APPENDIX 3C

Mapping Historic Hydropatterns

Lower Charlotte Harbor Flatwoods Strategic Hydrologic Restoration Plan

Lower Charlotte Harbor Flatwoods Strategic Hydrologic Restoration Plan

3C – Mapping Historic Hydropatterns

PREPARED FOR:

1050 Loveland Boulevard
Port Charlotte, Florida 33980

PREPARED BY:

Water Science Associates

IN CONJUNCTION WITH:

Lower Charlotte Harbor Flatwoods Hydrologic Modeling/Planning Project

Technical Memorandum – Task 3c Mapping Historic Hydropatterns

To:	Jennifer Hecker, Nicole Iadevaia, CHNEP
From:	Roger Copp and Kirk Martin, P.G., Water Science Associates
Date	August 30, 2021
Re:	Mapping Historic Hydropatterns

BACKGROUND

Water Science Associates was contracted by the Coastal & Heartland National Estuary Partnership (CHNEP) to develop a hydrologic restoration plan for the Lower Charlotte Harbor Flatwoods. Findings from this plan will promote sheet flow enhancement and restore wetland hydroperiods in Babcock Webb and Yucca Pens Wildlife Management Area (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 vegetation indicators of wetland health,
4. Maintenance of the monitoring stations and downloading measured 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.

The Task 1 Data Discovery Memorandum has been submitted to CHNEP. Task 2 deliverables already submitted include:

- Task 2a – Groundwater Monitoring Plan
- Task 2b – Flow Monitoring Plan
- Task 2c – Documentation that all equipment for monitoring wells, data loggers at existing stations, rain gages, and flow monitoring stations have been acquired and are ready for installation
- Task 2d – Maps of Monitoring Stations

Task 3 involves ecologic field work to identify evidence of average wet season water depths using vegetation indictors during both the dry and wet seasons, mapping historic hydropatterns, and explaining where existing evidence of average wet season water levels differs from estimated historic average wet season water depths. Task 3 deliverables already submitted include:

- Task 3a – Evaluation of Vegetation Indictors of Wetland Health

- Task 3b – Documentation of Seasonal High and Low Water Conditions

This memorandum summarizes completion of Task 3c. The project requirements for this Task are summarized below.

DESCRIPTION OF DELIVERABLE REQUIREMENTS

The requirement for Task 3c is to provide a map of historic hydropatterns and a technical memorandum explaining areas where water levels are higher or lower than optimum hydroperiod, how data collected compares to FWC data, and an explanation of the methodology utilized to compare the historic hydropatterns to vegetation indicators of hydrologic condition.

DOCUMENTATION

Historic Hydropatterns

Historic 1953 aerial photographs for Babcock Webb Wildlife Management Area and the Yucca Pens Unit were geo-referenced by Tim Liebermann (formerly of SFWMD, retired) and Mike Kemmerer of the Florida Fish and Wildlife Conservation Commission [FWC], (personal communication, Kemmerer, 2019). A GIS shape file of the SSURGO (USDA-NRCS soil survey) database was utilized to assist in the determination of hydrologic condition. Liebermann and Kemmerer developed four ranks of hydrologic condition, with Rank 1 representing uplands and Rank 4 representing wetlands. Rank 2 was used for lands that experienced minor flooding, and Rank 3 was used for lands that were more often wet than dry.

Information in the SSURGO database used to assign a rank is explained below:

Rank 1, Uplands: 0% ponding frequency, no drainage limitations

Rank 2, Conifers: minor flooding, no drainage limitations

Rank 3. Marshland: frequent flooding, poorly drained

Rank 4, Wetlands: 98% ponding frequency, very poorly drained

Hydrologic rank was also based on visual signatures evident in the historic aerial photographs, such as grayscale. Dark areas were frequently observed along known creeks or flow-ways. Areas assigned Hydrologic Rank 3 based on information in the SSURGO database were typically slightly less dark. Areas assigned Hydrologic Rank 2 typically had a mix of light and dark colored areas, and areas assigned Hydrologic Rank 1 typically had light grey shading. **Figure 1** illustrates geo-referenced aerial photographs and hydrologic rank for a portion of southern Yucca Pens.

Hydrologic Rank was also an indication of average wet season water depth. Average wet season water depths were assigned to each Hydrologic Rank based on ecologic work conducted across Southwest Florida by Mike Duever (See **Attachment 1**) and is presented in **Table 1**. Water Science Associates modified the GIS files created by Liebermann and Kemmerer to add the average wet season water depths presented in **Table 1**.

Comparison of Historic Hydropatterns to 2020 Vegetation Indicators of Hydrologic Condition

The Task 3b Memorandum presented a summary of field work conducted by the Water Science Team during the dry and wet seasons of 2020 (Copp and Martin, 2020). That memorandum summarized ecologic field work conducted at 58 locations in Babcock Webb and Yucca Pens. Average wet season water depths at each of the 58 locations from that effort were compared to the historic average wet season water depths that were based on the work conducted by Liebermann and Kemmerer. Average wet season water depths for the South Walk-In Area were determined based on measured water level data at monitoring stations STA-7 and STA-8 presented in **Figure 2** (station locations are shown in **Figure 3**). Average elevations for both stations for the period July 15 through Dec 25 were used in this analysis as average wet season water levels. These data were used for the South Walk-In Area rather the water depths measured at each vegetation indicator location because of varying hydrologic conditions in the South Walk-In Area during 2020. The existing hydrologic condition was considered below

optimum for those points where the 2020 average wet season water depths were less than historic average wet season water depths. The results of this analysis are presented in **Figures 3** through **6**.

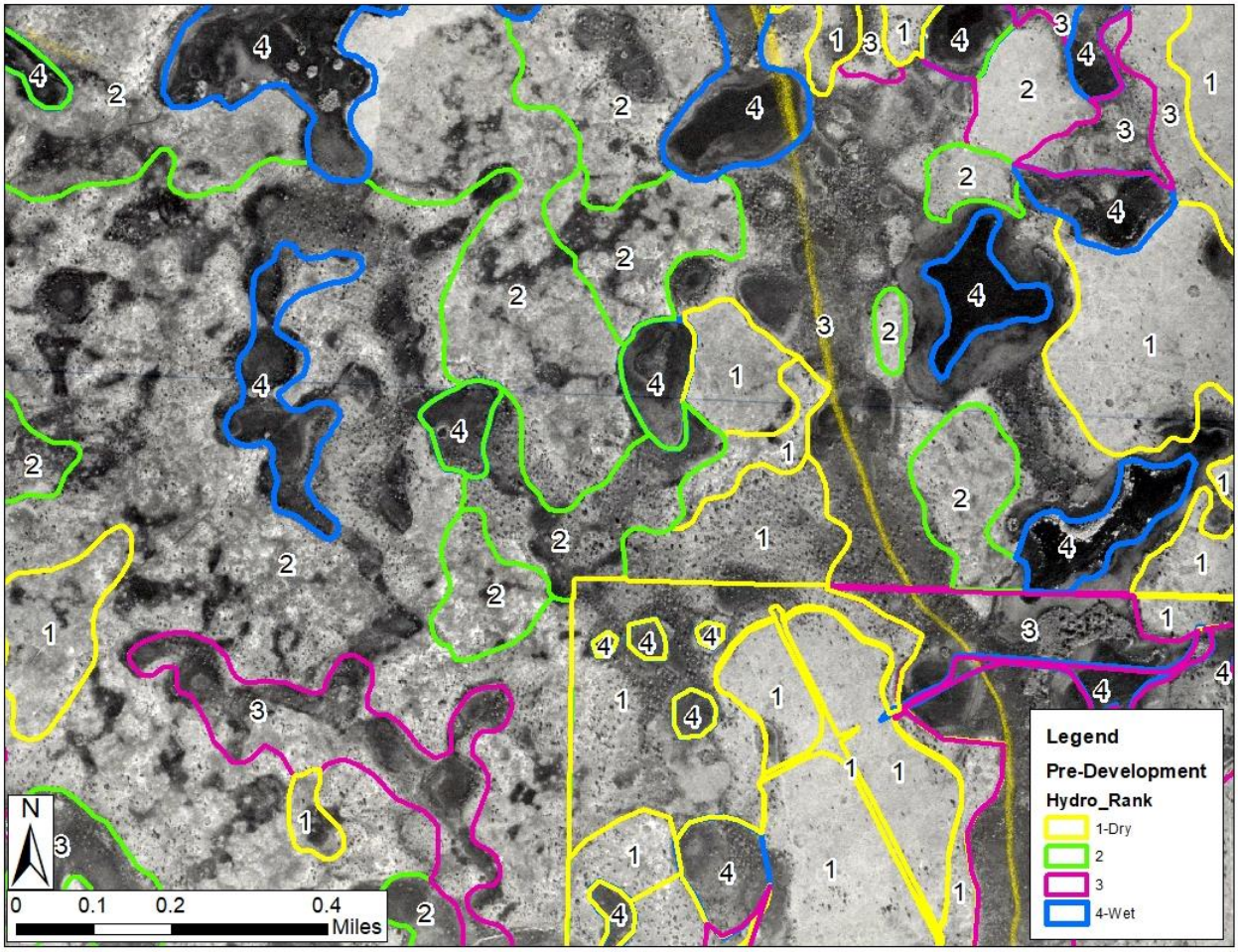

Figure 1 – Geo-referenced 1950's Aerial Photographs of South Yucca Pens and Hydrologic Rank Assignments

Table 1 – Hydrologic Rank and Optimum Wet Season Average Water Depth, ft

Hydrologic Rank and Typical Land Cover	Optimum Wet Season Average Water Depth, ft
1 – Mesic Flatwoods	0.0
2 – Hydric Flatwoods	0.33
3 – Marsh	0.75
4 – Cypress/Slough	1.5

Note: Optimum Wet Season Average Water Depths Taken from Duever and Roberts, 2013

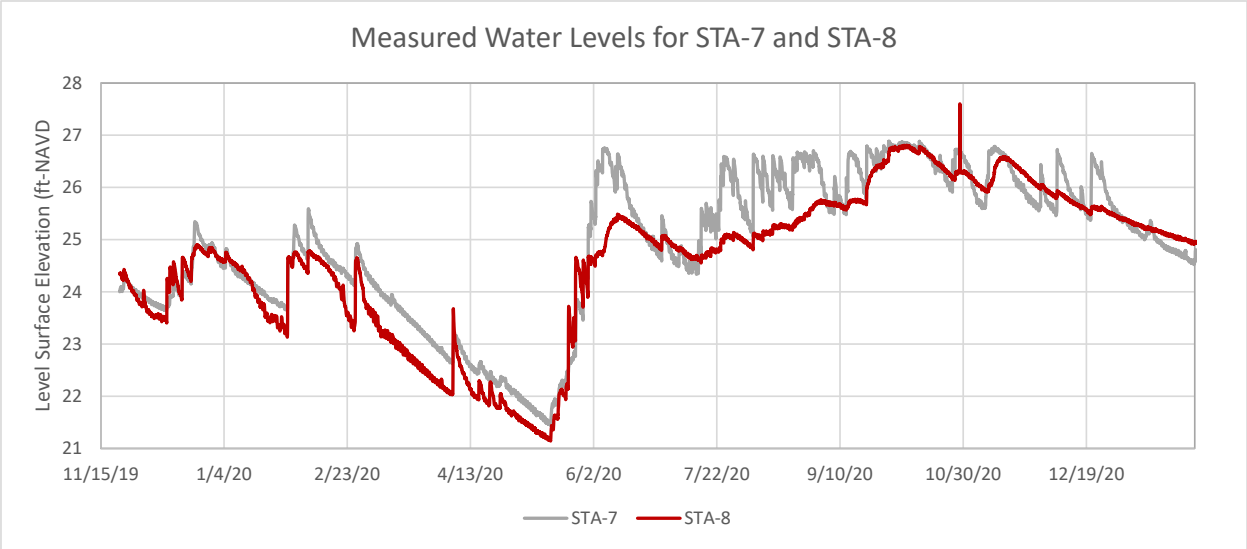

Figure 2 – Measured Water Elevations for Monitoring Stations STA-7 and STA-8

Babcock Webb. Vegetation indicator points in Babcock Webb located within the South Walk-In Area presented in **Figure 2** generally had higher water depths than optimum water depths. Of the 14 points within the South Walk-In Area, 10 locations had observed water depths higher than optimum with exceedances ranging from 0.3 to 1.6 feet (mean = 0.6 feet). The four locations with 2020 observed water depths less than optimum were in the northern portion of the South Walk-In Area, and those points were evaluated in September 2020, when it was drier than typical wet season conditions. As referenced above, since drier than average wet season conditions were encountered in 2020, data from STA-7 and 8 were used to determine for the South Walk-In Area rather the water depths measured at each vegetation indicator location because of varying hydrologic conditions in the South Walk-In Area during 2020.

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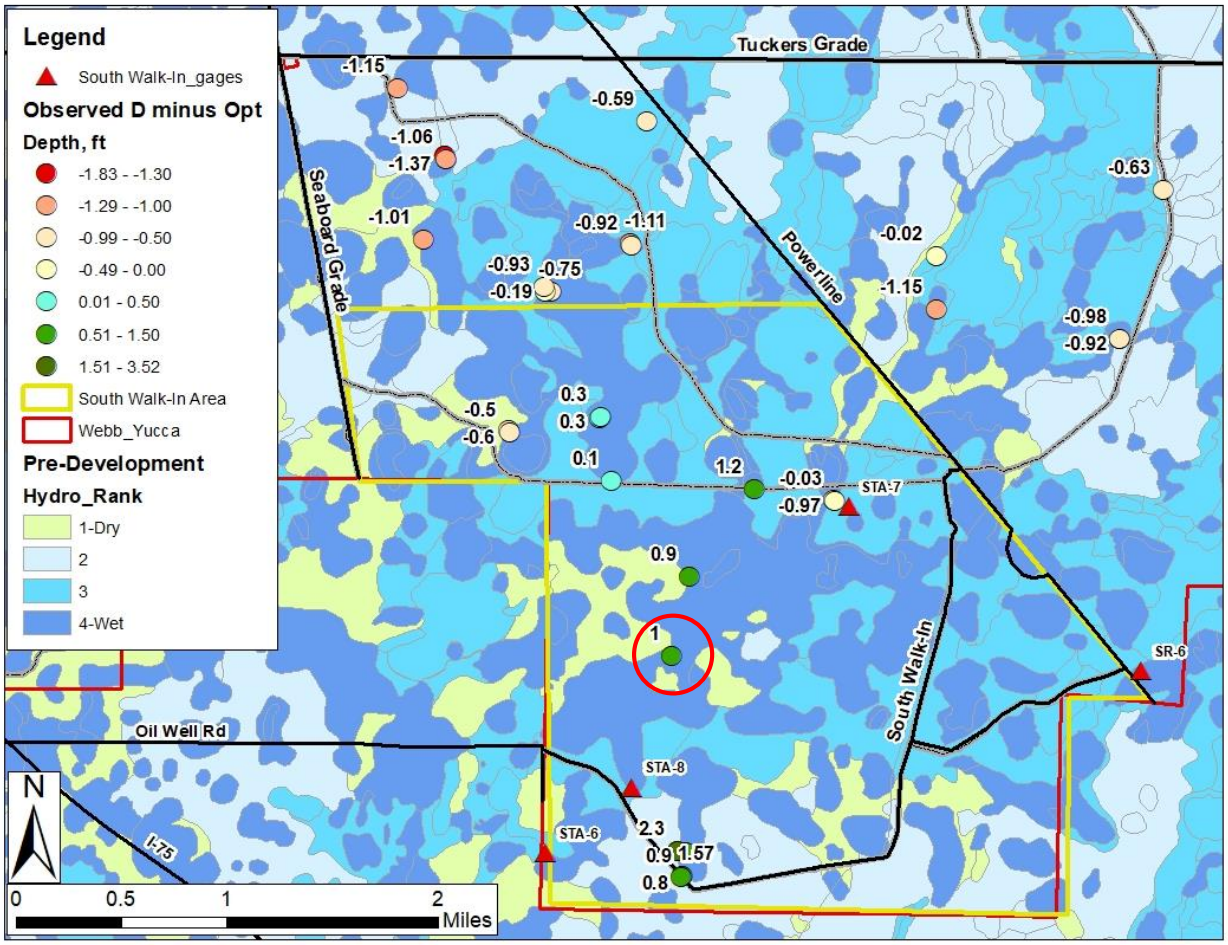


Figure 3 – Comparison of Predevelopment Hydrologic Rank and 2020 Observed Average Wet Season Water Depths for Southwestern Portion of Babcock Webb. (In the legend, dots ranging from green to light blue indicate existing depths (ft) exceed optimum depths)

Note: In the Figure 3 Legend, "Observed D minus Opt Depth" is Observed Depth minus Optimum Depth, which is equal to Average 2020 Wet Season Water Depth minus Optimum Depth. For example, see point in red circle above in **Figure 3.** Avg 2020 Wet Season Depth = 2.5 ft. Hydro Rank is 4, so optimum depth is 1.5 feet. Therefore, Observed Depth minus Optimum Depth = 1 ft

Yucca Pens. Yucca Pens 2020 observed wet season average water depths more representative of a typical wet season due to different rainfall patterns. Yucca Pens 2020 observed wet season average water depths were drier than optimum conditions at 60% of the vegetation stations and the average difference was -0.62 feet (observed depth was 0.62 feet lower than optimum average wet season water depths) (see **Figure 4**). The locations where water depths were higher than optimum were found in areas where roads have impounded outflows, such as the southeastern portion of Yucca Pens and Yucca Pens north of Zemel Road (see **Figure 5**). The greatest negative deviations from optimum wet season water depth (areas that were drier than optimum) were located on the southern and western areas of Yucca Pens most pronounced in proximity to the boundaries, suggesting that drainage has a significant impact on wetland hydrology in Yucca Pens. The predominance of negative values (indicating observed 2020 average wet season water levels were less than optimum levels) shown in **Figure 6** supports this conclusion.

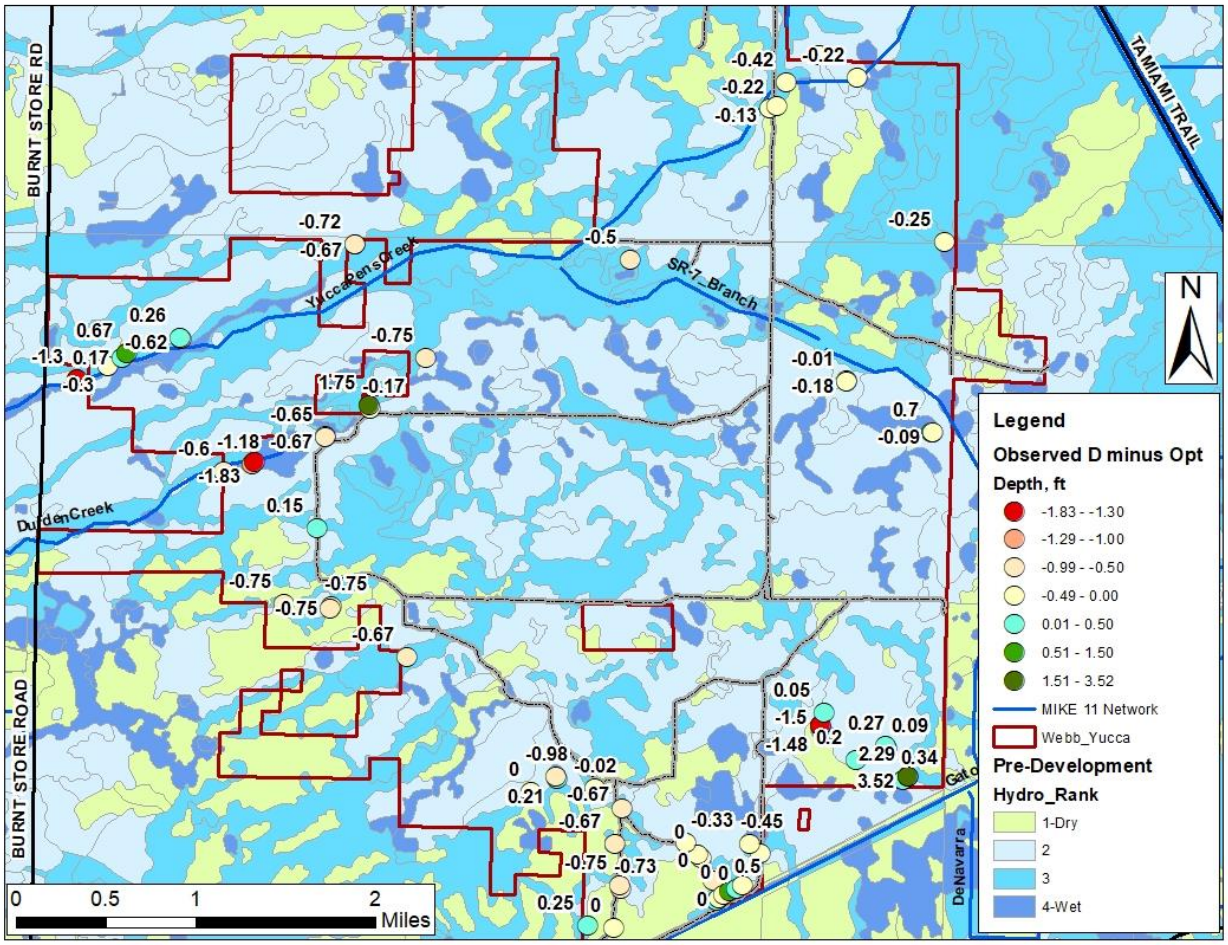


Figure 34– Comparison of Predevelopment Hydrologic Rank and 2020 Observed Average Wet Season Water Depths for Yucca Pens (yellow to red dots indicate existing depths are less than optimum depths)

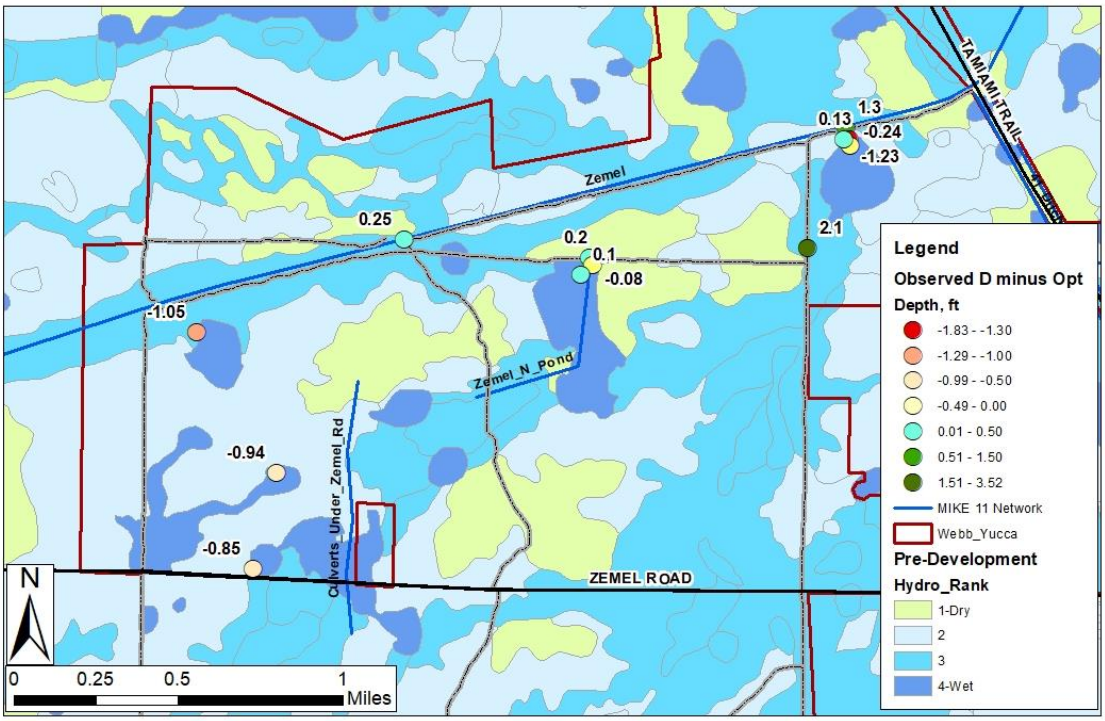


Figure 5 – Comparison of Predevelopment Hydrologic Rank and 2020 Observed Average Wet Season Water Depths for Northern Portion of Yucca Pens (yellow to red dots indicate existing depths are less than optimum depths)

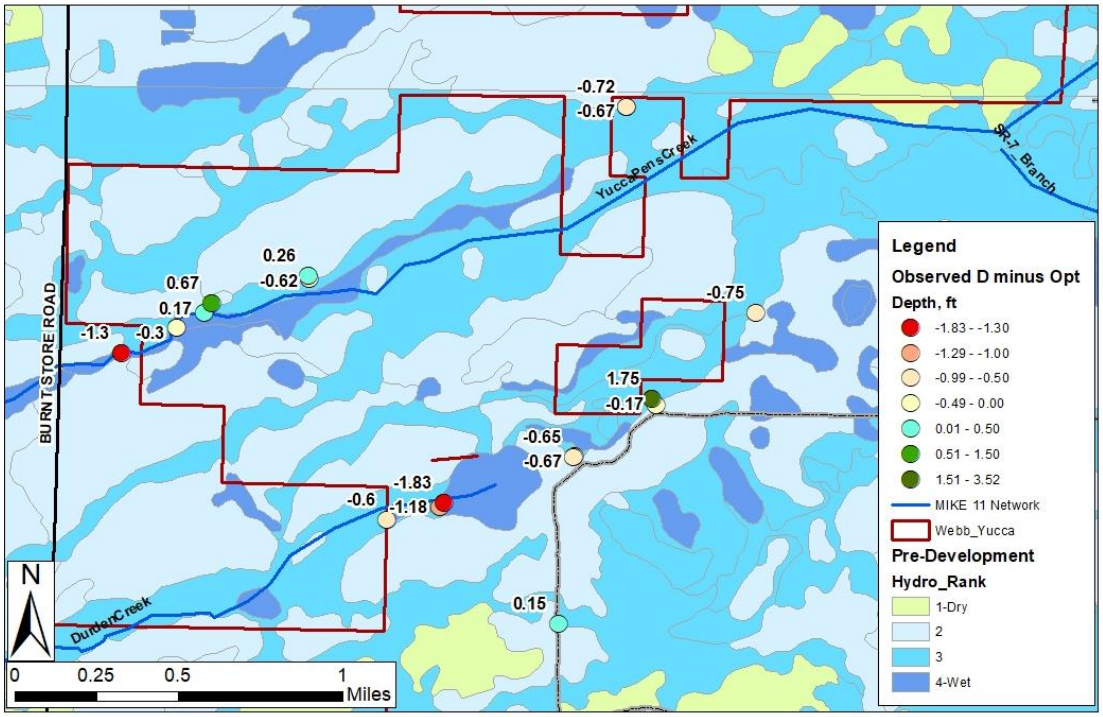


Figure 6 – Comparison of Predevelopment Hydrologic Rank and 2020 Observed Average Wet Season Water Depths for the Yucca Pens and Durden Creek portion of Yucca Pens (yellow to red dots indicate existing depths are less than optimum depths)

A detailed view of the portion of Yucca Pens immediately north of Gator Slough is presented in **Figures 7a and 7b**. Existing topography with current aerial photograph in **Figure 7a** illustrates a channel (blue band) draining west from a shallow depression classified as a ***historic wet prairie***. **Figure 7b** illustrates the same area with 1950's-era aerial photograph that clearly suggests the historic presence of wetland conditions in the area identified as a historic wet prairie. The vegetation assessment point (yellow dot, value -0.42 feet) within the historic wet prairie indicated existing water depths at less than optimum conditions. Other points along the channel were either similar to or higher than optimum conditions because they were located within the channel (concentrated flows within the erosion feature). **Figures 8a** and **8b** present dry and wet season photographs of this erosion feature. It is located upstream of an existing concrete weir constructed by FWC in 2014-2015. This channel currently is draining the historic wet prairie, and along with other eroded ATV trails, contributes to the low water levels throughout the southern portion of Yucca Pens.

Results of Comparison of Observed Average Wet Season Water Depths to Optimum Depths

Babcock Webb. The southwest portion of Babcock Webb WMA has water depths deeper than optimum conditions. Restrictions to historic flow-ways west of Babcock Webb are the primary cause for the flooding of southwest Babcock Webb. Areas north of the South Walk-In Area (identified in **Figure 3**) do not show water depths above optimum conditions, however this area could be evaluated further to confirm they do not warrant restoration measures, during a typical wet season.

Yucca Pens. The southern and western portions of Yucca Pens have water depths less than optimum conditions. Drainage via eroded ATV trails has been observed at numerous locations in Yucca Pens, and construction of additional ATV channel blocks will be evaluated as part of Task 6 – Modeling Natural (Pre-development) and Future Conditions.

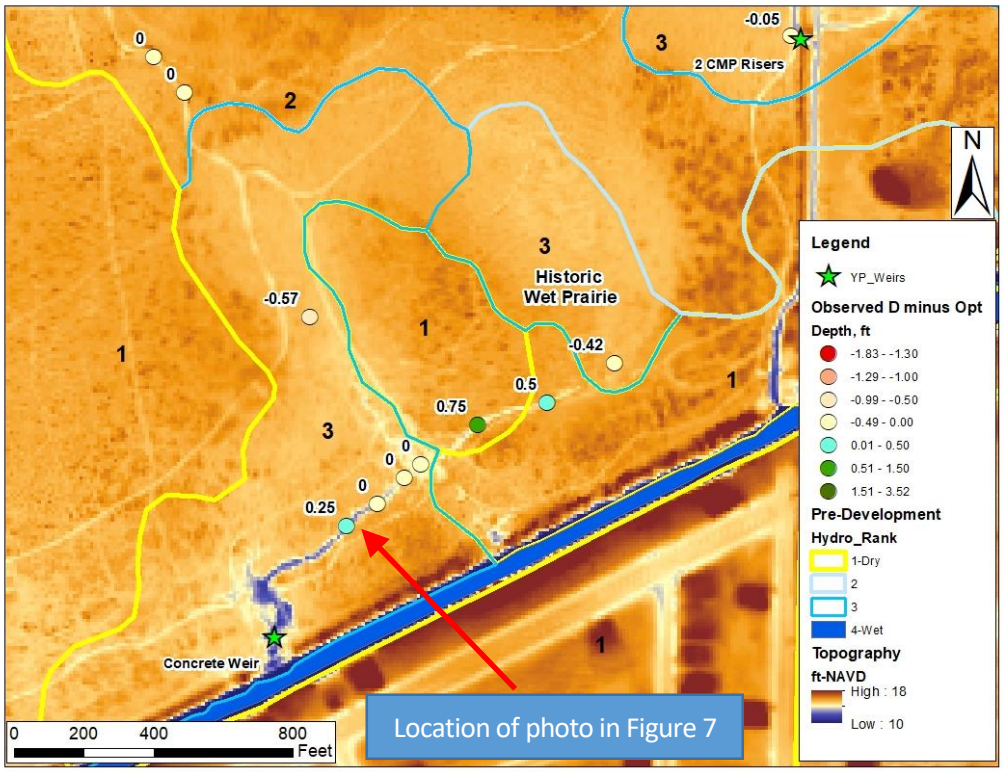


Figure 7a – Topography, Hydrologic Rank Coverage, and Deviations from Optimum Water Depth for South Yucca Pens

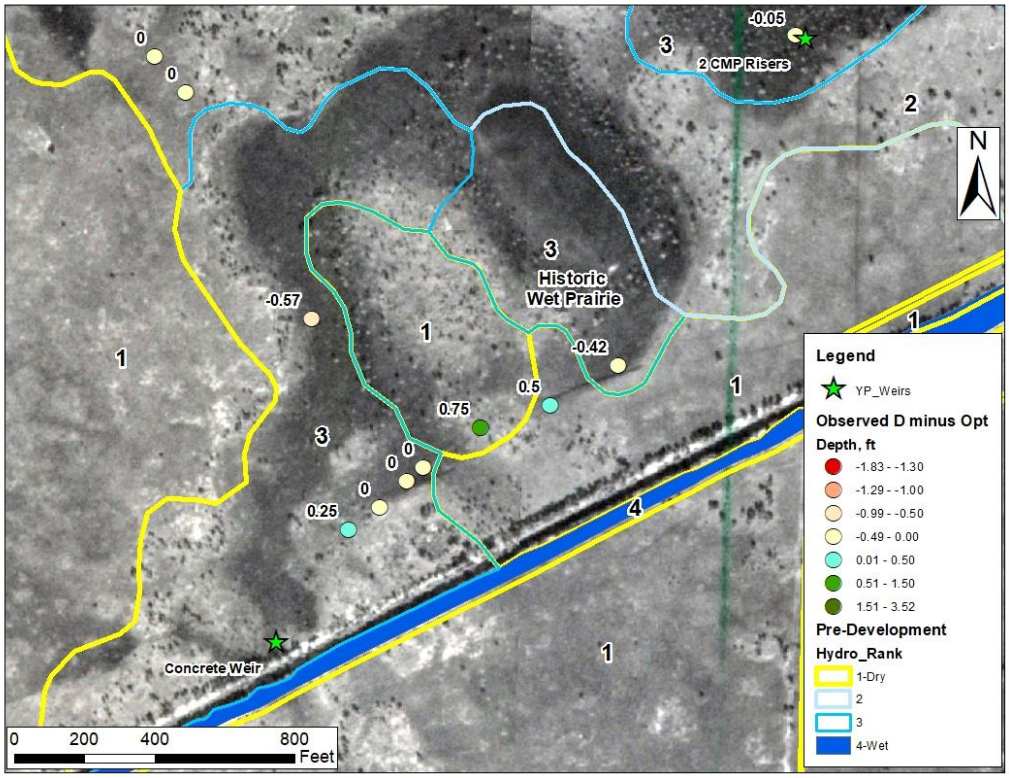


Figure 7b – Historic Aerial Photography, Hydrologic Rank Coverage, and Deviations from Optimum Water Depth for South Yucca Pens

Figure 8a – Dry Season Photograph of Eroded Channel in South Yucca Pens, 5-20-20, Looking South

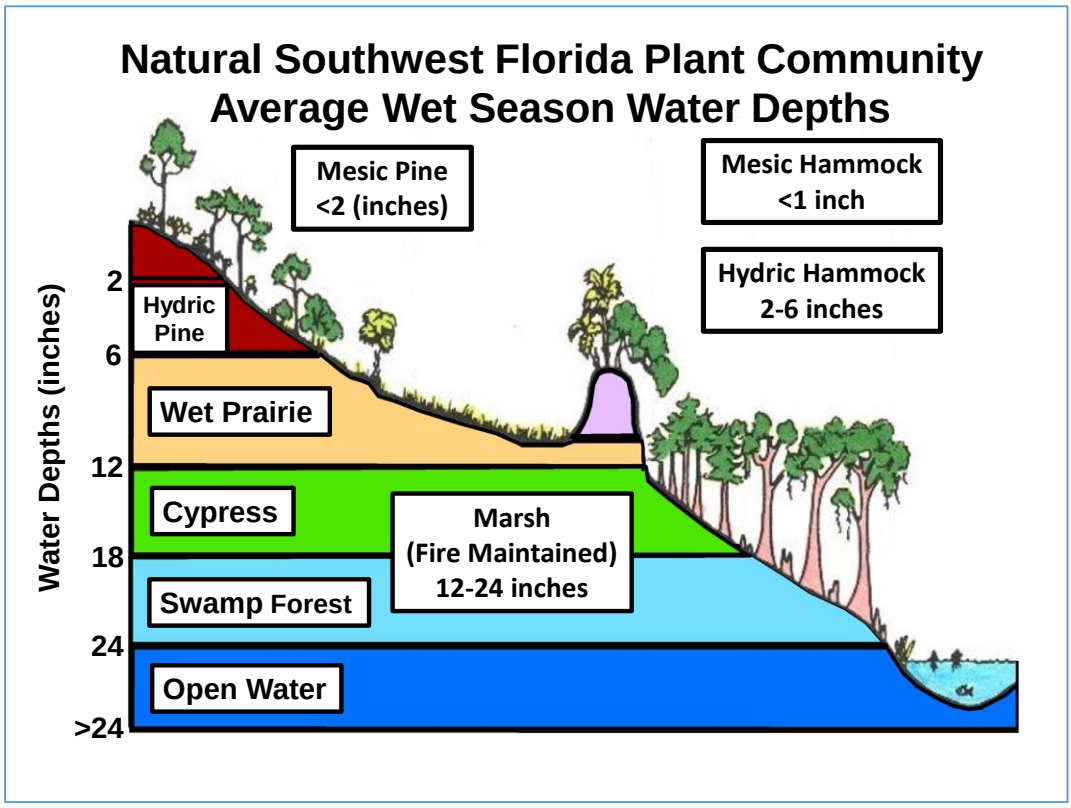
Figure 8b – Wet Season Photograph of Eroded Channel in South Yucca Pens, 10-15-20, Looking North

References

Copp, R... and W. Kirk Martin. 2020. Technical Memorandum – Task 3b Documentation of Seasonal High and Low Water Survey Data, Evaluations of Vegetation Indicators of Wetland Health. Prepared by Water Science Associates for Coastal and Heartlands National Estuary Partnership, December 2, 2020.

Duever, Michael J. and Richard E. Roberts. 2013. Successional and Transitional Models of Natural South Florida, USA, Plant Communities. Fire Ecology Volume 9, Issue 1, pages 110 – 123.

Attachment 1 – Average Wet Season Water Depths for Natural Southwest Florida Plant Communities



Source: Duever and Roberts, 2013