



Initial 2019 Restoration Allocation & Default Flow Schedule

January 17, 2019

Introduction

The following transmits the initial 2019 Restoration Allocation and Default Flow Schedule to the Restoration Administrator for the San Joaquin River Restoration Program (SJRRP), consistent with the Restoration Flows Guidelines (version 2.0, February 2017). This Restoration Allocation and Default Flow Schedule provides the following:

- Forecasted water year Unimpaired Inflow: the estimated flows that would occur absent regulation on the river. This value is also known as the “Natural River” or “Unimpaired Runoff” or “Full Natural Flow,” and is utilized to identify the Water Year Type.
- Hydrograph Volumes: the annual allocation hydrograph based on water year unimpaired inflow, utilizing the Method 3.1 with the Gamma Pathway (RFG-Appendix C, Figure C-3) 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 Unimpaired Inflow forecast.
- Unreleased Restoration Flows: the amount of Restoration Flows not released due to channel capacity constraints and 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 Flexible Flow Volume: the volume of Restoration Flows released and the remaining volume available for flexible scheduling.
- 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 Restoration Flow Guidelines

(Guidelines), the Restoration Administrator is requested to recommend a flow schedule showing the use of the entire annual allocation during the upcoming Restoration Year, categorize all recommended flows by account, and recommend both an unconstrained and a capacity limited recommendation. If an unconstrained recommendation and a capacity limited recommendation are not provided by the Restoration Administrator, the Default Flow Schedule without constraints (Table 5a) and the Default Flow Schedule with constraints (Table 5b) will be used respectively.

As this is the first allocation of water to the Restoration Program with substantial amount of the precipitation season remaining, there is wide spread between the 90% and 10% exceedance forecasts. The Restoration Allocation will be updated regularly until the end of June, and thus the allocation to the program will vary with the unfolding hydrology. Depending on the exceedance forecast used to set the allocation, which is dictated by the Restoration Flow Guidelines, the Restoration Allocation may expand and may shrink. Any adjustments to the allocation volume must be managed by the Restoration Administrator such that the Allocation volume is not exceeded and the scheduling of the water does not result in a water delivery reduction to any Friant long-term contractor beyond what is agreed upon in Exhibit B of the Settlement.

Forecasted Unimpaired Inflow

Unimpaired Inflow 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. It is calculated for the period of a Water Year. The forecast of the Unimpaired Inflow determines the volume of Restoration Flows available for the Restoration Year (i.e. the Restoration Allocation). Information for forecasting the Unimpaired Inflow primarily includes:

- Reclamation estimate of Unimpaired Inflow (i.e. Natural River or Full Natural Flow) into Millerton Lake to support the water supply allocation¹;
- 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 Lake⁵.

Table 1 shows the water year 2019 (October 1, 2018 to September 30, 2019) observed accumulated and forecasted water year Unimpaired Inflows at Millerton Lake. This table includes the published DWR forecast, the DWR forecast adjusted for 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 finally the NWS forecast with 7-day smoothing and adjusted for expected runoff for the current month. Figure 1a plots DWR and NWS forecast values over the entire water year, while Figure 1b shows the most recent period in detail.

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 "Natural River" Unimpaired Inflow, Jan 10, 2019 ¹	71.3 TAF				
Accumulated Unimpaired Inflow as percent of normal	50%				
DWR, Jan 1, 2019 ³ (Published Value)	680 TAF	990 TAF	1,290 TAF	1,860 TAF	2,430 TAF
DWR, Jan 1, 2019 ⁴ (Runoff Adjusted)	691 TAF	993 TAF	1,288 TAF	1,833 TAF	2,392 TAF
NWS, Jan 10, 2019 (Published Daily Value ⁵)	836 TAF	986 TAF	1,400 TAF	2,040 TAF	2,790 TAF
Smoothed NWS, Jan 10, 2019 (7-day Smoothing ⁶)	779 TAF	962 TAF	1,414 TAF	2,122 TAF	2,790 TAF
Smoothed NWS, Jan 10, 2019 (Runoff Adjusted ⁴)	779 TAF	967 TAF	1,425 TAF	2,131 TAF	2,790 TAF

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

² Projected value only presented from May through September; based on USBR-SCCAO runoff regression method

³ B120: <http://cdec.water.ca.gov/cgi-progs/ioidir?s=b120>, or B120 Update: http://cdec.water.ca.gov/cgi-progs/ioidir_ss/b120up, or WSI: <http://cdec.water.ca.gov/cgi-progs/ioidir/WSI.2017>

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

⁵ http://www.cnrfc.noaa.gov/water_resources_update.php?stn_id=FRAC1&stn_id2=FRAC1&product=WaterYear

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 These are interpolated values as the complete DWR forecast was not available at the time of issuance.

There is fairly good agreement between the DWR and NWS runoff forecasts. The lower DWR estimates are an understandable deviation given that the first storm of January (January 5-10) was not included in DWR estimates. Thus, the higher NWS estimates are thought to better capture the current hydrology.

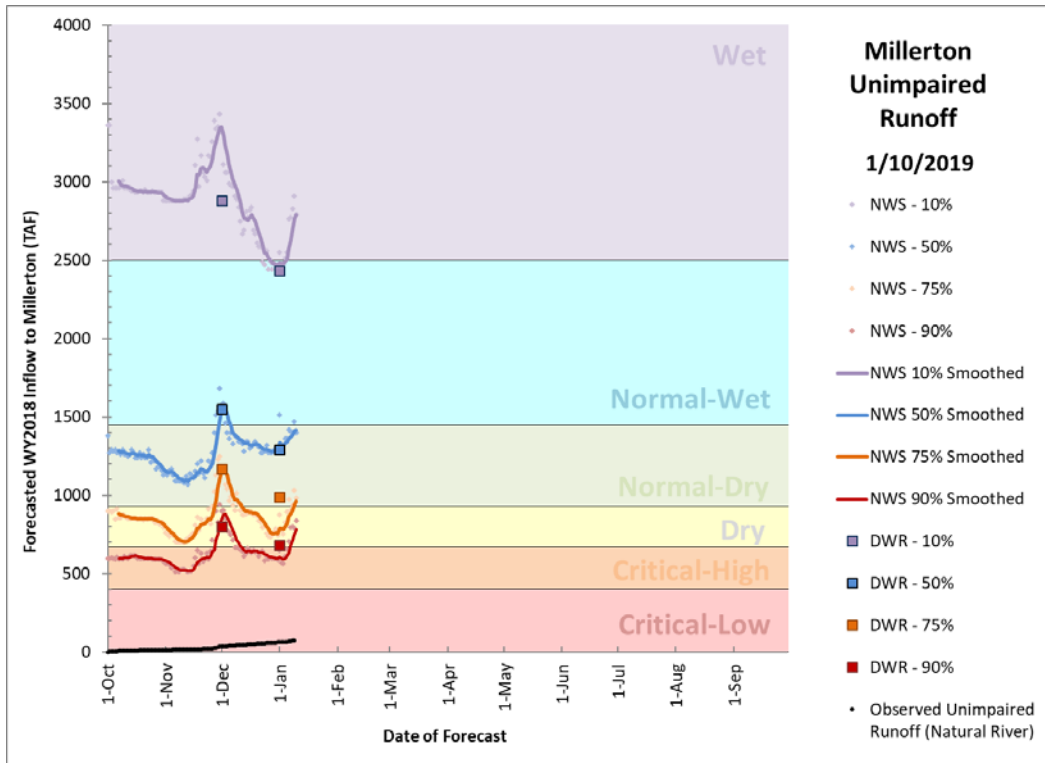


Figure 1a — Plot of 2019 Water Year forecasts, including both NWS Ensemble Streamflow Prediction Forecasts and DWR Forecasts

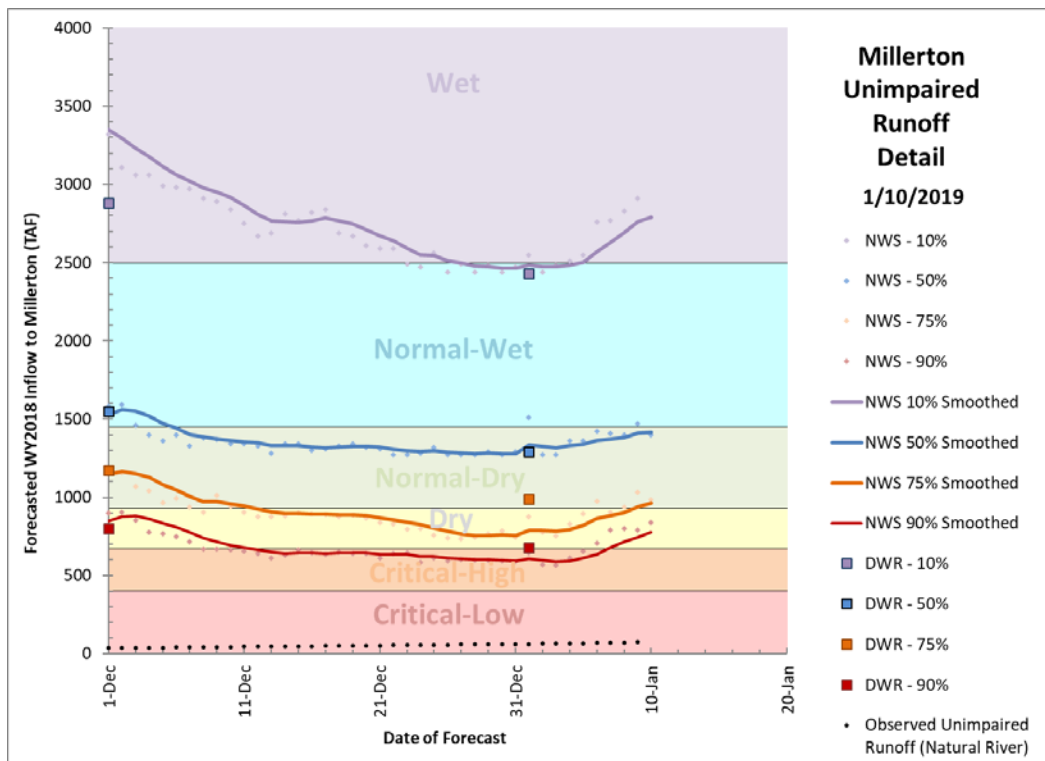


Figure 1b — Detail plot of most recent forecasts

Autumn and early winter have been relatively dry with the exception of two strong storms November 29-December 3, and January 5-10. These were vigorous and cold storms, adding to the snowpack above approximately 5,000'. Soils in the watershed are relatively dry, and any rain that fell below 5,000' was mostly absorbed by the dry soils. Soil moisture deficits above 5,000' are likely high (i.e. dry ground) which will reduce the water yield from snowmelt in late spring.

A subset of snow courses were measured January 2 in the San Joaquin and surrounding watersheds and demonstrate 89% of seasonal norms. Since January 2, automated snow pillows have registered an increase of 2-4" of snow water equivalent (SWE), and now demonstrate 110% of seasonal norms. The snow line is at roughly 5,500', far lower in elevation than January in recent years. This lower elevation is due to colder storms, which have resulted in reduced runoff and increased snowpack. The current snowpack in the San Joaquin watershed far exceeds early January 2018, and is less than early January 2017. As compared to 2017, 2019 has similar snowpack below 8,000' elevation and roughly half the snowpack above 8,000'. Complete snow course measurements will be made on or about February 1 and will provide a fuller picture of snowpack condition.

Two snowpack models were available from January 9 to inform the initial allocation. Both NWS's Snow-17 model used by the California Nevada River Forecast Center and the NOHRSC model show 602 and 504 TAF respectively. Using a conservative conversion ratio of snow to runoff, these confirm that the DWR and NWS 90% runoff forecast are likely to be achieved with little to no additional precipitation. Due to the lapse in appropriations, USDA-ARS snow model "iSnobal" is not available at this time. The first NASA Airborne Snow Observatory flight of 2019 is planned for February.

The 10-day forecast is for very wet conditions and moderate snow levels (5,000'-7000') (Figure 2a and 2b). Should the next projected storm series materialize, it would significantly add to the snowpack above the snowline and potentially satisfy the soil moisture deficits below that the rain-snow line elevation. These potential storms have not been integrated into the current runoff forecast, and should they materialize would result in an increase in observed runoff.

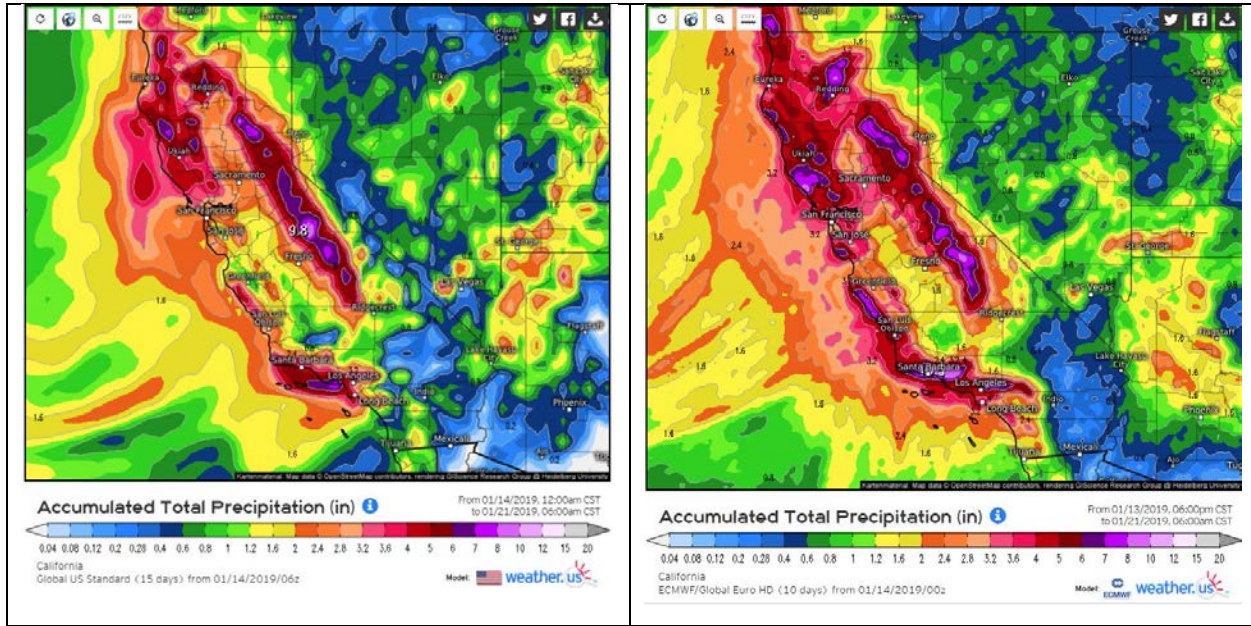


Figure 2a and 2b — Cumulative precipitation forecast for January 14-21. The first panel is the Global Forecast Model (e.g. American Model) and the second panel is the European Center model. They both depict an average of 6+” of precipitation across the San Joaquin watershed, adding 500 TAF of water volume.

Combining Forecasts

Staff from the South-Central California Area Office of Reclamation and SJRRP jointly track and evaluate the accuracy of runoff forecasts. Based on the age of these forecasts, the short-term and long-term weather forecasts, the climatological outlook, observed Unimpaired Inflow, and other available information, a hybrid forecast is generated. The weighting of the different components is regularly evaluated and selected using professional judgment and the best available information. **For the current allocation, the DWR “runoff adjusted” and NWS “smoothed runoff adjusted” forecasts are combined with a 30/70 blending respectively.** This results in the Hybrid Unimpaired Inflow Forecasts shown in Table 2.

Table 2 — Current Blending and Hybrid Unimpaired Inflow Forecast

	Forecast Probability of Exceedance using blending				
	90%	75%	50%	25%	10%
Blending Ratio (DWR/NWS)	30/70				
Hybrid Unimpaired Inflow Forecast (TAF)	751	971	1,381	2,033	2,665

This blending is chosen based on the historic performance of the DWR and NWS forecasts during this time of the year, the accuracy of these forecasts in predicting monthly unimpaired

inflow over the recent months, snow measurement and snowpack models, the long-range forecasted conditions over the current month, the seasonal climate outlook, and other performance factors. The DWR WSI forecast is given lower weight in large part for its older date, which omits the January 5-10 storm. Additionally, the smoothing function that is applied to the NWS forecast has reduced the values, adding conservatism. This smoothing function has been developed by experience with the NWS model which tends to overreact to future storms, effectively reducing the forecast when conditions are turning wetter and slightly increasing the forecast when entering dry conditions.

There are no easily identifiable historic analogs to the current hydrology given how early it is in the season. From this point in the season, analogs such as 1972 or 1997 are possible which had very little precipitation after February 1. Equally possible are analogs such as 1998 and 2017 which resulted in extremely wet conditions over the coming months.

Restoration Allocation

As per the current Guidelines, the **75% exceedance** forecast is used for the allocation under current hydrologic conditions to set the Restoration Flow Allocation. Table 3 below, from the Guidelines version 2.0, depicts the progression of forecast exceedance used to set the Restoration Allocation.

Table 3 — Guidance on Percent Exceedance Forecast to Use for Allocation

	Value (TAF)	Date of Allocation Issuance					
		January	February	March	April	May	June
If the 50% forecast is:	Above 2200	50	50	50	50	50	50
	1100 to 2200	75	75	50	50	50	50
	900 to 1099	75	75	75	50	50	50
	700 to 899	90	90	75	50	50	50
	500 to 699	90	90	75	50	50	50
	Below 500	90	90	90	90	75	50

Applying the 30/70 forecast blending determined by Reclamation, and using the 75% exceedance forecast dictated by the Guidelines, Reclamation calculates an **Unimpaired Inflow hybrid forecast of 971 TAF** and a **Normal-Dry Water Year Type**. This provides a **Restoration Allocation of 218.874 Thousand Acre-Feet (TAF)** as measured at Gravelly Ford (GRF). Combined with Holding Contracts on the San Joaquin River, this equates to a **Friant Dam Release of 335.819 TAF**. Future updates to these forecasts and their blending will alter the Restoration Allocation multiple times before it is finalized at the end of June. Other hypothetical allocations are presented in Table 4 as grayed values, and indicate the range of probable forecasts and the resultant Restoration Allocation.

Table 4 — SJRRP Water Year Type and Allocation for 2019 Restoration Year Shown with Other Hypothetical Values in Gray

	Forecast Probability of Exceedance using proposed blending				
	90%	75%	50%	25%	10%
Hybrid Unimpaired Inflow Forecast (TAF)	751	971	1,381	2,033	2,665
Water Year Type	Dry	Normal-Dry	Normal-Dry	Normal-Wet	Wet
Restoration Allocation at GRF (TAF)	173.410	218.874	274.066	365.031	556.542
Friant Dam Flow Releases (TAF)	290.355	335.819	391.012	481.976	673.488

Default Flow Schedule

The Default Flow Schedule, known as Exhibit B in the Settlement, identifies how Reclamation will schedule the Restoration Allocation for the current Water Year Type and Unimpaired Inflow volume absent a recommendation from the Restoration Administrator. The Guidelines provide detail on how a Default Flow Schedule is derived 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 Hydrograph

Table 5a shows the Exhibit B Method 3.1 default hydrograph flows and corresponding Restoration Allocation volumes for the entire year absent channel capacity constraints, including total releases from Friant Dam and Restoration Flows releases in excess of Holding Contracts.

Table 5b shows the Exhibit B Method 3.1 default hydrograph volumes with operational constraints, primarily controlled by a 1,210 cfs channel constraint in Reach 2B. This default hydrograph depicted in Table 5b will be implemented in the absence of a specific recommendation by the Restoration Administrator. Due to levee stability related channel capacity constraints in Reach 2B that constrain Friant Dam releases, a Restoration Flow volume of **2.795 TAF** is generated that is not scheduled in the constrained Default Flow Schedule and would become Unreleased Restoration Flows (URFs) under the default hydrograph. This is an estimated volume of water, actual URF volumes will depend on the Restoration Administrator Recommendation and real-time assessment of groundwater seepage channel constraints.

Table 5a — Default Hydrograph

Flow Period	Flow (cfs)				Volume (TAF)	
	Friant Dam Release	Holding Contracts ⁸	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	1511	150	1366	1361	44,943	40,480
Apr 16 – Apr 30	350	150	205	200	10,413	5,950
May 1 – Jun 30 ⁹	350	190	165	160	42,347	19,359
Jul 1 – Aug 31	350	230	125	120	43,041	14,757
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	120	575	570	5,554	4,522
Nov 11 – Dec 31	350	120	235	230	35,405	23,266
Jan 1 – Feb 28	350	100	255	250	40,959	29,256
Totals					335.819	218.874

Table 5b — Default Hydrograph with Channel Constraints

Flow Period	Flow (cfs)				Volume (TAF)		
	Friant Dam Release	Holding Contracts ⁷	Flow Target at GRF	Restoration Flow at GRF	Friant Dam Release	Restoration Flow at GRF	URF ⁸
Mar 1 – Mar 15	500	130	375	370	14,876	11,008	0
Mar 16 – Mar 31	1450	130	1325	1320	46,017	41,891	1.587
Apr 1 – Apr 15	1470	150	1325	1320	43,736	39,273	1.208
Apr 16 – Apr 30	350	150	205	200	10,413	5,950	0
May 1 – Jun 30 ⁹	350	190	165	160	42,347	19,359	0
Jul 1 – Aug 31	350	230	125	120	43,041	14,757	0
Sep 1 – Sep 30	350	210	145	140	20,826	8,331	0
Oct 1 – Oct 31	350	160	195	190	21,521	11,683	0
Nov 1 – Nov 6	700	130	575	570	8,331	6,783	0
Nov 7 – Nov 10	700	120	575	570	5,554	4,522	0
Nov 11 – Dec 31	350	120	235	230	35,405	23,266	0
Jan 1 – Feb 28	350	100	255	250	40,959	29,256	0
Totals					333.024	216.079	2.795 ⁸

⁷ 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.

⁸ This estimate of URF volume is based solely on Reach 2B channel capacity. Other flow and seepage constraints throughout the restoration area may result in higher actual URFs and is dependent on the Restoration Administrator's recommendation.

⁹ Riparian Recruitment releases in Wet Water Year Types are included in the May 1 – June 30 flow period

Exhibit B Restoration Flow Budget

Table 6 shows the components of the restoration budget for March 1, 2019, through February 28, 2020 (i.e. the Restoration Year). The base flow allocation, spring flexible flow, fall flexible flow, and riparian recruitment flow reflect the Exhibit B hydrograph for the Restoration Allocation. The estimated total release at Friant Dam consists of 116,945 acre-feet release for Holding Contracts in addition to the Restoration Flows as measured at Gravelly Ford (GRF). The volume for Restoration Flows as well as various accounting flow components may change with any subsequent Restoration Allocation.

Table 6 — Restoration Budget with Flow Accounts

Flow Period	Holding Contract Demand ¹⁰ (TAF)	Restoration Flow Accounting Volumes (TAF)							
		Spring Flexible Flow	Summer Base Flow	Fall Flexible Flow	Winter Base Flow	Riparian Recruitment Flow	Buffer Flow	Flexible Buffer Flow	
Mar 1 – Mar 15	3.868	11.008	–	–	–	–	1.488	–	
Mar 16 – Mar 31	4.126	43.478	–	–	–	–	4.760	–	
Apr 1 – Apr 15	4.463	40.480	–	–	–	–	4.494	–	
Apr 16 – Apr 30	4.463	5.950	–	–	–	–	1.041	–	
May 1 – May 28	10.552	0	8.886	–	–	0 within 60-90 days of flushing flow	4.235	Of which 5.311 may be applied Mar 1–May 1, or Oct 1–Nov 30	
May 29 – Jun 30	12.436	–	10.473	–	–				
Jul 1 – Aug 31	28.284	–	14.757	–	–				4.304
Sep 1 – Sep 30	12.496	–	8.331	0	–	–	2.083		
Oct 1 – Oct 31	9.838	–	–	11.683	–	–	2.152	Of which 7.080 may be applied Sep 3–Dec 28	
Nov 1 – Nov 6	1.547	–	–	6.783	–	–	0.833		
Nov 7 – Nov 10	0.952	–	–	4.522	–	–	0.555		
Nov 11 – Nov 30	4.760	–	–	9.124	–	–	1.388		
Dec 1 – Dec 31	7.379	–	–	0	14.142	–	2.152		
Jan 1 – Jan 31	6.149	–	–	–	15.372	–	2.152	–	
Feb 1 – Feb 28	5.554	0	–	–	13.884	–	1.944	–	
	116.945 ¹⁰	100.917	42.447	32.112	43.398	0	33.582		
		218.874 (Restoration Flow Volume)							
		335.819 ¹⁰ (Friant Dam Release Volume)							

¹⁰ In recent years, Holding Contract demands have been higher than assumed under Exhibit B of the Settlement, in which case, flows at Friant Dam are increased to achieve the Gravelly Ford Flow Target, and associated Friant Dam Release Volume is greater.

Remaining Flexible Flow Volume

The amount of water remaining for flexible flow scheduling is the volume of flexible flow water released from Friant Dam in excess of releases required to meet Holding Contract demands, less past releases. Table 7 tracks these balances. The released to date volumes are derived from QA/QC daily average data when available, and partly from provisional data posted to CDEC, and thus may have future adjustments. This may affect the remaining flow volume as well.

Table 7 — Estimated Flexible Flow Volume Remaining and Released to Date

Flow Account	Yearly Allocation ¹¹ (TAF)	Released to Date ¹² (TAF)	Remaining Flow Volume ^{12,13} (TAF)
Spring Period (Mar 1 – Apr 30)	100.917	0 ¹⁶	100.917
Riparian Recruitment	0	0	0
Summer Base Flows (May 1 – Sep 30)	42.447	0	42.447
Fall Period (Oct 1 – Nov 30)	32.112	0	32.112
Winter Base Flows (Dec 1 – Feb 28)	43.398	0	43.398
Buffer Flows	33.582	0	33.582
Unreleased Restoration Flows (Sales and Exchanges) ¹⁵	—	0	0
Unreleased Restoration Flows (Returned Exchanges) ¹⁵	—	0	0
Purchased Water	—	0	0
	Total:	0	218.874

¹¹ These Flow Volumes assume no channel constraints, as measured at Gravelly Ford

¹² As of 1/10/2019.

¹³ Restoration Flow Guidelines limit the application of the calculated Remaining Flow Volume to certain times, and thus all of this volume may not be available for use.

¹⁴ This volume of Restoration Flows was met by flood flows

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 8 summarizes known 2019 operational constraints.

Table 8 — Summary of Operational Constraints

Constraint	Period	Flow Limitation
Levee Stability	Currently in effect	1,210 cfs in Reach 2B
	Currently in effect	580 – 1,070 cfs in Eastside Bypass
Channel Conveyance / Seepage Limitation	Currently in effect	Approximately 600 cfs below Mendota Dam/Reach 3; Approximately 800 cfs below Sack Dam / Reach 4A

The 2018 Channel Capacity Report identifies a maximum flow in Reach 2B of 1,210 cfs. This results in a maximum release from Friant Dam between 1,310 cfs and 1,540 cfs depending on the time of year. The 2018 Restoration Year Channel Capacity Report also identifies a maximum flow in the Middle Eastside Bypass of 580 to 1,070 cfs, depending on the configuration of the weirs at the Merced National Wildlife Refuge. Reclamation will coordinate with the Restoration Administrator through the biweekly Flow Scheduling conference calls and on an as-needed basis to update these constraints. The 2019 Channel Capacity Report should be available by the next Restoration Allocation.

In addition, flows are limited to approximately 600 cfs below Mendota Dam into Reach 3, and 800 cfs below Sack Dam into Reach 4A due to groundwater seepage constraints as per the current Seepage Management Plan. The exact flow rate which can be accommodated through these two reaches is dependent on groundwater levels and Arroyo Canal deliveries through Reach 3 and will be determined through Flow Bench Evaluations. SJRRP will coordinate closely with Henry Miller Reclamation District for advanced planning of flows and carefully managing seepage constraints.

Reclamation will complete a Flow Bench Evaluation prior to any scheduled flow increases at or below Gravelly Ford to verify the scheduled increase is not anticipated to cause groundwater levels to rise above thresholds. Reclamation will also complete Flow Bench Evaluations for significant increases in irrigation deliveries at Arroyo Canal. Should the requested flow increase trigger projected groundwater level rises above seepage thresholds, Reclamation will inform the Restoration Administrator of the current constraint, implement additional monitoring of groundwater conditions, and adjust releases and/or Mendota Pool recapture accordingly.

2019 Allocation History

The Restoration Allocation will be adjusted, often many times, between the date of the initial allocation and the final allocation, based on the hydrologic conditions. The Restoration Administrator is responsible for contingency planning and managing releases to stay within current and anticipated future allocations. Table 9 summarizes the Allocation History for this Restoration Year.

Table 9 — Allocation History

Allocation Type	Date	Forecast Blending Applied	Unimpaired Inflow Forecast (at forecast exceedance)	Restoration Allocation at Gravelly Ford	Restoration Flows and URFs Released
Initial	January 17, 2019	30/70	971 TAF (@ 75%)	218.874 TAF	0 (thru 1/10/19)

Reclamation expects the next updated Restoration Allocation to be issued around February 20, or potentially sooner if dictated by hydrologic conditions.

Appendix A: Abbreviations, Acronyms, and Glossary

af	acre–feet
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 Flow Schedules
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 <i>NRDC, et al., v. Kirk Rodgers, et al.</i>
SJREC	San Joaquin River Exchange Contractors
SJRRP	San Joaquin River Restoration Program
SLCC	San Luis Canal Company
TAF	thousand acre–feet
URF	Unreleased Restoration Flows
WSI	DWR Water Supply Index
WY	water year, October 1 through September 30

Appendix B: History of Millerton Unimpaired Inflow

Table B — Water Year Totals in Thousand Acre-Feet

Water Year ¹	Unimpaired Inflow ² (Natural River)	SJRRP Water Year Type ³	Water Year ¹	Unimpaired Inflow ² (Natural River)	SJRRP Water Year Type ³	Water Year ¹	Unimpaired Inflow ² (Natural River)	SJRRP Water Year Type ³
1931	480.2	Critical-High	1961	647.428	Critical-High	1991	1,027.209	Normal-Dry
1932	2,047.4	Normal-Wet	1962	1,924.066	Normal-Wet	1992	807.759	Dry
1933	1,111.4	Normal-Dry	1963	1,945.266	Normal-Wet	1993	2,672.322	Wet
1934	691.5	Dry	1964	922.351	Dry	1994	824.097	Dry
1935	1,923.2	Normal-Wet	1965	2,271.191	Normal-Wet	1995	3,876.370	Wet
1936	1,853.3	Normal-Wet	1966	1,298.792	Normal-Dry	1996	2,200.707	Normal-Wet
1937	2,208.0	Normal-Wet	1967	3,233.097	Wet	1997	2,817.670	Wet
1938	3,688.4	Wet	1968	861.894	Dry	1998	3,160.759	Wet
1939	920.8	Dry	1969	4,040.864	Wet	1999	1,527.040	Normal-Wet
1940	1,880.6	Normal-Wet	1970	1,445.837	Normal-Dry	2000	1,735.653	Normal-Wet
1941	2,652.5	Wet	1971	1,416.812	Normal-Dry	2001	1,065.318	Normal-Dry
1942	2,254.0	Normal-Wet	1972	1,039.249	Normal-Dry	2002	1,171.457	Normal-Dry
1943	2,053.7	Normal-Wet	1973	2,047.585	Normal-Wet	2003	1,449.954	Normal-Dry
1944	1,265.4	Normal-Dry	1974	2,190.308	Normal-Wet	2004	1,130.823	Normal-Dry
1945	2,134.633	Normal-Wet	1975	1,795.922	Normal-Wet	2005	2,826.872	Wet
1946	1,727.115	Normal-Wet	1976	629.234	Critical-High	2006	3,180.816	Wet
1947	1,121.564	Normal-Dry	1977	361.253	Critical-Low	2007	684.333	Dry
1948	1,201.390	Normal-Dry	1978	3,402.805	Wet	2008	1,116.790	Normal-Dry
1949	1,167.008	Normal-Dry	1979	1,829.988	Normal-Wet	2009	1,455.379	Normal-Wet
1950	1,317.457	Normal-Dry	1980	2,973.169	Wet	2010	2,028.706	Normal-Wet
1951	1,827.254	Normal-Wet	1981	1,067.757	Normal-Dry	2011	3,304.824	Wet
1952	2,840.854	Wet	1982	3,317.171	Wet	2012	831.582	Dry
1953	1,226.830	Normal-Dry	1983	4,643.090	Wet	2013	856.626	Dry
1954	1,313.993	Normal-Dry	1984	2,042.750	Normal-Wet	2014	509.579	Critical-High
1955	1,161.161	Normal-Dry	1985	1,135.975	Normal-Dry	2015	327.410	Critical-Low
1956	2,959.812	Wet	1986	3,031.600	Wet	2016	1,300.986	Normal-Dry
1957	1,326.573	Normal-Dry	1987	756.853	Dry	2017	4,395.400	Wet
1958	2,631.392	Wet	1988	862.124	Dry	2018	1,348.979	Normal-Dry
1959	949.456	Normal-Dry	1989	939.168	Normal-Dry			
1960	826.021	Dry	1990	742.824	Dry			

¹ Water year is from Oct 1 through Sept 30, for example the 2010 water year began Oct 1, 2009.

² Also known as “Natural River” or “Unimpaired Inflow 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.

³ The six SJRRP Water Year Types are based on unimpaired inflow. 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 C: Previous Year (2017) Flow Accounting

Table C-1 — Restoration Flow Accounting and Unreleased Restoration Flows excluding Restoration Flows met by flood flows, Unreleased Restoration Flows lost to flood spill, and Holding Contracts during flood flows. For the period February, 2017 through February, 2018 (no 2017 Restoration Flows and some 2017 URFs were advanced into February of 2016).

Flow Period	Gravelly Ford 5 cfs requirement (TAF)	Released Restoration Flow Volumes (TAF)							URFs (TAF)
		Spring Flexible Flow	Summer Base Flow	Fall Flexible Flow	Winter Base Flow	Riparian Recruitment Flow	Buffer Flow	Flexible Buffer Flow	
Feb 1 – Feb 15	–	0	–	–	–	–	–	–	7.064
Feb 16 – Feb 28	–	0	–	–	–	–	–	–	
Mar 1 – Mar 15	–	0	–	–	–	–	0	–	45.484
Mar 16 – Mar 31	–	0	–	–	–	–	0	–	
Apr 1 – Apr 15	–	0	–	–	–	–	0	–	81.815
Apr 16 – Apr 30	–	0	–	–	–	–	0	–	
May 1 – May 28	–	0	0	–	–	0	0	0	136.810
May 29 – Jun 30	–	–	0	–	–		79.228		
Jul 1 – Aug 31	19.188	–	9.997	–	–		0		14.566
Sep 1 – Sep 30	9.951	–	8.331	3.792	–	–	0	–	
Oct 1 – Oct 31	10.034	–	–	11.873	–	–	0	0	–
Nov 1 – Nov 6	1.807	–	–	2.656	–	–	0		–
Nov 7 – Nov 10	1.174	–	–	1.801	–	–	0		–
Nov 11 – Nov 30	6.038	–	–	8.999	–	–	0		–
Dec 1 – Dec 31	8.934	–	–	0	14.342	–	0		–
Jan 1 – Jan 31	8.761	–	–	–	15.578	–	0	–	–
Feb 1 – Feb 28	8.309	0	–	0.839	13.487	–	0	–	2.491
	74.196	0	18.328	29.933	43.398	0	0.000		367.458
		91.659							
		91.659							
		459.117 (2017 Allocation = 556.542)							
	533.313								

Table C-2 — Restoration Flow Accounting and Unreleased Restoration Flows including Restoration Flows met by flood flows, Unreleased Restoration Flows lost to flood spill, and Holding Contracts during flood flows. For the period February, 2017 through February, 2018 (no 2017 Restoration Flows and some 2017 URFs were advanced into February of 2016).

Flow Period	Gravelly Ford 5 cfs requirement (TAF)	Released Restoration Flow Volumes (TAF)							URFs (TAF)
		Spring Flexible Flow	Summer Base Flow	Fall Flexible Flow	Winter Base Flow	Riparian Recruitment Flow	Buffer Flow	Flexible Buffer Flow	
Feb 1 – Feb 15	–	0	–	–	–	–	–	–	7.064
Feb 16 – Feb 28	–	0	–	–	–	–	–	–	
Mar 1 – Mar 15	11.139	12.198	–	–	–	–	0	–	45.484
Mar 16 – Mar 31	-12.171	13.012	–	–	–	–	0	–	
Apr 1 – Apr 15	9.947	12.198	–	–	–	–	0	–	81.815
Apr 16 – Apr 30	16.864	12.198	–	–	–	–	0	–	
May 1 – May 28	21.388	13.884	8.886	–	–	9.788	0	0	136.810
May 29 – Jun 30	29.671	–	10.473	–	–				79.228
Jul 1 – Aug 31	14.071	–	14.757	–	–		0		14.566
Sep 1 – Sep 30	9.951	–	8.331	3.792	–	–	0	–	
Oct 1 – Oct 31	10.034	–	–	11.873	–	–	0	0	–
Nov 1 – Nov 6	1.807	–	–	2.656	–	–	0		–
Nov 7 – Nov 10	1.174	–	–	1.801	–	–	0		–
Nov 11 – Nov 30	6.038	–	–	8.999	–	–	0		–
Dec 1 – Dec 31	8.934	–	–	0	14.342	–	0	–	
Jan 1 – Jan 31	8.761	–	–	–	15.578	–	0	–	–
Feb 1 – Feb 28	8.309	0	–	0.812	13.487	–	0	–	2.491
145.917		63.490	42.447	29.933	43.398	9.788	0.000		367.458
		189.056							
		189.056							
		556.514 (2017 Allocation = 556.542)							
702.431									