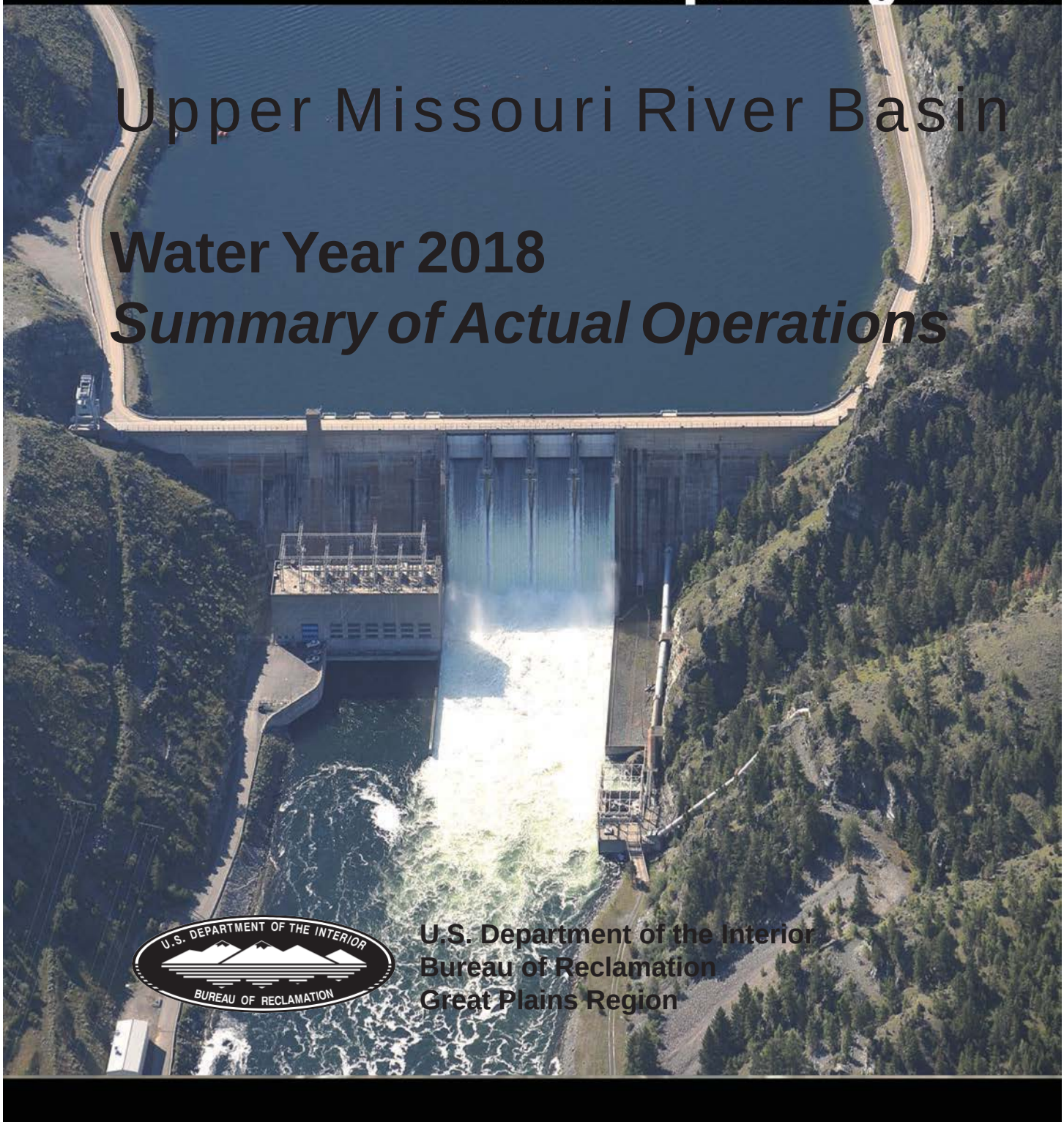
RECLAMATION

Managing Water in the West

Annual Operating Plans



Upper Missouri River Basin

Water Year 2018

Summary of Actual Operations

U.S. Department of the Interior
Bureau of Reclamation
Great Plains Region

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Annual Operating Plans for Water Year 2018 for Units Under the Responsibility of the Montana Area Office

Hydrologic Conditions and Flood Control

Water Year (WY) 2018 started with varying storage levels. Gibson Reservoir storage was 31 percent of average while Clark Canyon storage was 133 percent of average. The Reclamation reservoir with the greatest amount of carryover storage was Bighorn Lake at 99 percent of full capacity. Total inflows into Reclamation facilities in Montana east of the Continental Divide ranged from 87 percent of average at Fresno Dam to 210 percent of average at Bighorn Lake. At the start of water year 2018, all of Montana and parts of Wyoming were considered moderately to exceptionally dry.

October through December

WY 2018 began in October with dry conditions, as most of Montana was in a drought status. Temperatures were near normal to a few degrees below normal during October. Precipitation during the month varied across the state, with a low of 25 percent of normal in central Montana to a high of 300 percent of normal in the northwestern part of the state. Along the high-line, Havre, MT recorded a new 24-hour record snowfall total of 13 inches while Rocky Boy recorded 30 inches. Other locations received wind gust up to 50 mph with 6 feet snow drifts causing power outages and blocked roads. Northern Wyoming, in the Lower Yellowstone Basin, was a few degrees below normal with below normal precipitation.

November resulted in varied temperatures across Montana with the southwest at 3 degrees above normal and north central at 3 to 4 degrees below normal. Precipitation was heavy (200-300 percent of normal) over the Rocky Mountains and the western border. Precipitation in Northern Wyoming produced above-normal conditions in the Shoshone and Wind River basin, while colder or below-normal temperatures occurred.

A mix of above to below-normal temperatures occurred during December with above-normal precipitation dominating over most of Montana, Figure 1 and Figure 2. Snow spread over much of Montana from December the 18 through 21. A foot of snow fell at Fort Belknap, Loma, Zortman, and Bynum, while 24 inches fell at Marias Pass. On December 30, more heavy snow fell over much of Montana, with amounts of two to four feet accumulating from Hardin and Roundup to St. Mary and Babb. Northern Wyoming temperatures were near-normal and above-normal precipitation persisted in the Shoshone and Wind River basins.

The year-to-date mountain precipitation from October through December ranged from 78 percent of average above Lima Reservoir in the Beaverhead Basin to 126 percent of average above Tiber

Reservoir in the Marias Basin. The valley precipitation ranged from 97 percent of average in the Beaverhead Basin to 204 percent of average in the Marias Basin. Additional monthly data on valley and mountain precipitation per basin during WY 2018 can be found in Table 1, Table 2, Figure 3, and Figure 4.

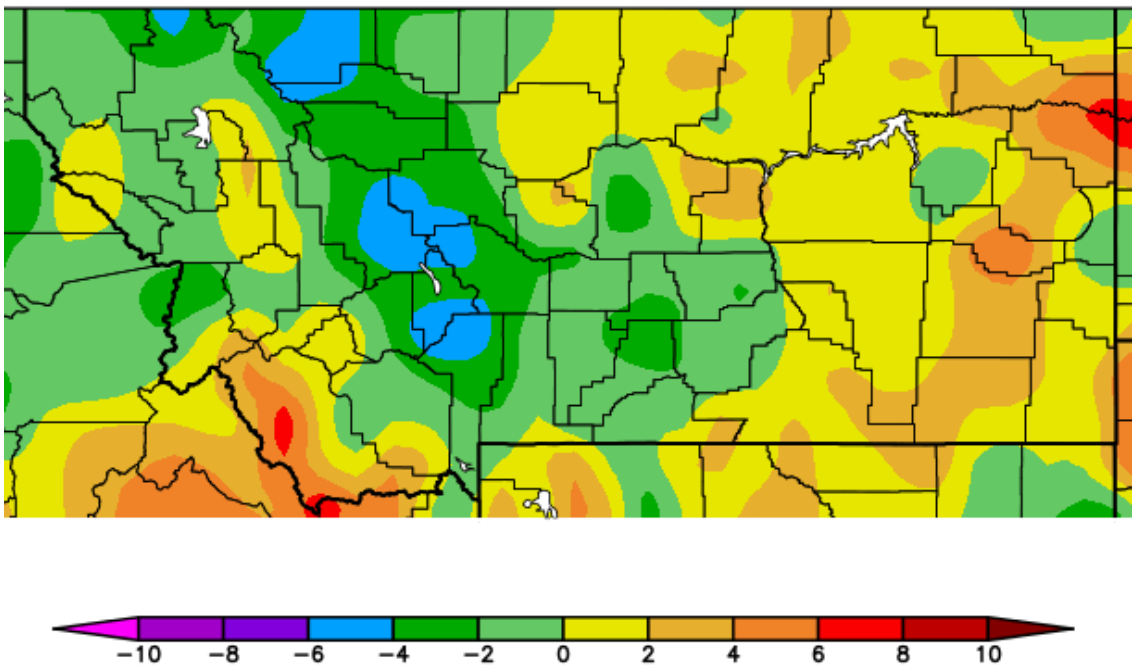


Figure 1. December 2017 temperature departures from normal (°F) (Western Region Climate Center).

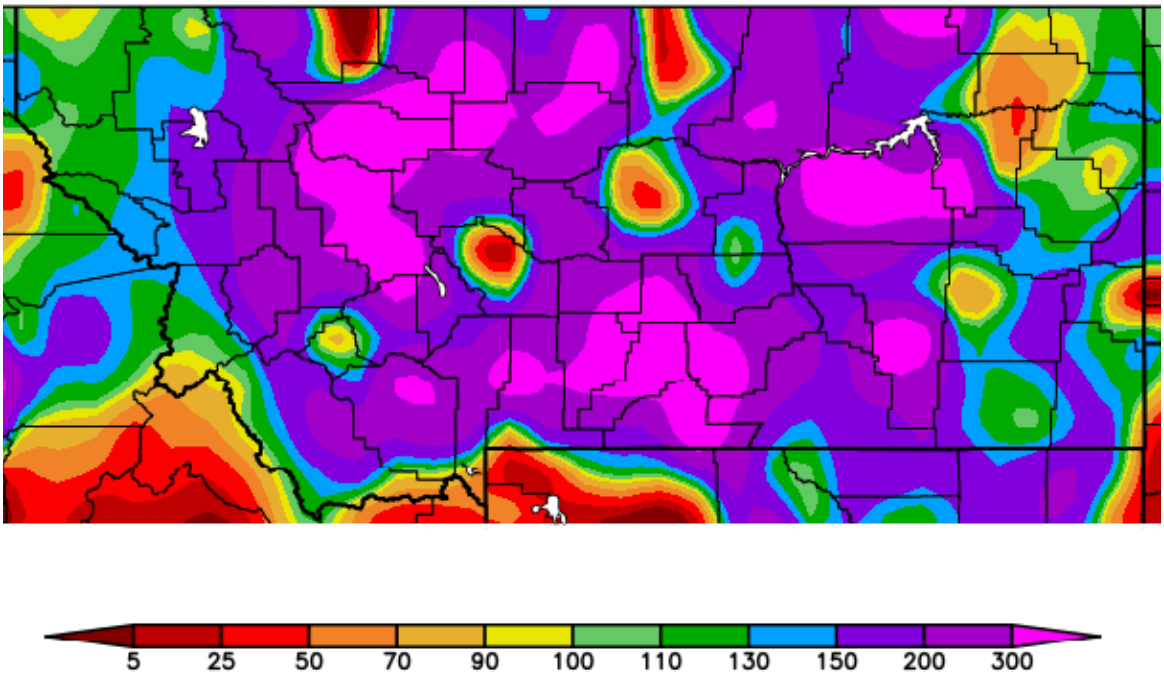


Figure 2. December 2017 precipitation departures from normal (percent) (Western Region Climate Center).

Table 1. Valley Precipitation in Inches and Percent of Average.

BASIN	OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP	
	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%
Beaverhead																								
Monthly Average Precip	0.98		0.69		0.60		0.61		0.51		0.79		1.21		2.11		2.11		1.25		1.13		0.95	
Monthly Precip and % of Average	0.46	47	1.00	145	0.75	125	0.50	82	0.69	135	0.88	111	1.71	142	2.06	98	3.76	178	0.16	13	0.75	67	0.16	17
Year-to-Date Precip and % of Average	0.46	47	1.46	87	2.21	97	2.71	94	3.40	100	4.28	102	5.99	111	8.06	107	11.82	123	11.98	110	12.73	106	12.89	100
Jefferson																								
Monthly Average Precip	0.88		0.57		0.45		0.40		0.38		0.63		1.04		1.91		2.05		1.26		1.15		0.94	
Monthly Precip and % of Average	0.43	50	0.94	166	0.78	173	0.42	105	0.47	124	0.84	132	1.74	168	1.85	97	3.75	183	0.21	17	0.91	79	0.30	32
Year-to-Date Precip and % of Average	0.43	50	1.37	95	2.16	114	2.58	112	3.05	114	3.88	117	5.62	129	7.47	119	11.22	135	11.43	120	12.34	115	12.64	109
Madison																								
Monthly Average Precip	1.59		1.69		1.76		1.56		1.35		1.73		2.01		2.73		2.60		1.63		1.32		1.27	
Monthly Precip and % of Average	1.18	75	3.21	190	2.13	121	1.84	118	1.97	146	2.57	149	3.05	152	2.65	97	3.84	147	0.46	28	1.21	92	0.21	17
Year-to-Date Precip and % of Average	1.18	75	4.39	134	6.52	129	8.36	127	10.34	130	12.91	133	15.96	136	18.61	129	22.45	132	22.90	123	24.12	121	24.33	115
Gallatin																								
Monthly Average Precip	1.28		0.85		0.59		0.56		0.53		1.01		1.73		2.63		2.66		1.38		1.18		1.23	
Monthly Precip and % of Average	0.91	71	1.92	226	1.68	283	1.07	190	0.80	149	1.41	140	3.39	196	2.82	107	3.99	150	0.35	25	1.18	100	0.57	46
Year-to-Date Precip and % of Average	0.91	71	2.82	133	4.50	165	5.57	169	6.36	167	7.77	161	11.16	170	13.98	152	17.96	152	18.31	138	19.49	135	20.06	128
Missouri Above Toston																								
Monthly Precip Average	1.13		0.91		0.81		0.74		0.65		0.99		1.42		2.29		2.34		1.40		1.21		1.09	
Monthly Precip and % of Average	0.70	62	1.71	188	1.28	159	0.90	122	0.92	141	1.42	143	2.35	166	2.29	100	3.86	165	0.30	21	1.04	86	0.35	32
Year-to-Date Precip and % of Average	0.70	62	2.42	118	3.70	130	4.60	128	5.52	130	6.94	133	9.30	140	11.59	130	15.45	137	15.75	124	16.78	121	17.13	114
Sun-Teton																								
Monthly Average Precip	0.81		0.47		0.41		0.39		0.39		0.79		1.33		2.19		2.54		1.33		1.43		1.41	
Monthly Precip and % of Average	0.55	68	0.88	186	1.62	394	0.27	69	1.41	361	1.19	151	1.27	96	3.16	144	4.44	174	0.49	37	0.54	38	1.09	78
Year-to-Date Precip and % of Average	0.55	68	1.42	111	3.04	180	3.31	159	4.72	191	5.91	182	7.18	157	10.34	153	14.78	159	15.27	144	15.81	131	16.90	125
Marias																								
Monthly Average Precip	0.67		0.75		0.64		0.62		0.57		0.85		1.11		1.96		2.55		1.38		1.19		1.20	
Monthly Precip and % of Average	1.19	178	1.30	173	1.71	267	0.54	86	2.16	382	1.26	149	1.66	150	1.99	101	3.10	122	0.38	27	0.59	49	0.94	78
Year-to-Date Precip and % of Average	1.19	178	2.49	175	4.20	204	4.74	177	6.90	212	8.16	199	9.82	189	11.81	165	14.91	154	15.29	138	15.88	129	16.82	125
Milk																								
Monthly Average Precip	0.72		0.46		0.39		0.38		0.28		0.52		0.90		2.05		2.52		1.56		1.17		1.26	
Monthly Precip and % of Average	1.17	161	0.34	73	0.77	197	0.24	64	1.10	387	1.03	198	0.54	60	1.19	58	2.42	96	0.82	52	1.01	86	1.96	156
Year-to-Date Precip and % of Average	1.17	161	1.51	127	2.28	144	2.52	129	3.62	162	4.66	169	5.19	142	6.39	112	8.80	107	9.62	98	10.63	97	12.60	103
St. Mary																								
Monthly Average Precip	1.87		2.80		2.30		2.27		2.15		2.47		2.24		2.80		3.54		1.72		1.43		1.80	
Monthly Precip and % of Average	2.39	128	4.64	166	3.71	162	2.54	112	5.45	253	1.78	72	2.46	110	1.82	65	3.39	96	0.69	40	0.72	50	0.63	35
Year-to-Date Precip and % of Average	2.39	128	7.03	151	10.74	154	13.28	144	18.73	165	20.51	148	22.97	143	24.79	131	28.18	126	28.87	120	29.58	116	30.21	110
Bighorn Above Yellowtail																								
Monthly Average Precip	0.93		0.55		0.42		0.36		0.39		0.67		1.16		1.81		1.43		0.88		0.60		1.06	
Monthly Precip and % of Average	0.58	63	0.94	169	0.87	205	0.41	114	0.82	209	0.65	96	1.18	102	3.56	196	1.98	139	0.57	65	0.83	139	0.25	23
Year-to-Date Precip and % of Average	0.58	63	1.52	103	2.39	125	2.80	123	3.63	136	4.27	128	5.46	121	9.01	143	10.99	142	11.56	134	12.39	135	12.64	123

Table MTT1A valley precipitation data was generated from Parameter-elevation Regressions on Independent Slopes Model (PRISM).

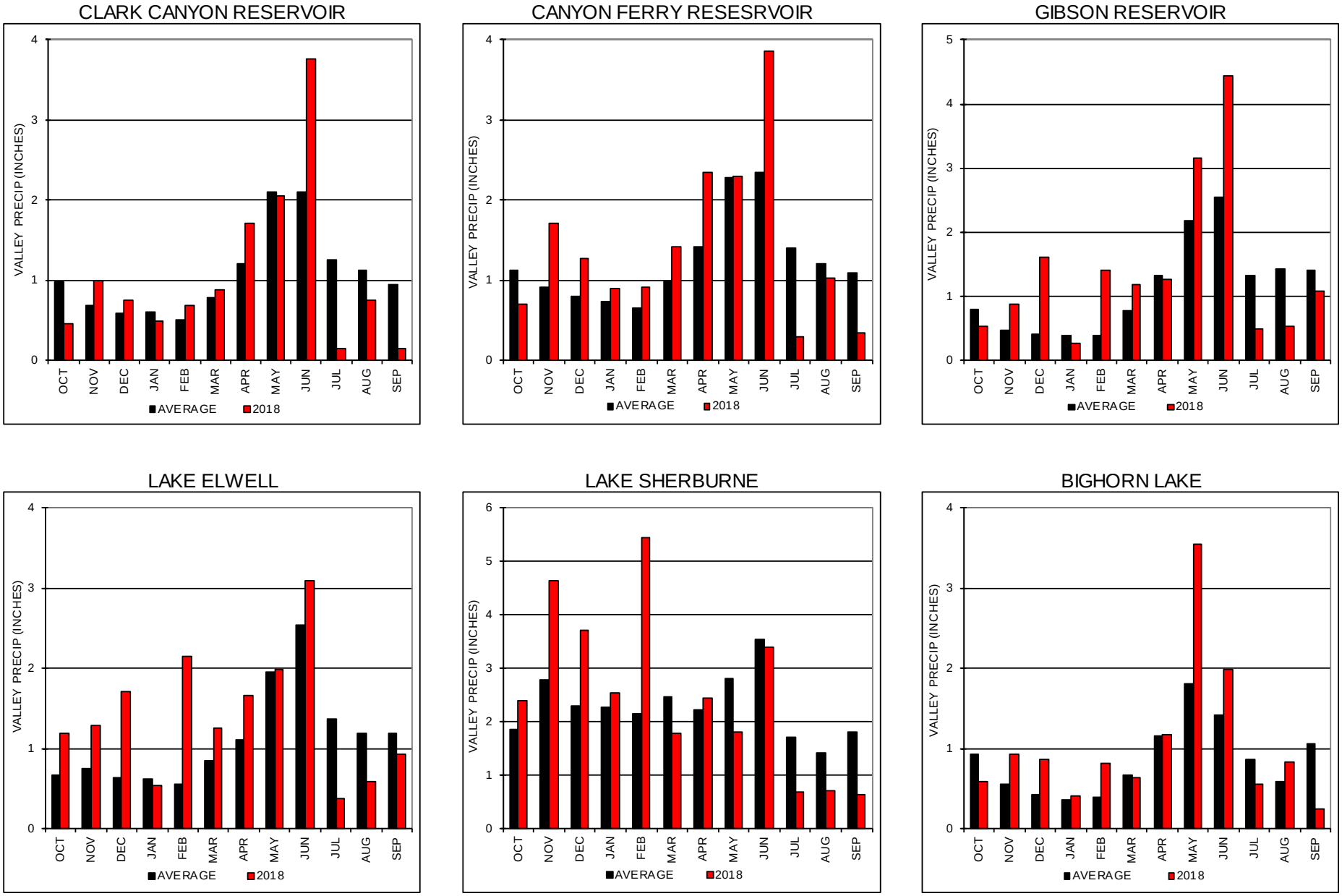


Figure 3. Valley Precipitation in Inches and Percent of Average.

Table 2. Mountain Precipitation in Inches and Percent of Average.

BASIN	OCT		NOV		DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP	
	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%	IN.	%
Lima Reservoir																								
Monthly Average Precip	2.04		2.42		2.70		2.58		2.18		2.54		2.54		3.06		2.84		1.64		1.32		1.54	
Monthly Precip and % of Average	1.18	58	2.82	117	1.58	59	2.28	88	1.94	89	5.04	198	2.98	117	2.74	90	3.72	131	0.32	20	0.76	58	0.30	19
Year-to-Date Precip and % of Average	1.18	58	4.00	90	5.58	78	7.86	81	9.80	82	14.84	103	17.82	105	20.56	102	24.28	106	24.60	100	25.36	98	25.66	94
Clark Canyon Reservoir																								
Monthly Average Precip	2.16		2.59		2.53		2.43		2.09		2.59		2.97		3.41		3.04		1.54		1.46		1.67	
Monthly Precip and % of Average	1.29	60	3.13	121	2.40	95	2.19	90	2.46	118	3.90	151	3.71	125	3.86	113	4.77	157	0.56	36	1.07	74	0.40	24
Year-to-Date Precip and % of Average	1.29	60	4.41	93	6.81	94	9.00	93	11.46	97	15.36	107	19.07	110	22.93	110	27.70	116	28.26	111	29.33	109	29.73	104
Jefferson Drainage																								
Monthly Average Precip	2.11		2.61		2.61		2.53		2.15		2.60		2.97		3.38		3.01		1.58		1.54		1.72	
Monthly Precip and % of Average	1.46	69	3.33	128	2.91	111	2.16	86	3.34	155	3.36	129	3.81	128	3.63	107	5.08	169	0.68	43	1.11	72	0.45	26
Year-to-Date Precip and % of Average	1.46	69	4.79	102	7.70	105	9.86	100	13.20	110	16.56	113	20.38	116	24.00	115	29.08	121	29.75	116	30.86	114	31.32	109
Madison Drainage																								
Monthly Average Precip	2.81		3.80		4.15		3.98		3.34		3.71		3.78		4.05		3.25		1.83		1.65		1.89	
Monthly Precip and % of Average	1.65	59	5.45	143	3.30	80	4.31	108	4.55	136	4.34	117	5.08	134	3.70	91	4.21	130	0.46	25	0.96	58	0.36	19
Year-to-Date Precip and % of Average	1.65	59	7.10	107	10.40	97	14.71	100	19.26	107	23.60	108	28.68	112	32.38	109	36.59	111	37.05	107	38.01	105	38.38	100
Gallatin Drainage																								
Monthly Average Precip	3.03		3.37		3.43		3.30		3.00		3.90		4.47		5.00		4.17		2.23		1.93		2.27	
Monthly Precip and % of Average	2.63	87	5.13	152	4.40	128	3.40	103	3.93	131	4.17	107	6.53	146	3.97	79	5.77	138	0.77	34	1.97	102	1.03	46
Year-to-Date Precip and % of Average	2.63	87	7.77	121	12.17	124	15.57	119	19.50	121	23.67	118	30.20	123	34.17	116	39.93	119	40.70	113	42.67	113	43.70	109
Canyon Ferry Reservoir																								
Monthly Average Precip	2.36		3.01		3.13		3.03		2.57		3.00		3.29		3.68		3.17		1.66		1.57		1.79	
Monthly Precip and % of Average	1.64	69	4.16	138	3.18	102	2.93	97	3.77	147	3.66	122	4.37	133	3.76	102	4.90	155	0.63	38	1.22	78	0.50	28
Year-to-Date Precip and % of Average	1.64	69	5.80	108	8.97	106	11.90	103	15.67	111	19.33	113	23.70	116	27.46	114	32.37	119	32.99	114	34.21	112	34.72	108
Gibson Reservoir																								
Monthly Average Precip	2.14		2.64		2.58		2.31		2.15		2.33		2.47		3.41		3.58		1.72		1.99		2.08	
Monthly Precip and % of Average	2.74	128	2.96	112	3.50	136	2.06	89	5.91	276	1.96	84	2.30	93	3.34	98	7.86	219	0.42	24	0.34	17	0.73	35
Year-to-Date Precip and % of Average	2.74	128	5.69	119	9.20	125	11.25	116	17.17	145	19.13	135	21.43	129	24.77	124	32.63	138	33.05	130	33.39	122	34.12	116
Lake Elwell Reservoir																								
Monthly Average Precip	2.75		3.80		3.78		3.48		3.10		3.20		3.08		3.90		3.98		1.85		2.10		2.45	
Monthly Precip and % of Average	3.48	126	4.68	123	4.85	128	3.55	102	7.38	238	2.45	77	3.18	103	3.15	81	6.43	162	0.50	27	0.53	25	0.75	31
Year-to-Date Precip and % of Average	3.48	126	8.15	124	13.00	126	16.55	120	23.93	142	26.38	131	29.55	128	32.70	121	39.13	126	39.63	120	40.15	115	40.90	109
Sherburne Reservoir																								
Monthly Average Precip	4.55		7.60		6.90		7.35		5.35		5.15		4.60		4.60		5.25		2.45		2.00		3.30	
Monthly Precip and % of Average	4.45	98	10.40	137	6.80	99	8.30	113	10.25	192	5.00	97	5.15	112	1.15	25	4.60	88	0.40	16	0.20	10	1.70	52
Year-to-Date Precip and % of Average	4.45	98	14.85	122	21.65	114	29.95	113	40.20	127	45.20	122	50.35	121	51.50	112	56.10	109	56.50	105	56.70	102	58.40	99
Bighorn Lake																								
Monthly Average Precip	2.37		2.29		2.16		2.08		1.86		2.59		3.09		3.69		2.86		1.83		1.31		2.19	
Monthly Precip and % of Average	1.78	75	3.34	145	2.46	114	1.85	89	3.48	187	2.40	93	3.55	115	4.36	118	3.35	117	0.84	46	1.24	95	0.49	22
Year-to-Date Precip and % of Average	1.78	75	5.12	110	7.58	111	9.43	106	12.91	120	15.31	115	18.86	115	23.22	115	26.56	115	27.40	110	28.64	110	29.13	103

Table MTT1B mountain precipitation data was compiled from Natural Resources Conservation Service (NRCS) snow telemetry (SNOTEL) data.

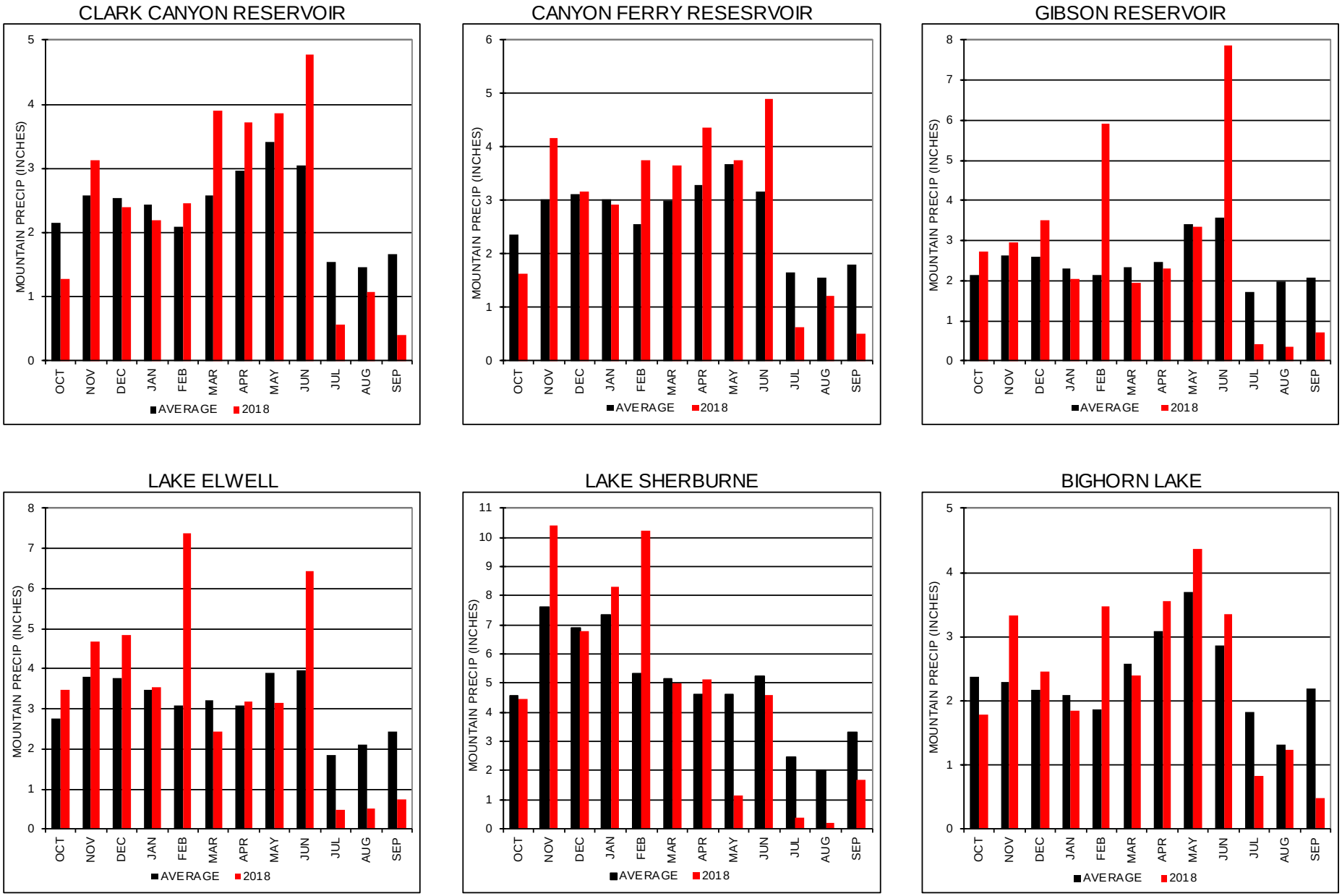


Figure 4. Mountain Precipitation in Inches and Percent of Average.

January through March

The Natural Resource Conservation Service (NRCS) reports the mountain snowpack or snow water equivalent (SWE) throughout Montana and Wyoming. Due to the persistent, heavy precipitation that fell in October through December, the NRCS January 1 mountain SWE ranged from 95 percent of normal in the St. Mary and Milk River Basin to 161 percent of normal in the Yellowstone River Basin, Figure 5. A tabular report of the snow water equivalent is also shown on Table 3. On January 1, Reclamation began forecasting the April through July spring runoff volumes for Reclamation reservoirs east of the Continental Divide. Therefore, the water supply forecasts prepared on January 1 indicated April through July runoff volumes varying from 98 percent of average at Tiber Dam to 143 percent of average at Yellowtail Dam, Table 4.

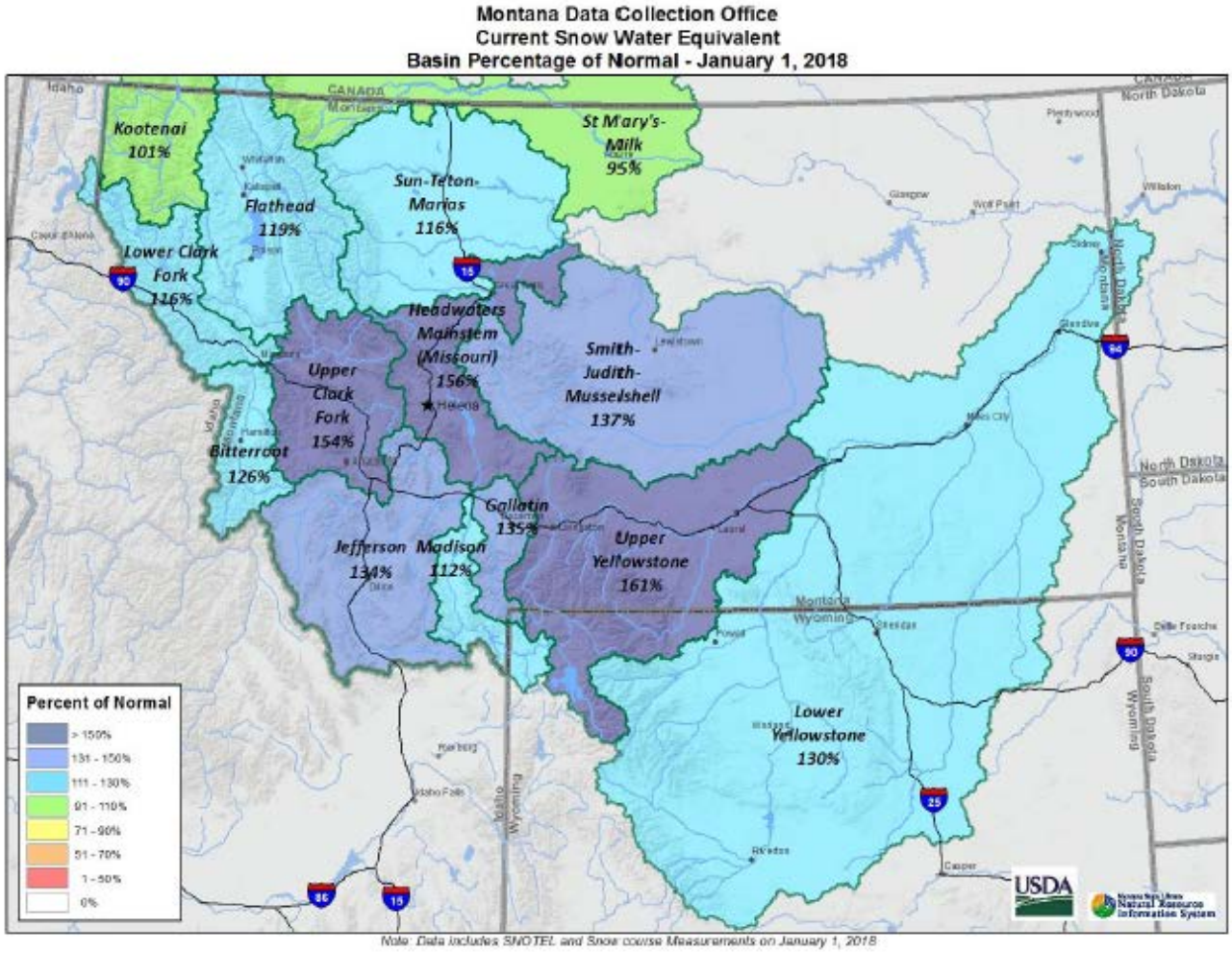


Figure 5. January 1, 2018 SWE, Percent of Normal (NRCS).

Continuing the trend, statewide composite for Montana temperatures were mixed during January. Above-normal temperatures prevailed along the rocky mountain front and below-normal temperatures occurred in the east. Above-average snowfall continued in the Upper Missouri River basin and central Montana, while the rest of the state received below average precipitation.

Table 3. 2018 Mountain SWE as a Percent of Median.

DRAINAGE BASIN	JAN 1	FEB 1	MAR 1	APR 1	MAY 1
Jefferson	134	125	133	134	130
Madison	114	116	125	122	127
Gallatin	136	132	140	132	148
Headwaters Mainstem Missouri	156	144	132	130	150
Sun-Teton-Marias	121	116	147	139	168
St. Mary - Milk River	95	101	135	134	163
Bighorn River Basin above Yellowtail	138	124	134	125	128

Table 4. 2018 Water Supply Forecasts.

RESERVOIR	JAN 1[1/]		FEB 1[1/]		MAR 1[1/]		APR 1[2/]		MAY 1[3/]		JUN 1[4/]		ACTUAL APRIL-JULY[5/]		% OF APRIL FORE-CAST REC'D
	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	1,000 AC-FT	% OF AVG	
Clark Canyon	78.5	105	77.7	104	77.4	104	95.4	123	65.0	104	42.3	68	140	202	146
Canyon Ferry	2,005.7	117	2,138.0	125	2,325.8	136	2,325.2	137	2,180.0	152	1,129.0	134	3,179.8	176	136
Gibson	455.4	112	470.4	115	614.4	151	600.3	147	563.0	156	240.0	99	666.7	164	111
Tiber	361.0	98	378.0	102	472.2	128	450.0	122	407.0	129	131.0	69	657.1	178	146
Sherburne	100.0	100	104.0	105	110.0	110	115.0	116	110.0	124	59.0	102	108.3	109	94
Fresno	101.7	126	71.1	88	72.7	90	76.1	149	58.5	134	25.1	104	130.8	162	180
Yellowtail	1,668.7	143	1,771.6	152	1,841.4	157	1,864.8	160	1,349.3	134	1,126.2	158	2,317.9	199	124

1/ Runoff Forecast for April-July; Fresno Reservoir is March-September.
2/ Runoff Forecast for April-July; Fresno Reservoir is April-September
3/ Runoff Forecast for May-July; Fresno Reservoir is May-September
4/ Runoff Forecast for June-July; Fresno Reservoir is June-September
5/ Actual Runoff for April-July; Fresno Reservoir is March-September.

Snowfall during the month of January favored the northwest part of the lower Yellowstone River basin, with the mountain basins tributary to the Shoshone River basin receiving above-normal snow totals for the month. However, below-normal snowfall was recorded in the Wind River basin. In general, higher elevation sites across the Yellowstone basin tended to have higher percentages of SWE.

February started out on the mild side, with some temperatures reaching into the 50s. However, a strong cold-front brought much colder air, snow, and wind to Montana by February 3 (Figure 6 and Figure 7). Wind chills reached -68 °F north of Hingham, MT. Record snow fell from East Glacier to Chinook, to Grass Range and south through Colstrip. Snowfall averaged 21.3 inches across Montana, which was 13.5 inches above normal and resulted in record snow accumulation. Approximately 145 inches of snow was reported at Noisy Basin at the end of the month; average is 97 inches. East Glacier reported the highest snowfall, with a total of 78 inches. Blizzard and white-out conditions caused roads to close for days at a time in the Browning area, especially during the last 4 days of the month. Many people were snowed-in around Browning and some could not return to their homes for several days as drifts were over 8 feet deep in places. Snow depths reached to nearly three feet over central Montana. Dillon set a new February wind record with a gust of 63 mph while West Yellowstone reached a new record low of -34 °F.

Precipitation across the tributary basins of the lower Yellowstone River in Wyoming was well above normal for February. The Wind River basin received well above-normal snow accumulation early in the Water Year 2018 season and has currently been tracking along with normal conditions since mid-November. Temperatures during February were cold, ranging up to 15 degrees below normal.

By the end of February, the year-to-date mountain precipitation resulted in a low of 82 percent of average at Lima Dam and a high of 145 percent of average at Gibson Reservoir.

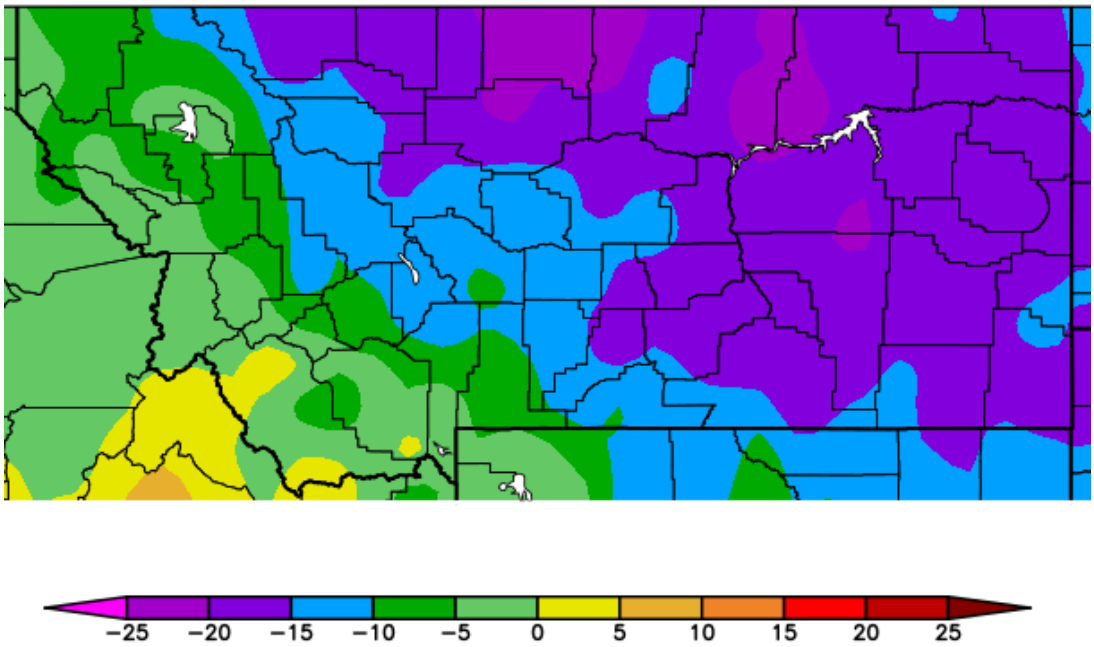


Figure 6. February 2018 temperature departures from normal (°F) (NOAA Regional Climate Center).

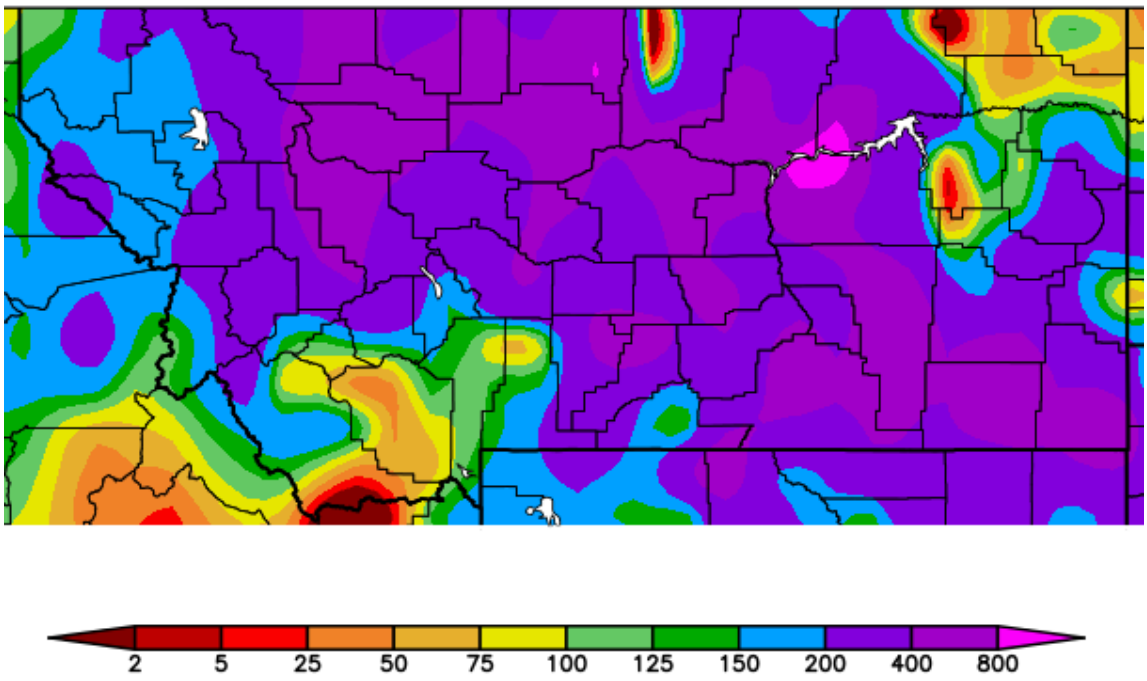


Figure 7. February 2018 percent of normal precipitation (%) (NOAA Regional Climate Center).

Due to the excess of precipitation in February, the April through July water supply forecasts increased or remained the same as the March 1 forecast except for Fresno Reservoir. Forecasts ranged from 90 percent of average at Fresno to 157 percent of average at Yellowtail.

March again produced above-normal precipitation and continued to build upon the already above-normal snowpack across Montana and Northern Wyoming. The snowpack in the basins were trending with other comparable years that produced some of the highest April through July runoff volumes of record.

By the end of March, the-year-to date mountain precipitation varied from a low of 103 percent of average above Lima Reservoir to 135 percent of average above Gibson Reservoir. The year-to-date valley precipitation varied from a low of 102 percent of average in the Beaverhead River basin to 199 percent of average in the Marias River basin.

April through June

As depicted in the NRCS map shown in Figure 8 the April 1 SWE across Montana and northern Wyoming recorded above-average conditions. The resulting April through July forecasted runoff volumes ranged from 116 percent of average into Lake Sherburne to 160 percent of average into Yellowtail Dam.

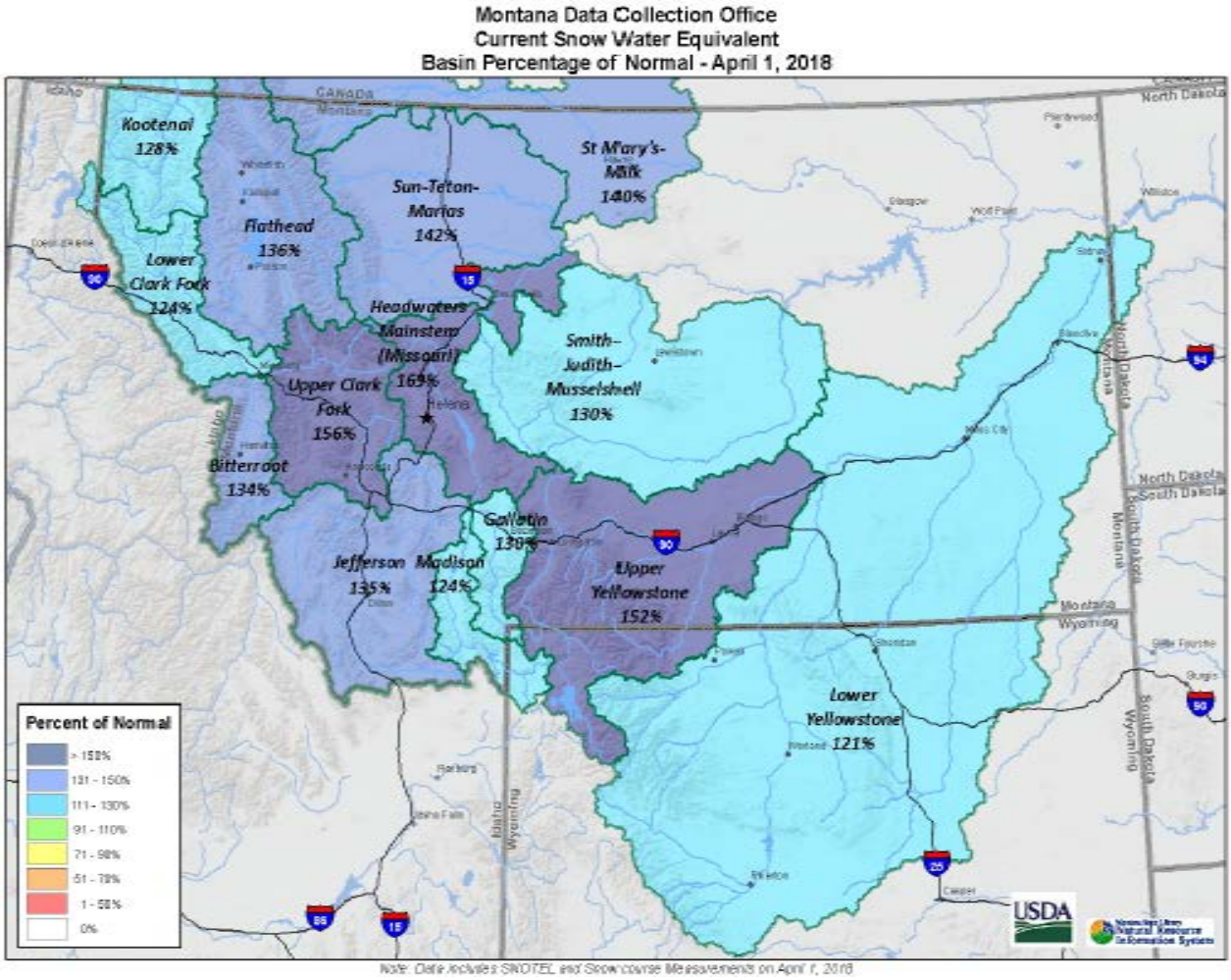


Figure 8. April 1, 2018 SWE, Percent of Normal (NRCS).

April temperature ranged from near-normal in the west to 10 degrees below normal over portions of the northeast in Montana. Precipitation was heaviest over the western mountains and the western border with above, to much-above-normal over most of the state, but portions of the hi-line were below-normal. Precipitation was 200 percent of normal in the Missouri River headwaters.

Near-average precipitation fell in April in the Lower Yellowstone Basin. Most of April's precipitation was received during the first half of the month. Warm temperatures initiated the low elevation snowmelt. Mid-to-high elevation sites in the Big Horn and Wind Rivers still have over 75% of their peak SWE left. Overall, the snowpack is above-normal in the Lower Yellowstone River basin. The Bighorn mountains recorded the second-highest snow water equivalent reading in 39 years.

The SWE above Reclamation's reservoirs reached its peak snowpack for the year by April 30, as shown in Figure 9, except for the snowpack above Gibson Reservoir, which peaked on May 13. Gibson Reservoir's snow graph shows spikes due to manual monthly measurements being made by NRCS at Badger Pass as the site was not transmitting daily data.

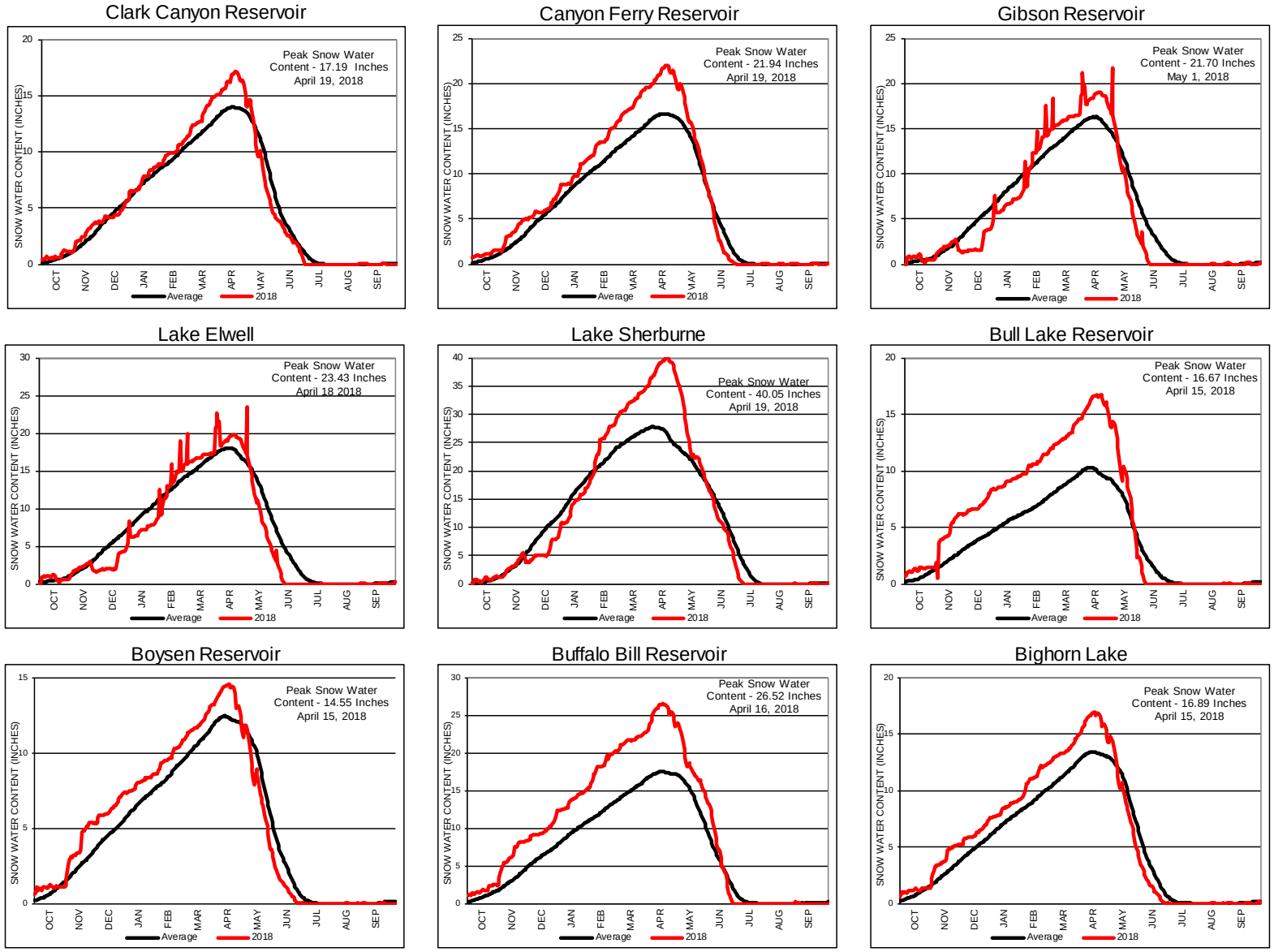


Figure 9. Snow Water Content for Several Reservoirs.

Above-normal temperatures dominated Montana in May, ranging from 1 to nearly 7 degrees above normal across the state (Figure 10). The state-wide temperature average of 57.2 °F was 5.2°F above normal, and the warmest May since 1958. Precipitation was heaviest over the central mountains and southward. Precipitation was below normal over the northern quarter of the state, along with portions of southwest and southeast Montana. Elsewhere it ranged from above normal to much-above normal (Figure 11). The statewide composite of 2.73 inches was 0.33 inches above normal.

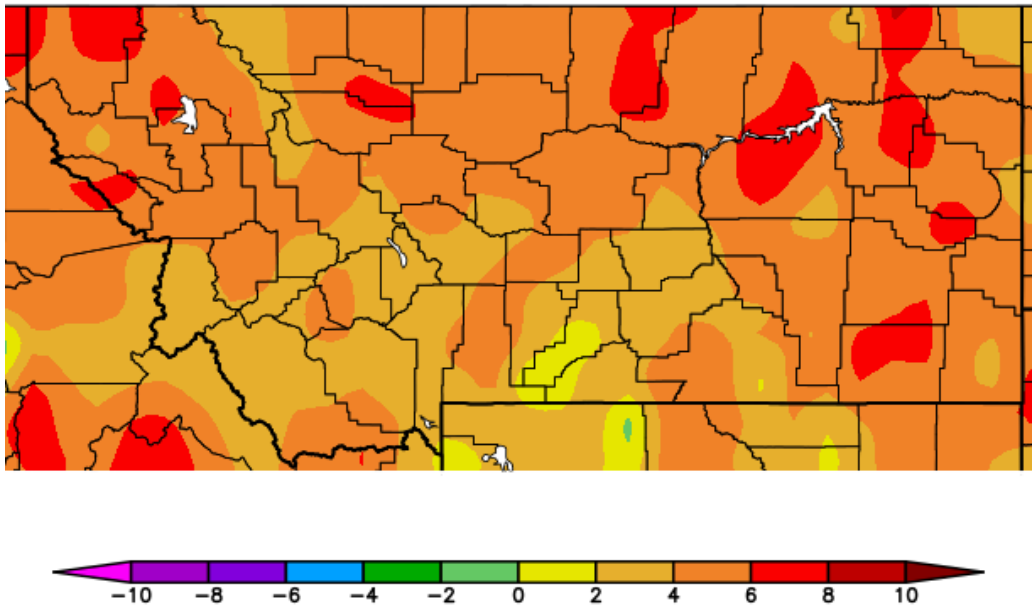


Figure 10. May 2018 temperature departures from normal (°F) (NOAA Regional Climate Center).

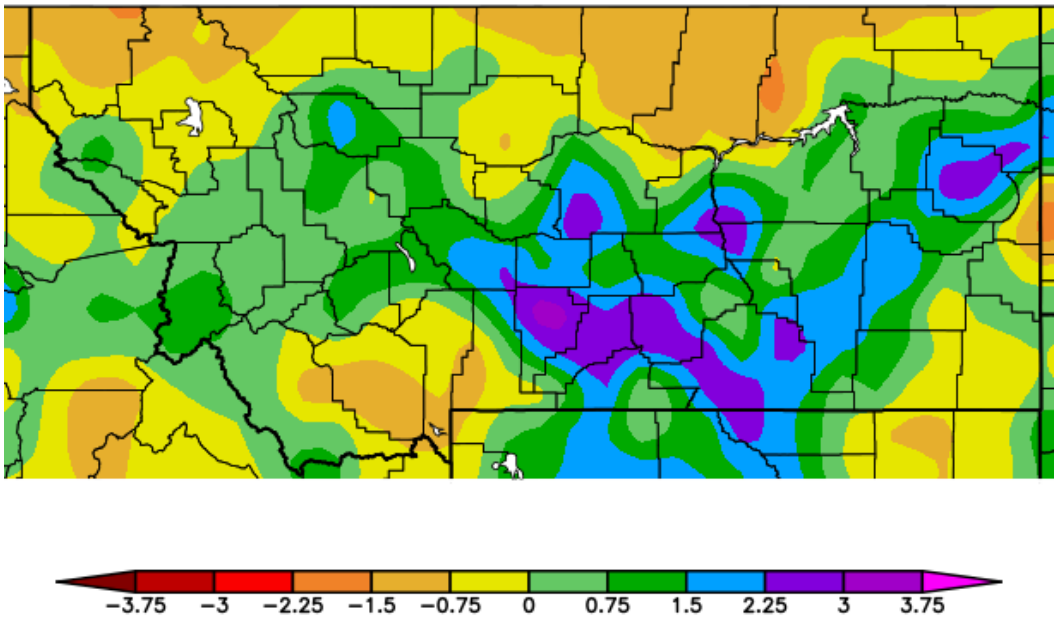


Figure 11. May 2018 precipitation departures from normal (inches) (NOAA Regional Climate Center).

With the high temperatures, snowmelt and runoff accelerated during May in the lower Yellowstone River tributary basins in Wyoming. Most of the lower-elevation snow in the basins had melted by the third week in May. However, the high elevation snowpack in the headwaters of the Shoshone and Wind River Range was still above normal. In conjunction with the rapid snowmelt, a precipitation event over Memorial Day in the northern Bighorn Mountains received over two inches of rain.

Integrating the effects of the much-above-average temperatures, and above-average snowpack and precipitation, the rapid snowmelt resulted in flooding or high river flows across Montana and Northern Wyoming. See the following sections for specific information on how Reclamation's reservoirs were managed in response to the rapid snowmelt and high runoff volumes that occurred in May.

By June 1, the rapid snowmelt runoff that occurred in May resulted in above-average reservoir storage and above-average release rates. The June 1 SWE ranged from below average to above-average Figure 12.

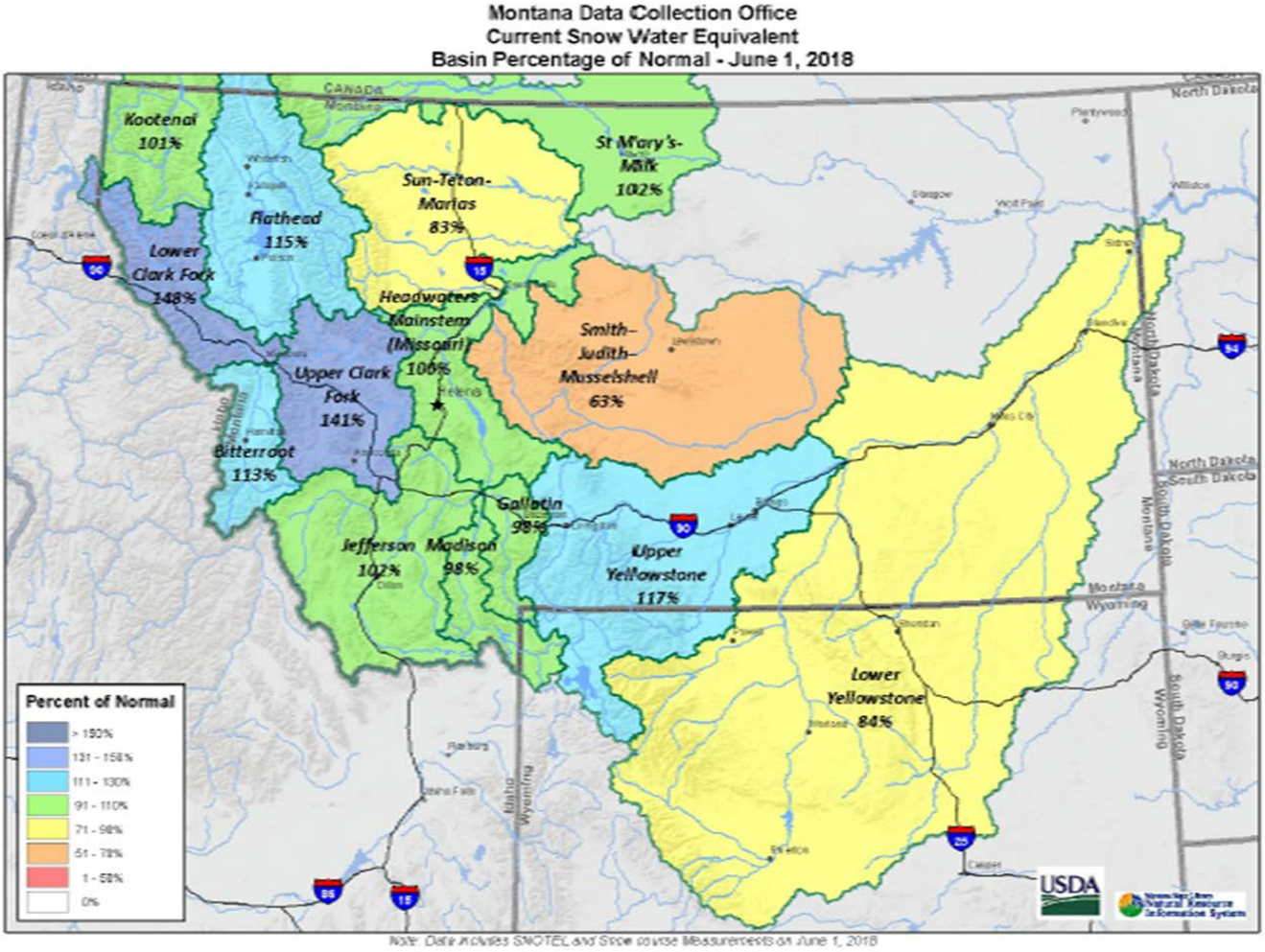


Figure 12. June 1, 2018 SWE, Percent of Normal (Natural Resource Conservation Service).

After a warm and wet May, June started out cold with some lingering rain from May. River flooding continued in southwest Montana through the first week of June. More heavy rain fell during June 7-8 where up to two inches of rain fell from Bozeman to Lewistown to the Bears Paws. During June 9-10 the low elevation temperatures dropped from near 90°F to near 60°F. This rapid cooling caused snow to fall over the mountains during June 10-11. Soon after, a large storm system was forecasted across central and southwestern Montana where heavy rain fell during June 16-19. Nine inches of rain fell at Wood Creek SNOTEL, while 7.54 inches fell at Gibson Dam. Amounts greater than five inches occurred along the Rocky Mountain Front from west of Choteau to west of Augusta. The 7.54-inch snowfall at Gibson Dam was the highest 4-day total since June 1964 at that location. Table 5 shows the 4-day rain totals above two inches across Montana. Moderate flooding was reported on most rivers in central Montana as a result and continued flooding through June 21. Some river stages were recorded higher than the snowmelt flooding in May, and higher than river stages recorded in 2011. All roads to Augusta were closed for a time. Highway 200 was closed on June 19 and then reopened on the 22. The Elk Creek Bridge on Highway 21 washed out and the road was closed for several months.

On June 23, torrential rains fell in the Shelby and Great Falls areas. Much of the western part of Shelby from the town to the Interstate Bridge was underwater. North of Great Falls, over four and a half inches of rain fell in a two-and-a-half-hour period, while over three inches fell in a separate fifteen-minute period. This downpour established many short-term precipitation intensity records for Montana. The heavy rain in June caused many areas to have their wettest water-year in many years. Bozeman had its wettest year since 1885. A wet microburst occurred between Fairfield and Sun River on June 25 causing heavy rain and hail which caused damage to buildings and downing trees.

Table 5. June 2018 Storm Event – Watershed Precipitation, Inches

SUN-TETON						
NOAA STATIONS						
	06/16/18	06/17/18	06/18/18	06/19/18		4-Day Total
CHOTEAU 8 NE	0.37	0.02	1.00	0.74		2.13
CHOTEAU	0.44	0.10	0.81	1.50		2.85
DUTTON 3.3 ENE	0.00	0.52	0.18	1.23		1.93
FAIRFIELD	0.00	0.00	0.00	1.02		1.02
GIBSON DAM	2.17	0.87	4.23	0.27		7.54
GREAT FALLS	0.71	0.00	0.74	0.59		2.04
ROGERS PASS 9 NNE	1.85	0.45	1.60	0.26		4.16
SUN RIVER 4 S	0.00	1.48	0.25	1.07		2.80
SNOTEL STATIONS						
DUPUYER CREEK	0.70	0.10	5.00	1.40		7.20
MOUNT LOCKHART	0.60	0.20	2.10	0.80		3.70
WALDRON	0.80	0.10	4.10	0.90		5.90

WOOD CREEK	3.80	0.30	3.90	0.90		8.90
AVERAGE	0.95	0.35	1.99	0.89		4.18

RED ROCK-BEAVERHEAD						
NOAA STATIONS						
	06/16/18	06/17/18	06/18/18	06/19/18		4-Day Total
DILLON 18 WSW	0.74	0.37	0.36	0.09		1.56
DILLON AIRPORT	0.54	0.31	0.64	0.12		1.61
GRANT 5 SE	0.63	0.19	0.58	0.35		1.75
LIMA	0.65	0.15	2.15	0.04		2.99
POLARIS 3.7 NNE	0.51	0.22	0.45	0.05		1.23
WISDOM	0.00	0.00	0.00	0.10		0.10
SNOTEL STATIONS						
CRAB CREEK	0.60	0.80	1.10	0.10		2.60
DIVIDE	0.10	0.30	0.80	0.30		1.50
ISLAND PARK	0.00	0.70	0.40	0.30		1.40
LAKEVIEW RIDGE	0.00	0.20	1.20	0.20		1.60
TEPEE CREEK	0.00	0.00	0.80	0.30		1.10
BEAGLE SPRINGS	1.10	0.90	0.80	0.10		2.90
BLOODY DICK	0.20	0.20	0.40	0.10		0.90
DARKHORSE LAKE	0.30	0.50	0.30	0.50		1.60
DIVIDE	0.10	0.30	0.80	0.30		1.50
LAKEVIEW RIDGE	0.00	0.20	1.20	0.20		1.60
LEMHI RIDGE	1.10	0.30	0.60	0.20		2.20
TEPEE CREEK	0.00	0.00	0.80	0.30		1.10
AVERAGE	0.37	0.31	0.74	0.20		1.62

JEFFERSON-MADISON-GALLATIN						
NOAA STATIONS						
	06/16/18	06/17/18	06/18/18	06/19/18		4-Day Total
ALDER 19 S	0.42	0.05	0.30	0.65		1.42
BOULDER 0.3 E	0.45	0.56	0.20	1.00		2.21
BOZEMAN 1.5 SSE	0.13	0.11	0.42	0.46		1.12
BOZEMAN 6 W	0.27	0.13	0.57	0.57		1.54
BOZEMAN AIRPORT	0.11	0.17	0.84	0.45		1.57
BOZEMAN MSU	0.20	0.19	0.59	0.40		1.38

DILLON 18 WSW	0.74	0.37	0.36	0.09		1.56
DILLON AIRPORT	0.54	0.31	0.64	0.12		1.61
ENNIS	0.22	0.17	0.67	0.13		1.19
GLEN 0.2 SE	0.67	0.20	0.56	0.33		1.76
GRANT 5 SE	0.63	0.19	0.58	0.35		1.75
HEBGEN DAM	0.48	1.30	0.51	0.06		2.35
LAURIN 2 NE	0.31	0.00	0.60	0.15		1.06
LIMA	0.65	0.15	2.15	0.04		2.99
LOGAN LANDFILL	0.00	0.00	0.37	0.41		0.78
NORRIS POWER	0.58	0.26	0.70	0.35		1.89
OLD FAITHFUL	1.17	0.00	0.00	0.13		1.30
POLARIS 3.7 NNE	0.51	0.22	0.45	0.05		1.23
SHERIDAN 1.4 ENE	0.38	0.16	0.51	0.24		1.29
TOWNSEND	0.68	0.00	0.53	0.94		2.15
TRIDENT	0.15	0.20	0.35	0.32		1.02
TWIN BRIDGES	0.41	0.05	0.55	0.26		1.27
WEST YELLOWSTONE	0.30	0.11	0.84	0.23		1.48
WISDOM	0.00	0.00	0.00	0.10		0.10
WISE RIVER 3 WNW	0.65	0.09	0.73	0.14		1.61
SNOTEL STATIONS						
BEAGLE SPRINGS	1.10	0.90	0.80	0.10		2.90
BEAVER CREEK	0.50	1.30	0.50	0.00		2.30
BLACK BEAR	0.20	0.60	0.70	0.30		1.80
BLOODY DICK	0.20	0.20	0.40	0.10		0.90
CALVERT CREEK	0.00	0.00	0.00	0.20		0.20
CARROT BASIN	0.00	1.00	0.50	0.20		1.70
CLOVER MEADOW	0.30	0.00	0.50	0.30		1.10
DARKHORSE LAKE	0.30	0.50	0.30	0.50		1.60
DIVIDE	0.10	0.30	0.80	0.30		1.50
FROHNER MEADOW	0.40	0.20	1.40	1.00		3.00
LAKEVIEW RIDGE	0.00	0.20	1.20	0.20		1.60
LEMHI RIDGE	1.10	0.30	0.60	0.20		2.20
LICK CREEK	0.00	0.40	0.40	0.40		1.20
LOWER TWIN	0.50	0.60	0.80	0.70		2.60
MADISON PLATEAU	0.00	0.90	0.70	0.20		1.80
MOOSE CREEK	0.80	0.50	1.00	0.00		2.30
MULE CREEK	0.90	0.80	0.60	0.20		2.50
ROCKER PEAK	1.00	0.00	1.60	0.70		3.30
SADDLE MTN.	0.00	0.50	0.90	0.40		1.80

SHORT CREEK	0.20	0.30	0.50	0.30		1.30
SHOWER FALLS	0.60	0.90	0.80	0.40		2.70
TEPEE CREEK	0.00	0.00	0.80	0.30		1.10
WHISKEY CREEK	0.00	0.20	0.30	0.50		1.00
AVERAGE	0.39	0.32	0.63	0.32		1.67

MARIAS						
NOAA STATIONS						
	06/16/18	06/17/18	06/18/18	06/19/18		4-Day Total
CHESTER	0.00	0.00	0.00	0.34		0.34
CONRAD	0.20	0.06	0.52	0.57		1.35
CUT BANK AIRPORT	0.56	0.00	0.38	0.15		1.09
DUNKIRK 19 NNE	0.04	0.18	0.02	0.46		0.70
EAST GLACIER	0.00	0.00	0.84	0.00		0.84
GALATA 16 SW	0.00	0.17	0.00	0.85		1.02
SHELBY	0.00	0.31	0.16	0.56		1.03
SNOTEL STATIONS						
DUPUYER CREEK	0.70	0.10	5.00	1.40		7.20
MOUNT LOCKHART	0.60	0.20	2.10	0.80		3.70
PIKE CREEK	1.40	0.00	1.00	0.60		3.00
WALDRON	0.80	0.10	4.10	0.90		5.90
AVERAGE	0.39	0.10	1.28	0.60		2.38

MILK						
NOAA STATIONS						
	06/16/18	06/17/18	06/18/18	06/19/18		4-Day Total
CHINOOK	0.00	0.00	0.27	0.20		0.47
FORT BELKNAP 2 SW	0.00	0.18	0.00	0.20		0.38
GILDFORD	0.06	0.00	0.30	0.33		0.69
GLASGOW WEATHER	0.22	0.00	0.04	0.01		0.27
GOLDBUTTE 7 N	0.13	0.38	0.00	1.45		1.96
HAVRE AIRPORT	0.07	0.00	0.05	0.15		0.27
HINGHAM 12 N	0.00	0.03	0.00	0.40		0.43
HINSDALE 4 SW	0.16	0.00	0.00	0.06		0.22
HOGELAND 7.0 SSE	0.00	0.02	0.00	0.25		0.27
MALTA	0.05	0.25	0.01	0.28		0.59
RUDYARD 21 N	0.00	0.00	0.00	0.41		0.41

SACO 1 NNW	0.00	0.20	0.00	0.14		0.34
SIMPSON 6 N	0.00	0.00	0.10	0.41		0.51
AVERAGE	0.05	0.08	0.06	0.33		0.52

SWIFTCURRENT						
NOAA STATIONS						
	06/16/18	06/17/18	06/18/18	06/19/18		4-Day Total
EAST GLACIER	0.00	0.00	0.84	0.00		0.84
ST. MARY 1 SSW	1.01	0.00	0.93	0.32		2.26
SNOTEL STATIONS						
FLATTOP MTN.	1.00	0.00	0.30	0.10		1.40
MANY GLACIER	1.10	0.00	1.00	0.30		2.40
AVERAGE	0.62	0.00	0.61	0.14		1.38

BIGHORN-WIND-SHOSHONE						
NOAA STATIONS						
	06/16/18	06/17/18	06/18/18	06/19/18		4-Day Total
BASIN	0.00	0.00	0.14	0.38		0.52
BLACK MOUNTAIN	0.02	0.03	0.22	0.20		0.47
BOYSEN DAM	0.00	0.11	0.29	0.29		0.69
BUFFALO BILL DAM	0.00	0.00	0.37	0.09		0.46
BURRIS	0.00	0.15	2.04	0.52		2.71
CODY 12 SE	0.70	0.24	0.39	0.48		1.81
CODY 7.6 NNW	0.64	0.41	0.43	0.33		1.81
DEAVER	0.44	0.00	0.34	0.52		1.30
DUBOIS	0.11	0.55	1.58	0.30		2.54
EMBLEM	0.10	0.15	0.65	0.00		0.90
FORT SMITH 0.5 ENE	0.46	0.08	0.23	0.77		1.54
GREYBULL AIRPORT	0.01	0.08	0.47	0.00		0.56
LANDER 11 SSE	0.04	1.09	0.19	0.04		1.36
LANDER 7.3 WNW	0.10	0.62	1.52	0.12		2.36
LANDER AIRPORT	0.07	1.21	0.25	0.00		1.53
LOVELL	0.00	0.73	0.57	0.02		1.32
PAHASKA	0.87	0.73	1.03	0.50		3.13
PAVILLION	0.00	1.20	0.31	0.10		1.61
POWELL FIELD	0.00	0.00	0.88	0.62		1.50

RAIRDEN 2 WSW	0.08	0.02	0.13	0.00		0.23
RIVERTON AIRPORT	0.20	0.72	0.10	0.02		1.04
SHELL 9.5 NNW	0.00	0.00	0.00	0.51		0.51
SHELL	0.15	0.00	0.06	0.27		0.48
SHOSHONI	0.00	0.12	0.29	0.00		0.41
SUNSHINE 3 NE	0.30	0.07	0.79	0.70		1.86
TEN SLEEP 0.3 SSW	0.00	0.00	0.11	0.15		0.26
TENSLEEP 16 SSE	0.10	0.08	0.14	0.12		0.44
THERMOPOLIS 9 NE	0.11	0.00	0.16	0.11		0.38
WORLAND 14.4 SW	0.07	0.00	0.12	0.18		0.37
WORLAND AIRPORT	0.00	0.02	0.08	0.01		0.11
SNOTEL STATIONS						
BALD MTN.	0.00	0.00	0.00	0.30		0.30
BEAR TRAP MEADOW	0.00	0.00	0.30	0.10		0.40
BLACKWATER	0.40	1.00	0.80	0.20		2.40
BONE SPRINGS DIV	0.00	0.20	0.40	0.10		0.70
BURGESS JUNCTION	0.00	0.00	0.30	0.30		0.60
DOME LAKE	0.00	0.00	0.00	0.10		0.10
EVENING STAR	1.10	0.70	1.40	0.00		3.20
HANSEN SAWMILL	0.00	0.20	0.00	0.10		0.30
KIRWIN	0.00	0.00	0.80	0.50		1.30
MIDDLE POWDER	0.00	0.00	0.00	1.00		1.00
OWL CREEK	0.10	1.70	0.80	0.20		2.80
POWDER RIVER PASS	0.00	0.10	0.30	0.20		0.60
SHELL CREEK	0.10	0.00	0.60	0.10		0.80
SUCKER CREEK	0.10	0.00	0.30	0.60		1.00
SYLVAN LAKE	0.90	0.80	1.00	0.10		2.80
SYLVAN ROAD	1.10	0.50	1.00	0.00		2.60
TIMBER CREEK	0.20	0.70	0.20	0.10		1.20
AVERAGE	0.18	0.30	0.46	0.24		1.17

July through September

July delivered a mix of temperatures and little to no precipitation across Montana, as shown in Figure 13 and Figure 14. Montana averaged only 0.29 inches which was the second driest July of record. Only 0.01 inches of rain fell at Helena, MT resulting in the driest July of record while Dillon, MT was second driest July of record with only a trace of precipitation. Irrigators started to draw on reservoir storage to satisfy their needs.

By the end of July, the actual April through July runoff volumes for WY 2018 ranged from 109 percent of average into Lake Sherburne to 202 percent of average into Clark Canyon Dam, and 199 percent of average into Yellowtail Dam, Table 4.

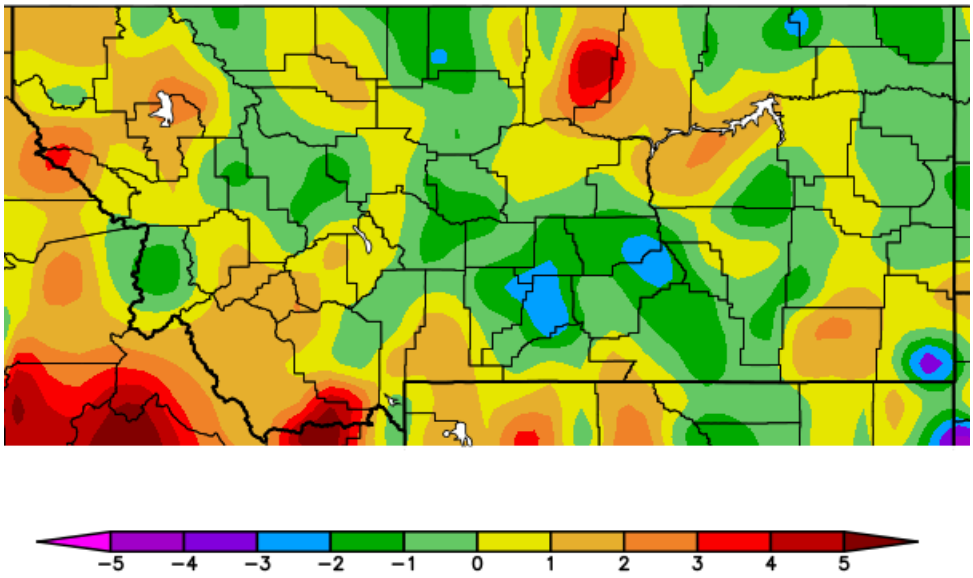


Figure 13. July 2018 temperature departures from normal (°F) (NOAA Regional Climate Center).

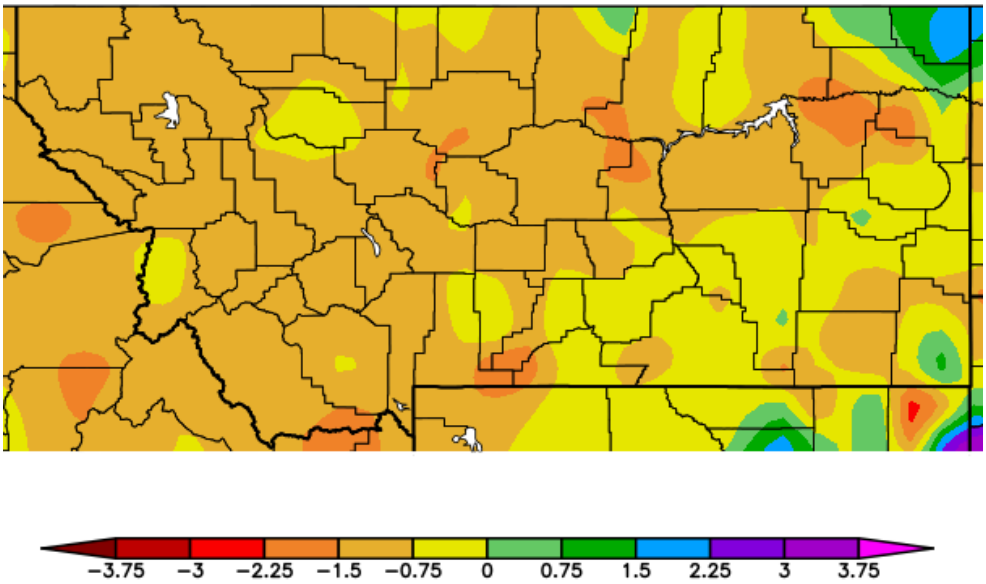


Figure 14. July 2018 precipitation departures from normal (inches) (NOAA Regional Climate Center).

The weather across Montana in August was typical for the month. Temperatures averaged a degree or two either side of normal, while precipitation varied across the state. Central to south central Montana received the most precipitation while the rest of the state was below normal. Cool weather patterns occurred during September and dry conditions continued except for north central and eastern Montana where above-average precipitation fell.

The Montana drought status was updated at the end of WY 2018 and ended the year with moderately moist conditions in south central, while near average to slightly dry conditions prevailed across most of the state, see Figure 15.

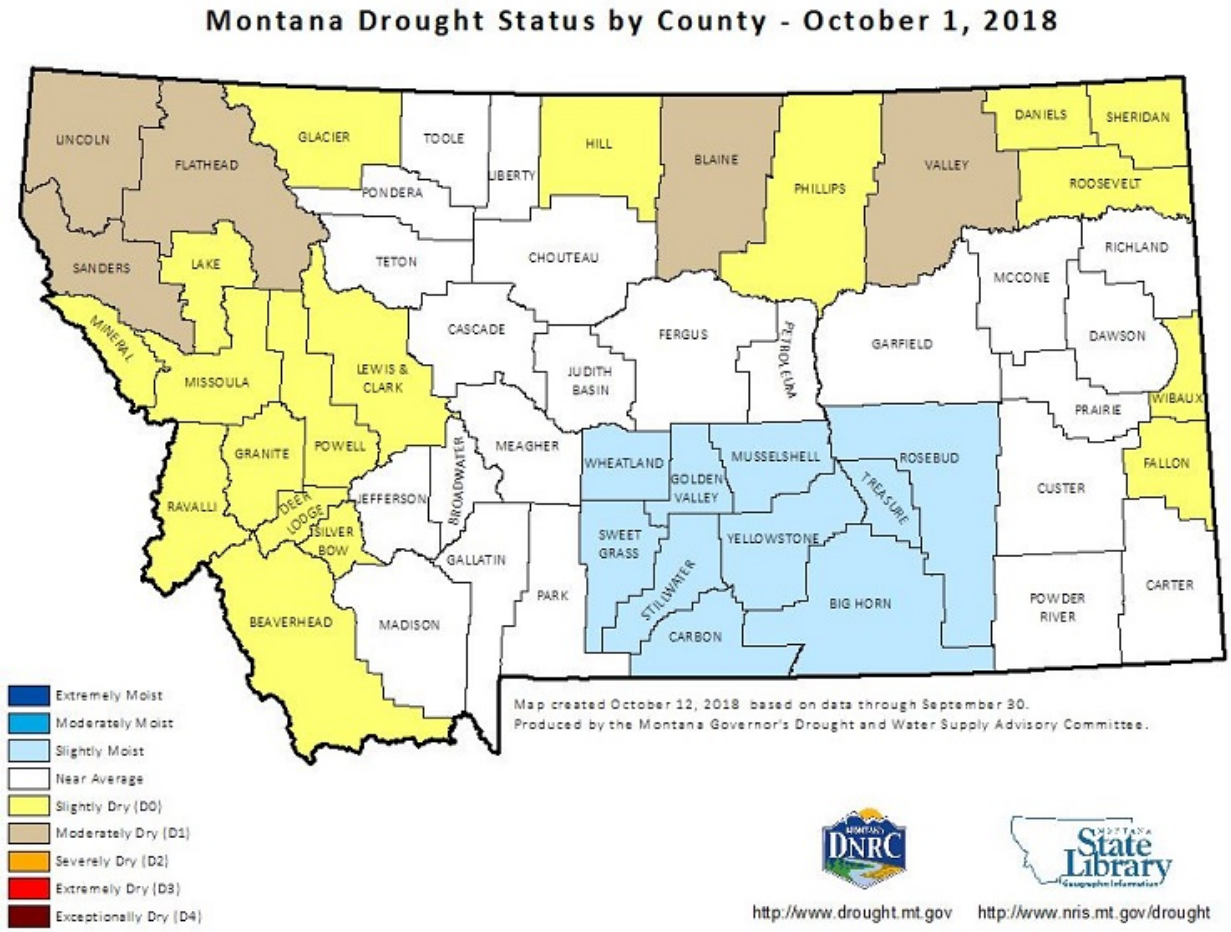


Figure 15. Montana Drought Status Map, October 1, 2018, produced by the Montana Governor's Drought and Water Supply Advisory Committee.

Water year 2018 ended with varying storage levels. Lake Sherburne was at 37 percent of average while Clark Canyon was 186 percent of average. The Reclamation reservoir with the greatest amount of carryover storage was Nelson Reservoir at 96 percent of full capacity. Total inflows into Reclamation facilities in Montana east of the Continental Divide ranged from 104 percent of average at Lake Sherburne to 173 percent of average at Bighorn Lake.

The Corps of Engineers reported the operations of Reclamation projects under the jurisdiction of the Montana Area Office (MTAO) east of the Continental Divide prevented approximately $45.5 million in total flood damages during WY 2018. The damages prevented in WY 2018 were credited to the operations of Clark Canyon, Canyon Ferry, Tiber, Fresno, Gibson and Yellowtail. The total flood damages prevented by MTAO's facilities since 1950 is approximately $613.8 million.

Flood Benefits

The Corps evaluated reservoir regulation data pertaining to Reclamation reservoirs within the jurisdiction of the MTAO and indicated 6 reservoirs provided flood relief during WY 2018. They were: Clark Canyon Reservoir on the Beaverhead River near Dillon; Canyon Ferry Reservoir on the Missouri River near Helena; Gibson Reservoir on the Sun River near Great Falls; Bighorn Lake on the Bighorn River near Fort Smith; Lake Elwell on the Marias River near Chester; and Fresno Reservoir on the Milk River near Havre. The most notable examples of peak flows regulated by Reclamation reservoirs during spring runoff can be found in Table 6.

Table 6. Notable examples of peak flows regulated by Reclamation reservoirs during spring runoff.

Reservoir	Peak Inflow (cfs)	River Discharge (cfs)	Date
Clark Canyon Reservoir	1,325	702	06/19/18
Canyon Ferry Lake	28,381	19,957	05/30/18
Lake Elwell	9,248	1,592	06/21/18
Fresno Reservoir	6,599	2,048	04/17/18
Gibson Reservoir	8,867	9,062	06/19/18
Bighorn Lake	17,790	14,110	06/20/18

The Corps estimated the operations of Reclamation reservoirs in Montana during WY 2018 reduced flood damages by $45,523,400. Some of these benefits were derived by reducing local damages and other benefits were derived by storing water which would have contributed to flooding downstream on the main stem of the Missouri River below Fort Peck Reservoir. The flood damages prevented are listed in Table 7. For additional information on the operations of the reservoirs within the jurisdiction of the MTAO, refer to the individual "Summary of Operations for 2018" for each reservoir in this report. Figure 16 shows the annual flood damages prevented by MTAO reservoirs since 1950. Unadjusted dollar amounts are a sum of yearly flood damages prevented. Values have not been adjusted to represent current year dollar amounts.

Table 7. Flood Damages Prevented (Thousands of Dollars, Unadjusted).

Reservoir	Local	Main Stem	2018 Total	Prev. Accum.	Total Accum.
Clark Canyon Reservoir	1,395	980	2,375	16,485	18,860
Canyon Ferry Lake	2,151	18,529	20,680	244,482	265,161
Lake Elwell	0	2,115	2,115	96,893	99,008
Fresno Reservoir	1,828	0	1,828	17,720	19,548
Gibson Reservoir[1]	16	0	16	3,086	3,102
Bighorn Lake	1,051	17,459	18,510	179,199	197,709
Lake Sherburne[2]	0	0	0	10,412	10,412
Total	6,441	39,083	45,523	568,276	613,799

1 No space allocated to flood control, but some flood protection provided by operation for other purposes.
2 Now includes historical flood damages prevented by Lake Sherburne since 1950 based on estimates provided by the Corps of Engineers.

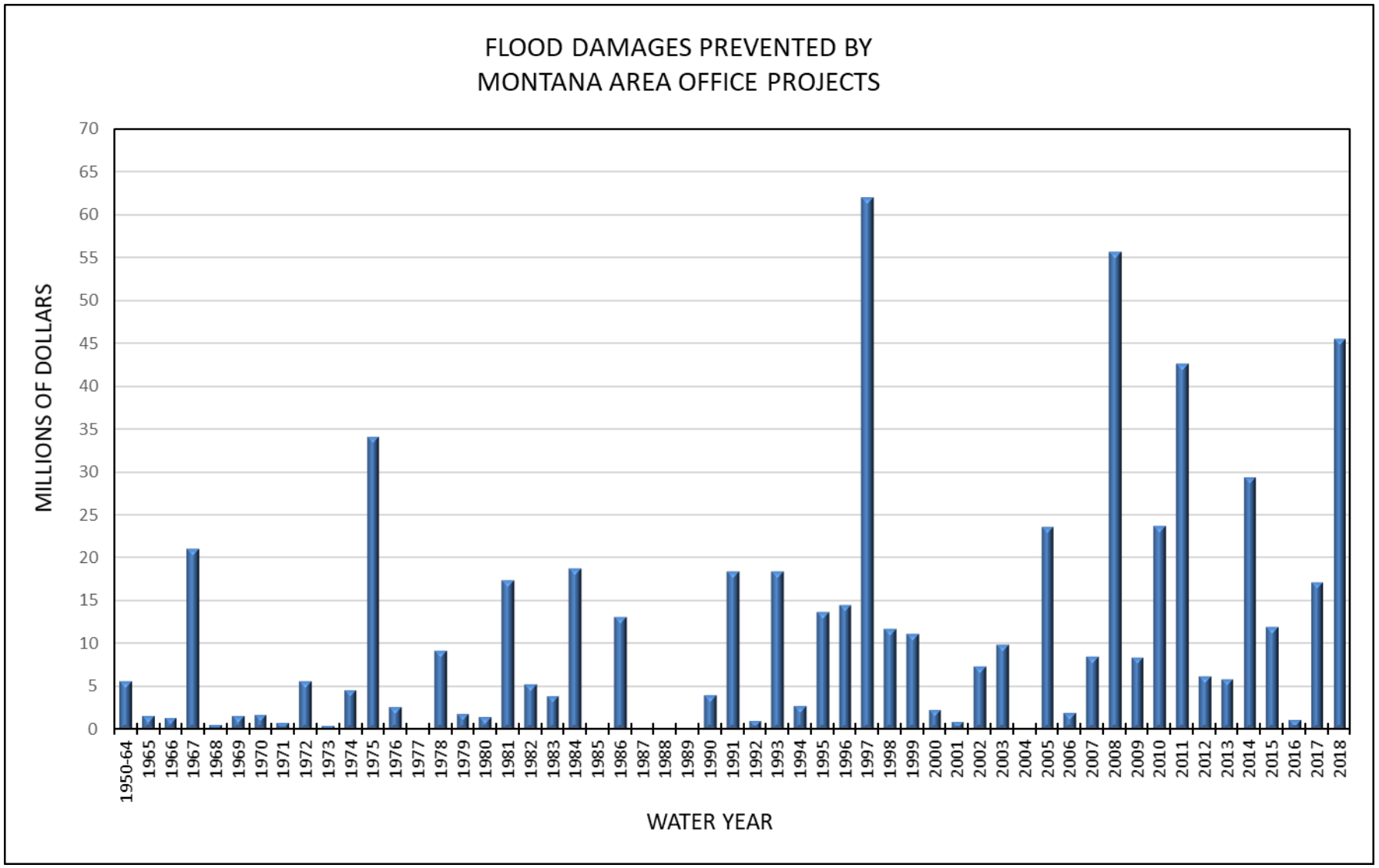


Figure 16. Flood Damages Prevented by Montana Area Office Projects (unadjusted amounts).

Unit Operational Summaries for Water Year 2018

Clark Canyon Reservoir

Clark Canyon Reservoir, a Pick-Sloan Missouri River Basin Program (P-S MBP) project is located on the Beaverhead River approximately 20 miles upstream from Dillon, Montana. It has a total capacity of 257,152 AF (255,643 AF active). The reservoir is the storage facility for the East Bench Unit providing a full water supply for irrigation of 21,800 acres and a supplemental supply for about 28,000 acres. Flood control, recreation, and fish and wildlife are among the other functions served by the reservoir.

In 2000, Reclamation surveyed Clark Canyon Reservoir to develop a topographic map and compute a present storage-elevation relationship (area-capacity tables). The data were used to calculate reservoir capacity changes since dam closure in August of 1964. The 2000 survey determined that Clark Canyon Reservoir has a storage capacity of 174,367 AF and a surface area of 5,151 acres at a reservoir elevation of 5,546.10 feet. Since closure in 1964, the reservoir capacity has decreased 4,106 AF below elevation 5,546.10 feet. This volume represents a 2.3 percent reduction in capacity and an average annual reduction of 114.7 AF. This change in capacity reflects the combination of all effects on reservoir storage, such as sediment accumulation, improved survey resolution, data collection, and interpolation techniques. The revised area-capacity table was put into effect on October 1, 2001, reflecting the new storage levels.

WY 2018 started with a storage content of 99,111 AF (138 percent of average) at elevation 5,529.63 feet and a river release about 75 cfs. The climatic conditions began with warm temperatures and below-average precipitation (50 percent) during the month of October. However, very wet conditions, up to 300 percent of average, prevailed during November with slightly warm temperatures (2-4 degrees). Inflows into Clark Canyon remained steady with an average near 300 cfs. December continued to bring warmer-than-normal temperatures and above-average precipitation to the Beaverhead and Red Rock River basins. By the end of December, the SWE for Clark Canyon reached 108 percent of average while inflows decreased to an average of 250 cfs.

On January 1, the SWE near Clark Canyon was 106 percent of average. A high-pressure system was positioned over western North America in January causing average temperature anomalies ranging from 4 to 5 degrees above normal in the Beaverhead and Red Rock Basins. The month brought a mix of above to below-normal precipitation, ranging from 50 percent to 130 percent of normal throughout the basin. With steady snow accumulation, the February 1 SWE was 103 percent of average. A low-pressure system over the Hudson Bay brought cold temperatures (3 to 9 degrees), above-average precipitation (125 percent), and some intense wind gusts to the basins.

By the end of February, the year-to-date mountain and valley precipitation was 97 and 100 percent of average, respectively.

The March 1 measured SWE remained steady at near average. Based on snowpack and basin conditions, the March 1 runoff projection for the April through July period was 77,400 AF, 104 percent of the 30-year average. The East Bench Unit Joint Board (Joint Board), consisting of three representatives from each water user entity, met on March 6 to discuss the water supply outlook for the 2018 irrigation season. The forecast projected above average storage levels, therefore the Joint Board tentatively set full allotments with the Clark Canyon Water Supply Company (CCWSC) at 4.0 AF/acre and the East Bench Irrigation District (EBID) at 3.1 AF/acre.

More precipitation fell during March, especially in the Red Rock River basin where the SWE increased to average. The Clark Canyon SWE rose to above average conditions. Inflow into Clark Canyon Reservoir for October through March was 92,800 AF, or 107 percent of the 30-year average. Due to near average inflows and releases near 75 cfs, the end-of-March reservoir elevation was recorded at 5,544.20 feet, approximately 1.9 feet below full pool. Mountain precipitation resulted in a March SWE of 151 percent of average while valley precipitation was 111 percent of average.

On April 1, the mountain SWE measured 113 percent of average. The water supply forecast prepared on April 1 predicted the April through July runoff into Clark Canyon Reservoir would be 123 percent of average, totaling approximately 95,400 AF. Due to the increased runoff forecasts and a forecasted full reservoir, the Joint Board allocated an additional 0.5 AF/acre for the 2018 irrigation season on April 3 (CCWSC 4.5 AF/acre, EBID 3.6 AF/acre).

The month of April brought 200 percent of normal precipitation to the basin with slightly below-average temperatures. Inflows into Clark Canyon continued to increase as the low elevation snow started to melt. On April 16, 2018 the U.S. Army Corps of Engineers issued Flood Control Regulation No. 1 to ramp up releases from 75 cfs to 600 cfs over a few days. This, in coordination with a flushing flow release, was intended to evacuate storage in the flood pool below the current elevation of 5,546.3 feet; 0.2 feet into the flood pool. The SWE steadily increased through midmonth and reached a peak SWE of 17.19 inches, 123 percent of average on April 19. Inflows for the month of April were 200 percent of average at 28,100 AF while releases totaled 16,500 AF; 214 percent of average. Releases by the end of the month were holding at 600 cfs because of continual high inflows.

On May 1, the measured mountain SWE decreased to 108 percent of average. The water supply forecast prepared on May 1 predicted a May through July runoff into Clark Canyon Reservoir of 65,000 AF; 104 percent of average. May brought dry and very warm conditions (2 to 7 degrees above average) in the valley and mountains of the Red Rocks and Beaverhead Basins. This warm weather pattern caused the mountain snowpack to quickly melt. The SWE declined from 108 percent of average on May 1 to 77 percent of average on May 31. The river channel just below Clark Canyon Dam was flowing near capacity and heavy rainfall was forecasted for the last week of May. Clark Canyon releases coupled with inflow from the Ruby River and other tributaries caused the Beaverhead River between Clark Canyon and Twin Bridges to approach channel capacity. Therefore, in coordination with the USACE, releases were decreased to 300 cfs by May

24 to reduce the risk of flooding downstream of Clark Canyon. Total inflow to Clark Canyon Reservoir for May was 45,900 AF; 313 percent of the 30-year average. By May 31 the reservoir elevation was 156 percent of the 30-year average, at 5,548.94 feet.

The water supply forecast prepared on June 1 predicted a June through July runoff into Clark Canyon Reservoir of 42,300 AF; 68 percent of average. The low forecast resulted from the rapid snowmelt, with only 79 percent of average SWE remaining. During the first week of June, inflows peaked near 1,100 cfs from the snowmelt runoff and slowly declined to 380 cfs by mid-June. After the peak inflow occurred, releases were increased to 600 cfs by May 6 and further increased to 700 cfs by June 12 as downstream channel capacity became available. These release changes were in coordination with the USACE to continue evacuating the flood control space. Inflows during June totaled 46,500 AF; 186 percent of average. Releases from Clark Canyon remained steady near 700 cfs while the June 30 reservoir elevation was 156 percent of the 30-year average, at 5,548.94 feet.

Inflow during July totaled 19,900 AF, or 95 percent of average. Temperatures were normal, however extremely dry conditions prevailed. Dillon, MT only received a trace of rain for the entire month.

Snowmelt runoff during April through July was much above average at 157 percent, totaling 140,400 AF. Daily inflows into Clark Canyon Reservoir averaged 473 cfs during April, 747 cfs during May, 782 cfs during June and 324 cfs during July. Releases during the April through July time period averaged 277 cfs in April, 537 cfs in May, 624 cfs in June, and 774 cfs in July. Storage reached the peak for the year of 199,989 AF at elevation 5,550.95 feet on June 25.

Lima Reservoir is a private irrigation facility located upstream of Clark Canyon Reservoir on the Red Rock River, a tributary of the Beaverhead River. Lima Reservoir filled to the top of the conservation pool and spilled over the spillway crest. The reservoir peaked at 76,440 AF, elevation of 6,581.30 feet, on June 24. Lima Reservoir ended the water year with a storage content of 38,599 AF, elevation 6,573.10 feet, and a release near 105 cfs. The drainage area above Lima Reservoir accounts for about 25 percent of the total drainage area above Clark Canyon Reservoir.

August temperatures were within 2 degrees of normal while precipitation was slightly above average above Clark Canyon Reservoir, but remained below average near Dillon, MT. Even though dry conditions occurred in July and August, Clark Canyon Reservoir only drafted to 5,540.91 feet by August 31 due to the high runoff conditions and utilization of the flood control pool. September continued with dry conditions, 24 percent of normal precipitation in the mountains and only 17 percent of normal in the Beaverhead Basin valley.

On September 11, the Joint Board held a meeting to discuss winter releases as per Contract 069D670009 and Contract 069D670010. Reclamation provided reservoir operation plans with minimum, maximum, and most probable inflows with a most probable 190 cfs winter release. The higher-than-average release rate resulted from higher than average forecasted winter inflows, higher than average storage content, and meeting a March 1 flood control target of 154,000 AF. The Joint Board discussed winter forecasts, ice concerns, and flood control target and purposes. The Joint Board agreed to a 190 cfs winter release rate as per a letter to Reclamation dated October 9, 2018. The winter release from Clark Canyon Reservoir was set

near 190 cfs on October 6.

Most of the storage water released from Clark Canyon Reservoir during WY 2018 was released from April 19 through September 30 for flood control purposes and meeting downstream irrigation demands. The EBID water users received approximately 63,450 AF at the point of diversion, leaving 18,230 AF of their allotment in the reservoir and CCWSC used approximately 80,497 AF, leaving 36,148 AF of their allotment in the reservoir. The total May 19 through September 16 irrigation deliveries recorded by the river commissioner for the "non-signer" users on the Beaverhead River was 36,452 AF on 4,900 acres.

The total inflow to Clark Canyon Reservoir during WY 2018 was 192 percent of the 30-year average, totaling approximately 269,600 AF. The total annual release to the Beaverhead River from Clark Canyon Reservoir was 235,891 AF. By the end of September, the total cumulative valley precipitation for the water year was 100 percent of average, while the total cumulative mountain precipitation was 104 percent of average.

The Corps determined that during WY 2018, Clark Canyon Reservoir prevented $1,394,700 in local flood damages and $980,400 in main stem flood damages.

Important Events – Water Year 2018

October 1, 2017: Clark Canyon Reservoir enters the water year with 99,111 AF of storage at elevation 5,529.63 feet. Following the 2017 irrigation season, releases from Clark Canyon Reservoir to the Beaverhead River were reduced to approximately 75 cfs for a winter release.

April 19, 2018: Flood Control Regulation Order No. 18-01 was issued by USACE. Increased releases to 600 cfs.

May 24, 2018: Flood Control Regulation Order No. 18-02 was issued by USACE. Decreased releases to 300 cfs.

June 4, 2018: Flood Control Regulation Order No. 18-03 was issued by USACE. Increased releases to 400 cfs.

June 5, 2018: Flood Control Regulation Order No. 18-04 was issued by USACE. Increased releases to 500 cfs.

June 6, 2018: Flood Control Regulation Order No. 18-05 was issued by USACE. Increased releases to 600 cfs.

June 11, 2018: Flood Control Regulation Order No. 18-06 was issued by USACE. Increased releases to 700 cfs.

June 25, 2018: Clark Canyon Reservoir reached peak storage content of 199,989 AF at elevation 5,550.95 feet, which was approximately 4.85 feet above full pool.

July 1, 2018: Flood Control Regulation Order No. 18-07 was issued by USACE. Increased releases to 800 cfs.

July 19, 2018: Inflows into Clark Canyon Reservoir peaked at 1,324 cfs. Flood Control Regulation Order No. 18-08 was issued by USACE. Decreased releases to 750 cfs.

July 28, 2018: Flood Control Regulation Order No. 18-09 was issued by USACE. Releases at 750 cfs and all flood storage has been evacuated from Clark Canyon Reservoir.

September 30, 2018: Clark Canyon Reservoir ended the water year with 132,839 AF of storage at elevation 5,537.63 feet.

Additional hydrologic and statistical information pertaining to the operation of Clark Canyon Reservoir during WY 2018 can be found in Table 8 and Figure 17.

Table 8. Hydrologic Data for Clark Canyon East Bench Unit 2018.

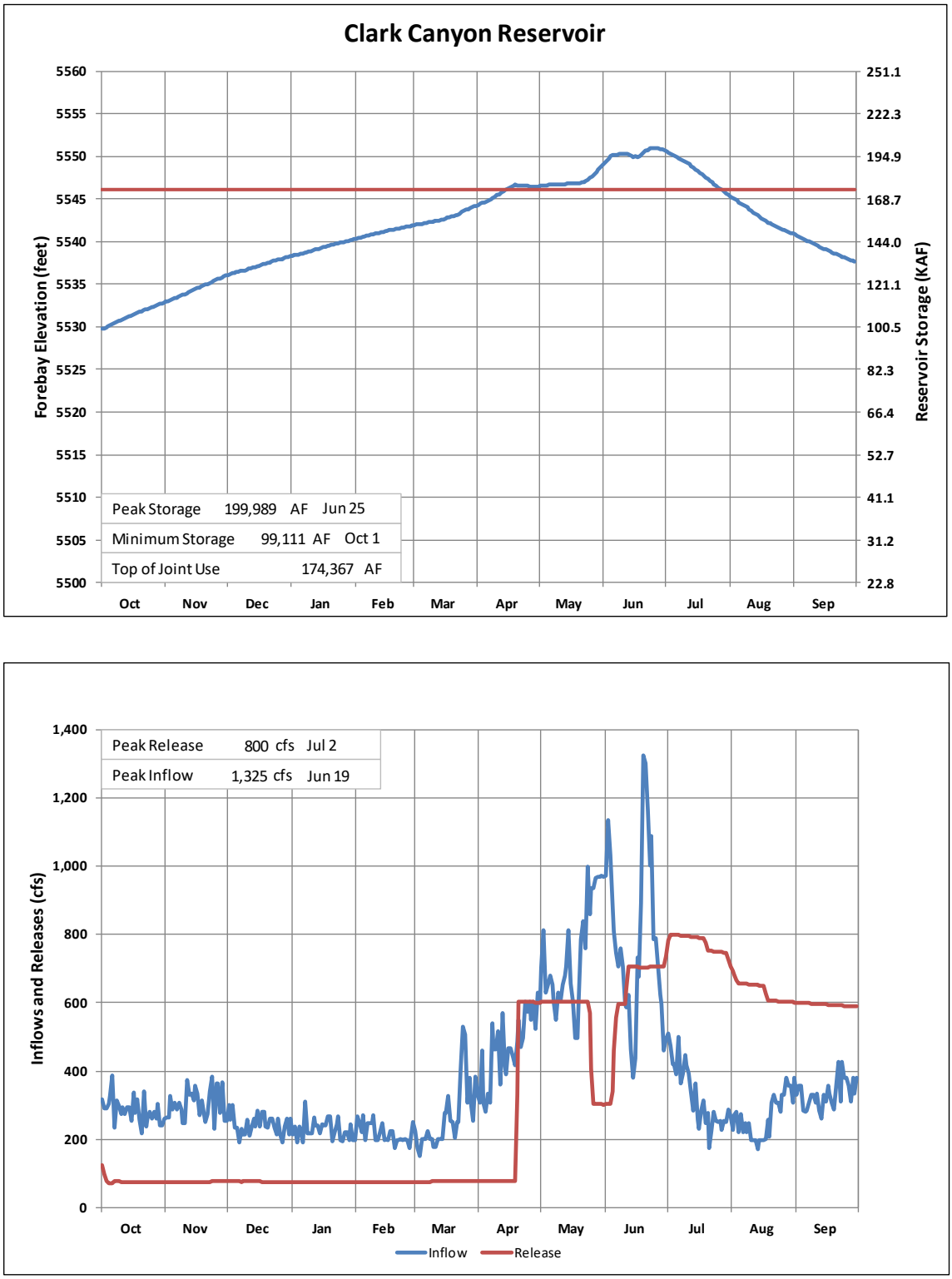
RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5,470.60	1,061	1,061
TOP OF ACTIVE CONSERVATION	5,535.70	124,160	123,099
TOP OF JOINT USE	5,546.10	174,367	50,207
TOP OF EXCLUSIVE FLOOD CONTROL	5,560.40	253,442	79,075

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5,529.63	99,111	OCT 01, 2017
END OF YEAR	5,537.63	132,839	SEP 30, 2018
ANNUAL LOW	5,529.63	99,111	OCT 01, 2017
ANNUAL HIGH	5,550.95	199,989	JUN 25, 2018
HISTORIC HIGH	5,564.70	283,073	JUN 25, 1984

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	269,619	OCT 17-SEP 18	235,891	OCT 17-SEP 18
DAILY PEAK (CFS)	1,324	JUN 19, 2018	800	JUL 02, 2018
DAILY MINIMUM (CFS)	150	MAR 03, 2018	74	OCT 11, 2017
PEAK SPILL (CFS)			0	N/A
TOTAL SPILL (AF)			0	N/A

MONTH	INFLOW*		OUTFLOW*		CONTENT*	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	17.5	104	4.7	59	111.9	137
NOVEMBER	18.0	106	4.5	58	125.4	136
DECEMBER	14.9	101	4.6	59	135.7	135
JANUARY	14.0	109	4.6	70	145.1	135
FEBRUARY	12.1	105	4.2	71	153.1	134
MARCH	16.3	109	4.7	70	164.7	134
APRIL	28.1	200	16.5	211	176.3	136
MAY	45.9	312	33.0	150	189.2	156
JUNE	46.5	188	37.1	113	198.6	179
JULY	19.9	94	47.6	111	171.0	198
AUGUST	16.3	113	38.9	92	148.4	212
SEPTEMBER	19.8	138	35.4	211	132.8	171
ANNUAL	269.6	143	235.9	125		
APRIL-JULY	140.4	198				

* Based on previous 30 years



Water Year 2018

Figure 17. Hydrologic Data for Clark Canyon Reservoir.

Canyon Ferry Lake and Powerplant

Canyon Ferry Lake (P-S MBP), formed by Canyon Ferry Dam, is located on the Missouri River near Helena, Montana. It has a total capacity of 1,992,977 AF. The top three feet were allocated to exclusive flood control in February 1966. The next 27 feet are allocated to joint conservation and flood control purposes. The joint use space is evacuated for flood control purposes, only to the extent that refill during the spring runoff is reasonably assured. The conservation storage is operated mainly for power generation and to provide replacement storage for several new irrigation developments located on the Missouri River and its tributaries above Great Falls, Montana. To date, however, the conservation storage has been used primarily for power production. The only new areas under irrigation are 5,000 acres on the Crow Creek Unit (P-S MBP), 13,900 acres on the Helena Valley Unit (P-S MBP), and 28,000 acres on the East Bench Unit (P-S MBP). In addition, about 5,200 acres in the Helena Valley Unit that was once irrigated by pumping from Lake Helena and from other streams are now irrigated by pumping from Canyon Ferry Reservoir. About 33,700 acres on the East Bench Unit also receive supplemental water supply. A small amount of municipal water is also furnished to the city of Helena, Montana, through facilities for the Helena Valley Unit.

In 1997, a hydrographic and a topographic survey were conducted resulting in a new elevation-area capacity table and curve. The survey determined that Canyon Ferry Lake had a storage capacity of 1,992,977 AF and a surface area of 34,048 acres at reservoir elevation 3,800.00 feet. Since closure in 1953, the reservoir volume has been reduced by 59,746 AF below reservoir elevation 3,800.00 feet. This volume represents a 2.91 percent reduction in capacity and an average annual reduction of 1,345.6 AF. This change in capacity reflects the combination of all effects on reservoir storage, such as sediment accumulation, improved survey resolution, data collection, and interpolation techniques. The revised area-capacity table was put into effect on October 1, 1998, reflecting the new storage levels.

WY 2018 started with a storage content of 1,544,696 AF at elevation 3,786.23 feet (99 percent of average), and releases near 3,700 cfs below Holter Dam.

October temperatures were two to four degrees below normal with normal precipitation patterns. Inflows averaged 3,660 cfs while releases remained near 3,600 cfs below Holter Dam. November temperatures reversed, exhibiting normal up to four degrees above normal while producing above normal precipitation patterns across the Upper Missouri Basin. Due to normal to above normal precipitation over the past few months, inflows into Canyon Ferry increased to an average of 4,380 cfs and in turn flows below Holter Dam were increased to nearly 4,500 cfs. By November 30 the SWE was 130 percent of average.

Warm trends continued during December in the Upper Missouri Basin. Temperatures ranged from normal to six degrees above average while precipitation patterns were up to 300 percent of normal for the month. However, extreme cold temperatures occurred near Great Falls, MT later in the month and Northwestern Energy requested additional flow for anticipated river icing per their

FERC License 2188 Article 403 (extreme winter weather operation). Releases from Canyon Ferry varied from 4,400 cfs up to a maximum of 5,600 cfs from December 21, 2018 through January 04, 2019. By the end of December, the year-to-date valley precipitation of 114 percent of average in the Jefferson, 129 percent of average in the Madison, and 165 percent of average in the Gallatin. On December 31 the storage content of Canyon Ferry Reservoir was at 1,493,313 AF; elevation 3,783.12 feet with inflows near 3,000 cfs.

On January 1 the mountain SWE above Canyon Ferry Reservoir was 120 percent of average. Temperature departures during January were four to five degrees above average in the Upper Missouri basin while precipitation ranged from 70 percent of average up to 300 percent of average. Snow accumulation continued to build throughout the month at near-average rates. On January 31, the storage content of Canyon Ferry Reservoir was at 1,469,685 AF; elevation 3,783.78 feet; inflow near 4,400 cfs; and releases near 4,600 cfs.

On February 1 the mountain SWE measured 115 percent of average. February brought cold temperatures, triggering a Northwestern Energy request for additional flow for anticipated river icing. Releases from Canyon Ferry increased from 4,600 cfs up to a maximum of 5,400 cfs from February 7 through the 28. Precipitation in the Upper Missouri basin continued to fall at an above average rate. This resulted in a monthly mountain precipitation of 124, 146, and 149 percent of average, respectively, in the Jefferson, the Madison, and the Gallatin River basins. The SWE above Canyon Ferry Reservoir increased from 114 to 123 percent of normal by the end of the month. Once the temperature increased to near-normal conditions, releases from Canyon Ferry were reduced to 5,300 cfs to maximize power production while continuing to evacuate storage.

Higher-than-expected precipitation accumulation, resulted in an above average forecasted March 1, 2018 April through July inflow volume into Canyon Ferry of 2,325.8 KAF; 136 percent of the 30-year average. Inflows rose from 4,100 cfs on March 1 to 7,000 cfs by March 15. This was triggered by temperature increases causing more of the low laying snow to melt along with above average valley precipitation, roughly 140 percent of average. Accordingly, releases from Canyon Ferry increased from 5,300 cfs to 6,300 cfs by the months end to continue evacuating storage. The increased release changes caused the reservoir to draft 3 feet in elevation resulting in an end of month elevation of 3,780.90 feet. As the month progressed, the snowpack accumulated at a normal rate.

On April 1 the mountain SWE remained steady at 122 percent of average, therefore Reclamation's April through July forecasted inflow volume also remained at 137 percent of average (2,325.2 KAF). Diversions for the Helena Valley Irrigation District to the Helena Valley Reservoir began on April 2. Inflows fluctuated between 5,000 cfs and 7,500 cfs for most of the month. Continual mountain and valley precipitation fell in the Upper Missouri basin, 133 and 166 percent of average for the month. Because of the above-average precipitation, the SWE peaked on April 19 at 130 percent of average. Shortly after, the rain and low to mid elevation snowmelt runoff caused inflows to quickly increase from 7,100 cfs on April 22 to near 13,500 cfs by April 30. Releases from Canyon Ferry were also increased to near 10,000 cfs by the months end to control the rate of fill. Canyon Ferry reservoir was at elevation 3,778.90 feet or 18.1 feet below full pool by the end of April.

On May 1 the mountain SWE remained steady at 124 percent of average, therefore Reclamation's May through July forecasted inflow volume increased to 152 percent of average (2,128.0 KAF). Inflows fluctuated between 13,000 cfs and 14,000 cfs until May 7. Above average temperatures in May caused the snowmelt runoff to accelerate. On May 8, inflows ramped up to around 23,000 cfs by May 12 and remained near 20,000 cfs through May 19. In response, Canyon Ferry releases were gradually increased to near 14,500 cfs by May 20 to control the rate of fill. On May 21 the reservoir elevation reached 3,786.27 feet; inflows near 21,000 cfs; and releases to the Missouri River were expected to reach 15,000 cfs. On May 23 Canyon Ferry Reservoir was at elevation 3,787.15 feet with inflows near 21,900 cfs. Inflows were forecasted to increase therefore releases would also be increased to 16,500 cfs on May 24. On May 25 the reservoir elevation was at 3,788.44 feet; 8.56 feet below the full pool elevation of 3,797.0 feet. Inflows were near 24,000 cfs and increasing, and planned releases would reach 18,000 cfs on the morning of Friday, May 26.

With peak inflow near 27,600 cfs on May 27, Canyon Ferry Reservoir's elevation reached 3,790.43 feet with a release of 18,600 cfs to the river by May 29. An increase to river releases occurred May 29, which resulted in a peak release of 19,700 cfs. This increase was made to control the rate of fill as there was potential of additional inflow volume due to future forecasted rain and there was also downstream river capacity available. These operations were coordinated with the U.S. Army Corps of Engineers. Over the next few days, the reservoir level continued to rise to elevation 3,793.19 feet. Inflows then began to decrease and releases from Canyon Ferry were also decreased to 18,500 cfs on June 4 to lessen downstream river capacity and/or minor flooding concerns near Cascade and Ulm.

As inflows continued to decline, releases also declined, and by June 6 releases to the river were near 15,500 cfs. On June 7, inflows had dropped to 21,500 cfs and the elevation of the reservoir was at 3,794.55 feet. Releases continued to decrease and by June 11 releases were near 11,700 cfs with inflows near 17,700 cfs and elevation 1.5 feet from full pool.

On June 17 and 18 heavy widespread precipitation, of about three to four inches fell above Canyon Ferry and up to nine inches of rain fell below Canyon Ferry Reservoir. The rain below Canyon Ferry Dam resulted in high tributary flows to the Missouri River, specifically the Dearborn and Sun Rivers. On June 19 the high tributary flows were anticipated to cause the river to reach minor flood stage near Cascade and Ulm. Canyon Ferry Reservoir was at 3,796.75 feet, only 0.25 feet from full pool, and inflows were at 17,800 cfs and increasing. Releases of 12,900 cfs would be maintained from the reservoir to provide as much downstream flood relief as prudent but were likely to increase as soon as June 20 with the dwindling flood control storage capacity and the increasing reservoir inflows.

The Dearborn River peaked near 10,000 cfs which contributed to the peak river stage at Cascade of 13.16 feet, estimated minor flooding on Wednesday, June 20 while the National Weather Service stated a peak river stage of 13.99 feet, minor flood stage at Ulm on Thursday, June 21. Inflows into Canyon Ferry continued to rise, and releases were increased as downstream channel capacity became available.

Inflows into Canyon Ferry Reservoir from the rain event peaked at 21,400 cfs on June 22 with a river release of 15,200 cfs. On June 23, both Cascade and Ulm were below flood stage. This

same day, Canyon Ferry reservoir elevation had reached 3,798.32 feet, or 1.68 feet below the top of flood control elevation of 3,800.00 feet. By June 28, the elevation had risen to 3,798.9 feet, inflows had decreased to 15,500 cfs and releases from the reservoir were at 16,000 cfs. Releases were reduced to 14,500 cfs on June 29 to provide additional channel capacity downstream.

Inflows continued to decline from 14,500 cfs starting July 1 to near 6,000 cfs by midmonth. River releases, in coordination with the U.S Army Corps of Engineers, were also reduced over this time while slowly evacuating the flood control pool. By July 23, the elevation dropped below the top of joint use pool, 3,797.0 feet while inflows were near 3,200 cfs with a river release of 5,000 cfs.

The April through July runoff into Canyon Ferry during WY 2018 was 185 percent of average, totaling approximately 3,182,000 AF, the third highest inflow volume of record, with 75 percent of that volume occurring during May and June. May inflows were the highest runoff on record at 1,269,121 AF.

August temperatures were average with above-average precipitation in the Gallatin Basin and dry conditions in the Jefferson Basin. Canyon Ferry Reservoir continued to slowly draft as inflows averaged near 2,500 cfs while releases to the Missouri River below Holter Dam averaged near 4,700 cfs. August precipitation continued to decline and was less than 25 percent of normal in the Beaverhead and Red Rock River basins and 50 to 75 percent of average in the remaining basins. Dryer conditions along with a dry forecast resulted in reduced flows below Holter Dam that averaged near 4,500 cfs.

By the end of the water year, Canyon Ferry Lake had a storage content of 1,633,041 AF at elevation 3,789.04 feet (105 percent of average), with inflows averaging near 3,700 cfs and releases maintained near 4,100 cfs. The annual inflow to Canyon Ferry Lake was 149 percent of average, totaling 4,966,427 AF.

During WY 2018, Canyon Ferry powerplant generated 363,626,000 kilowatt-hours, 96 percent of the long-term average dating back to 1967. The powerplant used 3,023,106 AF, or 62 percent of the total water released from the dam. The other 38 percent was released to meet irrigation needs for Helena Valley Irrigation District (178,207 AF), 237,315 AF spilled through the river outlet gates and 1,439,570 AF spilled through the spillway gates.

The Corps estimated that during WY 2018, Canyon Ferry Dam prevented $2,150,900 in local flood damages and prevented $18,528,600 in flood damages downstream on the Missouri River main stem.

Important Events- Water Year 2018

October 2017: Canyon Ferry personnel conducted maintenance on units. Unit 3 outage 10-13, Unit 2 outage 16-20, Unit 1 outage Oct 30 – Nov. 3.

November 2017: November operational plans indicated releases out of Canyon Ferry Reservoir would be increased to meet target reservoir elevations. Three separate increases were made throughout the month for a total increase of 900 cfs.

December 21-24, 2017: Due to the extended cold weather forecasted, Northwestern Energy requested additional flow for anticipated river icing per FERC License 2188 Article 403 (extreme winter weather operation). Total release from Canyon Ferry was increased to 5,600 cfs.

January 1-4, 2018: Temperatures were forecasted to return to normal therefore, releases out of Canyon Ferry were gradually reduced back to the previous release of 4,400 cfs. Also, Unit 1 annual maintenance took place from 2-30.

January 23, 2018: Releases out of Canyon Ferry Reservoir were increased to 4,600 cfs to meet targeted reservoir elevations.

January 30 – March 1, 2018: Canyon Ferry personnel conducted maintenance on Unit 2.

February 2, 2018: February operational plans indicated releases out of Canyon Ferry Reservoir would be increased to 4,900 cfs to meet target reservoir elevations.

February 7-28, 2018: Due to the extended cold weather forecasted, Northwestern Energy requested additional flow for anticipated river icing per FERC License 2188 Article 403 (extreme winter weather operation). Total release from Canyon Ferry was increased to 5,400 cfs. Temperatures increased, and flows were reduced to 5,300 cfs to meet elevation targets.

March 2018: March operational plans indicated releases out of Canyon Ferry Reservoir would be increased to 5,600 cfs to meet target reservoir elevations. Canyon Ferry Reservoir releases increased to 6,300 cfs to continue drafting the reservoir in preparation for the snowmelt runoff.

April 2018: April operational plans indicated the river releases out of Canyon Ferry Reservoir would be increased to 6,700 cfs to meet target reservoir elevations.

April 2, 2018: Helena Valley Irrigation District started pumping water to the Helena Valley Reservoir. Diversion from Canyon Ferry Reservoir were adjusted throughout the season to meet irrigation demands from the Helena Valley Reservoir.

April 10-27, 2018: Low elevation snowmelt and warm temperature started the runoff early. River releases were increased throughout the month to reach 10,000 cfs.

May 2018: May operational plans indicated the river releases out of Canyon Ferry Reservoir would be increased to 12,000 cfs to control rate of fill and store the anticipated May through July runoff volume. Inflows during the month of May ranged from 200 to 300 percent of average. To continue to control the rate of fill at Canyon Ferry Reservoir, releases to the Missouri River were increased throughout the month to a maximum near 20,000 cfs.

June 4-9, 2018: Inflows into Canyon Ferry Reservoir peaked, therefore Canyon Ferry Reservoir releases to the Missouri River were decreased daily to 12,500 cfs to improve downstream river conditions, increasing downstream channel capacity.

June 17-25, 2018: Three to four inches of rainfall over a four-day period caused inflows to rise. Canyon Ferry releases to the river were increased to 16,700 cfs in coordination with Corps of Engineers as the flood pool approached filling.

June 28- July 6, 2018: Canyon Ferry releases to the river were decreased to 9,000 cfs in coordination with Corps of Engineers as the flood pool was occupied.

July 7-27, 2018: Canyon Ferry releases to the river were decreased to 4,500 cfs in coordination with Corps of Engineers.

August & September 2018: Canyon Ferry releases to the river were maintained near 4,000 cfs.

October 4, 2018: HVID discontinued all diversions to Helena Valley Reservoir. Flows below Holter Dam were maintained at or above 4,100 cfs.

Additional statistical information of Canyon Ferry Reservoir and its operations during WY 2018 can be found on Table 9 and Figure 18.

Table 9. Hydrologic Data for 2018 for Canyon Ferry Reservoir.

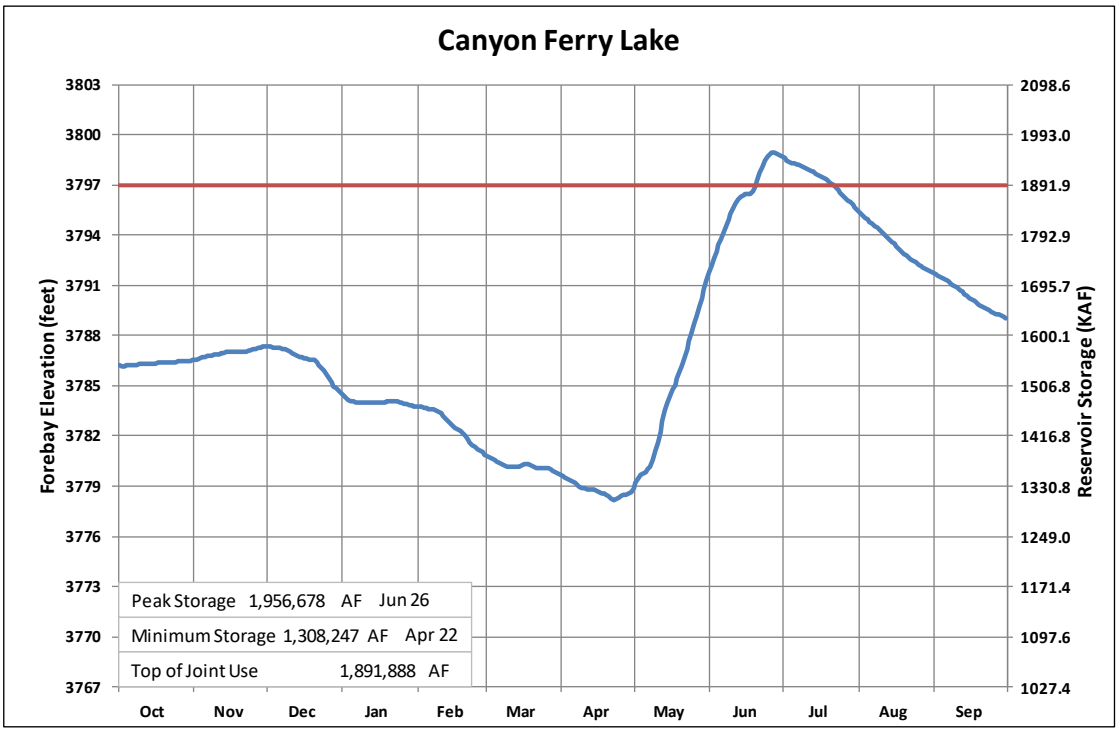
RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	3,728.00	396,031	396,031
TOP OF ACTIVE CONSERVATION	3,770.00	1,097,599	701,568
TOP OF JOINT USE	3,797.00	1,891,888	794,289
TOP OF EXCLUSIVE FLOOD CONTROL	3,800.00	1,992,977	101,089

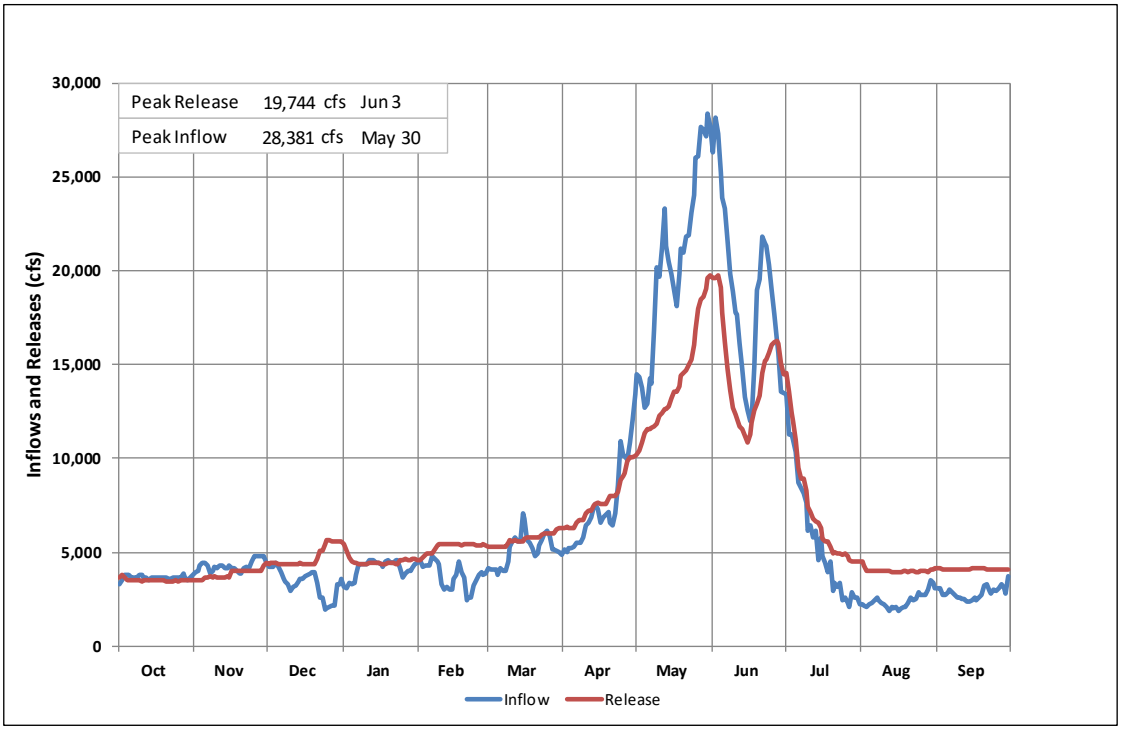
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	3,786.23	1,544,696	OCT 01, 2017
END OF YEAR	3,789.04	1,633,041	SEP 30, 2018
ANNUAL LOW	3,778.19	1,308,247	APR 22, 2018
ANNUAL HIGH	3,798.93	1,956,678	JUN 26, 2018
HISTORIC HIGH	3,800.00	2,050,900	JUN 23, 1964

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	4,966,427	OCT 17-SEP 18	4,878,082	OCT 17-SEP 18
DAILY PEAK (CFS)	28,380	MAY 30, 2018	20,127	JUN 03, 2018
DAILY MINIMUM (CFS)	1,905	AUG 16, 2018	3,453	OCT 21, 2017
PEAK SPILL (CFS)			14,400	JUN 03, 2018
TOTAL SPILL (AF)			1,676,885	OCT 17-SEP 18

MONTH	INFLOW*		OUTFLOW*				CONTENT*	
	KAF	% OF AVG	PUMPED TO HELENA VALLEY (KAF)	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	225.3	100	0.3	107	216.3	97	1,553.4	96
NOVEMBER	255.0	104	0.0	---	229.3	103	1,579.0	98
DECEMBER	206.9	100	0.0	---	292.6	116	1,493.3	95
JANUARY	255.0	124	0.0	---	278.7	107	1,469.7	97
FEBRUARY	207.8	104	0.0	---	292.7	120	1,384.7	94
MARCH	316.0	126	0.0	---	351.1	129	1,349.6	93
APRIL	445.0	149	5.0	65	461.6	167	1,327.9	89
MAY	1,269.1	266	9.1	55	869.1	253	1,718.8	106
JUNE	1,119.7	171	17.0	93	872.3	204	1,949.2	106
JULY	346.0	119	20.2	99	435.1	135	1,842.1	104
AUGUST	149.0	110	22.5	114	247.9	106	1,720.8	104
SEPTEMBER	169.3	107	12.2	111	244.8	114	1,633.0	102
ANNUAL	4,966.4	146	86.4	92	4,791.6	145		
APRIL-JULY	3,179.8	176						

* Based on previous 30 years





Water Year 2018

Figure 18. Hydrologic Data for Canyon Ferry Reservoir.

Helena Valley Reservoir

Helena Valley Reservoir is a regulating offstream reservoir for Helena Valley Unit (P-S MBP), located west of Canyon Ferry Reservoir. It has a total capacity of 10,451 AF, which is used for irrigation and furnishing a supplemental municipal water supply to the city of Helena, Montana. Helena Valley Reservoir receives its entire water supply by pumping from Canyon Ferry Reservoir. When fully developed, Helena Valley Unit can irrigate about 14,100 acres of full-service land and 3,500 acres of supplemental service lands. Present development services about 13,867 full-service acres, including 5,200 acres previously irrigated by pumping from Helena Valley Reservoir or from other streams.

At the beginning of the water year, storage in Helena Valley Reservoir was 8,968 AF at elevation 3,817.06 feet. Operating criteria goals were to fill Helena Valley Reservoir by May 1 and maintain it nearly full through June. In response, diversions to the Helena Valley Unit from Canyon Ferry Reservoir were started on April 2. Storage in Helena Valley Reservoir steadily increased with diversions from Canyon Ferry as well as from local snowmelt and rain runoff. In mid-June a slow-moving storm system produced two to four inches of rain over a four-day period in the Helena, MT area. This caused the operators to reduce diversion and caused the reservoir to fill to a peak content of 10,518 AF at elevation 3,819.20 feet on June 18, 2018. Normal diversions resumed by early July. By the end of the water year, Helena Valley Reservoir ended with a storage content of 8,879 AF at elevation 3,816.87 feet. During the water year, 86,107 AF of water was pumped to Helena Valley Reservoir from Canyon Ferry Reservoir. HVID released 77,318 AF for irrigation. All irrigation deliveries were discontinued for the 2018 season on October 2, 2018.

The reservoir provided an adequate water supply to satisfy all irrigation requirements for the Helena Valley Unit and supplement the city of Helena's municipal water supply.

Statistical information pertaining to Helena Valley Reservoir is shown in Table 10.

Table 10. Hydrologic Data for Helena Reservoir 2018.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
Top of Inactive Storage	3,805.00	4,554	4,554
Top of Active Conservation Storage	3,820.07	10,451	5,897
STORAGE ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
Beginning of Year	3,817.06	8,968	10/01/17
End of Year	3,816.87	8,879	09/30/18
Annual Low	3,812.01	6,837	03/14/18
Annual High	3,820.20	10,518	06/18/18
Historic High	3,820.60	10,738	6/02/75
INFLOW-OUTFLOW DATA			ANNUAL
Pumped from Canyon Ferry to Helena Valley Unit			86,107 AC-FT
Released from reservoir for irrigation			77,318 AC-FT
Delivered to the City of Helena for municipal use			1,617 AC-FT

MONTH	RESERVOIR		
	FOREBAY ELEVATION (FEET)	STORAGE CONTENT (KAF)	PUMPED TO HELENA VALLEY (KAF)
OCTOBER	3,815.45	8.2	0.3
NOVEMBER	3,814.16	7.7	0
DECEMBER	3,813.50	7.4	0
JANUARY	3,812.85	7.1	0
FEBRUARY	3,812.27	6.9	0
MARCH	3,812.43	7.0	0
APRIL	3,819.28	10.0	5.0
MAY	3,816.44	8.7	9.1
JUNE	3,818.90	9.9	17.0
JULY	3,814.23	7.7	20.2
AUGUST	3,816.85	8.9	22.5
SEPTEMBER	3,816.87	8.9	12.2
ANNUAL			86.3

Sun River Project

Storage for the Sun River Project is provided by Gibson, Willow Creek, and Pishkun Reservoirs, which are all single purpose irrigation structures. The project serves 95,000 acres on the Greenfields and Fort Shaw Irrigation Districts. A diversion dam is located on the Sun River about three miles below Gibson Reservoir to divert flows down the Pishkun Supply Canal to Pishkun Reservoir, or down the Willow Creek Feeder Canal to Willow Creek Reservoir. Releases are made from Pishkun Reservoir to supply Greenfields Irrigation District. Releases from Willow Creek Reservoir re-enter the Sun River where they can be diverted at the Fort Shaw Diversion Dam to supply Fort Shaw Irrigation District.

Gibson Reservoir

Gibson Reservoir is located on the Sun River west of Augusta, Montana, and has a total capacity of 96,477 AF. In 2009, a new hydrographic and topographic survey was conducted to measure reservoir volume, resulting in an updated elevation-area capacity table and curve. The previous survey, completed in 1996, was performed to measure the assumed reservoir volume reduction after major forest fires in 1988 caused widespread erosion.

The 2009 survey data yielded a capacity increase of 2,211 AF at elevation 4,724.0 feet from the previous survey conducted in 1996. The increase was likely due to more detailed survey data collection, increased survey resolution, and improved data processing techniques such as surface interpolation implemented in the years since 1996. The revised area-capacity table established a storage capacity of 98,688 AF and a surface area of 1,334 acres at elevation 4,724.0 feet (top of active conservation). Since closure in 1929, the reservoir volume has reduced, considering all effects on surveyed volume, by 6,172 AF below reservoir elevation 4,724.0 feet. The revised area-capacity table was placed into effect January 1, 2013.

The spillway crest is at elevation 4,712.0 feet (83,248 AF). Depending on runoff conditions and reservoir levels, spillway gates remain open during spring runoff, until inflows and remaining SWE indicate that the runoff is receding. Once runoff has peaked, the spillway gates are progressively closed to fill the reservoir another 12 feet to the top of the conservation pool at elevation 4,724.0 feet (98,688 AF).

Gibson Reservoir began WY 2018 with a storage content of 5,639 AF with a corresponding elevation of 4,610.63 feet, which is near the minimum reservoir elevation before sediment is sluiced through the river outlet works. At the end of the 2017 irrigation season, fall releases from Gibson Reservoir were diverted to Willow Creek Reservoir bringing the reservoir storage to desired winter carry-over levels, as well as preventing the need to move water after snow settles in the canals. All diversions to Willow Creek Reservoir were discontinued on December 1, 2017. After diversions ceased, the winter releases to the Sun River were reduced and maintained near 200 cfs.

Precipitation in the Sun-Teton basin was plentiful from October through December. The month of October yielded valley and mountain precipitation at 68 and 128 percent of average, respectively. Precipitation continued in November with valley and mountain at 186 and 112 percent of average, respectively. December precipitation totals were even higher, resulting in valley and mountain precipitation at 394 and 136 percent of average, respectively.

On January 1, the mountain SWE above Gibson Reservoir was at 112 percent of average. January temperatures were near normal to slightly above normal while precipitation halted and was below normal. The snowpack above Gibson reservoir remained steady, which resulted in a February 1 mountain SWE of 111 percent of average. Continual snowfall throughout the Sun River basin during February, with below normal temperatures, caused the build-up of significant low land snow cover. The valley and mountain precipitation during February were 361 and 276 percent of average, respectively. The snowstorms increased the Gibson reservoir basin SWE from 11.3 inches (111 percent of average) to 18.4 inches (142 percent of average) on March 1.

The precipitation pattern continued in March, although not as severe as the previous month. Inflows during March remained steady between 170 - 200 cfs with an average release near 190 cfs. Gibson Reservoir ended the month at elevation of 4,624.61 feet; storage of 11,366 AF. This is the lowest elevation on record for the end of March, creating addition space for expected high flows.

The much above average precipitation accumulation throughout the winter resulted in an April 1 SWE being recorded at 134 percent of average. During April, Reclamation met with the Sun River Watershed Group to discuss the above-average (147 percent of average) Gibson Reservoir spring inflow forecast stemming from the above-average snowpack coupled with a cool and wet weather outlook. It was described that these conditions have the potential for flooding impacts along the Sun River. As a result, the Cascade County DES held a separate town hall meeting at Sun River, MT to apprise residents and first responders of the potential flooding outlook.

Inflows into Gibson slowly increased from a steady 200 cfs mid-April to approximately 3,700 cfs by the end of April. The average monthly inflow was near 820 cfs; 106 percent of average. Greenfield Irrigation District began refilling Pishkun Reservoir through the Pishkun Supply Canal on April 30. By April 30, the storage level of Gibson Reservoir was at elevation 4,670.20 feet, 54 feet below the top of the conservation pool.

Inflows into Gibson Dam quickly increased during the beginning of May while near maximum releases were also occurring. The daily average inflow for May 4-9 was near 5,800 cfs. These inflows caused Gibson Dam to quickly fill 37 feet and reach the top of the spillway crest, elevation 4,712.0 feet on May 10, 2018. The warm temperatures caused the snowmelt runoff to reach an inflow into Gibson Dam of 7,500 cfs on May 10. All six spillway gates were fully open; therefore, all inflows were being passed through the dam to the Sun River.

On May 11, 2018 the reservoir elevation was 4,715.6 feet with inflows estimated to be near 8,000 cfs. Greenfield Irrigation District was diverting near 800 cfs, therefore, the Sun River below the Sun River Diversion Dam would be receiving flows between 7,000-8,000 cfs. This release, when combined with downstream tributaries, may exceed the safe channel capacity of

10,000 cfs. Minor flooding was forecasted by the National Weather Service near Simms and Vaughn.

By the morning of May 12, 2018, the elevation of the reservoir had fallen to 4,714.9 feet and all inflows were still being passed through the reservoir to the Sun River. Inflows at this point were decreasing and had reached an estimated 6,300 cfs. The Greenfield Irrigation District was diverting 700 cfs, leaving 5,600 cfs flowing in the Sun River below the Sun River Diversion Dam.

On May 13, the reservoir remained higher than the spillway crest with elevation 4,713.4 feet. Inflows and releases had decreased to near 5,500 cfs. Forecasts were projecting high releases again within the next several days. On May 16 inflows increased to a daily average of 7,050 cfs. This release, when combined with downstream tributaries, may exceed the safe channel capacity of 10,000 cfs. Minor flooding was forecasted by the National Weather Service near Simms and Vaughn.

By May 20, inflows and releases had decreased to near 4,500 cfs while the reservoir was at elevation of 4,713.72 feet. Forecasts were once again projecting high inflows and releases within the next several days. On May 26 and 27 inflows again increased to a daily average near 7,400 cfs. This release, when combined with downstream tributaries, may exceed the safe channel capacity of 10,000 cfs. Minor flooding was forecasted by the National Weather Service near Simms and Vaughn.

Inflows declined and by June 4 were estimated at 3,600 cfs with reservoir elevation of 4,716.73 feet. Inflows fluctuated above and below 3,000 cfs throughout the next several days. On June 8, the National Weather Service was forecasting additional rain which would cause inflows into Gibson to rise above 3,000 cfs by June 11-12. This storm did not materialize; however, another storm system was forecasted for the coming week.

Heavy rains fell over the Sun River Basin between June 15 and June 19 resulting in a four-day rain event with totals ranging from 3 to 9 inches. See the Climate Summary for the National Weather Service's 4-day rain totals reported over 2 inches. By the evening of June 18, Gibson Reservoir was at 4,723.54 feet while inflows were estimated near 4,800 cfs and increasing. Releases to the Sun River below Sun River Diversion Dam were near 6,500 cfs as tributary streams just below Gibson Dam were increasing quickly as well.

Early morning on June 19 inflows into Gibson Reservoir quickly reached 9,000 cfs and were increasing. Tributary streams just below Gibson Dam were also very high due to the rain events, therefore, the estimated flows in the Sun River below Sun River Diversion Dam were near 12,400 cfs.

Gibson Reservoir operational releases and combined downstream tributary flow did cause flooding on the Sun River. According to the National Weather Service, peak river gage at Simms was 10.75 feet, moderate flood stage (Tuesday, June 19, 2018), while the gage at Vaughn was 9.64 feet, major flood stage (Wednesday, June 20, 2018). The USGS estimated peak flow at 18,600 cfs through Simms, and 17,700 cfs through Vaughn. See Appendix A for flooding photos

throughout the Sun River watershed.

Releases from Gibson Dam were reduced from a peak of 9,500 cfs on June 19 to 6,100 cfs on June 21. Another reduction was made on June 22 to 3,100 cfs. By June 23, Gibson reservoir elevation was at 4,721.66 feet; 2.34 feet below the full pool elevation of 4,724.0 feet while inflows were near 3,300 cfs and decreasing. Simms and Vaughn fell below flood stage by June 23.

July temperatures were average, but precipitation was below average, increasing agricultural demands, which soon exceeded inflows into Gibson Reservoir. Gibson Reservoir was drawn down to elevation 4,698.9 feet by the end of the month. The above average snowpack generated an actual April through July runoff total of 666,600 AF, 164 percent of average. Inflows during April, May, June, and July were 106, 240, 132, and 96 percent of average, respectively.

Conditions during August were similar to July with average temperatures and little precipitation. From this point forward, releases from Gibson Reservoir were adjusted to meet downstream senior water rights and minimum river flows. Gibson Reservoir reached a storage content of 26,458 AF on August 31.

Diversions from the Sun River to the Pishkun Supply Canal were discontinued on September 10. The August through September inflow to Gibson Reservoir totaled 36,845 AF, 97 percent of average. Gibson Reservoir ended the water year with a content of 17,146.0 AF of storage at elevation 4,635.97 feet on September 30. Total annual inflow to Gibson Reservoir for WY 2018 was 779,290 AF, 150 percent of average.

Even though no space is allocated to flood control in Gibson Reservoir, the Corps still estimates flood damages prevented by Gibson Reservoir. The Corps determined that during WY 2018, Gibson Reservoir prevented $16,200 in local flood damages and no main stem flood damages on the Missouri River below Fort Peck Reservoir. Since 1950 Gibson Reservoir has prevented $3,101,800 in flood damages.

Additional hydrologic and statistical data pertaining to Gibson Reservoir can be found in Table 11 and Figure 19.

Pishkun Reservoir

Pishkun Reservoir, near Augusta, Montana, is an off-stream reservoir supplied by a feeder canal which diverts water from the Sun River below Gibson Reservoir. The reservoir serves the 81,000-acre Greenfields Division. The total capacity of the reservoir is 46,670 AF at elevation 4,370.0 feet.

In 2002, Reclamation surveyed Pishkun Reservoir to develop a bathymetric profile and compute a current storage-elevation relationship (area-capacity tables). Data was used to calculate reservoir capacity changes since the previous

survey, completed in 1940. The 2002 survey determined that Pishkun Reservoir has a storage capacity of 46,694 AF and a surface area of 1,522 acres at reservoir elevation 4,370.0 feet. Comparisons show the total reservoir capacity in 2002 was slightly greater than the original volume computed in 1940. It was the general conclusion that the difference between the surveys was due to differences in the detail of the two surveys. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

The content in Pishkun Reservoir at the beginning of the WY 2018 was 19,682 AF at elevation 4,346.80 feet. Storage during the fall and winter was maintained near 19,700 AF as a coffer dike was constructed. The dike was removed in the spring and diversions from the Sun River started refilling the reservoir on April 30. On May 12, irrigation releases from Pishkun Reservoir began and storage reached close to the top of active conservation pool at elevation 4,370.0 feet on May 30.

Once irrigation releases began, storage fluctuated while irrigation demands were met, and the reservoir refilled. The rain storm that passed through the basin on June 16-19 reduced irrigation demand sufficiently to allow the reservoir to fill. In response GID quickly reduced diversions to near 500 cfs by early evening on June 18. Further reductions to 160 cfs on June 19 were made to control the reservoir elevation. The reservoir reached a peak elevation near 4,370.09 feet on June 19. Once the storm passed diversions increased to near 530 cfs to maintain a full pool during the evening of June 20. Diversions increased on June 28 to near 800 cfs in response to irrigation demands. Diversions for the remainder of the water year fluctuated with demand. All diversions from the Sun River into Pishkun Reservoir were discontinued on September 10.

The above average water supply allowed Greenfields Irrigation District to deliver a full allotment (2.0 AF per acre) to its water users in 2018. Approximately 254,600 AF of water was released from Pishkun Reservoir from May 12 through September 30 to meet irrigation demands on the Sun River Project and evacuate storage, allowing the district to construct a trash rack at the outlet works. By the end of the water year, the reservoir storage was 19,700 AF at elevation 4,346.28 feet; 69 percent of average and 41 percent of full capacity.

Additional hydrologic and statistical data pertaining to Pishkun Reservoir can be found in Table 12 and Figure 20.

Willow Creek Reservoir

Willow Creek Reservoir obtains its water supply from Willow Creek and the Sun River via the Willow Creek Feeder Canal. The total reservoir capacity is 32,300 AF at elevation 4,142.0 feet. Releases from Willow Creek Reservoir enter the Sun River and can be diverted for irrigation at the Fort Shaw Diversion Dam, the Floweree Canal of the Broken O Ranch, and other downstream senior water users.

In 2002, Reclamation surveyed Willow Creek Reservoir to develop a bathymetric profile map and compute a present storage-elevation relationship (area-

capacity tables). Data were used to calculate reservoir capacity lost due to sediment accumulation since dam closure in 1911. The 2002 survey determined that Willow Creek Reservoir has a storage capacity of 34,819 AF and a surface area of 1,509 acres at a reservoir elevation of 4,144.00 feet. Since closure in 1911, the reservoir had an estimated volume change of 431 AF below reservoir elevation 4,144.00 feet. This volume represents a 1.2 percent change in total capacity at this elevation. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

Reservoir content at the beginning of WY 2018 was 17,485 AF at elevation 4,131.12 feet. Since storage in Willow Creek Reservoir was lower than average, diversions into the reservoir continued until December 3. Diversions throughout the fall and early winter gained approximately 9,900 AF of storage or 7.8 feet in reservoir elevation.

Snow accumulated throughout the winter and early spring at above average rates. The low elevation snow began to melt in late March to early April with natural inflows around 30 cfs. Since Willow Creek's storage content was at 29,253 AF by April 1, GID started a 60 cfs release to draw down the reservoir in preparation for additional runoff. Inflows throughout April ranged from 30 cfs to 90 cfs and additional precipitation fell in the basin. As temperatures in May began to increase so did the natural runoff. Inflows increased from 70 cfs to near 275 cfs by May 12. In response, GID increased releases to 120 cfs to control the rate of fill. By the months end, inflows slowly declined to near 100 cfs and releases were also reduced to near 20 cfs as most of the low land snow had melted.

The reservoir filled to full pool on June 4 therefore releases were adjusted between 20 cfs and 75 cfs as needed in response to the fluctuating inflows during the first half of June. Reclamation's MTAO reservoir and river operations group began monitoring a forecasted rain event in the Sun River drainage basin. On June 15, 2018, Willow Creek reservoir was at elevation 4,141.87 feet (31,658 AF) or 0.13 feet (190 AF) below full pool with a natural inflow of 20 cfs and releases near 63 cfs. There were no diversions into the Willow Creek Feeder Canal.

On June 16 rain began to fall in the basin and natural inflows increased from 20 cfs to a daily average of 110 cfs. In response, GID increased the outlet works release to near 120 cfs to control the rate of fill on June 16. Runoff and light rain continued in the basin and therefore inflows remained near 120 cfs and releases near 120 cfs on June 17. Significant rain fell again on June 18 and inflows increased to nearly 180 cfs. As the reservoir slowly began to rise, GID responded by increasing the releases to nearly 230 cfs on afternoon of June 18. The elevation by midnight on June 18 was 4,141.97 feet (31,804 AF) or 0.03 feet (44 AF) from full pool.

Rain continued to fall on June 19 with very saturated soils. Runoff from the rain was materializing by late morning of June 19. The reservoir elevation was slowly rising with a 230 cfs release. In response to the rising reservoir, GID increased the outlet works release to near 350 cfs. This was the maximum release made as there was concerns of overtopping the Parshall flume wing walls downstream of the outlet works.

The reservoir continued to rise and forecasted inflow and releases anticipated that the reservoir would reach the uncontrolled spillway crest, elevation 4,144.0 feet within the next day. The

spillway operated only one other time, in 1964 and it was reported that the downstream spillway channel suffered some erosion at an estimated maximum flow rate of 30 cfs. In response, MTAO and GID diverted staff to begin 24-hour visual monitoring of the spillway.

Daily average inflow for June 19 was 1,430 cfs, spillway release was 0 cfs and river outlet works averaged 289 cfs, for a total average release of 289 cfs. The reservoir elevation by midnight was 4,143.45 feet (33,993 AF). The 4-day rain total (June 16-19) at the NOAA Gibson Dam meteorological station was 7.5 inches while the SNOTEL station at Wood Creek reported the highest amounts of almost 9 inches. See Climate Summary for all NOAA/NWS precipitation data in the Sun-Teton watershed. The event was later classified by the National Weather service as greater than a 100-year event.

On June 20, in anticipation of using the spillway, GID responded by providing equipment, operators, and materials to perform emergency operations and construction of an armored channel approximately 1,000 feet downstream from the spillway. This was constructed to minimize downstream erosion. During the late evening hours, the water reached the spillway crest.

Water flowing over the spillway slowly filled in the small retention pond directly below the spillway throughout the day on June 21. Daily average inflow for June 21 was 603 cfs, spillway release was 5 cfs and river outlet works averaged 338 cfs, for a total average release of 343 cfs. The reservoir elevation by midnight was 4,144.73 feet (35,926 AF).

On June 22 water began to flow from the retention pond through the constructed armored channel. It was estimated that the spillway was contributing approximately 50 cfs, river outlet works releasing 335, for a total combined release of approximately 385 cfs. GID operators worked around the clock to maintain the channel when flow started to erode the armored channel. The District also performed minor emergency repairs on the outlet works channel to maintain maximum releases from the outlet works near 350 cfs.

Reclamation and GID staff continued to provide 24-hour coverage and information exchange. Duties included providing support and guidance to the irrigation district, visual monitoring of the progression of the spill and monitoring the performance of the spillway. The onsite teams established channel cross section and staff gauge station readings, collected survey data and provided real-time information and data on flows, weather conditions, and performance of the spillway.

Daily average inflow for June 22 was 455 cfs, spillway release was 56 cfs and river outlet works averaged 345 cfs, for a total average release of 401 cfs. The reservoir elevation by midnight was 4,144.80 feet (36,033 AF).

On June 23 the maximum estimated peak discharge over the spillway was 61 cfs. Inflows continue to recede and were below total releases allowing the reservoir to start slowly drafting. Daily average inflow was 368 cfs, spillway release was 57 cfs and river outlet works averaged 349 cfs, for a total average release of 406 cfs. The reservoir elevation by midnight was 4,144.75 feet (35,957 AF).

From June 24 – June 25, spillway releases slowly decline as the reservoir storage is evacuated and by June 26 the spillway was no longer flowing. Over the next several weeks, inflows continued to slowly decline, storage was slowly evacuated, and releases slowly were reduced. The reservoir reached full pool, elevation 4,142.0 feet on July 10 with a release near 100 cfs.

Releases from Willow Creek during the remaining water year were adjusted to meet irrigation demands. The reservoir ended the water year with a storage content of 20,562 AF at elevation 4,133.74 feet. This was 106 percent of average and 64 percent of normal full capacity. Fall diversions continued into Willow Creek Reservoir in attempt to refill the reservoir to a content of 28,000 AF.

Additional hydrologic and statistical data pertaining to Willow Creek Reservoir can be found in Table 13 and Figure 21.

Important Events – Water Year 2018

December 1, 2017: Diversion to Willow Creek was discontinued.

March 31, 2018: Lowest elevation at Gibson Reservoir since 1931 at 4,624.61 feet.

April 1, 2018: April – July water supply forecasts was 600,300 AF or 147 percent of average.

April 3, 2018: Releases out of Willow Creek Reservoir were initiated to control reservoir elevation.

April 30, 2018: Diversions to the Pishkun Supply Canal were initiated.

May 1, 2018: May – July water supply forecasts was 563,000 AF; 156 percent of average. The SWE in the Sun River basin reached a peak accumulation of 21.70 inches.

May 10-11, 2018: High inflows resulted in Gibson storage reaching the spillway crest causing releases to increase to a daily average of near 7,600 cfs.

June 19, 2018: Severe rainstorm in the basin caused daily average peak outflow from Gibson Reservoir to be increased to 9,062 cfs. The storm caused flooding all along the Sun River.

June 21-25, 2018: Willow Creek Reservoir spillway was used for the first time since 1964.

September 10, 2018: Diversions to Pishkun Supply Canal were discontinued for the year.

September 16, 2018: Releases from Willow Creek Reservoir were discontinued for the season.

September 17, 2018: Diversion from the Sun River Diversion Dam to the Willow Creek Feeder Canal was initiated for the year.

Table 11. Hydrologic Data for Gibson Reservoir (new sediment survey data effective 01/01/2013).

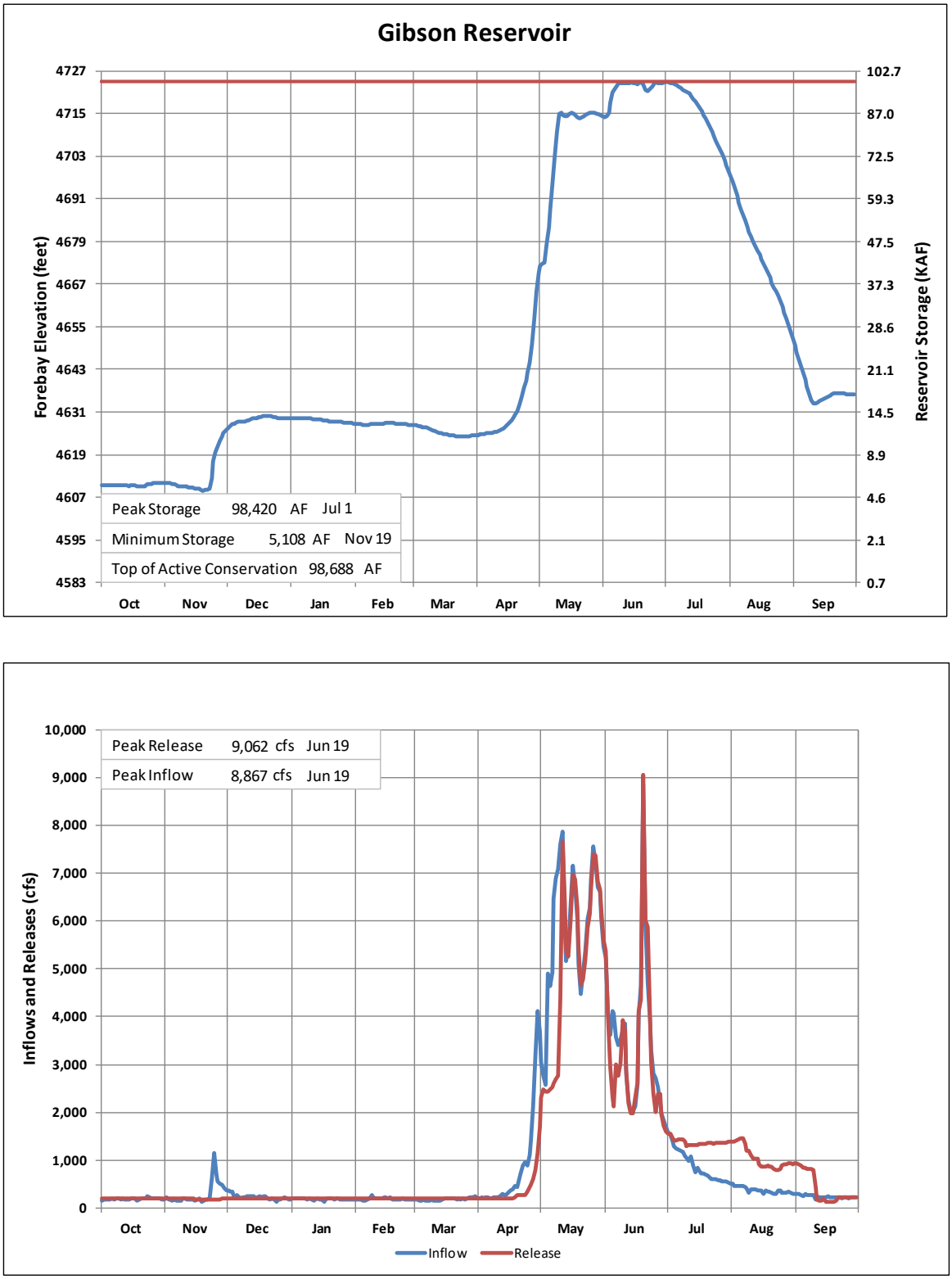
RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,557.50	0	0
TOP OF ACTIVE CONSERVATION	4,724.00	98,687	98,687

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4,610.63	5,639	OCT 01, 2017
END OF YEAR	4,634.97	17,146	SEP 30, 2018
ANNUAL LOW	4,608.86	5,108	NOV 16, 2018
ANNUAL HIGH	4,723.80	98,420	JUL 01, 2018
HISTORIC HIGH	4,732.23	116,400	JUN 08, 1964

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	779,290	OCT 17-SEP 18	767,015	OCT 17-SEP 18
DAILY PEAK (CFS)	8,867	JUNE 19, 2018	9,062	JUNE 19, 2018
DAILY MINIMUM (CFS)	130	NOV 13, 2018	165	NOV 20, 2017

MONTH	INFLOW*		OUTFLOW*				CONTENT*	
	KAF	% OF AVG	TOTAL CANAL KAF	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	11.8	83	6.6	175	6.6	97	5.7	53
NOVEMBER	17.2	113	5.1	413	7.8	108	11.9	88
DECEMBER	13.7	111	0.0	---	13.3	151	13.6	98
JANUARY	11.4	100	0.0	---	13.8	170	12.9	98
FEBRUARY	10.5	104	0.0	---	12.2	162	12.7	104
MARCH	11.2	77	0.0	---	12.9	140	11.4	99
APRIL	49.0	106	0.2	75	23.2	126	39.8	80
MAY	357.1	240	44.9	128	242.9	332	86.1	100
JUNE	206.6	132	49.5	135	156.3	170	98.4	104
JULY	53.9	96	82.9	114	7.8	42	67.8	85
AUGUST	22.7	98	56.6	104	9.2	90	26.4	26
SEPTEMBER	14.1	92	15.5	134	10.2	114	17.1	91
ANNUAL	779.3	116	261.5	101	516.2	192		
APRIL-JULY	666.7	164						

* Based on past 30 years



Water Year 2018

Figure 19. Hydrologic Data for Gibson Reservoir.

Table 12. Hydrologic Data for Pishkun Reservoir (new sediment survey data effective 10/01/2005).

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,342.00	16,008	16,008
TOP OF ACTIVE CONSERVATION	4,370.00	46,694	30,686

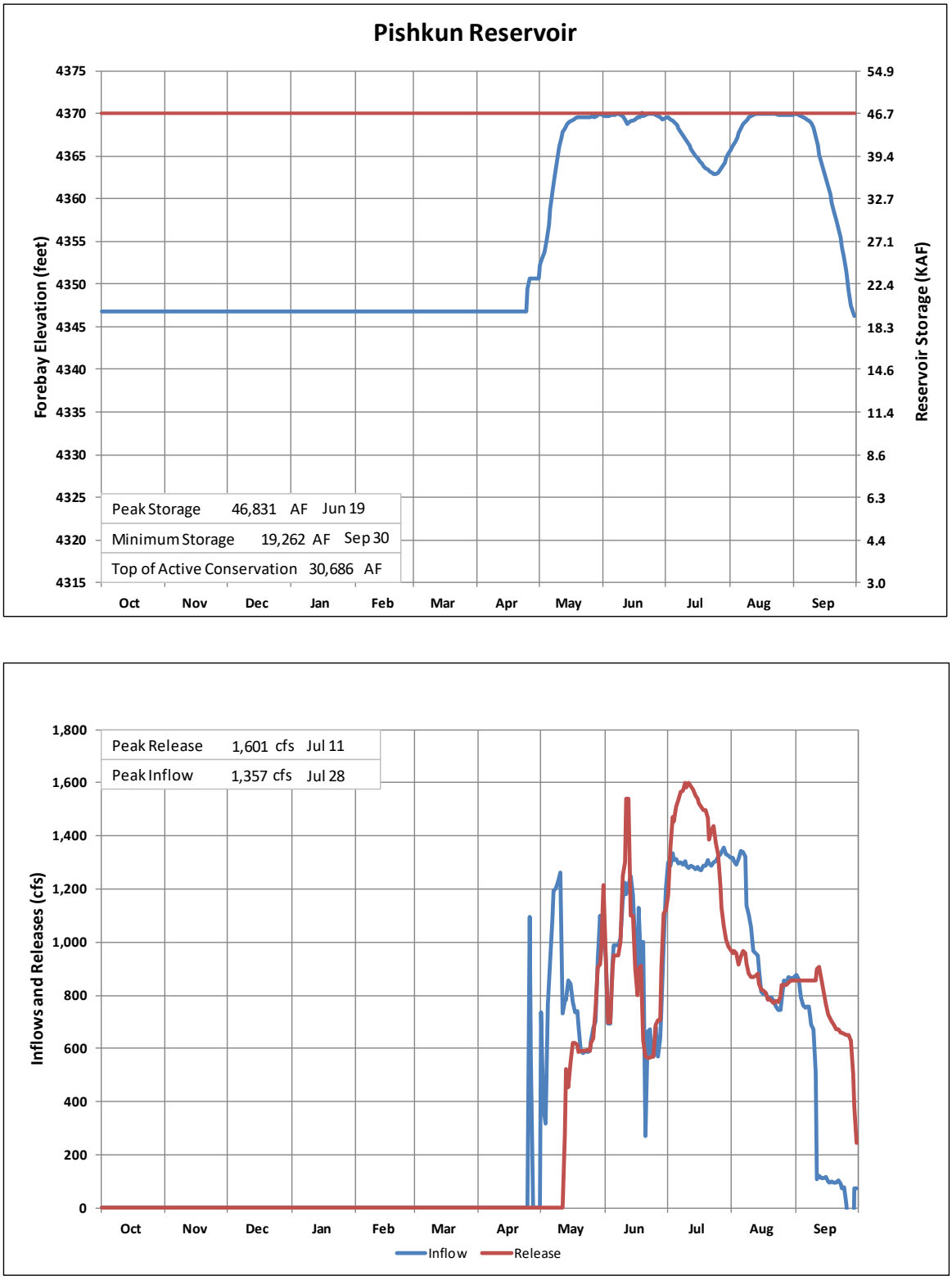
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4,346.83	19,706	OCT 01, 2017
END OF YEAR	4,346.28	19,262	SEP 30, 2018
ANNUAL LOW	4,346.28	19,262	SEP 30, 2018
ANNUAL HIGH	4,369.92	46,572	JUN 08, 2018
HISTORIC HIGH	4,371.40	48,950	JUL 04, 1953

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	262,660	OCT 17-SEP 18	262,829	OCT 17-SEP 18
DAILY PEAK (CFS)	1,356	JUL 28, 2018	1,600	JUL 11, 2018
DAILY MINIMUM (CFS)	0	*	0	*

* During nonirrigation season

MONTH	INFLOW*		OUTFLOW*		CONTENT*	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	0.0	---	0.0	---	19.7	63
NOVEMBER	0.0	---	0.0	---	19.7	61
DECEMBER	0.0	---	0.0	---	19.7	62
JANUARY	0.0	---	0.0	---	19.7	62
FEBRUARY	0.0	---	0.0	---	19.7	62
MARCH	0.0	---	0.0	---	19.7	61
APRIL	3.3	43	0.0	---	23.0	60
MAY	49.8	118	26.2	74	46.3	100
JUNE	53.3	86	53.8	80	45.8	145
JULY	80.0	105	86.2	110	39.7	106
AUGUST	59.7	157	52.9	130	46.5	135
SEPTEMBER	16.4	141	43.6	265	19.3	65
ANNUAL	262.6	109	262.8	109		
APRIL-JULY	186.4	99				

* Based on past 30 years



Water Year 2018

Figure 20. Hydrologic Data for Pishkun Reservoir.

Table 13. Hydrologic Data for Willow Creek Reservoir (new sediment survey data effective 10/01/2015).

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,085.28	1	1
TOP OF ACTIVE CONSERVATION	4,142.00	31,848	31,847

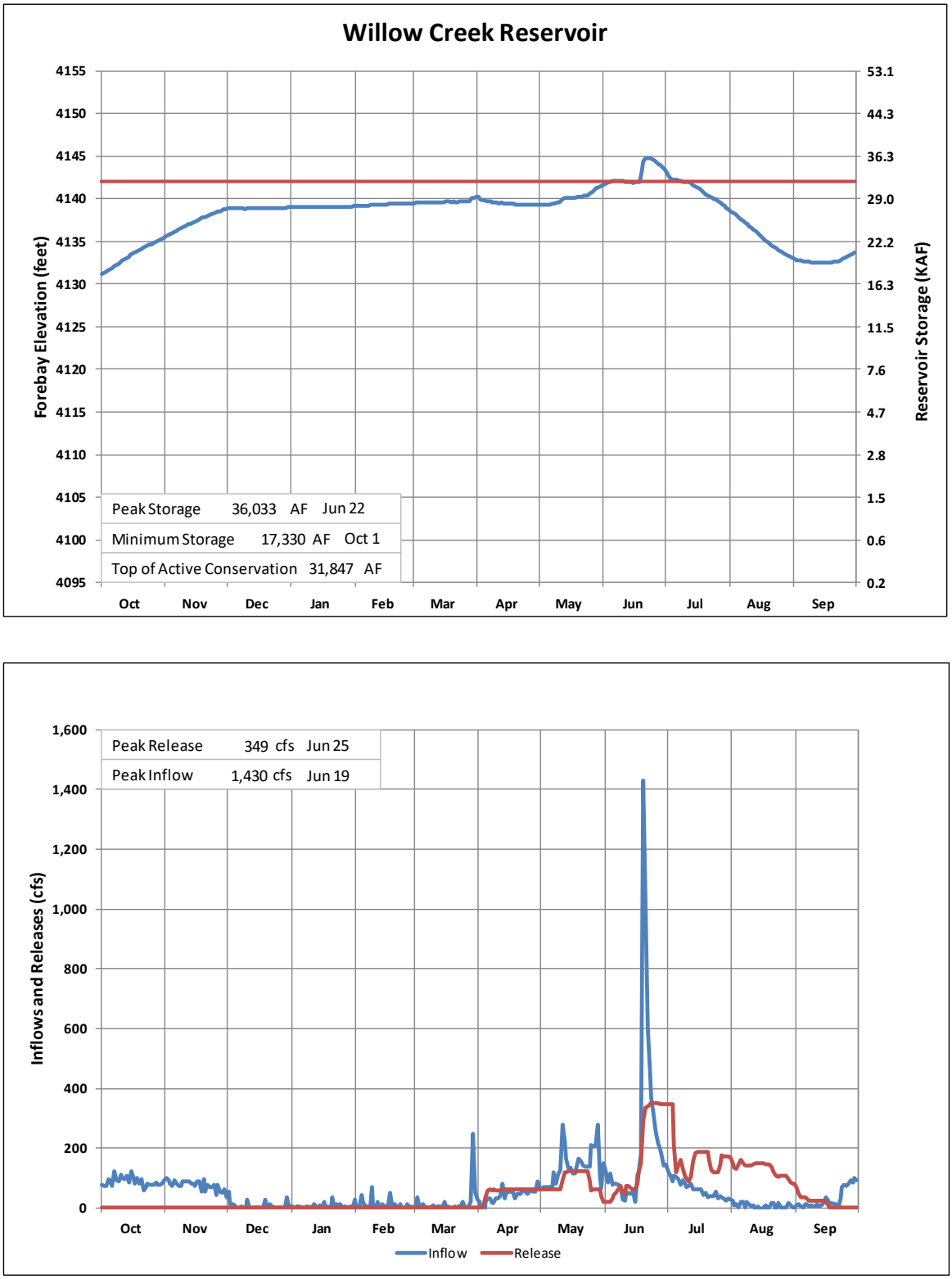
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4,130.98	17,330	OCT 01, 2017
END OF YEAR	4,133.74	20,562	SEP 30, 2018
ANNUAL LOW	4,130.98	17,330	OCT 01, 2017
ANNUAL HIGH	4,144.80	36,033	JUN 22, 2018
HISTORIC HIGH	4,144.80	36,033	JUN 22, 2018

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	41,806	OCT 17-SEP 18	38,574	OCT 17-SEP 18
DAILY PEAK (CFS)	1,430	JUN 19, 2018	407	JUN 23, 2018
DAILY MINIMUM (CFS)	0	*	0	*

* During nonirrigation season

MONTH	INFLOW*		OUTFLOW*		CONTENT*	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	5.4	385	0.0	---	22.7	109
NOVEMBER	4.4	275	0.0	---	27.2	121
DECEMBER	0.3	50	0.0	---	27.5	119
JANUARY	0.2	66	0.0	---	27.7	118
FEBRUARY	0.5	156	0.0	---	28.2	119
MARCH	1.0	217	0.0	---	29.2	121
APRIL	2.0	172	3.2	320	27.9	109
MAY	8.4	265	5.2	658	31.2	110
JUNE	13.4	536	10.7	446	33.9	117
JULY	3.8	543	10.6	177	27.2	118
AUGUST	0.4	400	7.9	232	19.6	101
SEPTEMBER	1.8	360	0.9	180	20.5	99
ANNUAL	41.8	265	38.7	280		

* Based on past 30 years



Water Year 2018

Figure 21. Hydrologic Data for Willow Creek Reservoir.

Lake Elwell (Tiber Dam)

Tiber Dam P-S MBP is located on the Marias River near Chester, Montana. It was built to provide adequate water supply for 127,000 acres in the Lower Marias Unit and for flood control. The crest section of Tiber Dam spillway began settling in 1956, following initial filling of the reservoir. Restrictions were placed on reservoir operating levels in the late 1950s to safeguard the structure until repairs could be made. The rate of settlement increased following the flood of 1964 and the heavy runoff of 1965. The settlement was attributed to a weakness of the underlying shale formation in which small lenses of gypsum slowly dissolved as water passed through the shale. Measures to protect the structure were approved by Congress, and construction was initiated in 1967 and completed in 1970. The construction consisted of modifying the canal outlet works for use as an auxiliary outlet works and closing the entrance channel of the spillway by a temporary earth fill cofferdam. To accommodate these changed conditions, the reservoir operating criteria were revised, and the active capacity was eliminated. Work on a modification of the spillway to restore active conservation capacity was started in 1976 and was completed in October 1981. The construction consisted of replacing the upstream section of the spillway and raising the dam five feet. After the work was completed, all restrictions on operating levels were lifted and normal operations were restored at Lake Elwell.

Because the irrigation distribution works have not yet been constructed, the reservoir is operated for flood control, fishery and recreation benefits. The reservoir provides irrigation water to several individual operators by water service contracts and about 1,500 AF to the Tiber County Water District for municipal, industrial, rural domestic, and livestock use. The city of Chester, Montana receives a small amount of water for municipal use. Approximately 3,000 acres are irrigated by contract from Lake Elwell storage.

In 2002, Reclamation surveyed Lake Elwell to develop a topographic map and compute area-capacity tables. Data were used to calculate reservoir capacity changes since dam closure in October of 1957. The 2002 survey determined that Lake Elwell has a storage capacity of 925,649 AF and a surface area of 18,275 acres at a reservoir elevation of 2,993.00 feet. Since closure in 1957, the reservoir volume has been reduced by 42,179 AF below elevation 2,993.00 feet. This change in capacity reflects the combination of all effects on reservoir storage, such as sediment accumulation, improved survey resolution, data collection, and interpolation techniques. This volume represents a 4.4 percent change in total capacity at this elevation. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

During September 2003, construction of a powerplant was permitted by the Federal Energy Regulatory Commission. The river outlet works underwent extensive modification to incorporate the addition of a 7.5-megawatt powerplant, privately owned by Tiber Montana, LLC. A bifurcation pipe was installed in the downstream end of the river outlet works tunnel to divert flow from the existing 72-inch outlet pipe through a bifurcation and 96-inch butterfly valve to the powerplant. Construction of the powerplant was completed and brought on-line in June 2004.

Normal operations of Lake Elwell through the end of WY 2017 drafted storage to 814,891 AF at elevation 2,986.51 feet. This storage level was 103 percent of average. Releases were reduced to the expected winter release rate of 500 cfs on September 6, 2017.

WY 2018 started off very wet in October, November, and December. Very warm temperatures in late November melted a considerable amount of the snow that accumulated in the mountains through mid-November. By mid-December temperatures were much cooler and snow started accumulating in the mountains. Cumulative valley precipitation through December was 204 percent of average and mountain precipitation was 126 percent of average. Inflow during this period totaled 46,982 AF; 87 percent of average. Releases were maintained at 500 cfs and by the end of December 2017, Lake Elwell storage was 771,251 AF; 104 percent of average.

On January 1, 2018 the NRCS reported the mountain SWE in the Marias River Basin above Lake Elwell was 112 percent of average. During WY 2018, the Badger Pass SNOTEL site was not operable so only manual SWE measurements were available. First of the month manual measurements made it possible to calculate a composite SWE data point that could be used for making comparisons to other water years and the manual measurement could be used for forecasting. The January 1, 2018 water supply forecast, based on mountain snowpack, indicated the April-July runoff into Lake Elwell would be 361,000 AF; 98 percent of average. During January 2018 valley precipitation was below average at 86 percent and mountain precipitation was 102 percent of average.

On February 1, 2018 the NRCS reported the mountain SWE was 111 percent of median. The February 1 water supply forecast indicated the April-July runoff would be about 378,000 AF, 102 percent of average. There was not much change from the previous month in water supply conditions.

Precipitation was much above average in February and on March 1, 2018 the mountain SWE was 139 percent of average. The March 1, 2018 water supply forecast was for an April-July runoff of 472,000 AF, 128 percent of average. The lowest storage content for the year occurred on March 17, 2018 at 739,703 AF, at elevation 2,981.42 feet.

Precipitation during March was above average while temperatures remained below average. Inflows increased from a daily average of 350 cfs on March 14 to a daily average of 2,125 cfs on March 26. Releases were increased to 600 cfs on March 21 and 22. Downstream ice conditions were still a concern; therefore, releases were not increased further in March.

On April 1, 2018 the mountain SWE was 129 percent of average. The water supply forecast prepared in April 2018 indicated the April-July runoff was expected to be 122 percent of average, totaling 450,000 AF. Releases were increased to powerplant capacity, approximately 700 cfs, on April 5, 2018. Inflows decreased slightly during the first part of April due to colder temperatures.

During April 16 through 18, 2018 releases were increased 1,500 cfs in response to the higher than normal forecasted inflows. Releases would have been increased sooner but there were concerns with ice conditions on the Marias River. There was ice on the river, but releases needed to be increased because the water supply forecast was above normal. There were no reported

downstream problems with the increases. Powerplant bypass releases were made through auxiliary outlet works instead of the spillway because ice still covered the reservoir.

On April 18, rapid low elevation snowmelt runoff downstream of Tiber Dam caused releases to be decreased to 700 cfs, powerplant capacity, to alleviate downstream flooding. There were three distinct reservoir inflow peaks in 2018. The first peak of 5,256 cfs occurred on April 16, 2018 and was tied to the low elevation snowmelt runoff. On April 15, two to eight inches of SWE remained on the plains around Lake Elwell, both upstream and downstream of Tiber Dam. By April 20, less than one inch remained in most of the area. Heavy runoff downstream caused the second highest flow of record, 10,200 cfs, at the USGS streamgage near Loma, Montana, second only to the flow measured during the 1964 flood, 10,800 cfs.

From April 21 through 26, 2018, as downstream conditions were improving, releases were increased to 3,500 cfs to reduce storage and prepare for the forecasted inflows. Although, there was heavy runoff from the low elevation snowmelt, the mountain snowpack had not started melting. April 2018 precipitation was above average in the valley and near average in the mountains. April inflow was 159,500 AF, 297 percent of average; the highest April inflow volume of record.

On May 1, 2018 the NRCS indicated the mountain SWE increased to 147 percent of average mainly because by May 1 not much of the mountain snowpack melted. The May 1, 2018 water supply forecast indicated May through July runoff of 407,000 AF; 129 percent of average. Releases were decreased to 3,000 cfs and the powerplant bypass was transferred from the auxiliary to spillway from May 9 through May 11. The second peak inflow of 6,525 cfs occurred on May 10 from the mountain snowpack runoff. On May 25 and 26, releases were increased to 4,000 cfs and again once more on May 29 to 4,250 cfs to control the rate of fill. Precipitation during May 2018 was 101 and 81 percent of average in the valley and mountains, respectively. Volume of inflow during May was 293,400 AF, 234 percent of average; the highest May inflow volume of record. Lake Elwell filled to 2,993.0 feet, normal full pool, at the end of May.

By June 1, 2018, the heavy melting of the snowpack in May had reduced the mountain SWE to just 67 percent of average. The June 1, 2018 water supply forecast for June and July was 131,000 AF, 69 percent of average. Inflows into Lake Elwell started decreasing and releases were reduced to 2,750 cfs from June 4 through June 6 to conserve storage. Releases were reduced again on June 11 and 12 to 1,750 cfs. A large weather system moved in from the west from June 15 through June 19, 2018 bringing moisture from the Gulf of Mexico. The heavy rain caused the third and highest peak inflow for the year. Inflow from the heavy precipitation peaked at 9,248 cfs on June 21, 2018. Releases were increased to 2,125 cfs on June 19. Releases would have been increased further but instead were reduced because the U.S. Army Corps of Engineers issued a reservoir regulation order to use replacement storage in Lake Elwell to assist with Missouri River mainstem flood control. In accordance with the reservoir regulation order, releases were reduced to powerplant capacity, 715 cfs, between June 21 and 22. Monthly precipitation percentages for June 2018 were above average at 122 and 162 percent of average for the valley and mountains, respectively.

Storage peaked on July 6, 2018 at 983,467 AF, at elevation 2,996.10 feet. Later in the month, once U.S. Army Corps of Engineers provided the order, releases were increased to 1,250 cfs

between July 18 and 19 and again to 1,500 cfs on July 23, to evacuate storage from the exclusive flood control pool. Powerplant bypass releases were made through the auxiliary outlet works for cooler temperature control on the Marias River.

Conditions in Montana started turning dry. July 2018 precipitation was only 52 percent of average in the valley and 27 percent of average in the mountains and July inflows were only 70 percent of average. The last of the storage in the exclusive flood control pool was evacuated on August 9, 2018. Releases were decreased to 1,000 cfs between August 9 and 13 to conserve storage. Releases were reduced to 730 cfs, powerplant capacity, on August 21 to conserve storage. Precipitation was a little better in August but was still far below average.

An efficiency test of the powerplant turbine was conducted on September 29 which required varied releases between 500 and 730 cfs. Following the efficiency test, releases were reduced to the winter release rate of 600 cfs. Precipitation in September was 78 and 31 percent of average in the valley and mountains, respectively.

Total annual valley precipitation and total annual mountain precipitation were 125 and 109 percent of average, respectively. The April-July runoff into Lake Elwell during WY 2018 was 178 percent of average, totaling 657,392 AF. This was 287,220 AF more than the April-July inflow experienced in 2017. The total annual inflow was 153 percent of average, totaling 802,939 AF. This was 174,283 AF more than the total annual inflow experienced in WY 2017. By the end of WY 2018, Lake Elwell storage was 855,038 AF at elevation 2,988.99 feet. This was 108 percent of normal and 40,147 AF (2.48 feet elevation) higher than reported on September 30, 2017.

The Corps determined that during WY 2018, Lake Elwell did not prevent any local flood damages but prevented $2,114,500 in flood damages downstream on the Missouri River below Fort Peck Reservoir. Since closure of Tiber Dam in 1954, Lake Elwell has reduced flood damages by a total of $99,007,700.

Important Events – Water Year 2018

January 1, 2018: NRCS reported a mountain SWE in the watershed above Lake Elwell were about 112 percent of average. The April-July runoff into Lake Elwell was forecasted to be 361,000 AF, 98 percent of average.

February 1, 2018: NRCS reported SWE in the watershed above Lake Elwell was about 111 percent of average. The February water supply forecast indicated the April-July runoff into Lake Elwell would be 378,000 AF which was 102 percent of average.

March 1, 2018: NRCS reported SWE in the Marias River Basin upstream of Lake Elwell was about 139 percent of average. The March water supply forecast was an April-July runoff volume into Lake Elwell of 472,000 AF which is 128 percent of average.

March 17, 2018: Storage was drafted to a water year low of 739,703 AF, at elevation 2,981.42 feet.

March 21-22, 2018: Releases were increased based on forecasted runoff. Releases were increased from the winter release rate of 500 to 600 cfs, powerplant capacity.

April 1, 2018: NRCS reported SWE in the watershed above Lake Elwell was 129 percent of average. Water supply forecast indicated the April-July runoff into Lake Elwell would be 450,000 AF or 122 percent of average.

April 5, 2018: Releases were increased to 700 cfs, powerplant capacity, based on forecasted inflows.

April 16-18, 2018: Releases were increased to 1,500 cfs based on forecasted inflows. Powerplant bypass was released through the auxiliary outlet works instead of the spillway due to the reservoir being ice covered.

April 18, 2018: Releases were decreased to 700 cfs, powerplant capacity, due to downstream flooding and specifically, the high flows on the Marias River at Loma.

April 21-26, 2018: Releases were increased to 3,500 cfs based on forecasted inflows and improved downstream conditions. Powerplant bypass was released through the auxiliary outlet works instead of the spillway due to the reservoir being ice covered.

May 1, 2018: NRCS reported SWE in the watershed above Lake Elwell were 147 percent of average. The water supply forecast indicated the May through July runoff into Lake Elwell would be 407,000 AF which is 129 percent of average.

May 9-11, 2018: Releases were decreased to 3,000 cfs based on forecasted inflows. Powerplant bypass was transferred from the auxiliary outlet works to the spillway.

May 25-26, 2018: Releases were increased to 4,000 cfs to manage the rate of fill of Lake Elwell. Powerplant bypass was released through the spillway.

May 29, 2018: Releases were increased to 4,250 cfs to manage the rate of fill of Lake Elwell. Powerplant bypass was released through the spillway. Releases were being coordinated with the U.S. Army Corps of Engineers.

June 1, 2018: NRCS reported SWE in the watershed above Lake Elwell were 67 percent of average. The water supply forecast indicated the June to July runoff into Lake Elwell would be 131,000 AF which is 69 percent of average.

June 4-6, 2018: Releases were decreased to 2,750 cfs based on forecasted inflows and to conserve storage. Powerplant bypass was released through the spillway.

June 11-12, 2018: Releases were decreased to 1,750 cfs based on forecasted inflows and to conserve storage. Powerplant bypass was released through the spillway.

June 19, 2018: Releases were increased to 2,125 cfs based on forecasted inflows from heavy precipitation runoff. Powerplant bypass was released through the spillway.

June 21, 2018: WY 2018 inflow peaked for the year at 9,248 cfs.

June 21-22, 2018: Releases were decreased to 715 cfs, powerplant capacity, to utilize replacement storage in Lake Elwell at the direction of the U.S. Army Corps of Engineers.

July 6, 2018: Storage peaked for WY 2018 at 983,467 AF, elevation 2,996.10 feet.

July 18-19, 2018: Releases were increased to 1,250 cfs to evacuate storage from the exclusive flood control pool. Powerplant bypass was released through the auxiliary outlet works.

July 23, 2018: Releases were increased to 1,500 cfs to evacuate storage from the exclusive flood control pool. Powerplant bypass was released through the auxiliary outlet works.

August 9 and 13, 2018: Releases were decreased to 1,000 cfs to conserve storage. Powerplant bypass was released through the auxiliary outlet works.

August 21, 2018: Releases were decreased to 730 cfs, powerplant capacity, to conserve storage.

September 29, 2018: An efficiency test was conducted on the powerplant turbine. Releases were briefly decreased to 500 and 550 cfs for the test. Releases were increased to 600 cfs for the winter release rate.

Additional hydrologic and statistical information pertaining to the operation of Lake Elwell during WY 2018 can be found in Table 14 and Figure 22.

Table 14. Hydrologic Data for Lake Elwell (Tiber Dam) (new sediment survey data effective 10/01/2005).

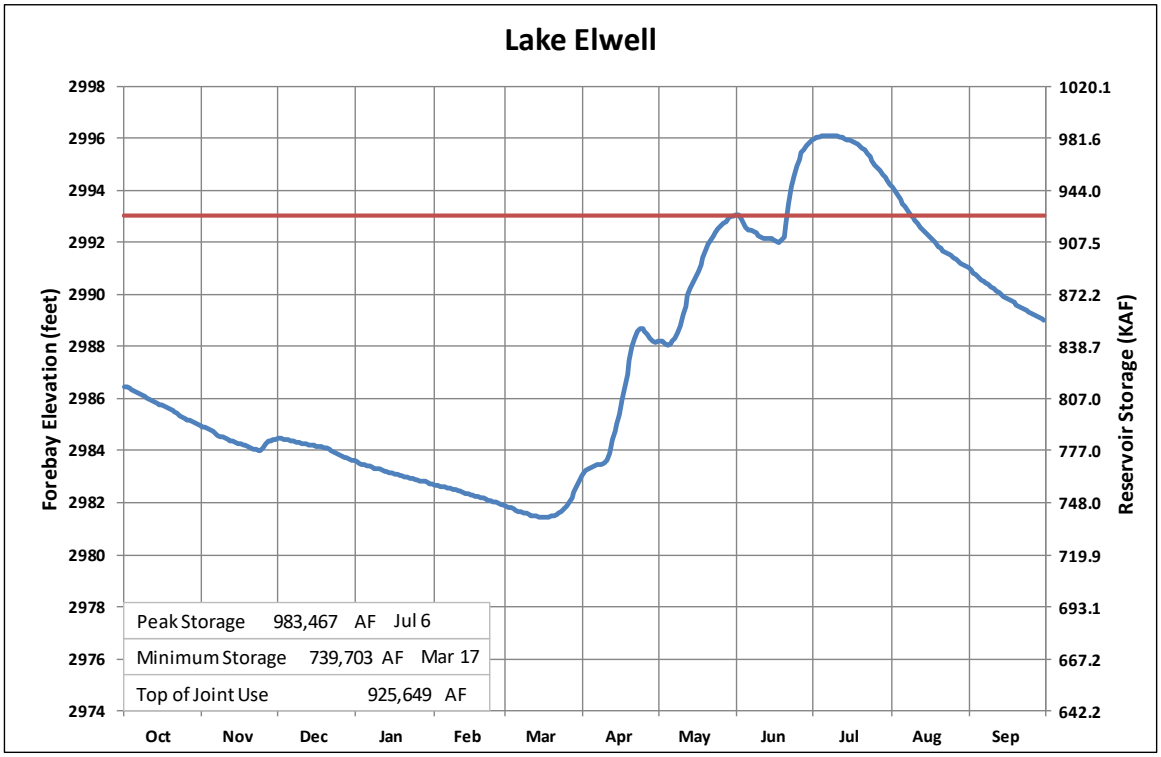
RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,966.40	554,330	554,330
TOP OF ACTIVE CONSERVATION	2,976.00	667,213	112,883
TOP OF JOINT USE	2,993.00	925,649	258,436
TOP OF EXCLUSIVE FLOOD CONTROL	3,012.50	1,328,723	403,074

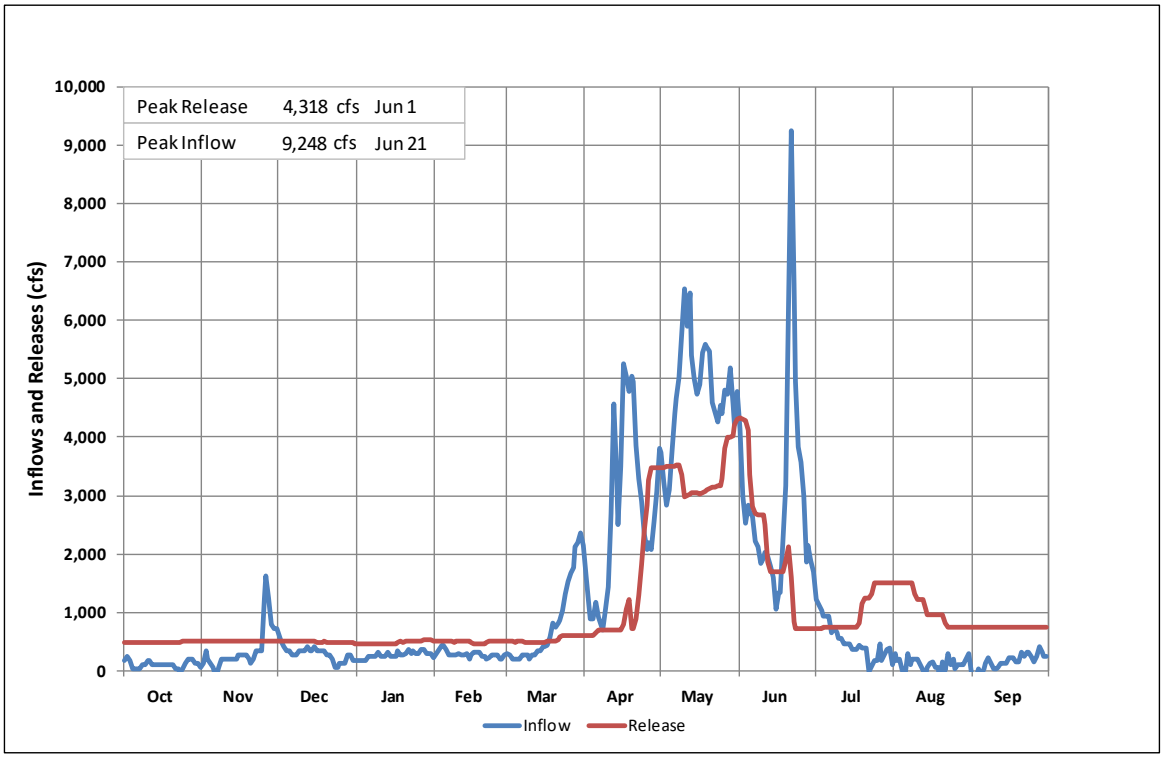
STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,986.51	814,891	OCT 01, 2017
END OF YEAR	2,988.99	855,038	SEP 30, 2018
ANNUAL LOW	2,982.67	739,703	MAR 17, 2018
ANNUAL HIGH	2,996.10	983,467	JUL 6, 2018
HISTORIC HIGH	3,011.42	1,303,858	JUL 19, 2011

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	802,939	OCT'17-SEP'18	763,150	OCT'17-SEP'18
DAILY PEAK (CFS)	9,248	JUN 21, 2018	4,318	JUN 1, 2018
DAILY MINIMUM (CFS)	-235	SEP 1, 2018	459	FEB 18, 2018
PEAK SPILL (CFS)			3,603	JUN 1, 2018
TOTAL SPILL (AF)			200,124	5/9-6/19/2018

MONTH	INFLOW		OUTFLOW		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	6.6	43	30.4	74	791.1	103
NOVEMBER	22.3	105	29.8	91	783.6	104
DECEMBER	18.0	104	30.4	94	771.3	104
JANUARY	16.7	102	29.9	92	758.0	105
FEBRUARY	15.9	76	27.3	92	746.5	104
MARCH	49.5	117	32.8	92	763.2	106
APRIL	159.5	297	81.1	216	841.6	114
MAY	293.4	234	208.5	422	926.6	114
JUNE	173.7	119	120.4	165	980.0	111
JULY	30.8	70	62.7	98	948.1	110
AUGUST	7.2	58	65.4	126	890.1	108
SEPTEMBER	9.4	92	44.5	99	855.0	108
ANNUAL	802.9	153	763.2	145		
APRIL-JULY	657.4	178				

Average based on previous 30 years





Water Year 2018

Figure 22. Hydrologic Data for Lake Elwell (Tiber Dam).

Milk River Project

The 117,000-acre Milk River Project, located in north-central Montana, is served by Sherburne, Fresno, and Nelson Reservoirs. Sherburne and Nelson Reservoirs are single-purpose irrigation structures. Fresno Reservoir has joint-use flood control space, provides a municipal water supply to several municipalities on or near the project, and serves as the primary irrigation storage structure for the Milk River Project. Approximately 101,500 acres are served by irrigation districts, 9,500 acres are served by private facilities and between 5,000 and 6,000 acres are served supplemental water by the Fort Belknap Indian Irrigation Project.

Lake Sherburne

Lake Sherburne is located in Glacier National Park on Swiftcurrent Creek, a tributary of the St. Mary River in the Hudson Bay Drainage Basin. Lake Sherburne has a total capacity of 66,147 AF at elevation 4,788.0 feet. The use of boundary waters of the St. Mary and Milk Rivers are divided between Canada and the United States by the 1909 Boundary Waters Treaty. The United States utilizes its entitlement to St. Mary River water by regulating flows through storage in Lake Sherburne and diverting St. Mary River flows through the St. Mary Canal to the Milk River Basin. The river outlet works has a capacity of 2,100 cfs at elevation 4,788.0 feet. The maximum combined discharge of the spillway and river outlet works is 4,000 cfs at a maximum water surface elevation of 4,810.0 feet.

In 2002, Reclamation surveyed Lake Sherburne to develop a topographic map and compute area-capacity tables. The data was used to calculate reservoir capacity changes since dam closure in 1919. The survey data determined a storage capacity of 66,147 AF and a surface area of 1,719 acres at a reservoir elevation of 4,788.0 feet. Since dam closure in 1919, the volume change at reservoir elevation 4,788.0 feet was estimated to be 1,707 AF between the 1983 and 2002 surveys. This change in capacity reflects the combination of all effects on reservoir storage, such as sediment accumulation, improved survey resolution, data collection, interpolation techniques, and the vertical datum. The revised area-capacity table was put into effect on October 1, 2005, reflecting the new storage levels.

Lake Sherburne storage on September 30, 2017 was 11,134 AF at elevation 4,743.41 feet, 69 percent of average. Releases from Lake Sherburne were shut off on October 18, 2017 while canal diversions were shut off for the season on September 22, 2017. The releases into October were being made to repay a deficit created in September in the St. Mary River Basin based on International Joint Commission Procedures Manual for the natural flow calculations of the St. Mary and Milk River Basins (IJC Accounting).

Precipitation in October 2017 was 128 and 98 percent of average in the valley and mountains, respectively but Lake Sherburne inflow was only 36 percent of average. Precipitation in the mountains was above average in November 2017 and temperatures were very warm at the end of November. Between the two conditions in November, inflows picked up into Lake Sherburne

during November. November inflows were 12,200 AF, 162 percent of average. In fact, the peak inflow for all of WY 2018 was 1,549 cfs and it occurred on November 24, 2017. Cumulative mountain precipitation through December was 114 percent of average. October through December 2017 inflows were 110 percent of average. Storage in Lake Sherburne by the end of December 2017 was at 28,915 AF at elevation 4,761.75 feet, 103 percent of average.

On January 1, 2018 the NRCS reported mountain SWE in the St. Mary Basin was 84 percent of average. The April-July runoff forecast for January 1, 2018 was 100,000 AF, 100 percent of average.

Precipitation in the mountains was above average during January 2018 and as a result, the February 1, 2018 mountain SWE for the St. Mary Basin was 96 percent of average. February precipitation was much above average and the SWE increased to 123 percent of average by March 1, 2018. The April-July runoff forecast for March 1, 2018 was 110,000 AF, 110 percent of average.

March precipitation was below average at 72 and 97 percent of average in the valley and mountains, respectively. Mountain SWE was 129 percent of average on April 1, 2018. The April 1, 2018 forecast for April-July runoff was 115,000 AF, 116 percent of average. Based on the April 1, 2018 forecast, Lake Sherburne was expected to fill to the normal full pool elevation of 4,788.0 feet, 66,147 AF.

In response to expected above-average runoff in the Milk River Basin, diversions to the St. Mary Canal did not start until May 9, 2018 and were slowly ramped up to 600 cfs by May 23, 2018 as irrigation demands in the Milk River Basin increased. Releases from Lake Sherburne were initiated on April 23, 2018 to reduce the high storage and prepare for high forecasted April through July inflow. Releases were 300 cfs by the end of April.

Mountain SWE was 147 percent of average on May 1, 2018. The May 1, 2018 runoff forecast for May-July was 110,000 AF; 124 percent of average. There was no drawdown on storage during the snowmelt runoff as inflows remained above releases throughout the runoff period. Sherburne releases were increased to approximately 700 cfs during the first part of May and later to 800 cfs to control the rate of fill with the plan to fill the reservoir to normal full pool by end of June. May precipitation was below average; only 65 and 25 percent of average in the valley and mountains, respectively. However, inflows into Lake Sherburne from early and heavy snowmelt runoff were 177 percent of average. Inflow during the spring runoff peaked at 1,295 cfs on May 26, 2018.

In accordance with the IJC Accounting and the Letter of Intent, deficit deliveries to Canada are allowed during March, April and May. A deficit delivery of St. Mary water to Canada did not occur before May 31, 2018 which meant no St. Mary water would have to be repaid in September or October 2018.

Mountain SWE was at 98 percent of average on June 1, 2018. The June 1, 2018 runoff forecast for June-July was 59,000 AF; 102 percent of average. By the end of May, releases from Lake Sherburne were reduced to 400 cfs and in June releases fluctuated between 350 and 750 cfs to control the rate of fill. Inflow in June was 90 percent of average at 34,900 AF as the remaining snow melted out. Precipitation in June was below average in the valley and mountains. Lake Sherburne peaked in storage on July 13 at 65,958 AF or elevation 4,787.89 feet.

Precipitation remained well below average in July, August and September. Precipitation from June through September was only 64 percent of average in valley and 53 percent of average in the mountains. Inflow was well below average in July and August at 69 percent of average.

Due to the continued demand for water in the Milk River Basin and snowmelt runoff dwindling, releases from Lake Sherburne were increased in July and kept high into September while inflows remained low. Much of the storage from Lake Sherburne was being used to keep flows above 580 cfs in the St. Mary Canal. While trying to continue with operations into middle of September and later, releases from Lake Sherburne became difficult because of sediment and debris that had been deposited in front of the outlet works. Releases were reduced to approximately 150 to 200 cfs which was capacity of the outlet works until early October when the crew was able to clean out a large amount of the debris and sediment.

Unlike the previous year, it was anticipated that releases would be limited when storage levels were around 10,000 AF or lower. Therefore, equipment and personnel were lined up to do an organized and coordinated effort to clean the area around the river outlet works. This work continued until about mid-October. Releases were shutoff for the season from Lake Sherburne on October 17, 2018.

Dry conditions during the summer resulted in no natural flow in the Milk River starting in early July and going through early September. A deficit delivery of natural flow to the U.S. occurred during this time period according to the IJC Accounting. This deficit was anticipated and during a Letter of Intent conference call with the Field Representatives of the International Joint Commission, it was agreed to concurrently create a deficit in the St. Mary Basin by providing less water to Canada to offset the deficit in the Milk River Basin. A sufficient deficit was created on the St. Mary by July 31 to offset any anticipated deficit on the Milk River and all remaining operations on the St. Mary were normal except for the cleanout as discussed in the previous paragraph.

The cumulative precipitation was 110 and 99 percent of average for valley and mountain areas, respectively. Lake Sherburne inflow for WY 2018 totaled 140,881 AF, 104 percent of average. This was approximately 9,092 AF more than the inflow experienced during WY 2017. The actual April-July runoff was 109 percent of average, totaling 108,269 AF. On September 30, 2018 the storage content in Lake Sherburne was 6,052 AF at elevation 4,736.56 feet, 39 percent of average. The low end of year storage was a result of the drawdown for the cleanout of the outlet works.

According to preliminary data, diversions from the St. Mary River to the Milk River totaled 152,103 AF. Canal diversions from the St. Mary River to the Milk River were discontinued on September 28, 2018 for lack of reliable release of storage from Lake Sherburne during the cleanout of the outlet works.

During the 2018 irrigation season several conference calls were conducted with the International Joint Commission Field Representatives to discuss accumulated deficits by the United States and Alberta, Canada on the St. Mary and Milk Rivers, respectively. More coordination than normal was needed to work out the details on how to balance water between the two nations, in a year with lack of an early deficit on the St. Mary and a deficit occurring on the Milk River.

During WY 2018, Lake Sherburne did not contribute to the reduction of local flood damages. Since 1950 Lake Sherburne has prevented $10,412,000 in flood damages.

Additional hydrologic and statistical information pertaining to the operation of Sherburne Reservoir during WY 2018 can be found in Table 15 and Figure 23.

Fresno Reservoir

Fresno Reservoir is located above all project lands on the Milk River near Havre, Montana. A sediment survey in 2010 and finalized in 2013 determined the normal full pool capacity was 91,746 AF, a capacity reduction of 1,134 AF from the previous survey. Reclamation started using the revised elevation-area capacity tables on October 1, 2013.

The top 33,841 AF of storage is used jointly for flood control and conservation and is not filled until the start of spring runoff. Fresno Reservoir stores the natural flow of the Milk River along with water diverted into the Milk River from the St. Mary River and Lake Sherburne. Stored water is used principally for irrigation but Havre and Chinook, Montana have a contract for a minimum flow in the river of 25 cfs during the winter to maintain suitable water for municipal use. The city of Harlem and the Hill County Water District also have contracts for municipal water use.

After drought shortened the 2017 irrigation season, storage in Fresno Reservoir rebounded and was 42,965 AF, at elevation 2,561.96 feet; 103 percent of average and 47 percent of normal full capacity on September 30, 2017.

Valley precipitation for October 2017 was above average at 117 percent of average. November precipitation was below average and December precipitation was much above average. Precipitation from October through December was 144 percent of average. Reservoir inflow was only 52 percent of average from October through December. End of December storage was 41,225 AF at elevation 2,561.86 feet, 100 percent of average.

Warm weather at the end of November melted all the snow in Bear Paw Mountains but by January 1, 2018 the NRCS reported mountain SWE in the Bear Paw Mountains was 129 percent of average. The NRCS reported mountain SWE on February 1 was 113 percent of average, and 156 percent of average on March 1.

Spring runoff season generally occurs during March through June. The peak snowpack and most reliable water supply runoff forecast for the Milk River Basin are based on March 1 conditions. The March 1, 2018 forecast for natural runoff above Fresno Reservoir for March through September 2018 was 72,700 AF; 90 percent of median. The Milk River runoff forecast is provided by Alberta Environment and Parks. Based on this forecast and expected St. Mary Canal operations, storage in Fresno Reservoir was expected to fill to the top of the conservation pool at elevation 2,575.0 feet by the end of April.

The NRCS reported mountain SWE was 183 percent of average on April 1. January through March precipitation was much above average while temperatures were well below average. This was one of the harshest winters experienced along the Hi-Line. A warmup at the end of March did cause some of the snow on the plains to melt. Inflows peaked at about 1,750 cfs on March 29, 2018. The inflow decreased to 270 cfs by April 4 when temperature dropped back to below normal. Frequent snowstorms with little snowmelt throughout the winter resulted in 1 to 2 feet of snow on April 1 throughout the Milk River Basin which was approximately 2 to 6 inches of SWE. The National Weather Service (NWS) was forecasting for potential flooding at the lower end of the Milk River Basin but probability was low at the upper end of the Basin. Storage in Fresno Reservoir at the end of March was 45,395 AF at elevation 2,562.92 feet; 87 percent of average. This was 12,510 AF below the bottom of the 33,841 AF joint-use pool which is used for flood control purposes.

Warming temperatures and a ripe snowpack brought the initiation of heavy runoff, raising inflows to an average 970 cfs on April 11 and 1,720 cfs on April 12. Temperatures stayed warm with overnight lows near or above freezing. By April 21, most of the snowpack on the plains had melted out. The rapid melt caused very high runoff in a very short time period.

Releases from Fresno Dam were increased for the first time from the winter release rate of 45 cfs to 100 cfs on April 12, 2018. Release increases were delayed preventing ice jam flooding downstream of Fresno Dam. Ice cover remained on the Milk River and the release increase was delayed preventing the type of ice jam flooding that occurred in 2017. Releases were also not increased any sooner due to storage conditions in Fresno Reservoir along with the forecasted inflows from the NWS. Storage in Fresno Reservoir on April 12 was 55,327 AF.

Inflows by April 14 averaged 3,608 cfs and releases were increased to 300 cfs. Releases were increased again to 500 cfs between April 14 and 15. As releases were being increased, tributary flows downstream from Fresno Dam were also increasing. High flows and ice jams led to flooding or projected flooding to occur at several locations along the Milk River.

By April 17, releases were increased to river outlet works capacity, 2,450 cfs due to current and projected inflows and the desire to spill the minimum amount of water possible since Fresno Reservoir was still ice covered. This was the first time since 1967 that the outlet works were fully opened and the second time in the reservoir's history. Inflows peaked at 6,599 cfs on April 17, 2018. On April 17, Fresno Reservoir reached the top of the joint-use pool, elevation 2,575.0 feet, and releases started going over the ungated spillway in addition to the 2,100 cfs release through the river outlet works. Fresno Reservoir end of day elevation peaked on April 19 at 2,576.50 feet. The total daily average release from Fresno Reservoir peaked at 3,512 cfs on April 19.

By April 23, receding inflows and reservoir levels led to discontinuation of daily notifications to downstream agencies through the emergency action plan. By April 27, Fresno Reservoir elevation was back below 2,575.0 feet, releases were reduced to 1,500 cfs, and average inflows were 791 cfs.

Releases were frequently reduced during the first half of May as inflows continued to decline to keep Fresno Reservoir near full pool. Releases from Fresno Reservoir were shut off on May 14 and started back up on May 15 to allow for irrigation districts to install the false works on their

diversion dams prior to the start of irrigation under the safest possible conditions. This is the first time since 1988 that the releases from Fresno Reservoir were shut off for any length of time. The plan was to have the releases shut off until May 16 but there were river flow concerns by the City of Havre at their water treatment intake and concerns were expressed by Montana Fish, Wildlife, and Parks about the river fishery.

Water from the St. Mary Basin through the St. Mary Canal reached Fresno Reservoir on approximately May 23, 2018. Fresno releases for irrigation were started on approximately June 4, 2018. Prior to this date, the priority was to keep Fresno Reservoir near full pool by adjusting releases based on forecasted inflows.

Precipitation was below average during the April through June time period. Fresno inflow for April was 353 percent of average due to the heavy runoff but was only 78 and 73 percent of average during May and June. By the end of June, Fresno was still near full at 2,574.80 feet, 90,923 AF, or 131 percent of average.

The Milk River Joint Board of Control set the irrigation allotment for the 2018 irrigation season at their July board meeting. The allotment was set at 2.7 AF/acre or September 30, 2018, whichever condition came first for each irrigation district. Nelson Reservoir required no water transferred from Fresno Reservoir because of filling from heavy runoff below Fresno Reservoir.

Conditions remained dry during July and August. Precipitation was only 52 and 86 percent of average during July and August. Inflows into Fresno Reservoir also remained below average as natural runoff above Fresno Reservoir went to zero in July and remained there until the end of August. Most of the inflow during July and August came from diversions through the St. Mary Canal. Fresno Reservoir inflow during July and August was only 68 and 90 percent of average respectively. By the end of August storage in Fresno Reservoir was at 37,875 AF at elevation 2,559.80 feet, 96 percent of average.

Irrigation demand kept releases from Fresno Reservoir at or above 600 cfs through September 19, 2018. During the second half of September, releases were ramped down as irrigation demand subsided. Precipitation was high in September, 156 percent of average. Releases remained at 50 cfs for Fort Belknap Indian Irrigation Project through the end of September. Releases were set at the winter release rate of 40 cfs by October 3, 2018.

The actual March through September 2018 inflow for Fresno Reservoir, excluding St. Mary Canal water was approximately 136,425 AF; 191 percent of median, based on the IJC Accounting for natural flow at the Milk River at Eastern Crossing gaging station. A majority of the flow occurred in April and May.

The cumulative valley precipitation through the end of September 2018 was 103 percent of average. Total inflow into Fresno Reservoir for WY 2018 was 276,038 AF, 109 percent of average. Diversions from the St. Mary River Basin to the Milk River Basin accounted for about 51 percent of the inflow to Fresno Reservoir during 2018. Storage in Fresno Reservoir at the end of the WY 2018 was 40,963 AF, at elevation 2,561.13 feet, 99 percent of average and 45 percent of normal full capacity.

The Corps determined that during WY 2018, Fresno Reservoir prevented $1,828,000 in local flood damage and no main stem flood damages on the Missouri River below Fort Peck Reservoir. Since 1950 Fresno Dam and Reservoir has reduced flood damages by a total of $19,547,900.

Additional hydrologic and statistical information pertaining to the operation of Fresno Reservoir during 2018 can be found in Table 16 and Figure 24.

Nelson Reservoir

Nelson Reservoir located near Malta, Montana, is an off-stream reservoir receiving its water supply from the Milk River by diversion through the Dodson South Canal. Nelson Reservoir is the only source of supply for the lower portion of the Malta Irrigation District. Nelson Reservoir also serves the Glasgow Irrigation District when water is not available from Fresno Reservoir. In 1999 a sediment survey was performed and finalized in 2001. Since Nelson Reservoir operation began in 1916, the measured total volume change was -446 AF. The new revised elevation-area capacity data was implemented on October 1, 2001. Nelson Reservoir has a revised total capacity of 78,950 AF and an active capacity of 60,810 AF.

Storage on September 30, 2017 was 50,665 AF at elevation 2,214.24 feet, 93 percent of average and 64 percent of normal full capacity. Storage slowly decreased under the effects of seepage and evaporation through March 29, 2018, when diversions through the Dodson South reached Nelson Reservoir. Storage in Nelson Reservoir on March 29, 2018 was 44,324 AF. Operations of Dodson Diversion Dam and associated headworks were more challenging than normal because of flooding and ice on the Milk River.

Releases for irrigation demands started on May 13, 2018. By May 21, 2018 releases exceeded inflows. Sufficient natural flow in the Milk River eliminated the need for releases through Nelson North Canal for Glasgow Irrigation District during May or June. Storage in Nelson Reservoir peaked at 74,244 AF, at elevation 2,220.49 feet on May 20.

All releases were stopped on June 26, 2018 when the first irrigation was completed to demoss the Nelson South Canal. Releases through the Nelson North Canal were initiated on July 5 to control storage in Nelson Reservoir. Storage in Nelson Reservoir peaked again on July 6, 2018 at 79,037 AF at elevation 2,221.62 feet, which was full pool. The second irrigation started on July 8, 2018.

Irrigation demands were lower in the lower end of the Milk River Basin in 2018. The low storage content for the 2018 irrigation season was 61,922 AF at elevation 2,217.38 feet on August 25, 2018.

Since Nelson Reservoir was nearly full diversions to Dodson South Canal were stopped on September 18, 2018. Inflows into Nelson Reservoir stopped about September 28. Releases from Nelson Reservoir were stopped on September 20, 2018. Total net inflow to Nelson Reservoir

during WY 2018 was 77,412 AF. Storage on September 30, 2018 was 76,297 AF at elevation 2,220.98 feet, 142 percent of average and 97 percent of normal full capacity.

Additional hydrologic and statistical information pertaining to the operation of Nelson Reservoir during 2018 can be found in Table 17 and Figure 25.

Important Events – Water Year 2018

March 1, 2018: Milk River runoff forecast indicated March through September runoff to be 90 percent of median.

March 29, 2018: Diversions to Dodson South Canal reach Nelson Reservoir.

April 1, 2018: Lake Sherburne runoff forecast indicated April-July runoff to be 116 percent of average.

April 17, 2018: Inflow to Fresno Reservoir peaked at 6,599 cfs.

April 17, 2018: Fresno Reservoir filled and began spilling water over the ungated spillway.

April 19, 2018: Storage in Fresno Reservoir reached a peak content for the year of 99,787 AF, at elevation 2,576.50 feet, 1.50 feet above normal full pool.

April 23, 2018: Releases begin from Lake Sherburne to control storage levels based on forecasted inflows.

May 4, 2018: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

May 9, 2018: Diversion to St. Mary Canal were started to move water to the Milk River Basin.

May 13, 2018: Releases were initiated from Nelson Reservoir for irrigation demands.

May 26, 2018: Inflow to Lake Sherburne peaked at 1,295 cfs.

June 4, 2018: Fresno Reservoir releases were increased for the first time for the year to meet irrigation demand.

June 22, 2018: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

July 6, 2018: Storage in Nelson Reservoir reached a peak content for the year of 79,037 AF, at elevation 2,221.62 feet, 0.02 feet above normal full pool.

July 11, 2018: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

July 12, 2018: Storage in Lake Sherburne reached a peak content for the year, 65,958 AF, at elevation 4,787.89 feet, 0.11 feet below normal full pool.

July 17, 2018: MRJBC set the irrigation allotment at 2.7 AF/acre or September 30, 2018, whichever condition came first for each irrigation district.

August 3, 2018: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

September 17, 2018: A conference call was held with the IJC Field Representatives to discuss St. Mary and Milk River apportionments.

September 20, 2018: Releases from Nelson Reservoir were discontinued.

September 28, 2018: St. Mary Canal diversions were discontinued.

October 3, 2018: Releases from Fresno Reservoir are set at approximately 40 cfs for the duration of the winter.

October 17, 2018: Lake Sherburne releases were discontinued.

Table 15. Hydrologic Data for Sherburne Reservoir (new sediment survey data effective 10/01/2005).

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,729.30	1,899	1,899
TOP OF ACTIVE CONSERVATION	4,788.00	66,147	64,248

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4,743.41	11,134	OCT 1, 2017
END OF YEAR	4,736.56	6,052	SEP 30, 2018
ANNUAL LOW	4,736.56	6,052	SEP 30, 2018
ANNUAL HIGH	4,787.89	65,958	JUL 12, 2018
HISTORIC HIGH	4,788.30	68,371	JUN 30, 1986

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	155,679	OCT'17-SEP'18	168,126	OCT'17-SEP'18
DAILY PEAK (CFS)	1,549	NOV 24, 2017	807	MAY 19, 2018
DAILY MINIMUM (CFS)	0	*	0	*

* During non-irrigation season

MONTH	INFLOW		OUTFLOW		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	2.5	36	1.8	63	11.7	60
NOVEMBER	12.2	162	0.0	---	23.9	95
DECEMBER	5.0	139	0.0	---	28.9	103
JANUARY	2.8	105	0.0	---	31.7	103
FEBRUARY	2.6	108	0.0	---	34.3	104
MARCH	2.0	51	0.0	---	36.3	117
APRIL	6.3	58	3.1	16	39.5	179
MAY	54.4	177	36.3	202	57.5	164
JUNE	34.9	90	28.8	157	63.7	113
JULY	12.7	72	17.2	68	59.2	122
AUGUST	6.5	85	36.3	118	29.4	109
SEPTEMBER	4.8	104	28.1	155	6.1	39
ANNUAL	146.6	104	151.7	107		
APRIL-JULY	108.3	109				

Average based on previous 30 years

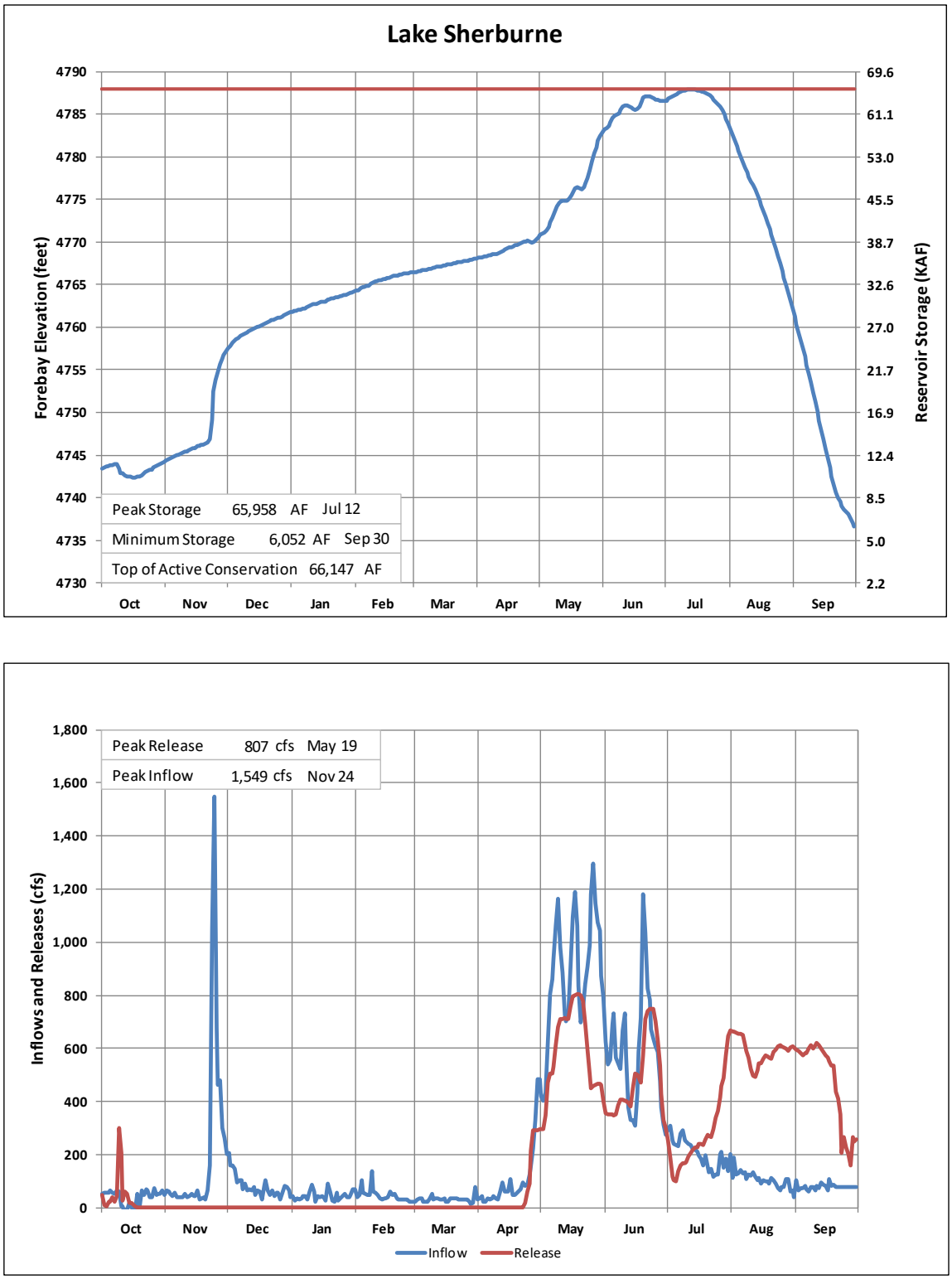


Figure 23. Hydrologic Data for Lake Sherburne.

Table 16. Hydrologic Data for Fresno Reservoir (new sediment survey data effective 10/01/2013).

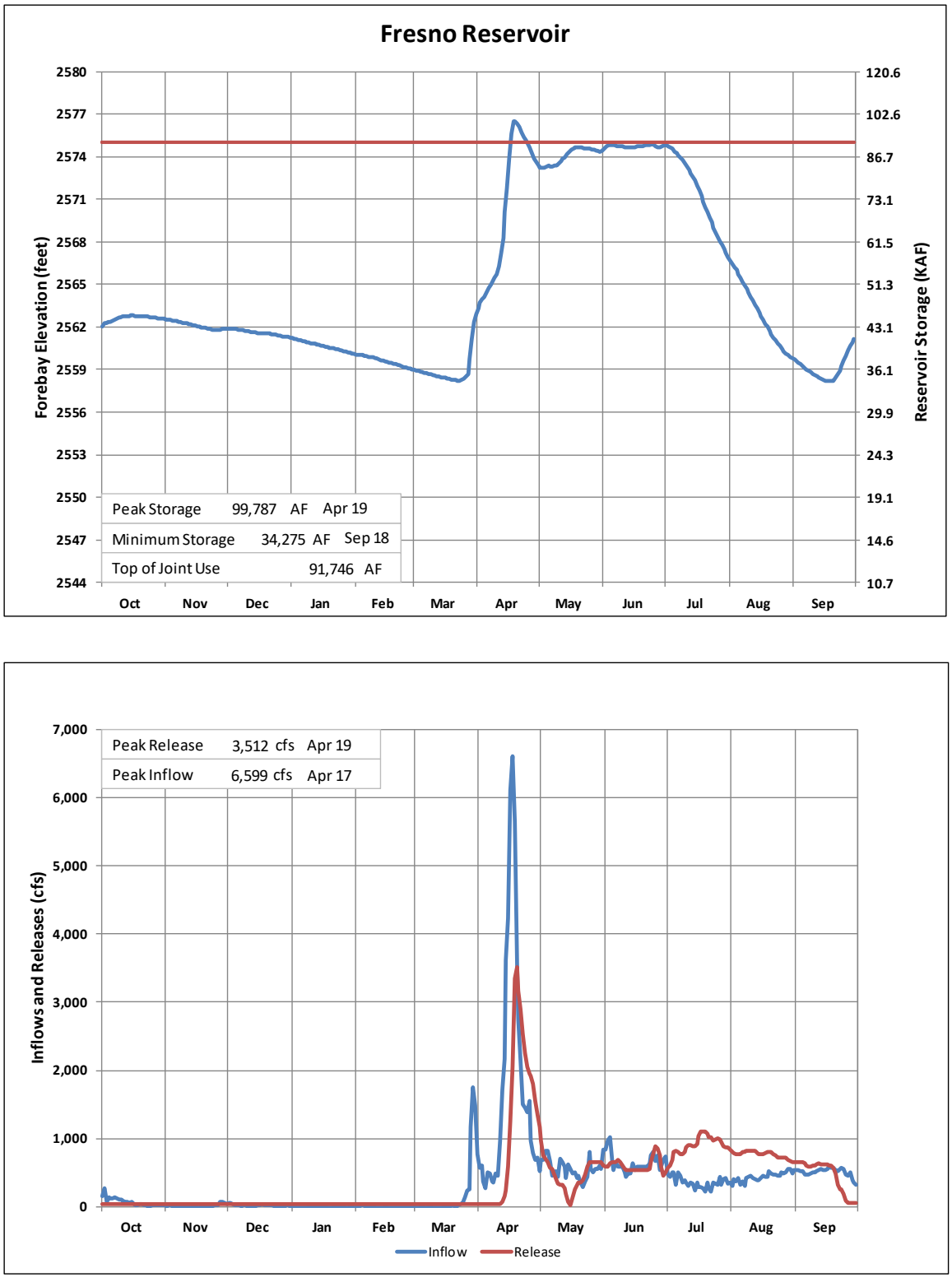
RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,530.00	158	158
TOP OF ACTIVE CONSERVATION	2,567.00	57,905	57,747
TOP OF JOINT USE	2,575.00	91,746	33,841
STORAGE-ELEVATION DATA	**ELEVATION (FT)**	**STORAGE (AF)**	**DATE**
BEGINNING OF YEAR	2,561.96	42,965	OCT 01, 2017
END OF YEAR	2,561.13	40,963	SEP 30, 2018
ANNUAL LOW	2,558.16	34,275	SEP 18, 2018
ANNUAL HIGH	2,576.50	99,787	APR 19, 2018
HISTORIC HIGH	2,579.35	154,023	APR 03, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	276,039	OCT'17-SEP'18	278,039	OCT'17-SEP'18
DAILY PEAK (CFS)	6,599	MAR 19, 2017	3,512	APR 19, 2018
DAILY MINIMUM (CFS)	0	*	29	MAY 15, 2018

* During non-irrigation season

MONTH	INFLOW		OUTFLOW*		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	4.2	55	2.7	44	44.5	104
NOVEMBER	0.8	29	2.8	88	42.7	100
DECEMBER	1.1	80	2.6	92	41.2	100
JANUARY	-0.1	---	2.6	90	38.6	98
FEBRUARY	-0.1	---	2.3	80	36.1	91
MARCH	11.8	47	2.5	24	45.4	87
APRIL	106.3	353	68.1	426	83.6	124
MAY	34.5	78	29.2	63	88.9	136
JUNE	38.1	73	36.2	74	90.9	131
JULY	22.0	68	55.3	108	57.7	114
AUGUST	27.2	90	47.0	109	37.9	96
SEPTEMBER	30.2	140	27.1	135	40.9	99
ANNUAL	276.0	109	278.0	110		
APRIL-JULY	200.9	126				

Average based on previous 30 years



Water Year 2018

Figure 24. Hydrologic Data for Fresno Reservoir.

Table 17. Hydrologic Data for Nelson Reservoir (new sediment survey data effective 10/01/2001).

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,200.00	18,140	18,140
TOP OF ACTIVE CONSERVATION	2,221.60	78,950	60,810

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,214.24	50,665	OCT 01, 2017
END OF YEAR	2,220.98	76,297	SEP 30, 2018
ANNUAL LOW	2,212.24	44,324	MAR 29, 2018
ANNUAL HIGH	2,221.62	79,037	JUL 6, 2018
HISTORIC HIGH	2,221.68	79,297	JUN 01, 2007

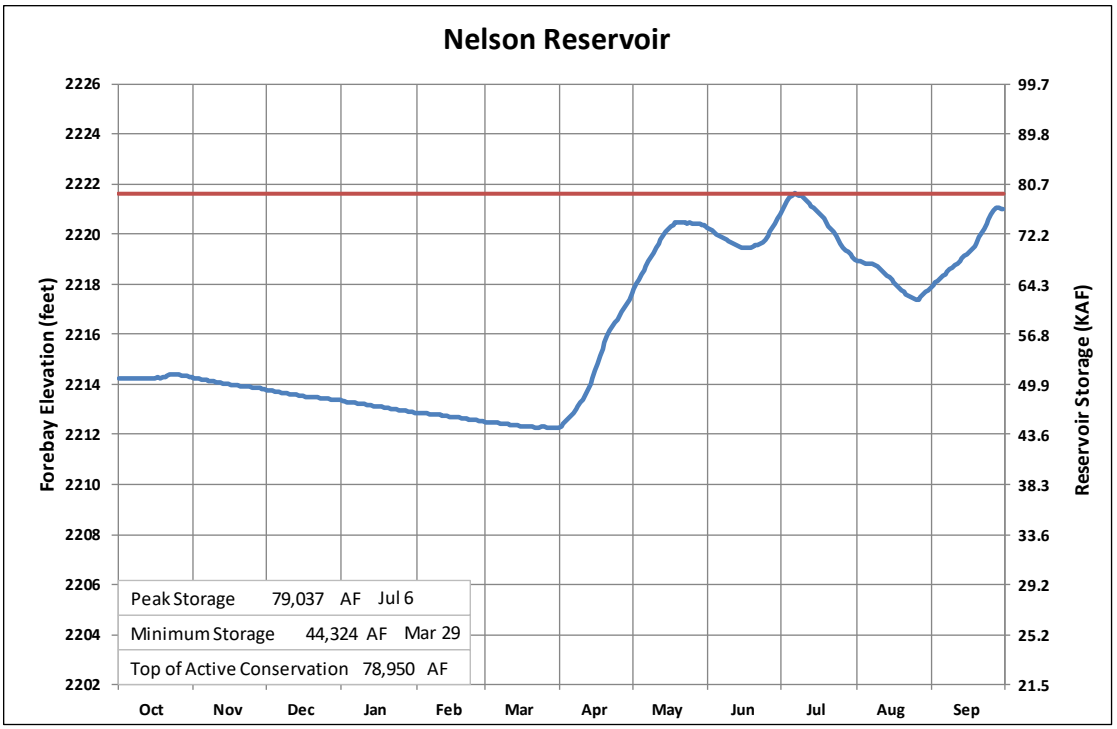
INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	77,712	OCT'17-SEP'18	52,092	OCT'17-SEP'18
DAILY PEAK (CFS)	562	APR 17, 2018	435	JUL 10, 2018
DAILY MINIMUM (CFS)	0	*	0	*

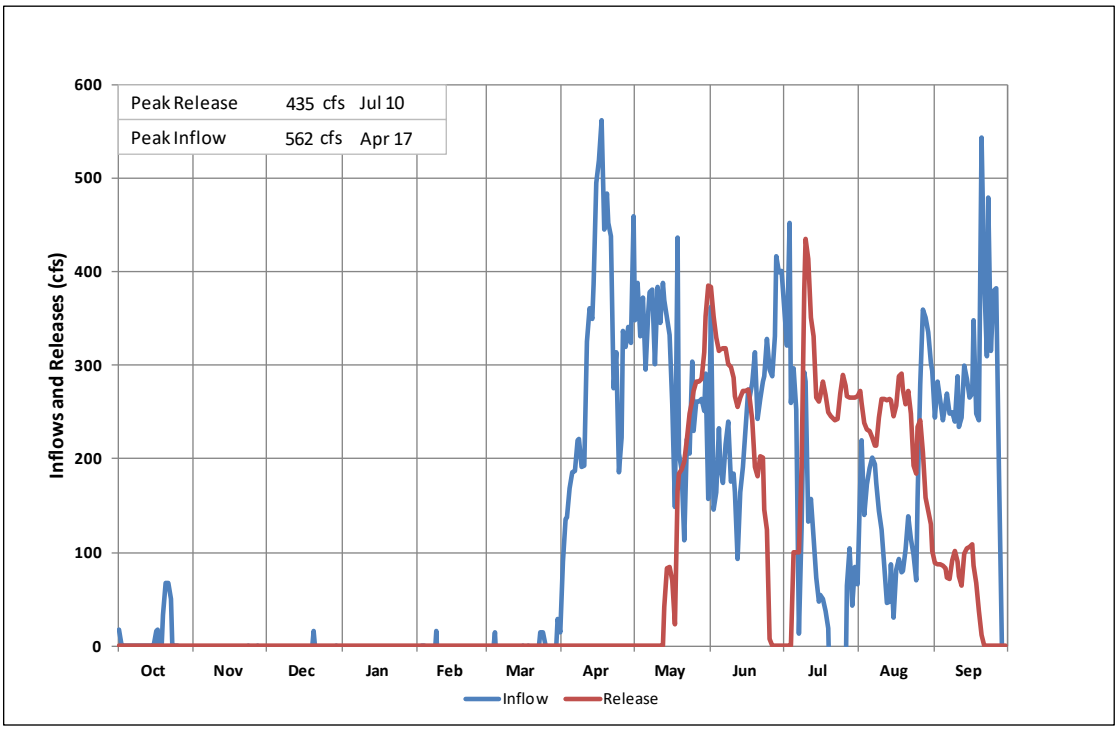
* During nonirrigation season

MONTH	INFLOW		OUTFLOW		CONTENT	
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG
OCTOBER	0.1	3.3	0.0	---	50.8	91
NOVEMBER	-1.5	---	0.0	---	49.2	91
DECEMBER	-1.4	---	0.0	---	47.8	91
JANUARY	-1.6	---	0.0	---	46.2	91
FEBRUARY	-1.0	---	0.0	---	45.2	91
MARCH	-0.8	---	0.0	---	44.4	83
APRIL	18.5	179	0.0	---	62.9	100
MAY	18.1	204	7.8	82	73.2	120
JUNE	15.1	154	12.7	131	75.6	124
JULY	6.7	103	14.2	95	68.2	128
AUGUST	9.9	100	14.2	126	63.8	124
SEPTEMBER	15.7	213	3.2	72	76.3	141
ANNUAL	77.7	141	52.1	95		

Average based on 1995 to 2017

FIGURE MTG11





Water Year 2018

Figure 25. Hydrologic Data for Nelson Reservoir.

Bighorn Lake and Yellowtail Powerplant

Bighorn Lake P-S, MBP is located on the Bighorn River about 45 miles southwest of Hardin, Montana. It has a total capacity of 1,331,725 AF. The dam and reservoir were built for power generation, irrigation, flood control, fish and wildlife and recreation. The nameplate capacity of Yellowtail Powerplant is 250,000 kilowatts. The water is managed to support multiple beneficial uses. Reclamation has a storage allocation agreement with the Northern Cheyenne Tribe for 30,000 AF and the Crow Tribe for up to 300,000 AF of water. Reclamation has an industrial water service contract with Talen Energy for 6,000 AF. No additional water can be contracted out of Yellowtail Dam after the passage of the Crow Tribe Water Rights Settlement Act of 2010. Bull Lake, Boysen, and Buffalo Bill Reservoirs are three major reservoirs located in Wyoming upstream of Bighorn Lake. These reservoirs are operated and managed by the Wyoming Area Office (WYAO) and all reservoir and river operations in the Bighorn River Basin are closely coordinated between the MTAO and WYAO.

In July 2007, a hydrographic and a topographic survey were conducted, and a new elevation-area capacity table and curve was developed. The 2007 survey determined Bighorn Lake has a storage capacity of 1,278,896 AF and a surface area of 17,279 acres at elevation 3,657.0 feet (the top of the spillway gates). Since closure of the dam in November 1965, Bighorn Reservoir volume was reduced by 103,415 AF below elevation 3,657.0 feet. The volume represents a 7.5 percent reduction in capacity and an average annual reduction of 2,480 AF from November 1965 through July 2007. This change in capacity reflects the combination of all effects on reservoir storage, such as sediment accumulation, improved survey resolution, data collection, and interpolation techniques. The revised area-capacity table was put into effect on January 1, 2011, reflecting the new storage levels.

WY 2017 was a record runoff year. Inflows continued to stay above average through September. The river release was increased toward the end of the month to 4,250 cfs. Valley and mountain precipitation in September were 256 and 184 percent of average, respectively. Storage in Bighorn Lake ended WY 2017 with a content of 1,014,564 AF at elevation 3,639.52 feet.

Precipitation was below average in October. Above-average releases from Boysen and Buffalo Bill Reservoirs gave rise to above-average inflows. High inflows required releases from Bighorn Lake to be increased twice during October to 5,000 cfs. Storage gradually decreased in Bighorn Lake during October to 1,001,315 AF at elevation 3,638.44 feet. Snowpack started accumulating in October with an early season snowstorm pushed through the Bighorn River Basin.

Typically, the winter releases are set in November from all three facilities in the Basin. The winter release was set at 4,000 cfs to the Bighorn River in late November but Boysen and Buffalo Bill releases were not set at their winter release rate until December 2017. This was a result of high inflows and high storage levels coming off the record runoff year of 2017. Releases from Buffalo Bill were reduced to 560 cfs in December and to 1,250 cfs from Boysen.

Releases were reduced to 3,700 cfs on December 11 to allow for scheduled Yellowtail Powerplant unit maintenance. The 3,700 cfs was the maximum release through the Yellowtail Powerplant during the unit maintenance.

Valley and mountain precipitation were above average in November and SWE was 138 percent of average by the end of November. Temperatures were above average during November with near record temperatures near the end of November.

On November 16, 2017 Reclamation hosted a public meeting in Billings, Montana to discuss the water supply outlook, projected fall and winter operations of the Bighorn River basin and review of the operating criteria.

Precipitation was above average in December while temperatures were below average. Cumulative precipitation through the end of December was 125 and 111 percent of average in the valley and mountains, respectively. Inflow into Bighorn Lake stayed well above average. The October through December inflow was 180 percent of average. Gains over the three-month period were 117 percent of average. Releases over the same three-month period were 178 percent of average.

Snow accumulated at an above average rate, on January 1, 2018 the NRCS measured mountain SWE at 125 percent of average. Based on the April through July inflow forecast releases to the Bighorn River were increased to 3,900 cfs on January 10, with the objective of drafting storage to attain the end of March elevation target; 3,617 feet.

During January snow fell in the mountains at an average rate. Temperatures remained below average. On February 1, 2018 the NRCS measured the mountain SWE at 112 percent of average. Releases to the Bighorn River were increased at the beginning and middle of the month to 4,500 cfs based on heavy snowpack and higher than projected end-of-January storage. The volume of water released in February was the highest on record.

Snowpack in February accumulated at a much above average rate and on March 1, 2018 the NRCS measured the mountain SWE at 121 percent of average. On March 1, 2018, the forecasted April through July runoff was 1,841,400 AF, 157 percent of average. Under the operating criteria, on March 1, the end of month target changes from March 31 to April 30. The end of April target is based on April-July runoff forecast and the operating rule curves. Based on the inflow forecast, the end of April target was 3,607.9 feet. Releases were increased several times during March as releases from Boysen and Buffalo were being increased and were 6,500 cfs by the end of the month. An unusually cold December and January resulted in ice buildup downstream on the Yellowstone River that was cause for concern when increases were being made. Contact with Disaster and Emergency Services offices were made prior to the increases.

During December, January, and February, snowpack was accumulating at the lower elevations. In the middle of the March, temperatures warmed enough to melt the low elevation snow. Inflows peaked at approximately 7,650 cfs from the low elevation runoff. March inflows were the highest of record. March releases were second highest on record, second only to 2017. Storage at the end of March in Bighorn Lake was 773,223 AF, at elevation 3,611.57 feet, 101 percent of average.

March temperatures were below average. Mountain and valley precipitation were 147 and 265 percent of average respectively. The mountain SWE above Bighorn Lake continued to stay above average at 117 percent of average. The April 1, 2018 forecasted April-July runoff was 1,864,800 AF, 160 percent of average. The high forecast required lowering the end of April target slightly to 3,607.40 feet and the river release was increased to 7,500 cfs. Above-average precipitation continued through April and ended the month at 115 percent of average in the mountains and 102 percent of average in the valley. Temperatures in April were below average. SWE above Yellowtail Dam peaked on April 15, 2018 at 126 percent of average.

By May 1, 2018 storage in Bighorn Lake decreased to 730,170 AF at elevation 3603.86 feet. This was the low elevation for the year. Mountain SWE on May 1, 2018 was 116 percent of average and the May through July runoff was forecasted to be 1,349,300 AF; 134 percent of average. Based on the forecast, the minimum elevation target was 3,608.4 feet for May 16. Releases to the Bighorn River were kept at 7,500 cfs. The elevation stayed below the minimum elevation target of 3,608.4 until May 13. Releases were increased to 8,000 cfs on May 15 to control the rate of fill.

On May 21, 2018, diversions to the Bighorn Canal were started at 100 cfs and were increased to 200 cfs. However, heavy rain in the area forced the canal to shut off on May 28. This same heavy rain caused forecasted flows on the Yellowstone River at Miles City to be at flood stage. The U.S. Army Corps of Engineers (Corps) ordered releases to the Bighorn River be reduced to 6,000 cfs. Releases reached 6,000 cfs on May 24 and remained at 6,000 cfs until May 31. This reduction did not keep flow from reaching flood stage but did reduce the peak stage at Miles City.

Temperatures were warm during the early part of May and the runoff increased rapidly early in the month. For the basin, mountain and valley precipitation were 118 and 196 percent of average, respectively. By the end of May, storage was 944,105 AF at elevation 3,633.36 feet.

June 1 SWE was only 63 percent of average. The June 1, 2018 forecast for June through July runoff was 1,126,200 AF; 158 percent of average. In coordination with the Corps, releases were increased again once the peak flow passed Miles City. The high forecasted water supply and increasing storage required releases to be increased. The required changes to the release were made over several days starting on May 31 to 12,000 cfs by June 6 and 14,000 cfs by June 18, 2018. The daily average inflow into Bighorn Lake peaked at 17,790 cfs on June 20, 2018. Inflows remained much above average, even after the peak runoff, because of much above average releases from Boysen and Buffalo Bill Dams. Storage peaked in Bighorn Lake on June 27, 2018 at 1,092,816 AF, at elevation 3,645.33 feet or 5.33 feet into the exclusive flood control pool.

Precipitation stayed above average during June while temperatures were above average. On June 11, 2018, diversions to the Bighorn Canal were restarted at 100 cfs and were increased to 200 cfs. Throughout the remainder of the year diversions to the Bighorn Canal were adjusted as needed to meet irrigation demands. Releases to the river remained at 14,000 cfs until June 29, 2018 when releases were decreased to 13,500 cfs since inflows finally dropped below 13,500 cfs.

Through coordination with the Corps, releases to the river were reduced several times through the first half of July and were 6,500 cfs by July 11, 2018. Releases were gradually decreased due to concerns with river back sloughing following the high releases during runoff. Releases were kept above inflows to continue to evacuate storage from the exclusive flood control pool. The

regulation orders from the Corps shifted to using Yellowtail storage to assist with flood control along the Missouri River mainstem. Heavy rain in other portions of the Missouri River Basin resulted in higher than anticipated storage levels in the mainstem reservoirs regulated by the Corps. This resulted in the Corps evacuating storage from the exclusive flood control pool at a slower rate.

July precipitation was below average for the first time since October 2017. Precipitation was 63 percent of average in the valley and 83 percent of average in the mountains while temperatures were above average. Releases to the river were reduced several more times in July and by the end of the month releases were 4,250 cfs. Operations through snowmelt runoff were closely coordinated between the MTAO, WYAO, Corps, National Park Service, and Montana Fish, Wildlife and Parks.

On August 1, 2018 storage in Bighorn Lake was 1,024,877 AF at elevation 3,640.3 feet, 112 percent of average. During the first week of August, releases to the Bighorn River were decreased two more times to 3,750 cfs as the remaining storage in the exclusive flood control pool was evacuated. All the storage in the exclusive flood control pool was evacuated on August 3. A week later releases were reduced a few more times to 3,000 cfs. Inflows into Bighorn Lake during August were 171,200 AF, 115 percent of average.

Inflows were right at average during September. The river release was maintained at 3,000 cfs throughout the month of September. Several shift changes to the river gage were required to keep up with the algae growth. Valley and mountain precipitation in September were well below average at 23 and 22 percent of average, respectively.

Storage in Bighorn Lake ended WY 2018 with a content of 952,099 AF at elevation 3,634.12 feet. This was 108 percent of average and 62,465 AF or 5.40 feet lower than at the end of WY 2017. Releases were reduced to 2,925 cfs in October and set at the winter release rate of 2,970 cfs in early November.

Inflows into Bighorn Lake during April-July were 199 percent of average, totaling 2,317,900 AF. This was the third highest April-July inflow. April-July inflow in 2018 was 635,200 AF lower than the April-July inflow that occurred in 2017. The annual runoff into Bighorn Lake during WY 2018 totaled 3,981,615 AF, or 180 percent of average. This was the second highest annual inflow into Bighorn Lake on record.

The total amount of water released to the Bighorn River during WY 2018 was 4,020,984 AF or 185 percent of average. This was 339,486 AF lower than what was released to the Bighorn River in WY 2017.

The water levels of Bighorn Lake during WY 2018 allowed for full service recreation at all marinas for most of the recreation season, from Memorial Day through Labor Day. The exception to this is Black Canyon Campground had to be closed for part of June and July due to the water level in Bighorn Lake being above elevation 3,642.00 feet which is the elevation at which the campground starts to become inundated.

Total generation produced at Yellowtail Powerplant during WY 2018 was 1,167,055 megawatt-hours, 155 percent of average. This was 175,561 megawatt-hours more than what was generated in WY 2017. Approximately 76 percent of all water released from Yellowtail Dam during WY 2018 was released through the powerplant, 3,077,370 AF. The remainder, 966,364 AF, was released either through the river outlet gates or the spillway gates.

The Corps estimated that during WY 2018, Bighorn Lake prevented $1,050,700 in local flood damages and $17,459,400 in flood damages downstream on the Missouri River below Fort Peck Reservoir. Since construction of Yellowtail Dam in 1965, Bighorn Lake has reduced flood damages by a total of $197,709,200.

Important Events - Water Year 2018

October 1, 2017 through June 1, 2018: Yellowtail Powerplant was limited to three units for the major rewind project with Unit 1 currently the unit that was unavailable.

October 2, 2017: Releases to the Bighorn River were increased to 4,500 cfs. (4,500 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

October 11, 2017: Releases to the Bighorn River were increased to 5,000 cfs. (5,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

November 1, 2017: Releases to the Bighorn River were decreased to 4,500 cfs. (4,500 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

November 15 and 16, 2017: Releases to the Bighorn River were decreased to 4,000 cfs. (4,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

November 16, 2017: Reclamation hosted a combined annual fall water supply meeting and Bighorn River System Issues Group meeting in Billings, Montana to discuss operations and operating criteria for the Bighorn River Basin.

December 11-17, 2017: Annual electrical and mechanical maintenance of Unit 2 of the Yellowtail Powerplant was conducted. Yellowtail Powerplant was limited to two units during this timeframe. Releases were reduced to 3,700 cfs due to limited turbine capacity. (3,700 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

January 1, 2018: NRCS reported SWE at 125 percent of average. The first April-July runoff forecast for 2018 for Bighorn Lake inflow was 1,668,700 AF, 143 percent of average.

January 10, 2018: Releases to the Bighorn River were increased to 3,900 cfs based on the January 1 runoff forecast. (3,900 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

January 22-28, 2018: Annual electrical and mechanical maintenance of Unit 4 of the Yellowtail Powerplant was conducted. Yellowtail Powerplant was limited to two units during this timeframe.

February 1, 2018: Releases to the Bighorn River were increased to 4,250 cfs based on current and expected inflows into Bighorn Lake. (4,250 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

February 1, 2018: NRCS reported the mountain SWE at 112 percent of average. The April-July snowmelt runoff forecast was 1,771,600 AF, 152 percent of average.

February 14, 2018: Releases to the Bighorn River were increased to 4,500 cfs based on current and expected inflows into Bighorn Lake. (4,500 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

February 26-March 4, 2018: Annual electrical and mechanical maintenance of Unit 3 of the Yellowtail Powerplant was conducted. Yellowtail Powerplant was limited to two units during this timeframe. A spill was initiated through river outlet works due to limited capacity through the Yellowtail Powerplant during the unit outage.

March 1, 2018: NRCS SWE was reported at 121 percent of average. The April-July snowmelt runoff forecast was 1,841,400 AF, 157 percent of average.

March 5-22, 2018: An extended inspection of river outlet works stilling basin required the Yellowtail Afterbay elevation be kept below 3,190.0 feet.

March 7-8, 2018: Releases to the Bighorn River were increased to 5,000 cfs over a two-day period to continue evacuating storage from Bighorn Lake based on expected inflow. (5,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

March 14-15, 2018: Due to the above average expected runoff, releases to the Bighorn River were increased to 5,500 cfs over a two-day period to continue evacuating storage from Bighorn Lake. Releases were greater than generation capacity and spill was started through the Yellowtail spillway. (5,500 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

March 19-20, 2018: Due to the above average expected runoff, releases to the Bighorn River were increased to 6,000 cfs over a two-day period to continue evacuating storage from Bighorn Lake. (6,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

March 26-27, 2018: Due to the above average expected runoff, releases to the Bighorn River were increased to 6,500 cfs over a two-day period to continue evacuating storage from Bighorn Lake. (6,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

April 1, 2018: NRCS reported mountain SWE at 117 percent of average. The April-July snowmelt runoff forecast was 1,864,800 AF, 160 percent of average.

April 2-5, 2018: Due to the above average expected runoff, releases to the Bighorn River were increased to 7,500 cfs over a four-day period to continue evacuating storage from Bighorn Lake. (7,500 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

April 9-27, 2018: Semi-annual maintenance of the Yellowtail Afterbay Dam sluicegates required the Yellowtail Afterbay Reservoir be maintained between elevations 3,186.0 and 3,190.0 feet to maintain river flows through the radial gates.

May 1, 2018: NRCS reported mountain SWE at 134 percent of average. The May through July snowmelt runoff forecast was 1,349,300 AF, 134 percent of average.

May 15, 2018: Releases to the Bighorn River were increased to 8,000 cfs to control the rate of fill of Bighorn Lake. (8,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

May 21-22, 2018: Diversions to the Bighorn Canal were started on May 21 and ramped up to 200 cfs on May 22. (8,000 cfs to the Bighorn River and 200 cfs to the Bighorn Canal) Throughout the remainder of the irrigation season, diversion to the Bighorn Canal was adjusted as needed to meet the irrigation demands.

May 23-24, 2018: Releases to the Bighorn River were decreased to 6,000 cfs over a two day period at the directions of the U.S. Army Corps of Engineers for flood control target on the Yellowstone River at Miles City. (6,000 cfs to the Bighorn River and 200 cfs to the Bighorn Canal)

May 31-June 6, 2018: Releases to the Bighorn River were increased to 10,500 cfs to control the rate of fill of Bighorn Lake through close coordination with the U.S. Army Corps of Engineers. (12,000 cfs to the Bighorn River and 0 cfs to the Bighorn Canal)

June 1, 2018: NRCS reported mountain SWE at 63 percent of average. The June through July runoff forecast for Bighorn Lake inflow was 1,126,200 AF, 158 percent of average.

June 11-12, 2018: Releases to the Bighorn River were increased to 13,000 cfs to control the rate of fill of Bighorn Lake through close coordination with the U.S. Army Corps of Engineers. (13,000 cfs to the Bighorn River and 200 cfs to the Bighorn Canal)

June 15, 2018: Releases to the Bighorn River were increased to 13,500 cfs to control the rate of fill of Bighorn Lake through close coordination with the U.S. Army Corps of Engineers. (13,500 cfs to the Bighorn River and 200 cfs to the Bighorn Canal)

June 18, 2018: Releases to the Bighorn River were increased to 14,000 cfs to control the rate of fill of Bighorn Lake through close coordination with the U.S. Army Corps of Engineers. (14,000 cfs to the Bighorn River and 200 cfs to the Bighorn Canal)

June 28, 2018: Unit 1 one of the Yellowtail Powerplant becomes available. All four units of the Yellowtail Powerplant were available.

June 29-July 11, 2018: Based on water supply conditions, releases to the Bighorn River were decreased to 6,500 cfs through close coordination with the U.S. Army Corps of Engineers. (6,500 cfs to the Bighorn River and 300 cfs to the Bighorn Canal)

July 9, 2018: Pre-rewind testing of Unit 4 of the Yellowtail Powerplant was conducted. Yellowtail Powerplant was limited to three units during this timeframe.

July 17-19, 2018: Based on water supply conditions, releases to the Bighorn River were decreased to 5,000 cfs through close coordination with the U.S. Army Corps of Engineers. (5,000 cfs to the Bighorn River and 450 cfs to the Bighorn Canal)

July 25-26, 2018: Based on water supply conditions, releases to the Bighorn River were decreased to 4,250 cfs through close coordination with the U.S. Army Corps of Engineers. (4,250 cfs to the Bighorn River and 450 cfs to the Bighorn Canal)

August 1-2, 2018: Based on water supply conditions, releases to the Bighorn River were decreased to 3,750 cfs through close coordination with the U.S. Army Corps of Engineers. (3,750 cfs to the Bighorn River and 500 cfs to the Bighorn Canal)

August 6-9, 2018: Based on water supply conditions, releases to the Bighorn River were decreased to 3,000 cfs. Diversions to the Bighorn Canal were fluctuated to allow for chemical treatment for the algae growth. (3,000 cfs to the Bighorn River and 450 cfs to the Bighorn Canal)

August 7-8, 2018: Unit 1 of the Yellowtail Powerplant was unavailable for inspection. Yellowtail Powerplant was limited to three units during this timeframe.

September 5, 2018: Emergency power testing of the Yellowtail Powerplant was conducted. All four units of the Yellowtail Powerplant were offline for approximately 3 hours. The Yellowtail Powerplant is restarted in black start using the standby generator.

September 10-14, 2018: Unit 1 and 2 of the Yellowtail Powerplant was unavailable due to transformer maintenance and testing. Yellowtail Powerplant was limited to two units during this timeframe.

September 17-21, 2018: Unit 3 and 4 of the Yellowtail Powerplant was unavailable due to transformer maintenance and testing. Yellowtail Powerplant was limited to two units during this timeframe.

October 4, 2018: The Bighorn Canal was shut down for the irrigation season.

Additional hydrologic and statistical information pertaining to the operations of Bighorn Lake during WY 2018 can be found on Table 18 and Figure 26.

For more detailed information on the operations of Boysen and Buffalo Bill Reservoirs during WY 2018, refer to the narratives for Boysen Reservoir and Powerplant and Shoshone Project under the responsibility of the WYAO.

Table 18. Hydrologic Data for Bighorn Lake (Yellowtail Dam) (new sediment survey data effective 01/01/2011).

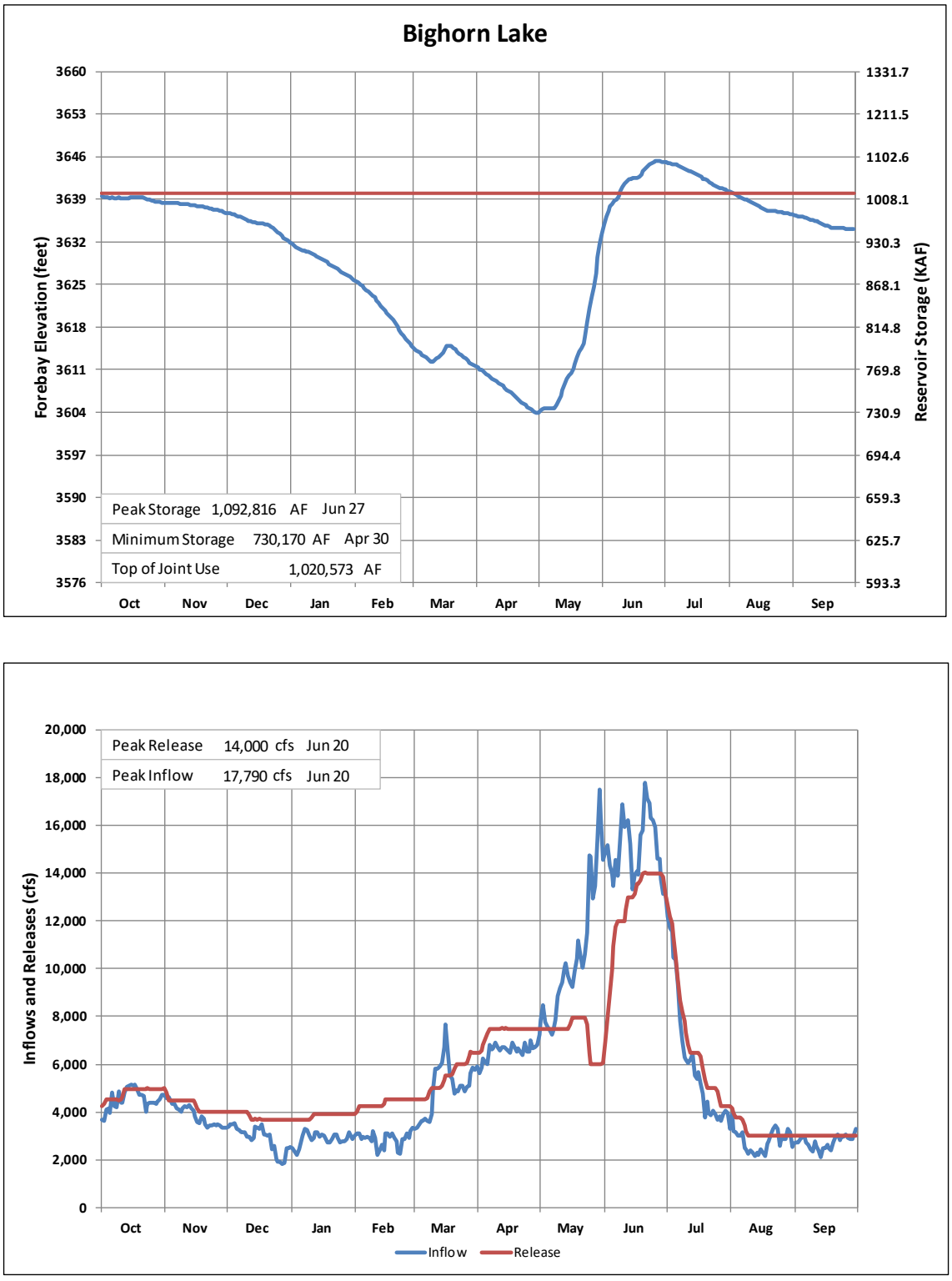
RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	3,547.00	469,910	469,910
TOP OF ACTIVE CONSERVATION	3,614.00	788,208	318,298
TOP OF JOINT USE	3,640.00	1,020,573	232,365
TOP OF EXCLUSIVE FLOOD CONTROL	3,657.00	1,278,896	258,323
STORAGE-ELEVATION DATA	**ELEVATION (FT)**	**STORAGE (AF)**	**DATE**
BEGINNING OF YEAR	3,639.52	1,014,564	OCT 01, 2017
END OF YEAR	3,634.12	952,099	SEP 30, 2018
ANNUAL LOW	3,603.86	730,170	APR 30, 2018
ANNUAL HIGH	3,645.33	1,092,816	JUN 27, 2018
HISTORIC HIGH	3,656.43	1,365,198	JUL 06, 1967

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW*	DATE
ANNUAL TOTAL (AF)	3,981,615	OCT'17-SEP'18	4,020,984	OCT'17-SEP'18
DAILY PEAK (CFS)	17,790	JUN 20, 2018	14,000	JUN 20, 2018
DAILY MINIMUM (CFS)	1,831	DEC 27, 2017	2,993	SEP 14, 2018
PEAK SPILL (CFS)			9,450	JUN 19, 2018
TOTAL SPILL (KAF)			966,364	FEB 26, 2018-JUL 19, 2018

*Discharge to the Bighorn River

MONTH	INFLOW		OUTFLOW*				CONTENT	
	KAF	% OF AVG	CANAL KAF	% OF AVG	RIVER KAF	% OF AVG	KAF	% OF AVG
OCTOBER	277.8	174	0.0	---	295.1	195	1,001.3	113
NOVEMBER	229.8	193	0.0	---	253.5	179	981.8	113
DECEMBER	177.4	174	0.0	---	233.8	159	929.7	112
JANUARY	177.3	173	0.0	---	236.4	158	874.7	110
FEBRUARY	158.9	147	0.0	---	243.1	178	793.9	103
MARCH	308.2	211	0.0	---	333.6	200	773.2	102
APRIL	391.2	243	0.0	---	438.5	180	730.2	98
MAY	657.1	224	2.6	23	444.5	209	944.1	116
JUNE	896.2	200	7.0	31	746.9	249	1,090.4	118
JULY	373.5	142	22.5	80	420.9	167	1,024.9	112
AUGUST	171.2	115	26.4	98	196.0	117	978.1	112
SEPTEMBER	163.0	100	14.3	83	178.8	122	952.1	108
ANNUAL	3,981.6	180	72.7	66	4,021.0	187		
APRIL-JULY	2,317.9	199						

Average based on previous 30 years



Water Year 2018

Figure 26. Hydrologic Data for Bighorn Lake (Yellowtail Dam).

Annual Operating Plans for Water Year 2018 for Units Under the Responsibility of the Wyoming Area Office

Wind River and Shoshone River Basin Climate Summaries

The following section contains climate summaries prepared by the Bureau of Reclamation Wyoming Area Office (WYAO) from data collected by the National Weather Service Riverton Office, High Plains Regional Climate Center, University of Wyoming Water Resources Data System, and Wyoming State Climate Office. The compiled data serves as a summary of climate conditions during Water Year 2018 for the Wind River and Shoshone River Basins.

Fall: October through November

Water Year 2018 began with above average October temperatures for most locations within the Wind River Drainage. The Wind River Drainage climate stations reported an average of 40.3°F, 1.5°F lower than the twentieth century average. Similar climate trends occurred in the Bighorn Basin with temperatures averaging 41.4°F, 1.2°F below the average. November 2017 brought above average temperatures around the region with Wind River and Bighorn basins recording their eleventh and twenty-second warmest Novembers of their respective 124-year period of records. Precipitation during October was well below average, with the Wind River and Bighorn Drainages receiving 77 percent and 69 percent of average precipitation in October respectively. November rainfall accumulations were well above average in the Wind River basin at 172 percent of average and the Bighorn Basin at 154 percent of average.

Winter: December through February

Temperatures in the Wind River Region and Bighorn Basins were above average for December and January and below average for February. Temperatures across the basins were generally 2.3 -7.3°F above normal in December and January, while February conditions were generally 3.1 - 6.1°F below normal. The 2018 precipitation for both basins was higher than normal in December and February, with below-normal precipitation in January. See Figure 27 for a summary of Wyoming temperature and precipitation data.

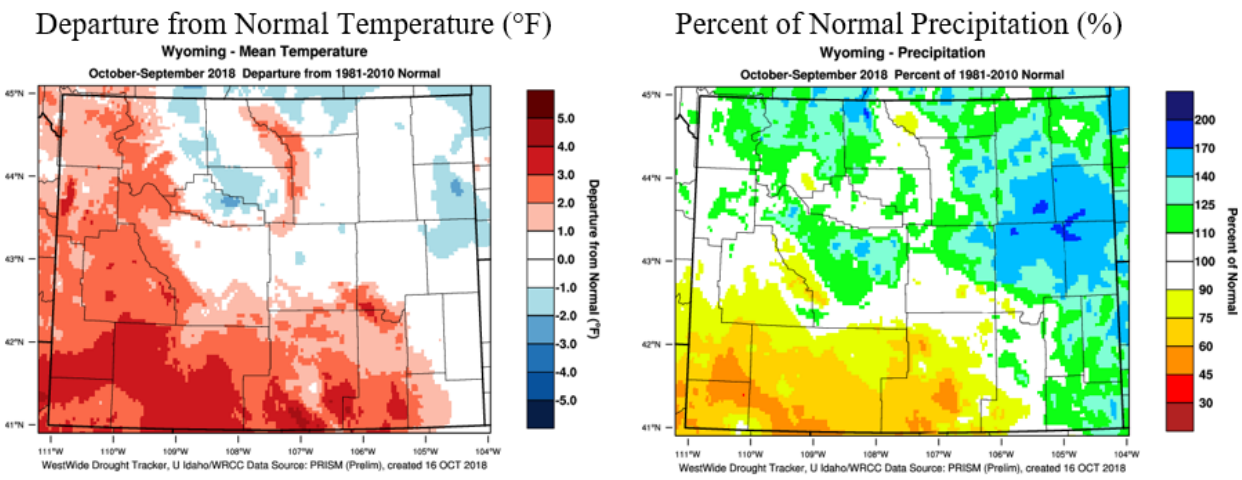


Figure 27. Summary of Station Data (December 2017-February 2018).

Spring/Summer: March through September (NWS)

Spring 2018 brought variable climate conditions to the Wind River and Bighorn Basins. March and April below-average precipitation was accompanied by above-average temperature. Much-above average precipitation occurred during the months of May and June. Below to near average precipitation totals were observed in the Wind River and Bighorn Basin during March respectively, however, much of the below-average precipitation occurred in April for the Wind River basin while the Bighorn Basin precipitation was 176 percent of the 30-year average.

Overall climate conditions during May and June for the Bighorn and Wind River drainage were well above average for precipitation and temperature. Late May and early June above-normal temperatures and well above normal precipitation brought the runoff into the Wind and Bighorn Basins.

Late August and September weather shifted to warmer and dryer conditions for both basins bringing below average inflows to both basins. Climate conditions during water year 2018 resulted in record-setting runoff for Buffalo Bill Reservoir and well above average runoff for Bull Lake and Boysen Reservoirs.

The snow-water equivalent for the reservoirs within the Bighorn Drainage Basin (BHDB) are shown in Table 19. The official forecasted runoff volumes by the Wyoming Area Office are shown in Table 20. Watershed precipitation data is shown in Table 21, Table 22, and Table 23 for the respective reservoirs. The Bighorn and Wind River Basins Flood Benefits are shown in Table 24.

Table 19. 2018 Mountain Snow Water Content.

DRAINAGE BASIN	January 1, 2018		February 1, 2018		March 1, 2018		April 1, 2018		May 1, 2018	
	INCHES	%	INCHES	%	INCHES	%	INCHES	%	INCHES	%
BULL LAKE [1]	8.37	149	9.70	133	12.03	134	14.8	124	14.13	118
BOYSEN [1]	9.78	159	11.33	139	14.58	147	17.50	137	17.08	128
BUFFALO BILL [1]	12.98	152	16.10	135	21.00	148	24.38	138	25.90	143

[1] A composite of the following Natural Resources Conservation Service SNOTEL sites was used to determine snow water content and percent of average for the basin; **Bull Lake** - Elkhart Park, Hobbs Park, and Little Warm; **Boysen** - Burroughs Creek, Hobbs Park, Kirwin, Little Warm, Togwotee Pass, Townsend Creek, and Younts Peak; Buffalo **Bill** – Blackwater, Evening Star, Marquette, Sylvan Lake, Sylvan Road, Togwotee Pass, and Younts Peak

Table 20. 2018 Water Supply Forecasts of April-July Snowmelt Runoff.

Drainage Basin	JAN		FEB		MAR		APR		MAY		JUN		WY.18	APR-JUL	% OF APRIL
	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG	KAF	% OF AVG	ACT. KAF	% OF AVG	FORECAST RECEIVED
BULL LAKE	180	118	170	121	170	121	170	121	160	114	160	114	174.6	140.4	124
BOYSEN	650	156	900	156	950	164	950	164	750	130	750	130	1007.0	577.7	174
BUFFALO BILL	750	135	1000	142	1050	149	1050	149	1100	156	1100	156	1299.7	704.4	185

Table 21. Boysen Watershed Precipitation.

Location	Oct	% AVG	Nov	% AVG	Dec	% AVG	Jan	% AVG	Feb	% AVG	Mar	% AVG	Apr	% AVG	May	% AVG	Jun	% AVG	Jul	% AVG	Aug	% AVG	Sep	% AVG
Burris	0.14	20%	0.65	191%	0.43	215%	0.08	53%	0.28	97%	0.02	5%	0.18	16%	4.05	207%	2.75	235%	0.76	100%	0.60	105%	0.00	0%
Diversion Dam	0.51	58%	0.40	118%	0.53	221%	0.12	75%	0.67	231%	0.65	107%	0.57	48%	4.37	196%	2.16	176%	0.11	15%	0.25	38%	0.00	0%
Dubois	0.95	113%	1.70	333%	0.74	211%	0.22	79%	0.52	121%	0.56	117%	1.26	109%	3.20	162%	2.88	238%	0.65	66%	0.74	86%	0.10	8%
Lander in ASOS	1.07	78%	0.45	59%	1.23	205%	0.68	162%	0.94	147%	1.09	87%	1.49	76%	4.07	156%	1.66	144%	0.67	106%	0.21	36%	0.05	5%
Riverton	0.53	58%	0.44	129%	0.66	254%	0.44	152%	0.70	184%	0.79	134%	0.48	44%	3.63	194%	0.65	59%	0.41	60%	019	40%	0.03	4%
Boysen	1.09	124%	0.12	49%	0.43	139%	0.00	0%	0.21	78%	0.18	29%	0.25	22%	4.46	223%	1.20	111%	1.42	184%	0.07	15%	0.04	4%
Totals	**4.29**	**77%**	**3.76**	**146%**	**4.02**	**205%**	**1.54**	**102%**	**3.32**	**144%**	**3.29**	**82%**	**4.23**	**55%**	**23.78**	**188%**	**11.30**	**163%**	**4.02**	**88%**	**2.06**	**57%**	**0.22**	**4%**
Site Avg	**0.72**	**77%**	**0.63**	**146%**	**0.67**	**205%**	**0.26**	**102%**	**0.55**	**144%**	**0.55**	**82%**	**0.71**	**55%**	**3.96**	**188%**	**1.88**	**163%**	**0.67**	**88%**	**0.34**	**57%**	**0.04**	**4%**
Cumulative	**0.72**	**77%**	**1.35**	**99%**	**2.02**	**120%**	**2.02**	**118%**	**2.83**	**122%**	**7.09**	**113%**	**4.09**	**96%**	**8.05**	**126%**	**9.93**	**132%**	**10.60**	**128%**	**10.94**	**123%**	**10.98**	**111%**

- Percent of average is based on 30 year averages (1988-2017)

Table 22. Buffalo Bill Watershed Precipitation.

Location	Oct	% AVG	Nov	% AVG	Dec	% AVG	Jan	% AVG	Feb	% AVG	Mar	% AVG	Apr	% AVG	May	% AVG	Jun	% AVG	Jul	% AVG	Aug	% AVG	Sep	% AVG
Buffalo Bill	0.62	63%	1.40	359%	0.06	17%	0.18	55%	0.84	227%	0.25	45%	3.00	226%	4.66	206%	2.06	120%	0.81	109%	1.13	153%	0.27	28%
Lake Yellowstone	0.26	16%	4.32	262%	1.88	102%	1.86	95%	2.62	157%	1.92	97%	3.15	156%	3.43	148%	4.69	195%	0.71	50%	1.39	91%	0.21	14%
Tower Falls	0.45	34%	3.44	273%	1.01	78%	1.17	103%	1.51	201%	1.47	144%	2.20	158%	2.28	119%	3.10	162%	0.12	9%	1.54	114%	0.32	25%
Totals	**1.33**	**34%**	**9.16**	**278%**	**2.95**	**84%**	**3.21**	**94%**	**4.97**	**178%**	**3.64**	**103%**	**8.35**	**176%**	**10.37**	**160%**	**9.85**	**163%**	**1.64**	**46%**	**4.06**	**112%**	**0.80**	**21%**
Site Average	**0.44**	**34%**	**3.05**	**278%**	**0.98**	**84%**	**1.07**	**94%**	**1.66**	**178%**	**1.21**	**103%**	**2.78**	**176%**	**3.46**	**160%**	**3.28**	**163%**	**0.55**	**46%**	**1.35**	**112%**	**0.27**	**21%**
Cumulative	**0.44**	**34%**	**3.49**	**145%**	**4.47**	**125%**	**5.54**	**118%**	**7.20**	**128%**	**8.41**	**123%**	**11.19**	**133%**	**14.65**	**139%**	**17.93**	**143%**	**18.48**	**134%**	**19.83**	**133%**	**20.10**	**124%**

- Percent of average is based on 30 year averages (1988-2017)

Table 23. Bull Lake Watershed Precipitation.

Location	Oct	% AVG	Nov	% AVG	Dec	% AVG	Jan	% AVG	Feb	% AVG	Mar	% AVG	Apr	% AVG	May	% AVG	Jun	% AVG	Jul	% AVG	Aug	% AVG	Sep	% AVG
Burris	0.14	20%	0.65	192%	0.43	210%	0.08	53%	0.28	97%	0.02	5%	0.18	16%	4.05	207%	1.17	235%	0.76	100%	0.60	105%	0.27	27%
DiversionDam	0.51	58%	0.40	116%	0.53	220%	0.12	75%	0.67	231%	0.65	107%	0.57	48%	4.37	196%	1.23	176%	0.11	15%	0.25	38%	0.21	22%
Dubois	0.95	113%	1.70	314%	0.74	210%	0.22	79%	0.52	121%	0.56	117%	1.26	109%	3.20	162%	1.21	238%	0.65	66%	0.74	86%	0.32	25%
Total	**1.60**	**224%**	**2.75**	**224%**	**1.70**	**213%**	**0.42**	**71%**	**1.47**	**146%**	**1.23**	**80%**	**2.01**	**58%**	**11.62**	**189%**	**3.61**	**216%**	**1.52**	**61%**	**1.59**	**76%**	**0.80**	**25%**
Site Average	**0.53**	**224%**	**0.92**	**224%**	**0.57**	**213%**	**0.14**	**71%**	**0.49**	**146%**	**0.41**	**80%**	**0.67**	**58%**	**3.87**	**189%**	**1.20**	**216%**	**0.51**	**61%**	**0.53**	**76%**	**0.27**	**25%**
Cumulative	**0.53**	**119%**	**1.45**	**119%**	**2.02**	**136%**	**2.16**	**128%**	**2.65**	**131%**	**3.06**	**120%**	**3.73**	**101%**	**7.60**	**132%**	**6.94**	**147%**	**10.71**	**138%**	**11.24**	**133%**	**11.51**	**121%**

- Percent of average is based on 30 year averages (1988-2017)

Table 24. Flood Damage Prevented in the Wind/Bighorn and Shoshone River Systems.

Flood Damage Prevented in the Wind/Bighorn and Shoshone River Systems[1]					
Reservoir	**Local**	**Main Stem**	**2018 Total**	**Previous Accumulation [3]**	**1950 - 2018 Accumulation Total**
Bull Lake[2]	$195,700	$0	$195,700	$11,711,500	$11,907,200
Boysen	$1,401,100	$12,988,400	$14,389,100	$334,977,600	$349,366,700
Buffalo Bill[2]	$1,786,800	$0	$1,786,800	$60,982,800	$62,769,600

1/ This data is received from the Army Corps of Engineers Omaha District Office and is revised every October. The period of assessment is 1950 - 2018.
2/ No space is allocated to flood control, but some flood protection is provided by operation for other purposes.
3/ Adjusted in 2006 by 0.1 to 0.5 to account for previous rounding of cumulative total to nearest 1.0.

Unit Operational Summaries for Water Year 2018

Riverton Unit

The Riverton Project was reauthorized as the Riverton Unit Pick-Sloan Missouri Basin Program (P-S MBP) on September 25, 1970. Major facilities of this unit are Bull Lake Reservoir, Wind River Diversion Dam, Wyoming Canal, Pilot Butte Powerplant, Pilot Butte Reservoir, and Pilot Butte Canal. The major facilities provide water for irrigation of about 73,000 acres on the Midvale Irrigation District (Midvale). The water supply comes partly from the natural flow of the Wind River and partly from water stored in Bull Lake and Pilot Butte Reservoirs.

Bull Lake Reservoir

Bull Lake Reservoir is located on Bull Lake Creek, a tributary of the Wind River near Crowheart, Wyoming. Bull Lake has an active capacity of 151,737 Acre Feet (AF), and is above all unit land. It is the principal storage facility for the unit and is operated by Midvale under contract with Reclamation. A small amount of flood control benefit is provided by normal operation for other purposes. However, during the ongoing Bull Lake spillway construction, the spillway is not operational and peak releases are limited to that of the outlet works, approximately 2,400 cfs. The status of the spillway requires adaptation of normal flood control operations as it is necessary to increase outflow as the inflows increase.

Bull Lake Reservoir carried 120,528 AF of storage into Water Year 2018, 79 percent of the reservoir's active storage capacity. The reservoir operations during the dam's spillway construction requires Reclamation to have Bull Lake Reservoir at or below elevation 5,783.00 feet (approximately 89,000 AF) on or before September 30, 2018 and maintain that elevation until April 1, 2019.

October inflows into Bull Lake amounted to 8,267 AF, 136 percent of the average. Releases during the same time span averaged 351 cfs for a total release of 24,548 AF. End of month storage in Bull Lake decreased to 104,247 AF, 140 percent of average. November and December inflows were 202 and 164 percent of average, respectively. The November inflow volume was the third highest for the reservoir. The Bull Lake Winter Release Agreement accounting was initiated December 7, 2017 and sustained through April 14, 2018. The end of December storage in Bull Lake totaled 104,576 AF, 138 percent of average.

On January 1, snow-water equivalent, as represented by the SNOTEL sites within the basin above Bull Lake, was reported at 120 percent of average. Water supply forecasts for the April-July snowmelt runoff are prepared by the Wyoming Area Office beginning in January and continue through June. The January 1, 2018 forecast projected an April-July snowmelt runoff of approximately 180,000 AF, which was 128 percent of average April-July volume (140,400 AF). Total inflow during January amounted to 2,858 AF, which was 136 percent of average. The liquid precipitation in the basin amounted to 71 percent of average.

The above average snow but below normal liquid precipitation in January resulted in a decreased February 1 April-July runoff forecast of approximately 170,000 AF. Inflow during February continued at much above average trend and amounted to 138 percent of average. The end of month content for the reservoir was 104,330 AF (137 percent of average). February precipitation was again well above average at 146 percent of average. The mountains above Bull Lake had accumulated a snow-water equivalent of approximately 134 percent of average.

The much above average liquid precipitation and snowpack remained the same as the previous month so demands used in the runoff forecast remained the same, and on March 1, Reclamation projected an April-July runoff volume of 170,000 AF (121 percent of average). The below average precipitation and above average snow pack trends for inflow and moisture continued into March. Monthly total inflow was 2,700 AF, 135 percent of average but reservoir levels required a greater release of 42 cfs to be maintained above the winter release agreement of 25 cfs throughout the month. The high inflow volume and sustained releases positively affected the reservoir and its end of month content was 104,467 AF. Below average moisture continued in March with liquid precipitation at 80 percent of average and the basin snow-water equivalent at 124 percent of average.

On April 1, Reclamation issued an April-July runoff volume forecast of 170,000 AF. The snowpack reported on April 1 was 124 percent of average. Midvale began diverting water into the Wyoming Canal on April 6 to flush the canal system and finish filling Pilot Butte and other storage locations within the district. Bull Lake's inflow total was 138 percent of average. Liquid precipitation was reported at below average, but the snowpack again experienced above average accumulations. Releases were increased from the winter agreement flows beginning on April 21. On April 30, Bull Lake held 102,383 AF of water.

The Bull Lake Reservoir snow-water equivalent on May 1 was 118 percent of average and the reservoir operations team in the WYAO determined that the runoff forecast would be reduced to 160,000 AF. Inflows during the month May surged to above 1,000 cfs by May 22 and remained there until the end of June. The inflows remained above average for the rest of the month. Around mid-month a storm helped melt off the remaining snowpack and inflows increased to a total of 48,429 AF, setting a new record for the basin. Midvale Irrigation District increased the reservoir release during the peak inflow for May, then subsequently decreased to within a range between 100-600 cfs for the month of June to fill the reservoir. The end of month storage content equaled 100,265 AF, which maintained the reservoir near 100,000 AF by the end of May.

By June 1, the snowpack had dropped to 52 percent of average, and the June 1 forecast remained the same at 160,000 AF, 114 percent of average. Inflows remained above 1,000 cfs through June 13 and reached a peak of 2,871 cfs on June 18. Releases from the dam were increased June 18 to slow the rate of fill and peaked at 1,200 cfs. Midvale Irrigation District closely monitored the rate of fill, to ensure that water levels remained below the elevation of the spillway, which was not operable at the time. Bull Lake's storage content at the end of the month was 139,440 AF with a pool elevation of 5,800.81 feet. In total, the June inflow amounted to 77,918 AF, 125 percent of average.

During July, Bull Lake inflows were near average at 95 percent. The peak inflow for the month occurred on July 10 with a computed flow rate of 990 cfs. Releases began the month below 500 cfs to fill the reservoir to capacity of 151,737 and were adjusted to manage the reservoir's elevation. The peak storage content for water year (WY) 2018 of 149,313 AF was measured on July 19 and 20. July inflows amounted to 42,741 AF, 95 percent of average. The April-July inflow volume was 174,735 AF.

Diversions into the Wyoming Canal began on April 6 and continued through September 29. The peak diversion of 1,547 cfs occurred on July 13. Bull Lake's August end of month storage content was approximately 128,265 AF, at elevation 5,797.10 feet, 126 percent of average.

Total inflow to Bull Lake for the water year was 225,091 AF, 120 percent of average, and a new

record for the reservoir. The discharge volume of the Wind River above Bull Lake Creek during for Water Year 2018 was estimated to be 163 percent of average, totaling 1,008,603 AF. The total diversion into the Wyoming Canal for the irrigation period WY 2018 was 367,600 AF, which was approximately 13,162 AF more than Water Year 2017.

Additional hydrologic and statistical information pertaining to Bull Lake operations during 2018 can be found in Table 25 and Figure 28.

Pilot Butte Reservoir

Pilot Butte Reservoir is an off-stream reservoir near Kinnear, Wyoming, and receives its water supply from the Wind River via the Wyoming Canal. Pilot Butte Reservoir has a total capacity of 33,721 AF. Of this amount 3,803 AF is inactive and 29,918 AF is active conservation storage. Pilot Butte Dam and the Wyoming Canal, which supplies the reservoir, are operated by Midvale under contract with Reclamation. The turbines at the inlet of the Wyoming canal are currently in mothballed status.

Pilot Butte Reservoir began WY 2018 with a total storage content of approximately 17,956 AF, a pool elevation of 5,440.05 feet above sea level. Irrigation deliveries for the Wyoming Canal and Pilot Canal ended the WY 2018 irrigation season on September 29. During October of water year 2018, the annual Bull Lake exchange agreement took place. The agreement allows Midvale to divert and store an additional 10,000 AF of water from Bull Lake to Pilot Butte Reservoir via the Wyoming Canal. The agreement simultaneously transfers an equal amount of Boysen storage into Bull Lake Reservoir. The purpose of the agreement is to maintain a flow of no less than 20 cfs in Bull Lake Creek during the winter months. Bull Lake Creek is a prized fishery and the agreement insures its production. With the 10,000 AF of exchange water, and additional storage operations, Pilot Butte Reservoir ended the month of October with a storage content of 29,751 AF, 109 percent of average.

Releases to Pilot Canal from the reservoir began on April 23, at which time Pilot Butte had a storage content of 29,199 AF. Storage in Pilot Butte peaked on June 26, with a content of 29,546 AF and elevation 5,455.23 feet. The peak release to the canal during the irrigation season occurred on July 16, for a flow rate of 793 cfs. Irrigation releases continued through the end of WY2018 and totaled 175,025 AF of releases to the canal for irrigation use. The reservoir ended the water year by being lowered to a content of 16,537 AF, which leaves enough room for the Bull Lake Exchange to occur.

Additional hydrologic and statistical information pertaining to Pilot Butte Reservoir during 2018 can be found in Table 26 and Figure 29.

Table 25. Hydrologic Data for Bull Lake Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5,739.00	722	722
TOP OF ACTIVE CONSERVATION	5,805.00	152,459	151,737

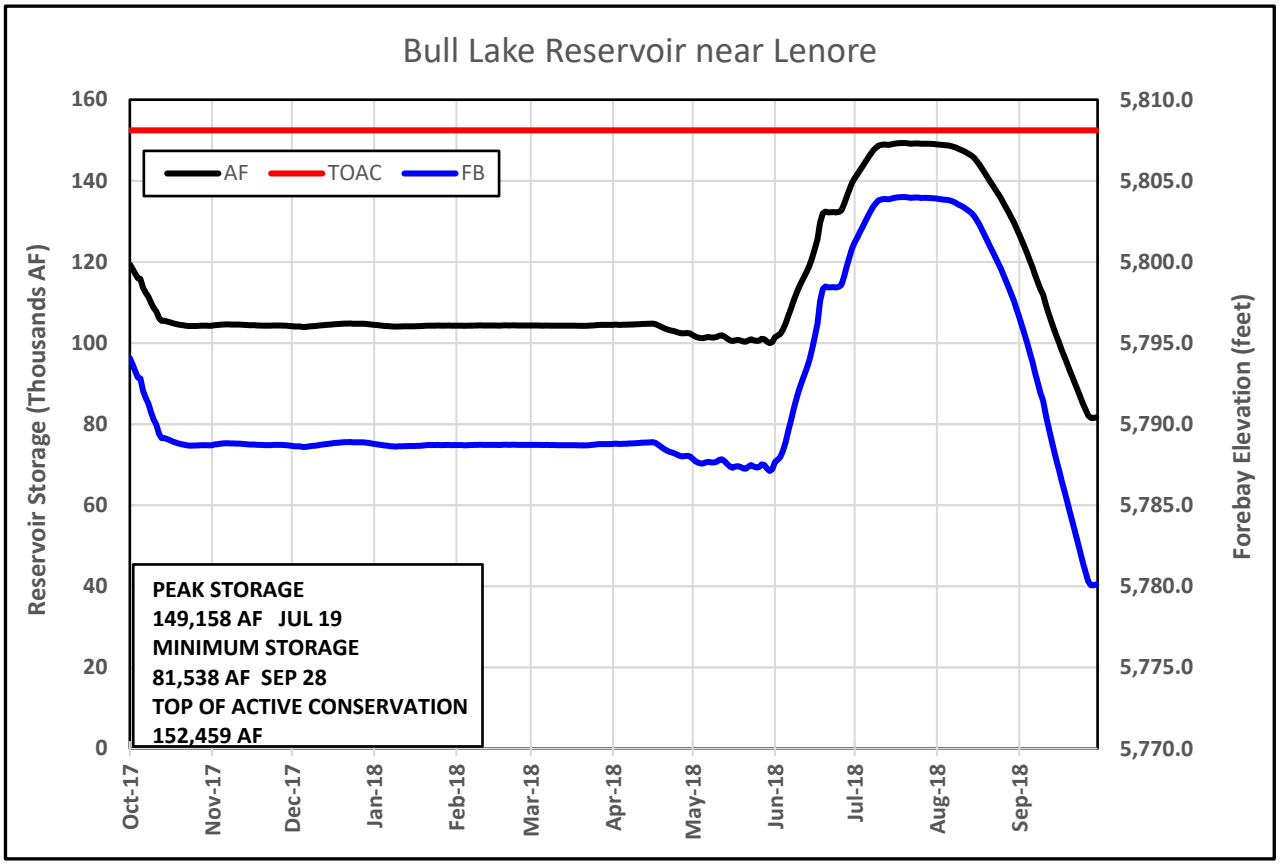
STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5,794.46	120,528	SEP 30, 2017
END OF YEAR	5,780.12	81,665	SEP 30, 2018
ANNUAL LOW	5,787.12	99,966	MAY 30, 2018
HISTORIC LOW*	5,743.03	6,228	SEP 2, 1950
ANNUAL HIGH	5,804.00	149,313	JUL 19, 2018
HISTORIC HIGH	5,805.70	154,677	AUG 10, 1965

* Prior to 1952 daily records are not available. End of month data was used to determine the historic low.

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	225,091	OCT 17-SEP 18	263,965	OCT 17-SEP 18
DAILY PEAK (cfs)	2,871	JUN 18, 2018	1,397	MAY 28, 2018
DAILY MINIMUM (cfs)	0	OCT 6, 2018	35	SEP 30, 2018
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

MONTH	INFLOW		OUTFLOW		CONTENT	
	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	8.3	136	24.5	378	104.2	140
NOVEMBER	6.5	202	6.5	282	104.2	138
DECEMBER	4.1	171	3.8	198	104.6	138
JANUARY	2.9	136	3.1	165	104.3	137
FEBRUARY	2.3	138	2.3	136	104.5	137
MARCH	2.7	135	2.6	142	102.4	137
APRIL	5.6	138	7.7	227	102.3	133
MAY	48.4	169	50.5	364	139.4	109
JUNE	77.9	125	38.7	146	149.3	109
JULY	42.7	95	33.1	77	149.0	115
AUGUST	18.4	95	39.2	82	128.3	126
SEPTEMBER	5.2	53	51.8	145	81.7	108
Water Year Summary	225.1	120%	264.0	142%		

* Average for the 1988-2017 period



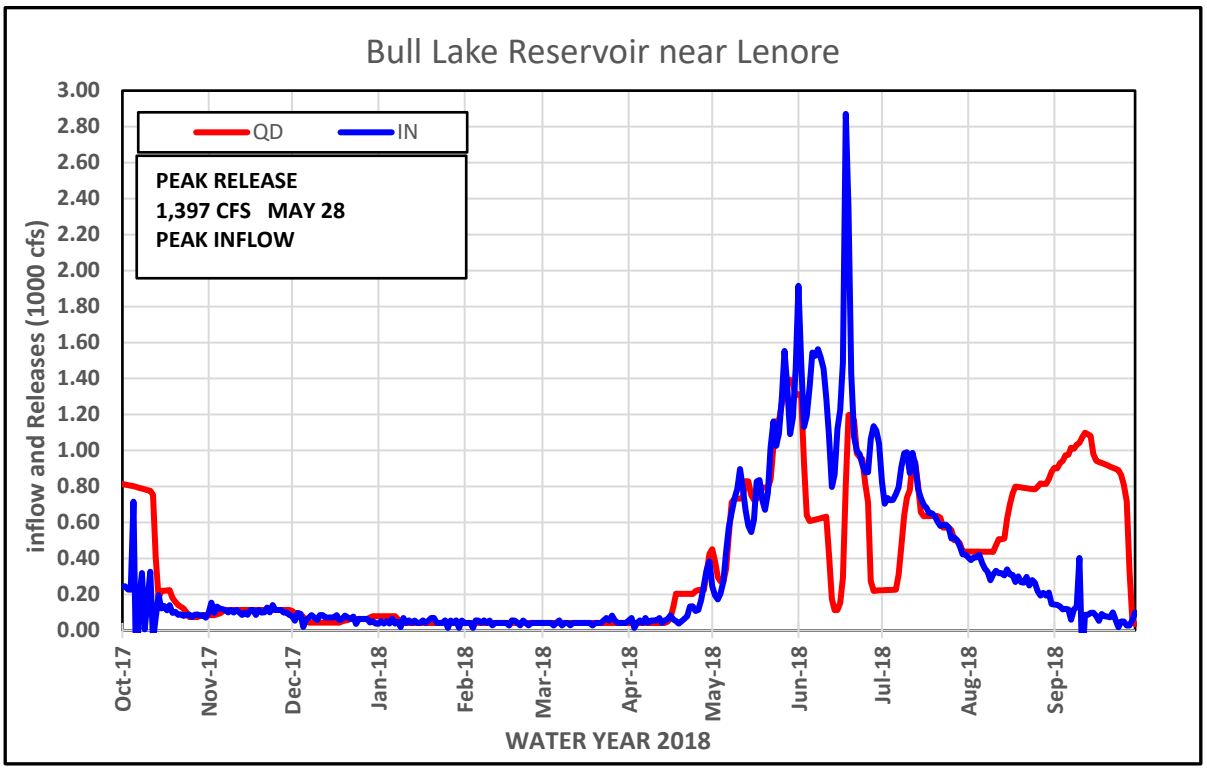


Figure 28. Hydrologic Data for Bull Lake Reservoir.

Table 26. Hydrologic Data for Pilot Butte Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5,410.00	3,803	3,803
TOP OF ACTIVE CONSERVATION	5,460.00	33,721	29,918

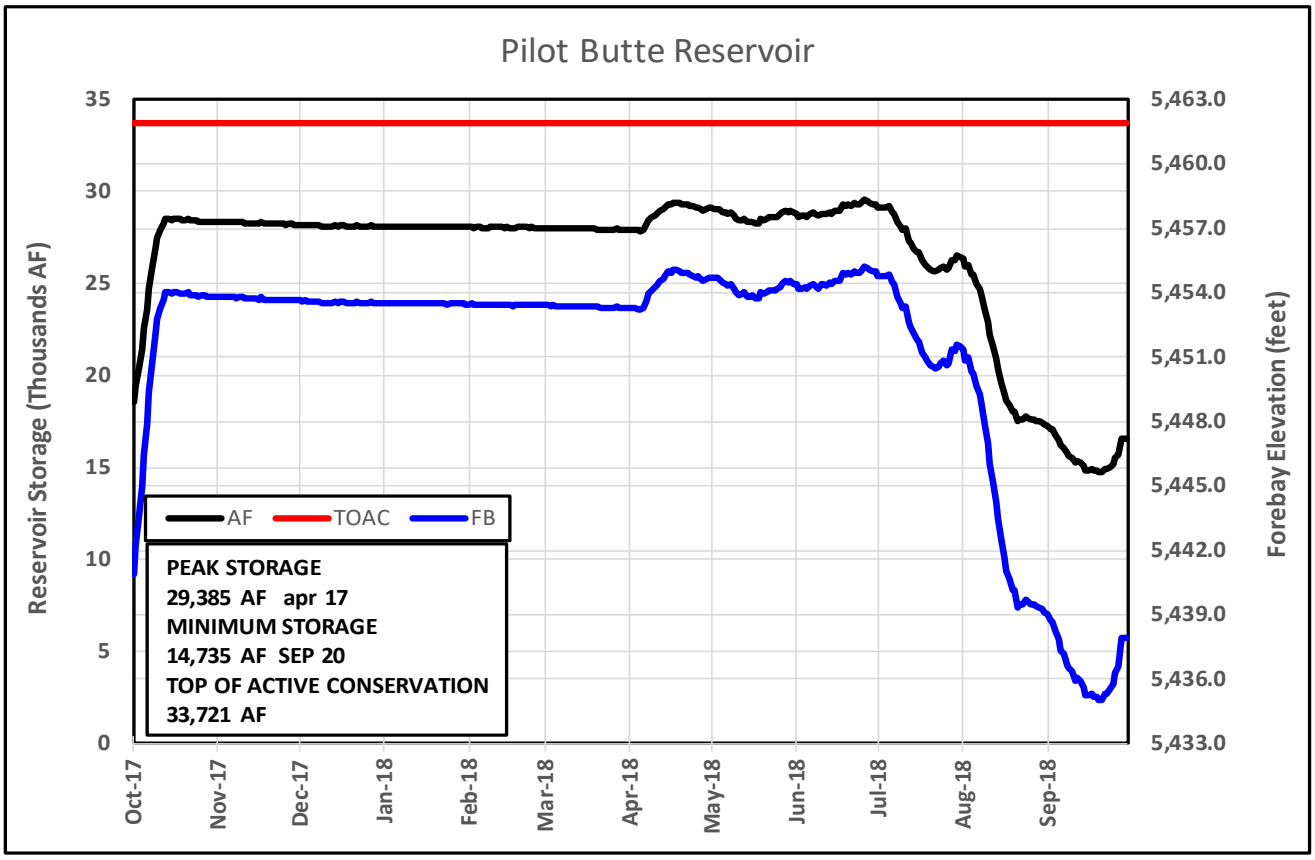
STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5,440.05	17,956	SEP 30, 2017
END OF YEAR	5,440.05	16,537	SEP 30, 2018
ANNUAL LOW	5,439.10	17,322	AUG 31, 2018
HISTORIC LOW	5,409.80	3,748	DEC 01, 2007
ANNUAL HIGH	5,454.15	29,564	JUN 26, 2018
HISTORIC HIGH	5,460.60	37,465	APR 20, 1988

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	156,494	OCT 17-SEP 18	156,914	OCT 17-SEP 18
DAILY PEAK (cfs)	949	JUL 28, 2018	793	JUL 16, 2018
DAILY MINIMUM (cfs)	0	WINTER MONTHS	0	WINTER MONTHS
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

MONTH	INFLOW		OUTFLOW		CONTENT	
	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	15.9	119	5.5	230	28.4	105
NOVEMBER	0.0	0	0.0	0	28.2	100
DECEMBER	0.0	0	0.0	0	28.1	100
JANUARY	0.0	0	0.0	0	28.1	99
FEBRUARY	0.0	0	0.0	0	28.0	98
MARCH	0.0	0	0.0	0	27.9	96
APRIL	4.9	79	3.7	65	29.1	98
MAY	22.4	102	22.7	86	28.8	110
JUNE	30.6	86	30.1	95	29.3	97
JULY	39.5	104	42.4	97	26.5	110
AUGUST	28.6	90	37.7	104	17.3	87
SEPTEMBER	14.0	62	14.8	58	16.5	98
Water Year Summary	155.5	90%	156.9	91%		

* Negative values are the result of calculated inflow based on reservoir release and change in reservoir content.

** Average for the 1988-2017 period



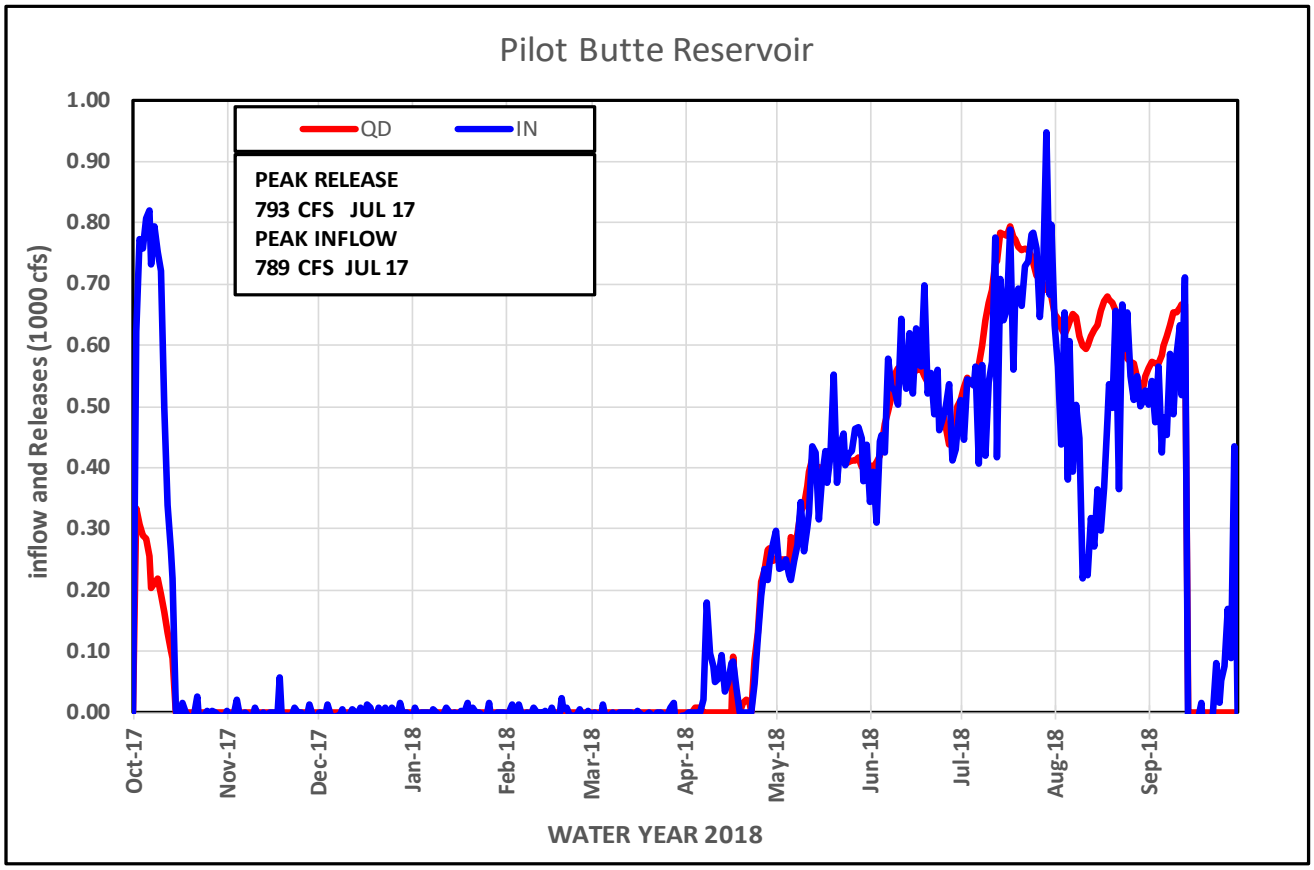


Figure 29. Hydrologic Data for Pilot Butte Reservoir.

Boysen Reservoir and Powerplant

Boysen Reservoir (P-S MBP) is located on the Wind River above Thermopolis, Wyoming. The dam and reservoir were built for flood control, power generation, irrigation, recreation, and fish and wildlife enhancement. Boysen Reservoir has a total capacity of 892,226 AF. Of this amount, 219,181 AF are allocated for inactive and dead storage, 522,413 AF is allocated for active conservation storage, and 150,632 AF is allocated for exclusive flood control storage. Of the amount allocated for active conservation, 144,229 AF are specifically allocated for joint-use flood control storage. All of the joint-use space is located between elevation 4,717.00 feet and elevation 4,725.00 feet, the top of the spillway gates when closed. The exclusive flood control space is located between elevation 4,725.00 feet and elevation 4,732.20 feet. When the reservoir rises above elevation 4,724.50 feet, the spillway gates are operated to maintain six (6) inches of clearance above the reservoir level for the prevention of over-topping of the spillway gates. When all flood control space is filled, releases cannot be controlled to less than 14,000 cfs due to the required gate clearance.

Irrigation water is provided from the reservoir for several units, both upstream and downstream of Boysen Dam. Water is furnished downstream to about 7,500 acres in the Hanover-Bluff Unit (P-S MBP) and 3,400 acres on the Lucerne Canal in the Owl Creek Unit (P-S MBP). Supplemental water is furnished to other irrigation districts and to a number of individual water users below the dam. The Bighorn Canal Irrigation District and Hanover Irrigation District receive water under long-term contracts with Reclamation. Depending on availability, water is provided to Bluff Irrigation District, Kirby Ditch Irrigation District, Lower Hanover Canal Association, Bighorn Canal Irrigation District, and Hanover Irrigation District under temporary water service contracts.

2018 Summary

Boysen WY 2017 reservoir storage carried forward into WY 2018 amounted to 717,007 AF, 125 percent of the thirty-year average. The corresponding reservoir elevation of 4,723.73 feet is within the joint-use pool, and 1.27 feet below the exclusive flood pool elevation. On September 17, 2017 flow releases below Boysen Dam were decreased to facilitate removal of an island in the Bighorn River near the town of Worland. The island had been the cause of damaging ice jams in the past. During the last two weeks in September and all of October, November, and most of December Boysen inflows remained above 1,000 cfs. In October releases were set at 1,000 cfs, however, the well above normal inflows required that the releases from Boysen be increased to 2,000 cfs on October 5 and later increased again to 2,500 cfs by October 15 to start drafting the reservoir back down to a manageable level. By early December inflows had decreased sufficiently to allow releases to be reduced to a winter release of 1,200 cfs. October inflows were 212 percent of average, and reservoir storage increased by 10,568 AF during the first week of October. After increasing the Boysen release the reservoir dropped to an end of month content 696,773 AF, 121 percent of average.

Inflows continued to be high through November and December, amounting to 182 percent and 171 percent of average respectively. November end of month storage content was 679,357 AF, which was 114 percent of average. The rate of storage increased in the reservoir resulted in increasing fall flow rates to the winter flow rate. December end of month storage was 644,653 AF, 118 percent of average.

Beginning January 1 of each year, the Bureau of Reclamation and other agencies prepare monthly inflow forecasts for the upcoming season. On January 1, 2018 the snowpack within the Boysen watershed, as calculated from a composite of SNOTEL sites within the basin, had accumulated to 159 percent of the median. After additional analysis of the snowpack and review of the output from the forecasting models, the WYAO issued a forecast for an April-July runoff volume of 900,000 AF, which would be 156 percent of average.

During the month of January, Boysen inflow was 151 percent of average. Operators in the control center maintained the winter flow rate of 1,200 cfs below the dam. January end of month content was 638,172 AF, 115 percent of average.

On February 1, 2018, the WYAO prepared a runoff forecast, which is derived from modeling programs and statistical analysis of the period of record. On February 1, the snowpack above Boysen Reservoir amounted to 139 percent of median, which was a slight decrease from the previous month. After analysis of the data, the office released a forecast for an April-July runoff volume of 900,000 AF, 156 percent of the thirty-year average.

During February, several late storms precipitated wet and heavy snow throughout the watershed. Low-level snowmelt caused inflows during February to be above normal, at 126 percent of average. The winter release rates were maintained through the end of the month and the end of month reservoir content was 615,916 AF, 111 percent of average.

The WYAO issued an updated runoff forecast on March 1, 2018. The watershed snowpack had significantly increased to 147 percent of median. Consequently, the April-July forecast increased to 950,000 AF, 164 percent of the average.

During March, above average temperatures and spring storms continued to drive the well above average trend for inflows and water supply. During March, the computed reservoir inflow

amounted to 141 percent of average. Releases from the reservoir were gradually increased beginning March 13 to a flow rate of approximately 2,500 cfs below the dam. This flow rate was held through April 4 and reservoir releases were increased and set at 3,000 cfs for remained of April. Reservoir discharge during March was 220 percent of average. The end of month reservoir content was 571,409 AF, 103 percent of average and nearly 44,500 AF lower than the February end of month content. A flushing flow for March was not request by the Wyoming Game and Fish Department this year due to the high releases from the previous year.

On April 1, 2018, the snow water equivalent showed a slight decrease in magnitude from the previous month. The computed snow water equivalent was 137 percent of the median. Considering this information, WYAO determined the previous month's forecast of 950,000 AF, 164 percent of average, would be carried forward.

During April inflows decreased to near or below 1,000 cfs for most of the month. Inflows picked up towards the end of the month totaling 62,181 AF, 127 percent of average. Releases from Boysen remained at 3,000 cfs for the rest of the month. Total releases during this month amounted to 265 percent of average. The reservoir's end of month content was 458,934 AF, 86 percent of average and 112,475 AF lower than the previous end of month content. The corresponding end of month pool elevation was 4,707.49 feet above sea level, 9.51 feet below the joint-use pool.

Powerful storms passed through the region in May and June which brought well above average precipitation and resulted in 188 and 163 percent of average precipitation respectively.

During May, the trend of well above average inflows continued as the low elevation snow melted quickly in response to the above average temperatures and rain-on-snow events during the month. Inflows for the month totaled 366,775 AF, 285 percent of average. Releases at the beginning of the month were approximately 3,000 cfs. On May 23 the United States Army Corp of Engineers (USACE) requested a reduction in the Boysen Reservoir release of 500 cfs to help alleviate downstream flooding on the Yellowstone River. By the end of May runoff into Boysen Reservoir had substantially increased to over 10,000 cfs daily.

Wet and warm climate trends continued into June 2018, and the magnitude of the hydrologic conditions remained severe. On June 20 Boysen Reservoir inflows peaked at 12,979 cfs. During June, the flow rates and volumes recorded on the major tributaries above the reservoir were well above average at 162 percent. The rain-on-snow in late May melted most of the snow, however, precipitation in the basin kept Boysen Reservoir inflows high with an inflow volume of 435,613 AF. During June, a second inflow spike occurred beginning June 18 and reached a peak of almost 13,000 cfs on June 20 before slowly declining to approximately 5,000 cfs by the end of June.

The reservoir began the month of June at a pool elevation of 4,722.00 feet, 3 feet below the top of the joint use pool, and with a reservoir release rate of approximately 4,000 cfs. By June 7, the reservoir had gained three feet of pool elevation and nearly 60,000 AF of storage. In coordination with the USACE, the WYAO was allowed to go into the flood pool and remain in the flood pool until river flow conditions downstream of Yellowtail Reservoir declined. Reservoir releases were increased gradually from 4,000 cfs to 7,000 cfs on June 22. Inflows began to decrease by June 22 from nearly 13,000 cfs to 5,000 cfs on June 30, which is near the flow rate at the beginning of the month. On June 7 the reservoir pool elevation was 4,725.10 feet, the top of the joint-use pool, and the reservoir release rate was 4,000 cfs. However, upstream of the reservoir a rain-on-snow event brought a surge of runoff into the streams. Before leaving for the weekend on Friday, June 8, the WYAO reservoir operators, in coordination the USACE, made the decision to increase the flow

rate to 6,000 cfs below the dam. The following Friday, WYAO reservoir operators in coordination with the USACE made the decision to increase the flow rate to 7,000 cfs below the dam in response to increased inflow into Boysen Reservoir. The 7,000 cfs would be the peak release for Water Year 2018, nearly 6,000 cfs lower than the peak inflow. Monthly inflow during June was 435,613 AF, 162 percent of average. The end of month pool elevation was 4,726.63 feet, which corresponds to a storage content of 777,275 AF. The peak release rate of 7,000 cfs was maintained for four days then reduced to 6,000 cfs through the end of the month, which slightly drafted the reservoir from the peak storage and provided storage space in case another significant storm hit upstream of the reservoir.

Warm and drier climate trends in the watershed above Boysen Reservoir were observed during July 2018, and hydrologic conditions were moderate compared to those observed in June. During the month, observed watershed precipitation was 88 percent of average. The warm temperatures and reduced precipitation during July resulted in below average flow rates in the tributaries above Boysen Reservoir.

Reservoir inflows began July with computed flow rates between 3,000-4,000 cfs. The peak inflow rate of 4,340 cfs was observed on July 1. Inflows gradually declined for the remainder of the month as the snowpack continued melting out of the high elevations. By the end of July, the inflows had dropped below 1,000 cfs. The release rate below the dam at the beginning the month was approximately 6,000 cfs. As the month progressed, releases were adjusted to stay slightly above the inflows. At the end of the month, the release rate was down to 1,900 cfs. The pool elevation decreased 2.9 feet through the month, and the reservoir exited the exclusive flood pool on July 19. WYAO reduced the release as the inflow decreased to limit the spill/waste, and to mitigate the flood pool occupation downstream at Yellowtail Reservoir. The July inflow volume for Boysen was 142,426 AF, 97 percent of average. The reservoir end of month pool elevation was 4,723.73 feet, slightly below the end of July reservoir target of 4,724.5 feet.

The observed inflow volume for the April-July period totaled 1,006,995 AF, 161 percent of average. Total inflow to Boysen during water year 2018 was 1,522,444 AF, 151 percent of the thirty-year average. The September 30, 3018 forebay elevation was 4,720.26 feet. The peak inflow for the year of 12,979 cfs occurred on June 20, and the maximum release from the reservoir was 7,000 cfs from June 22 to June 25. During water year 2018, Boysen powerplant had a gross generation of approximately 79,325 MWh of electricity, 131 percent of average. Of the 1,522,444 AF of water released from Boysen during water year 2018, approximately 635,278 AF of that amount was bypass release. During water year 2018, the bypass release comprised 43 percent of the total release. The estimated lost revenue of the bypass is $1,643,590. 953,346 AF of water used for generation resulted in a net generation value of $2,466,380.

Important Events – WY2018

December 5, 2017: Winter flow rate was set at 1,250 cfs.
March 13, 2018: Winter flow rate increased to 2,000 cfs.
March 20, 2018: Initiated a release above powerplant capacity to evacuate storage for runoff.
June 7, 2018: Boysen Reservoir entered the designated flood control pool.
June 22, 2018: Reservoir releases increased to the annual peak release target of 7,000 cfs.
June 22, 2018: Peak end of day forebay elevation observed at pool elevation 4,727.46 feet.
July 19, 2018: Boysen Reservoir exited the designated flood control pool.

Additional hydrologic and statistical information pertaining to the operation of Boysen Reservoir can be found in Table 27 and Figure 30.

Table 27. Hydrologic Data for Boysen Reservoir Data.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,685.00	219,181	219,181
TOP OF ACTIVE CONSERVATION	4,717.00	597,365	378,184
TOP OF JOINT USE	4,725.00	741,594	144,229
TOP OF EXCLUSIVE FLOOD CONTROL	4,732.20	892,226	150,632

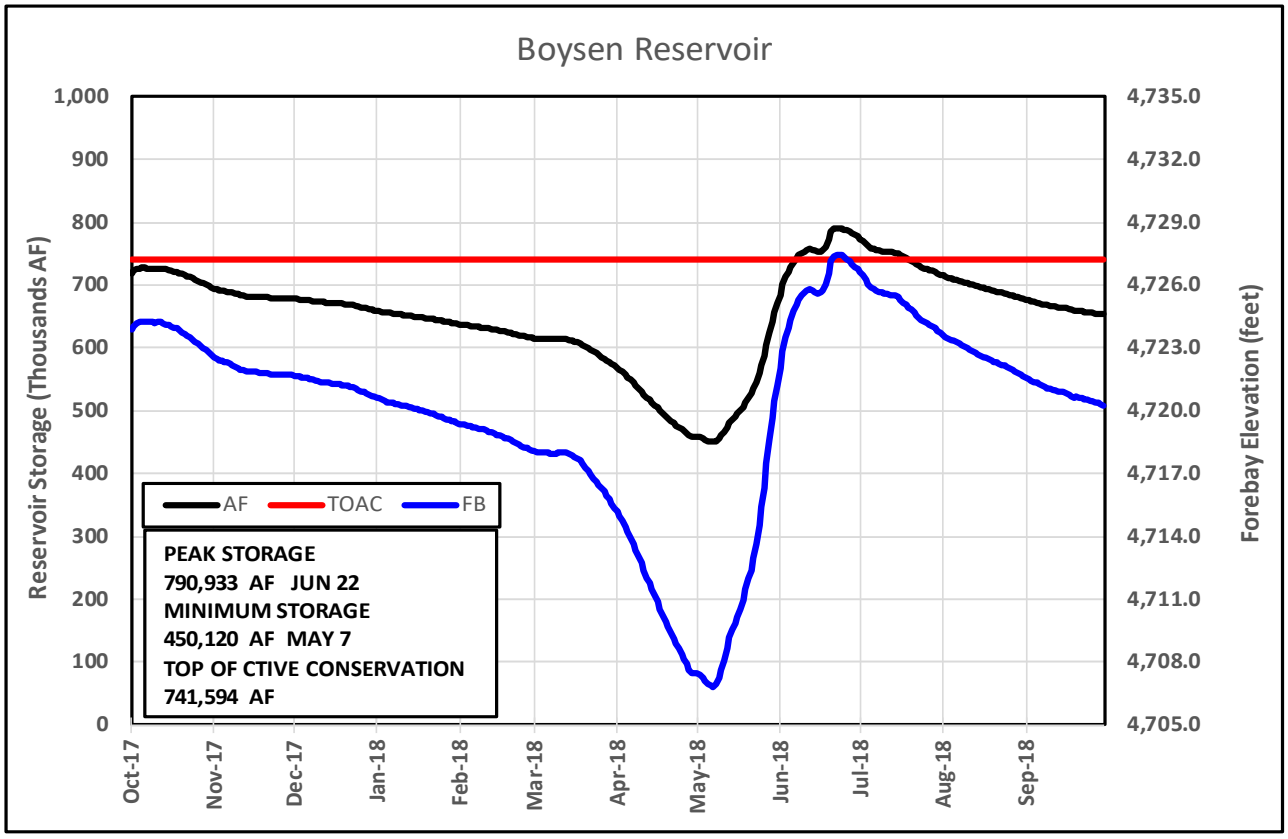
STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	4,723.73	717,007	SEP 30, 2017
END OF YEAR	4,723.73	652,966	SEP 30, 2018
ANNUAL LOW	4,706.81	450,102	MAY 7, 2018
HISTORIC LOW ELEVATION *	4,684.18		MAR 18, 1956
HISTORIC LOW CONTENT *		235,737	SEP 24, 2002
ANNUAL HIGH	4,727.46	790,933	JUNE 22, 2018
HISTORIC HIGH	4,730.83	922,406	JUL 06, 1967

*Because storage space in a reservoir is lost as sediment is trapped behind the dam, reservoirs are resurveyed periodically to determine actual capacity. Based on the 1994 resurvey of Boysen Reservoir, the historic low content of 235,737 AF occurred at an elevation that was 2.69 feet higher than the historic low elevation.

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	1,522,444	OCT 17-SEP 18	1,586,145	OCT 17-SEP 18
DAILY PEAK (cfs)	12,979	JUN 20, 2018	7,046	JUN 23, 2018
DAILY MINIMUM (cfs)	122	SEP 27, 2018	1,009	SEP 13, 2018
PEAK SPILLWAY FLOW (cfs)			5,806	JUN 23, 2018
TOTAL SPILLWAY FLOW (AF)			969,906	OCT 17-SEP 18

* High winds can affect the forebay reading used to calculate inflow.

MONTH	INFLOW		OUTFLOW		CONTENT	
	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	114.5	218	134.7	269	696.8	121
NOVEMBER	86.0	182	103.4	231	679.4	118
DECEMBER	59.3	159	78.3	165	660.3	116
JANUARY	55.0	151	77.1	166	638.2	115
FEBRUARY	47.5	126	69.8	168	615.9	111
MARCH	73.0	141	117.2	220	571.4	103
APRIL	62.2	127	174.7	265	458.9	86
MAY	366.8	285	155.3	136	670.4	122
JUNE	435.6	162	328.7	187	777.3	121
JULY	142.4	109	202.7	139	717.0	114
AUGUST	41.7	84	80.3	92	678.4	115
SEPTEMBER	38.4	82	63.9	100	653.0	114
April - July	1,007	174%				
Water Year Summary	1,522.4	162%	1,586.1	169%		



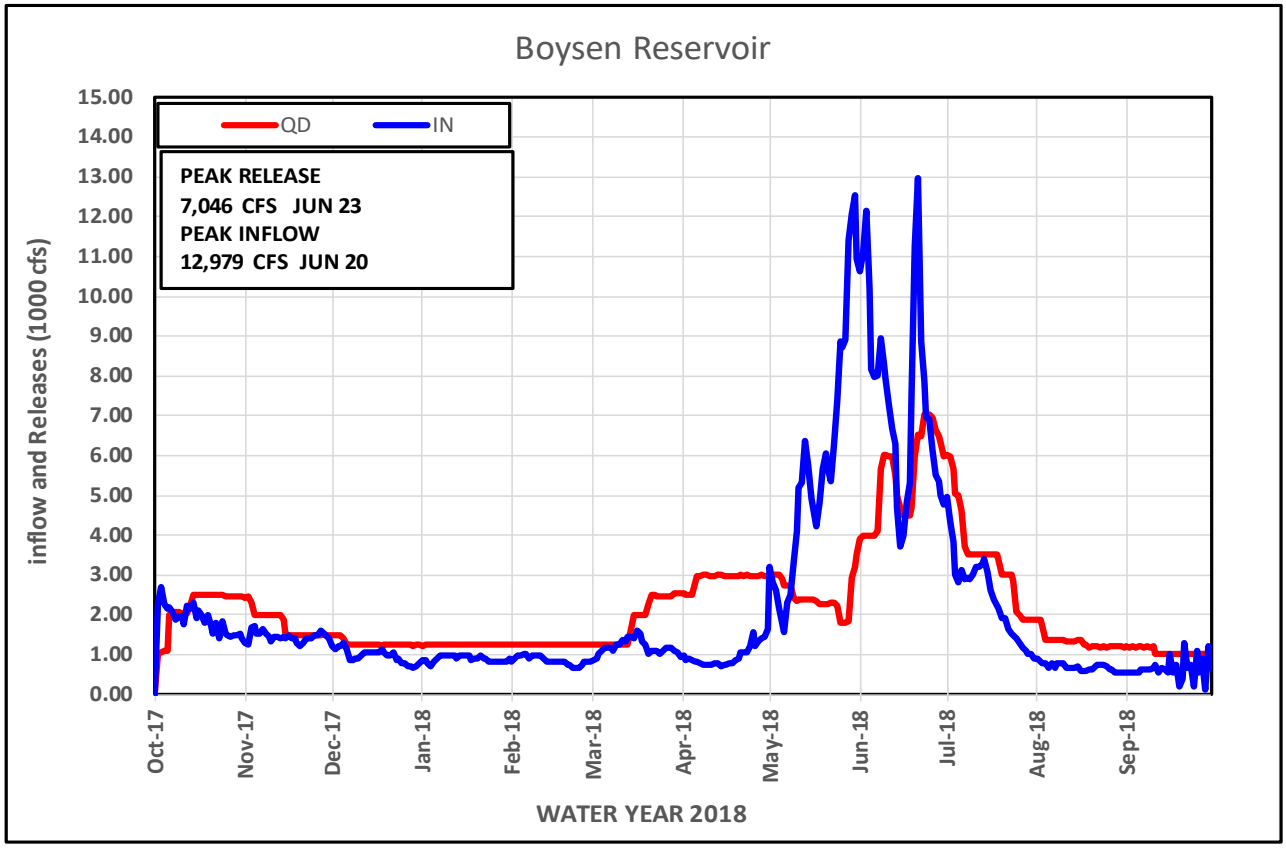


Figure 30. Hydrologic Data for Boysen Reservoir.

Anchor Reservoir

Anchor Reservoir (P-S MBP) is located on the South Fork of Owl Creek, a tributary of the Bighorn River near Thermopolis, Wyoming. It has a total storage capacity of 17,228 AF, of which, 17,160 AF is active storage. The dam provides supplemental irrigation supply for the Owl Creek Unit (P-S MBP). The dam was completed in November 1960. However, several major sinkholes developed in the lower portion of the reservoir after it began to fill, and corrective work to plug the sinkholes has not been successful. Two dikes, in service since 1979, partition off the portions of the reservoir with high seepage losses. The top of the dikes is at elevation 6,415.00 feet. However, when the reservoir rises above elevation 6,412.80 feet, water flows through a notch in one of the dikes into the sinkhole area. The reservoir is operated to not exceed an elevation of 6,412.80 feet. Operation and maintenance of Anchor Dam is performed by Owl Creek Irrigation District under contract with Reclamation. Reclamation requires notification from the irrigation district any time the reservoir level is expected to exceed elevation 6,400.00 feet. Operation above 6,400.00 feet will be directed by WYAO staff to avoid overtopping of the dikes.

The storage content of Anchor Reservoir at the beginning of WY 2018 was 1,174 AF. Releases for storage evacuation and irrigation began on May 17. Storage at the end of April was 1,260 AF. As snowmelt runoff commenced, releases were made from the reservoir as necessary to manage the rate of fill. Storage in the reservoir peaked on June 14 at a storage content of 7,179 AF. From that point forward, the reservoir was operated to manage the reservoir level and deliver water supply to irrigators.

Hydrologic and statistical data pertaining to Anchor Reservoir operations during 2018 can be found in Table 28 and Figure 31. The negative inflows displayed in Figure 31 are the result of the calculated inflow, which is subject to the wind influencing the pool elevation reading in addition to the normal seepage from the reservoir.

Table 28. Hydrologic Data for Anchor Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	6,343.75	68	68
TOP OF ACTIVE CONSERVATION*	6,441.00	17,228	17,160

* District operation has been restricted to elevation 6,400.00 feet or less to prevent damage to the dikes and to minimize the chance of creating new sinkholes. Operations above elevation 6,400.00 feet are directed by Reclamation.

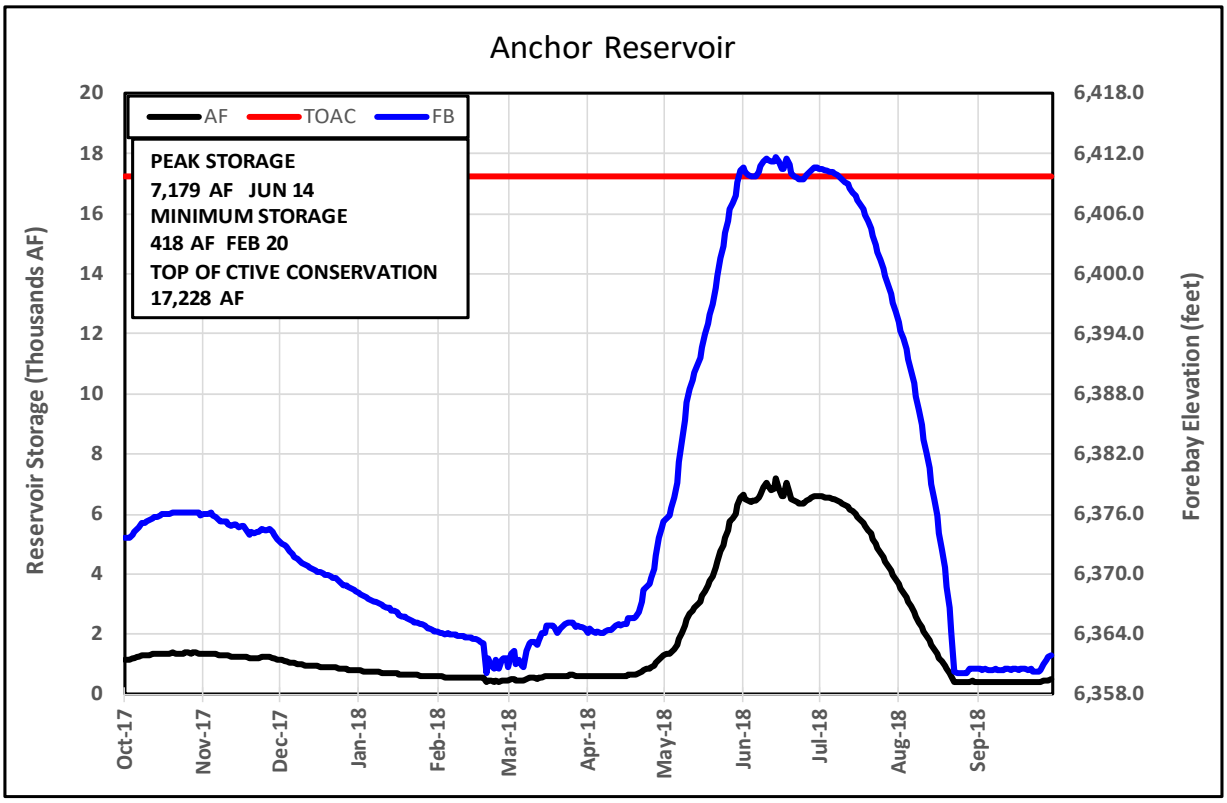
STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	6,373.63	1,174	SEP 30, 2017
END OF YEAR	6,361.98	491	SEP 30, 2018
ANNUAL LOW	6,360.10	418	FEB 20, 2018
HISTORIC LOW			
ANNUAL HIGH	6,411.71	7,179	JUN 14, 2018
HISTORIC HIGH	6,418.52	9,252	JUL 03, 1967

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW*	DATE
ANNUAL TOTAL (AF)	18,510	OCT 17-SEP 18	19,105	OCT 17-SEP 18
DAILY PEAK (cfs)	375	JUN 18, 2018	208	JUN 02, 2018
DAILY MINIMUM (cfs)	0	WINTER MONTHS	0	WINTER MONTHS
PEAK SPILLWAY FLOW (cfs)			0	
TOTAL SPILLWAY FLOW (AF)			0	

* Outflow is water released from the Dam to Owl Creek. When the reservoir level rises above approximately 6,412.80 feet, water flows through a notch in one of the dikes into the sinkhole area. This water is neither measured nor accounted for. Water flowed over the v-notch a total of approximately 13 days during Water Year 2018.

	INFLOW		OUTFLOW*		CONTENT	
MONTH	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	0.693	116	0.512	85	1.355	452
NOVEMBER	0	-	0	-	1.168	389
DECEMBER	0	-	0	-	0.809	270
JANUARY	0	-	0	-	0.593	198
FEBRUARY	0	-	0	-	0.474	158
MARCH	0.134	45	0	-	0.608	152
APRIL	0.736	123	0.082	16	1.260	252
MAY	7.915	203	2.607	100	6.567	364
JUNE	8.391	117	8.335	157	6.624	184
JULY	1.234	59	4.040	119	3.818	166
AUGUST	0	-	3.203	160	0.437	73
SEPTEMBER	0.381	64	0.327	41	0.491	123
ANNUAL	19.484	120	19.105	120		

* Average is for the 1991-2017 period. This period is used because of the availability of data at Anchor Reservoir



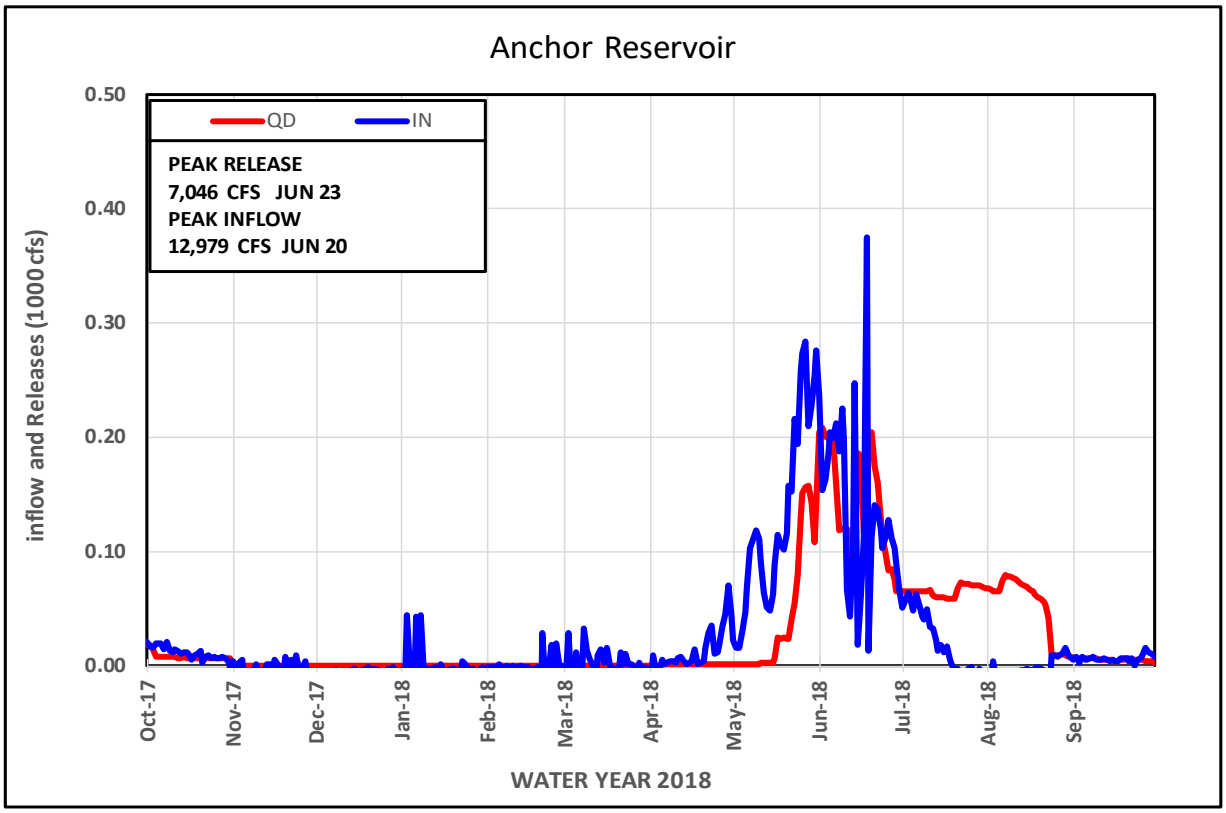


Figure 31. Hydrologic Data for Anchor Reservoir.

Shoshone Project and Buffalo Bill Unit

The primary features of the original Shoshone Project included Buffalo Bill Dam and Reservoir, Shoshone and Heart Mountain Powerplants, and the canal and lateral systems for the Willwood, Frannie, Garland, and Heart Mountain Divisions. In 1982, The Buffalo Bill Dam and Reservoir Modifications, Shoshone Project, Wyoming, was authorized as the Buffalo Bill Unit (P-S MBP). The principal modifications to Buffalo Bill Dam included raising the height of the Dam by 25 feet, reconstructing the Shoshone Powerplant, construction of the Buffalo Bill Powerplant, construction of the Spirit Mountain Energy Dissipation Structure, pressurizing a portion of the Shoshone Canyon Conduit, enlarging and gating the spillway, constructing a visitor's center, and constructing the North Fork, South Fork, and Diamond Creek Dikes. The North and South Fork dust abatement dikes were designed to impound water in areas of the enlarged reservoir that would be dry during periods when the reservoir elevation is low, thereby reducing the dust producing area of the reservoir. The Diamond Creek protective dike prevents the enlarged reservoir from inundating Irma Flats.

Controlled releases are made from Buffalo Bill Reservoir at four points: (1) Shoshone Canyon Conduit, (2) Shoshone Powerplant, (3) the gated spillway, and (4) two river outlets (jet-flow valve and 4X5 high-pressure gates). Water for the Willwood, Frannie, and Garland Divisions of the Shoshone Project is diverted from the Shoshone River below Buffalo Bill Reservoir. The Heart Mountain Division is irrigated by water released at the dam through a high-level outlet to the Shoshone Canyon Conduit and Heart Mountain Canal. Irrigation releases for the project land along the Shoshone River are made through the Shoshone Powerplant, the river outlets, or through the Shoshone Canyon Conduit and Buffalo Bill or Heart Mountain Powerplants. Project works presently serve about 93,000 acres in the four divisions.

Heart Mountain Powerplant

Heart Mountain Powerplant, Shoshone Project, with a nameplate capacity of 6,000 kilowatts (kW) and maximum discharge capacity of 360 cfs, is located at the end of the Shoshone Canyon Conduit, which obtains its water from a high-level outlet, elevation 5,233.00 feet, at Buffalo Bill Dam. The powerplant is located 3.5 miles below the dam and discharges into the Shoshone River. During the summer months, the water released through the powerplant is used to satisfy a portion of the irrigation demand of lands diverting directly from the river.

Shoshone Powerplant

Shoshone Powerplant, reconstructed as part of the Buffalo Bill Unit (P-S MBP), is located on the left bank of the Shoshone River at the toe of Buffalo Bill Dam and releases water directly into the Shoshone River. After 56 years of continuous use, the Shoshone Powerplant became obsolete because of safety problems beyond economical repair. On March 21, 1980, the original plant was taken out of service. In 1992, one of the three generating units was replaced with a new unit having a nameplate capability of 3,000 kW. In accordance with the Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement, a flow of at least 100 cfs is released to the Shoshone River at the base of the dam at all times. This is normally achieved by the use of the Shoshone Powerplant. A maximum release of approximately 200 cfs can be made through the Shoshone Powerplant.

Buffalo Bill Powerplant

Buffalo Bill Powerplant, Buffalo Bill Unit (P-S MBP), with a nameplate capacity of 18,000 kW,

is located about one mile downstream of Buffalo Bill Dam on the right bank of the Shoshone River. Water for generation at this powerplant is supplied through a portion of the Shoshone Canyon Conduit, which was pressurized as part of the Buffalo Bill modification. The maximum discharge capacity of the three units at the Buffalo Bill Powerplant is 930 cfs. The powerplant first generated power on July 15, 1992.

Spirit Mountain Powerplant

Spirit Mountain Powerplant, Buffalo Bill Unit (P-S MBP), with a nameplate capacity of 4,500 kW and discharge capacity of 560 cfs, is an energy dissipater powerplant located about one mile downstream of Buffalo Bill Dam on the right side of the Shoshone River. Water released through the Shoshone Canyon Conduit for Heart Mountain Canal or Heart Mountain Powerplant must be routed through the Spirit Mountain Powerplant or through associated sleeve valves to dissipate energy in the transition from the pressurized portion of the Shoshone Canyon Conduit to the free flow portion of the conduit. The discharge from the powerplant must be carried away from the plant by use of the free-flow conduit and operation of the powerplant depends on the availability of the conduit to carry discharged water.

Buffalo Bill Dam and Reservoir

Buffalo Bill Dam and Reservoir, located on the Shoshone River above Cody, Wyoming, is a multipurpose facility that provides water for domestic, irrigation, municipal, fish and wildlife, power, and recreational use. It also provides a small amount of incidental flood control, although no storage space is specifically reserved for this purpose. The total storage capacity of the reservoir is 646,565 AF at elevation 5,393.50 feet, the top of the active conservation pool.

Buffalo Bill storage carried over into WY 2018 was 528,150 AF, 117 percent of the thirty-year average. Operations to evacuate storage and deliver irrigation supply were maintained through the end of October. October inflows amounted to 203 percent of average, and reservoir storage decreased to approximately 500,860 AF, 116 percent of average.

Inflows continued to be high through November and December, amounting to 214 percent and 220 percent of average. November end of month storage content was approximately 500,227 AF, 116 percent of average. The winter flow rate, as determined by the criteria outlined in the Buffalo Bill Winter Release agreement, was set on October 1, 2018, however, the well above normal inflows required raising the release to 850 cfs to draft the reservoir down to elevation 5,370.00 feet by the end of November to manage ice jams on the South Fork of the Shoshone River. Above-normal inflows into Buffalo Bill Reservoir continued well into mid-December at which time it was determined that that the WYAO would not be able to reduce the reservoir release to the winter flow rate. Based on the then-current reservoir elevation of 5,373.50 the winter release was set at 500 cfs to manage the reservoir elevation. December end of month content was approximately 491,314 AF, 114 percent of average.

Beginning on January 1 of each year, Reclamation and other agencies prepare inflow forecasts for the upcoming runoff season. On January 1, 2018 the snowpack in the Buffalo Bill watershed, as calculated from a composite of SNOTEL sites within the basin, had reached 152 percent of median. After analysis of the snowpack and reviewing the output from the forecasting models, the WYAO issued a forecast for an April-July runoff volume of 950,000 AF, 135 percent of average.

During January, high inflows continued with 172 percent of average coming into the reservoir.

Operators in the control center maintained the winter flow rate of 500 cfs below the dam. January end of month content was approximately 485,337 AF, 113 percent of average.

On February 1, the snowpack above Boysen Reservoir amounted to 135 percent of median, which was a slight decrease from the previous month. After analysis of the data, and model runs, the WYAO forecasted an April-July runoff volume of 1,000,000 AF, 142 percent of the thirty-year average.

During February, several strong storm systems brought wet and heavy snow throughout the watershed. The resulting low-level snowmelt caused inflows during the month of February to be 148 percent of average. The end of month reservoir content was approximately 467,430 AF, 110 percent of average.

On March 1, 2018, the WYAO again prepared a runoff forecast for the basin. The watershed snowpack increased slightly to 148 percent of median. Consequently, the April-July inflow forecast issued by the WYAO remained at 1,000,000 AF, 142 percent of average.

During March, above average temperatures and spring storms continued to drive a well above average trend for inflows. During March, the computed reservoir inflow amounted to 339 percent of average. Releases from the reservoir increased on March 1 to counteract the high inflows. A bypass release was initiated on March 9. Reservoir discharge during March was 461 percent of average. March end of month reservoir content was approximately 457,100 AF, 109 percent of average and just over 26,000 AF lower than the February end of month content.

On April 1, 2017, the snow water equivalent showed a slight decrease in magnitude from the previous month. The computed snow water equivalent was 147 percent of median. The WYAO raised the forecast to 1,050,000 AF, 149 percent of average.

The snow water equivalent set a new record high for the month on April 12 with a value of 26.52 inches. Inflows continued to increase as warmer weather melted the low-level snow and reached 167 percent of average for the month. Total April releases were 174,650 AF, 240 percent of average. The end of month content was 349,551 AF, 87 percent of average.

A powerful storm system passed through the region in late April and into early May. Large amounts of snowfall accumulated in the mountain ranges. Reclamation issued an increased April-July inflow volume forecast to 1,100,000 AF, 156 percent of average. The WYAO forecast was in agreement with forecasts issued by several other agencies including the NRCS and the USACE.

Above average temperatures and rain-on-snow events during May caused above average inflows reaching 258 percent of average. Releases at the beginning of the month were approximately 3,000 cfs and increased to 5,500 cfs by the end of the month. Releases totaled 155,302 AF, 204 percent of average. May end of month content was approximately 535,300 AF, 120 percent of average.

During June, the reservoir received very high levels of inflow. Inflows at the beginning of the month were near 3,000 cfs and continued to increase throughout the month to reach a sustained peak inflow above 10,000 cfs. The peak inflow for May was recorded on May 28 at 12,538 cfs. After the initial inflow surge, which lasted through June 10, the reservoir had increased to a content of 601,000 AF, approximately 93 percent of capacity. In response to high inflows and forecasted wet conditions ahead, the release was raised to ensure the reservoir would not overtop. Releases

were later decreased on June 21, with additional decreases on June 23 and June 27 to a release of 7,000 cfs. Inflows jumped to 12,927 cfs on June 17 but by June 30 the computed inflow was down to 6,750 cfs. The pool elevation increased by nine feet during June. The end of month content was 615,187 AF, 106 percent of average and approximately 15,000 AF below the reservoir's normal capacity. June inflows were 435,613 AF, 175 percent of average and releases were 328,745 AF, 257 percent of average.

Warmer and drier climate trends were observed during July 2018, and hydrologic conditions were less extreme than those in June. During the month, observed precipitation was only 46 percent of average. Temperatures were well above normal.

Inflows began July with a computed flow rate of 5,500 cfs. Inflows gradually declined for the remainder of the month as the snowpack melted out of the high elevations. By the end of July, the inflows had dropped below 1,500 cfs. The release rate to the river below the dam decreased from 7,000 cfs in early July to 1,400 cfs by the end of the month. The annual peak pool elevation of 5,391.42 feet was observed on July 21, 2.1 feet below normal full pool. Reservoir operators typically target a max pool elevation of 5,391.50 feet around July 31, reserving room in the reservoir for a late season runoff event. The July inflow volume was 142,426 AF, 130 percent of average and releases were 202,694 AF, 122 percent of average.

The computed inflow volume for the April-July period totaled 1,299,694 AF, 185 percent of average. The 2018 runoff exceeded the previous record set in 2017 by approximately 37,700 AF.

Total inflow into Buffalo Bill Reservoir during water year 2018 was 1,580,878 AF, the second highest on record and 179 percent of the thirty-year average. The September 30, 3018 storage content was 489,384 AF, 109 percent of the average. During water year 2018, the powerplants associated with Buffalo Bill Reservoir had a net generation of approximately 122,488.3 MWh with a value estimated to be $3,851,032. The estimated lost revenue of the bypass release is $6,221,199.

Important Events - 2018

December 21, 2017: Releases to the Shoshone River reduced to the winter flow rate of 500 cfs.
April 19, 2018: Buffalo Bill Reservoir Public Information meeting was held in Powell to discuss WY 2017 operation and expected 2018 operation.
April 30, 2018: Irrigation diversions by the Shoshone Project were initiated for the 2018 irrigation season.
July 21, 2018: Buffalo Bill Reservoir reached a peak pool elevation for the water year of 5391.42 feet.
October 18, 2018: End of 2018 irrigation diversions by the Shoshone Projects.

Additional hydrologic and statistical information pertaining to the operations of Buffalo Bill Reservoir during WY 2017 can be found in Table 29 and Figure 32.

Table 29. Hydrologic Data for Buffalo Bill Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5,259.60	41,748	41,748
TOP OF ACTIVE CONSERVATION	5,393.50	646,565	604,817

STORAGE-ELEVATION DATA	ELEVATION (FEET)	STORAGE (AF)	DATE
BEGINNING OF YEAR	5,378.23	528,150	SEP 30, 2017
END OF YEAR	5,372.95	489,384	SEP 30, 2018
ANNUAL LOW	5,350.89	342,651	APR 27, 2018
HISTORIC LOW*		19,080	JAN 31, 1941
ANNUAL HIGH	5,391.42	629,804	JUL 21, 2018
HISTORIC HIGH	5,393.51	646,647	JUL 30, 1996

* Prior to 1952 daily records are not available. End-of-month data was used to determine the historic low.

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW*	DATE
ANNUAL TOTAL (AF)	1,580,878	OCT 17-SEP 18	1,619,688	OCT 17-SEP 18
DAILY PEAK (cfs)	12,927	JUN 18, 2018	8,769	JUN 10, 2018
DAILY MINIMUM (cfs)	133*	SEP 12, 2017	497	FEB 9, 2018
PEAK SPILLWAY FLOW (cfs)				
TOTAL SPILLWAY FLOW (AF)				

*High winds in the area can result in a false forebay reading.

MONTH	INFLOW		OUTFLOW		CONTENT	
	KAF	% of Avg*	KAF	% of Avg*	KAF	% of Avg*
OCTOBER	55.0	214	82.3	215	500.9	117
NOVEMBER	49.6	228	50.3	296	500.2	116
DECEMBER	33.3	212	42.2	257	491.3	114
JANUARY	25.4	172	31.4	204	485.3	113
FEBRUARY	17.9	137	35.8	146	467.4	110
MARCH	23.8	112	67.8	299	423.4	101
APRIL	76.5	167	150.4	240	349.6	87
MAY	451.3	258	265.6	204	535.3	120
JUNE	554.1	175	474.2	257	615.2	106
JULY	217.8	130	210.0	122	622.9	107
AUGUST	54.4	127	115.3	103	562.0	110
SEPTEMBER	21.7	87	94.3	109	489.4	109
April - July	1,299.7	185%				
Water Year Summary	1,580.9	179%	1,619.6	184%		

* Average for inflow and outflow is the 1988-2017 period. Because of the enlargement of Buffalo Bill Reservoir in 1992, the period of record on which average content is based spans 1993-2017.

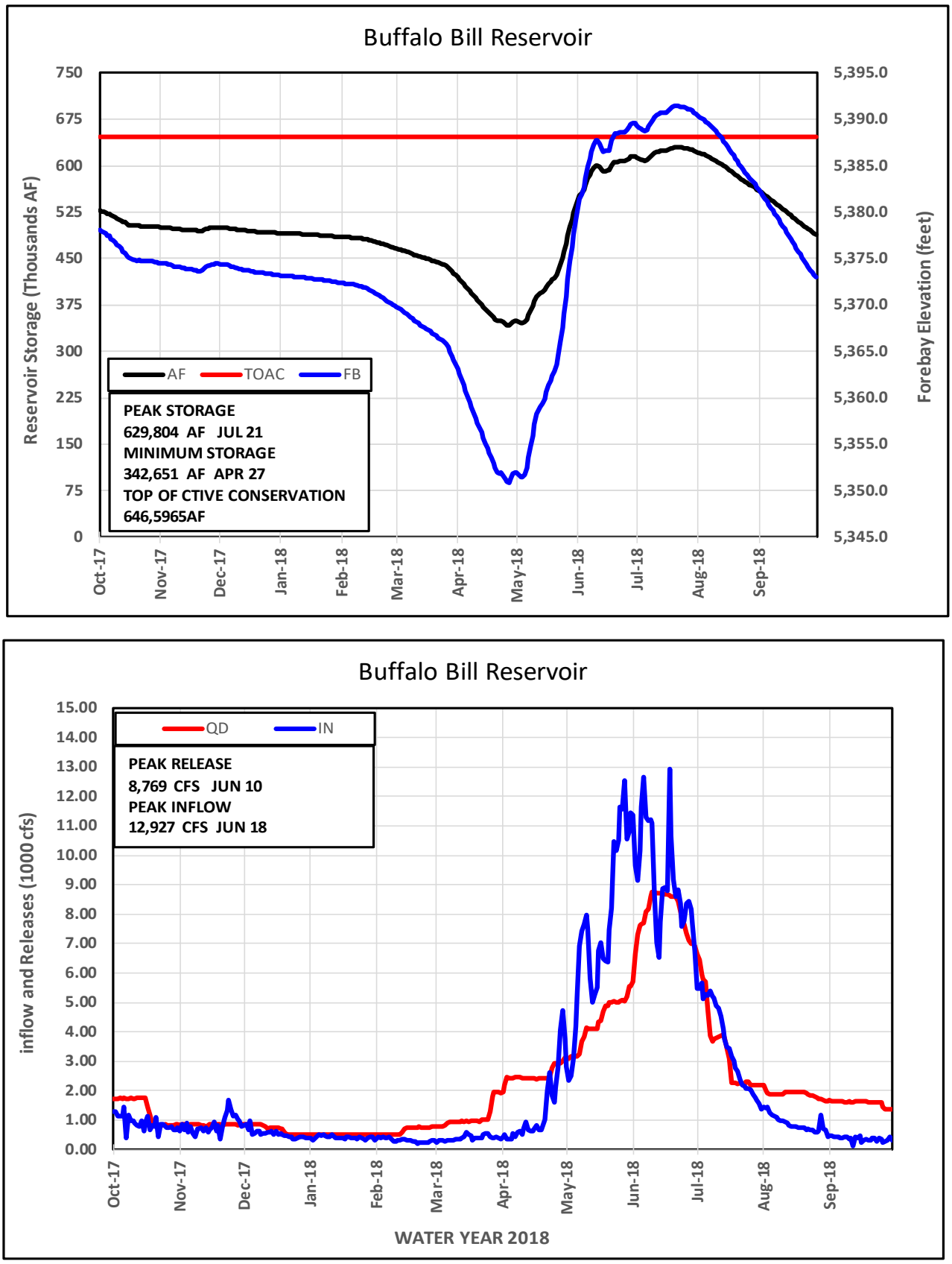


Figure 32. Hydrologic Data for Buffalo Bill Reservoir.

Summary of Reservoir Operations for Benefit of Fish and Wildlife, Environment, and Recreation

Bull Lake Reservoir

During the past several years, Midvale and Reclamation have entered into an annual agreement whereby Reclamation could store Boysen water in Bull Lake under any combination of four conditions set forth in the agreement. The agreement was approved for 2018 and the non-irrigation season releases were maintained above the required minimum flow rate of 20 cfs. As outlined in the agreement, a steady 20 cfs of the reservoir releases were accounted for as Boysen water being released from Bull Lake. During the typical runoff period of April-July, the inflows to Bull Lake were the highest on record and the reservoir filled in July.

Boysen Reservoir

Boysen Reservoir storage at the beginning of WY 2018 was 717,007 AF, approximately 97 percent of normal reservoir capacity. In the fall of 2017, releases were made to provide irrigation supply and to manage the reservoir. Due to abnormally high inflow conditions during October and November and the end of September reservoir content gave reservoir operators reason to increase the release from Boysen Reservoir to 2,450 cfs early in October. This release was maintained until the end of October. Early to mid-November releases were decreased to 1,500 cfs and held there for the rest of the month. In December the release was set to 1,250 cfs as the reservoir reached a manageable operation level of 660,773 AF by the end of December. The higher winter release of 1,250 cfs was held until mid-March. Due to the higher flows for water year 2018 the Wyoming Game and Fish Department did not request a one-day flushing flow.

Buffalo Bill Reservoir

Following the record setting inflows for water year 2017 irrigation season Buffalo Bill Reservoir storage ended at 500,860 AF, approximately 77 percent of normal reservoir capacity. Abnormally high inflow conditions during October and November and the end of September reservoir content gave reservoir operators reason to set the release from Buffalo Bill Reservoir to 900 cfs at the Cody river gage at the end of the irrigation season (mid- October). Normally the non-irrigation season releases are determined by the criteria outlined in the Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement, however the high reservoir content and inflows required higher releases to reduce the reservoir level to 5,370.00 feet by the end of November. The criteria includes the previous year's annual inflow, end of year reservoir content, and state account ownership. Based on those conditions, a winter release of 100 cfs, 150 cfs, 200 cfs, or 350 cfs will be provided below Buffalo Bill Powerplant. The agreement serves to ensure a minimum release of 100 cfs will be maintained at all times below the dam.

Reclamation continues to support the WGFD Reservoir Research Branch in its efforts to assess fish population and species distribution in the enlarged reservoir using hydro-acoustic technology

and by providing WGFD river access and an aluminum tube for planting fish in the Shoshone River off the deck of Buffalo Bill Powerplant.

As Buffalo Bill Reservoir is drawn down, the lake bed is exposed to wind erosion, which creates dust in the reservoir area and in the town of Cody, Wyoming. As a part of the enlargement of Buffalo Bill Reservoir, dust abatement dikes were built on the upper ends of the North and South Fork arms of the reservoir to hold water in areas that would become dry as the reservoir level decreased, thus reducing the area of dry lake bed. The top of the North Fork Dike is approximately 5,370 feet. When the reservoir pool elevation drops below 5,370 feet, the North Fork Dike helps to minimize the amount of lakebed exposure. The number of stop-logs at the outlet control structure on the South Fork Dike are used to maintain a nearly static water level above the dike of approximately 5,393.23 feet at the end of the water year. The stop-logs provide a larger impoundment behind the dike, which benefits waterfowl habitat and fishery conditions.

The Diamond Creek Dike was constructed to prevent Diamond Creek and the Irma Flats area from being inundated by the enlarged reservoir. Inflows from the Diamond Creek drainage enter Diamond Creek Reservoir that lies at the base of the dike. This water is then pumped into Buffalo Bill Reservoir to maintain the elevation of Diamond Creek Reservoir between a maximum of 5,340.40 feet and a minimum of 5,339.50 feet. The normal water surface elevation is typically 5,340.00 feet.

Reservoir levels during all of WY2018 were adequate to support recreational activities on Buffalo Bill Reservoir.

Projected Operating Plans for Bighorn Basin WY 2019

Bull Lake Reservoir

Three operating plans were prepared in October to project operations under various runoff conditions for WY 2019. The projected operations for three inflow scenarios are shown in Table 30 and Figure 33. The plans are prepared to show the probable limits of operations, but actual weather conditions and operations could vary widely from the most probable plan.

The primary objective of operations at Bull Lake is to provide irrigation water to the Midvale Irrigation District (Midvale). Under normal operation, the reservoir also provides flood control benefits and a water resource for fish, wildlife, and recreation. Bull Lake is operated under the following criteria and limitations:

(1) Based on forecasted inflows, March-June releases are scheduled with the objective of filling the lake to a content of 151,000 AF at elevation 5,804.50 feet during July while eliminating or minimizing any spill.

(2) During April-October, releases must be adequate to meet the irrigation needs of Midvale and downstream irrigators with senior water rights on Bull Lake Creek.

(3) Based on the available water supply, non-irrigation season releases from Bull Lake to Bull Lake Creek are generally maintained between 20 and 45 cfs.

(4) The reservoir pool level will be kept below elevation 5,783.00 feet during the winter to accommodate the Bull Lake Dam Spillway Modification construction for Water Year 2019. If not for the modification to the spillway, normal operations of the reservoir would be to maintain the reservoir below elevation 5,794.00 feet through the winter to prevent damage to the concrete in the spillway inlet from ice. The reservoir is operated to have a storage level of 100,000 AF or less by November 30. The objective at the onset of winter is to be as close as possible to the 100,000 AF level (5,787.13 feet) and to also provide fishery habitat.

2019 Operating Plans

Storage in Bull Lake at the end of WY 2018 was 81,665 AF at elevation 5,780.12 feet. Projected inflows for all months of WY 2019 under most probable inflow conditions selected as median flows or flows that have historically been exceeded 50 percent of the time. The reservoir is expected to fill during July under the most probable and reasonable maximum inflow scenarios. The reservoir is not expected to fill if minimum inflow conditions were to occur.

Reasonable minimum condition inflows are estimated to be lower decile flows for all months in WY 2019. Lower decile flows are flows that have historically been exceeded 90 percent of the time.

Under reasonable maximum inflow conditions, upper decile flows are expected for all months in WY 2019. Upper decile flows are flows that have historically been exceeded 10 percent of the time.

Under all inflow scenarios, releases in October following the end of irrigation season and continuing through the fall and winter will be adjusted to reach and maintain the target winter pool elevation.

Water diverted into the Wyoming Canal can be delivered to Midvale lands directly or routed through Pilot Butte Reservoir and delivered to district lands via the Pilot Canal. In June of 2009, both units at Pilot Butte Powerplant were placed in “mothballed” status and are not expected to generate electricity in WY 2019.

Table 30. Riverton Project Operating Plan Based on Oct. 1 Inflow Estimates.

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Based on Most Probable April-July runoff of: Bull Lake - 141 kaf / Wind River ab Bull Lake Creek - 427 kaf / Riverton - 221 kaf
This plan assumes an annual demand of 162 KAF for the North Canal and 182 KAF for the Pilot Canal

Bull Lake Reservoir Operations — Initial Content 81.7 Kaf — Operating Limits: Max 151.7 Kaf, 5804.76 Ft. / Min 20.0 Kaf, 5750.93 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	6.2	3.4	2.6	2.6	1.7	2.0	2.9	29.4	63.6	44.9	20.2	10.2	189.7
Total Dam Release	kaf	1.5	1.5	1.8	2.6	1.7	2.0	1.5	1.5	44.5	31.3	37.2	45.4	172.6
Total Dam Release	cfs	25.	25.	30.	42.	31.	33.	25.	25.	747.	509.	605.	763.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.0	29.8	0.1	0.0	72.8
End-month Content	kaf	86.4	88.3	89.0	89.0	89.0	89.0	90.4	118.3	137.4	151.0	134.0	98.8	
End-month Elevation	ft	5782.0	5782.7	5783.0	5783.0	5783.0	5783.0	5783.5	5793.7	5800.1	5804.5	5799.0	5786.7	
BLR Net Change	kaf	4.7	1.9	0.8	0.0	0.0	0.0	1.4	27.9	19.1	13.6	-17.0	-35.2	17.1

Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	34.8	25.0	18.9	16.4	15.3	17.7	29.1	105.4	175.3	117.1	52.2	36.1	643.3
Crowheart Gage Flow	kaf	36.3	26.5	20.7	19.0	17.0	19.7	30.6	106.9	219.8	148.4	89.4	81.5	815.9
Flow Below Div Dam	kaf	24.6	26.5	20.7	19.0	17.0	19.7	13.2	52.2	155.1	67.5	30.7	20.9	467.2
Gain/Return Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.4	7.1	7.4	6.1	5.4	38.2
Indian Irrigation	kaf	0.0	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	5.5	4.5	30.0
LeClair/Riverton	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.5	18.8	24.2	27.2	21.1	15.0	109.8
LeC/Riv Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riverton Gage Flow	cfs	400.7	445.1	337.4	308.7	306.5	320.9	212.8	563.8	2219.4	675.4	166.6	114.0	

Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	11.7	0.0	0.0	0.0	0.0	0.0	17.4	54.7	64.7	80.9	58.7	60.6	348.7
North Canal Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.8	26.4	31.2	36.5	30.9	27.0	161.8
North Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pilot Butte Reservoir Operations — Initial Content 16.5 Kaf — Operating Limits: Max 29.9 Kaf, 5459.98 Ft. / Min 10.0 Kaf, 5433.49 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	11.7	0.0	0.0	0.0	0.0	0.0	7.6	28.3	33.5	44.4	27.8	33.6	186.9
Power Generated	mwh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pilot Canal Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	6.7	28.0	33.1	43.9	37.4	33.3	182.4
Pilot Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	28.0	27.8	27.7	27.6	27.5	27.3	28.0	28.0	28.0	28.0	18.0	18.0	
PBR Net Change	kaf	11.5	-0.2	-0.1	-0.1	-0.1	-0.2	0.7	0.0	0.0	0.0	-10.0	0.0	1.5
End-month Elevation	ft	5457.8	5457.6	5457.5	5457.4	5457.3	5457.0	5457.8	5457.8	5457.8	5457.8	5445.5	5445.5	

WRBAOP V2.1E 07-Feb-1995 Run: 3-Oct-2018 15:34 Page 2
Based on Minimum April-July runoff of: Bull Lake - 99 kaf / Wind River ab Bull Lake Creek - 261 kaf / Riverton – 62 kaf
This plan assumes an annual demand of 162 KAF for the North Canal and 182 KAF for the Pilot Canal

Bull Lake Reservoir Operations — Initial Content 81.7 Kaf — Operating Limits: Max 151.9 Kaf, 5804.82 Ft. / Min 20.0 Kaf, 5750.93 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	4.3	2.2	1.6	1.7	1.3	1.7	3.7	26.3	38.6	30.7	15.0	7.5	134.6
Total Dam Release	kaf	1.5	1.5	1.5	1.5	1.4	1.5	1.5	14.0	18.6	42.3	54.3	38.3	178.0
Total Dam Release	cfs	25.	25.	25.	25.	25.	25.	25.	227.	313.	688.	883.	644.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.5	17.1	0.0	0.0	0.0	29.6
End-month Content	kaf	84.5	85.2	85.2	85.4	85.3	85.5	87.7	100.0	120.0	108.4	69.1	38.3	
End-month Elevation	ft	5781.2	5781.5	5781.5	5781.6	5781.6	5781.6	5782.5	5787.1	5794.3	5790.2	5775.0	5760.8	
BLR Net Change	kaf	2.8	0.7	0.1	0.2	-0.1	0.2	2.2	12.3	20.0	-11.6	-39.3	-30.8	-43.4

Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	29.0	21.4	17.2	15.0	13.7	16.5	24.0	74.8	102.8	58.9	36.1	29.2	438.6
Crowheart Gage Flow	kaf	30.5	22.9	18.7	16.5	15.1	18.0	25.5	88.8	121.4	101.2	90.4	67.5	616.6
Flow Below Div Dam	kaf	18.8	22.9	18.7	16.5	15.1	18.0	8.1	34.1	56.7	30.3	21.7	15.6	276.6
Gain/Return Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.4	7.1	7.4	6.1	5.4	38.2
Indian Irrigation	kaf	0.0	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	2.5	1.8	24.3
LeClair/Riverton	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.5	18.8	24.2	27.2	21.1	15.0	109.8
LeC/Riv Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riverton Gage Flow	cfs	306.4	384.6	304.7	269.0	271.7	293.3	127.1	268.6	566.2	70.0	70.0	70.0	

Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	11.7	0.0	0.0	0.0	0.0	0.0	17.4	54.7	64.7	70.9	68.7	51.9	340.0
North Canal Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.8	26.4	31.2	36.5	30.9	27.0	161.8
North Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pilot Butte Reservoir Operations — Initial Content 16.5 Kaf — Operating Limits: Max 29.9 Kaf, 5459.98 Ft. / Min 10.0 Kaf, 5433.49 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	11.7	0.0	0.0	0.0	0.0	0.0	7.6	28.3	33.5	34.4	37.8	24.9	178.2
Power Generated	mwh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pilot Canal Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	6.7	28.0	33.1	43.9	37.4	32.6	181.7
Pilot Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	28.0	27.8	27.7	27.6	27.5	27.3	28.0	28.0	28.0	18.0	18.0	10.0	
PBR Net Change	kaf	11.5	-0.2	-0.1	-0.1	-0.1	-0.2	0.7	0.0	0.0	-10.0	0.0	-8.0	-6.5
End-month Elevation	ft	5457.8	5457.6	5457.5	5457.4	5457.3	5457.0	5457.8	5457.8	5457.8	5445.5	5445.5	5433.5	

Based on Maximum April-July runoff of: Bull Lake - 197 kaf / Wind River ab Bull Lake Creek - 679 kaf / Riverton – 530 kaf
This plan assumes an annual demand of 162 KAF for the North Canal and 182 KAF for the Pilot Canal

Year Beginning Oct 2018

Bull Lake Reservoir Operations — Initial Content 81.7 Kaf — Operating Limits: Max 151.9 Kaf, 5804.82 Ft. / Min 20.0 Kaf, 5750.93 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	6.5	3.6	3.0	2.4	1.9	2.4	4.3	27.6	89.9	75.1	31.1	12.8	260.6
Total Dam Release	kaf	1.5	1.5	2.6	2.4	1.9	2.4	1.5	15.3	63.6	54.7	48.2	46.7	242.3
Total Dam Release	cfs	25.	25.	43.	39.	34.	39.	25.	248.	1069.	890.	784.	784.	
Excess Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	62.1	53.2	31.0	2.0	162.0
End-month Content	kaf	86.7	88.8	89.1	89.1	89.1	89.1	92.0	104.3	130.6	151.0	133.9	100.0	
End-month Elevation	ft	5782.1	5782.9	5783.0	5783.0	5783.0	5783.0	5784.1	5788.7	5797.9	5804.5	5799.0	5787.1	
BLR Net Change	kaf	5.0	2.1	0.4	0.0	0.0	0.0	2.8	12.3	26.3	20.4	-17.1	-33.9	18.3

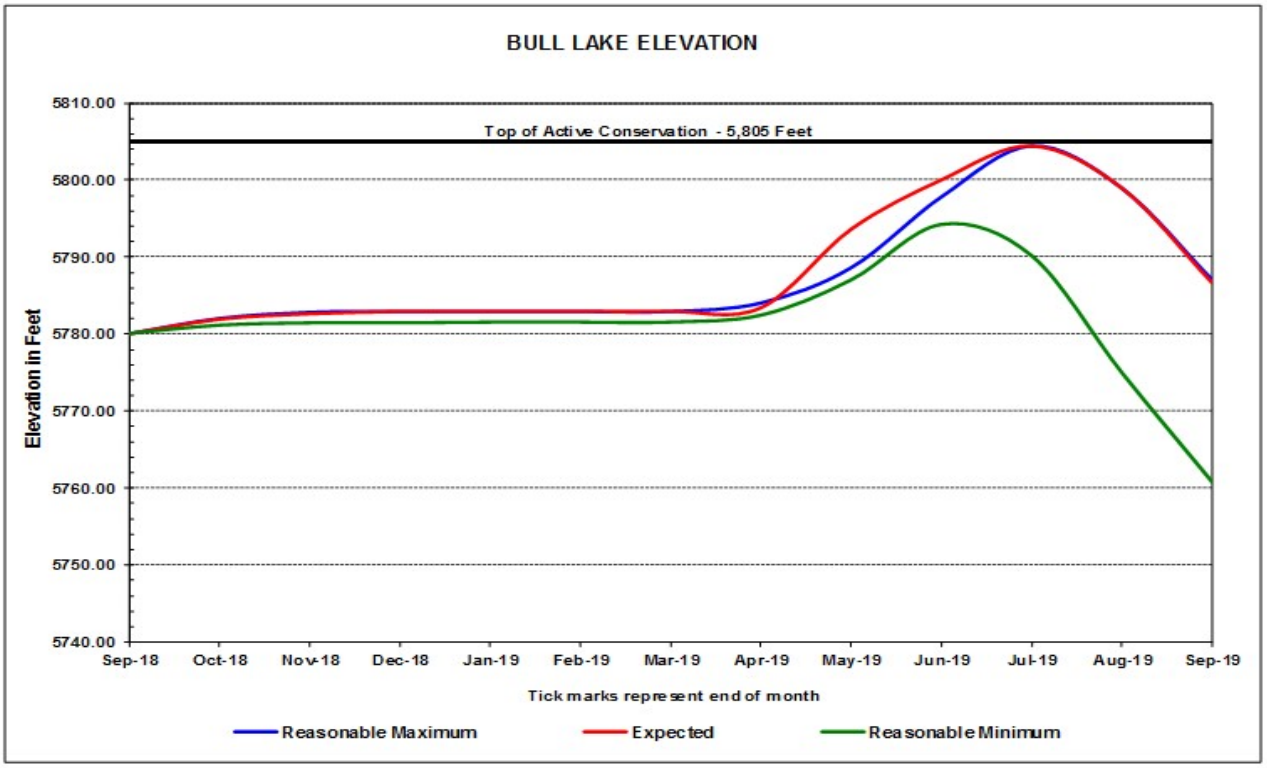
Wind River		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Flow abv BL Creek	kaf	35.8	25.7	20.1	18.5	15.9	20.0	27.0	132.0	323.8	196.6	77.3	43.8	936.5
Crowheart Gage Flow	kaf	37.3	27.2	22.7	20.9	17.8	22.4	28.5	147.3	387.4	251.3	125.5	90.5	1178.8
Flow Below Div Dam	kaf	25.6	27.2	22.7	20.9	17.8	22.4	11.1	92.6	322.7	170.4	56.8	39.9	830.1
Gain/Return Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	4.8	7.4	7.1	7.4	6.1	5.4	38.2
Indian Irrigation	kaf	0.0	0.0	0.0	0.0	0.0	0.0	1.8	6.1	6.0	6.1	5.5	4.5	30.0
LeClair/Riverton	kaf	0.0	0.0	0.0	0.0	0.0	0.0	3.5	18.8	24.2	27.2	21.1	15.0	109.8
LeC/Riv Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riverton Gage Flow	cfs	416.9	456.9	369.9	339.9	320.3	364.3	177.5	1219.6	5036.5	2348.9	591.1	433.0	

Wyoming Canal		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Diversion	kaf	11.7	0.0	0.0	0.0	0.0	0.0	17.4	54.7	64.7	80.9	68.7	50.6	348.7
North Canal Flow	kaf	0.0	0.0	0.0	0.0	0.0	0.0	9.8	26.4	31.2	36.5	30.9	27.0	161.8
North Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pilot Butte Reservoir Operations — Initial Content 16.5 Kaf — Operating Limits: Max 29.9 Kaf, 5459.98 Ft. / Min 1.0 Kaf, 5413.39 Ft.

		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Reservoir Inflow	kaf	11.7	0.0	0.0	0.0	0.0	0.0	7.6	28.3	33.5	44.4	37.8	23.6	186.9
Power Generated	mwh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pilot Canal Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	6.7	28.0	33.1	43.9	37.4	33.3	182.4
Pilot Canal Shortage	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-month Content	kaf	28.0	27.8	27.7	27.6	27.5	27.3	28.0	28.0	28.0	28.0	28.0	18.0	
PBR Net Change	kaf	11.5	-0.2	-0.1	-0.1	-0.1	-0.2	0.7	0.0	0.0	0.0	0.0	-10.0	1.5
End-month Elevation	ft	5457.8	5457.6	5457.5	5457.4	5457.3	5457.0	5457.8	5457.8	5457.8	5457.8	5457.8	5445.	

BULL LAKE RESERVOIR



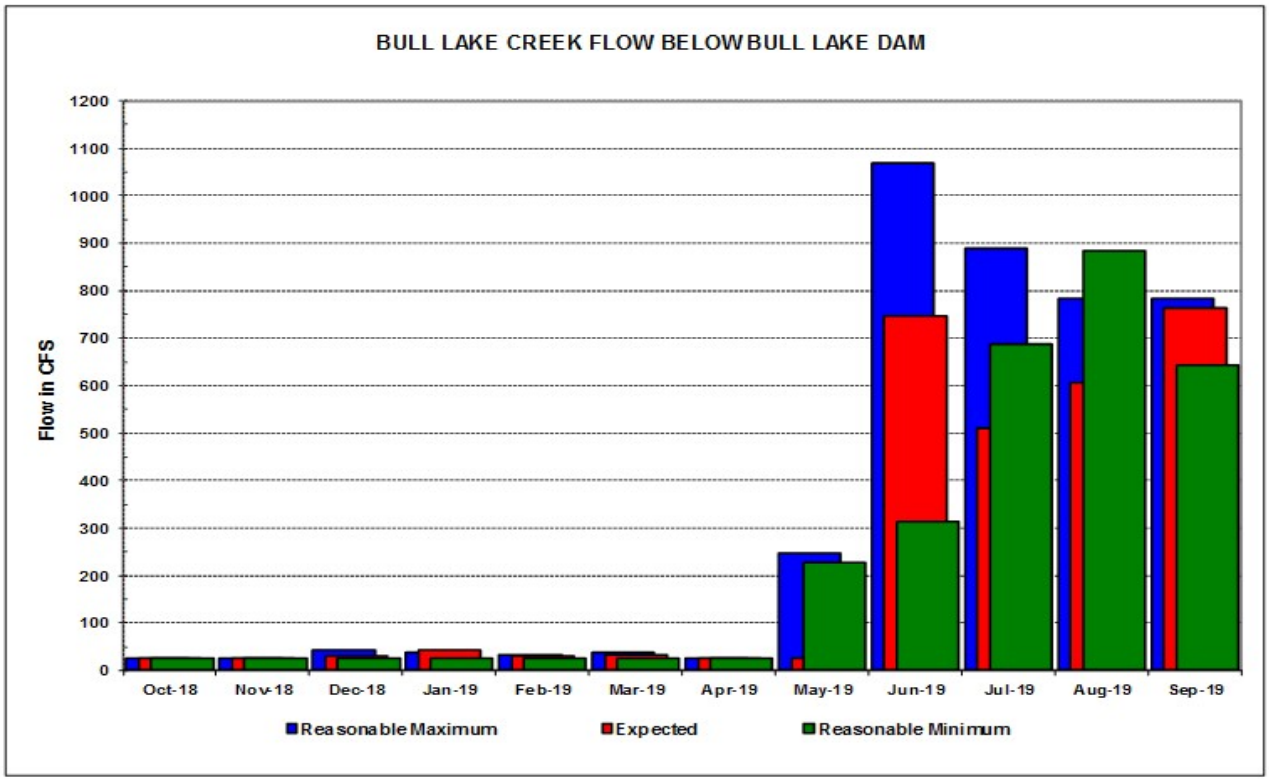


Figure 33. The projected operations for three inflow scenarios for Bull Lake.

Boysen Reservoir and Powerplant

Three operating plans were prepared in October to project water operations under various inflow conditions during WY 2019. The operations for the three runoff conditions are shown in Table 31 and Figure 34. These plans are presented only to show the probable limits of operations and therefore, actual conditions and operations could vary widely from the most probable plan.

The operating objectives at Boysen Dam and Reservoir are to provide water for irrigation, municipal and industrial use, and power generation; provide flood control in cooperation with the USACE; and enhance fish, wildlife, and recreation opportunities in both the reservoir and the Wind/Bighorn River.

Irrigation Season Release

During the irrigation season, water releases from Boysen Reservoir are made to satisfy all downstream senior water rights and storage contract commitments. Generally, demands for downstream senior water rights are met with a reservoir release between 900 cfs and 1,200 cfs. Releases above what is required to meet irrigation demands may be made to manage reservoir levels and generate power.

Non-irrigation Season Release

During the non-irrigation season, releases are made to produce power, enhance the river and reservoir fishery, and provide storage space for the expected spring runoff or conserve storage if the reservoir is not expected to fill. Winter releases are generally in the range between 400 cfs and 1,150 cfs, depending on reservoir conditions going into the winter. The Wyoming Game and Fish Department considers 800 cfs to be the preferred fishery flow from October - February and flows below 600 cfs to be detrimental to the river fishery. A release of approximately 1,150 cfs can be made through one unit at Boysen Powerplant. By releasing less than the capacity of one powerplant unit, annual maintenance can be performed on the other unit during the winter months.

General Operating Procedures

(1) October - February: Releases of water for power generation are scheduled to evacuate storage while assuring an adequate water supply for the upcoming irrigation season. It is desirable to maintain a uniform release during November - February to reduce the risk of ice jams, which may cause flooding or damage to bridges and other structures.

(2) March - July: Based upon monthly water supply forecasts and as soon as river ice conditions allow, releases are scheduled to meet the irrigation demand as a minimum. Greater releases may be made if necessary to eliminate or minimize a spill, with the objective of filling the reservoir to elevation 4,724.50 feet (731,841 AF) by the end of July. Depending on inflows, attempts will be made to provide a reservoir level of at least elevation 4,707.00 feet from the end of May through the end of August for recreational boating access. For the spawning of rainbow trout, it is desirable to have stable or slightly rising river flows from mid-March through early June. When conditions are suitable and without affecting power operations, attempts will be made to limit the drop-in reservoir level to two feet or less during the reservoir fish spawn and hatch period (which begins in March and ends in May). A rising pool is desirable during this period.

(3) August - September: As soon as storage has peaked, water releases are scheduled to meet the irrigation demand and generate power. Releases above what is needed to meet irrigation demand

may be made to generate power and prevent the need to release water through the spillway gates if inflow conditions warrant.

2019 Operating Plans

At the beginning of WY 2019, storage was 652,966 AF at elevation 4,720.26 feet. Monthly inflow volumes in the most probable plan are median flows or flows which have historically been exceeded 50 percent of the time. A release of 1,000 cfs is scheduled to be the winter flow rate but may increase if the reservoir conditions indicate a need for more storage evacuation. Under most probable inflow conditions, end of month reservoir content is expected to peak in July with 731,800 AF and reservoir elevation 4,724.50 feet. The reservoir is expected to fill if most probable or greater inflows are realized. If reasonable minimum inflows occur during each month of WY 2019, the reservoir is not expected to fill.

Reasonable minimum condition inflows are lower decile flows for all months in WY 2019. Lower decile flows are flows that have historically been exceeded 90 percent of the time.

In the maximum probable plan, upper decile inflow volumes are projected. Upper decile flows are the flows that have been historically exceeded 10 percent of the time.

Winter releases under minimum and maximum inflow scenarios are the same as under the most probable condition. This is because a release, which meets the operating objectives under the range of inflows, needs to be set prior to the time when the river might freeze. It must be assumed that releases cannot be changed significantly from mid-December through mid-March as the changes could potentially cause flooding downstream of the reservoir if ice conditions are present on the river.

Annual operating plans are found in Table 31. Turbine unit outage schedules are found in Table 33.

Table 31. Boysen Reservoir 2019 Operating Plan Based on Oct. 1 Inflow Estimates.

BOYAOP V1.48 Run: 01-Oct-2018 11:43
Based on Most Probable April-July Inflow of 648 kaf

BOYSEN RESERVOIR MONTHLY OPERATIONS

Boysen Reservoir		Initial Cont Elev	653.0 kaf 4720.26 ft			Maximum Cont Elev	892.2 kaf 4732.20 ft			Minimum Cont Elev	219.2 kaf 4685.00 ft		
2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	56.8	47.2	36.5	33.1	35.5	50.3	56.8	164.7	295.6	130.7	66.8	55.5	1029.5
Monthly Inflow	cfs	924	793	594	538	639	818	955	2679	4968	2126	1086	933	
Turbine Release	kaf	61.5	59.5	61.5	61.5	55.5	61.5	89.3	125.7	121.7	130.7	100.6	78.5	1007.5
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Release	kaf	61.5	59.5	61.5	61.5	55.5	61.5	89.3	125.7	121.7	130.7	100.6	78.5	1007.5
Total Release	cfs	1000	1000	1000	1000	999	1000	1501	2044	2045	2126	1636	1319	
End-Month Content	kaf	648.3	636.0	611.0	582.6	562.6	551.4	518.9	557.9	731.8	731.8	698.0	675.0	
End-Month Elevation	ft	4720.00	4719.29	4717.82	4716.08	4714.80	4714.06	4711.86	4714.49	4724.50	4724.50	4722.72	4721.48	
Net Change Content	kaf	-4.7	-12.3	-25.0	-28.4	-20.0	-11.2	-32.5	39.0	173.9	0.0	-33.8	-23.0	22.0

Boysen Power Plant	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	61.5	59.5	61.5	61.5	55.5	61.5	89.3	125.7	121.7	130.7	100.6	78.5	1007.5
Turbine Release	cfs	1000	1000	1000	1000	999	1000	1501	2044	2045	2126	1636	1319	
Generation	gwh	5.395	5.196	5.316	5.236	4.656	5.108	7.251	10.157	10.493	11.762	9.032	6.980	86.582
Max Generation	gwh	9.285	9.101	7.261	5.952	10.537	11.904	11.520	11.904	11.520	11.904	11.904	11.520	124.312
% Max Generation	%	58	57	73	88	44	43	63	85	91	99	76	61	
Ave kwh/af		88	87	86	85	84	83	81	81	86	90	90	89	86
End-Month Power Cap	mw	16	16	16	16	16	16	15	16	16	16	16	16	

BOYAOP V1.48 Run: 01-Oct-2018 11:43
Based on reasonable minimum April-July inflow of 219 kaf

BOYSEN RESERVOIR MONTHLY OPERATIONS

Boysen Reservoir		Initial Cont Elev	653.0 kaf 4720.26 ft			Maximum Cont Elev	892.2 kaf 4732.20 ft			Minimum Cont Elev	219.2 kaf 4685.00 ft		
2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	46.2	41.4	34.9	32.5	31.1	46.0	42.0	64.1	74.4	38.0	25.5	29.3	505.4
Monthly Inflow	cfs	751	696	568	529	560	748	706	1042	1250	618	415	492	
Turbine Release	kaf	61.5	59.5	61.4	61.5	55.5	36.9	41.7	72.2	71.4	70.7	67.6	53.6	713.5
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Release	kaf	61.5	59.5	61.4	61.5	55.5	36.9	41.7	72.2	71.4	70.7	67.6	53.6	713.5
Total Release	cfs	1000	1000	999	1000	999	600	701	1174	1200	1150	1099	901	
End-Month Content	kaf	637.7	619.6	593.1	564.1	539.7	548.8	549.1	541.0	544.0	511.3	469.2	444.9	
End-Month Elevation	ft	4719.39	4718.34	4716.73	4714.90	4713.28	4713.89	4713.91	4713.37	4713.57	4711.32	4708.27	4706.40	
Net Change Content	kaf	-15.3	-18.1	-26.5	-29.0	-24.4	9.1	0.3	-8.1	3.0	-32.7	-42.1	-24.3	-208.1

Boysen Power Plant	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	61.5	59.5	61.4	61.5	55.5	36.9	41.7	72.2	71.4	70.7	67.6	53.6	713.5
Turbine Release	cfs	1000	1000	999	1000	999	600	701	1174	1200	1150	1099	901	
Generation	gwh	5.380	5.158	5.257	5.178	4.594	3.065	3.466	5.932	5.854	5.743	5.337	4.098	59.062
Max Generation	gwh	9.285	9.101	7.261	5.952	10.537	11.904	11.520	11.904	11.520	11.904	11.904	11.520	124.312
% Max Generation	%	58	57	72	87	44	26	30	50	51	48	45	36	
Ave kwh/af		87	87	86	84	83	83	83	82	82	81	79	76	83
End-Month Power Cap	mw	16	16	16	16	16	16	16	16	16	15	14	14	

BOYAOP V1.48 Run: 01-Oct-2018 11:43
Based on reasonable maximum April-July inflow of 1,091 kaf

BOYSEN RESERVOIR MONTHLY OPERATIONS

Boysen Reservoir		Initial Cont Elev	653.0 kaf 4720.26 ft			Maximum Cont Elev	892.2 kaf 4732.20 ft			Minimum Cont Elev	219.2 kaf 4685.00 ft		
2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	76.4	55.6	42.1	42.0	50.0	60.8	67.2	202.6	540.4	280.8	88.9	70.4	1577.2
Monthly Inflow	cfs	1243	934	685	683	900	989	1129	3295	9082	4567	1446	1183	
Turbine Release	kaf	61.5	59.5	61.5	61.5	55.6	104.5	133.6	132.3	135.6	135.7	130.8	80.4	1152.5
Bypass/Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	96.3	105.3	94.3	101.8	0.0	0.0	397.7
Total Release	kaf	61.5	59.5	61.5	61.5	55.6	104.5	229.9	237.6	229.9	237.5	130.8	80.4	1550.2
Total Release	cfs	1000	1000	1000	1000	1001	1700	3864	3864	3864	3863	2127	1351	
End-Month Content	kaf	667.9	664.0	644.6	625.1	619.5	575.8	413.1	378.1	688.6	731.9	690.0	680.0	
End-Month Elevation	ft	4721.09	4720.87	4719.78	4718.66	4718.33	4715.65	4703.84	4700.87	4722.22	4724.50	4722.29	4721.75	
Net Change Content	kaf	14.9	-3.9	-19.4	-19.5	-5.6	-43.7	-162.7	-35.0	310.5	43.3	-41.9	-10.0	27.0

Boysen Power Plant	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Turbine Release	kaf	61.5	59.5	61.5	61.5	55.6	104.5	133.6	132.3	135.6	135.7	130.8	80.4	1152.5
Turbine Release	cfs	1000	1000	1000	1000	1001	1700	2245	2152	2279	2207	2127	1351	
Generation	gwh	5.423	5.262	5.406	5.350	4.803	8.809	10.111	8.850	10.696	11.903	11.655	7.140	95.408
Max Generation	gwh	9.285	9.101	7.261	5.952	10.537	11.904	11.520	11.904	11.520	11.904	11.904	11.520	124.312
% Max Generation	%	58	58	74	90	46	74	88	74	93	100	98	62	
Ave kwh/af		88	88	88	87	86	84	76	67	79	88	89	89	83
End-Month Power Cap	mw	16	16	16	16	16	16	12	11	16	16	16	16	

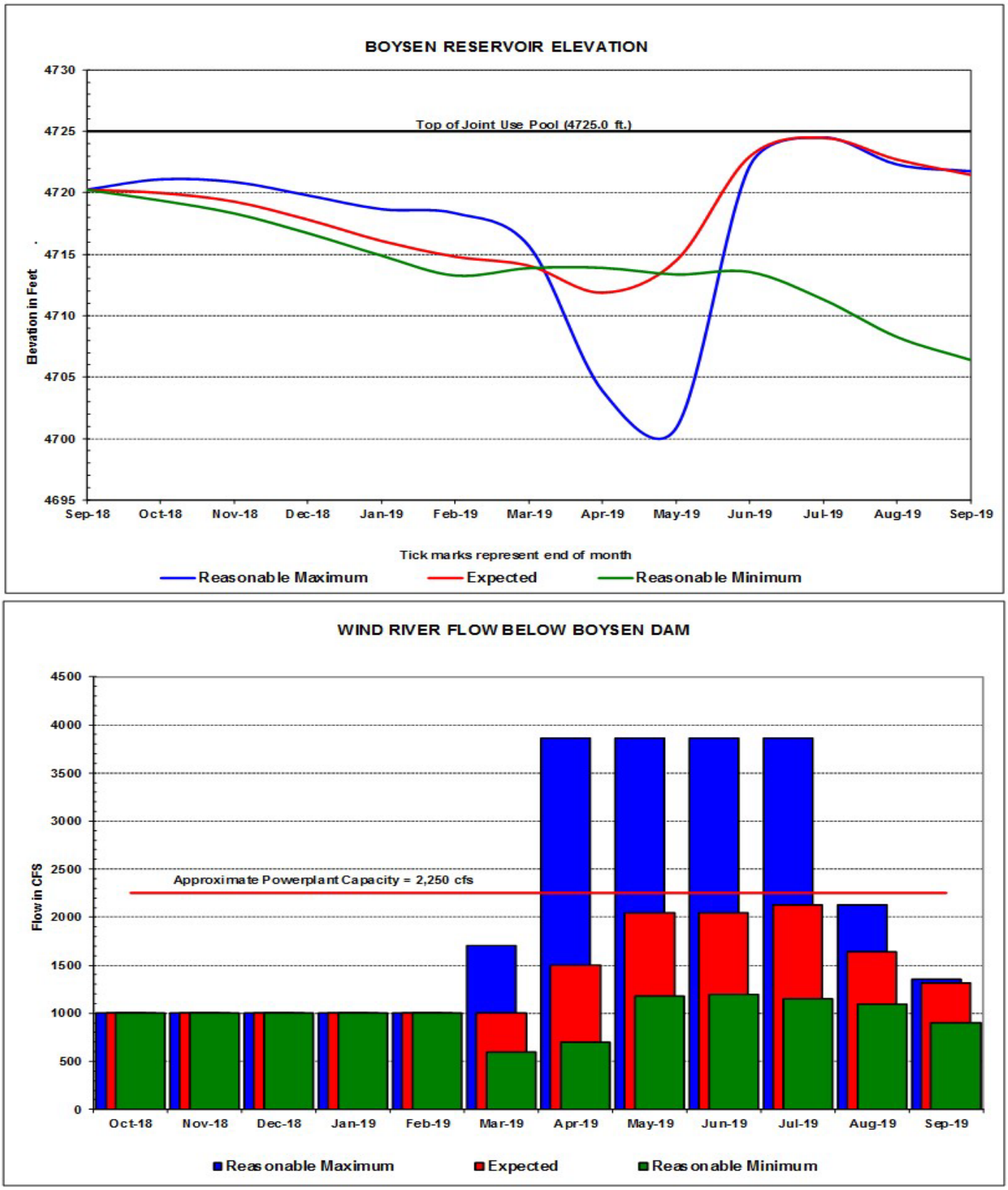


Figure 34. The projected operations for three inflow scenarios for Boysen Reservoir.

Buffalo Bill Reservoir and Powerplants

Three operating plans were prepared for WY 2019 to show the operations of Buffalo Bill Reservoir that could occur under various runoff conditions. The operations for the three-runoff conditions are shown in Table 32 and Figure 35. These plans were prepared only to show the probable limits of operations; therefore, actual conditions and operations could vary widely from the most probable plan.

Normal Operating Procedures

At the end of the irrigation season, releases will be adjusted with the objective of filling the reservoir to elevation 5,393.50 feet (646,565 AF) while meeting the release criteria of the ***Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement***. Under the Agreement, Buffalo Bill Reservoir will be operated to ensure that a minimum flow of 100 cfs is provided in the river below the dam at all times. Additional winter releases beyond the 100 cfs minimum release up to a combined total of 350 cfs in the river below Buffalo Bill Powerplant will be provided based on the criteria set forth in the Agreement.

Reservoir releases to meet downstream irrigation requirements will, to the extent possible, be made through the most efficient power turbines available, after meeting winter flow requirements. A release of at least 100 cfs will be made through the Shoshone Powerplant, whenever the powerplant is available, to provide the required river flow directly below the dam. If the Shoshone Powerplant is not available, the release will be made through the jet flow valve at the Dam.

During irrigation season, releases are determined by the requirements for irrigation, and municipal and industrial demand. If snow conditions, inflow, and reservoir content indicate an assured fill of the reservoir, additional releases may be required after the start of the spring runoff to provide flood control and make optimum use of the water for power generation. An attempt is made to maintain a release of 7,000 cfs or less during the runoff season and ensures that outflow is less than inflow at all times of flood rate inflow.

2019 Operating Plans

Under most probable inflow conditions, projected inflows for October, November, and December of WY 2019 have been adjusted to reflect the recent trends for the basin. Inflows for January through September of WY 2019 are median flows or flows that have historically been exceeded 50 percent of the time.

The reasonable minimum volumes are determined from historical lower decile flows for all months of WY 2019. A lower decile flow is a flow that has historically been exceeded 90 percent of the time.

Upper decile volumes are determined from flows that have historically been exceeded 10 percent of the time. These values are projected for January through September of WY 2019 in the reasonable maximum inflows operating plan.

At the beginning of WY 2019, storage in Buffalo Bill Reservoir was 489,384 AF. Winter releases under all three scenarios are the same as defined by the AOP. Based on the criteria set forth in the ***Buffalo Bill Reservoir Enlargement Winter Release Operation Agreement***, the 2019 winter release will be 350 cfs. Ice in the Shoshone River can limit Reclamation's ability to change releases during the winter months due to the potential of ice jams near Lovell, Wyoming.

The Shoshone, Buffalo Bill, Heart Mountain, and Spirit Mountain Powerplants will all be available for power generation in WY 2019. Releases from Buffalo Bill Reservoir will be dependent upon the

most efficient operation of all the powerplants while providing the required flow in the Shoshone River.

Table 32. Buffalo Bill Reservoir 2019 Operating Plan Based on Oct. 1 Inflow Estimates.

BBRAOP V1.04 Run: 02-Oct-2018 10:51
Based on Most Probable April - July inflow of 690 kaf

BUFFALO BILL RESERVOIR MONTHLY OPERATIONS

Buffalo Bill Reservoir		Initial Cont	486.0 kaf		Maximum Cont	643.1 kaf		Minimum Cont	41.8 kaf			
		Elev	5373.07 ft		Elev	5393.59 ft		Elev	5259.64 ft			
2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	27.6	22.5	17.7	15.7	13.9	16.9	35.9	144.0	324.6	185.8	51.3	28.3	884.2
Shoshone Release	kaf	6.1	6.0	6.1	6.1	5.6	6.1	6.0	8.2	10.7	11.2	8.0	6.5	86.6
Non-Power Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.4	0.0	0.0	26.4
Total Flow Below Dam	kaf	6.1	6.0	6.1	6.1	5.6	6.1	6.0	8.2	10.7	37.6	8.0	6.5	113.0
Buffalo Bill Release	kaf	29.4	14.8	15.4	15.4	13.8	29.2	40.2	57.0	52.4	51.6	51.2	50.8	421.2
Municipal Delivery	kaf	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.6
Heart Mtn Release	kaf	7.3	0.0	0.0	0.0	0.1	18.6	18.0	18.6	18.0	18.6	18.6	18.0	135.8
Heart Mtn Delivery	kaf	8.0	0.0	0.0	0.0	0.0	0.0	7.0	36.0	42.0	48.0	41.0	33.0	215.0
Total Outflow	kaf	51.1	21.1	21.8	21.8	19.8	54.2	71.5	120.1	123.4	156.1	119.1	108.6	888.6
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.4	0.0	0.0	26.4
End-Month Targets	kaf	462.5	463.9			450.0				600.0	629.7		481.6	
End-Month Content	kaf	462.5	463.9	459.8	453.7	447.8	410.5	374.9	398.8	600.0	629.7	561.9	481.6	
Est Total Storage	kaf	465.9	467.3	463.2	457.1	451.2	413.9	378.3	402.2	603.4	633.1	565.3	485.0	
End-Month Elevation	ft	5369.80	5370.00	5369.42	5368.56	5367.73	5362.23	5356.73	5360.45	5388.19	5391.93	5383.26	5372.46	
Net Change Content	kaf	-23.5	1.4	-4.1	-6.1	-5.9	-37.3	-35.6	23.9	201.2	29.7	-67.8	-80.3	-4.4
Flow Below BB Pwr	kaf	35.5	20.8	21.5	21.5	19.4	35.3	46.2	65.2	63.1	89.2	59.2	57.3	534.2
Flow Below BB Pwr	cfs	577	350	350	350	349	574	776	1060	1060	1451	963	963	
Spring Inflow	kaf	3.7	3.6	3.7	3.7	3.3	3.7	3.6	3.7	3.6	3.7	3.7	3.6	43.6
Passing Cody Gage	kaf	46.5	24.4	25.2	25.2	22.8	57.6	67.8	87.5	84.7	111.5	81.5	78.9	713.6
Passing Cody Gage	cfs	756	410	410	410	411	937	1139	1423	1423	1813	1325	1326	

Shoshone Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.1	6.0	6.1	6.1	5.6	6.1	6.0	8.2	10.7	11.2	8.0	6.5	86.6
Generation	gwh	1.131	1.105	1.123	1.119	1.024	1.101	1.057	1.438	2.009	2.222	1.582	1.237	16.148
Max Generation	gwh	2.232	2.160	2.232	2.232	1.290	1.451	2.160	2.232	2.160	2.232	2.232	2.160	24.773
% Max Generation		51	51	50	50	79	76	49	64	93	100	71	57	
Ave kwh/af		185	184	184	183	183	180	176	175	188	198	198	190	186
End-Month Power Cap	mw	3	3	3	3	2	2	3	3	3	3	3	3	

Buffalo Bill Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	29.4	14.8	15.4	15.4	13.8	29.2	40.2	57.0	52.4	51.6	51.2	50.8	421.2
Generation	gwh	7.962	4.057	4.219	4.209	3.761	7.726	10.207	13.387	12.956	13.385	13.381	12.968	108.218
Max Generation	gwh	13.392	10.368	10.312	10.312	10.886	9.910	12.960	13.392	12.960	13.392	13.392	12.960	144.236
% Max Generation		59	39	41	41	35	78	79	100	100	100	100	100	
Ave kwh/af		271	274	274	273	273	265	254	235	247	259	261	255	257
End-Month Power Cap	mw	18	14	14	14	16	13	18	18	18	18	18	18	

Spirit Mtn Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	15.3	0.0	0.0	0.0	0.1	18.6	25.0	34.4	33.3	34.4	34.4	33.3	228.8
Generation	gwh	1.575	0.000	0.000	0.000	0.010	1.793	2.156	2.331	2.681	3.214	3.267	2.953	19.980
Max Generation	gwh	1.607	3.143	3.348	3.348	3.024	3.248	3.013	3.348	3.240	3.348	3.348	3.240	37.255
% Max Generation		98	0	0	0	0	55	72	70	83	96	98	91	
Ave kwh/af		103				100	96	86	68	81	93	95	89	87
End-Month Power Cap	mw	2	3	3	1	1	2	3	4	5	5	5	4	

Heart Mtn Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	7.3	0.0	0.0	0.0	0.1	18.6	18.0	18.6	18.0	18.6	18.6	18.0	135.8
Generation	gwh	1.748	0.000	0.000	0.000	0.024	4.453	4.309	4.453	4.309	4.453	4.453	4.309	32.511
Max Generation	gwh	2.143	4.190	4.464	1.875	1.572	4.464	4.320	4.464	4.320	4.464	4.464	4.320	45.060
% Max Generation		82	0	0	0	2	100	100	100	100	100	100	100	
Ave kwh/af		239				240	239	239	239	239	239	239	239	239
End-Month Power Cap	mw	3	6	6	3	2	6	6	6	6	6	6	6	

Total Generation	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	12.416	5.162	5.342	5.328	4.819	15.073	17.729	21.609	21.955	23.274	22.683	21.467	176.857
End-month Power Cap	mw	26	26	26	21	21	23	30	31	32	32	32	31	

BBRAOP V1.04 Run: 02-Oct-2018 10:51
Based on reasonable minimum April-July inflow of 455 kaf

BUFFALO BILL RESERVOIR MONTHLY OPERATIONS

Buffalo Bill Reservoir		Initial Cont		486.0 kaf		Maximum Cont		643.1 kaf		Minimum Cont		41.8 kaf	
			Elev	5373.07 ft			Elev	5393.59 ft			Elev	5259.64 ft	
2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow kaf	25.2	22.2	14.4	12.8	11.7	15.8	38.7	145.3	199.1	71.4	25.3	20.6	602.5
Shoshone Release kaf	6.1	6.0	6.1	6.1	1.8	6.1	6.0	6.1	6.0	6.2	6.2	6.0	68.7
Non-Power Release kaf	0.0	0.0	0.0	0.0	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.8
Total Flow Below Dam kaf	6.1	6.0	6.1	6.1	5.6	6.1	6.0	6.1	6.0	6.2	6.2	6.0	72.5
Buffalo Bill Release kaf	29.4	14.8	15.4	15.4	13.8	15.4	14.8	53.0	50.3	51.9	53.0	53.1	380.3
Municipal Delivery kaf	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.6
Heart Mtn Release kaf	7.3	0.0	0.0	0.0	0.1	0.0	11.3	16.9	12.5	12.3	7.8	1.6	69.8
Heart Mtn Delivery kaf	8.0	0.0	0.0	0.0	0.0	0.0	7.0	36.0	42.0	48.0	41.0	33.0	215.0
Total Outflow kaf	51.1	21.1	21.8	21.8	19.8	21.8	39.4	112.3	111.1	118.7	108.3	94.0	741.2
Spill/Waste kaf	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
End-Month Targets kaf	460.1	463.9				430.7	430.0	463.0	551.0	628.0		481.6	
End-Month Content kaf	460.1	461.2	453.8	444.8	436.7	430.7	430.0	463.0	551.0	503.7	420.7	347.3	
Est Total Storage kaf	463.5	464.6	457.2	448.2	440.1	434.1	433.4	466.4	554.4	507.1	424.1	350.7	
End-Month Elevation ft	5369.47	5369.62	5368.58	5367.30	5366.13	5365.27	5365.17	5369.87	5381.82	5375.49	5363.78	5352.31	
Net Change Content kaf	-25.9	1.1	-7.4	-9.0	-8.1	-6.0	-0.7	33.0	88.0	-47.3	-83.0	-73.4	-138.7
Flow Below BB Pwr kaf	35.5	20.8	21.5	21.5	19.4	21.5	20.8	59.1	56.3	58.1	59.2	59.1	452.8
Flow Below BB Pwr cfs	577	350	350	350	349	350	350	961	946	945	963	993	
Spring Inflow kaf	3.7	3.6	3.7	3.7	3.3	3.7	3.6	3.7	3.6	3.7	3.7	3.6	43.6
Passing Cody Gage kaf	46.5	24.4	25.2	25.2	22.8	25.2	35.7	79.7	72.4	74.1	70.7	64.3	566.2
Passing Cody Gage cfs	756	410	410	410	411	410	600	1296	1217	1205	1150	1081	

Shoshone Power 2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release kaf	6.1	6.0	6.1	6.1	1.8	6.1	6.0	6.1	6.0	6.2	6.2	6.0	68.7
Generation gwh	1.130	1.103	1.120	1.114	0.327	1.104	1.084	1.113	1.133	1.184	1.141	1.051	12.604
Max Generation gwh	2.232	2.160	2.232	2.232	0.331	1.451	2.160	2.232	2.160	2.232	2.232	2.160	23.814
% Max Generation	51	51	50	50	99	76	50	50	52	53	51	49	
Ave kwh/af	185	184	184	183	182	181	181	182	189	191	184	175	183
End-Month Power Cap mw	3	3	3	3	0	2	3	3	3	3	3	3	

Buffalo Bill Power 2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release kaf	29.4	14.8	15.4	15.4	13.8	15.4	14.8	53.0	50.3	51.9	53.0	53.1	380.3
Generation gwh	7.958	4.052	4.210	4.195	3.744	4.164	3.966	13.027	12.685	13.119	13.226	12.942	97.288
Max Generation gwh	13.392	10.368	10.312	10.312	10.886	9.910	12.960	13.392	12.960	13.392	13.392	12.960	144.236
% Max Generation	59	39	41	41	34	42	31	97	98	98	99	100	
Ave kwh/af	271	274	273	272	271	270	268	246	252	253	250	244	256
End-Month Power Cap mw	18	14	14	14	16	13	18	18	18	18	18	18	

Spirit Mtn Power 2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release kaf	15.3	0.0	0.0	0.0	0.1	0.0	18.3	34.4	33.3	34.4	34.4	33.3	203.5
Generation gwh	1.572	0.000	0.000	0.000	0.010	0.000	1.812	2.710	2.843	2.958	2.846	2.557	17.308
Max Generation gwh	1.607	3.143	3.348	3.348	3.024	3.248	3.013	3.348	3.240	3.348	3.348	3.240	37.255
% Max Generation	98	0	0	0	0	0	60	81	88	88	85	79	
Ave kwh/af	103				100		99	79	85	86	83	77	85
End-Month Power Cap mw	2	3	3	1	1	2	3	4	4	4	4	3	

Heart Mtn Power 2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release kaf	7.3	0.0	0.0	0.0	0.1	0.0	11.3	16.9	12.5	12.3	7.8	1.6	69.8
Generation gwh	1.748	0.000	0.000	0.000	0.024	0.000	2.705	4.046	2.992	2.944	1.867	0.383	16.709
Max Generation gwh	2.143	4.190	4.464	1.875	1.572	4.464	4.320	4.464	4.320	4.464	4.464	4.320	45.060
% Max Generation	82	0	0	0	2	0	63	91	69	66	42	9	
Ave kwh/af	239				240		239	239	239	239	239	239	239
End-Month Power Cap mw	3	6	6	3	2	6	6	6	6	6	6	6	

Total Generation 2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation gwh	12.408	5.155	5.330	5.309	4.105	5.268	9.567	20.896	19.653	20.205	19.080	16.933	143.909
End-month Power Cap mw	26	26	26	21	19	23	30	31	31	31	31	30	

BBRAOP V1.04 Run: 02-Oct-2018 10:51
Based on reasonable maximum April-July inflow of 1,049 kaf

BUFFALO BILL RESERVOIR MONTHLY OPERATIONS

Buffalo Bill Reservoir		Initial Cont Elev	486.0 kaf 5373.07 ft			Maximum Cont Elev	643.1 kaf 5393.59 ft			Minimum Cont Elev	41.8 kaf 5259.64 ft		
2018		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Monthly Inflow	kaf	32.1	27.0	20.6	17.4	15.6	23.7	57.6	226.8	458.6	306.2	76.9	36.2	1298.7
Shoshone Release	kaf	6.2	6.0	6.2	6.1	5.6	7.6	12.5	13.2	11.8	11.3	11.3	11.4	109.2
Non-Power Release	kaf	0.0	0.0	0.0	0.0	0.0	0.0	32.6	91.7	91.7	145.9	13.7	11.7	387.3
Total Flow Below Dam	kaf	6.2	6.0	6.2	6.1	5.6	7.6	45.1	104.9	103.5	157.2	25.0	23.1	496.5
Buffalo Bill Release	kaf	38.3	14.8	15.3	15.4	13.8	37.7	52.6	57.2	53.3	51.9	51.2	50.7	452.2
Municipal Delivery	kaf	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3.6
Heart Mtn Release	kaf	7.3	0.0	0.0	0.0	0.1	18.6	18.0	18.6	18.0	18.6	18.6	18.0	135.8
Heart Mtn Delivery	kaf	8.0	0.0	0.0	0.0	0.0	0.0	7.0	36.0	42.0	48.0	41.0	33.0	215.0
Total Outflow	kaf	60.1	21.1	21.8	21.8	19.8	64.2	123.0	217.0	217.1	276.0	136.1	125.1	1303.1
Spill/Waste	kaf	0.0	0.0	0.0	0.0	0.0	0.0	32.6	91.7	91.7	145.9	13.7	11.7	387.3
End-Month Targets	kaf	458.0	463.9			454.1				599.5	629.7		481.6	
End-Month Content	kaf	458.0	463.9	462.7	458.3	454.1	413.6	348.2	358.0	599.5	629.7	570.5	481.6	
Est Total Storage	kaf	461.4	467.3	466.1	461.7	457.5	417.0	351.6	361.4	602.9	633.1	573.9	485.0	
End-Month Elevation	ft	5369.17	5370.00	5369.83	5369.21	5368.62	5362.71	5352.46	5354.04	5388.13	5391.93	5384.38	5372.46	
Net Change Content	kaf	-28.0	5.9	-1.2	-4.4	-4.2	-40.5	-65.4	9.8	241.5	30.2	-59.2	-88.9	-4.4
Flow Below BB Pwr	kaf	44.5	20.8	21.5	21.5	19.4	45.3	97.7	162.1	156.8	209.1	76.2	73.8	948.7
Flow Below BB Pwr	cfs	724	350	350	350	349	737	1642	2636	2635	3401	1239	1240	
Spring Inflow	kaf	3.7	3.6	3.7	3.7	3.3	3.7	3.6	3.7	3.6	3.7	3.7	3.6	43.6
Passing Cody Gage	kaf	55.5	24.4	25.2	25.2	22.8	67.6	119.3	184.4	178.4	231.4	98.5	95.4	1128.1
Passing Cody Gage	cfs	903	410	410	410	411	1099	2005	2999	2998	3763	1602	1603	

Shoshone Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Shoshone Release	kaf	6.2	6.0	6.2	6.1	5.6	7.6	12.5	13.2	11.8	11.3	11.3	11.4	109.2
Generation	gwh	1.148	1.104	1.142	1.122	1.027	1.375	2.166	2.232	2.166	2.224	2.229	2.165	20.100
Max Generation	gwh	2.232	2.160	2.232	2.232	1.290	1.451	2.160	2.232	2.160	2.232	2.232	2.160	24.773
% Max Generation		51	51	51	50	80	95	100	100	100	100	100	100	
Ave kwh/af		185	184	184	184	183	181	173	169	184	197	197	190	184
End-Month Power Cap	mw	3	3	3	3	2	2	3	3	3	3	3	3	

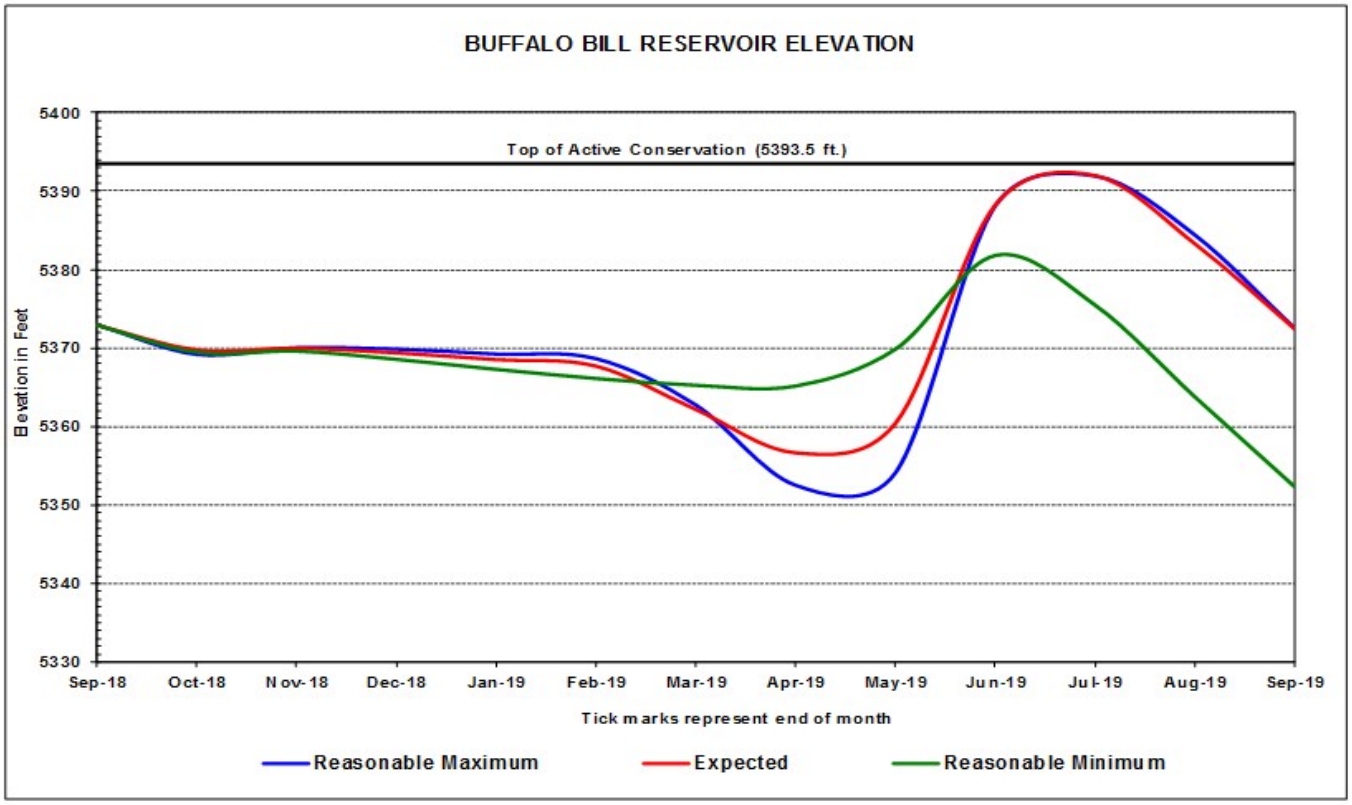
Buffalo Bill Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Buffalo Bill Release	kaf	38.3	14.8	15.3	15.4	13.8	37.7	52.6	57.2	53.3	51.9	51.2	50.7	452.2
Generation	gwh	10.263	4.053	4.194	4.216	3.771	9.900	12.968	13.090	12.952	13.386	13.392	12.957	115.142
Max Generation	gwh	13.392	10.368	10.312	10.312	10.886	9.910	12.960	13.392	12.960	13.392	13.392	12.960	144.236
% Max Generation		77	39	41	41	35	100	100	98	100	100	100	100	
Ave kwh/af		268	274	274	274	273	263	247	229	243	258	262	256	255
End-Month Power Cap	mw	18	14	14	14	16	13	18	18	18	18	18	18	

Spirit Mtn Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Spirit Mtn Release	kaf	15.3	0.0	0.0	0.0	0.1	18.6	25.0	34.4	33.3	34.4	34.4	33.3	228.8
Generation	gwh	1.540	0.000	0.000	0.000	0.010	1.767	2.008	2.158	2.577	3.207	3.284	2.973	19.524
Max Generation	gwh	1.607	3.143	3.348	3.348	3.024	3.248	3.013	3.348	3.240	3.348	3.348	3.240	37.255
% Max Generation		96	0	0	0	0	54	67	64	80	96	98	92	
Ave kwh/af		101				100	95	80	63	77	93	95	89	85
End-Month Power Cap	mw	2	3	3	1	1	2	3	3	5	5	5	4	

Heart Mtn Power	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Heart Mtn Release	kaf	7.3	0.0	0.0	0.0	0.1	18.6	18.0	18.6	18.0	18.6	18.6	18.0	135.8
Generation	gwh	1.748	0.000	0.000	0.000	0.024	4.453	4.309	4.453	4.309	4.453	4.453	4.309	32.511
Max Generation	gwh	2.143	4.190	4.464	1.875	1.572	4.464	4.320	4.464	4.320	4.464	4.464	4.320	45.060
% Max Generation		82	0	0	0	2	100	100	100	100	100	100	100	
Ave kwh/af		239				240	239	239	239	239	239	239	239	239
End-Month Power Cap	mw	3	6	6	3	2	6	6	6	6	6	6	6	

Total Generation	2018	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Total Generation	gwh	14.699	5.157	5.336	5.338	4.832	17.495	21.451	21.933	22.004	23.270	23.358	22.404	187.277
End-month Power Cap	mw	26	26	26	21	21	23	30	30	32	32	32	31	

BUFFALO BILL RESERVOIR



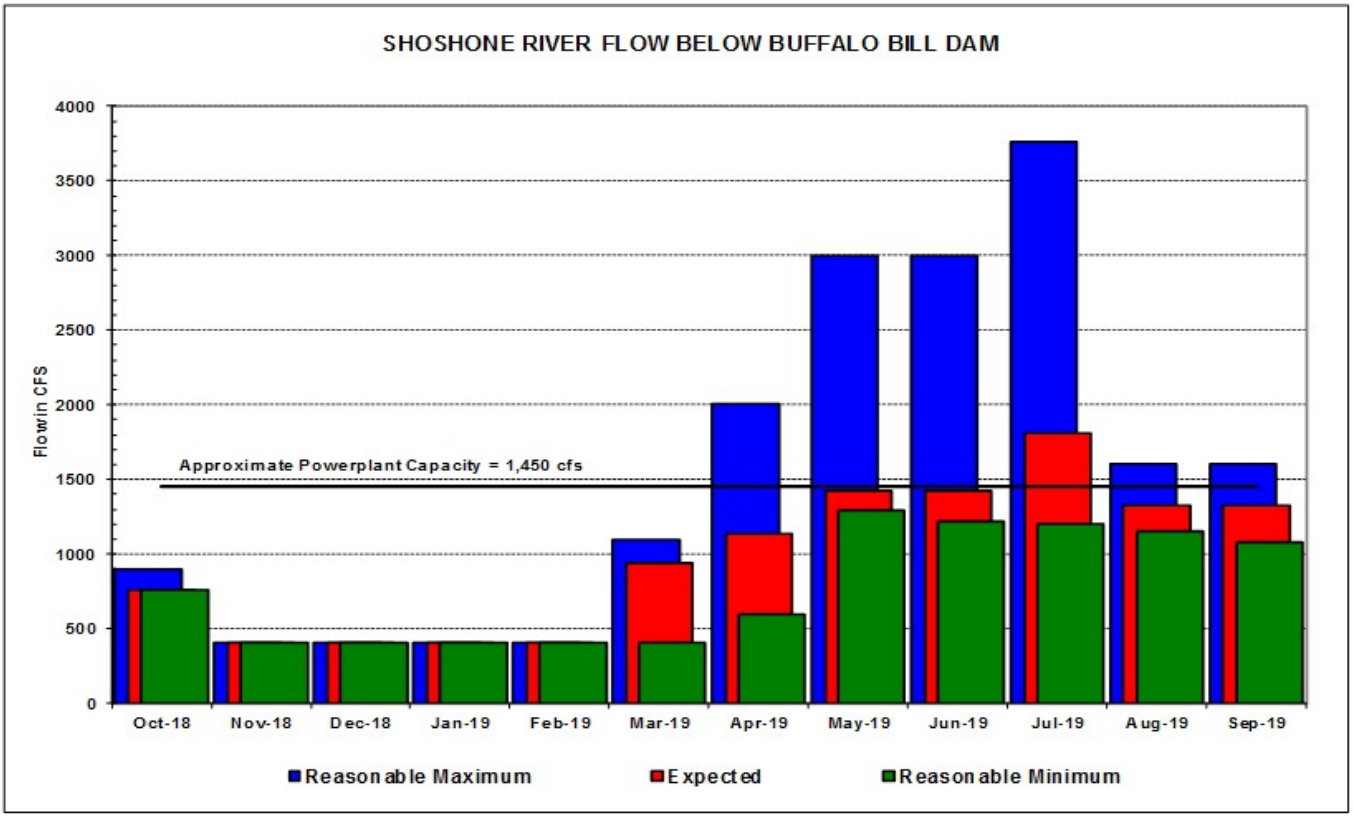


Figure 35. The project operations for three inflow scenarios for Buffalo Bill Reservoir

Table 33. Water Year 2019 Scheduled Outages for Bighorn Powerplants.

ID	Task Name	Start	Finish
239	**Big Horn**		
240	**Buffalo Bill**		
241	Buffalo Bill KZ1A		
251	**Buffalo Bill Unit One**		
252	**Annual**	**Tue 11/13/18**	**Thu 12/13/18**
253	Functional Testing	Mon 12/3/18	Thu 12/6/18
254	**Buffalo Bill Unit Two**		
255	**Annual**	**Mon 12/17/18**	**Thu 1/3/19**
256	**Buffalo Bill Unit Three**		
257	**Annual**	**Mon 3/18/19**	**Thu 3/28/19**
258	Neutral Grounding Transformer Testing	Mon 3/18/19	Thu 3/28/19
259	Neutral Grounding Transformer to Generator Cable	Mon 3/18/19	Thu 3/28/19
260	Stator Hi pot	Mon 3/18/19	Thu 3/28/19
261	Rotor Testing	Mon 3/18/19	Thu 3/28/19
262	Generator to Breaker Cable Hi pot	Mon 3/18/19	Thu 3/28/19
263	Unit Unavailable due to KZ2A outage	Mon 3/25/19	Thu 3/28/19
264	**Spirit Mountain**		
265	**Spirit Mountain Unit One**		
266	**Annual**	**Mon 10/22/18**	**Thu 11/8/18**
267	SCC Free Flow Walk Through Inspection	**Mon 3/15/19**	**Tue 3/16/19**
268	**Shoshone**		
269	**Shoshone Unit Three**		
270	**Annual**	**Tue 2/19/19**	**Fri 3/8/19**
271	Penstock Inspection	Tue 2/19/19	Thu 3/7/19
272	Breaker 1018	Tue 2/19/19	Thu 3/7/19
273	Draft Tube Inspection	Tue 2/19/19	Thu 3/7/19
274	Heat Run	Fri 3/8/19	Fri 3/8/19
275	**Unit Unavailable due to Buffalo Bill Bus 2 outage**	**Mon 3/25/19**	**Thu 3/28/19**
276	**Heart Mountain**		
282	**Heart Mountain Unit One**		
283	**Unavailable due to Spirit Mountain Annual Transformer**	**Mon 10/22/18**	**Thu 11/8/18**
284	Station Serivce Breaker status investigation	Mon 10/22/18	Tue 11/6/18
285	**Annual**	**Mon 1/14/19**	**Thu 2/7/19**
286	Neutral Grounding Transformer Testing	Mon 1/14/19	Thu 1/31/19
287	Neutral Grounding Transformer to Generator cable	Mon 1/14/19	Thu 1/31/19
288	Stator Hi pot	Mon 1/14/19	Thu 1/31/19
289	Rotor Testing	Mon 1/14/19	Thu 1/31/19
290	Breaker 104	Mon 1/14/19	Thu 1/31/19
291	Breaker 114	Mon 1/14/19	Thu 1/31/19
292	Breaker 124	Mon 1/14/19	Thu 1/31/19
293	Stator to Breaker Cable Hi pot	Mon 1/14/19	Thu 1/31/19
294	Functional Testing	Mon 2/4/19	Thu 2/7/19
295	**SCC Free Flow Walk Through Inspection**	**Mon 3/15/19**	**Tue 3/16/19**
296	**Boysen**		
297	**Boysen Unit One**		
298	**Ring Seal Gate Inspection Unit Unavailable**	**Tue 10/16/18**	**Thu 11/1/18**
299	**Annual**	**Tue 1/8/19**	**Tue 3/5/19**
300	BO U1 Stator	Tue 2/19/19	Thu 2/21/19
301	Governor Alignment	Mon 2/18/19	Wed 2/20/19
302	**Boysen Unit Two**		
303	**Ring Seal Gate Inspection Unit Unavailable**	**Tue 10/16/18**	**Thu 11/1/18**
304	**Annual**	**Mon 10/29/18**	**Thu 12/13/18**
305	BO U2 Stator	Mon 11/5/18	Thu 11/8/18

Annual Operating Plans for Water Year 2018 for Units Under the Responsibility of the Dakota Area Office

Weather Summary for North and South Dakota Water Year (WY) 2018

October precipitation was below normal at Keyhole reservoir; much below normal at Angostura, Deerfield, and Pactola reservoirs; very much below normal at Belle Fourche, Dickinson, Heart Butte, Jamestown, and Shadehill.

November precipitation was much above normal at Pactola reservoir; normal at Deerfield reservoir; below normal at Angostura, and Shadehill reservoirs; much below normal at Belle Fourche and Keyhole reservoirs, and very much below normal at Dickinson, Heart Butte and Jamestown reservoirs.

December precipitation was much above normal at Deerfield reservoir; normal at Angostura and Pactola reservoirs; below normal at Belle Fourche, Dickinson, and Heart Butte reservoirs; much below normal at Keyhole and Shadehill Reservoirs; and very much below normal at Jamestown reservoir.

January precipitation was much above normal at Deerfiled and Pactola reservoirs; normal at Angostura and Keyhole reservoirs; below normal at Belle Fourche and Heart Butte reservoirs; much below normal at Shadehill reservoir; much below normal at Dickinson and Jamestown reservoirs.

February precipitation was much above normal at Angostura, Belle Fourche, Deerfield, Keyhole, and Pactola reservoirs; below normal at Heart Butte and Shadehill reservoirs; much below normal at Dickinson reservoir; very much below normal at Jamestown reservoir.

March precipitation was very much above normal at Deerfiled reservoir; much above normal at Heart Butte and Shadehill reservoirs; above normal at Angostura and Keyhole reservoirs; normal at Belle Fourche, Dickinson, and Pactola reservoirs; much below normal at Jamestown reservoir.

April precipitation was much above normal at Shadehill reservoir; above normal at Deerfield reservoir; normal at Keyhole reservoir; below normal at Belle Fourche, Heart Butte and Pactola reservoirs; much below normal at Angostura and Deerfield reservoirs; and very much below normal at Jamestown reservoir.

May precipitation was very much above normal at Angostura and Deerfiled reservoirs; above normal at Pactola reservoir; normal at Belle Fourche, Deerfield, Jamestown, Keyhole, and Shadehill reservoirs; much below normal at Heart Butte reservoir.

June precipitation was very much above normal at Belle Fourche, Deerfield, Heart Butte, Keyhole, and Pactola reservoirs; much above normal at Dickinson reservoir; above normal at Angostura, and Jamestown reservoirs; below normal at Shadehill reservoir.
July precipitation was much above normal at Deerfield, Keyhole, and Pactola reservoirs; above normal at Angostura, Heart Butte, and Jamestown reservoirs; normal at Belle Fourche and Dickinson reservoirs; below normal at Shadehill reservoir.

August precipitation was much above normal at Belle Fourche and Keyhole reservoirs; above normal at Jamestown reservoir; normal at Deerfield, and Pactola reservoirs; below normal at Angostura reservoir; much below normal at Heart Butte reservoir; and very much below normal at Dickinson and Shadehill reservoirs.

September precipitation was very nuch above normal at Belle Fourche reservoir; much above normal at Keyhole reservoir; above normal at Pactola and Shadehill reservoirs; normal at Deerfield and Dickinson reservoirs; below normal at Angostura, Heart Butte, and Jamestown reservoirs.

Total annual precipitation for Reclamation facilities in North Dakota, South Dakota, and northeastern Wyoming are shown on Table 34. Changes in storage can be found in Table 35.

Table 34. Total Annual Precipitation for Reclamation Reservoirs in Inches.

Total Annual Precipitation for Reclamation Reservoirs in North Dakota, South Dakota, and Northeastern Wyoming in Inches			
Reservoir	**2018 Total**	**Average Total**	**Percent**
Angostura 1/	19.65	17.67	111
Belle Fourche 2/	21.97	15.86	139
Deerfield 3/	22.06	13.99	158
Keyhole 4/	26.00	19.20	135
Pactola	30.91	20.58	150
Shadehill 5/	14.45	17.86	81
Dickinson	14.12	15.77	90
Heart Butte	16.63	16.27	102
Jamestown	19.38	18.77	103

1/ Angostura Reservoir's annual precipitation data is from the Hot Springs, SD, climate station.
2/ Belle Fourche Reservoir's annual precipitation data is from the Newell, SD climate station.
3/ Deerfield reservoir's annual and average precipitation data is from the Deerfield, Dam flip bucket rain gauge recorded by Hydromet.
4/ Keyhole Reservoir's annual precipitation data is from the Sundance, WY climate station.
5/ Shadehill Reservoir's annual precipitation data is from the Lemmon, SD climate station.

Table 35. Displays changes in storage content between Sep. 30, 2017 and Sep. 30, 2018 at reservoirs in North and South Dakota and Eastern Wyoming.

Comparison of End-of-Water-Year Storage Content for Reservoirs in North Dakota, South Dakota, and Northeastern Wyoming in AF			
Reservoir	**Storage September 30, 2017**	**Storage September 30, 2018**	**Change in Storage**
Angostura	83,475	101,605	18,130
Belle Fourche	58,373	128,562	70,189
Deerfield	15,474	15,019	-455
Keyhole	122,129	158,110	35,981
Pactola	51,288	53,403	2,115
Shadehill	85,760	110,832	25,072
Dickinson	5,898	7,236	1,338
Heart Butte	51,387	58,336	6,979
Jamestown	29,408	27,787	-1,621

Flood Benefits

Reservoirs in North and South Dakota and Northeastern Wyoming

Several Bureau of Reclamation reservoirs in northeastern Wyoming, South Dakota, and North Dakota provided flood relief during WY 2018. They are: E.A. Patterson on the Heart River near Dickinson, North Dakota; Heart Butte on the Heart River near Glen Ullin, North Dakota; Jamestown on the James River near Jamestown, North Dakota; Shadehill on the Grand River near Lemmon, South Dakota; Angostura on the Cheyenne River near Hot Springs, South Dakota; Pactola on Rapid Creek near Rapid City, South Dakota; Keyhole on the Belle Fourche River near Moorcroft, Wyoming.

The information on the distribution of flood damages prevented is provided by the United States Army Corps of Engineers. The distributions of flood damages prevented for each reservoir can be found in Table 36 and Figure 36.

Table 36. Flood damages prevented by DKAO reservoirs between Garrison and Gavin's Point Dams.

Flood Damage Prevented in 2018 Accumulated Total 1950-2018 (unadjusted) (Thousands of dollars)					
	Local	**Main-Stem**	**2018 Total**	**Previous Accumulations**	**1950-2018 Accumulated Totals**
Heart Butte	$0	$69.4	$69.4	$16,183.1	$16,252.5
Shadehill	$0	$26.2	$26.2	$12,770.2	$12,796.4
Angostura	$0	$0	$0	$22,600	$22,600
Pactola	$17.3	$53.0	$70.3	$3,769.0	$3,839.3
Keyhole	$0	$84.8	$84.8	$4,703.2	$4,788.0
Jamestown	$0	$0	$0	$216,305.6	$216,305.6
Total	$17.3	$233.4	$250.7	$276,331.1	$276,581.8

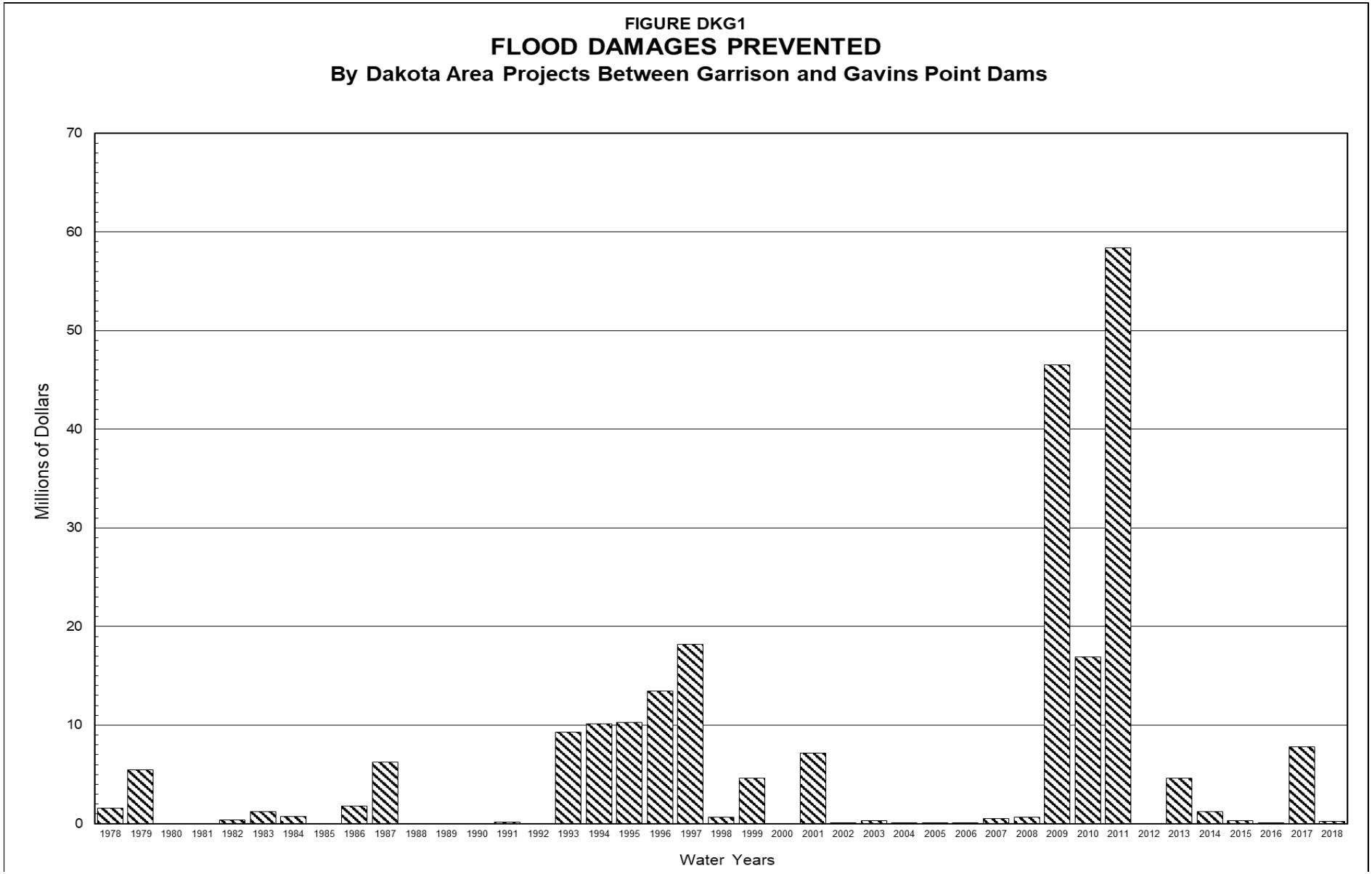


Figure 36. Flood damages prevented by DKAO reservoirs between Garrison and Gavin's Point Dams.

Unit Operational Summaries for WY 2018

Dickinson Reservoir

Background

Dickinson Dam and Edward Arthur Patterson Lake (Dickinson Reservoir) is located on the Heart River one mile west of Dickinson, North Dakota. The reservoir has a dead capacity of 356 acre-feet (AF), an inactive capacity of 100 AF and an active conservation capacity of 8,156 AF (for a total storage capacity of 8,612 AF at the top of conservation elevation 2,420.00 feet). Reservoir water is used for irrigating approximately 230 acres along the Heart River downstream of the dam and for municipal use by the Dickinson Parks and Recreation District.

WY 2018 Operations Summary

Dickinson Reservoir started WY 2018 at elevation 2,417.43 feet and storage of 5,898 acre-feet (AF), which is 2.57 feet, and 2,714 AF below the top of the conservation pool (elevation 2420.00 feet and storage 8,612 AF). Dickinson Reservoir peaked at elevation 2,420.71 feet on March 26 with 9,487 AF of storage. The minimum reservoir elevation for WY 2018 was 2,417.36 feet with storage of 5,833 AF occurred on October 31, 2017. The reservoir elevation on September 30, 2018 was 2,418.78 feet with storage of 7,236 AF, which is 1.22 feet, and 1,376 AF below the top of conservation pool.

The maximum instantaneous discharge of 1,703 cfs occurred on March 27, 2018. Reservoir net inflows for water year 2018 were the twenty-sixth highest on record for the dam and totaled 19,124 AF, 97 percent of average. The maximum 24 hour computed inflow occurred on March 27, 2018 with 1,601 cfs. Precipitation for the water year totaled 14.12 inches, which is 90 percent of average.

194 AF of water was released specifically for downstream irrigation.

An Emergency Management program, orientation seminar and communication's drill were conducted on February 28, 2018.

On March 25, 2018, E.A. Paterson Reservoir (Dickinson Dam) went into internal alert with a reservoir elevation over 2,420.00 feet and remained there until July 20, when the reservoir elevation decreased below elevation 2,420.00 feet and normal operations resumed.

A Comprehensive Review (CR) mechanical examination was conducted on June 19, 2018 by personnel from Denver TSC, Great Plains Regional Office and the Dakotas Area Office.

A Comprehensive Review (CR) civil examination was conducted on August 13, 2018 by personnel from Denver TSC, Great Plains Regional Office and the Dakotas Area Office.

Monthly Statistics for WY 2018

Record and near record monthly inflows in 67 years of record keeping were recorded in the following months: November had its sixteenth lowest inflow, December had its twentieth lowest inflow, January had its fourteenth lowest inflow, March had its fourteenth highest inflow, July had its fourteenth highest inflow, August had its fourteenth lowest inflow, and September had its eighteenth lowest inflow.

Record or near record monthly end of month content in 67 years of record keeping were recorded in the following months: March had its eleventh highest storage, April had its twelfth highest storage, May had its fifteenth highest storage, June had its eleventh highest storage, July had its fourteenth highest storage, August had its fourteenth highest storage, and September had its twelfth highest storage.

Additional statistical information on Dickinson Reservoir and its operations during 2018 can be found in Table 37 and Figure 37.

Table 37. Hydrologic Data for Dickinson Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE	2,405.00	438	438
TOP OF ACTIVE CONSERVATION	2,420.00	8,452	8,014
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,417.43	5,898	OCT 01, 2017
END OF YEAR	2,418.78	7,236	SEP 30, 2018
ANNUAL LOW	2,417.36	5,833	OCT 31, 2017
ANNUAL HIGH	2,420.71	9,487	MAR 26, 2018
HISTORIC HIGH	2,422.19	***9,348	MAR 21, 1997

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	19,124	OCT 17-SEP 18	17,785	OCT 17-SEP 18
DAILY PEAK (CFS)*	1,601	MAR 27, 2018	1,703	MAR 27, 2018
DAILY MINIMUM (CFS)**	0	**	0	**

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	-65	NA	0	NA	5,833	106
NOVEMBER	10	6	0	NA	5,843	107
DECEMBER	45	34	0	NA	5,888	108
JANUARY	0	NA	0	NA	5,888	106
FEBRUARY	244	22	0	NA	6,132	104
MARCH	13,879	205	10,851	189	9,160	131
APRIL	2,709	60	2,857	66	9,012	126
MAY	107	4	519	20	8,600	121
JUNE	209	90	1,752	74	8,938	126
JULY	826	98	1,459	107	8,305	127
AUGUST	-458	NA	299	36	7,548	125
SEPTEMBER	-262	NA	50	123	7,236	126
ANNUAL	19,124	97	17,785	91		
APRIL-JULY	5,732	57				

* 24 hour daily inflow and 15 minute instantaneous discharge
** Frequently observed during fall and winter months
*** Due to new area-capacity table, the capacity that corresponds to the new historic high elevation is less than a previous historic high capacity amount (11,520 AF @ Elevation 2,421.08 feet on June 9, 1982)

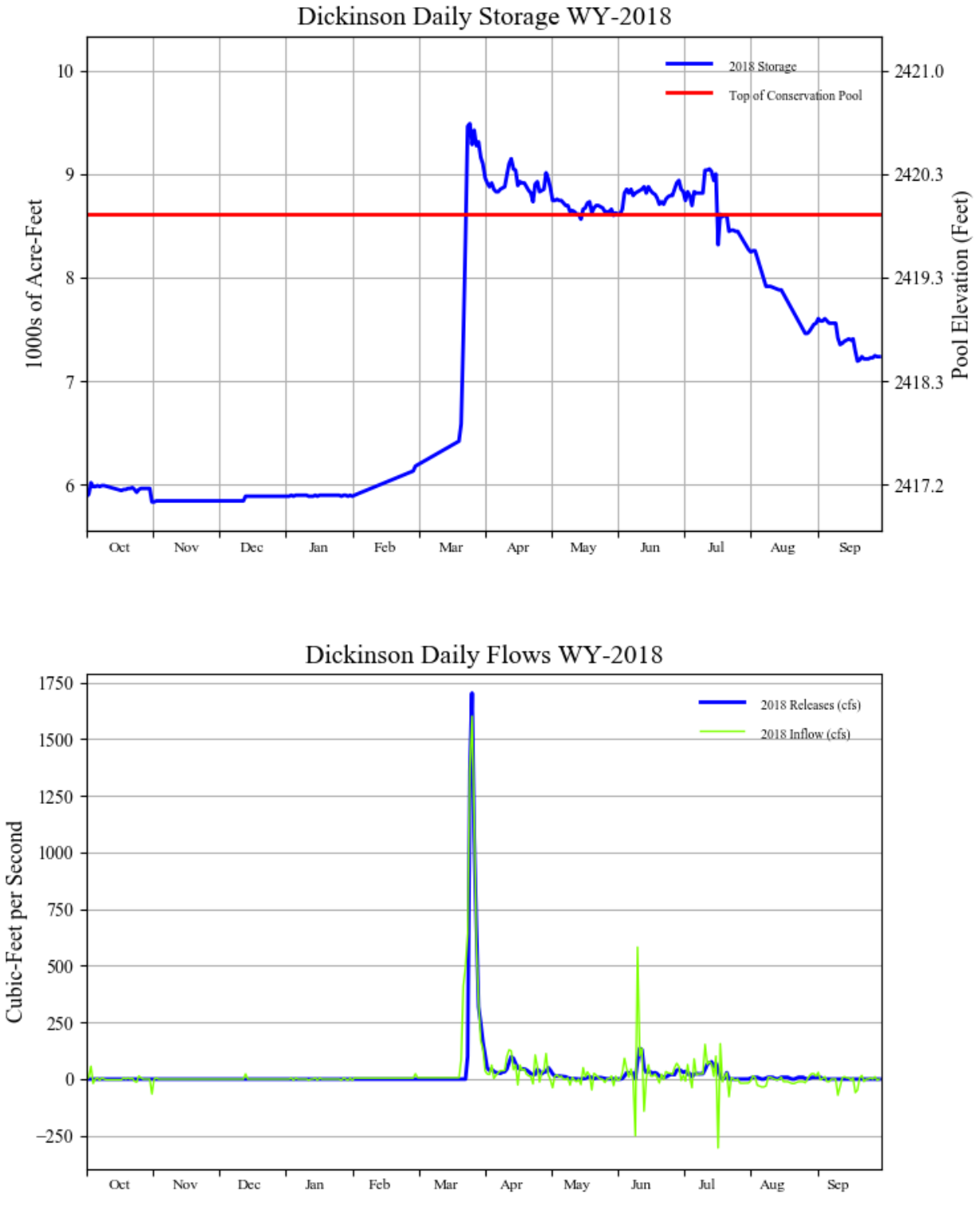


Figure 37. Hydrologic Data for Dickinson Dam.

Heart Butte Reservoir

Background

Heart Butte Dam and Lake Tschida (Heart Butte Reservoir) is located on the Heart River 15 miles south of Glen Ullin, North Dakota. The reservoir has a dead storage capacity of 5,227 AF, an active conservation capacity of 61,915 AF (for a total storage capacity of 67,142 AF at the top of active conservation elevation 2,064.50 feet), and an exclusive flood control space of 147,027 AF. Flood control storage is located above the crest of an ungated morning glory inlet spillway. Heart Butte Reservoir is primarily used for flood control and the authorized irrigation of up to 13,100 acres of which about 7,320 acres are now being irrigated.

WY 2018 Operations Summary

Heart Butte Reservoir started WY 2018 at elevation 2,059.38 feet and storage of 51,387 AF, which is 5.12 feet, and 15,755 AF below the top of conservation pool (elevation 2,064.50 feet and storage 67,142 AF). Heart Butte Reservoir peaked at elevation 2,067.46 feet on March 30 with 77,285 AF of storage. The minimum reservoir elevation for WY 2018 was 2,059.38 feet and storage of 51,387 AF occurred on October 10, 2017. The reservoir elevation on September 30, 2018 was 2,061.74 feet with storage of 58,366 AF, which is 2.76 feet and 8,776 AF below the top of conservation pool.

A maximum discharge of 1,269 cfs occurred on March 31. Reservoir net inflows for water year 2018 were the thirty-third lowest on record for the dam and totaled 61,817 AF, 72 percent of average. The maximum 24 hour computed inflow occurred on March 28, 2018 with 4,617 cfs. Precipitation for the water year totaled 16.63 inches, which is 102 percent of average.

2,975 AF was released specifically for downstream irrigation.

An Emergency Management program, orientation seminar and communication's drill were conducted on March 11, 2018.

On March 28, 2018, Lake Tschida Reservoir (Heart Butte Dam) went into internal alert with a reservoir elevation over 2,064.50 feet. The reservoir elevation continued to climb and on March 30, went into Response Level 1, when the reservoir elevation rose over 2,067.00 feet and remained there until April 2, when the reservoir elevation dropped below elevation 2,067.00 feet and internal alert was resumed, then on April 17, when the reservoir elevation dropped below elevation 2,064.50 feet and normal operations resumed.

A Comprehensive Review (CR) mechanical examination was conducted on June 19, 2018 by personnel from Denver Technical Sevice Center (TSC), Great Plains Regional Office and the Dakotas Area Office.

A CR civil examination was conducted on August 12, 2018 by personnel from Denver TSC, Great Plains Regional Office and the Dakotas Area Office.

Monthly Statistics for WY 2018

Record and near record monthly inflows in 69 years of record keeping were recorded in the following months: December had its sixteenth highest inflow, and September had its eighteenth highest inflow.

Record or near record monthly end of month content in 69 years of record keeping were recorded in the following months: October had its eleventh lowest storage, November had its twelfth lowest storage, December had its fourteenth lowest storage, January had its fourteenth lowest storage, April had its twelfth lowest storage, May had its lowest storage, and June had its thirteenth lowest inflow.

Additional statistical information on Heart Butte Reservoir and its operations during 2018 can be found in Table 38 and Figure 38.

Table 38. Hydrologic Data for Heart Butte Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,030.00	4,328	4,328
TOP OF ACTIVE CONSERVATION	2,064.50	65,091	60,763
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	2,094.50	212,696	147,605

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	2,059.38	51,387	OCT 01, 2017
END OF YEAR	2,061.74	58,366	SEP 30, 2018
ANNUAL LOW	2,059.38	51,387	OCT 19, 2017
ANNUAL HIGH	2,067.46	77,285	MAR 30, 2018
HISTORIC HIGH	2,086.23	173,203	APR 09, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	61,817	OCT 17-SEP 18	54,838	OCT 17-SEP 18
DAILY PEAK (CFS)	4,617	MAR 28, 2018	1,269	MAR 31, 2018
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	125	8	11	NA	51,501	88
NOVEMBER	1,183	93	582	41	52,102	90
DECEMBER	1,209	133	603	47	52,708	91
JANUARY	748	63	604	52	52,852	92
FEBRUARY	837	23	546	26	53,143	90
MARCH	30,969	111	7,005	40	77,107	111
APRIL	15,625	64	32,887	135	59,845	86
MAY	2,895	28	1,710	16	61,030	88
JUNE	5,279	51	3,415	36	62,894	90
JULY	3,038	74	3,863	50	62,069	94
AUGUST	-771	NA	2,932	53	58,366	94
SEPTEMBER	679	136	679	24	58,366	98
ANNUAL	61,817	71	54,838	63		
APRIL-JULY	26,837	62				

* Frequently observed during fall and winter months

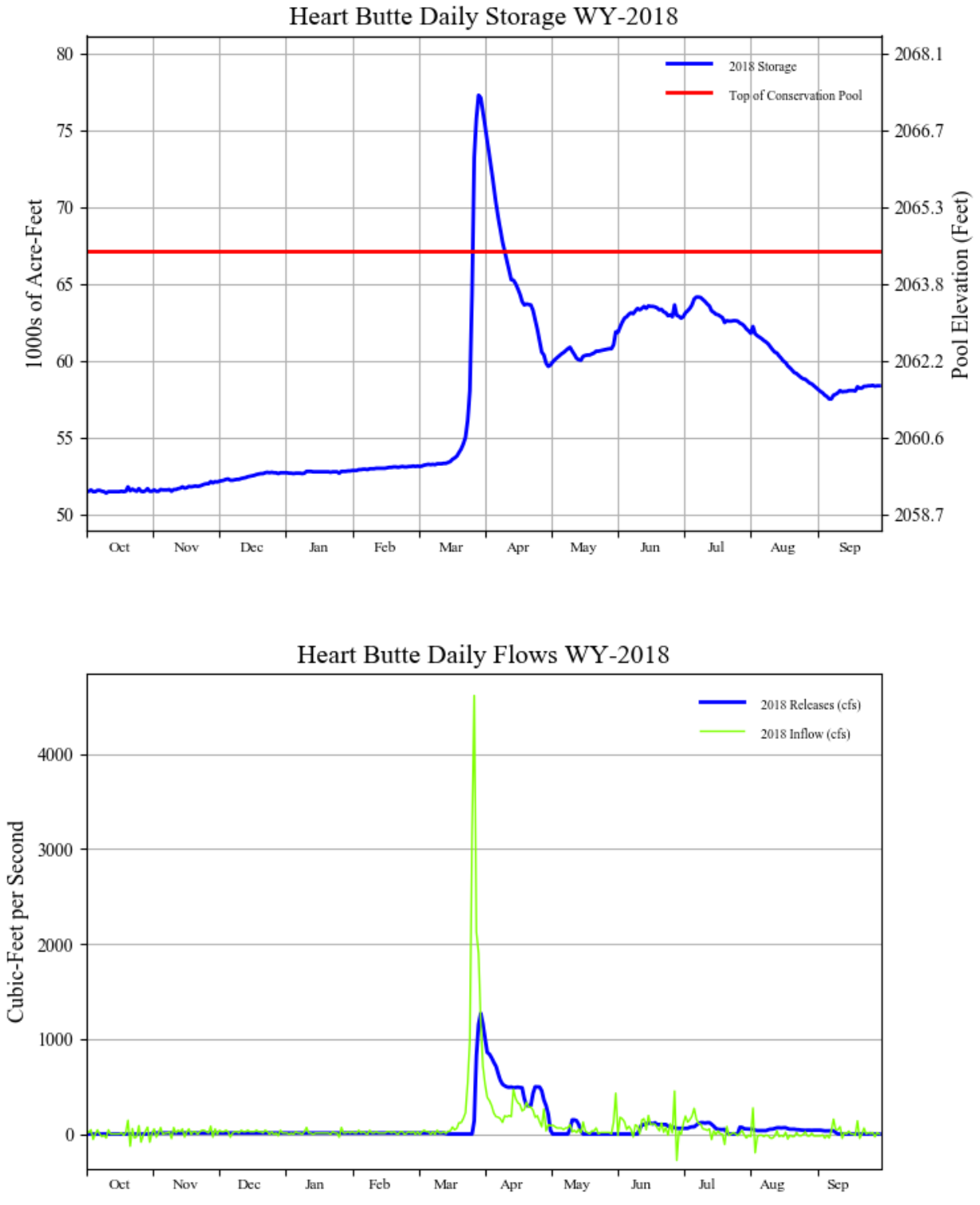


Figure 38. Hydrologic Data for Heart Butte Reservoir.

Jamestown Reservoir

Background

Jamestown Reservoir is located on the James River just above the city of Jamestown, North Dakota. The reservoir has a dead capacity of 292 AF, an active conservation capacity of 23,934 AF (for a total top of active conservation capacity of 24,226 AF at elevation 1,428.00 feet), a joint-use capacity of 6,262 AF, and an exclusive flood control space of 190,502 AF. Exclusive flood control storage is located below the crest of an ungated morning glory inlet spillway and flood control releases are controlled by two gated outlets. The joint-use space is available for flood control at the beginning of spring runoff and is used for conservation purposes during the summer months.

WY 2018 Operations Summary

Jamestown Reservoir started WY 2018 at elevation 1,430.53 feet and storage of 29,408 AF, which is 2.53 feet, and 5,182 AF above the top of the conservation pool (elevation 1,428.00 feet and storage 24,226 AF). Jamestown Reservoir peaked at elevation 1,432.34 feet on May 18, 2018 with 28,150 AF of storage. The minimum reservoir elevation for WY 2018 was 1,429.60 feet and storage of 27,387 AF occurred on October 31, 2017. The reservoir elevation on September 30, 2018 was 1,429.79 feet with storage of 27,787 AF, which is 1.79 feet, and 3,561 AF above the top of active conservation pool.

The maximum instantaneous discharge of 202 cfs occurred on May 25, 2018. Reservoir net inflows for water year 2018 were the twenty-seventh highest inflows on record for the dam and totaled 16,580 AF, 29 percent of average. The maximum 24 hour computed inflow occurred on August 19 with 550 cfs. Precipitation for the water year totaled 19.38 inches at 103 percent of average.

No water was released specifically for downstream irrigation.

An Emergency Management program, orientation seminar and communication's drill were conducted on February 10, 2018.

An Emergency Management program, tabletop exercise was conducted on July 25, 2018.

On April 23, 2018, Jamestown Reservoir (Jamestown Dam) went into internal alert with a reservoir elevation over 1,431.00 feet and remained there until June 3, when the reservoir elevation dropped below elevation 1,431.00 feet and normal operations resumed.

On July 20, 2018, the reservoir went back into internal alert with a reservoir elevation over 1,431.00 feet and remained there until August 2, when the reservoir elevation dropped below elevation 1,431.00 feet and normal operations resumed.

On August 19, 2018, the reservoir again went back into internal alert with a reservoir elevation over 1,431.00 feet and remained there until September 15, when the reservoir elevation dropped below elevation 1,431.00 feet and normal operations resumed.

An Annual Site Inspection (ASI) was conducted on August 7, 2018 by personnel from the Dakotas Area Office. The Annual Site Inspection report was signed on October 22, 2018.

The outlet works and spillway stilling basins were dewatered, cleaned, and inspected the week of September 10, 2018.

Monthly Statistics for WY 2018

Record and near record monthly inflows in 64 years of record keeping were recorded in the following months: January had its twentieth highest inflow, and March had its seventeenth highest inflow.

Record and near record monthly end of month content in 64 years of record keeping were recorded in the following months: June had its twentieth lowest storage

Additional statistical information on Jamestown Reservoir and its operations during 2018 can be found in Table 39 and Figure 39.

Table 39. Hydrologic Data for Jamestown Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	1,400.00	292	292
TOP OF ACTIVE CONSERVATION	1,428.00	24,226	23,934
TOP OF JOINT USE	1,431.00	30,488	6,262
TOP OF EXCLUSIVE FLOOD CONTROL	1,454.00	220,990	190,502

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE
BEGINNING OF YEAR	1,430.53	29,408	OCT 01, 2017
END OF YEAR	1,429.79	27,787	SEP 30, 2018
ANNUAL LOW	1,429.60	27,387	OCT 31, 2017
ANNUAL HIGH	1,432.34	33,790	MAY 18, 2018
HISTORIC HIGH	1,454.10	222,318	APR 26, 2009

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	16,580	OCT 17-SEP 18	18,011	OCT 17-SEP 18
DAILY PEAK (CFS)	550	AUG 19, 2018	202	MAY 25, 2018
DAILY MINIMUM (CFS)	0	*	0	*

MONTH	INFLOW		OUTFLOW		CONTENT	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	-76	NA	1,945	59	27,387	108
NOVEMBER	226	23	16	1	27,597	110
DECEMBER	105	25	0	NA	27,702	110
JANUARY	-84	NA	0	NA	27,618	110
FEBRUARY	-43	NA	0	NA	27,575	109
MARCH	575	9	0	NA	28,150	91
APRIL	2,987	12	414	4	30,723	66
MAY	6,264	66	6,346	43	30,535	74
JUNE	3,317	81	4,035	40	29,817	85
JULY	977	23	141	2	30,653	94
AUGUST	2,032	50	1,137	23	31,464	100
SEPTEMBER	300	23	3,977	81	27,787	99
ANNUAL	16,580	29	18,011	32		
APRIL-JULY	13,545	32				

* Frequently observed during fall and winter months

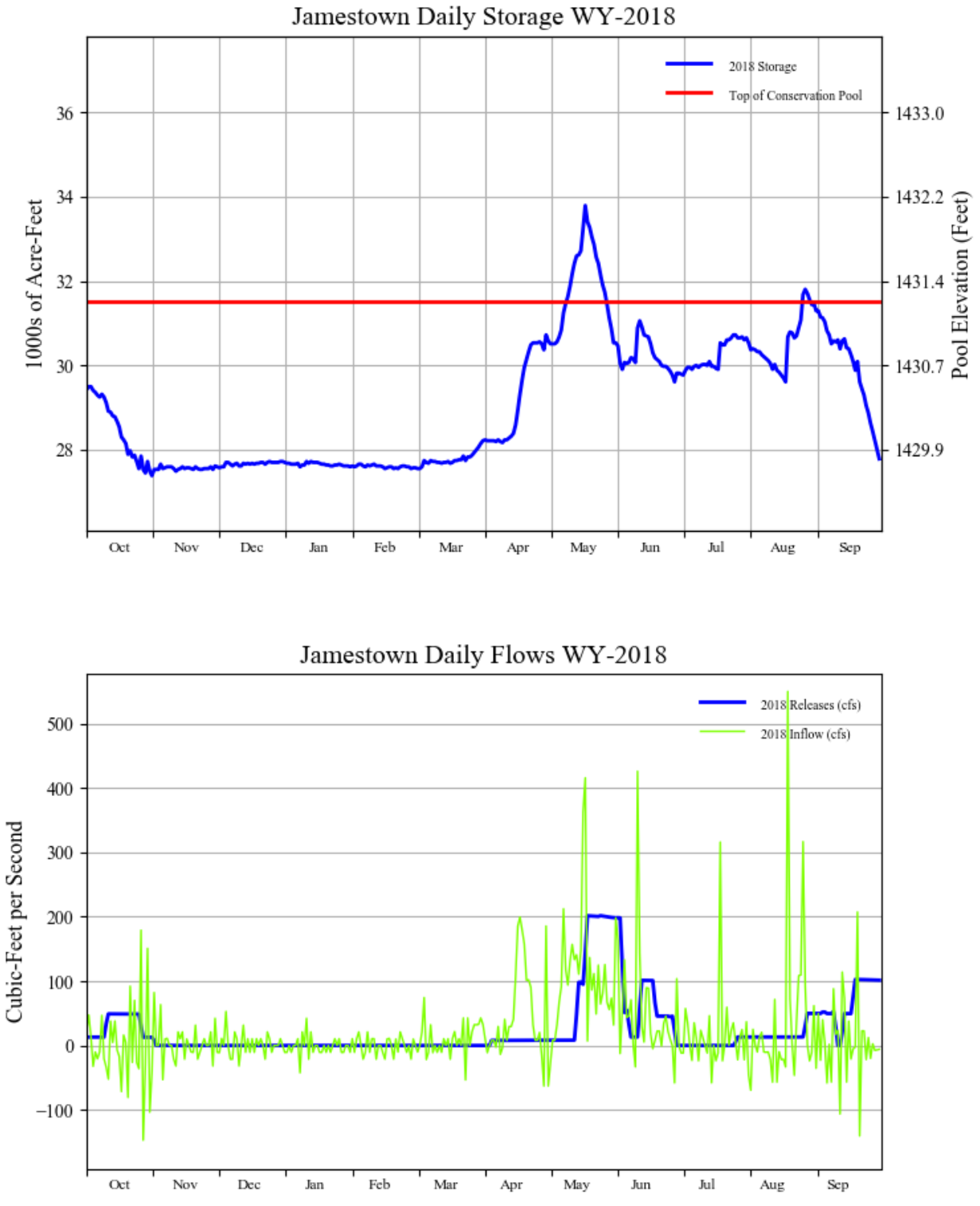


Figure 39. Hydrologic Data for Jamestown Dam.

Deerfield Reservoir

Background

Deerfield Reservoir, Rapid Valley Project is located on Castle Creek, a tributary of Rapid Creek above Rapid City, South Dakota. Deerfield Reservoir and Pactola Reservoir, Rapid Valley Unit, P-S MBP, furnish a supplemental irrigation supply to about 8,900 acres in the Rapid Valley Water Conservancy District (District) and furnish replacement water for a portion of the water used from Rapid Creek by Rapid City. A contract is in place between the United States, Rapid City, South Dakota and the District for the storage space at Deerfield Reservoir. The majority of prior rights to the flows of Rapid Creek during the irrigation season is held by individuals and ditch companies in the Rapid Valley Water Conservancy District.

In 1985 Deerfield Dam was modified to accommodate a larger flood as determined from the results of the Probable Maximum Flood analysis. These modifications consisted of raising the crest of the dam 38 feet, excavating an unlined auxiliary spillway, removing and filling in the old spillway, and extending the existing emergency gate passageway to the new control house at the higher crest elevation. The reservoir has a total capacity of 15,654 AF with an additional 26,657 AF of surcharge capacity.

During the winter of 1995-1996 the hollow jet valves were removed to allow the installation of the jet flow valves as part of the outlet works modification contract. The work was done to improve fish habitat in one and half miles of the creek immediately downstream of the dam. The stream improvement project was a cooperative effort accomplished by the City of Rapid City, Rapid Valley Water Conservancy District, Black Hills Fly Fishers, Reclamation, US Forest Service, and South Dakota Game, Fish, and Parks. The project modified the outlet works of Deerfield Dam by installing jet flow gates to allow greater minimum winter releases than the 6-inch bypass can provide.

WY 2018 Operations Summary

Deerfield Reservoir started WY 2018 at elevation 5,907.55 feet and with storage of 15,474 AF, which is 0.45 feet and 180 AF below the top of the conservation pool. Precipitation for WY 2018 was 158 percent of average. Inflows for WY 2018 totaled 10,083 AF (119 percent of the average). Peak inflows occurred in July totaling 1,574 AF for the month. The peak reservoir elevation for WY 2018 was 5,907.89 feet, storage of 15,618 AF and occurred on May 30, 2018. The minimum elevation for WY 2018 was 5,905.73 feet, storage of 14,718 AF and occurred on March 14, 2018. WY 2018 ended at elevation 5,906.46 feet and storage of 15,019 AF, which is 1.54 feet and 635 AF below the top of the conservation pool. Deerfield Reservoir ended the water year with 14,868 AF in active storage.

Rapid Valley Water Conservancy District did not order water from Deerfield for irrigation in WY 2018. The City of Rapid City did not release water from Deerfield for municipal use in WY 2018.

An Emergency Management/Security Orientation Exercise was held on March 28, 2018.

The ASI report for Deerfield Dam was completed on July 26, 2018. There are no incomplete Safety of Dam Recommendations.

Monthly Statistics for WY 2018

Record monthly inflows were recorded in the following months:
Inflows: No records were set in WY2018.

Record monthly end of month content were recorded in the following months:
End of Month Storage: October was fifth highest

Additional statistical information on Deerfield Reservoir and its operations during Water Year 2018 can be found in Table 40 and Figure 40.

Table 40. Hydrologic Data for Deerfield Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	5,839.00	151	151
TOP OF ACTIVE CONSERVATION	5,908.00	15,654	15,503
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE (end-of-day)
BEGINNING OF YEAR	5,907.55	15,474	OCT 01, 2017
END OF YEAR	5,906.46	15,019	SEP 30, 2018
ANNUAL LOW	5,905.73	14,718	MAR 14, 2018
ANNUAL HIGH	5,907.89	15,618	MAY 30, 2018
HISTORIC HIGH	5,909.05	16,157	FEB 25, 1985

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	11,980	OCT 01-SEP 30	12,435	OCT 01-SEP 30
PEAK DAILY (CFS)	54	MAY 29, 2018	30	MAR-APR-MAY, 2018
MINIMUM DAILY (CFS)	2	MAR 05, 2018	10	*

MONTH	INFLOW		OUTFLOW		EOM CONTENT**	
	AF	% OF AVG	AF	% OFAVG	AF	% OF AVG
OCTOBER	642	113	793	104	15,323	121
NOVEMBER	663	114	893	213	15,093	117
DECEMBER	660	121	825	214	14,928	113
JANUARY	696	128	799	210	14,825	110
FEBRUARY	664	137	722	190	14,767	108
MARCH	922	115	799	128	14,890	107
APRIL	1,462	88	827	80	15,525	110
MAY	1,313	71	1,233	92	15,605	110
JUNE	1,548	60	1,561	122	15,592	111
JULY	1,547	78	1,845	163	15,294	111
AUGUST	976	82	1,260	107	15,010	113
SEPTEMBER	887	109	878	78	15,019	117
ANNUAL	11,980	119	12,435	124	15,156	112
APRIL-JULY	5,870	125	5,466	115	15,504	111

* Frequently observed during non-runoff months

** EOM Content – End of Month Content

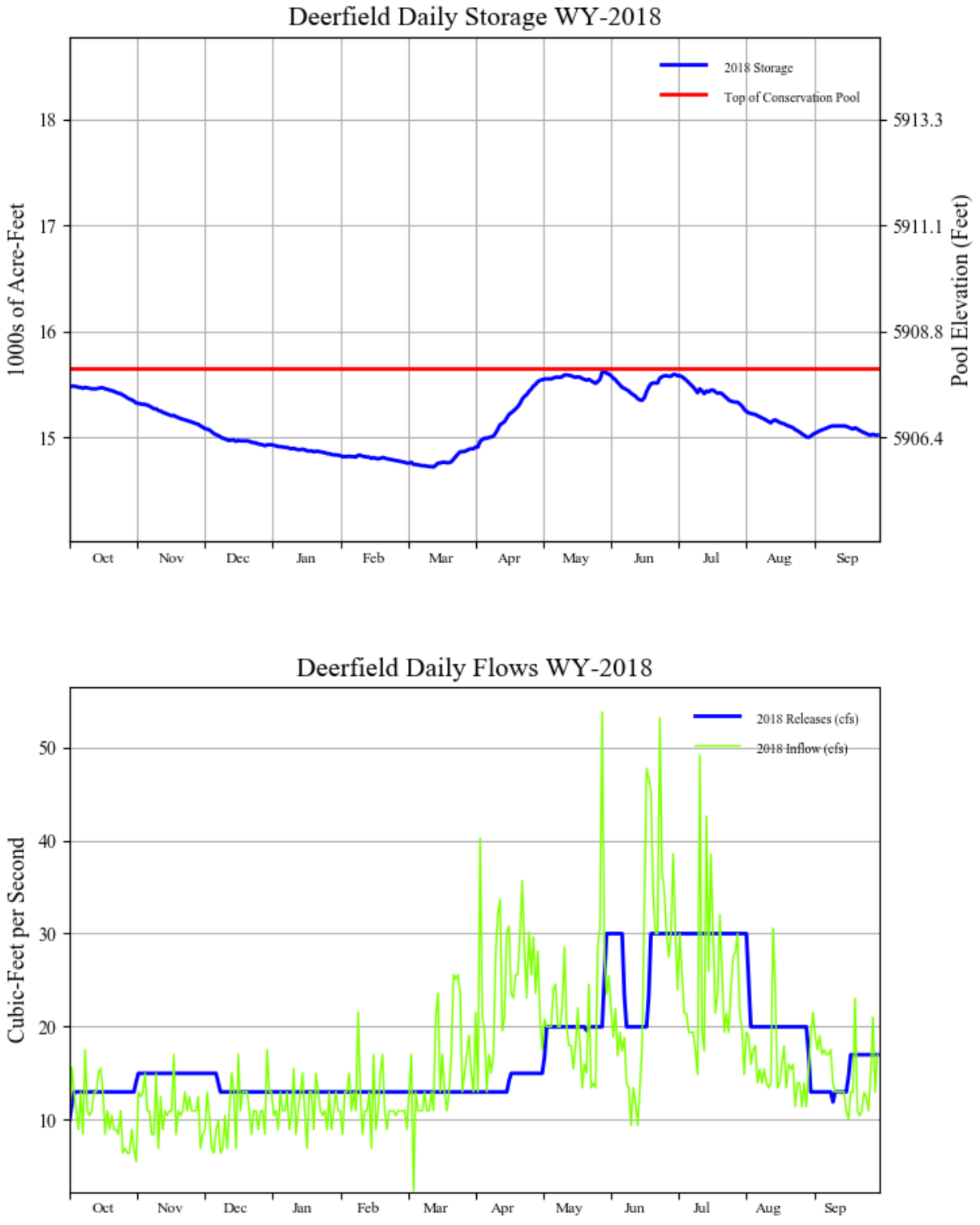


Figure 40. Hydrologic Data for Deerfield Reservoir.

Pactola Reservoir

Background

Pactola Reservoir, Rapid Valley Unit (P-S MBP), located on Rapid Creek above Rapid City, South Dakota, acts in conjunction with Deerfield Reservoir, Rapid Valley Project, to furnish a supplemental irrigation supply to about 8,900 acres in the Rapid Valley Water Conservancy District, replacement water for Rapid City, and a supply of domestic water for private water systems both above and below the Rapid City. The reservoir is also operated to provide flood control. It has a conservation capacity of 55,972 AF (54,955 AF active) and 43,057 AF of exclusive flood control space. The flood control space is all below the ungated spillway crest, and releases in this pool are controlled by the river outlet works. Rapid City has contracts for Pactola and Deerfield Reservoir water. The Rapid Valley Sanitation District and Hisega Meadows Water Inc. also have contracts for water service from Pactola Reservoir. Operation of the two reservoirs is integrated to maintain as much water as possible in the upstream facility, Deerfield Reservoir, and at the same time maintain a uniform outflow from Deerfield to maximize fishery benefits in the stream between the reservoirs. Since no inflow forecasts are available, the reservoir is normally operated as full as possible. Two SNOTEL (North Rapid Creek and Blind Park) sites were installed in the Pactola and Deerfield drainage basin in May of 1990.

As part of the Safety Examination of Existing Structures (Safety of Dams) Program, a study was made in the early 1980s to determine the adequacy of Pactola Dam, Spillway, and Reservoir to safely pass the new Inflow Design Flood (IDF) determined on the basis of present-day hydrologic technology. The studies showed that the facility was not able to safely handle the new IDF. Modification work was completed in 1987 and provided sufficient surcharge storage and spillway capacity to pass the IDF. Modification work consisted of raising the crest of the dam 15 feet, widening the existing rock-cut spillway chute and stilling basin from 240 feet to 425 feet, relocating Highway 385 to the new dam crest, extending the existing gate access shaft to the higher crest elevation, and reconstructing a new two-level gate control house at the higher crest elevation.

A new long-term storage contract was signed on July 31, 2007 between Reclamation and the city of Rapid City. The contract provides storage space of 49,000 AF for the city and 6,000 AF was retained by Reclamation.

WY 2018 Operations Summary

Pactola Reservoir started WY 2018 at elevation 4,574.57 feet and with storage of 51,288 AF, which is 5.63 feet and 4,684 AF below the top of the conservation pool. Precipitation for WY 2018 was 150 percent of average. Inflows for WY 2018 totaled 52,561 AF (140 percent of the average). Peak inflows occurred in July totaling 9,732 AF for the month. The peak reservoir elevation for WY 2018 was 4,581.08 feet, storage of 56,736 AF and occurred on May 30, 2018. The minimum elevation for WY 2018 was 4,574.50 feet, storage of 51,232 AF and occurred on October 31, 2017. WY 2018 ended at elevation 4,577.16 feet and storage of 53,403 AF, which is 3.04 feet and 2,569 AF below the top of the conservation pool. Pactola Reservoir ended the water year with 52,386 AF in active storage.

Pactola Dam went into Internal Alert on May 25, 2018. Normal operations were resumed on July 9, 2018.

No water was ordered by the City of Rapid City for municipal use in WY 2018.

An Emergency Management/Security Orientation Exercise was held on March 28, 2018.

The ASI report for Pactola Dam was completed on April 18, 2018. There are no incomplete SOD Recommendations.

Monthly Statistics for WY 2018

Record monthly inflows were recorded in the following months:
Inflows: July had its fourth highest inflows.

Record end of month reservoir content was recorded in the following months:
End of Month Storage: No records were set in WY2018.

Additional statistical information on Pactola Reservoir and its operations during Water Year 2018 can be found on Table 41 and Figure 41.

Table 41. Hydrologic Data for Pactola Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,456.10	1,017	1,017
TOP OF ACTIVE CONSERVATION	4,580.20	55,972	54,955
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	4,621.50	99,029	43,057

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE (end-of-day)
BEGINNING OF YEAR	4,574.57	51,288	SEP 30, 2017
END OF YEAR	4,577.16	53,403	SEP 30, 2018
ANNUAL LOW	4,574.50	51,232	OCT 31, 2017
ANNUAL HIGH	4,581.08	56,736	MAY 30, 2018
HISTORIC HIGH	4,589.43	64,246	JUN 29, 2015

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	52,055	OCT 01-SEP 30	49,940	OCT 01-SEP 30
DAILY PEAK (CFS)	3083.40	JUN 23, 2018	250	JUL 01, 2018
DAILY MINIMUM (CFS)	8	DEC 22, 2017	19	DEC 13, 2017

MONTH	INFLOW		OUTFLOW		EOM CONTENT*	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	2,216	100	2,272	126	51,232	113
NOVEMBER	2,440	147	2,191	148	51,481	114
DECEMBER	1,831	130	1,597	106	51,715	114
JANUARY	1,995	136	1,230	86	52,480	116
FEBRUARY	1,777	121	1,111	86	53,146	117
MARCH	2,828	113	1,230	68	54,744	119
APRIL	3,839	92	2,677	94	55,906	118
MAY	6,870	102	5,552	101	56,719	116
JUNE	9,920	142	10,930	170	55,709	113
JULY	9,732	251	9,973	179	55,468	116
AUGUST	6,014	219	7,412	177	54,070	119
SEPTEMBER	3,099	139	3,766	132	53,403	119
ANNUAL	52,561	140	49,941	136	53,839	116
APRIL-JULY	30,361	139	29,132	143	55,951	116

* EOM Content – End of Month Content

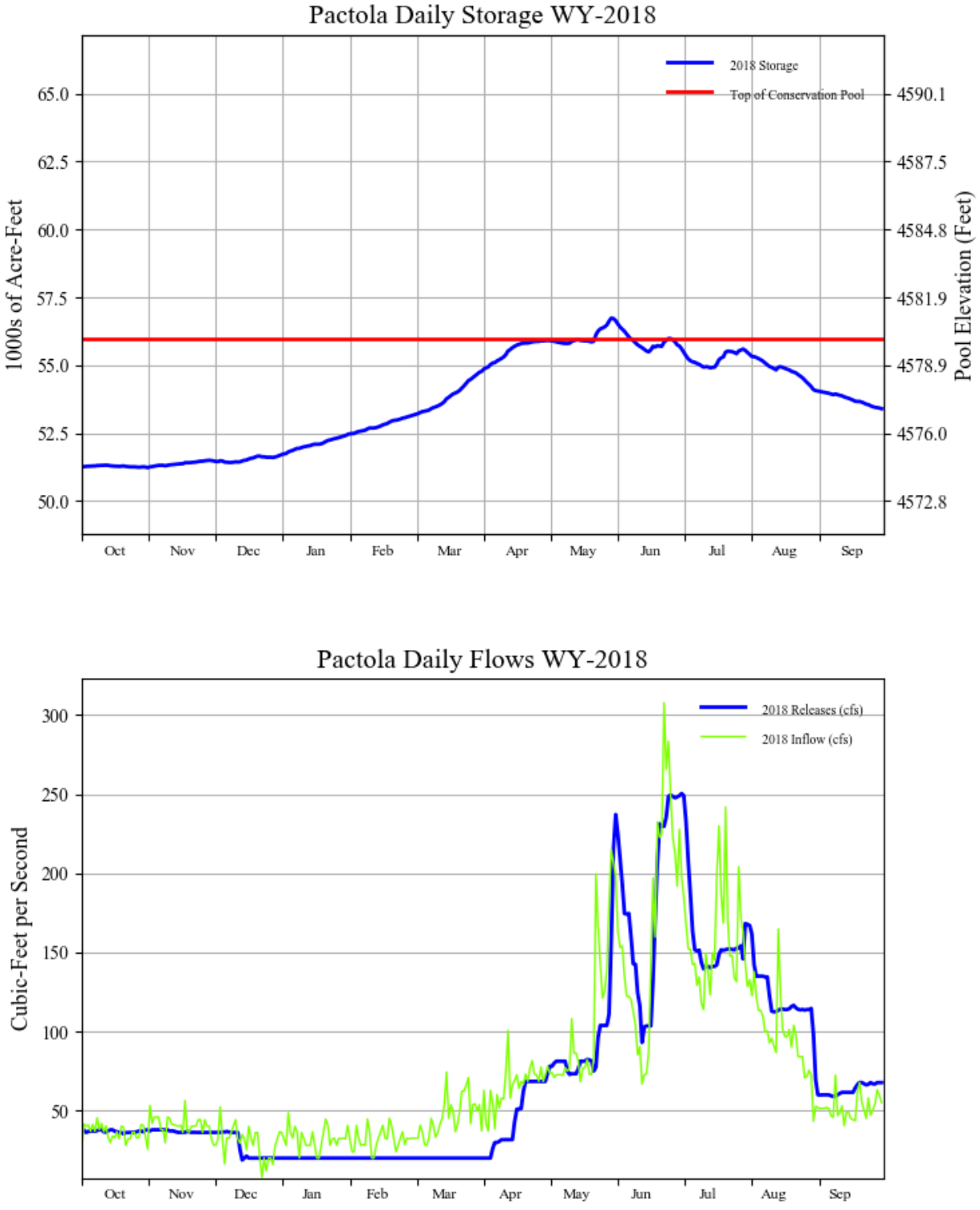


Figure 41. Hydrologic Data for Pactola Reservoir.

Angostura Reservoir

Background

Angostura Reservoir, P-S MBP, located on the Cheyenne River above Hot Springs, South Dakota, was built to service about 12,200 acres in the Angostura Unit and for power generation. It has a total capacity of 123,048 AF with an additional surcharge capacity of 57,308 AF. Its principle use is for irrigation of the Angostura Unit, which diverts its water from a high-level outlet at the dam. In the early years, water surplus to irrigation needs was released to the river through a small power plant with a nameplate capacity of 1,200 kilowatts. Because of the low runoff, and because actual irrigation diversions were higher than previously anticipated, it was concluded that continued operation of the power plant was economically infeasible. Except for a few operations of less than 24 hours each, the plant was last operated in February 1959. In 1966, the plant was officially closed, and the equipment was declared surplus in March 1968. Disposal of this equipment was completed in 1971. Releases for irrigation are made through the canal outlet works into the Angostura Main Canal having a design capacity of 290 cfs. Releases to the Cheyenne River are only made when the reservoir is assured of filling.

The Sedimentation and River Hydraulics Group, part of Reclamation's Technical Service Center in Denver, conducted a sedimentation survey of Angostura Reservoir in 2004 and provided a survey report and new area and capacity tables in August of 2005. The previous survey was done in 1979. Angostura Reservoir accumulated 7,716 AF of sediment since the last survey. Since construction in 1949, Angostura has accumulated 36,867 AF of sediment. The sedimentation rate from 1949 through 2004 has averaged 670 AF per year. The new area and capacity tables were first used in WY 2006.

WY 2018 Operations Summary

Angostura Reservoir started WY 2018 at elevation 3,177.46 feet and with storage of 83,475 AF, which is 9.74 feet and 39,573 AF below the top of the conservation pool. Precipitation for WY 2018 was 111 percent of average. Inflows for WY 2018 totaled 136,620 AF (171 percent of the average). Peak inflows occurred in June totaling 38,576 AF for the month. The peak reservoir elevation for WY 2018 was 3,186.73 feet, storage of 120,892 AF and occurred on May 21, 2018. The minimum elevation for WY 2018 was 3,177.48 feet, storage of 83,546 AF and occurred on October 1, 2017. WY 2018 ended at elevation 3,182.25 feet and storage of 101,605 AF, which is 4.95 feet and 21,443 AF below the top of the conservation pool. Angostura Reservoir ended the water year with 59,400 AF in active storage.

Angostura Dam went into Internal Alert May 9, 2018. Normal operations were resumed July 9, 2018.

The Angostura Irrigation District had a full water allotment for its irrigators. Releases for irrigation began May 14 and reached a peak of 263 cfs on August 14, 2018. The irrigation release was terminated on September 28, 2018. Total irrigation releases were 36,000 AF.

An Emergency Management/Security Orientation Exercise was held on March 27, 2018.

The ASI report for Angostura Dam was completed on May 15, 2018. There are no incomplete SOD Recommendations.

Monthly Statistics for WY 2018

Record monthly inflows were recorded in the following months:
Inflows: no inflow records achieved in WY2018.

Record end of month reservoir content was recorded in the following months:
End of Month Storage: no storage records achieved in WY2018

Additional statistical information on Angostura Reservoir and its operations during Water Year 2018 can be found on Table 42 and Figure 42.

Table 42. Hydrologic Data for Angostura Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	3,163.00	42,205	42,205
TOP OF ACTIVE CONSERVATION	3,187.20	123,048	80,843
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE (end-of-day)
BEGINNING OF YEAR	3,177.46	83,475	SEP 30, 2017
END OF YEAR	3,182.25	101,605	SEP 30, 2018
ANNUAL LOW	3,177.48	83,546	OCT 01, 2017
ANNUAL HIGH	3,186.73	120,892	MAY 21, 2018
HISTORIC HIGH	3,189.37	**152,228	MAY 20, 1978

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	136,602	OCT 01-SEP 30	118,472	OCT 01-SEP 30
DAILY PEAK (CFS)	3,662	JUN 01, 2018	4,389	JUN 01, 2018
DAILY MINIMUM (CFS)	-49	OCT 29, 2017	2	JAN 17, 2018

MONTH	INFLOW		OUTFLOW		EOM CONTENT***	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	1,730	80	560	51	84,645	87
NOVEMBER	2,638	118	192	14	87,091	88
DECEMBER	2,347	124	148	30	89,290	89
JANUARY	2,300	106	138	29	91,452	90
FEBRUARY	2,749	62	128	15	94,073	90
MARCH	27,285	242	3,181	78	118,177	105
APRIL	10,335	139	9,704	253	118,808	102
MAY	24,981	142	24,169	178	119,620	100
JUNE	38,576	193	41,449	201	116,747	98
JULY	16,431	244	16,814	107	116,346	105
AUGUST	6,200	209	15,242	120	107,304	106
SEPTEMBER	1,048	104	6,747	126	101,605	105
ANNUAL	136,620	171	118,472	148	103,763	97
APRIL-JULY	90,323	175	92,136	74	117,880	175

** Due to new area-capacity table, the capacity that corresponds to the new historic high elevation is less than a previous high capacity amount (169,020 AF @ Elevation 3189.0 feet on June 18, 1962)
*** EOM Content – End of Month Content

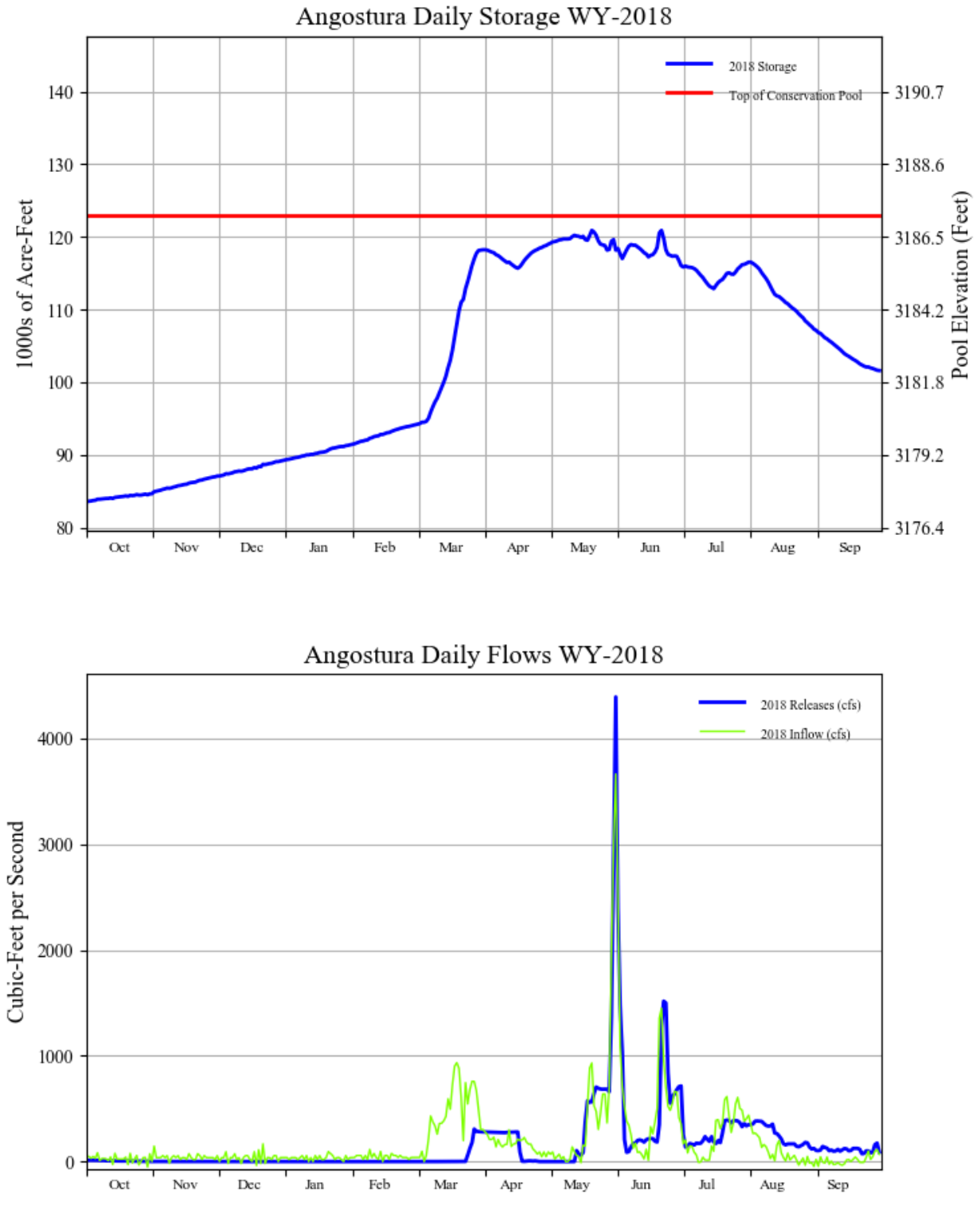


Figure 42. Hydrologic Data for Angostura Reservoir.

Keyhole Reservoir

Background

Keyhole Reservoir, P-S MBP, located on the Belle Fourche River below Moorcroft, Wyoming, has a conservation capacity of 188,671 AF (182,079 AF active) and 140,463 AF of exclusive flood control space. It was constructed to furnish a supplemental irrigation supply to 57,000 acres in the Belle Fourche Project and for flood control. Keyhole Reservoir is subject to the Belle Fourche River Compact, and the inflows and storage in the reservoir are allocated 10 percent to Wyoming users and 90 percent to South Dakota users, subject to prior rights. On January 3, 1963, the Belle Fourche Irrigation District executed a long-term contract for the use of 7.7 percent of active storage space in the reservoir. This space will be used to store water belonging to the irrigation district under its prior water right along with the District's pro rata share of storable inflows to Keyhole Reservoir. On January 1, 1985, the Crook County Irrigation District's contract for 18,080 AF of space in Keyhole Reservoir became effective. The allocated space is used by each organization to store its pro rata share of inflows to Keyhole Reservoir. The flood control space at Keyhole Reservoir is all located above an ungated spillway. The spillway capacity is 11,000 cfs at maximum water surface elevation. The downstream safe channel capacity is 3,000 cfs. Formulas for forecasting inflows have not been developed. Research by the Soil Conservation Service during water years 1992 - 1994 show that inflow forecasting to Keyhole Reservoir is not reliable since there is no consistent snow pack and precipitation is highly cyclical. No further efforts to develop forecast models are planned.

Reclamation's Sedimentation and River Hydraulics Group of the Technical Service Center in Denver conducted a sedimentation survey of Keyhole Reservoir in 2003 and provided a survey report and new area and capacity tables in July of 2005. The previous survey was done in 1978. Keyhole Reservoir accumulated 5,082 AF of sediment since the previous survey. Since construction in 1952, Keyhole has accumulated 12,495 AF of sediment. The sedimentation rate from 1952-2003 has averaged 240 AF per year. The new Area and Capacity Tables were first used in WY 2006.

WY 2018 Operations Summary

Keyhole Reservoir started WY 2018 at elevation 4,091.00 feet and storage of 122,129 AF, which is 8.30 feet and 66,542 AF below the top of the conservation pool. Precipitation for WY 2018 was 135 percent of average. Inflows for WY 2018 totaled 36,610 AF (234 percent of average). Peak inflows occurred in March, totaling 37,790 AF for the month. The peak reservoir elevation for WY 2018 was 4,096.59 feet, storage of 164,393 AF and occurred on June 29, 2018. The minimum elevation for WY 2018 was 4,090.43 feet, storage of 118,417 AF and occurred on December 9, 2017. WY 2018 ended at elevation 4,095.84 feet and storage of 158,110 AF, which is 3.46 feet and 30,561 AF below the top of the conservation pool. Keyhole Reservoir ended the water year with 151,518AF in active storage.

There were no irrigation releases ordered by the Belle Fourche Irrigation District (BFID) or the Crook County Irrigation District (CCID) for WY 2018.

An Emergency Management/Security Orientation Exercise was held March 14, 2018.

The ASI of Keyhole was conducted on May 23, 2018. There are no incomplete SOD recommendations.

Monthly Statistics for WY 2018

Record monthly inflows were recorded in the following months:
Inflows: October had its lowest inflows, March had its second highest inflows, and April had its second highest inflows on record.

Record end of month reservoir content were recorded in the following months:
End of Month Storage: no storage records achieved in WY2018

Additional statistical information on Keyhole Reservoir and its operations during Water Year 2018 can be found on Table 43 and Figure 43.

Table 43. Hydrologic Data for Keyhole Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	4,051.00	6,592	6,592
TOP OF ACTIVE CONSERVATION	4,099.30	188,671	182,079
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	4,111.50	329,134	140,463

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE (end-of-day)
BEGINNING OF YEAR	4,091.00	122,129	SEP 30, 2017
END OF YEAR	4,095.84	158,110	SEP 30, 2018
ANNUAL LOW	4,090.43	118,417	DEC 09, 2017
ANNUAL HIGH	4,096.59	164,393	JUN 29, 2018
HISTORIC HIGH	4,100.38	210,222	MAY 21, 1978

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	36,610	OCT 01-SEP 30	625	OCT 01-SEP 30
DAILY PEAK (CFS)	3,002	MAR 28, 2018	220	OCT 01, 2017
DAILY MINIMUM (CFS)	-335	MAY 23, 2018	0	OCT 03, 2017

MONTH	INFLOW		OUTFLOW		EOM CONTENT**	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	-2,120	-614	625	893	119,384	127
NOVEMBER	-839	-258	0	0	118,545	126
DECEMBER	-64	-40	0	0	118,481	126
JANUARY	129	25	0	0	118,610	125
FEBRUARY	968	35	0	0	119,578	123
MARCH	37,790	566	0	0	157,368	153
APRIL	2,314	95	0	0	159,682	154
MAY	2,176	45	0	0	161,858	152
JUNE	2,365	72	0	0	164,223	152
JULY	-2,028	-234	0	0	162,195	157
AUGUST	-1,842	-100	0	0	160,353	164
SEPTEMBER	-2,239	-132	0	0	158,110	166
ANNUAL	36,610	234	625	5	143,199	144
APRIL-JULY	4,827	50	0	0	161,990	154

* Frequently observed during fall and winter months
** EOM Content – End of Month Content

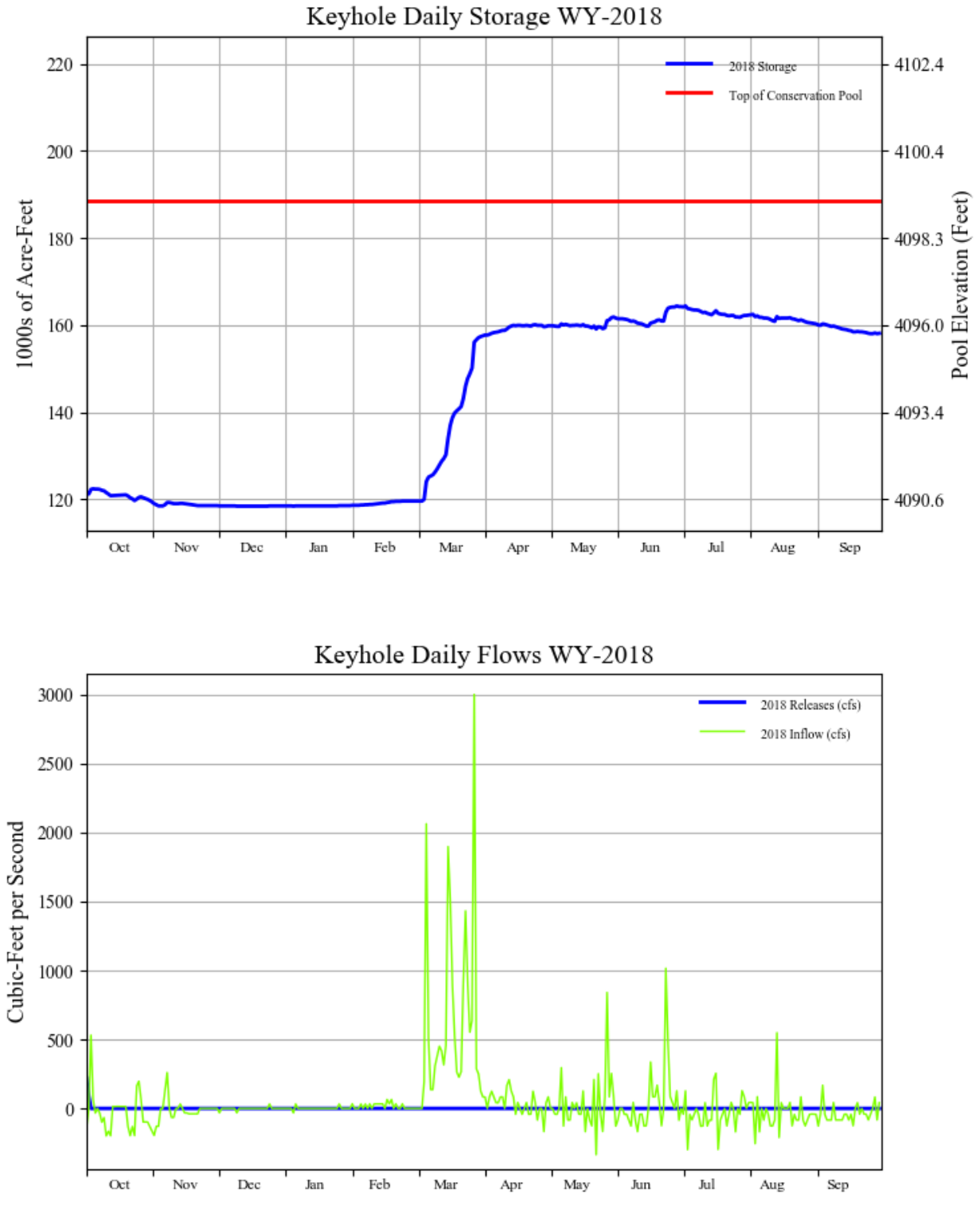


Figure 43. Hydrologic Data for Keyhole Reservoir.

Shadehill Reservoir

Background

Shadehill Reservoir, a feature of the Shadehill Unit, P-S MBP, is located on the Grand River near Shadehill, South Dakota, and was constructed for irrigation of 9,700 acres, and for flood control, recreation, and fish and wildlife purposes. The reservoir has a dead and conservation capacity totaling 120,172 AF with an additional exclusive flood control capacity of 230,004 AF and a surcharge capacity of 119,560 AF. Flood control space is all located above the crest of an un-gated glory-hole spillway. Because of the questionable quality of water, it was decided to postpone construction of distribution works for irrigation.

After further study, it was concluded that water from Shadehill Reservoir can be used for sustained irrigation if certain limitations of soils, leaching water, soil amendments, and drainage are met. A definite plan report covering 6,700 acres which meets these limitations has been completed, approved by the Commissioner, and released for distribution. On December 17, 1963, landowners within the area voted 24 to 21 against formation of an irrigation district. Further action on development of the area was deferred until the attitude of the landowners was more favorable. Pending more extensive irrigation development, an additional 51,500 AF of space between elevations 2260 and 2272 was allocated to flood control. Allocations and evacuation of this space was made possible by modification of the outlet works in 1969 to permit a discharge of 600 cfs to the river. In June of 1975, the West River Conservancy Sub-District was formed combining all but one of the old individual contracts for water supply from the reservoir into one. Acreage contracted for by the District was 5,000 acres; however, only 3,064 acres were developed. On March 18, 1986, the contract between Reclamation and the West River Conservancy Sub-District was assigned to the Shadehill Water User District, an organization, which succeeded the Sub-District under South Dakota law. This contract has expired and presently conservation releases are meeting irrigation demands. Should irrigation releases be required a temporary water service contract will need to be executed with the Shadehill Water User District.

Because certain release criteria reduced the effectiveness of flood control operations in the zone between elevation 2260 and 2272, and because the Corps of Engineers has constructed Bowman Haley Reservoir upstream from Shadehill Reservoir with 53,800 AF of flood control space, the Corps requested that the interim flood control agreement be terminated and that responsibility for the operations of Shadehill Reservoir when the pool is between elevations 2260 and 2272 revert to Reclamation. By a revised field working agreement dated May 15, 1972, it was agreed that the space between elevation 2,260 feet and 2,272 feet (51,500 AF) be reallocated to conservation use. However, space below elevation 2,272 feet will continue to be evacuated before the start of the spring runoff, but to a lesser extent than in the past.

WY 2018 Operations Summary

Shadehill Reservoir started WY 2018 at elevation 2,264.36 feet and with storage of 85,760 AF, which is 7.64 feet and 34,412 AF below the top of the conservation pool. Precipitation for WY 2018 was 81 percent of average. Inflows for WY 2018 totaled 37,669 AF (50 percent of the average). Peak inflows occurred in May totaling 2,833 AF for the month. The peak reservoir elevation for WY 2018 was 2,272.24 feet, storage of 121,381 AF and occurred on May 24, 2018. The minimum elevation for WY 2018 was 2,261.91 feet, storage of 76,483 AF and occurred on March 18, 2018. WY 2018 ended at elevation 2,270.09 feet and storage of 110,832 AF, which is 1.91 feet and 9,340 AF below the top of the conservation pool. Shadehill Reservoir ended the water year with 66,963 AF in active storage.

All irrigation demands were met from river maintenance releases. There were no storage releases for irrigation needed during water year 2018.

An Emergency Action Plan Orientation Meeting and Table Top Exercise were conducted on March 20, 2018 by Steve Schelske.

An ASI for Shadehill Dam was conducted on August 22, 2018. There are no incomplete SOD Recommendations.

Shadehill Dam went into Internal Alert May 25, 2018. Normal operations were resumed July 9, 2018.

The Shadehill Dam Service Spillway Stilling Basin Concrete Repairs Contract, No. R17PC00056, was awarded to Lillard and Clark Construction Company, Inc. for $616,000.00. The contractor demolished, cleaned, placed new rebar and placed a new silica fume concrete floor in the Shadehill Dam spillway stilling basin. The last concrete pour was conducted October 6, 2017. The contract final inspection of the stilling basin floor and dentate construction was completed on October 23, 2017.

Monthly Statistics for WY 2018

Record monthly inflows were recorded in the following months:
Inflows: November was fifth lowest on record, December was third lowest on record, January had its lowest ever inflows on record, July was second lowest on record, September was the fourth lowest on record.

Record end of month reservoir content were recorded in the following months:
End of Month Storage: no storage records were achieved in WY2018.

Additional statistical information on Shadehill Reservoir and its operations during Water Year 2018 can be found on Table 44 and Figure 44.

Table 44. Hydrologic Data for Shadehill Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,250.80	43,869	43,869
TOP OF ACTIVE CONSERVATION	2,272.00	120,172	76,303
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL	2,302.00	350,176	230,004

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE (end-of-day)
BEGINNING OF YEAR	2,264.36	85,760	SEP 30, 2017
END OF YEAR	2,270.09	110,832	SEP 30, 2018
ANNUAL LOW	2,261.91	76,483	MAR 18, 2018
ANNUAL HIGH	2,272.24	121,381	MAY 24, 2018
HISTORIC HIGH	2,297.90	318,438	APR 10, 1952

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	38,301	OCT 01-SEP 30	13,980	OCT 01-SEP 30
DAILY PEAK (CFS)	3,237	MAR 26, 2018	99	MAY 25, 2018
DAILY MINIMUM (CFS)	-475	AUG 16, 2018	13	MAR 20, 2018

MONTH	INFLOW		OUTFLOW		EOM CONTENT**	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	-996	-82	779	20	83,985	77
NOVEMBER	-556	-62	801	24	82,628	77
DECEMBER	-961	-122	833	33	80,834	77
JANUARY	-1,429	-147	811	34	78,594	75
FEBRUARY	-566	-17	714	34	77,314	73
MARCH	23,780	104	814	8	100,280	85
APRIL	17,742	87	984	6	117,038	96
MAY	6,671	60	2,833	28	120,876	99
JUNE	1,074	12	2,257	27	120,323	98
JULY	-2,743	-76	1,098	20	117,234	97
AUGUST	-2,416	-578	1,057	25	113,761	97
SEPTEMBER	-1931	-3941	998	28	110,832	98
ANNUAL	37,669	50	13,979	19	100,308	88
APRIL-JULY	22,744	51	7,172	17	118,868	97

* Frequently observed during fall and winter months
** EOM Content – End of Month Content

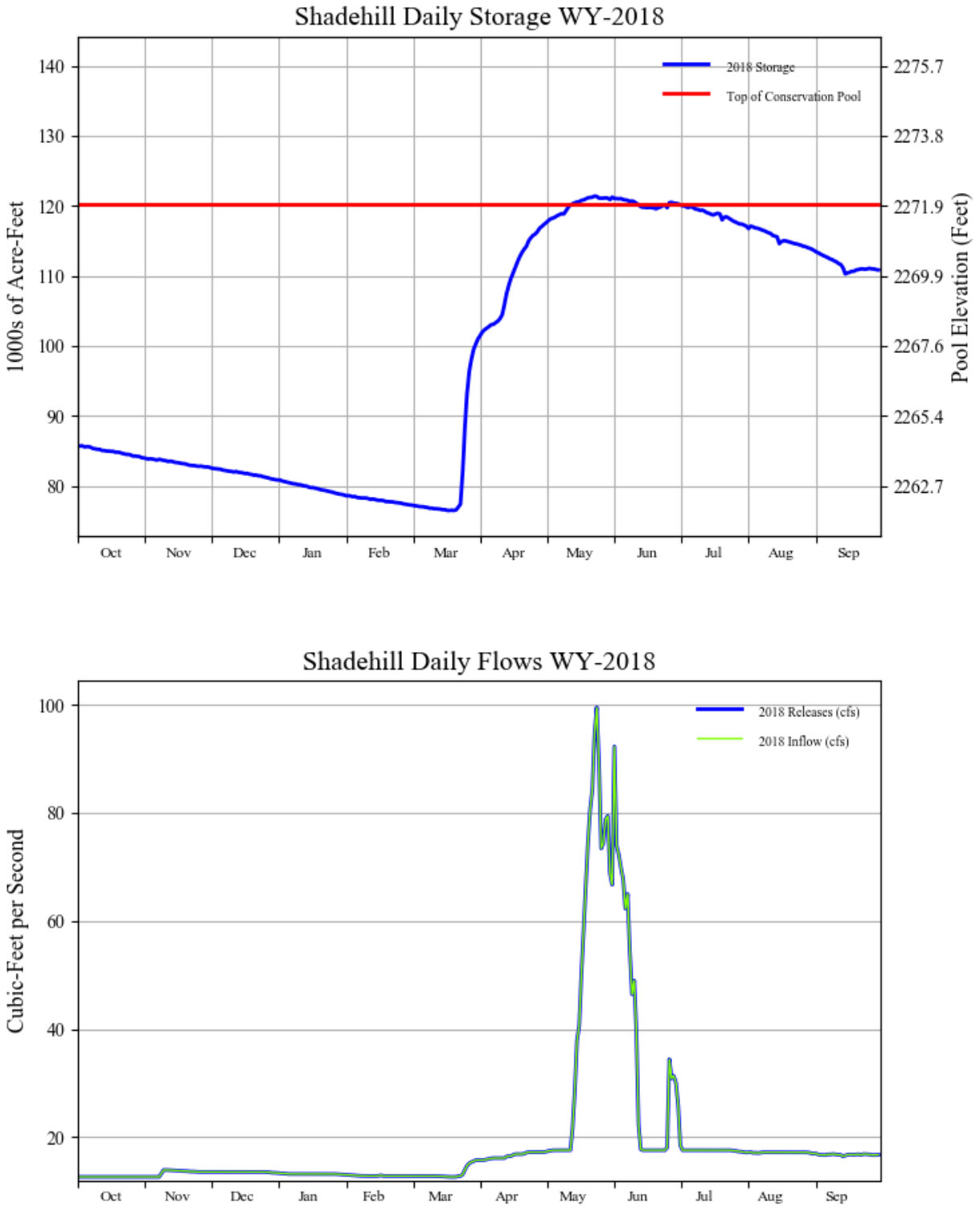


Figure 44. Hydrologic Data for Shadehil Reservoir.

Belle Fourche Reservoir

Background

Belle Fourche Reservoir located near Belle Fourche, South Dakota, is formed by Belle Fourche Dam on Owl Creek, a tributary of the Belle Fourche River. It has a total capacity of 172,873 AF (169,790 AF active). The reservoir is filled by diverting water from the Belle Fourche River through the Inlet Canal, which has a capacity of 1,300 cfs. The reservoir is used for irrigation of 57,000 acres in the Belle Fourche Project, which also receives a supplemental supply from Keyhole Reservoir. From November 1965 - May 1977, the active capacity of the reservoir was temporarily limited to 160,300 AF at elevation 2981.8 feet until the damaged spillway was replaced.

When the Belle Fourche Reservoir storage right is satisfied by the reservoir filling, the South Dakota Department of Environment and Natural Resources provide guidelines for complying with water rights on the Belle Fourche River. The District is required to continue to bypass 5 cfs for domestic use prior to diverting the Johnson Lateral water right for up to 40 cfs. If flows into the diversion dam are greater than 45 cfs, the District is required to bypass up to 60 cfs for downstream irrigation rights. Any flows in excess of these amounts can be diverted into the reservoir and stored. If all of these rights are not needed, the District can divert flows into the reservoir.

The Sedimentation and River Hydraulics Group, part of Reclamation's Technical Service Center in Denver, conducted a sedimentation survey of Belle Fourche Reservoir in 2006 and provided a survey report and new area and capacity tables in April 2007. The previous survey was done in 1949. Belle Fourche Reservoir accumulated 19,204 AF of sediment since the 1949 survey and 36,364 AF since the original survey in 1910. The sedimentation rate from 1910 - 2006 averages 375 AF per year. The new area and capacity tables were first used in WY 2008.

WY 2018 Operations Summary

Belle Fourche Reservoir started WY 2018 at elevation 2,956.45 feet and with storage of 58,373 AF, which is 18.55 feet and 114,500 AF below the top of the conservation pool. Precipitation for WY 2018 was 139 percent of average. Inflows for WY 2018 totaled 161,423 AF (141 percent of the average). Peak inflows occurred in March totaling 33,961 AF for the month. The peak reservoir elevation for WY 2018 was 2,974.87 feet, storage of 171,830 AF and occurred on May 30, 2018. The minimum elevation for WY 2018 was 2,956.44 feet, storage of 58,330 AF and occurred on October 1, 2017. WY 2018 ended at elevation 2,968.81 feet and storage of 126,562 AF, which is 6.19 feet and 46,311 AF below the top of the conservation pool. Belle Fourche Reservoir ended the water year with 151,518 AF in active storage.

Belle Fourche Dam went into Internal Alert on May 9, 2018. Normal operations were resumed July 9, 2018.

The Belle Fourche Irrigation District (BFID) had a full water allotment of 24 inches for its irrigators. The North Canal and South Canals began operations on May 6, 2018. Releases reached a peak of 400 cfs on June 24, 2018 for South Canal and a peak of 266 cfs on August 16,

2018 for North Canal. The South Canal was shut off October 5, 2018. The North Canal was shut off September 30, 2018. Total irrigation releases for the 2018 season were over 95,000 AF.

An Emergency Management/Security Orientation Exercise was held on March 13, 2018.

The Annual Site Inspection (ASI) report for Angostura Dam was completed on May 2, 2018. There are no incomplete SOD Recommendations.

The South Canal River Siphon Manhole Installation Project was completed on January 8, 2018. The project consisted of installing two manholes in the South Canal River Siphon to improve access. The contract was fully funded by the Belle Fourche Irrigation District. The project was designed and administered by RESPEC and constructed by Bachman LLC.

Belle Fourche Reservoir Road Maintenance Contract, No. 140R6018P0025, was awarded to Prairie Dakota Landscaping LLC for $29,694.48. The contractor bladed the Belle Fourche Reservoir roads on three separate dates during the 2018 recreation season. The contract was completed on November 1, 2018.

Monthly Statistics for WY 2018

Record monthly inflows were recorded in the following months:
Inflows: March was second highest inflows on record, April was second highest inflows on record.

Record end of month reservoir content was recorded in the following months:
End of Month Storage: July was second highest storage, August was second highest, and September was second highest storage.

Additional statistical information on Belle Fourche Reservoir and its operations during Water Year 2018 can be found on Table 45 and Figure 45.

Table 45. Hydrologic Data for Belle Fourche Reservoir.

RESERVOIR ALLOCATIONS	ELEVATION (FEET)	TOTAL RESERVOIR STORAGE (AF)	STORAGE ALLOCATION (AF)
TOP OF INACTIVE AND DEAD	2,927.00	3,083	3,083
TOP OF ACTIVE CONSERVATION	2,975.00	172,873	169,790
TOP OF JOINT USE			
TOP OF EXCLUSIVE FLOOD CONTROL			

STORAGE-ELEVATION DATA	ELEVATION (FT)	STORAGE (AF)	DATE (end-of-day)
BEGINNING OF YEAR	2,956.45	58,373	SEP 30, 2017
END OF YEAR	2,968.81	126,572	SEP 30, 2018
ANNUAL LOW	2,956.44	58,330	OCT 01, 2017
ANNUAL HIGH	2,974.81	171,830	MAY 30, 2018
HISTORIC HIGH	2,975.92	196,792	MAY 30, 1996

INFLOW-OUTFLOW DATA	INFLOW	DATE	OUTFLOW	DATE
ANNUAL TOTAL (AF)	161,423	OCT 01-SEP 30	93,234	OCT 01-SEP 30
DAILY PEAK (CFS)	2,270	MAR 26, 2018	575	JUN 02, 2018
DAILY MINIMUM (CFS)	-191	JUN 02, 2018	0	OCT 07, 2017

MONTH	INFLOW		OUTFLOW		EOM CONTENT**	
	AF	% OF AVG	AF	% OF AVG	AF	% OF AVG
OCTOBER	9,312	88	2,134	380	65,551	88
NOVEMBER	8,404	85	0	0	73,955	88
DECEMBER	8,128	90	0	0	82,083	88
JANUARY	10,055	111	0	0	92,138	90
FEBRUARY	9,578	99	0	0	101,716	91
MARCH	33,961	217	0	0	135,677	107
APRIL	27,206	197	0	0	162,883	117
MAY	18,258	126	9,471	127	171,670	117
JUNE	12,488	108	17,344	104	166,814	118
JULY	9,686	262	18,044	50	158,456	145
AUGUST	7,625	295	27,013	77	139,068	181
SEPTEMBER	6,722	136	19,228	111	126,562	196
ANNUAL	161,423	141	93,234	82	123,048	116
APRIL-JULY	67,638	156	44,859	74	164,956	123

* Frequently observed during fall and winter months
** EOM Content – End of Month Content

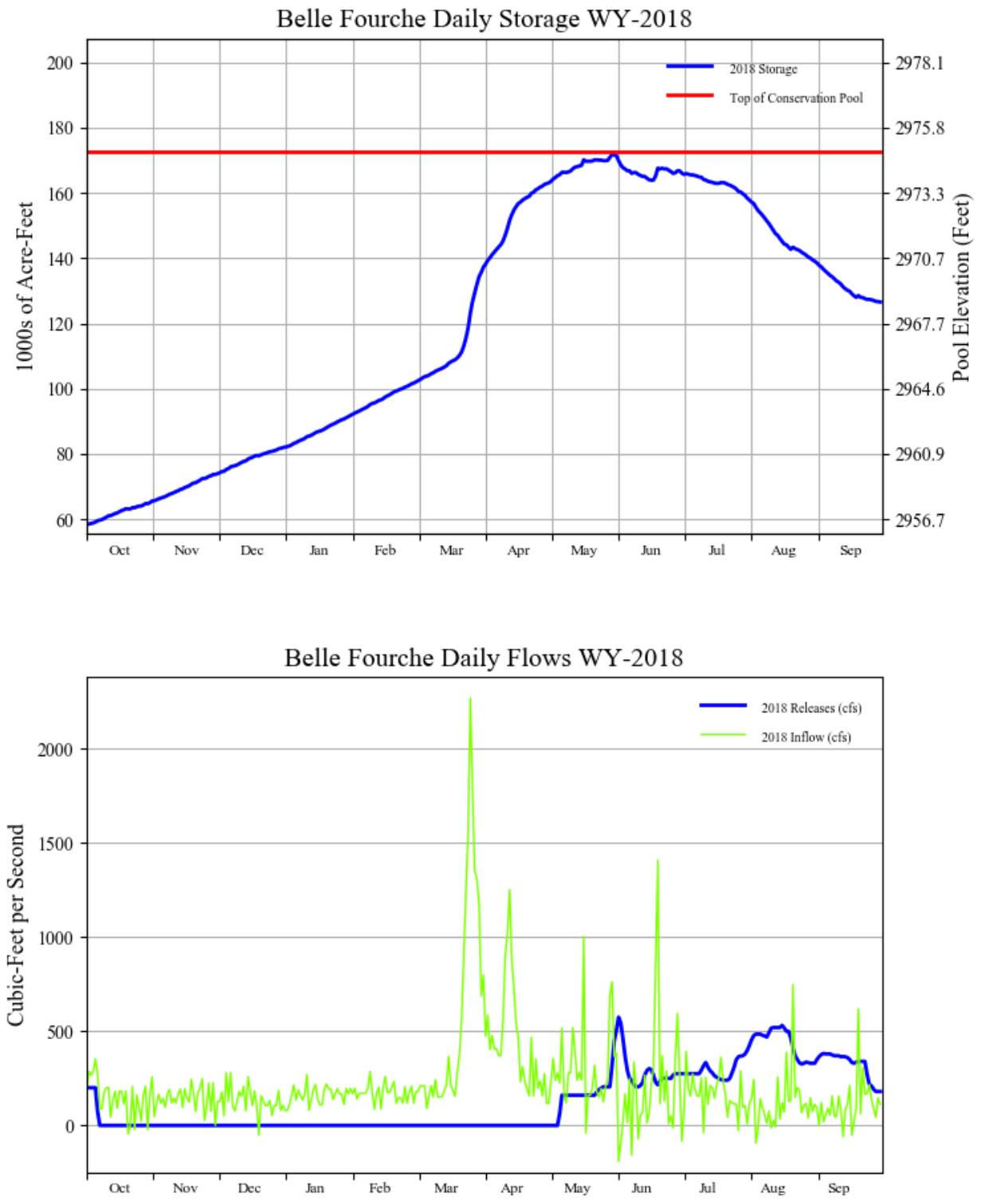


Figure 45. Hydrologic Data for Belle Fourche Reservoir.

Operating Plans for WY 2019

Dickinson Reservoir

At the beginning of WY 2019, Dickinson Dam and E. A. Patterson Lake (Dickinson Reservoir) had an elevation of 2,418.78 feet with storage of 7,236 AF, which is 1.22 feet and 1,216 AF below the top of the active conservation pool (elevation 2,420.00 feet at 8,452 AF). The reservoir is normally operated as full as possible at all times. Excess water will be released by spilling over the Bascule gate after the reservoir has filled, and by gated releases through the 24-inch river outlet valve. No releases are planned until irrigation water is required or if the spring runoff deems it necessary for flood protection.

Heart Butte Reservoir

At the beginning of WY 2019, Heart Butte Dam and Lake Tschida (Heart Butte Reservoir) had an elevation of 2,061.74 feet with storage of 58,366 AF, which is 2.76 feet and 6,725 AF below the top of the active conservation pool (elevation 2,064.50 feet at 65,091 AF). Since there are no accurate inflow forecasts available, plans are to operate the reservoir as close to the top of the conservation pool as possible while regulating releases required, maintaining downstream conservation commitments, and preserving flood control space. During winter months, and when the reservoir level is below the spillway crest at elevation 2,064.50 feet, the river releases will be maintained at about 10 cfs to ensure a live stream flows below Heart Butte Dam. This will continue through the winter until the spring runoff requires higher releases sometime in late March or early April. Excess water is released only when the reservoir is full or ensured of filling.

Jamestown Reservoir

At the beginning of WY 2019, Jamestown Reservoir had an elevation of 1,429.79 feet with storage of 27,787 AF, which is 1.79 feet and 3,561 AF above the top of the active conservation pool (elevation 1,428.00 feet at 24,226 AF). Water releases will be shut off when the reservoir elevation reaches approximately 1429.60 and will continue shut throughout the winter until spring runoff requires releases to be made for flood protection. The reservoir is normally operated under the following criteria and limitations set forth in the Field Working Agreement between the Corps and Reclamation that reads:

Flood Control Regulation of Joint-Use Pool - Jamestown Reservoir

The joint space between elevations 1,428 feet and 1,431 feet will be used for seasonal multipurpose regulation. For purposes of flood control storage, the reservoir water elevation will be no higher than 1,429.8 feet at the beginning of spring runoff period. That portion of the joint-use pool between elevations 1,429.8 feet and 1,431.0 feet will be used for storage and regulation of the spring runoff and summer rainstorms. In addition, water stored in this zone may be used during the summer months for conservation purposes. Storage remaining in the joint-use pool above elevation 1,429.8 feet after September 1 will be evacuated as directed by the Corps of Engineers.

The Bureau has the option of lowering the reservoir below elevation 1,429.8 feet should it be desirable based on water supply needs. There are no requirements for maintaining a specified minimum reservoir release.

Season: Beginning of Spring Runoff to September 1
Elevation 1,429.80 feet (Base of flood control zone) to Elevation 1,431.00 feet (Top of Joint Use Pool)

Release greater of:

a. Conservation releases

b. Based on inflows occurring at the time and the existing potential for further inflows, releases will be maintained as necessary to result in a pool elevation of 1,431 feet at the time inflows cease.

Season: September 1 to November 1
Make releases necessary to evacuate reservoir to elevation 1,429.80 feet prior to November 1.

Season: November 1 to Beginning of Spring Runoff
Make releases necessary to maintain elevation 1,429.80 feet.

Deerfield Reservoir

Deerfield Reservoir started WY2019 at elevation 5,906.46 feet and storage of 15,019 AF, which is 1.54 feet and 635 AF below the top of conservation (elevation 5,908 feet at 15,654 AF). The reservoir winter draw down was at 14,853 AF at December 1, 2018. A target of 15,000 AF of storage by March 1 will usually dictate the winter release, which is set near December 1. The winter release is set based on water usage from Deerfield by the Rapid Valley Water Conservancy District (District) and the storage target of 15,000 AF by March 1. The goal is to be near full by May 1 which is the start of the irrigation season. The Rapid Valley Water Conservancy District did not order water from Deerfield for irrigation in WY 2018. The City of Rapid City did not release water from Deerfield for municipal use in WY 2018.

A release of around 13 cfs will be maintained until the spring runoff requires higher releases in late March or early April. Excess water is normally released only when the reservoir is full or assured of filling. Since no inflow forecasts are available, the reservoir is normally operated as full as possible. Two SNOTEL sites (North Rapid Creek and Blind Park) are operated in the Pactola and Deerfield drainage basin. Deerfield storage may be required to meet District irrigation needs in WY 2019.

The jet flow gates will be used for winter releases and provide minimum stream flows of 6 cfs or more which will enhance winter fishery conditions in Castle Creek and improve fishery production conditions in the stream.

Storage at the end of water year will depend on the amount of inflow to the Pactola-Deerfield system and the need for project water deliveries from Deerfield Reservoir. During average and above average inflow years, summer releases will be made to bring the reservoir storage to about 14,900 AF by September 30. This is to accommodate minimum releases of 6 cfs into Castle Creek during the winter. The actual release will depend on runoff conditions and will take into account downstream ice conditions in Castle Creek.

Pactola Reservoir

Pactola Reservoir started WY 2019 at elevation 4,577.16 feet and storage of 53,403 AF, which is 3.04 feet and 2,569 AF below the top of conservation (elevation 4,580.2 feet at 55,972). Operating criteria established for the reservoir in the Definite Plan Report called for minimum winter conservation releases to be 7 cfs from October 1 to April 15 and 20 cfs from April 15 to October 1 when the reservoir content is below 29,000 AF and releases of 15 cfs from October 1-March 1 and 20 cfs from March 1 through October 1 are established for reservoir content above 29,000 AF. Minimum summer conservation releases are 20 cfs at all reservoir contents.

1. Reservoir content less than 29,000 AF (with no water in the U.S. storage)
   October 1 – April 15 7 cfs
   April 15 - October 1 20 cfs

2. Reservoir content greater than 29,000 AF (with no water in the U.S. storage)
   October 1 – March 1 15 cfs
   March 1 - October 1 20 cfs

Pactola Reservoir is operated as close to the top of the conservation pool as possible, while regulating releases required to maintain a downstream fishery and to preserve flood control space. The new long-term storage contract for Pactola, between Reclamation and the City of Rapid City, was signed on July 31, 2007. New operating criteria for releases to Rapid Creek were established in the Standard Operating Plans. The following minimum releases will be made as long as water is available in the Fisheries, Wildlife, and Recreation Pool.

1. Reservoir content less than 29,000 AF (with water in the U.S. storage)
   October 1 – April 15 15 cfs
   April 15 - October 1 20 cfs

2. Reservoir content greater than 29,000 AF (with water in the U.S. storage)
   Year round 20 cfs

Although it is not mandatory, if possible Pactola Releases can be adjusted during the summer months to aim for 40 cfs passing the gauging station in Founder's Park. Also, if possible during the cooler fall months the Reclamation aims for 30 to 35 cfs passing the gauging station in Founder's Park. Such releases are dependent on U.S. storage and inflows from the watershed below the dam.

The irrigators need to order flows from storage if their demand limits natural flows past Farmingdale to less than 10 cfs. Also, the Reclamation has an instream flow right for U.S. storage release flows that is in addition to the 10 cfs minimum required by the state for natural flows past Farmingdale.

The winter release for WY 2019 is approximately 20 cfs and has been coordinated with the City of Rapid City, South Dakota Department of Game, Fish, and Parks, local water users, Forest Service, and Corps of Engineers. With a reservoir content of 29,000 AF and above, a release of 20 cfs has been specified in the Finding of No Significant Impact for the Environmental Assessment for the Pactola Reservoir Water Service Contact Renewal (FONSI No. DK600-00-03). Pactola winter releases can be increased by 2 or 3 cfs during extremely cold weather to replace water that is lost in the formation of ice in the creek channel. Once the channel is covered with ice and snow, which provides insulation for the stream, the releases can be reduced if below average snow pack and inflow conditions indicate a need to conserve storage. During the flood control season, total releases will be controlled between 20 cfs and 1000 cfs. Releases in excess of 200 cfs when storage is below the top of the conservation pool at elevation 4,580.20 feet will be cleared with the Corps of Engineers. The Corps will issue release orders on a current basis when storage is in the exclusive flood control pool. Contract negotiations with water users at Pactola Reservoir will provide the basis for future reservoir operations.

During the irrigation season of May 1through October 30 sufficient natural flows to meet prior rights of the irrigators will be bypassed through the reservoir. Orders by water users will be released under the provisions of contracts with the water users. Drought conditions that have existed in past years have resulted in conservation measures being initiated by water users. Continuation of water conservation measures will assist in conserving reservoir storage and refilling of the reservoir.

Angostura Reservoir

Angostura Reservoir started WY 2019 at elevation 3,182.25 feet and storage of 101,605 AF, which is 4.95 feet and 21,443 AF below the top of active conservation (elevation 3,187.2 feet at 123,048 AF). Since Angostura Reservoir is the principle source of water for the Angostura Irrigation District and no accurate inflow forecasts are available for this reservoir, it is operated as full as possible at all times. Water may be released from the facility if the reservoir is expected to fill to meet irrigation demands; ergo, excess water is released through the spillway when the reservoir is nearly full and assured of filling.

Keyhole Reservoir

Keyhole Reservoir started WY 2019 at elevation 4,095.84 feet and storage of 158,110 AF, which is 3.46 feet and 30,561 AF below the top of conservation (elevation 4,099.3 feet at 188,671 AF). At the beginning of WY 2019, South Dakota storage for the Belle Fourche Irrigation District is 14,020 AF and Wyoming storage for the Crook County Irrigation District is 10,589 AF.

Releases from Keyhole Reservoir are made for either irrigation requirements or flood control. Releases are not anticipated from the reservoir from October through May. Flood control releases are not expected unless extreme precipitation events cause excessive inflows to the reservoir.

Discharges from toe drains of the dam and downstream inflows normally satisfy downstream requirements for stock water and other minor uses during this period. Releases from storage accounts will be made during the summer in response to irrigation demand from the Belle Fourche Irrigation District in South Dakota and the Crook County Irrigation District in Wyoming. Each organization maintains storage account in Keyhole Reservoir and the contract with the Belle Fourche Irrigation District also includes provisions for the annual purchase of additional unsold South Dakota storage. Peak irrigation demand releases are normally between 125 and 175 cfs.

The Belle Fourche Irrigation District has lands along the inlet canal that during drought conditions can depend entirely on Keyhole Reservoir for storage. These lands are served with flows from the Belle Fourche River and storage from Keyhole. Additionally, water contracted by Belle Fourche Irrigation District may be released from Keyhole Reservoir to supplement storage in Belle Fourche Reservoir if necessary. Finally, Crook Country Irrigation District also contracts irrigation water from Keyhole Reservoir.

Shadehill Reservoir

Shadehill Reservoir started WY 2019 at elevation 2,270.09 feet and storage of 110,832 AF, which is 1.91feet and 9,340 AF below the top of conservation (elevation 2,272.0 feet at 120,172 AF). The winter release will be maintained at approximately 13 cfs to prepare the reservoir elevation for spring inflows. This release rate will be maintained constant until ice comes out of the channel in the spring to prevent ice jams at crossings. In the spring, after ice comes out of the channel, the release will be adjusted based on inflows and storage in the reservoir. Operation is to fill the reservoir in the spring, maintain a near full reservoir during the summer and position the reservoir in the fall as discussed in the SOP. Releases for irrigation demands will be met by conservation releases.

Shadehill will have coatings work performed on the regulating gate in the outlet works tunnel during the month of June 2019. Dakotas Area Office will contact downstream water users to inform them of the reduction of flows prior to performing the work.

Belle Fourche Reservoir

Belle Fourche Reservoir started WY 2019 at elevation 2,968.81 feet and storage of 126,562 AF, which is 6.19 feet and 46,311 AF below the top of conservation (elevation 2,975.0 feet at 172,873 AF). Normal operation at the Diversion Dam during the winter is to maintain flows in the Inlet Canal to store water in Belle Fourche Reservoir. A bypass of 5 cfs is made at the Belle Fourche Diversion Dam to provide flows for domestic use between the diversion dam and the Belle Fourche River confluence with Owl Creek. No releases from the reservoir are planned until irrigation begins in the spring. When the volume of water supply available from the reservoir can be estimated in May or June, the Belle Fourche Irrigation District will establish allotments of water to each irrigator and the storage will be used accordingly. The Standing Operating Procedures for Belle Fourche Dam limit the maximum drawdown of the reservoir to 0.3 feet per day as established in the 1984 Safety Evaluation of Existing Dams report. Higher rates of drawdown are acceptable if the total drawdown is limited to 20 feet. This restriction will affect delivery rates to water users in the late summer if the reservoir does not fill. At low reservoir levels, the draw down rate becomes the governing factor for releases.

Corps of Engineers Main Stem Reservoirs

The Missouri River main stem reservoir system, consisting of six reservoirs located in Montana, North Dakota, South Dakota, and Nebraska, provides for the following beneficial uses: flood control, irrigation, navigation, power, municipal and industrial water supply, water quality control, fish and wildlife, and recreation. Based on information from the Corps' 2018-19 AOP, the capacity and storage allocations of the main stem system were updated to current values and are shown in upstream to downstream order in Table 46.

Table 46. Reservoir Storage Allocation (1,000 Acre-Feet).

Dam	Permanent	Carryover Multiple Use	Flood Control and Multiple Use	Exclusive Flood Control	Storage
Fort Peck, MT	4,088	10,700	2,704	971	18,463
Garrison, ND	4,794	12,951	4,211	1,495	23,451
Oahe, SD	5,315	13,353	3,208	1,107	22,983
Big Bend, SD	1,631	0	118	61	1,810
Fort Randall, SD	1,469	1,532	1,306	986	5,293
Gavins Point, NE	295	0	79	54	428
Totals	17,592	38,536	11,626	4,674	72,428

Each main stem facility serves a powerplant. The number of generating units and total nameplate capabilities are shown in Table 47.

Table 47. Main Stem Facility Powerplants with Number of Generating Units and Capabilities.

Powerplant	Units	(Kilowatts)
Fort Peck, MT	5	185,250
Garrison, ND	5	583,300
Oahe, SD	7	786,030
Big Bend, SD	8	494,320
Fort Randall, SD	8	320,000
Gavins Point, NE	3	132,300
Totals	36	2,501,200

Main stem system releases are regulated to support the multiple use purposes of the reservoirs. The navigation season on the Missouri River below the dams normally is from late March to late November. Generally, releases from the system for navigation are higher during late summer and fall lowering the system storage. During that time, much of the system's hydropower is generated from the lower most projects. During closure of the navigation season, higher releases are made and more power is generated from the upstream Fort Peck and Garrison Reservoirs. This offsets the reduced release and generation from the downstream projects during winter closure of the river for navigation. The desired annual target system storage level is 56.1 million acre-feet on the first of March.

Operation of the Missouri River main stem reservoir system provides the following eight beneficial uses: flood control, irrigation, navigation, power, municipal and industrial water supply, water quality control, fish and wildlife, and recreation. Table 48 presents the regulation benefit for most of those uses as recorded in 2017-2018, 2016-2017, and the average. Benefits are defined as the tons of produce shipped, dollars of damages prevented, kilowatt hours of electricity produced, and reservoir elevation and river stages maintained. For the shipping information, estimates also were provided this year which included the sand, gravel, and waterway material shipped. Table 48 shows damages prevented at September 2018 price levels.

Table 48. Comparison of Present and Past Benefits in the Main Stem Reservoir System.

Use of Regulated Water	Period of Use or Season	Totals	Totals	Long-Term
Navigation[1]	Apr. - Dec.[2]	0.679 million tons (2018)	0.736 million tons (2017)	1.63 million Tons[3]
Flood Damages Prevented	Oct. – Sept.	$1.72 billion (2018)	$ 253.0 million (2017)	$ 66.4 billion[4]
Energy	Aug. - Jul.	10.6 billion kWh (Aug. 17-July 18)	8.6 billion kWh (Aug. 16-July 17)	9.4 billion kWh[5]

[1]If sand, gravel, and waterway material are included:
4.685 million tons (2018)
4.957 million tons (2017)
6.57 million tons (1967-2018 average)
[2]End of navigation season extended 10 days in 2017 and 10 days in 2018
[3]1967-2018 average. Peak tonnage shipped in 1977 (3.336 million tons)
[4]Total damages prevented (1938-2018)
[5]1968-2018 Average

A detailed description of the main stem system operations is presented in annual operating reports prepared by and available for distribution from the U.S. Missouri River Basin Water Management Division, U.S. Army Corps of Engineers, Northwestern Division, Omaha, Nebraska.

Energy Generation

There are 14 Federal powerplants located in the Upper Missouri River Basin that are currently operating. Eight of the power plants are owned and operated by Reclamation and have a total capacity of 348,100 kilowatts. The other six are owned and operated by the Corps and have a total capacity of 2,501,200 kilowatts. Energy generated by the 14 power plants is marketed by the Department of Energy.

Total generation in the combined system in WY 2018 was 13,146.777 million kilowatt hours, 2,493.635 million kilowatt hours more than in WY 2017. A summary of the past 10 years of energy generation within the Upper Missouri River Basin is in Table 49.

Table 49. USBR and COE Energy Generation (Million Kilowatt Hours).

Year	USBR	USACE	TOTAL
2018	1790.992	11355.764	13146.777
2017	1560.628	9092.514	10653.142
2016	1164.801	7652.158	8816.969
2015	1316.344	9323.682	10640.026
2014	1559.297	8729.714	10289.197
2013	840.209	8183.967	9024.176
2012	1141.904	10779.032	11920.936
2011	1674.806	11267.588	12942.390
2010	1430.618	7422.355	8852.974
2009	1481.641	6273.697	7755.338

A comparison of 2017 and 2018 generation and other data from Missouri Basin Region powerplants is shown on Table 50. Table 51, Table 52, Table 53, Table 54, Table 55, Table 56, and Table 57 show the monthly generation, power releases, inflow amounts, and total downstream releases for all Federal plants in the Missouri Basin Region. The annual energy generation for each of the last several years for all Reclamation, Corps, and combined plants is shown graphically on Figure 46, Figure 48, and Figure 50, respectively, Monthly generation for each month during the past several years is shown graphically on Figure 47, Figure 49, and Figure 51.

For a more detailed account of powerplant operation at Reclamation facilities during the year, refer to the 2018 operation summaries. Information on the Corps' powerplant operations can be obtained from the annual operating reports prepared by and available for distribution from the Missouri River Basin Water Management Division, U.S. Army Corps of Engineers, Northwestern Division, Omaha, Nebraska.

Table 50. Annual Energy Production Data.

BUREAU PLANTS	INSTALLED CAPACITY (KW)	MILLION KILOWATT-HOURS GENERATED 2017	MILLION KILOWATT-HOURS GENERATED 2018	WATER USED FOR GENERATION IN 2018 1,000 AF	WATER USED FOR GENERATION IN 2018 PERCENT OF TOTAL RELEASE	WATER USED FOR GENERATION IN 2018 KW-HOURS PER AF	RIVER RELEASE 1,000 AF	TOTAL RELEASE 1,000 AF
Canyon Ferry	50,000	336.681	363.626	3,023.106	61.97	120.28	4,791.7	4,878.1
Pilot Butte[1]	1,600	0.000	0.000	0.000	0.00	N/A	156.9	156.9
Boysen	15,000	85.315	79.325	963.517	60.75	82.33	1,586.1	1,586.1
Buffalo Bill Reservoir Units								
Shoshone	3,000	18.731	19.819	105.366	6.51	188.10	See below for	total.
Buffalo Bill	18,000	90.413	122.743	512.714	31.66	239.40	See below for	total.
Heart Mountain	6,000	22.634	22.678	107.543	6.64	210.87	See below for	total.
Spirit Mountain [2]	4,500	15.360	15.746	155.546	9.60	101.23	See below for	total.
Total for Buffalo Bill Reservoir[3]	31,500	147.138	180.986	881.170	54.40	205.39	1,404.2	1,619.7
Yellowtail	250,000	991.494	1,167.055	3,077.371	76.10	379.24	4,021.0	4,043.7
Subtotal	**348,100**	**1,560.628**	**1,790.992**	**7,945.163**	**64.68**	**225.42**	**11,960.0**	**12,284.6**
CORPS PLANTS								
Fort Peck	185,250	816.111	1,130.401	6,717.00	80.69	168.29	8,324.0	8,324.0
Garrison	583,300	2,527.377	3,192.614	20,550.00	90.39	155.36	22,734.0	22,734.0
Oahe	786,030	2,481.144	3,351.368	22,002.00	98.94	152.32	22,237.0	22,237.0
Big Bend	494,320	908.475	1,198.948	20,141.00	100.00	59.53	20,141.0	20,141.0
Fort Randall	320,000	1,584.231	1,727.288	16,884.00	73.43	102.30	22,993.0	22,993.0
Gavins Point	132,300	775.176	755.166	17,459.00	69.76	43.25	25,027.0	25,027.0
Subtotal	**2,501,200**	**9,092.514**	**11,355.785**	**103,753.00**	**85.42**	**109.45**	**121,456.0**	**121,456.0**
TOTAL MISSOURI BASIN	**2,849,300**	**10,653.142**	**13,146.777**	**111,698.16**	**83.52**	**117.70**	**133,416.0**	**133,740.6**

[1] River Release and Total Release at Pilot Butte Reservoir is computed inflow to Pilot Butte Reservoir due to the location of the powerplant at inlet of supply canal.
[2] Spirit Mountain Powerplant is used to dissipate energy in the transition from the pressurized portion of the Shoshone Canyon Conduit to the free flow section of the conduit. Water used for generation at Spirit Mountain Powerplant is then routed to Heart Mountain Canal or used for generation at Heart Mountain Powerplant.
[3] This represents the total for the four separate powerplants at Buffalo Bill Dam.

Table 51. Monthly Energy Generation at Bureau of Reclamation Plants (Million Kilowatt-Hours).

	BUREAU OF RECLAMATION PLANTS								
				BUFFALO BILL PLANTS					
MONTH	CANYON FERRY	PILOT BUTTE	BOYSEN	HEART MOUNTAIN	SPIRIT MOUNTAIN	BUFFALO BILL	SHOSHONE	YELLOWTAIL	TOTAL
October	25.515	0.000	6.188	1.872	1.495	11.617	1.749	119.982	**168.418**
November	27.723	0.000	4.982	0.000	0.001	9.329	1.690	100.220	**143.945**
December	34.627	0.000	6.254	0.000	0.000	7.692	1.759	88.947	**139.279**
January	26.765	0.000	5.399	0.000	0.000	4.276	1.711	87.564	**125.715**
February	22.041	0.000	5.100	0.000	0.000	6.357	1.095	88.132	**122.725**
March	37.166	0.000	5.611	0.488	0.156	12.799	0.955	107.587	**164.762**
April	32.966	0.000	5.187	3.618	0.998	12.850	1.560	105.480	**162.659**
May	33.773	0.000	10.208	3.750	0.720	13.620	1.641	103.920	**167.632**
June	36.362	0.000	9.038	3.382	3.031	13.465	1.828	106.416	**173.522**
July	29.824	0.000	8.681	3.292	3.206	13.661	2.049	116.913	**177.626**
August	28.349	0.000	7.211	3.163	3.179	9.374	2.007	72.875	**126.158**
September	28.515	0.000	5.466	3.113	2.960	7.703	1.775	69.019	**118.551**
TOTAL	**363.626**	**0.000**	**79.325**	**22.678**	**15.746**	**122.743**	**19.819**	**1,167.055**	**1,790.992**

Table 52. Monthly Energy Generation at Army Corps of Engineers Plants (Million Kilowatt-Hours).

	ARMY CORPS OF ENGINEERS PLANTS							
MONTH	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT	TOTAL	MISSOURI BASIN TOTAL
October	58.067	156.698	164.639	60.849	162.345	79.856	**682.454**	**850.872**
November	57.560	141.204	202.173	75.620	150.524	76.039	**703.120**	**847.065**
December	68.630	158.978	208.529	75.871	118.861	59.511	**690.380**	**829.659**
January	100.174	224.064	224.598	88.316	112.305	57.664	**807.121**	**932.836**
February	94.598	208.639	143.393	54.466	91.044	44.316	**636.456**	**759.181**
March	83.675	207.485	193.069	73.802	104.791	34.462	**697.284**	**862.046**
April	94.851	256.884	251.599	91.820	147.233	27.660	**870.047**	**1,032.706**
May	115.195	353.367	320.653	112.679	158.207	70.616	**1,130.717**	**1,298.349**
June	109.297	384.973	326.547	110.942	155.209	66.299	**1,153.267**	**1,326.789**
July	120.828	399.967	419.007	129.066	185.600	81.367	**1,335.835**	**1,513.461**
August	121.155	377.211	500.012	173.339	175.307	78.939	**1,425.963**	**1,552.121**
September	106.371	323.144	397.149	152.178	165.862	78.437	**1,223.141**	**1,341.692**
TOTAL	**1,130.401**	**3,192.614**	**3,351.368**	**1,198.948**	**1,727.288**	**755.166**	**11,355.785**	**13,146.777**

Table 53. Water Used for Power Generation (1,000 Acre-Feet).

MONTH	CANYON FERRY	BOYSEN	PILOT BUTTE	BUFFALO BILL RESERVOIR UNITS				YELLOWTAIL	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT
				SHOSHONE	BUFF. BILL	HEART MTN.	SPIRIT MTN.[1]							
October	212.800	72.007	0.000	9.283	51.257	8.598	14.694	291.060	356.000	996.000	1,079.000	967.000	1,619.000	1,753.000
November	229.349	61.299	0.000	8.970	37.286	0.000	0.000	249.359	357.000	898.000	1,331.000	1,200.000	1,607.000	1,666.000
December	285.071	74.620	0.000	9.336	32.289	0.000	0.000	229.441	421.000	1,016.000	1,393.000	1,216.000	1,279.000	1,315.000
January	228.251	66.215	0.000	9.384	21.822	0.000	0.000	232.397	612.000	1,485.000	1,513.000	1,422.000	1,145.000	1,274.000
February	190.963	59.697	0.000	5.812	27.766	0.000	0.000	236.018	578.000	1,402.000	976.000	873.000	870.000	961.000
March	329.265	69.527	0.000	5.069	49.438	2.381	1.845	283.255	513.000	1,380.000	1,289.000	1,204.000	970.000	745.000
April	297.246	71.577	0.000	8.280	51.932	16.157	13.325	276.542	561.000	1,673.000	1,662.000	1,541.000	1,394.000	621.000
May	286.647	139.143	0.000	8.710	56.336	18.014	7.830	281.192	674.000	2,264.000	2,097.000	1,938.000	1,494.000	1,690.000
June	279.885	101.949	0.000	9.703	52.124	16.543	28.886	276.370	627.000	2,428.000	2,119.000	1,882.000	1,456.000	1,564.000
July	227.396	103.320	0.000	10.742	53.048	15.931	30.412	314.721	695.000	2,522.000	2,663.000	2,353.000	1,727.000	1,983.000
August	225.958	80.301	0.000	10.653	43.696	15.221	30.201	217.989	705.000	2,413.000	3,272.000	2,975.000	1,681.000	1,966.000
September	230.275	63.862	0.000	9.422	35.720	14.699	28.354	189.029	618.000	2,073.000	2,608.000	2,570.000	1,642.000	1,921.000
TOTAL	**3,023.106**	**963.517**	**0.000**	**105.366**	**512.714**	**107.543**	**155.546**	**3,077.371**	**6,717.000**	**20,550.000**	**22,002.000**	**20,141.000**	**16,884.000**	**17,459.000**

[1] Spirit Mountain Powerplant is used to dissipate energy in the transition from the pressurized portion of the Shoshone Canyon Conduit to the free flow section of the conduit. Water used for generation at Spirit Mountain Powerplant is then routed to Heart Mountain Canal or used for generation at Heart Mountain Powerplant.

Table 54. Total Release (1,000 Acre Feet)

MONTH	CANYON FERRY	BOYSEN	PILOT BUTTE	BUFFALO BILL	BULL LAKE	ANCHOR	YELLOWTAIL	FORT PECK	GARRISON	OAHE	BIG BEND	FORT RANDALL	GAVINS POINT
October	216.593	134.740	5.515	82.273	24.548	0.512	291.060	356.000	996.000	1,079.000	967.000	1,619.000	1,758.000
November	229.349	103.414	0.000	50.263	6.497	0.000	249.359	357.000	898.000	1,331.000	1,200.000	1,607.000	1,731.000
December	292.634	78.329	0.000	42.216	3.756	0.000	229.441	421.000	1,016.000	1,393.000	1,216.000	1,279.000	1,386.000
January	278.691	77.124	0.000	31.361	3.132	0.000	232.397	612.000	1,485.000	1,513.000	1,422.000	1,145.000	1,274.000
February	292.749	69.768	0.000	35.849	2.315	0.000	239.703	578.000	1,402.000	976.000	873.000	870.000	1,000.000
March	351.137	117.215	0.000	67.808	2.564	0.000	328.888	513.000	1,380.000	1,289.000	1,204.000	982.000	1,321.000
April	466.619	174.651	3.704	150.423	7.731	0.082	434.226	561.000	1,673.000	1,662.000	1,541.000	1,785.000	2,021.000
May	878.241	155.302	22.717	265.570	50.547	2.607	442.806	873.000	2,264.000	2,097.000	1,938.000	2,287.000	2,426.000
June	889.259	328.745	30.093	474.199	38.743	8.335	749.906	1,154.000	2,896.000	2,119.000	1,882.000	1,994.000	2,204.000
July	455.374	202.694	42.378	210.094	33.117	4.040	438.931	1,069.000	3,611.000	2,663.000	2,353.000	2,970.000	3,048.000
August	270.399	80.301	37.733	115.343	39.193	3.203	217.989	981.000	2,893.000	3,272.000	2,975.000	3,325.000	3,521.000
September	257.036	63.862	14.773	94.289	51.822	0.327	189.029	849.000	2,220.000	2,843.000	2,570.000	3,130.000	3,337.000
TOTAL	**4,878.082**	**1,586.145**	**156.913**	**1,619.688**	**263.965**	**19.105**	**4,043.735**	**8,324.000**	**22,734.000**	**22,237.000**	**20,141.000**	**22,993.000**	**25,027.000**

Table 55. Total Reservoir Storage Contents (1,000 Acre-Feet).

BUREAU RESERVOIRS	TOP OF CONSERVATION CAPACITY [3]	DEAD AND INACTIVE CAPACITY	TOTAL STORAGE SEPTEMBER 30		END OF SEPTEMBER PERCENT OF AVERAGE	
			2017	2018	2017	2018
Clark Canyon	174.4	1.1	99.1	132.8	105%	141%
Canyon Ferry	1,891.9	396.0	1,544.7	1,633.0	95%	101%
Helena Valley	10.5	4.6	9.0	8.9	120%	119%
Gibson	96.5	0.0	5.6	17.1	24%	72%
Willow Creek	31.8	1.0	17.3	20.6	86%	102%
Pishkun	46.7	16.0	19.7	19.3	61%	59%
Lake Elwell	925.6	554.3	814.9	855.0	103%	108%
Sherburne	66.1	1.9	11.1	6.1	66%	36%
Fresno	92.9	0.4	43.0	41.0	93%	89%
Nelson	79.0	18.1	50.7	76.3	89%	134%
Bull Lake	152.5	0.7	120.5	81.7	159%	108%
Pilot Butte	33.7	3.8	18.0	16.5	100%	92%
Boysen	741.6	219.2	717.0	653.0	120%	109%
Anchor[1]	17.2	0.1	1.2	0.5	358%	150%
Buffalo Bill[2]	646.6	41.7	528.2	489.4	119%	110%
Bighorn Lake	1,020.6	469.9	1,014.6	952.1	107%	100%
E. A. Patterson	8.6	0.5	5.9	7.2	95%	116%
Lake Tschida	67.1	5.2	51.4	58.4	90%	103%
Jamestown Reservoir	31.5	0.8	29.4	27.8	102%	97%
Shadehill Reservoir	120.2	43.9	85.8	110.8	81%	105%
Angostura Reservoir	123.0	42.2	83.5	101.6	98%	120%
Deerfield Reservoir	15.7	0.2	15.5	15.0	116%	113%
Pactola Reservoir	56.0	1.0	51.3	53.4	111%	115%
Keyhole Reservoir	188.7	6.6	122.1	158.1	138%	178%
Belle Fourche Reservoir	172.9	3.1	58.4	126.6	79%	171%
Subtotal	**6,811.2**	**1,832.3**	**5,517.7**	**5,662.1**		
CORPS RESERVOIRS						
Fort Peck	17,578.0	4,073.0	15,377.0	16,406.0		
Garrison	22,332.0	4,980.0	19,029.0	19,689.0		
Oahe	22,035.0	5,373.0	19,568.0	20,802.0		
Big Bend	1,738.0	1,621.0	1,660.0	1,690.0		
Fort Randall	4,433.0	1,517.0	3,257.0	3,204.0		
Gavins Point	393.0	307.0	362.0	364.0		
Subtotal	**68,509.0**	**17,871.0**	**59,253.0**	**62,155.0**		
TOTAL UPPER MISSOURI BASIN	**75,320.2**	**19,703.3**	**64,770.7**	**67,817.1**		

[1]Percent of average content of Anchor Reservoir is based on a 22-year average, 1991-2012.
[2]Percent of average content of Buffalo Bill Reservoir is based on a 20-year average, 1993-2012. [3]Includes joint-use space.

Table 56. End-of-Month Reservoir Contents (1,000 Acre-Feet).

RECLAMATION RESERVOIRS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
CLARK CANYON RESERVOIR	111.9	125.4	135.7	145.1	153.1	164.7	176.3	189.2	198.6	171.0	148.4	132.8
% of Average	108.2%	111.9%	115.1%	118.1%	119.9%	121.4%	123.5%	137.0%	151.1%	154.7%	158.0%	140.9%
CANYON FERRY RESERVOIR	1,553.4	1,579.0	1,493.3	1,469.7	1,384.8	1,349.6	1,328.0	1,718.8	1,949.2	1,842.1	1,720.8	1,633.0
% of Average	95.0%	95.4%	93.2%	95.7%	93.1%	92.3%	89.4%	104.6%	105.3%	103.2%	102.7%	100.8%
HELENA VALLEY RESERVOIR	8.2	7.7	7.4	7.2	6.9	7.0	10.0	8.7	9.9	7.7	8.9	8.9
% of Average	118.2%	114.4%	114.6%	117.3%	120.6%	122.9%	109.0%	95.0%	110.1%	103.8%	109.7%	118.6%
GIBSON RESERVOIR	5.7	11.9	13.6	12.9	12.7	11.4	39.8	86.1	98.4	67.8	26.5	17.1
% of Average	19.6%	35.8%	37.3%	32.3%	29.4%	23.7%	63.5%	95.9%	109.0%	131.8%	98.7%	72.2%
WILLOW CREEK	22.8	27.2	27.5	27.7	28.2	29.2	28.0	31.2	33.9	27.2	19.6	20.6
% of Average	0.1%	126.5%	125.6%	124.7%	124.6%	124.3%	110.3%	109.7%	116.4%	112.4%	96.0%	101.9%
PISHKUN RESERVOIR	19.7	19.7	19.7	19.7	19.7	19.7	23.0	46.3	45.9	39.7	46.5	19.3
% of Average	0.1%	57.4%	57.8%	58.5%	58.4%	57.7%	57.7%	100.9%	109.5%	107.1%	129.7%	59.5%
LAKE ELWELL (TIBER DAM)	791.1	783.6	771.3	758.0	746.5	763.2	841.6	926.6	980.0	948.1	890.2	855.0
% of Average	103.9%	104.3%	104.6%	104.9%	104.3%	106.1%	114.1%	113.3%	111.6%	110.6%	108.3%	107.8%
SHERBURNE LAKE	11.7	23.9	28.9	31.7	34.3	36.3	39.5	57.5	63.7	59.2	29.4	6.1
% of Average	58.9%	95.2%	103.8%	102.8%	103.7%	126.4%	194.2%	167.5%	113.1%	120.9%	104.5%	35.7%
FRESNO RESERVOIR	44.5	42.7	41.2	38.6	36.1	45.4	83.6	88.9	90.9	57.7	37.9	41.0
% of Average	98.1%	94.4%	94.4%	91.4%	82.8%	76.7%	110.4%	122.7%	119.9%	99.1%	83.1%	88.5%
NELSON RESERVOIR	50.8	49.2	47.8	46.2	45.2	44.4	62.9	73.2	75.6	68.2	63.8	76.3
% of Average	86.2%	85.3%	85.4%	85.0%	85.0%	81.5%	102.4%	120.4%	124.5%	123.6%	117.3%	134.1%
BULL LAKE	104.2	104.2	104.6	104.3	104.3	104.5	102.4	100.3	139.4	149.1	128.3	81.7
% of Average	139.5%	138.1%	137.8%	137.1%	137.1%	137.2%	135.0%	112.7%	110.6%	115.6%	124.4%	107.7%
PILOT BUTTE RESERVOIR	28.4	28.2	28.1	28.1	28.0	27.9	29.1	28.8	29.3	26.5	17.3	16.5
% of Average	106.8%	101.9%	101.5%	100.8%	100.2%	94.8%	95.0%	107.2%	98.5%	104.3%	81.2%	91.7%
BOYSEN RESERVOIR	696.8	679.4	660.3	638.2	615.9	571.4	458.9	670.4	777.3	717.0	678.4	653.0
% of Average	117.0%	115.1%	115.4%	114.6%	112.7%	105.9%	87.2%	122.1%	118.5%	110.5%	109.8%	109.0%
ANCHOR RESERVOIR	1.35	1.17	0.81	0.59	0.47	0.61	1.26	6.57	6.62	3.82	0.44	0.49
% of Average[1]	477.0%	474.7%	341.3%	255.6%	181.5%	167.0%	252.4%	428.9%	195.1%	174.5%	73.5%	149.8%
BUFFALO BILL RESERVOIR	500.9	500.2	491.3	485.3	467.4	423.4	349.6	535.3	615.2	622.9	562.0	489.4
% of Average[2]	118.5%	117.4%	115.7%	114.8%	111.7%	102.3%	88.6%	122.2%	108.4%	108.3%	110.6%	109.9%
BIGHORN LAKE	1,001.3	981.8	929.7	874.7	793.9	773.2	730.2	944.1	1,090.4	1,024.9	978.1	952.1
% of Average	104.1%	104.9%	104.7%	103.9%	97.6%	96.3%	92.5%	109.3%	109.2%	104.3%	103.6%	100.3%
E. A. PATTERSON LAKE	5.8	5.8	5.9	5.9	6.1	9.2	9.0	8.6	8.9	8.3	7.5	7.2
% of Average	97.7%	99.0%	100.3%	99.4%	95.0%	116.9%	113.9%	110.6%	116.7%	116.5%	114.2%	116.2%
LAKE TSCHIDA	51.5	52.1	52.7	52.9	53.1	77.1	59.8	61.0	62.9	62.1	58.4	58.4
% of Average	90.1%	90.6%	91.7%	92.0%	89.0%	113.6%	90.9%	93.2%	96.2%	100.2%	100.2%	102.8%
JAMESTOWN RESERVOIR	27.4	27.6	27.7	27.6	27.6	28.2	30.7	30.5	29.8	30.7	31.5	27.8
% of Average	101.8%	104.4%	104.2%	103.4%	102.2%	77.3%	54.2%	67.2%	80.1%	90.2%	96.3%	96.7%
SHADEHILL RESERVOIR	84.0	82.6	80.8	78.6	77.3	100.3	117.0	120.9	120.3	117.2	113.8	110.8
% of Average	81.9%	81.6%	80.9%	79.7%	76.6%	87.1%	100.0%	103.2%	103.8%	102.8%	103.8%	105.0%

ANGOSTURA RESERVOIR	84.6	87.1	89.3	91.5	94.1	118.2	118.8	119.6	116.7	116.3	107.3	101.6
% of Average	97.9%	99.6%	100.2%	100.2%	98.3%	115.4%	112.4%	109.3%	107.4%	117.5%	120.8%	119.7%
DEERFIELD RESERVOIR	15.3	15.1	14.9	14.8	14.8	14.9	15.5	15.6	15.6	15.3	15.0	15.0
% of Average	114.4%	111.6%	108.6%	106.2%	104.6%	104.0%	108.0%	107.8%	108.2%	108.3%	110.1%	112.5%
PACTOLA RESERVOIR	51.2	51.5	51.7	52.5	53.1	54.7	55.9	56.7	55.7	55.5	54.1	53.4
% of Average	110.0%	110.0%	111.1%	112.8%	114.0%	115.5%	114.9%	113.6%	110.5%	114.0%	114.9%	115.1%
KEYHOLE RESERVOIR	119.4	118.5	118.5	118.6	119.6	157.4	159.7	161.9	164.2	162.2	160.4	158.1
% of Average	135.1%	134.7%	134.3%	133.7%	131.0%	161.3%	161.5%	159.2%	161.8%	169.0%	176.8%	178.3%
BELLE FOURCHE RESERVOIR	65.6	74.0	82.1	92.1	101.7	135.7	162.9	171.7	166.8	158.5	139.1	126.6
% of Average	79.6%	80.1%	81.1%	83.4%	85.2%	101.6%	112.7%	110.6%	111.8%	134.2%	161.9%	171.0%
CORPS RESERVOIRS	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
FORT PECK RESERVOIR	15,297.0	15,220.0	15,182.0	14,934.0	14,766.0	15,208.0	16,070.0	17,122.0	17,852.0	17,518.0	16,902.0	16,406.0
GARRISON RESERVOIR	18,959.0	18,933.0	18,713.0	18,233.0	17,846.0	18,212.0	19,313.0	20,776.0	23,008.0	22,228.0	20,702.0	19,689.0
OAHE RESERVOIR	19,364.0	18,901.0	18,392.0	18,292.0	18,762.0	19,187.0	19,504.0	19,856.0	20,910.0	21,938.0	21,475.0	20,802.0
BIG BEND RESERVOIR	1,651.0	1,654.0	1,691.0	1,651.0	1,658.0	1,672.0	1,663.0	1,622.0	1,658.0	1,687.0	1,656.0	1,690.0
FORT RANDALL RESERVOIR	2,588.0	2,233.0	2,260.0	2,837.0	2,962.0	3,595.0	3,682.0	3,671.0	4,013.0	3,676.0	3,594.0	3,204.0
GAVINS POINT RESERVOIR	369.0	371.0	298.0	347.0	345.0	341.0	352.0	322.0	364.0	359.0	352.0	364.0

[1] Percent of average content of Anchor Reservoir is based on a 22-year average, 1991-2012; this is due to the availability of data for Anchor Reservoir.
[2] Percent of average content of Buffalo Bill Reservoir is based on a 20-year average, 1993-2012; to reflect the operation of the reservoir since 1992 when the dam was raised and the capacity of the reservoir was increased to 646,565 acre-feet.

Table 57. Monthly Inflow Amounts (1,000 Acre-Feet).

RECLAMATION RESERVOIRS	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
CLARK CANYON RESERVOIR	17.5	18.0	14.9	14.0	12.1	16.3	28.1	45.9	46.5	19.9	16.3	19.8	269.6
% of Average	83.8%	90.0%	89.5%	98.6%	95.7%	99.8%	165.0%	216.7%	147.2%	76.9%	86.3%	110.5 %	115.5%
CANYON FERRY RESERVOIR	225.3	255.0	206.9	255.1	207.8	316.0	445.0	1,269.1	1,119.7	348.3	149.0	169.3	4,966.4
% of Average	88.5%	96.2%	95.2%	119.4%	100.5%	124.8%	145.4%	254.7%	163.2%	118.5 %	97.1%	92.7%	140.7%
HELENA VALLEY RESERVOIR	-0.4	-0.3	-0.2	-0.3	-0.2	0.1	3.0	8.2	13.7	18.7	23.0	13.6	78.8
% of Average	N/A	N/A	N/A	N/A	N/A	1.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.1%
GIBSON RESERVOIR	11.8	17.2	13.8	11.4	10.5	11.3	49.0	357.1	206.6	53.9	22.7	14.1	779.3
% of Average	72.9%	103.7%	101.1%	94.4%	97.5%	77.1%	116.7%	243.0%	136.5%	96.0%	94.9%	81.8%	149.5%
WILLOW CREEK	5.4	4.5	0.3	0.2	0.5	1.0	2.0	8.4	13.4	3.9	0.4	1.9	41.8
% of Average	0.7%	0.6%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.3%	0.8%	N/A	0.4%	0.3%
PISHKUN RESERVOIR	0.0	0.0	0.0	0.0	0.0	0.0	3.3	49.8	53.4	80.1	59.7	16.4	262.7
% of Average	N/A	N/A	N/A	N/A	N/A	N/A	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
LAKE ELWELL (TIBER DAM)	6.6	22.3	18.0	16.7	15.9	49.5	159.5	293.4	173.7	30.8	7.2	9.4	802.9
% of Average	39.5%	104.7%	106.1%	104.9%	73.0%	128.2%	302.8%	236.6%	129.3%	73.6%	58.4%	81.2%	158.0%
SHERBURNE LAKE	2.5	12.2	5.0	2.8	2.6	2.0	6.3	54.4	34.9	12.7	6.5	4.8	146.6
% of Average	37.6%	175.6%	147.4%	94.2%	111.6%	56.8%	57.7%	176.5%	94.4%	68.1%	73.7%	79.1%	106.3%
FRESNO RESERVOIR	4.2	0.8	1.1	-0.1	-0.1	11.8	106.3	34.5	38.1	22.0	27.2	30.2	276.0
% of Average	58.7%	34.8%	134.5%	N/A	N/A	49.5%	357.5%	80.2%	78.0%	64.9%	90.6%	146.3 %	112.7%
NELSON RESERVOIR	0.1	-1.6	-1.4	-1.6	-1.0	-0.8	18.5	18.1	15.1	6.7	9.9	15.7	77.7
% of Average	0.0%	N/A	N/A	N/A	N/A	N/A	0.2%	0.3%	0.2%	0.1%	0.1%	0.2%	0.2%
BULL LAKE	8.3	6.5	4.1	2.9	2.3	2.7	5.6	48.4	77.9	42.7	18.4	5.2	225.1
% of Average	147.5%	205.9%	166.7%	133.2%	146.5%	148.9%	150.9%	173.2%	126.5%	92.4%	88.1%	55.0%	120.6%
PILOT BUTTE RESERVOIR[1]	15.9	-0.2	-0.1	-0.1	0.0	-0.1	4.9	22.4	30.6	39.5	28.6	14.0	155.5
% of Average	142.6%	N/A	N/A	N/A	N/A	N/A	69.9%	95.3%	82.2%	95.9%	88.0%	59.7%	86.9%
BOYSEN RESERVOIR	114.5	86.0	59.3	55.0	47.5	73.0	62.2	366.8	435.6	142.4	41.7	38.4	1,522.4
% of Average	194.1%	175.3%	157.5%	149.9%	127.2%	140.4%	127.1%	305.8%	170.1%	108.7 %	73.0%	73.5%	162.5%
ANCHOR RESERVOIR	0.69	-0.19	-0.36	-0.13	-0.12	0.13	0.74	7.91	8.39	1.23	-0.18	0.38	18.51
% of Average[2]	0.1%	N/A	N/A	N/A	N/A	0.0%	0.1%	0.2%	0.1%	0.1%	N/A	0.1%	0.1%
BUFFALO BILL RESERVOIR	55.0	49.6	33.3	25.4	17.9	23.8	76.5	451.3	554.1	217.8	54.4	21.7	1,580.9

% of Average	213.6%	232.1%	212.7%	173.2%	137.7%	125.9%	186.9%	284.4%	184.1%	135.8%	121.3%	87.4%	188.2%
BIGHORN LAKE	277.8	229.8	177.4	177.3	158.9	308.2	391.2	657.1	896.2	373.5	171.2	163.0	3,981.6
% of Average	165.5%	178.1%	162.1%	160.6%	142.2%	208.7%	275.2%	257.8%	219.5%	147.0%	113.2%	98.4%	185.0%
E. A. PATTERSON LAKE	-0.1	0.0	0.0	0.0	0.2	13.9	2.7	0.1	2.1	0.8	-0.5	-0.3	19.1
% of Average	N/A	4.4%	29.8%	N/A	14.7%	210.4%	81.4%	9.5%	115.2%	80.5%	N/A	N/A	111.2%
LAKE TSCHIDA	0.1	1.2	1.2	0.7	0.8	31.0	15.6	2.9	5.3	3.0	-0.8	0.7	61.8
% of Average	8.4%	78.8%	126.0%	88.6%	17.3%	105.5%	92.8%	52.9%	72.6%	82.5%	N/A	256.3%	83.7%
JAMESTOWN RESERVOIR	-0.1	0.2	0.1	-0.1	0.0	0.6	3.0	6.3	3.3	1.0	2.0	0.3	16.6
% of Average	N/A	17.4%	17.0%	N/A	N/A	5.3%	8.2%	67.8%	74.0%	17.6%	41.4%	14.9%	21.4%
SHADEHILL RESERVOIR	-1.0	-0.6	-1.0	-1.4	-0.6	23.8	17.7	6.7	1.7	-2.7	-2.4	-1.9	38.3
% of Average	N/A	N/A	N/A	N/A	N/A	93.5%	95.3%	52.8%	28.7%	N/A	N/A	N/A	50.4%
ANGOSTURA RESERVOIR	1.7	2.6	2.3	2.3	2.7	27.3	10.3	25.0	38.6	16.4	6.2	1.0	136.6
% of Average	71.8%	83.2%	118.1%	101.0%	54.3%	239.8%	122.6%	187.6%	248.4%	498.6%	370.1%	98.4%	196.3%
DEERFIELD RESERVOIR	0.6	0.7	0.7	0.7	0.7	0.9	1.5	1.3	1.5	1.5	1.0	0.9	12.0
% of Average	84.0%	96.9%	94.7%	102.1%	107.1%	92.7%	110.3%	85.0%	110.9%	155.3%	120.6%	124.7%	106.7%
PACTOLA RESERVOIR	2.2	2.4	1.8	2.0	1.8	2.8	3.8	6.4	9.9	9.7	6.0	3.1	52.1
% of Average	102.6%	131.1%	121.6%	126.8%	114.1%	101.1%	84.3%	92.3%	147.1%	257.3%	206.7%	144.9%	135.3%
KEYHOLE RESERVOIR	-2.1	-0.8	-0.1	0.1	1.0	37.8	2.3	2.2	2.4	-2.0	-1.8	-2.2	36.6
% of Average	N/A	N/A	N/A	26.2%	37.3%	604.2%	107.8%	53.4%	145.6%	N/A	N/A	N/A	274.3%
BELLE FOURCHE RESERVOIR	9.3	8.4	8.1	10.1	9.6	34.0	27.2	18.3	12.5	9.7	7.6	6.7	161.4
% of Average	80.9%	85.0%	90.9%	109.0%	106.7%	239.2%	232.4%	108.0%	121.3%	198.3%	352.0%	141.0%	142.3%

[1] Negative values are the result of calculated inflow based on reservoir release and change in reservoir content.
[2] Percent of average inflow for Anchor Reservoir is based on a 22-year average, 1991-2012, this is due to the availability of data for Anchor Reservoir.

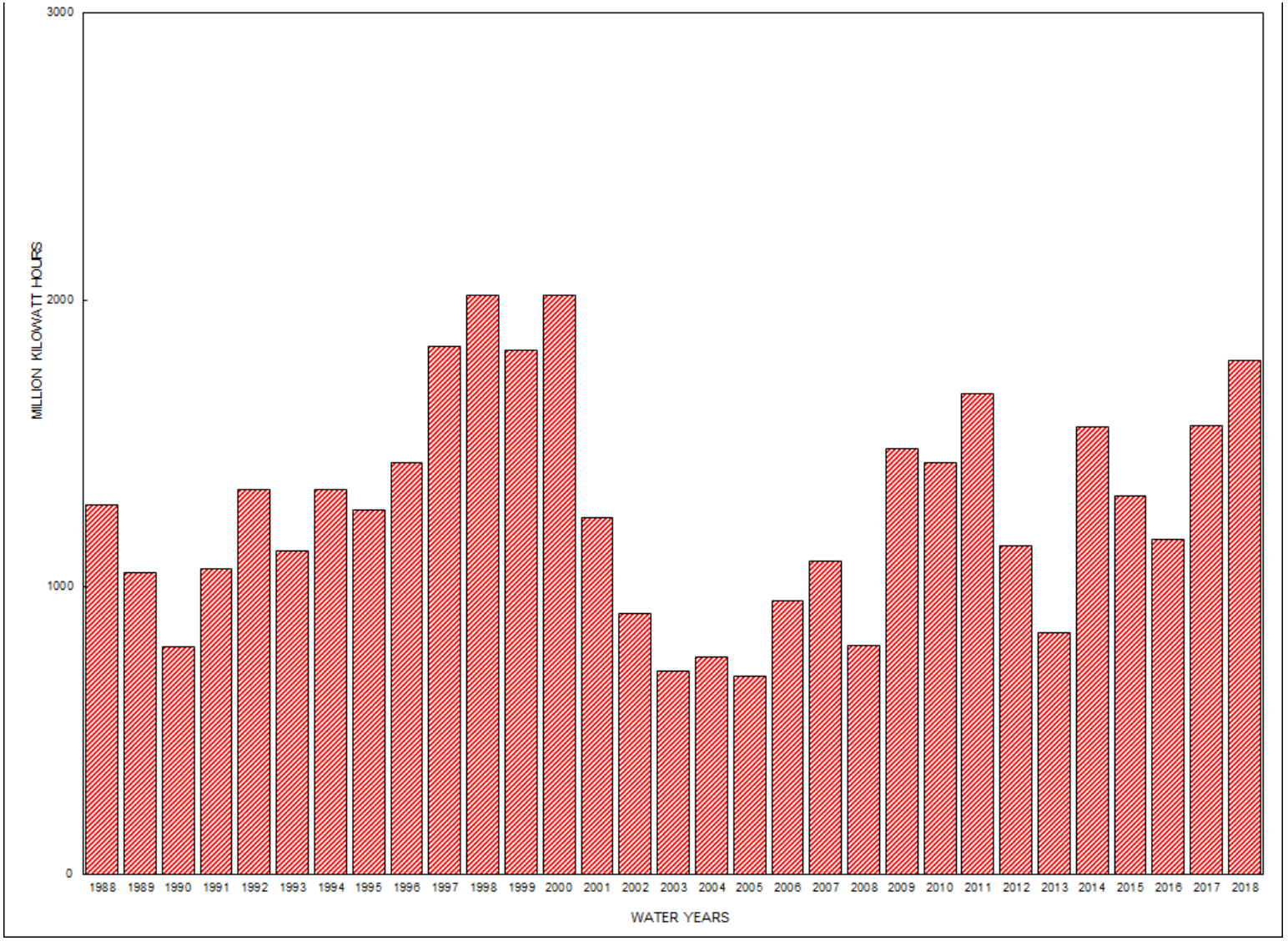


Figure 46. Annual Generation at USBR Plants.

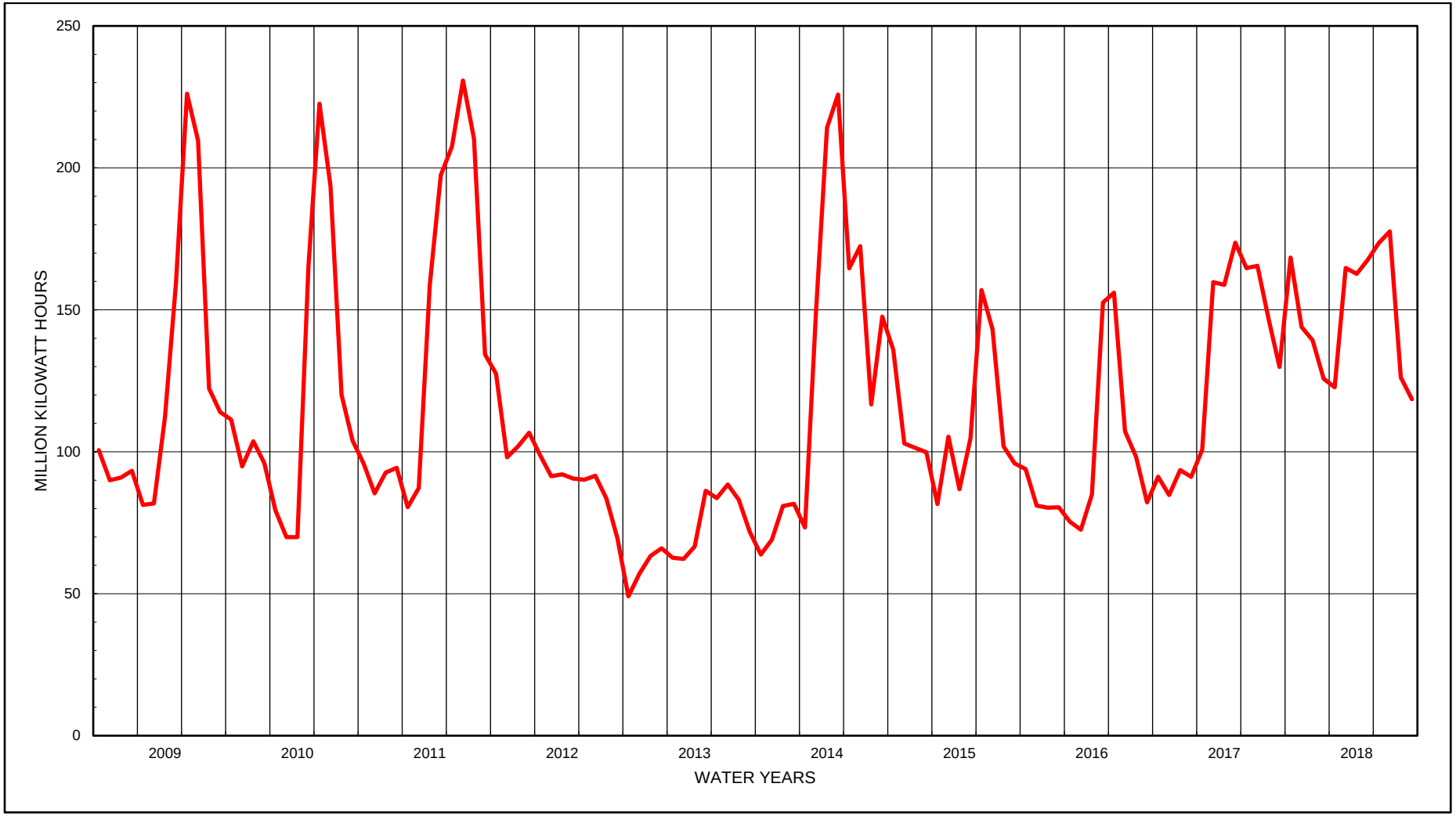


Figure 47. Monthly Generation at USBR Plants.

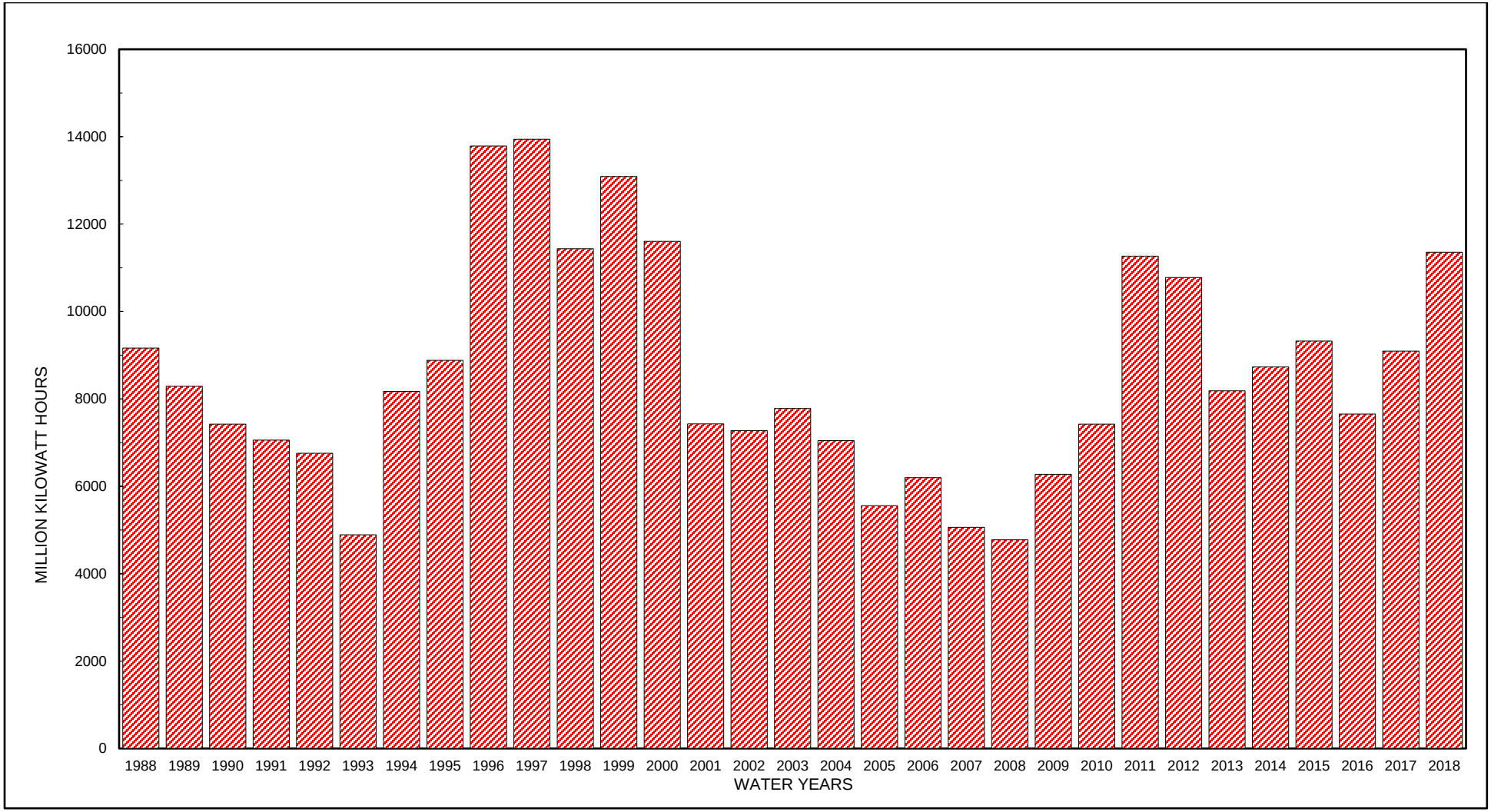


Figure 48. Annual Generation at USACE Plants.

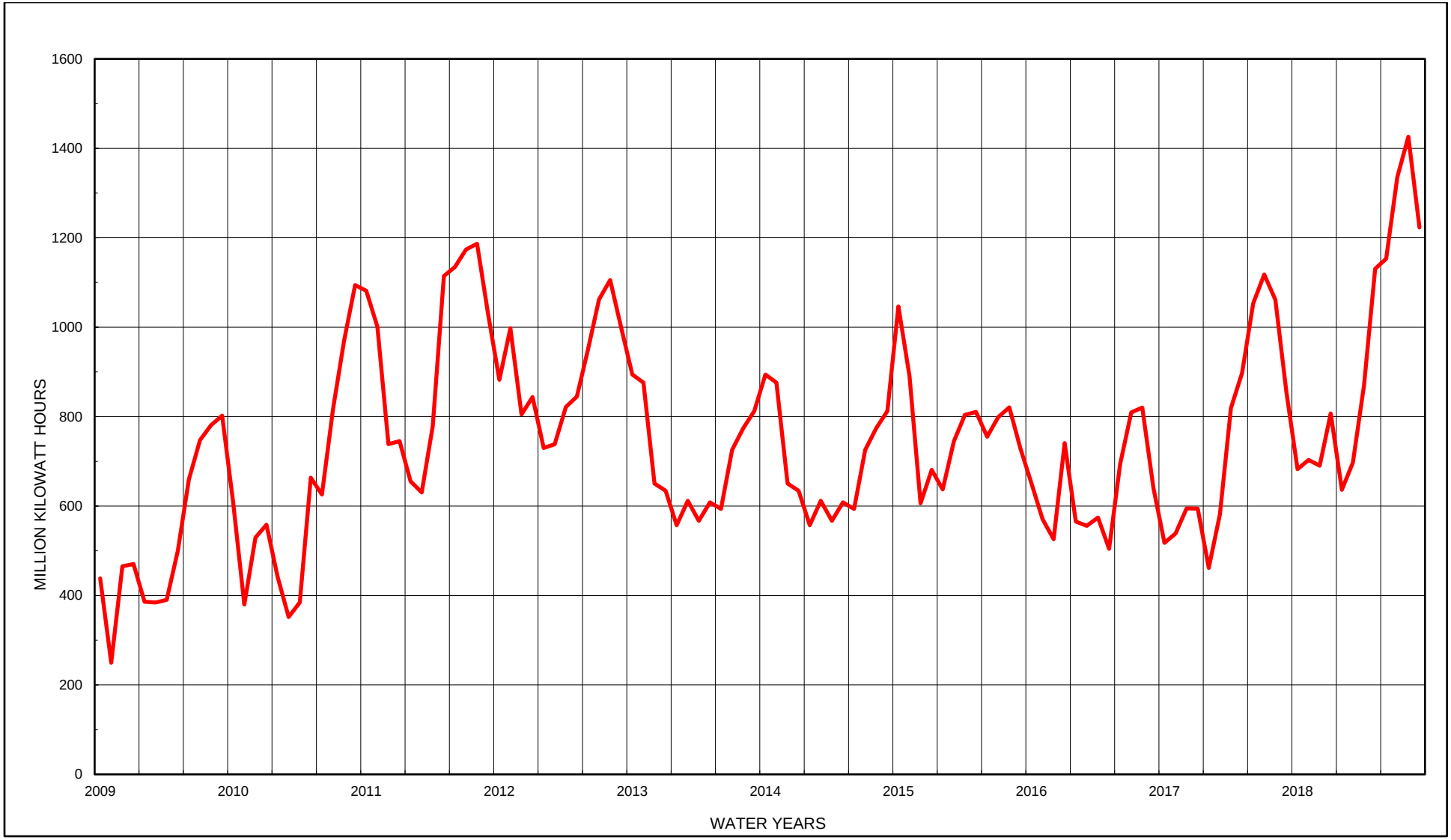


Figure 49. Monthly Generation at USACE Plants.

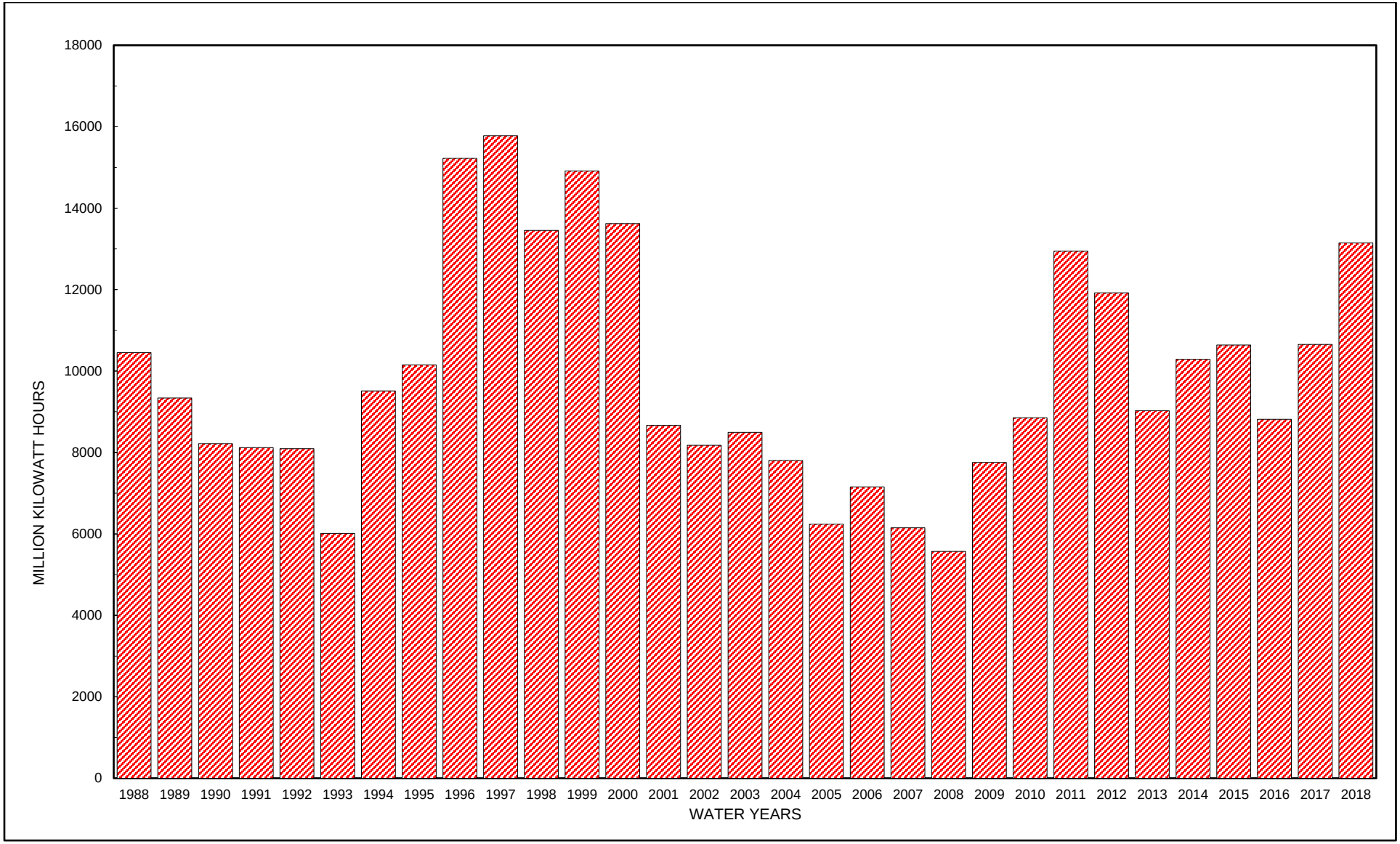


Figure 50. Annual Generation at USBR and USACE Plants.

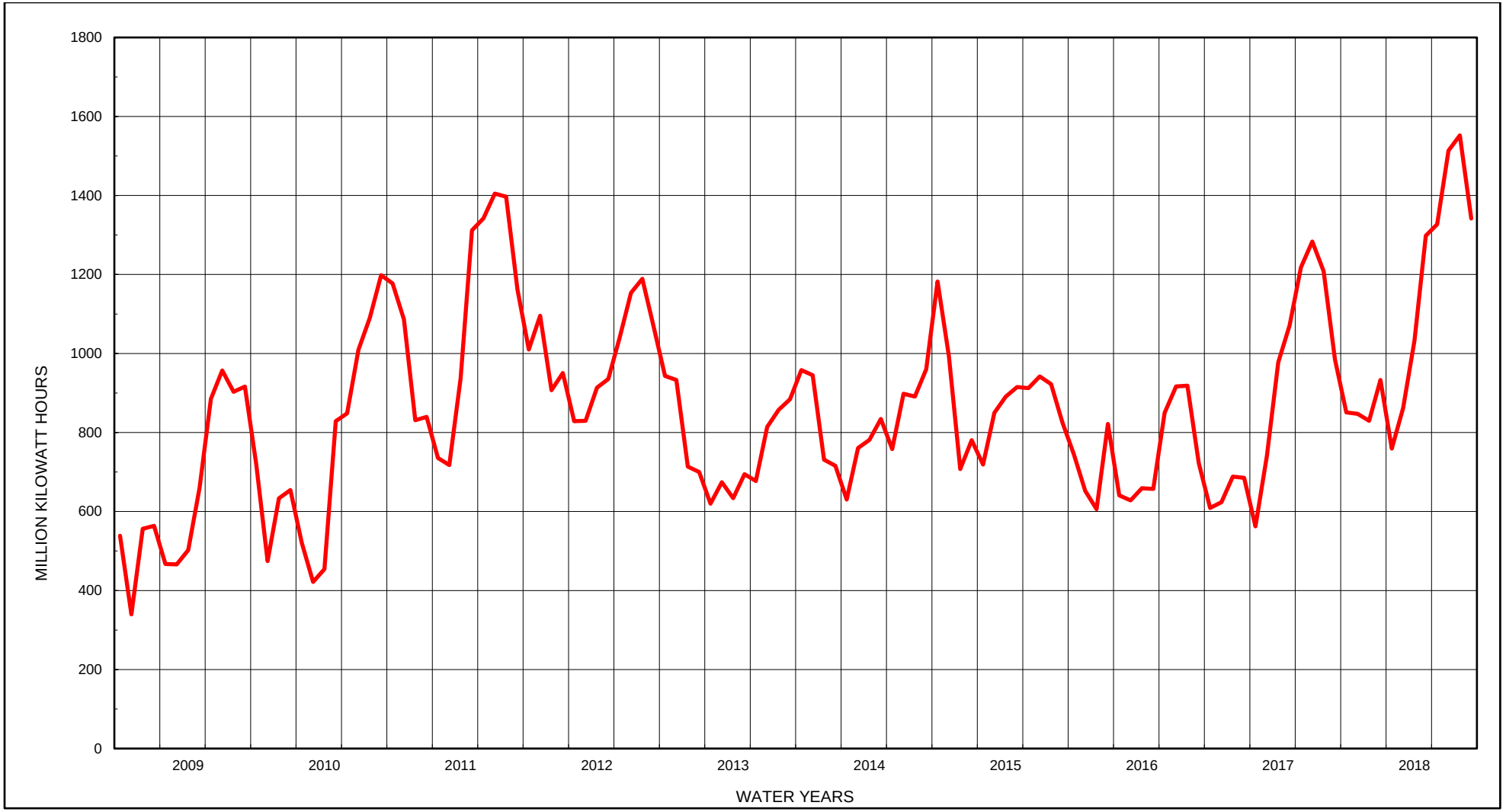


Figure 51. Monthly Generation at USBR and USACE Plants

Appendix A: Photos of flooding throughout the Sun River Watershed.

Photos Near Manchester, MT

Photo 1 (8/25/2014)

Photo 2 (6/20/2018)

Photo 4 (6/21/2018)

Location of high flows on the Sun River at the town of Manchester, MT (Photo 1). South Manchester Road and bridge during high water (Photo 2). South Manchester Road and bridge near the peak high water (Photo 3). Example of a nearby structures impacted by high flow (Photo 4). Structure and bridge post high water (Photo 5).

Photos by Google Earth, Cascade County DES, and Reclamation

Photo 3 (6/21/2018)


Photo 5 (10/19/2018)

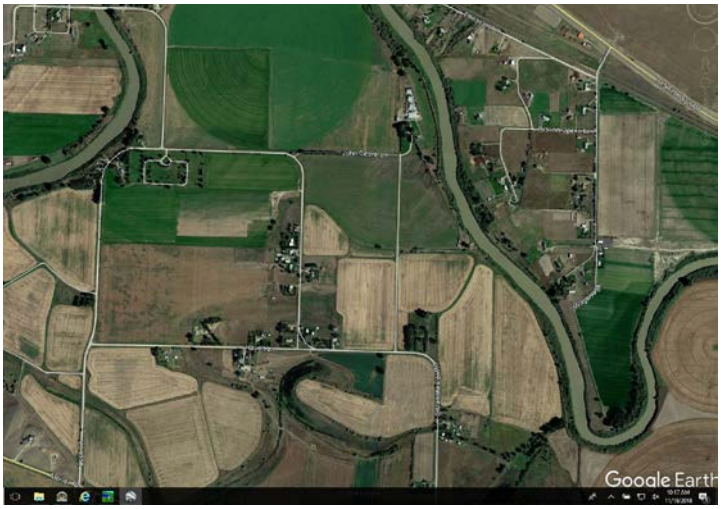


Photo 6 (8/25/2014)

Location of the two local land owner's berms along the Sun River near Manchester, MT (Photo 6). Fields west of berms were flooded by the breaches (Photo 7 & 8). Road inundated by water from berm breach (Photo 9). Field flooded by berm breach on (Photo 10).

Photos by Google Earth and Cascade County DES

Photo 7 (6/21/2018)

Photo 8 (6/21/2018)

Photo 9 (6/21/2018)

Photo 10 (6/21/2018)

Photos at Sun River, MT

Photo 1 (8/25/2014)

Town of Sun River, MT (Photo 1). Inundated Highway 200 and side street (Photo 2 and 3). Home sandbagged and inundated highway 200 (Photo 4). Same home and highway post high water (Photo 5).

Photos by Google Earth, Cascade County DES, and Reclamation

Photo 2 (6/21/2018)

Photo 3 (6/21/2018)

Photo 4 (6/21/2019)


Photo 5 (10/19/2018)

Photos near Vaughn, MT

Photo 1 (8/25/2014)

Town of Vaughn, MT (Photo 1). Fields and structure impacted during high water by the Ulm Vaughn Rd (Photo 2 and 3). High water mark on structure on 4th Street (Photo 4). Structure inundated off Highway 89 near Vaughn (Photo 5).

Photos by Google Earth and Cascade County DES

Photo 2 (6/21/2018)

Photo 3 (6/21/2018)

Photo 4 (6/21/2018)

Photo 5 (6/21/2018)

Photos near Simms, MT

Photo 1 (8/25/2014)

Location of Simms, MT (Photo 1). The Sun River at Highway 565 bridge north of Simms (Photo 2). Home inundated by high flows next to Highway 565 bridge and USGS gaging station (Photo 3). Same homes post high water (Photo 4).

Photos by Google Earth, Cascade County DES, and Reclamation

Photo 2 (6/20/2018)

Photo 3 (6/20/2018)


Photo 4 (10/19/2018)

Photos near Gibson Dam

Photo 1 (7/9/2014)

Location of Gibson Dam (Photo 1). Beaver Creek bridge after high flows (Photo 2). Beaver Creek road overtopping during high flows (Photo 3). Post high flows on a downstream tributary Norwegian Gulch under Sun River Road where part of the road was deteriorated (Photo 4). Example of debris and boulders moved because of high runoff (Photo 5).

Photos by Google Earth, Greenfield Irrigation District, and Reclamation


Photo 2 (6/23/2018)


Photo 3 (6/19/2018 @ 6 AM)


Photo 4 (9/27/2018)

Photo 5 (6/23/2018)

Photo 7 (6/19/2018 @ 6 AM)

Photo 8 (3/25/2013)

Photo 9 (6/19/2018 @ 6:45 AM)

Releases of 9,535 cfs from Gibson Dam and high flows from Beaver Creek (Photo 7). Example of low flows, 70 cfs, below Gibson Dam (Photo 8). Flows near 10,300 cfs over Sun River Diversion Dam (Photo 9).

Photos by Greenfield Irrigation District

Photos near Augusta, MT

Elk Creek causing flooding in Augusta, MT. Great Falls Tribune article and photos of Main Street Augusta, MT on 6/19/2018.

Flooding Elk Creek overtakes Augusta

Seaborn Larson
Great Falls Tribune
USA TODAY NETWORK

Standing in the middle of Main Street in Augusta at 11 a.m. Tuesday, water was rushing over the top of Candi Shalz's cowboy boots.

"The water is just roaring down the street, it's at least a foot high," said Shalz, who owns the Western Bar with her husband Jay.

Jay called at 7 a.m. when he left for his job with the state of Montana to tell his wife to head to the bar to check the basement.

"He said Elk Creek was flooding," Candi said. "I went down to check the sump pumps."

By the time she went back out to the street, about 7:30 a.m., neighbors were putting up sandbags.

See AUGUSTA, Page 2A

More than a foot of water flows along Main Street in Augusta. CANDI SHALZ PHOTO

The Western Bar in Augusta on Main Street is surrounded by floodwater Tuesday morning.

Augusta

Continued from Page 1A

"Everyone in our little town is trying to help," Shalz said. "We were trying to get to older residents' homes to help, but it was too late. They've already got water in their homes. We were not prepared for this at all. Now we are just waiting for the Red Cross to come and help."

The wrath of an unforeseen flooding evacuated the backcountry, washed out a bridge and put Main Street underwater as locals scrambled to stay above water.

A Red Cross Shelter for Augusta residents was in place by Tuesday night in Choteau, set to open by 7 p.m. at the LDS Church at 1000 1st NE.

The Elk Creek Bridge on Highway 21, about a half mile east of Augusta, washed out Tuesday afternoon. Cascade County Sheriff's Capt. Brent Colbert said the underside of the bridge was ripped away. The bridge will remain closed for the foreseeable future, he said.

Rainfall has surged in the past week, with more than 5 inches in the past two days falling along the Rocky Mountain Front, according to the National Weather Service. The highest amount so far has been 5.8 inches at Dupuyer Creek in western Teton County. Some areas in that region saw more than 7 inches of rain since Friday, while Wood Creek in northern Lewis and Clark County saw 8.3 inches from Friday through Tuesday.

Area residents still don't have a definitive answer on what will happen with the Augusta Rodeo planned for this weekend. Shalz said locals are still holding on to hope for one of the town's biggest events of the year.

"From what I understand, the rodeo grounds are three feet underwater," she said.

Photos of Willow Creek Dam and Spillway

Photo 1

Willow Creek Reservoir (photo 1). Willow Creek Spillway on 6/20/2018 (photo 2). Reinforced channel constructed by GID downstream of spillway (photo 3) on 6/21/2018. Willow Creek reservoir and spillway near the peak high water on 6/22/2018 (photo 4). Downstream of spillway connecting to the Sun River on 6/22/2018 (photo 5).

Photo 2

Photo 3

Photo 4

Photo 5