SJRRP Flow Bench Evaluation

April 4, 2013

The March 20, 2013 Restoration Administrator recommendation included increasing releases from Friant Dam for Interim Flows and riparian diversions to 700 cubic feet per second (cfs) on March 22, 2013. Releases were increased to 650 cfs on March 22nd and reduced to 600 cfs on March 27th, 2013. To date, groundwater levels in monitoring wells adjacent to the Eastside Bypass (ESBP) continue to restrict flows below Sack Dam to 0 cfs. Exchangeable demand in Mendota Pool is expected to rise and water quality is not anticipated to be a concern and thus the combined release from Friant Dam, including Interim Flow and riparian releases, will be increased to 700 cfs on April 4, 2013 at 3:00pm.

As of April 4, 2013:

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

2. Operations Conference Call: At the call, water district operators raised concerns regarding the amount of exchangeable demand available in Mendota Pool. Please see the analysis section for details.

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 levels are above the thresholds in MW-10-92, MW-10-95, and PZ-09-R2B-2. A license agreement that allows for exceeding the threshold is in place for the property adjacent to PZ-09-R2B-2, and the other two wells restrict releases below Sack Dam at this time.

6. Flow Stabilization: Flows have stabilized.

7. Projected Groundwater Level Increases: Projected groundwater levels indicate levels may continue to rise above the threshold in the two wells already above the threshold, based on the proposed increase in flow (Table 4) and groundwater measurements made the week ending March 30, 2013.

8. Levees: The LSJLD did not identify any concerns when asked about increasing to 700 cfs on March 22, 2013.

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

Mendota Pool Inflows: Water users have identified water quality concerns if Delta Mendota Canal flows drop below 500 cfs based on recent Check 13 DMC salinity values. Interim Flows into Mendota Pool at a 700 cfs release are anticipated to reach 425 cfs based on the Settlement Exhibit B loss assumptions modified by 2013 spring flow monitoring observations. Groundwater exchange into Mendota Pool is currently at 142 cfs, but will decrease to approximately 50 cfs between Friday April 5, and Monday April 8. Total inflows next week are predicted to rise to approximately 975 cfs on Wednesday April 10.

Mendota Pool Demands: Currently total demand in Mendota Pool is approximately 683 cfs. Demands are low due to rain and lower than normal pool elevation restricting diversions to Westlands Laterals 6 and 7. Demand is anticipated to increase by the time the 700 cfs Friant release fully reaches the Mendota Pool. Recapture agreements currently provide 145 cfs of diversions but with changes to Westlands Water District and James Irrigation District diversions, recapture agreements are expected to total 185 cfs by Wednesday April 10. This sums to a total demand of 683 cfs now, increasing to 975 cfs by April 10. This assumes exchange contractor demand will increase by the 252 cfs required by April 10. If demands do not increase, Reclamation will work to enter into a recapture agreement.

Table 1: Approximate Predicted Mendota Pool Mass Balance

Demand			Inflow		
Sources	4/4/2013	4/10/2013	Sources	4/4/2013	4/10/2013
Exchange Contractors	538	790	DMC Flows	400	500
Westlands	50	110	SJRRP	323	425
Meyers Water Bank	25	25	Pump-in	142	50
James ID	70	50			
CCID	0	Potential recapture agreement			
TOTAL	683	975		865	975

*Estimated

Priority well MW-10-95 (Reach 4B1 Eastside Bypass) measurements show depths to groundwater at 1.4 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 April 4, 2013 and manual measurements from field staff as reported in the weekly groundwater report with a publish date of March 30, 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, with numbers after each element corresponding to the column identification number.

$$Field\ Depth_{Current}(4) = D_{Well}(1) + GS_{Buffer}(2) + LG_{Buffer}(3) \quad (1)$$

Table 3 shows the anticipated flow rates used to evaluate future groundwater depths. Reclamation calculated losses from Friant Dam to the Mendota Pool for the purposes of groundwater level evaluation 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	8.4	-3.7	2.5	7.2	5.0	Acceptable
MW-09-47	2A	8.6	-3.5	3.3	8.4	7.0	Acceptable
MA-4	2A	12.0	-6.1	4.6	10.5	7.0	Acceptable
MW-09-49B	2A	6.0	-1.7	2.4	6.7	4.5	Acceptable
MW-09-54B	2B	14.8	-7.9	5.5	12.4	10.0	Acceptable
MW-09-55B	2B	9.5	-3.7	3.0	8.8	7.0	Acceptable
PZ-09-R2B-1	2B	-	-1.3	0.0	-	5.0	-
PZ-09-R2B-2	2B	8.3	-3.9	0.0	4.5	4.5	License Agreement
PZ-09-R3-5	3	11.5	-1.2	0.0	10.4	5.0	Acceptable
PZ-09-R3-6	3	10.3	-1.5	0.0	8.9	4.0	Acceptable
PZ-09-R3-7	3	9.3	-0.7	0.0	8.6	3.5	Acceptable
MW-10-75	3	11.7	-0.5	0.2	11.4	6.3	Acceptable
MW-11-130	4A	8.1	0.0	0.0	8.1	5.0	Acceptable
MW-09-87B	4A	Dry	-1.9	1.0	-	4.2	-
MW-10-89	4A	14.1	-3.4	0.0	10.6	7.6	Acceptable
MW-10-92	4A	6.2	-2.6	0.0	3.6	5.0	Above Threshold
MW-10-90	4B1	6.9	0.8	0.0	7.7	7.0	Acceptable
MW-10-94	4B1	7.8	0.0	1.0	8.8	7.0	Acceptable
MW-10-95	4B1	3.6	-2.2	1.0	2.3	5.0	Above Threshold
MW-11-142	4B1	5.8	0.0	0.0	5.8	4.0	Acceptable

bgs = below ground surface
GW = groundwater

Table 3: Anticipated Change in Flows

Reach	Recent Flows (cfs)	Projected Flows for Evaluation (cfs)
Reach 1	600	700
Reach 2A	455	555
Reach 2B	355	455
Reach 3	120	120
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. If the predicted field depth is shallower than the threshold, flows may be restricted.

$$\text{Field Depth}_{\text{Predicted}}(7) = \text{Field Depth}_{\text{Current}}(4) - \text{WSEL}_{\text{Max Increase}}(6) \qquad (2)$$

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.

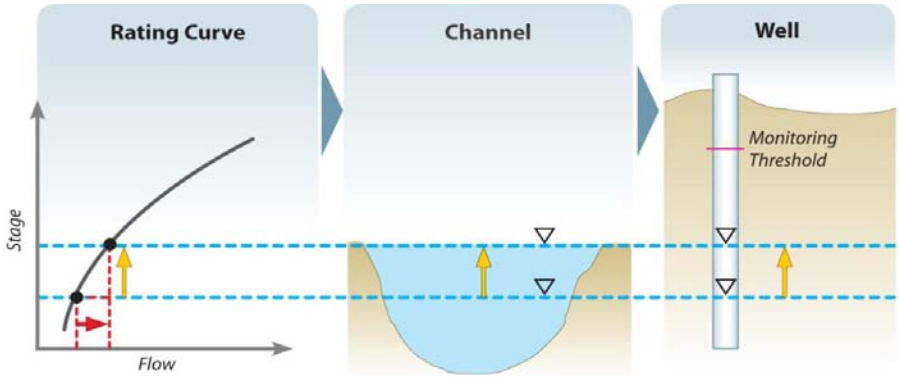

Figure 1: Conceptual Model of 1:1 Relationship between River Stage and Groundwater Level

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	8.4	-3.7	2.5	7.2	0.2	7.0	5.0	Acceptable
MW-09-47	2A	8.6	-3.5	3.3	8.4	0.2	8.2	7.0	Acceptable
MA-4	2A	12.0	-6.1	4.6	10.5	0.3	10.1	7.0	Acceptable
MW-09-49B	2A	6.0	-1.7	2.4	6.7	0.4	6.4	4.5	Acceptable
MW-09-54B	2B	14.8	-7.9	5.5	12.4	0.4	12.0	10.0	Acceptable
MW-09-55B	2B	9.5	-3.7	3.0	8.8	0.4	8.4	7.0	Acceptable
PZ-09-R2B-1	2B	-	-1.3	0.0	-	0.1	-	5.0	-
PZ-09-R2B-2	2B	8.3	-3.9	0.0	4.5	0.0	4.4	4.5	License Agreement
PZ-09-R3-5	3	11.5	-1.2	0.0	10.4	0.1	10.3	5.0	Acceptable
PZ-09-R3-6	3	10.3	-1.5	0.0	8.9	0.1	8.8	4.0	Acceptable
PZ-09-R3-7	3	9.3	-0.7	0.0	8.6	0.1	8.5	3.5	Acceptable
MW-10-75	3	11.7	-0.5	0.2	11.4	0.1	11.3	6.3	Acceptable
MW-11-130	4A	8.1	0.0	0.0	8.1	0.1	8.0	5.0	Acceptable
MW-09-87B	4A	Dry	-1.9	1.0	-	0.2	-	4.2	-
MW-10-89	4A	14.1	-3.4	0.0	10.6	0.9	9.7	7.6	Acceptable
MW-10-92	4A	6.2	-2.6	0.0	3.6	0.3	3.4	5.0	Above Threshold
MW-10-90	4B1	6.9	0.8	0.0	7.7	0.2	7.5	7.0	Acceptable
MW-10-94	4B1	7.8	0.0	1.0	8.8	0.3	8.5	7.0	Acceptable
MW-10-95	4B1	3.6	-2.2	1.0	2.3	0.3	2.0	5.0	Above Threshold
MW-11-142	4B1	5.8	0.0	0.0	5.8	0.0	5.8	4.0	Acceptable

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

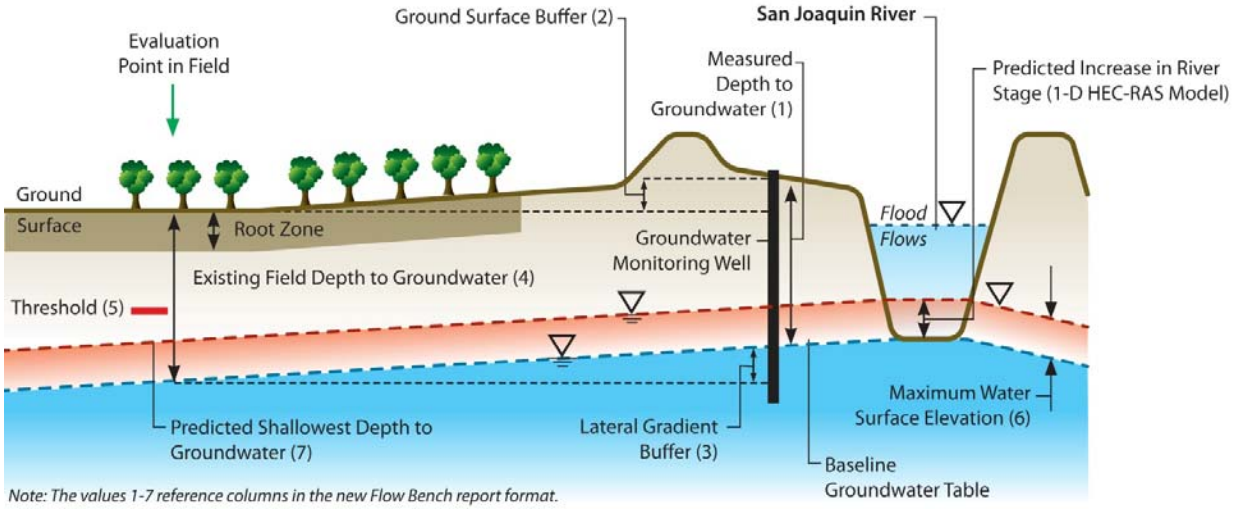

Figure 2: Conceptual Model for Increase in Stage Method

Table 5 shows the predicted maximum rise in groundwater based the elevation of the water surface in the river (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	99.8	98.0	98.4	Acceptable - Flood irrigation underway?
MW-10-90	4B1	94.4	94.2	95.1	Acceptable
MW-10-95	4B1	94.5	92.7	92.8	Does not allow drainage

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

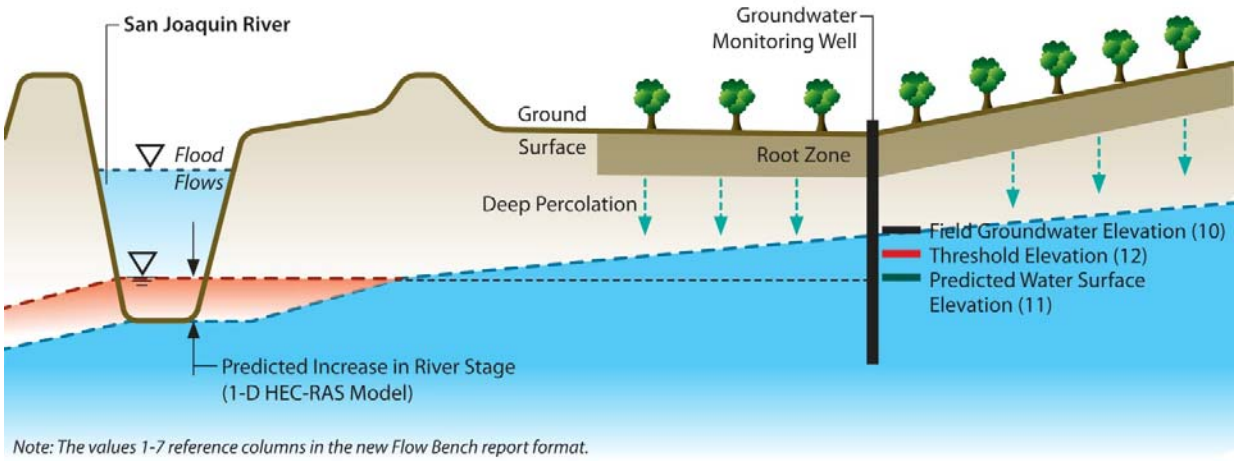

Figure 3: Conceptual Model for Drainage Method

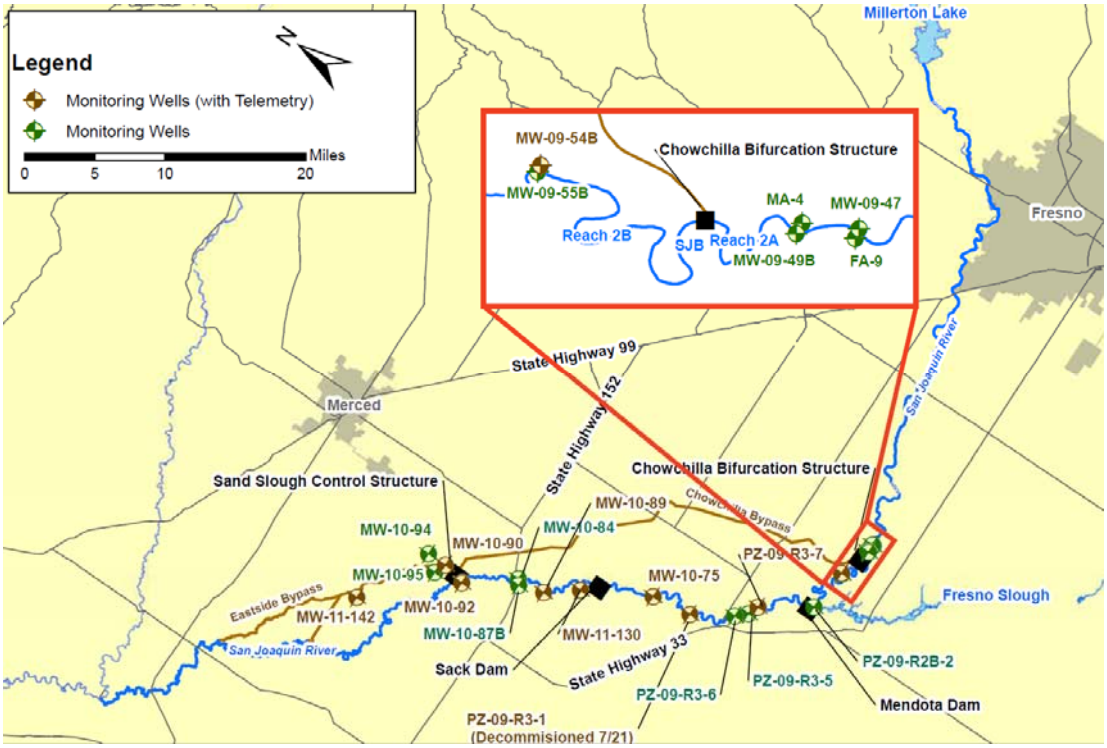

Figure 4: Key Monitoring Well Locations

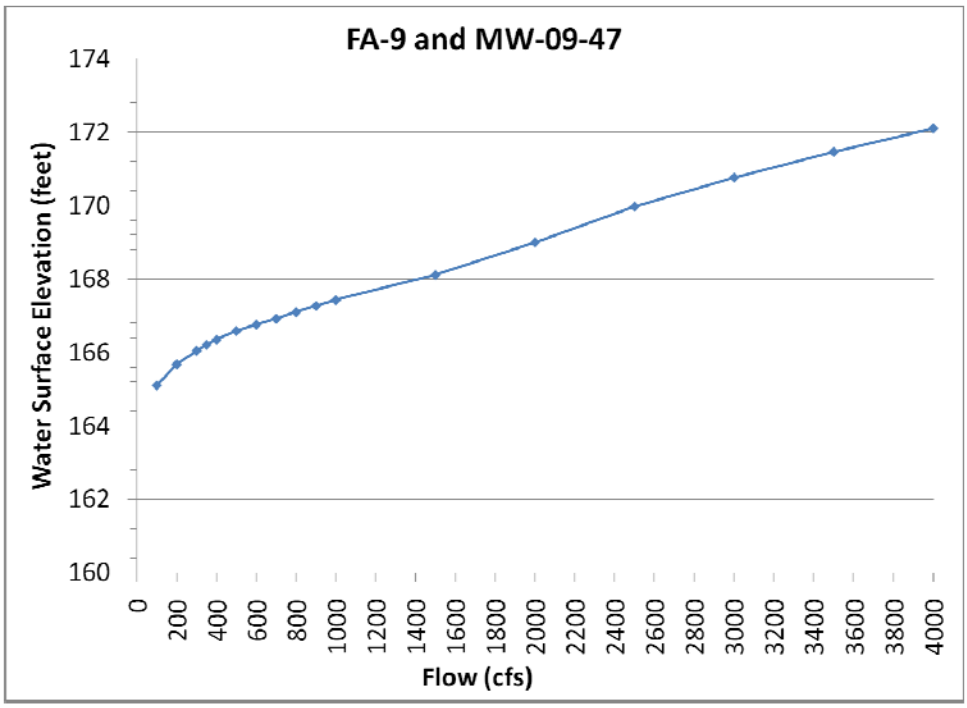

Figure 5. River Stage vs. Flow Rating Curve at Locations FA-9 and MW-09-47

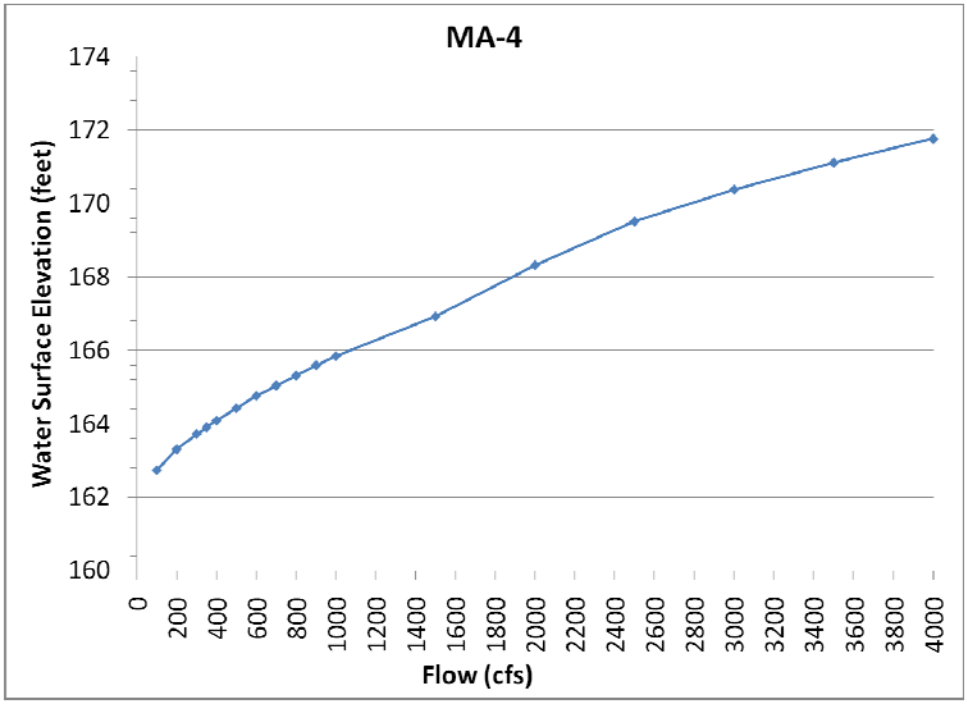

Figure 6. River Stage vs. Flow Rating Curve at Location MA-4

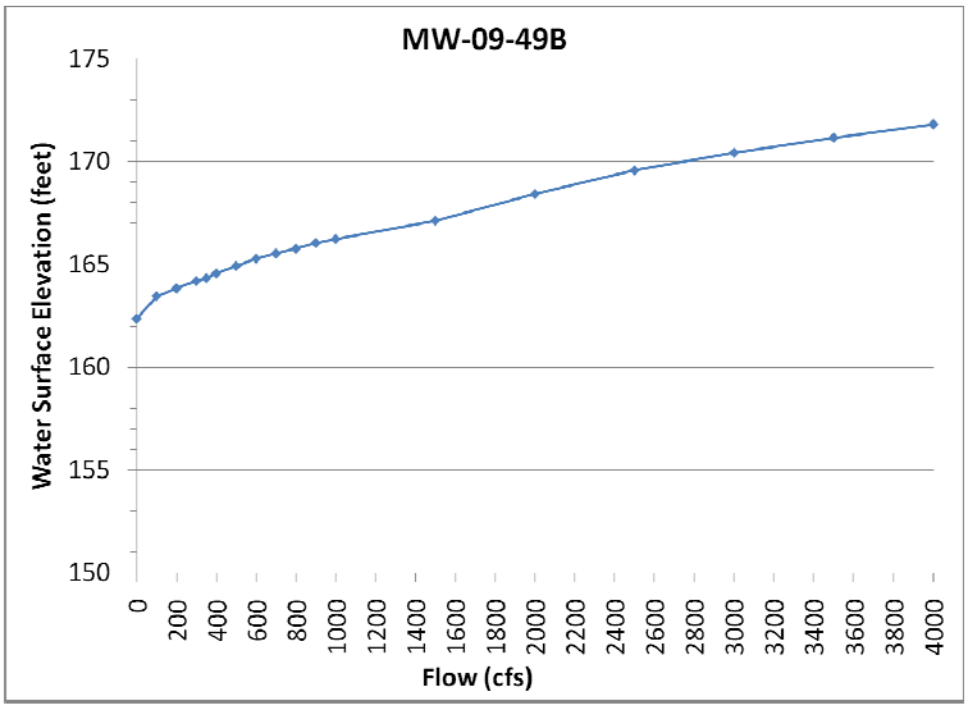

Figure 7. River Stage vs. Flow Rating Curve at Location MW-09-49B

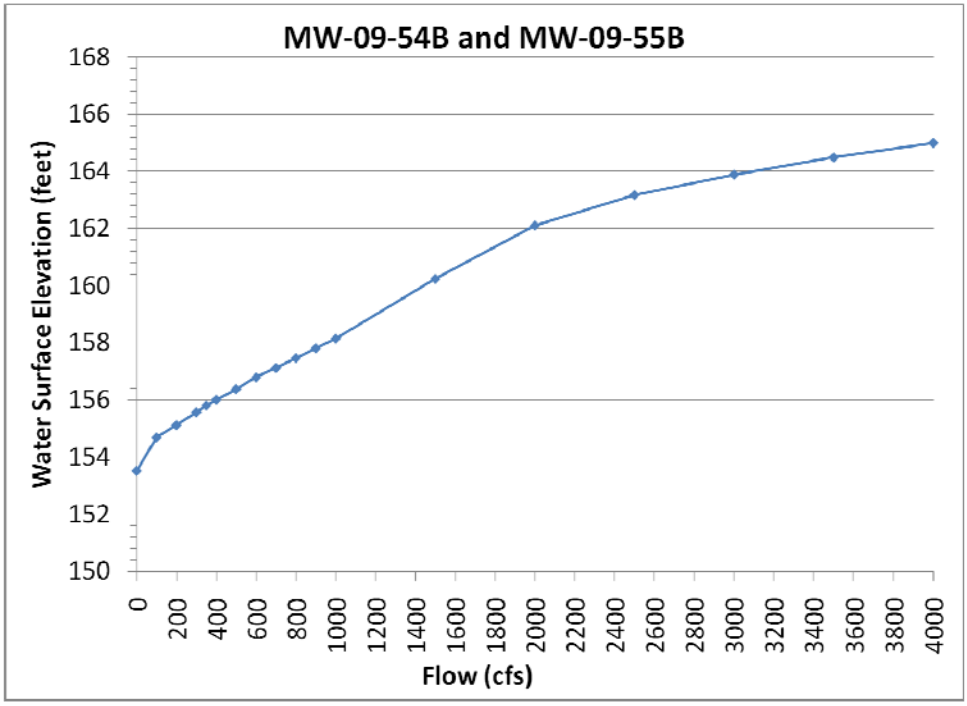

Figure 8. River Stage vs. Flow Rating Curve at Locations MW-09-54B and MW-09-55B

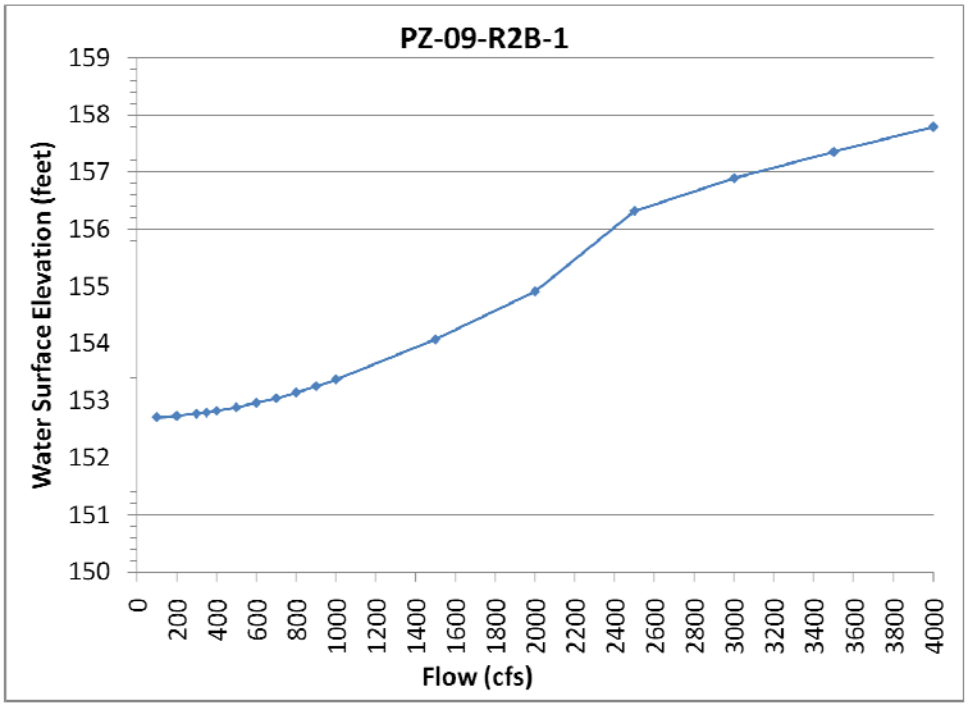

Figure 9. River Stage vs. Flow Rating Curve at Location PZ-09-R2B-1

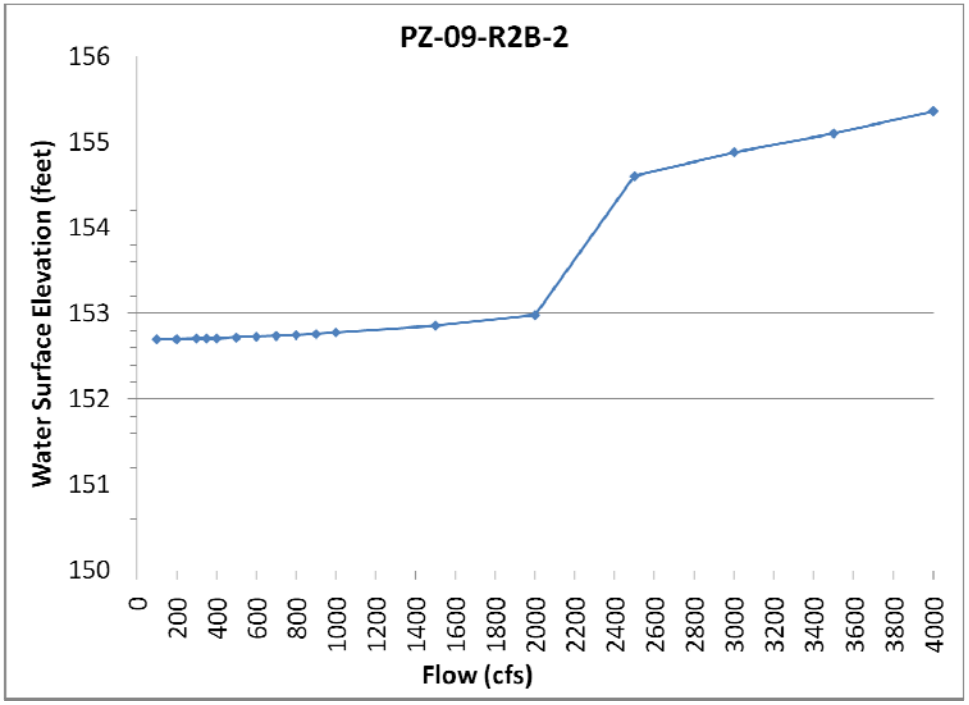

Figure 10. River Stage vs. Flow Rating Curve at Location PZ-09-R2B-2

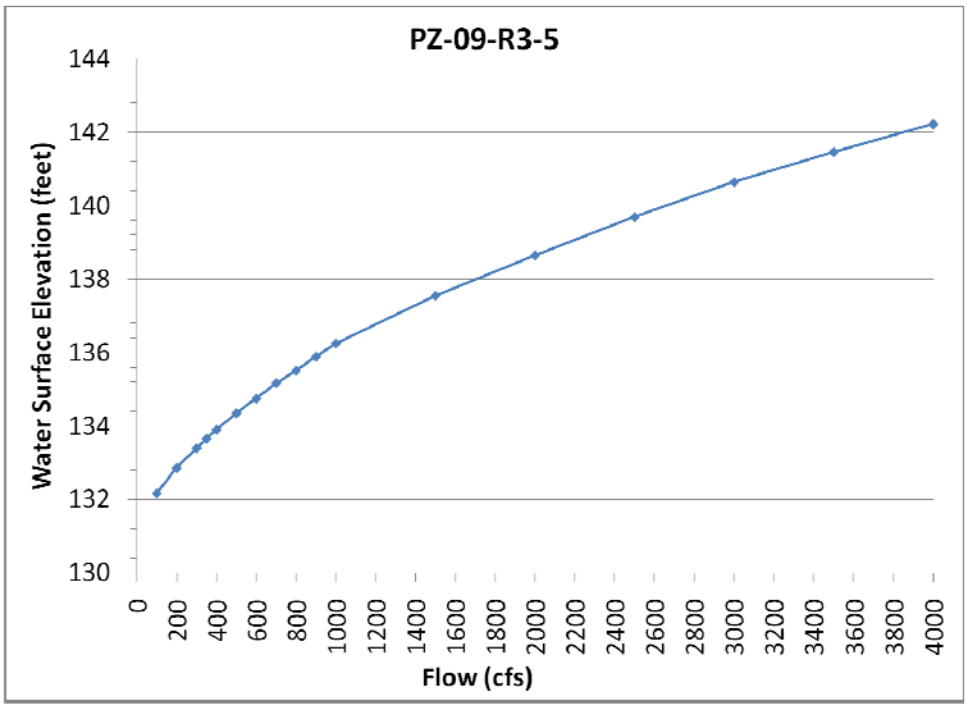

Figure 11. River Stage vs. Flow Rating Curve at Location PZ-09-R3-5

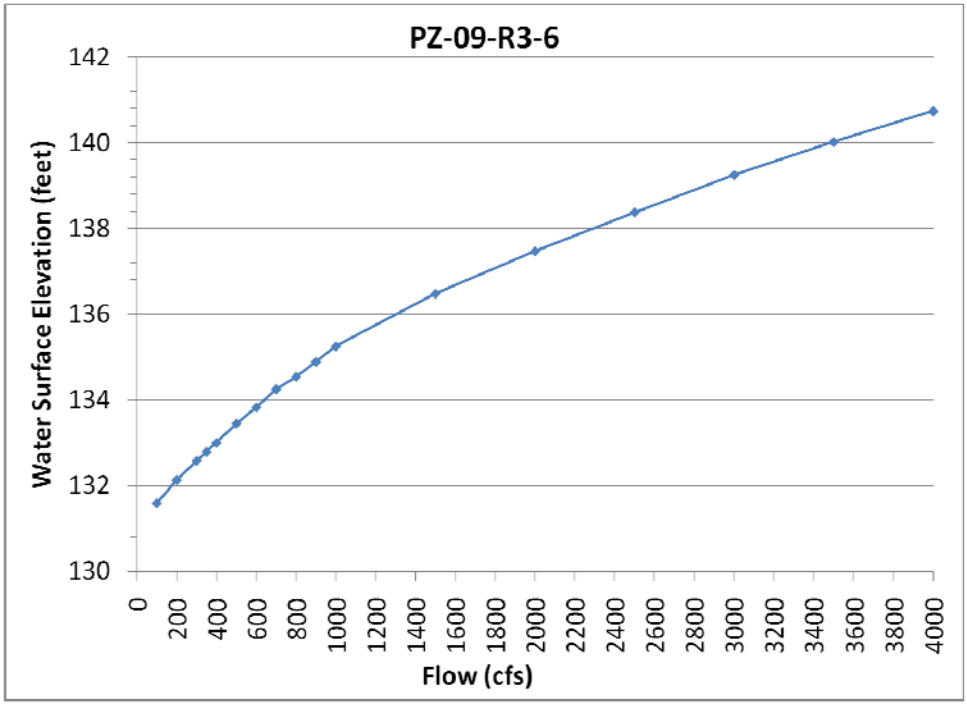

Figure 12. River Stage vs. Flow Rating Curve at Location PZ-09-R3-6

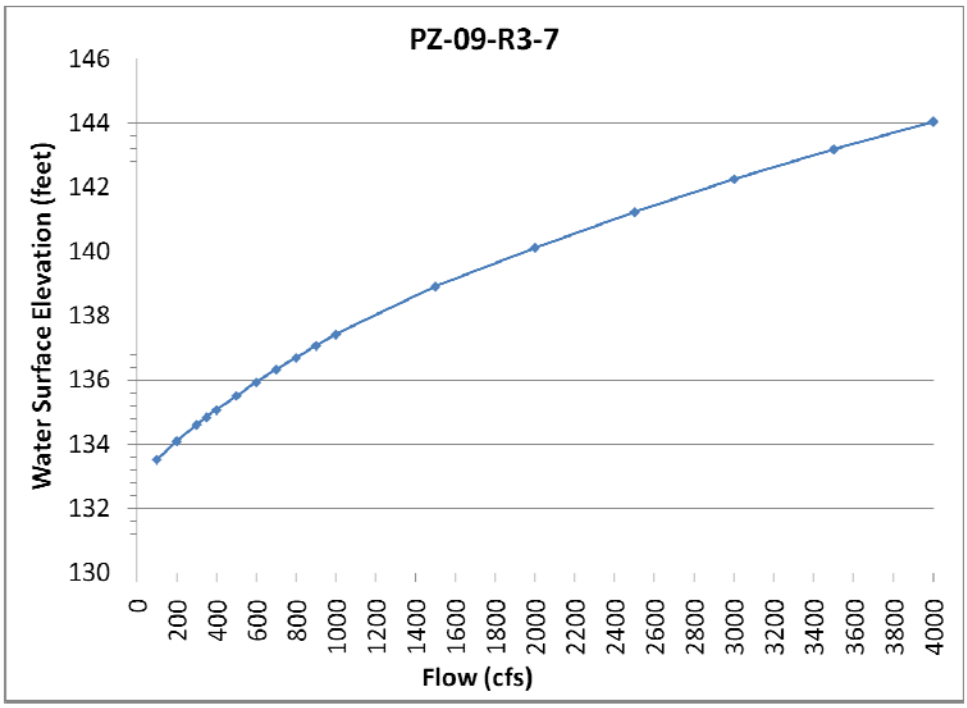

Figure 13. River Stage vs. Flow Rating Curve at Location PZ-09-R3-7

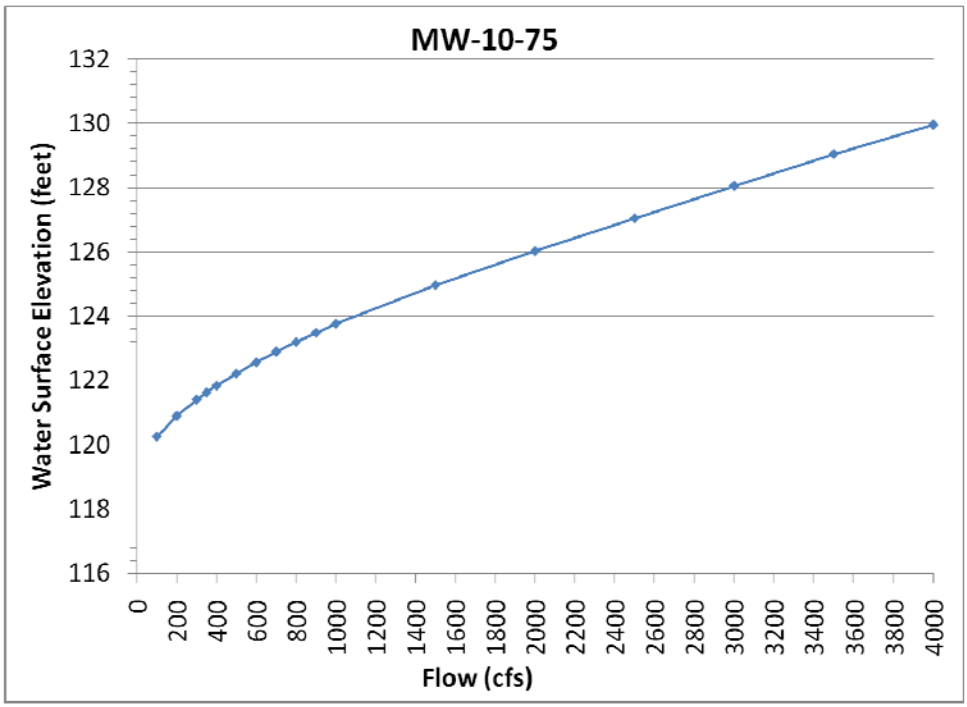

Figure 14. River Stage vs. Flow Rating Curve at Location MW-10-75

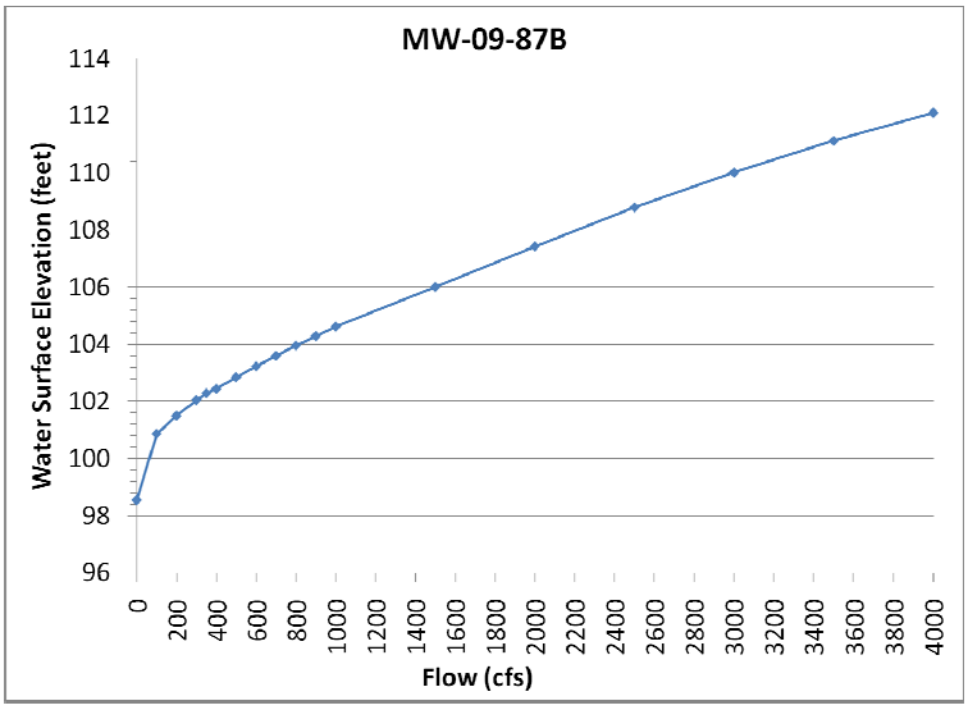

Figure 15. River Stage vs. Flow Rating Curve at Location MW-09-87B

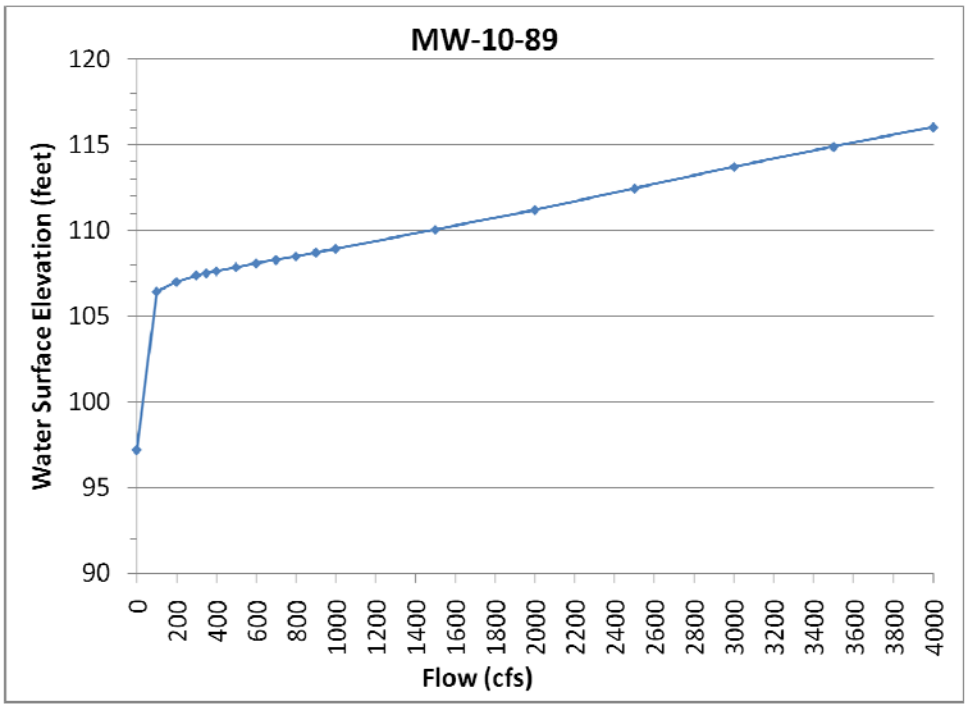

Figure 16. River Stage vs. Flow Rating Curve at Location MW-10-89

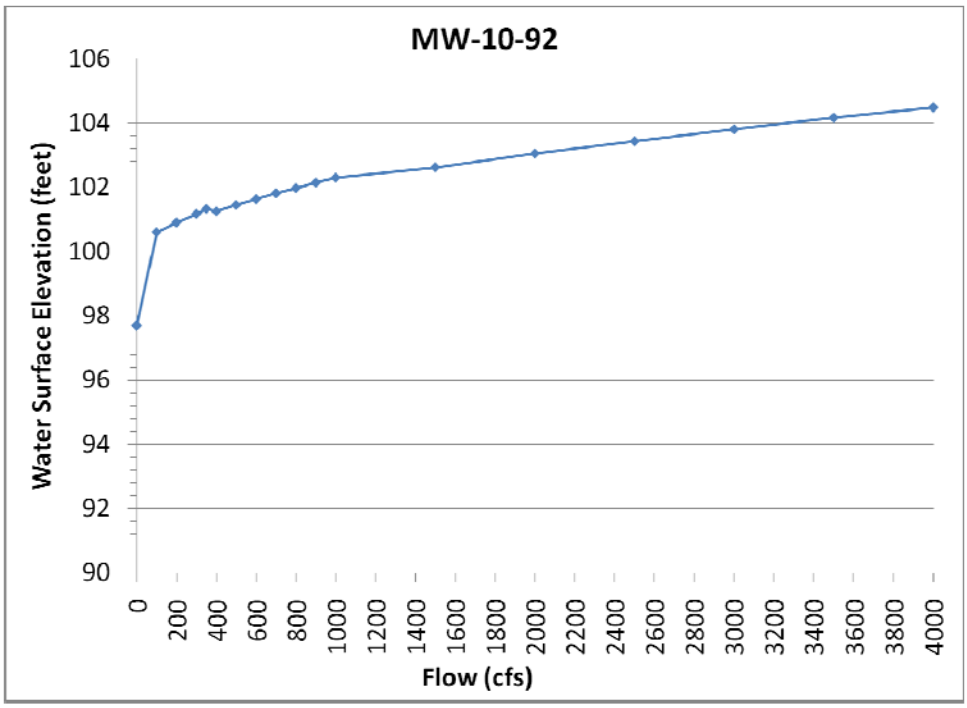

Figure 17. River Stage vs. Flow Rating Curve at Location MW-10-92

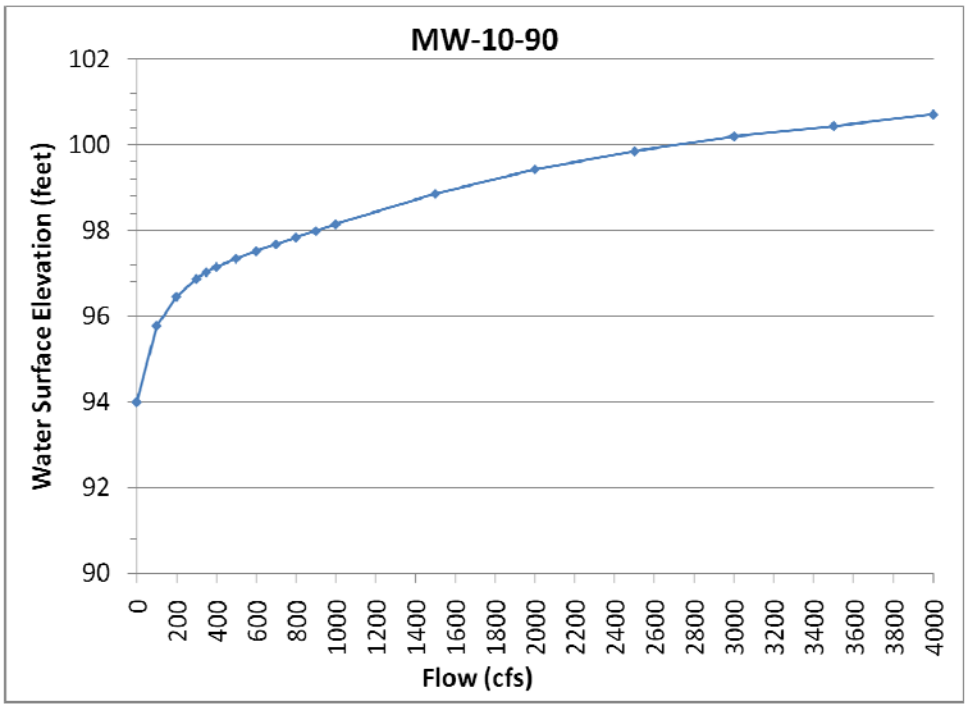

Figure 18. River Stage vs. Flow Rating Curve at Location MW-10-90

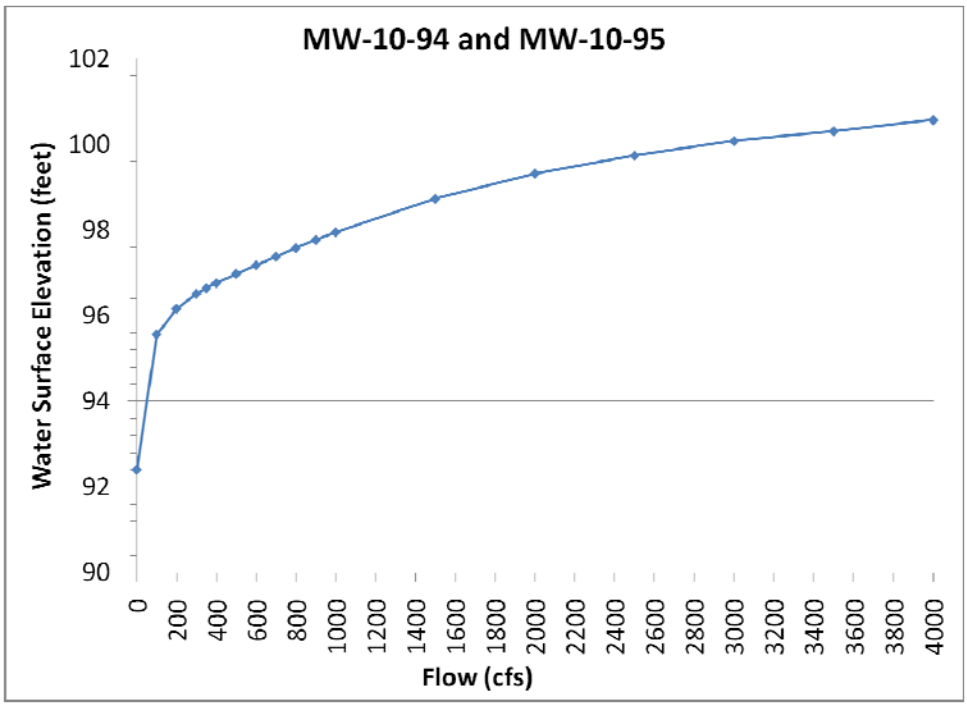

Figure 19. River Stage vs. Flow Rating Curve at Locations MW-10-94 and MW-10-95