Revised Minimum Levels Based on Reevaluation of Levels Adopted for 41 Southwest Florida Water Management District Wetlands

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Resource Evaluation Section
Water Resources Bureau
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Cover: Photograph by Michael Hancock

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Introduction

Executive Summary

This report describes the development of minimum levels (also referred to as “MFLs”) for 41 palustrine cypress wetlands (also referred to as “isolated cypress wetlands”) within the Southwest Florida Water Management District (District). These levels were developed based on the reevaluation of minimum levels approved by the District Governing Board in October 1998 and subsequently adopted into District rules. The proposed minimum levels represent necessary revisions to the currently adopted levels.

Adopted levels were reevaluated to support ongoing District assessment of minimum flows and levels (MFLs) in the Northern Tampa Bay Water Use Caution Area (NTB WUCA), a region of the District where recovery strategies are being implemented to support recovery to minimum flow and level thresholds.

A summary of the previously adopted and currently proposed levels can be found in Table 2.

Minimum Flows and Levels Program Overview

Legal Directives

Section 373.042, Florida Statutes (F.S.), directs the Department of Environmental Protection or the water management districts to establish minimum flows and levels (MFLs) for lakes, wetlands, rivers and aquifers. Section 373.042(1)(a), F.S., states that “[t]he minimum flow for a given watercourse shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." Section 373.042(1)(b), F.S., defines the minimum water level of an aquifer or surface water body as "…the level of groundwater in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area." MFLs are established and used by the Southwest Florida Water Management District (SWFWMD or District) for water resource planning, as one of the criteria used for evaluating water use permit applications, and for the design, construction and use of surface water management systems.

Established MFLs are key components of resource protection, recovery and regulatory compliance, as Section 373.0421(2) F.S., requires the development of a recovery or prevention strategy for water bodies “[i]f the existing flow or level in a water body is below, or is projected to fall within 20 years below, the applicable minimum flow or level established pursuant to S. 373.042.” Section 373.0421(2)(a), F.S., requires that recovery or prevention strategies be developed to: "(a) [a]chieve recovery to the established minimum flow or level as soon as practicable; or (b) [p]revent the existing flow or level from falling below the established minimum flow or level." Periodic reevaluation and, as

necessary, revision of established minimum flows and levels are required by Section 373.0421(3), F.S.

Minimum flows and levels are to be established based upon the best information available, and when appropriate, may be calculated to reflect seasonal variations (Section 373.042(1), F.S.). Also, establishment of MFLs is to involve consideration of, and at the governing board or department's discretion, may provide for the protection of nonconsumptive uses (Section 373.042(1), F.S.). Consideration must also be given to "…changes and structural alterations to watersheds, surface waters and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed, on the hydrology of the affected watershed, surface water, or aquifer…", with the requirement that these considerations shall not allow significant harm caused by withdrawals (Section 373.0421(1)(a), F.S.). Sections 373.042 and 373.0421 provide additional information regarding the prioritization and scheduling of minimum flows and levels, the independent scientific review of scientific or technical data, methodologies, models and scientific and technical assumptions employed in each model used to establish a minimum flow or level, and exclusions that may be considered when identifying the need for MFLs establishment.

The Florida Water Resource Implementation Rule, specifically Rule 62-40.473, Florida Administrative Code (F.A.C.), provides additional guidance for the establishment of MFLs, requiring that "…consideration shall be given to natural seasonal fluctuations in water flows or levels, nonconsumptive uses, and environmental values associated with coastal, estuarine, riverine, spring, aquatic and wetlands ecology, including: a) Recreation in and on the water; b) Fish and wildlife habitats and the passage of fish; c) estuarine resources; d) Transfer of detrital material; e) Maintenance of freshwater storage and supply; f) Aesthetic and scenic attributes; g) Filtration and absorption of nutrients and other pollutants; h) Sediment loads; i) Water quality; and j) Navigation."

Rule 62-40.473, F.A.C., also indicates that "[m]inimum flows and levels should be expressed as multiple flows or levels defining a minimum hydrologic regime, to the extent practical and necessary to establish the limit beyond which further withdrawals would be significantly harmful to the water resources or the ecology of the area as provided in Section 373.042(1), F.S." It further notes that, "…a minimum flow or level need not be expressed as multiple flows or levels if other resource protection tools, such as reservations implemented to protect fish and wildlife or public health and safety, that provide equivalent or greater protection of the hydrologic regime of the water body, are developed and adopted in coordination with the minimum flow or level." The rule also includes provision addressing: protection of MFLs during the construction and operation of water resource projects; the issuance of permits pursuant to Section 373.086 and Parts II and IV of Chapter 373, F.S.; water shortage declarations; development of recovery or prevention strategies, development and updates to a minimum flow and level priority list and schedule, and peer review for MFLs establishment.

Development of Minimum Wetland Levels in the Southwest Florida Water Management District

Programmatic Description and Major Assumptions

Since the enactment of the Florida Water Resources Act of 1972 (Chapter 373, F.S.), in which the legislative directive to establish MFLs originated, and following subsequent modifications to this directive and adoption of relevant requirements in the Water Resource Implementation Rule, the District has actively pursued the adoption, i.e., establishment of MFLs for priority water bodies. The District implements established MFLs primarily through its water supply planning, water use permitting and environmental resource permitting programs, and through the funding of water resource and water supply development projects that are part of a recovery or prevention strategy. The District's MFLs program addresses all relevant requirements expressed in the Florida Water Resources Act and the Water Resource Implementation Rule.

A substantial portion of the District's organizational resources has been dedicated to its MFLs Program, which logistically addresses six major tasks: 1) development and reassessment of methods for establishing MFLs; 2) adoption of MFLs for priority water bodies (including the prioritization of water bodies and facilitation of public and independent scientific review of proposed MFLs and methods used for their development); 3) monitoring and MFLs status assessments, i.e., compliance evaluations; 4) development and implementation of recovery strategies; 5) MFLs compliance reporting; and 6) ongoing support for minimum flow and level regulatory concerns and prevention strategies. Many of these tasks are discussed or addressed in this Minimum Levels report; additional information on all tasks associated with the District's MFLs Program is summarized by Hancock *et al.* (2010).

The District's MFLs Program is implemented based on three fundamental assumptions. First, it is assumed that many water resource values and associated features are dependent upon and affected by long-term hydrology and/or changes in long-term hydrology. Second, it is assumed that relationships between some of these variables can be quantified and used to develop significant harm thresholds or criteria that are useful for establishing MFLs. Third, the approach assumes that alternative hydrologic regimes may exist that differ from non-withdrawal impacted conditions but are sufficient to protect water resources and the ecology of these resources from significant harm.

Support for these assumptions is provided by a large body of published scientific work addressing relationships between hydrology, ecology and human-use values associated with water resources (e.g., see reviews and syntheses by Postel and Richter 2003, Wantzen *et al.* 2008, Poff *et al.* 2010, Poff and Zimmerman 2010). This information has been used by the District and other water management districts within the state to identify significant harm thresholds or criteria supporting development of MFLs for hundreds of water bodies, as summarized in the numerous publications associated with these efforts (e.g., SFWMD 2000, 2006, Flannery *et al*. 2002, SRWMD 2004, 2005, Neubauer *et al.* 2008, Mace 2009).

With regard to the assumption associated with alternative hydrologic regimes, consider a historic condition for an unaltered river or lake system with no local groundwater or surface water withdrawal impacts. A new hydrologic regime for the system would be associated with each increase in water use, from small withdrawals that have no measurable effect on the historic regime to large withdrawals that could substantially alter the regime. A threshold hydrologic regime may exist that is lower or less than the historic regime, but which protects the water resources and ecology of the system from significant harm. This threshold regime could conceptually allow for water withdrawals, while protecting the water resources and ecology of the area. Thus, MFLs may represent minimum acceptable rather than historic or potentially optimal hydrologic conditions.

Development of the Wetland Minimum Level Supporting Criteria

The District has developed specific methodologies for establishing minimum flows or levels for lakes, wetlands, rivers, estuaries and aquifers, subjected the methodologies to independent, scientific peer-review, and incorporated the methods for some system types into its Water Level and Rates of Flow rules (Chapter 40D-8, F.A.C.).

Information regarding the development of adopted methods for establishing minimum wetland levels is included in Southwest Florida Water Management District (1999). Additional information relevant to developing wetland minimum levels is presented by Schultz et al. (2004), Carr and Rochow (2004), Carr *et al.* (2006), and Hancock (2006, 2007). Independent scientific peer-review findings regarding the wetland level methods are summarized by Bedient *et al.* (1999).

Wetland minimum levels are set at a level that is 1.8 feet below a reference elevation referred to as Historic Normal Pool (HNP). This elevation is an estimate of historic high water levels within a wetland, generally believed to have been reached between 2 to 10 percent of the time. It is estimated using biological indicators of hydrology such as cypress tree buttress inflection points, the upper limit of the root crown on *Lyonia lucida* growing on tree tussocks, or the lower limit of epiphytic mosses that are intolerant of sustained inundation (Carr and Rochow 2004, Carr et al. 2006). The 1.8 foot offset from HNP metric is based on studies that were performed on mesic, isolated cypress domes, and was the level that generally separated impacted wetlands from non-impacted wetlands (SWFWMD 1999). Therefore, in order to utilize this method and set an appropriate minimum level on a wetland, the wetland must first be a mesic, isolated cypress dome, and then also have a reliable, reproducible HNP that can be measured.

To support wetland monitoring, including that of wetlands with established minimum levels, standard monitoring practices have been put in place throughout the District. The District has implemented the Wetland Assessment Procedure (WAP) to collect information on vegetation, hydrology, soils and other pertinent variables in monitored wetlands to characterize the biological condition and health of each wetland (SWFWMD and TBW, 2005). Additionally, hydrologic data is collected across the District, including at each wetland with established minimum levels. Generally speaking, each MFL wetland has a staff gage to record standing water elevations, as well as a wetland and

an upland surficial well, such as demonstrated in Figure 1. Over time, the wells or staff gages may have been replaced or moved for various reasons, which can explain some inconsistencies in the hydrographs that are presented in this report. Additionally, the land surface elevation that is presented in the following hydrographs is based on the land surface at the staff gage, which is typically, but not always, located in the deepest part of the wetland.

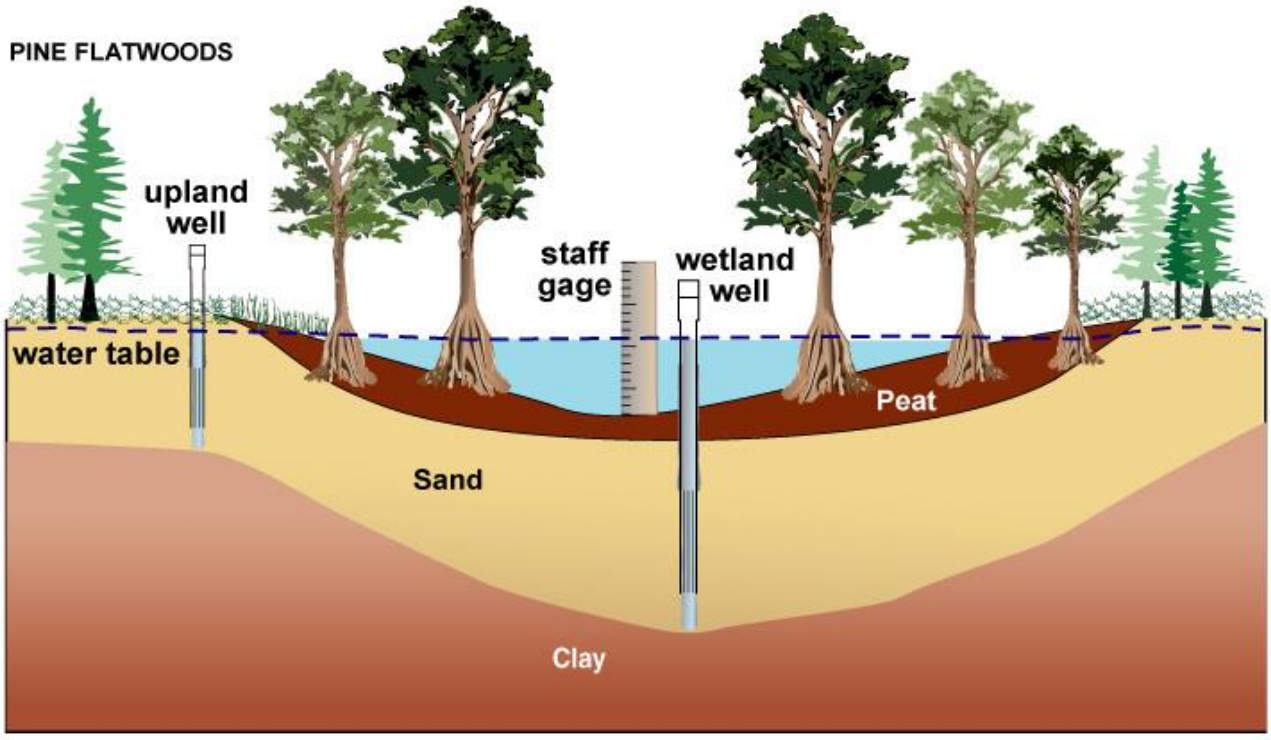

Figure 1: Wetland Monitoring Instrumentation example.

Consideration of Changes and Structural Alterations

When establishing MFLs, the District considers "…changes and structural alterations to watersheds, surface waters and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed, on the hydrology of the affected watershed, surface water, or aquifer…" in accordance with Section 373.0421(1)(a), F.S. Also, as required by statute, the District does not establish MFLs that would allow significant harm caused by withdrawals when considering the changes, alterations and their associated effects and constraints. These considerations are based on review and analysis of best available information, such as water level records, environmental and construction permit information, water control structure and drainage alteration histories, and observation of current site conditions.

A screening evaluation of structural changes to each MFL wetland was performed. The goal of this evaluation was to determine if there was any evidence that the existing structural situation at each wetland would require additional, more advanced

assessments. Lidar information in the vicinity of each MFL wetland was reviewed, and an inspection of the perimeter of each wetland was performed. Surveying was performed to determine the controlling elevation of any potential outlets, natural or manmade, at each wetland. Once these potential outlets were determined, an assessment of structural alteration was performed:

a. A Structural Alteration is defined in Chapter 40D-8.021(16), F.A.C as "man's physical alteration of the control point of a lake or wetland that affects water levels." Once a potential outlet on each wetland was identified, its general characteristics were noted, and its elevation was surveyed.
b. Most of the wetlands did not have an obvious, hardened outlet. Many low outlet elevations were lower than the HNP elevation, but that alone does not determine the outlet's effect on wetland water levels. An outlet's effect on a wetland's hydrology depends on many factors, including the rate of flow of water that can be accommodated by the outlet profile. For example, a 20-foot wide broad-crested weir would have a much larger effect on a wetland's hydrology than a 2-inch PVC pipe, so these factors need to be considered in any structural assessment.
c. A few wetlands did have a hardened, obvious man-made structure at their outlet. Most did not. For those without man-made structures at their outlet, many appeared to be natural, and a few appeared to be old agricultural drainage features, many of which were so old that they have become "naturalized." Because it is not always possible to tell the difference, an assessment was performed on all wetlands.
d. Several wetlands did not have an outlet elevation below HNP. These were considered "not structurally altered." For purposes of assessment, any wetland that did have an outlet with an elevation below the HNP was conservatively considered "potentially structurally altered."
e. For each wetland for which MFLs were recommended, the Current P10 and P50 were calculated from the data for each wetland for the period after wellfield cutbacks, or, in the case of Cypress Bridge, for the period of the new, increased pumping. This period is limited to 11 to 16 years, depending on the wellfield, which is normally not enough to truly represent long-term conditions. However, through experience with lakes located in the area of the MFL wetlands, the difference between the percentiles calculated using 11 to 16 years of data versus other techniques that extend this period (i.e., through statistical models using long-term rainfall records) is typically less than 0.5 feet.
f. Using this information, an assessment was performed that is analogous to methods in Chapter 40D-8, F.A.C. to determine the effect of structures in the lake MFL development process.

   Lake categories are defined in Chapter 40D-8.624(8) F.A.C as:
   i. Category 1 - Those lakes with lake-fringing cypress swamp(s) greater than 0.5 acres in size where Structural Alterations have not prevented the Historic P50 from equaling or rising above an elevation that is 1.8 feet below the normal pool of the cypress swamp(s).

ii. Category 2 - Those lakes with lake-fringing cypress swamp(s) greater than 0.5 acres in size where Structural Alterations have prevented the Historic P50 from equaling or rising above an elevation that is equal to an elevation that is 1.8 below normal pool and the lake-fringing cypress swamp(s) remain viable and perform functions beneficial to the lake in spite of the Structural Alterations."
iii. Category 3 - Those lakes where there are no lake-fringing cypress swamp(s) greater than 0.5 acre in size.

By definition, an isolated cypress wetland could not be considered Category 3. Therefore, an assessment was made to determine if each wetland was structurally altered to the point where they could be considered to meet the conditions of a Category 2 lake, where the 1.8 offset could not simply be applied.

i. For purposes of the assessment, it was assumed that outlets from wetlands could have been man-made, or at least have had man-made alterations. While many of the wetlands are currently on preserved lands, most of these lands have been subject to agricultural practices in the past, and may be structurally altered, intentionally or otherwise. For wetlands in the Cypress Bridge wellfield area, additional modern structural alterations for residential and commercial development may have occurred.
ii. The Current P10 and P50 where calculated for each wetland, based on data collected since the wellfield cutback.
iii. The High Guidance Level (HGL) was determined, based on methods in 40D-8, FAC. HGL calculations for both structurally altered and non-structurally altered lakes were followed depending on the case.
iv. The Historic P50 was calculated based on the Current P10-P50 difference.
v. If the Historic P50 is equal or above an elevation that is 1.8 feet below HNP, the wetland is equivalent to a Category 1 lake, and the cypress wetland is capable of reaching its MFL if the cypress wetland offset method is used.
vi. Note that past assessments of cypress wetlands not thought to be significantly affected by withdrawals have found that a typical P10 - P50 difference is commonly about 1 foot, plus or minus 0.2 or 0.3 ft. This difference can be larger or smaller, and may imply some affect by structural changes, but if the wetland still makes the Category 1 requirement, the cypress wetland offset would be appropriate.
vii. Again, this process is considered a screening mechanism, and was performed to see if significant evidence of structural alteration exists, which may require further assessment. Other information can be used as well.

The results of this assessment can be found in Appendix B. Most of the outlets were determined to be relatively inefficient, and in all cases, not capable of lowering each wetland significantly below the HNP.

Methods for Reevaluation of Wetland Minimum Levels

Florida Statutes 373.0421(3) requires that minimum levels be reevaluated periodically and revised as needed. In practice, the District reevaluates minimum levels when new methods become available that were not available at the time the minimum level was set. In other instances, the District will reevaluate minimum levels when enough time has passed that new available data or information may affect the determination of levels.

Although there are no new methods available for wetland MFL assessment, because the wetland MFLs have not been re-evaluated in twenty years, the District began reassessment of all 41 wetlands in 2015. Although the methods have not changed, additional information is available, and some of the lessons learned from twenty years of lake MFL development and assessment can be applied to wetland MFLs.

Additional information available for MFL reassessment include:

1) The District and Tampa Bay Water have installed high quality benchmarks at all existing monitoring sites and other locations, and have resurveyed all monitoring devices using the high-quality benchmarks. These benchmarks are also available for use in historic normal pool leveling as well.
2) Assessment approaches have been developed to assess the effects of structures on lakes, and while wetlands rarely have weirs installed for water level regulation, they are commonly structurally altered by roadside or agricultural ditches, culverts, or other land use changes. Further information about structural assessments can be found in the above sections and Appendix B.
3) All water level data has been further assessed for quality control since 1998, including clear identification of the devices used to collect the data.
4) Several new surficial aquifer monitor wells were installed in the 1999 to 2001 time period to supplement staff gage data.
5) Methods and information used to determine Historic Normal Pool have been improved and tested since 1998.
6) Over twenty years of observation, biologic monitoring and data collection has allowed District staff to better understand the physical attributes of each of the MFL wetlands, leading to an improved understanding of the wetland types.

The following steps were taken to reassess each of the wetlands with adopted MFLs:

1) In a coordinated effort, the District and Tampa Bay Water have installed two permanent benchmark monuments at each monitored wetland. Each benchmark was installed under the direct supervision of a Florida licensed Professional Surveyor and Mapper in accordance with applicable minimum technical standards as defined by Florida Administrative Code. Each benchmark is established using the NAVD 88 vertical reference, with a conversion to NGVD 29. A maintenance program to ensure the benchmarks' ongoing accuracy was developed by each agency.

Once each benchmark was installed, all measuring devices, including wells and staff gages, were resurveyed using the new benchmarks, and any necessary data adjustments were made.

2) Historic Normal Pools at each MFL site were reassessed, using as many field indicators as possible, and documenting all reasonable information used. Each indicator was leveled in using the NAVD 88 benchmarks. A summary of results can be found in Appendix A.

3) Soils assessments were performed at each wetland to determine whether the wetland was characterized as mesic or xeric soil dominated (see GPI 2016) as part of an overall evaluation of all monitored wetlands.

4) An overall assessment of the wetland health was performed.

5) Wetland names were updated in 40D-8.623 in order to clarify which wetlands were being referenced. Table 1 details the name modifications.

Table 1: Proposed wetland name modifications

Proposed Name	Name Currently in Rule 40D-8.623
n/a*	CC W-41
Cypress Creek W-11	CC W-11
Cypress Creek W-12	CC W-12
Cypress Creek W-17	CC W-17
Cypress Creek W-56 (G)	CC Site G
n/a*	STWF D
Starkey S-99	n/a**
Starkey Central	STWF Central Recorder
Starkey Z	STWF Z
Starkey Eastern (S-73)	STWF Eastern Recorder
Starkey S-75	STWF S-75
Starkey M (S-69)	STWF M
Starkey N	STWF N
Morris Bridge Entry Dome (MBR-35)	MBWF Entry Dome
Morris Bridge X-4 (MBR-89)	MBWF X-4
Morris Bridge Clay Gully Cypress (MBR-88)	MBWF Clay Gully Cypress
Morris Bridge Unnamed (MBR-16)	MBWF Unnamed
Eldridge Wilde 5	n/a**
Eldridge Wilde 11 (NW-44)	EWWF NW-44
n/a*	EWWF Salls Property Wetland 10S/10D
South Pasco 2 (NW-49)	SPWF NW-49
South Pasco South Cypress	SPWF South Cypress
South Pasco 6 (NW-50)	SPWF NW-50 South Pasco
n/a*	S21 WF NW-53 East
n/a*	Cosme WF Wetland
Cypress Bridge 16	CBRWF #16
Cypress Bridge A	CBRWF A
Cypress Bridge 25	CBRWF #25
Cypress Bridge 32	CBRWF #32
Cypress Bridge 4	CBRWF #4
n/a*	CBRWF #20
n/a*	CBARWF TQ-1 West
Cross Bar T-3	CBARWF T-3
Cross Bar Q-25 (Stop #7)	CBARWF Stop #7
Cross Bar Q-1	CBARWF Q-1
Cone Ranch 1	CR1
Cone Ranch 2	CR2
Cone Ranch 3	CR3
Cone Ranch 4	CR4
Cone Ranch 5	CR5
Cone Ranch 6	CR6
North Pasco 3	NPWF #3
North Pasco 21	NPWF #21

n/a* indicates the wetland is proposed to be dropped from Rule 40D-8.623, so there is no name update proposed

n/a** indicates the wetland is proposed to be added to Rule 40D-8.623

Results of Wetland Minimum Level Reevaluation

Eleven public water supply wellfields in the northern Tampa Bay area are collectively referred to as Tampa Bay Water's Consolidated Permit wellfields. It's in and around ten of these eleven wellfields that all but six of the adopted wetland MFLs were established (Figure 2). There are currently no wetland MFLs associated with the Northwest Hillsborough Regional wellfield. The remaining six wetlands in which MFLs were adopted are on the Lower Green Swamp Preserve, formerly known as Cone Ranch. At the time of MFL establishment, the Cone Ranch property was being considered as an additional source of water supply, but that effort was abandoned shortly after the MFLs were established. Together, 41 wetland MFLs throughout the northern Tampa Bay area were adopted in 1998.

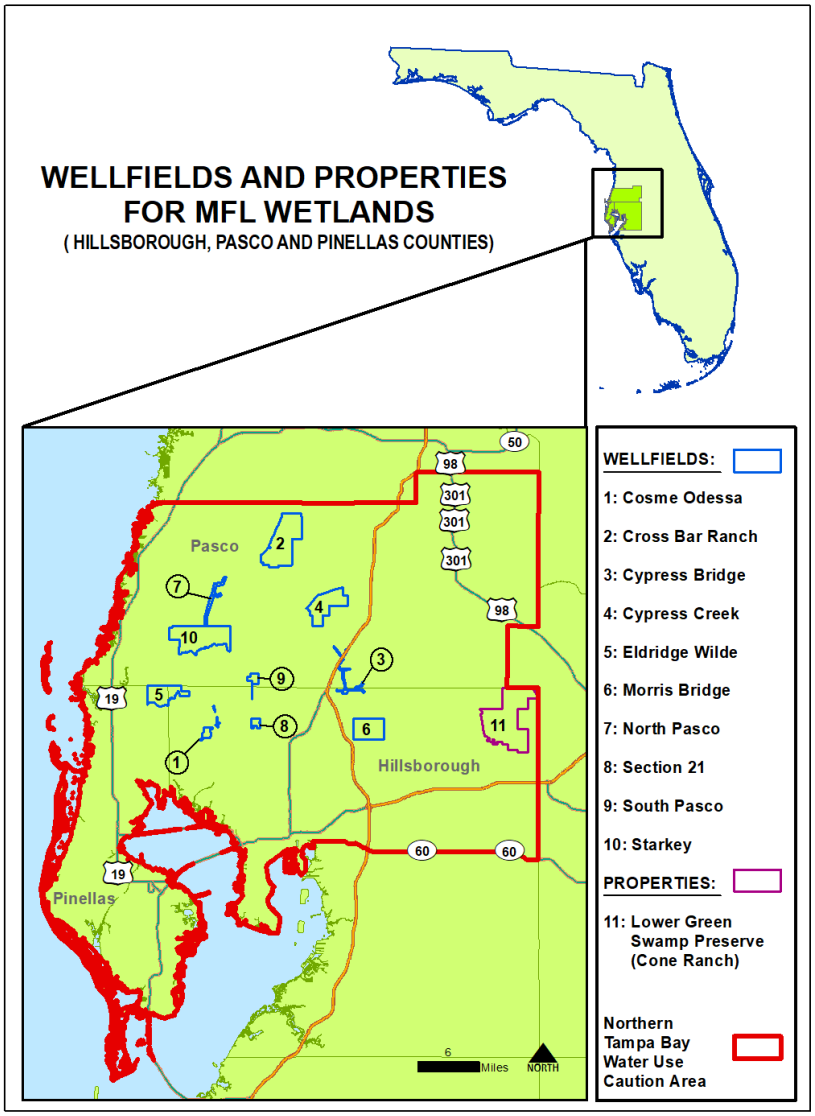

Figure 2: The Ten Public Water Supply Wellfields, and the Lower Green Swamp Preserve, Where Wetland MFLs are Established

Cone Ranch

The Cone Ranch property is located in the northeast corner of Hillsborough County (Figure 2). Cone Ranch was a proposed wellfield when the original MFLs were being proposed and adopted, but has since been purchased by Hillsborough County as conservation land (renamed the Lower Green Swamp Preserve). There are 6 wetlands with established minimum levels on the Cone Ranch property (Figure 3).

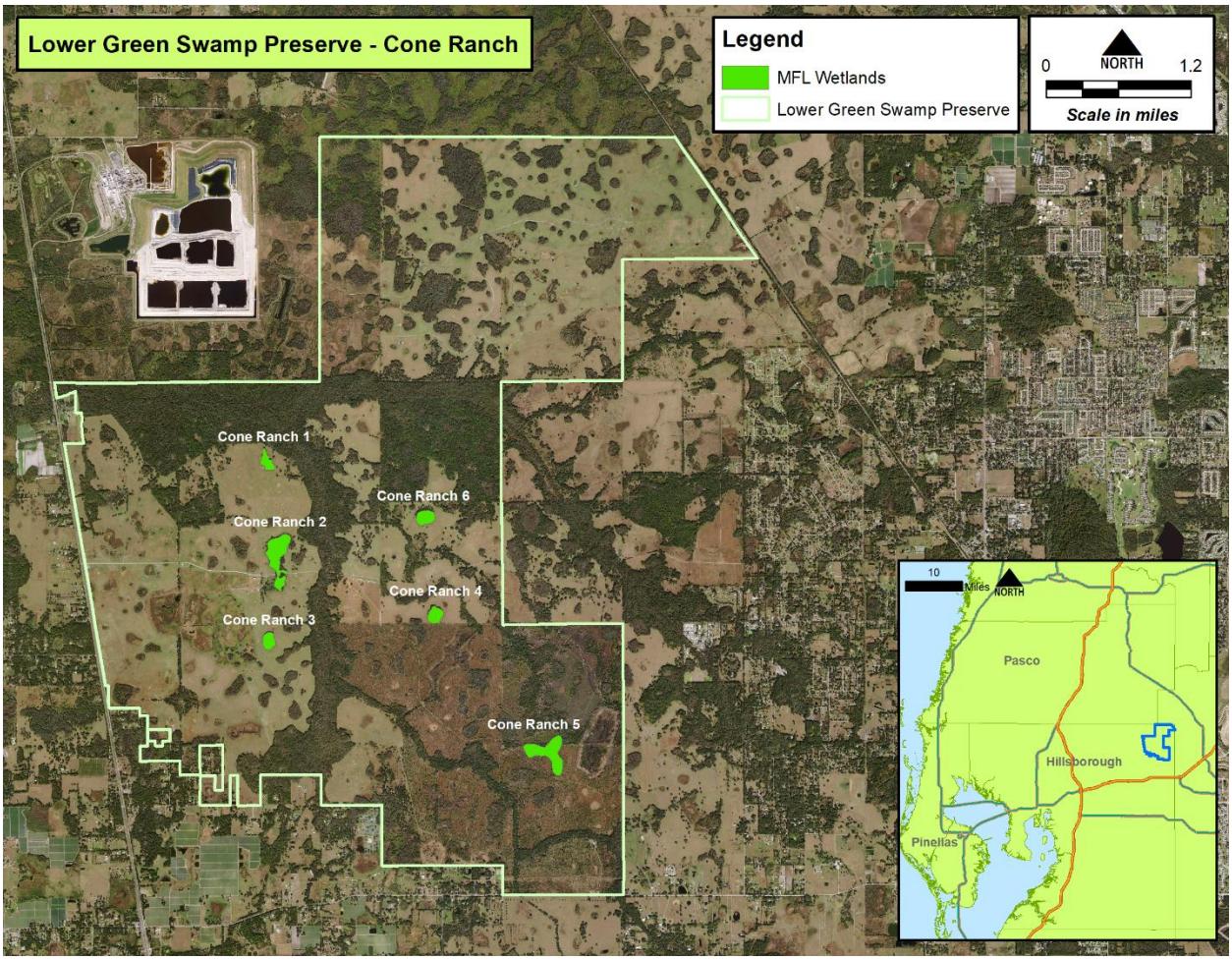

Figure 3: Cone Ranch wetlands with established minimum level wetlands

Cone Ranch 1 (Wetland ID 102)

The Cone Ranch 1 wetland is located in the northwest area of the property, and is the northernmost of the Lower Green Swamp Preserve wetlands with adopted MFLs (Figure 3). Cone Ranch 1 is an isolated cypress wetland, and is approximately 16.0 acres in size (Figure 4).

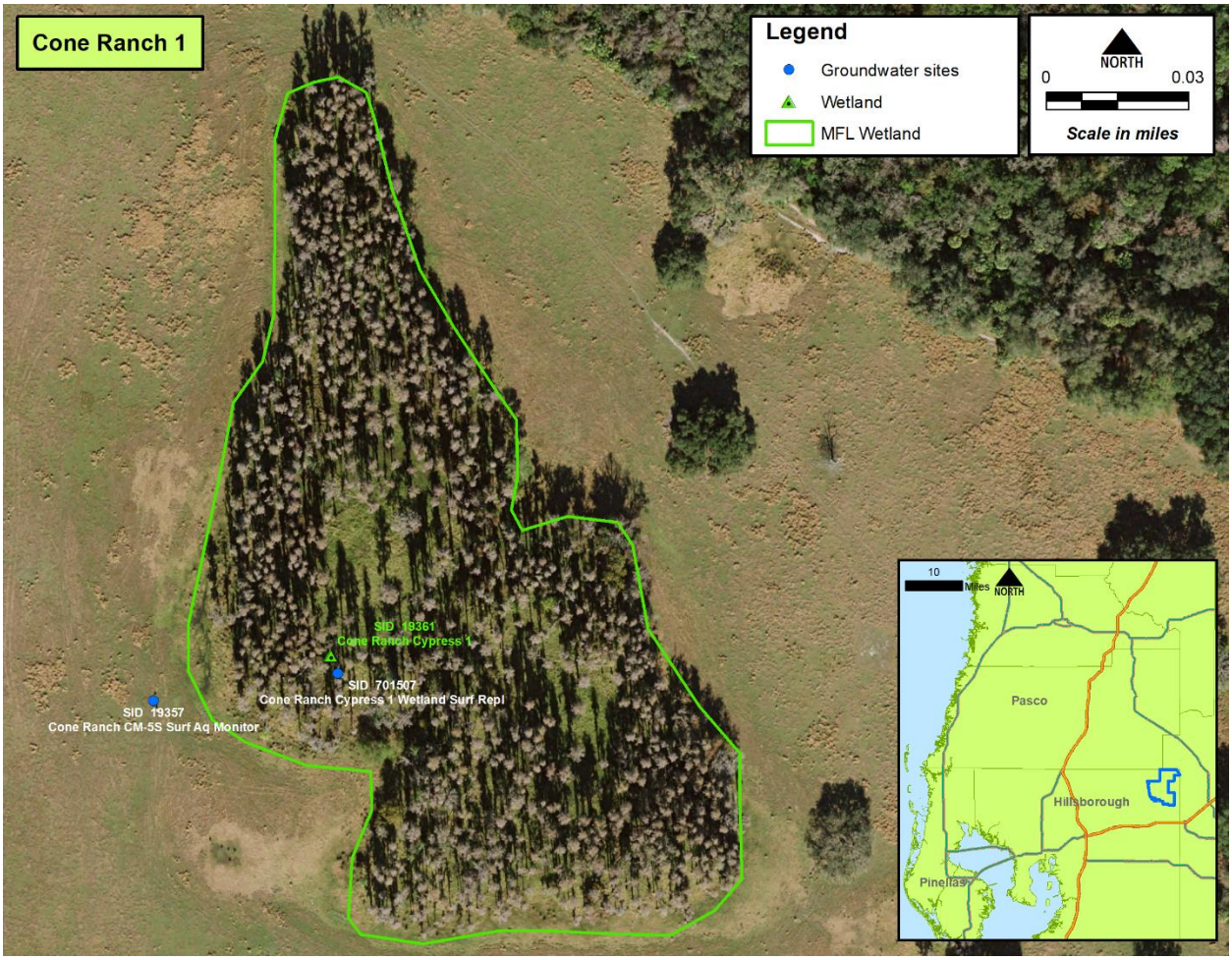

Figure 4: Cone Ranch 1 wetland

For general monitoring purposes, the District installed an upland well (SID 19357) (and an Upper Floridan aquifer monitor well) at this site in 1996. When the wetland was adopted as an MFL site, the District installed a wetland well (SID 19362) and a staff gage (SID 19361) in 2003 (Figure 4, Figure 5). The wetland well was damaged and replaced in 2007 (SID 701507). A WAP transect was established in 2005. With the exception of the upland well, the District has been exclusively collecting water level data from this site since 2010.

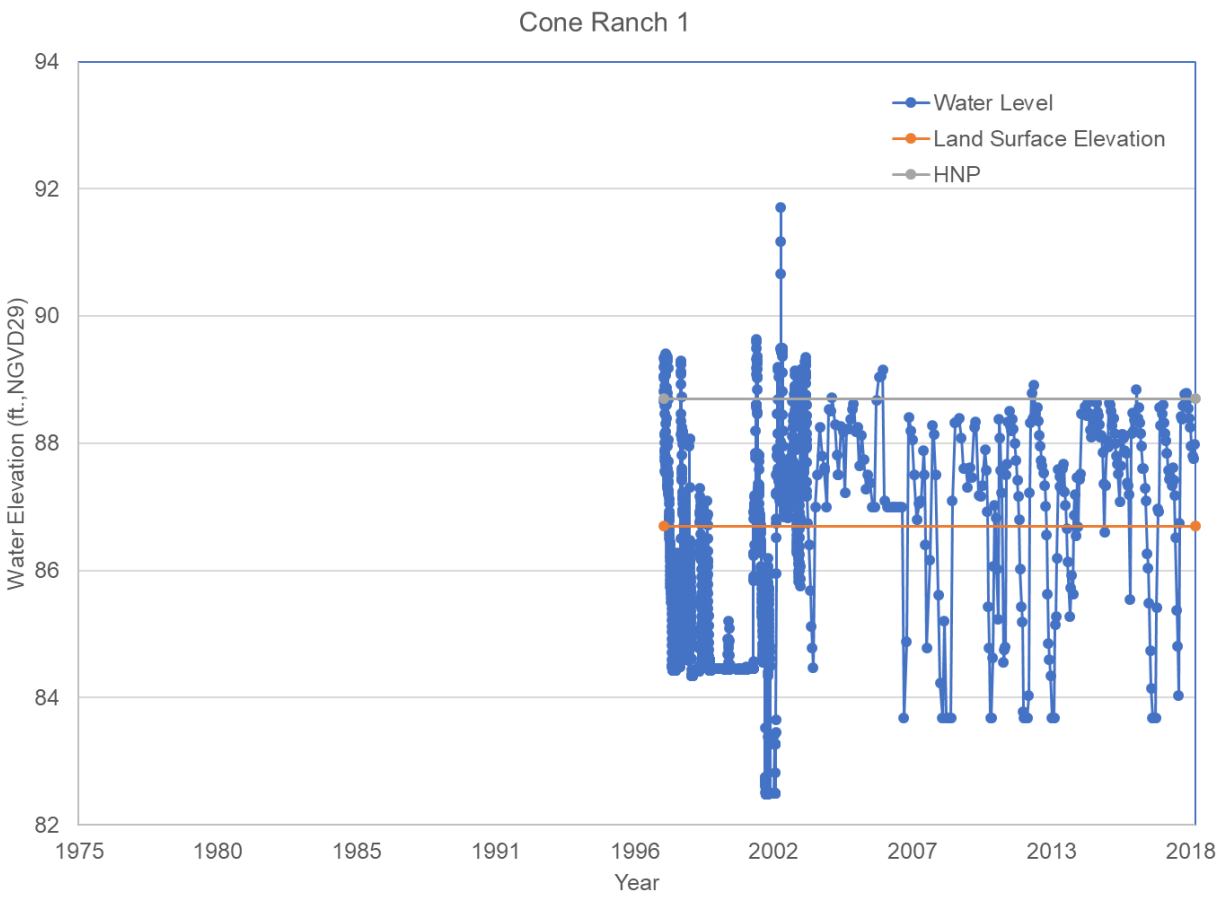

Figure 5: Cone Ranch 1 water levels

The Cone Ranch 1 wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 88.7 feet NGVD29, and a proposed MFL of 86.9 feet NGVD29. The currently adopted MFL at this site is 86.9 feet NGVD29, so there is no change recommended for the minimum level at this site.

The Cone Ranch 1 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.5 feet below the HNP (see Appendix B). The outlet flows toward the large floodplain to the east. Figure 5 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.7 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cone Ranch 1 wetland is recommended to be kept as an adopted MFL site, with an MFL of 86.9 feet NGVD29.

Cone Ranch 2 (Wetland ID 51)

The Cone Ranch 2 wetland is located in the west-central area of the property, south of Cone Ranch 1 (Figure 3). Cone Ranch 2 is an isolated cypress wetland, and is approximately 30.0 acres in size (Figure 6).

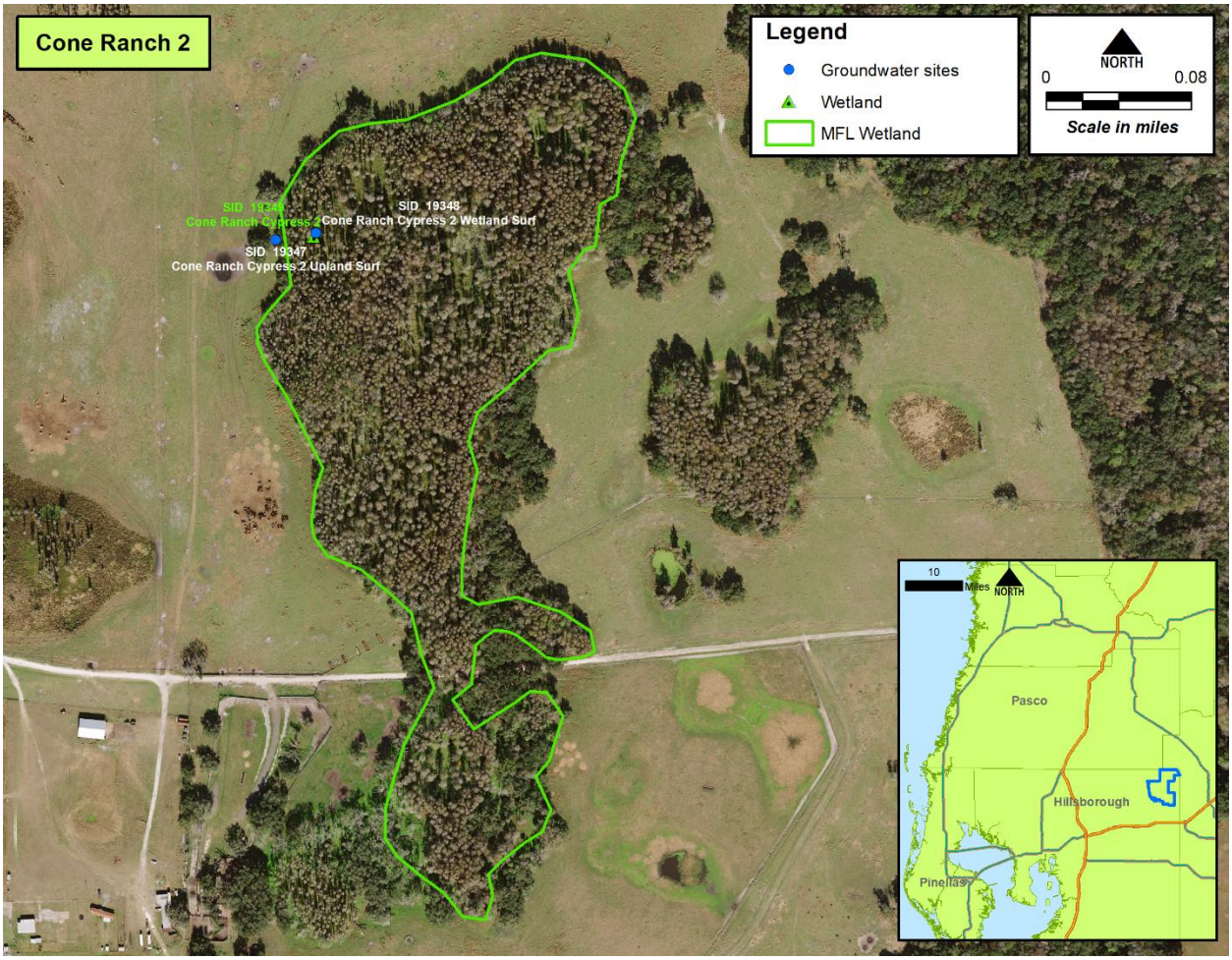

Figure 6: Cone Ranch 2 wetland

Tampa Bay Water installed a staff gage in 1989 and an upland well in 1990 at this site. When the wetland was adopted as an MFL site, the District installed a staff gage (SID 19349), wetland well (SID 19348), and upland well in 2003 (SID 19347) (Figure 6, Figure 7). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

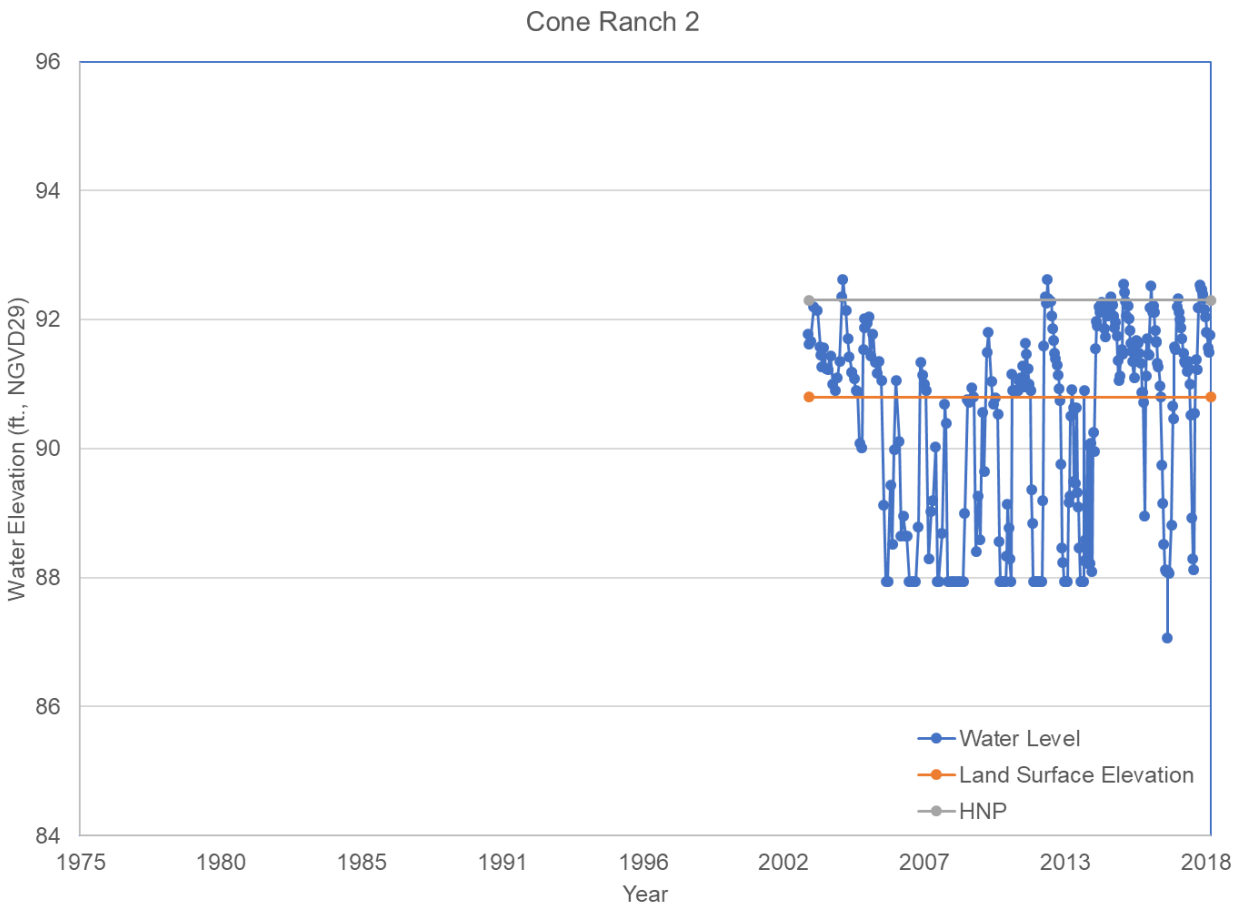

Figure 7: Cone Ranch 2 water levels

The Cone Ranch 2 wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 92.3 feet NGVD29, and a proposed MFL of 90.5 feet NGVD29. The currently adopted MFL at this site is 90.5 feet NGVD29, so there is no change recommended for this site.

The Cone Ranch 2 wetland has a very indistinct outlet, described as a “natural saddle,” and surveyed at the HNP (see Appendix B). Figure 7 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.8 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cone Ranch 2 wetland is recommended to be kept as an adopted MFL site, with an MFL of 90.5 feet NGVD29.

Cone Ranch 3 (Wetland ID 55)

The Cone Ranch 3 wetland is located in the southwestern area of the property, south of Cone Ranch 2 (Figure 3). Cone Ranch 3 is an isolated cypress wetland, and is approximately 7.8 acres in size (Figure 8).

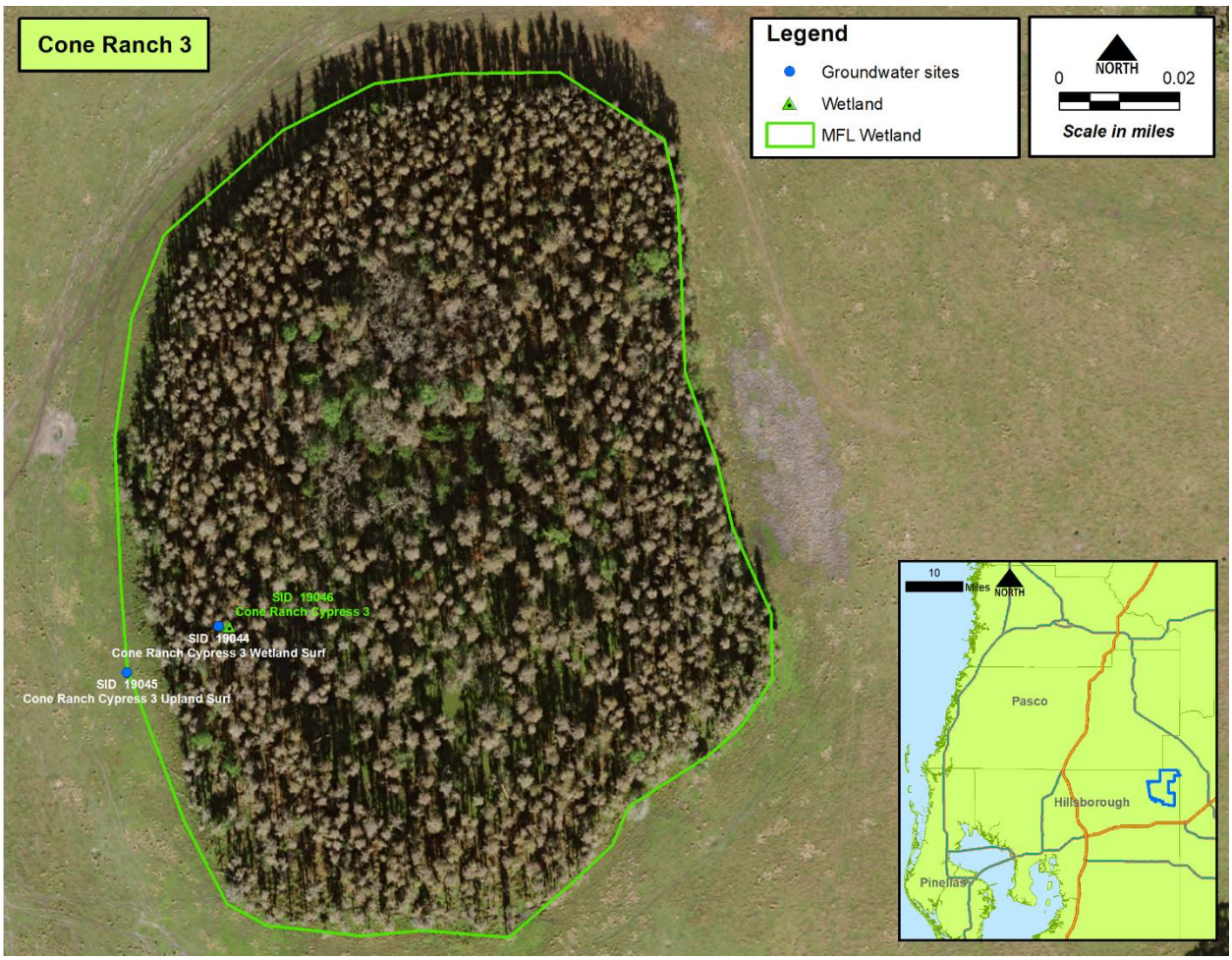

Figure 8: Cone Ranch 3 wetland

Tampa Bay Water installed a staff gage in 1989 and an upland well in 1990 at this site. When the wetland was adopted as an MFL site, the District installed a staff gage (SID 19046), wetland well (SID 19044), and upland well (SID 19045) in 2003 (Figure 8, Figure 9). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

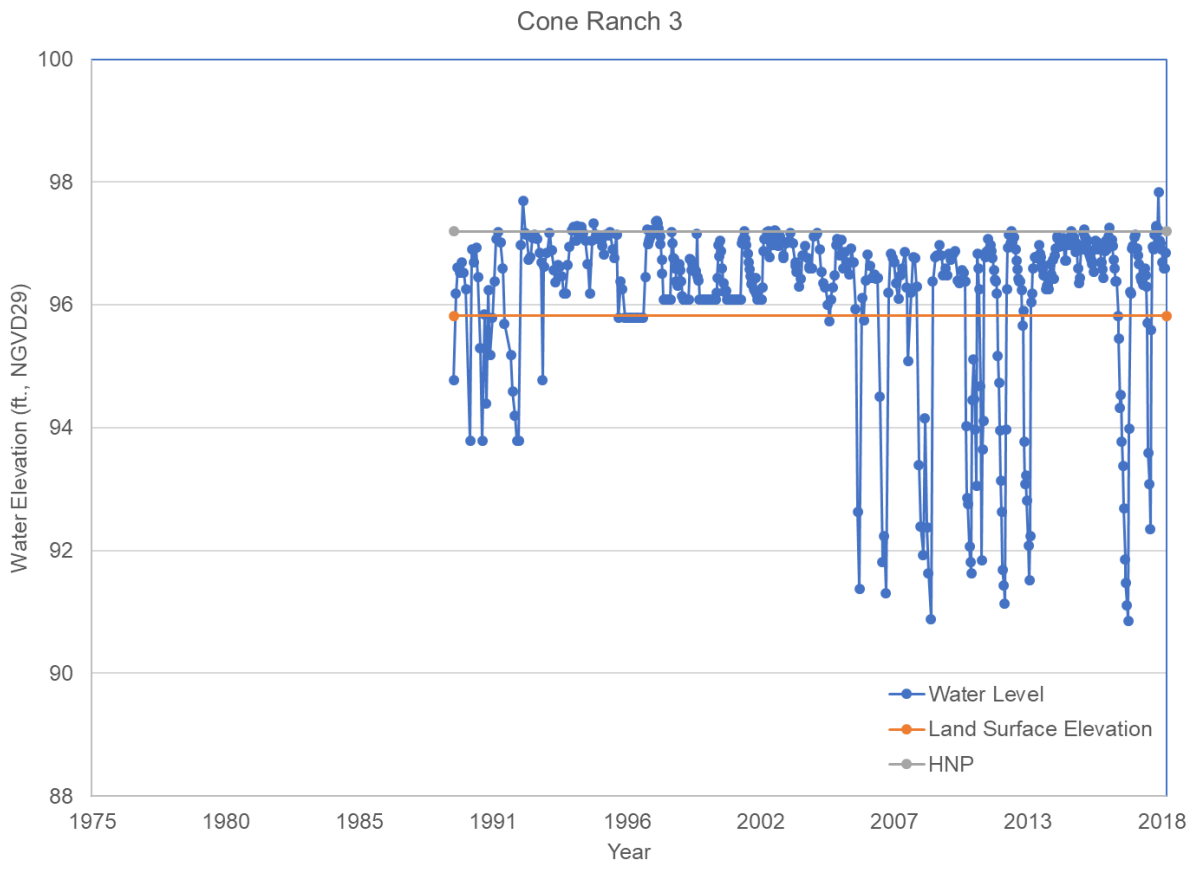

Figure 9: Cone Ranch 3 water levels

The Cone Ranch 3 wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 97.2 feet NGVD29, and a proposed MFL of 95.4 feet NGVD29. The currently adopted MFL at this site is 95.4 feet NGVD29, so there is no change recommended for this site.

The Cone Ranch 3 wetland has a very indistinct outlet, described as a “natural saddle,” and surveyed at the HNP (see Appendix B). Figure 9 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 1.3 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cone Ranch 3 wetland is recommended to be kept as an adopted MFL site, with an MFL of 95.4 feet NGVD29.

Cone Ranch 4 (Wetland ID 76)

The Cone Ranch 4 wetland is located near the southeastern boundary of the property, due east of Cone Ranch 3 (Figure 3). Cone Ranch 4 is an isolated cypress wetland, and is approximately 8.7 acres in size (Figure 10).

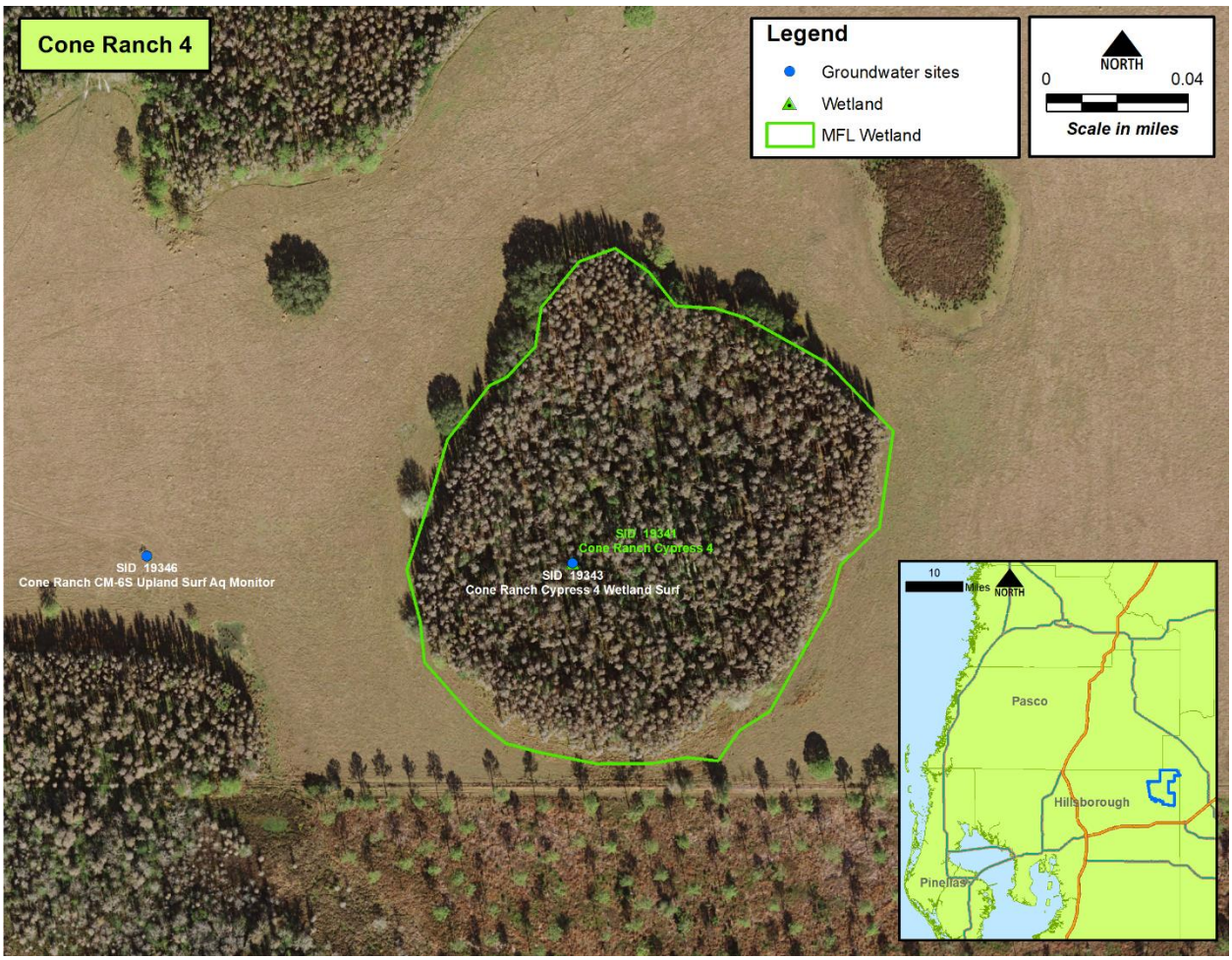

Figure 10: Cone Ranch 4 wetland

For general monitoring purposes, the District installed an upland well (SID 19356) (and an Upper Floridan aquifer monitor well) at this site in 1996. Tampa Bay Water installed a staff gage and wetland well in 1998. When the wetland was adopted as an MFL site, the District installed a staff gage (SID 19341) and a wetland well (19343) in 2003 (Figure 10, Figure 11). A WAP transect was established in 2005. With the exception of the upland well, the District has been exclusively collecting water level data from this site since 2010.

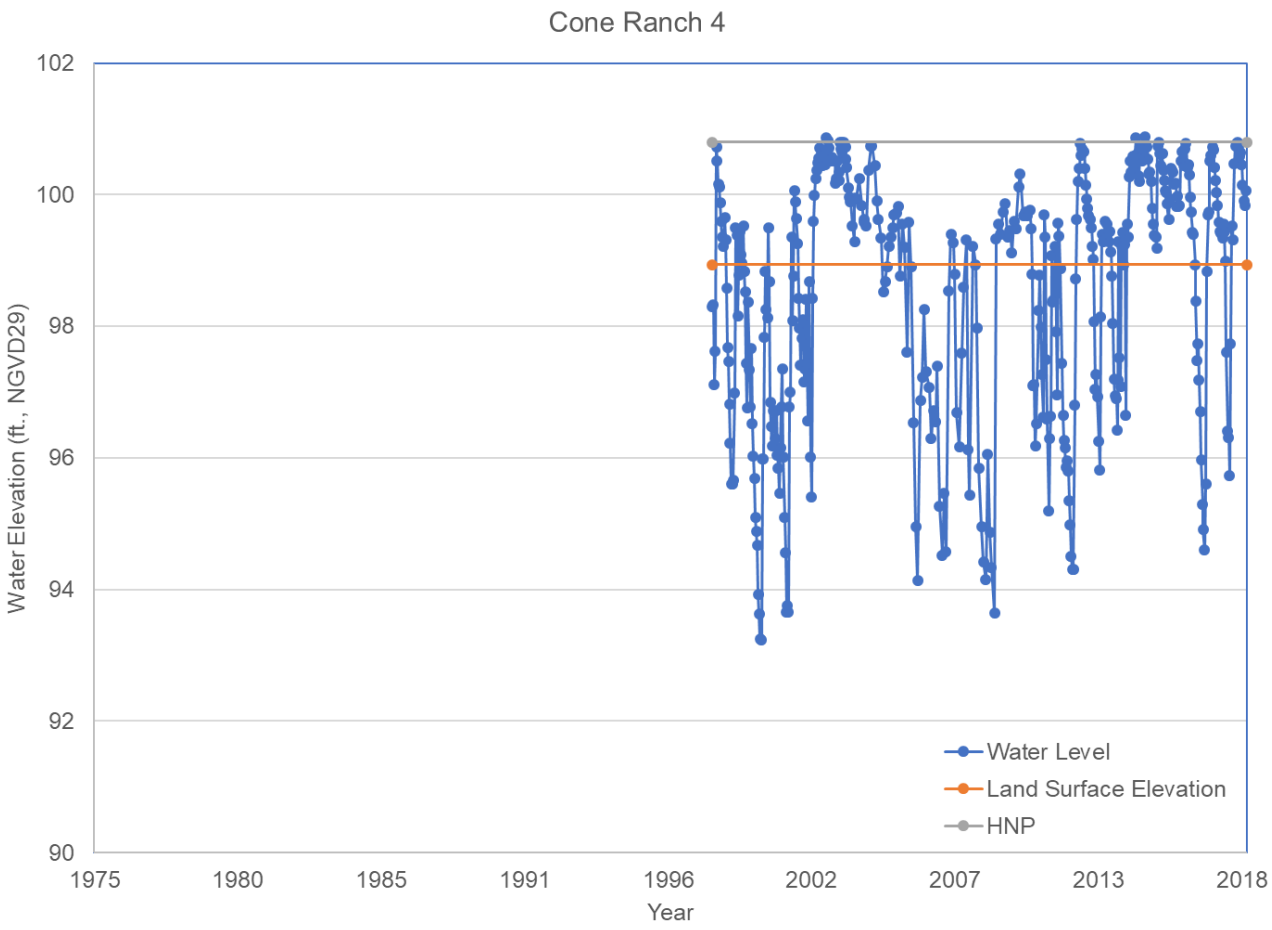

Figure 11: Cone Ranch 4 water levels

The Cone Ranch 4 wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 100.8 feet NGVD29, and a proposed MFL of 99.0 feet NGVD29. The currently adopted MFL at this site is 99.0 feet NGVD29, so there is no change recommended for this site.

The Cone Ranch 4 wetland has a very indistinct outlet, described as a "natural saddle," and surveyed at 0.1 feet above the HNP (see Appendix B). Figure 11 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.8 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cone Ranch 4 wetland is recommended to be kept as an adopted MFL site, with an MFL of 99.0 feet NGVD29.

Cone Ranch 5 (Wetland ID 85)

The Cone Ranch 5 wetland is the southernmost of the wetland MFLs established at the Lower Green Swamp Preserve, located near the southeastern boundary of the property (Figure 3). Cone Ranch 5 is an isolated cypress wetland, and is approximately 30.3 acres in size (Figure 12).

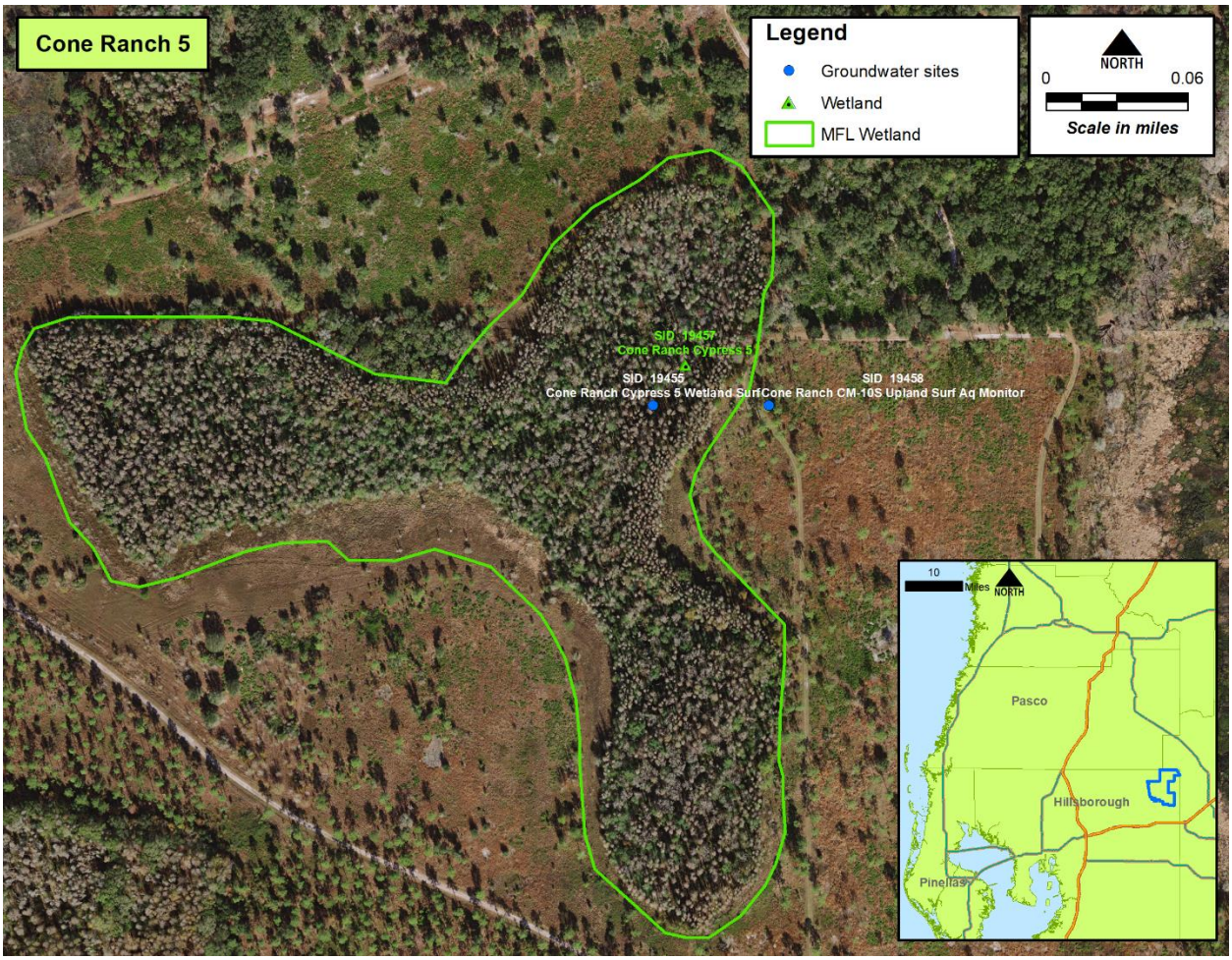

Figure 12: Cone Ranch 5 wetland

Tampa Bay Water installed a staff gage in 1989 and an upland well in 1990. For general monitoring purposes, the District installed an upland well (19458) (and an Upper Floridan aquifer monitor well) at this site in 1996. When the wetland was adopted as an MFL site, the District installed a staff gage (SID 19457) and a wetland well (SID 19455) in 2003 (Figure 12, Figure 13). A WAP transect was established in 2005. With the exception of the upland well, the District has been exclusively collecting water level data from this site since 2010.

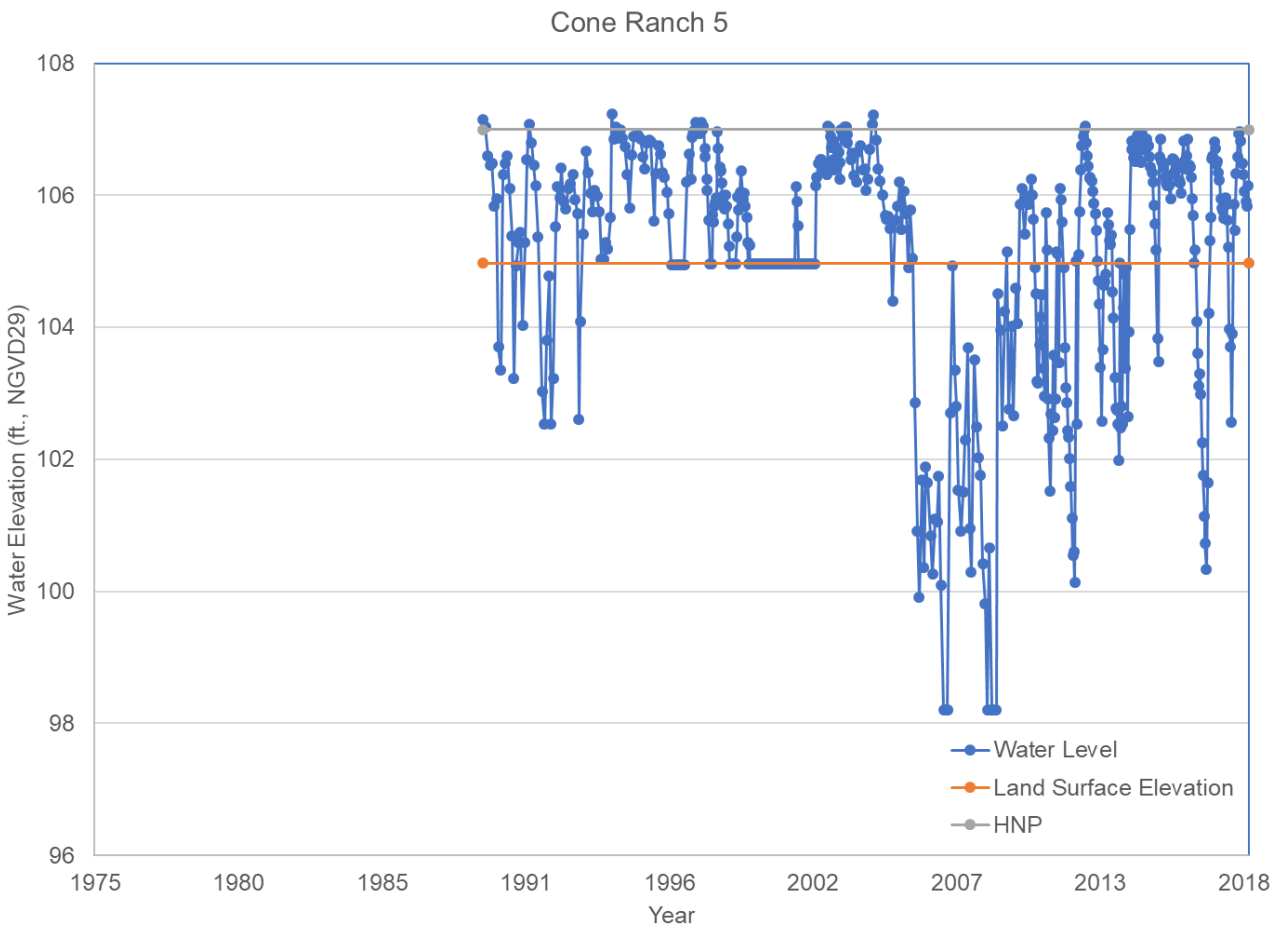

Figure 13: Cone Ranch 5 water levels

The Cone Ranch 5 wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 107.0 feet NGVD29, and a proposed MFL of 105.2 feet NGVD29. The currently adopted MFL at this site is 105.2 feet NGVD29, so there is no change recommended for this site.

The Cone Ranch 5 wetland has a very indistinct outlet, described as a "natural saddle," and surveyed at 0.6 feet below the HNP (see Appendix B). Figure 13 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.5 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cone Ranch 5 wetland is recommended to be kept as an adopted MFL site, with an MFL of 105.2 feet NGVD29.

Cone Ranch 6 (Wetland ID 74)

The Cone Ranch 6 wetland is located near east-central boundary of the property, north of the Cone Ranch 4 wetland (Figure 3). Cone Ranch 6 is an isolated cypress wetland, and is approximately 10.0 acres in size (Figure 14).

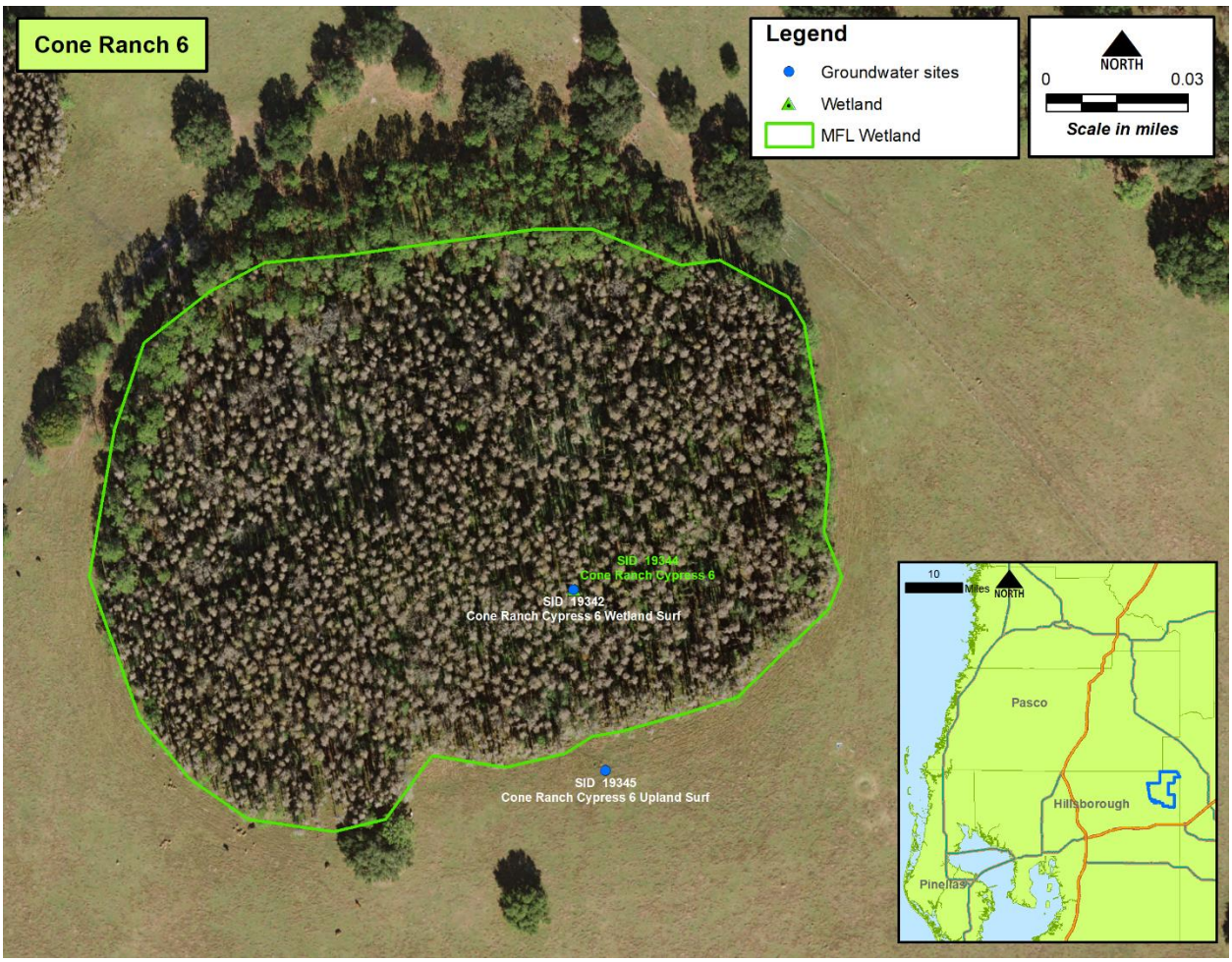

Figure 14: Cone Ranch 6 wetland

Tampa Bay Water installed a staff gage and wetland well in 1998. When the wetland was adopted as an MFL site, the District installed a staff gage (SID 19344), upland well (SID 19345), and wetland well in 2003 (SID 19342) (Figure 14, Figure 15). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

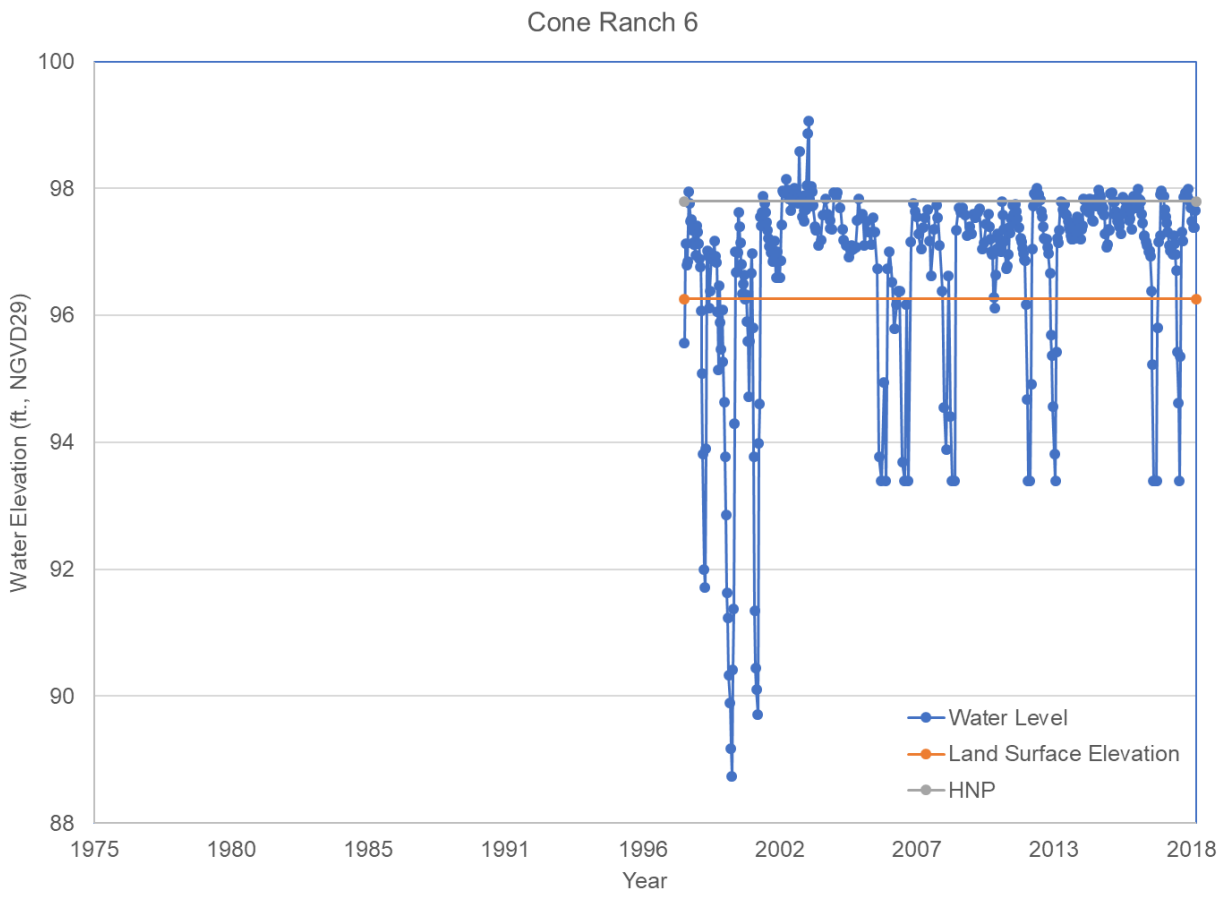

Figure 15: Cone Ranch 6 Wetland Water Levels

The Cone Ranch 6 wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 97.8 feet NGVD29, and a proposed MFL of 96.0 feet NGVD29. The currently adopted MFL at this site is 96.0 feet NGVD29, so there is no change recommended for this site.

The Cone Ranch 6 wetland has a very indistinct outlet, described as a “natural saddle,” and surveyed at 0.1 feet below the HNP (see Appendix B). Figure 15 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 1.4 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cone Ranch 6 wetland is recommended to be kept as an adopted MFL site, with an MFL of 96.0 feet NGVD29.

Cosme-Odessa Wellfield

The Cosme-Odessa wellfield is located in north Hillsborough County (Figure 2). This wellfield has the longest history of production, having begun in 1930. Production at Cosme-Odessa peaked in the 1960's at over 20 mgd, but generally declined as more wellfields were added. Since 2003, the average production has been between approximately 5-10 mgd, with one year being as low as 1.8 mgd. There is only one wetland within the Cosme-Odessa wellfield that has an established minimum level associated with it.

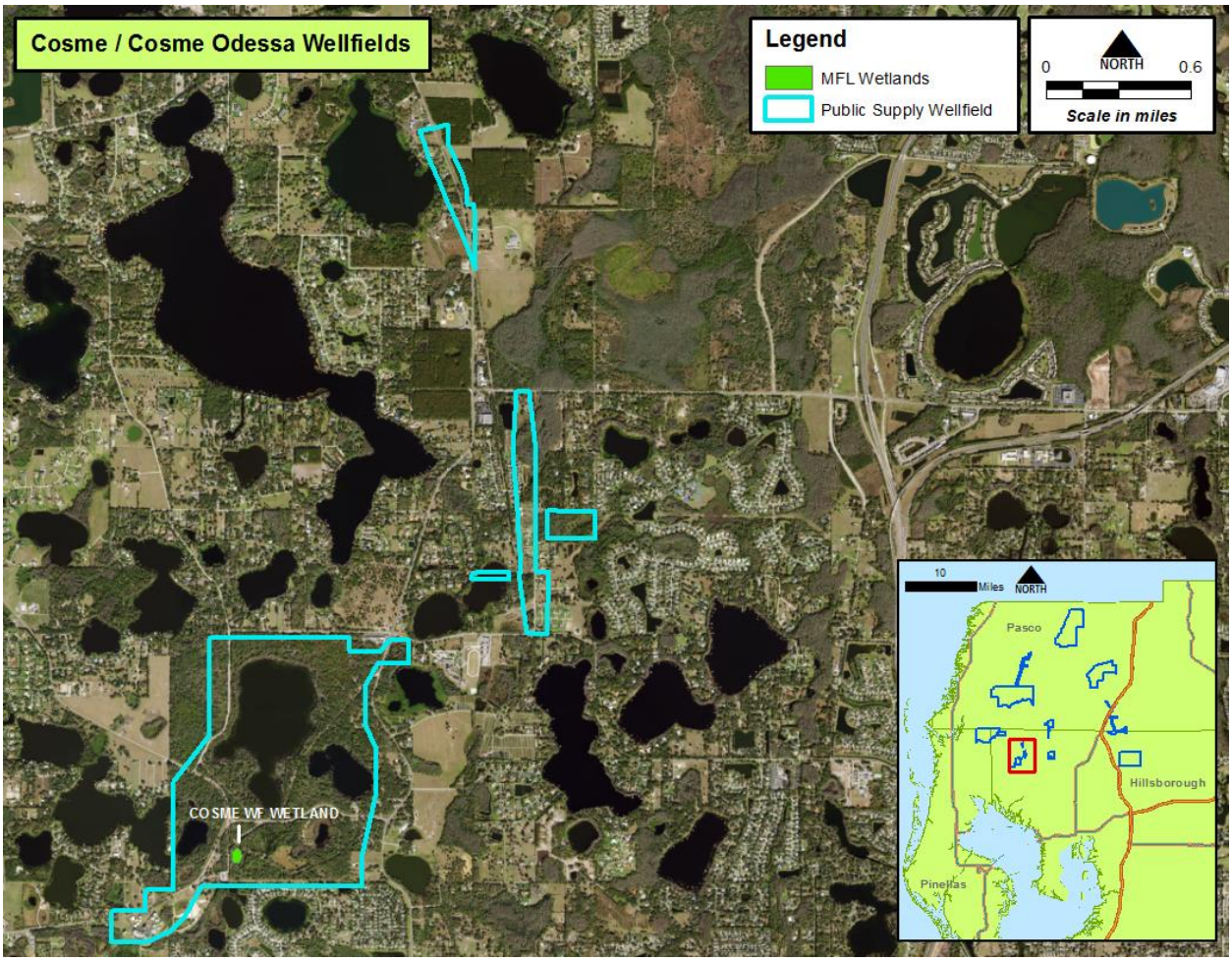

Figure 16: Cosme-Odessa Wellfield with established minimum level wetland

Cosme WF Wetland (Wetland ID 113)

The wetland with an established minimum level in the Cosme-Odessa wellfield is known as Cosme WF Wetland. It is an isolated cypress dome located on the south end of the wellfield (Figure 16). The wetland is approximately 1.4 acres in size (Figure 17).

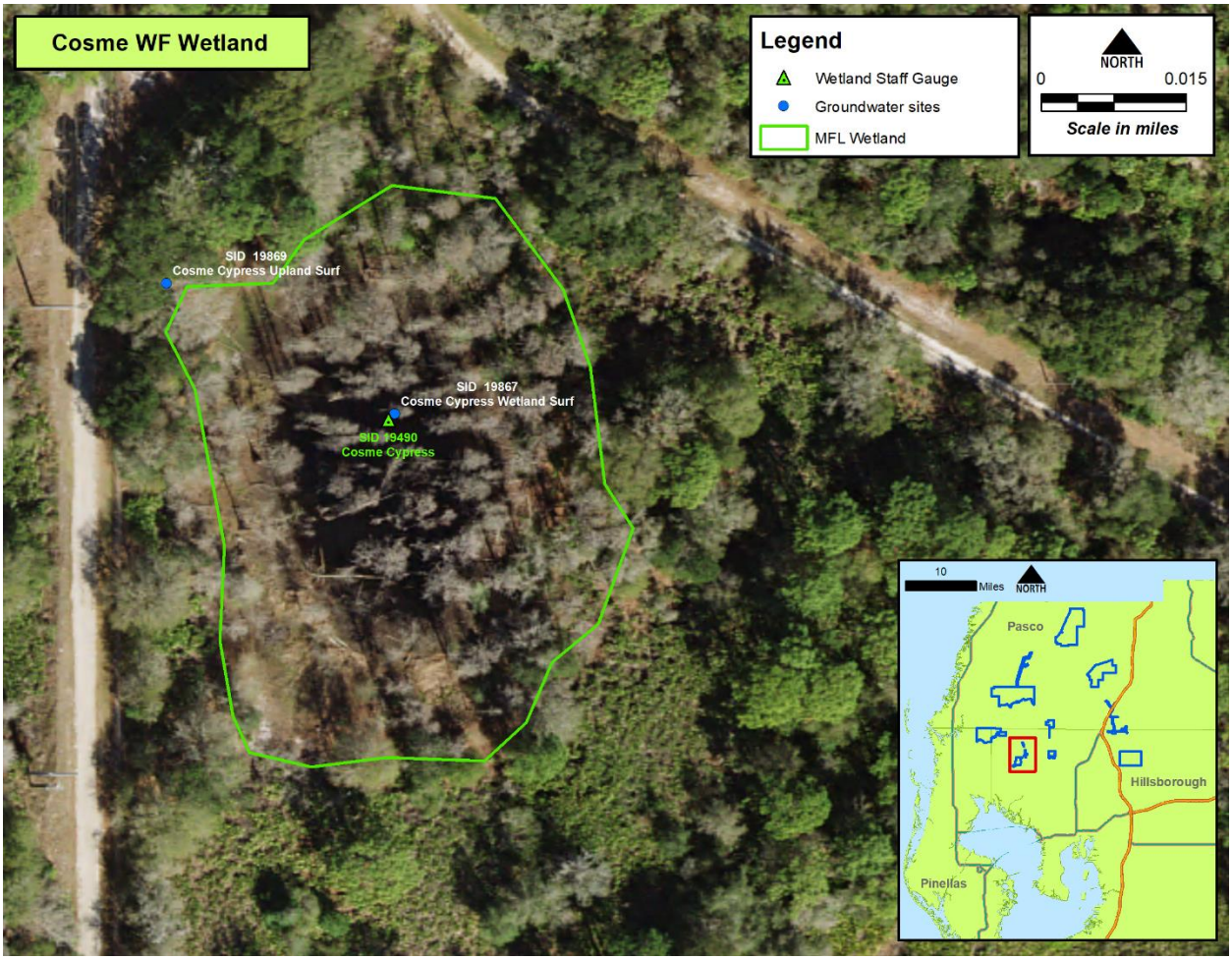

Figure 17: Cosme Wellfield wetland

TBW had a wetland well at this site since 1999. The District installed a wetland (SID 19687) and upland (SID 19689) well in 2001, and a staff gage (SID 19490) in 2002 (Figure 17, Figure 18). The District continues to monitor this site on a twice monthly basis at the time of this report. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

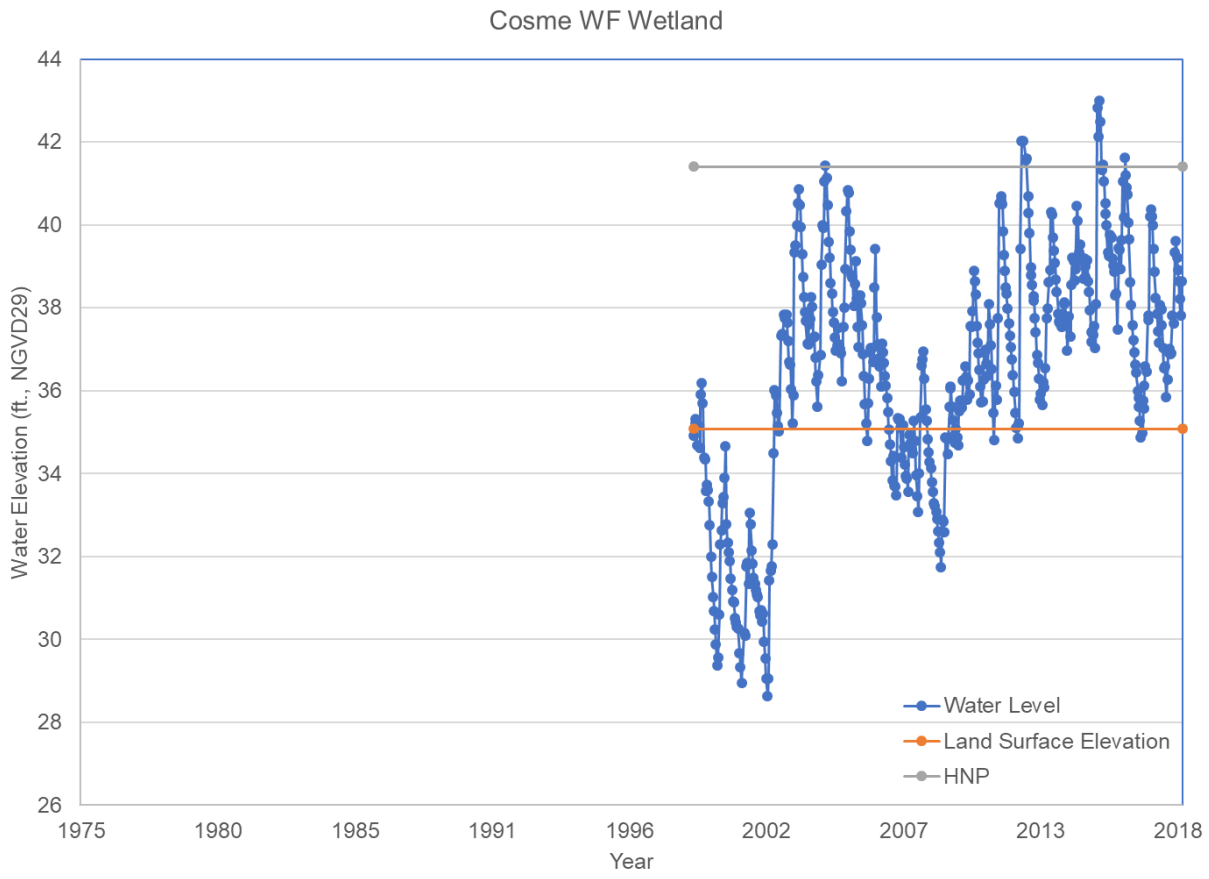

Figure 18: Cosme WF water levels

Observations of the wetland have shown significant soil subsidence around the cypress roots. The entire center of the wetland appears to have subsided. Since pumping from the Cosme Odessa wellfield began in the 1930's, it is thought that the wetland experienced many years of lower than normal water levels, and has undergone significant changes as a result. There have also been some observations of biological indicators of HNP having developed at two different elevations, given the long history of impact to the wetland. While the wetland is surrounded by mostly soils classified as mesic, a reliable HNP cannot be established due to the aforementioned reasons.

Conclusion and Recommendation:

Because Cosme WF wetland does not have an accurate, reliable HNP that can be established, it is recommended that this wetland not be used as an MFL. While there are no additional monitored isolated cypress wetlands within the wellfield that would make a desirable replacement for Cosme WF wetland, there are many lake minimum levels in the immediate area which are believed to provide the same protective purpose as a wetland minimum level would (Figure 19).

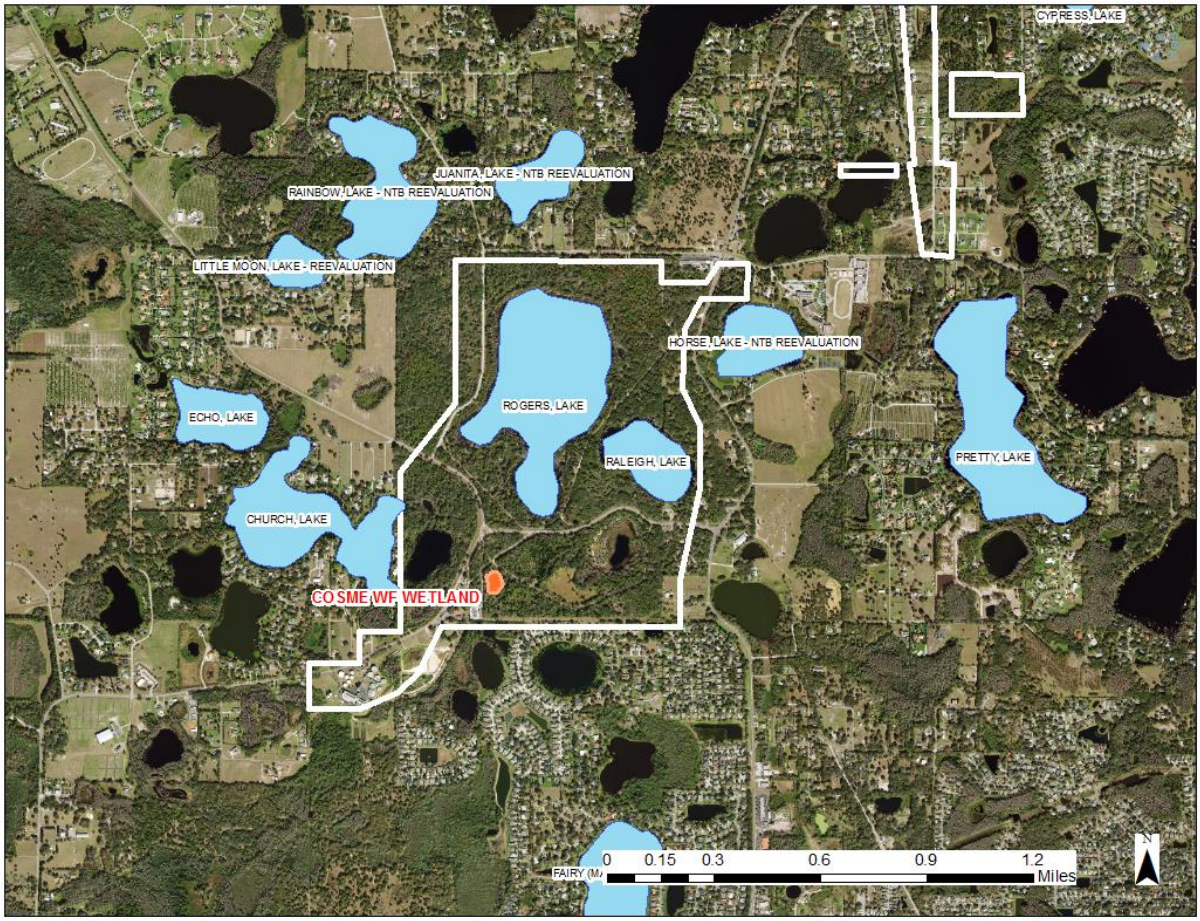

Figure 19: Cosme WF wetland and surrounding lakes with established minimum levels

Cross Bar Ranch

The Cross Bar Ranch wellfield is located in north-central Pasco County (Figure 2). The property is owned by Pinellas County, and it continues to be used as a working cattle ranch. Wellfield production in the Cross Bar Ranch began in 1980 at about 12 mgd, and steadily rose to approximately 20 to 30 mgd by 1990. Groundwater production was reduced to approximately 12-16 mgd in the early 2000s. There are 4 wetlands with established minimum levels at the Cross Bar Ranch wellfield (Figure 20).

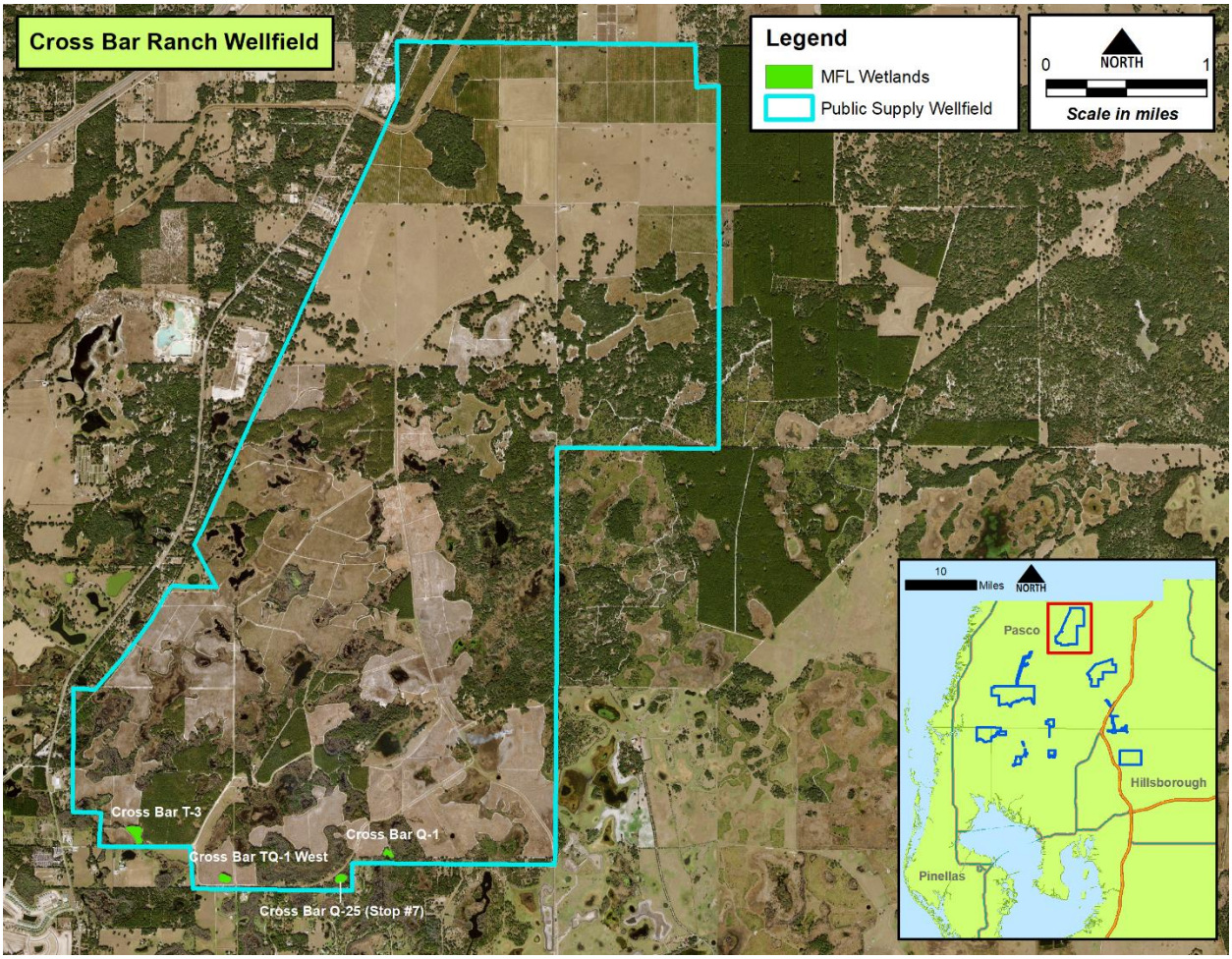

Figure 20: Cross Bar Ranch with established minimum level wetlands

Cross Bar TQ-1 West (Q-24) (Wetland ID 21)

Cross Bar TQ-1 West is located near the center of the southern boundary of the wellfield (Figure 20). Cross Bar TQ-1 West is an isolated cypress wetland, and is approximately 2.3 acres in size (Figure 21).

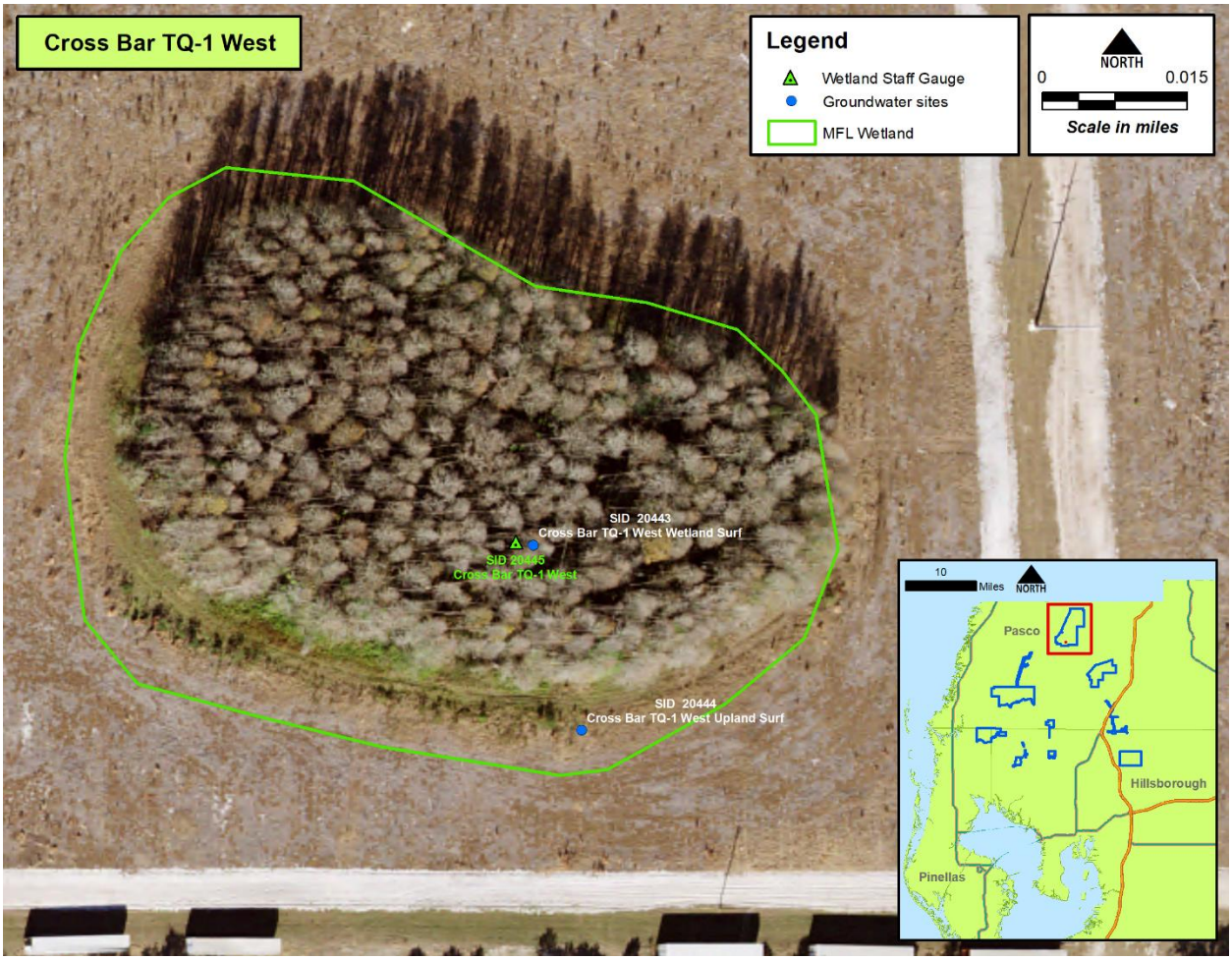

Figure 21: Cross Bar TQ-1 West wetland

Although some water level data is available from when Pinellas County monitored this wetland, Tampa Bay Water installed a wetland well at this site in 1999 (it has been replaced at least twice). When the wetland was adopted as an MFL site, the District installed wetland (SID 20443) and upland (SID 20444) wells in 2001, and a staff gage in 2002 (SID 20445) (Figure 21, Figure 22). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010, and the wetland has been augmented using water withdrawn from the Upper Floridan aquifer by Pinellas County since 2002.

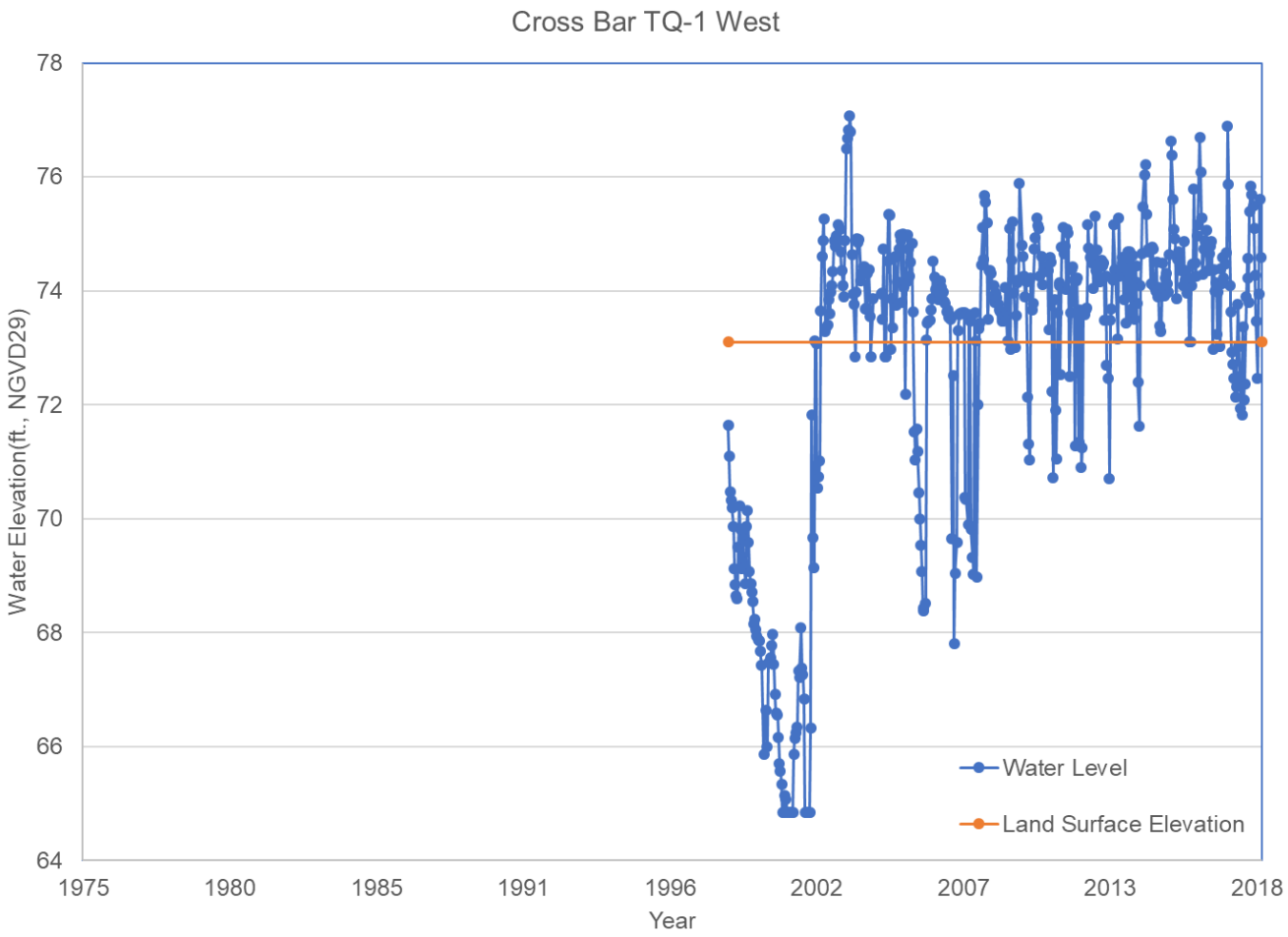

Figure 22: Cross Bar TQ-1 West water levels

Some subsidence has been noted at the Cross TQ-1 West wetland, and planted slash pine (recently harvested) has encroached into the transitional zone. Pinellas County began augmenting the wetland because it experienced prolonged dryness for several years. The wetland is surrounded by mostly soils classified as xeric, which is unusual for an isolated cypress swamp. Possibly because the wetland is xeric, an acceptable HNP has not been able to be established at this wetland.

Conclusion and Recommendation:

Because an acceptable HNP could not be established, the Cross Bar TQ-1 West wetland is considered to be classified as xeric, and because there are three other wetlands with adopted MFLs nearby, it is recommended that this wetland not be used as an MFL.

Cross Bar T-3 (Wetland ID 36)

Cross Bar T-3 is the western-most MFL at the Cross Bar Ranch, located near the center of the southern boundary of the wellfield (Figure 20). Cross Bar T-3 is an isolated cypress wetland, and is approximately 2.3 acres in size (Figure 23).

Figure 23: Cross Bar T-3 wetland

Tampa Bay Water and Pinellas County have monitored water levels in this wetland since the mid-1980s, but data is sparse in the early years. Many of the recorded values in the early years are dry. When the wetland was adopted as an MFL site, the District installed a wetland well (SID 20487) in 2001, and a staff gage (SID 20486) in 2002 (Figure 23, Figure 24). An existing upland well adjacent to the wetland (SID 20484) (with a paired Upper Floridan aquifer monitor well) was installed by the District in 1996 (CB 1SW Shallow), and was adopted as the upland well for this wetland. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

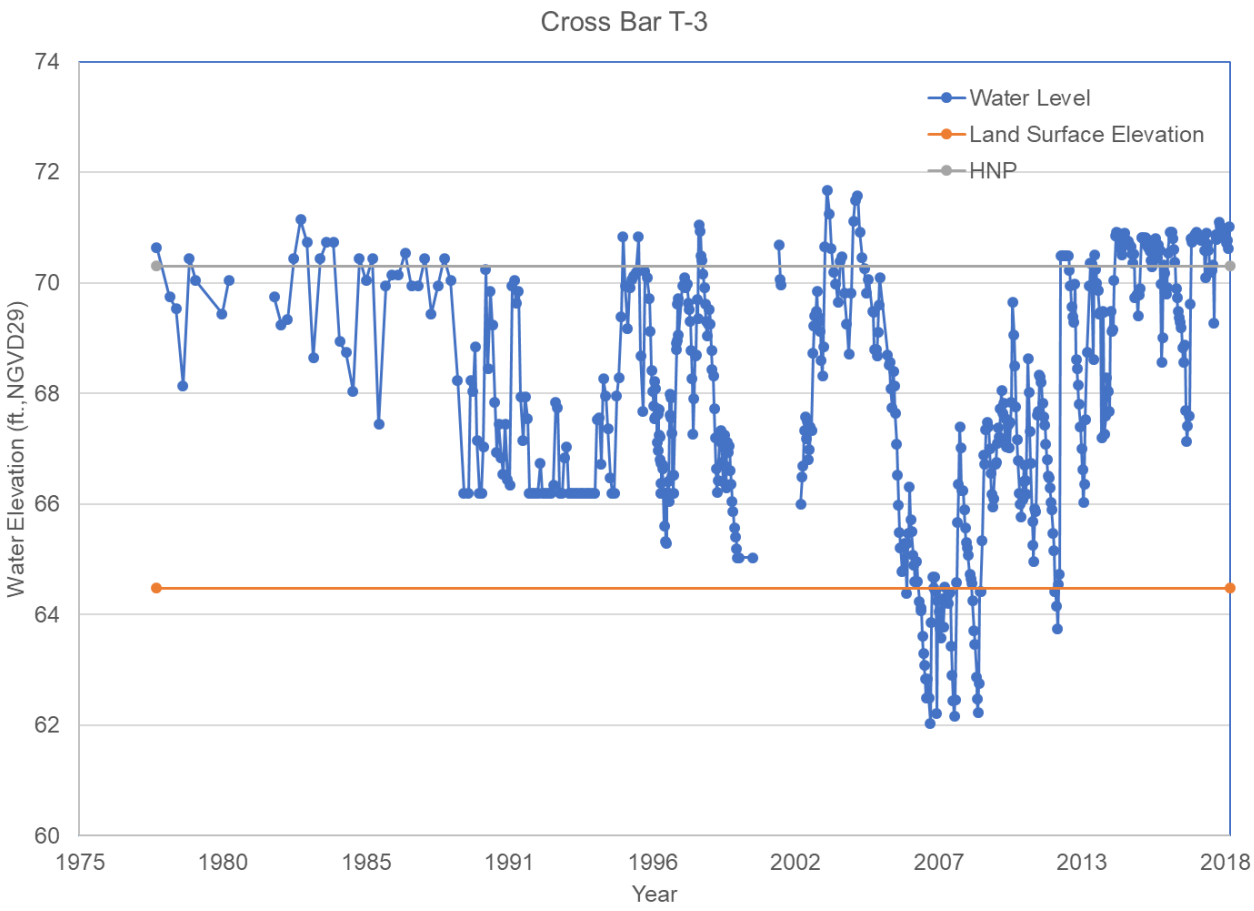

Figure 24: Cross Bar T-3 water levels

Significant subsidence and tree fall have been noted at the Cross Bar T-3 wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points near the wetland edge (to avoid potential subsidence) at 70.3 feet NGVD29, and a proposed MFL of 68.5 feet NGVD29. The currently adopted MFL at this site is 68.8 feet NGVD29.

The Cross Bar T-3 wetland has an outlet, identified as a low point on a wellfield road, and surveyed at 0.4 feet below the HNP (see Appendix B). Figure 24 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 1.3 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cross Bar T-3 wetland is recommended to be kept as an adopted MFL site, with an MFL of 68.5 feet NGVD29. The difference between the current and proposed MFL is thought to be due mostly to a more accurate benchmark elevation.

Cross Bar Q-25 (Stop #7) (Wetland ID 22)

Cross Bar Q-25 (Stop #7) is located near the center of the southern boundary of the wellfield (Figure 20). Cross Bar Q-25 is an isolated cypress wetland, and is approximately 4.5 acres in size (Figure 25)

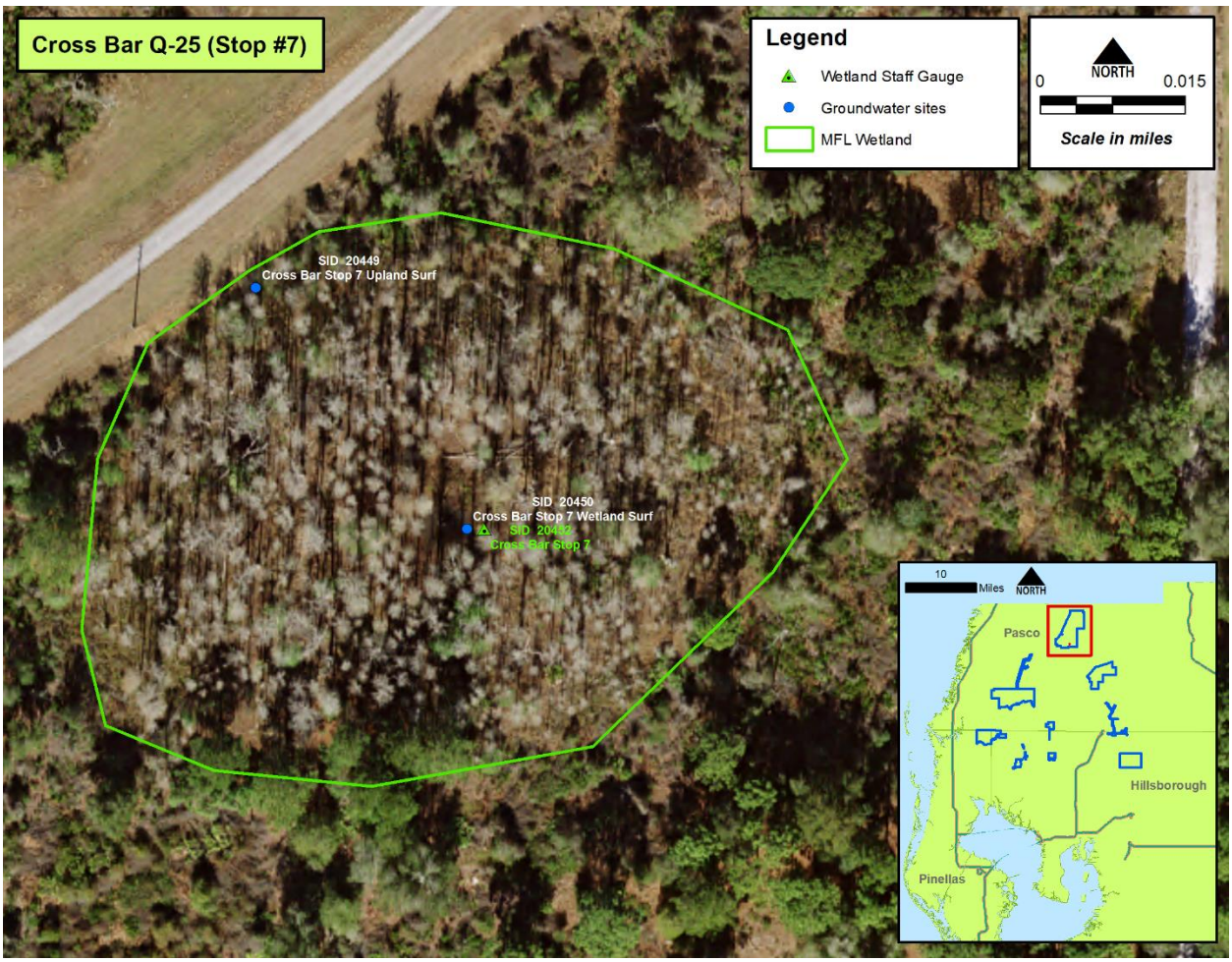

Figure 25: Cross Bar Q-25 (Stop #7) wetland

Tampa Bay Water installed a wetland well at this site in 1999. When the wetland was adopted as an MFL site, the District installed wetland (SID 20450) and upland (SID 20449) wells in 2001, and a staff gage (SID 20452) in 2002 (Figure 25, Figure 26). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

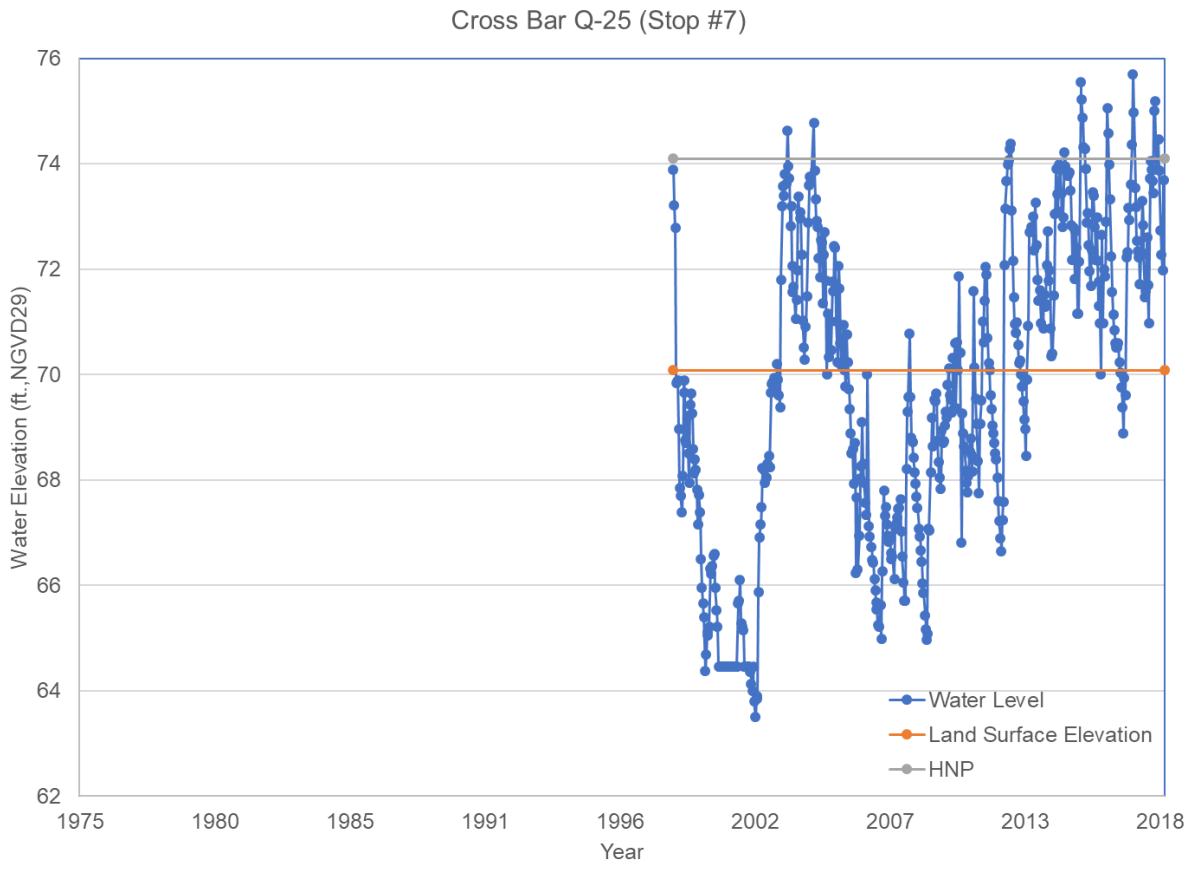

Figure 26: Cross Bar Q-25 (Stop #7) water levels

Significant subsidence and tree fall have been noted at the Cross Bar Q-25 (Stop #7) wetland. The wetland is surrounded by mostly soils classified as mesic. Due to subsidence in the wetland, further investigations to establish an appropriate HNP are necessary. HNP indicators of the bases of outer cypress and cypress inflection points were surveyed, however there is a difference in elevations of the indictors between the north and the south side of the wetland. The currently adopted MFL at this site is 72.3 feet NGVD29.

The Cross Bar Q-25 (Stop #7) wetland has a very indistinct outlet, described as a "natural saddle," and surveyed at 0.2 feet below the HNP (see Appendix B). Figure 26 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.6 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

At this time, no updates to the Cross Bar Q-25 (Stop #7) wetland adopted MFL are recommended. Further investigation is necessary, and an update will be provided in an amended report with a final recommendation for this wetland.

Cross Bar Q-1 (Wetland ID 1)

Cross Bar Q-1 is the eastern-most MFL at the Cross Bar Ranch, located along the southern boundary of the wellfield (Figure 20). Cross Bar Q-1 is an isolated cypress wetland, and is approximately 1.5 acres in size (Figure 27).

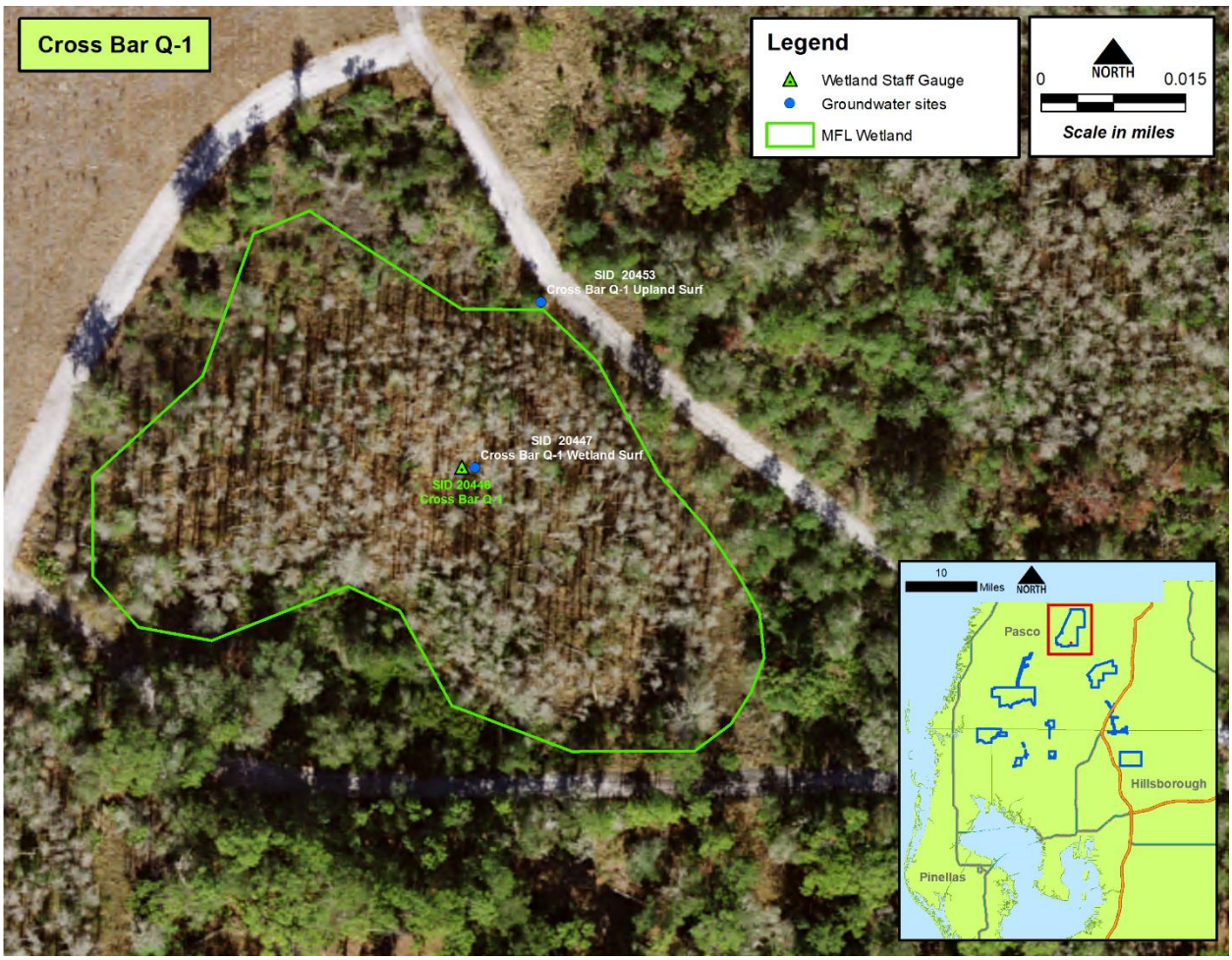

Figure 27: Cross Bar Q-1 wetland

Tampa Bay Water has had various wetland wells installed in this wetland since 1990. When the wetland was adopted as an MFL site, the District installed wetland (SID 20447) and upland (SID 20453) wells in 2001, and a staff gage (SID 20446) in 2002 (Figure 27, Figure 28). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

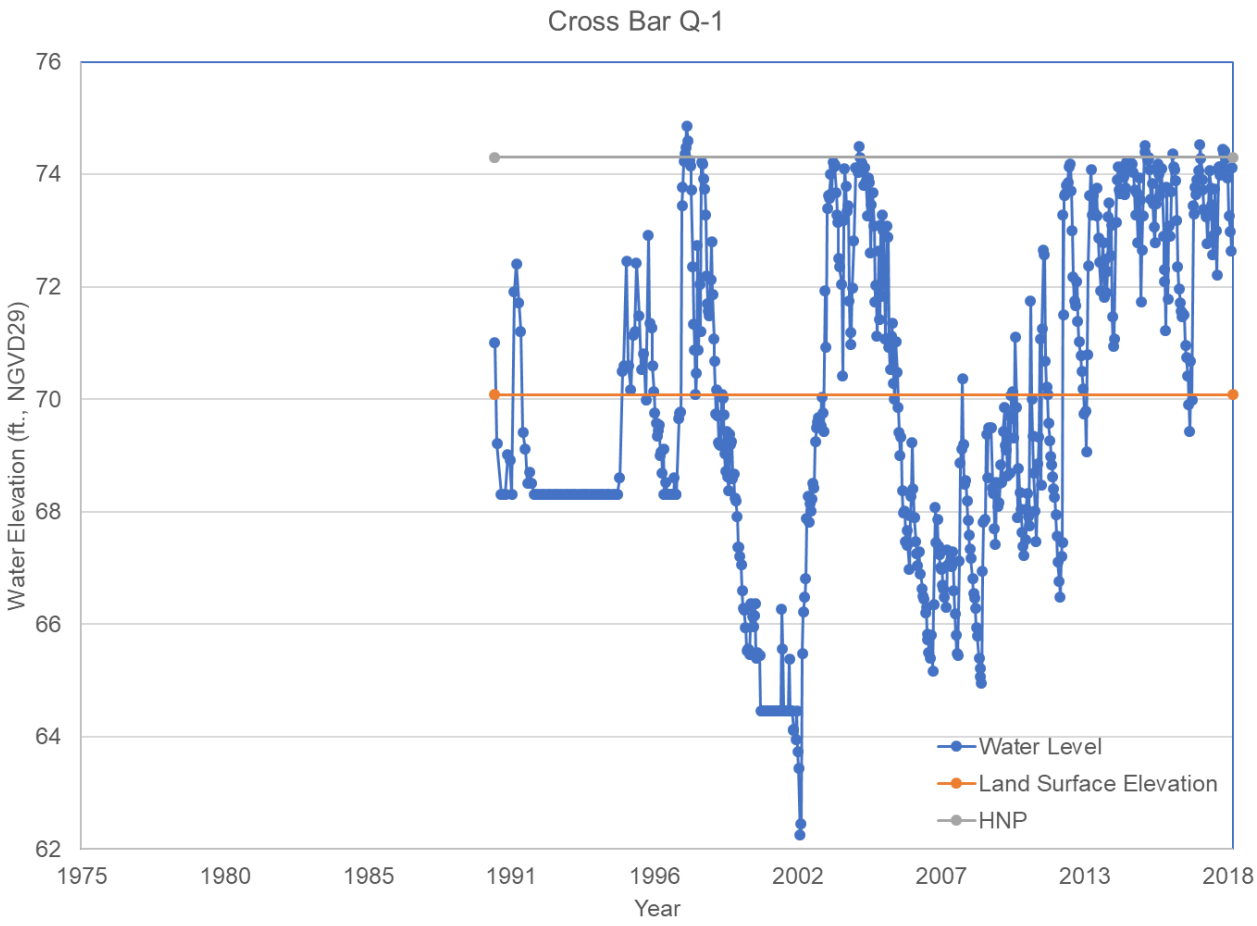

Figure 28: Cross Bar Q-1 water levels

Significant subsidence and tree fall have been noted at the Cross Bar Q-1 wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points near the wetland edge (to avoid potential subsidence) at 74.3 feet NGVD29, and a proposed MFL of 72.5 feet NGVD29. The currently adopted MFL at this site is 72.7 feet NGVD29.

The Cross Bar Q-1 wetland has an outlet, identified as a low point on a wellfield road, and surveyed at 0.3 feet below the HNP (see Appendix B). Figure 28 shows that water levels very regularly reach a point just below the HNP, suggesting that the outlet does have a small effect on high water levels. However, the calculated Historic P50 is located 1.4 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cross Bar Q-1 wetland is recommended to be kept as an adopted MFL site, with an MFL of 72.5 feet NGVD29. The difference between the current and proposed MFL is thought to be due mostly to a more accurate benchmark elevation.

Cypress Bridge

The Cypress Bridge wellfield is located in north-central Hillsborough and south-central Pasco counties (Figure 2). Unlike most of the Consolidated Permit wellfields, the production wells of the Cypress Bridge wellfield are scattered throughout the urban area of New Tampa, each on one-acre properties owned by Tampa Bay Water. Wellfield production in the Cypress Bridge wellfield began in the early 1990s, but was preceded back to 1982 since some of the productions wells originally were owned by a private utility. Cypress Bridge is the only Consolidated Permit wellfield that has not reduced withdrawals since the mid-2000s. Withdrawals peaked at about 10 mgd in the late 1990s and early 2000s, were reduced to a few mgd in the early 2000s, and have pumped between 6 and 17 mgd since then. There are 6 wetlands with established minimum levels at the Cypress Bridge wellfield (Figure 29).

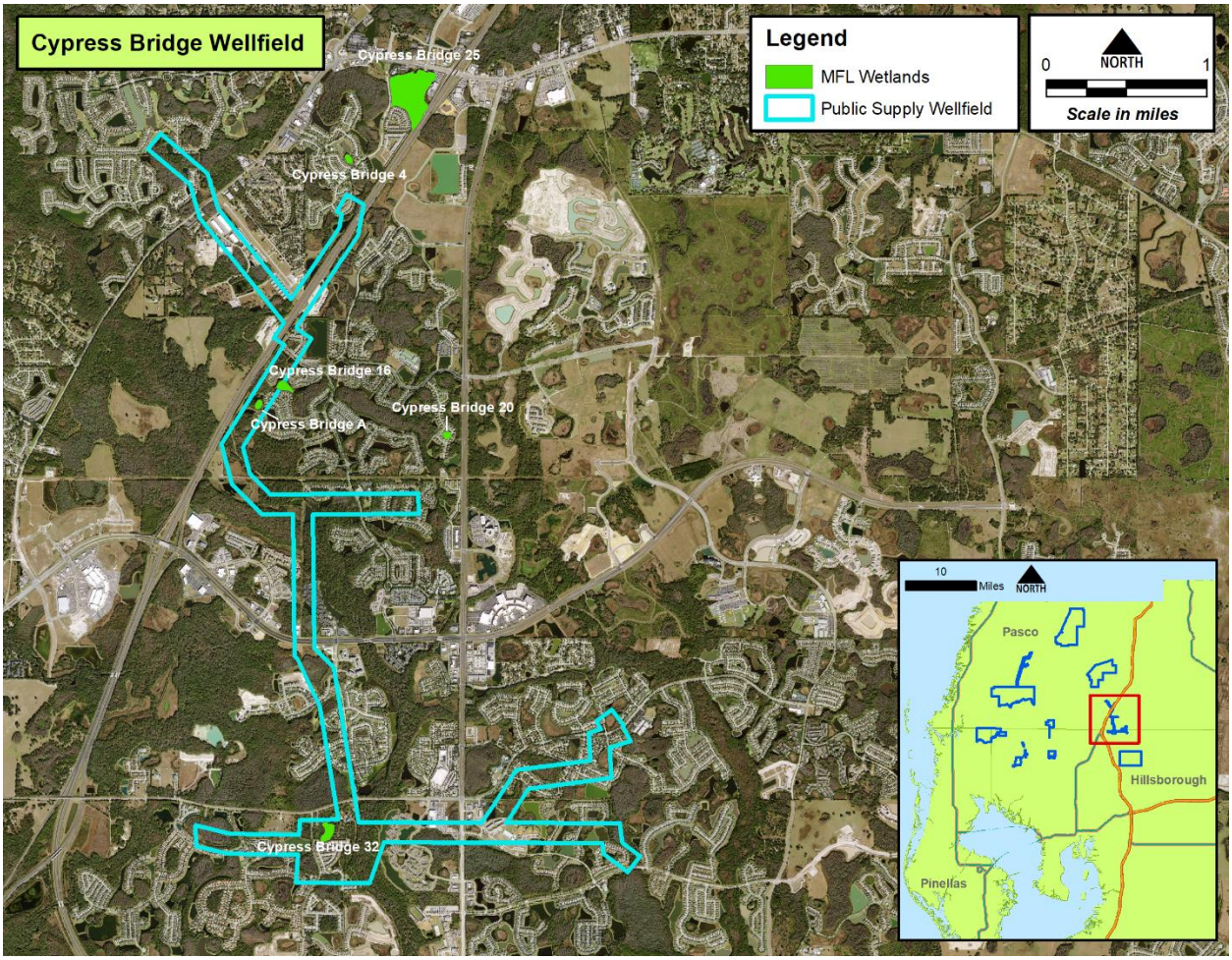

Figure 29: Cypress Bridge wellfield with established minimum level wetlands

Cypress Bridge 16 (Wetland ID 133)

Cypress Bridge 16 is located in the northern third of the Cypress Bridge wellfield in Pasco County (Figure 29). The wetland was surrounded by pasture when originally adopted as a MFL site, but is now surrounded by a subdivision. Cypress Bridge 16 is an isolated cypress wetland, and is approximately 2.9 acres in size (Figure 30).

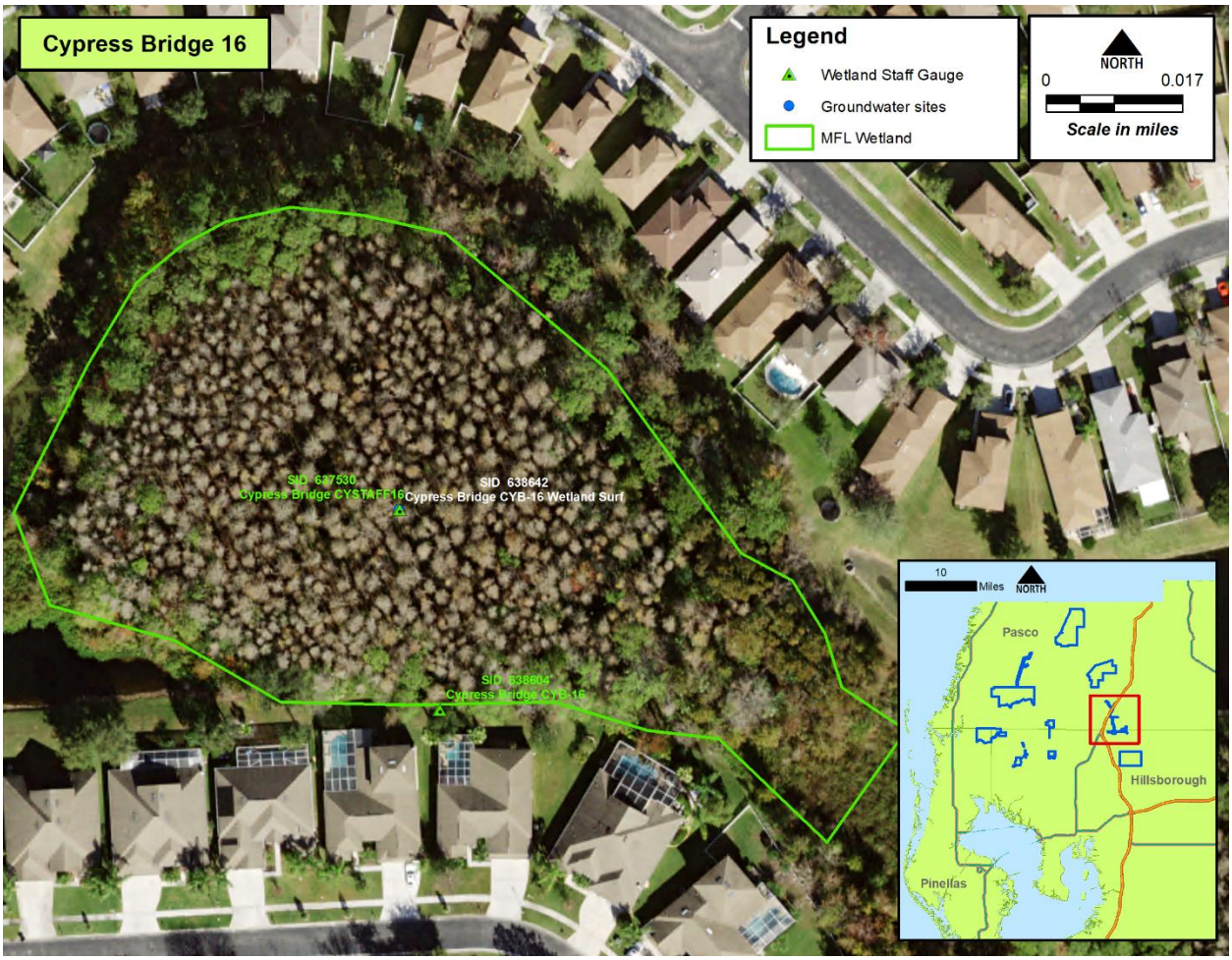

Figure 30: Cypress Bridge 16 wetland

Tampa Bay Water has had a staff gage (SID 637530) in the wetland since 1988, and a wetland well (SID 638642) since 1989. There is no upland well at this wetland (Figure 30, Figure 31). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

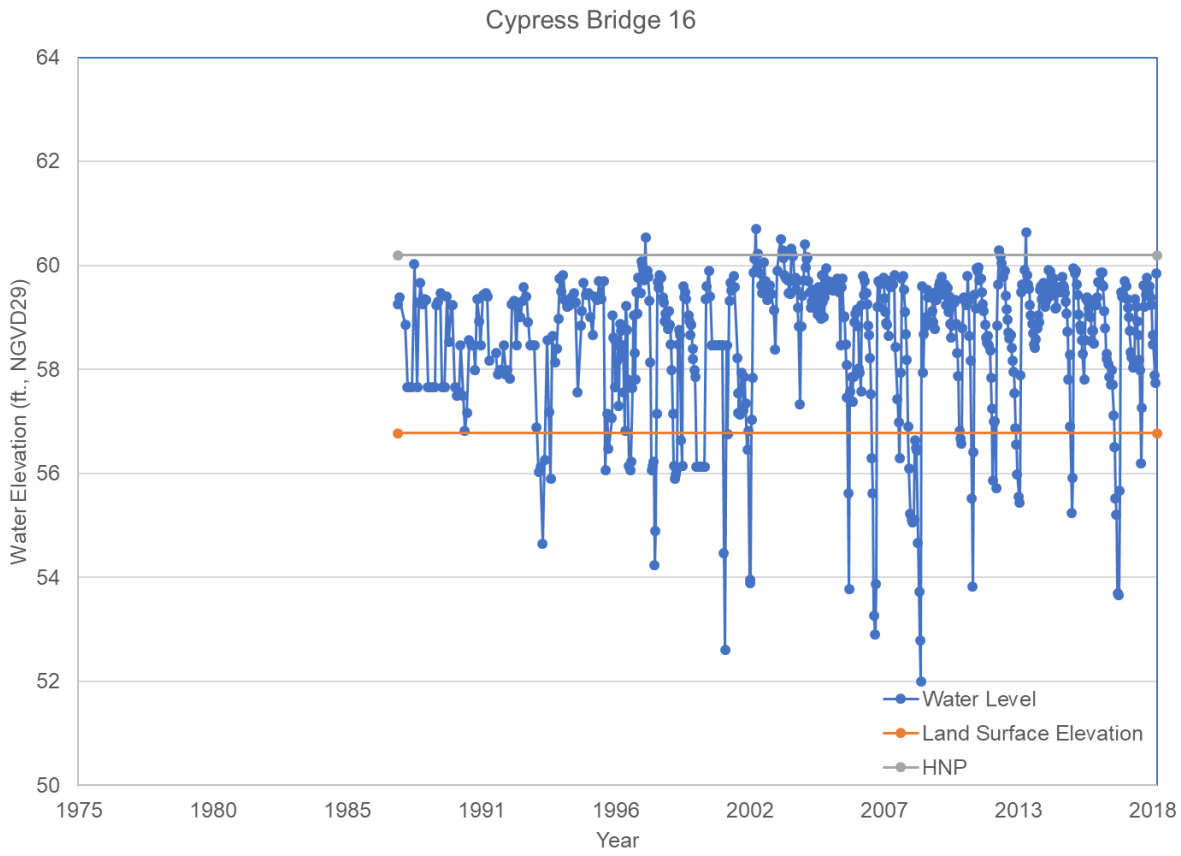

Figure 31: Cypress Bridge 16 water levels

The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 60.2 feet NGVD29, and a proposed MFL of 58.4 feet NGVD29. The currently adopted MFL at this site is 57.9 feet NGVD29.

The drainage systems in the area of the Cypress Bridge 16 wetland have been altered as part of a surface water management system installed in the residential development that surrounds the wetland. However, the outlet remains to be a naturalized swale leading to another cypress area. The outlet was surveyed with a control elevation that is 0.8 feet below the HNP (see Appendix B). Figure 31 shows that water levels regularly reach an elevation a few tenths below the HNP, so the swale may be preventing water levels from reaching the natural Historic normal pool. The calculated Historic P50 is 0.6 feet above the MFL, so the proposed MFL is clearly attainable. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cypress Bridge 16 wetland is recommended to be kept as an adopted MFL site, with an MFL of 58.4 feet NGVD29. The difference between the current and proposed MFL is thought to be due mostly to a more accurate benchmark elevation.

Cypress Bridge A (Wetland ID 153)

Cypress Bridge A is located in the northern third of the Cypress Bridge wellfield in Pasco County, just south of the Cypress Bridge 16 MFL wetland (Figure 29). Like Cypress Bridge 16, Cypress Bridge A was surrounded by pasture when originally adopted as an MFL site, but is now surrounded by a subdivision. Cypress Bridge A is an isolated cypress wetland, and is approximately 1.5 acres in size (Figure 32).

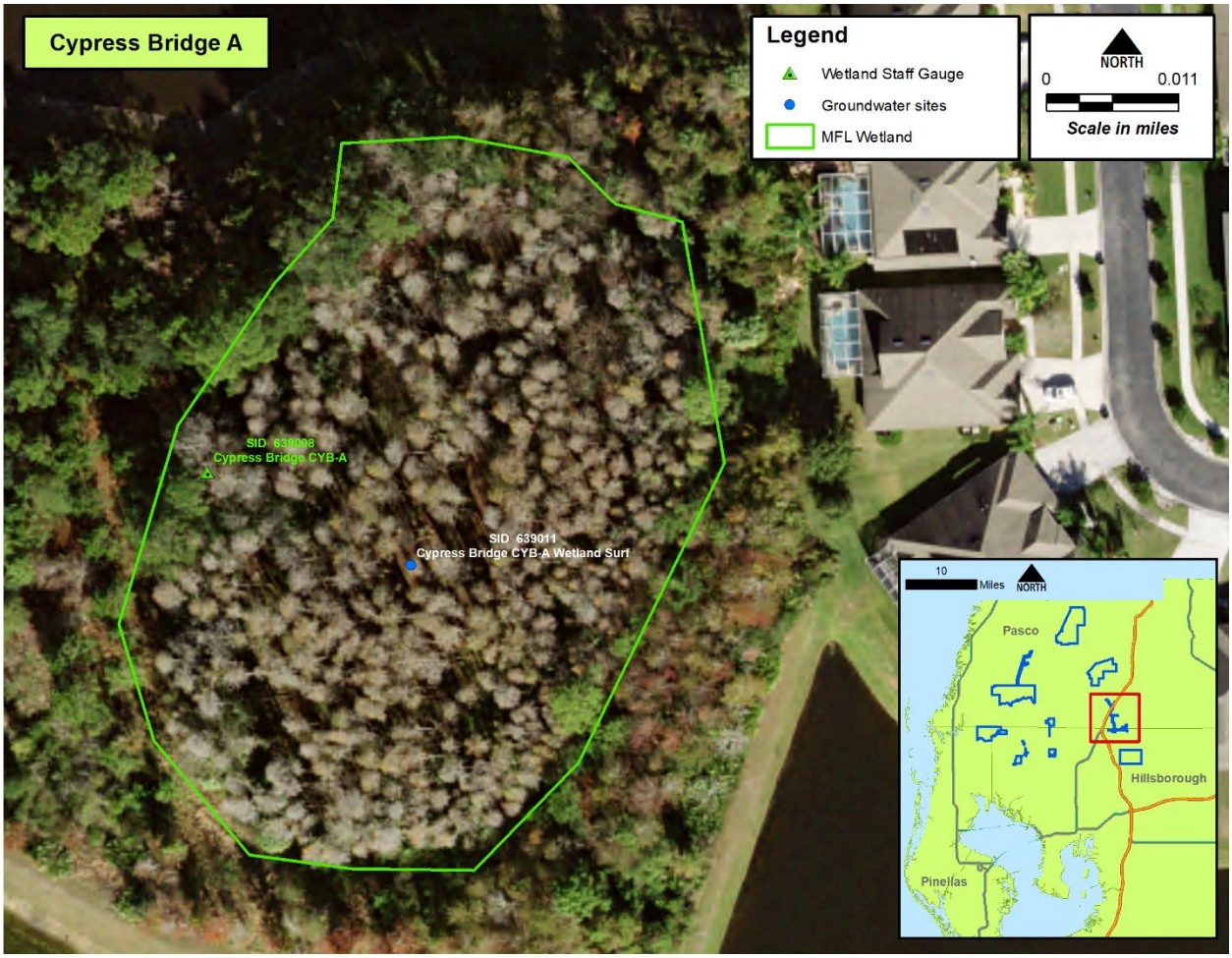

Figure 32: Cypress Bridge A wetland

Tampa Bay Water has had a staff gage (SID 639008) in the wetland since 2001, and a wetland well (SID 639011) since 2002. There is no upland well at this wetland (Figure 32, Figure 33). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

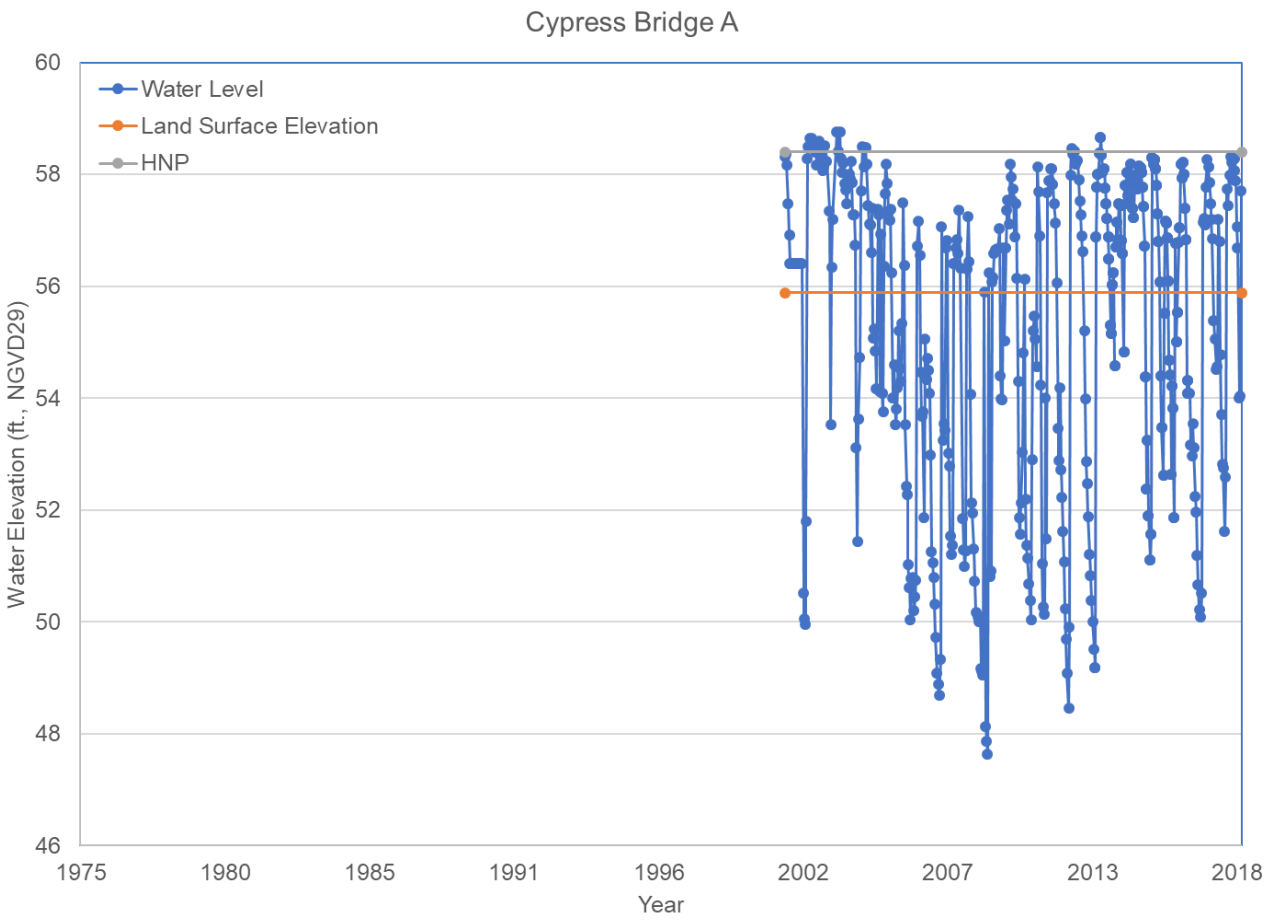

Figure 33: Cypress Bridge A water levels

The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 58.4 feet NGVD29, and a proposed MFL of 56.6 feet NGVD29. The currently adopted MFL at this site is 56.9 feet NGVD29.

The drainage systems in the area of the Cypress Bridge A wetland have been altered as part of a surface water management system installed in the residential development that surrounds the wetland. The outlet is now a hardened swale (lined with geoweb) on the north side of the wetland. The outlet was surveyed with a control elevation that is 0.8 feet below the HNP (see Appendix B). Figure 33 shows that water levels regularly reach an elevation at or slightly above the HNP. The calculated Historic P50 is located 0.4 feet above the MFL, so the proposed MFL is clearly attainable. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cypress Bridge A wetland is recommended to be kept as an adopted MFL site, with an MFL of 56.6 feet NGVD29. The difference between the current and proposed MFL is thought to be due mostly to a more accurate benchmark elevation.

Cypress Bridge 25 (Wetland ID 142)

Cypress Bridge 25 is located in the northern end of the Cypress Bridge wellfield in Pasco County (Figure 29). Cypress Bridge 25 is surrounded by an urban area. Cypress Bridge 25 is a large isolated cypress wetland, and is approximately 40 acres in size (Figure 34).

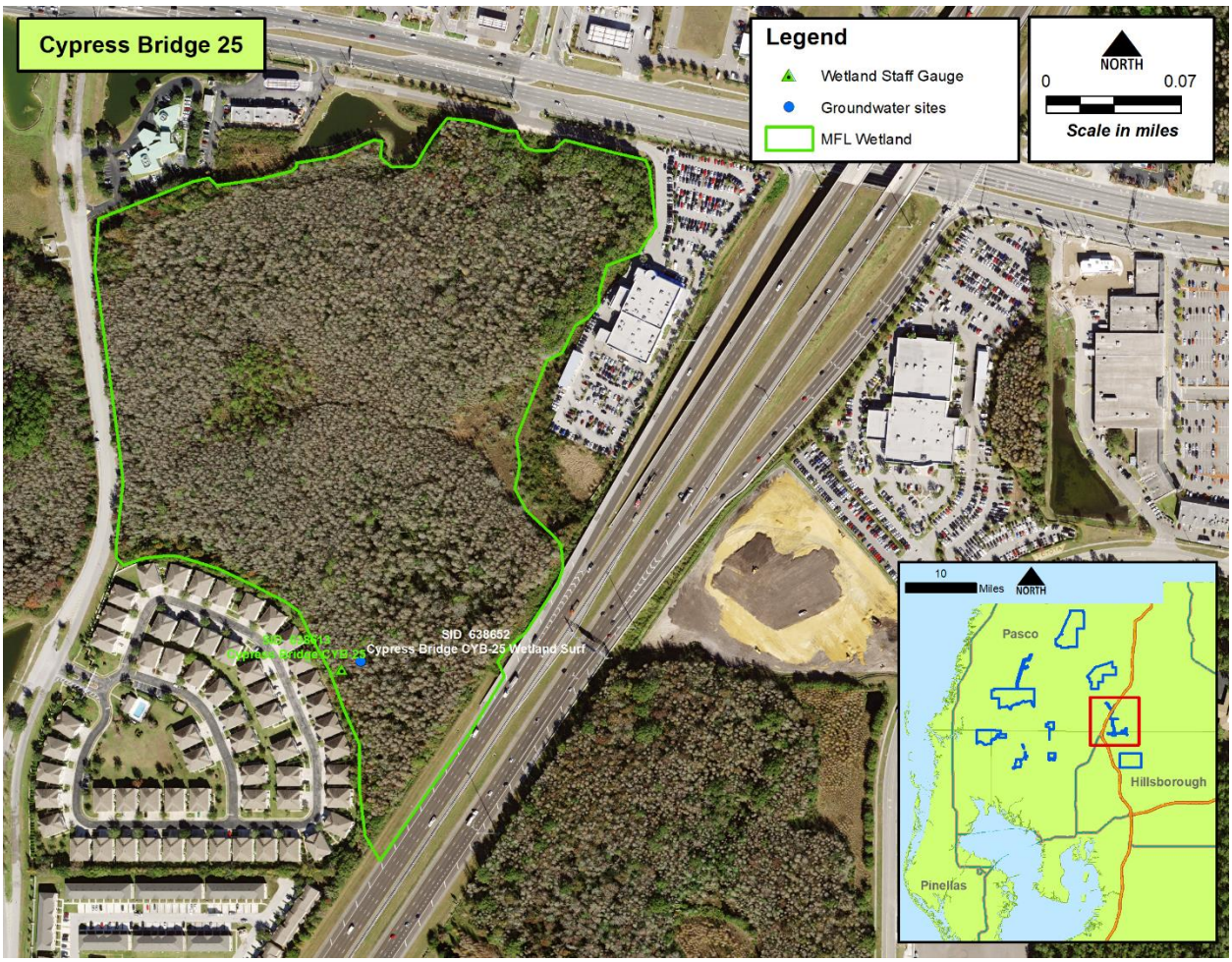

Figure 34: Cypress Bridge 25 wetland

Tampa Bay Water has had a staff gage (SID 638613) in the wetland since 1988, and a wetland well (SID 638652) since 1997. There is no upland well at this wetland (Figure 34, Figure 35). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

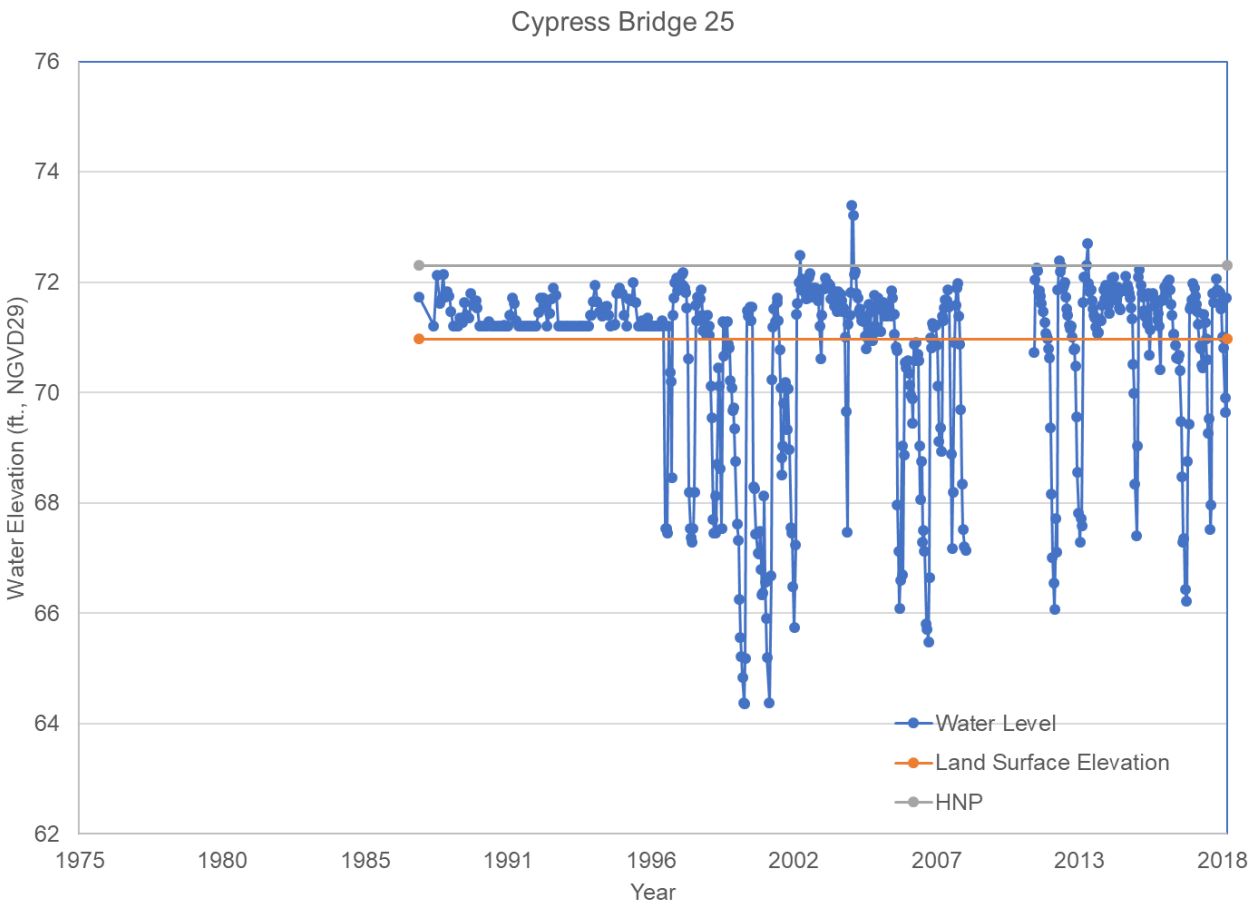

Figure 35: Cypress Bridge 25 water levels

The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 72.3 feet NGVD29, and a proposed MFL of 70.5 feet NGVD29. The currently adopted MFL at this site is 70.4 feet NGVD29.

The drainage systems in the area of Cypress Bridge 25 have been altered as part pf a surface water management system installed in the residential development that surrounds the wetland. However, the outlet remains to be a naturalized wide and shallow flow area into some other wetlands. The outlet was surveyed with a control elevation that is 0.7 feet below the HNP (see Appendix B). Figure 35 shows that water levels regularly reach the HNP elevation. The calculated Historic P50 is 0.8 feet above the MFL, so the proposed MFL is clearly attainable. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cypress Bridge 25 wetland is recommended to be kept as an adopted MFL site, with an MFL of 70.5 feet NGVD29. The small difference between the current and proposed MFL is thought to be due mostly to a more accurate benchmark elevation.

Cypress Bridge 32 (Wetland ID 149)

Cypress Bridge 32 is located in the southern end of the Cypress Bridge wellfield in Hillsborough County (Figure 29). Cypress Bridge 32 is surrounded by agricultural land, and a relatively new subdivision to the south. Cypress Bridge 32 is an isolated cypress wetland, and is approximately 4.5 acres in size (Figure 36).

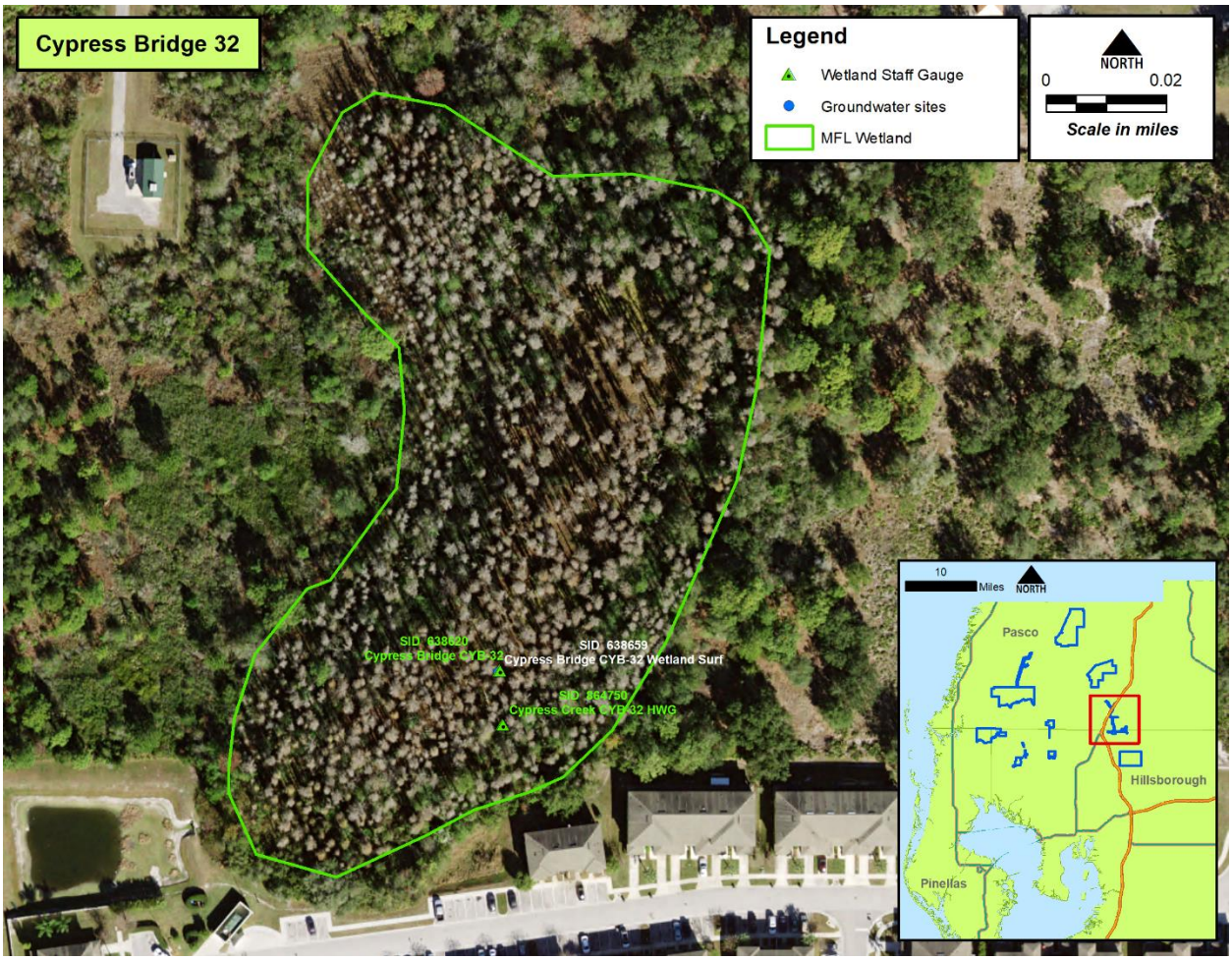

Figure 36: Cypress Bridge 32 wetland

Tampa Bay Water has had a staff gage (SID 638620) and wetland well (SID 638659) in the wetland since 1992. A high level staff gage was added (SID 864750). There is no upland well at this wetland (Figure 36, Figure 37). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

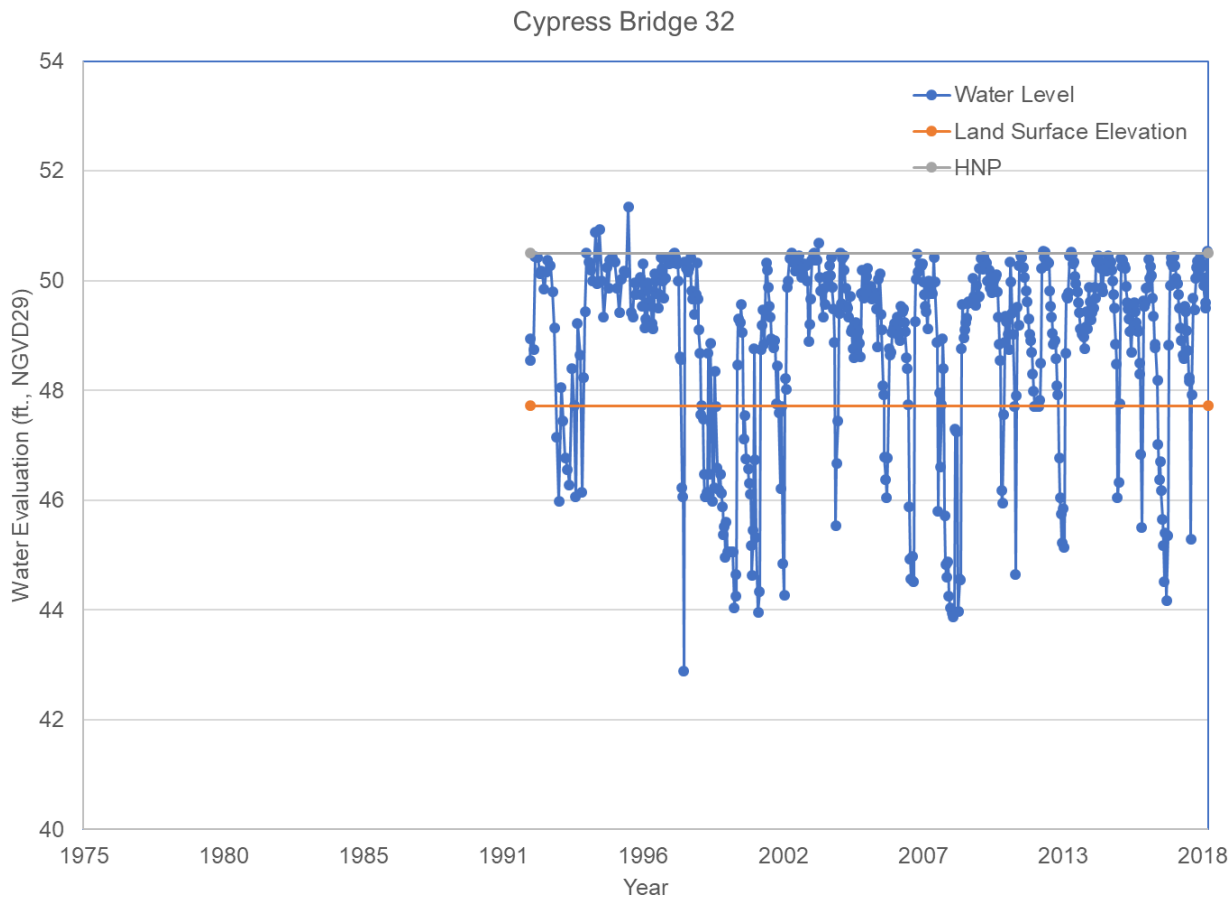

Figure 37: Cypress Bridge 32 water levels

The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 50.5 feet NGVD29, and a proposed MFL of 48.7 feet NGVD29. The currently adopted MFL at this site is 48.7 feet NGVD29, so no change is recommended.

The drainage systems near the outlet of the Cypress Bridge 32 wetland have been altered as part pf a surface water management system installed in the residential development in that direction. The outlet is a "V" north weir, which was surveyed with a control elevation that is right at the HNP (see Appendix B). Figure 37 shows that water levels regularly reach the HNP elevation. The calculated Historic P50 is 0.9 feet above the MFL, so the proposed MFL is clearly attainable. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cypress Bridge 32 wetland is recommended to be kept as an adopted MFL site, with an MFL of 48.7 feet NGVD29.

Cypress Bridge 4 (Wetland ID 124)

Cypress Bridge 4 is located in the northern end of the Cypress Bridge wellfield in Pasco County (Figure 29). Cypress Bridge 4 is surrounded by a subdivision. Cypress Bridge 4 is an isolated cypress wetland, and is approximately 1.3 acres in size (Figure 38).

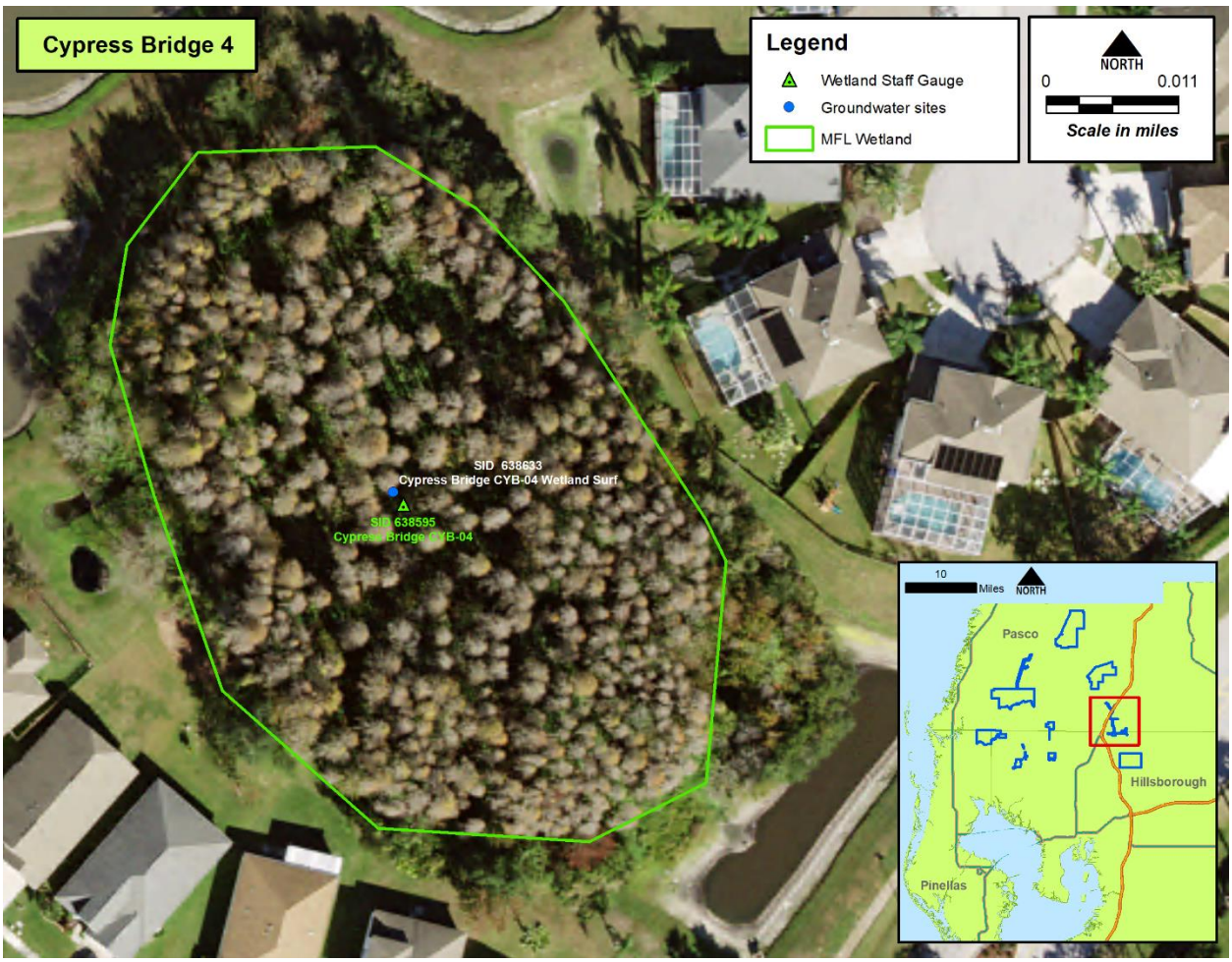

Figure 38: Cypress Bridge 4 wetland

Tampa Bay Water has had a staff gage (SID 638595) in the wetland since 1988, and a wetland well (SID 638633) in the wetland since 1997. There is no upland well at this wetland (Figure 38, Figure 39). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

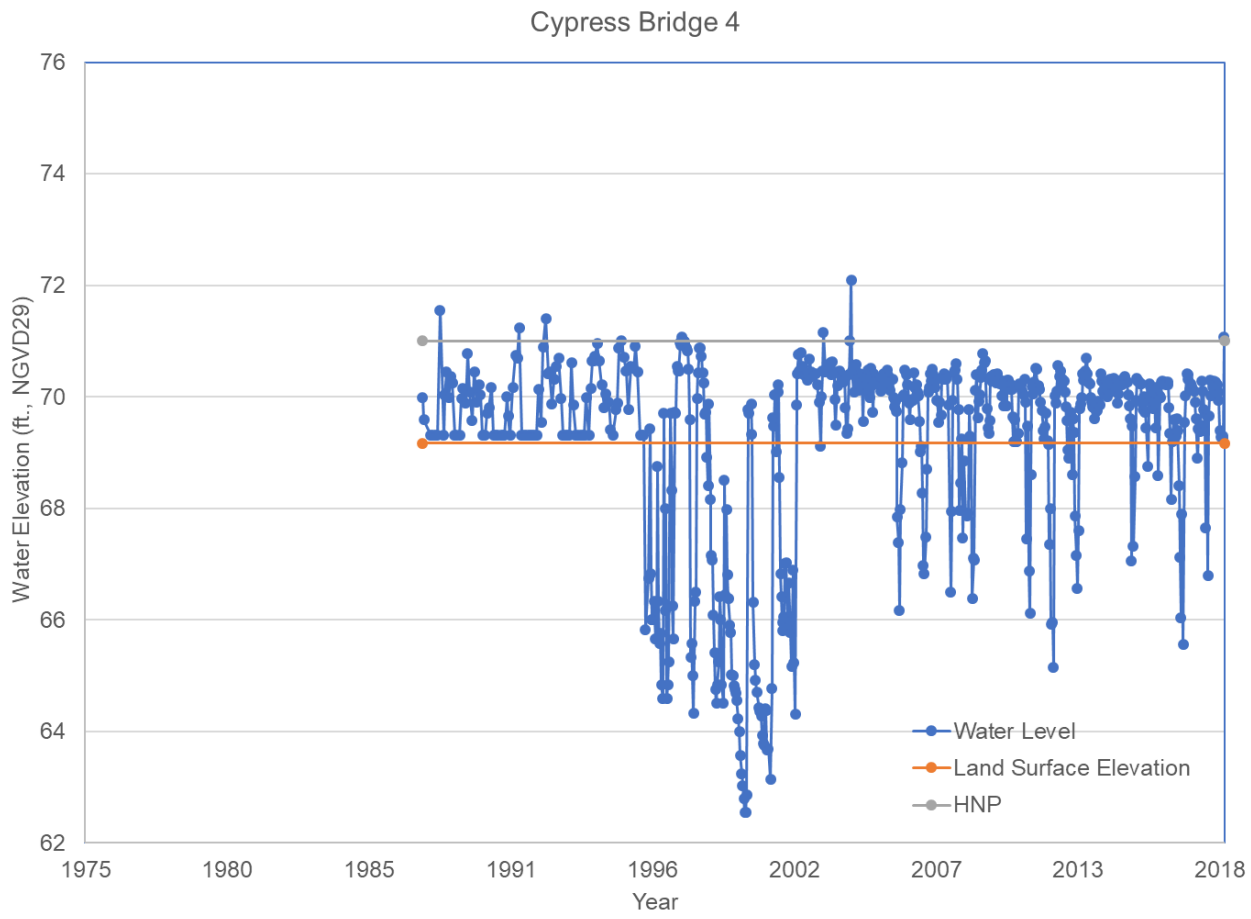

Figure 39: Cypress Bridge 4 water levels

The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 71.0 feet NGVD29, and a proposed MFL of 69.2 feet NGVD29. The currently adopted MFL at this site is 69.2 feet NGVD29, so no change is recommended.

The drainage systems in the area of the Cypress Bridge 4 wetland have been altered as part of a surface water management system installed in the residential development that surrounds the wetland. The outlet, a concrete structure on the north end of the wetland, was surveyed with a control elevation that is 0.7 feet below the HNP (see Appendix B). Figure 39 shows that water levels regularly reach an elevation a few tenths below the HNP, so the swale may be preventing water levels from reaching the natural Historic normal pool. The calculated Historic P50 is located 0.8 feet above the MFL, so the proposed MFL is clearly attainable. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

Cypress Bridge 4 wetland is recommended to be kept as an adopted MFL site, with an MFL of 69.2 feet NGVD29.

Cypress Bridge 20 (Wetland ID 137)

Cypress Bridge 20 was located near the center of the Cypress Bridge wellfield in Pasco County (Figure 29). Cypress Bridge 20 was located in a pasture area when it was chosen as an MFL site, but was mitigated as part of a subdivision development, and no longer exists. Cypress Bridge 20 was an isolated cypress wetland, and was approximately 1.4 acres in size (Figure 40).

Figure 40: Former location of Cypress Bridge 20 wetland

Conclusion and Recommendation:

It is recommended to remove Cypress Bridge 20 as an MFL site. Further investigation is necessary to determine if there is a suitable wetland to set a minimum level on to serve as a replacement for Cypress Bridge 20.

Cypress Creek

The Cypress Creek wellfield is located in central Pasco County (Figure 2). Wellfield production in Cypress Creek began in 1976, and quickly rose to approximately 30 mgd by 1979. Groundwater production became a little more variable in the 1990s, but then was reduced to approximately 15 mgd beginning around 2003. There are 5 wetlands with established minimum levels at the Cypress Creek wellfield (Figure 41).

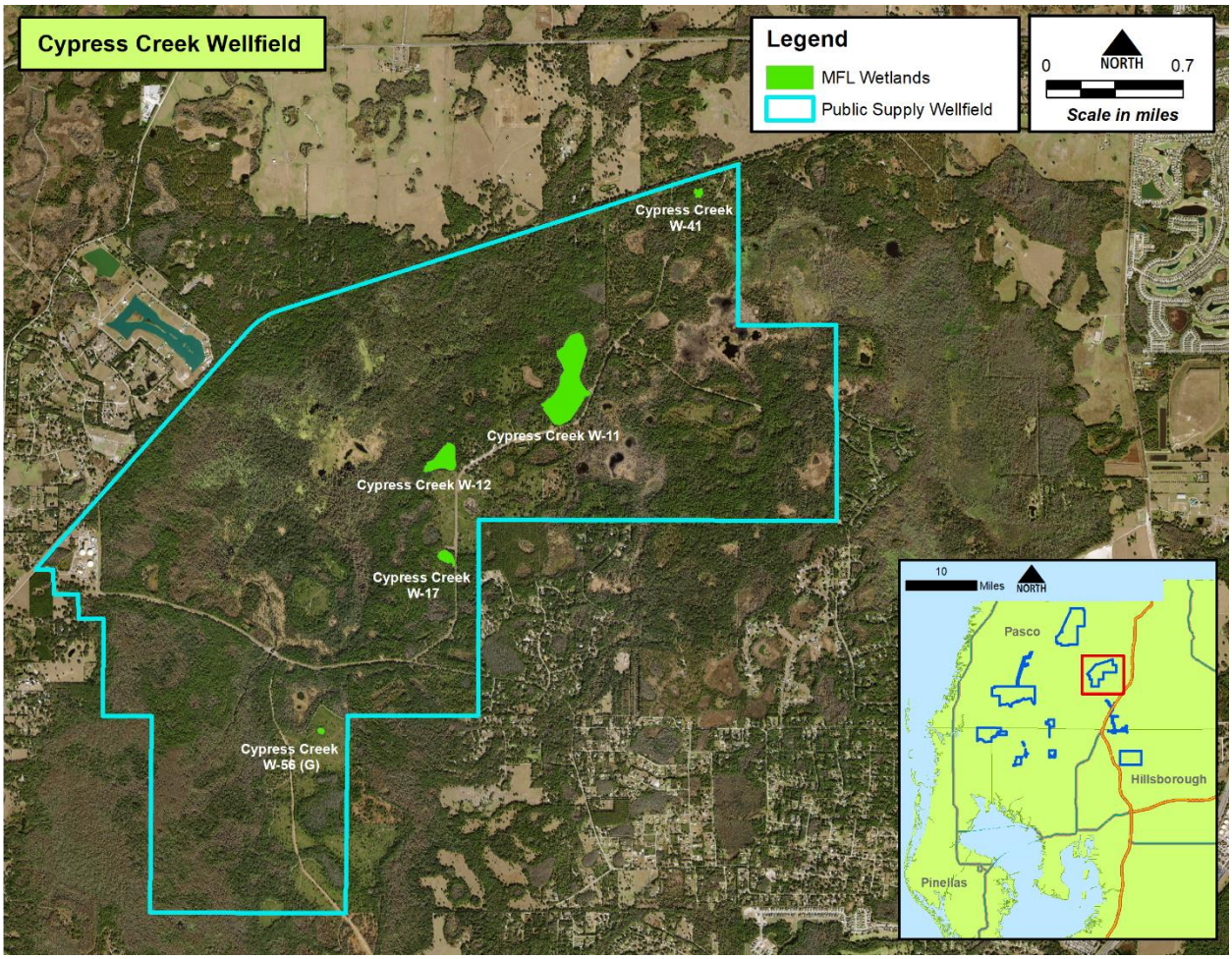

Figure 41: Cypress Creek wellfield with established minimum level wetlands

Cypress Creek W-41 (Wetland ID 217)

Cypress Creek W-41 is located in the northern tip of the wellfield (Figure 41). W-41 is a cypress and tupelo swamp, and is approximately 1.2 acres in size (Figure 42).

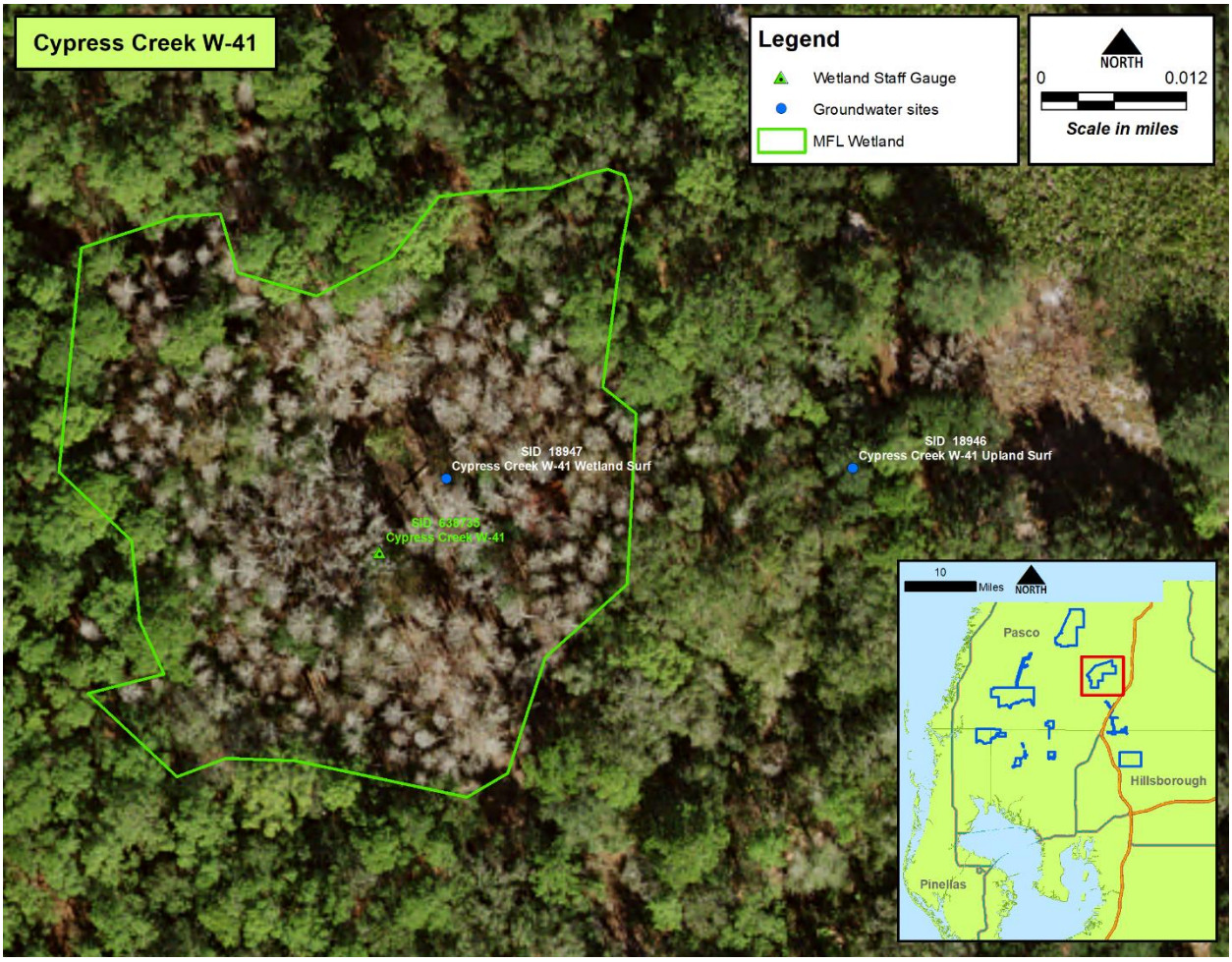

Figure 42: Cypress Creek 41 wetland

Tampa Bay Water installed a staff gage (SID 638735) and upland well at this site in 1981, and a wetland well in 1997. When the wetland was adopted as an MFL site, the District installed wetland (SID 18947) and upland (SID 18946) wells in 2001 (Figure 42, Figure 43). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

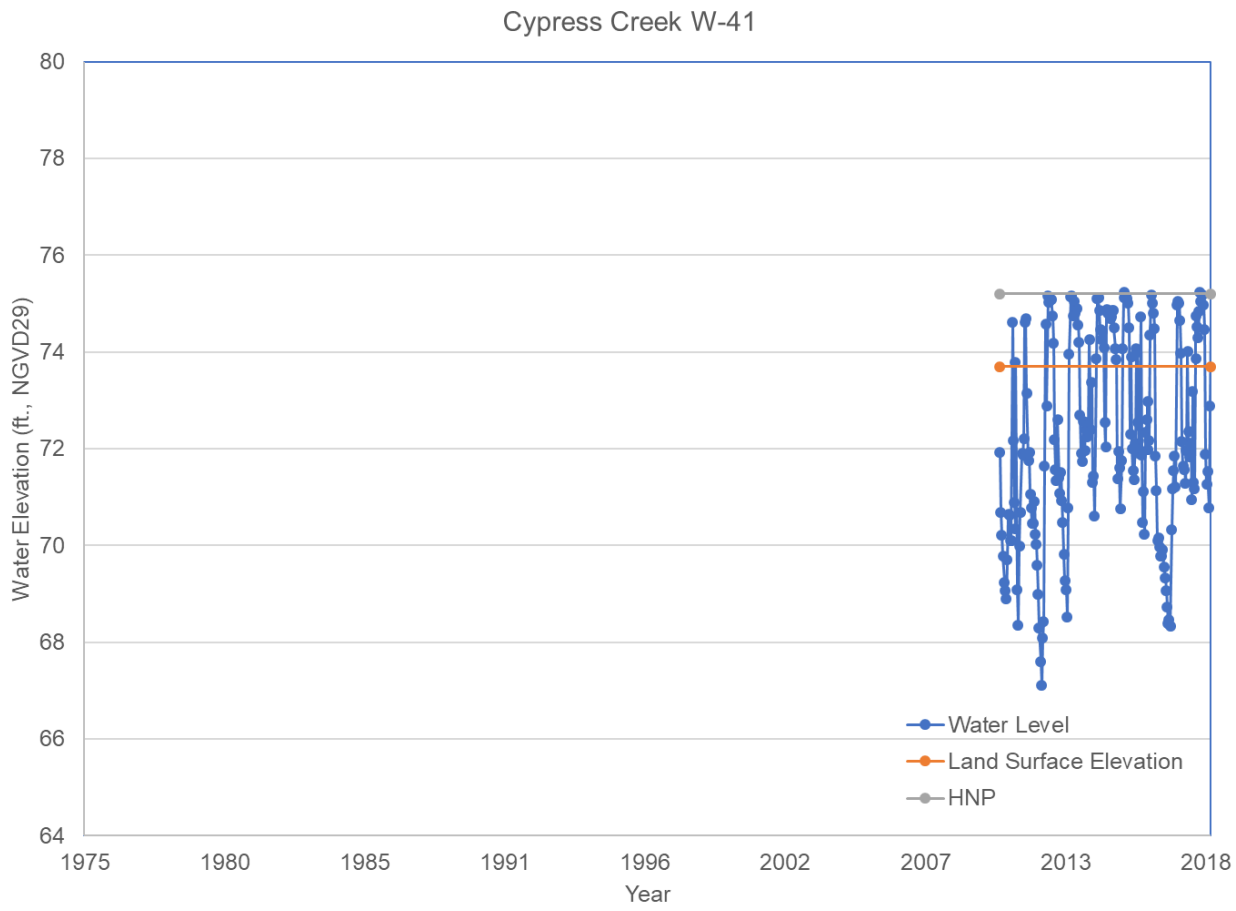

Figure 43: Cypress Creek W-41 water levels. Note: elevation on vertical axis goes higher than on other Cypress Creek hydrographs.

Significant subsidence and tree fall have been noted at the Cypress Creek W-41 wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP has not been established at this wetland, and it is believed that the wetland is a backwater wetland connected to the Cypress Creek floodplain.

Conclusion and Recommendation:

Because an acceptable HNP could not be established, and the Cypress Creek W-41 does not appear to be an isolated wetland, it is recommended that this wetland not be used as an MFL. Unfortunately, there are no adequate candidates to replace this wetland as an MFL in the vicinity of Cypress Creek W-41.

Cypress Creek W-11 (Wetland ID 195)

Cypress Creek W-11 is located toward the north end of the wellfield, but south of W-41 (Figure 41). W-11 is a relatively large isolated cypress wetland, and is approximately 39 acres in size (Figure 44).

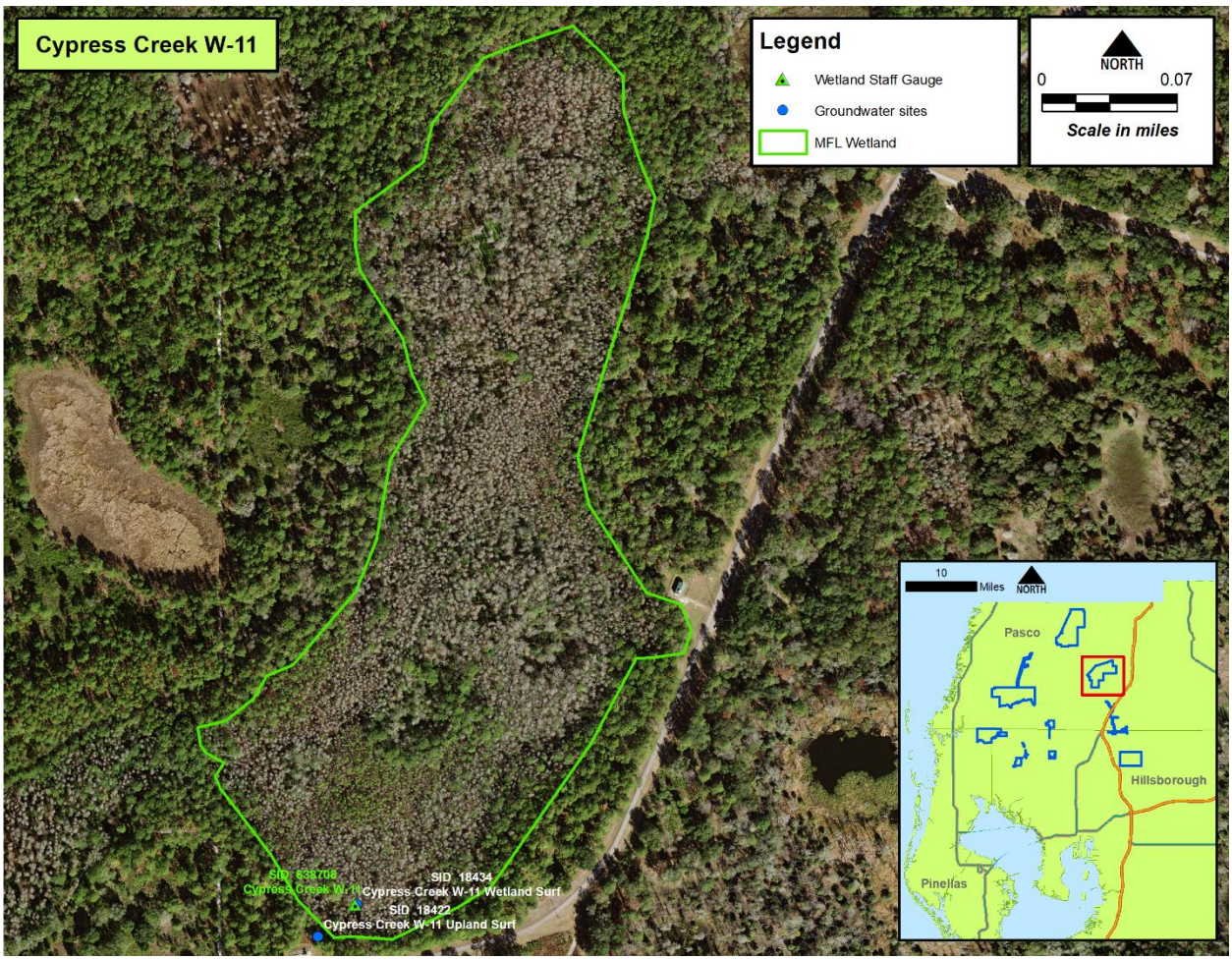

Figure 44: Cypress Creek 11 wetland

Tampa Bay Water installed a staff gage and wetland well at this site in 1978, and replaced the well in 1997. When the wetland was adopted as an MFL site, the District installed wetland (SID 18434) and upland (SID 18422) wells in 2001, and a staff gage (SID 638708) in 2002 (Figure 44, Figure 45). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

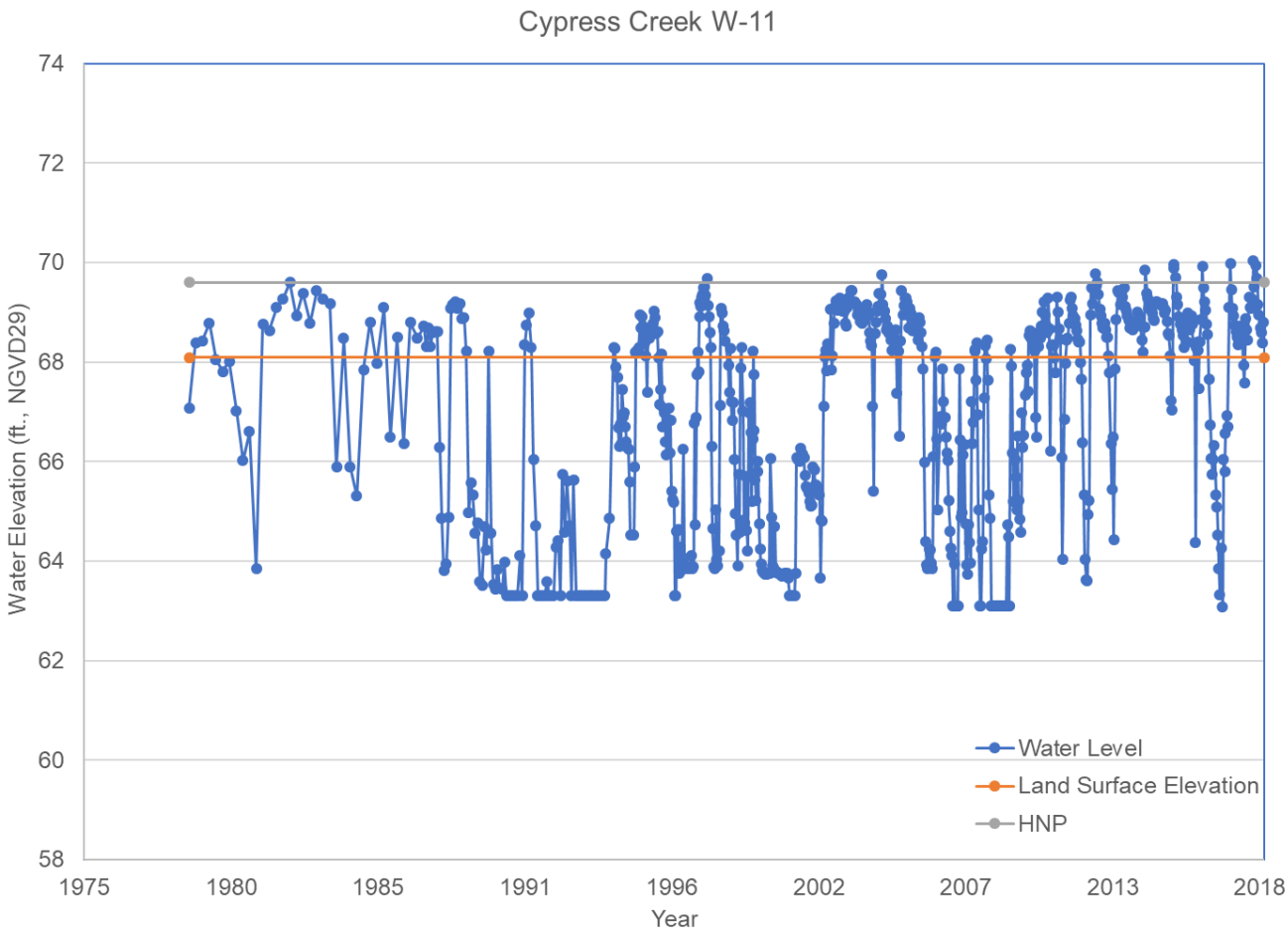

Figure 45: Cypress Creek W-11 water levels

Significant subsidence and tree fall have been noted at the Cypress Creek W-11 wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points near the wetland edge (to avoid potential subsidence) at 69.6 feet NGVD29, and a proposed MFL of 67.8 feet NGVD29. The currently adopted MFL at this site is 67.5 feet NGVD29.

The Cypress Creek W-11 wetland has a very natural-looking swale identified as its outlet, and was surveyed at 0.6 feet below the HNP (see Appendix B). Figure 45 shows that water levels regularly reach the HNP. The calculated Historic P50 is 0.7 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cypress Creek W-11 wetland is recommended to be kept as an adopted MFL site, with an MFL of 67.8 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation, and an improved assessment of HNP.

Cypress Creek W-12 (Wetland ID 196)

Cypress Creek W-12 is located in the center of the wellfield (Figure 41). W-12 is an isolated cypress wetland, and is approximately 9.5 acres in size (Figure 46)

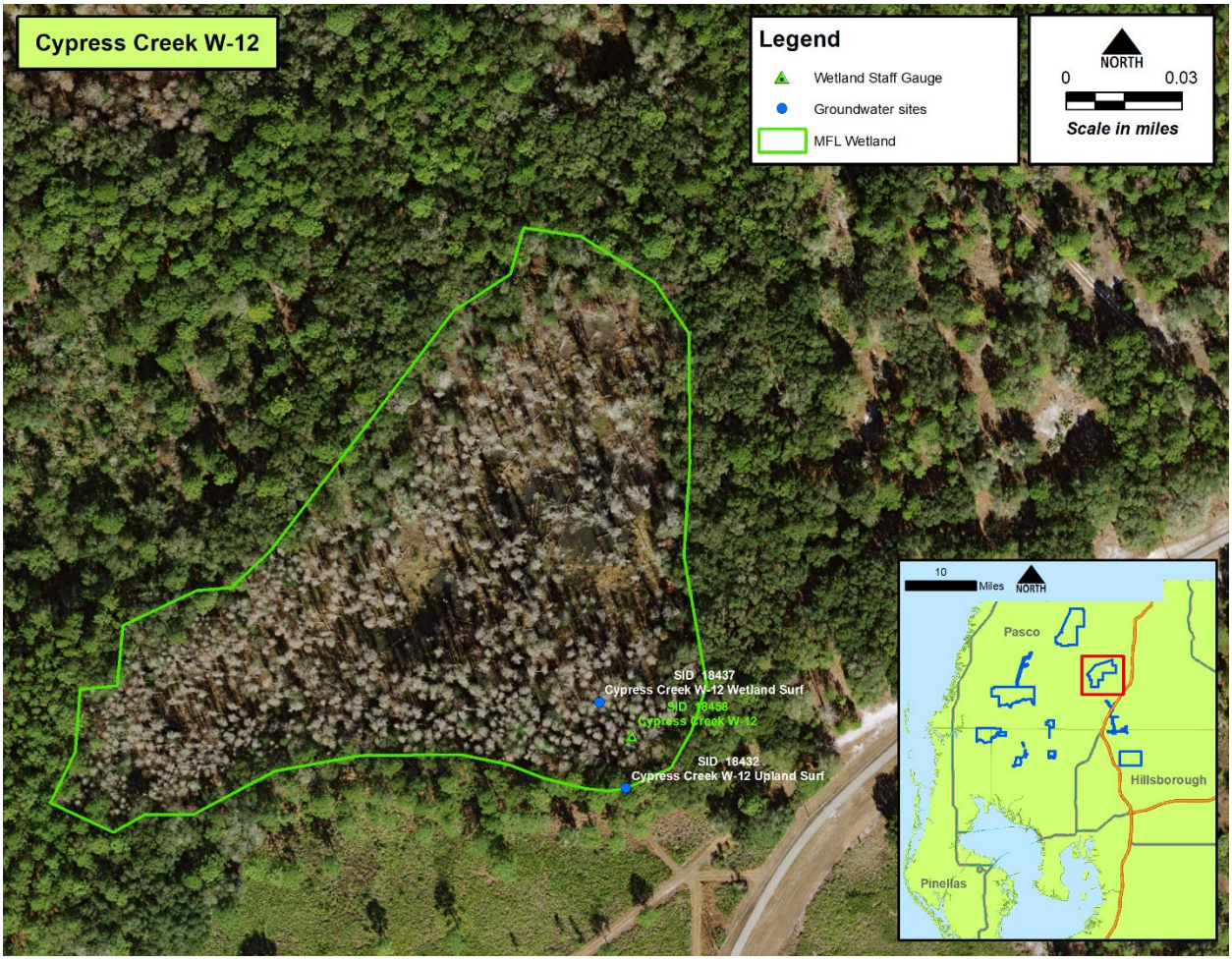

Figure 46: Cypress Creek W-12 wetland

Tampa Bay Water installed a staff gage (SID 18458) and wetland well at this site in 1979, and replaced the well in 1995 and 2000. When the wetland was adopted as an MFL site, the District installed wetland (SID 18437) and upland (SID 18432) wells in 2001 (Figure 46, Figure 47). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

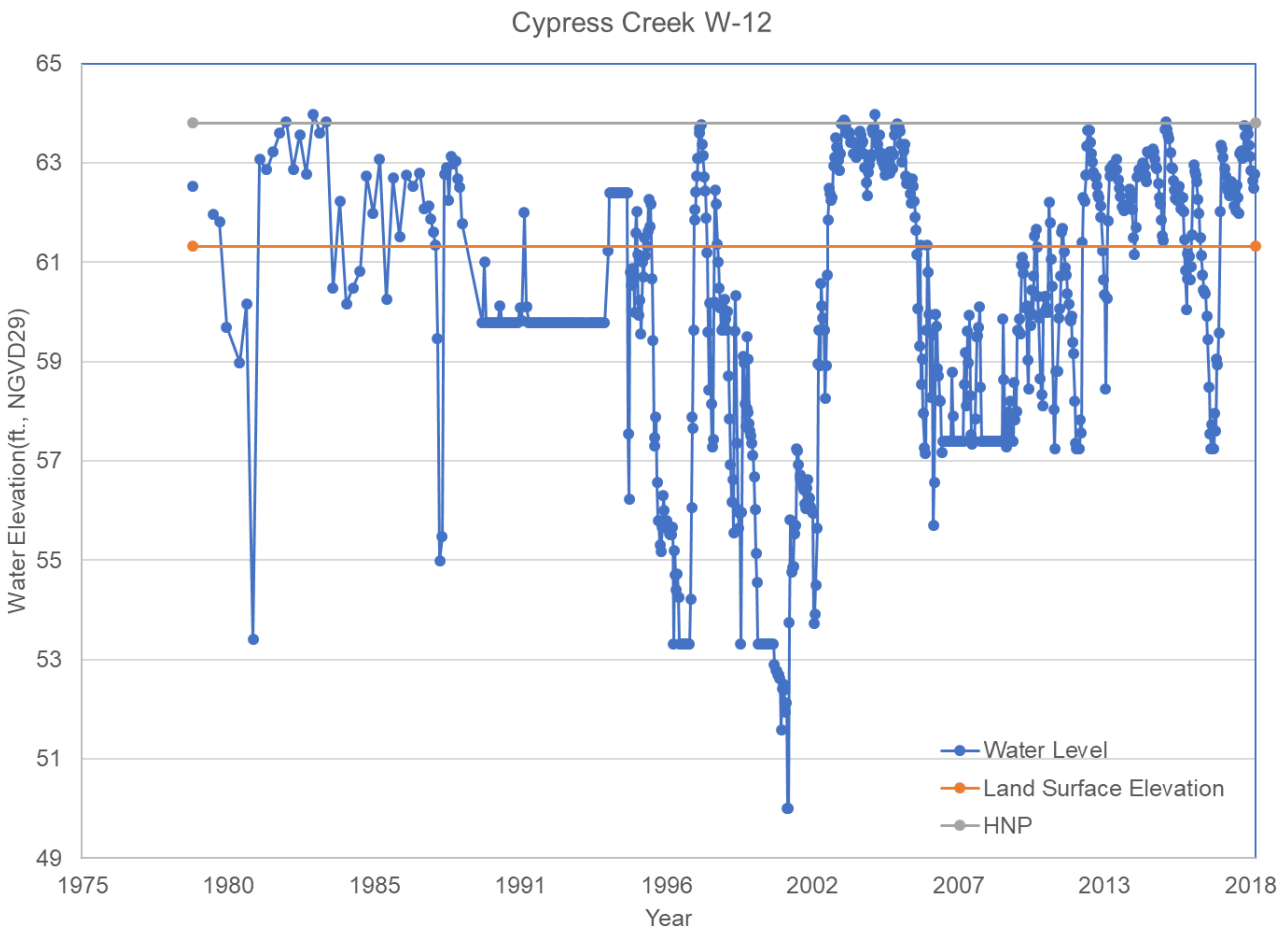

Figure 47: Cypress Creek W-12 water levels

Significant subsidence and tree fall have been noted at the Cypress Creek W-12 wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points near the wetland edge (to avoid potential subsidence) at 63.8 feet NGVD29, and a proposed MFL of 62.0 feet NGVD29. The currently adopted MFL at this site is 62.1 feet NGVD29.

The Cypress Creek W-12 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.4 feet below the HNP (see Appendix B). Figure 47 shows that water levels regularly reach the HNP. The calculated Historic P50 is 0.4 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cypress Creek W-12 wetland is recommended to be kept as an adopted MFL site, with an MFL of 62.0 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

Cypress Creek W-17 (Wetland ID 199)

Cypress Creek W-17 is located in the center of the wellfield (Figure 41). W-17 is an isolated cypress wetland, and is approximately 3 acres in size (Figure 48).

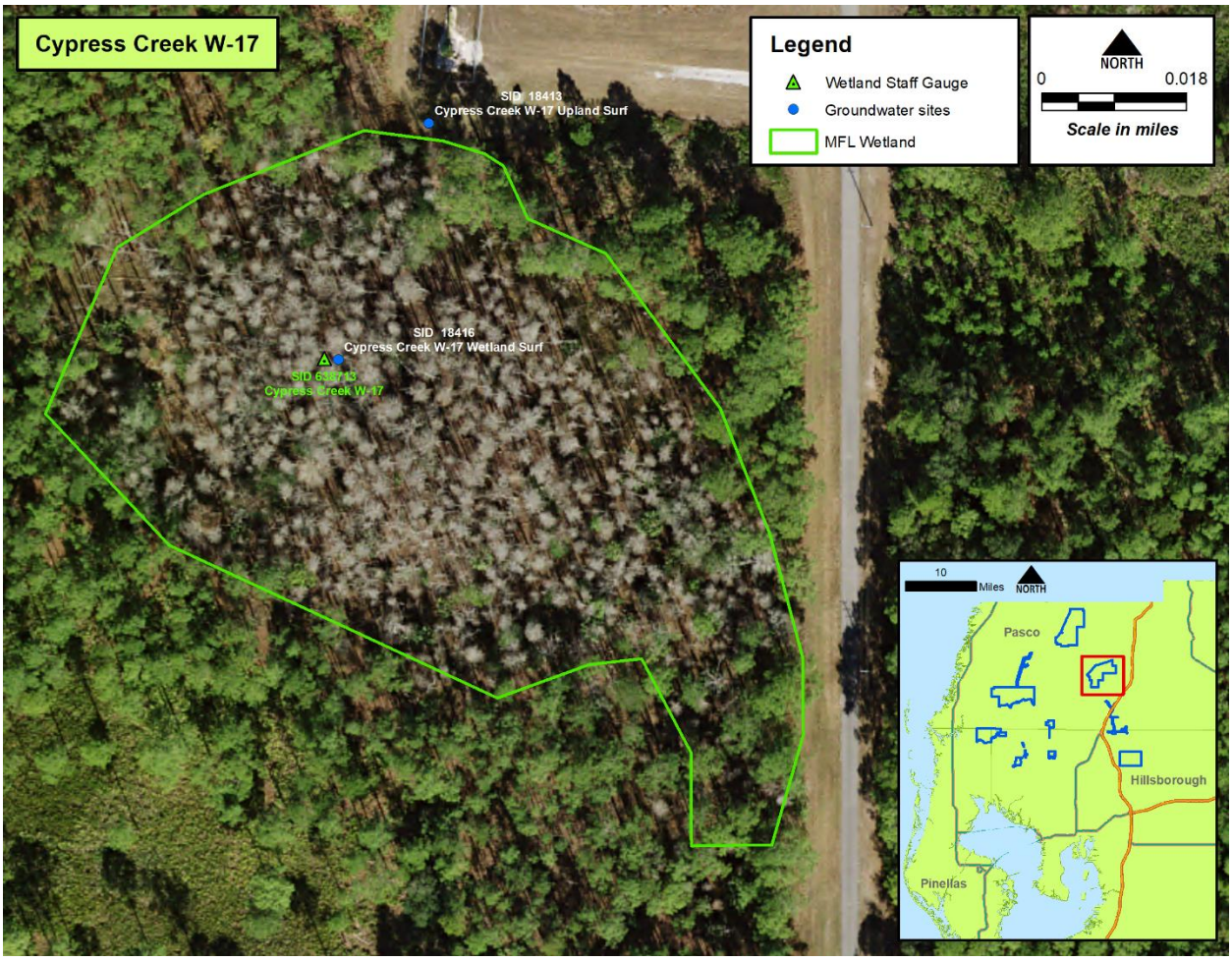

Figure 48: Cypress Creek W-17 wetland

Tampa Bay Water installed a staff gage (SID 638713) and wetland well at this site in 1978, and replaced the well in 1997. When the wetland was adopted as an MFL site, the District installed wetland (SID 18416) and upland (SID 18413) wells in 2001 (Figure 48, Figure 49). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

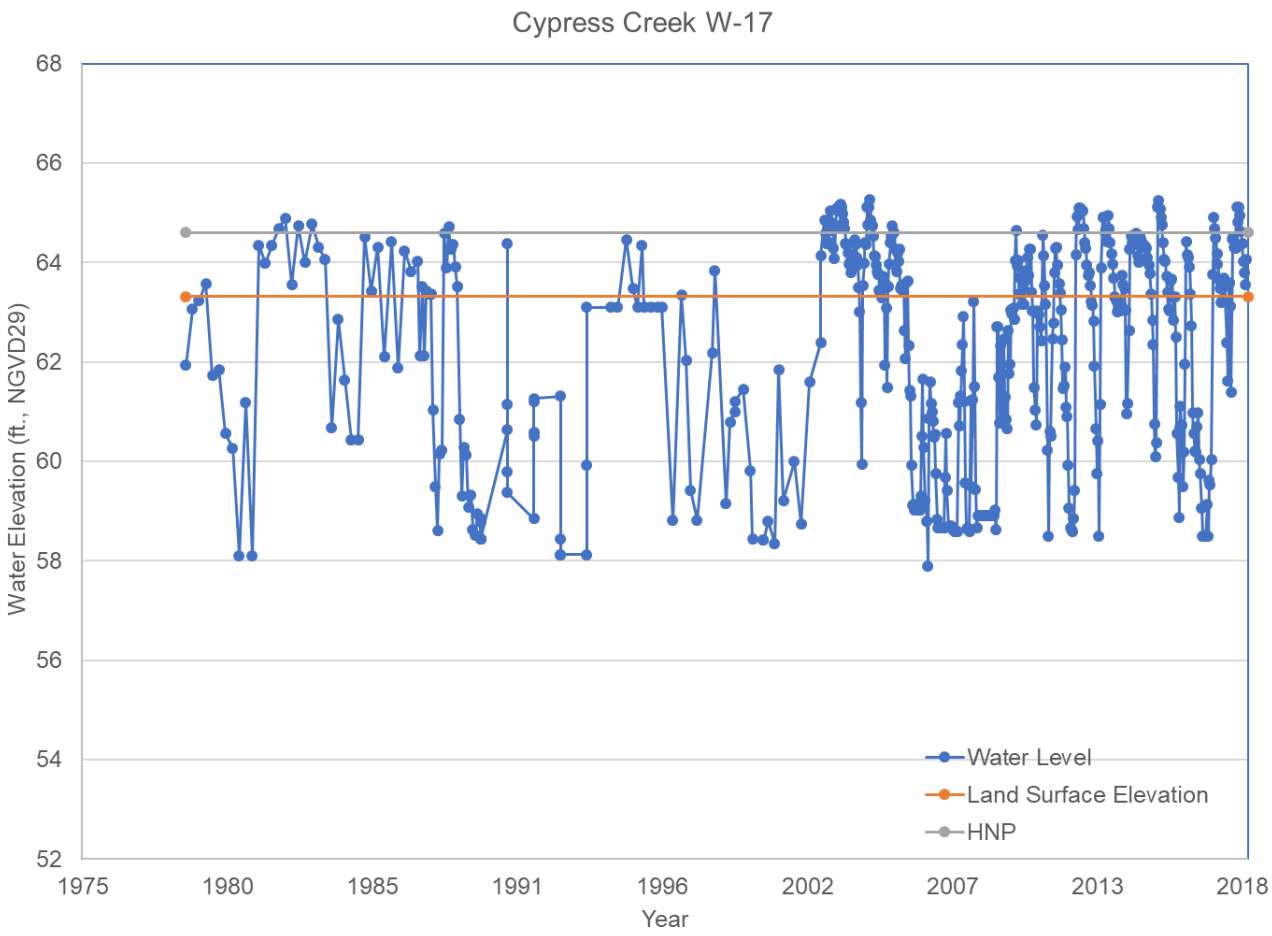

Figure 49: Cypress Creek W-17 water levels

Significant subsidence and tree fall have been noted at the Cypress Creek W-17 wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points near the wetland edge (to avoid potential subsidence) at 64.6 feet NGVD29, and a proposed MFL of 62.8 feet NGVD29. The currently adopted MFL at this site is 63.1 feet NGVD29.

The Cypress Creek W-17 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.1 feet above the HNP (see Appendix B). Figure 49 shows that water levels regularly reach the HNP. The calculated Historic P50 is 0.9 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cypress Creek W-17 wetland is recommended to be kept as an adopted MFL site, with an MFL of 62.8 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

Cypress Creek W-56 (G) (Wetland ID 230)

Cypress Creek W-56 (also known as Cypress Creek G) is located toward the southern end of the wellfield (Figure 41). W-56 is an isolated cypress wetland, and is approximately 0.7 acres in size (Figure 50).

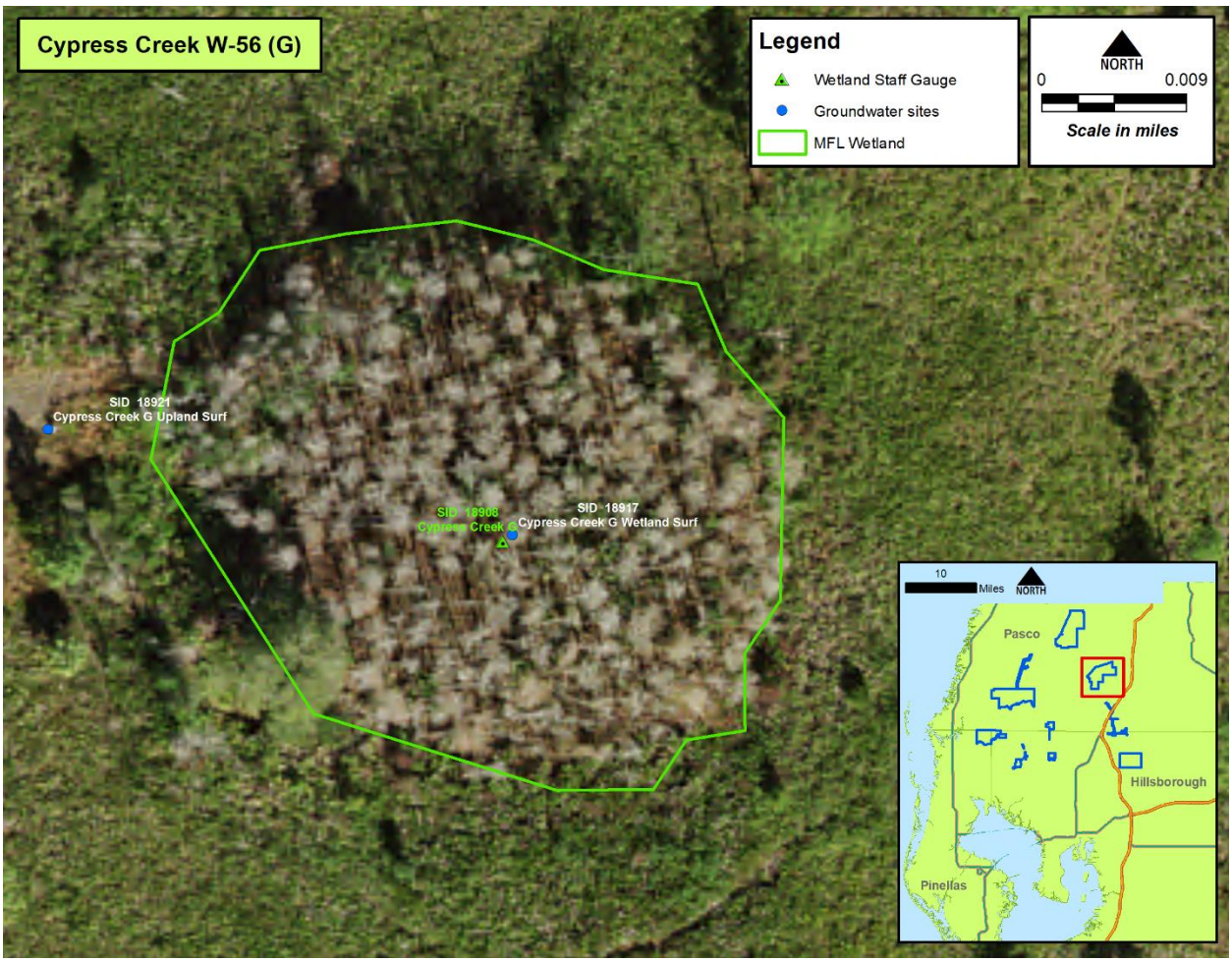

Figure 50: Cypress Creek W-56 (G) wetland

The District installed a staff gage (SID 18908) at this site in 1976. When the wetland was adopted as an MFL site, the District installed a wetland well (SID 18917) in 1999, and added an upland well (SID 18921) in 2001 (Figure 50, Figure 51). A WAP transect was established in 2005.

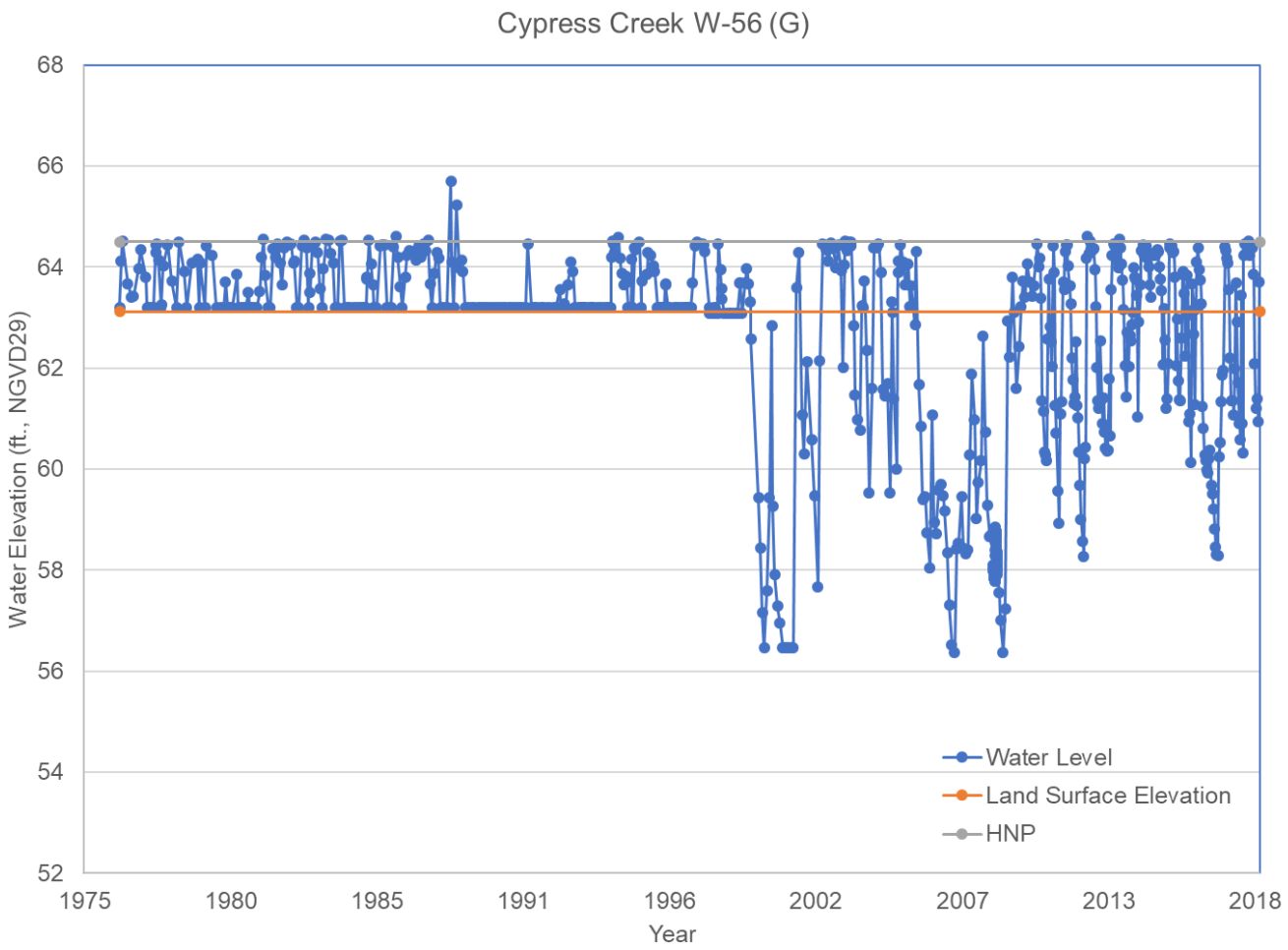

Figure 51: Cypress Creek W-56 (G) water levels

The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 64.5 feet NGVD29, and a proposed MFL of 62.7 feet NGVD29. The currently adopted MFL at this site is 62.7 feet NGVD29, so no changed is proposed.

The Cypress Creek W-56 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at the same elevation as the HNP (see Appendix B). Figure 51 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.8 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Cypress Creek W-56 wetland is recommended to be kept as an adopted MFL site, with an MFL of 62.7 feet NGVD29.

Eldridge Wilde

The western half of the Eldridge Wilde wellfield (EWWF) is located in Pinellas county, while the eastern half is located in Hillsborough County (Figure 2). Wellfield production in Eldridge Wilde began in 1956. EWWF was pumping approximately 30-40 mgd in the 1970's, 25-35 mgd in the 1980's, 25-30 mgd in the 1990's, and has cut back to approximately 8-15 mgd since 2004. There are 2 wetlands within EWWF that have established minimum levels associated with them (Figure 52).

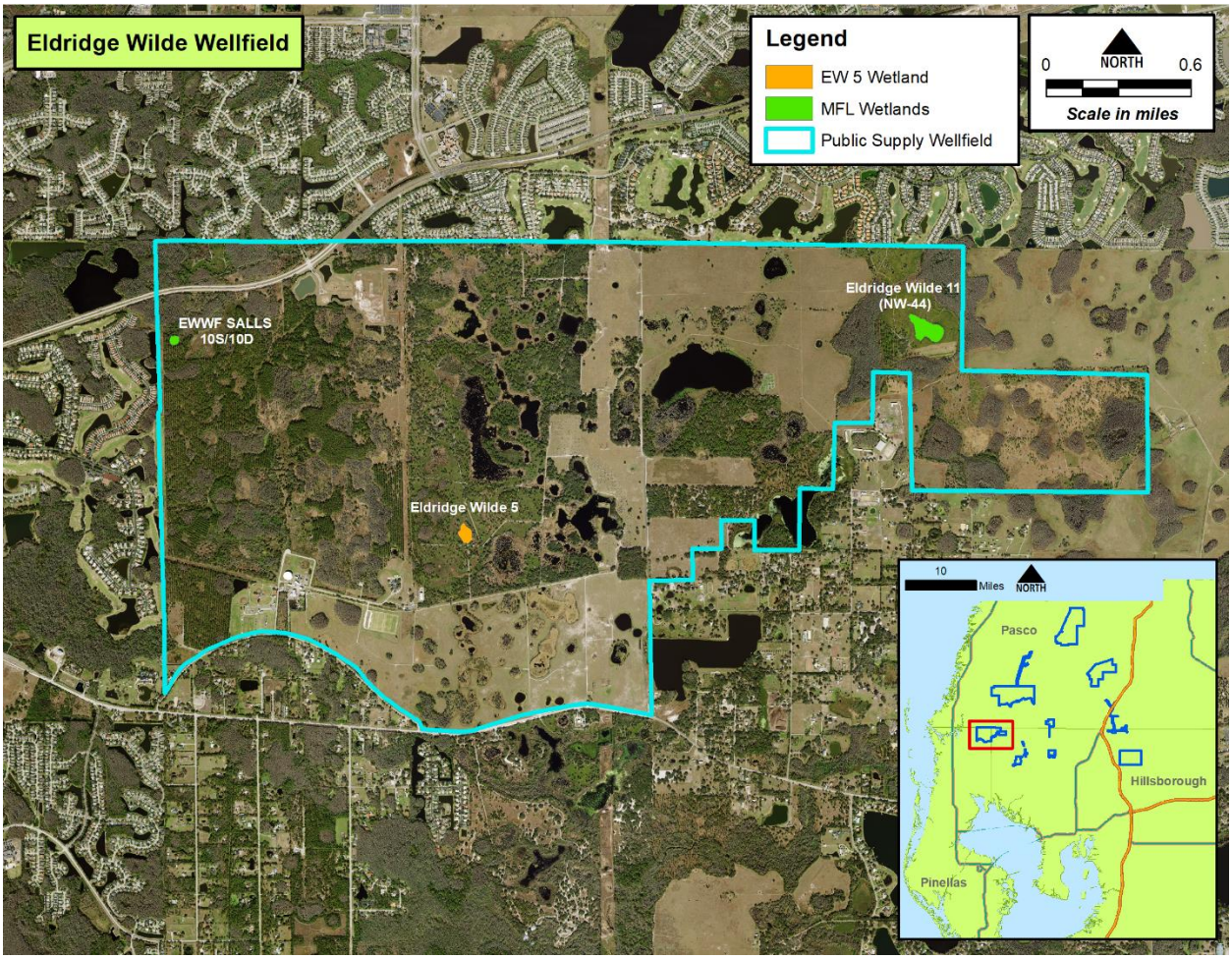

Figure 52: Eldridge Wilde wellfield with established minimum level wetlands

Eldridge Wilde 11 (NW-44) (Wetland ID 248)

Eldridge Wilde 11 (NW-44) is located in Hillsborough county, on the far east side of EWWF (Figure 52). This wetland is an isolated cypress wetland with an adjacent monitored wet prairie (known as EW Wet Prairie) on the western side, which are collectively considered one wetland now, of approximately 6 acres in size (Figure 53).

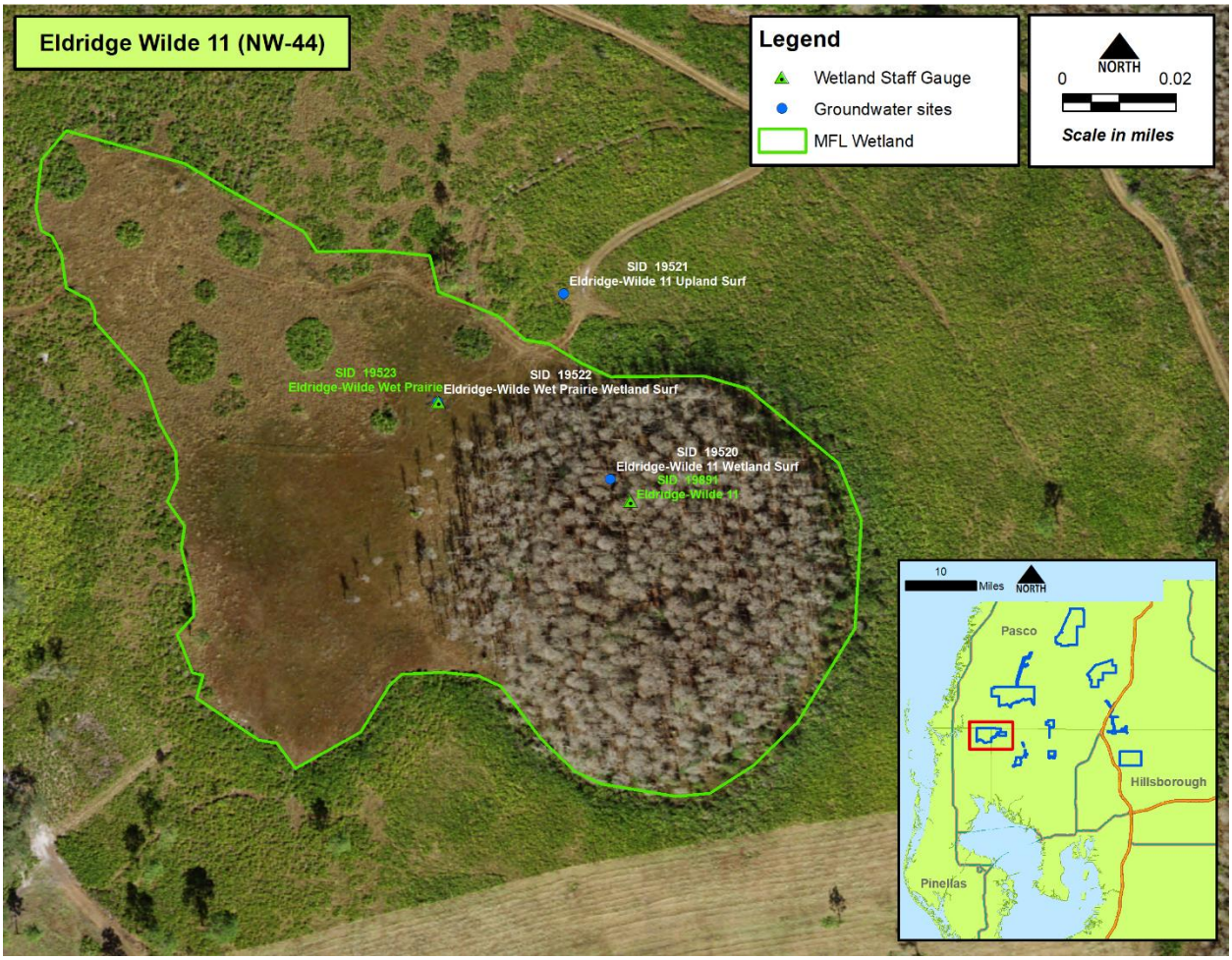

Figure 53: Eldridge Wilde 11 (NW-44) wetland

The District has had a staff gage (SID 19891) at this site since 1989. In 2001, the District installed upland (SID 19521) and wetland (SID 19520) surficial wells. The wet prairie has its own staff gage (SID 19523) and wetland well (SID 19522), but both wetlands are now considered one wetland. This wetland continues to be monitored on a twice monthly basis at the time of this report. A WAP transect was also established in 2005. The District has been exclusively collecting water level data from this site since 2010.

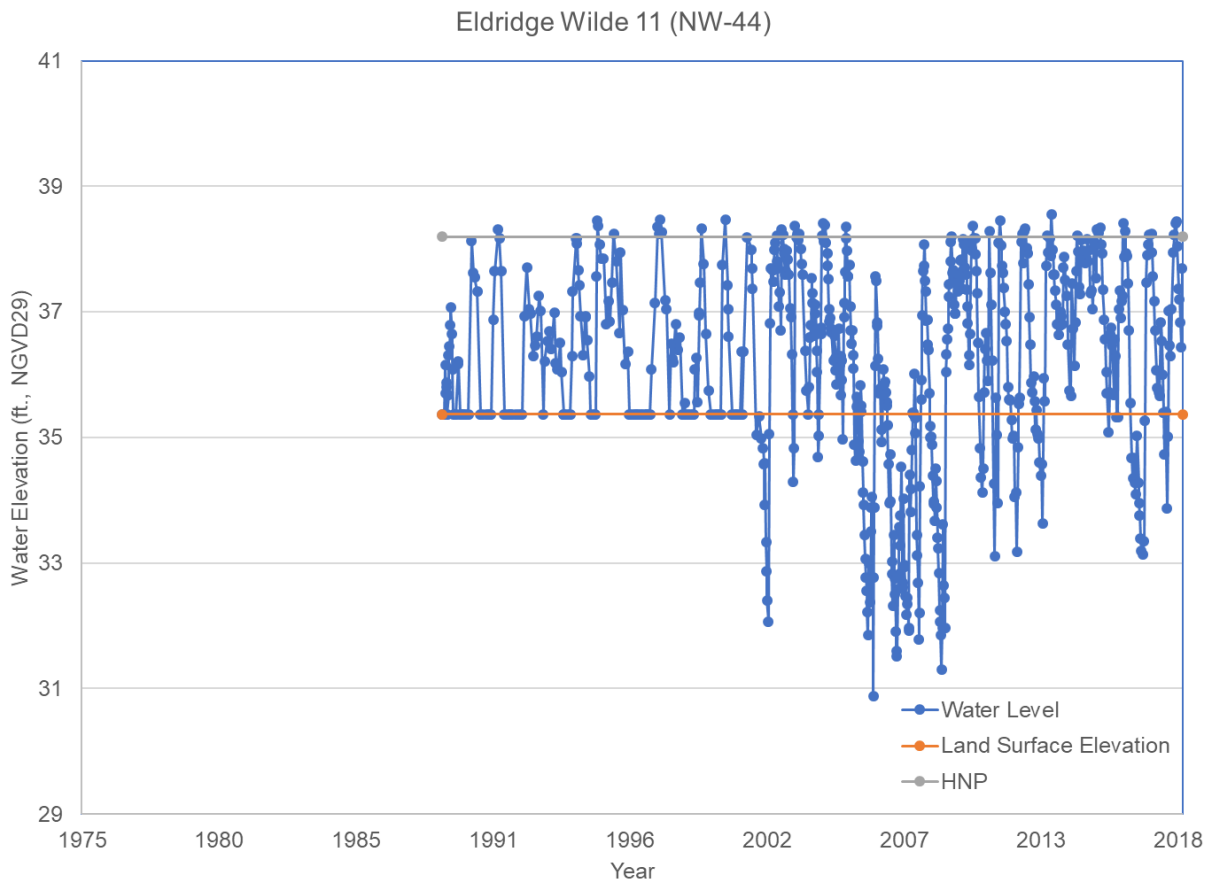

Figure 54: Eldridge Wilde 11 water levels

Eldridge Wilde 11 was monitored extensively for environmental information in the 1980's and 1990's, and during this time conditions typical of a wetland far removed from the impact of groundwater pumping were observed. It was noted that "an abundance of wetland plants were found in the dome and in the large surrounding wet meadow." Some minor subsidence has since been noted in the wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 38.2 feet NGVD29, and a proposed MFL of 36.4 feet NGVD29. The currently adopted MFL at this site is 36.7 feet NGVD29.

The Eldridge Wilde 11 wetland has a very natural-looking but small outlet, described as a "naturalized swale," and surveyed at 0.1 feet above the HNP (see Appendix B). Figure 54 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.8 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

This Eldridge Wilde 11 wetland is recommended to be kept as an adopted MFL site, with an MFL of 36.4 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

Eldridge Wilde Salls Property Wetland (10S/10D) (Wetland ID 247)

Eldridge Wilde Salls is located in Pinellas county, on the far west side of EWWF (Figure 52). This wetland is a small isolated cypress wetland of approximately 0.8 acres in size (Figure 55).

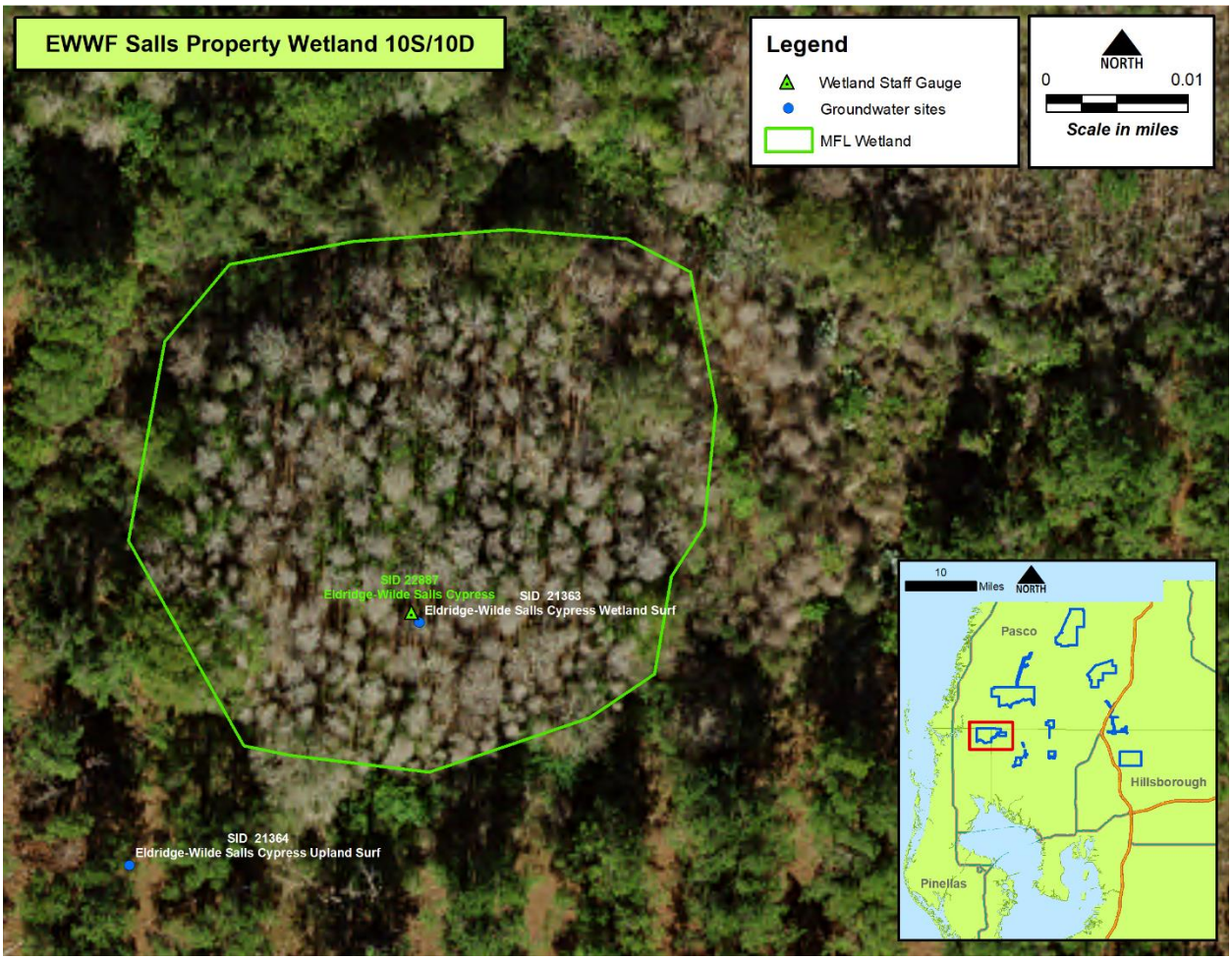

Figure 55: Eldridge Wilde Salls wetland

TBW had a staff gage and wetland well at this site since 1998. In 2001, the District installed a wetland well (SID 21363), upland well (SID 21364), and staff gage (SID 22887). The District took over monitoring of the site in 2010, and continues to do so on a twice monthly basis at the time of this report. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

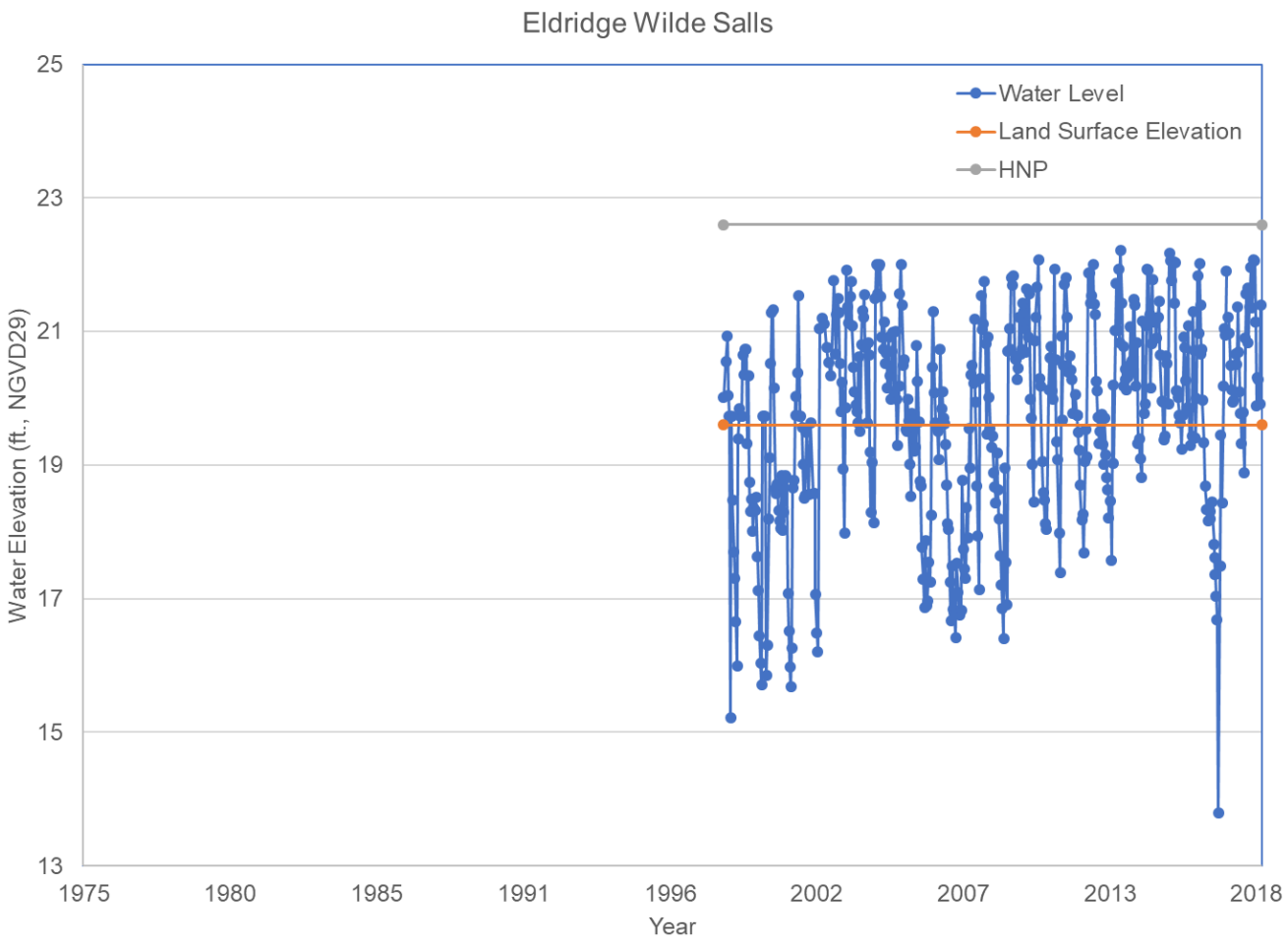

Figure 56: Eldridge Wilde Salls water levels

Despite several field visits to establish a good HNP at the Eldridge Wilde Salls wetland, the elevations of the biological indicators of HNP have been highly variable at this site, and a reliable HNP has not been able to be obtained. Additionally, the wetland does not appear to be hydrologically representative of the area. Despite little or no drawdowns due to groundwater withdrawals near the wetland, the wetland has been unable to meet its currently adopted minimum level. Eldridge Wilde Salls is surrounded by mostly soils classified as mesic.

Conclusion and Recommendation:

Because Eldridge Wilde Salls does not have a reliable HNP, and minimum wetland levels are so dependent on accurate HNP levels, as well as it not appearing to be representative of the area where it is located, it is recommended that this wetland not be used as an MFL. As a replacement for Eldridge Wilde Salls, it is proposed that Eldridge Wilde 5, be proposed for MFL adoption (Figure 57).

Eldridge Wilde 5

Eldridge Wilde 5 is located in Pinellas County, on the south side towards to the center of the wellfield (Figure 52). It is an isolated cypress dome approximately 2.2 acres in size (Figure 57).

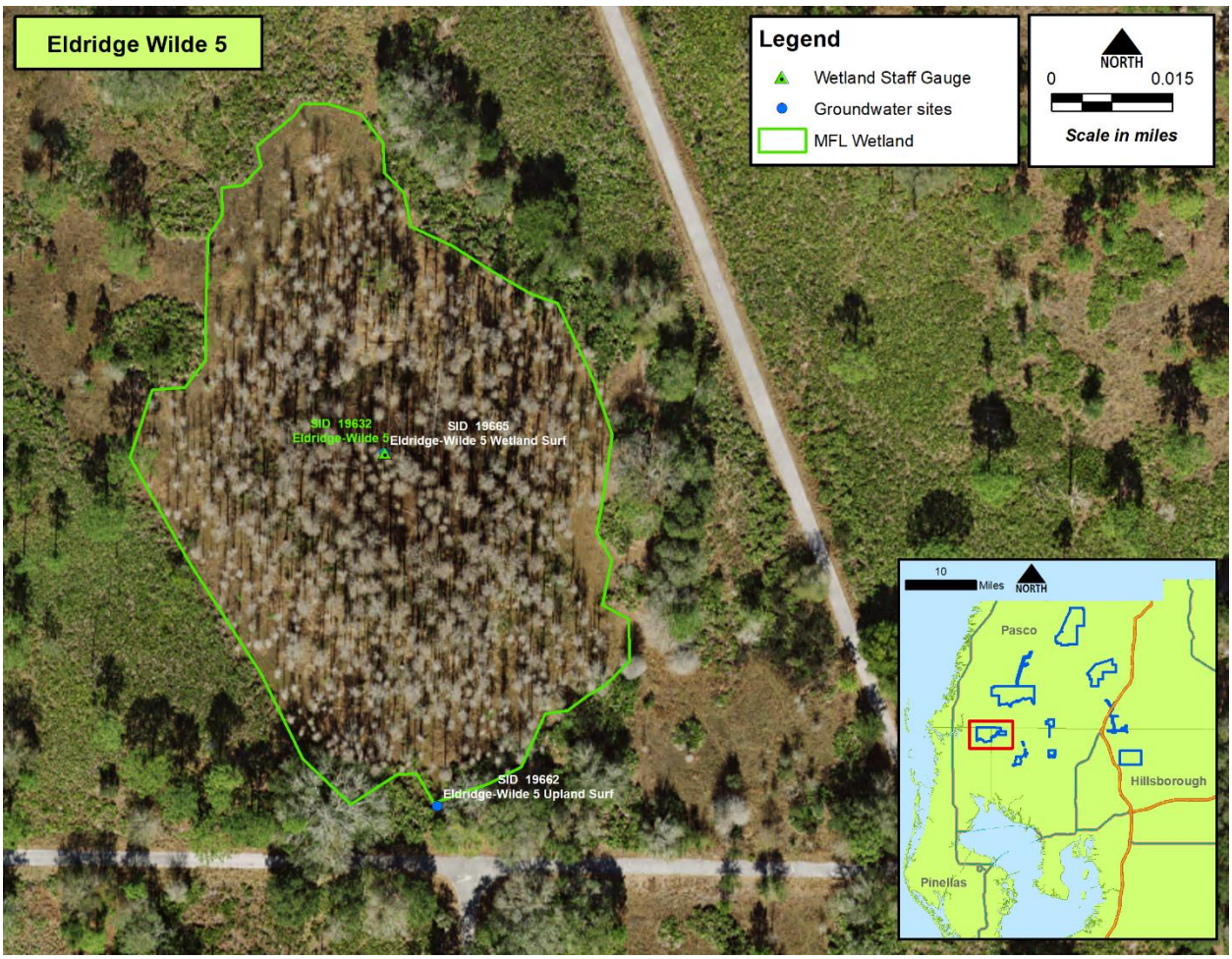

Figure 57: Eldridge Wilde 5 wetland

Monitoring of Eldridge Wilde 5 began from a District staff gage (SID 19632) in 1989. In 2001, upland (19622) and wetland (19665) surficial wells were added. A WAP transect was established in 2005. The District continues to monitor this site on a twice monthly basis at the time of this report.

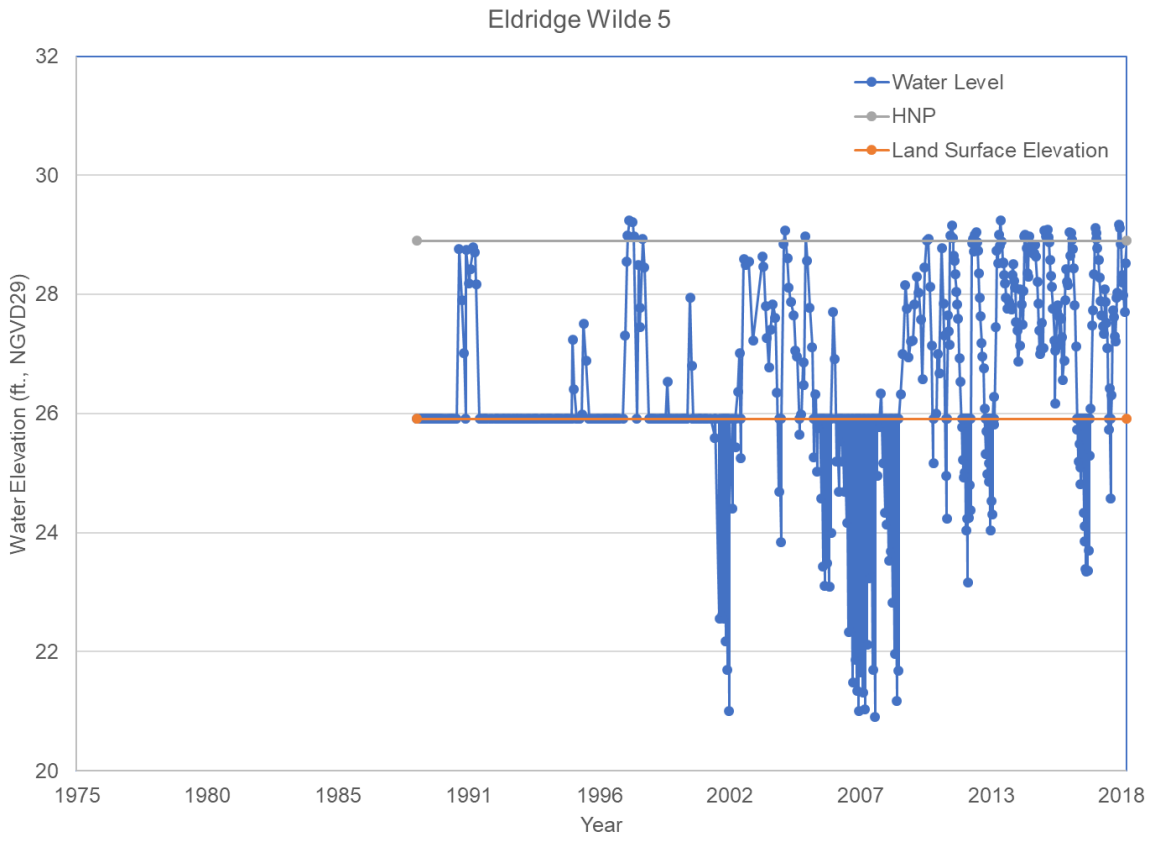

Figure 58: Eldridge Wilde 5 water levels

Eldridge Wilde 5 has had considerable environmental monitoring since the 1980's. Observances of considerable leaning and fallen trees, a thin canopy, and an overall appearance of poor health was thought to be a result of pumping impacts. Only on rare occasions was standing water observed in the wetland. Additionally, analysis of historic aerial photography concluded that the impacts observed started not too long after the initiation of pumping at the wellfield. However, in more recent years the wetland has shown longer hydroperiods and water levels regularly reaching the HNP. The wetland is mostly surrounded by soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflections at 28.9 feet NGVD29, with a proposed MFL of 27.1 feet NGVD.

The Eldridge Wilde 5 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at the same elevation as the HNP (see Appendix B). Figure 58 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.8 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Eldridge Wilde 5 wetland is recommended as an MFL replacement for Eldridge Wilde Salls, with an MFL of 27.1 feet NGVD29.

Morris Bridge

The Morris Bridge wellfield is located in Hillsborough County, just east of Interstate-75 (Figure 2). Wellfield production in Morris Bridge began in 1978. In 2003, there was a significant reduction in withdrawals from over 10 million gallons per day (mgd) to around 5 mgd, and has maintained an average of approximately 7 mgd since. There are 4 wetlands within the Morris Bridge wellfield that have established minimum levels associated with them (Figure 59).

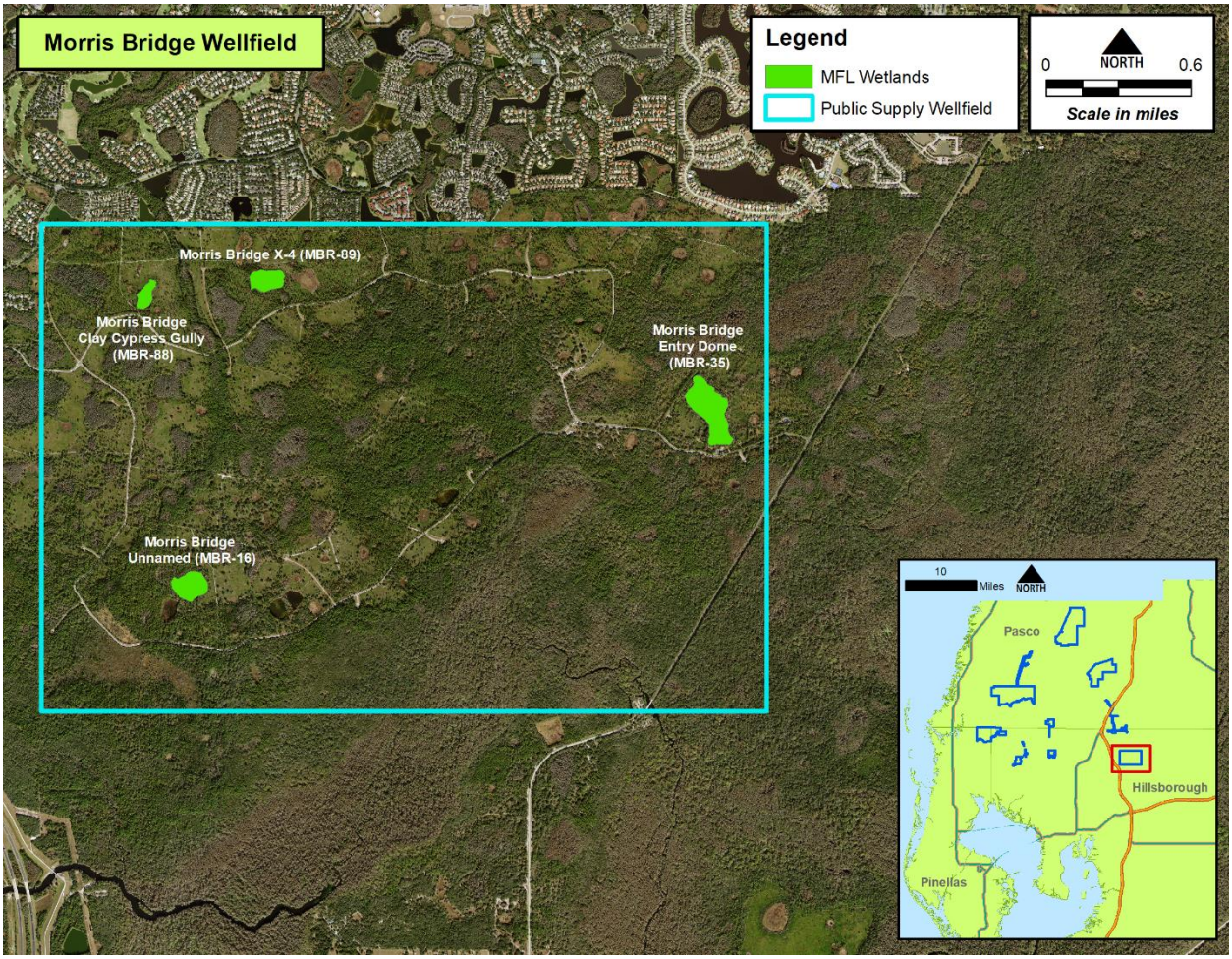

Figure 59: Morris Bridge Wellfield

Morris Bridge Entry Dome (MBR-35) (Wetland ID 264)

Morris Bridge Entry Dome (MBR-35) is located on the far east end of the Morris Bridge wellfield (Figure 59). This wetland is an isolated cypress wetland approximately 19 acres in size (Figure 60).

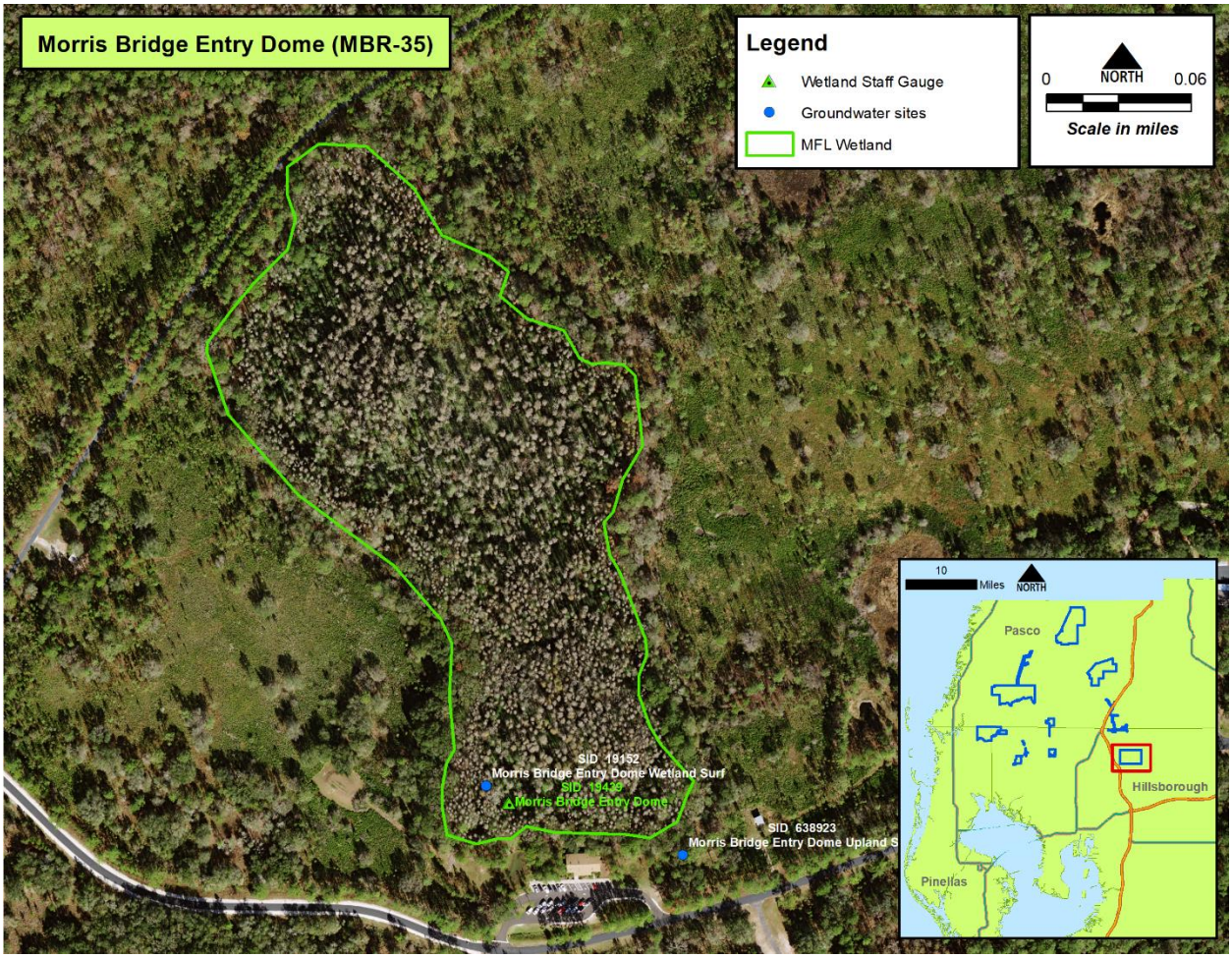

Figure 60: Morris Bridge Entry Dome wetland

TBW has had a staff gage and upland well (SID 638923 - south site) at this site since 1986. A wetland well was added in 1989, and a second upland well (north site) was installed in 1991. The District installed a wetland well (SID 19152) in 2001 and a staff gage (SID 19439) in 2002, located in a different part of the wetland than TBW's staff gage (Figure 60, Figure 61). In 2010, the District took over monitoring of the site, and continues to do so on a twice monthly basis. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

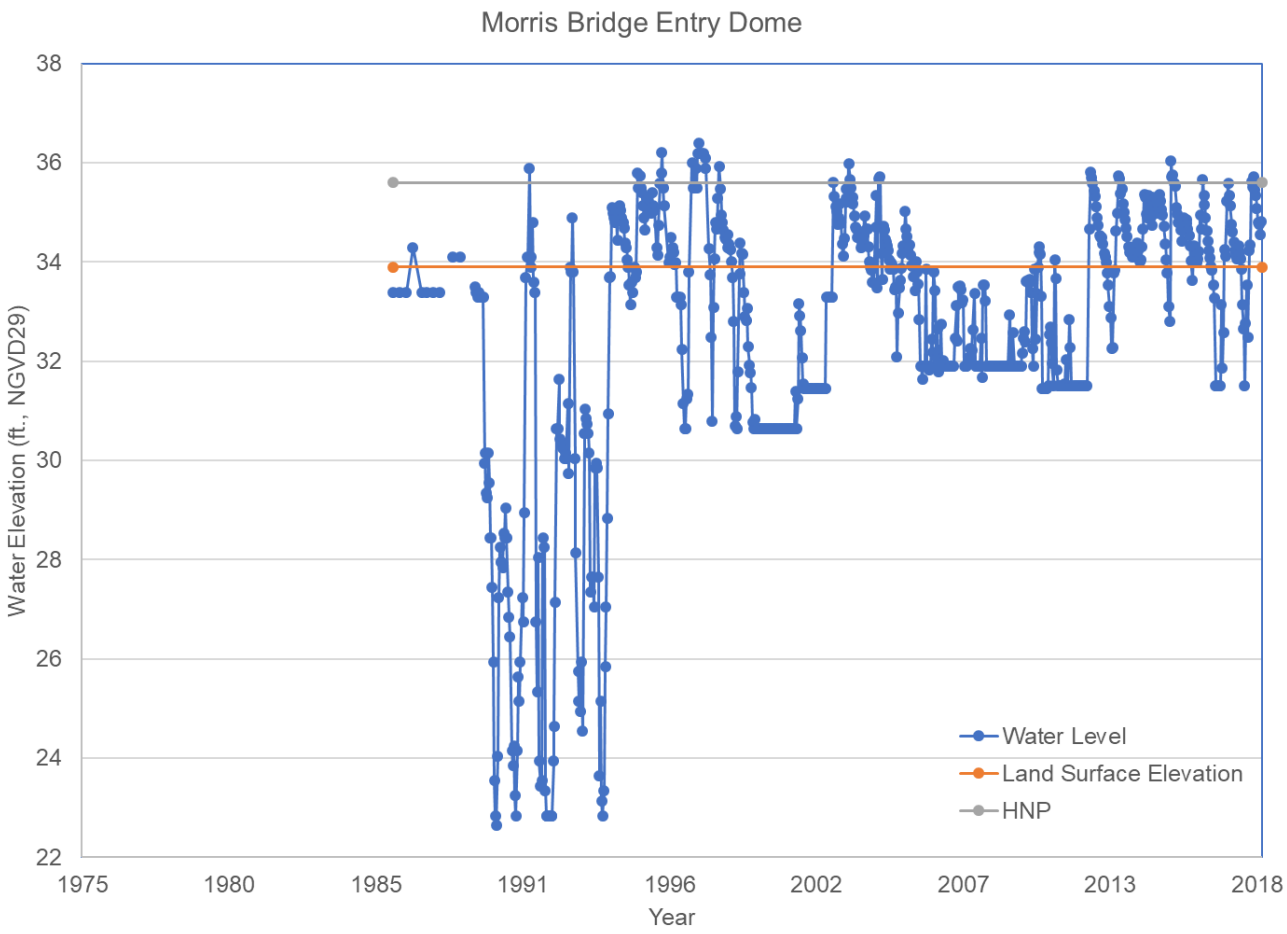

Figure 61: Morris Bridge Entry Dome water levels

Past monitoring of the site indicated some soil subsidence as seen in exposed roots and numerous fallen trees, however the majority of the subsidence was thought to have occurred between 1981-1985. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 35.6 feet NGVD29, and a proposed MFL of 33.8 feet NGVD29. The currently adopted MFL at this site is 33.7 feet NGVD29.

The Morris Bridge Entry Dome wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.1 feet below the HNP (see Appendix B). Figure 61 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.7 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Morris Bridge Entry Dome wetland is recommended to be kept as an adopted MFL site, with an MFL of 33.8 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

Morris Bridge X-4 (MBR-89) (Wetland ID 274)

Morris Bridge X-4 (MBR-89) is located in the northwest corner of the Morris Bridge wellfield (Figure 59). This wetland is an isolated cypress wetland approximately 7 acres in size (Figure 62).

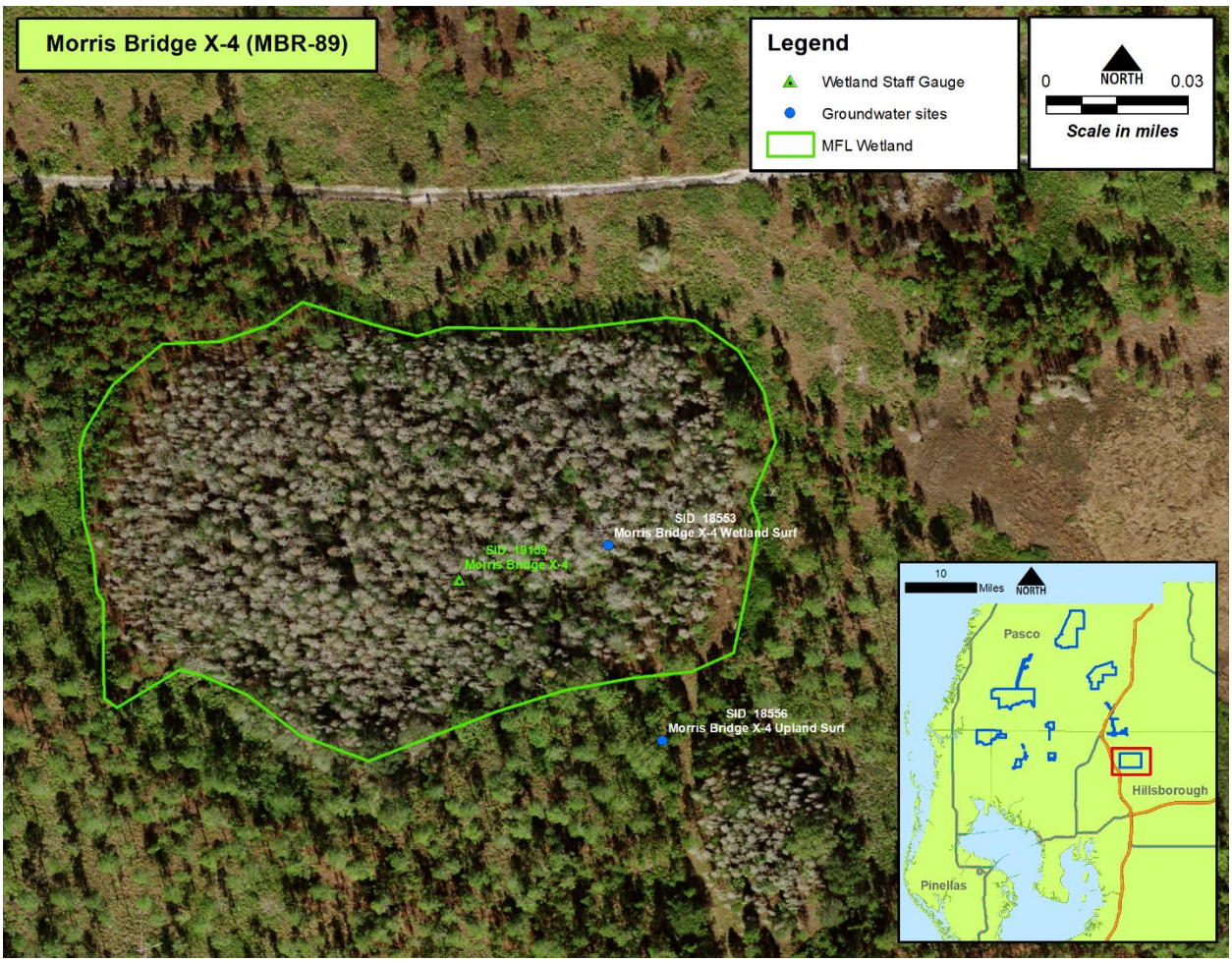

Figure 62: Morris Bridge X-4 wetland

The District has had a staff gage (SID 19159) at this site since 1985. The District installed an upland well (SID 18556) in 2000, and a wetland well (SID 18553) in 2001 (Figure 62, Figure 63). The District continues to monitor this site at the time of this report on a twice monthly basis. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

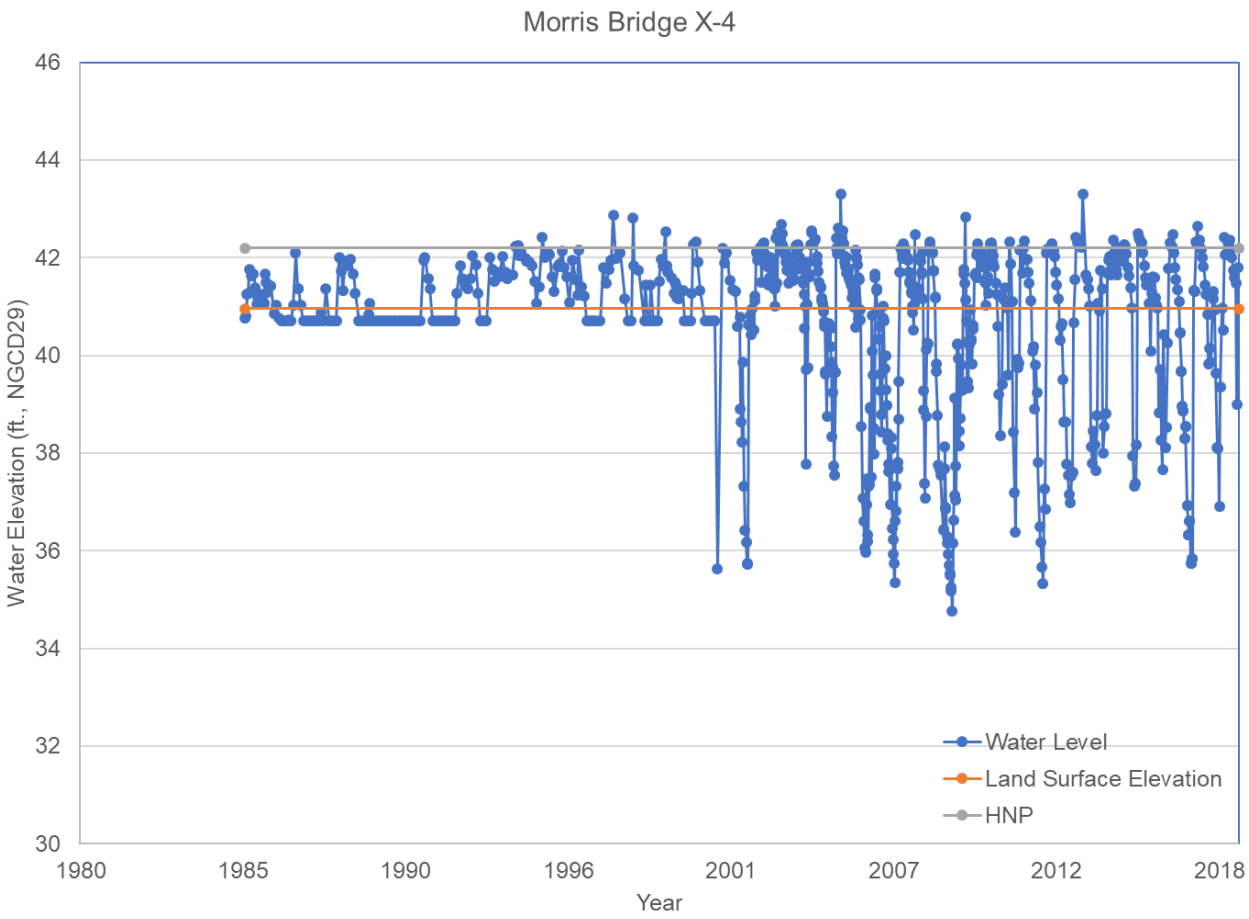

Figure 63: Morris Bridge X-4 water levels

Qualitative vegetation monitoring and review of site photographs had indicated that the cypress canopy of the Morris Bridge X-4 wetland was "considerably stressed" in the mid-1980's when the staff gage was installed. There has also been some subsidence observed in the wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 42.2 feet NGVD29, and a proposed MFL of 40.4 feet NGVD29. The currently adopted MFL at this site is 40.6 feet NGVD29.

The Morris Bridge X-4 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.3 feet below the HNP (see Appendix B). Figure 63 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.9 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Morris Bridge X-4 wetland is recommended to be kept as an adopted MFL site, with an MFL of 40.4 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

Morris Bridge Clay Gully Cypress (MBR-88) (Wetland ID 273)

Morris Bridge Clay Gully Cypress (MBR-88) is located in the northwest corner of the Morris Bridge wellfield, approximately 0.4 miles west of Morris Bridge X-4 (Figure 59). This wetland is an isolated cypress wetland approximately 3.7 acres in size (Figure 64).

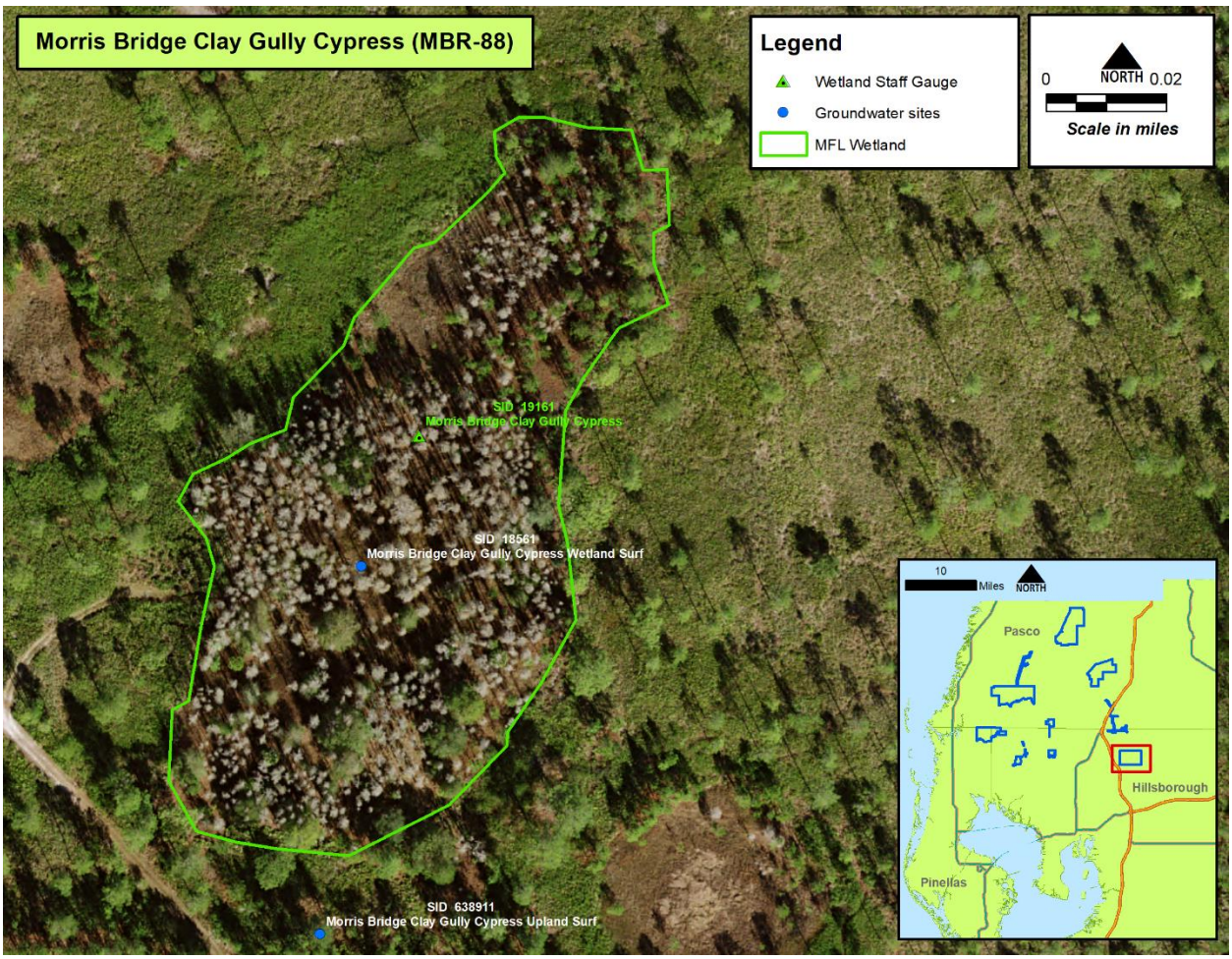

Figure 64: Clay Gully Cypress wetland

The District has had a staff gage at this site since 1977. The original staff gage (SID 785223) was replaced by a new gage (SID 19161) in 2002. TBW has had an upland and wetland well at the site since 1989. The District installed a wetland well (SID 18561) in 2001, and an upland well (SID 638911) in 2010 (Figure 64, Figure 65). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

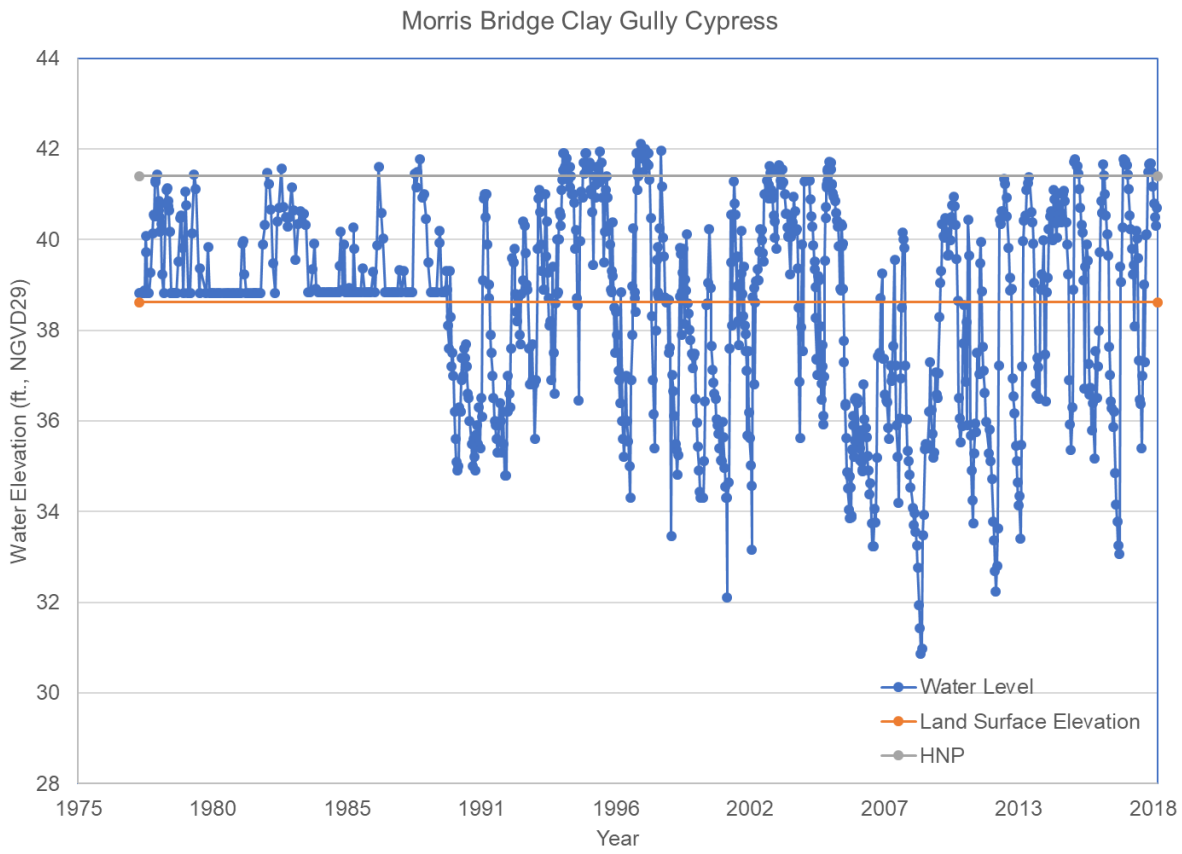

Figure 65: Morris Bridge Clay Gully Cypress water levels

The Morris Bridge Clay Gully Cypress wetland was originally used to monitor tree growth and survival and surface water levels. Additional vegetation monitoring began in the late 1990's. It was noted that vegetation suggested water levels and hydroperiods had likely been shorter than historically, however there was still little change in the vegetation composition since 1977. Additionally, little subsidence had been noted in the portion of the wetland that was monitored. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 41.4 feet NGVD29, and a proposed MFL of 39.6 feet NGVD29. The currently adopted MFL at this site is 39.8 feet NGVD29.

The Morris Bridge Clay Gully Cypress wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.2 feet above the HNP (see Appendix). Figure 65 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.8 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Morris Bridge Clay Gully Cypress wetland is recommended to be kept as an adopted MFL site, with an MFL of 39.6 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

Morris Bridge Unnamed (MBR-16) (Wetland ID 261)

Morris Bridge Unnamed (MBR-16) is located in the southwest corner of the Morris Bridge wellfield (Figure 59). This wetland is an isolated cypress wetland approximately 8.7 acres in size (Figure 66).

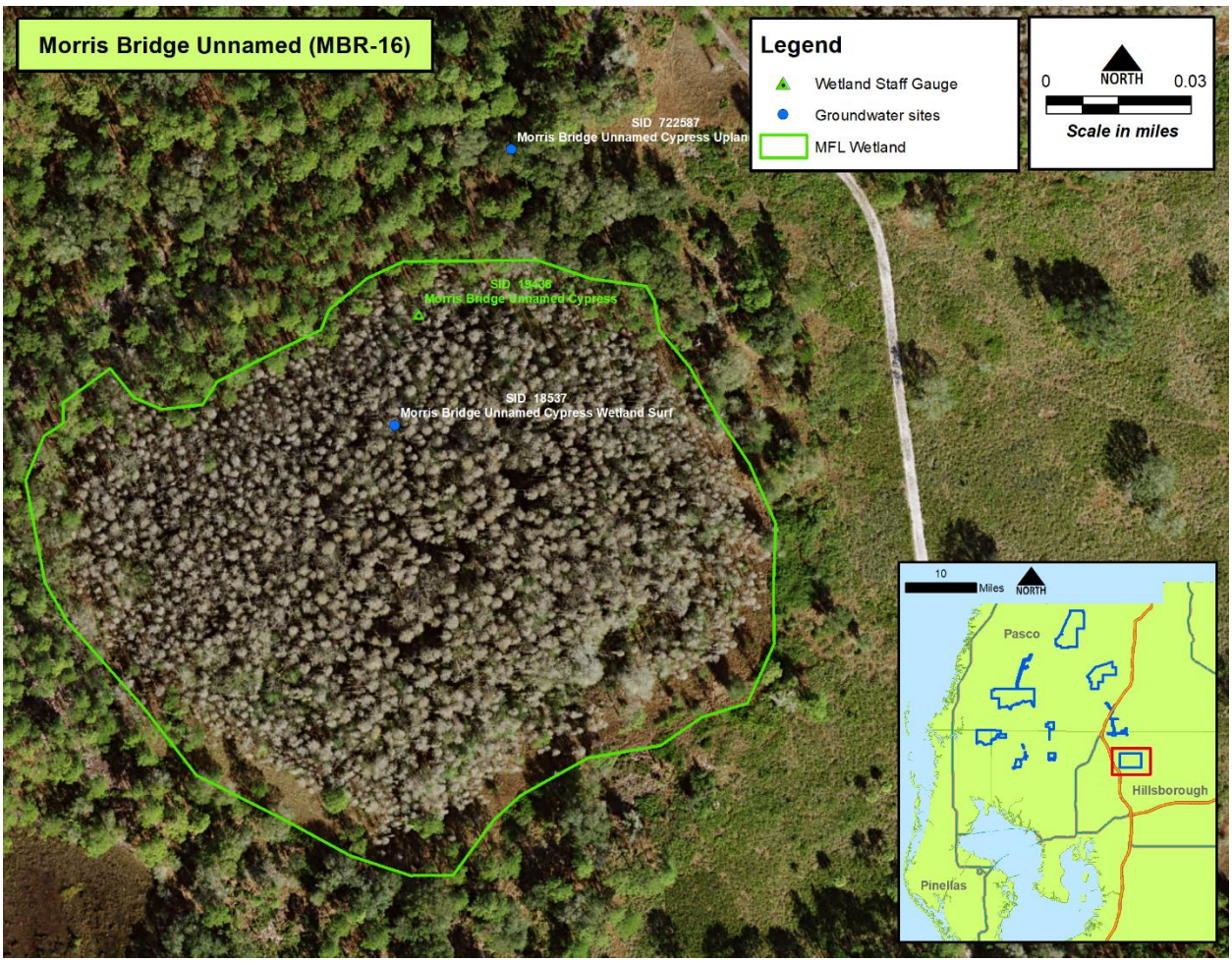

Figure 66: Morris Bridge Unnamed wetland

Monitoring began at Morris Bridge Unnamed (MBR-16) in 2002 using an upland surficial well (SID 18536) by TBW. In 2005, the well was plugged, but a District staff gage (SID 19438) was installed. In 2010 the District took over monitoring of a wetland (SID 18537) and upland (SID 722587) surficial well from TBW (Figure 66, Figure 67). The District continues to monitor this site on a twice monthly basis at the time of this report. A WAP transect was also established in 2005. The District has been exclusively collecting water level data from this site since 2010.

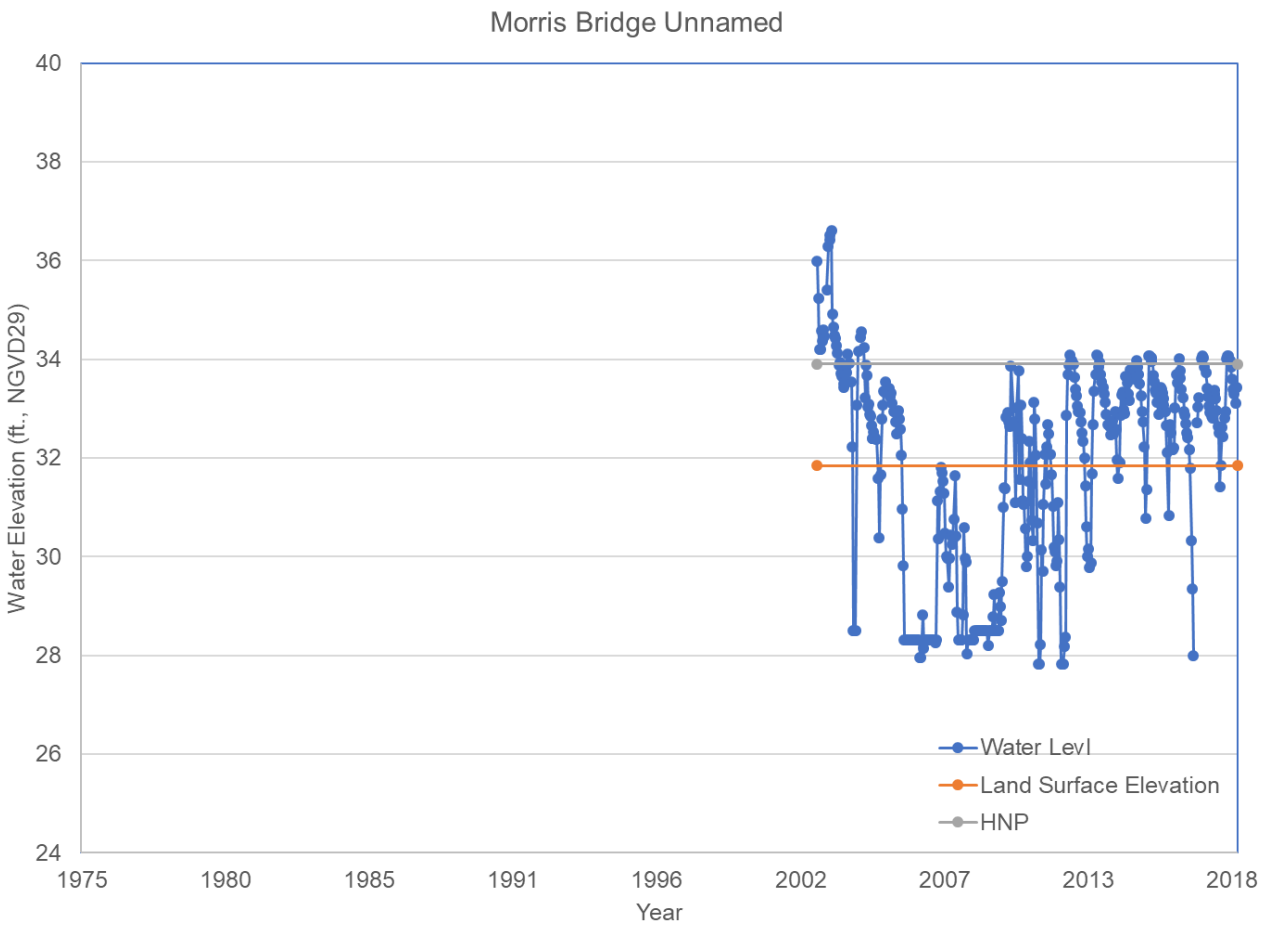

Figure 67: Morris Bridge Unnamed water levels

There is relatively little qualitative history on the Morris Bridge Unnamed wetland compared to other sites. However, little subsidence had been noted in the wetland, and it is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 33.9 feet NGVD29, and a proposed MFL of 32.1 feet NGVD29. The currently adopted MFL at this site is 32.2 feet NGVD29.

The Morris Bridge Unnamed wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at the same elevation as the HNP (see Appendix). Figure 67 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.9 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Morris Bridge Unnamed wetland is recommended to be kept as an adopted MFL site, with an MFL of 32.1 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

North Pasco

The North Pasco wellfield is located in west Pasco County, immediately north of the Starkey Wellfield (Figure 2). North Pasco was the last wellfield to begin production, commencing in 1992. Production had always been relatively low at the North Pasco wellfield (a maximum of approximately 5 mgd at its height), but in 2007 there was a significant reduction in withdrawals to typically less than 1 mgd. Both production wells at North Pasco wellfield were abandoned and pumping permanently stopped in July 2017. There are 2 wetlands within the North Pasco wellfield that have established minimum levels associated with them (Figure 68).

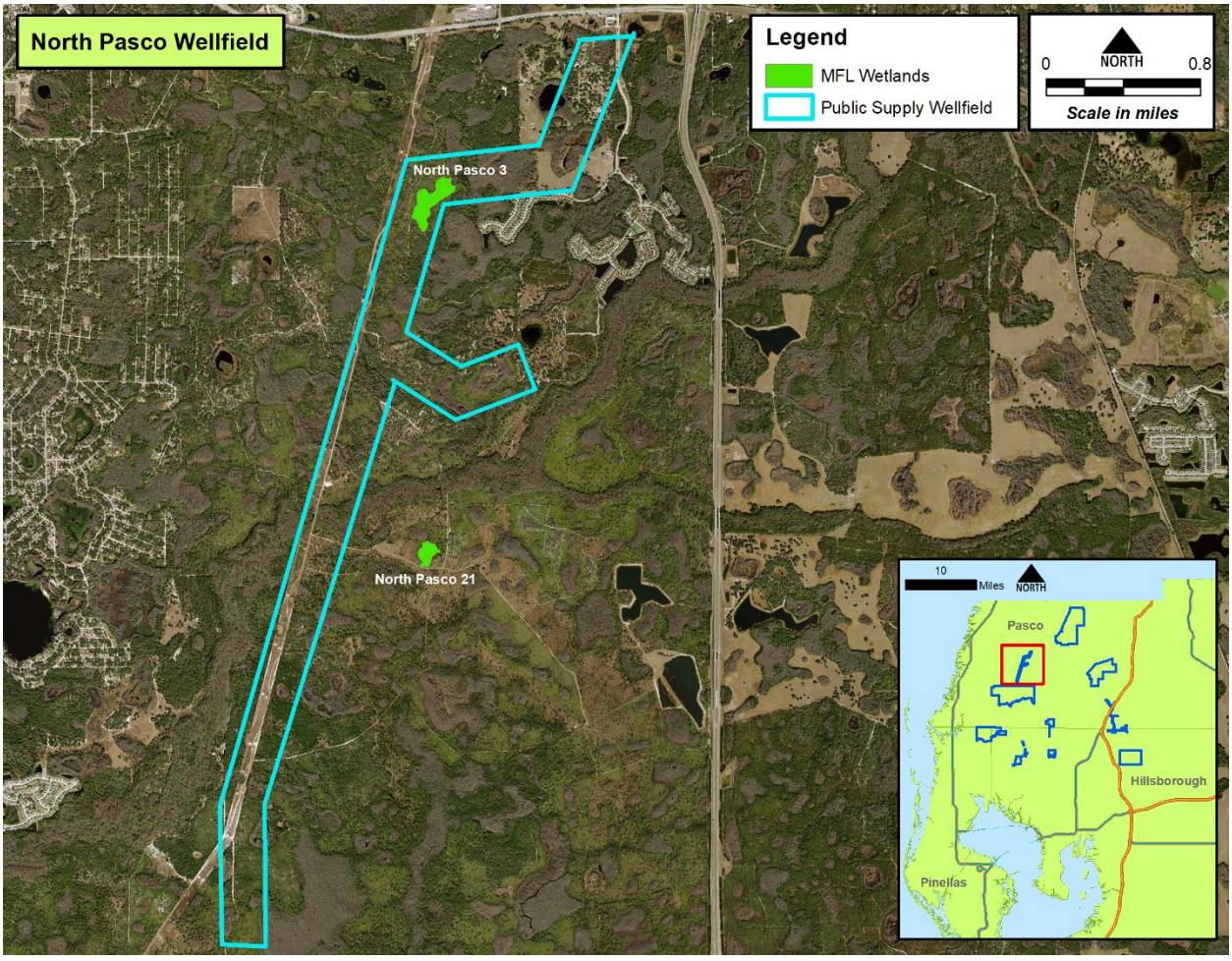

Figure 68: North Pasco Wellfield with established minimum level wetlands

North Pasco 3 (Wetland ID 338)

North Pasco 3 is located near the north end of the North Pasco wellfield (Figure 68). It is an isolated cypress dome that is approximately 16.7 acres in size (Figure 69).

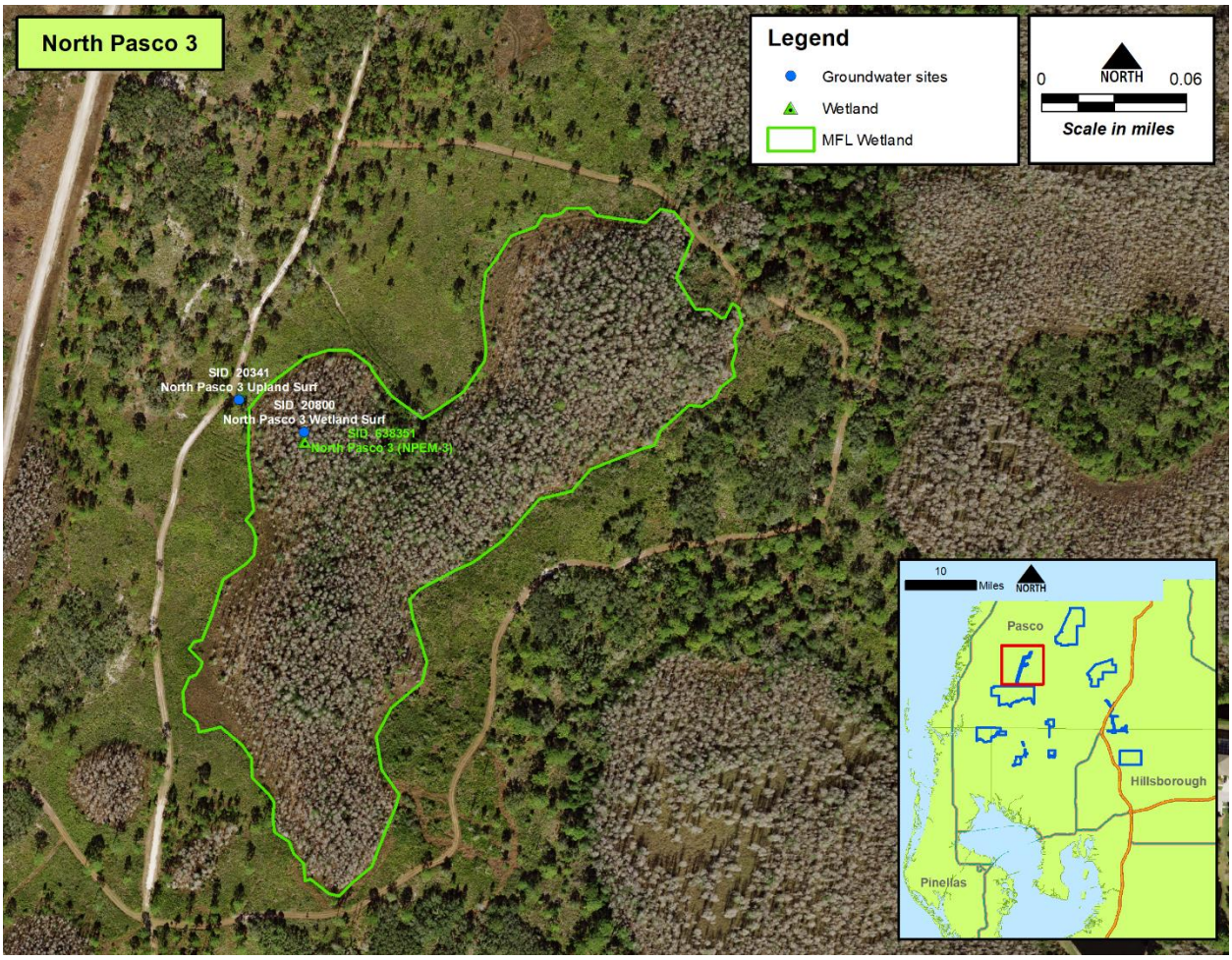

Figure 69: North Pasco 3 wetland

TBW has installed a staff gage and wetland well at this site in 1989. The District installed a wetland (SID 20800) and upland (SID 20341) well in 2001. The District took over monitoring of the site, including a staff gage (SID 638351) in 2010 (Figure 69, Figure 70). A WAP transect was also established in 2005. The District has been exclusively collecting water level data from this site since 2010.

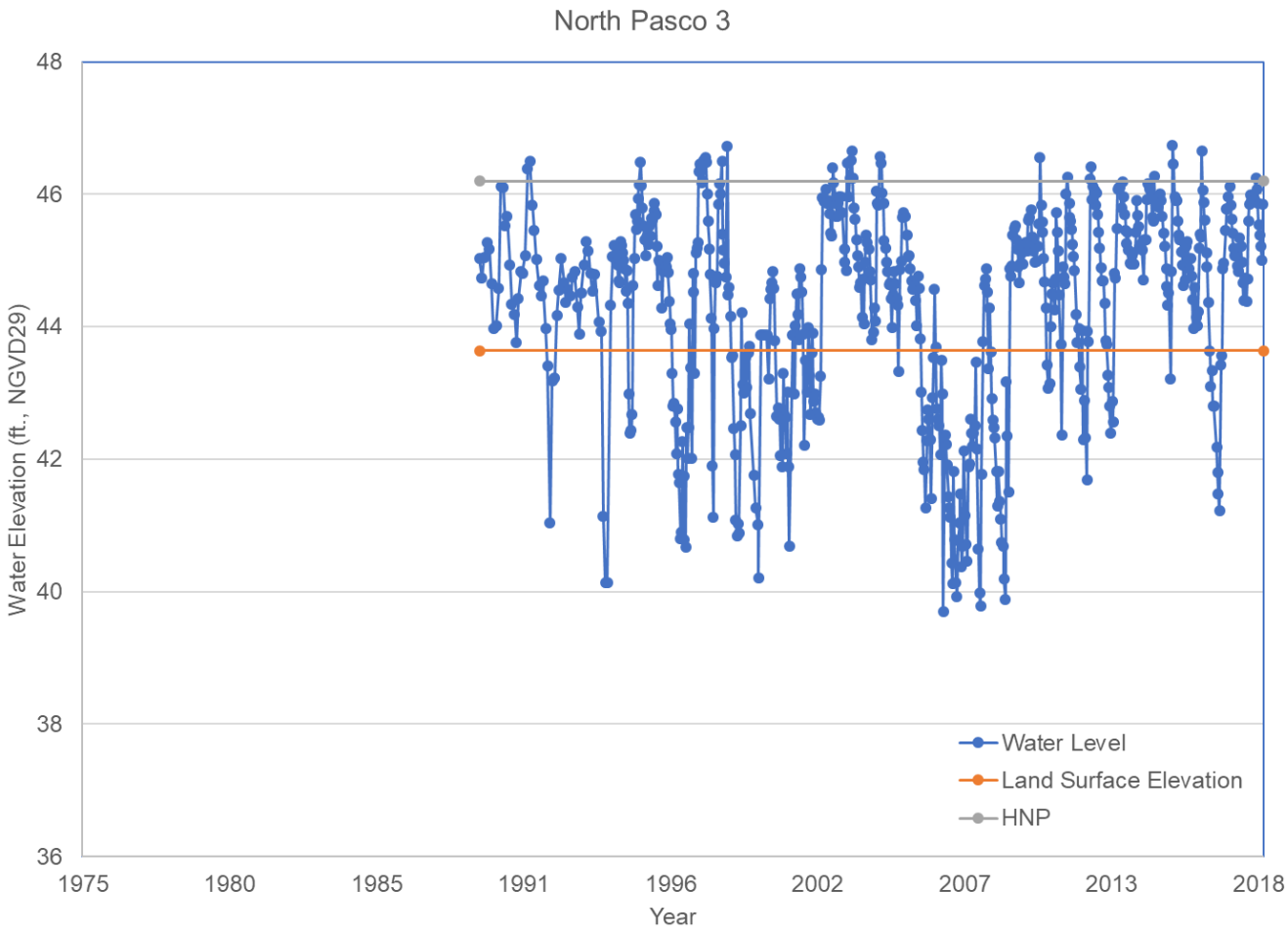

Figure 70: North Pasco 3 water levels

The North Pasco 3 wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using the elevation of the base of Lyonia roots on cypress trees at 46.2 feet NGVD29, and a proposed MFL of 44.4 feet NGVD29. The currently adopted MFL at this site is 44.4 feet NGVD29, so there is no change recommended for this site.

The North Pasco 3 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.5 feet below the HNP (see Appendix B). Figure 70 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.6 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The North Pasco 3 wetland is recommended to be kept as an adopted MFL site, with an MFL of 44.4 feet NGVD29.

North Pasco 21 (Wetland ID 352)

North Pasco 21 is located on the east side of the center of the North Pasco wellfield (Figure 68). It is a mostly isolated cypress dome approximately 6 acres in size (Figure 71).

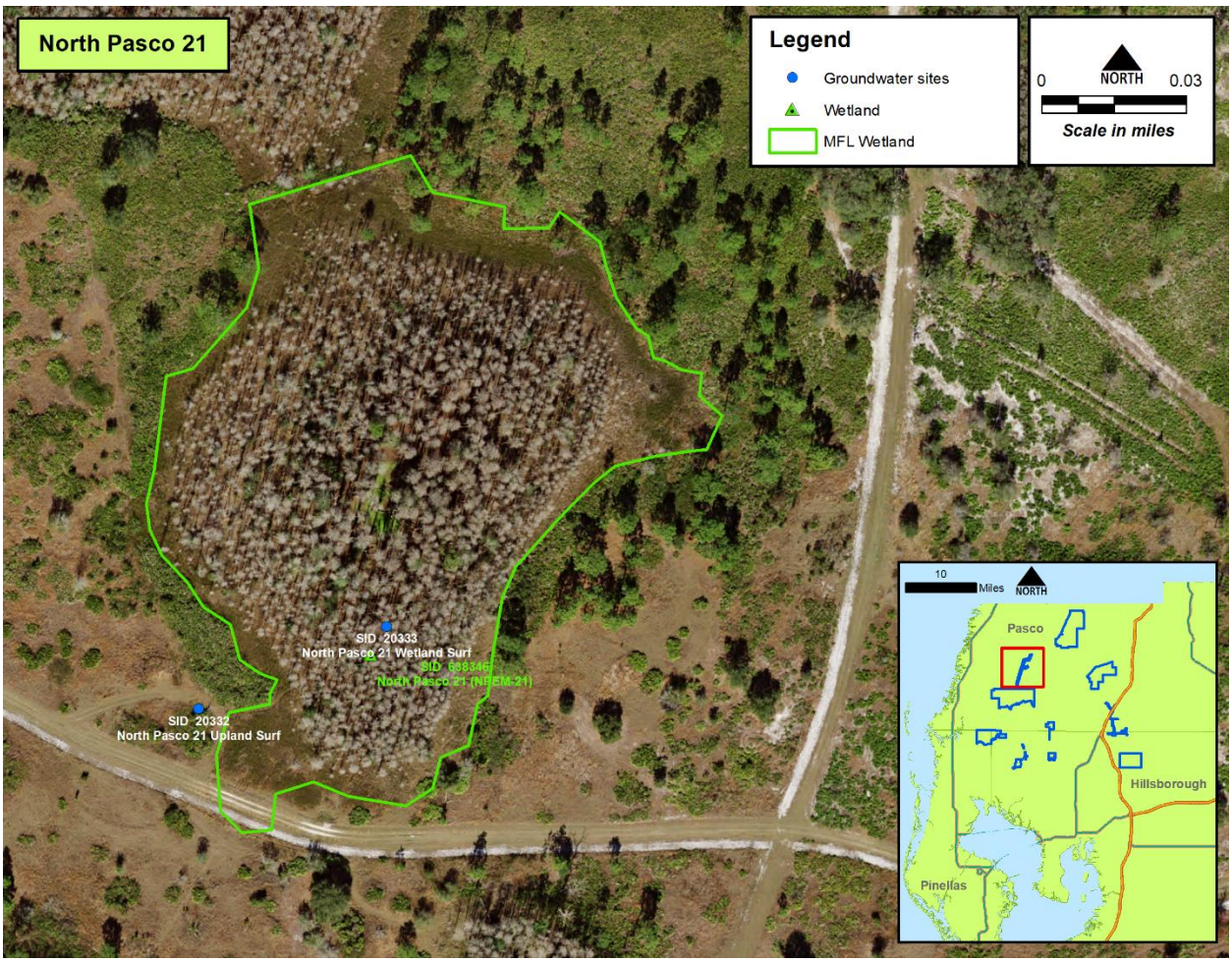

Figure 71: North Pasco 21 wetland

TBW has installed a staff gage and wetland well at this site in 1989. The District installed a wetland (SID 20333) and upland (SID 20332) well in 2001. The District took over monitoring of the site, including a staff gage (SID 638346) in 2010 (Figure 71, Figure 72). A WAP transect was also established in 2005. The District has been exclusively collecting water level data from this site since 2010.

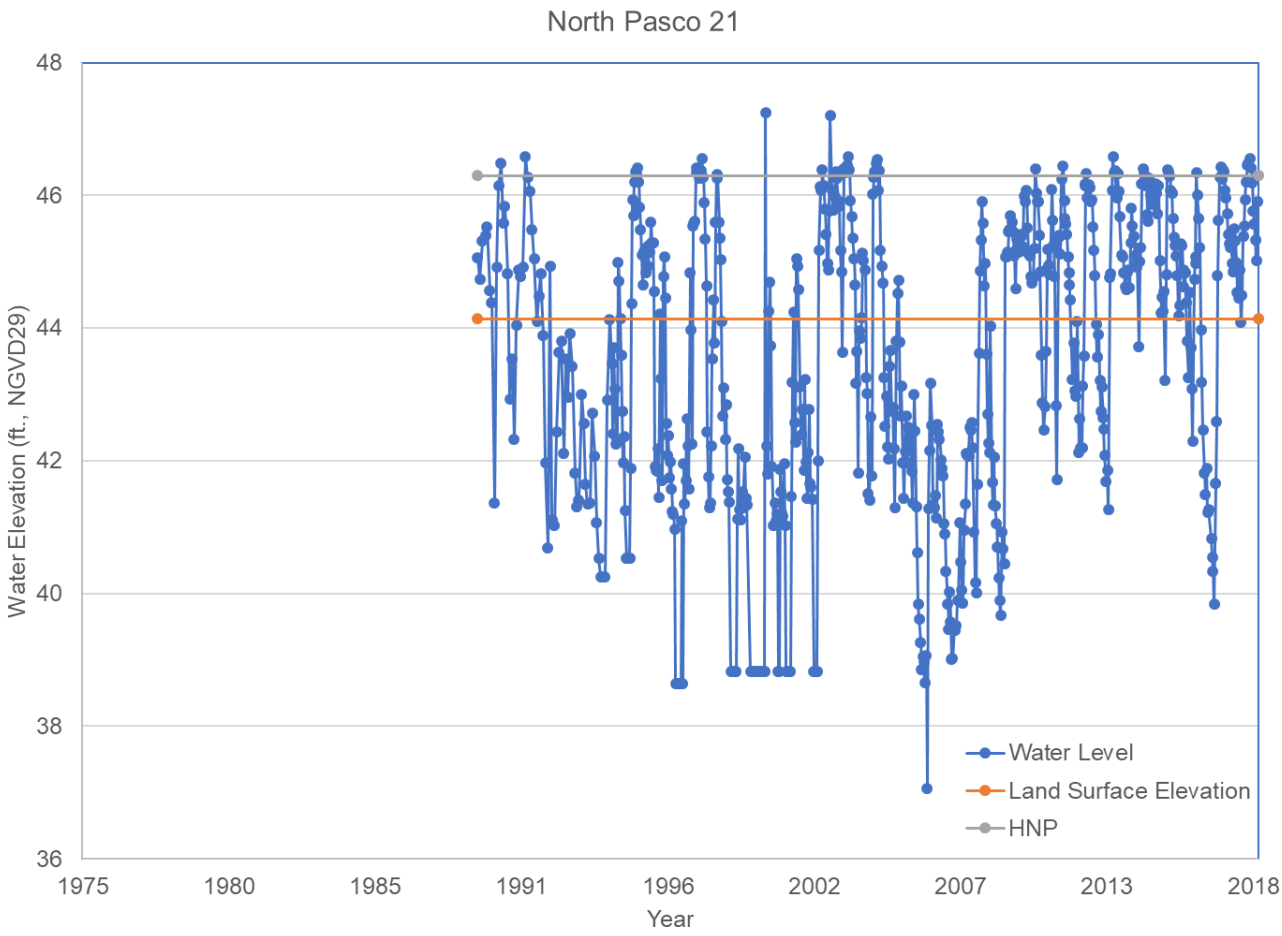

Figure 72: North Pasco 21 water levels

The North Pasco 21 wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using the elevation of the base of Lyonia roots, as well as cypress inflection points, at 46.3 feet NGVD29, and a proposed MFL of 44.5 feet NGVD29. The currently adopted MFL at this site is 44.5 feet NGVD29, so there is no change recommended for this site.

The North Pasco 21 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.1 feet above the HNP (see Appendix B). Figure 72 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.8 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The North Pasco 21 wetland is recommended to be kept as an adopted MFL site, with an MFL of 44.5 feet NGVD29.

Section 21

The Section 21 wellfield is located in Hillsborough County (Figure 2). This wellfield began production in 1963. Production at Section 21 was highest (up to 20mgd) until the early 70's, and then decreased to approximately 5-10 mgd following that. Further cutbacks occurred in 2004. There is only one wetland within the Section 21 wellfield that has an established minimum level associated with it (Figure 73).

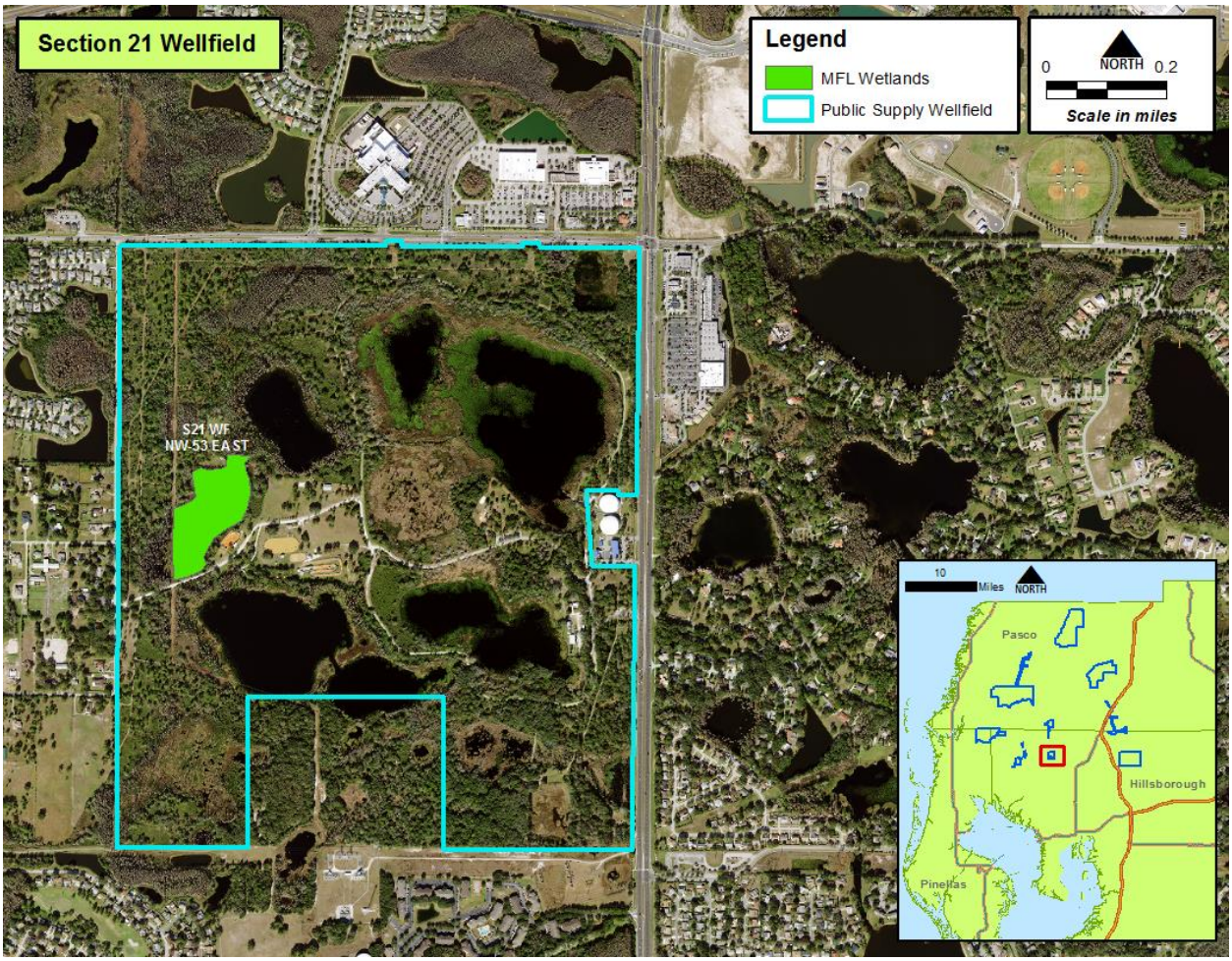

Figure 73: Section 21 Wellfield with established minimum level wetland

Section 21 Wetland (S21 WF NW 53 East) (Wetland ID 385)

The wetland with an established minimum level in the Section 21 wellfield is known as S21 WF NW-53 East. It is an isolated cypress dome, with a trail that cut off the southwest portion of it, located on the west side of the wellfield (Figure 73). The wetland is approximately 9.8 acres in size (Figure 74).

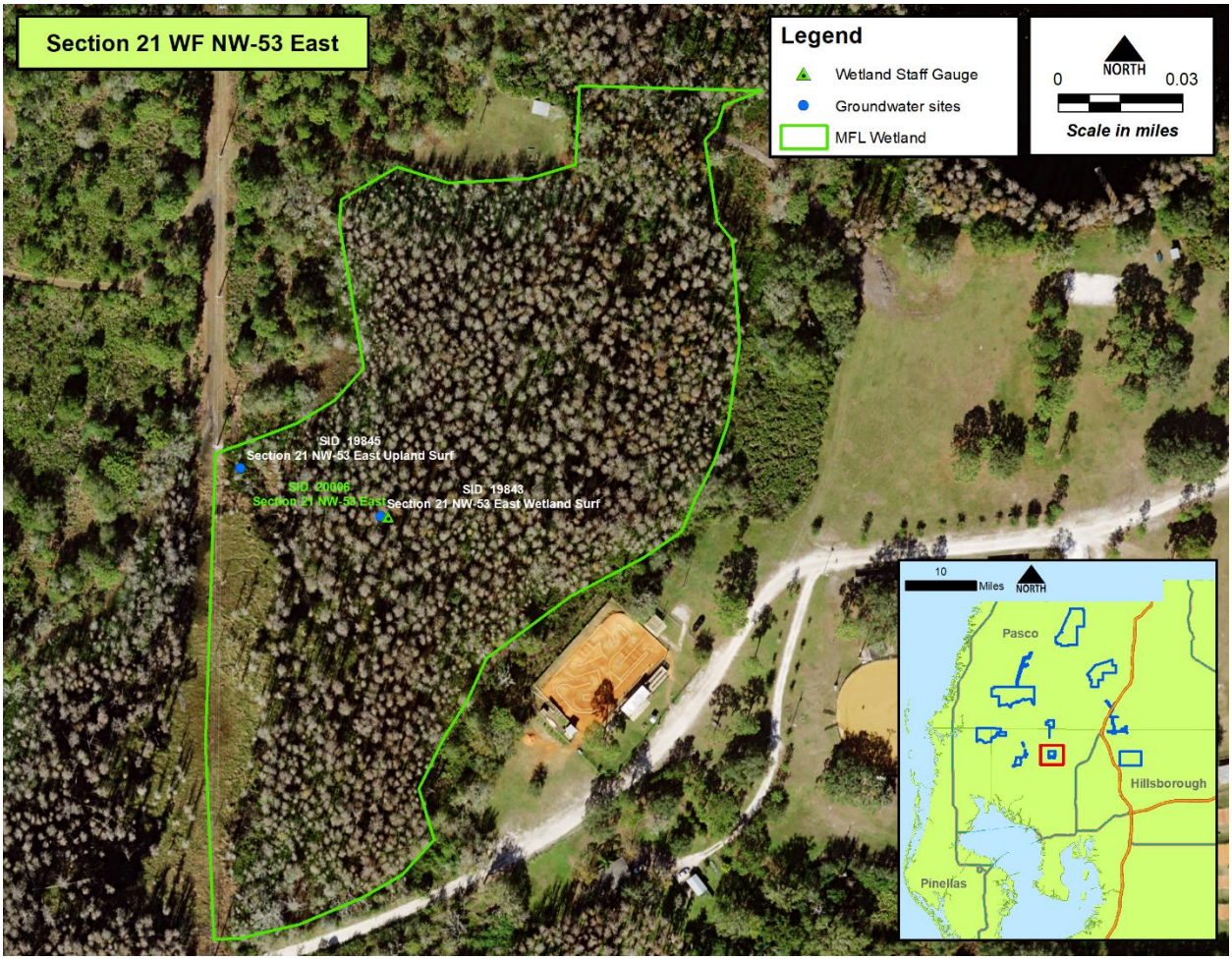

Figure 74: Section 21 WF NW-53 wetland

TBW had a wetland well at this site since 1999. The District installed a wetland (SID 49843) and upland (SID 19845) well in 2001, and a staff gage (SID 20006) in 2002 (Figure 74, Figure 75). The District continues to monitor this site on a twice monthly basis at the time of this report. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

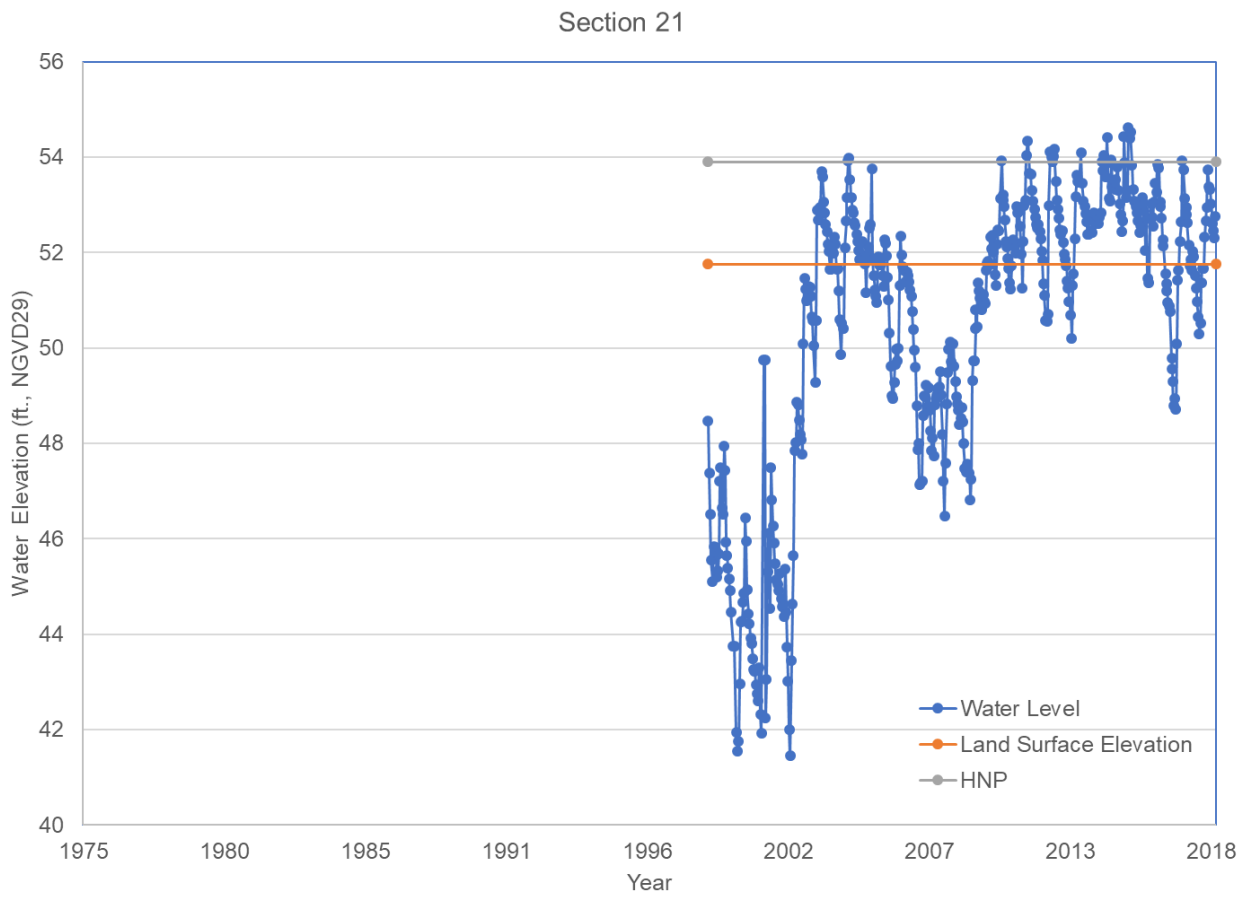

Figure 75: Section 21 WF NW-53 water levels

Observations of the wellfield have shown significant soil subsidence, and the entire center of the wetland appears to have subsided. It is thought that the wetland experienced many years of lower than normal water levels, and has undergone significant changes as a result. While the wetland is surrounded by mostly soils classified as mesic, a reliable HNP cannot be established due to the aforementioned reasons.

Conclusion and Recommendation:

Because Section 21 WF NW-53 wetland does not have an accurate, reliable HNP that can be established due to severe subsidence, it is recommended that this wetland not be used as an MFL. While there are no additional monitored isolated cypress wetlands within the wellfield that would make a desirable replacement for Section 21 WF NW-53 wetland, there are many lake minimum levels in the immediate area which are believed to provide the same protective purpose as a wetland minimum level would (Figure 76).

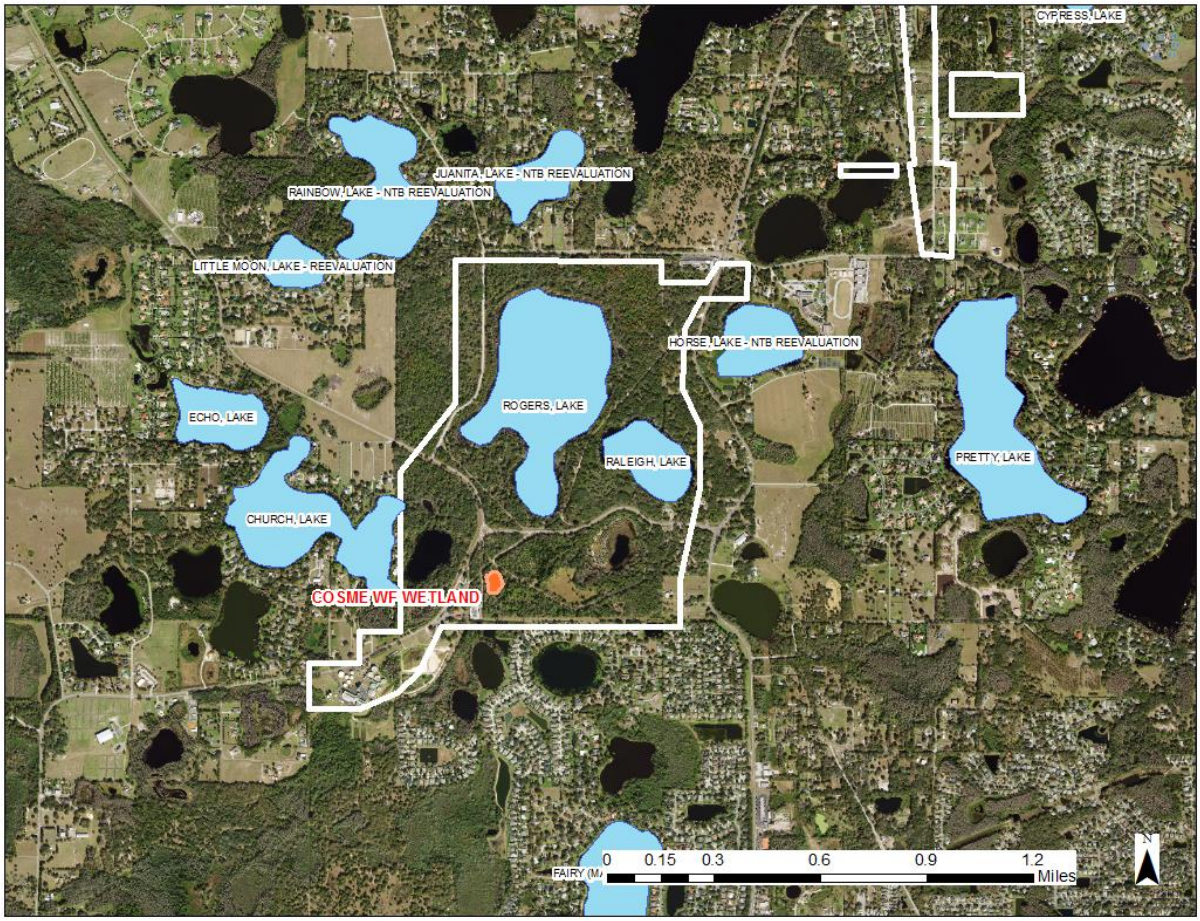

Figure 76: Section 21 WF NW-53 Wetland and surrounding lakes with established minimum levels

South Pasco

The South Pasco wellfield is located in south-central Pasco County, on the Pasco/Hillsborough county line (Figure 2). Wellfield production in the South Pasco wellfield began in 1973, and quickly rose to approximately 14-17 mgd. Groundwater production became a little more variable in the 1980s and 1990s, ranging from 10 to 15 mgd, but then was reduced to approximately 3-8 mgd beginning around 2003. There are 3 wetlands with established minimum levels at the South Pasco wellfield (Figure 77).

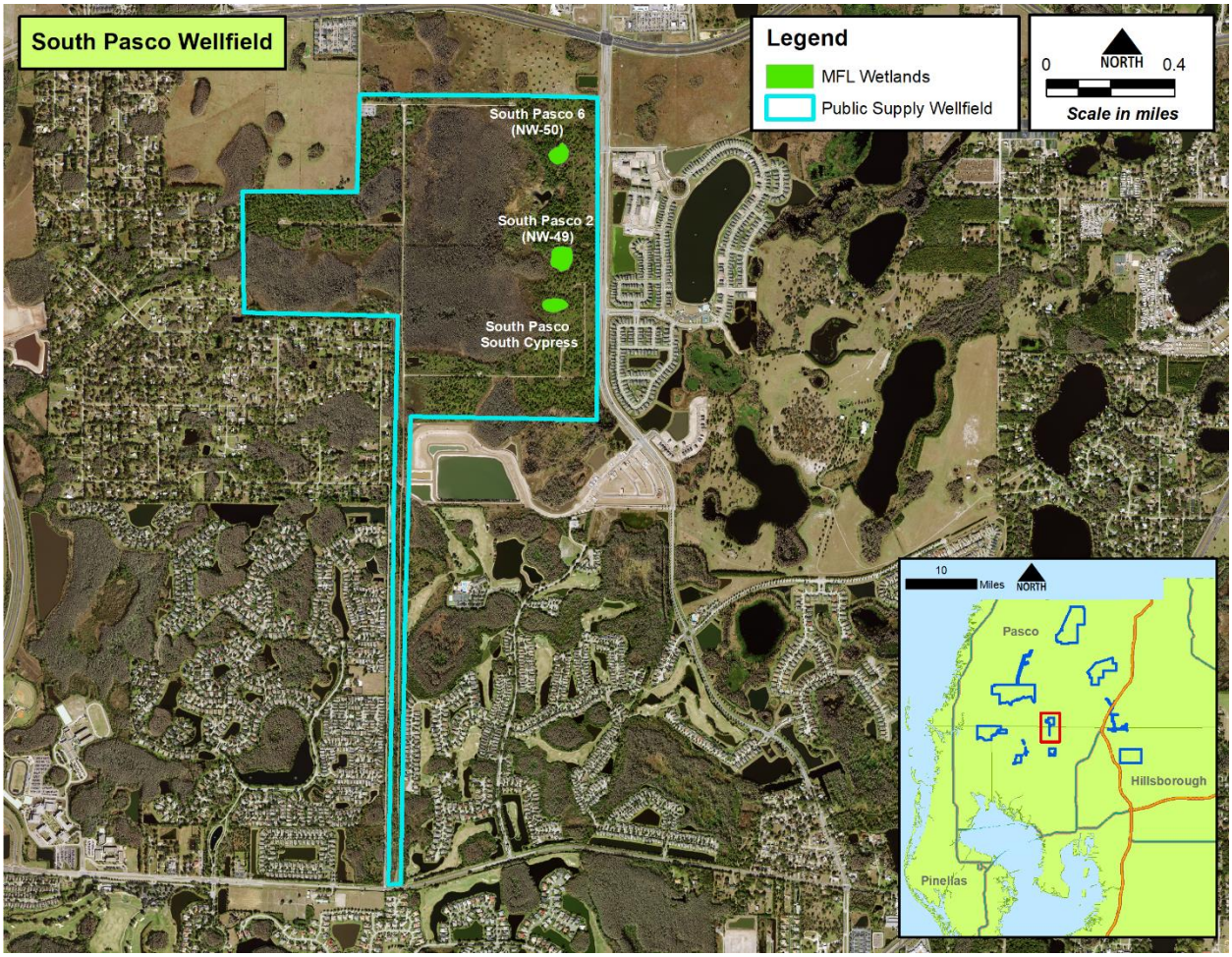

Figure 77: South Pasco Wellfield with established minimum level wetlands

South Pasco 2 (NW-49) (Wetland ID 405)

South Pasco 2 is located along the east-central property boundary of the wellfield. South Pasco 2 is an isolated cypress wetland, and is approximately 2.8 acres in size (Figure 78).

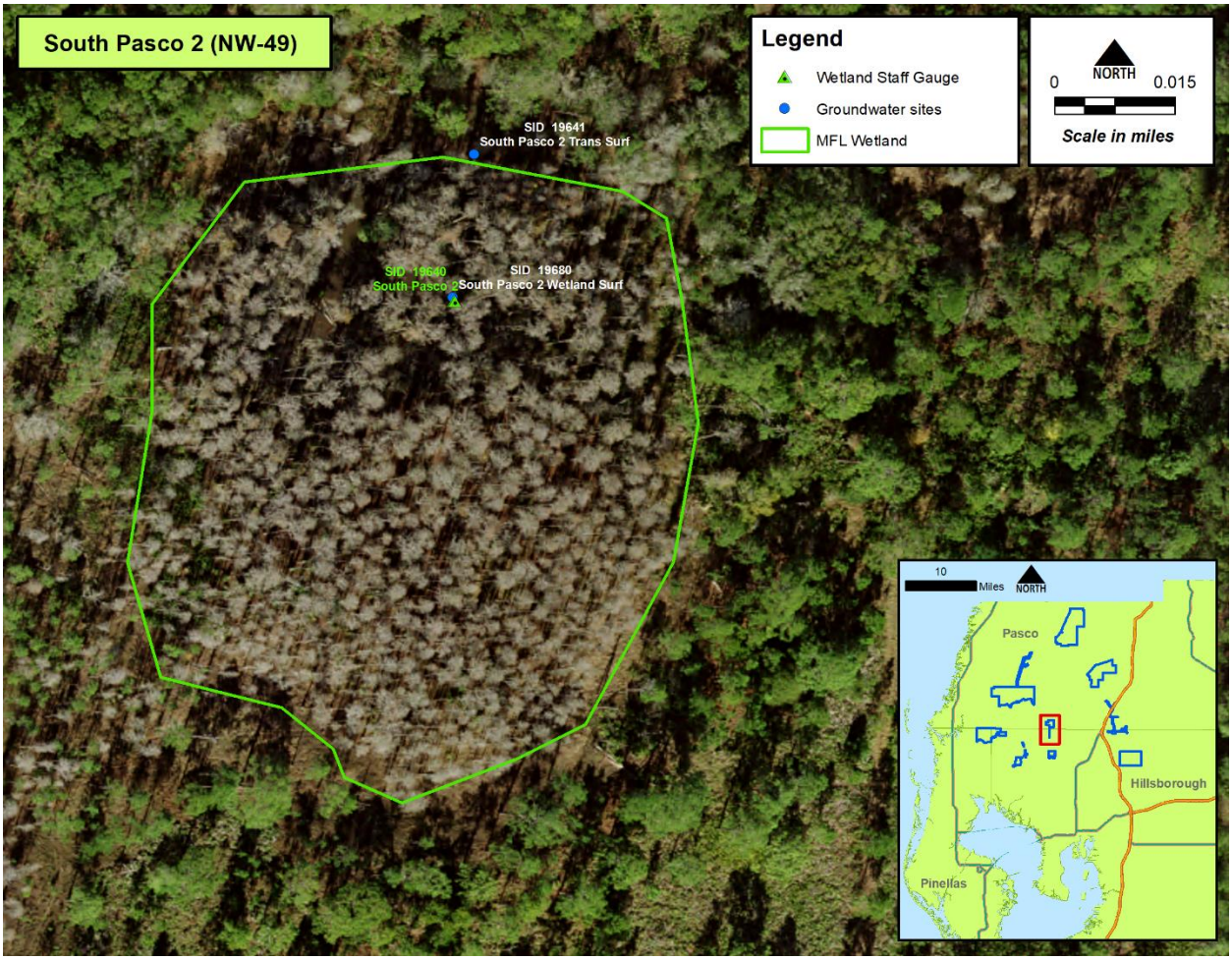

Figure 78: South Pasco 2 wetland

The District installed a staff gage (SID 19640) at this site in 1989. When the wetland was adopted as an MFL site, the District installed a wetland well (SID 19680) in 1999, and an upland well (SID 19641) in 2002 (Figure 78, Figure 79). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

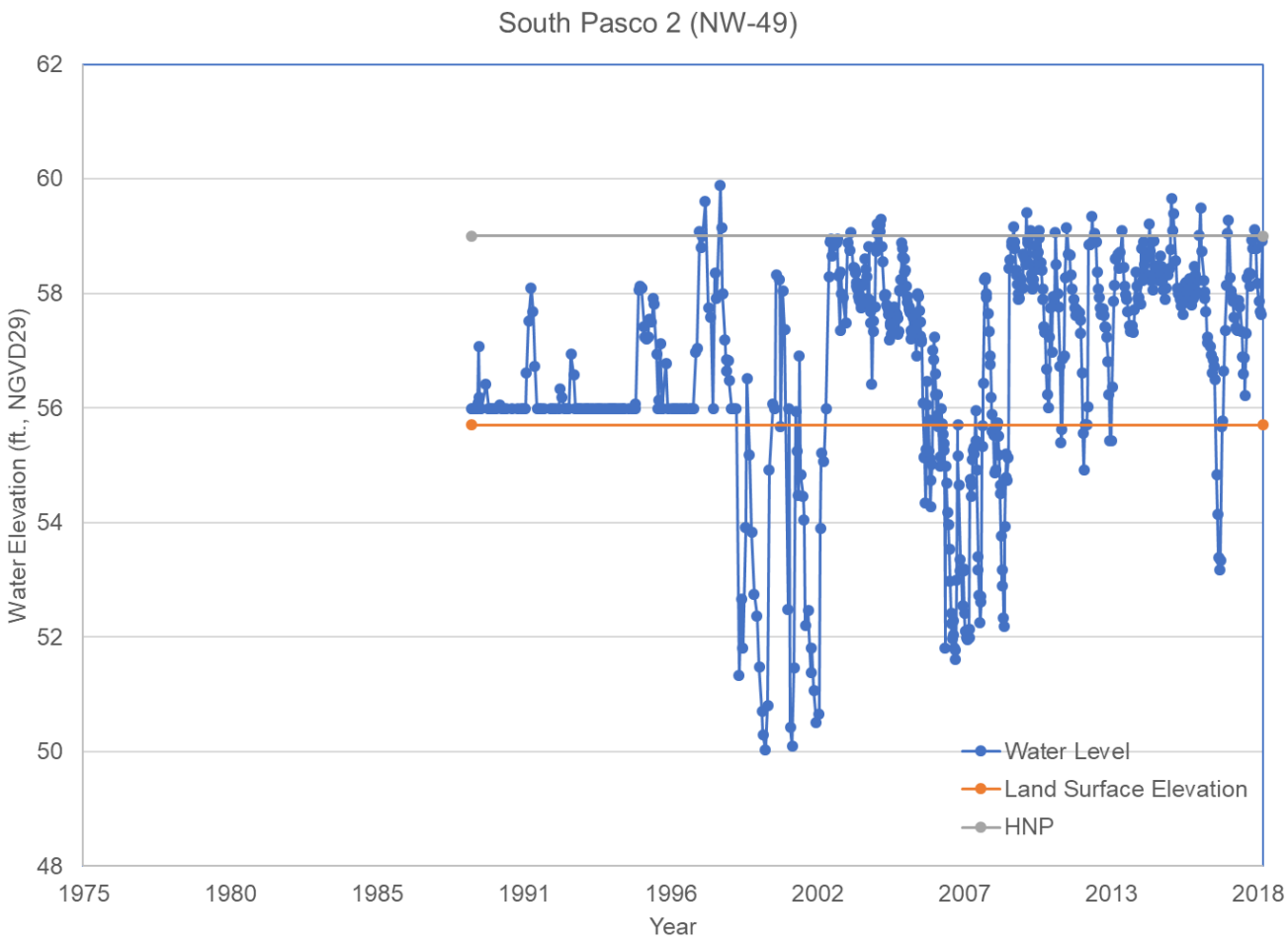

Figure 79: South Pasco 2 wetland water levels

Significant subsidence and tree fall have been noted at the South Pasco 2 wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points near the wetland edge (to avoid potential subsidence) at 59.0 feet NGVD29, and a proposed MFL of 57.2 feet NGVD29. The currently adopted MFL at this site is 57.4 feet NGVD29.

The South Pasco 2 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.6 feet below the HNP (see Appendix B). Figure 79 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.6 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The South Pasco 2 wetland is recommended to be kept as an adopted MFL site, with an MFL of 57.2 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

South Pasco South Cypress (Wetland ID 402)

The South Pasco South Cypress wetland is located along the east-central property boundary of the wellfield, and is the southernmost of the three MFL wetlands at the South Pasco wellfield (Figure 77). South Cypress is an isolated cypress wetland, and is approximately 1.8 acres in size (Figure 80).

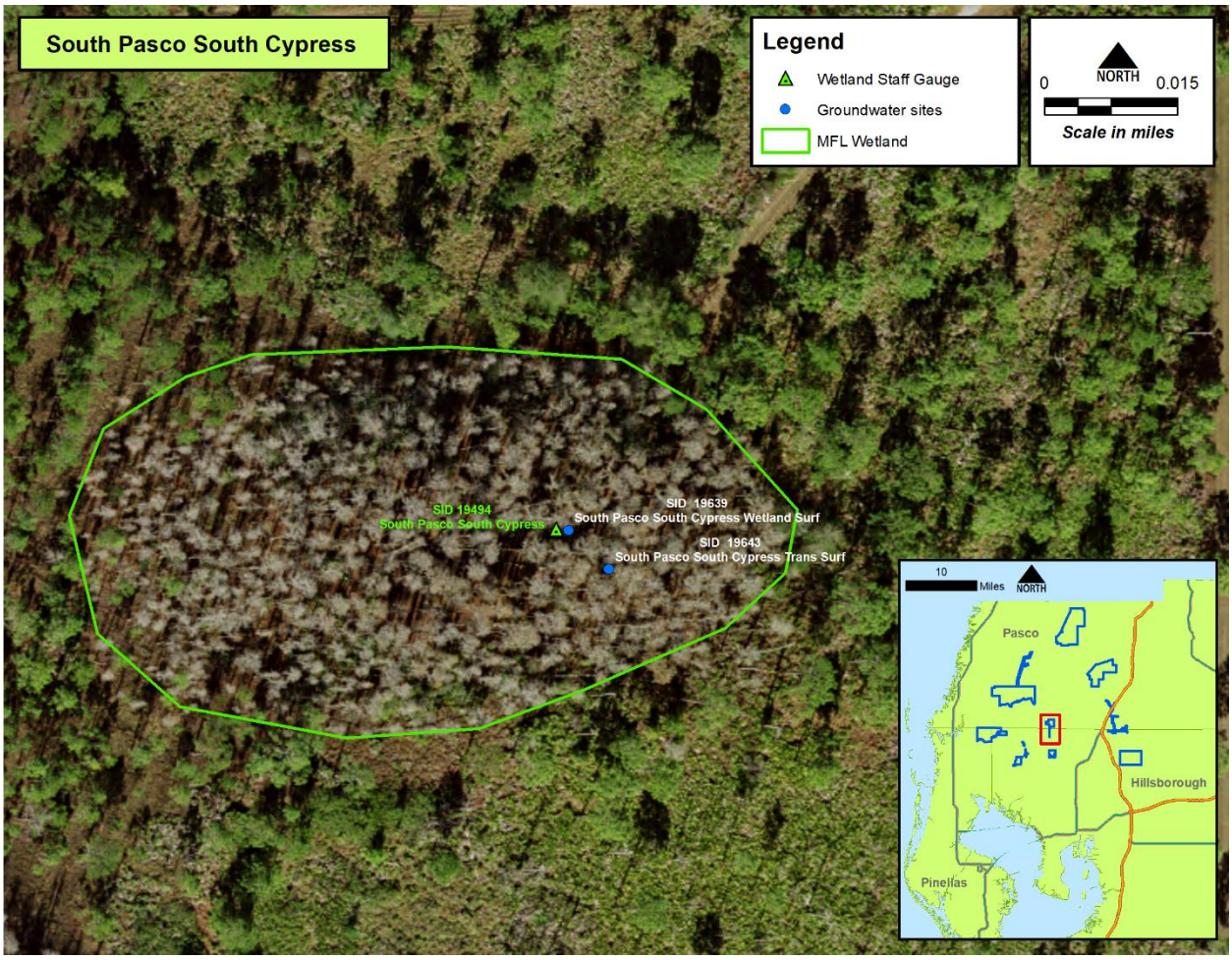

Figure 80: South Cypress wetland

When the wetland was adopted as an MFL site, the District installed a wetland well (SID 19639) in 2001, and an upland well (SID 19643) and staff gage (SID 19434) in 2002 (Figure 80, Figure 81). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

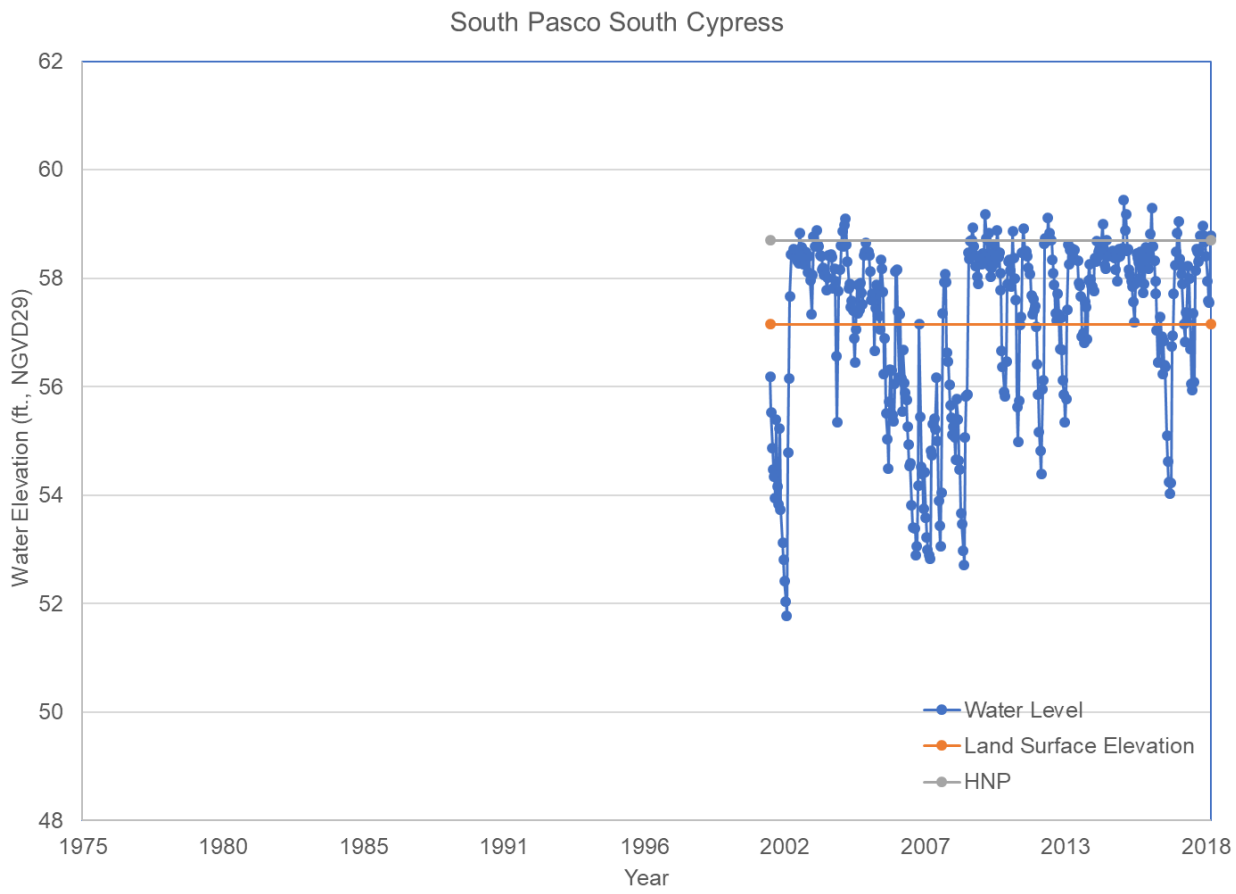

Figure 81: South Pasco South Cypress water levels

The South Cypress wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection at 58.7 feet NGVD29, and a proposed MFL of 56.9 feet NGVD29. The currently adopted MFL at this site is 57.5 feet NGVD29.

The South Pasco South Cypress wetland has a very natural-looking but small outlet, described as a “natural saddle,” and surveyed at the HNP (see Appendix B). Figure 81 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 1.1 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The South Pasco South Cypress wetland is recommended to be kept as an adopted MFL site, with an MFL of 56.9 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

South Pasco 6 (NW-50) (Wetland ID 403)

South Pasco 6 is located along the east-central property boundary of the wellfield, and is the northernmost of the three MFL wetlands at the South Pasco wellfield (Figure 77). South Pasco 6 is an isolated cypress wetland, and is approximately 1.9 acres in size (Figure 82).

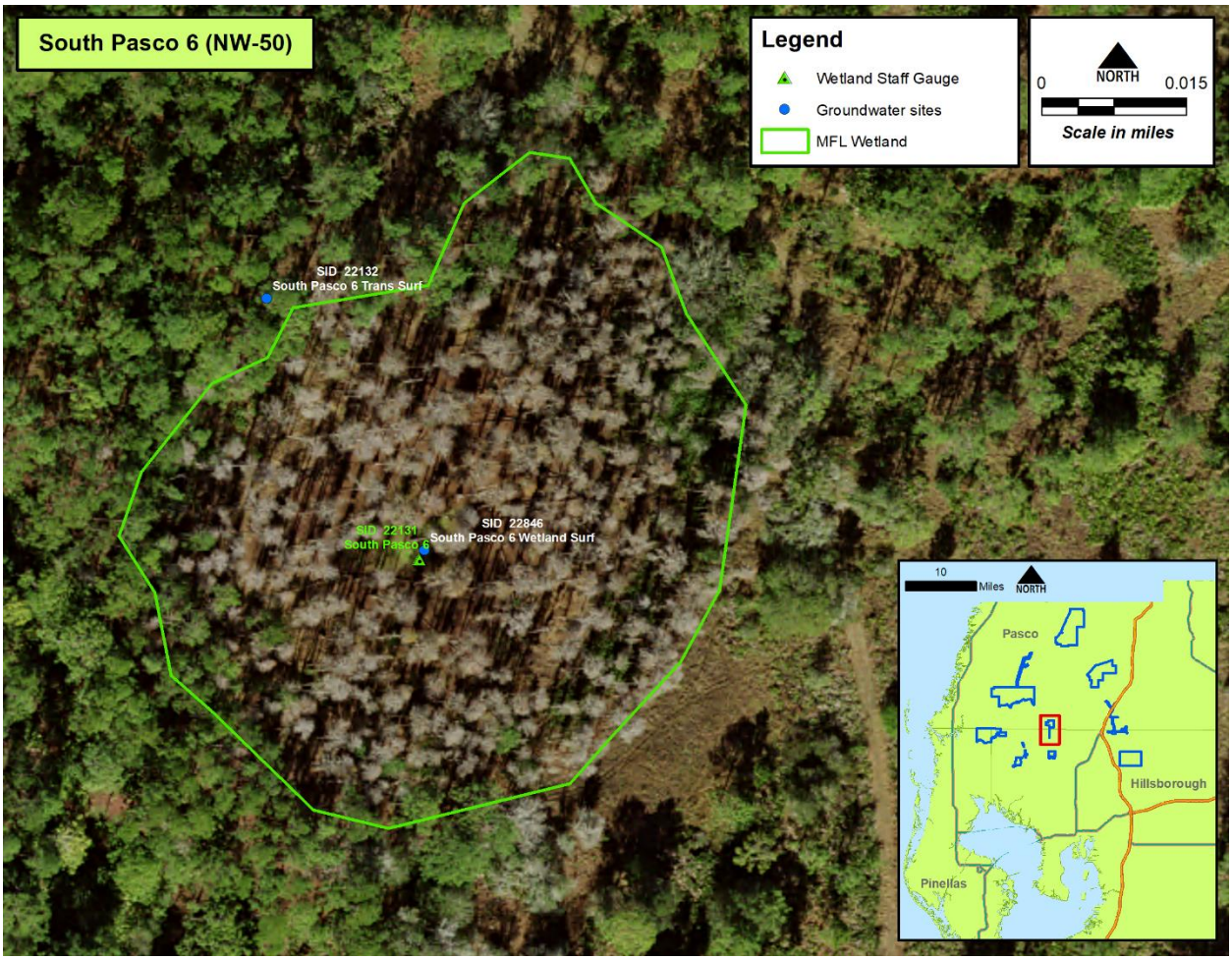

Figure 82: South Pasco 6 wetland

The District installed a staff gage (SID 22132) at this site in 1989. When the wetland was adopted as an MFL site, the District installed a wetland well (SID 22846) in 2001, and an upland well (SID 22132) in 2002 (Figure 82, Figure 83). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

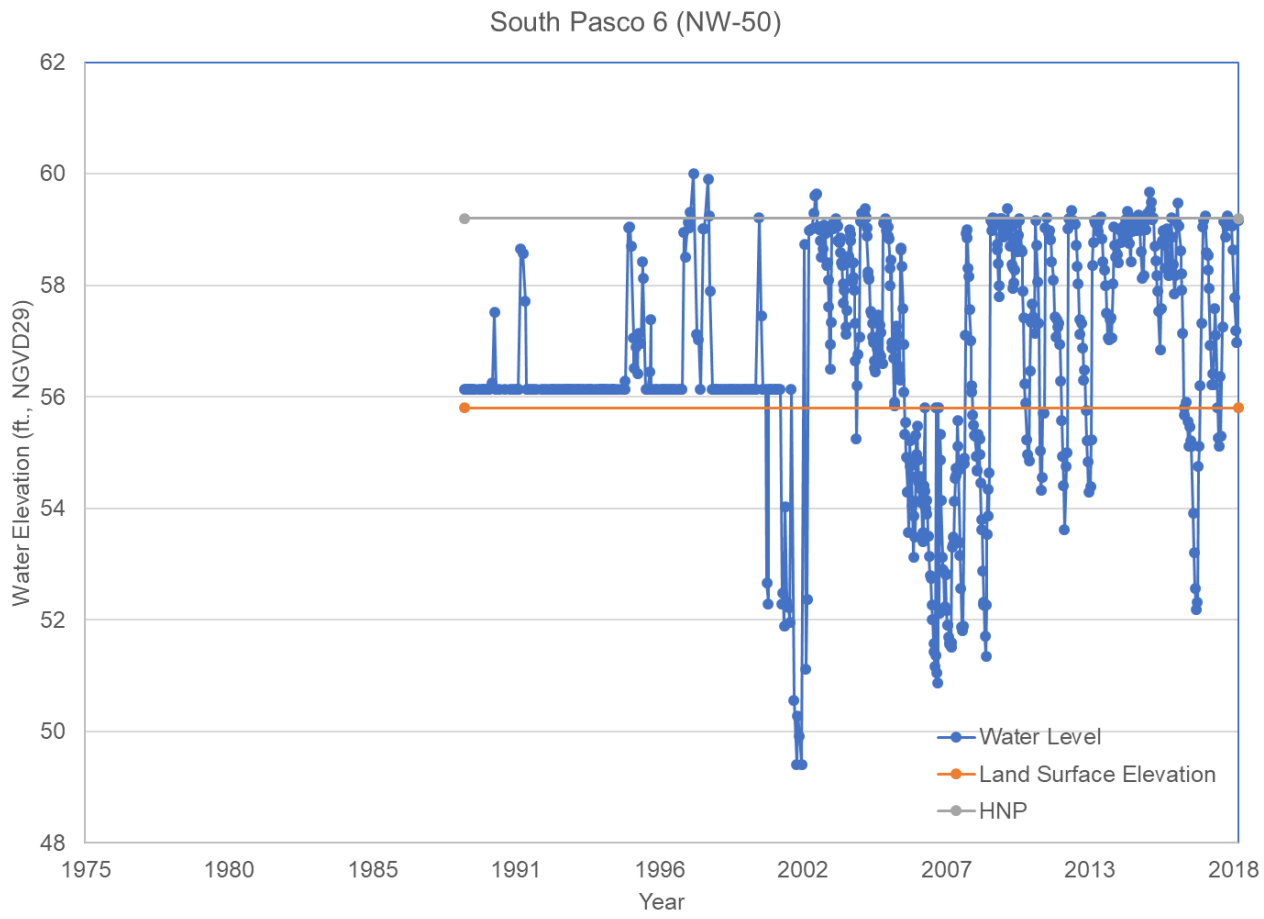

Figure 83: South Pasco 6 water levels

Significant subsidence and tree fall has been noted at the South Pasco 6 wetland. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points near the wetland edge (to avoid potential subsidence) at 59.2 feet NGVD29, and a proposed MFL of 57.4 feet NGVD29. The currently adopted MFL at this site is 57.3 feet NGVD29.

The South Pasco 6 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.3 feet below the HNP (see Appendix B). Figure 83 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.7 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The South Pasco 6 wetland is recommended to be kept as an adopted MFL site, with an MFL of 57.4 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

Starkey Wellfield

The Starkey wellfield is located in west Pasco County (Figure 2). Wellfield production in Starkey began in 1974. In 2007, there was a significant reduction in withdrawals from as high as 13 million gallons per day (mgd) to around 4 mgd, where it has mostly remained since. There are 7 wetlands within the Starkey wellfield that have established minimum levels associated with them (Figure 84).

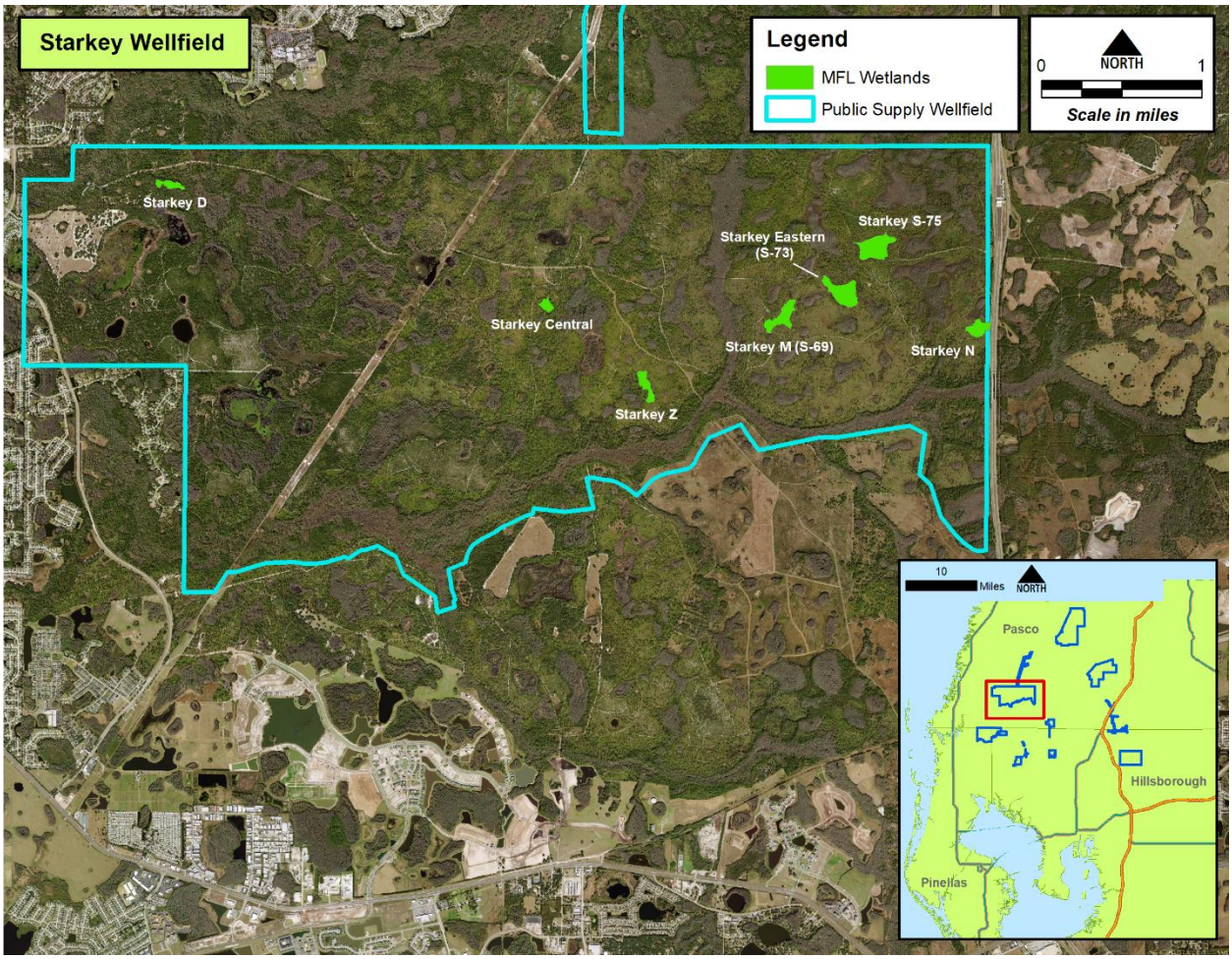

Figure 84: Starkey Wellfield with Wetland MFLs

Starkey D (Wetland ID 485)

STWF D (Starkey D) is located in the northwest area of the Starkey Wellfield, and is approximately 4 acres in size (Figure 84, Figure 85).

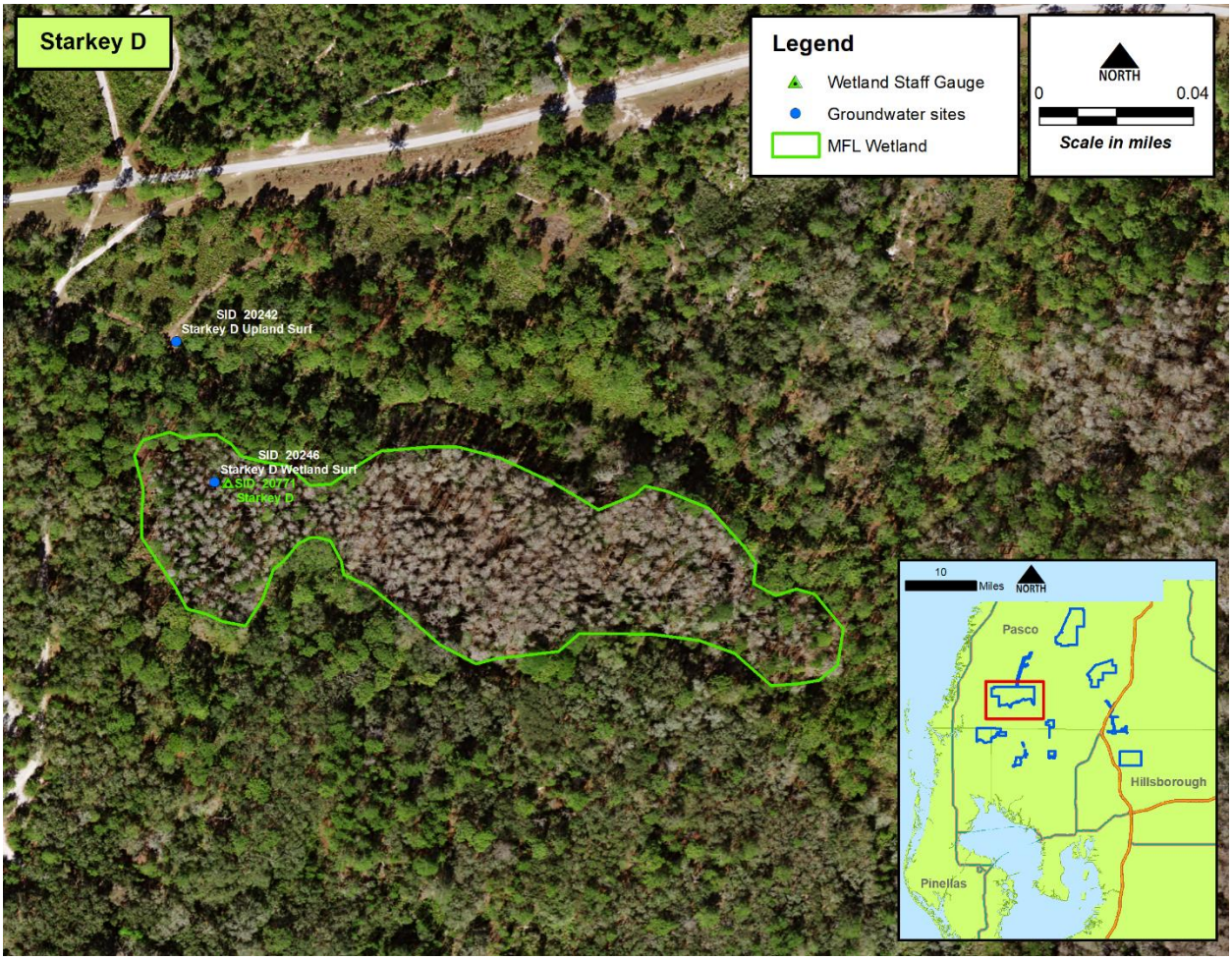

Figure 85: Starkey D wetland

Water level monitoring began at Starkey D on April 15, 1975 from District staff gage SID 20771, and continues through present day. In May 1999, a surficial wetland well (SID 20246) was installed next to the staff gage, as well as an upland surficial well (SID 20242), and monitoring continues from both wells bi-weekly through present day (Figure 85, Figure 86). A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

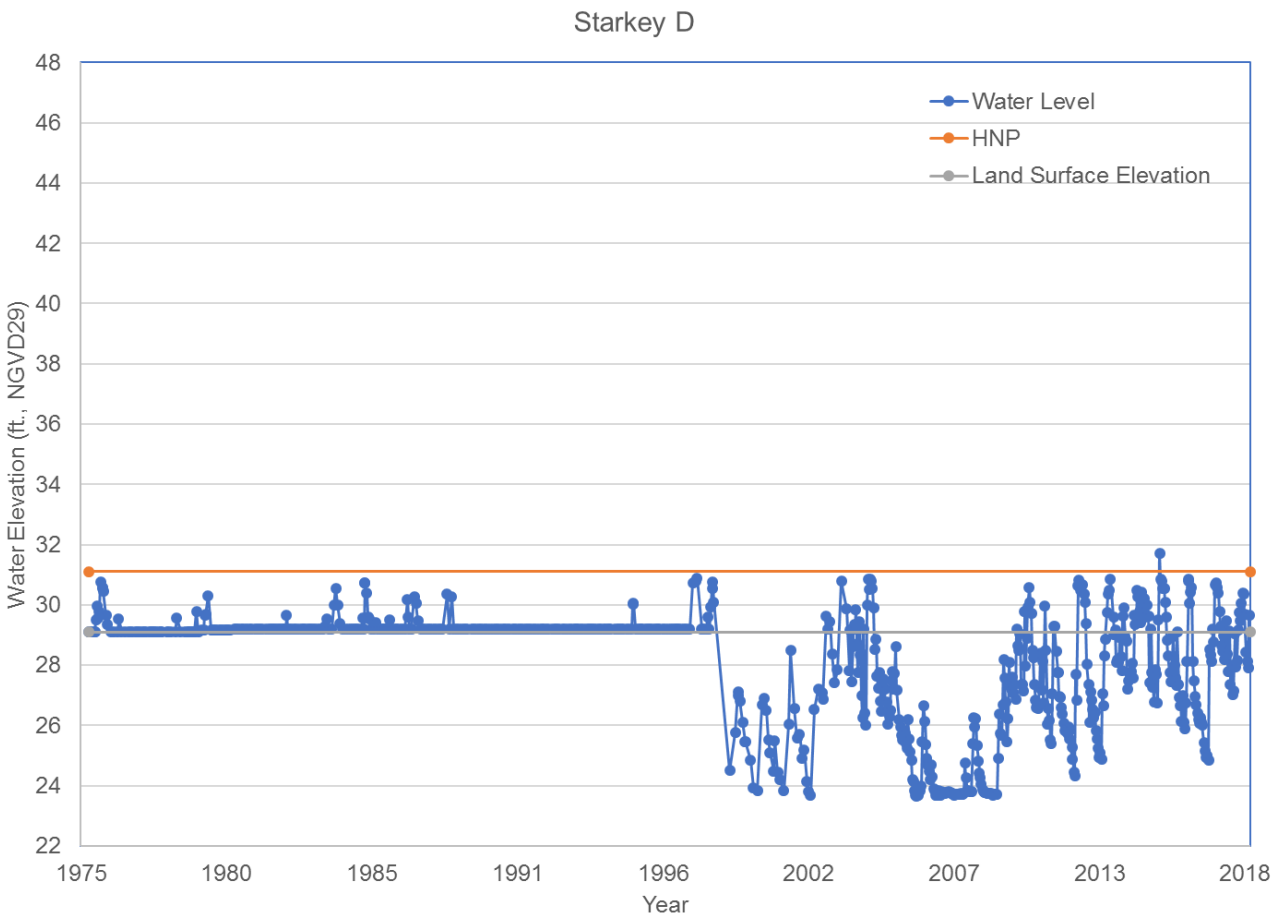

Figure 86: Starkey D water levels.

Although the Starkey D wetland had considerable standing water in 1975, subsequent years had been quite dry. In some years the dome recorded no standing water, which is atypical of normal cypress domes which even in relatively dry years still experience some standing water. In the 1980's it was observed that slash pines (*Pinus clausa*) had invaded into the wetland around the staff gage, and subsidence had been noted. The wetland is surrounded by mostly soils classified as xeric, and for this reason as well as those mentioned above, it is not thought to be representative of the area.

Conclusion and Recommendation:

Because Starkey D is considered to be xeric, and not representative of the area where it is located, it is recommended that this wetland not be used as an MFL. As a replacement for Starkey D, it is proposed that Starkey S-99 be proposed for MFL adoption.

Starkey S-99

Starkey S-99 is recommended as a replacement for Starkey D. Starkey S-99 is an isolated cypress wetland approximately 8.2 acres in size that is already monitored by Tampa Bay Water and located approximately 0.3 miles to the east of Starkey D (Figure 87, Figure 88).

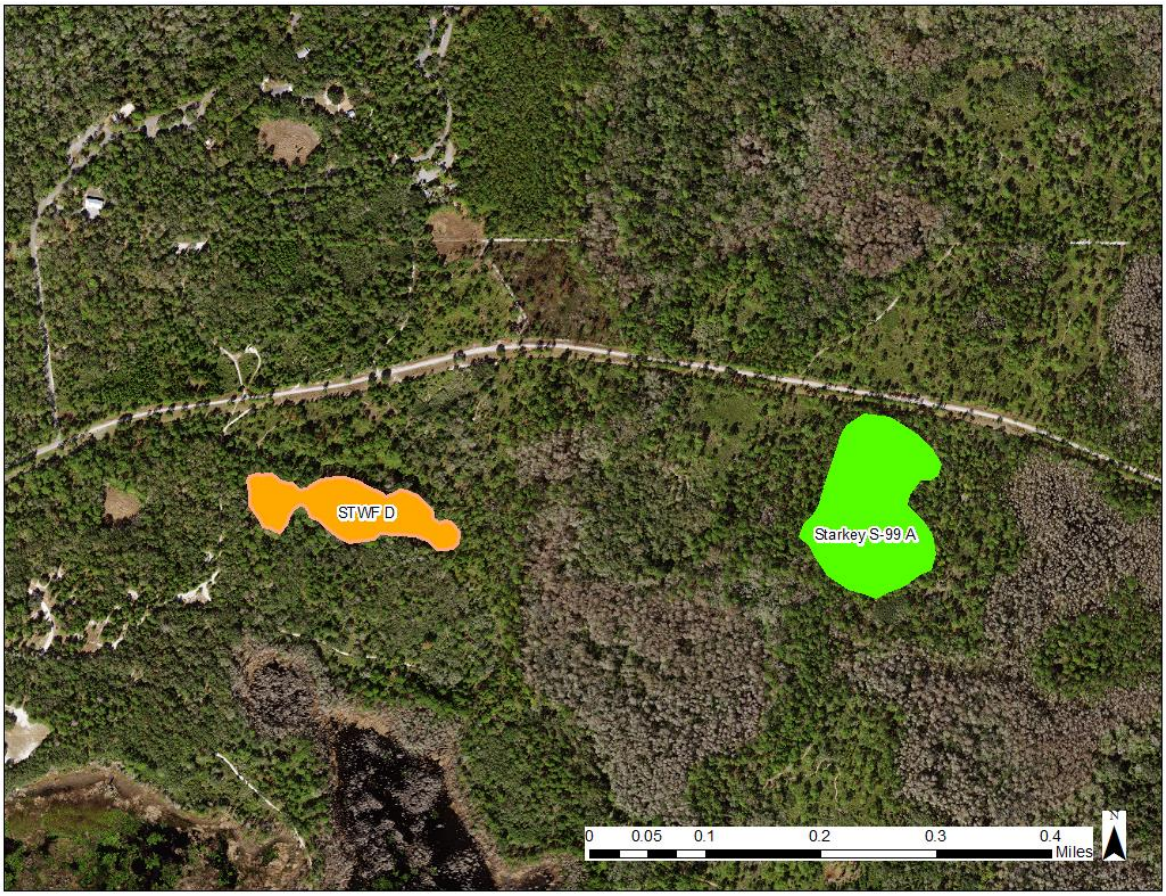

Figure 87: Starkey D and Starkey S-99

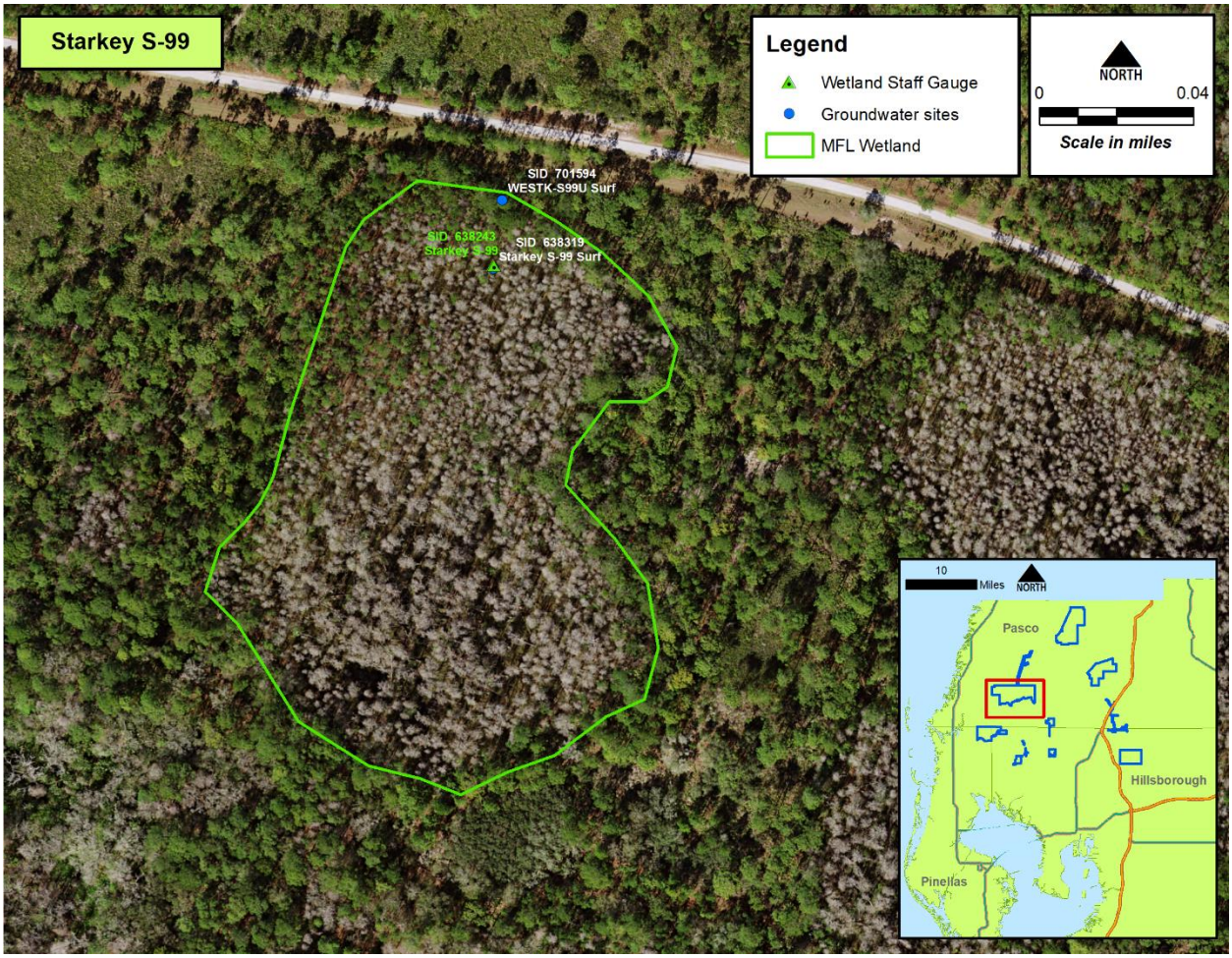

Figure 88: Starkey S-99 wetland

Tampa Bay Water has had a staff gage (SID 638243) and a wetland surficial well (SID 638319) in the wetland since 2001. Water level data has been collected from an upland well (SID 701594) since 2009 (Figure 88, Figure 89). A WAP transect was established in 2005.

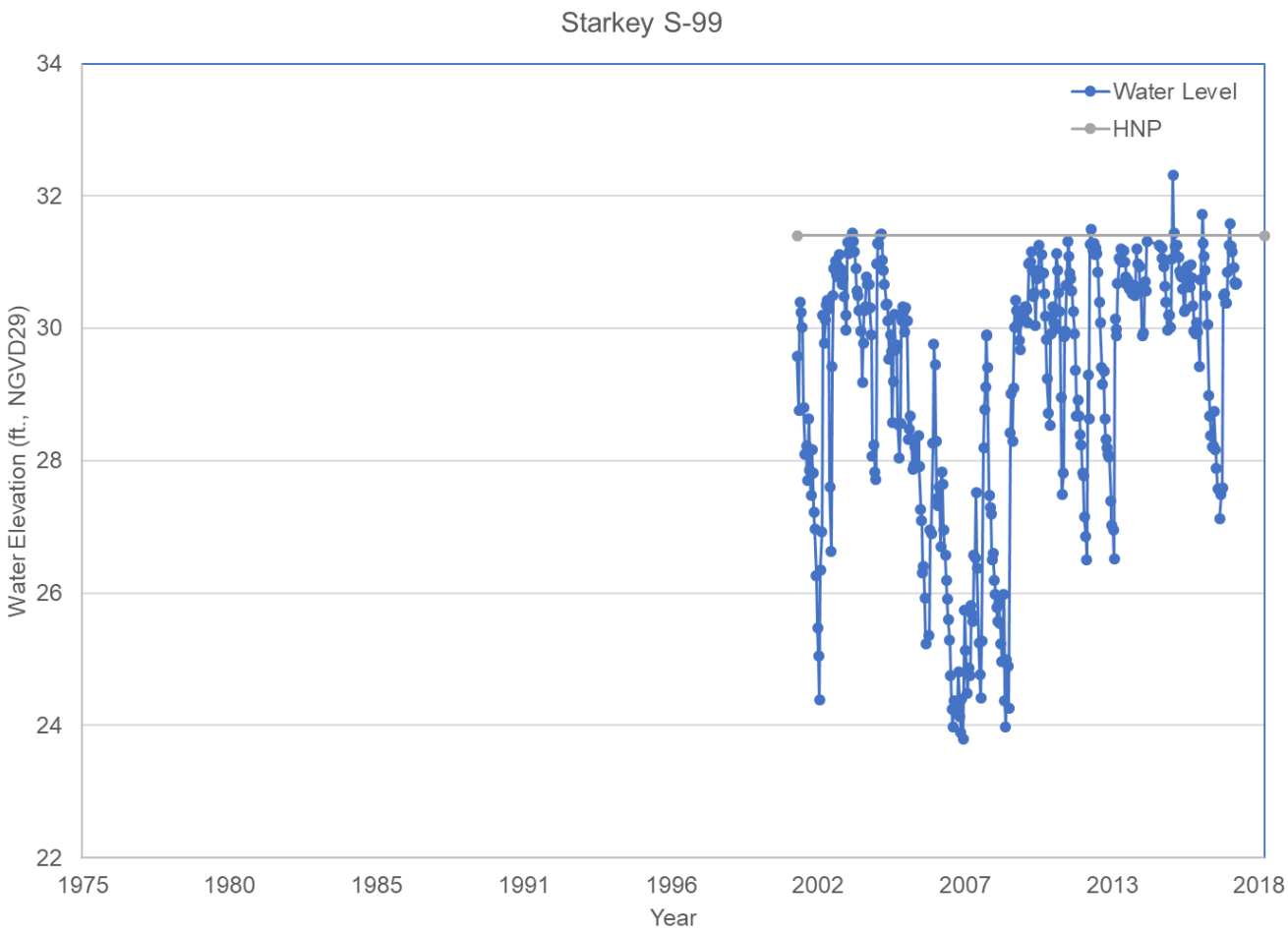

Figure 89: Starkey S-99 water levels

The Starkey S-99 wetland is surrounded by mostly soils classified as mesic, and is more representative of the area than Starkey D appears to be. An acceptable HNP was established at this wetland using Lyonia roots at 31.4 feet NGVD29, with a proposed MFL of 29.6 feet NGVD.

The S-99 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.3 feet below the HNP (see Appendix B). Figure 89 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.7 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Starkey S-99 wetland is recommended as an MFL replacement for Starkey D, with an MFL of 29.6 feet NGVD29.

Starkey Central (Wetland ID 484)

STWF Central (STWF Central recorder) is located in the central area of the Starkey Wellfield, as its name implies (Figure 84). Starkey Central is an isolated cypress wetland and is approximately 3.3 acres in size (Figure 90).

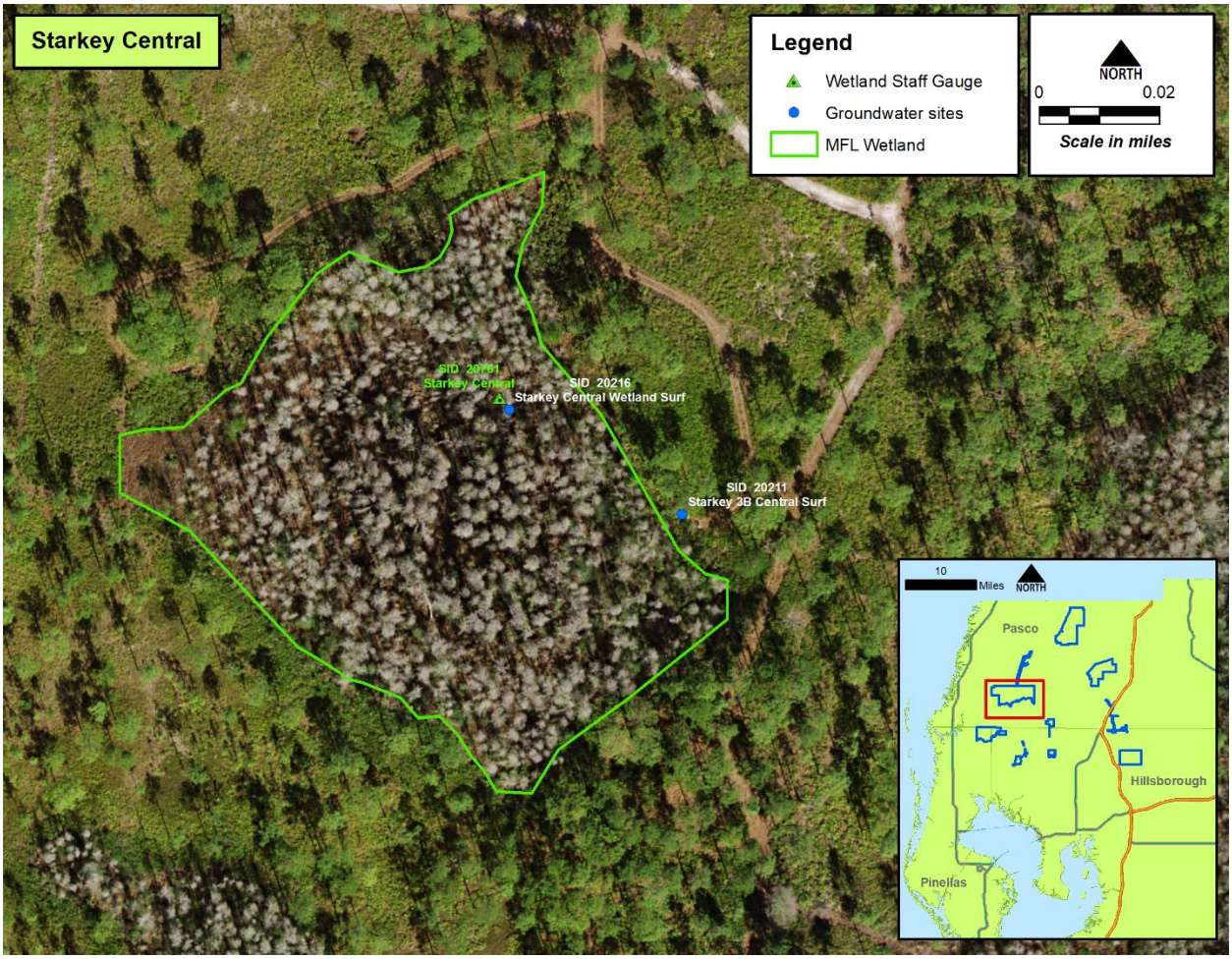

Figure 90: Starkey Central wetland

Water level monitoring began at Starkey Central on March 14, 1985 from District staff gage SID 20761, and continues through present day. A shallow stilling well was installed a short time later, and a series of wells of various depths were drilled in the center and edges of the dome in 1989 as part of the Watson et al. (1990) hydrogeologic study. A 6-inch surficial wetland well next to the staff gage was added in September 2001 (SID 20216), and monitoring continues from that well through present day (Figure 90, Figure 91). A WAP transect was established in 2005.

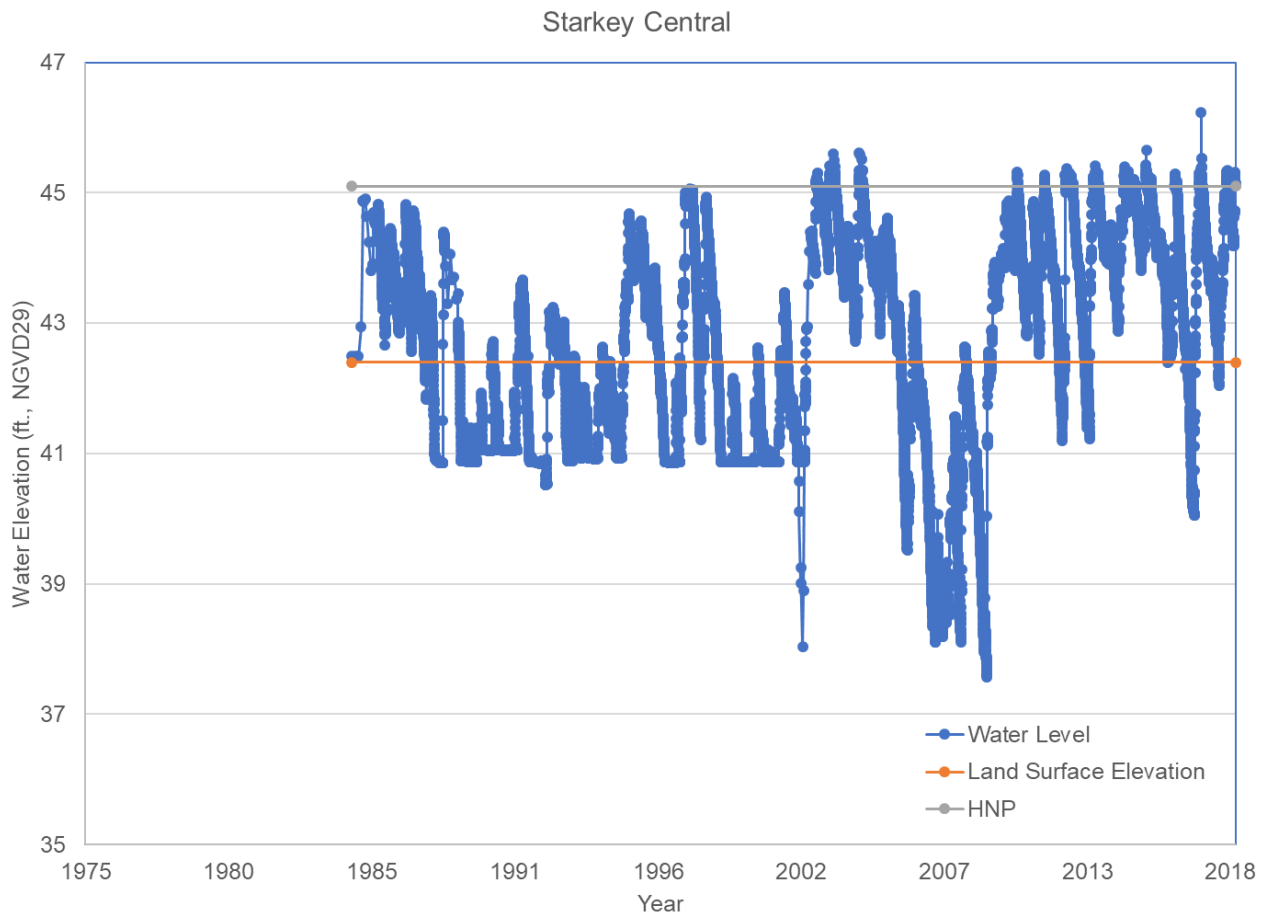

Figure 91: Starkey Central water levels

Staff files indicate that the wetland appeared to be in "good health" in 1985 when monitoring began, but that "some excess cypress mortality was apparent by 1992." Moderate soil subsidence was also observed in the early 2000's by staff. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress buttress inflections at 45.1 feet NGVD29, and a proposed MFL of 43.3 ft. NGVD. The currently adopted MFL at this site is 43.3 feet NGVD29, so no change is recommended.

The Starkey Central wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at the elevation of the HNP (see Appendix B). Figure 91 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.8 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Starkey Central wetland is recommended to be kept as an adopted MFL site, with an MFL of 43.3 feet NGVD29.

Starkey Z (Wetland ID 487)

Starkey Z is located toward the center of the wellfield, southeast of Starkey Central, and is an approximately 6.6 acres in size isolated cypress wetland (Figure 84, Figure 92).

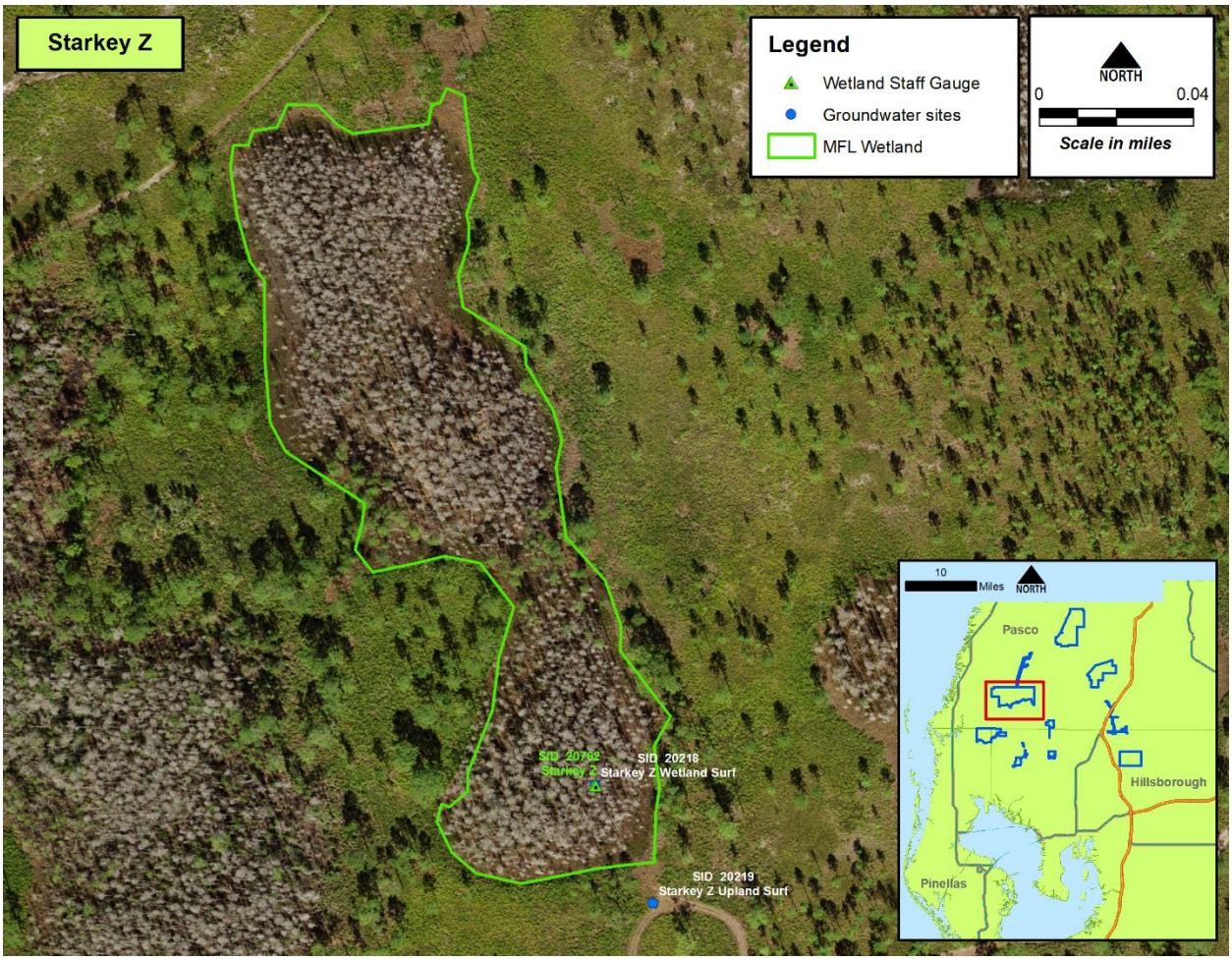

Figure 92: Starkey Z wetland

The District has had a staff gage (SID 20762) at this site since 1983, and added wetland (SID 20218) and upland (SID 20219) wells in 1999 (Figure 92, Figure 93). The District collects data from all District instruments at this site twice a month through present day. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

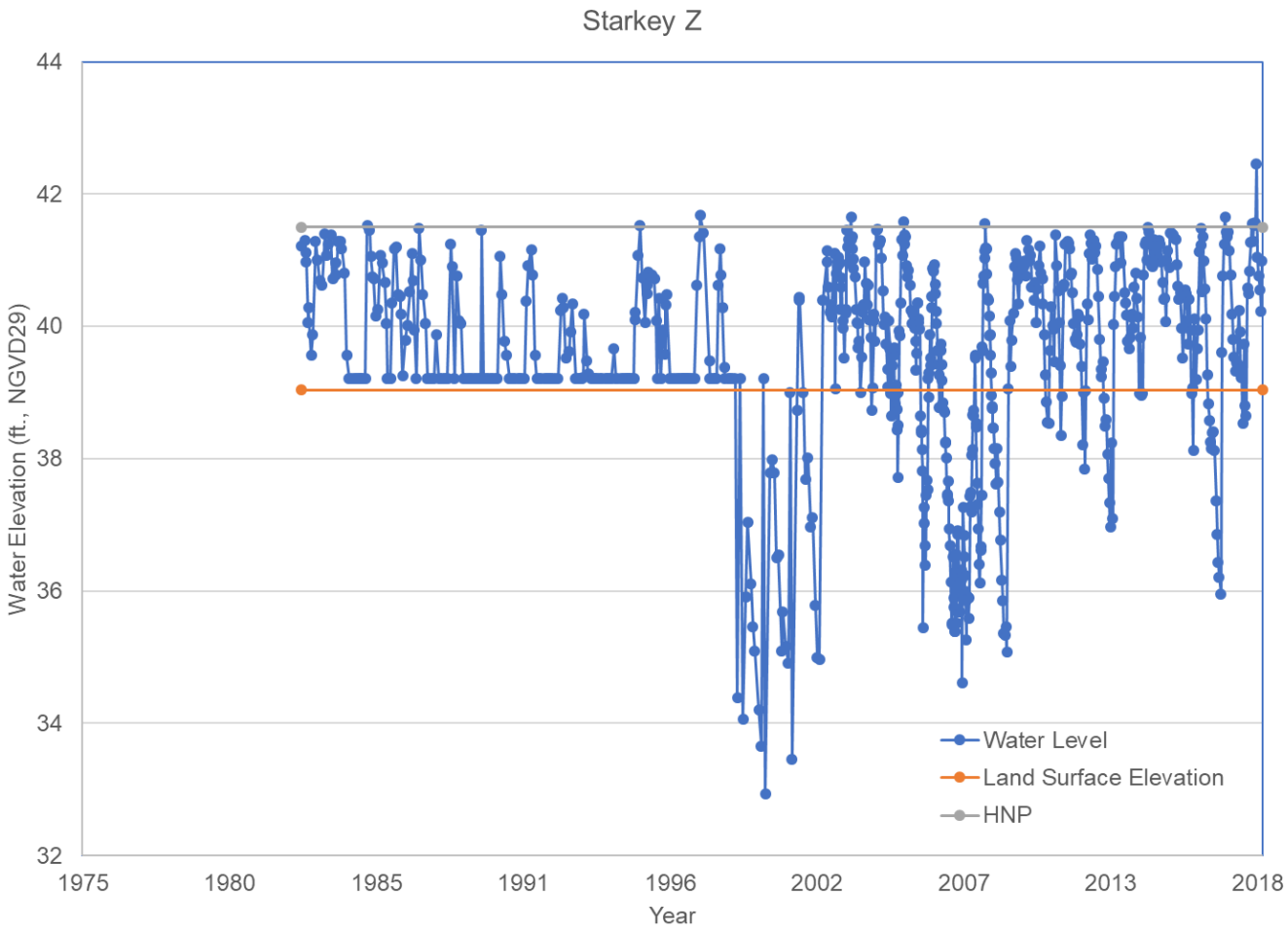

Figure 93: Starkey Z water levels

Qualitative vegetation monitoring up until the early 2000's indicated that likely less frequent inundation had led to the replacement of a sensitive wetland species (*eriocaulon sp.*) in the mid 1990's by a more tolerant species (*Andropogon spp.*). The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 41.5 feet NGVD29, and a proposed MFL of 39.7 feet NGVD29. The currently adopted MFL at this site is 40.0 feet NGVD29.

The Starkey Z wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.1 feet below the elevation of the HNP (see Appendix B). Figure 93 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.7 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

This Starkey Z wetland is recommended to be kept as an adopted MFL site, with an MFL of 39.7 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation, and an improved assessment of HNP.

Starkey Eastern (Wetland ID 447)

Starkey Eastern (STWF Eastern Recorder) is located in the eastern area of the Starkey Wellfield, adjacent to the easternmost Starkey water production well, and is approximately 15 acres in size (Figure 84, Figure 94).

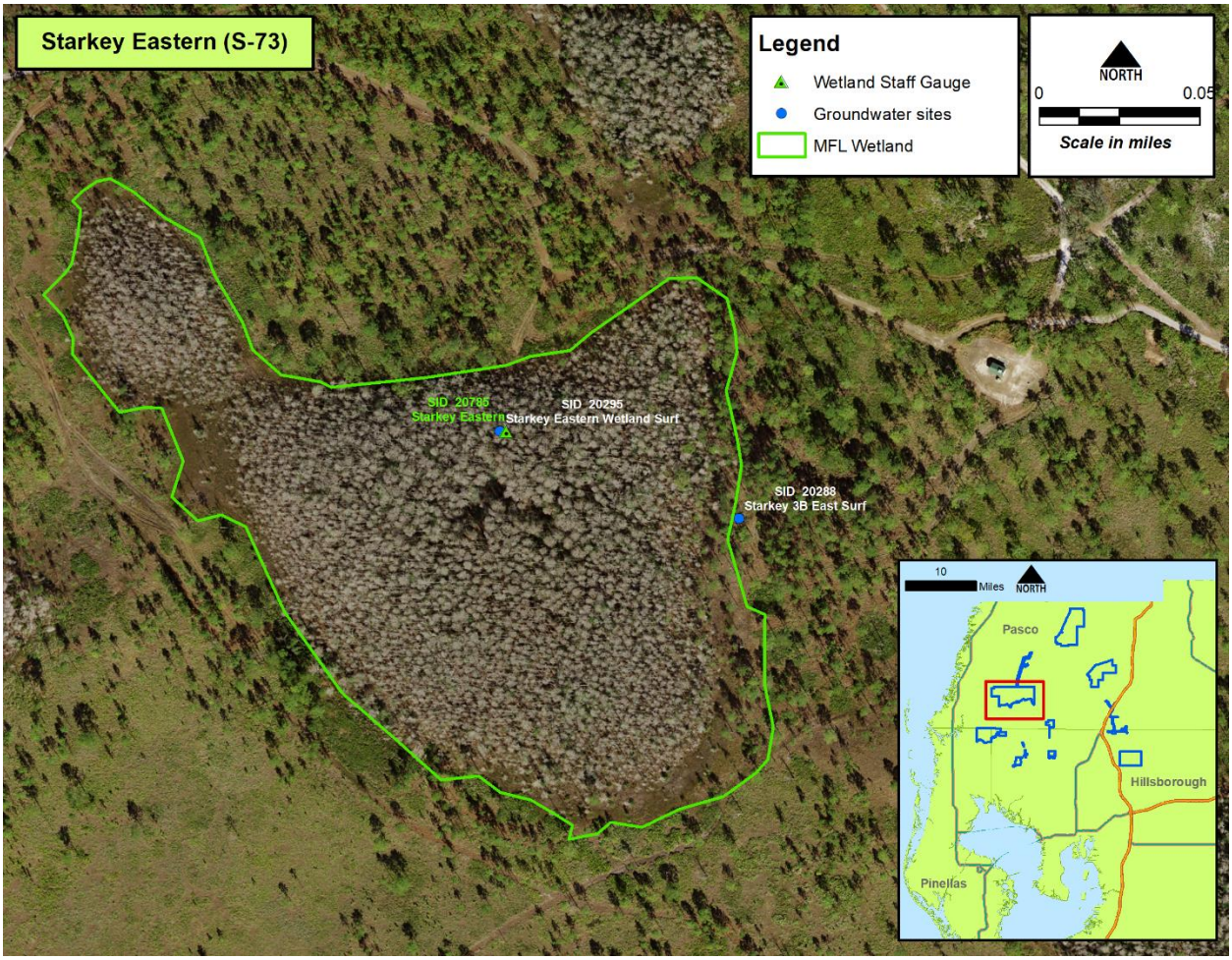

Figure 94: Starkey Eastern wetland

Water level monitoring began at Starkey Eastern on March 14, 1985 from District staff gage SID 20785, and continues through present day. A shallow stilling well was installed a short time later, and a series of wells of various depths were drilled in the center and edges of the dome in 1989 as part of the Watson et al. (1990) hydrogeologic study. In November 2001, a surficial wetland well (SID 20295) was installed next to the staff gage with continuous hourly recordings, and continuous monitoring continues through present day (Figure 94, Figure 95).

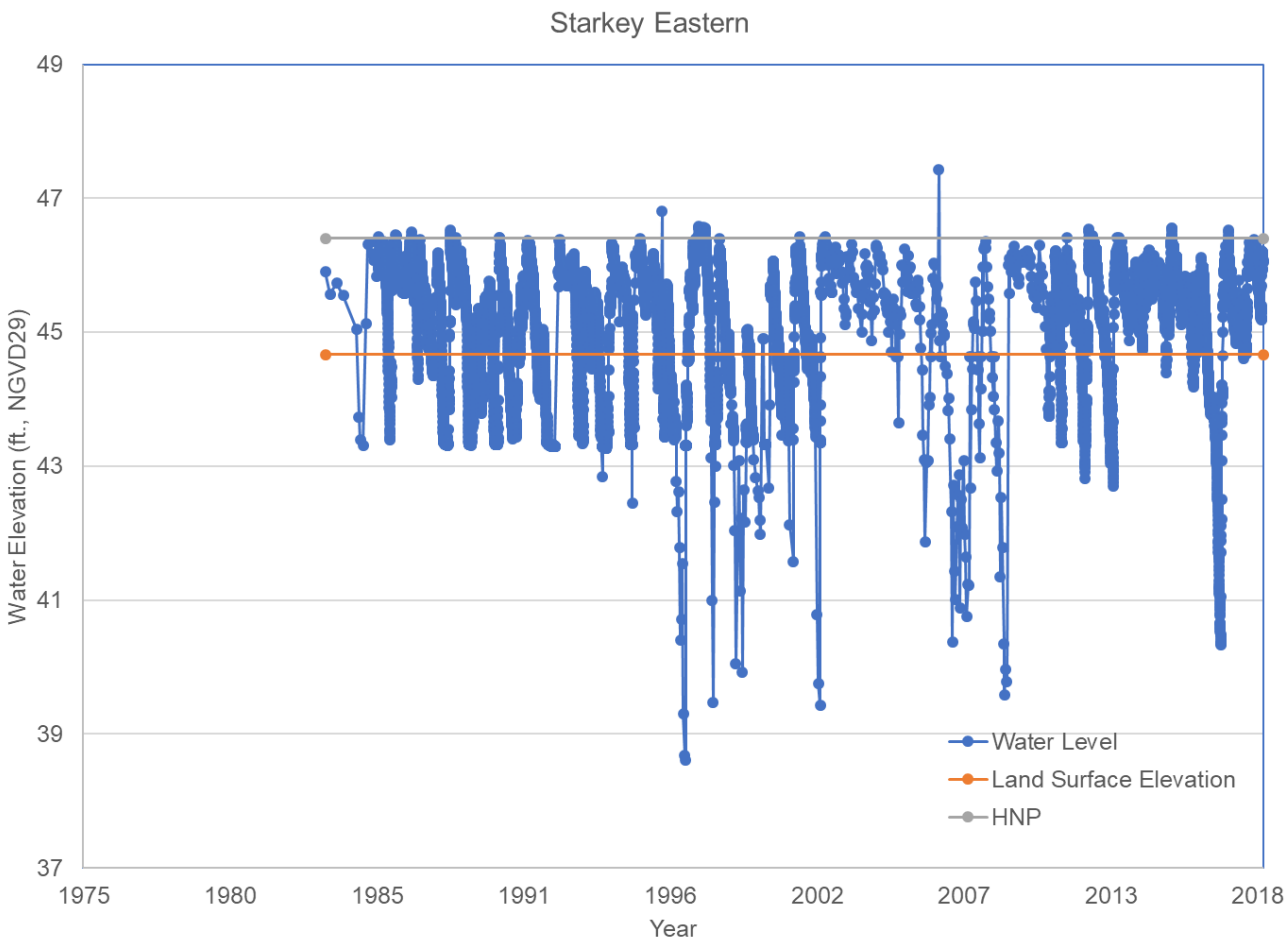

Figure 95: Starkey Eastern water levels

Qualitative monitoring between 1985 to 2005 indicated that the wetland appeared to have healthy canopy, shrub, and understory conditions. It was noted that a slight depression in water levels was observed, but that effects on the vegetation were not obvious. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress buttress inflections at 46.4 feet NGVD29, and a proposed MFL of 44.6 ft. NGVD. The currently adopted MFL at this site is 44.6 feet NGVD29, so no change is recommended.

The Starkey Eastern wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.3 feet below the elevation of the HNP (see Appendix B). Figure 95 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 0.9 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Starkey Eastern wetland is recommended to be kept as an adopted MFL site, with an MFL of 44.6 feet NGVD29.

Starkey S-75 (Wetland ID 449)

Starkey S-75 is located in the northeast of the Starkey Wellfield, and is a mostly isolated cypress dome approximately 16.4 acres in size (Figure 84, Figure 96).

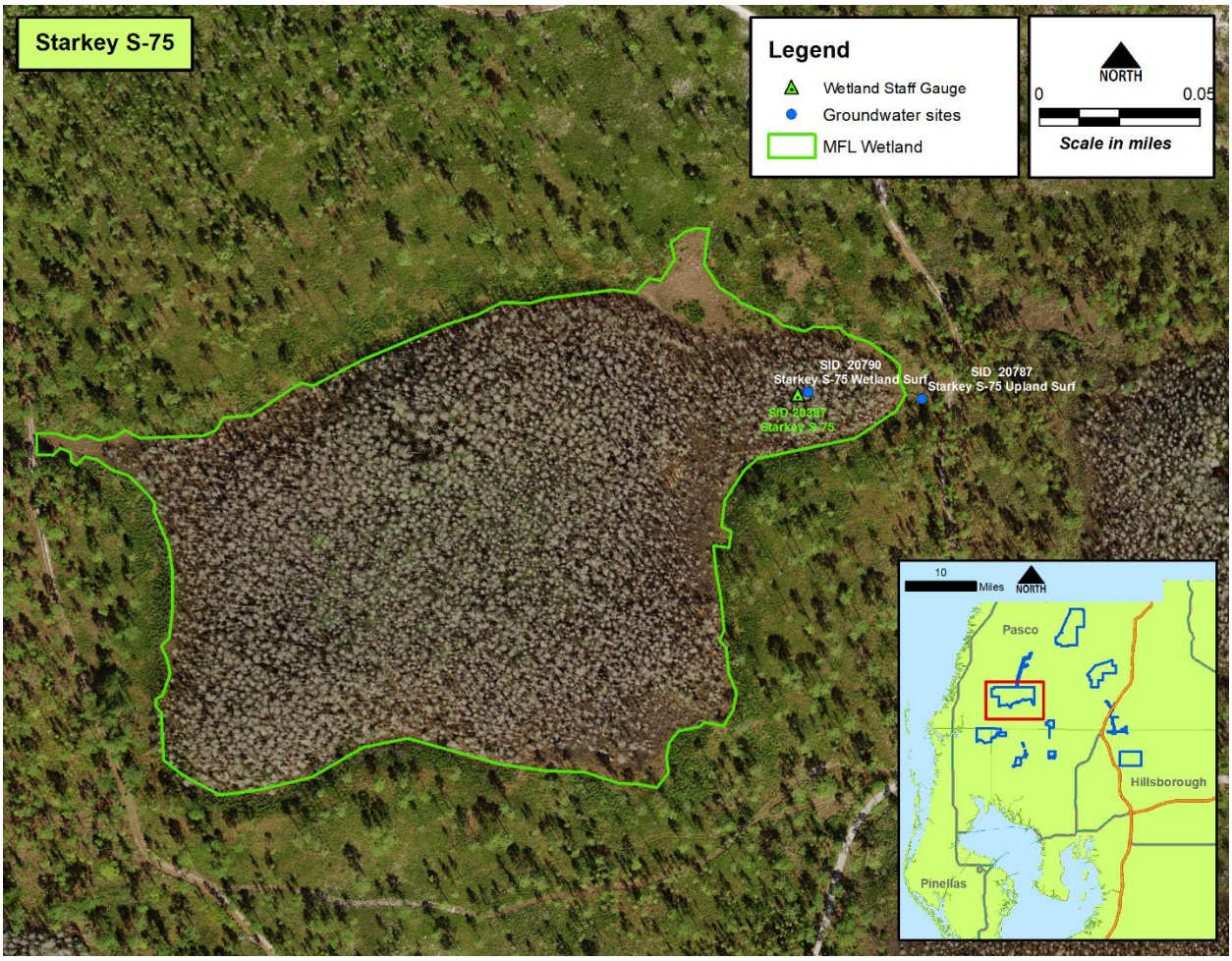

Figure 96: Starkey S-75 wetland

Starkey S-75 has been monitored since 1984, beginning with a Tampa Bay Water wetland well, which had reportedly been replaced more than once, followed by the addition of a staff gage in the 1990's. When the wetland was adopted as an MFL site, the District installed a staff gage and upland and wetland wells in 2002. In 2010, SWFWMD took over monitoring of S-75 with their staff gage (SID 20387), wetland well (SID 20790), and upland well (SID 20787) (Figure 96, Figure 97). Monitoring continues at these sites on a twice monthly basis at the time of this report. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

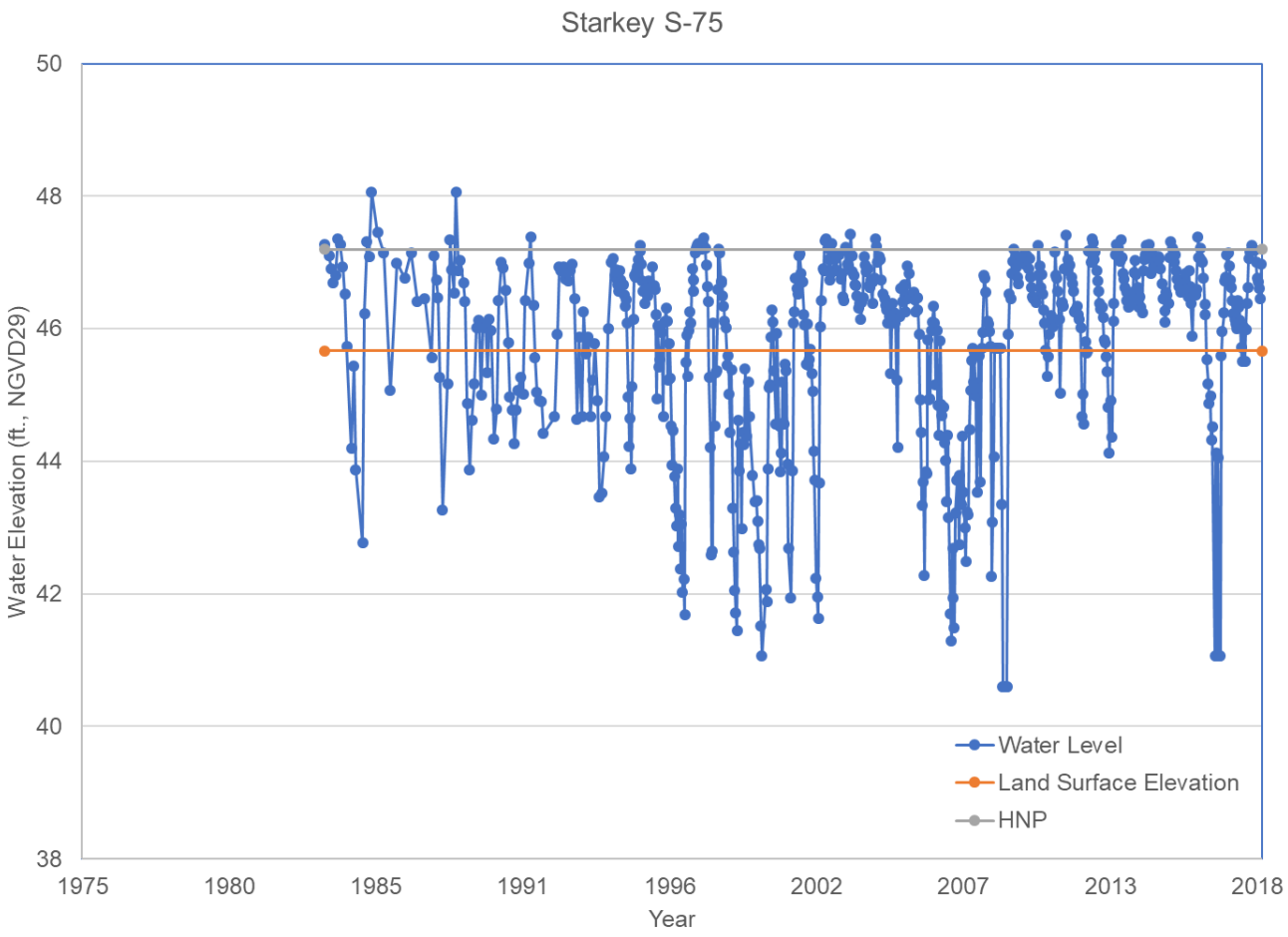

Figure 97: Starkey S-75 water levels

No subsidence has been noted at Starkey S-75, and the wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 47.2 feet NGVD29, and a proposed MFL of 45.4 feet NGVD29. The currently adopted MFL at this site is 45.4 feet NGVD29, so no change is recommended.

The Starkey S-75 wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.3 feet below the elevation of the HNP (see Appendix B). Figure 97 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 1.1 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Starkey S-75 wetland is recommended to be kept as an adopted MFL site, with an MFL of 45.4 feet NGVD29.

Starkey M (S-69) (Wetland ID 444)

Starkey M is located in the eastern part of the wellfield, and is an isolated cypress dome that is approximately 11 acres in size (Figure 84, Figure 98).

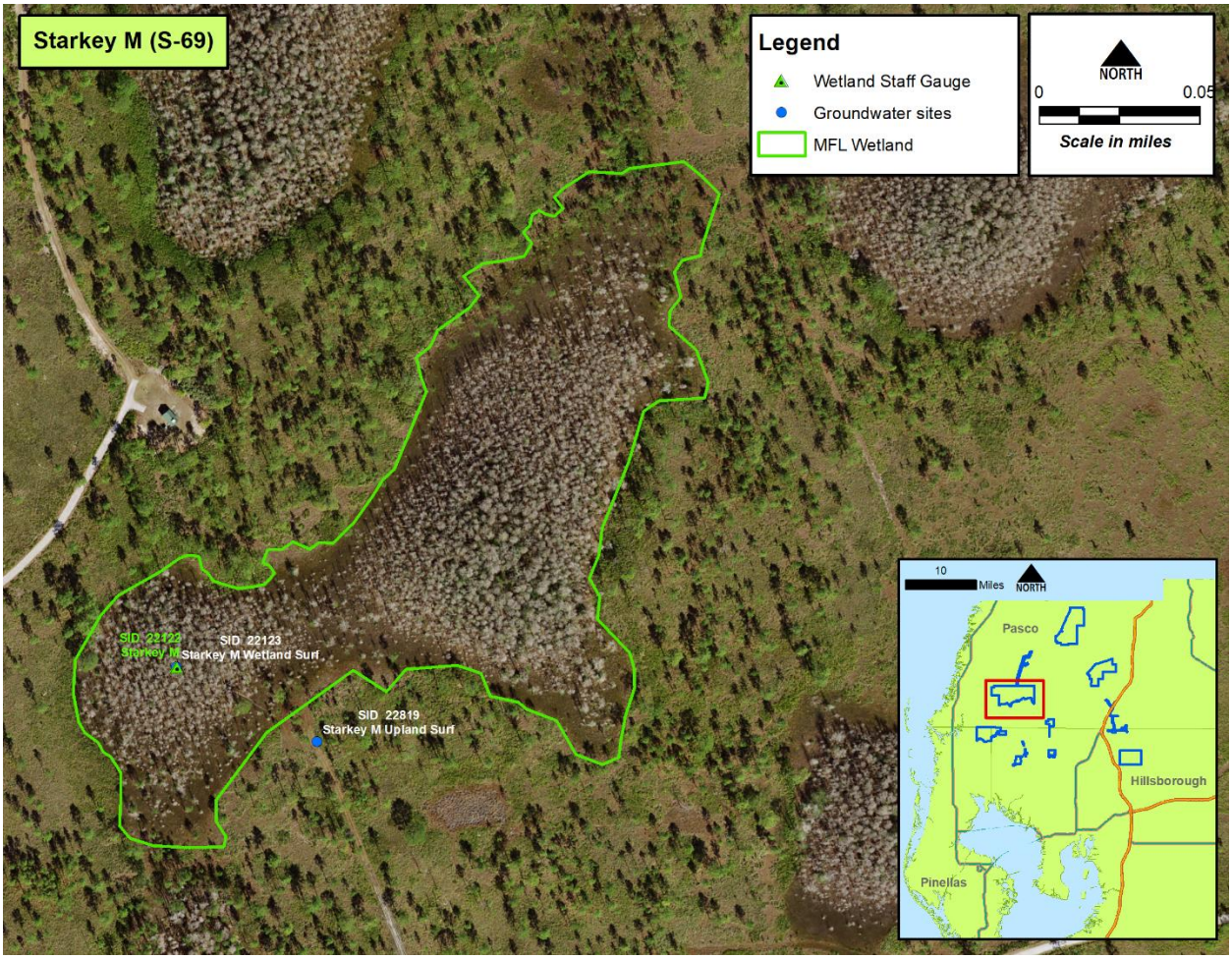

Figure 98: Starkey M wetland

The District has had a staff gage at this site since 1979 (SID 22122). TBW installed a stilling wetland well in 1983, which was replaced in 1995. In 2001, the District installed a wetland (SID 22123) and upland (SID 22819) well (Figure 98, Figure 99). Monitoring continues from these sites on a twice monthly basis at the time of this report. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

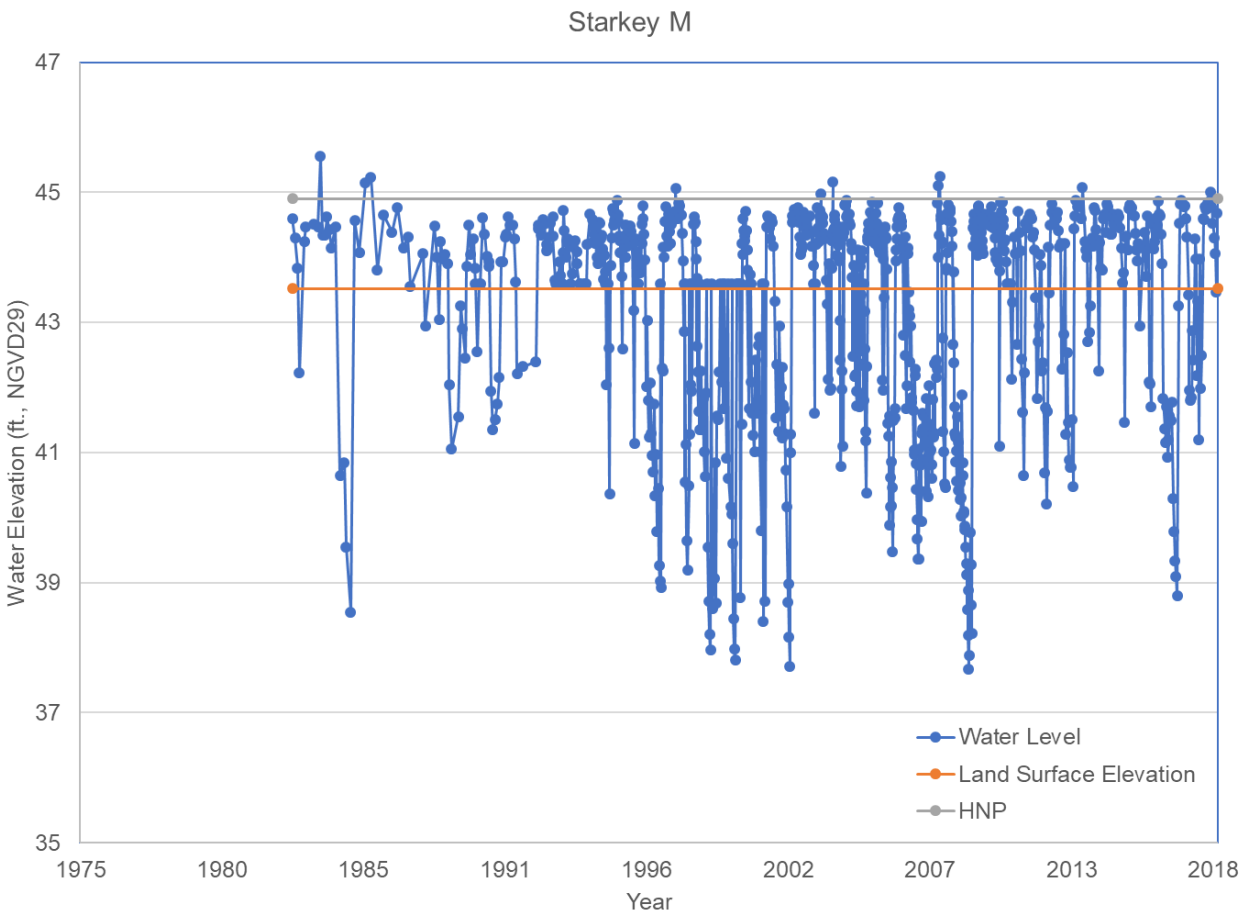

Figure 99: Starkey M water levels

Vegetation monitoring over the years showed that from 1979 to about 1990 arrowhead (*Sagittaria graminea*) was common in the center of the wetland near the staff gage, although by the mid-2000's maidencane and *Andropogon spp.* Had become more common than arrowhead. No subsidence has been noted, and the wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 44.9 ft. NGVD29, and a proposed MFL of 43.1 feet NGVD29. The currently adopted MFL at this site is 43.0 feet NGVD29.

The Starkey M wetland has a very natural-looking but small outlet, described as a "natural saddle," and surveyed at 0.4 feet below the elevation of the HNP (see Appendix B). Figure 99 shows that water levels regularly reach the HNP. The calculated Historic P50 is located 1.1 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

The Starkey M wetland is recommended to be kept as an adopted MFL site, with an MFL of 43.1 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

Starkey N (Wetland ID 486)

Starkey N is located on the far eastern side of the wellfield, with an area of approximately 6.9 acres (Figure 84, Figure 100). Starkey N is functionally isolated cypress wetland, despite a connection to wetland 489 (Starkey T-09) to the north, and culverts under the Suncoast Parkway to the east. The culverts were surveyed in 2015 to be at 44.6 feet NGVD, however despite being lower than the surveyed HNP, water level records indicated that the wetland is still able to stage up to the HNP.

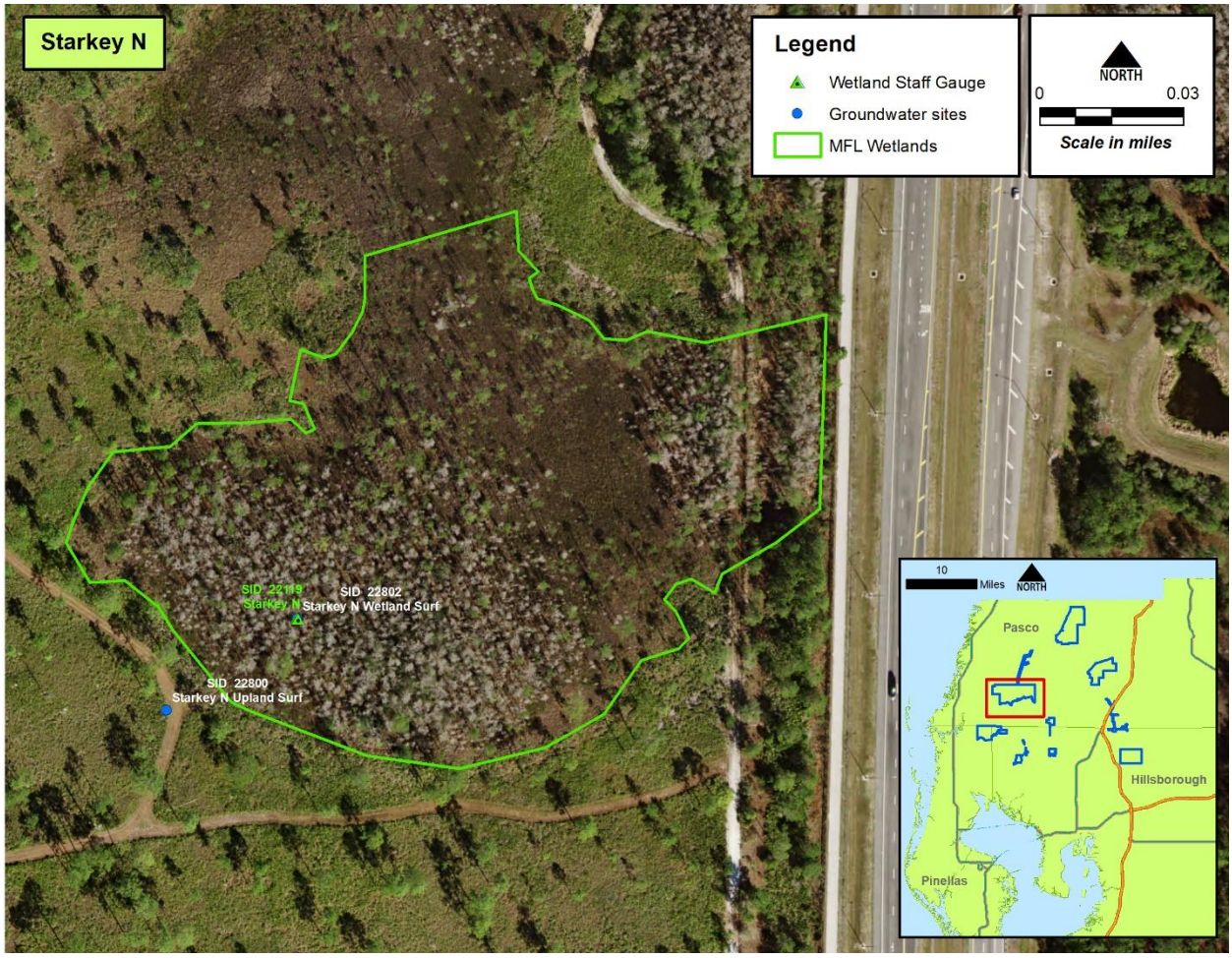

Figure 100: Starkey N

The District has had a staff gage (SID 22119) at this site since 1979, and installed upland (SID 22800) and wetland (SID 22802) wells in 1999 (Figure 100, Figure 101). The District continues to collect data on a twice monthly basis from these stations at the time of this report. A WAP transect was established in 2005. The District has been exclusively collecting water level data from this site since 2010.

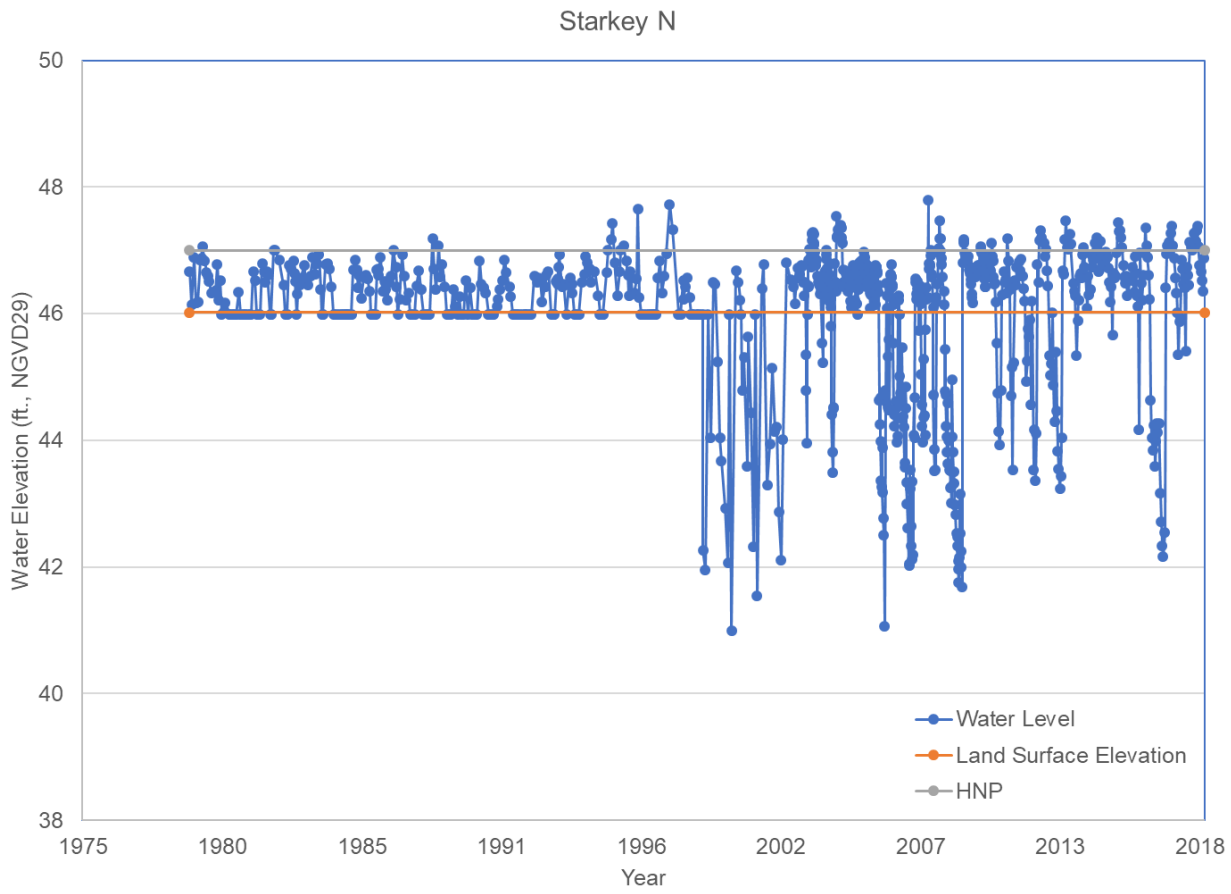

Figure 101: Starkey N water levels

Previous vegetation monitoring had shown relatively little vegetation changes over the years compared to some other wetlands in the wellfield, with some changes over time noted to be more evident around the outer cypress fringe. The wetland is surrounded by mostly soils classified as mesic. An acceptable HNP was established at this wetland using cypress inflection points at 47.0 feet NGVD29, and a proposed MFL of 45.2 feet NGVD29. The currently adopted MFL at this site is 45.1 feet NGVD29.

The Starkey M wetland has a very natural-looking but small outlet, described as a “natural saddle,” and surveyed at the elevation of the HNP (see Appendix B). There are two culverts on the east side of the wetland that connect to another wetland on the east side of the Suncoast Highway, but the natural flow, if any, between the wetlands is from east to west. Figure 101 shows that water levels regularly reach the HNP, and, if anything, are reaching higher levels in the last 20 years. The calculated Historic P50 is located 1.4 feet above the MFL. Therefore, there is no evidence implying significant structural alteration.

Conclusion and Recommendation:

This Starkey N wetland is recommended to be kept as an adopted MFL site, with an MFL of 45.2 feet NGVD29. The difference between the current and proposed MFL is thought to be due to a more accurate benchmark elevation.

Consideration of Environmental Values

Rule 62-40.473, F.A.C., part of the Water Resource Implementation Rule (see Chapter 62-40, F.A.C), provides a suite of ten environmental values that must be considered when establishing minimum flows and minimum water levels. The District's Minimum Flows and Levels Program addresses this requirement when it establishes minimum levels. The minimum levels for each wetland identified in this report are protective of all relevant environmental values identified for consideration in the Water Resource Implementation Rule.

A Cypress Standard (1.8 ft. below the historic normal pool elevation) was identified to support development of minimum levels for cypress-dominated, isolated wetlands within the District. The standard, based on peer-reviewed ecologic and hydrologic research (SWFWMD, 1999), is designed to protect the structure and function of wetlands from significant harm. Wetlands are well known to provide a multitude of ecosystem services, such as supporting biodiversity and filtering nutrients from water, and by protecting the wetlands from significant harm these ecosystem services are considered protected.

The following environmental values were considered by protecting the wetlands from significant harm, as they are intrinsic to the structure and function of wetlands:

- fish and wildlife habitats and the passage of fish
- transfer of detrital material
- filtration and absorption of nutrients and other pollutants
- water quality

Additionally, the following environmental values, which can also be associated with wetland structure and function, were considered to be supported when the wetlands are protected from significant harm:

- aesthetic and scenic attributes
- recreation in and on the water

The environmental value of maintenance of freshwater storage and supply is also expected to be protected by the minimum levels based on inclusion of conditions in water use permits that stipulate permitted withdrawals will not lead to violation of adopted minimum flows and levels.

Three environmental values identified in the Water Resource Implementation Rule were not considered relevant to development of the minimum wetland levels. Estuarine resources were not considered relevant because the wetlands are not connected to an estuarine resource. Since the wetlands are isolated cypress domes, it was determined that navigation was not considered relevant. Sediment loads were similarly not considered relevant for minimum levels development for the wetlands, because the transport of sediments as bedload or suspended load is a process typically associated with flowing water systems.

Comparison of Revised and Previously Adopted Levels

Table 2 shows the changes in Minimum Levels for each wetland from the previously adopted levels. Differences are primarily associated with improvements in elevation benchmark data as well as improved survey of Historic Normal Pool.

The Minimum and Guidance Levels identified in this report replace the previously adopted levels for each wetland.

Many federal, state, and local agencies, such as the U.S. Army Corps of Engineers, the Federal Emergency Management Agency, United States Geological Survey, and Florida's water management districts are in the process of upgrading from the National Geodetic Vertical Datum (NGVD29) standard to the North American Vertical Datum (NAVD88) standard. The District is in the process of converting from use of the NGVD29 datum to use of the North American Vertical Datum of 1988 (NAVD 88). While the NGVD29 datum is used for most elevation values included within this report, in most circumstances data was collected in NAVD88 and converted to elevations relative to NGVD29, calculated based on third-order leveling ties from vertical survey control stations with known elevations above the North American Vertical Datum of 1988 for the staff gage at each wetland. The Minimum Level for each wetland in both NGVD29 and NAVD88 can be seen in Table 3.

Table 2: Minimum Levels for District wetlands compared to previously adopted Minimum Levels (in the order they are presented in Rule 40D-8.623).

Wetland	Elevations (in Feet NGVD29)	Previously Adopted Elevations (in Feet NGVD29)
Cypress Creek W-41	n/a*	73.1
Cypress Creek W-11	67.8	67.5
Cypress Creek W-12	62.0	62.1
Cypress Creek W-17	62.8	63.1
Cypress Creek W-56 (G)	62.7	62.7
Starkey D	n/a*	29.1
Starkey S-99	29.6	n/a**
Starkey Central	43.3	43.3
Starkey Z	39.7	40.0
Starkey Eastern (S-73)	44.6	44.6
Starkey S-75	45.4	45.4
Starkey M (S-69)	43.1	43.0
Starkey N	45.2	45.1
Morris Bridge Entry Dome (MBR-35)	33.8	33.7
Morris Bridge X-4 (MBR-89)	40.4	40.6
Morris Bridge Clay Gully Cypress (MBR-88)	39.6	39.8
Morris Bridge Unnamed (MBR-16)	32.1	32.2
Eldridge Wilde 5	27.1	n/a**
Eldridge Wilde 11 (NW-44)	36.4	36.7
EWWF Salls Property Wetland 10S/10D	n/a*	19.8
South Pasco 2 (NW-49)	57.2	57.4
South Pasco South Cypress	56.9	57.5
South Pasco 6 (NW-50)	57.4	57.3
S21 WF NW-53 East	n/a*	51.5
Cosme WF Wetland	n/a*	39.5
Cypress Bridge 16	58.4	57.9
Cypress Bridge A	56.6	56.9
Cypress Bridge 25	70.5	70.4
Cypress Bridge 32	48.7	48.7
Cypress Bridge 4	69.2	69.2
Cypress Bridge 20	n/a*	60.4
Cross Bar TQ-1 West	n/a*	73.2
Cross Bar T-3	68.5	68.8
Cross Bar Q-25 (Stop #7)	72.3	72.3
Cross Bar Q-1	72.5	72.7
Cone Ranch 1	86.9	86.9
Cone Ranch 2	90.5	90.5
Cone Ranch 3	95.4	95.4
Cone Ranch 4	99.0	99.0
Cone Ranch 5	105.2	105.2
Cone Ranch 6	96.0	96.0
North Pasco 3	44.4	44.4
North Pasco 21	44.5	44.5

n/a* indicates that we are proposing to drop the minimum wetland level and do not have a reevaluated level to propose.
n/a** indicates that it is a newly proposed minimum wetland level which does not have a previous level to compare to.

Table 3: Conversion of Wetland Minimum Levels from NGVD29 to NAVD88 based on the conversion factor for the staff gage at each wetland.

Wetland	Elevations in Feet NGVD29	Elevations in Feet NAVD88
Cypress Creek W-41	n/a*	n/a*
Cypress Creek W-11	67.8	66.9
Cypress Creek W-12	62.0	61.1
Cypress Creek W-17	62.8	61.9
Cypress Creek W-56 (G)	62.7	61.9
Starkey D	n/a*	n/a*
Starkey S-99	29.6	TBD*
Starkey Central	43.3	42.4
Starkey Z	39.7	38.9
Starkey Eastern (S-73)	44.6	43.8
Starkey S-75	45.4	44.6
Starkey M (S-69)	43.1	42.3
Starkey N	45.2	44.4
Morris Bridge Entry Dome (MBR-35)	33.8	32.9
Morris Bridge X-4 (MBR-89)	40.4	39.5
Morris Bridge Clay Gully Cypress (MBR-88)	39.6	38.8
Morris Bridge Unnamed (MBR-16)	32.1	31.2
Eldridge Wilde 5	27.1	26.3
Eldridge Wilde 11 (NW-44)	36.4	35.6
EWWF Salls Property Wetland 10S/10D	n/a*	n/a*
South Pasco 2 (NW-49)	57.2	56.4
South Pasco South Cypress	56.9	56.3
South Pasco 6 (NW-50)	57.4	56.6
S21 WF NW-53 East	n/a*	n/a*
Cosme WF Wetland	n/a*	n/a*
Cypress Bridge 16	58.4	57.6
Cypress Bridge A	56.6	55.8
Cypress Bridge 25	70.5	69.7
Cypress Bridge 32	48.7	47.9
Cypress Bridge 4	69.2	68.4
Cypress Bridge 20	n/a*	n/a*
Cross Bar TQ-1 West	n/a*	n/a*
Cross Bar T-3	68.5	67.6
Cross Bar Q-25 (Stop #7)	73.7	72.9
Cross Bar Q-1	72.5	71.7
Cone Ranch 1	86.9	86.1
Cone Ranch 2	90.5	89.7
Cone Ranch 3	95.4	94.6
Cone Ranch 4	99.0	98.2
Cone Ranch 5	105.2	104.3
Cone Ranch 6	96.0	95.1
North Pasco 3	44.4	43.6
North Pasco 21	44.5	43.7

n/a* indicates that the wetland minimum level is proposed to be removed
*Starkey S-99 is TBD because the staff gage is still in NGVD29 and will need to be updated to NAVD88 when the District takes over monitoring of the site

Minimum Levels Status Assessment

To assess if the Minimum Levels are being met, the Current P50, based on the year that cutbacks occurred (noted in Appendix B for each wetland), was calculated and compared to the minimum level. Table 4 shows the results of the status assessment through 2018 for the previously adopted minimum levels as well as the levels proposed in this report. Aside from the wetlands that are being proposed to be dropped or added, the changes to the minimum levels changed the result of the status assessment for one wetland, Cross Bar T-3. Cross Bar T-3 would have been Not Met using the previously adopted minimum level, yet Met using the proposed level.

All of the wetlands are within the region of the District covered by an existing recovery strategy for the Northern Tampa Bay Water Use Caution Area (Rule 40D-80.073, F.A.C.).The District plans to continue regular monitoring of water levels in each wetland and will also routinely evaluate the status of water levels with respect to adopted minimum levels included in Chapter 40D-8, F.A.C.

Table 4: Wetland Minimum Level Status Assessment

Wetland	Meeting Adopted MFL in 2018?	Meeting Proposed MFL in 2018?
Cypress Creek W-41	Not Met	N/A
Cypress Creek W-11	Met	Met
Cypress Creek W-12	Not Met	Not Met
Cypress Creek W-17	Met	Met
Cypress Creek W-56 (G)	Not Met	Not Met
Starkey D	Not Met	N/A
Starkey S-99	N/A	Met
Starkey Central	Met	Met
Starkey Z	Met	Met
Starkey Eastern (S-73)	Met	Met
Starkey S-75	Met	Met
Starkey M (S-69)	Met	Met
Starkey N	Met	Met
Morris Bridge Entry Dome (MBR-35)	Met	Met
Morris Bridge X-4 (MBR-89)	Met	Met
Morris Bridge Clay Gully Cypress (MBR-88)	Not Met	Not Met
Morris Bridge Unnamed (MBR-16)	Met	Met
Eldridge Wilde 5	N/A	Met
Eldridge Wilde 11 (NW-44)	Met	Met
EWWF Salls Property Wetland 10S/10D	Met	N/A
South Pasco 2 (NW-49)	Met	Met
South Pasco South Cypress	Met	Met
South Pasco 6 (NW-50)	Met	Met
S21 WF NW-53 East	Not Met	N/A
Cosme WF Wetland	Not Met	N/A
Cypress Bridge 16	Met	Met
Cypress Bridge A	Not Met	Not Met
Cypress Bridge 25	Met	Met
Cypress Bridge 32	Met	Met
Cypress Bridge 4	Met	Met
Cypress Bridge 20	N/A	N/A
Cross Bar TQ-1 West	Not Met	N/A
Cross Bar T-3	Not Met	Met
Cross Bar Q-25 (Stop #7)	Not Met	Not Met
Cross Bar Q-1	Not Met	Not Met
Cone Ranch 1	Met	Met
Cone Ranch 2	Met	Met
Cone Ranch 3	Met	Met
Cone Ranch 4	Met	Met
Cone Ranch 5	Met	Met
Cone Ranch 6	Met	Met
North Pasco 3	Met	Met
North Pasco 21	Met	Met

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Appendix A

Historic Normal Pool Summary

Cone Ranch 1

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	88.71
Cypress Buttress Inflection	88.68
Cypress Buttress Inflection	89.20
Cypress Buttress Inflection	88.68
Cypress Buttress Inflection	89.13
Cypress Buttress Inflection	88.75
Cypress Buttress Inflection	88.42
Cypress Buttress Inflection	88.25
Cypress Buttress Inflection	88.52
Cypress Buttress Inflection	88.65
Cypress Buttress Inflection	88.89
Cypress Buttress Inflection	88.73
Cypress Buttress Inflection	88.84
Cypress Buttress Inflection	88.67
Cypress Buttress Inflection	88.85
N	15
Median	**88.7**
Mean	88.73
SD	0.24

Cone Ranch 2

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	92.20
Cypress Buttress Inflection	92.30
Cypress Buttress Inflection	92.30
Cypress Buttress Inflection	92.30
Cypress Buttress Inflection	92.25
Cypress Buttress Inflection	92.30
Cypress Buttress Inflection	92.25
Cypress Buttress Inflection	92.30
Cypress Buttress Inflection	92.25
Cypress Buttress Inflection	92.35
Cypress Buttress Inflection	92.25
Cypress Buttress Inflection	92.30
N	12
Median	**92.30**
Mean	92.28
SD	0.04

Cone Ranch 3

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	97.26
Cypress Buttress Inflection	97.24
Cypress Buttress Inflection	97.24
Cypress Buttress Inflection	97.35
Cypress Buttress Inflection	97.66
Cypress Buttress Inflection	97.19
Cypress Buttress Inflection	97.15
Cypress Buttress Inflection	97.19
Cypress Buttress Inflection	97.31
Cypress Buttress Inflection	97.22
Cypress Buttress Inflection	97.41
Cypress Buttress Inflection	97.35
Cypress Buttress Inflection	97.22
Cypress Buttress Inflection	97.47
Cypress Buttress Inflection	97.38
N	15
Median	**97.26**
Mean	97.31
SD	0.13

Cone Ranch 4

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	100.88
Cypress Buttress Inflection	100.83
Cypress Buttress Inflection	100.73
Cypress Buttress Inflection	100.76
Cypress Buttress Inflection	100.80
Cypress Buttress Inflection	100.74
Cypress Buttress Inflection	100.79
Cypress Buttress Inflection	100.75
Cypress Buttress Inflection	100.72
Cypress Buttress Inflection	100.92
Cypress Buttress Inflection	100.83
Cypress Buttress Inflection	100.80
Cypress Buttress Inflection	100.79
Cypress Buttress Inflection	100.66
Cypress Buttress Inflection	100.74
N	15
Median	**100.8**
Mean	100.80
SD	0.06

Cone Ranch 5

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	106.93
Cypress Buttress Inflection	106.63
Cypress Buttress Inflection	106.98
Cypress Buttress Inflection	107.06
Cypress Buttress Inflection	107.08
Cypress Buttress Inflection	106.76
Cypress Buttress Inflection	106.98
Cypress Buttress Inflection	107.27
Cypress Buttress Inflection	107.39
Cypress Buttress Inflection	106.87
Cypress Buttress Inflection	107.04
Cypress Buttress Inflection	107.06
Cypress Buttress Inflection	107.10
Cypress Buttress Inflection	107.08
Cypress Buttress Inflection	106.92
N	15
Median	**107.0**
Mean	107.01
SD	0.18

Cone Ranch 6

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	97.92
Cypress Buttress Inflection	97.92
Cypress Buttress Inflection	97.96
Cypress Buttress Inflection	97.86
Cypress Buttress Inflection	97.86
Cypress Buttress Inflection	97.88
Cypress Buttress Inflection	97.8
Cypress Buttress Inflection	97.86
Cypress Buttress Inflection	97.88
N	9
Median	**97.88**
Mean	97.88
SD	0.05

Cosme

Indicator Type	Elevation (NGVD29)
Palmetto with Offset	41.70
Palmetto with Offset	41.31
Palmetto with Offset	41.21
Palmetto with Offset	41.61
Cypress Buttress Inflection	41.56
Cypress Buttress Inflection	40.39
Cypress Buttress Inflection	41.91
Lichen Line	41.21
Cypress Buttress Inflection	41.86
Palmetto with Offset	41.16
Cypress Buttress Inflection	41.21
N	10
Median	**41.4**
Mean	41.39
SD	0.45

Cross Bar TQ-1 West

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	74.31
Cypress Buttress Inflection	74.41
Cypress Buttress Inflection	74.41
Cypress Buttress Inflection	74.29
Cypress Buttress Inflection	74.41
Cypress Buttress Inflection	74.41
Cypress Buttress Inflection	74.36
Cypress Buttress Inflection	74.31
Cypress Buttress Inflection	74.31
Cypress Buttress Inflection	74.31
Cypress Buttress Inflection	74.37
Cypress Buttress Inflection	74.36
Cypress Buttress Inflection	74.36
Cypress Buttress Inflection	74.33
Cypress Buttress Inflection	74.26
N	14
Median	**74.4**
Mean	74.35
SD	0.04

Cross Bar T-3

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	70.33
Cypress Buttress Inflection	70.33
Cypress Buttress Inflection	70.28
Cypress Buttress Inflection	70.28
Cypress Buttress Inflection	70.38
Cypress Buttress Inflection	70.33
Cypress Buttress Inflection	70.35
Cypress Buttress Inflection	70.32
Cypress Buttress Inflection	70.35
Cypress Buttress Inflection	70.33
Cypress Buttress Inflection	70.31
Cypress Buttress Inflection	70.38
Cypress Buttress Inflection	70.33
Cypress Buttress Inflection	70.34
Cypress Buttress Inflection	70.35
N	15
Median	**70.3**
Mean	70.33
SD	0.03

Cross Bar Stop #7

Indicator Type	Elevation (NGVD29)
Base of Outer Cypress with Offset (South)	75.62
Base of Outer Cypress with Offset (South)	75.38
Base of Outer Cypress with Offset (South)	75.21
Base of Outer Cypress with Offset (South)	75.54
Base of Outer Cypress with Offset (South)	75.64
Base of Outer Cypress with Offset (South)	75.54
Base of Outer Cypress with Offset (South)	75.46
Base of Outer Cypress with Offset (North)	73.96
Base of Outer Cypress with Offset (North)	74.06
Base of Outer Cypress with Offset (North)	74.14
Base of Outer Cypress with Offset (North)	74.46
Base of Outer Cypress with Offset (North)	74.10
Base of Outer Cypress with Offset (North)	74.26
Base of Outer Cypress with Offset (North)	74.17
Cypress Buttress Inflection (North)	73.22
Cypress Buttress Inflection (North)	74.18
N	16
Median	**74.4**
Mean	74.68
SD	0.78

Cross Bar Q-1

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	74.34
Cypress Buttress Inflection	74.32
Cypress Buttress Inflection	74.35
Cypress Buttress Inflection	74.32
Cypress Buttress Inflection	74.31
Cypress Buttress Inflection	74.27
Cypress Buttress Inflection	74.35
Cypress Buttress Inflection	74.33
Cypress Buttress Inflection	74.27
Cypress Buttress Inflection	74.22
Cypress Buttress Inflection	74.27
Cypress Buttress Inflection	74.29
Cypress Buttress Inflection	74.31
Cypress Buttress Inflection	74.32
Cypress Buttress Inflection	74.30
N	15
Median	**74.3**
Mean	74.30
SD	0.04

Cypress Bridge 16

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	60.18
Cypress Buttress Inflection	60.13
Cypress Buttress Inflection	60.16
Cypress Buttress Inflection	60.18
Cypress Buttress Inflection	60.14
Cypress Buttress Inflection	60.20
Cypress Buttress Inflection	60.13
Cypress Buttress Inflection	60.16
Cypress Buttress Inflection	60.12
Cypress Buttress Inflection	60.20
Cypress Buttress Inflection	60.16
Cypress Buttress Inflection	60.14
Cypress Buttress Inflection	60.16
Cypress Buttress Inflection	60.23
Cypress Buttress Inflection	60.18
N	15
Median	**60.2**
Mean	60.16
SD	0.03

Cypress Bridge A

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	58.45
Cypress Buttress Inflection	58.45
Cypress Buttress Inflection	58.50
Cypress Buttress Inflection	58.52
Cypress Buttress Inflection	58.48
Cypress Buttress Inflection	58.50
Cypress Buttress Inflection	58.52
Cypress Buttress Inflection	58.45
Cypress Buttress Inflection	58.35
Cypress Buttress Inflection	58.42
Cypress Buttress Inflection	58.42
Cypress Buttress Inflection	58.38
Cypress Buttress Inflection	58.34
Cypress Buttress Inflection	58.38
Cypress Buttress Inflection	58.42
N	15
Median	**58.45**
Mean	58.44
SD	0.06

Cypress Bridge 25

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	72.33
Cypress Buttress Inflection	72.38
Cypress Buttress Inflection	72.20
Cypress Buttress Inflection	72.26
Cypress Buttress Inflection	72.30
Cypress Buttress Inflection	72.33
Cypress Buttress Inflection	72.42
Cypress Buttress Inflection	72.26
Cypress Buttress Inflection	72.39
Cypress Buttress Inflection	72.21
Cypress Buttress Inflection	72.34
Cypress Buttress Inflection	72.24
Cypress Buttress Inflection	72.32
N	13
Median	**72.3**
Mean	72.31
SD	0.07

Cypress Bridge 32

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	50.50
Cypress Buttress Inflection	50.55
Cypress Buttress Inflection	50.50
Cypress Buttress Inflection	50.45
Cypress Buttress Inflection	50.50
Cypress Buttress Inflection	50.50
Cypress Buttress Inflection	50.55
Cypress Buttress Inflection	50.50
Cypress Buttress Inflection	50.50
Cypress Buttress Inflection	50.45
Cypress Buttress Inflection	50.55
Cypress Buttress Inflection	50.50
Cypress Buttress Inflection	50.45
Cypress Buttress Inflection	50.55
Cypress Buttress Inflection	50.50
N	15
Median	**50.5**
Mean	50.50
SD	0.04

Cypress Bridge 4

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	70.96
Cypress Buttress Inflection	71.07
Cypress Buttress Inflection	71.03
Cypress Buttress Inflection	70.93
Cypress Buttress Inflection	71.00
Cypress Buttress Inflection	70.95
Cypress Buttress Inflection	71.01
Cypress Buttress Inflection	71.06
Cypress Buttress Inflection	71.06
Cypress Buttress Inflection	70.95
Cypress Buttress Inflection	70.97
Cypress Buttress Inflection	71.03
Cypress Buttress Inflection	70.95
Cypress Buttress Inflection	71.06
Cypress Buttress Inflection	71.02
N	15
Median	**71.0**
Mean	71.00
SD	0.05

Cypress Bridge 20

Indicator Type	Elevation (NGVD29)
N/A	N/A

Cypress Creek W-41

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	75.40
Cypress Buttress Inflection	75.19
Cypress Buttress Inflection	75.58
Cypress Buttress Inflection	75.31
Cypress Buttress Inflection	75.25
Cypress Buttress Inflection	75.24
Cypress Buttress Inflection	75.15
Cypress Buttress Inflection	75.21
Cypress Buttress Inflection	75.38
Cypress Buttress Inflection	75.25
Cypress Buttress Inflection	75.20
Cypress Buttress Inflection	74.97
Cypress Buttress Inflection	75.06
Cypress Buttress Inflection	75.17
Cypress Buttress Inflection	75.18
N	15
Median	**75.2**
Mean	75.24
SD	0.14

Cypress Creek W-11

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	69.69
Cypress Buttress Inflection	69.58
Cypress Buttress Inflection	69.65
Cypress Buttress Inflection	69.71
Cypress Buttress Inflection	69.25
Cypress Buttress Inflection	69.59
Cypress Buttress Inflection	69.67
Cypress Buttress Inflection	69.76
Cypress Buttress Inflection	69.61
Cypress Buttress Inflection	69.59
Cypress Buttress Inflection	69.62
Cypress Buttress Inflection	69.71
Cypress Buttress Inflection	69.67
Cypress Buttress Inflection	69.83
Cypress Buttress Inflection	69.72
N	15
Median	**69.67**
Mean	69.64
SD	0.13

Cypress Creek W-12

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	64.04
Cypress Buttress Inflection	63.90
Cypress Buttress Inflection	63.81
Cypress Buttress Inflection	63.80
Cypress Buttress Inflection	63.78
Cypress Buttress Inflection	63.64
Cypress Buttress Inflection	63.48
Cypress Buttress Inflection	63.48
Cypress Buttress Inflection	63.82
Cypress Buttress Inflection	63.52
Cypress Buttress Inflection	63.80
Cypress Buttress Inflection	63.66
Cypress Buttress Inflection	67.24
N	13
Median	**63.8**
Mean	64.00
SD	0.99

Cypress Creek W-17

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	64.68
Cypress Buttress Inflection	64.58
Cypress Buttress Inflection	64.59
Cypress Buttress Inflection	64.73
Cypress Buttress Inflection	64.54
Cypress Buttress Inflection	64.63
Cypress Buttress Inflection	64.73
Cypress Buttress Inflection	64.57
Cypress Buttress Inflection	64.68
Cypress Buttress Inflection	64.73
Cypress Buttress Inflection	64.68
Cypress Buttress Inflection	64.73
Cypress Buttress Inflection	64.60
Cypress Buttress Inflection	64.62
Cypress Buttress Inflection	64.63
N	15
Median	**64.6**
Mean	64.65
SD	0.07

Cypress Creek W-56 (G)

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	64.49
Cypress Buttress Inflection	64.51
Cypress Buttress Inflection	64.48
Cypress Buttress Inflection	64.50
Cypress Buttress Inflection	64.53
Cypress Buttress Inflection	64.58
Cypress Buttress Inflection	64.51
Cypress Buttress Inflection	64.58
Cypress Buttress Inflection	64.47
Cypress Buttress Inflection	64.53
Cypress Buttress Inflection	64.55
Cypress Buttress Inflection	64.47
Cypress Buttress Inflection	64.53
Cypress Buttress Inflection	64.53
Cypress Buttress Inflection	64.49
N	15
Median	**64.5**
Mean	64.52
SD	0.04

Eldridge Wilde 11

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	38.26
Cypress Buttress Inflection	38.41
Cypress Buttress Inflection	38.17
Cypress Buttress Inflection	38.12
Cypress Buttress Inflection	38.16
Cypress Buttress Inflection	38.07
Cypress Buttress Inflection	38.23
Cypress Buttress Inflection	38.24
Cypress Buttress Inflection	38.19
Cypress Buttress Inflection	38.32
Cypress Buttress Inflection	38.26
Cypress Buttress Inflection	38.16
Cypress Buttress Inflection	38.23
Cypress Buttress Inflection	38.42
Cypress Buttress Inflection	38.23
Cypress Buttress Inflection	38.27
Cypress Buttress Inflection	38.13
N	17
Median	**38.2**
Mean	38.23
SD	0.09

Eldridge Wilde Salls

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	22.71
Cypress Buttress Inflection	22.71
Cypress Buttress Inflection	22.73
Cypress Buttress Inflection	22.65
Cypress Buttress Inflection	22.52
Cypress Buttress Inflection	22.57
Cypress Buttress Inflection	22.74
Cypress Buttress Inflection	22.61
Cypress Buttress Inflection	22.67
Cypress Buttress Inflection	22.57
Cypress Buttress Inflection	22.57
Cypress Buttress Inflection	22.64
Cypress Buttress Inflection	22.54
Cypress Buttress Inflection	22.62
Cypress Buttress Inflection	22.76
Cypress Buttress Inflection	22.48
Cypress Buttress Inflection	22.54
N	17
Median	**22.62**
Mean	22.63
SD	0.09

Eldridge Wilde 5

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	28.90
Cypress Buttress Inflection	29.00
Cypress Buttress Inflection	29.00
Cypress Buttress Inflection	28.90
Cypress Buttress Inflection	28.95
Cypress Buttress Inflection	29.00
Cypress Buttress Inflection	28.95
N	7
Median	**28.95**
Mean	28.96
SD	0.04

Morris Bridge Entry Dome

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	35.73
Cypress Buttress Inflection	35.70
Cypress Buttress Inflection	35.68
Cypress Buttress Inflection	35.67
Cypress Buttress Inflection	35.66
Cypress Buttress Inflection	35.64
Cypress Buttress Inflection	35.64
Cypress Buttress Inflection	35.64
Cypress Buttress Inflection	35.63
Cypress Buttress Inflection	35.63
Cypress Buttress Inflection	35.63
Cypress Buttress Inflection	35.61
Cypress Buttress Inflection	35.59
N	13
Median	**35.6**
Mean	35.65
SD	0.04

Morris Bridge X-4

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	42.05
Cypress Buttress Inflection	42.20
Cypress Buttress Inflection	41.93
Cypress Buttress Inflection	42.09
Cypress Buttress Inflection	42.29
Cypress Buttress Inflection	42.00
Cypress Buttress Inflection	42.30
Cypress Buttress Inflection	42.35
Cypress Buttress Inflection	41.98
Cypress Buttress Inflection	42.20
Cypress Buttress Inflection	42.21
N	11
Median	**42.2**
Mean	42.15
SD	0.14

Morris Bridge Clay Gully Cypress

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	41.48
Cypress Buttress Inflection	42.06
Cypress Buttress Inflection	41.61
Cypress Buttress Inflection	41.59
Cypress Buttress Inflection	41.39
Cypress Buttress Inflection	41.78
Cypress Buttress Inflection	41.78
Cypress Buttress Inflection	41.73
Cypress Buttress Inflection	40.98
Cypress Buttress Inflection	40.93
Cypress Buttress Inflection	41.35
Cypress Buttress Inflection	41.36
Cypress Buttress Inflection	41.38
Cypress Buttress Inflection	41.35
Cypress Buttress Inflection	41.37
N	15
Median	**41.4**
Mean	41.48
SD	0.30

Morris Bridge Unnamed

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	33.86
Cypress Buttress Inflection	33.89
Cypress Buttress Inflection	33.05
Cypress Buttress Inflection	34.14
Cypress Buttress Inflection	33.88
Cypress Buttress Inflection	33.86
Cypress Buttress Inflection	33.86
Cypress Buttress Inflection	33.89
Cypress Buttress Inflection	33.89
Cypress Buttress Inflection	33.86
Cypress Buttress Inflection	33.92
N	11
Median	**33.9**
Mean	33.83
SD	0.27

North Pasco 3

Indicator Type	Elevation (NGVD29)
Lyonia Lucida	46.01
Lyonia Lucida	46.07
Lyonia Lucida	46.12
Lyonia Lucida	46.14
Lyonia Lucida	46.12
Lyonia Lucida	46.07
Lyonia Lucida	46.01
Lyonia Lucida	46.07
Lyonia Lucida	46.12
Cypress Buttress Inflection	46.24
Cypress Buttress Inflection	46.34
Cypress Buttress Inflection	46.61
Cypress Buttress Inflection	46.26
Cypress Buttress Inflection	46.76
Cypress Buttress Inflection	46.28
Cypress Buttress Inflection	46.34
Cypress Buttress Inflection	46.38
Cypress Buttress Inflection	46.58
Cypress Buttress Inflection	46.25
Cypress Buttress Inflection	46.36
Cypress Buttress Inflection	46.34
Cypress Buttress Inflection	46.41
Cypress Buttress Inflection	46.55
Cypress Buttress Inflection	46.41
N	24
Median	**46.27**
Mean	46.29
SD	0.20

North Pasco 21

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	46.35
Cypress Buttress Inflection	46.22
Cypress Buttress Inflection	46.24
Cypress Buttress Inflection	46.28
Cypress Buttress Inflection	46.35
Cypress Buttress Inflection	46.33
Cypress Buttress Inflection	46.27
Cypress Buttress Inflection	46.31
Cypress Buttress Inflection	46.37
Cypress Buttress Inflection	46.25
Cypress Buttress Inflection	46.37
Cypress Buttress Inflection	46.31
Cypress Buttress Inflection	46.31
N	13
Median	**46.31**
Mean	46.30
SD	0.05

Section 21

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	54.08
Cypress Buttress Inflection	54.08
Cypress Buttress Inflection	53.98
Cypress Buttress Inflection	53.88
Cypress Buttress Inflection	53.88
Cypress Buttress Inflection	53.95
Cypress Buttress Inflection	53.93
Cypress Buttress Inflection	53.98
Cypress Buttress Inflection	53.98
Cypress Buttress Inflection	53.93
Cypress Buttress Inflection	53.93
Cypress Buttress Inflection	53.94
Cypress Buttress Inflection	53.92
Cypress Buttress Inflection	53.95
Cypress Buttress Inflection	53.98
N	15
Median	**53.95**
Mean	53.96
SD	0.06

South Pasco 2 (NW-49)

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	59.23
Cypress Buttress Inflection	59.31
Cypress Buttress Inflection	59.15
Cypress Buttress Inflection	58.93
Cypress Buttress Inflection	58.99
Cypress Buttress Inflection	58.90
Cypress Buttress Inflection	58.94
Cypress Buttress Inflection	58.94
Cypress Buttress Inflection	59.18
Cypress Buttress Inflection	59.14
Cypress Buttress Inflection	59.02
Cypress Buttress Inflection	58.86
Cypress Buttress Inflection	58.96
Cypress Buttress Inflection	59.19
Cypress Buttress Inflection	59.23
N	15
Median	**59.0**
Mean	59.06
SD	0.14

South Cypress

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	58.72
Cypress Buttress Inflection	58.72
Cypress Buttress Inflection	58.69
Cypress Buttress Inflection	58.72
Cypress Buttress Inflection	58.72
Cypress Buttress Inflection	58.59
Cypress Buttress Inflection	58.70
Cypress Buttress Inflection	58.67
Cypress Buttress Inflection	58.67
Cypress Buttress Inflection	58.72
Cypress Buttress Inflection	58.69
Cypress Buttress Inflection	58.63
Cypress Buttress Inflection	58.71
Cypress Buttress Inflection	58.67
Cypress Buttress Inflection	58.69
N	15
Median	**58.7**
Mean	58.69
SD	0.04

South Pasco 6 (NW-50)

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	59.20
Cypress Buttress Inflection	59.15
Cypress Buttress Inflection	59.24
Cypress Buttress Inflection	59.20
Cypress Buttress Inflection	59.21
Cypress Buttress Inflection	59.21
Cypress Buttress Inflection	59.09
Cypress Buttress Inflection	59.12
Cypress Buttress Inflection	59.05
Cypress Buttress Inflection	59.16
Cypress Buttress Inflection	59.16
Cypress Buttress Inflection	59.05
Cypress Buttress Inflection	59.06
Cypress Buttress Inflection	59.04
Cypress Buttress Inflection	59.05
N	15
Median	**59.2**
Mean	59.13
SD	0.07

Starkey D

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	30.97
Cypress Buttress Inflection	31.07
Cypress Buttress Inflection	30.90
Cypress Buttress Inflection	31.06
Cypress Buttress Inflection	31.09
Cypress Buttress Inflection	31.05
Cypress Buttress Inflection	31.25
Cypress Buttress Inflection	31.00
Cypress Buttress Inflection	31.08
Cypress Buttress Inflection	30.98
Cypress Buttress Inflection	30.99
N	11
Median	**31.1**
Mean	31.04
SD	0.09

Starkey S-99

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	31.23
Cypress Buttress Inflection	31.23
Cypress Buttress Inflection	31.43
Cypress Buttress Inflection	31.23
Cypress Buttress Inflection	31.48
Cypress Buttress Inflection	31.43
Cypress Buttress Inflection	31.33
Cypress Buttress Inflection	31.33
Cypress Buttress Inflection	31.43
Cypress Buttress Inflection	31.23
Cypress Buttress Inflection	31.53
Cypress Buttress Inflection	31.58
Cypress Buttress Inflection	31.63
Cypress Buttress Inflection	31.48
Cypress Buttress Inflection	31.33
N	15
Median	**31.4**
Mean	31.39
SD	0.13

Starkey Central

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	45.18
Cypress Buttress Inflection	45.15
Cypress Buttress Inflection	45.29
Cypress Buttress Inflection	45.09
Cypress Buttress Inflection	45.14
Cypress Buttress Inflection	45.12
Cypress Buttress Inflection	44.99
Cypress Buttress Inflection	45.09
Cypress Buttress Inflection	45.06
Cypress Buttress Inflection	45.17
Cypress Buttress Inflection	45.08
Cypress Buttress Inflection	45.23
Cypress Buttress Inflection	45.15
Cypress Buttress Inflection	45.21
Cypress Buttress Inflection	45.06
N	15
Median	**45.1**
Mean	45.13
SD	0.08

Starkey Z

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	41.51
Cypress Buttress Inflection	41.49
Cypress Buttress Inflection	41.53
Cypress Buttress Inflection	41.50
Cypress Buttress Inflection	41.60
Cypress Buttress Inflection	41.62
Cypress Buttress Inflection	41.54
Cypress Buttress Inflection	41.40
Cypress Buttress Inflection	41.48
Cypress Buttress Inflection	41.50
Cypress Buttress Inflection	41.56
Cypress Buttress Inflection	41.57
Cypress Buttress Inflection	41.59
Cypress Buttress Inflection	41.63
Cypress Buttress Inflection	41.52
N	15
Median	**41.5**
Mean	41.54
SD	0.06

Starkey Eastern

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	46.30
Cypress Buttress Inflection	46.33
Cypress Buttress Inflection	46.41
Cypress Buttress Inflection	46.33
Cypress Buttress Inflection	46.37
Cypress Buttress Inflection	46.36
Cypress Buttress Inflection	46.49
Cypress Buttress Inflection	46.41
Cypress Buttress Inflection	46.28
Cypress Buttress Inflection	46.40
Cypress Buttress Inflection	46.41
Cypress Buttress Inflection	46.40
Cypress Buttress Inflection	46.43
Cypress Buttress Inflection	46.34
Cypress Buttress Inflection	46.46
N	15
Median	**46.4**
Mean	46.38
SD	0.06

Starkey S-75

The original field sheet could not be located. However, records state that on 11/1/2014 an EPC field team led by Scott Emery surveyed HNP indicators at the wetland. The water level was 46.92' NGVD29 at the time, and the following was measured:

- 13 Cypress Buttress Inflection points with the median at 47.20' NGVD29 (range 47.18' - 47.24').
- 11 Lyonia with a median at 47.21' NGVD29 (range 47.17' – 47.25')

Starkey M

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	45.06
Cypress Buttress Inflection	44.64
Cypress Buttress Inflection	44.85
Cypress Buttress Inflection	44.76
Cypress Buttress Inflection	44.80
Cypress Buttress Inflection	44.90
Cypress Buttress Inflection	45.00
Cypress Buttress Inflection	44.90
Cypress Buttress Inflection	44.96
Cypress Buttress Inflection	44.94
Cypress Buttress Inflection	44.76
Cypress Buttress Inflection	44.99
Cypress Buttress Inflection	44.84
Cypress Buttress Inflection	44.80
Cypress Buttress Inflection	45.04
N	15
Median	**44.9**
Mean	44.88
SD	0.12

Starkey N

Indicator Type	Elevation (NGVD29)
Cypress Buttress Inflection	47.01
Cypress Buttress Inflection	47.03
Cypress Buttress Inflection	47.05
Cypress Buttress Inflection	47.07
Cypress Buttress Inflection	47.03
Cypress Buttress Inflection	47.01
Cypress Buttress Inflection	47.04
Cypress Buttress Inflection	46.97
Cypress Buttress Inflection	46.93
Cypress Buttress Inflection	46.97
Cypress Buttress Inflection	46.89
Cypress Buttress Inflection	47.01
Cypress Buttress Inflection	47.06
Cypress Buttress Inflection	46.95
Cypress Buttress Inflection	47.05
N	15
Median	**47.0**
Mean	47.00
SD	0.05

Appendix B

Structural Alteration Considerations and Calculations

Wetland	HNP	MFL	Lowest Outflow Measured	Description of Outflow	Structurally Altered?	Current Period Start Date	Current P10	Current P50	Current P10/P50 Difference	HGL	Historic P50	Discussion
Reevaluated MFLs												
CC W-41												
CC W-11	69.6	67.8	69.0	Naturalized Swale	Possibly	2003	69.3	68.5	0.8	69.3	68.5	Historic P50 is 0.7 feet above MFL
CC W-12	63.8	62.0	63.4	Natural Saddle	Possibly	2003	63.4	62.0	1.4	63.4	62.4	Historic P50 is 0.4 feet above MFL
CC W-17	64.6	62.8	64.7	Natural Saddle	No	2003	64.7	63.2	1.5	64.7	63.7	Historic P50 is 0.9 feet above MFL. Outlet at or above HNP.
CC SITE G	64.5	62.7	64.5	Natural Saddle	No	2003	64.4	61.7	2.7	64.5	63.5	Historic P50 is 0.8 feet above MFL. Outlet at or above HNP
STWF D												
STWF CENTRAL	45.1	43.3	45.1	Natural Saddle	No	2008	45.1	43.9	1.2	45.1	44.1	Historic P50 is 0.8 feet above MFL. Outlet at or above HNP
STWF Z	41.5	39.7	41.4	Natural Saddle	Possibly	2008	41.3	40.2	1.1	41.4	40.4	Historic P50 is 0.7 feet above MFL
STWF EASTERN	46.4	44.6	46.1	Natural Saddle	Possibly	2008	46.2	45.5	0.7	46.2	45.5	Historic P50 is 0.9 feet above MFL
STWF S-75	47.2	45.4	46.9	Natural Saddle	Possibly	2008	47.1	46.5	0.6	47.1	46.5	Historic P50 is 1.1 feet above MFL

Wetland	HNP	MFL	Lowest Outflow Measured	Description of Outflow	Structurally Altered?	Current Period Start Date	Current P10	Current P50	Current P10/P50 Difference	HGL	Historic P50	Discussion
STWF M	44.9	43.1	44.5	Natural Saddle	Possibly	2008	44.8	44.2	0.6	44.8	44.2	Historic P50 is 1.1 feet above MFL
STWF N	47.0	45.2	47.0	Natural Saddle	No	2008	47.1	46.6	0.5	47.1	46.6	Historic P50 is 1.4 feet above MFL
MBWF ENTRY DOME	35.6	33.8	35.5	Natural Saddle	Possibly	2003	35.3	33.9	1.4	35.5	34.5	Historic P50 is 0.7 feet above MFL
MBWF X-4	42.2	40.4	41.9	Natural Saddle	Possibly	2003	42.3	41.3	1.0	42.3	41.3	Historic P50 is 0.9 feet above MFL
MBWF CLAY GULLY CYPRESS	41.4	39.6	41.6	Natural Saddle	No	2003	41.3	38.9	2.4	41.4	40.4	Historic P50 is 0.8 feet above MFL Outlet at or above HNP
MBWF UNNAMED	33.9	32.1	33.9	Natural Saddle	No	2003	34.0	32.6	1.4	34.0	33.0	Historic P50 is 0.9 feet above MFL. Outlet at or above HNP
EWWF NW-44	38.2	36.4	38.3	Naturalized Swale	No	2003	38.1	36.5	1.6	38.2	37.2	Historic P50 is 0.8 feet above MFL Outlet at or above HNP
EWWF SALLS 10S/10D												
SPWF NW-49	59.0	57.2	58.4	Natural Saddle	Possibly	2003	58.8	57.8	1.0	58.8	57.8	Historic P50 is 0.6 feet above MFL

Wetland	HNP	MFL	Lowest Outflow Measured	Description of Outflow	Structurally Altered?	Current Period Start Date	Current P10	Current P50	Current P10/P50 Difference	HGL	Historic P50	Discussion
SPWF SOUTH CYPRESS	58.7	56.9	58.7	Natural Saddle	No	2003	58.6	57.9	0.7	58.7	58.0	Historic P50 is 1.1 feet above MFL. Outlet at or above HNP
SPWF NW-50	59.2	57.4	58.9	Natural Saddle	Possibly	2003	59.1	57.8	1.3	59.1	58.1	Historic P50 is 0.7 feet above MFL
S21 WF NW-53 EAST												
COSME WF WETLAND												
CBRWF #16	60.2	58.4	59.4	Swale	Possibly	2006	59.7	59.0	0.7	59.7	59.0	Historic P50 is 0.6 feet above MFL
CBRWF A	58.4	56.6	57.6	Hardened Swale	Possibly	2006	58.0	55.3	2.7	58.0	57.0	Historic P50 is 0.4 feet above MFL
CBRWF #25	72.3	70.5	71.6	Wide overland flow	Possibly	2006	71.9	71.3	0.6	71.9	71.3	Historic P50 is 0.8 feet above MFL
CBRWF #32	50.5	48.7	50.5	Structure	No	2006	50.3	49.4	0.9	50.5	49.6	Historic P50 is 0.9 feet above MFL. Outlet at or above HNP
CBRWF #4	71.0	69.2	70.3	Structure	Possibly	2006	70.4	70.0	0.4	70.4	70.0	Historic P50 is 0.8 feet above MFL
CBRWF #20												
CBARWF TQ-1 WEST												
CBARWF T-3	70.3	68.5	69.9	Low point on road	Possibly	2003	70.8	68.6	2.2	70.8	69.8	Historic P50 is 1.3 feet above MFL
CBARWF STOP #7	75.5	73.7	75.3	Natural Saddle	Possibly	2003	73.8	70.8	3.0	75.3	74.3	Historic P50 is 0.6 feet above MFL

Wetland	HNP	MFL	Lowest Outflow Measured	Description of Outflow	Structurally Altered?	Current Period Start Date	Current P10	Current P50	Current P10/P50 Difference	HGL	Historic P50	Discussion
CBARWF Q-1	74.3	72.5	74.0	Low point on road	Possibly	2003	74.1	71.4	2.7	74.1	73.1	Historic P50 is 0.6 feet above MFL
CR1	88.7	86.9	88.2	Natural Saddle	Possibly	2004	88.5	87.6	0.9	88.5	87.6	Historic P50 is 0.7 feet above MFL
CR2	92.3	90.5	92.3	Natural Saddle	No	2004	92.2	91.0	1.2	92.3	91.3	Historic P50 is 0.8 feet above MFL. Outlet at or above HNP.
CR3	97.2	95.4	97.2	Natural Saddle	No	2004	97.1	96.6	0.5	97.2	96.7	Historic P50 is 1.3 feet above MFL. Outlet at or above HNP.
CR4	100.8	99.0	100.9	Natural Saddle	No	2004	100.6	99.4	1.2	100.8	99.8	Historic P50 is 0.8 feet above MFL. Outlet at or above HNP
CR5	107.0	105.2	106.4	Natural Saddle	Possibly	2004	106.7	105.5	1.2	106.7	105.7	Historic P50 is 0.5 feet above MFL
CR6	97.8	96.0	97.7	Natural Saddle	Possibly	2004	97.8	97.4	0.4	97.8	97.4	Historic P50 is 1.4 feet above MFL
NPWF #3	46.2	44.4	45.7	Natural Saddle	Possibly	2008	46.0	45.0	1.0	46.0	45.0	Historic P50 is 0.6 feet above MFL
NPWF #21	46.3	44.5	46.4	Natural Saddle	No	2008	46.2	45.0	1.2	46.3	45.3	Historic P50 is 0.8 feet above MFL. Outlet at or above HNP
Proposed MFLs												
STWF S-99	31.4	29.6	31.1	Natural Saddle	Possibly	2008	31.2	30.3	0.9	31.2	30.3	Historic P50 is 0.7 feet above MFL
EWWF 5	28.9	27.1	28.9	Natural Saddle	No	2003	28.9	27.5	1.4	28.9	27.9	Historic P50 is 0.8 feet above MFL. Outlet at or above HNP