Bureau of Reclamation
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Final 2022 Restoration Allocation & Default Flow Schedule
May 13, 2022

Overview

The following transmits the updated 2022 Restoration Allocation and Default Flow Schedule to the Restoration Administrator for the San Joaquin River Restoration Program (SJRRP), consistent with the January 2020 (version 2.1) Restoration Flow Guidelines (Guidelines). This Restoration Allocation and Default Flow Schedule provides the following:

- Forecasted water year Unimpaired Runoff: the estimated flows that would occur absent regulation on the river. This value is also known as the "Natural River," "Unimpaired Runoff," "Unimpaired Inflow," or "Full Natural Flow," and is utilized to identify the water year type.
- Hydrograph Volumes: the annual allocation hydrograph based on water year unimpaired runoff, utilizing Method 3.1 with the Gamma Pathway (RFG-Appendix C, Figure C3) agreed to by the Parties in December 2008.
- Default Flow Schedule: the schedule of Restoration Flows in the absence of a recommendation from the Restoration Administrator.
- Additional Allocations: the hypothetical Restoration Allocations that would result from 10%, 50%, 75%, and 90% probability of exceedance of the Unimpaired Runoff forecast.
- Unreleased Restoration Flows: the amount of Restoration Flows not released due to channel capacity constraints, without delaying completion of Phase 1 improvements.
- Flow targets at Gravelly Ford: the flows at the head of Reach 2, and estimated scheduled releases from Friant Dam adjusted for the assumed Holding Contract demands and losses in Exhibit B.
- Restoration Budget: the volumes for the annual allocation, spring flexible flow, base flow, riparian recruitment, and fall flexible flow.
- Remaining Flow Volume: the volume of Restoration Flows released, the remaining volume available, and associated limitations and flexibility.
- Operational Constraints: the flow release limitations based on downstream channel capacity, regulatory, or legal constraints.

Consistent with Paragraph 18 of the Settlement, the Restoration Administrator shall make recommendations to the Secretary of the Interior concerning the manner in which the hydrographs shall be implemented. As described in the Guidelines, the Restoration Administrator is requested to recommend a flow schedule showing the use of the entire annual allocation during the upcoming Restoration Year or otherwise identify Unreleased Restoration Flows and categorize recommended flows by account, if a recommendation is not provided by the Restoration Administrator, the Capacity Constrained Default Flow Schedule (Table 6b) or the most recently approved schedule will be implemented.

Per the Guidelines, this is the final allocation for Restoration Flows. **Due to the current cessation of Restoration Flows, the Restoration Administrator may return a recommendation at their convenience.**

Forecasted Unimpaired Runoff

Unimpaired Runoff represents the natural water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds (a.k.a "Unimpaired Inflow" or "Natural River" or "Full Natural Flow"). It is calculated for the period of a water year. The forecast of the Unimpaired Runoff determines the volume of Restoration Flows available for the Restoration Year (i.e. the Restoration Allocation). Information for forecasting the Unimpaired Runoff includes:

- Observation of Unimpaired Runoff into Millerton Lake to support the water supply allocation[1];
- The California Department of Water Resources (DWR) Bulletin 120 latest update for San Joaquin River inflow to Millerton Lake Unimpaired Flow, and/or the most current DWR Bulletin Water Supply Index (WSI)[3];
- The National Weather Service (NWS) Ensemble Streamflow Prediction (ESP) Water Supply Forecast for the San Joaquin River at Millerton Lake[5];
- Other forecast models, ground-based observations, remotely-sensed observations, hydrologic models, analysis of historic patterns, and short-term weather forecasts as appropriate.

Table 1 shows the water year 2022 (October 1, 2021 to September 30, 2022) observed accumulated and forecasted water year Unimpaired Runoff into Millerton Lake. This table also includes the published DWR forecast, the DWR forecast adjusted for an expected runoff for the current month, the NWS forecast with and without a 7-day smoothing function applied to remove the day-to-day variance, and the NWS forecast with 7-day smoothing and adjustment for the expected runoff for the current month (Reclamation adjusts the DWR and NWS values by replacing the forecasted runoff for the current month with Reclamation's own estimate of runoff for the current month, which increases accuracy and incorporates the latest data). Figure 1a plots DWR and NWS forecast values over the entire water year, while Figure 1b shows the most recent period in detail.

The DWR Bulletin 120 forecast for May 1 (issued May 9) was adjusted by Reclamation to better align with observed runoff conditions to date and projections for the remainder of the month (becoming the "Runoff Adjusted DWR values"). NWS forecast values were also adjusted for runoff for the remainder of the month. Either with or without Reclamation's within-month adjustments, we have seen DWR and NWS forecast values converge toward one another over the past two weeks.

Table 1 — San Joaquin River Water Year Actuals and Forecasts at Millerton Lake, in Thousands of Acre-Feet (TAF)

	Forecast Exceedance Percentile				
	90%	75%	50%	25%	10%
Accumulated Unimpaired Runoff ("Natural River") May 11, 2022 [1]	749.9				
Accumulated Unimpaired Runoff as percent of normal [2]	87%				
DWR, May 1, 2022 [3] (Published Value)	1,000	1,035	1,075	1,170	1,250
DWR, May 11, 2022 [4] (Runoff Adjusted)	1,010	1,038	1,072	1,165	1,235
NWS, May 11, 2022 [5] (Published Daily Value)	1,040	1,050	1,060	1,070	1,110
Smoothed NWS, May 11, 2022 [6] (7-day Smoothing)	1,049	1,056	1,069	1,085	1,115
Smoothed NWS, May 11, 2022 [4] (Runoff Adjusted)	1,042	1,052	1,071	1,094	1,129

1 http://www.usbr.gov/mp/cvo/vungvari/milfln.pdf

2 Based on average accumulation of Unimpaired Runoff totaling 1830 TAF.

3 B120: http://cdec.water.ca.gov/cgi-progs/iodir?s=b120, or B120 Update: http://cdec.water.ca.gov/cgi-progs/iodir_ss/b120up, or WSI: http://cdec.water.ca.gov/cgi-progs/iodir/WSI.2020 . April-July runoffs are converted to Water Year equivalents in this table.

4 The adjusted data has been updated with the actual Unimpaired Runoff through the current date and projected out for the remainder of the month.

5 https://www.cnrfc.noaa.gov/ensembleProduct.php?id=FRAC1&prodID=9

6 The NWS smoothed data uses a 7-day triangular weighted moving average, where the most recent day (n) is given greater weight than each previous forecast day (n-1, 2, 3, etc.); this reduces noise stemming from ESP model input. The following formula is used: $((Forecast_{n} * 1) + (Forecast_{n-1} * 0.857) + (Forecast_{n-2} * 0.714) + (Forecast_{n-3} * 0.571) + (Forecast_{n-4} * 0.429) + (Forecast_{n-5} * 0.286) + (Forecast_{n-6} * 0.143)) / 4$

7 Values at the 75% exceedance and 25% exceedance are interpolated.

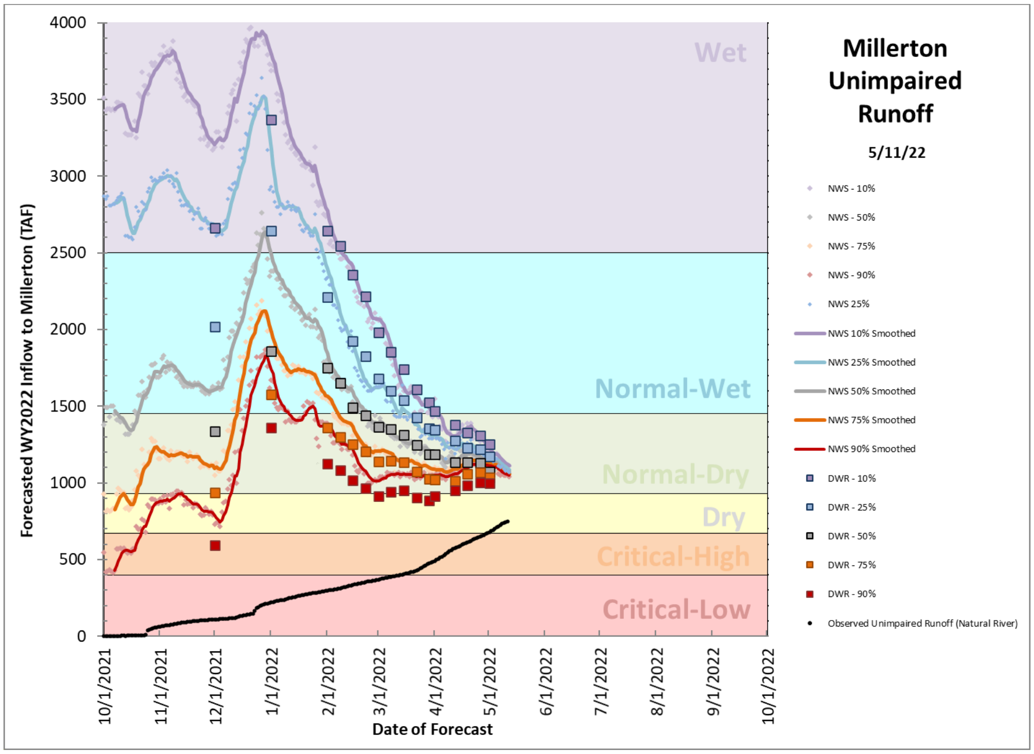

Figure 1a — Plot of 2022 Water Year forecasts. This includes both NWS Ensemble Streamflow Prediction Forecasts and DWR Forecasts

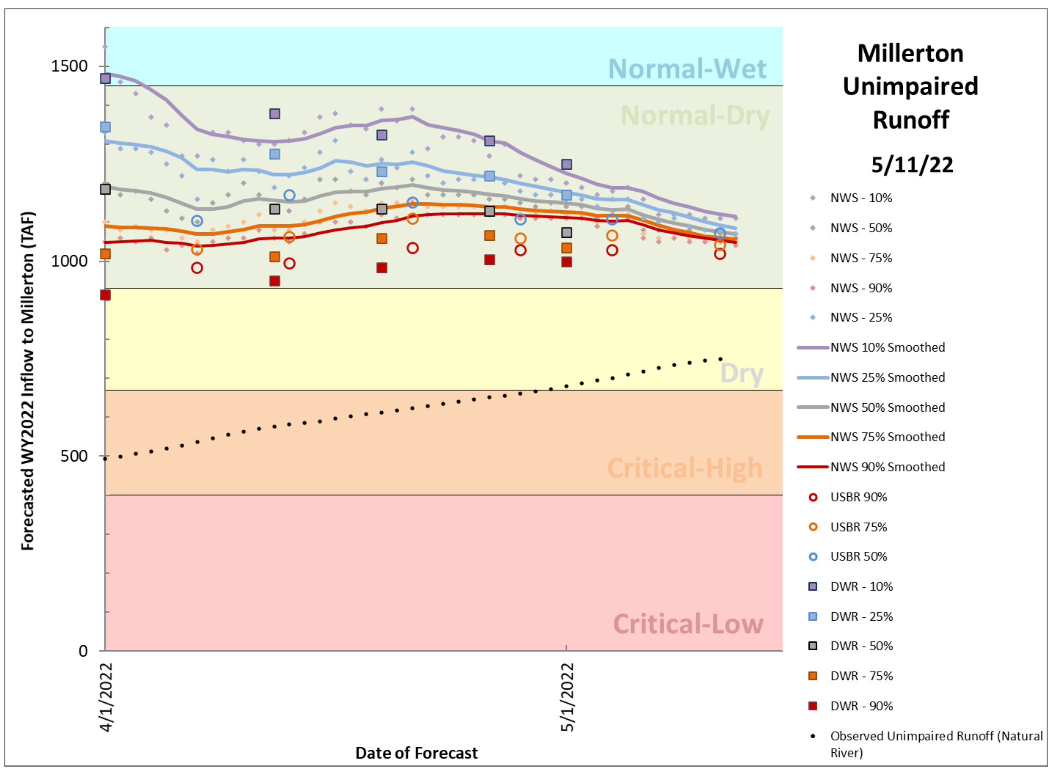

Figure 1b — Detail plot of most recent forecasts. Also shown are Reclamation's "hybrid" forecast with open circles.

Approximately 2.2” of precipitation fell during the month of April, a value which falls between the 75% and 50% exceedance statistical probability. Three storms on April 11, April 16, and April 22 reversed snowpack loss for a few days at a time and may have reduced overall melt rates slightly due to the higher reflectivity of fresh snow. Springtime runoff peaks occurred on April 8 and on May 6, both associated with higher than normal temperatures. Natural River flow rates are expected to remain strong into mid-May and then steadily decline

Table 2 depicts the aggregate snowpack volume from various models, the April 30 Airborne Snow Observatory survey, and Reclamation’s consensus estimate, which leans heavily toward the iSnobal modeled data from May 11 and the April 30 ASO survey (Figure 2). Snowpack has been predominantly ablated on south-facing slopes below 9000’. As observed in 2021, we are seeing a rise in runoff efficiency in early May as snowmelt occurs in locations favorable to runoff — north slopes with wetter soils and higher elevations with shallow saturated soils.

Table 2 — Total snowpack volume (TAF of Snow Water Equivalent) depicted by four models, an ASO measurement, and a consensus estimate for May 11, 2022.

	Snowpack Model Volumes					
	CNRFC	NOHRSC	CU Boulder	iSnobal (M3W)	Aerial Snow Survey (ASO)	Reclamation Consensus
May 11, 2022	243	214	314 [8]	200 [9]	308 [10]	**204**

[8] CU Boulder “Real-time SWE” model from May 1.

[9] The “iSnobal” model for the San Joaquin is produced by M3Works under a contract with ASO. The model was run on May 11 using ASO data for correction.

[10] ASO survey flown on April 30 and reported on May 5.

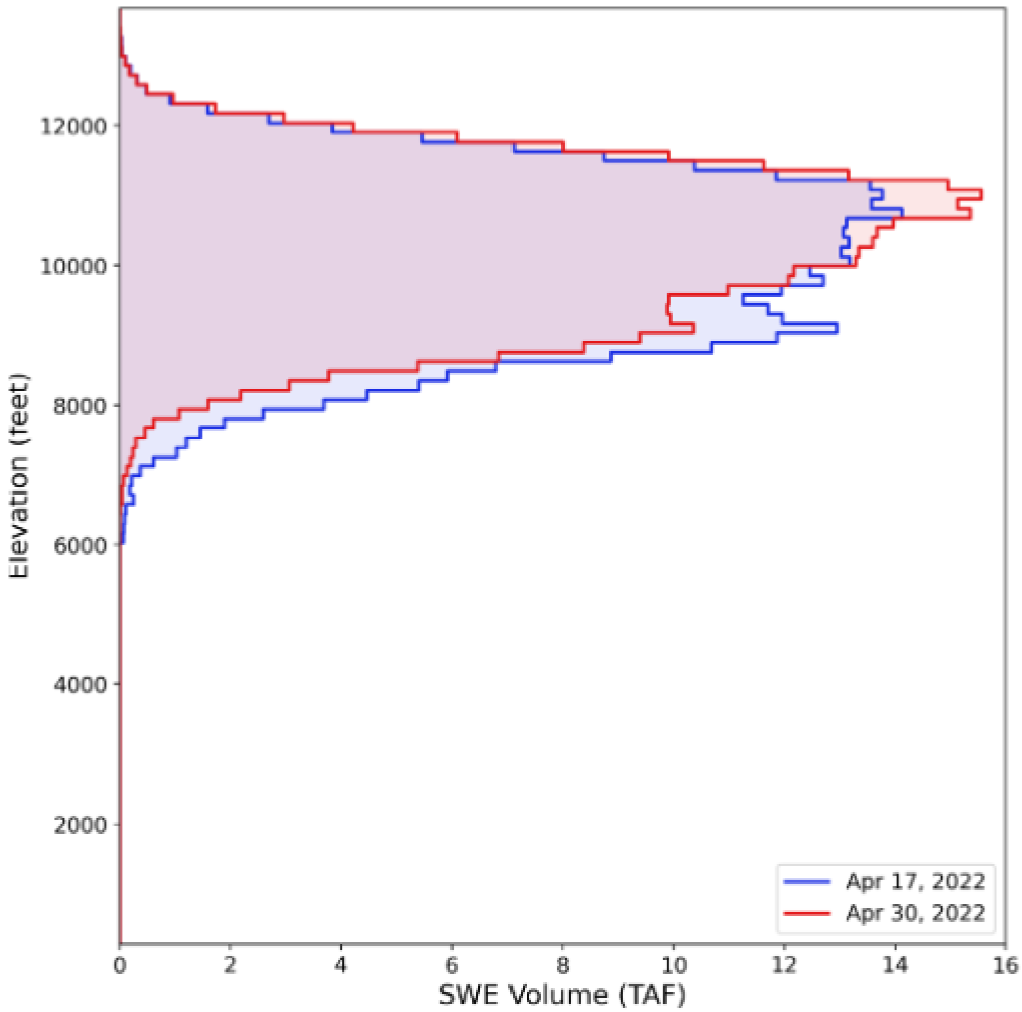

Figure 2 — Comparison of SWE volume distribution by elevation from ASO surveys on April 17 and April 30. Surveys showed gains in snowpack at elevations above 10,000'.

The four ASO surveys in 2022 have so far proven valuable in improving runoff forecasts and understanding snowmelt runoff. The modest amount of April precipitation was poorly characterized by ground-based stations and not properly distributed across the watershed by snowpack models. ASO surveys in April better identified where this precipitation occurred, at times distributing more precipitation at higher elevations where runoff is more efficient. ASO surveys were also very useful in understanding melt rates and tuning snowpack model parameters. This has been critical in projecting runoff after the autumn 2020 Creek Fire, which removed vegetative cover, reducing evapotranspiration as well as canopy shading. Preliminary findings indicate that the Creek Fire, which burned 38% of the watershed, has altered hydrologic processes significantly. Post 2020 snowpack data has been critical in recalibrating models that would otherwise suffer a reduction in accuracy due to those land cover changes.

Combining Forecasts

Staff from the South-Central California Area Office of Reclamation and SJRRP jointly track and evaluate the accuracy of runoff forecasts on a regular basis. Based on the age of these forecasts, the short-term and long-term weather forecasts, the climatological outlook, observed Unimpaired Runoff, and other available information, a hybrid forecast is generated. The weighting of the different components is regularly evaluated and selected using the best available information and professional judgment. **For the current allocation, the DWR "runoff adjusted" and NWS "smoothed runoff adjusted" forecasts are combined with a 70/30 blending respectively**. **No offset is applied to the blended forecast.** The selection of this blending ratio is influenced by the accuracy of runoff predictions over the last several weeks among the two forecast models, Reclamation's interpretation of the snowpack data using an in-house water budget model, and other data sources.

Table 3 — Current Blending and Hybrid Unimpaired Runoff Forecasts (TAF)

	Forecast Probability of Exceedance using blending				
	90%	**75%**	**50%**	**25%**	**10%**
Blending Ratio (DWR/NWS)	70/30 with no offset				
Hybrid Unimpaired Runoff Forecast (TAF)	1,020	1,042	1,072	1,144	1,203

Restoration Allocation

As per the Guidelines, the **50% exceedance** forecast is used for the allocation under current hydrologic conditions to set the Restoration Flow Allocation. Table 4 below, from the Guidelines version 2.1, depicts the progression of forecast exceedances used to set the Restoration Allocation.

Table 4 — Guidance on Percent Exceedance Forecast to Use for Allocation. The final allocation issuance will be made in May this year as per the Guidelines.

		Date of Forecast Used for the Allocation					
	Value (TAF)	**January**	**February**	**March**	**April**	**May**	**June**
If the 50% forecast is:	Above 2200	50	50	50	50	50	50
	1600 to 2200	75	75	50	50	50	50
	900 to 1599	75	75	75	50	**50**	50
	500 to 899	90	90	75	50	50	50
	Below 500	90	90	90	90	75	50

Applying the forecast blending and offsets determined by Reclamation and using the 50% exceedance forecast dictated by the Guidelines, Reclamation calculates an **Unimpaired Runoff hybrid forecast of 1,072 Thousand Acre-Feet (TAF) and a Normal-Dry Water Year Type. This provides a Restoration Allocation of 232.470 TAF as measured at Gravelly Ford (GRF).** Combined with Holding Contracts on the San Joaquin River, **this results in a Friant**

Dam Release of approximately 349.415 TAF. Other hypothetical allocations are presented in Table 5 as grayed values and indicate the range of probable forecasts and the resulting Restoration Allocations.

Table 5 — SJRRP Water Year Type and Allocation for 2022 Restoration Year Shown with Other Hypothetical Values in Gray

	Forecast Probability of Exceedance using proposed blending				
	90%	75%	50%	25%	10%
Hybrid Unimpaired Runoff Forecast (TAF)	1,020	1,042	**1,072**	1,144	1,203
Water Year Type	Normal-Dry	Normal-Dry	**Normal-Dry**	Normal-Dry	Normal-Dry
Restoration Allocation at GRF (TAF)	225.470	228.432	**232.470**	242.163	250.105
Friant Dam Flow Releases (TAF)	342.415	345.377	**349.415**	359.108	367.050

Unreleased Restoration Flow Pricing

The March 25 allocation update set the price for 2022 Tier 2 Unreleased Restoration Flows (URFs) which may be made available to Friant Contractors. In accordance with the 2020-2024 URF agreement, the Tier 2 URF price has been set at $188.87. Tier 1 URF pricing is independent of hydrology and fixed at $23.00 per acre-foot.

Contractual Obligation Considerations

Consistent with Section 10004(j) of the San Joaquin River Restoration Settlement Act, the Settlement and the Settlement Act do not modify the rights and obligations of the United States under the Purchase Contract between Miller and Lux and the United States (Purchase Contract) and the Second Amended Exchange Contact between the United States, Department of the Interior, Bureau of Reclamation and Central California Irrigation District, San Luis Canal Company, Firebaugh Canal Water District, and Columbia Canal Company (Exchange Contract). Reclamation's obligations in the Purchase Contract and Exchange Contract remain unchanged. This is consistent with Condition 17 of Reclamation's 2013 Water Rights order addressing Restoration Flows.

Hydrologic conditions in Northern California have been very dry, with Lake Shasta inflow expected to be about 50% of normal and Folsom Lake inflow projected to be about 70% of normal for the water year. The 2022 forecast approaches last water year's historic low runoff into Lake Shasta; combined such back-to-back dry years are extraordinary. This extended dry hydrology has resulted in a predicted shortfall in meeting the San Joaquin River Exchange Contract using San Luis unit supply at the 90%, 75%, and 50% exceedances.

In response to these conditions, Friant Dam began making releases for the San Joaquin River Exchange Contract on April 1. Although there has been some improvement in California hydrology since the last allocation issuance, the CVP operational plan still retains Friant releases for the Exchange Contract until September 30. There is some optimism that CVP operations updates in the coming weeks may shorten the period of needed deliveries from Friant Dam.

Table A-1 below provides a current estimate of substitute supply in Mendota Pool for the Exchange Contract and the corresponding flow rate from Friant Dam to achieve those deliveries. Reclamation expects that these estimates will be adjusted over the operational period, both for actual loss rates between Friant Dam and Mendota Pool, and for shifting delivery schedules at Mendota Pool. Loss rates have been recently revised downward, resulting in less volume having to be released from Friant Dam. Table A-2 depicts volumes by month. Reclamation will continue to coordinate with the Restoration Administrator as the schedule of releases is updated.

Table A-1 — Flow rates associated with likely Exchange Contractor substitute supply to Mendota Pool via the San Joaquin River, associated Friant Dam releases, and available seepage capacity for Restoration Flows (assuming 600 cfs seepage limitation in Reach 2A).

	Anticipated SJREC substitute supply at Mendota Pool (cfs)	Anticipated Holding Contract Losses (cfs)	Available Seepage Capacity for Restoration Flows at Gravelly Ford (cfs)	Anticipated Friant Dam Releases (cfs)
Apr 1 – Apr 10	0 cfs increasing to 543 cfs	200	600 cfs decreasing to 0 cfs	930 cfs increasing to 1100 cfs
Apr 11 – Apr 20	630 – 710	200	0	1000
Apr 21 – Apr 30	690	200	0	1100
May 1 – May 10	800	230	0	1280
May 11 – May 20	1210 [A1]	230	0	1500
May 21 – May 31	1210 [A1]	230	0	1500
Jun 1 – Jun 10	1210 [A1]	260	0	1540
Jun 11 – Jun 20	1210 [A1]	260	0	1540
Jun 21 – Jun 30	1210 [A1]	260	0	1540
Jul 1 – Jul 10	1210 [A1]	270	0	1560
Jul 11 – Jul 20	1210 [A1]	270	0	1560
Jul 21 – Jul 31	1210 [A1]	270	0	1560
Aug 1 – Aug 10	1210 [A1]	280	0	1570
Aug 11 – Aug 20	1210 [A1]	280	0	1570
Aug 21 – Aug 31	0 - 750 [A2]	280	Up to 600 [A3]	960 [A4]
Sep 1 – Sep 10	0 - 650 [A2]	250	Up to 600 [A3]	1090 [A4]
Sep 11 – Sep 20	0 - 550 [A2]	250	Up to 600 [A3]	980 [A4]
Sep 21 – Sep 30	0 - 500 [A2]	250	Up to 600 [A3]	930 [A4]
Oct 1 – Oct 10	0 [A2]	220	Up to 600 [A3]	610 [A4]
Oct 11 – Oct 20	0 [A2]	220	Up to 600 [A3]	610 [A4]
Oct 21 – Oct 31	0 [A2]	220	Up to 600 [A3]	610 [A4]
Nov 1 – Nov 10	0	200	Up to 600 [A3]	610 [A4]
Nov 11 – Nov 20	0	200	Up to 600 [A3]	610 [A4]
Nov 21 – Nov 30	0	200	Up to 600 [A3]	610 [A4]

[A1] Reach 2B levee rated at 1,210 cfs and SJREC flows are constrained by this limitation at SJB.

[A2] Higher uncertainty in SJREC deliveries to Mendota Pool due to CVO operational uncertainty. Releases for the Exchange Contract could cease in early August or could extend into October (the latter is becoming less likely).

[A3] Upon resumption of Restoration Flows, the seepage limitation is dictated by the ability of high groundwater to drain to the river. While Reach 2A is expected to drain rapidly due to porous soils, if groundwater levels are above threshold at the time Restoration Flows resume, the corresponding flow limitation may be substantially lower than 600 cfs.

[A4] Presumes ramp up flows at Gravelly Ford starting October 1 in accordance with Restoration Administrator April 5 flow recommendation. Also presumes no Exchange Contractor deliveries from the San Joaquin River.

Table A-2 — Flow volumes associated with likely Exchange Contractor substitute supply to Mendota Pool via the San Joaquin River and associated Friant Dam releases. Restoration Flow volumes assume a 600 cfs seepage limitation in Reach 2A and April 5 Restoration Flow recommendation.

	Anticipated SJREC substitute supply at Mendota Pool (AF)	Anticipated Holding Contract Losses (AF)	Anticipated Restoration Flows at Gravelly Ford (AF)	Anticipated Friant Dam Releases for SJREC (AF)	Cumulative Friant Dam Releases for SJREC (AF)	Anticipated Friant Dam Releases for all needs (AF)
April	*33,384*	*11,901*	*6,426*	*45,424*	*45,424*	*63,751*
May	*66,268*	*14,142*	*0*	*76,585*	*122,009*	*90,727*
June	*72,000*	*15,471*	*0*	*76,760*	*198,769*	*92,231*
July	*74,400*	*16,602*	*0*	*79,319*	*278,088*	*95,921*
August	*64,364* [A2]	*17,217*	*0*	*69,064* [A2]	*347,152* [A2]	*86,281*
September	*33,719* [A2]	*14,876*	*0*	*37,686* [A2]	*384,838* [A2]	*52,562*
October	*0* [A2]	*13,357*	*21,620* [A4]	*0* [A2]	*384,838* [A2]	*41,712* [A4]
November	*0*	*11,901*	*23,673* [A4]	*0*	*384,838* [A2]	*36,298* [A4]

[A2] High uncertainty in SJREC deliveries to Mendota Pool due to CVO operational uncertainty for these months.

[A4] Presumes ramp up flows at Gravelly Ford starting October 1 in accordance with Restoration Administrator April 5 flow recommendation. Also presumes no Exchange Contractor deliveries from the San Joaquin River after September 30.

Default Flow Schedule

The Default Flow Schedule, derived from Exhibit B in the Settlement, identifies how Reclamation will schedule the Restoration Allocation for the current Water Year Type and Unimpaired Runoff volume absent a recommendation from the Restoration Administrator. The Guidelines provide detail on how a Default Flow Schedule is parsed from the allocation volume. This approved method of distributing water throughout the year is referred to as "Method 3.1" with the "gamma pathway."

Exhibit B Method 3.1 Default Flow Schedules

Table 6a shows the Basic Default Flow Schedule flows and corresponding Restoration Allocation volumes for the entire year absent channel capacity and seepage constraints, including total releases from Friant Dam and Restoration Flows releases in excess of Holding Contracts. Volume is distributed as various flow rates across the year as per the methods explained in the Guidelines.

Table 6b shows the Capacity Constrained Default Flow Schedule volumes with all expected operational constraints, primarily controlled by seepage limitations in Reach 4A. Any volume within the Spring Flexible Flow Account and Fall Flexible Flow Account that cannot be released on the default schedule is shifted to times with available capacity as per the Guidelines. This Capacity Constrained Default Flow Schedule depicted in Table 6b will be implemented in the absence of a specific recommendation by the Restoration Administrator. **With these known constraints, a Restoration Flow volume of 49.117 TAF is generated that cannot be scheduled for release without shifting outside of the flexible flow periods (which would require a Water Supply Test). This volume would become Unreleased Restoration Flows (URFs) under the Capacity Constrained Default Flow Schedule.** This is an estimated volume of water, actual URF volumes will depend on several factors including the Restoration Administrator Recommendation, flow schedule to-date, recapture of Restoration Flows at Mendota Pool, Friant Dam releases made for the Exchange Contract, and real-time assessments of groundwater constraints.

Table 6a — Basic Default Flow Schedule

Flow Period	Flow (cfs)				Volume (TAF)	
	Friant Dam Release	Holding Contracts [11]	Flow Target at GRF	Restoration Flow at GRF	Friant Dam Release	Restoration Flow at GRF
Mar 1 – Mar 15	500	130	375	370	*14.876*	*11.008*
Mar 16 – Mar 31	1500	130	1375	1370	*47.603*	*43.478*
Apr 1 – Apr 15	1968	150	1823	1818	*58.539*	*54.077*
Apr 16 – Apr 30	350	150	205	200	*10.413*	*5.950*
May 1 – May 28	350	190	165	160	*19.438*	*8.886*
May 29 – Jun 30	350	190	165	160	*22.909*	*10.473*
July 1 – July 29	350	230	125	120	*20.132*	*6.902*
Jul 30 – Aug 31	350	230	125	120	*22.909*	*7.855*
Sep 1 – Sep 30	350	210	145	140	*20.826*	*8.331*
Oct 1 – Oct 31	350	160	195	190	*21.521*	*11.683*
Nov 1 – Nov 6	700	130	575	570	*8.331*	*6.783*
Nov 7 – Nov 10	700	130	575	570	*5.554*	*4.522*
Nov 11 – Nov 30	350	120	235	230	*13.884*	*9.124*
Dec 1 – Dec 31	350	120	235	230	*21.521*	*14.142*
Jan 1 – Jan 31	350	100	255	250	*21.521*	*15.372*
Feb 1 – Feb 28	350	100	255	250	*19.438*	*13.884*
				Totals	***349.415***	***232.470***

Table 6b — Capacity Constrained Default Flow Schedule

Flow Period	Flow (cfs)				Volume (TAF)		
	Friant Dam Release	Holding Contracts [11]	Flow Target at GRF	Restoration Flow at GRF	Friant Dam Release	Restoration Flow at GRF	Unreleased Restoration Flow [12]
Mar 1 – Mar 15	551	130	426	421	*16.387*	*12.519*	*-1.511*
Mar 16 – Mar 31	551	130	426	421	*17.480*	*13.354*	*30.124*
Apr 1 – Apr 15	571	150	426	421	*16.982*	*12.519*	*41.557*
Apr 16 – Apr 30	571	150	426	421	*16.982*	*12.519*	*-6.569*
May 1 – May 28	611	190	426	421	*33.922*	*23.369*	*-14.484*
May 29 – Jun 30	350	190	165	160	*22.909*	*10.473*	*0.000*
July 1 – July 29	350	230	125	120	*20.132*	*6.902*	*0.000*
Jul 30 – Aug 31	350	230	125	120	*22.909*	*7.855*	*0.000*
Sep 1 – Sep 30	350	210	145	140	*20.826*	*8.331*	*0.000*
Oct 1 – Oct 31	350	160	195	190	*21.521*	*11.683*	*0.000*
Nov 1 – Nov 6	551	130	426	421	*6.555*	*5.008*	*1.776*
Nov 7 – Nov 10	551	130	426	421	*4.370*	*3.338*	*1.184*
Nov 11 – Nov 30	425	120	310	305	*16.844*	*12.084*	*-2.960*
Dec 1 – Dec 31	350	120	235	230	*21.521*	*14.142*	*0.000*
Jan 1 – Jan 31	350	100	255	250	*21.521*	*15.372*	*0.000*
Feb 1 – Feb 28	350	100	255	250	*19.438*	*13.884*	*0.000*
				Totals	***300.298***	***183.353***	***49.117***

[11] In recent years, Holding Contract demands have been higher than assumed under Exhibit B of the Settlement, in which case, flows at Friant are increased to achieve the Gravelly Ford Flow Target.

[12] This estimate of URF volume is based on the most constraining reach, with Spring Flexible Flows redistributed March 1 through May 28 as necessary and Fall Flexible Flows redistributed Sept 3 through December 28 as necessary up to channel capacity constraints. Actual URF volume will depend on the Restoration Administrator's recommendations.

Exhibit B Restoration Flow Budget

Table 7 shows the components of the annual water budget for February 1, 2022, through February 28, 2023 (i.e. the Restoration Year). The Continuity Flow Account, Spring Flexible Flow Account, Riparian Recruitment Flow Account, and Fall Flexible Flow Account reflect the Exhibit B hydrograph for the current Restoration Allocation. The expected 116.945 TAF for Holding Contracts is shown. The volume for each flow account may change with subsequent Restoration Allocations.

Table 7 — Restoration Budget with Flow Accounts

<table>
<tr><th rowspan="2">Period</th><th rowspan="2">Holding Contract Demand (TAF)</th><th colspan="4">Restoration Flow Accounts (TAF)</th></tr>
<tr><th>Continuity Flow Account</th><th>Spring Flexible Flow Account</th><th>Riparian Recruitment Flow Account</th><th>Fall Flexible Flow Account</th></tr>
<tr><td>Feb 1 – Feb 28</td><td>–</td><td>0</td><td rowspan="3">89.085</td><td>–</td><td>–</td></tr>
<tr><td>Mar 1 – Apr 30</td><td>16.919</td><td>25.428</td><td>–</td><td>–</td></tr>
<tr><td>May 1 – May 28</td><td>10.552</td><td>8.886</td><td rowspan="2">0</td><td>–</td></tr>
<tr><td>May 29 – Jul 29</td><td>25.666</td><td>17.375</td><td>–</td><td>–</td></tr>
<tr><td>Jul 30 – Aug 31</td><td>15.055</td><td>7.855</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td>Sep 1 – Sep 30</td><td>12.496</td><td>8.331</td><td>–</td><td>–</td><td rowspan="3">6.942</td></tr>
<tr><td>Oct 1 – Nov 30</td><td>17.177</td><td>25.175</td><td>–</td><td>–</td></tr>
<tr><td>Dec 1 – Dec 31</td><td>7.379</td><td>14.142</td><td>–</td><td>–</td></tr>
<tr><td>Jan 1 – Feb 28</td><td>11.702</td><td>29.256</td><td>–</td><td>–</td><td>–</td></tr>
<tr><td rowspan="3"></td><td rowspan="2">116.945 [13]</td><td>136.443</td><td>89.085</td><td>0</td><td>6.942</td></tr>
<tr><td colspan="4">232.470 (Base Flow Volume)</td></tr>
<tr><td colspan="5">349.415 (approximate Friant Release Volume) [13]</td></tr>
</table>

[13] In recent years, Holding Contract demands have been higher than assumed under Exhibit B of the Settlement, in which case, flows at Friant are increased to achieve the Gravelly Ford Flow Target.

Remaining Flow Volumes

The amount of water remaining for scheduling is the volume of flows released from Friant Dam in excess of releases required to meet Holding Contract demands, less past releases. Table 8 tracks these balances among the four flow accounts. Tracking these four flow accounts is necessary for application of the Water Supply Test. The released to date volumes are derived from quality-assurance/quality-control daily average data when available, and partly from provisional data posted to CDEC, and thus may have future adjustments. Such adjustments may also affect the remaining flow volume.

Note that the Restoration Administrator has the option on the return of URF exchanges in 2022 (Table 9).

Table 8 — Estimated Restoration Flow Volume Remaining and Released to Date

Flow Account		Yearly Allocation (TAF)	Released to Date [15] (TAF)	Remaining Flow Volume (TAF)
Base Flows	Continuity Flow Account (Mar 1 — Feb 28)	136.443	17.296	119.147
	Spring Flexible Flows (Feb 1 – May 28)	89.085	21.998	67.087
	Riparian Recruitment Flows (May 1 — Jul 29)	0	0	0
	Fall Flexible Flows (Sep 3 – Dec 28)	6.942	0	6.942
Buffer Flows [14]		—	0	—
Unreleased Restoration Flows (Sales and Exchanges)		—	47.982	-47.982
Unreleased Restoration Flows (Returned Exchanges)		—	0	0
Purchased Water		—	0	0
		Totals:	**87.276**	**145.194**

[14] Buffer Flow volumes are based on actual releases, and are not an allocated volume per se.

[15] As of 5/11/2022

Available URF Exchange Returns

Reclamation is in the process of extending and revising three existing Unreleased Restoration Flow exchanges. The available water for return to the Restoration Administrator, incorporating the expected agreement revisions, is shown in Table 9.

Table 9 — Volume available from URF Exchange Returns

Exchange Partner	Period of return [16]	Minimum Required Return (TAF)	Maximum Annual Return (TAF)	Notes
AEWSD	Mar-Sep	3.500	3.500 [16]	Expires Feb 2025, requiring the use of 3,500 AF for each of the remaining three years
FID	Flexible	0	2.000	Exchange expires in 2023
FID	Mar-Sep	0	3.600	Exchange is reduced by 10% per year, expiring Feb 2025
OCID	Mar-Sep	0	Up to 3.000	Return ratio depends upon Class 1 declaration, expiring Feb 2025

[16] unless otherwise by mutual agreement

Operational Constraints

Operating criteria, such as channel conveyance capacity, ramping rate constraints, scheduled maintenance, reservoir storage, contractual obligations, and downstream seepage concerns, may restrict the release of Restoration Flows. Table 10 summarizes known 2022 operational constraints.

Table 10 — Summary of Operational Constraints

<table>
<tr><th>Type of Constraint</th><th>Period</th><th>Flow Limitation</th></tr>
<tr><td rowspan="3">Levee Stability</td><td>Currently in effect</td><td>1,210 cfs in Reach 2B</td></tr>
<tr><td>Currently in effect</td><td>2,600 cfs in Eastside Bypass</td></tr>
<tr><td>Currently in effect</td><td>2,350 cfs in Reach 5</td></tr>
<tr><td rowspan="3">Channel Conveyance / Seepage Limitation</td><td rowspan="3">Currently in effect, see latest Flow Bench Evaluation for precise values</td><td>Reach 2A: Approx. 600 cfs @ GRF</td></tr>
<tr><td>Reach 3: Approx. 850 cfs @ MEN</td></tr>
<tr><td>Reach 4A: Approx. 300 cfs @ SDP</td></tr>
<tr><td>USFWS Biological Opinion</td><td>Until consultation for “Phase 2”</td><td>1,660 cfs of Restoration Flows through Eastside Bypass</td></tr>
</table>

The 2022 Channel Capacity Report identifies a maximum flow in Reach 2B of 1,210 cfs due to levee stability constraints. This results in a maximum release from Friant Dam between 1,310 cfs and 1,540 cfs depending on the time of year. The 2022 Restoration Year Channel Capacity Report also identifies a maximum flow in the Middle Eastside Bypass of 2,600 cfs, which has increased from the 2021 Channel Capacity Report value of 1,070 cfs due to the completion of the Reach O levee improvements project and the removal of two weirs within the Eastside Bypass.

Friant Dam releases to meet the Exchange Contract began on April 1 and have reduced the ability for Restoration Flows to operate in the river alongside other flows. During these Exchange Contractors releases, the SJRRP will operate such that the combined flow does not exceed SJRRP Seepage Management Plan (SMP)[1] thresholds while Restoration Flows are present in the channel. However, Exchange Contractor flows are not subject to the thresholds of the SJRRP SMP. When the combined release reaches a SMP threshold, the SJRRP will follow the protocol defined in the SMP to evaluate response actions. SJRRP will work with the Restoration Administrator if a flow response is determined necessary to implement changes to the Restoration Flow schedule or otherwise reduce flows to comply with SMP thresholds. If Exchange Contractors flows exceed the SJRRP SMP thresholds, then Restoration Flows will cede the channel capacity and will not be released. While this guidance is applicable to this water year, the SJRRP is investigating aspects of co-releasing Restoration Flows and other waters, and future guidance may supersede this current operational assumption.

A site investigation on April 4 revealed that groundwater levels in portions of Reach 2A had just exceeded seepage thresholds. The flow rate at the time of exceedance was 603 cfs at Gravelly Ford. As per your April 1 ad-hoc flow recommendation, Reclamation smoothly reduced Restoration Flows at Gravelly Ford until 100 cfs, at which time Restoration Flows dropped to zero. This course of action resulted in declining Restoration Flows in the Eastside Bypass and Reach 5 beginning on April 8 and reaching zero around April 18. Reclamation will continue to monitor critical groundwater elevations during the cessation of Restoration Flows so we can better understand groundwater behavior and improve future operations constraints.

Upon resumption of Restoration Flows, the seepage limitation is dictated by the ability of high groundwater to drain to the river. While Reach 2A is expected to drain rapidly due to porous soils, if groundwater levels are above threshold at the time Restoration Flows resume, the corresponding flow limitation may be substantially lower than 600 cfs. SJRRP will be analyzing the seepage limit using the “drainage method” to forecast a maximum flow rate if then-current groundwater levels are higher than the river stage. Once groundwater levels fall below river stage, one can assume the maximum flow rate would be approximately 600 cfs, but this would need to be evaluated further with then-current groundwater levels. A table of Reach 2 partitioning of losses assuming a 600 cfs seepage limitation is shown in Table B.

Reclamation will inform the Restoration Administrator of any changes to groundwater conditions that are likely to result in a reduction or increase in allowable Restoration Flows, will implement monitoring of groundwater conditions as necessary, and will adjust Friant Dam releases and/or Mendota Pool recapture (as preferred by the Restoration Administrator) to stay within seepage and channel capacity constraints. Reclamation will work with the Restoration Administrator to

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[1] Seepage Projects – San Joaquin River Restoration Program (restoresjr.net)

provide the best estimates of the Exchange Contractor releases to inform when available channel capacity changes.

Table B — Table of Reach 2A seepage capacity. This table assumes a 600 cfs seepage limitation [B1]. Seepage thresholds may be significantly lower upon resumption of Restoration Flows if groundwater elevations are above thresholds due to the need to allow drainage of high groundwater.

SJREC Delivery to Mendota Pool (cfs)	Available Capacity for Restoration Flows at GRF (cfs)	Combined Flows at Gravelly Ford (cfs)	R2A Losses Assigned to Restoration Flows (cfs)	R2A Losses Assigned to Exchange Contract Flows (cfs)	Restoration Flows below Sack Dam [B3] (cfs)
600	0	705	0	105	0
550	0	655	0	105	0
500	0	605	0	105	0
450	115 [B2]	600	75	30	29
400	165	600	75	30	76
350	215	600	75	30	124
300	265	600	75	30	171
250	325	600	85	20	219
200	375	600	85	20	266
150	435	600	95	10	314 [B4]
100	585	600	95	10	361 [B4]
50	535	600	95	10	409 [B4]

[B1] Upon resumption of Restoration Flows, the seepage limitation is dictated by the ability of high groundwater to drain to the river. While Reach 2A is expected to drain rapidly due to porous soils, if groundwater levels are above threshold at the time Restoration Flows resume, the corresponding flow limitation may be substantially lower than 600 cfs.

[B2] 465 cfs of Exchange Contractor Flow to Mendota Pool allows 100 cfs of Restoration Flows

[B3] Restoration Flows below Sack Dam may be 10 cfs higher than what is shown here, pending discussions with SLDMWA

[B4] Seepage limitation in Reach 4A below Sack Dam is currently approximately 300 cfs.

2022 Allocation History

The Restoration Allocation are adjusted multiple times between the date of the initial allocation and the final allocation; issuances will generally take place on a monthly schedule but may also be issued based on rapidly changing hydrologic conditions. The Restoration Administrator is responsible for contingency planning and managing releases to stay within the current allocation to the extent possible, in accordance with the Guidelines. Table 11 summarizes the Allocation History for this Restoration Year.

Table 11 — Allocation History

Allocation Type	Issue Date	Forecast Blending Applied	Unimpaired Runoff Forecast (at forecast exceedance)	Year Type	Restoration Allocation at Gravelly Ford	Restoration Flows and URFs Released
Initial	January 13, 2022	30/70	1,678 TAF (@ 75%)	Normal-Wet	315.297 TAF	0 (thru 1/12/2022)
Update	February 18, 2022	40/60 w/ offsets	1,235 TAF (@ 75%)	Normal-Dry	254.413 TAF	0 (thru 2/17/2022)
Update	March 20, 2022	50/50 w/ offsets	1,105 TAF (@ 75%)	Normal-Dry	236.913 TAF	21.612 (thru 3/18/2022)
Update	March 25, 2022	40/60	1,109 TAF (@ 75%)	Normal-Dry	237.451 TAF	24.646 (thru 3/24/2022)
Update	April 18, 2022	60/40	1,169 TAF (@ 50%)	Normal-Dry	245.528 TAF	39.294 (thru 4/17/2022)
Final	May 13, 2022	70/30	1,072 TAF (@ 50%)	Normal-Dry	232.470 TAF	39.294 (thru 5/11/2022)

Appendix A: Abbreviations, Acronyms, and Glossary

af	Acre-feet
ARS	USDA Agricultural Research Service
ASO	Airborne Snow Observatory
CALSIM	California Statewide Integrated Model
CCID	Central California Irrigation District
CDEC	California Data Exchange Center
cfs	Cubic feet per second
CVP	Central Valley Project
Delta	Sacramento–San Joaquin Delta
DWR	California Department of Water Resources
ESP	Ensemble Streamflow Prediction
Exhibit B	Exhibit B of the Settlement depicting Default Hydrograph
GRF	Gravelly Ford Flow Gauge
Guidelines	Restoration Flow Guidelines
LSJLD	Lower San Joaquin Levee District
NWS	National Weather Service
QA/QC	Quality Assurance/Quality Control (i.e. finalized)
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
Restoration Year	the cycle of Restoration Flows, March 1 through February 28/29
RWA	SJRRP Reclaimed Water Account
Secretary	U.S. Secretary of the Interior
Settlement	Stipulation of Settlement in NRDC, et al., v. Kirk Rodgers, et al.
SJREC	San Joaquin River Exchange Contractors
SJRRP	San Joaquin River Restoration Program
SLCC	San Luis Canal Company
SMP	Seepage Management Plan
SWE	Snow Water Equivalent
SWP	State Water Project
TAF	thousand acre–feet
URF	Unreleased Restoration Flows
WSI	DWR Water Supply Index
WY	Water year, October 1 through September 30

Appendix B: Previous Year (2021) Flow Accounting

Table B — Restoration Flow Accounting and Unreleased Restoration Flows, and Holding Contracts, for the period February 2021 through February 2022. Flood management releases to San Joaquin River did not occur during this period. The final Restoration Allocation was 70.919 TAF. Additionally, Unreleased Restoration Flow exchange returns of 10.435 TAF were released, plus 0.902 TAF of Buffer Flows. The Restoration Allocation was expended with 0.000 TAF ending balance by transitioning from 2021 Allocation to 2022 Allocation midday on February 18, 2022.

<table>
<tr><th rowspan="2">Flow Period</th><th rowspan="2">Gravelly Ford 5 cfs requirement (TAF)</th><th rowspan="2">URF disposed</th><th colspan="7">Released Restoration Flow Volumes (TAF)</th></tr>
<tr><th>Continuity Flow</th><th>Spring Flexible Flow</th><th>Fall Flexible Flow</th><th>Riparian Recruitment Flow</th><th>Buffer Flow</th><th>Flexible Buffer Flow</th><th>URF returned</th></tr>
<tr><td>Feb 1 – Feb 28</td><td>–</td><td></td><td>–</td><td>0</td><td>–</td><td>–</td><td>–</td><td>–</td><td></td></tr>
<tr><td>Mar 1 – Mar 31</td><td>10.076</td><td></td><td>1.379</td><td>0</td><td>–</td><td>–</td><td>0</td><td>–</td><td>4.612</td></tr>
<tr><td>Apr 1 – Apr 30</td><td>12.922</td><td></td><td>0.986</td><td>0</td><td>–</td><td>–</td><td>0</td><td>–</td><td>5.813</td></tr>
<tr><td>May 1 – May 31</td><td>15.201</td><td></td><td>1.537</td><td>5.800[1]</td><td>–</td><td rowspan="4">0</td><td>0.783</td><td rowspan="5">0</td><td></td></tr>
<tr><td>Jun 1 – Jun 30</td><td>13.172</td><td></td><td>1.067</td><td>–</td><td>–</td><td>0.119</td><td></td></tr>
<tr><td>Jul 1 – Jul 31</td><td>16.322</td><td></td><td>0</td><td>–</td><td>–</td><td>0</td><td></td></tr>
<tr><td>Aug 1 – Aug 31</td><td>16.701</td><td></td><td>0</td><td>–</td><td>–</td><td>0</td><td></td></tr>
<tr><td>Sep 1 – Sep 30</td><td>14.957</td><td></td><td>0</td><td>–</td><td>0</td><td>–</td><td>0</td><td></td></tr>
<tr><td>Oct 1 – Oct 31</td><td>13.743</td><td></td><td>0.724</td><td>–</td><td>0</td><td>–</td><td>0</td><td rowspan="3">0</td><td></td></tr>
<tr><td>Nov 1 – Nov 30</td><td>13.738</td><td></td><td>2.878</td><td>–</td><td>0</td><td>–</td><td>0</td><td></td></tr>
<tr><td>Dec 1 – Dec 31</td><td>17.213</td><td></td><td>21.299</td><td>–</td><td>0.595</td><td>–</td><td>0</td><td></td></tr>
<tr><td>Jan 1 – Jan 31</td><td>12.182</td><td></td><td>26.243</td><td>–</td><td>–</td><td>–</td><td>0</td><td>–</td><td></td></tr>
<tr><td>Feb 1 – Feb 28</td><td>14.529</td><td></td><td>8.412</td><td>–</td><td>–</td><td>–</td><td>0</td><td>–</td><td></td></tr>
<tr><td rowspan="6"></td><td rowspan="5">170.757</td><td rowspan="4">0</td><td>64.525</td><td>5.800</td><td>0.595</td><td>0</td><td>0.902</td><td>0</td><td rowspan="3">10.425</td></tr>
<tr><td colspan="4">70.919 (allocated Restoration Flows)</td><td colspan="2">0.902 (all Buffer Flows)</td></tr>
<tr><td colspan="6">71.822 (Restoration Flows affecting Friant water supply)</td></tr>
<tr><td colspan="7">82.247 (Restoration Flows released to river)</td></tr>
<tr><td colspan="5">70.919 (Restoration Allocation used)</td><td colspan="3"></td></tr>
<tr><td></td><td></td><td colspan="7">253.004 (Friant Dam releases — excludes disposed URFs)</td></tr>
</table>

[1] On May 28, 35.159 TAF of the Spring Flexible Flow account was transferred into the Continuity Flow Account, passing a Water Supply Test, and released in October through February

Appendix C: History of Millerton Unimpaired Runoff

Table C — Water Year Totals in Thousand Acre-Feet

Water Year [1]	Unimpaired Runoff [2]	SJRRP Water Year Type [3]	Water Year [1]	Unimpaired Runoff [2]	SJRRP Water Year Type [3]	Water Year [1]	Unimpaired Runoff [2]	SJRRP Water Year Type [3]	Water Year [1]	Unimpaired Runoff [2]	SJRRP Water Year Type [3]
1901	3,227.9	Wet	1933	1,111.4	Normal-Dry	1965	2,271.191	Normal-Wet	1997	2,817.670	Wet
1902	1,704.0	Normal-Wet	1934	691.5	Dry	1966	1,298.792	Normal-Dry	1998	3,160.759	Wet
1903	1,727.0	Normal-Wet	1935	1,923.2	Normal-Wet	1967	3,233.097	Wet	1999	1,527.040	Normal-Wet
1904	2,062.0	Normal-Wet	1936	1,853.3	Normal-Wet	1968	861.894	Dry	2000	1,735.653	Normal-Wet
1905	1,795.4	Normal-Wet	1937	2,208.0	Normal-Wet	1969	4,040.864	Wet	2001	1,065.318	Normal-Dry
1906	4,367.8	Wet	1938	3,688.4	Wet	1970	1,445.837	Normal-Dry	2002	1,171.457	Normal-Dry
1907	3,113.9	Wet	1939	920.8	Dry	1971	1,416.812	Normal-Dry	2003	1,449.954	Normal-Dry
1908	1,163.4	Normal-Dry	1940	1,880.6	Normal-Wet	1972	1,039.249	Normal-Dry	2004	1,130.823	Normal-Dry
1909	2,900.7	Wet	1941	2,652.5	Wet	1973	2,047.585	Normal-Wet	2005	2,826.872	Wet
1910	2,041.5	Normal-Wet	1942	2,254.0	Normal-Wet	1974	2,190.308	Normal-Wet	2006	3,180.816	Wet
1911	3,586.0	Wet	1943	2,053.7	Normal-Wet	1975	1,795.922	Normal-Wet	2007	684.333	Dry
1912	1,043.9	Normal-Dry	1944	1,265.4	Normal-Dry	1976	629.234	Critical-High	2008	1,116.790	Normal-Dry
1913	879.4	Dry	1945	2,134.633	Normal-Wet	1977	361.253	Critical-Low	2009	1,455.379	Normal-Wet
1914	2,883.4	Wet	1946	1,727.115	Normal-Wet	1978	3,402.805	Wet	2010	2,028.706	Normal-Wet
1915	1,966.3	Normal-Wet	1947	1,121.564	Normal-Dry	1979	1,829.988	Normal-Wet	2011	3,304.824	Wet
1916	2,760.5	Wet	1948	1,201.390	Normal-Dry	1980	2,973.169	Wet	2012	831.582	Dry
1917	1,936.2	Normal-Wet	1949	1,167.008	Normal-Dry	1981	1,067.757	Normal-Dry	2013	856.626	Dry
1918	1,466.8	Normal-Wet	1950	1,317.457	Normal-Dry	1982	3,317.171	Wet	2014	509.579	Critical-High
1919	1,297.5	Normal-Dry	1951	1,827.254	Normal-Wet	1983	4,643.090	Wet	2015	327.410	Critical-Low
1920	1,322.5	Normal-Dry	1952	2,840.854	Wet	1984	2,042.750	Normal-Wet	2016	1,300.986	Normal-Dry
1921	1,604.4	Normal-Wet	1953	1,226.830	Normal-Dry	1985	1,135.975	Normal-Dry	2017	4,395.400	Wet
1922	2,355.1	Normal-Wet	1954	1,313.993	Normal-Dry	1986	3,031.600	Wet	2018	1,348.979	Normal-Dry
1923	1,654.3	Normal-Wet	1955	1,161.161	Normal-Dry	1987	756.853	Dry	2019	2,734.772	Wet
1924	444.1	Critical-High	1956	2,959.812	Wet	1988	862.124	Dry	2020	886.025	Dry
1925	1,438.7	Normal-Dry	1957	1,326.573	Normal-Dry	1989	939.168	Normal-Dry	2021	521.853	Critical-High
1926	1,161.4	Normal-Dry	1958	2,631.392	Wet	1990	742.824	Dry	2022	*Pending*	*Pending*
1927	2,001.3	Normal-Wet	1959	949.456	Normal-Dry	1991	1,027.209	Normal-Dry			
1928	1,153.7	Normal-Dry	1960	826.021	Dry	1992	807.759	Dry			
1929	862.4	Dry	1961	647.428	Critical-High	1993	2,672.322	Wet			
1930	859.1	Dry	1962	1,924.066	Normal-Wet	1994	824.097	Dry			
1931	480.2	Critical-High	1963	1,945.266	Normal-Wet	1995	3,876.370	Wet			
1932	2,047.4	Normal-Wet	1964	922.351	Dry	1996	2,200.707	Normal-Wet			

[1] Water year is from Oct 1 through Sept 30, for example the 2010 water year began Oct 1, 2009. Unimpaired Runoff is based on Reclamation calculations, and hypothetical water year types are shown here; actual Restoration water year types are based on the final allocation, which may sometimes differ slightly from the calculated water year total.

[2] Also known as "Natural River" or "Unimpaired Runoff into Millerton" – This is the total runoff that would flow into Millerton Lake if there were no dams or diversions upstream. There was a lower level of precision prior to 1945. Friant Dam uses 1.9835 conversion from cfs to AF.

[3] The six SJRRP Water Year Types are based on Unimpaired Runoff and are not updated as climatology changes as per the Settlement. Critical-Low= <400 TAF, Critical-High=400-669.999 TAF, Dry= 670-929.999 TAF, Normal-Dry 930-1449.999, Normal-Wet 1450-2500, Wet>2500

Appendix D: Final Restoration Allocations and Error

Table D — History of Restoration Allocations

Year	Type	Date of Final Allocation Issuance[2]	Unimpaired Runoff Forecast in Final Allocation (TAF)	Restoration Allocation in Final Issuance (TAF)	Observed Unimpaired Runoff on Sep. 30 (TAF)	Unimpaired Runoff Forecast Error	Allocation Error
2009	Interim Flows			261.5	1,455.379	—	—
2010	Interim Flows			98.2	2,028.706	—	—
2011	Interim Flows			152.4	3,304.824	—	—
2012	Interim Flows			183	831.582	—	—
2013	Interim Flows			65.5	856.626	—	—
2014	Restoration Flows	Mar 3	518	0 [1]	509.579	+8.421	0 [1]
2015	Restoration Flows	Sep 28	327	0	327.410	-0.410	0
2016	Restoration Flows	Sep 30	1300.986	263.295	1,300.986	0	0
2017	Restoration Flows	Jul 10	4,444	556.542	4,395.400	+48.600	0
2018	Restoration Flows	May 22	1,427	280.258	1,348.979	+78.021	+10.503
2019	Restoration Flows	May 20	2,690	556.542	2,734.772	-44.772	0
2020	Restoration Flows	June 19	880	202.197	886.025	-6.025	-1.345
2021	Restoration Flows	June 25	529	70.919	521.853	+7.147	0
2022	Restoration Flows	May 13	1072	232.470			

[1] No water was provided under this Critical-High designation due to necessity for Friant Dam to release flows for the Exchange Contract.

[2] In 2018 with the completion of Version 2.0 of the Restoration Flows Guidelines, the date of final Restoration Allocation issuance was advanced from September 30 to May (or June under dry hydrologic conditions).

Appendix E: Unreleased Restoration Flow History

Table E1 — URF Distributions (TAF)

Restoration Year	Gross Volume of URF Sales to Class 1	Gross Volume of URF Sales to Class 2	Net Volume of URF Sales to Class 1	Net Volume of URF Sales to Class 2	Gross Volume of URF put into Exchanges	Net Volume of URF put into Exchanges	Gross Volume of URFs spilled	Gross Total URF
2013	—	—	—	—	12.694	12.694	—	**12.694**
2014	11.219	—	11.219	—	—	—	0.206	**11.425**
2015	—	—	—	—	—	—	—	**0**
2016	70.860	56.959	67.317	54.111	18.947	18.000	—	**146.766**
2017	5.474	364.967	5.200	346.716	2.491	2.366	—	**372.932**
2018	65.249	40.000	61.986	38.000	19.543	18.565	—	**124.792**
2019	—	326.954	—	310.607	16.298	15.482	22.509	**365.761**
2020	43.500	—	41.325	—	20.002	19.697	—	**63.502**
2021	—	—	—	—	—	—	—	**0**
2022	42.087	—	39.983	—	5.895	5.600	—	**47.982**
Total	**238.389**	**788.88**	**227.03**	**749.434**	**95.87**	**92.404**	**22.715**	**1,145.854**

Note: 2022 URF actions have not yet been completed

Table E2 — URF Revenue for the Restoration Fund

Restoration Year	Revenue Generated from URF Sales	Revenue Generated from URF Exchanges	Total URF Revenue
2013	—	—	—
2014	$3,470,650	—	$3,470,650
2015	—	—	—
2016	$9,686,790	—	$9,686,790
2017	$7,038,380	—	$7,038,380
2018	$6,123,858	$494,504	$6,618,362
2019	$6,393,286	$306,680	$6,699,966
2020	$8,922,481	$1,251,630	$10,174,111
2021	—	$525,000	$525,000
2022	$7,551,589	$1,057,672	$8,609,261
Total	**$49,187,034**	**$3,635,486**	**$52,822,520**

Note: 2022 URF actions have not yet been completed

Table E3 — URF Exchanges Returned to the Program (TAF)

Restoration Year	Volume Returned	Notes
2013	—	—
2014	11.425	From 2013 URF Exchange with FID, used for 2014 sales
2015	—	—
2016	—	—
2017	5.474	Returned from San Luis Reservoir, 5.200 net URF sold
2018	2.129	Returned from 2018 DEID exchange
2019	9.000	Returned to SLR from 2019 AEWSD and LTRID exchange, transferred to CVO for San Luis Unit supply
2020	0.487	Returned from FID from 2019 exchange
2021	10.425	Returned from multi-party 2020 exchange
2022	3.500	From 2016 URF Exchange with AEWSD
Total	**42.440**	

Note: 2022 URF actions have not yet been completed