ High

# Mid-March Peak Flow Forecast - Percent of Average

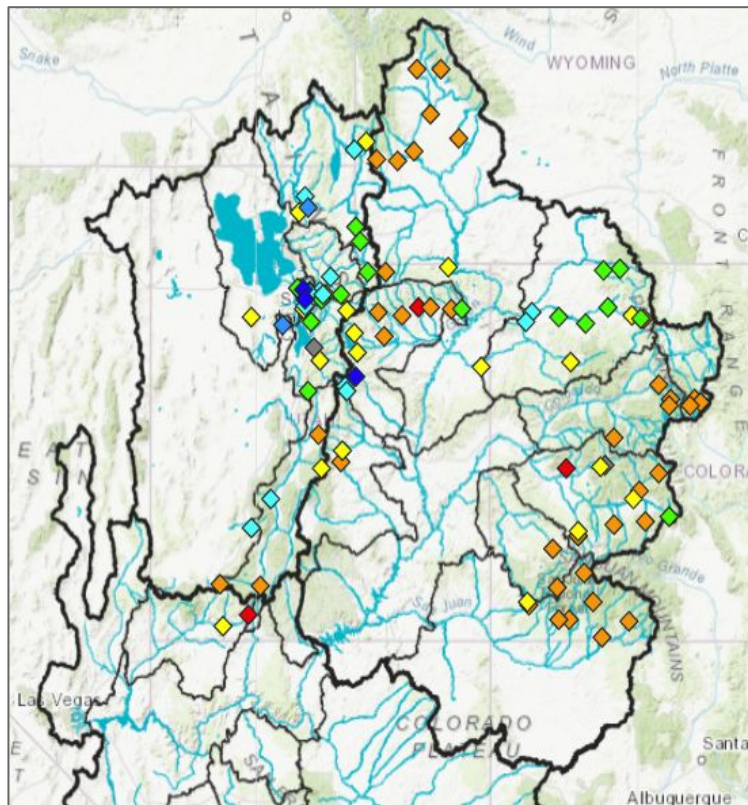
**Percent of Average:** the peak flow forecast percent of the 1991-2020 average peak flow.

## Legend: Percent of Average

Peak flow forecasts with a higher percent of average correspond to locations with better snowpack conditions.

## Peak flow forecasts >100% of average:

- White/Yampa
- Price
- Sevier
- Weber
- Six Creeks
- Bear



## Peak Flow Forecasts

Show Hide Other

Data Label

- Percentile [?]  
 Percent Average [?]

NWS Flood Stage Exceedance Probability

- Mean Daily [?]  
 Instantaneous [?]

Peak Flow Help

## Percent Average

- ◇ No Forecast
- ◇ No Stats
- ◇ < 30%
- ◇ 30-50%
- ◇ 50-70%
- ◇ 70-90%
- ◇ 90-100%
- ◇ 100-110%
- ◇ 110-130%
- ◇ 130-150%
- ◇ 150-200%
- ◇ 200-300%
- ◇ 300-500%
- ◇ >500%

# Mid-March Peak Flow Forecast - Flood Stage Exceedance Probability

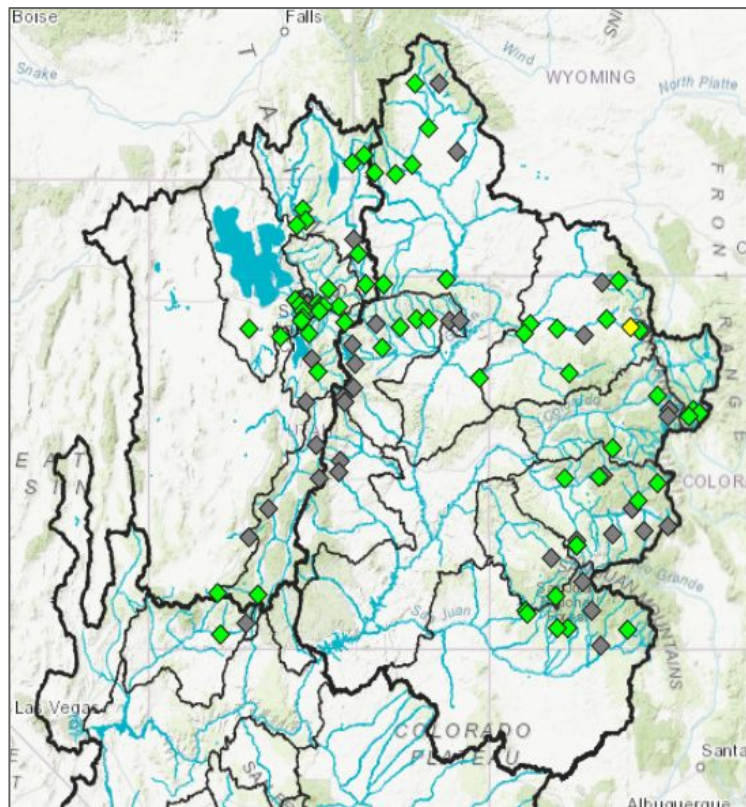
**NWS Flood Stage Exceedance Probability:** the probability of the peak flow forecast exceeding flood stage.

## Legend: Exceedance Probability

Peak flow forecasts with a higher exceedance probability correspond to locations with increased flood potential.

Peak flow forecasts >50%:  
None as of mid-March

*\*Note: flood stage not established at all peak flow forecast locations.*



## Peak Flow Forecasts

Show Hide Other

Data Label

Percentile [?]

Percent Average [?]

NWS Flood Stage Exceedance Probability

Mean Daily [?]

Instantaneous [?]

Peak Flow Help

## Mean Daily NWS Fld Excd Prob

- No Forecast
- No Flood Stage
- Already Peak(ed/ing)
- <10%
- >10-25%
- >25-50%
- >50%



# Mid-March Special Peak Flow Forecasts

Legend: Flood Stage Exceedance Probability

Includes mainstem river locations

Upstream water management impacts downstream flows:  
 -reservoirs  
 -diversions

Requires more forecaster involvement  
 -updated ~2x/month

## Examples

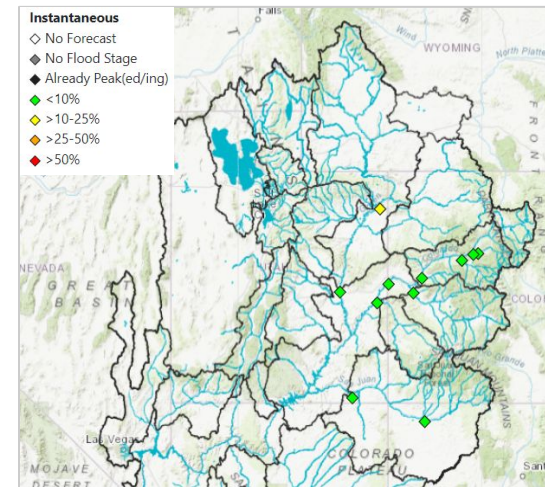
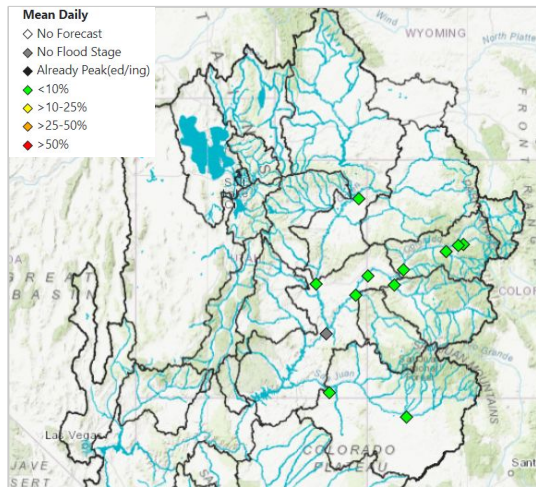
### Colorado River Mainstem

-peak flow augmentation

### Gunnison/Green River Basin

-downstream peak flow targets  
 -magnitude/duration

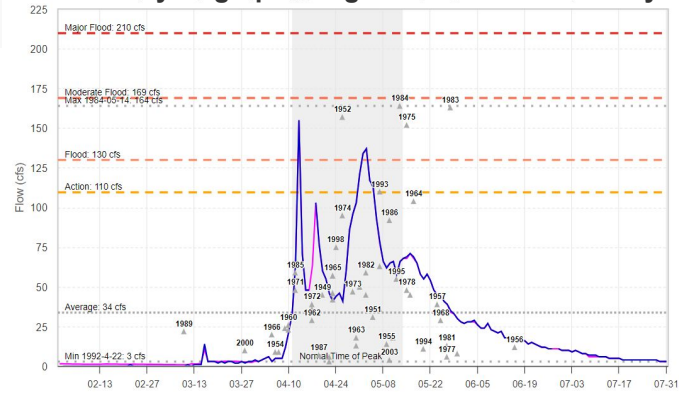
-Real-time multi-agency coordination



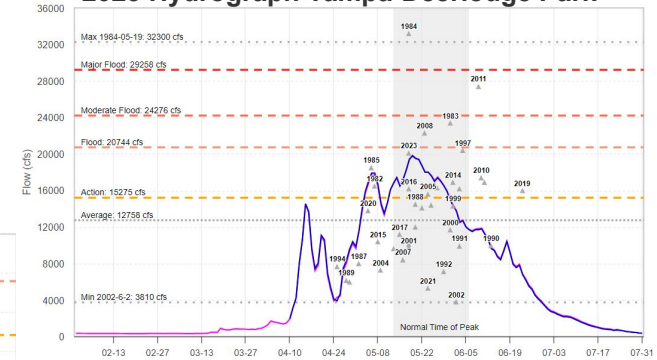
Area	Sub Area	NWS ID	River	Location	Issue Date	Daily Mean Cond	Daily Mean 90	Daily Mean 75	Daily Mean 50	Daily Mean 25	Daily Mean 10	Inst Cond	Inst 90	Inst 75	Inst 50	Inst 25	Inst 10	Average Peak	Flood Flow	Observed Peak to Date	Observed Date	Historic Peak	Hist Peak Date
Green	Lower	JESU1	Green	Jensen; Nr	2024-03-19	◆	14500	16500	18500	21000	24000	◆	15000	17000	19000	22000	25000	17012	24100		38500	1984-05-19	
Green	Lower	GRVU1	Green	Green River; Ut	2024-03-19	◆	16500	19000	23000	27000	30000	◆	17000	19000	23000	27000	31000	20869	37001		47200	1984-05-21	
San Juan		ARFNS	Animas	Farmington	2024-03-19	◆	2500	2800	3500	3900	4300	◆	3000	3400	4100	4500	4900	4510	9218		11000	1949-06-20	
San Juan		BEFU1	San Juan	Bluff; Nr	2024-03-19	◆	3000	3400	4000	4400	4800	◆	3700	4100	4800	5200	5600	6693	35640		15200	1979-05-31	
Colorado	Mainstem	GFSC2	Eagle	Gypsum; Blo	2024-03-19	◆	2300	2700	3200	3700	4800	◆	2600	3000	3600	4100	5400	3643	6027		6580	1984-05-26	
Colorado	Mainstem	EGLC2	Colorado	Dotsero; Nr	2024-03-19	◆	5000	6500	7500	9500	13000	◆	5300	6900	7900	10000	14000	8946	16949		20800	1984-05-26	
Colorado	Mainstem	GWSC2	Roaring Fork	Glenwood Springs	2024-03-19	◆	3200	3800	4100	5000	6000	◆	3700	4300	4700	5700	6800	5579	13139		11800	1995-07-13	
Colorado	Mainstem	CAMC2	Colorado	Cameo; Nr	2024-03-19	◆	9500	12000	13500	17000	22000	◆	10000	13000	14000	18000	23000	16440	25966		38000	1984-05-27	
Colorado	Gunnison	GRNC2	Gunnison	Grand Junction; Nr	2024-03-19	◆	5000	7500	8000	8000	10500	◆	5600	8100	8600	8600	11000	8659	20524		23200	1984-06-09	
Colorado	Mainstem	CCUC2	Colorado	Co	2024-03-19	◆	12500	18000	21000	24000	33000	◆	13000	19000	22000	25000	34000	23905	45947		68300	1984-05-28	
Colorado	Mainstem	CLRU1	Colorado	Cisco; Nr	2024-03-19	◆	14000	19500	23000	26000	35000	◆	15000	20000	24000	27000	36000	25464	54625		69500	1984-05-28	
Colorado	Mainstem	CTRU1	Colorado	Cataract Canyon	2024-03-19	◆	29000	37000	45000	52000	64000	◇						43534			117000	1984-05-29	

# Impacts of Spring Weather

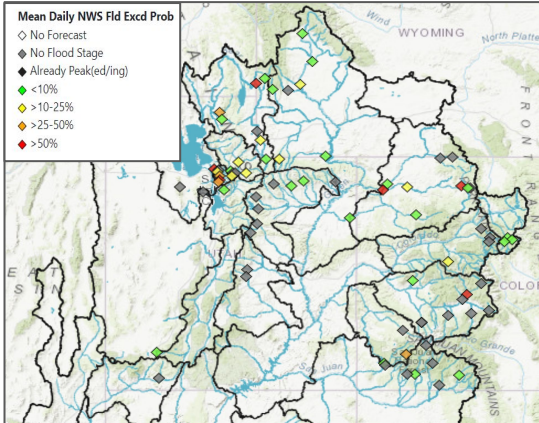
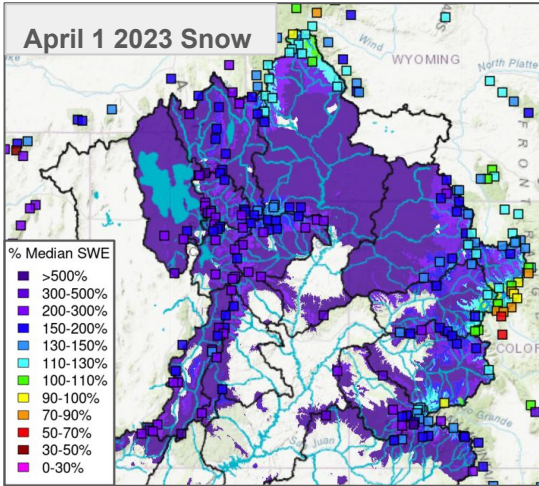
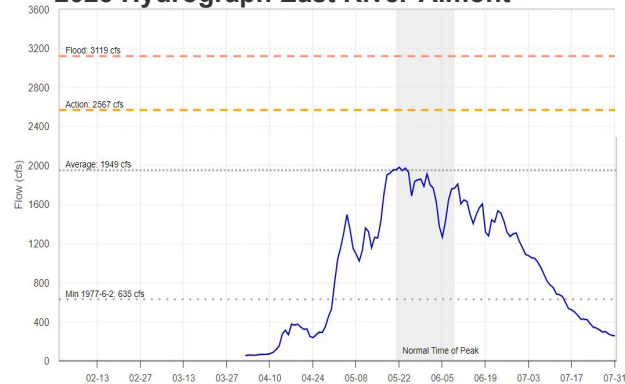
## 2023 Hydrograph Emigration Ck-Salt Lake City



## 2023 Hydrograph Yampa-Deerlodge Park



## 2023 Hydrograph East River-Almont

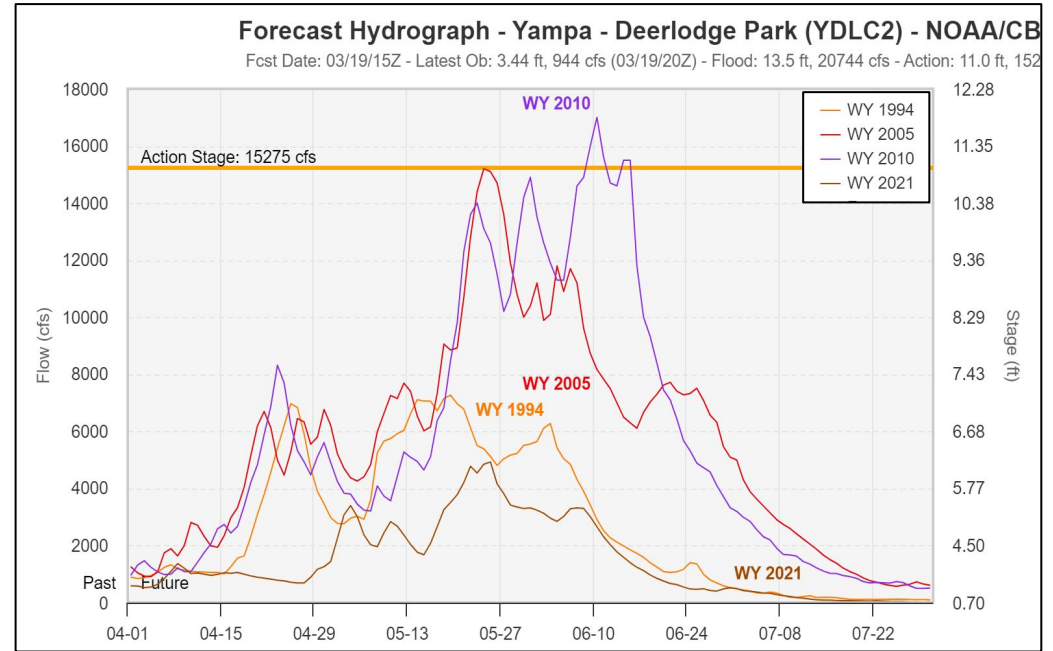


### April 1 2023 Flood Stage Exceedance Forecast



# Impacts of Spring Weather

Year	Mid-March SWE (in)	Peak SWE (in)	Peak Flow (CFS)	Peak Flow Date
1994	17.5	21.1	7270	May 20
2005	18.2	22.1	15200	May 25
2010	16.9	22.7	17000	June 11
2021	17.7	19.0	4930	May 26



**Peak flow forecasts have a high level of uncertainty and are highly dependent on spring weather.**

# Summary

- Peak flow forecasts represent a long range outlook of peak flows due to snowmelt.
- Mean daily peak flow forecast points are a subset of our daily river forecast points.
  - Available as:
    - Percentile
    - Percent Average
    - NWS Flood Stage Exceedance Probability
- Many, but not all, of these sites, have established flood stages and can provide some flood threat information.
- Peak flow forecasts have a high level of uncertainty and are highly dependent on spring weather.
  - *Typically only have a 5-10 day forecast lead time for timing the peak*
  - *10-Day streamflow forecasts are more accurate forecast of peak*
- Instantaneous Peak Flow Forecasts
  - Relationship between observed mean daily peak and instantaneous peak in each year
  - Only available for locations with strong correlations and long historical record
  - Sites with frequent heavy rain have poor relationships
- **Peak flow forecast points alone are not a comprehensive summary of any flood threat.**

# CBRFC Contacts & Water Year 2024 Basin Focal Points

## **Basin Focal Points (Forecasters)**

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