SJRRP Flow Bench Evaluation

March 25, 2022

Introduction

The following Flow Bench Evaluation (FBE) documents current releases and groundwater conditions prior to the anticipated increase in releases from Friant Dam to the San Joaquin River. This FBE report evaluates potential flows in the Restoration Area before exceeding any San Joaquin River Restoration Program (SJRRP) seepage thresholds. Note that use of "FBE" throughout the report refers specifically to the FBE model-based analysis described in Appendix J of the Seepage Management Plan (SMP).

Dry hydrology throughout California has resulted in a predicted shortfall in meeting the San Joaquin River Exchange Contract from north-of-Delta supply. Releases from Millerton Reservoir are planned to meet the Exchange Contract demand and are expected to start as early as April 1, continuing through the summer months ending as late as mid-September. During these Exchange Contractor releases, the SJRRP will operate such that the combined flow does not exceed SJRRP SMP thresholds while Restoration Flows are present in the channel. However, Exchange Contractor flows are not subject to the thresholds of the SJRRP SMP. This FBE evaluates the current Friant Dam releases and groundwater conditions monitored as of March 25, 2022 and conservatively evaluates seepage constraints above Mendota Pool to inform available capacity for Restoration Flows during the Exchange Contractor releases.

As of March 25, 2022:

1. Channel conveyance: Flow rates are below known conveyance thresholds.

2. Operations Conference Call: An operations call was held on March 23, 2022. No known operational constraints were identified on the call.

3. Seepage Hotline Calls: The seepage hotline has received no calls regarding Restoration Flows in Water Year 2022.

4. Real-time wells: A number of real-time equipment locations are currently going through equipment upgrades. All functioning telemetered groundwater monitoring well levels are below Seepage Management Plan (SMP) thresholds.

5. Priority wells: Weekly groundwater measurements in priority wells, both real-time and manually measured, indicate that all wells are below well thresholds. Note that some dataloggers are deployed throughout the well network and will be downloaded to supplement manual measurements.

6. Flow Stabilization: Releases at Friant Dam have generally been in the 600 – 700 cfs range for the month of March (varying from 580 cfs to 701 cfs). Reach 3 and Reach 4A flows have varied with both Arroyo Canal deliveries (which have declined from 320 cfs on March 1 to 100 cfs on March 25) and Restoration Flow recommendations (ranging 235 – 295 cfs during the same period). Note that rating curve corrections were necessary for the GRF and MEN gages during recent operations and the best available flow information was utilized for this FBE.

7. Projected Groundwater Level Changes: With the flow scenarios evaluated in this FBE, the most limiting groundwater levels are projected to increase 0.53 ft in Reach 2A (see Summary). Groundwater levels are also expected to increase in Reach 2B while Exchange Contractor releases are routed to Mendota Pool. Reach 3 and Reach 4A flows are projected to decline.

8. Levees: LSJLD has not expressed concerns about current flows.

9. Water Districts: The SJRECWA has not identified any operational concerns.

Data

The following Data section considers monitoring measurements collected prior to Exchange Contractor releases from Friant Dam with most measurements taken on March 25, but with some downstream measurements from March 15 as the best available. These values are referred to as "pre-condition" to inform current groundwater levels before any changes to Millerton releases. The "projected" values are the results from this FBE model-based analysis indicating potential flows in the Restoration Area before exceeding any San Joaquin River Restoration Program (SJRRP) seepage thresholds.

Table 1 shows groundwater depths in two real-time wells and nine manual measurements from field staff. Measurements were reported from the field on March 15 and March 25 and have been reported in the Weekly Groundwater Reports with publish dates for the weeks ending March 19, 2022 and March 26, 2022. Reclamation publishes the Weekly Groundwater Report with manual measurements via electronic well sounder on the SJRRP website HERE. To calculate field depths, Reclamation adds ground surface buffers and lateral gradient buffers to measured groundwater depths in the well (Equation 1, Figure 1).

$$Field\ Depth_{Current} = D_{well} - GS_{Buffer} + LG_{Buffer} \quad (1)$$

Where:

$Field\ Depth_{Current}$	Current groundwater level depth in the field
D_{Well}	Current groundwater level depth as measured in the monitoring well
GS_{Buffer}	Ground surface buffer, or the difference in elevation between the well and the field
LG_{Buffer}	Lateral gradient buffer, to account for losing reaches where the groundwater table slopes away from the river (if any)

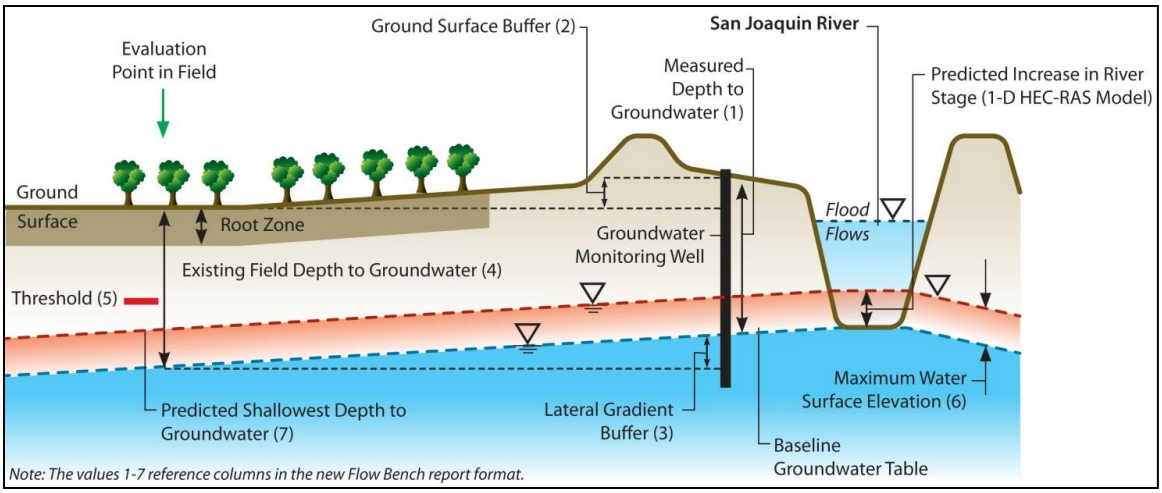

Figure 1. Conceptual Model for Observed Groundwater Level Method

The pre-condition well data in Table 1 show acceptable conditions throughout the priority monitoring locations. Again, the pre-condition data represents the levels observed prior to Exchange Contractor releases from Friant Dam. Groundwater depths in all wells indicate conditions below thresholds.

Table 1. Pre-Condition Well Data

Well	Reach	1 - Measured Groundwater Depth in Well (feet bgs)	Date Measured	2 - Ground Surface Buffer (feet)	3 - Lateral Gradient Buffer (feet)	4 - Field GW Depth (feet bgs)	5 - Field Threshold (feet bgs)	Comment
FA-9	2A	9.1	3/25/2022	2.0	2.5	9.6	6.0	Acceptable
MW-09-47	2A	8.2	3/25/2022	2.5	3.3	9.0	7.7	Acceptable
MA-4	2A	12.1	3/25/2022	6.1	4.6	10.6	7.0	Acceptable
MW-09-49B	2A	5.7	3/25/2022	1.7	2.4	6.5[1]	6.0	Acceptable
MW-09-54B	2B	14.8	3/25/2022	7.9	2.0	8.8	7.0	Acceptable
MW-09-55B	2B	8.0	3/17/2022	3.7	6.5	10.8	6.0	Acceptable
PZ-09-R3-5	3	7.7	3/25/2022	1.2	-	6.5	5.7	Acceptable
PZ-09-R3-7	3	10.5	3/25/2022	0.7	1.1	10.9	6.5	Acceptable
MW-18-80B	4A	10.4	3/15/2022	4.2	1.2	7.4	6.7	Acceptable
MW-17-225	4A	9.9	3/15/2022	2.9	1.1	8.1	6.5	Acceptable
MW-10-89	4A	12.0	3/15/2022	1.0	-	11.0	6.5	Acceptable

bgs = below ground surface; GW = groundwater

[1] Manual measurement taken in field.

Analysis

Groundwater levels have been stable below SMP thresholds thus far in Water Year 2022. During these Exchange Contractor releases, dynamic groundwater conditions will be closely monitored. Although groundwater levels are projected to rise in the upstream reaches, the FBE was specifically evaluated to estimate the flow rates that would result in no threshold exceedance. After consideration of 735 cfs at Friant Dam with Exhibit B losses in Reach 2A and Reach 2B, the largest anticipated water level increase was estimated based on the concept illustrated in Figure 2. This is expected to be 0.53 ft to avoid surpassing the nearest field threshold at MW-09-49B.

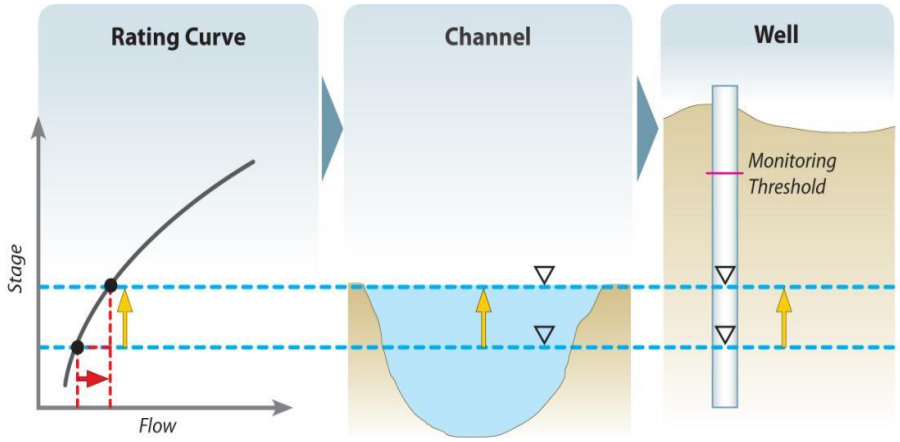

Figure 2. Conceptual Relationship between River Stage and Groundwater Levels

Table 2 shows the flow rates used to evaluate projected groundwater depths. Pre-condition flows are based on SJRRP Operations spreadsheet QAQC and preliminary data. Data was pulled for March 25, 2022 to correspond with groundwater measurements where available, otherwise pulled from March 15, 2022 to be consistent with the most recent groundwater measurements at downstream locations. Projected flows at Friant Dam were evaluated for the maximum flow that does not exceed SJRRP SMP thresholds after assuming Exhibit B losses in Reach 2A and Reach 2B. Reach 3 flows are based on a conservative assumption of SLCC demands for April and an assumed 300 cfs target at Sack Dam for Restoration Flows. The comparison of pre-condition and projected flows informs the estimated result of flow releases to maximize use of channel capacity without exceeding SMP thresholds.

Table 2. Anticipated Change in Flows

	Pre-condition Flows (cfs)	Projected Flows from Evaluation (cfs)
Friant Dam	662[1]	735
Reach 2A	417[1]	590[3]
Reach 2B	312[1]	490[3]
Reach 3	556[1]	460[4]
Reach 4A	279[2]	300[4]

[1] Source: SJRRP Operations spreadsheet, 3/25/2022 daily discharge
[2] Source: SJRRP Operations spreadsheet, 3/15/2022 daily discharge
[3] Assumes Exhibit B losses and are approximate

[4] Assumes conservative 160 cfs SLCC demand and 300 cfs Sack Dam target

Table 3 shows the change in groundwater based on estimated changes in river stage and the conceptual models shown in Figures 1 and Figure 2. Field depths are calculated by taking the most recent measurements from Table 1, adding the ground surface and the lateral gradient buffers, and subtracting the maximum predicted stage increase (Equation 2).

$$Field\ Depth_{Predicted} = Field\ Depth_{Current} - WSEL_{Max\ Increase} \quad (2)$$

Summary

This analysis, in combination with recent field measurements, indicates acceptable conditions for no greater than approximately 600 cfs at GRF gage (735 cfs releases at Friant Dam assuming Exhibit B losses equates to 590 cfs in Reach 2A, rounded to an upper-end target of 600 cfs at GRF for operational purposes). Groundwater levels will continue to be monitored so as not to surpass SMP thresholds, as well as to inform any additional capacity. SLCC demands will also be monitored to assess the capacity for Restoration Flows in Reach 3. Reclamation retains the right to recapture Restoration Flows in Mendota Pool to adjust for any Restoration Flow constraints. Subsequent FBEs will be performed to evaluate the changing conditions and to inform any other potential flow changes. If adjustments to Restoration Flows are necessary to avoid SMP thresholds, Restoration Flows will be modified consistent with Appendix J of the SMP.

Table 3. Predicted Groundwater Levels for Priority Wells with Projected Flows

Well	Reach	1 - Measured Groundwater Depth in Well (feet bgs)	Date Measured	2-Ground Surface Buffer (feet)	3 - Lateral Gradient Buffer (feet)	4 - Field GW Depth (feet bgs)	6 - Predicted WSEL Change (feet)	7 - Predicted Shallowest GW Depth (ft bgs_field)	5 - Field Threshold (feet bgs)	Comment
FA-9	2A	9.1	3/25/2022	2.0	2.5	9.6	0.5	9.0	6.0	Acceptable
MW-09-47	2A	8.2	3/25/2022	2.5	3.3	9.0	0.5	8.4	7.7	Acceptable
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MW-09-55B	2B	8.0	3/17/2022	3.7	6.5	10.8	0.9	9.9	6.0	Acceptable
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