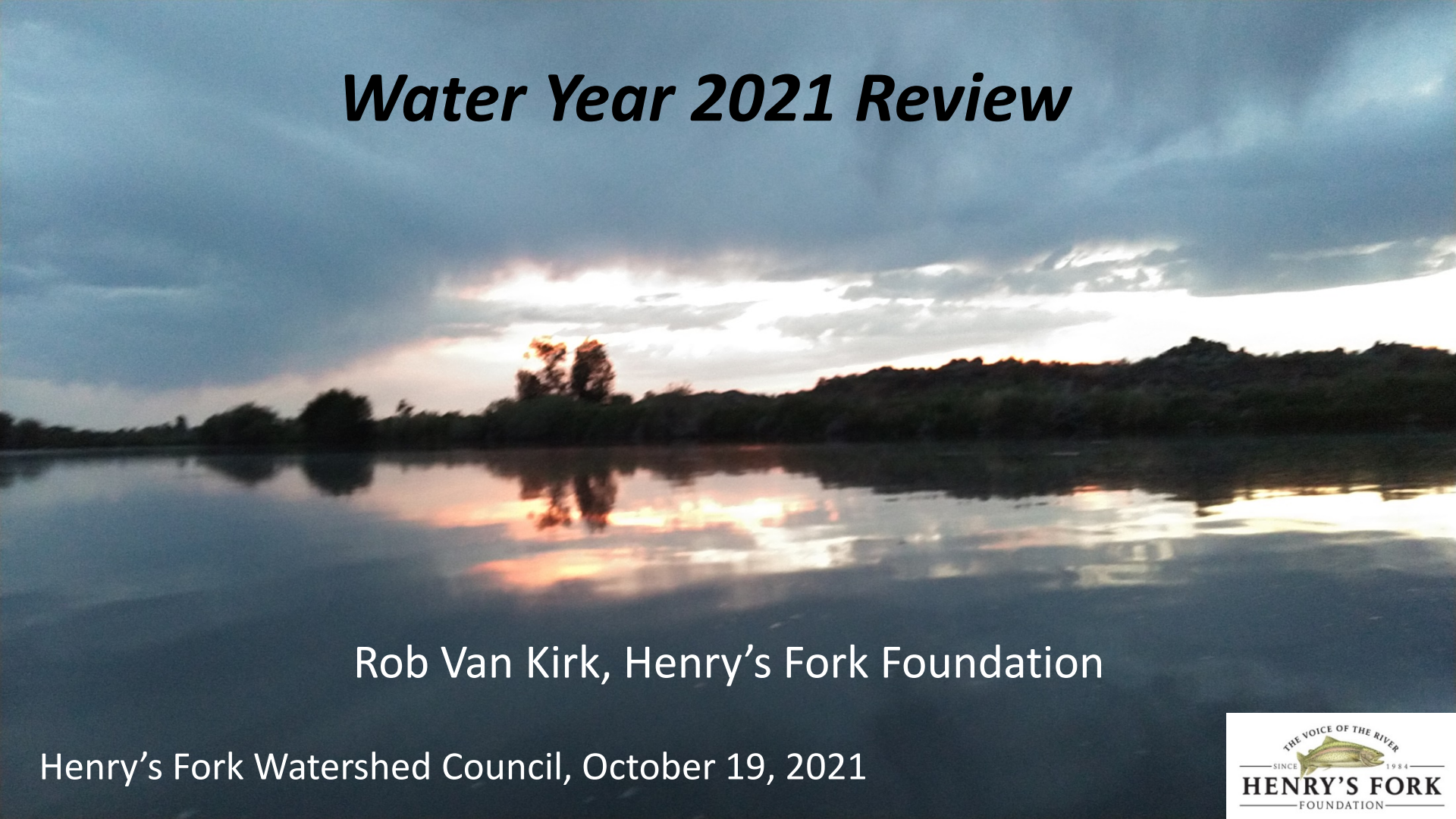
Water Year 2021 Review



Rob Van Kirk, Henry's Fork Foundation

Henry's Fork Watershed Council, October 19, 2021

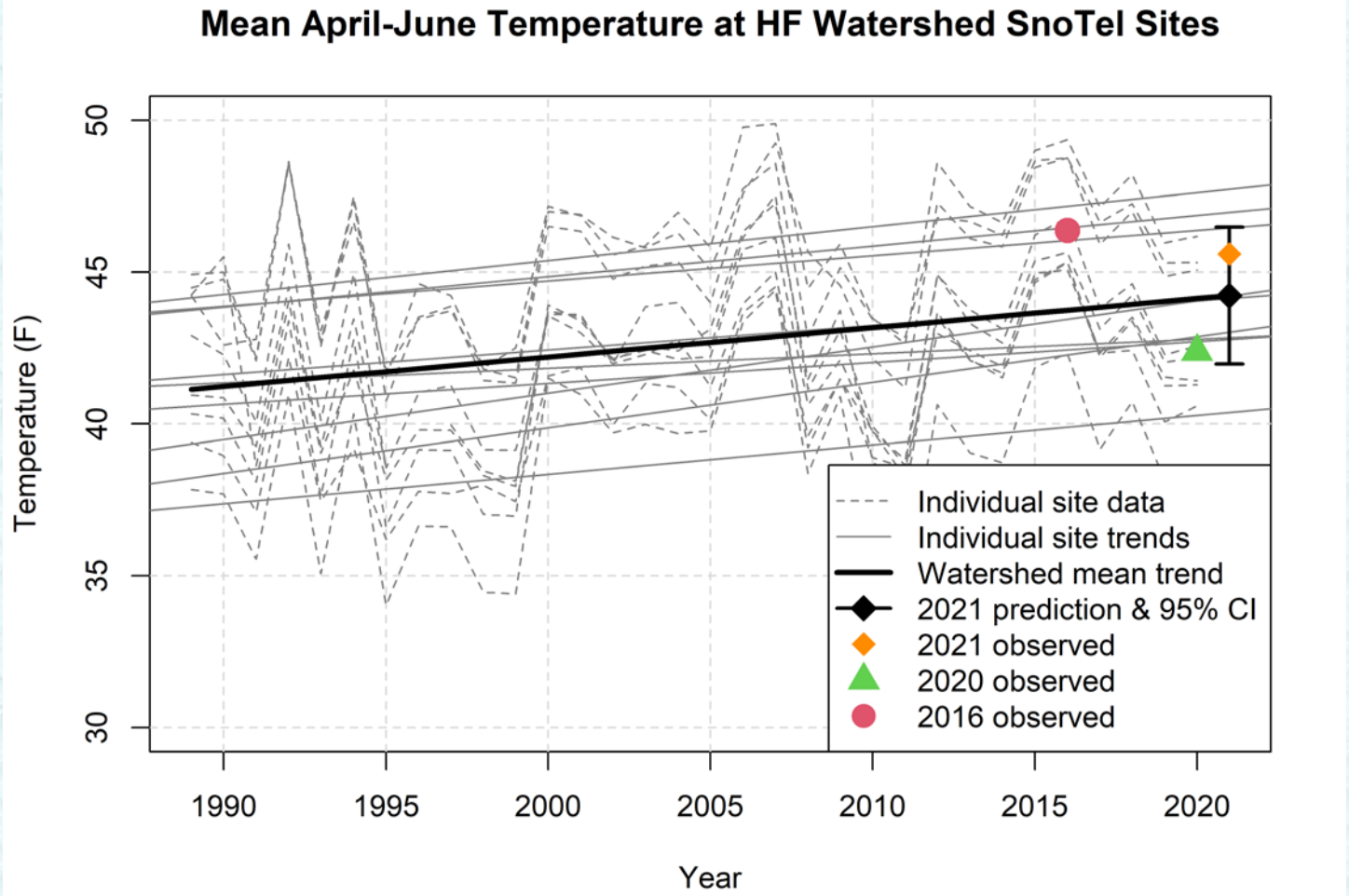
THE VOICE OF THE RIVER
SINCE 1984
HENRY'S FORK
FOUNDATION

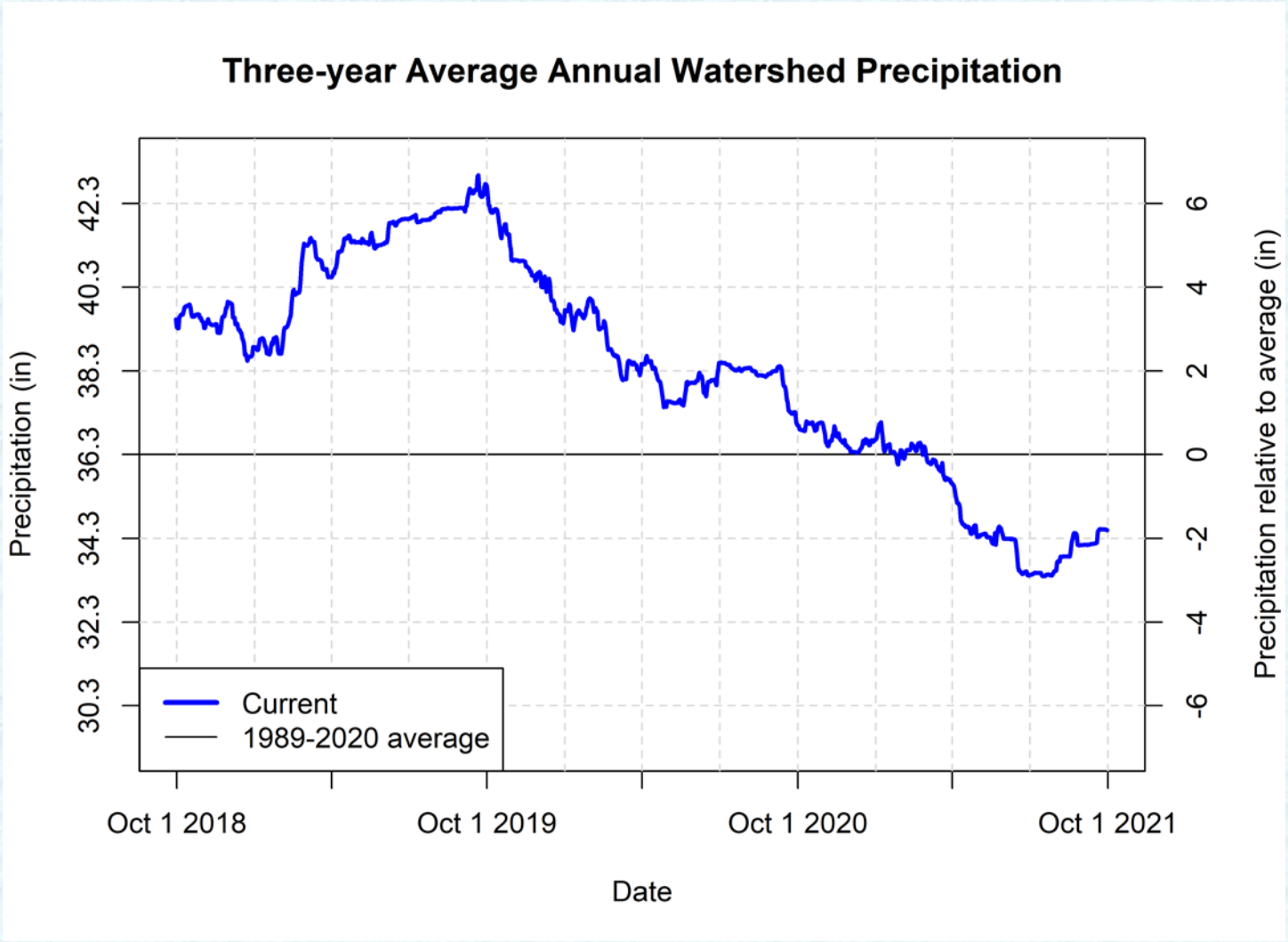
Outline

- Climate
- Natural flow
- Irrigation
- Island Park Reservoir and irrigation system management
- Sprinkled throughout:
  - observations vs. April 1 predictions
  - Comparisons with 2016
- WaterSMART applied science grant project update

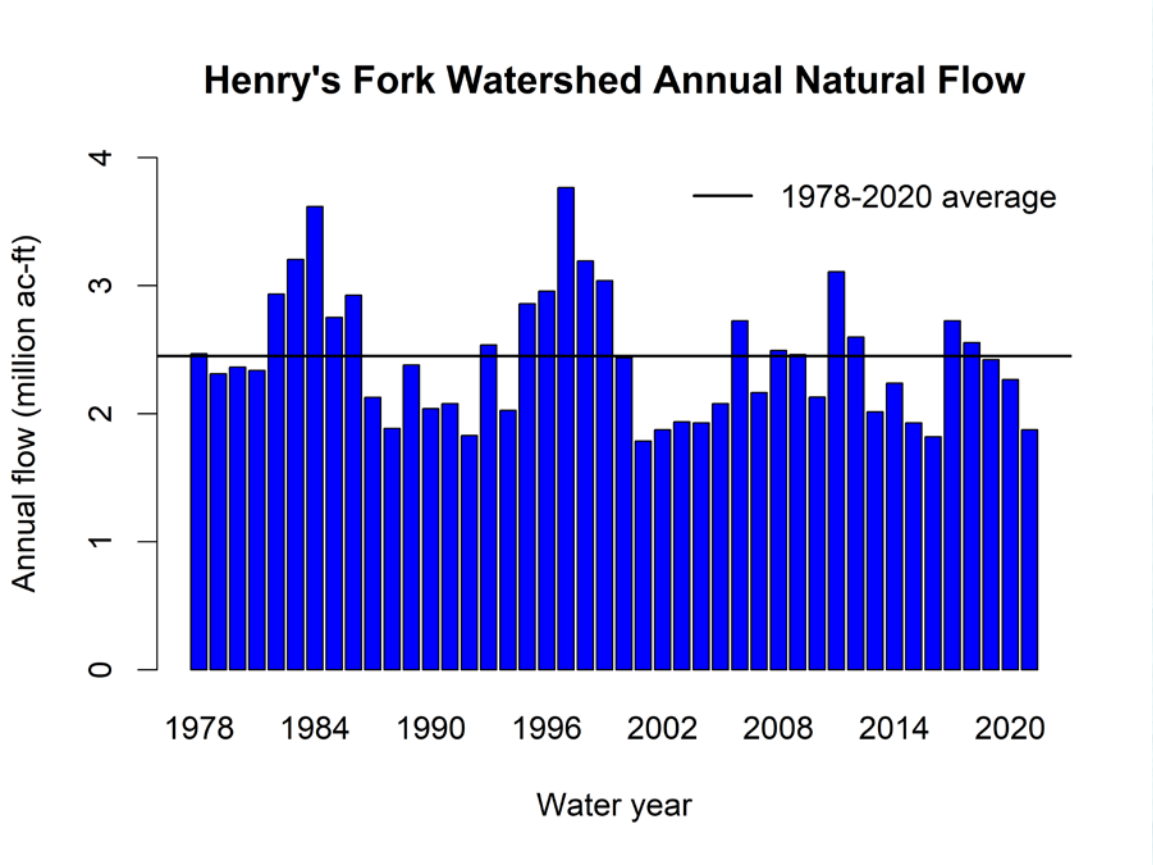
Key Climate Statistics

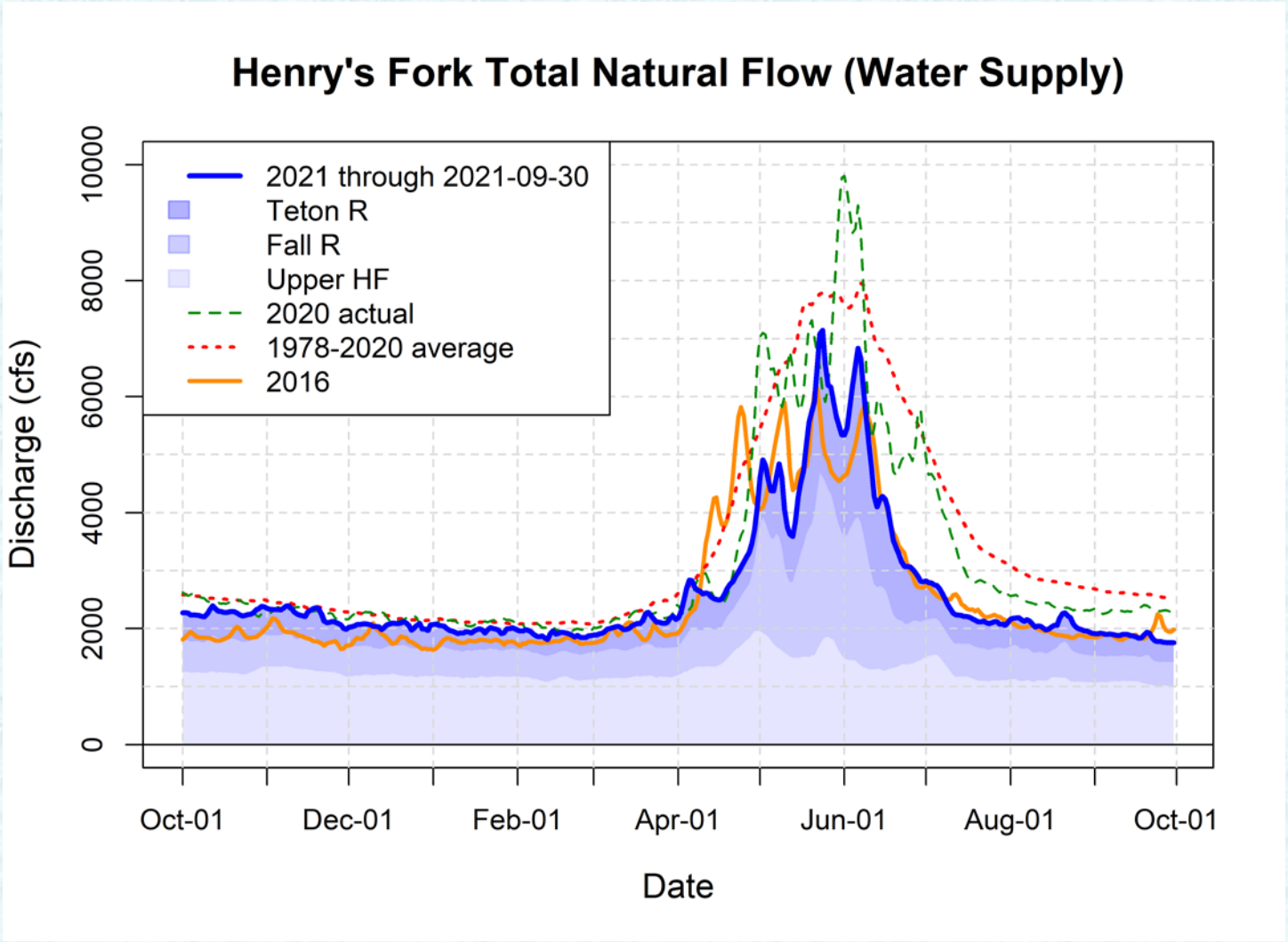
	2021	2016	Average
Peak SWE	22.2 in. (78% ave)	24.6 in. (86% ave)	28.6 in.
Date of peak SWE	March 26	March 31	April 14
Precipitation	29.4 in. (81% ave)	31.8 in. (88% ave)	36.3 in.
March-May temp.	36.6°F	38.9°F	36.7°F
June-July temp.	60.6°F (new record)	58.3°F	52.4°F


Mean April-June Temperature at HF Watershed SnoTel Sites
Temperature (F)
50
45
40
35
30
1990
1995
2000
2005
2010
2015
2020
Year
Individual site data
Individual site trends
Watershed mean trend
2021 prediction & 95% CI
2021 observed
2020 observed
2016 observed

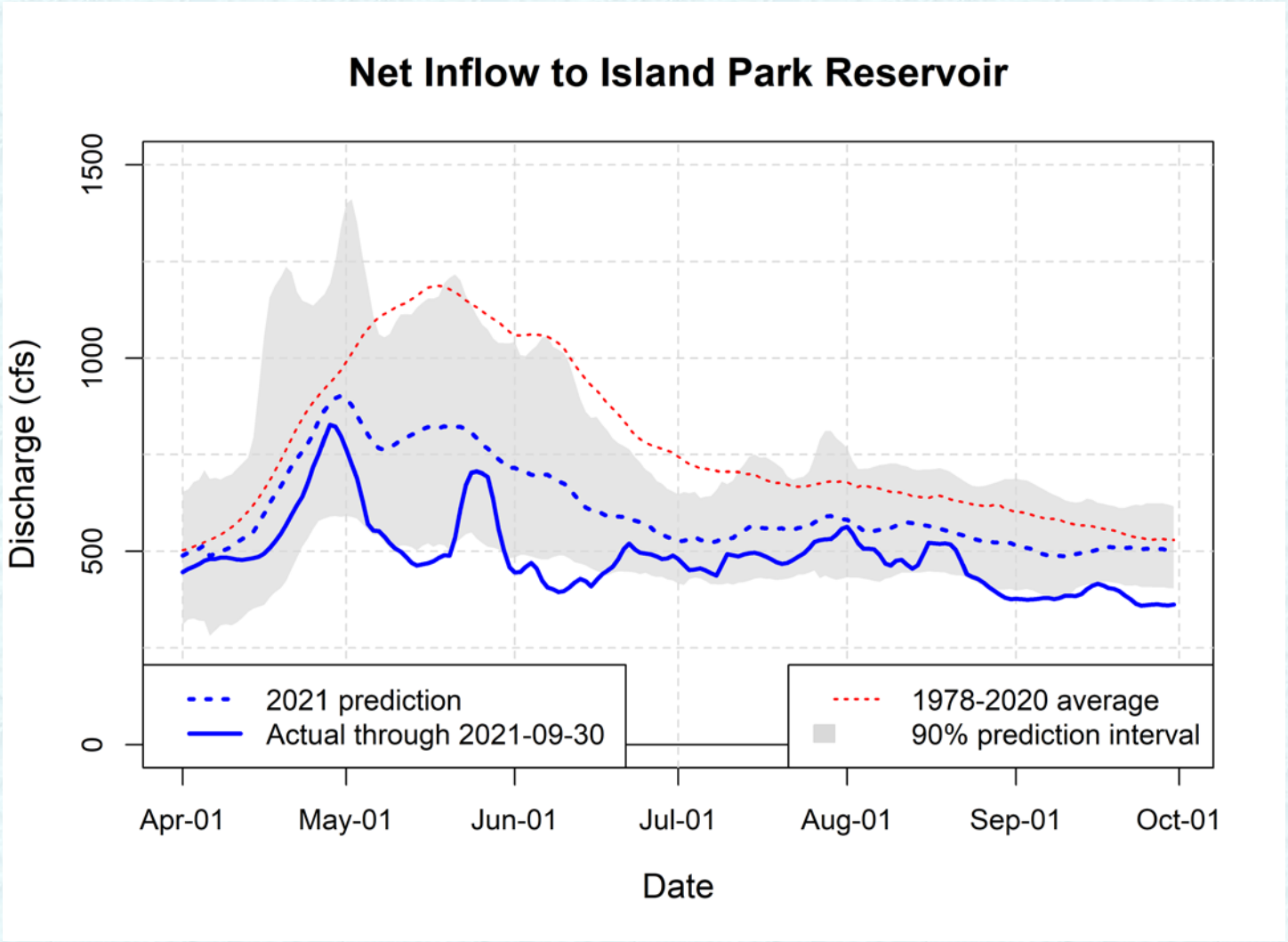

Three-year Average Annual Watershed Precipitation
Precipitation (in)
30.3
32.3
34.3
36.3
38.3
40.3
42.3
Precipitation relative to average (in)
-6
-4
-2
0
2
4
6
Current
1989-2020 average
Oct 1 2018
Oct 1 2019
Oct 1 2020
Oct 1 2021
Date

	2021	2016	Average
Mean natural flow	2,592 cfs (76% ave)	2,516 cfs (74% ave)	3,389 cfs




Henry's Fork Total Natural Flow (Water Supply)
2021 through 2021-09-30
Teton R
Fall R
Upper HF
2020 actual
1978-2020 average
2016
Discharge (cfs)
0
2000
4000
6000
8000
10000
Oct-01
Dec-01
Feb-01
Apr-01
Jun-01
Aug-01
Oct-01
Date

			Mean April 1 – September 30 natural flow					
	Predictors (% of ave.)		2021 prediction		2021 observed		2016 observed	
Subwatershed	Baseflow	SWE	cfs	% of ave.	cfs	% of ave.	cfs	% of ave.
Upper Henry's Fork	92%	76%	1570	82%	1324	70%	1316	69%
Fall River	91%	82%	1162	83%	961	70%	978	71%
Teton River	87%	88%	981	81%	807	66%	897	74%
WATERSHED TOTAL	**92%**	**83%**	**3713**	**83%**	**3092**	**69%**	**3191**	**70%**

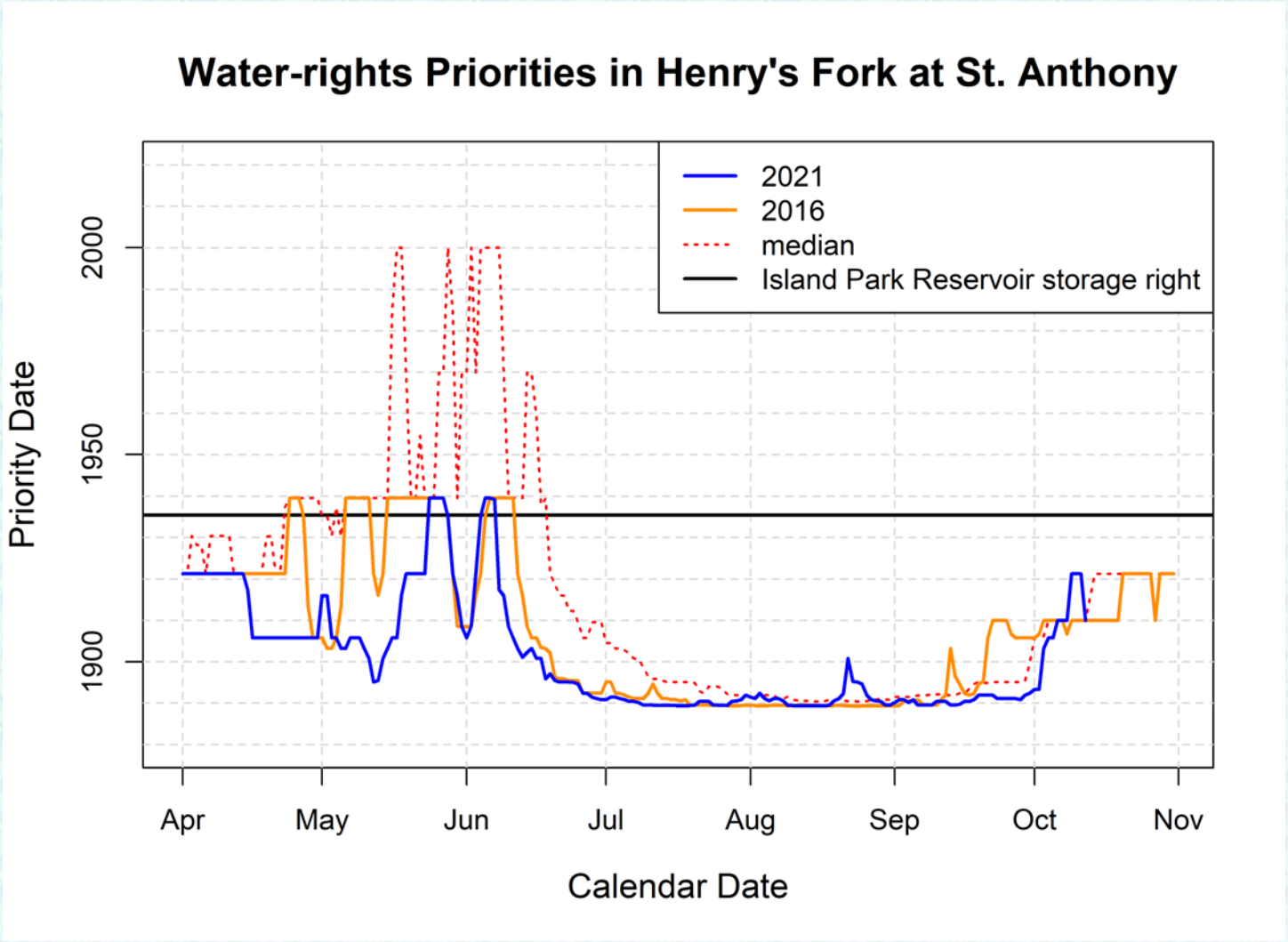

Net Inflow to Island Park Reservoir
Discharge (cfs)
0
500
1000
1500
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Date
2021 prediction
Actual through 2021-09-30
1978-2020 average
90% prediction interval

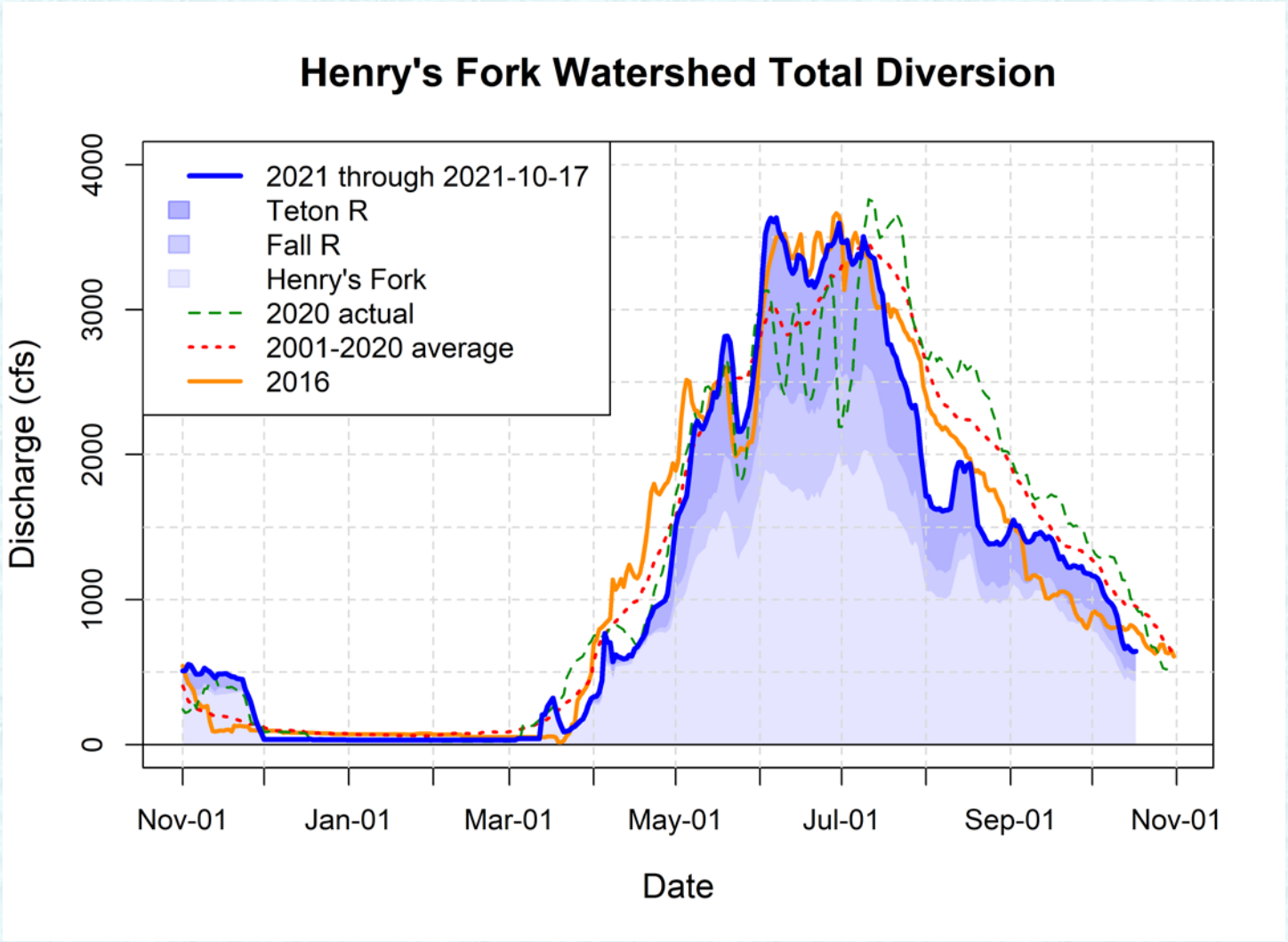
Irrigation

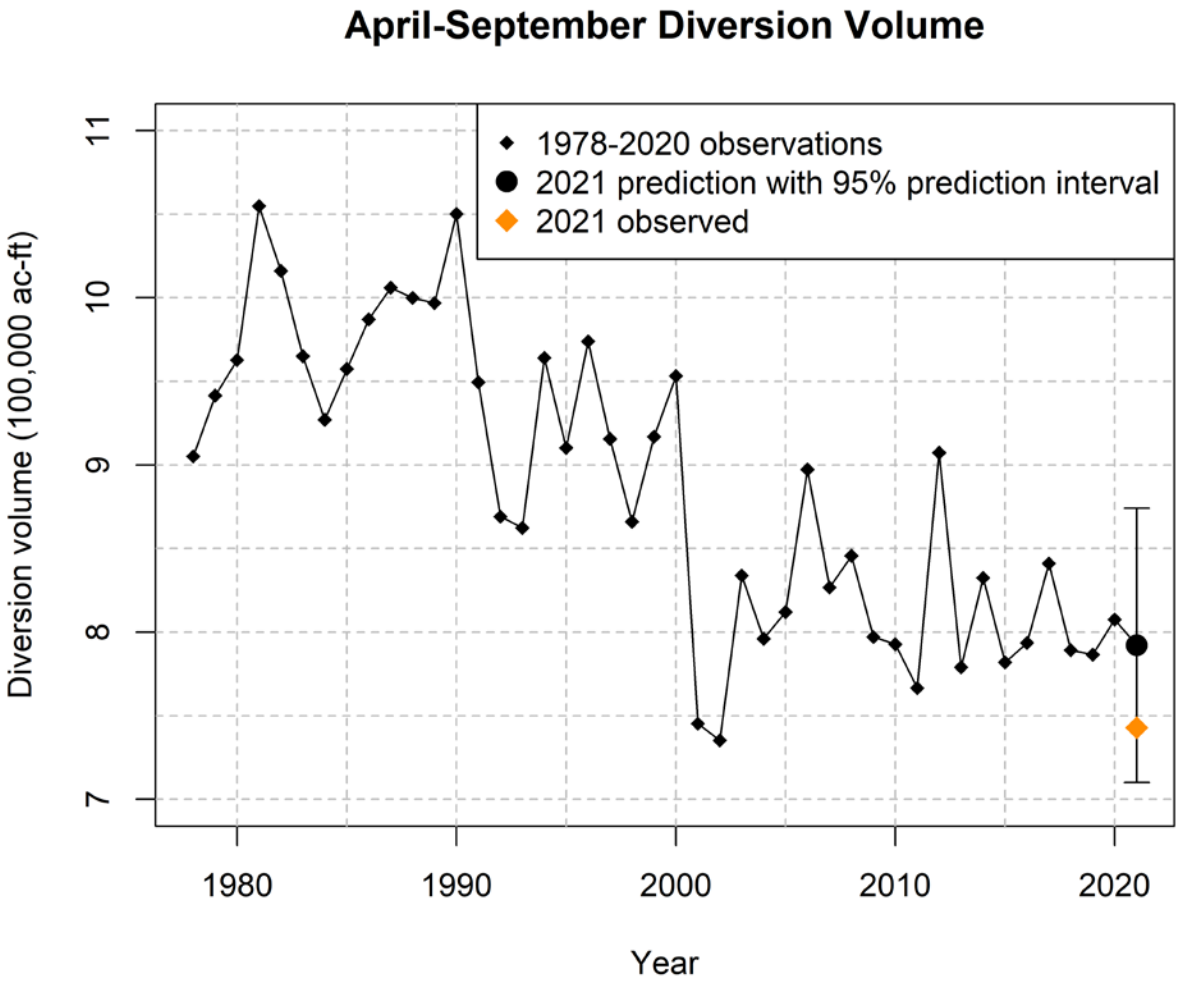
Administrative water availability

- Fremont-Madison received 74% of its storage allocation
- Natural-flow priority at St. Anthony first dropped to 1895-11-05 on June 19, vs. July 11 on average

	2021	2016	Average
April-Sept. Diversion	742,696 ac-ft (92% ave)	793,599 ac-ft (98% ave)	808,250 ac-ft
Crosscut Canal delivery	34,951 ac-ft (97% ave)	31,750 ac-ft (88% ave)	36,120 ac-ft
Teton R. Exchange wells	23,880 ac-ft (199% ave)	27,801 ac-ft (231% ave)	12,025 ac-ft


Water-rights Priorities in Henry's Fork at St. Anthony
2021
2016
median
Island Park Reservoir storage right
Priority Date
1900
1950
2000
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Calendar Date


Henry's Fork Watershed Total Diversion
2021 through 2021-10-17
Teton R
Fall R
Henry's Fork
2020 actual
2001-2020 average
2016
Discharge (cfs)
0
1000
2000
3000
4000
Nov-01
Jan-01
Mar-01
May-01
Jul-01
Sep-01
Nov-01
Date


April-September Diversion Volume
1978-2020 observations
2021 prediction with 95% prediction interval
2021 observed
Diversion volume (100,000 ac-ft)
7
8
9
10
11
1980
1990
2000
2010
2020
Year

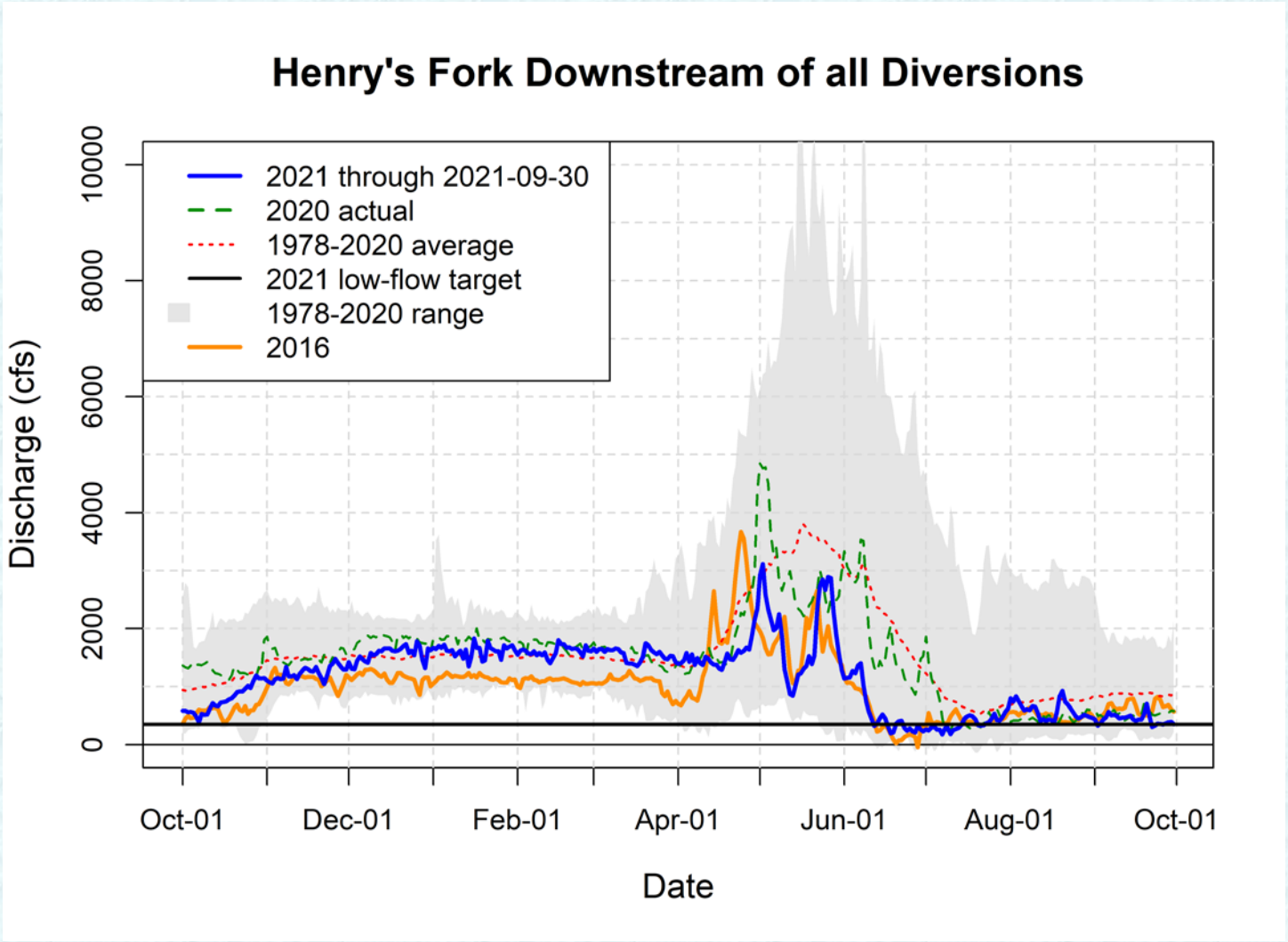
Reservoir and System Management

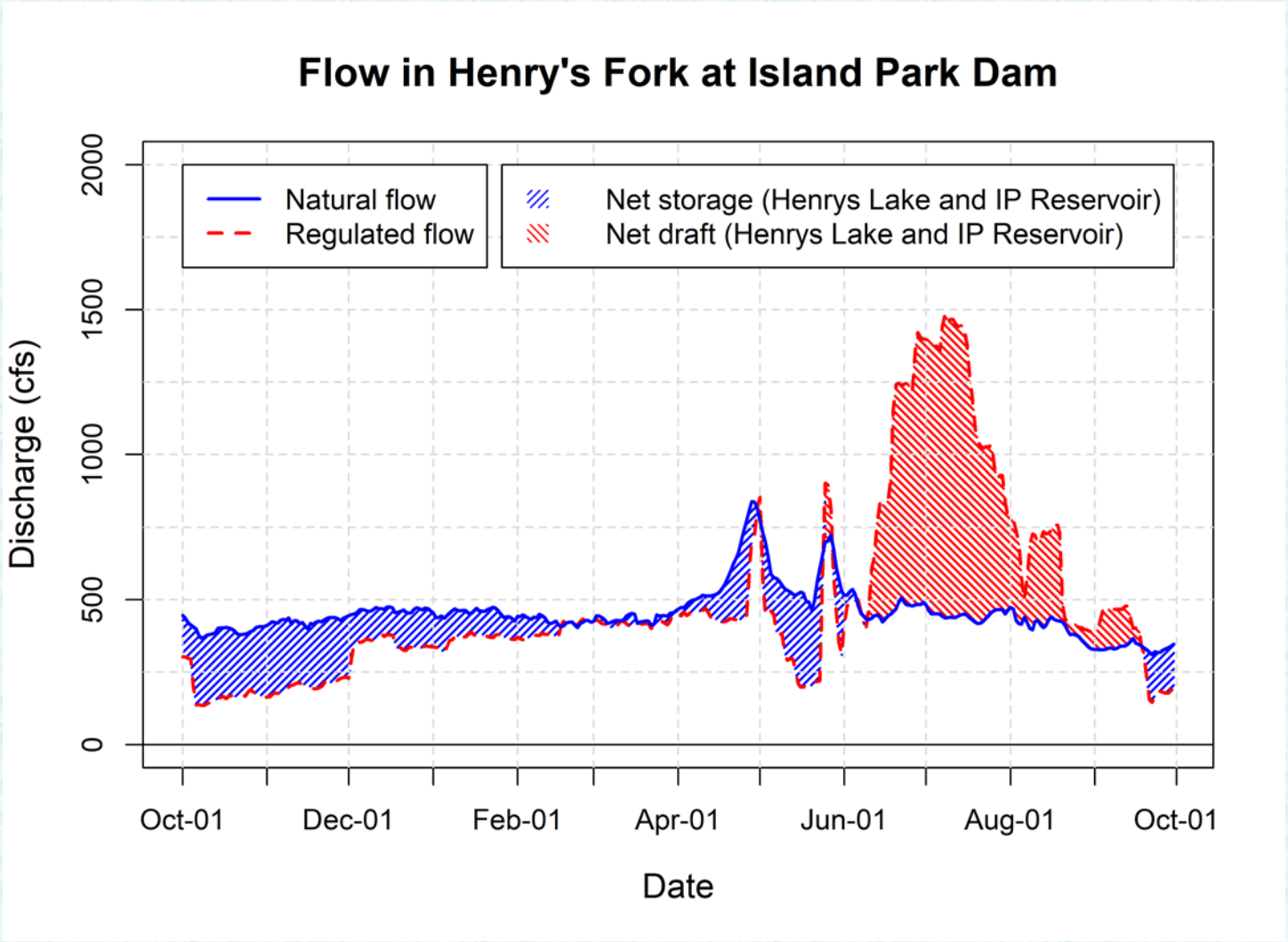
Lower-watershed streamflow targets during reservoir draft

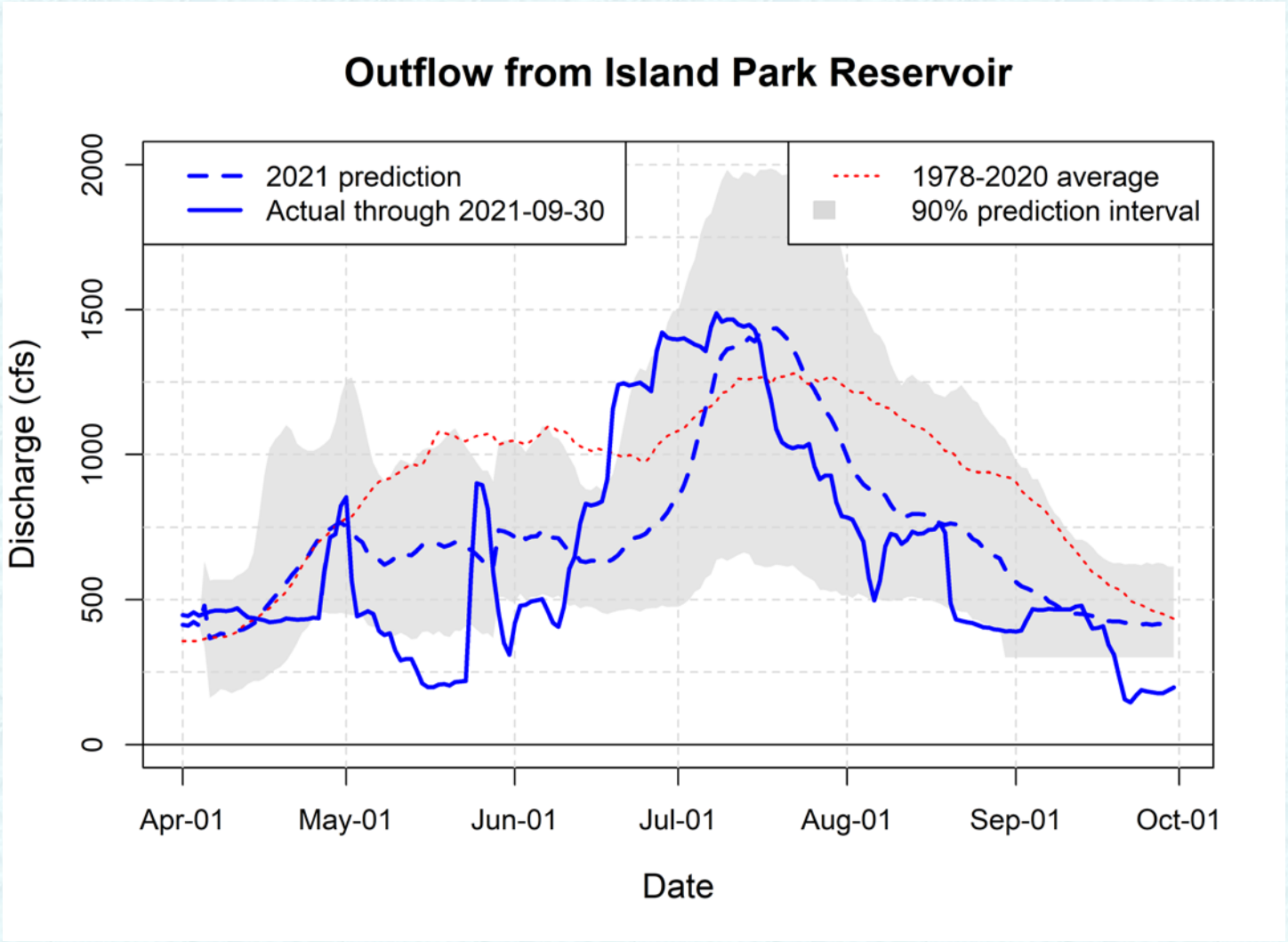
- 350 cfs in HF downstream of all diversions
- 0 cfs in NF Teton downstream of Teton Island Feeder
- Just enough in SF Teton River to meet variable needs of Rexburg Irrigation (downstream-most diversion)
- Stable flows

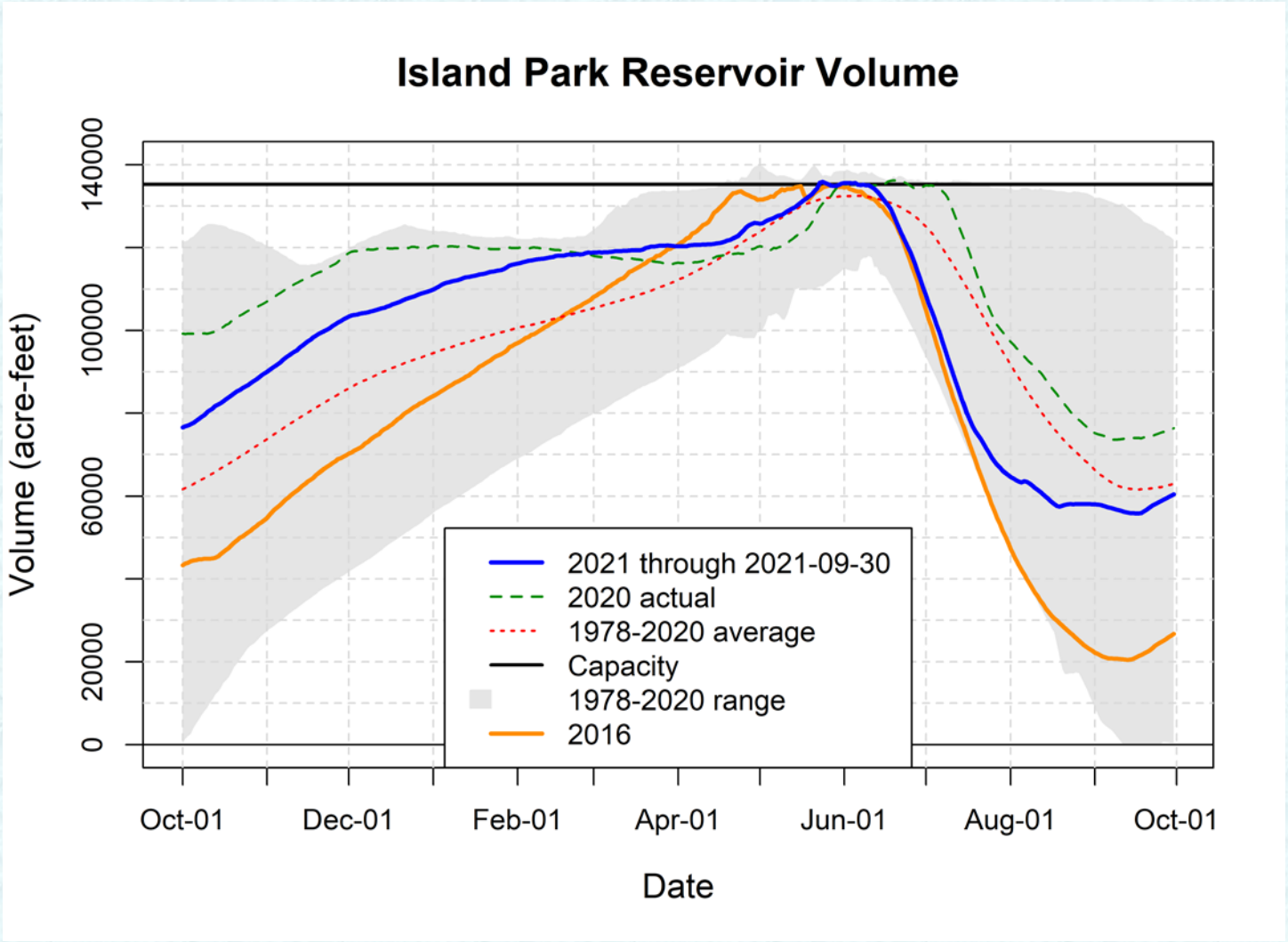
Streamflow and variability during Island Park Reservoir draft

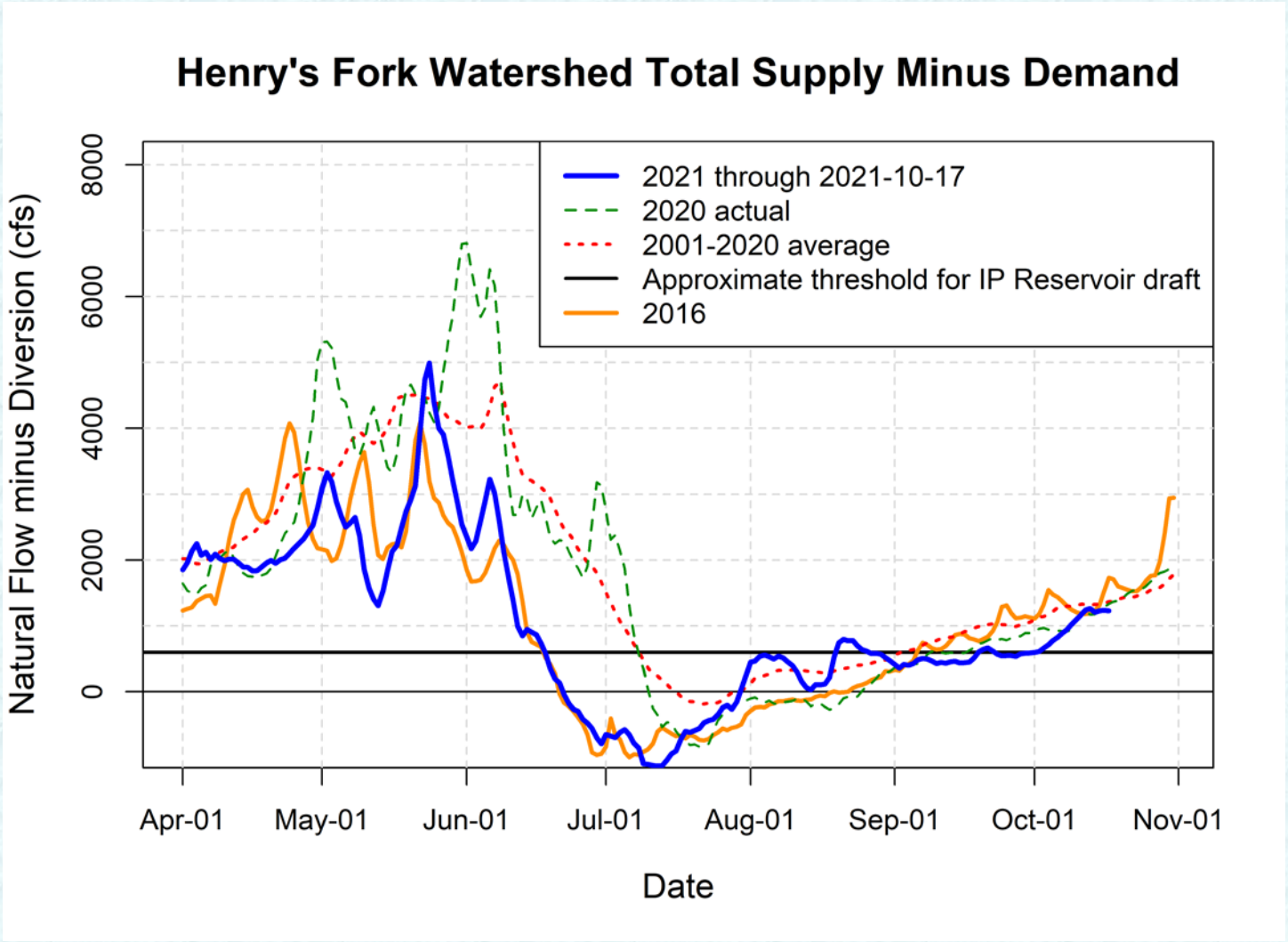
	2021	2016
Lower Henry's Fork	427 cfs (35% CV; 3 days < 200 cfs)	473 cfs (45% CV; 11 days < 200 cfs)
SF Teton River	120 cfs (127% CV)	213 cfs (130% CV)


Henry's Fork Downstream of all Diversions
2021 through 2021-09-30
2020 actual
1978-2020 average
2021 low-flow target
1978-2020 range
2016
Discharge (cfs)
0
2000
4000
6000
8000
10000
Oct-01
Dec-01
Feb-01
Apr-01
Jun-01
Aug-01
Oct-01
Date


Flow in Henry's Fork at Island Park Dam
Natural flow
Regulated flow
Net storage (Henrys Lake and IP Reservoir)
Net draft (Henrys Lake and IP Reservoir)
Discharge (cfs)
0
500
1000
1500
2000
Oct-01
Dec-01
Feb-01
Apr-01
Jun-01
Aug-01
Oct-01
Date

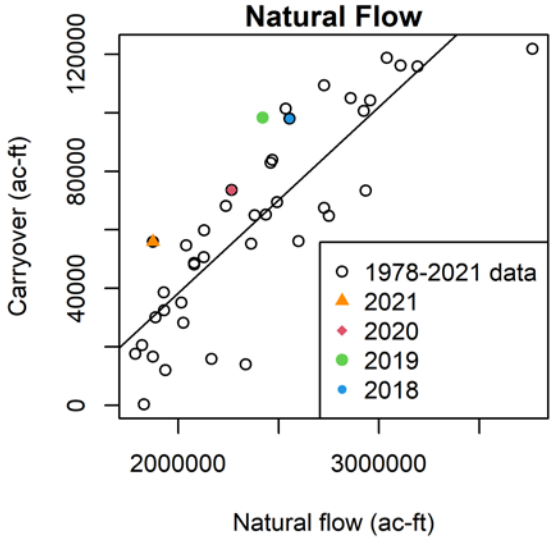

Outflow from Island Park Reservoir
2021 prediction
Actual through 2021-09-30
1978-2020 average
90% prediction interval
Discharge (cfs)
0
500
1000
1500
2000
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Date

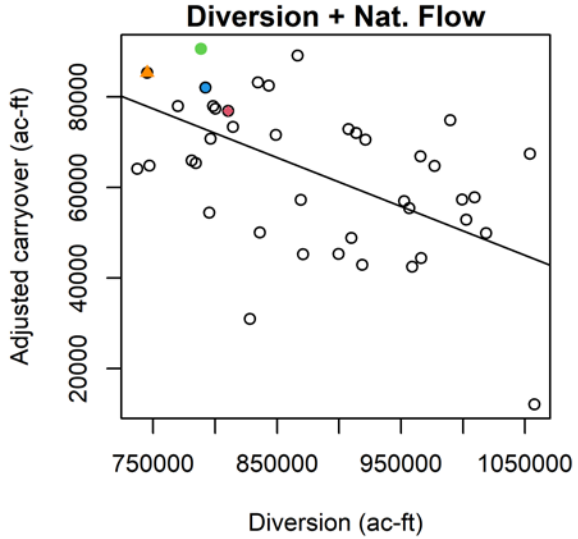

Island Park Reservoir Volume
Volume (acre-feet)
0
20000
60000
100000
140000
Oct-01
Dec-01
Feb-01
Apr-01
Jun-01
Aug-01
Oct-01
Date
2021 through 2021-09-30
2020 actual
1978-2020 average
Capacity
1978-2020 range
2016

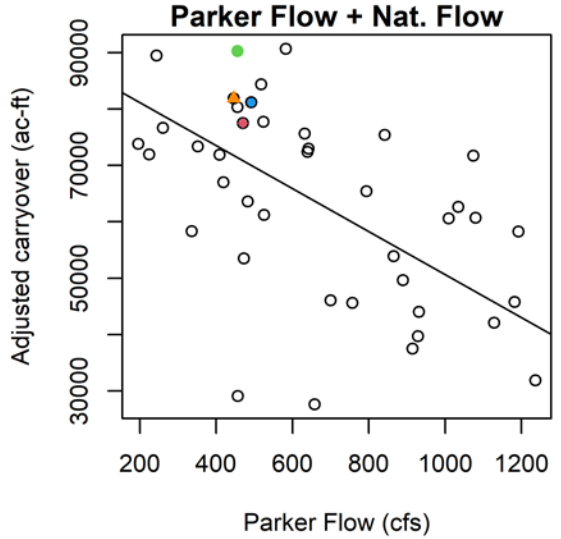

Henry's Fork Watershed Total Supply Minus Demand
Natural Flow minus Diversion (cfs)
0
2000
4000
6000
8000
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Nov-01
Date
2021 through 2021-10-17
2020 actual
2001-2020 average
Approximate threshold for IP Reservoir draft
2016

Factors Affecting IP Reservoir Carryover

1. Watershed total natural flow (72% of variability explained)
2. Total diversion (an additional 3% of variability explained)
3. Streamflow in Henry's Fork downstream of diversions (an additional 9%)







Sept. 30 IP Reservoir Content

Relative to Expected Values

	2016	2021	2018-2021 average
Based on natural flow availability	-6,281 ac-ft	+25,586 ac-ft	+25,364 ac-ft
Based on natural flow availability and diversion	-9,778 ac-ft	+18,638 ac-ft	+19,473 ac-ft
Based on natural flow availability, diversion and lower HF streamflow	-15,710 ac-ft	+8,996 ac-ft	+8,541 ac-ft

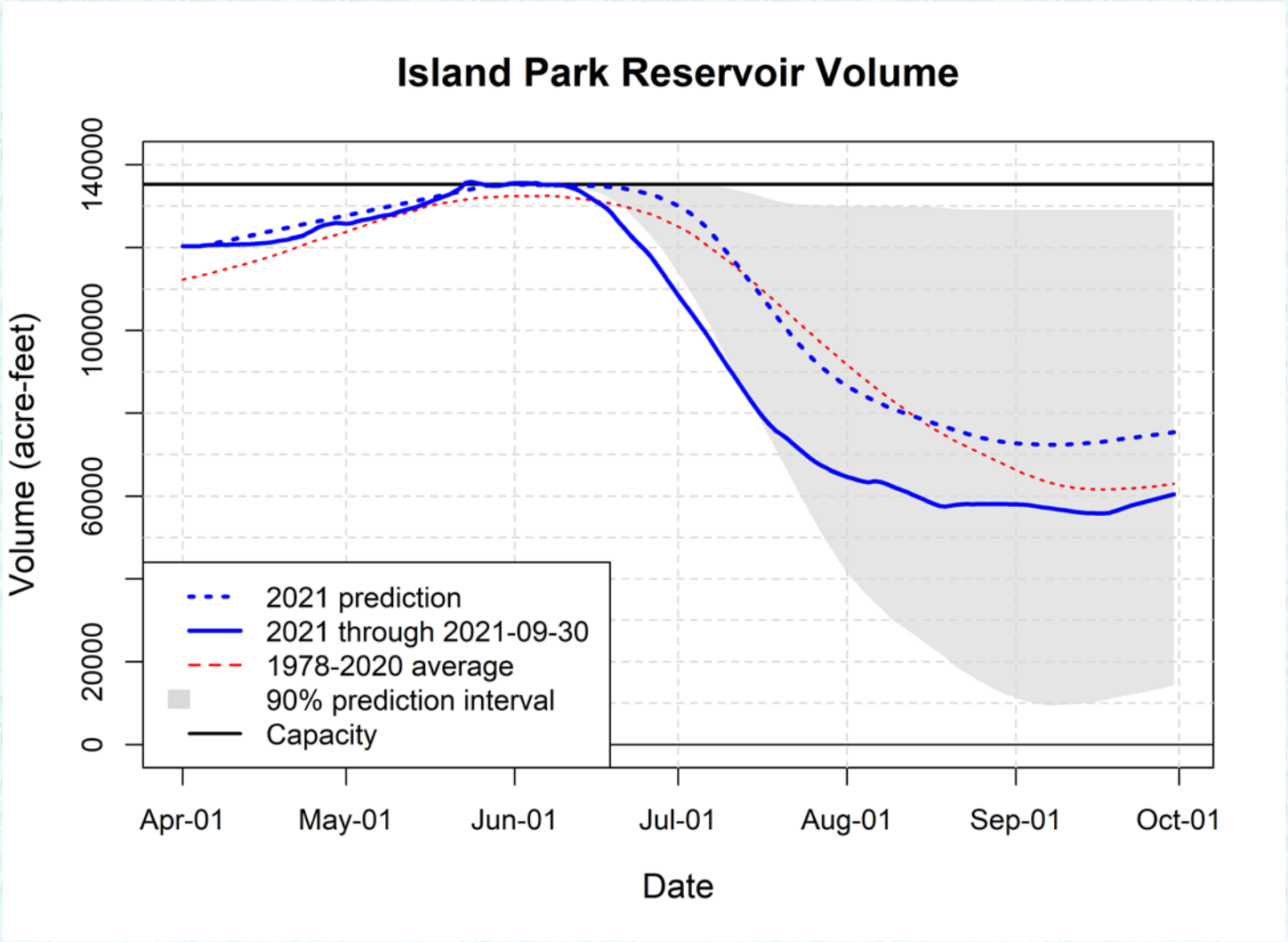
Why the difference between 2021 and 2016?

- Lower diversion in 2021
- Better anticipation of low water availability in 2021
- More physical water in HF watershed relative to basin-wide administrative water availability
- Use of different lower-HF flow target (Parker vs. St. Anthony)
- Use of 2,000 ac-ft more storage from Grassy Lake
- Rain in late July and mid-August (good for saving water but not for grain and hay harvest)
- Remote-control infrastructure on Crosscut and Teton splitter

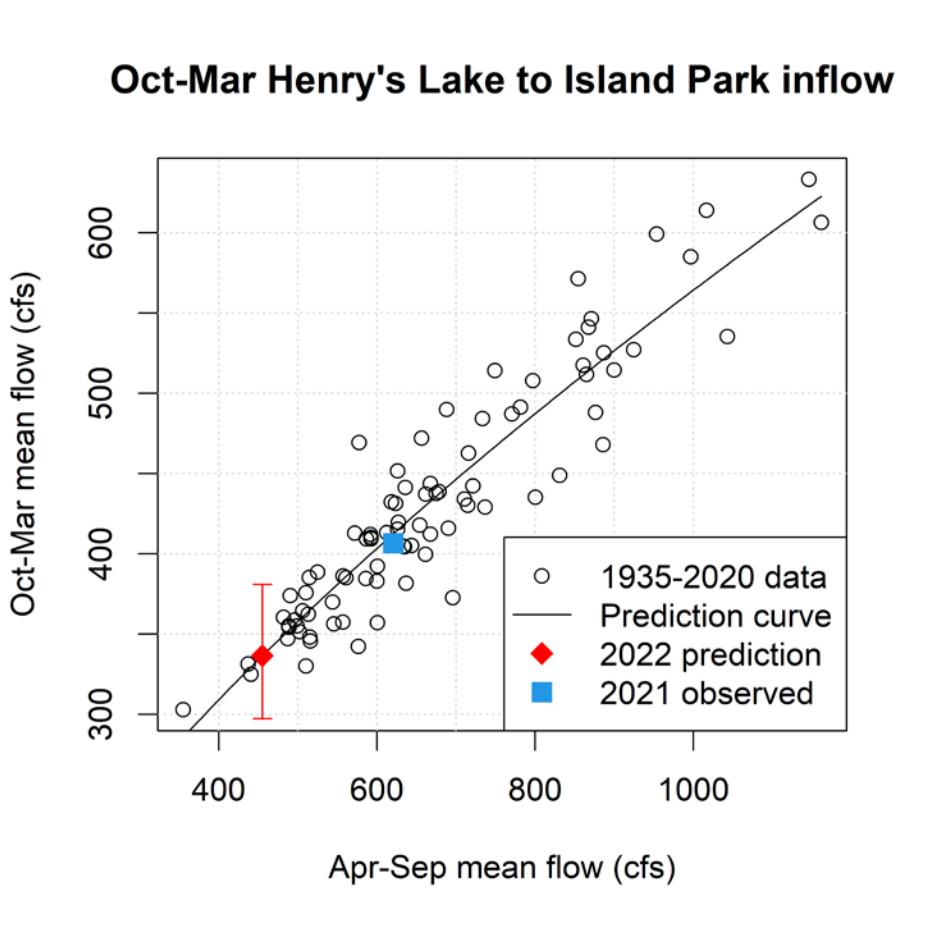
From my water report in early April:

“Thus, reasonable but conservative expectations for September-30 Island Park Reservoir carryover based on model results and previous observation lie in the range of 23,000 to 64,000 ac-ft, compared to the long-term median of 62,000 ac-ft.”

Actual September-30 reservoir content: 60,462 ac-ft


Island Park Reservoir Volume
Volume (acre-feet)
0
20000
60000
100000
140000
Apr-01
May-01
Jun-01
Jul-01
Aug-01
Sep-01
Oct-01
Date
2021 prediction
2021 through 2021-09-30
1978-2020 average
90% prediction interval
Capacity

Island Park Reservoir Fill Strategy



- 110 cfs outflow until Dec. 1
- Increase outflow Dec. 1, hopefully high enough for power plant to operate
- Target fill to spillway-collar brackets (~125,000 ac-ft) by ice-off (~April 15)

HFF WaterSMART Applied Science Grant

Year-1 Accomplishments

- Completed Teton Valley GW model structure
- Obtained permits for Buffalo R. and Teton R. stream gage stations (electronics supply issues prevented installation)
- Automated hydrologic model code
- Outlined new hydrologic data website
- Completed data collection for lower HF SW-GW model
- Started outreach/engagement for system optimization model
- In process of moving all data, code, and computing to cloud storage and servers
- Constant process of trouble-shooting!

Questions?

Contact: rob@henrysfork.org

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