APPENDIX G

Preliminary Model Performance Technical Memorandum

To: Nicole Iadevaia; Jennifer Hecker; Andrew Webb;
Coastal and Heartlands National Estuary Partnership (CHNEP)

From: Marcelo Lago, PhD; Maria C. Bravo, PE, PhD;
Lago Consulting and Services, LLC;

Date: April 5th, 2021

Re: South Lee County Watershed Initiative Hydrologic Modeling Project: Task 7. Preliminary Model Performance.
City of Punta Gorda PO No. 050909

Background

The Coastal and Heartland National Estuary Partnership (CHNEP) has selected Lago Consulting & Services to perform updated surface and ground water integrated modeling of the South Lee County area under the South Lee County Watershed Initiative (SLCWI). The main objective of the project is to develop a new MIKE SHE model of the area. The model will be used to evaluate various alternative water management scenarios for enhancement of the water and environmental resources of the region for the interest of the SLCWI stakeholders.

This technical memorandum summarizes the Task 7 activities of the project related to the model performance evaluation of the preliminary SLCWI MIKE SHE model.

Model Predictions at Observation Stations

Statistics at Observation Stations

Table 1 summarizes the statistical measures of model performance at observation stations in the Saturated Zone (SZ) component of the preliminary SLCWI model. They include observation wells at the different model computational layers 1, 2, 3, and 4 corresponding to the Water Table (WT), Lower Tamiami (LT), Sandstone (SS) and Mid-Hawthorne (MH) Aquifers, respectively. Some monitoring stations recording water levels at wetlands are also assigned to computational layer 1. Additionally, **Table 2** and **Table 3** summarize the statistical measures of model performance at surface water stage and flow monitoring stations, respectively.

Table 1. Statistics at saturated zone (SZ) stations 2013-2019.

SZ Station	Layer	ME (ft)	MAE (ft)
37-GW07	1	-0.1	0.2
40-GW03	1	0.0	0.4
40-GW14	2	0.1	0.1
40-GW15	3	0.0	0.1
45-GW06	2	---	---
46A-GW03	1	0.6	0.8
46A-GW04	1	0.7	0.9
46A-GW05	1	-0.7	0.9
46A-GW09	1	-0.2	0.5
46A-GW10	1	0.0	0.5
46A-GW11	1	0.1	0.6
46A-GW12	1	-0.1	0.7
46A-GW14	1	0.0	0.6
46A-GW15	1	-0.5	0.5
46A-GW16	2	0.0	0.8
46A-GW18	1	-1.8	1.8
46A-GW19	1	-1.4	1.5
46A-GW25	1	1.1	1.1
46A-GW26	1	0.1	0.6
46A-GW27	1	0.6	0.7
46A-GW28	1	0.2	0.6
46A-GW29	1	1.5	1.5
46A-GW30	1	-0.1	0.4
46A-GW31	1	-0.6	0.7
46A-GW32	1	-0.2	0.7
46B-GW01	1	1.3	1.3
46B-GW02	1	0.7	1.0
47A-GW01	2	-1.3	1.3
47A-GW02	1	-0.2	1.0
47A-GW03	2	-0.4	0.5
47A-GW04	1	-0.2	0.9
47A-GW05	1	-0.2	0.6
47A-GW06	1	1.1	1.1
47A-GW07	1	0.0	0.8
47A-GW08	1	-0.2	0.6
47A-GW10	1	0.0	1.0
47A-GW11	1	1.2	1.2
47A-GW12	1	-1.3	1.3
47A-GW13	1	-0.5	0.7
47A-GW14	1	-0.5	0.8

SZ Station	Layer	ME (ft)	MAE (ft)
47A-GW15	2	---	---
47B-GW02	1	0.6	1.4
48-GW01	1	-0.3	1.5
48-GW03	1	0.6	0.9
48-GW04	1	-0.1	1.9
48-GW5	1	---	---
49-GW01	1	0.0	0.1
49-GW02	1	-1.2	1.3
49-GW03	1	-1.8	1.9
49-GW04	1	-1.3	1.3
49-GW05	1	-0.6	0.8
49-GW06	1	0.1	0.5
49-GW07	1	-0.3	0.8
49-GW08	1	-1.2	1.2
49-GW09	1	0.4	0.7
49-GW10	1	0.6	1.2
49-GW11	1	0.7	1.4
49-GW12	1	1.3	1.3
49-GW13	1	-1.3	1.5
49-GW14	1	1.0	1.4
49-GW15	1	3.7	3.7
49-GW16	4	-1.0	1.0
49-GW17	1	3.4	3.4
49-GW19	1	2.7	2.7
49-GW20	1	0.2	0.8
49-GW22	1	-0.7	0.8
49-GW23	1	0.4	1.3
49-GW24	1	0.3	1.0
49-GW25	1	-1.2	1.3
49L-GW01	1	---	---
49L-GW03	1	-0.2	1.4
49L-GW04	1	0.9	1.1
951EXT	1	-0.9	0.9
BRDROOK_SW	1	0.9	1.0
C-0492	2	-1.8	1.8
C-1080	3	8.5	8.5
C-1280	1	0.0	0.0
C-1244	2	-3.0	3.1
C-1245	2	-1.5	1.6
C-1279	2	0.0	0.0

Table 1. Statistics at saturated zone (SZ) stations 2013-2019 (continuation)

SZ Station	Layer	ME (ft)	MAE (ft)
CRKSWPS	1	-0.7	0.7
DEW-MW4	1	-1.0	1.1
FP02_GW1	1	-0.6	0.7
FP07_GW1	1	---	---
FP08_GW1	1	-1.6	1.6
FP11	2	-0.6	1.0
HF1_G	1	-0.9	1.2
HF2_G	1	---	---
HF3_G	1	---	---
HF4_G	1	---	---
HF6_G	2	-4.0	4.0
HF7_G	1	---	---
L-0728	2	0.2	0.2
L-0729_G	3	0.3	1.2
L-0730	1	0.0	0.1
L-0731_G	3	-2.8	3.1
L-0735_G	4	-9.0	9.0
L-0738_G	2	-0.2	1.7
L-1138	1	0.2	0.4
L-1625_G	3	0.2	0.2
L-1691_G	2	-3.5	3.5
L-1853R	3	-14.3	14.3
L-1983_G	4	7.4	7.4
L-1985	2	-1.6	1.6
L-1993	4	-10.0	10.0
L-1994	3	-5.0	5.0
L-1995	2	-1.1	1.1
L-1998	3	-14.9	14.9
L-1999	1	-1.1	1.2
L-2192	3	-6.5	6.6
L-2193	3	-28.4	28.4
L-2194	3	-3.3	3.3
L-2195	1	1.2	1.3
L-2204	2	0.2	0.2
L-2215	3	-1.3	1.3
L-2550	2	-1.7	1.7
L-5648	3	-3.0	3.3
L-5667	2	0.4	0.6
L-5668R	3	-9.6	9.6
L-5673	3	-7.6	7.6

SZ Station	Layer	ME (ft)	MAE (ft)
L-5720	1	0.4	0.6
L-5724	1	3.8	3.8
L-5725	2	0.2	0.2
L-5730	1	2.5	2.5
L-5745R	2	-2.7	3.0
L-5747	2	-8.2	8.2
L-5808	4	-14.7	14.7
L-5844	2	0.6	0.7
L-5874	2	-1.0	1.1
Pa_MW1	1	0.4	0.5
Pa_MW2	1	-0.4	0.5
Pa_MW3	1	-0.5	0.5
Pa_MW4	1	-0.4	0.6
Pa_MW5	1	0.1	0.4
Pa_MW6	1	-0.2	0.4
Pa_MW6A	2	-0.4	0.5
Pa_MW7	1	0.1	0.5
Pa_MW8	1	-0.5	0.6
Pa_MW9	1	-0.5	0.6
Pa_MW10	1	-0.5	0.7
Pa_MW11	1	-0.1	0.4
Pa_MW12	1	-0.4	0.5
Pa_MW13	1	-0.2	0.3
Pa_MW14	1	-0.1	0.4
Pa_MW14A	2	0.8	1.4
Pa_MW15	1	-0.8	0.8
PWS-MW2	1	-2.7	2.7
PWS-MW3	1	-2.1	2.1
SOCREW1	1	-0.4	0.5
SOCREW2	1	-0.2	0.4
ST1_G	1	-0.1	0.5
ST2_G	1	0.0	0.5
ST3_G	1	---	---
WF2_G	1	0.1	0.7
WF3_G	1	0.8	1.0
WF4_G	1	---	---
WF5_G	1	---	---
WF6_G	1	---	---
WF7_G	1	---	---
WF7_G2	2	---	---

Table 1. Statistics at saturated zone (SZ) stations 2013-2019 (continuation)

SZ Station	Layer	ME (ft)	MAE (ft)
Northwest_Lake1	1	-0.2	0.3
Thumb_Central_Lake2	1	-0.3	0.5
Shark_Southeast_Lake3	1	-0.2	0.4
Finger_South_Lake4	1	-0.3	0.5
Esplanade_W2	1	-0.8	0.9
CS PZ-23	1	-0.9	1.2
GM_MW-1	3	-18.4	18.4
GM_MW-2	3	-9.2	9.2
GM_MW-3	3	-14.1	14.1
GM_MW-4	3	-11.0	11.0
GM_P-5	1	0.2	1.1
GM_P-6	1	-3.3	3.3
GM_PZ-9	1	-1.4	1.5
GM_SG-1	1	0.3	0.9
GM_SG-2	1	-0.4	0.7
GM_SG-9	1	1.8	1.8
MPW04	1	0.0	0.3
MPW07	1	-0.2	0.4
MPW08	1	1.0	1.2

SZ Station	Layer	ME (ft)	MAE (ft)
MPW09	1	-0.8	1.1
MPW11	1	-0.4	0.5
MPW14	1	0.5	1.0
MPW19	1	-0.4	1.2
MPW30	1	-0.6	0.8
MPW33	1	-0.5	0.7
MPW35	1	-1.0	1.0
BSU_MW-1	2	-3.9	4.0
BSU_MW-2	2	-2.1	2.9
BSU_MW-3	2	-1.5	1.7
BSU_MW-4	2	-11.3	11.3
BSU_MW-5	2	-1.9	2.8
BSU_MW-6	1	0.9	1.2
BSU_MW-7	2	-0.8	2.5
BSU_MW-8	2	-8.1	8.1
PIMB_MW-8	1	-0.4	0.8
PIMB_MW-9	1	-0.4	0.6
PIMB_MW-10	1	-0.9	1.1
PIMB_MW-11	1	-0.5	0.8

Table 2. Statistics at MIKE11 stage stations 2013-2019

Stage Station	ME (ft)	MAE (ft)
COCO3_H	0.0	0.0
COCO3_T	0.0	0.0
COCOH.95_H	---	---
Copperleaf	---	---
CORK	-0.6	0.6
CORK2	-0.1	0.1
CORK3	0.4	0.5
Estero_NB	0.2	0.6
Estero_SB	-0.3	0.6

Stage Station	ME (ft)	MAE (ft)
Halfway Creek S HW	---	---
Halfway Creek S TW	---	---
HalfwayCrDS HW	1.6	1.6
HalfwayCrDS TW	---	---
IMPERIA1	0.5	0.9
KEHL_H	0.0	0.8
KEHL_T	0.8	1.0
Spring_Ck	0.0	0.3

Note: Copperleaf and Halfway Creek stations data was not available at the time of the preliminary model simulation.

Table 3. Statistics at MIKE11 flow stations 2013-2019

Flow Station	CFE(%)
Estero_NB_Q	13
Estero_SB_Q	-21

Flow Station	CFE(%)
IMPERIAL_Q	6
Spring_Ck_Q	71

MIKE SHE uses the difference between the observed values and the simulated values to compute the mean error (ME) and the mean absolute error (MAE) at the monitoring stations. Note that a positive mean error in Table 1 and Table 2 (highlighted in orange) means that observation values are higher than the simulated ones, in average, and therefore, that the model is underpredicting the observed water levels, in average. On the contrary, negative ME values (highlighted in blue) mean model overprediction, in average.

In the case of the MAE values in Table 1 and Table 2, they are highlighted in darker orange when the MAE value is higher. Notice that it is advantageous to consider both metrics, ME and MAE, since a map of ME values may reveal systematic differences (i.e., model under- or over-prediction) in certain areas, while the MAE quantifies the absolute error.

The cumulative flow errors (CFE) at surface water flow stations are computed outside of the MIKE SHE software. The MIKE SHE convention for the ME is followed, and a positive CFE (highlighted in orange) in Table 3 means that observed cumulative value is higher than the predicted one, and therefore, that the model is underpredicting the observed cumulative flow. On the contrary, negative CFE values (highlighted in blue) mean model overprediction.

The spatial distribution of the ME values is presented in the maps of **Figure 1** and **Figure 2**. The spatial distribution of the CFE values is also presented in **Figure 3**.

Note that the statistical measures of model performance presented in this report are for the preliminary version of the model, prior to calibration. Improvements in those measures are anticipated after completion of the calibration task. The calibration targets are presented in the next section.

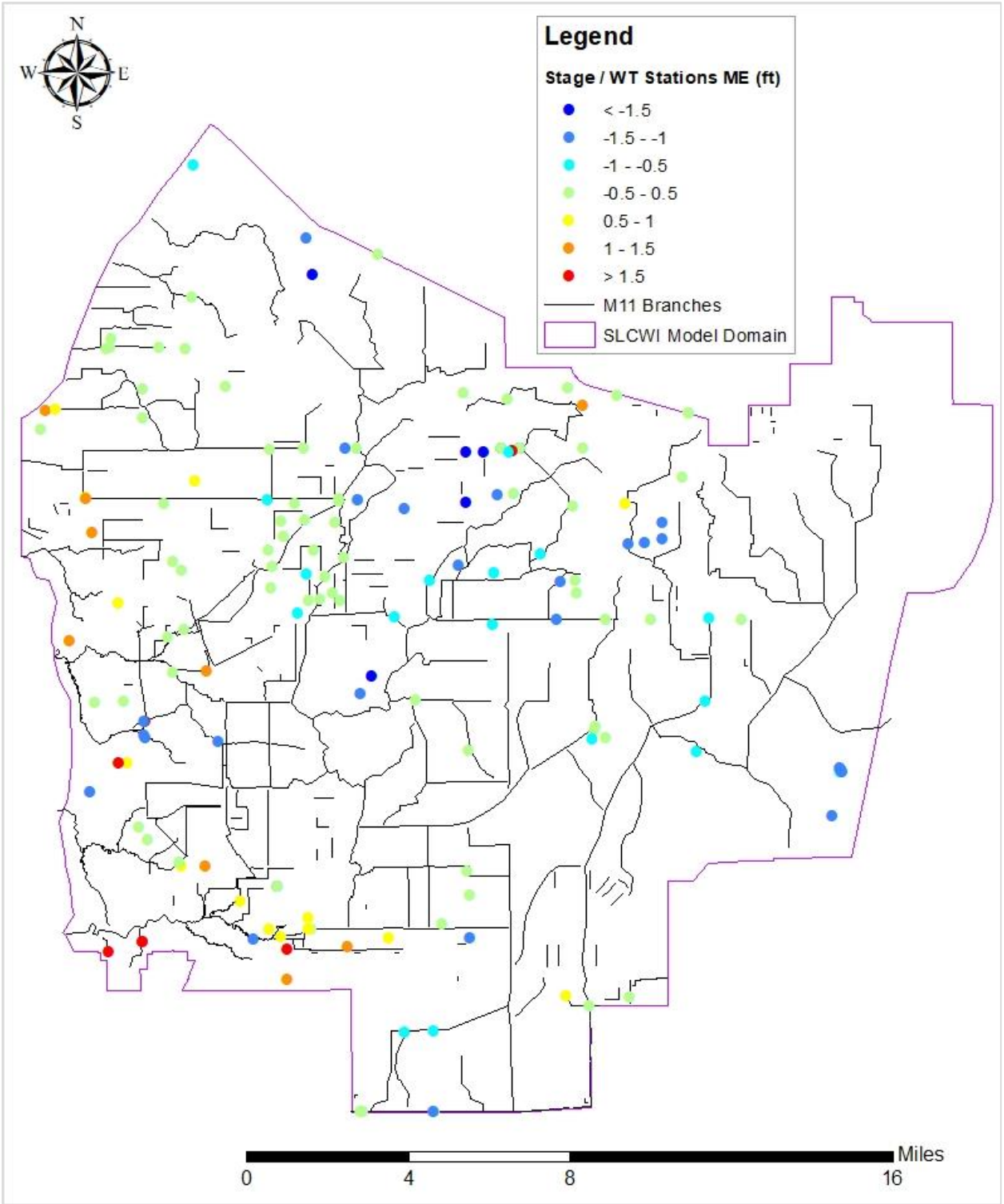


Figure 1. Mean Error (ME) of predicted water levels at surface water and WT aquifer stations.

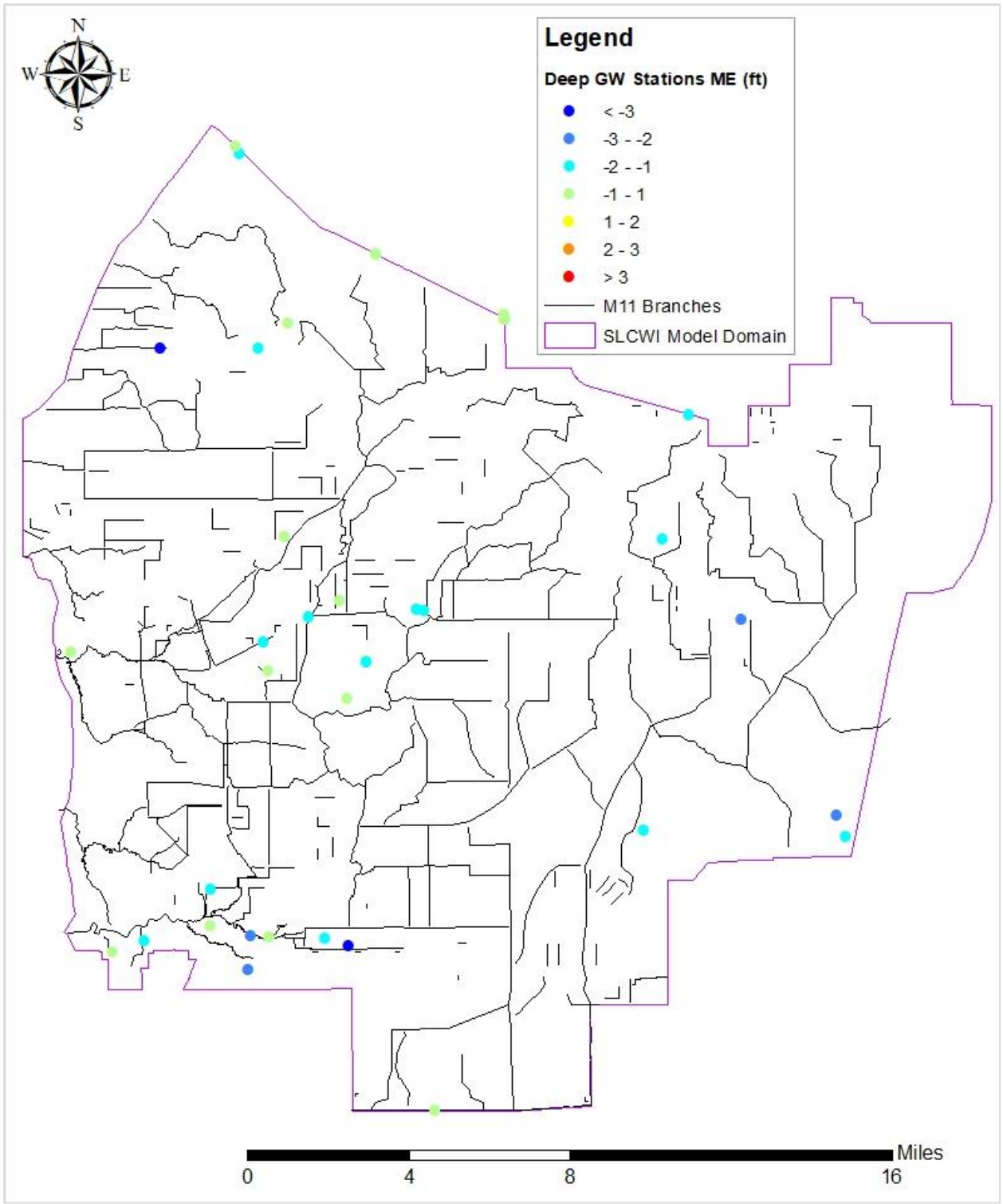


Figure 2. Mean Error (ME) of predicted water levels at LT, SS, and MH aquifer stations.

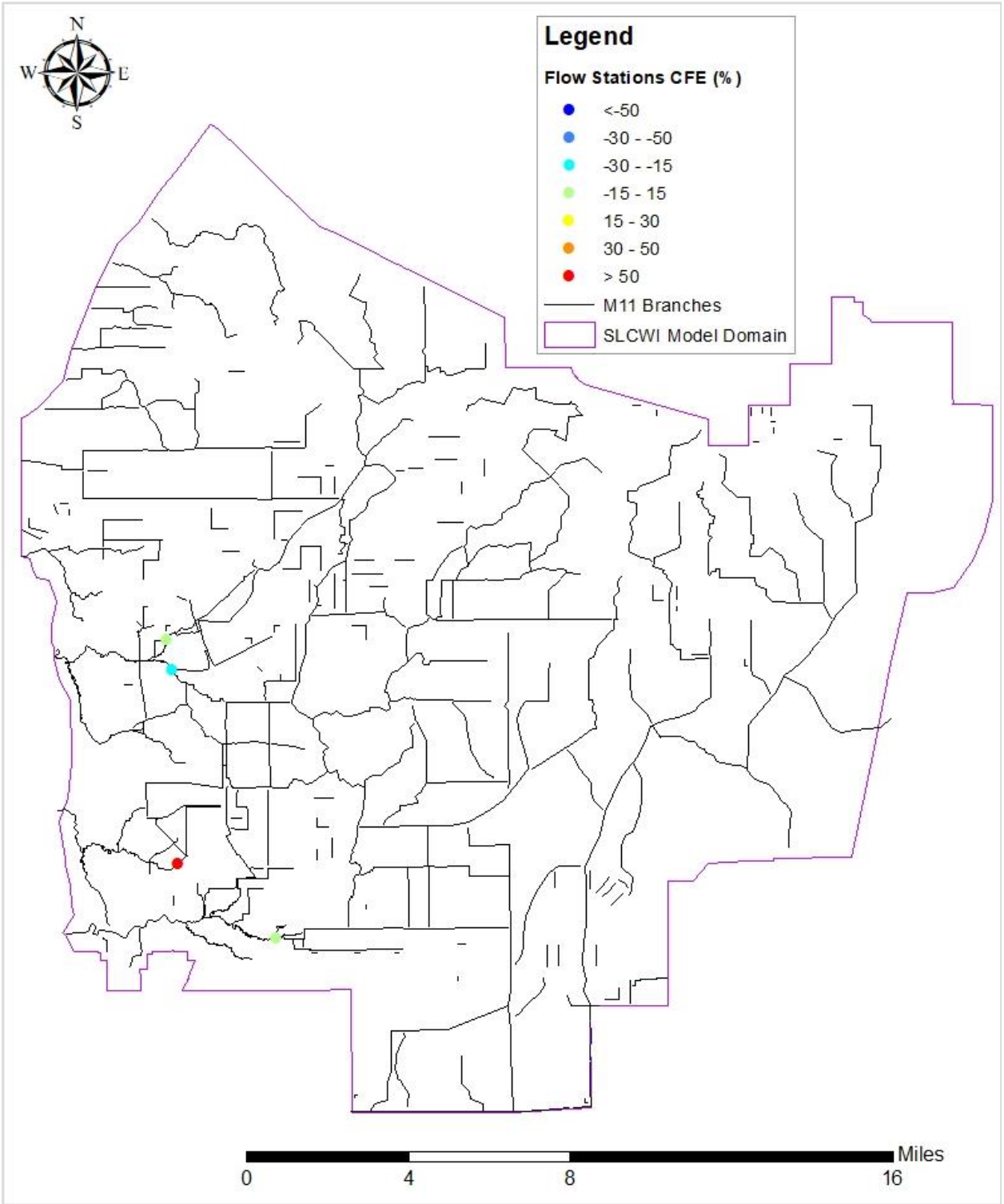


Figure 3. Cumulative Flow Error (CFE) at surface water flow stations.

Model Performance Level from Statistics

Table 4 defines the performance level criteria goals to be used in this SLCWI modeling project.

Table 4. Model performance criteria.

Observation Station type	Model Performance Criteria		
	Good	Okay	Poor
Surface water stage and shallow wells (comp. layer = 1)	MAE ≤ 0.75ft	0.75ft < MAE ≤ 1.5ft	MAE > 1.5ft
Deeper wells (comp. layer > 1)	MAE ≤ 1.5ft	1.5ft < MAE ≤ 2.5ft	MAE > 2.5ft
Surface water flow	CFE ≤ 15%	15% < CFE ≤ 30%	CFE > 30%

The number of stations that satisfy the performance level criteria defined in Table 4 in the preliminary model are presented in **Table 5**. Note that the total number of stations (175) presented in this table is smaller than the total number of stations (219) listed in Table 1, Table 2 and Table 3. The reason for that difference is that Table 5 only included stations with observation data points during the period 2013-2019 and are located at least a few grid cells away from the model boundary.

Table 5. Level of performance at observation stations in the preliminary SLCWI model, period 2013-2019.

Observation Station type	Number of stations with data and inside the domain			
	Total	Good	Okay	Poor
Surface water stage and shallow wells (comp. layer = 1)	126	53	57	16
Deeper wells (comp. layer > 1)	45	11	5	29
Surface water flow	4	2	1	1
Total	175	91	38	46

The performance of the model is expected to be improved during the calibration task with the goal to increase the number of stations in the "Good" level and to decrease them in the "Poor" level in Table 5.

Comparison Plots at Observation Stations

The comparison plots of simulated and observed water levels and flows at the monitoring stations are included in Appendix A. Cumulative flow comparison plots are also presented in Appendix B.

The comparison plots in Appendices A and B complement the level of model performance inferred from the MAE or the CFE statistical parameters. The model may perform well at one station during the wet season and not during the dry season, or vice versa. The model may also perform at one station better in some years than in others. Thus, the comparison plots can give additional information on the temporal variability of good or poor model performance occurring during the simulation period.

Hydroperiod and Water Depth Predictions

Figure 4 and **Figure 5** present the spatial distribution of simulated hydroperiod duration and mean water depth during the hydroperiod, respectively. These maps were produced at a finer spatial resolution by comparing at each day of the simulated water levels at the 375-ft model grid with the 50-ft resolution topography generated during Task 1 [Lago, 2021].

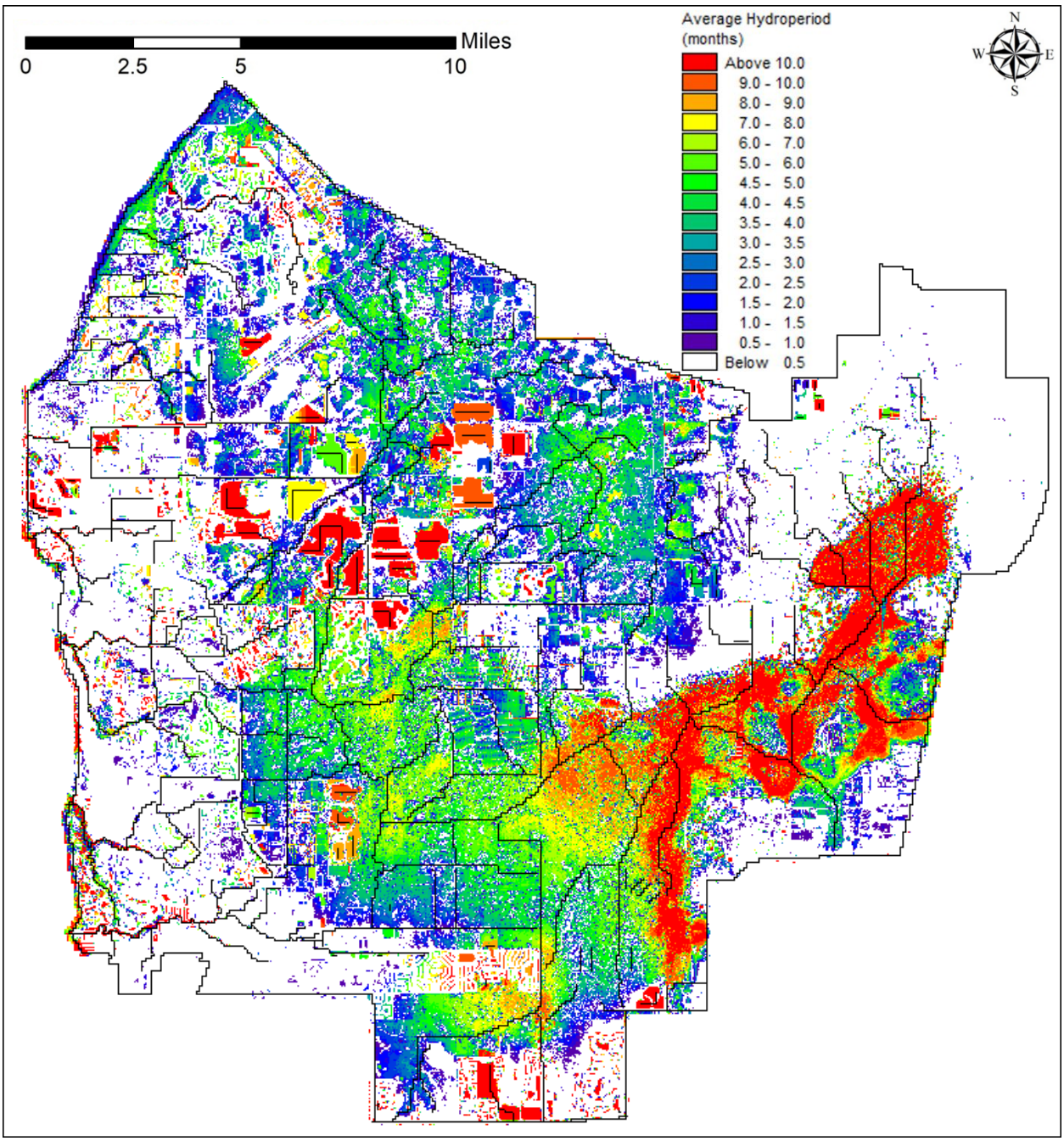


Figure 4. Average annual hydroperiod duration as predicted from the preliminary SLCWI Model during the period 2013-2019.

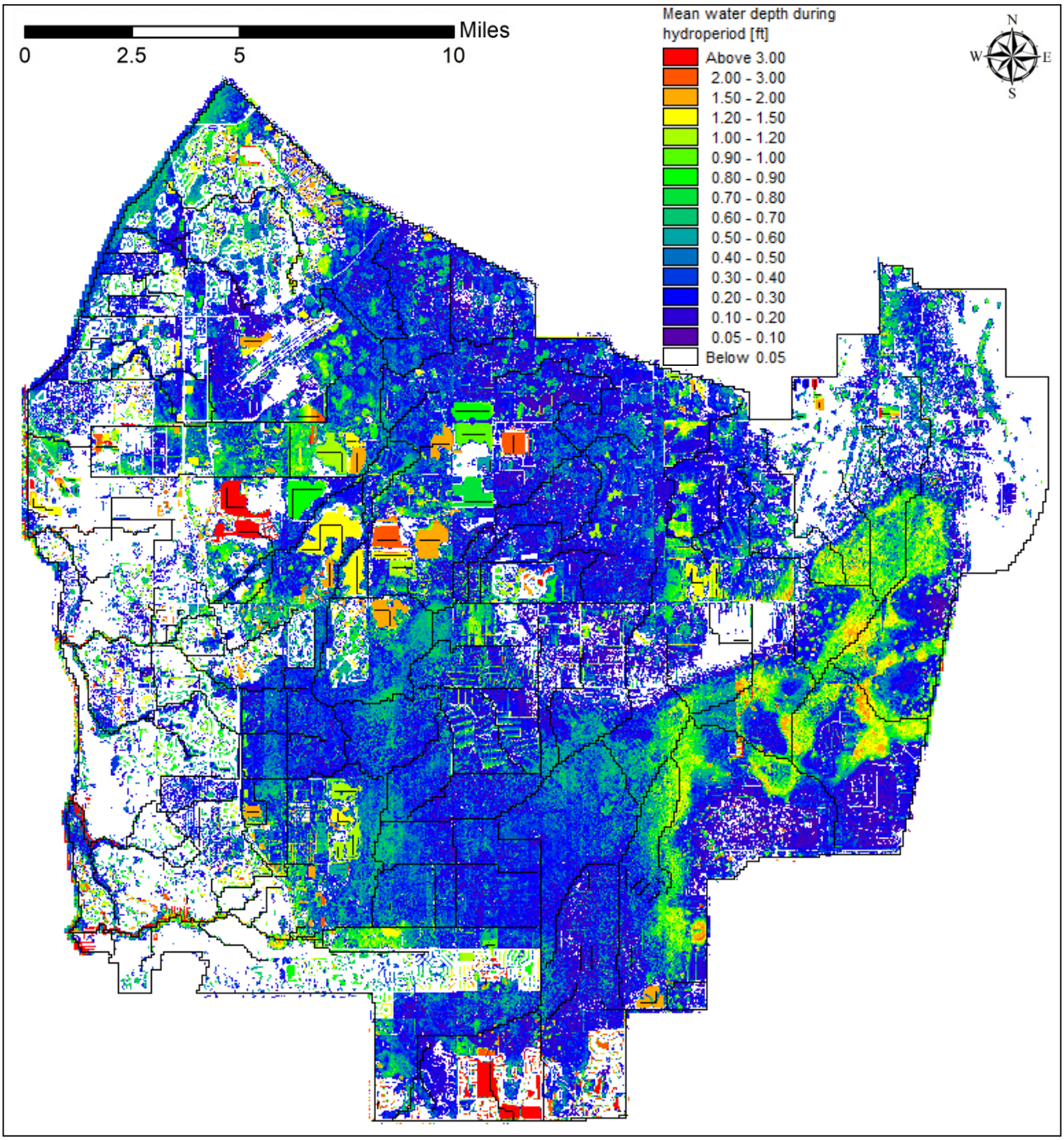


Figure 5. Mean water depth during the hydroperiod as predicted from the preliminary SLCWI Model during the period 2013-2019.

The predicted mean water depth during the wet season (i.e., from July 1st through October 15th) during the 7-year simulation period is also presented in **Figure 6**. Notice that these wet season water depth values are different than the mean water depth during hydroperiod shown in Figure 5. For example, areas with hydroperiods shorter than the wet season period will show smaller water depths in Figure 6.

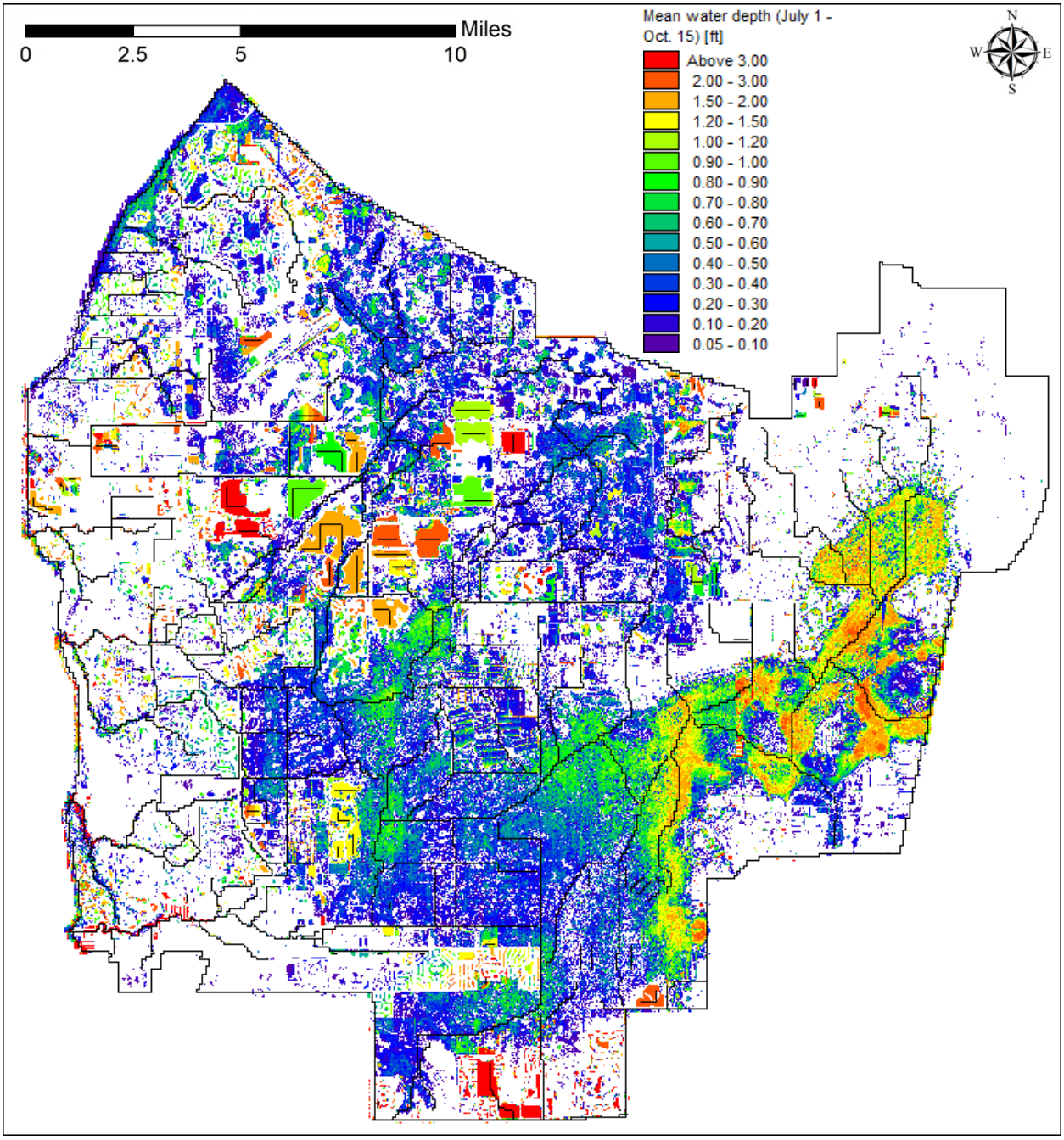


Figure 6. Mean water depth during the wet season (July 1 – Oct. 15) as predicted from the preliminary SLCWI Model during the period 2013-2019.

Model Performance at Field Investigation Sites

Ecologic team members visited numerous locations in the watershed and assessed a variety of vegetation indicators to estimate the average wet season water depth. These field investigations were started during the Corkscrew Swamp Sanctuary (CSS) modeling project, and they were complemented during Task 3 of this SLCWI project. The field site locations are shown in **Figure 7**.

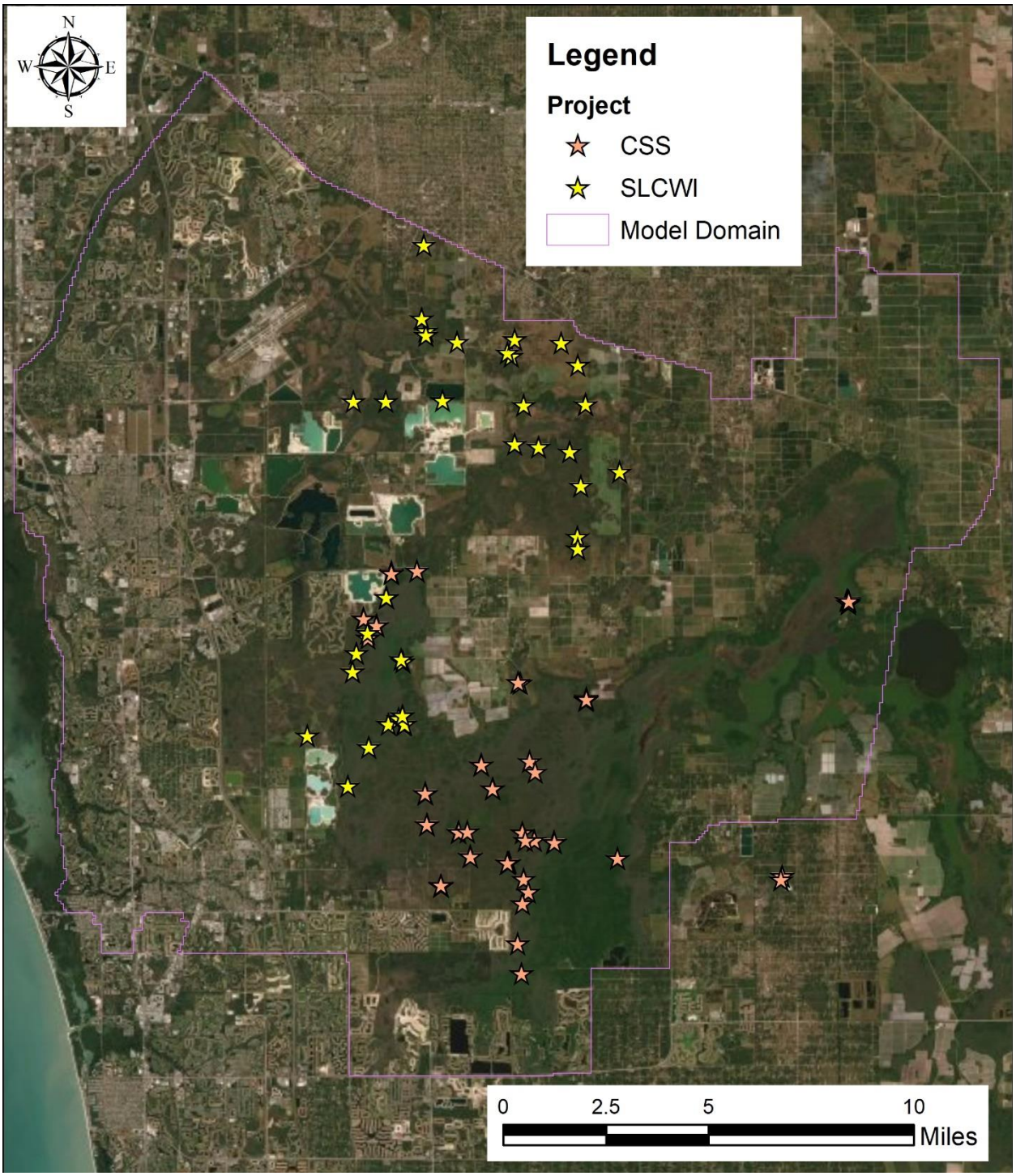


Figure 7. Locations visited to estimate average wet season water depth from vegetation indicators.

In order to estimate the average wet season water depths, the surface water levels at the field sites were computed in two ways:

- from the preliminary SLCWI model for the 2013 - 2019 simulation period, and
- from observation station time series data, in the cases where the station was adjacent to the site.

Moreover, the ground surface elevation at the field site was also estimated in two ways:

- directly from the 1-m LiDAR-based DEM, and
- from the 375-ft resolution model DEM.

The two ways of determining water and ground surface elevations produce a total of four data sets of average wet season water depths, which are compared with the ones estimated from vegetation indicators of hydrologic conditions from **Figure 8** though **Figure 11.**

Here, the wet season period is considered from July 1st through October 15th. The water surface elevation is estimated from the model results by finding the average wet season water levels at the 375-ft model grid and by conducting a bilinear spatial interpolation to find the water level value at the field location where the vegetation indicators were assessed. The depth to phreatic surface output in MIKE SHE was used to estimate water levels, and hence, the resulting average water depth can be negative (i.e., below ground) as can be noted in the plots. A hypothetical perfect match in the plots is represented by the line Y = X.

The model topography was obtained by averaging the 1-m LiDAR-based DEM at the 375-ft resolution model grid. Thus, the errors introduced from this smoothing procedure are removed by extracting the topographic elevation directly from the 1-m resolution DEM.

The differences between the average wet season water depth estimated from model results or from observation station data and the water depth estimated from vegetation indicators of hydrologic conditions were computed to obtain the mean error (ME) and the root mean squared error (RMSE), as presented in **Table 6**.

Table 6. Statistics of the differences between predicted and field estimated average wet season water depths.

Water Level Estimation Source	DEM resolution	Points Plotted in	Points Used	ME (ft)	RMSE (ft)
Preliminary Model	375 ft	Figure 8	107 (all)	-0.68	0.93
	1 m	Figure 9		-0.53	0.81
	375 ft	Figure 8	27 (with a nearby observation Station)	-0.69	0.85
	1 m	Figure 9		-0.50	0.71
Observation Stations	375 ft	Figure 10		-0.88	1.04
	1 m	Figure 11		-0.69	0.88

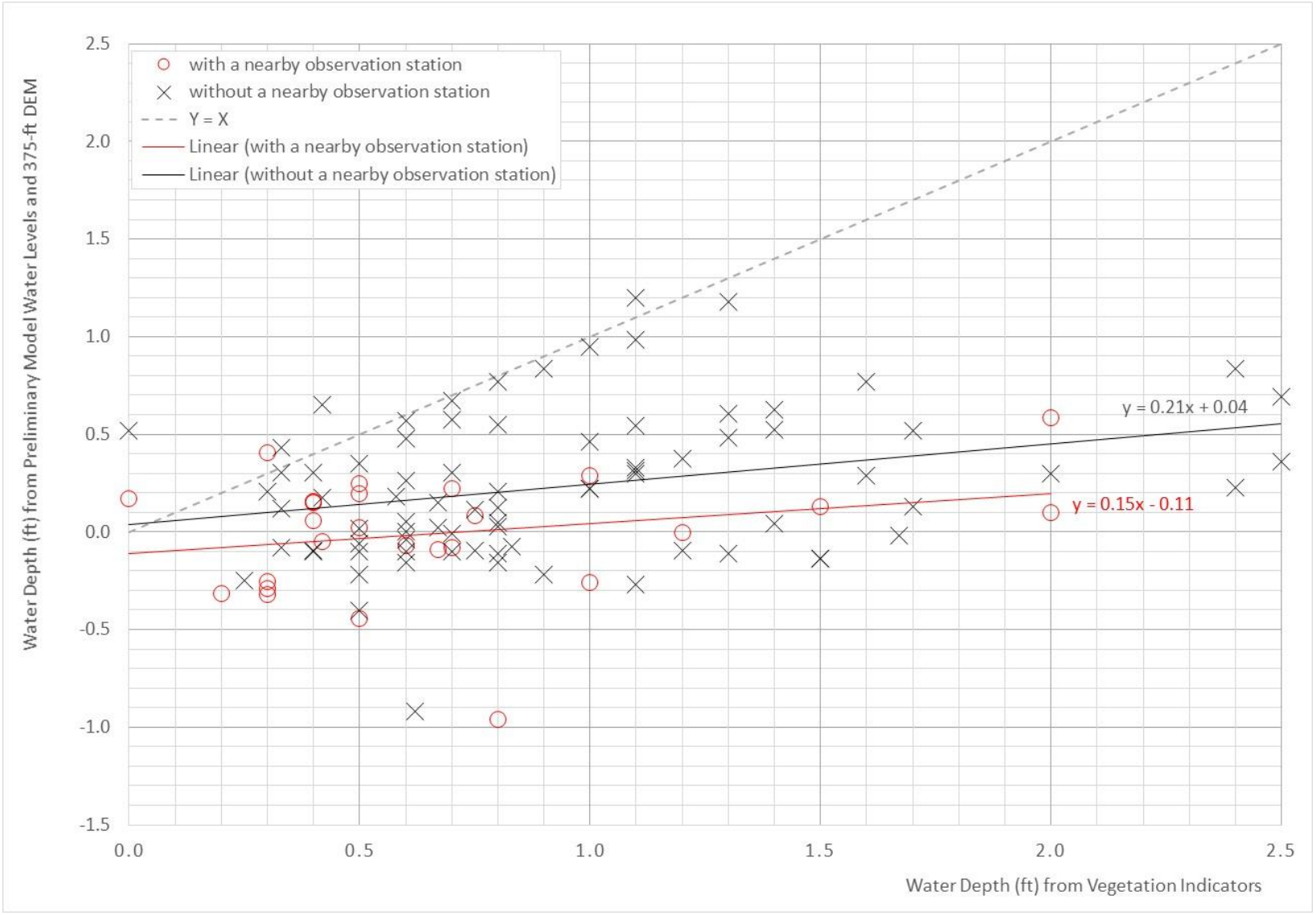


Figure 8. Correlation between water depth from vegetation indicators and the average wet season water depth from the preliminary model at a 375-ft resolution.

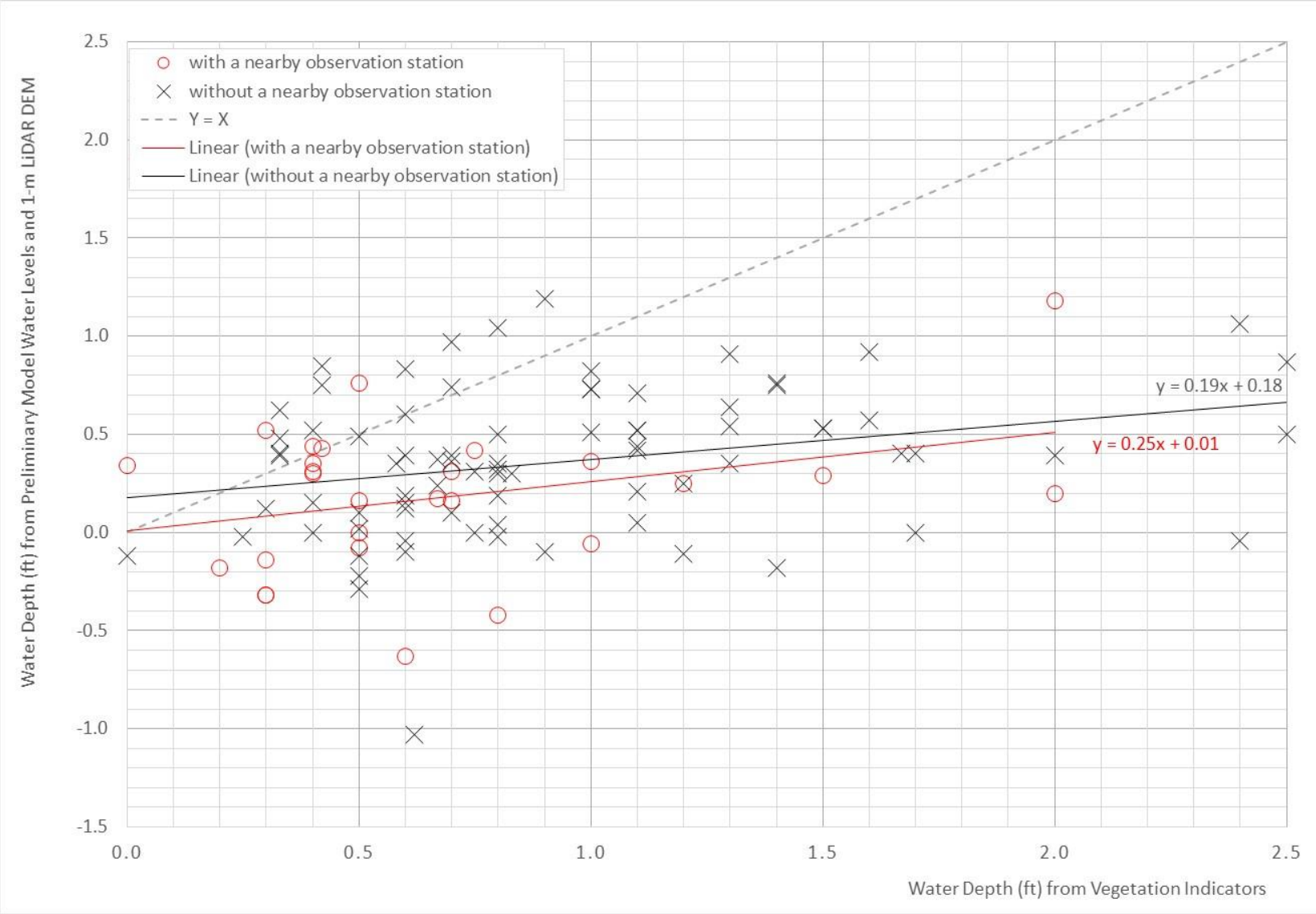


Figure 9. Correlation between water depth from vegetation indicators and the average wet season water depth from the preliminary model at a 1-m resolution.

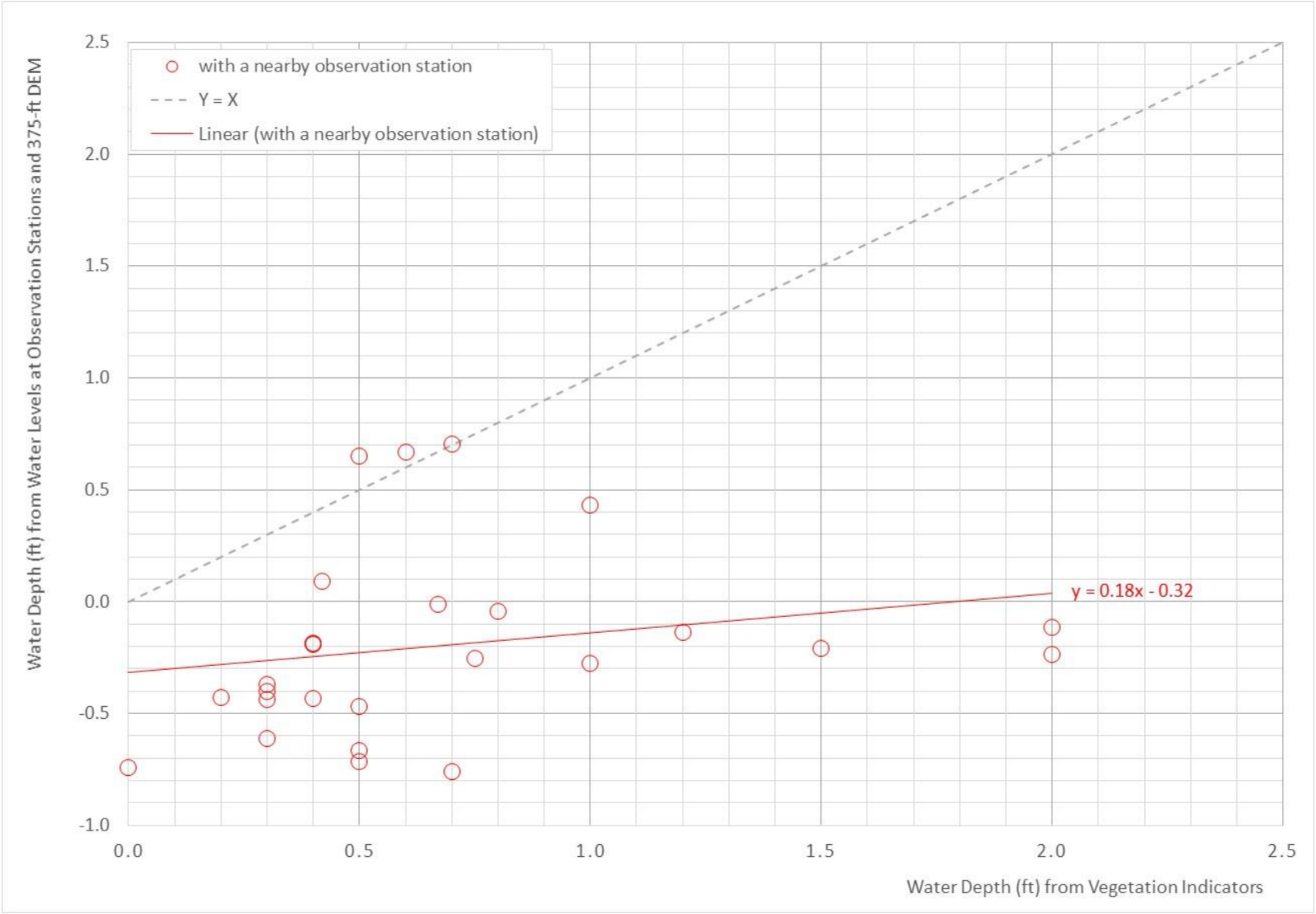


Figure 10. Correlation between water depth from vegetation indicators and the average wet season water depth from observed data at a 375-ft resolution.

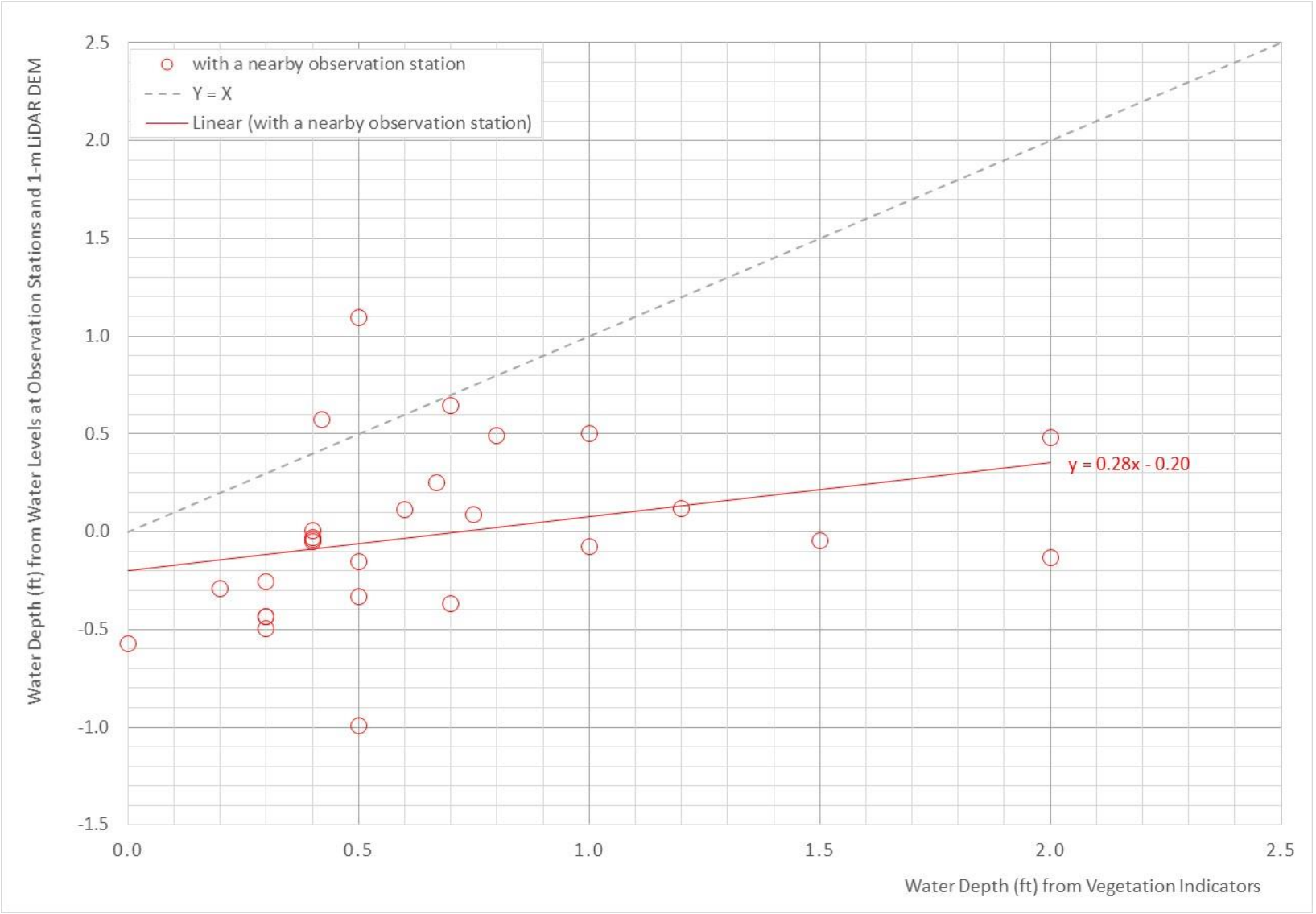


Figure 11. Correlation between water depth from vegetation indicators and the average wet season water depth from observed data at a 1-m resolution.

The following observations can be made from the comparison plots in Figure 8 through Figure 11 and from the statistical measures of the water depth differences as presented in Table 6.

1. In general, the use of the 1-m DEM in the water depth estimation produces values closer to the ones from vegetation indicators. This result is expected from the errors introduced during the smoothing procedure to obtain the 375-ft DEM.

2. The use of water levels from observation station data produces higher differences overall with respect to using water levels from the preliminary model. This result is unexpected since the observation data is expected to be more accurate than the model results. One reason may be that the datum at some of the observation stations need to be reviewed. Another explanation may be that systematic elevation differences in the LiDAR-based DEMs are cancelled to some extent with the water levels estimated from the model that uses such DEM to produce better water depth estimations.

3. Water depths from vegetation indicators are underestimated (in average by 0.5 ft or higher) by water depth estimations that use water levels from the model or from observation data. This may be a consequence of using a LiDAR based DEM, which did not penetrate the water surface when the LiDAR was flown. In this case, it is uncertain how much the calibration process will reduce the differences between the average wet season water depths predicted from the model and from vegetation indicators.

Model Predictions by Landuse Classes

The model results were processed to obtain actual evapotranspiration (ET), hydroperiod, and average water depth for the different landuse/vegetation classes, as shown in **Table 7**.

The actual ET rates computed in Table 7 are generated first by averaging predicted daily values at each 375-ft grid cell over the entire simulation period, and then by calculating the average inside the group of the cells with the same landuse classification. The higher ET rate at Golf Course cells is likely due to the application of irrigation. Bare ground has the lowest ET rate, as expected, because of the lack of vegetation and associated transpiration. Water has the highest ET rate because there is no water limitation for the ET processes as in other classes.

The hydroperiod values computed in Table 7 are generated first by computing the number of days with ponded water per year at each 375-ft grid cell over the entire simulation period, and then by finding the median in the group of cells with the same land use classification. A column is added with the hydroperiod values expected for the natural Southwest Florida (SWF) plant communities [SDI, 2008]. It is to be noted from this comparison that the model under predicts the expected hydroperiod values in the categories of Wet Prairie, Marsh, Cypress, and Swamp Forest.

The mean water depths during hydroperiod in Table 7 are estimated in a similar way, first by computing the values at each 375-ft grid cell over the entire simulation period, and then by finding the median in the group of the cells with the same landuse classification.

The wet season water levels above the ground in Table 7 are estimated similarly at each 375-ft grid cell over the entire simulation period, and then by finding the median in the group of the cells with the same land use classification. Here, the wet season period is considered from July 1st through October 15th. A column is added with the hydroperiod values expected for natural Southwest Florida (SWF) plant communities [SDI, 2008]. Note from this comparison that the model under predicts the expected wet season water levels in the categories of Wet Prairie, Marsh, Cypress, and Swamp Forest.

It is uncertain how much the calibration process will bring the hydroperiod and wet season water depths closer to the values expected for the natural Southwest Florida (SWF) plant communities. This model underprediction may be related to the fact that the model is using a LiDAR based DEM, which did not penetrate the water surface when the LiDAR was flown. Another reason for the underprediction is that the model uses averaged topographic elevation at grid cells that may have averaged the lower and higher ground levels in a 375-ft distance.

Table 7. Model results by landuse class.

Landuse Code	Landuse Name	Number of active 375-ft cells	Area (acres)	Area (%)	Actual ET (mm/day)	Hydroperiod (months)		WD during HP (ft)	Wet season WL above ground (inches)	
					Model	Model	Exp.	Model	Model	Exp.
1	Citrus	6,120	19,757	8.5	2.7	0.0		0.08	-41	
2	Pasture	6,601	21,310	9.2	2.6	0.3		0.15	-10	
5	Truck Crops	2,813	9,081	3.9	2.8	1.2		0.16	-5	
6	Golf Course	2,271	7,331	3.2	3.3	0.0		0.00	-46	
7	Bare Ground	1,517	4,897	2.1	1.5	0.0		0.10	-27	
8	Mesic Flatwood	5,882	18,989	8.2	2.6	0.4	≤ 1	0.13	-10	≤ -24
9	Mesic Hammock	573	1,850	0.8	2.3	0.5	≤ 1	0.17	-7	≤ -24
10	Xeric Flatwood	1	3	0.0	1.9	0.0	0	0.00	-94	≤ 2
11	Xeric Hammock	0	0	0.0			0			≤ 2
12	Hydric Flatwood	4,722	15,244	6.6	2.6	2.5	1 - 2	0.20	-3	2 - 6
13	Hydric Hammock	341	1,101	0.5	2.2	1.1	1 - 2	0.21	-6	2 - 6
14	Wet Prairie	647	2,089	0.9	2.6	2.4	2 - 6	0.24	-3	6 - 12
15	Willow	1,416	4,571	2.0	2.9	10.8		0.87	15	
16	Marsh	4,184	13,507	5.8	2.7	4.7	6 - 10	0.49	4	12 - 24
17	Cypress	10,570	34,123	14.7	2.7	4.4	6 - 8	0.32	2	12 - 18
18	Swamp Forest	6,263	20,219	8.7	2.7	3.0	8 - 10	0.24	-1	18 - 24
19	Mangrove	181	584	0.3	2.8	5.7		0.23	1	
20	Water	4,578	14,779	6.4	3.9	12.0	> 10	2.60	40	≥ 24
41	Urban Low Density	2,644	8,536	3.7	2.8	0.0		0.07	-27	
42	Urban Medium Density	5,844	18,866	8.1	2.9	0.0		0.00	-42	
43	Urban High Density	4,833	15,602	6.7	2.7	0.0		0.00	-46	
	total	72,001	232,441	100	2.76					

Notes:

ET: Evapotranspiration, WD: water depth, WL: water level, HP: Hydroperiod, Exp.: Expected at natural SWF plant communities [SDI, 2008].

Irrigation Rate Predictions

Monthly reported irrigation for several water use permits in the model area during the period 2013-2019 were compared with the preliminary model predicted irrigation rates in **Table 8**. Irrigation Command Area (ICA) parameters such as maximum application rates may be adjusted during the calibration task to better match the reported pumping.

Table 8. Reported and predicted irrigation rates for some water use permit areas in the preliminary SLCWI Model.

					Annual-average irrigation rate 2013-2019		
ICA Code	Vegetation type	Permit Number	Aquifer	No. 375-ft Cells	Reported (mm/day)	Predicted (mm/day)	Error (%)
104	Citrus	36-00167-W	WT	468	0.63	0.25	-60
106	Citrus	36-00167-W	SS	433	0.38	0.29	-22
110	Citrus	11-00094-W	SS	759	0.90	1.26	40
118	Citrus	36-00327-W	LT	326	0.55	0.27	-52
120	Citrus	36-00327-W	SS	77	0.36	0.27	-25
122	Citrus	36-00077-W	LT	452	0.28	0.98	247
124	Citrus	36-00077-W	SS	298	0.87	1.01	16
132	Citrus	11-00262-W	SS	1,529	0.84	1.35	61
134	Citrus	11-00128-W	LT	666	2.97	0.79	-73
136	Citrus	11-00128-W	SS	425	0.36	1.09	205
462	Urban	36-00688-W	SS	336	0.81	0.91	13
463	Urban	36-00688-W	LH	173	0.63	0.94	49
500	Truck Crops	11-00113-W	WT/LT	837	1.26	0.69	-45
508	Truck crops	36-00084-W	WT/LT	874	0.82	0.20	-76
512	Truck Crops	36-06942-W	LT	609	0.27	0.40	48
526	Truck crops	36-01461-W	SS	393	1.75	0.41	-77
			Total	8,655	0.94	0.78	-18

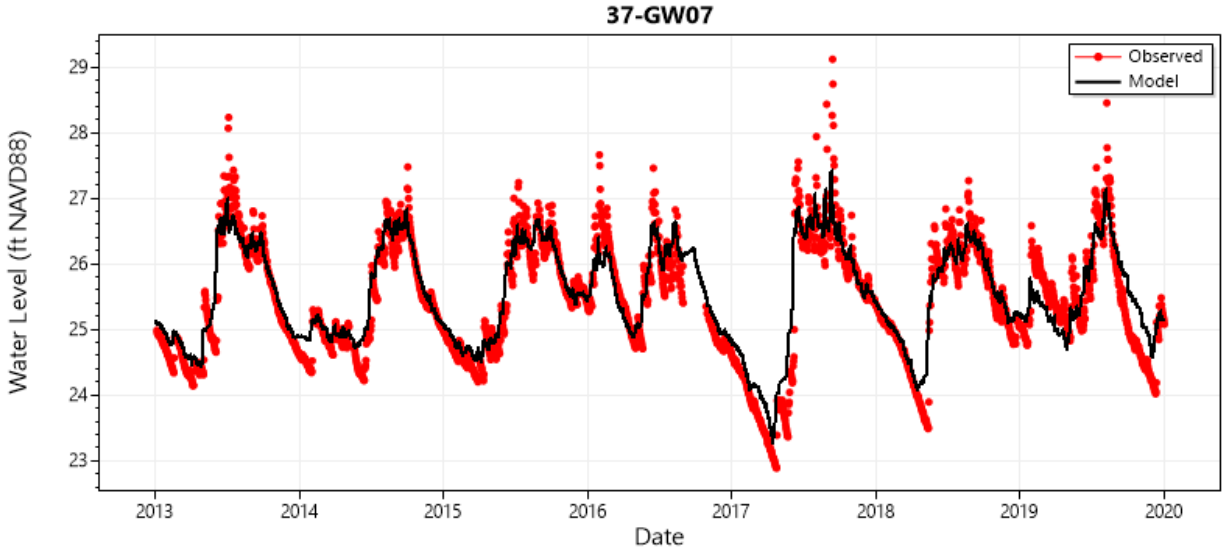
References

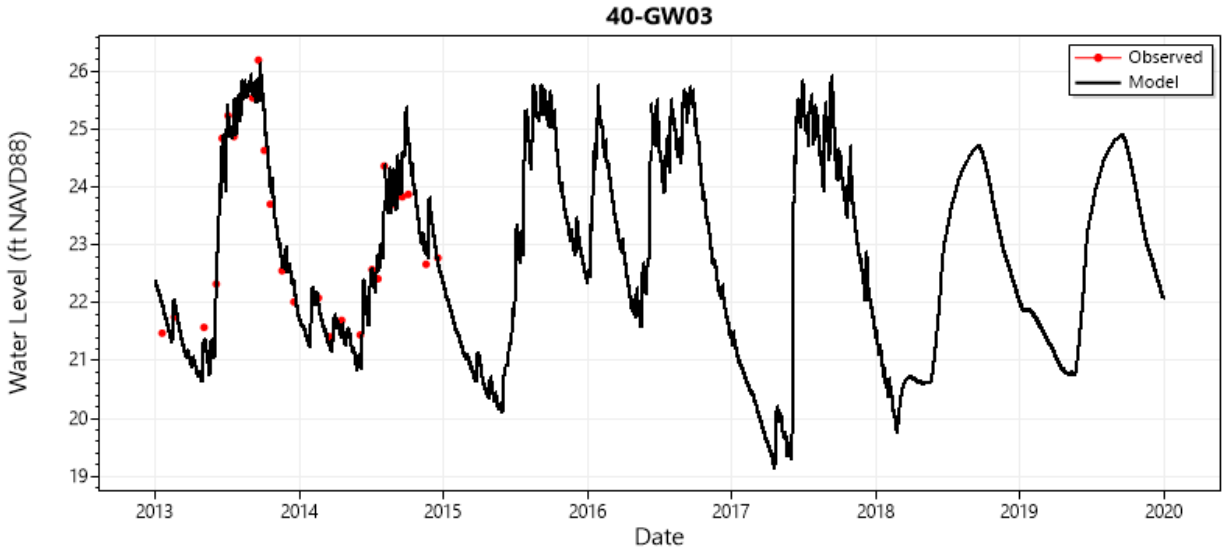
Lago, 2021. South Lee County Watershed Initiative Hydrologic Modeling Project: Task 1. Gather Existing Data and Models. City of Punta Gorda PO No. 050909. Draft Technical Memorandum submitted on January 29, 2021.

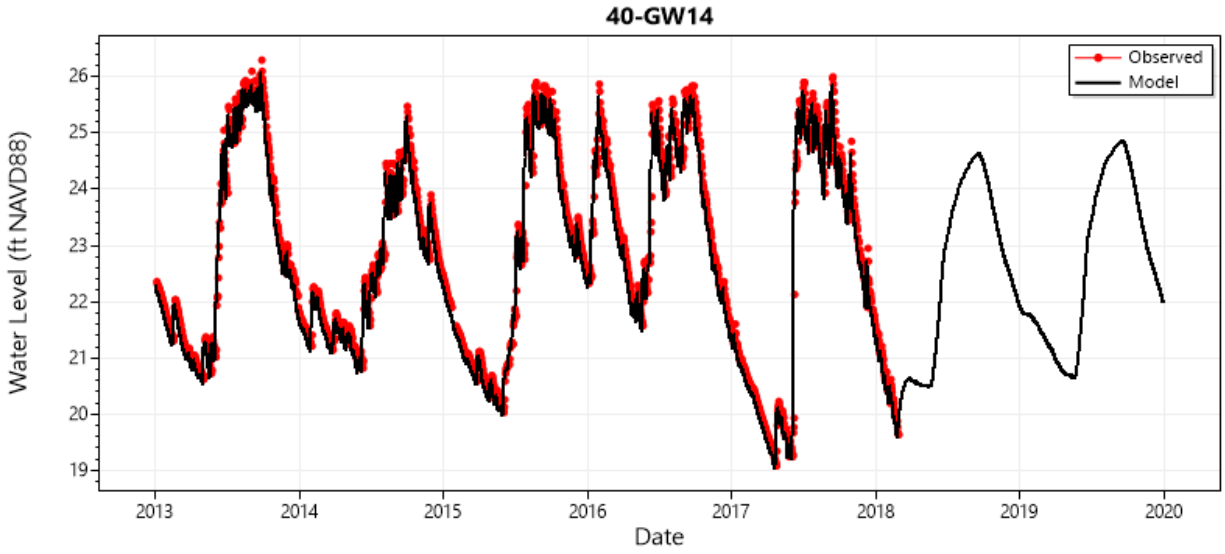
SDI, 2008. Southwest Florida Feasibility Study Integrated Hydrologic Model. Model Documentation Report Prepared for South Florida Water Management District, Ft. Myers, FL. Contract No. CN040922—Work Order 04, Task 6. SDI Project No. SFF-100. January 2008

Appendix A. Comparison Plots at Observation Stations

SZ Stations



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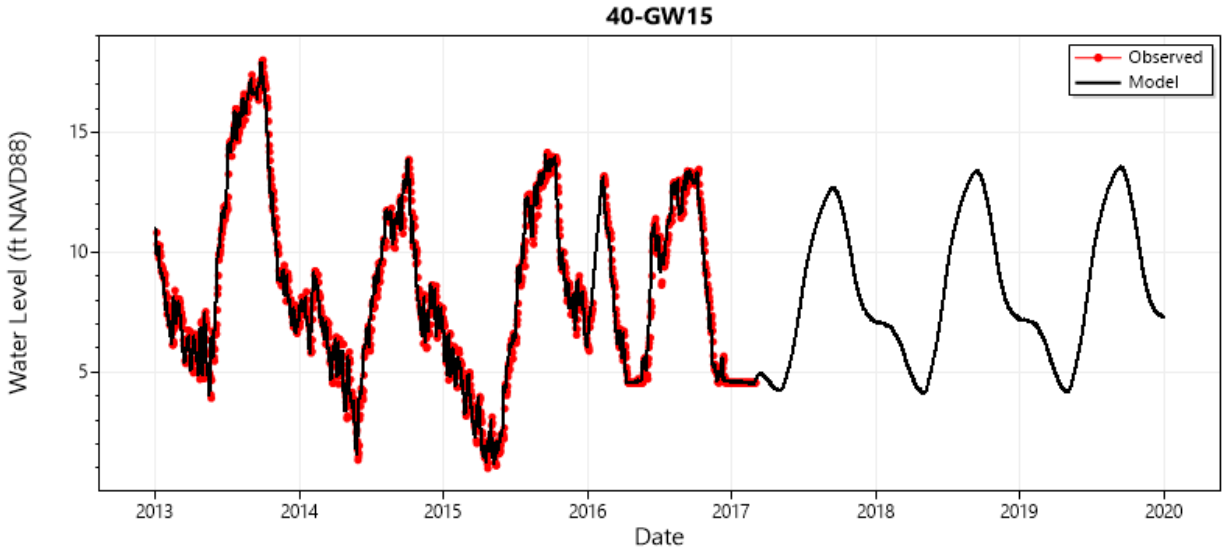
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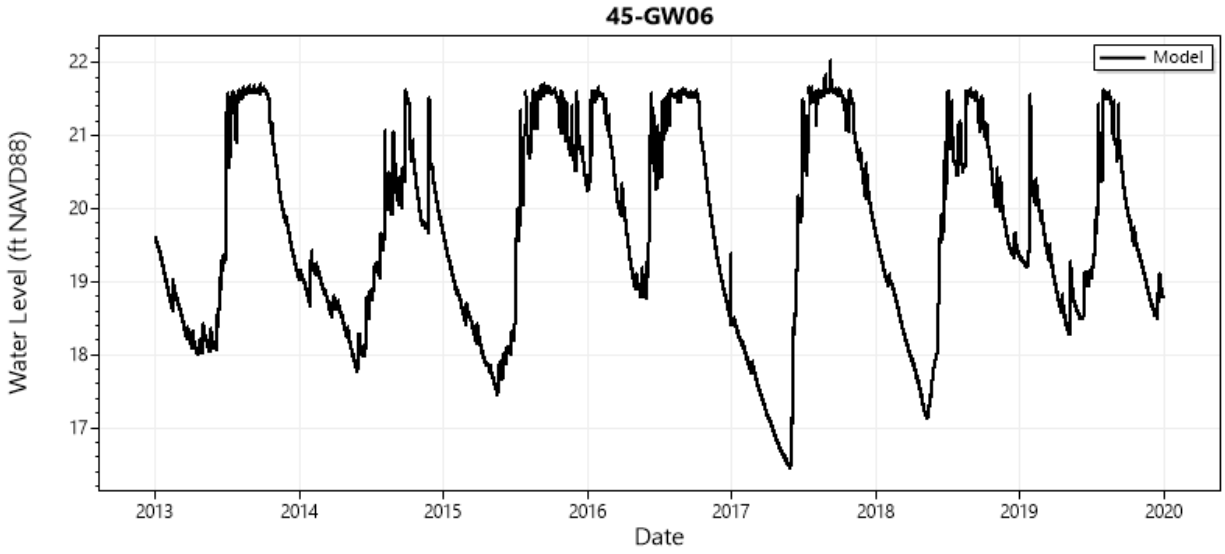
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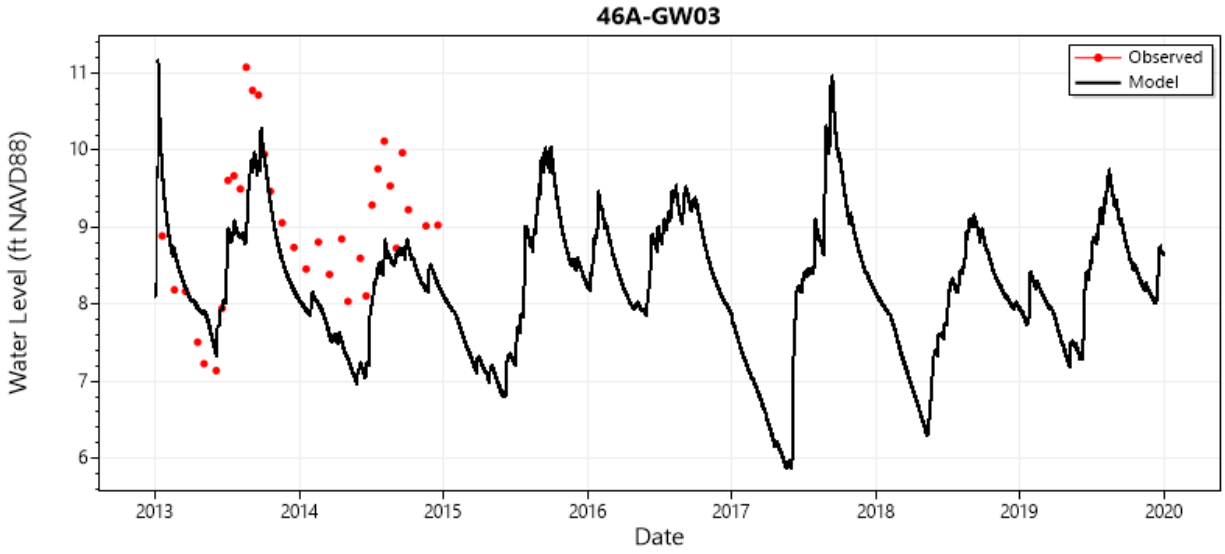
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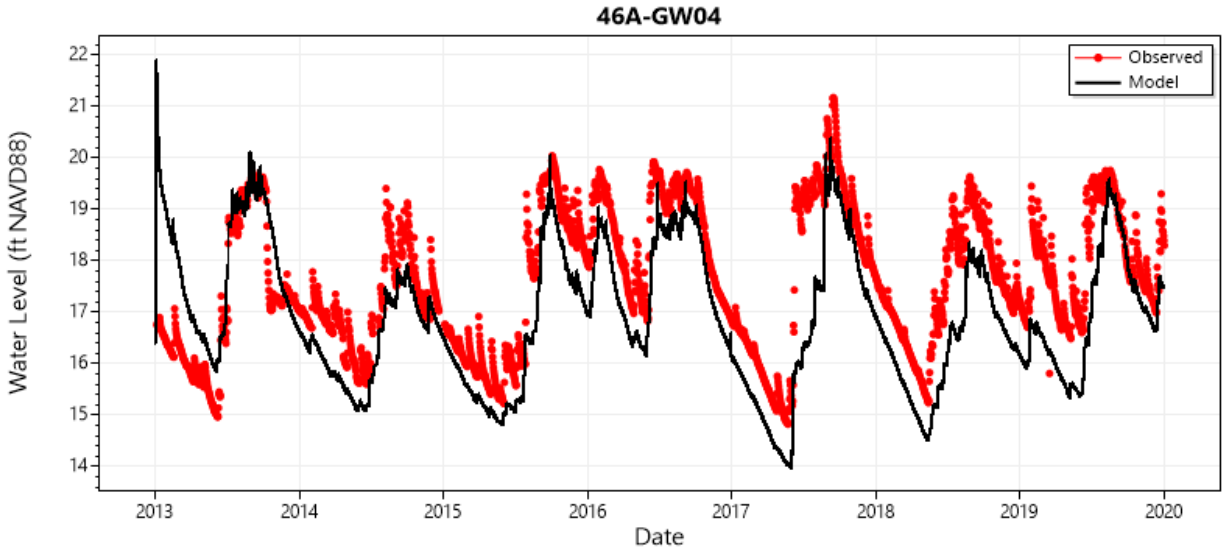
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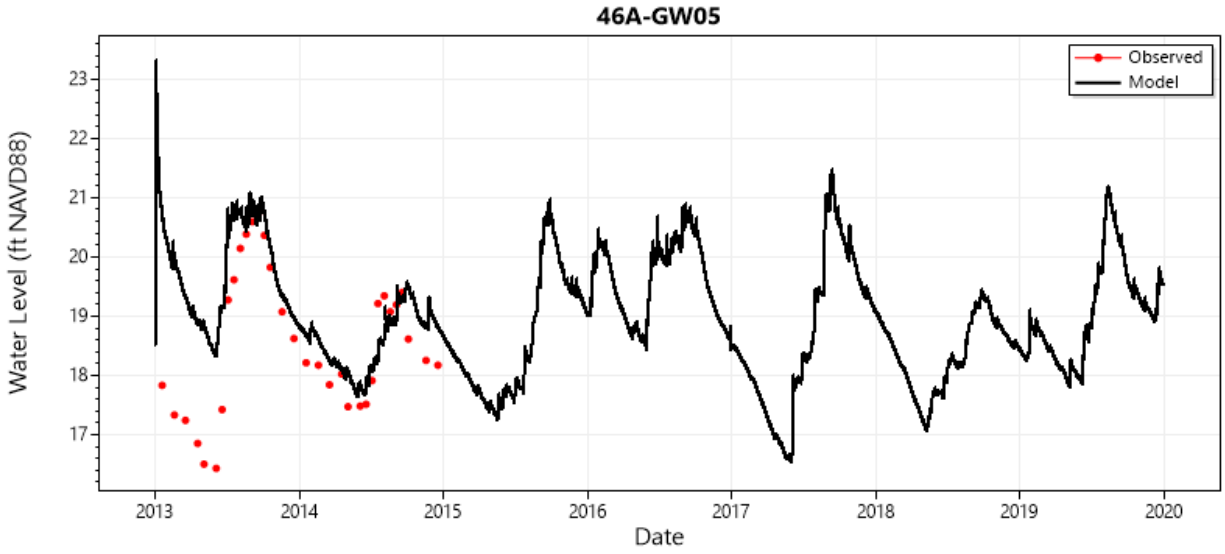
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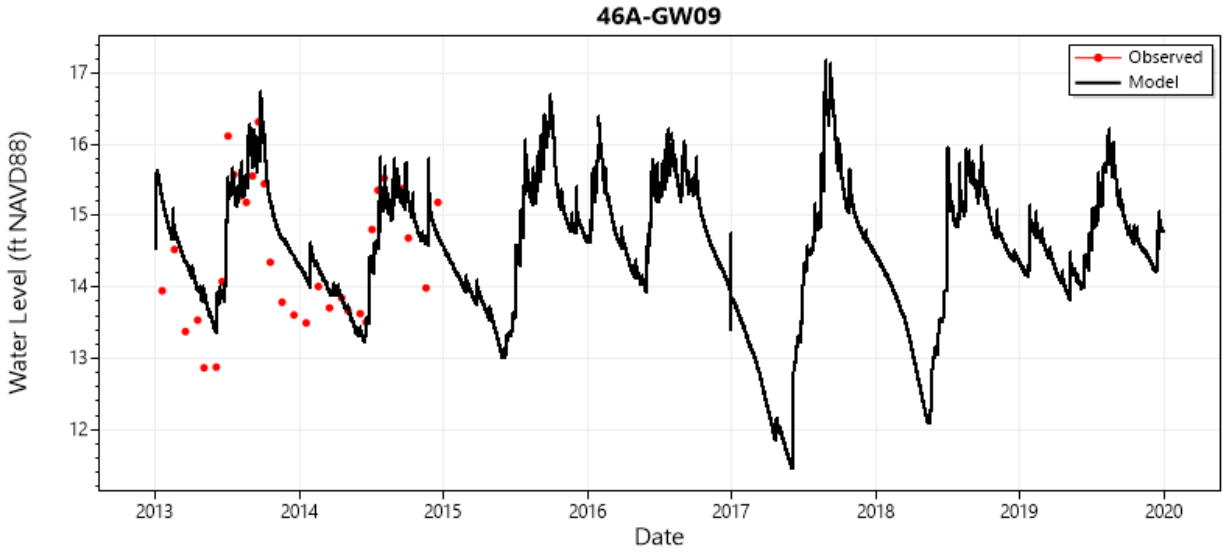
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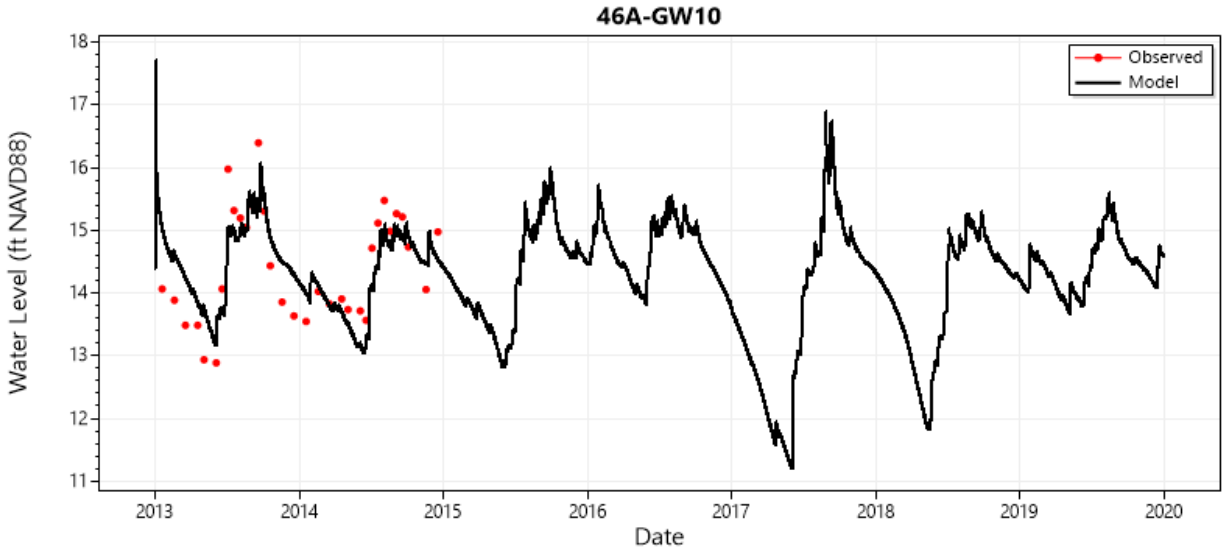
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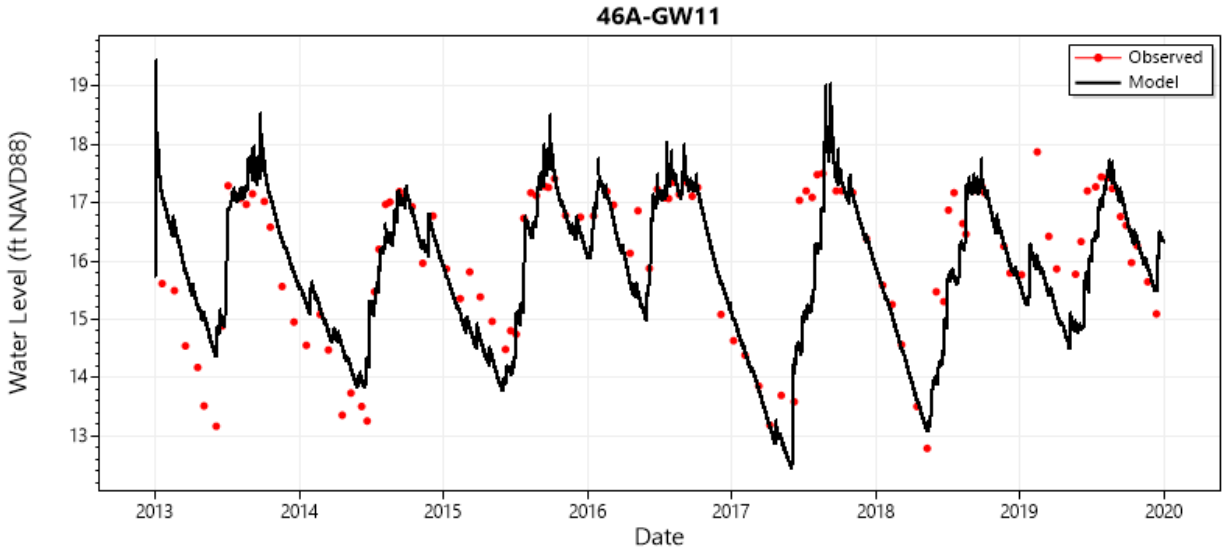
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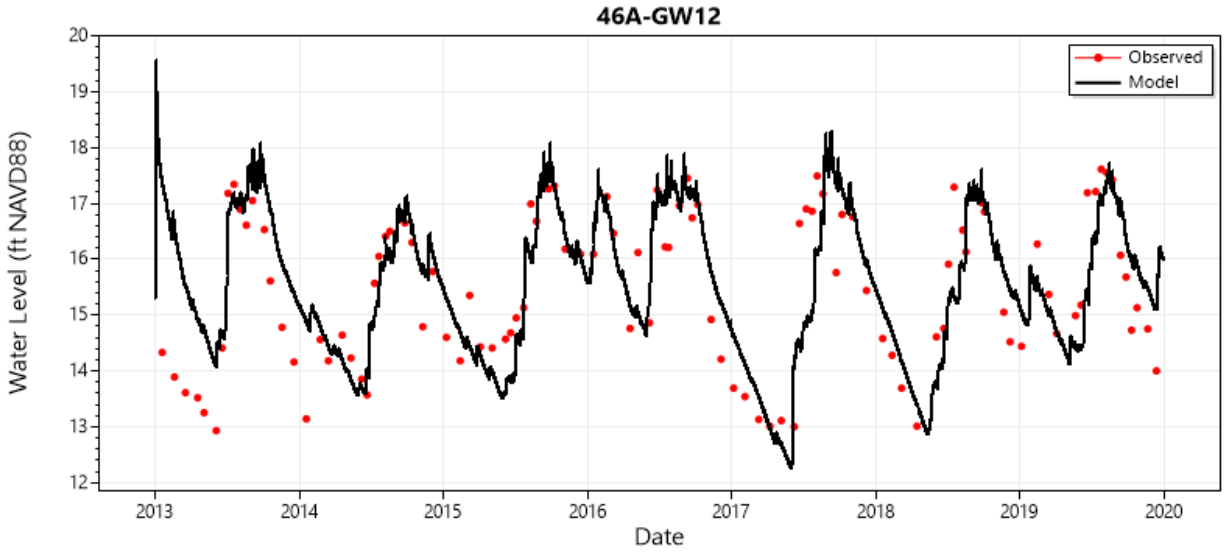
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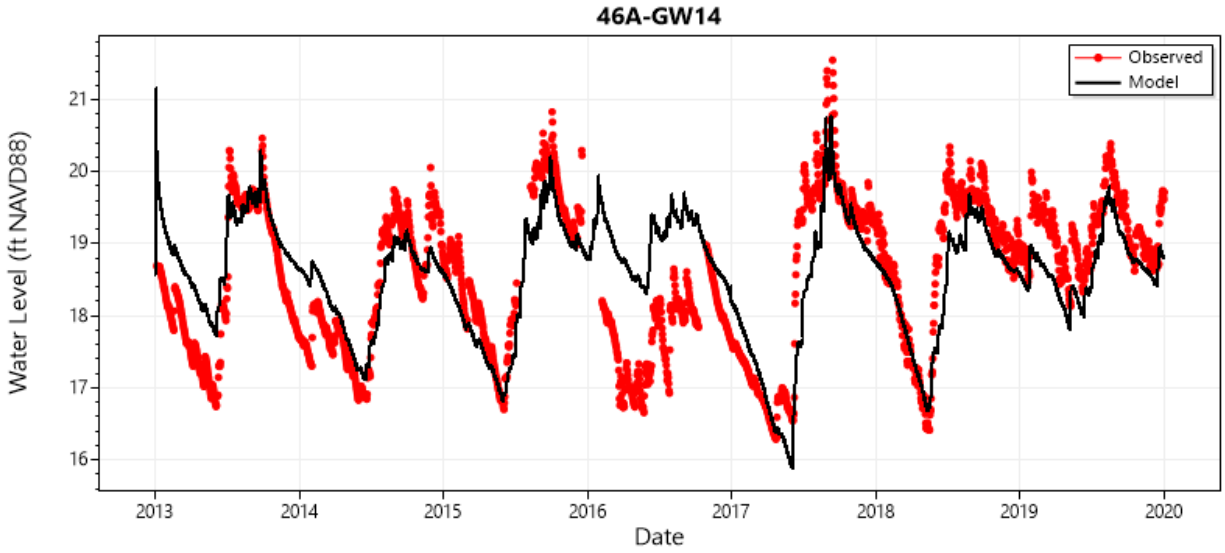
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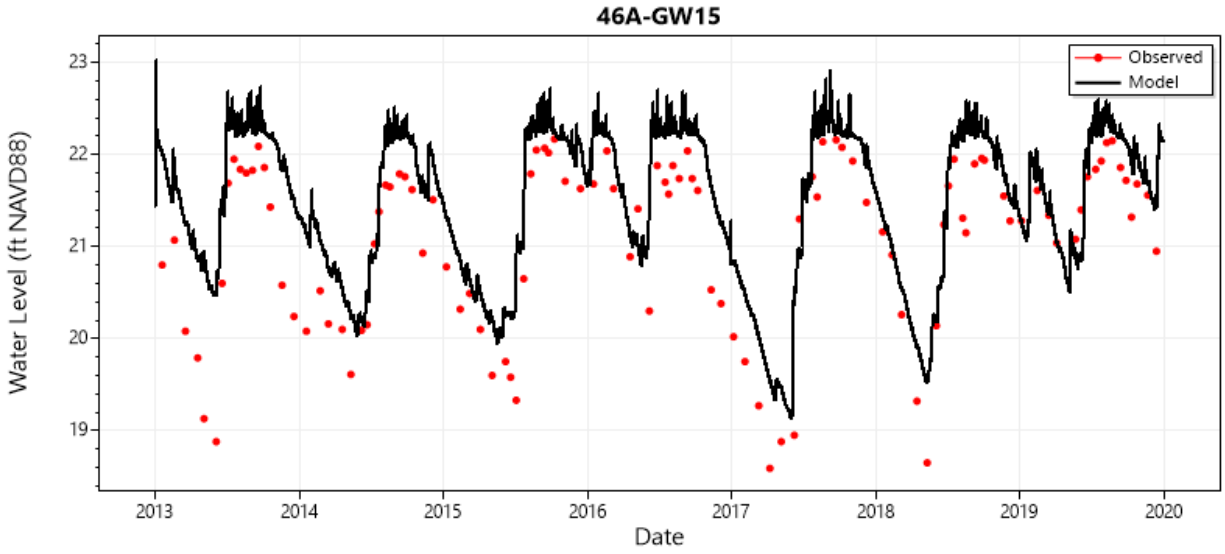
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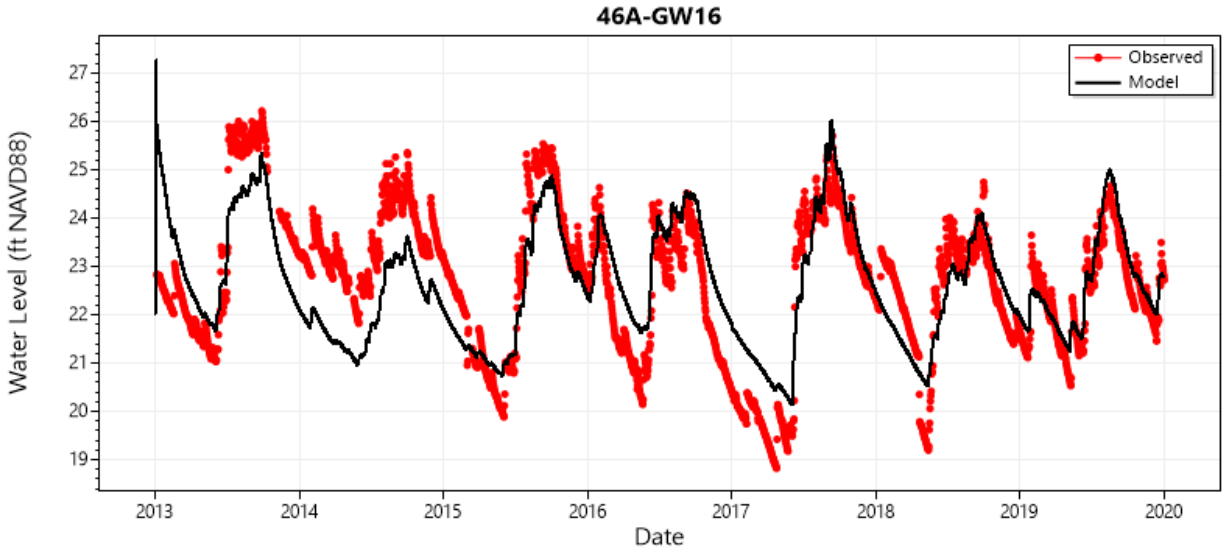
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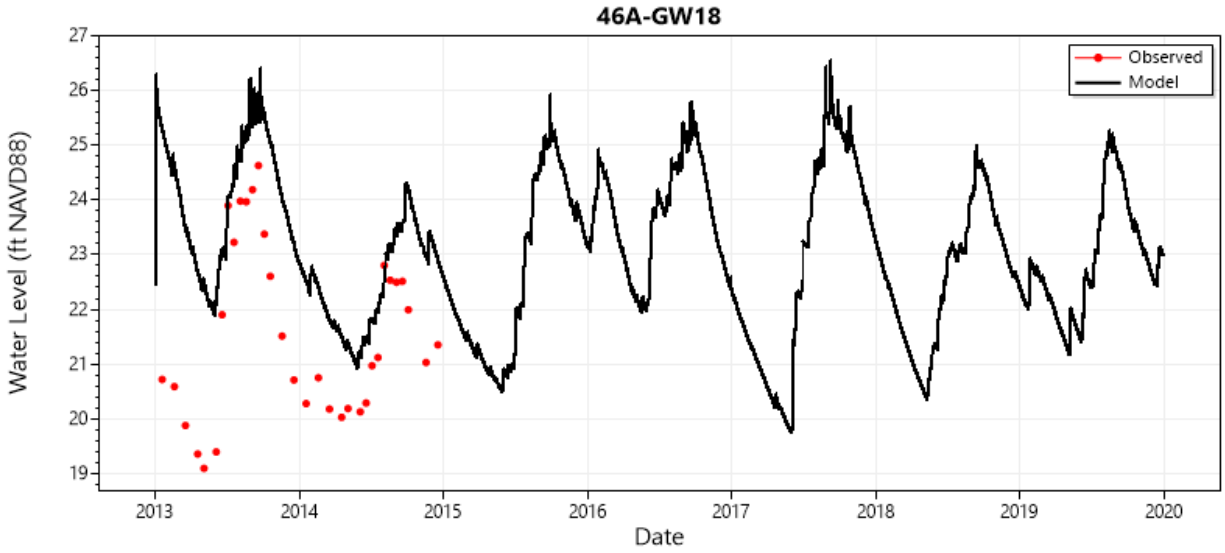
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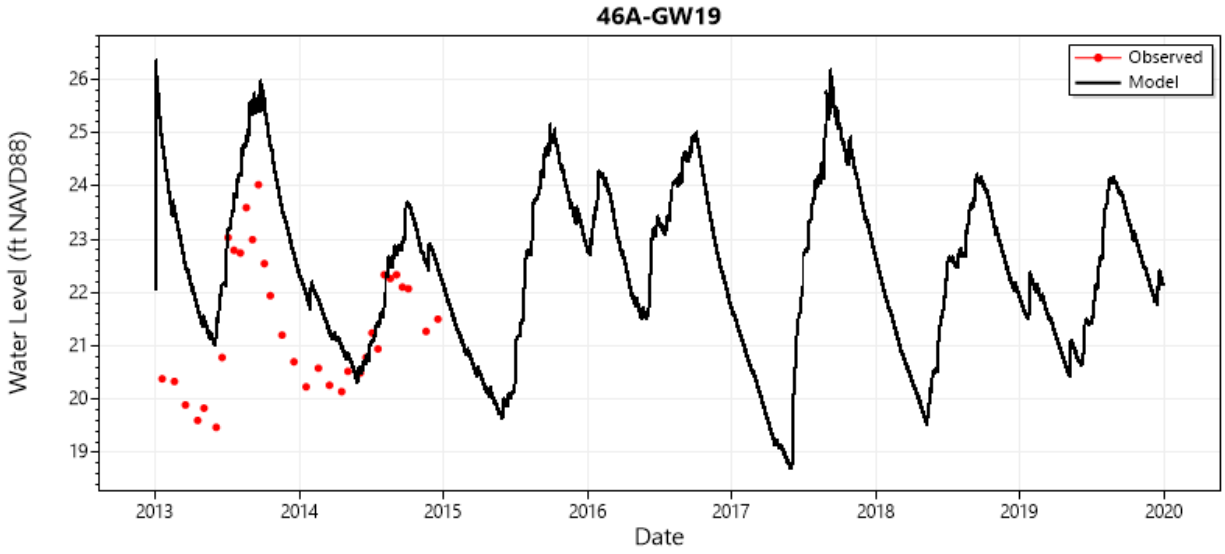
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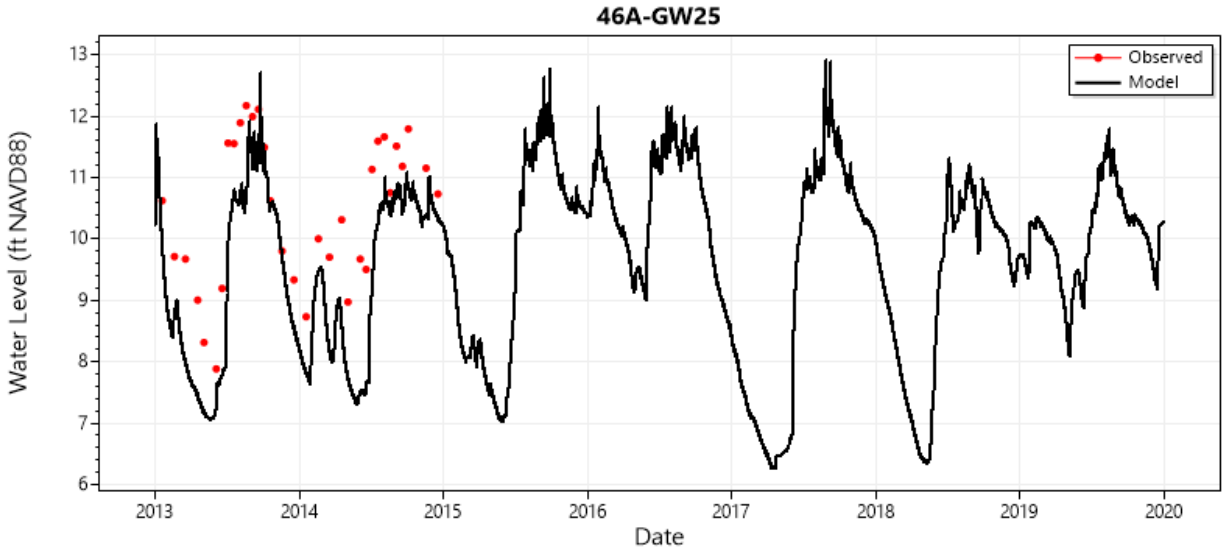
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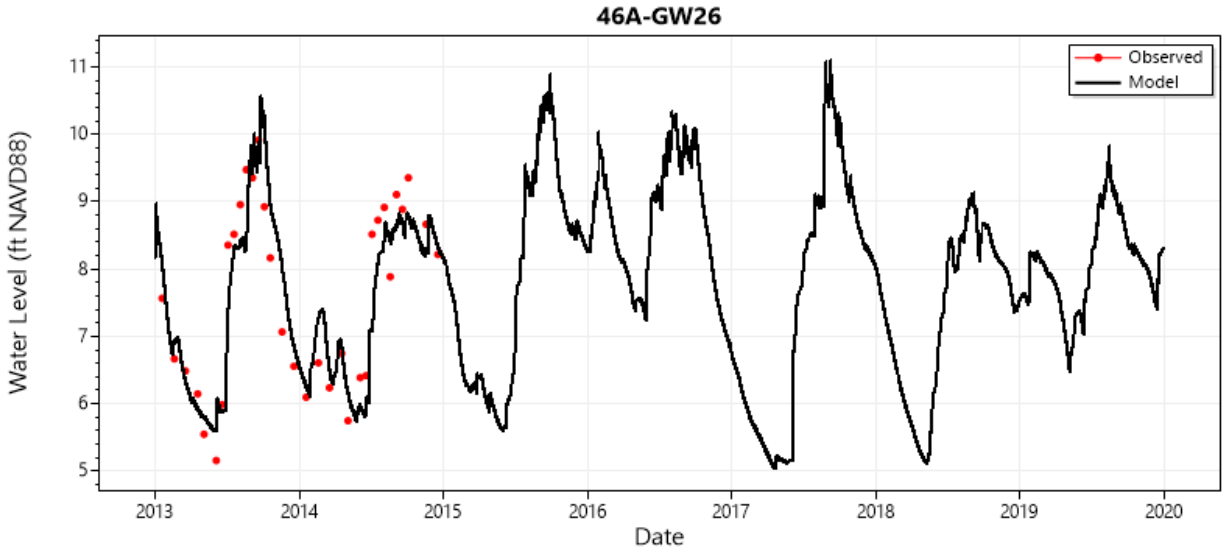
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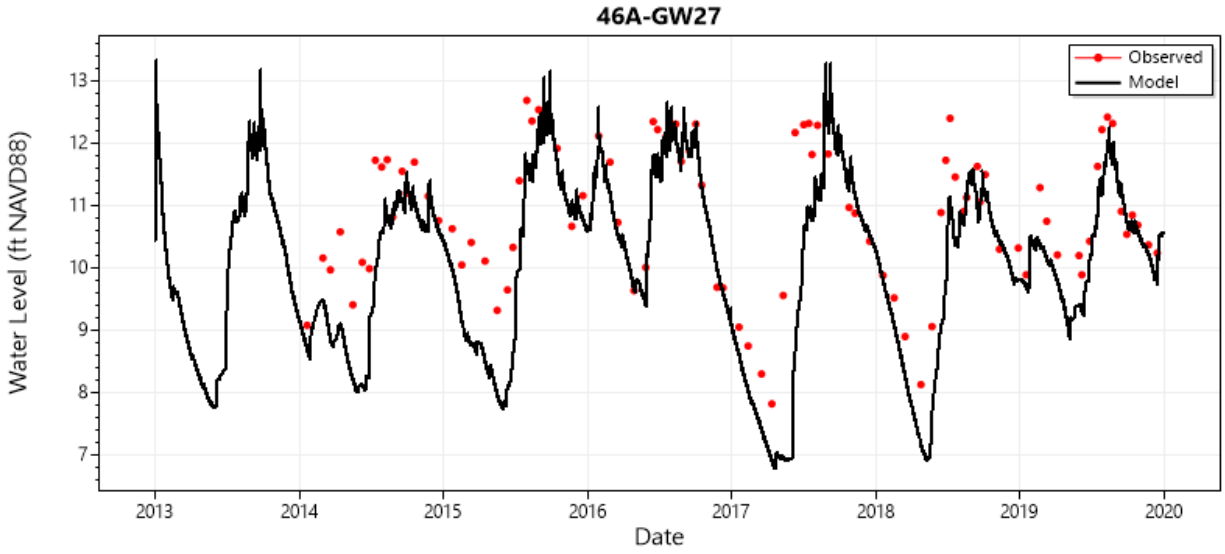
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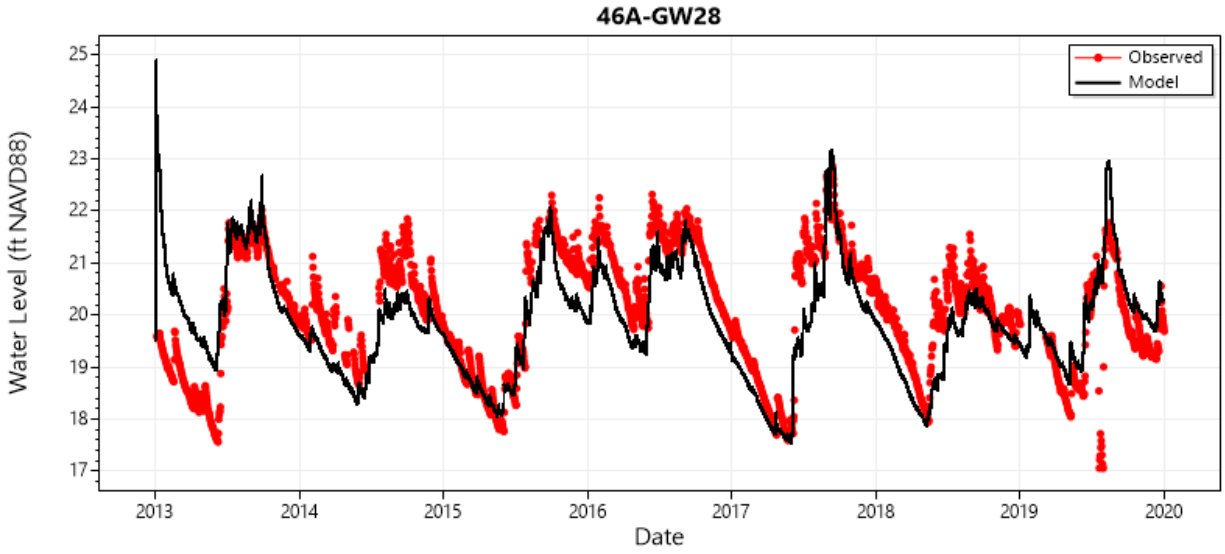
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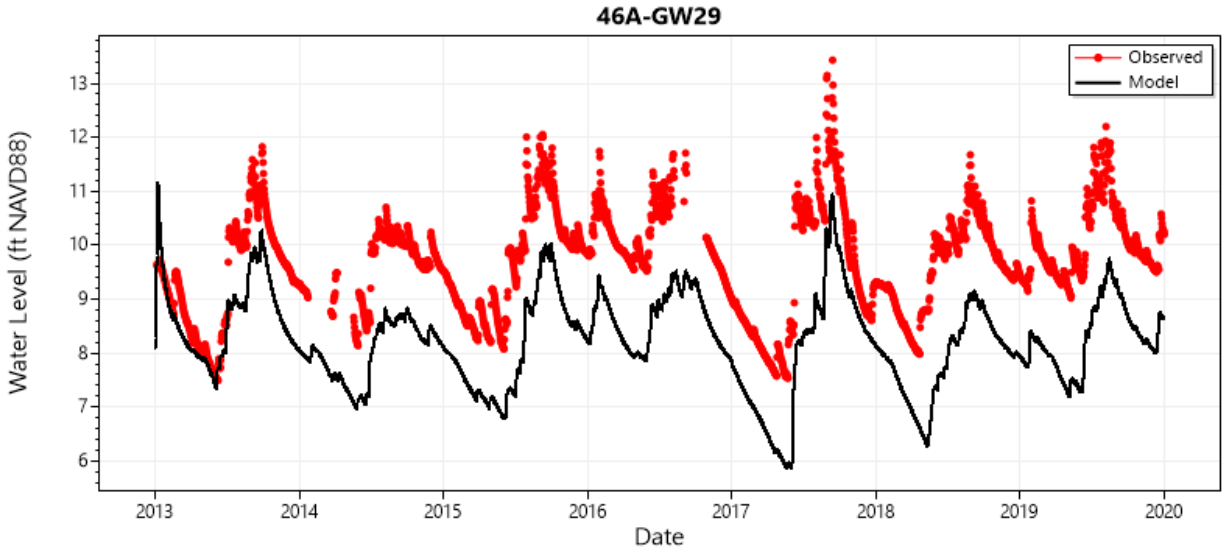
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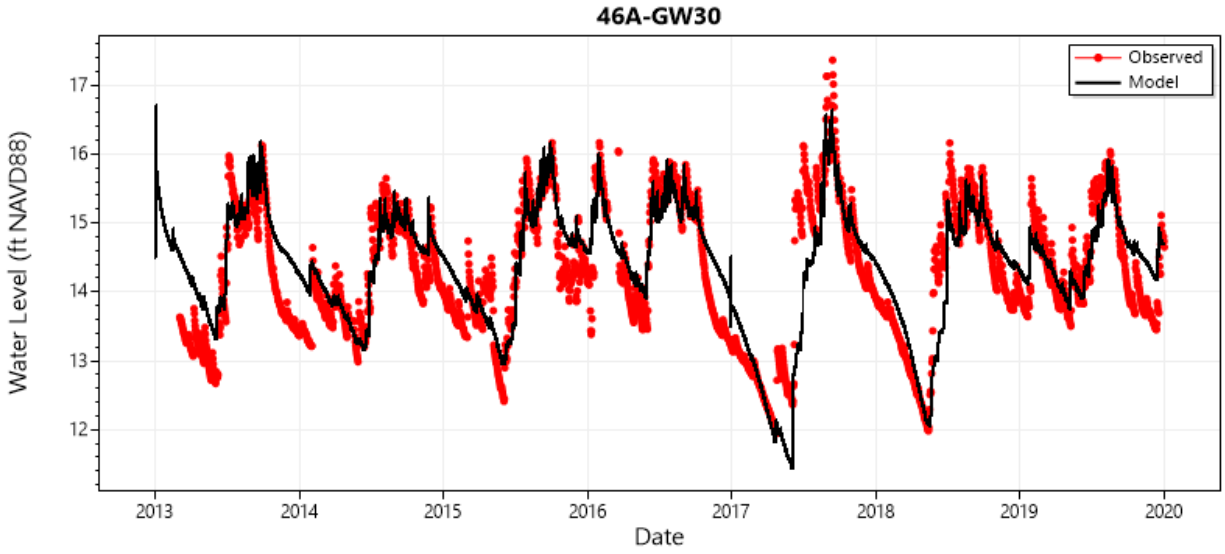
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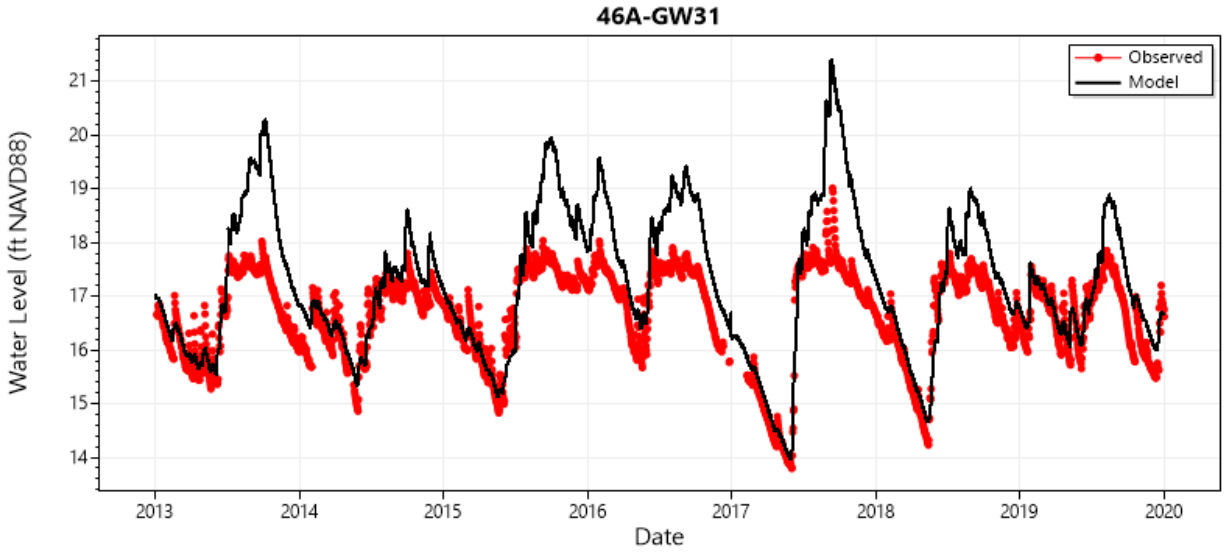
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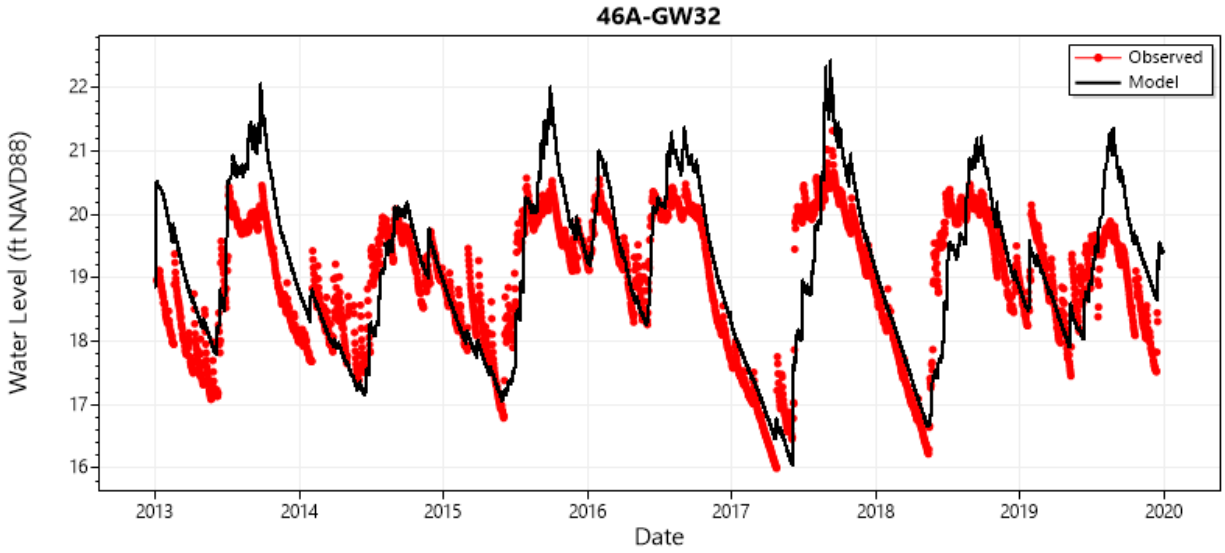
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Water Level (ft NAVD88)
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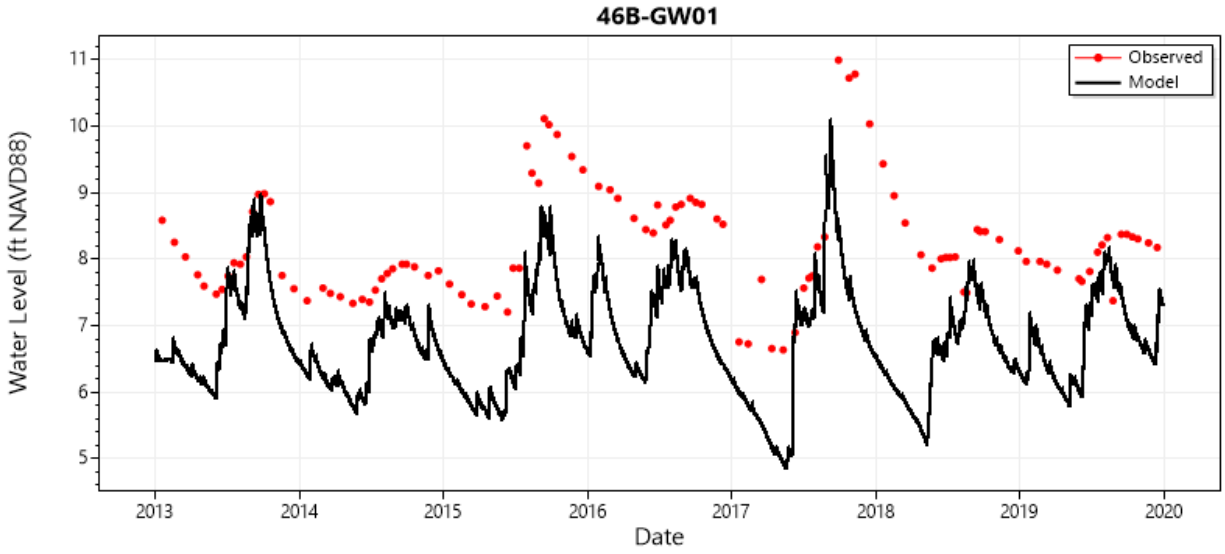
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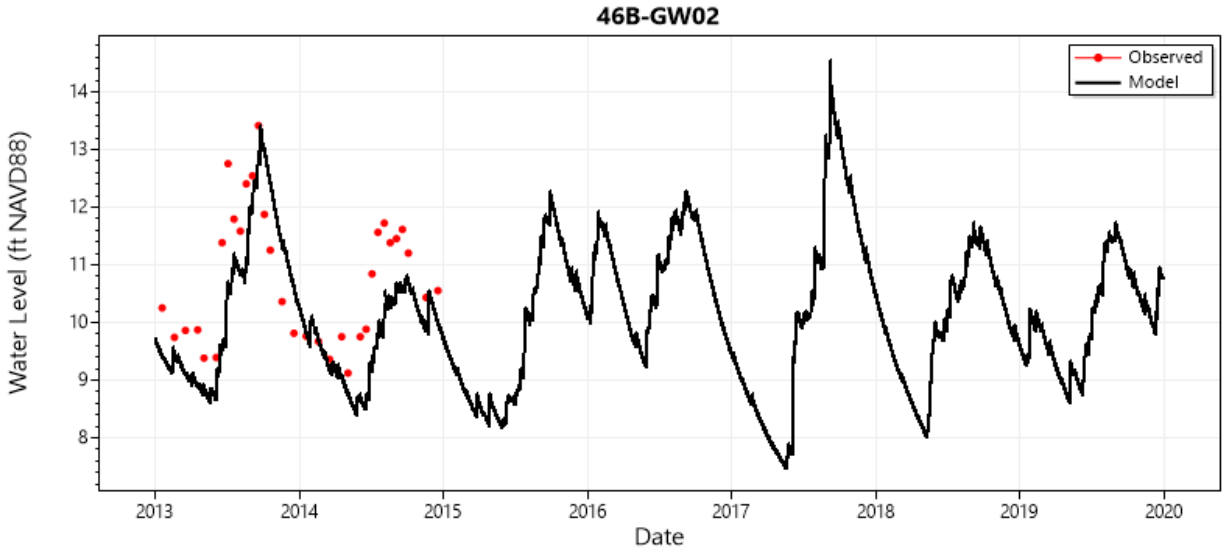
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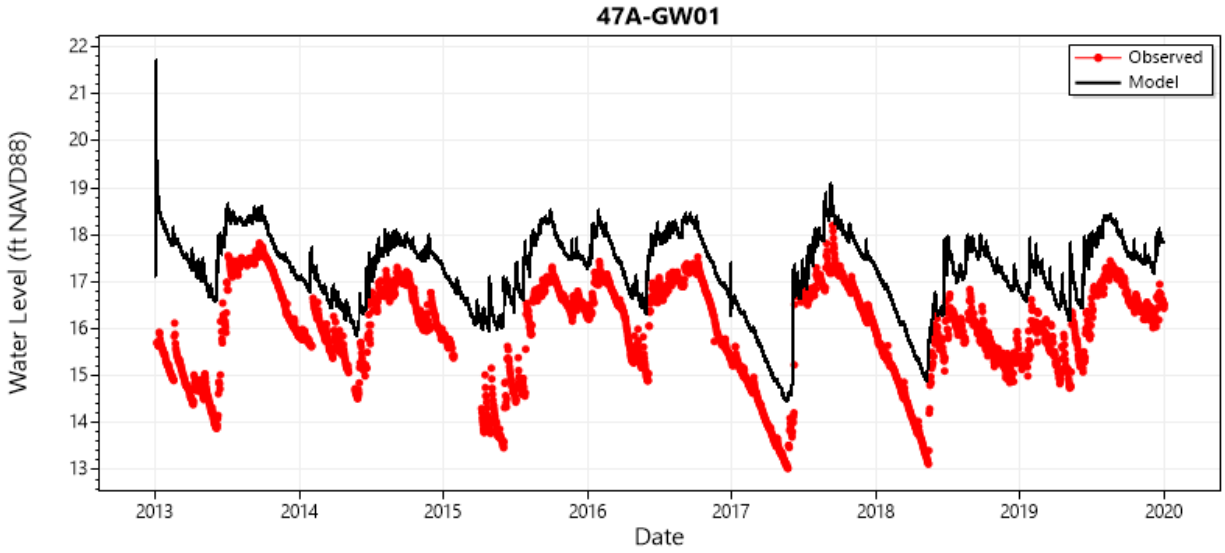
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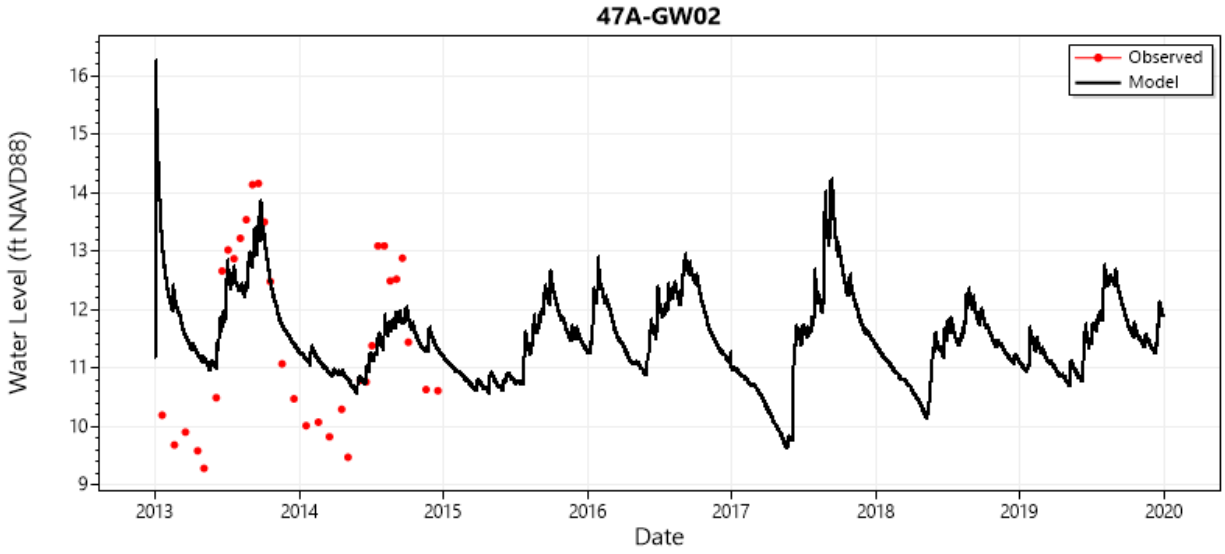
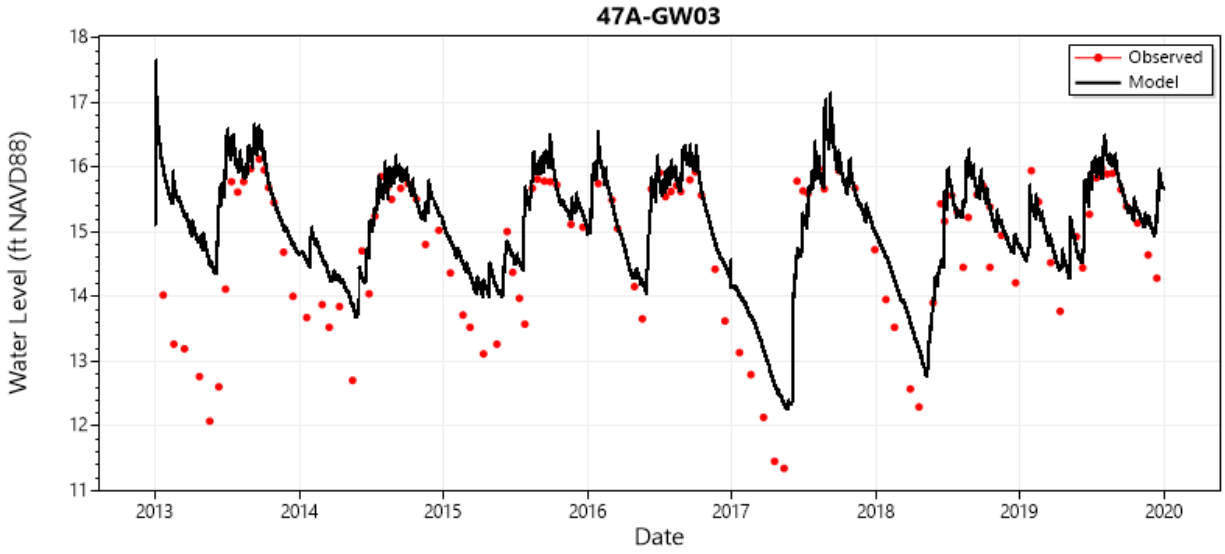
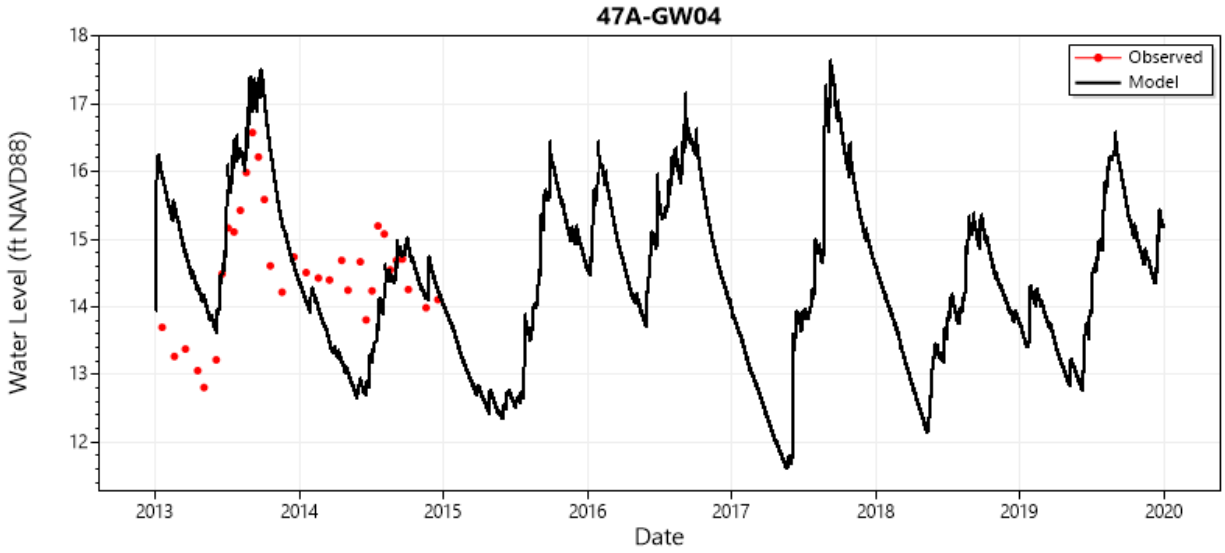
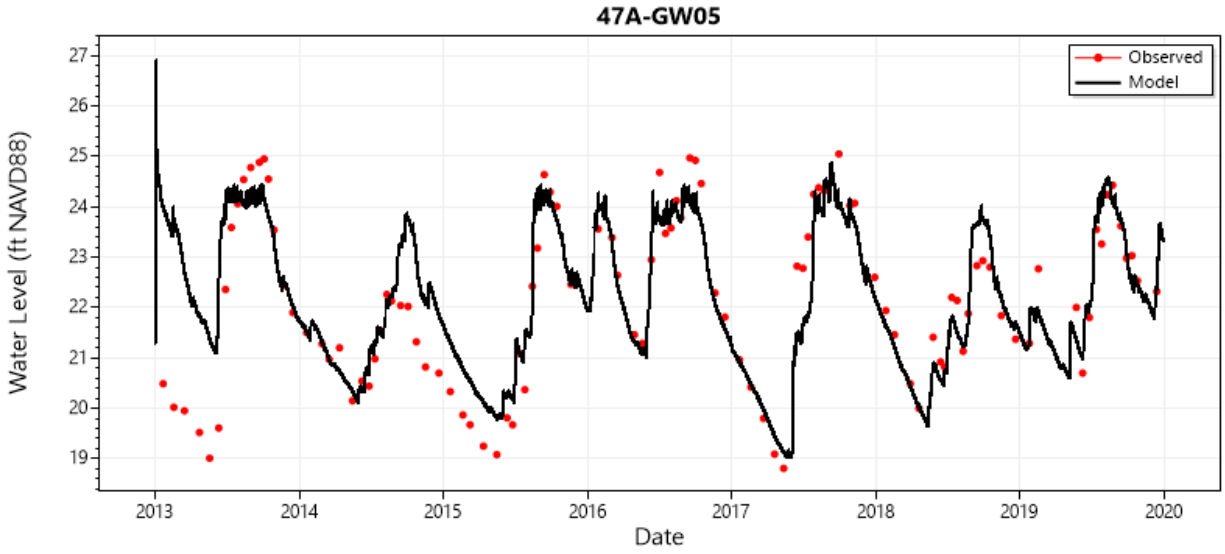
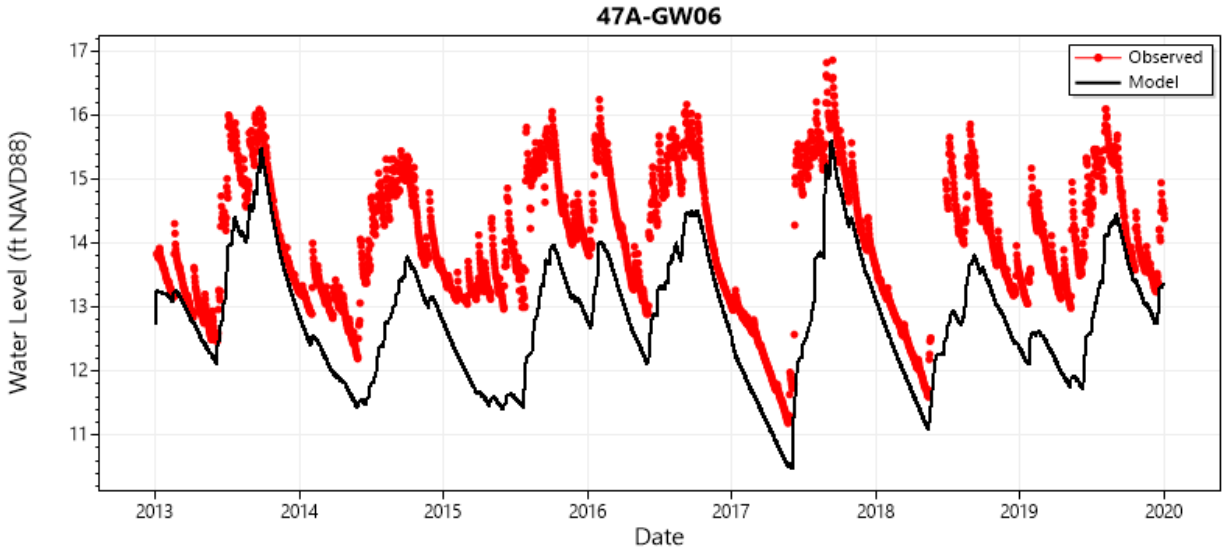
2020
Date

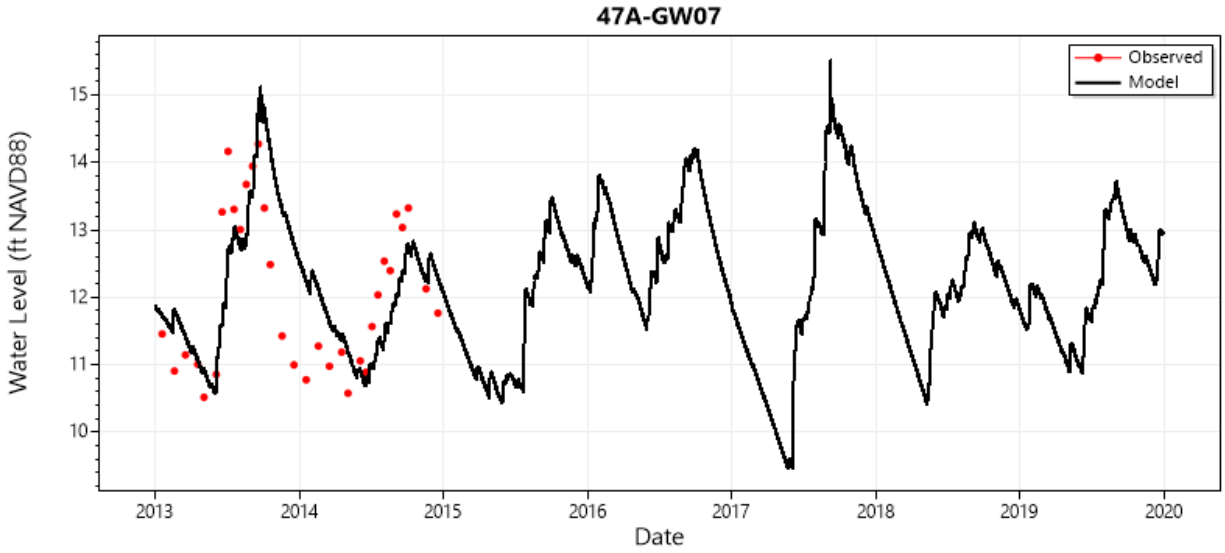

47A-GW02
Observed
Model
Water Level (ft NAVD88)
16
15
14
13
12
11
10
9
2013
2014
2015
2016
2017
2018
2019
2020
Date

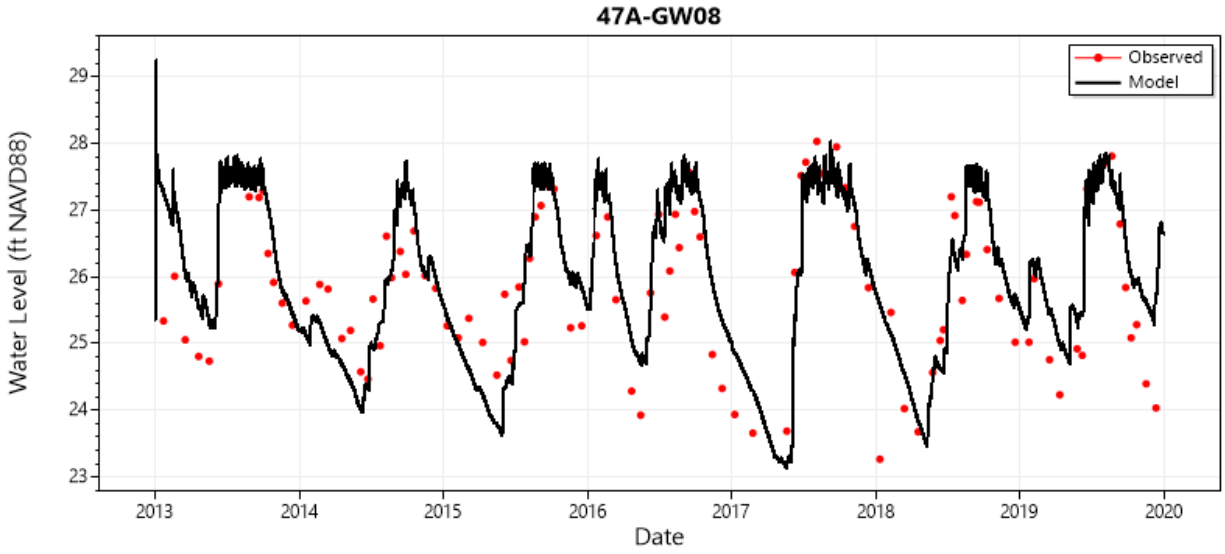

47A-GW03
Observed
Model
Water Level (ft NAVD88)
Date
18
17
16
15
14
13
12
11
2013
2014
2015
2016
2017
2018
2019
2020

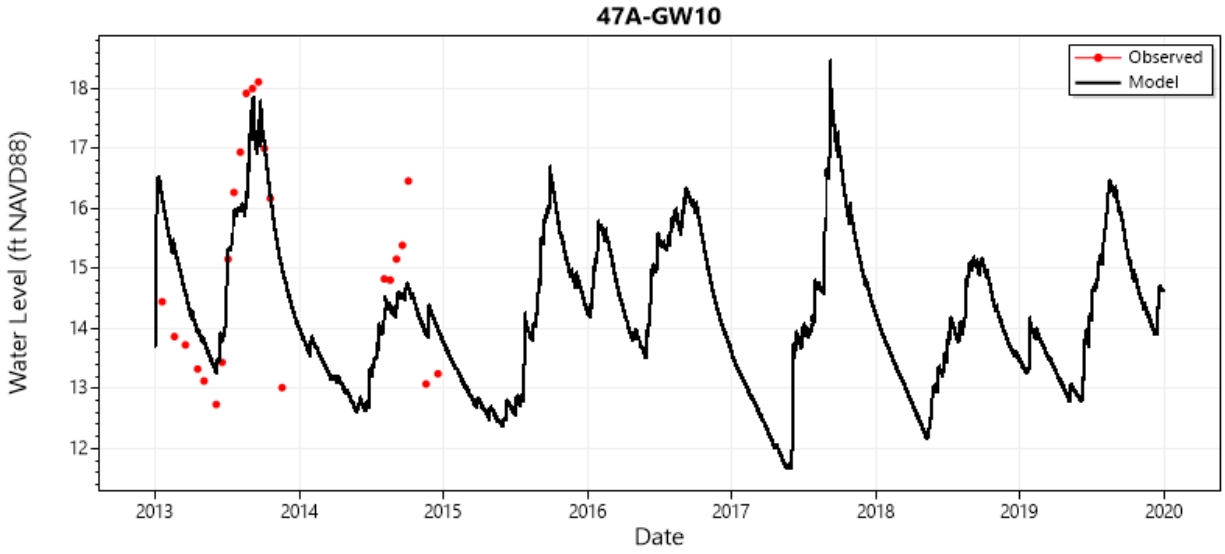

47A-GW04
Observed
Model
Water Level (ft NAVD88)
Date
18
17
16
15
14
13
12
2013
2014
2015
2016
2017
2018
2019
2020

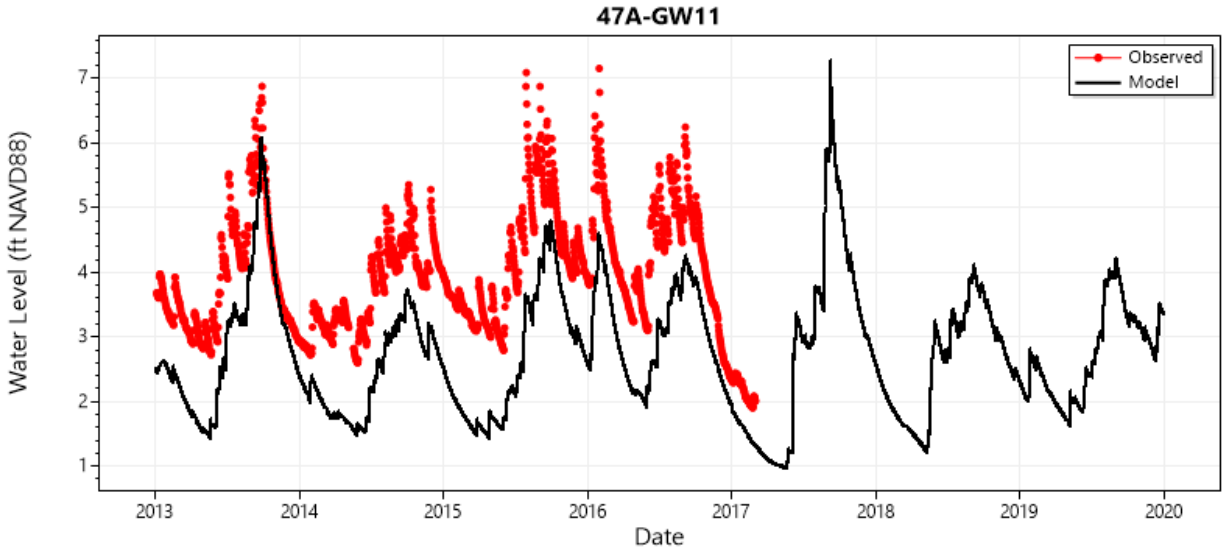

47A-GW05
Observed
Model
Water Level (ft NAVD88)
Date
27
26
25
24
23
22
21
20
19
2013
2014
2015
2016
2017
2018
2019
2020

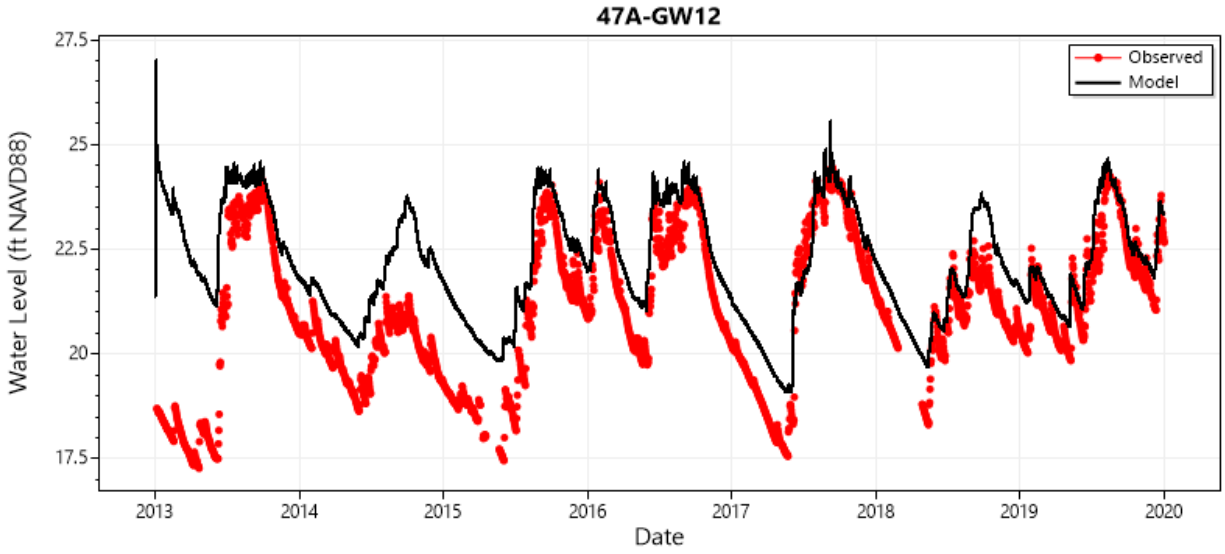

47A-GW06
Observed
Model
Water Level (ft NAVD88)
17
16
15
14
13
12
11
2013
2014
2015
2016
2017
2018
2019
2020
Date

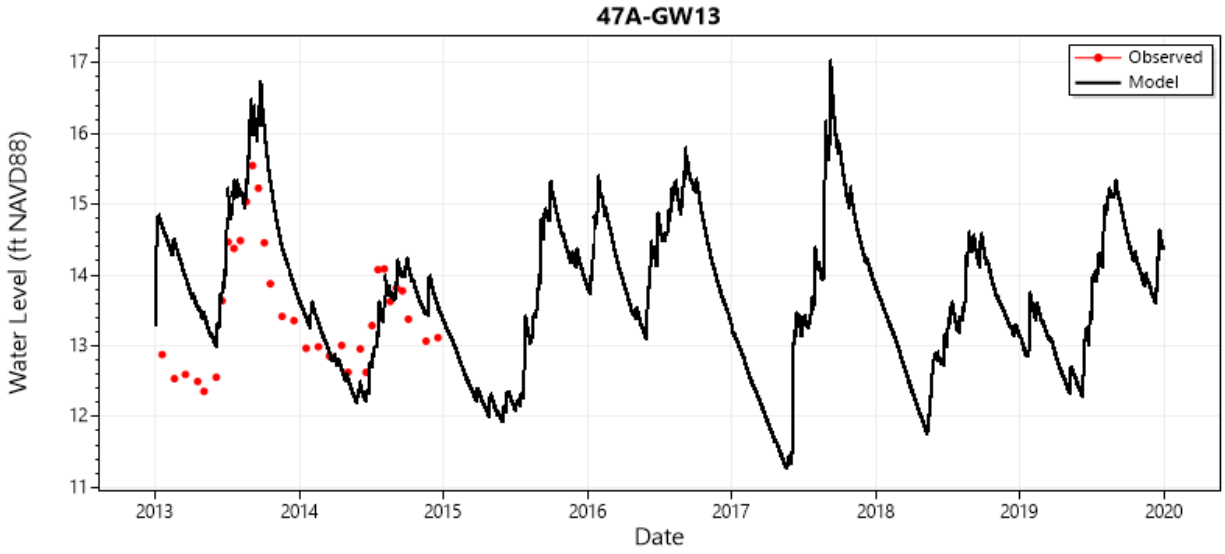

47A-GW07
Observed
Model
Water Level (ft NAVD88)
15
14
13
12
11
10
2013
2014
2015
2016
2017
2018
2019
2020
Date

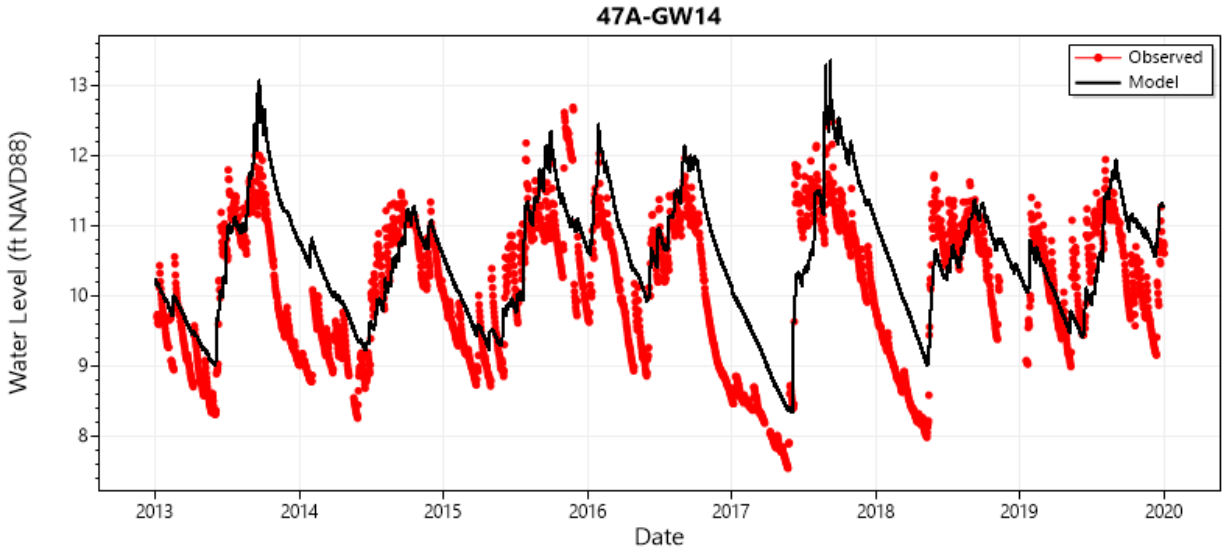

47A-GW08
Observed
Model
Water Level (ft NAVD88)
29
28
27
26
25
24
23
2013
2014
2015
2016
2017
2018
2019
2020
Date

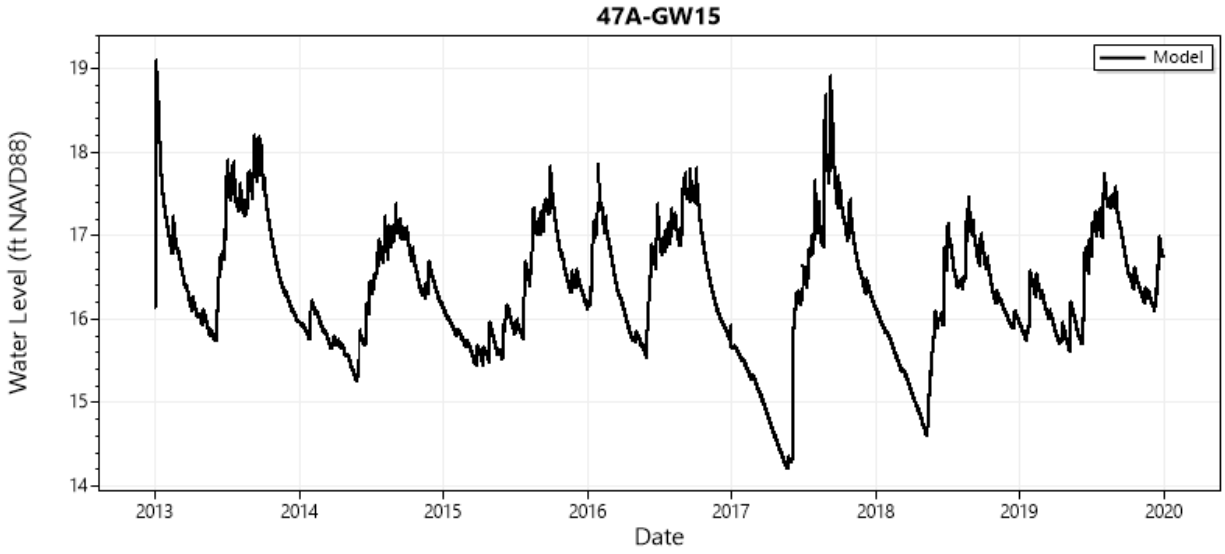

47A-GW10
Observed
Model
Water Level (ft NAVD88)
18
17
16
15
14
13
12
2013
2014
2015
2016
2017
2018
2019
2020
Date

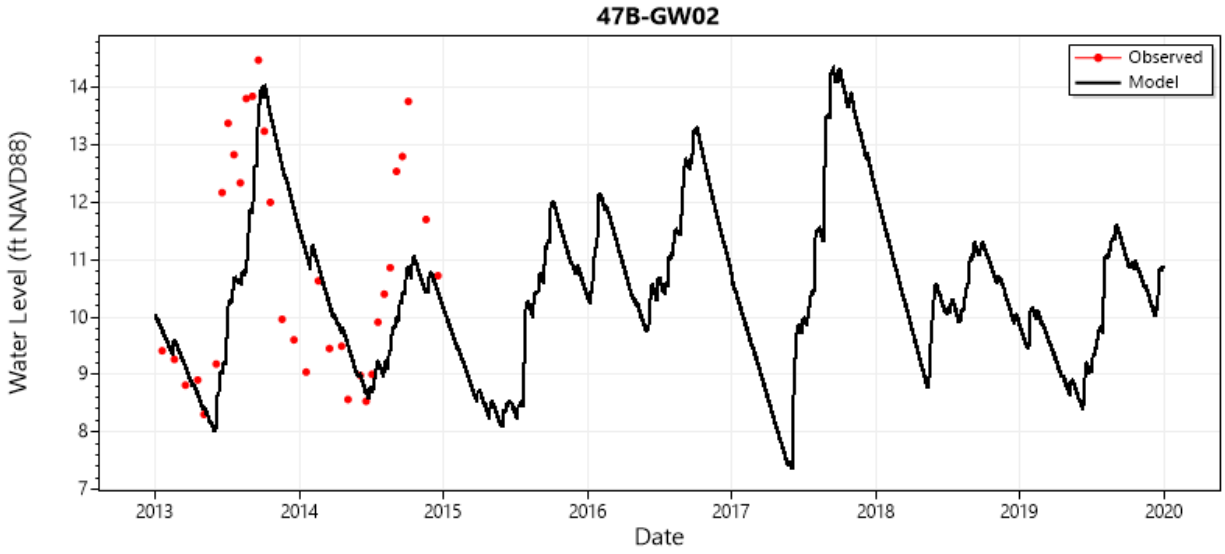

47A-GW11
Observed
Model
Water Level (ft NAVD88)
7
6
5
4
3
2
1
2013
2014
2015
2016
2017
2018
2019
2020
Date

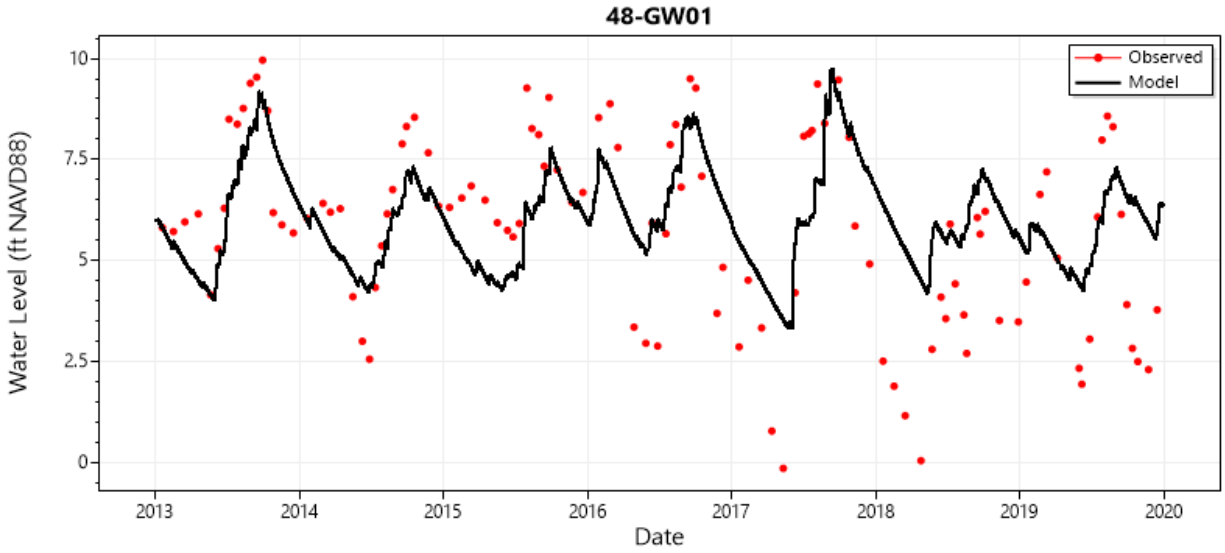

47A-GW12
Observed
Model
Water Level (ft NAVD88)
27.5
25
22.5
20
17.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

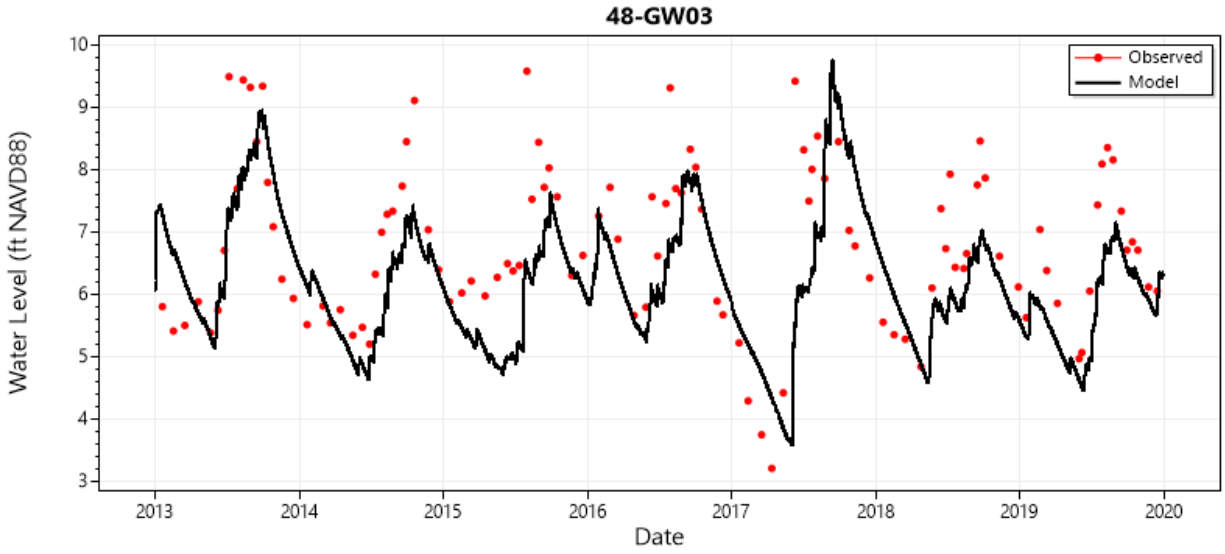

47A-GW13
Observed
Model
Water Level (ft NAVD88)
17
16
15
14
13
12
11
2013
2014
2015
2016
2017
2018
2019
2020
Date

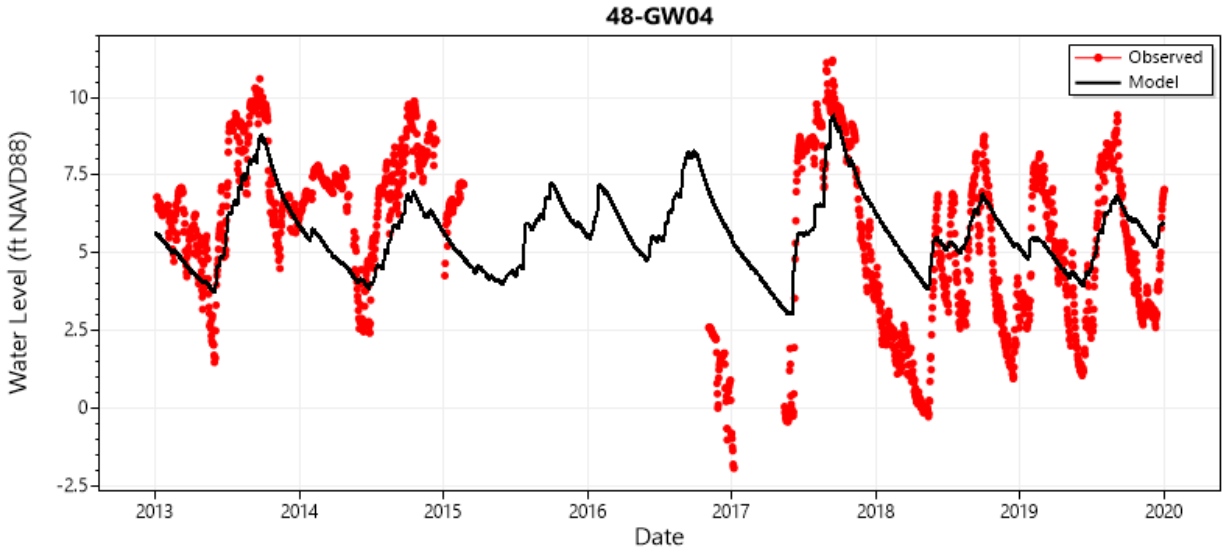

47A-GW14
Observed
Model
Water Level (ft NAVD88)
13
12
11
10
9
8
2013
2014
2015
2016
2017
2018
2019
2020
Date

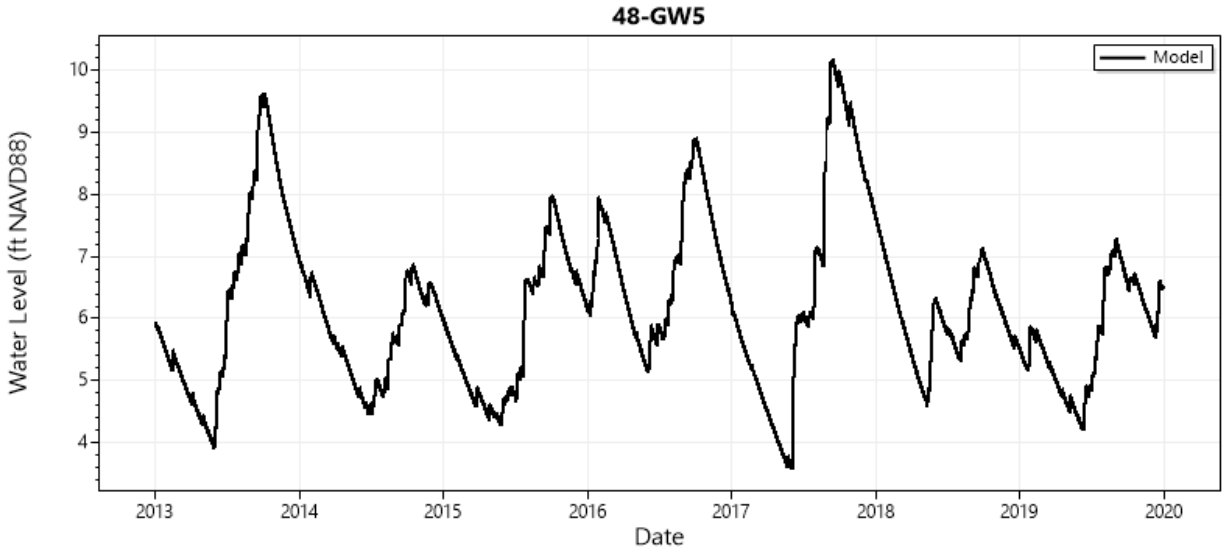

47A-GW15
Model
Water Level (ft NAVD88)
19
18
17
16
15
14
2013
2014
2015
2016
2017
2018
2019
2020
Date

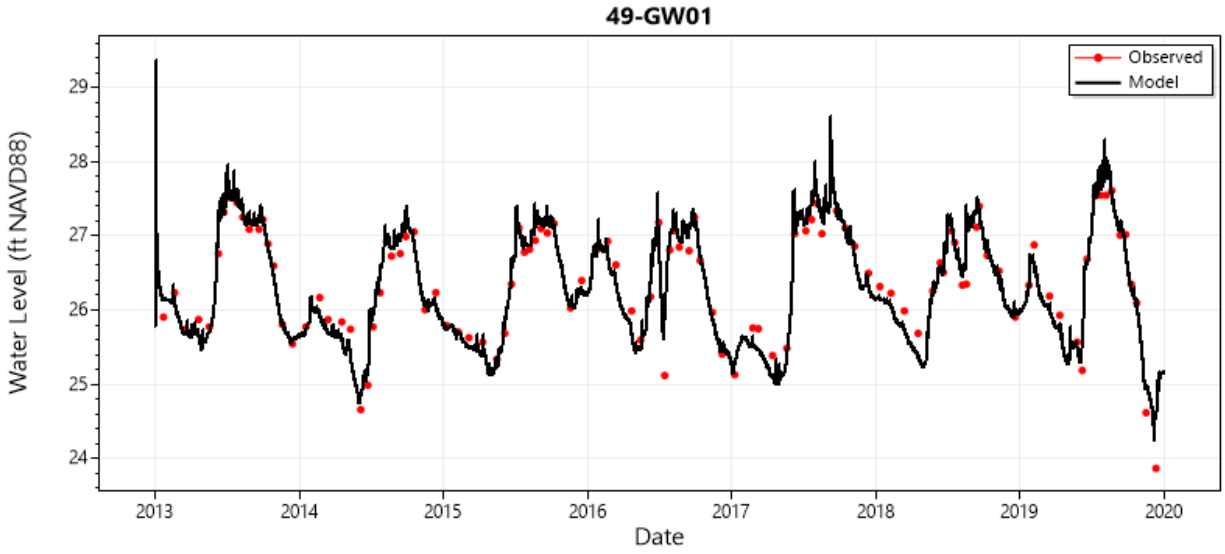

47B-GW02
Observed
Model
Water Level (ft NAVD88)
14
13
12
11
10
9
8
7
2013
2014
2015
2016
2017
2018
2019
2020
Date

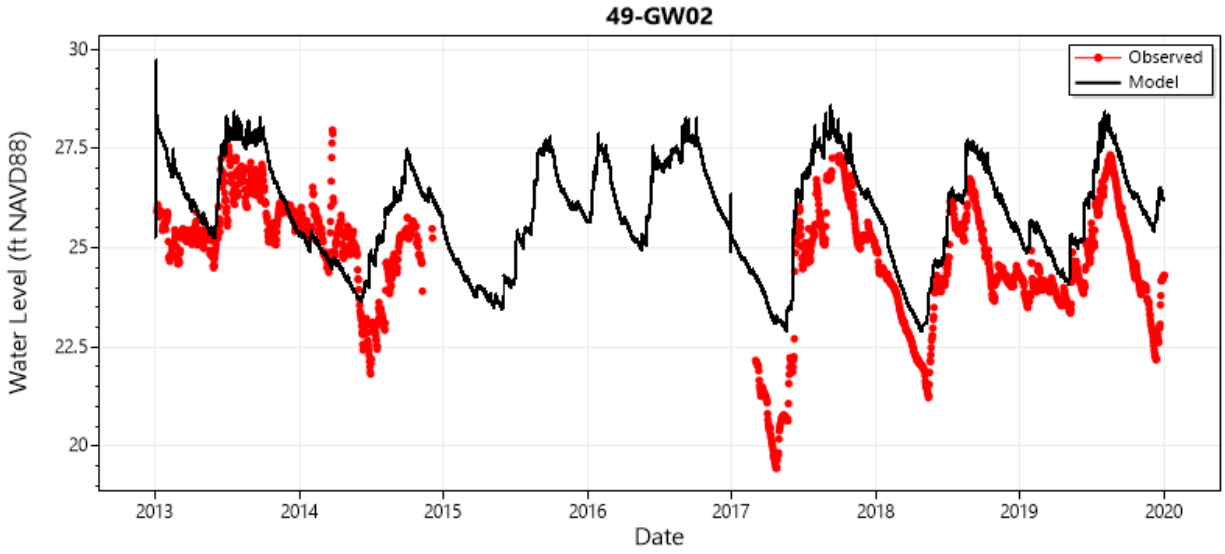

48-GW01
Observed
Model
Water Level (ft NAVD88)
10
7.5
5
2.5
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

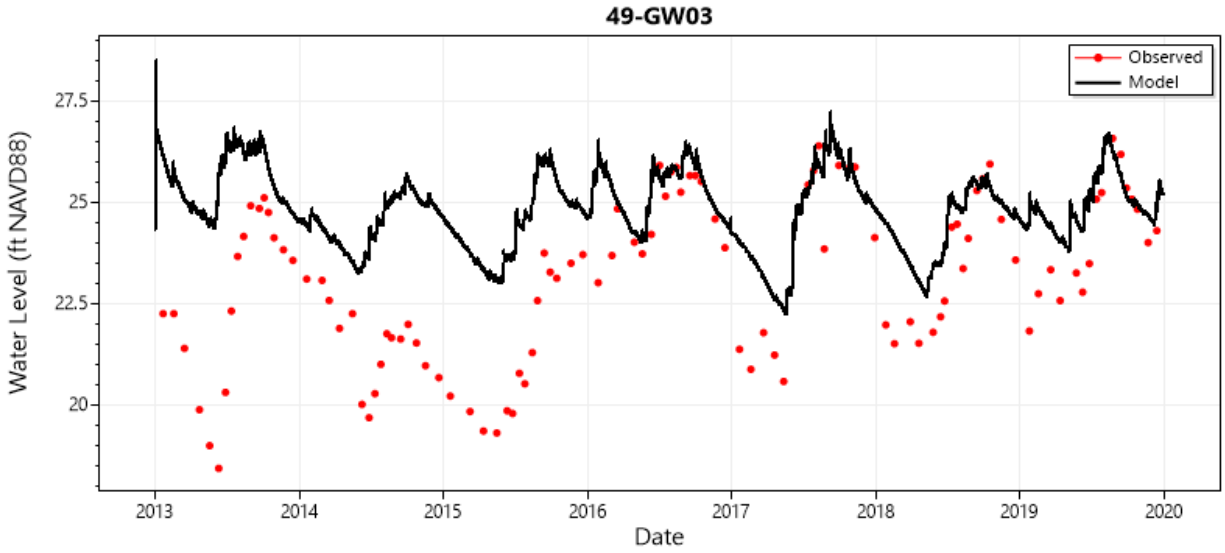

48-GW03
Observed
Model
Water Level (ft NAVD88)
10
9
8
7
6
5
4
3
2013
2014
2015
2016
2017
2018
2019
2020
Date

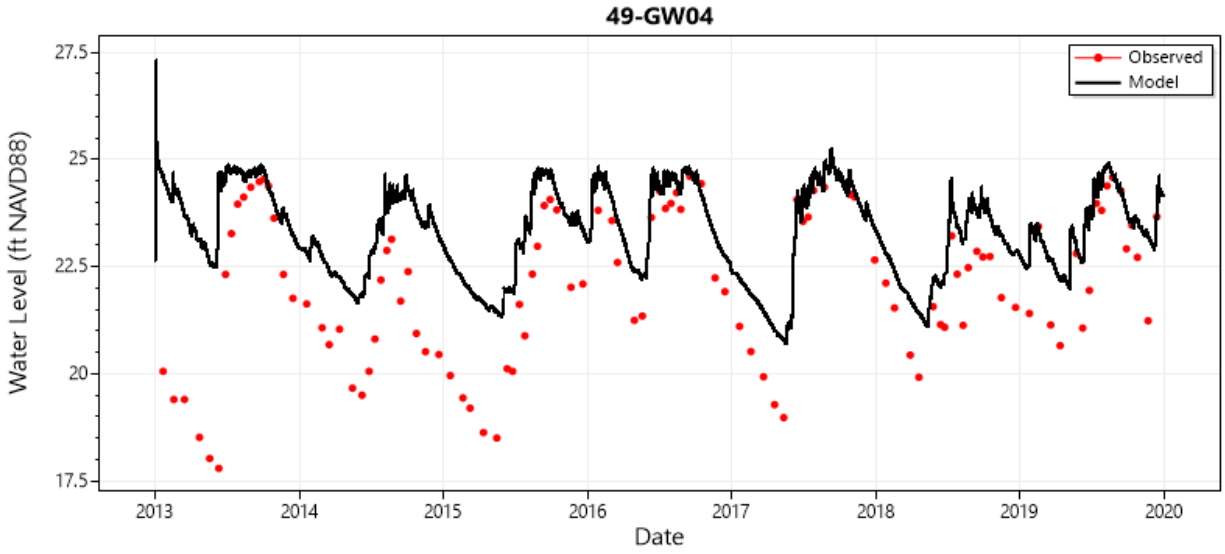

48-GW04
Observed
Model
Water Level (ft NAVD88)
10
7.5
5
2.5
0
-2.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

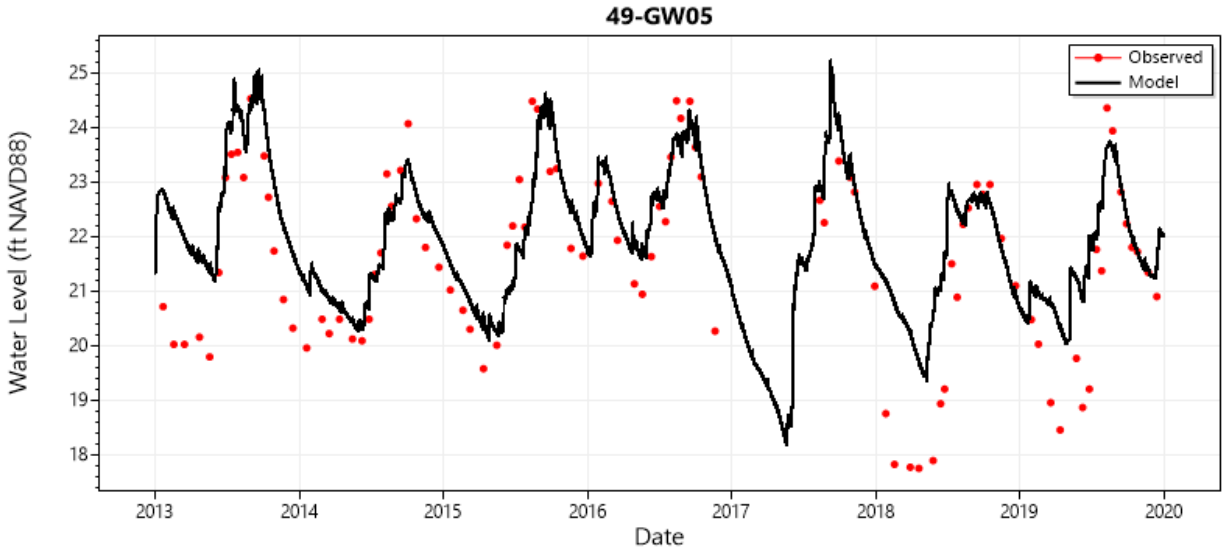

48-GW5
Model
Water Level (ft NAVD88)
10
9
8
7
6
5
4
2013
2014
2015
2016
2017
2018
2019
2020
Date

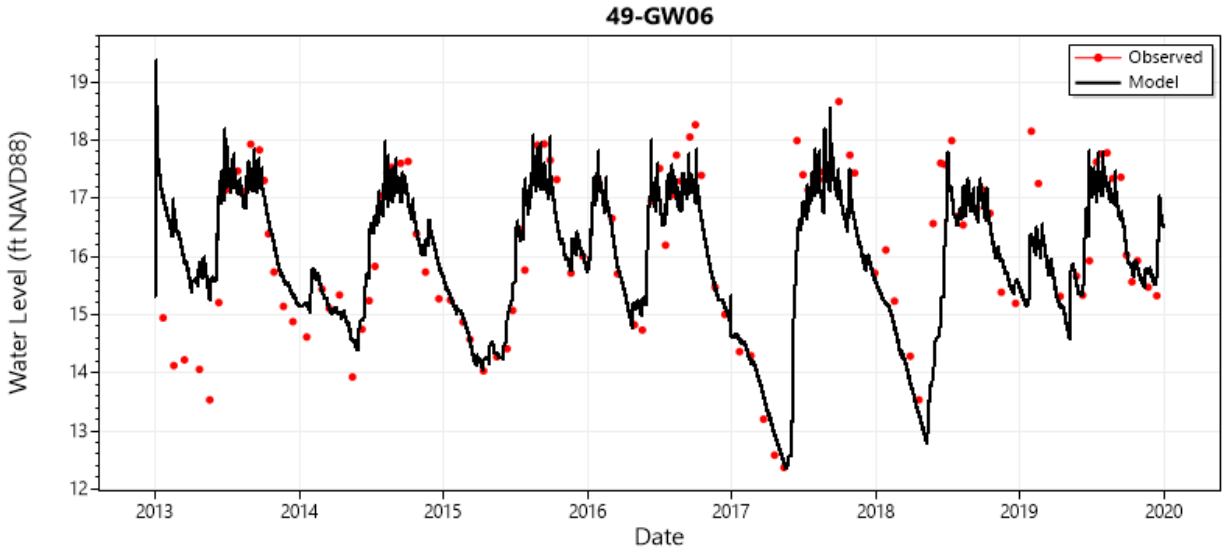

49-GW01
Observed
Model
Water Level (ft NAVD88)
29
28
27
26
25
24
2013
2014
2015
2016
2017
2018
2019
2020
Date

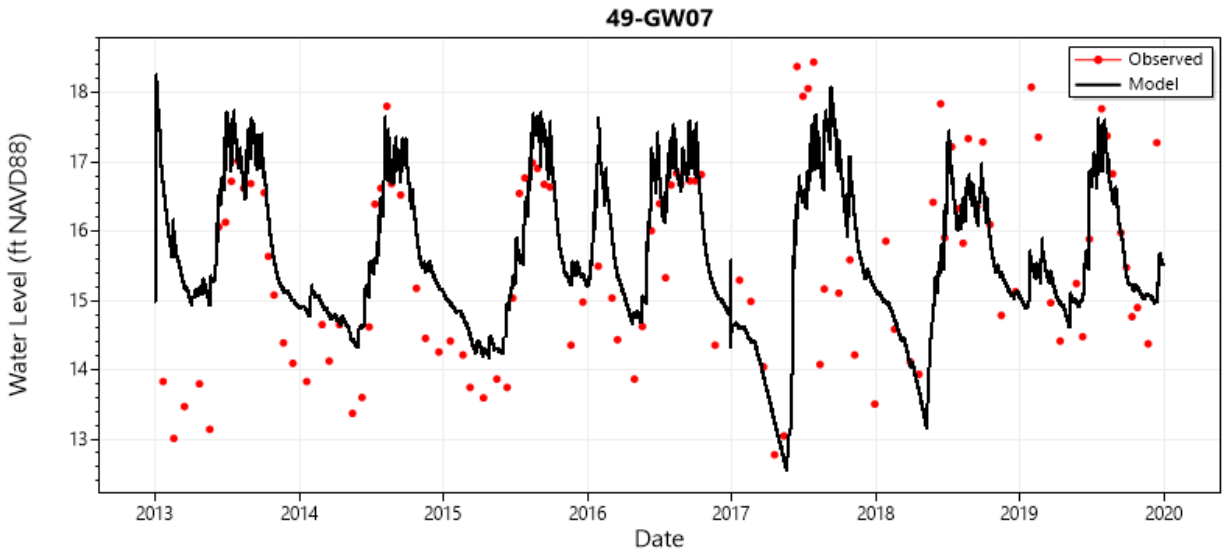

49-GW02
Observed
Model
Water Level (ft NAVD88)
30
27.5
25
22.5
20
2013
2014
2015
2016
2017
2018
2019
2020
Date

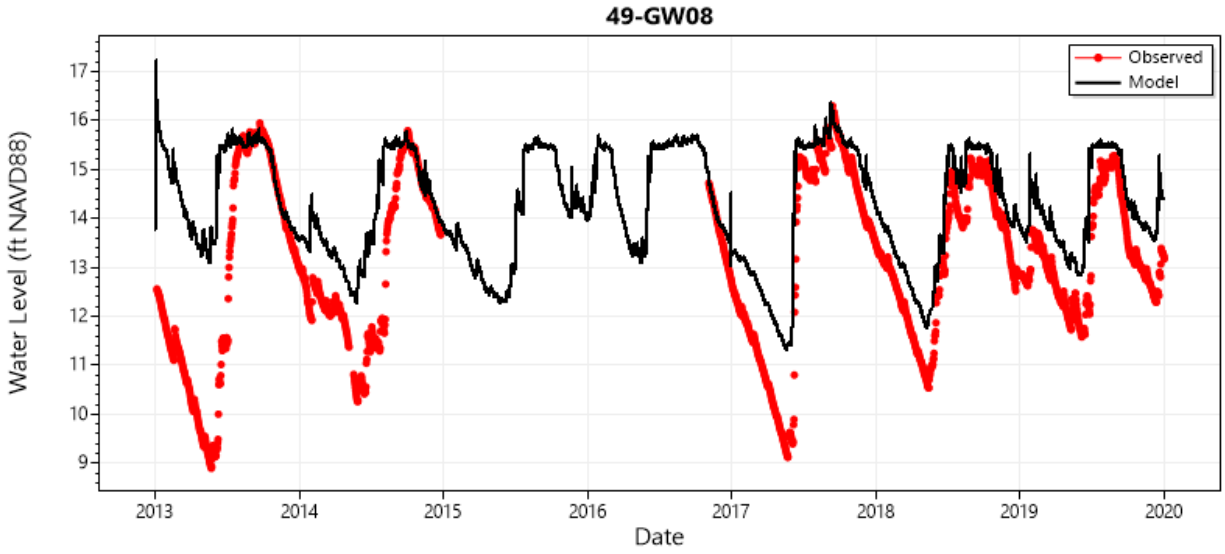

49-GW03
Observed
Model
Water Level (ft NAVD88)
27.5
25
22.5
20
2013
2014
2015
2016
2017
2018
2019
2020
Date

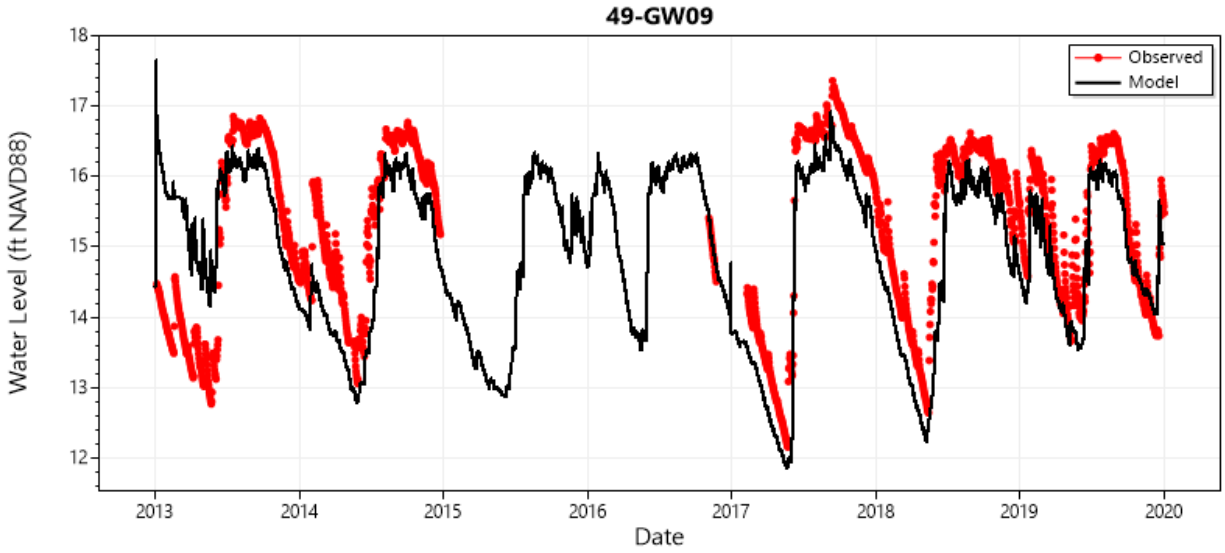

49-GW04
Observed
Model
Water Level (ft NAVD88)
27.5
25
22.5
20
17.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

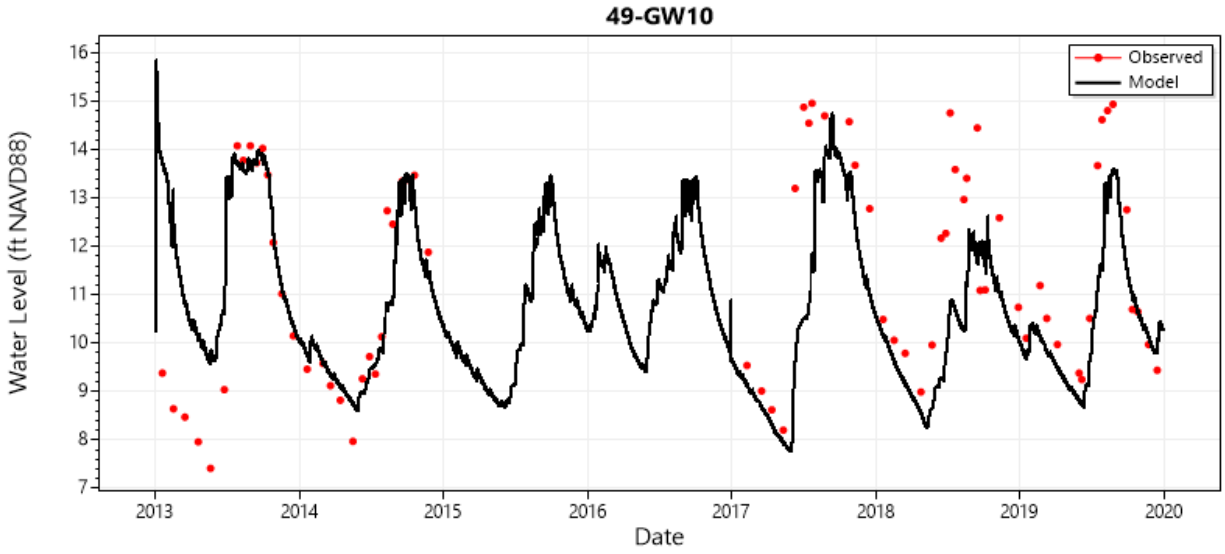

49-GW05
Observed
Model
Water Level (ft NAVD88)
25
24
23
22
21
20
19
18
2013
2014
2015
2016
2017
2018
2019
2020
Date

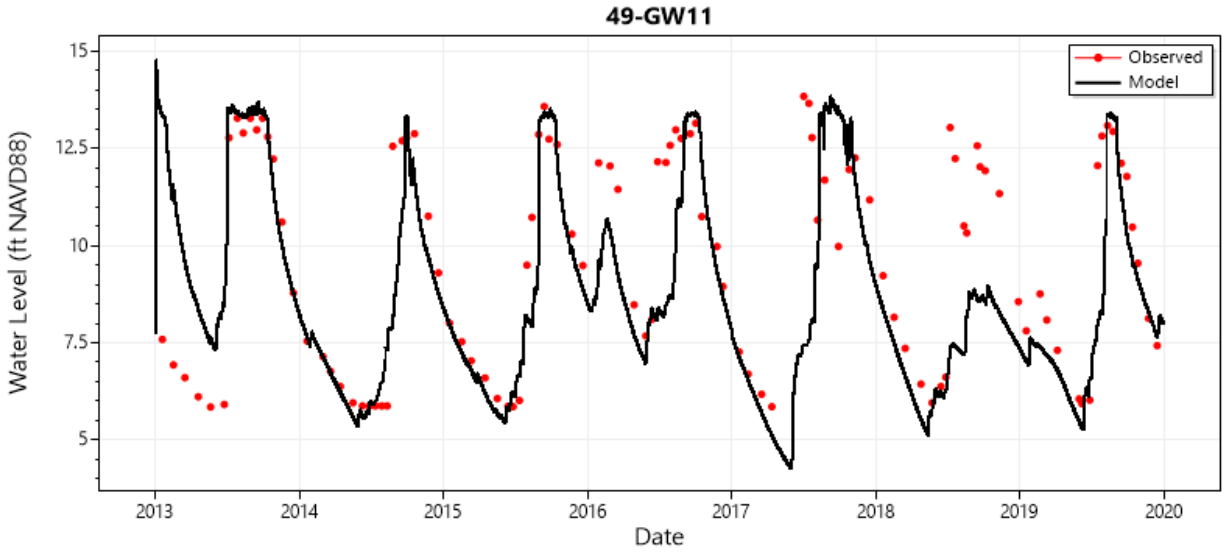

49-GW06
Observed
Model
Water Level (ft NAVD88)
19
18
17
16
15
14
13
12
2013
2014
2015
2016
2017
2018
2019
2020
Date

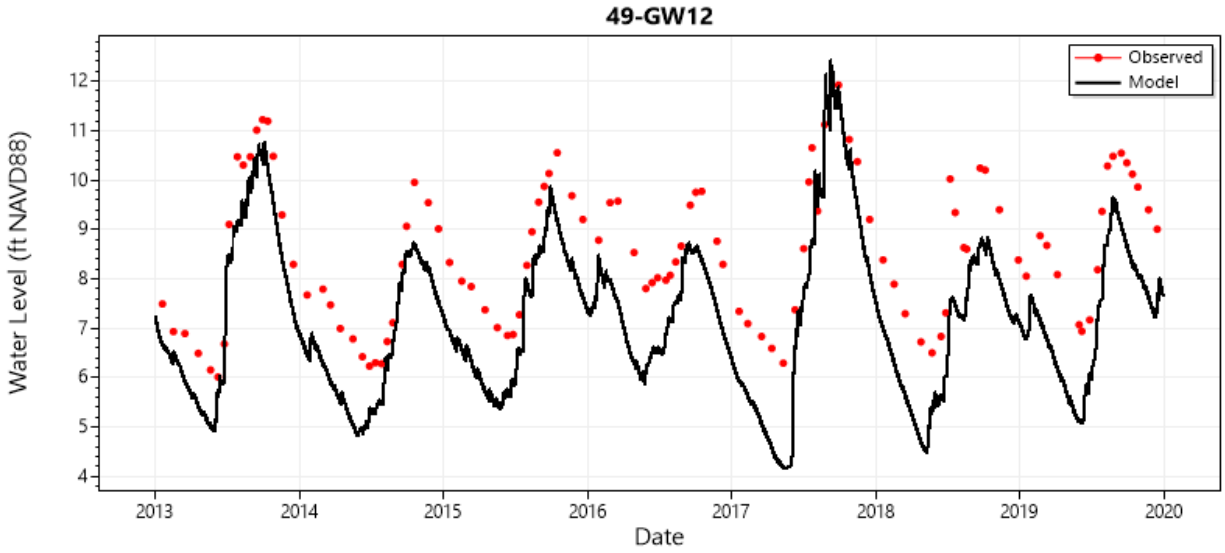

49-GW07
Observed
Model
Water Level (ft NAVD88)
18
17
16
15
14
13
2013
2014
2015
2016
2017
2018
2019
2020
Date

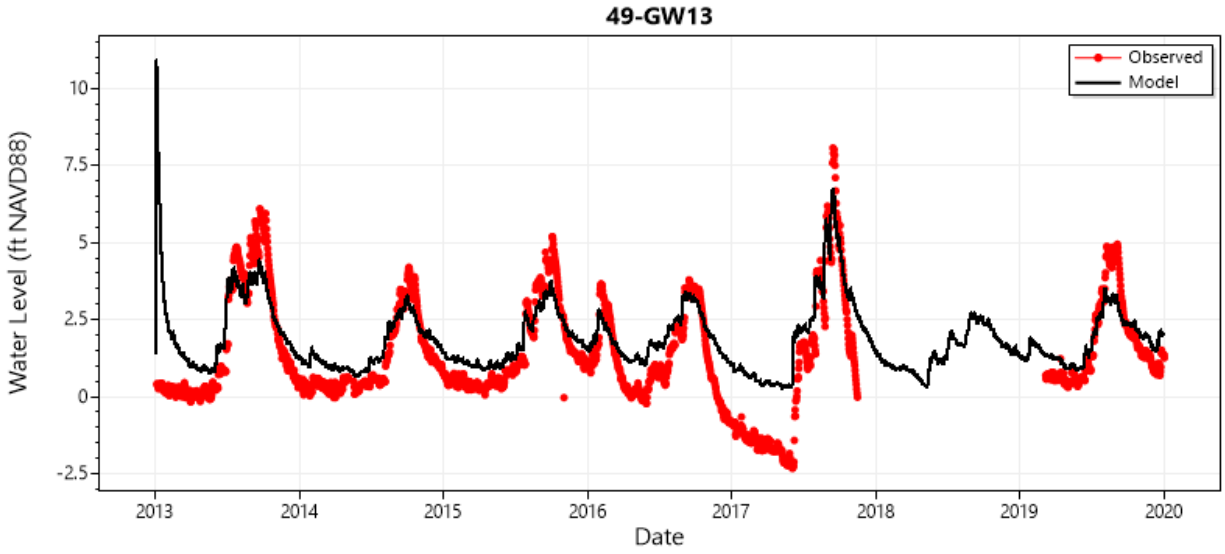

49-GW08
Observed
Model
Water Level (ft NAVD88)
17
16
15
14
13
12
11
10
9
2013
2014
2015
2016
2017
2018
2019
2020
Date

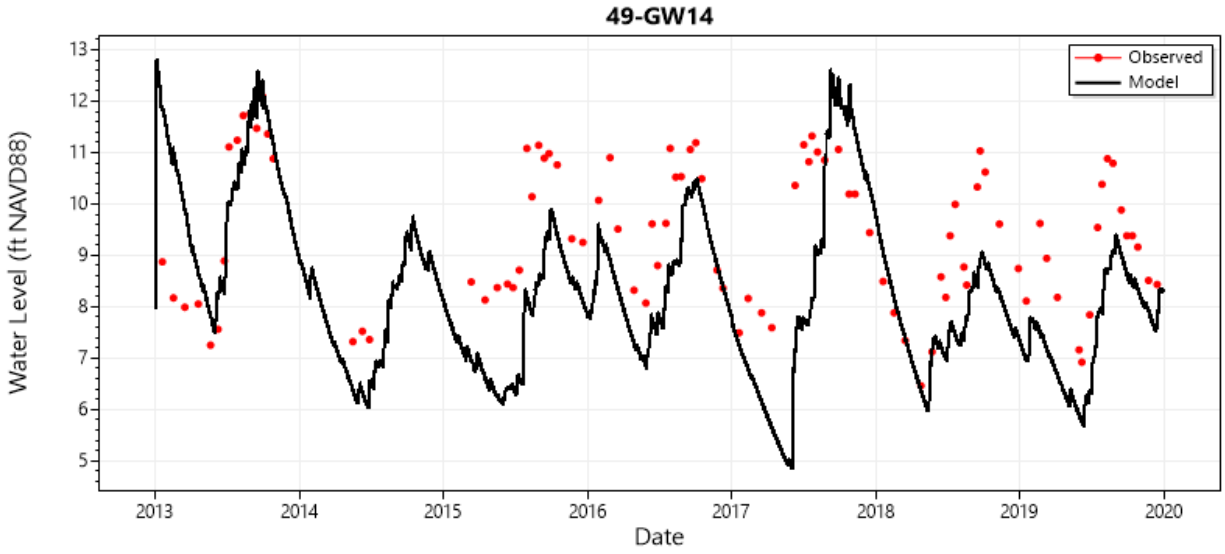

49-GW09
Observed
Model
Water Level (ft NAVD88)
18
17
16
15
14
13
12
2013
2014
2015
2016
2017
2018
2019
2020
Date

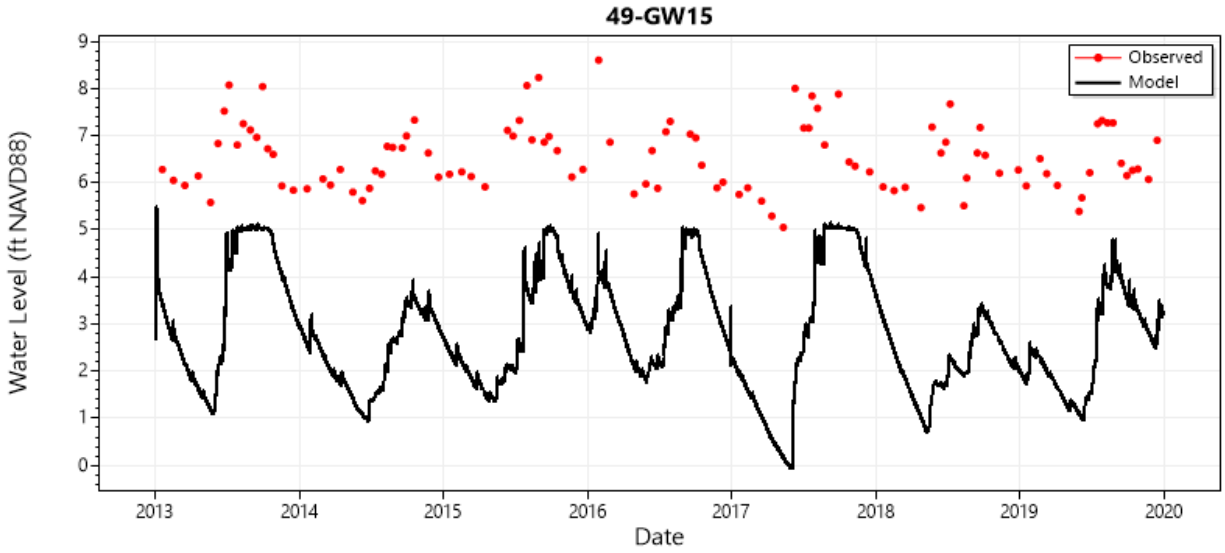

49-GW10
Observed
Model
Water Level (ft NAVD88)
16
15
14
13
12
11
10
9
8
7
2013
2014
2015
2016
2017
2018
2019
2020
Date

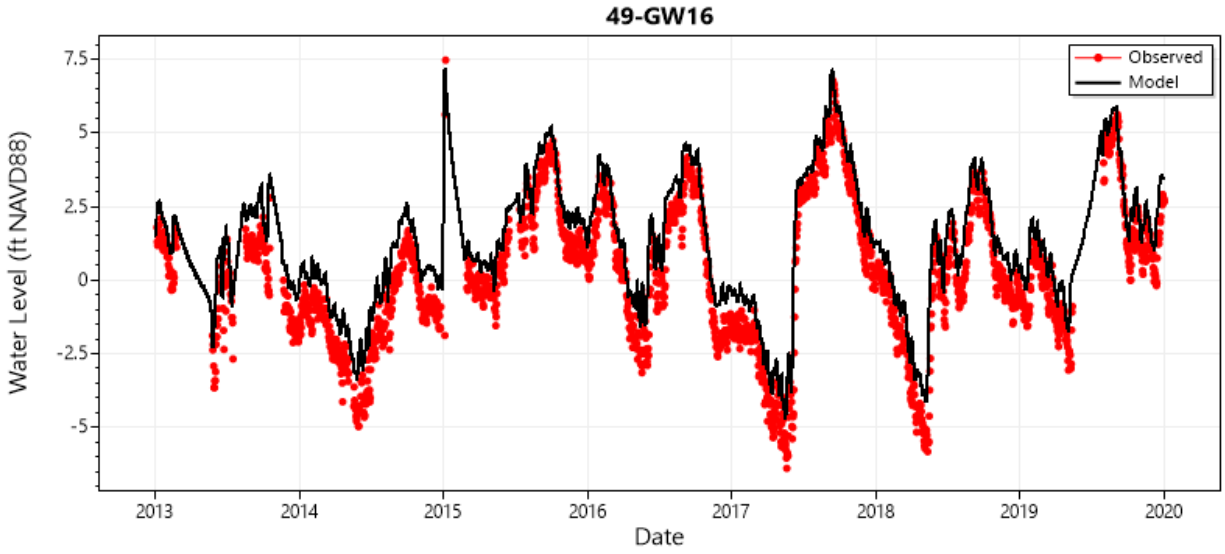

49-GW11
Observed
Model
Water Level (ft NAVD88)
15
12.5
10
7.5
5
2013
2014
2015
2016
2017
2018
2019
2020
Date

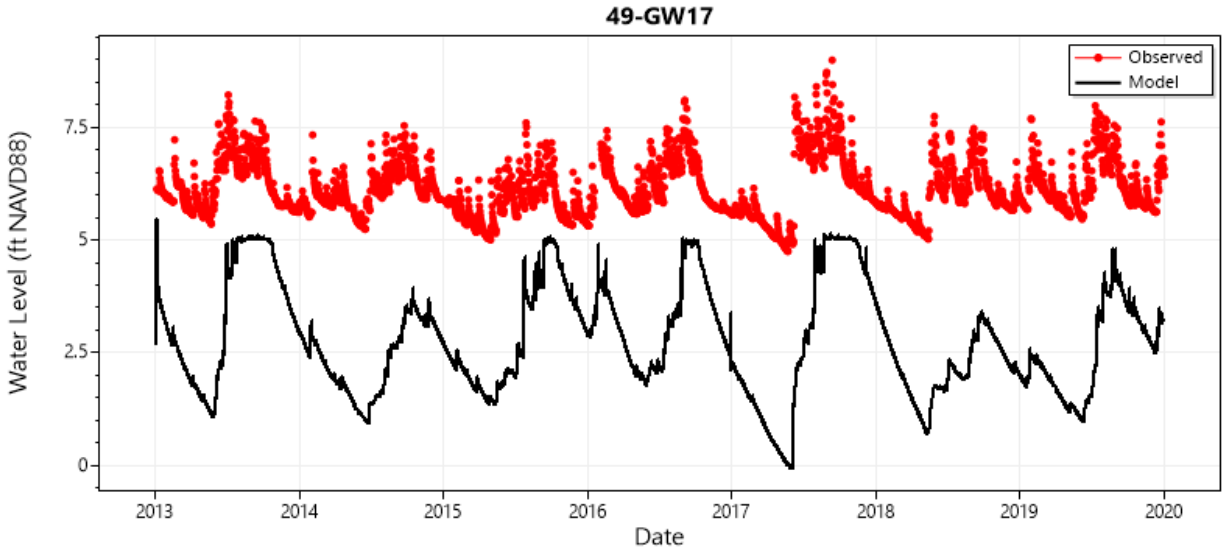

49-GW12
Observed
Model
Water Level (ft NAVD88)
12
11
10
9
8
7
6
5
4
2013
2014
2015
2016
2017
2018
2019
2020
Date

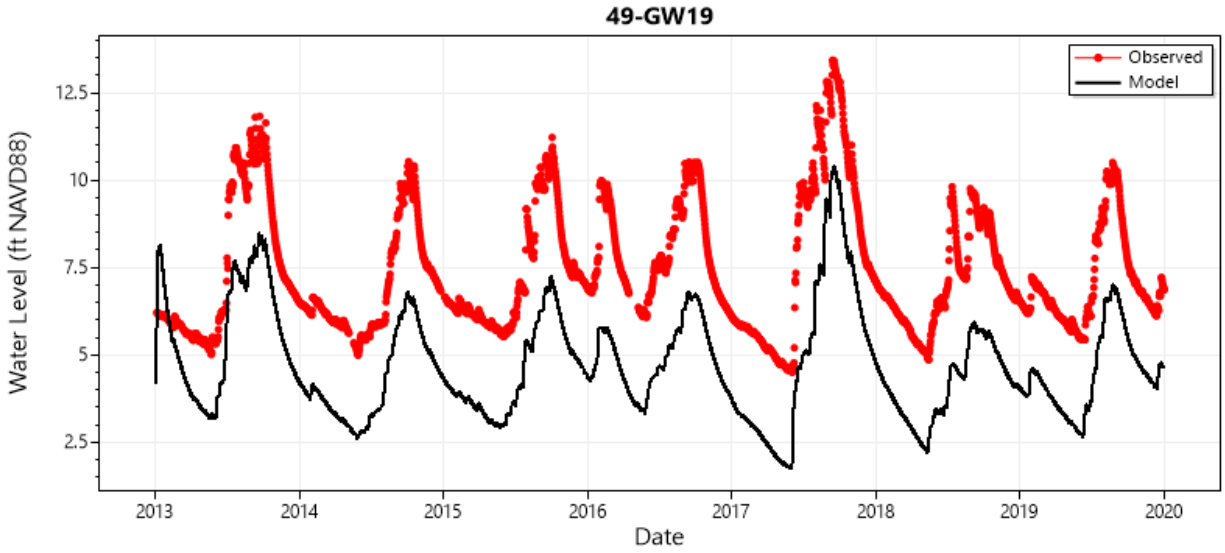

49-GW13
Observed
Model
Water Level (ft NAVD88)
10
7.5
5
2.5
0
-2.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

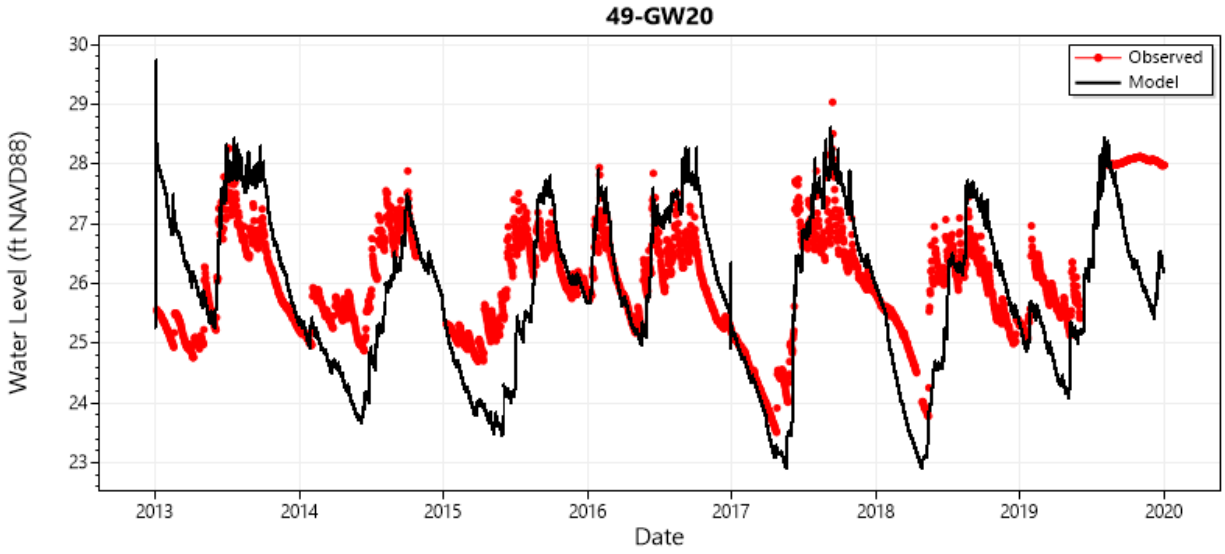

49-GW14
Observed
Model
Water Level (ft NAVD88)
Date
13
12
11
10
9
8
7
6
5
2013
2014
2015
2016
2017
2018
2019
2020

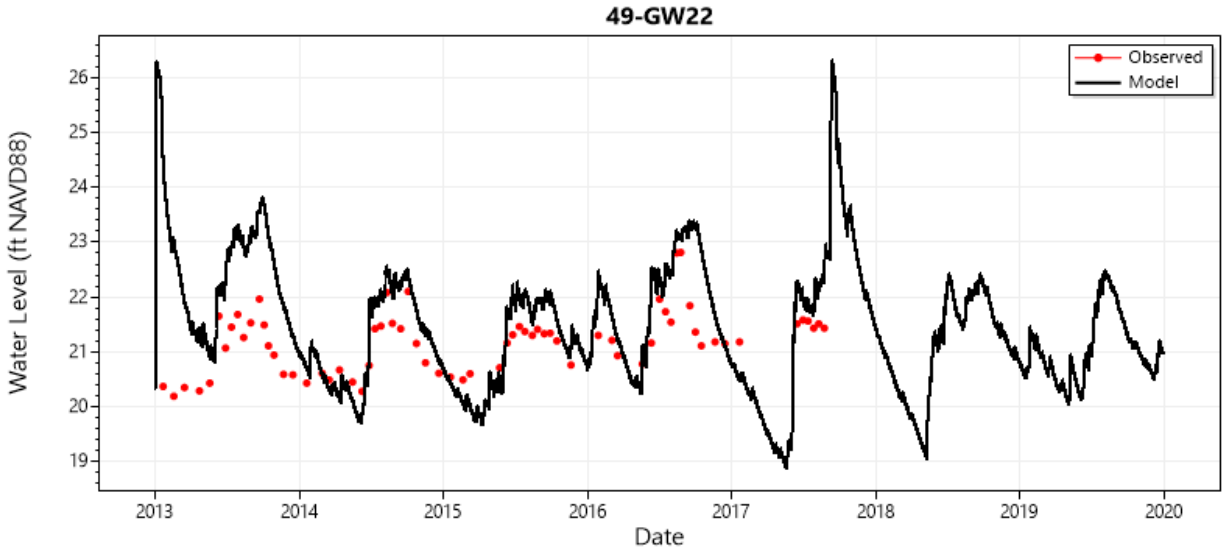

49-GW15
Observed
Model
Water Level (ft NAVD88)
Date
9
8
7
6
5
4
3
2
1
0
2013
2014
2015
2016
2017
2018
2019
2020

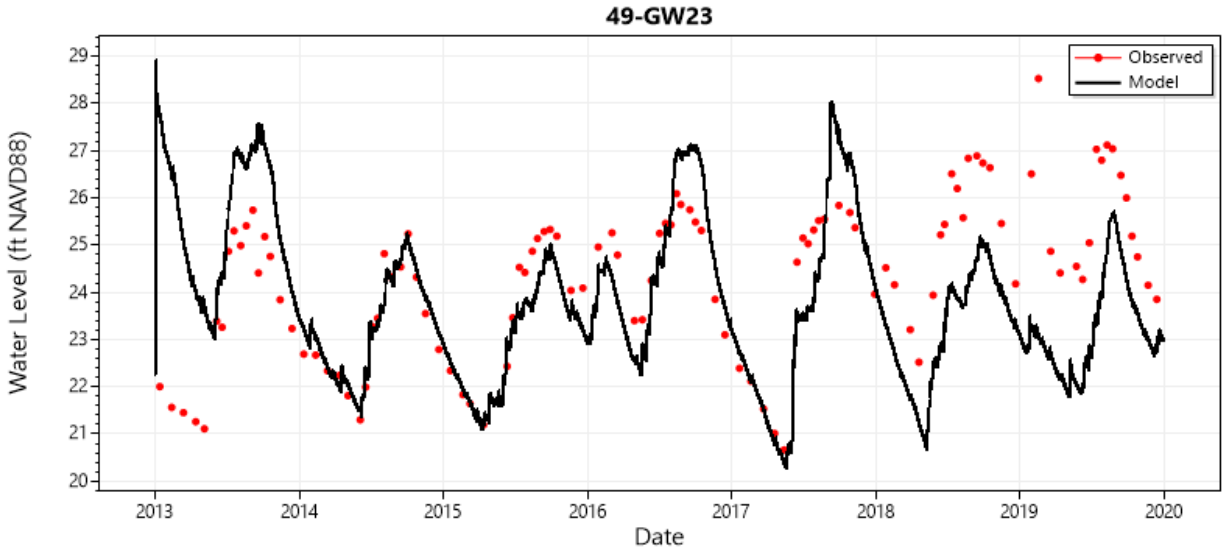

49-GW16
Observed
Model
Water Level (ft NAVD88)
Date
7.5
5
2.5
0
-2.5
-5
2013
2014
2015
2016
2017
2018
2019
2020

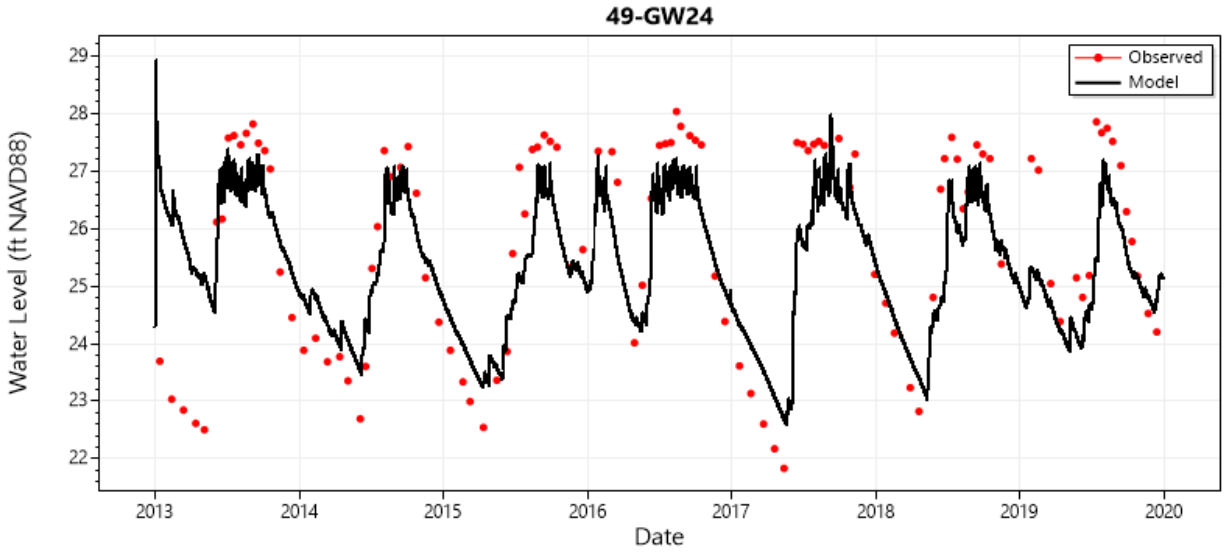

49-GW17
Observed
Model
Water Level (ft NAVD88)
7.5
5
2.5
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

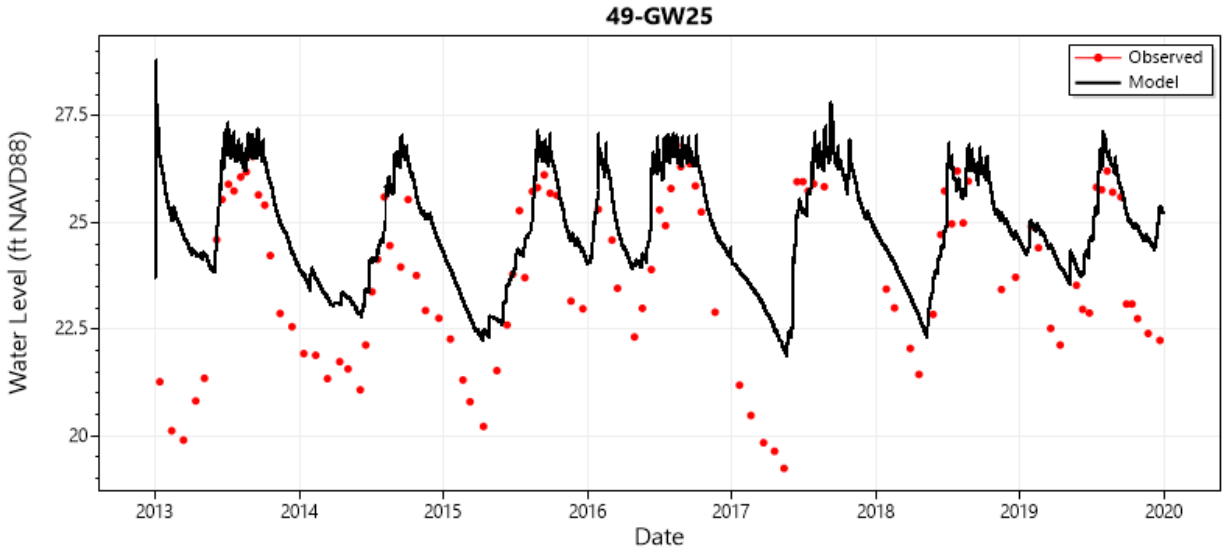

49-GW19
Observed
Model
Water Level (ft NAVD88)
12.5
10
7.5
5
2.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

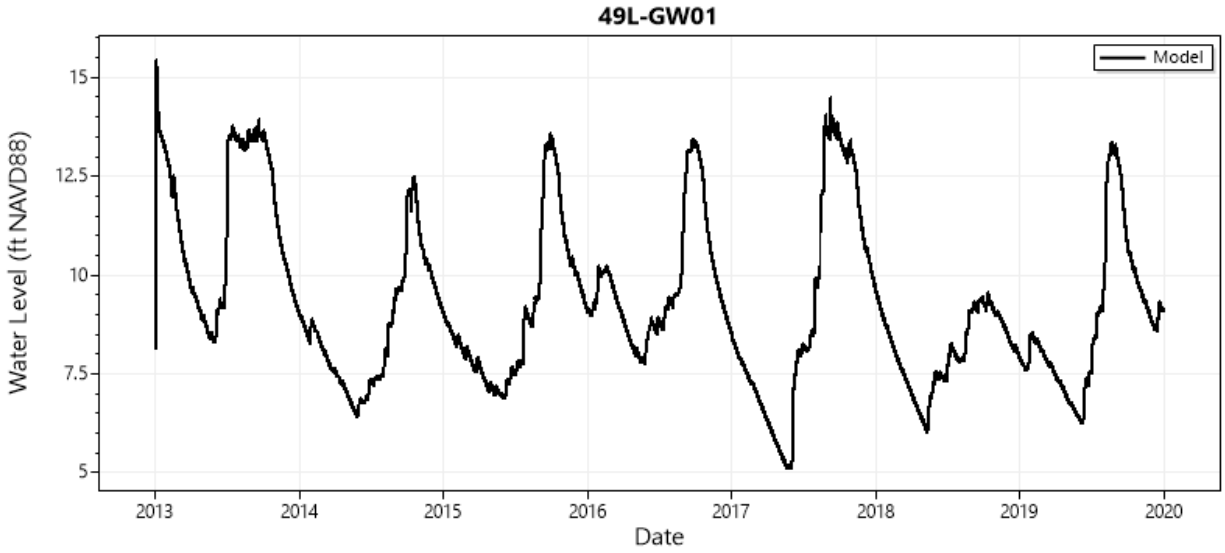

49-GW20
Observed
Model
Water Level (ft NAVD88)
30
29
28
27
26
25
24
23
2013
2014
2015
2016
2017
2018
2019
2020
Date

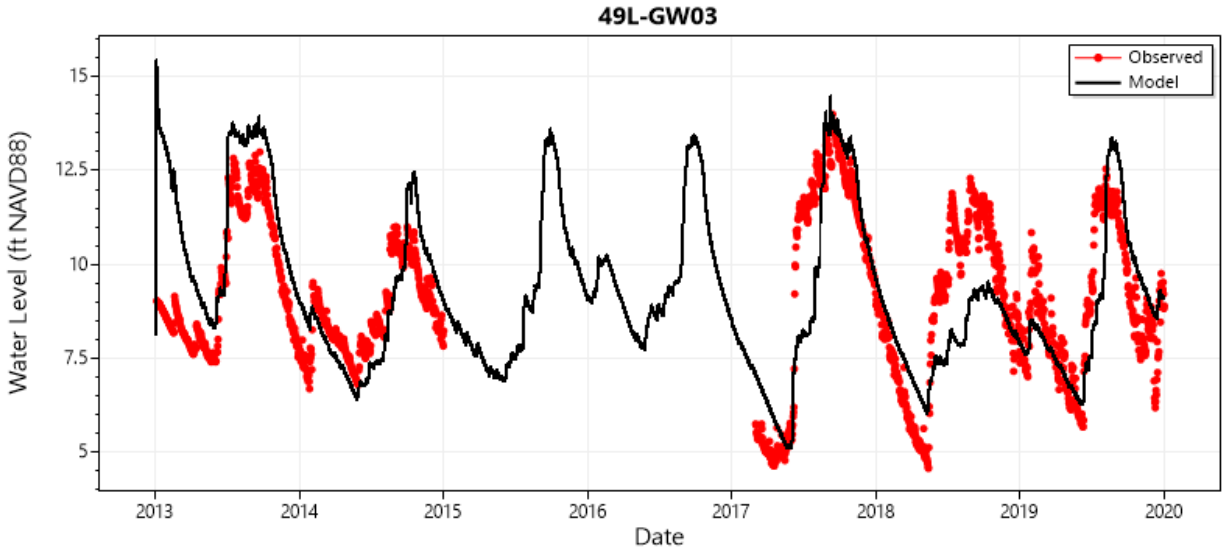

49-GW22
Observed
Model
Water Level (ft NAVD88)
Date
2013
2014
2015
2016
2017
2018
2019
2020

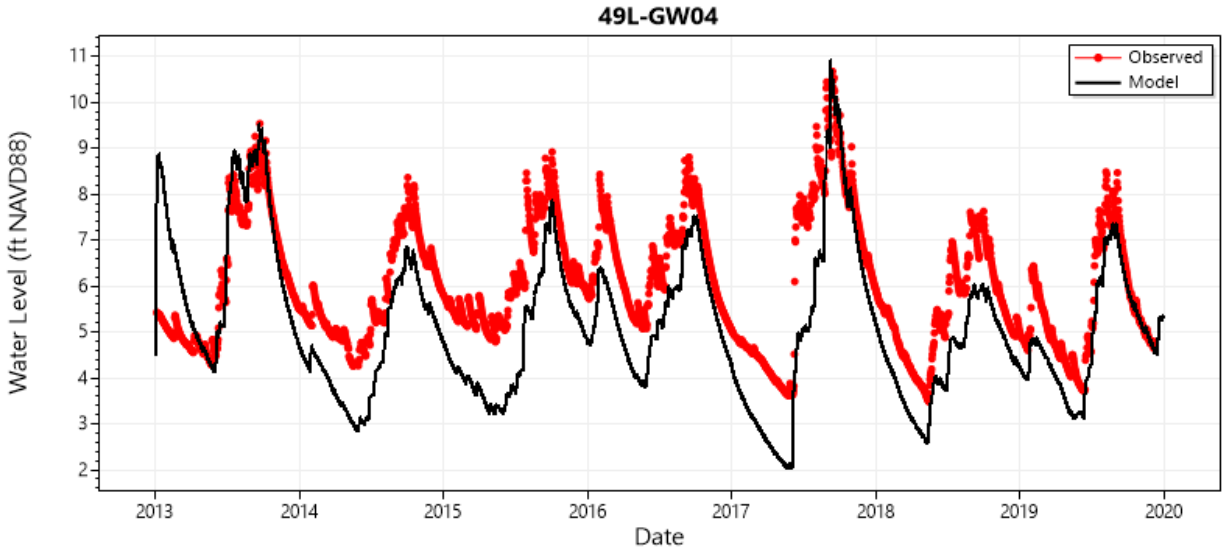

49-GW23
Observed
Model
Water Level (ft NAVD88)
Date
2013
2014
2015
2016
2017
2018
2019
2020

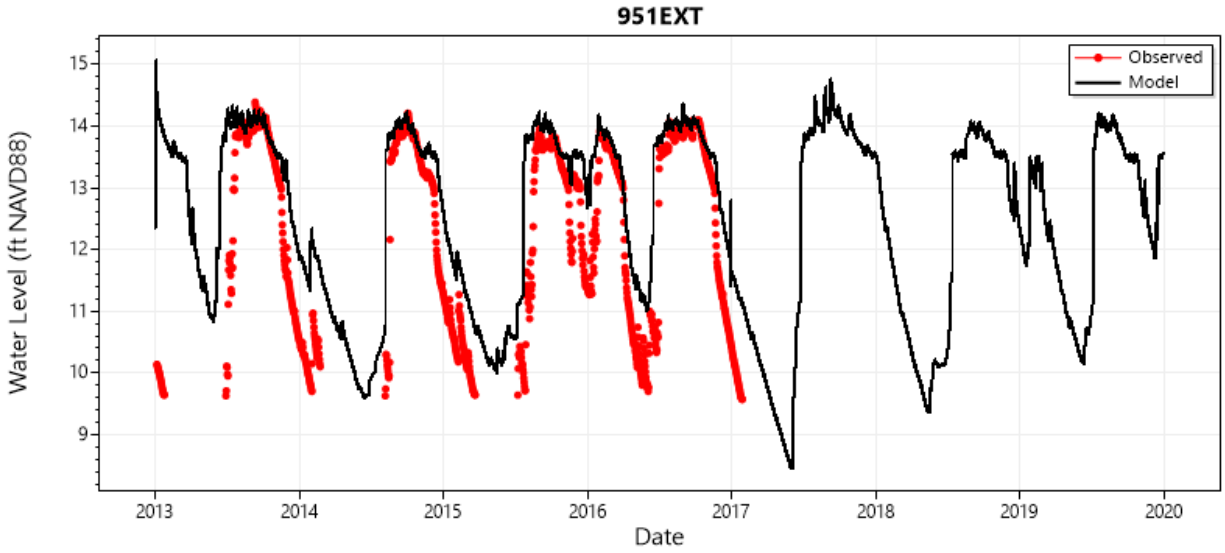

49-GW24
Observed
Model
Water Level (ft NAVD88)
Date
2013
2014
2015
2016
2017
2018
2019
2020

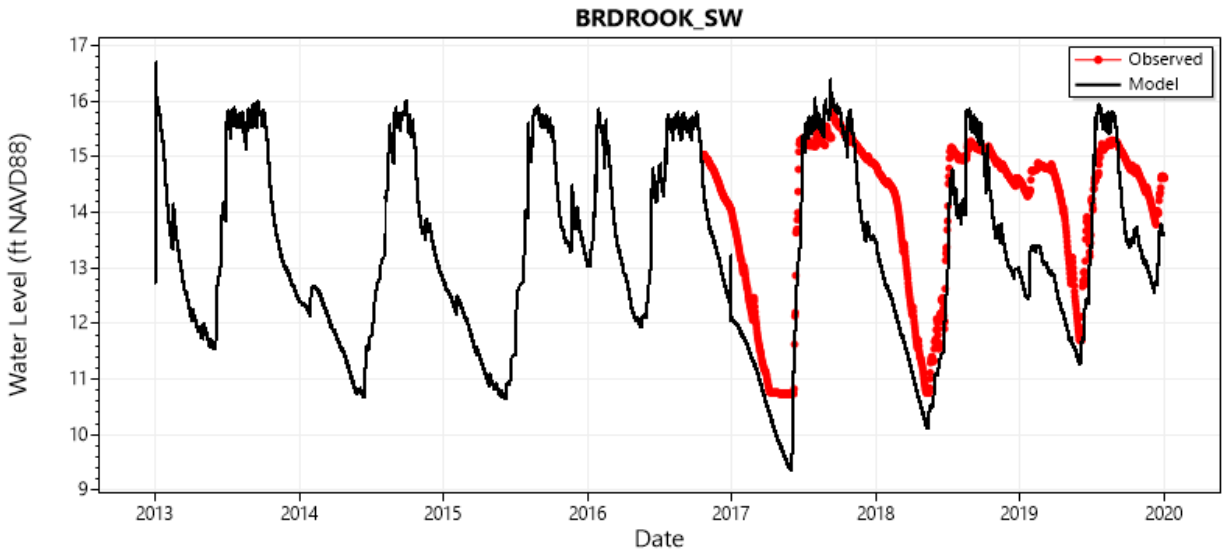

49-GW25
Observed
Model
Water Level (ft NAVD88)
27.5
25
22.5
20
2013
2014
2015
2016
2017
2018
2019
2020
Date

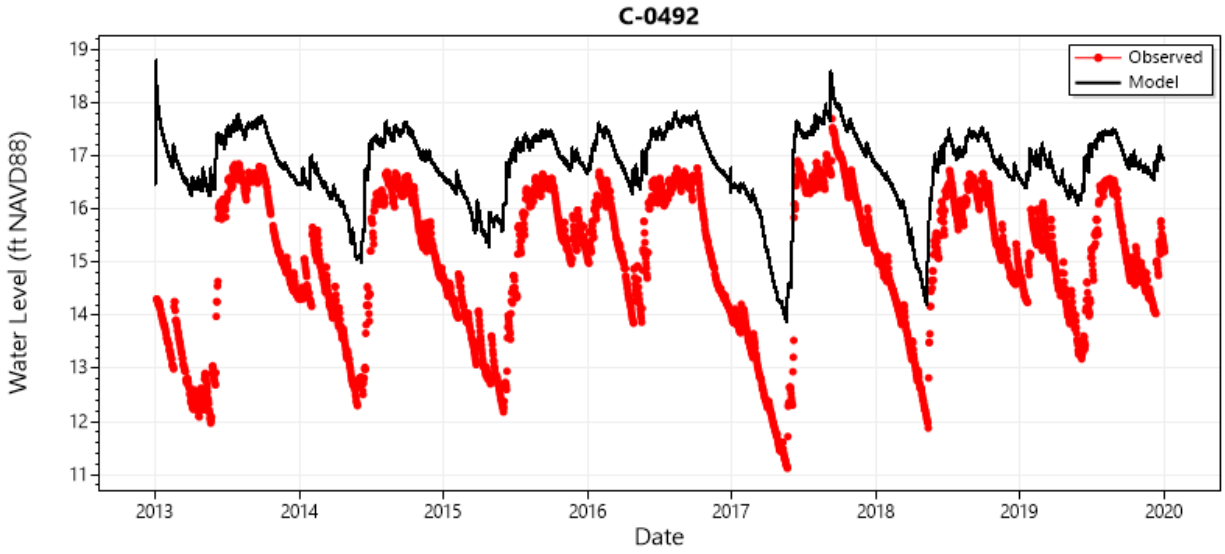

49L-GW01
Model
Water Level (ft NAVD88)
15
12.5
10
7.5
5
2013
2014
2015
2016
2017
2018
2019
2020
Date

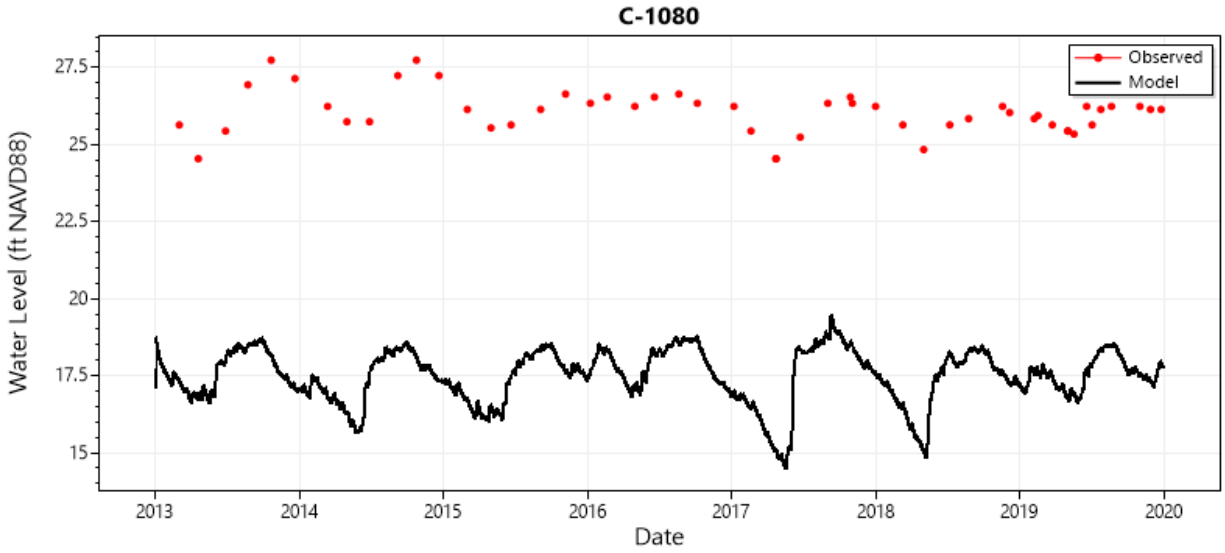

49L-GW03
Observed
Model
Water Level (ft NAVD88)
15
12.5
10
7.5
5
2013
2014
2015
2016
2017
2018
2019
2020
Date

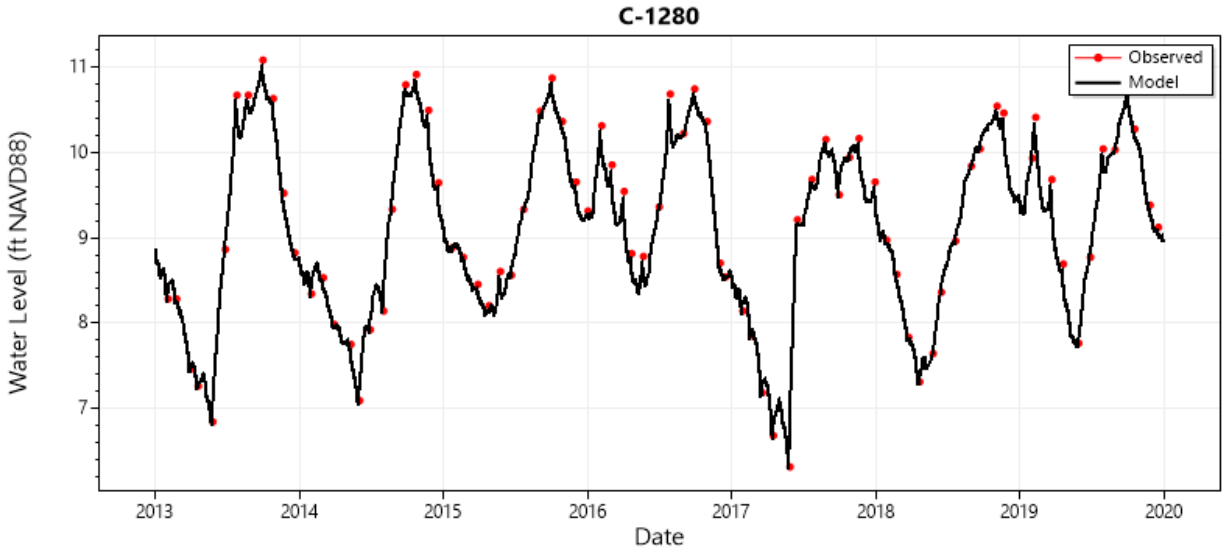

49L-GW04
Observed
Model
Water Level (ft NAVD88)
Date
2013
2014
2015
2016
2017
2018
2019
2020

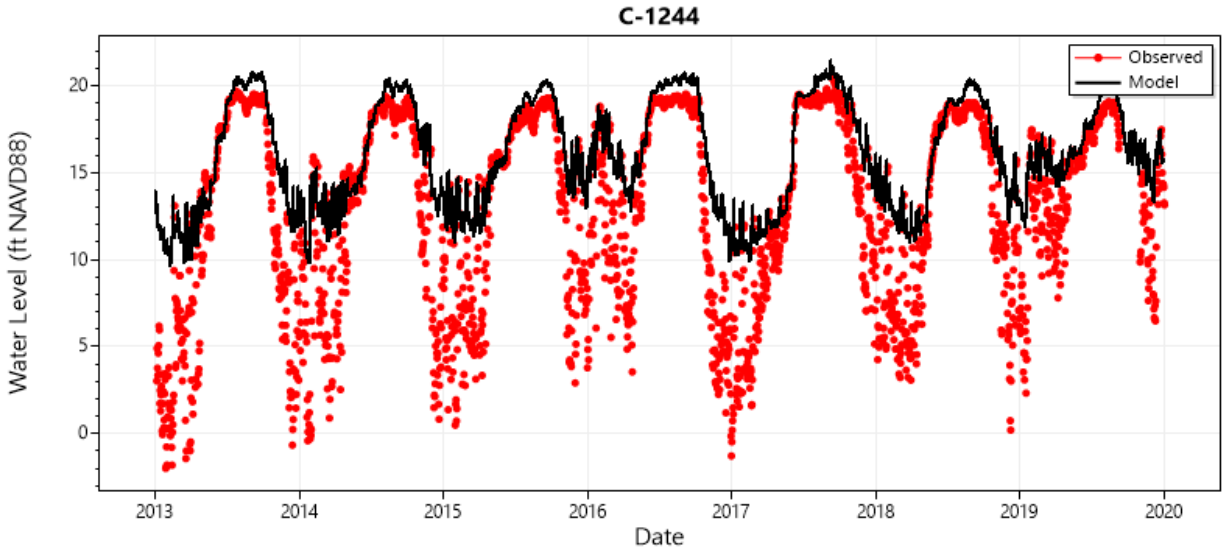

951EXT
Observed
Model
Water Level (ft NAVD88)
Date
2013
2014
2015
2016
2017
2018
2019
2020

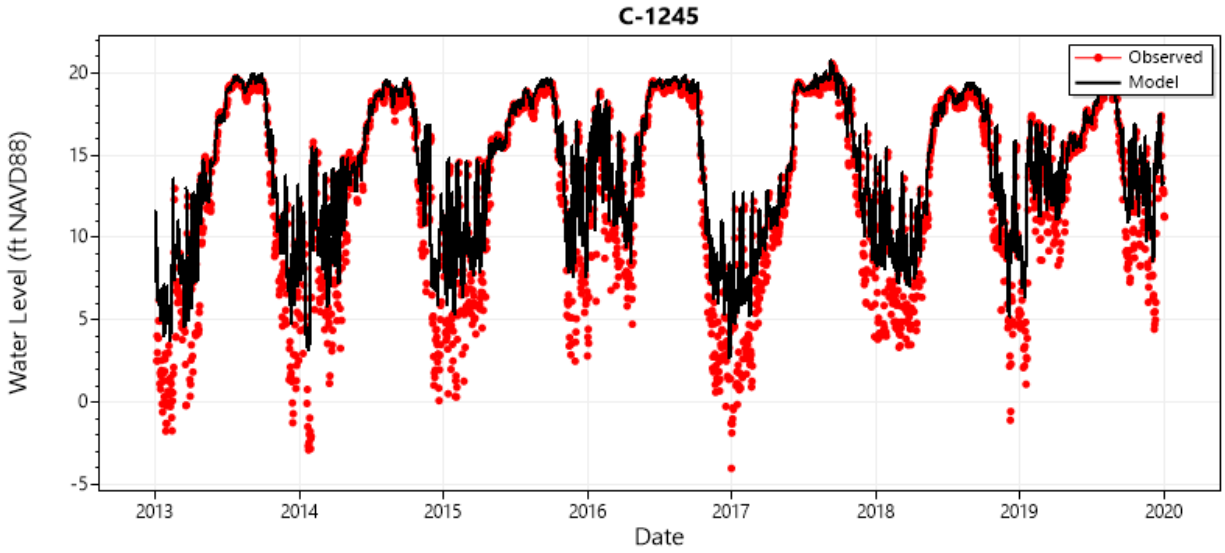

BRDROOK_SW
Observed
Model
Water Level (ft NAVD88)
Date
2013
2014
2015
2016
2017
2018
2019
2020

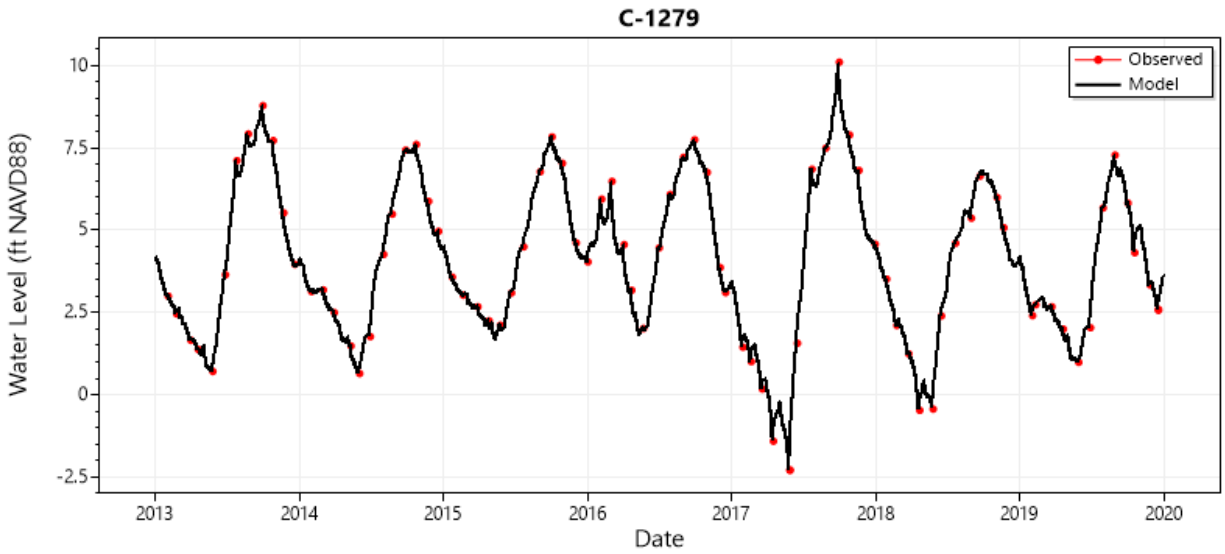

C-0492
Observed
Model
Water Level (ft NAVD88)
19
18
17
16
15
14
13
12
11
2013
2014
2015
2016
2017
2018
2019
2020
Date

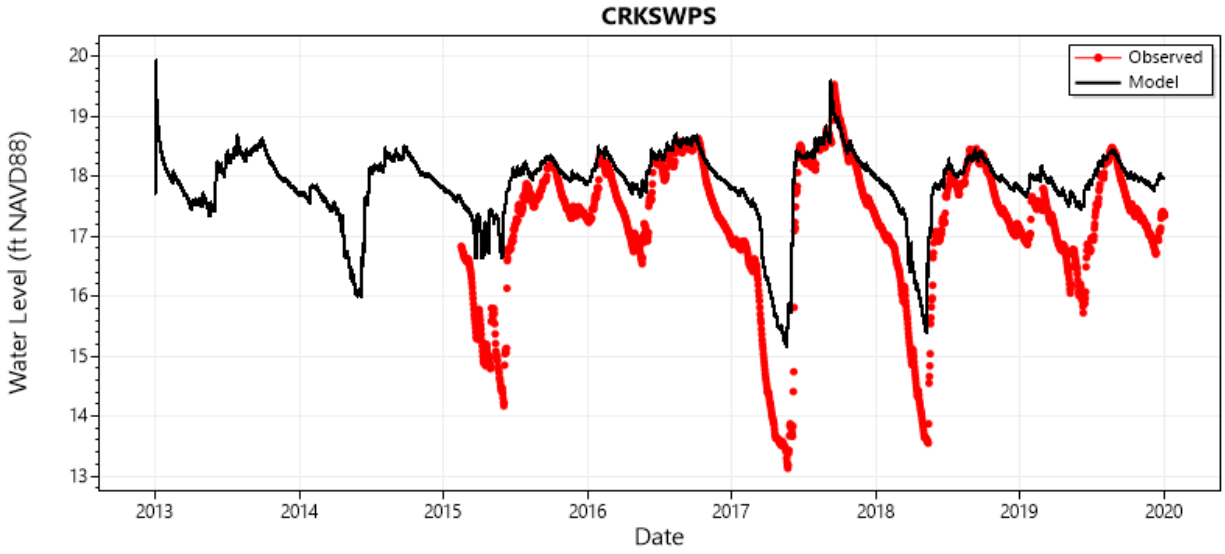

C-1080
Observed
Model
Water Level (ft NAVD88)
27.5
25
22.5
20
17.5
15
2013
2014
2015
2016
2017
2018
2019
2020
Date

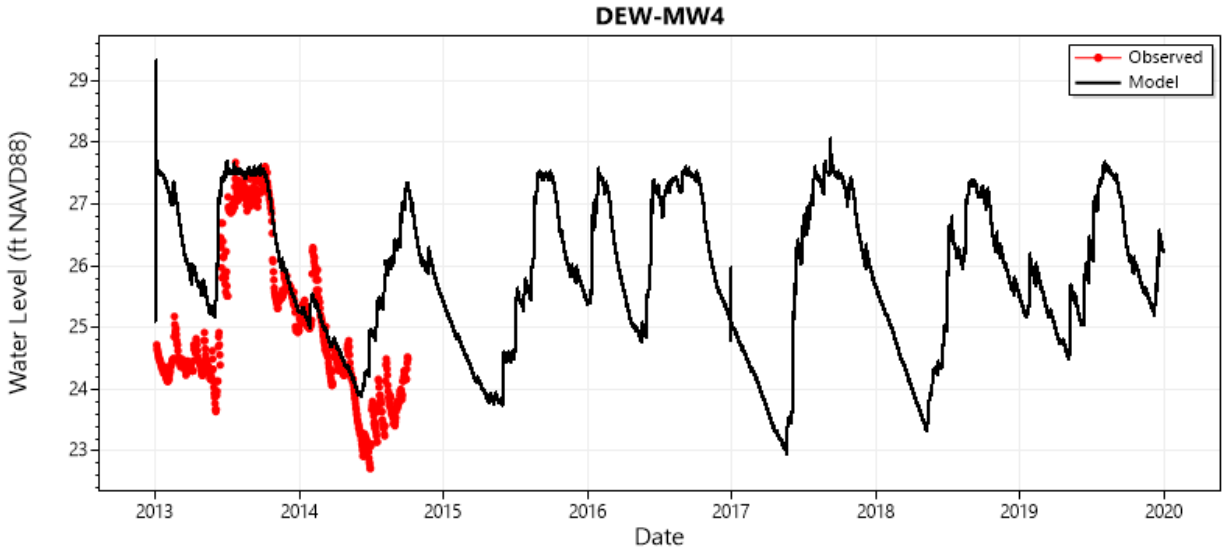

C-1280
Observed
Model
Water Level (ft NAVD88)
11
10
9
8
7
2013
2014
2015
2016
2017
2018
2019
2020
Date

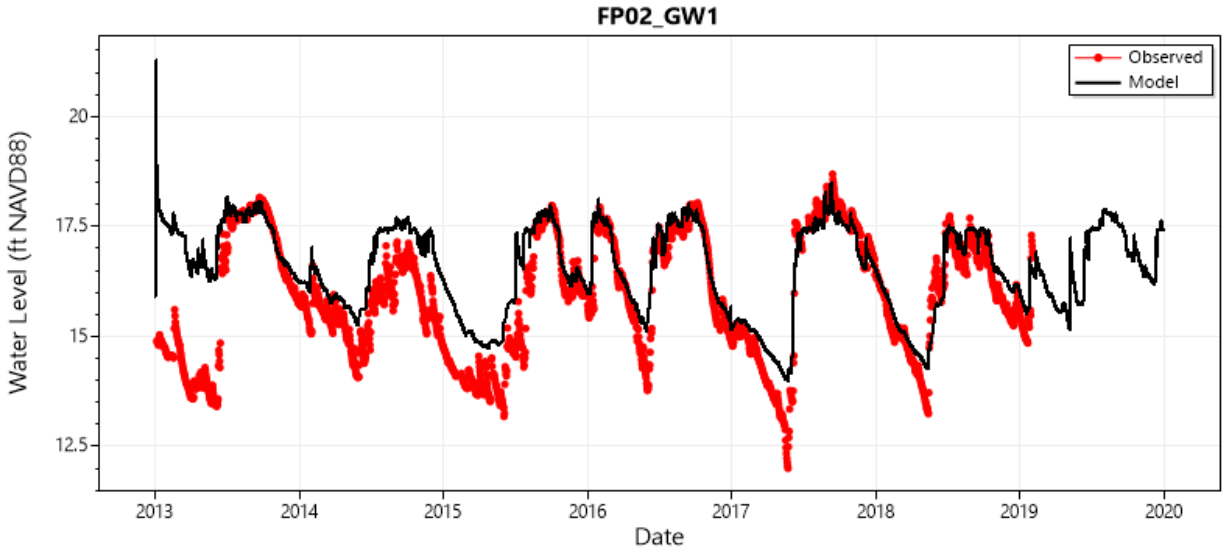

C-1244
Observed
Model
Water Level (ft NAVD88)
20
15
10
5
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

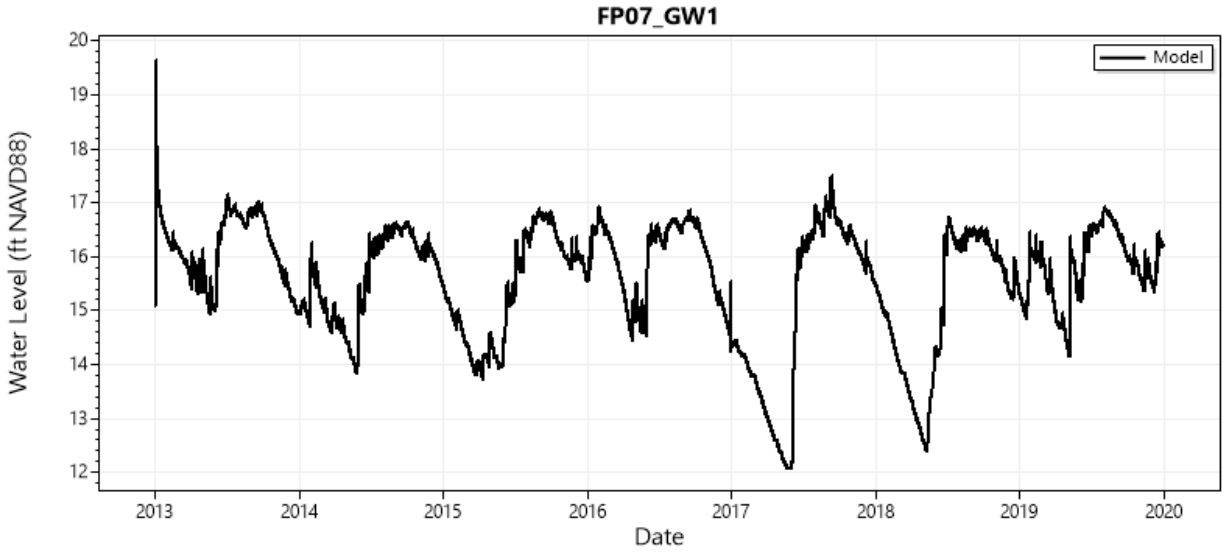

C-1245
Observed
Model
Water Level (ft NAVD88)
20
15
10
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date

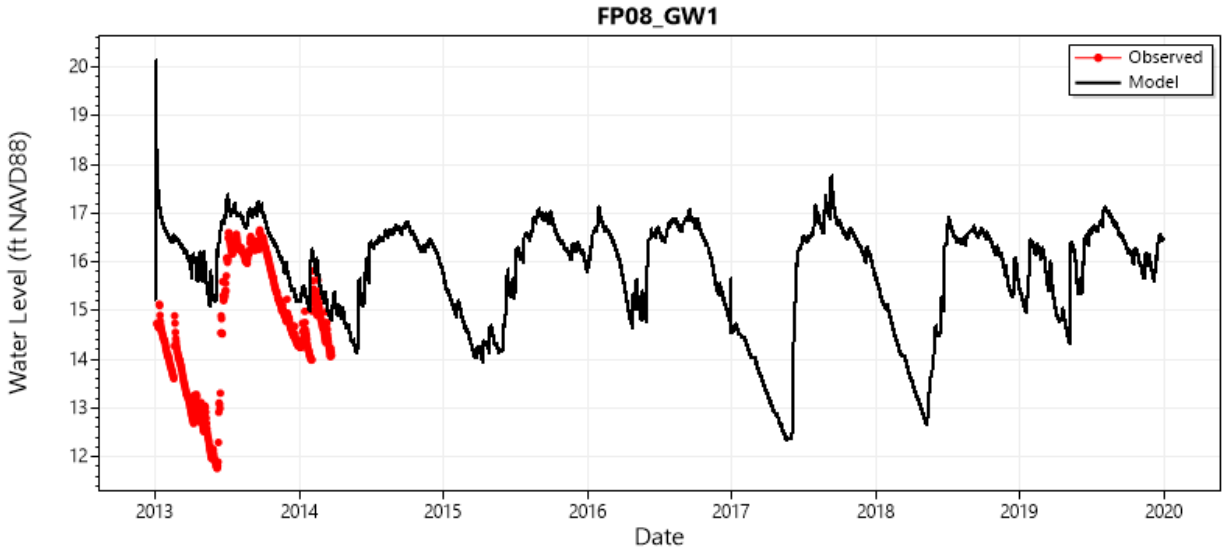

C-1279
Observed
Model
Water Level (ft NAVD88)
10
7.5
5
2.5
0
-2.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

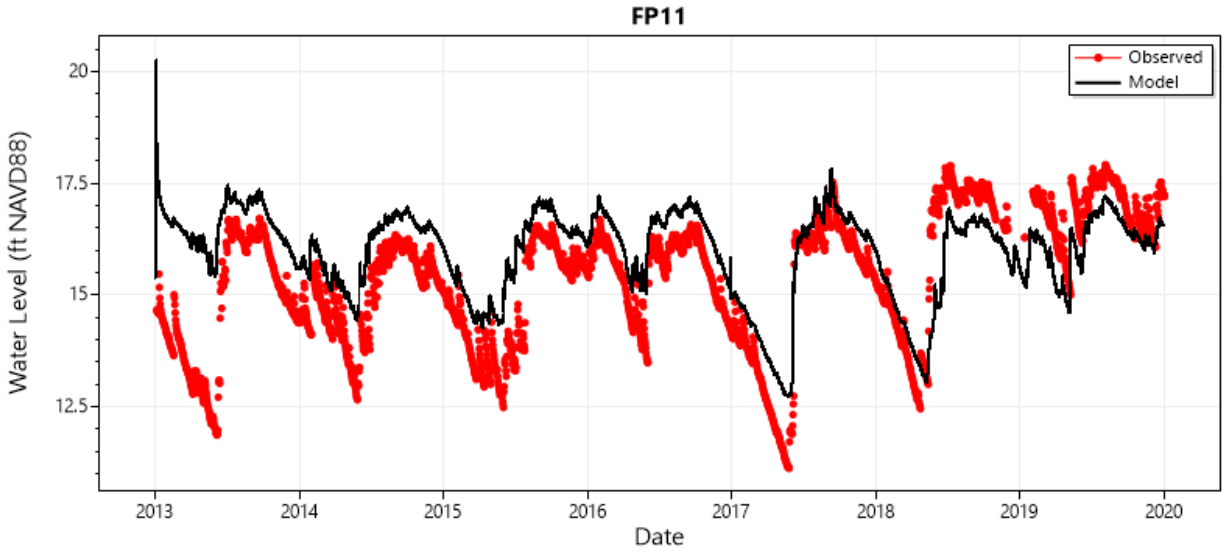

CRKSWPS
Observed
Model
Water Level (ft NAVD88)
20
19
18
17
16
15
14
13
2013
2014
2015
2016
2017
2018
2019
2020
Date

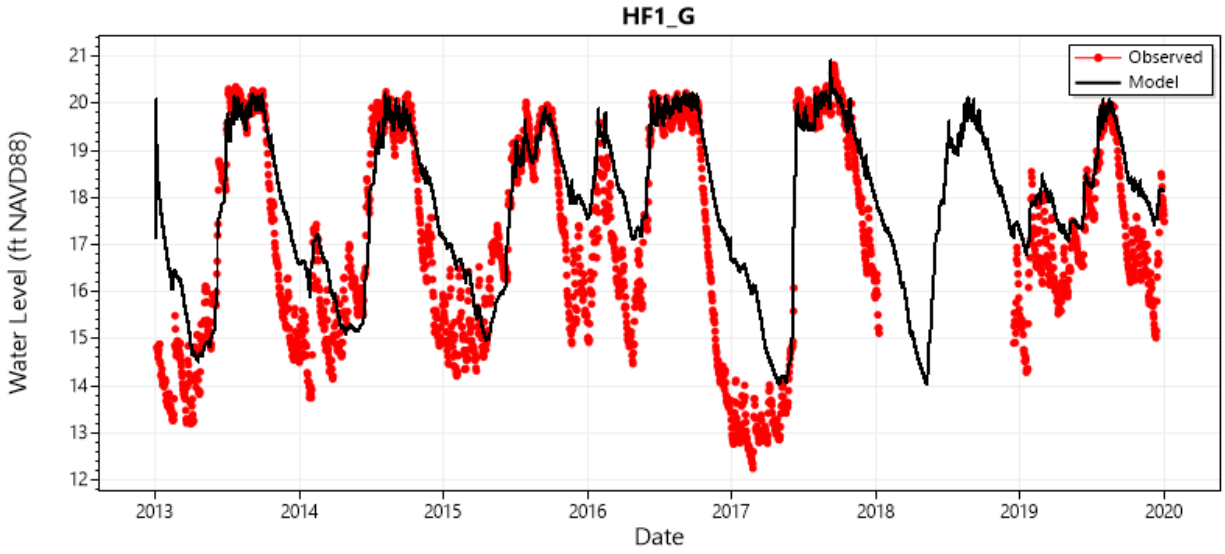

DEW-MW4
Observed
Model
Water Level (ft NAVD88)
29
28
27
26
25
24
23
2013
2014
2015
2016
2017
2018
2019
2020
Date

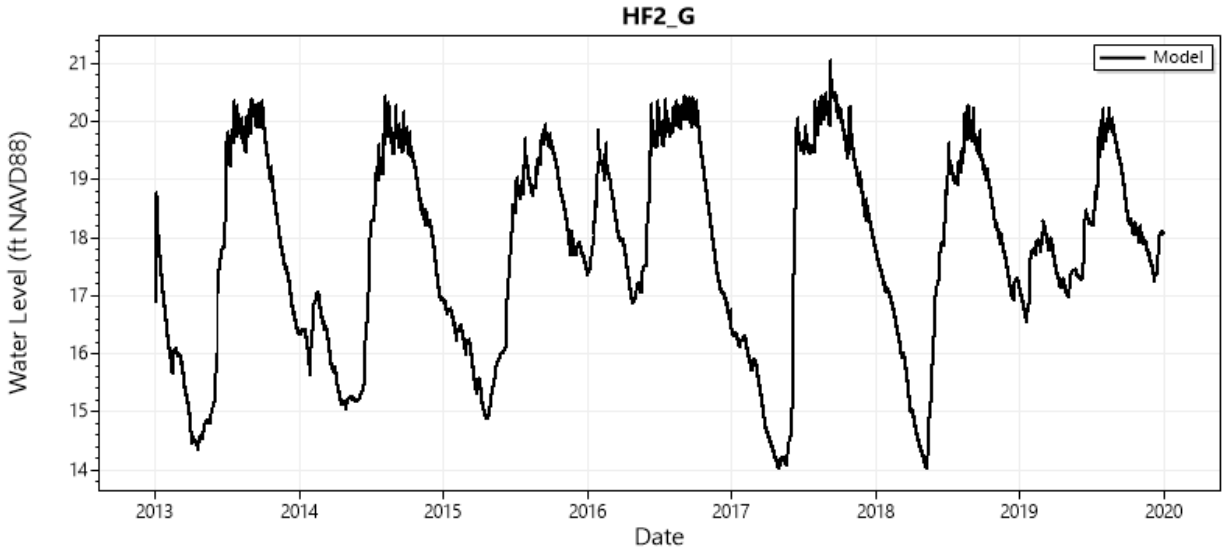

FP02_GW1
Observed
Model
Water Level (ft NAVD88)
20
17.5
15
12.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

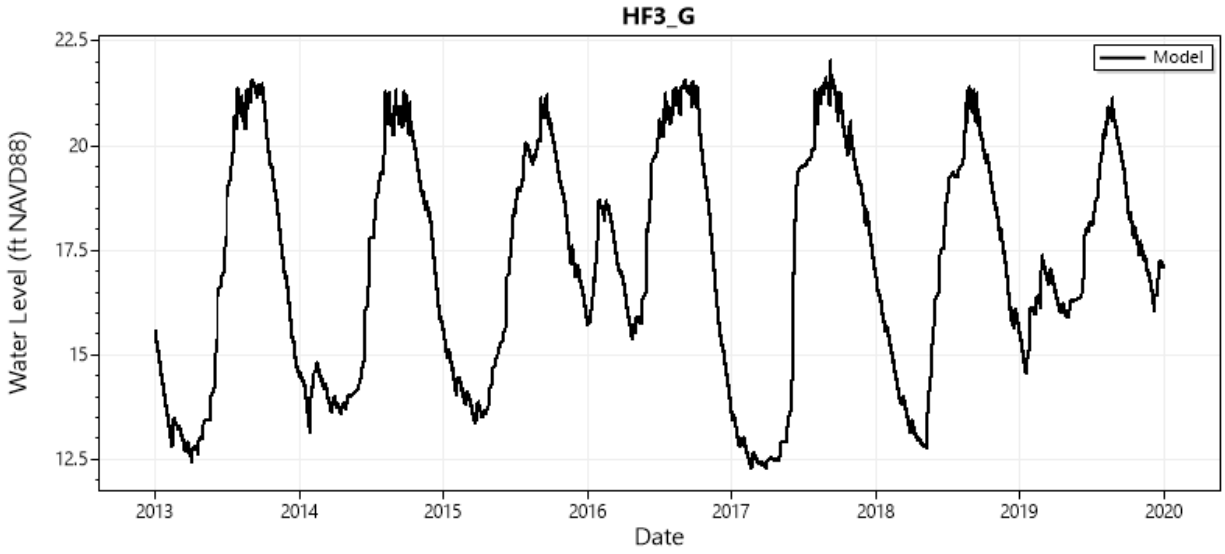

FP07_GW1
Model
Water Level (ft NAVD88)
20
19
18
17
16
15
14
13
12
2013
2014
2015
2016
2017
2018
2019
2020
Date

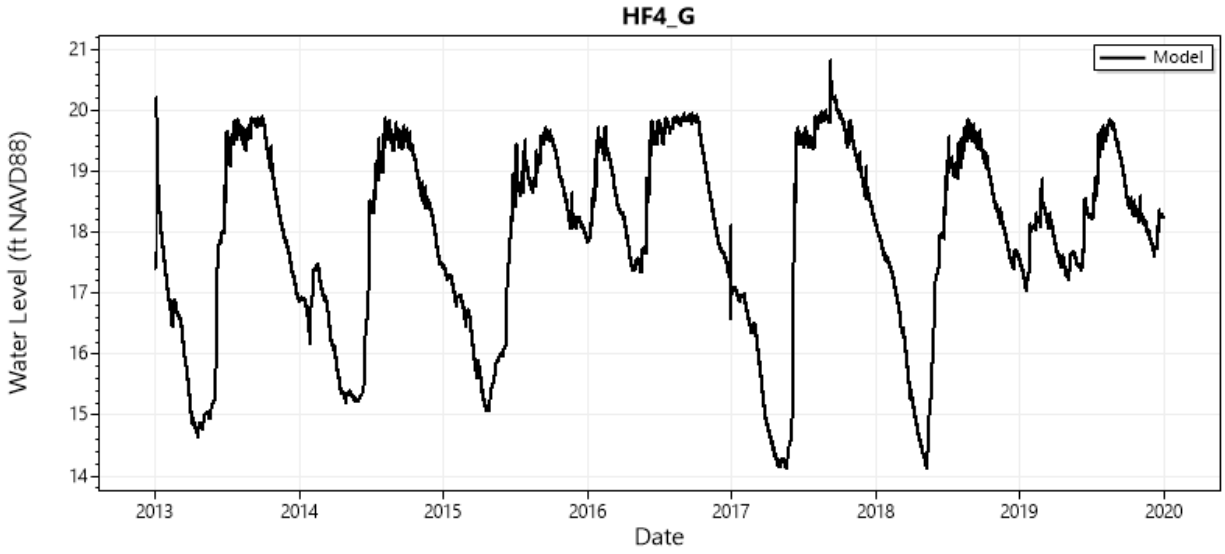

FP08_GW1
Observed
Model
Water Level (ft NAVD88)
20
19
18
17
16
15
14
13
12
2013
2014
2015
2016
2017
2018
2019
2020
Date

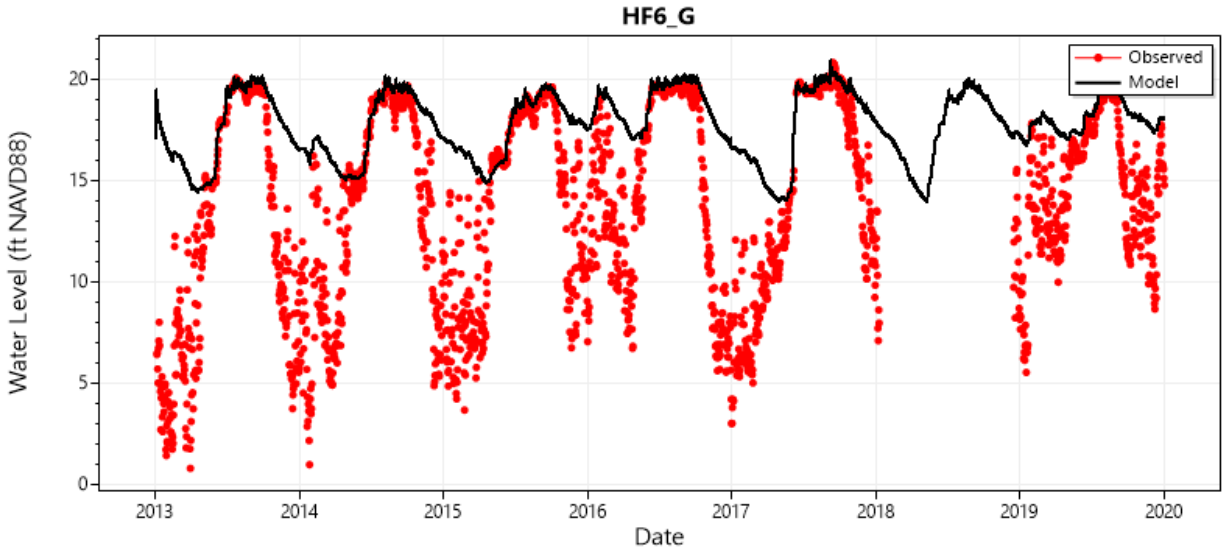

FP11
Observed
Model
Water Level (ft NAVD88)
20
17.5
15
12.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

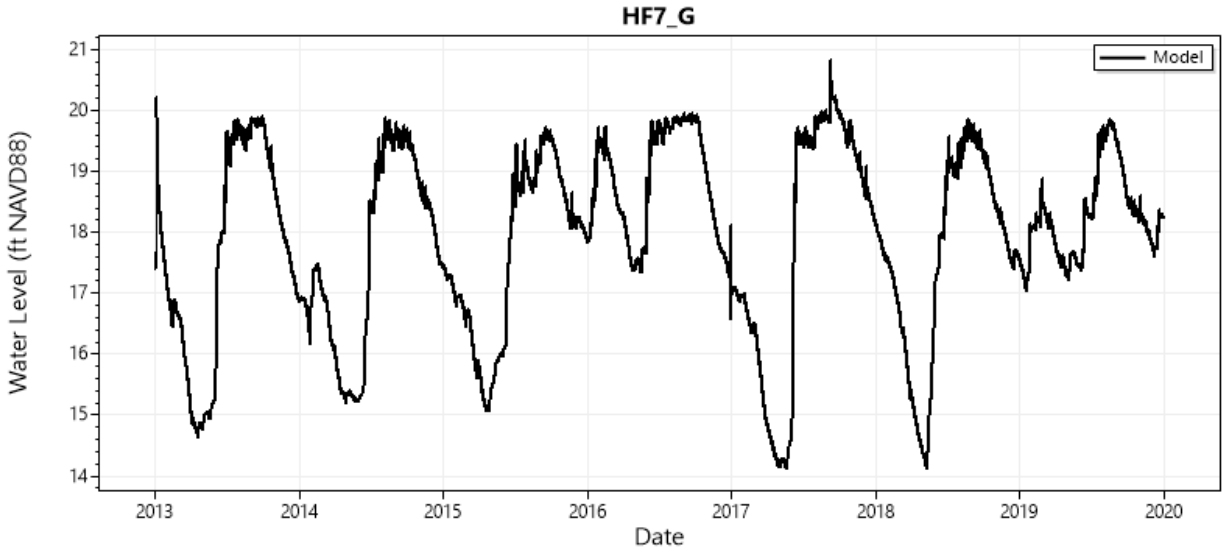

HF1_G
Observed
Model
Water Level (ft NAVD88)
21
20
19
18
17
16
15
14
13
12
2013
2014
2015
2016
2017
2018
2019
2020
Date

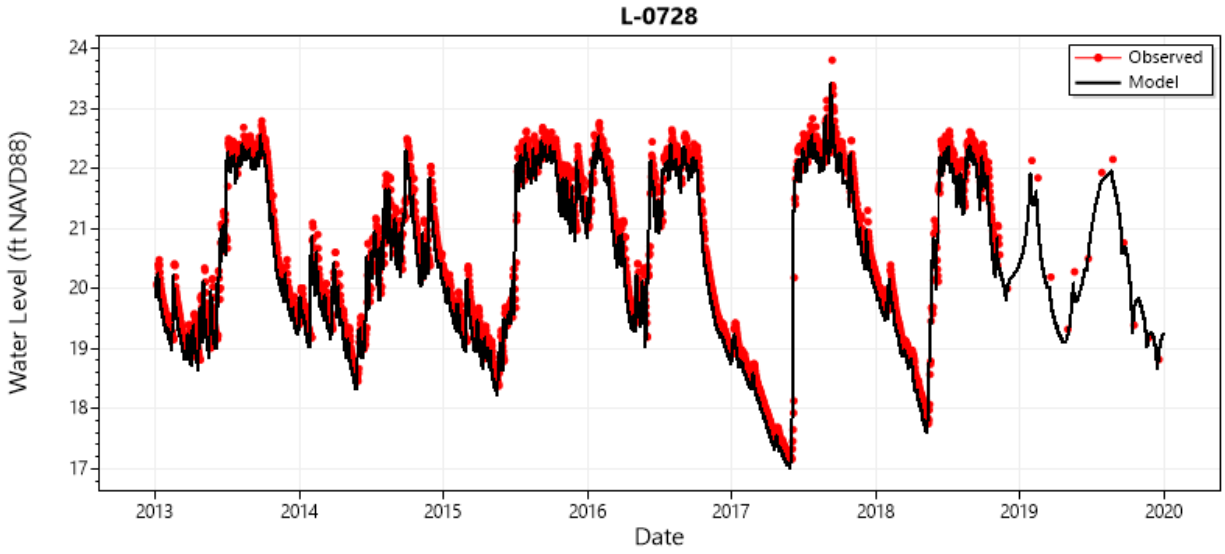

HF2_G
Model
Water Level (ft NAVD88)
21
20
19
18
17
16
15
14
2013
2014
2015
2016
2017
2018
2019
2020
Date

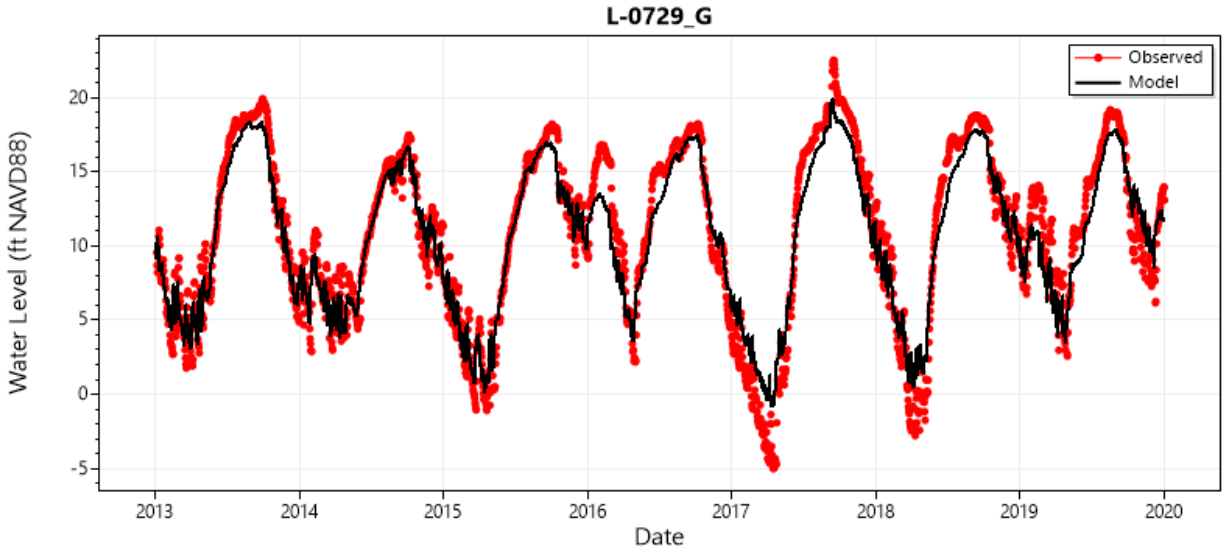

HF3_G
Model
Water Level (ft NAVD88)
22.5
20
17.5
15
12.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

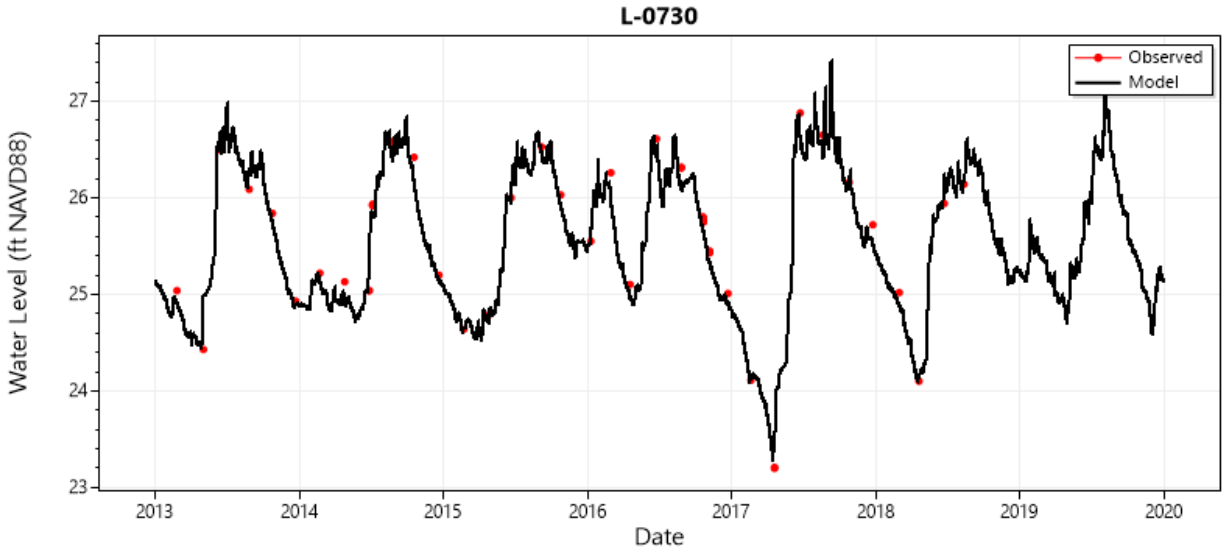

HF4_G
Model
Water Level (ft NAVD88)
21
20
19
18
17
16
15
14
2013
2014
2015
2016
2017
2018
2019
2020
Date

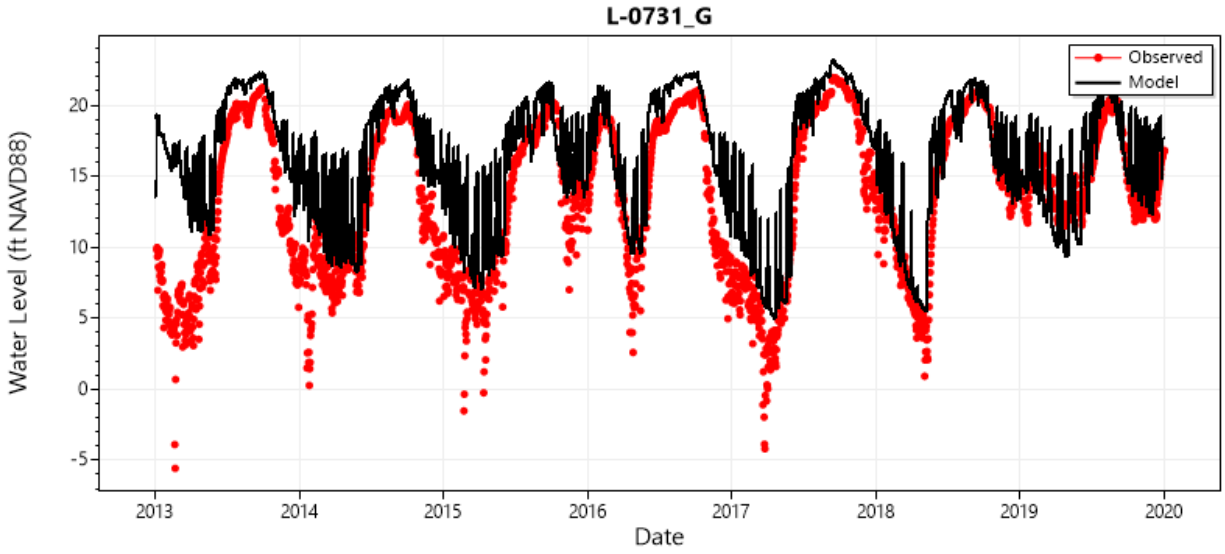

HF6_G
Observed
Model
Water Level (ft NAVD88)
20
15
10
5
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

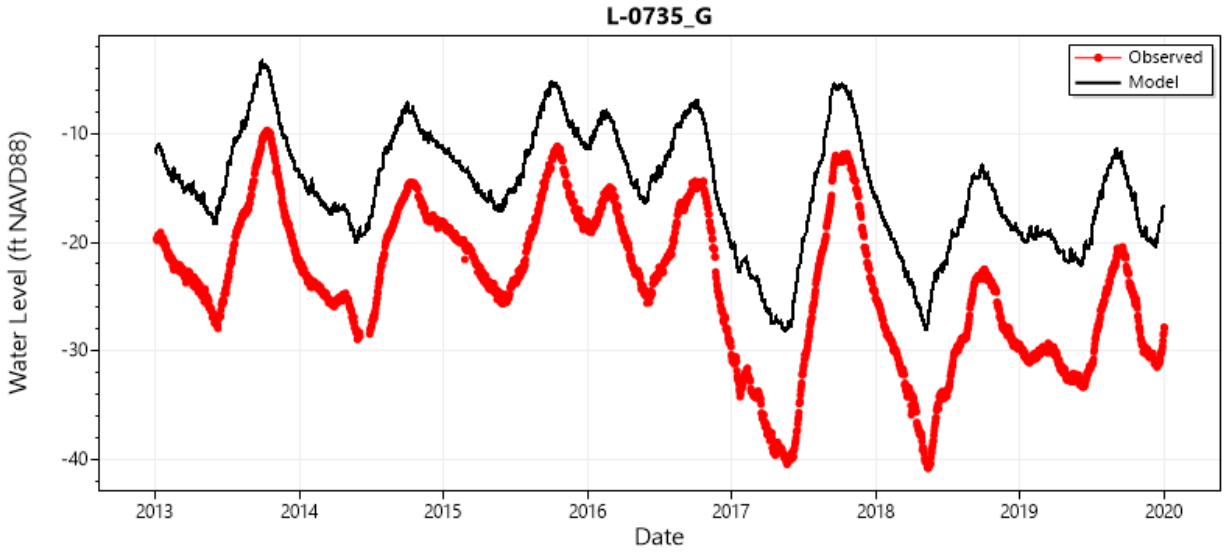

HF7_G
Model
Water Level (ft NAVD88)
21
20
19
18
17
16
15
14
2013
2014
2015
2016
2017
2018
2019
2020
Date

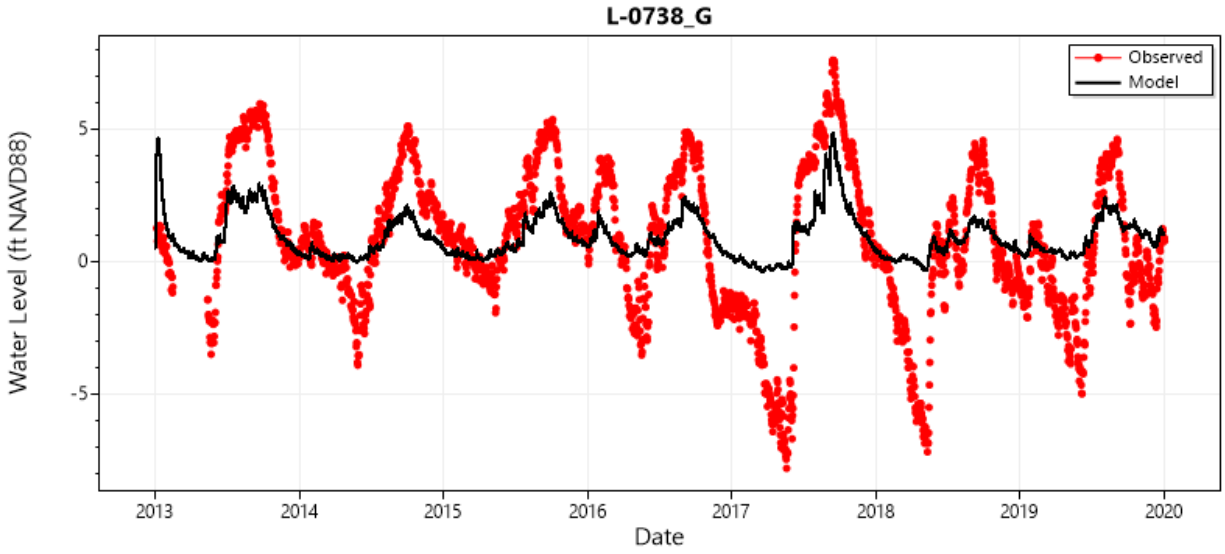

L-0728
Observed
Model
Water Level (ft NAVD88)
24
23
22
21
20
19
18
17
2013
2014
2015
2016
2017
2018
2019
2020
Date

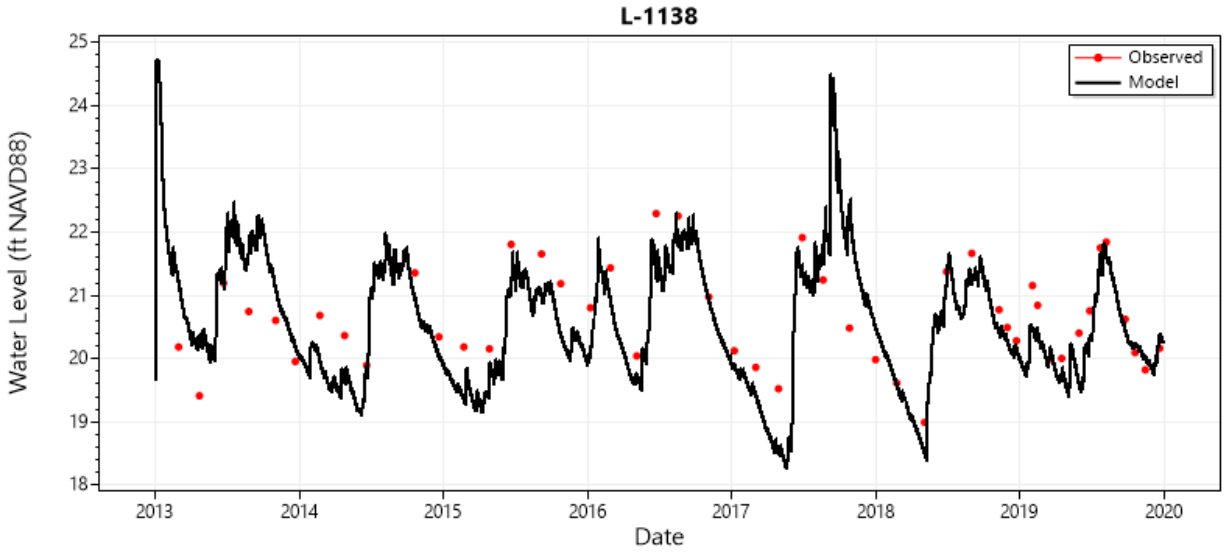

L-0729_G
Observed
Model
Water Level (ft NAVD88)
20
15
10
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date

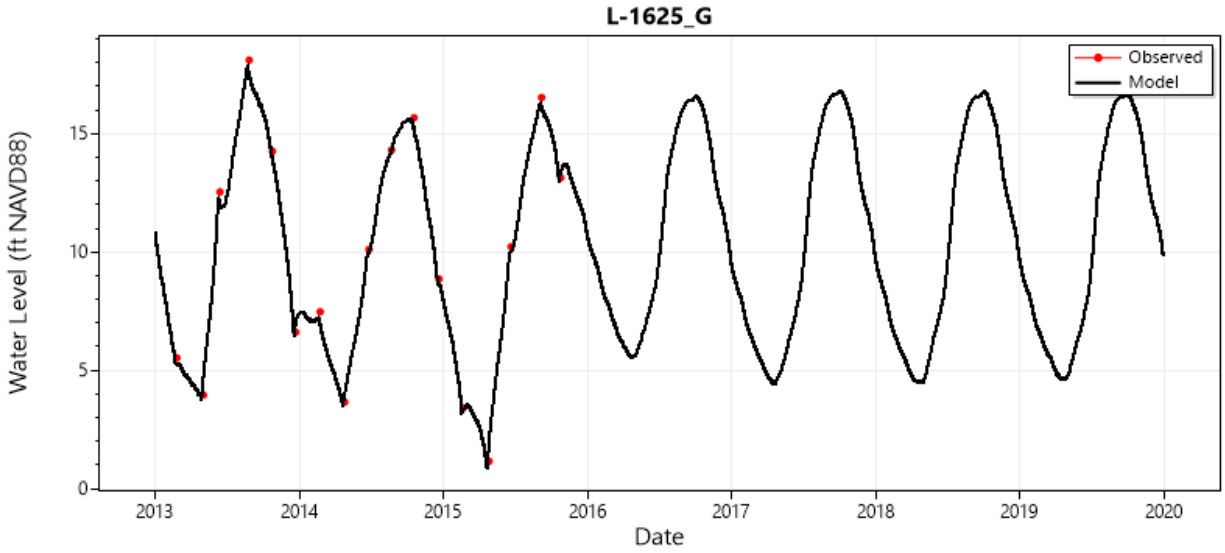

L-0730
Observed
Model
Water Level (ft NAVD88)
27
26
25
24
23
2013
2014
2015
2016
2017
2018
2019
2020
Date

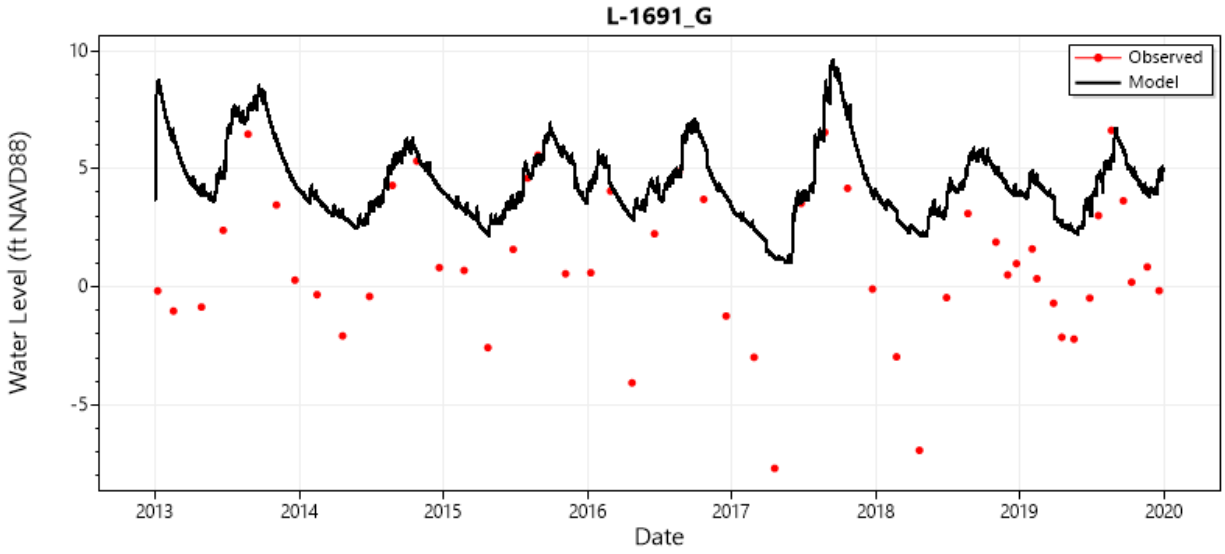

L-0731_G
Observed
Model
Water Level (ft NAVD88)
20
15
10
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date

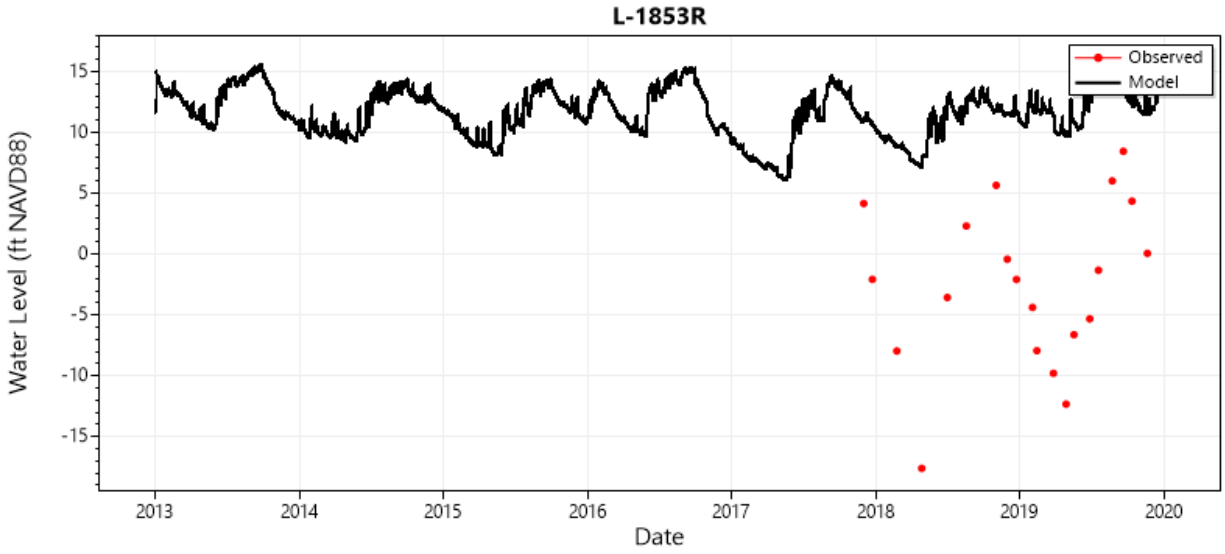

L-0735_G
Observed
Model
Water Level (ft NAVD88)
-10
-20
-30
-40
2013
2014
2015
2016
2017
2018
2019
2020
Date

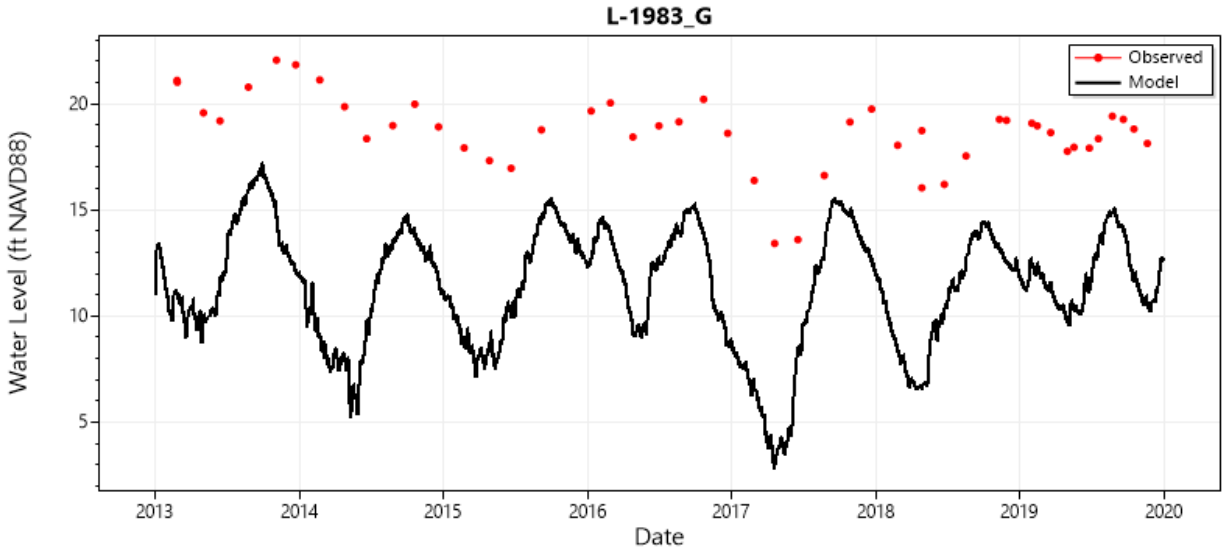

L-0738_G
Observed
Model
Water Level (ft NAVD88)
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date

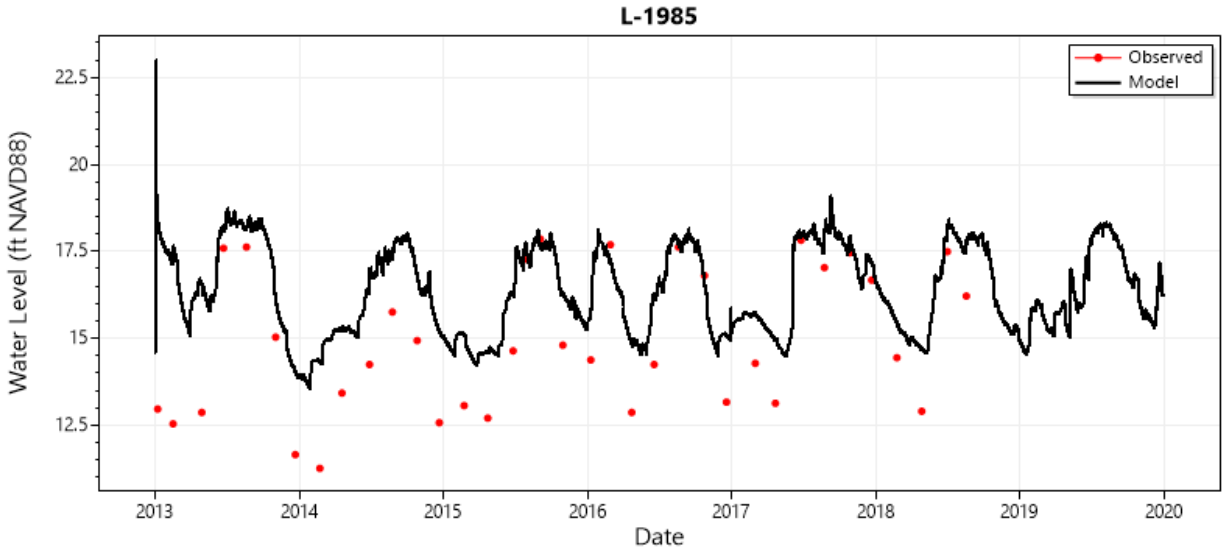

L-1138
Observed
Model
Water Level (ft NAVD88)
25
24
23
22
21
20
19
18
2013
2014
2015
2016
2017
2018
2019
2020
Date

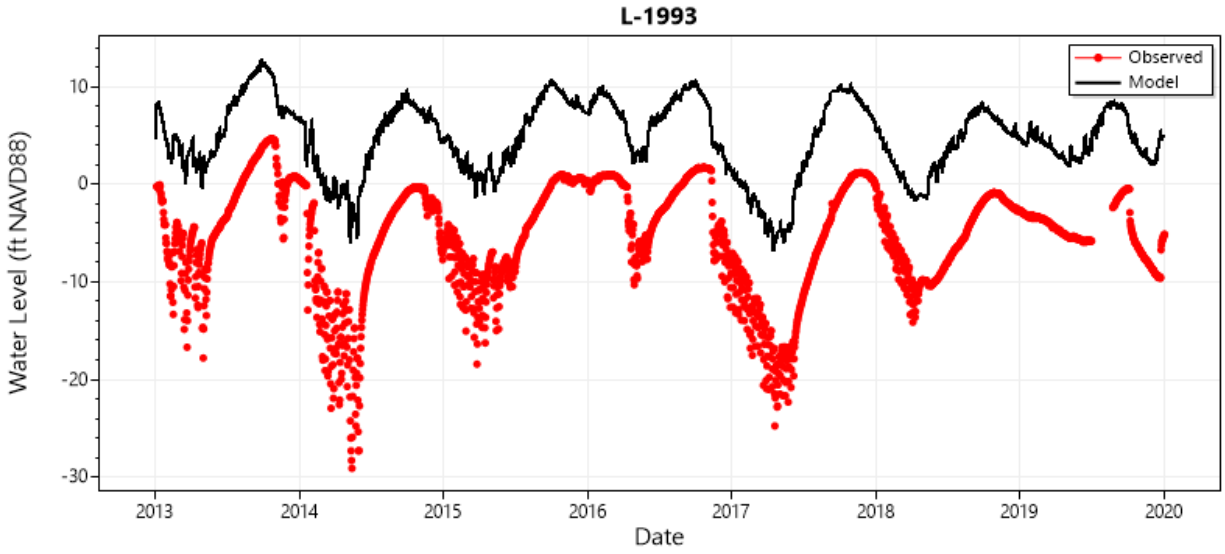

L-1625_G
Observed
Model
Water Level (ft NAVD88)
15
10
5
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

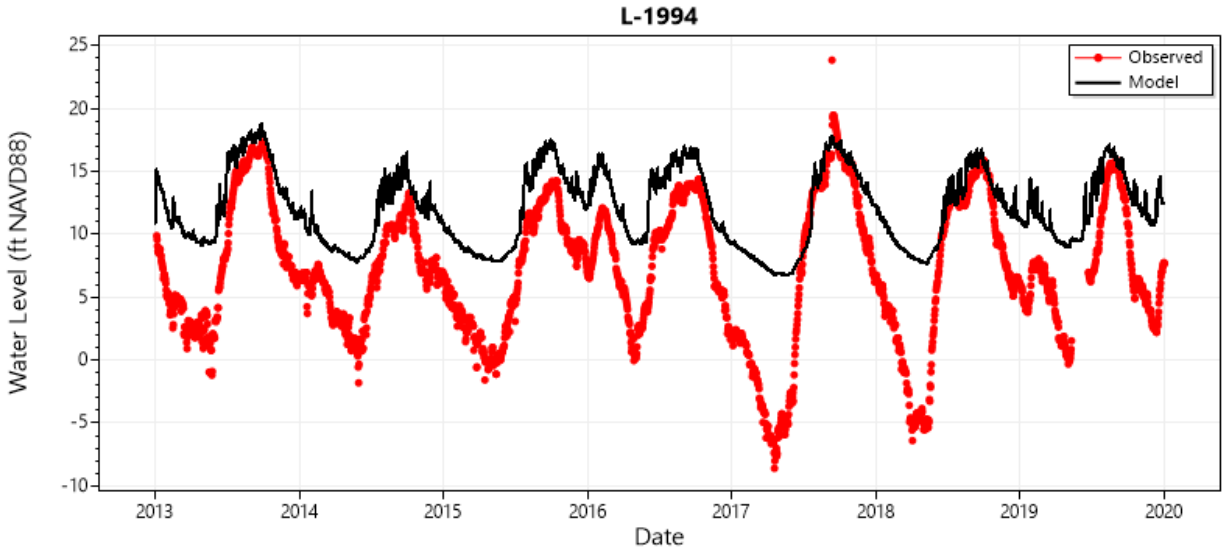

L-1691_G
Observed
Model
Water Level (ft NAVD88)
10
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date

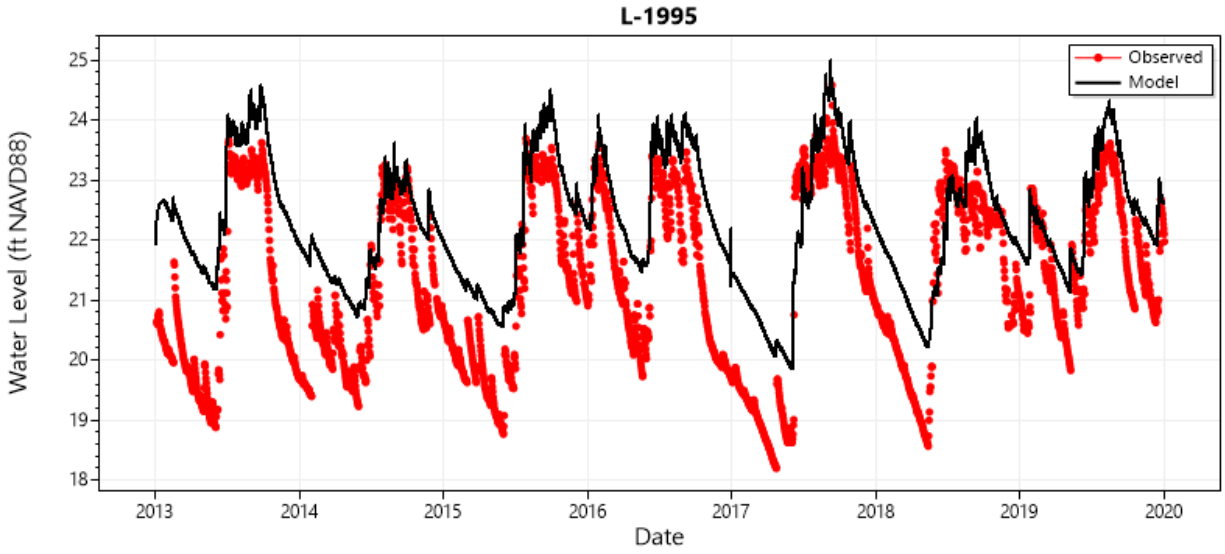

L-1853R
Observed
Model
Water Level (ft NAVD88)
15
10
5
0
-5
-10
-15
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-1983_G
Observed
Model
Water Level (ft NAVD88)
20
15
10
5
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-1985
Observed
Model
Water Level (ft NAVD88)
22.5
20
17.5
15
12.5
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-1993
Observed
Model
Water Level (ft NAVD88)
10
0
-10
-20
-30
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-1994
Observed
Model
Water Level (ft NAVD88)
25
20
15
10
5
0
-5
-10
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-1995
Observed
Model
Water Level (ft NAVD88)
25
24
23
22
21
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19
18
2013
2014
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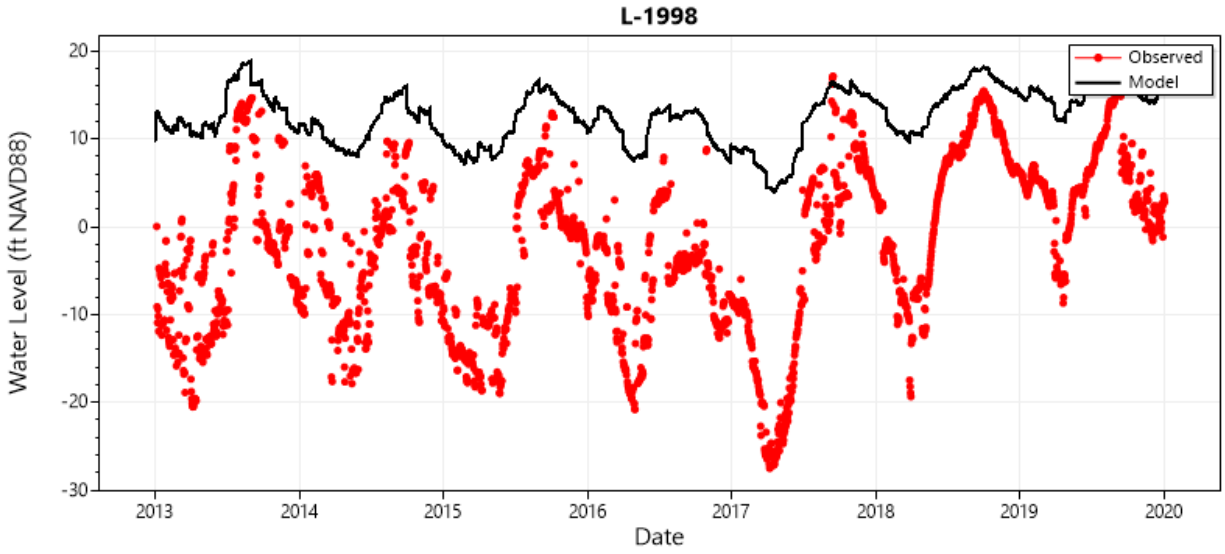
2018
2019
2020
Date


L-1998
Observed
Model
Water Level (ft NAVD88)
20
10
0
-10
-20
-30
2013
2014
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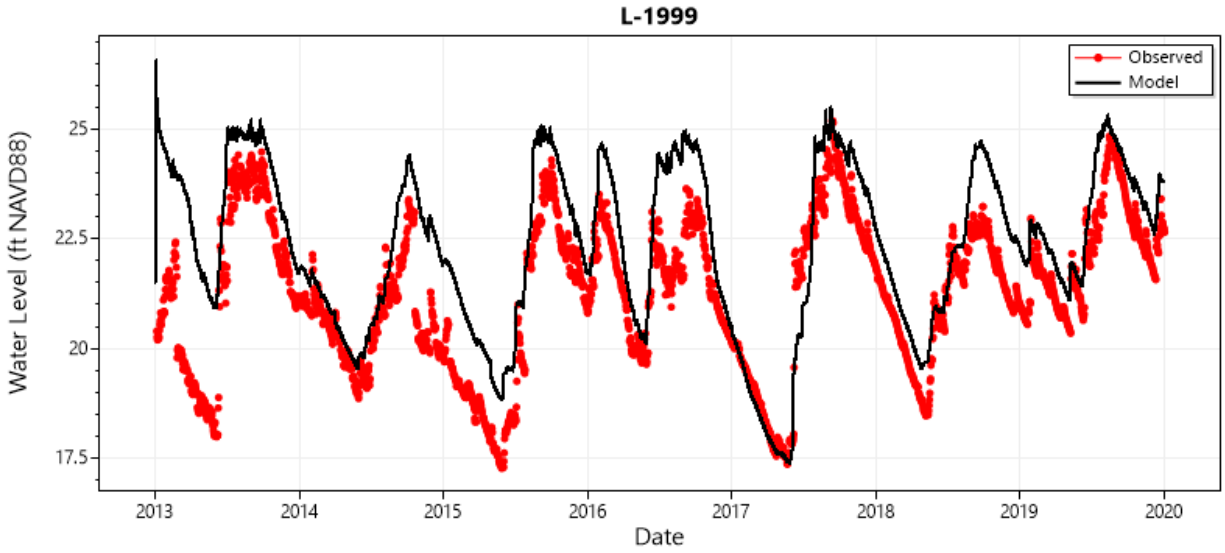
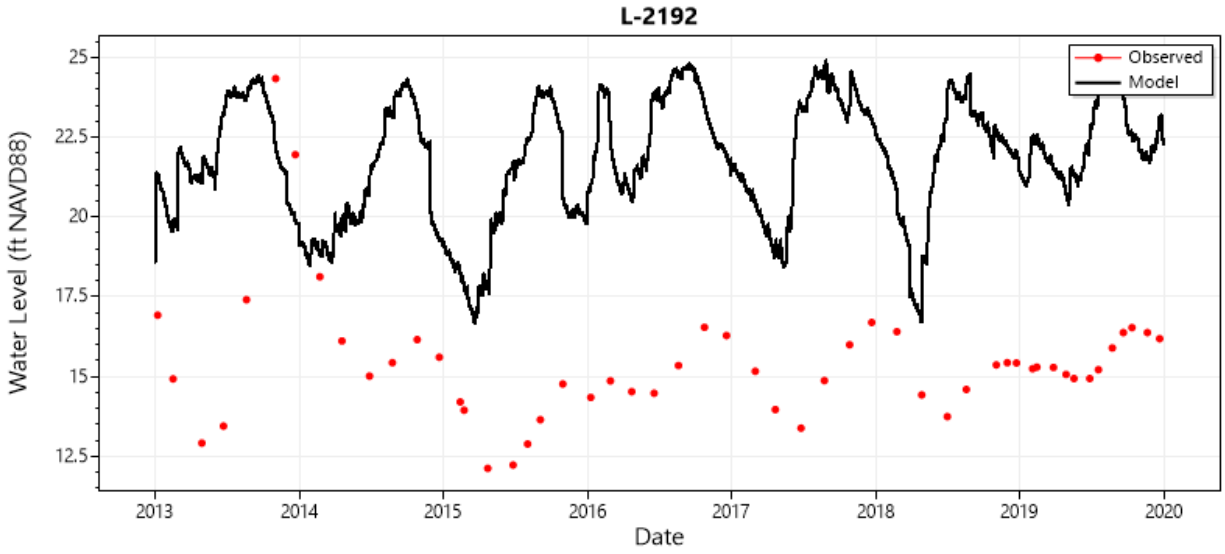
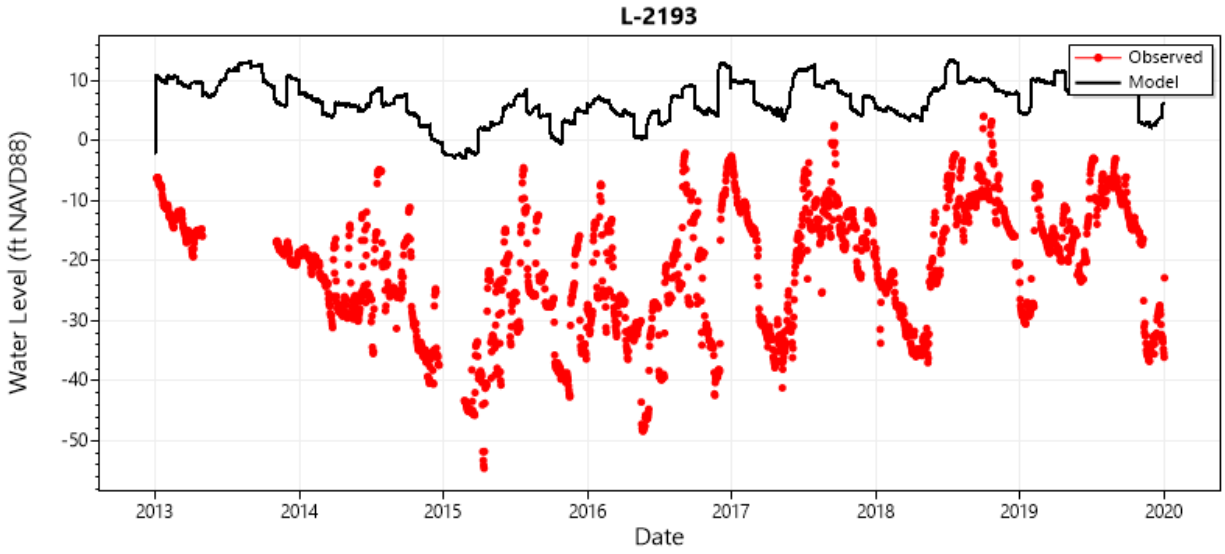
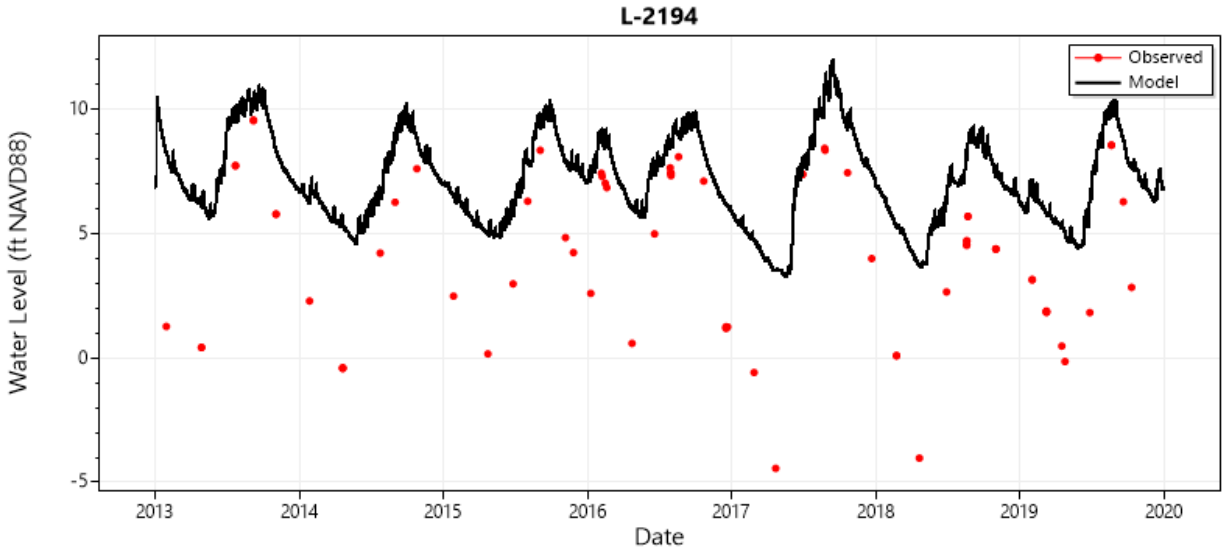
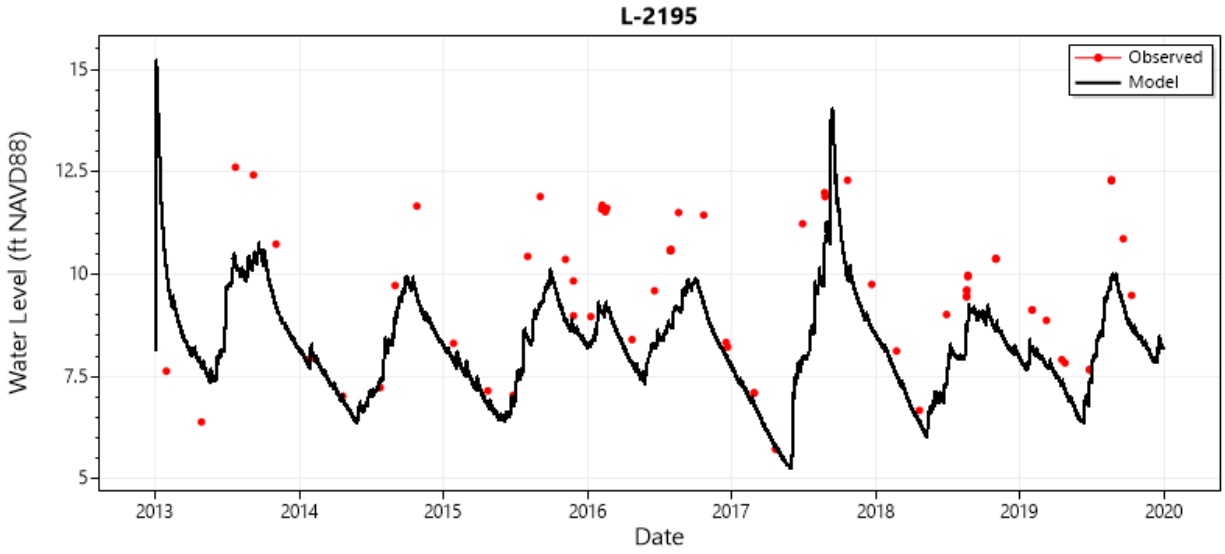
2016
2017
2018
2019
2020
Date

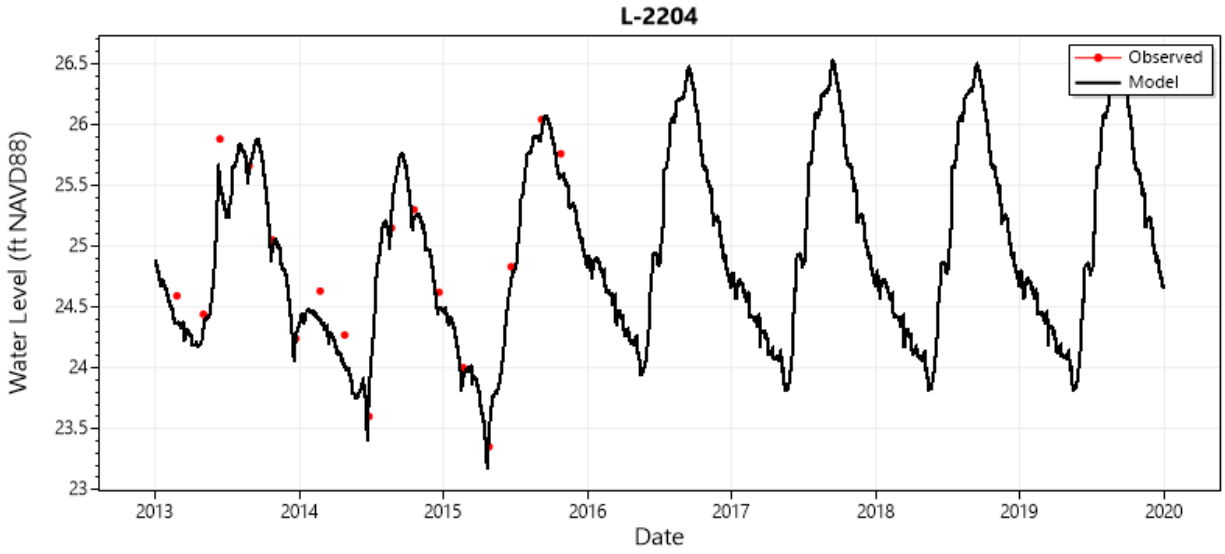

L-1999
Observed
Model
Water Level (ft NAVD88)
25
22.5
20
17.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

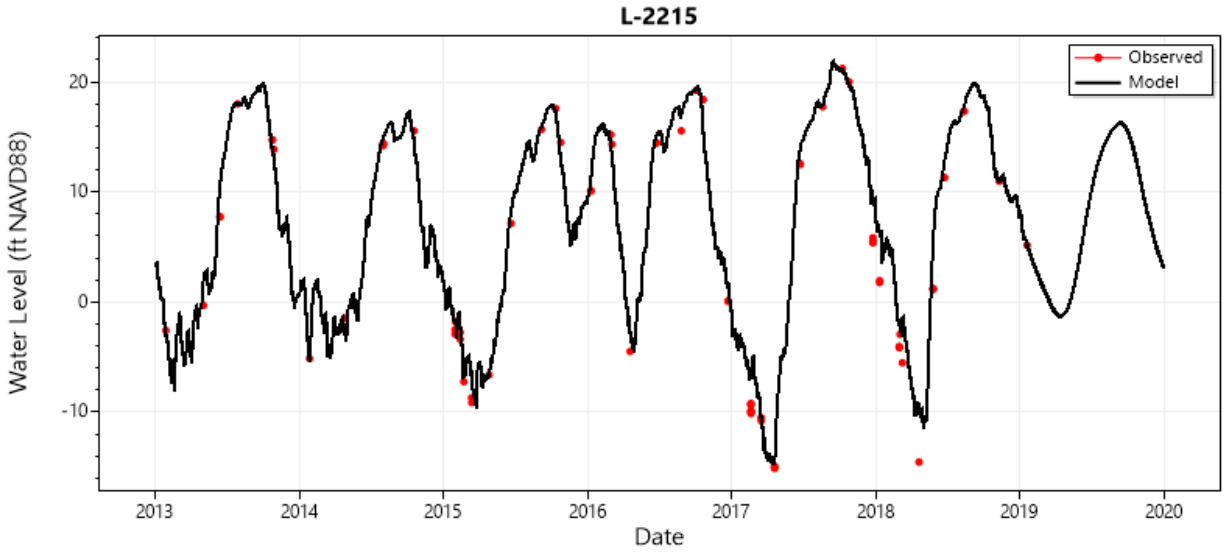

L-2192
Observed
Model
Water Level (ft NAVD88)
25
22.5
20
17.5
15
12.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

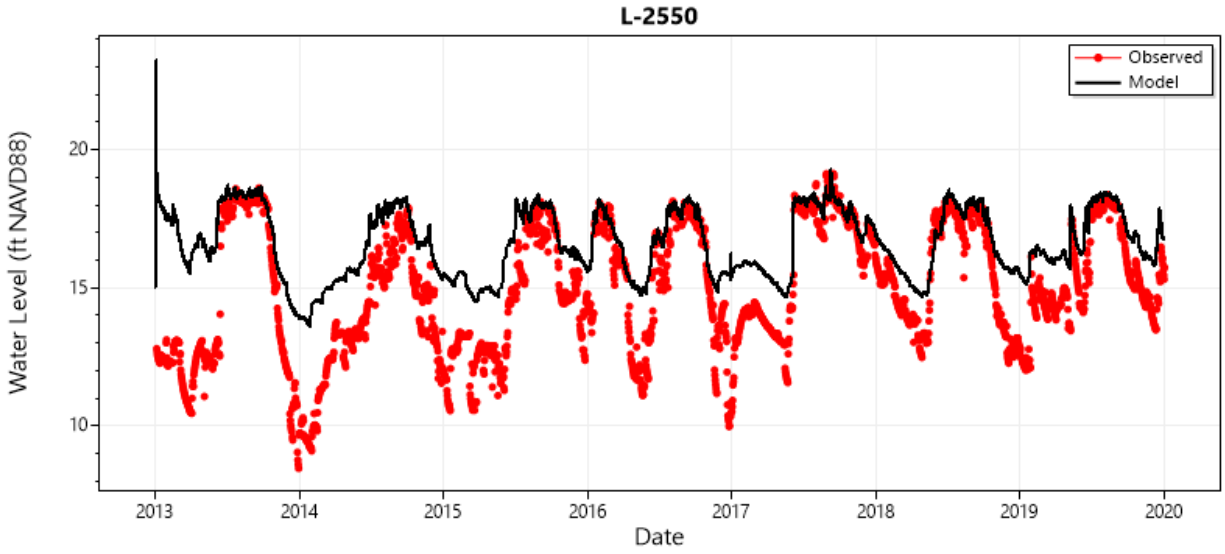

L-2193
Observed
Model
Water Level (ft NAVD88)
10
0
-10
-20
-30
-40
-50
2013
2014
2015
2016
2017
2018
2019
2020
Date

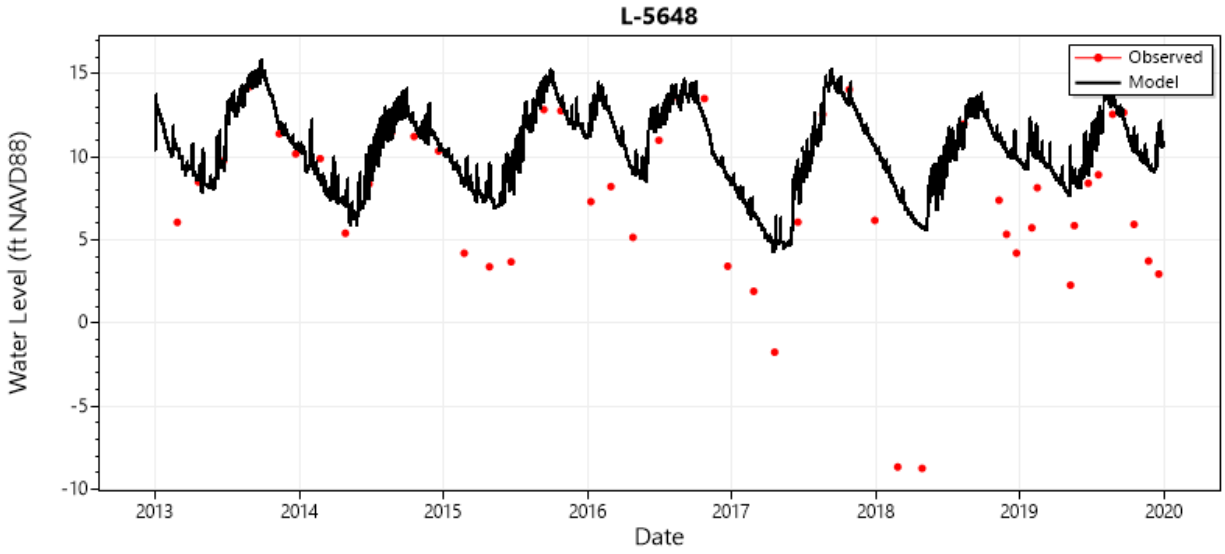

L-2194
Observed
Model
Water Level (ft NAVD88)
10
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date

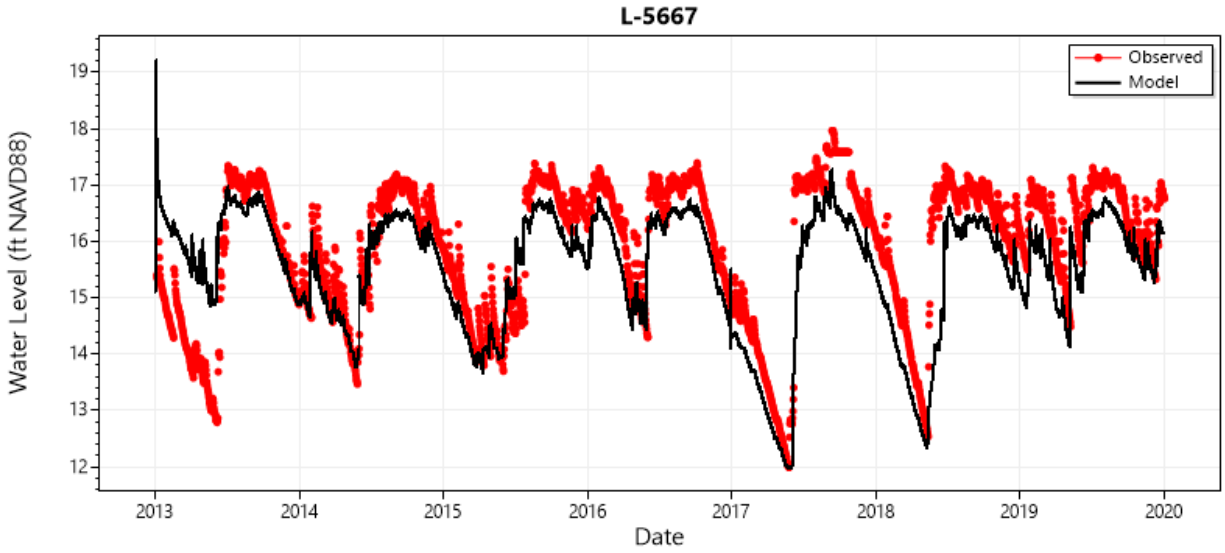

L-2195
Observed
Model
Water Level (ft NAVD88)
15
12.5
10
7.5
5
2013
2014
2015
2016
2017
2018
2019
2020
Date

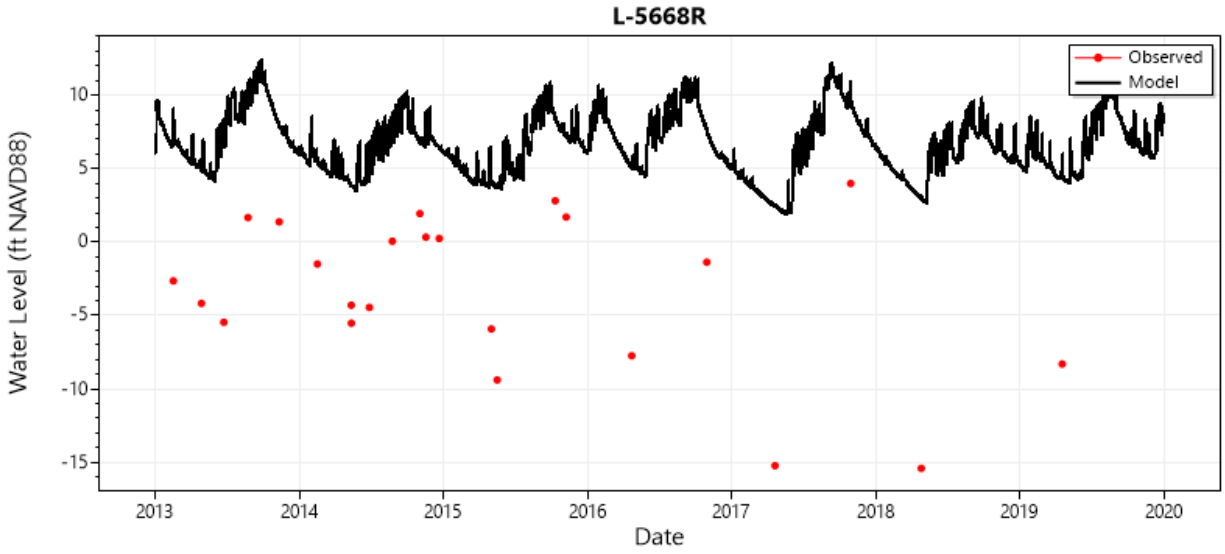

L-2204
Observed
Model
Water Level (ft NAVD88)
26.5
26
25.5
25
24.5
24
23.5
23
2013
2014
2015
2016
2017
2018
2019
2020
Date

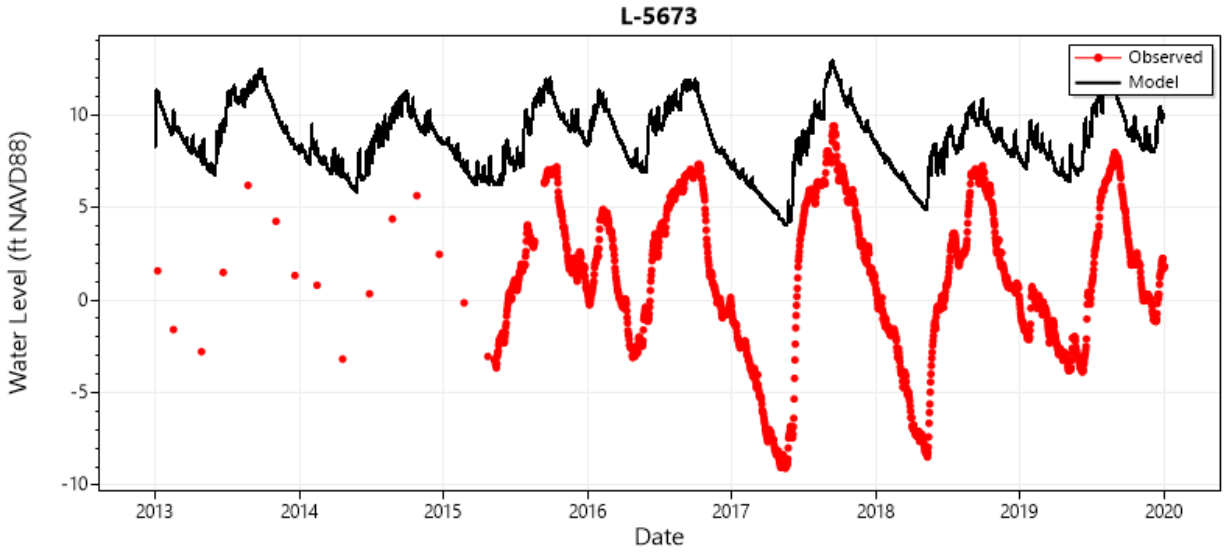

L-2215
Observed
Model
Water Level (ft NAVD88)
20
10
0
-10
2013
2014
2015
2016
2017
2018
2019
2020
Date

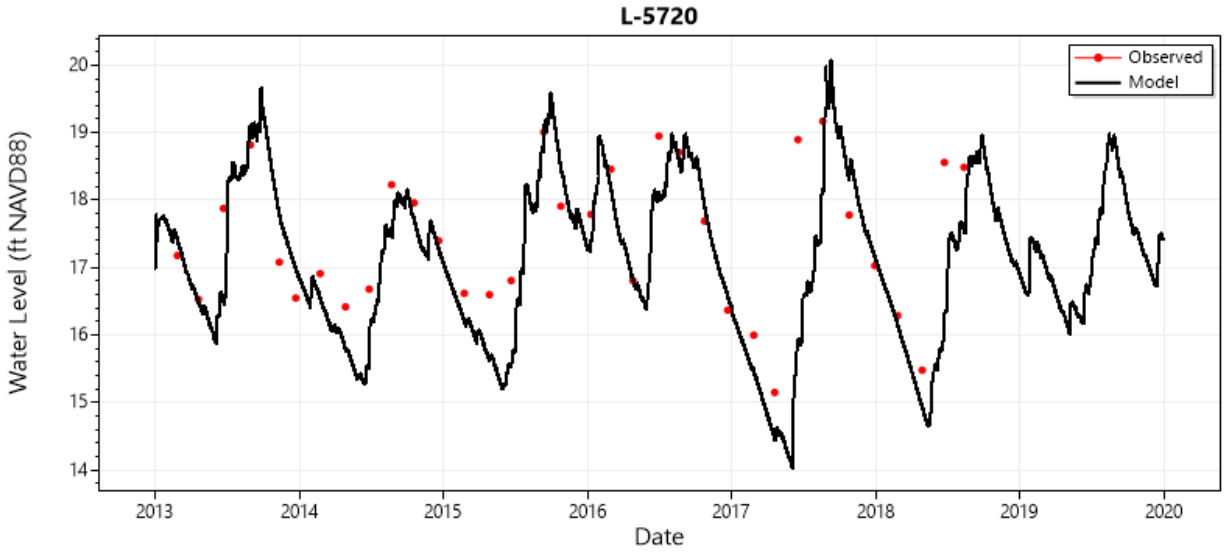

L-2550
Observed
Model
Water Level (ft NAVD88)
20
15
10
2013
2014
2015
2016
2017
2018
2019
2020
Date

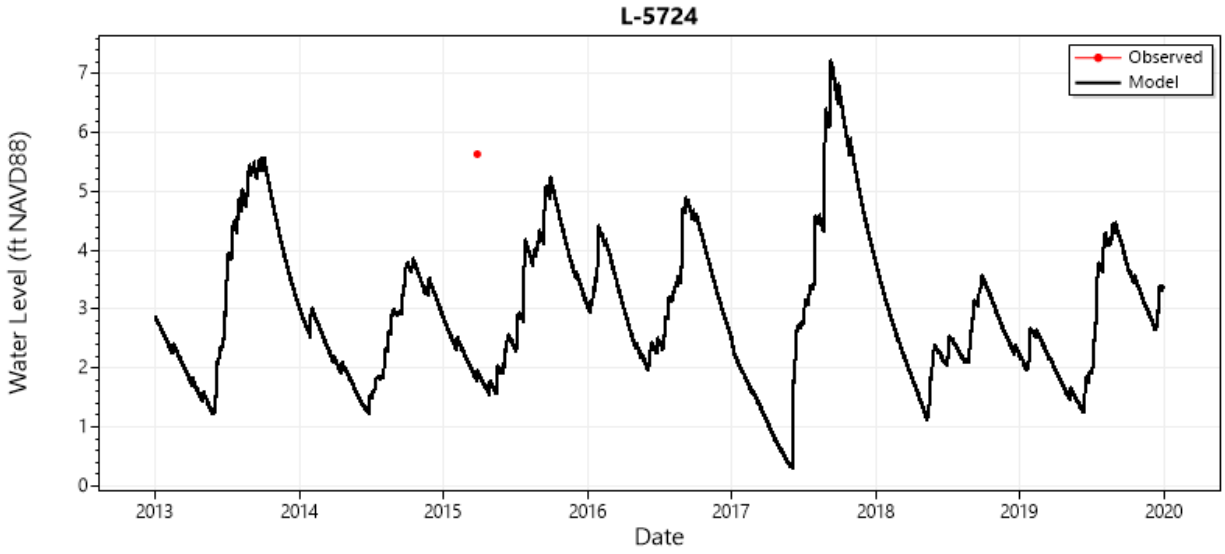

L-5648
Observed
Model
Water Level (ft NAVD88)
15
10
5
0
-5
-10
2013
2014
2015
2016
2017
2018
2019
2020
Date

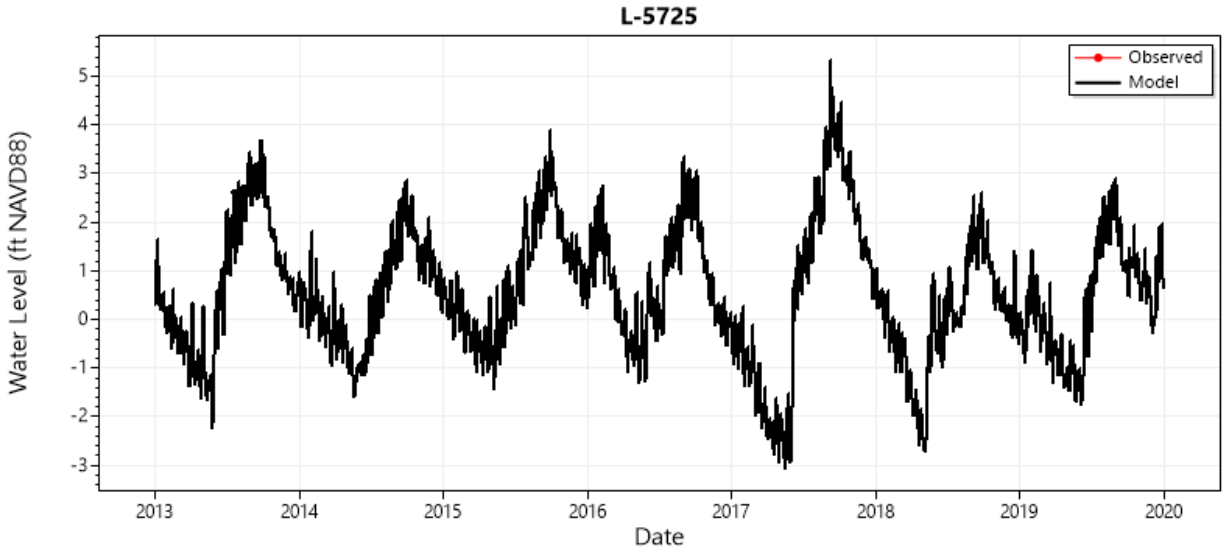

L-5667
Observed
Model
Water Level (ft NAVD88)
19
18
17
16
15
14
13
12
2013
2014
2015
2016
2017
2018
2019
2020
Date

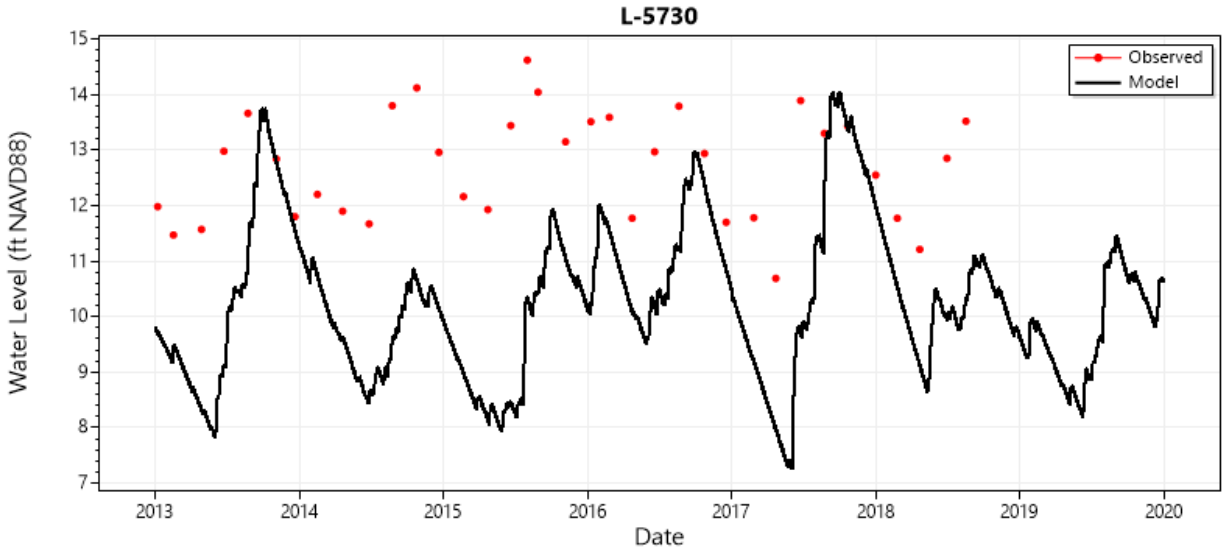

L-5668R
Observed
Model
Water Level (ft NAVD88)
10
5
0
-5
-10
-15
2013
2014
2015
2016
2017
2018
2019
2020
Date

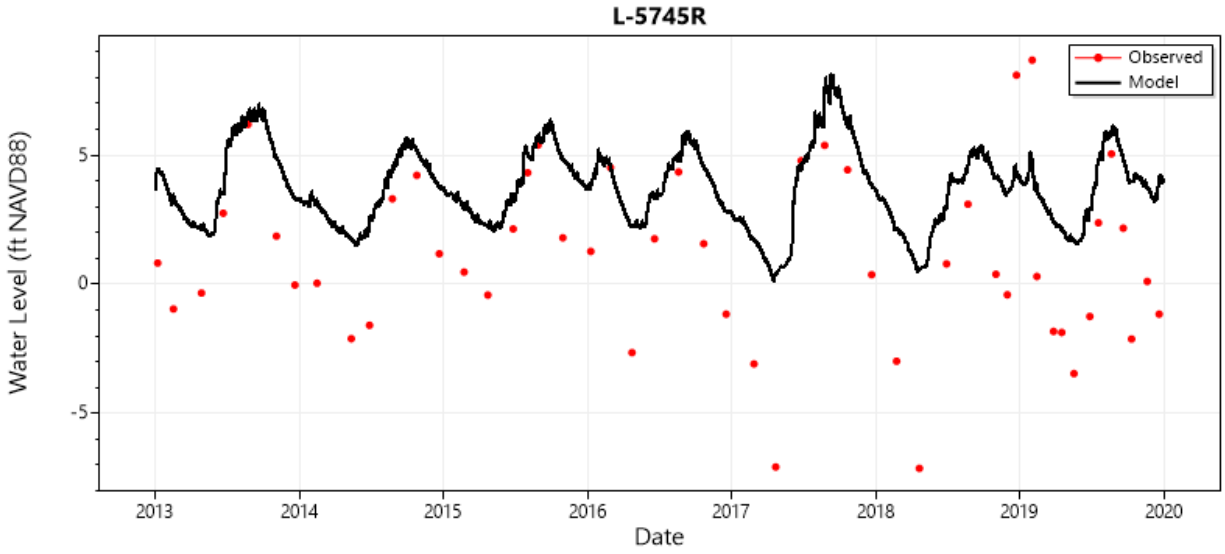

L-5673
Observed
Model
Water Level (ft NAVD88)
10
5
0
-5
-10
2013
2014
2015
2016
2017
2018
2019
2020
Date

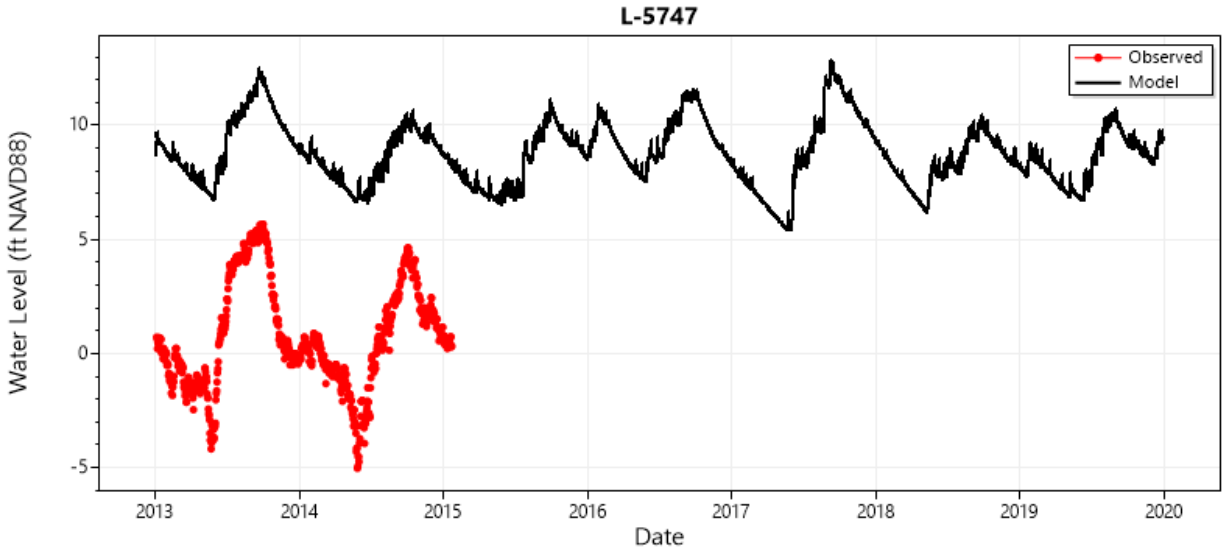

L-5720
Observed
Model
Water Level (ft NAVD88)
20
19
18
17
16
15
14
2013
2014
2015
2016
2017
2018
2019
2020
Date

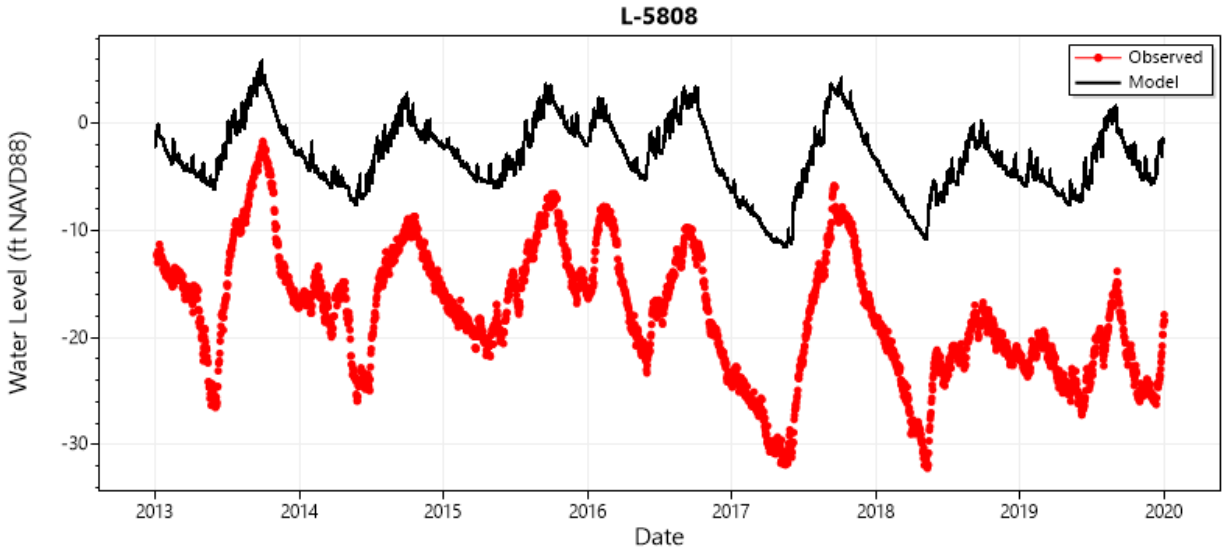

L-5724
Observed
Model
Water Level (ft NAVD88)
7
6
5
4
3
2
1
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

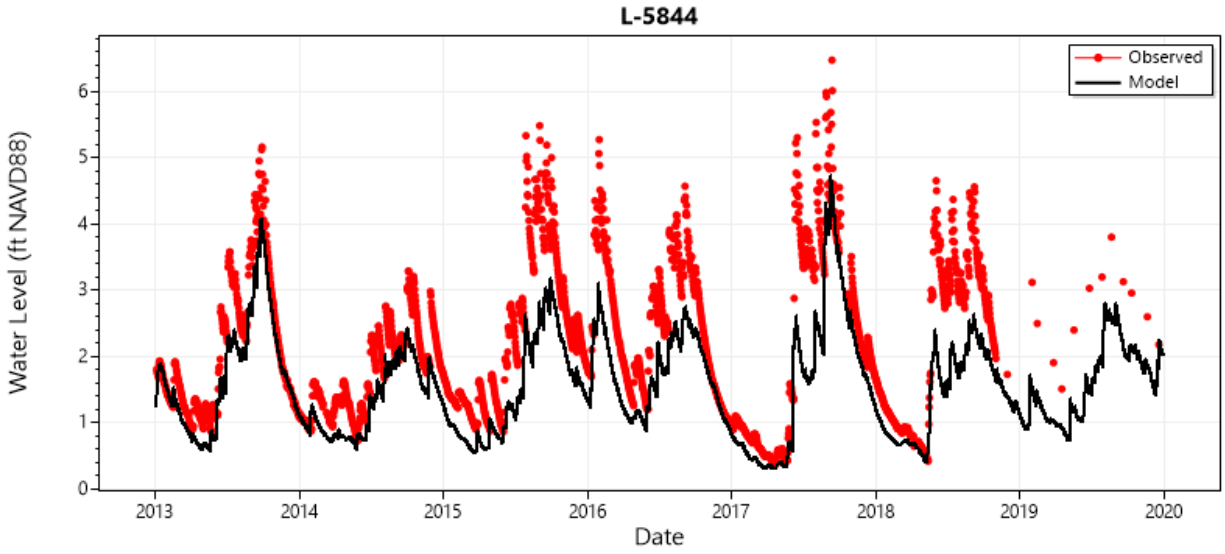

L-5725
Observed
Model
Water Level (ft NAVD88)
5
4
3
2
1
0
-1
-2
-3
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-5730
Observed
Model
Water Level (ft NAVD88)
15
14
13
12
11
10
9
8
7
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-5745R
Observed
Model
Water Level (ft NAVD88)
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-5747
Observed
Model
Water Level (ft NAVD88)
10
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-5808
Observed
Model
Water Level (ft NAVD88)
0
-10
-20
-30
2013
2014
2015
2016
2017
2018
2019
2020
Date


L-5844
Observed
Model
Water Level (ft NAVD88)
6
5
4
3
2
1
0
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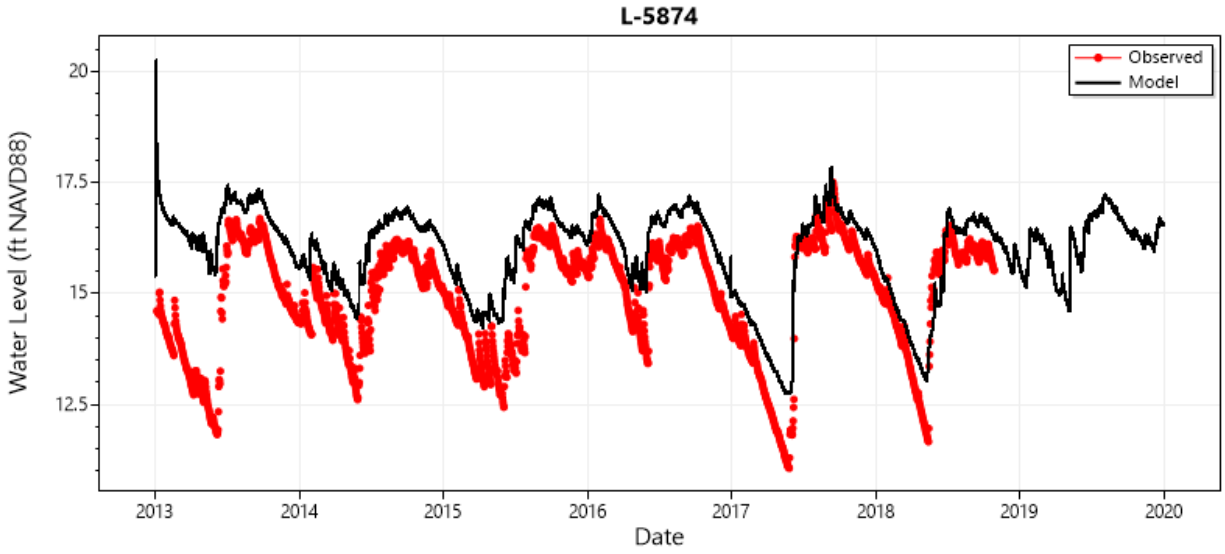
2014
2015
2016
2017
2018
2019
2020
Date


L-5874
Observed
Model
Water Level (ft NAVD88)
20
17.5
15
12.5
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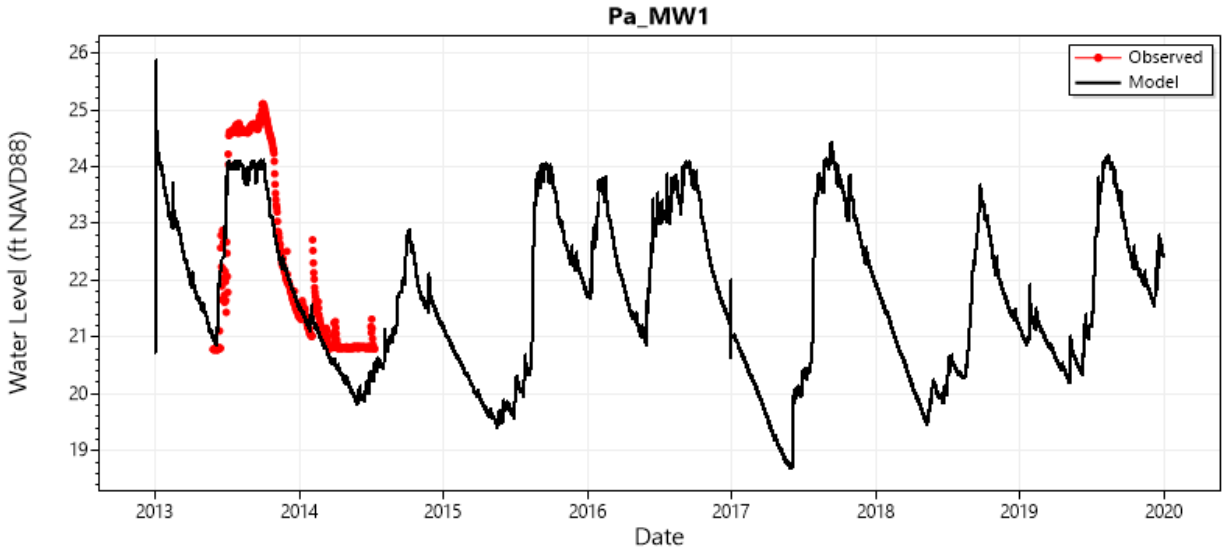
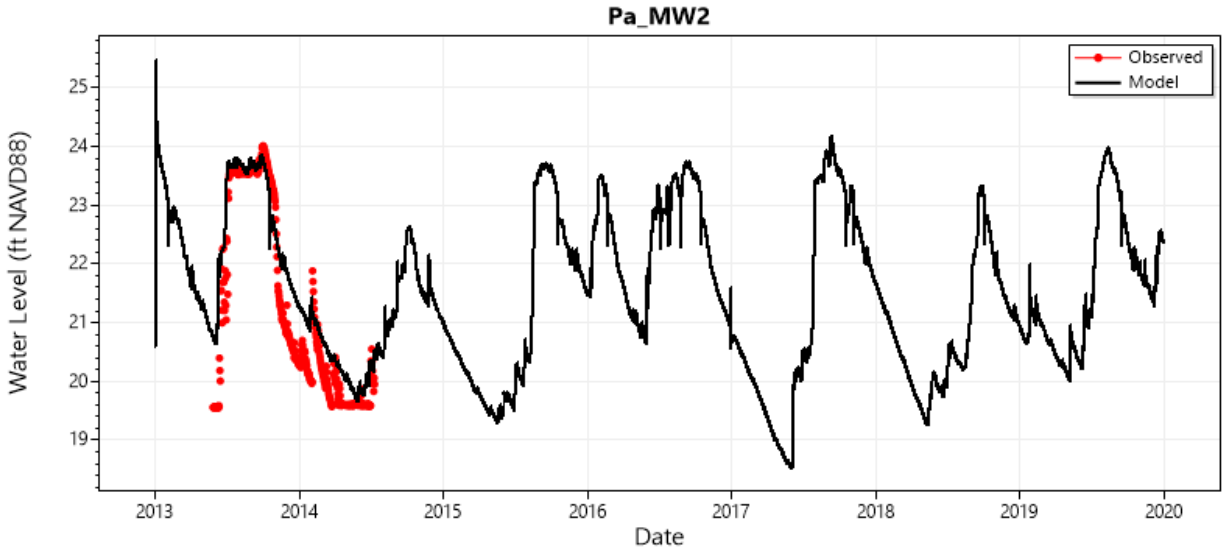
2014
2015
2016
2017
2018
2019
2020
Date


Pa_MW1
Observed
Model
Water Level (ft NAVD88)
26
25
24
23
22
21
20
19
2013
2014
2015
2016
2017
2018
2019
2020
Date


Pa_MW2
Observed
Model
Water Level (ft NAVD88)
25
24
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22
21
20
19
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2014
2015
2016
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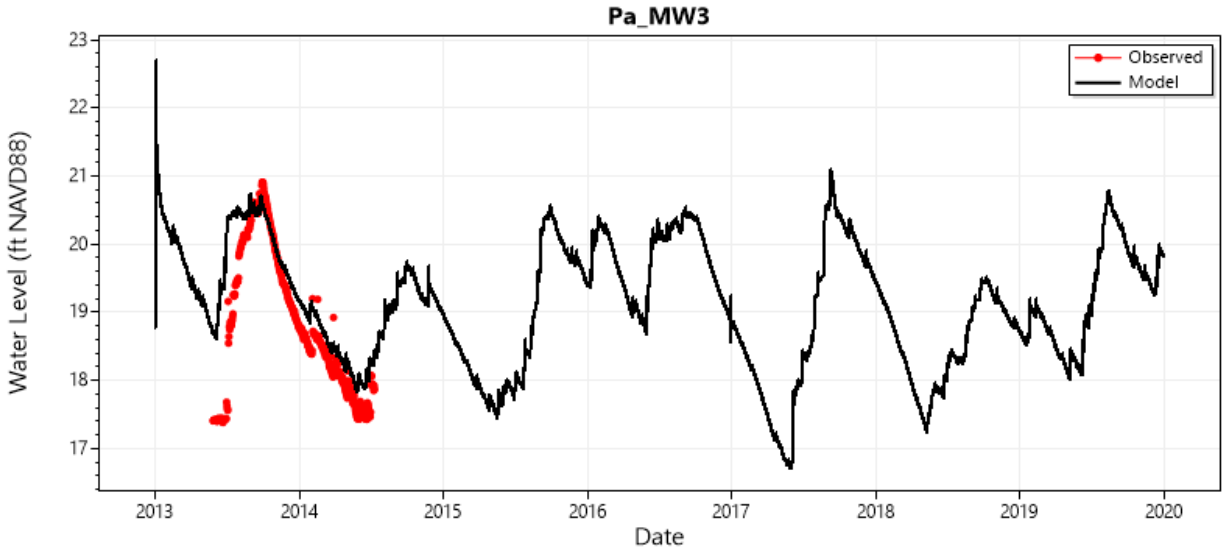
2018
2019
2020
Date


Pa_MW3
Observed
Model
Water Level (ft NAVD88)
Date
23
22
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20
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18
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2013
2014
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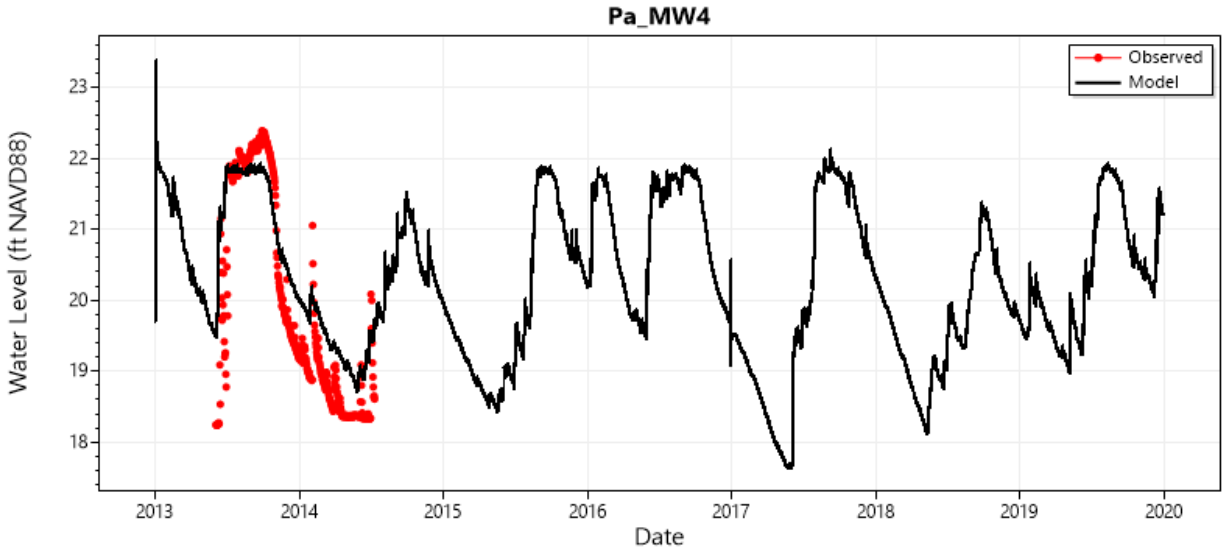
2017
2018
2019
2020


Pa_MW4
Observed
Model
Water Level (ft NAVD88)
Date
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22
21
20
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2013
2014
2015
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2017
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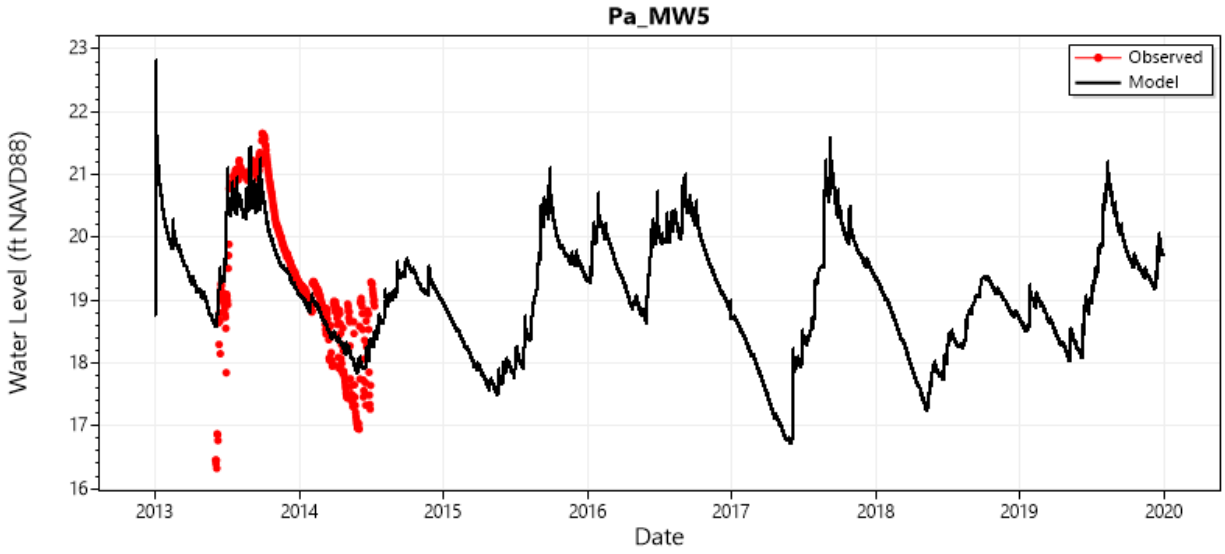
2019
2020


Pa_MW5
Observed
Model
Water Level (ft NAVD88)
Date
23
22
21
20
19
18
17
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2013
2014
2015
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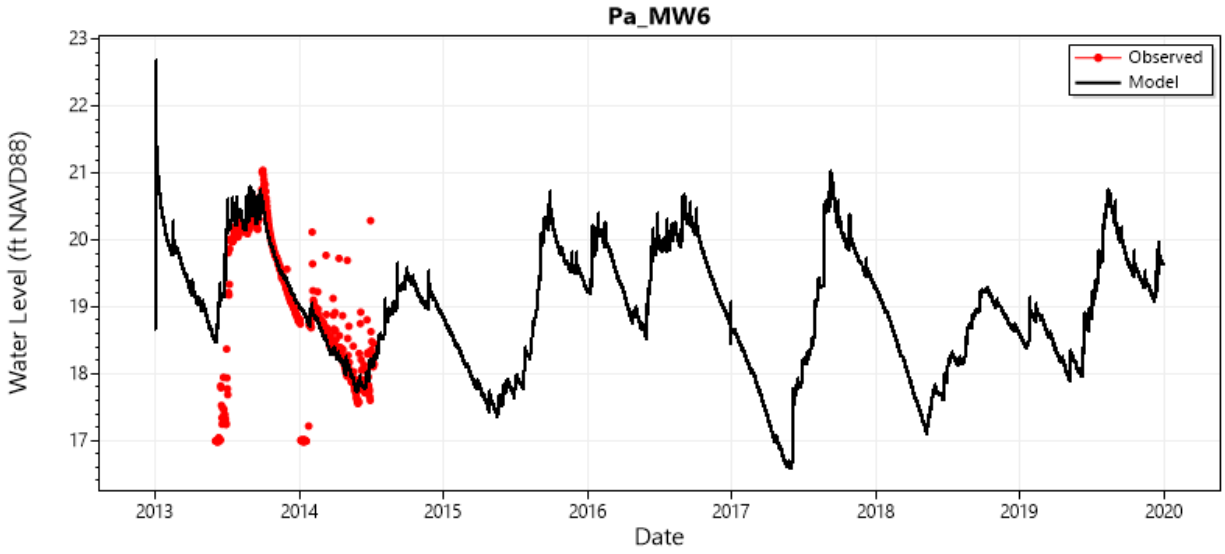
2017
2018
2019
2020


Pa_MW6
Observed
Model
Water Level (ft NAVD88)
23
22
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20
19
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17
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2014
2015
2016
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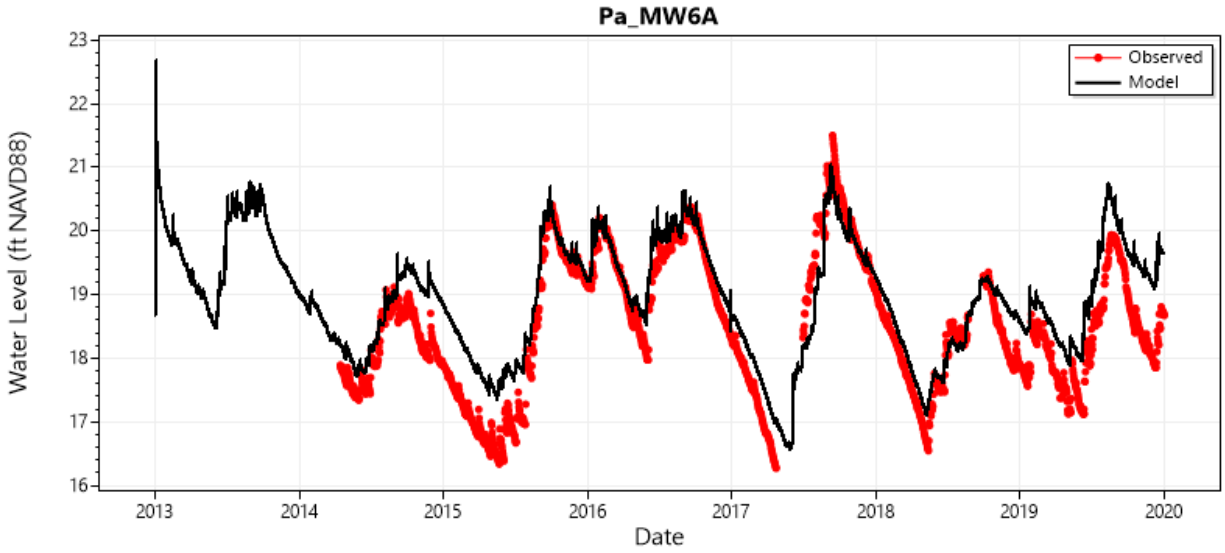
2018
2019
2020
Date


Pa_MW6A
Observed
Model
Water Level (ft NAVD88)
23
22
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16
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2014
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2016
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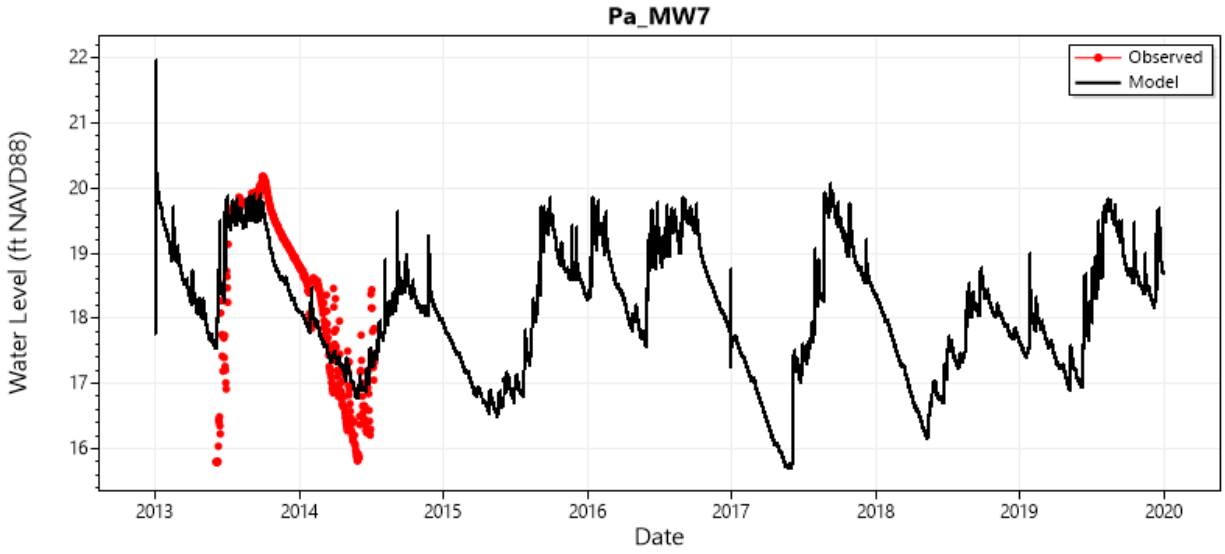
2018
2019
2020
Date


Pa_MW7
Observed
Model
Water Level (ft NAVD88)
22
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18
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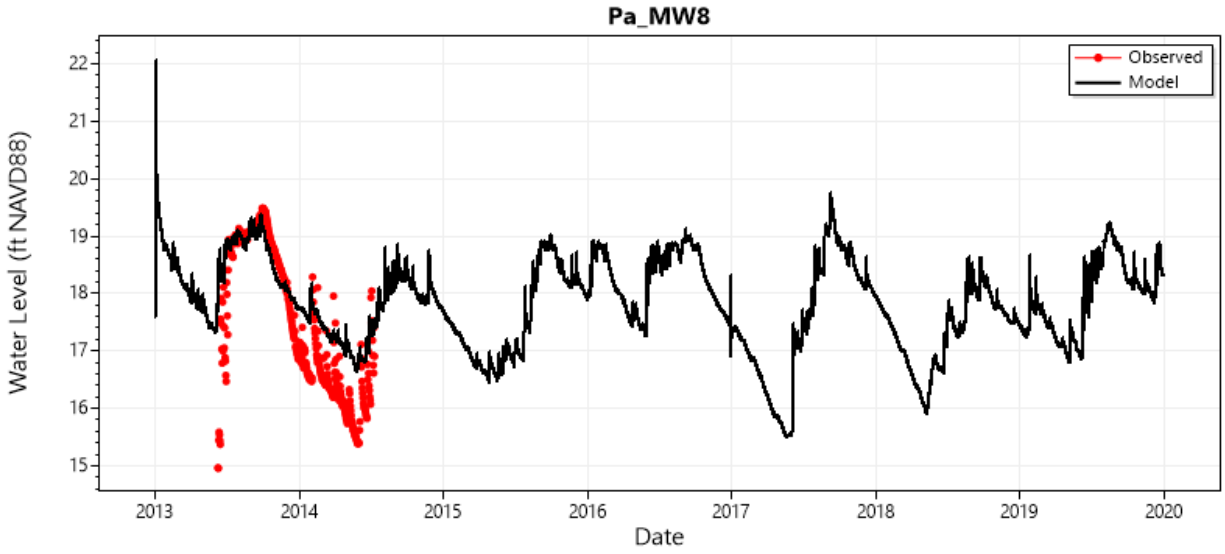
2014
2015
2016
2017
2018
2019
2020
Date


Pa_MW8
Observed
Model
Water Level (ft NAVD88)
22
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2014
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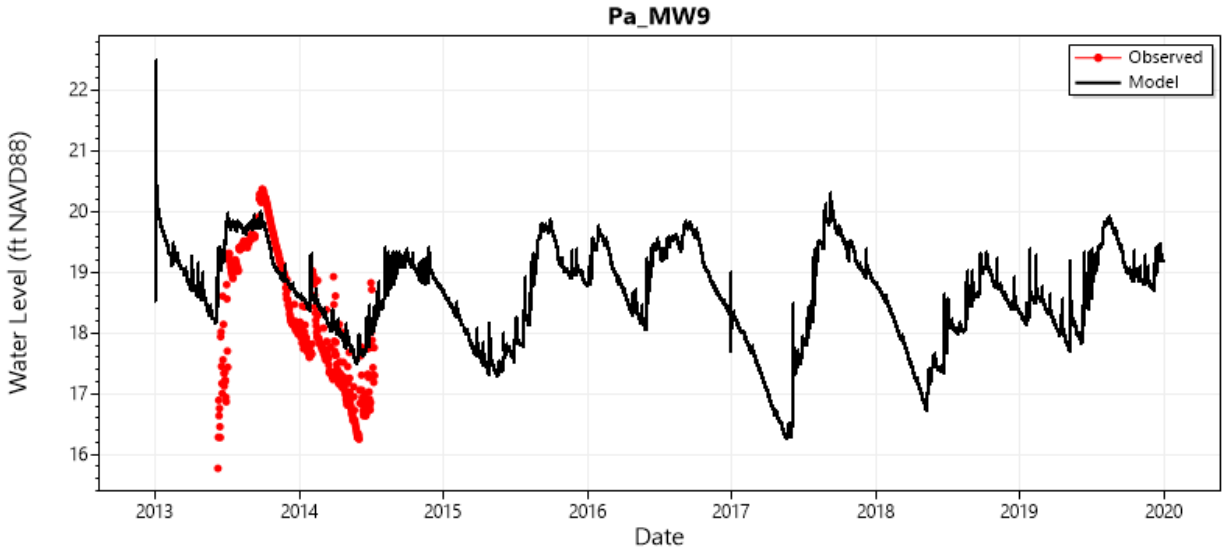
2018
2019
2020
Date


Pa_MW9
Observed
Model
Water Level (ft NAVD88)
22
21
20
19
18
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16
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2014
2015
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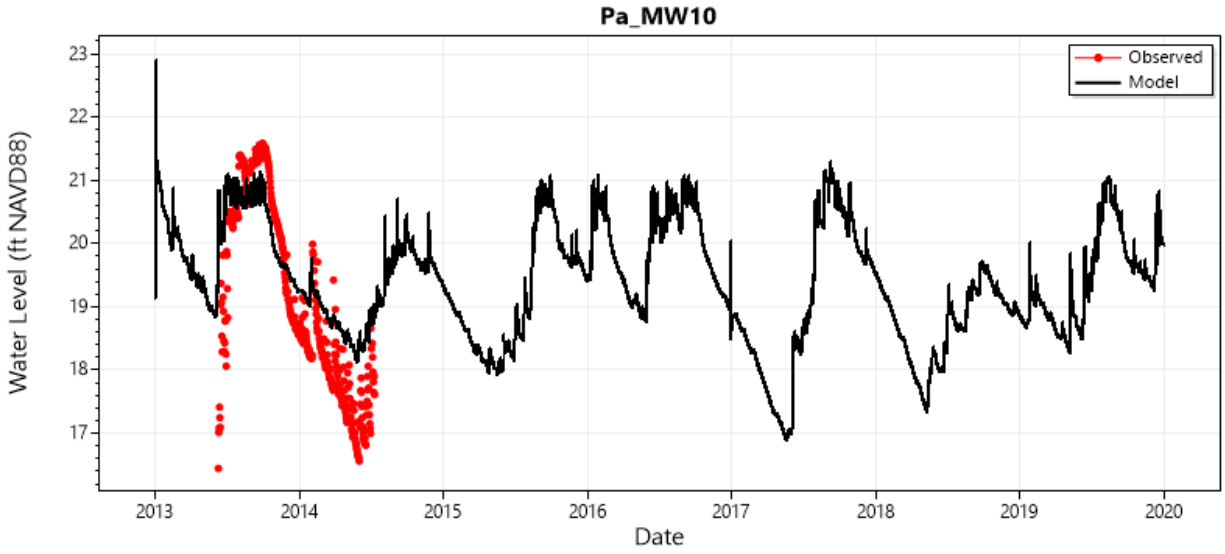
2018
2019
2020
Date


Pa_MW10
Observed
Model
Water Level (ft NAVD88)
23
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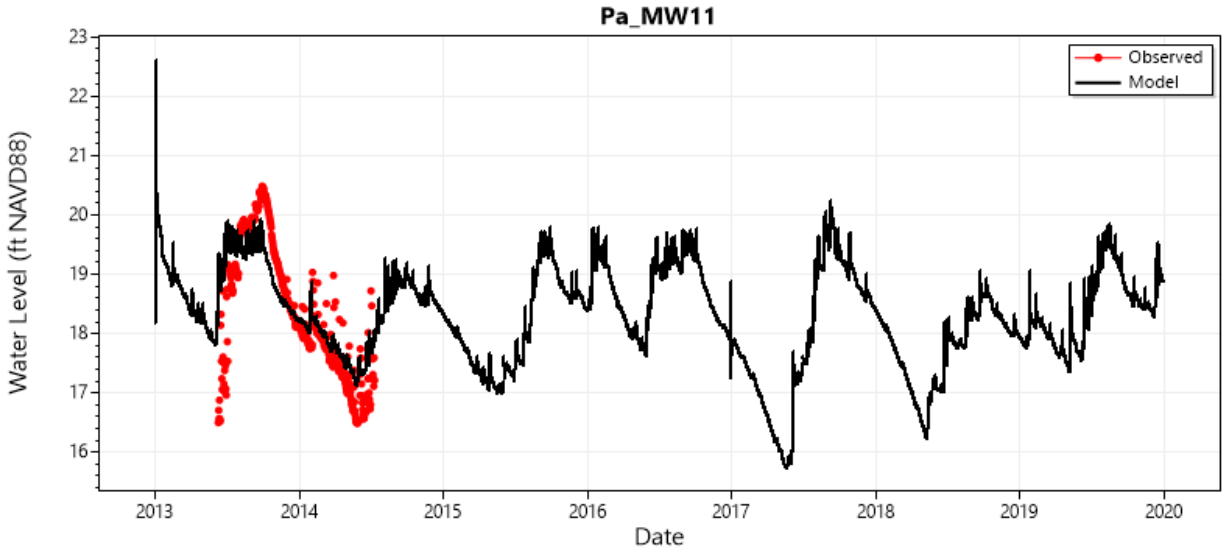
2020
Date


Pa_MW11
Observed
Model
Water Level (ft NAVD88)
Date
23
22
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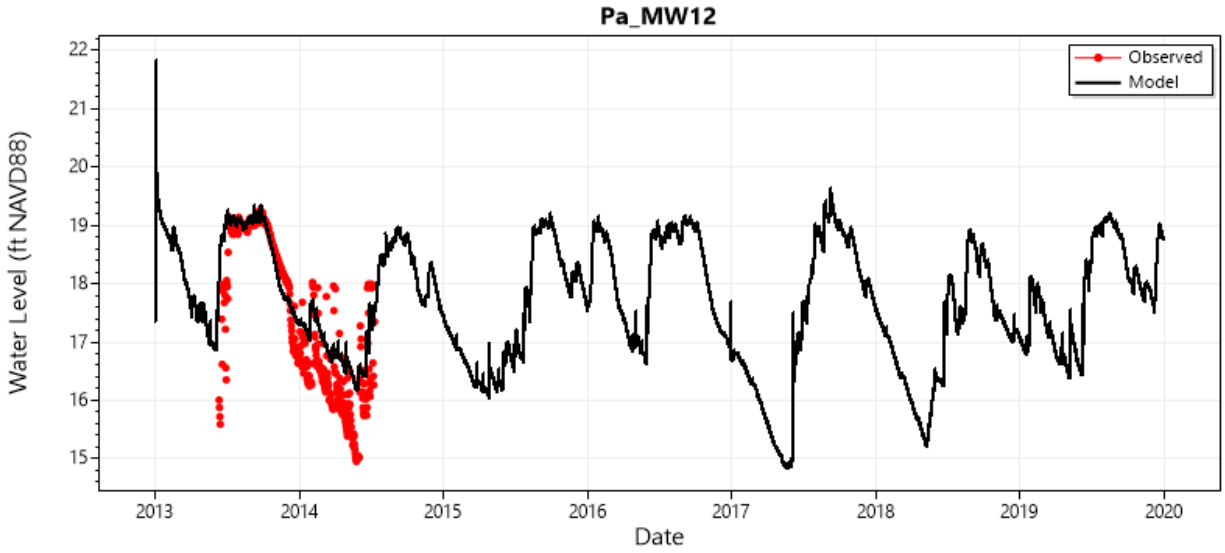
2017
2018
2019
2020


Pa_MW12
Observed
Model
Water Level (ft NAVD88)
Date
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2019
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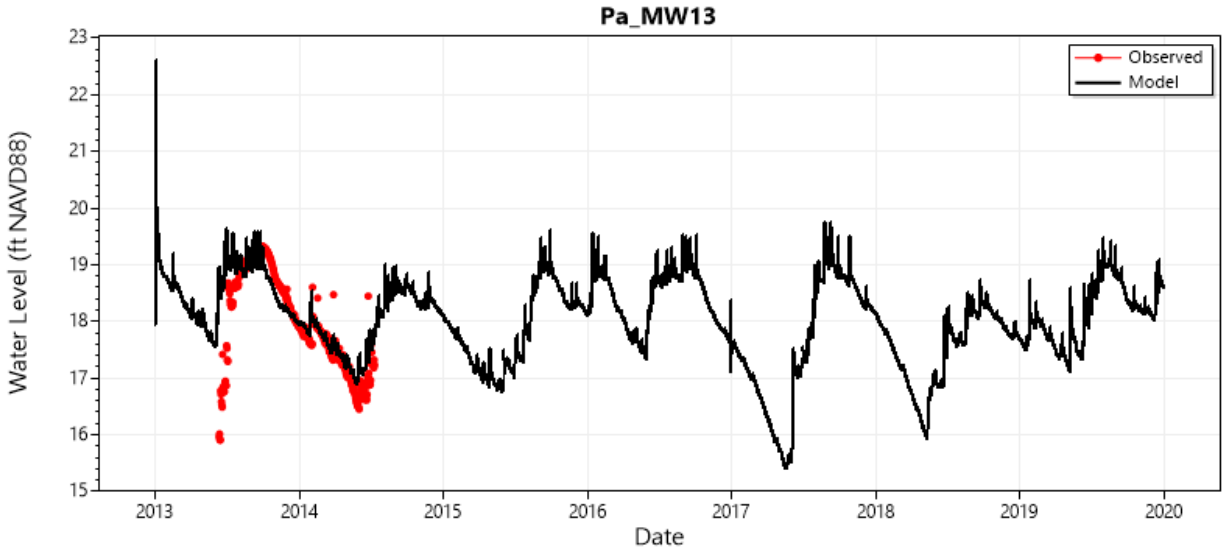
Pa_MW13
Observed
Model
Water Level (ft NAVD88)
Date
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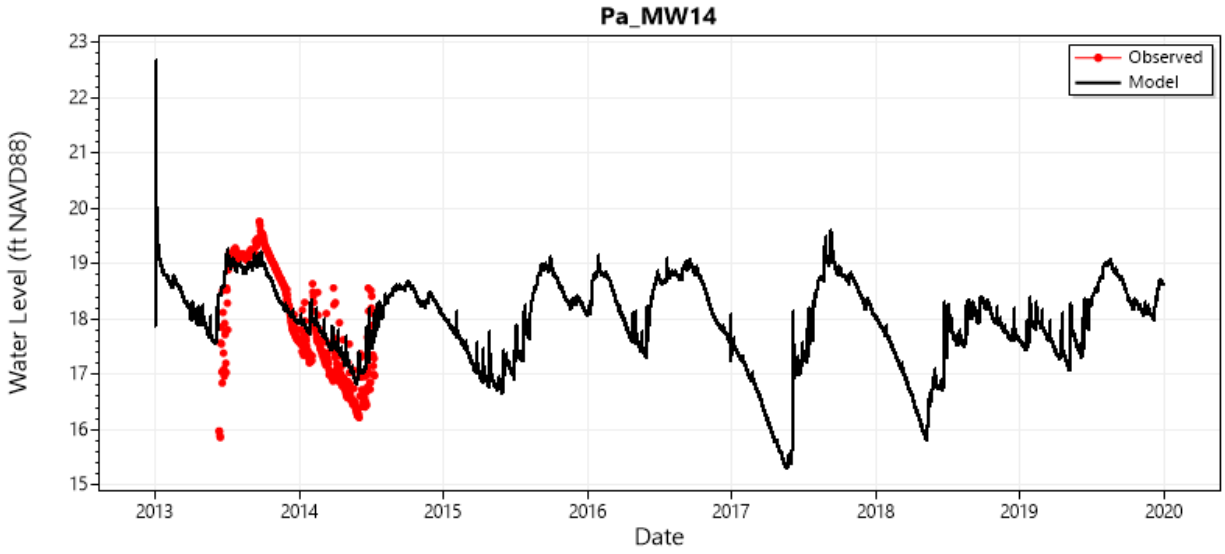
2019
2020


Pa_MW14
Observed
Model
Water Level (ft NAVD88)
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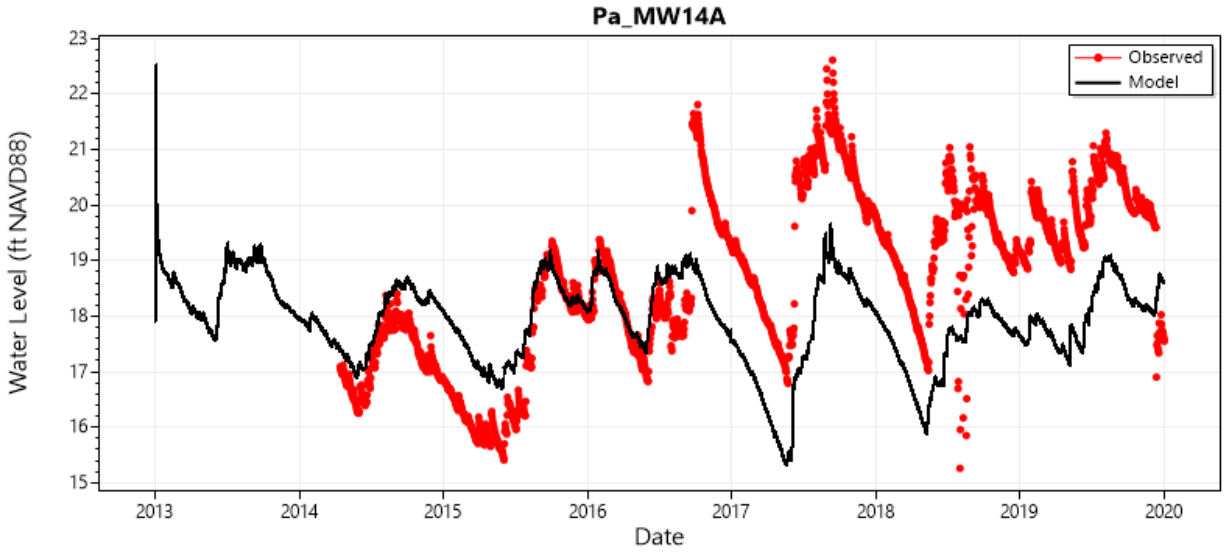
2018
2019
2020
Date


Pa_MW14A
Observed
Model
Water Level (ft NAVD88)
23
22
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20
19
18
17
16
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2013
2014
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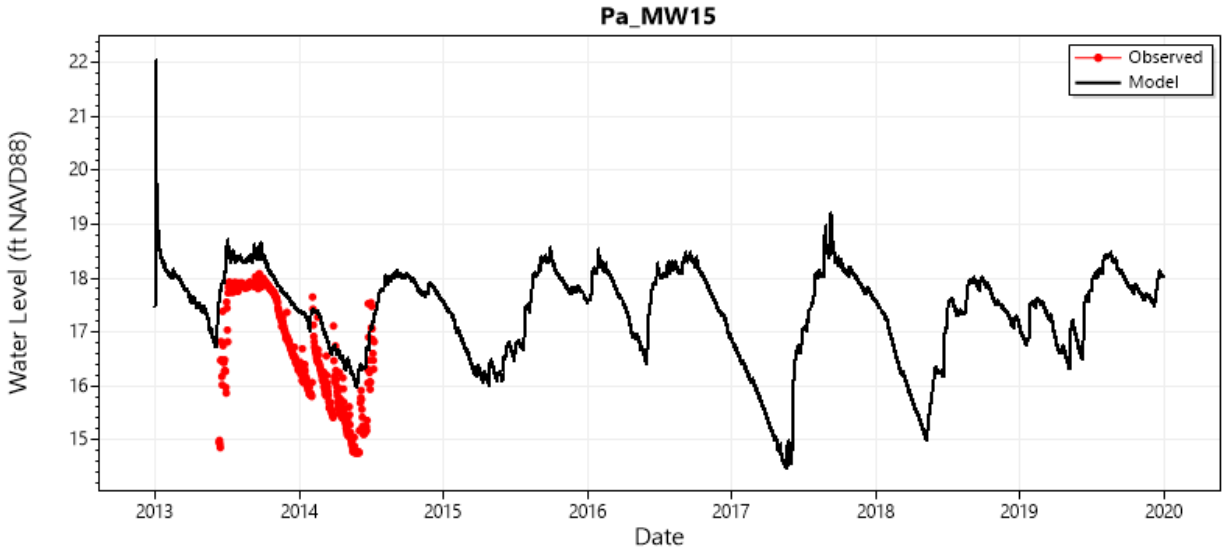
2016
2017
2018
2019
2020
Date


Pa_MW15
Observed
Model
Water Level (ft NAVD88)
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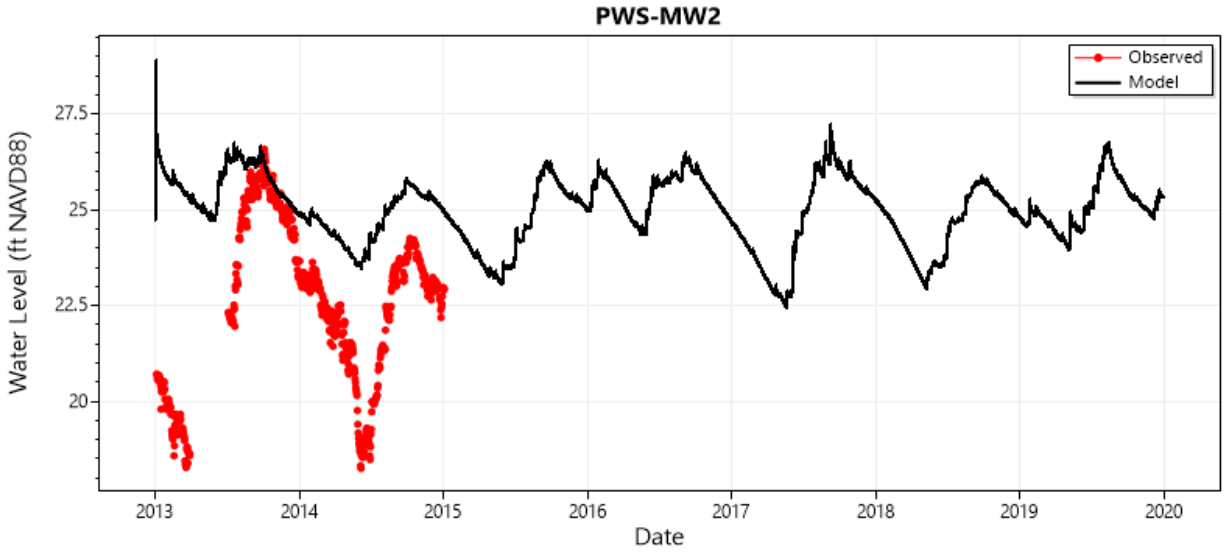
2020
Date


PWS-MW2
Observed
Model
Water Level (ft NAVD88)
27.5
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22.5
20
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2014
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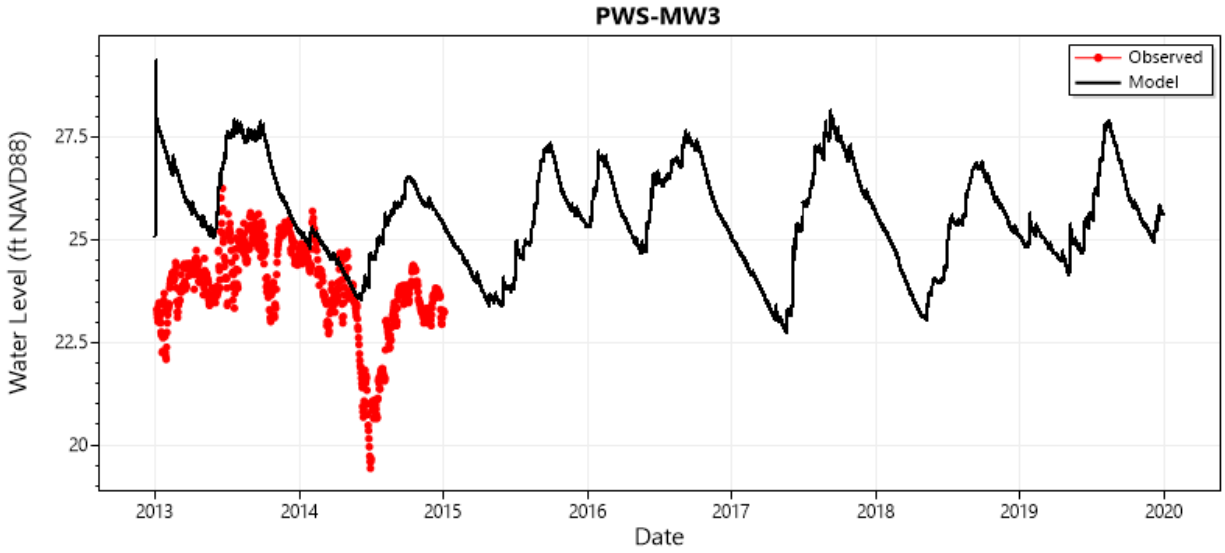
2016
2017
2018
2019
2020
Date


PWS-MW3
Observed
Model
Water Level (ft NAVD88)
27.5
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2014
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2016
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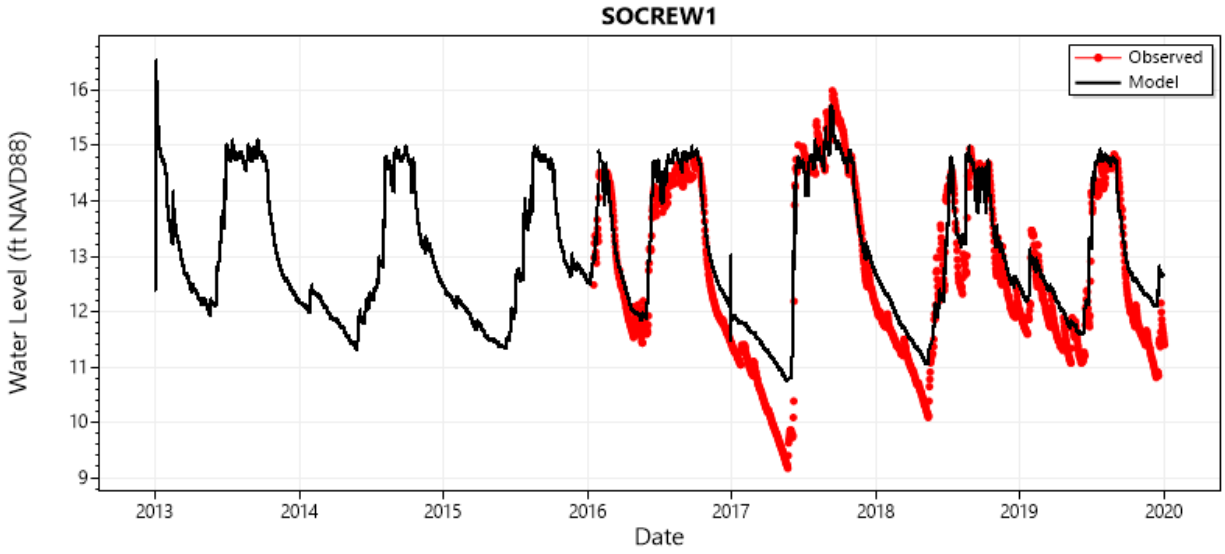
2019
2020
Date


SOCREW1
Observed
Model
Water Level (ft NAVD88)
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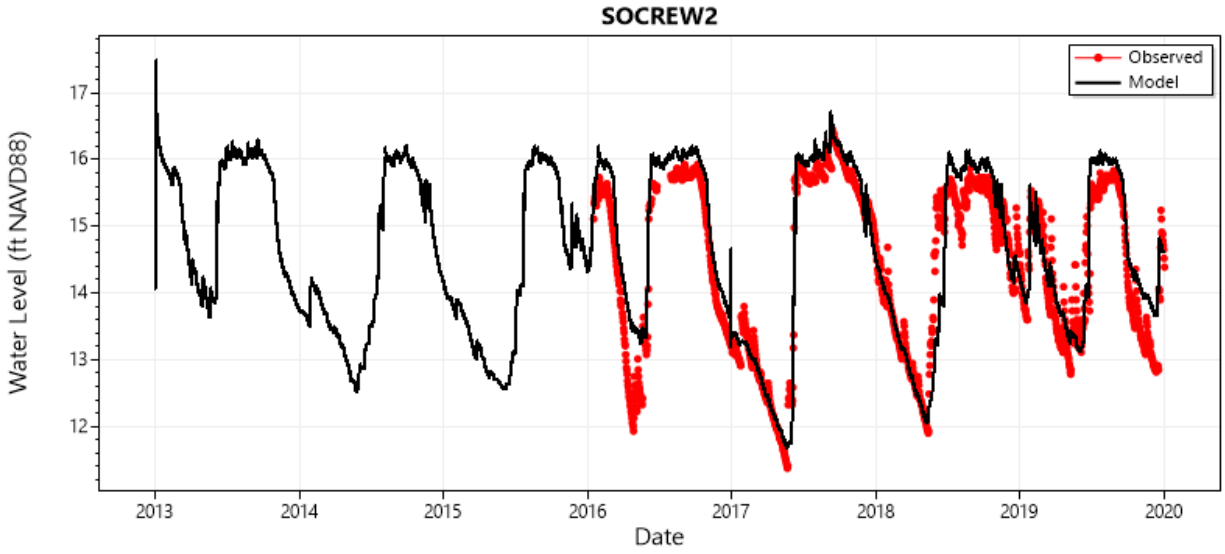
2020
Date


SOCREW2
Observed
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Water Level (ft NAVD88)
17
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2016
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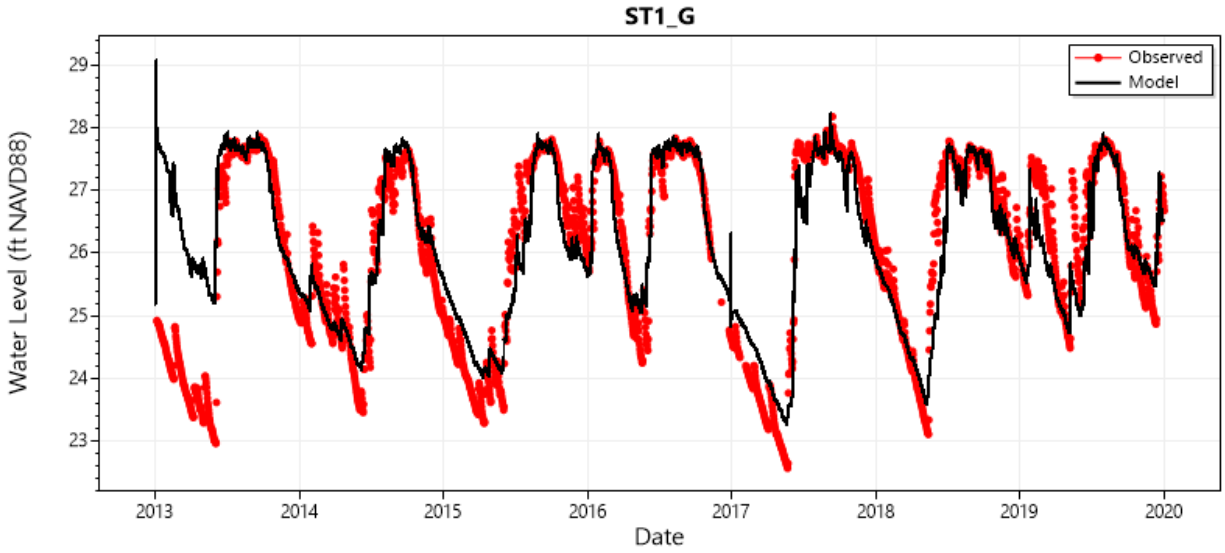
2018
2019
2020
Date


ST1_G
Observed
Model
Water Level (ft NAVD88)
29
28
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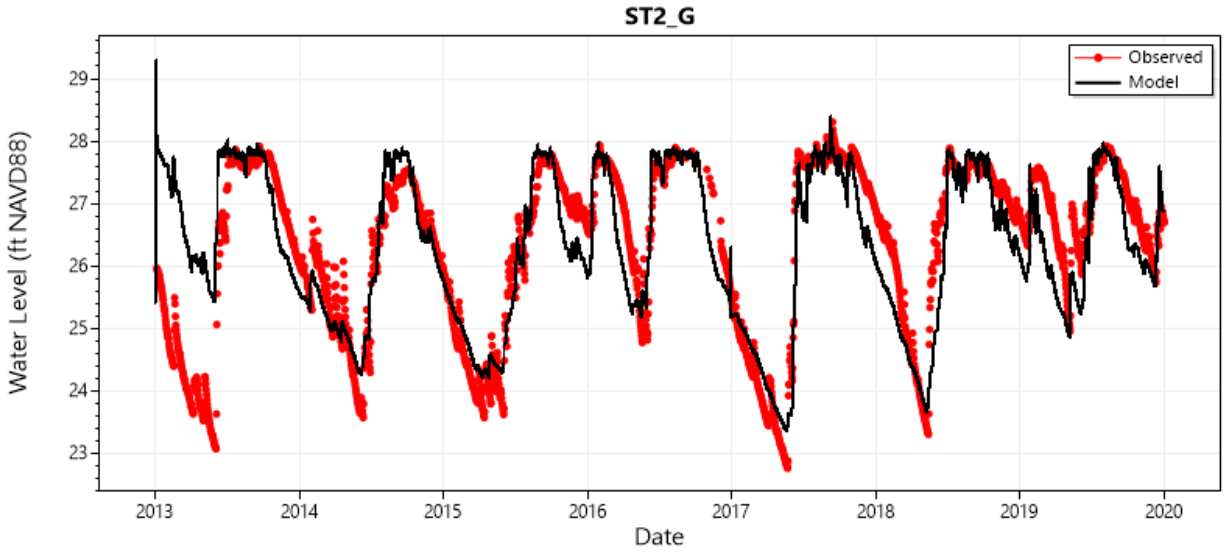
2018
2019
2020
Date


ST2_G
Observed
Model
Water Level (ft NAVD88)
29
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2014
2015
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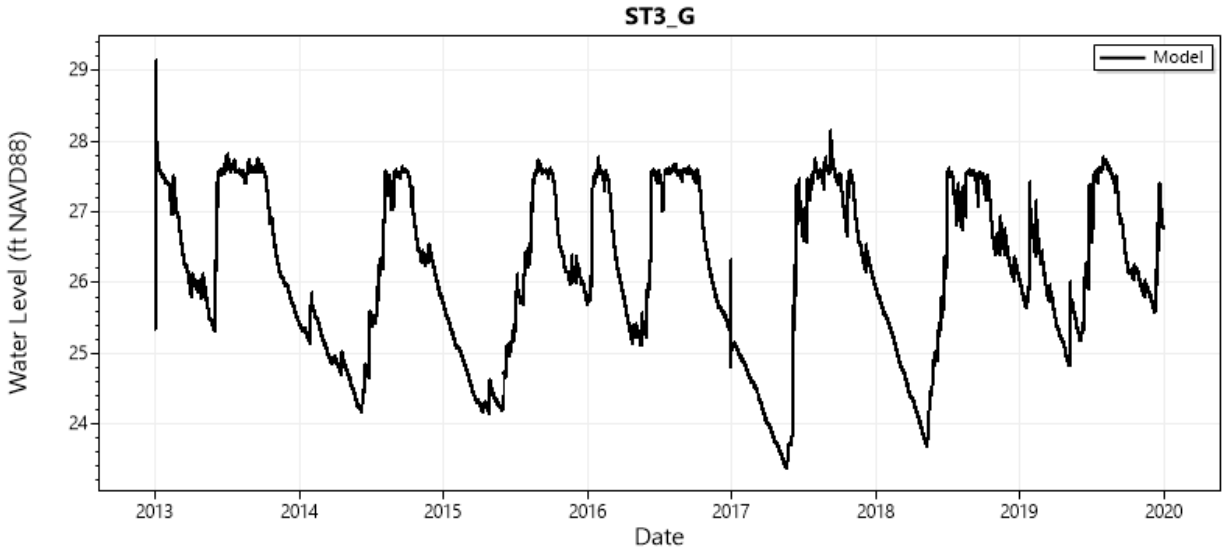
2018
2019
2020
Date


ST3_G
Model
Water Level (ft NAVD88)
29
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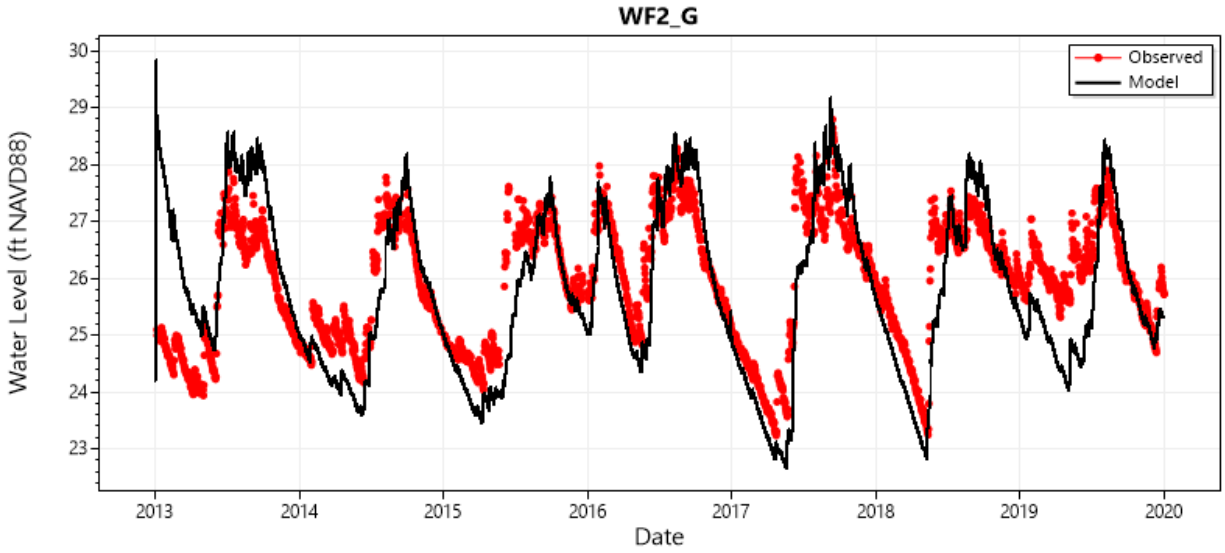
Date


WF2_G
Observed
Model
Water Level (ft NAVD88)
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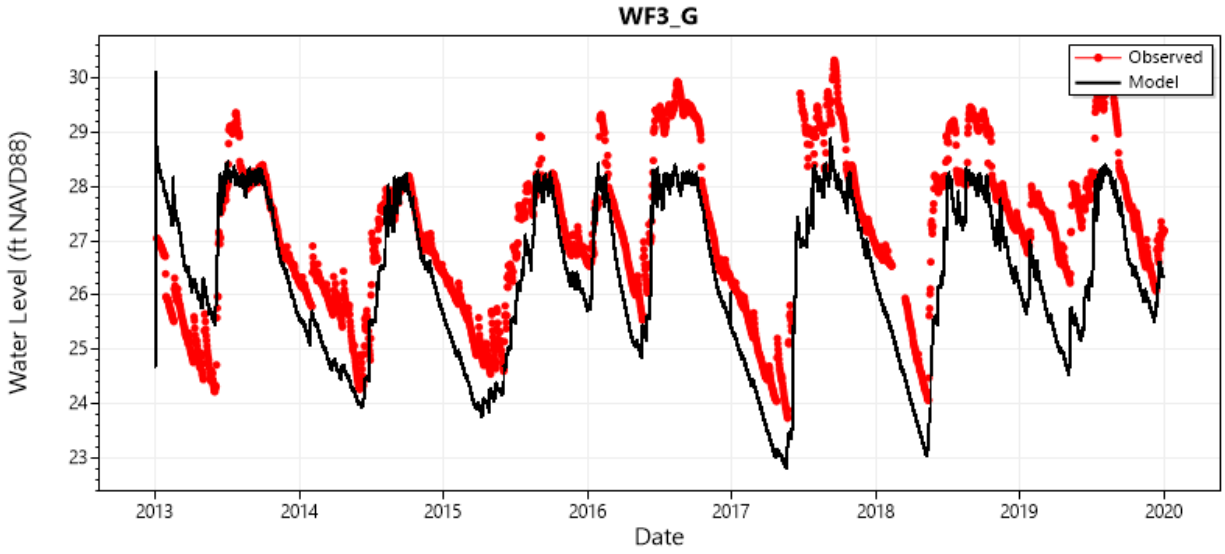
2020
Date


WF3_G
Observed
Model
Water Level (ft NAVD88)
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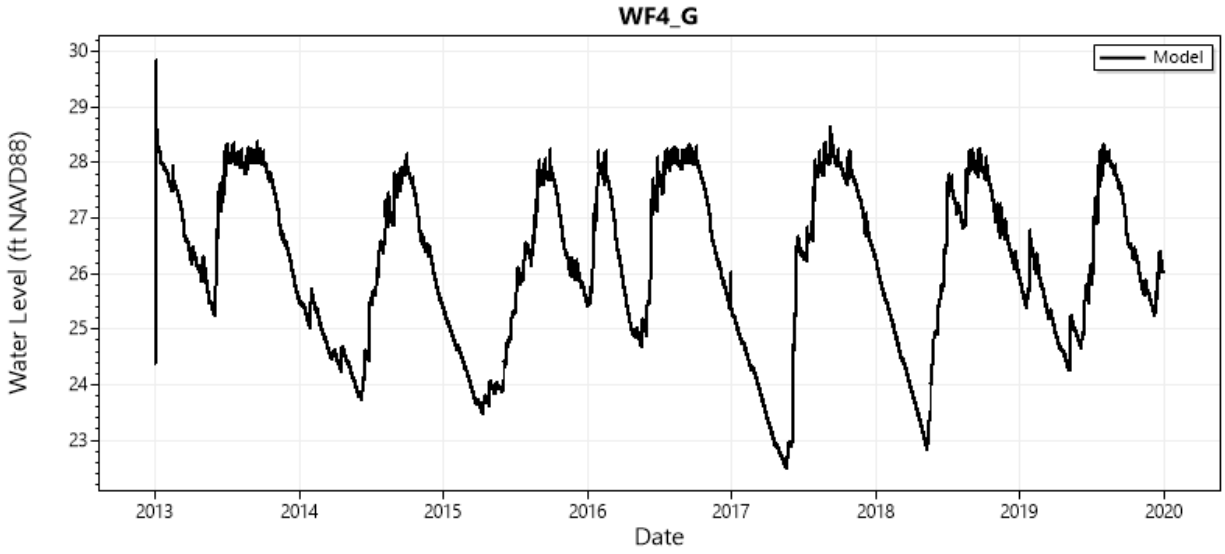
2019
2020
Date


WF4_G
Model
Water Level (ft NAVD88)
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2014
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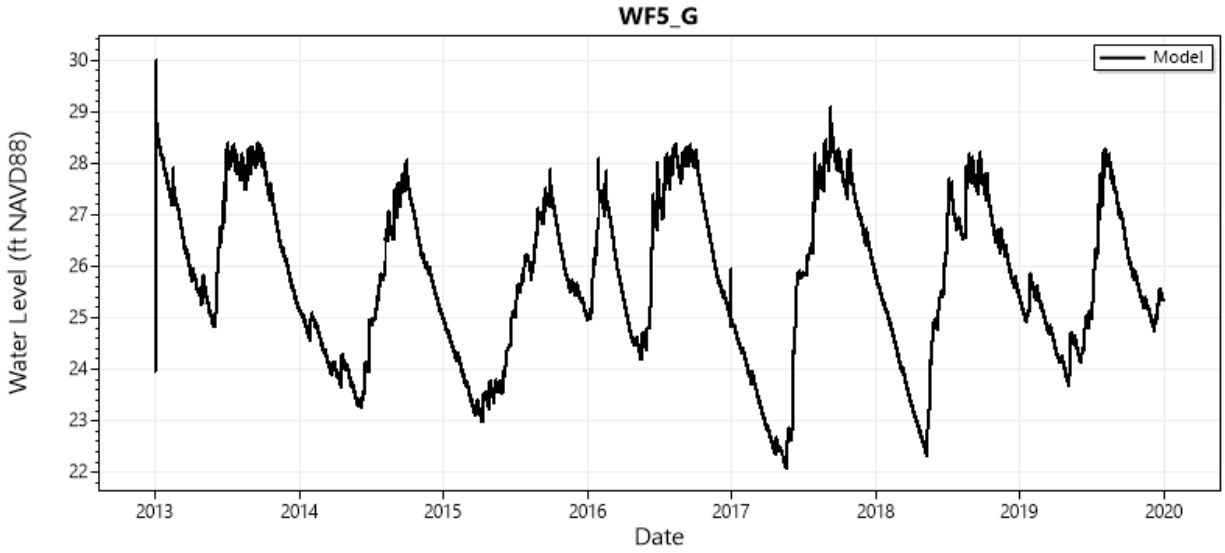
2018
2019
2020
Date


WF5_G
Model
Water Level (ft NAVD88)
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2014
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2016
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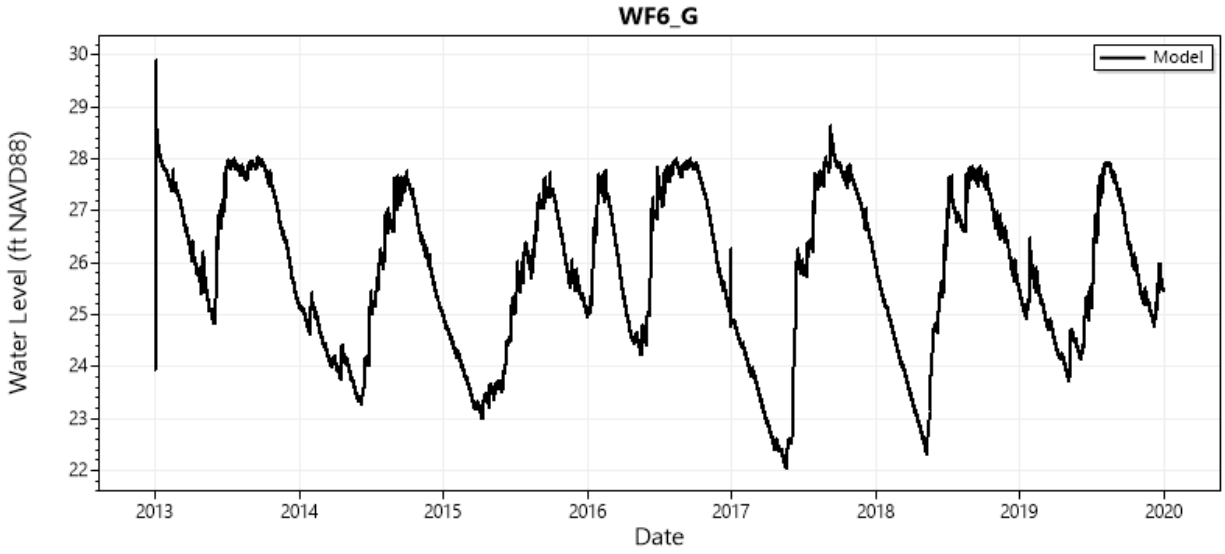
2018
2019
2020
Date


WF6_G
Model
Water Level (ft NAVD88)
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22
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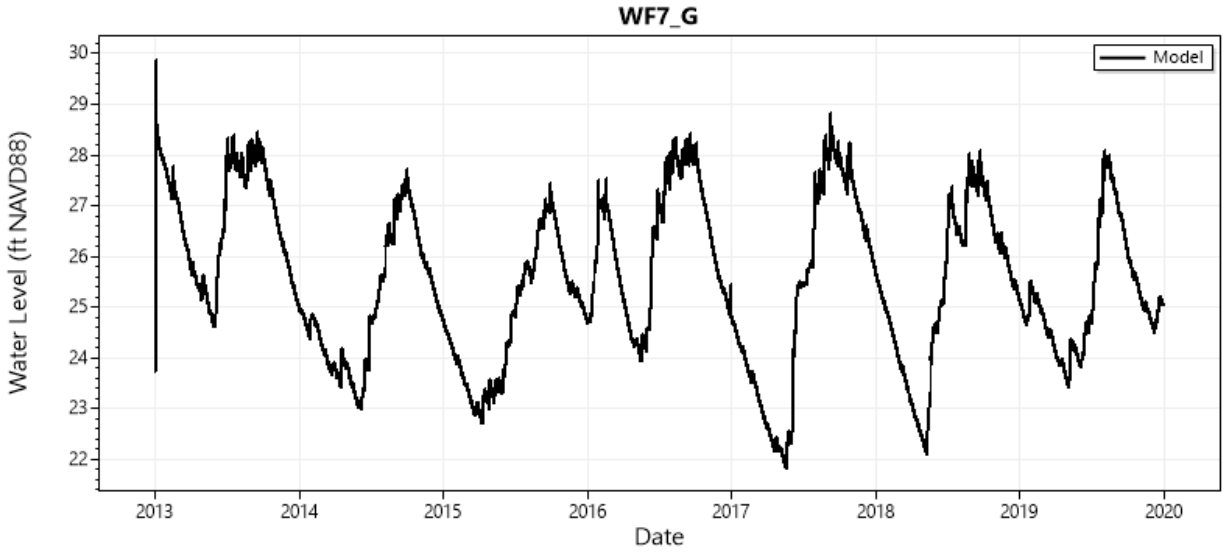
2014
2015
2016
2017
2018
2019
2020
Date


WF7_G
Model
Water Level (ft NAVD88)
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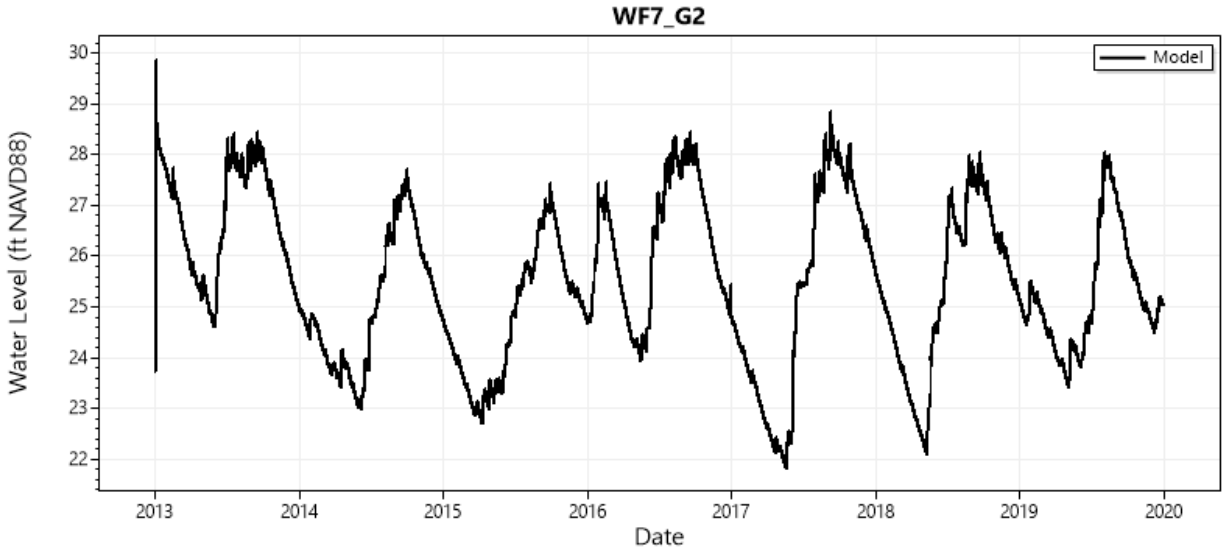
22
2013
2014
2015
2016
2017
2018
2019
2020
Date


WF7_G2
Model
Water Level (ft NAVD88)
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26
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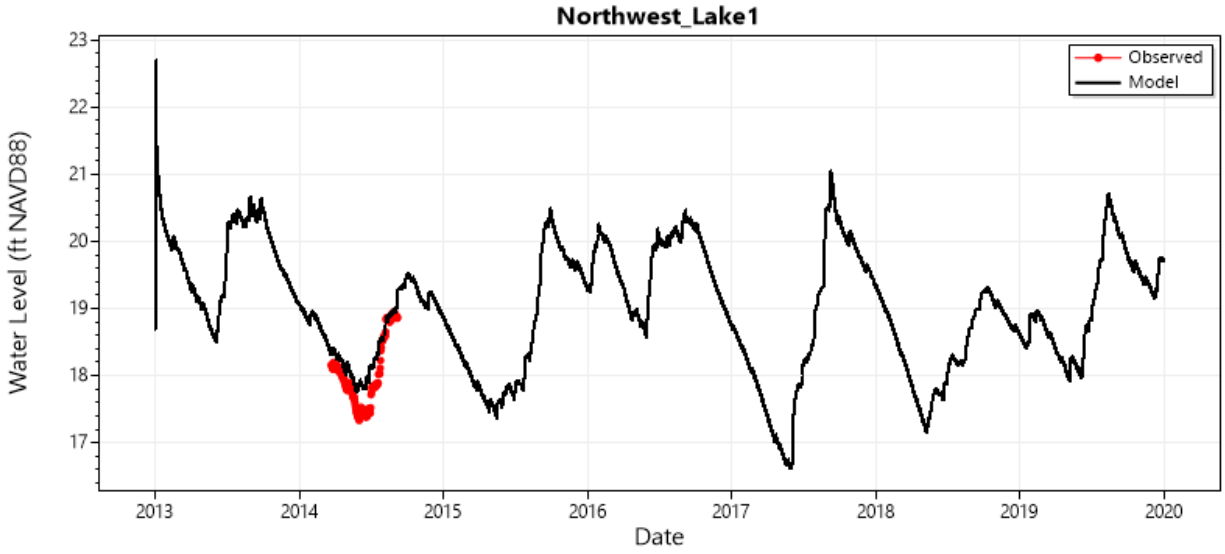
22
2013
2014
2015
2016
2017
2018
2019
2020
Date


Northwest_Lake1
Observed
Model
Water Level (ft NAVD88)
23
22
21
20
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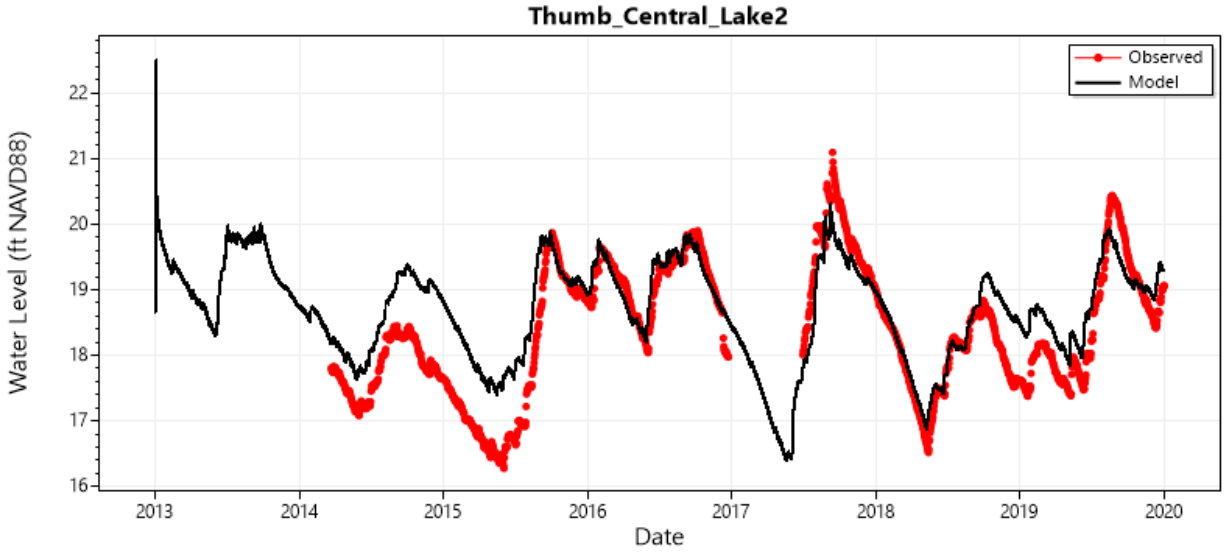
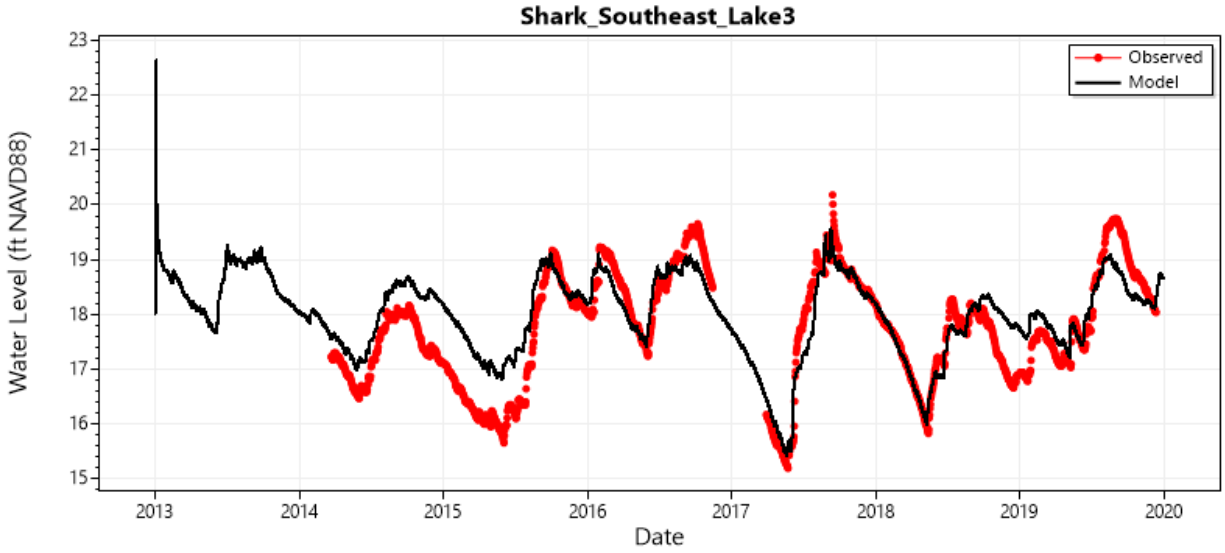
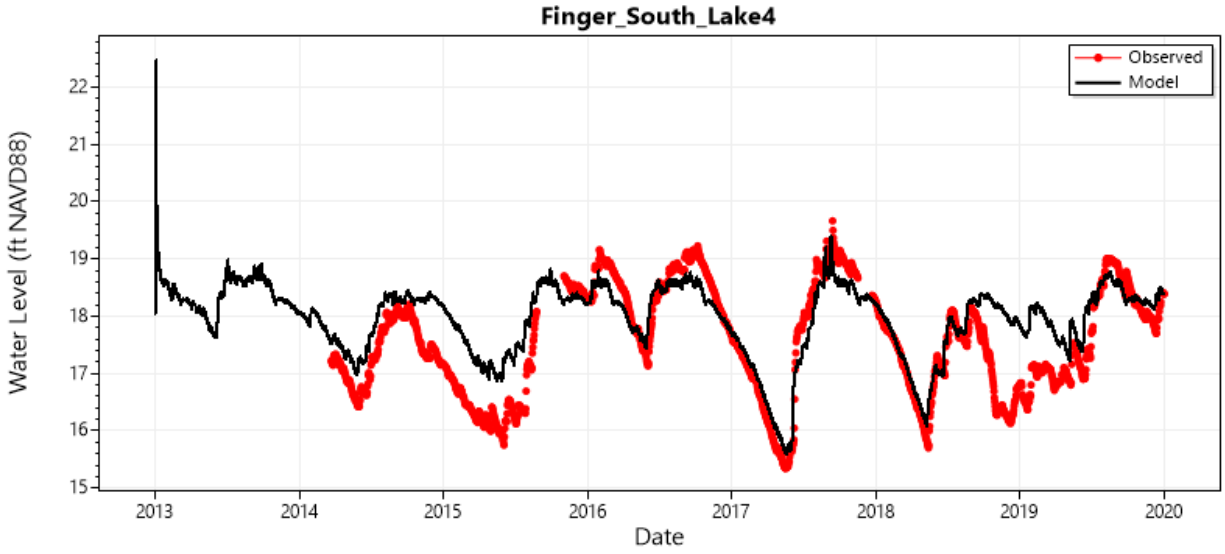
18
17
2013
2014
2015
2016
2017
2018
2019
2020
Date


Thumb_Central_Lake2
Observed
Model
Water Level (ft NAVD88)
22
21
20
19
18
17
16
2013
2014
2015
2016
2017
2018
2019
2020
Date


Shark_Southeast_Lake3
Observed
Model
Water Level (ft NAVD88)
23
22
21
20
19
18
17
16
15
2013
2014
2015
2016
2017
2018
2019
2020
Date


Finger_South_Lake4
Observed
Model
Water Level (ft NAVD88)
22
21
20
19
18
17
16
15
2013
2014
2015
2016
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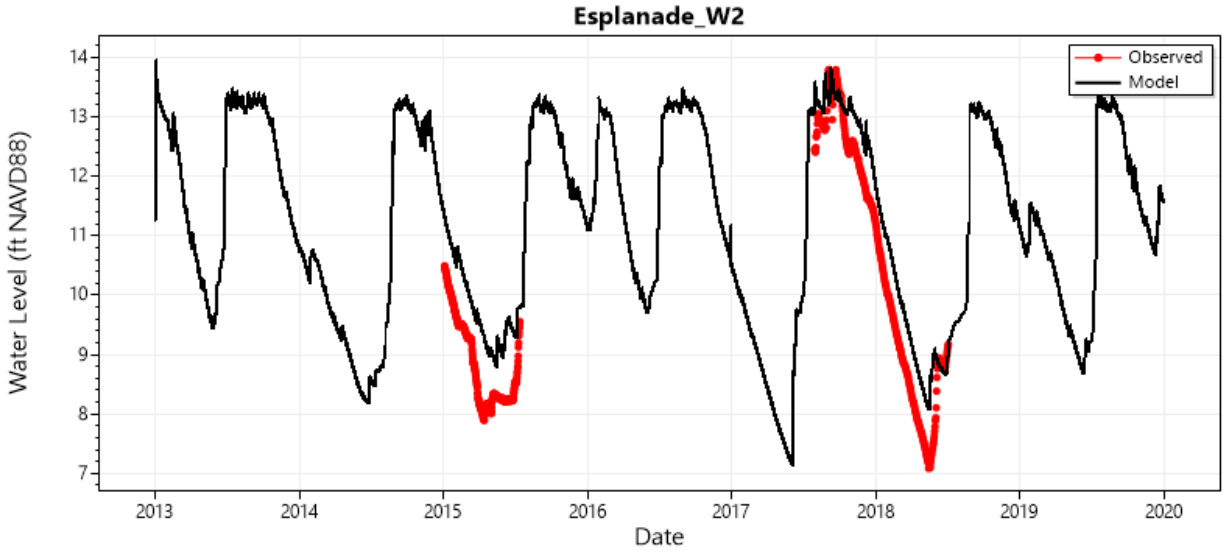
2018
2019
2020
Date


Esplanade_W2
Observed
Model
Water Level (ft NAVD88)
14
13
12
11
10
9
8
7
2013
2014
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2016
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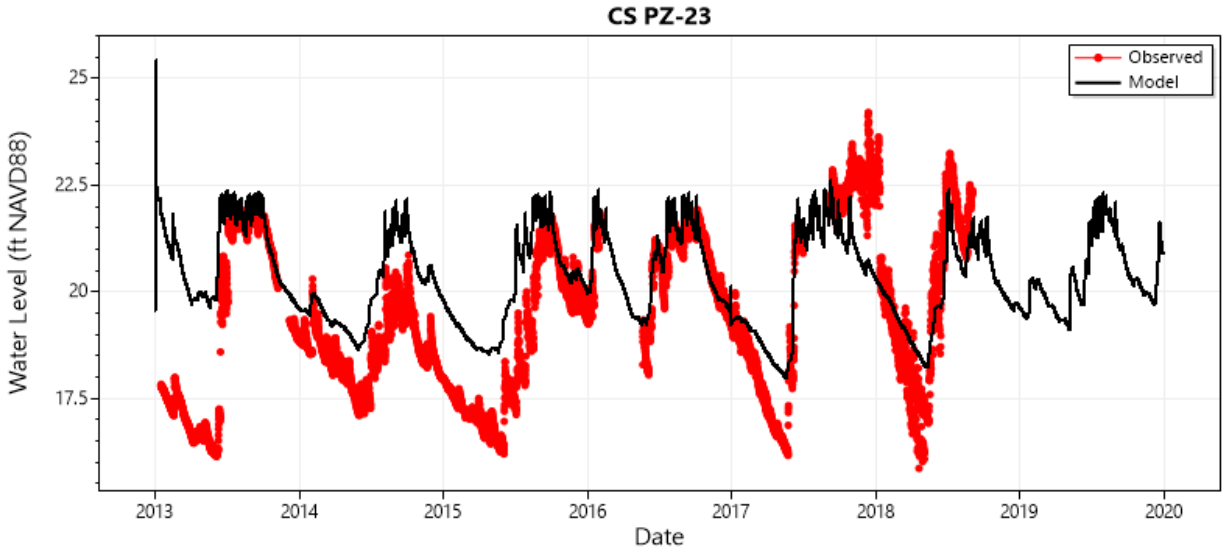
2018
2019
2020
Date


CS PZ-23
Observed
Model
Water Level (ft NAVD88)
25
22.5
20
17.5
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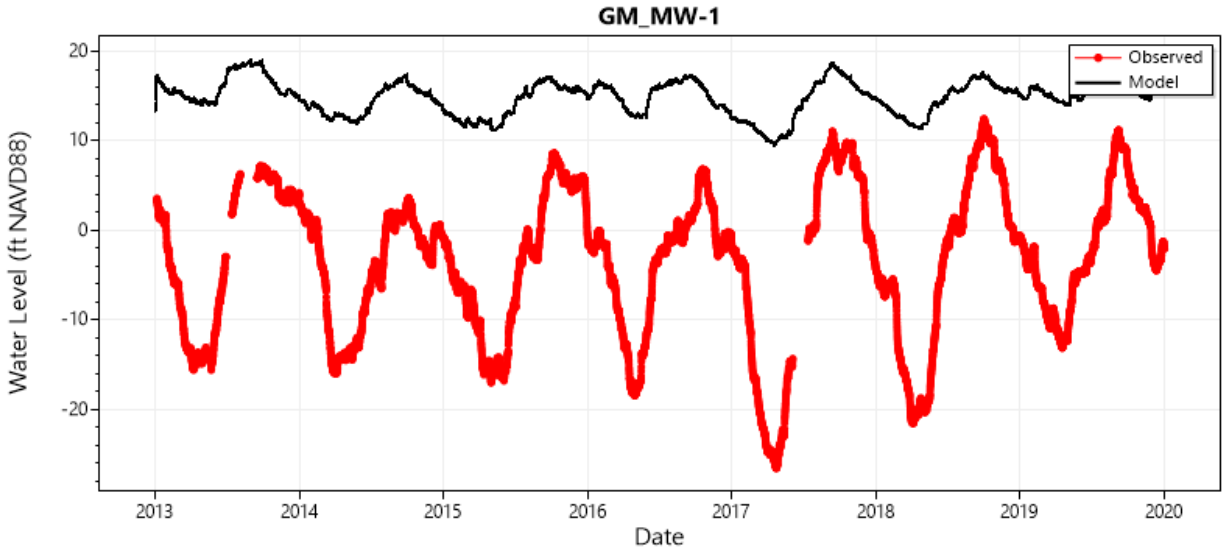
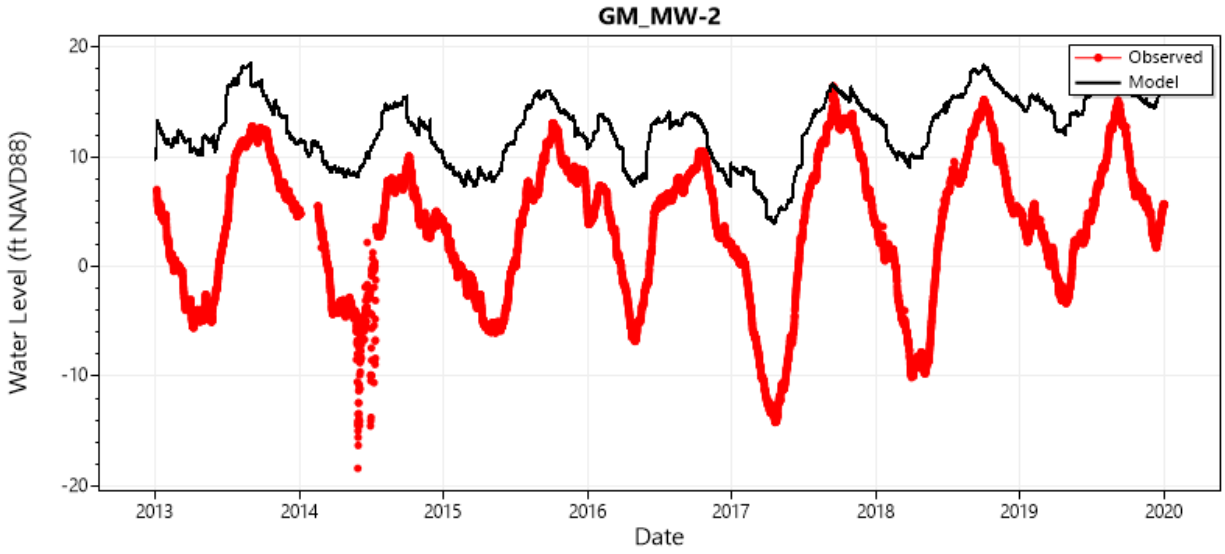
2014
2015
2016
2017
2018
2019
2020
Date


GM_MW-1
Observed
Model
Water Level (ft NAVD88)
20
10
0
-10
-20
2013
2014
2015
2016
2017
2018
2019
2020
Date


GM_MW-2
Observed
Model
Water Level (ft NAVD88)
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-10
-20
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2014
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2016
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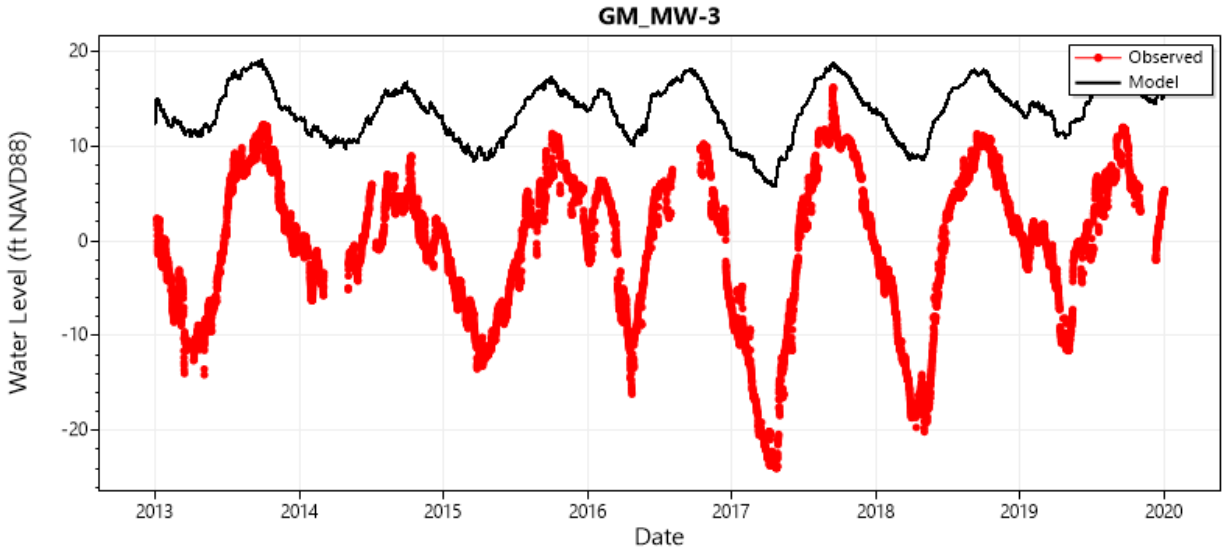
2018
2019
2020
Date


GM_MW-3
Observed
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Water Level (ft NAVD88)
20
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-20
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2020
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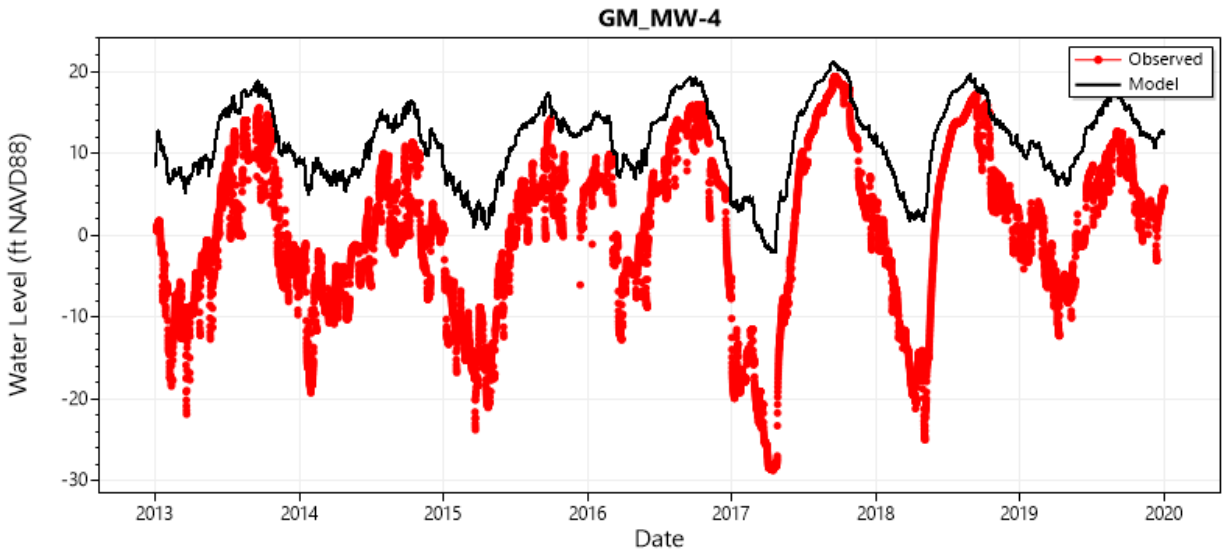
GM_MW-4
Observed
Model
Water Level (ft NAVD88)
20
10
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-10
-20
-30
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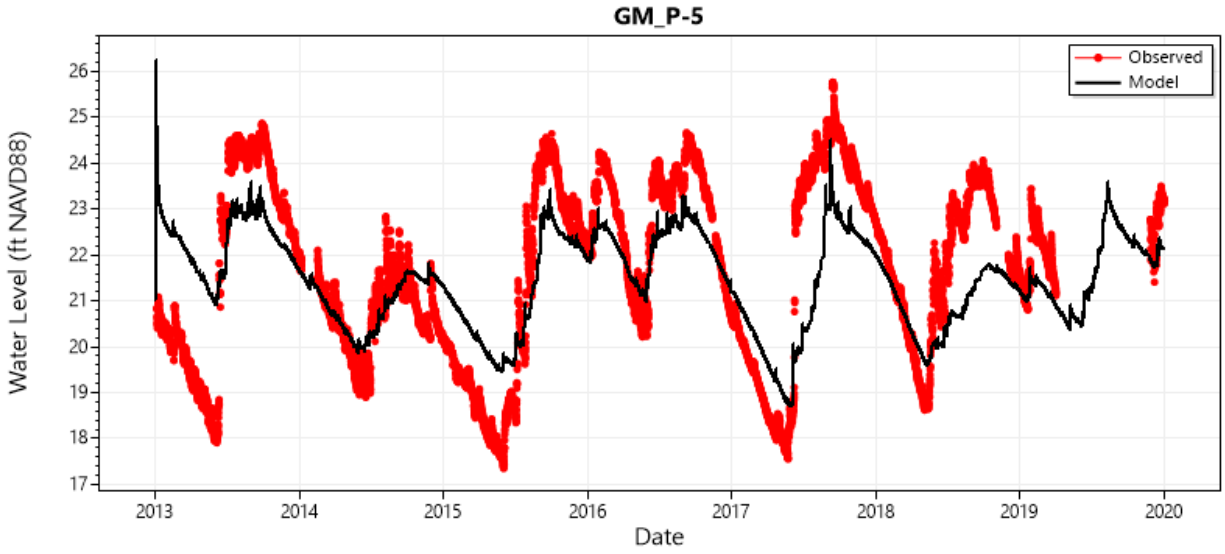
2020
Date


GM_P-5
Observed
Model
Water Level (ft NAVD88)
26
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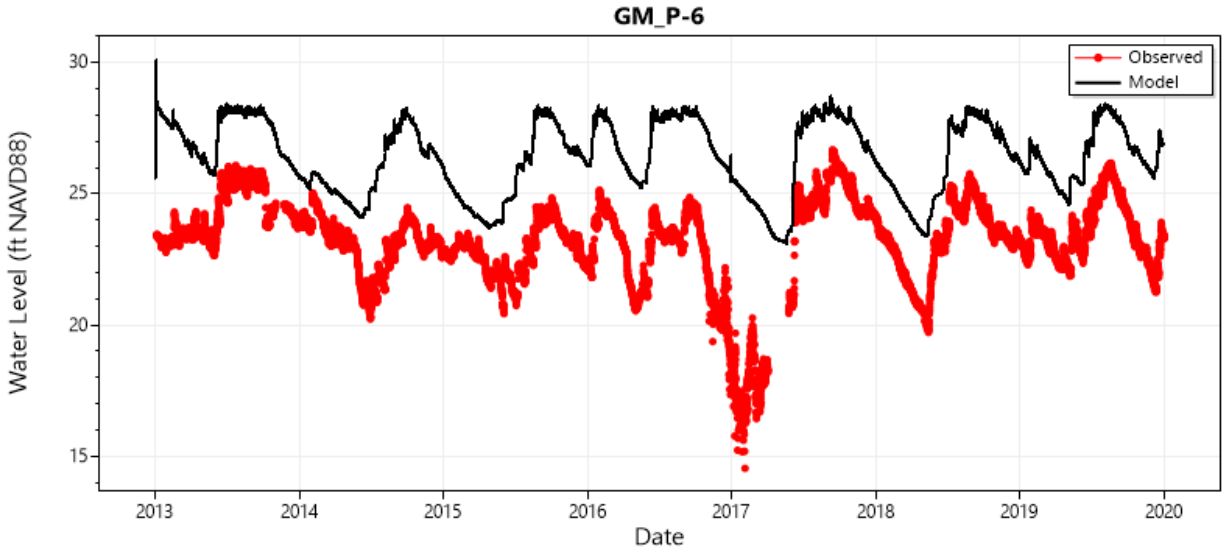
2018
2019
2020
Date


GM_P-6
Observed
Model
Water Level (ft NAVD88)
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2014
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2016
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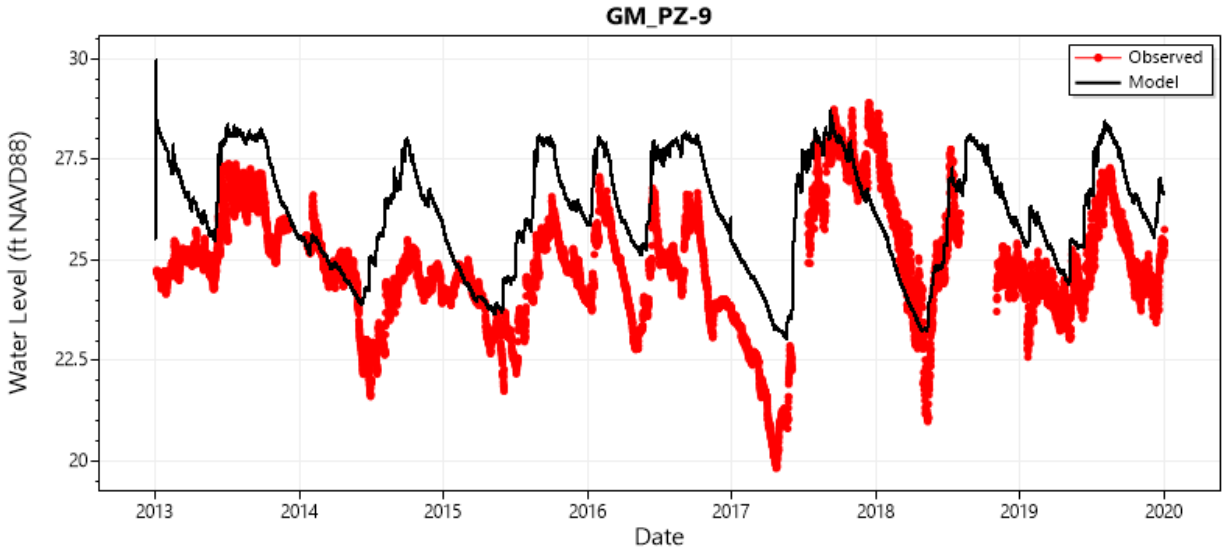
2018
2019
2020
Date


GM_PZ-9
Observed
Model
Water Level (ft NAVD88)
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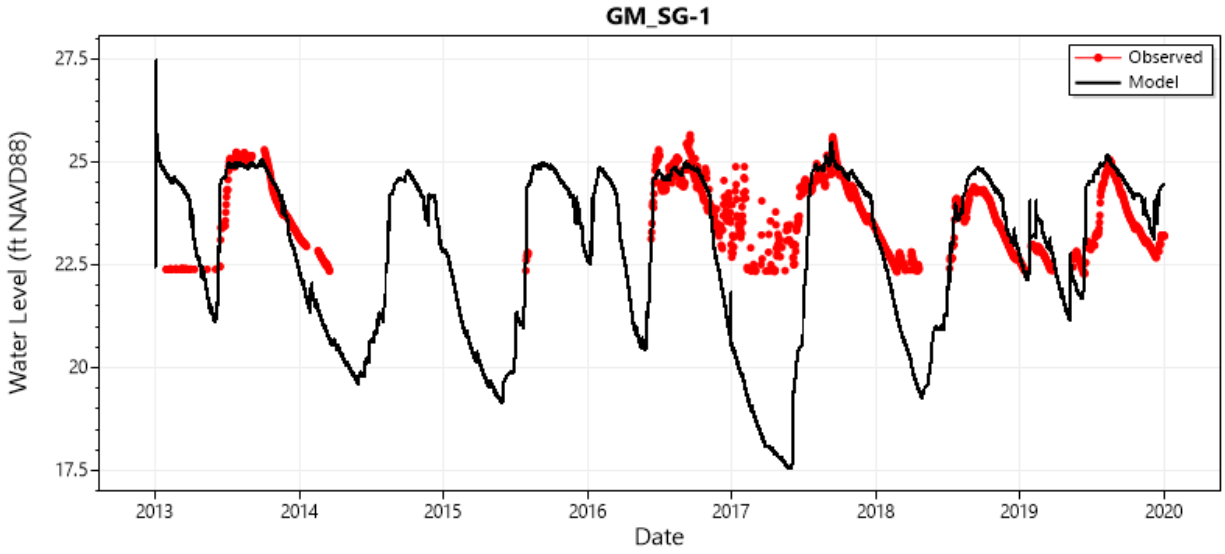
2020
Date


GM_SG-1
Observed
Model
Water Level (ft NAVD88)
27.5
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17.5
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2014
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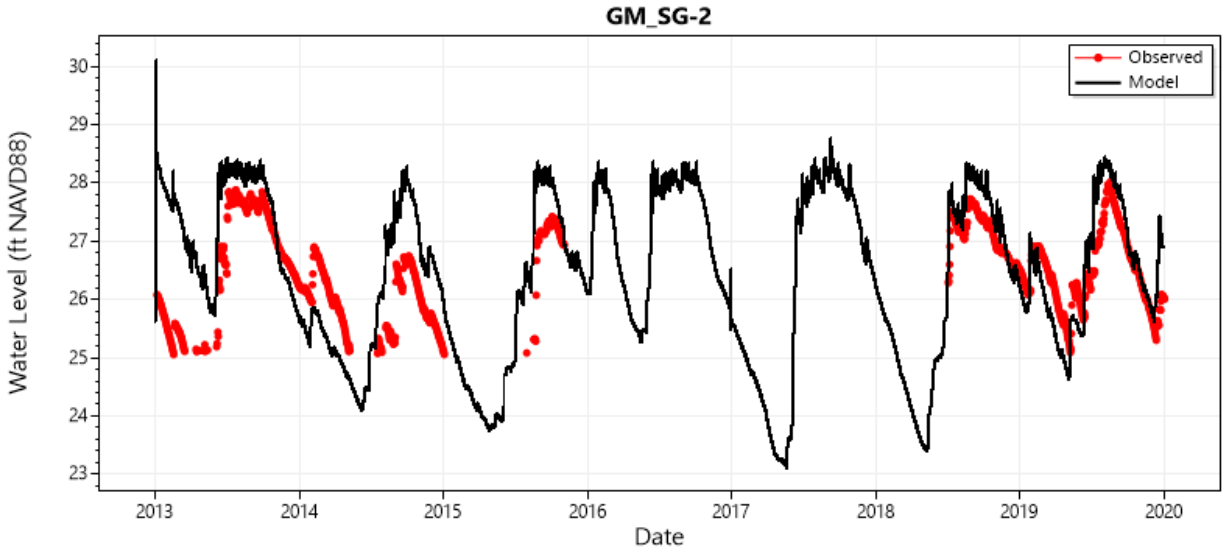
2016
2017
2018
2019
2020
Date


GM_SG-2
Observed
Model
Water Level (ft NAVD88)
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2014
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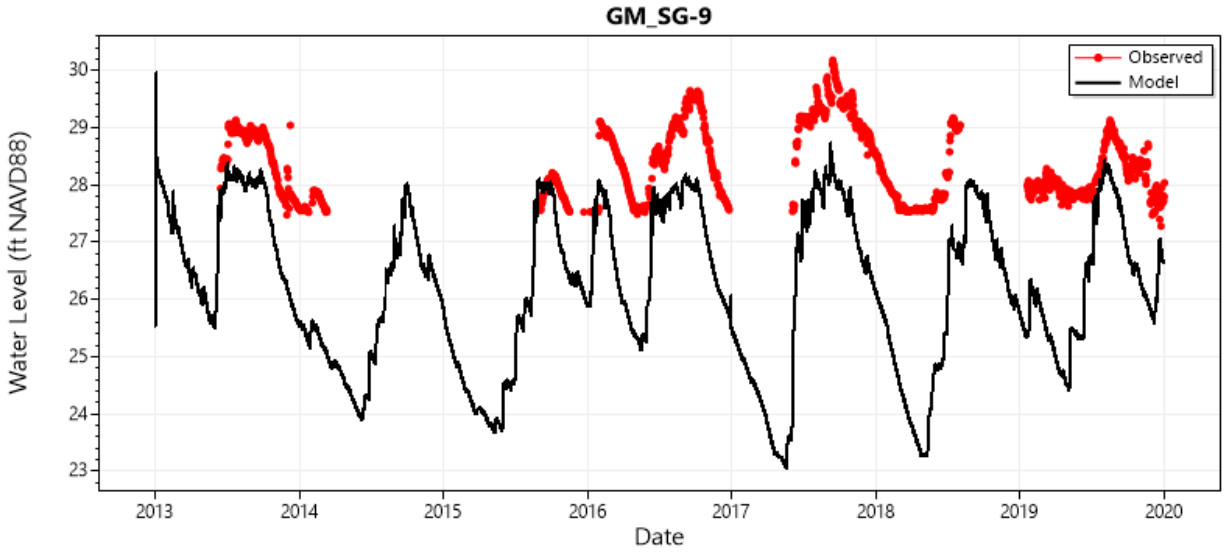
2018
2019
2020
Date


GM_SG-9
Observed
Model
Water Level (ft NAVD88)
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2014
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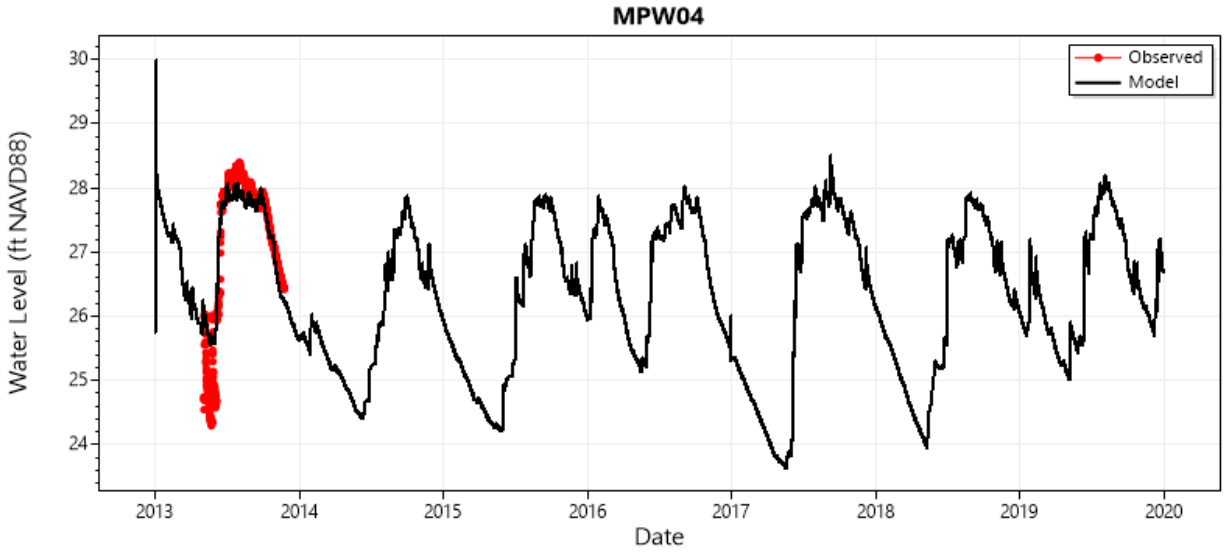
2018
2019
2020
Date


MPW04
Observed
Model
Water Level (ft NAVD88)
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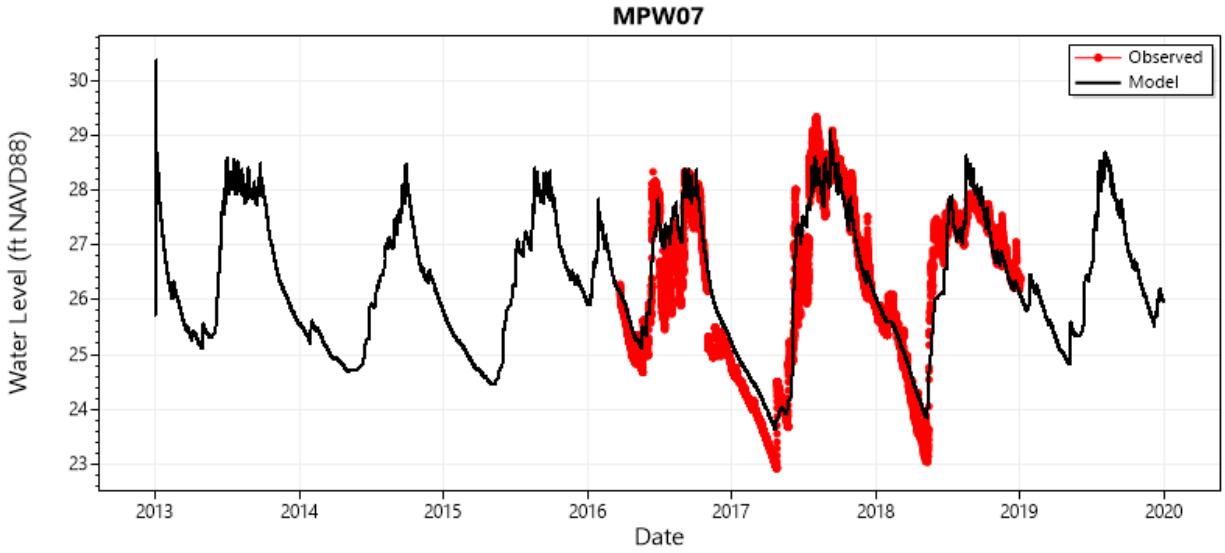
2020
Date


MPW07
Observed
Model
Water Level (ft NAVD88)
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2014
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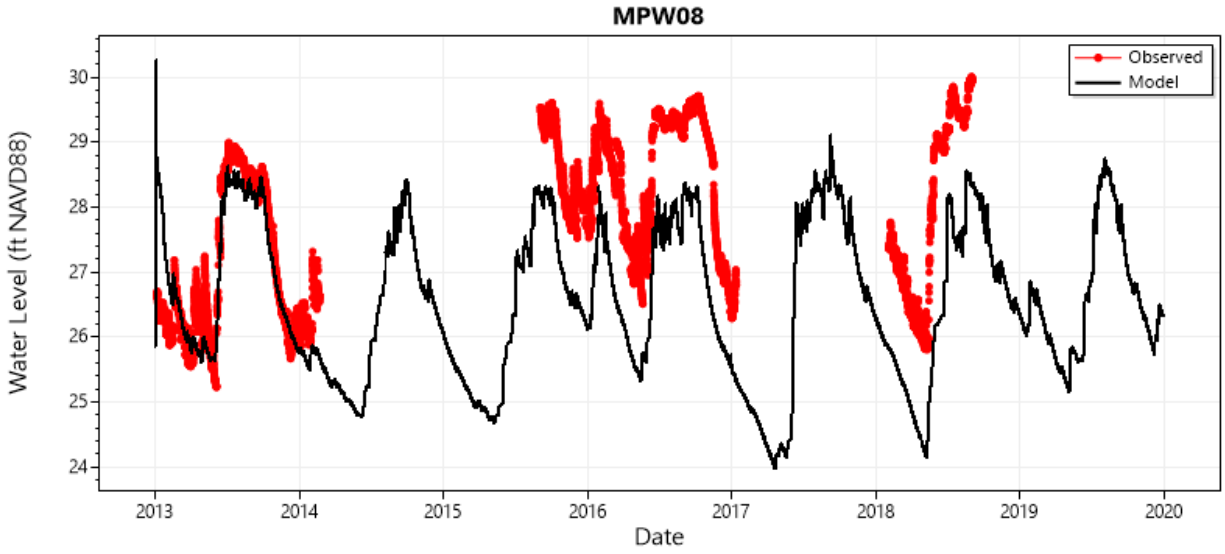
2020
Date


MPW08
Observed
Model
Water Level (ft NAVD88)
30
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2014
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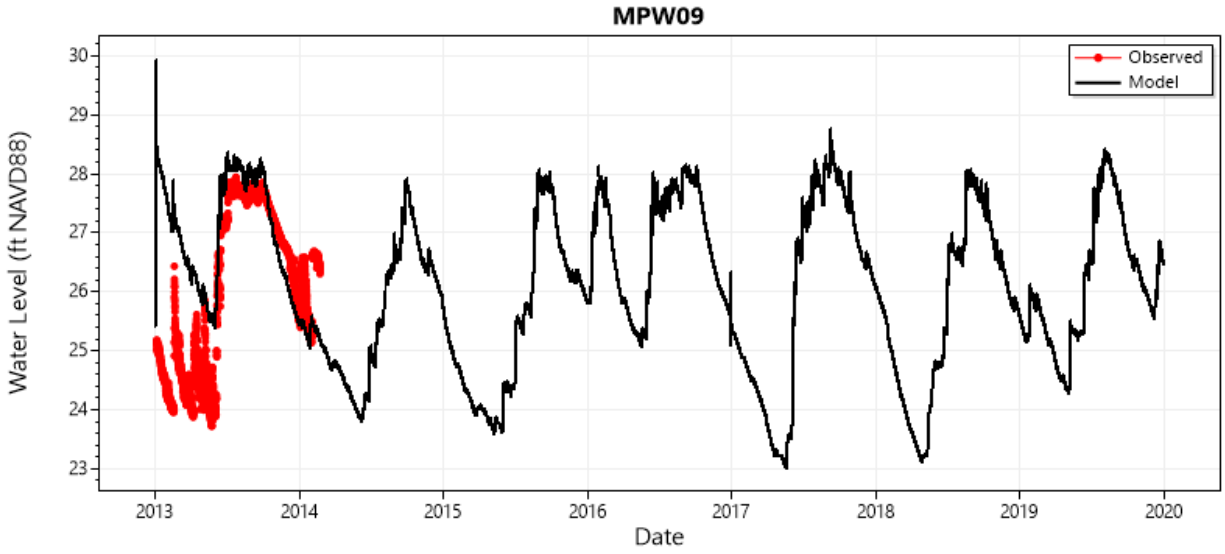
2019
2020
Date


MPW09
Observed
Model
Water Level (ft NAVD88)
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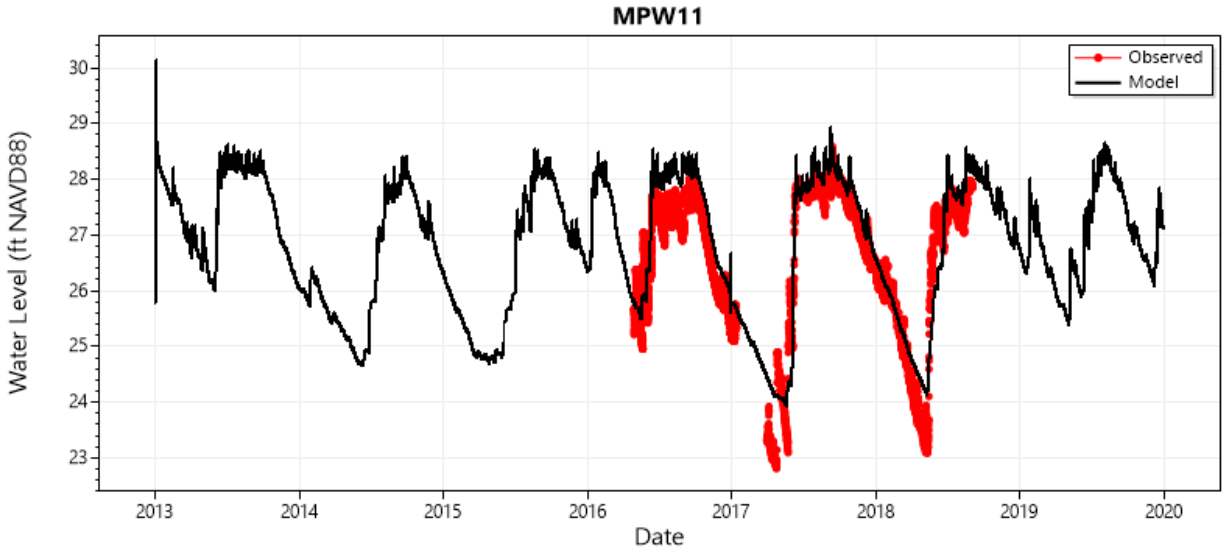
2020
Date


MPW11
Observed
Model
Water Level (ft NAVD88)
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2014
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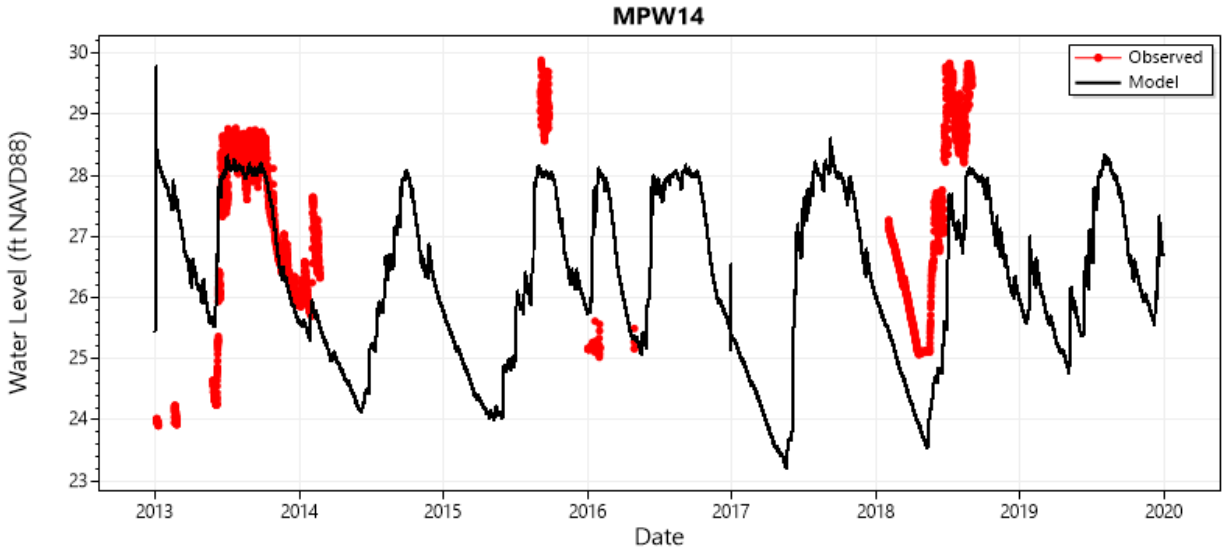
2019
2020
Date


MPW14
Observed
Model
Water Level (ft NAVD88)
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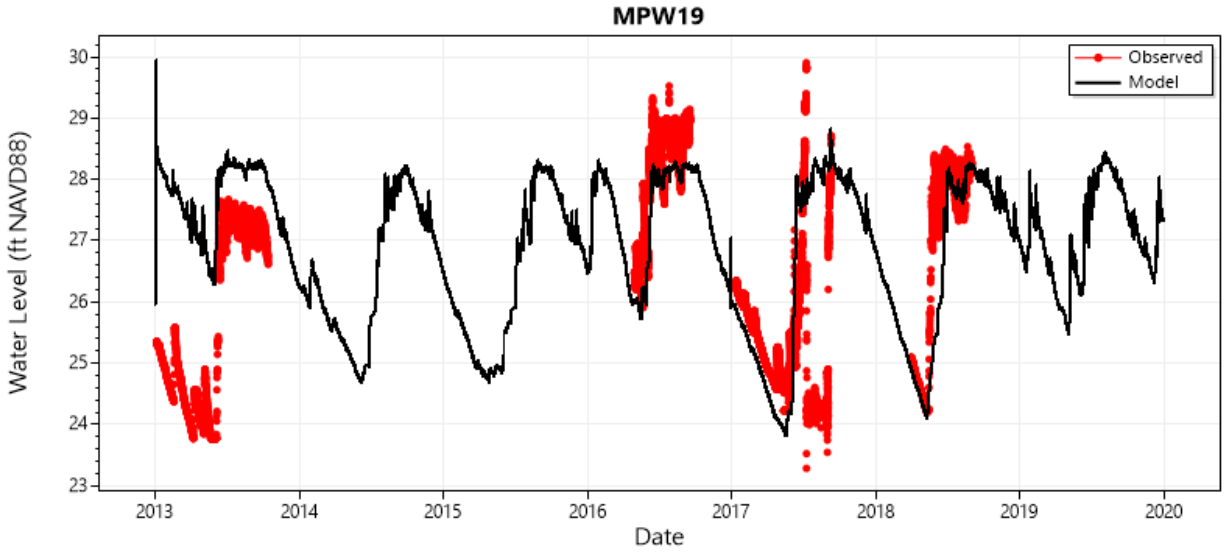
2020
Date


MPW19
Observed
Model
Water Level (ft NAVD88)
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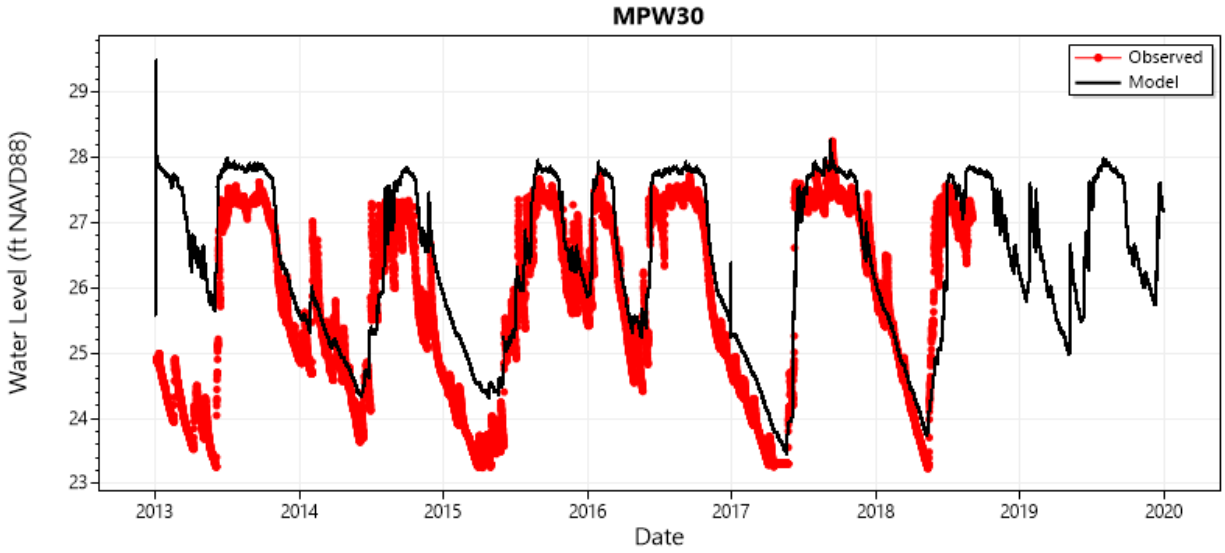
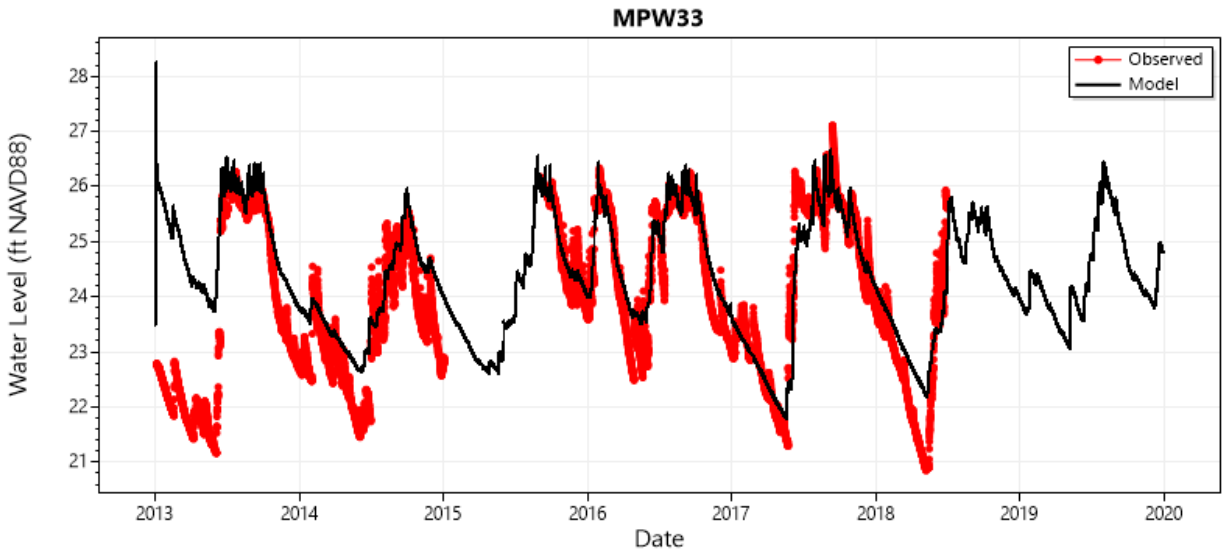
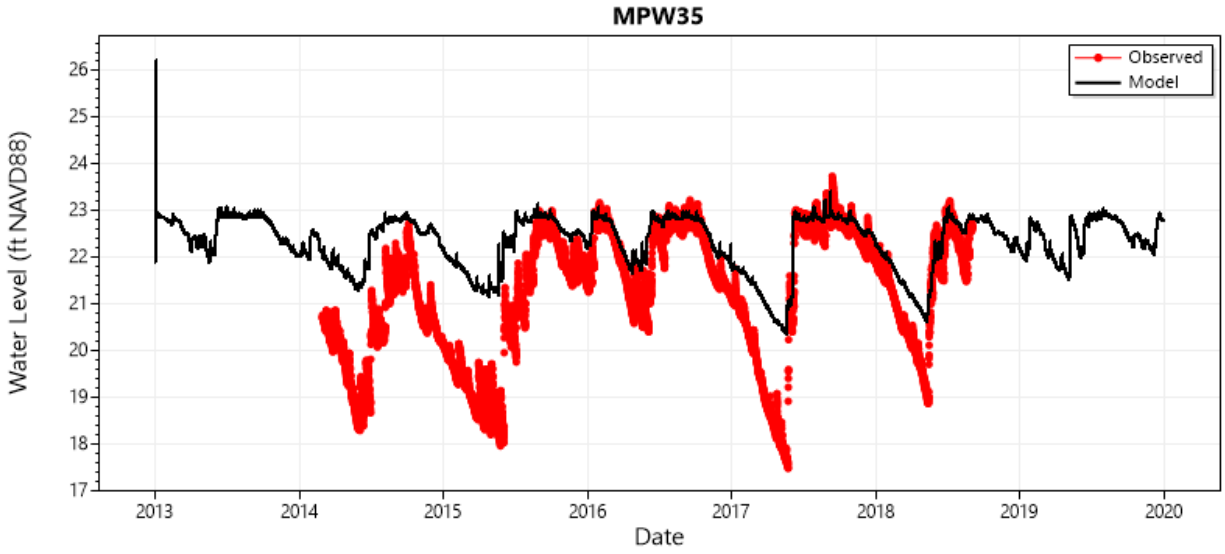
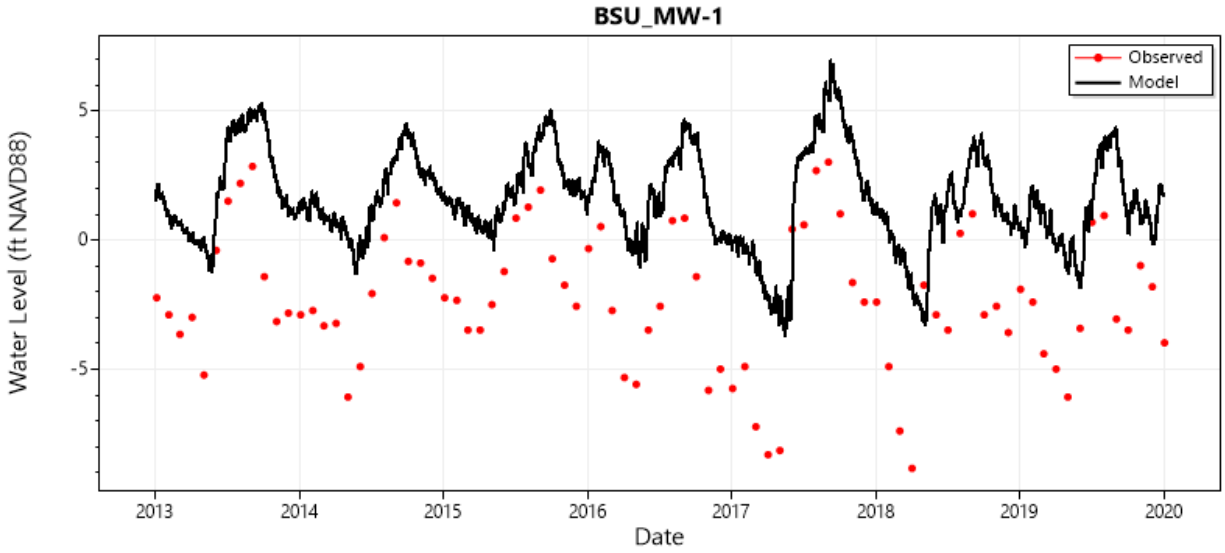
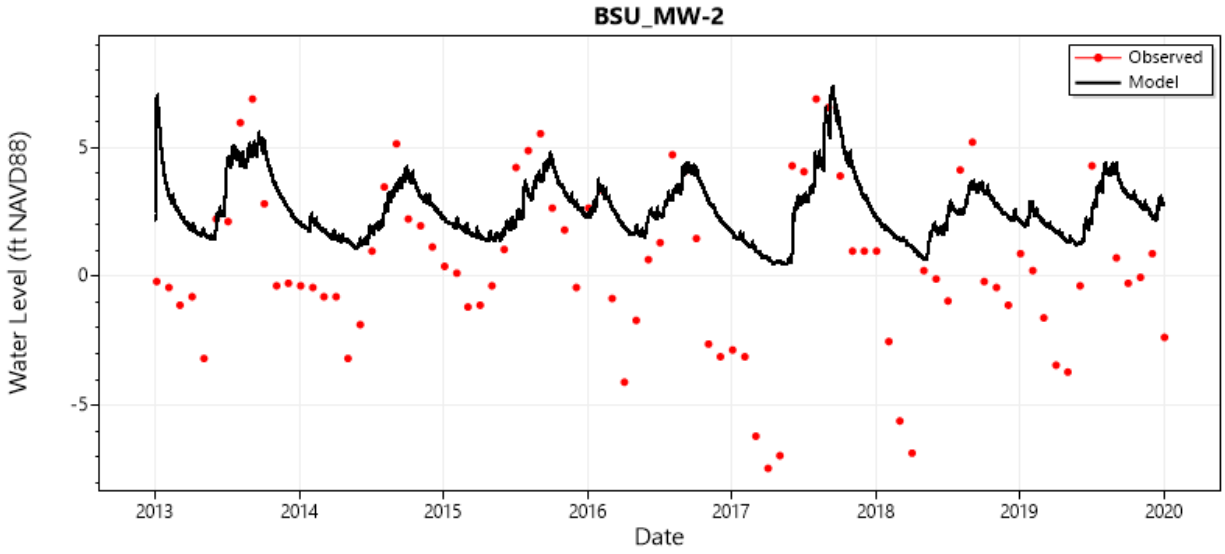
2019
2020
Date

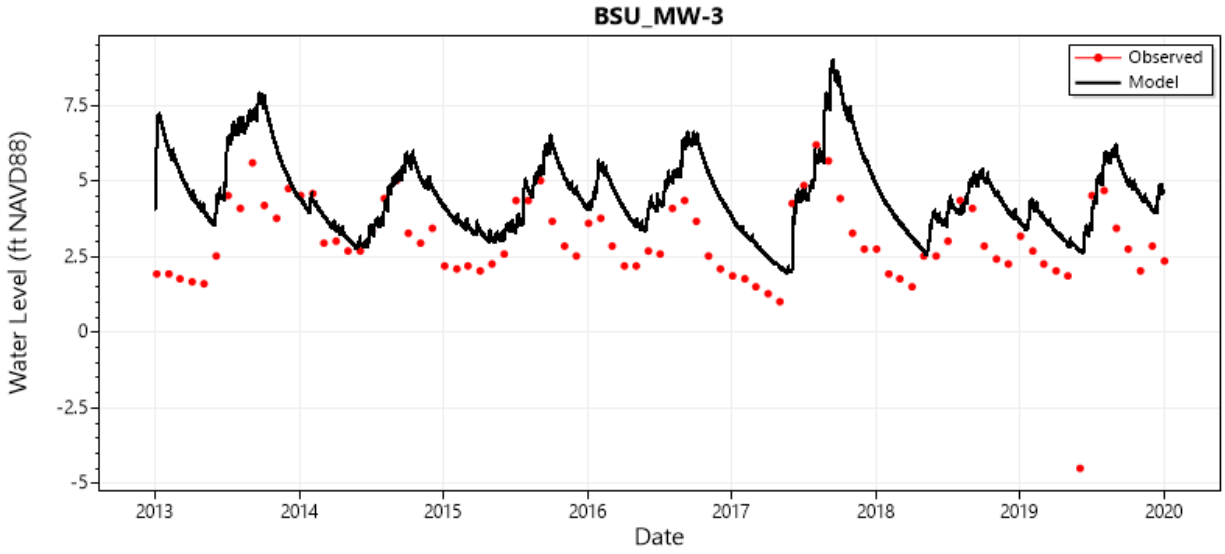

MPW30
Observed
Model
Water Level (ft NAVD88)
29
28
27
26
25
24
23
2013
2014
2015
2016
2017
2018
2019
2020
Date

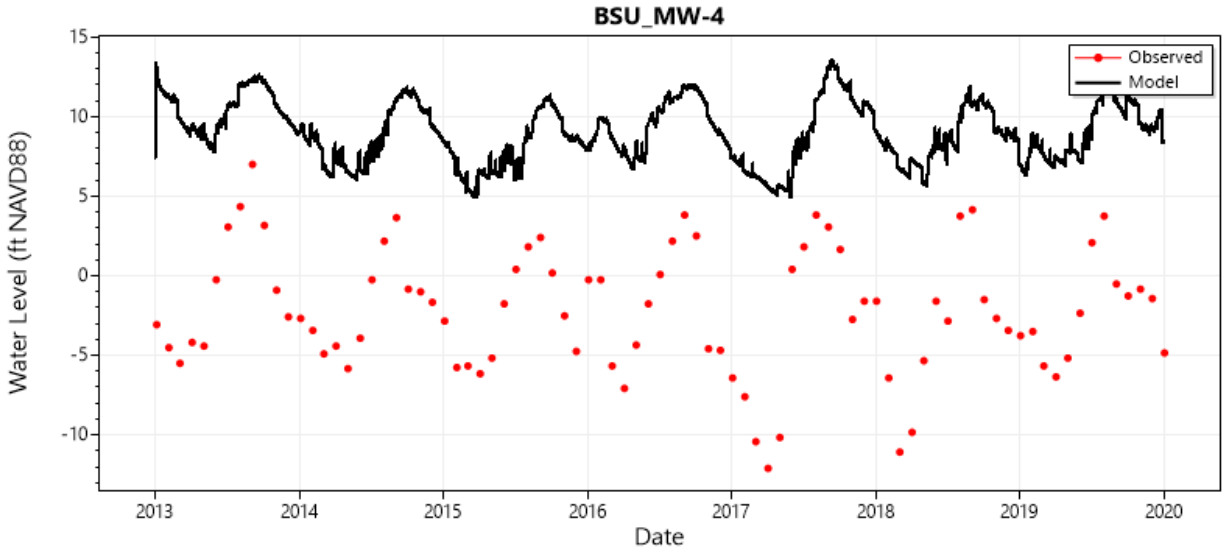

MPW33
Observed
Model
Water Level (ft NAVD88)
28
27
26
25
24
23
22
21
2013
2014
2015
2016
2017
2018
2019
2020
Date

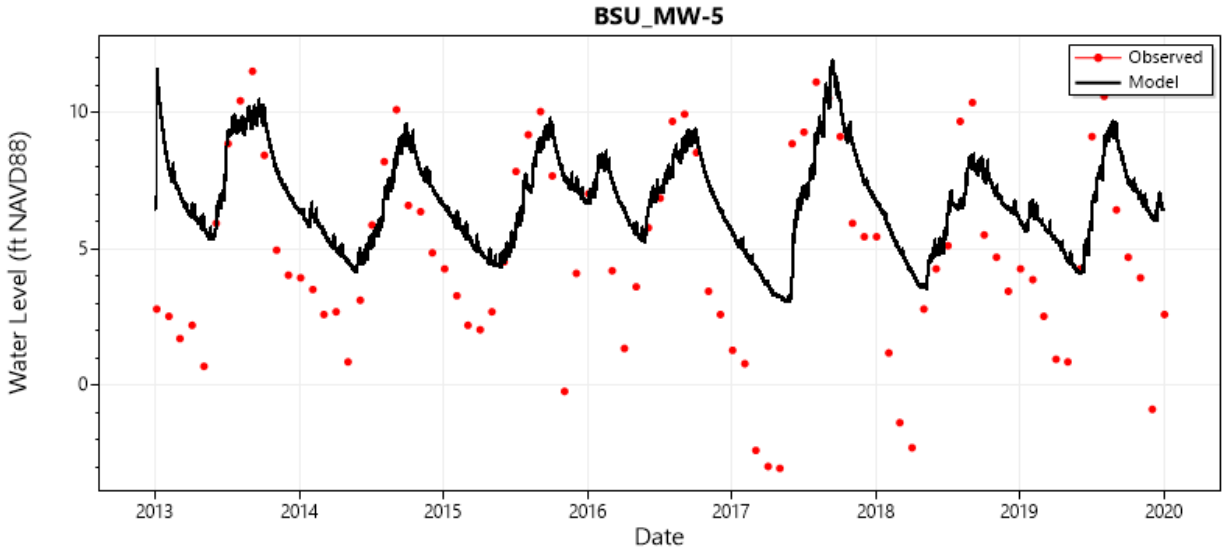

MPW35
Observed
Model
Water Level (ft NAVD88)
26
25
24
23
22
21
20
19
18
17
2013
2014
2015
2016
2017
2018
2019
2020
Date

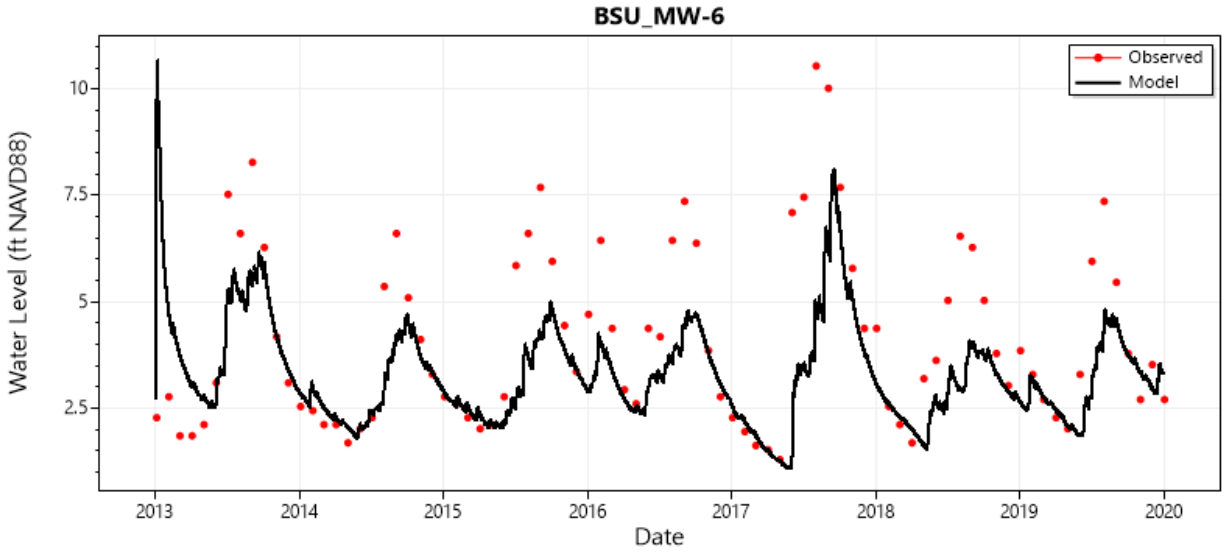

BSU_MW-1
Observed
Model
Water Level (ft NAVD88)
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date

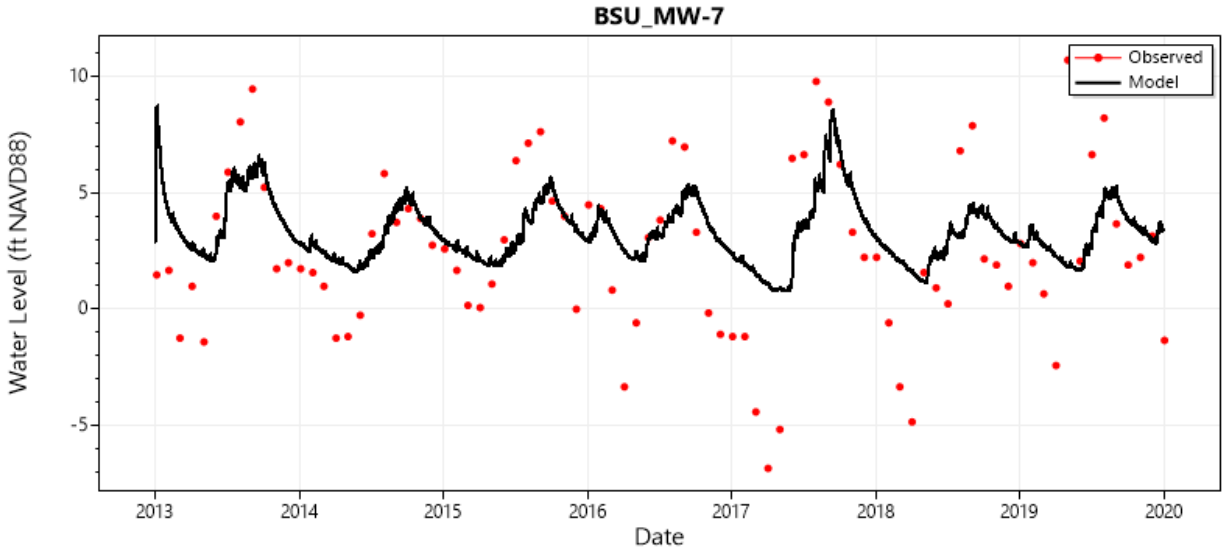

BSU_MW-2
Observed
Model
Water Level (ft NAVD88)
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date

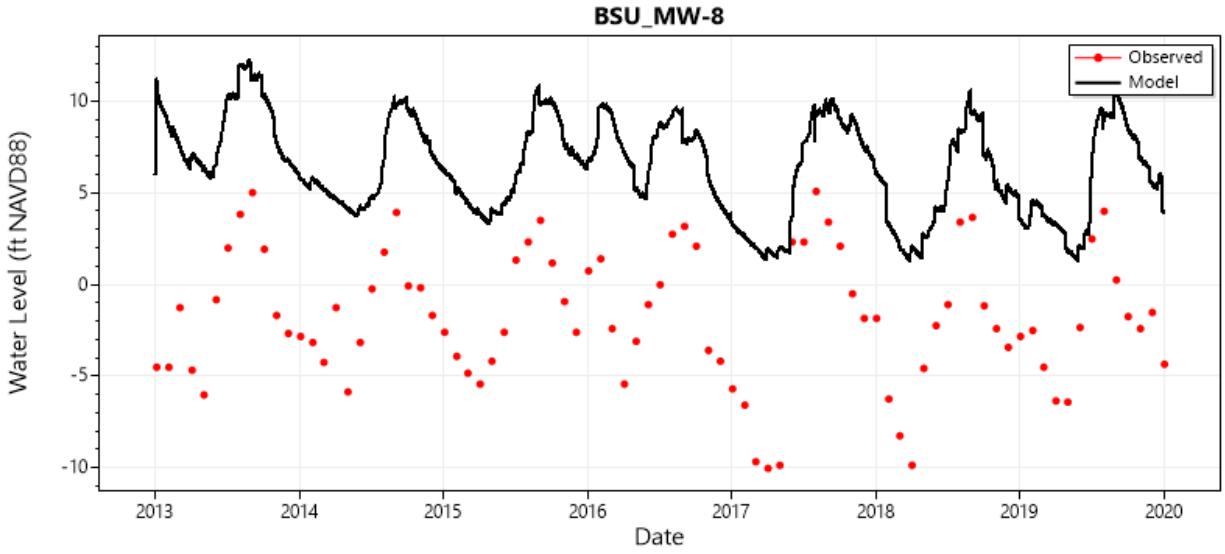

BSU_MW-3
Observed
Model
Water Level (ft NAVD88)
7.5
5
2.5
0
-2.5
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date

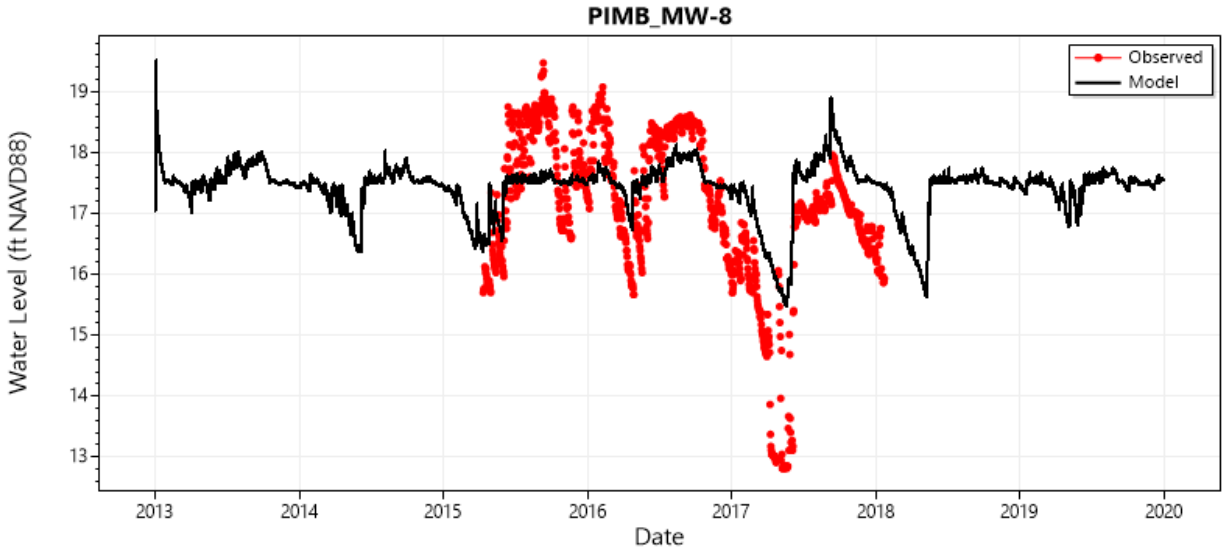

BSU_MW-4
Observed
Model
Water Level (ft NAVD88)
15
10
5
0
-5
-10
2013
2014
2015
2016
2017
2018
2019
2020
Date

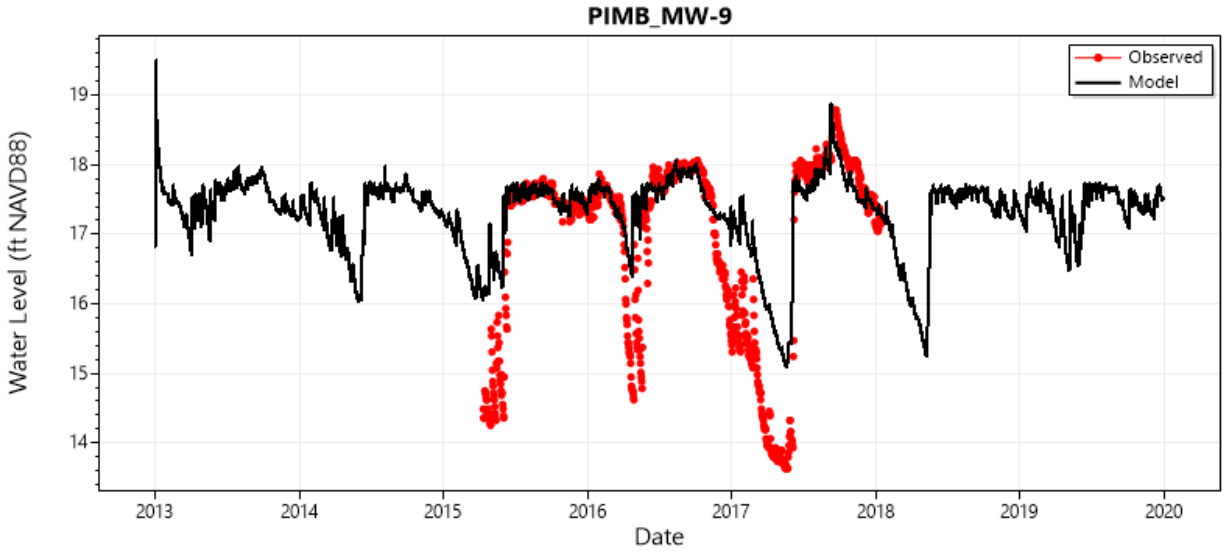

BSU_MW-5
Observed
Model
Water Level (ft NAVD88)
10
5
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

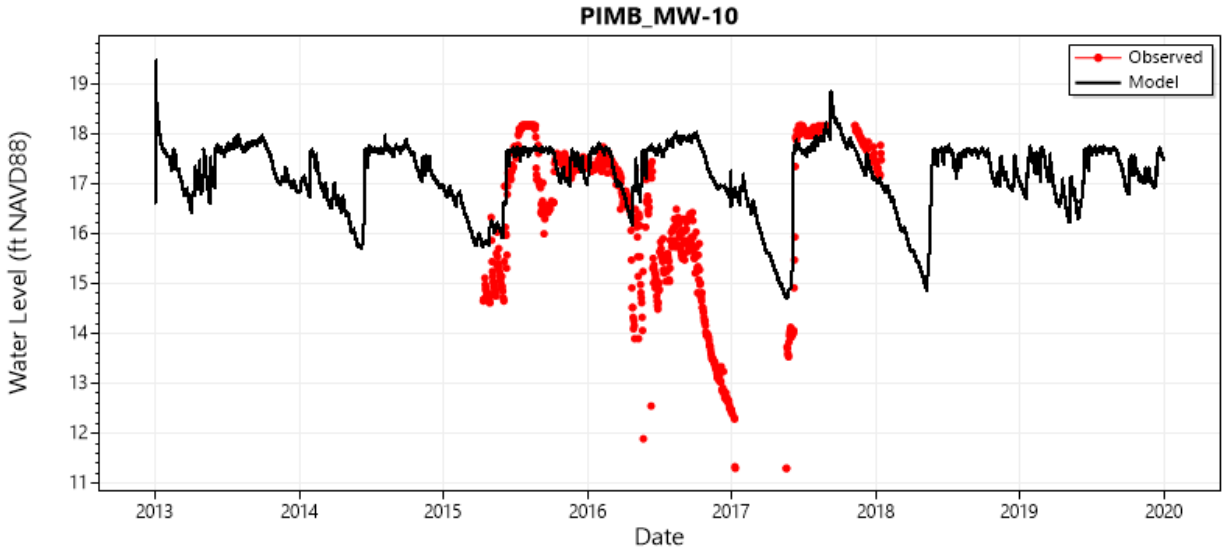

BSU_MW-6
Observed
Model
Water Level (ft NAVD88)
10
7.5
5
2.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

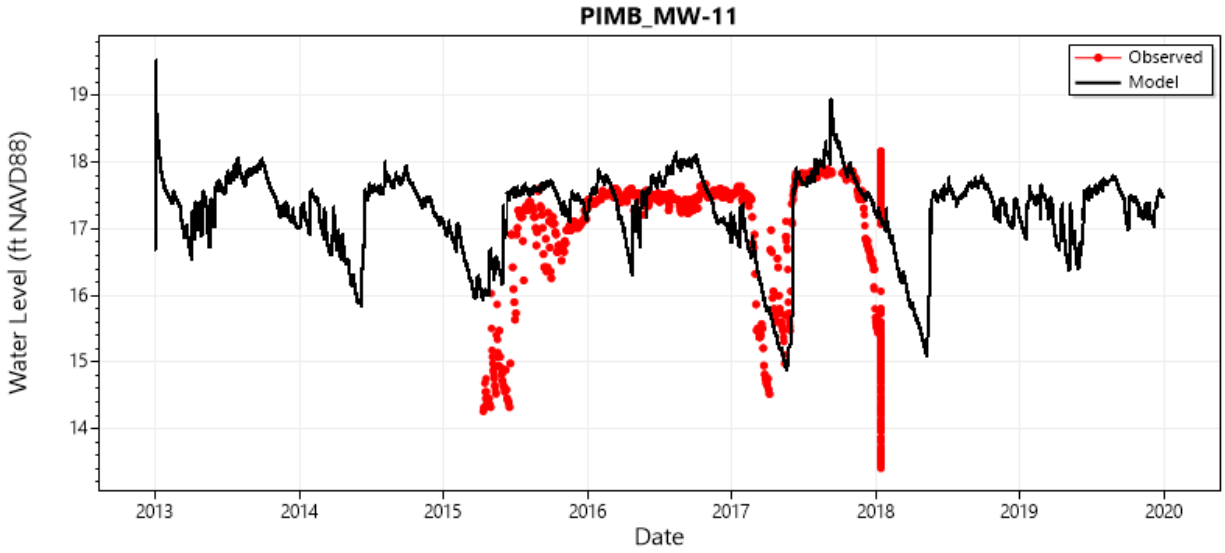

BSU_MW-7
Observed
Model
Water Level (ft NAVD88)
10
5
0
-5
2013
2014
2015
2016
2017
2018
2019
2020
Date


BSU_MW-8
Observed
Model
Water Level (ft NAVD88)
10
5
0
-5
-10
2013
2014
2015
2016
2017
2018
2019
2020
Date

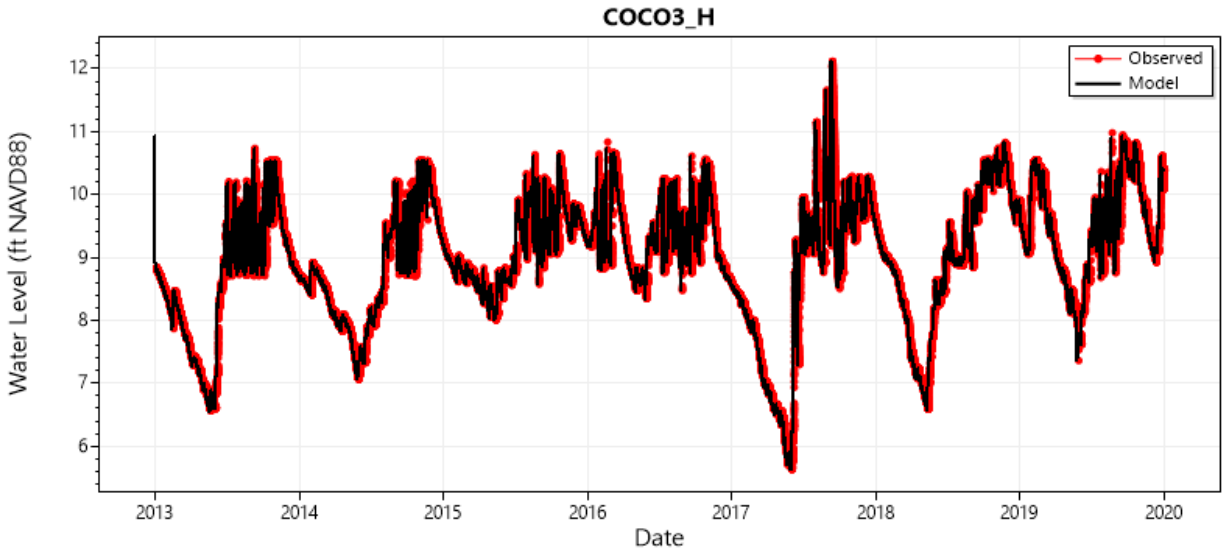

PIMB_MW-8
Observed
Model
Water Level (ft NAVD88)
19
18
17
16
15
14
13
2013
2014
2015
2016
2017
2018
2019
2020
Date

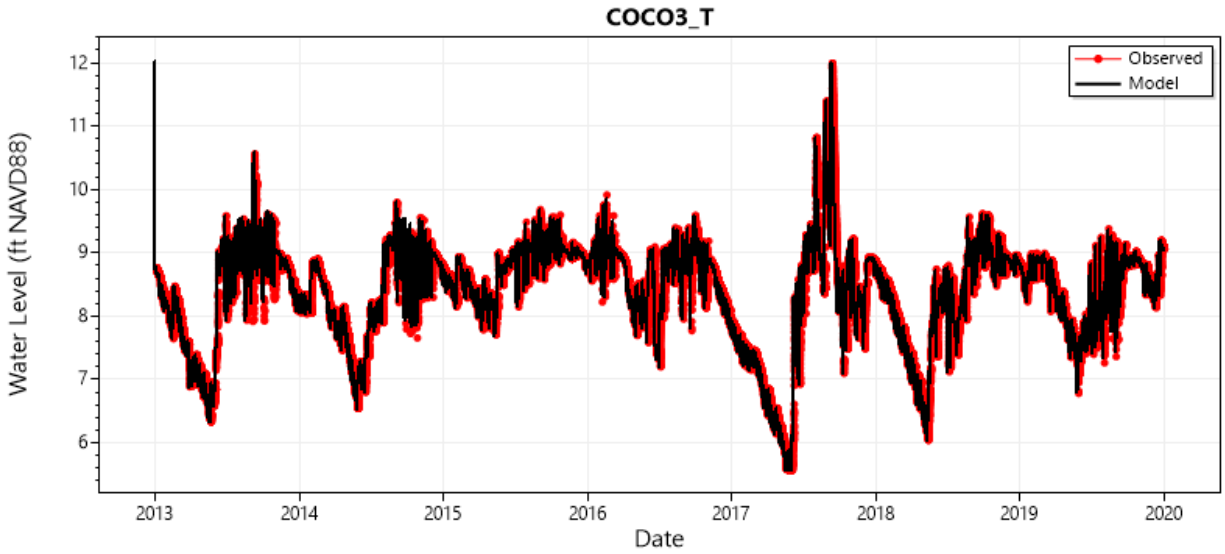

PIMB_MW-9
Observed
Model
Water Level (ft NAVD88)
19
18
17
16
15
14
2013
2014
2015
2016
2017
2018
2019
2020
Date

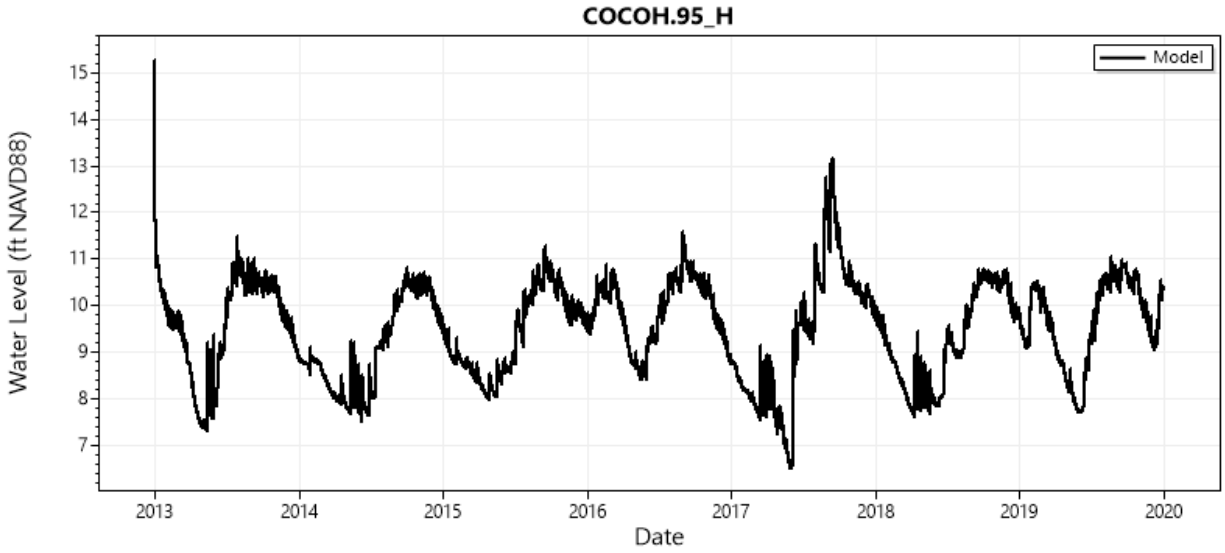

PIMB_MW-10
Observed
Model
Water Level (ft NAVD88)
19
18
17
16
15
14
13
12
11
2013
2014
2015
2016
2017
2018
2019
2020
Date

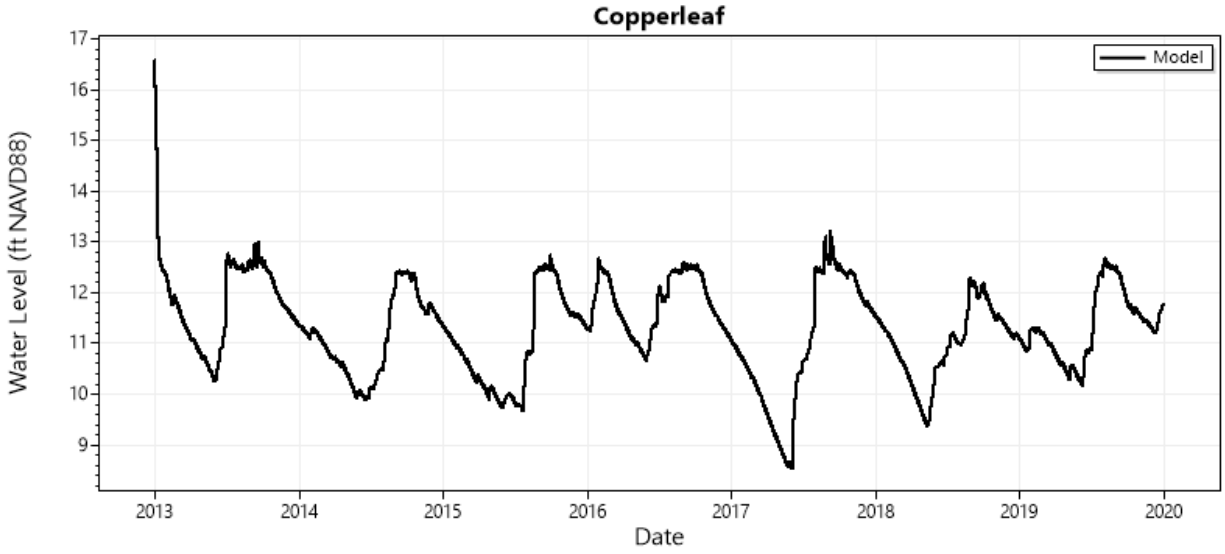

PIMB_MW-11
Observed
Model
Water Level (ft NAVD88)
19
18
17
16
15
14
2013
2014
2015
2016
2017
2018
2019
2020
Date

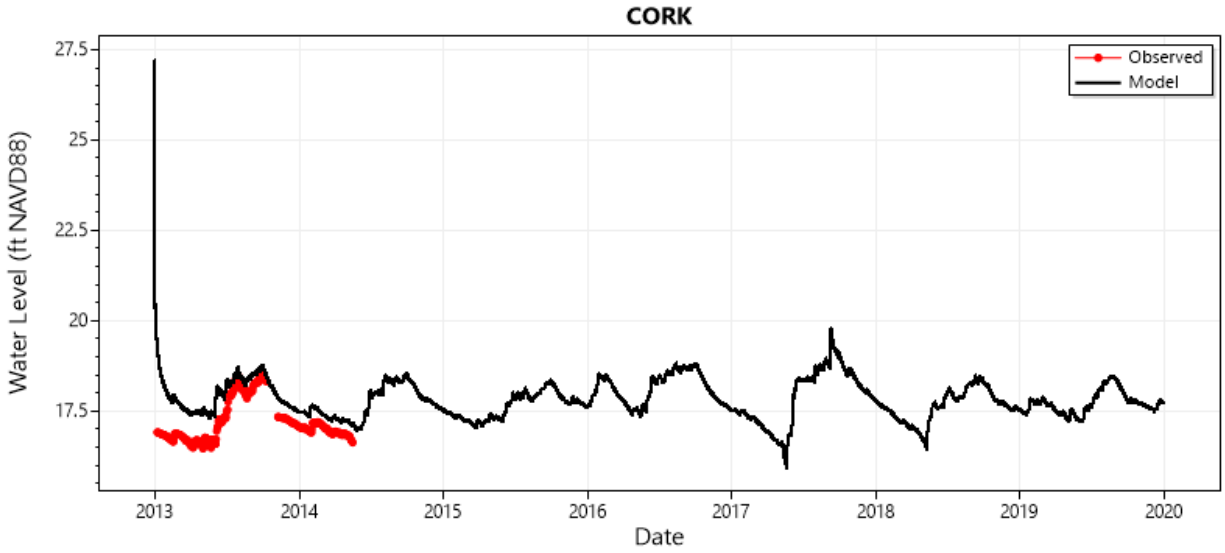
MIKE11 Stations

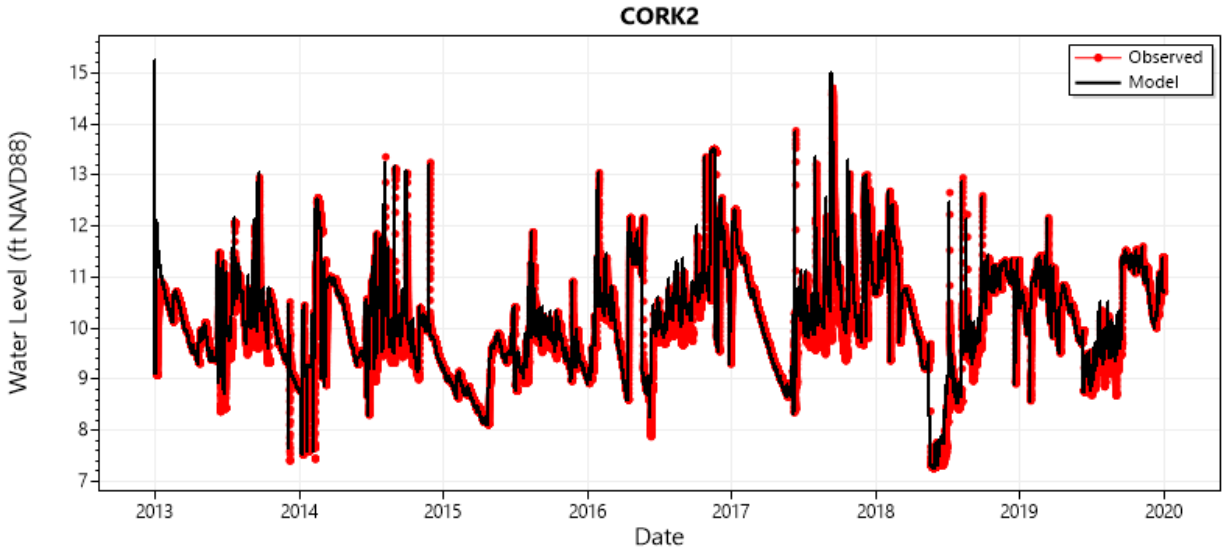


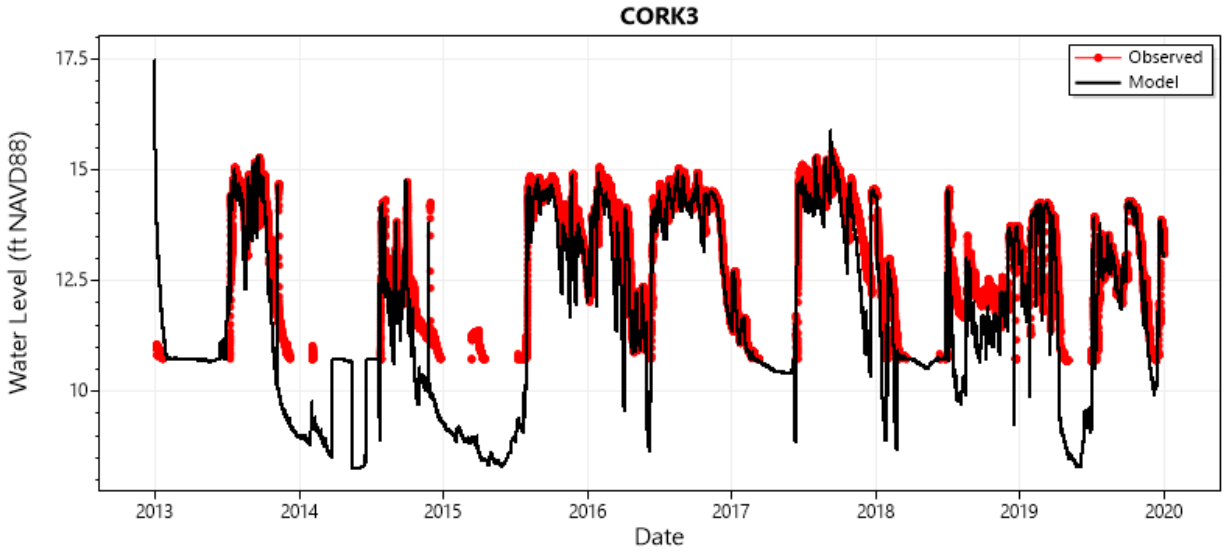


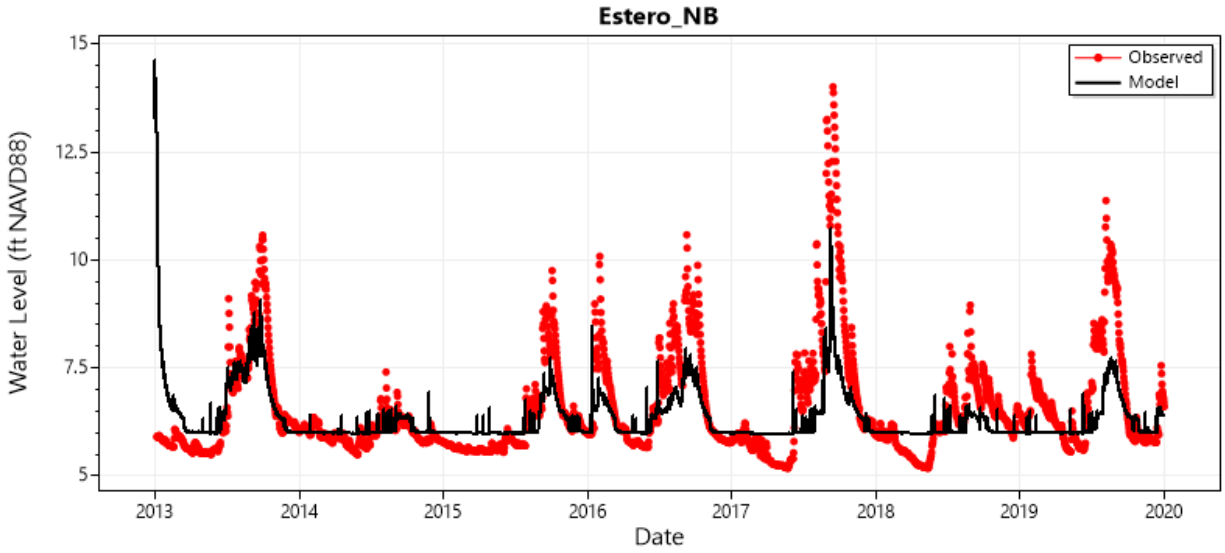


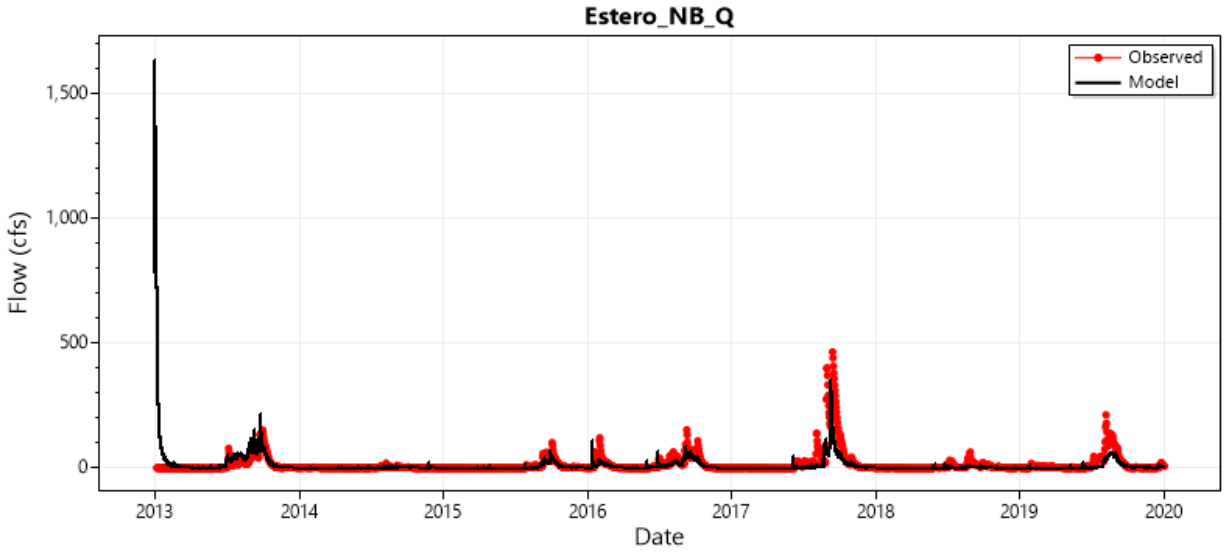

Copperleaf
Model
Water Level (ft NAVD88)
17
16
15
14
13
12
11
10
9
2013
2014
2015
2016
2017
2018
2019
2020
Date

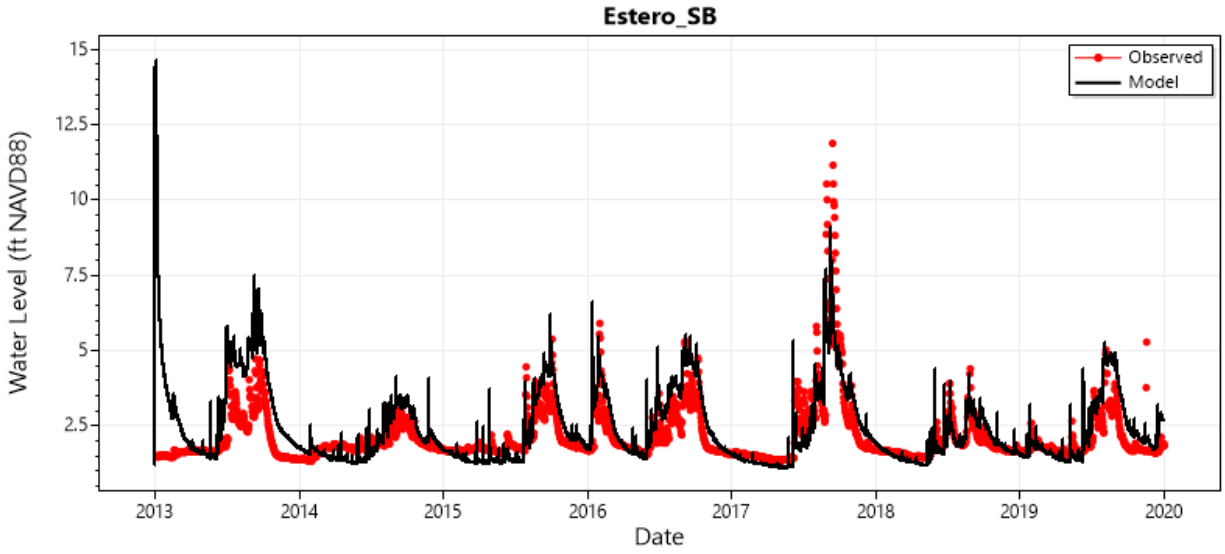

CORK
Observed
Model
Water Level (ft NAVD88)
27.5
25
22.5
20
17.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

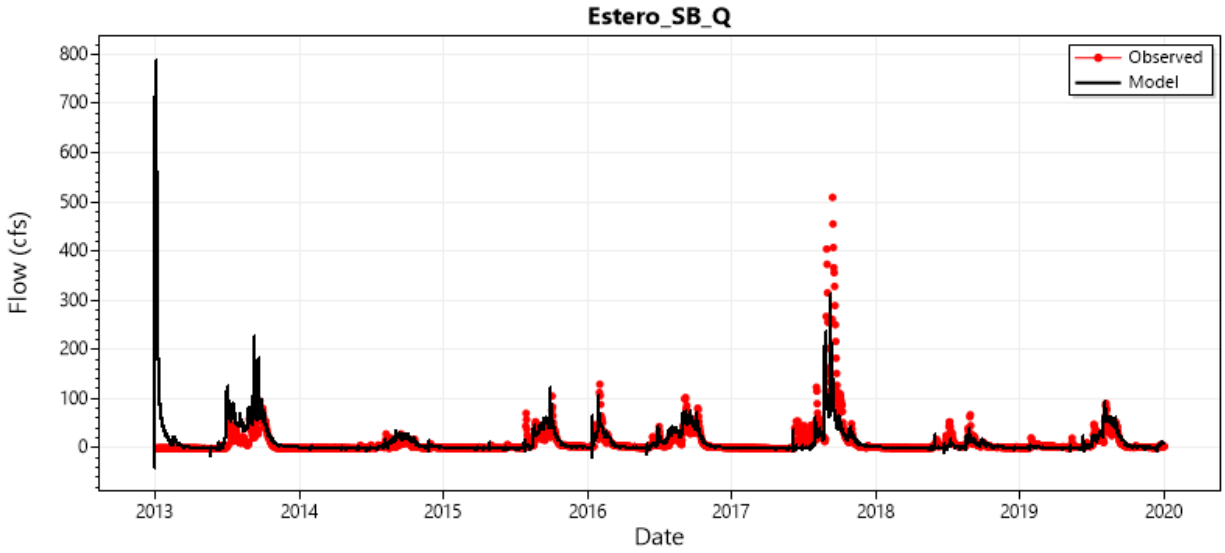

CORK2
Observed
Model
Water Level (ft NAVD88)
15
14
13
12
11
10
9
8
7
2013
2014
2015
2016
2017
2018
2019
2020
Date

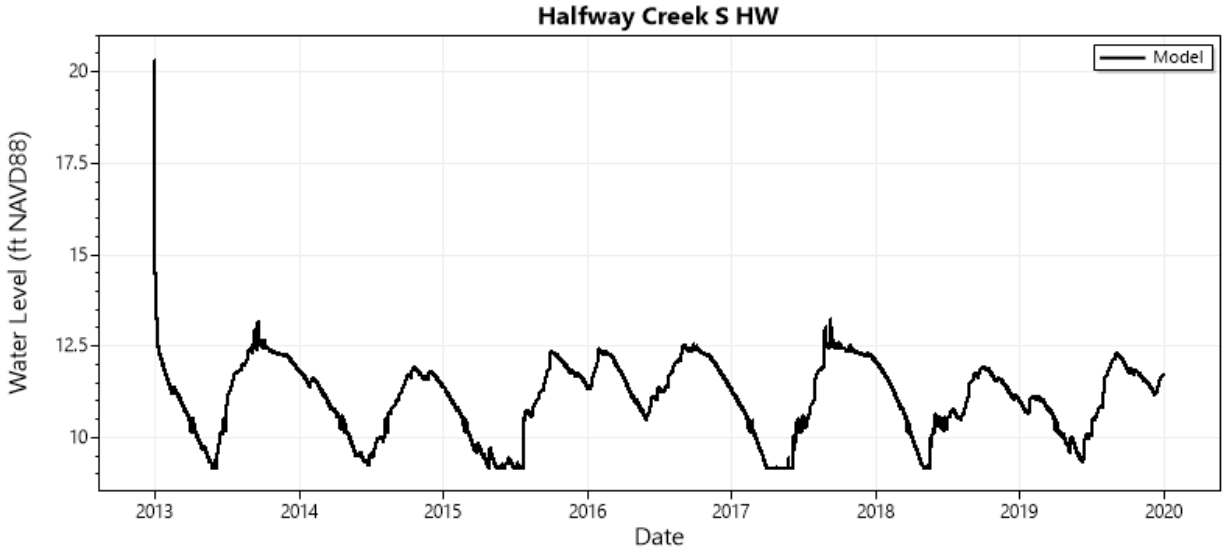

CORK3
Observed
Model
Water Level (ft NAVD88)
17.5
15
12.5
10
2013
2014
2015
2016
2017
2018
2019
2020
Date

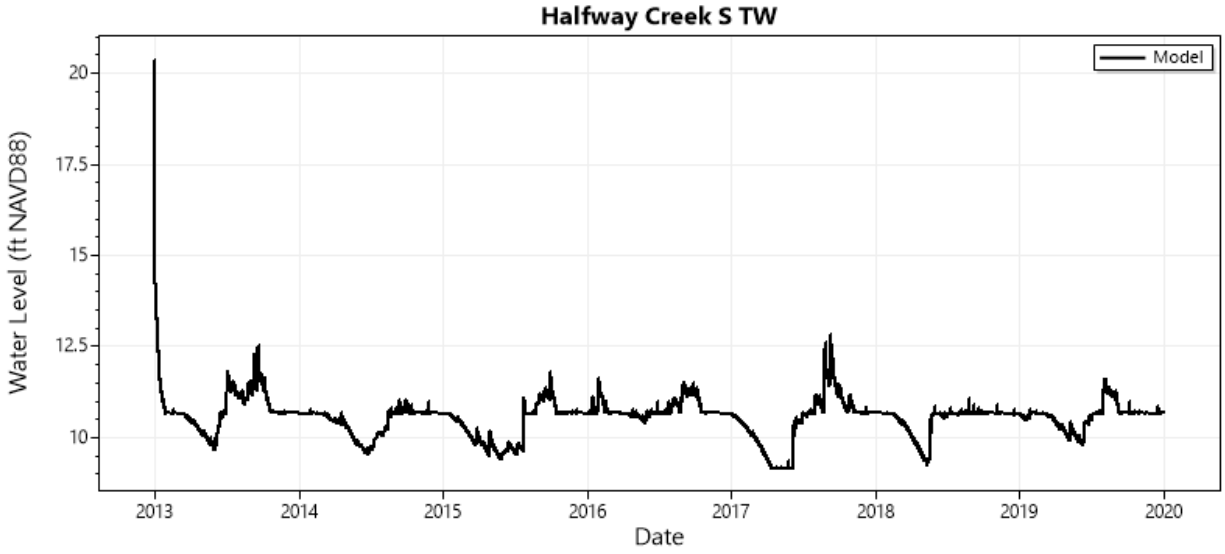

Estero_NB
Observed
Model
Water Level (ft NAVD88)
15
12.5
10
7.5
5
2013
2014
2015
2016
2017
2018
2019
2020
Date

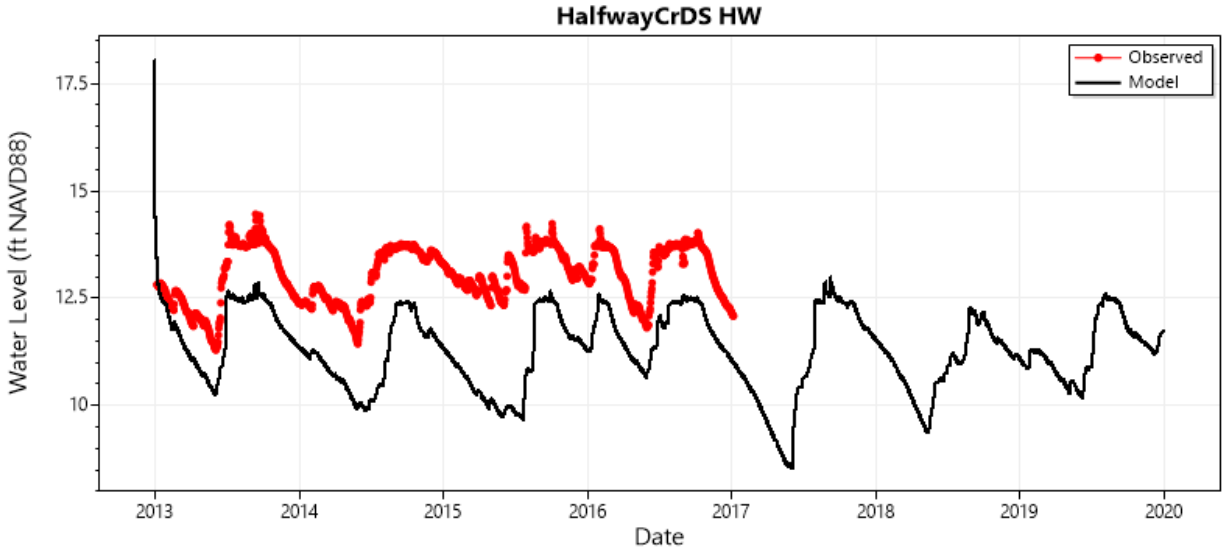

Estero_NB_Q
Observed
Model
Flow (cfs)
1,500
1,000
500
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

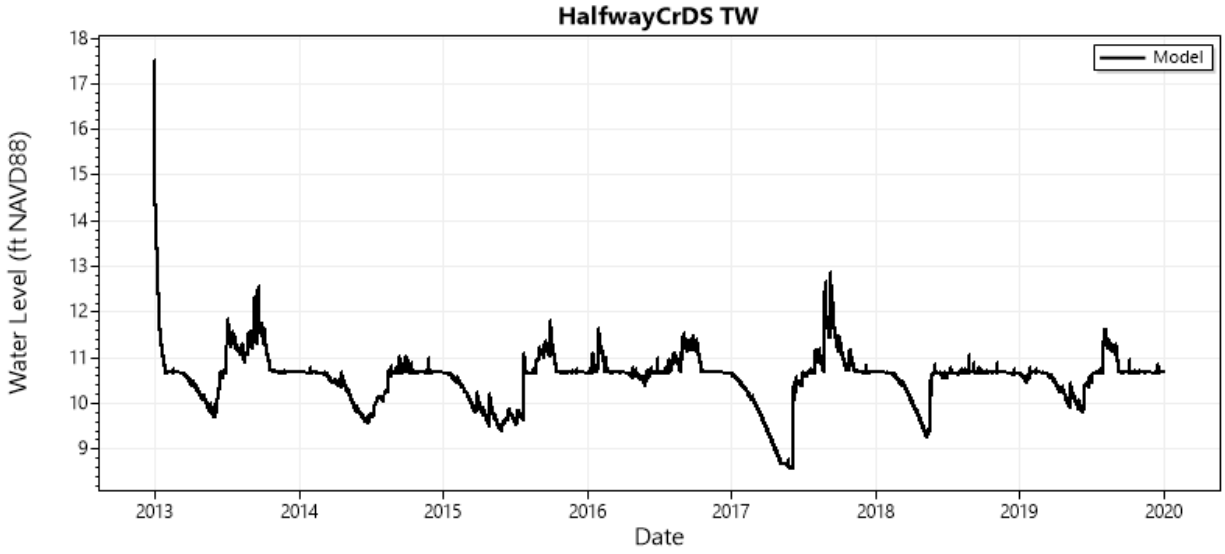

Estero_SB
Observed
Model
Water Level (ft NAVD88)
15
12.5
10
7.5
5
2.5
2013
2014
2015
2016
2017
2018
2019
2020
Date

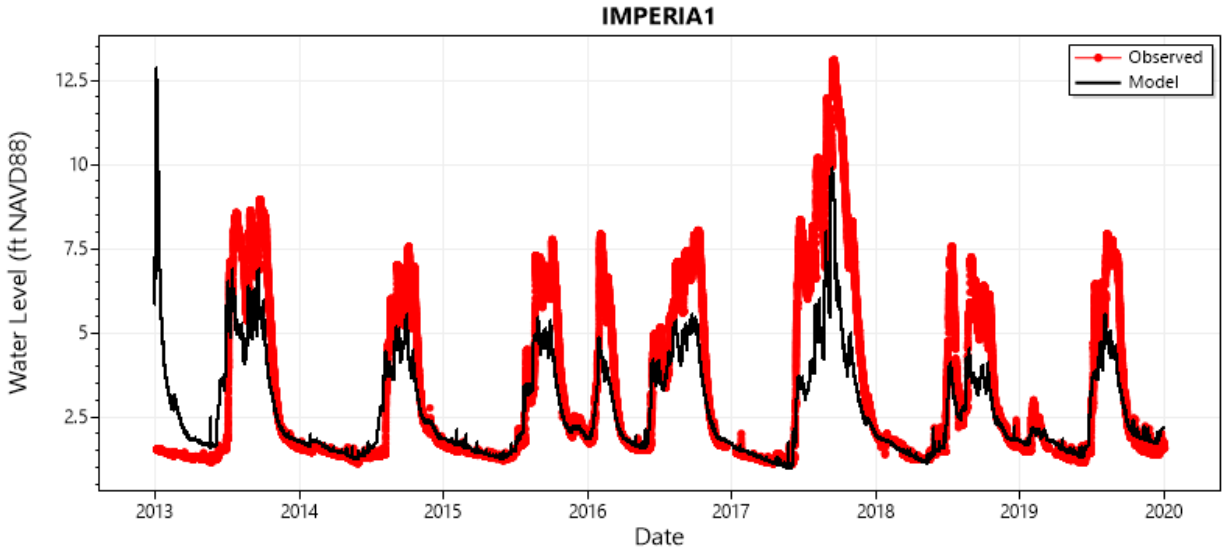

Estero_SB_Q
Observed
Model
Flow (cfs)
800
700
600
500
400
300
200
100
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

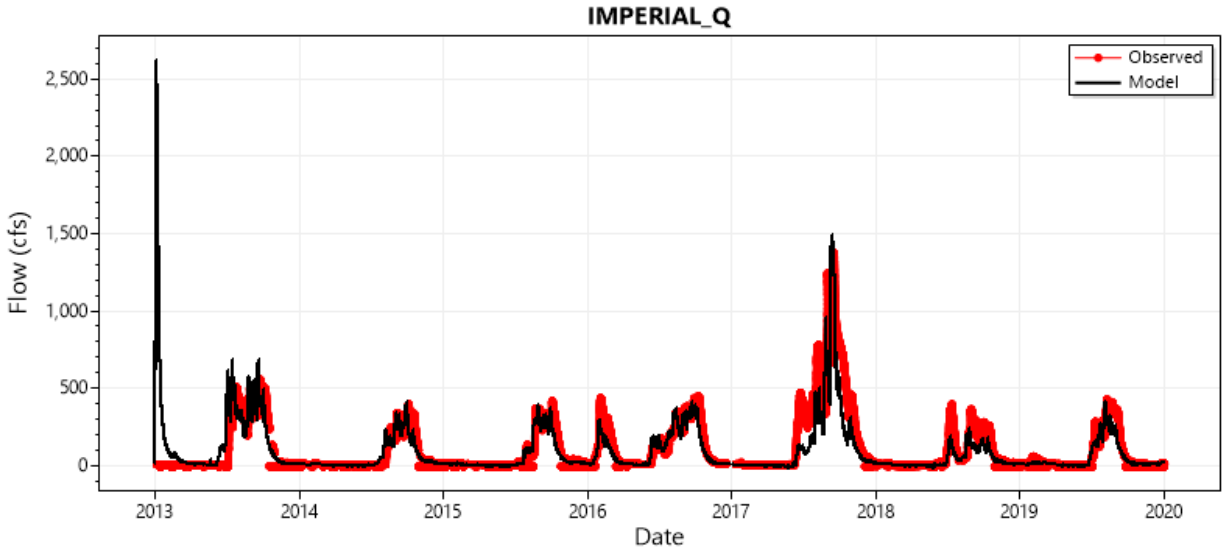

Halfway Creek S HW
Model
Water Level (ft NAVD88)
20
17.5
15
12.5
10
2013
2014
2015
2016
2017
2018
2019
2020
Date

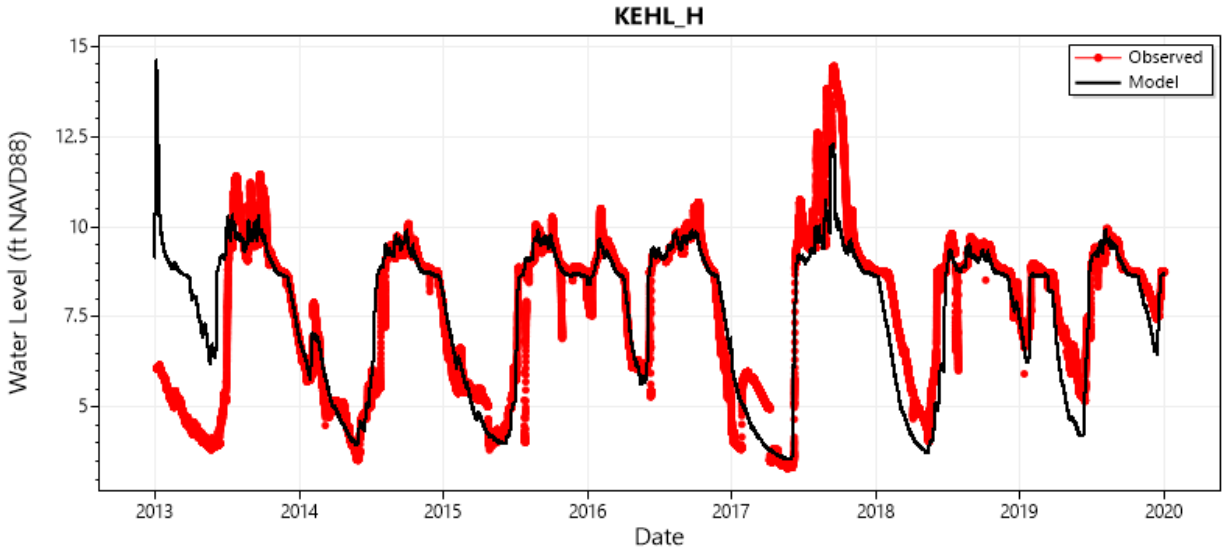

Halfway Creek S TW
Model
Water Level (ft NAVD88)
20
17.5
15
12.5
10
2013
2014
2015
2016
2017
2018
2019
2020
Date

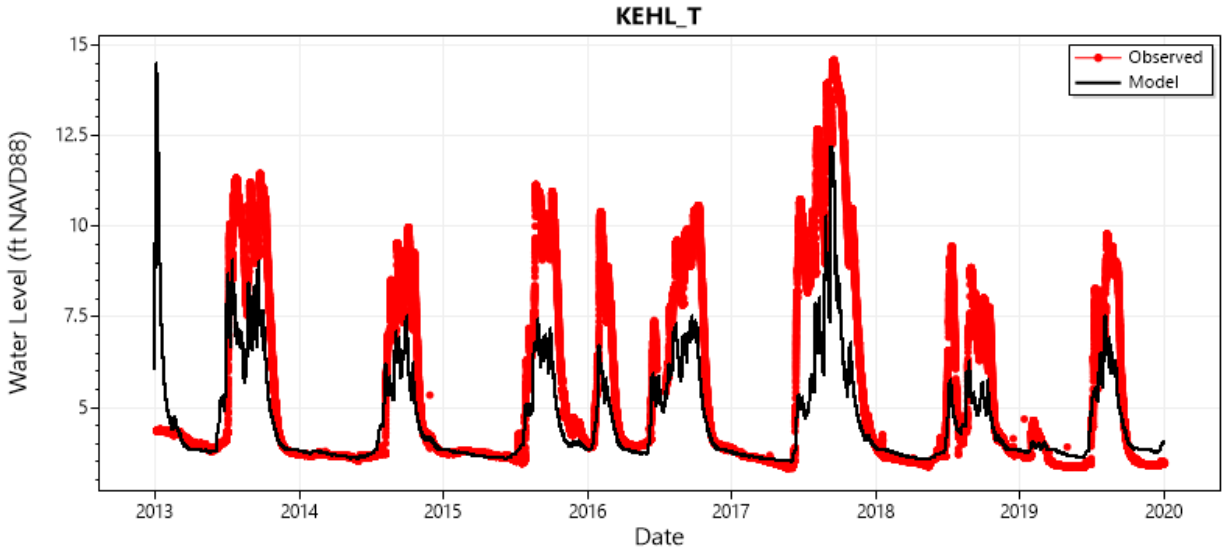

HalfwayCrDS HW
Observed
Model
Water Level (ft NAVD88)
17.5
15
12.5
10
2013
2014
2015
2016
2017
2018
2019
2020
Date

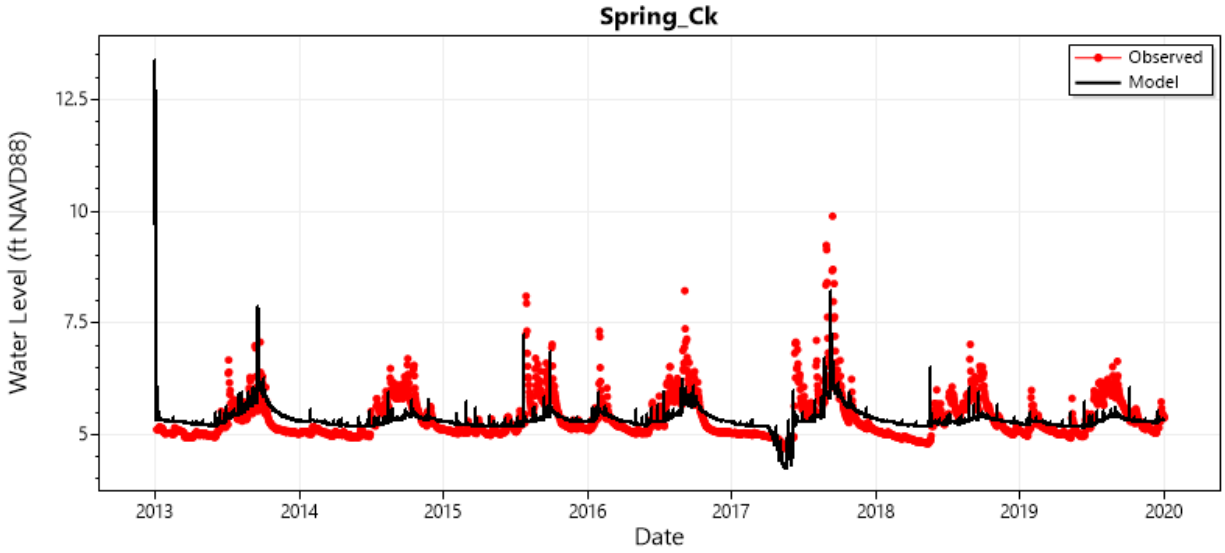

HalfwayCrDS TW
Model
Water Level (ft NAVD88)
18
17
16
15
14
13
12
11
10
9
2013
2014
2015
2016
2017
2018
2019
2020
Date

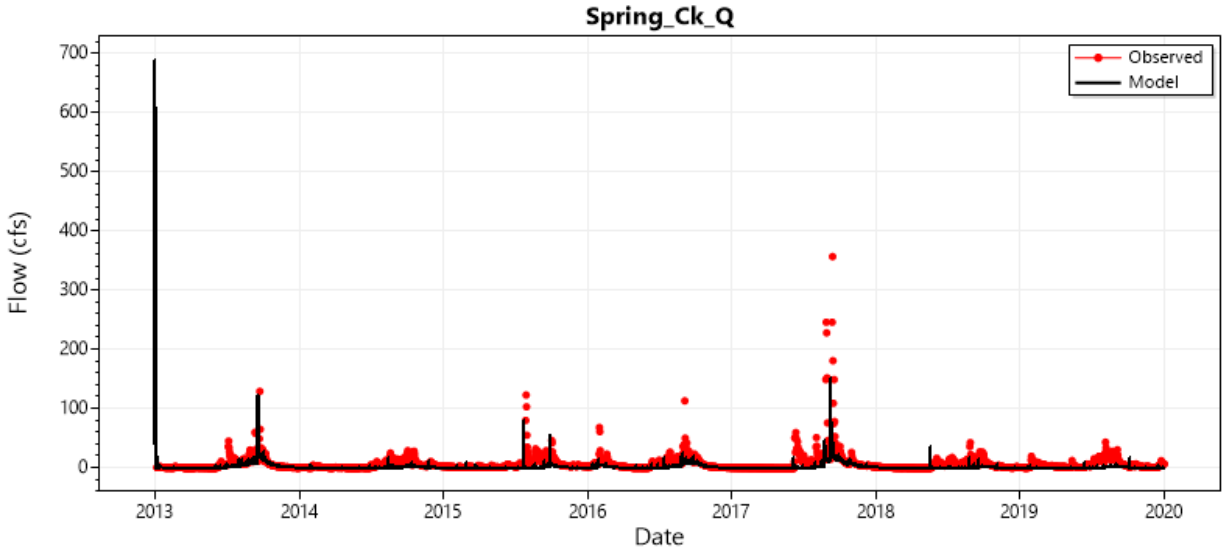

IMPERIA1
Observed
Model
Water Level (ft NAVD88)
12.5
10
7.5
5
2.5
2013
2014
2015
2016
2017
2018
2019
2020
Date


IMPERIAL_Q
Observed
Model
Flow (cfs)
2,500
2,000
1,500
1,000
500
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

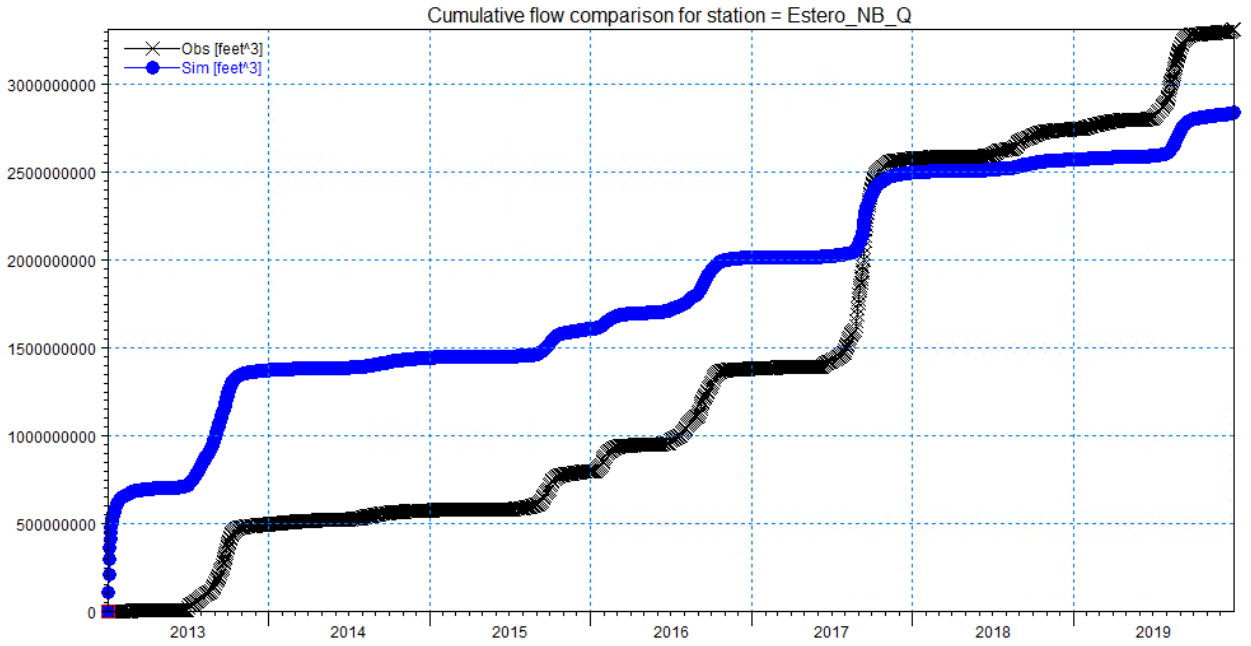

KEHL_H
Observed
Model
Water Level (ft NAVD88)
15
12.5
10
7.5
5
2013
2014
2015
2016
2017
2018
2019
2020
Date

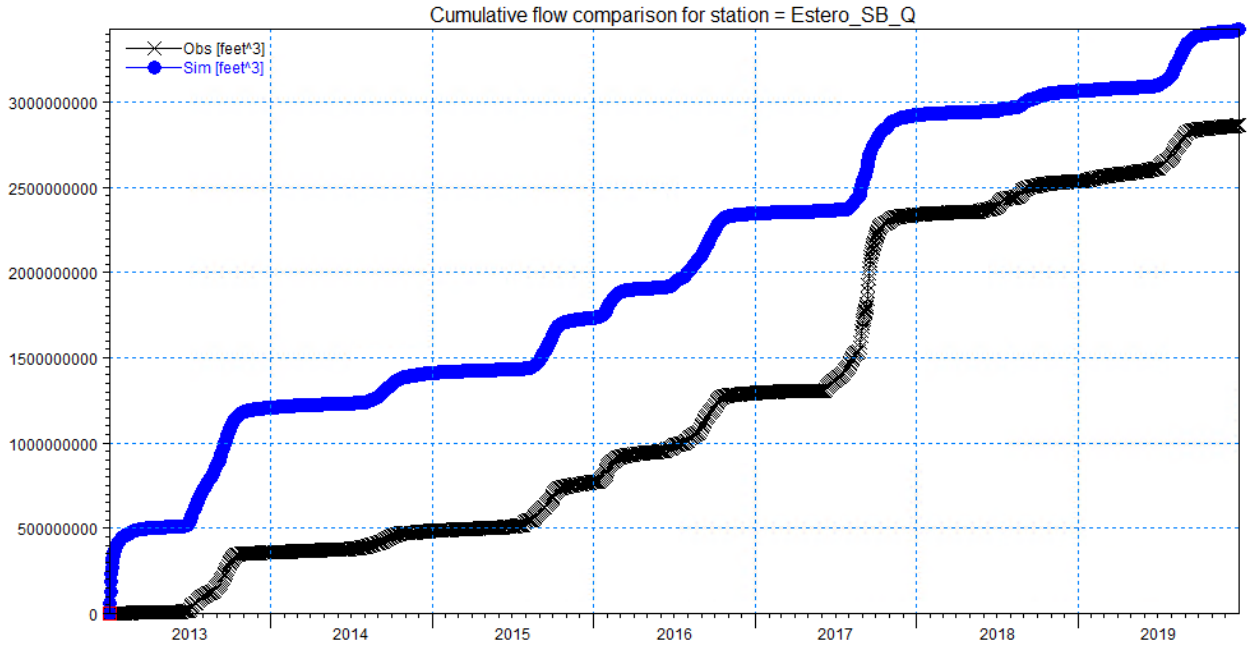

KEHL_T
Observed
Model
Water Level (ft NAVD88)
15
12.5
10
7.5
5
2013
2014
2015
2016
2017
2018
2019
2020
Date

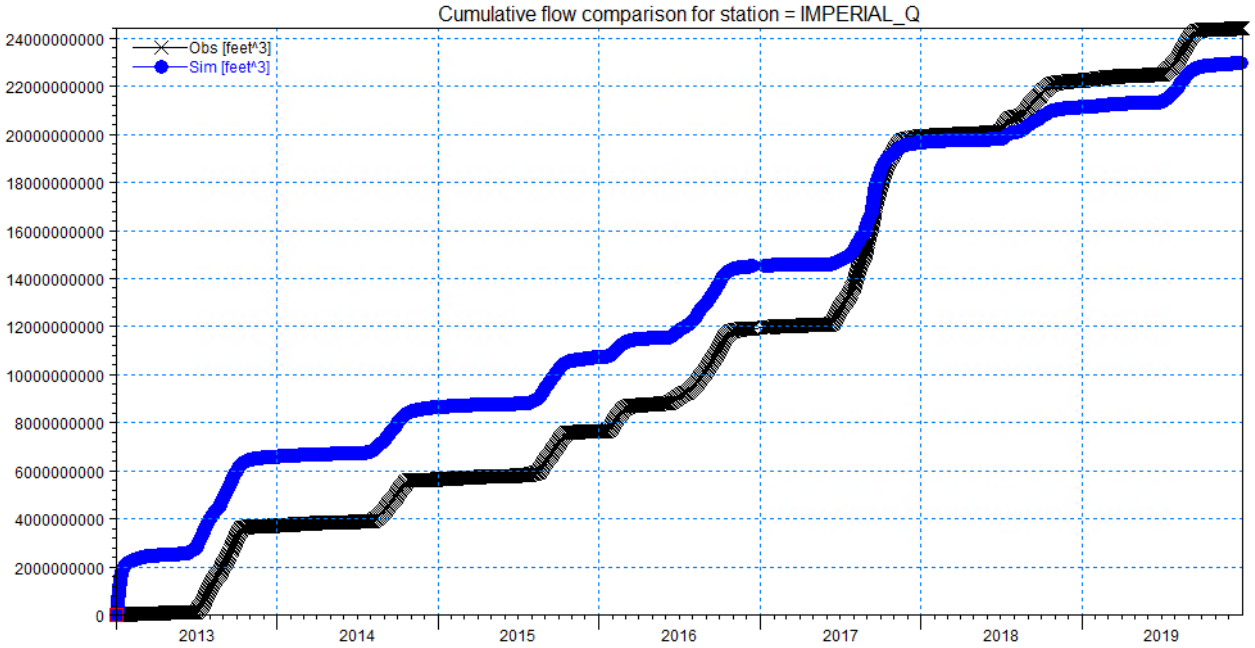

Spring_Ck
Observed
Model
Water Level (ft NAVD88)
12.5
10
7.5
5
2013
2014
2015
2016
2017
2018
2019
2020
Date

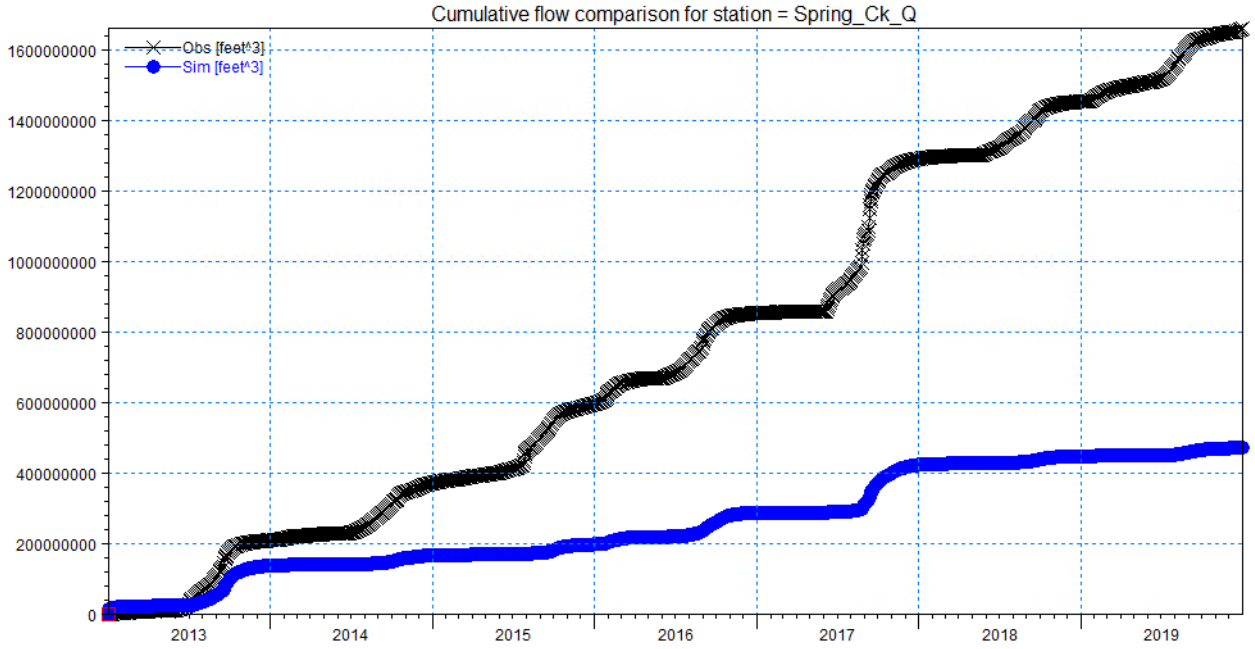

Spring_Ck_Q
Observed
Model
Flow (cfs)
700
600
500
400
300
200
100
0
2013
2014
2015
2016
2017
2018
2019
2020
Date

Appendix B. Cumulative Flow Comparison Plots






Cumulative flow comparison for station = IMPERIAL_Q
Obs [feet^3]
Sim [feet^3]
24000000000
22000000000
20000000000
18000000000
16000000000
14000000000
12000000000
10000000000
8000000000
6000000000
4000000000
2000000000
0
2013
2014
2015
2016
2017
2018
2019


Cumulative flow comparison for station = Spring_Ck_Q
Obs [feet^3]
Sim [feet^3]
1600000000
1400000000
1200000000
1000000000
800000000
600000000
400000000
200000000
0
2013
2014
2015
2016
2017
2018
2019