SJRRP Flow Bench Evaluation

March 22, 2013

The Restoration Administrator, as of March 20, 2013, recommends increasing releases from Friant Dam for Interim Flows and riparian diversions to 700 cubic feet per second (cfs) on March 22, 2013. To date, groundwater levels in monitoring wells adjacent to the Eastside Bypass (ESBP) continue to restrict flows below Sack Dam to 0 cfs. Lack of exchangeable demand in Mendota Pool and water quality concerns in the lower Delta Mendota Canal restrict Friant Dam releases to 650 cfs at this time. Reclamation has consulted with the Restoration Administrator. The combined release from Friant Dam, including Interim Flow and riparian releases, will be increased to 650 cfs on March 22, 2013 at 3 pm.

As of March 22, 2013:

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

2. Operations Conference Call: At the weekly call, water district operators raised concerns regarding the amount of exchangeable demand available in Mendota Pool. Please see the analysis section for details. This currently limits Friant Dam releases to 650 cfs.

3. Seepage Hotline Calls: The seepage hotline has received no calls in Water Year 2013.

4. Real-Time Wells: Groundwater monitoring well levels are below thresholds. These wells do not restrict releases.

5. Priority Wells: Weekly groundwater measurements in priority wells, Table 2, indicate the groundwater level is above the threshold in MW-10-95. This restricts releases below Sack Dam at this time.

6. Flow Stabilization: Flows have stabilized.

7. Projected Groundwater Level Increases: Projected groundwater levels indicate levels may rise above the threshold in one well, based on the proposed increase in flow (Table 4) and groundwater measurements made the week ending March 16, 2013.

8. Levees: The LSJLD has not identified any concerns.

9. Water Districts: The San Joaquin River Exchange Contractors Water Authority (SJRECWA) and member agencies have not identified any concerns other than the lack of exchangeable demand in Mendota Pool, described in part 2 above.

Analysis

Currently Mendota Pool demand is approximately 863 cfs. Additional operational diversions starting on March 25th will provide 200 cfs of demand by March 28, and ramp up to approximately 220 cfs by April 1st. This sums to a total demand of 1063 by March 28 and 1083 cfs by April 1. Water users have identified water quality concerns if Delta Mendota Canal flows drop below 500 cfs. Interim Flows into Mendota Pool at a 700 cfs release are estimated at 475

cfs. Approximately 138 cfs of groundwater exchange into Mendota Pool also adds input, summing to total inflow of 1,113 cfs. Thus, to avoid oversupplying Mendota Pool when the Interim Flows fully arrive in Mendota Pool on March 28, it is necessary to increase Friant Dam releases to 650 cfs rather than 700 cfs. Releases will be increased to meet the Restoration Administrator's recommendation as demand in the Pool becomes available, and when beneficial for ongoing fisheries studies in the San Joaquin River.

Table 1: Approximate Predicted Mendota Pool Mass Balance

Demand				Inflow (Recommended / Actual)	
Sources	3/26/2013	3/28/2013	4/1/2013	Sources	All Dates
Mendota Pool Demand	863	863	863	DMC Flows	500
Westlands	95	95	95	SJRRP	475* / 425
Meyers Water Bank	25	25	25	Pump-in	138
James ID	30	80	80		
Subsidence Transfer	0	0	20		
TOTAL	1013	1063	1083		1113 / 1063

*At a 700 cfs release from Friant.

Priority well MW-10-95 (Reach 4B1 Eastside Bypass) measurements show depths to groundwater at 2.3 feet above the threshold. No water from the San Joaquin River currently reaches the Eastside Bypass. The projected water surface elevation in the Eastside Bypass adjacent to this well with 10 cfs in the channel is 92.7 feet above sea level. The threshold elevation in MW-10-95 is 92.8 feet above sea level. This does not provide enough of a gradient (0.1 feet) to allow groundwater levels to drain below the threshold. This well restricts releases past Sack Dam to 0 cfs at this time.

Data

Table 2 shows the groundwater depth in seven realtime wells as of March 22, 2013 and manual measurements from field staff as reported in the weekly groundwater report with a publish date of March 23, 2013. Reclamation publishes the weekly groundwater report with manual measurements via electronic well sounder and recent flow data on the SJRRP website at: http://www.restoresjr.net/flows/Groundwater/Groundwater.html. To calculate field depths, Reclamation adds ground surface buffers and lateral gradient buffers to measured groundwater depths in the well. A negative ground surface buffer indicates the well is above the field. See Figure 1 for a visual depiction and Equation 1 for a mathematical one.

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

Table 3 shows the anticipated flow rates used to evaluate future groundwater depths. Reclamation calculated losses from Friant Dam to the Mendota Pool based on the long-term pattern established by Exhibit B.

Table 2: Well Data

Column ID		1	2	3	4	5	
Well	**Reach**	**Measured Groundwater Depth in Well (feet bgs)**	**Ground Surface Buffer (feet)**	**Lateral Gradient Buffer (feet)**	**Field GW Depth (feet bgs)**	**Field Threshold (feet bgs)**	**Comment**
FA-9	2A	8.6	-3.7	2.5	7.4	5	Acceptable
MW-09-47	2A	8.8	-3.5	3.3	8.6	7	Acceptable
MA-4	2A	12.0	-6.1	4.6	10.5	7	Acceptable
MW-09-49B	2A	6.2	-1.7	2.4	6.9	4.5	Acceptable
MW-09-54B	2B	16.1	-7.9	5.5	13.7	10	Acceptable
MW-09-55B	2B	9.6	-3.7	3	8.9	7	Acceptable
PZ-09-R2B-1	2B	-	-1.3	0	-	5	-
PZ-09-R2B-2	2B	8.4	-3.9	0	4.5	4.5	Acceptable
PZ-09-R3-5	3	11.4	-1.2	0	10.2	5	Acceptable
PZ-09-R3-6	3	10.2	-1.5	0	8.7	4	Acceptable
PZ-09-R3-7	3	9.3	-0.7	0	8.6	3.5	Acceptable
MW-10-75	3	11.1	-0.5	0.2	10.8	6.3	Acceptable
MW-11-130	4A	7.9	0	0	7.9	5	Acceptable
MW-09-87B	4A	Dry	-1.9	1	-	4.2	-
MW-10-89	4A	14.3	-3.4	0	10.9	7.6	Acceptable
MW-10-92	4A	7.6	-2.6	0	5.0	5	Acceptable
MW-10-90	4B1	6.8	0.8	0	7.6	7	Acceptable
MW-10-94	4B1	7.7	0	1	8.7	7	Acceptable
MW-10-95	4B1	2.1	-2.2	1	0.9	5	Above Threshold
MW-11-142	4B1	5.5	0	0	5.5	4	Acceptable

bgs = below ground surface
GW = groundwater

Table 3: Anticipated Change in Flows

Reach	Recent Flows (cfs)	Projected Flows for Evaluation (cfs)
Reach 1	350	700
Reach 2A	225	575
Reach 2B	145	475
Reach 3	120	130
Reach 4A	0	10
Reach 4B1 (ESBP)	0	10

Table 4 shows the current and maximum rise in groundwater based on estimated changes in river stage and the conceptual model shown in Figure 1 and Figure 2. Field depths are calculated by taking the most recent measurements from Table 2, adding the ground surface and the lateral gradient buffer, and subtracting the maximum predicted stage increase, as shown below in Equation 2.

$$\text{Field Depth}_{\text{Predicted}} = \text{Field Depth}_{\text{Current}} - \text{WSEL}_{\text{Max Increase}} \quad (2)$$

See Figure 4 for the locations of these monitoring wells and the rating curves (Figure 5 through 19) for each of the key wells from the Mussetter Engineering, Inc., 2008 San Joaquin HEC-RAS Model Documentation Technical Memorandum prepared for California Dept. of Water Resources, Fresno, California, June 2. These rating curves are used to determine the maximum predicted increase in water surface elevation, as shown in Figure 1.

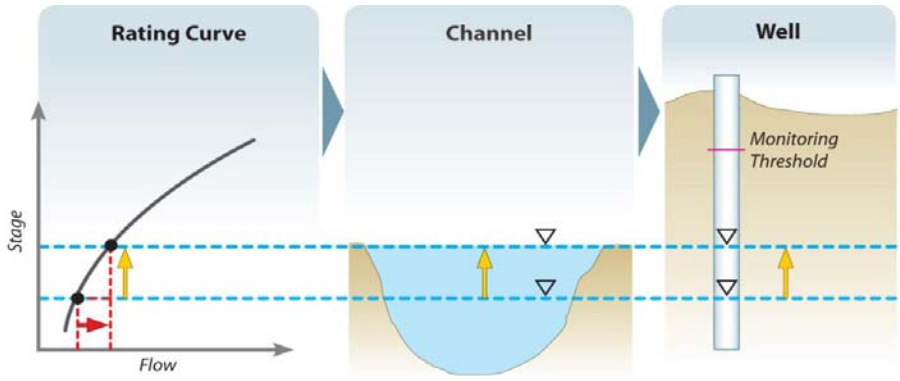

Figure 1: Conceptual Model of 1:1 Relationship between River Stage and Groundwater Level

Table 4: Predicted Groundwater Levels for Key Wells – Increase in Stage Method

Column ID		1	2	3	4	6	7	5	
Well	**Reach**	**Measured Groundwater Depth in Well (feet bgs)**	**Ground Surface Buffer (feet)**	**Lateral Gradient Buffer (feet)**	**Field GW Depth (feet bgs)**	**Maximum Predicted WSEL Increase (feet)**	**Predicted Shallowest GW Depth (feet bgs)**	**Field Threshold (feet bgs)**	**Comment**
FA-9	2A	8.6	-3.7	2.5	7.4	0.9	6.5	5	Acceptable
MW-09-47	2A	8.8	-3.5	3.3	8.6	0.9	7.7	7	Acceptable
MA-4	2A	12.0	-6.1	4.6	10.5	1.3	9.2	7	Acceptable
MW-09-49B	2A	6.2	-1.7	2.4	6.9	1.3	5.6	4.5	Acceptable
MW-09-54B	2B	16.1	-7.9	5.5	13.7	1.4	12.3	10	Acceptable
MW-09-55B	2B	9.6	-3.7	3	8.9	1.4	7.5	7	Acceptable
PZ-09-R2B-1	2B	-	-1.3	0	-	0.1	-	5	-
PZ-09-R2B-2	2B	8.4	-3.9	0	4.5	0	4.5	4.5	Acceptable
PZ-09-R3-5	3	11.4	-1.2	0	10.2	0.1	10.1	5	Acceptable
PZ-09-R3-6	3	10.2	-1.5	0	8.7	0.1	8.6	4	Acceptable
PZ-09-R3-7	3	9.3	-0.7	0	8.6	0.1	8.5	3.5	Acceptable
MW-10-75	3	11.1	-0.5	0.2	10.8	0.1	10.7	6.3	Acceptable
MW-11-130	4A	7.9	0	0	7.9	0.1	7.8	5	Acceptable
MW-09-87B	4A	Dry	-1.9	1	-	0.2	-	4.2	-
MW-10-89	4A	14.3	-3.4	0	10.9	0.9	10.0	7.6	Acceptable
MW-10-94	4B1	7.7	0	1	8.7	0.3	8.4	7	Acceptable
MW-11-142	4B1	5.5	0	0	5.5	0	5.5	4	Acceptable

bgs = below ground surface
GW = groundwater
WSEL = water surface elevation

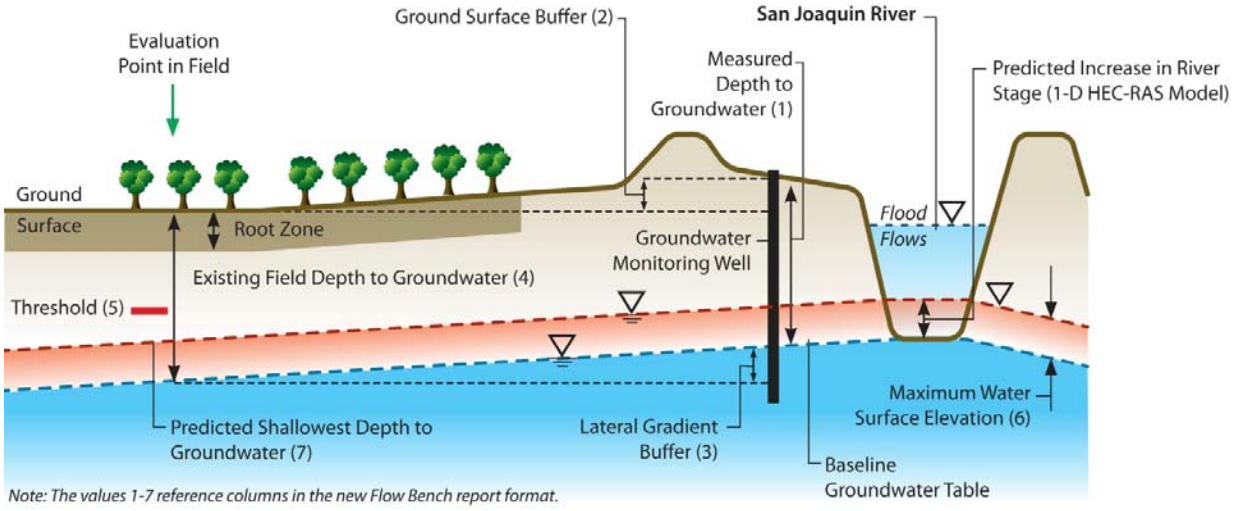

Figure 2: Conceptual Model for Increase in Stage Method

Table 5 shows the predicted maximum rise in groundwater based the elevation of the water surface in the river and the conceptual model shown in Figure 3. Reclamation uses this drainage method where current groundwater levels are higher than thresholds without flows in the San Joaquin River. A predicted water surface elevation (WSEL) above (or within 0.3 feet) of the threshold elevation does not allow drainage and therefore restricts flows.

Table 5: Predicted Groundwater Elevation for Key Wells – Drainage Method

Column ID		10	11	12	
Well	**Reach**	**Existing Field GW Elevation (feet)**	**Predicted WSEL (feet)**	**Threshold Elevation (feet)**	**Drainage Method Comment**
MW-10-92	4A	98.6	98.0	98.4	Acceptable
MW-10-90	4B1	95.0	94.2	95.1	Acceptable
MW-10-95	4B1	95.3	92.7	92.8	Does not allow drainage

bgs = below ground surface
GW = groundwater
WSEL = water surface elevation

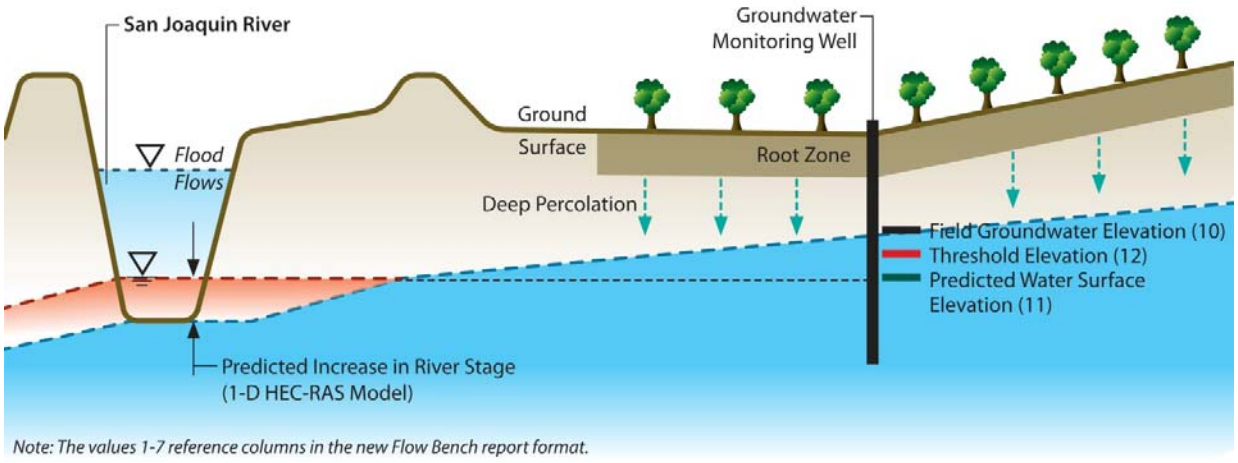

Figure 3: Conceptual Model for Drainage Method

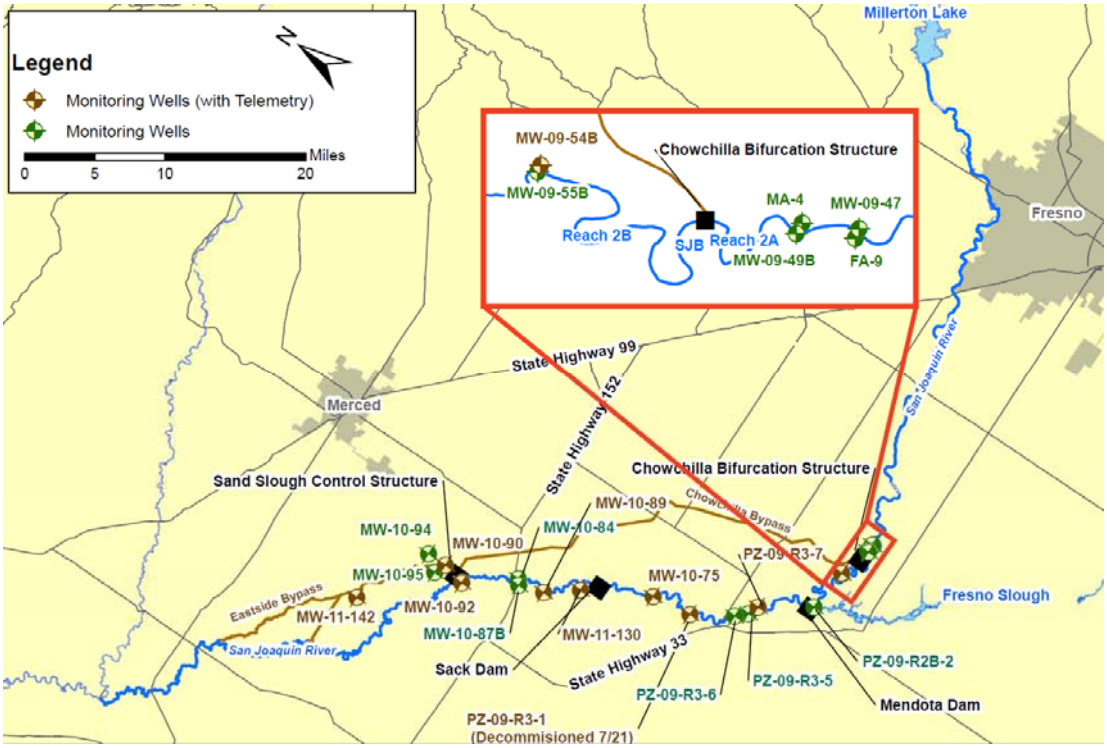

Figure 4: Key Monitoring Well Locations

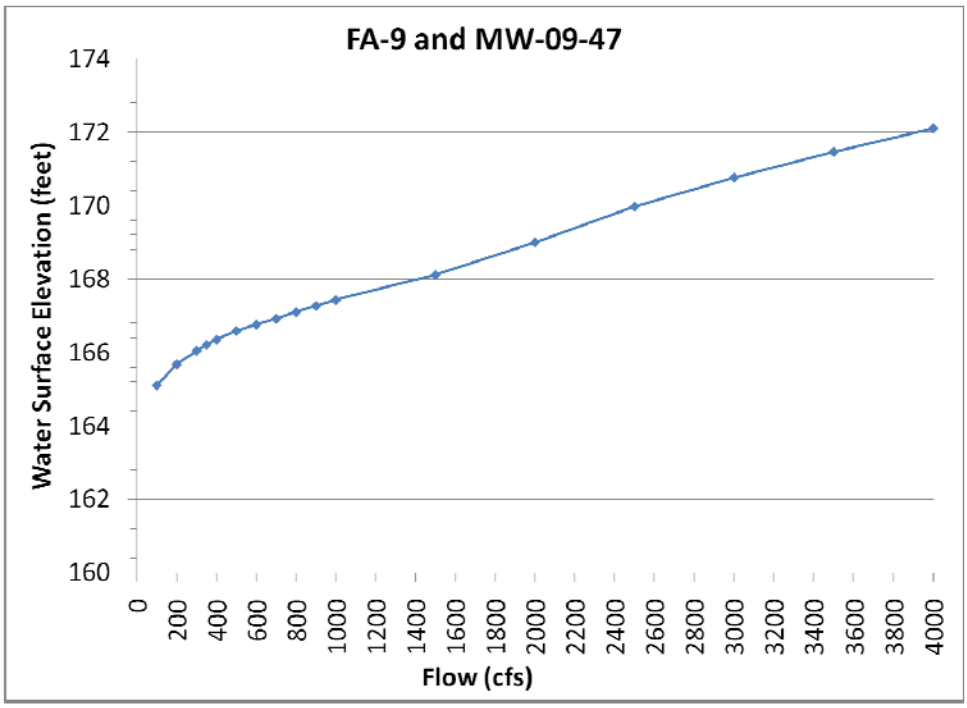

Figure 5. River Stage vs. Flow Rating Curve at Locations FA-9 and MW-09-47

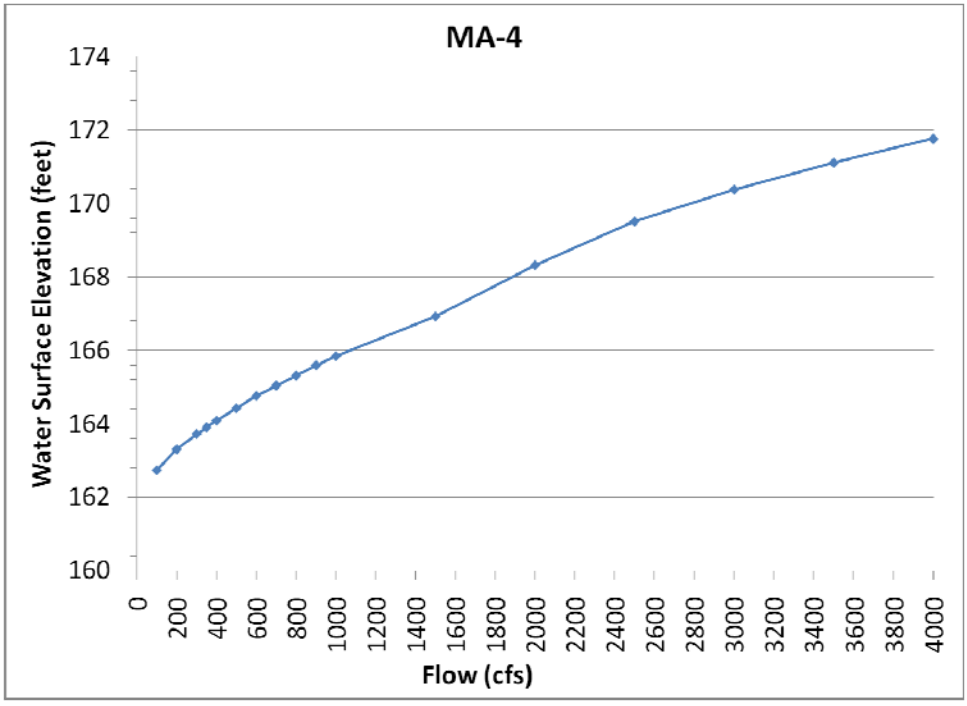

Figure 6. River Stage vs. Flow Rating Curve at Location MA-4

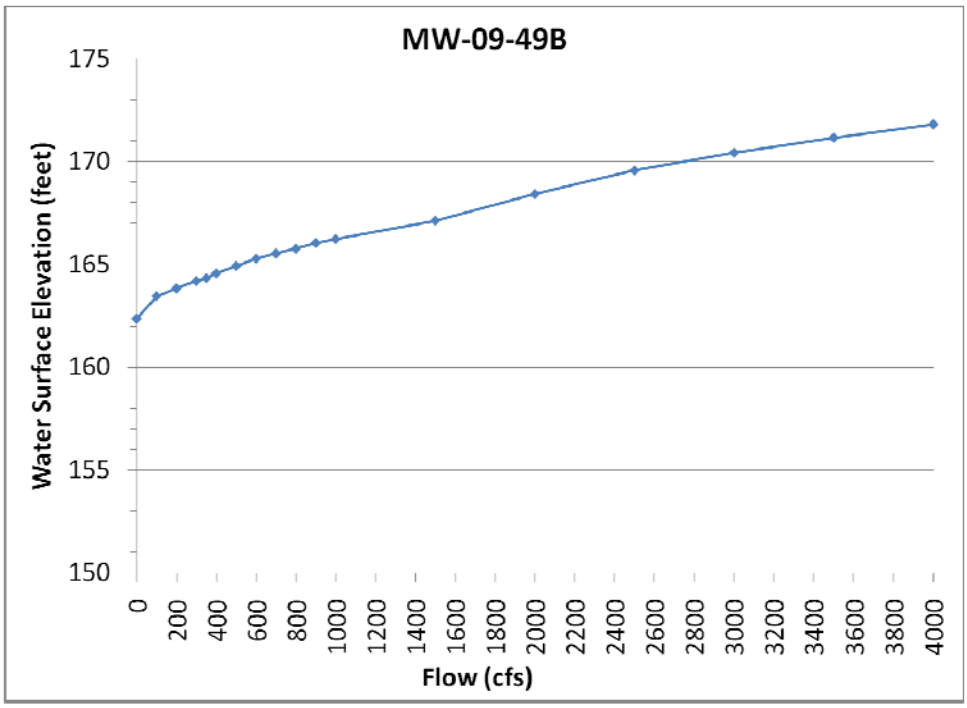

Figure 7. River Stage vs. Flow Rating Curve at Location MW-09-49B

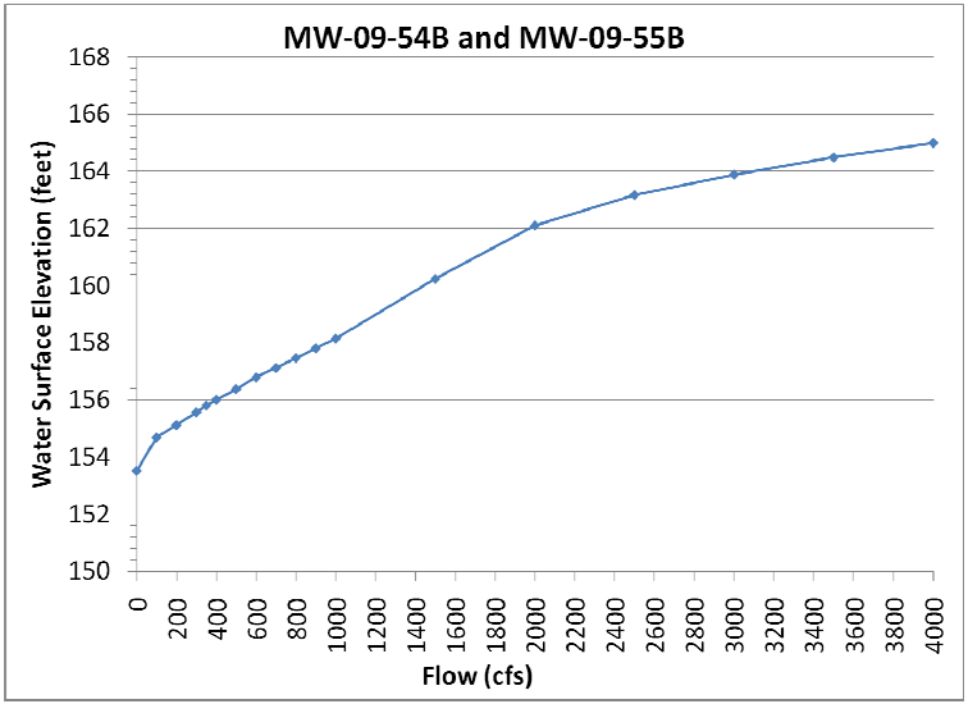

Figure 8. River Stage vs. Flow Rating Curve at Locations MW-09-54B and MW-09-55B

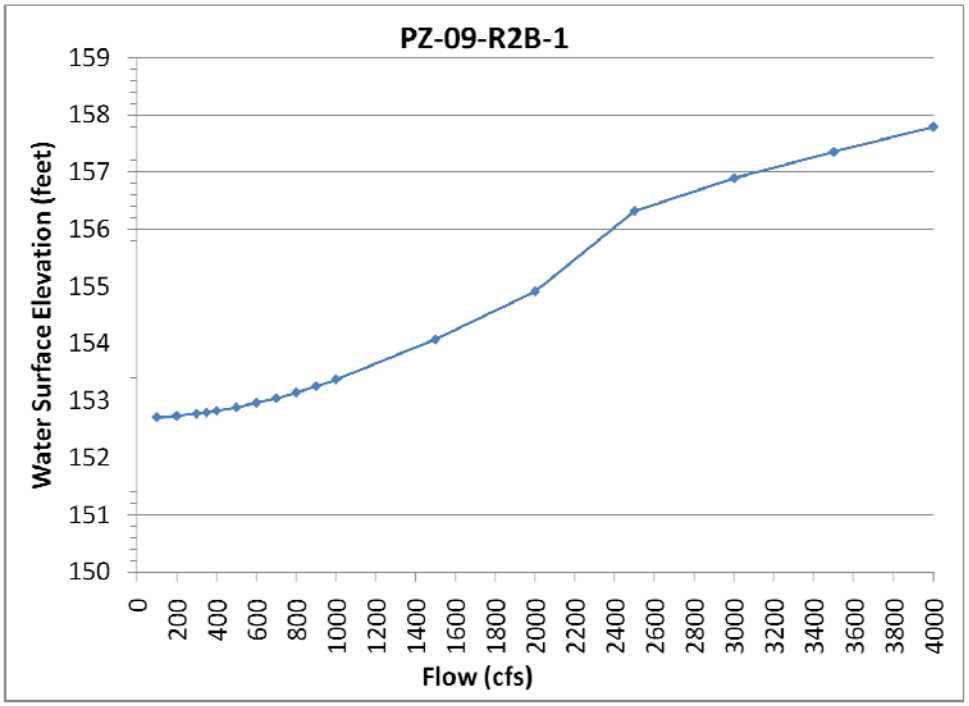

Figure 9. River Stage vs. Flow Rating Curve at Location PZ-09-R2B-1

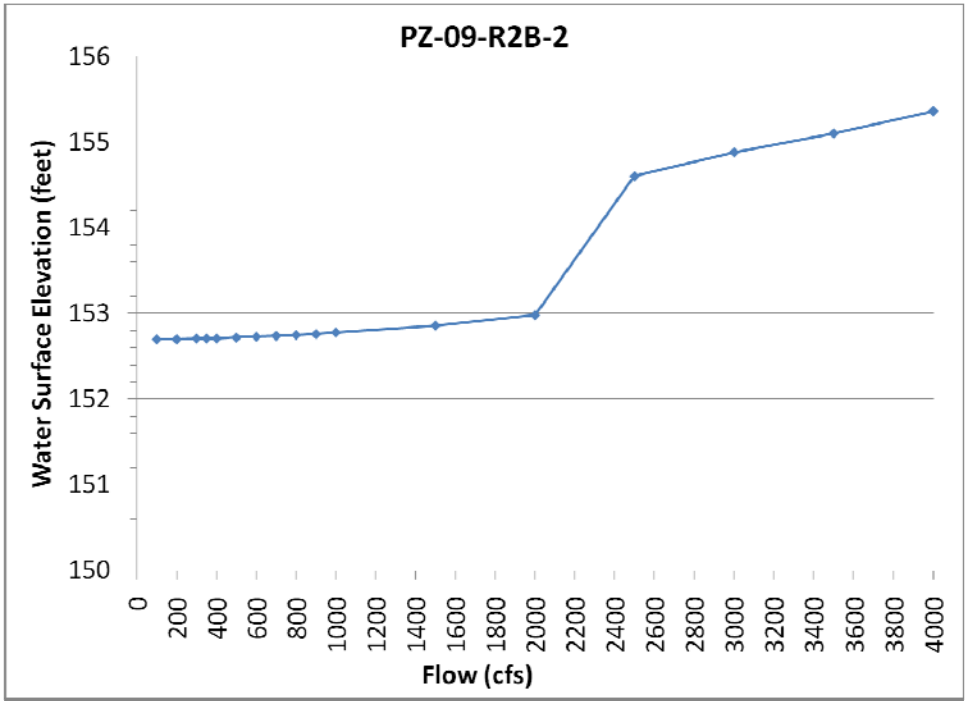

Figure 10. River Stage vs. Flow Rating Curve at Location PZ-09-R2B-2

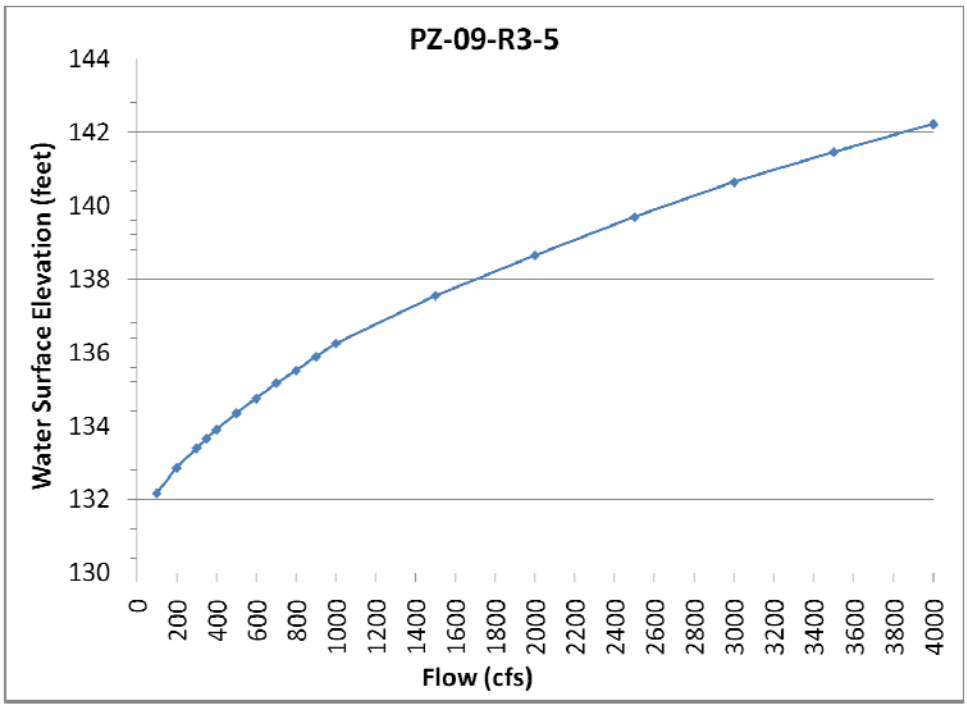

Figure 11. River Stage vs. Flow Rating Curve at Location PZ-09-R3-5

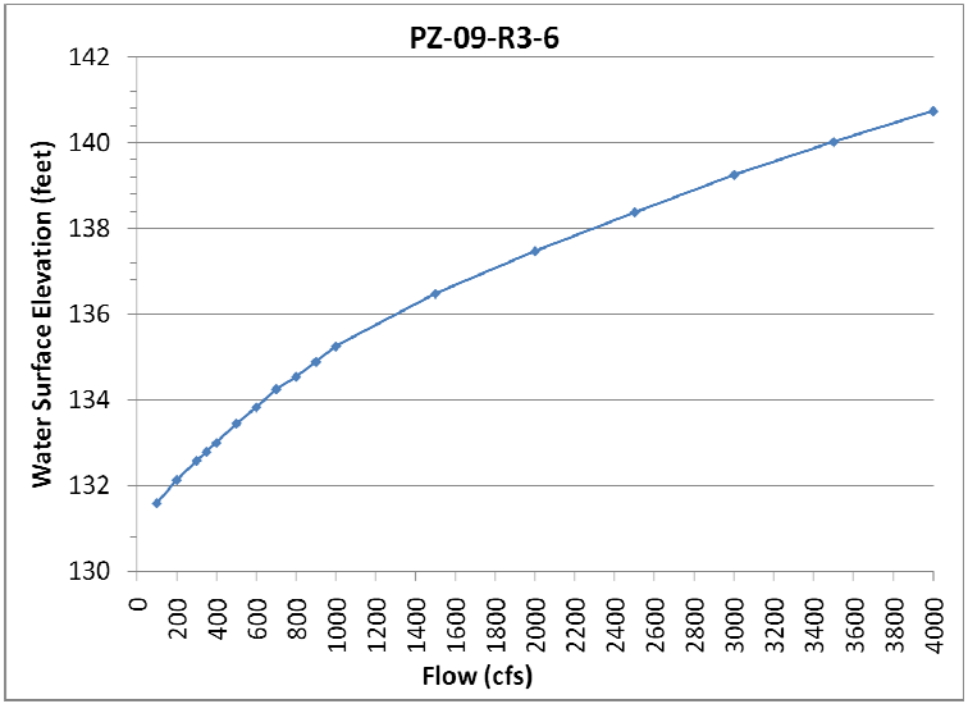

Figure 12. River Stage vs. Flow Rating Curve at Location PZ-09-R3-6

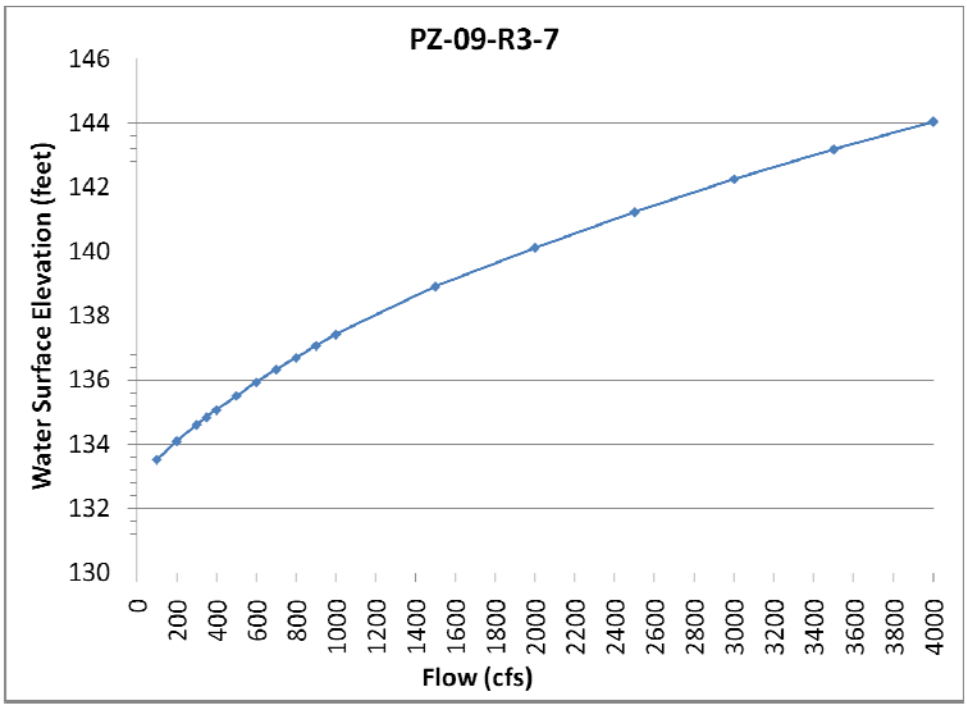

Figure 13. River Stage vs. Flow Rating Curve at Location PZ-09-R3-7

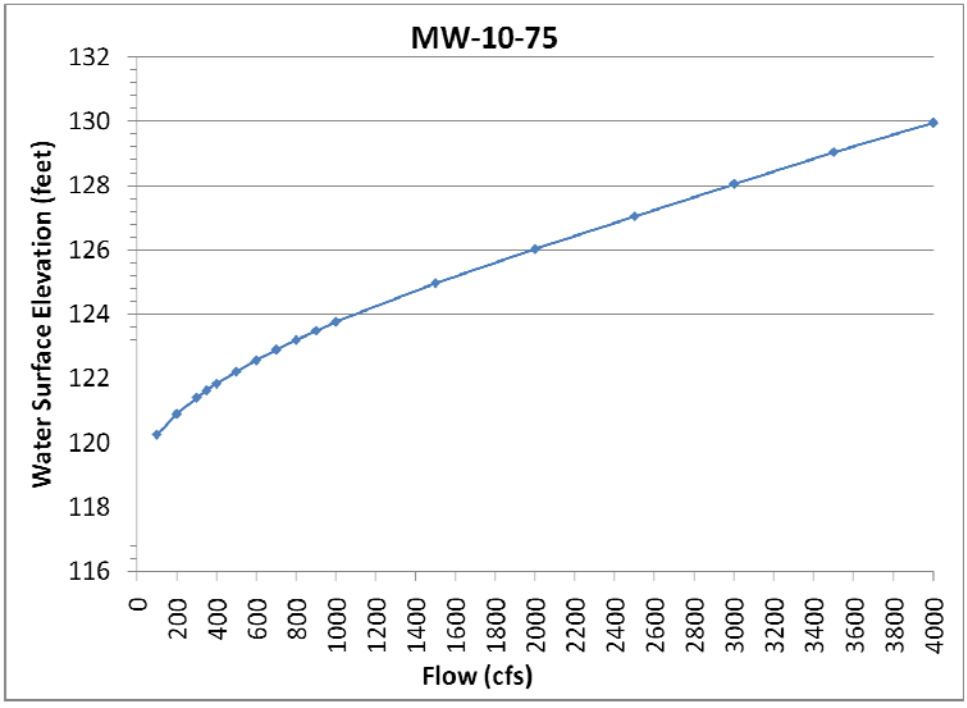

Figure 14. River Stage vs. Flow Rating Curve at Location MW-10-75

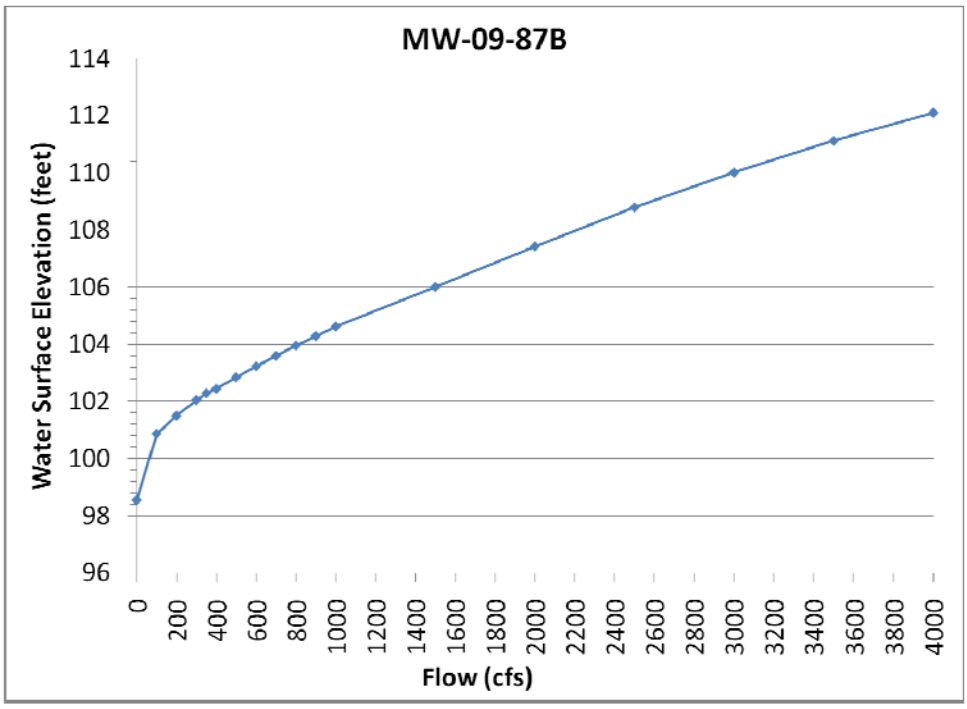

Figure 15. River Stage vs. Flow Rating Curve at Location MW-09-87B

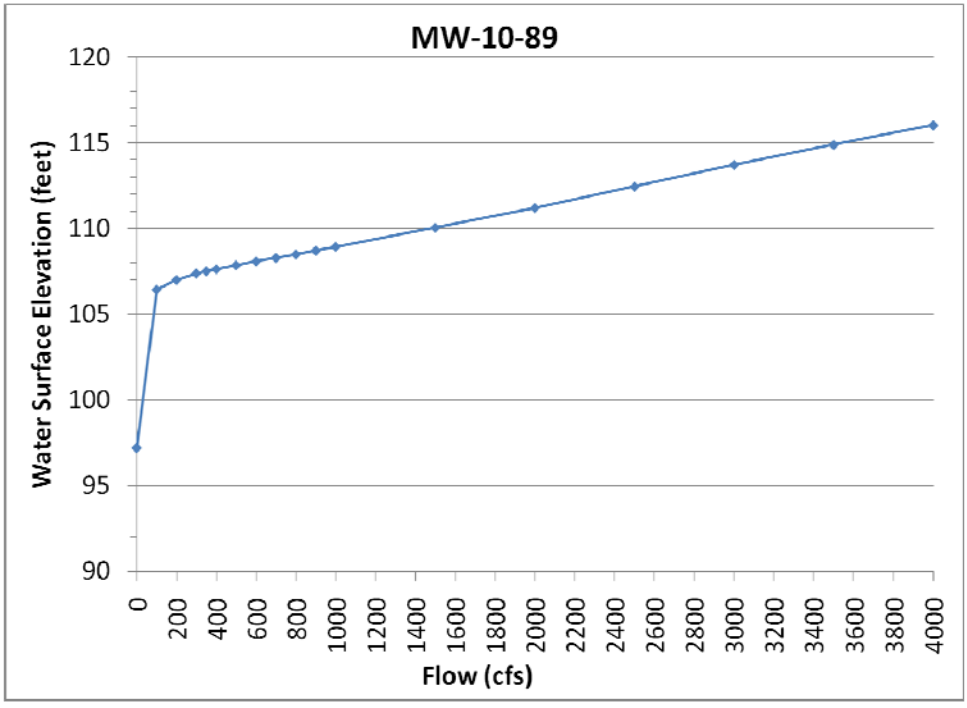

Figure 16. River Stage vs. Flow Rating Curve at Location MW-10-89

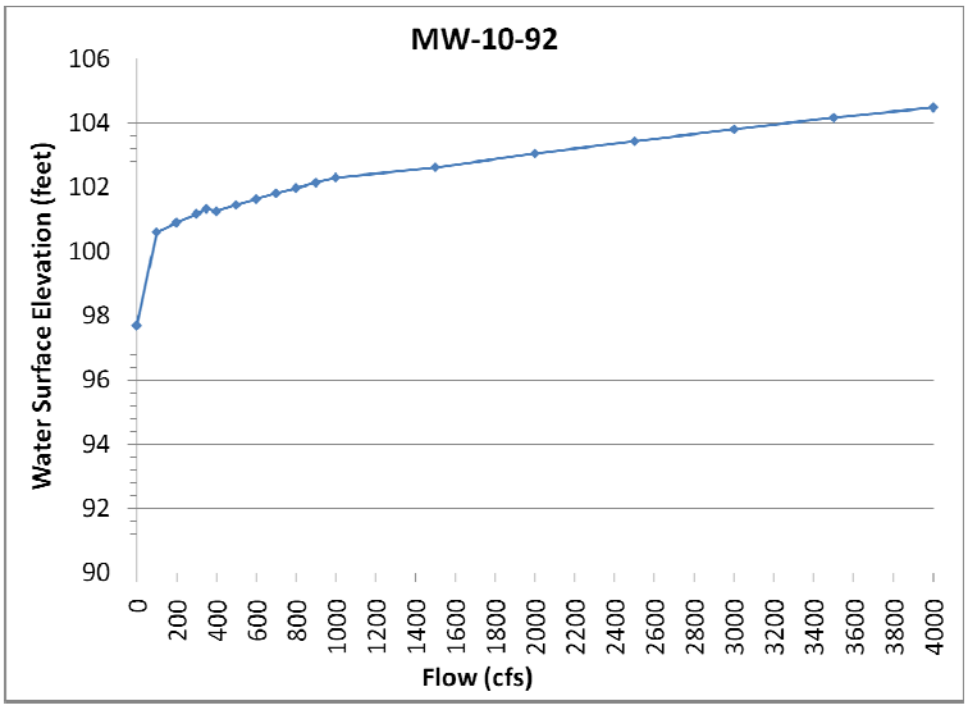

Figure 17. River Stage vs. Flow Rating Curve at Location MW-10-92

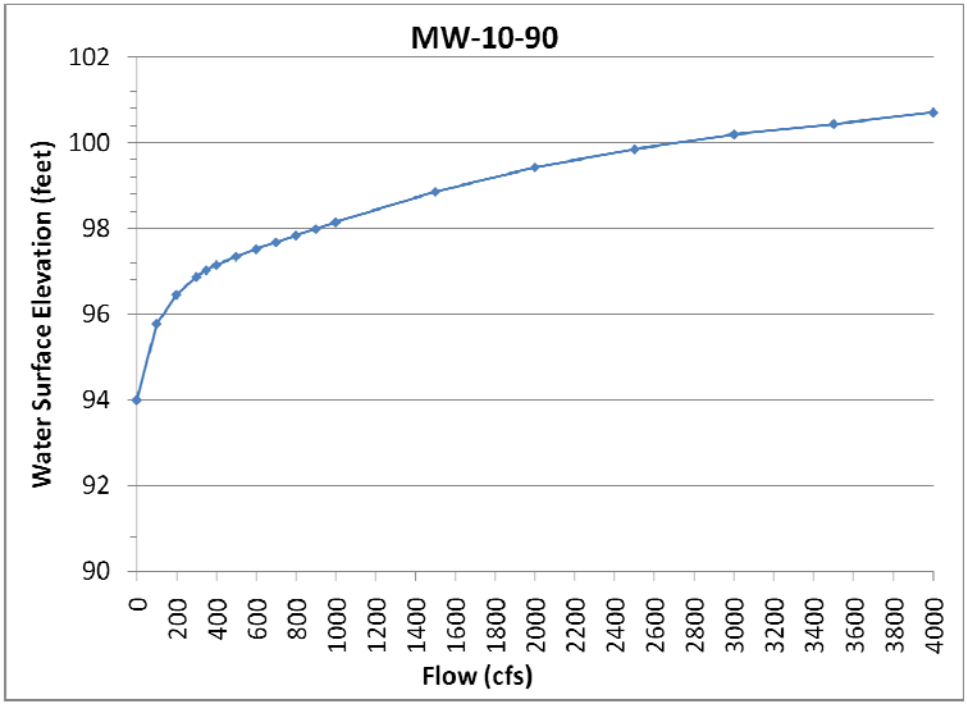

Figure 18. River Stage vs. Flow Rating Curve at Location MW-10-90

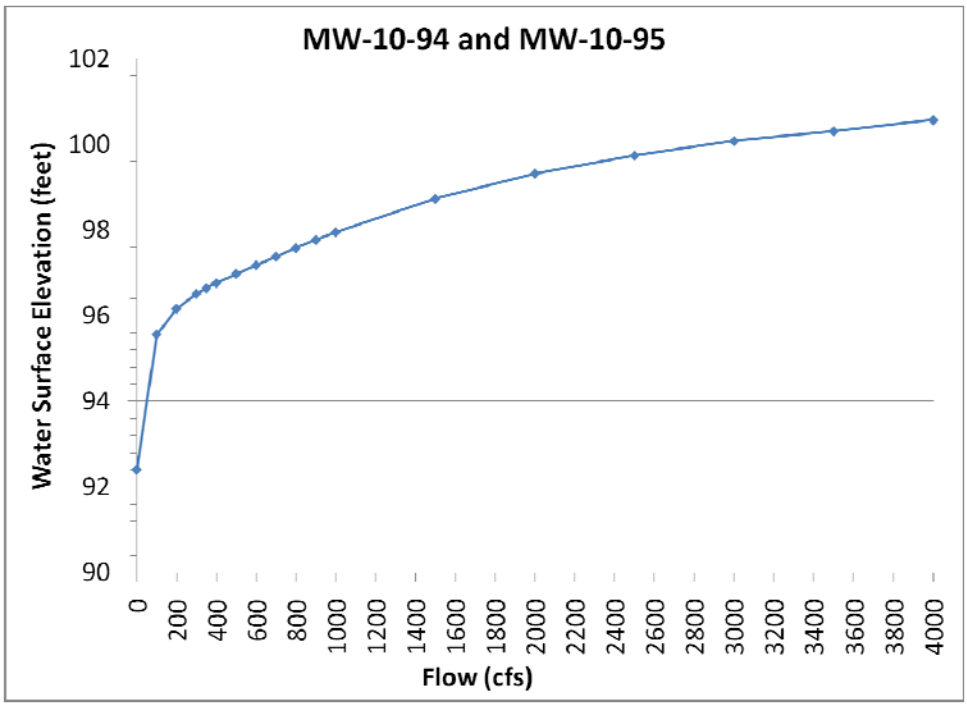

Figure 19. River Stage vs. Flow Rating Curve at Locations MW-10-94 and MW-10-95