VOLUME 2

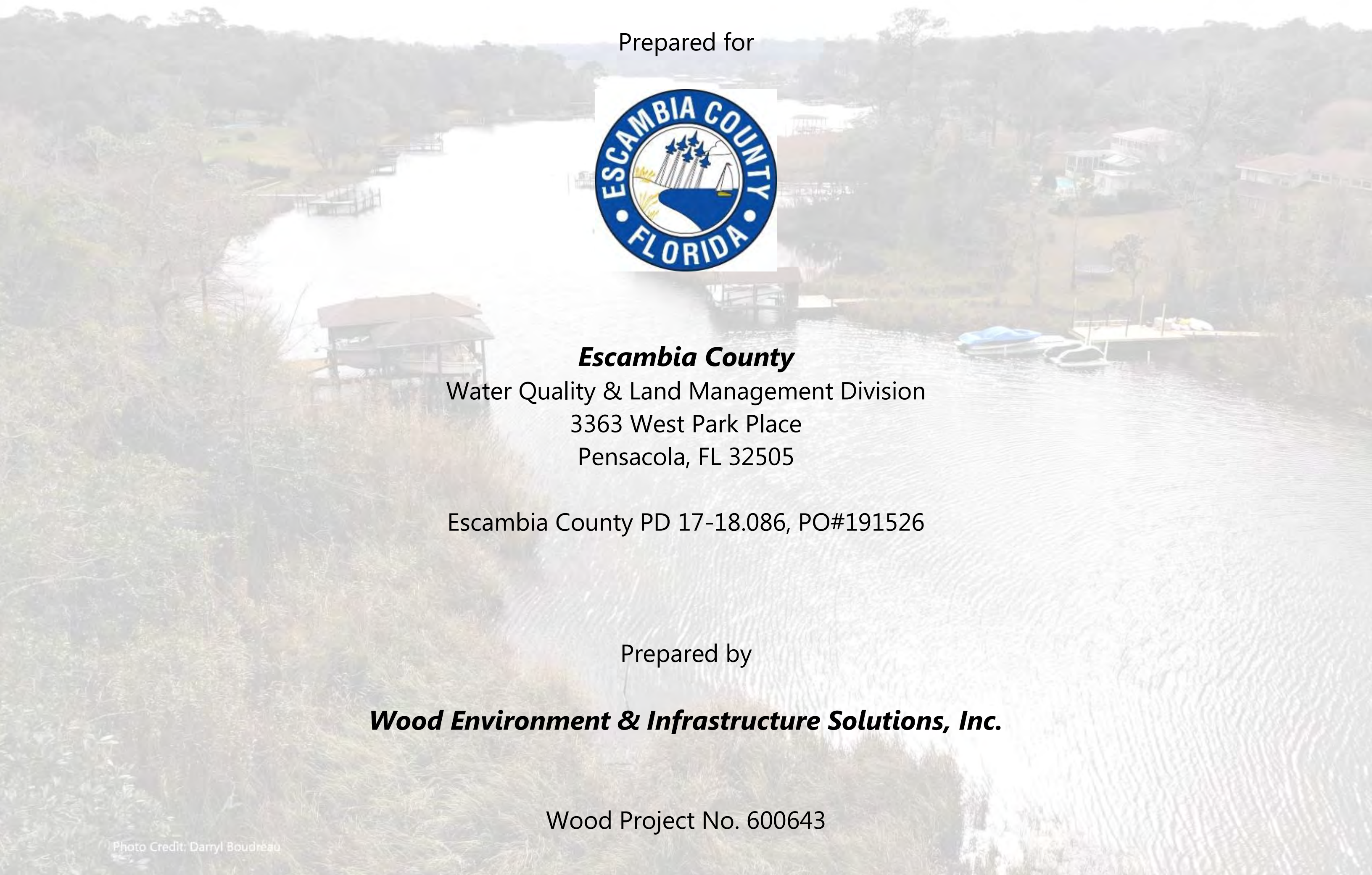
WATERSHED EVALUATION

VOLUME 2

WATERSHED EVALUATION REPORT

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

WATERSHED EVALUATION REPORT



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Document Revision History

Date	Version	Description	Changes Made
August 28, 2020	Version 1.0	Initial Draft Watershed Evaluation Report	N/A
November 20, 2020	Version 2.0	Revised Watershed Evaluation Report. Revisions based on County Comments	Added Reference Tables to each section Added Content: • Percolation Section 5.4.3.2 • Initial Subbasins Section 5.4.4.1 • DEM Review and Topographic Void Update, Section 5.1.4
March 16, 2021	Version 3.0	Revised Watershed Evaluation Report Revisions based on Technical Stakeholder feedback and new content added to complete WE subtasks.	ACRONYMS - Minor revisions to Acronyms and data tables based on comments received from technical stakeholders Section 5.5 - Added content for Field Reconnaissance findings and development of Initial Subbasins and Hydraulic Inventory. Edits also made to address County review comments. Appendices – Summary of ERPs/FDOT Plans Added

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LIST OF ABBREVIATIONS

ADA	American Disability Act
AFB	Air Force Base
BPCP	Bacteria Pollution Control Plan
CISMA	Cooperative Invasive Species Management Area
DEM	Digital Elevation Model
DOACS	Department of Agriculture and Consumer Services
ECUA	Emerald Coast Utilities Authority
EPA	Environmental Protection Agency
ERP	Environmental Resource Permit
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDHR	Florida Division of Historical Resources
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FLEPPC	Florida Exotic Pest Plant Council (nka Florida Invasive Species Council)
FLUCCS	Florida Land Use, Cover and Forms Classification System
FNAI	Florida Natural Areas Inventory
FWC	Florida Fish and Wildlife Conservation Commission
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
HARN	High Accuracy Reference Network
H&H	Hydrologic & Hydraulic
HPGN	High Precision Geodetic Network
HSG	Hydrologic Soil Group
HWMDB	High-Water Mark Database
ICPR4	Interconnected Pond Routing Model Version 4
IPaC	Information for Planning and Consultation
IWR	Impaired Waters Rule
LID	Low-Impact Design
LiDAR	Light Detection and Ranging
MPN	Most Probable Number
MRO	Maintenance, Repair, Overhaul
MS4	Municipal Separate Storm Sewer System
MSA	Marine Science Academy

MSL	Mean Sea Level
NAVD88	North American Vertical Datum of 1988
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Agency
NPDES	National Pollutant Discharge and Elimination System
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWFWMD	Northwest Florida Water Management District
NWI	National Wetlands Inventory
NWS	National Weather Service
OSTDS	Onsite Sewage Treatment & Disposal System
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PERCH	Partnership for Environmental Research and Community Health
POT	Potentiometric
RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act
RFS	Reticulated Flatwoods Salamander
SHPO	State Historic Preservation Office
STORET	STOrage and RETrieval
SWAT	Stormwater Advisory Team
SWIM	Surface Water Improvement and Management Act of 1987
SWMP	Stormwater Master Plan
TMDL	Total Maximum Daily Load
TN	Total nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey
UWF	University of West Florida
WBID	Water Body Identification
WHPAs	Wellhead Protection Areas
WLA	Waste Load Allocation
WMP	Watershed Management Plan

EXECUTIVE SUMMARY

Watershed Management Plan Purpose

Escambia County is developing a comprehensive Watershed Management Plan (WMP) for the Carpenter Creek and Bayou Texar watersheds. Funding for the development of the WMP has been secured through the Escambia County Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) Direct Component allocation (Pot 1). The Carpenter Creek and Bayou Texar WMP will provide a roadmap for identifying, addressing, and recommending actions for at least the following objectives:

• **Water Quantity & Quality:** Identify watershed-specific issues related to water quantity (including erosion, aging or inadequate stormwater infrastructure, flooding) and quality (including point and non-point source pollution such as excess nutrients, metals, pathogens, trash, and sedimentation), and determine appropriate corrective actions necessary to address the root cause of issues identified.

• **Fish & Wildlife Habitat:** Identify current conditions throughout the watersheds relating to terrestrial and aquatic fish & wildlife habitats (including riparian buffers, floodplain connectivity, wildlife corridors, invasive species abundance, locally important native species, legacy contamination), and determine appropriate corrective actions necessary to protect, enhance, and/or restore fish & wildlife habitat within the watersheds.

• **Public Access & Recreation:** Identify and characterize existing Carpenter Creek and Bayou Texar public access and recreation utilization and develop strategies to expand existing public access and recreation opportunities.

• **Community Resiliency:** Identify and characterize watershed vulnerabilities (including flooding, sea level rise, hurricanes, future development). Actions should improve watershed resiliency by balancing both natural and built environments.

The WMP will be developed in three phases: Desktop Watershed Evaluation, Watershed Assessment/Field Reconnaissance, and Watershed Management Recommendations.

Watershed Evaluation Report Purpose

This report summarizes the Desktop Watershed Evaluation portion of the WMP. This report documents the findings of the team's extensive literature and data review and community engagement activities and describes the overall characteristics of the watersheds related to hydrology, land use, soils, potential sources of pollution, history and culture of the watersheds, public access, and ecological communities and invasive species. This report also documents the team's proposed approach to the hydrologic and hydraulic (H&H) modeling tasks to ensue and provides a gap analysis related to the flood data and water quality and sediment data available in the watersheds.

Diagnosis of Watersheds from Desktop Evaluation

The Carpenter Creek and Bayou Texar watersheds are rich in historic and cultural significance, and because of this, have been the subject matter of decades of studies. Over the years, erosion due to channel modification from development, non-attenuated stormwater, gray vs. green infrastructure, and diminishment of the protective riparian zone have dramatically changed the Carpenter Creek stream pattern and profile, as well as water quality, and has jeopardized several structures located along its banks. Displaced sediments from channel modifications and erosion in the upper headwaters have accumulated in the lower reaches of the creek and have significantly altered the mouth of Carpenter Creek that discharges into upper Bayou Texar. Channel modification and urban land uses have also created vectors for nuisance and exotic species within the watersheds.

The Carpenter Creek and Bayou Texar watersheds are within the Pensacola Bay System, which is a Surface Water Improvement and Management Act of 1987 (SWIM) priority water body under the administration of the Northwest Florida Water Management District (NWFWMD). The watersheds have been identified as impaired for fecal coliform bacteria and, in 2012 the Florida Department of Environmental Protection (FDEP) adopted a fecal coliform Total Maximum Daily Load (TMDL) for both watersheds with a requirement of bacteria reductions necessary to meet the surface water quality standards. TMDLs require a fecal coliform reduction of 28% and 49% for the creek and bayou, respectively.

Past sediment data have shown contamination in the bayou. In addition to water quality impairments, the creek and bayou do not fulfill their potential for providing public access and recreational opportunities. Residents of the area emphasize a strong connection to the creek and bayou, from both a historic and cultural perspective.

Bayou Texar is one of Pensacola's most important watersheds and recreational water bodies for watersports, swimming, and fishing. Numerous studies have been undertaken over the last several decades and have documented contamination by fecal coliform and Enterococcus bacteria, likely in part originating from sedimentation inputs from Carpenter Creek and various stormwater outfalls. Legacy contaminants such as heavy metals, polychlorinated biphenyl (PCB), polycyclic aromatic hydrocarbons (PAHs), and pesticides have been found in the bayou sediments as well. Contamination of surface waters and sediments is compounded by the constricted mouth of the bayou, the low tidal amplitude, and short tidal duration.

Land use in the watersheds is predominately residential and commercial. The riparian areas of the bayou are almost fully developed with single-family residential homes. Very limited natural riparian buffers exist, which has diminished diversity and density of native vegetation. Additionally, most of the single-family residential neighborhoods were developed before state or municipal stormwater treatment and/or attenuation requirements were established. Untreated stormwater enters the bayou through numerous outfalls along the waterfront.

The Bayou Texar watershed has experienced large increases in commercial and residential development over the years. Also, two Superfund sites have an impact on the watersheds due to their groundwater contaminant plumes. These include the Agrico Chemical Company, which produced fertilizers, and the Escambia Wood Treating Company, which previously released untreated wastewater into the bayou.

Over the past six decades, the Carpenter Creek and Bayou Texar watersheds have experienced alterations to their natural state, degrading the biophysical integrity of segments of the drainage system, primarily due to the strains of increased urbanization. Numerous directly connected impervious surfaces throughout the watersheds create a flashy hydrograph and have led to bank erosion and subsequent downstream sedimentation. Sections of the drainage network are still responding and adjusting to the altered watersheds as erosion and sedimentation progress over time and position.

Additional stressors are not ubiquitous along the drainage network but collectively include hardening of the creek banks, development within the riparian zone, creek crossing fragmentation, and channel straightening, to name a few. These factors contribute to the hydrologic stress of native riparian wetland habitat, loss of instream fish habitat, increased colonization by non-native invasive species, reduced water quality, and reduced recreational values.

Summary of Watershed Evaluation Key Findings

Wetland and Biological Resources

The project team used current and historical aerial photography, Natural Resources Conservation Service (NRCS) soil survey maps, and field ground-truthing to determine ecological community limits. Nine vegetative communities were identified, including: upland hardwood forest, coastal strand, coastal grassland, salt marsh, clastic lake, baygall, shrub bog, freshwater marsh, and dome swamp. Upland hardwood forest dominated the watersheds, with 670 acres, covering approximately 5.5% of the study area.

The project team identified approximately 281.4 acres of palustrine wetlands, freshwater clastic lakes, and emergent tidal marsh resources within the study area. This does not include any tidally influenced surface waters, shallow mud flats, or tidally influenced submersed resources.

Listed species data was obtained for the watersheds. No critical habitats were identified within the study area. However, 25 protected species were listed that may occur in the study area, including: mammals - west Indian manatee; birds - piping plover, red knot, wood stork; reptiles - eastern indigo snake, gopher tortoise, reticulated flatwoods salamander; fish - Atlantic sturgeon, saltmarsh topminnow; and 16 plant species.

Field reconnaissance efforts conducted in the watersheds confirm that extensive urbanization has taken a toll, leaving only a few isolated patches of remnant habitat, most of which has seen some form of anthropogenic impact. Urbanization of the terrestrial environment has disconnected the study area from any intact upland wildlife corridor. However, water and wetland land uses, which make up approximately 5% of the study area, represent the most significant wildlife corridor in the study area. From north to south these two land uses stretch the entire length of the study area and are largely contiguous, except for several highway crossings including Interstate I-10, Interstate 110, Brent Lane, N 9th Avenue, N 12 Avenue, and Cervantes Street.

Based on the team's research, fifteen invasive plant species are likely to occur within the study area. Fourteen are Florida Invasive Species Council (FISC) Category I species and one is a Category II species. Six species are listed on the Florida Noxious Weed list, two on the Federal Noxious Weed list, and four on the Florida Prohibited Aquatic Plant list. Research indicates twelve invasive animal species may occur in the study area.

Community Engagement

Community engagement is a key element to ensuring the success of this WMP, and the team's strategy to community engagement is meant to both *inform* community members and stakeholders about existing watershed conditions and *engage* them in the process of developing the goals, priorities, and recommendations of the plan. The Carpenter Creek/Bayou Texar watershed community is well-informed and environmentally active. The project's WMP community engagement activities formally kicked off in February 2020 with three events: Stakeholder Site Walk, Technical Stakeholder Group Meeting, and Public Open House. Each of the events was well attended and provided the project team with a wealth of knowledge regarding the cultural and environmental history of the watersheds.

History and Culture

The Carpenter Creek and Bayou Texar waterbodies and watershed area are part of the rich history of the Pensacola area. The original inhabitants of the Pensacola Bay region were Native American people of the Creek, Seminole, Yamassee, Choctaw, Apalachee, Parch, and Muskogee tribes.

Historic accounts describe both productive trade relations as well as ongoing conflict and war with the different colonial settlers. Pensacola played a key role in the Spanish colonization of North America. European exploration of the northern Gulf Coast began in the early 16th century, with the first attempted settlement led in 1559 by Tristán de Luna y Arellano, who sailed from Veracruz. The settlement failed due to a hurricane that struck the area shortly after it reached the shore, and it wasn't until 1690 that Pensacola became a colonial town.

The watersheds' landscape appears repeatedly in historic accounts of the region. Multiple community members noted natural features in their descriptions and memories of the creek and bayou and shared childhood experiences directly linked to the landscape. Historically, the creek and bayou were used for a wide range of recreational uses, including swimming, platform diving, skiing, canoeing, boating, fishing, and horseback riding.

Many noticed changes in the landscape over time, from clean, clear waters and a deep and wide creek, to a heavily sedimented body of water with contamination. However, some community members noted in their interviews and written comments that creek and bayou conditions have improved in recent years and noted the resilience of the ecosystem. Although urban development and current critical infrastructure do not allow the return of the watersheds to their historical natural state, the local community hopes for restoration and preservation of key recognizable features to maintain the landscape's identity.

Existing and Future Land Use

Today, the watersheds are highly urbanized with 85.6% of the land use classified as Urban and Built-Up, per the Florida Land Use, Cover and Forms Classification System (FLUCCS) Level 1 classification. Most of the Urban and Built-Up land exhibits patterns indicative of post-war suburban sprawl. The predominant land use in the watersheds is medium-density residential (2-5 dwelling units per acre) with a significant amount of low- and high-density residential, commercial (big-box stores, malls, and strip malls), institutional (colleges and hospitals), and transportation uses (airport and interstate highways). Very little of the watersheds are industrial; however, there are past and present industrial land use areas adjacent to the watersheds, including two Environmental Protection Agency (EPA) - designated Superfund sites (Agrico Chemical Company and the Escambia Wood Treating Company) with documented groundwater contamination that has migrated within the watersheds' boundary.

Today, the waterbodies are classified as fishable and swimmable but are not always accessible. There is no public access to Carpenter Creek, and Bayou Texar has experienced beach closures related to water quality health concerns, largely due to untreated wastewater entering the system. The County provided a Geographic Information System (GIS) shapefile that depicts their future land use for the year 2030. The shapefile provides data for the entire County, and only includes pertinent future-land-use data for the unincorporated portion of the study area. The 2030 future-land-use (by % area) for the unincorporated portion of the study area, is comprised primarily of mixed-use urban type (84.6%), followed by commercial (11.4%), industrial (3.6%), and recreation (0.4%) types.

In addition to the County's 2030 future-land-use file, the County has also provided information regarding recently acquired County-owned properties, properties within the watersheds that are being considered for near-future County acquisition, and other properties that are considered as demonstrating high potential for possible future acquisition, due to their proximity to the creek and other factors. Knowledge of these County-owned properties will be important during the future phase of the project that will involve the development of watershed-wide improvement recommendations.

Flooding and Hydrologic & Hydraulic (H&H) Model Development

Carpenter Creek and Bayou Texar are generally well-drained watersheds, however, they do experience flood conditions due to localized drainage issues and rainfall and storm surge from large events. On the night of April 29, 2014, rainfall exceeded 20 inches in the area, and was classified by the National Weather Service as a record 24-hour storm event for Pensacola. This storm is referred to locally as the April 2014 storm event and was well documented by the County in terms of recorded rainfall and flood complaints/flood depths.

Hurricane Sally made landfall early on the morning of September 16, 2020 across Gulf Shores, Alabama. The area between Mobile, Alabama, and Pensacola, Florida took the brunt of the storm with widespread damage, storm surge flooding, and over 20 inches of rainfall. In an effort to obtain documentation related to high-water marks and storm-related impacts within the watershed, the Wood Team conducted field reconnaissance beginning on September 29, 2020, with additional reconnaissance conducted on October 6^{th} and 7^{th}, 2020.

Future phases of the WMP will include the development of a comprehensive hydrologic & hydraulic (H&H) model for the entirety of the Carpenter Creek and Bayou Texar watersheds. The comprehensive H&H model will build upon the H&H model developed as part of the City of Pensacola's Stormwater Master Plan (SWMP), completed in July 2019. As part of the desktop reconnaissance conducted under the WMP, several data sources were collected and analyzed for information related to the existing stormwater infrastructure in the watersheds. The data sources included County GIS databases, County plans, Environmental Resource Permits (ERPs), Florida Department of Transportation (FDOT) plans, and the City's SWMP. The Wood team is proposing to utilize the April 2014 storm event for model calibration, because of the availability of rainfall and flood information related to it. Hurricane Sally data collection will be used to corroborate flooding areas as well as information gathered during public meetings.

Sources of Pollution

There are several potential sources of pollution in the Carpenter Creek and Bayou Texar watersheds (for both surface water and groundwater resources) that impact water quality and drive impairments in these waterbodies. Sources include urban development such as atmospheric deposition, stormwater runoff (fertilizer runoff from residential land use, golf courses and/or other sports fields), trash and garbage, wastewater (both from facility discharge/sewer and septic systems), erosion or resuspension of sediment from within the waterbodies leading to downstream transport and cycling, human and wildlife contributions, etc.

Also, the Agrico Chemical Company and the Escambia Wood Treating Company are two Superfund sites located just west of the watersheds that have an impact on the Carpenter Creek and Bayou Texar watersheds due to their groundwater contaminant plume migration.

Water Quality

The County's monitoring programs, and associated data were reviewed, along with relevant literature. The FDEP listed the creek and bayou as impaired in 2006 and adopted a TMDL in 2012 for fecal coliforms, which required a reduction to meet the TMDLs. Possible sources for fecal coliform loadings were noted to include failed septic tanks, sewer line leakage, wildlife, sediments, and pet waste. A seasonal pattern in Bayou Texar was observed by FDEP where a peak in fecal coliform concentrations and exceedances were observed during July-September months, suggesting an association with the wet season. Spatial patterns were noted by FDEP where most of the fecal coliform exceedances seemed to occur around Bayview Park. The middle reach of Carpenter Creek seemed to have the highest number of exceedances, which was attributed to a large stormwater pond that discharges to the creek and possibly Interstate-110 runoff.

Recent water quality data, in respect to legacy and current land uses will be analyzed to assess spatial and temporal patterns/trends/relationships of fecal indicator bacteria and other water quality parameters. Other fecal indicator bacteria such as E. coli and Enterococci data will be assessed for exceedances and results will be compared to the County's Bacteria Pollution Control Plan (BPCP) results, which recently showed that downstream reaches on Carpenter Creek (i.e. 9^{th} and 12^{th} Ave. sites) have had exceedances of E. coli that would qualify as an impairment according to the new State criteria. At those same stations, total nitrogen also appeared to be elevated, according to the BPCP document, which suggests that this area within the Carpenter Creek watershed is contributing pollutant sources to the creek. Potential sources will be more closely assessed to understand potential causes of water quality issues using more recent water quality data with an expanded parameter list that will include nutrients and other associated parameters.

Based on review of the literature, it is evident that sediments have impacted portions of Bayou Texar, and it is likely that legacy effects from internal pollutant loading will continue to impact water quality until sediment management programs are established to improve sediment quality to reduce large volumes of sediment transport to the bayou. The groundwater aquifer has been historically impacted by industrial discharges and urbanization by various sources (e.g. fertilizer, septic, etc.). Due to limited available data, it is unknown if groundwater is still impacted or if conditions have improved. Further investigation is needed to assess current groundwater quality conditions, but limited data are available. Data were reviewed to assess if any data gaps were evident in terms of relevant parameters, station distribution and or frequency that would preclude a detailed assessment of identifying potential pollutant sources in the watershed. Comprehensive data analyses will be conducted in a later task that will assess water quality issues and potential drivers of issues.

Data Gaps and Recommendations

The combined Carpenter Creek and Bayou Texar watersheds occupy approximately 19 square miles and are fully contained within the Escambia County and City of Pensacola jurisdictional boundaries. A County-City partnership, along with stakeholder engagement, is necessary throughout the project process and during implementation to fully gain an understanding of current conditions and the ability to restore and maintain healthy watershed conditions. Strong communication between the County and the City will be critical to ensuring the success of the WMP and its future recommendations. Data gap analysis recommendations are listed in **Table ES-1**.

Table ES-1 - Data Collection Recommendation

Data Type	Recommendation
Stormwater Inventory	Survey will be needed to collect inverts and dimensions of existing stormwater inventory, for those features marked for potential inclusion in the H&H model. Wood is still waiting for plans for the following roads and developments. In the event plans are not available, these will be included for survey. • Interstate 110 (I-110) and Interstate 10 (I-10) interchange • I-110 and North Davis Highway (SR-291) interchange • I-10 between I-110 and North Davis Highway • I-10 between I-I-110 and Highway 29 • I-10 and Highway 29 interchange • Burgess Road existing conditions • Woodham High School at northeast corner of East Burgess Road and the CSX Railroad • Former University Mall (new BJ's Wholesale location) at northwest corner of Davis Highway and Creighton Road
Flood areas of concern	High water mark data from the April 2014 and Hurricane Sally events is available to calibrate/verify the H&H model. Wood recommends additional data collection: • Survey for up to 10 locations observed to exhibit visible high-water marks during the post-Hurricane Sally. • The Team will use public meetings and other community engagement opportunities such as newsletters with links to the Social PinPoint website as opportunities to request additional quantitative or qualitative information related to flooding in the watershed.
Stream Stage and Flow	Install a minimum of one staff gage equipped with a continuous water level recorder and develop rating curve to calculate flow. Highly recommend five total flow gages on Carpenter Creek and two on inflowing tributaries. Detailed recommended sampling plan can be found in **Appendix F.**
Groundwater Quality	Begin monthly sampling at four locations. Conduct groundwater seepage study. Detailed recommended sampling plan can be found in **Appendix F.**
Sediment	Conduct pre-screening sediment characterization sampling event and flux incubation study. Detailed recommended sampling plan can be found in **Appendix F.**

Data Type	Recommendation
Surface Water Quality	Increase frequency and add locations to water quality collection program. Detailed recommended sampling plan can be found in **Appendix F.** *Note: County planned to conduct monthly samples beginning August and will provide additional data to project team in Nov/Dec.*

One identified data gap for the study area seems to be a potential shortage of recorded water and flow levels with direct correlation to particular rainfall events. This combination of recorded rainfall data and documented flooding/flood depths is crucial to proper H&H model calibration and validation. The County's 2013 Basin Study Guidelines and Specifications refers to a high-water mark database (HWMDB) that is under continued development by the County. But as of the date of this report, the County did not have the HWMDB available for use. However, the County did provide rainfall data and related flood complaints/flood data related to the April 2014 storm event, which the Wood team is proposing to utilize during model calibration efforts under subsequent tasks. Ideally, a separate rainfall event is necessary to ensure proper model validation.

The Wood team will continue to work with entities such as the FDOT and the University of Florida to determine if additional data is available for use for model verification. In the absence of such data, the Wood team may propose the use of anecdotal information, perhaps to come from future community engagement activities, to assist with model verification. Additionally, the Wood Team is recommending traditional survey for the collection of up to 10 specific locations observed to exhibit visible high-water marks during the post-Hurricane Sally (September 2020 event) field reconnaissance. The vertical elevation data from the high-water marks will provide quantitative data that is beneficial for use during future model calibration and verification efforts. Specifically,.

Also, as of the date of this report, there are 152 infrastructure points identified as requiring traditional survey for use in the subsequent modeling efforts. The selected survey points represent grate inlets, pipe inlets/outlets, and control structures that were identified for model inclusion but also missing all or some of their information necessary for modeling, It should be noted that, if information is available and provided for the above-mentioned data gaps in Table ES-1, the preliminarily identified survey needs may be reduced proportionately.

The gap analysis of the available water quality and sediment data is complete and is documented within this report. Data gaps were found by the project team with respect to surface water quality, groundwater, and hydrologic information in Carpenter Creek and Bayou Texar. The Wood team presented recommendations to the County for three different monitoring enhancement programs, varying in complexity and cost. The monitoring enhancements generally included recommendations for increasing sampling frequency, sampling locations, and analyte coverage. The comprehensive monitoring enhancement recommendation also included components such as groundwater seepage meters to assess groundwater seepage within the creek, additional stream flow gages at surface water monitoring stations to estimate loads, and characterization of sediment flux dynamics and internal loading from legacy sedimentation. The combination of flow measurement and water quality sampling is beneficial to defining relationships between flow and water quality parameters of concern and to estimate loading rates and yields.

Future Tasks to be Completed Under WMP

Subsequent WMP project tasks will include detailed H&H modeling, water quality analysis and pollutant load modeling, stream assessments, project recommendations, regulatory framework review, monitoring plan development, and final plan development.

As part of an ongoing effort to restore the watershed and reclaim the waters for public use and enjoyment, Escambia County is embarking on a mission to create a resilient community by developing a Watershed Management Plan for Carpenter Creek and Bayou Texar for the benefit of generations to come.

1.0 INTRODUCTION

Wood Environment & Infrastructure Solutions, Inc. (Wood) was contracted by Escambia County (County) to develop a comprehensive watershed management plan (WMP) for the Carpenter Creek and Bayou Texar watersheds to address legacy impairments, development practices, and identify future site-specific projects and activities through stakeholder engagement and best-available science. Funding for the development of the plan has been secured through the Escambia County Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) Direct Component allocation (Pot 1). The Wood team is comprised of the following subconsultants: Impact Campaigns (Impact), SCAPE Landscape Architecture DPC (SCAPE), and Wetland Sciences, Incorporated (WSI).

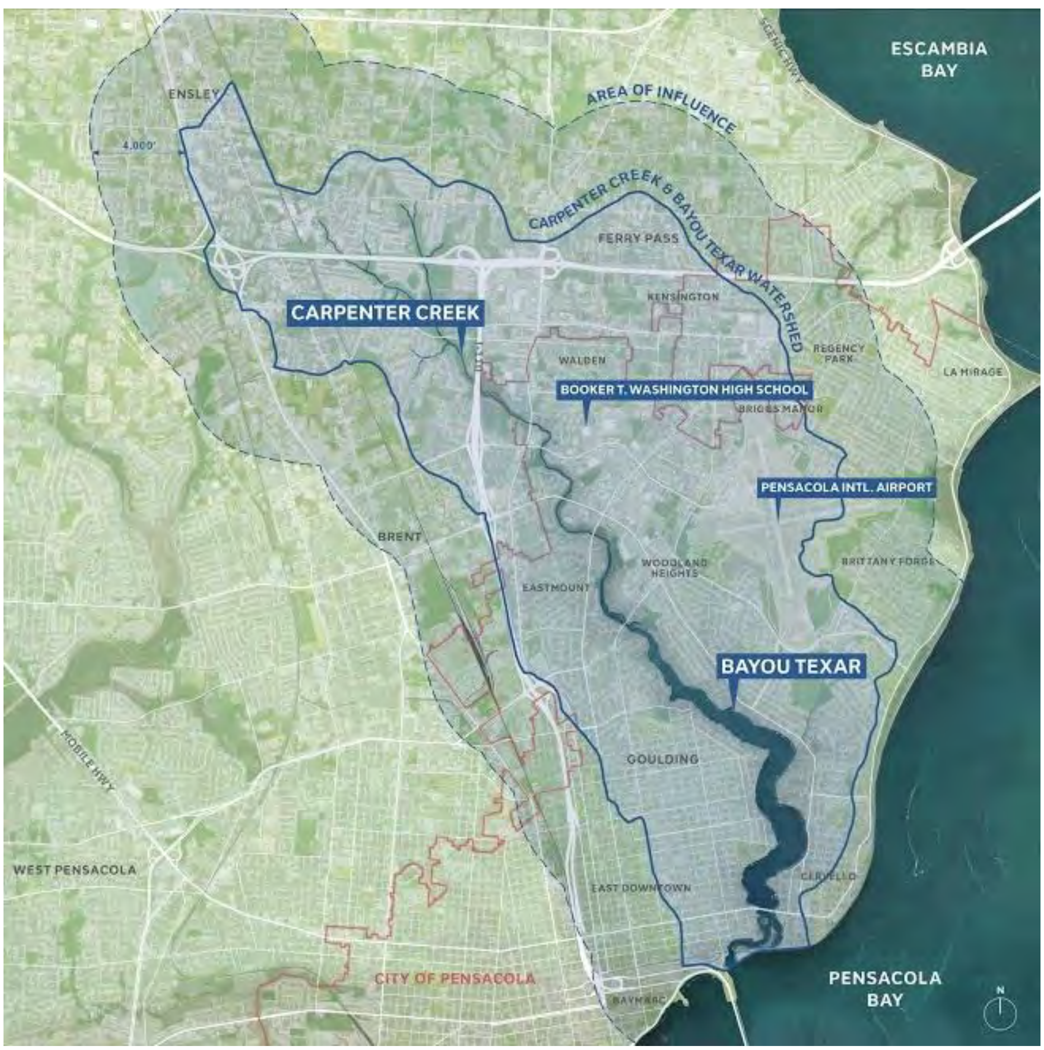
1.1. What is a Watershed?

A **watershed** is the area of land where runoff (rainwater, yard irrigation, etc.) flows into a lake, river, stream, wetland, estuary, or bay. In this case, the Carpenter Creek/Bayou Texar watersheds are the areas of Pensacola and Escambia County that contribute runoff to those waterways (**Figure 1.1-1**).

A **watershed management plan** examines the environmental health of the overall watershed, including water quality, water flow, pollution sources, and structural problems. The WMP also identifies ways for surrounding communities to support a healthier watershed environment, ways to keep the water clean, and how citizens can interact with, and in some cases, enjoy the water.

The best and most effective WMPs include active participation from citizens, stakeholders, property owners, and government agencies. Working together, these groups can build and implement an effective plan to protect the watershed for generations to come.

Figure 1.1-1 – Carpenter Creek & Bayou Texar Watershed Study Area



1.2. Plan Objectives

Carpenter Creek and Bayou Texar both suffer from historical pollution and ongoing challenges to the watersheds which impact the health of the watersheds' ecosystem and the quality of life for residents and visitors. Increased storm and rain events, coupled with the urban nature of these waterways, create additional stress on the plants, animals, and water quality in this ecosystem.

These challenges, along with other physical changes to Carpenter Creek and Bayou Texar, have damaged the environmental health of both waterways.

The WMP will identify existing challenges and provide a roadmap to:

Manage **water quantity** and improve **water quality** for a safer and healthier environment.
Protect, enhance, and restore **fish and wildlife habitat** for a stronger ecosystem.
Expand **public access** and **recreational opportunities** for learning and fun!
Build more **equitable** and **resilient communities** in the face of a changing climate.
Connect residents to their **watershed and waterways** for stewardship and conservation.

1.3. Plan Alignment

The Carpenter Creek and Bayou Texar WMP will be developed in accordance with the Guidelines and Specifications for:

- Escambia County Basin Study Guidelines and Specifications (2013)
- The nine elements listed in the United States Environmental Protection Agency (EPA) 319(h) Guidance Manual (https://www.epa.gov/sites/production/files/201509/documents/ 2008_04_18_nps_watershed_handbook_handbook-2.pdf.)

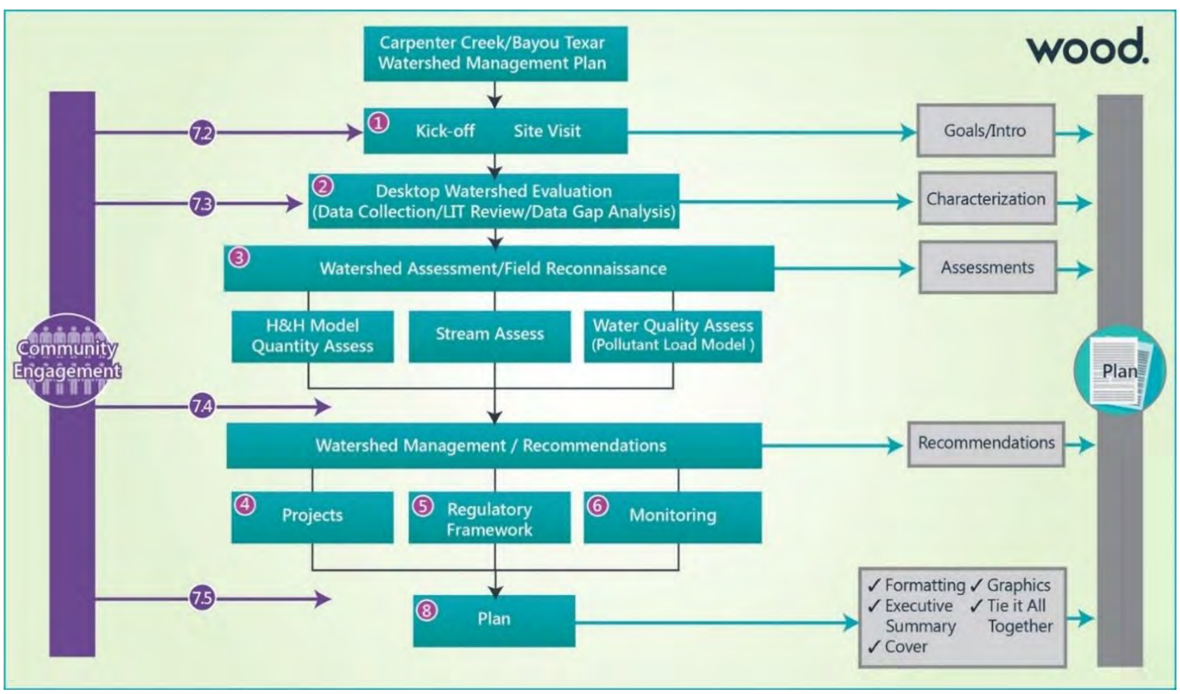
1.4. Plan Overview

The WMP will be developed in three phases: Desktop Watershed Evaluation, Watershed Assessment/Field Reconnaissance, and Watershed Management Recommendations. See **Figure 1.4-1** for the project flow chart. This report summarizes the work completed for the Desktop Watershed Evaluation portion (Tasks 1, 2, and 7.2 of the project scope), which includes, but is not limited to, the subtasks listed below.

- Kickoff Meeting/Site Visit
- Literature/Data Review
- Definition of the combined watershed boundary, and subbasin delineations for future modeling efforts to be conducted under **Task 3** of the project
- Desktop and field reconnaissance to develop, in GIS, the hydraulic network consisting of pipes, weirs, drop structures, and channels necessary for future modeling efforts to be conducted under **Task 3** of the project

- Assembly of flood data for the watershed (surveys, photos/videos of past flood events, historical water levels, public input, stream/rain gage data, etc.)
- Review of existing and future land use files, to include public recreation and access locations as well. Update to existing land use files
- Compilation of existing and historical water quality data, and development of a monitoring and data gap analysis summary to assist the County with the determination of additional monitoring/sampling locations/parameters
- Review of historic and cultural resources that are of significance to the Carpenter Creek and Bayou Texar watersheds
- Ecological assessments of wetlands, exotic and nuisance species, wildlife corridors, and listed species
- Development of a comprehensive data gap analysis and collection plan, which will detail the locations and parameters of suggested additional data collection efforts deemed necessary to support future project tasks
- Documentation to support the proposed methodology associated with the H&H modeling efforts to be conducted under **Task 3** of the project
- Development of a Public and Stakeholder Engagement Plan
- Development, organization, and facilitation of stakeholder workshop and public meeting

Figure 1.4-1 – WMP Development Flow Chart



1.5. Overview of Desktop Watershed Evaluation/Literature and Data Review

The following sections describe the Desktop Watershed Evaluation. The Wood team began by collecting and analyzing the vast amount of data and information available for the watersheds, within the purview of the project. **Appendix A** includes a complete inventory as a list of data folders collected and assessed as of the date of this report. It should be noted that this data list is anticipated to expand as the project progresses. Datasets and data sources included in **Appendix A** include, but are not limited to, previous studies, monitoring data, stormwater inventories, and spatial data.

1.6. Previous Key Studies and Efforts

Over the decades, there have been numerous efforts aimed at studying and improving the water quality in Carpenter Creek and Bayou Texar. This section highlights some of the selected notable studies and efforts.

- Washington High School's Marine Science Academy (MSA) "Bringing Back the Bayou" program: high school honor students gather and analyze nutrient level data and propose mitigation solutions and projects. The program aims to encourage community awareness and involvement in the restoration of the bayou.
- City of Pensacola Stormwater Master Plan: Completed by Mott MacDonald in July 2019 for the City limits, approximately 23 square miles, to address the challenges associated with aging infrastructure and flooding. The Carpenter Creek and Bayou Texar WMP will utilize and build upon the Interconnected Pond and Routing (ICPR) Version 4 (ICPR4) H&H model developed as part of the City's Stormwater Master Plan.
- Escambia County Bacteria Pollution Control Plan (BPCP) for Carpenter Creek, submitted June 29, 2016: County's National Pollutant Discharge and Elimination System (NPDES)/Municipal Separate Storm Sewer System (MS4) permit requires that a BPCP be prepared and implemented to achieve fecal coliform load reductions allocated in the Total Maximum Daily Load (TMDL). The BPCP goals were to establish a water quality monitoring program for Carpenter Creek, assess the watershed using a "Walk the WBID" field assessment approach, identify and track existing projects with the potential to reduce fecal coliform loading, identify new projects to reduce fecal coliform loading, and track water quality and project implementation.
- University of Florida study conducted by Traci Goodhart and Dr. Matthew Deitch, titled "Examining the Spatial and Temporal Dynamics of Stormwater Pollutants in an Urbanized Watershed": analyzed data from three site locations in Carpenter Creek to determine the effect of effective total imperviousness and variations in land use on creating spatial differences affecting flow dynamics, water contaminants, concentration and loading between sites.
- "Carpenter Creek Stormwater Needs Assessment", prepared for the City of Pensacola in September of 2003: the study focused on the portion of Carpenter Creek between the

Interstate 110 and the 12th Avenue bridge, approximately 2 miles. The purpose of the assessment was to identify potential problems and propose conceptual improvement alternatives that will help reduce stormwater pollution loading into the creek. The study identified existing drainage patterns and facilities as well as potential sources of stormwater pollution and potential sites for stormwater management and treatment facilities. The focus of the effort was on the 16 major outfalls to Carpenter Creek.

- Partnership for Environmental Research and Community Health (PERCH): noted as a collaborative effort of the University of West Florida (UWF) Center for Environmental Diagnostics and Bioremediation, the Florida Department of Health, Escambia County Health Department, and the Santa Rosa County Health Department. The PERCH bibliography contains a sort of database that houses countless publications – many of which provide data and information related to the water quality, biology, and ecology of Carpenter Creek and Bayou Texar.
- UWF study "Profiles of Selected Pollutants in Bayou Texar", May 2005: designed to assess environmental impacts of toxic pollutants in Bayou Texar with an emphasis on possible Superfund site impacts.
- UWF study "Pollution in an Urban Bayou: Magnitude, Spatial Distribution and Origin", January 2006: determined the level and distribution of some of the pollutants in the bayou and identified the most likely sources for them.
- "Submerged Aquatic Vegetation Investigation", by Barbara Albrecht and Iris Knoebl, April 2019: field investigation summary of the creek and bayou, with emphasis on conditions and vegetation observed.
- Escambia County Stormwater Advisory Team (SWAT) County-wide Stormwater Recommendation Report, July 28, 2015: The SWAT was established by the County after heavy rains and flooding in early 2014. The SWAT considered many of the challenges associated with stormwater management in the County. The effort resulted in two sets of recommendations: infrastructural priorities that feature high-impact, cost-effective projects, and policy enhancements to include more precise design requirements, updates to stormwater basin data, GIS database upgrades, and the adoption of new Low-Impact Design (LID) standards.
- Northwest Florida Water Management District's (NWFWMD) "Pensacola Bay System SWIM Plan", November 2017: this document is the third update to the Pensacola Bay Surface Water Improvement and Management Act of 1987 (SWIM) plan. The purpose of the plan is to provide a framework for surface water resource management, protection, and restoration using a watershed approach.

1.7. Summary of Deliverables

Wood is providing this report to summarize the data collection and evaluation efforts from project kickoff through Draft Desktop Watershed Evaluation. Below is a summary of the deliverables by task. All GIS files are being submitted in accordance with Escambia County guidelines and are provided in State Plane Coordinates in U.S. Feet for North Florida, Zone 0903. The horizontal datum is High Precision Geodetic Network (HPGN) also known as High Accuracy Reference Network (HARN). Vertical datum is the North American Vertical Datum of 1988 (NAVD88).

Task 1 Deliverables

Kickoff Meeting Agenda & Notes (**Appendix B**)

Task 2 Deliverables

A. List of available literature and data (**Appendix A**)
B. Data Gap Analysis and Collection Plan (**Section 6**)
C. Watershed Evaluation Report (This Report)
D. List of ERP and Roadway Plans collected and utilized for the development of the hydraulic inventory database for model development (**Appendix D**)
E. GIS databases containing feature classes for field reconnaissance locations/photos, reference documentation, watershed-specific information, stormwater hydraulic inventory features, initial subbasins, and various other spatial data pertinent to the Watershed Evaluation
F. Graphic representations of complex modeling and testing to explain the outcomes of tasks. Drawings will be synthetic in nature and be used for client and community engagement efforts. (Throughout Report)
G. QA/QC documentation (**Appendix G**)

2.0 COMMUNITY ENGAGEMENT

2.1. Engagement Strategy

A Public and Stakeholder Engagement Plan was provided to Escambia County in November 2019. The purpose of the plan was to present an overview of the anticipated efforts focused on engaging local communities and building a strong and committed constituency within the watershed area.

The engagement strategy is meant to inform community members and stakeholders about existing conditions within the watershed and engage them in the process of developing the goals, priorities, and recommendations of the plan. Working with strong and engaged communities already active along and throughout the watershed, the project team will leverage existing networks of local partners to develop direct relationships with agencies, local businesses, churches, schools, neighborhood groups, property owners, and community-based organizations to better understand their needs and wants for the watershed vision and recommendations. The team will also work to reach out specifically to typically underrepresented communities not yet engaged in planning and environmental stewardship of the watershed to achieve well-balanced and diverse project input.

The project team will:

- Identify and engage focus group members already working in and around the watersheds, including government agencies and technical experts,
- Identify and engage key existing community groups, organizations, and members of the general public,
- Host (4) workshops at critical moments in the project schedule,
- Communicate regularly with stakeholders and the general public by newsletter, website, and social media, and
- Produce clear and accessible graphics to synthesize and communicate complex information to a wide audience.

2.2. Workshops

WORKSHOP 1

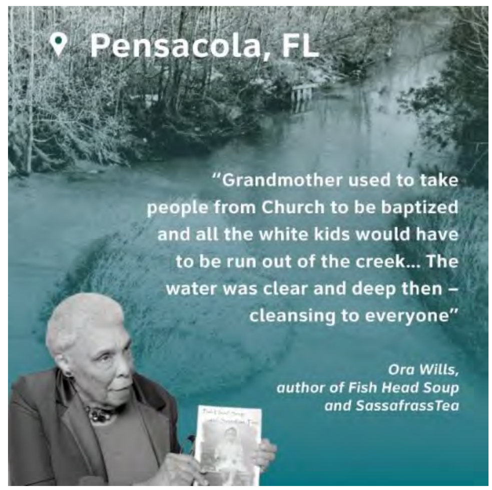
Workshop 1 was a two-day event held in February 2020. Please see **Section 2.4** and **Appendix B** for detailed information on the schedule of events and follow-up summary. The strategy from the engagement plan is below:

SITE WALK

Purpose
To introduce the project, define goals and areas of inquiry, and begin the watershed evaluation

Overview
A two-day workshop

Day 1: Site visit for team members to become acquainted with the site



Day 2: Small focus group meetings in the morning and afternoon. Exercises were conducted to articulate goals and objectives and identify challenges and opportunities. A large public meeting was hosted after work hours.

When
February 2020

Where
Booker T. Washington High School

WORKSHOP 2

At the time of this report, Workshop #2 is in the planning stages. Due to the COVID-19 pandemic, the workshop will be moved to an online platform.

SHARING INITIAL FINDINGS

Purpose
To summarize and share results of the desktop watershed evaluation, identify gaps and focus areas to further develop in following assessment and planning phases

Overview
Online engagement strategies are being developed.
When
Fall 2020

Where
Online

WORKSHOP 3

DESIGN PRIORITIES

Purpose
To share identified potential areas for improvement and gather public input on priorities for conceptual site designs

Overview
Day 1: Small working group workshops and a public meeting in a presentation format

Day 2: Site visit to potential locations for conceptual site designs as part of an excursion such as a 'creek crawl' to gain insight into on-the-ground perceptions and challenges

Public and stakeholder feedback will be gathered to inform selection and design priorities. The final selection of the conceptual site designs will be done by the County.

When
December 2021

Where
Workshop location to be determined, site visit at potential restoration opportunities along the creek and bayou

WORKSHOP 4

FINAL RECOMMENDATIONS

Purpose
To roll out the final watershed management plan

Overview
A series of unique watershed opportunities and recommendations will be shared at an open public meeting format. A selection of the conceptual site designs will be presented, including 3 priority restoration sites.

When
March 2022

Where
To be determined

2.3. Engagement Platforms

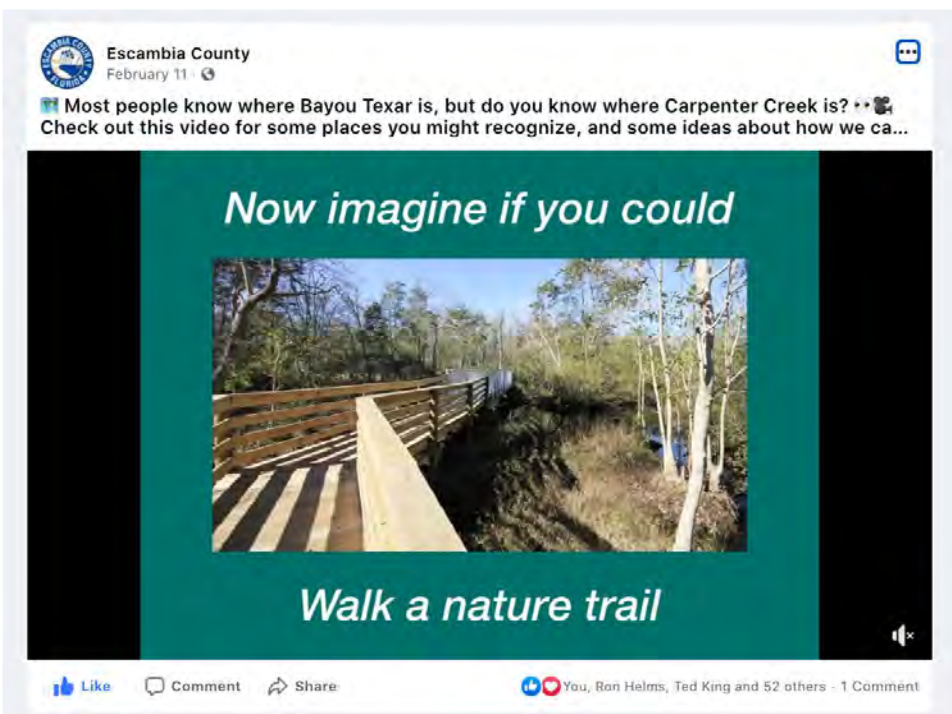
Project Website

Relevant content and information developed through this plan will be hosted on a project website, www.restorethewatershed.com, managed by the project team. This website will be mobile-responsive, American Disability Act (ADA)-compliant, and will enable two-way information exchange between the project team and the public. Included in this platform will be a library of relevant project materials, notices of meetings or public input opportunities, a tentative project calendar, updates on the project progress, human interest stories, and basic educational information about how watersheds impact the public. In addition, the website will include opportunities for online surveys, email list signups, questions and answers, and ways for the public to reach out to the project team.

Social Media

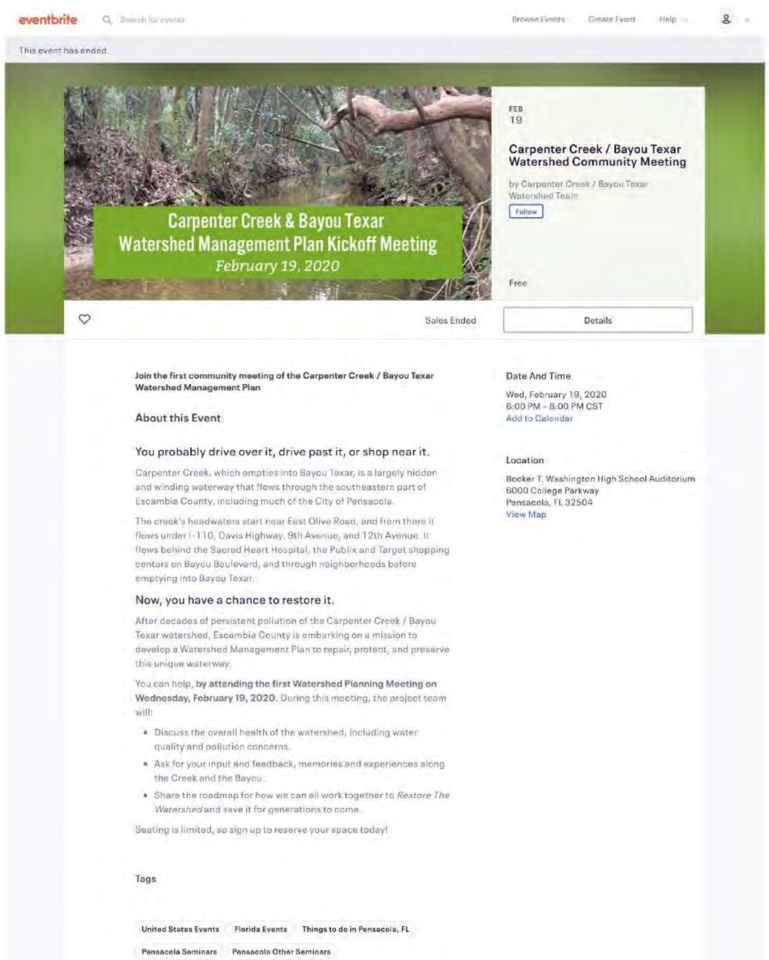
In addition to the project website, the project team will also work with the County to develop and manage content for social media platform(s) to help distribute the information held on the project website. Social media will also be used to document the progress of the project, highlight project activities, engage the public in a more real-time and conversational manner, and create ongoing interest in the project.

Social media will be used to promote engagement opportunities, share quick updates and information, and support the overall goals of the project.



Email Newsletter

The project team has compiled an initial email list based on existing stakeholders, available email addresses, and neighborhood and community group lists. The list will be continuously updated over the life of the project. Members of the public can also opt-in to the email list via the website, social media platforms, and at events throughout the project duration.



eventbrite Search for events Browse Events Create Event Help

This event has ended.

Carpenter Creek & Bayou Texar
Watershed Management Plan Kickoff Meeting
February 19, 2020

FEB
19

Carpenter Creek / Bayou Texar Watershed Community Meeting

by Carpenter Creek / Bayou Texar Watershed Team

Follow

Free

Sales Ended

Details

Join the first community meeting of the Carpenter Creek / Bayou Texar Watershed Management Plan

About this Event

You probably drive over it, drive past it, or shop near it.

Carpenter Creek, which empties into Bayou Texar, is a largely hidden and winding waterway that flows through the southeastern part of Escambia County, including much of the City of Pensacola.

The creek's headwaters start near East Olive Road, and from there it flows under I-110, Davis Highway, 9th Avenue, and 12th Avenue. It flows behind the Sacred Heart Hospital, the Publix and Target shopping centers on Bayou Boulevard, and through neighborhoods before emptying into Bayou Texar.

Now, you have a chance to restore it.

After decades of persistent pollution of the Carpenter Creek / Bayou Texar watershed, Escambia County is embarking on a mission to develop a Watershed Management Plan to repair, protect, and preserve this unique waterway.

You can help, **by attending the first Watershed Planning Meeting on Wednesday, February 19, 2020.** During this meeting, the project team will:

- Discuss the overall health of the watershed, including water quality and pollution concerns.
- Ask for your input and feedback, memories and experiences along the Creek and the Bayou.
- Share the roadmap for how we can all work together to *Restore The Watershed* and save it for generations to come.

Seating is limited, so sign up to reserve your space today!

Tags

United States Events | Florida Events | Things to do in Pensacola, FL | Pensacola Seminars | Pensacola Other Seminars

Date And Time

Wed, February 19, 2020
6:00 PM - 8:00 PM CST
Add to Calendar

Location

Booker T. Washington High School Auditorium
6000 College Parkway
Pensacola, FL 32504
View Map

Earned Media

Using our partnerships with local and regional media, the project team will utilize press releases, media pitches, opinion/editorial pieces, and interview requests to promote the goals of the project. These efforts will focus on promoting project events, informing the public on project goals, and highlighting the importance of the watershed in the broader community. We will also work to include human interest stories gathered through the engagement process in local media coverage of the project. See example of article in the Pensacola News Journal reporting on the team's site visit and workshop: https://www.pnj.com/story/news/2020/02/20/carpenter-creek-restoration-plan-kickoff-gathers-feedback-public/4818500002/.

Educational Partners

The project team will work with the UWF, Pensacola State College, and local school groups to engage young people in the project. The goal will be to integrate students with appropriate subject-matter backgrounds (water quality, environmental studies) or geographic proximity to the watersheds into our community engagement activities.
The team will work with community partners and educational leaders to determine the appropriate level of involvement and activity for each age group.

2.4. Desktop Evaluation Phase Community Engagement

A critical part of the watershed evaluation included robust community and stakeholder engagement activities. These activities included the identification of key individuals, groups, organizations, and elected officials to engage as project stakeholders. The stakeholder groups were engaged and mobilized through email marketing, social media outreach, earned media, and organizational outreach to neighborhood, advocacy, civic, and educational organizations. Activities also included a watershed tour, a targeted stakeholder meeting, and a public meeting.

The watershed tour, targeted stakeholder meeting, and the first project public meeting were conducted as part of a two-day event which took place on February 18, 2020, and February 19, 2020. These events were designed to both *inform* the public of the project details and to *solicit insight, information, and historical knowledge* from stakeholders and the community to help guide the project. The full summary memorandum documenting this two-day event is provided as **Appendix B**, which includes photographs taken during the tour, details and maps related to the locations visited, participant lists, and detailed notes on the feedback received during the stakeholder and public meetings. A summary of the events is provided in the following paragraphs.

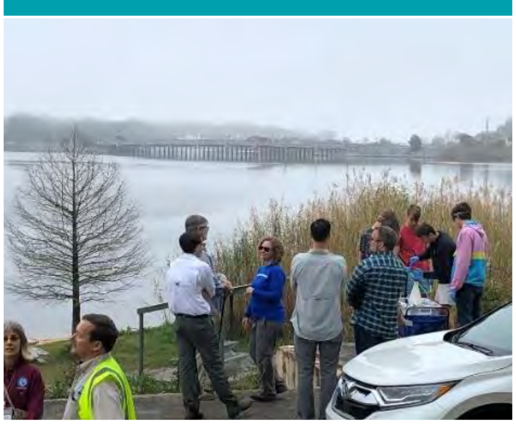
The watershed tour occurred on February 18, and included project members from Wood, Impact, SCAPE, and WSI, as well as County and City staff and select members of the news media. The tour included visits to over 18 locations in the watersheds which represented typical conditions ranging from open, publicly owned sites to privately owned sites to large commercial sites along the creek and bayou. This tour allowed the team to engage in invaluable first-hand field reconnaissance across the watersheds and provided a full day of open dialogue amongst the entire project team.

The project's first targeted stakeholder meeting was held on the morning of February 19, with stakeholders included from government entities, educational institutions, nonprofit groups, community groups, and other vested individuals in the watersheds. The stakeholder meeting included a presentation documenting the team's preliminary research to-date and a guided discussion in small working groups. Group facilitators used large maps and aerial photographs to prompt discussion and capture information provided by participants. A physical 3-D model prepared by the project team was used to solicit impressions and characteristics of the watersheds using color-coded pin markers.

Stakeholder Meeting

3D Watershed Model

Site Tour Bayview Park with Washington High School Marine Science Academy



On the evening of February 19, a public meeting was held at Washington High School, to inform the general public about the project while inviting and encouraging suggestions and opinions from the community. The material and information collected during this public meeting was used to guide the watershed characterization phase of the project and will be used throughout the future phases. Nearly 200 members of the public participated at the public meeting.

Community engagement, participation, feedback, ownership, input, and ultimate approval is essential to the success of the Carpenter Creek and Bayou Texar WMP. Therefore, the project will include several future engagement activities in the upcoming phases. These will include, but not be limited to:

- Community engagement workshop #2 to be held in the fall of 2020, intended to share the team's progress-to-date on the watershed evaluation and continue the dialogue with stakeholders and members of the public on watershed priorities
- Community engagement workshop #3 to be held in the winter of 2021, intended to share preliminary watershed improvement recommendations, and gather stakeholder and public feedback
- Community engagement #4 to be held in the spring of 2022, intended to share the results of the final watershed management plan with the community
- Social media, website content, email marketing, and public relations efforts to support and mobilize the public for each of the three upcoming engagement events

3.0 OVERVIEW OF WATERSHEDS

The Carpenter Creek and Bayou Texar watersheds are within the Pensacola Bay System, which is a SWIM priority water body under the administration of the NWFWMD. The watersheds have been identified as impaired for fecal coliform bacteria and, in 2012 the Florida Department of Environmental Protection (FDEP) adopted a fecal coliform TMDL for both watersheds with a requirement of bacteria reductions necessary to meet the surface water quality standards. TMDLs require a fecal coliform reduction of 28% and 49% for the creek and bayou, respectively. Past sediment data have shown contamination in the bayou. In addition to water quality impairments, the creek and bayou do not fulfill their potential for providing public access and recreational opportunities. Residents of the area emphasize a strong connection to the creek and bayou, from both a historic and cultural perspective.

3.1. Carpenter Creek

The Carpenter Creek watershed is designated by the FDEP as Water Body Identification (WBID) number 676, occupying approximately 6,805 acres (10.6 sq. mi.). The headwaters of the creek are in south-central Escambia County, north of Interstate 10 (I-10) and west of Interstate 110 (I-110), as shown in **Figure 3.3-1**. The creek generally flows southeast under Olive Road, I-10, Burgess Road, I-110, Davis Highway, Airport Boulevard, Brent Lane, 9th Avenue, and 12th Avenue before entering Bayou Texar. The Carpenter Creek watershed is located entirely within Escambia County with the downstream portion of the creek and the entirety of the bayou located within the political boundary of the City of Pensacola.

The watershed is primarily comprised of urban land (urban and built up, low-, medium-, and high-density residential; and transportation, communications, and utilities), with the remaining area consisting of rangeland, water, wetlands, upland forest, and barren land.

Urban stream syndrome, caused by erosion and channel modification from development, non-attenuated stormwater, gray vs. green infrastructure, and diminishment of the protective riparian zone, has dramatically changed the Carpenter Creek stream pattern and profile, as well as water quality, and has jeopardized several structures located nearby. Displaced sediments from channel modifications and erosion in the upper headwaters have accumulated in the lower reaches of the creek and have significantly altered the mouth of Carpenter Creek that discharges into upper Bayou Texar. Channel modification and urban land uses have also created vectors for nuisance and exotic species within the watershed.

3.2. Bayou Texar Watershed

The Bayou Texar watershed includes approximately 5,350 acres (8.4 sq. miles) of additional drainage area not already included with the Carpenter Creek watershed. The Bayou Texar watershed is designated by the FDEP as WBID number 738 and is generally located in southern Escambia County, as shown in **Figure 3.3-1**.

Carpenter Creek is the sole significant tributary to Bayou Texar. The bayou is approximately 3.7 miles long, generally oriented in a north/south direction, with widths varying from over 1,000 feet in the south to less than 150 feet in the north.

Bayou Texar is one of Pensacola's most important watersheds and recreational water bodies for watersports, swimming, and fishing. Numerous studies have been undertaken over the last several decades and have documented contamination by fecal coliform and Enterococcus bacteria, likely in part originating from sedimentation inputs from Carpenter Creek and various stormwater outfalls. Legacy contaminants such as heavy metals, polychlorinated biphenyl (PCB), polycyclic aromatic hydrocarbons (PAHs), and pesticides have been found in the bayou sediments as well. Contamination of surface waters and sediments is compounded by the constricted mouth of the bayou, the low tidal amplitude, and short tidal duration.

Land use in the watershed is predominately residential and commercial. The riparian areas of the bayou are almost fully developed with single-family residential homes. Very limited natural riparian buffers exist, which has diminished diversity and density of native vegetation. Additionally, most of the single-family residential neighborhoods were developed before state or municipal stormwater treatment and/or attenuation requirements were established. Untreated stormwater enters the bayou through numerous outfalls along the waterfront, which will be assessed as part of the overall project with recommendations for remediating contamination issues and improving water quality.

3.3. Study Area

The project's "study area" (**Figure 3.3-1**) was defined by the outer borders of the combined WBID boundaries for the Carpenter Creek and Bayou Texar watersheds. This "study area" was developed to establish a fixed extent to direct data collection efforts and to provide a boundary that can be used during the watershed characterization phase.

A buffer of 2,000 feet was applied to the Carpenter Creek and Bayou Texar watershed WBID polygons to cast a wider net during the data collection phase, which allowed the project team to include the collection of additional information sources that are near the Carpenter Creek and Bayou Texar watersheds that may be of significance to the project. The drainage patterns within the buffered area were also examined to better define the extents of the area to be included in the modeled subbasins.

Figure 3.3-1 – Study Area Location Map

Sawmill between Carpenter Creek and the Scenic Highway, 1925

4.0 HISTORY AND CULTURE

4.1. History

Data Sources

Data Source	Description	Period of Record / Reference Date	Data Gaps/ Limitations	Additional Data Needed for this Study
Reflections on Carpenter's Creek – Rick's Blog	Documentation of community meeting held at the Cokesbury United Methodist Church in Asbury Place, written by Jeremy Morrison, includes accounts by Ora Wills, E.B. Williams, Roger Williams, Jenette	2/20/2019	N/A	No

Data Source	Description	Period of Record / Reference Date	Data Gaps/ Limitations	Additional Data Needed for this Study
	Norman, Boyce Crawford, Gary Bedgood.			
Wills, Ora; Fish Head Soup and Sassafras Tea, Proper Publishing 2018	Memoir published by a long-time resident of the watershed, granddaughter of Jenny known for "Aunt Jenny's Hole"	2018	N/A	No
Florida photographic collection, Florida Department of State, Division of Library and Information Services	"The largest and most comprehensive collection of Florida-related images in existence; a nationally recognized component of the State Archives of Florida"	1845-present	Limited photographic documentation of Black Community events and gatherings	No, written and oral history provided sufficient information
UWF Historic Trust Archives	Historic photographs of the project area	N/A	N/A	No
The Pensacola Indian Trade / Peter A. Brannon, The Florida Historical Quarterly, Vol. 31, No. 1 (July 1952), pp. 1-15	Scholarly essay on trade and relations between Native American tribes in the Pensacola region and the Spanish and British settlers	Written in 1952, references primarily 1700s and 1800s	N/A	No
Materials gathered through engagement activities during Workshop #1:	Personal, lived experience provided by watershed residents, including: • Individual interviews with residents of the watershed including several long-time residents who grew up in the area • Notes and comments provided on maps, drawings, and	Approximately 1920 - 2020	N/A	Additional information of this nature will be continuously gathered through the engagement process

Data Source	Description	Period of Record / Reference Date	Data Gaps/ Limitations	Additional Data Needed for this Study
	model prepared by the design team Notes provided by workshop participants who completed questionnaires and post cards			
Florida Division of Historical Resources (FDHR) Master Site File, including: Archaeological sites, Historical structures, Historical cemeteries, Historical bridges, Historical districts, landscape and linear features	Florida's official inventory of historical, cultural resources. The Site File also maintains copies of archaeological and historical survey reports and other manuscripts relevant to history and historic preservation in Florida. Note – data can be reviewed by the team for analysis and planning purposes but cannot be shared publicly due to its confidential nature	N/A	Limited spatial information available regarding historic Native American sites within the watershed	No
African American Heritage Society of Pensacola	List of historically significant locations included in the Society's Heritage Trail map	N/A	No sites were noted within the watershed	No
Publisher/Creator: U.S. Department of Agriculture, holding location: University of Florida, Map and Imagery Library, George A. Smathers Libraries	Historic aerial photography	1940, 1951, 1958, 1965	N/A	No

Native American Tribes

The original inhabitants of the Pensacola Bay region, which includes the watersheds of Carpenter Creek and Bayou Texar, were Native American people of the Creek, Seminole, Yamassee, Choctaw, Apalachee, Parch, and Muskogee tribes. Historic accounts describe both productive trade relations as well as ongoing conflict and war with the different colonial settlers. The nearest significant site found to contain relics of Native American habitation and use is the Bottle Creek Mounds on Mound Island, Alabama.

Early European Settlement

Pensacola played a key role in the Spanish colonization of North America. European exploration of the northern Gulf Coast began in the early 16th century, with the first attempted settlement led in 1559 by Tristán de Luna y Arellano, who sailed from Veracruz. The settlement failed due to a hurricane that struck the area shortly after it reached the shore, and it wasn't until 1690 that Pensacola became a colonial town. It remained so, changing hands between the Spanish, British, and Spanish again until the 19th century when Florida became a territory of the United States. This history is reflected in the moniker "City of Five Flags", as well as in many of Pensacola's street names, but the name Pensacola itself dates back to Native American tribes that resided in the area beforehand (from the Choctaw word *Panzacola*, meaning long-haired people). Pensacola's deep-water port and sheltered bay attracted much maritime activity over the years, leaving a range of submerged historic shipwreck sites in Pensacola Bay, beyond the mouth of Bayou Texar.

American History

Pensacola's first United States period, between 1821-1861, was marked by Andrew Jackson's governorship, noted for his persecution of Native Americans and Creoles. The area is home to three historic U.S. forts dating from this period, including Fort Pickens, Fort Barrancas, and Fort McRee.

Florida seceded from the union in 1861 and remained part of the Confederate States until 1865. Florida was readmitted to the union in 1868. The region offered opportunities to freed slaves to own land and participate in local government; however, overt racism was present through segregation and well into the 1970s. The local economy slowly shifted from cotton and shipping to lumber, paper, and brick manufacturing, as well as military industries.

4.2. Cultural Significance

African - American significance

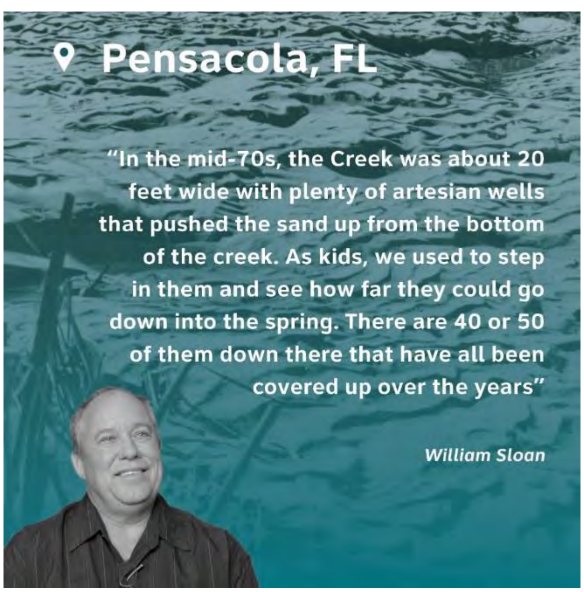
A collection of historic sites significant to Pensacola's black community (compiled by the African American Heritage Society for the Heritage

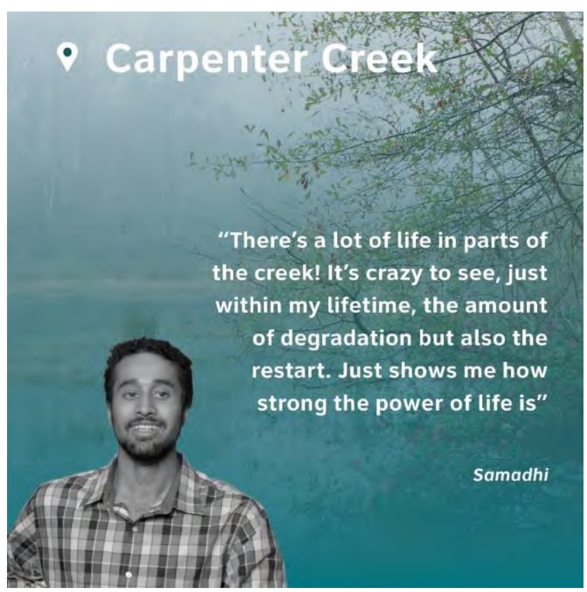
Trail Guide) includes a concentration of religious and cultural sites clustered around downtown Pensacola, outside of the study area. Documentation of the historical black communities within the watersheds is sparse and found primarily in family records and personal histories. One such history is found in Ora Wills' book "Fish Head Soup and Sassafras Tea". Wills' family owned a 10-acre property along Carpenter Creek when she was a child. In vivid detail, the book narrates the experience of children swimming and playing in the water, women doing their laundry, and large celebratory community events where the black congregation gathered after church for Sunday baptisms in the creek. Wills' great grandmother was known as Aunt Jenny and one of the more popular swimming holes in the creek, mentioned in several accounts, was referred to as Aunt Jenny's swimming hole. When describing walking around the forested areas surrounding the creek, Ms. Wills' descriptions make note of the red hard clay soil, violets and blackberry vines, and small plum trees, as well as water lilies, tadpoles, and minnows visible in the clear water.

Many members of the public, who had grown up along the creek and bayou, mentioned Aunt Jenny's swimming hole as a location where youth gathered, children learned to swim, and many spent time. It is important to note that the swimming hole's location, adjacent to and named after an African American matriarch, served as a social and recreational gathering place for many of the area's white residents, possibly during times of segregation.

Cultural Significance of Landscape and Ecological Characteristics

The watersheds' landscape, including not only the bayou and creek but also the coastal plain forest, the distinct red clay soil and Citronelle formation, and iconic long leaf pine forests, appear repeatedly in historic accounts of the region. From first European settlers to the region's current older residents thinking back to their youth in the area, this unique landscape plays a key role in the watersheds' culture and history. Although urban development and current critical infrastructure do not allow the return of the watersheds to their historical natural state, the local community hopes for restoration and preservation of key recognizable features to maintain the landscape's identity.





Multiple community members noted natural features in their descriptions and memories of the creek and bayou and shared childhood experiences directly linked to the landscape. From foraging for berries, through playing with fish and noticing wildlife, to describing the forested banks, the character and quality of the landscape plays a critical role in participants' recollections. Many noticed changes in the landscape over time, from clean, clear waters and a deep and wide creek, to a heavily sedimented body of water with contamination. However, some community members noted in their interviews and written comments that creek and bayou conditions have improved in recent years and noted the resilience of the ecosystem.

4.3. Archaeological sites and locations

As of November 2019, the Florida Division of Historical Resources (FDHR) Master Site File identifies approximately 28 archaeological site locations within the study area. These locations range broadly in size, type, and historic period. Sites appear to be evenly distributed along Carpenter Creek and Bayou Texar. The majority of sites have not been evaluated by the State Historic Preservation Office (SHPO) for their eligibility for designation. A small number of sites were evaluated by a survey and were recommended for preservation under the National Register of Historic Places (NRHP).

Site types include areas of historical refuse, locations of low-density scattered artifacts, and re-deposition sites. Periods and cultures represented include primarily nineteenth- and twentieth-century American (1821-1899 and 1900-present), with a small number of sites representing Archaic (8500 B.C. – 1000 B.C.), Santa Rosa-Swift Creek, and Swift Creek (300 B.C – A.D. 450), Weeden Island (A.D. 450-1000), Ft. Walton (A.D. 100-1500), Spanish First Period (1513-1763), British (1763-1783), and the Spanish Second Period (1783-1821). Three cemeteries are also identified within the study area; all are in active use and are well-maintained.

Approximately 330 standing structures are included in the FDHR, built between the years of 1905 and 1972 and ranging in styles between Bungalow, Frame Vernacular, Masonry Vernacular, Minimal Traditional, Ranch, and other. A small number of structures may be eligible for NRHP inclusion based on SHPO evaluation, while a larger number may contribute to National Register historic districts.

Within the watersheds, three bridges are identified by the FDHR. One of the bridges is located at the 17th Street underpass (known as the Graffiti Bridge or the Painted Bridge), as shown below, and is eligible for NRHP inclusion based on SHPO evaluation. It is a steel bridge (Stringer – Girder Box/Multi Beam structure) erected around 1888.

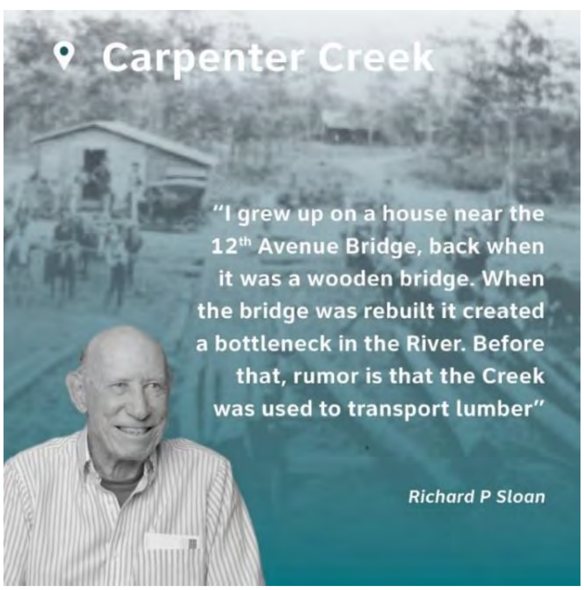
Railroad bridge known as Graffiti Bridge

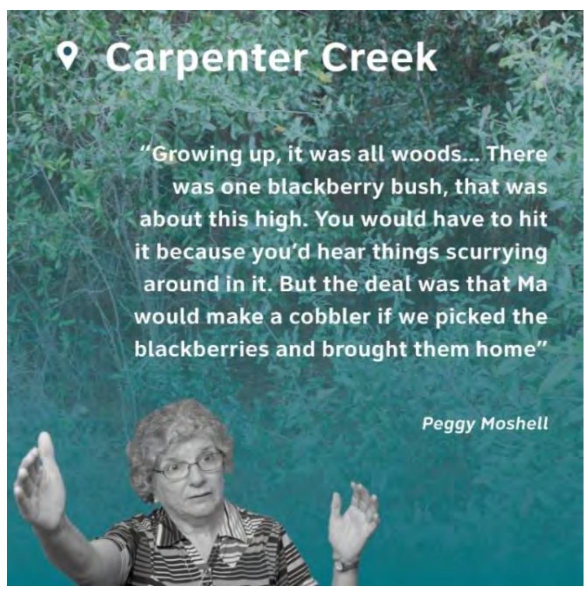
4.4. Historical Uses of Creek and Bayou

Historical aerial and standard photographs, maps, and as well as other documentation depict the gradual change of uses along the bayou and creek and within the watersheds. Oral histories and conversations conducted for this project expanded the range of historical activities registered. Below is a collection of productive activities (including household uses, agriculture, and manufacturing) as well as recreational and cultural activities found through these various means. Just outside of the study area are two Environmental Protection Agency (EPA) Superfund sites that mark historical industrial uses whose environmental impact and contaminant plumes reach into the watersheds.

4.5. Productive Uses (Agricultural, manufacturing, household uses)

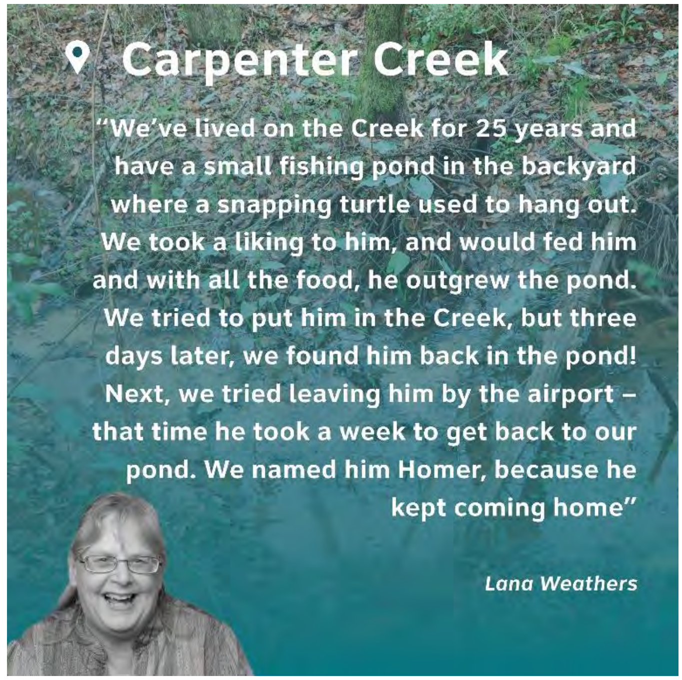
- Subsistence farming including vegetable gardens, harvesting edible wild roots and leaves, beehives. Several members of the public mentioned foraging for blackberries and huckleberries to make a cobbler, both historically and currently.
- Clothes washing (Black community).
- Lumberyards and sawmills. Historical documents and interviews repeatedly note the sawmill and the creek is used to transport logs. The creek's name – Carpenter or Carpenter's Creek (reports vary) may be associated with this industry.
- Two historical industrial facilities outside the study area impact the watersheds due to their groundwater contaminant plumes. These include the Agrico Chemical Company, a fertilizer manufacturer, and the Escambia Wood Treating Company, which used creosote or pentachlorophenol to treat lumber.
-





4.6. Recreational and cultural

- Recreational swimming and play
- Canoeing, kayaking, and paddle-boarding
- Religious ceremonies including baptisms (Black community)
- Holiday gatherings and celebrations at Bayview Park
- Platform diving, jumping off the tower at Bayview park
- Water skiing (ski demonstrations in the 60s and 70s) and wakeboarding
- Small craft boating
- Moonlight paddle tours
- Movie nights
- Fishing
- Horseback riding
- Nature-based and ecological exploration – many community members noted looking for and playing with fish (minnows, mullets, red tails, bass, brim), frogs, toads, snakes, blue crabs, and turtles, listening to bird song (Whippoorwills), birdwatching (owls, eagles, hawks), and noticing various other animals including foxes, raccoons, and possums.



5.0 WATERSHED CHARACTERIZATION

5.1. Physical Setting

Data Sources

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
USGS	GIS shapefile depicting physiographic regions	2010	None	No
NRCS	GIS shapefile file depicting soils	2018	None	No
NWFWMD	Digital elevation model (DEM)	2017	None	No

5.1.1. Physiography

The study area is located within the Pensacola Bay watershed and includes Bayou Texar and Carpenter Creek, both Class III waters of the State (**Figure 3.3-1**). The study area is dominated by erosional remnant hills, small deeply cut tributaries, and creek floodplains. Near the center of the study area is Carpenter Creek, a perennial stream flowing generally north to south. Carpenter Creek discharges into Bayou Texar just north of 12th Avenue. Several small seepage streams discharge into Carpenter Creek. The study area is largely developed.

The study area lies in the Coastal Plain Province, a major physiographic division of the United States. There are two topographic divisions in Escambia County: The Coastal Lowland and the Western Highlands. The Coastal Plain province is a broad belt of primarily unconsolidated sand, gravel, silt, and clay. Falling sea levels during the Pleistocene Epoch eroded the Citronelle Highlands or Western Highlands division of the Coastal Plain province and formed the Coastal Lowlands.

The study area is comprised mostly of the Western Highlands region which begins just south of E Cervantes Street and runs along the southern limits of E La Rua Street and Chipley Avenue extending north of the northern boundary of Escambia County. This area is a southward-sloping plateau, with hills, and small deeply cut freshwater streams (Rupert, 1993). The Coastal Lowlands represent a small fraction of the study area located generally between E Cervantes Street and Pensacola Bay. This region is dominated by sedimentary landforms, which are relatively flat and highly dissected by low-velocity tidal channels (Rupert, 1993).

5.1.2. Geology

Most landforms characterizing Florida's modern topography, as well as the streams, lakes, springs, and wetlands dotting the state today, formed during the most recent period of geologic time, the Quaternary (1.8 million years ago to present, Lane, 1994). The Quaternary Period, which is made up of two geologic epochs (the Pleistocene or "Ice Age" and the Holocene), has been a time of world-wide glaciations and widely fluctuating sea levels, with seas alternately flooding and retreating from Florida's land area. At peak interglacial stages, sea level rose to approximately 150 feet above the present level, and peninsular Florida likely consisted only of islands (Lane, 1994). As seas retreated, waves and currents eroded a series of relict, parallel scarps and constructed sand ridges spanning the state. Many of these features are found today stranded many miles inland, including the Cody Scarp, Trail Ridge, Brooksville Ridge, and Lake Wales Ridge (Lane, 1994). The development of Pleistocene landforms has also been influenced by the karst nature of Florida's foundation, as naturally acidic rain and groundwater have flowed through the limestone for millions of years dissolving conduits and caverns. Sometimes caverns collapse to create sinkholes, the largest of which can be seen today as lakes (Lane, 1994).

Florida's geology results in three distinctly different water, solute, and sediment delivery systems to Florida stream valleys greatly affecting their biophysical characteristics (Kiefer et al. 2015, AMEC 2013). Florida fluvial systems follow gradients of declining groundwater input and increasing wet season flood pulses as follows:

1) Karst terrain with copious and steady groundwater emitted through limestone springs under pressure. These systems provide clear, hard water with some of the least variable flow regimes in nature.
2) Highlands landscapes consisting of unconfined lateral groundwater seepage through thick columns of sand or gravel. In the panhandle, watersheds have at least 30% cover by well-drained soils consisting of the Natural Resources Conservation Service (NRCS) Hydrologic Soil Group (HSG) A and B types (AMEC 2013). They have steady and clear baseflow between and during moderate rains, and sporadic flood pulses from large rainfall events.
3) Flatwoods landscapes are dominated by rainfall runoff coursing through and over combinations of flat shallow organic and sandy soils. Flow is generally acidic and darkly colored by tannins, with a hydrograph very closely reflecting the rainfall pattern.

Karst terrain is absent in the study area and flatwoods landscapes are absent or perhaps confined to small tributaries. Highlands terrain is the most common fluvial landscape in the Florida panhandle, and it dominates the Carpenter Creek and Bayou Texar watersheds. Highlands terrain provides a steady source of groundwater baseflow to the drainage network with periodic large flood pulses occurring during intense rainfall events that overwhelm the copious infiltration capacity of the watersheds. Flatwoods landscapes and urbanization provide greater power during equivalent rainfall events, eroding a broader alluvial valley versus that of a natural highlands condition. For these reasons, characterizing land use changes affecting soil infiltration and runoff regimes is important.

Of note, the Carpenter Creek drainage network variably dissects the near-surface Sand and Gravel Aquifer. This is a feature unique to the western panhandle in Florida, offering substantial groundwater inflow to its stream valleys. It is the source of gravel bars and riffles on the streambed where its materials are exposed and transported, thus forming significant benthic habitat that is comparatively rare in other parts of the state. Such features are subject to burial and embedment by sands and silts released by floodplain erosion. Such erosion can be accelerated by impervious surfaces in urban landscapes, which effectively cause hydromodification akin to that of a major geologic change to the watershed.

5.1.3. Soils

Escambia County soils are coarser and drainage density is higher than in other parts of Florida. Major rivers draining the continental landmass dissect the panhandle on their journey to the Gulf of Mexico.

Both the Carpenter Creek and Bayou Texar watersheds are dominated by highly permeable sands, with 80% and 90% of the watersheds, respectively, comprised of well-drained HSG Type A soils, as shown in **Figure 5.1-1** and summarized in **Tables 5.1-1** and **5.1-2** below. In the developed portions of the watersheds, the natural soils reside below manufactured media such as asphalt and concrete.

Table 5.1-1 – Hydrologic Soil Group Summary by Watershed

Hydrologic Soil Group	Carpenter Creek		Bayou Texar	
	Sum of Acres	Percent of Total Acres	Sum of Acres	Percent of Total Acres
A	5387	80%	4777	90%
A/D	19	0%	24	0%
B	15	0%	0	0%
B/D	152	2%	0	0%
C	918	14%	0	0%
Other	272	4%	517	10%
Grand Total	**6,763**	**100.0%**	**5,318**	**100.0%**

Note: Other indicates water, urban land, or pits. Acreages based on project study area boundary.

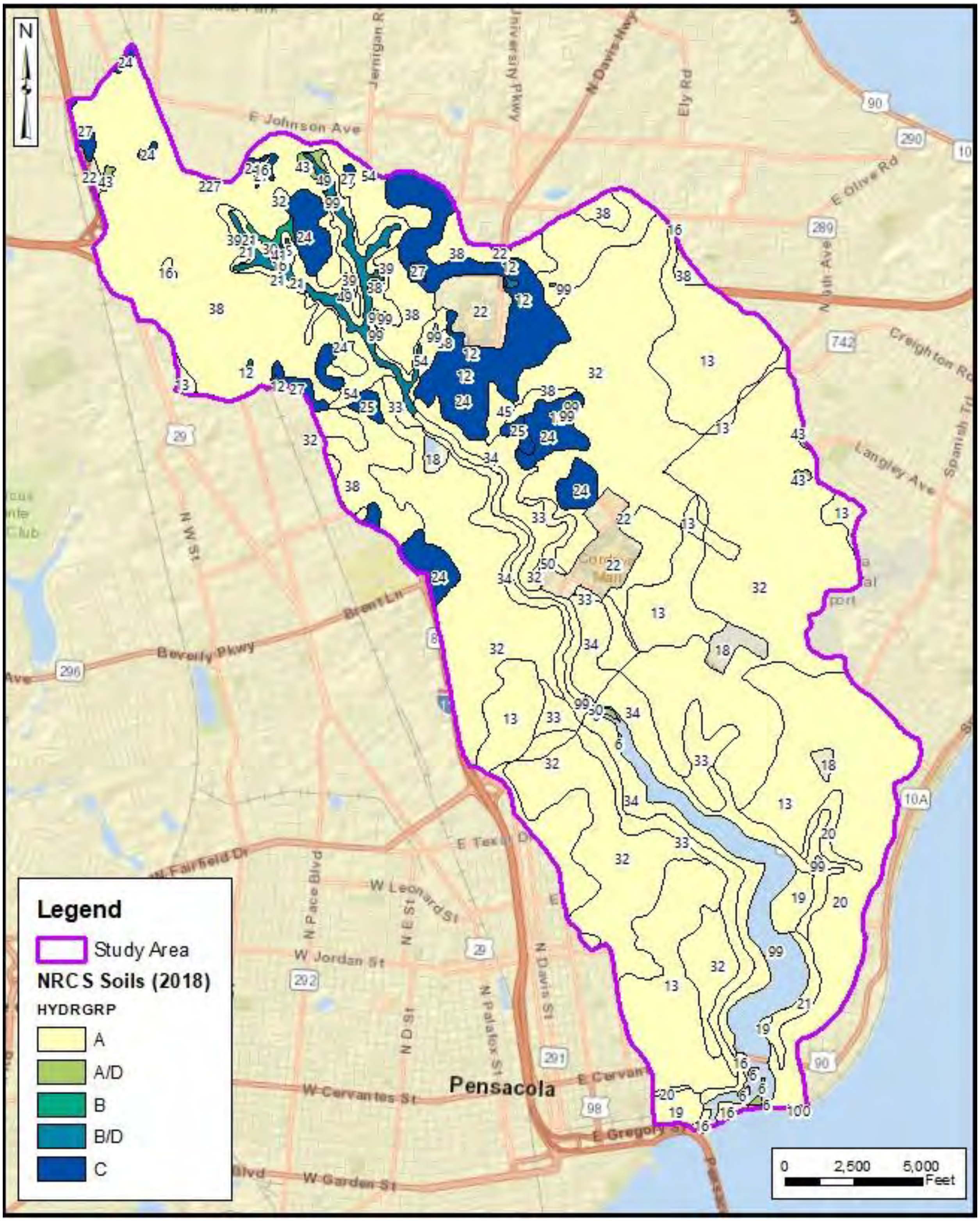
Table 5.1-2 – Soil Type Summary by Watershed

MU Symbol	MU Name	HSG	Carpenter Creek		Bayou Texar	
			Sum of Acres	Percent of Total Acres	Sum of Acres	Percent of Total Acres
5	CROATAN AND PICKNEY SOILS, DEPRESSIONAL	B/D	2	0.0%	0	0.0%
6	DIREGO MUCK, TIDAL	A/D	0	0.0%	14	0.3%
12	CROATAN MUCK, DEPRESSIONAL	B/D	16	0.2%	0	0.0%
13	LAKELAND SAND, 0 TO 5 PERCENT SLOPES	A	753	11.1%	1,808	34.0%
16	ARENTS-URBAN LAND COMPLEX	A	17	0.3%	22	0.4%
18	PITS		21	0.3%	63	1.2%
19	FOXWORTH SAND, 0 TO 5 PERCENT SLOPES	A	0	0.0%	107	2.0%
20	LAKELAND SAND, 5 TO 8 PERCENT SLOPES	A	0	0.0%	73	1.4%
21	LAKELAND SAND, 8 TO 12 PERCENT SLOPES	A	89	1.3%	55	1.0%
22	URBAN LAND	N/A	238	3.5%	64	1.2%
24	POARCH SANDY LOAM, 0 TO 2 PERCENT SLOPES	C	820	12.1%	0	0.0%
25	POARCH SANDY LOAM, 2 TO 5 PERCENT SLOPES	C	39	0.6%	0	0.0%
27	ESCAMBIA FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	C	57	0.8%	0	0.0%
30	PERDIDO SANDY LOAM, 2 TO 5 PERCENT SLOPES	B	15	0.2%	0	0.0%
32	TROUP SAND, 0 TO 5 PERCENT SLOPES	A	1,754	25.9%	2,096	39.4%
33	TROUP SAND, 5 TO 8 PERCENT SLOPES	A	106	1.6%	255	4.8%
34	TROUP SAND, 8 TO 12 PERCENT SLOPES	A	344	5.1%	360	6.8%
38	BONIFAY LOAMY SAND, 0 TO 5 PERCENT SLOPES	A	1,973	29.2%	0	0.0%
39	BONIFAY LOAMY SAND, 5 TO 8 PERCENT SLOPES	A	120	1.8%	0	0.0%
41	MALBIS SANDY LOAM, 0 TO 2 PERCENT SLOPES	C	3	0.0%	0	0.0%

MU Symbol	MU Name	HSG	Carpenter Creek		Bayou Texar	
			Sum of Acres	Percent of Total Acres	Sum of Acres	Percent of Total Acres
43	ALBANY SAND, 0 TO 5 PERCENT SLOPES	A/D	19	0.3%	10	0.2%
45	TROUP AND PERDIDO SOILS, 8 TO 35 PERCENT SLOPES, SEVERELY ERODED	A	29	0.4%	0	0.0%
49	DOROVAN MUCK AND FLUVAQUENTS, FREQUENTLY FLOODED	B/D	134	2.0%	0	0.0%
50	BIGBEE-GARCON-FLUVAQUENTS COMPLEX, FLOODED	A	91	1.3%	2	0.0%
54	TROUP-POARCH COMPLEX, 8 TO 12 PERCENT SLOPES	A	109	1.6%	0	0.0%
99	WATER	N/A	13	0.2%	386	7.3%
100	WATERS OF THE GULF OF MEXICO	N/A	0	0.0%	5	0.1%
Grand Total			**6,762**	**100.0%**	**5,318**	**100.0%**

Notes: Acreages based on project study area boundary. HSG = hydrologic soil group.
Grand Totals may differ slightly from calculated totals based on rounding of data

Figure 5.1-1 – NRCS Soil Summary



5.1.4. Topography

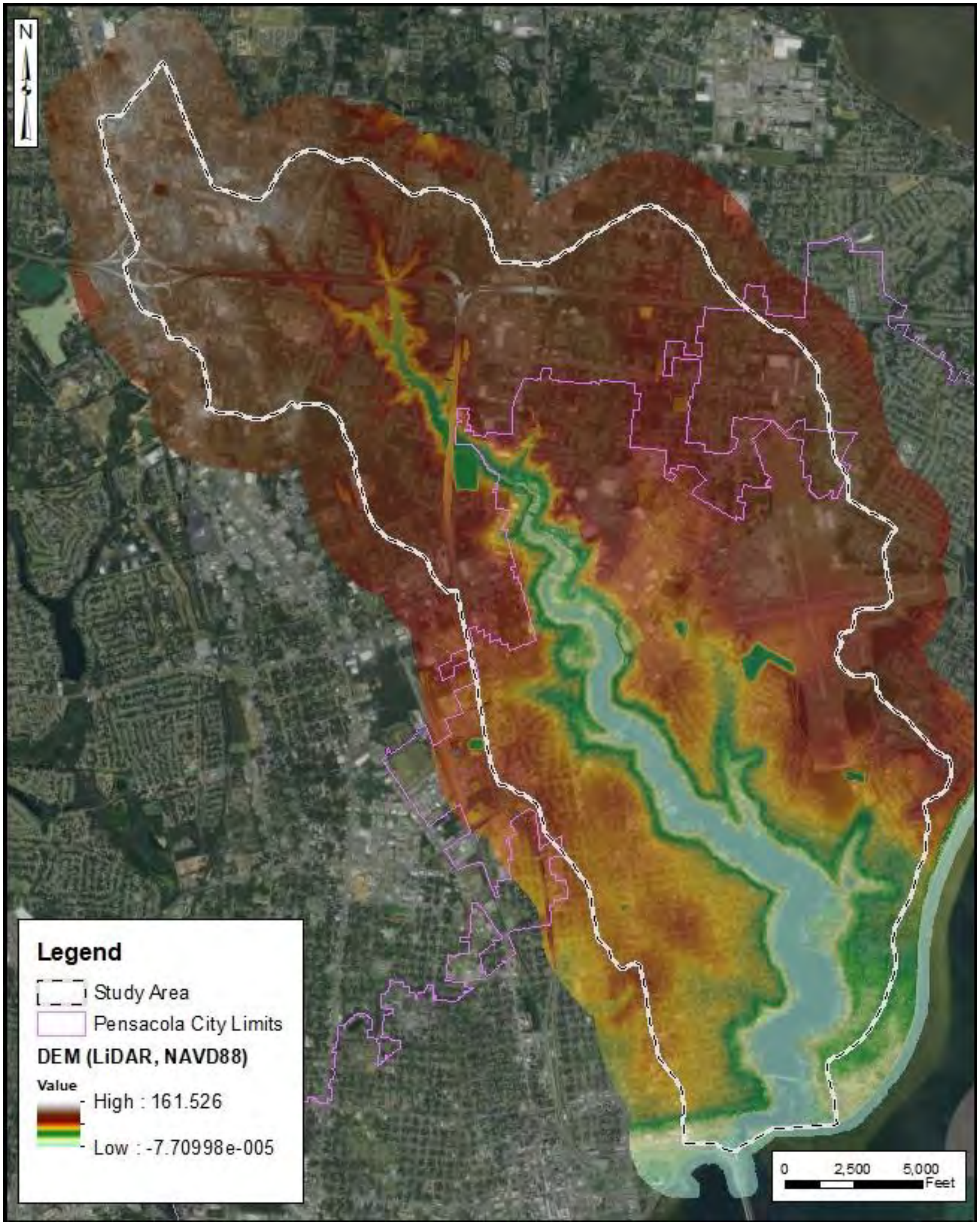
Generally, northwest Florida has greater topographic relief than other areas of the state, with elevations ranging from 75 to 405 feet above mean sea level (MSL), (Metcalf, 2009). The topography of the study area is dominated by a series of marine terraces, which were formed by erosion at different elevations caused by sea level fluctuations. When the sea level dropped to a lower level, the sea floor became relatively level and terraced, and the shoreline became a relatively abrupt drop in land surface elevation (known as a scarp). Up to eight marine terraces have been recognized in Florida (Rupert, 1993).

For use in the Carpenter Creek and Bayou Texar WMP, the 2017 Light Detection and Ranging (LiDAR) Digital Elevation Model (DEM) was retrieved from the NWFWMD. As shown in **Figure 5.1-2** below, the elevations within the Carpenter Creek and Bayou Texar project study area, provided in the NAVD88, range from a low elevation of 0 feet to a high elevation of 161 feet. **Figure 5.1-2** shows the March 2019 aerial imagery obtained from the Florida Department of Transportation (FDOT), overlaid by the project-area DEM.

As part of the characterization of the watersheds, the unincorporated portion of the project-area DEM was reviewed for topographic errors and for topographic voids in areas of new development that may have occurred between the 2017 fly-date and currently. Topographic voids are areas where the available topographic information in the DEM does not represent the actual current ground terrain due to new development or other land use changes that have occurred after the LiDAR fly-date. To assist with the identification of areas of new development that occurred, and to address the DEM alterations associated with these areas, information obtained from ERP plans, as well as FDOT and County plans, were used. ERPs were obtained from the NWFWMD and the FDEP. Topographic errors are similar to topographic voids in that they result in erroneous or missing data in the DEM, but they are different from topographic voids in that they are errors that occur within the data themselves. They can occur in the data when it is originally collected or when it is processed. An example is a cell in the DEM dataset having a "NoData" value or finished floor elevations of buildings that existed during the fly-date not being captured correctly.

During the Watershed Evaluation, there were two topographic voids identified and remedied within the unincorporated portions of the project area, and a total of 35 topographic errors were identified and corrected. However, during the course of future model development, it is possible that additional topographic voids or errors may be encountered. Correcting for topographic voids and errors is done only for areas significant enough to cause modeling inaccuracies. The corrected DEM is utilized for later modeling parameterization such as node stage/area calculations and invert elevations for overland weirs.

Figure 5.1-2 – Study Area LiDAR DEM



5.2. Land Use

Data Sources

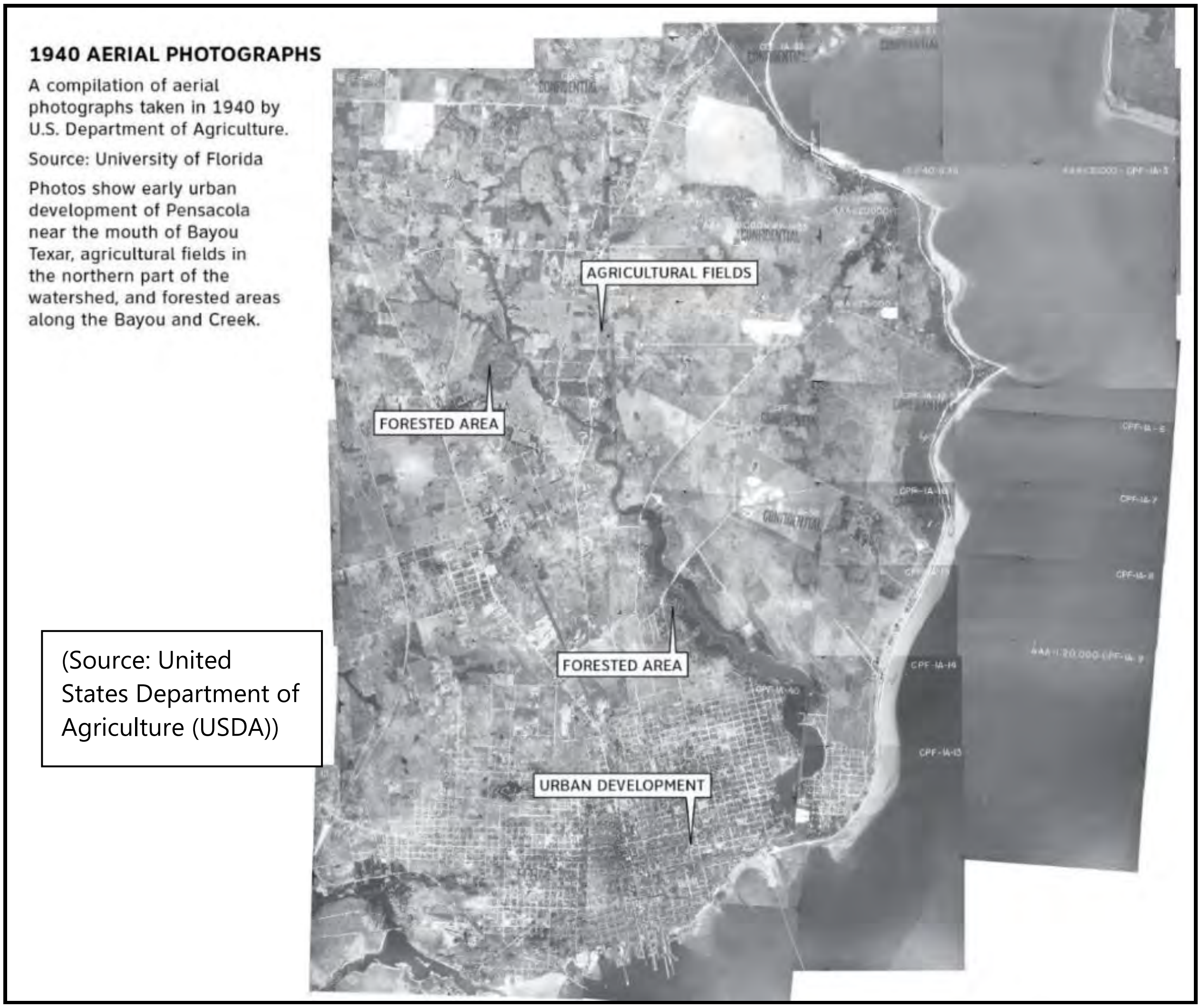
Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
Florida photographic collection, Florida Department of State, Division of Library and Information Services	"The largest and most comprehensive collection of Florida-related images in existence; a nationally recognized component of the State Archives of Florida"	1845-present	N/A	No
US Geological Survey	GIS shapefile depicting historic land use distribution in the watershed	1970-1980	No land use information was available before 1970, information from 1970-80 had lower level of detail than information for later years	No
University of Florida GeoPlan Center, NWFWMD, Greenhorne & O'Mara Inc., FDEP	NWFWMD Land Use, Cover, and Forms Classification System (FLUCCS)	1995	No	No
Florida Department of Environmental Protection's Bureau of Watershed Restoration	Inventory of Land Use and Land Cover classified in the State of Florida's NWFWMD	2004, 2007, 2009/2010, 2012/2013, 2015/2016, 2019	No	No

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
Publisher/Creator: U.S. Department of Agriculture, holding location: University of Florida, Map and Imagery Library, George A. Smathers Libraries	Historic aerial photography	1940, 1951, 1958, 1965	No	No
County's 2030 Future Land Use GIS shapefile	County-wide future land use file for 2030, developed by County	Updated May 21, 2019 by County. Downloaded February 2020 by Wood	Unsure of reliability of this data. Does not reflect recent County land acquisitions or planned acquisitions	NA
GIS shapefile of County acquisition locations within watershed	Developed by Wood, contains locations for County-owned lands, in-progress acquisitions, and locations to be considered for acquisition	2019-2020	NA, living file – to be updated throughout project as needed	NA

5.2.1. Historical Land Use

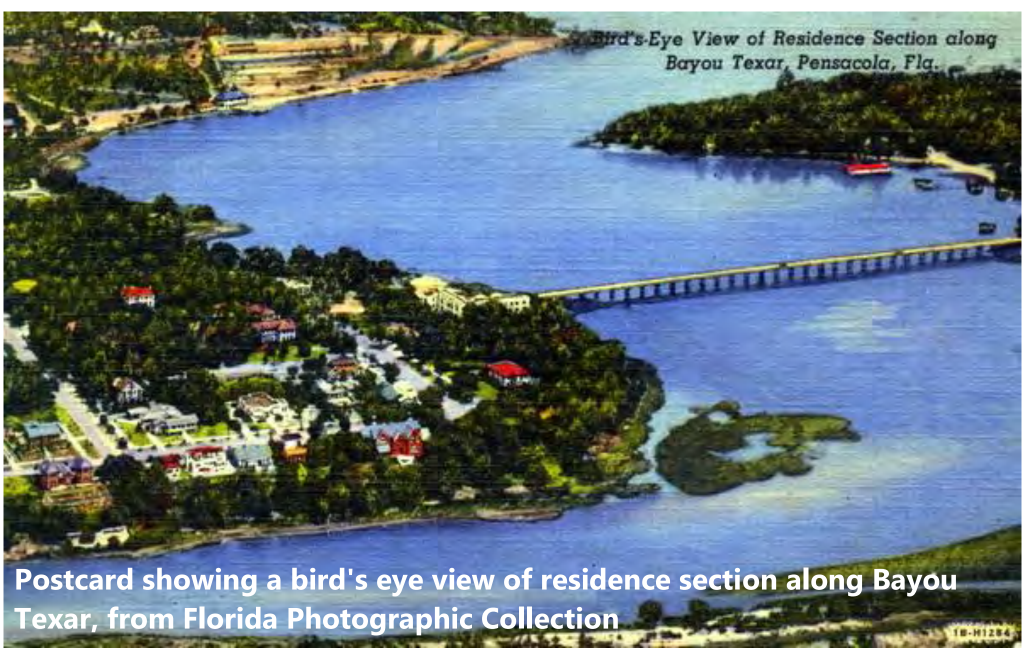
Early development in Pensacola was focused around the port and later the railroad, which was first connected in 1883. Up until the 1950s, urbanization in the watersheds was limited to the East Hill neighborhood and followed a relatively consistent and dense grid pattern (**Figure 5.2-1**). Land use on the east side of Bayou Texar was limited to the airport, which was established in 1935. After World War 2, development rapidly expanded along both sides of Bayou Texar, spurred by the development of the interstate and other major roadways. The upper part of Carpenter Creek and the forests around the airport remained largely intact.

Figure 5.2-1 – 1940 Aerial Photograph



(Source: United States Department of Agriculture (USDA))

The majority of urbanization in the watersheds had taken place by the late 1970s, following the construction of a series of bridges across the creek and bayou constructed in the 1950s and 1960s, as shown in the photos below. Sacred Heart Hospital relocated to its current location in 1965 and Cordova Mall opened in 1971. By 1976, the commercial corridor along 9th Avenue, anchored by the mall, hospital, and airport, was fairly developed, as shown in **Figure 5.2-2**. A second commercial corridor along North Davis Highway was anchored with the opening of University Mall in 1974. Residential suburban development continued throughout the watershed, but large tracts of intact forest along Carpenter Creek remained.



Postcard showing a bird's eye view of residence section along Bayou Texar, from Florida Photographic Collection

1955 Construction of Bayou Texar bridge, from Florida Photographic Collection

1955 photograph showing a bridge over Carpenter Creek, from Florida Photographic Collection

The pattern of development since the 1970s has remained largely the same to the present day, characterized by relatively small residential and larger commercial developments incrementally encroaching on undeveloped land adjacent to Carpenter Creek. In the upper part of the watersheds (northwest of I-110), residential developments of moderate-density (2-5 units per acre) to high-density (6 or more units per acre) and single-family detached homes are the predominant pattern of development. Commercial developments of strip malls and box stores continue to encroach upon the creek over time, as shown in **Figure 5.2-3, Figure 5.2-4**, and **Figure 5.2-5** below.

Figure 5.2-2 – 1976 Land Use Distribution in the Study Area

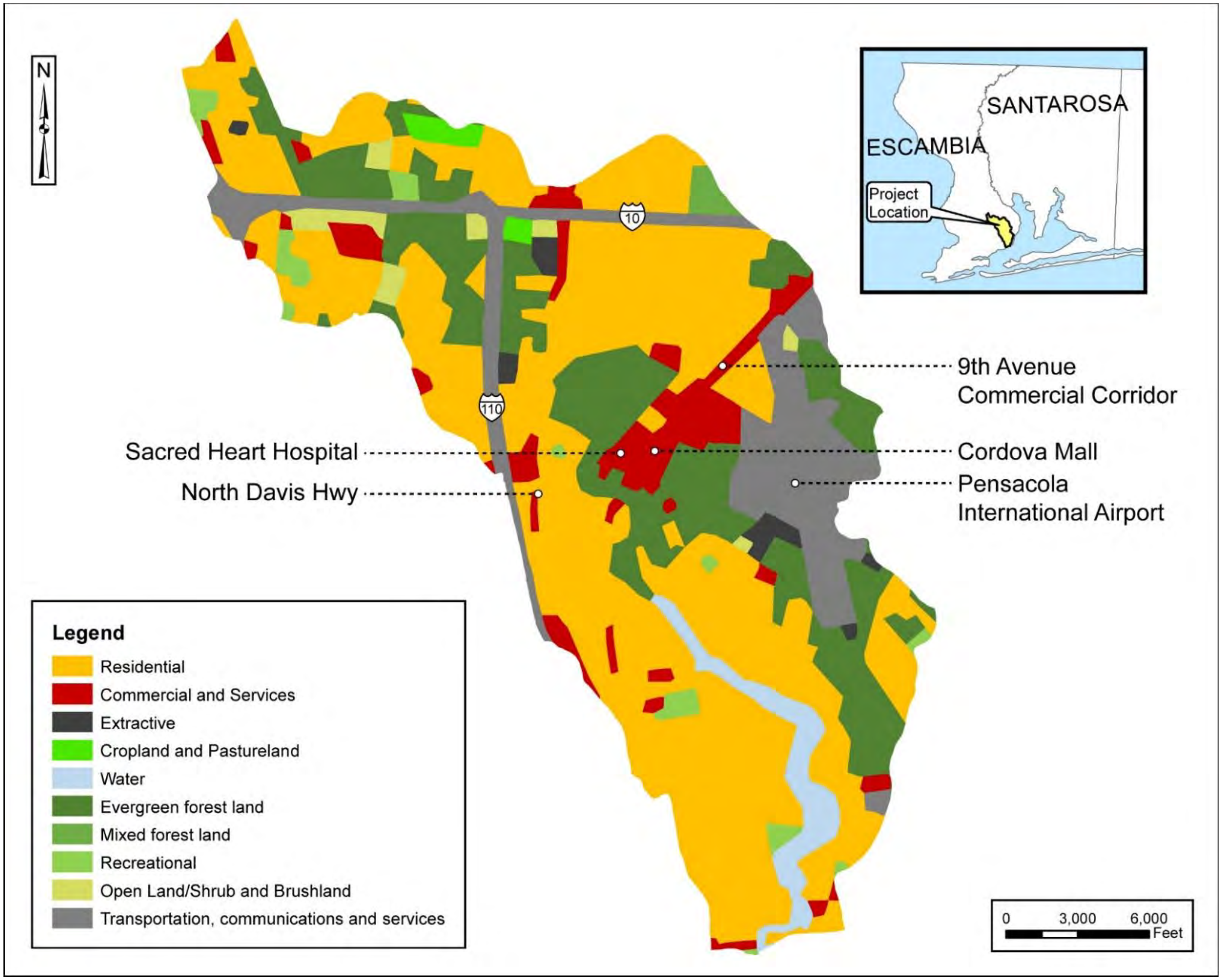


Figure 5.2-3 – 1995 Land Use Distribution in the Study Area

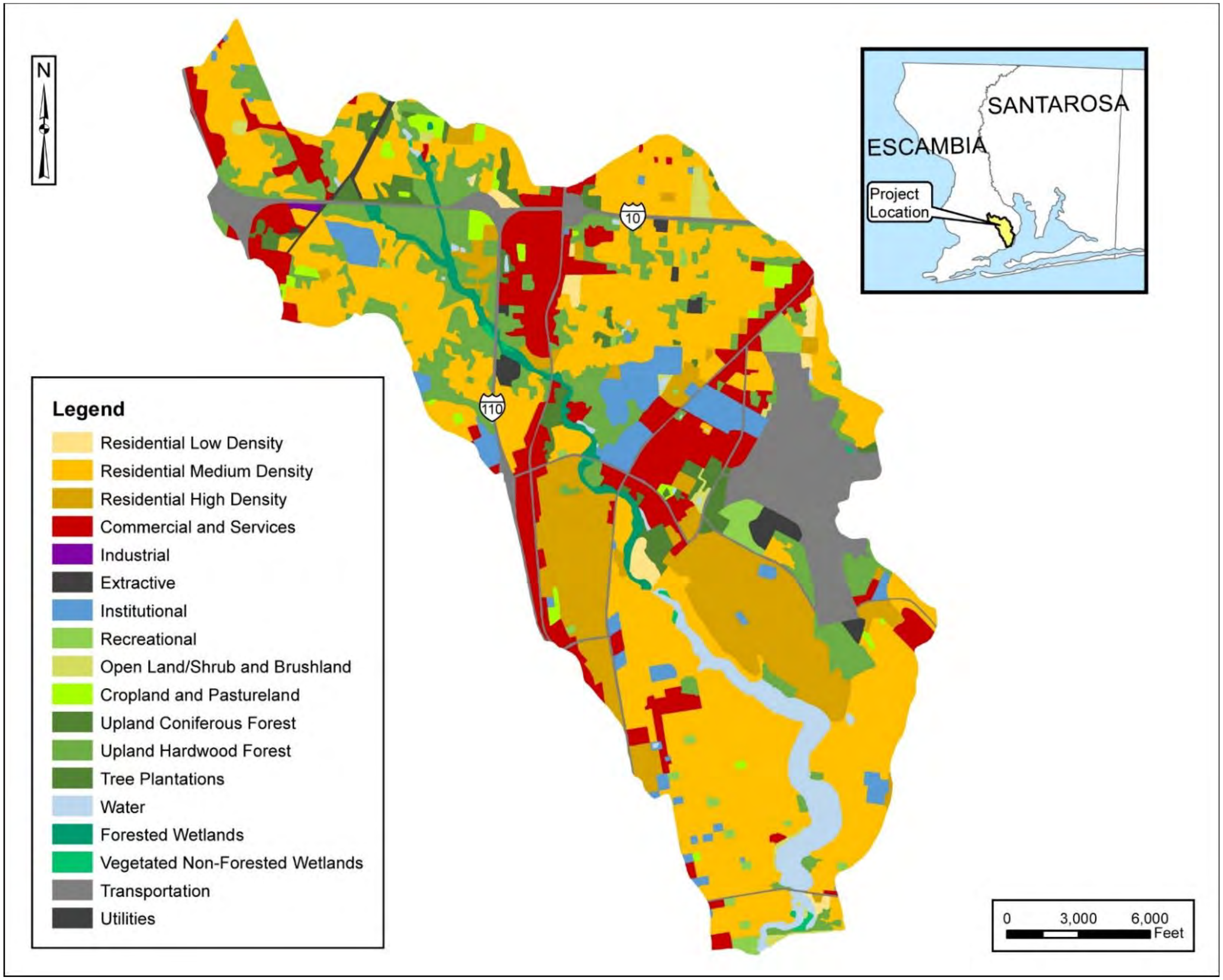


Figure 5.2-4 – 2004 Land Use Distribution in the Study Area

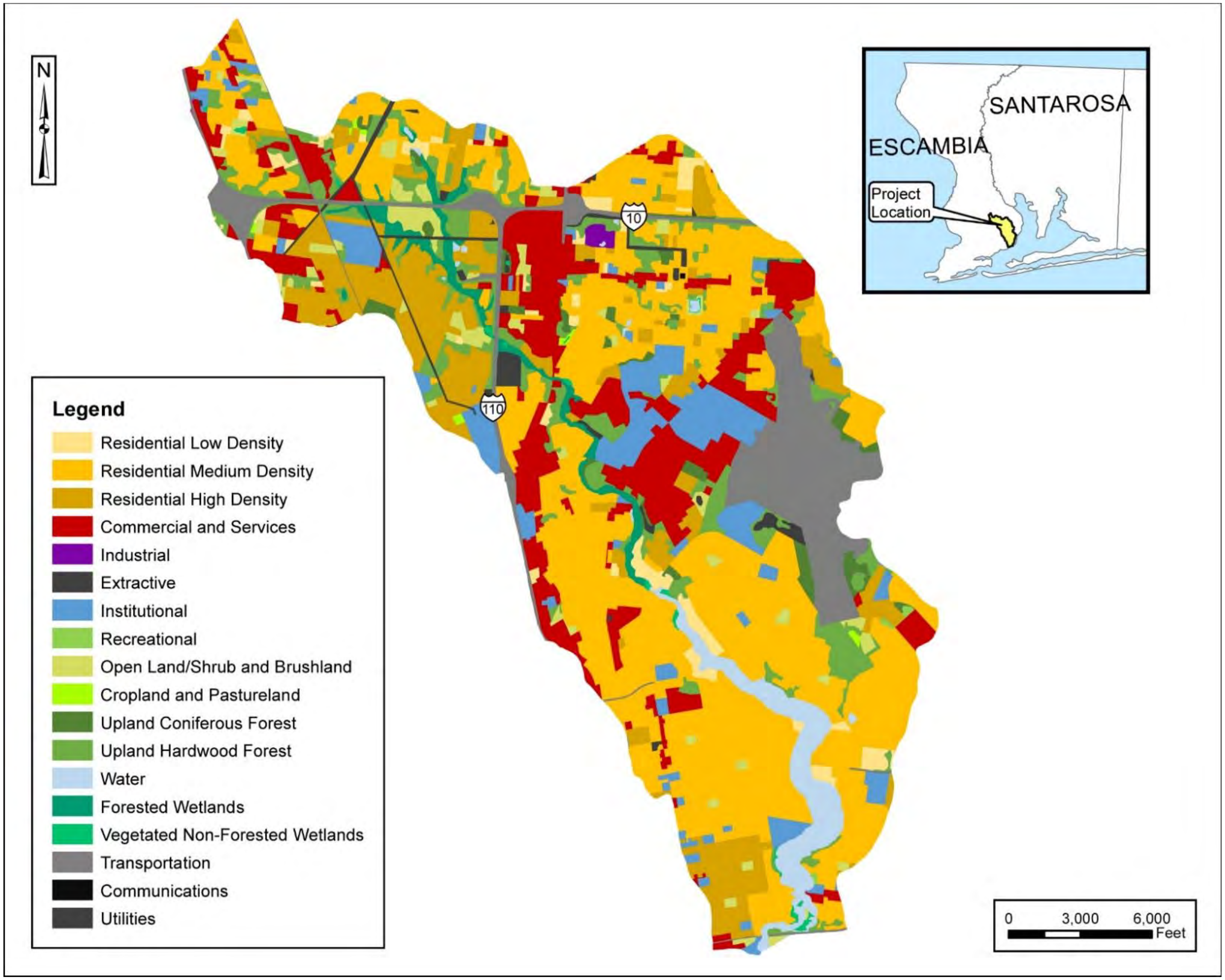
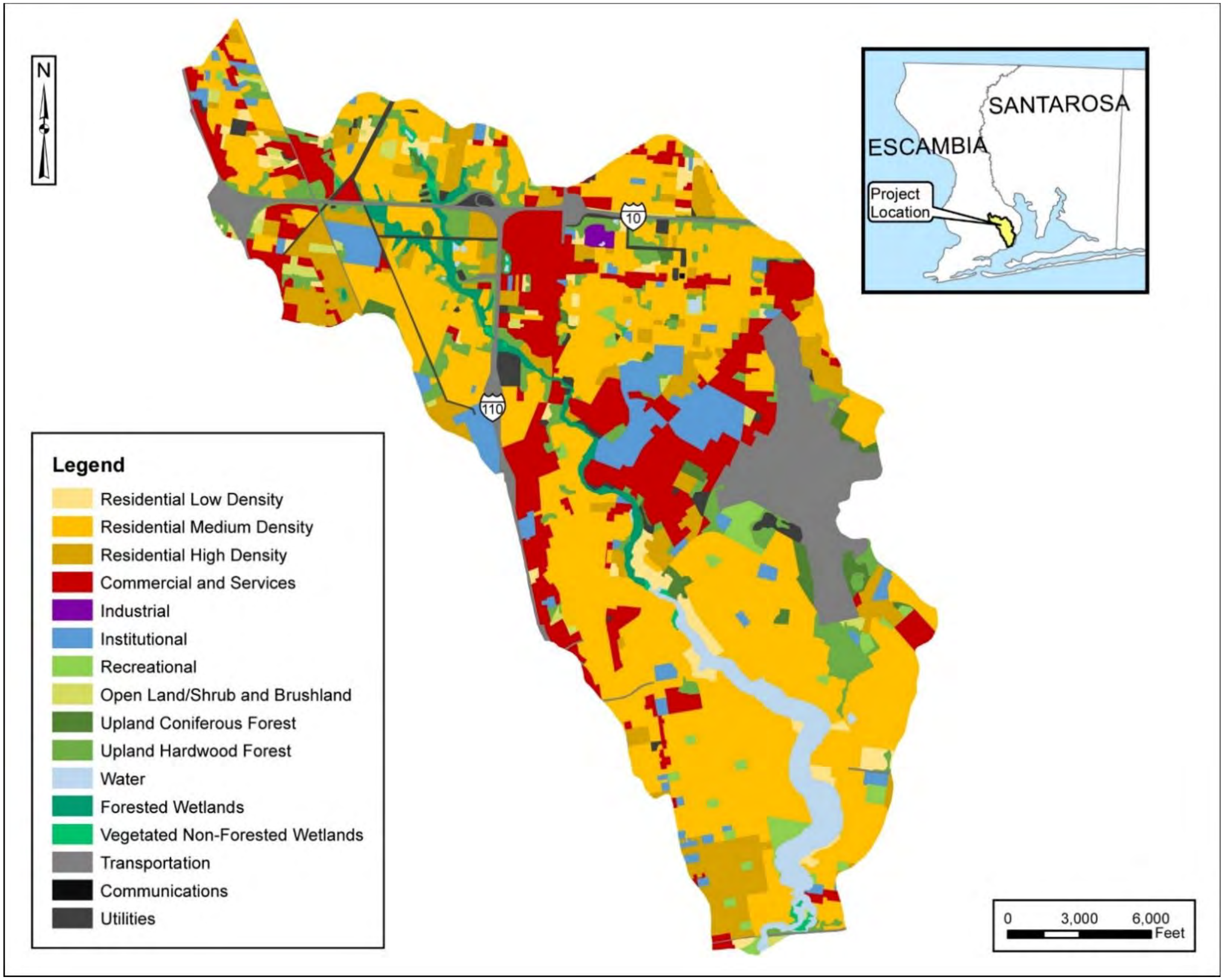


Figure 5.2-5 – 2010 Land Use Distribution in the Study Area

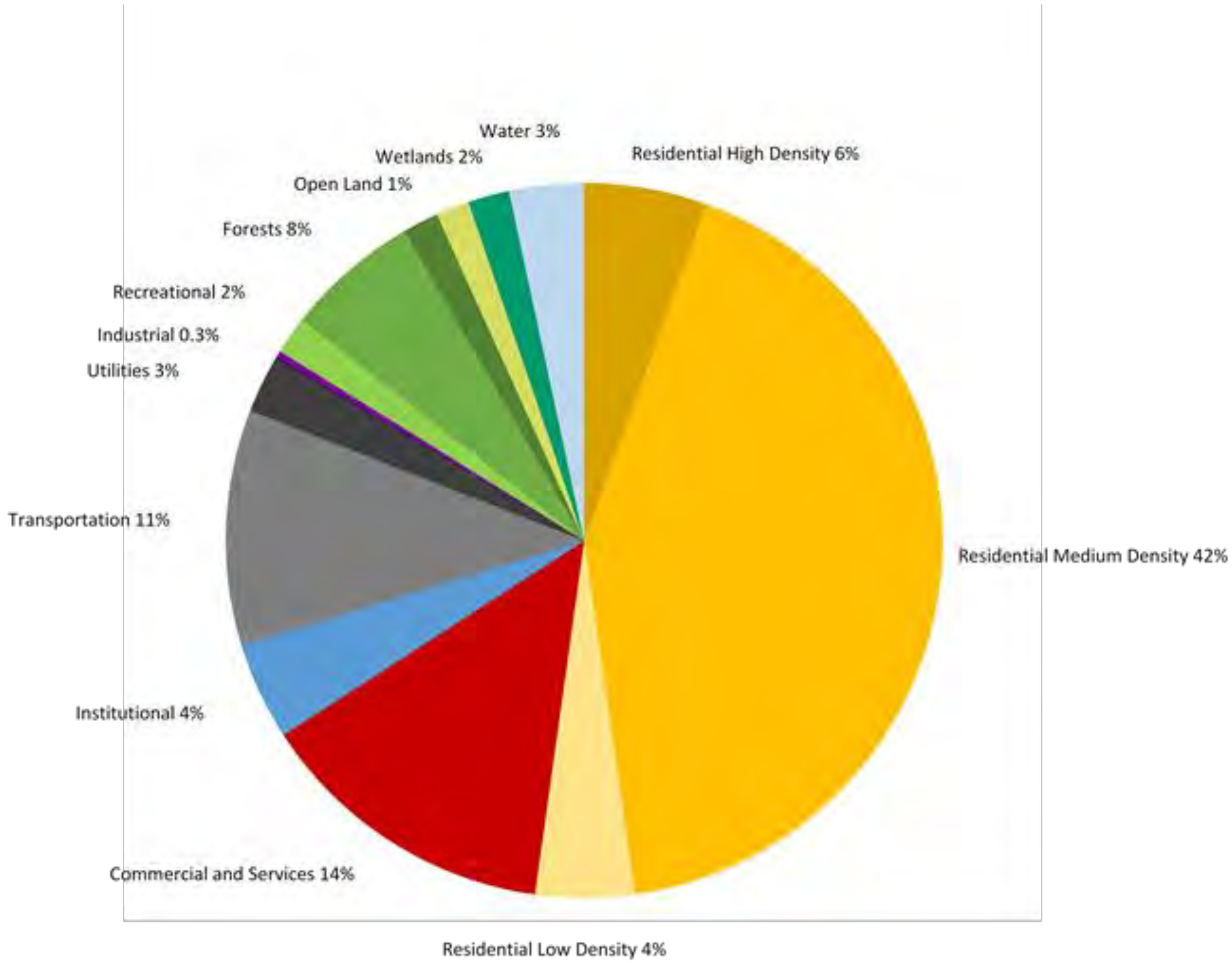


5.2.2. Existing Land Use

2016 land use data was obtained from the NWFWMD and classified according to Level 2 Florida Land Use, Cover and Forms Classification System (FLUCCS). The dataset was cross-referenced with aerial imagery dated January 5, 2019 and updated for any changes that have taken place as visible in the aerial imagery. Within the study area, seventeen features totaling 63 acres were identified as having different FLUCCS Level 2 land uses than what appeared in the imagery. Most involved minor changes to reclassify small features as either Medium-Density Residential or Commercial. The most significant change was the addition of a Maintenance, Repair, Overhaul (MRO) hangar at the Pensacola airport.

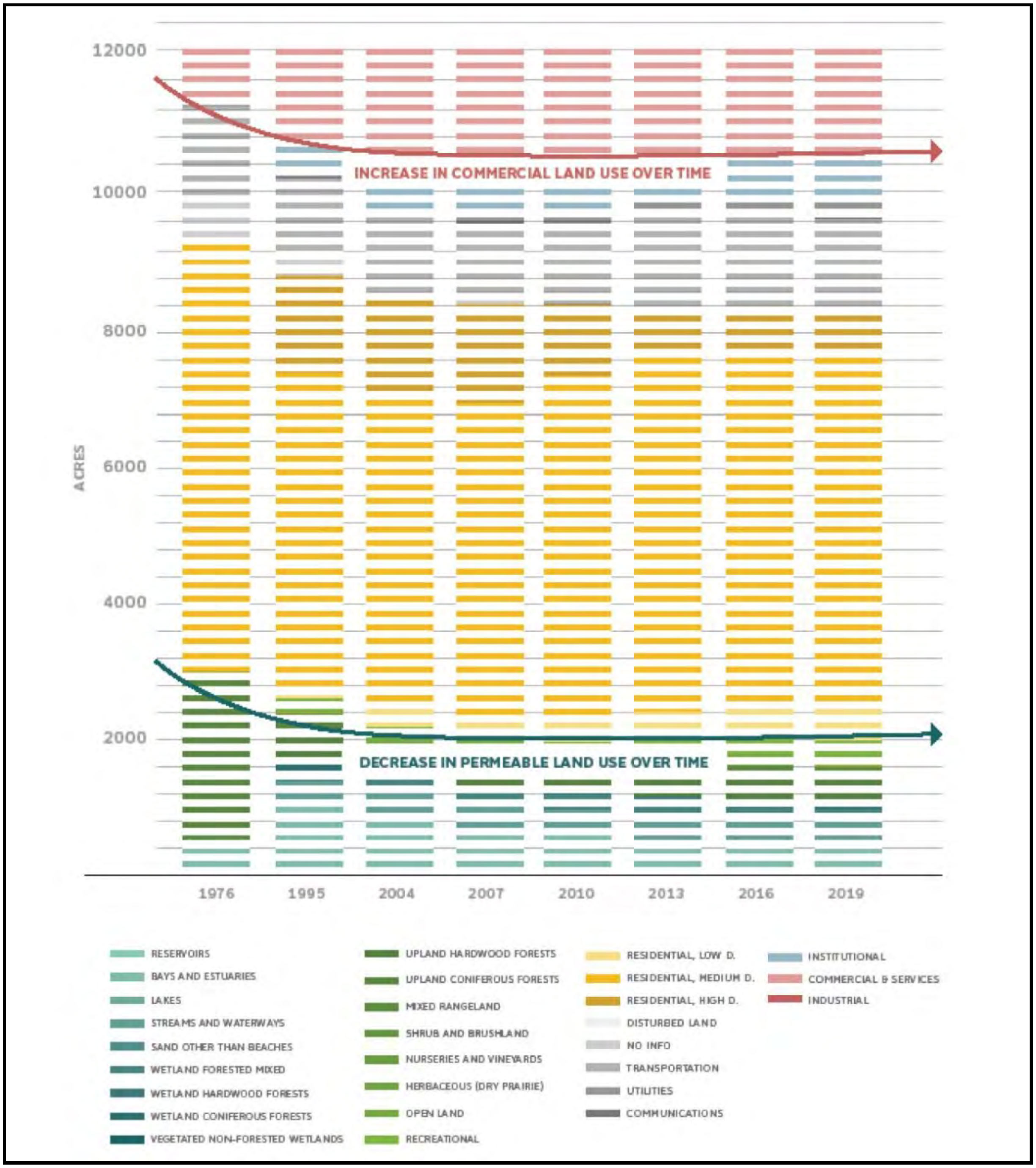
Today, the watersheds are highly urbanized with 85.6% of the land use classified as Urban and Built-Up, per the FLUCCS Level 1 classification (the FLUCCS system categorizes land use at three different scales with increasing specificity; level 1 differentiates between Urban and Built-Up; Agriculture; Rangeland; Upland Forests; Water; Wetlands; Barren Land; Transportation, Communication, and Utilities), as shown in **Figure 5.2-6** below. Most of the Urban and Built-Up land exhibits patterns indicative of post-war suburban sprawl. The predominant land use in the watersheds is medium-density residential (2-5 dwelling units per acre) with a significant amount of low- and high-density residential, commercial (big-box stores, malls, and strip malls), institutional (colleges and hospitals), and transportation uses (airport and interstate highways). Very little of the watersheds are industrial; however, there are past and present industrial land use areas adjacent to the watersheds, including two EPA-designated Superfund sites (Agrico Chemical Company and the Escambia Wood Treating Company) with documented groundwater contamination that has migrated within the watersheds' boundary.

Figure 5.2-6 – 2019 Land Use Percentage in the Study Area



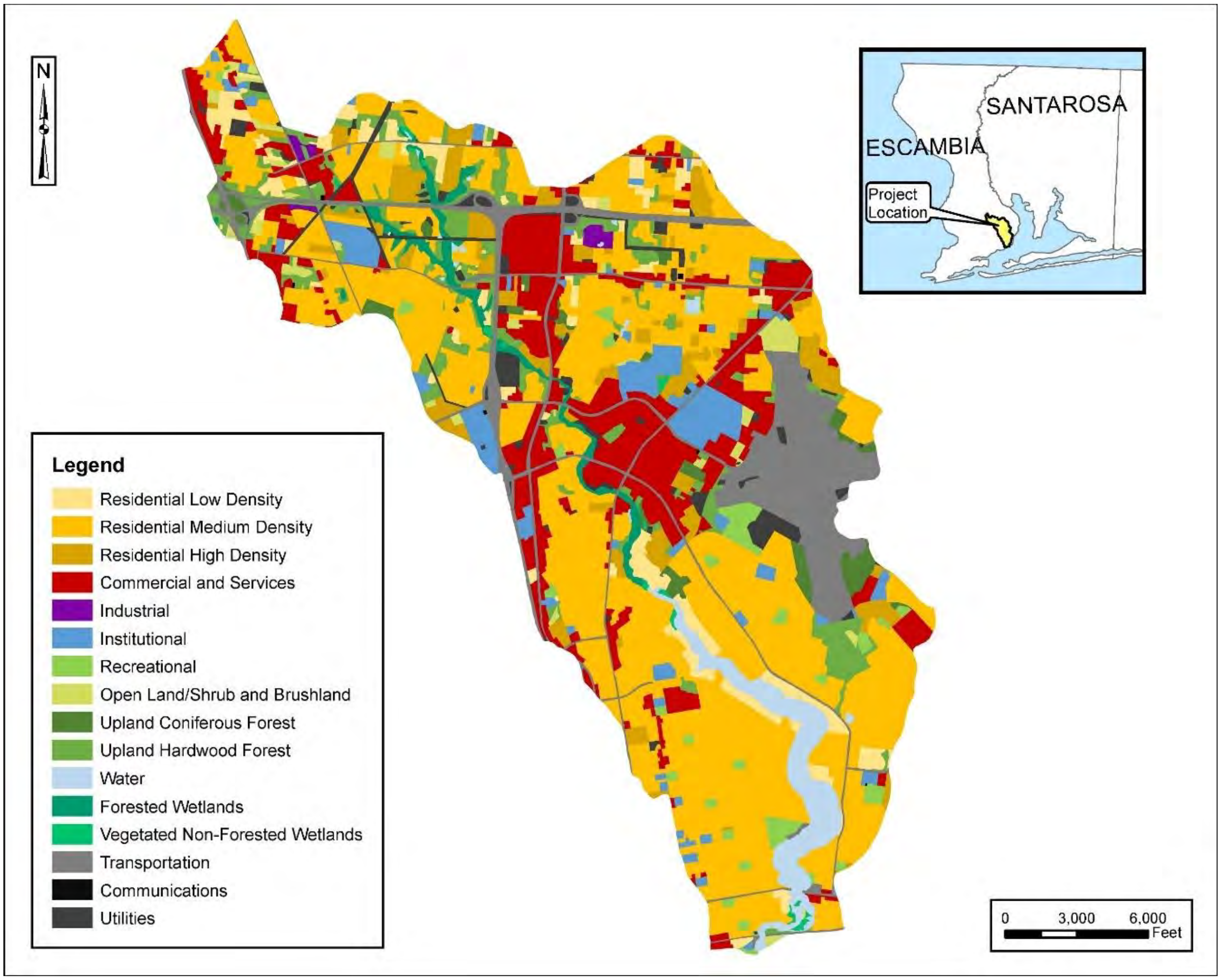
Using the data from the historical and current land use GIS shapefiles to graph the relative change over time (**Figure 5.2-7**), we can see how land uses are distributed throughout the watersheds. Two key takeaways from the analysis are an increase in commercial areas and a decrease in open/permeable areas – the changes are prominent in the 1976 to 2007 transition. A more subtle change includes an increase in low-density residential development and a decrease in medium-density residential development, however, the total residential area remains relatively constant.

Figure 5.2-7 – Change in Land Use Distribution Over Time



Other non-urban land uses include forests and wetlands (10%), most of which are immediately adjacent to Carpenter Creek and its tributaries, and patches of remnant upland forest, open land, and open water, primarily in Bayou Texar. **Figure 5.2-8** below shows the land use distribution with the watersheds, based on the study area boundary.

Figure 5.2-8 – 2019 Land Use Distribution in the Study Area

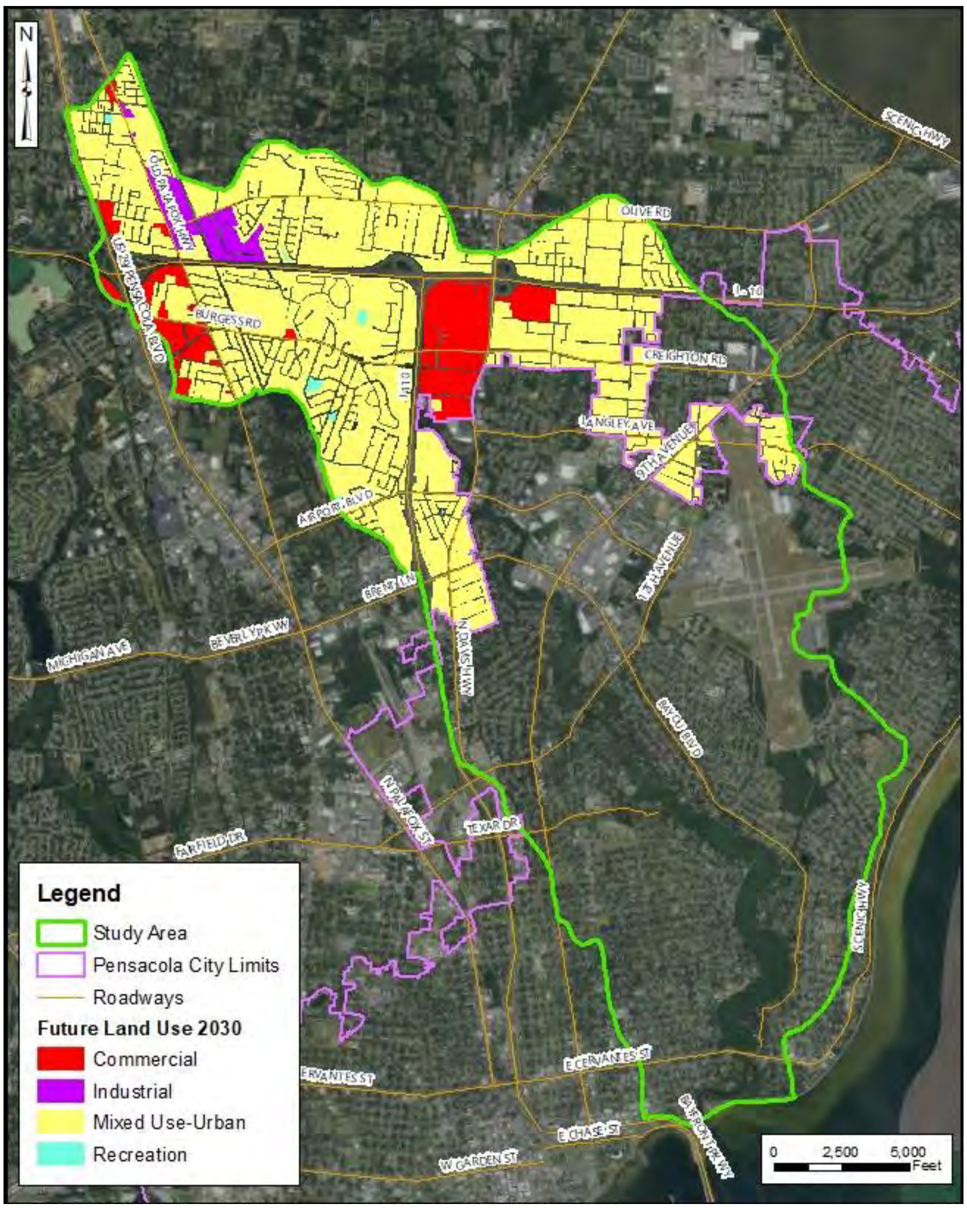


5.2.3. Future Land Use

On February 27, 2020, the County provided a recent version of their future-land-use 2030 GIS shapefile. According to the metadata from the shapefile, it was last edited by the County on May 21, 2019. The shapefile provides data for the entire County, and only includes pertinent future-land-use data for the unincorporated portion of the study area, as shown below in **Figure 5.2-9**.

The 2030 future-land-use (by % area), for the unincorporated portion of the study area, is comprised primarily of mixed-use urban type (84.6%), followed by commercial (11.4%), industrial (3.6%), and recreation (0.4%) types.

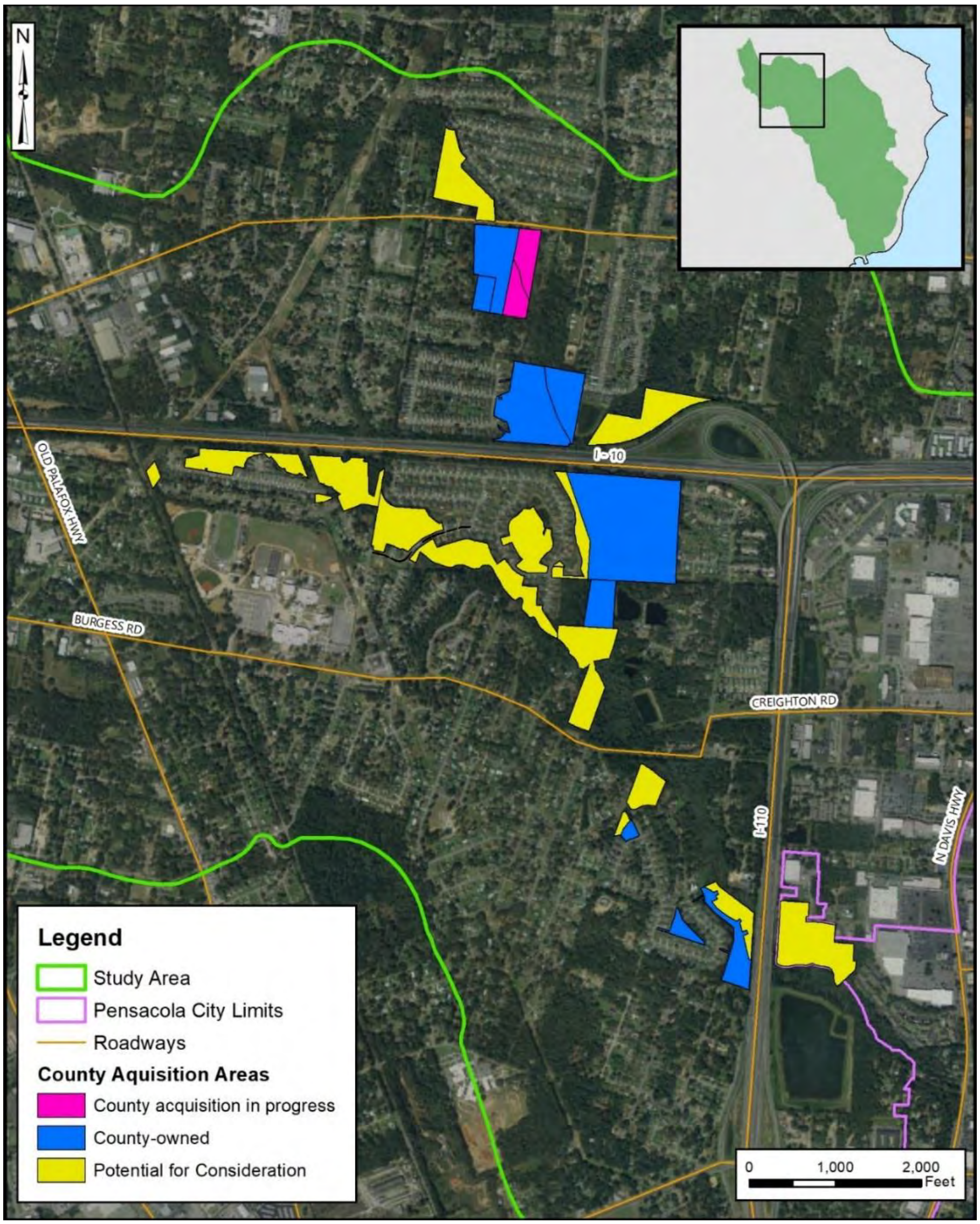
Figure 5.2-9 – 2030 Future Land Use



Note: Future land use data from County GIS layer

In addition to the County's 2030 future-land-use file, the County also provided information regarding recently acquired County-owned properties, properties within the watersheds that are being considered for near-future County acquisition, and other properties that are considered as demonstrating high potential for possible future acquisition. These locations are shown in **Figure 5.2-10** below. Knowledge of these County-owned properties will be important during the future phase of the project that will involve the development of watershed-wide improvement recommendations.

Figure 5.2-10 – County Acquisition Areas of Interest



5.3. Existing Recreational Use

Data Sources

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
City of Pensacola	Proposed Paddling Trail Locations - The City is preparing a grant application for several new non-motorized boat launches. Pdf of locations was provided	11/11/2019	Will need to keep track of status and final locations as they pertain to potential recommendations	No
Escambia County Parks and Recreation and the Escambia County Property Appraiser's Office	GIS shapefile providing location and number of parcels for each park in the county	Data downloaded in 2019 and does not contain information about applicable date	None	Team is following ongoing land acquisition that may increase potential for future parkland
Escambia County	GIS shapefile providing location of public boat access	Data downloaded in 2019 and does not contain information about applicable date	None	No
Materials gathered through engagement activities during Workshop #1	Personal, lived experience provided by watershed residents including: • Individual interviews with residents of the watershed including several long-time residents who grew up in the area • Notes and comments provided	Approximately 1920 - 2020	N/A	Additional information of this nature will be continuously gathered through the engagement process

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
	on maps, drawings, and model prepared by the design team • Notes provided by workshop participants who completed questionnaires and post cards			
Reflections on Carpenter's Creek – Rick's Blog	Documentation of community meeting held at the Cokesbury United Methodist Church in Asbury Place, written by Jeremy Morrison includes accounts by Ora Wills, E.B. Williams, Roger Williams, Jenette Norman, Boyce Crawford, Gary Bedgood.	2/20/2019	N/A	No
Wills, Ora; Fish Head Soup and Sassafras Tea, Proper Publishing 2018	Memoir published by a long-time resident of the watershed and granddaughter of Jenny, known for "Aunt Jenny's Hole"		N/A	No
Florida photographic collection, Florida Department of State, Division of Library and Information Services	"The largest and most comprehensive collection of Florida-related images in existence; a nationally recognized component of the State Archives of Florida"	1845-present	Limited documentation available of recreational use by local Black community	No, sufficient written and oral information was gathered

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
UWF Historic Trust Archives	Historic photographs of the project area	Not available	None	NA
Escambia county 2019 aerial photography	Used to generate GIS shapefile noting location of private boat docks within the watershed	2019	None	NA
OpenStreetMap	User-generated worldwide map, used to locate existing walking and biking trails	2019	There may be additional trails in the project area that are not documented in this file, although none were mentioned in workshop #1 conversations focused on this topic	No

Recreational features in the study area generally fall into six categories: small neighborhood parks, medium-sized community/regional parks, boat launches, informal/unimproved recreational features, private boat docks, and paths/trails. Generally, neighborhoods in the south portion of the study area and close to Bayou Texar (such as East Hill and Cordova Park) have more access to recreational features than neighborhoods in the north end of the study area. There is no public access to Carpenter Creek; however, the County owns several unimproved parcels in the headwaters that may provide access in the future.

Figure 5.3-1 below shows the locations and types of the various recreational assets and uses within the watersheds (Recreation point data was combined from County and City sources and cross-referenced with Google Maps, Parks and Recreational Facilities Boundaries were obtained from the University of Florida GeoPlan Center, Bike lane data was obtained from the Florida Department of Transportation, and the LEAP trail and Summit Trail were obtained from OpenStreetMaps). There are other types of recreational use areas in the watersheds, such as playgrounds and ballfields located on school grounds. However, it is unclear as to whether some of these areas are open and accessible to the general public, and therefore, they were not included.

5.3.1. Small Neighborhood Parks and Squares

These parks or squares may have playground equipment, walking trails, and ball courts, but otherwise do not have many facilities. They are distributed throughout the watershed, predominately in residential areas; however, their distribution appears to be concentrated in some neighborhoods and absent in others. East Hill and other neighborhoods adjacent to Bayou Texar appear to have the highest density of small parks. The neighborhoods further north have fewer parks that are farther apart.

5.3.2. Medium-Sized Community/Regional Parks

There are three medium-sized parks in the study area, as shown in **Figure 5.3-1**. Bayview Park is located near the mouth of Bayou Texar. It has a rowing club, a senior citizens center, and a dog park. The Roger Scott Athletic Complex is adjacent to the airport in the Cordova Park neighborhood. It has the Vickrey Community Center, a public pool, a dog park, tennis courts, baseball diamonds, and a walking trail. Baars Park is unprogrammed and has no facilities but has a well-developed tree canopy and informal walking paths through a rich ecological gradient.

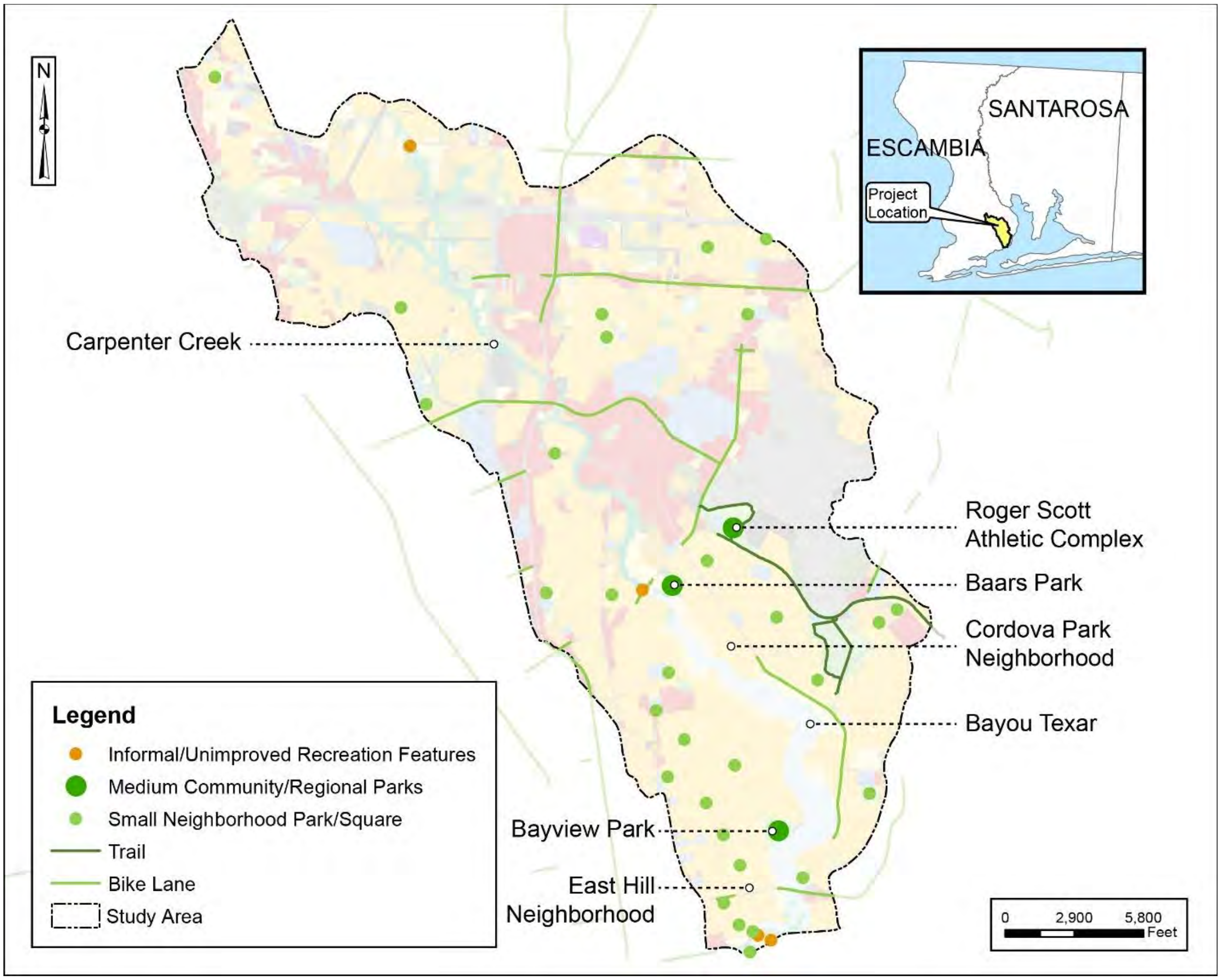
5.3.3. Informal/Unimproved Recreational Features

In addition to the formal recreational features, there are various informal places where people recreate, also shown in **Figure 5.3-1**. Graffiti Bridge, like the name implies, is a local landmark that serves as a haven for artists, with its continuously changing painted murals, located near the 17th Avenue Boat Launch. The Railroad Trestle is a popular spot for jumping off into the bayou. Across the trestle, 'Hobo Beach' is a dredge spoil site that is used as a beach/campground. Just north of the 12th Avenue Bridge, there is an informal kayak launch. The area between the 12th Avenue Bridge and the 9th Avenue Bridge is a popular fishing spot and is partially accessible.

5.3.4. Paths/Trails

The network of pedestrian and bike infrastructure across the watersheds is fragmented (**Figure 5.3-1**). There are limited safe options and many unconnected or disconnected segments. Except for small trails embedded within parks, the only publicly accessible trails are the LEAP Trail (between the Roger Scott Athletic Complex and Bay Bluffs Preserve) and the Summit Trail (south of the airport).

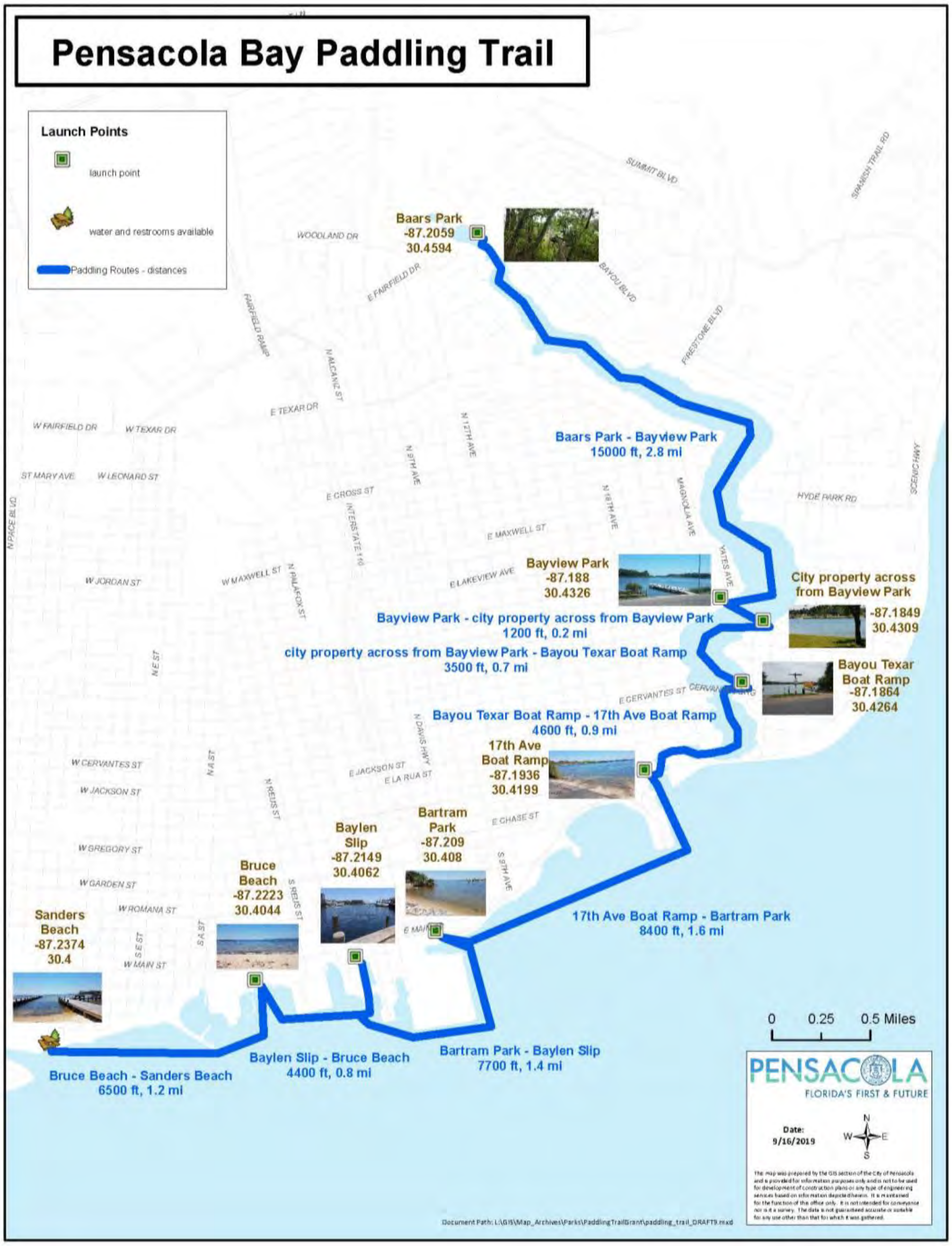
Figure 5.3-1 – Existing Recreational Use Features in the Study Area



5.3.5. City Paddling Trail

The City of Pensacola has preliminarily proposed the “Pensacola Bay Paddling Trail”, which consists of a boating route along Bayou Texar and Pensacola Bay to include kayak and motorboat ramps and launches for recreational use. As of the date of this report, this City Paddling Trail has not been implemented. See **Figure 5.3-2** for planned trail locations.

Figure 5.3-2 – City-Proposed Paddling Trail



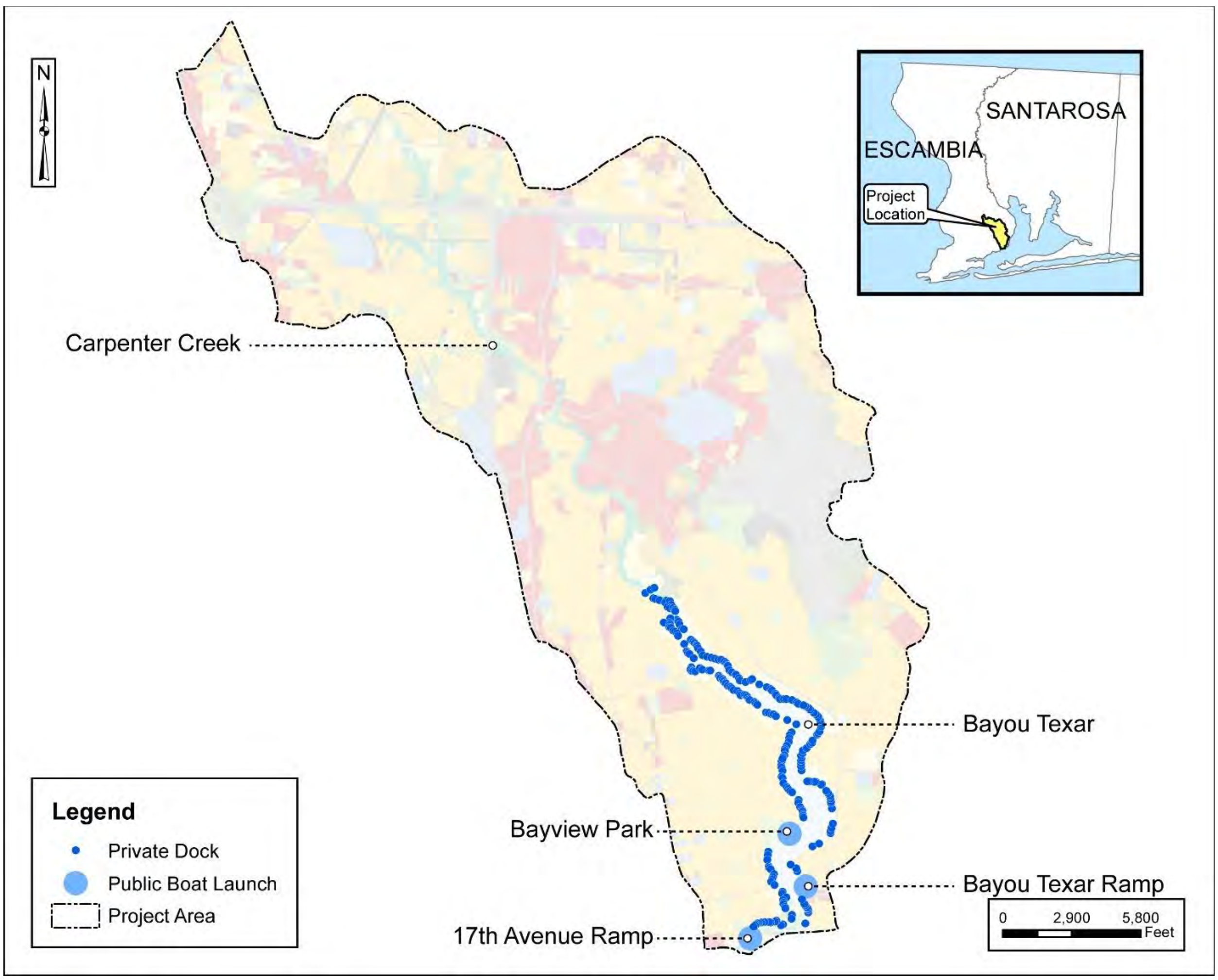
5.3.6. Boat Launches

There are currently two established public boat launches at the mouth of the bayou, as shown in **Figure 5.3-3**. The Bayou Texar Boat Ramp is located near the E Cervantes St Bridge. The 17th Avenue Boat Launch is located at the mouth of Bayou Texar, near the railroad trestle.

5.3.7. Private Boat Docks

Nearly every private residence that abuts Bayou Texar has a boat dock (**Figure 5.3-3**), resulting in approximately 233 private boat docks on Bayou Texar.

Figure 5.3-3 – Public Boat Launches and Private Docks Within Study Area



5.4. Hydrology

Data Sources

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
Carpenter Creek Stormwater Needs Assessment, 2003, Baskerville-Donovan, Inc.	Proposes conceptual improvement alternatives that will help reduce stormwater pollution into Carpenter Creek	September 2003	Not focused on flooding issues, more on water quality. Consult w/County to determine if proposed recommendations have been implemented.	Yes – Status of proposed recommend ations
City of Pensacola	City Pond locations in "CarpentersCreek.gdb"	Nov 2018	None	No
City of Pensacola Stormwater Master Plan (SWMP) and related H&H model	Study to address the flooding and environmental impacts of stormwater within the City's limits	July 2019	SWMP report did not mention what source was used for model calibration/verifica tion, or if City has a HWMDB on record. SWMP noted that flow contributions from upper reaches of Carpenter Creek not included in City's model	No – Per discussions with County, Team is moving forward with assumptions listed in Appendix C
Escambia County	County Pond locations in "WOOD_Carpenters_Texa r.gdb"	Nov 2018	None	No
Escambia County Walk the WBID program	Over 80 points identified throughout Carpenter Creek WBID, pertaining to a variety of issues. Twenty-two points related to "Flooding/Erosion"	2017	Qualitative information only, no associated depths or elevations of high-water marks. Consult w/County staff to determine	Yes – Status of proposed recommend ations

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
			status of proposed follow-up actions	
Escambia County Basin Study Guidelines and Specifications	Basis Study process guidelines, developed by County	Sept 2013	No High-water mark database (HWMDB) mentioned in document, but not available from County	Yes – HWM collection when appropriate (ie Hurricane Sally)
Escambia County Stormwater Advisory Team (SWAT) County-Wide Stormwater Recommendation Report	Suggests recommendations for stormwater challenges, following April 2014 storm event	July 2015	Consult w/County staff to determine if proposed recommendations have been implemented	Yes – Status of proposed recommend ations
FEMA FIRM Maps	Flood Insurance Study and rate maps	2006	Escambia County map revisions anticipated to be adopted in 2021.	Yes - download revised FIRM maps when adopted Fall 2021
HDR April 2014 Storm Event Re-creation Report	Radar-based assessment of rain event on April 29-30, 2014	April 2014	N/A	No
National Oceanic Atmospheric Agency's (NOAA's) National Weather Service (NWS) Office website	Precipitation, Temperature	Nov 1879-Oct 2020 Daily, Monthly	None	No

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
NWFWMD's Data portal/directory (Aquarius) http://aquarius-web.nwfwmd.state.fl.us/	Stage Data	None available	No gage data available for Carpenter Creek or Bayou Texar	Yes – Creek stage/flow data needed. See data gap section for recommendations
NWFWMD	NWFWMD Potentiometric Surface - Nov 2000.pdf & independent GIS spatial files	Nov 2000	Data >20 years old, and doesn't factor in climatic changes over two decades	No
NWFWMD	WellheadProtectionArea_S.EscambiaCo.1997.pdf	Dec 1997	GIS files not available	No
USGS website	Precipitation Station 02376079	Oct 1970 – May 1977 Daily	Short POR does not align with events to be modeled / evaluated	No
USGS https://waterdata.usgs.gov/nwis	Station 02376079 Discharge (Daily, Monthly, Annual)	Feb 1976 – May 1977	Continuous discharge data limited to one year of data collected over 40 years ago. No continuous stage data.	Yes – Creek stage/flow data needed. See data gap section for recommendations
USGS	Station 02376079 Peak Streamflow	June 1976 – August 1984		Yes – Creek stage/flow data needed. See data gap section for recommendations

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
USGS	Station 02376077 Field Measurements	Oct 1959 – Aug 1993	Limited to spot stage and discharge measurements, majority of which were collected 40 years ago	Yes – Creek stage/flow data needed. See data gap section for recommendations
USGS https://waterdata.usgs.gov/nwis	Historical data were found for 12 monitoring wells	Earliest record was 1947, and most recent was 1989	Several wells were noted that could be reactivated if still viable (see Data Gap section)	Yes – Creek stage/flow data needed. See data gap section for recommendations
University of Florida (Goodhart and Dietch)	Stations: Carmike, Walton, & Shiloh Water Levels and Discharge measurements (spreadsheets and PPT provided by UF)	Jan 2018 – Dec 2018	Stage and discharge data limited to one year	Yes – Creek stage/flow data needed. See data gap section for recommendations
Escambia County / ECUA / City of Pensacola	Wellhead Protection Zone GIS Data	Unavailable	Geospatial delineations of wellhead protection zones in watershed are not available	No
Wood Team Post-Hurricane Sally Field Reconnaissance	Field reconnaissance conducted between September 29th and October 7th, 2020 to capture high-water marks and evidence of flooding following Hurricane Sally	September 29th through October 7th, 2020	Mostly qualitative data collected, but opportunity to obtain quantitative data from some of the locations visited	Yes, may request survey at key locations noted, to obtain quantitative data for H&H model

5.4.1. Climate and Rainfall

Escambia County has a warm subtropical climate. Climate and rainfall data are available for the Pensacola Regional Airport through the National Oceanic Atmospheric Agency's (NOAA's) National Weather Service (NWS) Office **(Figure 5.4-1)** and Pensacola Naval Air Station through US Climate Data **(Figure 5.4-2)**. The images below from the US Climate and NOAA websites indicate average temperature ranges, in degrees Fahrenheit, from the 40's in winter to 90's in summer. The average annual rainfall is 65 inches. **Tables 5.4-1** and **5.4-2** show monthly total precipitation and temperature ranges based on the NOAA data collected between 1879-October 2020.

Table 5.4-1 - NOAA NWS Monthly Total Precipitation Ranges (Nov 1879-Oct 2020)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	Inch	4.43	4.65	5.36	4.56	3.91	5.74	7.27	7.44	6.16	4.12	3.79	4.61
Max	Inch	18.77	12.53	16.53	29.53	12.56	21.14	20.36	21.43	19.71	20.51	14.82	16.55
	Year	1991	1919	1948	2014	1946	1994	1979	1935	1998	1934	1930	2018
Min	Inch	0.21	0.38	0.24	0.06	0.04	0.26	1.69	0.72	0.29	0.00	0.09	0.18
	Year	2003	1911	2006	1915	1898	1954	1970	1891	2019	1978	2017	1889

Table 5.4-2 - NOAA NWS Monthly Temperature Ranges (Nov 1879-Oct 2020)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean		52.6	55.2	60.7	67.3	74.4	80.2	81.7	81.5	78.5	70	60.3	54.4
Min	°F	5	7	22	33	44	55	61	60	43	32	22	11
	Year	1985	1899	1980	1987	1921	1913	1967	2004	1967	1993	1950	1989
Max	°F	81	82	90	96	102	102	106	104	102	97	89	81
	Year	1949	2018	2017	1987	1953	2011	1980	1986	2019	2019	2016	2019

Figure 5.4-1 – NOAA NWS Average Temperature & Precipitation

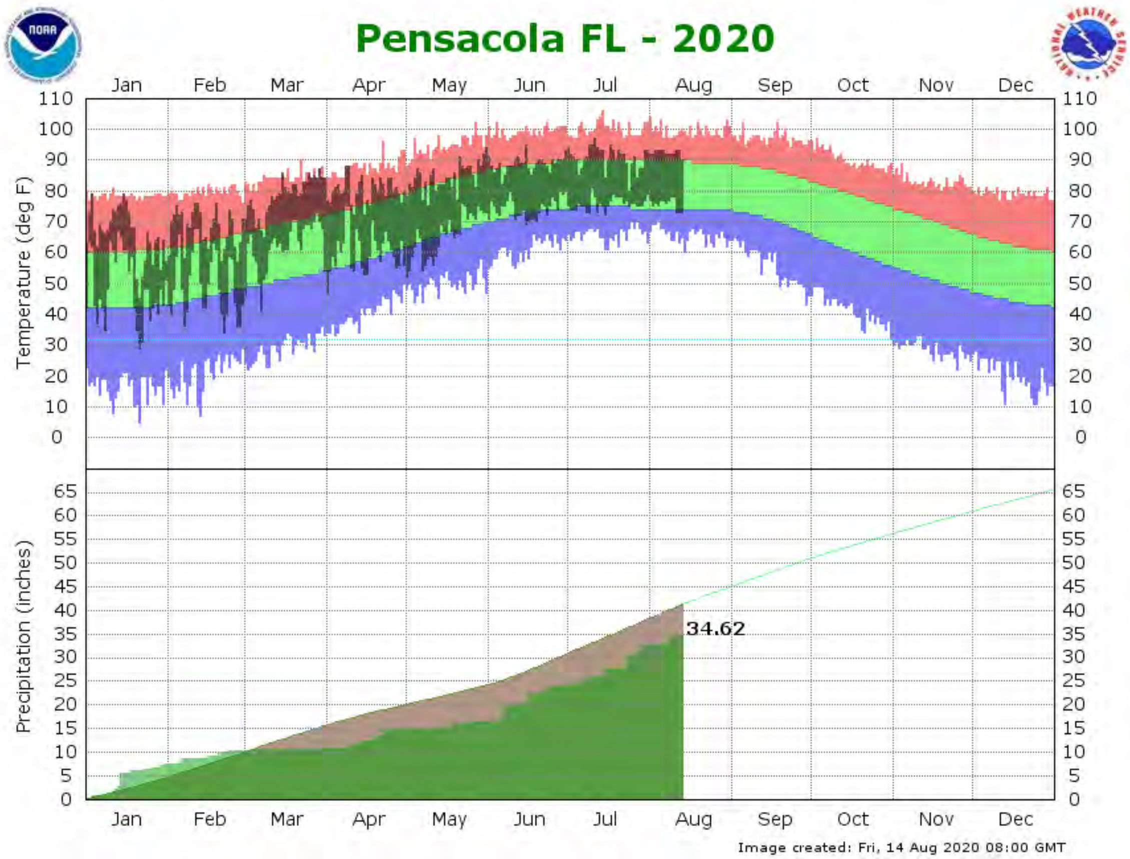
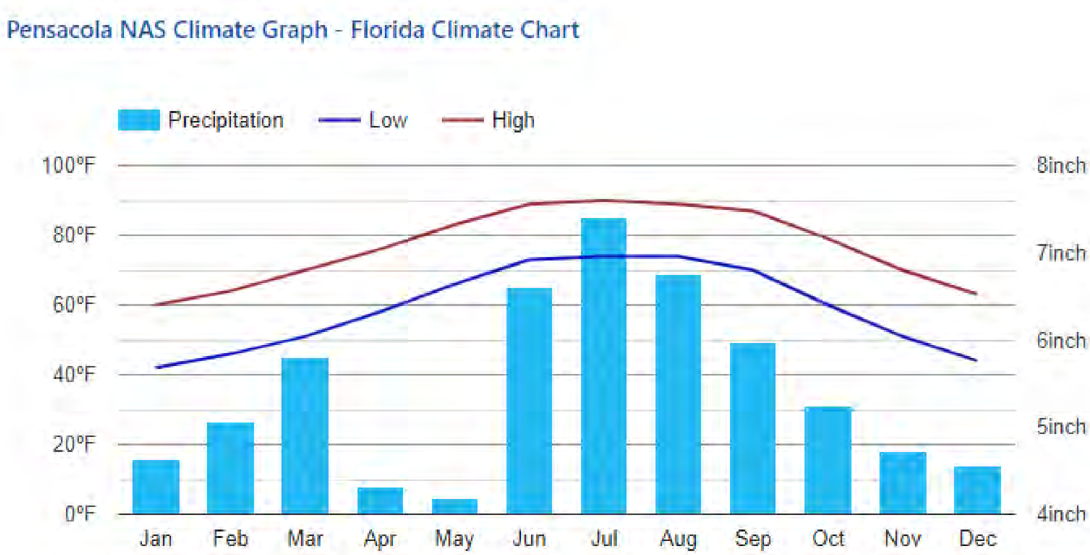


Figure 5.4-2 – US Climate Data Average Temperature and Precipitation



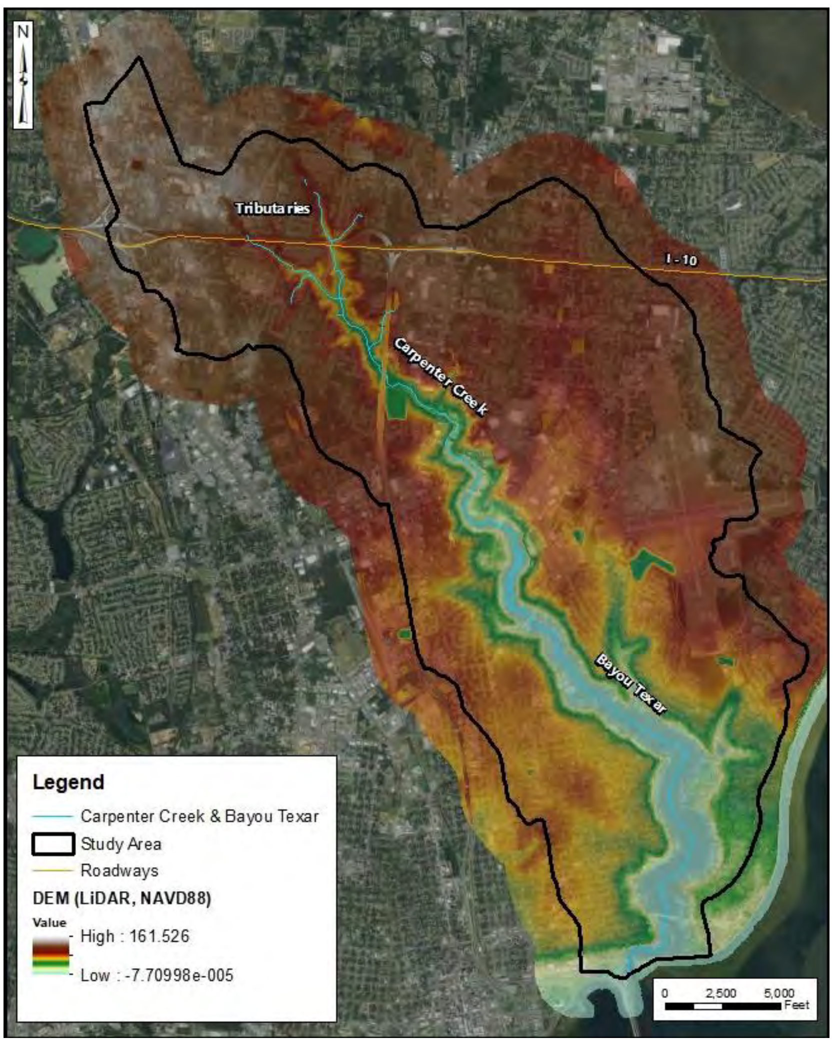
5.4.2. Surface Water Resources

Carpenter Creek and Bayou Texar are the largest surface waters in the watersheds. Carpenter Creek is the sole significant tributary to Bayou Texar. Currently, Carpenter Creek is fed by three primary tributaries, starting just north of Interstate 10, as shown in **Figure 5.4-3**.

5.4.2.1. *Carpenter Creek and Tributaries*

The central tributary of Carpenter Creek begins around Olive Road, and this starting point is referred to as the headwaters. North of Burgess Road, the western tributary meets its confluence with the central stem of Carpenter Creek. The eastern tributary meets its confluence with the central stem of Carpenter Creek near Interstate 10. From this point, Carpenter Creek travels south under Interstate 110 and other major roadways such as Davis Highway, Airport Boulevard, Bayou Boulevard, and 9th Avenue. The creek then approaches 12th Avenue, as it then discharges into the mouth of Bayou Texar and continues to flow south until it reaches its final discharge into Pensacola Bay, near the 17th Avenue bridge.

Figure 5.4-3 – Tributaries and Surface Waters Within Study Area

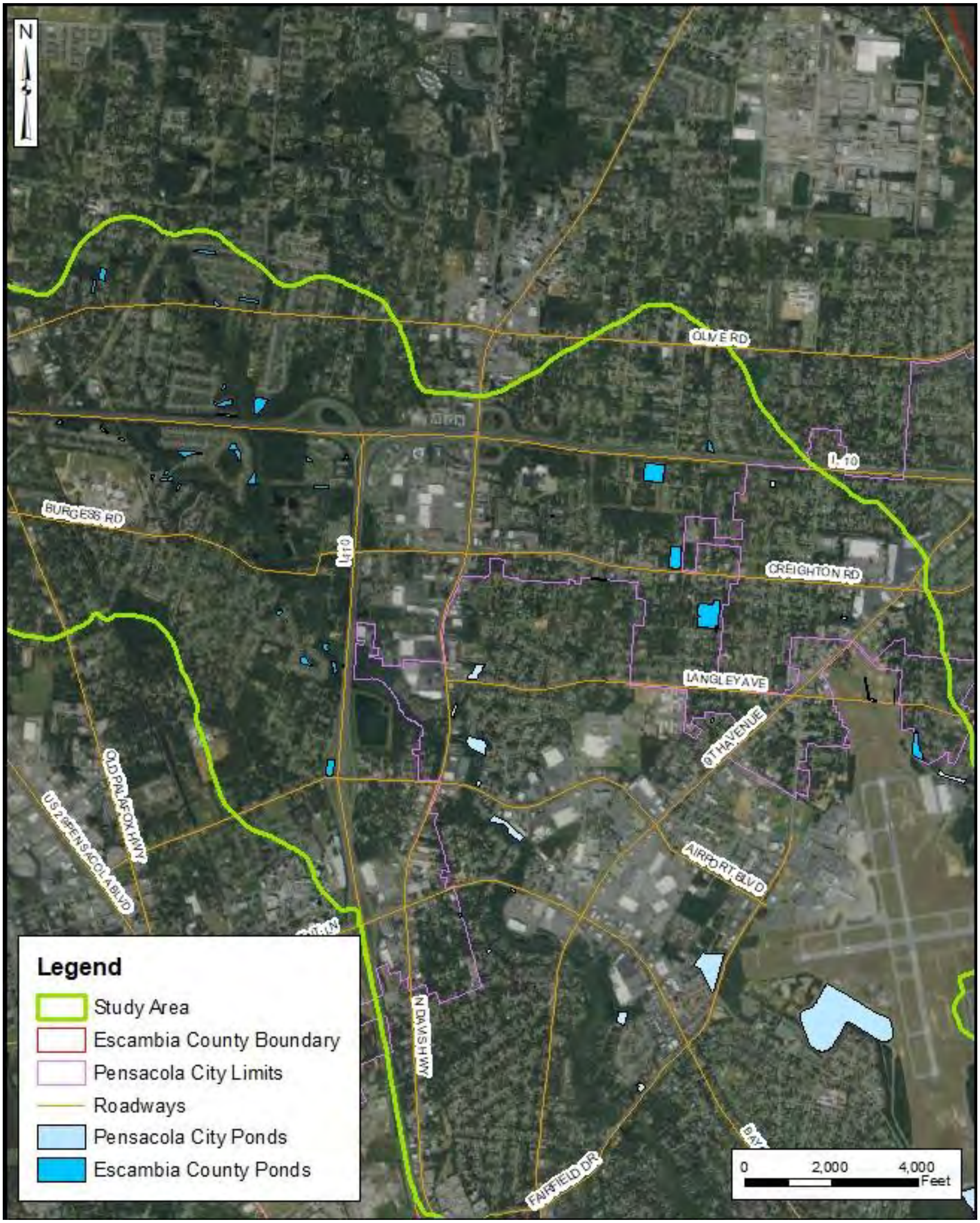


5.4.2.2. *Ponds*

In November of 2018, the County provided a GIS polygon shapefile for County pond locations. According to the County's shapefile, there are 37 ponds identified within the unincorporated area of the study area, as shown in **Figures 5.4-4** and **5.4-5** below. Thirty-three of the 37 ponds were designated within the shapefile as being "County-Maintained".

Also, in November of 2018, the City of Pensacola provided a GIS polygon shapefile of pond locations. According to the City's shapefile, there are 33 pond features located with the City's jurisdictional area of the study area, as shown in **Figures 5.4-4** and **5.4-5** below. However, the City's shapefile denoted multiple "types", ranging from "ditch", "outfall", "pond", "pump", and "vault". Of the 33 polygons within the study area, 26 were classified within the shapefile as being owned by the City.

Figure 5.4-4 – City and County Pond Locations, Northern Portion of Study Area



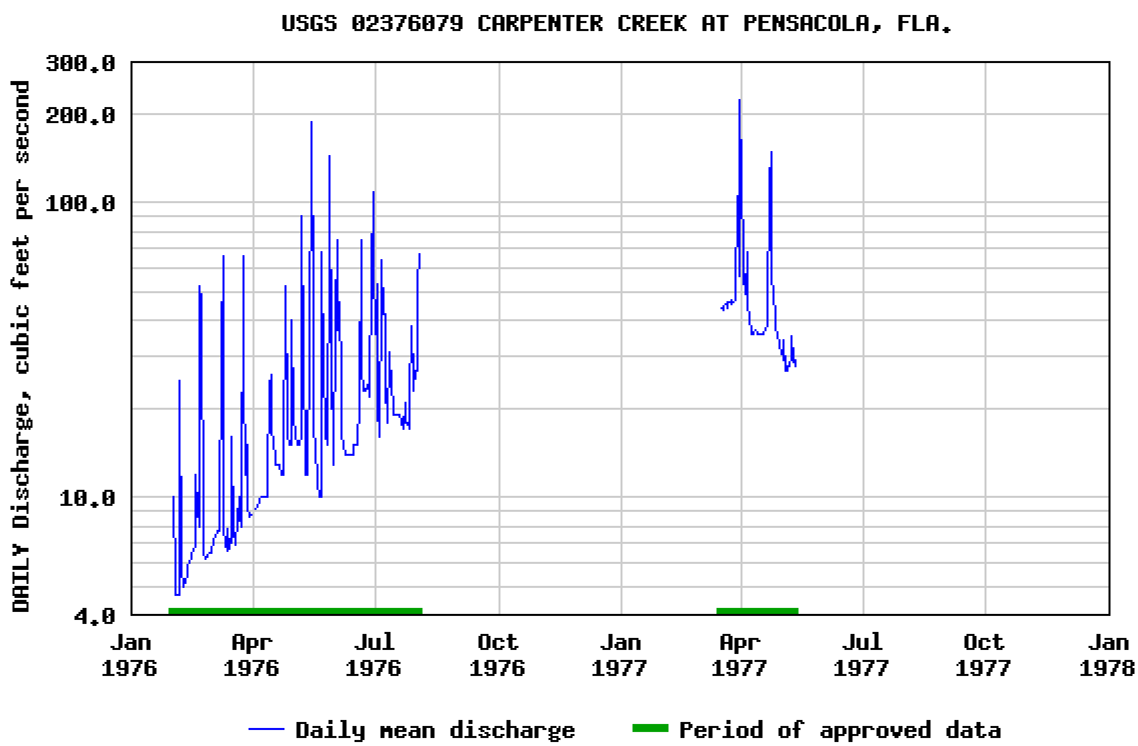
wood. IMPACT Campaigns WETLAND SCIENCES INCORPORATED SCAPE

Figure 5.4-5 – City and County Pond Locations, Southern Portion of Study Area

5.4.2.3. *Stream Gage Data*

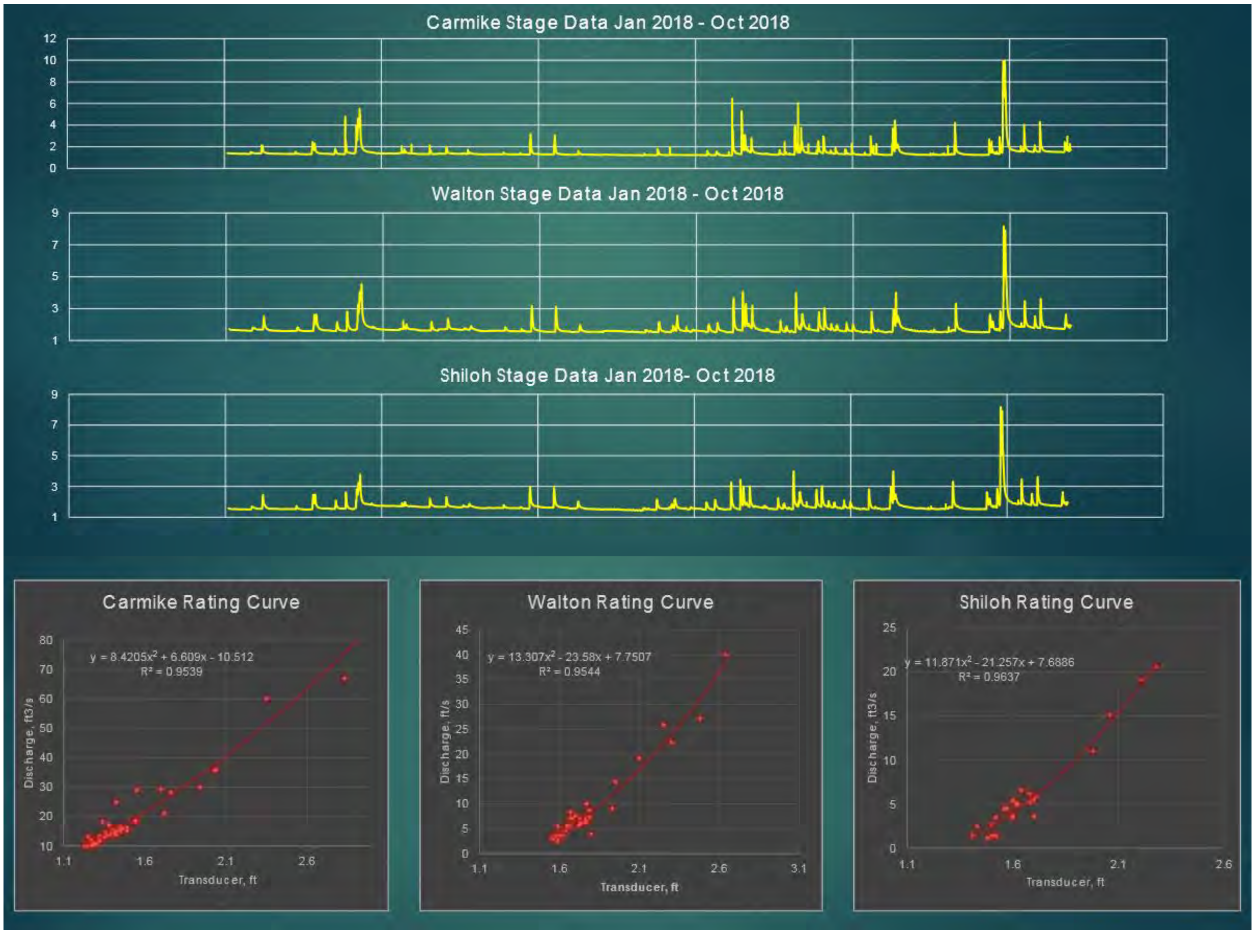
Water level and discharge data are limited within the study area. One United States Geologic Survey (USGS) station (02376079 - Carpenter Creek at Pensacola located near N 9th Ave and Springhill Dr) collected daily discharge from February 1976 to May 1977. Discharge recorded at this station ranged from approximately 5 to 200 cfs, with an average discharge of 18 cfs (**Figure 5.4-6**). Twenty-seven field discharge measurements were collected from USGS Station 02376077 (located near N Davis Highway and Walton St) between October 1959 and August 1993, averaging 12.4 cfs. No NWFWMD gaging stations were found within the study area.

Figure 5.4-6 – Daily Discharge of Carpenter Creek - United States Geological Survey



A study conducted by the University of Florida scientists Goodhart and Deitch examined the spatial and temporal dynamics of stormwater pollutants within portions of the study area. As a part of this study, water levels were recorded from January 2018 to October 2018 and discharge measurements were collected at three locations along Carpenter Creek (Carmike, Walton, Shiloh). The results are provided in **Figure 5.4-7** below.

Figure 5.4-7 – Stage Data Documented along Carpenter Creek Stations(Goodhart, n.d.)

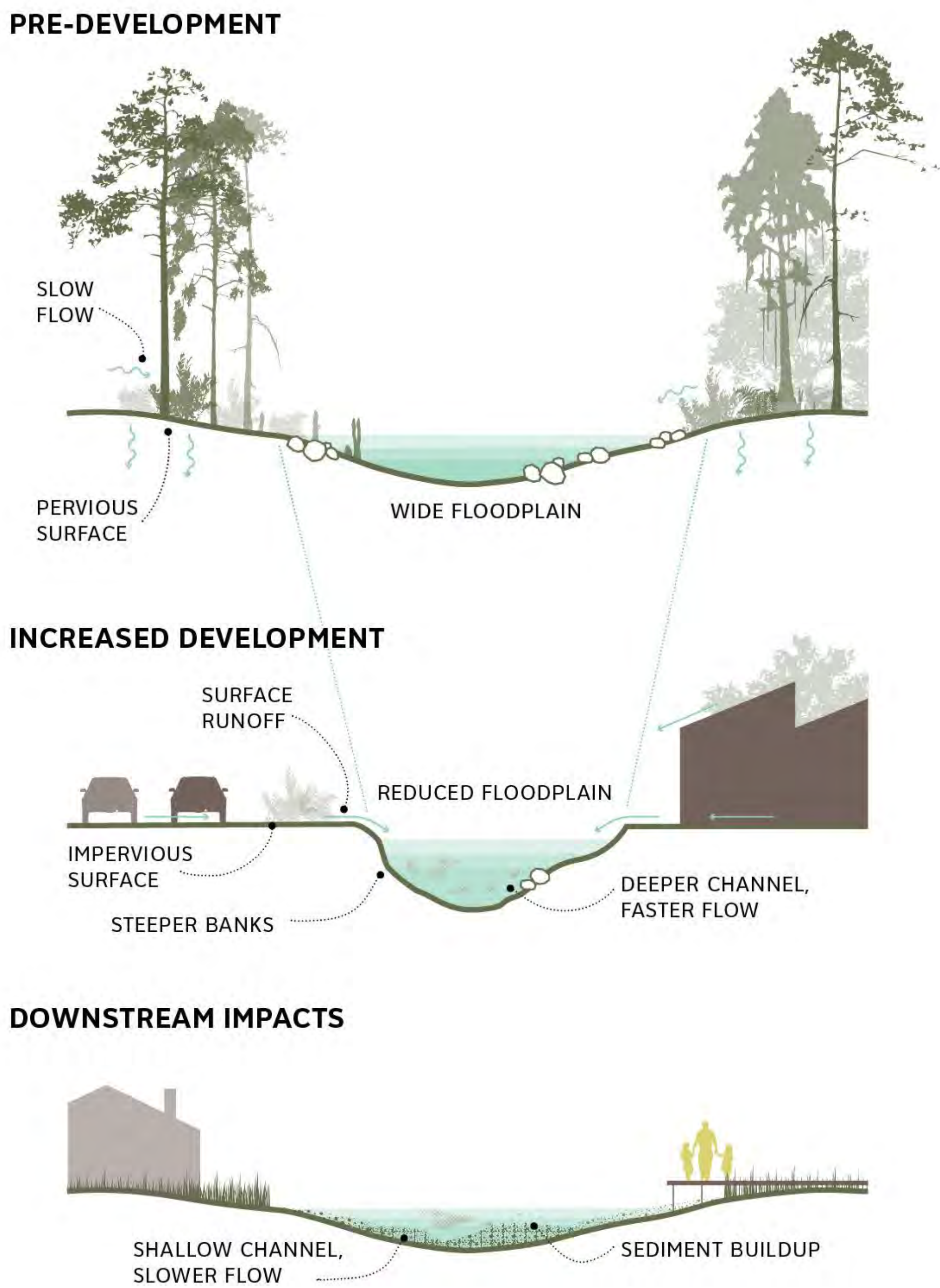


5.4.2.4. *Hydrologic and Geomorphological Alterations*

Over the past six decades, the Carpenter Creek and Bayou Texar watersheds have experienced alterations to their natural state degrading the biophysical integrity of segments of the drainage system, primarily due to the strains of increased urbanization (**Figure 5.4-8**). Numerous directly connected impervious surfaces throughout the watersheds create a flashy hydrograph and have led to bank erosion and subsequent downstream sedimentation. Sections of the drainage network are still responding and adjusting to the altered watersheds as erosion and sedimentation progress over time and position.

Additional stressors are not ubiquitous along the drainage network but collectively include hardening of the creek banks, development within the riparian zone, creek crossing fragmentation, and channel straightening, to name a few. These factors contribute to the hydrologic stress of native riparian wetland habitat, loss of instream fish habitat, increased colonization by non-native invasive species, reduced water quality, and reduced recreational values.

Figure 5.4-8 – Creek Geomorphic Alterations



Historically, it has been noted that Carpenter Creek used to be narrower with deep gravel bottoms and crystal-clear water. Today, however, the creek is observed to be comparatively wide and shallow, with a sandy and sedimented bottom and banks.

Development within Riparian Zone

Creeks belong to their valleys and watersheds and can enter into a complex series of adjustments in response to changes in forest cover and land use. Early logging efforts and subsequent land use conversions of the watersheds created the first hydromodifications and sediment load imbalances in the system. Land clearing along the bayou waterway reduced the natural riparian buffer with potential impacts on water quality and fisheries. Upstream erosion and increased sediment yields have contributed to the loss of recreation in the bayou, which once held annual ski competitions and other water sports. Coastal resiliency and inland riparian zones depend on vegetated buffers to mitigate and attenuate not only sea level rise, but also stabilize shorelines and creek banks through root systems.

Fragmentation

The headwaters of Carpenter Creek were considered rural in 1960. Today, the headwaters of the creek to the mouth of the bayou are fragmented by ten culverts and five bridges. Some of the culvert and bridge openings and outlets have been reinforced by inert materials such as riprap lining and boulder grade control structures to protect adjacent infrastructure.

The interstate (I-10) and south feeder (I-110) were built in the early 1970s and fragmented the upper tributaries from the main channel. The University of West Florida opened in 1970, which also contributed to the shift from a rural to suburban landscape through the mid-1980s. Other developments have included University Mall, the expansion of Davis Highway, the addition of West Florida Hospital, and numerous subdivisions that popped up to accommodate growth in the area. These developments have likely contributed to instream habitat discontinuities in the creek system.

The I-110 expansion, which lasted several years between 2004 and 2010, doubled the size of the road corridor. Although additional stormwater ponds were mandated and added due to the expansion, some were reportedly located in low lying flood-prone areas. It appears that some of the ponds (including City ponds) could benefit from some more routine maintenance or improvements.

Biogeomorphology

The headwaters of Carpenter Creek and parts of its main stem support a beaver population. Beaver activity diversifies the bottomland habitat and creates pockets of open water generally beneficial to fish, which leads to water quality improvements along the small creeks in the study area. Overly aggressive beaver control activities can leave their dams in disrepair and disrupt their functional benefits, even releasing legacy sediments downstream when they fail.

5.4.2.5. *Bayou Texar*

Bayou Texar is an estuarine waterbody with a surface area of approximately 390 acres. The bayou begins near the 12th Avenue Bridge and flows approximately 4 miles before emptying into Pensacola Bay near the Graffiti Bridge at the 17th Avenue Boat Ramp. The bayou is also spanned by the East Cervantes Street Bridge. The bayou generally runs in a north-south direction and is approximately 1,400 feet wide in the middle.

Bayou Texar is a freshwater receiving water body for groundwater discharge, freshwater from Carpenter Creek, and stormwater runoff from directly connected urban areas and numerous stormwater outfalls. Saltwater enters the bayou from Pensacola Bay. The bayou is commonly stratified, and the bottom salinity can range from 5 to 20 parts per thousand (ppt) (Mohrherr et al., 2005). Water movement is affected by diurnal tides with a normal range of 42cm (Stone and Morgan, 1990).

The bayou is classified as a Class II waterbody by the FDEP, with a designated use of recreation, propagation, and maintenance of health, a well-balanced population of fish and wildlife. (FDEP, 2012).

The Bayou Texar watershed has experienced large increases in commercial and residential development over the years. Two Superfund sites in the watershed are Agrico Chemical Company, which produced fertilizers, and Escambia Wood Treating Company, which previously released untreated wastewater into the bayou, along with commercial sites in the Palafox Industrial Corridor (Mohrherr et al., 2005). Properties on the edge of the bayou have lawns running to the edge of the water. These properties have insufficient native terrestrial and aquatic vegetation to provide a riparian buffer for the bayou which can reduce nonpoint source pollutants to the bayou. Bayou Texar is filling in with sediment and associated pollutants, and it had significant eutrophication in the 1970s (Mohrherr et al., 2005). The bayou has water quality, erosion, and habitat issues that will be evaluated in detail in subsequent tasks of this project.

"Bayou Texar also has a vibrant history; its lower reaches were used to 'hold oysters' until they were needed as oystermen returned to Pensacola from East Bay and upper Escambia Bay. To avoid saturating the market, oystermen had 'plots' where they held them until timing was best. Today, the lower bayou, below the Cervantes Street Bridge still has small oyster bars which some believe are the descendants from earlier days" (Albrecht).

5.4.3. Groundwater Resources

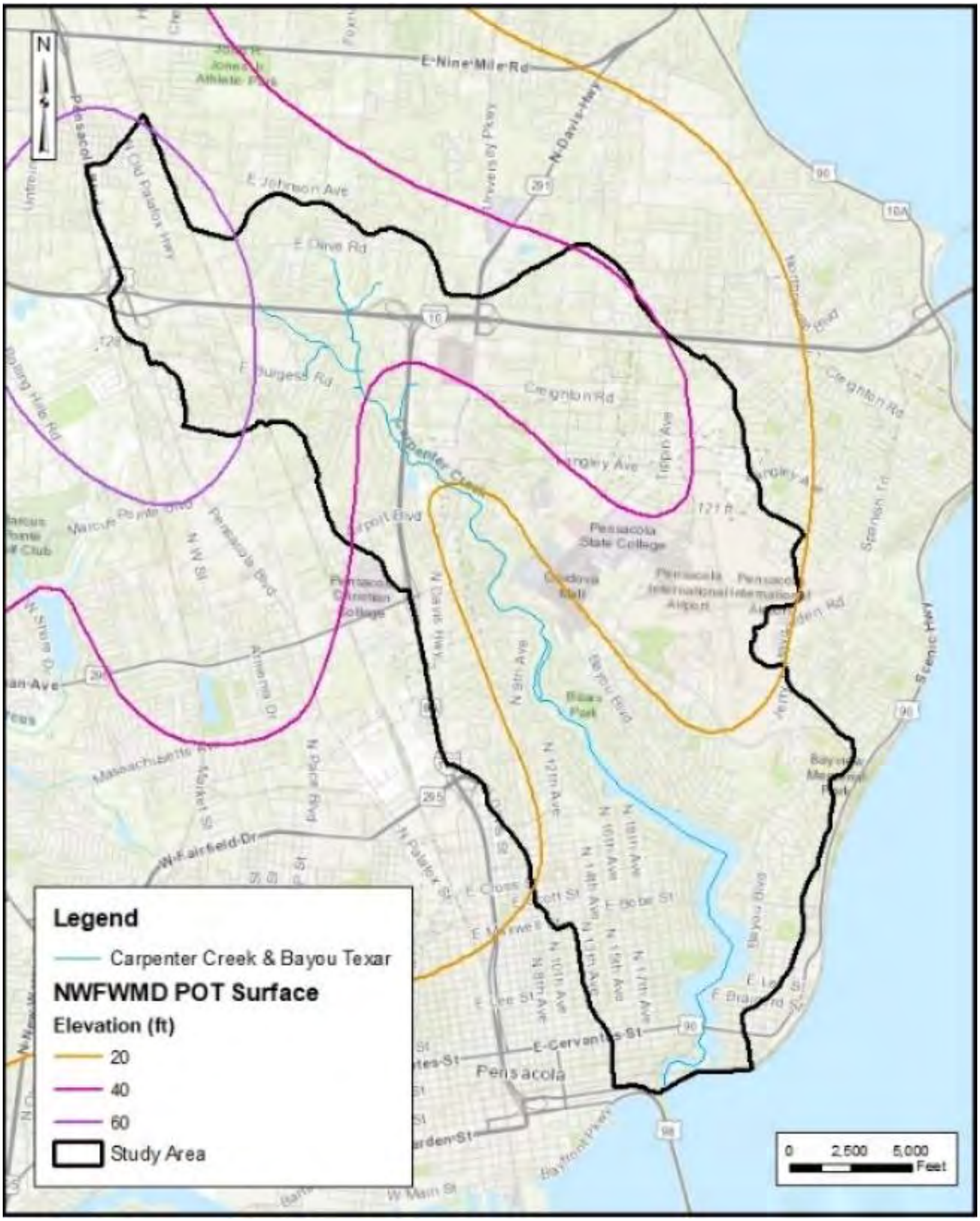
5.4.3.1. *Aquifer*

The western portion of the Florida panhandle contains the Sand and Gravel Aquifer. As a result, large washload continental rivers and gravel aquifer streams are unique to this region of Florida. The main groundwater resource underlaying Carpenter Creek (its tributaries) and Bayou Texar is the Sand and Gravel Aquifer which, along with the prominent Type A soils, create a condition that promotes connectivity of the land surface to groundwater and to surface waters in the region.

5.4.3.2. *Percolation and Potentiometric*

Groundwater in the southern half of Escambia County is derived from substantial local recharge. Groundwater flows radially away from the potentiometric high and naturally discharges to nearby bays, major bayous, and streams. Additional discharge occurs via pumping wells from the surrounding aquifer (Wellhead Protection Area Delineation in Southern Escambia County, Florida, 1997). The potentiometric (POT) groundwater surface map (NWFWMD 2000), shown below as **Figure 5.4-9,** shows that groundwater tends to travel from the northwest to the southeast, and from the outer edges of the study area in toward the creek and bayou. However, this map is now over 20 years old and should be updated due to climatic changes within the last couple of decades that could have shifted the potentiometric delineations. The Wood team recommends the County consider collecting additional groundwater level data and delineating updated potentiometric surfaces. A review of existing groundwater monitoring wells was conducted, and information regarding groundwater wells with respect to data gaps is provided in **Section 6**.

Figure 5.4-9 – Potentiometric (POT) Groundwater Surface Map (Source: NWFWMD 2000)



The Carpenter Creek/Bayou Texar watershed is comprised of several depressional areas with sandy soils likely to exhibit high rates and volumes of percolation. The majority of the watershed is characterized with Type A, well-drained soils. Furthermore, after a preliminary review of permit and plan data, several ponds were found to be constructed with sand chimneys meant to allow the underlying permeable soil layer to percolate to the aquifer and improve overall pond recovery performance. For these reasons, percolation links are to be included in the unincorporated areas of the model to account for these sand chimneys. In several instances, the sand chimneys take the place of a more conventional drop structure for discharge. For modeling purposes, percolation links are typically recommended in the presence of hydrologic soil group type A well-drained sandy soils, coupled with a relatively deep-water table (3 feet or deeper). Much of the watershed meets these standards. Therefore, percolation links will be specified for stormwater ponds of interest and other areas with high infiltration rates (as deemed necessary). The proposed methodology for the inclusion of percolation links is included in **Appendix C**.

5.4.3.3. *Well-head Protection Zones*

A delineation of wellhead protection areas (WHPAs) for the principle public supply wells in southern Escambia County was prepared by the NWFWMD in 1997 (WHPA Delineation in Southern Escambia County, Florida, 1997). WHPA delineations were performed for a total of 56 public supply wells including wells owned by Emerald Coast Utilities Authority (ECUA), U.S. Navy, Peoples Water Service, Farm Hill Utilities, Gonzalez Utilities, Cottage Hill Utilities, and Molino Utilities. Smaller public wells, along with wells with water use classifications other than public supply, were not delineated.

Carpenter Creek and Bayou Texar are generally well-drained watersheds, however, they do experience flood conditions due to localized drainage issues and rainfall and storm surge from large events. Per the County's Basin Study Guidelines and Specifications, a high-water mark database (HWMDB) is under continued development and is available from the County. But as of the date of this report, the County did not have the HWMDB available for use. However, other pertinent flood data was obtained and will be utilized during the WMP development, as described in the following sections.

5.4.4. Hydrologic and Hydraulic Modeling

As part of future WMP project phases, the Wood team will develop a comprehensive H&H stormwater model, using the Interconnected Channel and Pond Routing (ICPR) model software, Version 4, for the Carpenter Creek and Bayou Texar watersheds. The Wood team will develop the ICPR model for the unincorporated portion of the watersheds, building onto an existing model developed for the City.

In July of 2019, the City's Stormwater Master Plan (SWMP) was developed for the entire City extents. Per discussions with the County and City staff, Wood will use the City model as provided by the City. The City was not able to provide the project team with model results from the calibrated model to verify that the project team was starting with the calibrated model and associated inputs. There is inherent risk in using the model as-is without the ability to verify the starting model and results, however, the team determined the best course of action was to start with the model provided and develop the unincorporated area model onto the City's base model.

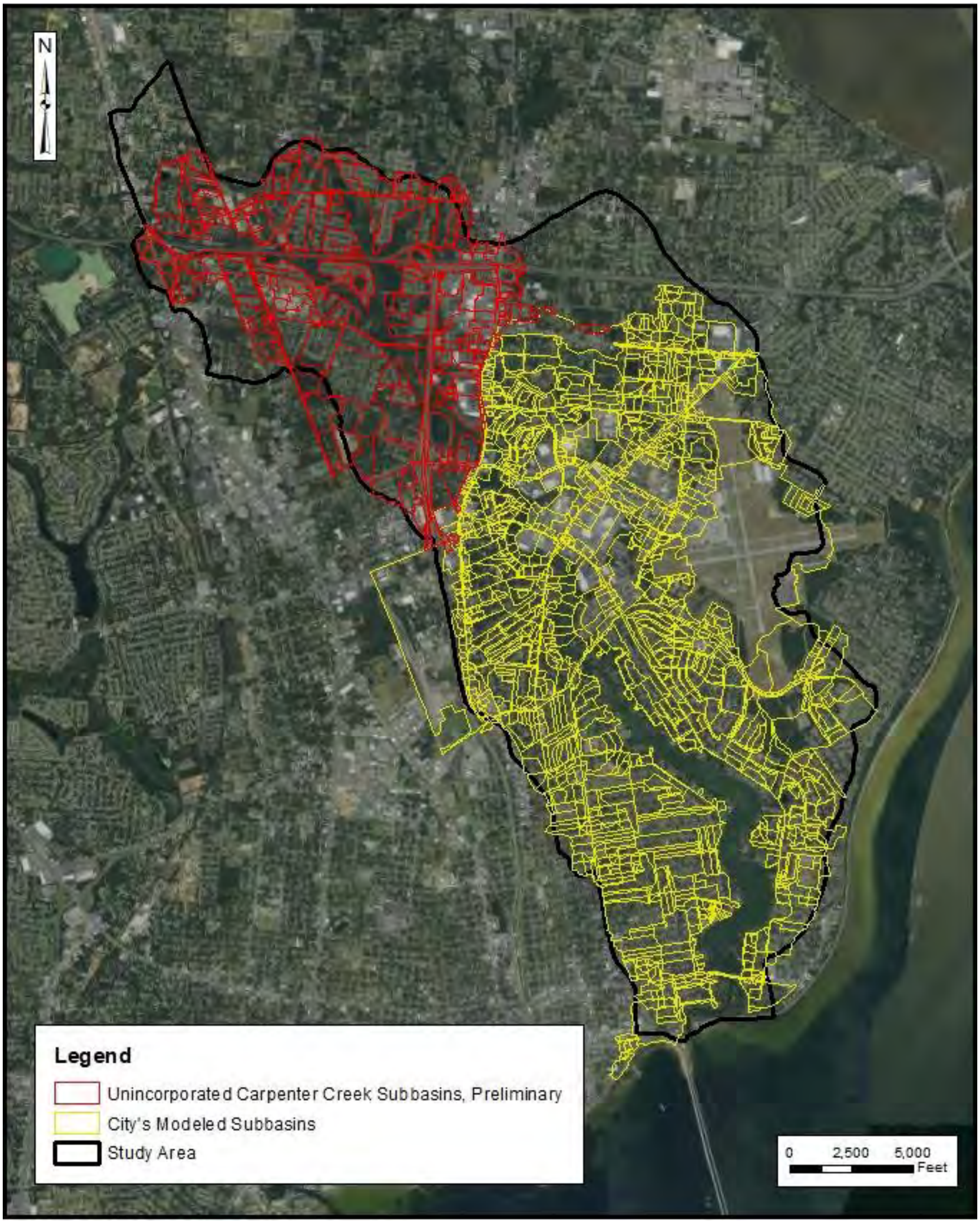
The Wood team's approach to the unincorporated area's model development, and incorporation of the City's modeled area, is provided as **Appendix C**.

5.4.4.1. *Initial Subbasin Delineations*

As part of the watershed characterization phase, initial subbasins were generated for the unincorporated portion of the study area. It should be noted that these subbasins are only preliminary and are subject to change during the subsequent modeling and assessment phases of the project.

Within the unincorporated areas, initial subbasins were delineated using a combination of GIS-based ArcHydro tools, followed by manual manipulation. The ArcHydro tools generated rough subbasin delineations based on the underlying 2017 DEM and a user-specified minimum drainage area. Although these tools are effective in generating very rough subbasins, manual manipulation is needed to further define and edit the subbasins, especially in urban environments where infrastructure is prevalent. Manual manipulation of subbasins was conducted based on information from the 2017 DEM, recent aerial imagery, and drainage infrastructure patterns presented in information sources that included ERPs, County residential and roadway plan sets, FDOT plan sets, and from field reconnaissance efforts. Generally, the subbasins were delineated at a regional scale, as shown in **Figure 5.4-10** below.

Figure 5.4-10 – Initial Subbasin Delineations

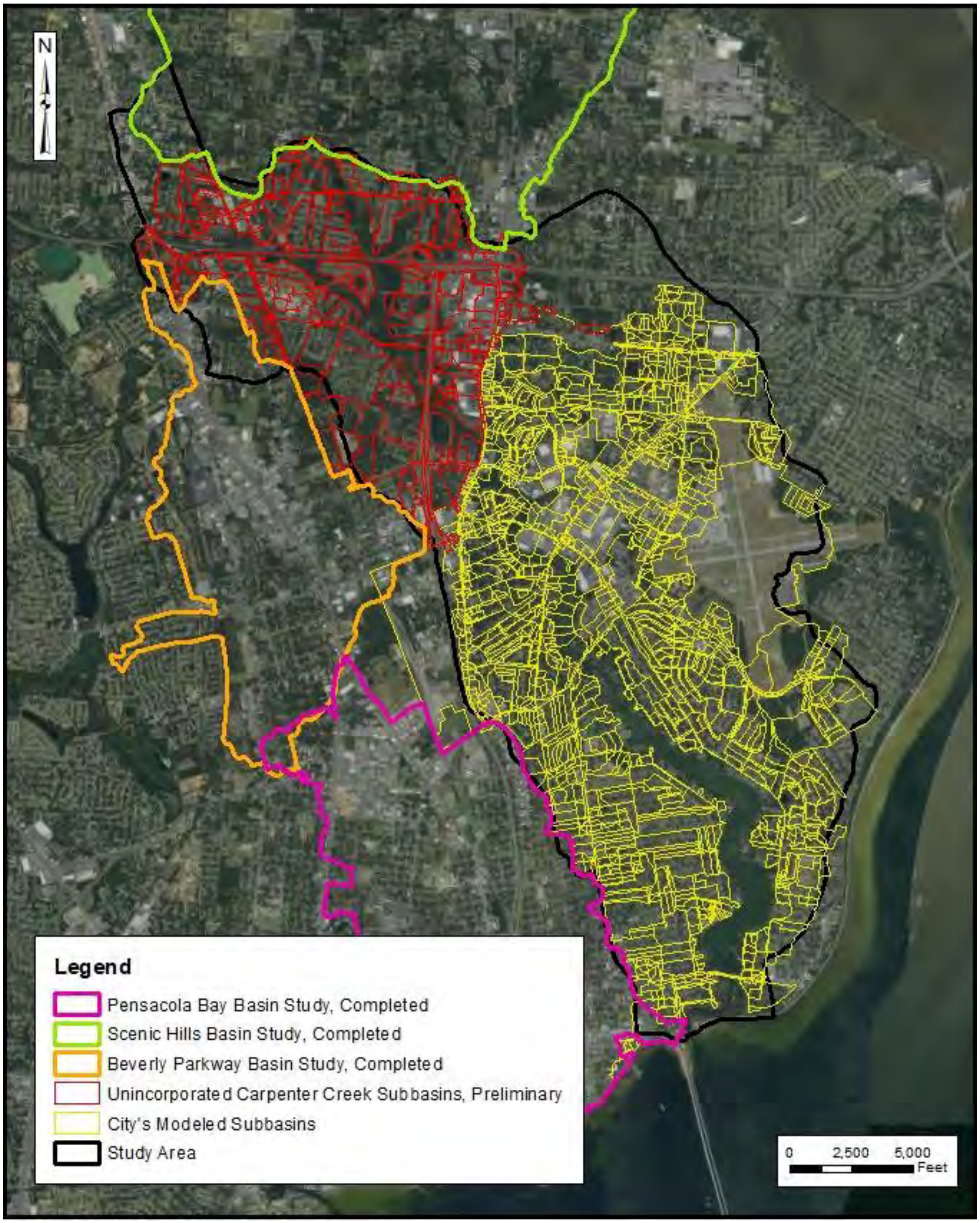


As part of the watershed boundary refinement, the edges of the City's existing model subbasins were reviewed for accuracy, from a hydrologic and hydraulic standpoint. Utilizing the 2017 DEM, in conjunction with the nodes and links included in the City's model, it was determined that the subbasins included in the City model's Existing Watersheds 04, 05, 06, and 09 scenarios are generally appropriate for inclusion within the Carpenter Creek and Bayou Texar watershed boundary. In summary, a total of 1,765 subbasins from the City's existing model scenarios are preliminarily proposed for inclusion in the Carpenter Creek/Bayou Texar model. These 1,765 subbasins range in size from less than an acre to approximately 655 acres, with an average acreage of 4.3.

Also, the County provided information for completed Basin Studies adjacent to the Carpenter Creek and Bayou Texar watersheds. The adjacent Basin Studies are Beverly Parkway and Pensacola Bay to the west, Escambia Bay to the east, and Scenic Hills to the north. To date, the Escambia Bay Basin does not have a completed Basin Study. The Beverly Parkway, Pensacola Bay, and Scenic Hills Basins were completed in 2003, 2007, and 1994 respectively.

The County provided GIS subbasins for the Beverly Parkway and Pensacola Bay Basins, and in pdf format for the Scenic Hills Basin. To the highest practical extent, the edges of the subbasins within the unincorporated portion of the study areas were edge-matched with the subbasins provided as part of the completed County Basin Studies, as shown in **Figure 5.4-11,** below. However, based on the 2017 LiDAR data and drainage patterns observed under this study, variations (gaps and overlaps) do exist in some cases between the subbasins in the unincorporated portion of the study area and the subbasins previously completed under County Basin Studies. Also, during the subsequent modeling task, the edges of the watershed along these adjoining Basin edges are subject to change based upon closer examination of model parameters.

Figure 5.4-11 – Initial Subbasin Delineations & Adjacent Completed Basin Study Boundaries



5.4.5. Historical Storm Events on Record

According to NOAA, a 100-year, 24-hour storm event for this area is defined as 16 inches of rain in 24 hours, meaning there's a 1% chance each year that 16 inches will occur in a 24-hour period. The Pensacola area has had four recorded storm events since 1934 that produced intense 24-hour rainfalls (Escambia County, 2015). The rainfall totals for these events are shown in **Table 5.4-1** below.

Table 5.4-1 – Historical Rainfall Events

Year	24-hour Rainfall (inches)
1934	15.29
2005	13.96
2012	13.22
2014	20
2020	20

Heavy Rain Event March 1 through April 30, 2005

The Pensacola area received 12.93 inches of rain for the month of March 2005. This was the sixth wettest March since records began in 1880. The wettest March occurred in 1948 when 16.53 inches of rain fell.

The rainfall total for April 2005 at the Pensacola Regional Airport (KPNS) was 24.46 inches. This was the wettest month ever recorded in Pensacola since records began in 1880. Prior to the 2005 event, the April rainfall record was 17.03 inches in 1937 and the wettest month was in August 1935, with a recorded rainfall of 21.43 inches.

April 2014 Storm

Escambia County established a Stormwater Advisory Team (SWAT) after heavy rains and flooding occurred in April 2014. The SWAT County-Wide Stormwater Recommendation Report notes that rainfall exceeded 20 inches on the evening of April 29, 2014. This storm was classified by the National Weather Service as a record 24-hour storm event for Pensacola. The flooding resulting from the storm affected all types of infrastructure. Most privately-owned infrastructure, typically being designed for a 25-yr storm, was quickly overwhelmed, and began discharging the runoff with little to no attenuation (decrease) of the peak intensity (Escambia County, 2015).

HDR Engineering, Inc. (HDR) developed a storm event recreation for this April 2014 event, dated January 27, 2015. HDR completed a radar-based assessment of the period of heavy rainfall associated with this storm, where they analyzed archived radar data for the event from NOAA but also reviewed the gauged data for verification and calibration purposes. As part of this study, HDR developed electronic files for hydrologic input over the region.

Also, the County provided GIS layers in reference to the April 2014 storm event, as summarized below and shown in **Figure 5.4-12**:

Public_Works_Damage_Assess_April2014_Flood

- 75 point locations are within the study area (67 locations are located within the unincorporated area, and 8 locations are within City limits).
- Data fields contain information related to flood-related observations due to the April 2014 storm. In some instances, observed flood depths were recorded. However, for most locations the observations were only qualitative in nature.

BID_Damage_Assess_April2014_Flood

- 100 point locations are within the study area (All locations are located within the unincorporated area).
- Data fields contain information related to flood-related observations due to the April 2014 storm, developed for the County's Building Inspection Department. In most instances, a flood depth was recorded, although in some cases the data was qualitative only.

Tropical Storm Cindy, June 16, 2017

Tropical storm Cindy made landfall well to the west of Escambia County, however significant rainfall and wind impacts were felt within the study area. Pensacola International Airport (KPNS) recorded rainfall of 8.28 inches in a 48-hour period (June 20 to June 23). Peak storm surge inundation was generally 2-3 feet based on official tide gauges across Escambia County. At least one tornado was spawned in Escambia County. NOAA did not record the location.

Hurricane Nate, October 7-8, 2017

Hurricane Nate made landfall near Biloxi, Mississippi. As a result, Escambia County had up to 3 feet of storm surge impacts to Pensacola Bay. It is not clear if the storm surge impacted Bayou Texar, but it is important to note that the received water body was impacted, nonetheless.

Tropical Storm Gordon, September 4-5, 2018

Tropical Storm Gordon's angle of approach showered much of the Gulf Coast, from Alabama to northwest Florida, with heavy rainfall. Peak storm surge in Pensacola Bay reached 2.24 feet. Pensacola International Airport (KPNS) recorded 11.67 inches in 48 hours (September 4 to September 6). University of Florida scientists Goodhart and Deitch collected stage and flow data for this storm event. The stage data is noted by the scientists as being more reliable than the flow data collected from this storm.

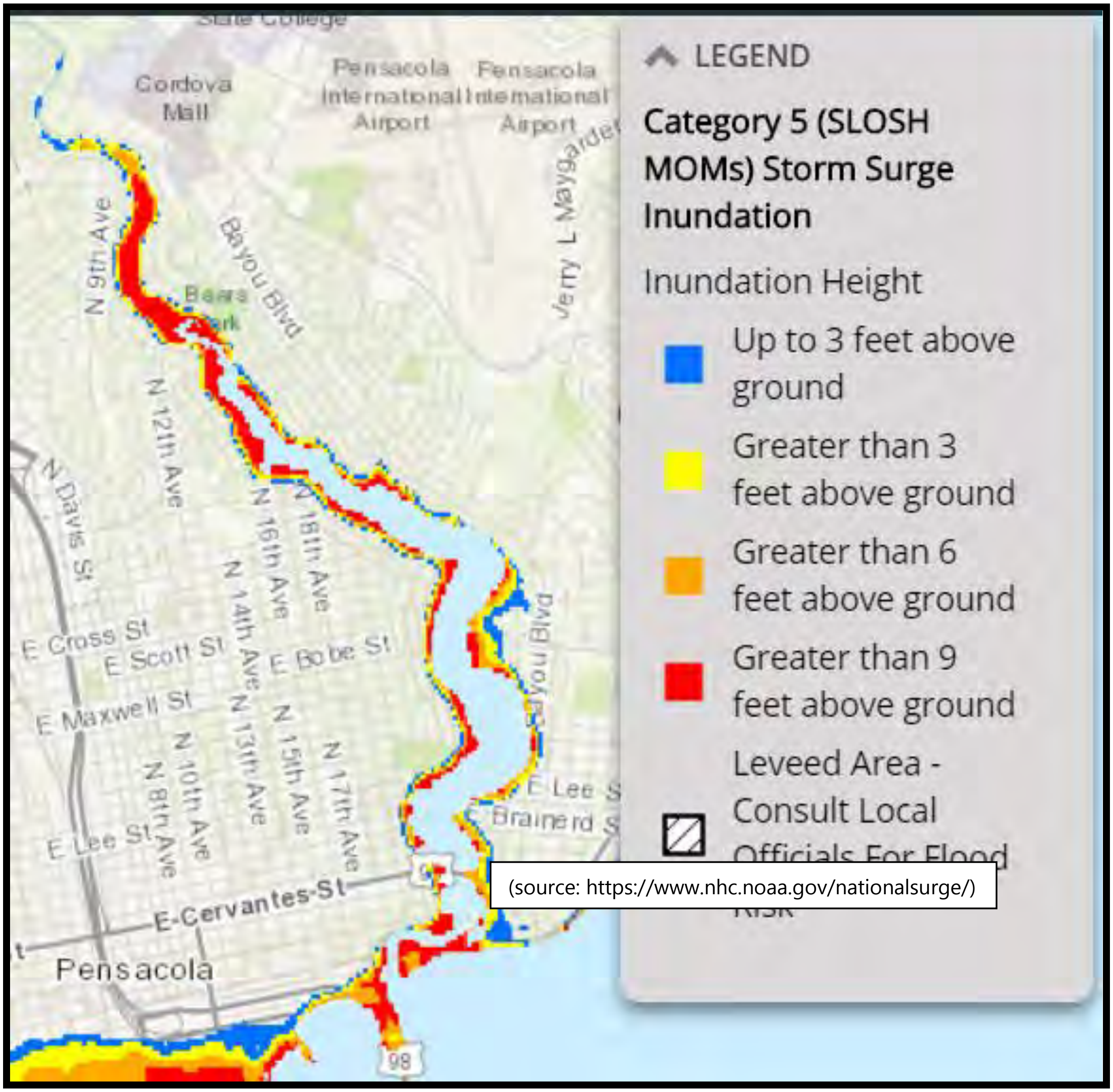
Hurricane Sally, September 16, 2020

Hurricane Sally made landfall early on the morning of September 16, 2020 across Gulf Shores, Alabama. The area between Mobile, Alabama, and Pensacola, Florida took the brunt of the storm with widespread damage, storm surge flooding, and over 20 inches of rainfall. In an effort to obtain documentation related to high-water marks and storm-related impacts within the watershed, the Wood Team conducted field reconnaissance beginning on September 29, 2020, with additional reconnaissance conducted on October 6th and 7th, 2020. Field reconnaissance findings were documented through photographs and field notes captured along key creek and bayou roadway crossings and other key areas. Although much of the data collected during the post-storm field reconnaissance was qualitative in nature, high-water marks recorded in certain locations provide the opportunity to obtain quantitative elevations for use in the H&H model to be developed under a subsequent task.

5.4.6. Storm Surge

Although Bayou Texar and Carpenter Creek are protected by barrier islands, there is still a high chance of elevated storm surge occurring in the bayou and along the creek. Storm surge is produced by water being pushed towards the shore by the force of winds during a storm event. NOAA has developed models predicting storm surge for the entire United States as they related to Category 1 through Category 5 hurricanes. **Figure 5.4-12**, taken from NOAA's website, indicates that for a Category 5 hurricane, storm surge may reach 9 feet above the ground and have impacts as far upstream as Bayou Boulevard.

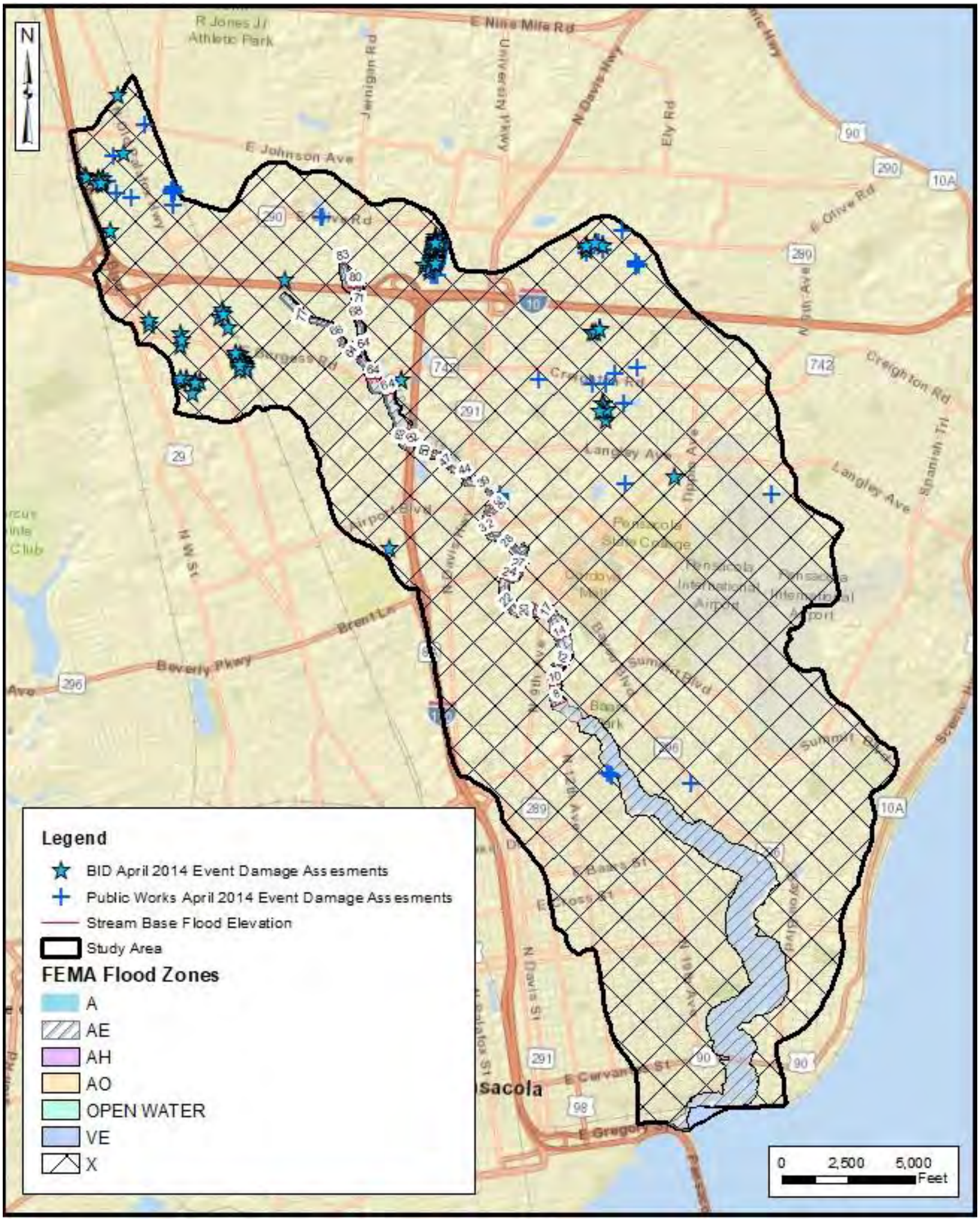
Figure 5.4-12 – NOAA Category 5 Hurricane Storm Surge Projection



5.4.7. FEMA Flood Insurance Study

The Federal Emergency Management Agency (FEMA) published a Flood Insurance Study (FIS) in September 2006 to investigate the existence and severity of flood hazards for Escambia County, which includes the Carpenter Creek and Bayou Texar watersheds. The FEMA Flood Zones are shown in **Figure 5.4-13.** The project team understands that the FEMA flood maps are currently being updated. The project team will evaluate the updated maps for concurrence flood inundation areas during the model development in **Task 3** and again as a reference for project recommendations during **Task 4**.

Figure 5.4-13 – FEMA Floodplains & April 2014 Damage Locations



Note: April 2014 damage assessment locations provided by County

5.5. Existing Hydraulic Inventory

Data Sources

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
City Stormwater Treatment Units	City water quality treatment units planned for City outfalls	January 2016 map	Consult w/City staff to discuss status of these improvements	Yes – status from City
Completed County Basin Studies for Adjacent Watersheds	GIS files (basins, links, nodes) provided for Pensacola Bay and Beverly Parkway Basins	Pensacola Bay Basin Study completed 2007, Beverly Parkway Basin Study completed 2003, Scenic Hills Basin Study completed 1994	Escambia Bay Basin Study not complete. Scenic Hills Basin Study – no GIS data (basins, links, nodes) provided	No
County Stormwater Inventory Database	GIS database containing point and line features for structures and conduits in County	No Data Available	County GIS department noted that inventory may not be complete, and vertical datum couldn't be verified.	Yes – field recon & survey will need to be collected for modeled structures/cross-sections
County Development Plans	Numerous plans for developments within County	Varies	Consult w/County staff, as needed, to resolve questions regarding planned vs. constructed developments	Yes – consult with County.

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
Environmental Resource Permits (ERPs)	ERP plans collected from the NWFWMD and the FDEP for developments in watersheds	1995-2017	NA	No
Florida Department of Transportation (FDOT) plans	Plans requested and collected for state roads within watersheds	Varies	Awaiting additional information from specific state road segments	Yes – Data request pending
City of Pensacola Stormwater Master Plan (SWMP) and related H&H model	Study to address the flooding and environmental impacts of stormwater within the City's limits	July 2019	NA, see Appendix C	No

As part of the desktop reconnaissance, several data sources were collected and analyzed for information related to the existing stormwater infrastructure in the watersheds. The data sources included County GIS databases, County plans, Environmental Resource Permits (ERPs), FDOT plans, and the City's SWMP, completed in July 2019.

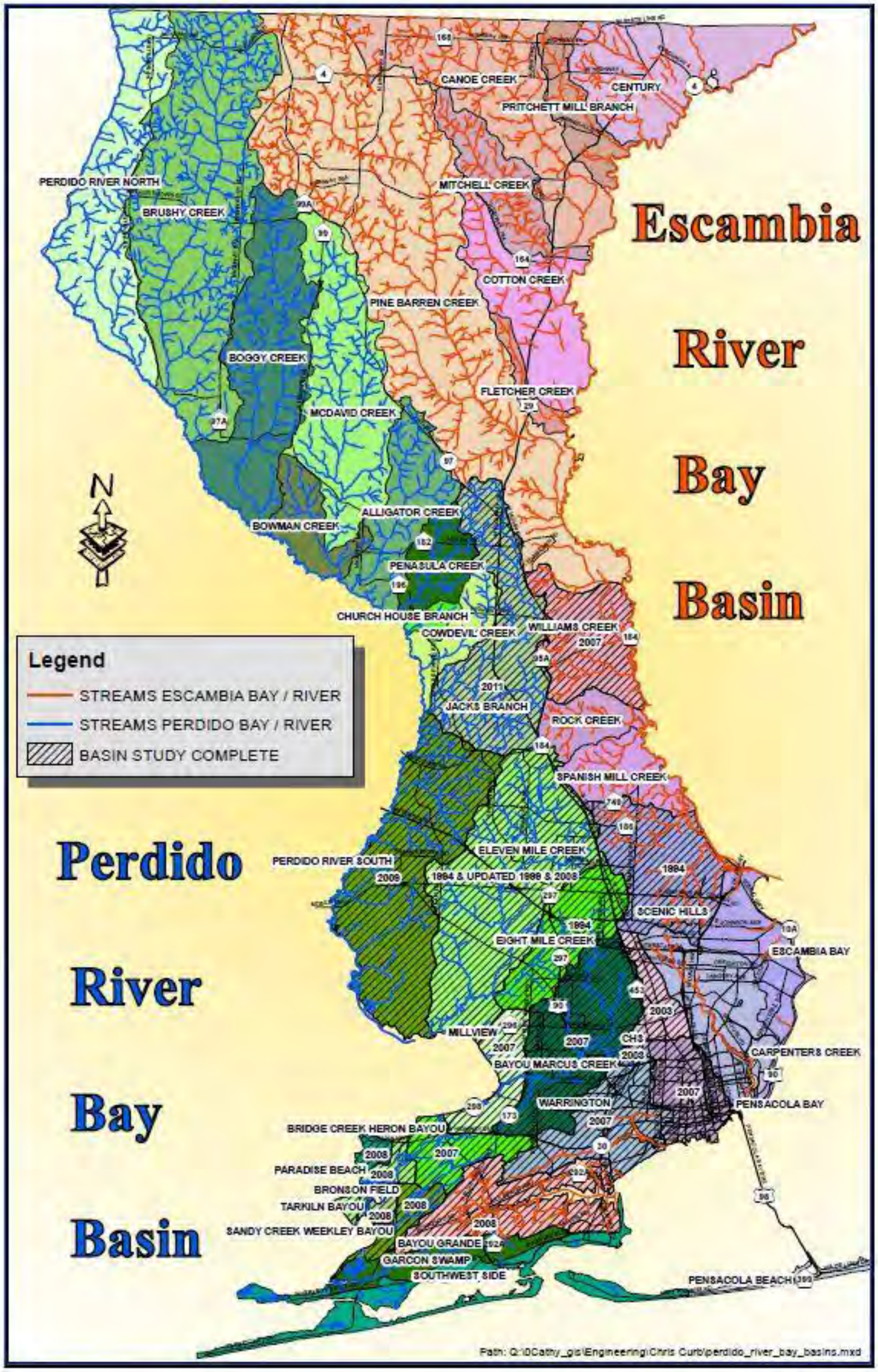
5.5.1. County Data

In November 2018, the County provided numerous GIS files, including GIS feature classes for storm structures and conduits within the County limits. The GIS files contained 454 spatial point features for various manholes, grates, and other storm structures, and 190 line features for enclosed gravity and open channel conduits. The feature classes have various attribute columns for data related to material, elevations, inverts, height, width, etc. However, through subsequent discussions with the County GIS staff, it was determined that the spatial locations and the data associated with the features (elevations, dimensions, material, etc.) may not be accurate or completely reliable for modeling purposes. Although many of the features have a recorded elevation or invert, the vertical datum of the elevations could not be verified by County staff. Therefore, the County's GIS storm feature classes are to be used for reference and general information purposes, only.

In addition to the County GIS files, the County also provided multiple plan sets for residential developments built and/or planned for construction within the unincorporated portion of the watershed. These developments include Bridgewood, Brook Meadow, Cascade Hills, Crystal Wells, Green Acres, Hillburn Grove, Home Depot Park, Kimberly Woods, Lost Creek, Mazurek, Norwood Subdivision, Oakfield Acres, Oak Forest, Olive Road, Robins Ridge, Sears Boulevard, Silverton, Twin Lakes Villas, Whitmire Sabra, and Willow Tree Acres. When applicable, hydraulic inventory from these plans will be used for the development of the hydraulic features to be incorporated in the H&H model. A complete inventory of the plans sets provided by the County is included in **Appendix D**.

Finally, the County provided information for completed Basin Studies adjacent to the Carpenter Creek and Bayou Texar watersheds. As shown in **Figure 5.5-1** below, the adjacent Basin Studies are Beverly Parkway and Pensacola Bay to the west, Escambia Bay to the east, and Scenic Hills to the north. To date, the Escambia Bay Basin does not have a completed Basin Study. The Beverly Parkway, Pensacola Bay, and Scenic Hills Basins were completed in 2003, 2007, and 1994, respectively. The County provided model and GIS files for the completed Basin Studies. Hydraulic features/model links from these completed studies will be utilized in the development of the hydraulic features to be incorporated in the H&H model for the Carpenter Creek and Bayou Texar WMP, to the highest practical extent.

Figure 5.5-1 – Adjacent County Basin Studies



wood. IMPACT Campaigns WETLAND SCIENCES INCORPORATED SCAPE

5.5.2. Environmental Resource Permits (ERPs)

For the unincorporated portion of the study area, ERPs were collected from the NWFWMD and the FDEP, and were assessed to determine if they contained viable information pertaining to stormwater infrastructure and facilities. There were no ERPs provided by the NWFWMD that were not included in the FDEP-provided ERPs. In total, 210 ERPs were identified within the unincorporated portion of the study area. After assessment of those 210 identified ERPs, 196 were found to have information potentially viable for model development. Through further assessment of the 196 selected plans, it was found that 83 ERPs contained legible information that was pertinent to stormwater infrastructure and facilities that may be useful for future model development in the unincorporated portion of the study area.

Appendix D contains a summary of the ERPs collected, assessed, and utilized during the Watershed Evaluation phase of the project.

5.5.3. FDOT Plans

Additional information has been solicited and provided from the FDOT. On April 15, 2020, a phone meeting took place and included staff from the FDOT, the County, and the Wood project team. That meeting initiated communication and coordination between all parties and developed a communication plan for future discussions as the WMP progresses.

During this meeting, the FDOT discussed ongoing/planned projects, from their 5-year work plan, that were noted to be located within the study area and deemed relevant to the WMP, described below:

- State Road (SR) 742 (Burgess Road) from SR 95 (U.S. Hwy 29) to Hilburn Road: design is complete and has been shelved until construction is funded. Construction funding is not yet programmed in the FDOT 5-year workplan.
- Lanier Drive Sidewalk: this is a Safe Routes to School Project applied for by the County and added into the FDOT work plan in October 2018. The project is funded for design in fiscal year 2023 and construction in fiscal year 2024.
- 9th Avenue bridge: the bridge is fully designed, and the construction began in early 2021.

Due to the FDOT projects' timeframes described above, as of the date of this report it is anticipated that only the 9th Avenue bridge project will be complete enough to be included in the H&H model to be developed during the subsequent modeling task of the project.

In addition to the ongoing and future projects mentioned above, the Wood team collected various plan sets for existing state roads within the unincorporated portion of the study area. **Appendix D** provides a list of the plans provided by the FDOT, and notes which plans were utilized for the purpose of developing the stormwater infrastructure relevant to the future modeling task.

It should be noted that, at the time of this report, the Wood team is continuing to solicit information from the FDOT that is relevant to the model development for the study area. Additional data received from the FDOT will potentially reduce the degree of required surveying efforts necessary for model development. Additional information requests include obtaining as-built drainage information for stormwater ponds and structures along the interstates and state roads that fall within the study area, as well as gage data that could be useful during model development. The remaining data gaps are described in further detail in **Section 6.0.**

5.5.4. City's Stormwater Master Plan Model

As part of the City of Pensacola's Stormwater Master Plan, an ICPR4 model was completed for the City. This model will be utilized as the basis of the development of a complete model for the entire Carpenter Creek and Bayou Texar watersheds. A total of 2,413 links within the City's model Existing Watershed Scenarios 04, 05, 06, and 09, are preliminarily proposed for inclusion in the entire watershed model (**Table 5.5-1**).

Table 5.5-1 – Summary of City of Pensacola H&H Model Links to be Utilized in WMP

Existing City Watershed ID	City Model Link Count per Type				
	Pipe	Weir	Drop Structure	Channel	Rating Curve
04	152	6	3	6	
05	456	8	8	7	1
06	1524	69	70	55	2
09	281	6	1	6	1
TOTALS	**2413**	**89**	**82**	**74**	**4**

Further information regarding the proposed methodology for the model development is provided in **Appendix C**.

5.5.5. Field Reconnaissance

The Wood team conducted field reconnaissance during the months of September and October of 2020 for the purpose of retrieving information related to drainage connectivity and drainage patterns, which is essential for the future model development. Generally, field reconnaissance efforts were targeted within the unincorporated portion of the study area, and toward the collection of data that could not be obtained through the desktop reconnaissance efforts or provided within the available ERPs, FDOT plans, or County development plans.

During field reconnaissance, spatial GPS points were collected to document locations with specific notes, structures, features, and//or drainage patterns. The collected point types include control structures, manholes, concrete flumes, bridges, weirs, culvert endpoints, curb inlets, grate inlets, pond features, sand chimneys, and general note locations. When accessible, and only when suspected to be significant for modeling purposes, specific notes were recorded for the features, which included information related to size/dimensions, material, condition, etc.

Vertical data (i.e. pipe/weir invert elevations) were not collected during field reconnaissance. If deemed necessary for modeling purposes, the associated vertical data for the features will be obtained from information from plans or will be acquired during future surveying efforts.

For many of the features observed during field reconnaissance, field photographs were also taken to document the observations. In general, field photographs were taken for the structures/features that could be relevant for future model development. In some instances, notes relating to structure condition were included. Specifically, condition notes were included for structures that were observed to be in poor or failing condition.

5.5.6. GIS Database Development

Information from the datasets described above will be used to develop a project database in GIS to house the features and data for pertinent stormwater infrastructure in the watersheds.

Generally, the stormwater features input into the GIS database will be of "regional scale", or those features that may be necessary for the purpose of developing a regional scale model under the subsequent project tasks. The GIS database developed is not intended to serve as an all-inclusive stormwater inventory database, as it is not intended to house all features, especially those that are considered to serve a more "local" purpose (driveway culverts, for example, and pipes less than 24-inch diameter). The GIS database houses the information for the stormwater features that will eventually be utilized during the subsequent modeling task.

5.6. Wetlands

Data Sources

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
USFWS	National Wetlands Inventory	December 4, 2019	Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data as source used to detect wetlands. The accuracy of image interpretation depends of the quality of the imagery, the experience of the image analysts, the amount of quality of collateral data and the amount of groundtruth verification work conducted.	No
NWFWMD LiDAR – Retrieved from NOAA	LiDAR Data	May 1, 2020	None	No

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
United States Department of Agriculture Natural Resource Conservation Service	Soil Survey Data	June 15, 2020	None	No
Florida Department of Environmental Protection OCULUS	Historic ERP Permits	Historic Permits issued 20 years ago to present	ERP permits were reviewed to identify wetland surveys for large development tracts. Data limited to only those recent developments that triggered ERP permit	No
Northwest Florida Water Management District E-Permitting Portal	Historic ERP Permits	October 1, 2013- Present. Access May 1, 2020	ERP permits were reviewed to identify wetland surveys for large development tracts. Data limited to only those recent developments that triggered ERP permit.	No
USGS National Hydrography	Represents the water drainage network of the United Sttes with features such as rivers, streams, canals, lakes, ponds, coastline, dams, and streamgages	June 2020	Data are designed to be used in general mapping and in the analysis of surface-water systems via GIS.	No

The project team utilized a combination of desktop resources and ground-truthing to identify wetland resources within the study area. Desktop resources employed during this effort included high-resolution aerial photography, United Stated Fish & Wildlife Service (USFWS) National Wetlands Inventory (NWI) data (**Figure 5.6-1**), NWFWMD LiDAR data (NOAA, 2020), United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Soil Survey data (Staff S. S., 2020), and historical ERPs issued either by the NWFWMD or the FDEP (FDEP, 2020). Evaluation of desktop resources was facilitated by Autodesk AutoCAD Map 3D, ESRI ArcGIS Pro, Trimble GPS Pathfinder Office, and Trimble TerraSync Professional software.


Photo Credit: Darryl Boudreau

Each data source was interpreted by the Wood team's wetland scientists to identify wetland resources within the study area. Portions of this interpreted wetland boundary line were reviewed in the field or "ground-truthed" to verify that the interpreted wetland boundary line accurately represented in-situ conditions. More specifically, the team evaluated field conditions at various locations along the interpreted wetland boundary to verify that areas mapped as wetlands met the delineation criteria set forth in the Florida Wetland Delineation Manual (Gilbert, Tobe, Cantrell, Sweeley, & Cooper, 1995), Florida Administrative Code (F.A.C.) 62-340, and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual; Atlantic and Gulf Coastal Plain Region, Version 2.0 (Engineers, 2008). Any differences between the desktop-delineated wetland boundary line and those observed in the field were noted using a Trimble Geo7x handheld high-accuracy Global Navigation Satellite System (GNSS) receiver. This data was used to refine the interpreted wetland boundary line.

The project team identified approximately 281.4 acres of palustrine wetlands, freshwater clastic lakes, and emergent tidal marsh resources within the study area (**Figure 5.6-2**). This does not include any tidally influenced surface waters, shallow mud flats, or tidally influenced submersed resources. Individual wetland ecological communities identified in the study area are described in the following sections of this report.

Figure 5.6-1 – National Wetlands Inventory Map

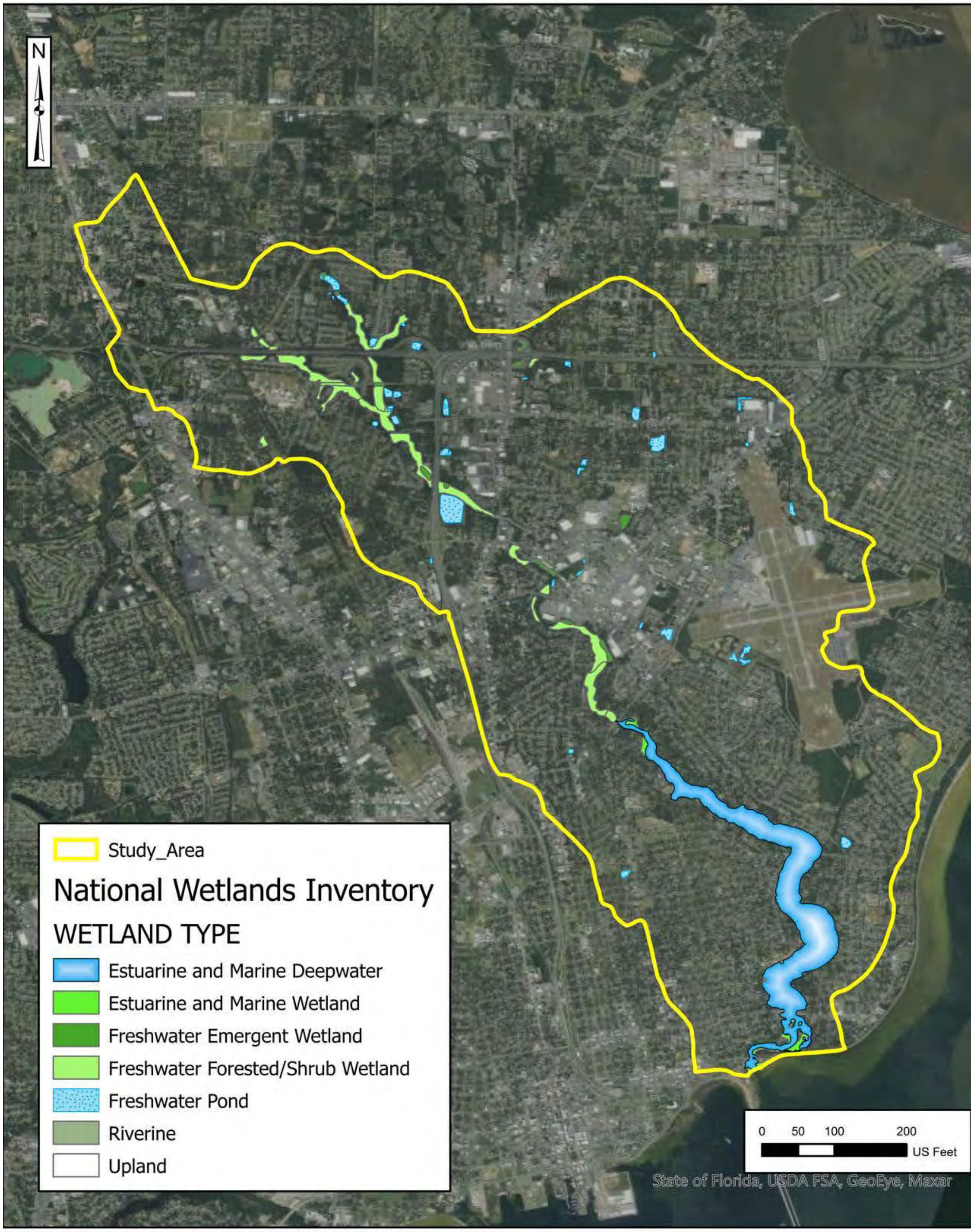
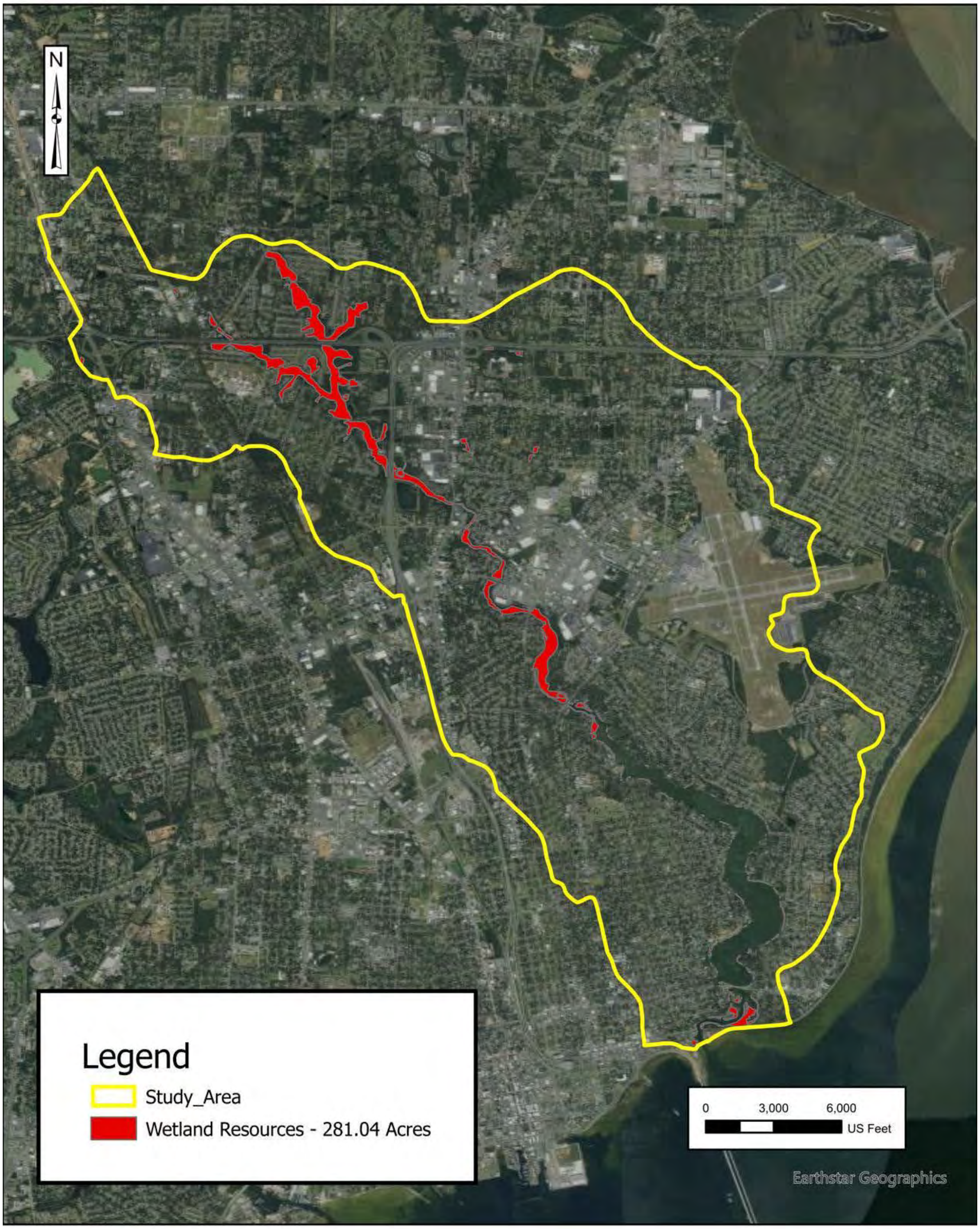


Figure 5.6-2 – Interpreted Wetland Boundary Map



5.7. Biological Resources

Data Sources

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
EPA	GIS shapefile depicting ecoregions	Unknown	None	No
FDEP Open Data Portal	Northwest Florida Water Management District Land Use	2015-2016/May 2020	None	No

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
Florida Natural Areas Inventory	Guide to Natural Communities of Florida	2010/May 2020	Provides written description of ecological communities in Florida. Does not provide specific locational data	No
USFWS Information for Planning and Consultation	Listed species and critical habitat	April 2020	No specific occurrence data	No
Florida Department of Agriculture and Consumer Services	List of plants on the Endangered and Commercially Exploited Plant List	01/08/20/May 2020	No specific occurrence data	No
Florida Fish and Wildlife Conservation Commission	Florida's Endangered and Threatened Species	2012/May 2020	No specific occurrence data	No
Florida Fish and Wildlife Conservation Commission	Florida's Imperiled Species Management Plan	2016/May 2020	None	No
Florida Department of Agriculture and Consumer Services	Notes on Florida's Endangered and Threatened Plants	2010/May 2020	None	No
Florida Exotic Pest Plant Council (NKA Florida Invasive Species Council)	2019 List of Invasive Plant Species	2020/May 2020	None	No
US Department of Agricultural	State of Florida Noxious Weed List	May 2020	None	No
Department of Agriculture and Consumer Services	Prohibited Aquatic Plants	06/30/08/May 2020	None	No
Florida Fish and Wildlife Conservation Commission	Non-Native Species List	May 2020	None	No

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
University of Georgia Center for Invasive Species and Ecosystem Health	EDD MapS specific invasive species occurrence data	May 2020	Based on user input.	No

5.7.1. Existing Ecological Communities

The utilization of a consistently applied community classification system allows a generalized conceptualization of existing communities for research and planning purposes. At the broader scale, the study area falls within EPA level III Southern Coastal Plain (**Figure 5.7-1**) and level IV Gulf Coast Flatwoods ecoregions (**Figure 5.7-2**). The Florida Natural Areas Inventory (FNAI) (FNAI, 2010) provides further specificity regarding ecological communities within the study area, and FNAI descriptions were used to define and map the study area's ecological communities **Figure 5.7-3**).

The project team used current and historical aerial photography, NRCS soil survey maps, and field ground-truthing to determine ecological community limits. A summary of observed vegetative communities is included in **Table 5.7-1**.

Table 5.7-1 – Summary of ecological communities delineated within the study area

FNAI Community	Wetland	Acreage	% of Study Area
Upland Hardwood Forest	No	670.17	5.55%
Coastal Strand	No	1.42	0.01%
Coastal Grassland	No	4.01	0.03%
Salt Marsh	Yes	29.45	0.24%
Clastic Lake	Yes	12.46	0.10%
Baygall	Yes	221.3	1.83%
Shrub Bog	Yes	3.38	0.03%
Freshwater Marsh	Yes	8.45	0.07%
Dome Swamp	Yes	0.95	0.01%
	Total Wetland Communities	275.99	2.28%
	Total Upland Communities	675.60	5.59%

Figure 5.7-1 – EPA Level III Eco-Regions

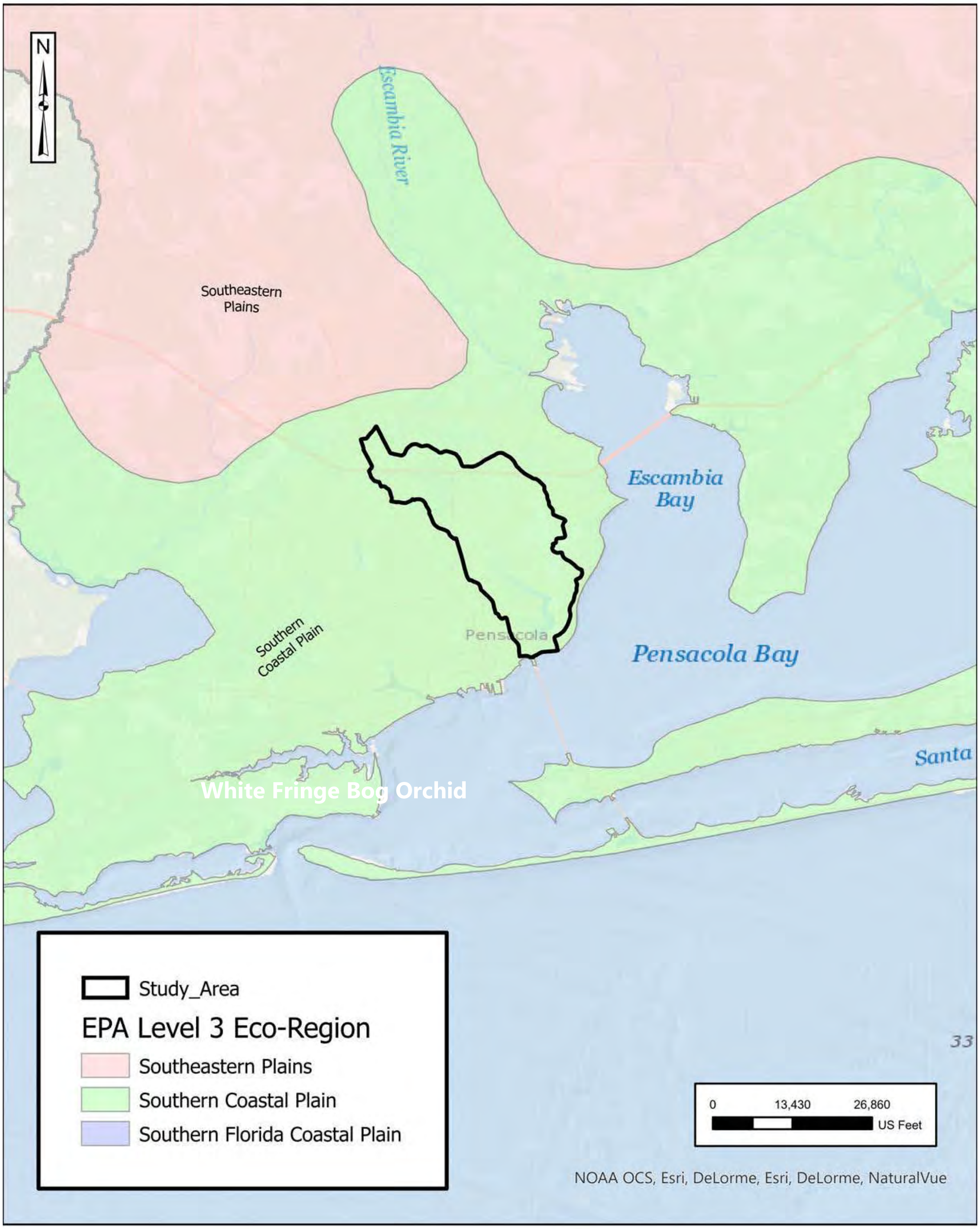


Figure 5.7-2 – EPA Level IV Eco-Regions

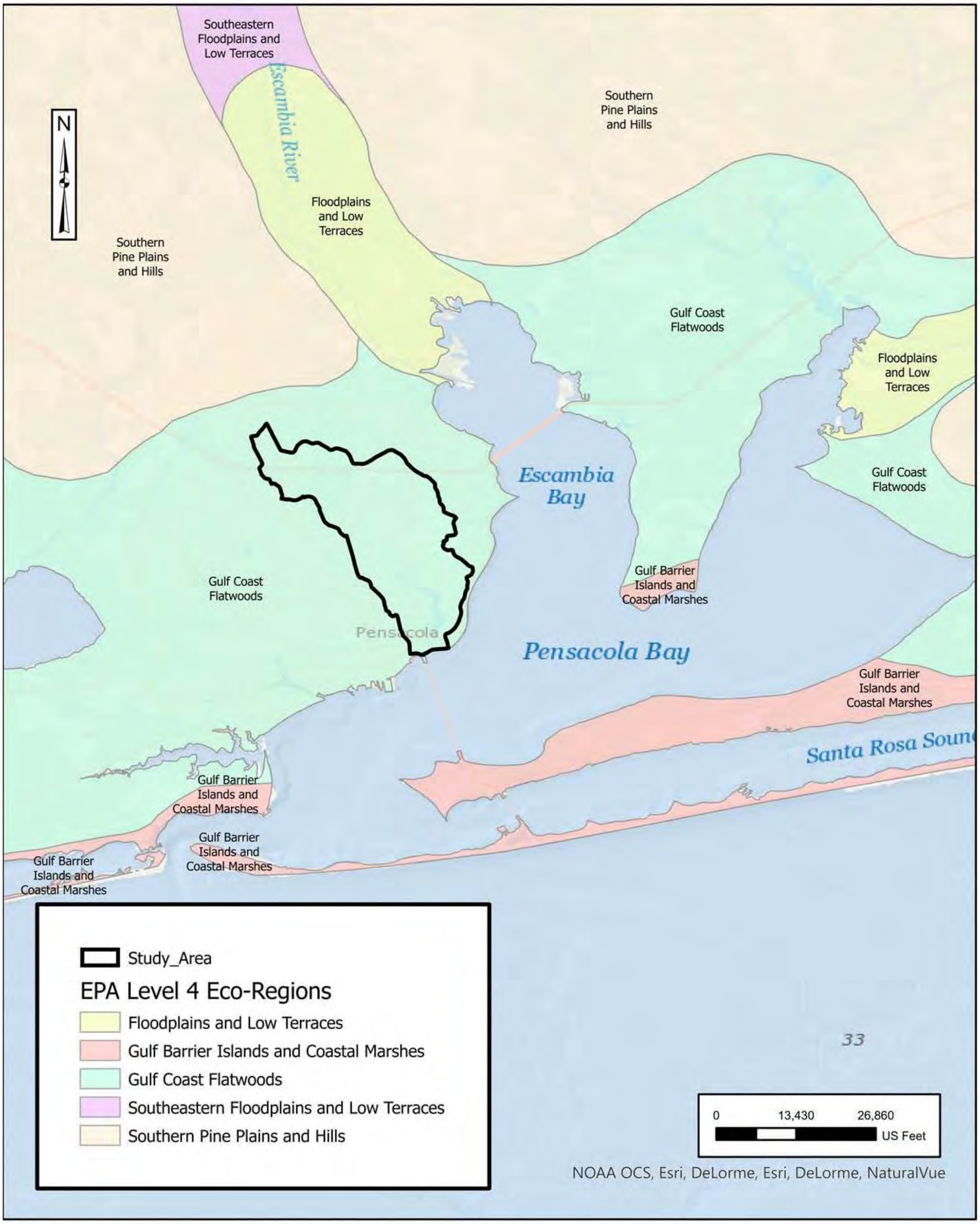
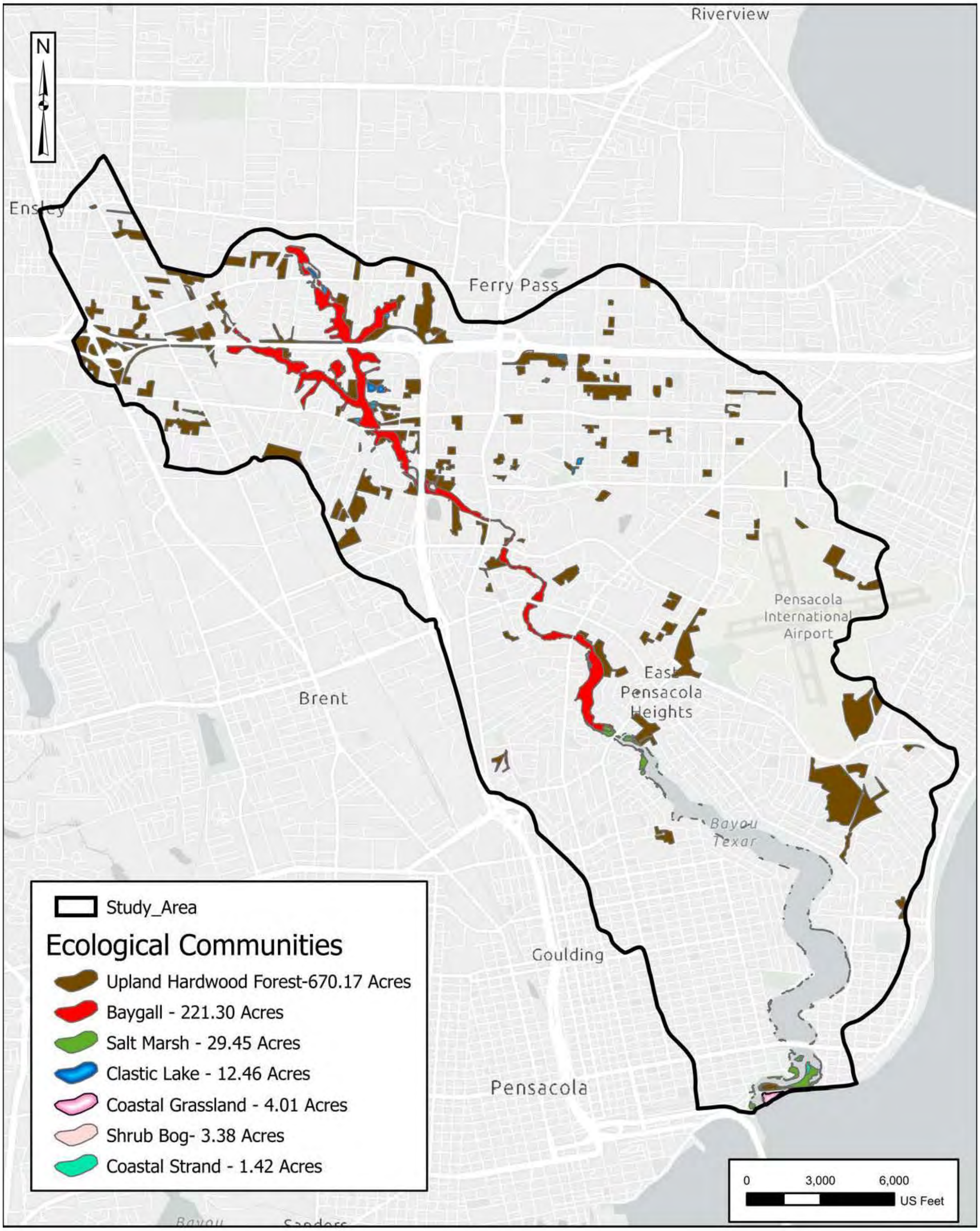


Figure 5.7-3 – Ecological Community Map



wood. IMPACT Campaigns WETLAND SCIENCES INCORPORATED SCAPE

The following is a brief description of the species composition and structure found within each community identified within the study area, beginning with the broader EPA ecoregions and followed by the more specific FNAI communities.

Southern Coastal Plain

The Southern Coastal Plain extends from South Carolina and Georgia through much of central Florida, and along the Gulf Coast lowlands of the Florida Panhandle, Alabama, Mississippi, and eastern Louisiana. Consisting mostly of flat plains, it also includes barrier islands, coastal lagoons, marshes, and swampy lowlands along the Gulf and Atlantic coasts. In Florida, an area of discontinuous highlands contains numerous lakes. This ecoregion is lower in elevation with less relief and wetter soils than the Southeastern Plains (EPA Eco Region 65). Once covered mainly by longleaf pine flatwoods and savannas, this ecoregion also had a variety of other forest communities that supported slash pine, pond pine, pond cypress, beech, sweetgum, southern magnolia, white oak, and laurel oak. Land cover in the region is now mostly slash and loblolly pine, often mixed with various hardwoods, bottomland hardwood forest in some low-lying areas, citrus groves in Florida, pasture for beef cattle, and urban land.

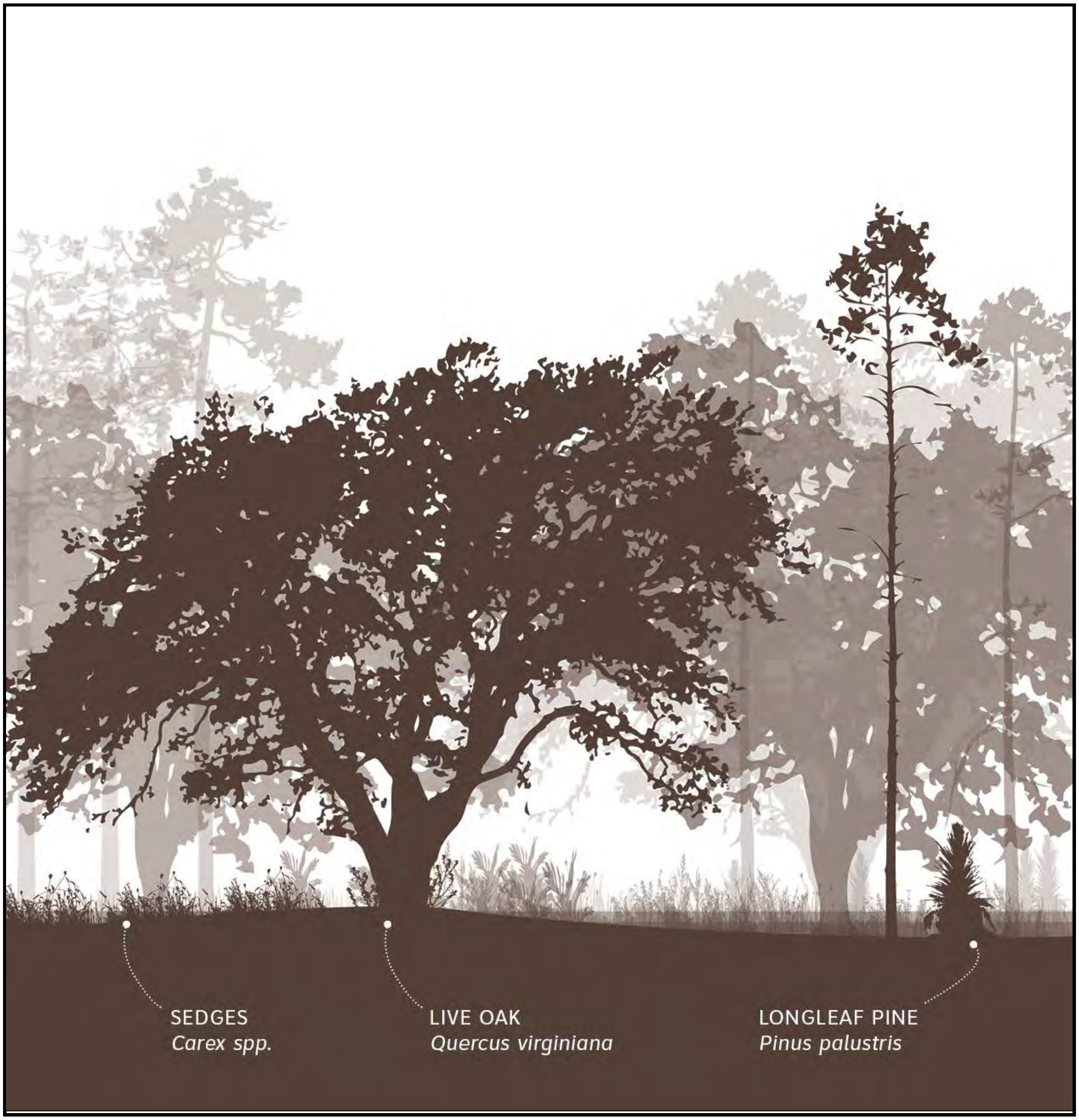
Gulf Coast Flatwoods

The Gulf Coast Flatwoods is a narrow region of nearly level terraces and alluvial and deltaic deposits composed of Quaternary-age sands and clays. Soils are a mix of poorly to moderately well-drained Entisols, Alfisols, and Ultisols with silty and fine sandy loam surfaces. Historically, longleaf pine dominated the broad flats and low ridges, forming more densely stocked flatwoods and open savannas. A high natural fire frequency was typical, often sparked by lightning and fueled by grasses, and maintained the open pine flatwoods and savannas. While most of the longleaf pine savannas have been lost, remnant savannas are centers of biodiversity supporting a variety of grasses, sedges, rushes, and an array of wildflowers: red lilies, orange milkweeds, yellow pitcher plants, white, orange, and pink orchids, lavender butterworts, and purple sundews. Much of the landscape is now in mixed forest or pine plantations, while some better-drained land has been cleared for pasture or crops. Dominant land uses include woodland, wildlife habitat, and urban.

Upland Hardwood Forest

The upland hardwood forest occurs on knolls and slopes above Bayou Texar and Carpenter Creek floodplains and comprises approximately 5.5% of the study area. This community is characterized by a closed canopy dominated by deciduous hardwood trees (**Figure 5.7-4)**. It has a diverse assemblage of deciduous and evergreen tree species in the canopy and midstory, shade-tolerant shrubs, and a sparse groundcover. The canopy is comprised primarily of live oak (*Quercus virginiana*), laurel oak (*Quercus hemisphaerica*), southern magnolia (*Magnolia grandiflora*), longleaf pine (*Pinus palustris*), and loblolly pine (*Pinus taeda*). The midstory layer is composed of younger canopy species as well as small trees and tall shrubs, such as American holly (*Ilex opaca*), American hornbeam (*Carpinus caroliniana*), devil's walking stick (*Aralia spinosa*), flowering dogwood (*Cornus florida*), eastern redbud (*Cercis canadensis*), horse sugar (*Symplocos tinctoria*), American strawberry bush (*Euonymus americanus*), silverbells (*Halesia* spp.), winged elm (*Ulmus* *alata*), black cherry (*Prunus serotina*), and basswood (*Tilia americana*). Generally, the groundcover is composed of shade-tolerant herbs, graminoids, and vines, such as partridgeberry (*Mitchella repens*), Virginia creeper (*Parthenocissus quinquefolia*), violets (*Viola* spp.), sedges (Carex spp.), sarsaparilla vine (*Smilax pumila*), ebony spleenwort (*Asplenium platyneuron*), woodsgrass (*Oplismenus hirtellus*), and longleaf woodoats (*Chasmanthium laxum var. sessiliflorum*).

Figure 5.7-4 – Upland Hardwood Forests Habitat



Coastal Strand

This community is limited to two small upland islands located near the mouth of Bayou Texar, which comprise approximately 0.01% of the study area. It is dominated by salt pruned evergreen shrubs such as live oak (*Quercus virginiana*), Chapman's oak (*Quercus chapmanii*), yaupon holly (*Ilex vomitoria*), and saw palmetto (*Serenoa repens*) situated atop relict wind stabilized dunes. Other typical plants may include myrtle oak (*Quercus myrtifolia*), lantana (*Lantana* spp.), greenbrier (*Smilax* spp.), Spanish bayonet (*Yucca aloifolia*), and woody goldenrod (*Chrysoma pauciflosculosa*).

Coastal Grassland

The coastal grassland community is limited to a single isolated area located at the mouth of Bayou Texar and comprises approximately 0.03% of the study area. This community was formed largely from the disposal of dredged sediments from the interior portions of the bayou. This community is dominated by a variety of coastal grasses and vines such as sea oats (*Uniola paniculata*), bitter panicgrass (*Panicum amarum*), saltmeadow cordgrass (*Spartina patens*), and earleaf greenbrier (*Smilax auriculata*). This community is utilized by shorebirds for nesting, roosting, and feeding.

Salt Marsh

Salt marsh habitats exist generally along the shores of Bayou Texar and comprise approximately 0.24% of the study area. This habitat is generally characterized as an estuarine, intertidal, emergent, persistent, and irregularly flooded wetlands. The salt marsh wetlands are generally dominated by saltmeadow cordgrass (*Spartina patens*), black needle rush (*Juncus roemerianus*), sawgrass (*Cladium jamaicense*), marsh fimbry (*Fimbristylis castanea*), and saltgrass (*Distichlis spicata*).

Clastic Upland Lakes

This community includes irregularly shaped surface water bodies, the origins of which are unknown. They comprise approximately 0.10% of the study area. They are most commonly adjacent to existing headwater wetlands suggesting they are the result of man-made influence; however, others appear to be small basins potentially underlain by a clay substrate that allows a relatively stable permanent pool. The shorelines of these lakes are often dominated by hydrophytic shrubs such as wax myrtle (*Myrica cerifera*), sweet pepperbush (*Clethra alnifolia*), black titi (*Cliftonia monophylla*), swamp cyrilla (*Cyrilla racemiflora*), and gallberry and large gallberry (*Ilex coriacea & Ilex glabra*).

Baygall

Baygalls (syn: bayhead swamp or forested seep) are located within and adjacent to the floodplains of Carpenter Creek and its tributaries. Baygall is the largest wetland ecological community within the study area comprising approximately 1.83% of the land area. The name baygall is derived from sweetbay magnolia or bay tree (*Magnolia virginiana*) and gallberry (I*lex glabra* and *I. coriacea*), which are two plant species that generally dominate the canopy and shrub stratums. Baygalls are generally located downgradient of the upland hardwood forests in broad, shallow braided drains, along margins of creeks, in depressional areas in flatwoods, or occupying the headwaters of creeks (**Figure 5.7-5)**.

Sweetbay (*Magnolia virginiana*) generally dominates the canopy subtended by slash pine (*Pinus elliottii*), red maple (*Acer rubrum*), black gum (*Nyssa slyvatica*), and pond cypress (*Taxodium ascendens*). The understory is generally dominated by fetterbush (*Lyonia lucida*), large gallberry (*Ilex coriacea*), dahoon (*Ilex cassine*), swamp cyrilla (*Cyrilla racemiflora*), black titi (*Cliftonia monophylla*), wax myrtle (*Myrica cerifera*), red maple (*Acer rubrum*), Florida anisetree (*Illicium floridanum*), and Virginia willow (*Itea virginica*). Due to the dense nature of the canopy and understory, the herbaceous stratum is often absent, but when present consists of ferns such as cinnamon fern (*Osmunda cinnamomea*), netted chain fern (*Woodwardia areolata*), and Virginia chain fern (*Woodwardia virginica*).

Baygall have long hydroperiods, high water tables, and mucky organic soils which generally precludes fire from entering but once every 50 to 100 years (Florida Natural Areas Inventory , 2010). Trees and shrubs damaged by fire generally regenerate via coppicing and depending on the intensity and return internal such events may result in a shift to a shrub bog.

Figure 5.7-5 – Baygall Habitat

Shrub Bog

The shrub bog community is found on the border of Carpenter Creek and stream-head drainages in flat, poorly drained areas and comprises approximately 0.03% of the study area. This community consists of dense stands of broadleaved evergreen shrubs, vines, and short trees growing in mucky soil where water is usually less than a foot deep. As the name would suggest, this community is dominated by a variety of hydrophytic shrubs including titi (*Cyrilla racemiflora*), black titi (*Cliftonia monophylla*), fetterbush (*Lyonia lucida*), large gallberry (*Ilex coriacea*), gallberry (*Ilex glabra*), wax myrtle (*Myrica cerifera*), and sweet pepperbush (*Clethra alnifolia*), often laced together with laurel greenbrier (*Smilax laurifolia*). Canopy species may include pond pine (*Pinus serotina*), slash pine *(Pinus elliottii*), loblolly pine (*Pinus taeda*), sweetbay (*Magnolia virginiana*), swamp bay (*Persea palustris*), pond cypress (*Taxodium ascendens*), and red maple (*Acer rubrum*). Herbs are sparse and patchy, confined to sunny openings, and often include pipewort (*Eriocaulon spp.*), Virginia chain fern (*Woodwardia virginica*), and pitcher plants *(Sarracenia* spp.).


Freshwater Marsh

Freshwater Marsh

This community consists of shallow, non-tidal, non-forested, open water areas within the floodplain of Carpenter Creek, comprising approximately 0.07% of the study area. This community is dominated by a variety of emergent macrophytes such as cattail (*Typha* sp.), rushes (*Juncus* spp.), saw grass (*Cladium jamaicense*), maidencane (*Panicum hemitomon*), beakrush (*Rhynchospora* sp.), and spike rush (*Eleocharis* sp.).

Dome Swamp

The project team identified a single dome swamp community located in the far western margins of the study area, comprising approximately 0.01% of the study area. This community is a small isolated depression dominated by swamp tupelo (*Nyssa biflora*) and pond cypress (*Taxodium ascendens*). Shrub stratum includes black titi (*Cliftonia monophylla*), fetterbush (*Lyonia lucida*), large gallberry (*Ilex coriacea*), gallberry (*Ilex glabra*), wax myrtle (*Myrica cerifera*), and sweet pepperbush (*Clethra alnifolia*). Herbs are generally absent due to the dense coverage of upper stratums.

5.7.2. Wildlife Corridors

Wildlife corridors are defined as natural areas that facilitate the natural movement of wildlife. The overall function of corridors is largely dictated by the quality of habitat, size, and connectivity. Large, connected corridors may be used as migratory pathways for a variety of animals, whereas smaller and disconnected corridors may be used as "stepping-stones" between patches of suitable wildlife habitat (Omondi, 2018).

Extensive urbanization of the terrestrial environment has disconnected the study area from any intact upland wildlife corridor, leaving only a few isolated patches of remnant habitat most of which has seen some form of anthropogenic impact. Water and wetland land uses, which make up approximately 5% of the study area, however, represents the most significant wildlife corridor in the study area. From north to south these two land uses stretch the entire length of the study area and are largely contiguous, except for several highway crossings including Interstate I-10, Interstate 110, Brent Lane, N 9th Avenue, N 12 Avenue, and Cervantes Street.


Box Turtle

Isolated patches of disconnected healthy or suitable habitat often mimic the Theory of Island Biogeography described by R.A. Macarthur and E.O. Wilson (Macarther & Wilson, 1967). These two prominent ecologists, among other things, found that:

1. Larger islands will host more species due to greater habitat diversity.
2. Smaller islands will have higher extinction rates.
3. Distant islands (separated from the mainland or other islands) have lower immigration rates and equilibrium will occur with fewer species.
4. Close islands will have higher immigration rates and support more species.

Metapopulation Theory is a modern adaption of Island Biogeography that includes the terrestrial environment (Omondi, 2018). In ecology, metapopulation is a regional or smaller population of a species (Thompson, 2020). Metapopulation theory explains how the movement of species is influenced by the configurations of isolated habitats.

<u>There are four concepts or configurations of metapopulations (Omondi, 2018):</u>

1. Patchy Metapopulation – are well-connected patches of habitat that are ideal for recolonization.
2. Core-satellite Metapopulation – consists of a large area of habitat with one or more connected smaller peripheral patches of habitat.
3. Levin's Classic Metapopulation – small patches of connected habitat surrounded by an unsuitable matrix (i.e. sea, urban, or other obstruction) with dispersal from occupied to unoccupied habitats.
4. Nonequilibrium Metapopulation – small patches of disconnected habitat with no large secure metapopulation and generally unfit for recolonization.

In the terrestrial environment, natural areas are limited to 7.63% of the study area. Two distinct ecological communities make up more than 90% of the intact communities within the study area: upland hardwood forest (approximately 670 acres) and wetland baygall (approximately 221 acres). The wetland baygall community is mostly contiguous but has suffered from loss of upland buffer and floodplain habitats and fragmentation associated with the construction of several large highways including Interstate 10, Interstate 110, Brent Lane, N 9th Avenue, N 12 Avenue, and Cervantes Street. The team's observations suggest these communities are highly fragmented, disconnected, and surrounded by dense urban development, consistent with Levin's Classic Metapopulation (Levins, 1969).

5.7.3. Protected Species

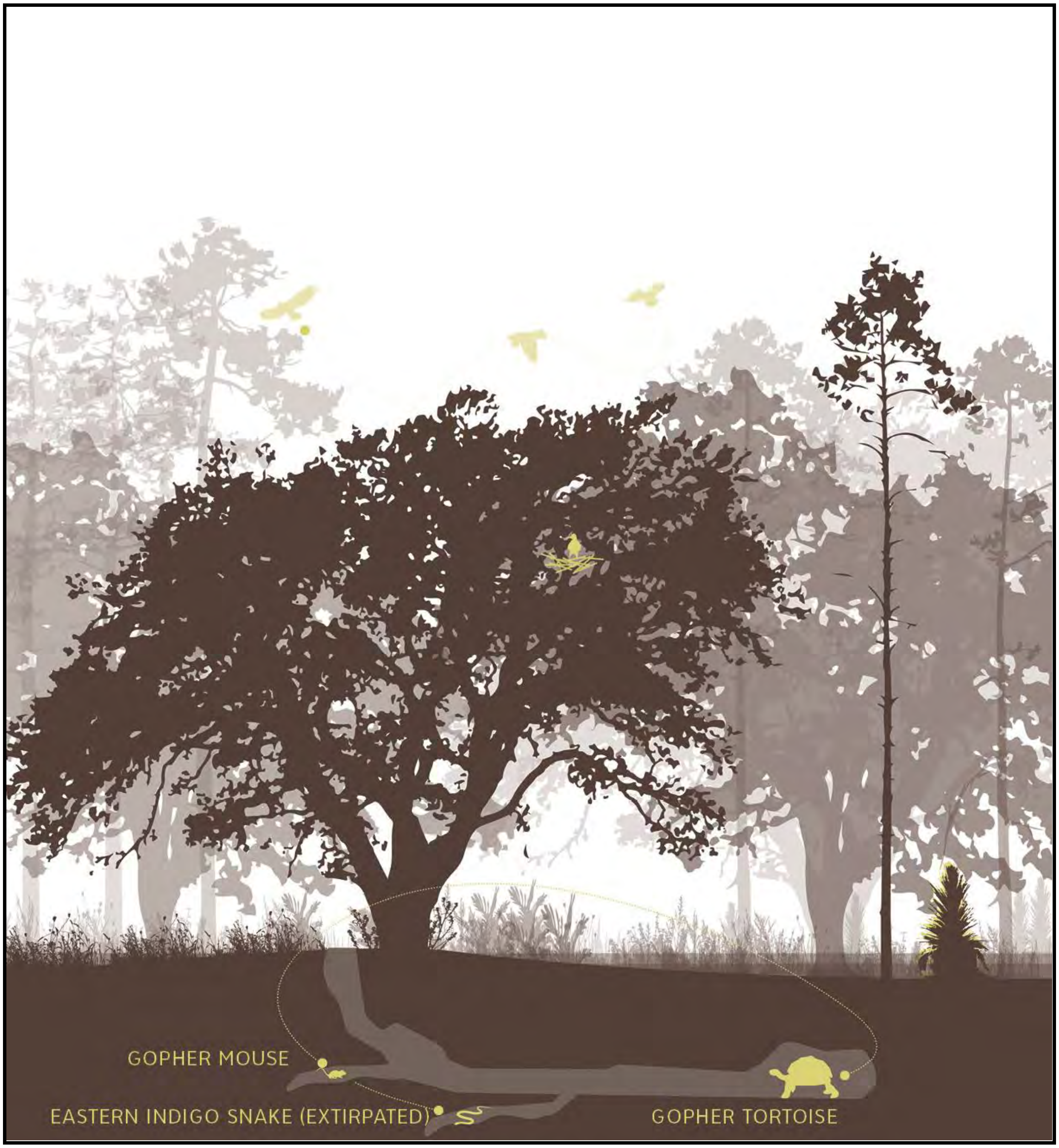
This portion of the assessment focused on the presence of any rare, threatened, or endangered species and/or their critical habitats within the study area. Listed species include those with federal endangered or threatened status, federal candidate species, and state endangered, threatened, and species of special concern status. Listed species data were obtained from USFWS' Information for Planning and Consultation (IPaC) Report (**Appendix E**), Florida Fish and Wildlife Conservation Commission (FWC) Florida's Endangered and Threatened Species (FWC, 2012), and Florida Department of Agriculture and Consumer Services (DOACS) via F.A.C. 5B-40. No critical habitats were identified within the study area. The USFWS' IPaC (Service, 2020) report lists 17 federally protected species that may occur in the study area. The project team also consulted species lists contained in Florida's Endangered and Threatened Species (FWC, 2012), Florida's Imperiled Species Management Plan (FWC, 2016), Florida Regulated Plant Index (F.A.C. 5B-40), and Notes on Florida's Endangered and Threatened Plants (Jr. & Anderson, 2010) and compiled the following list of listed species that may occur in the study area (**Table 5.7-2**). Figure **5.7-6** illustrates endangered species that may occur in the upland hardwood forest habitat.

Table 5.7-2 – Listed Species that May Occur in the Study Area

Category	Species Common Name	Scientific Name	Federal Status	State Status
Mammals	West Indian Manatee	*Trichechus manatus*	FT/CH	FT
Birds	Piping Plover	*Charadrius melodus*	FT	FT
	Red Knot	*Calidris canutus rufa*	FT	FT
	Wood Stork	*Mycteria americana*	FT	FT
Reptile	Eastern Indigo Snake	*Drymarchon corais couperi*	FT	FT
	Gopher Tortoise	*Gopherus polyphemus*	C	ST
	Reticulated Flatwoods Salamander	*Ambystoma bishopi*	FE/CH	FE
Fish	Atlantic Sturgeon (Gulf Subspecies)	*Acipencer oxyrinchus*	FT/CH	FT
	Saltmarsh Topminnow	*Fundulus jenkinsi*	NL	SSC
Plants	Harvest-lice	*Agrimonia incisa*	NL	SE
	Curtis' sandgrass	*Calamovilfa curtissii*	NL	ST
	Panhandle bogbuttons	*Lachnocaulon digynum*	NL	ST
	Panhandle Lily	*Lilium iridollae*	NL	SE
	West's flax	*Linum westii*	NL	SE
	Hummingbird flower	*Macranthera flammea*	NL	SE
	Primrose-flowered butterwort	*Pinguicula primuliflora*	NL	SE
	Orange rein orchid	*Platanthera integra*	NL	SE
	Large-leaved jointweed	*Polygonella macrophylla*	NL	ST
	Arkansas oak	*Quercus arkansana*	NL	ST
	Apalachicola meadow-beauty	*Rhexia parviflora*	NL	SE
	Panhandle meadow beauty	*Rhexia salicifolia*	NL	ST
	Florida flame azalea	*Rhododendron austrinum*	NL	SE
	White-top pitcher-plant	*Sarracenia leucophylla*	NL	SE
	Hoary pea	*Tephrosia virginiana*	NL	SE
	Harper’s yellow-eyed grass	*Xyris scabrifolia*	NL	ST

Code key; FT= Federal Threatened, ST=State Threatened, FE = Federal Endangered, SE = State Endangered, CH=Critical Habitat Designated, SSC = Species of Special Concern, NL = Not listed, C = Candidate.

Figure 5.7-6 – Upland Hardwood Forests Endangered Species



The following paragraphs summarize the listed species that may occur within the study area.

Mammals

West Indian Manatee (*Trichechus manatus)* The West Indian Manatee was listed as endangered throughout its range in Florida in 1967 (32 Federal Register 4061) and further protections provided in the Marine Mammal Protection Act (16 U.S.C. 1461 *et. seq*) and Endangered Species Act of 1973 (16 U.S.C. ch. 35 § 1531 *et seq*).

Manatees are found in marine, estuarine, and freshwater environments. The West Indian manatee (*Trichechus manatus)* includes two distinct subspecies: the Florida manatee (*Trichechus manatus latirostris*) and the Antillean manatee (*Trichechus manatus manatus*). Along the Gulf of Mexico, the population of the Florida manatee is divided into two regional groups: Northwest and Southwest (USFWS, 2001). The Northwest group would include individuals located north of Tampa Bay west along the Gulf coastal waters to the Alabama state line.

Manatees have large, seal-shaped bodies with paired flippers and a round, paddle-shaped tail. They are typically grey in color (color can range from black to light brown) and occasionally spotted with barnacles or colored by patches of green or red algae. The muzzle is heavily whiskered and coarse, single hairs are sparsely distributed throughout the body. Adult manatees, on average, are about nine feet long (3 meters) and weigh about 1,000 pounds (200 kilograms). At birth, calves are between three and four feet long (1 meter) and weigh between 40 and 60 pounds (USFWS, 2001).

Birds

Piping Plover (*Charadrius melodus*) is listed as threatened and afforded protection under the Endangered Species Act of 1973 as amended. This small shorebird overwinters (October-March) along sandy beaches along most of Florida's coastline (USFWS 1996). The coastal grassland ecological community located just east of the mouth of Bayou Texar which was historically used as a dredge disposal site maintains suitable habitat for piping plovers.

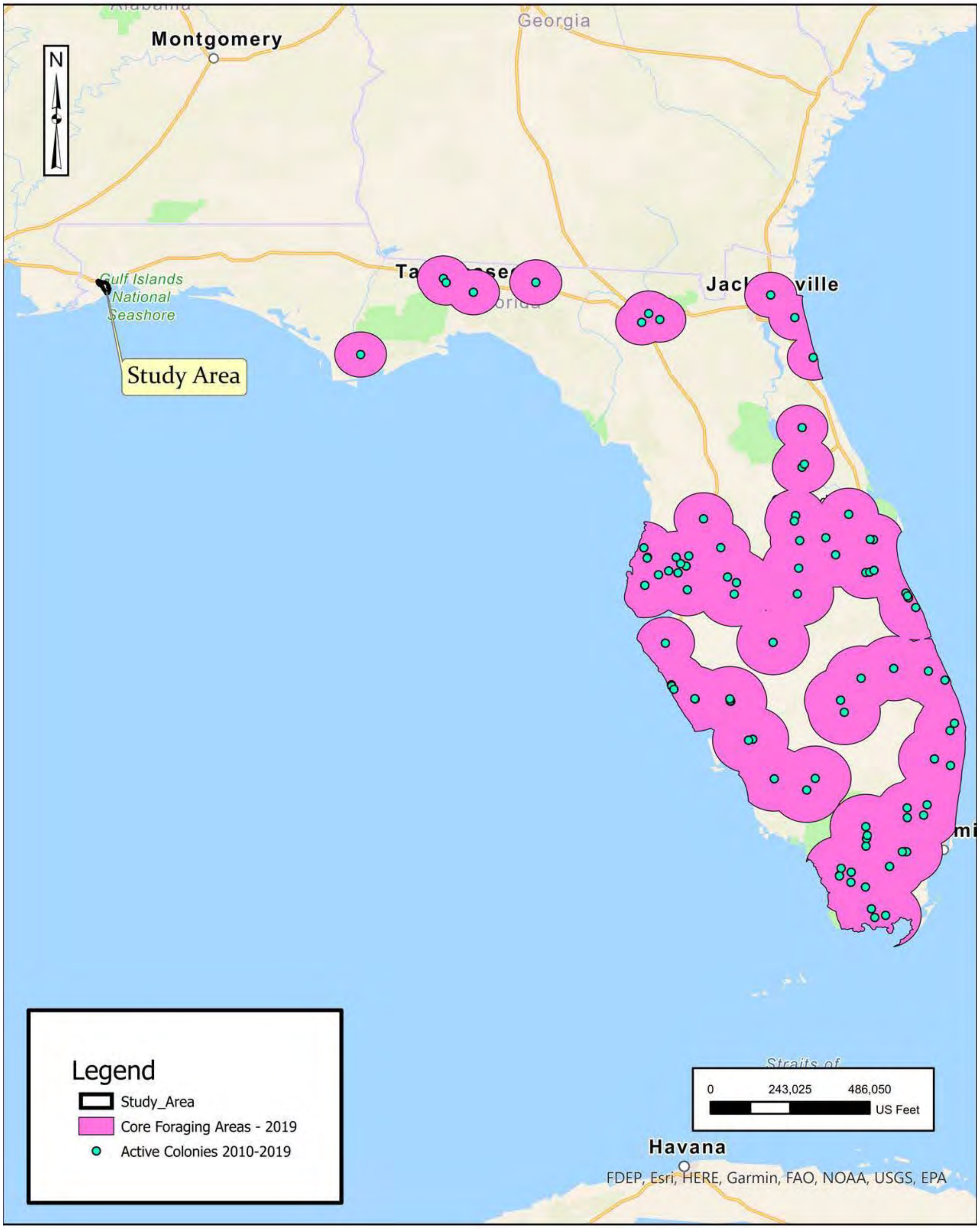
Rufa Red Knot (*Calidris canutus rufa)* is a medium-sized, migratory shorebird that was listed as federally threatened throughout its entire range on December 22, 2014 (79 FR 73705-73748). The rufa red knot migrates annually between its breeding grounds on the central Canadian arctic tundra and four wintering regions; the Southeast United States/Caribbean, the Northwest Gulf of Mexico, the northern coast of South America, and Tierra del Fuego (Argentina and Chile) at the southern tip of South America (USFWS, 2014). The Rufa Red Knot overwinters along the Northwest Gulf Coast, but the current range generally does not include Escambia County (USFWS, 2020). The lower reaches of Bayou Texar include coastal habitat features (tidal mudflats and salt marshes) that provide overwinter forage areas the Red Knot favors.

Wood Stork (*Mycteria americana*) The USFWS listed the United States breeding populations of wood stork as endangered on February 28, 1984, pursuant to the Endangered Species Act of 1973, as amended [F.R. 49(4):7332-73335]. The wood stork is primarily associated with freshwater and estuarine habitats that are used for nesting, roosting, and foraging (USFWS, 1986). Wood storks typically nest colonially in medium to tall trees that occur in stands located either in swamps or on islands surrounded by relatively broad expanses of open water (Ogden, 1990). Successful breeding sites are those that remain permanently inundated in waters between 3 and 5 feet deep and free from human and predatory influences (Ogden, 1990).

Shallow palustrine or tidally influenced wetlands where small fish are concentrated from falling water levels generally represent the ideal feeding habitat which includes freshwater marshes, depressions in cypress heads, swamp sloughs, managed impoundments, stock ponds, shallow-seasonally flooded roadside or agricultural ditches, and narrow tidal creeks or shallow tidal pools (Ogden, 1990).

USFWS has not designated critical habitat for the wood stork but has designated nesting colonies and core foraging areas (**Figure 5.7-7**). In north Florida, the core foraging area includes any suitable foraging habitat within a 13-mile radius of a colony (U.S. Department of the Army Corps of Engineers, 2008). The study area is far removed from any nesting colonies and/or core forage areas and therefore, this species is not expected to occur in the study area even though it was identified in the USFWS IPaC report.

Figure 5.7-7 – Wood Stork Nesting Colonies and Core Foraging Areas in Florida



Reptiles

Eastern Indigo Snake (*Drymarchon corais couperi*) was listed as federally threatened by the USFWS in 1979. This species generally requires exceptionally large tracts of land to survive and occupy a range of habitats, from flatwoods, hammocks, stream bottoms, riparian zones, and high ground with deep, well-drained to excessively drained, sandy soils. Habitat preferences vary seasonally (Hallam, 1998). Pine sandhill winter dens are used from December to April. Summer territories are selected from May to July. From August through November, indigo snakes are frequently located in shady creek bottoms. These seasonal changes in habitat encourage the maintenance of travel corridors that link these different habitat types. They are considered commensals of the gopher tortoise, wintering over in their burrows in the uplands, but foraging in more mesic to hydric habitats. The Eastern indigo snake is found throughout Florida but is rare in most areas. There is a low potential for the indigo snake to occupy habitat within the study area due to the parcel's historical land use and disturbances.

Gopher tortoise *(Gopherus polyphemus)* is the only tortoise indigenous to the southeastern United States (USFWS, 1990). Gopher tortoises have been regulated in Florida since 1972 and have been fully protected since 1988 as a species of special concern. Its status was elevated to threatened on November 8, 2007. Both the tortoise and its burrow are protected under state law.

The gopher tortoise is a large dark brown to a grayish-black terrestrial tortoise. The shell is approximately 15 to 37 centimeters or 5.9 to 14.6 inches long. The gopher tortoise has elephantine hind feet, shovel-like forefeet, and a gular projection beneath the head of the yellowish, hinge-less plastron or under the shell. For refuge, gopher tortoises dig burrows which average 5 to 10 feet in depth and may be 10 to 20 feet or more in length. Several other species may share gopher tortoise burrows, including the eastern indigo snake, the eastern diamondback rattlesnake, the black pine snake, and the gopher frog, as well as several small mammals.

Gopher tortoises favor dry sandy ridges with open stands of longleaf pine, turkey oak, and other scrub oaks. They feed on grasses and other low growing vegetation. Fire suppression is problematic to gopher tortoise habitat preventing sunlight from reaching the forest floor, and thus decreasing ground cover which the turtles depend on. It is commonly associated with a pine overstory and an open understory with a grass and forb (non-woody) groundcover and sunny areas for nesting. Gopher tortoises can also sometimes be found in more marginal habitat such as roadsides, ditch banks, utility and pipeline rights-of-way, pastures, and even marginal wetland habitat, especially if their preferred habitat has been lost.

Reticulated Flatwoods Salamander (*bishopi*) is a mole salamander that was federally listed as a threatened species in April 1999 (64 Federal Register 15691) under the name of *Ambystoma cingulatum*. Flatwood salamanders have been divided into two species as of September 2008: the frosted flatwoods salamander (*Ambystoma cingulatum*) and the reticulated flatwoods salamander (*Ambystoma bishopi*) under the rule change (64 Federal Register 15691). The habitat of the reticulated flatwoods salamander is a wet flatwoods dominated by longleaf pine (*Pinus palustris*) and wiregrass (*Aristida stricta*) (John Palis, 2020). On February 10, 2009, the USFWS designated

4,453 acres as critical habitat for reticulated flatwoods salamander (73 Federal Register 47257 47324). The critical habitat is in Baker, Calhoun, Franklin, Holmes, Jackson, Jefferson, Liberty, Santa Rosa, Wakulla, Walton, and Washington Counties in Florida. No habitat was designed in Escambia County. There is a low potential for occurrence within the study area due to a lack of suitable habitat.

Fish

Atlantic Sturgeon (*Acipenser oxyrinchus desotoi*) The USFWS and National Marine Fisheries Service (NMFS) listed the Gulf Sturgeon (*Acipenser oxyrhinchus desotoi*), a subspecies of the Atlantic sturgeon (*A. oxyrhinchus*), as a threatened species listed under the Endangered Species Act of 1973, as amended. On March 19, 2003, USFWS and NMFS designated habitat essential to the conservation of the Gulf Sturgeon (68 FR 13369). This "critical" habitat includes 14 geographical areas among the Gulf of Mexico Rivers and tributaries (**Figure 5.7-8**). The study area borders Critical Habitat Unit 9 – Pensacola Bay System in Escambia and Santa Rosa Counties, Florida. Unit 9 includes Pensacola Bay and its adjacent main bays and coves. These include Big Lagoon, Escambia Bay, East Bay, Blackwater Bay, Bayou Grande, Macky Bay, Saultsmar Cove, Bass Hole Cove, and Catfish Basin (68 FR 13369). Bayou Texar and Carpenter Creek are excluded at their mouths.

As with other sturgeon species, the damming of rivers has been the most significant threat to the Gulf sturgeon. Other threats to the species include over exploitation, incidental catch, dredging activities, the removal of snags and dredged material placement associated with channel improvements and maintenance.

The gulf sturgeon is anadromous, which means the species breeds in freshwater environments, but spends the remainder of the year in marine and estuarine environments. Spawning occurs in the deeper portions of rivers during the warmer months of the year. The remaining months (November through March), the Gulf sturgeon migrates to estuarine or Gulf of Mexico waters to feed. In early to late spring, the fish migrate to the riverine systems to spawn (USFWS and Gulf States Marine Fisheries Commission, 1995).

Saltmarsh Topminnow (*Fundulus jenkinsi*) is protected as a State-designate Threatened species by Florida's Endangered and Threatened Species Rule. This small non-migratory estuarine fish is known to occur sporadically in tidal marsh habitat along the Gulf Coast with its Florida range limited to Perdido and Pensacola Bay (Lopez, Petersen, Lang, & Charbonnet, 2010). This species prefers estuarine tidal marsh habitats with low to moderate salinity which would include those located between the Cervantes street bridge and the mouth of the bayou (Environmental Institute of Houston, University of Houston - Clear Lake, 2015). While no specimens have been historically collected from the study area, the Biological Status Review completed by the FWC identified potential habitat between the Cervantes Street Bridge and the mouth of Bayou Texar (FWC, 2011).

Figure 5.7-8 – Gulf Sturgeon critical habitat map (NOAA, 2020)

Plants

<u>Harvest-lice *(Agrimonia incisa)*</u> is protected as a State-designate Endangered species by Florida's Endangered and Threatened Species Rule. This Rosaceae species is often associated with longleaf pines and generally prefers sandy yet not xeric conditions (Kral, 1983).

<u>Curtis' sandgrass (*Sporobolus vaseyi)*</u> is endemic to Florida and is an ecotonal species that is found with flatwood species. This species is generally found where there is consistent prescribe burns and the species may need fire to reproduce (Cooper & Chafin, 2020). This species is protected as a State-designate Threatened species by Florida's Endangered and Threatened Species Rule.

<u>Panhandle bogbutton (*Lachnocaulon digynum*)</u> is also referred as Pineland Bogbutton and is protected as a State-designate Threatened species by Florida's Endangered and Threatened Species Rule. This species requires saturated soils, wet acid sands, peat or seepage bogs or pond margins with little to no cover (Morse & rev. VEC, 2020).

Panhandle Lily (*Lilium iridollae*), also known as the pot-of-gold lily, is protected as a State-designate Endangered species by Florida's Endangered and Threatened Species Rule. First discovered by Mary Gibson Henry in a cattle pasture in southern Alabama near the Gulf of Mexico in 1940 (Harrison, 2000). This plant is known for its showy flower that Mrs. Henry described as a pot of gold at the end of her rainbow. Panhandle lily is found in wet pine flatwoods, wet prairies, floodplain forests, baygalls, seepage slopes, and swamps and bogs along small streams (Chafin, 2000).

West's flax (*Linium westii*) is protected as a State-designate Endangered species by Florida's Endangered and Threatened Species Rule. Endemic to the Florida panhandle and northeast Florida, this species favors bogs, wet flatwoods, and cypress pond margins (Clewell, 1985). This plant only flowers in the evening which makes it difficult to census (Chafin, 2000). Like the white top pitcher plant, this species thrives in wet flatwoods that are subject to a routine fire regime.

Hummingbird flower (*Macranthera flammea*) is protected as a State-designate Endangered species by Florida's Endangered and Threatened Species Rule. This species ranges from the lower coastal plains of Georgia to southeast Louisiana. This species is found in bogs and wet boggy thickets, edges of shrub-tree bogs or bays, and occasionally in shallow waters of cypress-gum ponds or depressions (Godfrey & Wooten, Aquatic and Wetland Plants of Southeastern United States: Dicotyledons, 1981). This plant is known for its flower and is commonly referred to as flame flower or Spanish princess (Alford & Anderson, 2002).

Primrose-flowered butterwort (*Pinguicula pumila*) is protected as a State-designate Endangered species by Florida's Endangered and Threatened Species Rule. It is found along the coastal plains from North Carolina down to the Florida Keys and westward along the Gulf Coast to Louisiana (Gluch, 2005). There is no documented or vouchered presence in Escambia County (Atlas of Florida Plants Institute for Systematic Botany, 2020).

Orange rein orchid (*Plantanthera integra*) is protected as a State-designate Endangered species by Florida's Endangered and Threatened Species Rule. This species is found in acid swamps, pine savannas, flatwoods, prairies, and swamp meadows along the coastal plain from New Jersey and south down the east coast and along the Gulf Coast from Florida to Texas, including some populations in the mountains of North Carolina and Tennessee (Godfrey & Wooten, Aquatic and Wetland Plants of Southeastern United States: Dicotyledons, 1981). The inflorescence of this species forms a dense cluster of deep gold-colored flowers atop a fluted, blue-green stem (Subrahmanyam, 2020). Dr. James R. Burkhalter documented this species in low wiregrass savannah habitat in a powerline easement in Escambia County in 1982 (Florida Museum of Natural History, 2020). Habitat requirements of this species would suggest potential occurrence in the far upper reaches of the study area.

Large-leaved jointweed (*Polygonella macrophylla*) is listed as threatened by the state of Florida. Big Lagoon State Park, located in western Escambia County and removed from the study area, supports the largest population of Large-leaf Jointweed, which accounts for approximately 20 percent of the total Florida population (FDEP, 2020).

Arkansas oak (*Quercus arkansana*) is listed as threatened by the state of Florida. This species is found in upland mesic hardwood forests in sandy and loamy sand soils along the heads of small creeks (Duncan & Duncan, 1988). There is no documented or vouchered presence in Escambia County (Atlas of Florida Plants Institute for Systematic Botany, 2020).

Apalachicola meadow-beauty (*Rhexia parviflora*), or small-flowered meadow-beauty, is protected as a State-designate Endangered species by Florida's Endangered and Threatened Species Rule. This species is found in wet sands or peaty sands, in seepage slopes, depression marshes, or bordering cypress ponds and shrub bogs (Godfrey & Wooten, Aquatic and Wetland Plants of Southeastern United States: Dicotyledons, 1981). Nearest populations are located on Eglin Air Force Base and Apalachicola National Forest (Chafin, 2000). There is no documented or vouchered presence in Escambia County (Atlas of Florida Plants Institute for Systematic Botany, 2020).

Panhandle meadow beauty (*Rhexia salicifolia*) is listed as threatened by the state of Florida and found along sandy shores or exposed shores of limesink lakes, exposed bottoms of limesink cypress ponds, and coastal interdunal swales of the Florida panhandle (Godfrey & Wooten, Aquatic and Wetland Plants of Southeastern United States: Dicotyledons, 1981). Escambia County lacks the typical karst morphology that this species favors, with the only exception being the interdunal swale communities which are located on the barrier islands and removed from the study area. There is no documented or vouchered presence in Escambia County (Atlas of Florida Plants Institute for Systematic Botany, 2020).

Florida flame azalea (*Rhododendron austrinum*) is state-listed as endangered. This deciduous shrub is known for its showy yellow-orange flowers that appear in early spring. This species is found in Escambia County typically along the ecotone of upland mesic hardwood forests and wetland baygall communities.

White-top pitcher plant (*Sarracenia leucophylla*) is state-listed as endangered and found along many of the coastal counties in the Florida panhandle. The pitcher plant favors wet prairies, wet flatwoods, seepage slopes, swamps, and bogs adjacent to small streams that are frequented by fire. These plants are known for the characteristic leaves that form a pitcher and covered by a hood. This pitcher is filled with liquid and is covered by a slippery covering. The rim and hood are brightly colored, which attracts a variety of insects that the plant uses to supplement its energy needs, especially considering this species favors nutrient-poor soils. Without a regular fire regime, these plants become shaded and will often lose the typical pitcher plant leaf. If fire suppressed, the pitcher plant habitat will persist and generally recover following a fire (Godfrey & Wooten, Aquatic and Wetland Plants of Southeastern United States: Dicotyledons, 1981).

The presence of this species will be limited to the upper reaches of the Carpenter Creek watershed. It is typically found in open sandy or mucky substrate in the shrub bog and baygall communities. No large colonies were identified during the team's ground-truthing efforts, and its presence is merely sporadic. Field observation included groups of 1 to 3 individuals that often were not producing "pitchers", most likely due to light deficiency.

<u>Pineland Hoary pea or Goat's Rue (*Tephrosia virginiana*)</u> is listed as threatened by the state of Florida and is found in sandhill communities of the Florida panhandle. It ranges from Texas eastward to Florida, northward to New Hampshire and New York, and inland to Minnesota and Nebraska (Weakley, 2015) with documented presence in Escambia County (Atlas of Florida Plants Institute for Systematic Botany, 2020).

<u>Harper's yellow-eyed grass (*Xyris scabrifolia*)</u> is listed as threatened by the state of Florida. This species is the rarest of the genus *Xyris* known only from a few scattered localities in the Florida panhandle. This species is found in seepage areas of wet pine flatwoods and sphagnous bogs (Godfrey & Wooten, Aquatic and Wetland Plants of the Southeastern United States (Monocotyledons), 1979). Several documented occurrences have been noted in Escambia County (Atlas of Florida Plants Institute for Systematic Botany, 2020).

5.7.4. Exotic and Nuisance Species

For purposes of this plan, exotic and nuisance species (collectively referred to as invasive species) include non-native organisms whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health within the study area. Invasive species management in Florida dates to the late 1800s, when densities of water hyacinths precluded steamboat traffic in the St. John's River near Palatka (FWC, 2020). Further state initiatives began in 1984 with the establishment of the Florida Exotic Plan Pest Council (NKA Florida Invasive Species Council) resulting from efforts to control the widespread invasion of melaleuca (*Melaleuca quinquenervia*) in the Everglades National Park. Local efforts include the formation of the Six Rivers Cooperative Invasive Species Management Area (CISMA), a partnership of public and private agencies, and landowners from across nine Florida and Alabama counties. CISMA's mission is to implement a comprehensive, cooperative approach across boundaries to address the threats of invasive species to the lands and waters within the boundaries of the Six Rivers CISMA.

The project team compiled a list of invasive plant and animal species known to occur or may occur within the study area.

This list was compiled using a variety of resources including:

- Florida Exotic Pest Plant Council's 2019 List of Invasive Plant Species (FL EPPC, 2020)
- State of Florida Noxious Weed List (Rule 5B-57, F.A.C.)
- State of Florida Prohibited Aquatic Plants List (Rule 5B-64.001, F.A.C.)
- Florida Fish and Wildlife Conservation Commission Nonnative Species List (FWC, 2020)
- University of Georgia Center for Invasive Species and Ecosystem Health Early Detection & Distribution (EDD) MapS (University of Georgia, 2020)
- Federal Noxious Weed List (USDA NRCS, 2020)

Based on the team's research, fifteen invasive plant species are likely to occur within the study area. Fourteen are Florida EPPC Category I species and one is a Category II species (**Table 5.7-3**). Six species are listed on the Florida Noxious Weed list, two on the Federal Noxious Weed list, and four on the Florida Prohibited Aquatic Plant list.

Table 5.7-3 – Invasive plant species likely to occur in the study area

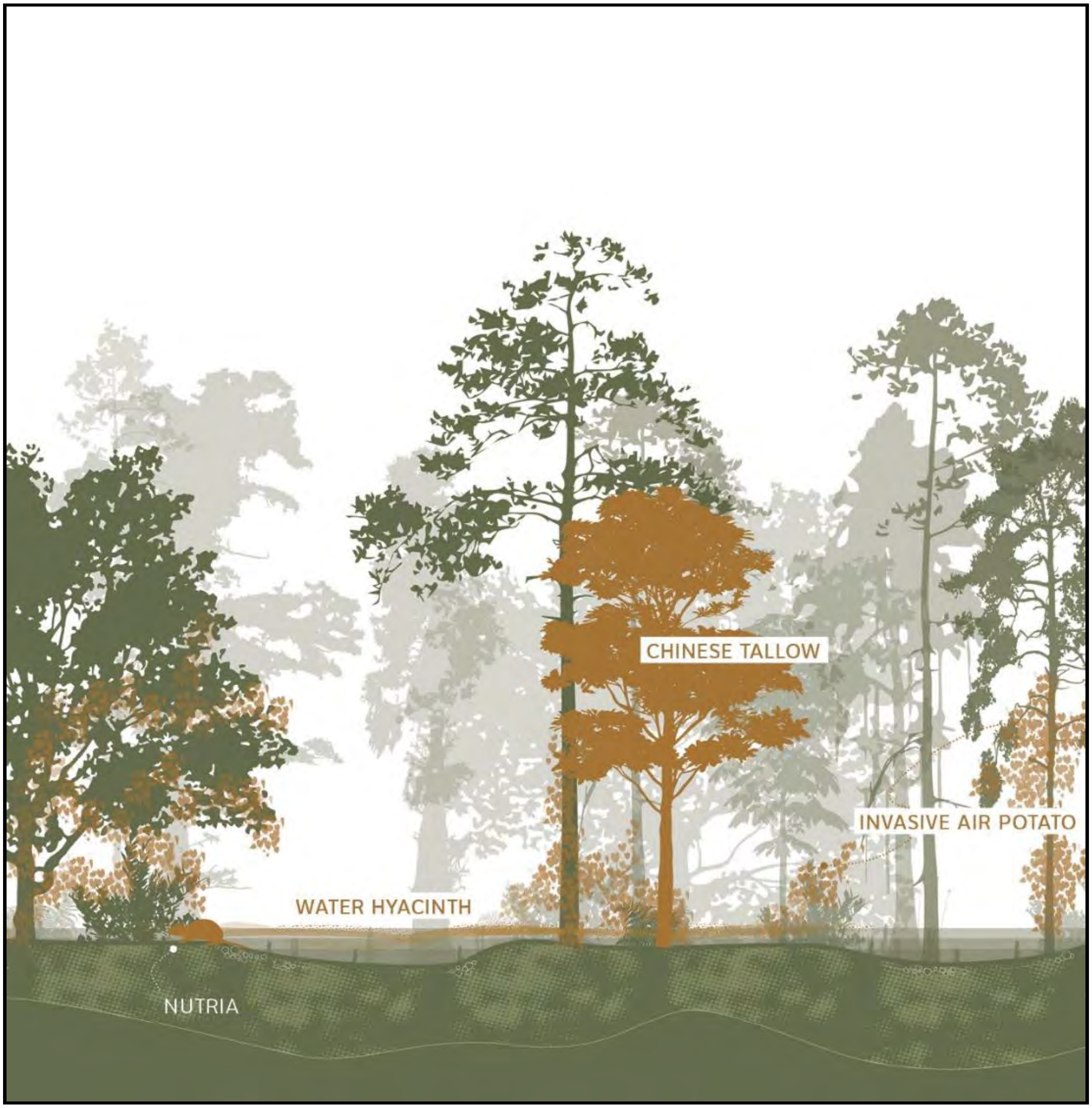
Scientific Name	Common Name	FLEPPC Category	Florida Noxious Weed List	Federal Noxious Weed List	Florida Prohibited Aquatic Plant List
Albizia julibrissin	Mimosa, silk tree	I	No	No	No
Cinnamomum camphora	Camphor tree	I	No	No	No
Colocasia esculenta	Wild taro, coco yam	I	No	No	No
Dioscorea bulbifera	Air potato	I	Yes	No	No
Eichhornia crassipes	Water hyacinth	I	No	No	Yes
Imperata cylindrica	Cogongrass	I	Yes	Yes	Yes
Lonicera japonica	Japanese honeysuckle	I	No	No	No
Ligustrum sinense	Chinese privet	I	Yes	No	No
Lygodium japonicum	Japanese Climbing Fern	I	Yes	No	No
Myriophyllum spicatum	Eurasian milfoil	II	No	No	Yes
Panicum repens	Torpedograss	I	No	No	No
Pueraria montana	Kudzu	I	Yes	No	No
Salvinia molesta	Giant salvinia	I	No	Yes	Yes
Triadica sebifera	Chinese tallow	I	Yes	No	No

Research indicates twelve invasive animal species may occur in the study area (**Table 5.7-4**). It should be noted that the redbay ambrosia beetle (*Xyleborus glabratus)* and associated fungus (*Raffaelea lauricola)* (laurel wilt) are known to exist within the study area, although there is no documented occurrence within the University of Georgia's EDD MapS system. Also, red lionfish are mostly present within the nearshore coastal waters of Escambia County, but based on its ability to live within relatively low salinity waters (<7 ppt) (O'Connor, 2020), its range may extend into the lower reaches of Bayou Texar. Finally, feral hogs are widespread throughout Escambia County and potential presence in the study area is low based on the density of urban development and lack of suitable habitat. **Figure 5.7-9** illustrates invasive plant species likely to occur in the Baygall Habitat

Table 5.7-4 – Invasive animal species likely to occur in the study area

Scientific Name	Common Name	Escambia County Occurrence	CISMA Occurrence	Panhandle Occurrence
Invertebrates				
Bulimulus sporadicus	Bulimulus snail	1	1	2
Penaeus monodon	Giant Tiger Prawn	4	17	17
Perna viridis	Green mussel	1	1	1
Xyleborus glabratus	Ambrosia beetle	0	0	0
Amphibians				
Eleutherodactylus planirostris	Greenhouse frog	0	4	6
Osteopilus septentrionalis	Cuban treefrog	1	5	8
Rhinella marina	Cane toad	0	1	1
Reptiles				
Python molurus ssp. Bivittatus	Burmese python	0	2	2
Salvator merianae	Argentine black and white tegu	0	5	5
Fish				
Pterois miles	Red lionfish	37	181	197
Mammals				
Myocastor coypus	Nutria	2	5	6
Sus scrofa	Feral hogs			

Figure 5.7-9 – Baygall Invasive Species



5.8. Water Quality - Existing Studies and Data Review

Data Sources

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
Washington High School Marine Science Academy Data	"Bringing Back the Bayou" student poster with water quality data summaries reviewed; Interactive GIS Dashboard with 8 years of data https://www.arcgis.com/apps/opsdashboard/index.html#/d9876c7f500d4044a050d6caba1d3206	Fall/Winter 2019 for Poster; 2012-2020 for GIS Dashboard	Data collection by the High School does not meet DEP standards and will therefore not be used in the study for statistical analysis purposes.	No
April 2014 Flood Event – Fecal Monitoring Data, Escambia County	April 2014 Flood fecal indicator bacteria and other associated data reviewed	Varies by parameter, essentially April – August 2014	Team will ensure these data are included in the compiled County water quality database	No
Escambia County Longterm Ambient Report and Water Quality Database	Report used to summarize monitoring plan and water quality data collected by the County NPDES/MS4 monitoring program (TSS, turbidity, Chl-a, nutrients, field parameters, and bacteria) with comparison against criteria.	Report dated January 2019; data 2017 - 2019; Five Carpenter Creek and two Bayou Texar stations;	Data gap analysis section describes proposed enhancements to monitoring program based on data review	Yes – see data gap analysis
FDEP Wastewater Facility Regulation (WAFR)	Shapefiles used during monitoring program review and in preparation of recommendations to enhance monitoring program.	N/A	N/A	No

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
FDEP IWR (Run 58) and WIN Databases	Data from both WBIDs reviewed to assess if additional water quality stations and data available in addition to County data . Information used in data gap analysis.	68 stations retrieved from IWR; four station retrieved from WIN	Data gap analysis section describes proposed enhancements to monitoring program based on data review	Yes – see data gap analysis
FDEP Strategic Sampling Plan 2020	Spreadsheet reviewed to assess which WBIDs are slated for specialized sampling in 2019/2020; Data will be pulled from WIN in January 2021 and included in analyses.	N/A	N/A	No
Carpenter Creek Stormwater Needs Assessment, 2003, Baskerville Donovan	Conceptual alternatives proposed, which will be reviewed in more detail during BMP assessment.	2003	N/A	No
Escambia County Bacteria Pollution Control Plan (BPCP)	Plan provides purpose and scope of the plan, trends in the watershed, potential sources, and TMDL implementation plan including restoration activities to reduce fecal coliform loading. Plan and list of projects will be reviewed in more detail during BMP assessment task.	Report dated May 2016; data reported 2006-2014	N/A	No
Escambia County Walk the WBID program	Shapefiles, maps and spreadsheet lists multiple categories of issues identified (flooding, erosion, SSOs, septic concentration areas, failing infrastructure, etc.) with follow up action items that will be further reviewed during BMP assessment task	2018	N/A	No

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
2000 NWFWMD Potentiometric Surface Shapefile	Shapefiles used to conduct gap analysis and provide recommendations	2000	N/A	No
ECUA Infrastructure Database	GIS and Access Database provide ECUA infrastructure location information. Will be reviewed in more detail during source assessment and analysis task.	2020	N/A	No
County Map of Aging Stormwater CMP infrastructure	Will be reviewed in more detail during source and BMP assessment tasks.		N/A	No
Biophysical Monitoring Data – Bathymetry, Sediment, Macroinvertebrate , UWF	Data for 12 stormwater outfalls in Bayou Texar; sediment data will be reviewed in more detail during source assessment task.	1999	N/A	No
University of Florida (Goodhart and Dietch)	Stations: Carmike, Walton, & Shiloh chloride, nitrate and sulfate data (spreadsheets and PPT provided by UF)	High frequency data collected from Dec 2017 – Nov 2018	Water quality data limited to one year	No
Sediment and Water Quality Monitoring and Assessment Study, 2012, William Debusk			No sites included in Carpenter Creek or Bayou Texar	No
Profiles of Selected Pollutants in Bayou Texar, 2005, Carl Mohrherr	Assesses environmental impacts of toxic pollutants in Bayou Texar with emphasis on possible Superfund site impacts	2005		No

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
Pollution in an Urban Bayou, 2005-2006, Carl Mohrherr	Abstract suggests metals do not come from groundwater plume.	2005-2006	N/A	No
EPA Environmental Quality of the Pensacola Bay System	Report provides an updated summary of the ecological condition of the Pensacola Bay System (which includes Bayou Texar) and the value of its ecological goods and services with relevant sections on surface/ground water quality and sediment quality.	April 2016	N/A	No
University of West Florida (Sommerville)	Master's Thesis on the Spatial and Temporal Variability in Water Quality in Three Urbanized Bayous of the Pensacola Bay System (including Bayou Texar)	May 2018-March 2019	Data only available for Bayou Texar	No
ERP Transmittal for 5 outfalls in Bayou Texar, 2019	Includes 2018 sediment data	2019		No
Escambia County Stormwater Advisory Team (SWAT) report, 2015		2015	Consult with County to determine if proposed recommendations were implemented	Yes – Consult with County
2017 Pensacola Bay SWIM Plan	Reviewed SWIM Plan. Document is the third update for surface water resource management, protection, and restoration using a watershed approach. Recommendations will be reviewed in more detail during BMP assessment task.	2017	N/A	No

Data Source	Description	Period of Record / Reference Date	Data Gaps / Limitations	Additional Data Needed for this Study
PERCH Bibliography	Includes references to several scientific papers/studies relevant to water quality for the general area. Further review will be conducted during analysis for additional Bayou Texar or Carpenter Creek information.		N/A	No
FDEP Petroleum Cleanup Sites shapefile	GIS shapefile; will be included in BMP assessment		N/A	No
FDOH Sampling Data	Fecal indicator bacteria, field parameters and rainfall data for both WBIDs for annual surveys and weekly monitoring	1999-2001	Need to confirm that IWR/WIN databases contain these data prior to data analyses	No
FDOH Septic Tank Inventory	Shapefile reviewed and will be used to assess potential sources in future data analysis task.		N/A	No
Laurie Murphy, Emerald Coastkeeper	Personal accounts from Laurie Murphy related to observations along Carpenter Creek	October 2020	N/A	No

The County's monitoring programs, and associated data were reviewed, along with relevant literature. The County has an ambient program where water quality parameters have been sampled for several years, with some historical data but the consistent data are currently limited since 2017. The data were retrieved and compiled from several sources: Impaired Waters Rule database (Run 58, FDEP), FDEP WIN and STORET online data portals, shapefiles provided by Escambia County, USGS website data portal.

The FDEP listed the creek and bayou as impaired in 2006 and adopted a TMDL in 2012 for fecal coliforms, which required a reduction to meet the TMDLs. Possible sources for fecal coliform loadings were noted to include failed septic tanks, sewer line leakage, wildlife, sediments, and pet waste. A seasonal pattern in Bayou Texar was observed by FDEP where a peak in fecal coliform concentrations and exceedances were observed during July-September months, suggesting an association with the wet season. Spatial patterns were noted by FDEP where most of the fecal coliform exceedances seemed to occur around Bayview Park. The middle reach of Carpenter Creek seemed to have the highest number of exceedances, which was attributed to a large stormwater pond that discharges to the creek and possibly Interstate-110 runoff.

Recent water quality data, in respect to legacy and current land uses will be analyzed to assess spatial and temporal patterns/trends/relationships of fecal indicator bacteria and other water quality parameters. Other fecal indicator bacteria such as E. coli and Enterococci data will be assessed for exceedances and results will be compared to the County's Bacteria Pollution Control Plan (BPCP) results, which recently showed that downstream reaches on Carpenter Creek (i.e. 9th and 12th Ave. sites) have had exceedances of E. coli that would qualify as an impairment according to the new State criteria. At those same stations, total nitrogen also appeared to be elevated, according to the BPCP document, which suggests that this area within the Carpenter Creek watershed is contributing pollutant sources to the creek. Potential sources will be more closely assessed to understand potential causes of water quality issues using more recent water quality data with an expanded parameter list that will include nutrients and other associated parameters. Based on review of the literature, it is evident that sediments have impacted portions of Bayou Texar, and it is likely that legacy effects from internal pollutant loading will continue to impact water quality until sediment management programs are established to improve sediment quality to reduce large volumes of sediment transport to the bayou. The groundwater aquifer has been historically impacted by industrial discharges and urbanization by various sources (e.g. fertilizer, septic, etc.). Due to limited available data, it is unknown if groundwater is still impacted or if conditions have improved. Further investigation is needed to assess current groundwater quality conditions, but limited data are available. Data were reviewed to assess if any data gaps were evident in terms of relevant parameters, station distribution and or frequency that would preclude a detailed assessment of identifying potential pollutant sources in the watershed.

A comprehensive water quality data analysis effort to assess patterns, trends (both spatial and temporal) and relationships across different variables is planned for a later task once additional data become available. The assessment will include an evaluation of water quality conditions (i.e. numeric nutrient criteria exceedances), statistical analysis of hydrological and water quality data from surface water and groundwater, a focused assessment of pollutant sources within the watershed and impacts to water quality, pollutant load modeling and recommendations to improve water quality in the creek and bayou. Items that were reviewed as part of this desktop evaluation are briefly summarized below.

5.8.1. Monitoring Programs and Permits

The County has a joint NPDES/MS4 permit (FLS000019-004, issued 7/10/2017) with the FDOT, the City of Pensacola, and the Town of Century as co-permittees. The County developed a collaborative assessment monitoring plan, which included an ambient surface water monitoring program (Part I) and an intensive study basins program (Part II) for the County and its co-permittees. More information regarding the MS4 permit is noted below.

The stormwater management program (SWMP) monitoring plan is included in the 2017 NPDES/MS4 Annual Report (dated January 2019). The active portion of the plan is a long-term surface water quality monitoring program designed to assess the general effectiveness of the SWMP and to assist in identifying and prioritizing portions of the MS4 requiring additional controls, and to evaluate load reductions. The program is also intended to identify problem sources where urban stormwater is negatively impacting surface water resources.

The stations include general ambient stations, and several were included in the Bacteria Pollution Control Plan (BPCP) for Carpenter Creek. The ambient stations have been monitored since 2017 and are currently being sampled quarterly for nutrients, total suspended solids (TSS), and chlorophyll-a (Bayou Texar only), and monthly for bacteria. A summary of the number of samples collected in 2017-2018 for each of the five Carpenter Creek stations in WBID 676 and the two Bayou Texar stations (WBID 738) as part of the BPCP and ambient program are provided in the annual NPDES/MS4 report. Per the TMDL, the MS4 permit's waste load allocation (WLA) for stormwater discharges require a 49% and 28% reduction in current fecal coliform loadings for Bayou Texar and Carpenter Creek, respectively (Rhew, 2012).

Based on the report, summarizing data from January 2017 to June 2018, Carpenter Creek stations at 12th Avenue and 9th Avenue exceeded the freshwater bacteria (E. coli) water quality standard (>410 Most Probably Number (MPN)/100mL) for 22% and 28% of the samples, respectively. Bayou Texar did not have E. Coli exceedances during that reporting period. Carpenter Creek and Bayou Texar have impairments and TMDLs for fecal coliform bacteria and the County and co-permittees are implementing the BPCP to assess and reduce the impairment.

None of the stations in either the Carpenter Creek or Bayou Texar WBIDs exceeded the dissolved oxygen saturation or total phosphorus (TP) criteria. One station on Bayou Texar (Hyde Park station) and two stations on Carpenter Creek (9th Avenue and 12th Avenue) exceeded the 0.67 mg/L total nitrogen (TN) criterion (Panhandle West Nutrient Watershed Region) for 100% of the samples reported during that time period. The report notes that nitrogen is the most significant water quality concern in these watersheds and, while the sources of nitrogen have not yet been determined, that groundwater inputs from septic tank leachate should be considered.

As part of the watershed characterization, average values of existing nutrient data from surface water stations were calculated and plotted for a preliminary visual representation of the spatial distribution of TN (**Figure 5.8-1**) and TP (**Figure 5.8-2**) concentrations in the creek and bayou. The figures show larger TN magnitudes in Carpenter Creek before the confluence with the bayou. Greater TP concentrations were noticed in the bayou, and at one station in Carpenter Creek. Under subsequent project tasks, the available data will be processed and analyzed to assess trends and to identify potential sources of contaminants.

5.8.2. Available Data

Surface Water

The County's ambient monitoring program was reviewed as part of the watershed evaluation that was mainly geared to conduct a data gap analysis for water quality data (**Section 6.0** and **Appendix F**). Based on the review, it was found that there is a good distribution of monitoring stations along the creek and bayou, however, there were some stations that were overlapping with other data providers and it was determined that tributaries were not in the monitoring network. In addition, sampling frequencies were mostly sampled on a quarterly basis (excluding the fecal indicator bacteria parameters). Data that were provided from academic institutions (UF and UWF) were also reviewed and may be further assessed during the data analysis phase of this project.

Items of note regarding the monitoring network include the following:

- Station 21FLKWATESC-CA-CREEK-1 had nutrient data (sampled quarterly) for a period of record (POR) from 2000-2014 (retrieved from IWR database). The shapefile of Escambia County (County) monitoring stations (provided to Wood by the County in September 2019) showed the station Carpenter Creek at Davis Hwy in the same location as 21FLKWATESC-CA-CREEK-1.
- Station 33020HF1 had nutrient data (sampled approximately quarterly) for a POR from 1999-2017 (retrieved from WIN database). The shapefile of County monitoring stations (provided to Wood by the County) showed the station Bayou Texar at 12th Ave Bridge in the same location as 33020HF1.
- Station 21FLDOH ESCAMBIA317 (near the confluence with Pensacola Bay) had bacteria data for POR from 2000-2018, with bi-weekly sampling frequency in the last 2 years (retrieved from IWR database).
- The stations 21FLKWATESC-BA-TEX-1, 21FLKWATESC-BA-TEX-2, and 21FLKWATESC-BA-TEX-3 have nutrient data sampled quarterly from 2007-2017. These stations appear to be previous Escambia County stations.

Average values of existing nutrient data from surface water stations were calculated and plotted for a preliminary visual representation of the spatial distribution of TN (**Figure 5.8-1**) and TP (**Figure 5.8-2**) concentrations in the creek and bayou. The figures show larger TN magnitudes in Carpenter Creek before the confluence with the bayou. Greater TP concentrations were noticed in the bayou, and at one station in Carpenter Creek. Under subsequent project tasks, the available data will be processed and analyzed to assess trends and to identify potential sources of contaminants.

Figure 5.8-1 – Average Total Nitrogen at Surface Water Stations in Creek and Bayou

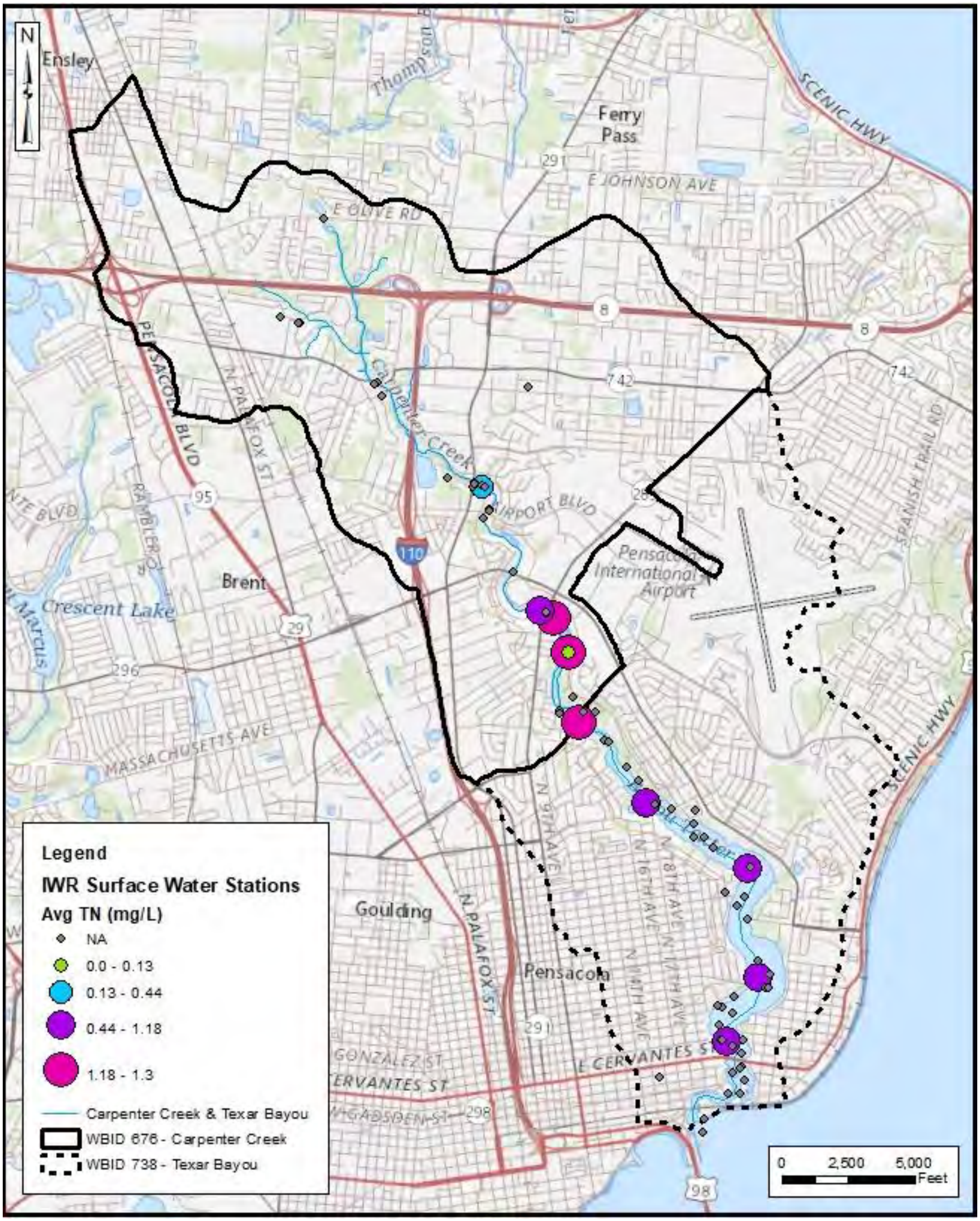
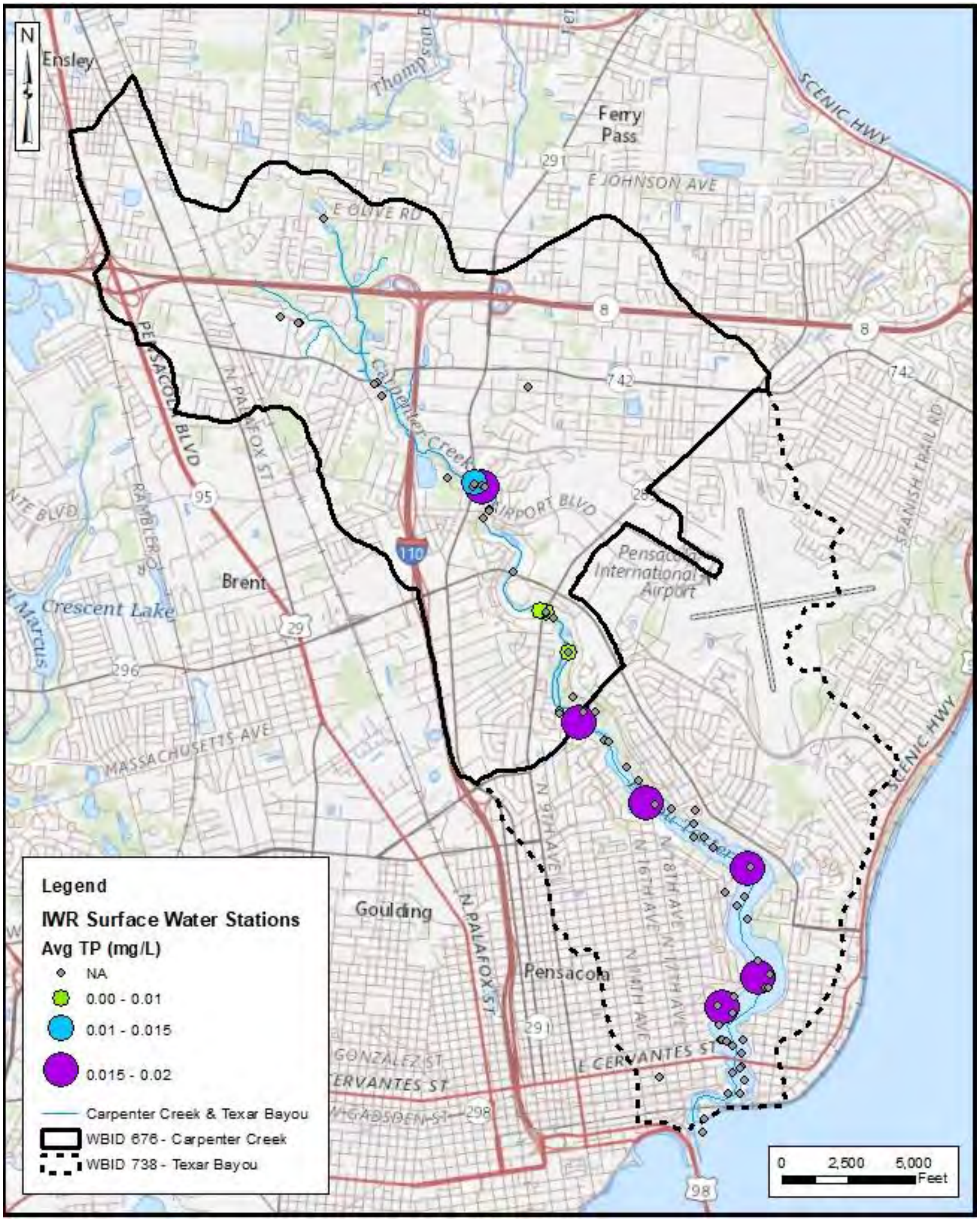


Figure 5.8-2 – Average Total Phosphorus at Surface Water Stations in Creek and Bayou



wood. IMPACT Campaigns WETLAND SCIENCES INCORPORATED SCAPE

Groundwater

Similar to surface water, groundwater data were retrieved and reviewed to assess what data are available and at what frequency, and the spatial distribution. As part of the data gap analysis (**Section 6.0** and **Appendix F**), relevant geospatial data were assessed to inform the effective placement of groundwater monitoring wells. The NRCS 2018 soils layer showed that most soils in the watershed and surrounding area are well-drained hydrologic soil group (HSG) A or B. As mentioned, the POT map (NWFWMD 2000) showed that groundwater tends to travel from the northwest corner of the Carpenter Creek watershed to the southeast corner, and from the outer edges of the watershed in toward the creek and bayou. FDOH septic system shapefiles provided by the County showed large, concentrated areas of septic systems throughout most of the Carpenter Creek watershed, specifically in the northwest corner and along the western and eastern boundaries of the watershed. According to the POT map, these septic areas are up-gradient of the creek and bayou and may contribute nutrients and bacteria via surficial groundwater connectivity.

Industrial and domestic wastewater facilities, monitoring wells, outfalls, and disposal types (from FDEP public data portal) were also assessed. Several sand mine and concrete batch plant industrial waste facilities were observed, but no domestic wastewater facilities or disposals exist within the watershed (or estimated area of groundwater influence). The ECUA-Central Water Reclamation Facility, which is not within the watershed, does provide public reuse, however, it is not clear how much of the distribution network is within the Carpenter Creek watershed. This will be investigated further during later tasks.

While there was no substantial recent data found for any groundwater wells in the watershed, many wells previously sampled exist within the watershed, including NWFWMD and USGS wells. According to the NWFWMD Hydrologic Data Services staff, there are five groundwater monitoring wells within the basin for the creek and bayou that are being measured for groundwater level, with some being shallow and some deep (Station IDs: 3007, 3006, 2275, 2276, and 2277). The District has expressed that these wells are viable and can be made available to collect water quality if desired by the County.

Well data were also retrieved from USGS, and several wells had historical data from the 1970s and 80s, but no recent data. Two wells (PENSACOLA 12TH AVE. WELL and USGS OBS.WELL 026-713-5) showed elevated nitrate concentrations above 6 mg/L. These wells are located within a concentrated septic area. Only one monitoring well within the Carpenter Creek/Texar Bayou watersheds was found to have recent water quality data (WIN station ID 52289), with one sample on 12/12/2017 (variety of nutrients, tracer, and biological parameters.). Other historical USGS wells that were found are not within the Carpenter Creek watershed but are within the estimated area of groundwater influence and downgradient of a large concentrated septic area (i.e. clusters of septic systems) and two industrial wastewater facilities.

5.8.3. Potential Sources of Pollution

There are several potential sources of pollution in the Carpenter Creek and Bayou Texar watersheds (for both surface water and groundwater resources) that impact water quality and drive impairments in these waterbodies. Sources include urban development such as stormwater runoff (fertilizer runoff from residential land use, golf courses and/or other sports fields), wastewater (both from facility discharge/sewer and septic systems), hazardous contamination adjacent to the study area, erosion or resuspension of sediment from within the waterbodies leading to downstream transport and cycling, trash, and other human and wildlife contributions, etc. Areas of the watershed that had agricultural land uses could also be potential sources of contamination to groundwater and ultimately surface water. In addition, atmospheric deposition (wet and dry) is another potential source through the combustion of fossil fuels, electric power generation, residential and agricultural fertilizer applications, and other agricultural activities can generate atmospheric-derived nutrient loads received by surface water bodies. The potential sources within the watersheds are briefly described below and will be further evaluated during subsequent project tasks.

5.8.3.1. *Trash*

Trash, garbage, and waste debris are obvious sources of pollution that are evident in both Carpenter Creek and Bayou Texar, which is unfortunately common for such urban waterbodies. However, there are many stormwater entries into the creek and bayou that offer little to no opportunity for initial screening of trash and debris before they enter the waterways. For example, there are many private developments that are designed to discharge their stormwater via concrete flumes directly into Carpenter Creek, with no mechanism to capture debris prior to entry.

The Pensacola and Perdido Bay Estuary Program (PPBEP) recently obtained a grant from the EPA for a comprehensive pilot project to study the quantity, composition, and extent of water-borne trash in local waterways and work to identify, reduce, and eliminate potential sources. The project will focus on three waterbodies in the area, one of which is Carpenter Creek.

Also, Emerald Coastkeeper is a local non-profit organization that hosts routine "Carpenter Creek Headwater's Cleanup" events, with the aim of cleaning up trash and debris along Carpenter Creek with the help of local volunteers. To date, the group has facilitated approximately 20 cleanups along the creek, primarily within City limits between Davis Highway and 12th Avenue. There were two cleanups noted in the unincorporated area: one at the headwaters near Olive Road and the other off of Burgess Road. Altogether, there were over 20 tons of debris estimated to be removed from the creek bed. The items recovered seemed to originate from illegal dumping and homeless camps. Thirteen homeless camps were documented within the City limits, observed during the various cleanups. Illegal dumping was noted to be prevalent behind commercial businesses and empty properties, in particular. Many of the homeless camps were reported as being removed or cleaned up through the cooperation of property owners, code enforcement, and the Pensacola Police Department.

5.8.3.2. *Stormwater*

Stormwater outfalls and non-point sources (i.e. infiltration and runoff of fertilizer, oil and grease, human and animal waste, etc.) within Carpenter Creek and Bayou Texar are potential sources of contaminants such as nutrients, fecal bacteria indicators, and metals within the area. Known outfalls are present along the western shore of the northern part of the bayou where constituent concentrations are elevated, and it has been expected that reduced tidal flushing has contributed to elevated metal concentrations in the northern part of the bayou (Mohrherr et al., 2005).

5.8.3.3. *Wastewater*

There is one NPDES-permitted facility (the Gulf Power Company-Crist Power Plant, FL0002275) located within the Escambia River boundary and one NPDES-permitted wastewater facility (Cemex-Pensacola Plant, FLG110354) located within the Carpenter Creek WBID boundary (Rhew, 2012). The TMDL report notes that these facilities do not contribute fecal coliform bacteria to surface water, but other constituents may be contributing to the waterbody.

Also, the Wood team, alongside the County, has been in communication with the ECUA throughout the Watershed Evaluation phase of the project. As a stakeholder in the project, ECUA has been forthcoming in sharing information related to their ongoing and planned projects that could be relevant to this study. In February of 2021, ECUA shared that they soon will be beginning a design project that will involve the rehabilitation of a trunk main in the vicinity of Carpenter Creek. The ECUA trunk main project is anticipated to have a schedule of approximately 7 years. As this watershed management plan progresses into the phase of watershed recommendations and project recommendations, Wood will continue discussions with ECUA in an effort to coordinate project timelines and efficiencies, as needed.

5.8.3.4. *Septic*

Large areas of septic systems are present throughout the Carpenter Creek watershed, concentrated in the northwest corner and along the western and eastern boundaries of the watershed (Florida Department of Health (FDOH)). These septic areas are up gradient of Carpenter Creek and Bayou Texar and have the potential to contribute nutrients and bacteria through groundwater connectivity. According to the FDOH Onsite Sewage Treatment & Disposal System (OSTDS)/septic GIS layer (2013), there are 1,201 septic systems within the Carpenter Creek WBID boundary and 82 septic systems within the Bayou Texar WBID boundary.

No measured septic tank failure rate data is available for Escambia County. Septic tank failure rates for use in the development of TMDLs were derived using the number of septic tanks in Escambia County based on FDOH septic tank inventory and the number of septic tank repair permits issued within the County. Based on the FDOH 2009-2010 inventory, the average annual septic tank failure discovery rate was calculated to be about 0.72% for the County (Rhew, 2012).

In recent discussions with the ECUA, the Wood team has been informed that ECUA has an active septic-to-sewer program. The Wood team will continue discussions with ECUA throughout the subsequent assessment and recommendations phases of the project.

5.8.3.5. *Sediments*

Channel constriction at the southern end of Bayou Texar began in the late 1800s and has continued to increase with commercial and residential development. Major increases in siltation occurred in the 1970s and 1980s and were thought to be reduced by the construction of a jetty at the mouth of Bayou Texar in 1991 (Liebens et al., 2006). Previous sediment transport analyses have shown that sediments are trapped in the northern part of Bayou Texar and have led to long term accumulations of sediment-bound contaminants. Such contaminants have shown to exceed sediment quality guidelines and can be resuspended in the water column during certain conditions. Presently, native terrestrial and aquatic vegetation has been replaced by non-native lawns that run to the water’s edge, possibly increasing runoff and sedimentation into the creek and bayou (Liebens et al., 2006).

UWF had conducted numerous physical, chemical, biological, and hydrographic studies in Bayou Texar in the late 1980s and early 1990s in an effort to assess sediment transport dynamics. Some of the studies were completed to establish a baseline in relation to jetty construction in the bayou (Stone and Morgan, 1992). The UWF studies concluded that the geometry of the entrance channel to Bayou Texar was not equilibrated with the tidal prism and, prior to jetty construction in 1991, served as a sediment sink. The studies have shown an increase in sedimentation rates and a decrease in channel depths from infilling, based on bathymetric survey data and volumetric calculations. Over the decades, there have been efforts to dredge the bayou on several occasions, so the rates of deposition are likely to be off due to the occasional dredging activities in the channel. Also, changing the channel cross section from dredging activities may have changed the flushing potential of the channel, which alters the overall deposition or downstream transport rates of sediment. Other studies assessed sediment deposition at the stormwater outfalls in Bayou Texar and provided recommendations to dredge some of the outfalls.

A PERCH study showed that elevated concentrations of most evaluated pollutants were present in surficial sediments only, and specifically in the northern section of the bayou (Mohrherr et al., 2005). The study also noted relationships between sediment size distribution (i.e. grain size) and level of contaminants, mainly due to mechanisms such as adsorption/desorption of contaminants bound to particles. It was noted that soft sediments in the bayou between Cervantes Street and the 12th Ave Bridge present the most serious impact to the bayou. The PERCH study also noted that increased erosion and sediment transport from stormwater runoff has accumulated sediments in Carpenter Creek as well, with some areas of the creek being dredged in the 1980s. The previous studies have documented that sediments are an issue in both the creek and bayou.

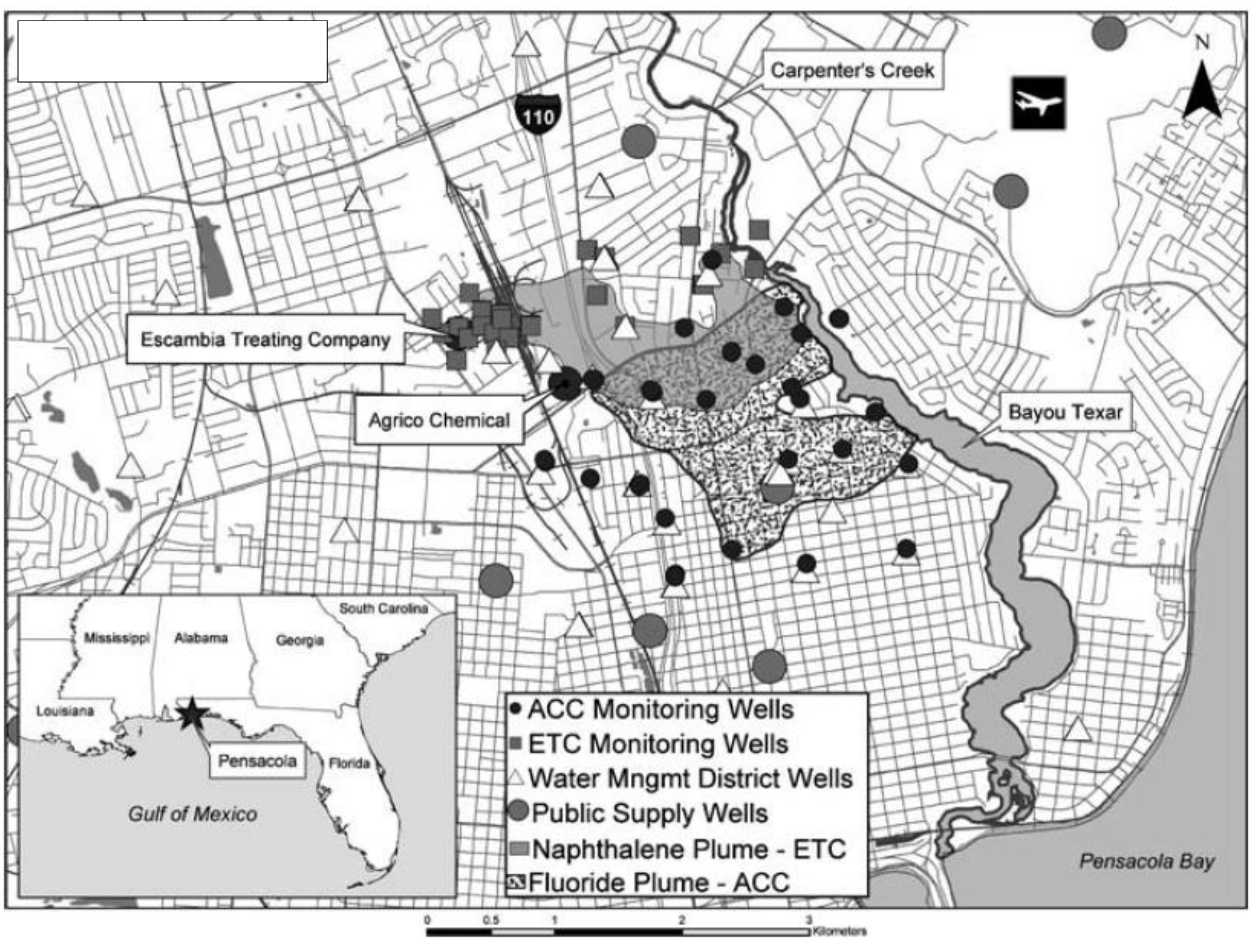
5.8.3.6. *Known Hazardous Contamination*

The Agrico Chemical Company (Agrico) is a 35-acre former chemical production facility adjacent to Carpenter Creek and Bayou Texar. **Figure 5.8-3** below shows the proximity of the Agrico facility to the Cceek and bayou. Agrico was in operation from 1889 to 1975 and was placed on the EPA Superfund Program's National Priorities List (NPL) in 1989 due to contaminated groundwater, sludge, and soil resulting from the discharge of wastewater in four onsite unlined ponds (EPA 2020). Bayou Texar is downstream from the Agrico site and the contaminated groundwater plume.

The Escambia Wood Treating company is a 31-acre former facility located southeast of the Agrico Chemical Company, as shown in **Figure 5.8-3.** The Escambia Wood Treating company was operational from 1942 to 1982 and was placed on the EPA NPL in 1994 due to groundwater and soil contamination (EPA 2020).

Agrico and the Escambia Wood Treating Company have directly impacted the Sand and Gravel aquifer and drinking water wells within the areas, as shown in **Figure 5.8-3** (Geraghty and Miller 1993). The main pollutants of concern include fluoride, heavy metals, polycyclic aromatic hydrocarbons (PAHs), sediments, nutrients, pesticides, and bacteria (Mohrherr et al. 2005), and studies have shown that contaminants have the highest concentrations within the northern part of the Bayou (Liebens et al. 2006, Mohrherr et al. 2005).

Figure 5.8-3 – Location of Groundwater Plumes Emanating From Priorities List Sites




Erosion along Carpenter Creek near Spring Hill Drive

6.0 WATERSHED EVALUATION DATA GAP ANALYSIS

During the Desktop Watershed Evaluation, the Wood team conducted an assessment of the available and collected data to identify if there were gaps in the critical data sets necessary for the completion of future project phases. The following sections summarize the data gaps identified, and the recommendations proposed to further develop the datasets necessary to prepare a comprehensive WMP.

6.1. Water Quality Information Gaps

This section provides a summary of data gaps that were identified from a review of water quality stations (surface and groundwater) that were retrieved by querying the following:

1) Impaired Waters Rule (IWR) database (Run 58, FDEP)
2) FDEP Watershed Information Network (WIN) and STOrage and RETrieval (STORET) database
3) Shapefiles provided by Escambia County
4) USGS website data portal

There are several surface water monitoring stations, as discussed above, that are part of the County's monitoring network. However, no tributaries were found to be monitored as part of this network, and the frequencies for nutrient monitoring are quarterly. This presents a gap in data in terms of spatial and temporal resolution relevant to assessing sources of pollutants within the watersheds.

Groundwater stations were also assessed to investigate if certain areas are influenced by potential groundwater contamination upgradient of Carpenter Creek and Bayou Texar, and if sufficient monitoring wells are available to assess contamination from groundwater into these waterbodies. Sampling frequency and analytes that are currently being collected for both surface and groundwater were reviewed and some key parameters were found to be needed to fill out a more comprehensive dataset that can be used to track pollutant sources within the watersheds.

As mentioned above, nutrients are being collected quarterly for most parameters, which is sufficient to track nominal trends at stations within the creek and bayou. However, monthly sampling is needed on a greater spatial distribution and for more parameters to conduct a more refined assessment of potential sources within the watersheds that are contributing to elevated pollutant loads and impairments. Recommendations for adjusting sampling frequency and analytes are provided in a later section.

There have been several studies characterizing sediment sources and loads from within the freshwater drainage network, but they need to be updated and targeted to provide a better understanding of sediment quality in both waterbodies.

6.2. Monitoring Recommendations

Data gaps were found in respect to surface water quality, groundwater, and hydrologic information in Carpenter Creek and Bayou Texar. General recommendations for adjusting sampling frequency and analytes were provided to the County.

Following the stakeholder meeting on February 19, 2020, a meeting was held between the County, Wood, and other stakeholders to discuss the preliminary data gaps identified by the Wood team in the monitoring network. As a result of this meeting, the County requested that Wood provide monitoring program enhancement options for consideration, with the options having varying levels of required effort and costs.

Therefore, Wood prepared recommendations for three different monitoring enhancement programs: basic, comprehensive, and long-term, varying in complexity and cost. The details of the three program recommendations are provided in the technical memorandum included in **Appendix F**. The proposed programs would enhance the existing monitoring programs by increasing the number and distribution of surface water and groundwater monitoring stations and flow stations, as well as their respective parameters and frequencies.

The purpose of combining flow measurements and water quality sampling programs is to define relationships between flow and water quality parameters of concern and to estimate loading rates and yields. Based on a preliminary evaluation of soils and potentiometric surface data, there appears to be potential connectivity between groundwater and surface water in the watersheds. Therefore, additional groundwater data is needed to further evaluate the effects of groundwater contributions on surface water quality conditions in both Carpenter Creek and Bayou Texar.

In summary, the basic monitoring program includes the minimum distribution of stations, parameters and associated frequencies recommended by the team. This program would include modifying the County's existing monitoring program by adding or enhancing the monitoring plan for surface water stations, establishing a limited groundwater monitoring well network, and adding a staff gage. In general, the basic program called for increased monitoring frequency at two surface water stations, initiation of monitoring at one surface water station and three groundwater locations, and installation of one staff gage.

The comprehensive monitoring program includes a more thorough array of monitoring that would address questions regarding pollutant sources, which may only require a year or more of intensive monitoring, rather than the alternative long-term program. The comprehensive program enhances the number and distribution of stations. In addition to the basic program, described above, the comprehensive program would include components such as groundwater seepage meters to assess groundwater seepage within the creek, additional stream flow gages at surface water monitoring stations to estimate loads, and characterization of sediment flux dynamics and internal loading from legacy sedimentation.

In summary, the comprehensive plan proposed monitoring for additional parameters, beyond what was proposed under the basic plan, for 4 existing surface water stations along the creek, adding 3 new surface water stations and 4 flow gages along the creek, and conducting an initial groundwater seepage study. If groundwater contamination is confirmed by the seepage meter study, the team further suggested the installation of surficial groundwater monitoring wells. In addition, the comprehensive program suggested an evaluation on the characterization of sediment flux dynamics and internal loading from legacy sedimentation in Bayou Texar. Finally, a long-term monitoring program was recommended for future consideration following the implementation of the comprehensive program described above.

Additional meetings were held with Escambia County in April 2020 to discuss the team's recommendations. The County elected to conduct monthly sampling in July, August, and September 2020 for use in the project's upcoming water quality analysis task.

6.3. Hydrologic/Hydraulic Information Gaps

This section provides a summary of the data gaps related to the hydrologic/hydraulic information necessary for proper model development under the subsequent project task.

6.3.1. Stormwater Structure Inventory

As part of the desktop reconnaissance, several data sources were collected and analyzed for information related to the existing stormwater infrastructure in the watersheds. The data sources included, but were not limited to, recent aerial photography, County GIS databases, County development plans, ERPs, FDOT plans, and the City's Stormwater Master Plan, completed in July 2019. Field reconnaissance efforts resulted in the collection of additional stormwater feature and infrastructure locations.

Although much information has been collected and assessed under the desktop and field reconnaissance, hydrologic/hydraulic data gaps are present within the unincorporated portion of the study area. Data gaps are specific areas or specific features that are missing information that is necessary or beneficial to model development.

As noted in Section 5.5, there has been much information provided by the ERPs and the FDOT and the County in relation to the roads within the study area. However, as of the date of this report, the Wood team is awaiting further information (if available) to assist with the model development, specifically in relation to the following sections of roads:

- Interstate 110 (I-110) and Interstate 10 (I-10) interchange
- I-110 and North Davis Highway (SR-291) interchange
- I-10 between I-110 and North Davis Highway
- I-10 between I-I-110 and Highway 29
- I-10 and Highway 29 interchange
- Burgess Road existing conditions

Also, within the unincorporated portion of the study area, there are 2 notable and rather significant areas of development that did not produce available ERP plans during the data collection phase, as noted below:

- Woodham High School at northeast corner of East Burgess Road and the CSX Railroad
- Former University Mall (new BJ's Wholesale location) at northwest corner of Davis Highway and Creighton Road

Although field reconnaissance helped to fill many of the data gaps in these areas, the lack of information from plans presents a challenge for proper modeling of these areas.

As part of the Watershed Evaluation, the features incorporated within the inventory database, described under **Section 5.5**, were assessed to determine which were applicable to include as model links under the subsequent model task. For those features that were marked for potential inclusion in the model, additional assessment was performed to determine which were missing vertical elevation data or other data necessary for model development. Then, those select features were noted to require future traditional survey to fill in the data gaps.

In total, as of the date of this report, there are 152 points identified as requiring traditional survey for use in the subsequent modeling efforts. The selected survey points represent grate inlets, pipe inlets/outlets, and control structures. It should be noted that, if information is available and provided for the above-mentioned data gaps, the preliminarily identified survey needs may be reduced proportionately.

6.3.2. Areas of Concern/Historical Water Levels

There is substantial data available from the April 2014 storm event, related to rainfall data and high water records/flood complaints. The April 2014 storm event appears to have enough information to assist with future H&H model calibration.

University of Florida scientists Goodhart and Deitch also collected stage and flow data during the Tropical Storm Gordon in September of 2018. The stage data is noted by the scientists as being more reliable than the flow data collected from this storm. The Wood team will review the data collected during Tropical Storm Gordon in further detail, to determine whether there is sufficient and accurate data available for use during model verification.

In late September of 2020, and early October of 2020, field reconnaissance efforts were conducted to document high-water marks and storm-related impacts following Hurricane Sally. Although much of the data collected during the post-storm field reconnaissance was qualitative in nature, high-water marks recorded in certain locations provide the opportunity to obtain quantitative elevations for potential use in the H&H model to be developed under a subsequent task. There were ten such high-water marks noted during the post-Hurricane Sally field reconnaissance.

Other than what is noted above, there is limited measured or anecdotal information related to recent flood events. This information is important to verify the H&H model results and projected flooding areas.

The Wood team recommends collecting anecdotal histories, accounts, and photos during subsequent community engagement activities for the project. Additionally, the collection of vertical elevations from documented high-water marks, noted during the field reconnaissance following Hurricane Sally, may provide additional quantitative data to help with model verification efforts under the subsequent modeling task. The Wood team recommends traditional survey methods be utilized for the collection of vertical elevations at up to ten specific locations, noted as exhibiting post-Hurricane Sally high water marks, within the study area.

7.0 REFERENCES

Albrecht, Barbara. Carpenter Creek Watershed REE Proposal Concept Paper.

Alford, J. D., & Anderson, L. C. (2002). The Taxonomy and Morphology of Macranthera Flammea (Orobanchaceae). *SIDA, Contributions to Botany, 20*(1), 189-207.

AMEC. 2013. Technical Support for Numeric Nutrient Concentration Sensitivities Associated with Different Types of Florida Freshwater Streams. Prepared for Florida Department of Environmental Protection. Tallahassee, FL. 98 p.

Atlas of Florida Plants Institute for Systematic Botany. (2020, June 15). *Atlas of Florida Plants >> Species Page* . Retrieved from Atlas of Florida Plants >> Species Page : https://florida.plantatlas.usf.edu/Plant.aspx?id=2615

Averhart, S. (2017, May 1). *WUWF 88.1*. Retrieved from Luna Site Confirmed As Largest Mid-16th Century Spanish Settlement in the Southeast : https://www.wuwf.org/post/luna-site-confirmed-largest-mid-16th-century-spanish-settlement-southeast#stream/0

Berndt, M.P., E.T. Oaksford and G.L. Mahon, 1998. Groundwater. In E.A. Fernald and E.D.

Chafin, L. G. (2000). *Field Guide to the Rare Plants of Florida* . Tallahassee, Florida : Florida Natural Area Inventory.

Clewell, A. F. (1985). *Guide to the Vascular Plants of the Florida Panhandle.* Tallahassee, Florida : University Presses of Florida .

Commission, Florida Fish and Wildlife Conservation. (2016). *Florida's Imperiled Species Management Plan.* Tallahassee, Florida : Florida Fish and Wildlife Conservation Commission.

Cooper, S. E., & Chafin, r. L. (2020, July 01). *NatureServe Explorer*. (A. V. NatureServe, Producer) Retrieved from https://explorer.natureserve.org/

Duncan, W. H., & Duncan, M. B. (1988). *Trees of the Southeastern United States* . Athens, Georgia: University of Georgia Press .

Engineers, U. A. (2008). *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region.* Vicksburg: U.S. Army Engineer Research and Development Center .

Environmental Institute of Houston, University of Houston - Clear Lake . (2015). *Distribution, Abundance, and Habitat Use of the Saltmarsh Topminnow (Fundulus jenkinsi).* Houston, TX: University of Houston - Clear Lake .

Escambia County. (2015, July 28). *Stormwater Advisory Team (SWAT) County-Wide Stormwater Recommendation Report.*

Escambia County. (2016). *Bacteria Pollution Control Plan.* Pensacola : Escambia County .

Escambia County. (2016). *Bacteria Pollution Control Plan Carpenter Creek (WBID 676).* Pensacola, FL: Escambia County .

Escambia County. (2013). Escambia County Basin Study Guidelines and Specifications.

FDEP. (2012). *Final TMDL Report Fecal Coliform TMDL for Escambia River (WBID 10F), Texar Bayou (WBID 738), and Carpenter Creek (WBID 676).*

FDEP. (2020, May 1). *Map Direct*. Retrieved from Map Direct: https://ca.dep.state.fl.us/mapdirect/

Federal Register. (1999, February 3). Executive Order 13112 - Invasive Species. District of Columbia.

Federal Register. (2016, December 8). Executive Order 13751 of December 5, 2016 . *Safeguarding the Nation From the Impacts of Invasive Species* . District of Columbia .

Fenneman, N. M., 1946. Physical Divisions of the United States, Map (scale 1:7,000,000). U.S. Geological Survey, Reston, Virginia.

FFWCC. (2020, June 15). *Florida Fish and Wildlife Conservation Commission* . Retrieved from Prohibited Nonnative Species List : https://myfwc.com/wildlifehabitats/nonnatives/prohibited-species-list/

FFWCC. (2020, June 15). *Invasive Plant Management*. Retrieved from The Historical Aspects of Invasive Plant Management in Florida: https://myfwc.com/wildlifehabitats/habitat/invasive-plants/#:~:text=The%20Invasive%20Plant%20Management%20Section,and%20waterways%20throughout%20the%20state.

FLEPPC. (2020, June 15). *Florida Exotic Pest Plant Council*. Retrieved from 2019 List of Invasive Plant Species: https://www.fleppc.org/

Florida Department of Environmental Protection . (2020, June 15). *Florida State Parkws*. Retrieved from Large-Leaf Jointweed at Big Lagoon: https://www.floridastateparks.org/learn/large-leaf-jointweed-big-lagoon

Florida Fish and Wildlife Conservation Commission . (2012). *Florida's Endangered and Threatened Species* . Tallahassee: Florida Fish and Wildlife Conservation Commission.

Florida Fish and Wildlife Conservation Commission. (2011). *Saltmarsh Topminnow Biological Status Review Report*. Tallahassee, Florida: FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION.

Florida Museum of Natural History . (2020, June 15). *UNIVERSITY OF FLORIDA HERBARIUM COLLECTIONS CATALOG*. Retrieved from UNIVERSITY OF FLORIDA HERBARIUM COLLECTIONS CATALOG: https://www.floridamuseum.ufl.edu/scripts/dbs/herbs_project/herbsproject/herbs_pub_proc.asp?accno=151265&famsys=A&output_style=Report_type&trys=2

Florida Natural Areas Inventory . (2010). *Guide to the natural communities of Florida: 2010 edition*. Tallahassee, FL: Florida Natural Areas Inventory.

Geraghty and Miller, Inc: 1993, Final feasibility study Agrico Chemical site, Pensacola, FL. Prepared for: Conoco, Inc. and Freeport-McMoran, Inc.

Gerbert, W.A., D.J. Graczyk, and W.R. Krug, 1987. Average Annual Runoff in the United States, 1951-1980, Map (scale 1:7,500,000). U.S. Geological Survey Hydrologic Atlas HA-710.

Gilbert, K. M., Tobe, J. D., Cantrell, R. W., Sweeley, M. E., & Cooper, J. R. (1995). *The Florida Wetlands Delineation Manual*. Tallahassee: Florida Department of Environmental Protection .

Gluch, O. (2005). Pinguicula species (Lentibulariaceae) from the southeastern United States: observations of different habitats in Florida. *Acta Botanica Gallica, 152*(2), 197-204.

Godfrey, R. K., & Wooten, J. W. (1979). *Aquatic and Wetland Plants of the Southeastern United States (Monocotyledons)*. Athens, GA: The University of Georgia Press .

Godfrey, R. K., & Wooten, J. W. (1981). *Aquatic and Wetland Plants of Southeastern United States: Dicotyledons*. Athens, Georgia: University of Georgia Press.

Goodhart, T. Examining the Spatial and Temporal Dynamics of Stormwater Pollutants in an Urbanized Watershed. PowerPoint Presentation.

Hallam, C. K. (1998). *Species Profile: Eastern Indigo Snake (Drymarchon corais couperi) on Military Installations in the Southeastern United States; Technical Report SEWDP-98-2*. Vicksburg, MS: U.S. Army Corps of Engineers Waterways and Experiment Station.

Harrison, M. (2000). Mary Gibson Henry, Plants woman Extraordinaire. *Arnoldia 60/1*, 11.

Henry, J. A., 1998. Weather and Climate. In E.A. Fernald and E.D. Purdum, eds. Water Resources Atlas of Florida. Institute of Science and Public Affairs, Florida State University, Tallahassee.

John Palis, G. H. (2020, July 02). *Ambystoma bishopi*. Retrieved from The IUCN Red List of Threatened Species 2008: e.T136128A4245386.: https://dx.doi.org/10.2305/IUCN.UK.2008.RLTS.T136128A4245386.en

Jr., W. R., & Anderson, P. J. (2010). *Notes on Florida's Endangered and Threatened Plants 5th Edition.* Gainesville, FL : Florida Department of Agriculture and Consumer Services; Bureau of Entomology, Nematology and Plant Pathology - Botany Section .

Kiefer, J.H., Mossa, J., Nowak, K.B., Wise, W.R., Portier, K.M., & Crisman, T.L. 2015. Peninsular Florida Stream Systems: Guidance for Their Classification and Restoration. Final Report. No. 05-03—154R. FIPR Institute. Bartow FL. 653 p.

Kral, R. U. (1983). *A report on some rare, threatened, or endangered forest-related vascular plants of the South.* . Atlanta, Ga: USDA Forest Service, Southern Region.

Lane, E., 1994. Florida's Geological History and Geological Resources. Florida Geological Survey Special Publication No. 35, Tallahassee.

Levins, R. (1969). Some demographic and genetic consequence of environmental heterogeneity for biological control. . *Bull. Entomol. Soc. Am.* , 237-240.

Liebens, J., Mohrherr, C. J., Rao, K. R., & Houser, C. A. 2006. Pollution in an urban bayou: magnitude, spatial distribution and origin. Water, air, and soil pollution, 174(1-4), 235-263.

Lopez, J. D., Petersen, M. S., Lang, E. T., & Charbonnet, A. M. (2010). Linking habitat and life history for conservation of the rare saltmarsh topminnow Fundulus jenkinsi: morphometrics, reproduction, and trophic ecology. *Endangered Species Research* , 15.

Macarther, R., & Wilson, E. (n.d.). The Theory of Island Biogeography .

Metcalf, C., 2004. Regional Channel Characteristics for Maintaining Natural Fluvial Geomorphology in Florida Streams. U.S. Fish and Wildlife Service, Panama City, Florida, pp. 45.

Mohrherr, C. J., Liebens, J., Lepo, J. E., & Rao, K. R. 2005. Profiles of selected pollutants in Bayou Texar, Pensacola, FL. University of West Florida. Center for Environmental Research and Bioremediation.

Morse, L. &., & rev. VEC, r. T. (2020, July 01). *NatureServe*. Retrieved from https://explorer.natureserve.org

Mossa, J., 1998. Surface Water. In E.A. Fernald and E.D. Purdum, eds. Water Resources Atlas of Florida. Institute of Science and Public Affairs, Florida State University, Tallahassee.

Mott Macdonald. (July 2019). City of Pensacola Stormwater Master Plan.

NOAA. (2020, May 1). *Data Access Viewer*. Retrieved from NOAA: Data Access Viewer: https://coast.noaa.gov/dataviewer/?redirect=301ocm&keyword=lidar#/

NOAA. (2020, June 15). *Gulf Sturgeon Critical Habitat Map and GIS Data* . Retrieved from Gulf Sturgeon Critical Habitat Map and GIS Data : https://www.fisheries.noaa.gov/resource/map/gulf-sturgeon-critical-habitat-map-and-gis-data

O'Connor, R. (2020, July 1). Invasive Animals. (K. Johnson, Interviewer)

Ogden, J. C. (1990). *Habitat Management Guidelines for the Wood Stork in the Southeast Region.* Atlanta, Georgia : U.S. Fish and Wildlife Service, Southeast Region .

Omondi, S. (2018, July 30). *What is a Wildlife Corridor?* Retrieved from Environment: https://www.worldatlas.com/articles/what-is-a-wildlife-corridor.html

Pratt, T.R., Wellhead Protection Area Delineation in Southern Escambia County, Florida. Water Resources Special Report 97-4. Northwest Florida Water Management District.

Rhew, K. 2012. Final TMDL Report: Fecal Coliform TMDL for Escambia River (WBID 10F), Texar Bayou (WBID 738), and Carpenter Creek (WBID 676). Florida Department of Environmental Protection.

Rupert, F. R. (1993). *The Geomorphology and geology of Escambia County, Florida*. Tallahassee, Florida : Florida Geological Survey .

Service, U. F. (2020, May 25). *IPaC Information for Planning and Conservation* . Retrieved from IPaC Information for Planning and Conservation : https://ecos.fws.gov/ipac/

Staff, S. S. (2004). *Soil Survey of Escambia County, Florida* . Washington, D.C.: Government Printing Office .

Staff, S. S. (2020, June 15). *Web Soil Survey* . Retrieved from Web Soil Survey : https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

Stone, G. W. and J. P. Morgan. 1992. Recent Sediment Flux and Bathymetric Changes in the Entrance Channel to Bayou Texar: Escambia County, Florida. Report prepared for the City of Pensacola by the Institute for Coastal and Estuarine Research, University of West Florida, Pensacola, Florida.

Subrahmanyam, P. (2020, June 15). *Florida's Native and Naturalized Orchids*. Retrieved from Orange Fringeless Orchid (Platanthera integra): https://www.flnativeorchids.com/natives_gallery/platanthera_integra.htm

Thompson, J. N. (2020, May 1). *Encyclopedia Britannica*. Retrieved from Metapopulation - published November 22, 2016: https://www.britannica.com/science/metapopulation

U.S. Department of the Army Corps of Engineers . (2008). *The Corps of Engineers, Jacksonville District, U.S. Fish and Wildlife Service, Jacksonville Ecological Services Field Office and State of Florida Effect Determination Key for the Wood Stork in Central and North Peninsular Florida*. Jacksonville, Florida : U.S. Department of the Army Corps of Engineers.

U.S. Fish and Wildlife Service . (1986). *Revised Recovery Plan for the U.S. Breeding Population of the Wood Stork*. Atlanta, Georgia: U.S. Fish and Wildlife Service, Southeast Region.

U.S. Fish and Wildlife Service and Gulf States Marine Fisheries Commission. (1995). *Gulf Sturgeon Recovery Plan*. Atlanta, Georgia: Fish and Wildlife Service .

U.S. Fish and Wildlife Service . (2020, May 1). *ECOS Environmental Conservation Online System* . Retrieved from Red Knot (Calidris canutus rufa): https://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=B0DM#crithab

U.S. Fish and Wildlife Service. (1990). *A Gopher Tortoise Recovery Plan*. Jackson, MS: U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service. (2001). *Florida Manatee Recovery Plan, (Trichechus manatus latirostris)*. Atlanta, Georgia.: U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service. (2014). *Rufa Red Knot Background Information and Threats Assessment. Supplement to Endangered and Threatened Wildlife and Plants; Final Threatened Status for Rufa Red Knot (Calidris canutus rufa) [Docket No. FWS-R5-ES-2013-0097; RIN AY17]*. Pleasantville, New Jersey : U.S. Fish and Wildlife Service, Northeast Region.

University of Georgia. (2020, June 15). *Center for Invasive Species and Ecosystem Health*. Retrieved from EDD MapS Distribution Maps : https://www.eddmaps.org/distribution/

USDA NRCS. (2020, June 15). *Introduced, Invasive, and Noxious Plants*. Retrieved from Introduced, Invasive, and Noxious Plants: https://plants.usda.gov/java/noxious

Weakley, A. (2015). *Flora of the Southern and Mid-Atlantic States.* . Chapel Hill, NC: University of North Carolina Herbarium.

VOLUME 2 APPENDIX A

SUMMARY OF DATA COLLECTED AND ANALYZED

Folder ID	Data Request	Notes	Spatial Reference File Available?	Notes on follow-up needed	Received / Not Received	Received from Entity
1	RESTORE Grant Application	Concept paper for project, and RESTORE application	NA		Received	County
2	Study Area polygon	Decision is to utilize the WBID boundary with a 2000 ft buffer as initial study area.	Independent Spatial File in Folder		Received	County
3	Topographic Information - LiDAR	Downloaded from WMD. Contact is John Krowe. Follow-up request for LAS files.County provided additional link to data.	Independent Spatial File in Folder		Received	WMD
4	Topographic Information - Contours	Some contours provided in "County_Data Request 2 November 2018" gdb and the City's CarpentersCreek.gdb received in November 2018.	Independent Spatial File in Folder		Received	County
5	County Basin Delineations_Existing	Use City model files for basins within City. County doesn't have other delineations.	NA		Not Available	
6	Aerial Imagery - pre 2019	1951 and 2016 Imagery uploaded.	Independent Spatial File in Folder		Received	Scape
7	March 2019 imagery - DOT flight	Link to data, provided by County. https://www.fdot.gov/geospatial/aerialmain.shtm	Independent Spatial File in Folder		Received	FDOT/ County
8	Mapped Impervious Surfaces	Received "MajorPavementSurfaces_clip2Nov2018" in County_Data_Request_2Nov2018_version10.gdb. This file was last updated in 2001/2002. May be a bit out of date but could be of use.	Independent Spatial File in Folder		Received	County
9	County roads	GIS files included	Independent Spatial File in Folder		Received	County
10	Parcel Layer	Received "Parcels_LandUse" in City's CarpentersCreek.gdb. Appears to be a joined GIS feature class.	Independent Spatial File in Folder		Received	City
11	Historical and Existing Land Use	2016 from NWFWMD. Historical land use files from Scape. Updated 2019 land use file from Scape	Independent Spatial File in Folder		Received	NWFWMD/Scape
12	Future Land Use	Received Future Land Use 2030 in "County_Data Request 2 November 2018" gdb received in November 2018. County noted this file is sometimes updated and can be used with confidence. City Future LU not available	Independent Spatial File in Folder		Received	County
13	Soils Data	Received in County_Data_Request_2Nov2018_version10.gdb and also in the City's CarpentersCreek.gdb	Independent Spatial File in Folder		Received	County/City
14	Water bodies	NHD layer downloaded. Ponds layers received in County_Data_Request_2Nov2018_version10.gdb and also in the City's CarpentersCreek.gdb	Independent Spatial File in Folder		Received	NHD/County/ City
15	Historical Water Levels	County doesn't have a layer for this. Some Data available for the April 2014 event. See the Folder 16 April 2014 Storm Event. Per County/City meetings, none noted from City either	NA		Not Available	

Folder ID	Data Request	Notes	Spatial Reference File Available?	Notes on follow-up needed	Received / Not Received	Received from Entity
16	April 2014 Storm Event Re-creation	Contains an April 2014 storm recreation report by HDR. Also has some KMZ files and a relevant NOAA article	Included in master project spatial file		Received	County
17	City Flood Complaints			None - per County/City Meetings - none available	Not Available	
18	Stormwater Inventory	This folder has pdf of the locations of stormwater treatment units within the City. However, see folder 63 for GIS databases provided by City and County	Independent and also included in master project spatial file		Received	County/City
19	ECUA infrastructure database	Contains GIS files of Emerald Coast Utilities infrastructure (wastewater/water)	Independent and also included in master project spatial file		Received	ECUA
20	Corrugated metal pipe mapping	CMP inventory noted to be unavailable by County. However, County did provide maps of two areas with known CMP issues that have not yet been addressed. Could be of signficance in terms of stormwater interference with the ECUA infrastructure	Included in master project spatial file		Received	County
21	County ponds preliminarily identified for potential retrofits	See this folder for pertinent information that identifies particular ponds that are preliminarily identified as being in need of improvements or are being looked at already by the County	Included in master project spatial file		Received	County
22	Public Facilities and Recreational Use	Escambia County Buildings and Park Parcels layers provided	Independent Spatial File in Folder		Received	County
23	Existing COUNTY Park/Preservation Areas Layer	Escambia County Park Parcels layers provided in Folder 22	Independent Spatial File in Folder		Received	County
24	CITY and COUNTY BMP layer and/or locations to reflect future CIP projects	GIS files obtained from County CIP (CIP_COUNTY_PROJECTS, CIP_ENGINEERING_POINTS, CIP_TRAFFIC). GIS files from County also include damage assessment layers for bridges, drainage, ponds, and roads, and Public Works damage assessment layer for the April 2014 flood event. Local Option Sales Tax (LOST) IV provides information for the County projects planned. Also see the SWAT report. Olive Road sidewalk project also planned.	Independent Spatial File in Folder		Received	County
25	COUNTY and City rain and stream gage locations	County does not have any relevant data.			Not Available	
26	County monitoring station locations (6-8 noted by County)	County provided GIS files - Escambia County monitoring stations.	Independent Spatial File in Folder		Received	County
27	COUNTY septic tank GIS Database	County referred us to FDOH for data. See Folder 28			Not Available	
28	Florida Department of Health (FDOH) septic tank GIS Database	Andrew Morris was the contact at DEP that assisted with this. Contains points for the centroid of the parcels noted to have septic.	Independent Spatial File in Folder		Received	FDEP

Folder ID	Data Request	Notes	Spatial Reference File Available?	Notes on follow-up needed	Received / Not Received	Received from Entity
29	ERP digital datasets	GIS layers for ERPs from FDEP and the WMD. ERP files also included	Independent Spatial File in Folder		Received	FDEP/WMD
30	Plans for Old Subdivision - Oakfield Acres	Direct discharges to Carpenter Creek. mentioned in meeting. Relevant as this area has potentially old CMP pipes that could potentially be allowing for pollution introduction. Folder contains pipe inspection videos, area maps, photos, etc. for the area	Independent Spatial File in Folder		Received	County
31	FDOT Plans	Burgess Road - Significant future project - ponds planned and a roadway expansion included. Project is of significance b/c there are proposed ponds that we should know about, etc. However, probably won't be constructed until 2030 per David Forte. 30% Plans provide drainage basins along r/w alignment on page 2. Plans also received for the 9th Avenue Bridge replacement, 17th Ave and Pens Bay Bridge, and Lanier Dr Sidewalk projects.	Independent Spatial File in Folder	Continuing to work with FDOT on receiving additional plans. Ongoing effort	Received	FDOT
32	County Drainage Project Plans	Contains plan details for 30 different projects, with 20 project plans identifying significant infrastructure to consider for modeling, and 23 sheeets to be georeferenced.	Independent Spatial File in Folder		Received	County
33	Wetland Assessments			Request in future if needed.	Not Received	
34	Wildlife Management Plans			Request in future if needed.	Not Received	
35	COUNTY Phase-I NPDES-MS4 permit	Permit and TMDL Prioritization Report. Separate shapefile of NPDES activities.	Independent and also included in master project spatial file		Received	County
36	Marine Science Academy of Washington High School	Washington High School Marine Science Academy students have been collecting data for a while in the watershed. Team should utilize their data to the highest practical extent and look to engage this student group throughout the project. GIS Dashboard link: https://btwhs-msa.maps.arcgis.com/apps/opsdashboard/index.html#/d9876c7f500d4044a050d6caba1d3206	Included in master project spatial file		Received	WHS
37	County Basin Management Guidelines	Plan to use the County's Basin Study Guidelines and Specifications, Sept 2013 as a guidance.	NA		Received	County
38	Corridor Study Olive Road	2009 PBS&J study. Identifies problem areas along the corridor and to recommend potential improvements that would increase safety while preserving mobility and accessibility along the corridor.	NA		Received	County
39	Adjacent Watershed Studies - Basin Studies	Map of adjacent drainage basins provided by County. Also master plan files for Scenic Hills (early 90s), Pensacola Bay (Nov 2007) and Beverly Parkway (Nov 2003) Basins	Independent Spatial File in Folder		Received	County

Folder ID	Data Request	Notes	Spatial Reference File Available?	Notes on follow-up needed	Received / Not Received	Received from Entity
40	City Stormwater Management Plan and related GIS/model	CADD dxf received 1/6/2020, model received 4/1/20. Model results files requested but unavailable	No		Received	City
41	Microbial Source Tracking sample data in watersh	Bacterial data can be found within IWR and STORET data sets located in Folders 43 and 46 - IWR includes qPCR data	Independent Spatial File in Folder		Received	Varies
42	Water Quality Data					
43	STORET	Shapefile of STORET sampling locations	Independent Spatial File in Folder		Not Received	
44	County Data	County data for April 2014 flood event - Fecal monitoring data results. Also a long-term ambient report provided. County WQ data for June-October 2020, and associated Pace lab reports	Included in master project spatial file		Received	County
45	FDEP's Waterbody Identification (WBID) basin shapefiles for WBIDs within the watershed	Contains shapefile of WBIDs	Independent Spatial File in Folder		Received	FDEP
46	FDEP's Impaired Water Rule (IWR) Database	Full POR for Carpenter and Bayou Texar. Shapefiles in folder for selected stations.	Independent Spatial File in Folder		Received	FDEP
47	Sediment Data	William Debusk report, Keith's City data, county XRF metals at outfalls, profiles of select pollutants in Bayou Texar. UWF report (Matt Posner) - all referenced as potential sources of info by the County. See folders 65-69 for potential information	NA		Received	Various
48	Aquatic Gap Analysis Project (GAP)	Link: https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap/science/aquatic-gap-analysis?qt-science_center_objects=0#qt-science_center_objects. Nothing dowloaded. AGAP works to synthesize existing data and generate new data products to answer questions about aquatic species, their habitats and their conservation needs at multiple scales. Working to build a national data framework. Species range and predicted habitat data available for download. National Terrestrial Ecosystem 2011 Map data downloaded.	Independent Spatial File in Folder		Received	USGS
49	NWFWMD's Data portal/directory (Aquarius)	Hydrologic data (Rainfall, stage station data) for rivers in NW Florida http://aquarius-web.nwfwmd.state.fl.us/. Data not for Carpenter Creek of Bayou Texar	NA		Not Available	NA
50	Potentiometric Elevation Data	November 2000 potentiometric surface. Shapefile also provided in folder. Carpenter Creek springshed shapefile	Independent Spatial File in Folder		Received	WMD
51	FDEP's Watershed Information Network (WIN) Database	POR table and raw data. Shapefile of clipped WIN results	Independent Spatial File in Folder		Received	FDEP
52	FDEP Wastewater Facility Regulation (WAFR)	Shapefiles and xls received for 3 mile bridge pre-cast facility and Bayou Concrete - Pensacola Plant	Independent Spatial File in Folder		Received	

Folder ID	Data Request	Notes	Spatial Reference File Available?	Notes on follow-up needed	Received / Not Received	Received from Entity
53	Tidal and Sea Level Rise Material	POR Table and raw data from NWIS. NOAA data and related KMZ file included.	Independent Spatial File in Folder		Received	Varies
54	Census data for relevant adjacent parcels including income level, owner vs. renter, family size, race, educational attainment.	Census data in GIS	Independent Spatial File in Folder		Received	Scape
55	Carpenter Creek Bacteria Pollution Control Plan	contains numerous pdfs	Included in master project spatial file		Received	County
56	Escambia County Comprehensive Plan 2030	Document serves as Part of the Escambia County Code of Ordinances. Provides orderly growth management procedures - intended not to terminate growth but instead to provide mechanisms for growth management to serve the citizens of the County. Chapters include future land use, mobility, housing, infrastructure, coastal management, conservaation, rec. and open space, and capital improvements	Included in master project spatial file		Received	County
57	Escambia County LID Manual 2016	September 30, 2016 Low Impact Development Manual	NA		Received	County
58	Walk the WBID - Maps on the Table - issues log and shapefile	Carpenter Creek WTWpts in Escambia_Basemap	Independent Spatial File in Folder		Received	County
59	UF (Matt Deitch, Tracy Goodhart) data collected in the watershed. Also, specific study conducted by Tracy for stormwater/GI impacts	Constituant and load data realted to base and peak flow conditions for Shiloh, Walton, and Carmike sub-rainage basins. Includes spreadsheets of streamflow and water conditions.	Included in master project spatial file		Received	County/UF
60	Escambia County Preliminary FIRM maps	Escambia County to adopt preliminary maps by fall 2020. Downloaded latest ones.	NA		Received	WMD
62	Carpenter Creek Stormwater Management Needs Assessment Sept 2003, Baskerville Donovan	2003 Baskerville Donovan study for Carpenter Creek. identifies potential problems and proposes conceptual improvement alternatives that will help reduce stormwater pollution loading into Carpenter Creek. Looked at existing drainage patterns and facilities and sources of contam. Focus was on 16 major outfalls to Carpenter Creek as identified in the Dames and Moore study of 2000. Summary document developed and included within file	Included in master project spatial file		Received	County
63	Miscellaneous GIS files for City and County (land use, roads, jurisdictional lines, parcels, etc)	Contains multiple GIS files from County and City.	Independent Spatial File in Folder		Received	County
64	Miscellaneous GIS files from NWFWMD (land use, roads, jurisdictional lines, parcels, etc)	Contains GIS files from the NWFWMD	Independent Spatial File in Folder		Received	WMD
65	Publication - Biophysical Monitoring Data - bathymetry, sediment, macroinvertebrate for 12 stormwater outfalls in Bayou Texar -1999	Includes monitoring data analyzed by Stone and Assoc. and UWF - for twelve stormwater outfalls within Bayou Texar	Included in master project spatial file		Received	WSI

Folder ID	Data Request	Notes	Spatial Reference File Available?	Notes on follow-up needed	Received / Not Received	Received from Entity
66	PERCH (Partnership for Environmental Research and Community Health" Bibliography - collaborative effort of UWF, FDOH, Escambia County Health Dept and Santa Rosa County Health Dept.	Includes references to over 1,000 scientific papers/studies with some degree of relevancy for the general area. Search within to find references to Bayou Texar or Carpenter Creek	Included in master project spatial file		Received	County
67	Bill DeBusk -Sediment and Water Quality Monitoring and Assessment Study	Per Brent - this document does not include any sites in Bayou Texar or Carpenter Creek. May be irrelevant, or at best use as reference only as needed	NA		Received	County
68	UWF Publication - "Profiles of Selected Pollutants in Bayou Texar"	Dr. Carl Mohrherr and others contributed.Notes the main contam. of concern include flouride, heavy metals, polycyclic aromatic compounds, sediments, nutrients, and bacteria. Study first looked at location and conc. of contam. affecting water and sediment quailty. Study then looked at flouride and radium in sediments. Included a bathymetric survey and effect of sediment particle size on pollution.	Independent Spatial File in Folder		Received	County
69	UWF Publications - 1) "Pollution in an Urban Bayou: Magnitude, Spatial, Distribution and Origin" and 2) "SPATIAL AND TEMPORAL VARIABILITY IN WATER QUALITY IN THREE URBANIZED BAYOUS OF THE PENSACOLA BAY SYSTEM, ESCAMBIA COUNTY, FLORIDA, USA"	1) Dr. Carl Mohrherr and others contributed. Determined the level and dist. of some pollutants in Bayou Texar and ID'd likely sources. Results show that flouride enters sediments in the N part of the Bayou and migrates into the water from contaminated GW plume from the USEPA's Priorities List sites. Radium also eminates from the contaminated GW plume. Metals are in exceedance in many places of the bayou - highest conc. in the norther part. Study concludes metals are surficial and not from the GW plume. Likely in the sediment 2) Thesis by Grace Sommerville (Dr. Caffrey's student) regarding WQ in Texar Bayou, Excel file of raw WQ data also provided.	Independent and also included in master project spatial file		Received	County
70	EPA "Environmental Quality of the Pensacola Bay System: Retrospective Review for Future Resource Management and Rehabilitation"	This report supports the EPAs Sustainable and Healthy Communities Research Program. The objective of the program is to assist communities make decisions that preserve the environment and the vital services they provide. The report provides an updated summary of the ecological condition of the Pensacola Bay System and the value of its ecological goods and services. Technical resource for resource management.	Included in master project spatial file		Received	County
71	Escambia County Paddling Trail Map	City putting together grant app for several new non-motorized boat launches	Included in master project spatial file		Received	County
72	Submerged Aquatic Vegetation Report for CC and Bayou Texar	April 2019 brief investigation by Barabara Albrecht and Iris Knoebl, documenting with pictures areas along the creek. Vegetation, habitat, development, etc. noted	NA		Received	County
73	Engineering Profiles and Recommendations - Carpenters Creek and Bayou Texar	Drawings from Jan 1978. Gives survey info for the canal and many inflow/outflow structures along creek. Unknown if these can be taken as constructed	Included in master project spatial file		Received	County

Folder ID	Data Request	Notes	Spatial Reference File Available?	Notes on follow-up needed	Received / Not Received	Received from Entity
74	County Superfund Sites - Escambia Wood Treating and Agrico Site	Stormwater outfall maintenance proposal by Wetland Sciences, outfall and boring locations, and soil analytical sumamry with metals & Benzo(a)pyrene Conversion Table. Old note: Sent by Brent Wipf. Sites themselves not within watershed, but groundwater contamination from sites is of concern.	Included in master project spatial file		Received	County
75	ERP transmittal for dredging of five City outfalls_data collected	2019 ERP transmittal for City of Pensacola, completed by Wetland Sciences with help from Mott MacDonald requesting authorization to dredge five City stormwater outfalls. Accompanying spreadsheet that summarizes total petroleum Hydrocarbons and metals, non-carcinogenic PAHs, and carcingogenic PAHs for the five outfalls. Shapfile developed for the five outfalls	Included in master project spatial file		Received	Keith Johnson
76	Shapefile of Areas and Key Identified during County Institutional Knowledge Meetings	See Meeting Notes in the Teams file for important notes from each meeting. This shapefile contains spatial locations for key notes that have a location associated. See Meeting Notes and shapefile for full information	Independent Spatial File in Folder	Internal Team use only. Not deli	Received	Jeanette
77	Escambia County SWAT (Stormwater Advisory Team) Stormwater Recommendations Report	July 2015 document, containing Countywide stormwater recommendations. The SWAT was established after the April 2014 rain event. To serve as a planning tool to help with future improvement and funding priorities. Focuses on insfrastructural priorities and policy enhancements. Included as an attachment to this document is the Stormwater Needs ASsessment study completed by Baskerville Donovan. That study indicates all known stormwater infrastructure needs to-date along with their rankings and other critical information.	NA		Received	County
78	Historical Resources	GIS files for archaelogical site locations, cemeteries, resource groups, bridges, structures, surveys. NOTE: THIS FOLDER'S DATA IS NOT ALLOWED TO BE SHARED OUTSIDE OF INTERNAL PROJECT TEAM. DO NOT DELIVER EXTERNALLY	Independent Spatial File in Folder	DO NOT EVER DELIVER THIS FOLDER. COPYRIGHTED INFORMATION	Received	Scape
79	FDEP Petroleum Cleanup Sites	Waste cleanup site layer from FDEP, extracted by County and petroleum program (excludes brownfields, etc since they typically have deep wells). Full dataset from Escambia County also in file.	Independent Spatial File in Folder		Received	FDEP
80	FDEP Strategic Monitoring Plan	County provided a spreadsheet for FDEP's strategic sampling plan for 2020. Includes sites in CC and Bayou Texar.	Included in master project spatial file		Received	County/FDEP
81	City-owned Submerged Lands in Bayou Texar	Keith provided pdf of title determination for lands, with map. Keep this in mind during BMP phase.	Included in master project spatial file		Received	WSI
82	Barbara Albrecht Windshield Tour Photos 0210202	Photos taken from windshield tour on 02102020	Included in master project spatial file		Received	Barbara Albrecht
83	Laurie Murphy Meeting Notes 02072020	Meeting notes and follow-up email from Laurie. Contains GIS shapefile of specific locations mentioned in meeting.	Independent Spatial File in Folder		Received	Laurie Murphy

Folder ID	Data Request	Notes	Spatial Reference File Available?	Notes on follow-up needed	Received / Not Received	Received from Entity
84	Coucilwoman Myers Meeting Notes 02102020	Meeting notes from meeting with Myers. Contains GIS shapefile of specific locations mentioned in meeting.	Independent Spatial File in Folder		Received	Myers
85	City Shoreline Protection District	Keith Johnson provided information related to the City's ordinances related to shoreline protection. Stormwater management plans required for properties within the Bayou Texar and Escambia Bay shoreline protection districts	NA		Received	WSI
86	Department of Health Sampling Data	Bacterial sampling data from 1999-2002	NA		Received	FDOH
87	NWFWMD Pensacola Bay SWIM Plan November 2(	November 2017 SWIM plan developed for the Pensacola Bay system	NA		Received	NWFWMD
88	Wellhead Protection Area		No		Received	County
89	Relevent Media and News Releases		No		Received	PNJ
90	Spatial Notes	This is an internal working file meant to help direct Team members on data folders that may have spatial data.	Yes		Developed	Varies

VOLUME 2 APPENDIX B

SITE WALK AND STAKEHOLDER COMMUNITY WORKSHOP #1

WOOD
SCAPE
IMPACT CAMPAIGNS
WETLAND SCIENCES
REBOL-BATTLE & ASSOCIATES

CARPENTER CREEK & BAYOU TEXAR WATERSHED MANAGEMENT PLAN

FOR ESCAMBIA COUNTY

SITE WALK AND STAKEHOLDER/ COMMUNITY WORKSHOP #1

SUMMARY MEMO
FEBRUARY 2020

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SUMMARY MEMO OVERVIEW

Task 7.2 of the project scope consisted of two primary components – a Site Walk and Stakeholder/Community Meetings.

The goal of the site walk was to observe the ground conditions along Carpenter Creek and Bayou Texar, to allow the project team to develop familiarity of the watershed and to open team discussion regarding known areas of concern and sharing of institutional knowledge. Site visit observations were documented through photographs, sketches, and videos that will be crucial to informing the watershed analysis and subsequent phases of the project.

The Stakeholder/Community Meetings component consisted of two separate events – an invited stakeholder meeting, and an open public meeting. The meetings were designed to engage with community members and stakeholders regarding existing conditions within the watershed and the process of developing the goals, priorities, and recommendations of the plan.

SCHEDULE OF EVENTS

TUESDAY FEBRUARY 18, 2020

7:30am	Site Walk
11:30am	Bayview Park – Washington High School Marine Science Group
12:00pm	Lunch with Pensacola Mayor and City Administrator
1:00pm	Site Walk cont'd
5pm	Wrap up meeting at Escambia County Central Office Complex

WEDNESDAY FEBRUARY 19, 2020

7:30am	Stakeholder Meeting Setup
8:30-10:30am	Stakeholder Meeting at Hilton Garden Inn
10:30-11:30am	Water Quality Monitoring Data Gap Meeting
5pm	Public Meeting Setup
5:30-8:30pm	Public Meeting at Washington High School

SITE WALK SUMMARY

OVERVIEW

The site walk included visits to 18 predetermined locations as well as several impromptu stops within the watershed which represented typical conditions, ranging from open, publicly owned sites along the Bayou and Creek, to privately owned sites where homes and back yards face the creek banks, to large commercial sites where parking lots surround densely forested areas.

General questions shared with the County in advance of, and discussed throughout, the site walk include:

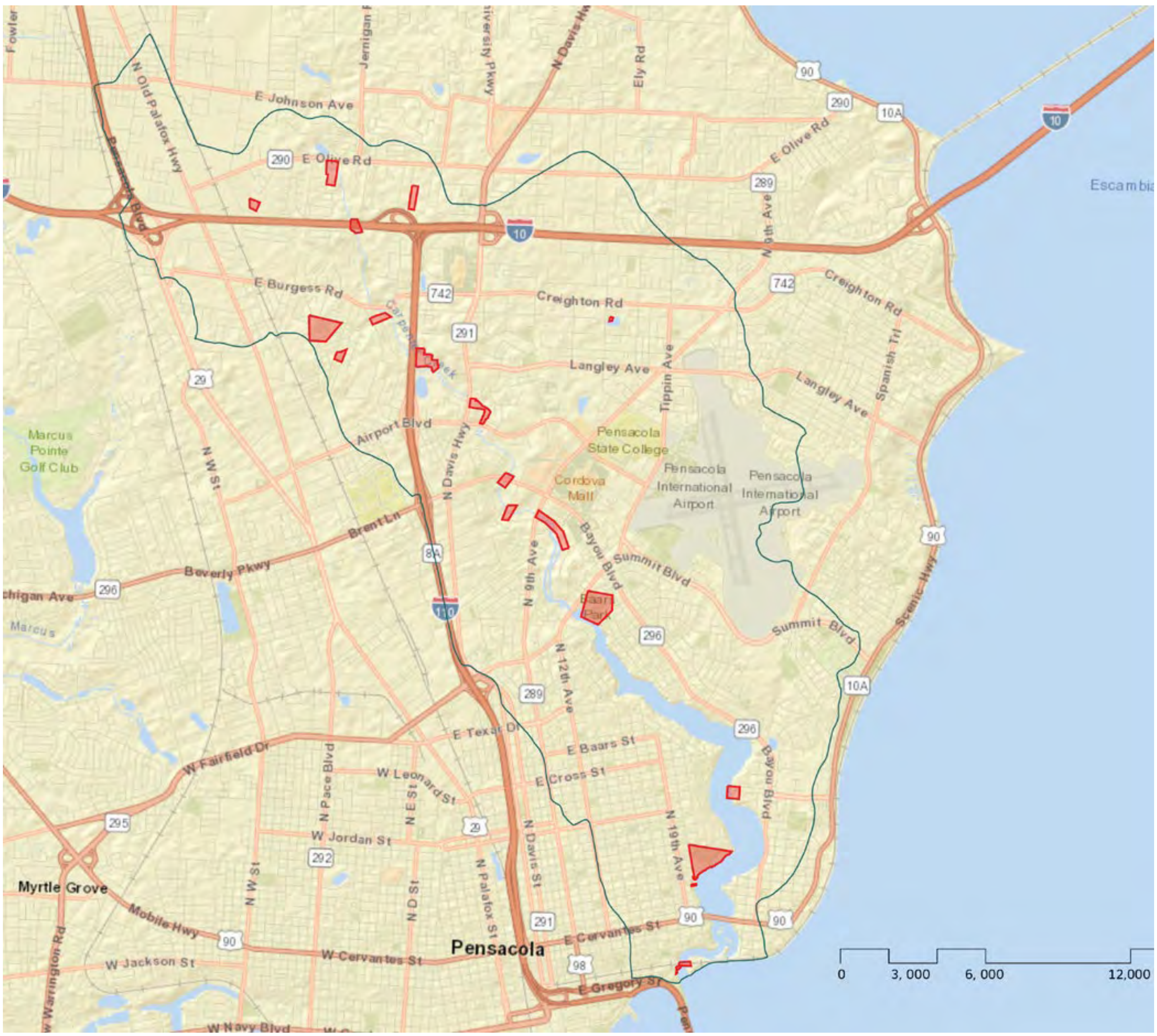
- What did the site look like historically compared to how it looks today?
- Why did the changes occur (if known)? Development, infrastructure, flow changes, etc.
- Does the County or City have specific knowledge of issues related to flooding, water quality, erosion at this location?
- Have there been any projects proposed or restoration ideas discussed for this location?
- What kind of thoughts/ideas has the County been hearing or entertaining for the Headwaters property, if any? Or is this an open slate for now?
- Are there key stakeholders/landowners/private partnership opportunities at this location?
- It has been theorized that the beavers have been building dams and restricting the proper flow within the culverts under Olive Road. Is the County interested in exploring the idea of a span bridge in place of the existing box culvert?
- What are the possibilities for implementing invasive species removal and maintenance strategies?
- Are the County/City open and/or hopeful to employ revisions to their tree ordinances or development regulations, especially as it pertains to building/not building in the riparian zones?
- Who is responsible for maintenance in general along creek banks? For example, noted during previous site recon that many pine limbs and other vegetative debris were left in swales adjacent to the headwaters, due to pine tree limbs trimmed along power lines.
- What is the reasoning for material selected for rock being used for bank stabilization, for example near Davis Hwy Bridge?
- Are there already some local businesses interested in advancing the project and the future creek enhancements? How can we work with them to create an amenity? Example, the area behind Target – could this area realistically entertain a board walk type of structure behind the businesses? What are the obstacles?
- How can we engage businesses in better land management practices? Particularly, for example, in removal of invasive species upstream?

PARTICIPANT LIST

Escambia County: Terri Berry, Matt Posner, Brent Wipf, Dana Morton, Chris Curb, Matt Kelly; Wood: Christine Mehle, Jeanette Kelson, John Kiefer, Mary Szafraniec; SCAPE: Gena Wirth, Lee Altman, Mike Biros; WSI: Keith Johnson; Impact Campaigns: Travis Peterson; City of Pensacola: Chris Mauldin; Other: Liam Dunaway (videographer)

MAP OF PLANNED SITE WALK LOCATIONS

Scanned notes from the site walk are attached as Appendix A.



WETLAND SCIENCES INCORPORATED IMPACT Campaigns wood. SCAPE

1.

Address/Location: North of 7507 Sears Blvd, Pensacola, Florida 32514

Note: Parcel owned by ECUA. Possible stormwater retrofit/enhancement

2.

Address/Location: 715 Olive Road, Pensacola, FL 32514

Note: County owned lands, extreme headwaters of Carpenter Creek. Highly disturbed wetlands. Exotic and nuisance species. Potential location for innovative stormwater treatment, ecological restoration, and public access.

3.

Address/Location: South of 8011 Nalo Creek Loop Road, Pensacola, Fl 32514

Note: Lost Creek Subdivision. Access creek from stormwater parcel. Parcel A&B Stormwater retention parcels include portions of creek.

4.

Address/Location: 7620 Hilburn Ave, Pensacola, FL 32514

Note: Near Hillburn and Atwood - potential area for pond retrofit.

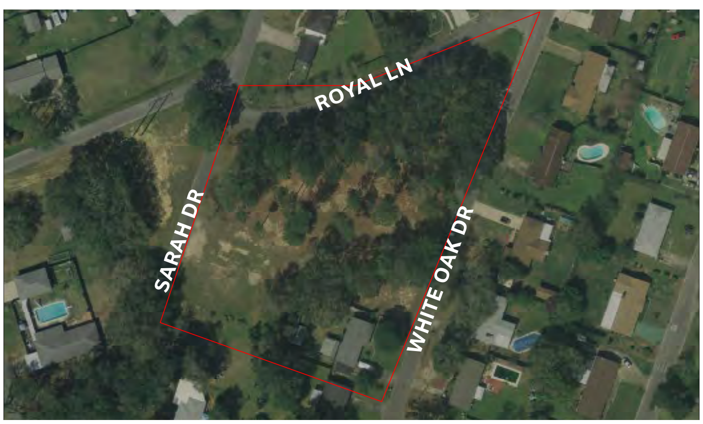
5.

Address/Location: Shiloh Drive at Intersection with Gettysburg Drive. Site Name - Oakfield Acres

Note: Outfall of old corrugated metal pipe system.

6.

Address/Location: Just South of Gettysburg Drive at Vicksburg Drive. Site Name - Oakfield AcresNote: Oakfield Acres known to have old corrugated metal pipe. Potential for wastewater intrusion into stormwater system. This is also a good example of a County park.



7.

Address/Location: Along east side of Sarah Drive between Royal Lane and Prince Road. Site Name - Oakfield Acres

Note: County park. Evaluate public access/utilization.

8.

Address/Location: Western terminus of Village Oak Drive.

Note: Privately owned stormwater management system for The Park at Sterling Hills Apartments. In disrepair and needs maintenance.

9.

Address/Location: Carpenter Creek between Davis & Airport Blvd

Note: Site of Natural Resource Conservation Service Emergency Watershed Project. Stream bank instability. Potential location for stream improvements.

10.

Address/Location: 2000 E Lloyd Street. Site Name - Bayview Park

Note: Evaluate public access and utilization including possible riparian buffer and enhancements

11.

Address/Location: Eastern terminus of Brainerd Street. Site Name Brainerd Street Outfall

Note: One of many stormwater outfalls into Bayou Texar. Documented contamination of bayou sediments (metals and volatile organics) near many of these outfalls. Potential location for stormwater retrofits and removal of contaminants from bayou sediments.

12.

Address/Location: N 17th Ave just south of Cervantes and south of Graffiti Bridge. Site Name 17th Ave Boat Ramp

Note: Potential location to improve public access and utilization. City park just north of this location.

13.

Address/Location: N 17th Ave. Same location as #12. Site Name - CSX Crossing Over Bayou Texar

Note: Evaluate possible channel improvements to improve tidal exchange and water quality of Bayou

14.

Address/Location: Western terminus of Hyde Park Road. Site Name - Hyde Park.

Note: City Park. Evaluate public access/utilization.

15.

Address/Location: Southern terminus of Pintado Drive south of Karmich Place. Site Name - Baars Park

Note: City Park. Potential for public access/utilization.

16.

Address/Location: 4751 Bayou Blvd behind Winn Dixie. Site Name - 9th Avenue at Carpenter Creek - from 9th to Target

Note: Evaluate stream condition/ potential improvements

17.

Address/Location: 5149 Bayou Blvd. Site Name - Springhill Movie Theater 1

Note: Evaluate stream condition/ potential improvements

* Not visited on site walk

18.

Address/Location: 5175 Bayou Blvd. Site Name - Springhill Movie Theater 2

Note: Evaluate stream condition/ potential improvements

* Not visited on site walk

19.

Address/Location: 5170 Springhill Dr.

Note: Private back yard fronting Creek

* Impromptu visit during site walk.

20.

Address/Location: 9th Avenue Bridge

Note:

* Impromptu visit during site walk.

Site Walk Location 01. Berm across tributary near headwaters, powerline ROW

Site Walk Location 02. County acquired property near headwaters, public access opportunity

Site Walk Location 02. Creek headwaters, evidence of beaver activity

Site Walk Location 05. Stormwater outfall and resulting scour

Site Visit Location 09. Erosion near hardened creek bank site along east side of Davis Hwy, sedimented creekbed.

Site Visit Location 10. Bayview park. One of few formal public access points.

Site Visit Location 13. Graffiti bridge at mouth of Bayou Texar. Army Corps dredging site and spoil bank. Opportunity for increased public benefit and access.

View from Site Visit Location 14. Private shoreline along Bayou Texar. Mostly grass and bulkhead.

Site Visit Location 15. Baar's Park. Wood's Dr. John Kiefer points out the longleaf pines that are part of a wonderful ecological/topographic section from upland to bayou. Public access opportunity.

Site Visit Location 16. Encampments along creek behind big box stores.


Site Walk Location 20. Sediment trapped under 9th Ave Bridge


Site not visited on tour. EPA-funded floating treatment wetlands harvested and transplanted at restoration sites


EXIT
CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

STAKEHOLDER MEETING

OVERVIEW

The project team reached out to relevant government entities, educational institutions, nonprofit groups, community groups, and individuals within the project area and invited them to participate in a targeted workshop. The workshop was designed to engage with stakeholders and inform the group about the project goals, process, and timeline, and collect information to assist with the watershed analysis.

The workshop included a presentation documenting the team's preliminary research into site history and ecology, a brief overview of the site walk, and a guided discussion in small working groups. The presentation is included as Appendix B. Group facilitators used large format maps and aerial photographs to prompt discussion and capture information provided by participants. A facilitator guide (included as Appendix C) included prompt questions on topics of site history and cultural resources, water quality issues, natural systems, ecology and hydrology, access and recreation, and plans and projects.

A physical model of the watershed was used to capture participants' high-level impressions using flags denoting the following characteristics: 'unsafe/safe', 'inaccessible/accessible', 'unwelcoming/welcoming', 'boring/fun', 'flooding', 'polluting', and 'special'.

PARTICIPANT LIST

The following list includes participants who RSVP'd to the event using Eventbrite:

Edward Bauer	Escambia County Education
Elizabeth Benchley	University of West Florida
Shawn Brown	Visit Pensacola
Kyle Buck	EPA
Jane Caffrey	University of West Florida
Cynthia Cannon	City of Pensacola
Warren Carruth	University of West Florida
Brian Cooper	City of Pensacola
William DeBusk	Environmental professional
Matt Deitch	University of Florida
Louviminda Donado	Florida Department of Health
David Ferguson	ORAU-NSSC Sustainable and Healthy Communities
David Fries	Institute for Human and Machine Cognition (IHMC)
Doug Heatwole	Environmental professional
Rand Hicks	Council of Neighborhood Associations
Brandon Jarvis	EPA
Ross Johnstone	Pensacola Rowing
Dan Lindeman	
LeeAnn Lutz	Florida Department of Health
Thomas Mayhair	Select Medical
Paul Pipes	City of Pensacola
Dawn Rudolph	Sacred Heart Hospital
Carrie Stevenson	University of Florida
Paul Thorpe	Northwest Florida Water Management District

County team and design team participants:

Matt Posner	Escambia County
Terri Berry	Escambia County
Brent Wipf	Escambia County
Dana Morton	Escambia County
Chips Kirschenfeld	Escambia County
Matt Kelly	Escambia County
Mary Szafraniec	Wood
Christine Mehle	Wood
Jeanette Kelson	Wood
John Kiefer	Wood
Stephen Hanks	Wood
Travis Peterson	Impact Campaigns
Brooke Fleming	Impact Campaigns
Keith Johnson	Wetland Sciences
Gena Wirth	SCAPE
Lee Altman	SCAPE
Mike Biros	SCAPE

NOTES - SUMMARY OF TABLE DISCUSSIONS

The notes below are meant to capture the participants thoughts as they were recorded, with minimal interference or interpretation:

Projects and Plans

- 9th Avenue Bridge – current proposed design not viewed favorably by some. Prefer a less 'boxy' concept to discourage sediment buildup.
- With the homeless population often seeking refuge and shelter along the creek, we will need to be cognizant and sympathetic to them regarding potential displacement in the event of future improvements in those areas.
- 21 Lot Subdivision named "Whispers" immediately adjacent to Carpenter Creek (to be verified).
- Concerns over new land development projects such as Baptist Hospital on Brent lane. City has annexed property. Hospitals are exempt from City tree ordinance.
- Proposed land development near hotel behind airport as medical park for West Florida Hospital/ Baptist near Summit Blvd. Another project that will clear cut large tracts of forested property.
- Development of Movie Theatre clear cut vast forested area. Tree ordinance does not preserve trees especially if the development has the means to pay the required mitigation fee.
- Old Florida Fish and Wildlife Conservation building near 17th Ave. will be demolished. This is location of planned roundabout.

Hydrology, pollution, erosion

- Seek opportunities to work with FDOT.
- Large stormwater pond at the airport. Earth excavated to form pond deposited at old WWTP site just north of Main Street.
- Admiral Mason park: good example of incorporating public use for stormwater management facility.
- City has installed several vaults or treatment systems along some of the outfalls along Bayou Texar.
- Living shoreline project along Bayfront. Could be used to encourage owners along Bayou to implement such BMPs.
- UWF had a stream gauge at one time at Shiloh Road.
- Publix did incorporate additional features above and beyond what was required to protect the watershed.
- Stream grade change more pronounced at road crossings.
- Log vanes – can they be used to enhance stream channel?
- "Dumpster juice" flowing into creek behind big box stores noted as a problem throughout the watershed, especially for those facilities that keep dumpsters directly adjacent to the creek or adjacent to connected storm inlets.
- Piedmont Ave.: significant erosion of roadway and homes following April 2014 Flood Event. Heavy erosion also noted along Scenic Hwy although outside the watershed.
- Use of beetles to control Air Potato.
- Spoil Island across railroad trestle. Camp location?
- Channel erosion at Springhill.
- Avulsion occurring along shoreline just north of Baars park.

- High elevation low grade change north side of watershed. Low dissolved oxygen levels.
- Reconnect natural floodplain.
- Is gravel bed stream a goal?
- How much of the floodplain to reconnect? Establish a goal with metrics.
- BMP - Pervious pavement or other green infrastructure concepts could be considered for businesses with parking lots that are usually at least 80% empty during non-peak hours.
- City of Pensacola has been installing "vortex" or quality improvement units - how effective?
- 2014 flooding - extreme rain events.
- Specific needs for stream and floodplain - stream is very incised - creative restoration/engineering.
- Better balance of sediment management and erosion control.

Public access and recreation

- Access to creek (boardwalk) would serve as a favored amenity.
- City plans for Baars park potentially include a kayak launch.
- Contamination concerns have minimized public utilization of Bayou by rowing community.
- Marina Oyster Barn – Only public marina.
- Florida circumnavigation paddle trail stop in Bayou.
- Most of Carpenter Creek in private ownership. Limited public access.
- Public would benefit from more pocket parks to provide access to stream.
- Lack of green space.
- Large green space near driving range (south of Airport?).
- LEAP constructed recreational trail (bike/ped) along Summit around west edge of airport. Heavily utilized. Very active. Doesn't connect to water.
- o Navy point park has a 2-mile loop coastal path that could be used as a design case study.
- People are blind to the creek - access, trail + boardwalk! Get people to see it!
- Walking trail + paddle trail loop throughout watershed - link neighborhoods with greenway.
- "Eyes on the Creek"- the idea that encouraging people to enjoy the creek and activate it will help increase visibility and in turn reduce vandalism, litter, etc. and improve the sense of security.
- Carpenter creek signage at every bridge.
- Restaurants by creek, seating faces road, not the creek (Miller's Ale house, Sake Cafe).
- More education, visibility, when people see it they take better care.
- Community engagement - help people see in the future - creek is overlooked.
- Show projects from other cities - Charlotte, Greenville.

Contacts and resources

- UWF participants at the table asked that the County and Team consider ways to incorporate these stakeholders in the project, the process, and even future projects, to the highest practical extent.

- Springhill and Valley Drive residences may be willing to share "Flood Stories."
- LeeAnn Lutz- DOH - shared historical monitoring data.
- Tracy Goodhart - thesis – hydrograph.
- Northwest Florida Water Management District - Daryl Boudreau.
- Beth Fugate - FDEP - living shoreline projects at Bayou Texar (6-7 projects).

History and culture

- Creek behind Olive Garden and near doctor's office – noted as near the historic mill location.
- Brown Barge middle school moved due to contamination concerns.
- During 60s and 70s Bayou was utilized by ski demonstration team who knew it wasn't safe to swim.
- 12th Ave Tree Tunnel: cultural feature in watershed (nearby Wisteria Tavern also has significance).
- Cordova Mall located over historic landfill.
- Public use of Bayou has included moonlight paddle tours of Bayou Texar from Bayview Park.
- Storm Drain stenciling projects.
- If floated logs to sawmill, was the creek navigable?

Ownership and policy

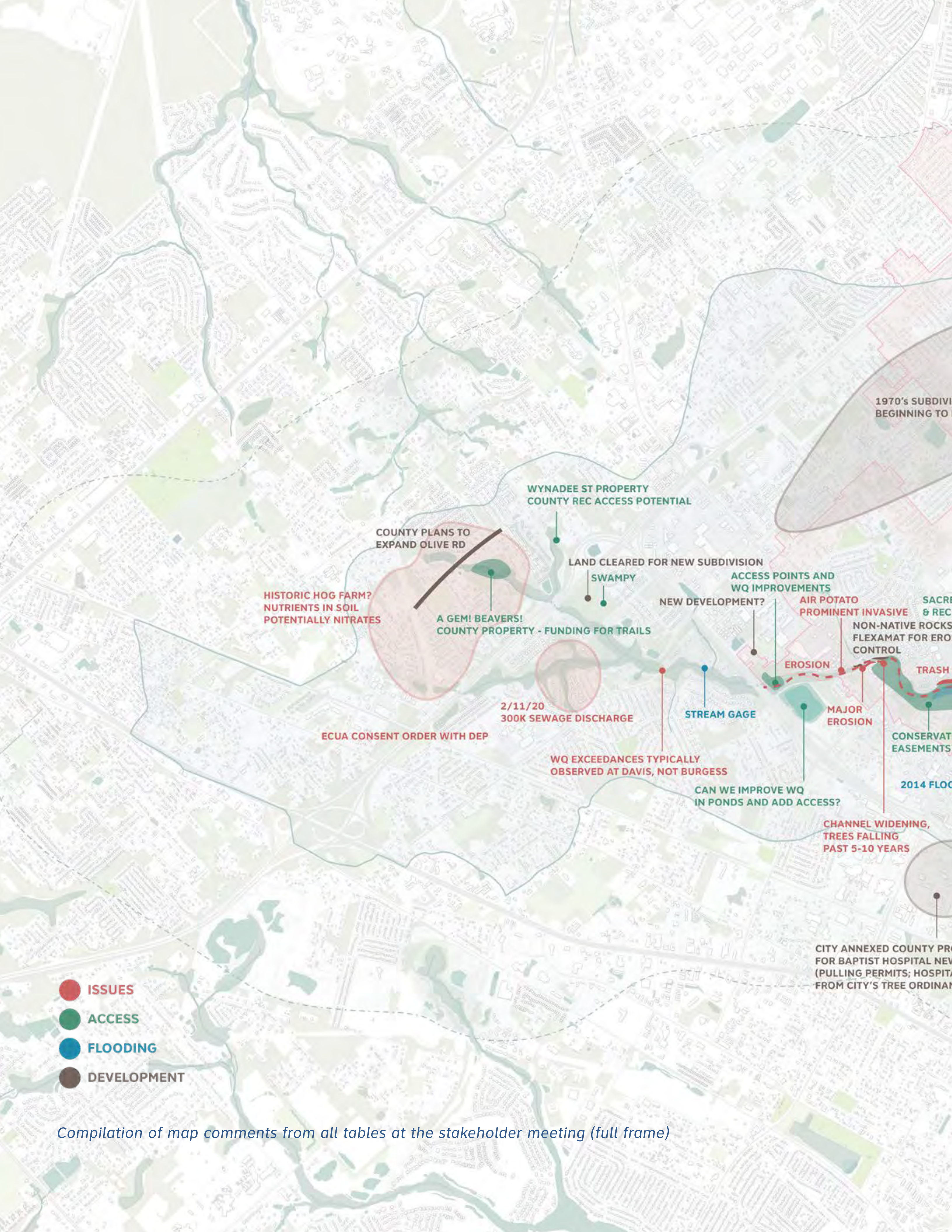
- Noted that currently private property ownership extends to the creek center – this will be a challenge to overcome during the BMP phase.
- Will Dunaway noted there is a real possibility to involve and incorporate residents in future BMP activities, engaging them to take stewardship and ownership in their backyards. This can be an option especially in areas where residents don't prefer the option of creating public access opportunities. One area noted was just north of Baars Park, along the Bayou.
- Concerns over manicured lawns adjacent to the Bayou (i.e. runoff). Homeowners are not held accountable.
- Toolkit of shoreline solutions for private landowners.
- City/County property ownership - some own to creek centerline - some creek is private - waters of state? – jurisdictional.
- Edge improvements – Bayou Texar has a shoreline protection district - treat first 1" of runoff.
- Tree ordinance: Revisions to both City and County ordinance are needed for greater protection and better implementation of mitigation (i.e. species selection, spacing, etc.). Need to ensure mitigation trees will create a resilient and appropriate canopy, including interconnected tree wells. Mitigation should replace what is being removed.
- 30' creek buffer in code, not enforced.
- Drain markings and QR codes.
- Work with FDOT on future design considerations that overlap with the watershed management plan efforts.
- City of Pensacola has stormwater utility fee.
- Pair with economic revitalization - box store model is dying - can new model embrace creek?

Sample map with workshop participant comments

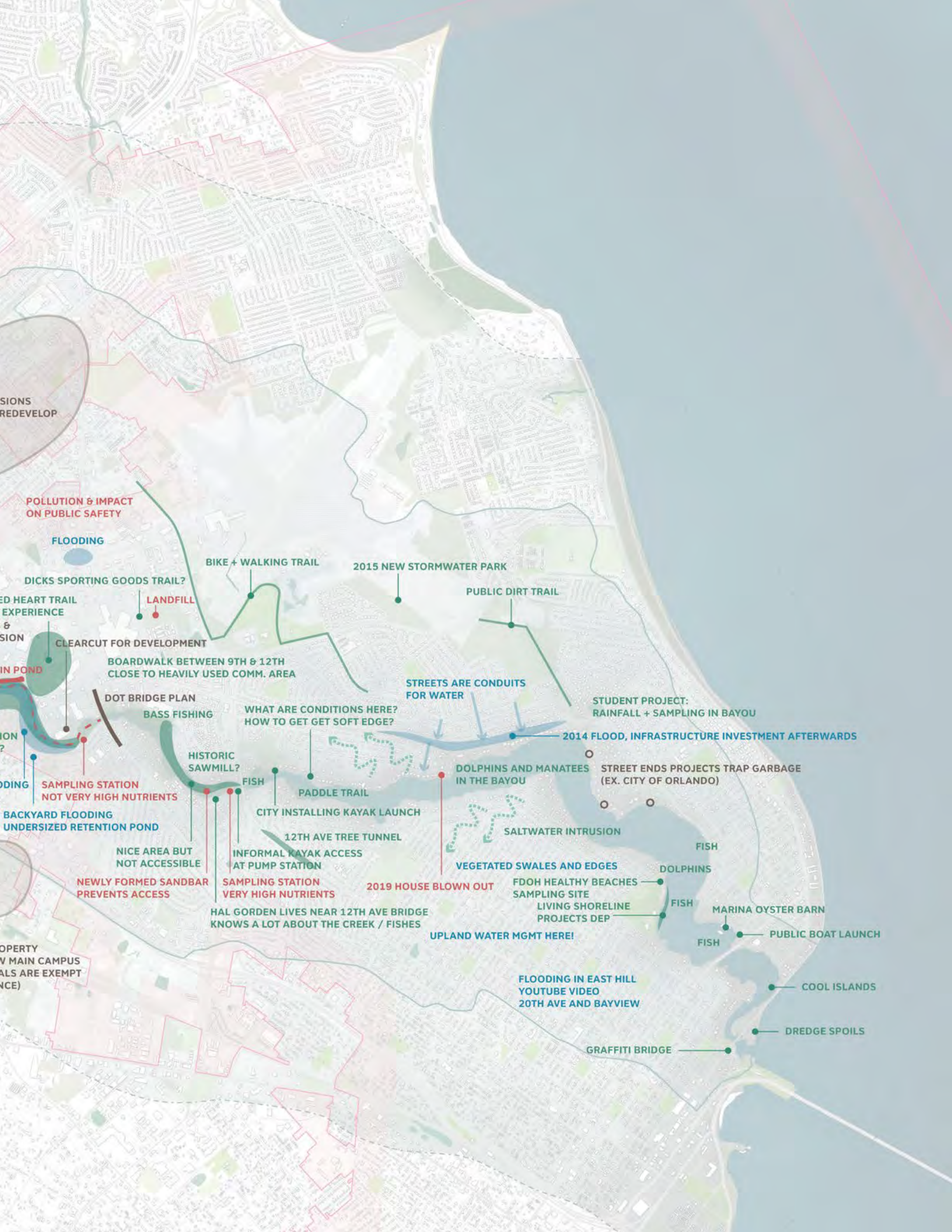
Model with workshop participant annotations

Workshop participants reporting back on discussion results

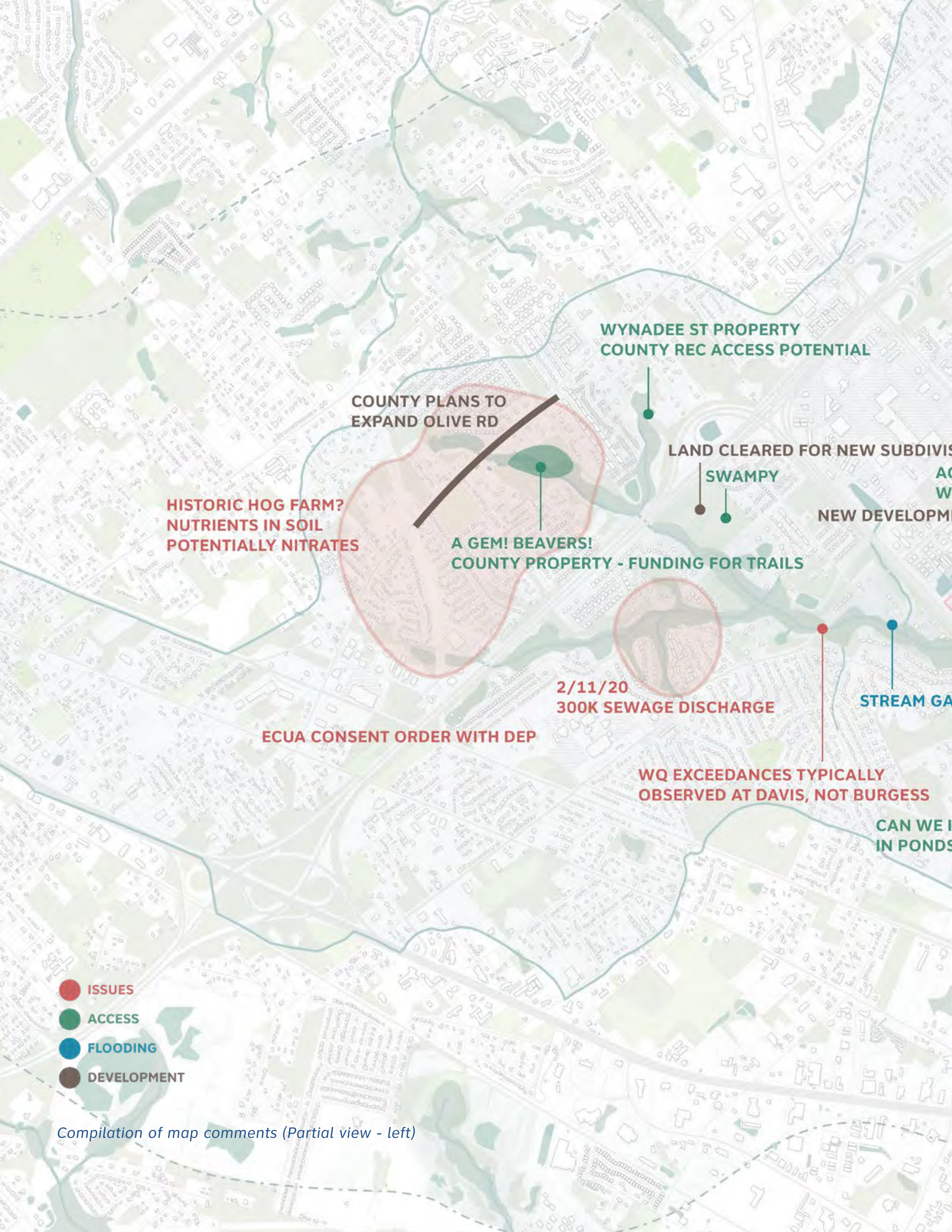
Workshop participants reporting back on discussion results



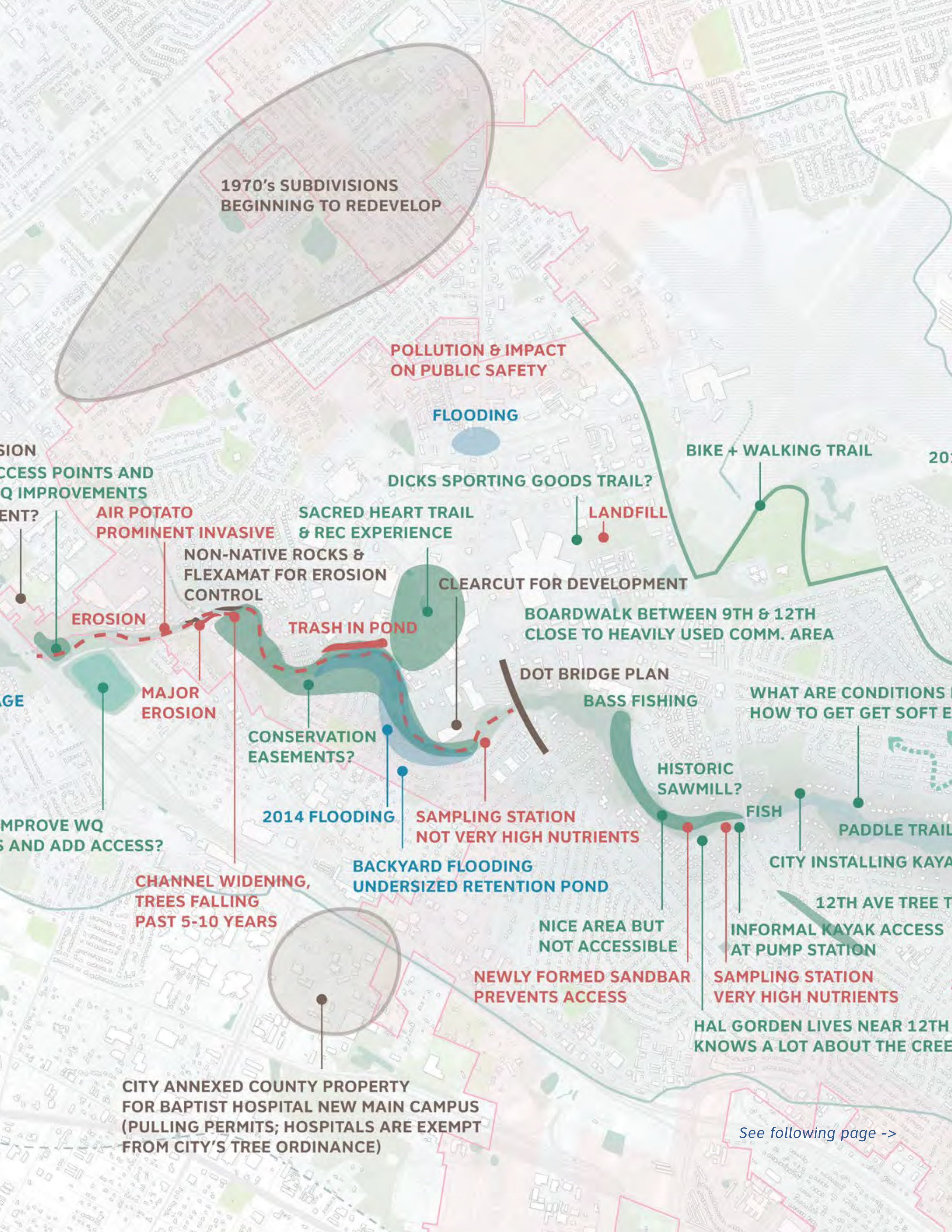
Compilation of map comments from all tables at the stakeholder meeting (full frame)



SIONS
REDEVELOP
POLLUTION & IMPACT
ON PUBLIC SAFETY
FLOODING
BIKE + WALKING TRAIL
2015 NEW STORMWATER PARK
DICKS SPORTING GOODS TRAIL?
PUBLIC DIRT TRAIL
ED HEART TRAIL
EXPERIENCE
LANDFILL
&
SION
CLEARCUT FOR DEVELOPMENT
BOARDWALK BETWEEN 9TH & 12TH
CLOSE TO HEAVILY USED COMM. AREA
IN POND
STREETS ARE CONDUITS
FOR WATER
DOT BRIDGE PLAN
STUDENT PROJECT:
RAINFALL + SAMPLING IN BAYOU
BASS FISHING
WHAT ARE CONDITIONS HERE?
HOW TO GET GET SOFT EDGE?
ION
?
2014 FLOOD, INFRASTRUCTURE INVESTMENT AFTERWARDS
HISTORIC
SAWMILL?
DOLPHINS AND MANATEES
IN THE BAYOU
STREET ENDS PROJECTS TRAP GARBAGE
(EX. CITY OF ORLANDO)
FISH
DING
SAMPLING STATION
NOT VERY HIGH NUTRIENTS
PADDLE TRAIL
BACKYARD FLOODING
UNDERSIZED RETENTION POND
CITY INSTALLING KAYAK LAUNCH
12TH AVE TREE TUNNEL
SALTWATER INTRUSION
FISH
NICE AREA BUT
NOT ACCESSIBLE
INFORMAL KAYAK ACCESS
AT PUMP STATION
VEGETATED SWALES AND EDGES
DOLPHINS
NEWLY FORMED SANDBAR
PREVENTS ACCESS
SAMPLING STATION
VERY HIGH NUTRIENTS
2019 HOUSE BLOWN OUT
FDOH HEALTHY BEACHES
SAMPLING SITE
FISH
LIVING SHORELINE
PROJECTS DEP
MARINA OYSTER BARN
HAL GORDEN LIVES NEAR 12TH AVE BRIDGE
KNOWS A LOT ABOUT THE CREEK / FISHES
UPLAND WATER MGMT HERE!
PUBLIC BOAT LAUNCH
FISH
OPERTY
V MAIN CAMPUS
ALS ARE EXEMPT
NCE)
FLOODING IN EAST HILL
YOUTUBE VIDEO
20TH AVE AND BAYVIEW
COOL ISLANDS
DREDGE SPOILS
GRAFFITI BRIDGE



Compilation of map comments (Partial view - left)



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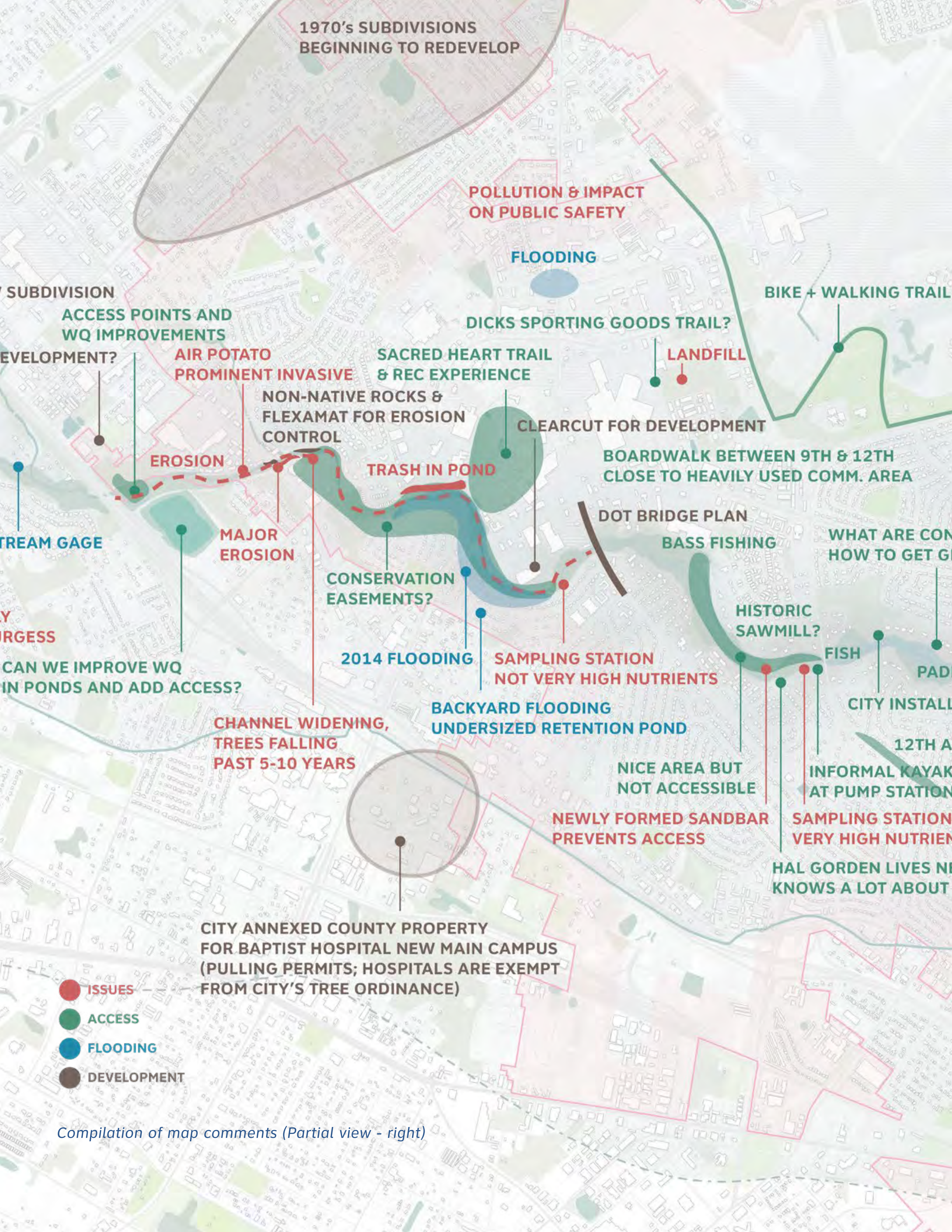

Compilation of map comments (Partial view - right)


2015 NEW STORMWATER PARK
PUBLIC DIRT TRAIL
STREETS ARE CONDUITS FOR WATER
NDITIONS HERE?
ET SOFT EDGE?
STUDENT PROJECT:
RAINFALL + SAMPLING IN BAYOU
2014 FLOOD, INFRASTRUCTURE INVESTMENT AFTERWARDS
DOLPHINS AND MANATEES IN THE BAYOU
STREET ENDS PROJECTS TRAP GARBAGE
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FISH
FLOODING IN EAST HILL
YOUTUBE VIDEO
20TH AVE AND BAYVIEW
COOL ISLANDS
DREDGE SPOILS
GRAFFITI BRIDGE


CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

PUBLIC MEETING

OVERVIEW

A public meeting was held at Washington High School, with the goal of informing the general public about the project and inviting watershed residents and stakeholders to engage with the team throughout the life of the project. A key objective of the meeting was to gather information on the cultural and historical significance of the Creek and Bayou, specifically reaching out to individuals, groups, and organizations representing traditionally underrepresented groups and gathering relevant historic information not included in State records. Additionally, information was gathered on water quality, flooding, natural systems and ecology, and other characteristics of the watershed.

The meeting included an introduction by County District 4 Commissioner Robert Bender, and a presentation by Wood and SCAPE documenting the team's preliminary research and a brief overview of the site visit. A series of interactive tools were used to discuss the watershed with attendees and capture relevant information. These included:

- Participant Questionnaires (completed questionnaires included as Appendix C)
- Bayou and Creek postcards including targeted questions, intended to be mailed back to project team
- Interactive table maps
- A physical model of the watershed was used to capture participants' high-level impressions using flags denoting characteristics such as 'welcoming', 'inaccessible', 'polluted', 'special', etc.
- A 'Watershed Story Booth' set up to capture short interviews with residents and stakeholders who shared their memories and watershed related experiences

The material and information collected at this public meeting will be utilized and expanded upon during the project's watershed evaluation and characterization phase. In addition, these materials will be used to continue and sustain public engagement throughout the process by sharing them through the project newsletter, website, and social media presence.

PUBLIC MEETING PARTICIPANTS

The following elected officials attended the public meeting:

County Commissioner Robert Bender

Mayor Grover Robinson

Councilwoman Sherri Myers

Councilman Jared Moore

High School Marine Science Program displayed relevant student projects.

Approximately 120 individuals registered for the event using the Eventbrite platform. Approximately 50 additional participants signed in at the event, and 20 participants shared their notes using the provided questionnaires.

County Commissioner Robert Bender introducing the project

Gena Wirth of SCAPE discusses project goals

Christine Mehle of WOOD discusses watersheds


Sign-in and postcard station

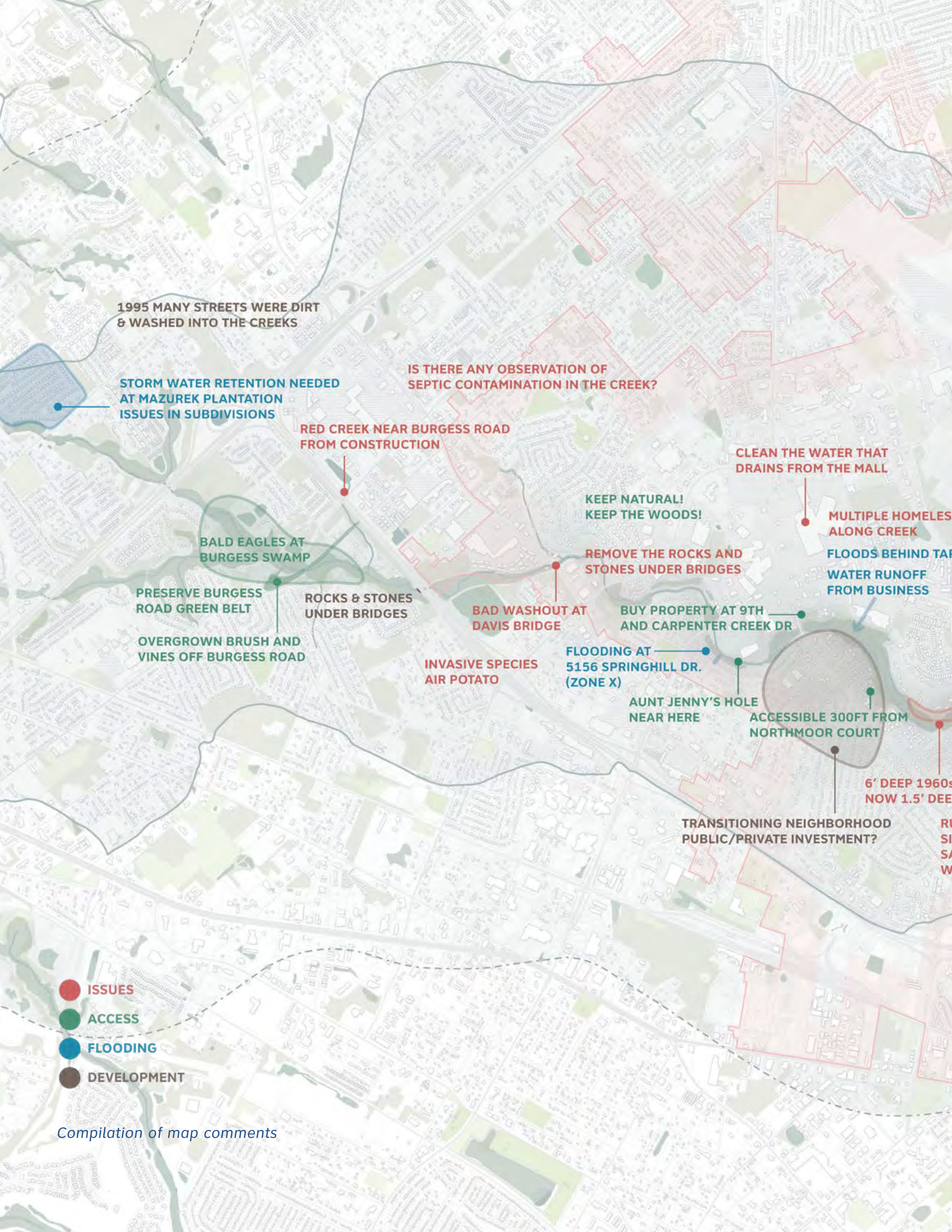
Pensacola Mayor Grover Robinson participating in interactive 3d-model activity

Participants reviewing project area maps

WETLAND SCIENCES INCORPORATED IMPACT Campaigns wood. SCAPE

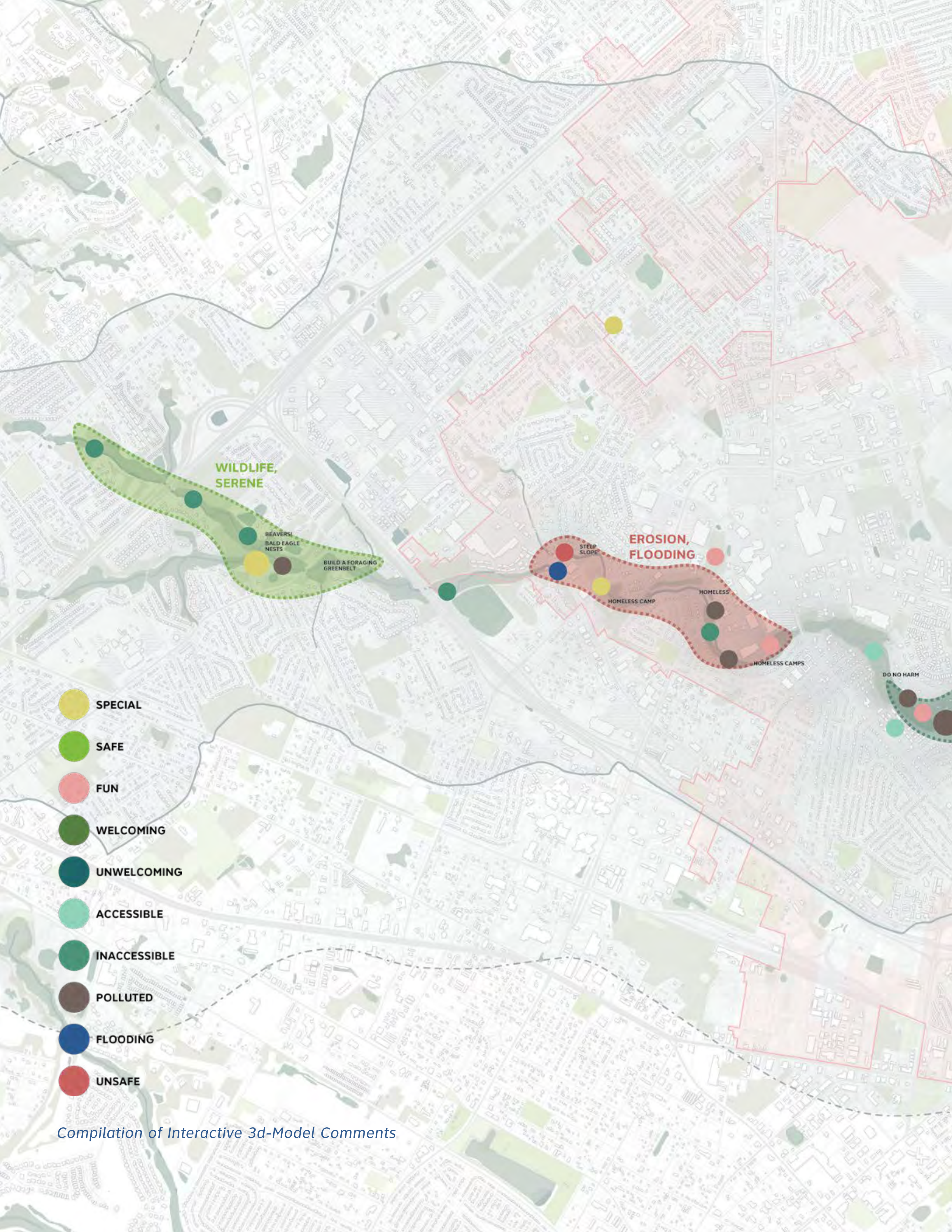
Watershed Stories photobooth

Participants adding notes and comments to interactive maps

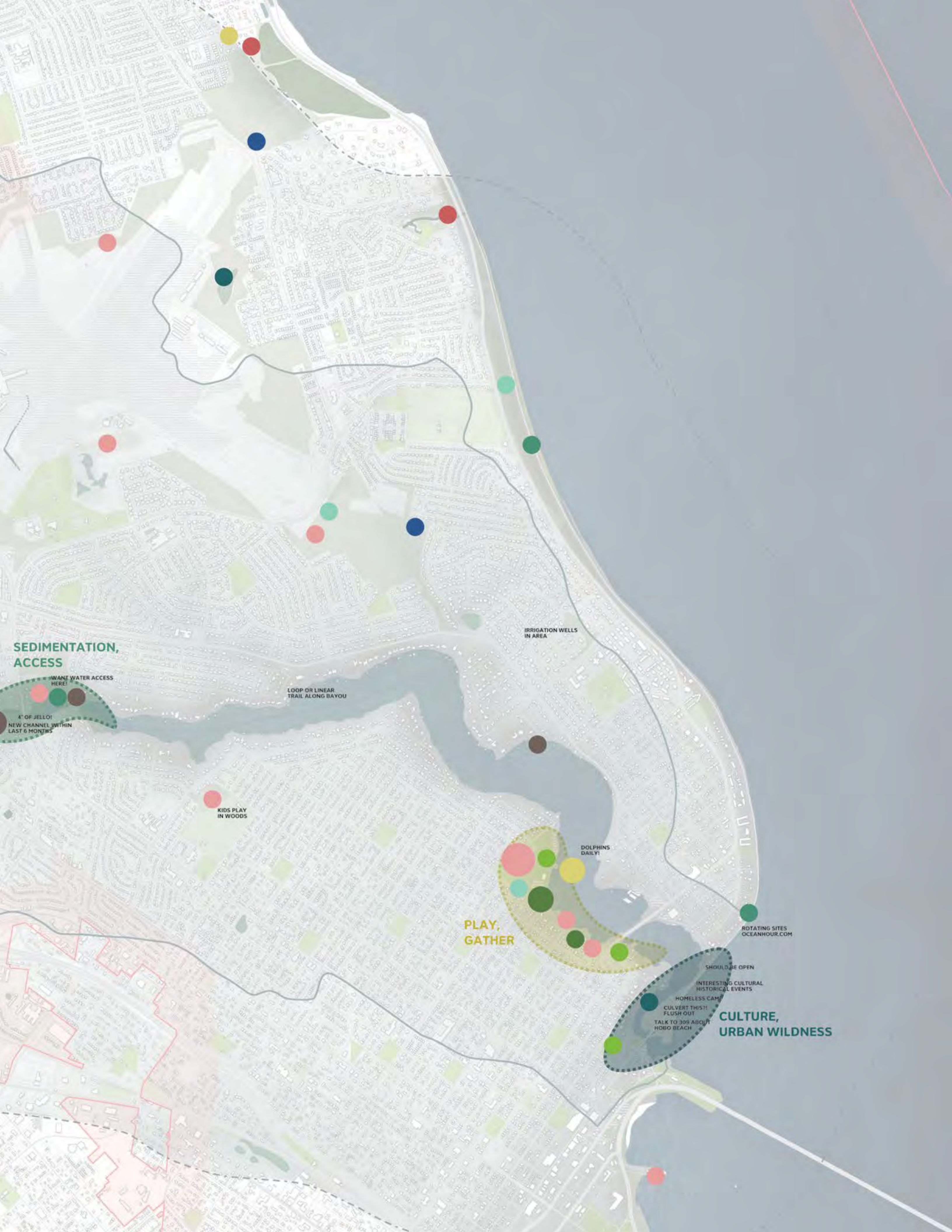


Compilation of map comments

ADD "GULF OF MEXICO WATERSHED"
TO MAPS, SIGNS
ID ALL PROPERTY OWNERS ALONG
CREEK AND WORK WITH THEM TO
REMOVE VAGRANT ENCAMPMENTS
I GO TO SCHOOL HERE!
S ENCAMPMENTS
RGET
NARROWED FLOW AT
12TH AVE BRIDGE
WIDEN 12TH AVE BRIDGE
TO ALLOW MORE FLOW THROUGH
2420 BLUFF CIR. STREET FLOODS
CONCERNED WITH FERTILIZER
BAARS PARK KEEP NATURAL
REDUCE IMPERVIOUS SURFACES
PADDLE TRAIL?
BIRNAM WOODS HAS BRANCHES
& GRASS CLIPPINGS IN STORM DRAINS
DREDGE!
VERY STINKY!
BACTERIA RELATED FATALITIES
FROM WATER CONTACT
UNOFF
LT FILLING CREEK
AND BARS
AS 2.5' DEEP, NOW 6"
TUBING
"HIGH FECAL CONTENT"
PERMANENTLY POSTED AT BAYVIEW
INTERSECTIONAL CULTURAL HISTORY
TALK TO 309 ABOUT "HOBO BEACH"
IS "HOBO BEACH" GOING TO BE
CONSIDERED FOR THIS PROJECT?
COULD BE DE LUNA BEACH!



Compilation of Interactive 3d-Model Comments



IRRIGATION WELLS IN AREA
SEDIMENTATION, ACCESS
WANT WATER ACCESS HERE!
4" OF JELLO!
NEW CHANNEL WITHIN LAST 6 MONTHS
LOOP OR LINEAR TRAIL ALONG BAYOU
KIDS PLAY IN WOODS
DOLPHINS DAILY!
PLAY, GATHER
ROTATING SITES OCEANHOUR.COM
SHOULD BE OPEN
INTERESTING CULTURAL HISTORICAL EVENTS
HOMELESS CAMP
CULVERT THIS?! FLUSH OUT
TALK TO 309 ABOUT HOBO BEACH
CULTURE, URBAN WILDNESS

QUESTIONNAIRES RESPONSE SUMMARY

Have you ever used the creek or bayou for recreational purposes? Kayaking, canoeing, swimming, fishing, playing along the water's edge, walking your dog, sitting on a bench and watching the sunset – these all count!

- Responses include canoeing, kayaking, paddleboarding, tubing, swimming (+learned to swim), fishing, playing at the water's edge, bird watching, walking in the woods, dog walking, outdoor movies, playing on swings, watching water skiers and high-powered race boats, family gathering at picnic tables, watched sunset, kids' parties.
- Locations: canoeing off dead end Scott Street up to Brookside Apts., kayaking and paddleboarding from 12th Ave to 17th St., Bayview Park for group gatherings

How and where do you access the water? Do you typically drive your car to Bayview Park? Have you ever biked/walked to the water or along it?

- Responses include walking to the creek (multiple residents with direct private access), driving and biking to Bayview Park and dog park, Graffiti Bridge at 17th St., Marina Oyster Barn.

Do you have any special or important memories related to Carpenter Creek and Bayou Texar? Recent or distant past, happy times, scary moments, meaningful events, family stories...

- Responses include learning to swim at Bayview Park summer program, roamed the woods by the creek, picked blackberries, finding consolation and healing in being around the creek, riding horses, watching houses being built on the bayou over the years, hearing whip-poor-wills, watching pelicans feeding, dolphin sighting and noticing widgeon grass in past 2-3 years

What are places in the greater watershed (not just along the water!) that make you feel connected to nature? What about these places gives you this feeling? Do you enjoy environment-related activities like bird watching, beach cleanups, hiking? Where do you go to do those?

- Places mentioned include Marina Oyster Barn, around 12th Ave. Bridge, Bayview Park (in watershed), Bay Bluffs Park, Scenic Highway, Fort Pickens, Blackwater State Forest, Bruce Beach, old growth pine forest/the woods (outside watershed)
- Activities mentioned include bird watching, observing wildlife with children (noted racoons, turtles, opossum, and snakes), kayaking through grassy areas and small islands near bay mouth

Have you seen or experienced severe flooding in the watershed? Where and when did you experience flooding? How did the flooding impact your living or working environment, your commute or other travel, your recreation and leisure?

- Locations mentioned include 9th Avenue crossing, Piedmont Drive
- Times mentioned include April 2014 flood, Hurricane Ivan (2004)
- Descriptions include 20' of a hill behind resident's house fell into the creek (4/2014), 50' of resident's land washed away along creek, seeing hundreds of brown pelicans taking shelter north-west of Cervantes St. Bridge after Hurricane Ivan
- Other notes included resident who complained about adjacent building not being properly

inspected and resulting in drainage issues, resident who worked to evacuate residents and patients in facilities, flood insurance runs $1,800/year after three damaging floods

Have you seen or experienced poor water quality in the creek or bayou? What do you think causes this condition? How often have you noticed this?

- Locations noted include creek below Burgess and around Davis Highway
- Descriptions include trash related to homeless individuals, small amounts of raw sewage (old sewage lines presumably have leaks), receiving weekly water quality reports noting fecal and other bacteria ratings, high bacteria levels usually only mid/late summer, fish kills, lack of wildlife (fish, crab, fowl), businesses draining waste directly into the creek
- Also noted a resident who does water sampling for Lake Watch; Gov. agencies seem very good about warning the public. Contaminated sediment in Bayou is from Agrico Chemical and Escambia Treating Co. Resident described experience of canoe tipping over and coming up covered in black tar-like sediment.

What do you think connects you to the water, and makes you part of the greater watershed? All thoughts and answers welcome!

- Responses include communing with nature, hearing birds, seeing turtles, being one with the water, recognizing plant life, visual and physical interaction with water for all ages, prioritizing cleanup first and access later.

General comments and questions

- I see signs all over town saying that I am in the Carpenter Creek watershed. These need to be replaced with signs that say you are in the GULF OF MEXICO watershed – it all flows to the gulf. Saying it stops at Bayou Texar does the whole project a disservice.
- Why/who cut the trees on the west side of 9th Ave? They butchered the trees...
- George Sanders who now lives on Parker Circle grew up on Royce Street and has many Carpenter Creek stories and experiences. If a staff person were to contact him, I am sure he would share these memories. Sherry Myers knows him.
- When will Texar be dredged?
- I believe it is very important that we do no further harm to this watershed. No master plan can work if we continue to engineer the flow. It is also important to ensure we get the right people on the team (ie: UWF Cultural Research). My vision is that the Creek look more like Rock Creek Park vs. the LA River. This will require a champion (City of Pensacola? County?). Will the city step up? Who will own the plan? Who will enforce the plan? Is it enforceable?
- City and County targeting tree replanting areas for sustainable canopy increase. Both have tree mitigation funding, review comprehensive Urban Tree Canopy Analysis on city website. 2 Phase; shows tree canopy trends over 20 years, also current canopy and public spaces and planting area recommendations
- Beavers, beaver dams, and dens are the primary blockage of water flow from upstream. Where Olive Road crosses Carpenter Creek over a culvert. If you park near this crossing and look upstream (Northwest) beyond the culvert, you will see a beaver dam, then a large amount of leaves upstream from that. The beavers need to be removed or relocated, then their dams and the backup of leaves removes to restore normal water flow from the source of the creek.

APPENDICES

A - SITE WALK NOTES

B - PUBLIC MEETING PRESENTATION

C - QUESTIONNAIRES AND COMMENT SHEETS

D - ADDITIONAL ENGAGEMENT MATERIALS: POST CARDS, FACILITATORS' GUIDE, SIGN-IN SHEETS

APPENDIX A
SITE WALK NOTES

OVERALL MAP

LOCATION 01

ADDRESS: NORTH OF 7507 SEARS BLVD

TIME: 8:00-8:15

CITY LIMITS: NO

Location Notes

Parcel owned by ECUA. Possible stormwater retrofit/enhancement

Field Notes

NEEDS NEW OVERFLOW STRUCTURE.

CORR. PIPE STRUCTURE

LIFT STATION/UTILITY EASEMENTS.

OLD HEADWATER WETLAND.

NEED FOR STORMWATER PONDS

AS OLIVE ROAD DITCHES → PIPES

W/ SIDEWALK IMPROVEMENTS.

MTN BIKERS/WALKERS/

DIRT BIKES

LOCATION 02

ADDRESS: 715 OLIVE ROAD

TIME: 8:20-8:40

CITY LIMITS: NO

Location Notes

County owned lands, extreme headwaters of Carpenter Creek. Highly disturbed wetlands. Exotic and nuisance species. Potential location for innovative stormwater treatement, ecological restoration, and public access.

Field Notes:

DEP FLORIDA GRANT FOR PARK AMMENITIES, ACQUISITION OF E HEADWATERS & WQ IMPROVEMENTS

STORMWATER BACKS UP INTO ZURIK PLANTATION. SOLUTION: COUNTY INSTALL SWT POND N. OLIVE RD.

RED WINGED BLACKBIRDS

LOCATION 03

ADDRESS:
JUST SOUTH OF 8011 NALO CREEK LOOP ROAD

TIME: 8:50-9:15

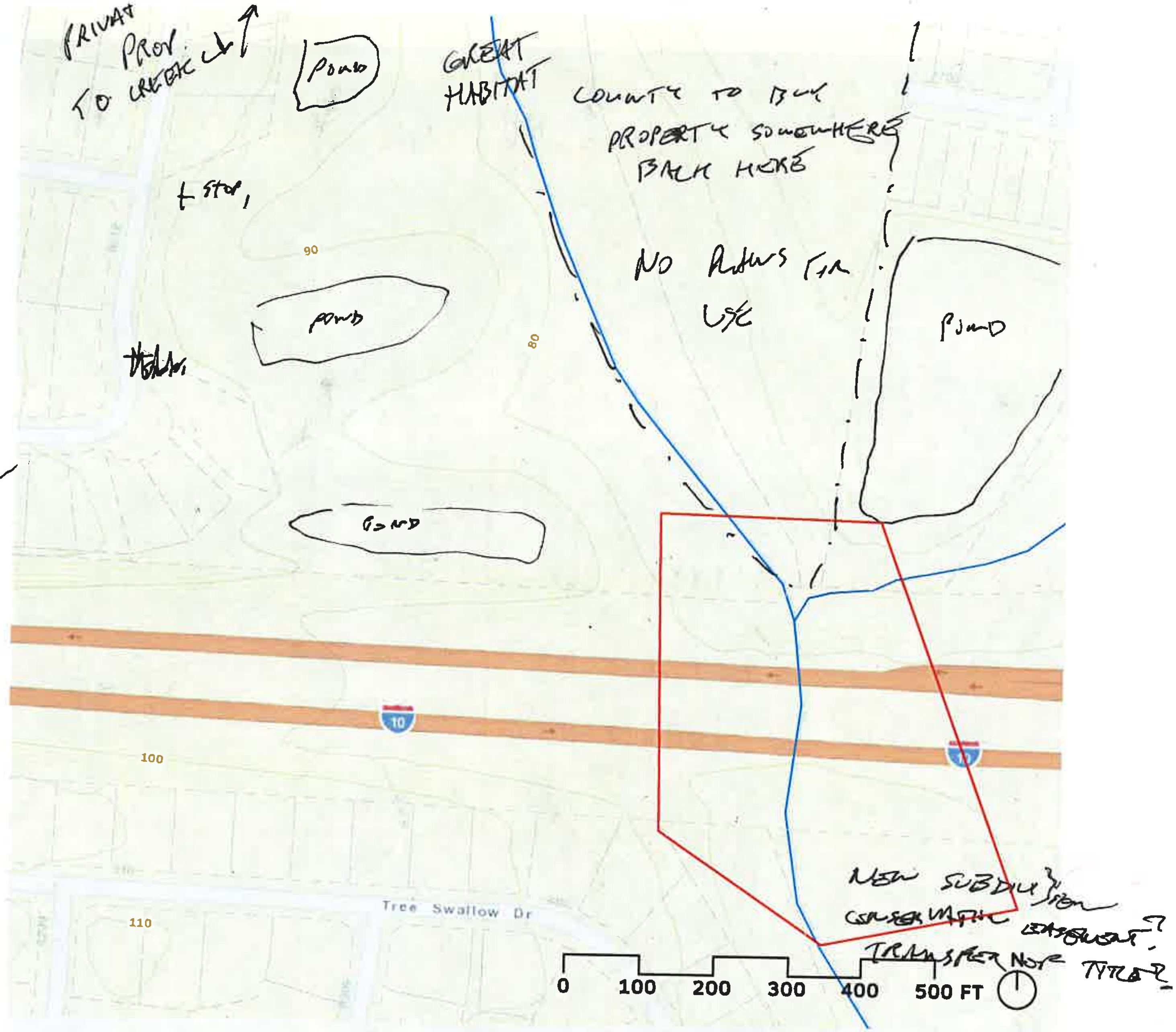
CITY LIMITS: NO

Location Notes

Lost Creek Subdivision. Access creek from stormwater parcel. Parcel A&B Stormwater retention parcels include portions of creek.

Field Notes

819 Brook Meadow



LOCATION 04

ADDRESS:
7620 HILLBURN AVE

TIME: 9:20-9:30

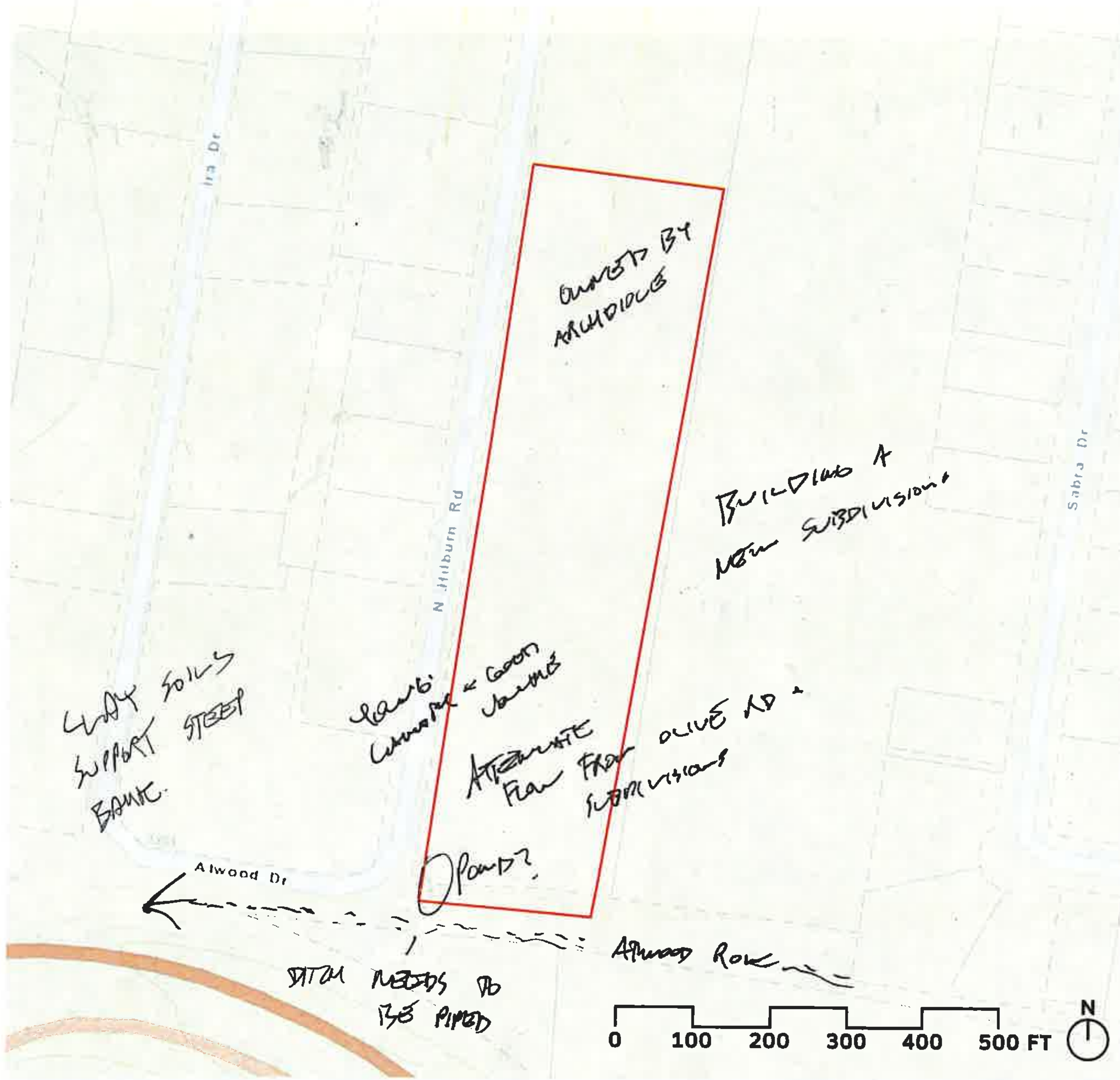
CITY LIMITS: NO

Location Notes

Near Hillburn and Atwood - potential area for pond retrofit.

Field Notes

NEED STORMWATER POND.
ONLY VACANT PARCEL
IN AREA



LOCATION 05

ADDRESS: SHILOH DRIVE AT INTERSECTION WITH GETTYSBURG DRIVE

TIME: 9:40-9:50

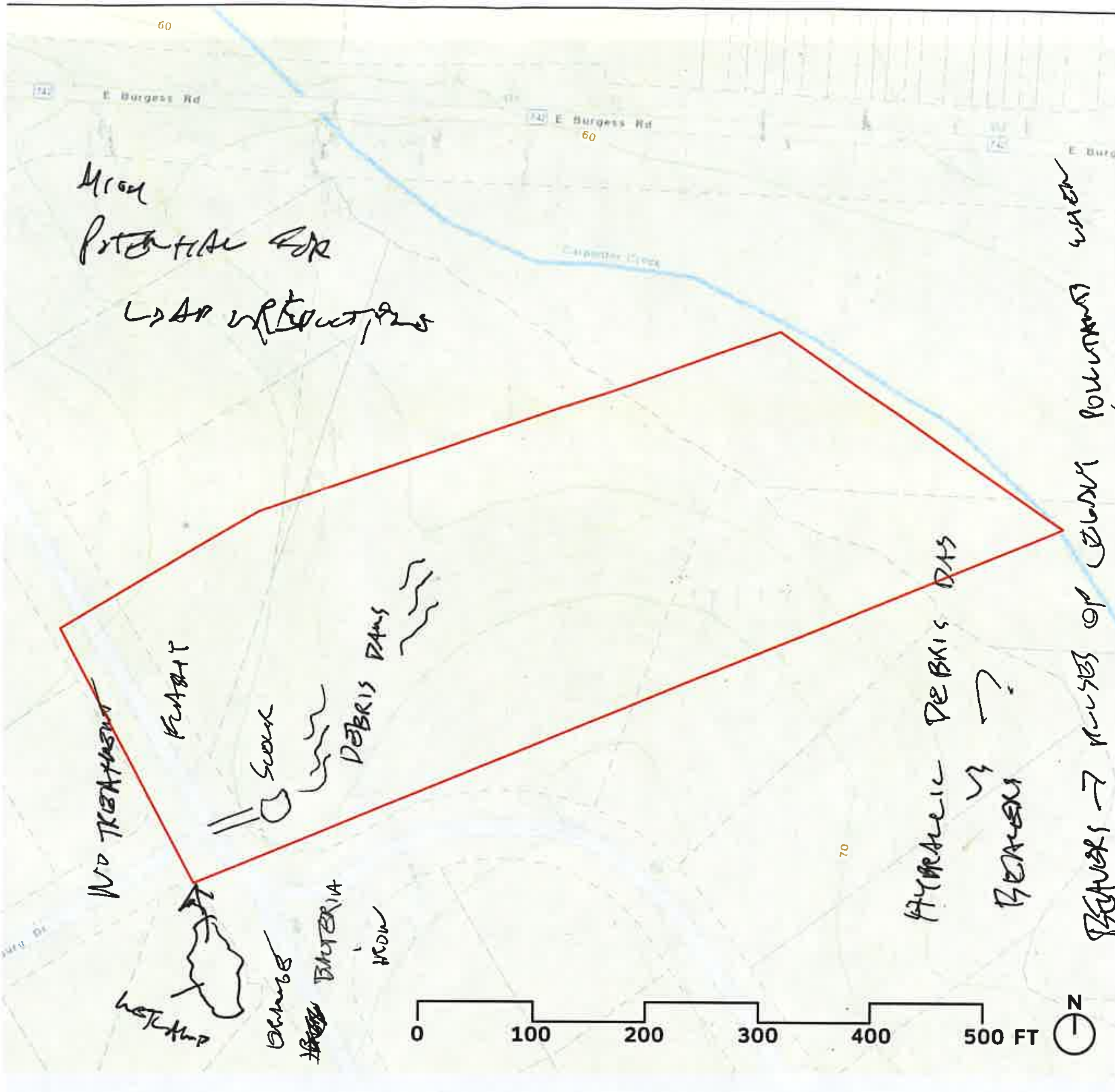
CITY LIMITS: NO

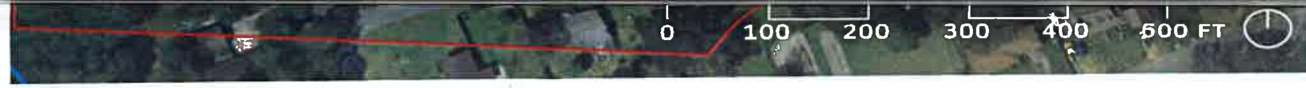
Location Notes

Oakfield Acres 2. Outfall of old corrugated metal pipe system. Connected to Oakfield Acres 1 (Location 06).

Field Notes

LOC. 5.5 BURGESS RD
MONITORING ST.
CITY OWNS 4 AC N
OF BRIDGE
(BRIDGE MAY BE
IN MATERIAL PHOTOS)





LOCATION 07

ADDRESS: ALONG EAST SIDE OF SARAH DRIVE BETWEEN ROYAL LANE AND PRINCE ROAD

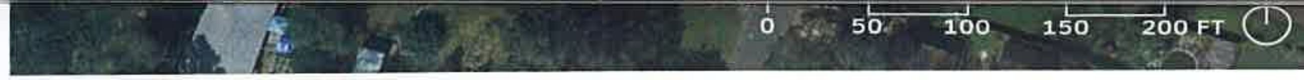
TIME: 10:05-10:10

CITY LIMITS: NO

Location Notes

County park. Evaluate public access/utilization.

Field Notes



LOCATION 08

ADDRESS: WESTERN TERMINUS OF VILLAGE OAK DRIVE

TIME: 10:20-11:00

CITY LIMITS: YES

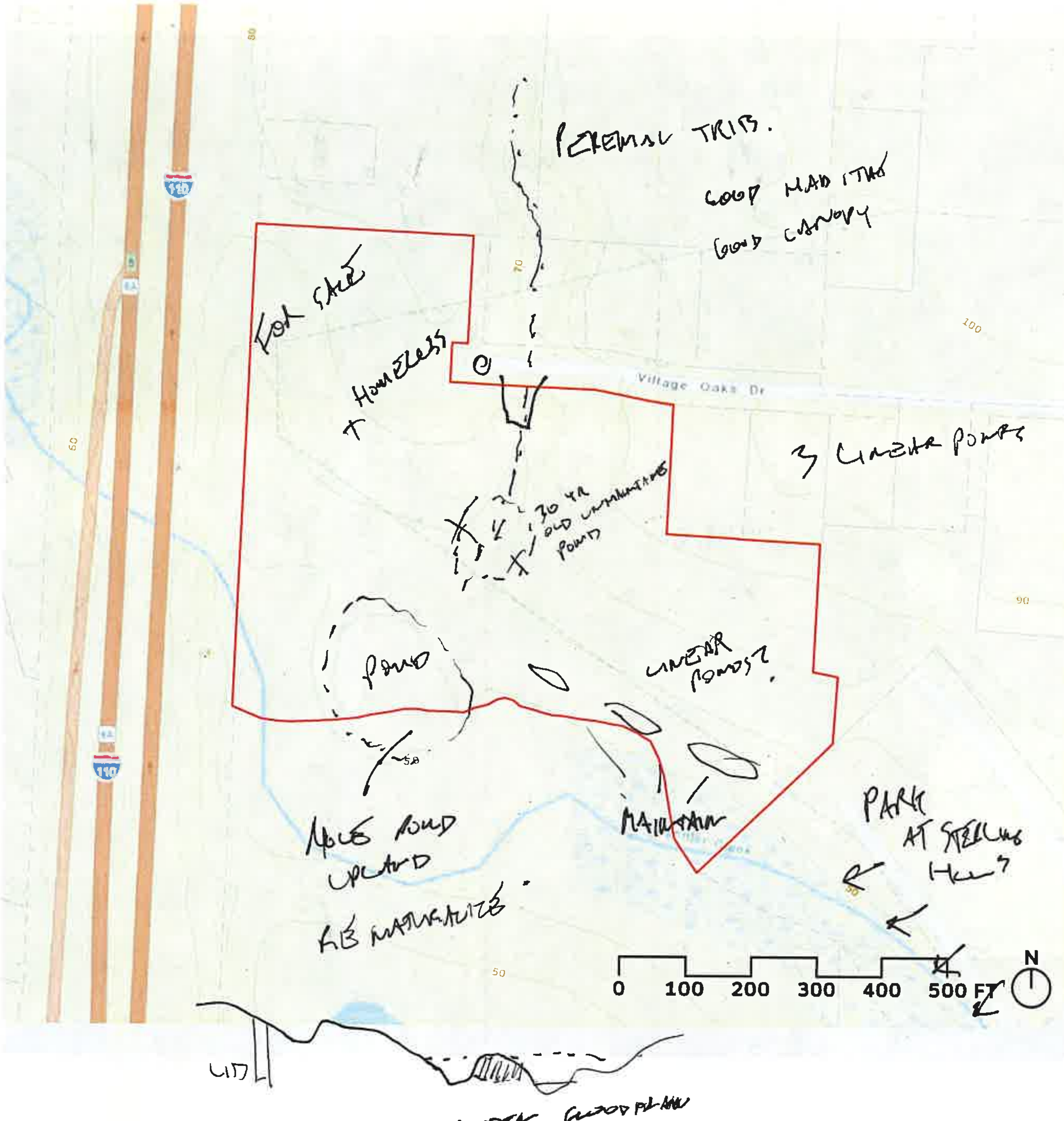
Location Notes

Privately owned stormwater management system for The Park at Sterling Hills Apartments. In disrepair and needs maintenance. Owner has expressed interest in selling property. County appraisal process started.

Possible point of instability for Carpenter Creek just east of I-110. Potential location for tree preservation, stream restoration, maint. of storm systems. Water management system hasn't been maintained in decades possibly.

Field Notes

PARK AT STERLING HILLS



LOCATION 09

ADDRESS: CARPENTER CREEK BETWEEN DAVIS & AIRPORT BLVD

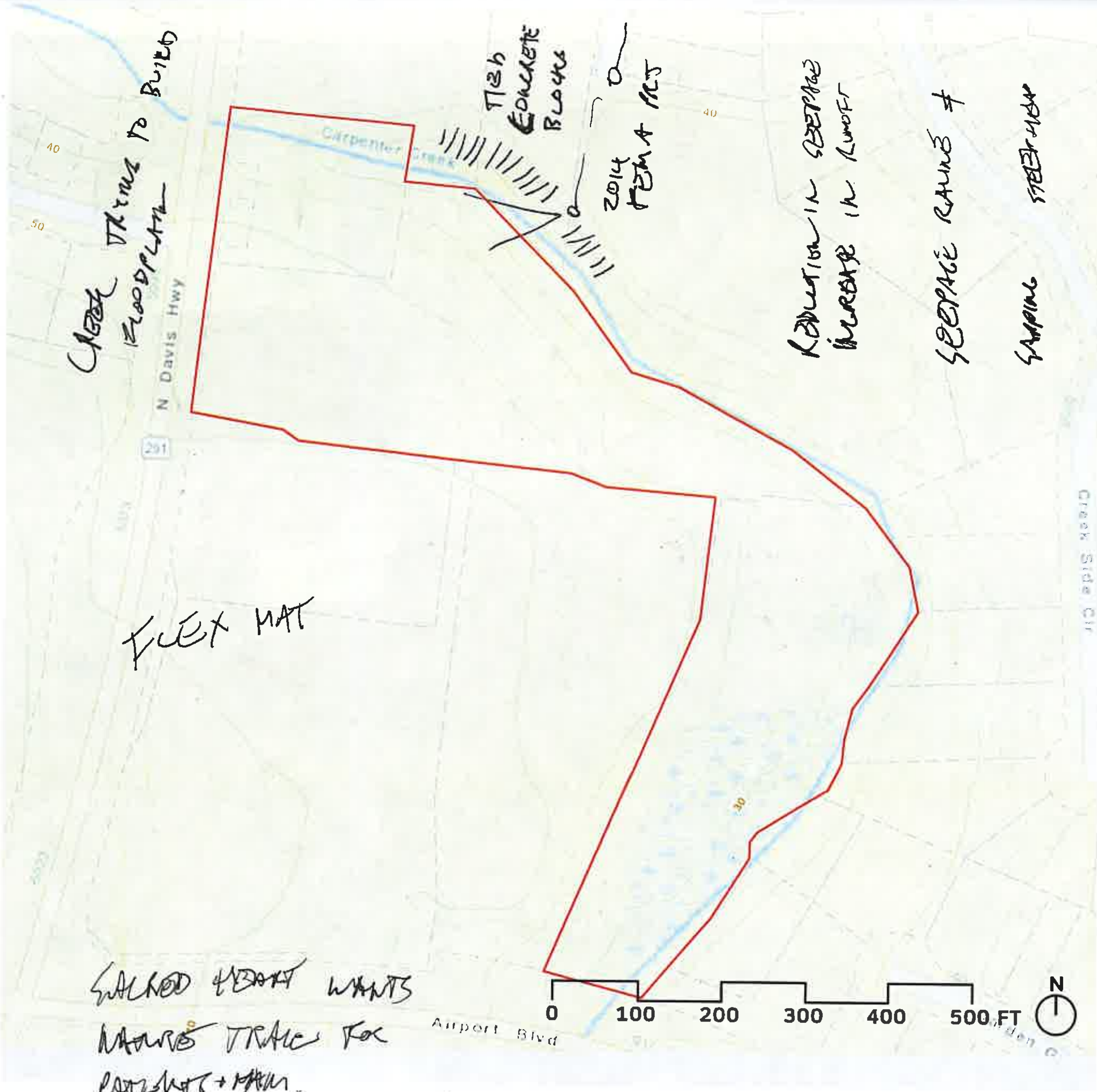
TIME: 11:10-11:30

CITY LIMITS: YES

Location Notes

Site of Natural Resource Conservation Service Emergency Watershed Project. Stream bank instability. Potential location for stream improvements.

Field Notes



LOCATION 10

ADDRESS: BAYVIEW PARK, 2000 E LLOYD ST

TIME: 11:45-12:30

CITY LIMITS: YES

Location Notes

City of Pensacola Park/Public Access. City has made several improvements over the last several years. Portions of enhanced living shorelines.

Potential area for public access and utilization, and riparian buffer and enhancements

Field Notes

ED BAKER

SCIENCE TEACHER

BOOKER T WASH. HS.

STUDENTS SAMPLE, MONITOR WQ

PLANT LIVING SHORELINE

LOCATION 12

ADDRESS: 17TH AVE BOAT RAMP, N 17TH AVE JUST SOUTH OF CERVANTES AND SOUTH OF GRAFFITI BRIDGE

TIME: 13:00-13:15

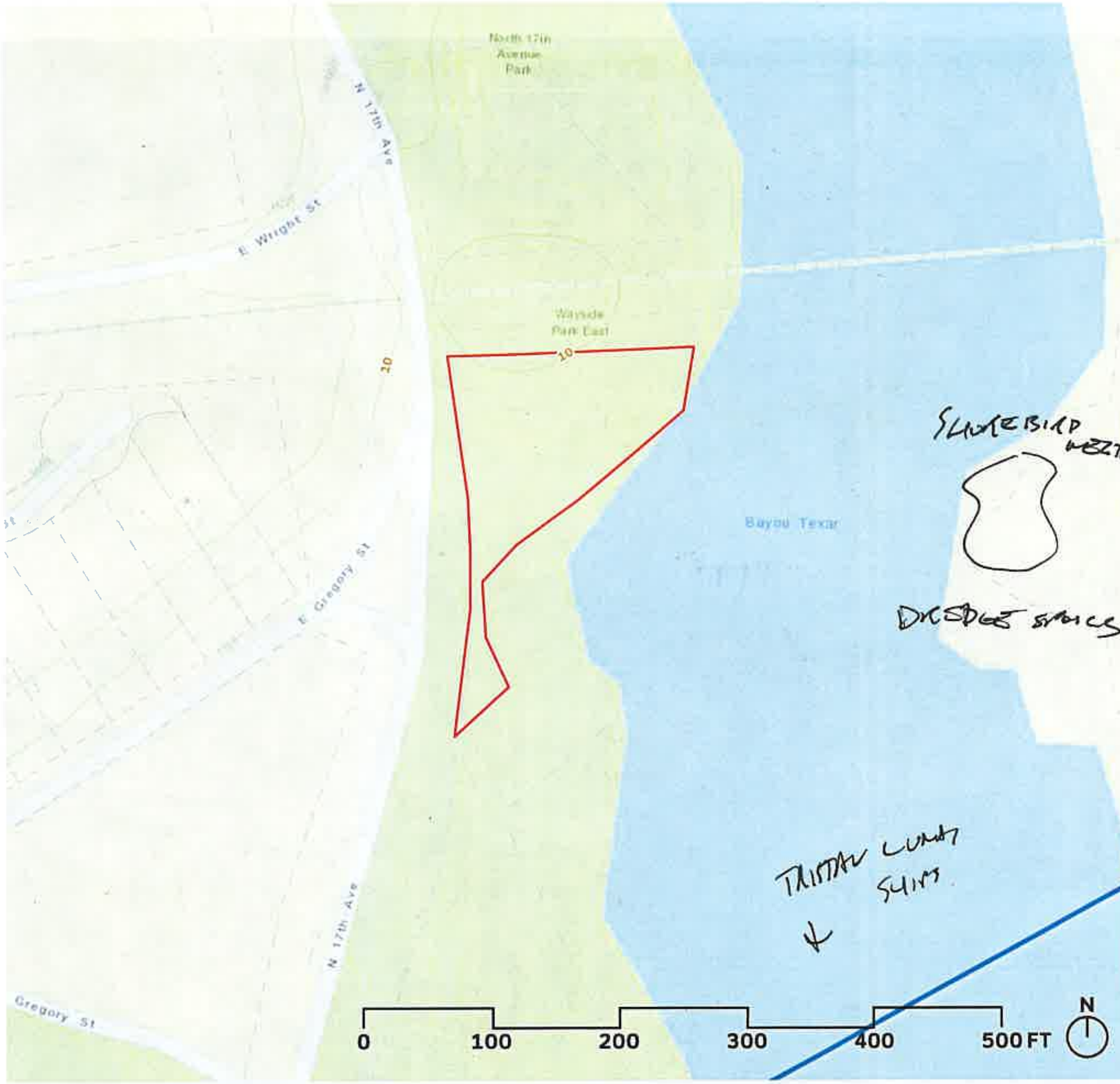
CITY LIMITS: YES

Location Notes

Municipal boat ramp and public access point. Located between Wayside Park (south) and the 17th Ave Stormwater Treatment Project, but there is no connection between systems. Existing infrastructure in poor condition.

Potential location to improve public access and utilization. Consider potential for tying into city site to its north.

Field Notes



CONTROVERSY. RESIDENTS DON'T WANT PARK DEVELOPMENT
- NO BOAT LAUNCH - LEAVE IT QUIET

LOCATION 15

ADDRESS: BAARS PARK. SOUTHERN TERMINUS OF PINTADO DRIVE SOUTH OF KARMICH PLACE.

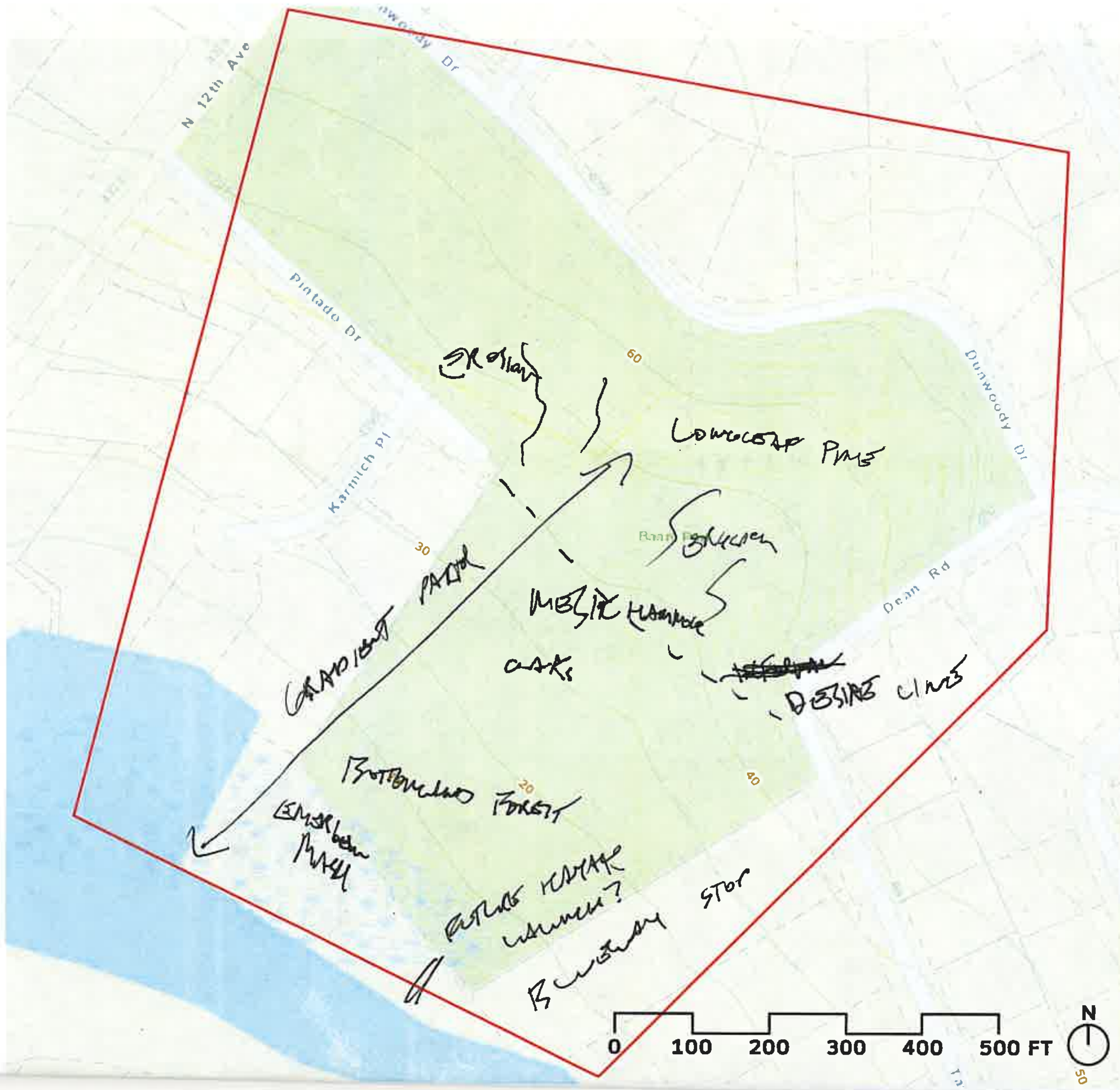
TIME: 14:10-14:30

CITY LIMITS: YES

Location Notes

City park. Evaluate public access/ utilization. Historic dump.

Field Notes



LOCATION 17

ADDRESS: SPRINGHILL MOVIE THEATER 1. 5149 BAYOU BLVD.

TIME: 15:20-15:50

CITY LIMITS: YES

Location Notes

Evaluate stream condition/potential improvements. Stream bank erosion due to below-grade stormwater outfall behind movie theater. Buried infrastructure on west bank, as well as stability issues. Potentially an archaeologically significant site nearby.

Field Notes

5170 SPRINGHILL DR

DEEP SCAR HOLE

LOCATION 17

ADDRESS: SPRINGHILL MOVIE THEATER 1.
5149 BAYOU BLVD.

TIME: 15:20-15:50

CITY LIMITS: YES

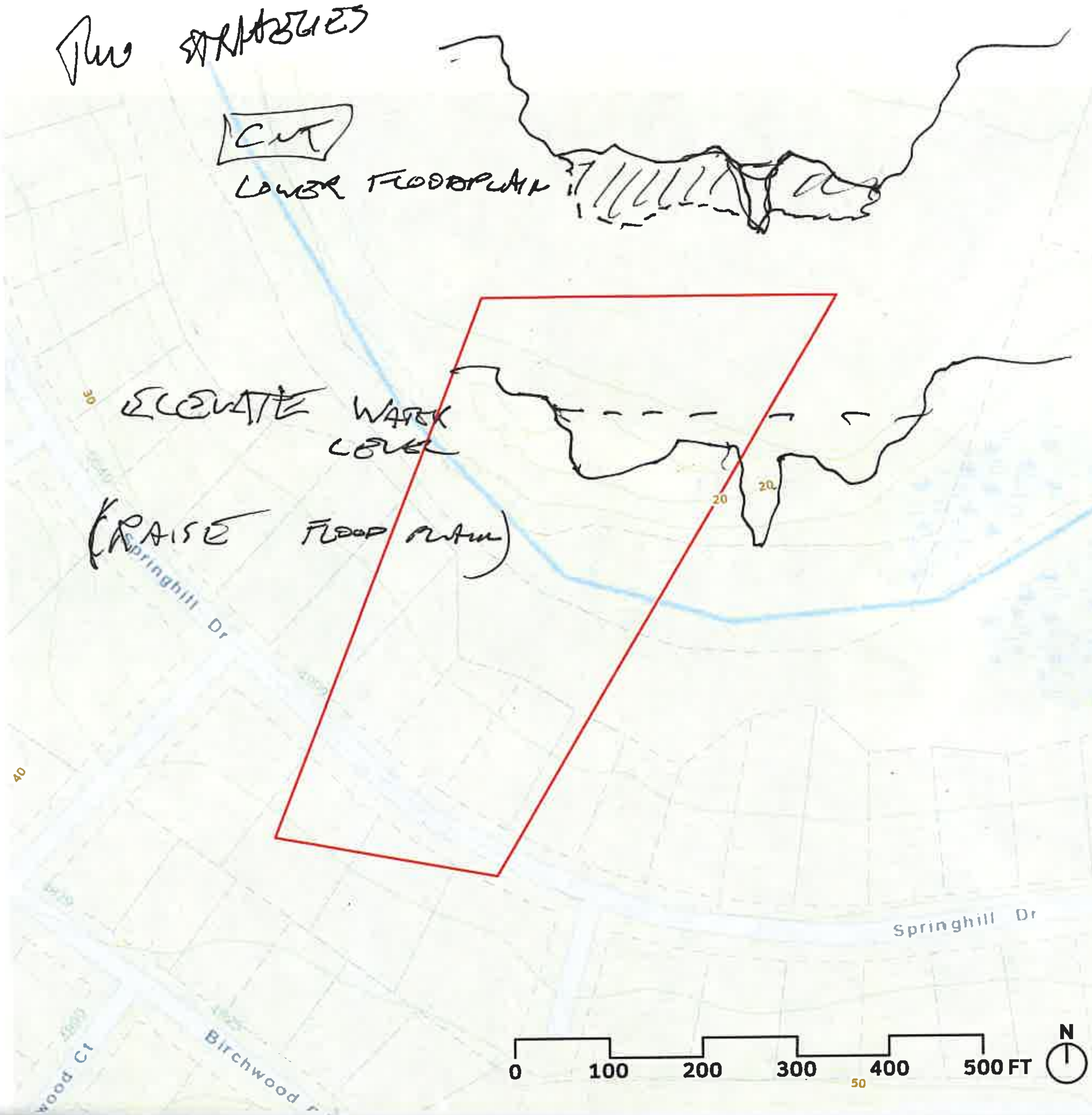
Location Notes

Evaluate stream condition/potential improvements. Stream bank erosion due to below-grade stormwater outfall behind movie theater. Buried infrastructure on west bank, as well as stability issues. Potentially an archaeologically significant site nearby.

Field Notes

5' TO SPRINGHILL DR

DEEP SCOUR



LOCATION 13

ADDRESS: CSX CROSSING OVER BAYOU TEXAR. N 17TH AVE.

TIME: 13:15-13:30

CITY LIMITS: YES

Location Notes

Evaluate possible channel improvements to improve tidal exchange and water quality of Bayou

Field Notes

LOCATION 14

ADDRESS: WESTERN TERMINUS OF HYDE PARK ROAD.

TIME: 13:40-14:00

CITY LIMITS: YES

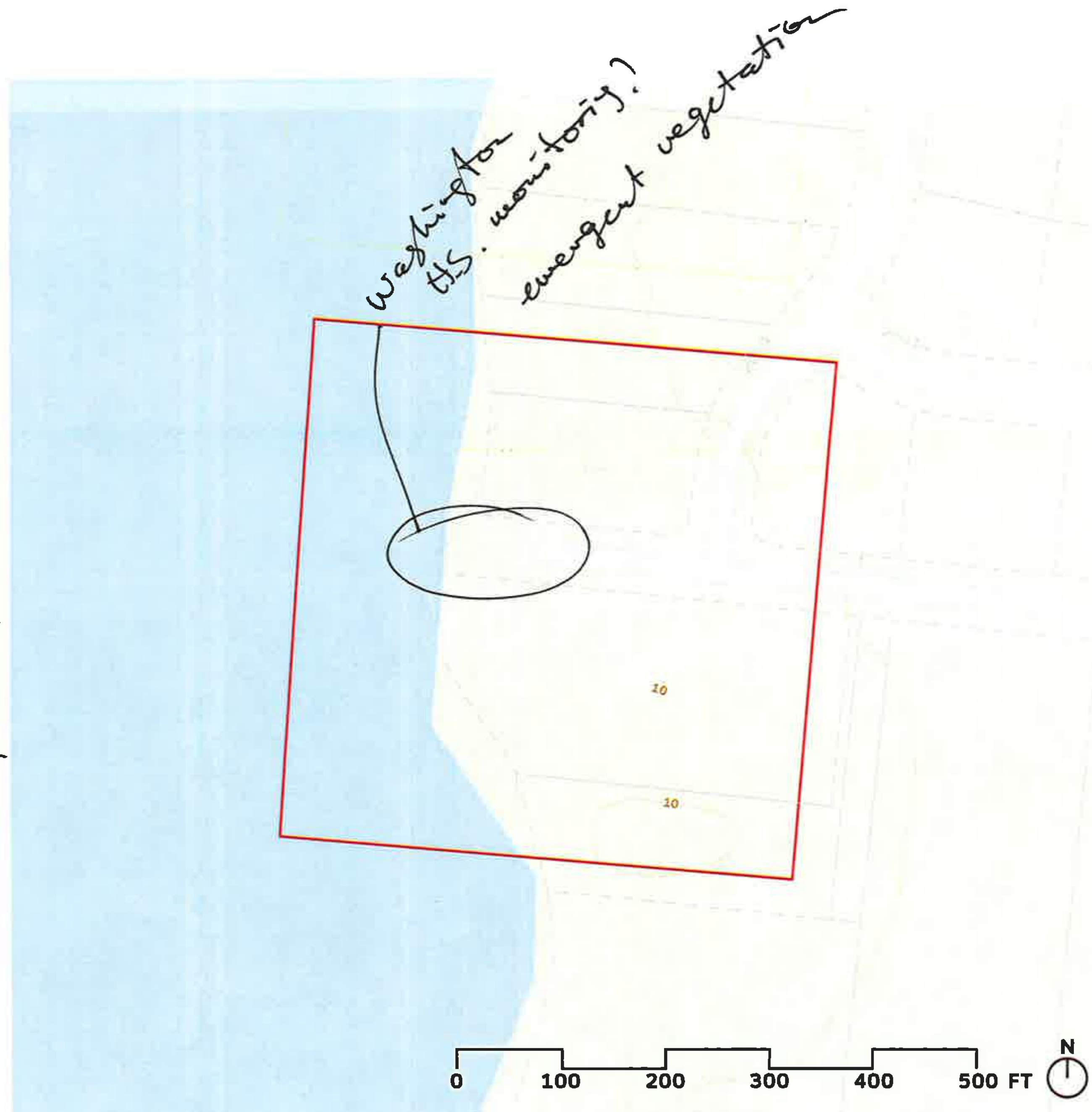
Location Notes

Evaluate public access/utilization.

Field Notes

ROW dead-end @ Bayou + outfalls

city - GIS - shoreline protection district, new homes have to develop ~~s~~ stormwater plan for first 1" on all impervious (layer in CityView)



LOCATION 14

ADDRESS: WESTERN TERMINUS OF HYDE PARK ROAD.

TIME: 13:40-14:00

CITY LIMITS: YES

Location Notes

Evaluate public access/utilization.

Field Notes

Wekaiva River - spring shed assessment to show enhanced fertilizer ordinance

LOCATION 15

ADDRESS: BAARS PARK, SOUTHERN TERMINUS OF PINTADO DRIVE SOUTH OF KARMICH PLACE.

TIME: 14:10-14:30

CITY LIMITS: YES

Location Notes

City park. Evaluate public access/ utilization. Historic dump.

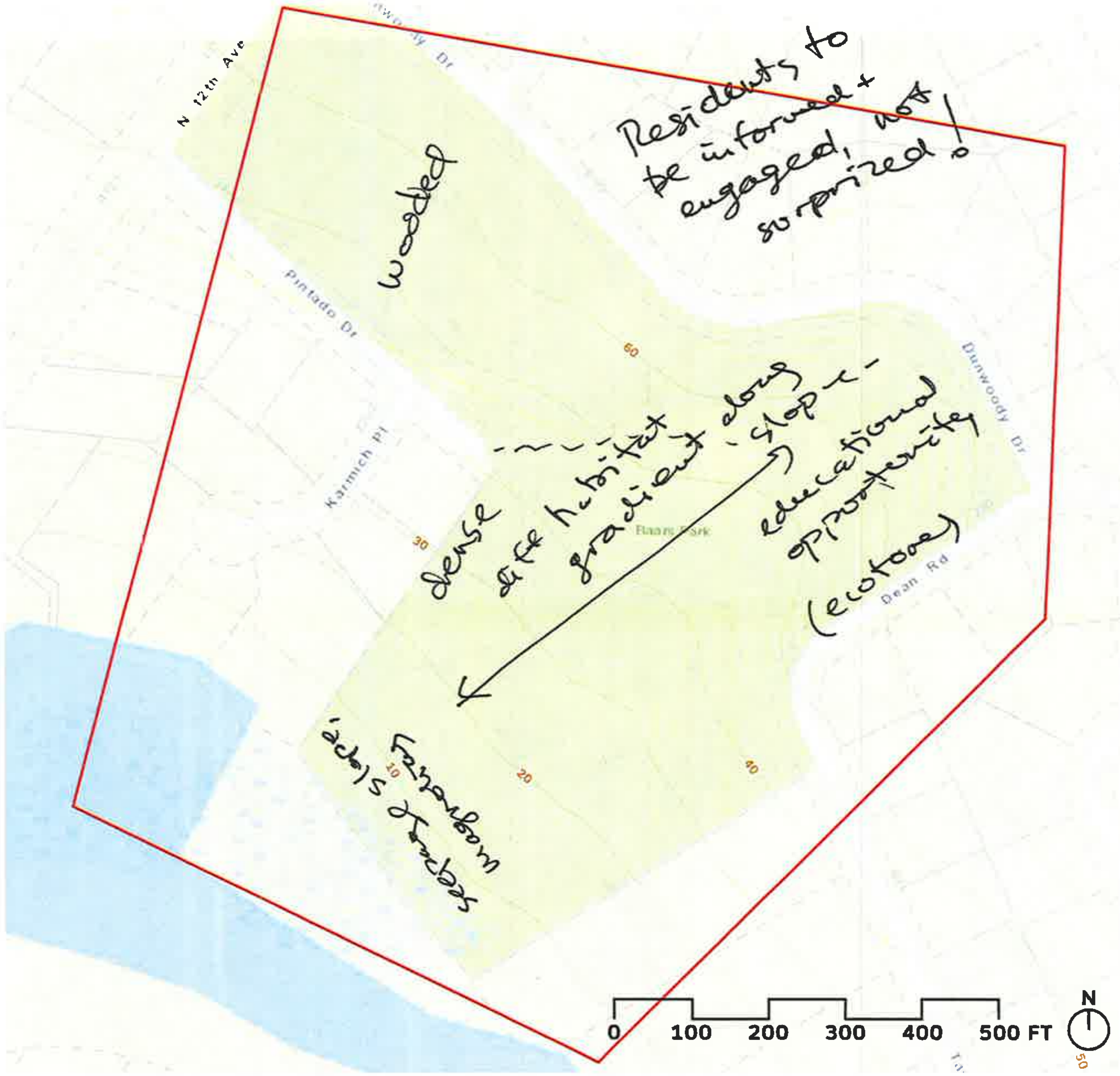
Field Notes

No plans at un

Upland + water access -

(Gulf breeze shoreline park - reference)

path connect subdivision to park



LOCATION 15

ADDRESS: BAARS PARK. SOUTHERN TERMINUS OF PINTADO DRIVE SOUTH OF KARMICH PLACE.

TIME: 14:10-14:30

CITY LIMITS: YES

Location Notes

City park. Evaluate public access/ utilization. Historic dump.

Field Notes

erosion

Sandy + clay soil

LOCATION 16

ADDRESS: 9TH AVE TO TARGET. 4751 BAYOU BLVD. BEHIND WINN DIXIE.

TIME: 14:40-15:10

CITY LIMITS: YES

Location Notes

Evaluate stream condition/potential improvements. Carpenters Creek Mill.

Field Notes

Relatively unimpacted
Good age distribution
of trees,
ferns
Virginia chain fern

Pines - slash, loblolly
blackgum
cherry laurel (wild)

LOCATION 16

ADDRESS: 9TH AVE TO TARGET. 4751 BAYOU BLVD. BEHIND WINN DIXIE.

TIME: 14:40-15:10

CITY LIMITS: YES

Location Notes

Evaluate stream condition/potential improvements. Carpenters Creek Mill.

Field Notes

LOCATION 17

ADDRESS: SPRINGHILL MOVIE THEATER 1.
5149 BAYOU BLVD.

TIME: 15:20-15:50

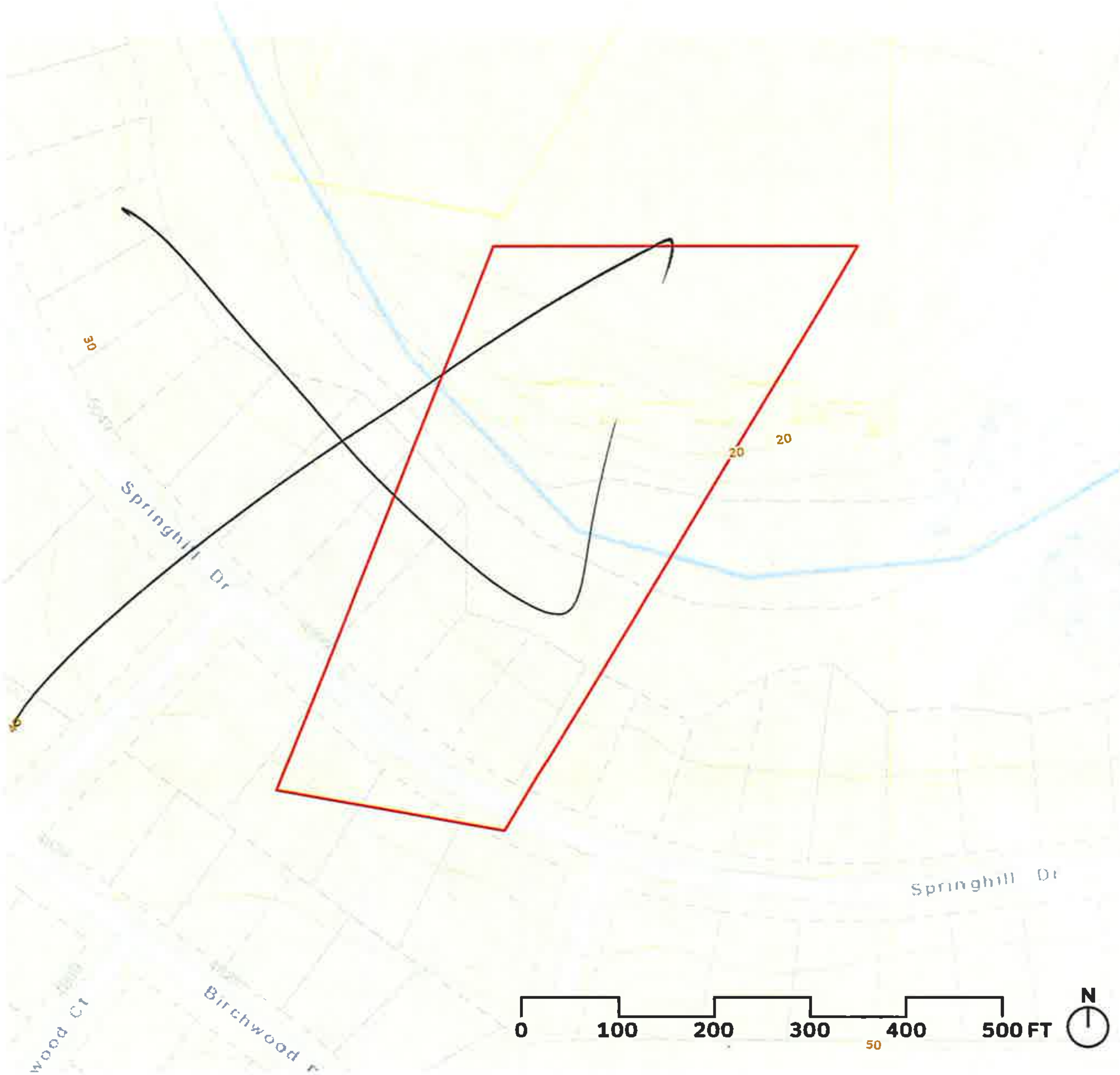
CITY LIMITS: YES

Location Notes

Evaluate stream condition/potential improvements. Stream bank erosion due to below-grade stormwater outfall behind movie theater. Buried infrastructure on west bank, as well as stability issues. Potentially an archaeologically significant site nearby.

Field Notes

Alt site-
5170 springhill Dr.



LOCATION 18

ADDRESS: SPRINGHILL MOVIE THEATER 2. 5175 BAYOU BLVD.

TIME: 16:00-16:30

CITY LIMITS: YES

Location Notes

Evaluate stream condition/ potential improvements. Stormwater infrastructure (outfalls) are buried in some cases and causing significant erosion in other cases.

Field Notes

North 9th bridge

clear water

Sandy sediment

John- will measure and compare to less developed ~~water~~/ urbanized watershed, have numbers for Panhandle

see historic photos-

APPENDIX B PUBLIC MEETING PRESENTATION

CARPENTER CREEK & BAYOU TEXAR WATERSHED MANAGEMENT PLAN

FEBRUARY 19, 2020

MATT POSNER

RESTORE PROGRAM MANAGER

TERRI BERRY

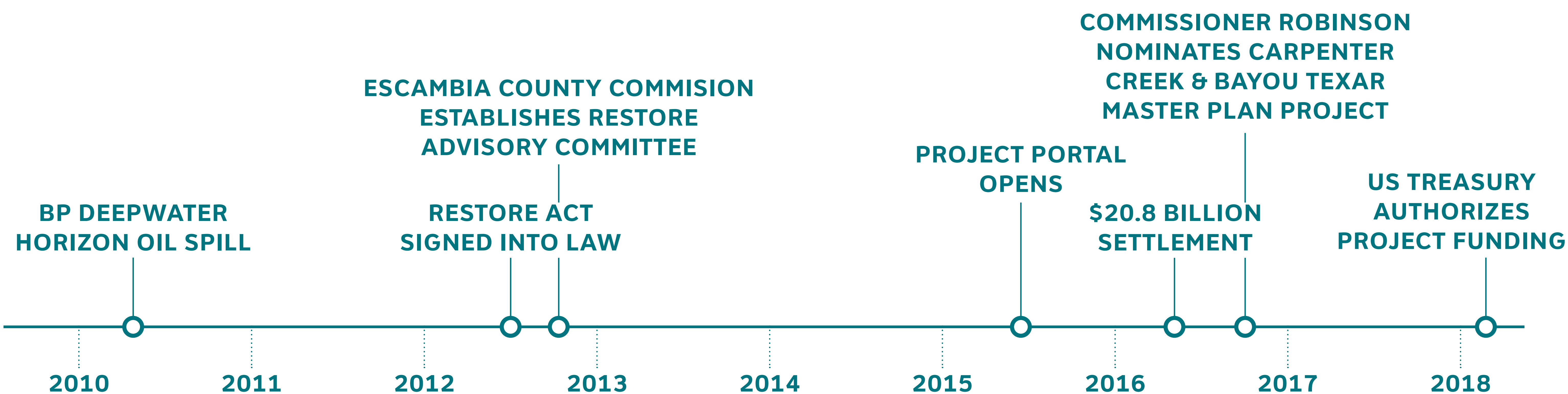
ENVIRONMENTAL PROJECT COORDINATOR

BRENT WIPF

WATER QUALITY & LAND MANAGEMENT MANAGER

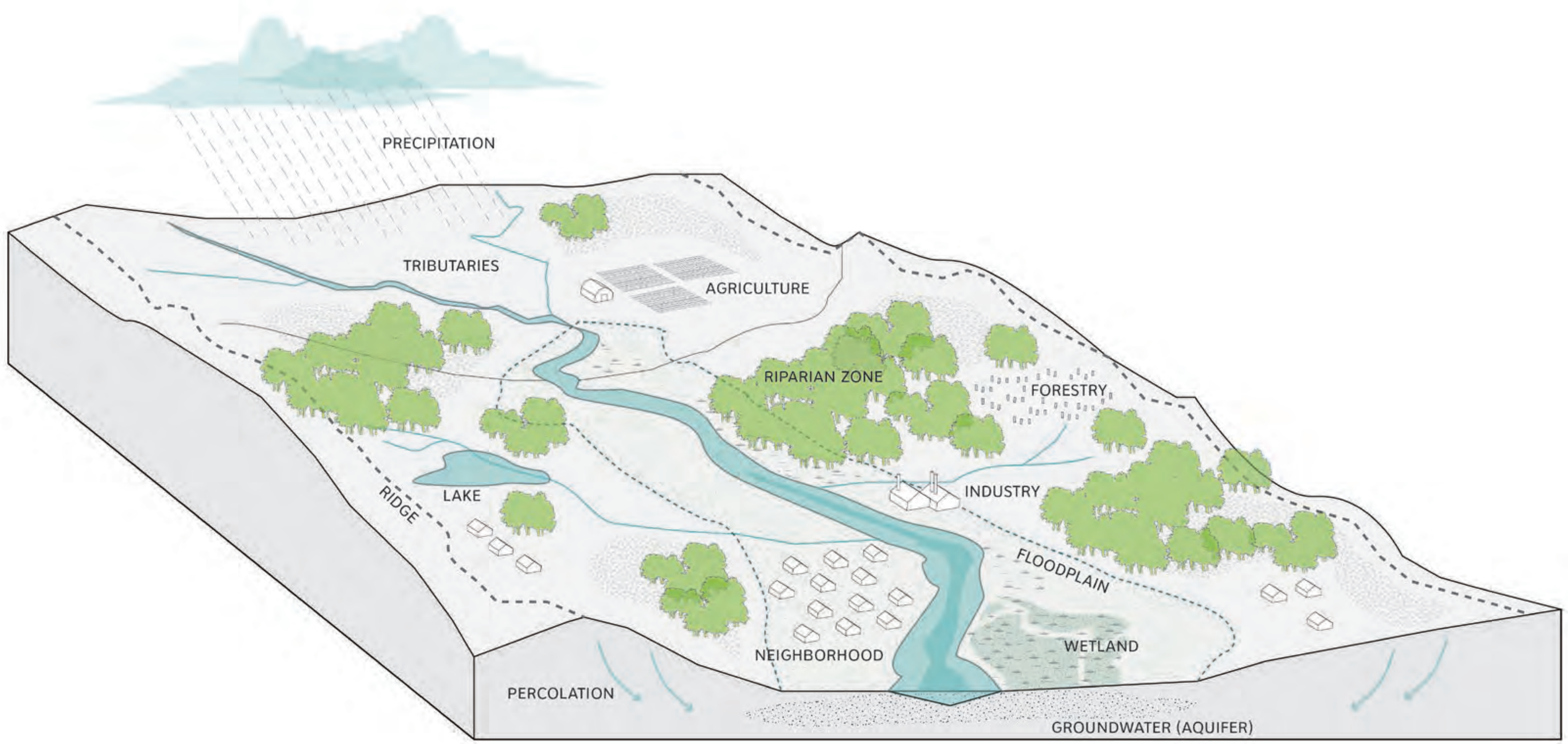
RESTORE ACT

The RESTORE Act dedicates 80 percent of all administrative and civil penalties related to the Deepwater Horizon spill to restore and protect the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, coastal wetlands, and economy of the Gulf Coast region.



WHAT IS A WATERSHED?

A watershed is an area of land that drains all of its streams and rainfall to a common outlet, such as the mouth of a bay or a point along a stream's channel.



WHAT IS A WATERSHED MANAGEMENT PLAN?

A watershed plan is a strategy and a work plan for achieving water resource goals that provides assessment and management information for a geographically defined watershed.

It includes the analyses, actions, participants, and resources related to development and implementation of the plan.

TODAY'S WORKSHOP

- Discuss the Watershed Management Plan and our next steps in the process.
- Gather expert knowledge and information for further analysis.
- Listen to histories, stories, and anecdotes about the cultural and social significance of the creek and bayou.
- Share preliminary watershed insights.

MEET THE TEAM

wood.

CHRISTINE MEHLE

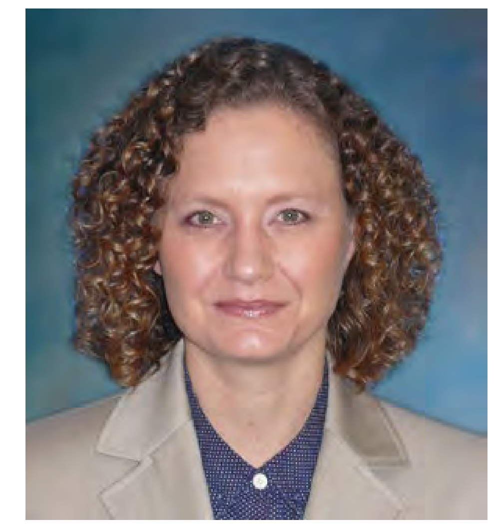
PROJECT MANAGER

JEANETTE KELSON

ASSISTANT PROJECT MANAGER / SENIOR ENGINEER

JOHN KIEFER

BIOPHYSICAL ENGINEER AND TECHNICAL ADVISOR



MARY SZAFRANIEC

WATER QUALITY TECHNICAL LEAD

SCAPE LANDSCAPE ARCHITECTURE DPC

GENA WIRTH
PRINCIPAL IN CHARGE

LEE ALTMAN
PROJECT MANAGER

MIKE BIROS
LEAD DESIGNER

KEITH JOHNSON

ENVIRONMENTAL SCIENTIST

TRAVIS PETERSON

COMMUNITY ENGAGEMENT

BROOKE FLEMING

COMMUNITY ENGAGEMENT

PREVIOUS AND ONGOING EFFORTS:

- Emerald CoastKeeper
- University of West Florida
- The Bream Fishermen Association
- Panhandle Watershed Alliance
- Local advocates, activists, and public officials

PROJECT GOALS

MANAGE WATER QUANTITY AND IMPROVE WATER QUALITY

PROTECT, ENHANCE, AND RESTORE WILDLIFE HABITAT

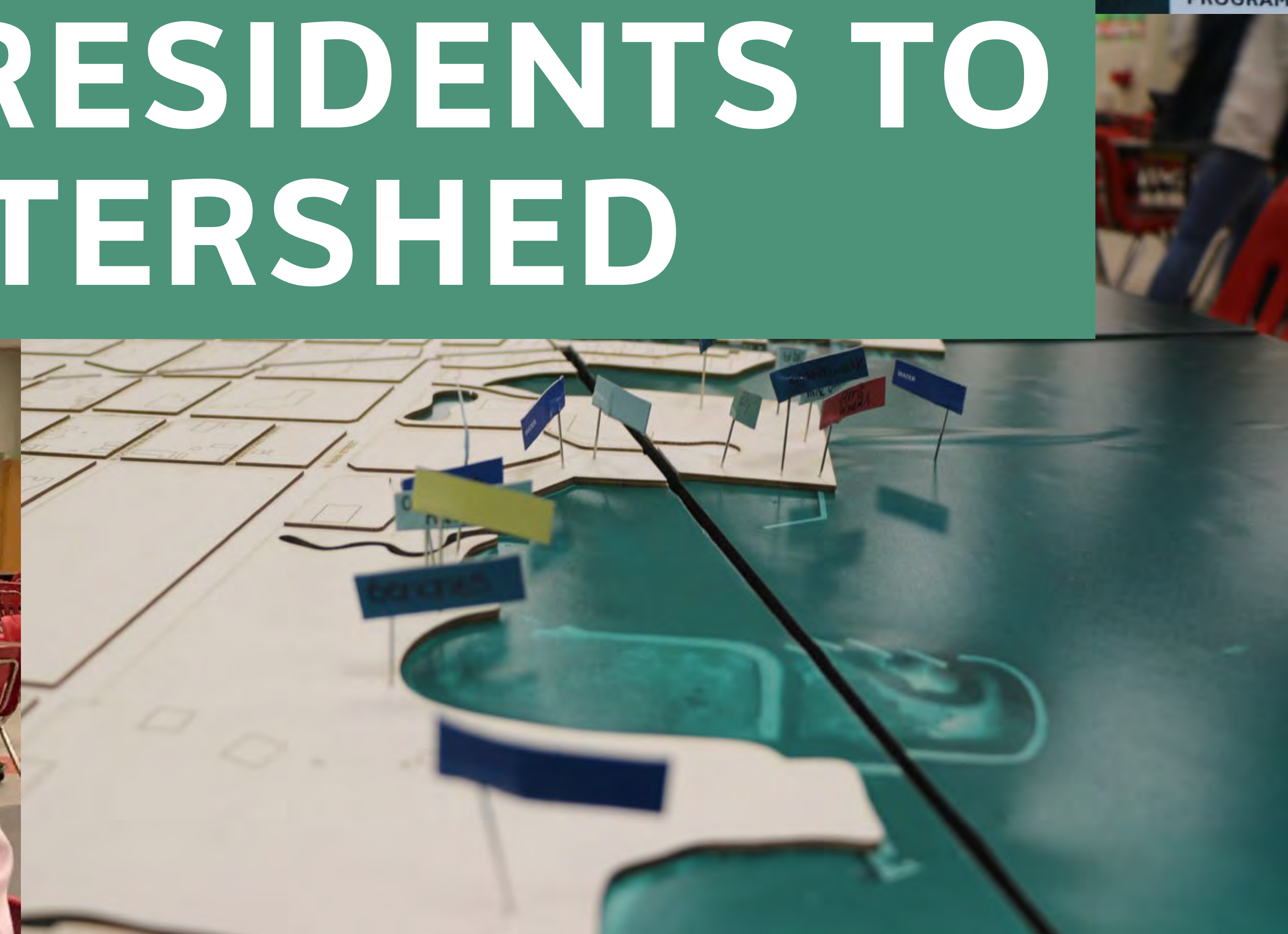
PHOTO: DARRYL BOUDREAU

EXPAND PUBLIC ACCESS AND RECREATION OPPORTUNITIES

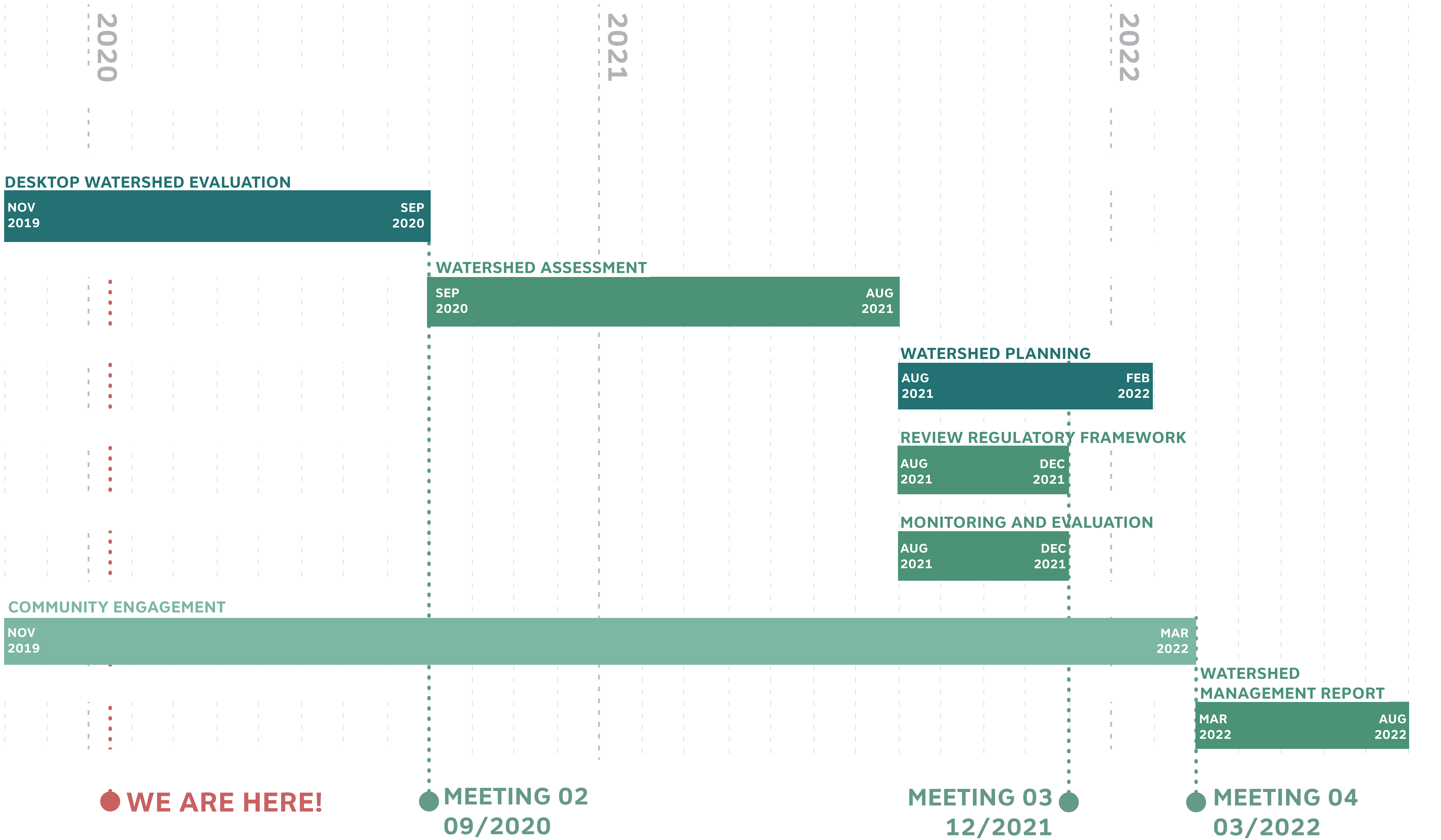
BUILD MORE EQUITABLE AND RESILIENT COMMUNITIES

PHOTO: DARRYL BOUDREAU

FOSTER STEWARDSHIP BY CONNECTING RESIDENTS TO THEIR WATERSHED

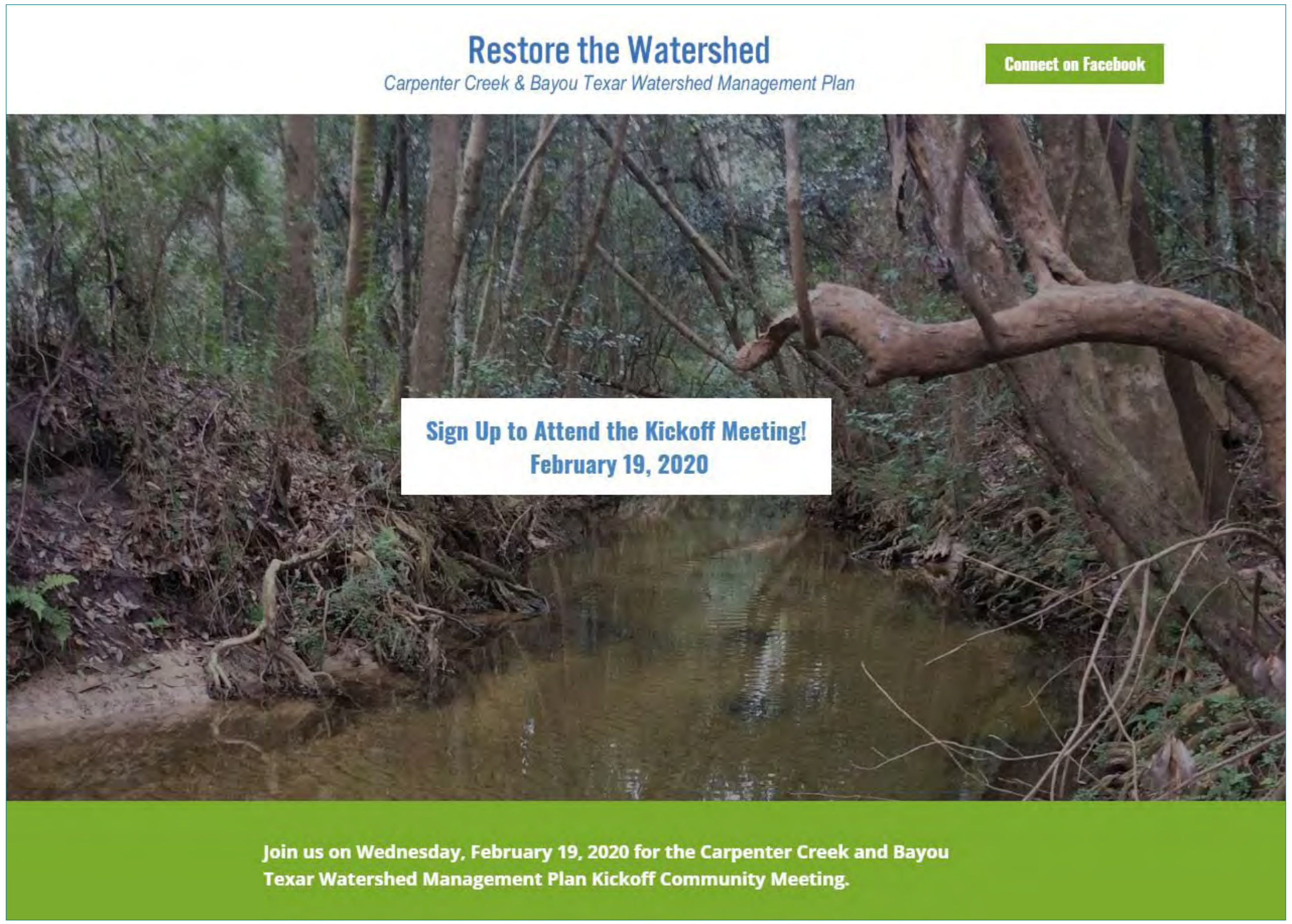


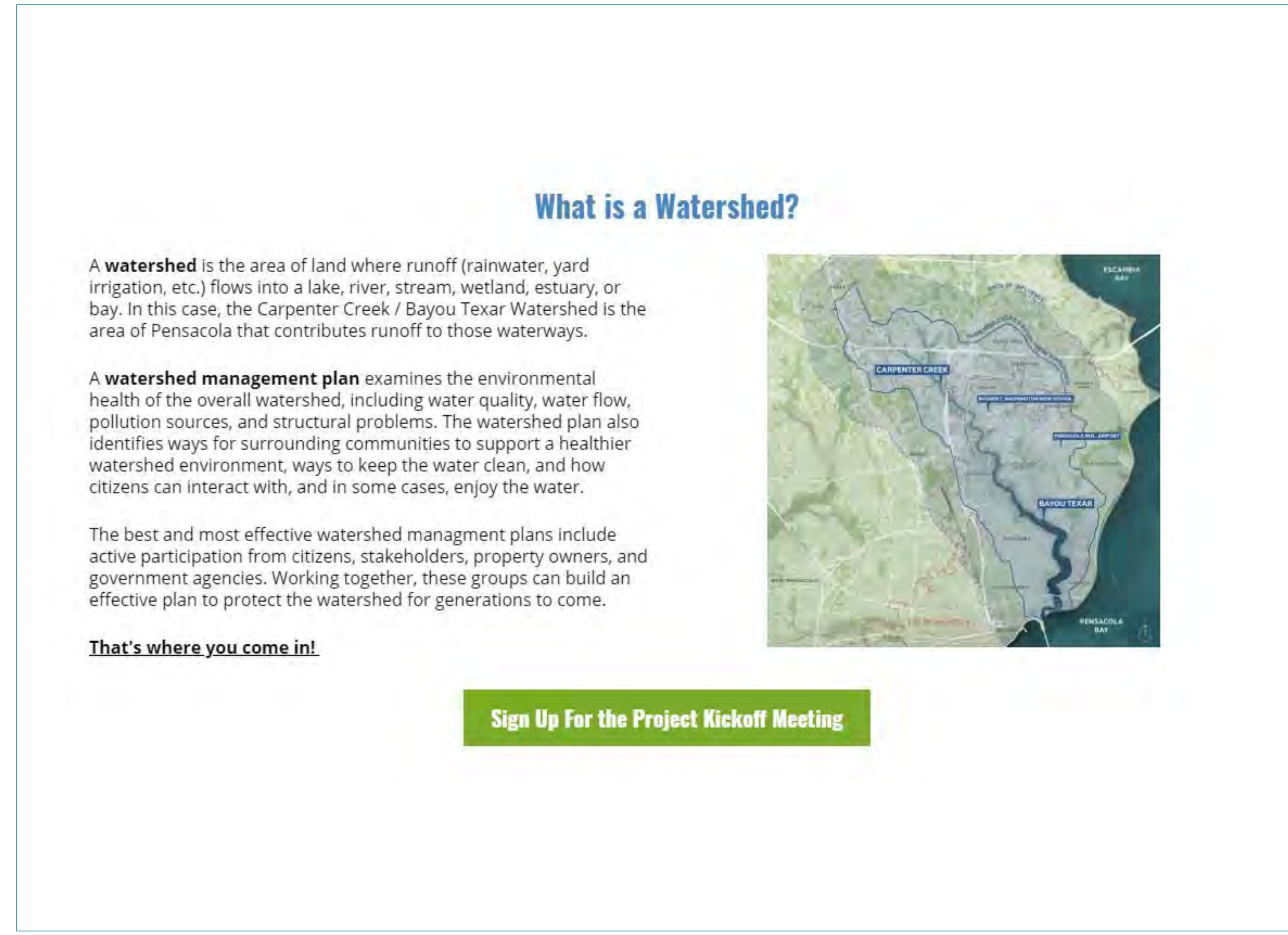
PROJECT TIMELINE



CARPENTER CREEK & BAYOU TEXAR WATERSHED MANAGEMENT PLAN
February 19, 2020

VISIT THE WEBSITE AT:
RESTORE THE WATERSHED.COM

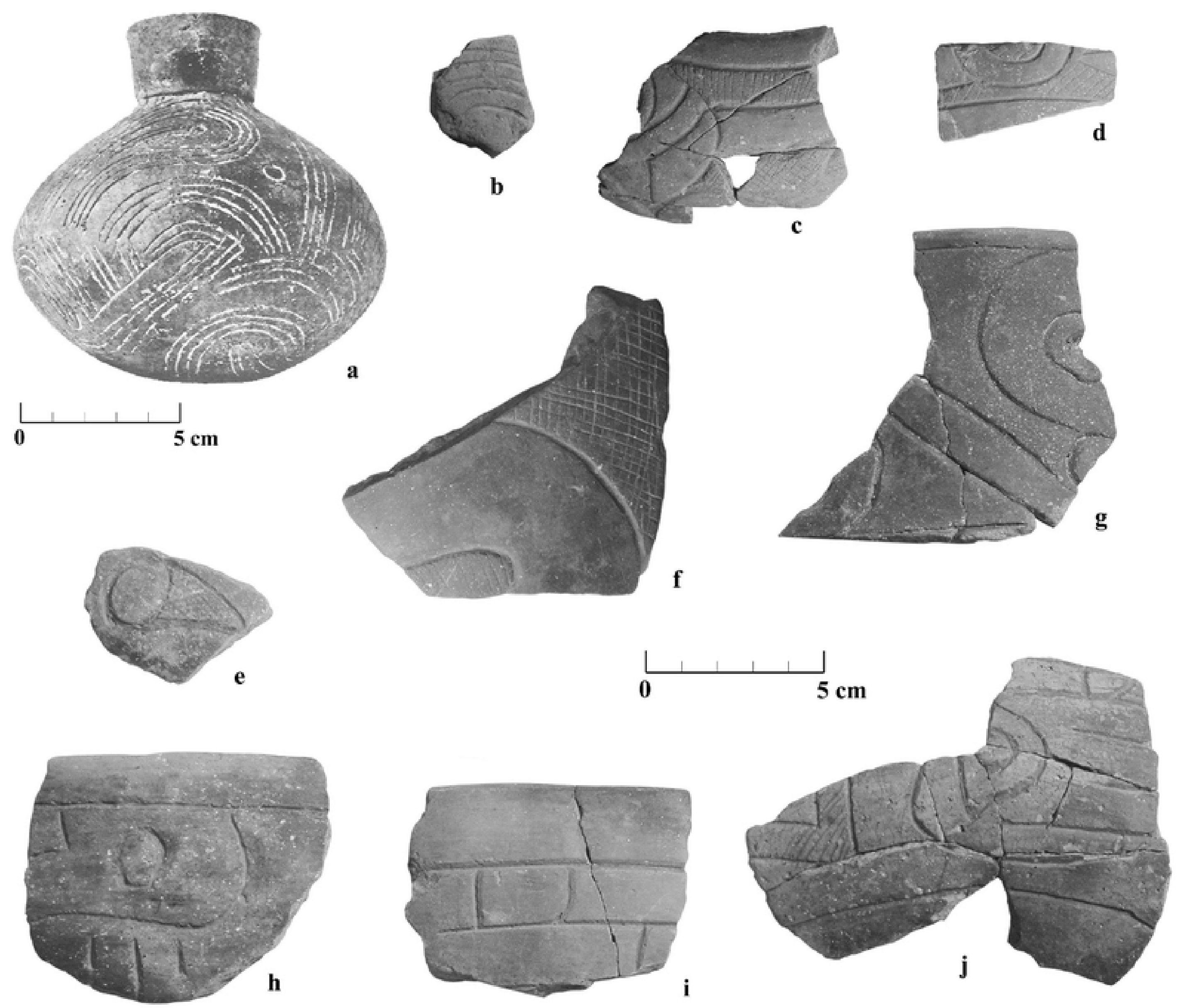




SIGN UP FOR THE PROJECT NEWSLETTER AND STAY IN TOUCH ON SOCIAL MEDIA!

THE CARPENTER CREEK/ BAYOU TEXAR STORY

INDIGENOUS PEOPLES - PENSACOLA CULTURE 1100-1700 CE



Pensacola Culture Ceramics from Mobile Bay

- **Mixture of Late Woodland period Weeden Island culture and Mississippian culture from north.**
- **Bottle Creek site near Mobile Bay is largest Pensacola culture site.**
- **Relied more on coastal resources than agriculture.**
- **Shell middens and pottery fragments found in watershed.**

Source: www.aaanativearts.com/pensacola-indians
Source: Pensacola Historic Trust

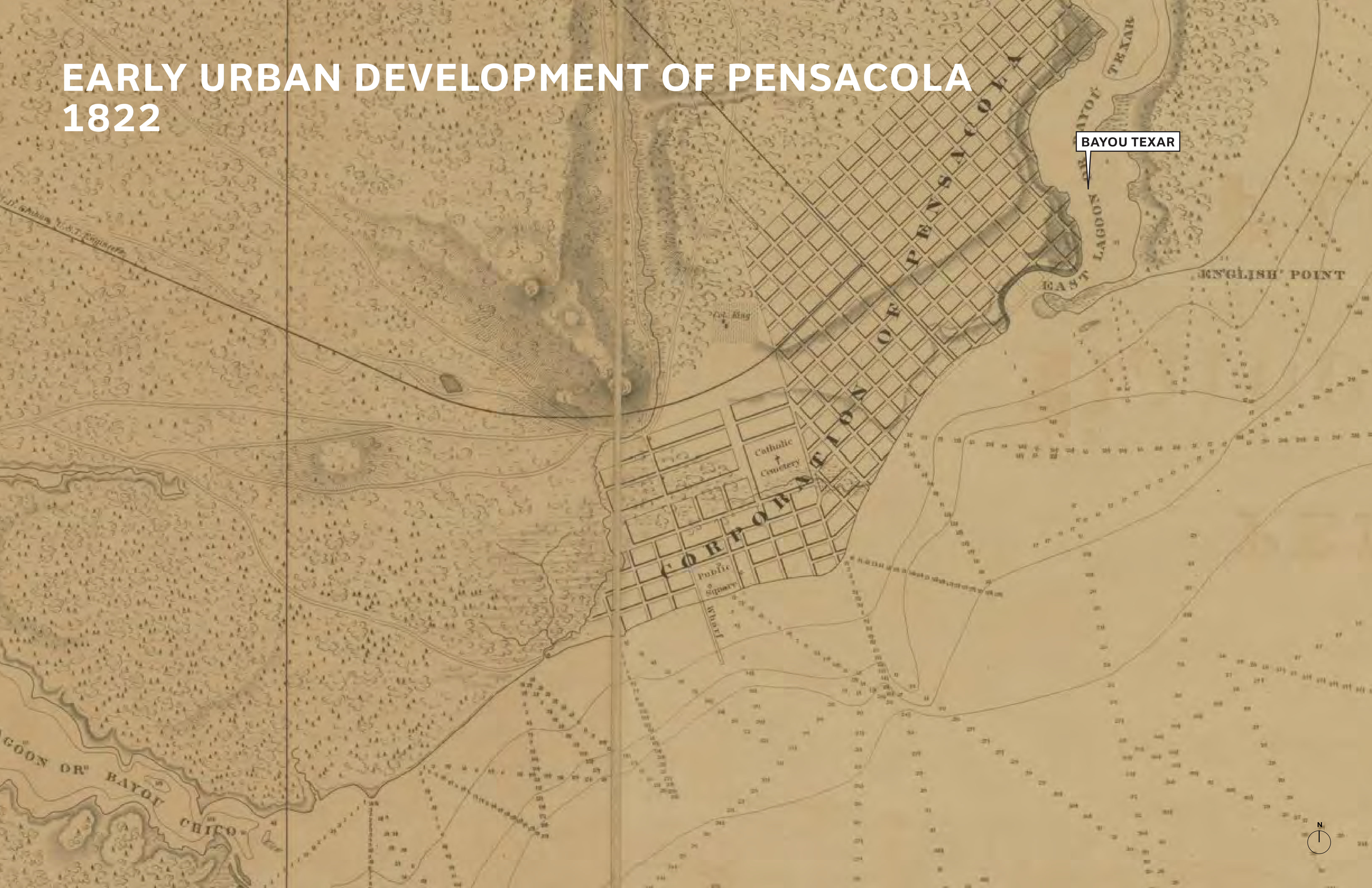
LUNA SETTLEMENT
1559-1561

Painting by Herbert Rudeen (1888-1985)

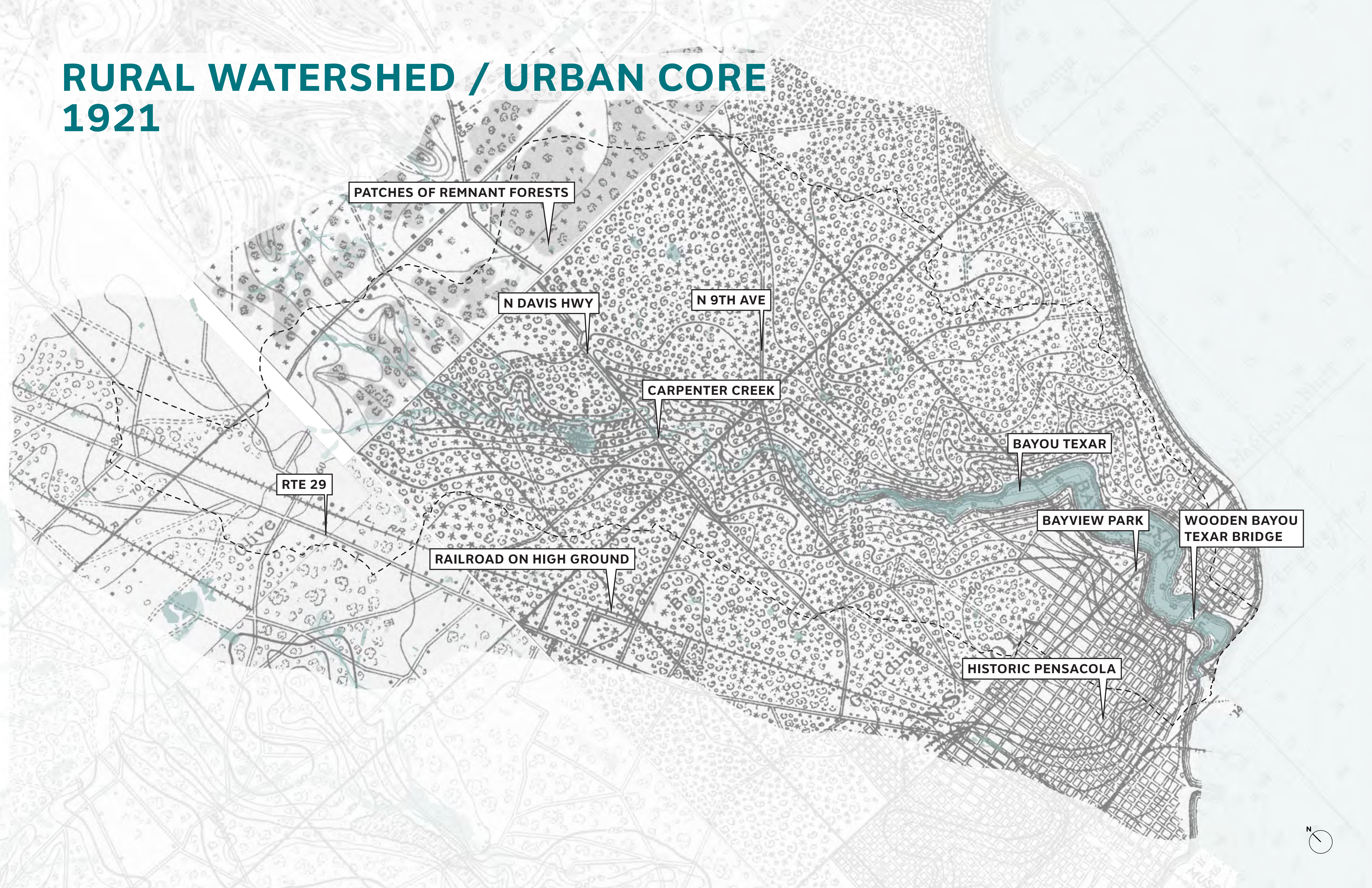
Anchor from Emanuel Point Shipwreck

Source: Pensacola Historic Trust

EARLY URBAN DEVELOPMENT OF PENSACOLA 1822



RURAL WATERSHED / URBAN CORE 1921



HISTORIC USE OF CREEK AND BAYOU

Group Swimming at Bayview Park, Unknown Date

Sawmill on Carpenter Creek, 1925

Source: Florida Memory - State Library and Archives of Florida

"There was a famous swimming hole called 'Aunt Jenny's Hole' owned by a black family. Blacks and whites congregated there, and swam together. This creek has a lot of meaning to the history of Pensacola. We need to tell that history."

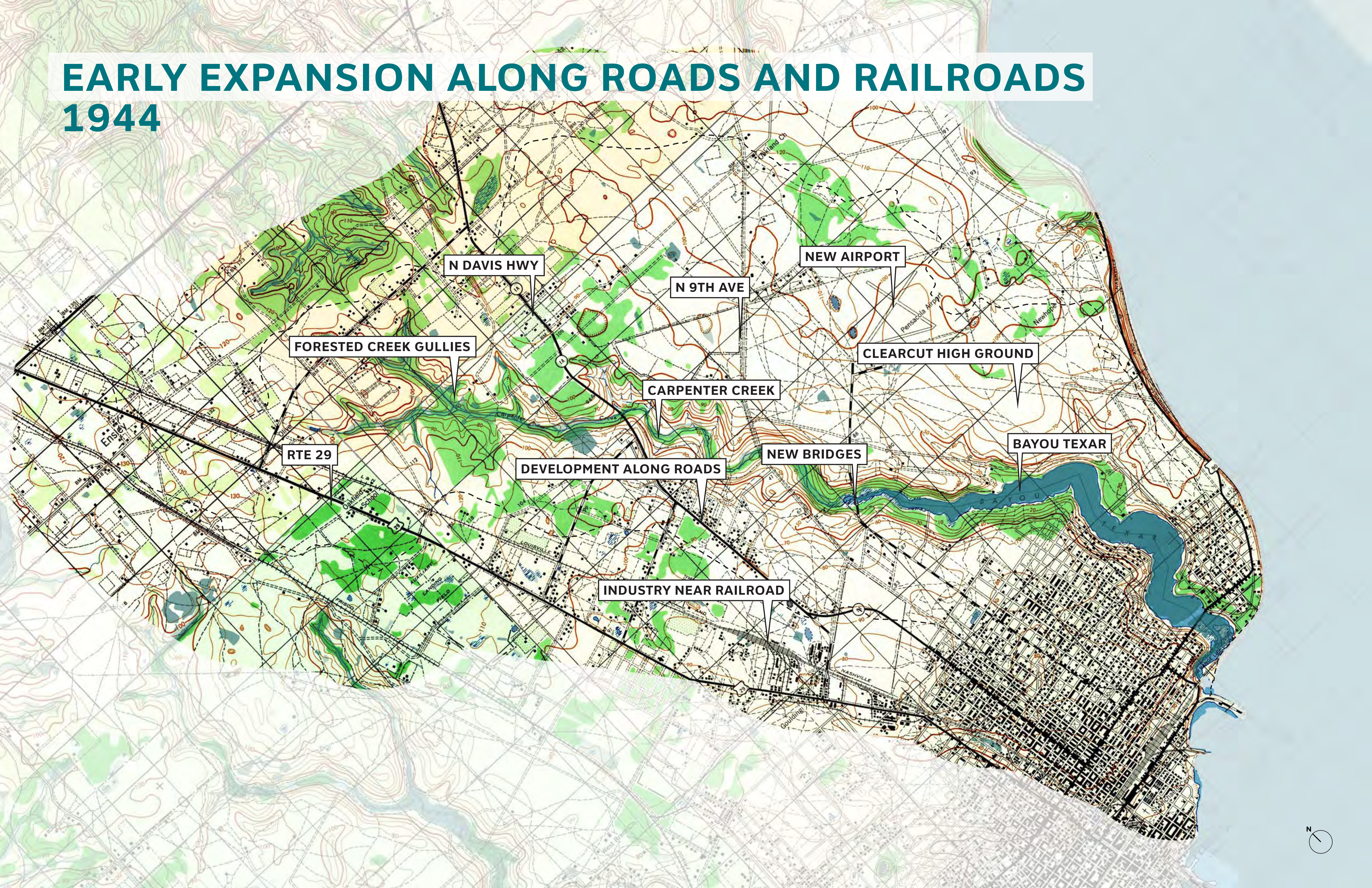
— Pensacola City Councilwoman Sherri Myers

PUBLIC GATHERING

Boat House on Bayou Texar, 1880

Independence Day at Bayview Park, 1908

EARLY EXPANSION ALONG ROADS AND RAILROADS
1944



PASSIVE RECREATION

Bayou Texar, 1973

Bayou Texar, early 1900s

ACTIVE RECREATION

Bayou Texar Ski Club

Bayview Park 30ft diving platform

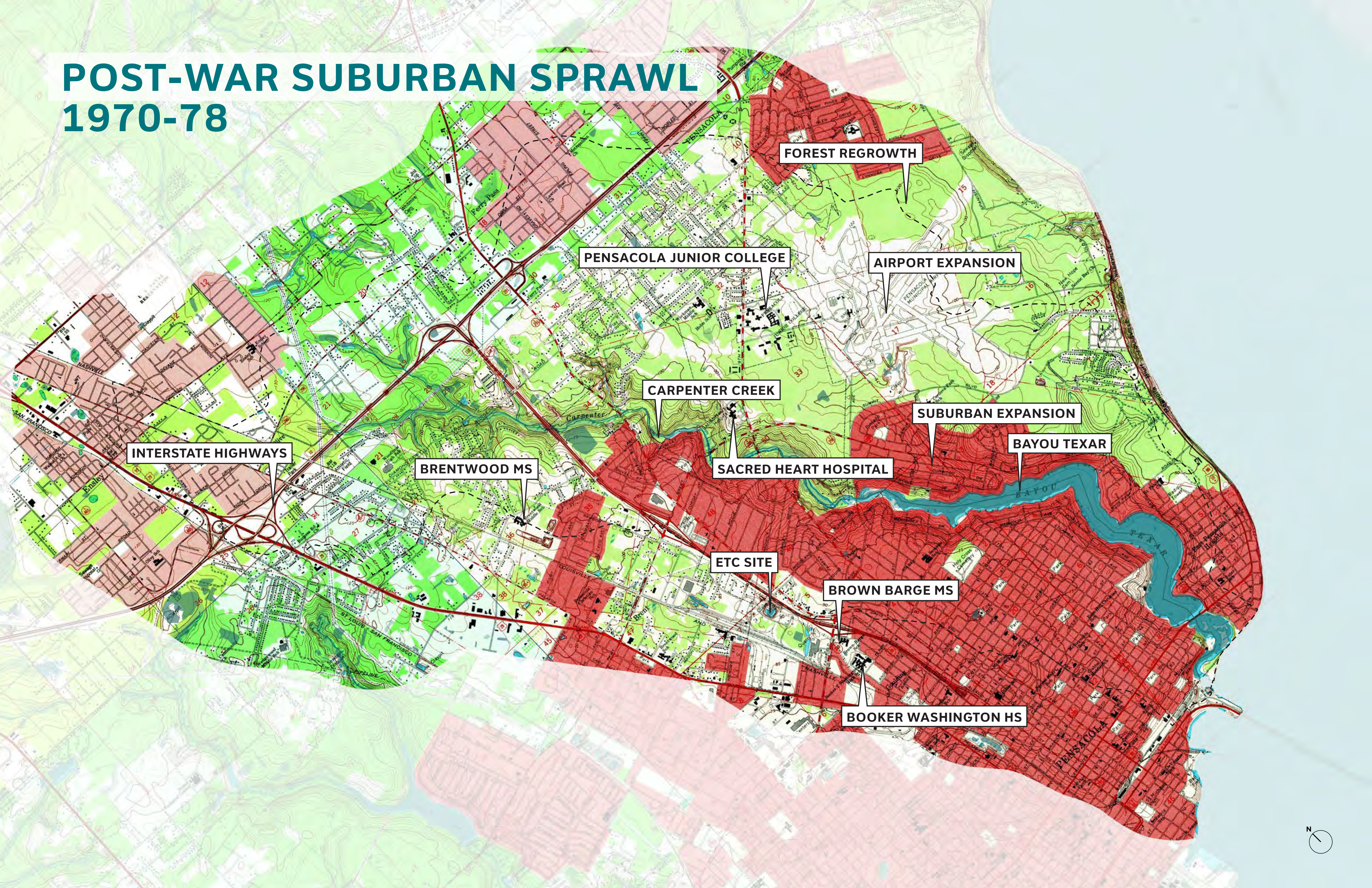
BRIDGE CONSTRUCTION

Construction of Bayou Texar Bridge, 1955

Construction of Bayou Texar Bridge, 1955

Source: Florida Memory - State Library and Archives of Florida

POST-WAR SUBURBAN SPRAWL 1970-78



PHYSIOLOGICAL CHANGES

"The creek used to be crystal clear with a gravel bottom. It had runs, riffles, pools and glides. Some pools were 4-8' deep with runs through narrow banks such that a grown man could stand in the creek and touch both banks from the center."

— Bream Fishermen Association Newsletter

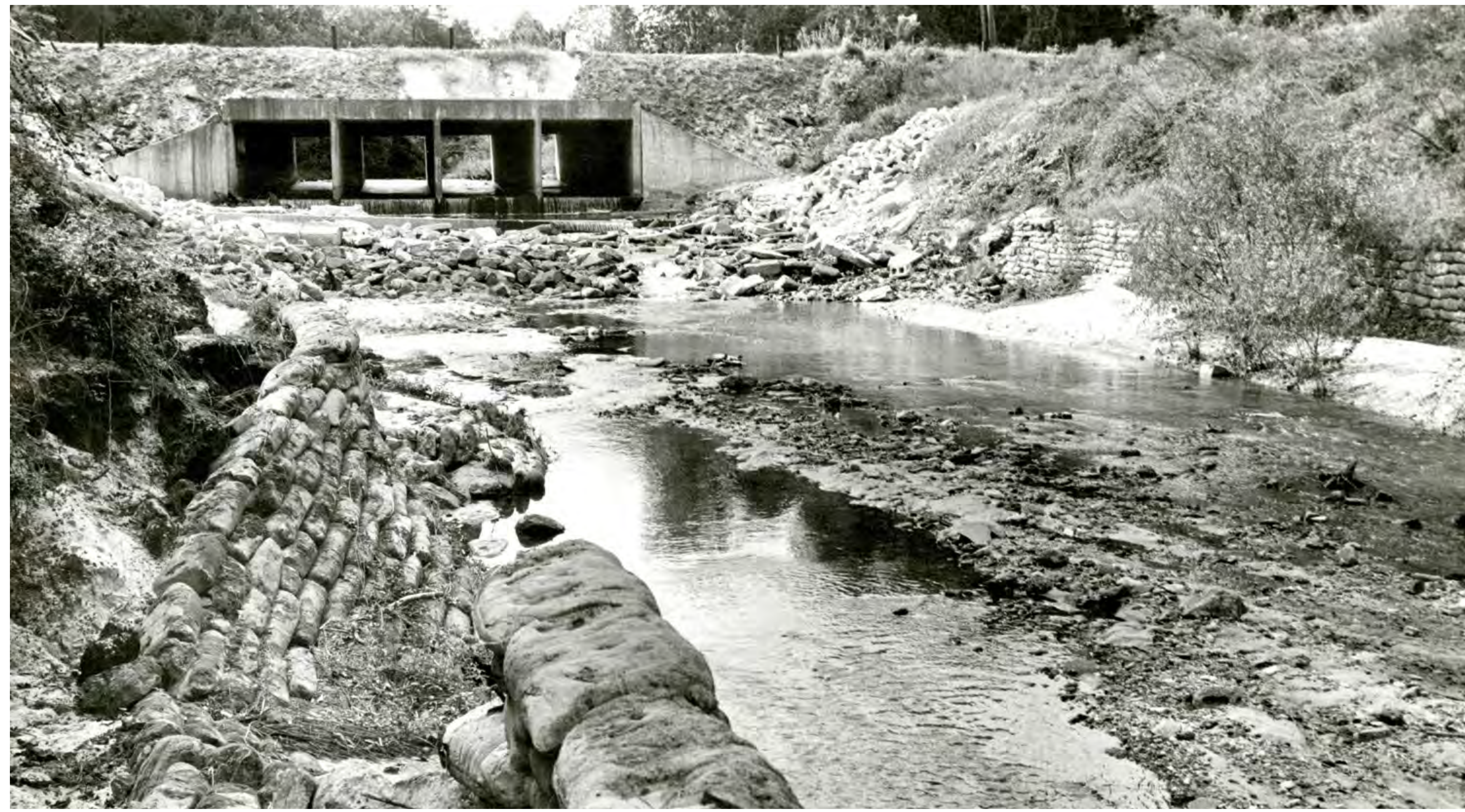
PHYSIOLOGICAL CHANGES

"Today the creek is less than 2' deep and sands have smothered the gravel bars leaving a wide and scoured system. Many of the remaining native species have been displaced by invasive non-native species."

— Bream Fishermen Association Newsletter

PHYSIOLOGICAL CHANGES

Sewage Discharge into Carpenter Creek, 1976



Hardened Banks and Box Culvert on Carpenter Creek, 1978

Source: UWF Archives

PHYSIOLOGICAL CHANGES

Streambank Hardening, 1976

Sedimentation in Carpenter Creek, 1977

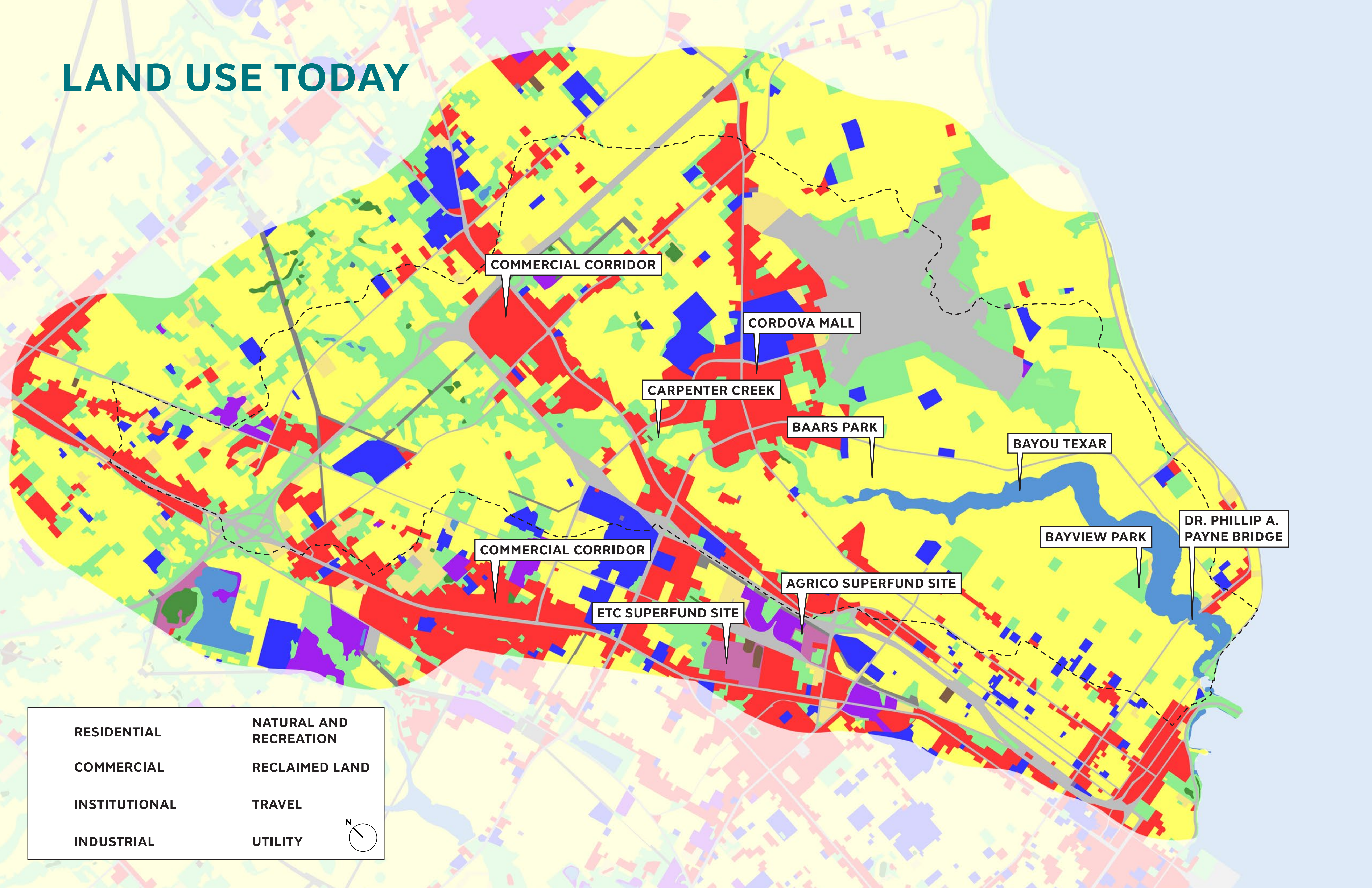
Source: UWF Archives

PHYSIOLOGICAL CHANGES

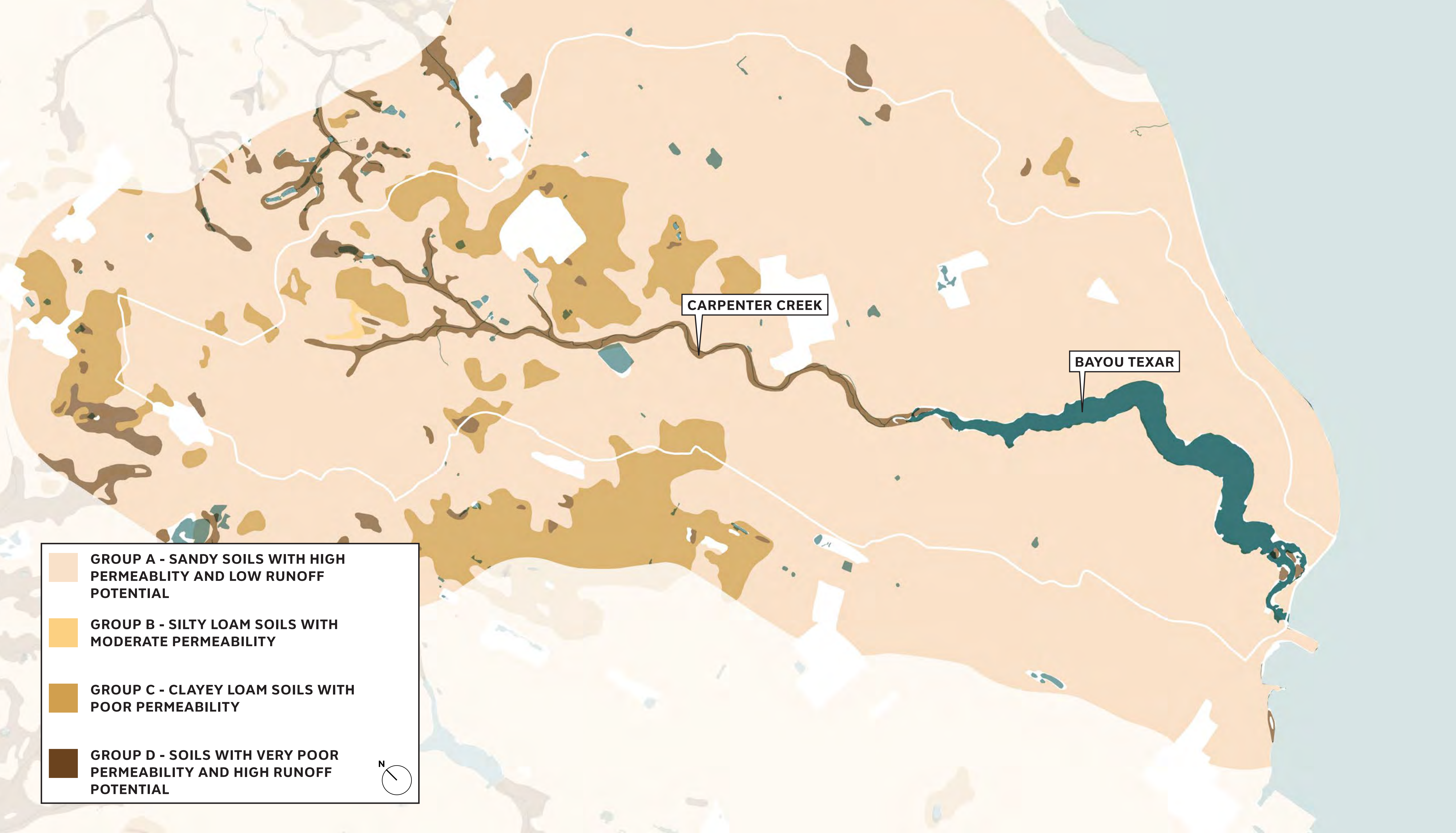
Army Corps dredging of Bayou Texar, 1982

Removing sandbar near Bayview Park, 1985

Source: UWF Archives


LAND USE TODAY
COMMERCIAL CORRIDOR
CORDOVA MALL
CARPENTER CREEK
BAARS PARK
BAYOU TEXAR
BAYVIEW PARK
DR. PHILLIP A. PAYNE BRIDGE
COMMERCIAL CORRIDOR
AGRICO SUPERFUND SITE
ETC SUPERFUND SITE
RESIDENTIAL
COMMERCIAL
INSTITUTIONAL
INDUSTRIAL
NATURAL AND RECREATION
RECLAIMED LAND
TRAVEL
UTILITY
N

SOILS — HYDROLOGIC GROUPS



SOILS — HIGHLY PERMEABLE SANDS

Restoration Work by County Crews on Carpenter Creek, 1976

ECOLOGY — REMNANT PATCHES

ECOLOGY — REMNANT PATCHES

Construction of Grocery Store next to Carpenter Creek, 1975

STATE OF THE WATERSHED

BY THE NUMBERS:

- The Carpenter Creek watershed is approximately 6,760 acres, or 10.5 square miles
- The Bayou Texar watershed includes approximately an additional 5,266 acres or 8.2 square miles
- Combined area: approx. 12,026 acres or 18.7 square miles

EXISTING CONDITIONS:

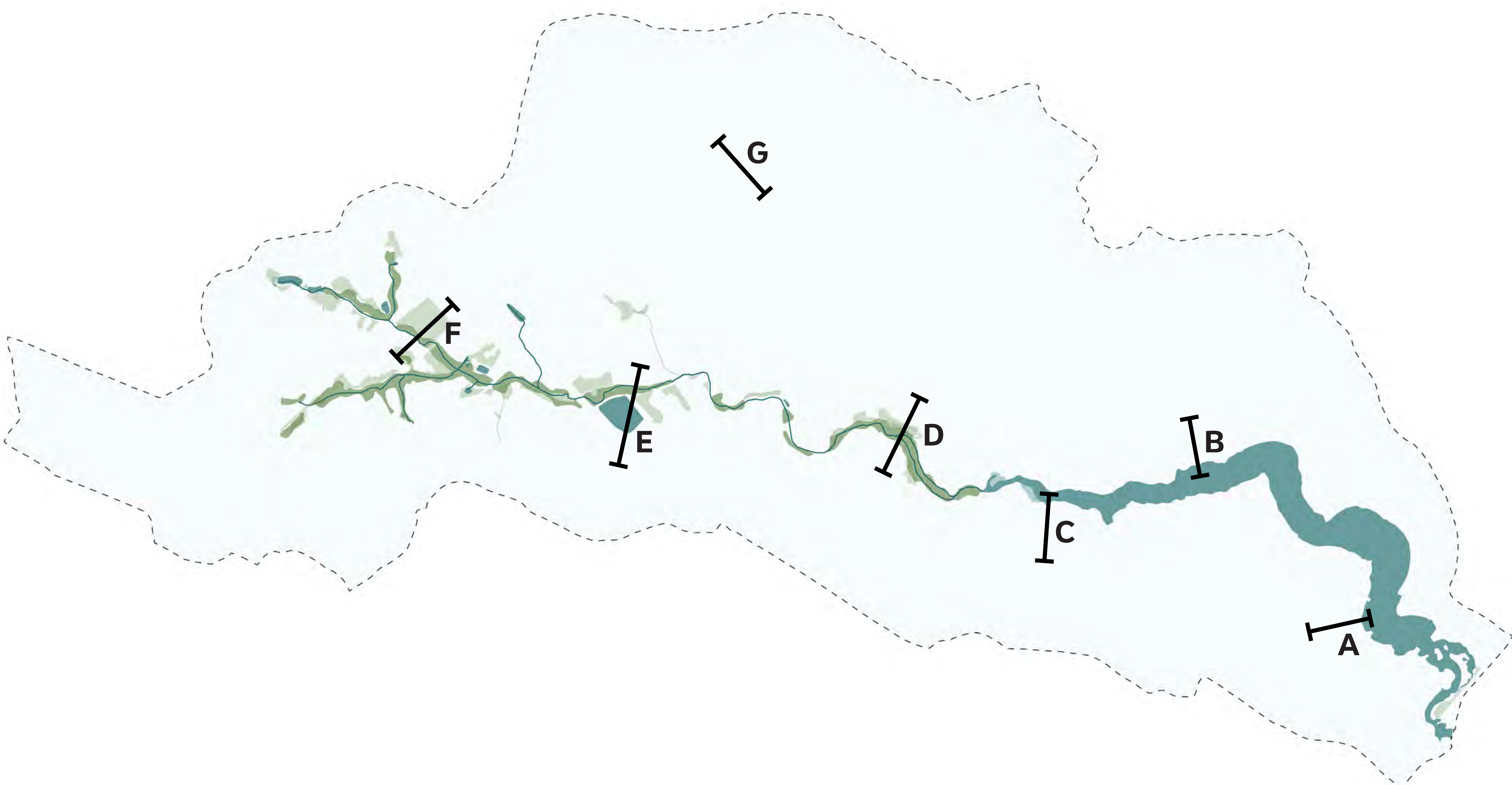
- Water quality in both creek and bayou is impaired (Florida DEP)
- Stormwater infrastructure is aging and vulnerable to storms
- Legacy contamination of heavy metals and pesticides in bayou sediments
- Majority of the watershed is urbanized / built up
- Fragmented ecosystems
- Stream banks suffer from erosion or are hardened
- Few public access points available

FUTURE OPPORTUNITIES:

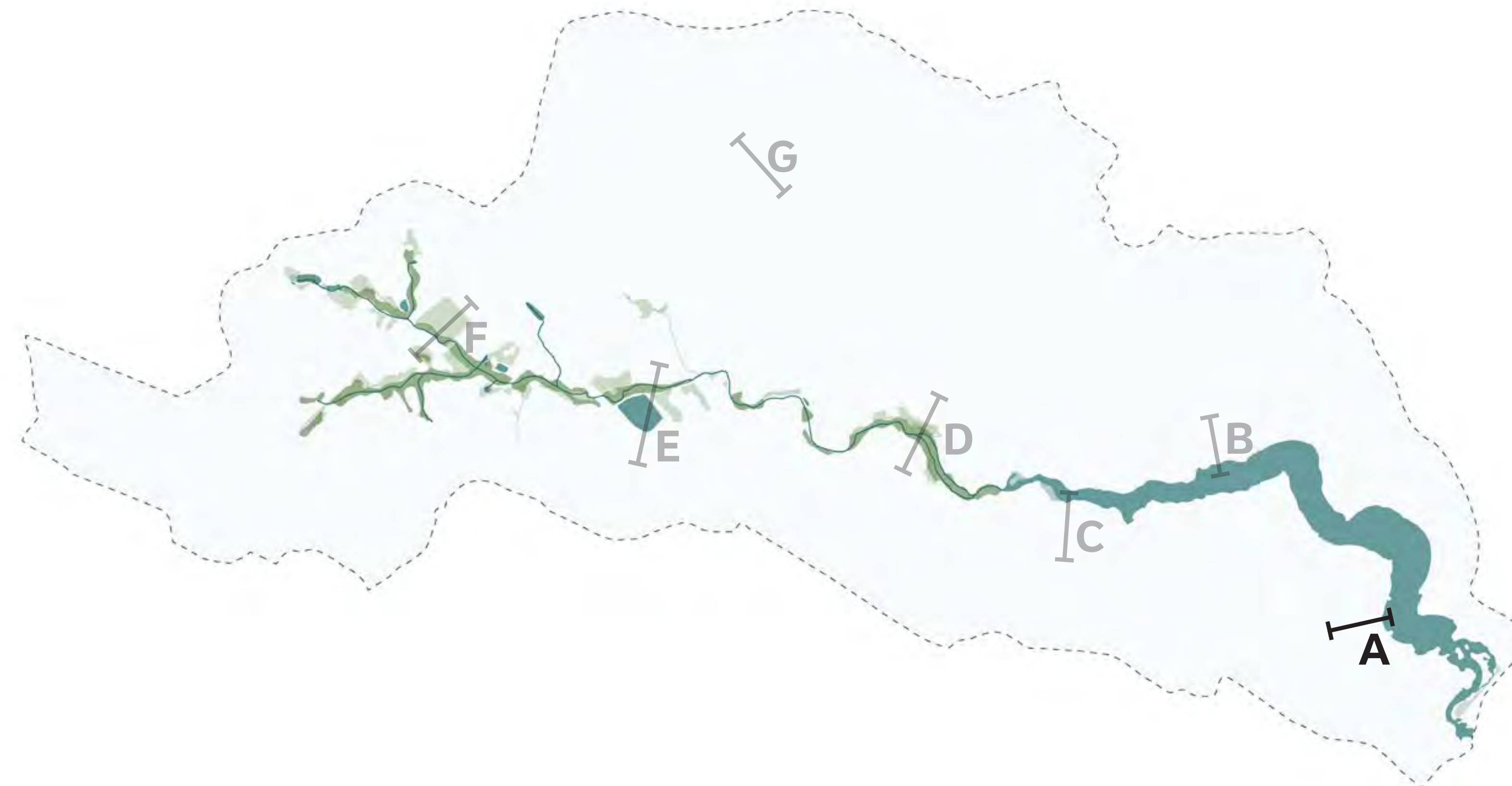
- Creek and Bayou waters are (and have always been) public!
- Rich history and cultural resources
- Green infrastructure
- Diverse local ecology and assets
- RESTORE funding available for key improvements

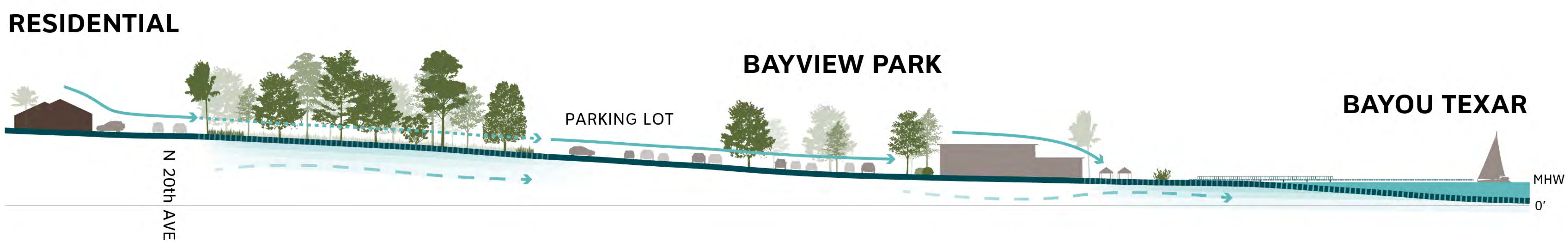
A WALK THROUGH THE WATERSHED

TYPICAL CONDITIONS THROUGHOUT THE WATERSHED

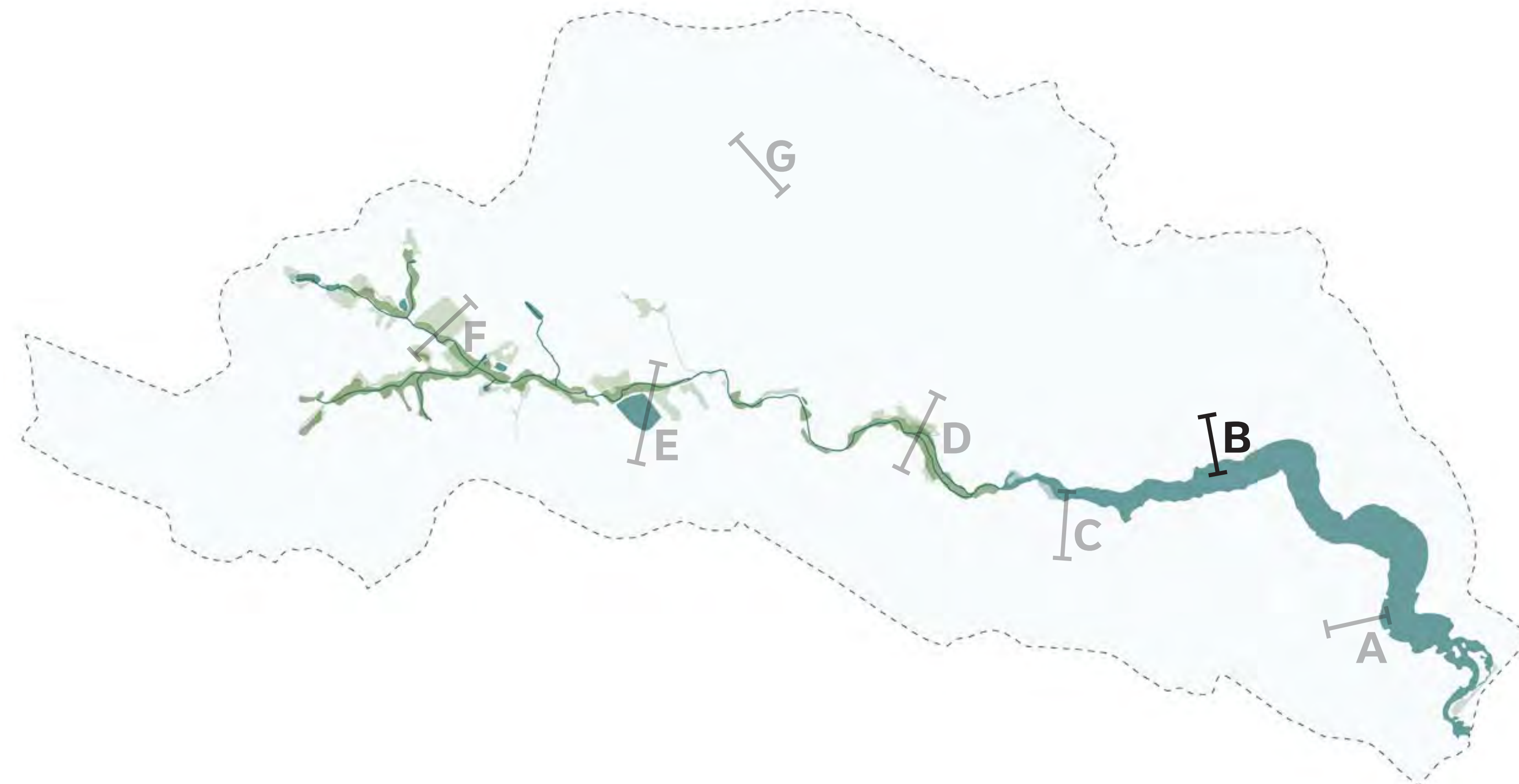


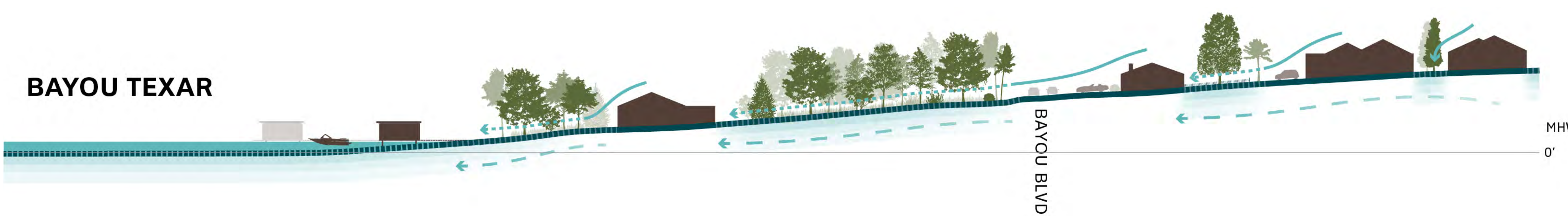
PUBLIC WATERFRONT - BAYVIEW PARK



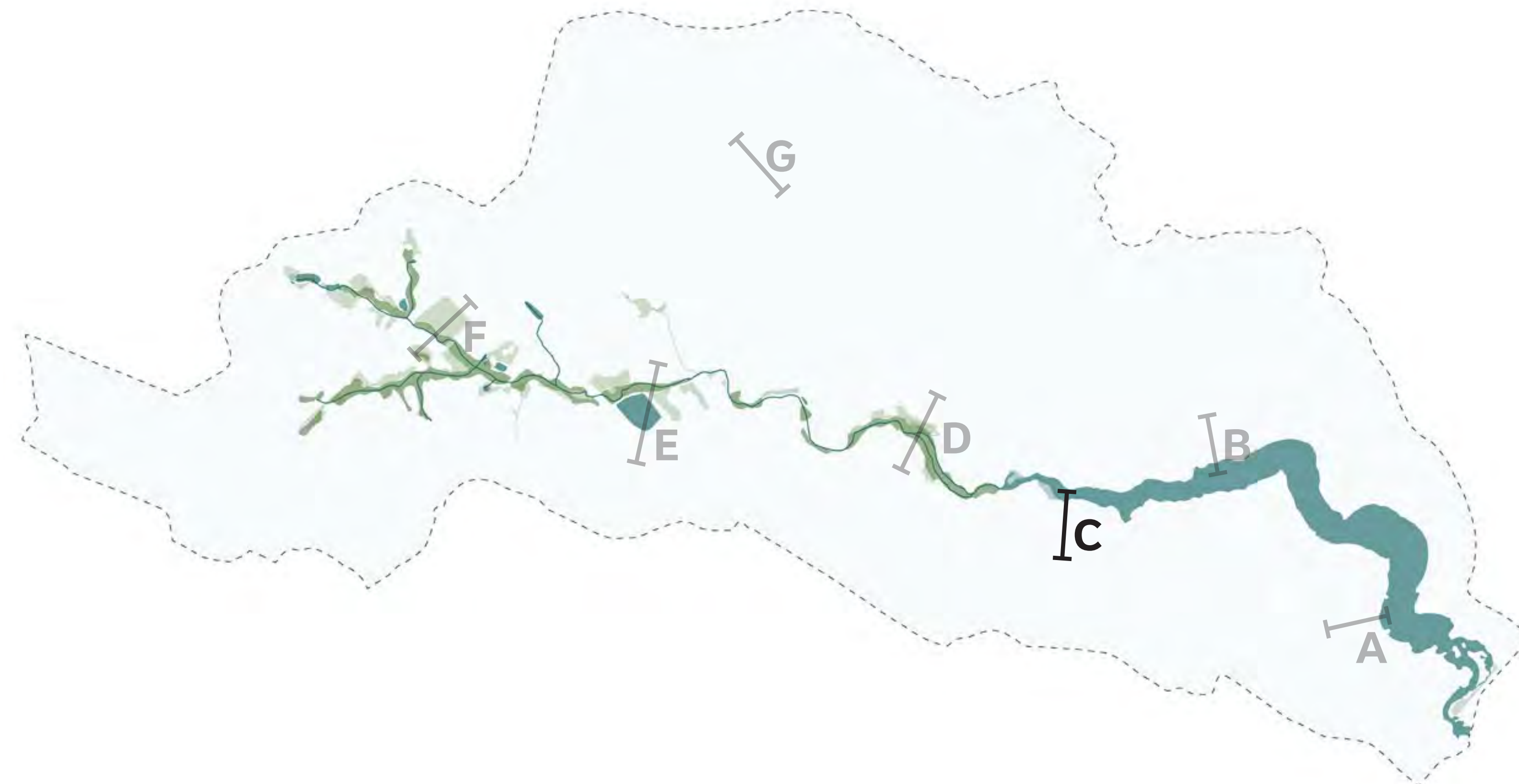


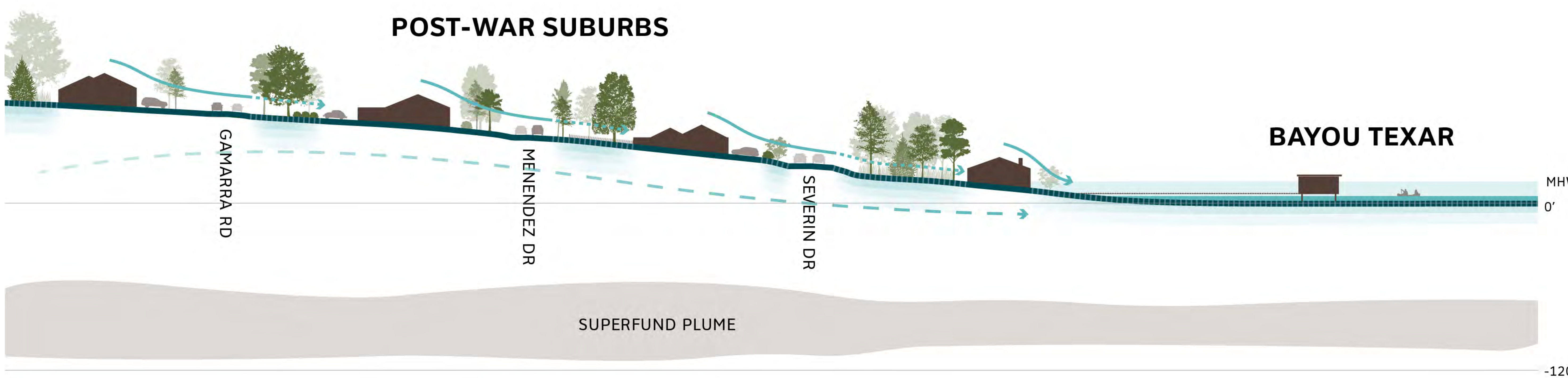
PRIVATE WATERFRONT - HOMES ALONG BAYOU BLVD



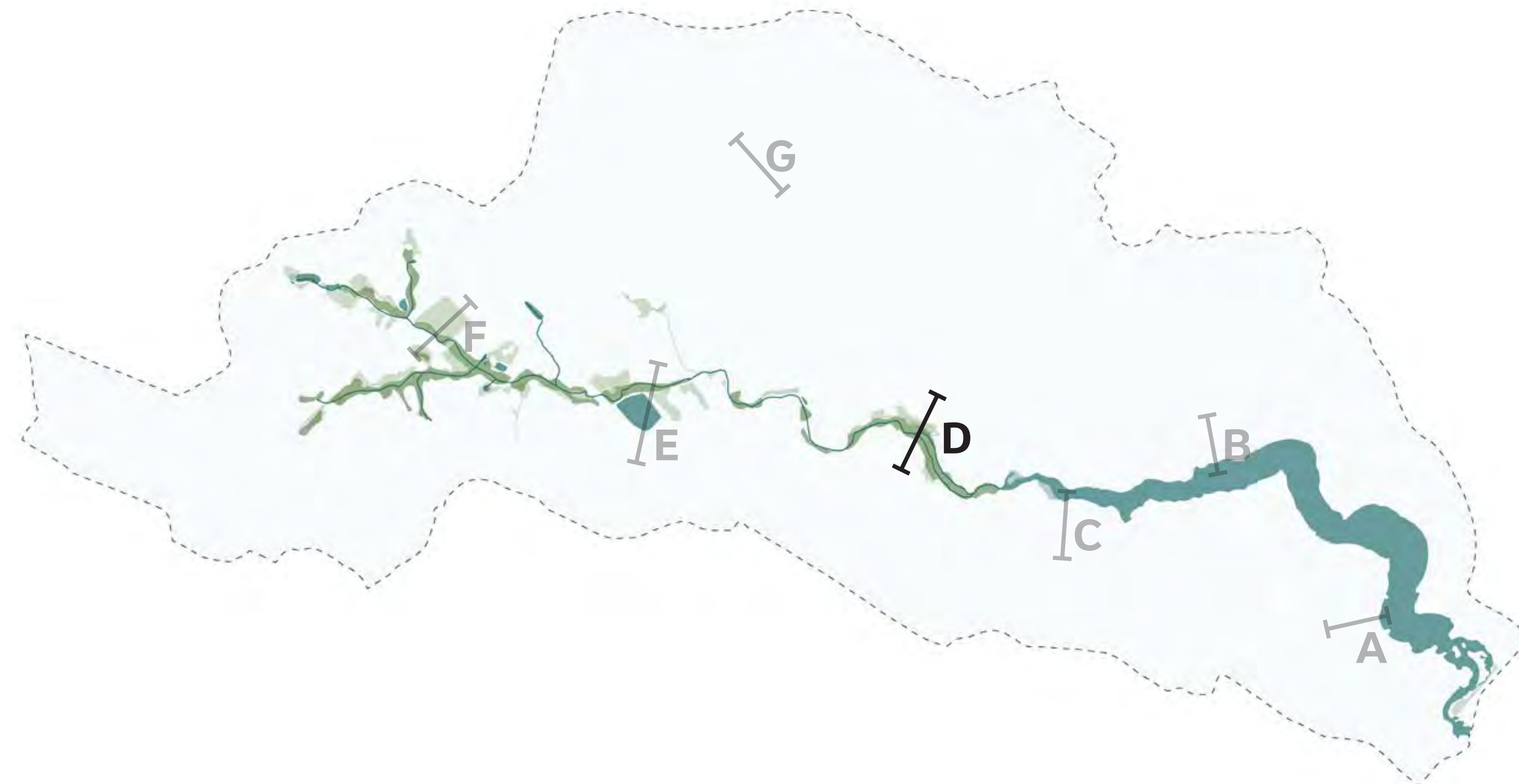


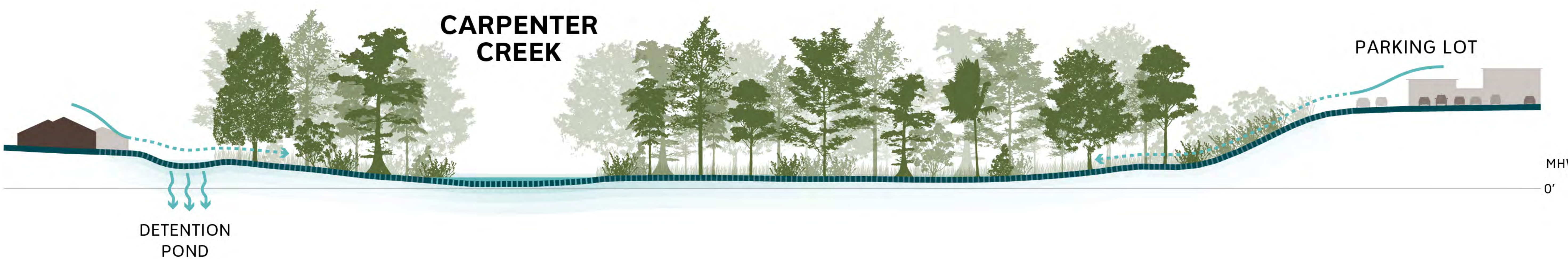
PRIVATE WATERFRONT - BACKYARD CREEK



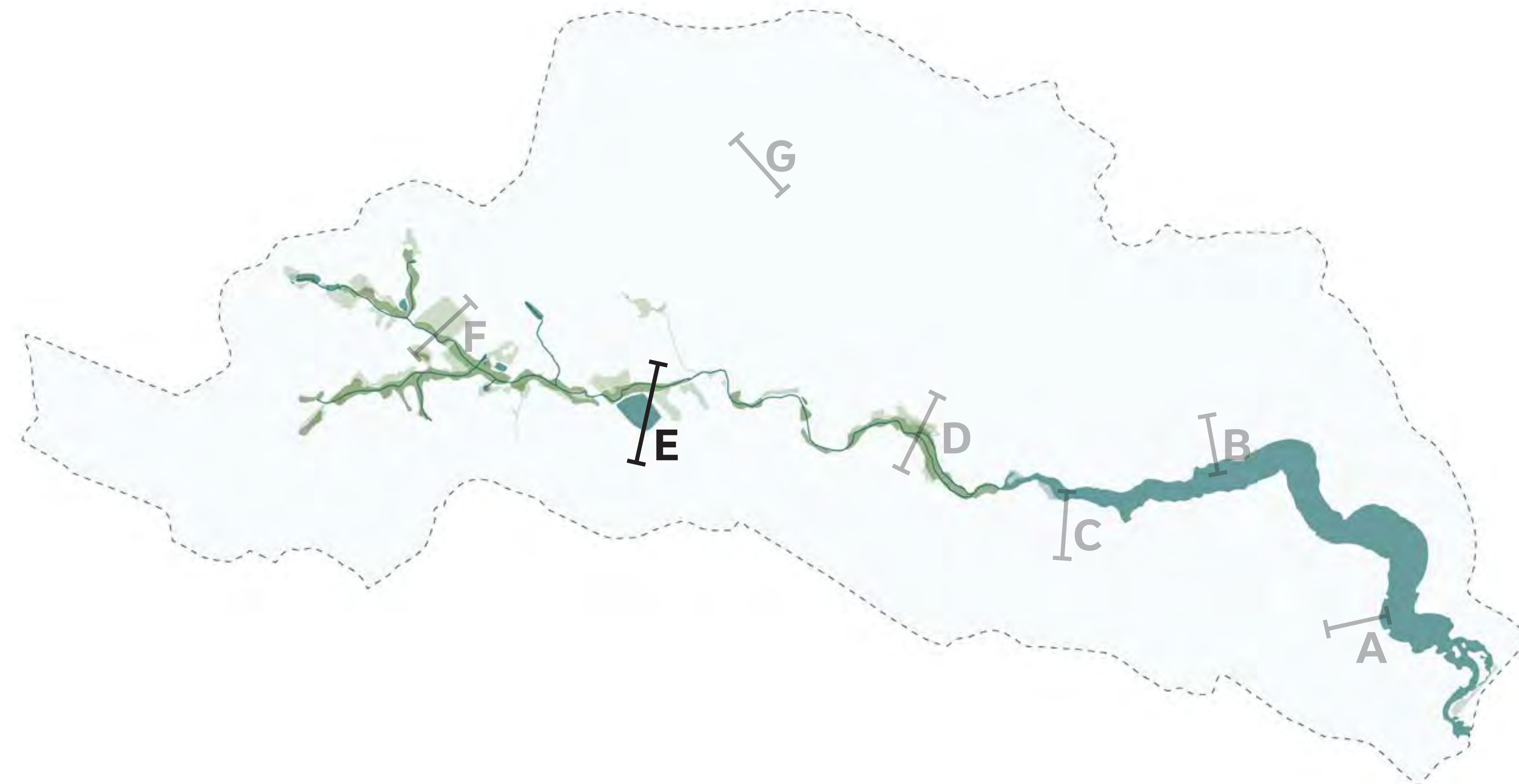


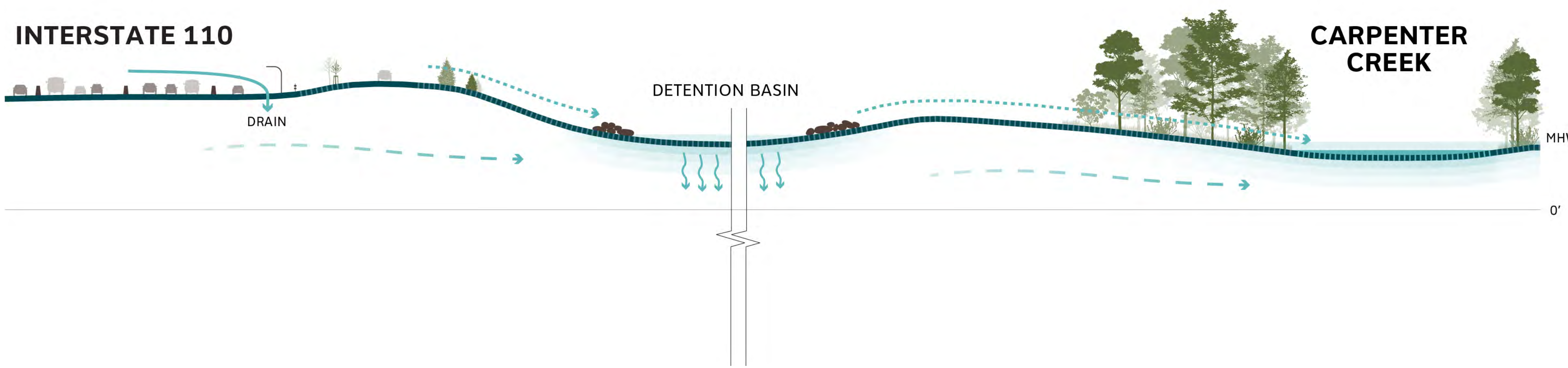
NON-POINT SOURCES - POLLUTION FROM PARKING LOTS



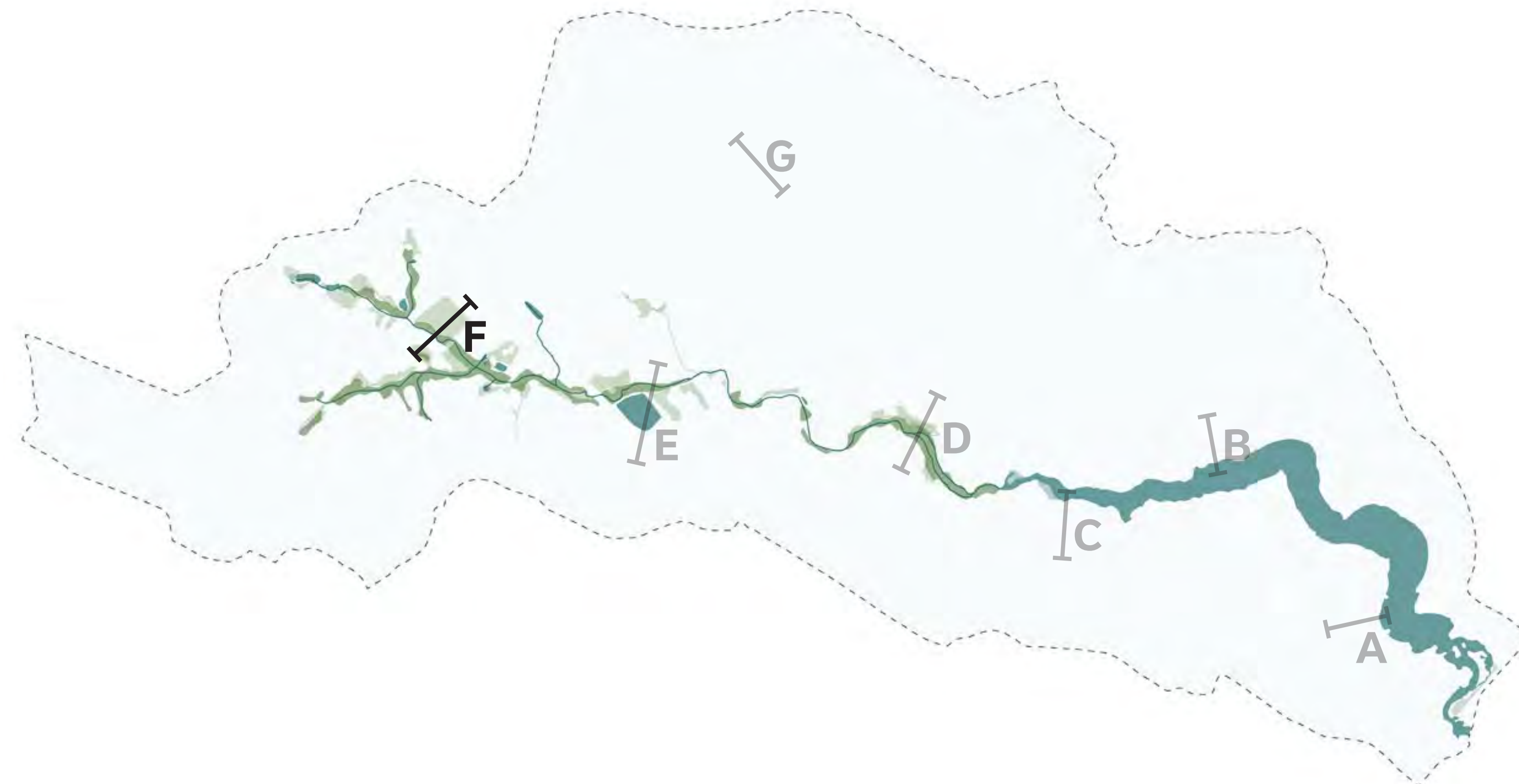


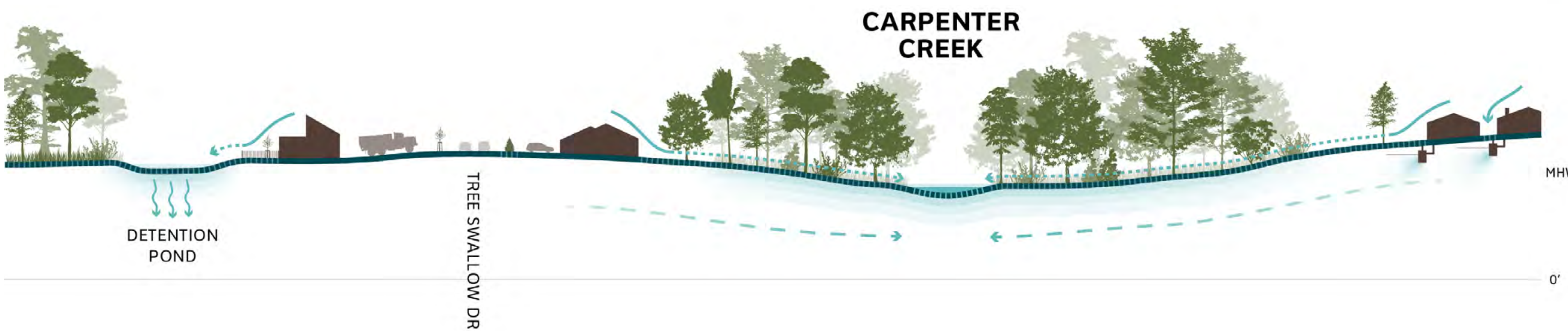
BIG INFRASTRUCTURE - HIGHWAYS AND DETENTION BASINS



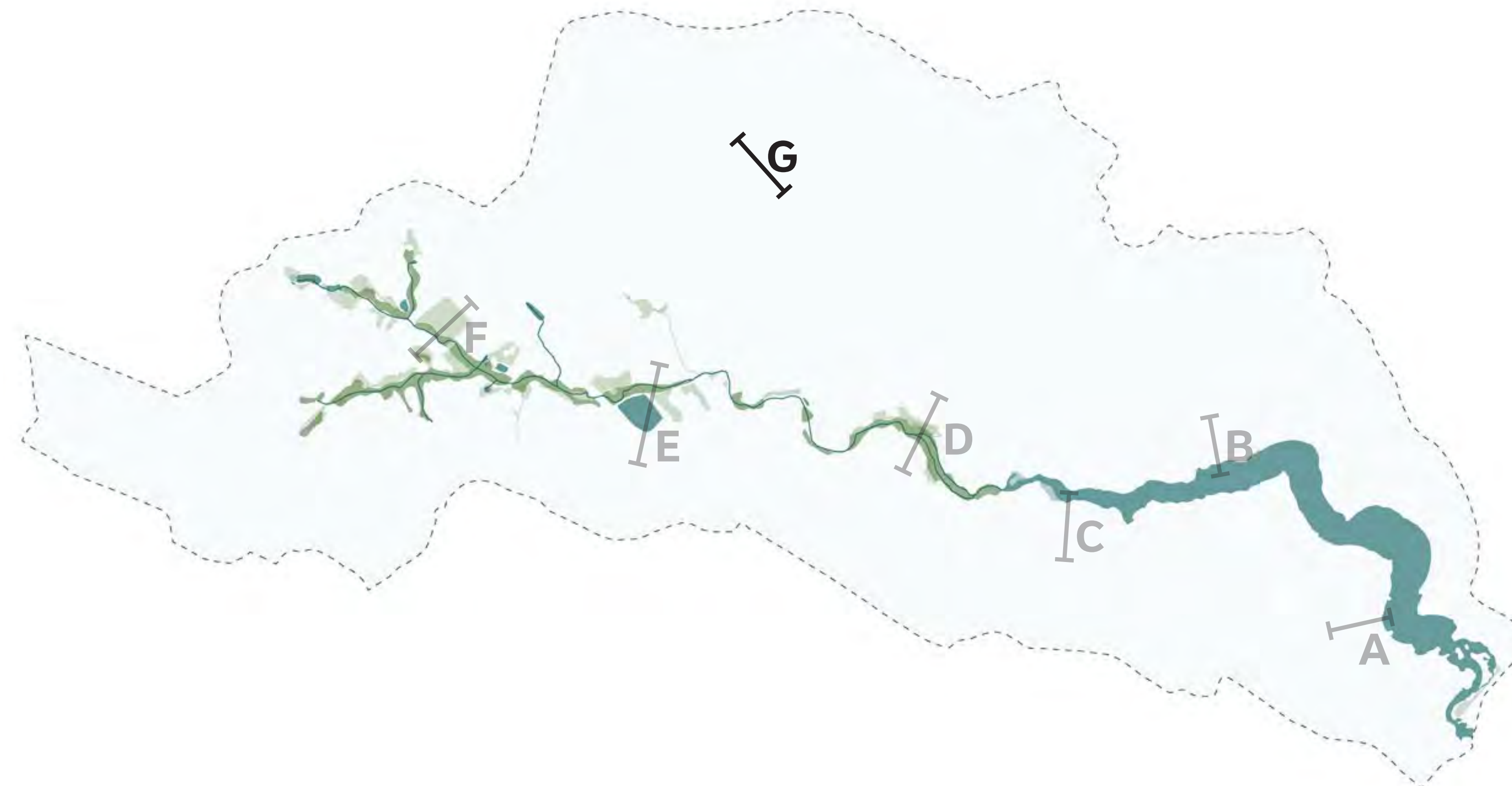


CREEK HEADWATERS





UPPER WATERSHED - FROM BOGS TO BASINS



TODAY'S WORKSHOP

TODAY'S WORKSHOP

- Discuss the Watershed Management Plan and our next steps in the process.
- Gather expert knowledge and information for further analysis.
- Listen to histories, stories, and anecdotes about the cultural and social significance of the creek and bayou.
- Share preliminary watershed insights.

SHARE YOUR KNOWLEDGE! - ANSWER THE QUESTIONNAIRE

SHARE YOUR KNOWLEDGE! - FLAG THE MODEL

FUN

BORING

SAFE

UNSAFE

ACCESSIBLE

INACCESSIBLE

WELCOMING

UNWELCOMING

FLOODING

POLLUTED

SPECIAL

BLANK

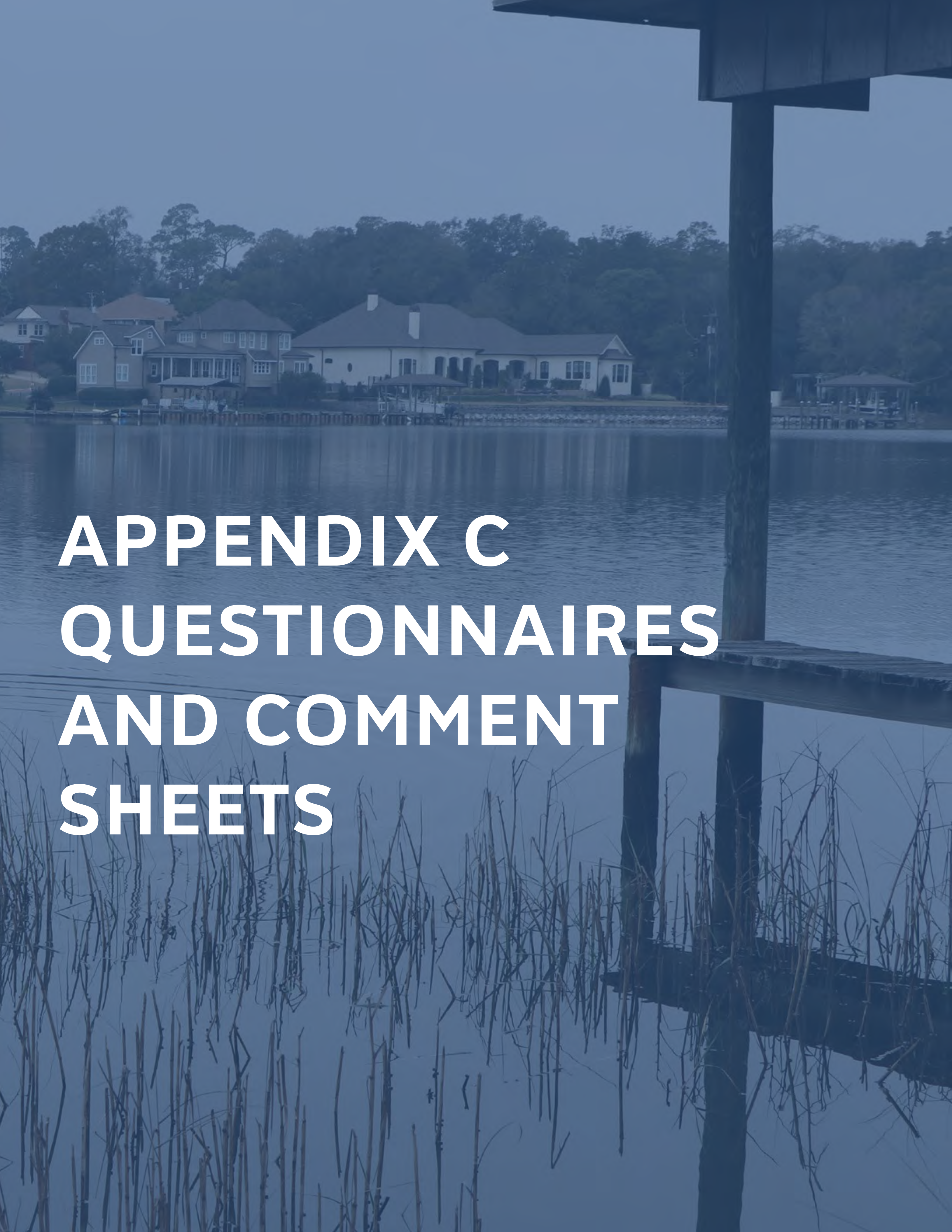
SHARE YOUR KNOWLEDGE! - ADD TO THE MAPS


CARPENTER CREEK
BAYOU TEXAR
N


CARPENTER CREEK
BAYOU TEXAR
N

SHARE YOUR KNOWLEDGE! - WRITE A POSTCARD

SHARE YOUR KNOWLEDGE! - TELL US A STORY



APPENDIX C QUESTIONNAIRES AND COMMENT SHEETS

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: ROBIN ROWAN **DATE:** 2.19.20

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

I took a canoe from the dead-end of Scott St (East Hill) up Bayou Texar and under the 12th Ave bridge to Brookside apts. In many places we had to portage around obstructions and once we dumped over when we hit a pile of logs. When I came up, I had black dripping sediment in my hair + a tar-like substance clinging to my clothes! Eeeew!

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

The sediment on the bottom of the Bayou is from Agrico Chemical and Escambia Treating Co. and is so toxic that I won't dip a toe in that water. I don't imagine there's any way to remove it now, meaning Bayou Texar is basically a dead bayou.

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

I see signs all over town saying that I am in the Carpenter Creek watershed. These need to be replaced with signs that say you are in the GULF OF MEXICO watershed - it all flows to the gulf. Saying it stops at Bayou Texar does the whole project a disservice!

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

I give tours of Scenic Highway for UWF Leisure Learning. People are amazed at the miles of preserved bayfront north of East Pensacola Heights and all the way to Chimney Park! If you walk down to the bay at Bay Bluffs Park, you have no idea that you're within the city limits - there are ravines and bluffs and water and miles of empty waterfront!

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

9th Ave flooded severely right where Carpenter Creek crosses.

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

Please see canoeing experience on the other side! I spent 4 years trying to get the students out of Brown-Barge Middle School which is across the street from Escambia Treating + Agrico Chemical sites. The contaminated groundwater has been dumping into the bayou for 100 years.

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

Who doesn't love opportunities to commune with nature, to hear bird song, to see turtles sunning on logs, to be surrounded by nature's majesty? It's magical and we all need to do more of it!

WANT TO STAY CONNECTED?

SHARE YOUR EMAIL TO RECEIVE UPDATES: rrowan55@gmail.com

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: ____________________ **DATE:** ____________________

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

Walked in those woods before the mall & other buildings.

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

Roamed the woods by the creek. Picked blackberries one now buys in the store. Mr. Conti's peacock always got out. On the east side a guy's ducks attracted a gator. Could hear whip-or wills @ night. Brothers investigated the drainpipes that come from the mall right into the creek.

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

The woods!
Why/who cut the trees on the west side of 9th ave? They butchered the trees..

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

Only once during 62 years of living across from the Creek. It flooded the houses on the north side

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

The drains from businesses along side the Creek have direct drainage to the Creek. Whatever they pour done goes right into the Creek

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

It's been by my home since I was a kid and my brothers and I enjoyed walking in those woods many times

WANT TO STAY CONNECTED?
SHARE YOUR EMAIL TO RECEIVE UPDATES: peggymd@aol.com

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: JN Davis **DATE:** 2/19/2020

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

This is the nearest bayou to me
But I've lived on the others,
Absolute necessity to preserve Thank you

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

Graffiti Bridge 17th & Oyster Barn
Next Bayview
We need more put-ins for kayaks, North end!

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

My street is "La Rua" (of De La Rua) who married
Mariana Bonifay's daughter, purchased property @ Gull Point
and they utilized the Bayou for transportation

That Pensacola was once considered an island is so unique
So much is underground - NOT TOTALLY NECESSARY, IS IT!
Washerwoman's Creek (SPG ST) + Bayou Texar!

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

Any & all access or nearness.
for visuals, finding bird types tell you seasons, fortunes of healthy environ.
Bruce beach is becoming Then perdido...
Tree lines (old ANY growth) Pine forest...
I do see & look for the creek, I FEEL IT & AM CONCERNED, driving about or bicycling about

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE? = EVACUATION OF RESIDENTS/PATIENTS IN FACILITIES.

Haven't been "home" long enough
[Actually West of watershed @ other bayous]

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

Often we can tell by lack of wildlife, fish, crab, fowl...
Bayou empties out and I've smelled & seen its condition at times

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

@ [We are it & it is us]
+ We are made in equal porportion as our earth, even same minerals.
☆ I cannot live without water. It speaks in many languages & purposes to us.
× We cannot dump into These Lower "drains" without filters, hello!

WANT TO STAY CONNECTED?
SHARE YOUR EMAIL TO RECEIVE UPDATES: jndavissainta@gmail

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

MAY GOD BLESS YOUR WORK

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Russell Roemer **DATE:** 2/19/20

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

Kayaked & paddleboarded from 12th Ave to 17th St.
Spent many days fishing & walking my dog from Magnolia Ave

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

Bayou Park

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

Found consolation when Mom passed Away
Very Healing

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

Above 12th Ave & Just Below

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

Had moved away

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

Fish kills & dog "rolling" in rotting fish
Had to walk her home (Long ~~Rope~~ Rope!)

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

Had Lived off Mulatto Bayou when Ivan Hit.
Had friends that lives off Bayou Texar during Ivan. Same story.

WANT TO STAY CONNECTED?
SHARE YOUR EMAIL TO RECEIVE UPDATES: sophiapoerner@AOL.com

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Terry Newton **DATE:** 2-19-20

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

used to use ramp access for PWC use

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

- drive to Bayview Park from upper 12th Ave neighborhood
- frequently bike in and

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES... no - just moved her 2½ y ago

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

- enjoy kayaking thru grassy areas and small islands near entrance to bay

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

n/a

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

high bacteria levels - usually only mid/late summer with heat and lack of rain. Government agencies seem very good about warnings to public

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

visual and physical interaction with water whether at Bayou, Bayfront or Beach is important to our entire family from ages 10 to 69

WANT TO STAY CONNECTED?
SHARE YOUR EMAIL TO RECEIVE UPDATES: jerrynewton@cox.net

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: LISA EVERS **DATE:** 2/19/20

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

YES- BUT CANNOT USE IT OFTEN DUE TO DEPTH ISSUES BECAUSE IT NEEDS TO BE DREDGED! IT IS VERY SMELLY SO CAN'T EVEN GET NEAR IT AT TIMES. THIS IS UNACCEPTABLE AS IT USED TO BE 4' DEEPER.

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

LIVE ALONG IT

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

PELICANS FEEDING... WHICH I WORRY ABOUT DUE TO UNHEALTHY FISH FOR BIRDS

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

AT MY HOME DUE TO CITY INSPECTION NOT PROPERLY INSPECTING A NEW BUILD AND ALLOWING IT TO BE BUILT AND CAUSE HUGE DRAINAGE ISSUES

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

YES I CAN SMELL IT AS I LIVE ON IT. ALSO I RECEIVE WEEKLY WATER QUALITY REPORTS AND THEY SHOW VERY HIGH FECAL AND OTHER BACTERIA ISSUES/RATINGS.

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

NEED TO CONCENTRATE ON DREDGING & CLEANING IO WATER BEFORE YOU START TO PLAN FOR ACCESS FOR PEOPLE! WHY WASTE $ & TIME ON ACCESSIBILITY UNTIL THE WATE IS CLEAN.

WANT TO STAY CONNECTED?

SHARE YOUR EMAIL TO RECEIVE UPDATES: [redacted]

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Suzanne Weathers **DATE:** 2/19/2020

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

learned to swim in Bayou - went to outdoor movies there - played on swings - went canoeing -

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

Hundreds of times to bayview in the 1940's and 1950's
now I drive moastly to the dog park
I can go swimming just east of Davis Hy. Bridge
my Daughter owns land there.

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

used to ride horses down there to go swimming

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

Anyplace with water and trees

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

yes - washed about 50 ft of my daughters land along the creek

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

few times after severe storms

I also do sampling of water for Lake Watch

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

I have worked around water all my life now I teach swimming

WANT TO STAY CONNECTED?

SHARE YOUR EMAIL TO RECEIVE UPDATES: Weatherss@cox.net

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Gena Buchanan **DATE:** 2/19/2020

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

In my growing-up years Bayview Park played an important part of my life. Canoeing, walking, & tennis mostly. We watched water skiers and there were high-powered boat races. Family gatherings at the covered tables. Watching the sun set from inside the exercise classroom in the Community Center.

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

When I grew up on Texar Dr we were not allowed to walk to the water because it was all sawgrass and we were afraid of snakes. In high school my friends & I spent hundreds of hours at Bayview - we walked or drove.

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

My father worked for the construction co. that built OJ Semmes. He bought the lot at Texar & Cortez & built our house ≈ 1957 when both streets were dirt roads. Texar sloped steeply in front of our house and when it rained a raging muddy river made Class 5 rapids. The septic tank was higher than the drainfield so sewage bubbled up in the yard. Over the course of the years houses were built on the bayou.

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

I've lived close to (but not on) Bayou Chico (age 5-9) Bayou Texar, Lee St. in East Hill, Weekley Bayou and even Pensacola Beach (age 5) All this nearness instills a love of nature. I could/do spent hours at the Marina Oyster Barn. The character of the bayou and quality of light constantly change

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

My friends who took swimming lessons at Bayview got ear infections! In the 1960's.

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

Recognizing the plant life. That's what draws my eye. After Hurrican Ivan hundreds of brown pelicans found shelter in the area NW of the Cervantes St. bridge. Seeing them on my way to work is a memory that will stay with me.

WANT TO STAY CONNECTED?

SHARE YOUR EMAIL TO RECEIVE UPDATES: gingerlily2718@gmail.com

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Lonnie N Webster **DATE:** 2-19-20

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

Yes, I live along Carpenters Creek. I spend a great deal of time in the woods.

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

Our property line is Carpenter's Creek

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

Just growing up in those areas behind our house.

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

I have daughters now. I spend time with them, observing nature. (mostly wildlife raccoons, turtles, Opossum and snakes

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

yes, when a large rain is happening. flooding has not had any negative effects on everyday life

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

yes, definitely the smell. A raw sewage line runs accross our yard. these lines are very old, and I'm sure they have leaks

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

time I've spend in it. Proximity to it. We have direct access to Carpenter's Creek flood plain on the west as it runs south of 9th Ave

WANT TO STAY CONNECTED?

SHARE YOUR EMAIL TO RECEIVE UPDATES: jbo89@yahoo.com

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

251-402-6198

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Marilyn Wolfe **DATE:** 2/19/20

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, ~~FISHING, PLAYING~~ ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

when clean 40 yrs ago

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

I back on creek

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

When I grew up we all played and swam in it from 9th to Bayou Blvd

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?
WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

Bird watching

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?
WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

YES

3 floods - 1 from Creek 2 from City runoff and poor drainage. 2 large pipes drain to one directly in creek
Flood insurance runs 1800 a year after 3 losses

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?
WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

lots of trash from homeless

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?
ALL THOUGHTS AND ANSWERS WELCOME!

WANT TO STAY CONNECTED?
SHARE YOUR EMAIL TO RECEIVE UPDATES: MARILYN.WOLFE1949@gmail

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

email: ajerick@bellsouth.net

NAME: Jay Erickson **DATE:** 2/19/20

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

All of above

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

Waterfront property

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

Live on Bayou 10 yrs Have noticed improvement in water clarity, diversity of fish species. Dolphin frequently sighted over past 2-3yr
Now Widgeon grass along shore in spring/summer over last 2 yrs.

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

WANT TO STAY CONNECTED?
SHARE YOUR EMAIL TO RECEIVE UPDATES: ____________________

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Anne French **DATE:** 2/19/20

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

Boating, fishing, playing at the edge of the creek in our backyard

skiing — a LONG time ago.

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

Our backyard.

- Boat slip by Johnson's Marina

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

WANT TO STAY CONNECTED?
SHARE YOUR EMAIL TO RECEIVE UPDATES: ______________________

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Craig Iversen **DATE:** 2/17/20

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

Bayview Park - picnics, kids' parties
Oyster Barn restaurant

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

Drive to Bayview. As far as I can tell, the rest is private and I am trespassing if I cross it.

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

Bay Bluffs Park is the only place in Pensacola,
I go to Fort Pickens or Blackwater State
Forest to feel connected

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

2014 floods. Didnt impact me directly.
Saw awesome damage on Piedmont Drive.

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

Creek below Burgess and around Davis Hwy!
Trash and sediment-filled.

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

WANT TO STAY CONNECTED?

SHARE YOUR EMAIL TO RECEIVE UPDATES: calforester86@outlook.com

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Lana Weathers **DATE:** Feb. 19, 2020

HAVE YOU EVER USED THE CREEK OR BAYOU FOR RECREATIONAL PURPOSES?
KAYAKING, CANOEING, SWIMMING, FISHING, PLAYING ALONG THE WATER'S EDGE, WALKING YOUR DOG, SITTING ON A BENCH AND WATCHING THE SUNSET – THESE ALL COUNT!

Canoeing, tubing, swimming, fishing, swimming with dogs, playing along the water's edge, sitting on bench watching birds

HOW AND WHERE DO YOU ACCESS THE WATER?
DO YOU TYPICALLY DRIVE YOUR CAR TO BAYVIEW PARK? HAVE YOU EVER BIKED/WALKED TO THE WATER OR ALONG IT?

I walk to Carpenter's creek (it is in my backyard) and drive to Bayview Park. I also enjoy taking my dog to the water dog park

DO YOU HAVE ANY SPECIAL OR IMPORTANT MEMORIES RELATED TO CARPENTER CREEK AND BAYOU TEXAR?
RECENT OR DISTANT PAST, HAPPY TIMES, SCARY MOMENTS, MEANINGFUL EVENTS, FAMILY STORIES...

I have lived on the creek for 25+ years and have enjoyed it

I learned to swim at Bay View Park in the summer program

WHAT ARE PLACES IN THE GREATER WATERSHED (NOT JUST ALONG THE WATER!) THAT MAKE YOU FEEL CONNECTED TO NATURE?

WHAT ABOUT THESE PLACES GIVES YOU THIS FEELING? DO YOU ENJOY ENVIRONMENT-RELATED ACTIVITIES LIKE BIRD WATCHING, BEACH CLEANUPS, HIKING? WHERE DO YOU GO TO DO THOSE?

All above activities - usually along the creek, sometimes to Bayview Park

HAVE YOU SEEN OR EXPERIENCED SEVERE FLOODING IN THE WATERSHED?

WHERE AND WHEN DID YOU EXPERIENCE FLOODING? HOW DID THE FLOODING IMPACT YOUR LIVING OR WORKING ENVIRONMENT, YOUR COMMUTE OR OTHER TRAVEL, YOUR RECREATION AND LEISURE?

The April 2014 flood caused about 20' of the hill behind my house to fall into the creek-

HAVE YOU SEEN OR EXPERIENCED POOR WATER QUALITY IN THE CREEK OR BAYOU?

WHAT DO YOU THINK CAUSES THIS CONDITION? HOW OFTEN HAVE YOU NOTICED THIS?

WHAT DO YOU THINK CONNECTS YOU TO THE WATER, AND MAKES YOU PART OF THE GREATER WATERSHED?

ALL THOUGHTS AND ANSWERS WELCOME!

WANT TO STAY CONNECTED?

SHARE YOUR EMAIL TO RECEIVE UPDATES: LGweathers@juno.com

Please mail this questionnaire to: SCAPE, 316 St Joseph St, New Orleans, LA 70130 or email to team@restorethewatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: LISA EVERS
EMAIL: LR.EVERS@YAHOO.COM
ORGANIZATION: RESIDENT
DATE: 2/19/20

COMMENTS / QUESTIONS

? WHEN WILL TEXAR BE DREDGED

Contact us at team@RestoreTheWatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: William J. Dunaway EMAIL: wdunaway@clarkpartington.com
ORGANIZATION: Clark Partington / SCI CivicCon DATE: 2/19/2020

COMMENTS / QUESTIONS

I believe it is very important that we do NO further harm to this watershed. No Master Plan CAN work if we continue to engineer the flow. It is also important to ensure we get the right people on the team (ie: UWF Cultural Research). My vision is that the Creek look more like Rock Creek Park vice the LA River. This will require A Champion (City of Pensacola)? (County)? Will the City step up?
Who will OWN the Plan?
Who will enforce the Plan? Is it enforceable?

Contact us at team@RestoreTheWatershed.com

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: Jimmie Jarratt EMAIL: jnjarrat@myescambia.com

ORGANIZATION: Escambia County Arborist. DATE: 2-19-20

COMMENTS / QUESTIONS

- City & County targeting tree replanting areas for sustainable canopy increase. Both have tree mitigation funding.
- Review comprehesive Urban Tree Canopy Analysis on City website. 2 Phase.
  - Shows tree canopy trends over 20 years.
  - Also current canopy & public spaces. & planting area recommendations

Contact us at team@RestoreTheWatershed.com

2-19-'20

all one word

RESTORETHEWATERSHED.COM

Dcc: DIANE P.

BEAVERS, BEAVER DAMS AND DENS ARE THE PRIMARY BLOCKAGE OF WATER FLOW FROM UPSTREAM WHERE OLIVE RD CROSSES CARPENTER CREEK OVER A CULVERT.

IF YOU PARK NEAR THIS CROSSING AND LOOK UPSTREAM (NORTH-WEST) BEYOND THE CULVERT, YOU WILL SEE A BEAVER DAM, THEN A LARGE AMOUNT OF LEAVES UPSTREAM FROM THAT.

THE BEAVERS NEED TO BE REMOVED OR RELOCATED, THEN THEIR DAMS AND THE BACKUP OF LEAVES REMOVED TO RESTORE NORMAL WATER FLOW FROM THE SOURCE OF THE CREEK.

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

NAME: John Phillips **EMAIL:** jwp2@cox.net

ORGANIZATION: Parker Circle Neighborhood Assn. **DATE:** 02/18/20

COMMENTS / QUESTIONS

George Sanders who now lives on Parker Circle grew up on Royce Street and has many Carpenter Creek stories and experiences. If a staff person were to contact him, I am sure he would share those memories. Sherry Myers knows him.
His phone is 476-3348.

John W. Phillips

Parker Circle Neighborhood Association
Past President

590 Parker Circle
Pensacola, Florida 32504-7077
Email: jwp2@cox.net (850) 479-3886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APPENDIX D ADDITIONAL ENGAGEMENT MATERIALS

SCAPE LANDSCAPE ARCHITECTURE DPC
277 BROADWAY NINTH FLOOR NEW YORK NY 10007
T 212 462 2628 SCAPESTUDIO.COM

FACILITATORS' GUIDE

Date: February 19, 2020

Re: Carpenter Creek and Bayou Texar Watershed Management Plan

GOALS

The plan will identify existing challenges and provide a roadmap to:

- Manage **water quantity** and improve **water quality** for a safer and healthier environment
- Protect, enhance, and restore **fish and wildlife habitat** for a stronger ecosystem
- Expand **public access and recreation opportunities** for learning and fun!
- Build more equitable and **resilient communities** in the face of a changing climate
- Connect residents to their **watershed and waterways** for stewardship and conservation

DISCUSSION PROMPTS

ECOLOGY AND HYDROLOGY

- Flooding: locate (on the map) and describe areas prone to flooding, what happens during flood conditions, frequency and severity of flooding
- Erosion and bank stability: where have you observed issues of severe erosion, bank stability issues and/or risk of collapse, projects that address stability issues (what are the strategies being used, are they successful, benefits and issues)
- Water quality: locate (on the map, if possible) and describe water quality issues. Include both anecdotal observations and measured data, past and present. If you are familiar with ongoing efforts and would like to suggest we connect with folks involved, please let us know!
- Pollution/contamination sources: located (on the map) and describe any point or non-point source pollution you are aware of
- Ecology: tell us about local/native ecological features that are special to this region, where are they still present, where in the region are similar ecosystems we could look to for design inspiration. What are specific plant and animal species we should take note of. What are invasive or particularly damaging species in the area? Where are they concentrated? (mark on map)
- Sedimentation: are there particular areas that are prone to sedimentation, filling up/clogging the waterway? Specific areas that seem to be flowing undisturbed? Where is sediment coming from? Are there any ongoing or past dredging activities? What were the impacts of such efforts?
- Are there important locations within the watershed (from ecology/hydrology perspective) that we should take note of?

ACCESS AND RECREATION

- Where can you see the creek?
- How do people perceive the creek? Is it a place to go? In what condition is it?
- What are current public access points to the water? Who uses them? How often? What are they used for?
- Where were past public access points that are no longer accessible/used by public? Why?
- How do people use the river and bayou for recreation today? How were they used in the past?
- Who uses the creek and bayou today? Who doesn't? are there specific groups that are more likely or less likely to visit and use the water or adjacent open spaces?
- If you do visit the creek and/or bayou, how do you get there? What makes it easy/difficult to access?
- Are there other creeks or bayous in the area that you visit? how do you access them? What can we learn from them (the good, the bad, the ugly)?
- What social, cultural, and environmental groups and organizations are active in the watershed and should be engaged in this process? How do we reach them?

PLANS AND PROJECTS

- Are you aware of any plans or ongoing projects along the creek and bayou, and around the whole watershed?
- What are some of the recent or planned developments happening in the watershed? Who is leading them? Who owns the property?
- What are some of the recent or planned infrastructure projects happening in the watershed? Who is leading them? Who owns the property?
- What projects are related to stormwater management, water quality, public access, environmental restoration?
- What are relevant recent or ongoing studies or other efforts related to the plan's efforts?
- Are there properties that the city or county are planning to purchase or recently purchased within the watershed? Are there properties that the city or county recently sold within the watershed?

THE WATERSHED MANAGEMENT PLAN WILL BUILD ON MEANINGFUL STORIES AND PLACES ALONG THE WATER

Do you have any **special or important memories** related to Carpenter Creek and Bayou Texar?

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Want to learn more? Visit RestoreTheWatershed.com

Carpenter Creek and Bayou Texar
Watershed Management Plan Project

c/o SCAPE Landscape Architecture
316 St. Joseph Street
New Orleans, LA 70130

WETLAND SCIENCES INCORPORATED   IMPACT Campaigns   wood.   SCAPE

THE WATERSHED MANAGEMENT PLAN AIMS TO EXPAND THE POSSIBLE ACTIVITIES ALONG THE WATER

Have you ever used the creek or bayou for recreational purposes? Kayaking, canoing, swimming, fishing, etc.

. . . .

. . . .

. . . .

How could you imagine using it in the future?

. . . .

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Want to learn more? Visit RestoreTheWatershed.com

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Watershed Management Plan Project

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New Orleans, LA 70130

THE WATERSHED MANAGEMENT PLAN AIMS TO IMPROVE THE WATER QUALITY OF THE CREEK AND BAYOU

Have you seen or experienced poor water quality? Where?

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Want to learn more? Visit RestoreTheWatershed.com

Carpenter Creek and Bayou Texar
Watershed Management Plan Project

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New Orleans, LA 70130

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THE WATERSHED MANAGEMENT PLAN AIMS TO INCREASE THE ACCESS TO THE WATER'S EDGE

How and where do you currently access the water?

. . . .

. . . .

. . . .

Are there obstacles that we should know about?

. . . .

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Want to learn more? Visit RestoreTheWatershed.com

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Watershed Management Plan Project

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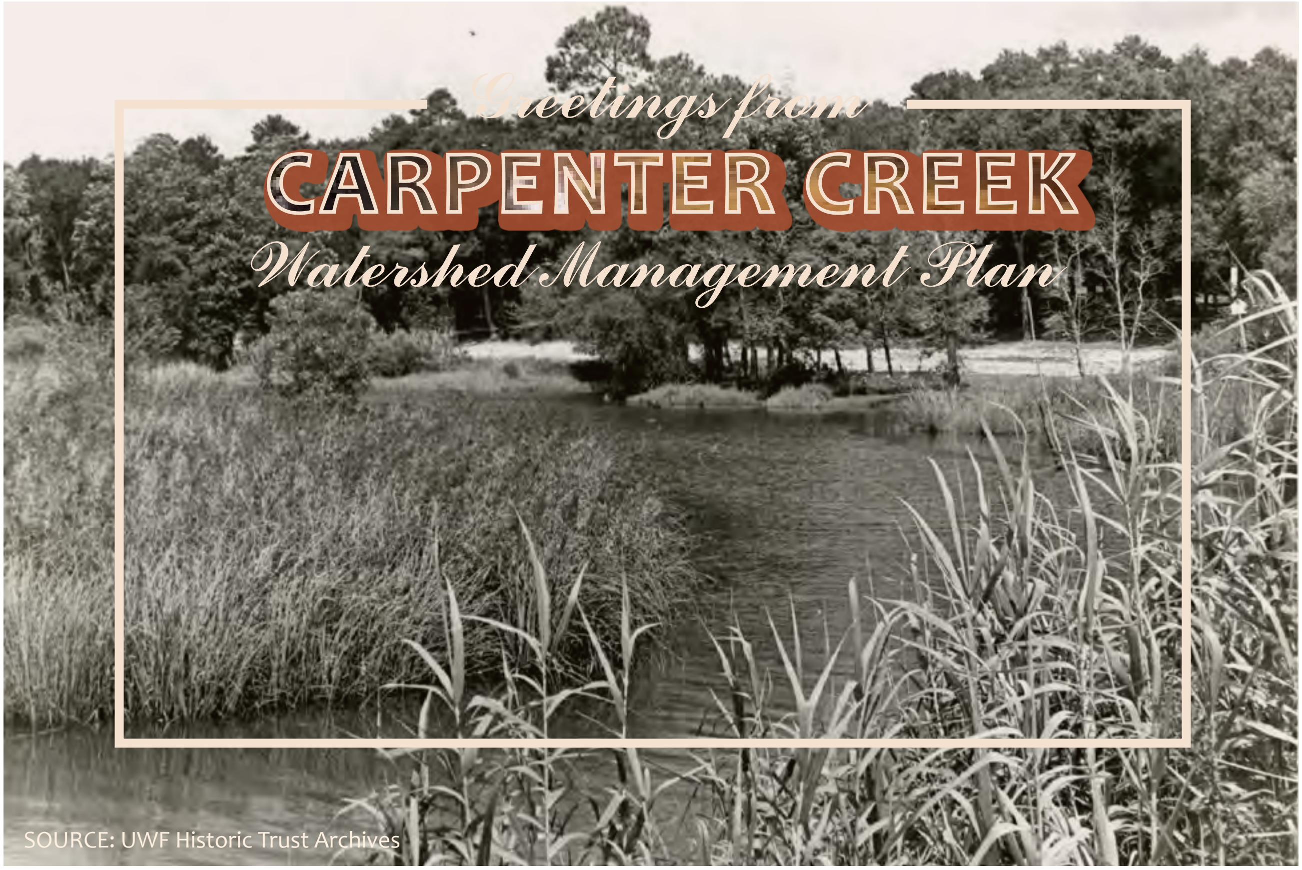
316 St. Joseph Street
New Orleans, LA 70130



THE WATERSHED MANAGEMENT PLAN AIMS TO INSPIRE A STRONG CONNECTION TO NATURE

What are places at or surrounding Carpenter Creek and Bayou Texar that make you feel a strong connection to nature?

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Want to learn more? Visit RestoreTheWatershed.com

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Watershed Management Plan Project

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CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

SIGN IN SHEET

EVENT: Public Meeting 2/19/20 **DATE: FEBRUARY 19, 2020**

NAME	ORGANIZATION	CONTACT INFO
Peggy Moshell	—	peggymo@aol.com
MICHAEL WOLF	MCWOLFCONSULTANTS	MCWOLFCONSULTANTS.COM
MARILYN WOLFE		850 723 4021 (text)
Jay Erickson		850 549-5821
Julia Pearsall		850-450 8488
Joe A. Edmisten	———	850-433-1098
Paula Montgomery	~~PAPOT~~	montpas@aol.com
Gena Buchanan	Scenic Highway Foundation	gingerlily2718@gmail.com
Jeannette Norman	Broadview Farms	
Randee Hartley	The Grant 32504	birdwoman46@gmail.com
Lana Weathers		Lgweathers@juno.com
John Melcher, Jr		PanhandlePanhandler@gmail.com
Betty Wilson	Dem Envt Caucus & Soil & Water Cons. Dist	bawava@gmail.com
William Sloan	Resident	Sloan696@bellsouth.net
Tammy Kouns		lakemarie alley@cox.net
MIKE ELISA EVERS	RESIDENT	LR.EVERS@YAHOO.com
Sharon Posner	Business owners	posnerMarine@netscape.net
Jeff Posner	— —	— — —
John Phillips	Parker Circle N.A.	jwp2@cox.net
Barbara Fritz Buss	SOS	bfbuss2@gmail.com
MARTY DONOVAN		MARTY@DONOVANREALTY.COM
Suzanne Weathers	garden club	weathers99@cox.net
Jerrade Braughton		
Christine Cameron	—	ccameron491@gmail.
LEO CHERON	Resident	LEOCHERON@ATT.NET

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

SIGN IN SHEET

EVENT: Public Meeting 2/19/20 **DATE: FEBRUARY 19, 2020**

NAME	ORGANIZATION	CONTACT INFO
Gena Wirth	SCAPE	gena@scapestudio.com
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Sharon Linezo Hong		sharonlinezohong@gmail.com
David Reeves		brosnaham@aol.com
Rand Hicks	CNAPP	randhicks@me.com 850-293-1859
Brian Wyer	GCMCC	Bwyer@gcmcc.info
Ed Bauer	MSA	ebauer@ecsdfl.us
Patricia Edmisten	concerned citizen	pedmiste@uwf.edu
David McAferty	Property Owner	luckydcaf@cox.net
Amy Mixon	AECOM	amy.mixon@aecom.com
Chris Stinson	Owner	Chris@metal-craft.net
David Mitchell	CPotB	Dmitchell4@me.com
Kate Buffington	CPotB	Katecoleb@yahoo.com
Elizabeth Benchley	UWF	ebenchle@uwf.edu
Chris Phillips		chris@hotspotscharters.com
Ted King	Personal	[illegible]
Robin Rowan	Scenic Highway Foundation	rrowan55@gmail.com
Mike Horgan		HORGANMTH@COX.NET
Eric Schneider	ESA	eschneider@esassoc.com
Howard Ed Turner	[illegible]	huturn@Juno.com
Dale Perkins	ECUA / citizen	DalePerk@aol.com
Darryl Boudreau	TNC	dboudreau@tnc.org
Ryan Cummins	WALM	

CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

SIGN IN SHEET

EVENT: ______________________ **DATE: FEBRUARY 19, 2020**

NAME	ORGANIZATION	CONTACT INFO
Mollie Taylor	Geosyntec	mtaylor@geosyntec.com
BLASE BUTTS	Oceanhour, Pens F.AB	blasebutts@live.cn
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Lockett DeGraaf	Trinitas Christian School	lockett.degraaf@yahoo.com
David Brewer		Dreedavidb@msn.com
Bree Conover		
TIM HAAG	ECUA	tim.haag@ecua.fl.gov
Mary C Williams		
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CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

SIGN IN SHEET

EVENT: ______________________ **DATE: FEBRUARY 19, 2020**

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CARPENTER CREEK & BAYOU TEXAR
WATERSHED MANAGEMENT PLAN

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VOLUME 2 APPENDIX C

H&H MODELING METHODOLOGY SUMMARY

Escambia County

Modeling Methodology Summary

Wood Project #600643
Date: August 2020

MODELING METHODOLOGY SUMMARY

Prepared for

Escambia County
Florida

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Wood Project No. 600643

July 2020

Revised August 2020

Revised November 2020

Document Revision History

Date	Version	Description	Changes Made
July 29, 2020	Version 1.0	Initial Draft Model Methodology Approach	N/A
August 28, 2020	Version 2.0	Final Model Methodology Approach	In response to County and City comments and related meetings, clarifying language was added to Section 1 and County deviations were identified in the attachment.
November 20, 2020	Version 3.0	Revised Final Model Methodology Approach	Added additional language for; modeling percolation links (Section 6.2.2.2.7), incorporation of neighboring subbasin model features (Sections 5.2.2, 6.1.1.2, and 6.2.1.2), and utilizing "Walk the WBID" issue locations to assist with model verification efforts (Section 8.2.2)

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1.0 BACKGROUND

The Wood Team will develop a comprehensive hydrologic/hydraulic stormwater model, using the Interconnected Channel and Pond Routing Model Version 4 (ICPR4) software, for the Carpenter Creek and Bayou Texar watersheds in Escambia County, Florida. The Wood Team will develop the ICPR4 model for the unincorporated portion of the watersheds, building onto an existing ICPR4 model developed for the City of Pensacola (City). The final deliverable will consist of one ICPR4 model for the entire watershed domain.

In July of 2019, Mott MacDonald completed a Stormwater Master Plan (SWMP) for the City. As part of the City's SWMP, Mott MacDonald developed a hydrologic/hydraulic stormwater model using the ICPR Version 4.04.00 software. The ICPR4 model was developed for the entire City extents, which covers approximately 22.7 square miles, and includes limited areas beyond the City limits that were determined to contribute hydrologically/hydraulically to the City's modeled area. Per the Mott Macdonald report, the City model does not include inputs from the upstream portions of Carpenter Creek and associated drainage areas.

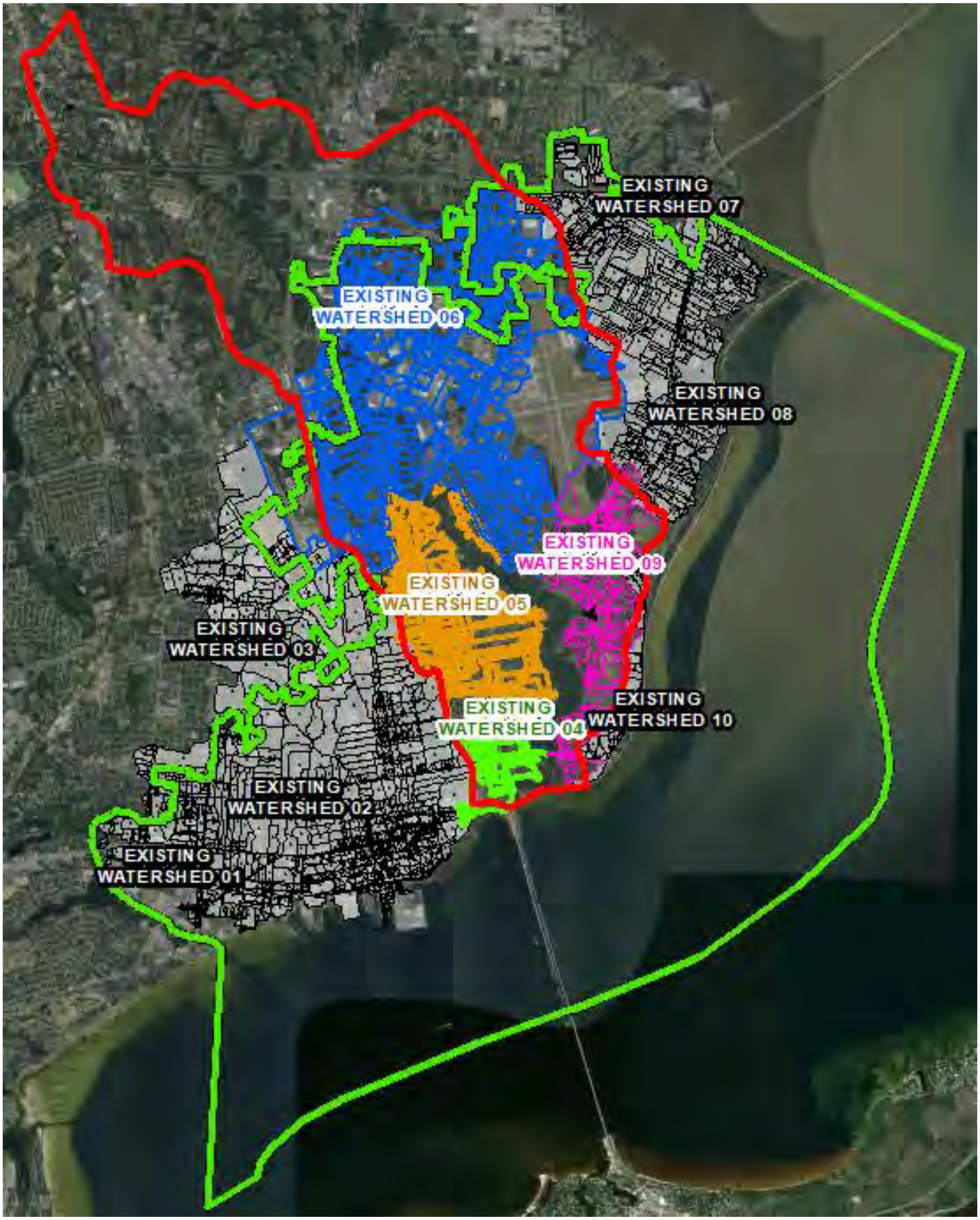
The City's model includes 10 scenarios or basin groups, to represent the existing watershed conditions at the time of the City's study, labeled as "Existing Watershed 01 – 10" in the model. **Figure 1** below shows the City's 10 existing conditions scenarios in relation to the City limits and the County project's study area.

The City's model also included multiple proposed conditions scenarios, developed to demonstrate the results of the City study's proposed recommendations. However, due to the July 2019 date of completion for the City's study, it is assumed that the proposed conditions scenarios will not be relevant for consideration during this project. Therefore, only the Existing Watershed 01-10 scenarios were considered for the purpose of establishing a base model to build upon for this project.

Per discussions with the County and City staff, Wood will use the City model as provided by the City. The City was not able to provide the project team with model results from the calibrated model to verify that the project team was starting with the calibrated model and associated inputs. There is inherent risk in using the model as-is without the ability to verify the starting model and results, however, the team determined the best course of action was to start with the model provided and develop the unincorporated area model onto the City's base model.

In general, the Wood Team will adhere to the Escambia County Basin Management Guidelines (BMG), dated September 2013, for the development of the model in the unincorporated area. The following paragraphs outline the proposed methodology for the completion of the model in the unincorporated area of the watersheds, as well as summarizations pertaining to the input and methodology of the City's modeled area. **Attachment 1 - Summary of Model Differences** provides a summary of the proposed model parameterization approach compared to the SWMP approach and specifies agreed upon deviations from the County BMG, in a table format.

Figure 1 - City's Existing Model Subbasins



2.0 <u>INHERENT AND APPLIED ASSUMPTIONS PERTAINING TO USE OF CITY'S MODEL</u>

This section outlines assumptions and criteria that have been gleaned or implied from the information received from the City's model and SWMP report.

2.1. Assumptions Outlined in City's SWMP Report

The City's SWMP report, dated July 2019, outlines key assumptions and criteria utilized during the completion of the City's study. As the Carpenter Creek and Bayou Texar WMP includes the adoption of a portion of the City's SWMP model, it is imperative to note the assumptions and criteria that may have relevance to the development and results of the Carpenter Creek/Bayou Texar WMP model.

- City's SWMP replaces the original Stormwater Master Plan completed by the City of Pensacola Engineering Division in December 1987.
- External stormwater flow contributions, such as those from the upper reaches of Carpenter Creek, were not included in the City's SWMP model as there was no existing compatible stormwater modeling for this system to accurately simulate the timing and flow contributions from areas outside of the City limits. Future coordination with the County was encouraged for the incorporation of any stormwater modeling to be done under the Carpenter Creek and Bayou Texar WMP.
- The analysis level-of-detail for the City's SWMP was set at the "primary drainage system", consisting of open ditches, streams, ponds, and lakes draining an area of 50 acres or more, in addition to closed conveyances with an equivalent diameter of 12 inches or more.
- The ICPR Version 4.04.00 modeling software was utilized under the City's SWMP.
- The basis for the City's SWMP model is the ICPR Version 3 models from HDR's Pensacola Bay Basin Study, which included five major drainage areas within the Pensacola Bay Basin; A Street, Coyle Street, Eastern (the largest model including downtown Pensacola up to approximately Fairfield Drive), Gregory Street, and Western (from B Street to G Street). The five models were independently imported into ICPR Version 4 and georeferenced using available GIS data provided for the models. The models were then merged into a single ICPR Version 4 model file and combined with the final City SWMP model. The majority of basin delineations and link connectivity originally developed by HDR was maintained in the City's July 2019 SWMP; however, some basins were altered as necessary to coincide with adjacent basins when combining models or to more accurately assign contributing basins to the model stormwater piping networks. Furthermore, link connectivity was corrected as necessary, based on ground-truthing or information from plans.
- Stormwater infrastructure included in the City's SWMP model was derived from the Pensacola Atlas Map (circa 1954) and validated or supplemented through desktop review of plans and ground-truthing.
- Base maps for soil zones and land use cover are utilized by ICPR to perform hydrologic computations. ICPR utilizes user-generated lookup tables to assign a curve number (CN)

to each subbasin based on the land use and soil type combinations that occur with its boundary. For the City's SWMP, land use GIS data was obtained from the FDEP's Geospatial Open Data – Statewide Land Use Cover for the City of Pensacola. The dataset (NWFWMD 2015-2016) is a compilation of the land use/land cover datasets created by the water management districts in Florida. The land use data was processed in GIS and shapefiles were created for each land use area for import into ICPR. For the soils map layer, information from the NRCS Web Soil Survey was used. The soil zone information was processed in GIS and shapefiles were generated for each soil zone to import into ICPR.

- A DEM, based on the NWFWMD 2006 LiDAR data, was created and used for the City's SWMP.
- FDOT 2016 aerial imagery was utilized during the City's SWMP development.
- The City provided 50 plan sets for review and incorporation into the SWMP. Due to poor scanning quality and conflicting data, not all plan sets were utilized or incorporated into the SWMP model.
- Construction plans, permitted through the Environmental Resource Permitting (ERP) program, were obtained from the FDEP Map Direct website, from 1982-present (present at the time of the City's project) and utilized to develop the City's model.
- Other miscellaneous construction plans were utilized for model development, too, obtained from private engineering consultants.
- Inverts in the City's model were generally derived and entered from the obtained construction plans, or previous survey efforts. However, the City's model employs several assumptions and relied on computer software to aid in determining invert elevations that could not be determined from existing data sources. The 2006 DEM was used to determine rim elevations, then inverts were globally specified using an algorithm in ArcMap, which assumed three feet of cover from the crown of the pipe. Also, inverts were manually rectified in areas where the use of the algorithm resulted in adverse pipe slopes/run.
- The FDOT 100-year, 8-hour storm event, with a rainfall depth of 9.44 inches, was selected as the design storm event for the City's model.
- Tailwater elevations for drainage systems discharging into lakes, ponds, and creeks were determined based on water surface data, 2006 LiDAR elevations, or surveyed information. The tailwater elevation for drainage systems discharging into Escambia and Pensacola Bay was based on the mean highwater elevations. The tailwater elevation used in the City's model for Escambia Bay and Pensacola Bay is 1.10 feet.
- For City model calibration, once the hydraulic model was complete and simulations were executed, the predicted flooding areas were compared with known flooding areas. Areas in which flooding conditions were predicted were catalogued and a list of the most significant areas was provided to the City for verification as known points of flooding. City staff subsequently provided a list of areas for detailed study and conceptual design.
- The results of the City model were noted to identify existing hydraulic deficiencies and potential flooding areas within each watershed. Mott MacDonald met with City staff to

discuss the model results and potential flooding areas. Based on a review of the results from the existing model scenarios, a number of locations were identified, based upon roadway flooding significance, on which Mott MacDonald further focused their investigation during their subsequent analysis. Based on the results from the existing models, the following locations were identified to evaluate proposed drainage improvements: drainage system on West Strong Street, Barrancas Avenue, L Street south of Barrancas Avenue, Main Street, Langley Avenue/Spanish Trail, and Aragon Street and South 9th Avenue.

- Opinions of probable costs were developed for each of the proposed project areas identified in the City's SWMP. Each proposed project was also evaluated, and a numeric score assigned, for six separate criteria. The scores were then summed per project to determine their cumulative score. The drainage improvement rankings were based on the benefited drainage area, environmental sensitivity, potential contamination, community impacts, and construction sequence.

2.2. Applied Assumptions and Limitations Related to Use of City Model Files

The City's SWMP report provides limited detail regarding the methodology employed for the development of model parameters in the City's model. Therefore, assumptions have been made regarding the City's methodology, as summarized throughout this section. Unless otherwise noted, the Wood Team shall use the City's model as-is, without updates or alterations. It should be stated that Wood did not perform a detailed and thorough review of the City's model performance or results. Instead, the findings presented in this memorandum were based on a limited preliminary review of the City's model input, with a focus on ensuring the City's model provides a reasonably sound model to build upon for this project.

- There is no documentation that explicitly notes the vertical datum used in the City's ICPR4 model. The City's SWMP report notes that the information for the infrastructure in the model came from various previous studies and miscellaneous sources. The City's SWMP report does not explain if or how the vertical datums were determined, or whether a conversion factor was applied to convert elevation data from the National Geodetic Vertical Datum of 1929 (NGVD29) to the North American Vertical Datum of 1988 (NAVD88) if required. Due to the completion date of the City's SWMP, the Wood Team is assuming that the elevation data supplied within the City's model is entirely in the NAVD88 vertical datum.
- There is no documentation that explicitly notes the methodology or source utilized to develop the cross-sections for the City's modeled channel links. The Wood Team is proposing to utilize the City's cross-section data as-is, without manipulation or verification.
- On April 15, 2020, a phone meeting took place and included staff from the FDOT, the County, and the Wood Team. At the time of the meeting on April 15, and as of the date of this report, only three ongoing/planned FDOT projects were noted to be located within the watersheds and deemed relevant to the WMP. Of the three projects, the 9th Avenue bridge project was noted as being fully designed, with construction estimated to begin

around December of 2020. This project is located within the City's modeled area, and the final approved design differs from what is presented in the City's SWMP model. Therefore, the Wood Team proposes to update the City's model to reflect the final design plans for the 9th Avenue Bridge.

- There appear to be only ten (10) irregular weirs modeled in the City's ICPR Existing Watersheds 04, 05, 06, and 09. Overland weirs are typically modeled as irregular weirs in ICPR4. In the absence of modeled overland weirs, the model has no mechanism to allow for the flow of water between basins other than through the structural links modeled (pipes, for example). In some cases, this will cause the basin to "stage up" higher than it does in the real-world because it has not been provided a model mechanism for an overland path to take over to the adjacent basin. The Wood Team is scoped to utilize the City's model as-is. However, it is recommended that further analysis be performed on the City's model results to determine if additional weirs within the City's modeled area are necessary to achieve more accurate results.
- The City's model did not include spatial features for subbasins (they did have the spatial nodes and links, but no basins). However, the City had previously provided an AutoCAD dxf file that displayed only subbasins. The Wood Team performed a comparison between the City's model features and the dxf file and came to a reasonable conclusion that the subbasins previously provided in the dxf file seem to correspond to the subbasins modeled for the Existing Watersheds 01-10 scenarios in the City's model. Therefore, the Wood Team converted the subbasin polygons (only provided in dxf format) into GIS shapefiles. However, the subbasins provided in the dxf had no assigned subbasin names. As a work-around to this issue, the Wood Team utilized GIS tools to assign names of the GIS subbasin polygons based on the corresponding names of the storage nodes that fall within them.
- There were no model output files or floodplains provided with the information received from the City. Therefore, there is no record of the actual output produced by the City's model at its time of completion/submittal. However, the Wood Team is making the reasonable assumption that the City's model files can be re-run and will produce results that coincide with the results observed in the final SWMP submittal.
- Upon initial investigation, topology errors have been observed within the City model's GIS feature classes (Example: "floating" nodes that aren't attached to the endpoint of a link). These topology errors will need to be evaluated and corrected, where needed.

3.0 DIGITAL ELEVATION MODEL (DEM) UTILIZED

3.1. City's Modeled Area

A DEM, based on the NWFWMD 2006 LiDAR data, was developed and used for the City's SWMP. The City's SWMP report does not note any corrections made to the 2006 DEM based on observed topographic errors or voids in the dataset. Topographic voids are areas where the available topographic information in the DEM does not represent the actual current ground terrain due to new development, topographic error, or other land use changes that have occurred. It is assumed that the NWFWMD 2006 DEM was provided in the NAVD88 vertical datum.

3.2. Unincorporated Area

For the unincorporated portion of the model, the Wood Team will utilize the 2017 LiDAR DEM, retrieved from the NWFWMD, provided in the NAVD88 vertical datum. For the unincorporated area of the watersheds, the ESRI 2020 aerial imagery, along with other data sources, were used for comparison to the 2017 DEM to review for topovoids and areas of new development that may have occurred between the 2017 LiDAR fly-date and 2020. Within the unincorporated area, observed areas of new development will be applied to the 2017 DEM, to represent current ground conditions, as needed. As the City's model is to be utilized as-is, the Wood Team will not evaluate for differences between the 2006 DEM (utilized in the City's model area) and the 2017 DEM within the City's modeled area.

4.0 VERTICAL ELEVATION DATUM

4.1. City's Modeled Area

There is no documentation that explicitly notes the vertical datum used in the City's ICPR4 model, nor a specific datum conversion that may have been used to convert between the NGVD29 and NAVD88 datums. The City's SWMP report notes that the information for the infrastructure in the model came from various previous studies and miscellaneous sources. Due to the completion date of the City's SWMP, the Wood Team is assuming that the elevation data supplied within the City's model is currently presented all in the NAVD88 vertical datum.

4.2. Unincorporated Area

The elevation data for the Carpenter Creek/Bayou Texar WMP and model will be presented in the NAVD88 vertical datum, which corresponds to the 2017 DEM. It may be necessary, for certain data sources, to convert provided elevation data from the NGVD29 vertical datum to the NAVD88 vertical datum. Using the U.S. Army Corps of Engineers' CORPSCON tool, it was determined that, within the unincorporated area of the watershed boundary, the conversion factors range from -0.09 ft to -0.16 ft, with a mean conversion factor of -0.14 ft (rounded from -0.136667 ft). The Wood Team proposes to adopt the mean conversion factor of -0.14 ft for use throughout the unincorporated area of the watershed boundary to convert from the NGVD29 datum to the NAVD88 datum, as necessary (NGVD29 elevation + (-0.14 ft) = NAVD88 elevation).

5.0 WATERSHED BOUNDARY AND INITIAL SUBBASIN DELINEATIONS

5.1. Watershed Boundary Definition

As part of the project, the Wood Team is tasked with refining the "watershed boundary" as needed, based on the hydrologic and hydraulic characteristics of the area. The watershed boundary shall coincide with the edges of the subbasins that are to be modeled as part of the Carpenter Creek and Bayou Texar WMP and will be inclusive of areas that are hydrologically and/or hydraulically connected to Carpenter Creek and Bayou Texar. As the hydrologic & hydraulic model becomes further developed during future project phases, the exact limits of the watershed boundary are subject to change, although it's anticipated that any changes would be slight.

5.2. Subbasin Delineations

It should be noted that this section describes the initial subbasin delineations only, based on findings from desktop reconnaissance. Further refinement of subbasins may be necessary upon completion of field reconnaissance and survey efforts.

5.2.1. City's Modeled Area

As part of the watershed boundary refinement, the Wood Team reviewed the edges of the City's existing model basins for accuracy, from a hydrologic and hydraulic standpoint. Utilizing the 2017 LiDAR-derived Digital Elevation Model (DEM), in conjunction with the nodes and links included in the City's model, the Wood Team determined that the subbasins included in the City model's Existing Watersheds 04, 05, 06, and 09 scenarios are appropriate for inclusion within the Carpenter Creek and Bayou Texar watershed boundary. Also, as shown in **Figure 1**, the City's Existing Watersheds 03, 07, 08, and 10 include subbasins that are adjacent to the study area and were therefore also reviewed to determine eligibility for inclusion in the Carpenter Creek/Bayou Texar watershed boundary. Upon examination, the Wood Team determined that two subbasins (Basin B-3062 Basin 2811B600B), modeled in the City's Existing Watershed 03, were appropriate for at least partial inclusion into the Carpenter Creek/Bayou Texar watershed boundary, due to their hydrologic and hydraulic connectivity behavior.

In summary, a total of 1,765 subbasins from the City's existing model scenarios are proposed for inclusion in the Carpenter Creek/Bayou Texar model. These 1,765 subbasins range in size from less than an acre to approximately 655 acres, with an average acreage of 4.3.

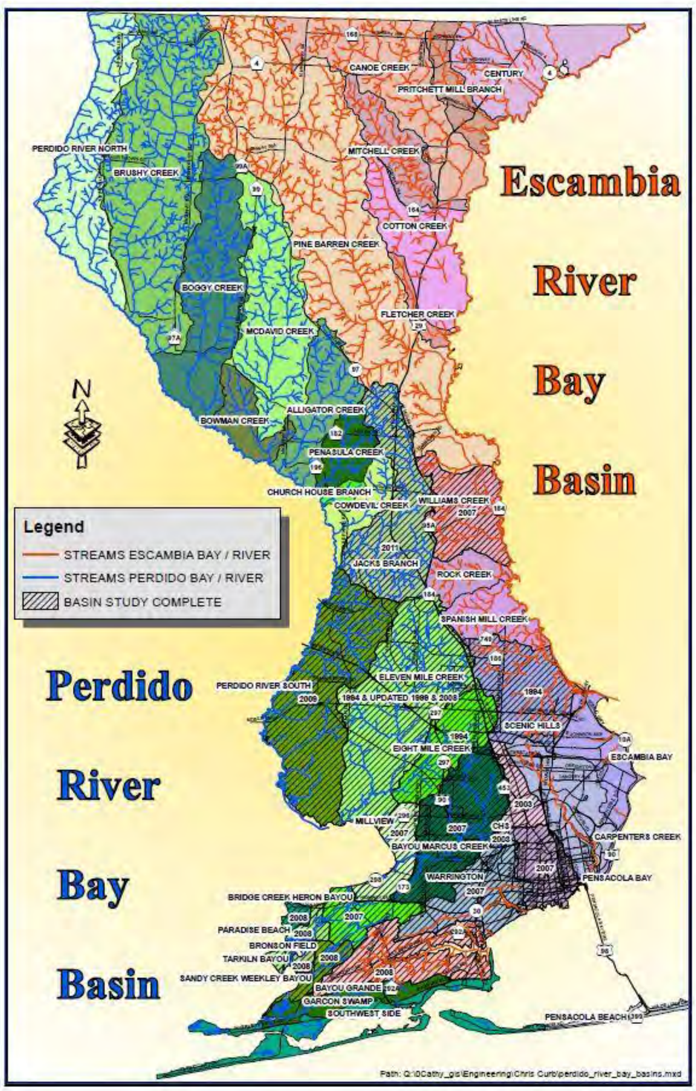
5.2.2. Unincorporated Areas

Within the unincorporated areas, subbasins will be delineated using a combination of GIS-based ArcHydro tools, followed by manual manipulation. The ArcHydro tools generate rough subbasin delineations based on the underlying DEM (2017 DEM, for this project) and a user-specified minimum drainage area. Although these tools are effective in generating very rough subbasins, manual manipulation is needed to further define and edit the subbasins, especially in urban environments where infrastructure is prevalent. Manual manipulation of subbasins will be conducted based on information from the 2017 DEM, recent aerial imagery, and drainage infrastructure patterns presented in information sources that included Environmental Resource Permits (ERPs), County residential and roadway plan sets, and FDOT plan sets, and from field reconnaissance and survey efforts. Generally, the subbasin level-of-detail shall mimic the level-of-detail established in the City's model, which is a more regional scale.

As shown in **Figure 2** below, the County has completed basin master plans for many of the County's major basins. In particular, the Scenic Hills, Beverly Parkway, Pensacola Bay, and Escambia Bay basins are adjacent to the Carpenter Creek/Bayou Texar study area. The Scenic Hills, Beverly Parkway, and Pensacola Bay basins are denoted as being completed in 1994, 2003, and 2007 respectively.

Wood has received subbasin delineations in GIS format for the Beverly Parkway and Pensacola Bay basins, and in pdf format for the Beverly Parkway basin. As part of the initial subbasin delineations for the Carpenter Creek/Bayou Texar WMP, Wood will review the adjoining subbasin delineations for the completed basins. Wood will make suggestions for edits to the adjoining basins, if necessary, during the course of completing the initial subbasins for the Carpenter Creek/Bayou Texar watershed.

Figure 2 - County Basin Study Map



5.3. Subbasin Parameterization

5.3.1. Unit Hydrograph

A unit hydrograph, by definition, is the hydrograph resulting from one inch of direct runoff (rainfall excess) generated uniformly over a subbasin area at a constant rate during a specified time interval. Generally, lower peak rate factors and corresponding unit hydrographs are used for flatter terrains and higher peak rate factors are used for steeper terrains.

5.3.1.1. *City's Modeled Area*

For runoff hydrograph generation for subbasins within the Existing 04, 05, 06, and 09 scenarios, the City's model uses the National Resources Conservation Service (NRCS) (formerly the Soil Conservation Service (SCS)) Unit Hydrograph method, with a peak rate factor of 323.

5.3.1.2. *Unincorporated Area*

Per the County's BMG, the unit hydrograph/peak rate factor shall be based on average overland slopes of the subbasins as follows: less than 0.5 percent – 256, 0.5 to 1.5 percent – 323, greater than 1.5 percent – 484. Due to the proximity of the City's modeled area to the unincorporated area, and to ensure consistency between the City's model input and the input for the unincorporated area, Wood is proposing to also utilize a peak rate factor of 323 for model development in the unincorporated area.

5.3.2. Infiltration Method

ICPR uses base maps for soil zones and land use cover to perform hydrologic computations. User-generated lookup tables are used to assign a curve number (CN) to each subbasin based on the land use and soil type combinations that occur with its boundary.

5.3.2.1. *City's Modeled Area*

For the City's SWMP, land use GIS data was obtained from the FDEP's Geospatial Open Data – Statewide Land Use Cover for the City of Pensacola. The dataset (NWFWMD 2015-2016) is a compilation of the land use/land cover datasets created by the water management districts in Florida. The land use data was processed in GIS and shapefiles were created for each land use area for import into the City's ICPR model. For the soils map layer, information from the NRCS Web Soil Survey was used. The soil zone information was processed in GIS and shapefiles were generated for each soil zone to import into the City's ICPR model. These GIS shapefiles were not provided with the model data received from the City; however, the values from the utilized land use and soils layers, along with the CN values calculated by ICPR4, were populated per subbasin in the City's ICPR4 model.

The Wood Team will utilize the existing CN values provided within the City's model as-is for those subbasins within the City's modeled area. The City's model did not appear to account for Directly

Connected Impervious Area (DCIA) in its infiltration calculations. DCIA includes impervious surfaces that are directly connected to the subbasin design point without flowing over pervious surfaces.

5.3.2.2. *Unincorporated Area*

For the unincorporated area, CN values will be calculated per subbasin. As part of the Carpenter Creek/Bayou Texar WMP, revised existing land use shapefiles were developed in GIS to reflect current 2019 conditions, utilizing the 2016 land use shapefiles from the Northwest Florida Water Management District (NWFWMD) as the basis. These revised existing land use files, in conjunction with the NRCS 2018 soils layer, will be utilized to develop CN values in ICPR4 for the subbasins in the unincorporated area of the watershed boundary.

Per the County's BMG, DCIA may also be delineated separately if sufficient data is available (e.g., Escambia County GIS layers) or values may be assumed for a particular land use. DCIA data was requested from the County on July 8, 2020, and it was confirmed that the County does not have such a dataset for use. Therefore, the Wood Team is proposing to calculate CN values for each subbasin but will not calculate DCIA. This is also consistent with the methodology utilized for the City's model.

Utilizing the lookup tables for the revised existing land use and soils layers, ICPR4 will inherently calculate CN values presented in **Figure 3** below:

Figure 3 - Runoff Curve Numbers for Urban Areas

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.
2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

5.3.3. Time of Concentration

Time of Concentration (Tc) represents the amount of time it takes for a particle of water to travel from the hydraulically most distant point in a subbasin to the subbasin outlet. The travel path of the particle is defined as the "longest flow path" of the subbasin.

5.3.3.1. *City's Modeled Area*

There were no spatial features provided to illustrate the longest flow path lines that may have been utilized for Tc calculations in the City's model. Therefore, it is not possible to review the reasonableness of the methodology of the longest flow path development or the resulting Tc calculations in the City's model.

The Tc values in the City's model range from a minimum of 10 minutes to a maximum of 100 minutes for the subbasins within the Existing Watersheds 04, 05,06, and 09 scenarios. Although the methodology and assumptions utilized for Tc calculations were not explicitly outlined in the City's SWMP report, it is presumed that the NWFWMD 2006 DEM, along with information from previous studies, plans, and possibly field verification may have been utilized for this purpose.

5.3.3.2. *Unincorporated Area*

For Tc development in the unincorporated area of the watershed boundary, the Wood Team will use the guidelines from the United States Department of Agriculture's (USDA) Urban Hydrology for Small Watersheds, Technical Release TR-55, which provides a popular method for determining the longest flow path and the Tc.

Using this method, flow in the longest flow path will be divided into sheet flow (overland flow) and shallow concentrated flow. Sheet flow generally occurs in the headwater area of a basin. Calculations will assume the initial 100 feet as sheet flow and then the remaining flow will be given to shallow concentrated flow. Tc for each subbasin is computed by summing all the travel times along the longest flow path in the subbasin. The GIS-based ArcHydro toolset will be used to automate the generation of the longest flow paths, utilizing the 2017 project-area DEM. Manual visual checks will be performed to provide a "sanity check" on the generated longest flow path lines.

Once the longest flow path lines have been developed, Tc will be calculated from an automated process (ArcGIS python code), which automates a succession of steps as follows:

- Calculate the length and slope for each flow type along the longest flow path. The slope for each flow type is calculated by dividing the elevation difference between the two ends of the flow path section by flow length. The code automatically extracts these elevations from the DEM.

- Determine the hydraulic parameters (such as Manning's n, velocity) for each flow type. Manning's n will be determined for each landuse type using the manning's roughness coefficient for sheet flow table from TR-55, as shown in **Figure 4** below:

Figure 4 - Manning's Roughness Coefficients for Sheet Flow

Table 15–1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

Surface description	***n*** [1]
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤ 20%	0.06
Residue cover > 20%	0.17
Grass:	
Short-grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3]	
Light underbrush	0.40
Dense underbrush	0.80

1 The Manning's *n* values are a composite of information compiled by Engman (1986).
2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
3 When selecting *n*, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

- Using the County's latest GIS parcels layer in combination with the updated existing land use layer, denote the shallow concentrated flow paths as either paved or unpaved. For subbasins that have a shallow concentrated flow path that travels over both paved and unpaved areas, the assignment of paved or unpaved will be based on which line segment is longest.
- Calculate the travel time for each flow type:
  i. Sheet Flow Calculation

The commonly used formula for sheet flow calculation is provided by the TR-55, as follows:

$$T_{ts} = \frac{0.007(nLs)^{0.8}}{P^{0.5} S_s^{\ 0.4}} \tag{1}$$

where:

T_{ts} = travel time of sheet flow (*hr*)
n = Manning's roughness coefficient (see **Figure 4**)
L_s = length of sheet flow (*ft*)
P = 2-year, 24-hour rainfall amount in inches
S_s = slope of overland (*ft/ft*).

P is determined according to FDOT's Drainage Manual.

ii. Shallow Concentrated Flow Calculation

After 100 *ft*, sheet flow becomes shallow concentrated flow. Travel time for shallow concentrated flow is proportional to flow length and inverse to average flow velocity, expressed as:

$$T_{tc} = \frac{L_c}{3600V_c} \tag{2}$$

where:

T_{tc} = travel time of shallow concentrated flow (*hr*)
L_c = length of shallow concentrated flow (*ft*)
V_c = average velocity of shallow concentrated flow (*ft/s*).

The average velocity (V_c) is a function of watercourse slope and type of channel (paved or unpaved). According to TR-55, velocity is determined by the following equations:

$$V_c = 16.1345(S_c)^{0.5}, \quad \textit{for unpaved} \tag{3}$$
$$V_c = 20.3282(S_c)^{0.5}, \quad \textit{for paved} \tag{4}$$

where:

S_c = slope of shallow concentrated flow (*ft/ft*).

i. Pipe and Open Channel Flow Calculation

As presented in the County's BMG, when necessary, pipe flow shall be assumed to be 3 feet/second, unless other information is available to support a different velocity or travel time. For open channel flow, the Tc flow paths will be truncated to the point that correlates to the initial stage within the channel, as the channel flow time is inherently accounted for in the channel feature itself. For each subbasin, Tc is the sum of the travel time of the three flow types.

6.0 NODE AND LINK DEVELOPMENT AND PARAMETERIZATION

6.1. Node Features

6.1.1. Node Feature Development

Little information related to the methodology of node feature or parameter development was provided in the City's SWMP report or provided model files. Therefore, this section will serve to summarize the City's nodes and parameters, rather than describe the employed methodology.

6.1.1.1. *City's Modeled Area*

The Wood Team proposes to incorporate all the nodes from the City's Existing Watersheds 04, 05, 06, and 09 model scenarios into the Carpenter Creek/Bayou Texar model. **Table 1** below summarizes the numbers of model nodes proposed to be imported from the City's model.

Table 1 - City Nodes to be Incorporated from City's Model

Existing Watershed ID	Node Count
04	182
05	487
06	1,685
09	315
TOTALS	**2,669**

There is a total of 2,669 nodes within the City's Existing Watersheds 04, 05, 06, and 09 scenarios, proposed to be incorporated into the Carpenter Creek/Bayou Texar WMP model. Of these nodes, 2,593 are assigned as stage/area type, 74 as time/stage type, and 2 as stage/volume type. Stage/area nodes consist of user-defined areas assigned to specific vertical elevations, representing the available storage for each modeled node. Stage/volume nodes are similar, but they consist of user-defined volumes assigned to specific vertical elevations, representing the available volume storage for each modeled node. Time/stage nodes are referred to as boundary nodes and consist of time elements assigned to specific vertical elevations.

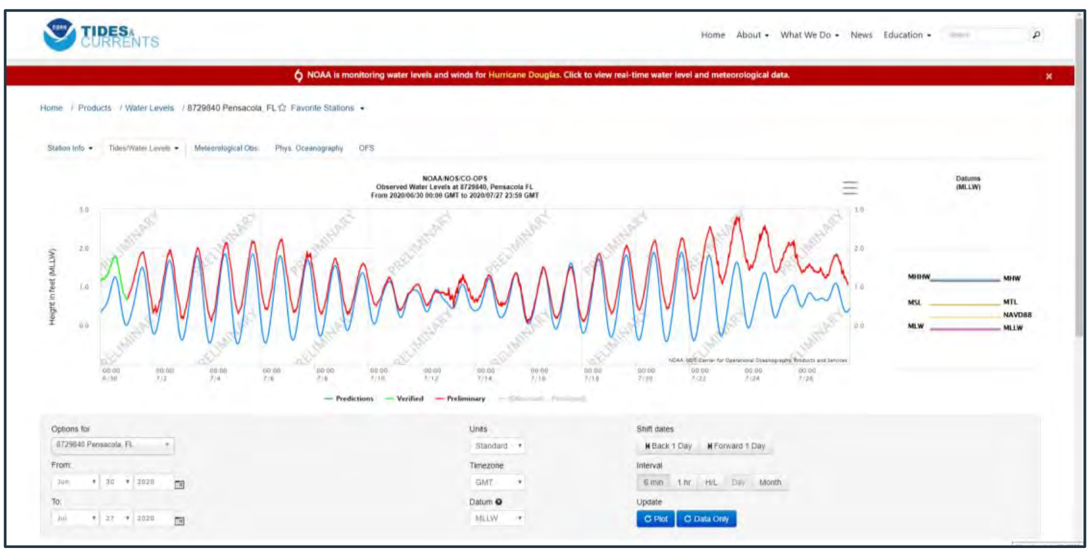
For boundary nodes, these elevations are typically set at a constant value that represents the tailwater elevations. As noted within the City's SWMP report, the tailwater elevation used in the City's model for Escambia Bay and Pensacola Bay is 1.10 feet. There is no mention in the City's SWMP report of model simulations conducted to evaluate for sea-level rise (SLR) scenarios, so it is presumed that the City's SWMP did not include this analysis.

6.1.1.2. <u>Unincorporated Areas</u>

For the unincorporated area of the watershed, a stage/area loading node will be assigned to each subbasin developed. Additional stage/area nodes (with nominal storage) may be placed as necessary to account for significant junctions, bends, or diameter changes that occur along a series of pipes. Furthermore, nodes shall be located so that channel lengths are generally kept to a maximum length of 1,000 feet and channel segments are approximately uniform in length to the greatest extent possible.

Boundary conditions will be modeled as time/stage nodes. In some cases, where practical, the unincorporated portion of the model will be connected to existing boundary nodes from the City's model or nodes modeled in an adjacent County basin master plan (Pensacola Bay, Beverly Parkway, and Scenic Hills basins). However, additional boundary nodes will be placed as needed to appropriately model the unincorporated area. Pensacola Bay tidal boundary conditions will be based on the mean highwater elevations. Based on observed National Oceanic and Atmospheric Administration (NOAA) Gulf of Mexico tide gauge 8729840, the tailwater elevation of 1.10 ft that was used in the City's model for Escambia Bay and Pensacola Bay is found to be acceptable, as shown below in **Figure 5**. Wood also proposed to utilize the 1.10 ft for the Escambia Bay and Pensacola Bay tidal boundary stages in the unincorporated area of the model.

Figure 5 - Water Levels at NOAA Gauge 8729840 near Pensacola, FL



6.1.2. Node Parameterization

6.1.2.1. *Stage/Area Relationships*

6.1.2.1.1. **City's Modeled Area**

The City's model contains 2,593 stage area type nodes and 2 stage/volume type nodes within the Existing Watersheds 04, 05, 06, and 09 scenarios. It is presumed that the City's model made use of the NWFWMD 2006 DEM, along with information from previous studies, plans, and possibly field verification to develop the stage/area relationships, although this was not explicitly outlined in the City's SWMP report. Also, the City's SWMP report did not note whether channel storage was deducted from the calculated stage/area relationships for the storage nodes.

6.1.2.1.2. **Unincorporated Area**

For each of the basins developed within the unincorporated area of the watershed boundary, one stage/area node will be assigned. The stage/area nodes will contain vertical elevations and their respective storage areas, in increments up to the basin's rim elevation. Generally, ArcHydro tools will be utilized to develop the stage/area relationships per node, using the underlying 2017 project-area DEM. However, other data sets may be utilized, when available, for a more accurate representation of stage/area information, such as as-built drawings that provide details for onsite ponds. In certain cases, field recon and/or survey information may be used to provide more reliable data, on an as-needed basis.

For modeled channel links, GIS polygons will be drawn to represent the area associated to them, based on their dimensions/cross-sections. The area associated to these channel polygons will be removed from the total basin area used to calculate the available stage/area for each storage node. This is necessary to prevent "double-counting" of available basin storage.

Although only one stage/area node will be included per basin to represent the basin's storage, additional stage/area type nodes may be included for modeling purposes, although they will include nominal storage and are modeled to represent such things as changes in pipe sizes, connectivity junctions, etc.

6.1.2.2. *Initial Water Surface Elevations*

Initial water surface elevations (IWSE)s for nodes are the water surface elevations (or ground elevation if the node is dry) expected at the onset of a simulation. Initial flows through model links are calculated based on the initial stages, so care must be given in setting the most appropriate values.

6.1.2.2.1. **City's Modeled Area**

The precise methodology utilized for the development of IWSE in the City's model was not presented in the City's SWMP report. However, the City's report did note that tailwater elevations for drainage systems discharging into lakes, ponds, and creeks were determined based on water surface data, 2006 LiDAR elevations, or surveyed information.

6.1.2.2.2. Unincorporated Area

For the unincorporated areas of the model, and per the County's BMG, IWSEs shall be set to seasonal highwater levels (SHWL) based on the best available information (i.e., wetland SHWL evaluations, control structure operating schedules, etc.). In cases where documentation of the SHWL or other starting elevations is not available, the overflow elevation for the node shall be assumed for the initial water level in the node. This elevation shall be compared to the limits of wetlands as defined by soils survey information of the National Wetlands Inventory. Downstream conditions (e.g., structure inverts or other water level controls) shall also be considered when establishing initial water surface elevations.

Wood will also be developing model simulations for the low, medium, and high Sea-Level-Rise (SLR) scenarios for the short-term horizon (Year 2045), based on the June 2016 Coastal Vulnerability Assessment for Escambia County, Florida. The low, medium, and high scenarios will be run for the 100-year, 24-hour storm event with respective SLR projections of 0.4 feet, 0.6 feet, and 1.4 feet.

Initial conditions in the unincorporated area shall be evaluated by inspecting model time series results for unexpected flows in the model at the onset of a simulation (i.e., time = 0 hours). Such flow rates typically result from incorrect and unbalanced initial water surface elevations. If baseflow is intended at the simulation onset, then initial node stages in the unincorporated areas shall be defined in such a way as to produce those baseflows without system drawdown and baseflow rates shall be entered into the appropriate node location(s) to maintain that baseflow rate.

Finally, a "no rain" bleeddown simulation will be performed that is sufficiently long enough to allow drawdown to define overflow elevations. For the unincorporated area, the final drawdown elevation will then become the final IWSE that will be used for modeling for the storage nodes. Also, with respect to time-stage nodes (boundary conditions), elevations that correlate with the time zero will be used as initial stages.

6.2. Link Features

6.2.1. Hydraulic Connectivity and Link Development

6.2.1.1. *City's Modeled Area*

All links, a total of 2,413, within the City model's Existing Watersheds 04, 05, 06, and 09 are proposed to be imported and utilized in the Carpenter Creek/Bayou Texar WMP model. **Table 2** below summarizes the numbers of model links proposed to be imported from the City's model.

Table 2 - City Links to be Incorporated from City's Model

Existing Watershed ID	Model Link Count per Type				
	Pipe	**Weir**	**Drop Structure**	**Channel**	**Rating Curve**
04	152	6	3	6	
05	456	8	8	7	1
06	1524	69	70	55	2
09	281	6	1	6	1
TOTALS	**2413**	**89**	**82**	**74**	**4**

6.2.1.2. *Unincorporated Area*

The Wood Team shall develop an inventory of existing drainage structures and conveyance features from the data and primary drainage system information compiled from County GIS databases, County plans, ERPs, FDOT plans, and findings from field reconnaissance and survey efforts. As applicable, boundary links will be added to account for flows into and out of the Carpenter Creek and Bayou Texar watersheds to/from the adjacent completed basin studies (Beverly Parkway, Pensacola Bay, and Scenic Hills basins). The inventory shall include all pipes or drainage ways with conveyance equal to or greater than a 24-inch pipe as well as locations of identified drainage problems (regardless of conveyance area). Drainage features located downstream of the areas mentioned above which have smaller conveyance areas will be included as well.

Within the unincorporated area, overland weir features will be generated for subbasins that demonstrate the need for such features based on the results of the 100-year, 24-hour storm event. These overland weir features are necessary in order to prevent "glass walls", or false flood staging, from occurring by providing a mechanism to allow overland flow between subbasins. The overland weir features will be generated with the help of ArcHydro tools and other automated GIS processes. The automated GIS processes will utilize the underlying 2017 DEM to determine the lowest elevation along each subbasin boundary, which will correspond to the point at which the overland weir model features are generated. The elevation at this crossing will become the invert elevation for the overland weir feature. Additional information on the development of the cross-sections for the overland weir features is described in **Section 6.2.2.2.6**.

6.2.2. Link Parameterization

6.2.2.1. *City's Modeled Area*

Little information related to the methodology of link parameter development was provided in the City's SWMP report or provided model files. Therefore, this section will serve to summarize the City's link parameters, rather than describe the employed methodology.

As noted in the City's SWMP report, invert elevations in the City's model were generally derived and entered from the obtained construction plans, or previous survey efforts. However, the City's model employs several assumptions and relied on computer software to aid in determining invert elevations that could not be determined from existing data sources. The NWFWMD 2006 DEM was used to determine rim elevations, then inverts were globally specified using an algorithm in GIS, which assumed three feet of cover from the crown of the pipe. Also, inverts were manually rectified in areas where use of the algorithm resulted in adverse pipe slopes/run.

The City model's pipe depths range from a minimum of 0.011 ft to a maximum of 15 ft. The upstream inverts of these pipe links range from a minimum elevation of -0.69 ft to a maximum elevation of 115.9 ft, and the downstream inverts of these pipes range from a minimum elevation of -5.09 ft to a maximum elevation of 115 ft. These elevations are presumed to correlate to the NAVD88 vertical datum. The entrance and exit losses for the City's modeled pipes are within a range varying from 0 to 1. The Manning's n values assigned to pipes in the Cities are 0.011, 0.012, 0.013, and 0.024.

There is a total of 74 channel links proposed to be imported from the City model's Existing Watersheds 04, 05, 06, and 09. The channel links' lengths range from a minimum of 14.71 ft to a maximum of 1,953.42 ft. The channels' upstream inverts range from a minimum elevation of 1 ft to a maximum elevation of 109.5, and the downstream inverts range from a minimum elevation of 0 ft to a maximum elevation of 105 ft. These elevations are presumed to correlate to the NAVD88 vertical datum. Of the proposed imported City model channels, 55 were modeled with irregular type geometries, with inputted cross sections. There is no documentation provided in the City's SWMP report or model file to denote the methodology employed, or sources utilized, to determine the inputted cross sections. Four of the 74 channels were modeled with parabolic geometries, while 15 were modeled as trapezoidal type.

There are 89 weir links proposed to be imported from the City model's Existing Watersheds 04, 05, 06, and 09. Fourteen of the weirs are assigned as trapezoidal type, while 64 are assigned as rectangular type, and one weir is assigned as an arch structural plate type. Ten of these weirs are designated as having "irregular" geometry, which means they are assigned to an inputted cross-section in the model. Typically, overland weirs, or weirs that are to represent overland flow connections, are modeled as "irregular" weirs, with inputted cross-sections that are derived from the DEM or some other surveyed data source. In a watershed-scale model, overland weirs are important as they provide the modeled basins a mechanism by which to discharge, in addition to any structural mechanisms, when peak stages surpass the rim elevation of a basin. The absence of the overland weir features can theoretically cause the model to create false peak stages per basin. In the case of the City's model, there seem to be very few overland, irregular-type, weir features modeled. The effect of so few overland weir features may become evident during subsequent phases of the project once model results are produced. The invert elevations of the 89 modeled weir links range from a minimum of 2.19 ft to a maximum of 119.5 ft.

The City's model has an orifice discharge coefficient of 0.6 assigned to each weir, and a weir discharge coefficient value of 2.8 for each weir, except for two (City model weirs LSW-10420W and L-12760W have weir coefficient values of 3).

There are two rating curve links modeled in the Existing Watershed 06 scenario, one modeled in the Existing Watershed 05 scenario, and one modeled in the Existing Watershed 09 scenario, as detailed below:

- Rating Curve Link L-10130RC (Existing Watershed 05) – comment within the City's model states "Force Main 6", per City of Pensacola 12th Avenue and Cross Street Pond Reconstruction Plans. Pump Rate estimated based upon plan specified capacity of 1,270 GPM."
- Rating Curve Link L-7650RC (Existing Watershed 06) – comment within the City's model states "Force Main 18 inch"
- Rating Curve Link L-0950RC (Existing Watershed 06) – no comment provided in City's model file
- Rating Curve Link L-S0010RC (Existing Watershed 09) – comment within the City's model states "Force Main 12", Estimated Elevations on/off"

There are no percolation links provided in the City's model.

6.2.2.2. *Unincorporated Area*

6.2.2.2.1. Geometry, Length, and Invert Elevations

For the unincorporated area of the watershed, information related to the geometry, material, invert elevations, and lengths of pipes, drop structures, channels and weirs will be recorded from various information sources including County GIS databases, County plans, ERPs, FDOT plans, and findings from field reconnaissance and survey efforts. Information gleaned from field reconnaissance, survey, or as-built plans will be taken as best-available data and will supersede overlapping or contradictory data provided in design drawings, aerial imagery estimations, or the County's GIS databases.

Similar to the methodology utilized in the City's SWMP model, and in an effort to minimize project survey costs, the Wood Team is proposing to utilize field-recorded drop-down measurements, in conjunction with ground elevations from the 2017 DEM, to calculate estimated invert elevations when feasible and practical. Drop-down measurements are distances measured in the field from the ground to a point-of-interest such as the invert of a pipe. Then, utilizing the 2017 DEM to extract the ground elevation at the location, the pipe invert can be reasonably calculated by subtracting the combination of the drop-down measurement, a known pipe diameter, and an assumed amount of cover (assumed to be 3 feet to provide consistency with City's assumptions) from the crown of the pipe.

Then invert elevations for the model will be input in the NAVD88 vertical datum, which also corresponds to the 2017 DEM being utilized for the project. When necessary to convert between NGVD29 and NAVD88 datums, a conversion factor of -0.14 ft will be applied for elevation data within the unincorporated area.

6.2.2.2.2. Entrance, Exit, and Bend Losses

ICPR4 utilizes user-assigned entrance, exit, and bend losses to modeled pipes and channels for model computations. For each modeled pipe link, an entrance loss coefficient is manually assigned based on its type of inlet design, as provided in **Figure 6** below:

Figure 6 - Entrance Loss Coefficients for Pipes

Type of Structure and Design of Entrance	Coefficient K_e
• Pipe, Concrete	
Projecting from fill, socket end (groove-end)	0.2
Projecting from fill, sq. cut end	0.5
Headwall or headwall and wingwalls	
Socket end of pipe (groove-end	0.2
Square-edge	0.5
Rounded (radius = D/12	0.2
Mitered to conform to fill slope	0.7
*End-Section conforming to fill slope	0.5
Beveled edges, 33.7^{0} or 45^{0} bevels	0.2
Side- or slope-tapered inlet	0.2
• Pipe. or Pipe-Arch. Corrugated Metal	
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
*End-Section conforming to fill slope	0.5
Beveled edges, 33.7^{0} or 45^{0} bevels	0.2
Side- or slope-tapered inlet	0.2
• Box, Reinforced Concrete	
Headwall parallel to embankment (no wingwalls)	
Square-edged on 3 edges	0.5
Rounded on 3 edges to radius of D/12 or B/12 or beveled edges on 3 sides	0.2
Wingwalls at 30^{0} to 75^{0} to barrel	
Square-edged at crown	0.4
Crown edge rounded to radius of D/12 or beveled top edge	0.2
Wingwall at 10^{0} to 25^{0} to barrel	
Square-edged at crown	0.5
Wingwalls parallel (extension of sides)	
Square-edged at crown	0.7
Side- or slope-tapered inlet	0.2

*Note: "End Sections conforming to fill slope," made of either metal or concrete, are the sections commonly available from manufacturers. From limited hydraulic tests they are equivalent in operation to a headwall in both inlet and outlet control. Some end sections, incorporating a closed taper in their design have a superior hydraulic performance. These latter sections can be designed using the information given for the beveled inlet.

Source: FHWA, "Hydraulic Design of Highway Culverts, Third Edition", April 2012 (Report No. FHWA-HIF-12-026, Hydraulic Design Series No. 5, Table C-2).

Exit losses for pipes are also manually inputted and range in values from 0 to 1. In general, the value assigned depends on the differences in velocities between the outlet of the pipe and immediately downstream of the outlet. Engineering judgment must be exercised when selecting the appropriate exit loss coefficient.

If the velocity in a pipe is expected to drop to zero, or nearly zero, immediately upon exit, the exit loss shall be set to a value of 1. An example of this scenario is a pipe discharging into a pond, lake, or reservoir, or perpendicular to a channel. Conversely, if the exit velocity from the pipe is expected to be unchanged as it leaves the pipe to the next downstream link, then the exit loss should be set to a value of zero. Otherwise, the exit loss coefficient can be set between 0 and 1 based on the differences in velocities between the pipe outlet and the entrance of the next downstream link.

Bend losses can also be assigned to pipe links, as needed, based on values shown in **Figure 7** below:

Figure 7 - Bend Loss Coefficients (FHWA Table 5.1)

Table 5.1. Loss Coefficients for Bends.

	Angle of Bend in Degrees)		
Radius of Bend / Pipe Diameter	90°	45°	22.5°
1	0.50	0.37	0.25
2	0.30	0.22	0.15
4	0.25	0.19	0.12
6	0.15	0.11	0.08
8	0.15	0.11	0.08

Source: FHWA, "Hydraulic Design of Highway Culverts, Third Edition", April 2012 (Report No. FHWA-HIF-12-026, Hydraulic Design Series No. 5, Table 5-1).

The entrance loss for a channel link is a function of the velocity head at its upstream end, which is typically negligible. In most cases, the entrance loss coefficient should be set to zero. However, if a channel link is leaving a large water body, like a lake, and the entrance configuration warrants additional minor losses, engineering judgment shall be used to determine an appropriate entrance loss coefficient.

The exit loss for a channel link is a function of the velocity heard at its downstream end. Although exit losses associated with channels are typically minor and the exit loss coefficient is set to zero, there are some situations where it may be appropriate to include an exit loss. Engineering judgement shall be exercised when selecting an exit loss coefficient. If the velocity of a channel is expected to drop to zero after leaving the outlet of the channel, like in the case of a channel discharging into a pond, lake, or reservoir then exit loss shall be set to a value of 1. Conversely, if the velocity of the channel is expected to be carried to the next downstream link, then the exit loss should be set to zero.

6.2.2.2.3. <u>Manning's n values</u>

The roughness coefficient (Manning's n) is related to structure size, shape, and materials. **Figure 8** below lists appropriate Manning's n values for pipe links, based on the type of culvert being modeled.

Figure 8 - Manning's n Values for Culverts

B.1. Manning's n Values for Culverts.[1]

Type of Culvert	Roughness or Corrugation	Manning's n	Reference
Concrete Pipe	Smooth	0.010-0.011	Straub et al. 1960 May et al. 1986 Tullis 1986 & 1991a
Concrete Boxes	Smooth	0.012-0.015	FHWA 1961
Spiral Rib Metal Pipe	Smooth	0.012-0.013	Tullis 1983 & 1991b
Corrugated Metal Pipe[2] (Helical Corrugations)	2-2/3 by 1/2 in 68 by 13 mm	0.011-0.023	FHWA 1980 Tullis 1991c
Corrugated Metal Pipe[2] (Helical Corrugations)	6 by 1 in 150 by 25 mm	0.022-0.025	FHWA 1980
Corrugated Metal Pipe[2], Pipe-Arch and Box (Annular Corrugations)	2-2/3 by 1/2 in 68 by 13 mm	0.022-0.027	FHWA 1980
Corrugated Metal Pipe[2], Pipe-Arch and Box (Annular Corrugations)	5 by 1 in 125 by 25 mm	0.025-0.026	FHWA 1980
Corrugated Metal Pipe[2], Pipe-Arch and Box (Annular Corrugations)	3 by 1 in 75 by 25 mm	0.027-0.028	FHWA 1980
Corrugated Metal Structural Plate[2] (Annular Corrugations)	6 by 2 in 150 by 50 mm	0.033-0.035	FHWA 1980
Corrugated Metal Structural Plate[2] (Annular Corrugations)	9 by 2-1/2 in 230 by 64 mm	0.033-0.037	FHWA 1980
Corrugated Polyethylene	Smooth	0.009-0.015	Barfuss & Tullis 1988 Tullis et al. 1990
Corrugated Polyethylene	Corrugated	0.018-0.025	Clyde 1980 USBR 1985
Polyvinyl chloride (PVC)	Smooth	0.009-0.011	Neale and Price 1964 Bishop and Jeppson 1975

[1]The Manning's n values indicated in this table were obtained in the laboratory and are supported by the provided reference. Actual field values for culverts may vary depending on the effect of abrasion, corrosion, deflection, and joint conditions.

[2]See Figure B.3, Manning's n varies with barrel size.

Source: FHWA, "Hydraulic Design of Highway Culverts, Third Edition", April 2012 (Report No. FHWA-HIF-12-026, Hydraulic Design Series No. 5, Table B-1).

For channel link features modeled as irregular type, ICPR4 allows for variable roughness coefficients to be used across the cross-section. A Manning's n value is specified for each station and elevation along the cross-section. The Manning's n value is based on the channel bottom material, as detailed in **Table 3** below.

Table 3 - Manning's Value Selection

Type of Channel and Description	n value	Notes
Lined or Built-Up Channels		
Concrete w/ Trowel Finish	0.013	Smooth Concrete.
Gravel Bottom with sides of Formed Concrete	0.020	Fabriform.
Gravel Bottom with sides of Rubble Riprap	0.033	Loose Rocks.
Excavated or Dredged		
Earth, straight and uniform:		
Clean	0.022	
Gravel	0.025	
With Short Grass, few weeds	0.027	Maintained roadside swales.
Earth, winding and sluggish:		
No vegetation	0.025	
Grass, some weeds	0.030	
Dense weeds or aquatic plants in deep channels	0.035	
Channels not maintained, weed and brush uncut:		
Clean bottom, brush on sides	0.050	
Dense weeds, high as flow depth	0.080	
Dense weeds, high as flow depth & brush in the channel	0.120	
Natural Streams - Minor Streams (top width at flood stage <100 ft.)		
Clean, straight, full stage, no rifts or deep pools	0.030	
Same as above, but more stones and weeds	0.035	
Clean, winding, some pools and shoals	0.040	
Same as above, but some stones and weeds	0.045	
Sluggish reaches, weedy, deep pools	0.070	
Very weedy reaches, deep pools	0.100	
Natural Streams - Flood Plains		
Pasture, no brush:		
Short grass	0.030	May also be used for overbank flow areas in developed areas.
High grass	0.035	
Cultivated areas:		
No crop	0.030	
Mature row crops	0.035	
Mature field crops	0.040	
Brush:		
Scattered brush, heavy weeds	0.050	
Light brush and trees	0.060	
Medium to dense brush	0.150	Only used in extremely overgrown sections.
Natural Streams -Major Streams (top width at flood stage> 100 ft.)		
Regular section with no boulders or brush	0.043	
Irregular and rough section	0.068	

6.2.2.2.4. Weir Discharge Coefficients

Weir coefficients can be obtained from standard hydraulic handbooks such as Brater and King "Handbook of Hydraulics". Per the County's BMG, the weir discharge coefficient for sharp crested weirs range from about 3.0 to 3.2, and for broad crested weirs range from about 2.4 to 2.8, but these coefficients may vary depending on specific conditions. Also, per the County's BMP, the orifice discharge coefficient will range between 0.6 and 0.7, but these coefficients may vary depending on specific conditions.

6.2.2.2.5. Contraction and Expansion Coefficients

Eddy losses account for contracting or expanding flow from one end of a link to the other. The eddy loss for a channel link is a function of the velocity heads at its upstream and downstream ends. **Table 4** below, provides general guidelines for setting appropriate contraction and expansion coefficients.

Table 4 - Subcritical Flow Contraction and Expansion Coefficients

Description	Contraction Coefficient	Expansion Coefficient
No Transition Loss Computed	0.0	0.0
Gradual Transitions	0.1	0.3
Typical Bridge Sections	0.3	0.5
Abrupt Transitions	0.6	0.8

6.2.2.2.6. Cross-Sections

For overland weir features, the corresponding cross-section elevation data will be generated by utilizing the underlying DEM and GIS automated toolsets. Cross-sections cut from the DEM shall include enough points to adequately characterize the overland flow and shall include the lowest overflow point elevation. This may include some "thinning" processes, where non-critical points are removed while the overall shape of the cross-section is preserved. This automated GIS process may also be applied to certain channel links, but only if the DEM is reflective of dry conditions in the channel. Channel cross section locations should typically be at the node.

For wet channels, or channels that normally have standing or flowing water, utilization of the DEM and the automated GIS toolsets will not be applicable, as the DEM will likely be reflective of water surface elevations instead of the channel bottom. For these cases, cross-section data will be developed based on information from as-built plans, where available, or will be collected from field reconnaissance and/or survey efforts. Channel cross section locations should typically be at the node.

6.2.2.2.7. Percolation

The Carpenter Creek/Bayou Texar watershed is comprised of several depressional areas with sandy soils likely to exhibit high rates and volumes of percolation. The majority of the watershed (approximately 86% of area) is characterized with Type A, well-drained soils. Furthermore, after a preliminary review of permit and plan data, several ponds were found to be constructed with sand chimneys meant to allow the underlying permeable soil layer to percolate to the aquifer and improve overall pond recovery performance. For these reasons, Wood will include percolation links in the unincorporated areas of the model to account for these sand chimneys. For these percolation links that represent these sand chimney features, it's anticipated that percolation parameters will be derived from plan sets when available.

Hydrologic characteristics within the unincorporated portion of the watershed were evaluated to identify locations suitable for modeling of percolation. For modeling purposes, percolation links are typically recommended in the presence of hydrologic soil group type A well-drained sandy soils, coupled with a relatively deep-water table (3 feet or deeper). Much of the watershed meets these standards. Therefore, percolation links will be specified for stormwater ponds of interest and other areas with high infiltration rates (as deemed necessary). Percolation links for stormwater ponds will be based on the as-built, or best available, plans for each pond. Likewise, stormwater ponds with sand chimneys will have percolation links based on the as-built design details of those sand chimneys. Where no plans are available, aerial imagery will be used to measure the approximate area of sand chimneys and ponds.

Site-specific percolation parameterization from studies or ERPs is preferential to the more generalized soil based/ potentiometric surface parameterization. In the absence of site-specific data from ERP documents, percolation parameters needed for the model, such as horizontal and vertical conductivity, fillable porosity, and water table conditions, may be estimated based on Escambia County soil, FDEP data, and NRCS' SSURGO database (accessed through the NRCS Web Soil Survey) as approximate values for use in parameterization of the percolation links. . For the percolation calculations in ICPR4, three perimeter lengths (P1, P2, and P3) must be specified for saturated horizontal flow. The P1 perimeter represents the edge of the unsaturated vertical flow zone and P2 and P3 perimeters will be buffered out 50 feet and 500 feet, respectively, from the P1 perimeter. The percolation perimeters will be created using an in-house ArcGIS python tool. Since the model will focus on design storm events, dynamic groundwater flow and its interaction with surface water (using pond control volume) will not be simulated.

7.0 MODEL NOMENCLATURE

7.1. City's Modeled Area

Although the City's SWMP report does not explain the methodology behind the nomenclature assigned to the City's model features, this section provides at least a summary of the City's model's nomenclature. It is possible that much of the nomenclature in the City's model comes from the previous studies the City's model was built upon, but this is not stated in the SWMP report explicitly. Wood is not proposing to change or alter the nomenclature within the City's model as part of the Carpenter Creek/Bayou Texar WMP.

Within the Existing Watershed 04, 05, 06, and 09 model scenarios, the subbasins are named with a prefix of "B" for basin, followed by either "BA", "BAA", "BL", "BLL", "BSA", "BSWA", "BZA" and some numerical, and in few instances alphabetical, values (i.e. B-006, BSA-3380). Similarly, each basin's loading node appears to be named with a prefix of "N" followed by the same characters that succeed the corresponding basin's name.

It does not appear that the links in the City's model were named to correlate with their related subbasins or nodes. For pipe features, the City's model nomenclature consists of a prefix of "L", "LS", "L-S", "LL", "LAA", or "LA", followed by some form of numeric values and a suffix of "P". For weir features, the City's model nomenclature consists of a prefix of "L", "LS", or "LSW" followed by some form of numeric values and a suffix of "W". For channel features, the City's model nomenclature consists of a prefix of "L" followed by some form of numeric values and a suffix of "C". For drop structures, the City's model nomenclature consists of a prefix of "L", "LL", "LS", or "LSW", followed by some form of numeric values and a suffix of "DS". There are limited rating curve links in the City's model, but the City's model nomenclature for rating curves consists of a prefix of "L" followed by some form of numeric values and a suffix of "RC". For cross-sections, the City's model nomenclature consists of a prefix of "X", "XS", or "XSW", followed by some form of numeric values and a suffix of "C" or "W" for channel and weir, respectively.

7.2. Unincorporated Area

For the nomenclature of the model network features to be developed within the unincorporated area of the watershed, Wood will follow the guidelines outlined in the County's BMG.

All elements of the ICPR4 model network (subbasins, nodes, links, and cross sections) will be labeled with a designation that includes a master index number, a character tributary designation, a sequential sub-system number, and a model element type designation. The master index number corresponds to the major basin. For the Carpenter Creek/Bayou Texar WMP, the Carpenter Creek is the master basin, which has an index number of "11".

Next, the tributary designations are to be labeled alphabetically beginning with the main tributary and continuing with lateral tributaries starting with the downstream-most outfall. In the case of subbasins that require more tributary designations than A through Z, the tributary designations shall continue with double letters (i.e. AA, BB, CC, etc.) The sequential portion of the designations indicates relative positioning of the model location within a given tributary beginning at the downstream limit. These designations will be identified using values that are incremented by 10's (e.g. 010, 020, etc.) thus leaving room for additional elements to be inserted later.

Element designations will begin with nodes. Subbasins shall have the same designation as the node to which it drains. If multiple basins are to be assigned to the same node, then designations shall be suffixed with a numeric value. Links leaving the node shall also have the same numeric designation as the node with the last character changed to reflect the link type. Designations will often need to account for multiple links at a given location. Such situations shall be suffixed with a numeric value (beginning with the lowest or first flowing link).

An example model designation would be “11A150P1”. The “11” designates the Carpenters Creek master basin, the letter “A” designates tributary “A” of Carpenters Creek (succeeding tributary systems would use remaining letters of the alphabet), the number “150” is the number of the element in downstream to upstream order along tributary “A”, the letter “P” signifies the type of element, as shown in **Table 5** below, and the “1” signifies it’s the first pipe of multiple pipes associated with the particular node.

Table 5 - Model Element Type Designations

ICPR Element	Model Code	ICPR Element	Model Code
Sub-basin	B	Node	N
Cross-Section	X	Pipe	P
Channel	C	Weir	W
Drop Structure	D	Bridge	G
Rating Curve	R	Breach	E

8.0 MODEL SIMULATIONS

Model simulations will be generated for the 3-, 5-, 10-, 25-, 50- and 100- year design storm events for the critical duration rainfall. Model results will be checked for continuity and stability concerns. Nodes or links within the model that exhibit anomalous behavior in stage or flow (i.e. oscillations, divergence, etc.) will be identified and addressed as necessary.

8.1. Rainfall

8.1.1. City’s Modeled Area

The City’s SWMP model used rainfall depths as summarized in **Table 6** below for the 8-hour and 24-hour storm events:

Table 6 - Rainfall Utilized in City’s SWMP Model

Storm	8-hr	24-hr
25 year	7.44	10.5
100 year	9.44	13.4

The rainfall depths utilized in the City's model were noted to be calculated using the FDOT Intensity-Duration-Frequency (IDF) curves for Florida Zone 1. The FDOT 100-year, 8-hour storm event, with a rainfall depth of 9.44 inches, was selected as the design storm event for the City's model.

8.1.2. Unincorporated Area

Rainfall volumes will be based on the Florida Department of Transportation (FDOT) Rainfall Intensity-Duration-Frequency (IDF) Curves for Florida - Zone 1 for storm durations up to 24 hours. For storm durations of 3, 7, and 10 days, recorded rainfall depths at NOAA Station ID 08-6997 will be used. The location of the NOAA station is shown in **Figure 9** below, and the related rainfall data from the station is shown in **Figure 10** below.

Figure 9 - Location Map for NOAA Station ID 08-6997

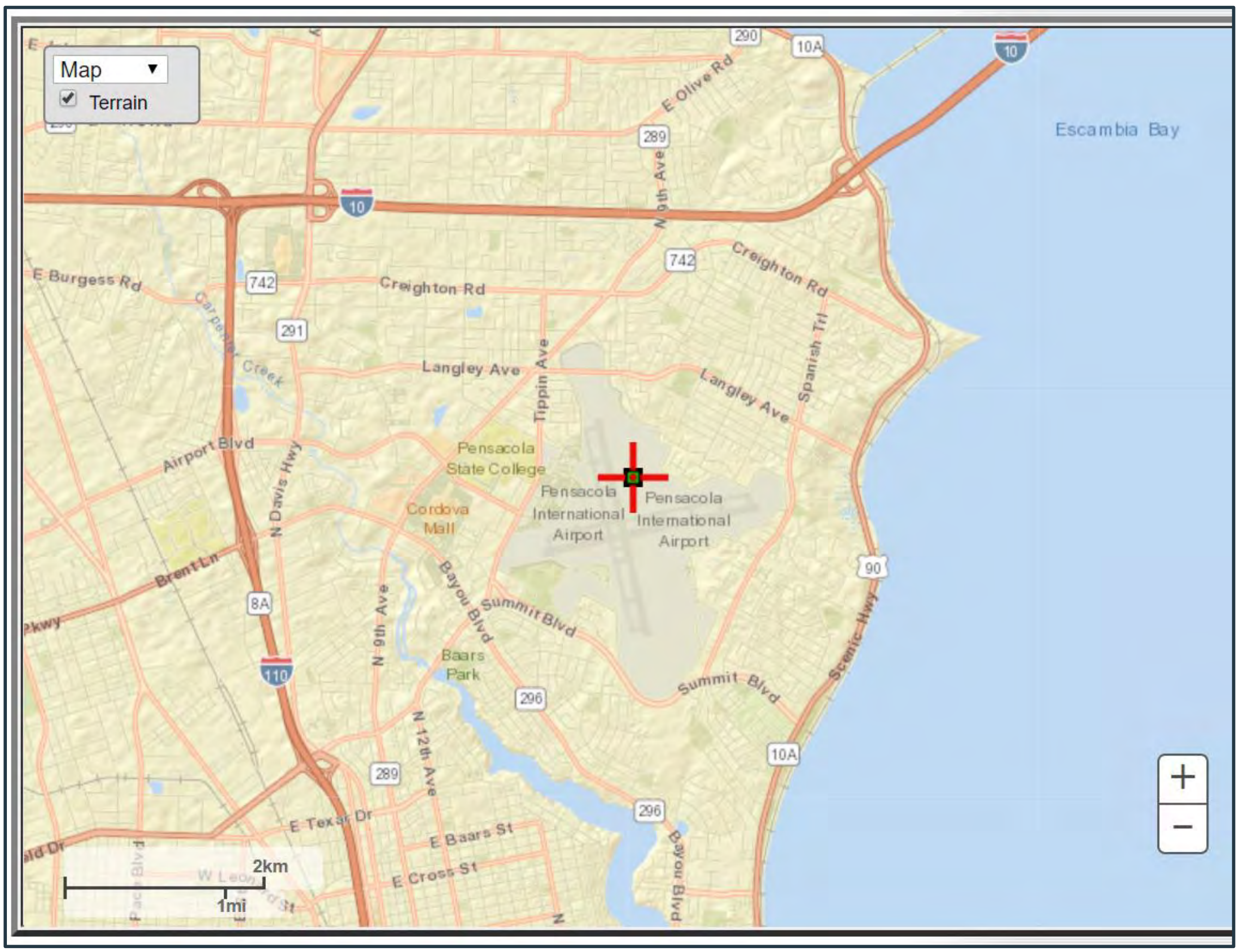


Figure 10 - NOAA Point Precipitation Estimates from Station ID 08-6997

NOAA Atlas 14, Volume 9, Version 2 PENSACOLA
RGNL AP
Station ID: 08-6997
Location name: Pensacola, Florida, USA*
Latitude: 30.4781°, Longitude: -87.1869°
Elevation:
Elevation (station metadata): 112 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.570 (0.488-0.671)	0.657 (0.563-0.775)	0.797 (0.679-0.942)	0.909 (0.769-1.08)	1.06 (0.854-1.29)	1.17 (0.918-1.45)	1.28 (0.960-1.62)	1.38 (0.986-1.81)	1.51 (1.03-2.05)	1.61 (1.06-2.22)
10-min	0.834 (0.715-0.983)	0.962 (0.824-1.14)	1.17 (0.994-1.38)	1.33 (1.13-1.58)	1.55 (1.25-1.89)	1.71 (1.35-2.12)	1.87 (1.41-2.38)	2.02 (1.44-2.65)	2.22 (1.51-3.00)	2.36 (1.56-3.26)
15-min	1.02 (0.872-1.20)	1.17 (1.00-1.38)	1.42 (1.21-1.68)	1.62 (1.37-1.93)	1.89 (1.53-2.30)	2.09 (1.64-2.59)	2.28 (1.72-2.90)	2.47 (1.76-3.23)	2.70 (1.84-3.65)	2.88 (1.90-3.97)
30-min	1.57 (1.34-1.85)	1.78 (1.52-2.10)	2.13 (1.82-2.53)	2.43 (2.06-2.89)	2.85 (2.31-3.50)	3.18 (2.51-3.96)	3.51 (2.65-4.49)	3.85 (2.76-5.08)	4.31 (2.94-5.85)	4.66 (3.08-6.44)
60-min	2.15 (1.84-2.53)	2.43 (2.08-2.87)	2.91 (2.48-3.44)	3.32 (2.81-3.95)	3.92 (3.19-4.83)	4.39 (3.47-5.50)	4.89 (3.70-6.28)	5.42 (3.89-7.16)	6.14 (4.20-8.35)	6.70 (4.43-9.25)
2-hr	2.73 (2.36-3.20)	3.08 (2.65-3.61)	3.68 (3.15-4.32)	4.21 (3.58-4.97)	4.98 (4.08-6.12)	5.61 (4.46-6.99)	6.27 (4.78-8.02)	6.98 (5.04-9.18)	7.96 (5.48-10.8)	8.74 (5.81-12.0)
3-hr	3.11 (2.69-3.63)	3.51 (3.02-4.09)	4.20 (3.61-4.92)	4.83 (4.12-5.68)	5.77 (4.75-7.09)	6.55 (5.23-8.15)	7.38 (5.64-9.42)	8.27 (6.00-10.9)	9.52 (6.59-12.9)	10.5 (7.03-14.4)
6-hr	3.76 (3.26-4.36)	4.26 (3.69-4.93)	5.17 (4.46-6.01)	6.03 (5.17-7.05)	7.36 (6.12-9.06)	8.51 (6.85-10.6)	9.75 (7.52-12.4)	11.1 (8.14-14.6)	13.1 (9.13-17.7)	14.7 (9.89-20.0)
12-hr	4.42 (3.85-5.09)	5.04 (4.39-5.80)	6.24 (5.41-7.21)	7.41 (6.38-8.61)	9.30 (7.82-11.5)	11.0 (8.90-13.6)	12.8 (9.96-16.3)	14.9 (11.0-19.5)	17.9 (12.6-24.1)	20.4 (13.8-27.5)
24-hr	5.10 (4.47-5.84)	5.89 (5.15-6.74)	7.44 (6.48-8.54)	8.98 (7.77-10.4)	11.5 (9.72-14.1)	13.7 (11.2-17.0)	16.2 (12.7-20.6)	19.0 (14.1-24.7)	23.1 (16.3-30.9)	26.5 (18.0-35.5)
2-day	5.87 (5.17-6.67)	6.82 (6.00-7.76)	8.70 (7.62-9.92)	10.6 (9.18-12.1)	13.6 (11.5-16.6)	16.2 (13.3-20.0)	19.2 (15.1-24.2)	22.5 (16.8-29.1)	27.4 (19.5-36.4)	31.4 (21.5-41.9)
3-day	6.41 (5.66-7.25)	7.38 (6.50-8.35)	9.31 (8.17-10.6)	11.2 (9.79-12.8)	14.4 (12.3-17.5)	17.2 (14.1-21.1)	20.3 (16.0-25.5)	23.8 (17.9-30.7)	29.0 (20.7-38.4)	33.3 (22.9-44.1)
4-day	6.85 (6.06-7.73)	7.81 (6.90-8.82)	9.75 (8.57-11.0)	11.7 (10.2-13.3)	14.9 (12.7-18.1)	17.7 (14.6-21.7)	20.9 (16.6-26.2)	24.5 (18.4-31.5)	29.8 (21.4-39.3)	34.2 (23.6-45.3)
7-day	7.92 (7.04-8.89)	8.93 (7.92-10.0)	10.9 (9.65-12.3)	12.9 (11.3-14.6)	16.2 (13.9-19.5)	19.0 (15.8-23.1)	22.3 (17.7-27.7)	25.9 (19.6-33.0)	31.2 (22.5-40.9)	35.6 (24.7-46.8)
10-day	8.87 (7.90-9.92)	9.96 (8.85-11.1)	12.1 (10.7-13.5)	14.1 (12.4-15.9)	17.3 (14.9-20.7)	20.2 (16.8-24.3)	23.3 (18.6-28.8)	26.8 (20.3-34.1)	31.9 (23.1-41.7)	36.2 (25.2-47.4)
20-day	11.6 (10.4-12.9)	13.0 (11.6-14.5)	15.5 (13.8-17.2)	17.7 (15.6-19.8)	20.9 (17.9-24.4)	23.6 (19.6-27.9)	26.5 (21.1-32.1)	29.5 (22.4-36.9)	33.8 (24.5-43.5)	37.3 (26.1-48.5)
30-day	13.9 (12.4-15.3)	15.6 (13.9-17.2)	18.4 (16.4-20.4)	20.8 (18.4-23.2)	24.1 (20.6-27.9)	26.8 (22.3-31.4)	29.5 (23.5-35.5)	32.3 (24.6-40.0)	36.1 (26.2-46.1)	39.0 (27.5-50.6)
45-day	16.7 (15.0-18.4)	18.8 (16.9-20.7)	22.1 (19.8-24.4)	24.8 (22.1-27.6)	28.5 (24.3-32.5)	31.3 (26.0-36.3)	34.0 (27.1-40.5)	36.7 (27.9-45.0)	40.1 (29.2-50.7)	42.7 (30.1-55.1)
60-day	19.0 (17.2-20.9)	21.5 (19.3-23.6)	25.3 (22.7-27.9)	28.4 (25.3-31.4)	32.4 (27.6-36.8)	35.3 (29.4-40.8)	38.2 (30.5-45.3)	40.9 (31.2-50.0)	44.3 (32.3-55.8)	46.8 (33.1-60.2)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

To determine the critical duration event for the study area, the 10-year and 100-year storm events will be simulated with durations of 1, 2, 4, 8, and 24 hours, 3, 7, and 10 days. Each node will be evaluated based on the maximum stage reached for each of these durations. The duration producing the majority of the maximum stages will then be deemed the critical duration for the basin. Specific problem areas that have critical durations different from the study area require additional simulations based on their particular critical duration.

The rainfall for the multi-day storms will be taken from the average precipitation amounts shown in Figure 10. In summary, Wood proposes to use the rainfall depths shown in **Table 7** below for the unincorporated area:

Table 7 - Proposed Rainfall Depths (inches) for Unincorporated Area of Model

Storm	1-hr	2-hr	4-hr	8-hr	24-hr	3-day	7-day	10-day
10 year	3.20	4.16	5.16	6.40	9.12	12.24	16.63	15.50
25 year	3.70	4.80	5.96	7.44	10.50	15.38	17.38	18.63
100 year	4.58	6.00	7.60	9.44	13.40	20.00	22.13	23.25

8.2. Model Calibrations and Verification

8.2.1. City's Modeled Area

The following is an excerpt from the City's SWMP, describing the methodology utilized for model calibration in the City's modeled area:

"Once the existing hydraulic model development was complete, the model rainfall event simulations were executed, and the predicted flooding areas were compared with known flooding areas. Areas in which flooding conditions were predicted were catalogued and a list of the most significant areas was provided to the City for verification as known points of flooding. City staff subsequently provided a list of areas for detailed study and conceptual design. The ICPR Model was further refined within the areas of detailed study to ensure that simulated results met reasonable hydraulic expectations. At worst, the comparison indicates that the model provides moderately conservative results within the selected areas of interest, which would diminish with lesser storm events. Therefore, the model is considered acceptable for evaluation of the existing watershed, for identification of the causes of flooding, and for development of the proposed improvement to mitigate areas of flooding, within the areas selected for detailed study." The City's SWMP mentions a comparison of the "predicted flooding areas" with "known flooding areas". Wood did not receive any additional information related to these areas.

8.2.2. Unincorporated Area

As model calibration was noted to have been conducted as part of the City's SWMP modeling effort, Wood is proposing to utilize the City's model as-is and will focus calibration and verification efforts within the unincorporated areas of the watershed only.

Model calibration typically makes use of historic gage data that represents rainfall, flood stage, and discharge rates for specific storms. The goal of this process is to produce model output results that are similar to observed conditions in flooding area extent, depth, and timing.

Wood is proposing to utilize the April 2014 storm event, which occurred between April 29th and April 30th, 2014, to calibrate the unincorporated portion of the model. This storm was classified by the National Weather Service (NWS) as a record 24-hour storm event for the City of Pensacola and the southern portion of Escambia County.

HDR Engineering, Inc. (HDR) developed a storm event recreation for this April 2014 event, dated January 27, 2015. HDR completed a radar-based assessment of the period of heavy rainfall associated with this storm, where they analyzed archived radar data for the event from the National Oceanic and Atmospheric Administration (NOAA) but also reviewed the gauged data for verification and calibration purposes. As part of this study, HDR developed electronic files for hydrologic input over the region. The files were noted to consist of .csv files that contain 5-minute temporal data for every grid cell within the 1km x 1km and 0.5 km x 0.5 km fields, for each of the two waves of precipitation that accompanied this storm. Wood is assuming that the County has, and can provide, the electronic rainfall files mentioned in the HDR report. Wood proposes to utilize these electronic files to create a calibration model simulation for the unincorporated area.

For comparison purposes, Wood will compare the April 2014 calibration simulation results to recorded flood elevations and noted flood complaints from the April 2014 event. Per the County's BMG, a High Water Mark Database (HWMDB) is under continuous development and is available to be used during model calibration efforts to supplement gage data or in lieu of gage data if such data do not exist. However, Wood requested the HWMDB from the County, and it was stated that this database is not available. The County did provide other information related to the April 2014 record storm event, which occurred over the course of April 29th and 30th. The County provided the following GIS layers in reference to the April 2014 storm event, and the details related to the data provided within each layer are described below:

- Public_Works_Damage_Assess_April2014_Flood
  - 75 point locations are within the study area (67 locations are located within the unincorporated area, and 8 locations are within City limits).
  - Data fields contain information related to flood-related observations due to the April 2014 storm. In some instances, observed flood depths were recorded. However, for most locations, the observations were only qualitative in nature.
- BID_Damage_Assess_April2014_Flood
  - 100 point locations are within the study area (All locations are located within the unincorporated area).
  - Data fields contain information related to flood-related observations due to the April 2014 storm, developed for the County's Building Inspection Department. In

most instances, a flood depth was recorded, although in some cases the data was qualitative only.

During model calibration iterations, model-projected surface water stages and flows for the calibration event shall be compared to observed surface water stages and flows noted in the GIS files. Discrepancies between observed and simulated peak stages shall be reviewed to determine if they fall within an acceptable range. The model will be considered as acceptable when the simulated stages and flows are in a reasonable range when compared to recorded data at the established locations.

If the observed and simulated hydrographs vary by more than approximately 10 percent for any incremental hour, Wood will investigate and tweak the model or provide potential valid reasons for the difference. If the model results do not reasonably resemble the inundation experienced from the calibration event, some of the more sensitive model input parameters shall be revisited, such as:

- Additional model refinement (additional nodes, links, cross sections, etc.)
- CN
- Manning’s n values for channels
- Inclusion or omission of percolation in the model
- Seasonal high water table (SHWT) elevation
- Initial conditions (Antecedent Moisture Condition (AMC), stages, presence or absence of baseflow)
- Control elevations along major conveyance systems
- Boundary conditions

Adjustments to roughness coefficients should consider reports or interviews with County maintenance crews, citizen questionnaire responses, and other factors that affect maintenance including accessibility and location. Initial elevations at gauging stations, large lakes, or wetlands should also be evaluated relative to conditions that existed at onset of the calibration storm. Similarly, baseflow shall be reviewed and compared to that measured at gauging stations. The resulting baseflow rate shall be included in the modeling such that elevations measured at the gage at the onset of the storm result.

Following calibration, one or more verification events will be evaluated to ensure adjustments made to the model during calibration are appropriate and that the model will produce reliable results. The verification events should have magnitudes and durations that differ from the calibration event and are large enough and long enough to impact all points in the watershed.

Evaluation of the model results should include a comparison of the results to flood complaint information and photos provided by the County or from information gleaned from public comments. One potential source of additional flood complaint information is the County's "Walk the WBID Field Event", which was a cooperative event toward implementing the Carpenter Creek Bacteria Pollution Control Plan (BPCP) adopted in 2015. During the "Walk the WBID Field Event", multiple locations within Carpenter Creek were identified and categorized with one of the following types: "Trailer Park", "Stormwater", "Septic Area, Repairs", "Sanitary/SW/Stream Confluence", "Restaurant", "Private Lift Station", "Pets/Animals", "Homeless/Illegal Dumping", "Flooding/Erosion", and "ECUA/SSO". To the highest practical extent, Wood will utilize these identified locations, particularly those noted as "Flooding/Erosion" and "Stormwater", to assist with the verification of model results. However, it should be noted that these locations did not include notes related to flood depths or elevations. Qualitative information, only, was provided. Also, the "Walk the WBID Field Event" did not include Bayou Texar. Only locations within Carpenter Creek were identified.

It's understood that the County may not have adequate information (High Water Mark Database, etc.) to assist with model verification. Wood suggests that future project public meetings be utilized, in part, to glean community and public input on areas of known flooding, peak stages, etc. to assist with the model verification.

ATTACHMENT 1

Summary of Model Differences

#	City Model Methodology Issue/Discrepancy/Point of Clarification	City Clarification Necessary?	Proposed Wood Methodology, Assumption or Workaround for Model Development	Deviates from County BMG	Variation between City methodology/ data and proposed methodology/ data for unincorporated area?	Proposed Changes to City Model or City GIS Data Suggested/ Required?	Level of Effort Related to Proposed Modifications
1	City's model uses a peak rate factor of 323 for Existing Watersheds 04, 05, 06, and 09	No	BMG says the unit hydrograph/peak rate factor shall be based on average overland slopes of the subbasins as follows: less than 0.5 percent – 256, 0.5 to 1.5 percent – 323, greater than 1.5 percent – 484. Due to the proximity of the City's modeled area to the unincorporated area, and to ensure consistency between the City's model input and the input for the unincorporated area, Wood is proposing to also utilize a peak rate factor of 323 for model development in the unincorporated area.	Yes	No	No	
2	N/A	N/A	Wood is proposing to update the future land use maps to determine significant changes from existing to future. Our scope notes that CN numbers will be updated, if needed. During project recommendations, Wood will determine appropriate model scenarios, which may or may not include full watershed build out conditions. It may be determined that existing conditions with the recommendations are preferred to fully evaluate recommended project benefits. or that future land use full build out conditions may only be updated in project areas.	Yes	N/A	No	
3	Level-of-detail for City's SWMP consisted of open ditches, streams, ponds, and lakes draining an area of 50 acres or more, in addition to closed conveyances with an equivalent diameter of 12 inches or more	No	Compatible with proposed level-of-detail in unincorporated area of model. Wood scope proposes to include pipos or drainage ways with conveyance equal to or greater than a 24-inch pipe as well as locations of identified drainage problems. Both the City's methodology and Wood's methodology represent intermediate scale. No changes requested.	No	Yes	No	
4	City SWMP model utilized land use and soils data from the NWFWMD 2015-2016 dataset as base data for hydrologic computations.	No	Wood proposes that the unincorporated area of the model utilize the updated land use files that reflect current 2019 conditions, and the NRCS 2018 soils layer. Land use and soils layers in the City's area will not be updated as part of County project, and the City's model will be used as-is.	No	Yes	No	
5	Unknown vertical datum conversion (NGVD29 to NAVD88) used in City's model, and unknown if all elevations have been converted properly to NAVD88	Yes	Wood is assuming the City's model is already in NAVD88 vertical datum. For the unincorporated area, Wood is proposing a conversion factor of -0.14 ft to convert from the NGVD29 datum to the NAVD88 datum, when necessary.	No	Yes	No	
6	Shortage of overland weir features in City model	Yes	Will develop overland weirs as needed to prevent "glass walls" in unincorporated are of model. Wood proposes to review the floodplains from the City's Existing Watersheds 04, 05, 06, and 09 scenario simulations to determine where additional overland weirs may be warranted. Wood proposes to add additional weirs to City's modeled area to correct for areas of significant false staging due to the missing overland weir connections.	No	Yes	Potential	TBD
7	City model calibration was conducted by comparing model results to known flooding areas, per the City's SWMP report. These known flooding areas were not documented or provided by City for use in County's project.	Preferred	Wood is not proposing to focus calibration efforts within City's modeled area, as it was noted to have been calibrated during the City's SWMP. Wood is proposing to conduct calibration/verification efforts only within the unincorporated area of the watershed, based on data from the April 2014 storm event and other known areas of flooding documentation, if available. Wood proposes to utilize the rainfall data developed as part of the HDR April 2014 Storm Event Recreation project.	No	Yes	No	

#	City Model Methodology Issue/Discrepancy/Point of Clarification	City Clarification Necessary?	Proposed Wood Methodology, Assumption or Workaround for Model Development	Deviates from County BMG	Variation between City methodology/ data and proposed methodology/ data for unincorporated area?	Proposed Changes to City Model or City GIS Data Suggested/ Required?	Level of Effort Related to Proposed Modifications
8	ERPs were obtained from the FDEP Map Direct website from 1982-present (present at time of City's model development) and utilized to develop the City's model	No	Wood will develop unincorporated area of model utilizing ERPs and plans up to 2019. Wood is not proposing to update the City's model with additional ERP plans as part of County project.	No	Yes	No	
9	In the absence of construction plans or survey data, inverts in City's model were derived from field-collected drop-down measurements, in conjuction with rim elevations derived from 2006 LiDAR and an assumed 3 feet of cover from the crown of the pipe.	No	Wood proposing similar methodology to minimize survey data collection efforts in the unincorporated area, when practical. However, the 2017 LiDAR will be utilized for rim and ground elevations in the unincorporated areas.	No	No	No	
10	FDOT 100-year, 8-hour storm event, with a rainfall depth of 9.44 inches, was selected as the design storm for the City's model.	No	Rainfall volumes will be based on the Florida Department of Transportation (FDOT) Rainfall Intensity-Duration-Frequency (IDF) Curves for Florida - Zone 1 for storm durations up to 24 hours. For storm durations of 3, 7 and 10 days, recorded rainfall depths at NOAA Station ID 08-6997 will be used.	No	Yes	No	
11	Tailwater elevations for drainage systems discharging into lakes, ponds, or creeks was determined based on water surface data, 2006 LiDAR elevations, or surveyed information.	No	Wood proposes to keep City model as-is, but utilize current plans, survey data, and 2017 LiDAR data for tailwater conditions in unincorporated area.	No	No	No	
12	Tailwater elevations used in the City's model for Escambia Bay and Pensacola Bay is 1.10 feet	No	Wood proposes to also use a tailwater elevation of 1.10 ft for the bay boundaries.	No	No	No	
13	Unknown information sources for cross-sections in City model channels and weirs	No	Wood is proposing to utilize City's model as-is. Cross-sections in unincorporated area will be developed from information from plans, survey, field recon, or derived from 2017 LiDAR data.	No	Yes	No	
14	Topographic errors observed in the City's GIS files that correspond to the modeled basins, links, and nodes	No	Wood did not do a thorough analysis of the City's GIS data to check for the severity of this issue, but from the initial analysis this does not appear to be very wide-spread or serious. Wood proposes to run some basic topology checks on the base GIS data for the existing City watersheds, and correct for those errors prior to building upon for the unincorporated area.	No	NA	Yes	TBD
15	DCIA not calculated or included in Curve Number calculations for City's model input	No	Wood proposes to utilize the City's modeled area as-is and adopt a similar methodology for the unincorporated area of the model, with no DCIA calculated. However, CN calcs in the unincorporated area will be based on updated land use and soils layers that are more recent than those files utilized in the City's model.	No	No	No	
16	Unclear whether the City's model deducted channel link storage from the node's available stage/area, or if channel exclusion polygons were developed for City's model	No	Wood proposes to utilize the City's modeled area as-is, but in the unincorporate area Wood will develop channel exclusion polygons for channel links and discount the associated channel storage area from the node's available storage	No	Unknown	No	
17	City's model nomenclature does not correspond to the County's Basin Management Guidelines	No	Wood proposes no changes to the City's model nomenclature, and will keep the City's model feature names for the City's model features. Wood will adopt the County's Basin Management Guidelines nomenclature specifications for the unincorporated area.	No	Yes	No	
18	The City calcuated CN values for each subbasin but did not calculate DCIA	No	Wood is proposing the same methodology	No			
19	City's model included multiple proposed conditions scenarios and Existing Watershed 01-10 scenarios. Unsure if the Existing Watershed scenarios are still current, or if any of the proposed scenarios have been implemented.	Preferred	Proposing to utilize only the Existing Watersheds 04, 05, 06, and 09 scenarios from the City's model as the basis for the County's model, unless City clarification suggests otherwise.	NA	NA	No	

#	City Model Methodology Issue/Discrepancy/Point of Clarification	City Clarification Necessary?	Proposed Wood Methodology, Assumption or Workaround for Model Development	Deviates from County BMG	Variation between City methodology/ data and proposed methodology/ data for unincorporated area?	Proposed Changes to City Model or City GIS Data Suggested/ Required?	Level of Effort Related to Proposed Modifications
20	ICPR Version 4.04.00 software was utilized for the City's SWMP model development	No	Compatible with latest ICPR version 4.05.02, which will be utilized under the County's project. No changes needed.	NA	Yes	No	
21	City's SWMP model is based on ICPR Version 3 models from the previously completed Pensacola Bay Basin study. These models were imported into ICPR4 and combined with the final City SWMP model that was developed by Mott MacDonald.	No	Wood is proposing to utilize City's model as-is and build upon for unincorporated area. No changes needed.	NA	NA	No	
22	The City did not provide spatial features in GIS format for the subbasins in the model. Subbasins were provided by the City under a previous submittal, but in dxf format. Names were not assigned to the subbasins provided in dxf format.	Yes	Wood suggests asking City for the GIS spatial basin files that correspond to the subbasins (with associated model subbasin names) modeled in Existing Watershed Scenarios 04, 05, 06, and 09. If not available, Wood suggests a workaround by converting the dxf file of subbasins into GIS format, and assigning names to the subbasins based on the corresponding name of the storage nodes that fall within them.	N/A	Yes	Yes	TBD
23	NWFWMD 2006 LiDAR data used for the City's SWMP model development	No	Will keep City model as-is, but utilize the NWFWMD 2017 LiDAR data for model development in unincorporated area.	N/A	Yes	No	
24	FDOT 2016 aerial imagery was utilized during the City's SWMP development	No	Will keep City model as-is, but utilize the 2019-2020 aerial imagery for model development and parameterization in unincorporated area.	N/A	Yes	No	
25	City's model does not include the latest approved plans for the FDOT 9th Avenue bridge project	No	Wood proposes to alter the City's model to include the latest design plans for the 9th Avenue bridge	N/A	Yes	Yes	TBD
26	No model output files provided for City's model	No	Wood is making the reasonable assumption that the Existing Watershed Scenarios 04, 05, 06, and 09 can be rerun and will generate results that coincide with the results observed in the City's submittal.	N/A	NA	No	
27	The City's model did not include percolation links	No	Wood will include percolation links in the unincorporated area of the model, as needed. Wood will not revise the City's model area to include percolation links.	N/A	Yes	No	

Wood

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VOLUME 2 APPENDIX D

SUMMARY OF ERP AND FDOT PLANS RECEIVED/UTILIZED

Source	Folder Directory	Project Name/Site ID	File Name	Plan Type	Collected	Assessed	Data Used
County	32_County Drainage Project Plans/Bridgewood	Bridgewood Subdivision	Asbuilt	As-Builts	Y	Y	Y
County	32_County Drainage Project Plans/Brook Meadow	Brook Meadow	Brook Meadow Drawing-2	Submitted Plans	Y	Y	Y
County	32_County Drainage Project Plans/Cascade Hills	Cascade Hills	Cascade Hills Drawings	Approved	Y	Y	Y
County	32_County Drainage Project Plans/Crystal Wells	Crystal Wells / Bristol Wells / Olive Hill	Crystal Wells Drawings	Approved	Y	Y	Y
County	32_County Drainage Project Plans/Green Acres	Green Acres	Green Acres Drawing	Unknown	Y	Y	Y
County	32_County Drainage Project Plans/Hillburn Grove	Hilburn Grove	Hilburn Grove SD Drainage Calcs P141	As-Builts	Y	Y	Y
County	32_County Drainage Project Plans/Home Depot Park	Home Depot	as-built drawing	As-Builts	Y	Y	Y
County	32_County Drainage Project Plans/Kimberly Woods	Kimberly Woods	Kimberly Woods Drawings-Construction_Plans	Constr Plans	Y	Y	Y
County	32_County Drainage Project Plans/Lost Creek	Lost Creek	Lost Creek Drawing-Master_Plan	Master Plan	Y	Y	Y
County	32_County Drainage Project Plans/Mazurek	Mazurek Plantation	LL PLANS	As-Builts	Y	Y	Y
County	32_County Drainage Project Plans/Norwood/Unit 6	Norwood Subdivision	unit 6 drawing	Study	Y	Y	Y
County	32_County Drainage Project Plans/Oak Forest	Oak Forest	Oak Forest Drawings	Approved	Y	Y	Y
County	32_County Drainage Project Plans/Oakfield Acres Subd/Drawings/Archive Drawings	Oakfield Acres Parcel 7	Oakfield Acres Drawing Parcel 7	Approved	Y	Y	Y
County	32_County Drainage Project Plans/Oakfield Acres Subd/Drawings/Archive Drawings	Oakfield Acres Parcel 8	Oakfield Acres Drawing Parcel 8	Approved	Y	Y	Y
County	32_County Drainage Project Plans/Oakfield Acres Subd/SURVEY	Oakfield Acres 2017 Survey	OAKFIELD ACRES 20170074	As-Builts	Y	Y	Y
County	32_County Drainage Project Plans/Olive Road	I-110 Bridge	I-110 Bridge	Proposed Plans	Y	Y	Y
County	32_County Drainage Project Plans/Olive Road	Survey Cody Mazurek	Survey Olive_Cody_MazurekD993	As-Builts	Y	Y	Y
County	32_County Drainage Project Plans/Olive Road	Olive Road Drainage Plans	Olive Road As-Builts1	As-Builts	Y	Y	Y
County	32_County Drainage Project Plans/Olive Road	Survey Olive_Palafox	Survey Olive_Palafox_C6672	As-Builts	Y	Y	Y
County	32_County Drainage Project Plans/Robins Ridge	Robins Ridge	Drawing-Lot_Grading	Constr Plans	Y	Y	Y
County	32_County Drainage Project Plans/Sears Blvd	Sears Dam	_Olive Road Industrial Park - Sears Blvd Drawings	Proposed	Y	Y	Y
County	32_County Drainage Project Plans/Sears Blvd	Sears Warehouse	SEARS_drawings	Unknown	Y	Y	Y
County	32_County Drainage Project Plans/Silverton	Silverton	Drawing-Engineering_As_Builts_12/5/2001	Constr Plans	Y	Y	Y
County	32_County Drainage Project Plans/Twin Lake Villas	Twin Lakes	Final Plat	Approved	Y	Y	Y
County	32_County Drainage Project Plans/Whitmire Sabra	Olive Road Oriental Massage	1530 E Olive Road Site_Plan	Approved	Y	Y	Y
County	32_County Drainage Project Plans/Whitmire Sabra	1540 E Olive	1540 E Olive Road original drawings	approved	Y	Y	Y
County	32_County Drainage Project Plans/Whitmire Sabra	Whitmire Basins	Map From Olive Road Stormwater Report Whitmire	Study	Y	Y	Y
County	32_County Drainage Project Plans/Whitmire Sabra	Maxton	Maxton OFFSITE FORCEMAIN	UNK Not Built	Y	Y	N
County	32_County Drainage Project Plans/Whitmire Sabra	Sabra Drive	SABRA DRIVE	As-Builts	Y	Y	Y
County	32_County Drainage Project Plans/Willow Tree Acres	Willow Tree	As-built dwg	As-Builts	Y	Y	Y

Source	Folder Directory	Project Name/Site ID	File Name	Plan Type	Collected	Assessed	Data Used
FDEP	29_ERP Digital datasets/ERPs	4237	4237	Submitted Plans with AB cert and Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	67751	67751	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	70015	70015	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	71409	71409	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	74941	74941	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	75437	75437	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	77838	77838	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	78251	78251	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	79447	79447	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	100959	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	123419	123419	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	124801	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	127278	127278	Submitted Plans with AB cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	129202	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	132874	132874	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	133670	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	134038	134038	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	135076	135076	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	139130	139130	Unknown	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	142644	142644	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	143630	143630	No plans. Only AB cert and Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	144133	144133	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	144530	144530	No plans. Only AB cert and Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	145398	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	147696	147696	Submitted Plans with AB cert and Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	148890	148890	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	149041	149041	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	149451	149451	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	150572	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	150927	150927	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	152404	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	152676	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	152822	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	154594	154594_Rev0andRev1	Submitted Plans with Permit memo (rev 0) and Unknown (rev 1)	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	156702	156702	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	157516	157516	Submitted Plans with AB cert and Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	159567	159567	Submitted Plans with AB cert and Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	160244	160244	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	161206	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	163930	163930	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	163958	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	164956	164956	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	165990	165990	No plans. Only AB cert and Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	166413	166413	Unknown	Y	Y	N

Source	Folder Directory	Project Name/Site ID	File Name	Plan Type	Collected	Assessed	Data Used
FDEP	29_ERP Digital datasets/ERPs	167269	167269	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	168199	168199_Rev0, 168199_Rev1	As-built	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	168463	168463	No plans. Only AB cert and Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	170452	170452	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	171597	171597_rev0, 171597_rev1	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	175790	175790	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	177073	177073	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	177201	177201	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	178401	178401	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	179718	179718	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	179819	179819	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	180290	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	180584	180584	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	182304	182304	Submitted Plans with AB cert and Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	183373	183373	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	185322	185322	Submitted Plans with AB cert and Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	186114	186114_rev1	Permitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	189199	189199	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	190759	190759	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	192207	192207	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	193402	193402	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	193480	193480	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	194042	194042	Submitted Plans with Permit exemption memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	195692	195692	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	196621	196621	As-built	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	196667	196667	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	197096	197096_rev0, 197096_rev1	Submitted Plans with AB cert	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	198085	198085	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	198509	198509	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	202137	202137	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	203502	203502	Submitted Plan with letter of Exemption	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	203506	203506	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	204720	204720	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	205124	205124	Submitted Plans with AB cert and Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	205848	205848	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	208015	208015_PP, 208015_AB	As-built	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	213748	213748	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	214571	214571	Submitted Plans with AB cert and Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	214845	214845	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	215251	215251_Rev0, 215251_Rev1	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	215497	215497	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	219542	219542	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	221740	221740	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	223027	223027	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	Dec-18	226072	Submitted Plans with Permit memo	Y	Y	N

Source	Folder Directory	Project Name/Site ID	File Name	Plan Type	Collected	Assessed	Data Used
FDEP	29_ERP Digital datasets/ERPs	226468	226468	Submitted Plans with AB cert and Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	227242	227242	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	227920	227920	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	228463	228463	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	229409	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	230908	230908	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	231190	231190	Permitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	231599	231599	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	232572	232572	As-built	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	232664	232664	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	234186	234186	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	234206	234206	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	235642	235642	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	235913	235913	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	236076	236076	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	238905	238905	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	239707	239707	Permit and basin map only	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	239708	239708	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	243892	243892	Submitted Plans with AB cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	244781	244781	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	249773	249773	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	250068	250068	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	250209	250209	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	250959	250959_rev0, 250959_rev1	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	251012	251012	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	251074	251074	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	251448	251448	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	255614	255614	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	256155	256155_rev0, 256155_rev1	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	256617	256617	As-built	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	256747	256747	Submitted Plans with AB cert and Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	257346	257346_Rev0, 257346_Rev1	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	258105	258105	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	258670	258670_rev0, 258670_rev1	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	262573	262573	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	262781	262781	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	263451	263451	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	266281	266281	Submitted Plans with Permit memo	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	266568	266568, 266568_AB	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	268657	268657_rev0, 268657_rev1, 268657_rev2	As-built	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	268690	268690	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	270668	270668	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	270757	270757	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	271297	271297	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	271932	271932	Submitted Plans	Y	Y	N

Source	Folder Directory	Project Name/Site ID	File Name	Plan Type	Collected	Assessed	Data Used
FDEP	29_ERP Digital datasets/ERPs	272669	272669	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	274244	274244	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	276320	276320	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	278080	278080	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	278082	278082_Part1, 278082_Part2	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	278266	278266	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	279590	279590	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	279778	279778	Submitted Plans with Permit memo	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	280463	280463_rev0, 280463_rev1	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	282250	282250	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	282263	282263	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	282637	N/A	No plans	Y	N	N
FDEP	29_ERP Digital datasets/ERPs	282857	282857	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	282948	282948	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	316292	316292	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	316678	316678	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	327824	327824	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	336584	336584	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	343449	343449	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	346746	346746	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	346874	346874	Submitted Plans	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	347064	347064	Submitted Plans	Y	Y	Y
FDEP	29_ERP Digital datasets/ERPs	357783	357783	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	359123	359123	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	359124	359124	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	363411	363411	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	365513	365513	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	368205	368205	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	373086	373086	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	373868	373868	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	375318	375318	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	378223	378223	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	379320	379320	Self-Cert	Y	Y	N
FDEP	29_ERP Digital datasets/ERPs	379688	379688	Self-Cert	Y	Y	N

Source	Folder Directory	Project Name/Site ID	File Name	Plan Type	Collected	Assessed	Data Used
FDOT	31_FDOT Plans\Existing_State_Roads_Plans_Received_Nov2020	DavisHWY_FairfieldDrtoI10_1969	DavisHWY_FairfieldDrtoI10_1969	Approved Plans	Y	Y	Y
FDOT	31_FDOT Plans\Existing_State_Roads_Plans_Received_Nov2020	BrentToKilbee_2001	BrentToKilbee_2001	Unknown	Y	Y	N
FDOT	31_FDOT Plans\Existing_State_Roads_Plans_Received_Nov2020	Scenic Rd	Scenic Rd	Approved Plans	Y	Y	N
FDOT	31_FDOT Plans\Existing_State_Roads_Plans_Received_Nov2020	I110andBrent_2004	I110andBrent_2004	Approved Plans	Y	Y	Y
FDOT	31_FDOT Plans\Existing_State_Roads_Plans_Received_Nov2020	I110andBrent_2006	I110andBrent_2006	Approved Plans	Y	Y	Y
FDOT	31_FDOT Plans\Existing_State_Roads_Plans_Received_Nov2020	I10_DavisHWY_to_EscambiaBay_1965	I10_DavisHWY_to_EscambiaBay_1965	As-built	Y	Y	Y
FDOT	31_FDOT Plans\Existing_State_Roads_Plans_Received_Nov2020	SR30_1959	SR30_1959	Approved Plans	Y	Y	N
FDOT	31_FDOT Plans\Existing_State_Roads_Plans_Received_Nov2020	StateRoad8_HeadingNW_1958	StateRoad8_HeadingNW_1958	Approved Plans	Y	Y	N
FDOT	31_FDOT Plans\9th Ave Bridge\Final_Received_03102021	9th Avenue Bridge	43717815201-PLANS-01-ROADWAY	Submitted Plans	Y	Y	Y
FDOT	31_FDOT Plans\17th Avenue and Pensacola Bay Bridge	17th Avenue and Pensacola Bay Bridge	PBB-17th Drainage Design Documentation_409334 & 4378454-1-52-01	Submitted Plans	Y	Y	N
FDOT	31_FDOT Plans\Burgess Road	Burgess Road	Burgess Road 30 percent plans Roadway Plans	Submitted Plans (30%)	Y	Y	Y
FDOT	31_FDOT Plans\Burgess Road_HNTB	Burgess Road HNTB	21842915201-PLANS-01-ROADWAY	Submitted Plans	Y	Y	Y

VOLUME 2 APPENDIX E

THREATENED AND ENDANGERED SPECIES LETTER FROM FWS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Panama City Ecological Services Field Office
1601 Balboa Avenue
Panama City, FL 32405-3792
Phone: (850) 769-0552 Fax: (850) 763-2177
http://www.fws.gov/panamacity/specieslist.html
http://www.fws.gov/panamacity/pcdata.html

In Reply Refer To: May 25, 2020
Consultation Code: 04EF3000-2020-SLI-0374
Event Code: 04EF3000-2020-E-00651
Project Name: Bayou Texar/Carpenter Creek Watershed Management Plan

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office. All correspondence should be submitted to panamacityregs@fws.gov.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Panama City Ecological Services Field Office
1601 Balboa Avenue
Panama City, FL 32405-3792
(850) 769-0552

Project Summary

Consultation Code: 04EF3000-2020-SLI-0374

Event Code: 04EF3000-2020-E-00651

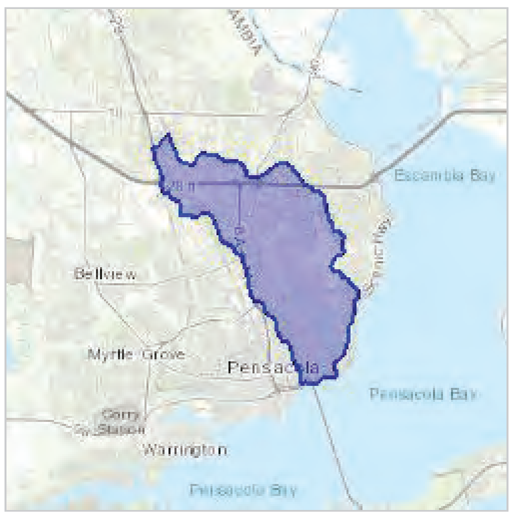
Project Name: Bayou Texar/Carpenter Creek Watershed Management Plan

Project Type: Guidance

Project Description: Plan focuses on access, water quality, ecological conditions, and opportunities for parallel restoration and recreation projects throughout the 18 square mile watershed

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/30.471529619619858N87.20553371823027W



Counties: Escambia, FL

Endangered Species Act Species

There is a total of 8 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Mammals

NAME	STATUS
West Indian Manatee *Trichechus manatus* There is **final** critical habitat for this species. Your location is outside the critical habitat. ***This species is also protected by the Marine Mammal Protection Act, and may have additional consultation requirements.*** Species profile: https://ecos.fws.gov/ecp/species/4469	Threatened

Birds

NAME	STATUS
Piping Plover *Charadrius melodus* Population: [Atlantic Coast and Northern Great Plains populations] - Wherever found, except those areas where listed as endangered. There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/6039	Threatened
Red Knot *Calidris canutus rufa* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/1864	Threatened
Wood Stork *Mycteria americana* Population: AL, FL, GA, MS, NC, SC No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8477	Threatened

Reptiles

NAME	STATUS
Eastern Indigo Snake *Drymarchon corais couperi* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/646	Threatened
Gopher Tortoise *Gopherus polyphemus* Population: eastern No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/6994	Candidate

Amphibians

NAME	STATUS
Reticulated Flatwoods Salamander *Ambystoma bishopi* There is **final** critical habitat for this species. Your location is outside the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/8939	Endangered

Fishes

NAME	STATUS
Atlantic Sturgeon (gulf Subspecies) *Acipenser oxyrinchus (=oxyrhynchus) desotoi* There is **final** critical habitat for this species. Your location overlaps the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/651	Threatened

Critical habitats

There is 1 critical habitat wholly or partially within your project area under this office's jurisdiction.

NAME	STATUS
Atlantic Sturgeon (gulf Subspecies) *Acipenser oxyrinchus (=oxyrhynchus) desotoi* https://ecos.fws.gov/ecp/species/651#crithab	Final

VOLUME 2 APPENDIX F

WATER QUALITY MONITORING PROGRAM OPTIONS TECHNICAL MEMORANDUM

Technical Memorandum

To: Terri Berry
Escambia County

From: Mary Szafraniec, PhD, PWS
Wood Environment & Infrastructure Solutions, Inc.

Date: April 17, 2020

Re. Monitoring Program Options for Carpenter Creek and Bayou Texar

Wood Project No. 600643

A previous Wood Technical Memorandum titled 'Preliminary Monitoring Station Review Recommendations for Carpenter Creek & Bayou Texar' (submitted on January 31, 2020) provided a preliminary review of potential data gaps in the existing monitoring station network. Gaps were found in respect to surface water quality, groundwater, and hydrologic information in Carpenter Creek and Bayou Texar. General recommendations for adjusting sampling frequency and analytes were provided as part of that Technical Memorandum. A meeting was held following the Stakeholder Meeting on February 19, 2020 between the County, Wood and other stakeholders to discuss the preliminary data gaps in the monitoring network. The County requested that Wood provide additional recommendations regarding varying levels of monitoring effort and cost for the County to consider moving forward with enhancement of their existing monitoring programs.

As requested, this document provides recommendations for three different monitoring programs that vary in complexity and cost from a minimum level to more involved. The three programs include 1) basic, 2) comprehensive, and 3) long-term programs. The proposed programs enhance the existing monitoring programs by increasing the number and distribution of surface water quality, groundwater and flow stations, their respective parameters and frequencies.

The purpose of combining flow measurements and water quality sampling programs is to define relationships between flow and water quality parameters of concern and to estimate loading rates and yields. Based on a preliminary evaluation of soils and potentiometric surface data, there appears to be potential connectivity between groundwater and surface water in the subject watersheds. Therefore, additional groundwater data is needed to further evaluate the effect of groundwater contributions on surface water quality conditions in both Carpenter Creek and Bayou Texar. High-level recommendations are provided in the following sections that should meet various goals of the monitoring programs. Additional detail and cost information can be provided upon request. A summary of recommendations is provided in **Table 1**.

Table 1. Summary of Recommendations

	Basic	Comprehensive
Surface Water Quality*		
21FLKWATESC-CA-CREEK-1	increase frequency to monthly and continue monitoring	
Bayou Texar at 12th Ave Bridge:	increase frequency to monthly and continue monitoring	
21FLDOH ESCAMBIA317	begin monitoring on a monthly basis	
21FLKWATESC-BA-TEX-1	begin sampling on a monthly basis	
21FLKWATESC-BA-TEX-2	begin sampling on a monthly basis	
21FLKWATESC-BA-TEX-3	begin sampling on a monthly basis	
Olive Road		Add parameters and conduct monthly sampling
Burgess Road		Add parameters and conduct monthly sampling
Davis Hwy		Add parameters and conduct monthly sampling
Brent Ave		Add parameters and conduct monthly sampling
Add New Station on "natural" reach of Carpenter Creek		Add Station
Add station on tributary north of I-10		Add Station
Add station at the canal that flows into Carpenter at Hilburn Ave. to characterize tributary inflows		Add Station
Flow		
No existing staff gages	Install at least one staff gage equipped with a continuous water level recorder and develop rating curve to calculate flow	Basic + 4 additional flow gages are recommended, with 2 on Carpenter Creek and 2 on inflowing tributaries; consider side looking doppler current meters to measure continuous water velocities and level

	Basic	Comprehensive
Groundwater Water Quality*		
Groundwater Seepage Study		Conduct groundwater seepage study
PENSACOLA 12TH AVE. WELL (Tier 1)	begin sampling on a monthly basis	Same as Basic
WELL 026-713-5 (Tier 1)	begin sampling on a monthly basis	Same as Basic
WIN station ID **52289 (Tier 2)**	begin sampling on a monthly basis	Same as Basic
Tier 3	begin sampling on a monthly basis at any wells that may still be viable	Same as Basic
Sediment Cycling		
		Pre-screening sediment characterization sampling event and flux incubation study

Note: *Recommended water quality parameters are provided in Table 2.

1.0 BASIC MONITORING PROGRAM

This program includes the minimum distribution of stations, parameters and associated frequencies as shown in **Table 2**. This program would include modifying the existing monitoring program by adding or enhancing the monitoring plan for surface water stations, establishing a limited groundwater monitoring well network and adding a staff gage to the existing program.

1.1. Water Quality

Station **21FLKWATESC-CA-CREEK-1** has nutrient data (sampled quarterly) for a period of record (POR) from 2000-2014 (retrieved from IWR database). The shapefile of Escambia County (County) monitoring stations (provided to Wood by the County in September 2019) shows the station **Carpenter Creek at Davis Hwy** in the same location as **21FLKWATESC-CA-CREEK-1**. It is recommended that this location continue to be monitored for nutrients, at least monthly.

Station **33020HF1** has nutrient data (sampled approximately quarterly) for a POR from 1999-2017 (retrieved from WIN database). The shapefile of County monitoring stations (provided to Wood by the County) shows the station **Bayou Texar at 12th Ave Bridge** in the same location as **33020HF1**. It is recommended that this location continue to be monitored for nutrients, at least monthly.

Station **21FLDOH ESCAMBIA317** (near the confluence with Pensacola Bay) has bacteria data for POR from 2000-2018, with bi-weekly sampling frequency in the last 2 years (retrieved from IWR database). It is recommended that this station also be sampled for nutrients, at least monthly.

The stations **21FLKWATESC-BA-TEX-1**, **21FLKWATESC-BA-TEX-2**, and **21FLKWATESC-BA-TEX-3** have nutrient data sampled quarterly from 2007-2017. These stations appear to be previous Escambia County stations. If there was not a specific reason these stations were discontinued or not included in the provided County station shapefile, it is recommended that these stations continue to be monitored, at least monthly.

1.2. Flow Monitoring

A minimum of one staff gage is recommended (two are preferred) on Carpenter Creek. The staff gage should be equipped with a continuous water level recorder (i.e. pressure transducer).

Measured water levels should be converted to flow data based upon a minimum of twelve flow measurements using an acoustic Doppler velocimeter. Flow readings should be taken at various water levels in order to develop a rating curve, which relates water level to flow. This curve can be used to convert the water level record to a flow record for the gage, which will ultimately help determine how water quality varies with flow.

1.3. Groundwater Monitoring

To inform effective placement of groundwater monitoring wells, all available, relevant geospatial data were assessed. The NRCS 2018 soils layer showed that most soils in the watershed and surrounding area are well drained hydrologic soil group (HSG) A or B. The potentiometric groundwater surface (POT) map (NWFWMD 2000) showed that groundwater tends to travel from the northwest corner of the Carpenter Creek watershed to the southeast corner, and from the outer edges of the watershed in toward the creek and bayou. FDOH septic system shapefiles provided by the County showed large, concentrated areas of septic systems throughout most of the Carpenter Creek watershed, specifically in the northwest corner and along the western and eastern boundaries of the watershed. According to the POT map, these septic areas are up-gradient of the creek and bayou and may contribute nutrients and bacteria via surficial groundwater connectivity.

Industrial and domestic wastewater facilities, monitoring wells, outfalls, and disposal types (from FDEP public data portal) were also assessed. Several sand mine and concrete batch plant industrial waste facilities were observed, but no domestic wastewater facilities or disposals exist within the watershed (or estimated area of groundwater influence). The ECUA-Central Water Reclamation Facility, which is not within the watershed, does provide public reuse, however it is not clear how much of the distribution network is within the Carpenter Creek watershed. This will be investigated further during later tasks.

While there was no substantial recent data found for any groundwater wells in the watershed, many wells previously sampled exist within the watershed. If any of these historic wells are still viable, it is recommended that one well is sampled within each priority monitoring area (shown in the figures below). The monitoring areas are prioritized by tiers, with 1 being the most important to collect groundwater data.

Well data were also retrieved from USGS, and several wells had historic data from the 1970s and 80s, but no recent data. Two wells (**PENSACOLA 12TH AVE. WELL** and **USGS OBS.WELL 026-713-5**) showed elevated nitrate concentrations above 6 mg/L. These wells are located within a concentrated septic area in the Tier 1 monitoring area, so it is recommended that, if possible, monthly monitoring for water quality is reestablished at one of these locations and the parameters in **Table 2** are collected.

Only one monitoring well within the Carpenter Creek/Texar Bayou watersheds was found to have recent data (WIN station ID 52289), with one sample on 12/12/2017 (variety of nutrient, tracer, and biological parameters.). This well is located within the Tier 2 monitoring area and, if possible, it is recommended that monthly monitoring should be reestablished at one of these locations.

The historic USGS wells shown in Tier 3 are not within the Carpenter Creek watershed but are within the estimated area of groundwater influence and downgradient of a large concentrated septic area (i.e. clusters of septic systems) and two industrial wastewater facilities. If any of the wells within the Tier 3 area are still viable, it is recommended that monthly monitoring be reestablished at one of these locations (water level, nutrients, bacteria, and tracer data).

Table 2. Water Quality Parameters

Parameters	Field or Lab
pH	Field
Specific conductance	Field
Dissolved oxygen	Field
Temperature	Field
Turbidity	Field
Fecal indicators	Lab
Chlorophyll-a (only surface water)	Lab
Chloride	Lab
Calcium	Lab
Magnesium	Lab
Bromide	Lab
Alkalinity	Lab
Ammonia (N)	Lab
Nitrate+Nitrite (N)	Lab
Total Kjeldahl Nitrogen	Lab
Orthophosphate	Lab

Parameters	Field or Lab
Total Phosphorus	Lab
Total Organic Carbon	Lab
Sulfate	Lab
True Color	Lab
Total Suspended Solids	Lab

1.4. Summary of Enhancements to Meet the Minimum Level Monitoring Program

<u>Surface water</u>

- Station **21FLKWATESC-CA-CREEK-1 / Carpenter Creek at Davis Hwy:** increase frequency to monthly and continue monitoring
- Station **33020HF1 / Bayou Texar at 12th Ave Bridge:** increase frequency to monthly and continue monitoring
- Station **21FLDOH ESCAMBIA317:** begin monitoring on a monthly basis
- **21FLKWATESC-BA-TEX-1**, **21FLKWATESC-BA-TEX-2**, and **21FLKWATESC-BA-TEX-3:** begin sampling on a monthly basis

<u>Flow</u>

- Install at least one staff gage equipped with a continuous water level recorder (i.e. pressure transducer) and develop rating curve to calculate flow

<u>Groundwater</u>

- **PENSACOLA 12TH AVE. WELL** and **USGS OBS.WELL 026-713-5 (Tier 1):** begin sampling on a monthly basis
- WIN station ID **52289 (Tier 2):** begin sampling on a monthly basis
- **Tier 3**: begin sampling on a monthly basis at any wells that may still be viable

2.0 <u>COMPREHENSIVE MONITORING PROGRAM</u>

This program includes a more comprehensive array of monitoring that would address questions regarding pollutant sources, which may only require a year of more intensive monitoring, rather than long term. This program enhances the number and distribution of stations. In addition to the Basic Program in Section 1.0, this program would include components such as groundwater seepage meters to assess groundwater seepage within the channel (possibly prior to new construction of groundwater monitoring wells), additional stream flow gages at surface water monitoring stations to estimate loads, and characterization of sediment flux dynamics and internal loading from legacy sedimentation.

2.1. Water Quality

In addition to the recommendations provided in the Basic Monitoring Program, the following stations on Carpenter Creek are recommended to add parameters from **Table 2** that are already not being collected on a monthly basis:

1) Olive Rd.
2) Burgess Rd.
3) Davis Hwy.
4) Brent Ave.
5) Add new station that would be representative of a “natural” reach of Carpenter Creek that appears to have intact instream habitat and is not highly disturbed in terms of erosion and sedimentation. This station could be in the vicinity of 819 Brookmeadow Dr.
6) Tributaries:
    a. Add station on tributary north of I-10
    b. Add station at the canal that flows into Carpenter at Hilburn Ave. to characterize tributary inflows

2.2. Flow Monitoring

In addition to the recommendations provided in the Basic Program, 4 additional flow gages are recommended, with 2 on Carpenter Creek and 2 on inflowing tributaries. To enhance data quality and to measure discharge, side looking doppler current meters are recommended to measure continuous water velocities and level. They would provide more accurate and reliable data and the data can uploaded to a telemetric system for real-time measurements (on 15-minute frequency).

2.3. Groundwater Monitoring

To assess potential groundwater contamination that may be influencing water quality in Carpenter Creek and Texar Bayou, several more wells would be needed than what was proposed in the Basic Program. However, prior to constructing new wells, a groundwater seepage study is recommended to assess the level of potential groundwater contamination in the creek and bayou. A minimum of 12 seepage meters are recommended (approximately 6 in the creek and 6 in bayou) to be installed for a minimum of nine months (one year is preferred). Samples would be collected on a bi-monthly basis for the parameters in **Table 2,** at a minimum. If groundwater contamination is confirmed by the seepage meter study, then a network of at least 10 surficial groundwater monitoring wells are recommended to identify the sources that contribute to groundwater contamination. In addition to the parameters in **Table 2**, nitrogen and oxygen isotopes and wastewater tracers are recommended to pursue a pollutant source tracking study to attribute proportions of each source (i.e. urban turf/sports turf fertilizer, wastewater, septic waste, animal waste, etc.). Wood has completed similar groundwater contamination studies and can provide more detailed recommendations if desired.

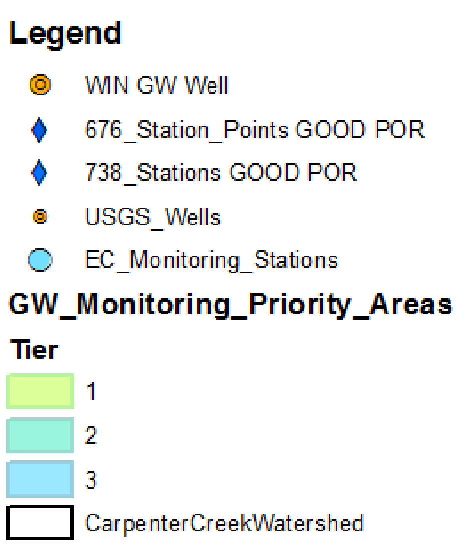
2.4. Sediment Cycling Evaluation

Characterization of sediment flux dynamics and internal loading from legacy sedimentation should be evaluated in Texar Bayou since sediment quality and deposition are inherent issues in the bayou. This would include a pre-screening sediment characterization sampling event, which would inform locations to conduct a benthic nutrient flux study. The results of the flux study would provide site-specific nutrient flux rates and loads from the sediment. Recommendations on sediment management could then be provided on a detailed basis by identifying hot spots within the bayou that require immediate attention to reduce persistent nutrient contamination derived from the sediment.

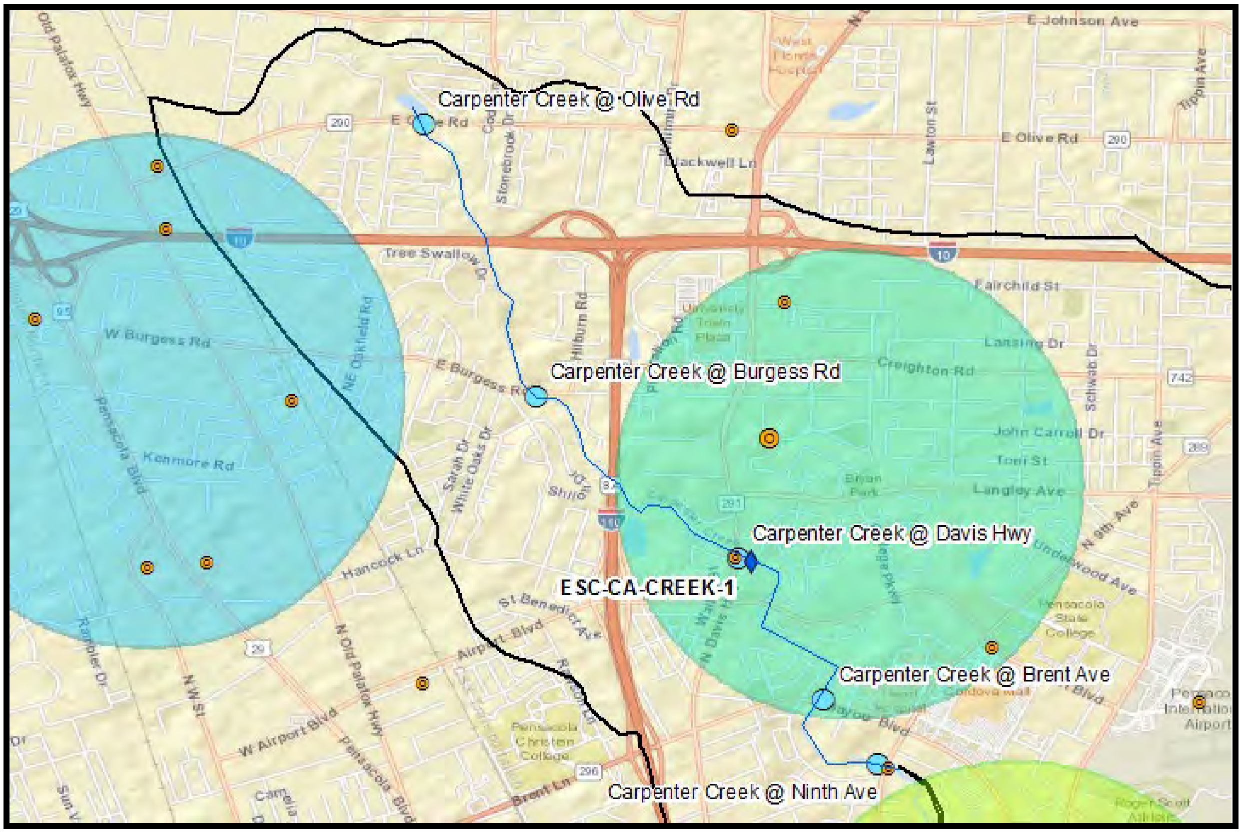
3.0 LONG-TERM MONITORING PROGRAM

A long-term monitoring program can de designed after some of the components from the Comprehensive Program are implemented. Ideally, a variation of the items described in the Basic and Comprehensive monitoring programs should provide the County with sufficient data to effectively assess changes to water quality and trends in the system. This program will be based on available budget and results from data reviewed from the Basic and Comprehensive Programs.

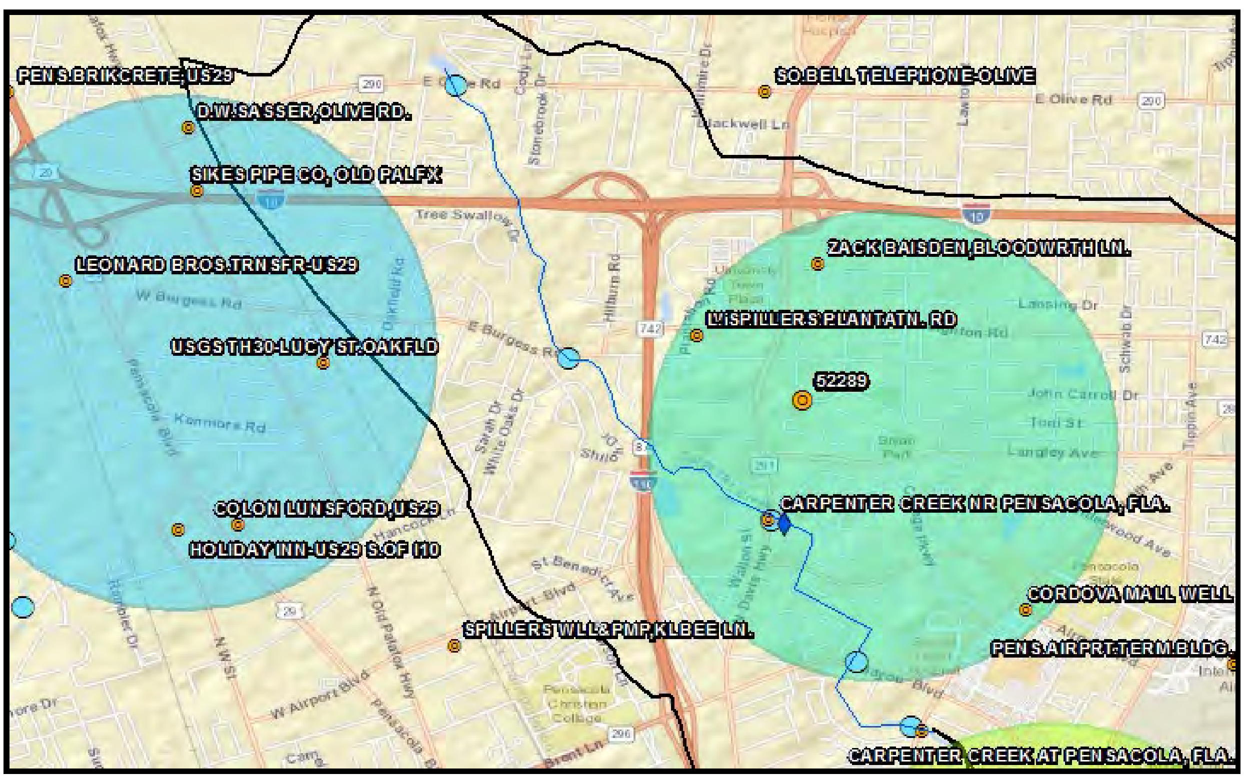
Figures Showing Existing Station within Tiers




CARPENTER CREEK AT PENSACOLA, FLA.
PENSACOLA,FL WBAP
W93859 PENSACOLA FAA AP
NOAA STATION 6997
Bayou Texar @ 12 Ave
BAYOU TEXAR AT 12TH AVE BRIDGE
ALVIN VOSS-10TH AVE
ESC-BA-TEX-1
Bayou Texar @ Seville Dr
0267136
USGS OBS.WELL 026-713-5
PENSACOLA 12TH AVE. WELL
ESC-BA-TEX-2
Bayou Texar @ Hyde Park Rd
ESC-BA-TEX-3
Bayou Texar
WELL 2 NR PENSACOLA, FL
USGS TH1-17TH&GONZALEZ ST
USGS THIA-17TH&GONZALEZ
Pensacola



Carpenter Creek @ Olive Rd
Carpenter Creek @ Burgess Rd
Carpenter Creek @ Davis Hwy
ESC-CA-CREEK-1
Carpenter Creek @ Brent Ave
Carpenter Creek @ Ninth Ave



PENS.BRIKCRETE,US29
D.W.SASSER,OLIVE RD.
SIKES PIPE CO, OLD PALFX
SO.BELL TELEPHONE-OLIVE
LEONARD BROS.TRNSFR-US29
ZACK BAISDEN,BLOODWRTH LN.
W.SPILLERS PLANTATN. RD
USGS TH30-LUCY ST.OAKFLD
52289
CARPENTER CREEK NR PENSACOLA, FLA.
COLON LUNSFORD,US29
HOLIDAY INN-US29 S.OF I10
CORDOVA MALL WELL
SPILLERS WLL&PMP,KLBEE LN.
PENS.AIRPRT.TERM.BLDG.
CARPENTER CREEK AT PENSACOLA, FLA.

VOLUME 2 APPENDIX G

WOOD RECORD OF TECHNICAL REVIEW

E&IA - Record of Technical Review

Prop/Proj No: 600643.02.02	Prop/Proj Name: Carpenter Creek & Bayou Texar WMP
Prop/Proj Mgr: Crissy Mehle	Doc Revisions: Jeanette Kelson, Mary Szafraniec, Keith Johnson
Doc Name: Watershed Evaluation Report V3	Doc Date: March 16, 2021
Doc Type: ____ Letter _X___ Report ____ Design ____ Proposal _____ Drawing(s) ____ Other ______________________________	
Doc Status: _ ___ Preliminary __X__ Draft ___ _ Final	
Review Scope: Reviewed revisions to the report	
Review Status: _X___ Acceptable ____ Revise and Resubmit	
Technical Reviewer (print): Crissy Mehle	Date: 3/13/21
Technical Reviewer (signature): CMehle	

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E&IA - Record of Technical Review

Prop/Proj No: 600643.02.02	Prop/Proj Name: Carpenter Creek & Bayou Texar WMP
Prop/Proj Mgr: Crissy Mehle	Doc Originator: Jeanette Kelson, Mary Szafraniec, Kristen Nowak, Keith Johnson, Lee Altman, John Kiefer
Doc Name: Watershed Evaluation Report revised	Doc Date: November 17, 2020
Doc Type: ____ Letter _X___ Report ____ Design ____ Proposal _____ Drawing(s) ____ Other ________________________________	
Doc Status: _ ___ Preliminary __X__ Draft ___ _ Final	
Review Scope: Reviewed revisions to the report including additions of reference tables and revised text based on client comments.	
Review Status: _X___ Acceptable ____ Revise and Resubmit	
Technical Reviewer (print): Crissy Mehle	Date: 11/17/2020
Technical Reviewer (signature): CMehle	

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E&IA - Record of Technical Review

Prop/Proj No: 600643	Prop/Proj Name: Carpenter Creek and Bayou Texar WMP
Prop/Proj Mgr: Crissy Mehle	Doc Originator: Jeanette Kelson, Francesca Lauterman, Kristen Nowak, Mary Szafraniec, Lee Altman (SCAPE), Keith Johnson (WSI)
Doc Name: Watershed Evaluation Report	Doc Date: August 27, 2020
Doc Type: ____ Letter _X_ Report ____ Design ____ Proposal _____ Drawing(s) ____ Other ______________________________	
Doc Status: ____ Preliminary _X_ Draft ____ Final	
Review Scope: Jeanette, Crissy, and Lee provided detailed review of report sections including content, grammar, spelling, formatting. John Provided high level technical review of scope items.	
Review Status: _X_ Acceptable ____ Revise and Resubmit	
Technical Reviewer (print and sign): John Kiefer Jeanette Kelson Jeanette Kelson Crissy Mehle CMehle Lee Altman	Date: August 27, 2020

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