

# Comparison of Water Year 2021 Streamflow to Historical Data at Selected Sites in the Snake River Basin, Wyoming

The headwaters of the Snake River are in the mountains of northwestern Wyoming on lands primarily administered by the National Park Service and the Bridger-Teton National Forest. Streamflow in the Snake River Basin has been measured at some sites for more than 100 years (U.S. Geological Survey, 2021). Water from this drainage basin is used for recreation, agriculture, municipal supply, and power generation. Comparison of streamflows in the basin in water year 2021 with historical data can increase understanding of how these multiple uses, along with the ongoing drought in the Western United States, affect water availability during different times of the year (U.S. Department of Agriculture, 2022). Historical streamflow data are defined as the operational period of the streamgage through water year 2020. A water year is named for the year in which it ends; therefore, water year 2021 is October 1, 2020, through September 30, 2021.

## Streamflow Data Collected in the Snake River Basin

Sixteen streamgages were in year-round operation and one streamgage was operated from April 1 to September 30 during water year 2021 at sites on the main stem of the Snake River and its tributaries (table 1, fig. 1) (U.S. Geological Survey, 2021). The streamgages recorded streamflow at sites with drainage areas ranging from 5.13 square miles in the tributary Leidy Creek (station number 13012465; table 1) to 3,465 square miles on the main-stem Snake River, just upstream from Palisades Reservoir (station number 13022500; table 1) (U.S. Geological Survey, 2021). Streamflow in the Snake River in Wyoming is primarily a result of snowmelt runoff that typically begins in May and continues through July, depending on the area and elevation of the watershed upstream from the streamgage. Additionally, streamflow is regulated by dams and diversions at the more downstream sites (table 1) in the basin, which modifies natural streamflow patterns by storing and releasing water to meet downstream water needs.

Streamflow from water year 2021 at each site was compared graphically (fig. 1) to the streamflow for the period of record that predates the 2021 water year (historical data) (U.S. Geological Survey, 2021). The water year 2021 data are the daily mean streamflow at that site (fig. 1). The historical data are the mean daily streamflow (mean of all the daily means for the period of record through water year 2020) (U.S. Geological Survey, 2021). The daily mean and mean daily streamflow data are useful for observing the timing of streamflow and how large the flows are each day.



Snake River above Reservoir, near Alpine, Wyoming (station number 13022500), is located 100 miles downstream from the headwaters site of Leidy Creek at mouth, near Moran, Wyoming (station number 13012465). The annual streamflow at Snake River above Reservoir, near Alpine, Wyoming, is about 700 times the annual streamflow in Leidy Creek. Photograph by Jerrod D. Wheeler, July 15, 2020.

**Table 1.** U.S. Geological Survey streamgages in operation during water year 2021 in the Snake River Basin upstream from Palisades Reservoir, Idaho (U.S. Geological Survey, 2021).

[mi<sup>2</sup>, square mile]

Station number	Station name	Period of record (water year)	Number of years of record used to calculate daily mean streamflow	Drainage area (mi <sup>2</sup> )
13010065 <sup>a</sup>	Snake River above Jackson Lake near Flagg Ranch, Wyoming	1984–2021	37	486
13011000 <sup>b</sup>	Snake River near Moran, Wyoming	1904–2021	117	807
13011500 <sup>a</sup>	Pacific Creek at Moran, Wyoming	1917–2021	73–77 <sup>c</sup>	169
13011820 <sup>a</sup>	Blackrock Creek below Split Rock Creek, near Moran, Wyoming	2018–21	3	32.1
13011900 <sup>a</sup>	Buffalo Fork above Lava Creek near Moran, Wyoming	1965–2021	55	323
13012465 <sup>a</sup>	Leidy Creek at mouth, near Moran, Wyoming	2019–21	2	5.13
13012475 <sup>a</sup>	South Fork Spread Creek at mouth, near Moran, Wyoming	2019–21	2	44.4
13013650 <sup>d</sup>	Snake River at Moose, Wyoming	1995–2021	26	1,677
13014300 <sup>a</sup>	Gros Ventre River above Upper Slide Lake, near Kelly, Wyoming	2017–21	2–3 <sup>c</sup>	407
13014500 <sup>a</sup>	Gros Ventre River at Kelly, Wyoming	1917–2021	23–28 <sup>c</sup>	622
13015000 <sup>d</sup>	Gros Ventre River at Zenith, Wyoming	1917–18, 1987–2021	0–35 <sup>c,e</sup>	683
13016305 <sup>a</sup>	Granite Creek above Granite Creek Supplemental near Moose, Wyoming	1995–2021	25	14.9
13016450 <sup>d</sup>	Fish Creek at Wilson, Wyoming	1994–2021	26	71.1
13018300 <sup>a</sup>	Cache Creek near Jackson, Wyoming	1963–2021	58	10.6
13018350 <sup>d</sup>	Flat Creek below Cache Creek, near Jackson, Wyoming	1989–2021	29	129
13018750 <sup>d</sup>	Snake River below Flat Creek, near Jackson, Wyoming	1976–2021	46	2,627
13022500 <sup>d</sup>	Snake River above Reservoir, near Alpine, Wyoming	1938–2021	70	3,465

<sup>a</sup>Streamflow is unregulated.

<sup>b</sup>Streamflow is primarily regulated.

<sup>c</sup>Because the site did not operate year-round during some years, the daily mean calculation for individual days may be based on a different number of years of data. The range of years used for calculation are noted.

<sup>d</sup>Streamflow is a combination of unregulated and regulated.

<sup>e</sup>Seasonal site typically operated between about April 1 and September 30.

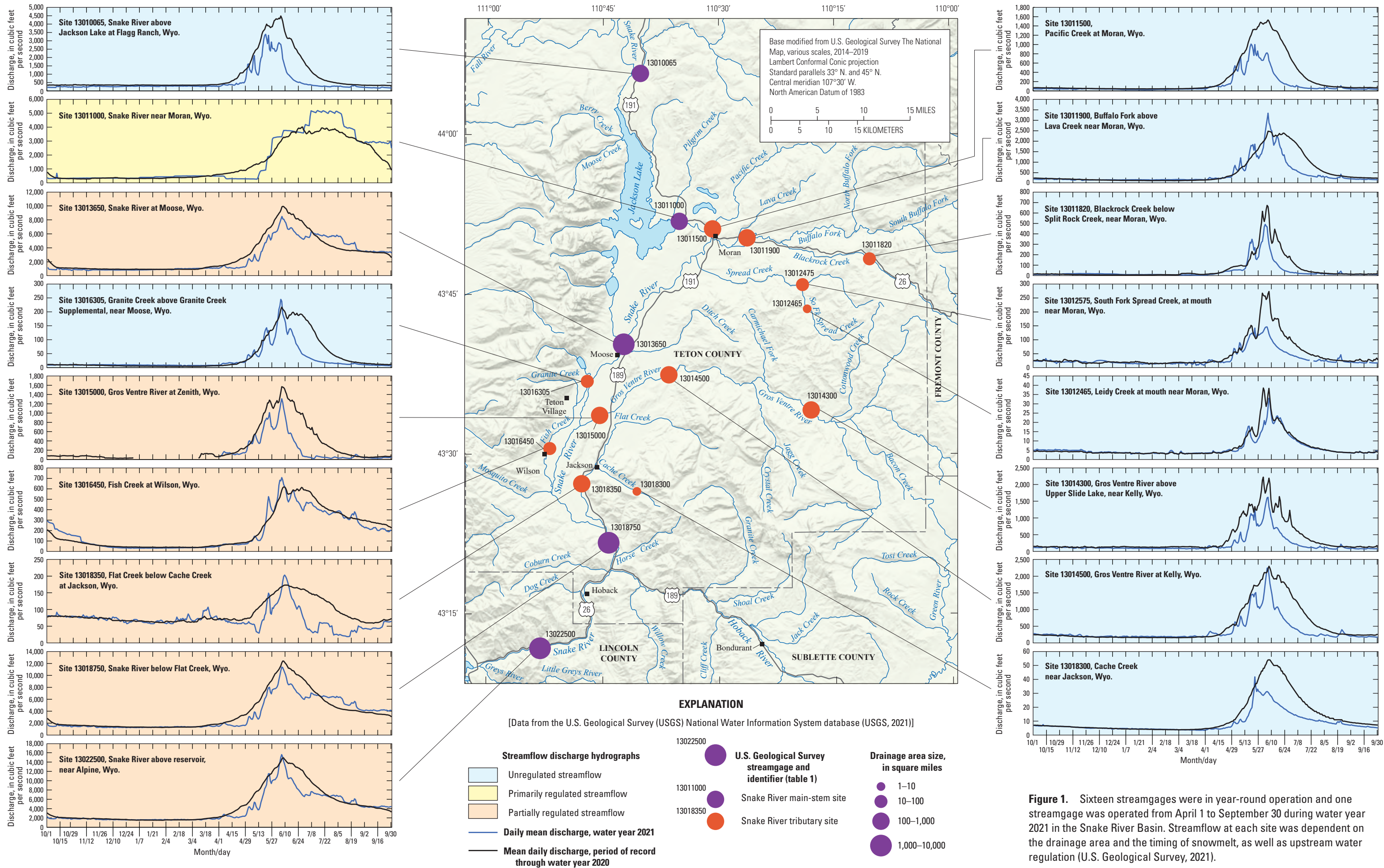


The rapid melting of snow quickly creates high flows in South Fork Spread Creek at mouth, near Moran, Wyoming (station number 13012475). Photograph by Cheryl Eddy-Miller, June 23, 2020.

## Comparison of Streamflow During Water Year 2021 to Historical Data

Cumulative streamflow is useful to determine the total amount of streamflow that flowed past each site during the entire month or each season and was calculated at each site using the daily streamflow data (table 2) (U.S. Geological Survey, 2021). Annual streamflow during water year 2021 tended to be lower than historical annual streamflow for the period of record through the 2020 water year (U.S. Geological Survey, 2021). At unregulated sites, the annual streamflow during water year 2021 ranged from 49 to 78 percent of the historical mean annual streamflow for the period of record through the 2020 water year (table 2). At sites with some level of regulation (table 2), the streamflow during water year 2021 ranged from 79 to 113 percent of the historical mean annual streamflow for the period of record through the 2020 water year (U.S. Geological Survey, 2021).





**Table 2.** Annual streamflow during water year 2021 and period of record through water year 2020 at U.S. Geological Survey streamgages, Snake River Basin (U.S. Geological Survey, 2021).

[Mcf, million cubic feet; POR, period of record; NA, not applicable]

Station number	Station name	Annual streamflow water year 2021 (Mcf)	Annual streamflow POR through water year 2020 (Mcf)	Percentage annual streamflow water year 2021 compared to mean annual streamflow POR through water year 2020	April, May, June streamflow, water year 2021 (Mcf)	April, May, June streamflow, POR through water year 2020 (Mcf)	Percentage mean annual streamflow during April, May, June during water year 2021	Percentage annual streamflow during April, May, June for POR through water year 2020
13010065 <sup>a</sup>	Snake River above Jackson Lake near Flagg Ranch, Wyoming	16,110	27,940	58	9,868	18,130	61	65
13011000 <sup>b</sup>	Snake River near Moran, Wyoming	51,130	45,240	113	13,530	15,170	26	34
13011500 <sup>a</sup>	Pacific Creek at Moran, Wyoming	4,080	8,381	49	3,026	6,270	74	75
13011820 <sup>a</sup>	Blackrock Creek below Split Rock Creek, near Moran, Wyoming	1,278	1,934	66	955	1,525	75	79
13011900 <sup>a</sup>	Buffalo Fork above Lava Creek near Moran, Wyoming	13,500	17,210	78	8,517	9,488	63	55
13012465 <sup>a</sup>	Leidy Creek at mouth, near Moran, Wyoming	154	208	74	70	106	45	51
13012475 <sup>a</sup>	South Fork Spread Creek at mouth, near Moran, Wyoming	1,019	1,439	71	535	828	53	58
13013650 <sup>c</sup>	Snake River at Moose, Wyoming	82,210	91,830	90	30,860	42,480	38	46
13014300 <sup>a</sup>	Gros Ventre River above Upper Slide Lake, near Kelly, Wyoming	6,587	11,530	57	4,082	7,439	62	65
13014500 <sup>a</sup>	Gros Ventre River at Kelly, Wyoming	11,300	15,910	71	6,148	9,229	54	58
13015000 <sup>c</sup>	Gros Ventre River at Zenith, Wyoming.	NA <sup>d</sup>	NA <sup>d</sup>	NA <sup>d</sup>	3,483	5,803	NA	NA
13016305 <sup>a</sup>	Granite Creek above Granite Creek Supplemental near Moose, Wyoming	840	1,248	67	580	767	69	61
13016450 <sup>c</sup>	Fish Creek at Wilson, Wyoming	5,854	6,118	96	2,197	2,287	38	37
13018300 <sup>a</sup>	Cache Creek near Jackson, Wyoming	272	403	68	124	211	45	52
13018350 <sup>c</sup>	Flat Creek below Cache Creek, near Jackson, Wyoming	2,187	2,764	79	715	919	33	33
13018750 <sup>c</sup>	Snake River below Flat Creek, near Jackson, Wyoming	103,900	114,900	90	39,540	52,960	38	46
13022500 <sup>c</sup>	Snake River above Reservoir, near Alpine, Wyoming.	123,800	142,500	87	51,790	67,770	42	48

<sup>a</sup>Streamflow is unregulated.

<sup>b</sup>Streamflow is primarily regulated.

<sup>c</sup>Streamflow is a combination of unregulated and regulated.

<sup>d</sup>Annual streamflow is not computed for the seasonally operated streamgage.





Streamflow in Leidy Creek at mouth, near Moran, Wyoming (station number 13012465), located in the mountainous headwater of Snake River Basin is relatively consistent throughout the winter months owing to base flow as the area snowpack accumulates. Photograph by Jerrod D. Wheeler, February 23, 2020.

Snowmelt runoff began near the same time of year at most unregulated sites when comparing the increase in streamflow in the spring of water year 2021 to the historical spring streamflow increase. At most unregulated sites, the peak snowmelt streamflow for water year 2021 occurred near the same time as historical flows, but the duration of the peak flows was shorter in 2021, with streamflow dropping to base flow, or low flow, conditions in midsummer. Peak streamflows at sites that were primarily regulated or partially regulated were similar to unregulated sites, but the decrease in flow after the peak and base flow tended to resemble historical streamflow in magnitude and timing (U.S. Geological Survey, 2021).

Streamflow at unregulated sites indicates that the snowmelt runoff in April, May, and June typically accounts for more than 50 percent of the annual flow (table 2). Streamflow during the same 3 months, at sites with year-round data collection that are regulated or partially regulated, is less than 50 percent of the annual flow, which indicates the effect of storing the water from spring runoff. At most sites, regardless of the amount of regulation, during water year 2021 the percentage of annual streamflow during April, May, and June was similar to the percentage during the historical period of record (table 2) (U.S. Geological Survey, 2021).



Snake River near Moran, Wyoming (station number 13011000), monitors regulated streamflow releases from the Jackson Lake Dam. Photograph by James R. Campbell, November 20, 2020.

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