Bureau of Reclamation
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2016 Restoration Allocation & Default Flow Schedule

July 7, 2016

Introduction

The following transmits the 2016 Restoration Allocation and Default Flow Schedule to the Restoration Administrator for the San Joaquin River Restoration Program (SJRRP), consistent with the Restoration Flows Guidelines (RFG, December 2013). This Restoration Allocation and Default Flow Schedule provide the following:

- Forecasted Water Year Unimpaired Runoff: estimated flows that would occur absent regulation on the river. This runoff is utilized to identify the Restoration Year Type.
- Hydrograph Volumes: 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: hypothetical Restoration Allocations that would result from 10%, 50%, 75%, and 90% probability of exceedance unimpaired runoff forecast.
- Unreleased Restoration Flows: amount of Restoration Flows not released due to channel capacity constraints and without delaying completion of Phase 1 improvements.
- Flow targets at Gravelly Ford: 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: 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: 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 RFGs, 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.

Forecast 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. 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 primarily includes:

- Reclamation estimate of unimpaired runoff into Millerton Lake to support the water supply allocation[1];
- The Department of Water Resources (DWR) Bulletin 120 latest update for Water Year 2016 San Joaquin River inflow to Millerton Lake Unimpaired Flow[3, 4], and/or the most current DWR Bulletin Water Supply Index (WSI)[5];
- The National Weather Service (NWS) Ensemble Streamflow Prediction (ESP) Water Supply Forecast (Water Year 2016) for the San Joaquin River at Millerton Lake[6].

Table 1 shows the 2016 San Joaquin River Water Year observed runoff and runoff forecasts at Millerton Lake. This includes the DWR forecast expressed for the full water year and the NWS forecast with and without a 7-day smoothing function applied to remove the day-to-day variance in that forecast product. Figure 1a plots these values over the entire water year, while Figure 1b shows the most recent period in detail.

The water year unimpaired runoff, also known as the Full Natural River at Friant Dam, as of July 4, 2016 is 1237.4 thousand acre-feet (TAF). This is 77% of average for this date. If accumulated runoff tracks at 77% of average runoff (1843 TAF according to the NWS) for the remainder of the year, a total water year runoff of 1428 TAF would result. The percent of average runoff to date has been gradually falling, and should continue to decline and then stabilize. Barring a significant summer rain event, the water year type will remain Normal-Dry.

DWR is no longer issuing runoff forecasts, the last update being from June 7, 2016. There is still a substantial difference between the DWR and NWS runoff forecasts, in part due to the age of the DWR forecast.

Table 1 — San Joaquin River Water Year Actuals and Forecasts at Millerton Lake

	Forecast Exceedance Percentile			
Forecast Source	**90**%	**75**%	**50**%	**10**%
Accumulated "Full Natural" Runoff, July 4, 2016 [1]	1237.4 TAF			
Accumulated Runoff projected to end of water year [2]	1428 TAF			
DWR, June 7, 2016 [3, 4, 5]	1220 TAF	1260 TAF	1305 TAF	1365 TAF
NWS, July 5, 2016 (Daily Value [6])	1360 TAF	1360 TAF	1370 TAF	1410 TAF
NWS, July 5, 2016 (7-day Smoothed Value [7])	1360 TAF	1364 TAF	1374 TAF	1419 TAF

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

[2] Projected value only presented from April through September; based on NWS average runoff value of 1843 TAF

[3] http://cdec.water.ca.gov/cgi-progs/iodir?s=b120

[4] http://cdec.water.ca.gov/cgi-progs/iodir_ss/b120up

[5] http://cdec.water.ca.gov/cgi-progs/iodir/WSI.2016

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

[7] The NWS smoothed data uses a 7-day 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 us used: $((Forecast_n * 1) + (Forecast_{n-1} * 0.857) + (Forecast_{n-2} * 0.714) + (Forecast_{n-3} * 0.571) + (Forecast_{n-4} * 0.429) + (Forecast_{n-5} * 0.286) + (Forecast_{n-6} * 0.143)) / 4$

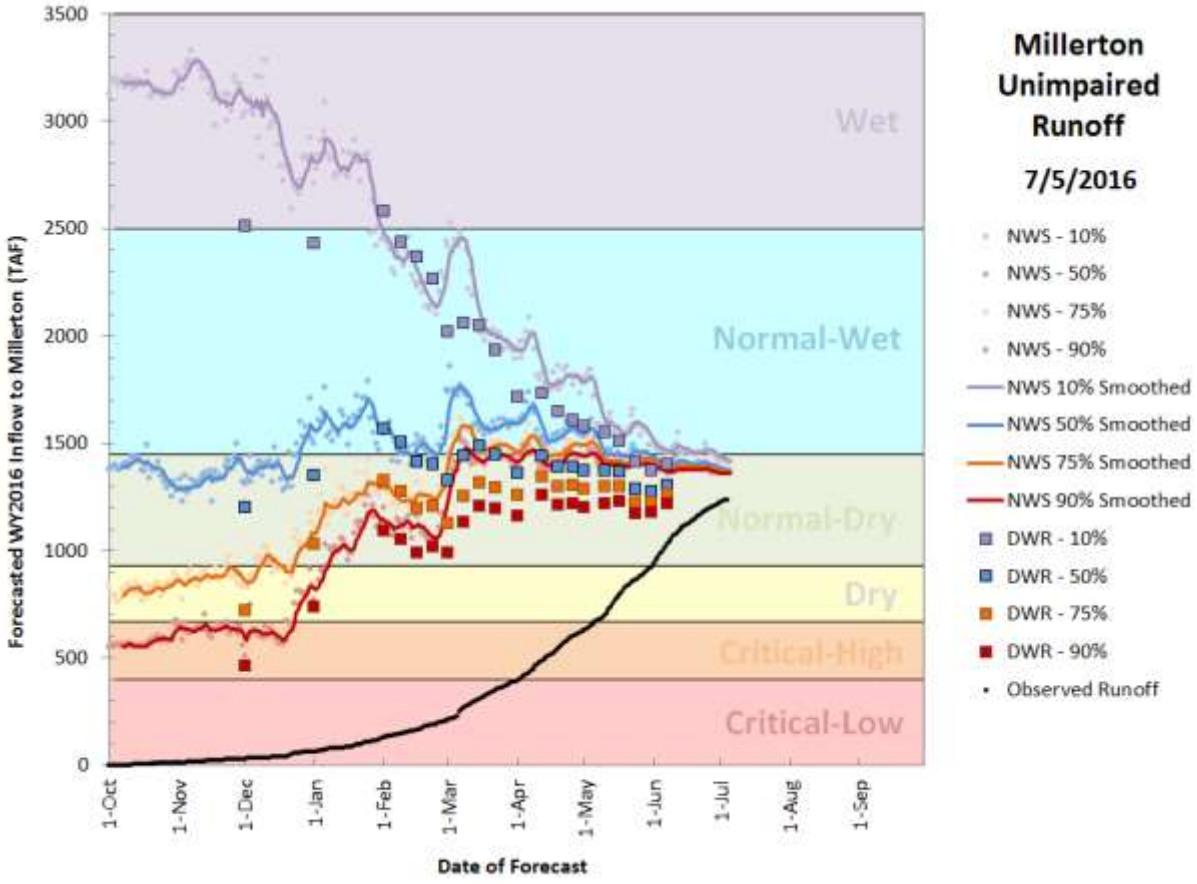

Figure 1a — Plot of Water Year 2016 forecasts, including both NWS Ensemble Streamflow Prediction Forecast and DWR Forecast

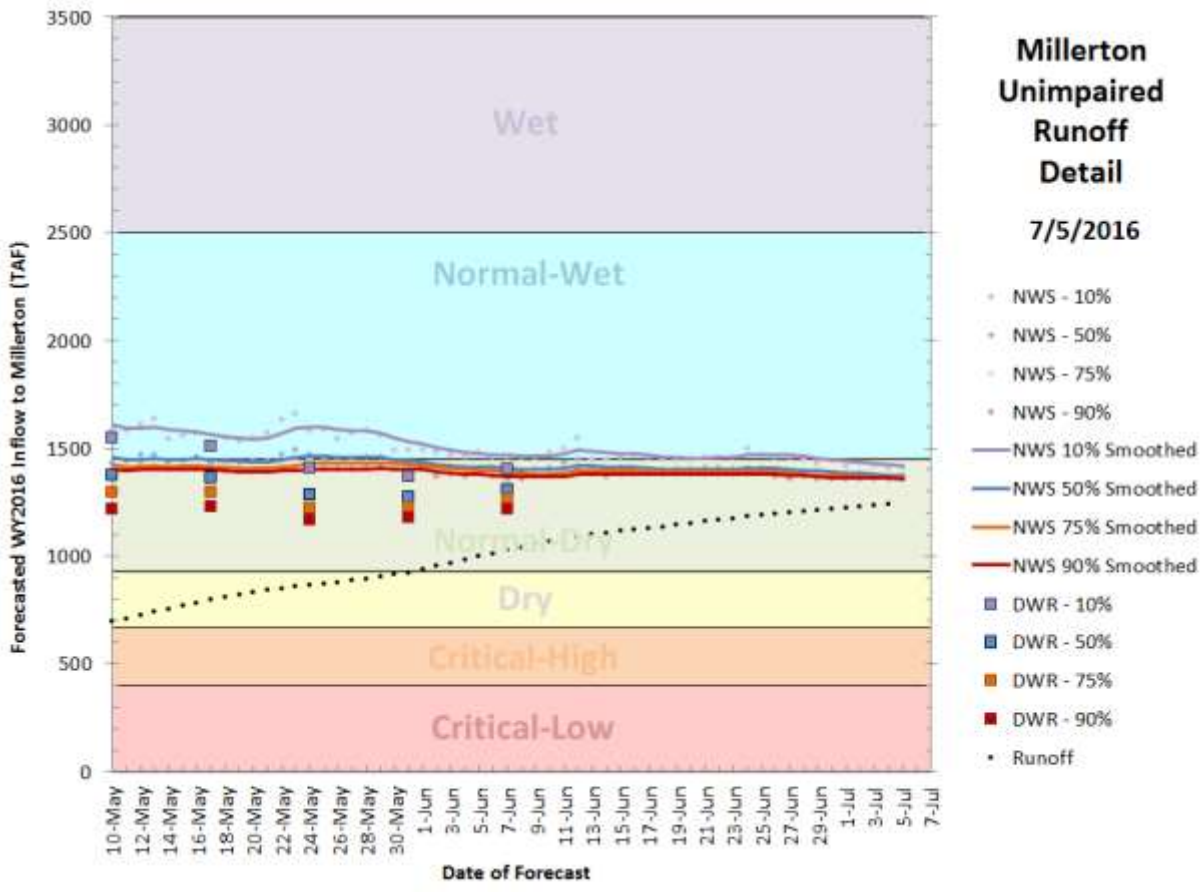

Figure 1b — Detail plot of most recent forecasts

Uncertainty in runoff forecasting has declined considerably since the last allocation. Observed runoff has tracked much closer to NWS forecast than DWR forecast. The 90% DWR forecast has already been exceeded and the 75% DWR forecast will be exceeded in the next few days. Observed runoff is tracking close to the DWR 10% exceedance forecast. Observed runoff is now at about 4 TAF per day and is smoothly declining at an average exponential rate of about 3 to 4% per day. Satellite imagery shows a small snowpack continuing to provide modest runoff (Figure 2). Using past runoff histories as a guide, the total water year runoff possibilities are constrained to between 1330 TAF and 1420 TAF.

Residual uncertainty is due to 1) the slight bias in the NWS forecast which historically has tended to project runoff as slightly higher than actual, 2) the volume of remaining snowpack, and 3) the potential for summer thunderstorms to add to the runoff total.

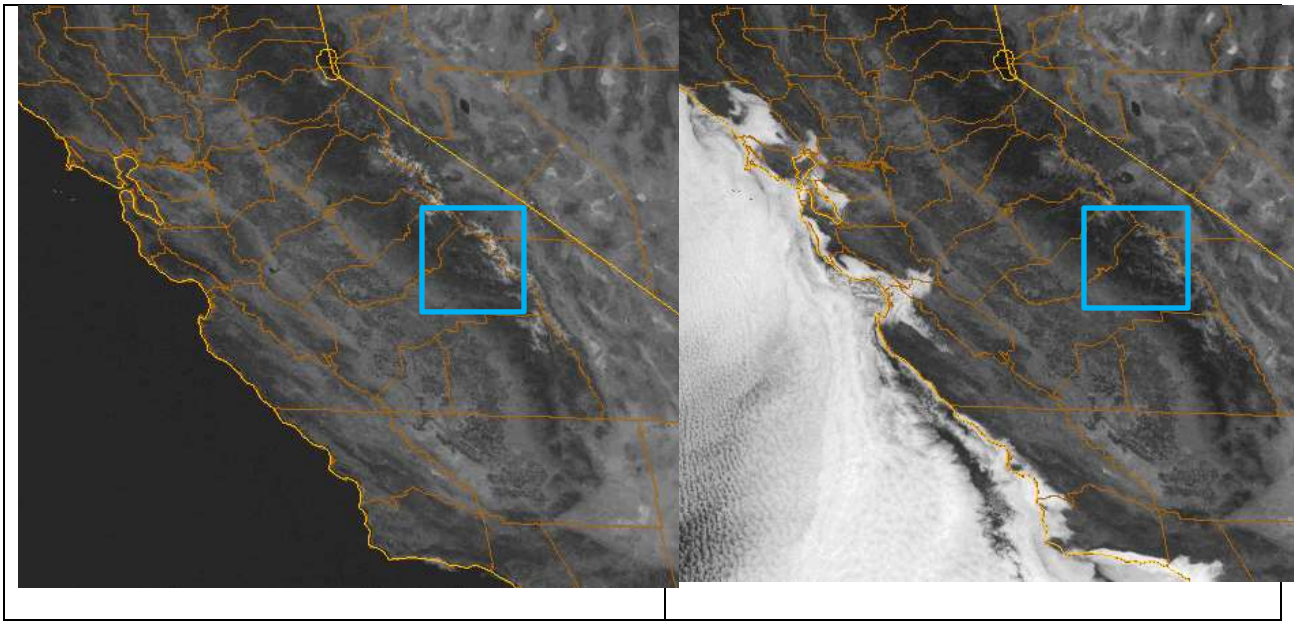

Figure 2 — GOES Satellite image of Central California from June 24, 2016 (left) and July 5, 2016 (right) showing bright snow in the high elevations of the Sierra Nevada, San Joaquin watershed is highlighted with square. High elevation snowpack has diminished over the last 10 days but some snowpack is still present.

Restoration Allocation

A three-step process is used to determine the exceedance percentile required to determine the Restoration Allocation. This process is described in greater detail in the RFGs. To initialize the process, an averaging of the DWR and NWS forecasts is made with equal weighting to produce a single forecast value, shown in Table 2 for each exceedance probability.

Table 2 —Combined Unimpaired Inflow Forecasts

	Forecast Probability of Exceedance			
	90%	**75%**	**50%**	**10%**
Combined Unimpaired Inflow Forecast (50% DWR / 50% NWS)	1290 TAF	1312 TAF	1339 TAF	1409 TAF

The pattern-year type is then determined by first comparing the 50% exceedance forecast to the average runoff, which results in a Normal-Dry pattern-year type (Table 3). The date of the allocation and the pattern-year type are then used to determine the appropriate exceedance probability. Currently, this process directs Reclamation to use the 75% exceedance forecast for the Restoration Allocation.

Table 3 — Allocation Determination Steps

Allocation Step	Result
1. 50% Exceedance Forecast compared to average runoff	Below Average
2. Initial Pattern Year Type	Normal-Dry
3. Option 1D Percent Exceedance for this period	75%

Following the RFG directive to assess the best available records and forecast information, Reclamation finds that an equal weighting (i.e. 50%/50%) is inappropriate given the age of the DWR forecast and the observed runoff trend. Reclamation then evaluated different blending of the DWR and NWS 75% exceedance forecasts. Multiple sources of information were used to select an appropriate blending, including evidence of remaining snowpack, historical runoff analogs, and current forecast performance. For the past six weeks, actual runoff has closely tracked the NWS 75% forecast for both 5-day and monthly periods, increasing confidence in its accuracy. The observed runoff to date is plotted in Figure 3, along with the typical runoff accumulation curve scaled to a 10/90 blending of the DWR and NWS 75% exceedance. This provides a graphical depiction of the confidence in the forecast and the blending selected by Reclamation. It is apparent that the observed runoff trace is trending above the scaled curve and is likely to remain so, thus Reclamation is comfortable with giving increasing weight to the NWS forecast by using a 10/90 blending.

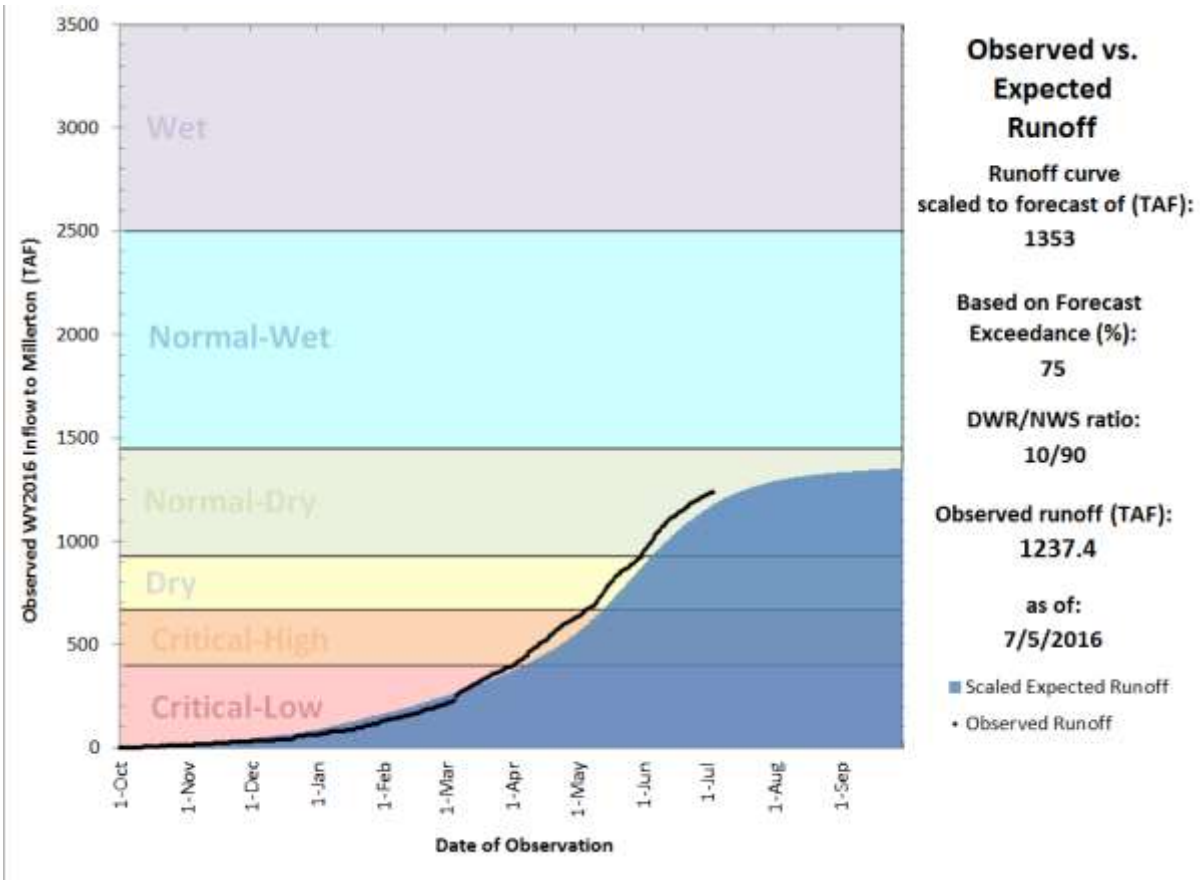

Figure 3 — Observed runoff trace shown with expected runoff curve from 10/90 blending of DWR and NWS 75% exceedance forecasts.

Using the 75% exceedance with a 10/90 blending results in a forecast value of 1353 TAF, the Water Year Type for Restoration Flows is **Normal-Dry**. The **Restoration Allocation is 270.297 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 387.242 TAF**. This represents an increase of 3.365 TAF from the previous allocation issued on May 31, 2016. Other hypothetical allocations are presented in Table 4 as grayed values, useful for contingency planning.

Table 4 — Restoration Flow Water Year Type and Allocation shown with Other Hypothetical Values in Gray

	Forecast Probability of Exceedance using proposed blending			
	90%	**75**%	**50**%	**10**%
Water Year Type	Normal-Dry	**Normal-Dry**	Normal-Dry	Normal-Dry
Combined Unimpaired Runoff Forecast (TAF)	1346	**1353**	1367	1417
Friant Dam Flow Releases (TAF)	386.300	**387.242**	389.127	395.858
Restoration Allocation at GRF (TAF)	269.355	**270.297**	272.182	278.913

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. As a result, if a situation were to occur where the Restoration Flows conflicted with Reclamation making necessary deliveries under the Purchase Contract and Exchange Contract, Reclamation would make water available to meet the contractual requirements and/or refrain from making restoration releases under the Settlement.

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 runoff volume absent a recommendation from the Restoration Administrator, consistent with the Settlement. The RFG provides detail on how a Default Flow Schedule is derived from 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 1,120 cfs channel capacity 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, Restoration Flows of **36.516 TAF** are generated that are not scheduled in the constrained Default Flow Schedule and would become Unreleased Restoration Flows (URFs) under the default hydrograph. Actual URF volumes will depend on the Restoration Administrator Recommendation and a more complex calculation of channel constraints.

Table 5a — Default Hydrograph

Flow Period	Friant Dam Release (cfs)	Holding Contracts[8] (cfs)	Flow Target at GRF (cfs)	Restoration Flow at GRF (cfs)	Friant Release Volume (TAF)	Restoration Flow Volume at GRF (TAF)
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	2500	150	2355	2350	74.380	69.917
Apr 16 – Apr 30	1089	150	944	826	32.399	27.937
May 1 – Jun 30	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	130	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	**387.242**	**270.297**

Table 5b — Default Hydrograph with Channel Constraints

Flow Period	Friant Dam Release (cfs)	Holding Contracts[8] (cfs)	Flow Target at GRF (cfs)	Restoration Flow at GRF (cfs)	Friant Release Volume (TAF)	Restoration Flow Volume at GRF (TAF)	URF Volume (TAF)
Mar 1 – Mar 15	500	130	375	370	14.876	11.008	0
Mar 16 – Mar 31	1390	130	1265	1260	44.112	39.987	3.491
Apr 1 – Apr 15	1390	150	1245	1240	41.355	36.893	33.025
Apr 16 – Apr 30	1089	150	944	826	32.399	27.937	0
May 1 – Jun 30	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	130	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	**350.727**	**233.781**	**36.516**

[8] 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.

Exhibit B Restoration Flow Budget

Table 6 shows the components of the restoration budget for March 1, 2016, through February 28, 2017 (i.e. the Restoration Year). The base flow allocation, spring flexible flow, and fall flexible flow reflect the Exhibit B hydrograph for the Restoration Allocation. The riparian recruitment component is without any balance because the restoration Water Year Type is Normal-Dry. 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. The volume for Restoration Flows as well as various accounting flow components will change with any subsequent Restoration Allocation.

Table 6 — Restoration Budget with Flow Accounts

Flow Period	Holding Contract Demand [9] (TAF)	Restoration Flow Accounting						
		Spring Flexible Flow (TAF)	**Summer Base Flow** (TAF)	**Fall Flexible Flow** (TAF)	**Winter Base Flow** (TAF)	**Riparian Recruit-ment Flow** (TAF)	**Buffer Flow** (TAF)	**Flexible Buffer Flow** (TAF)
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	69.917	–	–	–	–	7.438	–
Apr 16 – Apr 30	4.463	27.937	–	–	–	–	3.240	–
May 1 – May 28	10.552	0	8.886	–	–	0	1.944	5.000
May 29 – Jun 30	12.436	–	10.473	–	–	0	2.291	
Jul 1 – Aug 31	28.284	–	14.757	–	–	–	4.304	
Sep 1 – Sep 30	12.496	–	8.331	–	–	–	2.083	7.081
Oct 1 – Oct 31	9.838	–	11.683	0	–	–	2.152	
Nov 1 – Nov 6	1.547	–	–	6.783	–	–	0.833	
Nov 7 – Nov 10	1.031	–	–	4.522	–	–	0.555	
Nov 11 – Nov 30	4.760	–	–	0	9.124	–	1.388	–
Dec 1 – Dec 31	7.379	–	–	–	14.142	–	2.152	–
Jan 1 – Jan 31	6.149	–	–	–	15.372	–	2.152	–
Feb 1 — Feb 28	5.554	–	–	–	13.884	–	1.944	–
	116.945 [9]	**152.340**	**54.129**	**11.306**	**52.522**	**0**	**38.724**	
		270.297 (Restoration Flow Volume)						
		387.242 [9] (Friant Release Volume)						

[9] 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, and associated Friant 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[10] (TAF)	Released to Date [11] (TAF)	Remaining Flexible Flow Volume[12] (TAF)
Spring Pulse (Mar 1 – Apr 30)	152.340	**15.156** (2/15-5/10)	137.184
Riparian Recruitment	0	0	0
Summer Base Flows (May 1 – Oct 31)	54.129	**9.650** (5/11-7/4)	—
Fall Pulse (Nov 1 – Nov 10)	11.306	0	11.306
Winter Base Flows (Nov 10 – Feb 28)	52.522	0	—
Buffer Flow	38.724	0	38.724
Purchased Water	0	0	0
	Total:	**24.806**	

[10] Flow Volumes assume no channel constraints, as this is the volume available for flexible rescheduling as per the Restoration Flow Guidelines

[11] As of 7/5/2016 at 12:00 AM based on QA/QC data and provisional data at Gravelly Ford. Period of release may extend beyond spring and fall pulses in accordance with the Restoration Flow Guidelines.

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

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 2016 operational constraints.

Table 8 — Summary of Operational Constraints

Constraint	Period	Flow Limitation
Environmental Commitments	Currently in effect, flow constraints expected to be lifted August 1	0 cfs below Sack Dam
Eastside Bypass Maintenance for Sand Removal	Currently in effect, expected to be completed August 31	0 cfs below Sack Dam
Lower San Joaquin Levee District Maintenance (Chowchilla, Mariposa, and Eastside structures)	September 1 – October 31	Approximately 150 cfs at structures
Mendota Pool maintenance and inspection	Tentatively November 24 – December 23, possibly through January 15	0 cfs into Mendota Pool
Red-Top pipeline crossing	Tentatively November 24 – December 23	0 cfs at Sack Dam
Sack Dam maintenance	Unknown	0 cfs at Sack Dam
Channel Conveyance / Seepage Limitation	Currently in effect	70 cfs below Sack Dam

At this time environmental commitments prevent any flows below Sack Dam. Additional construction projects along the river are planned for the coming months; these include a sand removal project to improve channel conveyance on the Eastside Bypass, maintenance on the LSJLD structures, draining of Mendota Pool to inspect the dam and conduct maintenance, a water pipeline to be routed under the channel bed below Sack Dam, and undetermined maintenance at Sack Dam. Reclamation is working on coordinating additional channel maintenance activities with the goal of reducing time that there are river flow constraints.

Aside from these maintenance efforts, channel conveyance is limited to 70 cfs below Sack Dam and through the Eastside Bypass. This is expected to be the limitation through the fall period, with the possibility of higher flows in winter. If flows must be reduced at Sack Dam, Reclamation will make arrangement to capture Restoration Flows at approved points of rediversion such as Mendota Pool upstream of Sack Dam.

Reclamation will complete a Flow Bench Evaluation prior to any increases below Sack Dam to verify the allowed flow increase is not anticipated to cause groundwater levels to rise above thresholds. Once environmental commitments are met, an initial 50 cfs will be allowed to pass below Sack Dam while monitoring groundwater levels for two weeks. Upon completion of an additional seepage easement, which is expected in 2016, approximately 300 cfs will be allowable past Sack Dam. Only after groundwater levels have stabilized below thresholds will Reclamation will perform another Flow Bench Evaluation to evaluate an increase to 70 cfs (or 150 cfs if the

seepage easement is acquired), if the Restoration Administrator requests such an increase. If the seepage easement is acquired, after two weeks at 150 cfs and groundwater stabilization, Reclamation will evaluate an increase to 300 cfs. After two weeks at 300 cfs and groundwater stabilization, Reclamation will complete another Flow Bench Evaluation to evaluate whether any additional increase can be made while maintaining groundwater levels below thresholds. These incremental releases allow groundwater levels in monitoring wells to respond to 6 inch changes in water surface elevation in the river, as based on one-dimensional hydraulic modeling shown in Figure 2, and avoid potential groundwater seepage impacts. Future Restoration Allocations will provide updates to seepage limitations.

In addition, the 2016 Restoration Year Channel Capacity Report identifies a maximum flow in Reach 2B of 1,120 cfs. This results in a maximum release from Friant Dam between 1,360 cfs and 1,490 cfs depending on the time of year. Reclamation will coordinate with the Restoration Administrator through the biweekly Flow Scheduling Subgroup conference calls and on an as-needed basis to update these constraints.

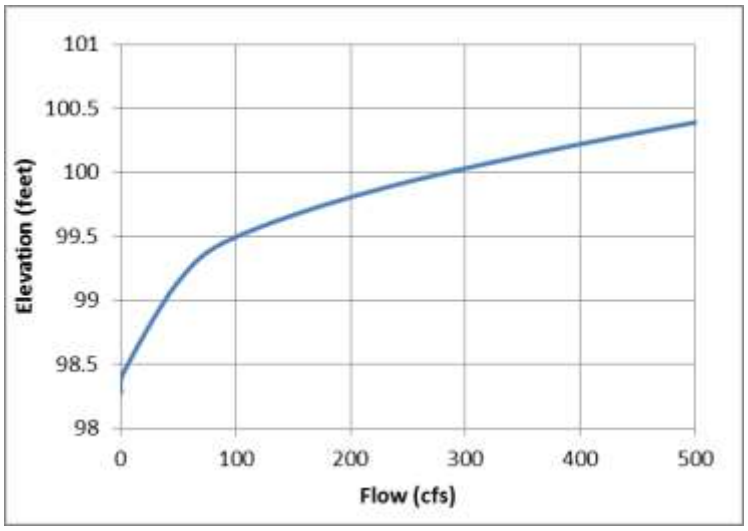

Figure 4 — Rating Curve at El Nido Road in the Eastside Bypass

A sand removal project in the Eastside Bypass will affect any potential flows below Sack Dam during the summer months. The two-month construction project is anticipated to commence July 1, 2016 and requires drying the channel starting June 1, 2016. Therefore, flows below Sack Dam should be 0 cfs from June 1 through August 31, 2016. If construction is completed sooner than anticipated, flows may begin again before August 31, 2016. Resuming flows below Sack Dam would be completed in a ramp-up similar to that described above.

All of these operational constraints will be evaluated in the next update to the Restoration Allocation and adjusted as necessary based on the most current information.

Appendix A: Abbreviations, Acronyms, and Glossary

af	acre–feet
CALSIM	California Statewide Integrated Model
CCID	Central California Irrigation District
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
LSJLD	Lower San Joaquin Levee District
NWS	National Weather Service
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
Restoration Year	the cycle of the SJRRP, March 1 through February 28/29
RFG	Restoration Flow Guidelines
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
TAF	thousand acre–feet
URFs	Unreleased Restoration Flows
WY	water year, October 1 through September 30

Appendix B: History of Millerton Runoff

Table B — Annual Runoff History, in Thousand Acre-Feet

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

[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