APPENDIX 6B

Future Conditions Scenario 1

Lower Charlotte Harbor Flatwoods Strategic Hydrologic Restoration Plan

Lower Charlotte Harbor Flatwoods Strategic Hydrologic Restoration Plan

6B – Future Conditions Scenario 1

PREPARED FOR:

Coastal & Heartland National Estuary Partnership
1050 Loveland Boulevard
Port Charlotte, Florida 33980

PREPARED BY:

Water Science Associates
Coastal & Heartland National Estuary Partnership

IN CONJUNCTION WITH:

South Florida Water Management District
Florida Fish and Wildlife Conservation Commission
Southwest Florida Water Management District

LOWER CHARLOTTE HARBOR FLATWOODS HYDROLOGIC MODELING AND PLANNING PROJECT

TECHNICAL MEMORANDUM – TASK 6B – SCENARIO 1

To:	Ms. Jennifer Hecker, Ms. Nicole Iadevaia, Ms. Sarina Weiss
From:	Roger Copp and Kirk Martin, P.G. Water Science Associates
Date	June 12, 2023
Re:	Task 6B – Scenario 1

INTRODUCTION

Water Science Associates (Water Science) was contracted by the Coastal & Heartland National Estuary Partnership (CHNEP) to develop a hydrologic restoration plan for the Lower Charlotte Harbor Flatwoods that will promote sheet flow enhancement, restore wetland hydroperiods in the Babcock Webb and the Yucca Pens Wildlife Management Areas (WMA), and improve the timing and magnitude of flows to tidal creeks west of Yucca Pens WMA.

Project tasks include:

1. Compilation of existing hydrologic data,
2. Installation of new surface and groundwater monitoring stations and rain gages,
3. Evaluation of vegetative indicators of wetland health,
4. Maintenance of the monitoring stations and management of manual and electronic data,
5. Development of an existing conditions hydrologic model of the study area,
6. Evaluation of alternative management scenarios, and
7. Development of a Lower Charlotte Harbor Flatwoods Strategic Hydrological Restoration Planning Tool and Report.

Tasks 1 through 5 have been completed. Task 6 includes modeling natural pre-development and three future conditions scenarios. The Task 6A Natural Systems Analysis Technical Memorandum (TM) has been completed. This TM describes the work associated with Task 6B, the development and results of Scenario 1 of the three planned Scenario evaluations. The Scope of Work stipulates that this memorandum describe the predicted water levels, flows, and hydroperiods for Scenario 1.

Future conditions scenarios include restoration projects that are set to be completed in the near future including the Bond Farm Hydrological Enhancement Impoundment (HEI) which is a permitted project (FDEP ERP No. 0375475-001 EI & State 404 Program Individual Permit No. 0375475-004 SFI).

During project meetings, the three scenarios will include the following assumptions:

1. Scenario 1 will model ATV channel blocks, low-water fords, or weirs in Yucca Pens to minimize excessive drainage caused by eroded all-terrain vehicle (ATV) trails, and to store more water pumped from the southwestern portion of Babcock Webb WMA in the proposed Bond Farm Hydrologic Enhancement Impoundment (HEI) during the wet season and to release water during the dry season. Bond Farm HEI outflows will be directed south during the dry season (see **Scenario 1 Assumptions** for additional information). If the simulation does not indicate sufficient restoration in Yucca Pens, a groundwater seepage barrier will be added to Scenario 1. If the simulation does not indicate sufficient restoration in Babcock Webb, additional storage for flooded areas of Babcock Webb will be included in Scenario 2.
2. Scenario 2 will include additional storage for flooded areas of Babcock Webb. A flow-way from Bond Farm to Yucca Pens will be included in this scenario if additional hydroperiod restoration is desired in Yucca Pens. Scenario 2 is intended as a refinement of Scenario 1 with the intention that Scenario 2 will most likely be the recommended course of action.
3. Scenario 3 will include all components of Scenario 2 and will assume higher evapotranspiration

rates and sea level rise associated with climate change.

SCENARIO 1 ASSUMPTIONS

Scenario 1 models ATV channel blocks, low-water fords, or weirs in Yucca Pens to minimize excessive drainage caused by eroded all-terrain vehicle (ATV) trails. The Bond Farm HEI was programmed in Scenario 1 to store water pumped from the southwestern portion of Babcock Webb WMA during the wet season and to release water during the dry season. The initial conceptual restoration plan developed in 2014 (ADA, 2014) included a proposed flow-way from Bond Farm west to Yucca Pens with the intention that outflows would be released during the early part of the dry season (December and January) to extend hydroperiods in Yucca Pens. Scenario 1 did not include flow deliveries from Bond Farm to Yucca Pens so that Scenario 1 could clearly identify the hydroperiod benefits from reducing over-drainage of Yucca Pens via eroded ATV trails. In addition, securing property easements or purchasing a flow-way west of U.S. 41 was expected to be difficult. Therefore, Scenario 1 was designed to evaluate the impacts of discharging water south under I-75 towards Prairie Pines Preserve in the dry season only. Since a portion of the water discharged from Bond Farm HEI to the south ultimately would flow during the early dry season towards the Caloosahatchee River estuary via Powell Creek, these flows could have a beneficial impact on restoration of the salinity regime in the Caloosahatchee estuary. If the simulation does not indicate sufficient restoration in Yucca Pens, a groundwater seepage barrier will be added at the Gator Slough Canal. These projects were identified as high priority by stakeholders that were likely to be completed in the near future. If a limited response is seen in Babcock Webb and Yucca Pens key areas and management needs are not met, then Scenario 2 will model additional storage and other solutions.

During the development of Scenario 1, the following assumptions were made:

1. The Bond Farm HEI will have a maximum storage depth of 4 feet, which translates to a storage volume of 2,400 acre-feet.
2. The Bond Farm HEI inflow pump station will be located on the east side of Bond Farm approximately 1,300 feet south of the northern property line of Bond Farm (locations shown in ***Figure 1***).
3. The Bond Farm HEI inflow pump station operation will gradually increase from no flow (0 cfs) to 20 cfs between upstream stages of 24.5 and 25 ft-NAVD. No flow will be permitted if water levels within the impoundment are above 28 ft-NAVD. The pump will only operate between June and November (wet season), as indicated by the Bond Farm HEI permit (FDEP ERP No. 0375475-001 EI & State 404 Program Individual Permit No. 0375475-004 SFI). Assumed stages to turn on the pump were based on observed wet season water levels at monitoring station STA-6 located just east of the proposed pump.
4. The Bond Farm HEI outflow will be directed south towards Prairie Pines Preserve at a constant flow of 20 cfs during the early dry season in December and January. No outflow will be permitted during the wet season unless a major storm event is anticipated. If discharges south to Prairie Pines Preserve (PPP) are ultimately the recommended route, the period of discharges and the discharge rate should be based on optimal hydroperiod conditions in PPP and flow augmentation needs during the dry season in the ultimate receiving waters (Caloosahatchee Estuary or Gator Slough) without reducing flood protection to nearby or downstream communities.

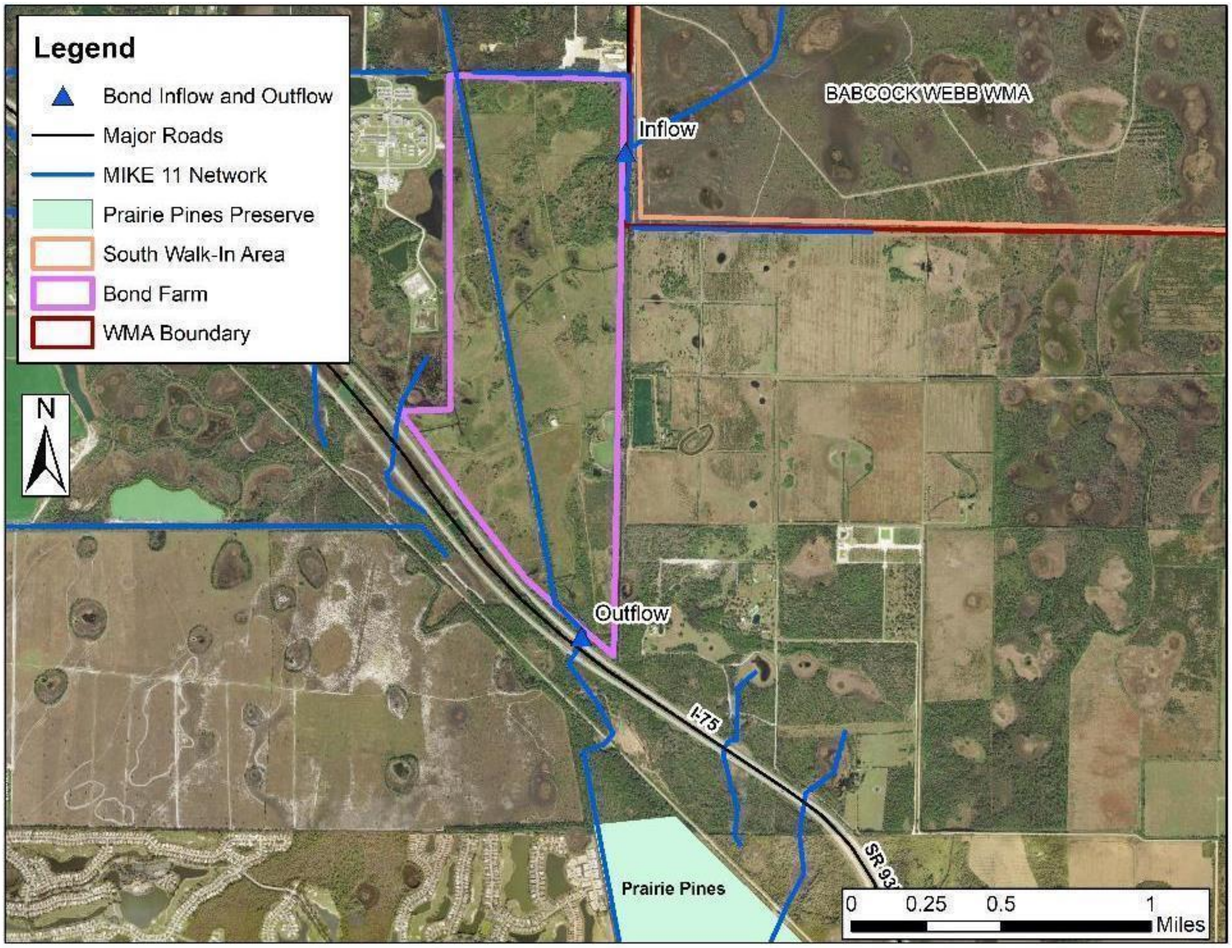

Figure 1. Bond Farm Hydrologic Enhancement Project

5. Twenty-six weirs representing either low-water fords or constructed weirs were added in Yucca Pens. The dimensions of the weirs are presented in ***Table 1***, and the locations are presented in ***Figure 2***. Locations of weirs were determined by landscape conditions and best outcomes in modeled iterations. Column 1 of ***Table 1*** provides the map number for the weir locations shown in ***Figure 2.*** Further details of the proposed weirs are presented in ***Appendix A***. The weir dimensions are conceptual and refinement may be appropriate during more detailed investigations or design modeling. They are modeled in MIKE 11 as broad-crested weirs, such as the concrete weir at the south end of Yucca Pens.
6. Isolated wetlands on Yucca Pens that are drained by existing ATV trails will be restored with small ATV channel blocks to increase detention. The location of those identified isolated wetlands is presented in ***Figure 2***. Most of these isolated wetlands are marsh wetlands and a few are cypress, as identified on the ground or in high resolution aerial photography.
7. Initial testing of ATV channel blocks in south Yucca Pens indicated that higher groundwater levels as a result of the increased detention was resulting in higher groundwater elevations in private lands west of southern Yucca Pens (see ***Figure 3*** for location of the private lands). As a result, a seepage barrier was included in the model along the southern portion of Yucca Pens as shown in ***Figure 3***. The seepage rate has been set at 30 ft/day, which is 88% lower than the groundwater horizontal conductivity of approximately 280 ft/day utilized in the baseline existing conditions simulation. A lower seepage rate of 1 ft/day was tested but was not used since the cost of a 2-foot wide by 30-foot deep clay barrier was deemed to be too expensive. A grout curtain consisting of a line of boreholes backfilled with concrete is estimated to be more cost effective than a clay barrier. Further explanation can be found in the following section SIMULATED PERFORMANCE FOR BOND FARM HEI.

Table 1. Scenario 1 Weir Dimensions, Chainage in meters, elevations in ft-NAVD

Map #	Weir Label	MIKE 11 Branch	Chainage, m.	Lowest Control Elevation and Width	U/S XS Invert
1	Zemel_New_Weir	Zemel	6700	10 ft wide at 15.0 ft	13.4 ft
2	Bear_HW_New_Weir	Bear_Branch	360	10 ft wide at 16.0 ft	14.2 ft
3	Hog_New_Weir	Hog_Branch	430	20 ft wide at 14.4 ft	13.7 ft
4	New_Weir_YPensN	YuccaPensN	790	10 ft wide at 11.0 ft	10.3 ft
5	New_Weir_YuccaPensCk	YuccaPensCreek	10000	10 ft wide at 10.5 ft	8.8 ft
6	Yucca_New_Weir2	YuccaPensCreek	9090	10 ft wide at 12.6 ft	12.0 ft
7	Yucca_New_Weir3	YuccaPensCreek	7850	5 ft wide at 15.0 ft	14.1 ft
8	YuccaP_4_NewWeir	YuccaPensCreek	5270	10 ft wide at 15.9 ft	15.1 ft
9	Durden_4_NewWeir2	SR-7_Branch	1440	10 ft wide at 16.25 ft	14.7 ft
10	New_Weir_DurdenN	Durden_N	100	7 ft wide at 13.0 ft	11.0 ft
11	New_Weir2_DurdenN	Durden_N	770	5 ft wide at 12.0 ft	10.5 ft
12	New_Weir_DurdenCk	DurdenCreek	4700	10 ft wide at 13.0 ft	11.8 ft
13	Durden_New_Weir2	DurdenCreek	3720	10 ft wide at 14.3 ft	13.5 ft
14	Durden_4_NewWeir	DurdenCreek	330	10 ft wide at 16.25 ft	13.8 ft
15	New_Weir_DurdenCreek1	DurdenCreek1	100	10 ft wide at 12.5 ft	11.0 ft
16	YP-6_W_New_Weir	SR10-YPN-1	380	10 ft wide at 12.0 ft	11.0 ft
17	New_Weir_YP-6	SR10-YPPN	2200	10 ft wide at 12.7 ft	11.9 ft
18	New_Weir_YPPS	SR10-YPPS	2800	10 ft wide at 14.35 ft	13.6 ft
19	YP_Jak_NewWeir	YP_Jacaranda	740	10 ft wide at 13.7 ft	12.2 ft
20	SY_YP_NewWeir	ATV3	400	10 ft wide at 15.0 ft	12.4 ft
21	ATV_New_Weir	ATV2	500	7 ft wide at 14.8 ft	14.7 ft
22	SYP2_New_Weir	SYP2_Weir	170	5 ft wide at 14.5 ft	12.8 ft
23	TrapConc (Ex conc weir)	ATV2	1065	5 ft wide at 11.8 ft	8.2 ft
24	CMP_Riser	ATV1	540	Raise riser 1.0 ft	13.2 ft
25	SR-7_S_NewWeir	SR-7_South	1050	10 ft wide at 17.5 ft	15.8 ft
26	Durden_3_NewWeir	DurdenCreek	2850	10 ft wide at 15.7 ft	14.6 ft

Note: m – meters, U/S – upstream, XS – cross section

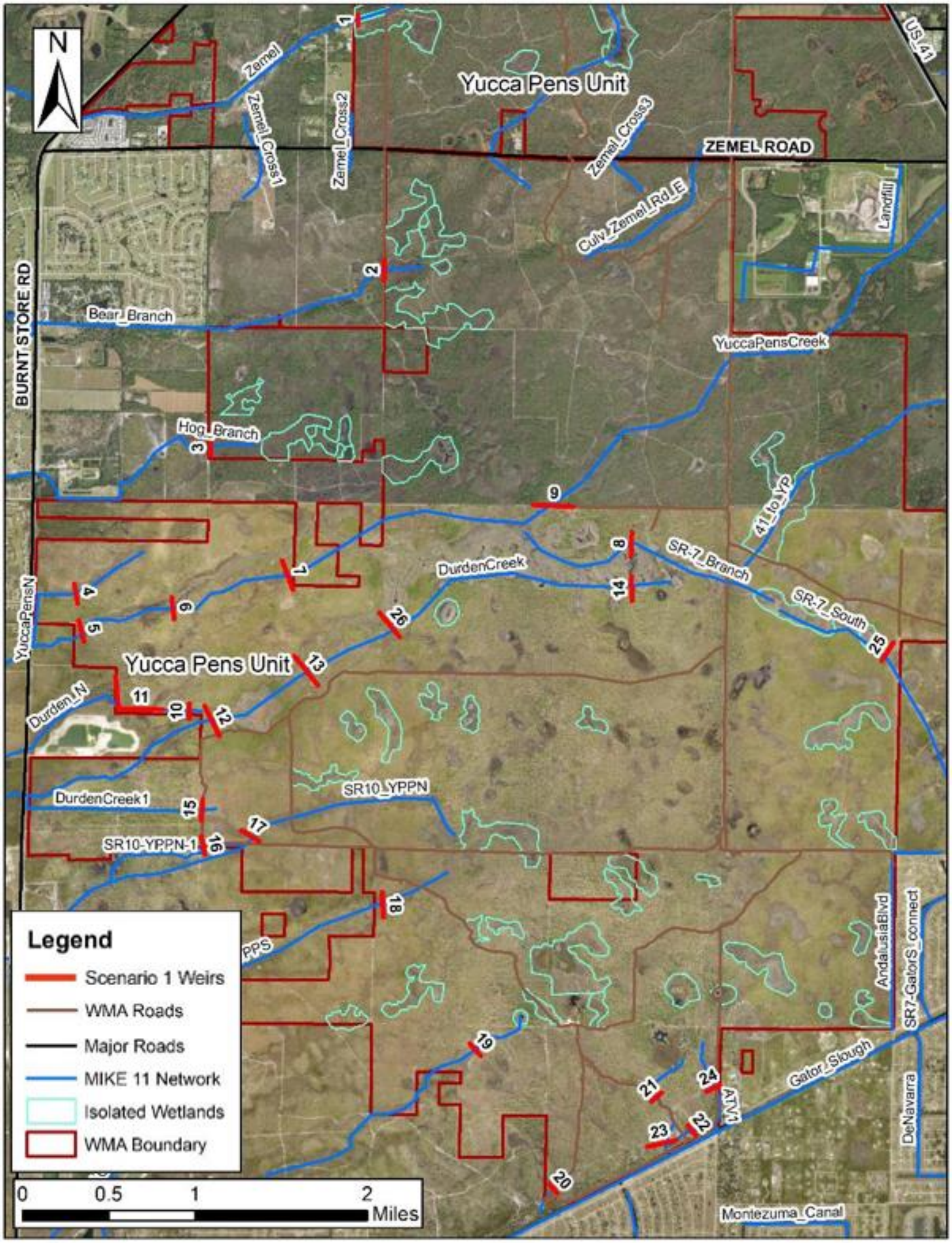

Figure 2. Map of Proposed Weirs/Low Water Fords in Yucca Pens WMA

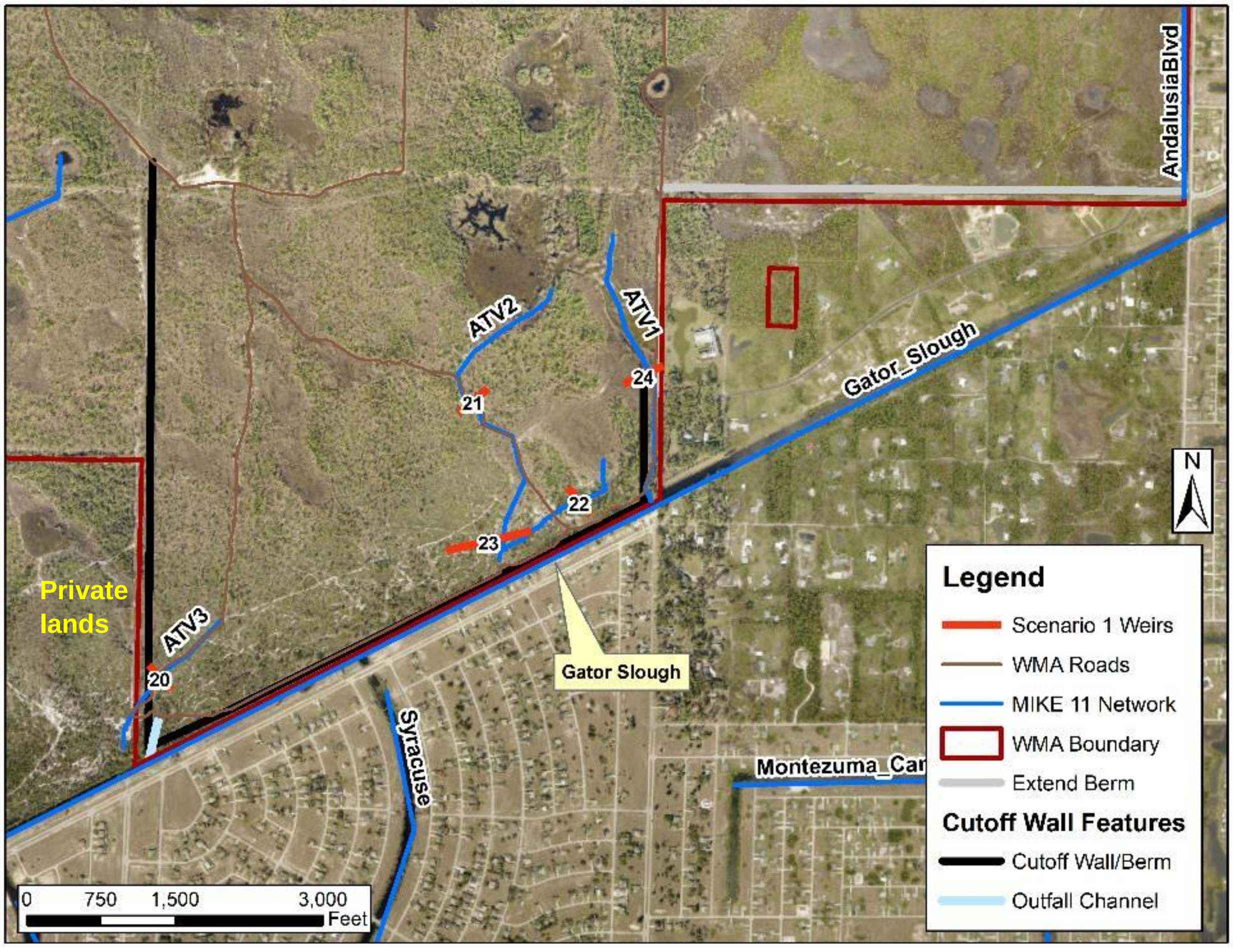

Figure 3. Restoration Measures in South Yucca Pens

SCENARIO 1 HYDROPERIODS AND WET SEASON WATER DEPTHS

Scenario 1 and baseline existing conditions simulations were run for the period 2012 – 2021, and the difference between simulation results were analyzed to determine the hydrologic response of the Scenario 1 restoration measures. ***Figure 4*** presents the difference in simulated hydroperiods for the 10-year period between Scenario 1 and the baseline existing conditions models. Significant improvements in hydroperiods are predicted for Scenario 1 in Yucca Pens and areas south and east of the proposed Bond Farm HEI. Minor decreases in wetland hydroperiods are predicted for Scenario 1 in a small area of Babcock Webb northeast of Bond Farm. Hydroperiod increases in Scenario 1 in Yucca Pens generally range from 0.5 to 4 months, with a few small areas with hydroperiod increases of 5 months. The hydroperiod increases are observed upstream of proposed new water control structures (ATV channel blocks, low-water fords, or weirs) in southern Yucca Pens near Gator Slough and in western Yucca Pens. A portion of Prairie Pines Preserve experiences higher hydroperiods due to the Bond Farm discharges in Scenario 1.

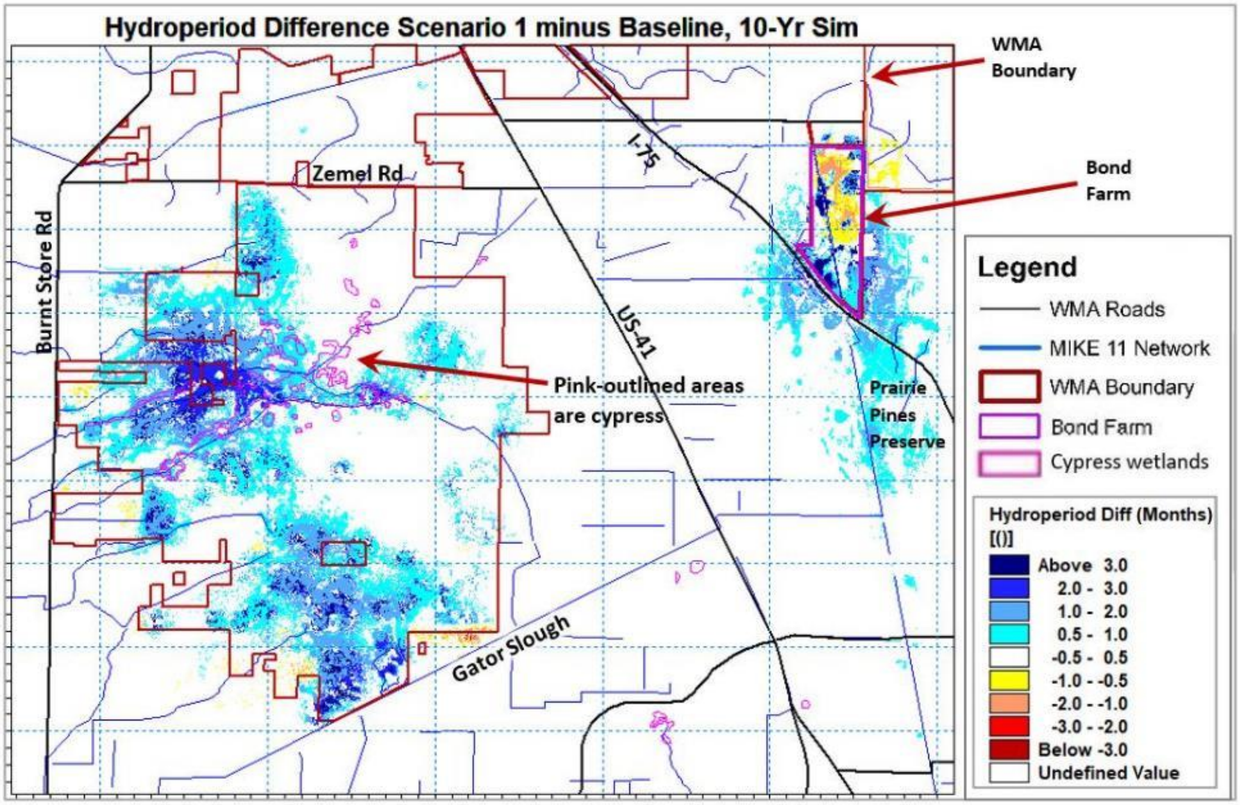

Figure 4. Scenario 1 minus baseline average annual hydroperiod difference at a 50-ft resolution during the period 2012-2021

Figure 5 presents simulated differences between Scenario 1 and baseline existing conditions for average wet season (defined as July 1 – November 30) water levels during the 2012 – 2021 period. Increased wet season average water depths range from 0.1 to 0.5 feet in Scenario 1 in portions of Yucca Pens during the 10-year period. Water levels in the cypress wetlands will be higher during the wet season in Scenario 1 than in the baseline existings conditions model, as shown in ***Figure 6***. Additionally, dry season recession rates will be extended in Scenario 1. Hydroperiods typically do not extend past the end of a calendar year in the cypress wetlands for the baseline existing conditions simulation, while hydroperiods typically extend into the next calendar year for most of the 10 years for Scenario 1.

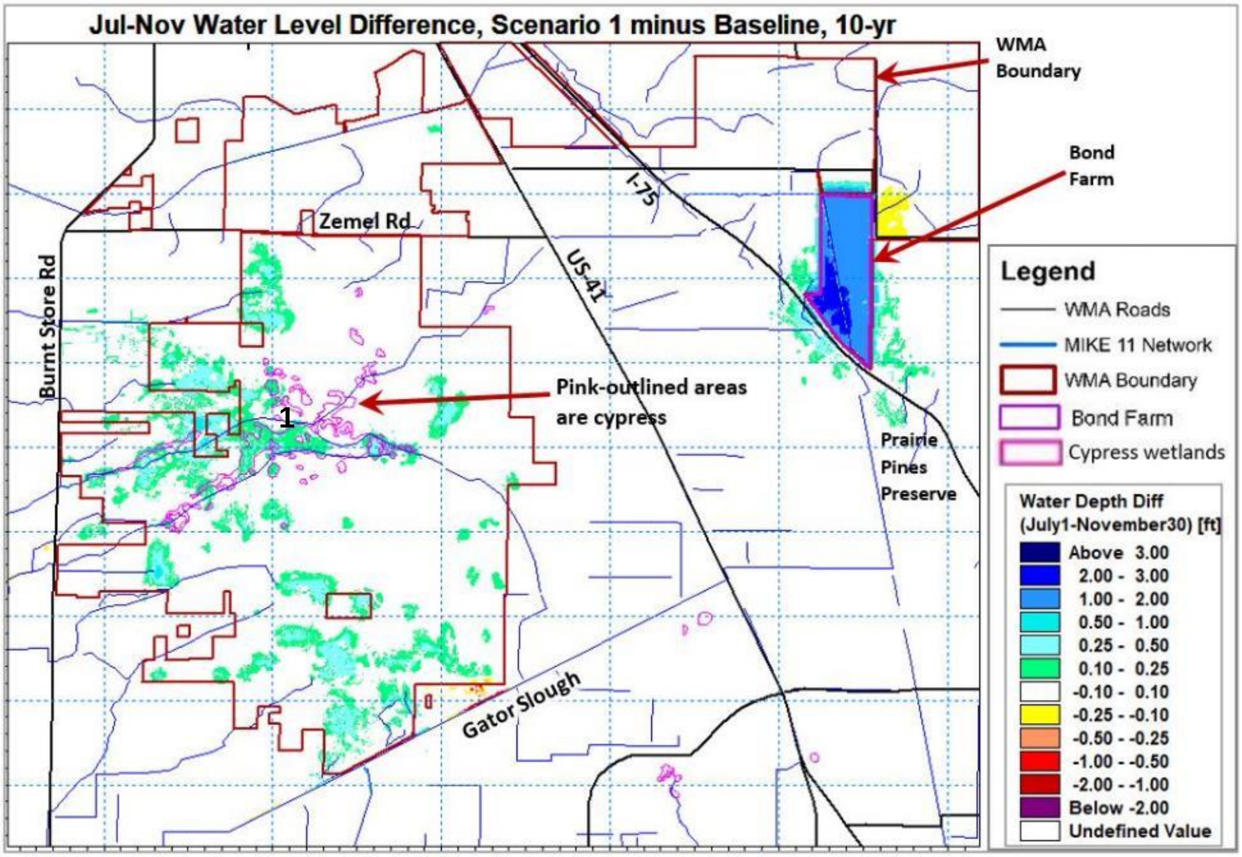

Figure 5. Scenario 1 minus baseline average water depth differences for the wet season (July 1 – November 30) during the period 2012-2020

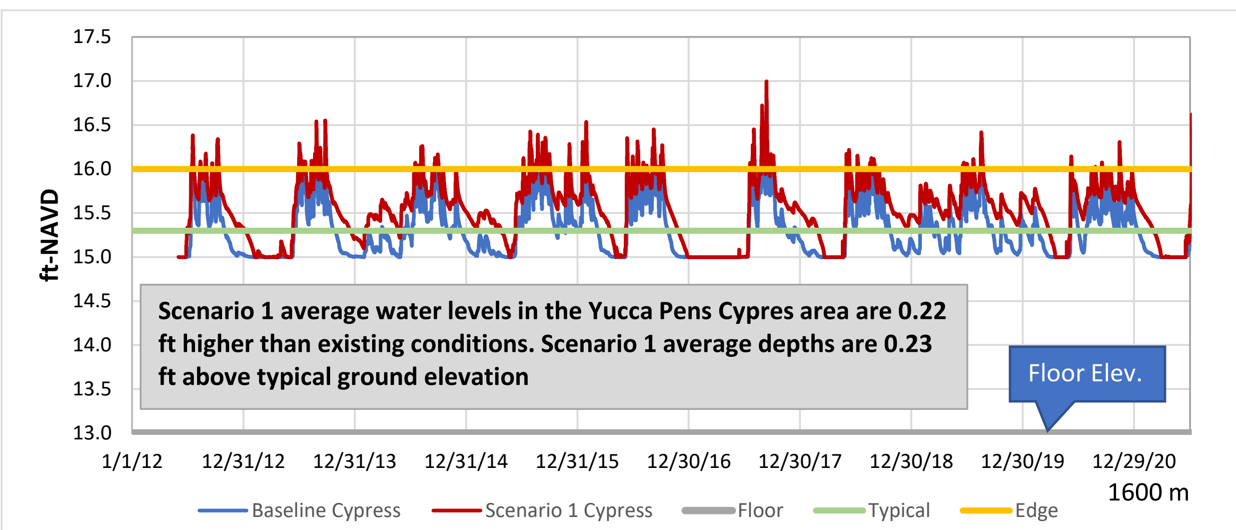

Figure 6. Simulated water levels for Scenario 1 and Existing Conditions (point 1 in Figure 5)

Differences between Scenario 1 and baseline existing conditions for dry season water levels are presented in ***Figure 7***. The greatest changes in water levels in Scenario 1 are predicted in the southern portion of Yucca Pens, with groundwater levels increasing by an average of 1-2 feet during the months of March and April for the 2012 – 2021 period. Scenario 1 indicates increases in groundwater elevations south of Bond Farm during the dry season (March-April) in Prairie Pines Preserve consistent with receiving outflows from Bond Farm.

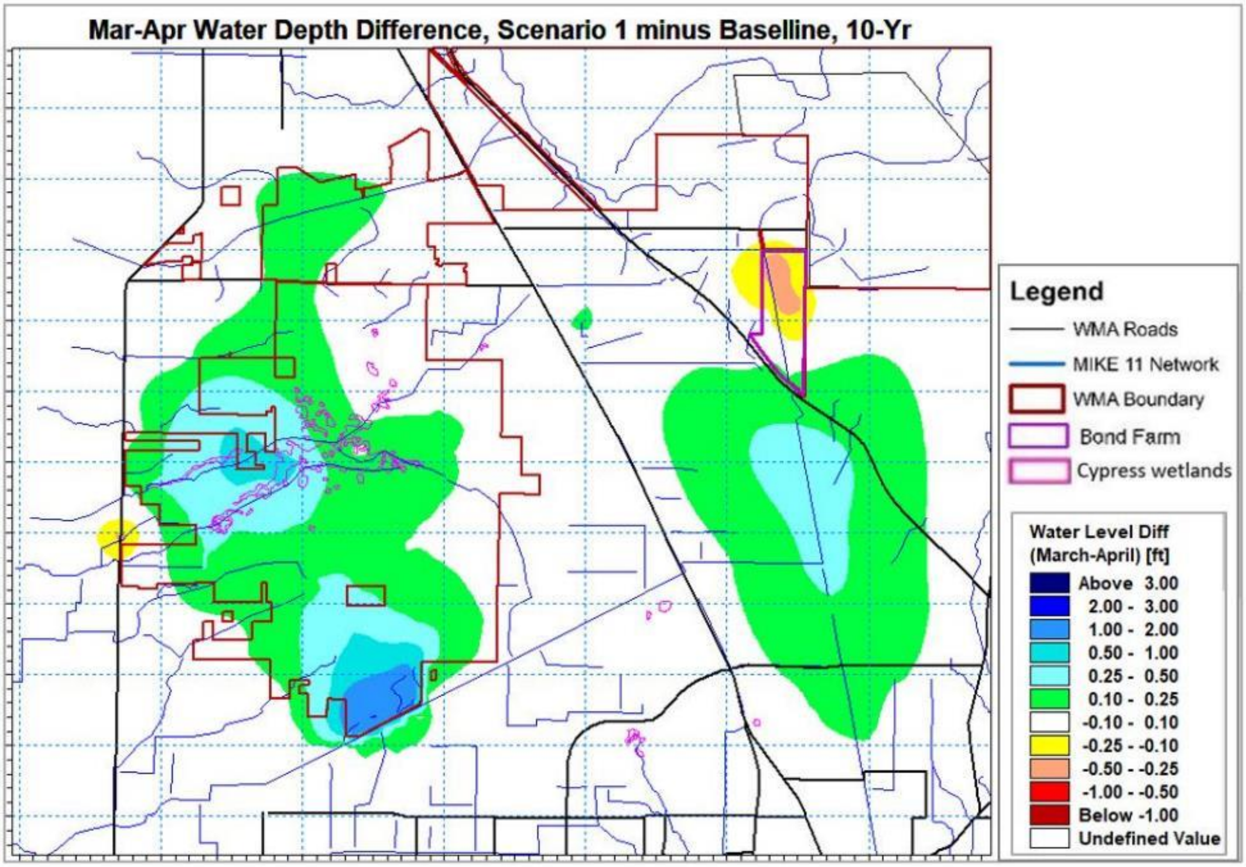

Figure 7. Scenario 1 minus baseline water table level difference during the dry season months of March - April during the period 2012 – 2021

Quantitative acreage summaries of the Scenario 1 changes in Yucca Pens are presented below in ***Table 2***. Although specific quantitative acreage targets were not identified as a project goal, the acreage totals presented below demonstrate the extent of hydrologic restoration. Hydroperiod increases of greater than one month are predicted for 2,554 acres of Yucca Pens in Scenario 1. The difference in water table levels during March and April (end of dry season) are predicted to exceed 1 foot over 410 acres and to exceed 0.25 feet for 4,672 acres. SWIA hydroperiods decreased by 0.35 months for 121 acres and by 0.66 months for 42 acres. Additional storage will be needed to accomplish hydrologic restoration in Babcock Webb and will be explored further as part of the Scenario 2 analysis.

Table 2. Summary of Scenario 1 Hydroperiod and March – April Water Level Improvements in Yucca Pens

Hydroperiod Difference	Area, ac.	Avg months
> 2 months	726	2.86
1 - 2 months	1,828	1.38
0.5 - 1 months	2,601	0.72
0.25 - 0.5 months	2,333	0.36
Water Level Difference	**Area, ac.**	**Avg, ft**
> 1.5 ft	131	1.66
1 - 1.5 ft	279	1.24
0.5 - 1 ft	838	0.65
0.25 - 0.5 ft	3,424	0.32
0.1 - 0.25 ft	8,422	0.16

Water levels in Yucca Pens Creek (SR-8) and Durden Creek (SR-9) are predicted to increase as a result of the Scenario 1 restoration measures, as shown below in ***Figure 8*** and ***Figure 9***, respectively. SR-8 and SR-9 are locations 5 and 12 in ***Figure 3***, respectively. Simulated combined flows at Burnt Store Road for Greenwell Branch, Durden Creek, Yucca Pens Creek, and Hog Branch are presented in ***Figure 10***. In general, peak flows are reduced, and the recession limb of each rain or storm event has been extended due to the restoration measures in Scenario 1. The reductions in peak flow and the changes to the recession limb are shown more clearly in expanded graphs for 2017 and 2018 in ***Figure 11*** and ***Figure 12***, respectively. Locations of the Burnt Store Road stations are presented in ***Figure 13***. The median reduction in peak flows for 74 rain or storm events over the 10-year period was 16% (25th percentile = 8%, 75th percentile = 22%). Additional plots of Scenario 1 versus the baseline existing conditions simulations are presented in **Appendix B**.

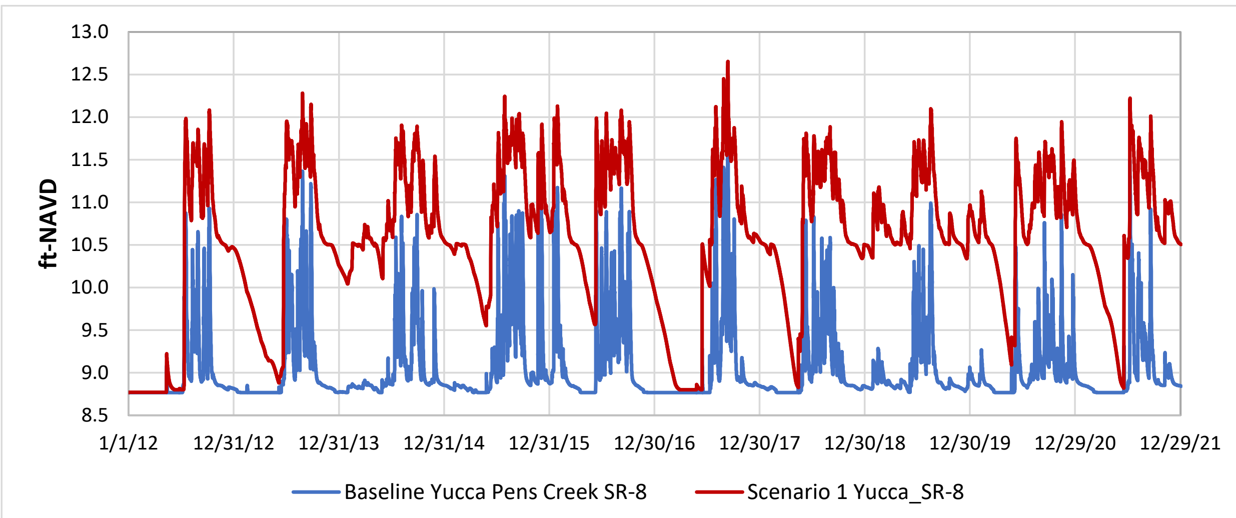

Figure 8. Simulated water levels in Yucca Pens Creek at SR-9 for Scenario 1 and Existing Conditions

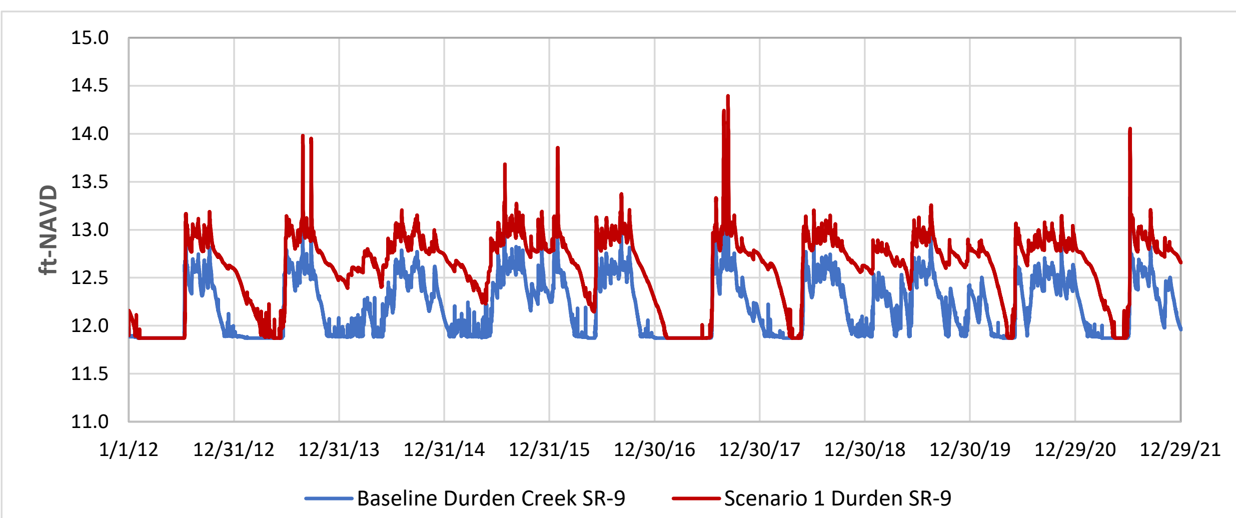

Figure 9. Simulated water levels in Durden Creek at SR-8 for Scenario 1 and Existing Conditions

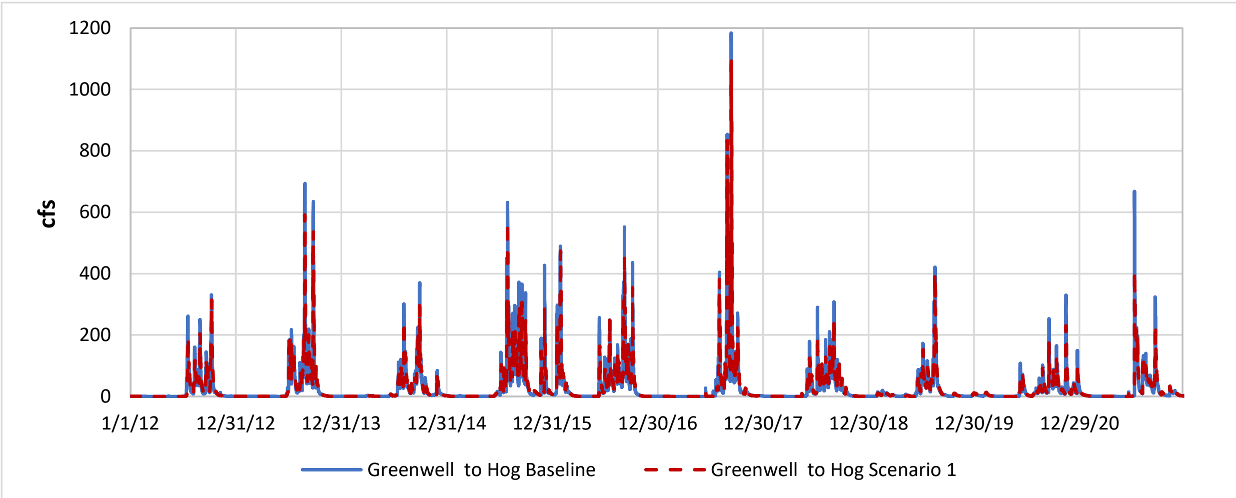

Figure 10. Simulated flows under Burnt Store Road for Greenwell Branch, Durden Creek, Yucca Pens Creek, and Hog Branch for Scenario 1 and Existing Conditions

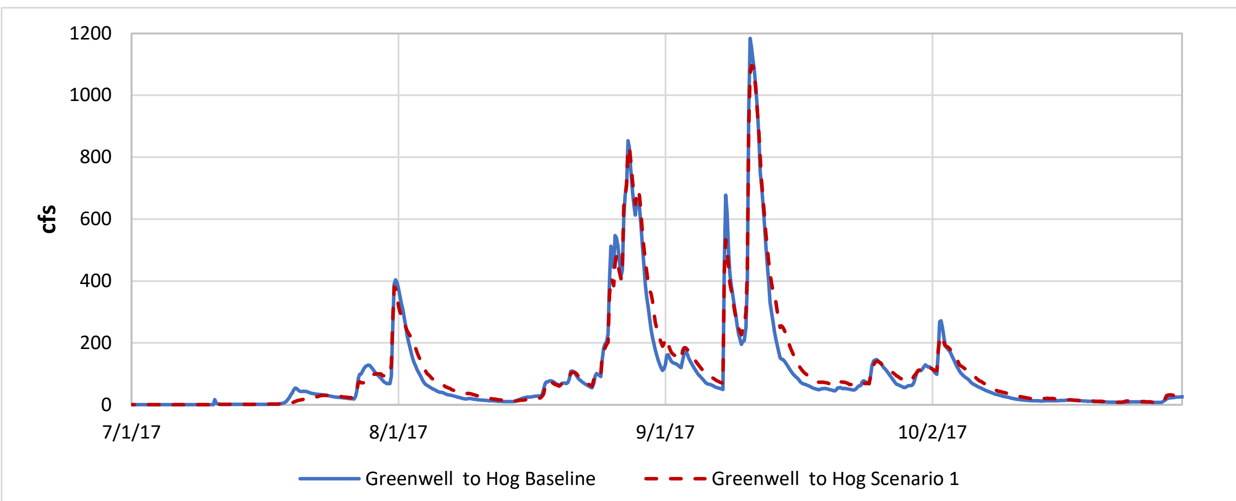

Figure 11. Simulated 2017 flows at Burnt Store Road for Greenwell Branch, Durden Creek, Yucca Pens Creek, and Hog Branch

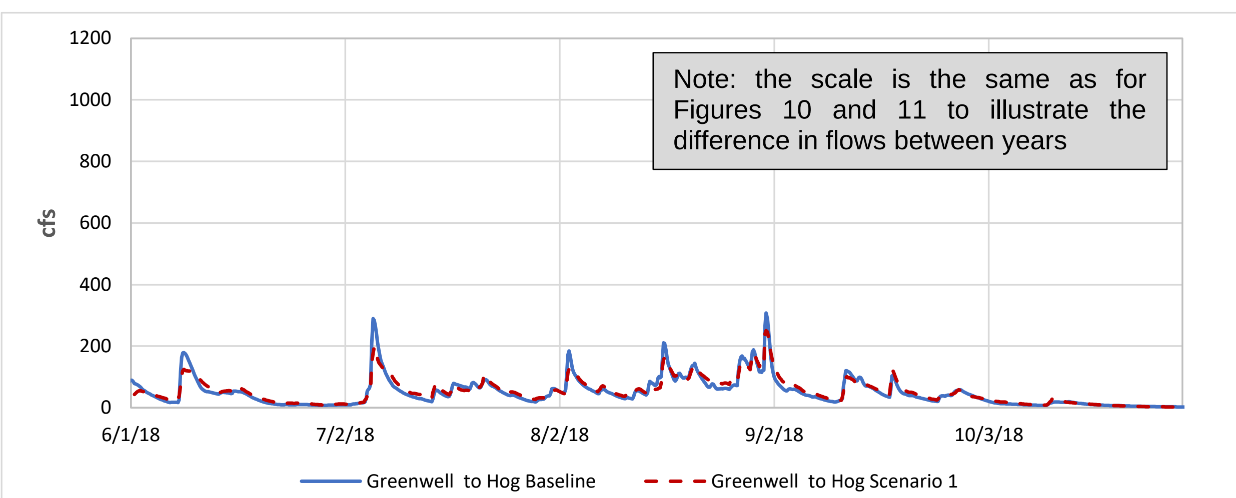

Figure 12. Simulated 2018 flows at Burnt Store Road for Greenwell Branch, Durden Creek, Yucca Pens Creek, and Hog Branch

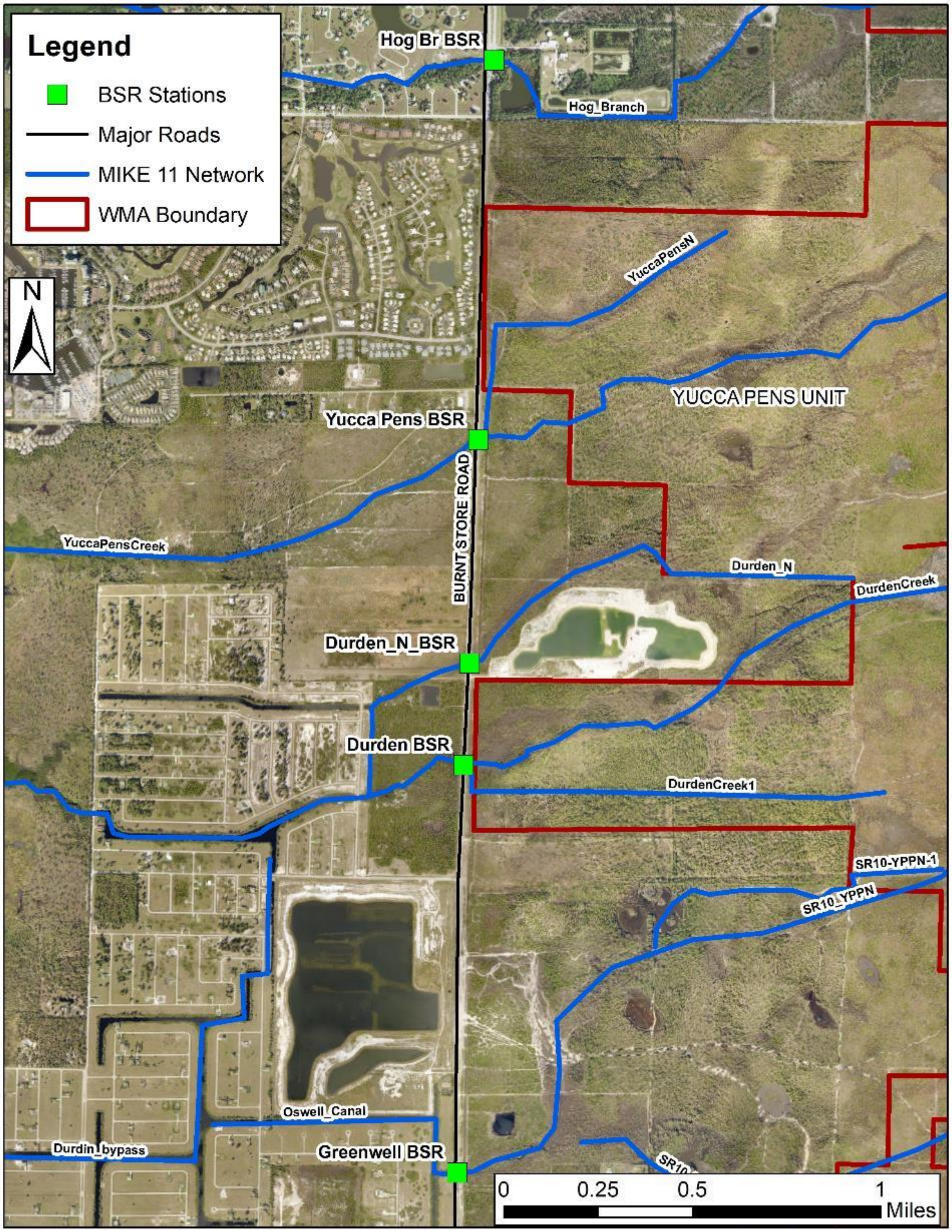

Figure 13. Greenwell Branch, Durden Creek, Yucca Pens Creek, and Hog Branch at Burnt Store Road

HISTOGRAM ANALYSIS OF SCENARIO 1 HYDROPERIODS

The natural systems analysis presented in TM 6A compared the baseline existing conditions simulated hydroperiods and average wet season water depths to the optimum conditions expected under pre-development conditions and were referred to as the natural system. The natural systems analysis was a GIS exercise. An explanation for the rationale for that approach can be found in TM 6a (WSA & CHNEP, 2022a). The natural systems analysis results were presented as a series of histograms for Areas of Interest (AOIs) within Babcock Webb and Yucca Pens. The AOI boundary was developed by the modelers to encompass all natural areas, both within and outside of FWC WMA, which may be impacted by the proposed changes. The FWC WMA has an irregular boundary due to private land inholdings. These private parcels are experiencing changes in hydrology due to changes made in the WMA. Therefore, modelers included these areas that are impacted by those changes.

To evaluate the performance of Scenario 1, simulated Scenario 1 results were compared to the baseline existing condition results for mapped soil units assigned to Hydrologic Ranks 3 and 4 (see REF and TMs 3a and 6a). These units represent historical wetlands that now experience reduced hydroperiods and water levels. Comparisons are presented for Yucca Pens Cypress and ATV AOIs for Hydro Rank levels 3 and 4 in **Figure 6-18** histograms.

In order to evaluate the performance of Scenario 1, simulated Scenario 1 results were compared to the baseline existing condition results for Hydro Ranks 3 and 4, which are the wetter two conditions considered in the TM6a natural systems model. Comparisons are presented for Babcock Webb South Walk-In Reduced for Hydro Ranks 3 and 4 in ***Figure 14*** and ***Figure 15***. Comparisons are presented for Yucca Pens Cypress for Hydro Ranks 3 and 4 in ***Figure 16*** *and* ***Figure 17***. The Yucca Pens Cypress area is the pink-outlined area shown in ***Figure 7***. Comparisons are presented for the Yucca Pens ATV AOI for Hydro Ranks 3 and 4 in ***Figure 18 and Figure 19***.

Babcock Webb South Walk-In Area Reduced AOI. Scenario 1 simulated hydroperiods for the Babcock Webb South Walk-In Area Reduced did not change substantially when compared to the baseline existing conditions. The most common peak hydroperiod values for both baseline existing conditions and Scenario 1 simulations were 10.8 months for Hydro Rank 3 and 11.5 months for Hydro Rank 4.

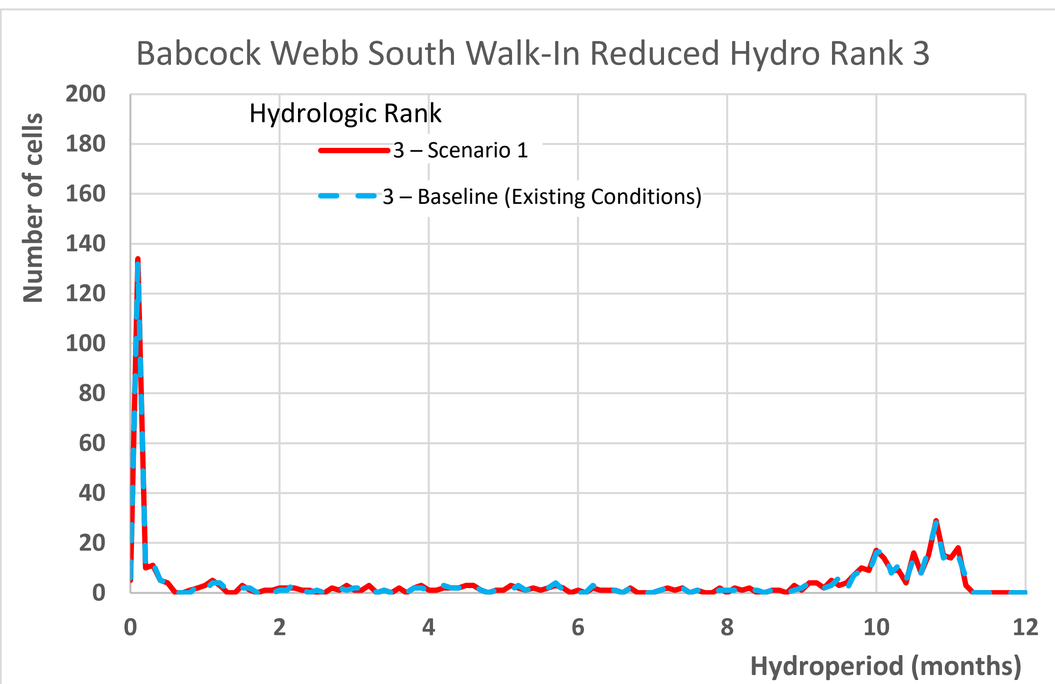

Figure 14. Hydroperiods for Babcock Webb South Walk-In Reduced Hydro Rank 3

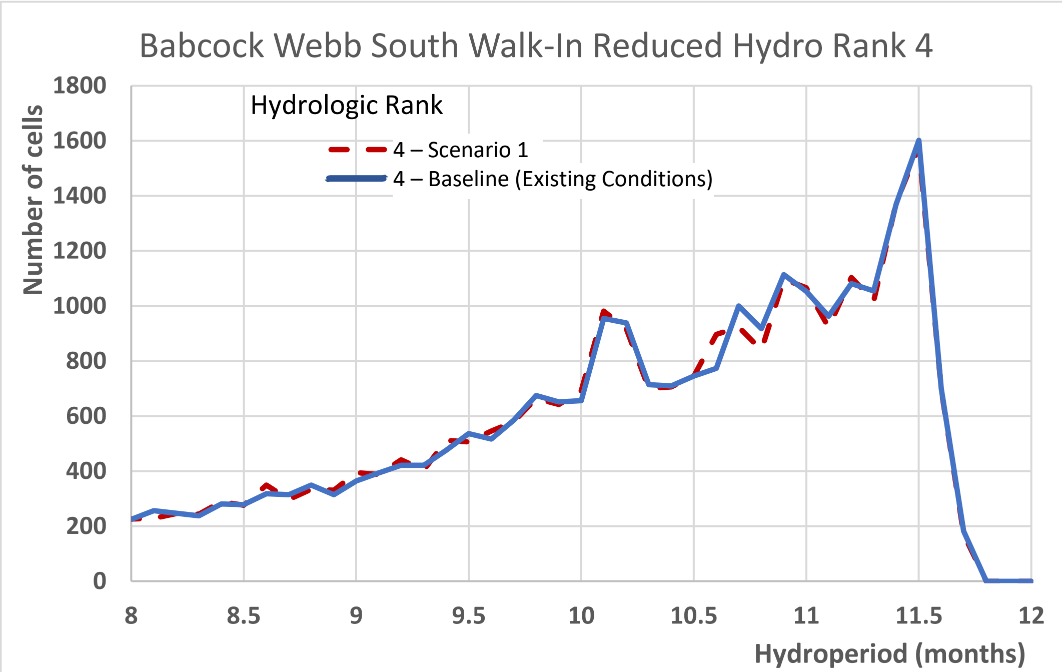

Figure 15. Hydroperiods for Babcock Webb South Walk-In Reduced Hydro Rank 4

Yucca Pens Cypress AOI. This AOI refers **ONLY** to Cypress wetlands in Yucca Pens (Cypress AOI is shown in pink in ***Figure 7***). The most common hydroperiod for Hydro Rank 3 in the baseline existing conditions scenario in Yucca Pens Cypress was approximately 5.5 months, while Scenario 1 hydroperiods were more broadly distributed with peaks at 5.6 months and 7.7 months. The scenario histogram shows decreased area with hydroperiods between 3 and 5.5 months and an increased area of hydroperiods between 7 and 10 months. The optimum hydroperiod for cypress in hydro rank 3 should be 2 to 6 months. This means that the hydroperiod range in this AOI is now closer to optimum conditions for these cypress wetlands. The most common hydroperiod for Hydro Rank 4 in the baseline existing conditions scenario in Yucca Pens Cypress was approximately 5.9 months, which increased in Scenario 1 and was more broadly distributed with peaks at 8.9 and 10.8 months. The scenario histogram shows decreased area with hydroperiods under 6 months and an increase increased area of hydroperiods between 7 and 12 months. The optimum hydroperiod for cypress in hydro rank 4 should be 6 to 10 months. This means that the hydroperiod range in this AOI is now closer to optimum conditions for these cypress wetlands.

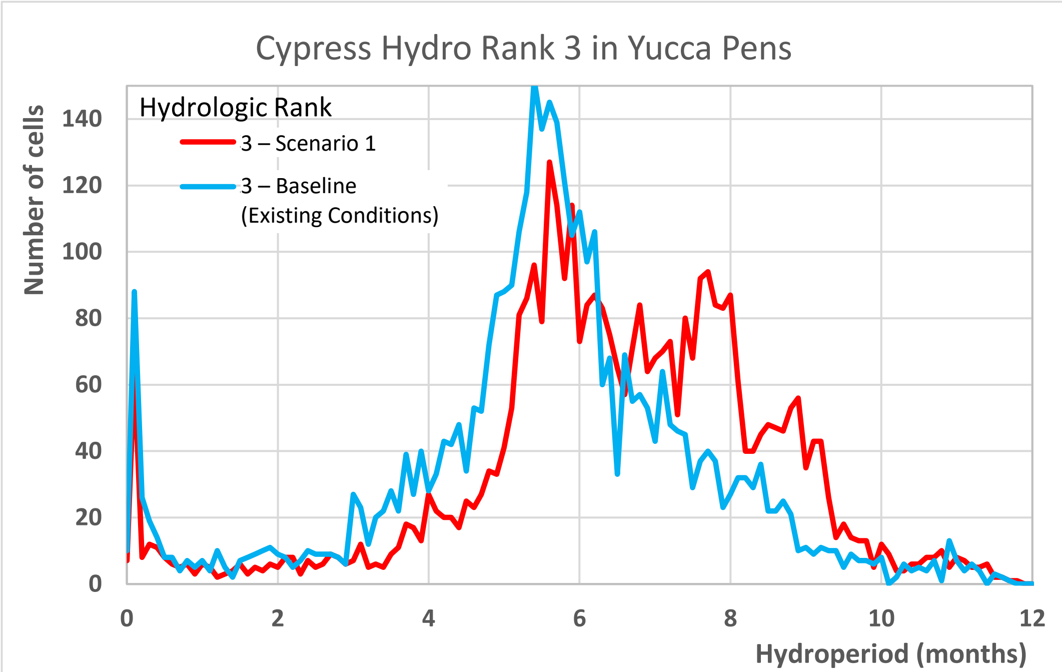

Figure 16. Hydroperiods for Yucca Pens Cypress Hydro Rank 3

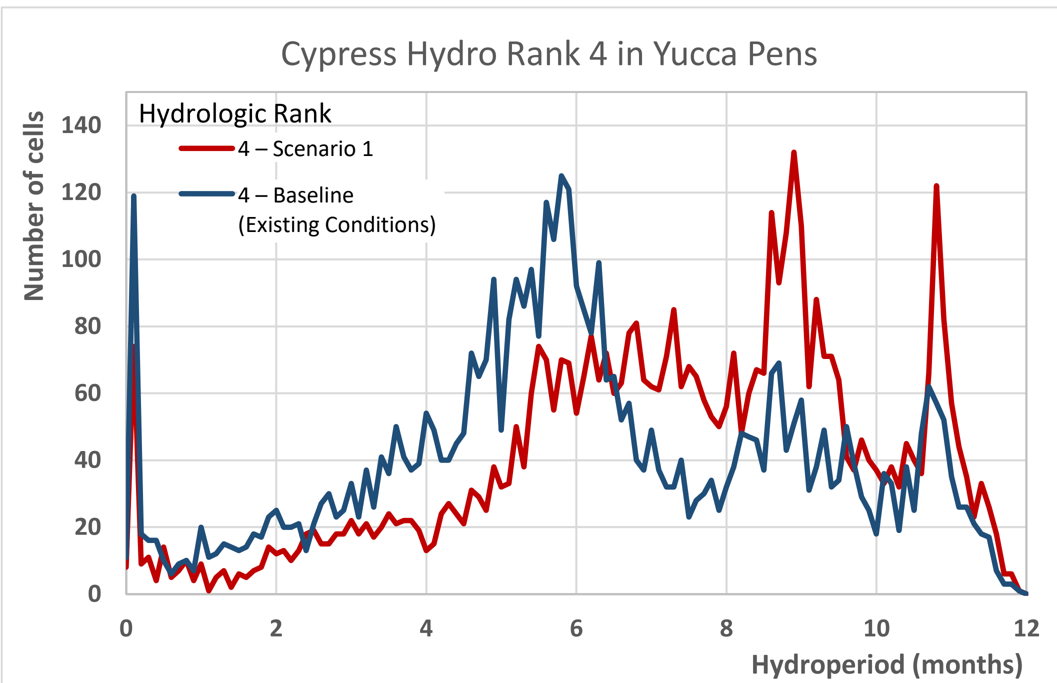

Figure 17. Hydroperiods for Yucca Pens Cypress Hydro Rank 4

Yucca Pens ATV AOI. The most common hydroperiod for Hydro Rank 3 in the baseline existing conditions scenario in the Yucca Pens ATV area was approximately 4.5 months, while the distribution of hydroperiods for Scenario 1 increased to 6.3 months. The most common hydroperiods for Hydro Rank 4 in the baseline existing conditions scenario in the Yucca Pens ATV area were at 3.9 and 5.7 months, while the most common hydroperiods for Hydro Rank 4 in Scenario 1 increased to 4.9 months and exhibited a broader distribution with a secondary peak at 8 months.

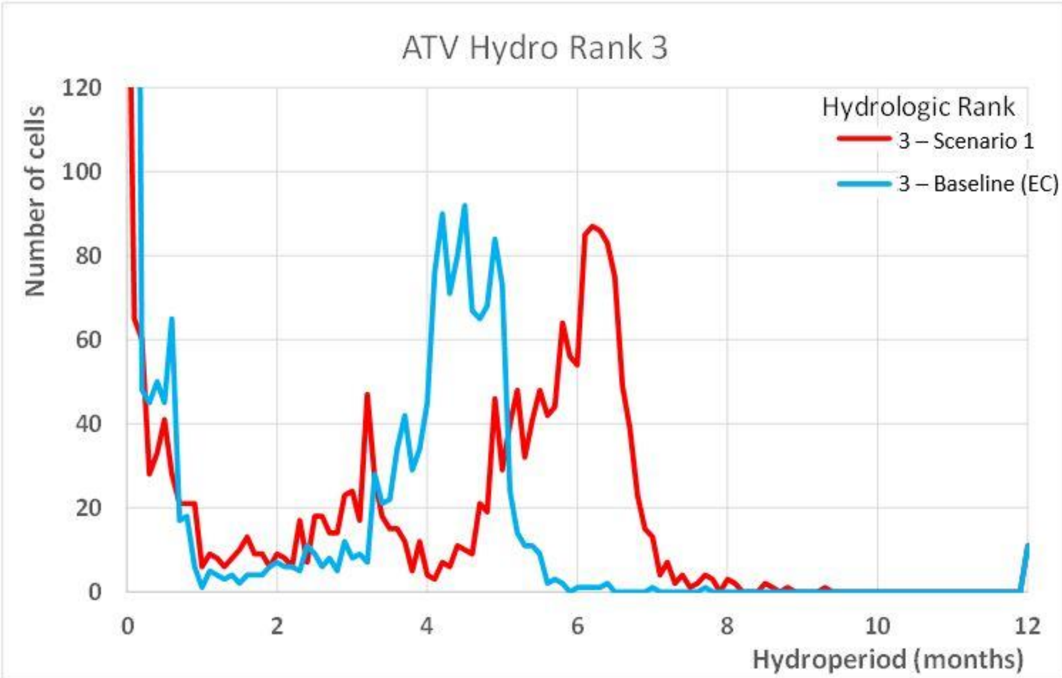

Figure 18. Hydroperiods for Yucca Pens ATV Area, Hydro Rank 3

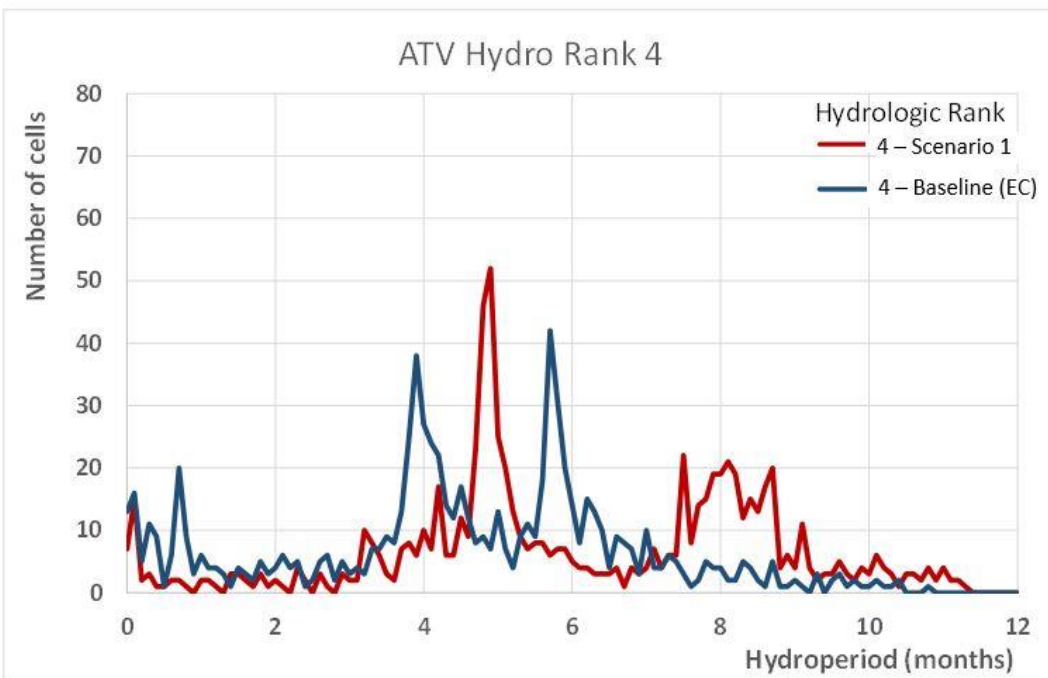

Figure 19. Hydroperiods for Yucca Pens ATV Area, Hydro Rank 4

Overall Findings of Histogram Analysis. The histogram analysis findings are consistent with the hydroperiod and water level difference maps (see ***Figures 4-7*** and the quantitative analysis of areal changes presented in ***Table 2***). Hydroperiod and water level improvements are predicted for Yucca Pens and slight improvements are predicted for Babcock Webb in Scenario 1.

SIMULATED PERFORMANCE FOR BOND FARM HEI

The Bond Farm HEI was programmed in Scenario 1 to store water pumped from the southwestern portion of Babcock Webb WMA during the wet season and to release water during the dry season. The initial conceptual restoration plan developed in 2014 (ADA, 2014) included a proposed flow-way from Bond Farm west to Yucca Pens with the intention that outflows would be released during the early part of the dry season (December and January) to extend hydroperiods in Yucca Pens. Scenario 1 did not include flow deliveries from Bond Farm to Yucca Pens so that Scenario 1 could clearly identify the hydroperiod benefits from reducing over-drainage of Yucca Pens via eroded ATV trails. In addition, securing property easements or purchasing a flow-way west of U.S. 41 was expected to be difficult. Therefore, Scenario 1 was designed to evaluate the positive and negative impacts of discharging water south under I-75 towards Prairie Pines Preserve (location shown in ***Figure 1***). Since a portion of the water discharged from Bond Farm HEI to the south ultimately would flow during the early dry season towards the Caloosahatchee River estuary via Powell Creek, these flows could have a beneficial impact on restoration of the salinity regime in the Caloosahatchee estuary (Barnes et al., 2006).

The Scenario 1 simulated inflows and outflows for Bond Farm during the period of 2012 – 2021 are summarized below in ***Table 3*** and in ***Figure 20***. Outflows are less than 50% of inflows for the original calibrated model (assumed lower water table hydraulic conductivity in Bond Farm only). The majority of the losses (i.e., difference between inflows and outflows) are due to groundwater seepage. ***Table 3*** also presents results for a sensitivity analysis with water table horizontal hydraulic conductivities around Bond Farm capped at 297 ft/day (see **Appendix C** for discussion of Scenario 1 analysis using the Reduced Hydraulic Conductivity sensitivity test). That sensitivity test indicates lower overall losses to groundwater. Simulated outflows in year 2013 were 81% of simulated inflows for the reduced hydraulic conductivity simulation. Appendix C provides future recommendations for additional modeling and survey work to address this issue.

Table 3. Simulated annual inflows and outflows from Bond Farm HEI

	Final Calibration		Reduced Hydraulic Conductivity	
Period	**Inflow, Ac-ft**	**Outflow, Ac-ft**	**Inflow, Ac-ft**	**Outflow, Ac-ft**
10-yr Avg	4,080	1,528	2,842	1,877
Year 2013	3,675	1,313	2,183	1,762

Note: final calibration model described in TM 5c (WSA & CHNEP, 2022b). Reduced hydraulic conductivity sensitivity tests changed any horizontal hydraulic conductivity values greater than 297 ft/day to 297 ft/day.

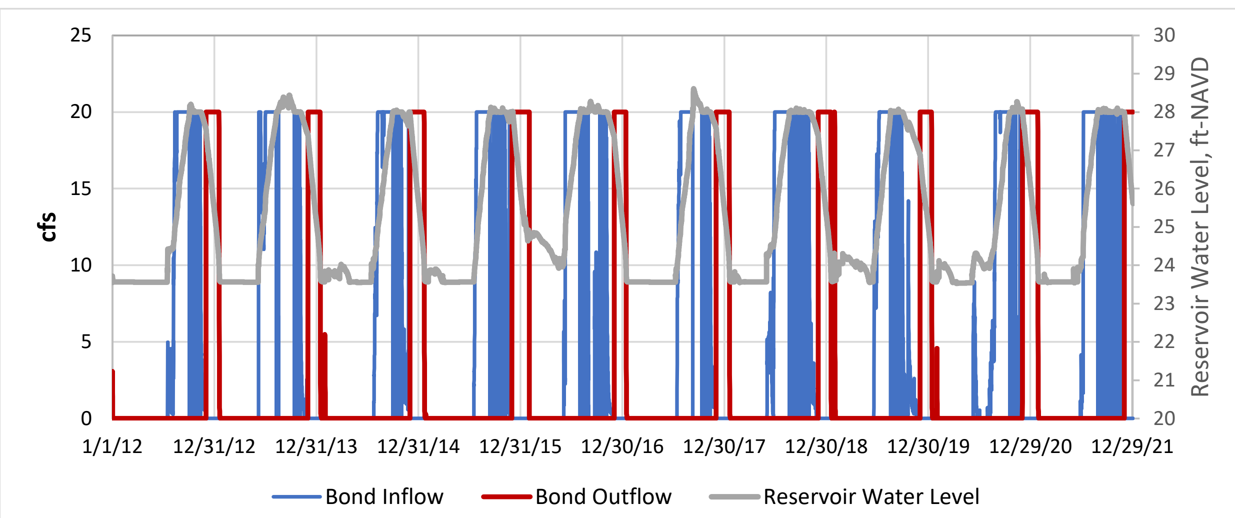

Figure 20. Simulated inflows, outflows, and water levels in Bond Farm HEI (Original Calibration)

Flows from Yucca Pens area tidal creeks under Burnt Store Road (Greenwell Branch, Durden Creek, Yucca Pens Creek, and Hog Branch) for Scenario 1 are less than they are for the baseline condition scenario, and the recession limb of the flow after each storm event has been extended due to the restoration measures. One example of this is the ATV ditch blocks which slow flow out of Yucca Pens wetland areas and help retain water. This indicates reduced flashiness in streams and more consistent flow. The median reduction in peak flows for 74 rain or storm events over the 10-year period was 16% (25th percentile = 8%, 75th percentile = 22%). Scenario 1 combined flow discharges under Burnt Store Road from Greenwell Branch to Hog Branch also showed that slowing of water leaving Yucca Pens did not reduce flows during the early dry season period of November 1 through January 31.

SUMMARY OF SCENARIO 1 RESULTS

Scenario 1 assumed that the Bond Farm Hydrological Enhancement Impoundment (HEI) would be used to store water up to a depth of 4 feet with water discharged south through Prairie Pines Preserve only during the early dry season. Scenario 1 also assumed addition of 26 weir-structures in Yucca Pens to increase on-site detention in the historic wetlands of Yucca Pens. Such structures will include, but not be limited to, ditch blocks in eroded ATV trails, low water fords, and constructed weirs. The design details at each of the proposed weir locations will be determined during subsequent design studies. Scenario 1 also includes a seepage barrier along the southern portion of Yucca Pens just north of Gator Slough. At this point, it is anticipated that this seepage barrier will not be a complete barrier to groundwater flow, but it will reduce seepage rates to the degree that hydroperiods are increased in Yucca Pens wetlands north of Gator Slough.

The Scenario 1 analysis indicated that some slight improvements to hydroperiods and water depths in the Babcock Webb South Walk-In Area northeast of Bond Farm. This finding is substantiated by the hydroperiod difference map shown in ***Figure 4***, the wet season water depth difference map in ***Figure 5***, the quantitative analysis presented in ***Table 2***, and the histogram analysis presented in ***Figure 14*** and ***Figure 15***. Additional storage will be needed to accomplish this restoration goal, which will be explored further as part of the Scenario 2 analysis.

Yucca Pens hydroperiods and dry season water table levels will increase as a result of the proposed restoration measures in Scenario 1 described above. Hydroperiod increases of greater than one month are predicted for 2,568 acres of Yucca Pens. Water table levels in March and April are predicted to be greater than one foot for 411 acres, and water depths are predicted to increase by more than 0.25 feet for 4,229 acres. Histogram analysis predicted hydroperiod improvements in the Yucca Pens Cypress and ATV areas (see ***Figures 16 – 19***).

Flows from Yucca Pens tidal creeks under Burnt Store Road (Greenwell Branch, Durden Creek, Yucca Pens Creek, and Hog Branch) for Scenario 1 are less than the flow for the baseline condition scenario, and the recession limb of the flow after each rain or storm event has been extended due to the restoration measures.

Bond Farm HEI is filled to capacity in all 10 years of the long-term simulations conducted for this Task. Outflows are less than 50% of inflows for the original calibrated model (assumed lower water table hydraulic conductivity in Bond Farm only). The majority of the losses (i.e., difference between inflows and outflows) are due to groundwater seepage. A second long-term simulation was run using lower hydraulic conductivities, which predicts higher outflow rates, 66% of inflows.

RECOMMENDATIONS

The Scenario 1 analysis was intended by CHFI partners to address key questions: Is Bond Farm HEI sufficient to restore Babcock Webb hydrology? Can reducing discharges from Yucca Pens eroded ATV trails restore Yucca Pens hydrology to desired levels? Scenario 1 results were then intended to provide guidance on what components should be part of Scenario 2 to address the unresolved key questions. This analysis indicates that additional off-line storage of wet season flows from Babcock Webb is needed beyond Bond Farm HEI. This analysis also indicates that the ATV channel blocks, low-water fords, weirs, and the seepage barrier, provided significant improvements, however, additional measures are needed to restore natural hydrology in Yucca Pens. Thus, Scenario 2 should consider routing Bond Farm HEI outflows west to Yucca Pens.

The analysis also suggests that Bond Farm HEI discharges south to Prairie Pines Preserve will result in higher dry season (March – April) water levels. Prairie Pines Preserve could benefit from higher water levels in March – April. Water would only leave Bond Farm during the dry season when freshwater flows would be beneficial to these areas.

The Scenario 1 analysis also indicates relatively high seepage losses from the Bond Farm HEI, and seepage losses were lower in a simulation using lower hydraulic conductivities. Additional studies are therefore recommended to quantify groundwater seepage rates. These studies should include groundwater seepage field investigations and re-calibration of the model utilizing the results of those field investigations and the extended time period of measured water levels provided by an on-going hydrologic monitoring project underway by FWC. In addition, further studies are recommended to evaluate groundwater seepage in south Yucca Pens to provide a foundation for design of a grout curtain to reduce seepage.

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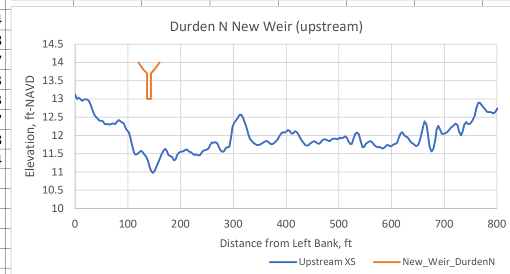
Appendix A

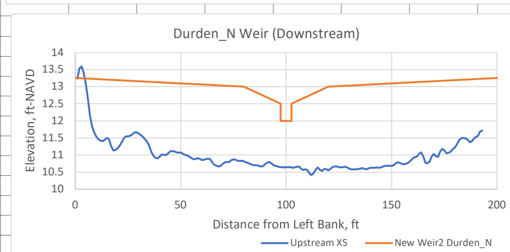
Additional Information of Proposed Weirs

CH-NCRB_20220320_BL_scenario_1							Separated_Overland_Areas_20211117r_ATV_alt1.dfs2			
Branch	Name	chainage	Notes	Level	Width		Adj Statior	Station	Elevation	
SR-7_South	SR-7_S_NewWeir	1050		0	10		450	0	18.2	
	Invert		17.5	0.5	10		500	50	18.1	
				0.6	100		570	120	18	
				0.7	250		570	120	17.5	
							580	130	17.5	
							580	130	18	
							600	150	18.1	
							700	250	18.2	

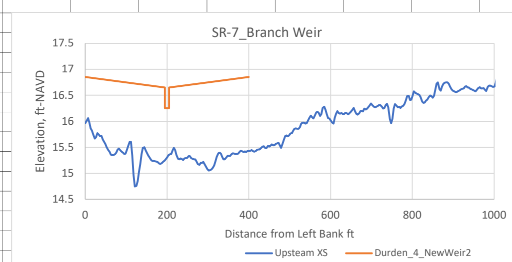
Durden_N	New_Weir_DurdenN	100		Level	Width		120	0	14
				13	7		130	10	13.8
				13.7	7		136.5	16.5	13.7
				13.8	20		136.5	16.5	13
				14	40		143.5	23.5	13
							143.5	23.5	13.7
							150	30	13.8
							160	40	14



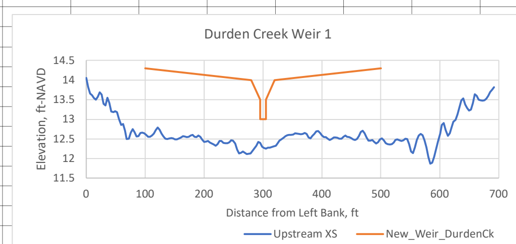
Durden_N	New Weir2 Durden_N			Level	Width			0	13.25
			12	0	5			80	13
				0.5	5			97.5	12.5
				1	40			97.5	12
				1.25	200			102.5	12
								102.5	12.5
								120	13
								200	13.25



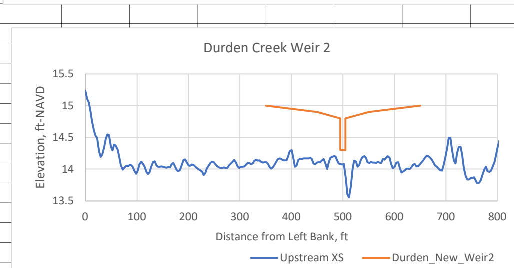
SR-7_Branch	Durden_4_NewWeir2	1440		Level	Width			Station	Elevation
			16.25	0	10			0	16.85
				0.4	10			100	16.75
				0.5	100			195	16.65
				0.6	400			195	16.25
								205	16.25
								205	16.65
								300	16.75
								400	16.85



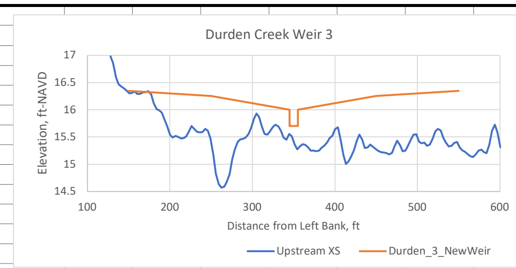
DurdenCreek	New_Weir_DurdenCk	4700		Level	Width		Adj Statior	Station	Elevation
	Invert			13	10		100	0	14.3
				13.5	10		280	180	14
				14	40		295	195	13.5
				14.3	400		295	195	13
							305	205	13
							305	205	13.5
							320	220	14
							500	400	14.3



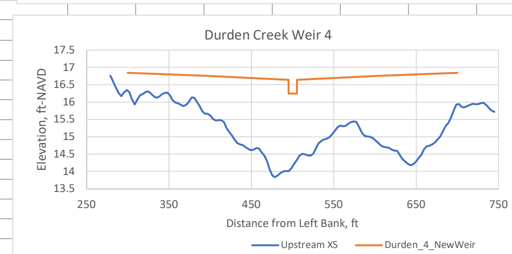
DurdenCreek	Durden_New_Weir2	3720		Level	Width		Adj Statior	Station	Elevation
	Invert		14.3	0	10		350	0	15
				0.5	10		450	100	14.9
				0.6	100		495	145	14.8
				0.7	300		495	145	14.3
							505	155	14.3
							505	155	14.8
							550	200	14.9
							650	300	15



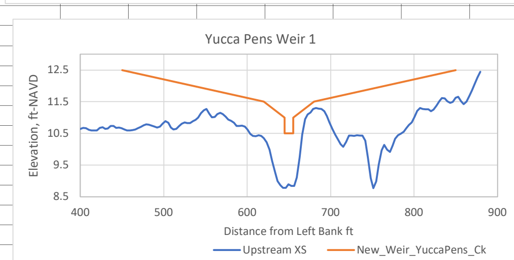
DurdenCreek	Durden_3_NewWeir	2850							
			15.7	**Level**	**Width**		Adj Statior	Station	Elevation
				0	10		150	0	16.35
				0.3	10.1		250	100	16.25
				0.55	100		345	195	16
				0.65	400		345	195	15.7
							355	205	15.7
							355	205	16
							450	300	16.25
							550	400	16.35



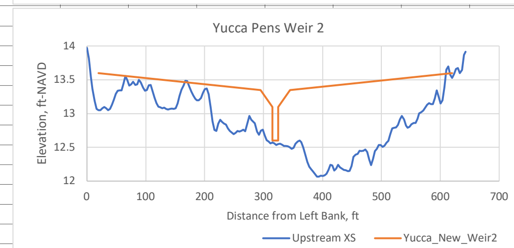
DurdenCreek	Durden_4_NewWeir	330	16.25	**Level**	**Width**		300	0	16.85
				0	10		400	100	16.75
				0.4	10.1		495	195	16.65
				0.5	100		495	195	16.25
				0.6	400		505	205	16.25
							505	205	16.65
							600	300	16.75
							700	400	16.85



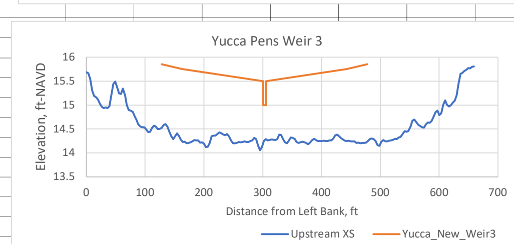
YuccaPensCreek	New_Weir_YuccaPens_	10000		**Level**	**Width**		Adj Statior	Station	Elevation
				10.5	10		450	0	12.5
				11	10		620	170	11.5
				11.5	60		645	195	11
				12.5	400		645	195	10.5
							655	205	10.5
							655	205	11
							680	230	11.5
							850	400	12.5



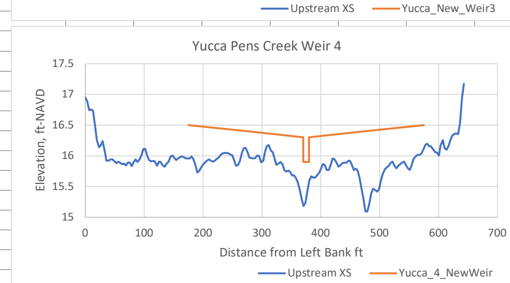
YuccaPensCreek	Yucca_New_Weir2	9090		**Level**	**Width**		Adj Statior	Station	Elevation
	Invert		12.6	0	10		20	0	13.6
				0.5	10.1		295	275	13.35
				0.75	50		315	295	13.1
				1	600		315	295	12.6
							325	305	12.6
							325	305	13.1
							345	325	13.35
							620	600	13.6



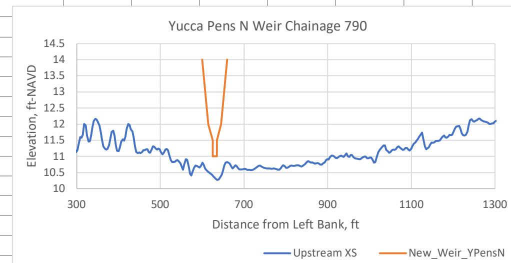
YuccaPensCreek	Yucca_New_Weir3	7850		**Level**	**Width**		Adj Statior	Station	Elevation
	Invert		15	0	5		128	0	15.85
				0.5	5		163	35	15.75
				0.75	70		300.5	172.5	15.5
				0.85	350		300.5	172.5	15
							305.5	177.5	15
							305.5	177.5	15.5
							443	315	15.75
							478	350	15.85



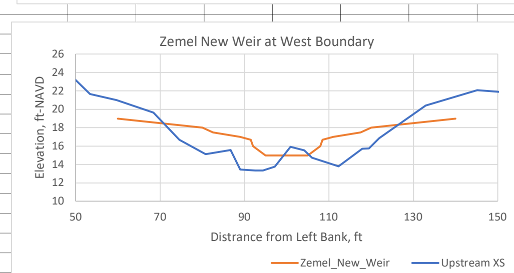
YuccaPensCreek	Yucca_4_NewWeir	5270		**Level**	**Width**		Adj Statior	Station	Elevation
			15.9	0	10		175	0	16.5
				0.4	10.1		275	100	16.4
				0.5	100		370	195	16.3
				0.6	400		370	195	15.9
							380	205	15.9
							380	205	16.3
							475	300	16.4
							575	400	16.5



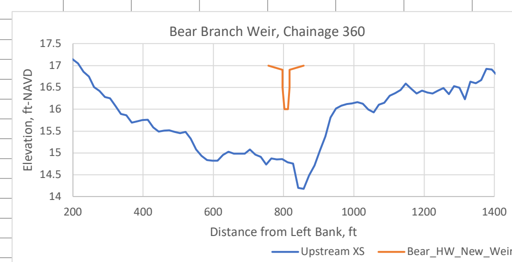
						Adj Station	Station	Elevation
YuccaPensN	New_Weir_YPensN	790		Level	Width	600	0	14
				11	10	615	15	12
				11.5	10	625	25	11.5
				12	20	625	25	11
				14	30	635	35	11
				14.5	60	635	35	11.5
						645	45	12
						660	60	14



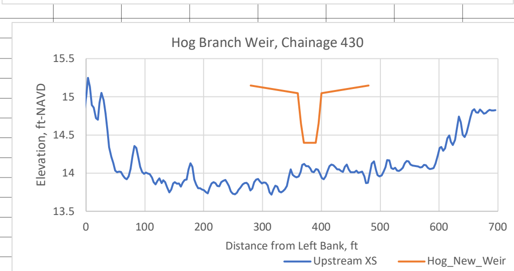
						offset	Station	Elevation
Zemel	Zemel_New_Weir	6700		Level	Width	60	0	19
			15	0	10	80	20	18
				1	16	82.5	22.5	17.5
				1.7	17	89	29	17
				2	22	91.5	31.5	16.7
				2.5	35	92	32	16
				3	40	95	35	15
				4	80	105	45	15
						108	48	16
						108.5	48.5	16.7
						111	51	17
						117.5	57.5	17.5
						120	60	18
						140	80	19



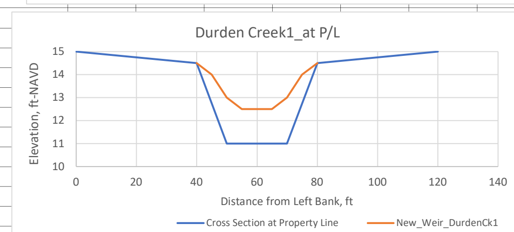
Bear Branch	Bear_HW_New_Weir	360		Level	Width	Offset	Station	Elevation
			16	0	10	757	0	17
				0.5	20	797	40	16.9
				0.9	20	797	40	16.5
				1	100	802	45	16
						812	55	16
						817	60	16.5
						817	60	16.9
						857	100	17



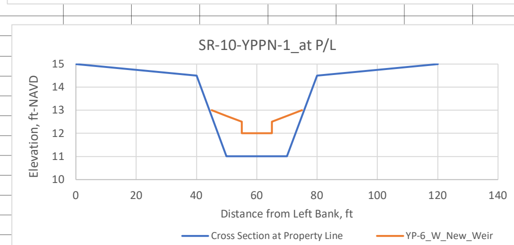
Hog Branch	Hog_New_Weir	430		Level	Width	Offset	Station	Elevation
			14.4	0	20	280	0	15.15
				0.25	30	360	80	15.05
				0.65	40	365	85	14.65
				0.75	200	370	90	14.4
						390	110	14.4
						395	115	14.65
						400	120	15.05
						480	200	15.15



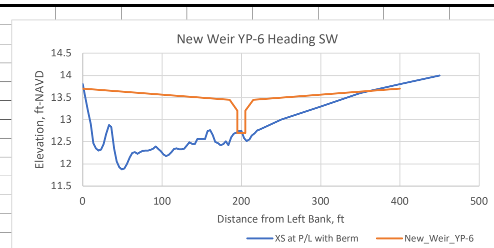
						Offset	Station	Elevation
DurdenCreek1	New_Weir_DurdenCk1	100		Level	Width	40	0	14.5
				12.5	10	45	5	14
				13	20	50	10	13
				14	30	55	15	12.5
				14.5	40	65	25	12.5
						70	30	13
						75	35	14
						80	40	14.5



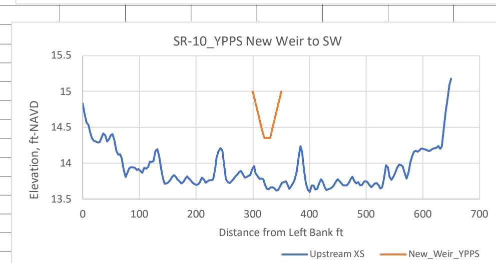
						Offset	Station	Elevation
SR10-YPPN-1	YP-6_W_New_Weir	380		Level	Width	45	0	13
			12	0	10	50	5	12.75
				0.5	10	55	10	12.5
				0.75	20	55	10	12
				1	30	65	20	12
						65	20	12.5
						70	25	12.75
						75	30	13



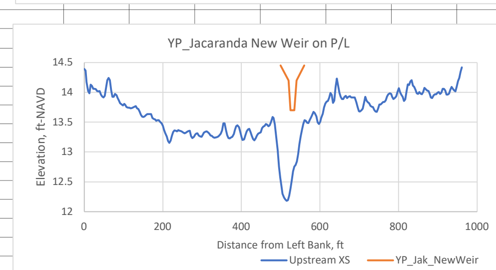
								Station	Elevation
SR10-YPPN	New_Weir_YP-6	2200		Level	Width			0	13.7
			12.7	0	10			185	13.45
				0.5	10			195	13.2
				0.75	60			195	12.7
				1	400			205	12.7
								205	13.2
								215	13.45
								400	13.7



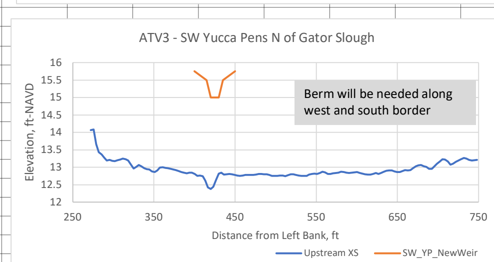
SR10_YPPS	New_Weir_YPPS	2800		Level	Width			Station	Elevation
				14.35	10		300	0	15
				14.5	20		315	15	14.5
				15	50		320	20	14.35
							330	30	14.35
							335	35	14.5
							350	50	15



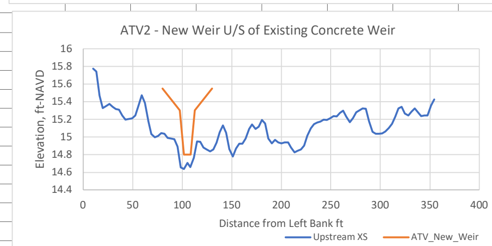
YP_Jacaranda	YP_Jak_NewWeir	740		Level	Width		Adj Sta	Station	Elevation
			13.7	0	10		500	0	14.45
				0.5	20		520	20	14.2
				0.75	60		525	25	13.7
							535	35	13.7
							540	40	14.2
							560	60	14.45



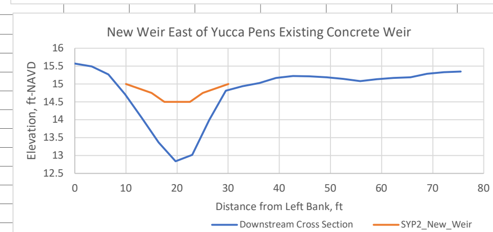
ATV3	SW_YP_NewWeir	400		Level	Width		Adj Sta	Station	Elevation
			15	0	10		400	0	15.75
				0.5	20		415	15	15.5
				0.75	50		420	20	15
							430	30	15
							435	35	15.5
							450	50	15.75



ATV2	ATV_New_Weir	500		Level	Width			Station	Elevation
			14.8	0	7		80	0	15.55
				0.5	15		97.5	17.5	15.3
				0.75	50		101.5	21.5	14.8
							108.5	28.5	14.8
							112.5	32.5	15.3
							130	50	15.55



SYP2_Weir	SYP2_New_Weir	170		Level	Width		10	0	15
			14.5	0	5		15	5	14.75
				0.25	10		17.5	7.5	14.5
				0.5	20		22.5	12.5	14.5
							25	15	14.75
							30	20	15

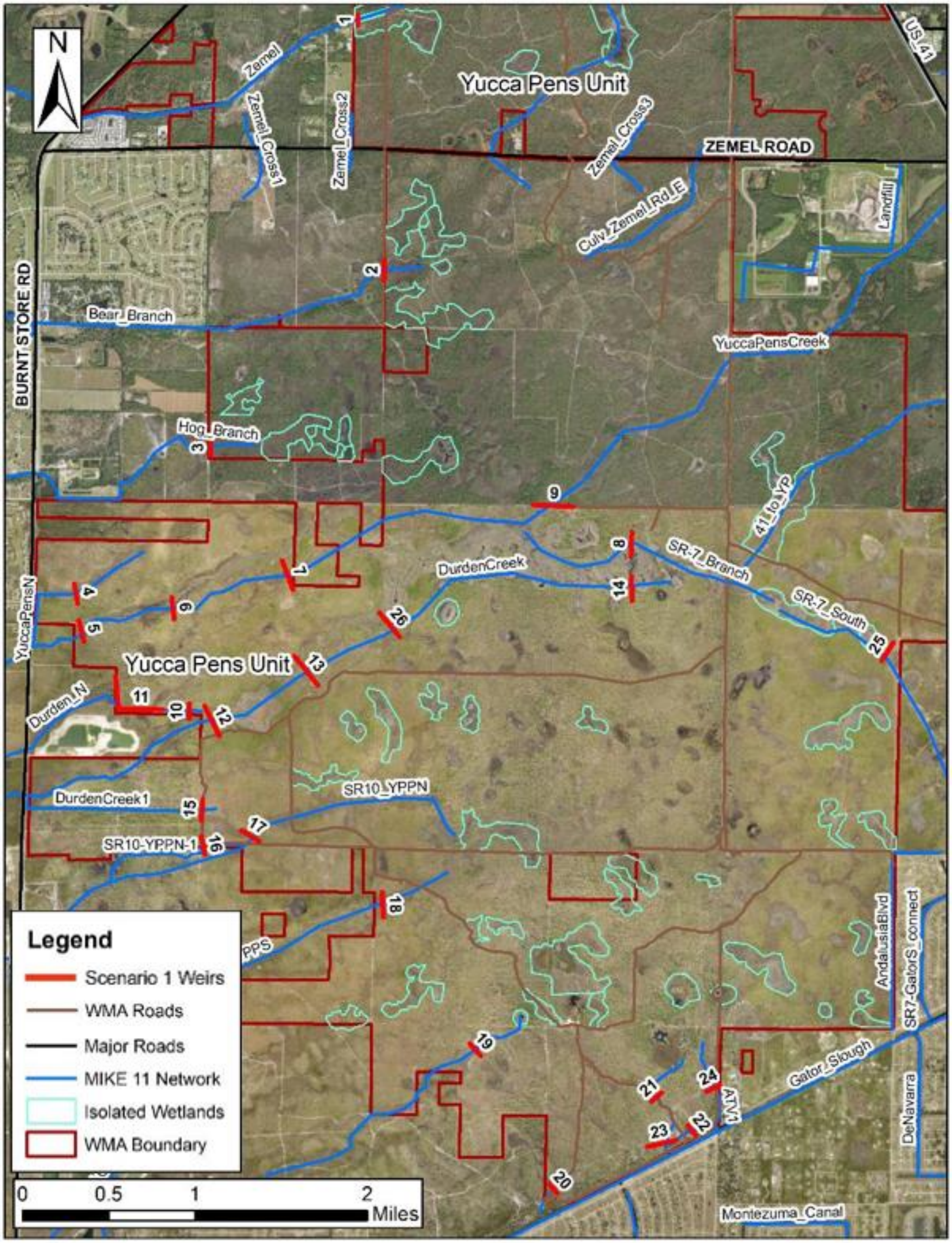


			Proposed Weir				Existing Weir		
ATV2	TrapConc	1065	Level	Width			Level	Width	
		11.8	0	5		11.8	0	15	
			2	5			1	50	
			2.5	50			2.7	150	
			3	150					
		Adj Sta	Station	Elevation		Adj Sta	Station	Elevation	
		50	0	14.8		50	0	14.5	
		100	50	14.3		100	50	12.8	
		122.5	72.5	13.8		117.5	67.5	11.8	
		122.5	72.5	11.8		132.5	82.5	11.8	
		127.5	77.5	11.8		150	100	12.8	
		127.5	77.5	13.8		200	150	14.5	
		150	100	14.3					
		200	150	14.8					

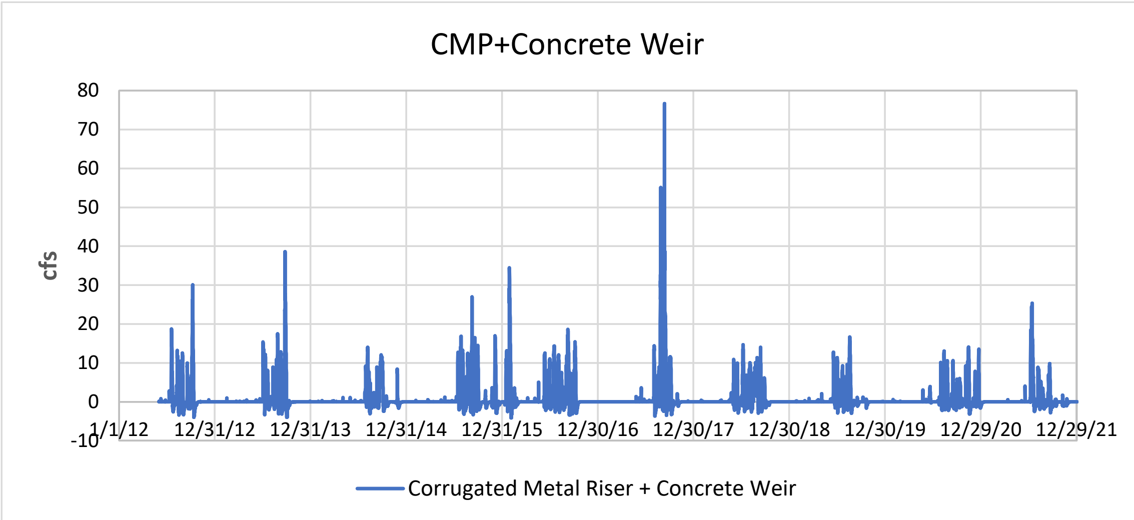
Appendix B

Additional Graphs of Scenario 1 Simulation Results

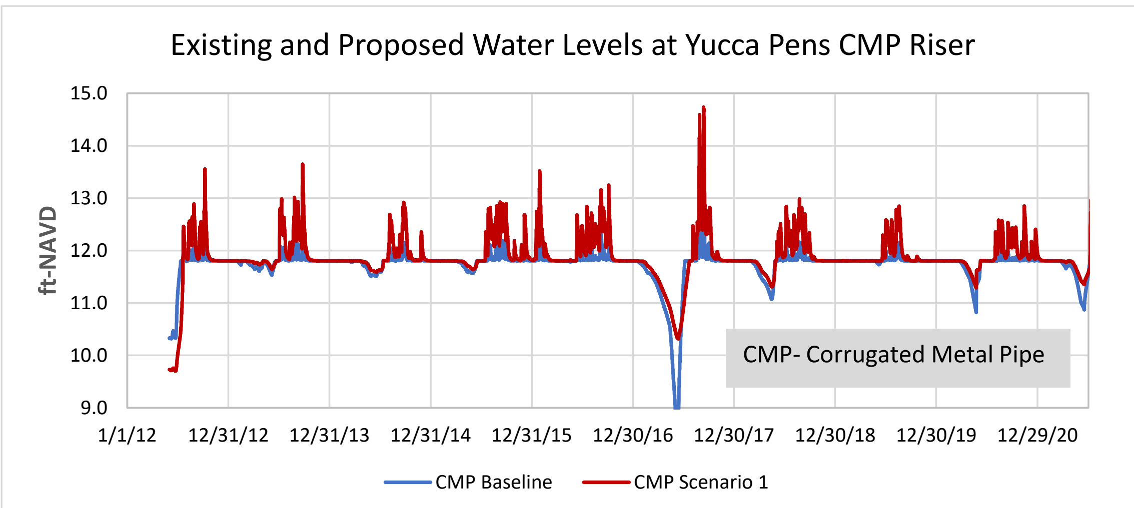
Refer to this figure when reviewing Scenario 1 plots shown below.



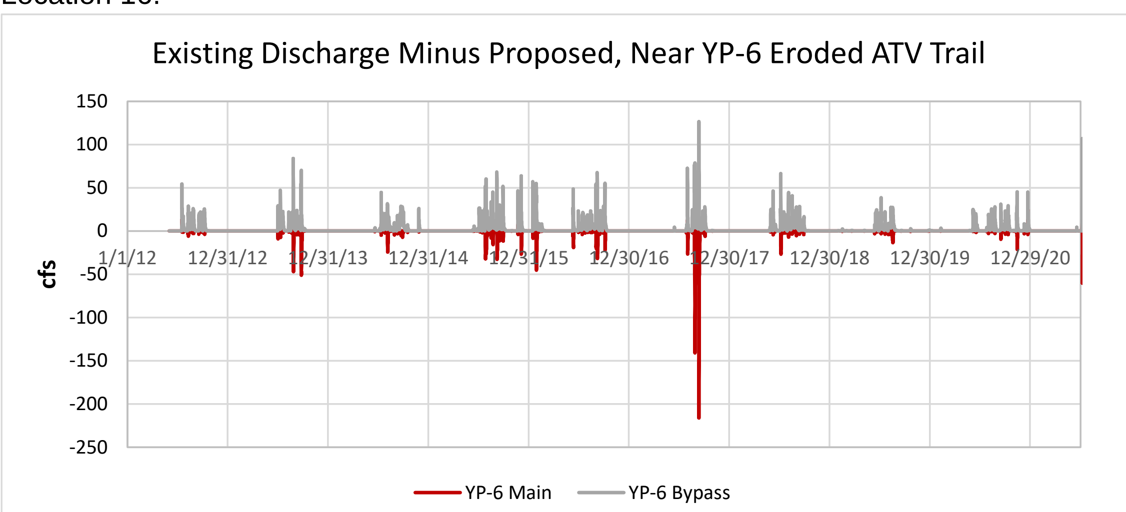
Location 24:



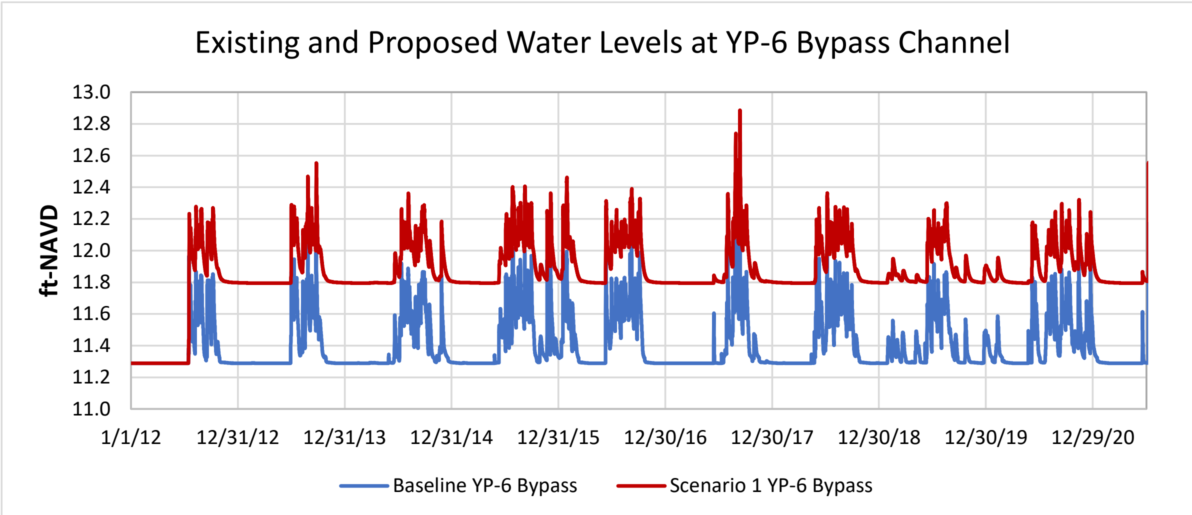
Location 23:



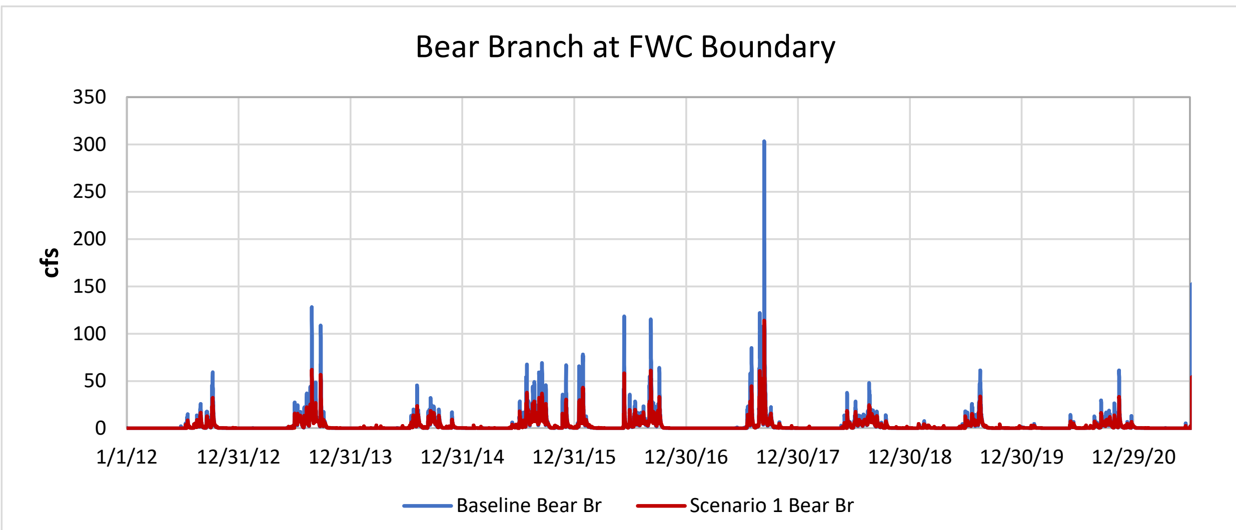
Location 16:



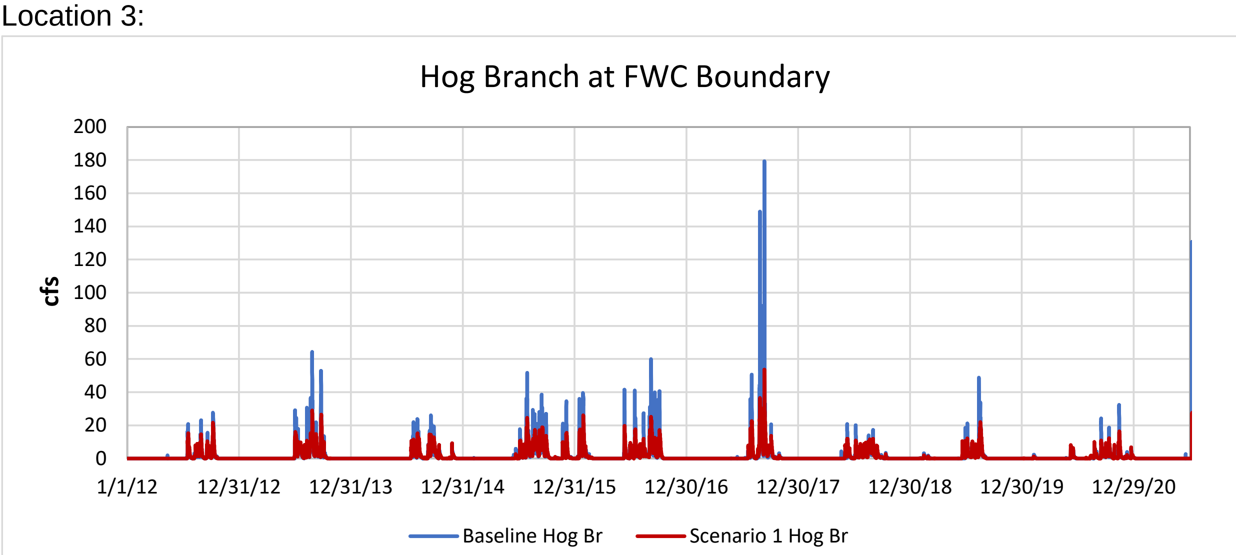
Location 16:



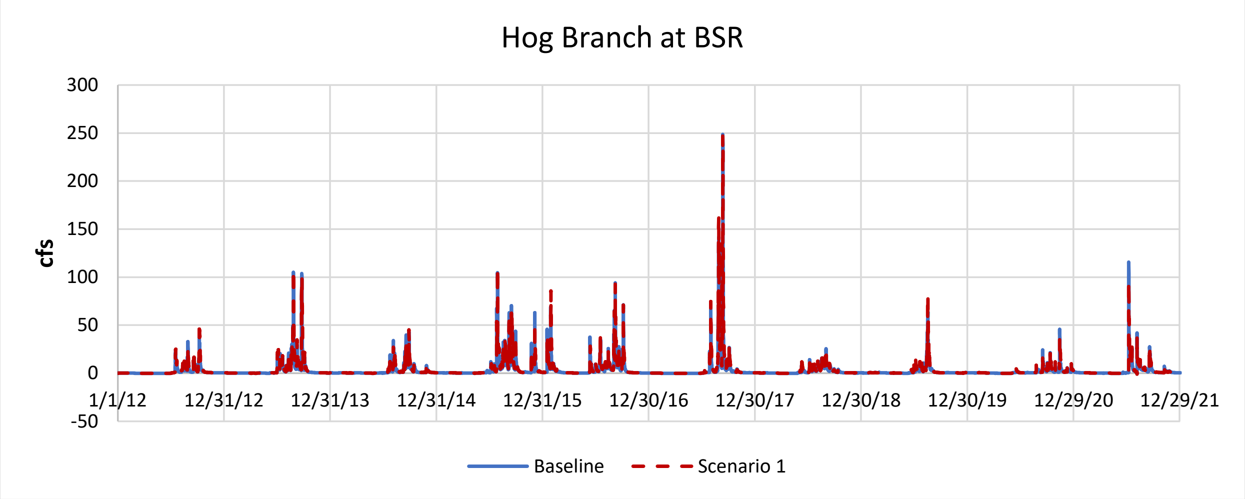
Location 2:



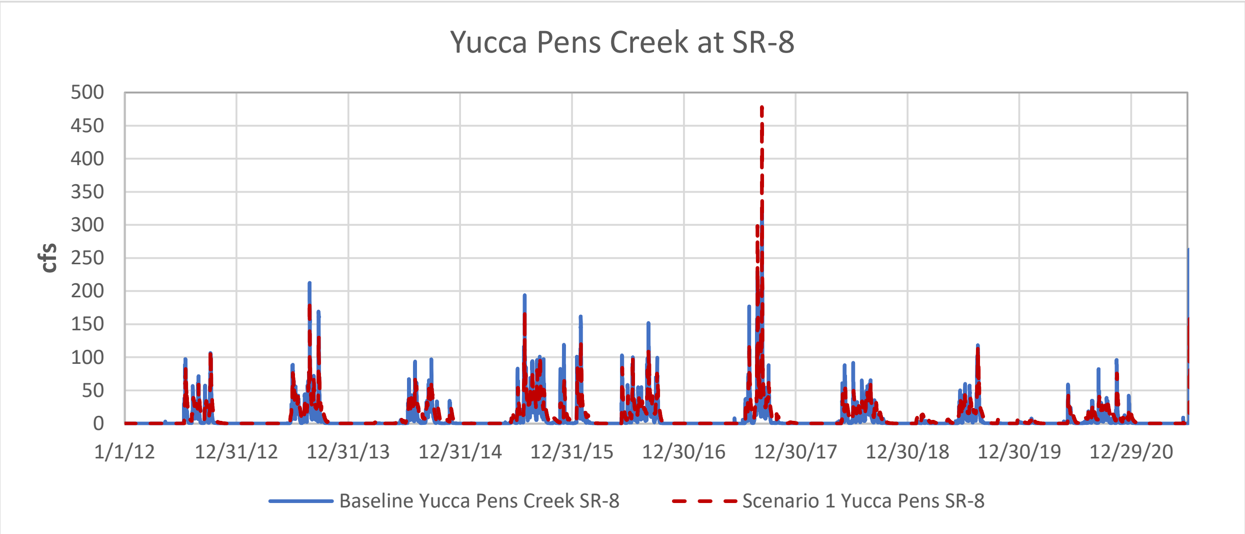
Location 3:

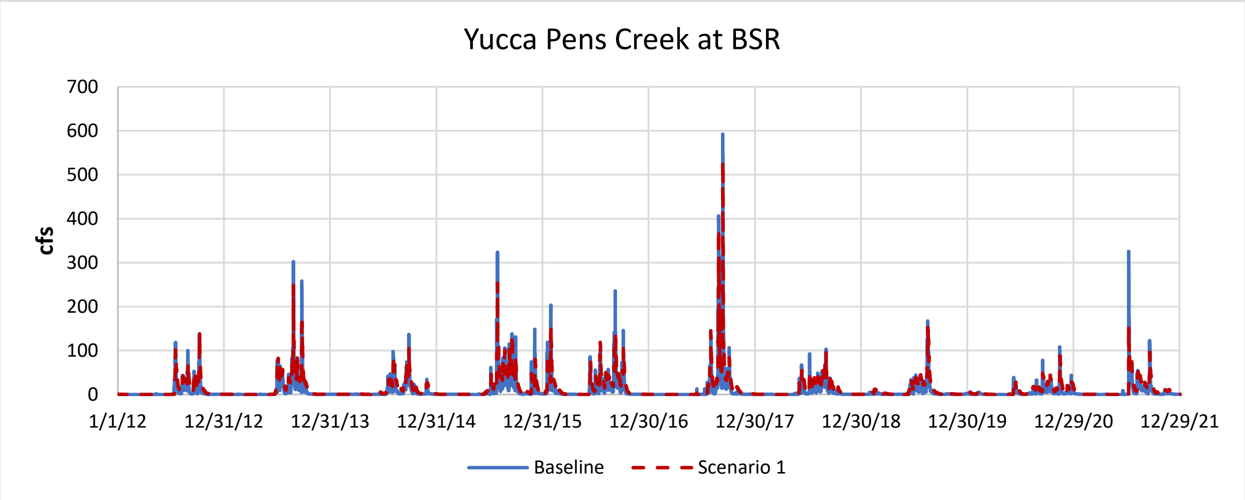


See Figure 13 for location:

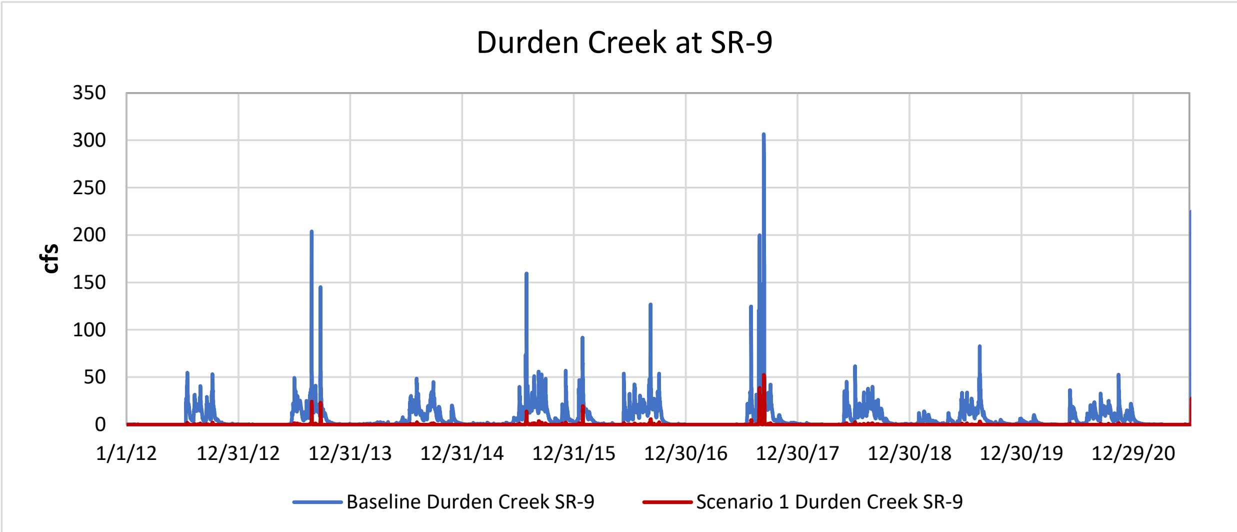


Location 5:

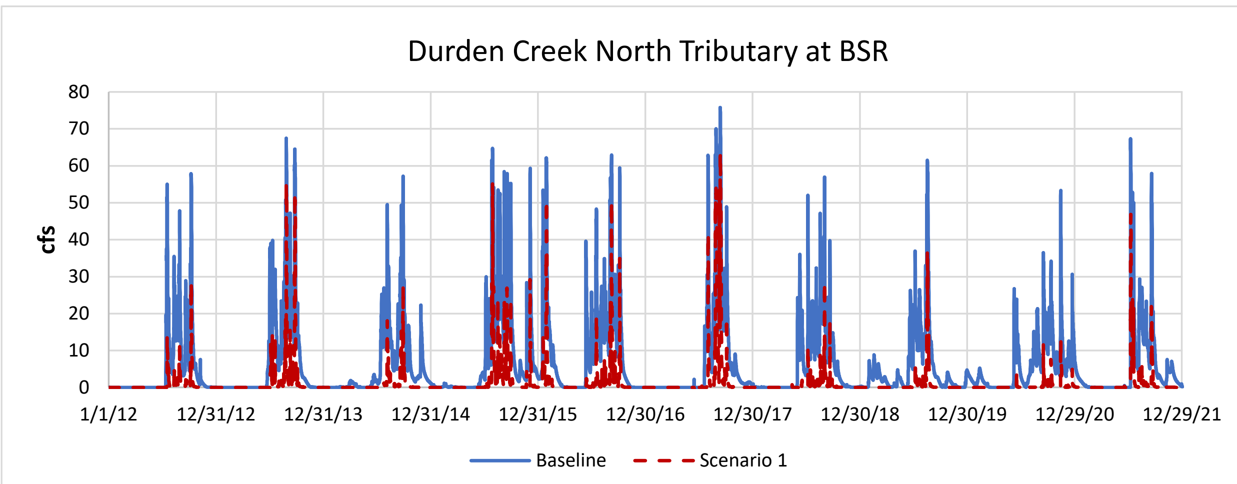




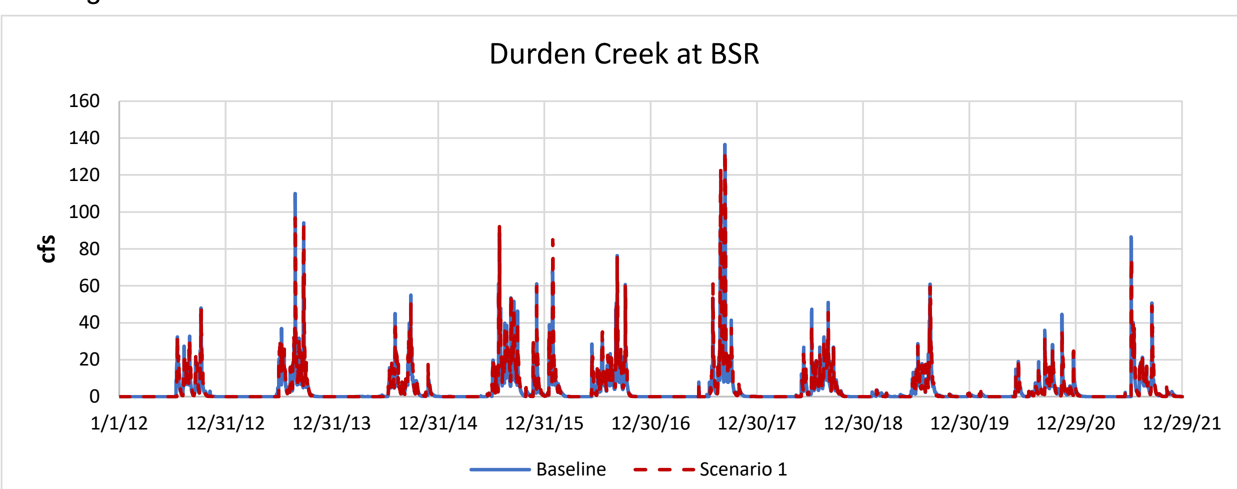
Location 12:



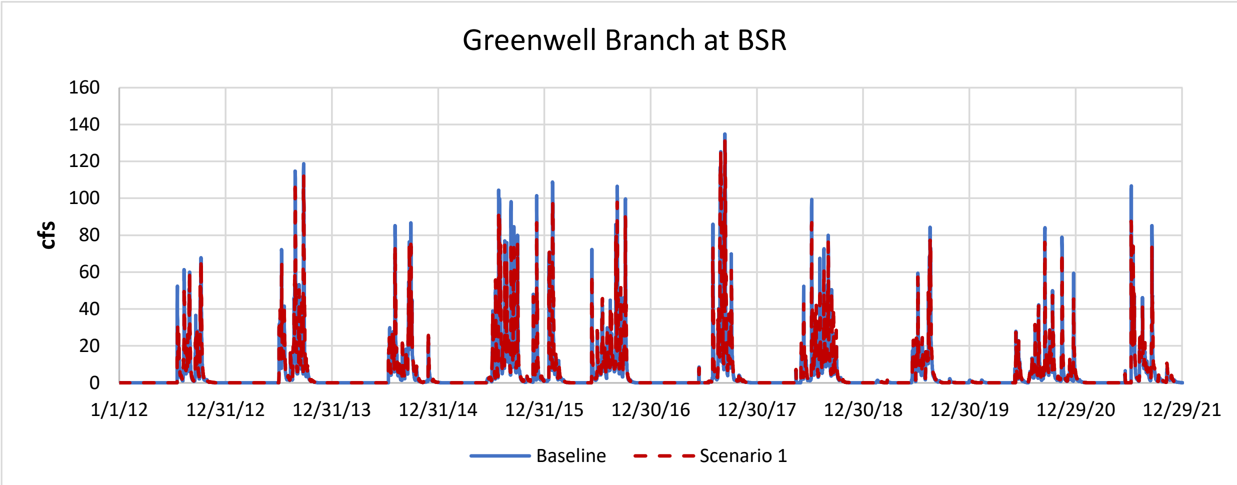
See Figure 13 for location



See Figure 13 for location



See Figure 13 for location



Appendix C

Calibration Comparison – Original Calibration vs Model with Lower Hydraulic Conductivity

Explanation of Modified Hydraulic Conductivities Referenced in Table 3 Bond Farm HEI Inflows/Outflows

All results in the scenario analysis memoranda use the final calibration with horizontal hydraulic conductivity capped only under Bond Farm at 35 ft/day. Results from the sensitity test with reduced hydraulic conductivities were only presented for Bond Farm HEI and Southwest Aggregates Reservoir water balance results presented in Table 3 as a comparison.

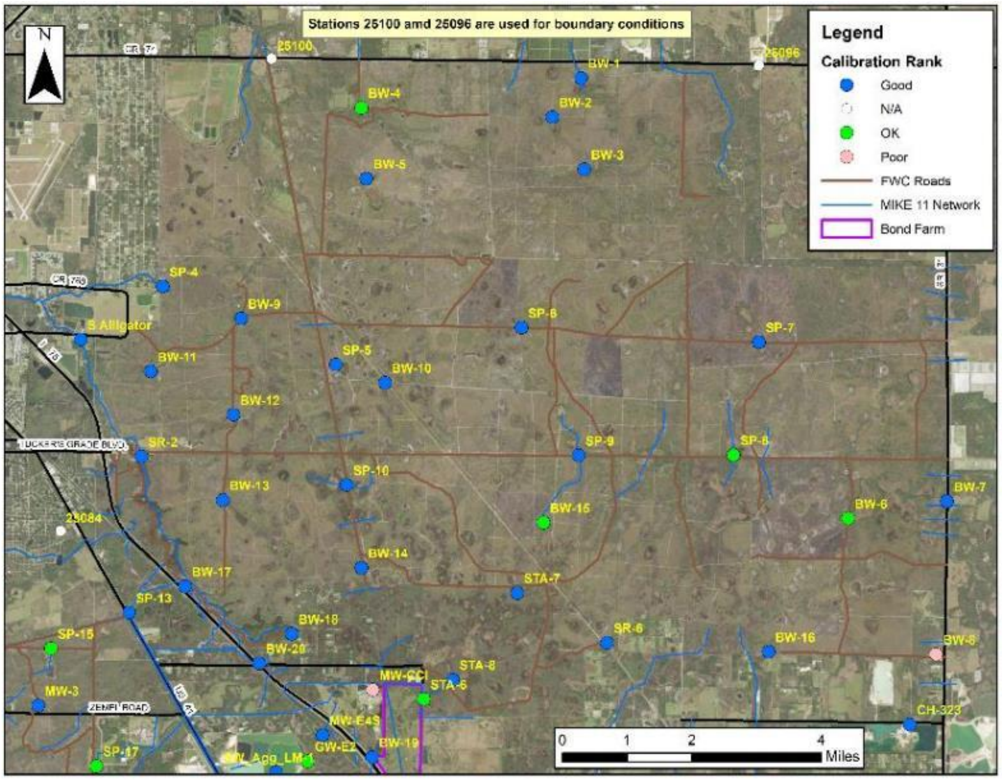
During scenario analysis of Bond Farm, seepage rates from Bond Farm were significantly greater than expected. The project area and larger Charlotte County is known to have porous shell layers. Hydrogeologic studies of the Bond Farm area included lithologic descriptions of multiple borings around the perimeter of the proposed impoundment as well as field permeability measurements. Field permeability testing in Bond Farm estimated a permeability rate of 40 ft/day for the limestone layer (HDR, 2020), however there have not been any full scale studies looking at seepage throughout Bond Farm. These additional studies will provide insight on varied hydraulic conducitivity throughout Bond Farm. A zone of lower water table horizontal hydraulic conductivity (35 ft/day) was used for only the area of Bond Farm based on the Bond Farm hydrologic investigation, along with findings from a previous study in the nearby Southwest Aggregates mining cells which calculated horizontal hydraulic conductivities of 35 ft/day (WSA, 2017). Therefore, these conservative hydraulic conductivities were used to avoid over-estimating the capacity of Bond Farm to hold water. Additional studies are recommended to quantify groundwater seepage rates throughout Bond Farm and the project area (see RECOMMENDATIONS section for more information).

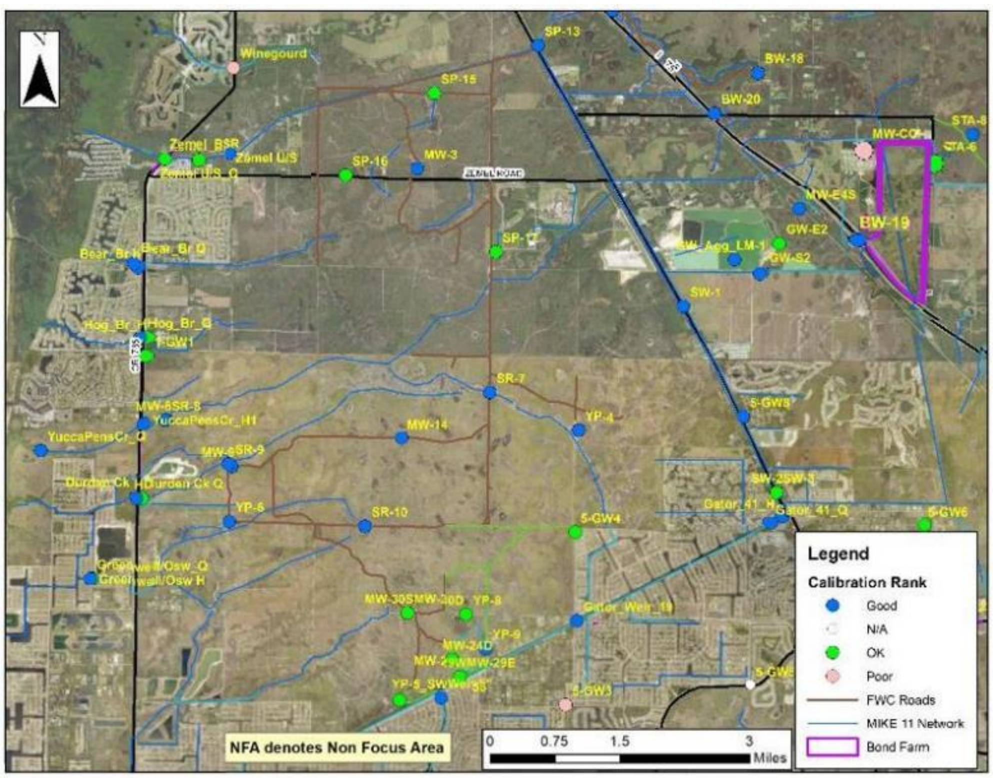
The initial analysis of Scenario 1 used the final calibrated model (see TM 5c, WSA & CHNEP, 2022b). Maps of calibration stations are shown below, and tables comparing the final calibrated model to a sensitivity test with lower hydraulic conductivities follow the maps of calibration station locations. The final calibrated model had upper water table horizontal hydraulic conductivities ranging from 456 to 1,500 ft/day with vertical conductivity values 10 times less than horizontal values. Lower water table horizontal hydraulic conductivity values ranged from 123 to 543 ft/day. Model calibration was best with these lower water table hydraulic conductivities, and resulted from an effort to match measured dry season water levels at numerous stations, most notably at stations STA-6, -7, and -8 northeast of Bond Farm. The adjustment of hydraulic conductivity values was performed after all surface water conveyance details had been added to the model and all other model input files had been vetted and sensitivity testing had been completed.

Seepage losses from Bond Farm were higher than what was deemed to be appropriate in additional testing of Scenario 1, therefore it was decided to perform a sensitivity test on Scenario 1 with lower hydraulic conductivities. Two iterations of the entire model domain were conducted, one with a maximum horizontal hydraulic conductivity of 35 ft/day and another with the maximum set to 300 ft/day. Then, two iterations were simulated that varied horizontal hydraulic conductivity between 35 and 300 ft/day, and the resulting best calibration was for a simulation with the maximum horizontal hydraulic conductivity value of 297 ft/day for the upper water table. The resulting lower water table aquifer horizontal hydraulic conductivities ranged from 70 to 292 ft/day.

Comparison of the final calibration and the sensitivity test is presented in the tables shown below. Calibration improved at 14 stations. Slight reductions in calibration performance were observed at stations SP-4, BW-19, and 20-GW3 in the sensitivity test. Performance changed from either Good to OK or OK to Poor in the sensitivity test at the following stations: MW-29W, SP-17, SP-17, STA-6, 5-GW4, L-721, MW-29E, SW_Agg_GW-E2 and SW_Agg_GW-S2. (NOTE: Performance deteriorated at Gator Slough at Weir 19 because the revised model used program logic (gates open according to prescribed rules) rather than known gate operations. Therefore, the drop in performance at this station is not considered valid. Gator Slough at US 41 was also affected because it is upstream of Weir 19).

Additional model calibration is proposed once additional hydrologic surveys are performed for this area and that information is available (see RECOMMENDATIONS section for more information).





	Final	Test	Final	Test	Final	Test		
Name	MAE	MAE	R_Corr	R_Corr	R2 NS	R2 NS	Overall	Change
Bear Branch H	0.36	0.37	0.82	0.84	0.11	0.11	Good	Same
Durden Creek H	0.84	0.95	0.87	0.88	0.61	0.57	OK	Same
Gator_Weir11_H	0.53	0.62	0.61	0.50	-5.11	-6.05	Poor	Same
Gator_41_H	0.46	0.60	0.95	0.94	0.37	-0.08	Good	Worse
Gator_Weir_19	0.17	0.63	0.96	-0.10	0.87	-1.04	Good	See note
Greenwell/Osw H	0.47	0.57	0.80	0.75	-0.62	-1.37	OK	Same
Hog Branch H	0.40	0.38	0.72	0.71	-0.36	-0.28	OK	Same
S Alligator	0.67	0.57	0.88	0.91	0.61	0.71	Good	Same
SP-4	0.45	0.82	0.93	0.87	0.85	0.71	Good	Worse
SP-8, BigWaterFor	0.97	0.65	0.88	0.88	0.54	0.75	OK	Better
SP-13, Zemel at 41	0.63	0.61	0.81	0.88	0.44	0.50	Good	Same
SR-2, WebbLake	0.46	0.58	0.94	0.92	0.83	0.72	Good	Same
SW-1, US_41	0.51	0.40	0.92	0.93	0.14	0.45	Good	Better
SW-2, US_41 E	0.62	0.62	0.88	0.86	-1.03	-1.19	OK	Same
SW-3, US_41 W	0.42	0.45	0.85	0.84	-0.04	-0.39	OK	Same
YuccaPensCr_H1	0.71	0.67	0.77	0.89	0.48	0.52	Good	Same
Weir 58	0.18	0.26	0.86	0.83	0.68	0.39	Good	Same
Winegourd	1.33	1.11	0.03	0.00	-5.43	-3.75	Poor	Same
Zemel U/S	0.43	0.41	0.86	0.90	0.67	0.72	Good	Same
Zemel_BSR	0.58	0.48	0.63	0.70	-1.25	-0.74	OK	Same
17-GW4	0.80	0.91	0.76	0.74	0.48	0.39	OK	Same
BW-1	0.47	0.55	0.94	0.93	0.84	0.81	Good	Same
BW-2	0.65	0.61	0.90	0.91	0.67	0.74	Good	Same
BW-3	0.50	0.33	0.94	0.96	0.73	0.91	Good	Better
BW-4	0.91	0.66	0.88	0.89	0.49	0.79	OK	Better
BW-5	0.67	0.66	0.80	0.84	0.59	0.68	Good	Better
BW-6	0.89	0.82	0.91	0.89	0.50	0.60	OK	Same
BW-7	0.53	0.54	0.94	0.93	0.81	0.80	Good	Same
BW-8	1.15	1.20	0.90	0.90	0.33	0.28	Poor	Same
BW-9	0.66	0.71	0.87	0.90	0.71	0.67	Good	Same
BW-10	0.29	0.29	0.96	0.96	0.90	0.90	Good	Same
BW-11	0.69	0.68	0.86	0.85	0.58	0.65	Good	Same
BW-12	0.45	0.48	0.90	0.91	0.80	0.79	Good	Same
BW-13	0.42	0.42	0.93	0.92	0.80	0.84	Good	Same
BW-14	0.31	0.34	0.96	0.96	0.91	0.89	Good	Same
BW-15	0.84	0.72	0.90	0.90	0.22	0.40	OK	Better
BW-16	0.46	0.45	0.96	0.96	0.80	0.82	Good	Same
BW-17	0.45	0.42	0.92	0.92	0.79	0.82	Good	Same
BW-18	0.38	0.31	0.95	0.96	0.86	0.92	Good	Same
BW-19	0.57	0.98	0.93	0.85	0.74	0.22	Good	Worse
BW-20	0.46	0.37	0.97	0.94	0.80	0.80	Good	Same
MW-23S	1.01	0.86	0.92	0.91	0.51	0.61	OK	Better
MW-24S	1.00	0.98	0.89	0.89	0.30	0.35	OK	Better
MW-29W	0.54	0.82	0.43	0.46	-0.28	-1.71	OK	Worse
MW-30S	0.82	0.73	0.82	0.81	0.04	0.29	OK	Better
SP-5	0.35	0.30	0.97	0.97	0.90	0.92	Good	Same
SP-6	0.45	0.56	0.94	0.93	0.81	0.68	Good	Same
SP-7	0.54	0.63	0.88	0.80	0.69	0.55	Good	Same

Name	Final MAE	Test MAE	Final R_Corr	Test R_Corr	Final R2 NS	Test R2 NS	Overall	Change
SP-9	0.26	0.33	0.97	0.95	0.92	0.89	Good	Same
SP-10	0.59	0.60	0.97	0.96	0.56	0.53	Good	Same
SP-16	0.84	1.09	0.85	0.83	0.37	-0.01	OK	Worse
SP-17	0.93	1.24	0.56	0.47	-1.36	-3.21	OK	Worse
STA-6	1.07	1.24	0.82	0.80	0.19	-0.09	OK	Worse
STA-7	0.63	0.56	0.96	0.96	0.67	0.74	Good	Same
SW_Agg_LM-1	0.51	0.75	0.83	0.79	0.50	0.18	Good	Same
YP-5_SW	1.13	0.68	0.97	0.96	0.55	0.78	OK	Better
YP-8	0.91	0.79	0.91	0.90	0.22	0.40	OK	Better
YP-9	0.63	0.70	0.96	0.96	0.77	0.74	Good	Same
1-GW1	0.95	0.90	0.87	0.85	0.20	0.31	OK	Same
5-GW3	1.04	1.33	0.91	0.84	-0.18	-0.66	Poor	Same
5-GW4	1.14	1.49	0.91	0.89	0.22	-0.25	OK	Worse
5-GW6	0.78	0.97	0.95	0.94	0.66	0.47	OK	Same
5-GW8	0.65	0.73	0.92	0.85	0.47	0.18	Good	Same
16E-GW3	0.70	0.71	0.90	0.88	0.34	0.25	Good	Same
20-GW3	0.64	0.99	0.97	0.94	0.82	0.55	Good	Worse
CH-323	0.58	0.54	0.81	0.82	0.65	0.66	Good	Same
L-721	0.54	1.37	0.97	0.92	0.49	-2.20	Good	Worse
L-3207	0.21	0.29	0.91	0.90	0.82	0.70	Good	Same
MW-3	0.63	0.54	0.85	0.87	0.54	0.70	Good	Same
MW-8	0.64	0.62	0.89	0.88	0.40	0.52	Good	Same
MW-9	0.38	0.46	0.89	0.89	0.74	0.74	Good	Same
MW-14	0.48	0.50	0.89	0.88	0.70	0.70	Good	Same
MW-23D	0.94	0.83	0.93	0.92	0.55	0.64	OK	Same
MW-24D	0.96	0.99	0.90	0.90	0.44	0.44	OK	Same
MW-29E	0.77	1.08	0.87	0.87	0.21	-0.49	OK	Worse
MW-30D	0.76	0.69	0.84	0.83	0.18	0.40	OK	Better
SP-15	0.89	0.72	0.89	0.89	0.36	0.63	OK	Same
SR-6	0.42	0.49	0.94	0.95	0.84	0.81	Good	Same
SR-7	0.71	0.80	0.94	0.94	0.55	0.46	Good	Same
SR-8	0.54	0.67	0.91	0.90	0.73	0.61	Good	Same
SR-9	0.42	0.44	0.92	0.93	0.83	0.82	Good	Same
SR-10	0.37	0.42	0.90	0.88	0.79	0.72	Good	Same
STA-8	0.39	0.43	0.94	0.94	0.86	0.84	Good	Same
SW_Agg_MW-CCI	1.50	1.72	0.95	0.95	-0.38	-0.77	Poor	Same
SW_Agg_MW-E4S	0.39	0.45	0.92	0.91	0.82	0.79	Good	Same
SW_Agg_GW-E2	0.80	1.09	0.78	0.71	-0.01	-0.69	OK	Worse
SW_Agg_GW-S2	0.46	0.92	0.94	0.92	0.49	-0.80	Good	Worse
YP-4	0.57	0.57	0.78	0.79	0.53	0.52	Good	Same
YP-6	0.62	0.67	0.84	0.82	0.55	0.60	Good	Same
Bear Branch Q	4.16	3.92	0.76	0.83	0.48	0.53	Good	Better
Durden Creek Q	3.00	4.28	0.86	0.89	0.72	0.59	Good	Same
Gator_41_Q	6.17	6.84	0.89	0.89	0.78	0.78	Good	Same
Greenwell/Osw_Q	6.11	6.02	0.76	0.79	0.50	0.59	Good	Same
Hog_Q	2.49	2.32	0.81	0.81	0.53	0.61	Good	Same
NS Transfer	2.56	4.36	0.90	0.82	0.81	0.63	Good	Same
YuccaPensCr_Q	6.91	7.66	0.86	0.83	0.72	0.60	Good	Same
Zemel U/S_Q	11.33	10.46	0.69	0.74	0.45	0.51	OK	Better