

ESCAMBIA COUNTY

CARPENTER CREEK & BAYOU TEXAR WATERSHED MANAGEMENT PLAN

DECEMBER 15, 2022





CARPENTER CREEK & BAYOU TEXAR

WATERSHED MANAGEMENT PLAN

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QUALITY MANAGEMENT

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1 WATERSHED MANAGEMENT PLAN INTRODUCTION

1.1 Project Authorization

In September 2019, Wood Environment & Infrastructure Solutions, Inc. (Wood), now operating as WSP USA Environment and Infrastructure Inc., 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, develop best management practices (BMPs), and identify future site-specific projects and activities through stakeholder engagement and best available science. The Wood team included Impact Campaigns, Wetland Sciences, Inc., and SCAPE Landscape Architecture. Funding for the development of the WMP was 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).

Please note that on September 21, 2022, WSP USA Inc. acquired Wood Environment & Infrastructure Solutions, Inc., and its subsidiaries. WSP USA E&I is a Nevada corporation. For record purposes, this report and supporting documentation contain references to “Wood” and the “Wood team,” pertaining to the entity under which the work was completed.

1.2 Project Purpose and Objectives

Carpenter Creek and Bayou Texar both suffer from historical pollution and ongoing challenges which impact the health of the watersheds’ ecosystems 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 these ecosystems. 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 habitats** for a more vital 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 Overview of Watersheds

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 respective waterways. Throughout this report, the Carpenter Creek and Bayou Texar watersheds will be referred to collectively as the watershed, where applicable.

CARPENTER CREEK

The creek is commonly called “Carpenters Creek” by some locals but is named Carpenter Creek (no “s”) by the Florida Department of Environmental Protection (FDEP). The creek is designated 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** in **Volume 2**. 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 creek's downstream portion and the bayou's entirety 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.

BAYOU TEXAR

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** in **Volume 2**. 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 that 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 the 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. Minimal natural riparian buffers exist, which has diminished the diversity and density of native vegetation. Additionally, most 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.

1.4 Project Elements

The project was conducted in three phases: Desktop Watershed Evaluation, Watershed Assessment/Reconnaissance, and Watershed Management Recommendations. Community and stakeholder engagement activities were injected throughout each of these phases for both sharing and gathering information and opinions. The project also included a review of existing water quality-driven regulations that govern the watersheds and specific recommendations for long-term monitoring and evaluation to gage the overall success of the plan's recommendations.

The Watershed Evaluation phase consisted of extensive collection and review of available datasets. Hundreds of files and pieces of information were collected and reviewed during this stage of the project. Following this phase, additional data was obtained through field reconnaissance and other methods. Newly collected information and the data collected during the Watershed Evaluation phase were used to conduct detailed assessments of the watersheds. Assessments included the development of hydrologic & hydraulic models to determine areas of flooding, pollutant loading models and statistical analysis to investigate water quality hot spots, and detailed categorical stream restoration alternatives, to name a few.

1.5 WMP Report Structure Overviews

Throughout the duration of the project, many reports, memorandums, and deliverables of other formats were prepared to document the details and findings related to the various project tasks. This WMP Report is purposely structured to serve as a comprehensive package to house the various completed task documents for future reference and use. The remainder of the WMP Report structure is organized with the following chapters:

- ▶ Chapter 2 Community Engagement – documents the memorandums and other information that serve to support the various community engagement efforts associated with the project (provided in **Volume 1**)
 - Chapter 2.1 Community Workshops
 - 2.1.1 Community Workshop –#1- February 2020 (supporting documentation provided in **Volume 1A** and **Volume 1B**)

- 2.1.2 Community Workshop – May, - May 2022 (supporting documentation provided in **Volume 1C**)
- 2.1.3 Community Workshop –#3- November 15, 2022 (supporting documentation provided in **Volume 1D**)
- Chapter 2.2 Additional Community Engagement Platforms (supporting documentation provided in **Volume 1E**)
- ▶ Chapter 3 - Desktop Watershed Evaluation - houses the comprehensive report that documents the findings of the extensive desktop review of available information for the watersheds (Watershed Evaluation and related appendices are provided in **Volume 2**).
- ▶ Chapter 4 - Watershed Assessment - contains various reports and memorandums that describe the findings of the assessment phase of the project. Assessments were completed for flooding, water quality, and stream conditions (provided in **Volume 3**).
 - 4.1 Flooding / Hydrologic & Hydraulic Assessment (supporting documentation provided in **Volume 3A**)
 - 4.2 Water Quality Assessment (supporting documentation provided in **Volume 3B**)
 - 4.3 Stream Conditions Assessment (supporting documentation provided in **Volume 3C**).
- ▶ Chapter 5 - Watershed Management Recommendations – documents the recommendations that were suggested for the watersheds, building upon the findings from the watershed evaluation and assessment stages of the project. Conceptual design recommendations were developed for 15 specific areas of the watershed. Also, three areas included “catalytic” concepts, emphasizing public access, recreation, use, and community resiliency.
 - 5.1 Site-specific Concepts (supporting documentation provided in **Volume 4A**)
 - 5.2 Catalytic Concepts (supporting documentation provided in **Volume 4B**)
- ▶ Chapter 6 - Review of Regulatory Framework – provides a comprehensive review of the existing active regulations in the watersheds that impact water quality and potential opportunities to coordinate efforts to meet the WMP goals. (Supporting documentation provided in **Volume 5**).
- ▶ Chapter 7 - Monitoring & Evaluation - describes the proposed strategy for monitoring the effectiveness of the actions recommended in the WMP (provided in **Volume 6**).
- ▶ Chapter 8 - Conclusions – summarizes the key findings and recommendations from the WMP.

Each of these chapters and sub-chapters can be viewed and referenced independently, as needed. Each chapter may contain its own figures, tables, and appendices that provide supplemental information to support its technical content.

2 COMMUNITY ENGAGEMENT

Early and routine engagement with the community and its stakeholders was essential to the project for two reasons. First, engagement was used to inform the stakeholders about the project's progress, findings, and recommendations. Second, engagement was critical for allowing for stakeholder feedback and input, which helped to drive the direction of the WMP and its recommendations. This chapter summarizes the multitude of community engagement efforts conducted as part of the project, provided in **Volume 1**.

2.1 Community Workshops

In total, there were three in-person community workshops held throughout the project, as bulletized below:

2.1.1 Community Workshop – February 2020

The first workshop was held near the project's commencement in February 2020. It was conducted over two days. On the first day, the project team became acquainted with the watershed through a guided site walk. The second day involved a small focus group meeting in the morning and afternoon and a large public meeting in the evening at the Booker T. Washington High School. The details of this community workshop are provided as **Volume 1A**.

During this community workshop, many stakeholders shared their individual accounts and memories of the watershed. They recounted memories regarding recreation, access, water quality, habitat, and wildlife encounters, etc., along Carpenter Creek and Bayou Texar. These documentations are memorialized in **Volume 1B**.

2.1.2 Community Workshop - May 2, 2022

The second community workshop was held on the evening of May 2, 2022, at the Bayview Community Center. A key objective of this meeting was to understand stakeholder priorities related to the WMP recommendations and to solicit feedback to help drive the catalytic concepts in the watershed. A summary memorandum with details regarding this workshop is included in **Volume 1C**.

2.1.3 Community Workshop – November 15, 2022

The third community workshop was held on the evening of November 15, 2022, at the Bayview Community Center in Pensacola. A key objective of the meeting was to remind the public of the WMP recommendations and update them on the steps being taken toward initial implementation measures. This meeting served as the last in-person public engagement workshop for the project. A summary memorandum with details regarding the workshop is included in **Volume 1D**.

2.2 Additional Community Engagement Platforms

In addition to the community workshops noted above, other means of community and stakeholder engagement were used over the course of the project. These additional platforms included a project website, social media, emailed newsletters, earned media (such as the Pensacola News Journal), partnerships with educational partners (University of West Florida, Pensacola State College, Washington High School Marine Science Academy), "creek geek" interviews with project team members, and others. Virtual engagement became especially critical in order to continue community engagement efforts throughout the COVID-19 pandemic. Increased virtual engagement replaced one planned in-person public workshop in 2021. Additional details related to the community engagement platforms used throughout the project can be found in **Volume 1E**.

3 WATERSHED EVALUATION

The Watershed Evaluation an extensive literature and data review used to characterize the watershed and as a foundation for establishing work plans for the assessment phase. The Watershed Evaluation report is provided as **Volume 2**, which describes the characteristics of the Carpenter Creek and Bayou Texar watersheds related to hydrology, land use, soils, topography, potential sources of pollution, stormwater infrastructure, water quality, history and culture, public access, and ecological communities and invasive species, among other things.

Volume 2, Appendix F, titled “Monitoring Program Options for Carpenter Creek and Bayou Texar”, included recommendations to enhance the County’s ambient water quality monitoring program based on a preliminary data gap analysis, which summarized gaps in available data related to water quality and hydrologic & hydraulic information. The memorandum provided recommendations for three different monitoring program enhancement alternatives. The three alternative programs varied in complexity and cost and included a basic, comprehensive, and long-term program.

It should be noted that the Watershed Evaluation report was completed in March 2021. The information presented in the Watershed Evaluation report was considered accurate and represented the best available information at the time of the report submittal.

4 WATERSHED ASSESSMENTS

The watershed assessment phase of the project involved a detailed look into three primary categories: hydrologic & hydraulic (flooding issues), water quality, and stream conditions, provided in **Volume 3**. Building upon the desktop reconnaissance conducted under the Watershed evaluation, the assessment phase included model development, statistical analysis, field reconnaissance and verification, and other means to further assess the conditions of the watershed.

4.1 Hydrologic & Hydraulic (H&H) Assessment

An H&H model and accompanying GIS database was developed for the watershed using the Interconnected Channel and Pond Routing Version 4 (ICPR4) software. The comprehensive model was used to assist with identifying flood-prone areas, providing quantitative data for the water quality and stream analysis, and served as a test bed for alternative analysis scenarios during the recommendations stage. The report in **Volume 3A** details relevant background information, methodologies of model development, and the results of the H&H model simulations, which include design storm event and sea level rise scenario simulations.

In July of 2019, the City of Pensacola completed a Stormwater Master Plan, which included an H&H stormwater model in ICPR4. The ICPR4 model was developed for the entire City extent, which covers approximately 22.7 square miles. The model included limited areas beyond the city limits that were determined to contribute hydrologically/hydraulically to the City's modeled area. The Wood team utilized relevant portions of the City's model generally as-is to build upon for the entire Watershed extent.

The ICPR4 model and corresponding GIS database included subbasins, links, and nodes for modeled elements. The report in **Volume 3A** provides relevant information related to the model's findings and the limitations and assumptions regarding the use of the City's existing model.

4.2 Water Quality Assessment

The water quality assessment involved analyzing water quality data to identify trends, potential impairment risks, and hot spots, and to document noteworthy water quality issues that may be impacting the watershed. Exploratory statistical data analyses were conducted to understand the distribution of the data and assess relationships between certain parameters. Historical and recent water quality data were reviewed and analyzed for trends using available long-term data from monitoring stations within the watershed utilizing a variation of temporal and spatial attributes from the overall period of record.

Based on the recommendations presented in the preliminary water quality data gap analysis, included in **Volume 2, Appendix F**, conducted as part of the Watershed Evaluation phase, the County enhanced its existing ambient water quality monitoring program to include additional monitoring stations and parameters. Utilizing information attained during the Watershed Evaluation phase, along with the new data collected via the County's improved water quality monitoring program, the Wood team prepared a Water Quality Assessment Report, dated November 2021, and included in **Volume 3B**. The findings presented in the Water Quality Assessment Report were utilized in the development of watershed-wide recommendations, which are described in Section 5 of this report.

Appendix A of **Volume 3B** includes a Monitoring Program Gap Analysis and Geospatial Assessment, which provides an updated review of the County's enhanced monitoring program, including a review of new and additional data resulting from the County's enhanced monitoring program. This review identified several temporal data gaps in addition to an inconsistent collection of water quality parameters. Upon commencement of the water quality assessment, the Wood team developed a water quality assessment approach and a gap analysis related to existing data available in the Watershed. On April 17, 2020, the Wood team delivered a technical memorandum titled "Monitoring Program Options for Carpenter Creek and Bayou Texar", provided in **Volume 3B**, which provided a preliminary review of potential data gaps in the County's existing monitoring network, and recommendations for three different monitoring program enhancement alternatives. The three alternative programs varied in complexity and cost and included a basic, comprehensive, and long-term program. The County used these recommendations to make decisions to increase its monitoring program for four months, which provided more data points to better assess the water quality in the creek.

Utilizing information attained during the Watershed Evaluation phase, along with and newly collected data collected via the County's improved water quality monitoring program, the Wood team prepared a Water Quality Assessment Report, dated November 2021, and included in **Volume 3C**. The findings presented in the Water Quality Assessment Report were utilized in the development of developing watershed-wide recommendations.

A pollutant loading model was developed to assess nutrient loads generated from stormwater runoff at a subbasin level. The model utilizes the Environmental Protection Agency's (EPA's) Simple Method to estimate stormwater pollutant loads as the product of annual runoff volume and pollutant concentrations. Annual pollutant loads for each subbasin were analyzed for the 12 pollutants required by the EPA for National Pollutant Discharge Elimination System (NPDES) municipal separate storm sewer system (MS4) permits. An existing-conditions model and a future-conditions model were developed for the watershed. A hot spot map was created to help locate areas with relatively high total nitrogen and total phosphorus loading.

4.3 Stream Conditions Assessment

In addition to the water quality and hydrologic & hydraulic assessments, a stream conditions assessment was completed as part of the WMP. The stream conditions assessment included a channel system classification, categorical improvement recommendations, unit costs and a total life-cycle cost model, open channel system GIS maps, and a compiled stream assessment report and guidance manual for future implementation. The Stream Assessment Guidance Manual and Summary Report is included as **Volume 3C**.

Attachment A of **Volume 3C** contains the channel system classification, which documented the first step toward developing a guidance manual for stream restoration concepts in the watershed. The report created descriptions of the streams and tributaries in the watershed based on their key geomorphic processes, geography, physical integrity, and resiliency, which are key variables in understanding and conceiving potential remedies. This document includes maps depicting geomorphic classifications and the degree of channel stability and vulnerability. Ultimately, this understanding was used to conceive and categorize effective time-critical and long-term management and restoration strategies and techniques across the watershed.

Building upon the channel classifications detailed above, categorical channel improvements were developed, which delved into the treatment options available to create a more stable and resilient drainage network in balance with the hydraulic and sediment loads of the watershed. The memorandum, included in **Attachment B** of **Volume 3C**, describes treatments that were suggested for incorporation into the WMP to provide alternatives to create a more stable stream condition.

Then, a Unit Cost and Life-Cycle Cost Estimate Report was developed, provided in **Attachment C** of **Volume 3C**, providing a cost-benefit analysis (CBA) for stream corridor restoration activities described in the former tasks. A triple-bottom-line approach was used to account for the combined financial, environmental, and social dimensions of each assessed retrofit type.

A holistic approach, in conjunction with the development of the watershed-wide recommendations for the WMP, was taken toward developing a channel management system, which describes a process for selecting from among the treatment alternatives for any given stream segment. The channel system classifications and mapping, categorical improvements assessment, and cost-benefit analysis were considered, along with the results of the H&H and water quality modeling assessments, existing and potential recreational and public access opportunities, and feedback from stakeholders, to develop recommendations for channel and watershed improvement projects.

The Stream Assessment Guidance Manual and Summary Report, presented in **Volume 3C**, summarizes all stream assessment components described above, and serves as a guidance for future implementation of proposed stream restoration projects. Ideally, all top-ranked stream restoration projects would be designed, permitted, and constructed concurrently. Simultaneous implementation would take at least three years from design commencement to construction completion. However, a phased implementation may be a better option due to the limited funding availability and other factors. The Stream Assessment Guidance Manual and Summary Report presents recommendations related to prioritization and phasing for the implementation of the alternatives.

5 WATERSHED MANAGEMENT RECOMMENDATIONS

5.1 Site-specific Concepts

Utilizing the findings from the desktop Watershed Evaluation and the Watershed Assessments, Watershed-wide recommendations were developed based on several key factors, including assessment results, known issue areas, available public lands, appropriate land use designations and easements, and previous discussions with potential private partners. Water quality, hydromodification, erosion and sedimentation, invasive plants and wildlife, localized flooding, sea level rise, and community equity and public access were identified as primary concerns and, therefore, are the focus of watershed-wide recommendations. Initially, 48 sites/areas were identified as potential recommendation areas. The preliminary list of sites was pared down to 15 locations based on feedback from Escambia County and the City of Pensacola, further evaluation of concept feasibility, assessment of available lands, and other things. In some cases, multiple sites/areas were clustered into one to create a larger-scale impact.

Volume 4A provides the report detailing the 15 site-specific recommendations, scoring criteria, and concept plans. Technical stakeholder input was solicited and used to improve the draft recommendations. The details of the stakeholder input are also provided as part of **Volume 4A**.

In addition to the 15 site-specific recommendations, watershed-wide programmatic recommendations were also put forward in the report. These programmatic recommendations could be advantageous for reaching overall restoration objectives and include things like appointing a watershed task force or coordinator to lead watershed restoration efforts, strategic land acquisition and conservation, stormwater and water quality data and database expansion, septic abatement coordination, revisions to existing ordinances, codes, and regulations, and watershed-wide stormwater retrofit opportunities.

5.2 Catalytic Concepts

Following the development of the 15 site-specific recommendations in the watershed, and accounting for feedback gleaned from the community workshop held on May 2, 2022, three of the 15 locations emerged as priorities for catalytic recommendations. Catalytic design is guided by three central principles that speak to the RESTORE grant categories and priorities articulated by watershed residents and stakeholders:

- ▶ Ecological restoration
- ▶ Historical and cultural recognition
- ▶ Equitable public access

Above all others, three of the 15 sites were deemed to be most appropriate for additional catalytic consideration. These three sites included the following:

- ▶ The Creek from Davis Highway to Airport Boulevard (located within “The Creek at Sterling Hills”)
- ▶ The Creek at Jennie’s Swimming Hole (located within “The Creek from Davis Highway to 9th Avenue”)
- ▶ The Creek at N 9th Avenue (located at the intersection of “The Creek from Davis Highway to 9th Avenue” and “The Creek from 9th Avenue to 12th Avenue”)

Each of the three areas required a site-specific design process. Public feedback on preferred programming guided the design and were evaluated for feasibility based on site constraints, including existing topography, proposed stream restoration profiles, and adjacent land ownership and uses. Specific design exercises included comparison scale studies to understand the applicability of various park precedents and programmatic elements, conceptual grading studies to minimize switchbacks and other disturbances along accessible paths within the floodplain and identifying key gathering locations.

In addition to previous community engagement and technical expertise, the design development of these three sites was driven by input from a targeted stakeholder workshop held on June 6, 2022.

The memorandum that documents the catalytic site selection and design is included in **Volume 4B**.

6 REVIEW OF REGULATORY FRAMEWORK

A thorough review of applicable rules granted to local, state, and federal entities in the watershed to address water quality issues, including nutrient and pathogen control and stormwater runoff, was completed in support of the WMP. Regulations that govern and impact water quality either directly or indirectly may be found at all levels of government. The narrative in **Volume 5** summarizes each applicable rule, describes the resource agency with the regulatory purview, and discusses potential opportunities to coordinate efforts or integrate goals or strategies identified within the WMP.

Regulations reviewed include the federal Clean Water Act and Coastal Zone Management Act. State regulations and information reviewed included the Environmental Land and Water Management Act, the Florida Water Resources Act, the State Comprehensive Plan, the Local Government Comprehensive Planning and Land Development Regulation Act, the Community Planning Act, the Florida Watershed Restoration Act, the State Water Resource Implementation Rule, the Air and Water Pollution Control Act, the Florida Pollutant Discharge Prevention and Control Act, the Water Quality Assurance Act, the Environmental Resource Permitting Program, Standards for Onsite Sewage Treatment and Disposal Systems, the 2020 Clean Waterways Act, the Florida Coastal Management Program, the National Pollutant Discharge Elimination System (NPDES) rules, and the Wastewater Collection System and Transmission Facilities rule.

Local Escambia County and City of Pensacola regulations and ordinances were also reviewed. Escambia County regulations reviewed included the Escambia County 2030 Comprehensive Plan, County ordinances related to zoning, stormwater management, wetland protection, marine, estuarine, and riverine shoreline protections, tree protections, storage of hazardous or infectious wastes, and urban fertilizer usage.

City of Pensacola regulations and ordinances included rules related to future land use and zoning, shoreline protection districts (Bayou Texar), stormwater management and control of erosion, sedimentation, and runoff, tree protection codes, and the fertilizer ordinance. A discussion was also included in **Volume 5** regarding the City's existing stormwater utility fee, which was put in place in response to the overwhelming stormwater improvements needed within the City of Pensacola. It should be noted that Escambia County does not currently have such a stormwater utility fee in place.

The narrative in **Volume 5** also includes recommendations for consideration to help achieve the overall goals of the Watershed Management Plan. Recommendations were suggested for Escambia County and the City related to stormwater design requirements, fertilizer ordinances, litter ordinances, and the use of stakeholder input to guide local codification. Consideration of the development of a stormwater utility fee was also explicitly noted for Escambia County.

7 MONITORING AND EVALUATION

Watershed management plans and programs require a broad and effective monitoring and evaluation strategy to track performance against objectives and provide information to help managers at all levels with the implementation of WMP recommendations. The narrative in **Volume 6** provides a monitoring and evaluation strategy specifically tailored to track the performance of the recommendations provided as part of the Carpenter Creek and Bayou Texar WMP.

As described in **Chapter 5**, 15 site-specific project recommendations were developed as part of the WMP, all of which were designed to execute watershed management goals and objectives. The projects were organized by segments beginning near the headwaters of Carpenter Creek (Headwater Sites), further downstream along Carpenter Creek (Creek Sites), and finally progressing into and ending at Bayou Texar (Bayou Sites).

Each of the 15 identified projects is unique with differing goals and implementation strategies. To effectively understand the true benefits of each project it is important to develop metrics that may be monitored to evaluate improvements to the Carpenter Creek and Bayou Texar watersheds resulting from the implementation of each project. The WMP is anticipated to have a long life and hopefully, will be used as a guide by County and City officials to continually find new opportunities to further program goals. As such, monitoring and evaluation should be reactive and adaptive to the continual progression of the WMP. The monitoring and evaluation plan should be periodically reviewed and, if necessary, updated to address the evolution of the WMP.

Volume 6 provides suggested monitoring methodologies for surface water quality, biological indicators, and geomorphic stream conditions, as well as procedures for sample collection, documentation, and data analysis. Specificity is provided for the proposed monitoring methodologies and procedures for each of the three project-area segments (Headwaters, Creek, and Bayou).

8 CONCLUSIONS

In summary, implementation of all 15 proposed site-specific conceptual designs is estimated to result in the removal of approximately 3,300 lb/year of total nitrogen (TN), 118.5 lb/year of total phosphorus (TP), and 2,224.8 tons/year of sediment, while allowing for restoration of approximately 2.4 miles of stream/creek length and approximately 27.5 acres of wetlands.

The single most impactful site-specific concept, in terms of potential pollutant removal and restoration, is “The Creek from Davis Highway to 9th Avenue (Site 10)” (see **Volume 4A**). This concept is estimated to allow for the removal of approximately 1,954 lb/year of TN and 2,000 tons/year of sediment, with the potential restoration of approximately 1.3 miles of stream/creek length and 14.6 acres of wetlands.

The WMP also includes proposed programmatic recommendations that undoubtedly would offer additional unquantified benefits on a watershed scale if implemented. These programmatic recommendations include things like strategic land acquisition and conservation, expansion of the County’s water quality monitoring program, septic abatement program coordination, enhanced litter and trash abatement, revisions to codes and ordinances, and identification of stormwater retrofit opportunities for low-impact development (LID) and green infrastructure (GI), among others. There are also “human” benefits offered to the community by many of the 15 proposed site-specific concepts and the three proposed catalytic projects. These benefits are immeasurable and include things like enhanced public access and recreation, connection to the creek and bayou, community resiliency, etc.

While the immediate implementation of all the WMP’s proposed recommendations would certainly be ideal in terms of overall watershed benefit, it’s likely more realistic to assume a phased approach to implementation for many reasons. County and City staff resource capabilities and limitations, funding cycles, grant development, and thoughtful consideration for the timing of other County and City projects and initiatives, among other factors, will need to be considered for implementation planning.

Funding projects and activities on a watershed scale can be a complex process. Watershed boundaries do not follow municipal jurisdictions; therefore, successful implementation of the proposed recommendations depends on the long-term commitment of financial resources and cooperation between local, County, City, and state governments, non-profits, academic institutions, utilities, stakeholders, as well as surrounding communities. There are a variety of different resources to consider for implementation funding, including federal, state, and local funding sources, as well as public-private partnerships. Leveraging multiple funding opportunities simultaneously will maximize the implementation potential of the WMP. Ultimately, success will be linked to the degree of coordination and level of financial resources available. Many of the proposed recommendations will require public-private partnerships between landowners and sponsors, such as local governments, utilities, academia, or civic/non-profit organizations. Establishing an inter-governmental partnership may provide additional funding options for watershed management and may be the most effective way to accomplish the goals of the WMP.

Finally, and perhaps most importantly, an immediate recommendation is suggested for developing or designating a “Watershed champion” or a “Watershed Management Plan Implementation Team.” The designated champion, or team of champions, can be selected or nominated from various sources and may include County and City staff, academic leaders, non-profit organization members, professional consultants, members or leaders of the Pensacola and Perdido Bays Estuary Program, etc. Much excitement and momentum have been gained during the course of the WMP development, and it would be beneficial to continue this momentum into the implementation stage to ensure success.