DRAFT SJRRP Flow Bench Evaluation

April 12, 2013

The Restoration Administrator, as of April 11, 2013, recommends increasing releases from Friant Dam for Interim Flows and riparian diversions to 1060 cfs on April 12, 2013. To date, groundwater levels in monitoring wells adjacent to the Eastside Bypass continue to restrict flows below Sack Dam to 0 cfs. The combined release from Friant Dam including Interim Flow and riparian releases will be increased to 1060 cfs on April 12, 2013 at 3:00 pm.

As of April 12, 2013:

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

2. Operations Conference Call: During the week of April 8 the call has been held for daily discussion of demand in Mendota Pool. Operators have raised concerns regarding the amount of exchangeable demand available in Mendota Pool. Currently Mendota Pool demand is approximately 1036 cfs. If demand remains at this level through Thursday April 18, this allows the full 1060 cfs release from Friant (784 cfs at the pool) to be recaptured with an additional 500 cfs providing the remaining demand from the Delta Mendota Canal (DMC).

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 between Friant Dam and Mendota Pool are relatively stable, following the last change to 700 cfs at Friant Dam on Friday April 5.

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 April 6, 2013.

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

9. Water Districts: The SJRECWA and member agencies have identified concerns including the lack of exchangeable demand in Mendota Pool, and water quality in the lower DMC at flows <500 cfs, as 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. Interim Flows into Mendota Pool at a 1060 cfs release are estimated at 784 cfs based on the Settlement Exhibit B loss assumptions. Groundwater exchange

into Mendota Pool is currently at 57 cfs. Total inflows next week are predicted to be approximately 1341 cfs.

Mendota Pool Demands: Currently exchange contractor demand in Mendota Pool is approximately 651 cfs. Operational diversions currently provide 385 cfs of demand but will increase to 625 cfs of demand prior to April 18. This sums to a total demand of 1341 cfs by late next week.

Table 1: Approximate Predicted Mendota Pool Mass Balance

Demand			Inflow		
Sources	4/12/2013	4/18/2013*	Sources	4/12/2013	4/18/2013*
Mendota Pool Demand[1]	651	716[3]	DMC Flows	750[2]	500
Westlands	100	100	SJRRP	399	784
Meyers Water Bank	25	25	Pump-in	57	57
James ID	70	90			
CCID- in lieu of groundwater	190	360			
Panoche WD	0	50 (pending)			
SLCC- in lieu of groundwater	0	(pending)			
CCID routing to lower SJR	0	Contingency			
TOTAL	1036	1341		1206	1341

*Estimated

1. Total of demand including Exchange contractors, Tranquilty, Department of Fish and Wildlife, etc. Excludes recapture agreements set up by SJRRP.

2. DMC flows exceed orders today, to regain elevation in Mendota Pool.

3. Anticipated increase of at least 64 cfs by Thursday, April 18. If demand does not increase, SJRRP will exchange water with SLCC, or route water through CCID's system to the lower river.

Priority well MW-10-95 (Reach 4B1 Eastside Bypass) measurements show depths to groundwater at 1.43 feet above the threshold (3/30/13 measurement). 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 7 realtime wells as of April 11, 2013 and manual measurements from field staff as reported in the weekly groundwater report with a publish date of April 6, 2013 (or March 30, 2013 where noted). 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 2: Well Data

Well	Reach	1 - Measured Groundwater Depth in Well (feet bgs)	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	8.0	-3.7	2.5	6.8	5.0	Acceptable
MW-09-47	2A	8.25	-3.5	3.3	8.05	7.0	Acceptable
MA-4	2A	11.7	-6.1	4.6	10.2	7.0	Acceptable
MW-09-49B	2A	5.5	-1.7	2.4	6.2	4.5	Acceptable
MW-09-54B	2B	14.2	-7.9	5.5	11.8	10.0	Acceptable
MW-09-55B	2B	8.3	-3.7	3.0	7.6	7.0	Acceptable
PZ-09-R2B-1	2B	-	-1.3	0.0	-1.3	5.0	-
PZ-09-R2B-2	2B	8.6	-3.9	0.0	4.7	4.5	Acceptable
PZ-09-R3-5	3	11.8	-1.2	0.0	10.6	5.0	Acceptable
PZ-09-R3-6	3	10.6	-1.5	0.0	9.1	4.0	Acceptable
PZ-09-R3-7	3	9.4	-0.7	0.0	8.7	3.5	Acceptable
MW-10-75	3	10.9	-0.5	0.2	10.6	6.3	Acceptable
MW-11-130	4A	-	0.0	0.0	0	5.0	Acceptable
MW-09-87B	4A	-	-1.9	1.0	-0.9	4.2	-
MW-10-89	4A	13.4	-3.4	0.0	10	7.6	-
MW-10-92	4A	5.9	-2.6	0.0	3.3	5.0	Above Threshold
MW-10-90	4B1	6.3	0.8	0.0	7.1	7.0	Acceptable
MW-10-94	4B1	7.8*	0.0	1.0	1	7.0	Acceptable
MW-10-95	4B1	3.6*	-2.2	1.0	-1.2	5.0	Above Threshold
MW-11-142	4B1	5.4	0.0	0.0	5.4	4.0	Acceptable

bgs = below ground surface; GW = groundwater; *3/30/13 Report

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 3: Anticipated Change in Flows

	Recent Flows (cfs)	Projected Flows for Evaluation (cfs)
Reach 1	700	1060
Reach 2A	555	915
Reach 2B	455	784
Reach 3	100	110
Reach 4A	0	10
Reach 4B1 (ESB)	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 Figures 1 and 2. Field depths are calculated by taking the most recent measurements from Table 1, adding the ground surface and the lateral gradient buffer, and subtracting the maximum predicted stage increase, as shown below in Equation 2.

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

See Figure 4 and the last pages for the locations of these monitoring wells and the rating curves 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.

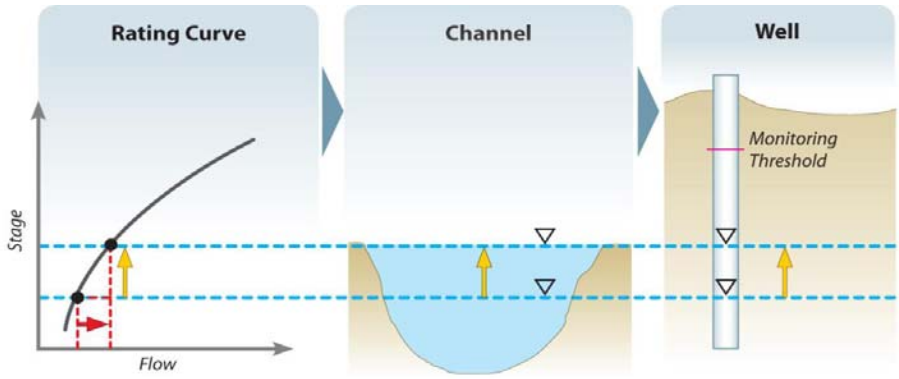


Figure 1: One to one surface to groundwater relationship for Increase in Stage Method

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

Well	Reach	1 - Measured Groundwater Depth in Well (feet bgs)	2 - Ground Surface Buffer (feet)	3 - Lateral Gradient Buffer (feet)	4 - Field GW Depth (feet bgs)	6 - Maximum Predicted WSEL Increase (feet)	7 - Predicted Shallowest GW Depth (feet bgs)	5 - Field Threshold (feet bgs)	Comment
FA-9	2A	8.0	-3.7	2.5	6.8	0.6	6.2	5.0	Acceptable
MW-09-47	2A	8.3	-3.5	3.3	8.1	0.6	7.5	7.0	Acceptable
MA-4	2A	11.7	-6.1	4.6	10.2	1.0	9.2	7.0	Acceptable
MW-09-49B	2A	5.5	-1.7	2.4	6.2	1.0	5.3	4.5	Acceptable
MW-09-54B	2B	14.2	-7.9	5.5	11.8	1.2	10.6	10.0	Acceptable
PZ-09-R2B-1	2B	-	-1.3	0.0	-	0.3	-	5.0	-
PZ-09-R2B-2	2B	8.6	-3.9	0.0	4.7	0.0	-	4.5	Acceptable
PZ-09-R3-5	3	11.8	-1.2	0.0	10.6	0.0	10.6	5.0	Acceptable
PZ-09-R3-6	3	10.6	-1.5	0.0	9.1	0.0	9.1	4.0	Acceptable
PZ-09-R3-7	3	9.4	-0.7	0.0	8.7	0.0	8.7	3.5	Acceptable
MW-10-75	3	10.9	-0.5	0.2	10.6	0.0	10.6	6.3	Acceptable
MW-11-130	4A	-	0.0	0.0	-	0.0	-	5.0	-
MW-09-87B	4A	-	-1.9	1.0	-	0.0	-	4.2	-
MW-10-89	4A	13.4	-3.4	0.0	10.0	0.0	10.0	7.6	Acceptable

Bgs = below ground surface; GW = groundwater; WSEL = water surface elevation

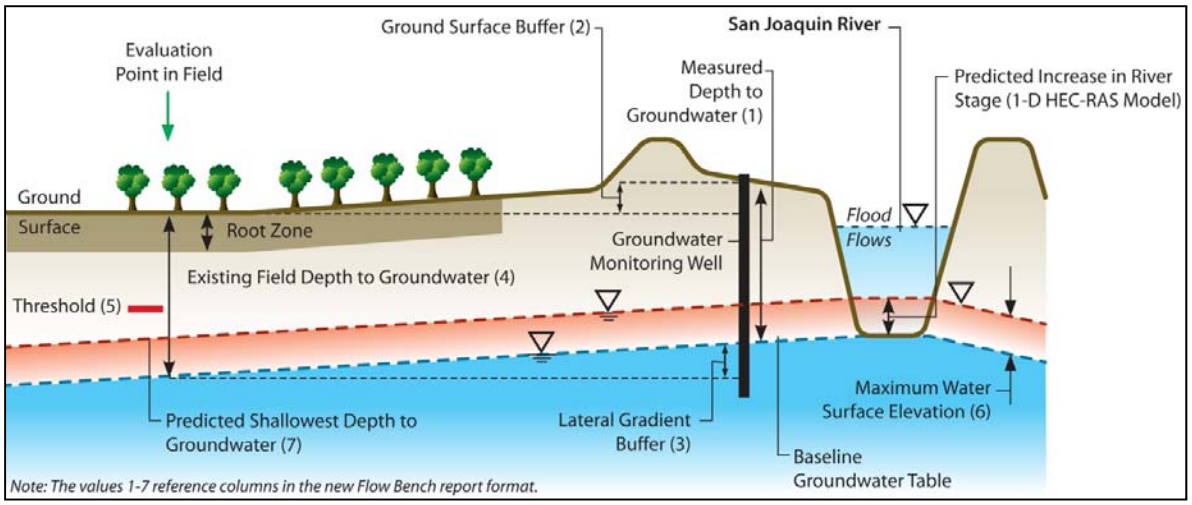


Figure 2: Conceptual Model for Increase in Stage Method

Table 4 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

Well	Reach	10 - Existing Field GW Elevation (feet)	11 - Predicted WSEL (feet)	12 - Threshold Elevation (feet)	Drainage Method Comment
MW-10-55B	2B	154.4	157.4	158.0	Acceptable
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

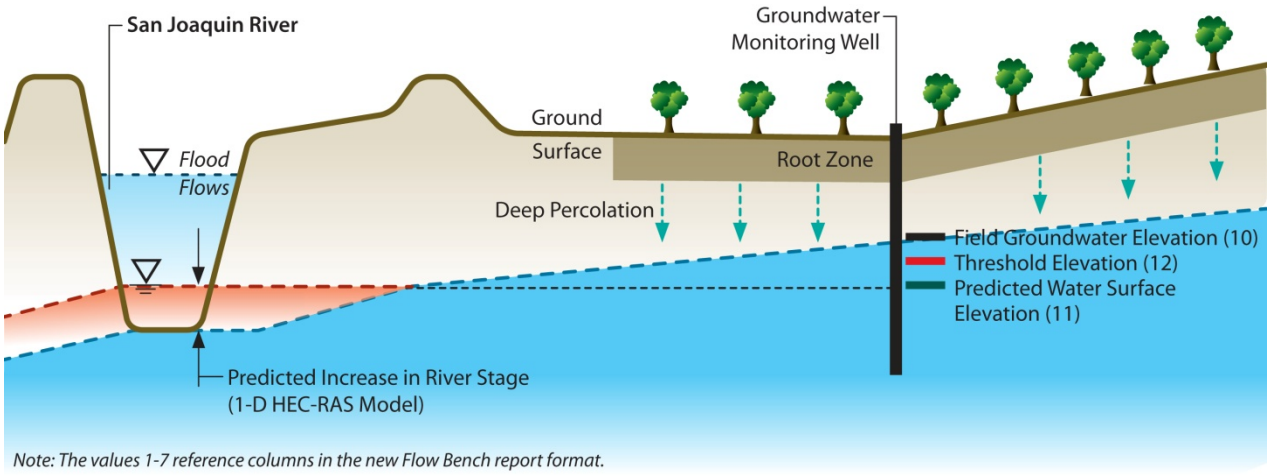


Figure 3: Conceptual Model for Drainage Method

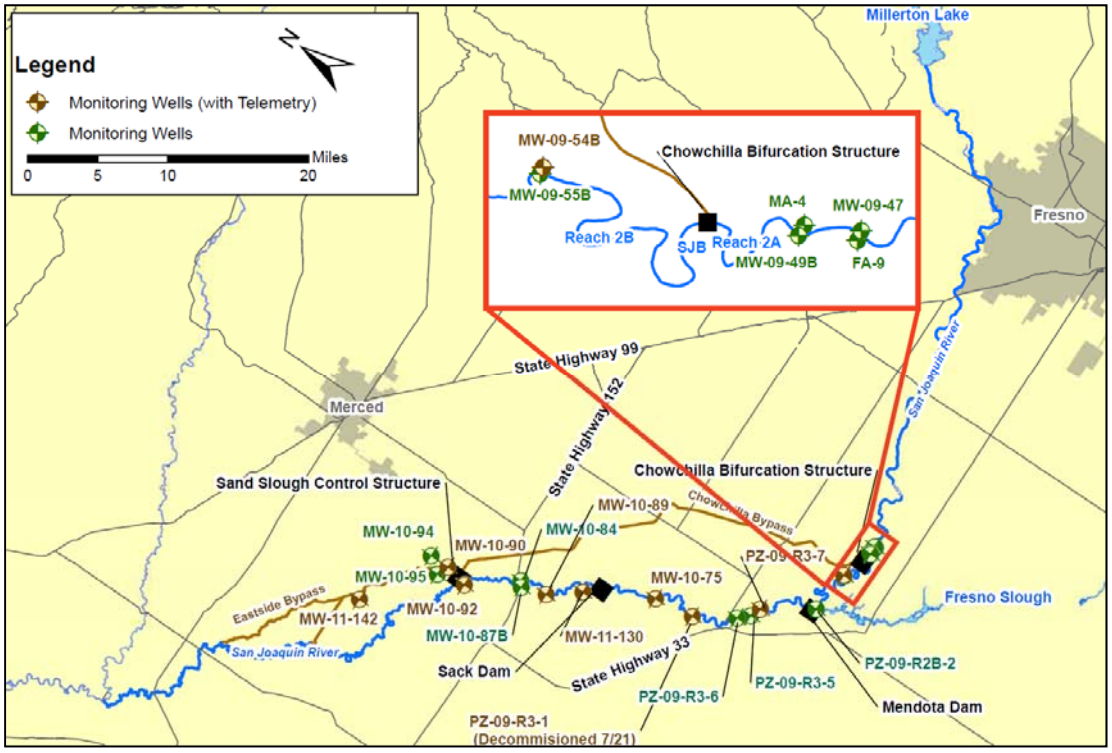
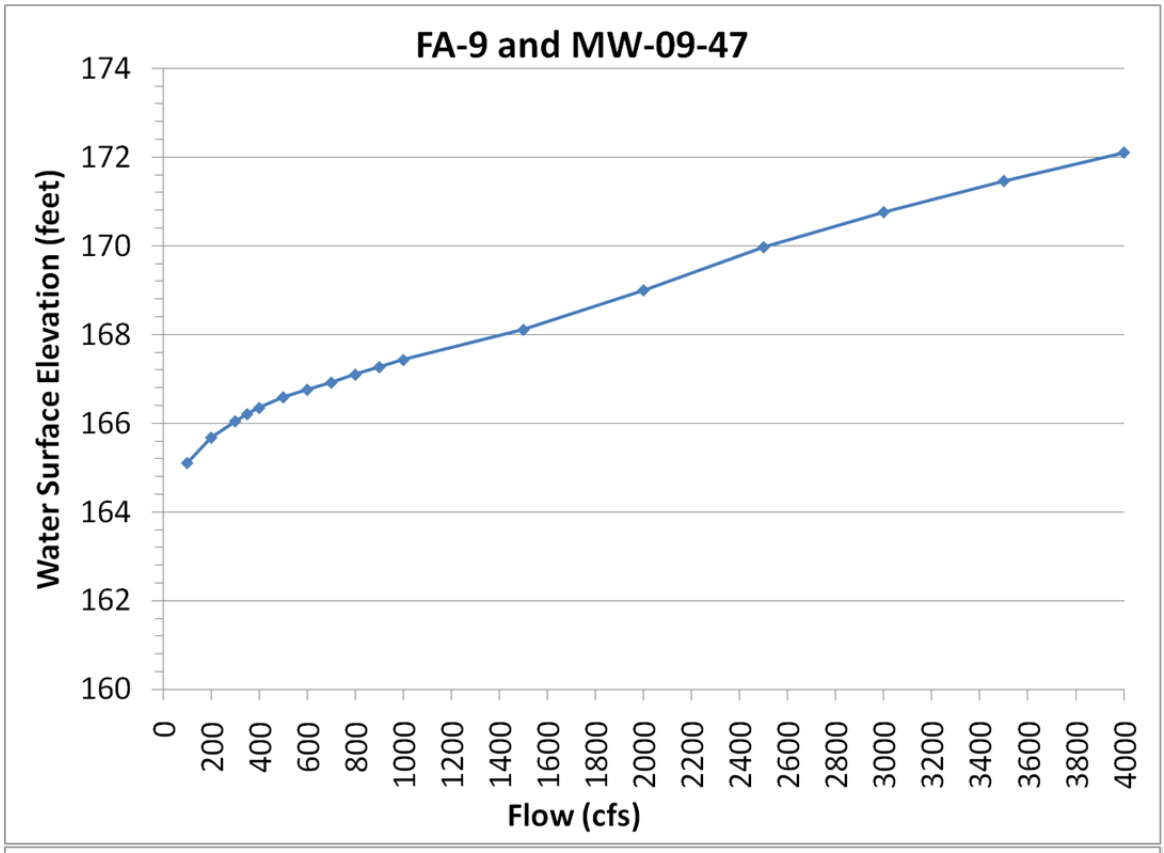
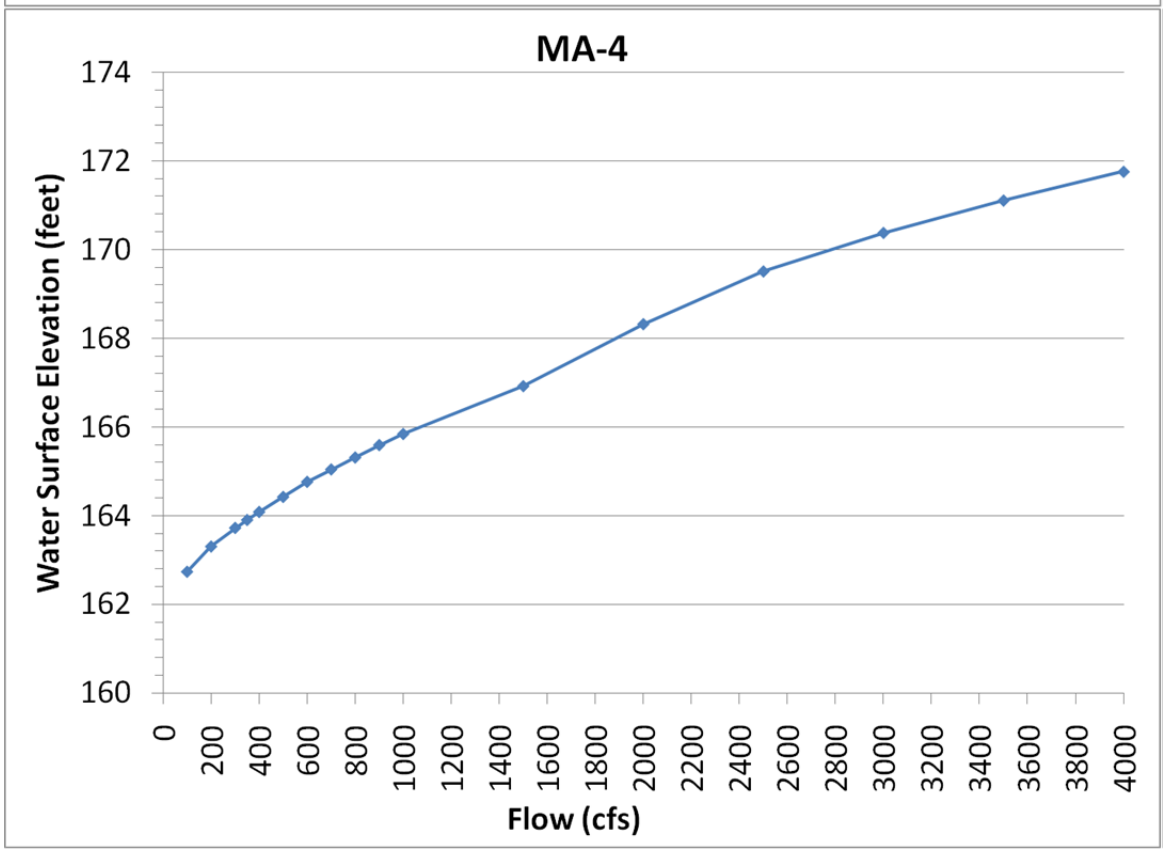
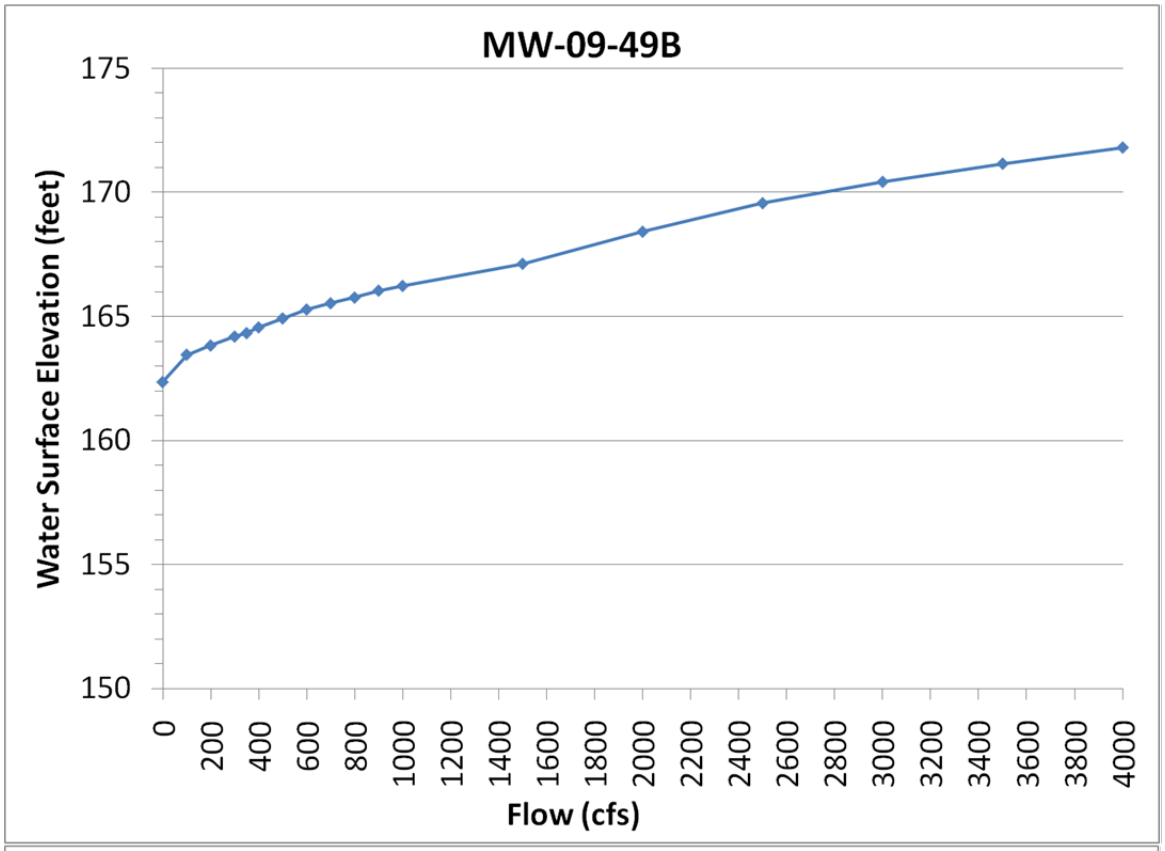
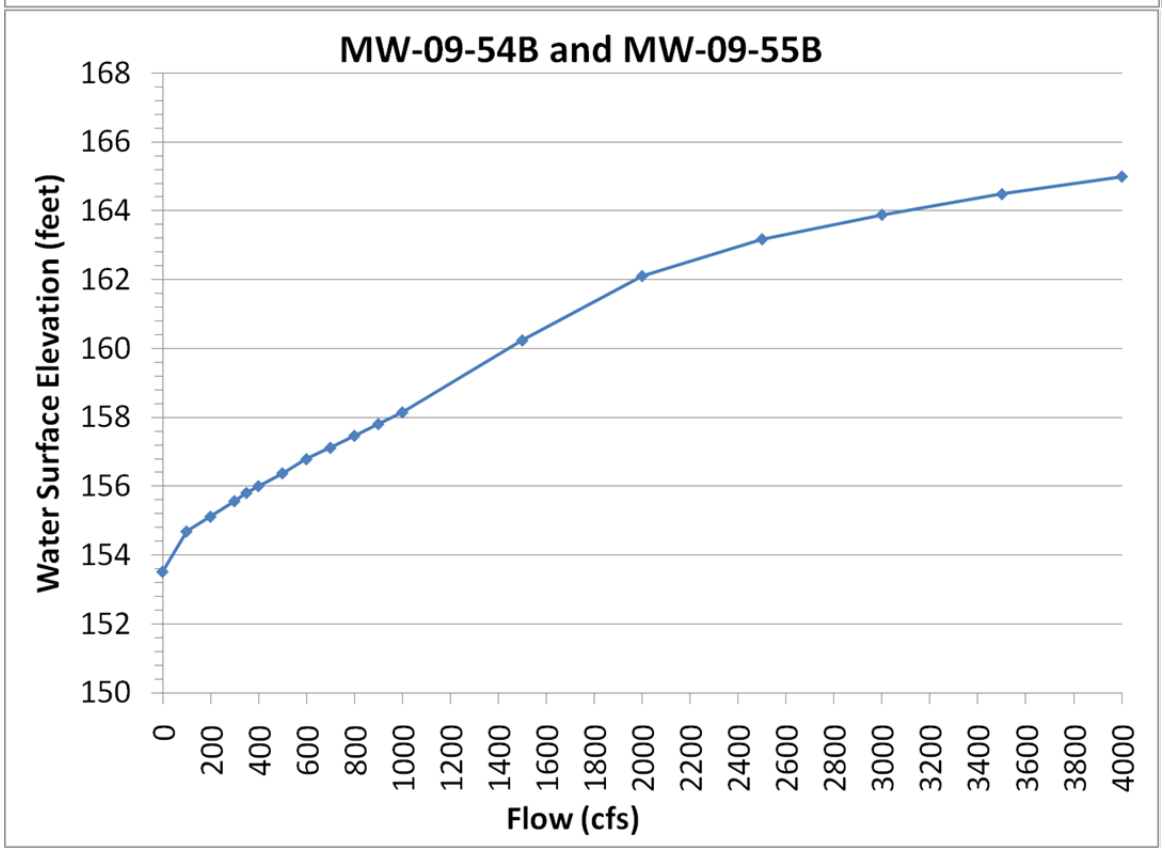


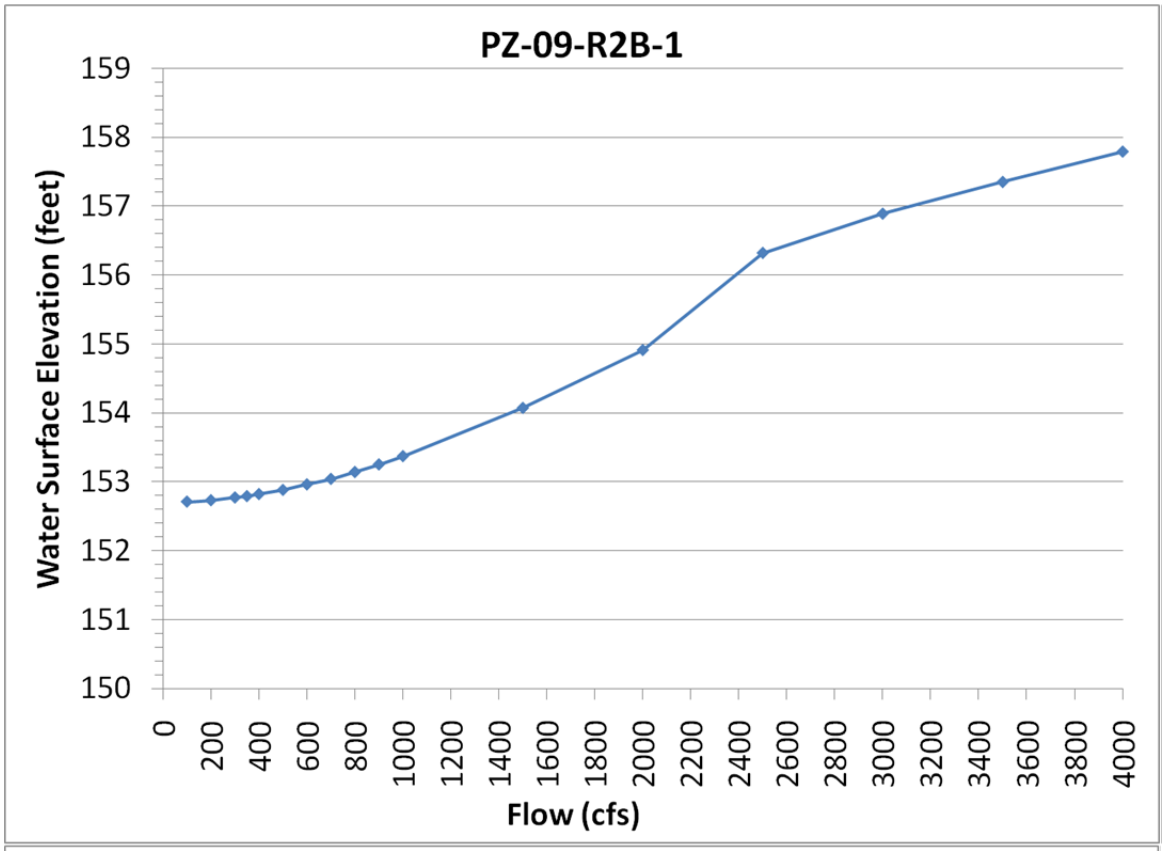
Figure 4: Key Monitoring Well Locations

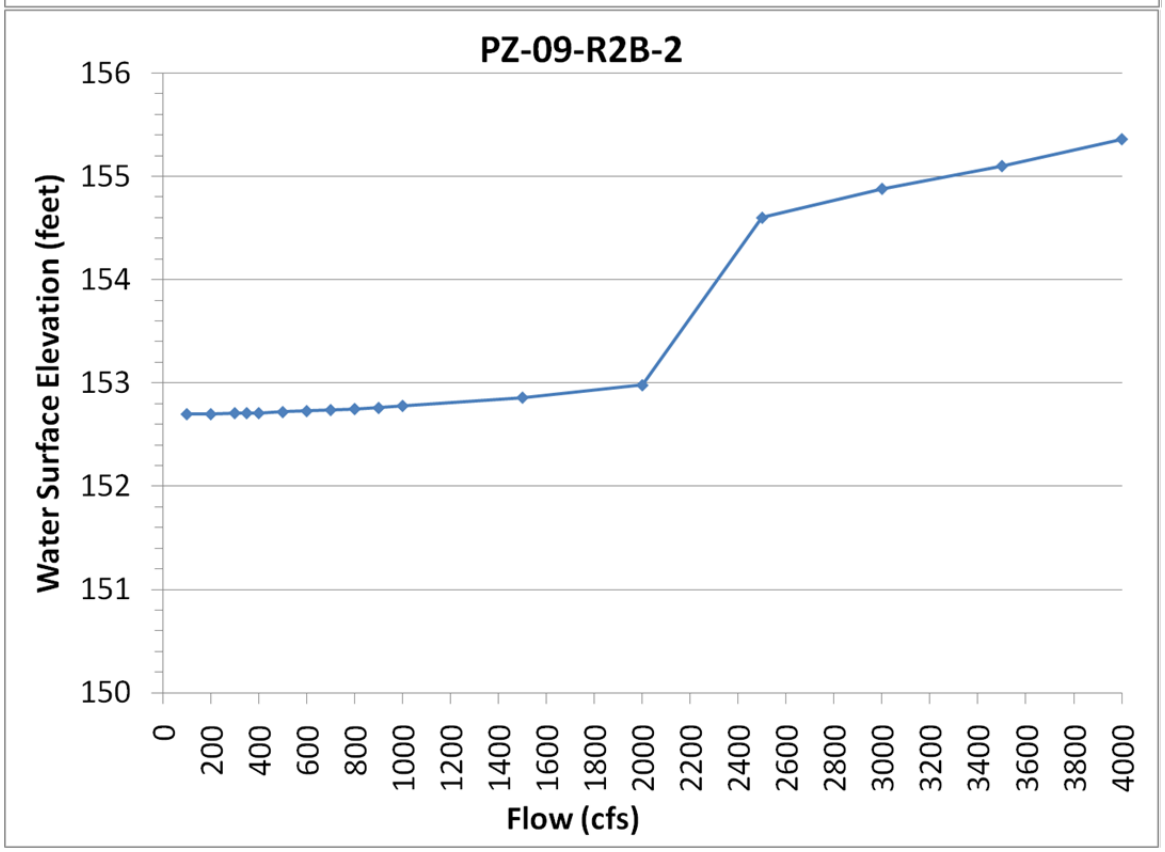

FA-9 and MW-09-47
Water Surface Elevation (feet)
174
172
170
168
166
164
162
160
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)

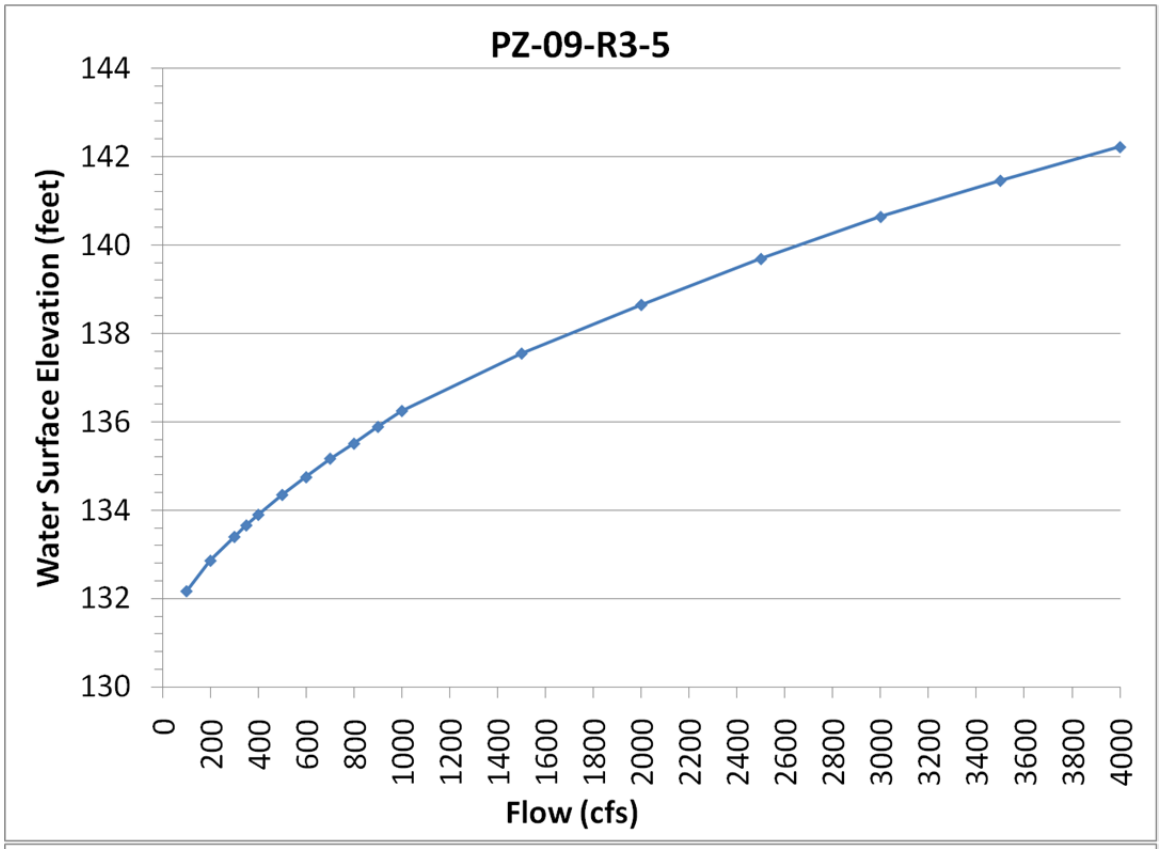

MA-4
Water Surface Elevation (feet)
174
172
170
168
166
164
162
160
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)

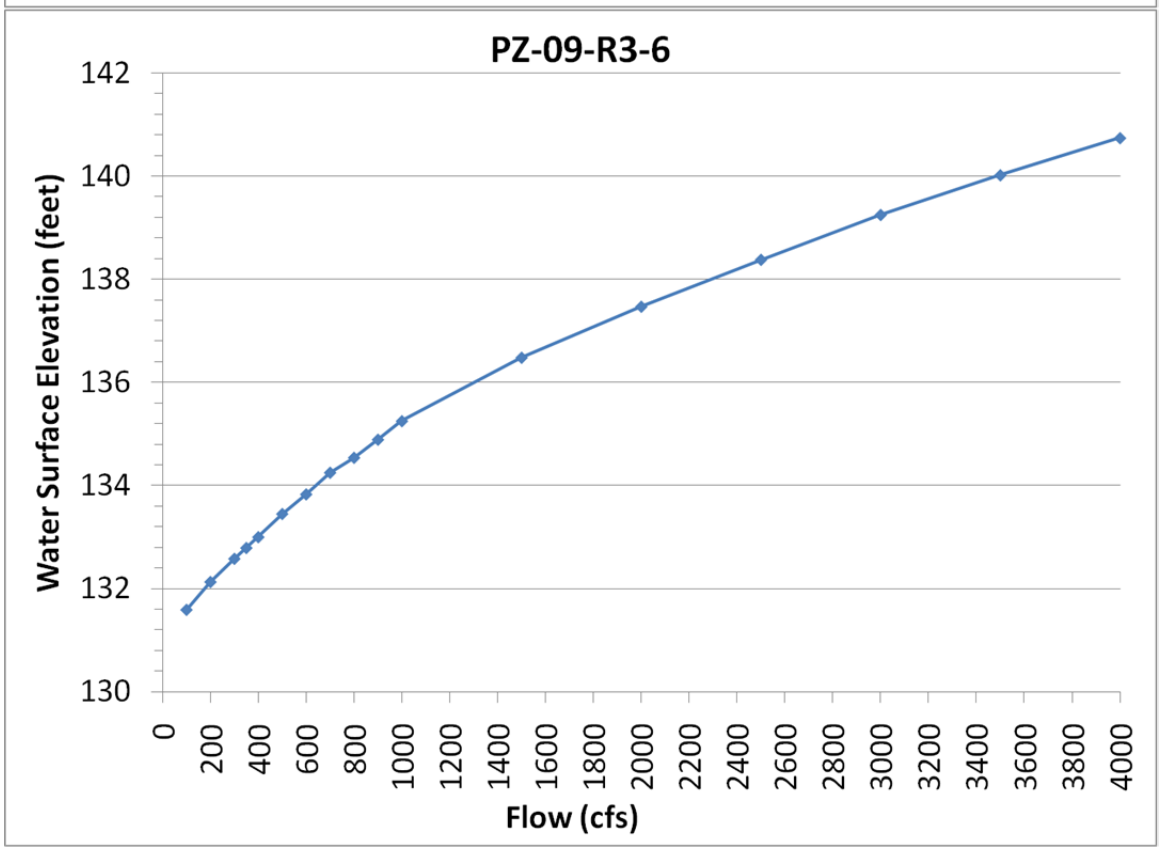

MW-09-49B
Water Surface Elevation (feet)
175
170
165
160
155
150
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)

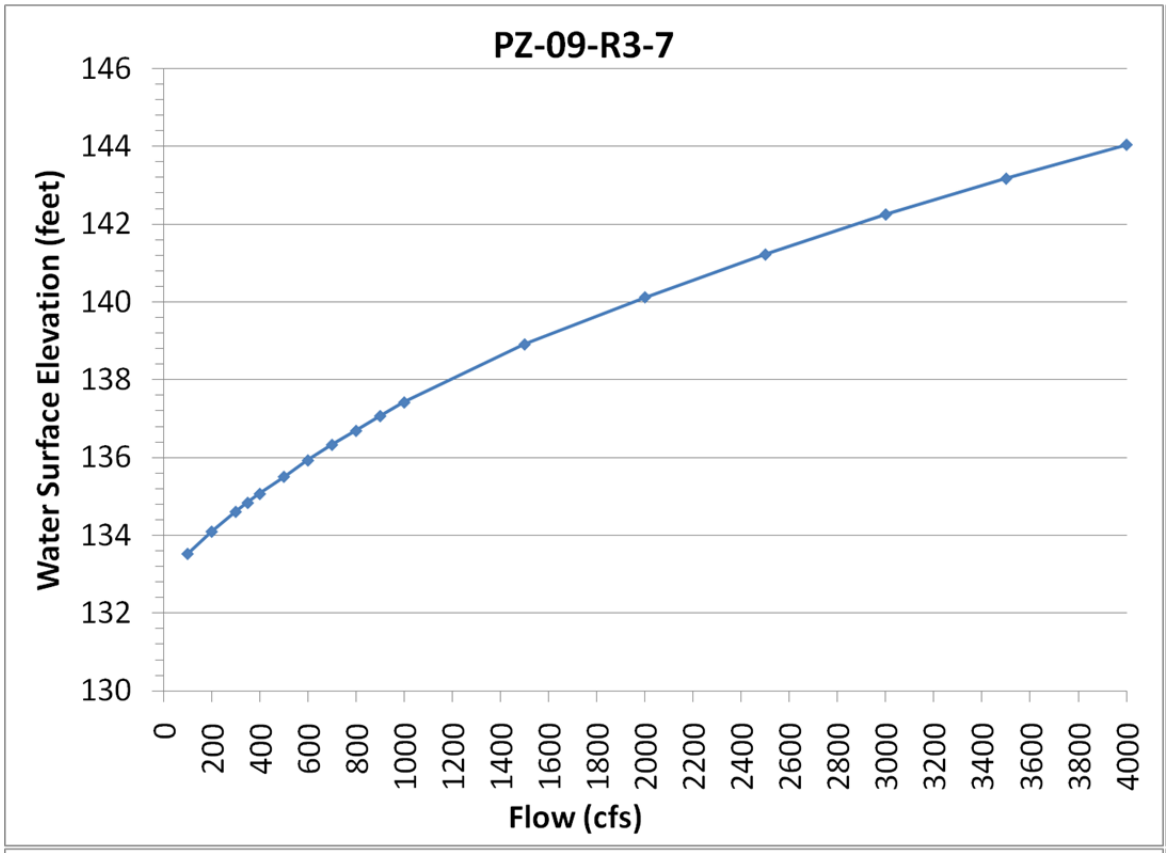

MW-09-54B and MW-09-55B
Water Surface Elevation (feet)
168
166
164
162
160
158
156
154
152
150
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)

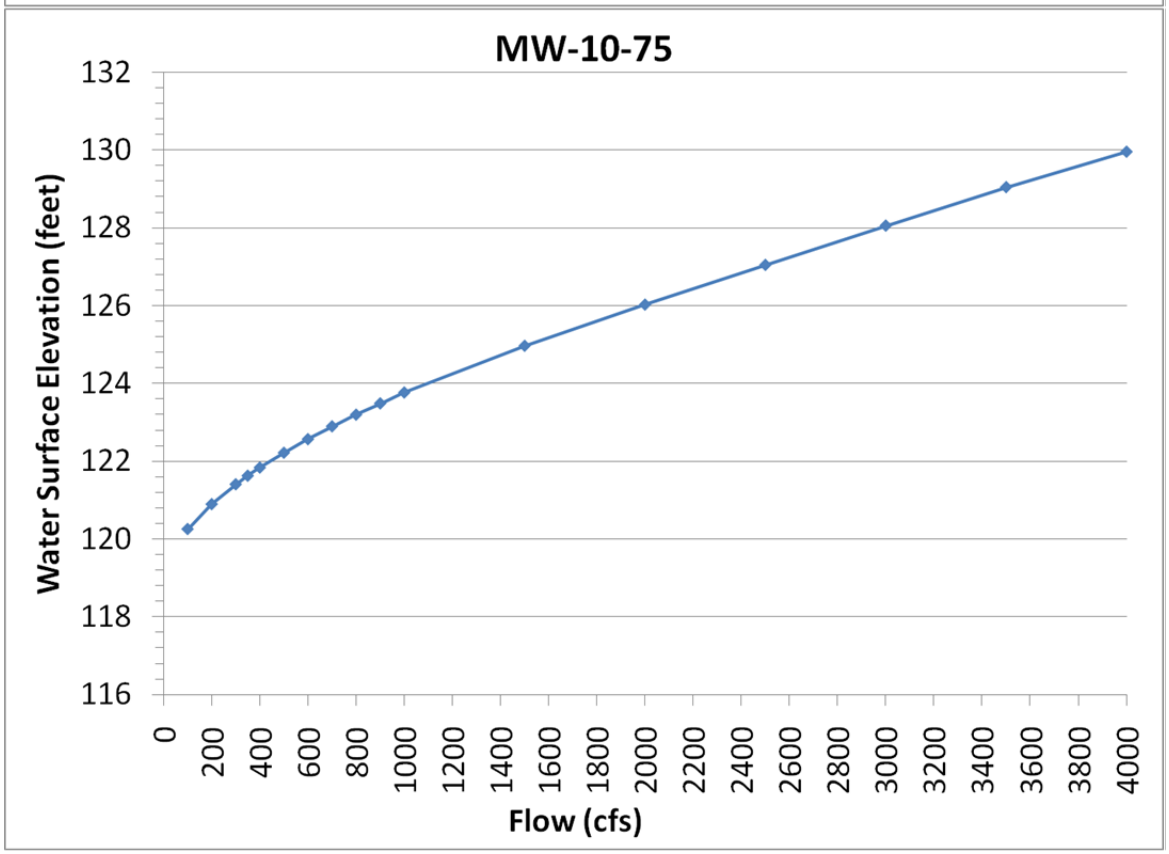

PZ-09-R2B-1
Water Surface Elevation (feet)
159
158
157
156
155
154
153
152
151
150
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)

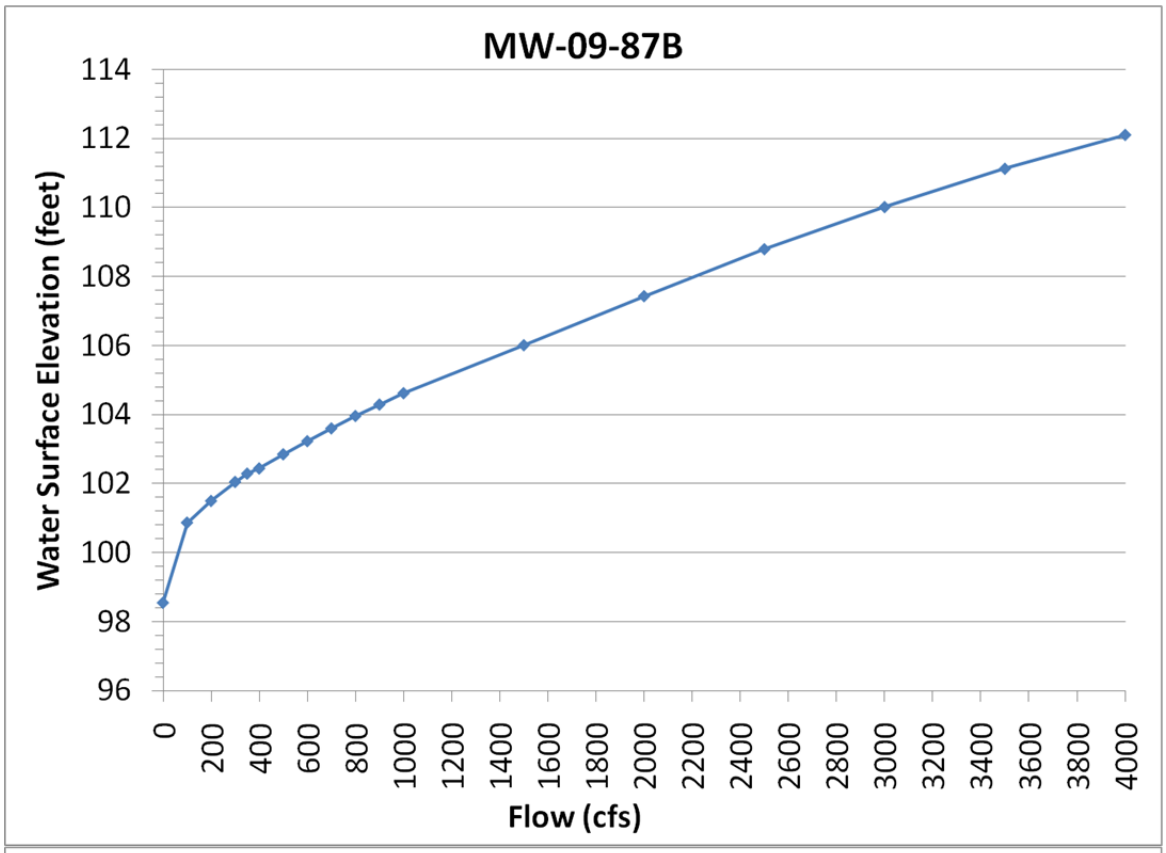

PZ-09-R2B-2
Water Surface Elevation (feet)
156
155
154
153
152
151
150
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)

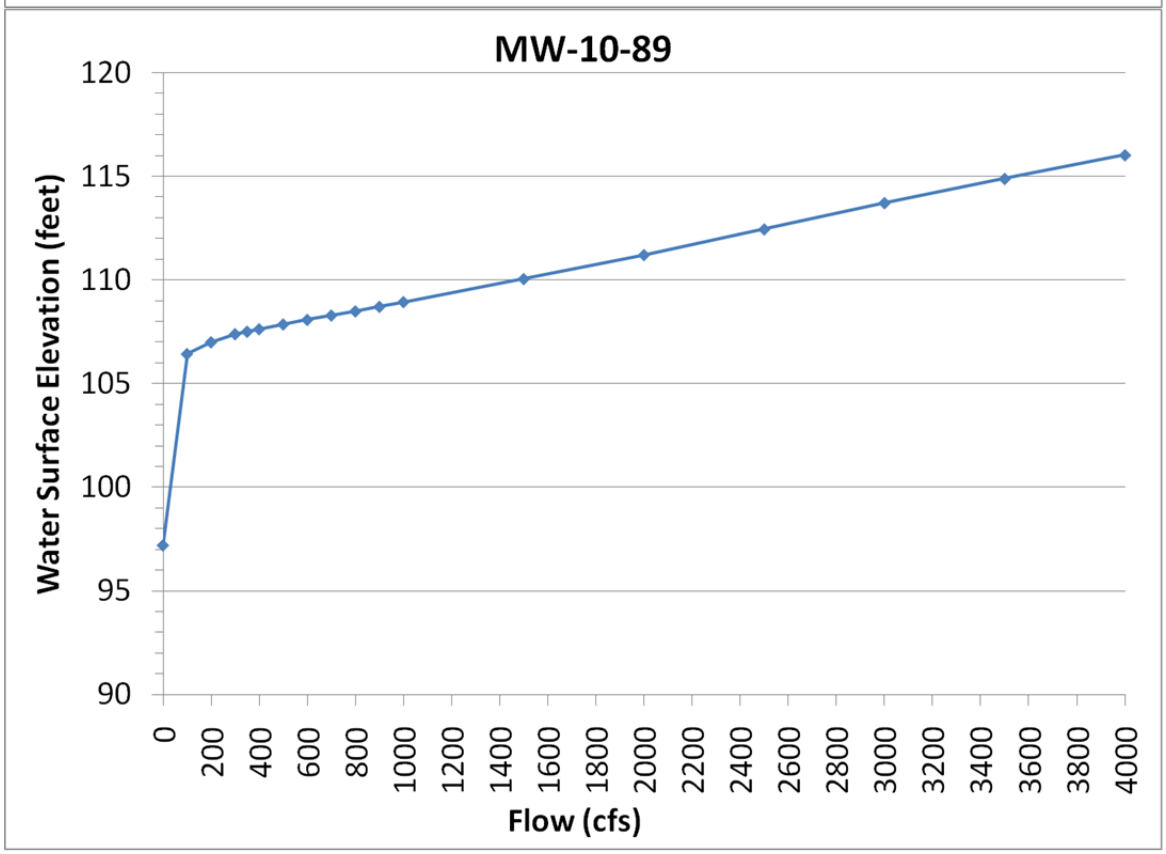

PZ-09-R3-5
Water Surface Elevation (feet)
144
142
140
138
136
134
132
130
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)


PZ-09-R3-6
Water Surface Elevation (feet)
142
140
138
136
134
132
130
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)


PZ-09-R3-7
Water Surface Elevation (feet)
146
144
142
140
138
136
134
132
130
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)


MW-10-75
Water Surface Elevation (feet)
132
130
128
126
124
122
120
118
116
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)


MW-09-87B
Water Surface Elevation (feet)
114
112
110
108
106
104
102
100
98
96
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)


MW-10-89
Water Surface Elevation (feet)
120
115
110
105
100
95
90
0
200
400
600
800
1000
1200
1400
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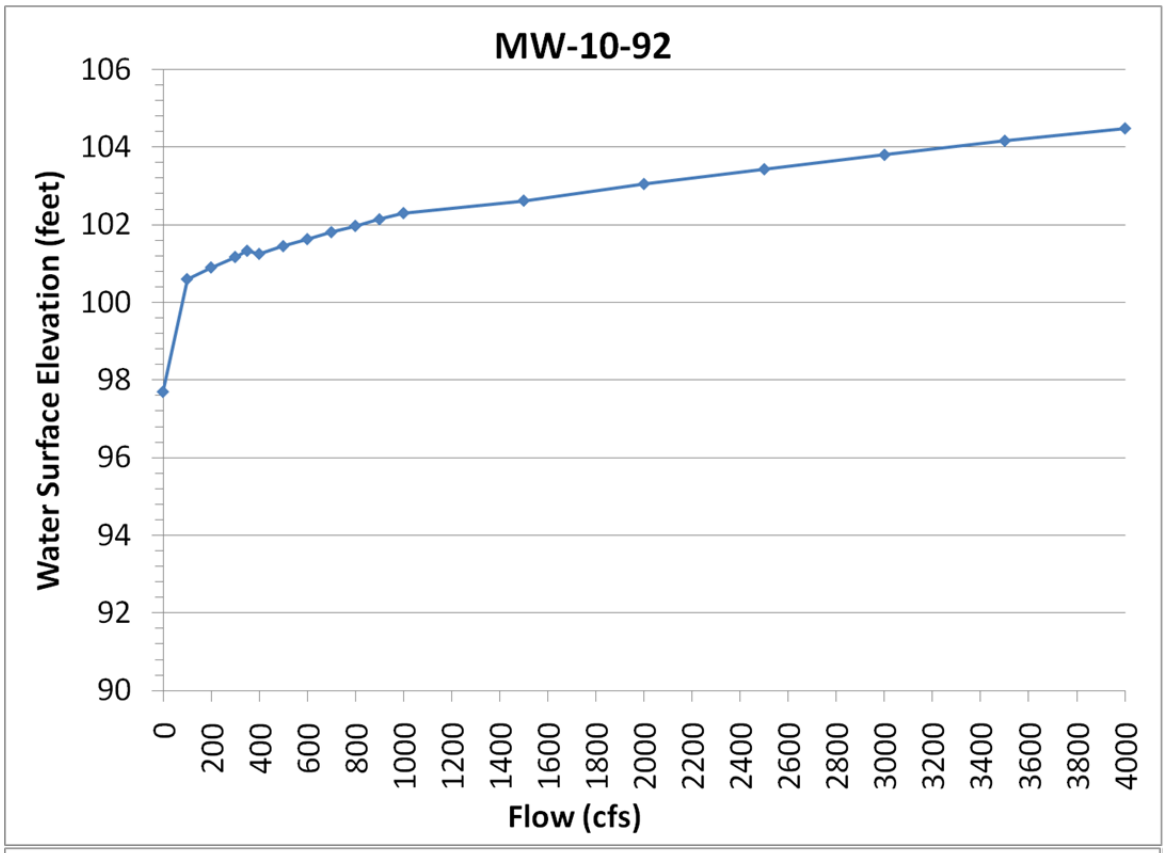
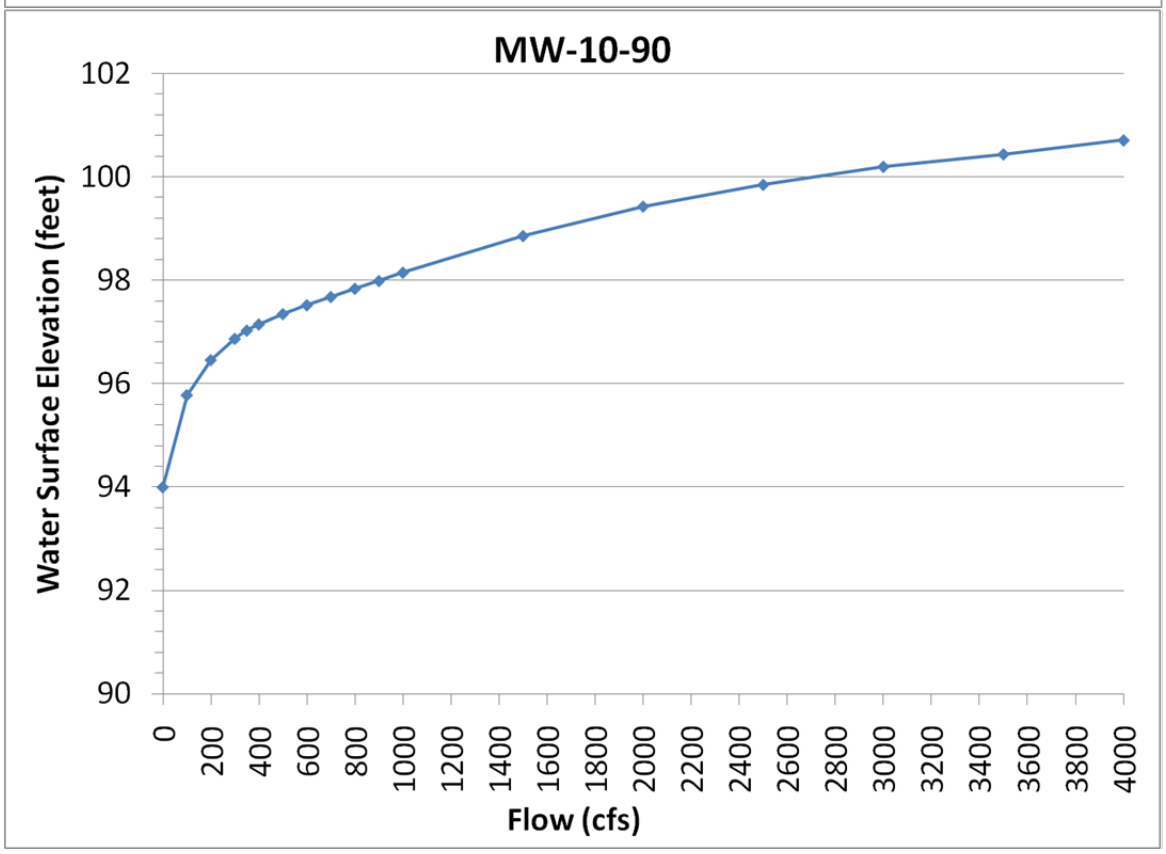
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)


MW-10-92
Water Surface Elevation (feet)
106
104
102
100
98
96
94
92
90
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)


MW-10-90
Water Surface Elevation (feet)
102
100
98
96
94
92
90
0
200
400
600
800
1000
1200
1400
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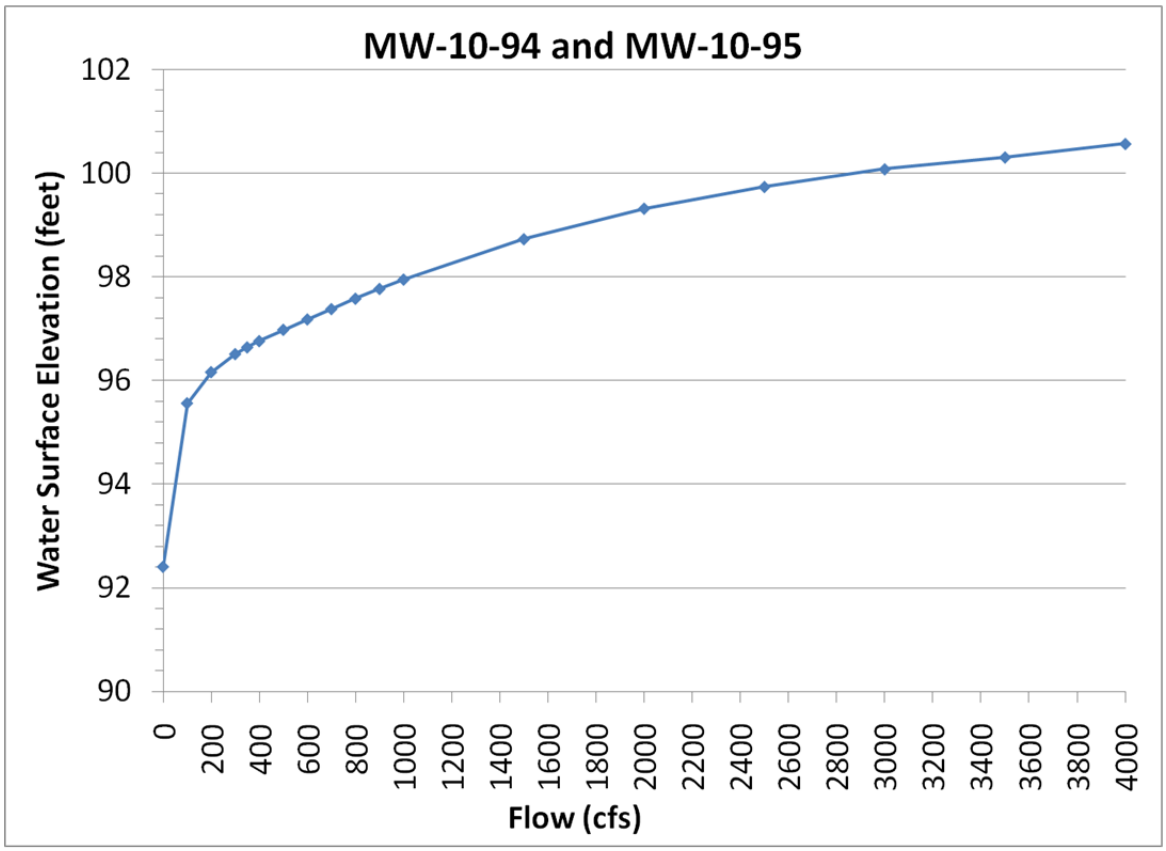
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)


MW-10-94 and MW-10-95
Water Surface Elevation (feet)
102
100
98
96
94
92
90
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Flow (cfs)