

**DEPARTMENT OF THE ARMY PERMIT APPLICATION  
APRIL 2020**

**COLLIER COUNTY  
COMPREHENSIVE WATERSHED IMPROVEMENT PLAN  
COLLIER COUNTY, FLORIDA**

**SUPPLEMENTAL INFORMATION  
ATTACHMENT 10  
OPERATIONS & MANAGEMENT PLAN**

## Supplemental Information Attachment 10 - Collier County Watershed Improvement Plan Conceptual Operations & Management Plan

### Pump Operations

Pumped diversion rates were established through hydrologic and hydraulic modeling of water availability in the Golden Gate Canal, in combination with an analysis of downstream effects on hydrology, vegetation, and infrastructure (Refer to **Supplemental Information Attachment 5: Hydrologic and Hydraulic Modeling Narrative**). The proposed pumped diversion rates are 100 cfs whenever flows in the GGC (in the vicinity of GG3 control structure) exceed 450 cfs, and 50 cfs whenever the flow is between 200 cfs and 450 cfs.

Pump operations will be tied to observations of headwater elevation (HW), tailwater elevation (TW), and gate position (GP) at the GG3 structure. The SFWMD has developed rating formulas that relate these three levels to discharge rates through the structure. When the combination of levels indicates that the discharge through GG3 exceeds 200 cfs, pumping from the GGC into the northern flowway will begin at a rate of 50 cfs. Because the pump station will be located upstream of GG3, the discharge through GG3 will be reduced by 50 cfs.

When the combination of levels indicates that discharges through the GG3 structure exceed 400 cfs (i.e., a total GGC flow of 450 cfs including the 50 cfs pumped diversion), the pumping rate will be increased by an additional 50 cfs, for a total pumped diversion of 100 cfs. When the discharge rate through GG3 drops below 350 cfs, the pumping rate will fall back to 50 cfs. When the discharge through GG3 drops below 150 cfs, the pumps will be turned off. The southern pump station on the I-75 South canal will be operated in tandem with the northern pump station, with a 5-hour lag to account for the travel time between the two pump stations.

Pumps will be shut off when any of the following occurs:

1. The 72-hour rainfall forecasts anywhere in the project area exceeds 5 inches of rainfall. Rainfall forecasts are published daily at: <https://www.wpc.ncep.noaa.gov/qpf/day1-3.shtml> and at <https://www.sfwmd.gov/weather-radar/sfwmd-forecast>. The 5-inch depth is approximately one-half of the 3-Day, 10-year rainfall per the SFWMD ERP Basis of Review.
2. High water levels in the CWIP effect area are observed that may result in negative impacts to infrastructure.
3. Flooding conditions are observed in any of the developed areas downstream of the I-75 pump station, including Sabal Palm Road (West of Triple G Loop).

### Proposed Gated Control Structure on I-75 North Canal

An operable underflow/sluice gate will be built in the I-75 North Canal just west of the junction between the North Belle Meade Flowway and the I-75 North Canal. The purpose of the gate is to keep pumped CWIP water from flowing westwards into the Henderson Creek Canal. The operable gate will be designed to close partially on days when CCWIP discharge is being pumped into I-75 North Canal and will ensure uninterrupted and unobstructed flows for the rest of the days when pumps are off. Approximately 30 minutes after the commencement of pumping into the northern flowway, the gate will be partially closed, to a level of approximately 0.6 feet above the sill elevation. When pumping stops, the gate will be fully opened (following a 30-minute lag) and will remain fully open until pumps are re-started.

## Monitoring Plan

Collier County has defined a monitoring plan, installed a monitoring system, and is currently collecting background information from that system. Sixty shallow wells were installed to a target depth of approximately four (4) feet below grade surface or until refusal occurred. Hobo MX2001 water level loggers were installed to record water depths at four (4) hour intervals and is downloaded quarterly. Water quality data is collected during each download event at 20 of the wells. At each well location, beginning with well installation in the late spring and summer of 2019, transect and plot vegetation data, along with site photographs are recorded annually. The vegetation sampling plan includes groundcover, mid-story, and canopy species measurements to allow understanding of both short-term and long-term vegetation community responses and allow consideration of conditions important to key plant and animal species. The pre-construction data collection period will provide the baseline information that will allow validation of the hydrologic simulation model and if appropriate modification of the model parameters to best simulate the existing conditions. During project operation, the collected data will support validation of the model (with modifications if appropriate) and allow adaptive management to provide the long-term best project execution of the project. The basic monitoring system is described in further in **Appendix 1: Monitoring Plan.**

## **APPENDIX 1: MONTORING PLAN**



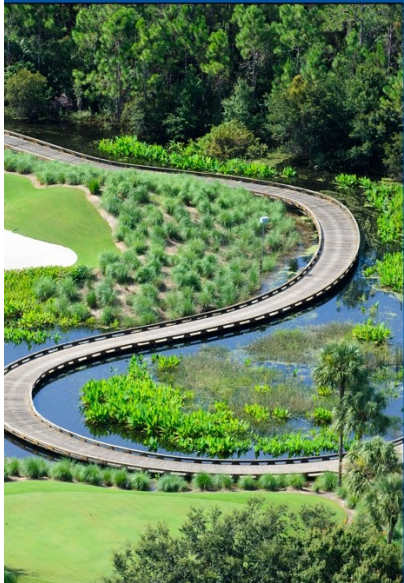
# COLLIER COUNTY COMPREHENSIVE WATERSHED IMPROVEMENT PLAN

## MONITORING PLAN

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**Attachments**

- Attachment A** Proposed Monitoring Well Locations
- Attachment B** Well Installation Cross Section\Data Form
- Attachment C** Example Well and Vegetation Transect Map

## 1.0 INTRODUCTION

This monitoring plan outlines the methods to quantify baseline (pre-project) and with-project vegetation and surface water conditions in and around the Collier County Comprehensive Watershed Improvement Project (CCCWIP). The project includes about 25,761 acres including the western portion of the Picayune Strand State Forest and the landward end of Rookery Bay. Water withdrawn from Golden Gate Canal will flow through a preliminary water treatment flow-way north of I-75 and discharge into the CCCWIP area south of Interstate 75, east of Collier Boulevard and west of the southern blocks of the Golden Gate Estates. The majority of the total project area (about 22,839 acres)

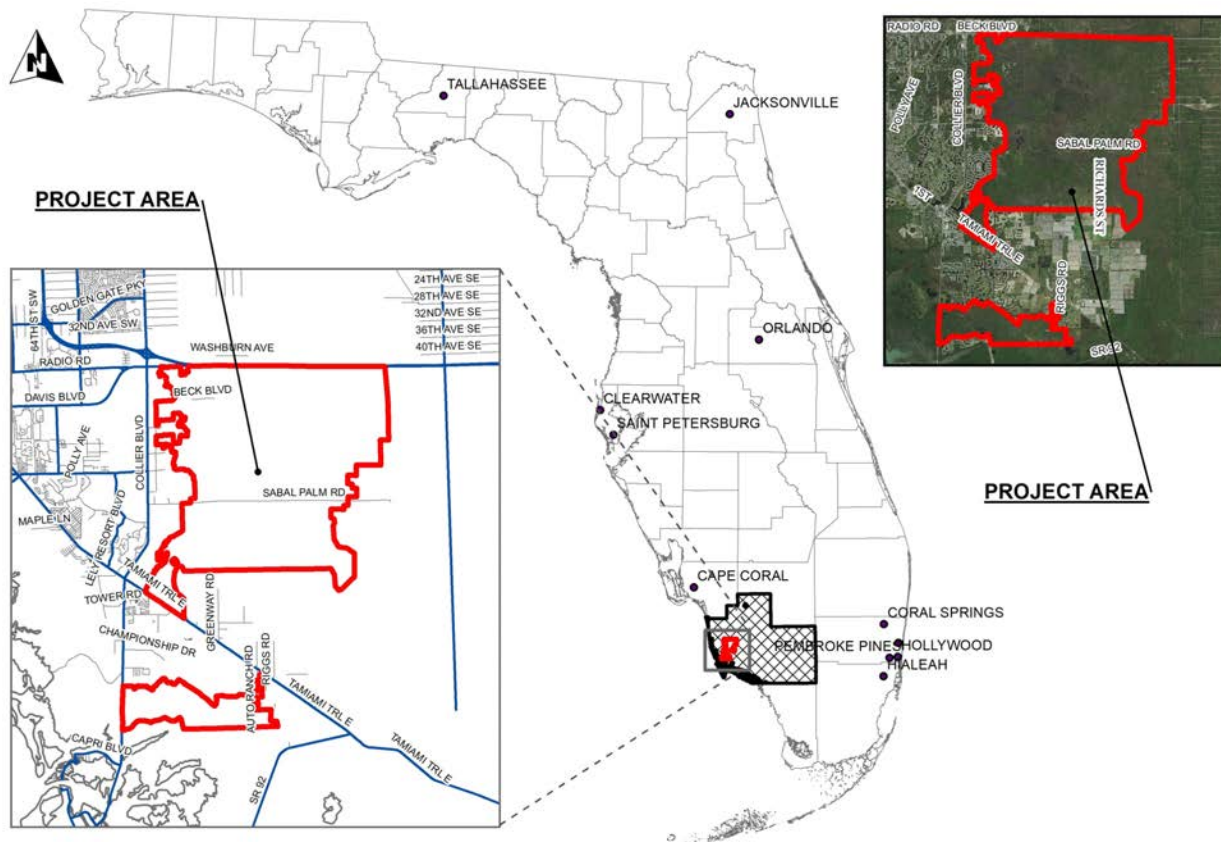


Figure 1. Project Location Map

is within the western portion of Picayune Strand State Forest (PSSF). Based on a conservative estimate of the water available from Golden Gate canal, the potential effect area is about 14,309 acres. The remainder of the main project area is defined to ensure that the project effects are separated from development (to the west) and the SFWMD Picayune Strand Restoration project to the east. The potential effect area may change as the available water calculations are refined. Water will flow out of the CCCWIP under US 41 / Alligator Alley into the mangroves of Rookery Bay (see Figures 1 and 2). The project boundary includes about 2,921 acres of the landward end of the Rookery Bay watershed where monitoring for salinity changes will occur.

The goal of the monitoring program is to provide an accurate understanding of project-related ecosystem changes by comparing areas potentially influenced by the project with adjacent areas not expected to be influenced used for comparison. The monitoring objective is to provide data sufficiently accurate to assess changes in the hydrology, water quality, and vegetation communities in and around the project area of influence. The baseline monitoring plan includes hydrologic, water



quality, and vegetation monitoring at 60 locations in and around the Picayune Strand State Forest (PSSF), and water quality sampling at the Golden Gate Canal inflow point, after passage through the initial flow-way, and at the project outflow points on the east side of the Tamiami Trail.

The sampling design is before – after, control – impact (BACI). Baseline sampling (before project operation) will be compared to with-project (after construction) data. Baseline data for all monitoring locations will be collected from the time of monitoring plan implementation until project construction. Based on pre-project simulation modeling, the anticipated limits of the core flow-way are shown in (Figure 2). Sampling will occur in the common, dominant Florida Land Use and Cover Classification System (FLUCCS) community types at inflow location and at outflow locations at the southern end of the project. Sampling will also occur at locations outside (control locations) and within (impact locations) the projected core flow-way.

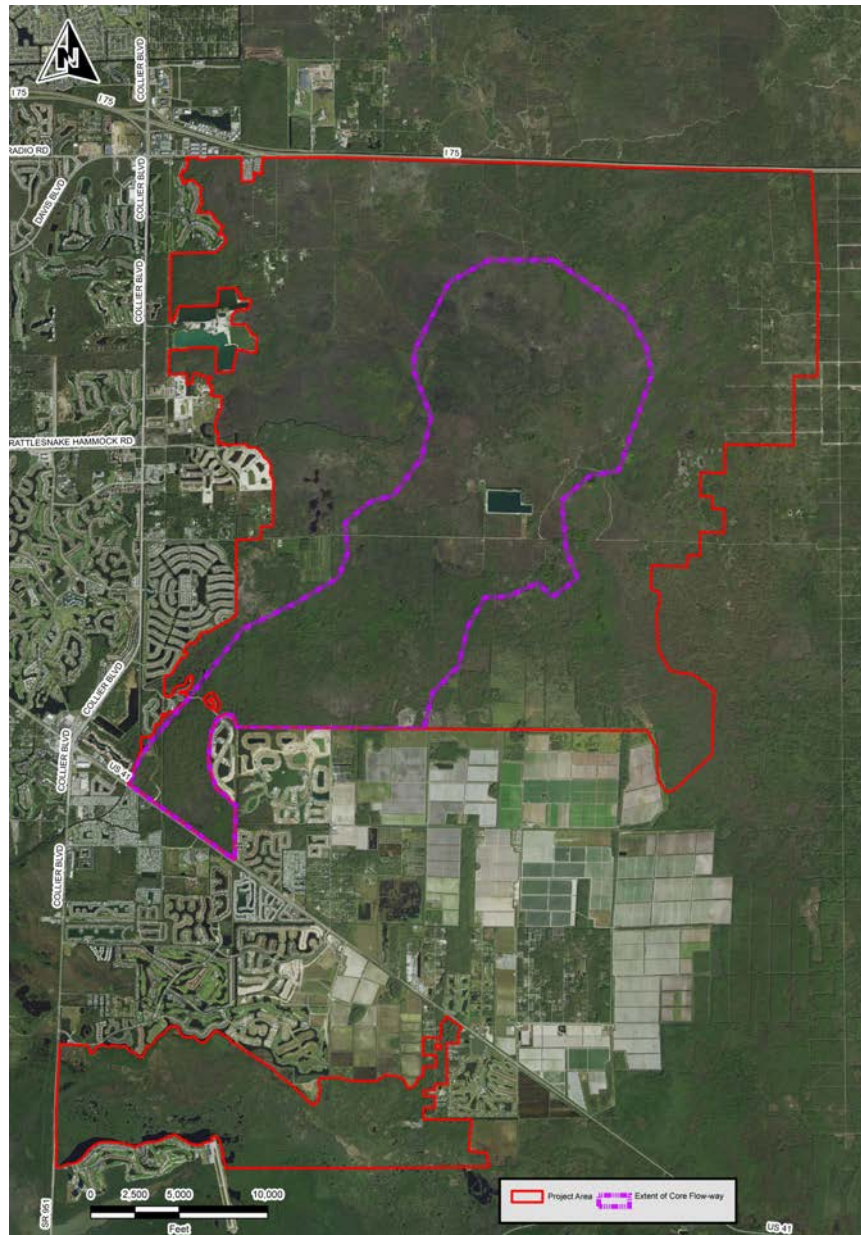


Figure 2. Project Area with Anticipated Limits of Core Flow-way (Area of Influence).



## **2.0 HYDROLOGIC MONITORING**

Sixty (60) shallow groundwater monitoring wells will be installed within and outside the area of potential project influence (see Attachment A for well locations). Monitoring wells will be placed in as diverse a selection of existing vegetation communities as possible. Each monitoring well will be equipped with a HOB0 MX2001-04 water level data logger that will record water levels and barometric pressure at least twice daily. On a quarterly basis, water level data will be downloaded, saved in raw data and spreadsheet formats, and summarized in graphs. Rainfall data will be obtained from the same stations used in the surface water – ground water modeling effort or obtained from appropriate stations reported in National Oceanic and Atmospheric Administration’s (NOAA) Climate Data Online (CDO) for correlations to surface water and ground water elevations. Alternatively, if a site can be identified within the PSSF, a stand-alone rain gauge will be installed to directly collect rainfall data for the project area.

At each quarterly download event, the wells will be inspected and appropriately maintained.

### **2.1 Well Installation Methodology**

At each well location, soil borings will be conducted utilizing a mechanical auger, a hand auger, or a combination of the two in order to reach a target depth of 4 feet below grade surface (bgs). Once the target depth is achieved a screened portion of PVC, with a well point, will be placed into the boring hole. Clean gravel will be poured around the screened portion of the PVC to alleviate silt/fine sediment build up around the screen. A solid PVC riser will be attached to the screened portion of PVC to achieve an elevation of approximately 3 feet above grade surface (ags). The HOB0 MX2001-04 water level data logger will be placed within the well, suspended just above the bottom of the well. A cap equipped with a combination lock will be placed on top of the riser portion of the PVC for protection. Each well will be labeled with an ETE company sticker for identification. The well locations, natural ground level elevation, and top of pipe elevations will be surveyed by Marco Surveying & Mapping LLC following the completed installation. See Attachment B for well installation cross section\data form.

## **3.0 WATER QUALITY MONITORING**

The primary objective of the water quality monitoring is to assess project-related changes in total nitrogen and total phosphorus. The data will allow assessment of these changes in the project area and Rookery Bay receiving waters within the overall project footprint (Figure 2). Samples collected at the inflow and outflow ends of the project will provide the data to assess inflow and outflow nutrient concentration differences. Water quality data collected in the receiving waters of Rookery Bay will assess salinity changes as a result of the project. Samples collected within the project area will allow assessment of any differences in nutrient levels within and outside the project area of influence.

Samples for lab analysis of water quality will be collected on a quarterly basis from twenty (20) of the monitoring wells (See Attachment A; monitoring wells where lab analyzed water sampling will take place are showing in blue). If the surface water depth is greater than 15 cm (6 inches) at any of the well locations, a surface water sample will also be collected for lab analysis. Sampling will be conducted in accordance with the Florida Department of Environmental Protection’s (FDEP) Standard Operating Procedures (SOPs) F.A.C 62-160.110, FS 2100 for surface water sampling and FS 2200 for groundwater sampling. All water samples will be properly labeled in laboratory provided sample bottles, stored on ice in a cooler, and sent to a National Environmental Laboratory Accreditation Program (NELAP) certified laboratory.

The following water quality parameters will be measured.

- Field Sampling Parameters (taken at all wells)
  - water temperature
  - pH
  - dissolved oxygen
  - specific conductance (as the basis for salinity calculation)
- Well and/or Surface Water\* Laboratory Parameters (taken at 20 wells)
  - NO<sub>x</sub> (NO<sub>2</sub> + NO<sub>3</sub> soluble)
  - Total Kjeldahl nitrogen (TKN)
  - Total dissolved Kjeldahl nitrogen (TKN-D)
  - total phosphorus (TP)
  - total dissolved phosphorus (TPD)

\*Surface water samples will only be obtained if the surface water depth at the well location is greater than 15 cm (6 inches)

At each sampling location, the sampling technician will also collect general meteorological conditions (wind speed/direction, air temperature, etc.) date, time of day, water depth within the well, and, if surface water is present, surface water depth and sample collection depth. If no surface water is present, soil saturation condition (saturated or not saturated) will be recorded. During each day of water quality sampling, a field blank and equipment blank will be submitted to the NELAP Lab for quality assurance.

#### **4.0 SOIL CHARACTERIZATION**

Soil characterizations will provide information necessary to fully understand changes in hydrology and vegetation over time. An initial physical/hydrologic characterization of the soil will be made at each well location during installation and at the center of each of the tree and shrub vegetation monitoring plots along each transect (see below) using the methods outlined in *Field Indicators of Hydric Soils in the United States, A Guide for Identifying and Delineating Hydric Soils*. Each soil characterization will be cross-referenced with the Natural Resources Conservation Service (NRCS) soil survey data for that location.

#### **5.0 QUANTITATIVE VEGETATION MONITORING**

Sixty (60) 75-meter monitoring transects will be established to monitor vegetation changes over time. Transects will be placed near well locations within homogeneous vegetation communities (FLUCCS community). Transect orientation will be field-determined. Each transect will contain three (3) canopy/shrub vegetation monitoring plots and six (6) groundcover vegetation monitoring plots. Plot-based methods will quantify vegetation along each transect. See Attachment C for a sample well location with vegetation transect layout. After initial monitoring efforts are completed, some transects, particularly those associated with wells outside natural vegetation areas, may be eliminated from future monitoring.

Field ecologists will establish each monitoring transect using a sub-meter, Differential Global Positioning System (DGPS) and tape measure. Each vegetation monitoring plot will be a 10-meter square and the corners will be permanently marked using PVC pipes. The GPS coordinates will be recorded at the center of each plot. Additionally, the center of each 1-meter groundcover quadrat will be marked with PVC and GPS located along the monitoring transect.

Quantitative vegetation monitoring parameters will consist of:

- a) density, dominance, area, and composition of canopy and sub-canopy species;
- b) percent cover and composition of shrub species;
- c) percent cover and composition of groundcover species.

The vegetation strata to be monitored are defined as follows:

1. Canopy and sub-canopy trees will be defined as those woody plants with a diameter at breast height (dbh) greater than 2.5 cm (dbh to be measured 130 cm above ground surface).
2. The shrub layer will consist of shrub species and trees with a dbh less than 2.5 cm.
3. Ground cover will consist of all plants not found in the other strata, primarily herbaceous species.

Canopy, sub-canopy, shrub species, and groundcover will be monitored annually during the dry season. High water levels in portions of the PSSF and limited access would make monitoring of vegetation (especially groundcover) difficult during the rainy season. For this reason, vegetation monitoring will take place on an annual basis, in early spring.

### 5.1 Canopy, Sub-canopy, and Shrub Vegetation Monitoring Methodology

Quantification of canopy and sub-canopy species will occur at three (3) 10-meter square plots centered on three randomly selected quadrat locations of the six (6) groundcover monitoring locations along each transect. Once the sampling areas are established, subsequent monitoring will occur at the same locations during each annual monitoring event. Each canopy, sub-canopy, and shrub species will be identified to the lowest taxonomic level possible and percent coverage will be determined. All trees located within each 10-meter plot with a dbh greater than 2.5 cm will be identified with numbered tree tags to allow tracking of health and growth rates over time. Measurements will include dbh, percent canopy cover, and general health. For trees with multiple trunks, each trunk dbh will be measured separately and recorded to indicate the affiliation of the multiple trunks with a single tree.

In evaluating health condition of each tagged tree, a Health Assessment Score (HAS) will be assigned. The HAS scoring matrix breaks down as follows:

<b>Canopy Tree Health Assessment Scoring System</b>		
<b>Tree Condition</b>	<b>Condition Characteristics</b>	<b>Health Assessment Score (HAS)</b>
Dead	no foliage or other signs of life, fallen	0
Stressed	wilting, dead limbs/trunks, brittle, peeling bark, insect damage, root damage, masses/growths	1
Good	robust, abundant leaves/needles/limbs, no signs of stress	2

Once each tree is assigned a HAS, each plot will then be assigned an average HAS relative to the total number of trees in that plot. A plot HAS closer to “0” generally indicates poorer health, while a HAS closer to “2” generally indicates greater health.

**5.2 Groundcover Vegetation Monitoring Methodology**

Groundcover will be quantified within 1-meter quadrats located at 15-meter intervals along each transect (total of 6 quadrats). A 1-meter square quadrat frame centered on a fixed transect point will provide the areal basis for groundcover data collection. The composition and cover of vegetation, as defined above, will be quantified using direct visual estimates. Vegetation not identified to species level will be identified to the lowest taxonomic level possible.

All monitoring data will be entered into a Microsoft Excel database. The wetland indicator status as defined in Chapter 62-340, Florida Administrative Code and the native/non-native status of each species will also be recorded. An example vegetation plot data form is attached.

**6.0 QUALITATIVE MONITORING**

Qualitative monitoring will occur at each plot location. Notes on the type of community being sampled, the general health of the vegetation, soil inundation, standing water levels, recruitment of new species, and the presence or spread of nuisance/exotic species will be recorded on field data sheets. Observations of wildlife, consisting of direct sightings, scat, tracks, or vocalizations, will also be noted. The qualitative monitoring for each plot will be summarized in paragraph format.

**7.0 PHOTOGRAPHIC DOCUMENTATION**

On an annual basis, 180-degree panoramic photos will be taken at each plot location. Orientation of the panoramas will be north, with the plot station marker in the center of the frame. Panoramas are meant to assist in documentation of trends over time.

**8.0 SCHEDULE AND REPORTING**

Quarterly well data (water levels \ water quality) and annual vegetation monitoring data will be compiled into an annual report at the end of each calendar year. The annual report will contain data for each monitoring plot with GIS exhibits, spreadsheets, and summary graphs sufficient enough to convey field data.

The annual schedule below is anticipated to continue in this format as the project progresses.

Task	Date
Initial Well Install and Vegetation Transect Setup (Baseline)	March 2019
Quarterly Well Download & Water Quality	June 2019
Quarterly Well Download & Water Quality	September 2019
Quarterly Well Download & Water Quality	December 2019
First Annual Vegetation Monitoring with Well Download & Water Quality	March 2020
Quarterly Well Download & Water Quality	June 2020
Quarterly Well Download & Water Quality	September 2020
Quarterly Well Download & Water Quality	December 2020
Second Annual Vegetation Monitoring with Well Download & Water Quality	March 2021

## **9.0 MODIFICATIONS TO MONITORING PLAN**

Future modifications to the methodology or scope of this plan may be necessary due to changes in the Collier County Comprehensive Watershed Improvement Project.

## **10.0 REFERENCES CITED**

Delineation of the Landward Extent of Wetlands and Surface Waters, Chapter 62-340, Florida Administrative Code. 1994.

Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner. 2014. The National Wetland Plant List: 2014 Update of Wetland Ratings. *Phytoneuron* 2014-41: 1-42.

Water Use/Consumptive Use Permits Wetlands/Surface Waters Monitoring Plan Guidelines, South Florida Water Management District. 2018.

United States Department of Agriculture, Natural Resources Conservation Service. 2010. Field Indicators of Hydric Soils in the United States, Version 7.0. L.M. Vasilas, G.W. Hurt, and C.V. Noble (eds.). USDA, NRCS, in cooperation with the National Technical Committee for Hydric Soils.

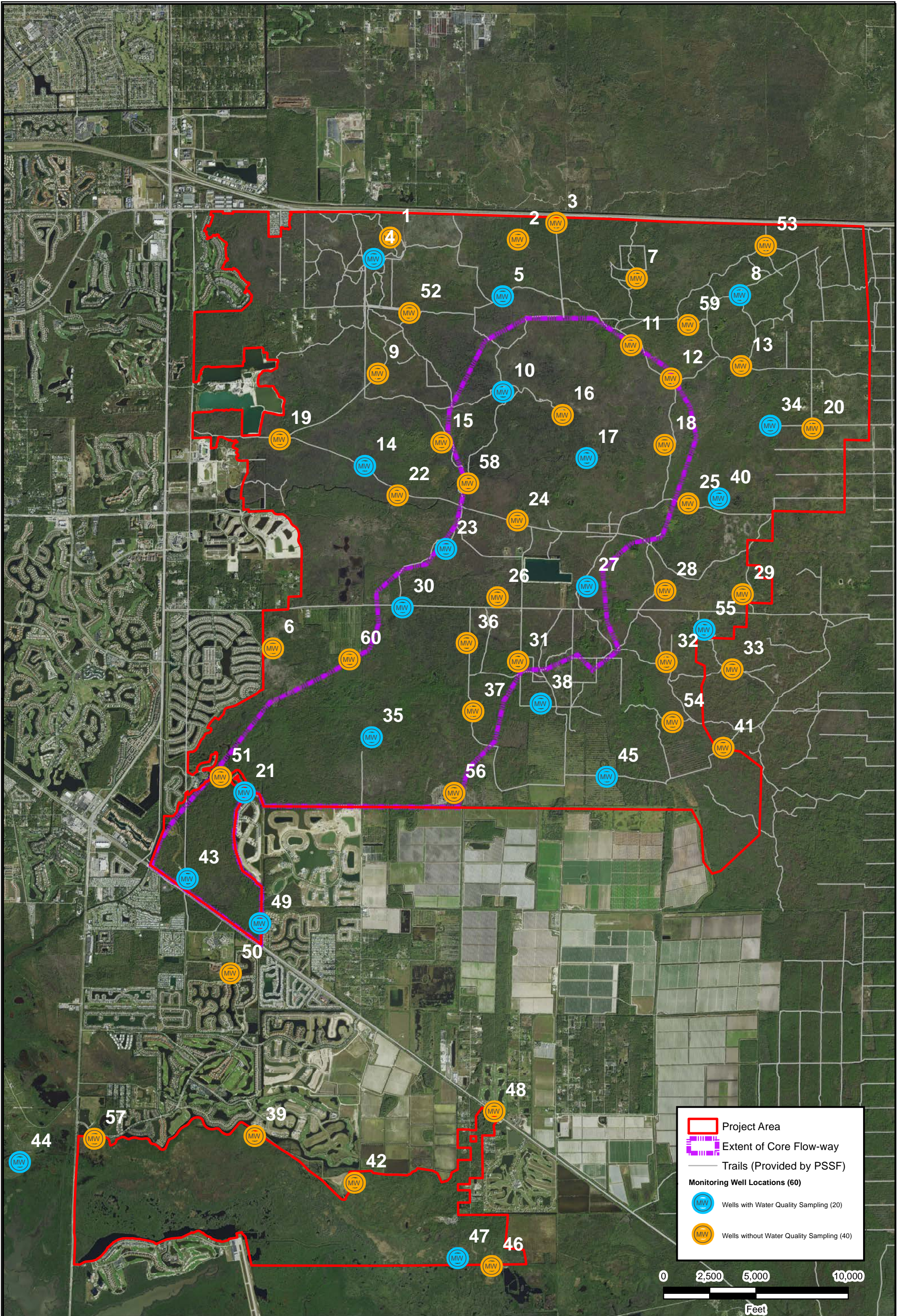
National Academies of Sciences, Engineering & Medicine 2017. *Effective Monitoring of Evaluate Ecological Restoration in the Gulf of Mexico*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/23476>.

Florida Department of Environmental Protection's (FDEP) Standard Operating Procedures (SOPs), F.A.C 62-160.110. FS 2100. Surface Water Sampling & FS 2200 Groundwater Sampling.

Attachment A

Proposed Monitoring Well Locations





CCCWIP  
Collier County, Florida



EARTH TECH ENVIRONMENTAL, LLC  
10600 JOLEA AVE  
BONITA SPRINGS, FLORIDA 34135  
PHONE (239) 304-0030



SHEET NO.

HABITAT & GROUNDWATER  
MONITORING LOCATIONS

DATE  
2/25/19

PROJECT NO.  
N/A

SCALE  
AS SHOWN



Attachment B

Well Installation Cross Section \ Data Form



Environmental, LLC

# Well Installation Form

Project: \_\_\_\_\_

Well #: \_\_\_\_\_

Date Installed: \_\_\_\_\_

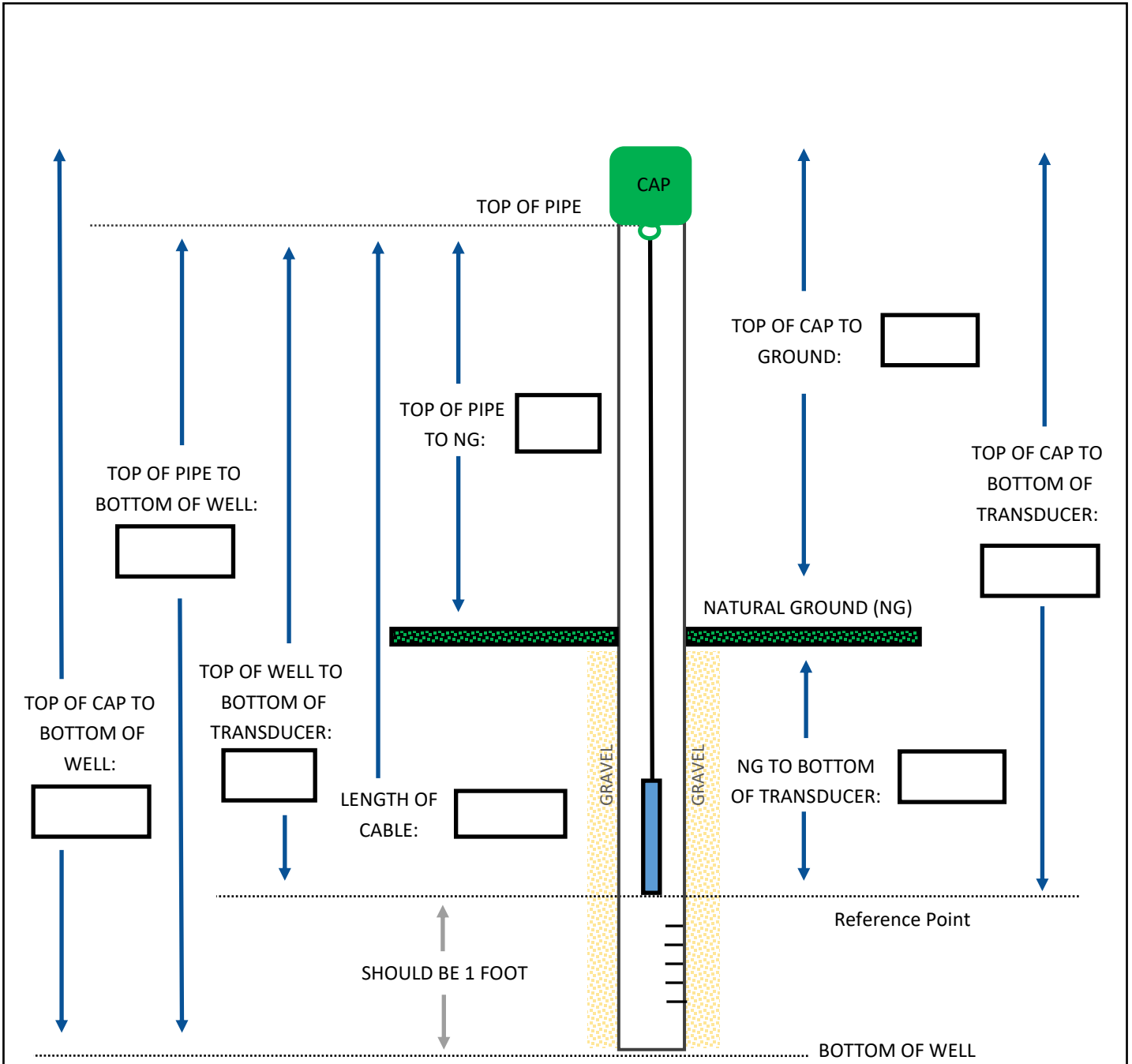
Hobo Logger S/N: \_\_\_\_\_

Installed by: \_\_\_\_\_

Hobo Water Level S/N: \_\_\_\_\_

Well #: \_\_\_\_\_

Logging Interval: \_\_\_\_\_

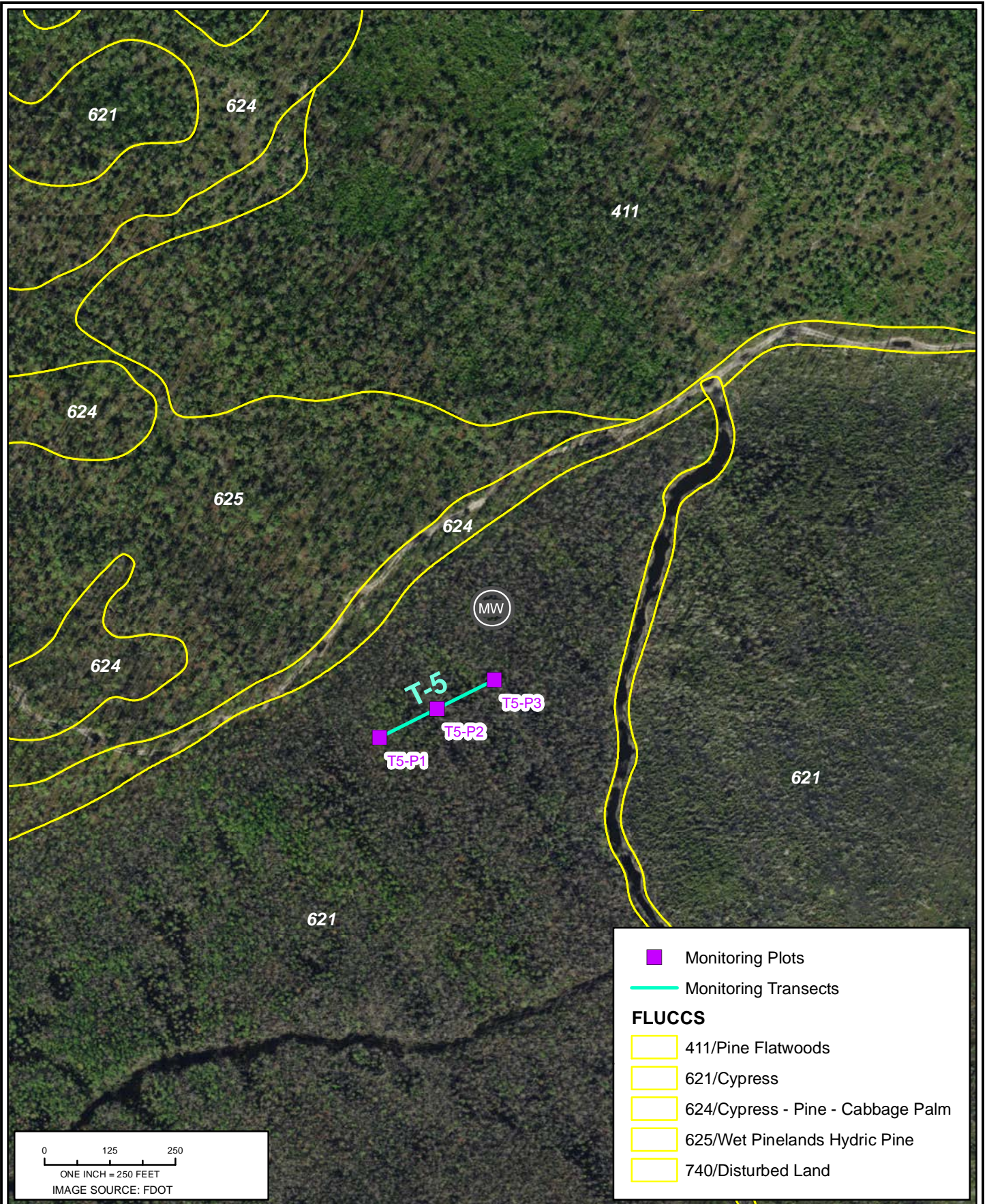



**Notes:**

Attachment C

Example Well and Vegetation Transect Map





 **TAYLOR ENGINEERING INC.**  
10199 SOUTHSIDE BOULEVARD  
SUITE 310  
JACKSONVILLE, FL 32256  
CERTIFICATE OF AUTHORIZATION # 4815

**CCCWIP EXAMPLE WELL & TRANSECT**  
**WELL POINT # 5**  
**COLLIER COUNTY, FLORIDA**

PROJECT	C2018-052
DRAWN BY	KM
SHEET	5 OF 60
DATE	FEB 2019