WATERSHED EVALUATION REPORT

PEARCE DRAIN/GAP CREEK WATERSHED (N759, 17TW481)

Task Work Assignment 17TW0000481

Southwest Florida Water Management District
Brooksville, Florida
and
Manatee County Board of County Commissioners
112 Manatee Avenue West
Bradenton, Florida 34205

June 2018

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Introduction

1.1 Authorization

Under Agreement #14MA0000013 and Task Work Assignment 17TW0000481, CDM Smith Inc. (CDM Smith) is tasked by the Southwest Florida Water Management District (DISTRICT) with developing a Watershed Management Plan for the Pearce Drain/Gap Creek (PDGC) Watershed located in Manatee County. This project will be completed in accordance with the DISTRICT's guidance documents located at: ftp://ftp.swfwmd.state.fl.us/pub/GWIS/WMP_Guidance_Documents.

1.2 Project Location and General Description

The PDGC Watershed encompasses an area of approximately 10.6 square miles (approximately 6,800 acres) in southwestern Manatee County, Florida. The watershed drains towards the Pearce Drain Canal, a manmade channel that runs along the central portion of the watershed. The Pearce Drain Canal opens up to Gap Creek and outfalls to the Braden River, which ultimately flows to the Manatee River into the Gulf of Mexico. The Pearce Drain Canal can also flow to the south towards Sarasota Bay under certain hydraulic conditions via the fixed weir structure located just southwest of the Dolomite Lakes. There are several adjacent watersheds, some with interconnections to the PDGC Watershed, which include the Bowlees Creek Watershed to the west, Whitaker Bayou Watershed to the southwest, Braden River Watershed to the east, and Sugarhouse/Glen Creek Watershed to the north. Major roadways located within the watershed include 53rd Ave. on the north, US-301 on the west, 45th St. on the east, and University Parkway on the south side of the watershed, as shown on **Figure 1-1**.

The watershed is predominantly urbanized with residential areas in the northern and eastern potions, with some industrial, commercial, and open lands dominating the south and southwest portions of the watershed. Ground elevations range from approximately 34 feet NAVD88 in the northwest portion down to sea level at the outfall to the Braden River.

Significant flooding in the watershed occurred during both Tropical Storm Hermine (September 2016) and in August of 2017. Prior to the August 2017 flooding, Tropical Storm Emily occurred in July of 2017. During Tropical Storm Emily, approximately 4 inches of rainfall occurred; this was followed by another 13 inches of rainfall within the watershed between August 25 and August 28, 2017. As a result, significant structural flooding occurred within the vicinity of the Centre Lake Subdivision.

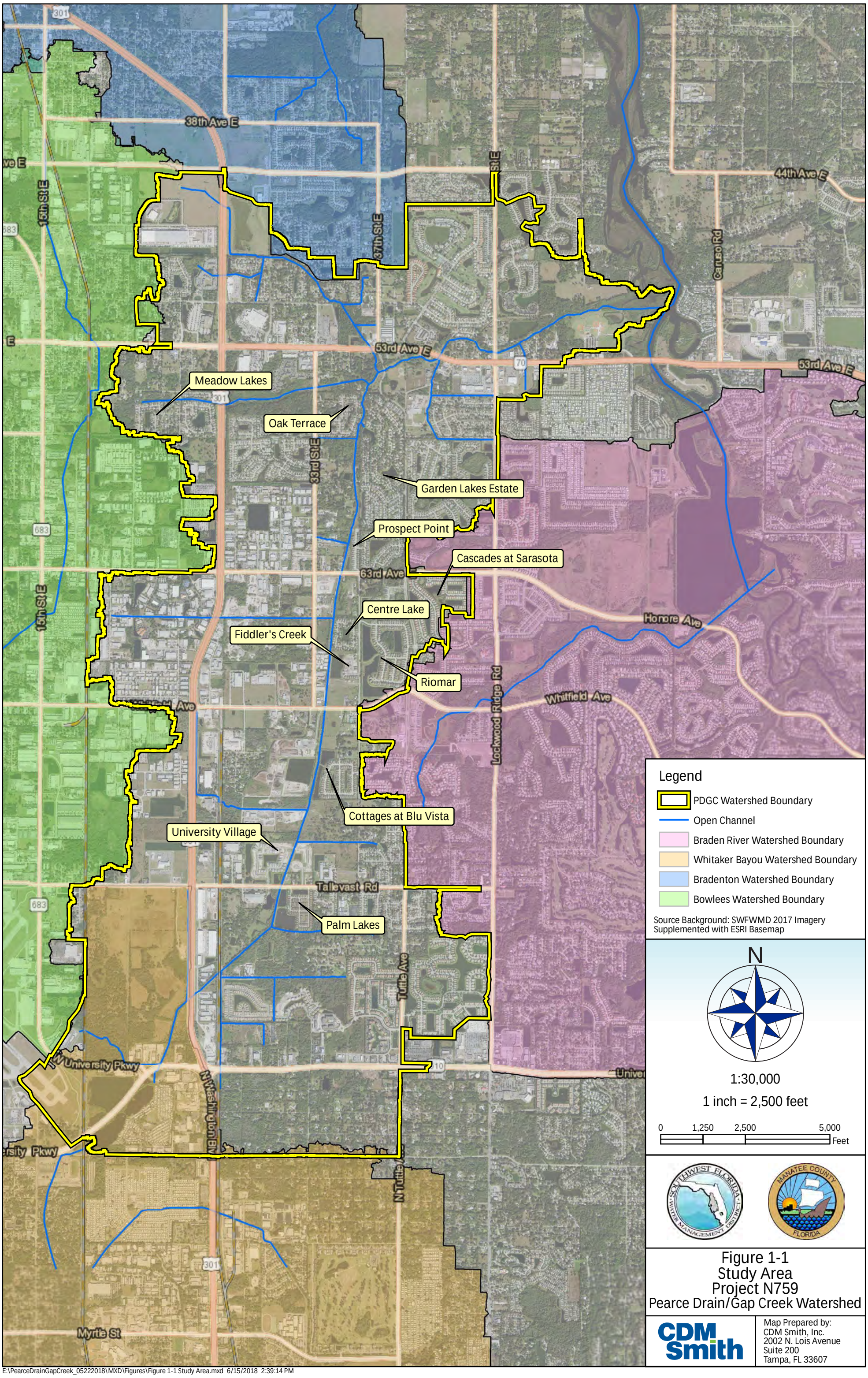

Figure 1-1
Study Area
Project N759
Pearce Drain/Gap Creek Watershed

Map Prepared by:
CDM Smith, Inc.
2002 N. Lois Avenue
Suite 200
Tampa, FL 33607

E:\PearceDrainGapCreek_05222018\MXD\Figures\Figure 1-1 Study Area.mxd 6/15/2018 2:39:14 PM

1.3 Purpose and Objectives

This report presents a summary of the data compilation and evaluation completed for Watershed Evaluation (Task 2.2) element of the Watershed Management Plan. The Watershed Evaluation element has the following goals:

- Compile, review and evaluate existing watershed data.
- Develop watershed features that define watershed hydrology and hydraulics.
- Develop a Geographic Watershed Information System (GWIS) database.
- Develop preliminary model features representation and proposed approach of how the watershed will be modeled under Task 2.3 (Floodplain Analysis).

1.3.1 Approach

To address the recent flooding within the watershed, the DISTRICT and the County have requested that certain tasks of the WMP be expedited to identify early-out alternatives for the County to consider. The County's goal for this study is to identify feasible alternatives that could lower peak stages to 14 feet NAVD88 as well as other options to reduce flood damage within the vicinity of the Centre Lake subdivision. To accomplish this objective within the County specified timelines, this watershed evaluation focuses on detail in the primary conveyance system and known flooding problem areas such as the Centre Lake Subdivision. This will be referred to throughout this memorandum as the "priority area." CDM Smith assigned priority to subbasins/catchments using the criteria below and input from the DISTRICT. The priority area is also shown graphically on **Figure 1-2**.

- High Priority - these areas in the watershed are represented at the highest level of detail with the following considerations:
    - Includes known problem areas (e.g., Centre Lake Subdivisions), or areas with significant impact on the primary system (e.g., developments with compensatory storage or hydraulically significant developments).
    - Includes developed areas served by ponds greater or equal to 1 acre, along with interconnections to other ponds, and the ultimate control structure.
    - Includes routing of the areas described above to the primary system.
    - Hydrologic parameters will be generated on a catchment/pond tributary area level.

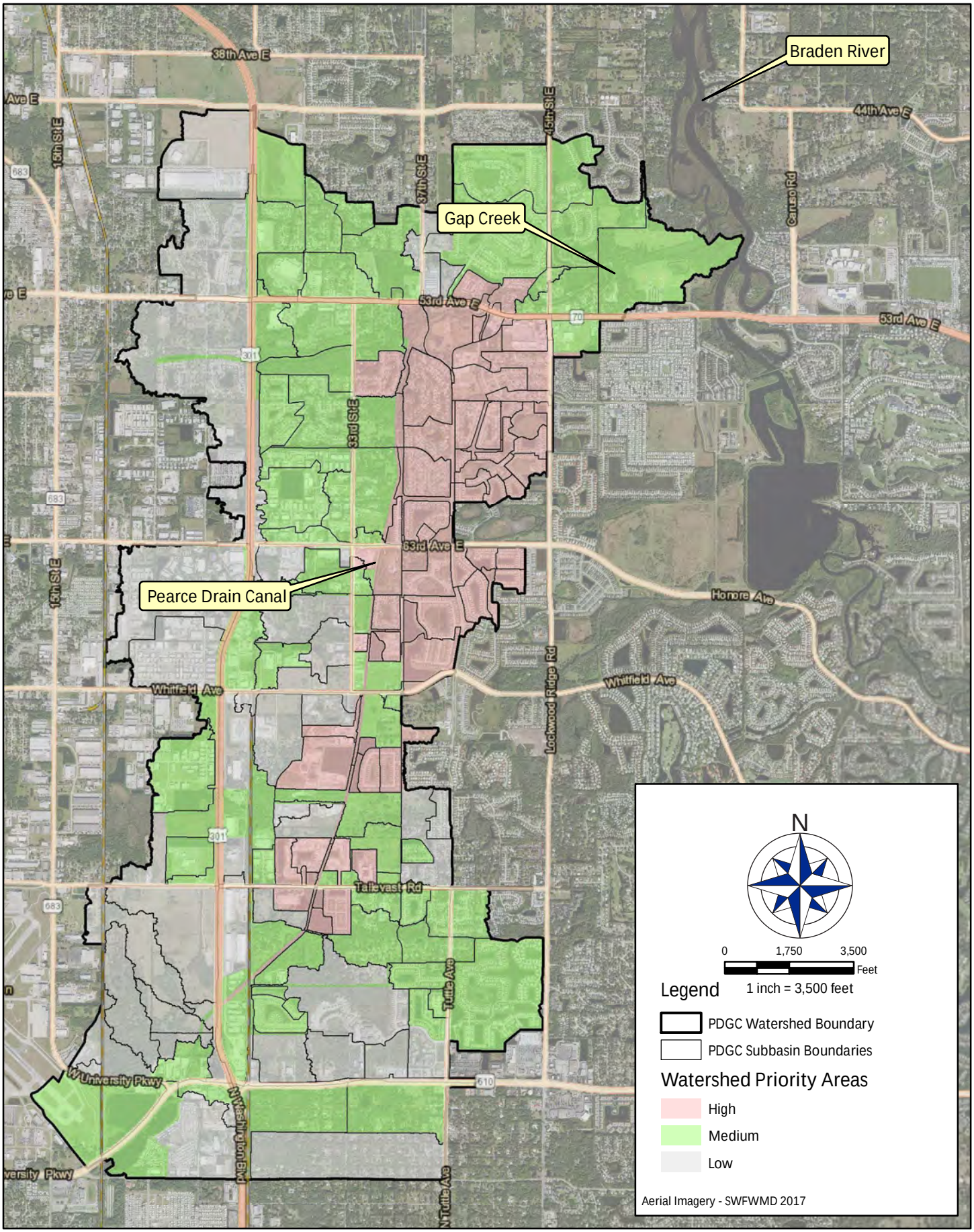

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Figure 1-2 Watershed Priority Areas
Pearce Drain/Gap Creek Watershed Evaluation
Manatee County, FL

- Medium Priority - these areas in the watershed are represented at a medium level of detail with the following considerations:
  - Includes areas of development that are hydraulically significant but do not meet the criteria above (i.e., combining pond volumes and including the ultimate control structure to the primary or secondary system.)
  - Is tributary to either the primary or secondary (i.e., lateral) system and includes details associated with the primary/secondary hydraulics for major crossings and open channel segments,
  - Hydrologic parameters will be generated at the subbasin level.
- Low Priority - these areas in the watershed are represented at a low level of detail with the following considerations:
  - Typically includes an undeveloped area or areas not directly tributary to areas of concern and/or the primary/secondary system.
  - Where applicable, area will load to a single stage/area node (quantified by ArcHydro tools) and subsequently into primary or secondary system as appropriate. In other cases, it may be loaded directly to the primary/secondary system.
  - Hydrologic parameters will be generated at the subbasin level.

1.4 Quality Assurance

For this deliverable, CDM Smith has adhered to the Quality Assurance Plan submitted with the Project Plan (March 2018). A project specific QA/QC document has been developed and included with this deliverable. This also documents the various Watershed Evaluation components that are included with this deliverable. CDM Smith maintains a Quality Management System (QMS) for this project and technical reviews of deliverables have been performed and are indicated as such on the QA/QC document that is included as **Appendix A**. This deliverable also reflects the incorporation of review comments previously made by the DISTRICT and the County on the Task 2.2.1 deliverable (Assembly and Evaluation of Watershed Data).

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Section 2
Watershed Inventory

2.1 Watershed Primary Conveyance Description

The primary stormwater management system (PSMS) consists of the Pearce Drain Canal, which generally flows north, from the Sarasota/Manatee County line, to the confluence with Gap Creek, which is just south of the City of Bradenton. There are several residential developments adjacent to the main stem of the Pearce Drain Canal and Gap Creek, including the Centre Lake, Fiddler's Creek, Cascades at Sarasota, University Village and Garden Lakes Estate subdivisions. Gap Creek generally flows to the east, from the western watershed boundary to the confluence with the Braden River (previously shown on Figure 1-1). At the headwaters of the Pearce Drain Canal (Dolomite Lakes), there is a control structure between the Pearce Drain Canal and Whitaker Bayou (which is an adjacent watershed and drains south to the Gulf of Mexico). The control elevation of this divide is at elevation 10.22 feet NAVD88. Below elevation 10.22 feet NAVD88, flow is conveyed to the north through the Pearce Drain Canal. Above this elevation, flow can occur to the south towards the Whitaker Bayou Watershed.

2.2 Previous Watershed Studies/Models

CDM Smith compiled and reviewed several available studies of the PDGC Watershed. Below is a summary of each study and how it may be useful to this current study. In addition to studies of the subject watershed, there are also several studies of adjacent watersheds, including the City of Bradenton (to the north), the Braden River, and Whitaker Bayou, which will be used for consistency of watershed boundaries.

Technical Memorandum 25 Year Floodplain Mapping Program (January 1995)

This study was completed by Camp Dresser & McKee Inc. and Lombardo and Skipper, Inc. The focus of this study was to map the 25-year floodplain. The modeling and resultant peak stages had been studied by FEMA using regression equations to determine peak runoff rates from each subbasin and routed using an existing HEC-2 model. Several basins were mapped including PDGC, Upper Braden River, Cabbage Slough, East Fork of Cooper Creek, Cypress Strand, Frog Creek/Buffalo Canal, Gamble Creek, and Rattlesnake Slough.

The stages (NGVD) in PDGC range from a high of 16.7 feet to a low of 7.6 feet at the mouth of the system. In addition to tabular elevations, flood profiles are also included in this report. One item to note, is at approximately 7,000 feet from the confluence with the Braden River, there appears to be a conveyance restriction. There is a decrease in head of approximately 0.8 feet, which could be due to the culvert at either 53rd Avenue East or 37th Street East.

Manatee County 25 Year Floodplain Study – Book Two (1998)

This study appears to be raw model results and HEC-2 inputs associated with the January 1995 study prepared by Camp Dresser & McKee Inc. and Lombardo and Skipper, Inc. In addition to the 25-year model results, 10-, 50-, 100-, and 500-year model results are also provided in tabular format. This may prove useful in vetting the current studies modeling results, for a series of

return period events. Additionally, the HEC-2 model inputs are included. It is possible that these inputs may no longer be applicable but may provide some insight into the system.

Pearce Canal (Gap Creek) Floodplain Information Study (2002)

This study was completed by Thomas Shoopman, P.E. to determine the 25- and 100-year flood elevations at "Stonebriar" development.

The 1987 Manatee County Master Stormwater Drainage Plan and the 1992 Flood Insurance Study (FIS) were the sources of the model inputs. Relevant information will be used from this model as applicable. As this information is somewhat dated, it may be necessary to verify with available plans, field verification, and/or survey.

Flood Insurance Study, Manatee County, Florida and Incorporated Areas (March 17, 2014)

This document discusses the various studies used to generate the floodplains, floodways, and profiles for Gap Creek, as well as other systems within Manatee County. The Gap Creek system was studied in 1992 and resulted in defining base flood elevations (i.e., AE zones and floodways) from the Braden River to immediately downstream of Saunders Road. The flood study provides flow and stage estimates for various return period events. These can be used for validation of model results as well as boundary conditions.

Adjacent Watershed Studies

As mentioned in the introduction to this section, there were also studies completed for adjacent watersheds. These include a study of the City of Bradenton, study of the Braden River, and a study of Whitaker Bayou. All these studies were completed for the DISTRICT and hence include comprehensive geodatabases of the model input (e.g., catchments). These studies can be used to provide a comparison of the common basin boundaries. Following is a brief discussion of each study.

City of Bradenton (Jones Edmunds, 2016)

The City of Bradenton model domain is located to the north of the PDGC Watershed. A review of the initial PDGC catchment delineation (discussed later in this memorandum) indicated that the boundary of the City of Bradenton model should be used to assist with the delineation of the northern edge of the PDGC catchment.

Braden River Study (Singhofen & Associates, Inc., September 2012 (revised September 2013)

The Braden River model domain is located along the eastern boundary of the PDGC Watershed. The specific watershed included in this model of interest is Rattlesnake Slough. The boundaries are largely similar. There are some minor overlaps between these two watersheds, such as Whitfield Avenue between Prospect Road and Tuttle Avenue. As-built data for this location show the roadway discharges north into PDGC, but it had been included within Rattlesnake Slough.

Whitaker Bayou Study (Singhofen & Associates, Inc., August 31, 2009 (revised July 20, 2011)

The Whitaker Bayou model domain is in the south-western portion of the PDGC Watershed. There is considerable overlap between the two models in the area bounded by the Bradenton/Sarasota Airport in the west, SR301 in the east, Desoto Road to the south, and Tallevast Road to the north. In the Whitaker Bayou model, it appears this area largely discharges

to a section of Pearce Drain, with an applied boundary condition (immediately east of SR 301). The applied boundary condition, as well as the explicit modeling of this area, results in backflow into the "Dolomite Lakes" that are located between University Parkway, immediately north of Desoto Road. This flow will ultimately discharge south, into the Whitaker Bayou system. There is also overlap along Desoto Road east of SR301. Based on a review of the model, it appears that these basins discharge north (i.e., in the PDGC Watershed).

The connection between the PDGC and Whitaker Bayou system is located at the southwestern side of the Dolomite Lakes. There is a weir that separates the two systems until the water elevation reaches 10.22 feet NAVD. It is anticipated that this structure will be included in the PDGC Watershed model.

Bowless Creek Study (Boyle Engineering Corporation, 1998)

The Bowless Creek Watershed is located immediately to the west of the PDGC Watershed. An Appendix for the 25-year Floodplain Study was provided at the kick-off meeting. There is a watershed map included that could be used to obtain general basin boundaries. It is noted that there is parallel effort by the DISTRICT to study the Bowless Creek Watershed. During the Watershed Evaluation effort, CDM Smith held a remote meeting with the WMP consultant tasked with the Bowlees Creek WMP. Boundary differences are relatively minor. CDM Smith will continue coordination with the WMP consultant and the DISTRICT to ensure a fully coincident boundary between the two watersheds.

2.3 Data Compilation

Geographic Information System (GIS) site characteristics data were collected and compiled for this project from various sources. In addition to GIS data, other data items were compiled to support the assembly of watershed data. A general listing of the data compiled is listed below:

- From the DISTRICT's publicly available data:
  - 2011 Land Use Land Cover polygons
  - Boundary polygon Public Land Survey Sections
  - Environmental Resource Permit (ERP) polygons
  - Rainfall and Water Level information from 26252 & 26253 gages located at Pearce Drain & 63rd Avenue East (period of record 2001 to present).
  - Soil data for Sarasota NE and Sarasota coverage extents. The soils data were originated from the U.S. Department of Agriculture, Natural Resources Conservation Service with publication date of 2006.
  - Historical Water Levels (02/28/2017)
- Data provided by the DISTRICT:
  - Manatee County aerial imagery (2017 and 2015)
  - Manatee County Watershed Evaluation (2014) including a working GWIS geodatabase, including a feature dataset "MANATEE_DATA"

- Braden River (B310) Topographic Information, including 2.5- and 5-foot Digital Elevation Model (DEM), which was flown in 2016
- Environmental Resource Permit (ERP) centroids within the Bowlees Creek, Pearce Drain, and Sarasota Bay Watersheds
- Digital FIRM mapping data and hydraulic models (HEC-RAS) titled 09-04-8602S_Final_DFIRM_Studies_1453920221941
- Braden River Governing-board approved directory including Aerials, DTM, Geodatabase and miscellaneous TSDN data (2013)
- Whitaker Bayou Governing-board approved directory including Aerials, DTM, Geodatabase and miscellaneous TSDN data (2011)

- Data Provided by Manatee County:
  - Flood photograph documentation for 9/1/2016 (Tropical Storm Hermine) and 8/27/2017 storm events
  - Various plans and as-built drawings for areas of development
  - ICPR model developed by Thomas Shoopman, P.E. (Shoopman) and supporting documentation
  - Digital FIRM mapping data and hydraulic models (HEC-RAS) titled 09-04-8602S_Final_DFIRM_Studies_1453920221941
  - Survey cross-sections of major crossings along Pearce Drain and Gap Creek in PDF format (dated 3/16/1990)
  - Preliminary FEMA Coastal Maps
- Historical Aerials from FDOT (Partial Coverage, 1980, 1991)
- U.S. Geological Survey (USGS) 7.5' quadrangle maps
- Manatee County publicly available GIS data including jurisdictional boundaries, subdivisions boundaries, building footprints, and parcel polygons
- FDOT roadway plans for US-301 and SR 70 (Request made by CDM Smith).
- NCRS Soils SSURGO database

2.4 Historical Water Levels

Historic water level information for the study area was compiled from flooding photo documentation, water levels depicted on ERP plans, as well as the DISTRICT's most current High-Water geodatabase (2/28/2017). These are stored in the GWIS geodatabase PDGC_20180122.gdb in the "HISTORICAL_WATER_LEVELS" and "PHOTO_LOCATION" point feature classes. See **Figure 2-1** for the location of Historical Water Levels obtained, and **Figure 2-2** for the locations of flood photos provided by the County.

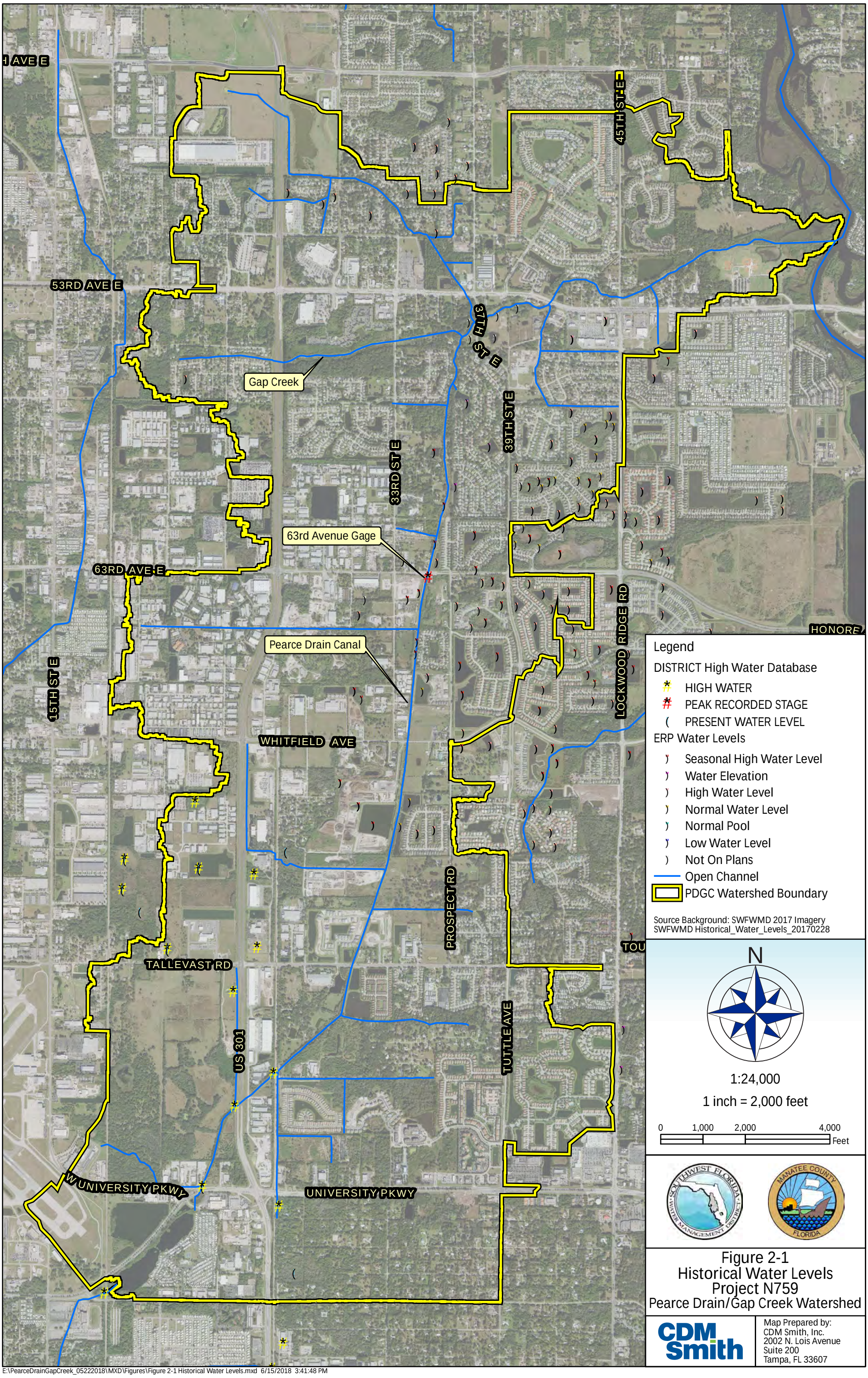

Figure 2-1
Historical Water Levels
Project N759
Pearce Drain/Gap Creek Watershed

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Map Prepared by:
CDM Smith, Inc.
2002 N. Lois Avenue
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Tampa, FL 33607

E:\PearceDrainGapCreek_05222018\MXD\Figures\Figure 2-1 Historical Water Levels.mxd 6/15/2018 3:41:48 PM

15th Street E @ 44th Ave E

37th Street E @ Pearce Drain

63rd Avenue E @ Pearce Drain

Center Lake Subdivision

33rd Street E

Whitfield Ave @ Pearce Drain

University Village

3131 Tallevast Road

Honore Ave @ Rattlesnake Slough?

Whitfield Ave at 43rd Court East

W Country Club Drive N

Tournament Boulevard

Palm Aire Drive @ Estates Drive

Cypress Lake Drive

45TH ST E

37TH ST E

39TH ST E

33RD ST E

63RD AVE E

53RD AVE E

15TH ST E

LOCKWOOD RIDGE RD

HONORE AVE

WHITFIELD AVE

COUNTRY CLUB DR N

TOURNAMENT BLVD

TALLEVAST RD

US 301

TUTTLE AVE

W UNIVERSITY PKWY

UNIVERSITY PKWY

Legend

Photo Date

- 8/27/17
- 9/1/2016

Open Channel

PDGC Watershed Boundary

Source Background: SWFWMD 2017 Imagery
Supplemented with ESRI Basemap

N

1:30,000

1 inch = 2,500 feet

0 1,250 2,500 5,000 Feet

Figure 2-2
Photograph Locations
Project N759
Pearce Drain/Gap Creek Watershed

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2.4.1 Storm Event Flooding Documentation

During an unnamed storm in late August of 2017, the County experienced significant flooding. **Figure 2-3** shows the rainfall and water level response in Pearce Drain during the fall of 2017, where approximately 13 inches of rainfall fell at 63rd Street East between August 25 and August 28. The gage at 63rd Street East is located approximately 0.5 mile north (downstream) of the Centre Lake Subdivision. It should be noted that the figure shown does not reflect the calibrated data per conversations with the County, as the level gage pressure transducer was malfunctioning around the time of the event. CDM Smith has requested the updated dataset, which includes a correction factor of approximately +5 feet per County comments. Certain areas along Pearce Drain Canal were significantly impacted (i.e., residential structural flooding) including the Centre Lake Subdivision. The 37th Street East crossing with Pearce Drain was also identified by the County as another flood problem area. **Figure 2-4** shows a comparison between an aerial image looking south beyond the Centre Lake subdivision and a DEM inundation of the study area.

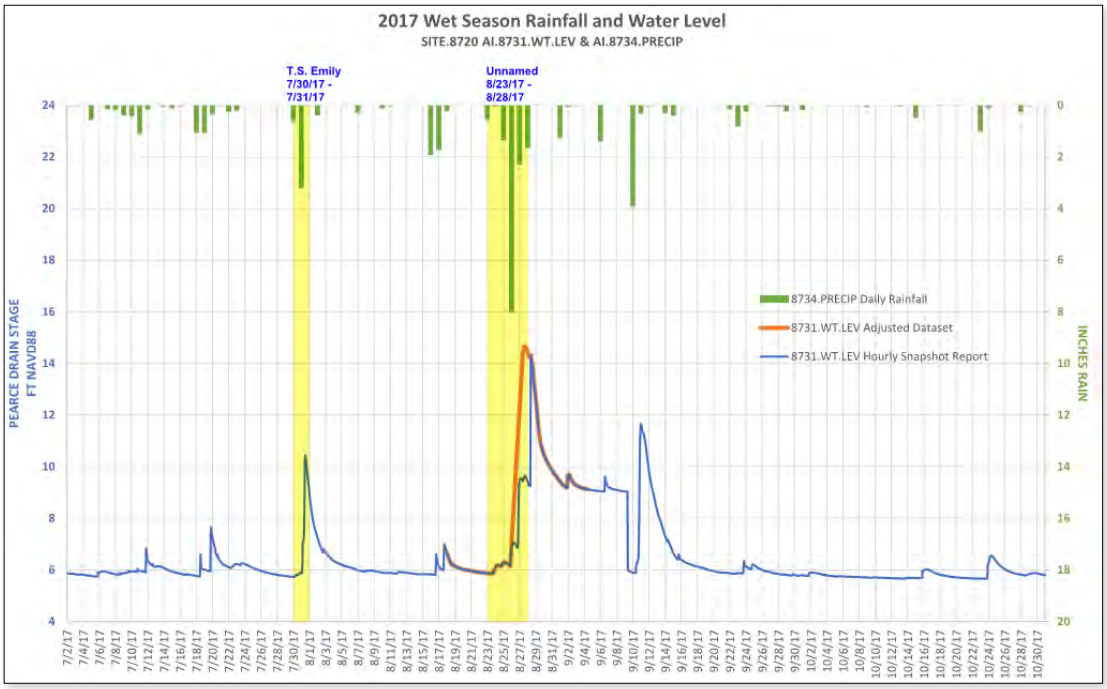

Figure 2-3 2017 Pearce Drain Wet Season Rainfall and Water Level at 63rd Avenue East*

*Adjusted dataset provided by Manatee County for period between 8/18/2017 and 9/4/2017.

Figure 2-4 Centre Lake & Fiddler's Creek Subdivisions Aerial Imagery and DEM Comparison*

*Imagery shown is facing south; Aerial Imagery dated 8/27/17 (Left) and Digital Elevation Model at approximately 15 feet NAVD88 (right)

Photographs and field notes were obtained from Manatee County for the locations in the study area shown in **Table 2-1** and on Figure 2-2 following the August 2016 and August 2017 storm events.

Table 2-1 Photographic Flooding Documentation by Location

Location of Interest	In Watershed	Photos from 8/27/2017	Photos from 9/1/2016
Tallevast Road at Pearce Drain Canal	X	X	X
University Village at Pearce Drain Canal	X		X
Whitfield Avenue at Pearce Drain Canal	X	X	
33rd Street E	X	X	
Centre Lake Subdivision (Prospect Road @ 65th Ave Circle East)	X	X	X
63rd Avenue at Pearce Drain Canal	X	X	X
37th Street at Pearce Drain Canal/Gap Creek	X	X	X
Whitfield Avenue W of 43rd Court E (Rattlesnake Slough)		X	
Honor Avenue @ Rattlesnake Slough		X	
W Country Club Drive N		X	
Tournament Boulevard		X	
Palm Aire Drive @ Estates Drive		X	
Cypress Lake Drive		X	
15th Street E at 44th Street E		X	

2.5 Topographic Data

Topographic data for the study area were provided by the DISTRICT including the 2016 Braden River 2.5- and 5-foot DEMs, as well as LiDAR LAS datasets, breaklines, and 1-foot contours.

Most of the study area ranges between approximately 5 feet NAVD88 and 35 feet NAVD88, with the higher elevations along the southeast, southwest, and northwest basin boundaries. The watershed generally slopes toward the northeast portion of the watershed at the outfall to the Braden River, which is ultimately the lowest portion of the study area. The western, eastern, and southern boundaries may include connections to adjacent watersheds (Bowlees, Rattlesnake Slough, and Whitaker Bayou respectively), with elevations ranging between approximately 10 and 20 feet NAVD88. Interconnections may need to be added following initial model runs.

2.5.1 Vertical Datum

Elevation data utilized for this study is referenced to the North American Vertical Datum of 1988 (NAVD88). The average vertical datum conversion factor for the PDGC Watershed was referenced from the 2014 Manatee County FIS as 0.98 feet. As such:

NGVD29 elevation – 0.98 feet = NAVD88 elevation

2.5.2 Topographic Voids

For this evaluation, topographic voids are defined as those areas where available digital topographic information does not accurately describe terrain as it currently exists today. The initial digital terrain model (DTM) was reviewed and compared to 2017 aerial photography to identify any topographic voids that may exist in the DTM, such as areas where new development has occurred since the collection of the topographic data. The majority of the topographic voids identified within the study area were a result of commercial development, transportation expansions, or residential subdivisions constructed after the aerial topographic data were collected. The topographic voids identified are documented within the "TopoVoids" polygon feature class and shown on **Figure 2-5**. An example topographic void is shown on **Figure 2-6**, below. The significant topographic voids identified are shown by priority in **Table 2-2**. It should be noted that identification of topographic voids was completed for the entire watershed, as this information may be needed to complete components to support the hydrologic/hydraulic modeling to be completed in subsequent tasks.

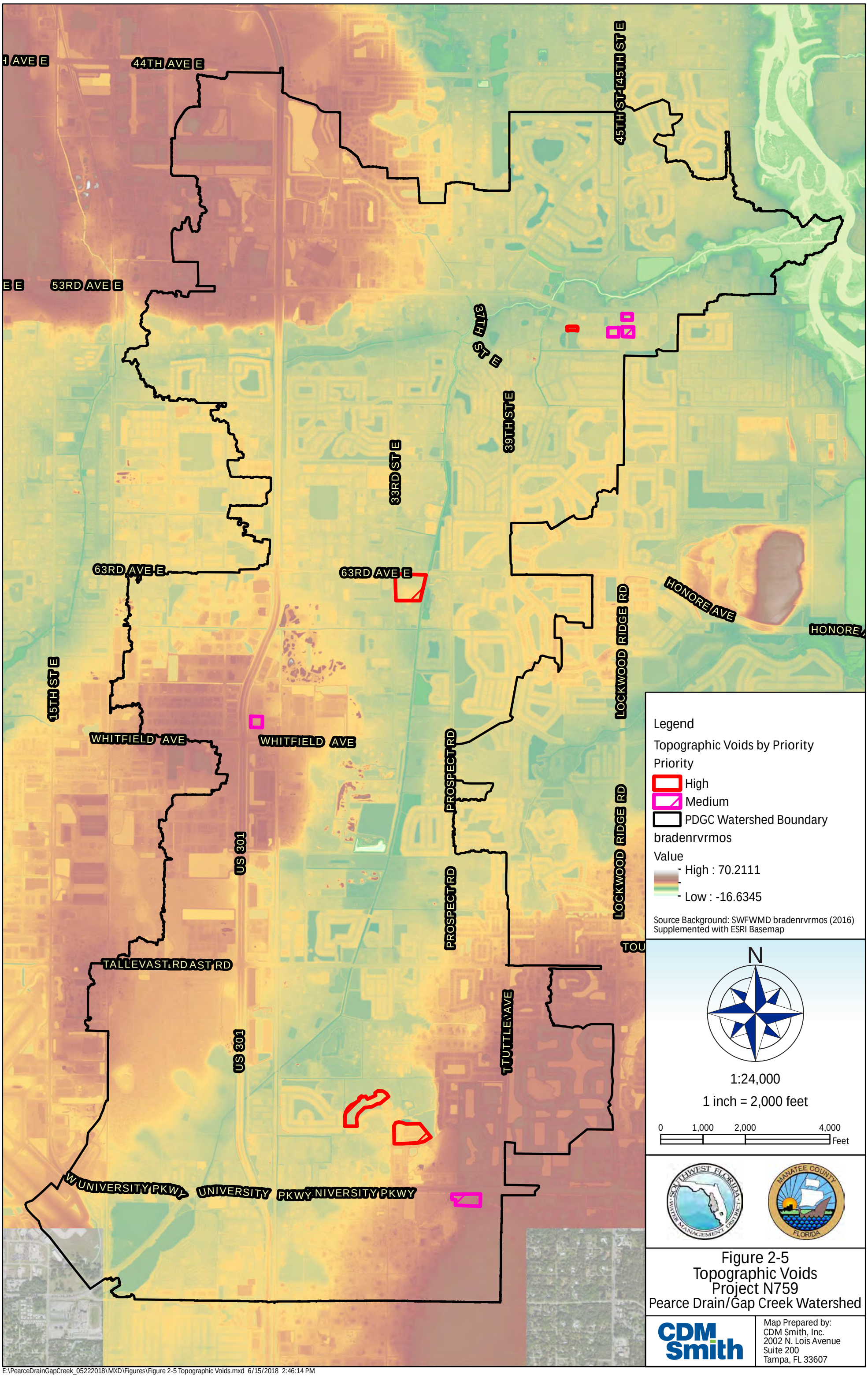

Figure 2-5
Topographic Voids
Project N759
Pearce Drain/Gap Creek Watershed

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E:\PearceDrainGapCreek_05222018\MXD\Figures\Figure 2-5 Topographic Voids.mxd 6/15/2018 2:46:14 PM

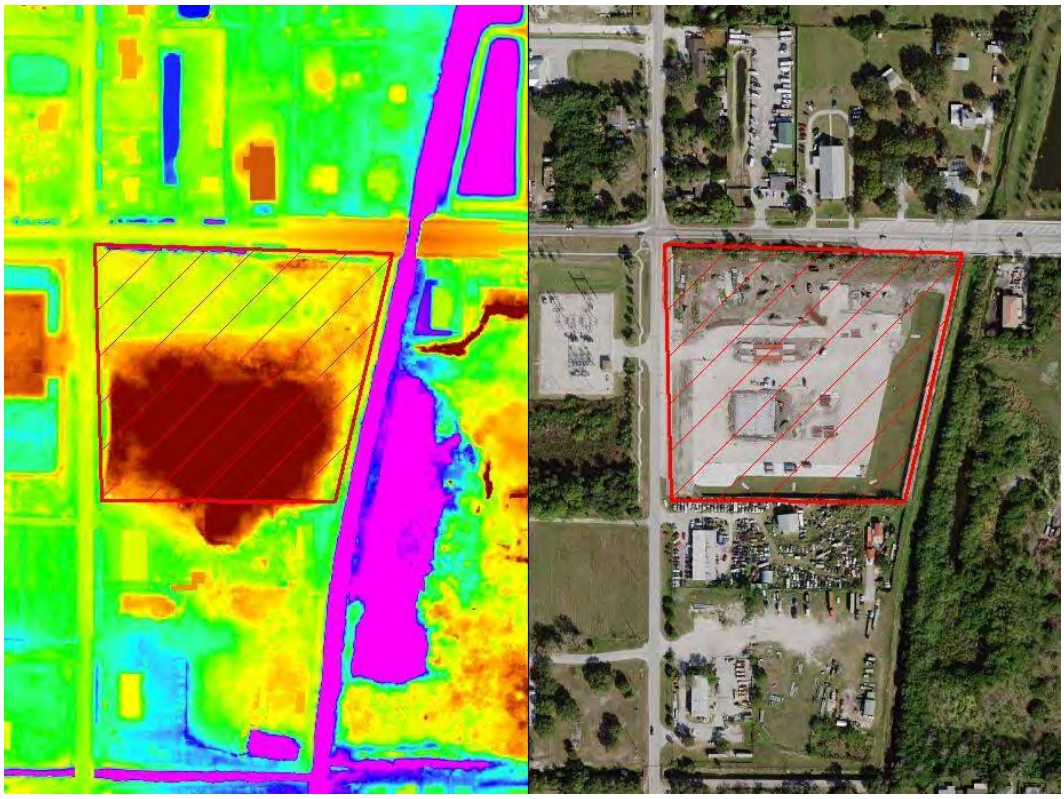

Figure 2-6
Example Topographic Void

2.5.3 Elimination of Topographic Voids

During the initial void identification, CDM Smith had established a defined buffer to identify voids within as the watershed boundary delineation was concurrently under development. This was done as a safety measure to ensure that all voids would be captured within the final watershed boundary. CDM Smith categorized topographic voids by a high, medium, or low priority. A memorandum outlining CDM Smith's approach to eliminate topographic voids that were identified is included in **Appendix B**. Low priority topographic voids are located either outside of the watershed or are not anticipated to have a significant impact on model results and were not corrected. Based on DISTRICT and County feedback, the DEM was modified for only the medium and high priority topographic voids. Medium and high priority topographic voids were accounted for by georeferencing the site grading plans and manually digitizing proposed spot elevations, building finished floor elevations, and contours to patch in a subset DEM within GIS. An example of a topographic void replacement is shown on **Figure 2-7**.

Table 2-2 Topographic Voids Identified

Permit/Reference	Description	Location Description	Priority
ERP_026632_008	Subdivision expansion and regrading	The Enclave at University Groves	High
ERP_026632_013	DEM doesn't capture completed construction	University Groves Apartment Complex	High
ERP_040416_004	Pond Modification	Paley Place OP A Parking	High
ERP_042055_000	Pond Void; Adjacent to Pearce Drain; Site Under construction in 2017 aerial	Renovo Resource Recovery	High
ERP_022526_002	New Development - Pond Void	Autumn Leaves of Sarasota ALF	Medium
ERP_005453_002	DEM includes excavation for gas station tanks (need to remove)	Wawa - Lockwood Ridge Road & SR 70	Medium
ERP_005453_006	Site Under construction in 2017 aerial	Burger King @ West Lakes Plaza	Medium
ERP_040416_003	New construction missing from DEM	Paley Place Outparcels D & E	Medium
ERP_042634_000	Site Under construction in 2017 aerial	Arctic Air	Medium

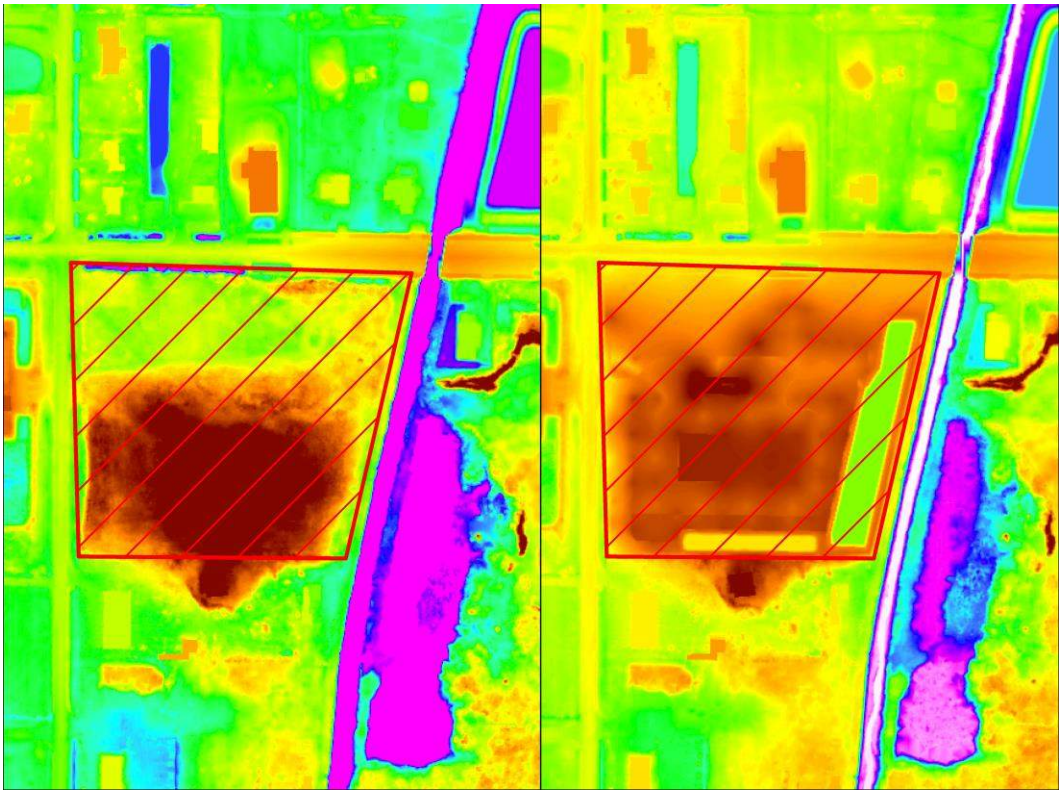

Figure 2-7
Example Topographic Void Replacement

2.6 Areas of Ongoing Construction

There are four major areas of ongoing construction within the PDGC watershed. The calibration event of the unnamed storm in August 2017 and the verification event of Tropical Storm Hermine in September 2016 occurred prior to the construction of these four projects. For purposes of calibration and verification, the pre-development condition of these areas will be modeled initially in the Floodplain Analysis phase. Once a fully calibrated model has been created, the design storm event models will be created to capture the post-development condition of the Westport development. The Westport development involves construction in the floodplain near the Pearce Drain and Gap Creek confluence and may affect the validity of results of a pre-/post-comparison in the Alternatives Analysis phase of this project. This approach will be revisited in the Floodplain Analysis phase with DISTRICT and County input. **Table 2-3** summarizes the projects and their expected level of impact on model results.

Table 2-3 Areas of Ongoing Construction (as of May 2018)

Project	Description	Documents Available	Expected Impact on Model Results
45th Street Improvements	Widening of bridge over Gap Creek, construction of 2 stormwater facilities	Contract Drawings	Medium; outside of priority area and near Gap Creek confluence with Braden River
Oasis at University	Construction of apartment complex, 2 stormwater facilities	Final Construction Plans	Low; outside of priority area and does not discharge directly to Pearce Drain.
University Groves	Part of an existing development master plan; construction of 3 additional buildings	Final Construction Plans	Low; outside of priority area. Also, stormwater facilities have already been constructed and are reflected in DEM and current schematic.
Westport	New residential neighborhood, includes construction of 5 stormwater facilities.	Permitted Plans	High; Construction around Gap Creek/Pearce Drain confluence, within floodplain, within priority area.

2.7 FEMA Floodplains

Figure 2-8 shows the current FEMA floodplain delineations (2014) in the PDGC Watershed. The detailed study's extent (including floodways) is from the Braden River south to 63rd Avenue/Saunders Road (AE Zone); south of this extent BFEs are not defined (Zone A).

The 2014 FIS Study shows a flood profile (included as **Figure 2-9** delineated for Gap Creek, which upon comparison of road crossings and cross section information, the Gap Creek flood profile includes Pearce Drain from 63rd Avenue E (Saunders Road) downstream to the confluence with the Braden River. West of the confluence with Pearce Drain, Gap Creek is referred to as the Gap Creek West Tributary in the FIS Study. Braden River at the confluence of Gap Creek is also included in the 2014 FIS Study and is shown on **Figure 2-10**. Braden River stages are discussed further in Section 5 with respect to watershed boundary conditions.

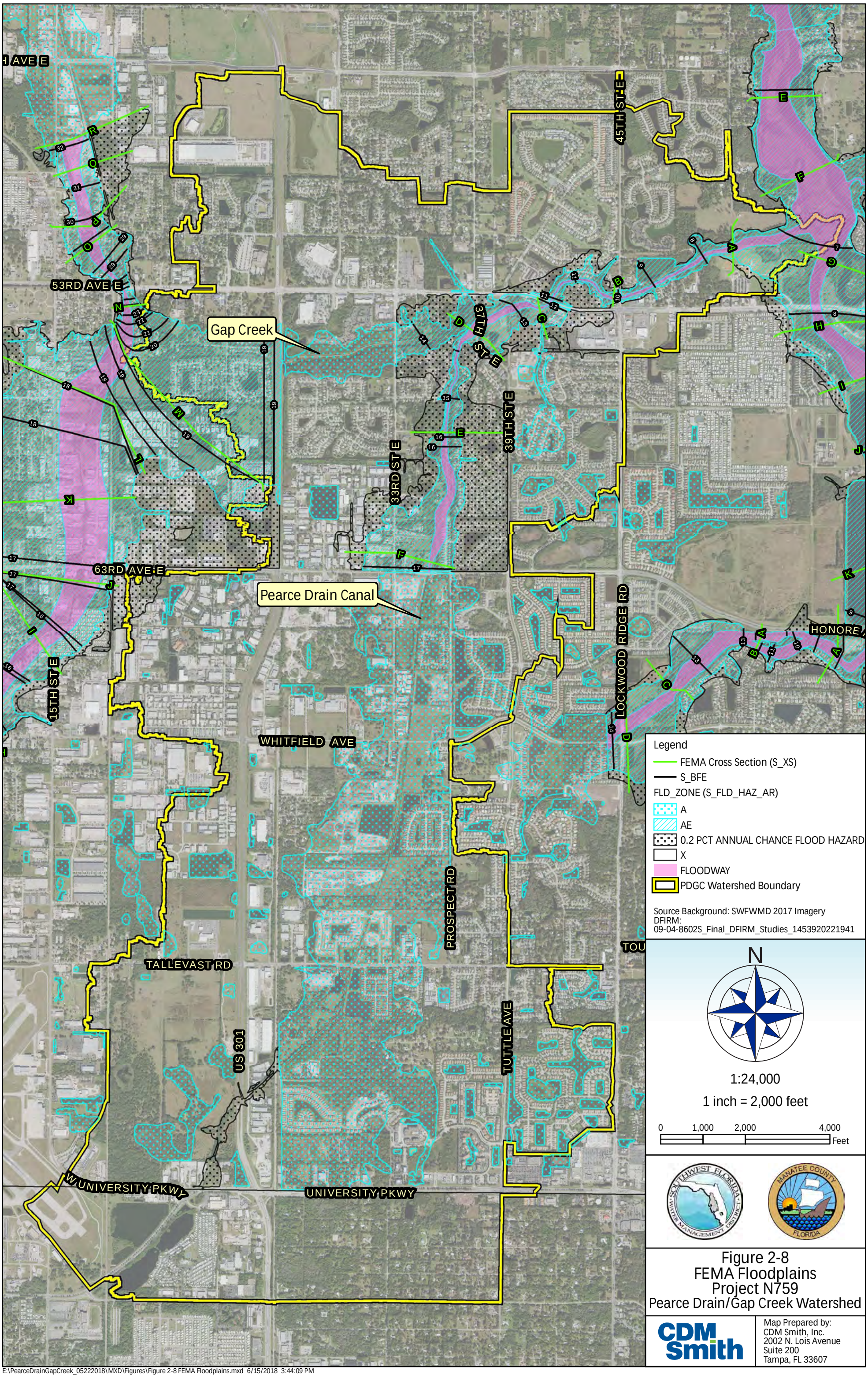

Figure 2-8
FEMA Floodplains
Project N759
Pearce Drain/Gap Creek Watershed

Map Prepared by:
CDM Smith, Inc.
2002 N. Lois Avenue
Suite 200
Tampa, FL 33607

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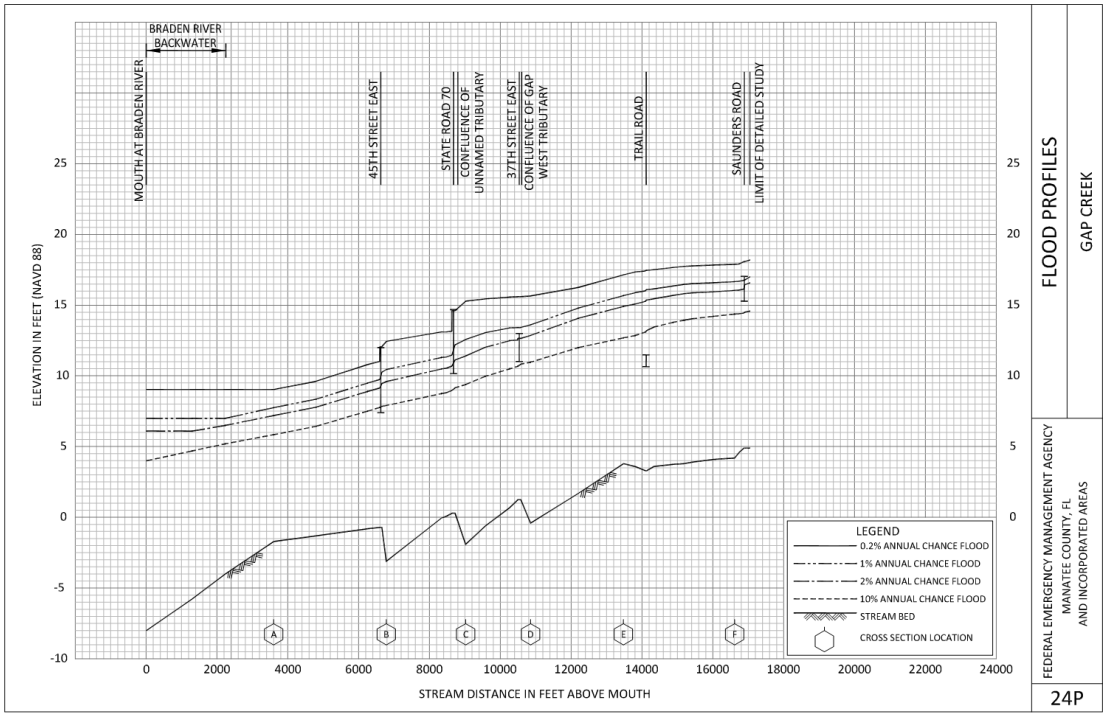

Figure 2-9
FEMA Flood Profile for Gap Creek from Manatee County FIS (2014)

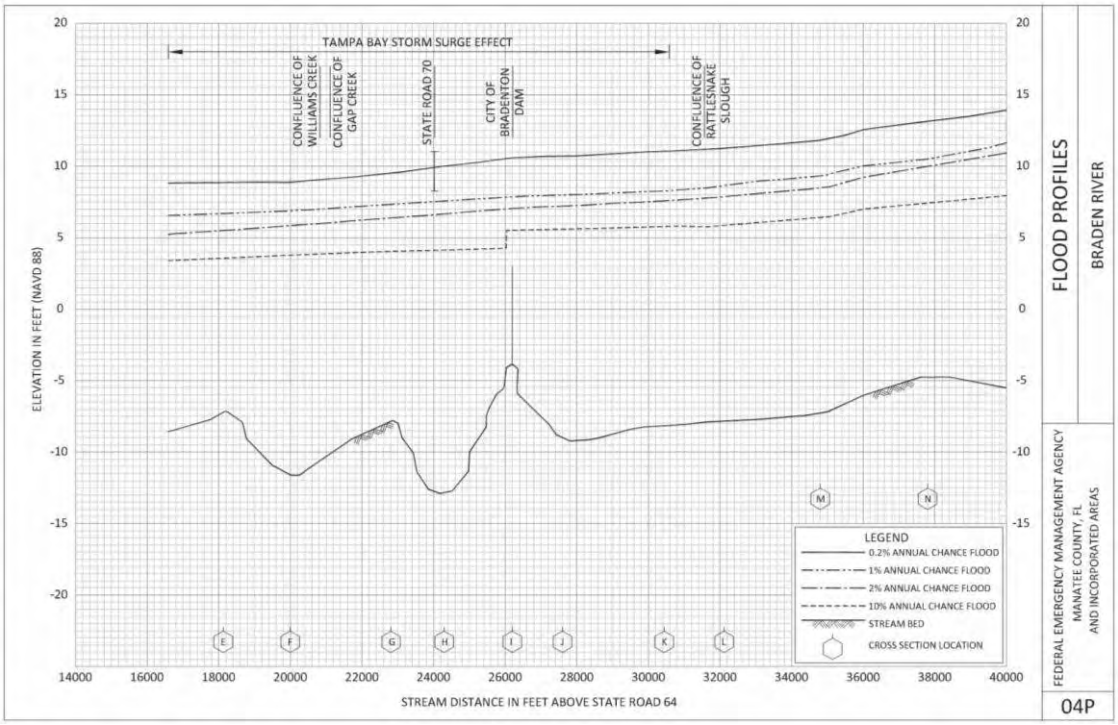

Figure 2-10
FEMA Flood Profile for Braden River from Manatee County FIS (2014)

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Section 3
Hydrologic Features

The watershed hydrologic GIS features include soils polygons with hydrologic classes (Hydrologic Soil Groups) for infiltration capacity calculations, land use type polygons to estimate imperviousness, and drainage sub-basin polygons to calculate rainfall excess (runoff) at areas of interest. The study hydrologic features were compiled in the GWIS geodatabase by CDM Smith.

3.1 Watershed Boundary and Catchment Delineation

The DISTRICT's Geographic Watershed Information System (GWIS) geodatabase and tools were used to delineate the initial version of the catchments, define the overall watershed boundary, develop surface connectivity, and define the preferential flow paths in the deranged (i.e., limited outfall) areas. The general flow characteristics of the basin is dendritic, however to ensure subdivisions within the "priority area" are accurately represented, the stormwater management ponds were included as sinks. Additionally, to confirm runoff loading to the ponds is only from the portion of the subdivision that is piped to it, walls were built to exclude non- subdivision flows. The 5-foot DEM was used for the topographic analysis to decrease processing time, as well as to coordinate with the Bowless Creek GIS processing that is concurrently underway as a separate effort. As part of this current task, catchments were further refined as described further in this section. Refer to **Figure 3-1** for the refined drainage catchment delineation.

The boundary of the overall watershed was compared to adjacent studies (i.e., the City of Bradenton, Braden River, Whitaker Bayou) and a determination was made of the most appropriate boundary based on available information. CDM Smith also performed additional coordination with the WMP Consultant for the adjacent Bowlees Creek Watershed which is also concurrently under development. CDM Smith and the WMP Consultant compared respective basin boundaries and worked to resolve any differences. Field verification was done to confirm areas of discrepancy between the Bowlees Creek Watershed and PDGC Watershed, specifically along the Sarasota-Bradenton Airport and just north of 53rd Avenue (west of US-301).

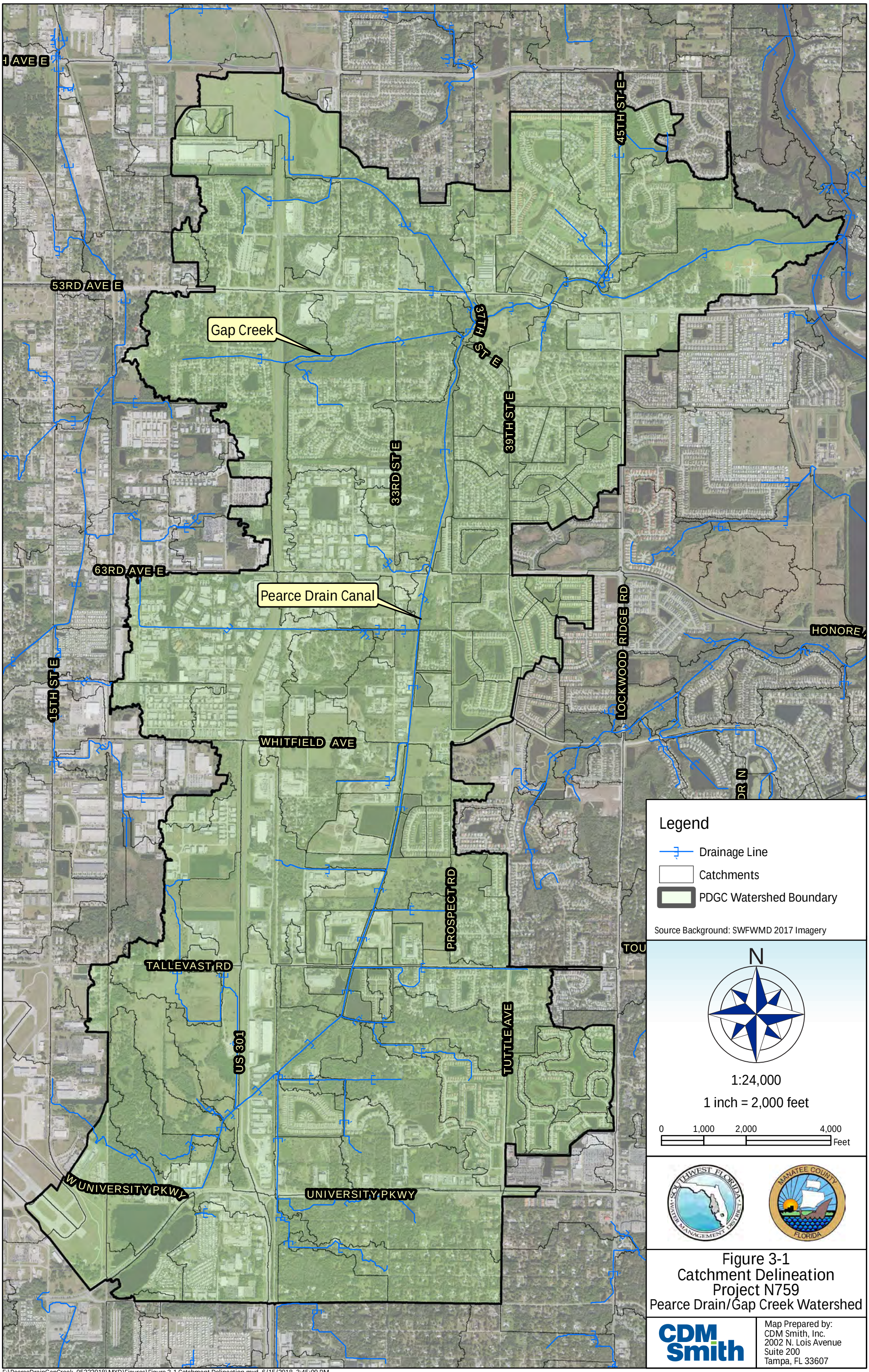

Figure 3-1
Catchment Delineation
Project N759
Pearce Drain/Gap Creek Watershed

Map Prepared by:
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Suite 200
Tampa, FL 33607

E:\PearceDrainGapCreek_05222018\MXD\Figures\Figure 3-1 Catchment Delineation.mxd 6/15/2018 3:45:00 PM

3.1.1 Tributary Subbasin and Characterization

The catchments described above as well as the priority area are the basis for developing the subbasins (ICPR_BASINS) to be included in the model parameterization. As the watershed is highly urbanized, especially in the priority area, additional manual revisions were made to ensure the catchment extents were consistent with as-built and ERP plans. Overall, eight major groups were defined and are described below:

- A - Pearce Drain, south of Tallevast Rd (43 basins, 2026.8 acres)
- B - Pearce Drain, between Tallevast and Whitfield Rd (34 basins, 884.4 acres)
- C - Pearce Drain, north of Whitfield & south of SR 70 (18 basins, 974.7 acres)
- D - Pearce Drain (priority area) Centre Lake and adjacent neighborhoods, between Whitfield Ave and 63rd Ave (19 basins, 281.4 acres)
- E - Pearce Drain (priority area) between 63rd Ave and SR 70 (32 basins, 482.3 acres)
- F - Gap Creek and directly contributing areas (11 basins, 636 acres)
- G – Unnamed northwest tributary (11 basins, 578.7 acres)
- H – Gap Creek, SR 70 to confluence with Braden River (14 basins, 618 acres)

A map showing the subbasin groups is provided on **Figure 3-2**.

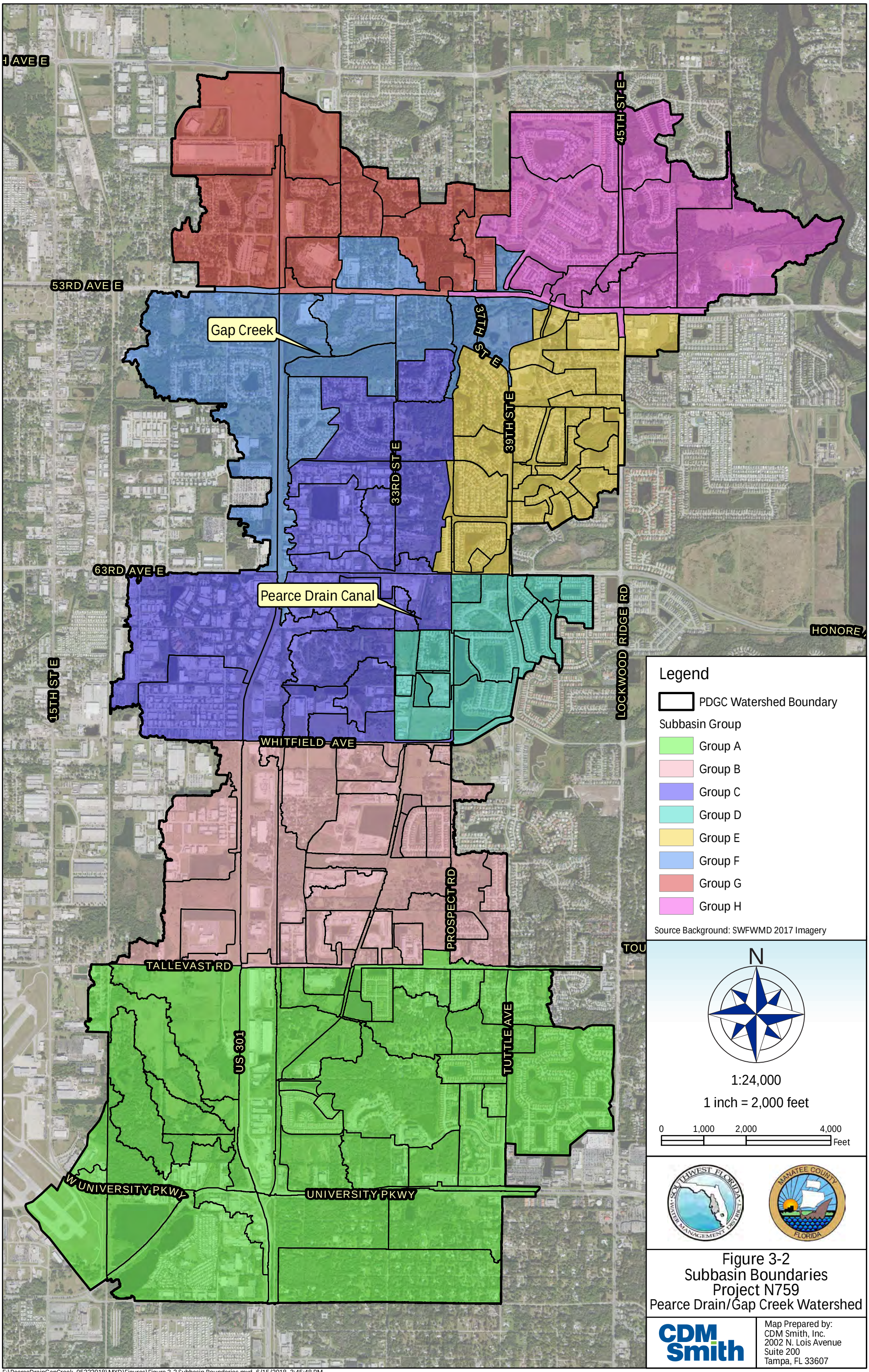

Figure 3-2
Subbasin Boundaries
Project N759
Pearce Drain/Gap Creek Watershed

CDM Smith

Map Prepared by:
CDM Smith, Inc.
2002 N. Lois Avenue
Suite 200
Tampa, FL 33607

E:\PearceDrainGapCreek_05222018\MXD\Figures\Figure 3-2 Subbasin Boundaries.mxd 6/15/2018 3:45:48 PM

3.2 Soils Characterization

Soils data for the study area were downloaded from the Web Soil Survey from the U.S. Department of Agriculture, Natural Resources Conservation Service with publication dates of 2015 (Sarasota County) and 2017 (Manatee County). The hydrologic classes of the soils (Hydrologic Soils Groups) in the watershed are summarized in **Table 3-1** and depicted on **Figure 3-3**.

Most of the study area is comprised of A/D soils (approximately 69 percent). It should be noted that the soils characterization was completed for the entire watershed as this information will be needed to develop parameters to support the hydrologic/hydraulic modeling to be completed in subsequent tasks.

Table 3-1 Hydrologic Soil Groups in the PDGC Watershed

Subwatershed	Hydrologic Group	Acres	% Area
A	A	74.5	3.7%
	A/D	1534.3	75.7%
	B/D	264.6	13.1%
	C/D	93.3	4.6%
	W	55.3	2.7%
	N/A[1]	4.7	0.2%
Subtotal		**2026.8**	**100.0%**
B	A	14.8	1.7%
	A/D	694.9	78.6%
	B/D	22.2	2.5%
	C/D	152.2	17.2%
Subtotal		**884.2**	**100.0%**
C	A	7.5	0.8%
	A/D	611.5	62.7%
	B/D	119.0	12.2%
	C/D	231.9	23.8%
	W	4.8	0.5%
Subtotal		**974.7**	**100.0%**
D	A/D	151.9	54.0%
	B/D	45.7	16.2%
	C/D	82.1	29.2%
	W	1.7	0.6%
Subtotal		**281.4**	**100.0%**
E	A/D	328.4	68.1%
	B/D	106.0	22.0%
	C/D	47.9	9.9%
Subtotal		**482.3**	**100.0%**
F	A	66.9	10.5%

Table 3-1 Hydrologic Soil Groups in the PDGC Watershed

Subwatershed	Hydrologic Group	Acres	% Area
	A/D	320.7	50.4%
	B/D	124.4	19.6%
	C/D	120.2	18.9%
	W	3.9	0.6%
Subtotal		**636.0**	**100.0%**
G	A	23.0	4.0%
	A/D	409.6	70.8%
	B/D	78.3	13.5%
	C/D	67.8	11.7%
Subtotal		**578.7**	**100.0%**
H	A	20.0	3.2%
	A/D	431.2	69.8%
	B/D	12.4	2.0%
	C/D	154.3	25.0%
	W	0.1	0.0%
Subtotal		**618.0**	**100.0%**

[1] Unclassified, soil name is pits and dumps

3.3 Percolation Locations

Ideally percolation links should be used in depression areas or ponds located in portions of the basin with low runoff potential. This would include areas with A types soils and a significant amount of separation between the bottom of the pond or depression and the water table. As noted in Table 3-1, there is a minimal amount of single A soils, approximately 3.2 percent. The soils largely consist of dual class (A/D, B/D, C/D), with A/D making up the largest percentage (69.2 percent). The dual class is due to the presence of a high-water table or hard pan underlaying the soil, both conditions would limit the potential rate of percolation. The minimal soil storage available would likely be filled during infiltration and thus not available to provide percolation of ponded water.

Another indicator of the potential for percolation would be the presence of retention ponds or rapid infiltration basins (RIBs) within the watershed. Based on the review of ERP information within the watershed, it appears nearly all of the stormwater facilities are wet ponds which presumes a seasonal high-water table (SHWT) significantly higher than the bottom of the pond.

Based on the soils data, ERP information, and a review of site conditions during field reconnaissance, percolation links will not be included.

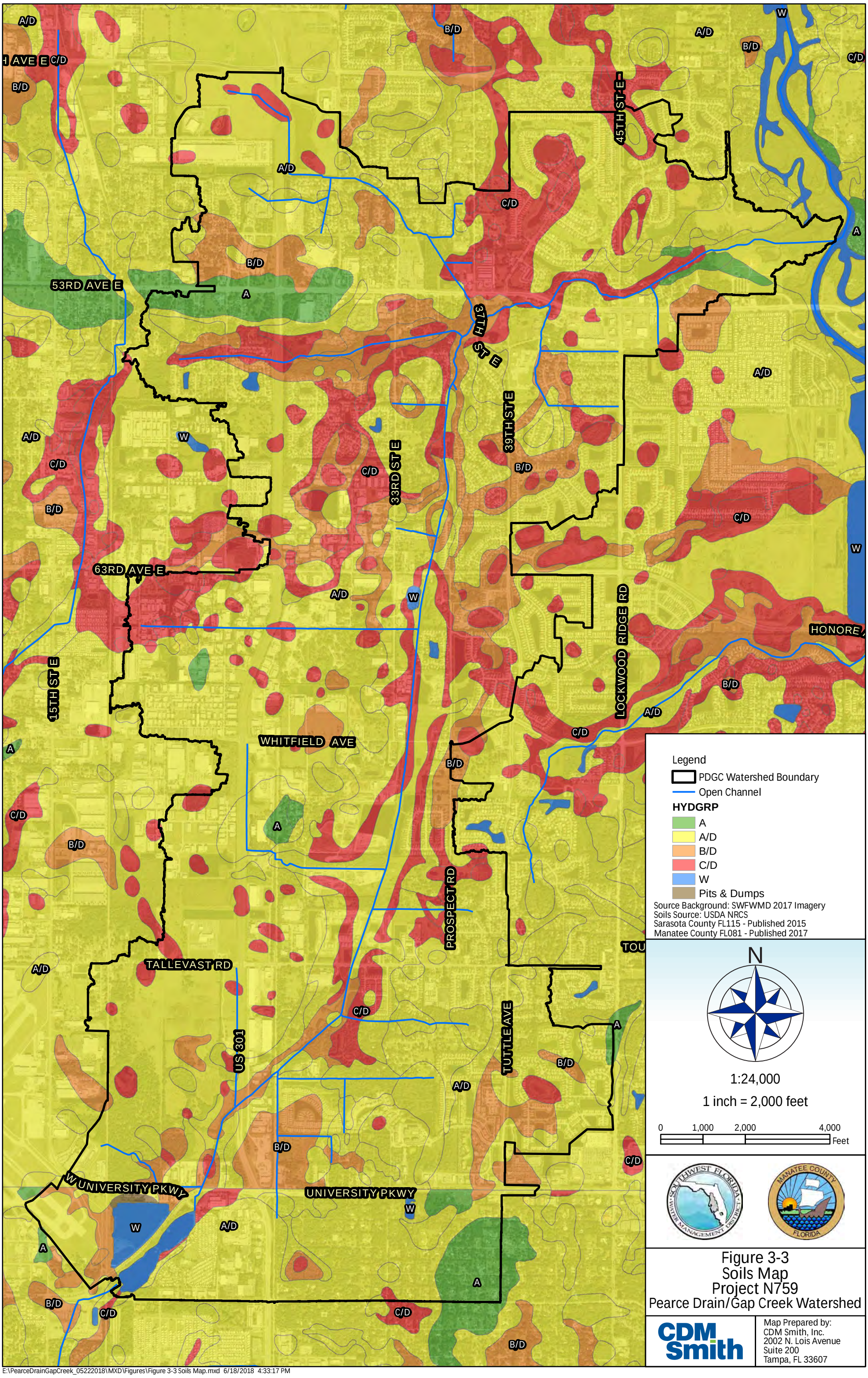

Figure 3-3
Soils Map
Project N759
Pearce Drain/Gap Creek Watershed

Map Prepared by:
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Tampa, FL 33607

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3.4 Land Use Characterization

2011 land use data obtained from the DISTRICT were updated by CDM Smith as necessary using aerial photography dated 2017. Refer to **Table 3-2** for a summary of the land use types in the PDGC Watershed, which are also shown on **Figure 3-4**. Most of the study area (approximately 40 percent) is comprised of residential and industrial land use, followed by lakes and other urban land uses. Also shown in Table 3-2 are look-up values to correlate land use to impervious characteristics based on the DISTRICT's guidance. CDM Smith revised the look-up table impervious attributes for medium density residential, extractive, and transportation land uses to better fit the characteristics of the PDGC watershed.

Table 3-2 Land Use Parameters Look-up Table

FLUCCS	Land Use Description	Acres	Percent	Mannings "n"	% DCIA	% Impervious
1100	Residential, low density (less than 2 dwellings)	642.2	9.9%	0.16	0	10
1200	Residential, medium density (2-5 dwelling units)	363.8	5.6%	0.13	10	40
1300	Residential, high density (6+ dwelling units)	1,393	21.5%	0.08	20	70
1400	Commercial and services	304.4	4.7%	0.05	50	70
1500	Industrial	1,093.1	16.9%	0.07	72	77
1600	Extractive	48.3	0.7%	0.3	0	20
1700	Institutional	71.6	1.1%	0.13	65	70
1800	Recreational	49.3	0.8%	0.13	2	5
1820	Golf courses	46.5	0.7%	0.13	2	5
1900	Open land (urban)	432.6	6.7%	0.3	0	0
2100	Cropland and pastureland	411.5	6.3%	0.15	0	0
2400	Nurseries and vineyards	26.2	0.4%	0.2	5	10
2600	Other Open Lands (rural)	14.5	0.2%	0.15	0	0
3200	Shrub and brushland	13.5	0.2%	0.3	0	0
4100	Upland Coniferous Forest	10.3	0.1%	0.45	0	0
4110	Pine Flatwoods	96.9	1.5%	0.45	0	0
4200	Upland hardwood forests	12.9	0.2%	0.45	0	0
4340	Hardwood Conifer Mixed	182.2	2.8%	0.45	0	0
4400	Tree Plantations	24.1	0.4%	0.45	0	0
5300	Reservoirs	445.9	6.9%	0	100	100
5400	Bays and Estuaries[1]	1.5	0.0%	0	100	100
6120	Mangrove Swamps[1]	2.3	0.0%	0.45	100	100
6150	Stream and lake swamps (bottomland)	31.5	0.5%	0.3	100	100
6210	Cypress	11.3	0.2%	0.35	100	100
6300	Wetland forested mixed	323.0	5.0%	0.3	100	100
6410	Freshwater marshes	54.1	0.8%	0.06	100	100
6420	Saltwater marshes[1]	27.5	0.4%	0.06	100	100
6430	Wet prairies	47.9	0.7%	0.06	100	100

Table 3-2 Land Use Parameters Look-up Table

FLUCCS	Land Use Description	Acres	Percent	Mannings "n"	% DCIA	% Impervious
6440	Emergent aquatic vegetation	33.6	0.5%	0.06	100	100
6530	Intermittent ponds	1.9	0.0%	0.06	100	100
8100	Transportation[2]	261.8	4.0%	0.15	95	90
8300	Utilities	2.9	0.0%	0.15	2	5
	TOTAL	**6,482**	**100.0%**			

[1] FLUCCs 5400, 6120, and 6420 not included in SWFWMD guidance look-up table and subsequently added
[2] Transportation has been further refined to represent the impervious portion of the R/W.

It should be noted that the land use refinement was completed for the entire watershed, as this information will be needed to develop parameters to support the hydrologic/hydraulic modeling to be completed in subsequent tasks. **Table 3-3** provides a breakdown of land use at the sub-watershed level.

Table 3-3 Land Use Breakdown in the PDGC Watershed

Subwatershed	FLUCCS Code	Land Use Description	Acres	% Area
A	1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	380.8	18.8%
	1200	RESIDENTIAL MED DENSITY 2->5 DWELLING UNIT	20.7	1.0%
	1300	RESIDENTIAL HIGH DENSITY	361.7	17.8%
	1400	COMMERCIAL AND SERVICES	36.4	1.8%
	1500	INDUSTRIAL	234.7	11.6%
	1700	INSTITUTIONAL	10.3	0.5%
	1800	RECREATIONAL	5.8	0.3%
	1820	GOLF COURSES	0.6	0.0%
	1900	OPEN LAND	98.8	4.9%
	2100	CROPLAND AND PASTURELAND	178.9	8.8%
	2400	NURSERIES AND VINEYARDS	14.3	0.7%
	3200	SHRUB AND BRUSHLAND	13.5	0.7%
	4110	PINE FLATWOODS	70.2	3.5%
	4200	UPLAND HARDWOOD FORESTS - PART 1	10.6	0.5%
	4340	HARDWOOD CONIFER MIXED	82.8	4.1%
	5300	RESERVOIRS	139.4	6.9%
	6210	CYPRESS	11.3	0.6%
	6300	WETLAND FORESTED MIXED	182.0	9.0%
	6410	FRESHWATER MARSHES	13.4	0.7%
	6430	WET PRAIRIES	7.8	0.4%
	6440	EMERGENT AQUATIC VEGETATION	12.7	0.6%
	8100	TRANSPORTATION	140.2	6.9%
	Subtotal		2026.8	100.0%
B	1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	91.7	10.4%
	1200	RESIDENTIAL MED DENSITY 2->5 DWELLING UNIT	83.5	9.4%

Table 3-3 Land Use Breakdown in the PDGC Watershed

Subwatershed	FLUCCS Code	Land Use Description	Acres	% Area
	1300	RESIDENTIAL HIGH DENSITY	75.8	8.6%
	1400	COMMERCIAL AND SERVICES	54.9	6.2%
	1500	INDUSTRIAL	218.5	24.7%
	1700	INSTITUTIONAL	8.6	1.0%
	1900	OPEN LAND	87.8	9.9%
	2100	CROPLAND AND PASTURELAND	84.3	9.5%
	2600	OTHER OPEN LANDS <RURAL>	14.5	1.6%
	4340	HARDWOOD CONIFER MIXED	2.1	0.2%
	4400	TREE PLANTATIONS	24.1	2.7%
	5300	RESERVOIRS	70.4	8.0%
	6300	WETLAND FORESTED MIXED	30.2	3.4%
	6410	FRESHWATER MARSHES	10.0	1.1%
	6430	WET PRAIRIES	7.0	0.8%
	6440	EMERGENT AQUATIC VEGETATION	1.5	0.2%
	8100	TRANSPORTATION	19.2	2.2%
	Subtotal		884.2	100.0%
C	1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	74.2	7.6%
	1300	RESIDENTIAL HIGH DENSITY	81.1	8.3%
	1400	COMMERCIAL AND SERVICES	12.5	1.3%
	1500	INDUSTRIAL	542.9	55.7%
	1600	EXTRACTIVE	47.9	4.9%
	1700	INSTITUTIONAL	5.5	0.6%
	1900	OPEN LAND	72.1	7.4%
	2100	CROPLAND AND PASTURELAND	11.3	1.2%
	4110	PINE FLATWOODS	14.5	1.5%
	4340	HARDWOOD CONIFER MIXED	20.6	2.1%
	5300	RESERVOIRS	48.0	4.9%
	6150	STREAM AND LAKE SWAMPS (BOTTOMLAND)	2.9	0.3%
	6300	WETLAND FORESTED MIXED	13.8	1.4%
	6410	FRESHWATER MARSHES	2.6	0.3%
	6430	WET PRAIRIES	0.0	0.0%
	6440	EMERGENT AQUATIC VEGETATION	5.7	0.6%
	8100	TRANSPORTATION	16.0	1.6%
	8300	UTILITIES	2.9	0.3%
	Subtotal		974.7	100.0%
D	1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	11.6	4.1%
	1300	RESIDENTIAL HIGH DENSITY	154.0	54.7%
	1500	INDUSTRIAL	14.1	5.0%
	1900	OPEN LAND	21.3	7.6%

Table 3-3 Land Use Breakdown in the PDGC Watershed

Subwatershed	FLUCCS Code	Land Use Description	Acres	% Area
	2100	CROPLAND AND PASTURELAND	19.2	6.8%
	5300	RESERVOIRS	34.6	12.3%
	6300	WETLAND FORESTED MIXED	15.6	5.5%
	6410	FRESHWATER MARSHES	2.3	0.8%
	6530	INTERMITTENT PONDS	1.2	0.4%
	8100	TRANSPORTATION	7.4	2.6%
	Subtotal		281.4	100.0%
E	1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	4.9	1.0%
	1300	RESIDENTIAL HIGH DENSITY	322.6	66.9%
	1400	COMMERCIAL AND SERVICES	56.3	11.7%
	1700	INSTITUTIONAL	10.1	2.1%
	1900	OPEN LAND	13.0	2.7%
	4340	HARDWOOD CONIFER MIXED	0.6	0.1%
	5300	RESERVOIRS	35.4	7.3%
	6150	STREAM AND LAKE SWAMPS (BOTTOMLAND)	0.2	0.0%
	6300	WETLAND FORESTED MIXED	18.8	3.9%
	6410	FRESHWATER MARSHES	6.0	1.3%
	6440	EMERGENT AQUATIC VEGETATION	2.7	0.6%
	8100	TRANSPORTATION	11.8	2.4%
	Subtotal		482.3	100.0%
F	1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	14.4	2.3%
	1200	RESIDENTIAL MED DENSITY 2->5 DWELLING UNIT	165.4	26.0%
	1300	RESIDENTIAL HIGH DENSITY	62.6	9.8%
	1400	COMMERCIAL AND SERVICES	55.4	8.7%
	1500	INDUSTRIAL	39.8	6.3%
	1600	EXTRACTIVE	0.4	0.1%
	1700	INSTITUTIONAL	17.5	2.7%
	1800	RECREATIONAL	0.2	0.0%
	1900	OPEN LAND	86.7	13.6%
	4110	PINE FLATWOODS	12.2	1.9%
	4340	HARDWOOD CONIFER MIXED	34.8	5.5%
	5300	RESERVOIRS	19.3	3.0%
	6150	STREAM AND LAKE SWAMPS (BOTTOMLAND)	28.3	4.5%
	6300	WETLAND FORESTED MIXED	36.1	5.7%
	6410	FRESHWATER MARSHES	4.0	0.6%
	6430	WET PRAIRIES	33.1	5.2%
	6440	EMERGENT AQUATIC VEGETATION	3.4	0.5%
	6530	INTERMITTENT PONDS	0.7	0.1%
	8100	TRANSPORTATION	21.8	3.4%

Table 3-3 Land Use Breakdown in the PDGC Watershed

Subwatershed	FLUCCS Code	Land Use Description	Acres	% Area
	Subtotal		636.0	100.0%
G	1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	30.6	5.3%
	1200	RESIDENTIAL MED DENSITY 2->5 DWELLING UNIT	66.3	11.5%
	1300	RESIDENTIAL HIGH DENSITY	116.2	20.1%
	1400	COMMERCIAL AND SERVICES	67.7	11.7%
	1500	INDUSTRIAL	43.0	7.4%
	1700	INSTITUTIONAL	15.4	2.7%
	1800	RECREATIONAL	6.6	1.1%
	1900	OPEN LAND	39.2	6.8%
	2100	CROPLAND AND PASTURELAND	75.1	13.0%
	2400	NURSERIES AND VINEYARDS	11.9	2.1%
	4100	UPLAND CONIFEROUS FOREST	10.3	1.8%
	5300	RESERVOIRS	49.6	8.6%
	6150	STREAM AND LAKE SWAMPS (BOTTOMLAND)	0.0	0.0%
	6300	WETLAND FORESTED MIXED	4.9	0.9%
	6410	FRESHWATER MARSHES	14.3	2.5%
	6440	EMERGENT AQUATIC VEGETATION	5.5	0.9%
	6530	INTERMITTENT PONDS	0.0	0.0%
	8100	TRANSPORTATION	22.1	3.8%
	Subtotal		578.7	100.0%
H	1100	RESIDENTIAL LOW DENSITY < 2 DWELLING UNITS	34.1	5.5%
	1200	RESIDENTIAL MED DENSITY 2->5 DWELLING UNIT	27.9	4.5%
	1300	RESIDENTIAL HIGH DENSITY	219.0	35.4%
	1400	COMMERCIAL AND SERVICES	21.2	3.4%
	1700	INSTITUTIONAL	4.2	0.7%
	1800	RECREATIONAL	36.7	5.9%
	1820	GOLF COURSES	46.0	7.4%
	1900	OPEN LAND	13.7	2.2%
	2100	CROPLAND AND PASTURELAND	42.7	6.9%
	4100	UPLAND CONIFEROUS FOREST	0.0	0.0%
	4200	UPLAND HARDWOOD FORESTS - PART 1	2.3	0.4%
	4340	HARDWOOD CONIFER MIXED	41.2	6.7%
	5300	RESERVOIRS	49.3	8.0%
	5400	BAYS AND ESTUARIES	1.5	0.2%
	6120	MANGROVE SWAMPS	2.3	0.4%
	6300	WETLAND FORESTED MIXED	21.6	3.5%
	6410	FRESHWATER MARSHES	1.4	0.2%
	6420	SALTWATER MARSHES	27.5	4.4%
	6440	EMERGENT AQUATIC VEGETATION	2.0	0.3%

Table 3-3 Land Use Breakdown in the PDGC Watershed

Subwatershed	FLUCCS Code	Land Use Description	Acres	% Area
	8100	TRANSPORTATION	23.3	3.8%
	Subtotal		618.0	100.0%

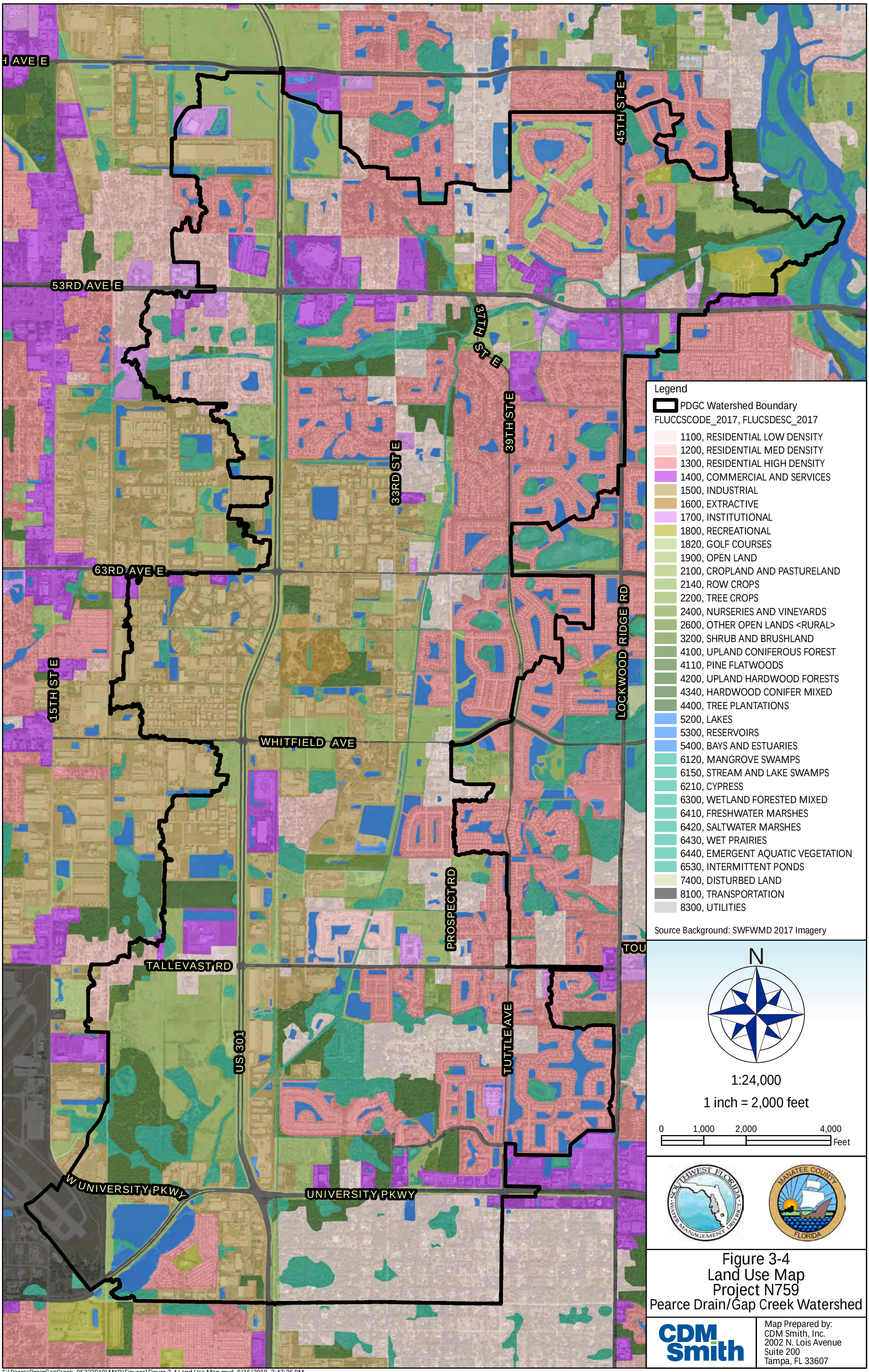


Figure 3-4
Land Use Map
Project N759
Pearce Drain/Gap Creek Watershed

Map Prepared by:
CDM Smith, Inc.
2002 N. Lois Avenue
Suite 200
Tampa, FL 33607

E:\PearceDrainGapCreek_05222018\MXD\Figures\Figure 3-4 Land Use Map.mxd 6/15/2018 3:47:36 PM

Section 4
Hydraulic Features

The data collected from ERPs, existing GIS drainage inventories, construction plans, existing models and field investigations were utilized by CDM Smith to develop an inventory of the hydraulic features within the PDGC Watershed. These features were utilized to develop the hydraulic inventory with a higher level of detail focused in the "priority area".

4.1 Hydraulic Feature Inventory Development

A hydraulic feature inventory for the watershed was developed based on a number of sources of information including the following:

- Manatee County GIS Inventory
- ERP Plans Review
- As-Built /Construction Plan Review
- Shoopman Model Review and Supporting Documentation
- Whitaker Bayou Model

Each of these is described in more detail in the following sub-sections.

4.1.1 Manatee County Inventory

CDM Smith was provided with a geodatabase that contained an inventory of digitized Manatee County drainage structures, dated 2014. The geodatabase contains stormwater structures divided into separate feature classes by inlet, manhole, open conveyance (channel), outfalls, pipe, ponds, and structures. The structures within the Manatee County inventory were generally used to review connectivity of the watershed rather than obtain model-specific parameters such as inverts and sizes. A summary of the number of Manatee County inventory features within the PDGC watershed is provided in **Table 4-1**.

Table 4-1 Summary of Manatee County Inventory

Feature Class	Number of Features in PDGC Watershed	Number of Features, Total
Inlet	979	22,713
Manhole	104	3,172
Outfall	11	264
Structure	1,281	18,595
Open Conveyance	489	19,249
Pipe	1,324	22,576
Pond	161	11,341

4.1.2 ERP Plan Review

ERP information for areas of development within and adjacent to the entire watershed were provided by the DISTRICT. Additional permit information was downloaded by CDM Smith from the DISTRICT's Watershed Management Information System (WMIS). The ERP documents for all permit polygons within the watershed boundary were initially reviewed for data type (i.e., as-built, approved, non-approved, or missing). The permits within the watershed were then reviewed in more detail for drainage infrastructure, modeling, and geotechnical data that may be used for model development under subsequent tasks. Refer to **Figure 4-1** for locations where plans were georeferenced for the "priority area."

4.1.3 As-Built Plan Review

As-built or record drawing information was obtained for most of the developments in the priority area, which was the focus of the in-depth review. Construction plans and as-built drawings provided by the DISTRICT, County, and obtained through the DISTRICT's Water Management Information System (WMIS) were georeferenced and digitized for the priority area where the provided GIS infrastructure inventory (MANATEE_DATA) data were missing or did not match the development in the recent aerial imagery. For the remaining areas where as-built information was not available, permitted plans were used to characterize developments that agreed with aerial and topographic information. Refer to **Table 4-2** for a list of the plans identified from the review for the priority area.

Table 4-2 Plans Obtained for Priority Area Review

Type	Project Name	Permit Number	Source
As-Built	45th Street Parcel nka Sabal Harbour	ERP_017305_000	DISTRICT Hard Drive
As-Built	Barrington Ridge, Phase 1B (fka Villages at Lockwood Ridge)	ERP_023589_008	DISTRICT Hard Drive
As-Built	Bealls Distribution Center 2002 Addition	ERP_012233_003	DISTRICT Hard Drive
As-Built	Braden Crossing	ERP_013944_000	DISTRICT Hard Drive
As-Built	Braden River Park	ERP_012222_001	DISTRICT Hard Drive
As-Built	Briarwood, Phase I	ERP_002033_001	DISTRICT Hard Drive
As-Built	Briarwood, Phases 5 and 6	ERP_002033_006	DISTRICT Hard Drive
As-Built	Candlewood Subdivision	Unknown	County Data Request
As-Built	Cascades at Sarasota Phase III	ERP_023591_006	WMIS
As-Built	Cascades at Sarasota Whitfield Ave East	ERP_023591_014	WMIS
As-Built	Cascades at Sarasota Whitfield Ave W	ERP_023591_009	DISTRICT Hard Drive
As-Built	Centre Lake	ERP_001020_000	WMIS
As-Built	Consolidated Resource Recovery	ERP_024219_000	DISTRICT Hard Drive
As-Built	Cottages at Blu Vista (fka Savannah)	ERP_028522_001	DISTRICT Hard Drive
As-Built	Depend-O-Drain	ERP_008593_000	DISTRICT Hard Drive
As-Built	Fairfield (fka Tradition)	ERP_028948_000	DISTRICT Hard Drive
As-Built	Fiddler's Creek	ERP_030602_000	CDM Smith from WMIS
As-Built	Garden Lakes Estates	ERP_009907_000	DISTRICT Hard Drive
As-Built	Garden Lakes Phase I	Unknown	County Data Request

Table 4-2 Plans Obtained for Priority Area Review

Type	Project Name	Permit Number	Source
As-Built	Garden Lakes Phase IV	Unknown	County Data Request
As-Built	Lionshead	ERP_001103_001	DISTRICT Hard Drive
As-Built	Lockwood Ridge Road	ERP_020290_001	County Data Request
As-Built	Lockwood Ridge Road	ERP_029069_000	County Data Request
As-Built	Magnolia Point	PDR-13-35/13-5-41/FSP-13-70	County Data Request
As-Built	Manatee Co-63rd Ave Bridge Expansion	ERP_019387_002	DISTRICT Hard Drive
As-Built	Manatee Oaks	Unknown	County Data Request
As-Built	Mandalay Phase 1 (Villages at Lockwood Ridge - Village II)	Unknown	County Data Request
As-Built	Meadow Lake	Unknown	County Data Request
As-Built	Meadow Lakes East	ERP_011983_000	DISTRICT Hard Drive
As-Built	Meadow Lakes East	Unknown	County Data Request
As-Built	Paley Place Shopping Center	ERP_040416_000	WMIS
As-Built	Pearce Business Center	ERP_031291_002	DISTRICT Hard Drive
As-Built	Peridia Office Park	ERP_021659_000	DISTRICT Hard Drive
As-Built	Peridia Subdivision	ERP_000997_000	DISTRICT Hard Drive
As-Built	Renovo Resource Recovery	ERP_042055_000	CDM Smith from WMIS
As-Built	Rio Mar at Sarasota (fka Cascades, Phase II)	ERP_023591_004	DISTRICT Hard Drive
As-Built	Sabal Cove Apartments	ERP_018907_002	DISTRICT Hard Drive
As-Built	Sabal Harbour Phase III	ERP_017305_004	DISTRICT Hard Drive
As-Built	Sabal Harbour, Phases IIA and V	ERP_017305_003	DISTRICT Hard Drive
As-Built	Sam's Club	ERP_018907_003	DISTRICT Hard Drive
As-Built	Sarasota Trucking	ERP_021352_000	DISTRICT Hard Drive
As-Built	Shady Grove	ERP_018967_001	DISTRICT Hard Drive
As-Built	Silver Lake @ Gold Tree	PDR-00-07/FSP-01-28	County Data Request
As-Built	Silver Lake Subdivision By-Pass Ditch	ERP_000279_005	WMIS
As-Built	The Trails	ERP_002553_000	County Data Request
As-Built	U.S. 301 Park of Commerce Phase IV	ERP_005246_005	DISTRICT Hard Drive
As-Built	Woodbrook	ERP_027112_003	WMIS
As-Built	Woodbrook, Phase 3	ERP_027112_006	WMIS
As-Built	Woodridge Oaks	PDR-99-18/FSP-01-102	County Data Request
As-Built	Woodruf Industrial Park	ERP_003390_000	DISTRICT Hard Drive
Pre-Dev. Survey	Meyer and Gabbert Storage Facility	ERP_034082_000	DISTRICT Hard Drive
Pre-Dev. Survey	On the Creek	ERP_034649_000	DISTRICT Hard Drive
Pre-Dev. Survey	The Preserve at Walden Lake	ERP_018907_007	DISTRICT Hard Drive
Pre-Dev. Survey	Whitfield/Lockwood Ridge Mass Grading Plan	ERP_023591_020	CDM Smith from WMIS

Table 4-2 Plans Obtained for Priority Area Review

Type	Project Name	Permit Number	Source
Cert w/ no Subst. Deviation	Prospect Point - Floodplain Compensation Area Modification	ERP_032729_001	DISTRICT Hard Drive
Approved Plans	301 Park of Commerce, PH 3 & 4	ERP_005246_000	DISTRICT Hard Drive
Approved Plans	Cascades at Sarasota PH V FKA Stonebriar	ERP_023591_010	CDM Smith from WMIS
Approved Plans	Manatee County - MARS 63RD Ave Booster Pump	ERP_025912_000	DISTRICT Hard Drive
Approved Plans	Sara Palms Subdivision	ERP_002098_000	WMIS
Approved Plans	Westport	ERP_042505_000	DISTRICT Hard Drive
Unknown	Lockwood Ridge Road	ERP_014347_000	County Data Request

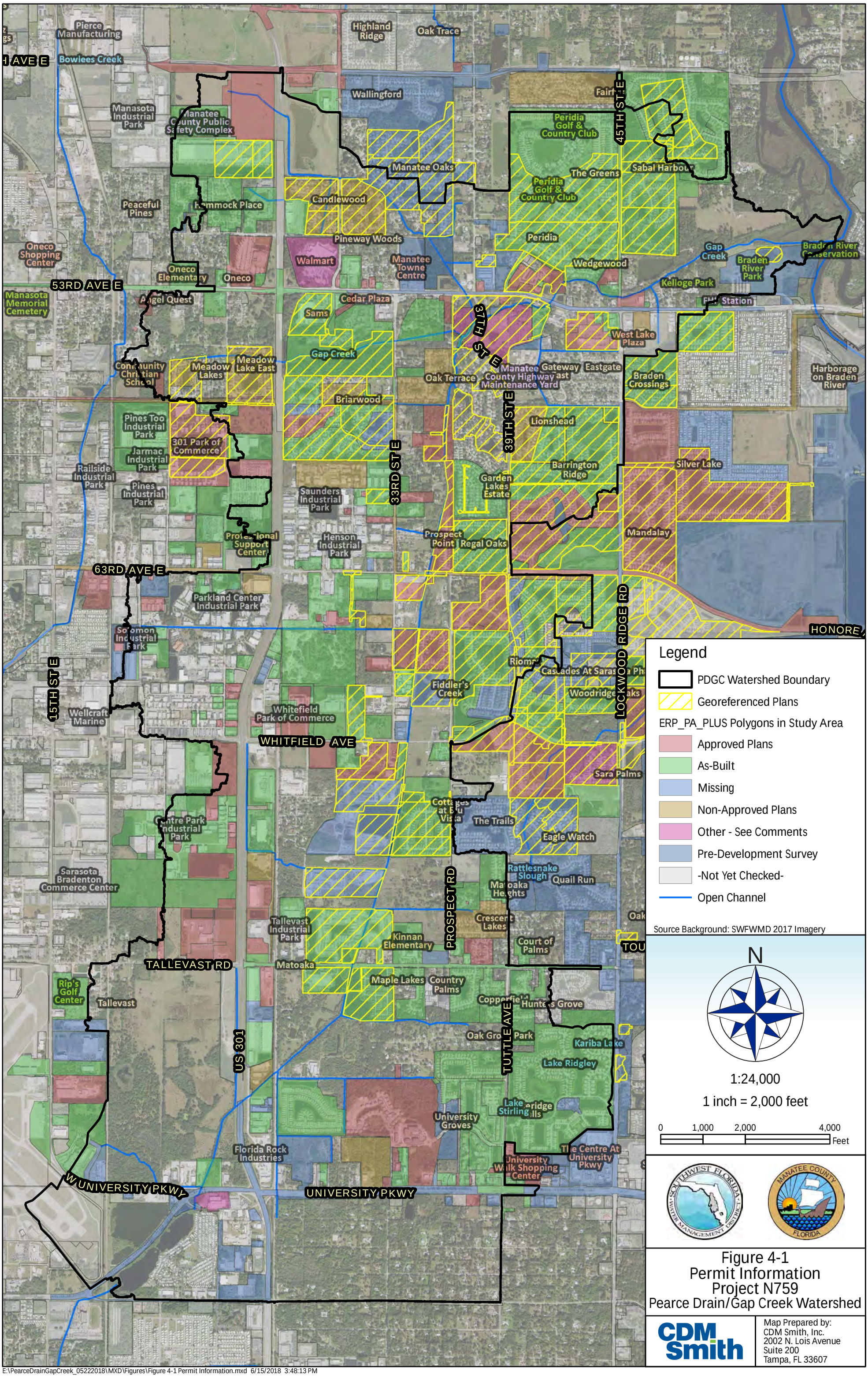
4.1.4 Shoopman Model

CDM Smith received two versions of the Shoopman model and supporting documentation for the PDGC system. The first was the original 2002 version and then the 2005 version was provided. The extents of the two models are similar, the later model has additional detail. Also, a CAD file was provided that gave general spatial locations of catchments, nodes, and links. These models are referenced to the National Geodetic Vertical Datum of 1929 (NGVD29).

The area of the 2005 model is 9.4 square miles. The modeled portion of Pearce Drain starts in the Dolomite Lakes immediately to the south east of the Sarasota/Bradenton airport and flows generally northwards to the confluence with Gap Creek. Gap Creek starts immediately to the east of 24th Street East, just south of 55th Avenue East, after joining with Pearce Drain in the general vicinity of 36th Street East, south of 53rd Street East, it flows eastward to the confluence with the Braden River. In addition to these main open channel sections, there were several other areas modeled in more detail, including University Terrace, University Groves, Savannah, Fiddler's Creek, Center Lake, Trident Building Systems, Palm Lakes Condominiums, and Cascades (aka Stonebriar).

For this PDGC Watershed Evaluation, the primary use of the Shoopman model is to gather information on the hydraulic system, primarily culvert/bridge geometry and inverts and channel cross sections for comparison purposes. Based on review, as-built information and information confirmed through field verification for structures was used to populate model parameters in most cases. Ultimately, there are four cases where inverts from the Shoopman model were used. None of these locations are in the priority area and these have been noted within the GWIS database by use of the HYPERLINK table. Any elevation component (e.g. culvert inverts) was converted to the North American Vertical Datum of 1988 (NAVD88) by subtracting 0.98 feet.

The culvert/bridge information was compared with the results of the field verification. For instances outside of the priority area where a culvert was field confirmed for size and dimensions, but no invert information was available in as-builts and approved plans, the Shoopman model inverts were used for the model parameter tables where a reasonable comparison was made to the DEM and surrounding structure inverts.



Legend

- PDGC Watershed Boundary
- Georeferenced Plans

ERP_PA_PLUS Polygons in Study Area

- Approved Plans
- As-Built
- Missing
- Non-Approved Plans
- Other - See Comments
- Pre-Development Survey
- -Not Yet Checked-
- Open Channel

Source Background: SWFWMD 2017 Imagery

N

1:24,000

1 inch = 2,000 feet

0 1,000 2,000 4,000 Feet

Figure 4-1
Permit Information
Project N759
Pearce Drain/Gap Creek Watershed

Map Prepared by:
CDM Smith, Inc.
2002 N. Lois Avenue
Suite 200
Tampa, FL 33607

E:\PearceDrainGapCreek_05222018\MXD\Figures\Figure 4-1 Permit Information.mxd 6/15/2018 3:48:13 PM

Various sources were used by Shoopman for the open channel cross sections, with a range of dates (as early as 1988). For example, the FIS (1992) cross sections were used. The County provided CDM Smith with a document of surveyed cross sections from 1990 that appeared to be the same as the FIS cross sections used in the Shoopman model.

Based upon a review of the historic cross-sections compared to cross-sections extracted from the project DEM, it appears that the conveyance of the main channel is similar for the incised portion of the channel. **Figure 4-2** presents a comparison between cross-section ID 13518 from the Shoopman model and a 2016 DEM derived cross section. Historic cross-sections have been included in the GWIS database for reference and comparison purposes only and will be refined under the next task once survey has been completed. Cross-sections from the Shoopman model have been noted with a "SH" prefix in the ICPR_XSECT feature class of the GWIS database. Cross sections from the 1992 FIS study have been marked with a prefix of "FIS."

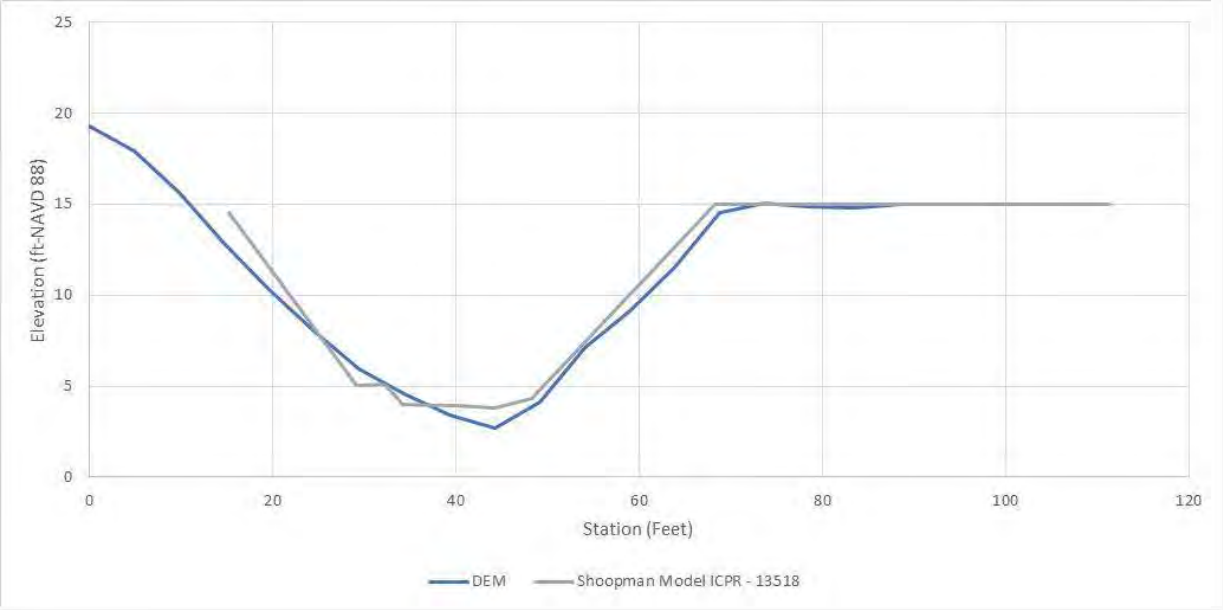


Figure 4-2 Comparison of Incised Channel Cross-Section between 2016 DEM and Shoopman Model

4.1.5 Whitaker Bayou Model

As discussed in Section 2, the Whitaker Bayou study was completed in 2011 by Singhofen and Associates, Inc., and overlaps the PDGC watershed. The model is in NAVD88. There are eight structures within the PDGC that were surveyed for the Whitaker Bayou study, including double 66-inch pipes at US-301. There are 10 non-surveyed structures in the Whitaker Bayou ICPR model that lie within the PDGC watershed. Size and invert information has been used for the model parameter tables of these 18 structures and confirmed with field review. These instances have been noted within the GWIS database by use of the HYPERLINK table. There are also five surveyed cross sections from the Whitaker Bayou model that have been migrated into the PDGC GWIS database. These cross sections have been noted with a "WB" prefix in the ICPR_XSECT feature class.

The anticipated approach to modeling this overlap and tailwater conditions at the Whitaker Bayou headwater is provided in Section 5.

4.2 Hydraulic Connectivity

The drainage infrastructure within the PDGC watershed was digitized by CDM Smith as hydro-junctions and hydro-edges within the Geographical Watershed Information System (GWIS) using the data sources described above in addition to the field verification described below in Section 4.4. The HydroNetwork establishes the preliminary drainage connectivity within the watershed and includes the full Manatee County drainage inventory. Following the HydroNetwork development, key drainage structures (model elements) were digitized by CDM Smith as hydraulic element points (HEPs), which consist of HEPs at the upstream and downstream inverts of each culvert, at drop structure weirs, and structural weirs. HEP lines were digitized between upstream and downstream culvert HEPs to represent culverts.

The digitized HEPs are related to the pipe, drop structure, and weir tables in the GWIS for the structures that would ultimately be included in the hydraulic model. CDM Smith assembled specific structure details such as pipe invert, length, and diameter into the GWIS tables which are related to the HEPs by relationship classes within the GWIS. The feature and tabular data are related by a unique ID field stored in both the digitized features and related table. As a result, the structure details of the modeled drainage infrastructure elements were populated in the GWIS during model development. A map of the HEPs and HEP lines network for the study area has been prepared and is shown on **Figure 4-3**. The hydraulic network for the priority area of the PDGC Watershed consists of 616 HEPs and 204 HEP lines. It should be noted that the HydroNetwork was more detailed in the priority area while providing sufficient level of detail in low priority areas so that these areas can be represented in the model.

4.3 Field Verification Efforts

Once the HydroNetwork was established, CDM Smith identified hydraulic elements within the priority area to be included as part of the preliminary model schematic. These elements were subsequently included as part of the field reconnaissance evaluation. Detailed field investigations of the watershed were conducted by CDM Smith personnel in April and May 2018. The purpose of the field investigations was to inspect the drainage basin and locate and verify hydraulic structures identified during the plans review, confirm drainage and sub-basin boundaries, observe drainage patterns, and develop the survey plan (see section 4.4).

A field geodatabase was created which contained feature classes for upstream and downstream culvert points, horizontal and vertical weirs, bridge points, and general comment points. These feature classes were populated with known HEPs developed during the initial development of the HydroNetwork and flagged for field reconnaissance priority. The field feature classes mimic GWIS field domains (for post-processing comparison) and known data (such as size, shape, material) was populated for field comparison.

CDM Smith

6/15/2018

Legend

- PDGC Watershed Boundary
- HYDROJUNCTION
- HYDROEDGE
- HEP_LINE

HYDRAULIC_ELEMENT_POINT

- PIPE
- WEIR

Notes:

This information is being developed in accordance with the Southwest Florida Water Management District's Watershed Management Program Guidelines and is provided for informational and review purposes. The Guidelines define the watershed parameters used to develop a computer model that simulates projected surface water levels. This information should be used as a reference only. The District does not guarantee the completeness of this information and it is being provided as preliminary. The District shall not be liable for any damages suffered as a result of using this information. If you have questions or comments on the information and the methods used, please contact the Southwest Florida Water Management District's Engineering Section at 352-796-7211 ext. 4232. Environmental Resource Permit (ERP) applicants are encouraged to schedule a pre-application meeting(s) with the District's Regulatory staff to discuss the use of any watershed study/model in a subsequent ERP application.

Find the District's Guidelines at:
ftp://ftp.swfwmd.state.fl.us/public/GWIS/WMP_Guidance_Documents

N

1:9,600

1 inch = 800 feet

0 800 1,600 3,200 Feet

0 0.15 0.3 0.6 Miles

Figure 4-3
HEPs and HEP Lines Network

Project N759

Pearce Drain/Gap Creek Watershed

Filename:	Map Date:	Map Prepared by:
Figure 4-3 HEPs and HEP Lines Network.mxd	6/15/2018	CDM Smith, Inc. 2002 N. Lois Avenue Suite 200 Tampa, FL 33607

Source Background:

Manatee County 2017 Imagery

The geodatabase was hosted on ArcGIS online during field reconnaissance for real-time field input, and the majority of the "Scheduled High" locations were visited (while those that were not accessible were subsequently flagged for the Survey plan). Once a feature was visited, the "Field Visited" attribute was updated from scheduled high, medium, or low to "Visited," which helped to track progress both in the field and from desktop coordination. Example screenshots of the Collector for ArcGIS Field Verification are shown on **Figure 4-4**, with the WebMap viewer shown on the left, and Collector for ArcGIS in the middle and right.

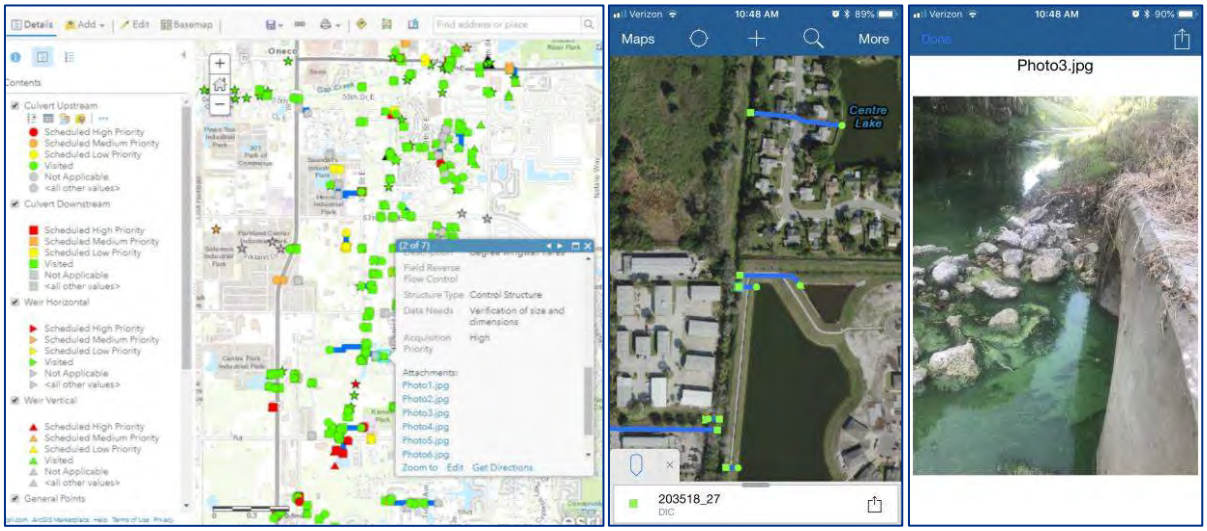


Figure 4-4 Collector for ArcGIS Field Verification Example

Field staff updated feature information such as geometry, condition, and material and took photographs at each location visited. Photographs were collected at field locations and are associated with the respective feature points (for drop structures, photos are associated with the upstream pipe feature point). The field reconnaissance geodatabase deliverable contains this information with photographs embedded as attachments to the features, as well as a standalone photo point feature class with an attachment table (based on the approximate GPS location of the photo taken).

The field data obtained were subsequently compared to the information already obtained to identify additional data needs, as described in the following section.

4.4 Survey

CDM Smith performed a comparison using the following sources to identify remaining structures that would require survey under this effort:

- Hydraulic information extracted from as-built construction and approved plans and reflected in the HEPs.
- Hydraulic information contained in the Shoopman model.
- Results of the verification of hydraulic structures confirmed through the field reconnaissance efforts.

Generally, the structure size information gathered during field review corresponds well to the initial data gathered by reviewing as-builts and approved plans. The most common discrepancy between plan and field data occurred for control structure weirs dimensions, but these were usually limited to less than 6 inches difference. Some discrepancies were noted in pipe sizes, where plans called out a circular size but based on field it appeared a horizontal elliptical equivalent size had been constructed. The plans and as-built information sources are provided in the HYPERLINK table. The ICPR COMMENT also establishes the source of structure sizes and inverts.

A total of 22 structures, including 3 bridges, have been recommended for survey at this time. These are outstanding data gaps where no hydraulic data could be obtained through desktop reconnaissance. Priority was given to structures within areas identified for a higher level of detail. Best engineering judgment, field measurements, and the DEM will be used to estimate all other unknown inverts.

For channel cross-sections, a total of 40 locations have been identified for survey. Survey at these locations will be for the incised portion of the channel only. Locations were prioritized to capture the channel geometry at major roadway crossings and within the priority area. Survey cross sections will be used in conjunction with the DEM (for floodplain extents). The incised portion of the cross-sections may be interpolated where appropriate between surveyed cross-sections but will be compared for reasonableness to existing data (i.e. FIS, Shoopman) such as shown in Figure 4-2.

The preliminary survey plan is shown on **Figure 4-5**.

Due to the expedited schedule for this effort, the survey plan has been submitted to Southeastern Surveying Mapping Corp. (SSMC) for review. Based on input from the DISTRICT and the County, adjustments may be needed to the survey plan prior to SSMC initiating the survey effort. Once the survey is complete, the information will be incorporated into the electronic deliverable once the information is available.

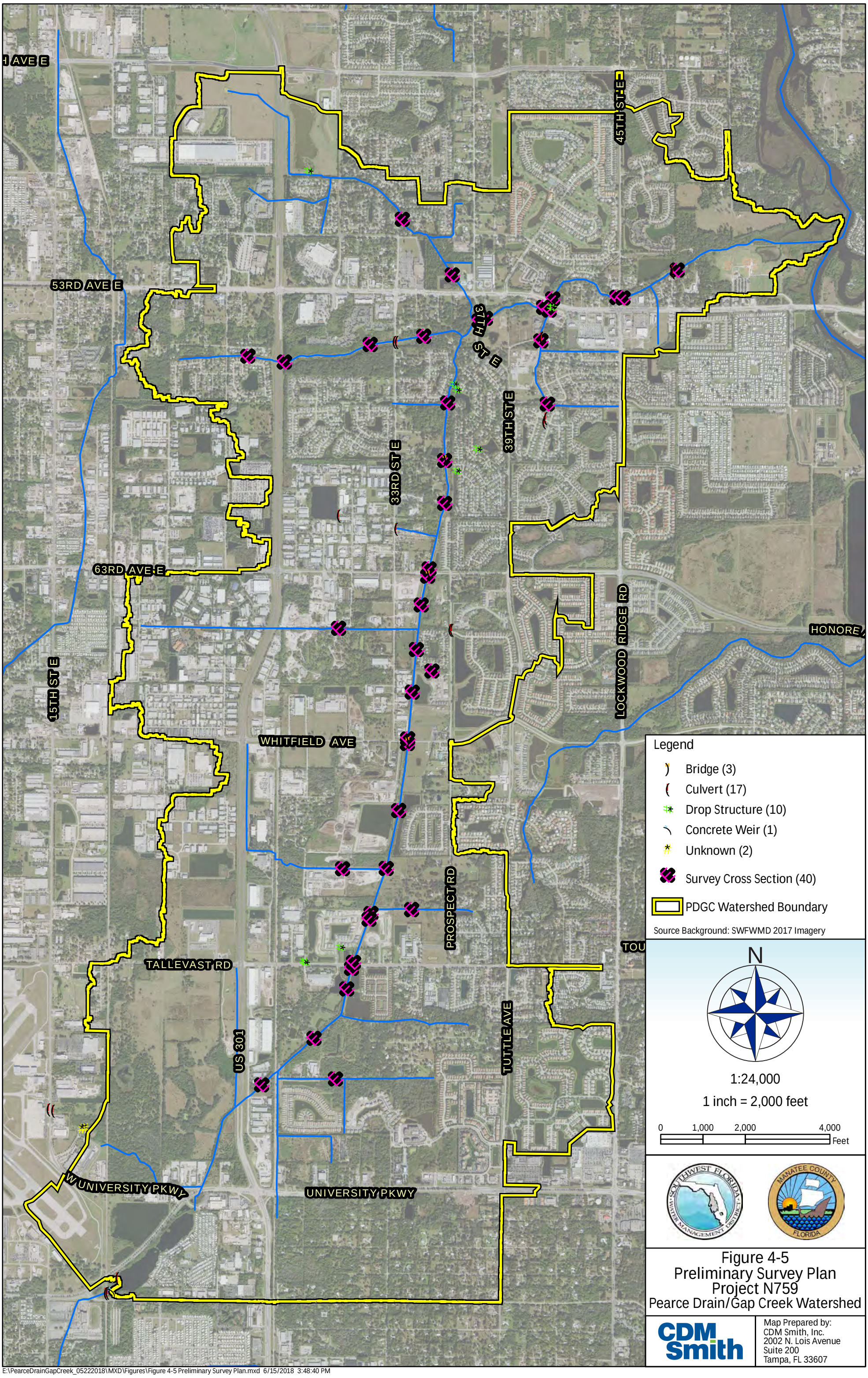


Figure 4-5
Preliminary Survey Plan
Project N759
Pearce Drain/Gap Creek Watershed

Map Prepared by:
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Tampa, FL 33607

E:\PearceDrainGapCreek_05222018\MXD\Figures\Figure 4-5 Preliminary Survey Plan.mxd 6/15/2018 3:48:40 PM

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Section 5

Preliminary Model Features and Parameterization Approach

CDM Smith developed a model network (basins, nodes and links) based on the digitized drainage infrastructure and the model level of detail considered necessary to meet the objectives of the Watershed Evaluation. In general, the network includes the PSMS in the PDGC watershed, which consists of significant stormwater ponds in the priority area and the connectivity between them.

5.1 Preliminary Model Schematic

Based on review of the HydroNetwork and the established priority area within the watershed, CDM Smith developed a preliminary model schematic to define the model representation of the conveyance system. The schematic has been reflected in the GWIS model feature dataset. The links relate to their respective parameter tables (e.g., PIPE_BARREL, WEIR, DROP_STRUCTURE) with all elevations converted to NAVD. A value of '9999' indicates a size or invert was not available and will either be estimated or obtained in accordance with the survey plan.

The following types of hydraulic feature links were established as part of the schematic and described below:

- Open Channels – open channels portion of the incised section of the Pearce Drain Canal. Gap Creek and major tributaries/laterals tying into these features. The open channels are located primarily along the main stem of Pearce Drain and Gap Creek but also along the lateral tributaries that discharge into these water bodies. There are currently 102 open channel links defined in the preliminary model schematic. It is anticipated that the incised open channel portions for the PDGC model will be used from a combination of survey and DEM. Survey will be used for the incised portion of the channel cross-section. The 2016 DEM will be used to define and extrapolate the floodplain portion of the open channel section.

- Bridge – there are currently four bridge crossings along the Pearce Drain Canal, at Whitfield Avenue, at 63rd Avenue, at an unnamed dirt road just north of 59th Drive, and at 45th Street. These bridges will be modeled as channels with a top clip set at the bridge low chord. Channel dimensions will be obtained from survey or from plan data, if available. If no survey or plan data is available, an approximate cross-section will be developed based on a combination of field review measurements obtained and the DEM. A weir will also be modeled at each bridge to allow for overtopping.

- Pipe - Pipe links were created based upon as-built plan information, field verification and survey in some instances. Pipe links correspond to HEPs and HEP points and there are currently 121 pipe links included in the model schematic. Manning's roughness coefficients will be assigned to the pipe links in accordance with DISTRICT guidance. Additional losses such as entrance, bend, and exit losses will be accounted for where applicable.

- Weir - There are two types of weir links included in the preliminary model schematic – structural weirs and natural overland flow weirs. Structural weirs were identified through survey data or as-built plans. Natural overland flow weirs were placed to allow for at least one overtopping location between basins. These weirs are preliminary and will be refined after initial model runs are used to identify and confirm overflow locations. Inverts and cross-sections associated with overtopping weirs will be generated using the DEM. There are currently 147 weir links; 15 of these are structural while 132 represent overland flow.
- Drop Structure – Drop structure links were created based upon as-built plan information, field verification and in some instances, survey. These links correspond to HEPs and HEP points and there are currently 83 drop structure links included in the model schematic.
- Nodes –nodes within natural subbasins, the node was placed in the lowest point of the subbasin based on the DEM. For nodes within developed subbasins, the node was placed at the center of the stormwater pond. Additional nodes were added for connections along channels, pipes, drop structures and as boundary nodes. There is a total of 278 nodes included in the preliminary model schematic.

The preliminary model schematic is shown on **Figure 5-1**. The model schematic has varying levels of detail based on the defined priority areas.

5.2 Watershed Model Parameterization Approach

This section discusses CDM Smith's approach for model parameterization for storm events, rainfall excess, time of concentration, node storage, initial conditions, boundary conditions, and percolation. Input on this approach will be needed from both the DISTRICT and the County prior to initiating the modeling effort under the next phase.

5.2.1 Design, Multi-Day, Calibration and Verification Storms

Rainfall data will be used to generate runoff for the stormwater evaluations. Data are generally characterized by amount (inches), intensity (inches per hour), frequency, return period (years), duration (hours), spatial distribution (locational variance), and temporal distribution (time variance).

For design storm events, the following nine design storms will be simulated:

- 2.33-year, 5-year, 10-year, 25-year, 50-year, and 100-year, 1-day events using the Florida Modified Type II 24-hour distribution
- 10-year, 50-year, and 100-year, 5-day events using the DISTRICT's 120-hour distribution

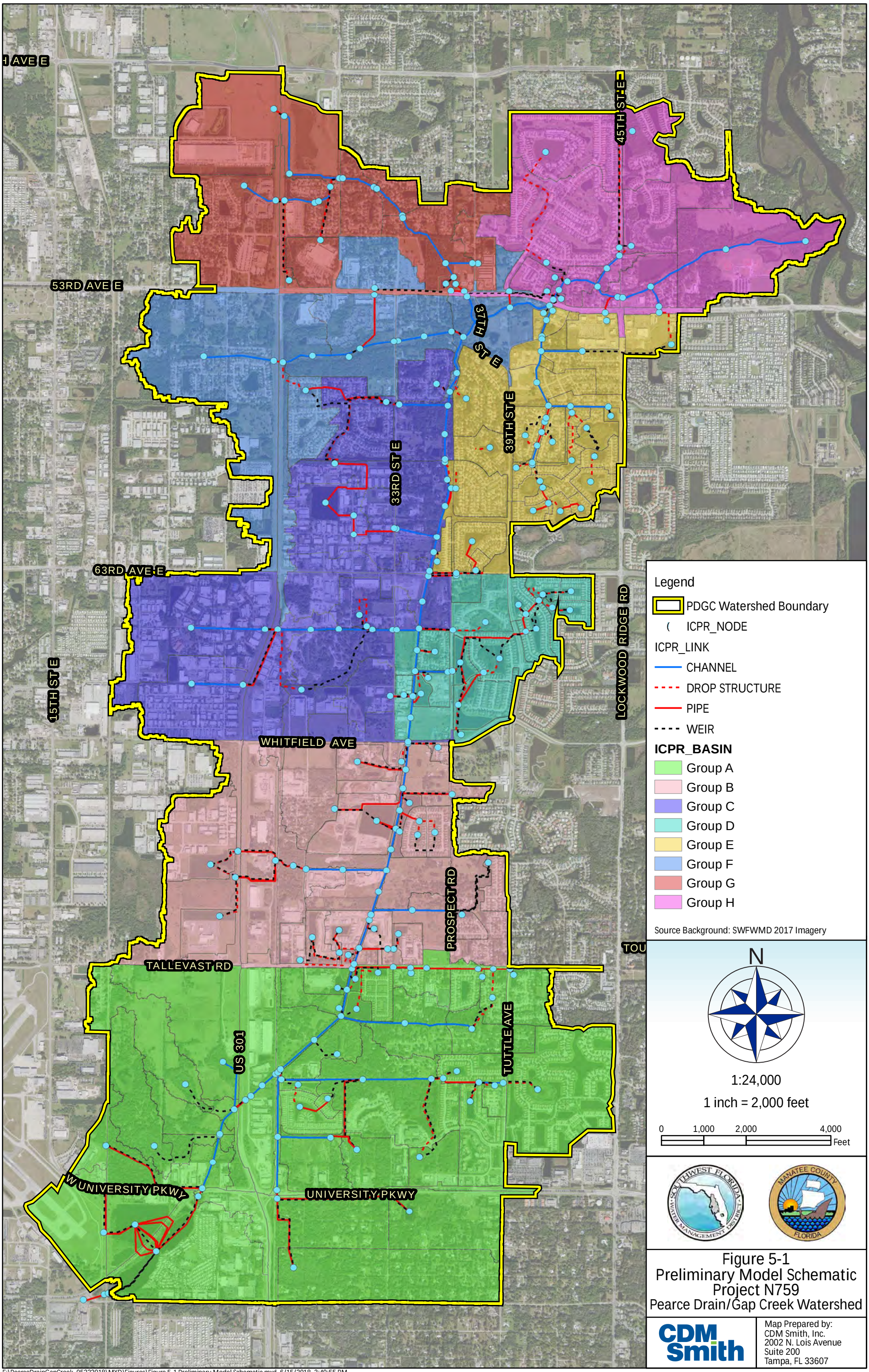


Figure 5-1
Preliminary Model Schematic
Project N759
Pearce Drain/Gap Creek Watershed

CDM Smith

Map Prepared by:
CDM Smith, Inc.
2002 N. Lois Avenue
Suite 200
Tampa, FL 33607

E:\PearceDrainGapCreek_05222018\MXD\Figures\Figure 5-1 Preliminary Model Schematic.mxd 6/15/2018 3:40:55 PM

For the multi-day storm events, the following event will be simulated:

- 100-year/3-day, 100-year/7-day, and 100-year/10-day events using FDOT rainfall distribution

CDM Smith will use the unnamed storm event in late August 2017 for calibration purposes and will use Tropical Storm Hermine (September 2016) for model verification. The 2011 land use that has been updated to reflect land cover shown in the 2017 aerials will be used for the hydrologic inputs for the model simulations. Rainfall data for these events will be obtained from the following sources: SWFWMD SCADA, Manatee County.

5.2.2 Rainfall Excess

The two widely used methodologies for calculating the rainfall excess are curve number (CN) and Green-Ampt (GA). Both methods consider land use and soil characteristics to estimate the volume of runoff from a given rainfall event. The CN methodology is empirical, whereas the GA is physically based. For both methodologies, it is necessary to perform an "intersection" in GIS of the land use, soils, and the catchment coverages, resulting in a set of polygons with unique combinations of soils, land use, and catchment values. Following are brief descriptions of each method.

The CN methodology is documented in the Natural Resources Conservation Service's technical release 55 (TR-55). This method results in single CN associated with each basin. The CN is a number between 40 and 100 and is a function of rainfall abstraction. The components of the abstraction are associated with land use/cover e.g. interception storage; as well as the soil storage available in a specific type of soil. As mentioned, one of the initial steps in calculating the CN is to perform an intersection in GIS. The resultant shape file characterizes the catchment in terms of a soils hydrologic soil group (HSG), and land use. Lookup tables (e.g. Table 2-2a in TR-55) associate land use and HSG with a specific CN. It is necessary to post process the intersection information to obtain a set of CN associated with each basin. These are aerially weighted to obtain a single CN for each catchment.

The GA methodology is described in both District as well as the Interconnected Channel and Pond Routing Version 4 (ICPR4) Stormwater model documentation. As this methodology is physically based, the soils data required is considerably more detailed than that required for the CN methodology. This method results in a set of infiltration characteristics for each intersection polygon. These characteristics include the soil's moisture content (initial, saturated, wilting, residual) as well as the saturated vertical conductivity, pore size index, and bubble pressure. Using the same GIS intersection (of soils, land use, and catchment) a lookup table of soil characteristics is used to develop a set of unique soil/land use polygons for each catchment. The District had previously developed the GA lookup table for the parameters used in ICPR3 that is consistent with the watershed model setup. As the implementation of the GA methodology in ICPR4 is more rigorous, and includes additional soil characteristics, the District is currently developing a revised lookup table.

From the District's Guidance and Specifications, it is stated that the GA method is preferred compared to the CN method for areas with sandy soils and high hydraulic conductivities. However, it is stated that the CN method may yield similar results in areas with a high-water table

and low permeability soils. Another additional benefit of the GA methodology is for long-term continuous simulations, where a more nuanced representation of soil storage and infiltration is required.

Most of the PDGC watershed consists of poorly drained soils, with a relatively high water table, and the longest simulation will likely be less than a week (i.e. not continuous). The County and the District will continue to discuss the two methodologies and provide direction to CDM Smith prior to the initiation of the Floodplain Analysis.

5.2.3 Time of Concentration

The time of concentration (Tc) is the time for stormwater runoff to travel from the hydraulically most distant point of the watershed to the point of interest (outflow from the area). The time of concentration for each catchment will be determined by identifying the longest flow path, which will subsequently be subdivided into three types of flow (sheet flow, shallow concentrated flow, and open channel/pipe flow). The total time of concentration is the sum of the travel times for each of the three types of flow, which will be calculated in accordance with TR-55. In most cases, the sheet flow component accounts for a significant percent of the total time of concentration for the hydrologic unit, even though it makes up a small percentage of the total flow length in larger basins (sheet flow is limited to 100-feet for Tc calculations, as shallow concentrated flow is assumed beyond this length).

5.2.4 Node Storage

Based on the character of the watershed, node storage will primarily be defined for detention ponds and depressional areas based on topography. Storage nodes in the model will be defined as Stage/ Area and will be used to model storage areas like stormwater ponds/depressions. Stage/Area curves will be assigned for storage nodes in the model to represent storage at the stormwater ponds, and depressional areas. The stage-area pairs will be extracted from the DEM using ArcHydro tools at 0.1-ft increments and stored in the GWIS database in the geodatabase table ICPR_NODE_STORAGE, which is related to the feature class ICPR_NODE. There are no lakes or other natural water bodies that impound water in the watershed that will require node storage to be defined.

5.2.5 Initial Conditions

Initial stages will be set such that the model simulation would begin in static equilibrium. Wet pond initial stages will be set at the pond control elevation. The watershed does not appear to have any constructed dry ponds. For natural depressions, an initial stage will be estimated by a review of the aerial imagery against the DEM. In cases where these natural depressions appear dry, the initial stage will be set to the lowest point on the DEM or the basin's outfall pipe invert, whichever is lower. The model initial stage of the Pearce Drain Canal and Gap Creek will be set to the invert for design-storm events and some defined initial stage for calibration events based on measured elevations in the Canal and Creek.

5.2.6 Boundary Conditions

It is anticipated the watershed model for the calibration, verification and design storm event model simulations will contain the following boundary condition nodes in the model as described below:

- Braden River - This will be represented as a time/stage node based on the FEMA FIS flood profile of the Braden River at the Gap Creek confluence. According to the flood profile, the 100-year, 50-year, and 10-year elevations at this location are approximately 8-feet, 6-feet, and 4-feet, respectively (NAVD88). Tailwater elevations for all other design storms will be derived using a logarithmic interpolation.

- Bowlees Creek Watershed – The western terminus of Gap Creek is an undeveloped area located south of 55th Avenue East, and west of 21st St Ct East. Additionally, the southern end of this area appears to be the eastern terminus of a tributary to Bowlees Creek. It will be necessary to coordinate with the WMP Consultant developing the Bowlees Creek Watershed model to further define the boundary condition.

  The initial approach will be to define the storage associated with this undeveloped area as a stage/area node and load the associated basin. It may be necessary to make some revisions to the catchments in this area. An overland flow weir will be defined from this area to the linear lake (located due north of 55th Ave Dr East), which is the furthest upstream portion of the proposed representation of Gap Creek. An overland flow weir will also be defined in the southern portion from the storage node to a boundary condition node representative of the upstream end of the Bowlees tributary. The elevation of both weirs will be derived from the DEM.

  Coordination with the WMP Consultant developing the Bowlees Creek Watershed model will be ongoing, the interaction associated with this location will depend upon the results of the initial model runs. If it is determined that the southern overland weir is active, flows will be provided to the Bowlees Creek WMP Consultant and more specific elevations requested, for example, the upstream invert of the culvert under the railroad. The specific location will be dependent on how far upstream this tributary is modeled. If this area does contribute flow to the Bowlees Creek Watershed, it is expected that the ultimate boundary condition will be a time/stage node in both models.

- Whitaker Bayou Watershed – As mentioned in section 2.2, the boundary of the Whitaker Bayou model is on the east side of SR301, and there is a significant amount of overlap between the Whitaker Bayou watershed and the PDGC watershed. Empirical knowledge (Shoopman's model domain, the slope of the majority of the culverts in the overlap area, and input from County staff) indicate that the boundary between these two watersheds is actually the weir located at the southwestern side of the Dolomite Lakes. During the field visit to this location, the water level on both sides was below the top of weir. Depending upon the spatial distribution of rainfall, and antecedent conditions, it is conceivable that the flow direction could be either way.

  To generate a time varying boundary condition for the southwestern side of this weir, it is proposed to make use of the Whitaker Bayou model. The boundary condition time series used in the Whitaker Bayou model (immediately east of SR301) will be inactivated. Rainfall will be converted from global to catchment specific, and those catchments that overlap with the PDGC model will have a zero rainfall depth applied. The required rainfall events will be applied to the remaining catchments. This will result in a time varying stage at the

southwestern side of the weir, which will be extracted and used in the PDGC model. This will result in dynamic interplay between the two watersheds.

5.2.7 Percolation

As mentioned in Section 3, no percolation links will be included in the model.

Appendices

Appendix A
QA/QC Documentation

SWFWMD WMP Submittal Checklist

Watershed Name:	Pearce Drain/Gap Creek	**Work Order:**	TWA 17TW0000481
Submittal Date:	5/24/2018	**Tasks(s):**	2.2 Watershed Evaluation

Note: *Please refer to the cell comments for instructions on populating the fields.*

Item	Created By	QA/QC By	Submitted	For Review	Directory Location	Comments
Comments Geodatabase	ER	PS	x	x	\Comments	Comments from previous deliverable with responses
ERPs	PS	ER	x		\Hyperlink\Documents\ERP	Additional ERPs obtained located within individual permit #s
DTM	ER	PS	x		\DTM	1-foot contours added per County Comments
Floodplain Depth Grids						
Aerial Photos	ER	PS	x		\Aerial_Photos	2016 Aerials added per County Comments
GeoTIFFs	ER	PS	x		\Geodatabase\General\Plans\GeoTIFF_Areas.gdb	Additional georeferenced plans since last submittal located within Permit # Folder. See "GeoTIFF" geodatabase for spatial & hyperlink information about Georeferenced plans
ArcHydro files	DM	ER	x		\Geodatabase\General\ArcHydro\20180221_AH_Draft	Most recent ArcHydro processing files used as basis for subbasin delineation
Topographic Void Locations	PS	ER	x		\Geodatabase\General\TopoVoids\PDGC_TASK2214_TopoVoids.gdb	Comment made, refer to comment geodatabase.
Revised DEM (For TopoVoids)	BA	DM	x	x	\DTM\DEM_UpdatedforTopovoids	Revised DEM for High and Medium topovoids
Field Recon Locations	ER	PS	x	x	\Geodatabase\General\Field_Recon\FieldRecon.gdb	Geodatabase used for Field Acquisition.
Proposed Survey Locations	ER	PS	x	x	\Geodatabase\General\Survey Plan	Structures and cross section locations proposed for Survey
GIS Background Research	PS	ER	x		\Geodatabase\General\From_Others	
Support Data Research	ER	PS	x		\Support_Data\1_Watershed_Evaluation	Half Section Maps, FEMA Coastal maps, Calibrated Gage Data added
Watershed Priority Areas	ER	PS	x	x	\Geodatabase\General\Reference\WatershedPriorityArea.gdb	Priority Areas as presented in the Project Plan and W.E. Report
Metadata	ER	PS	x		\Metadata	Updated for ICPR_BASIN, LINK, NODE, HEP, HEP_LINE
GWIS Geodatabase						
Basin						
CATCHMENT	ER	PS	x			CATCHMENT populated with ArcHydro output
HydroNetwork						
HYDROEDGE	PS	ER	x	x	\Geodatabase\GWIS	Feature dataset contains subset to be modeled as well as "FULL" version (including outside areas)
HYDROJUNCTION	PS	ER	x	x	\Geodatabase\GWIS	Feature dataset contains subset to be modeled as well as "FULL" version (including outside areas)
Model						
ICPR_BASIN	ER	PS	x	x	\Geodatabase\GWIS	Preliminary model schematic to be refined in Task 2.3
ICPR_LINK	ER	PS	x	x	\Geodatabase\GWIS	Preliminary model schematic to be refined in Task 2.3
ICPR_NODE	ER	PS	x	x	\Geodatabase\GWIS	Preliminary model schematic to be refined in Task 2.3
ICPR_SLURP						
ICPR_XSECT	ER	DM	x	x	\Geodatabase\GWIS	Preliminary model schematic to be refined in Task 2.3
Topographic Information						
COASTSHORELINE						
CONTOUR						
HYDROGRAPHICFEATURE						
ISLAND						
TcLongestFlowPath						
LIDARPROJECTGRID						
LOWCONFIDENCEAREAS						

Item	Created By	QA/QC By	Submitted	For Review	Directory Location	Comments
MASSPOINT						
OVERPASS						
ROADBREAKLINE						
SOFTFEATURE						
STORAGE_EXCLUSION						
TOPOGRAPHIC_BOUNDARY						
WATERBODY						
Watershed						
GWIS_FLOOD						
GWIS_LANDUSE	ER	PS	x	x	\Geodatabase\GWIS	Refined since last submittal
GWIS_SOIL	ER	PS	x		\Geodatabase\GWIS	No changes
GWIS_WATERBODY						
HEP_LINE	ER	PS	x	x	\Geodatabase\GWIS	
HISTORICAL_WATER_LEVELS	PS	ER	x		\Geodatabase\GWIS	No changes
HYDRAULIC_ELEMENT_POINT	ER	PS	x	x	\Geodatabase\GWIS	
IRREGULAR_CROSSSECTION						
IRREGULAR_WEIR						
PHOTO_LOCATION	PS	ER	x		\Geodatabase\GWIS	No changes, photo points for provided storm event/flooding photos only. For Field Recon photo location points see \Geodatabase\General\Field_Recon
PROFILE_LINE						
Tables						
ADDL_MODEL_DATA						
APUNIQUEID						
BRIDGE_DECK						
BRIDGE_OPENING						
BRIDGE_PIER						
BRIDGE_RATINGCURVE						
BRIDGE_SPURDIKE						
BRIDGESECTION_TYPE						
CHANNEL	ER	PS	x	x	\Geodatabase\GWIS	To be populated in Task 2.3
CROSSSECTION_STATIONS						
DROP_STRUCTURE	ER	PS	x	x	\Geodatabase\GWIS	Populated from plans & field recon, placeholder values & comments included where survey and/or estimations will be made in Task 2.3
GWIS_METADATA						
HYDRAULIC_ELEMENT_METADATA						
HYDROIDXREF						
HYPERLINK	ER	PS	x	x	\Geodatabase\GWIS	
ICPR_BOTTOMCLIP_OPTABLE						
ICPR_BREACH						
ICPR_COMMENT	ER	PS	x	x	\Geodatabase\GWIS	Linked to preliminary model components (with HEP sources identified)
ICPR_EXFILTRATIONTRENCH						
ICPR_FILTER						
ICPR_LINK_HYDROGRAPH						
ICPR_LINK_RESULT						

Item	Created By	QA/QC By	Submitted	For Review	Directory Location	Comments
ICPR_TIMEDISCHARGE						
ICPR_MANHOLETYPE						
ICPR_NODE_HYDROGRAPH						
ICPR_NODE_RESULT						
ICPR_NODE_STAGEDISCHARGE						
ICPR_NODE_STORAGE						
ICPR_NODE_TIMEDISCHARGE						
ICPR_TIMESTAGE						
ICPR_ORIFICECOEF_OPTABLE						
ICPR_OVERFLOWPLANE						
ICPR_PARAMETERS						
ICPR_PERCOLATION						
ICPR_RATINGCURVE						
ICPR_RATINGCURVE_OPTABLE						
ICPR_TOPCLIP_OPTABLE						
ICPR_WEIRCOEF_OPTABLE						
ICPR_XSECT_STATIONS						
LandUseLookUp	PS	ER	x	x	\Geodatabase\GWIS	GreenAmptExample_20080507)
LAYERKEYTABLE						
OTHER_SOURCES						
PIPE_BARELL	ER	PS	x	x	\Geodatabase\GWIS	Populated from plans & field recon, placeholder values & comments included where survey and/or estimations will be made in Task 2.3
PROFILE_STATIONS						
RAINFALL_DISTRIBUTION						
SoilLookup	PS	ER	x		\Geodatabase\GWIS	
SWFWMDDONERAIN						
TimeSeries						
VariableDefinition						
WEIR	ER	PS	x	x	\Geodatabase\GWIS	Populated from plans & field recon, placeholder values & comments included where survey and/or estimations will be made in Task 2.3
WEIR_STATIONS						
Hyperlinks						
Documents	ER	PS	x	x	\Hyperlink\Documents	ERPs updated
Photos	ER	PS	x	x	\Hyperlink\Photographs	Field Recon photos added
Model						
1 Day Mean Annual						
1 Day 5 Year						
1 Day10 Year						
1 Day 25 Year						
1 Day 50 Year						
1 Day 100 Year						
1 Day 500 Year						
5 Day Mean Annual						
5 Day 5 Year						

Item	Created By	QA/QC By	Submitted	For Review	Directory Location	Comments
5 Day 10 Year						
5 Day 25 Year						
5 Day 50 Year						
5 Day 100 Year						
5 Day 500 Year						
3 Day 100 Year						
7 Day 100 Year						
Additional Information						
Percolation Points						
Percolation Polygons						
TC Paths						
NEXRAD						
Floodplains						
MXD	ER	PS	x	x	\MXD	Updated MXD with applicable layers loaded in version 10.1 and 10.3
Reports	DH, DM	BM, ER	x	x	\Reports	Watershed Evaluation Report included, TopoVoid approach memo included
TSDN_Report						

Reference Key:

Name	Initials
Bala Aboki	BA
Danielle Honour	DH
Brian Mack	BM
Melanie Moore	MM
Doug Moulton	DM
Ben Pernezny	BP
Elizabeth Radford	ER
Priscilla Sale	PS

Name	Danielle M. Honour	
Florida P.E. No.	56733	
Signature and Date	 5/24/2018	

Appendix B

Topographic Void Memorandum

Memorandum

To: *Jezabel Pagan Garcia, Southwest Florida Water Management District*
Ken Kohn, Manatee County Public Works Department

From: *CDM Smith*

Date: *April 27, 2018*

Subject: *Pearce Drain/Gap Creek Watershed (N759, 17TW481) – Topographic Voids Refinement Approach*

Under Agreement #14MA0000013 and Task Work Assignment 17TW0000481, CDM Smith, Inc. is tasked by the Southwest Florida Water Management District (DISTRICT) with developing a Watershed Management Plan for the Pearce Drain/Gap Creek (PDGC) Watershed located in Manatee County, Florida.

As part of the Watershed Evaluation task, a topographic void analysis was performed to identify areas where the available topographic information (Digital Elevation Model (DEM)) does not accurately describe the terrain as it currently exists today, based upon more accurate or updated information such as recent aerial imagery, ERP plans, and field reconnaissance.

In accordance with DISTICT guidance and the Project Plan, the approach for addressing and resolving the topographic voids identified shall be agreed upon by the DISTRICT and Manatee County. The purpose of this memorandum is to detail topographic voids identified and the proposed action of how to address each of the voids.

Basis of Comparison

The topographic data for the study area provided by the DISTRICT included a 2.5- and 5-foot DEMs, as well as LiDAR LAS datasets, breaklines, and 1-foot contours. The LiDAR, obtained by Merrick & Company, was flown in February 2016.

The 2.5-foot DEM was initially reviewed and compared to 2017 aerial photography to identify any topographic voids that may exist, such as areas where new development has occurred since the collection of the topographic data. The majority of the topographic voids identified within the study area were a result of commercial development, transportation expansions, or residential subdivisions constructed after the aerial topographic data were collected.

The topographic voids identified within the study area are documented within the "TopoVoids" polygon feature class within the Geodatabase directory and shown in **Figure 1**. The topographic voids identified are shown tabularly by priority in **Appendix A**. The significant topographic voids identified (voids 1-19) are also shown graphically in **Appendix B**. The available plan information for the voids shown in Appendix B are included in **Appendix C**. From Figure 1,

there are a number of voids located outside the watershed boundary. During the initial void identification, CDM Smith had established a defined buffer to identify voids within as the watershed boundary delineation was concurrently under development. This was done as a safety measure to ensure that all voids would be captured within the final watershed boundary.

Approach Methodology to Eliminate Topographic Voids

As shown in Appendix A, most of the topographic voids identified are minor, or "low" priority, and will not require correction and can be addressed by making adjustments to model parametrization and floodplain delineation.

For the remaining topographic voids, CDM Smith has proposed an approach to address those that are listed as High or Medium priority in Appendix A. In addition, there are ten topographic void locations that require further input and discussion with the DISTRICT and the County, primarily related to voids that are either outside of the study area or in unknown phases of construction at the time of "date certain".

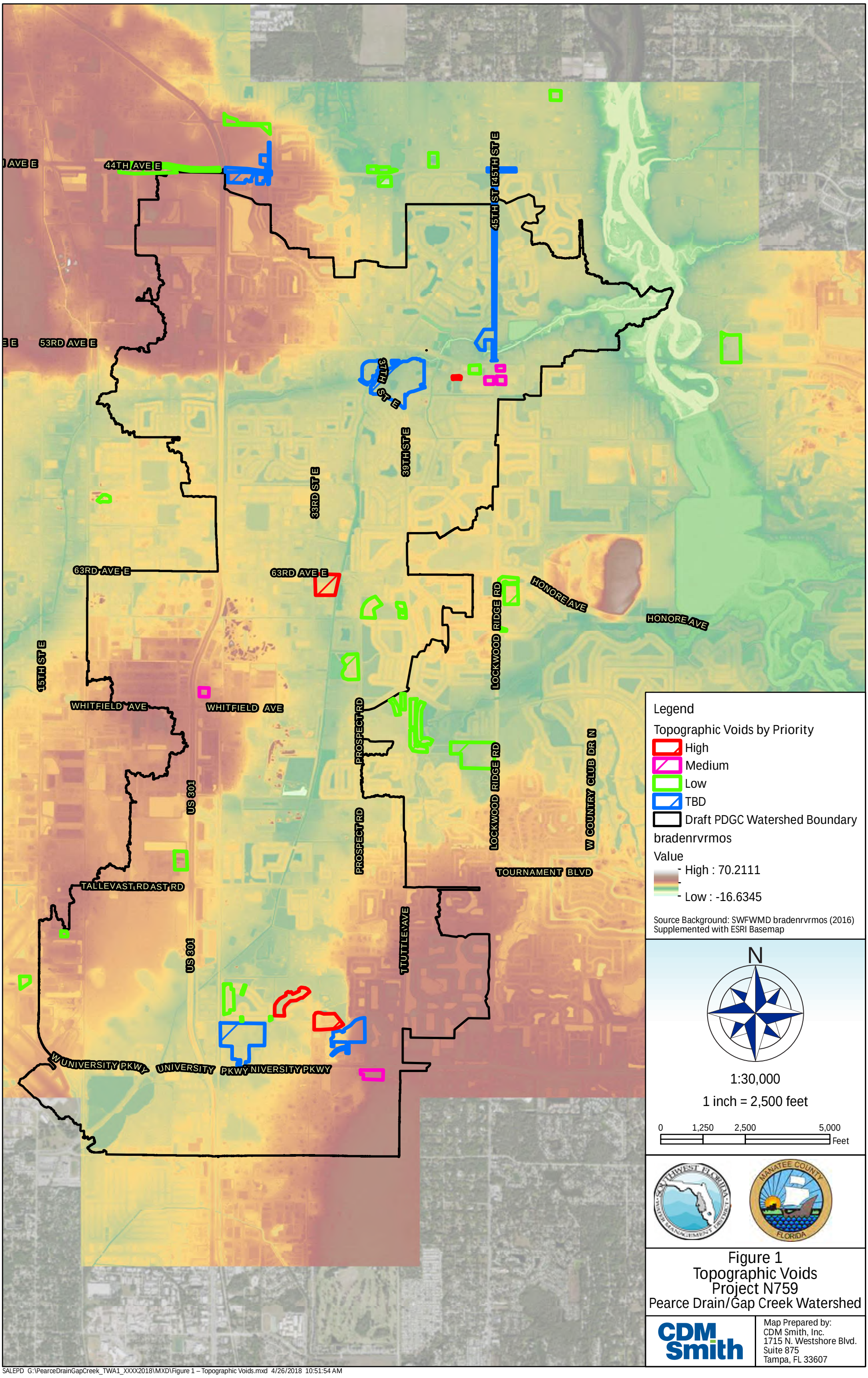
For the majority of the topographic voids that CDM Smith has proposed either refinement or further discussion, the best available topographic information available are ERP approved plans. The breakdown of available data are shown below in **Table 1**. It is CDM Smith's understanding that CADD data may be available from the District for several developments.

Upon review of this memorandum and input from the County and the District, CDM Smith will update and implement the approach to address the identified topographic voids.

Table 1 – Topographic Voids to be addressed

Topo Void	Priority	Location	Permit Number	Data Have	Within PDGC	Approach
1	High	The Enclave at University Groves	ERP_026632_008	Approved Plan	Yes	Digitize Approved Grading Plan & Update DEM with Patch (or with CADD data if available, requested by JPG from Banks Engineering)
2	High	University Groves Apartment Complex	ERP_026632_013	Approved Plan	Yes	Digitize Approved Grading Plan & Update DEM with Patch (or with CADD data if available, requested by JPG from Stantec)
3	High	Paley Place OP A Parking	ERP_040416_004	Approved Plan	Yes	Digitize Approved Grading Plan & Update DEM with Patch (or with CADD data if available, requested by JPG from WRA)
4	High	Renovo Resource Recovery	ERP_042055_000	Record Drawings	Yes	Digitize Record Drawing Grading Plan & Update DEM with Patch (Apparent that firm out of business, As-Built best information available)
5	Medium	Autumn Leaves of Sarasota ALF	ERP_022526_002	Permitted Plan	Yes	Digitize Permitted Grading Plan & Update DEM with Patch
6	Medium	Wawa - Lockwood Ridge Road & SR 70	ERP_005453_002	Approved Plan	Yes	Digitize Approved Grading Plan & Update DEM with Patch
7	Medium	Burger King @ West Lakes Plaza	ERP_005453_006	Approved Plan	Yes	Digitize Approved Grading Plan & Update DEM with Patch
8	Medium	Paley Place Outparcels D & E	ERP_040416_003	As-Built Plans	Yes	Digitize As-Built Grading Plan & Update DEM with Patch
9	Medium	Arctic Air	ERP_042634_000	Approved Plan	Yes	Digitize Approved Grading Plan & Update DEM with Patch
10	TBD	44th Ave E from 19th St Ct E to 30th St E	ERP_035341_008	Permitted Plans	No	To be Discussed - Roadway Improvements immediately outside Watershed Boundary
11	TBD	44th Ave E from 19th St Ct E to 30th St E	ERP_035341_004	Permitted Plans	No	To be Discussed - Pond immediately outside Watershed Boundary

Topo Void	Priority	Location	Permit Number	Data Have	Within PDGC	Approach
12	TBD	44th Ave E from 19th St Ct E to 30th St E	ERP_035341_000	Permitted Plans	No	To be Discussed - New Roadway immediately outside Watershed Boundary
13	TBD	Near 44th Ave E from 19th St Ct E to 30th St E		None	No	To be Discussed - Minor impact of small pond added to lot (immediately outside Watershed Boundary)
14	TBD	Near 44th Ave E from 19th St Ct E to 30th St E		None	No	To be Discussed - Minor impact of lot regrading (immediately outside Watershed Boundary)
15	TBD	44th Ave at 45th Street East	ERP_035341_009	Permitted Plans	No	To be Discussed - Roadway Improvements immediately outside Watershed Boundary
16	TBD	45th Street East from SR 70 to 44th Avenue East	ERP_010075_001	Approved Plans	Yes	To be Discussed - Only future construction phases would affect topo
17	TBD	Westport	ERP_042505_000	Approved Plans	Yes	To be Discussed - Unknown construction phasing/timeline and topo impacts for modeling
18	TBD	Oasis at University Apartments	ERP_042950_000	Permitted Plans	Yes	To be Discussed - Only future construction phases would affect topo
19	TBD	Town Center at University Groves Phase III	ERP_026632_016	Approved Plans	Yes	To be Discussed - Only future construction phases would affect topo



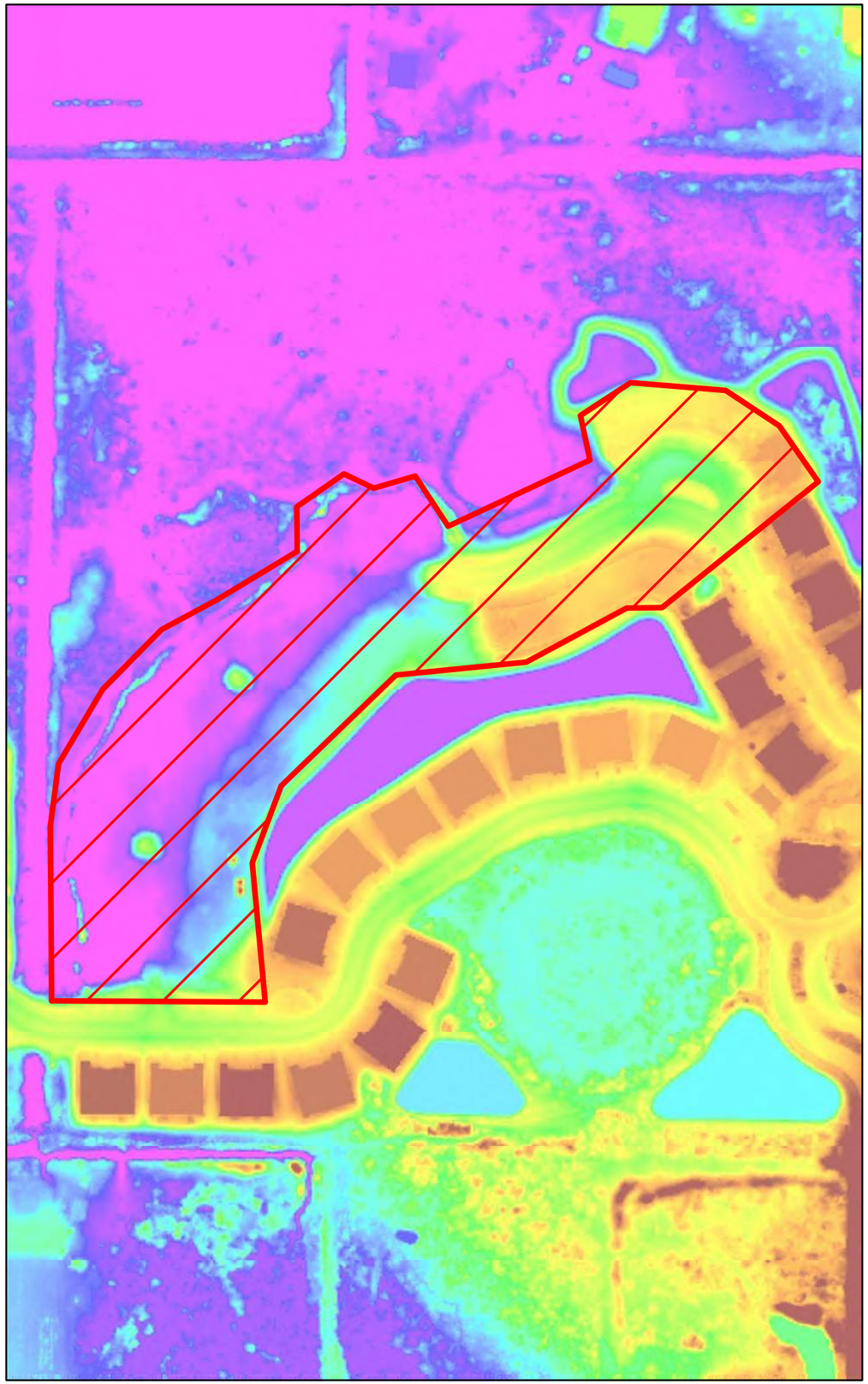
SALEPD G:\PearceDrainGapCreek_TWA1_XXXX2018\MXD\Figure 1 – Topographic Voids.mxd 4/26/2018 10:51:54 AM

Appendix A
TopoVoid Descriptions

Topo Void	Priority	Location	Description	Permit Number	Available Data to Address Voids	Approach	Within PDGC
1	High	The Enclave at University Groves	Subdivision expansion and regrading	ERP_026632_008	Approved Plan - Grading Plan on Sheet 5 (and some of Sheet 6)	Digitize Approved Grading Plan & Update DEM with Patch (or with CADD data if available, requested by JPG from Banks Engineering)	Yes
2	High	University Groves Apartment Complex	DEM doesn't capture completed construction	ERP_026632_013	Approved Plan - Grading Plan on Sheet 5	Digitize Approved Grading Plan & Update DEM with Patch (or with CADD data if available, requested by JPG from Stantec)	Yes
3	High	Paley Place OP A Parking	Pond Modification	ERP_040416_004	Approved Plan doesn't match for GeoRef well (As-Built requested)	Digitize Approved Grading Plan & Update DEM with Patch (or with CADD data if available, requested by JPG from WRA)	Yes
4	High	Renovo Resource Recovery	Pond Void; Adjacent to Pearce Drain; Site Under construction in 2017 aerial	ERP_042055_000	Record Drawing - Grading Plan on Sheet 4 (PDF Page 2)	Digitize Record Drawing Grading Plan & Update DEM with Patch (Apparent that firm out of business, As-Built best information available)	Yes
5	Medium	Autumn Leaves of Sarasota ALF	New Development - Pond Void	ERP_022526_002	Permitted Plans - Grading Plan on Sheet B-4 (PDF Page 10)	Digitize Permitted Grading Plan & Update DEM with Patch	Yes
6	Medium	Wawa - Lockwood Ridge Road & SR 70	DEM includes excavation for gas station tanks (need to remove)	ERP_005453_002	Approved Plan - Grading Plan on Sheet C-6 (PDF Page 5)	Digitize Approved Grading Plan & Update DEM with Patch	Yes
7	Medium	Burger King @ West Lakes Plaza	Site Under construction in 2017 aerial	ERP_005453_006	Approved Plan - Grading Plan on Sheet C-5 (PDF Page 4)	Digitize Approved Grading Plan & Update DEM with Patch	Yes
8	Medium	Paley Place Outparcels D & E	New construction missing from DEM	ERP_040416_003	As-Built Plans - Grading Plan on Sheet C-8 (Page 5)	Digitize As-Built Grading Plan & Update DEM with Patch	Yes
9	Medium	Arctic Air	Site Under construction in 2017 aerial	ERP_042634_000	Approved Plan - Grading Plan on Sheet 4	Digitize Approved Grading Plan & Update DEM with Patch	Yes
10	TBD	44th Ave E from 19th St Ct E to 30th St E	Immediately Outside Study Area; Roadside Swale Void	ERP_035341_008	Permitted Plans - P&P Sheets 36-37 (PDF Pages 4 & 5)	To be Discussed - Roadway Improvements immediately outside Watershed Boundary	No
11	TBD	44th Ave E from 19th St Ct E to 30th St E	Immediately Outside Study Area; Pond Void	ERP_035341_004	Permitted Plans - Pond 5 Site Plan (Outside Study Area)	To be Discussed - Pond immediately outside Watershed Boundary	No
12	TBD	44th Ave E from 19th St Ct E to 30th St E	Immediately Outside Study Area; Road Construction	ERP_035341_000	Permitted Plans - Sheets 24,25,26	To be Discussed - New Roadway immediately outside Watershed Boundary	No
13	TBD	Near 44th Ave E from 19th St Ct E to 30th St E	Immediately Outside Study Area; Pond/Grading Voids		Small pond added NW corner in Aerial	To be Discussed - Minor impact of small pond added to lot (immediately outside Watershed Boundary)	No
14	TBD	Near 44th Ave E from 19th St Ct E to 30th St E	Outside Study Area; Area regraded		N/A	To be Discussed - Minor impact of lot regrading (immediately outside Watershed Boundary)	No
15	TBD	44th Ave at 45th Street East	Immediately Outside Study Area; Construction progress between MAR 2017 & DEC 2017 per Google Earth Aerials	ERP_035341_009	Permitted Plans - Roadway Sheets 39-41 (PDF page 36 -38)	To be Discussed - Roadway Improvements immediately outside Watershed Boundary	No
16	TBD	45th Street East from SR 70 to 44th Avenue East	Under Construction	ERP_010075_001	Approved Plans - Pond Sheet 38 (PDF Page 37), Roadway Sheets 67-69 (PDF Pages 66-68)	To be Discussed - Only future construction phases would affect topo	Yes
17	TBD	Westport	Under Construction	ERP_042505_000	Approved Plans - Sheet 8 (PDF Page 7) - Construction Status?	To be Discussed - Unknown construction phasing/timeline and topo impacts for modeling	Yes
18	TBD	Oasis at University Apartments	Under Construction per KK Comments. Not constructed in 2017 Aerial.	ERP_042950_000	Permitted Plans - Grading & Drainage Sheets 9 &10.	To be Discussed - Only future construction phases would affect topo	Yes
19	TBD	Town Center t University Groves Phase III	Under Construction per KK Comments. Not constructed in 2017 Aerial.	ERP_026632_016	Approved Plans - Grading Plan Sheet 8 (PDF Page 7)	To be Discussed - Only future construction phases would affect topo	Yes
20	Low	Chase Bank - SR 70 & Lockwood	Site Under construction in 2017 aerial	ERP_040416_005	Approved Plans - Grading Plan Sheet C-5 (PDF Page 5)	No Action Proposed, Included in the master permit for the shopping center and already reflected in land use layer	Yes
21	Low	Waste Pro - Recycling Facility Expansion	Constructed building void, but DEM appears to include pond modification	ERP_000653_005	Permitted Plans - Proposed Site Plan Sheet SP2.00 (PDF Page 3)	No Action Proposed	Yes
22	Low	US-41 @ Tower Road	Outside Study Area; West of Airport	ERP_009458_037/041 or ERP_026571_000	N/A	No Action Proposed, Outside Watershed	No
23	Low	Validus Hangar Expansion	Outside Study Area (Airport)	ERP_009458_038/041	N/A	No Action Proposed, Outside Watershed	No
24	Low	Magnolia Point	Outside Study Area; New home constructed/site graded, Subdivision already included in DEM	ERP_023591_017	Permitted Plans - Grading Plan Sheets 7-9	No Action Proposed, Outside Watershed	No
25	Low	Magnolia Point	Outside Study Area; New home constructed/site graded, Subdivision already included in DEM	ERP_023591_017	Permitted Plans - Grading Plan Sheets 7-9	No Action Proposed, Outside Watershed	No
25	Low	Magnolia Point	Outside Study Area; New home constructed/site graded, Subdivision already included in DEM	ERP_023591_017	Permitted Plans - Grading Plan Sheets 7-9	No Action Proposed, Outside Watershed	No
25	Low	Magnolia Point	Outside Study Area; New home constructed/site graded, Subdivision already included in DEM	ERP_023591_017	Permitted Plans - Grading Plan Sheets 7-9	No Action Proposed, Outside Watershed	No
26	Low	Magnolia Point	Outside Study Area; Subdivision already included in DEM	ERP_023591_017	Permitted Plans - Grading Plan Sheets 7-9	No Action Proposed, Outside Watershed	No
27	Low	Woodbrook	Outside Study Area; New home constructed/site graded, Subdivision already included in DEM	ERP_027112_003	As-Built Plans - Grading Plan Sheet 9 (PDF Page 4)	No Action Proposed, Outside Watershed	No
28	Low	Woodbrook	Outside Study Area; Subdivision already included in DEM	ERP_027112_006	As-Built Plans - Grading Plan Sheet 4 (PDF Page 6)	No Action Proposed, Outside Watershed	No
29	Low	Woodbrook	Outside Study Area; New home constructed/site graded, Subdivision already included in DEM	ERP_027112_006	As-Built Plans - Grading Plan Sheet 4 (PDF Page 6)	No Action Proposed, Outside Watershed	No
30	Low	Manatee County Transit Fleet Facility	Voids (piles of fill) appears to be from construction phase	ERP_027575_004	As-Built Plans - Grading Plan Sheet C-010 and C-011 (PDF Page 2-3)	No Action Proposed	Yes
31	Low	Fiddler's Creek	New home constructed/site graded, Subdivision already included in DEM	ERP_030602_000	As-Built Plans - Grading Plan Sheet C-05 (PDF Page 2)	No Action Proposed, Subdivision already included in DEM	Yes
32	Low	44th Ave E from 19th St Ct E to 30th St E	Immediately Outside Study Area; Partial Pond Construction Void, in Bradenton Watershed	ERP_035341_000	Permitted Plans - Plan and Profile Sheets 24-26	No Action Proposed, Outside Watershed	Yes
33	Low	38th Ave E of 301	Outside Study Area; Road Construction, Pond Void	ERP_035341_000	Permitted Plans	No Action Proposed, Outside Watershed	No
34	Low	44th Ave E from 19th St Ct E to 30th St E	Immediately Outside Study Area; Partial Road Construction Void	ERP_035341_000	Approved Plans. Ken commented here "Include as-built information for 44th" only have Approved Plans	No Action Proposed, Outside Watershed	No
35	Low	44th Ave E from 19th St Ct E to 30th St E	Outside Study Area	ERP_035341_001	Approved Plans	No Action Proposed, Outside Watershed	No
36	Low	44th Ave East of 37th St E	Outside Study Area; New Pond	ERP_035341_002	Plans - Drainage Map	No Action Proposed, Outside Watershed	No

Appendix A
TopoVoid Descriptions

Topo Void	Priority	Location	Description	Permit Number	Available Data to Address Voids	Approach	Within PDGC
36	Low	44th Ave East of 37th St E	Outside Study Area; Pond Shape Change	ERP_035341_002	Plans - Drainage Map	No Action Proposed, Outside Watershed	No
36	Low	44th Ave East of 39th St E	Outside Study Area; New Pond	ERP_035341_002	Plans - Drainage Map	No Action Proposed, Outside Watershed	No
36	Low	44th Ave E @ 37th St E	Outside Study Area; New Pond	ERP_035341_002	Plans - Drainage Map	No Action Proposed, Outside Watershed	No
37	Low	Soleil West - Phase 1	New home constructed/site graded, Subdivision already included in DEM	ERP_041238_001	As-Builts - Grading Plans Sheets 6A-6D (PDF Page 3-6)	No Action Proposed, Subdivision already included in DEM	Yes
37	Low	Soleil West - Phase 1	New home constructed/site graded, Subdivision already included in DEM	ERP_041238_001	As-Builts - Grading Plans Sheets 6A-6D (PDF Page 3-6)	No Action Proposed, Subdivision already included in DEM	Yes
37	Low	Soleil West - Phase 1	New home constructed/site graded, Subdivision already included in DEM	ERP_041238_001	As-Builts - Grading Plans Sheets 6A-6D (PDF Page 3-6)	No Action Proposed, Subdivision already included in DEM	Yes
37	Low	Soleil West - Phase 1	New home constructed/site graded, Subdivision already included in DEM	ERP_041238_001	As-Builts - Grading Plans Sheets 6A-6D (PDF Page 3-6)	No Action Proposed, Subdivision already included in DEM	Yes
37	Low	Soleil West - Phase 1	New home constructed/site graded, Subdivision already included in DEM	ERP_041238_001	As-Builts - Grading Plans Sheets 6A-6D (PDF Page 3-6)	No Action Proposed, Subdivision already included in DEM	Yes
38	Low	Woodlands Trace	New home constructed/site graded, Subdivision already included in DEM	ERP_041566_000	As-Builts - Grading Plan Sheets 6-8 (PDF Pages 3-5)	No Action Proposed, Subdivision already included in DEM	Yes
38	Low	Woodlands Trace	New home constructed/site graded, Subdivision already included in DEM	ERP_041566_000	As-Builts - Grading Plan Sheets 6-8 (PDF Pages 3-5)	No Action Proposed, Subdivision already included in DEM	Yes
39	Low	Sage Green Terrace	Outside Study Area; Void South of Rattlesnake Slough	ERP_041743_000	As-Builts - Grading Plan Sheet 6 (PDF page 3)	No Action Proposed, Outside Watershed	No
40	Low	RaceTrac - Caruso Rd @ 53rd Ave	Outside Study Area; Void is east of Braden River	ERP_041984_001	N/A	No Action Proposed, Outside Watershed	No
41	Low	4804 34TH AVE E	Outside Study Area		N/A	No Action Proposed, Outside Watershed	No
41	Low	5916 21ST ST E	Outside Study Area		N/A	No Action Proposed, Outside Watershed	No



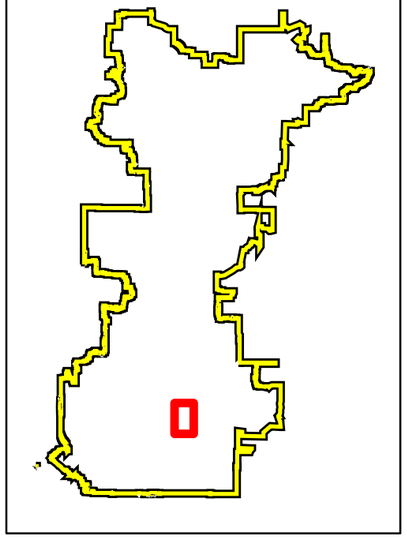
Appendix B
TopoVoid #1

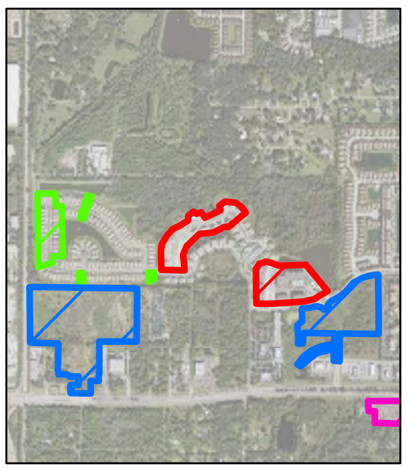
N

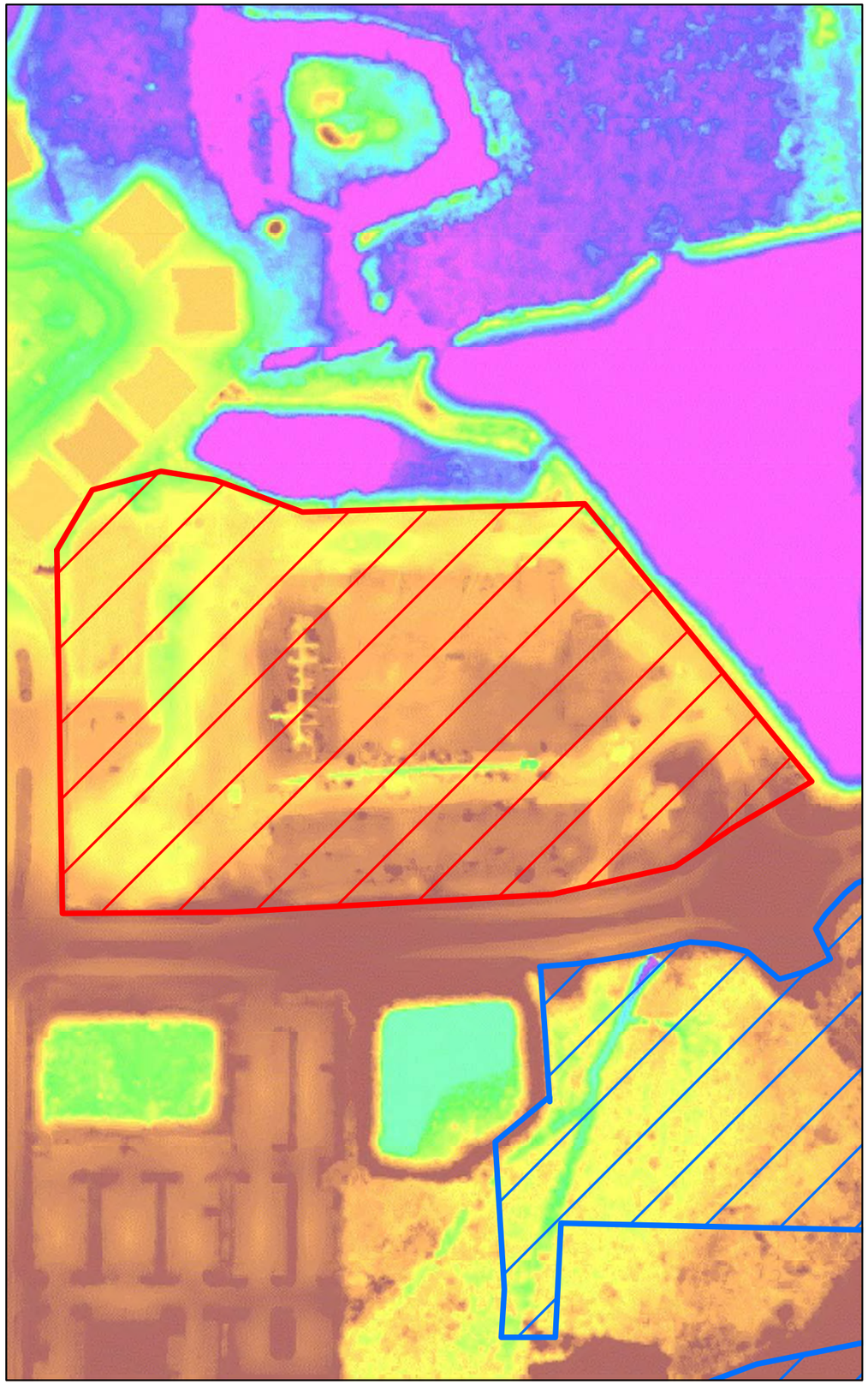
0 87.5 175 350
Feet

1 in = 175 ft

Topographic Voids
Priority
High
Medium
Low
TBD







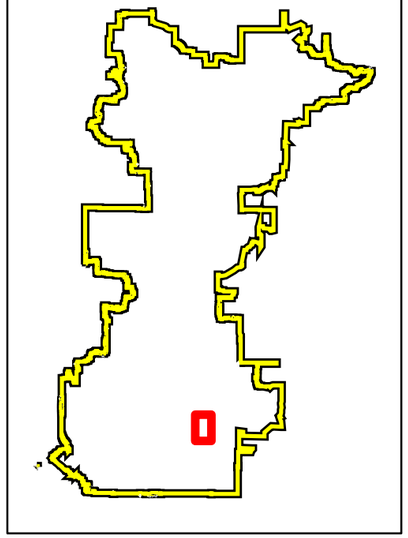
Appendix B
TopoVoid #2

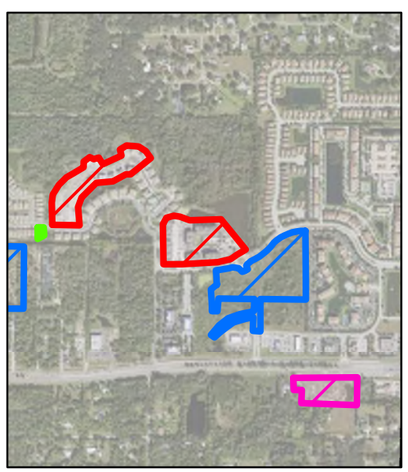
N

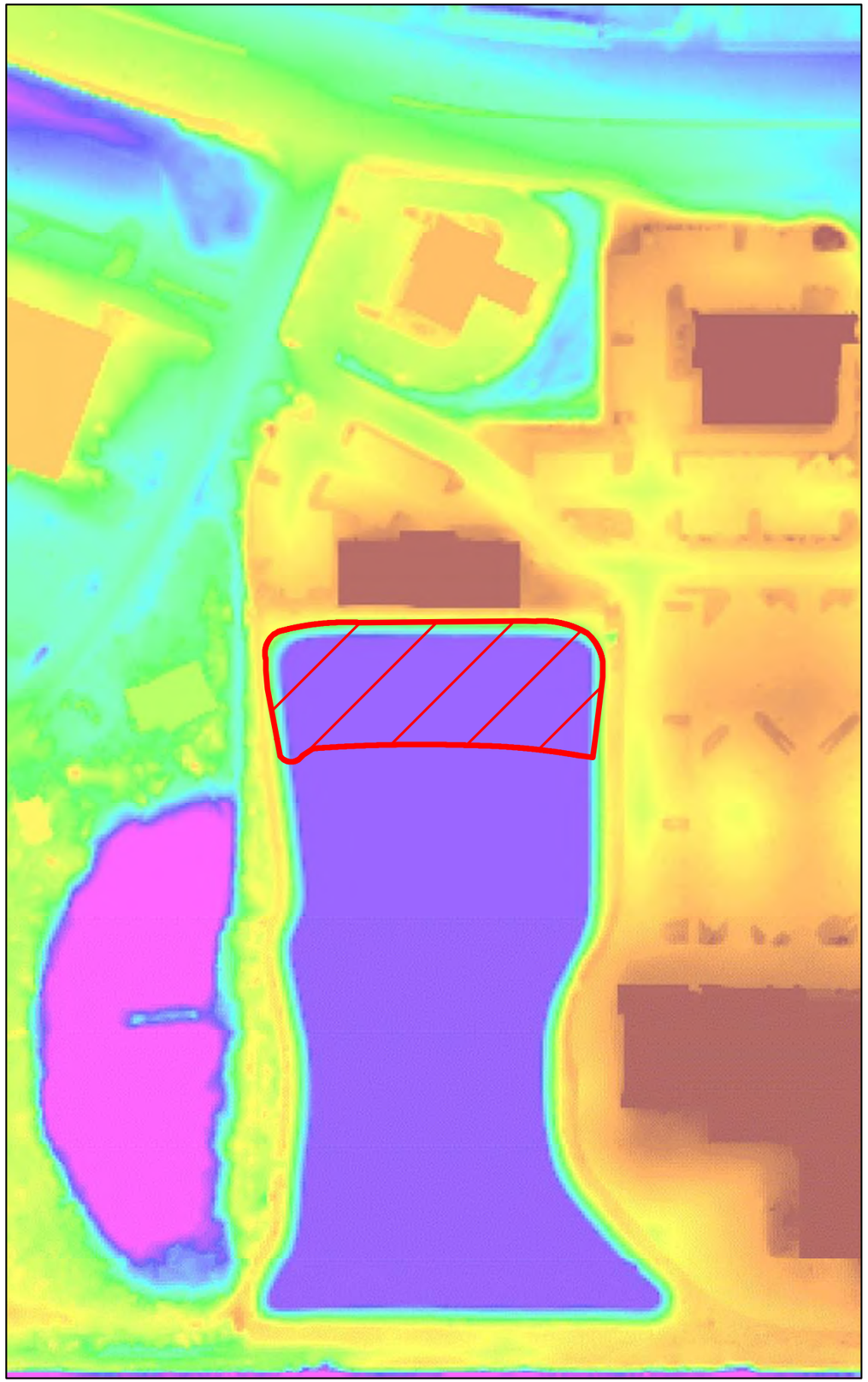
0 75 150 300
Feet

1 in = 150 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD







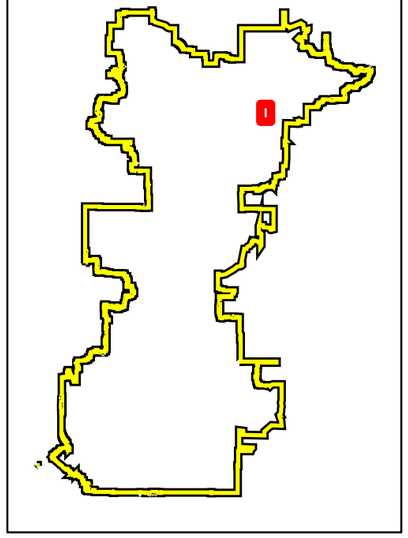
Appendix B
TopoVoid #3

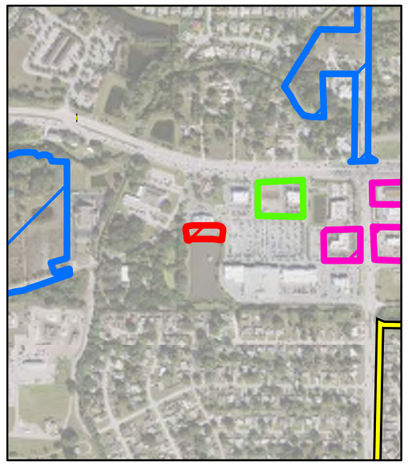
N

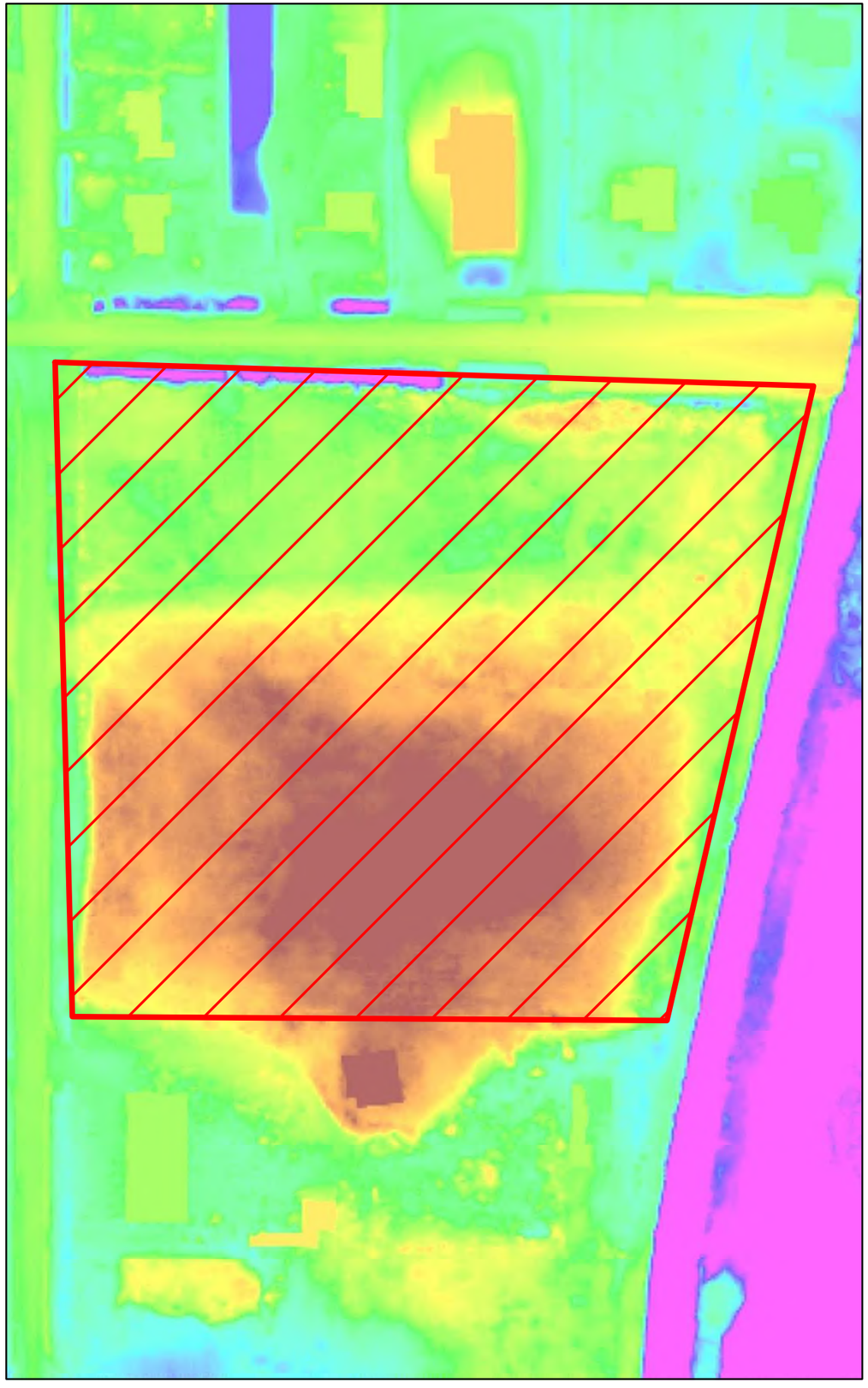
0 50 100 200
Feet

1 in = 100 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD







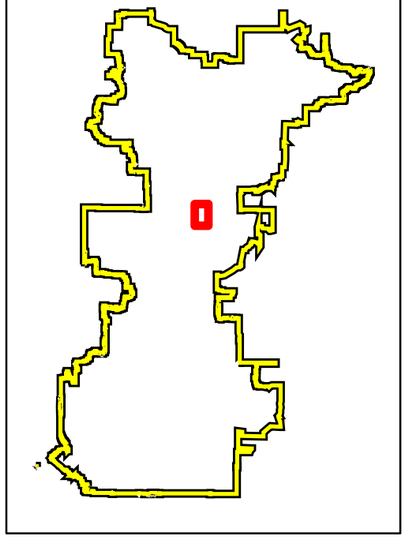
Appendix B
TopoVoid #4

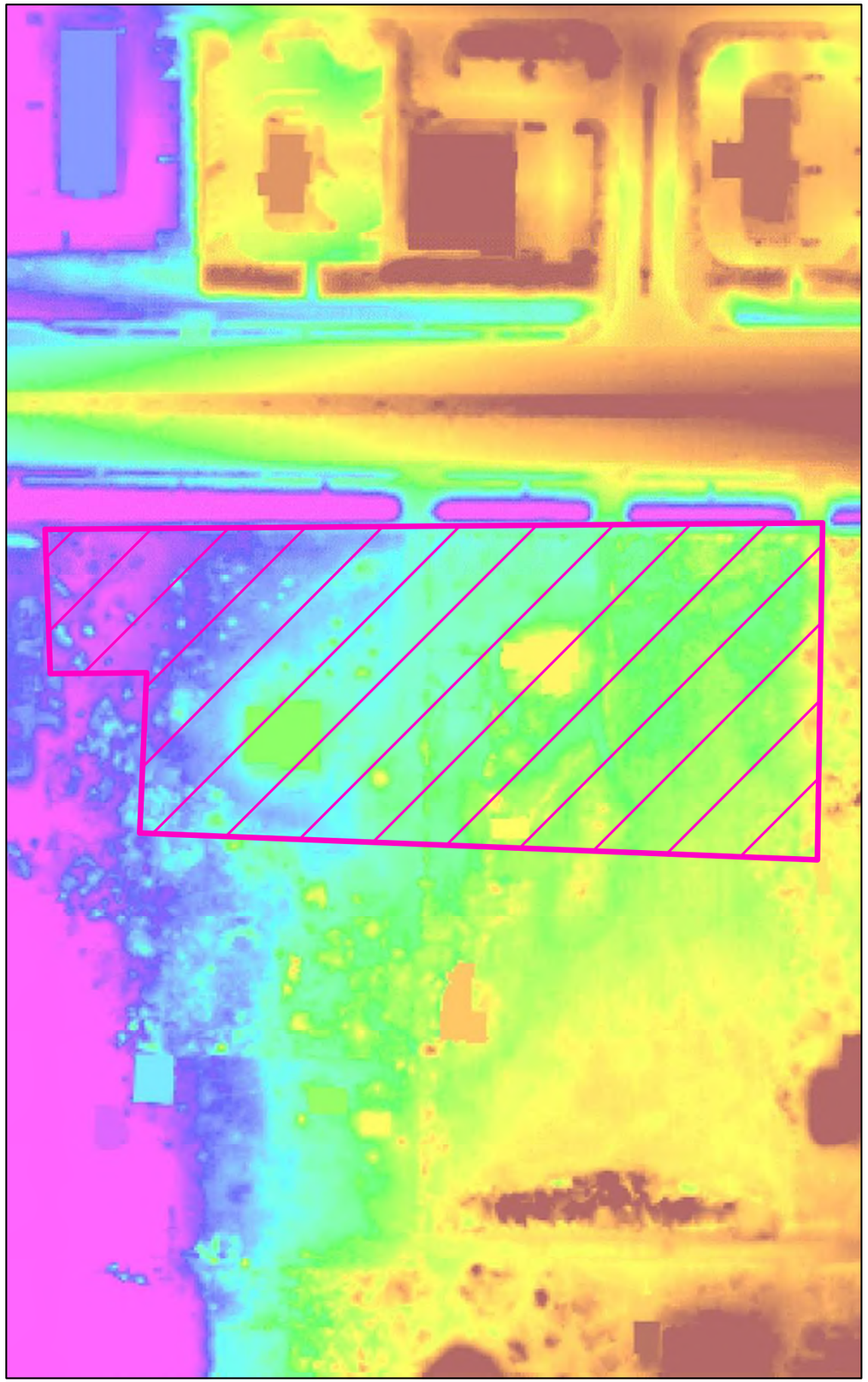
N

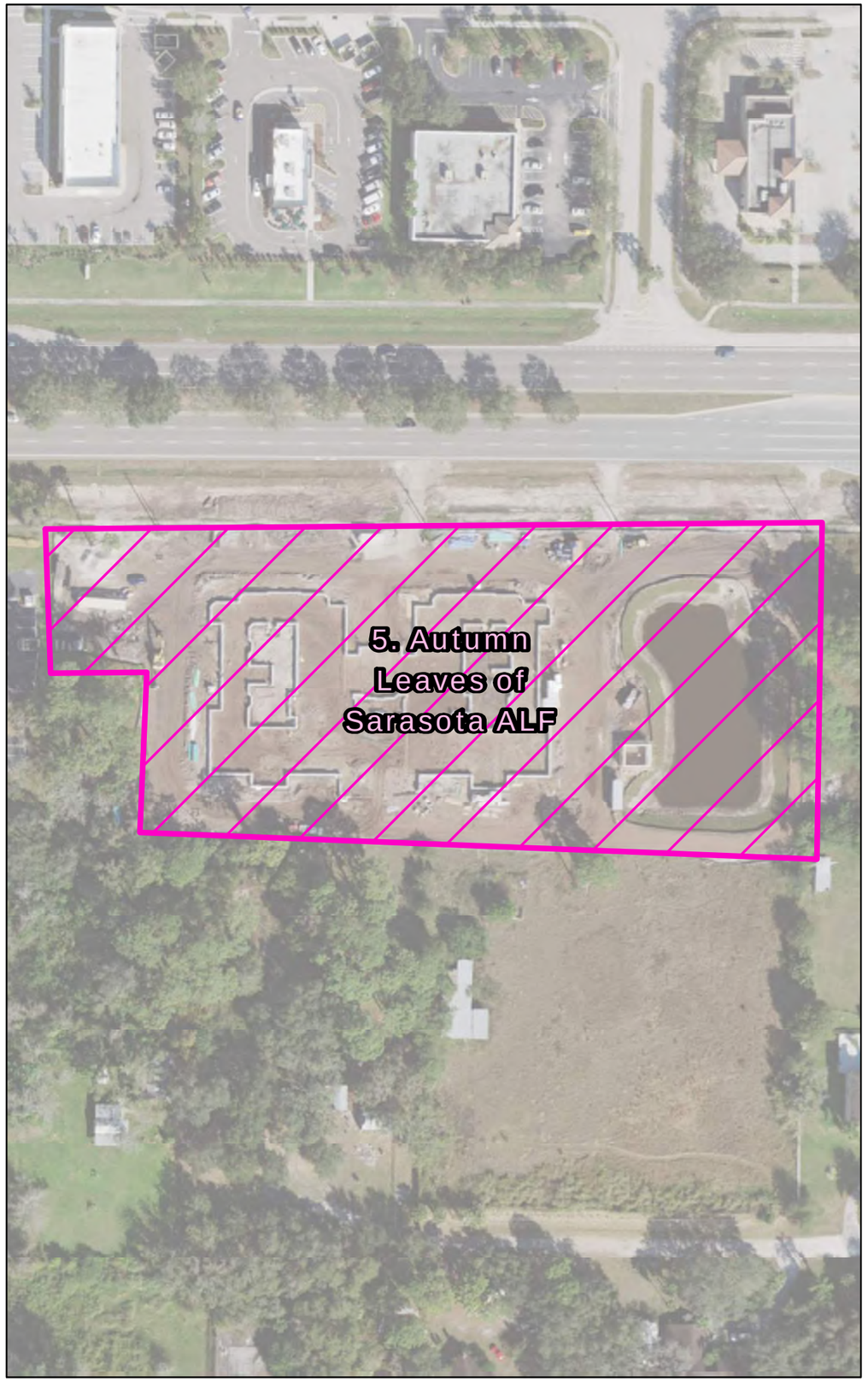
0 62.5 125 250
Feet

1 in = 125 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD







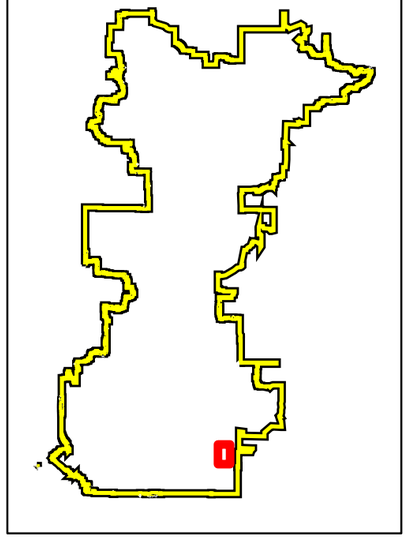
Appendix B
TopoVoid #5

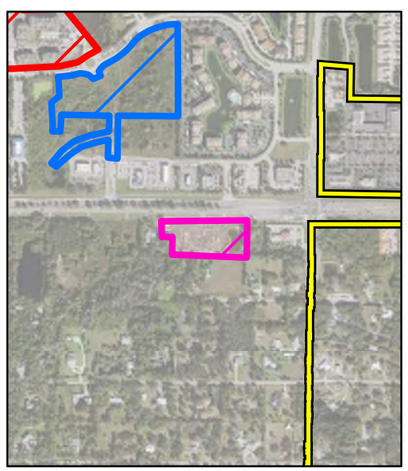
N

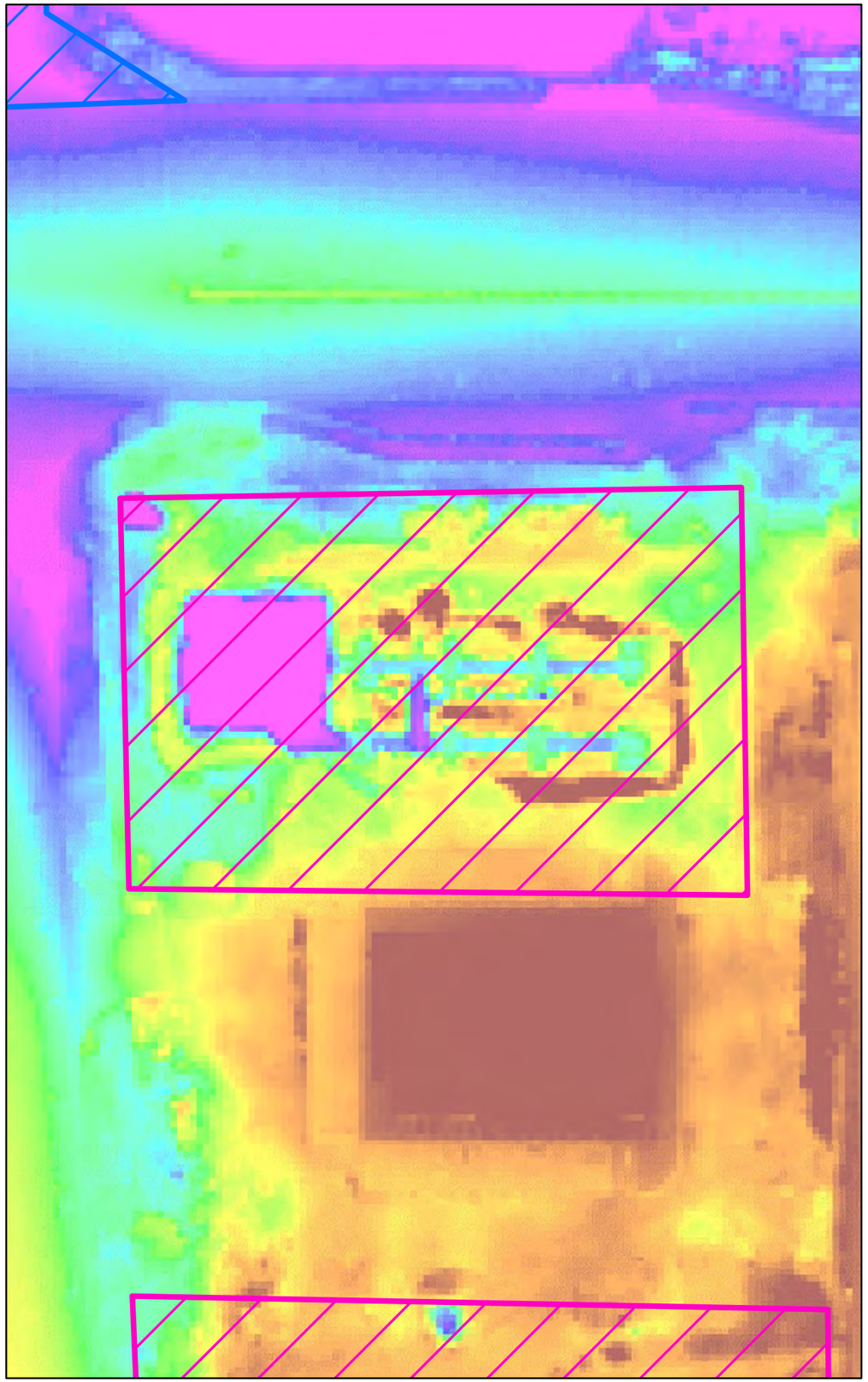
0 55 110 220 Feet

1 in = 112.23731 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD







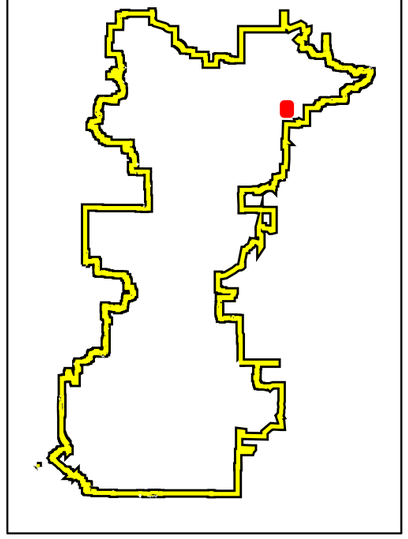
Appendix B
TopoVoid #6

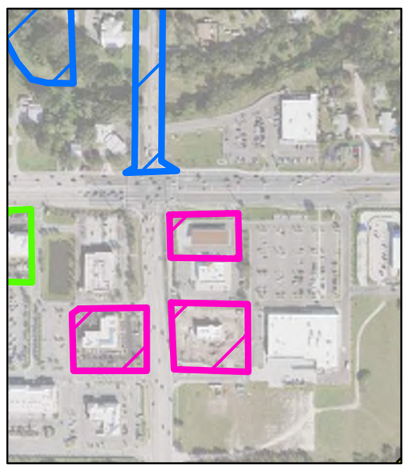
N

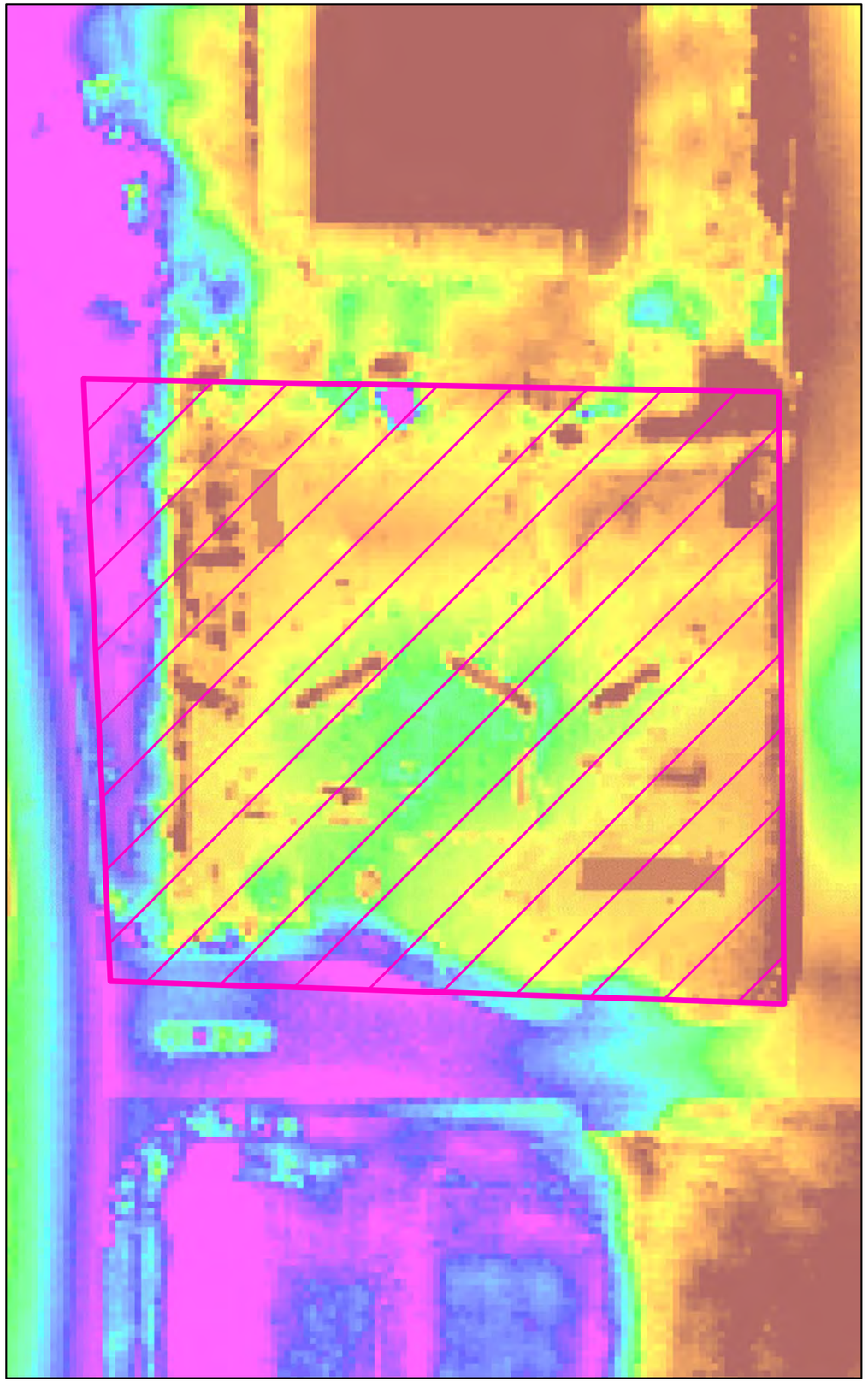
0 25 50 100
Feet

1 in = 50 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD







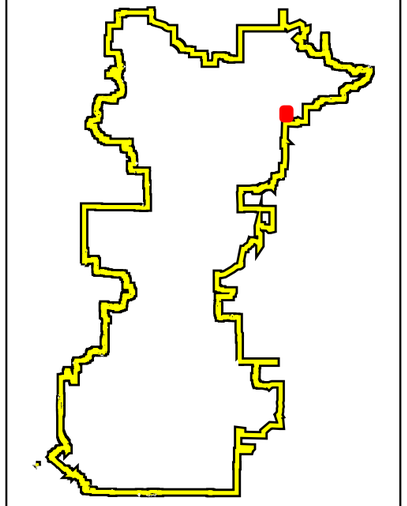
Appendix B
TopoVoid #7

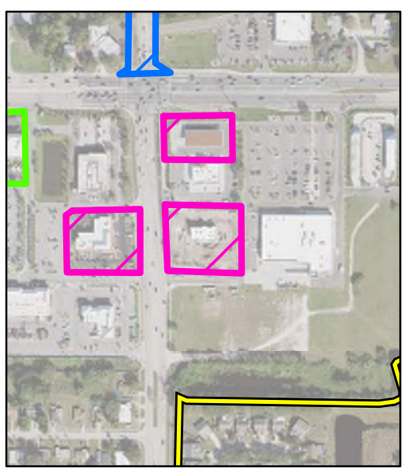
N

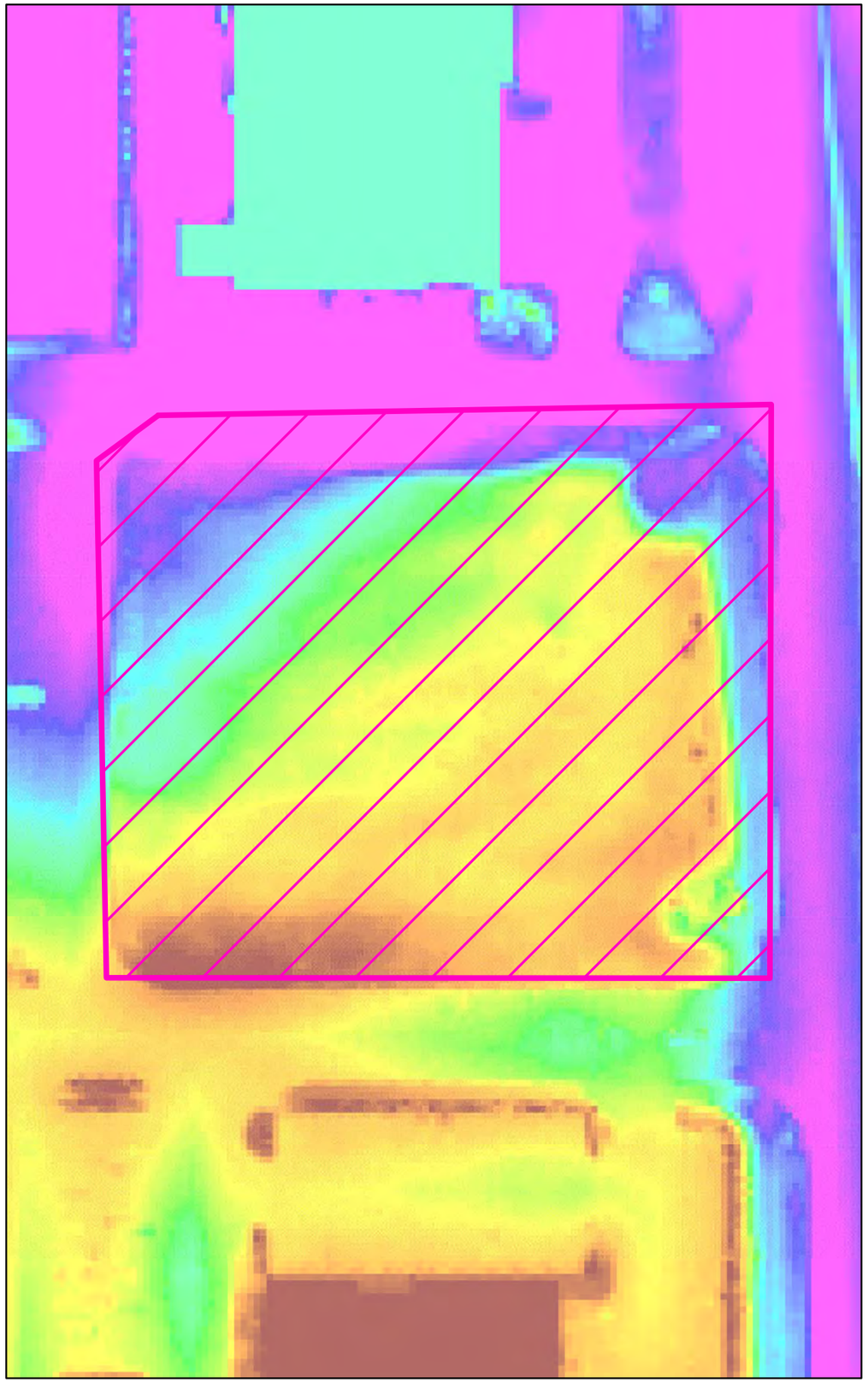
0 25 50 100
Feet

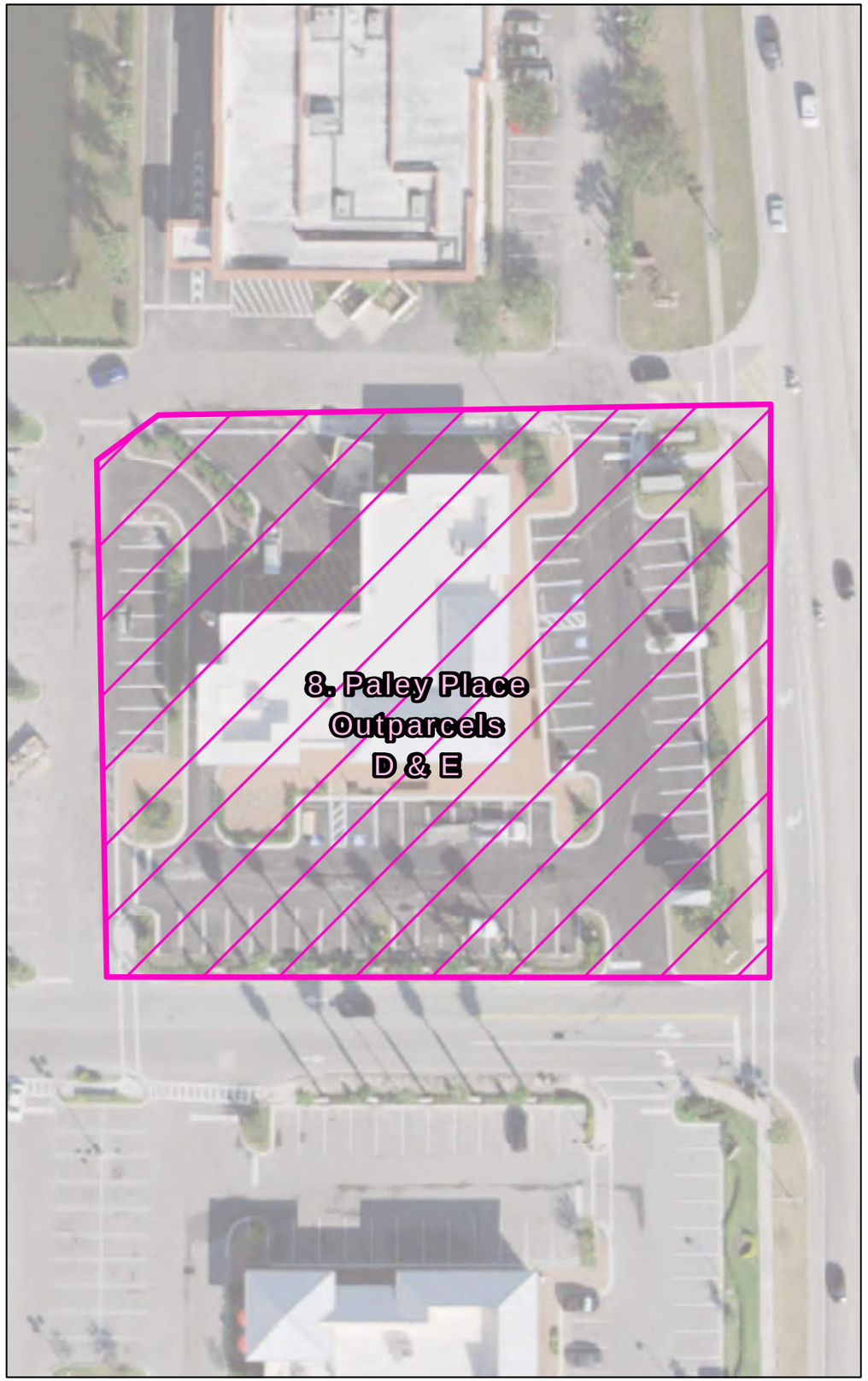
1 in = 50 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD









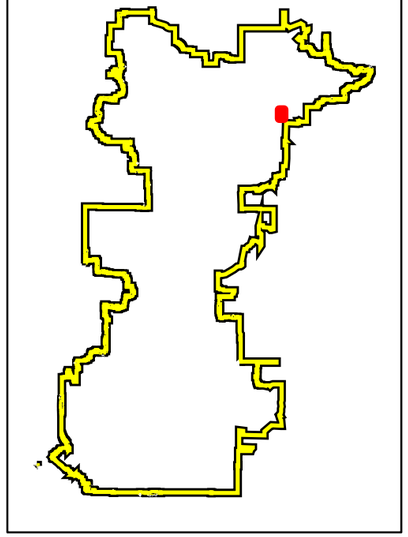
Appendix B
TopoVoid #8

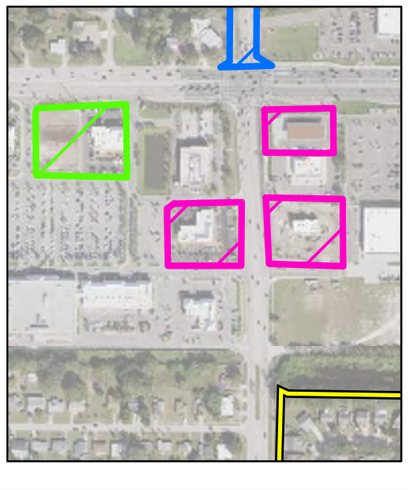
N

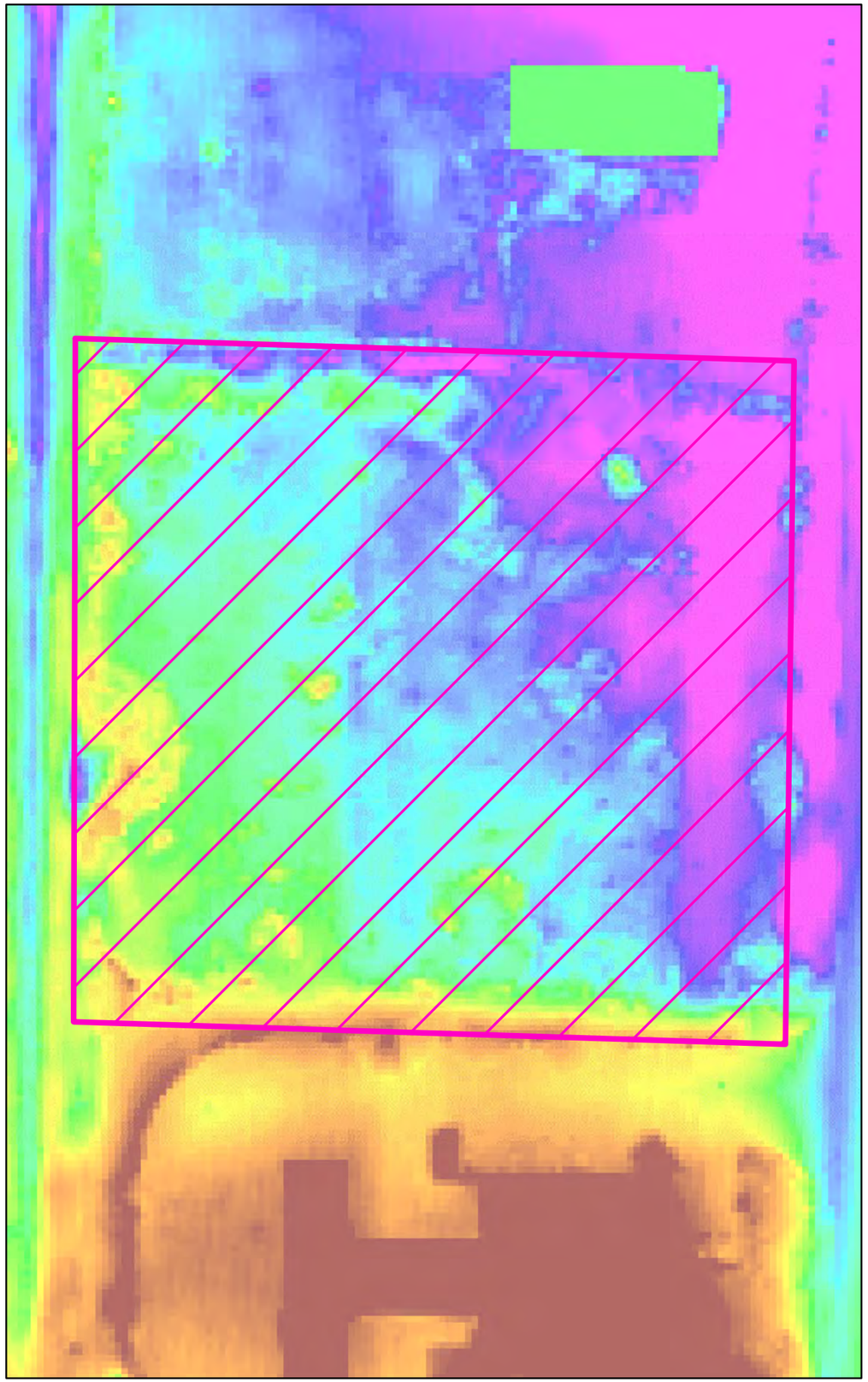
0 25 50 100
Feet

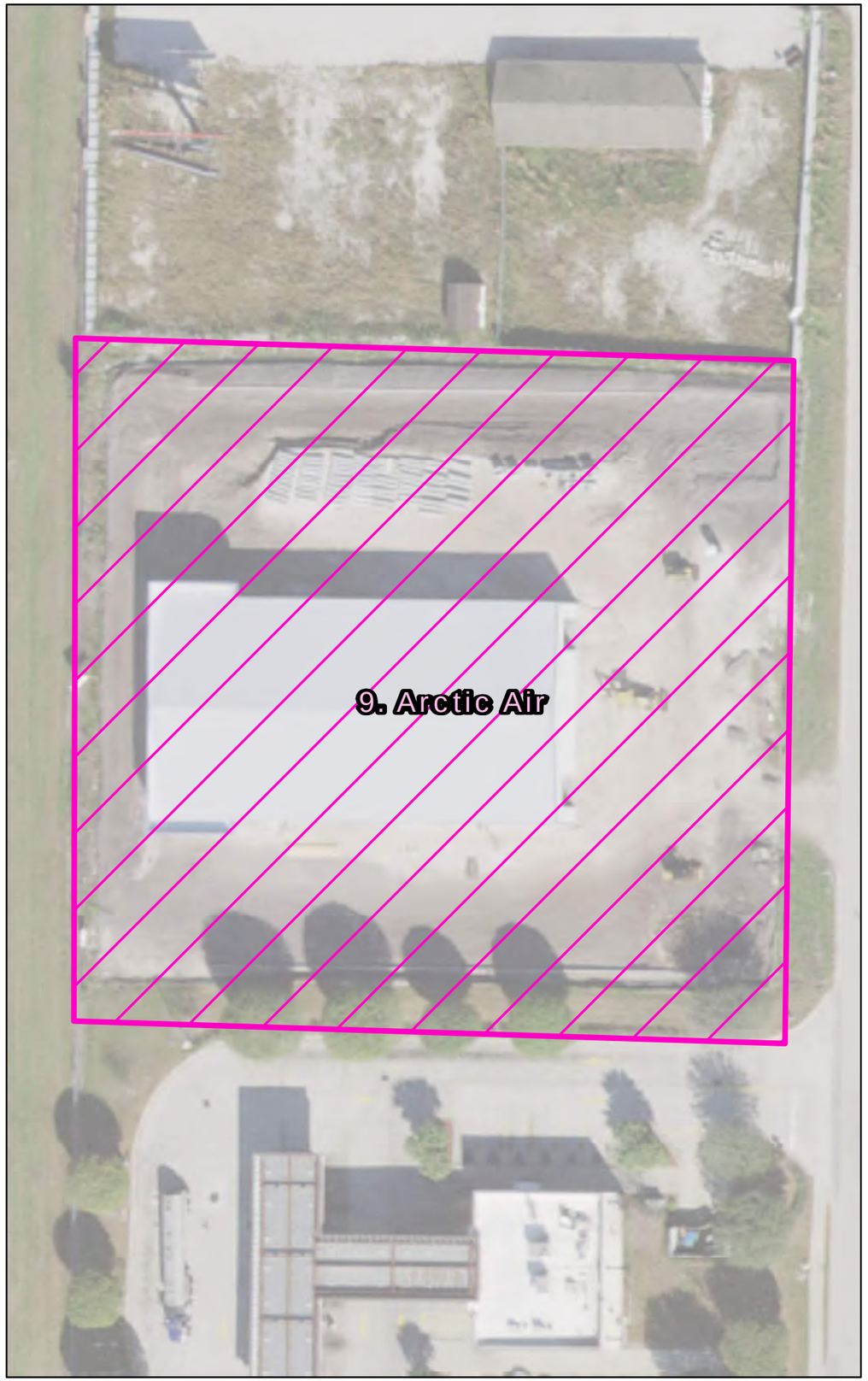
1 in = 50 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD









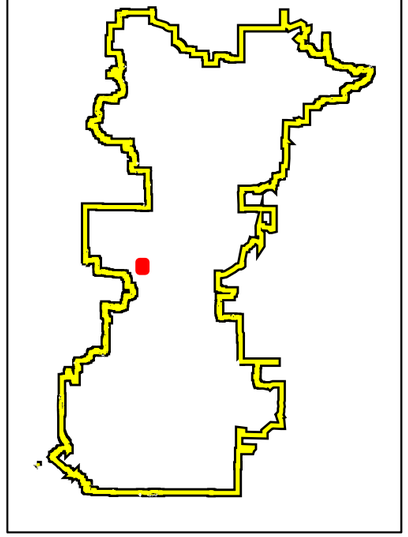
Appendix B
TopoVoid #9

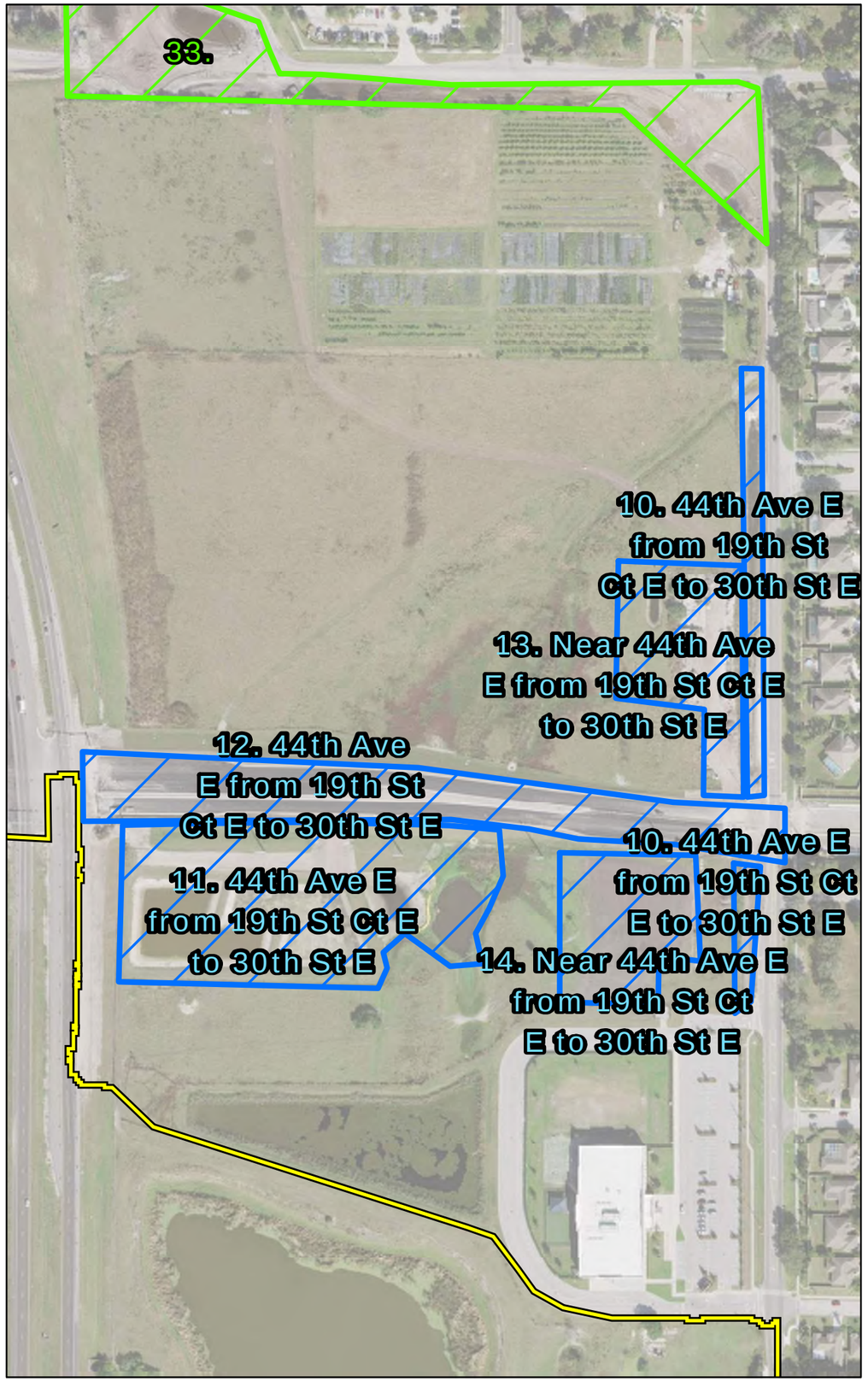
N

0 25 50 100
Feet

1 in = 50 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD





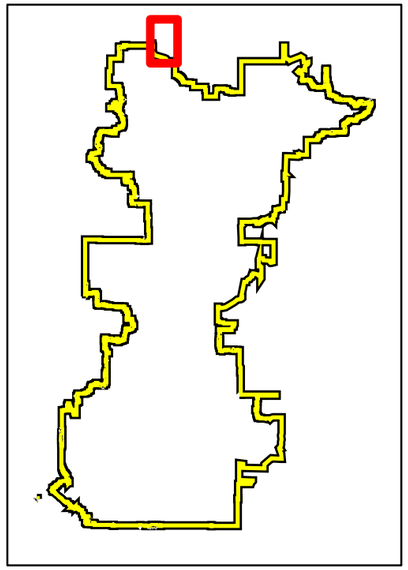
Appendix B
TopoVoid #10-14

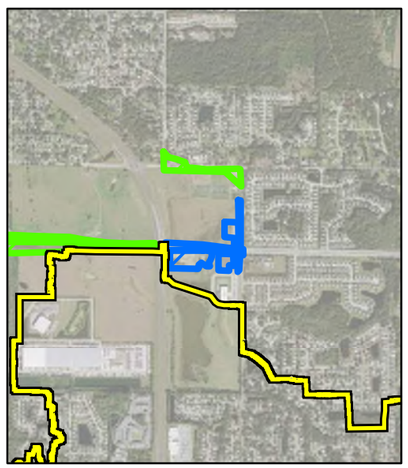
N

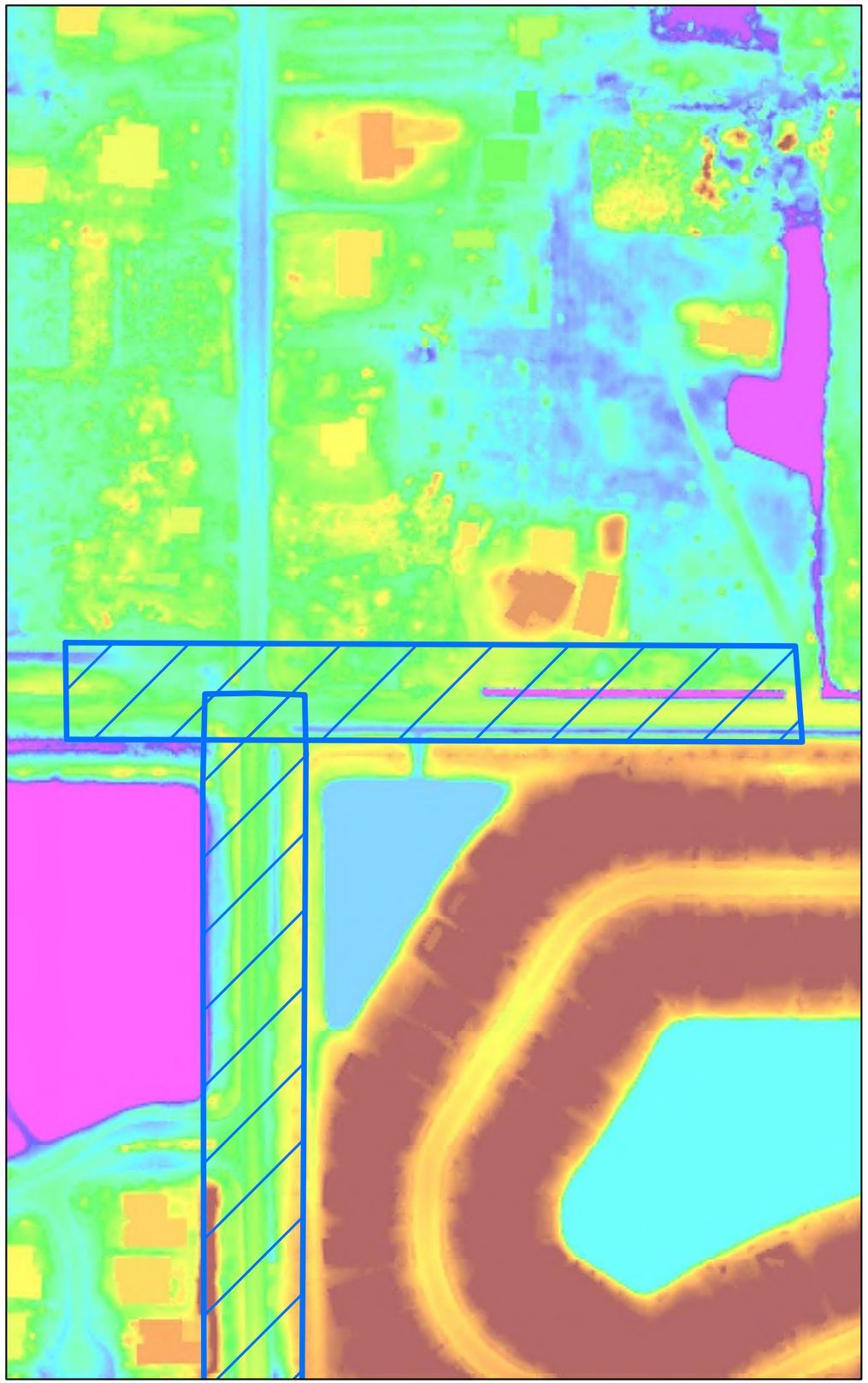
0 125 250 500
Feet

1 in = 250 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD







Appendix B
TopoVoid #15

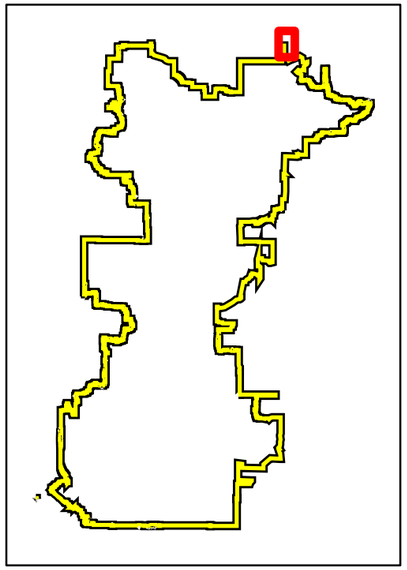
0 75 150 300 Feet

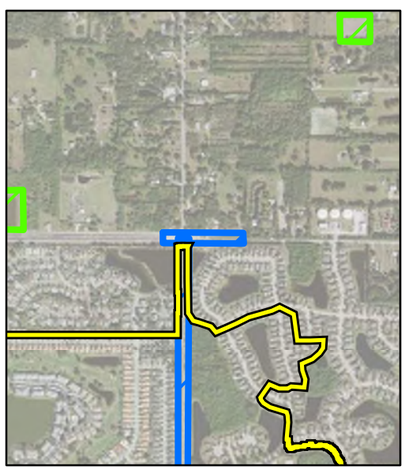
1 in = 150 ft

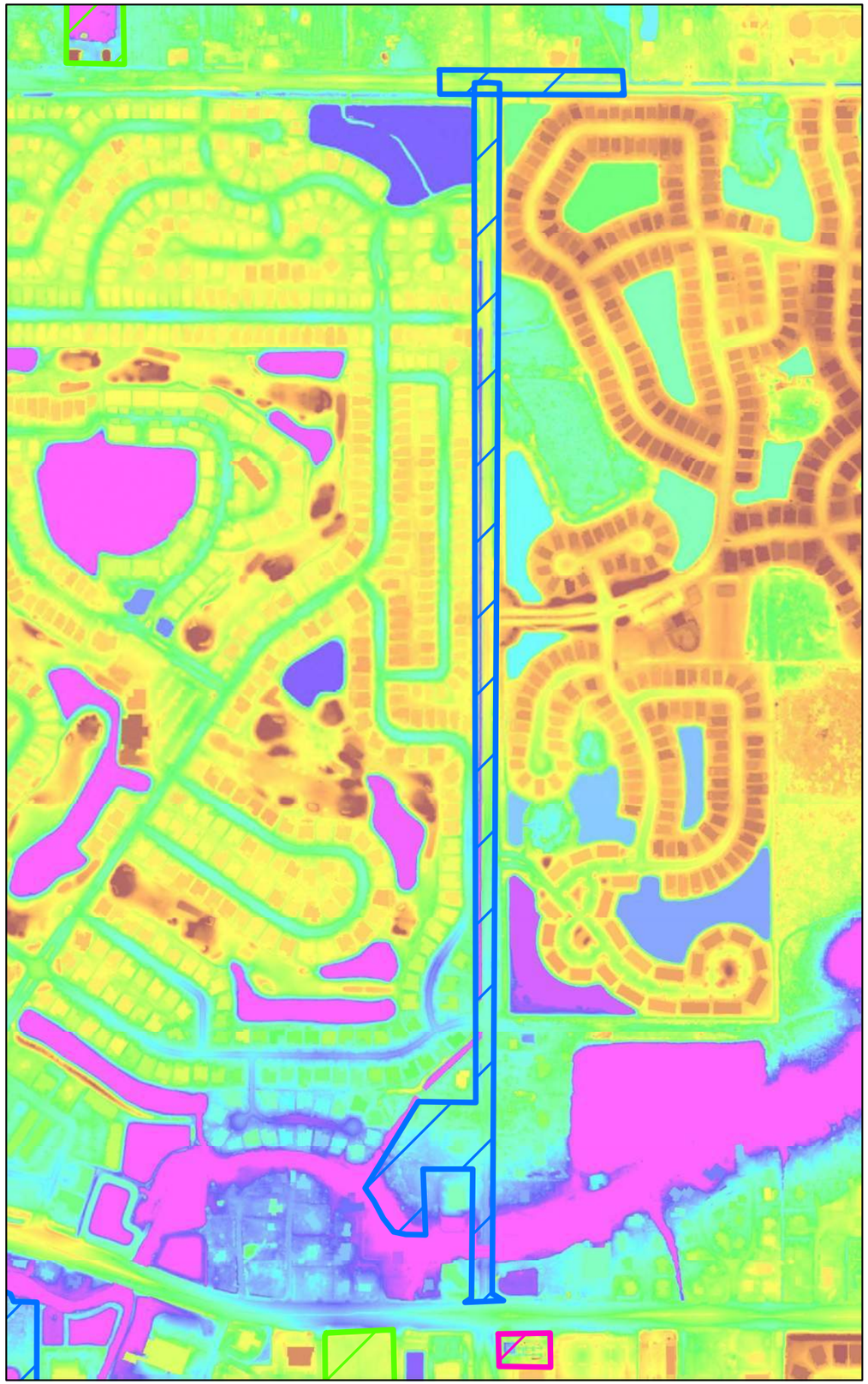
Topographic Voids

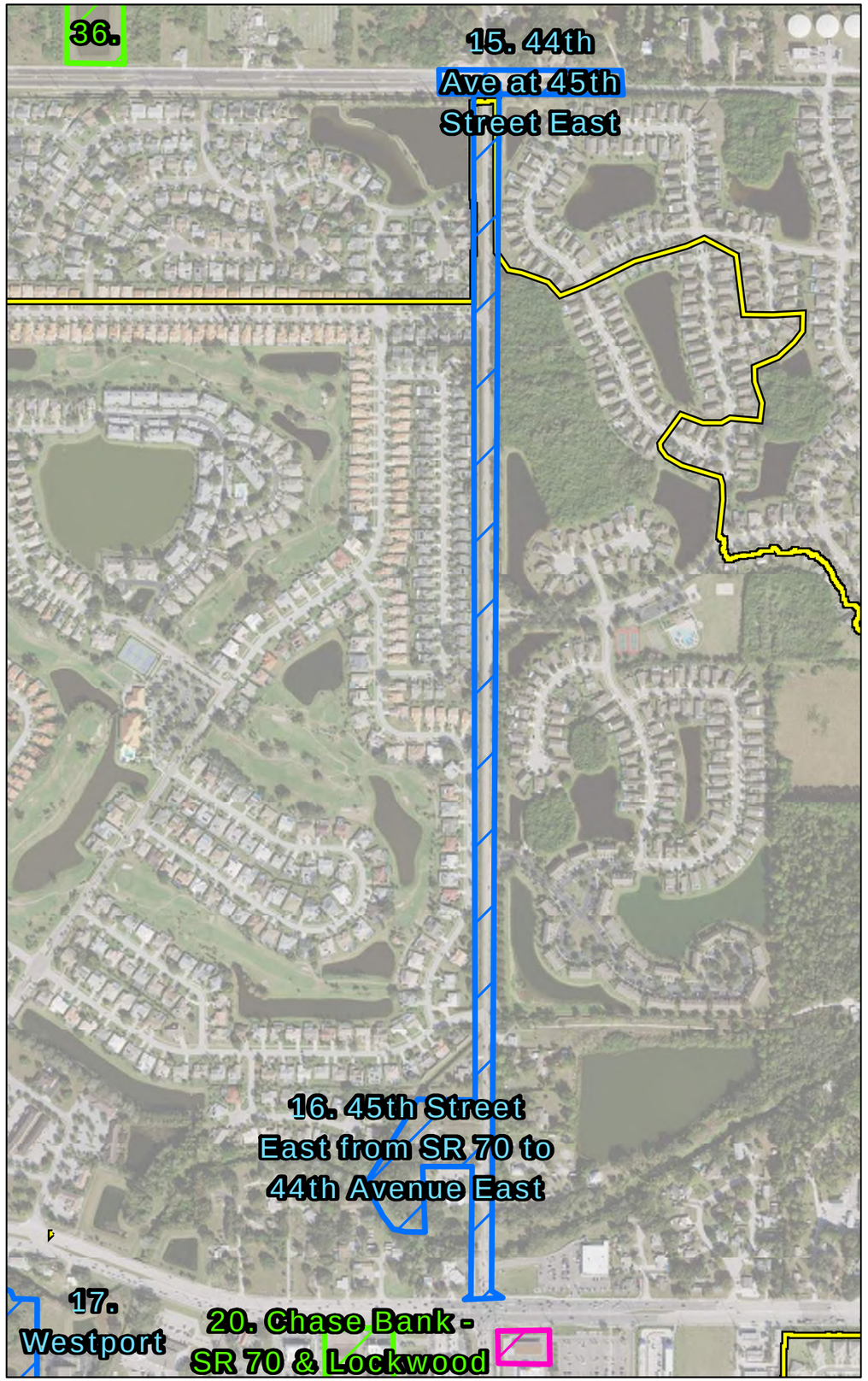
Priority

- High
- Medium
- Low
- TBD









Appendix B
TopoVoid #16

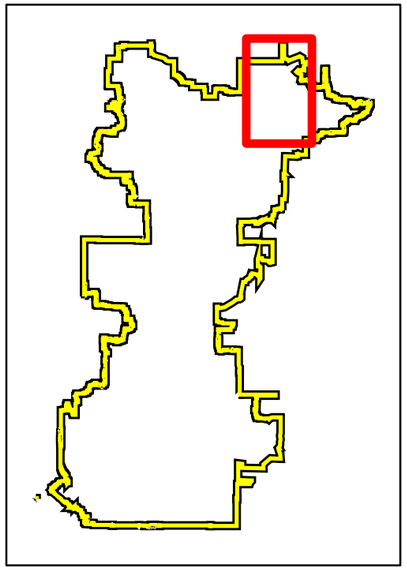
0 300 600 1,200 Feet

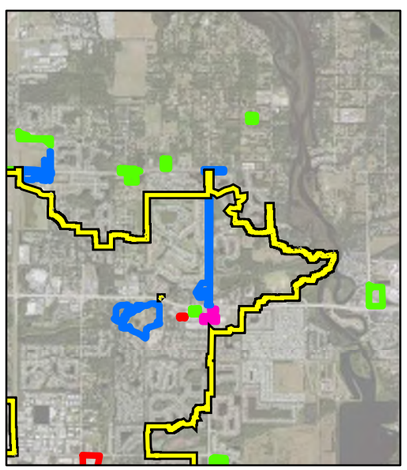
1 in = 600 ft

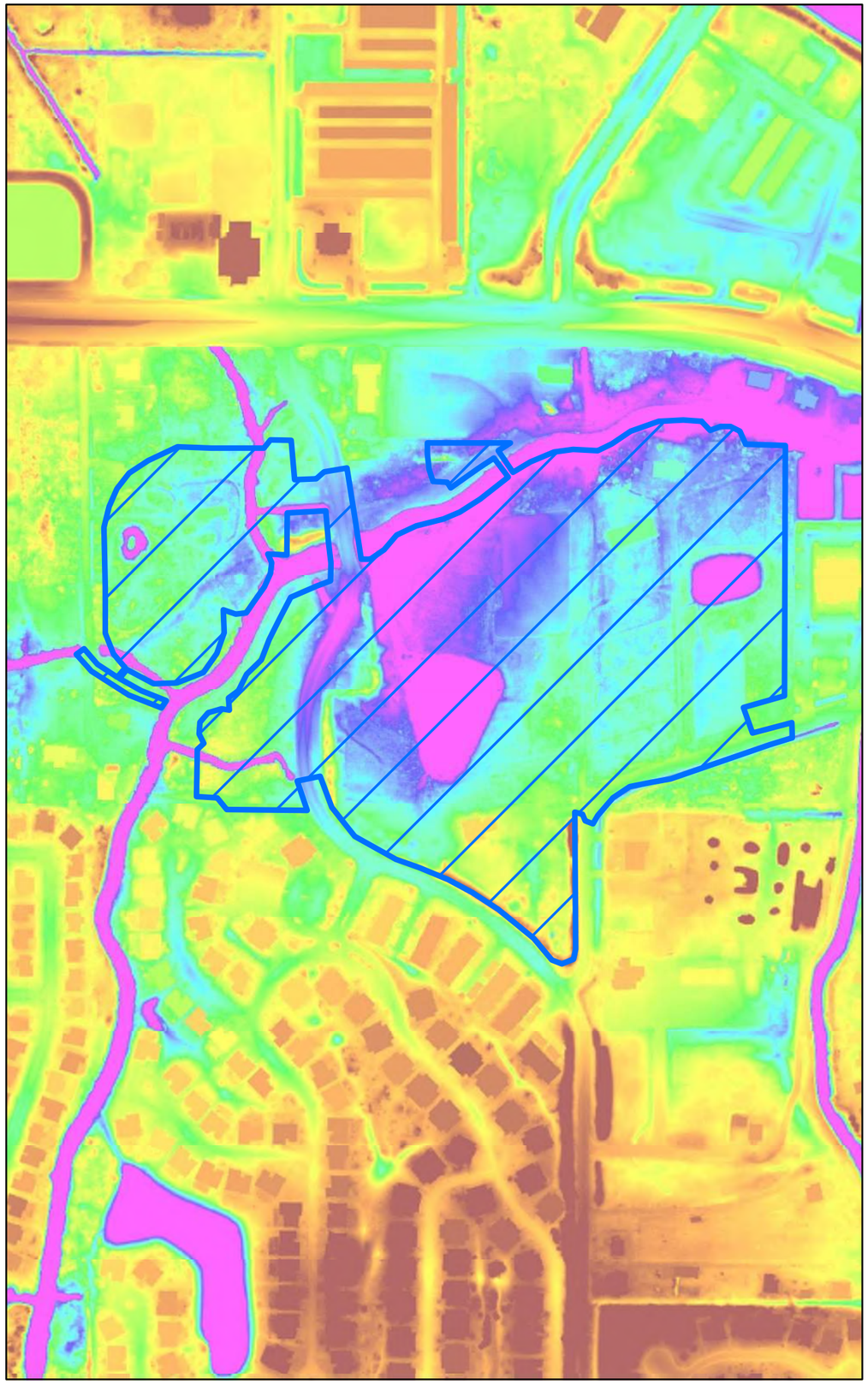
Topographic Voids

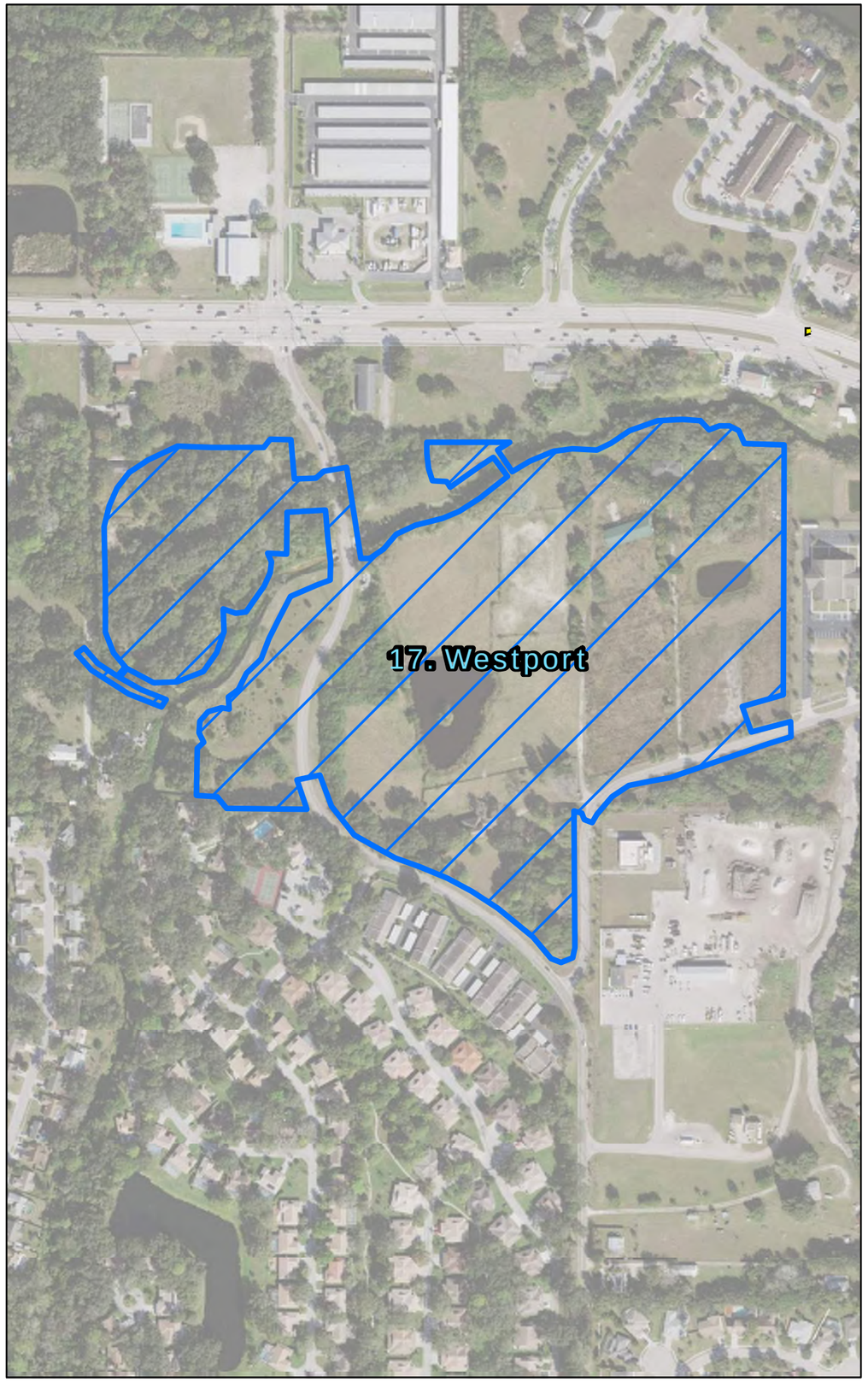
Priority

- High
- Medium
- Low
- TBD









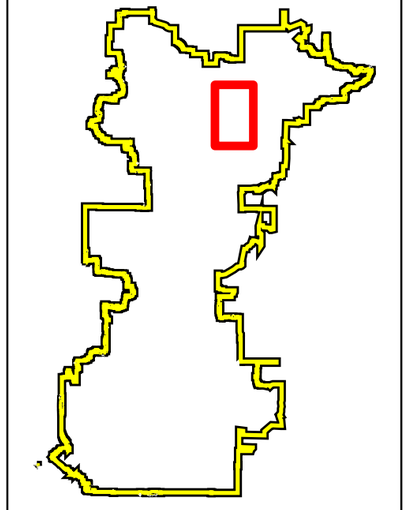
Appendix B
TopoVoid #17

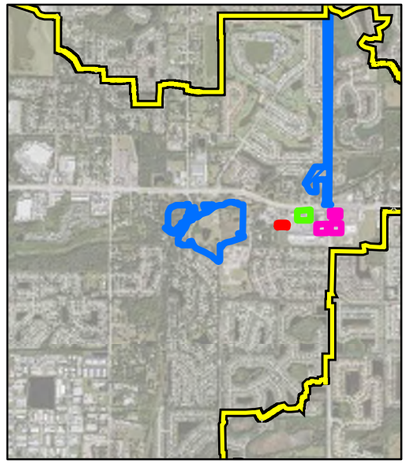
N

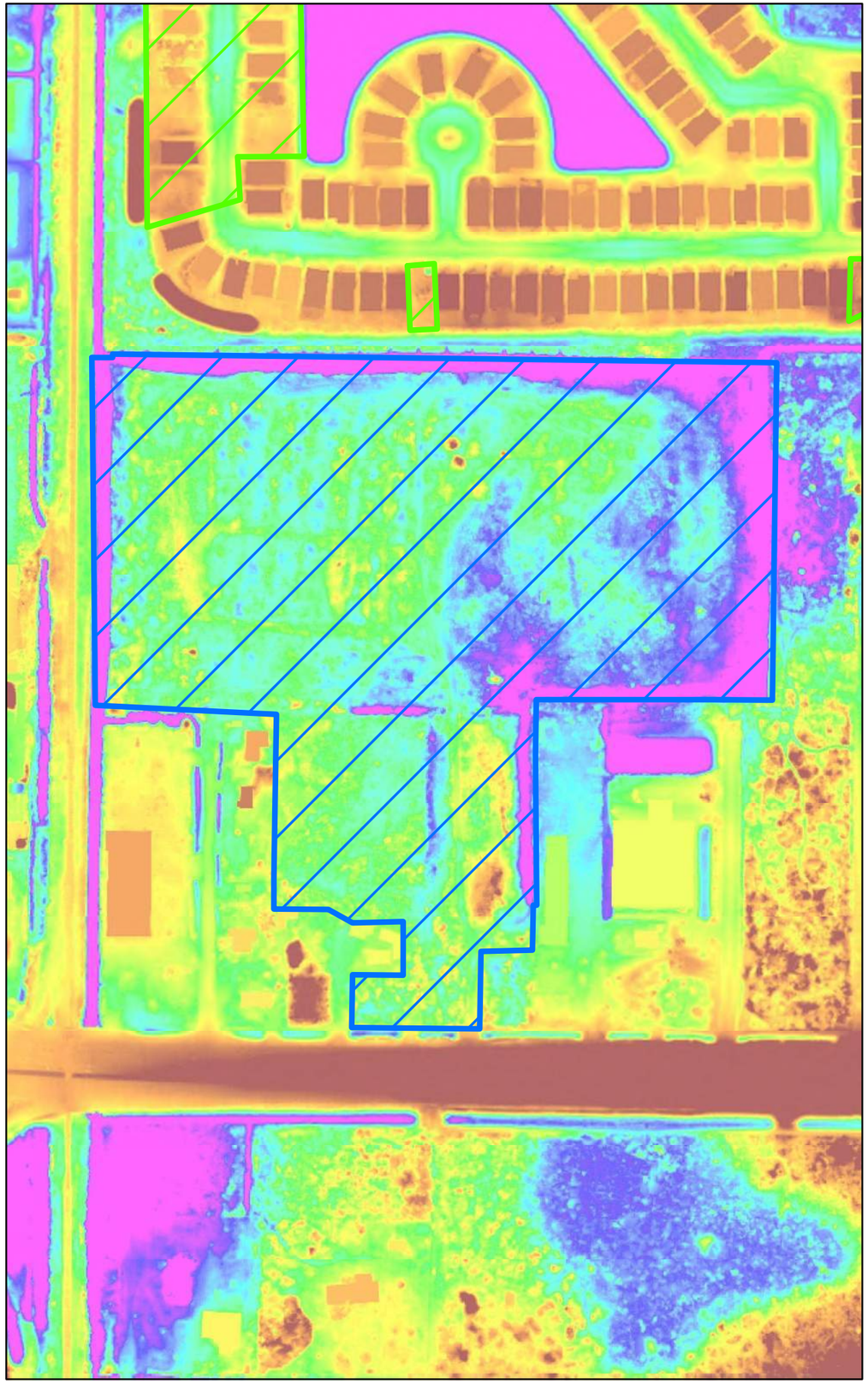
0 175 350 700
Feet

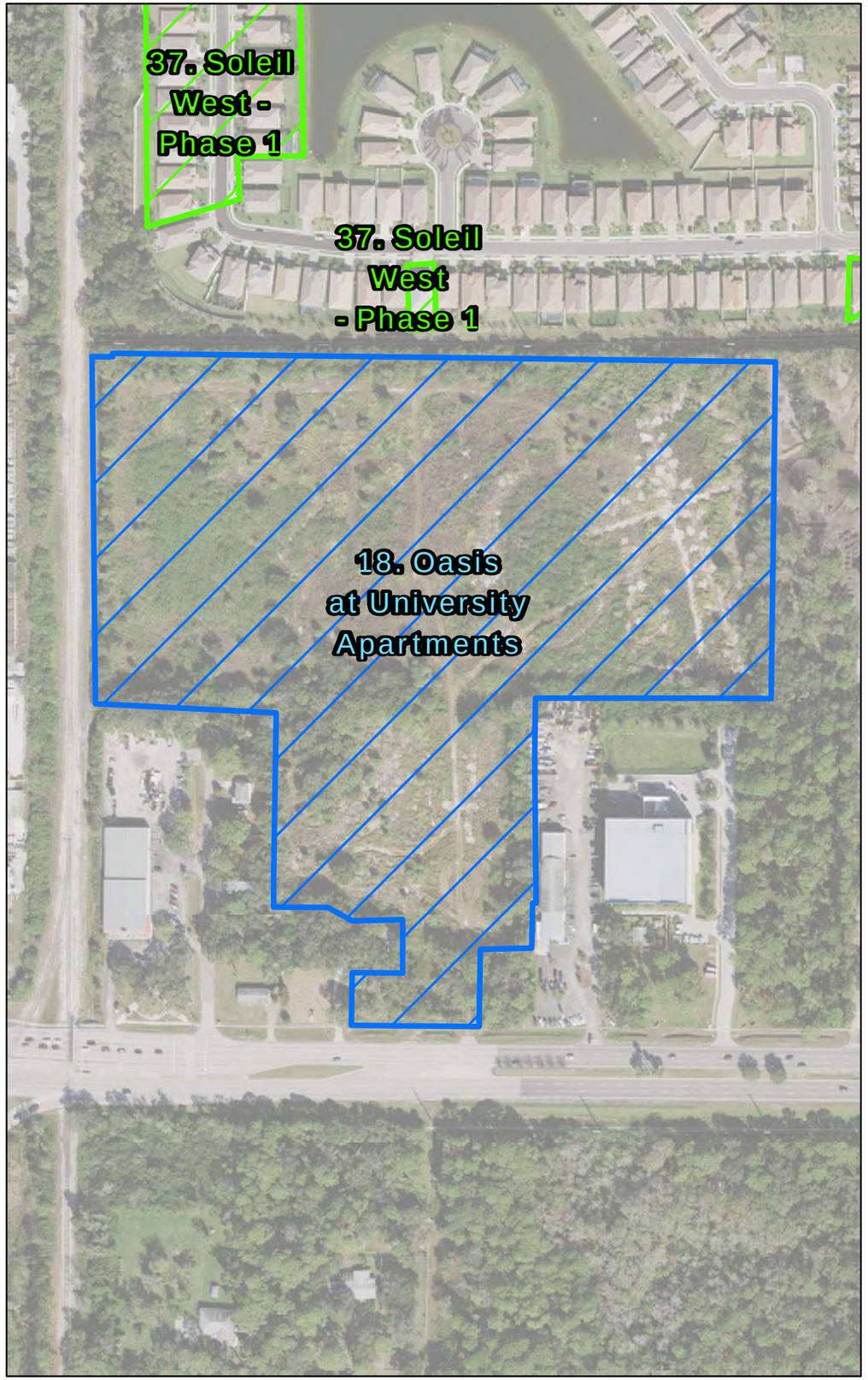
1 in = 350 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD

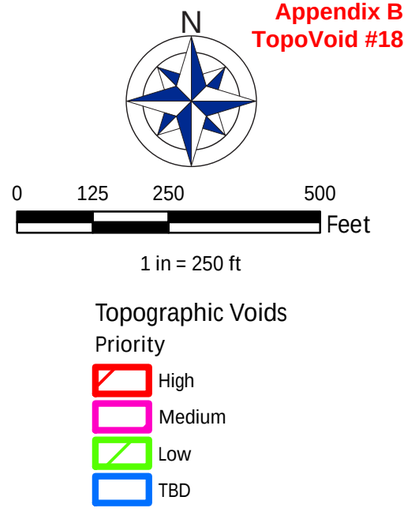


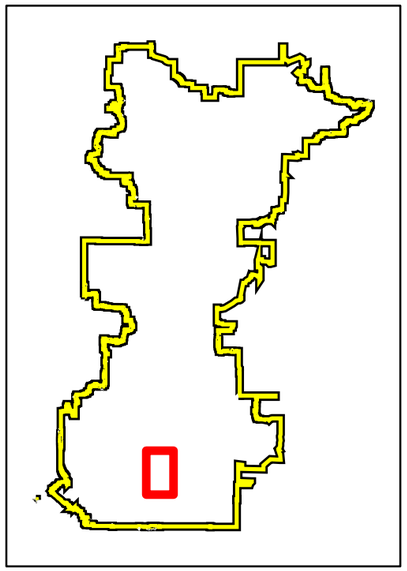


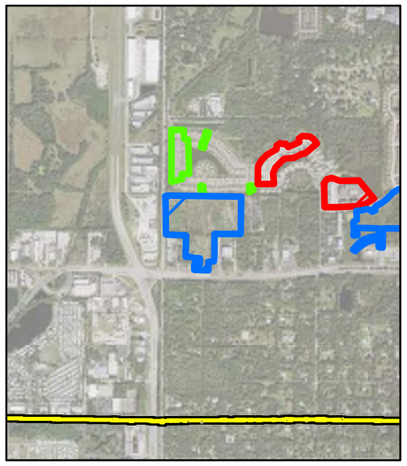


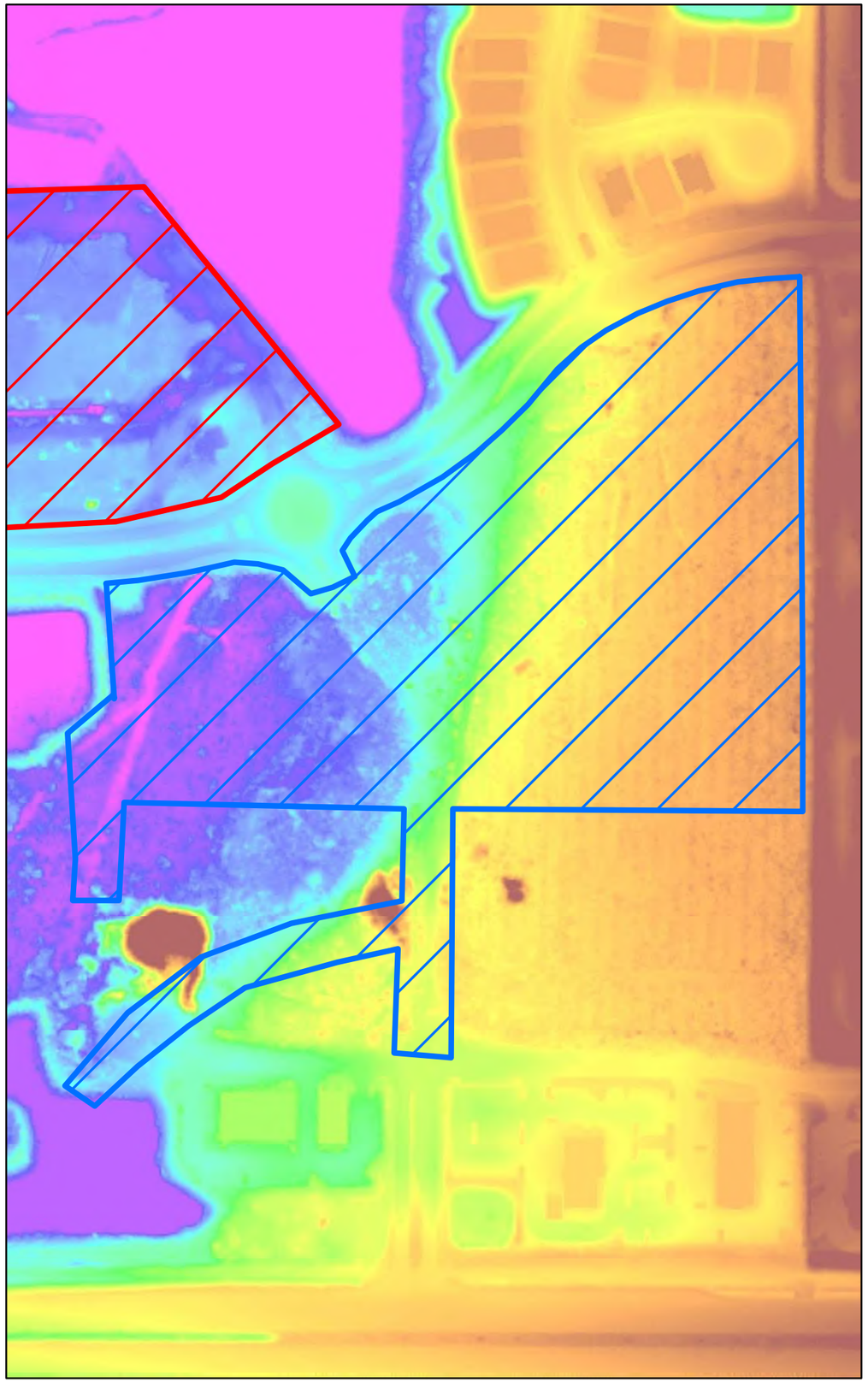


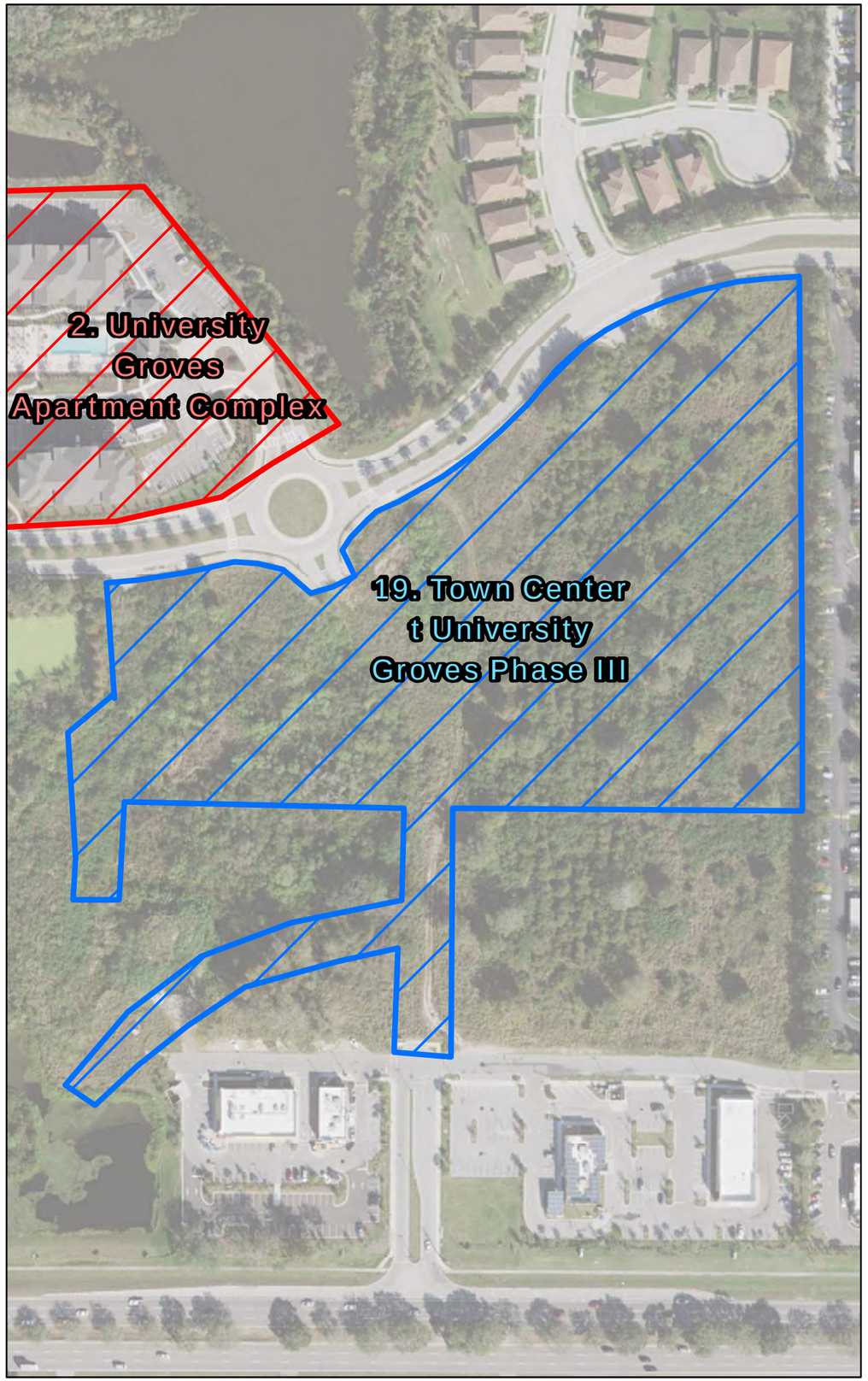
Appendix B
TopoVoid #18











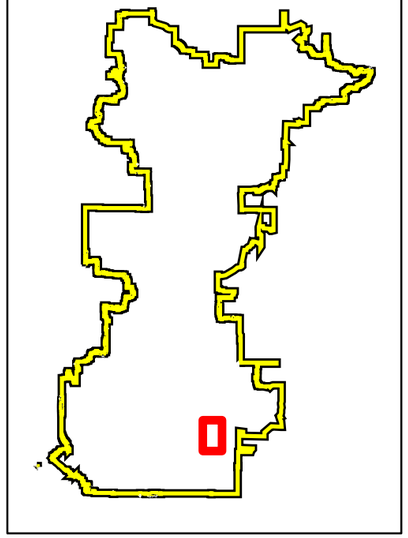
Appendix B
TopoVoid #19

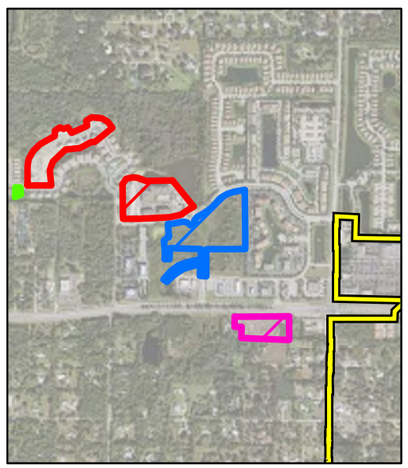
N

0 87.5 175 350
Feet

1 in = 175 ft

Topographic Voids
Priority
- High
- Medium
- Low
- TBD





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