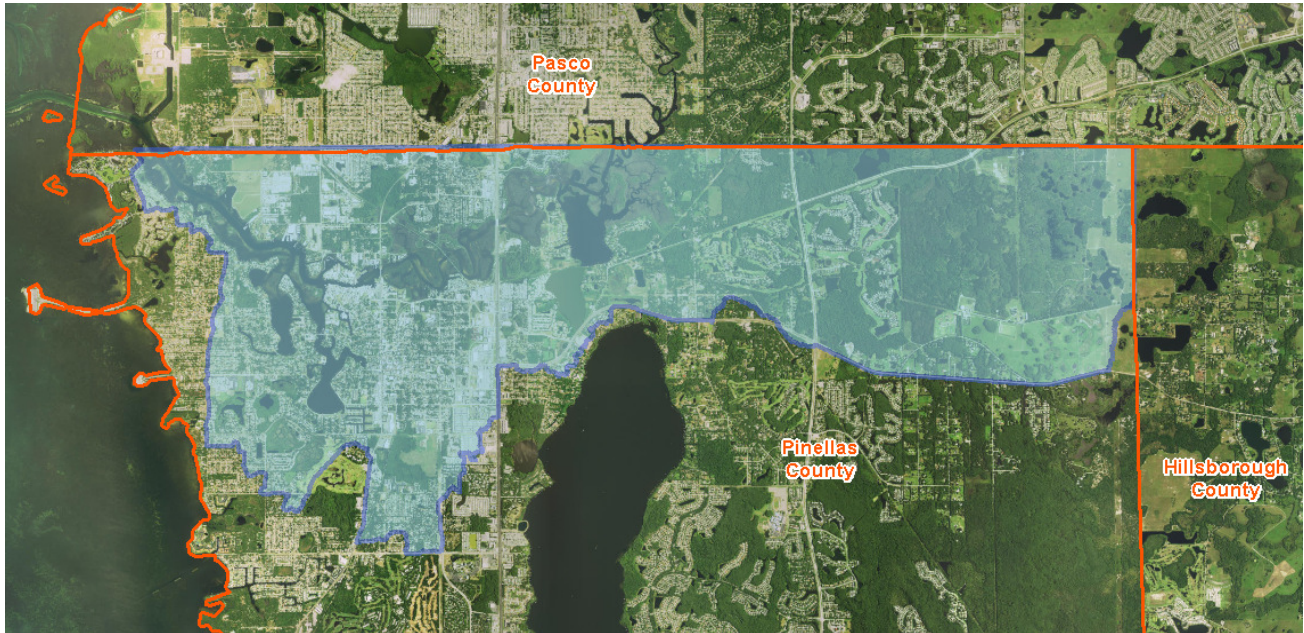




Anclote River Watershed Management Master Plan

Final Project Plan



Prepared By

ATKINS

July 2017



Southwest Florida
Water Management District



TABLE OF CONTENTS

Chapter	Page
Table of Contents	i
1.0 PROJECT PLAN	1
1.1 Authorization.....	1
1.2 Project Location	1
1.3 Goals and Objectives.....	2
1.4 Scope of Work (SOW)	3
1.5 Project Approach.....	3
1.6 Project Schedule.....	7
1.7 Project Cost and Staff Allocation.....	7
1.8 Quality Assurance Plan	8
1.9 Communication Plan.....	8
1.10 Assumptions and Issues Management	8
Appendix A: Scope-of-Work	
Appendix B: Project Budget Spreadsheet	
Appendix C: Quality Assurance/Quality Control (QA/QC) Plan	

1.0 PROJECT PLAN

1.1 Authorization

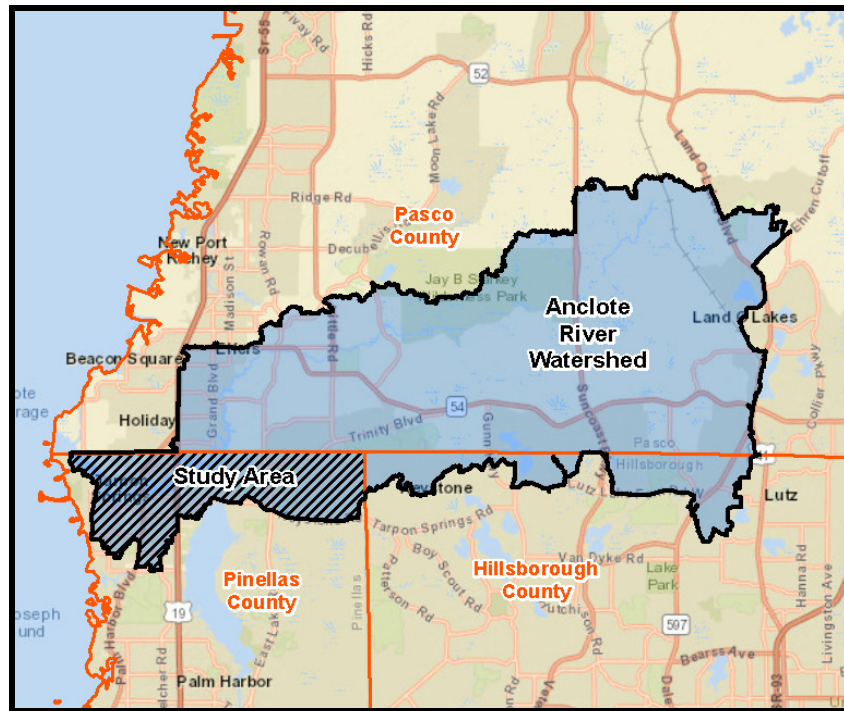
Pinellas County (County) has authorized Atkins North America, Inc. (Atkins) to conduct a watershed management plan for the Pinellas County portion of the Anclote River watershed under RFP 167-0002-NC (SS) which was executed on April 26th, 2017. Work for this project will include project development; watershed evaluation; surface water resource assessment (SWRA); watershed management plan-floodplain analysis; and watershed management plan-floodplain level-of-service, drainage improvement alternatives analysis and recommendations.

1.2 Project Location

The Anclote River Watershed encompasses over 120 square miles. The lower and westernmost portion of this watershed lies within Pinellas County, as shown in **Figure 1.1**. This 14-square-mile portion of the watershed will be the focus of this study. The Anclote River originates in south-central Pasco County, near US 41 and north of SR 54. The river flows to the west where it traverses the Jay B. Starkey Wilderness Park before crossing under Starkey Boulevard and flowing through the residential areas of Seven Springs, Elfers, and Holiday in Pasco County. The river then enters Pinellas County just west of East Fern Lake Road where the main channel becomes tidally influenced. In Pinellas County, the river begins to meander with many oxbows as it flows by Salt Lake, Tarpon and Kreamer Bayous before discharging to the northernmost portion of Saint Joseph Sound.

The study area for this project includes the approximately 9,095 acres of the watershed located within Pinellas County. **Figure 1.1** is a location map showing the estimated study area.

Figure 1.1
Project Location Map



1.3 Goals and Objectives

The County, in cooperation with the Southwest Florida Water Management District (District) and City of Tarpon Springs (City), has identified the implementation of a Watershed Management Program as one of its Comprehensive Watershed Management initiatives. This program provides the methodology to evaluate the capacity of a watershed to protect, enhance and restore water quality and natural systems, while achieving flood protection.

The Anclote River Watershed Management Master Plan (WMP) provides an evaluation of the watershed to identify problems requiring management of resources and recommend solutions affecting water quantity and natural resources. The WMP will include the initial data collection of design and water quality data; the evaluation of the 25-year and 100-year existing conditions design storm event flood elevations; the creation of an appropriate hydraulic/hydrologic model; and the development of a management plan that provides recommendations for non-structural and site-specific structural improvements. A pollutant loading model will be developed to estimate pollutant loads generated by subbasins; and relative pollutant loads delivered from the watershed to St. Joseph Sound. The model will also estimate pollutant load reductions that may result through implementation of the recommended alternatives.

The WMP will include, as feasible, the conceptual design for recommended structural alternatives that will be necessary to determine permitting and construction feasibility, and cost effectiveness at the planning level. This plan does not include preparing plans or information for permit applications or FEMA submittals. The WMP will also address the Florida Department of Environmental Protection's (FDEP) Total Maximum Daily Load (TMDL) program.

1.4 Scope of Work (SOW)

The Anclote River Watershed Management Master Plan will be completed through a series of tasks as outlined in the project scope-of-work shown in **Appendix A**. This scope-of-work includes the details for each task, including deliverables, budgets and schedules. This project will be funded through a series of purchase orders (PO) corresponding to County fiscal years.

1.5 Project Approach

As shown in the SOW included in **Appendix A**, the Anclote River Watershed Management Plan will be completed in four major tasks: Project Development; Watershed Evaluation; WMP-Floodplain Analysis; and WMP-FPLOS, SWRA, Drainage Improvement Alternatives Analysis and Recommendations. Atkins proposes the following approaches to execute project tasks.

- Project Development
 - Data Collection and Initial Evaluation
 - County to provide the 2016 aerials; Capital Improvement Plans (as-builts and permitted); water quality data; and stormwater inventory data. District to provide digital Environmental Resource Permits; PACE model data and deliverables; and high water mark database. City of Tarpon Springs to provide flooding documentation; Capital Improvement Plans (as-builts and permitted); and data from existing design projects.
 - The latest Land Use/Land Cover GIS layer will be downloaded from the District.
 - Draft/Final Project Plan
 - Project manager to develop a draft and then final project plan that includes scope-of-work, deliverables, approach, budget, schedule, project quality assurance plan and project communication plan.

- Kick-off Meeting
 - Project manager and deputy project manager to attend a project kick-off meeting with County, District and City.
- Watershed Evaluation
 - Assembly and Evaluation of Watershed Data
 - Drainage Pattern and Watershed Boundary
 - Atkins to evaluate 2016 aerials, project DEM, updated boundaries of available watershed studies, and plan/permit data to evaluate changes to drainage patterns and potential project boundary.
 - Areas of Development
 - Atkins will review the plan/permit data and the 2016 aerials to determine which plans/permits need to be incorporated.
 - Topographic Voids
 - Atkins will utilize the project DEM in addition to the 2016 aerials to identify topographic voids. A meeting/conference call will be held to determine which DEM this project will utilize.
 - Historical Water Levels
 - The District will provide the most up-to-date high water level database.
 - Significant development throughout the watershed has led to changes to drainage patterns, potentially causing many of the historical water levels to no longer be valid. Atkins will evaluate the data in the database to determine which data is valid for use in a validation process.
 - Hydrologic and Hydraulic Feature Database
 - Atkins will develop the HydroJunctions, HydroEdges, and Hydraulic Element Points (HEP) using stormwater inventory data, PACE model data and plan/permit information.
 - Atkins will update the District's Land Use coverage to reflect conditions shown in the 2016 aerials.

- No changes are anticipated for the soils coverage. The latest Natural Resource Conservation Service (NRCS) soil information will be used.
- Atkins will conduct a hydraulic inventory (field reconnaissance) of non-permitted hydraulic features needed to model the watershed and are reasonable to access.
- Preliminary Model Features
 - Atkins will process all data collected, with an emphasis on catchments, connectivity and overflows, to develop the final hydro network.
- Peer Review of Watershed Evaluation and Model Parameterization Approach
 - County will conduct a peer review of the completed watershed evaluation tasks.
- Final Approved Watershed Evaluation Deliverables
 - Atkins will make updates to address comments from the County, District and Peer Reviewer
- WMP-Floodplain Analysis
 - Watershed Model Parameterization
 - Atkins will establish model parameters based on best available information. Ex. Node initial stages will be based on control structure elevation, orthophotography or seasonal high water levels.
 - Watershed Model Development and Floodplain Delineation
 - Model calibration and verification will be performed based on recent storm events lasting at least 10 hours and meeting or exceeding the magnitude of a mean annual storm event.
 - Existing conditions for multiple design storm events (2.33-year, 10-year, 25-year, 50-year and 100-year, 1-day events; and 100-year, 5-day event) will be simulated.
 - Atkins will delineate the 100-year floodplain with the 100-year/24-hour design storm event. Floodplain transitions will not be included in the draft floodplain but will be added as a part of the final floodplain delineation following the Peer Review task.

- Peer Review of Watershed Model Development and Floodplain Delineation
 - County will conduct a peer review of the completed model development and floodplain tasks.
- Final Approved Floodplain Analysis Deliverables for Open House
 - Atkins will make updates to address comments from the County, District and Peer Reviewer
- Floodplain Open House
 - A public meeting will be conducted to present the draft floodplain delineation.
- Final Approved Floodplain Analysis Deliverables
 - Atkins will make updates to address comments from the open house
- WMP-FPLOS, SWRA, Drainage Improvement Alternatives Analysis and Recommendations
 - FPLOS
 - Atkins will perform an existing conditions level of service analysis. A meeting will be held to determine the level of service criterion to use for the analysis.
 - Surface Water Resource Assessment
 - Atkins and Environmental Science Associates (ESA) will work with Pinellas County to develop an approach to evaluate watershed water quality and help in the establishment of total maximum daily loads (TMDLs). Once an approach is established, a pollutant loading model and water quality analysis will be performed to meet the project needs.
 - BMP Alternatives Analysis and Recommendations
 - Atkins will conduct analysis for up to ten (10) structural BMPs and two (2) non-structural BMPs to address flooding and water quality needs throughout the watershed.
- Project Management – This task will be included throughout the project duration and will include progress meetings and/or conference calls; as well as quality assurance/quality control (QA/QC) checks and documentation.

1.6 Project Schedule

The Anclote River Watershed Management Master Plan is anticipated to be completed in three (3) years from the notice to proceed. A project schedule is included in the scope-of-work shown in **Appendix A**.

1.7 Project Cost and Staff Allocation

The Anclote River Watershed Management Master Plan is budgeted to be completed for approximately \$808,760. A detailed budget, covering all project tasks, is included in **Appendix B**. A summary of the staff assigned to this project and a general description of their role is included below:

Charlotte Maddox, D.WRE, PE: Contract Manager
Shayne Paynter, Ph.D., PE, PG: Principle-In-Charge
Mark Erwin, PE, CFM: QC Officer
Andrea Graves, P.E.: Project Manager
Daniel Parson, P.E., CFM, ENV SP: Deputy Project Manager
Joe Walter, P.E.: Senior Engineer
Andrew Sharnprapai: Staff Engineer
Jon Gale, CFM: Staff Engineer
Nicholas Stapf, EI: Staff Engineer
David Tomasko, PhD: Senior Scientist
Emily Keenan: Staff Scientist

1.8 Quality Assurance Plan

Consistent with internal Atkins' quality control policies, Atkins staff develops a Quality Assurance/Quality Control (QA/QC) plan for every project that we complete. This QA/QC plan must demonstrate how reviews will be performed on project deliverables to ensure the following quality objectives:

- Ensure all actions assigned to Atkins in the task work assignment and scope of work are carried out according the contract requirements.
- Define work elements thoroughly prior to task initiation to eliminate rework.
- Identify problems and/or conflicts immediately upon recognition and take immediate steps to rectify them.
- Maintain a record of QA/QC activities.

In keeping consistent with Atkins requirements, a QA/QC plan for the Anclote East Watershed Management Plan Update has been developed and is included in **Appendix C**. This plan includes a summary of QA/QC procedures, in addition to listing the major work elements, the staff person/people predicted to initiate the review on the major work element, and the senior engineer who will be responsible for performing the review.

1.9 Communication Plan

As Atkins project manager, Andrea Graves, P.E., will serve as the point of contact for the Anclote River Watershed Management Mater Plan. In her role as project manager, she will be responsible for County coordination, project quality assurance/quality control, progress reports and meetings, invoicing, and all project deliverables. Deliverables will be submitted directly to Pinellas County, who will then coordinate distribution of deliverables to project stakeholders as appropriate.

1.10 Assumptions and Issues Management

Project Assumptions:

Assumptions made relative to this project have been listed directly within the project scope-of-work included in **Appendix A**. Changes to project assumptions may impact overall project budget and schedule. Project assumptions, scope-of-works, budget and schedule will be evaluated at key points throughout the duration of the project. Changes to any of these items will be discussed and modified only after agreement of both the County and Atkins.

Project Issues:

Project issues will be communicated to the County by the project manager as soon as they are determined. The County and Atkins will work together to address and/or resolve any potential issues and will modify this project plan (including scopes-of-work, schedule and budget), as appropriate, to address these issues. It is expected that this project plan will be updated at key points throughout the project.

Completion of this project is dependent on completion of stakeholder and peer reviews. Delays in completion of these reviews could impact the overall project schedule.

Issues Management:

In the event that Atkins falls behind schedule (unless for delays beyond Atkins' control), additional qualified staff will be assigned to this project to ensure that the project schedule is met. Atkins has over 2,500 employees nationwide that can be utilized, including nearly 900 employees in Florida and 200 in our fully staffed and operating office in Tampa.

In the event of key personnel leaving the project team, Atkins will immediately reassign the personnel's tasks and/or responsibilities to an equivalent or more qualified Atkins staff member.

APPENDIX A

Scope-of-Work

Exhibit A

**TASK ORDER
SCOPE OF SERVICES**

**PROFESSIONAL SERVICES
Contract No.: 167-0002-NC (SS)**

**For
Anclote River Watershed Management Master Plan
County Project No. 003064**

Prepared for:

**Pinellas County
Department of Public Works
22211 US Hwy 19 N Bldg 10
Clearwater, FL 33765**

Prepared by:

**Atkins
4030 West Boy Scout Blvd, Suite 700
Tampa, FL 33607**

February 2017

Table of Contents

OBJECTIVE	3
BACKGROUND	5
PROJECT DESCRIPTION	5
PROJECT SCOPE OF WORK.....	6
COMPENSATION	29

Scope of Services

PROJECT TITLE

Anclote River Watershed Management Master Plan (Project # 003064A)

OBJECTIVE

The Anclote River Watershed Management Master Plan (WMP) provides an evaluation of the watershed to identify problems requiring management of resources and recommend solutions affecting water quantity and natural resources. The WMP will include the initial data collection of design and water quality data; the evaluation of the 25-year and 100-year existing conditions design storm event flood elevations; the use of an appropriate hydraulic/hydrologic model that is accepted by the National Flood Insurance Program (NFIP), Pinellas County (COUNTY) and the Southwest Florida Water Management District (DISTRICT); and the development of a management plan that provides recommendations for non-structural and site-specific structural improvements. Interconnected Pond Routing version four (ICPRv4) is the preferred surface water modeling software package and will be used for this project unless the County otherwise directs the use of ICPRv3.2. A switch to ICPRv3.2 may be initiated by the COUNTY at any point before Task 2.2.3.3 (Model Parameterization) begins. A pollutant loading model will be developed to estimate pollutant loads generated by subbasins; and relative pollutant loads delivered from the watershed to St. Joseph Sound. The model will also estimate pollutant load reductions that may result through implementation of the recommended alternatives.

The WMP will include, as feasible, the conceptual design for recommended structural alternatives that will be necessary to determine permitting and construction feasibility, and cost effectiveness at the planning level. This plan does not include preparing plans or information for permit applications or FEMA submittals. The WMP will also address the Florida Department of Environmental Protection's (FDEP) Total Maximum Daily Load (TMDL) program.

1.1 Limits of Work

- 1.1.1 The WMP shall encompass all areas for the improvements described herein and shall extend to those boundaries delineated as the Pinellas County portion of the Anclote River watershed, a total area of approximately 9,095 acres. A detailed project area will be determined upon project initiation.

- 1.1.2** Proposed improvements, when feasible and practical, should be contained within the limits of existing publicly owned lands, rights-of-way, or easements. Regional improvements on privately held land that could further the objectives of the WMP may also be considered.

1.2 Key Personnel

- 1.2.1** The COUNTY and the DISTRICT reserve the right to approve/disapprove for whatsoever reason all personnel assigned to this project by the CONSULTANT. The individual(s) named in the proposal response and/or such other individuals who are to be assigned to work under this contract are necessary for the successful performance of this contract. The CONSULTANT agrees that whenever for any reason, one or more of the individuals named in the proposal are unavailable for performance under this contract; the CONSULTANT shall replace such individual(s) with an individual(s) of substantially equal abilities, qualifications, and demonstrated applicable experience, subject to approval by the COUNTY and the DISTRICT.
- 1.2.2** The CONSULTANT shall submit to the COUNTY a resume giving the full name, title, qualifications, and experience, for all successors and/or new persons prior to assignment of such personnel to perform work under this contract. Should the COUNTY or DISTRICT decide the successor personnel does not meet the qualifications of the replaced personnel, or in the case of new personnel, the COUNTY or DISTRICT determines they are not qualified to perform the work assigned, the COUNTY will advise the CONSULTANT accordingly. The CONSULTANT shall then submit name(s) and qualifications of an individual(s) to the COUNTY until a determination is made by the COUNTY or DISTRICT that the replacement individual(s) has substantially equal abilities, qualifications, and demonstrated applicable experience of the individual(s) named herein.
- 1.2.3** The designated Project Manager shall serve as the project representative for the CONSULTANT. The CONSULTANT, in recognition of the existing Cooperative Agreement, will submit correspondence to the COUNTY and the DISTRICT, who will in turn copy project correspondence to all members of the TEAM as appropriate.

BACKGROUND

The Anclote River watershed within Pinellas County has an area of 9,095 acres and is the largest river system in Pinellas County. In recent years, the watershed and its associated natural resources have begun to exhibit signs of ecological stress. The watershed is now listed on the State's verified impaired waters list for dissolved oxygen and nutrients. Dominant land use categories in the Anclote River watershed include residential, commercial and recreational open space. The main channel of the Anclote River flows from east to west, ultimately discharging into St. Joseph Sound. The primary tributaries to the Anclote River have existing poor water quality and are known to contribute significant sediment loadings to St. Joseph Sound.

PROJECT DESCRIPTION

The PROJECT involves the development of a comprehensive watershed management plan for the watershed that results in recommendations for water quality, flood control, and natural system improvement projects. Further, the WMP shall consider sea level rise, where appropriate, as part of the County's resiliency planning efforts. SWFWMD and Pasco County are currently working on an update to the WMP for the part of the Anclote River located in Pasco County.

Performing elements of the watershed management program in cooperation with local governments is one of the Comprehensive Watershed Management (CWM) initiatives implemented by the DISTRICT. CWM teams for each of the major watersheds of the DISTRICT were assembled to address issues regarding the DISTRICT'S four areas of responsibility: Flood Protection, Water Quality, Water Supply, and Natural Systems. Out of this team effort, the DISTRICT recommended strategies and goals to address issues associated with these areas of responsibility. A recurrent theme of the CWM teams is the need for a watershed decision support system by which current and projected watershed conditions could be evaluated.

The WMP addresses this need. The WMP includes five major elements: 1) Digital Topographic Information, 2) Watershed Evaluation, 3) Watershed Management Plan, 4) Identification of Best Management Practices (BMPs), and 5) Watershed Management Plan Database Maintenance and Watershed Model Updates. Implementing elements of the watershed management program with local governments is one of the CWM initiative strategies. The watershed management program provides a method of evaluating the capacity of a watershed to protect, enhance, and restore water quality and natural systems, while achieving flood protection, and of measuring the effectiveness of the strategies and goals of the CWM initiative to reach the desired watershed condition through data analysis, modeling, projection, evaluation.

PROJECT SCOPE OF WORK

2.1 Project Development

2.1.1 Data Collection and Initial Evaluation

This task includes coordination and research for the CONSULTANT to become familiar with the watershed, project goals, background, data available, scope of work, and the COUNTY/ DISTRICT study process and Guidance documents. The COUNTY/DISTRICT will provide or direct the CONSULTANT to obtain the following relevant information:

- Topographic Information (DEM created from 2016 LiDAR)
- Aerial Imagery
- Landuse and Soils Maps
- The DISTRICT Planning Units
- USGS National Hydrography Dataset (NHD)
- ERP Polygons
- Historical Water Levels
- USGS Gage Locations
- COUNTY/DISTRICT Data Collection Site Locations and Data
- Stormwater Inventory, if any
- Site-Specific Information, if any
- Existing Studies and Models, if any
- Adjacent Watershed Studies, if any
- Data Collection (based on built conditions shown on 2016 Aerials)

2.1.2 Draft Project Plan

The CONSULTANT will document the approach to execute tasks and identify outstanding project related issues; establish a communication protocol with members of the project team, the COUNTY, the DISTRICT, and other project stakeholders; and establish a project specific Quality Assurance/Quality Control (QA/QC) plan. This is the initial effort; however, this document shall be revisited periodically to assess the actual progress, evaluate staff allocations, and update the project budget spreadsheet.

2.1.3 Kick-off Meeting

Upon the acceptance of the draft Project Plan, the kick-off meeting will be conducted to discuss the draft Project Plan accomplished in Task 2.1.2. Details may be added for anticipated work effort and issues of importance.

2.1.4 Final Project Plan

The CONSULTANT shall finalize the Project Plan developed in Task 2.1.2 to include additional information from Task 2.1.3 and submit to the COUNTY for approval.

Deliverables:

- Draft Project Plan
- Final Project Plan
- Kick-off Meeting Minutes

2.2 Watershed Evaluation

2.2.1 Assembly and Evaluations of Watershed Data

2.2.1.1 Drainage Pattern and Watershed Boundary

The CONSULTANT shall examine drainage patterns and define the preliminary watershed boundary based on, but not limited to, the following:

- The DISTRICT Planning Units
- 2016 Topographic Information
- USGS National Hydrography Dataset (NHD)
- 2016 Aerial Imagery
- Stormwater Inventory, if any
- ERPs and Roadway Plans
- Existing Studies and Models, if any
- Adjacent Watershed Studies, if any

2.2.1.2 Areas of Development

The CONSULTANT shall identify ERPs and roadway plans to be incorporated into the watershed model based on, but not limited to, the following:

- Data Collection Cut-off Date (built conditions shown on the 2016 aerials)
- 2016 Aerial Imagery
- 2016 Topographic Information
- The DISTRICT Guidance Documents
- Public Interest

Plan/permit data will be reviewed and incorporated as appropriate to accurately model conditions to establish new floodplain elevations. It is assumed that the DISTRICT will provide digital copies of the selected ERPs.

2.2.1.3 Initial GIS Processing

The CONSULTANT shall perform initial GIS processing to develop the following:

- Catchment
- Surface Connectivity (Delineation inventory linework)

The CONSULTANT will place junctions appropriately to determine the effects of storage routing on hydrologically determined flow rates. As a goal, the CONSULTANT will place junctions in stormwater management and storage areas, ponds or lakes, natural lakes, wetlands and depressions that are larger than 10,000 square feet. Data will be based on the permit data, roadway plans, inventory and other documents obtained in Tasks 2.2.1.1 and 2.2.1.2.

It is anticipated a meeting, if appropriate, will be conducted between the COUNTY, the CONSULTANT, and the Cooperator if needed, to discuss preliminary results, alternative threshold criteria, potential to expand the task scope and task budget, and other issues.

2.2.1.4 Topographic Voids

The CONSULTANT shall identify and document the topographic voids based on, but not limited to, the following:

- Data Collection Cut-off Date (built conditions shown on the 2016 aerials)
- 2016 Aerial Imagery
- ERPs and Roadway Plans
- Site-Specific Information, if any
- Existing Studies and Models, if any

The CONSULTANT shall propose the methodology to eliminate topographic voids, such as: refinement of topographic information based on ERPs or roadway plans, limited acquisition of new LiDAR data, or no action needs be taken but adjustment will be given to model parameterization and floodplain delineation. The proposed methodology shall be included in Task 2.2.1.9.

2.2.1.5 Hydrologic Characteristics and Percolation

The CONSULTANT shall examine hydrologic characteristics of the watershed. When applicable, the CONSULTANT shall identify locations where percolation or groundwater simulation is necessary to accurately represent flood stages. Data will be based on, but not limited to, the following:

- Soil Map
- Potentiometric Surface Map
- ERP and Roadway Plans
- Site-Specific Information, if any

It is anticipated that percolation/groundwater data will be available from ERP files or site-specific investigation. The CONSULTANT shall review existing data and develop a watershed specific approach to conduct additional geotechnical investigation, if any. Note, collection of additional geotechnical data recommended as part of Task 2.2.1.5 is not included as part of this scope of work.

2.2.1.6 Historical Water Levels

The CONSULTANT shall assemble information on historic water levels, surveys, photos or videos of flooding, and any other available information including, but not limited to, the following:

- Seasonal High Water Level (SHWL)
- Lake levels
- High water levels
- Flood photos
- Flooding complaints

The CONSULTANT shall identify locations where additional historic water levels information is desired but unavailable based on the data listed above. Note, collection of this additional data is not included as part of this scope of work.

2.2.1.7 Data Acquisition Plan

Upon evaluation of available watershed data and initial GIS processing the CONSULTANT shall develop an approach of data acquisition. This watershed specific approach shall identify locations where collection will occur and what the method of collection will be. The proposed approach shall be included in Task 2.2.1.9. This task may include the identification of a survey of up to 200 hydraulic structures/channels that are reasonable to access.

2.2.1.8 Pre-field Reconnaissance Evaluation

HydroJunctions shall be placed where field work is required to parameterize a hydraulic feature and will be developed for use in the field data acquisition, GWIS and for eventual documentation of the acquisition process. A preliminary HydroNetwork with HydroJunction and HydroEdge feature classes will be further developed upon completion of field data acquisition.

The CONSULTANT shall also document level of accuracy for acquisition of additional spatial information. It is anticipated that vertical referencing to LiDAR derived data points on hard surfaces will be acceptable. Field survey may also be performed for hydraulic structures, cross-sections, and other topographic information. Field survey may be accomplished with a combination of GPS and traditional survey techniques when sufficient information is not attainable from data sources (i.e. LiDAR, As-Built drawings, etc.). GPS surveying may involve Real-Time Kinematic (RTK) units or Differential GPS (DGPS) depending on the circumstances. The appropriate level of accuracy for the information to be gathered will be determined by the CONSULTANT in close consultation with the COUNTY and must be approved by the COUNTY prior to field data acquisition.

2.2.1.9 Task Memorandum

The CONSULTANT shall document the efforts involved in Tasks 2.2.1.1 through 2.2.1.8. The document shall include, but not limited to, the following:

- Watershed Boundary and Surroundings
- Major Conveyance Systems and Drainage Pattern
- List of ERP & Roadway Plans to Incorporate
- Initial GIS Processing
- Topographic Voids Locations
- Methodology to Eliminate Topographic Voids, if any
- Landuse Distribution by Cut-off Date (built conditions shown on the 2016 aerials)
- Hydrologic Soil Group Distribution
- Historical Water Levels
- Potential Data Issues, if any

2.2.1.10 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the data assembly and evaluation; get input from the COUNTY/DISTRICT on additional data they may be able to provide; and any additional data collection that may be required. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Task Memorandum
- Project Specific QA/QC Document
- Responses to Comments Geodatabase
- Digital Elevation Model (DEM)
- GWIS Geodatabase

2.2.2 Hydrologic and Hydraulic Feature Database

2.2.2.1 Acquisition of Data

The CONSULTANT shall perform data acquisition based on the approach developed in Task 2.2.1.7 for, but not limited to, the following:

- Field Reconnaissance and Survey
 - Drainage Feature
 - Topographic Information

This task also includes a maintenance evaluation for those non-permitted structures that are reasonable to access.

2.2.2.2 HydroNetwork Development

The CONSULTANT shall develop the HydroNetwork with information collected from Task 2.2.2.1, including:

- HydroJunctions and HydroEdges
- Hydraulic Element Points (HEPs)

2.2.2.3 Topographic Information Refinement

When identified in the methodology of elimination of topographic voids in Task 2.2.1.4, the CONSULTANT shall refine the topographic information with ERP and roadway plans (e.g., computer aided drafting files) or field data acquisition (e.g., site-specific survey). For the Anclote River Watershed, topographic refinement will be performed in the

form of pond polygons in place of full topographic refinement updates.

Note: This task and associated budget assumes minimal topographic information refinement will be required, as the DEM is based on the new 2016 LiDAR data.

2.2.2.4 Hydrologic Feature Database

The CONSULTANT shall review and update, if necessary, the latest landuse map based on, but not limited to, the following:

- Data Collection Cut-off Date (built conditions shown on the 2016 aerials)
- 2016 Aerial Imagery
- ERPs and Roadway plans
- Site-Specific Information, if any

The CONSULTANT shall develop a generic lookup table for the watershed to include landuse parameters

Deliverables:

- Response to Comments Geodatabase
- Refined Topographic Information
- Updated GWIS Geodatabase
- TSDN
- Project Specific QA/QC Document

2.2.3 Preliminary Model Features

2.2.3.1 Additional GIS Processing

When deemed necessary, the CONSULTANT shall perform additional GIS processing to update the following:

- Catchment
- Surface Connectivity (delineation inventory)

2.2.3.2 Preliminary Model Schematic

The CONSULTANT shall refine the GIS processed catchments and connectivity in conjunction with ERP and roadway plans and HydroNetwork developed in Task 2.2.2.2. The CONSULTANT shall identify the data source of each hydraulic feature to be included in the watershed model.

The CONSULTANT shall also coordinate with adjacent watershed(s) when necessary.

2.2.3.3 Model Parameterization Approach

A final determination of the version of the ICPR modeling software shall be made prior to beginning this task.

The CONSULTANT shall develop and document the approach to parameterize model features developed in Task 2.2.3.2. The proposed approach shall be included in Task 2.2.3.4. The model parameters shall include, but not limited to, the following (note parameters may differ slightly depending on the version of ICPR selected):

Subbasin Stage-Storage: The CONSULTANT will develop stage-storage relationships for each subbasin, as appropriate. This process will be conducted using a GIS tool. Channel storage exclusion polygons will be used to exclude storage that will be modeled within a channel.

Doppler Storm Runoff Generation: The CONSULTANT will use Doppler radar rainfall information to develop rainfall coverage for calibration and verification events. Calibration and verification events shall have a discharge duration of at least ten (10) hours and a depth meeting or exceeding the depth of a mean annual storm event. It is anticipated that the rainfall data will be available directly from the DISTRICT in fifteen (15) minute incremental rainfall amounts over 2-kilometer-square grids.

Starting Water Levels: The CONSULTANT will establish initial stages for stormwater management areas and ponds based on best available information such as ERP documents, control feature data, orthophotography, or seasonal high water levels when control feature data are not applicable. Initial stages in wetland areas may be based on a desktop vegetation/terrain evaluation. The CONSULTANT will discuss proposed methods with the COUNTY project manager and DISTRICT project manager before selecting starting water elevations. The CONSULTANT will plot the area inundated by the initial conditions.

Directly Connected Impervious Area (DCIA) and Unconnected Impervious Area (UCIA): The CONSULTANT will discuss the methodology for assigning DCIA and UCIA with the COUNTY project manager and the DISTRICT project manager before it is used. This task will not include developing a spatial DCIA/UCIA feature.

Main Channel Parameterization: The CONSULTANT will discuss the model-set up and parameterization for the main channel region of the Anclote River. The CONSULTANT will discuss proposed methods with the COUNTY project manager and DISTRICT project manager before establishing main channel model set-up.

Hydrology: The CONSULTANT will develop an event-based surface water model for this project using the computer program selected prior to the start of Task 2.2.1.5. This program will either be Version 3.2 or Version 4 of the Interconnected Pond Routing (ICPR) modeling software. The most recent service pack at the time of the model development will be used. The hydrology will be based on the NRCS Curve Number (CN) method with DCIA parameters, if applicable, unless a more rigorous infiltration method, such as Green-Ampt, is needed to accurately represent runoff from the watershed's well-drained soils.

The CONSULTANT will use the methodology for estimating times of concentration that is referenced in the Natural Resources Conservation Service Technical Release 55 (NRCS TR-55).

Cross-Sections for Weirs: The CONSULTANT will generate cross-sections to represent weirs for the surface water model. It is anticipated that all cross-sections will either be derived from the terrain or based on surveys, as-built drawings, or construction plan information. The process of deriving the cross-section information from the terrain in x,y,z format will be automated using ArcHydro or alternative GIS tool. Some manipulation of the data may be necessary for input into the surface water model. The irregular weirs and weir cross-section tables in the GWIS geodatabase will be completed with additional inputs from surveyed information.

2.2.3.4 Watershed Evaluation Report

The CONSULTANT shall document the efforts involved in the Watershed Evaluation. This report can be an expansion of the memorandum developed in Task 2.2.1.9 with documentation of its subsequent tasks up to this point.

A meeting, if needed, will be held to discuss the results of the watershed evaluation and begin preparation for the start of the Peer Review process.

2.2.3.5 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the results of the Watershed Evaluation and begin preparation for the start of the Peer Review process. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Watershed Evaluation Report
- TSDN
- Project Specific QA/QC Document
- Refined Topographic Information
- GWIS Geodatabase

2.2.4 Peer Review of Watershed Evaluation and Model Parameterization Approach

2.2.4.1 Peer Review Kick-off Meeting and Presentation

The CONSULTANT will conduct a PowerPoint presentation to the peer review consultant, the COUNTY, the Cooperator, and other interested parties, by summarizing the work accomplished in the Watershed Evaluation with emphasis on approach, effort, and product. The full deliverables shall be transmitted to the peer review consultant at this meeting.

2.2.4.2 Meeting to Present Peer Review Comments

A meeting will be held for the peer review consultant to present draft review comments to the CONSULTANT, the COUNTY, and the Cooperator if needed. The meeting will be in remote format, unless otherwise specified. Peer review deliverables shall be transmitted to the CONSULTANT prior to this meeting.

2.2.4.3 Meeting to Discuss Approach of Responding to Peer Review Comments

A meeting will be held for the CONSULTANT to present the approach to respond to peer review comments. The meeting will be in remote format, unless otherwise specified.

2.2.5 Final Approved Watershed Evaluation Deliverables

2.2.5.1 Revised Deliverables

Within sixty (60) days of receiving COUNTY/DISTRICT review comments (Task 2.2.3.6), CONSULTANT shall address and re-submit watershed evaluation deliverables to the DISTRICT.

2.2.5.2 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the updates made to the Watershed Evaluation. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Response to Comment Geodatabase
- Revised Watershed Evaluation
- Project Specific QA/QC Document

2.3 WMP – Floodplain Analysis

2.3.1 Watershed Parameterization

2.3.1.1 Acquisition of Additional Model Parameters

Additional information needed to fill the watershed parameter gaps, if any, shall be acquired. These parameter gaps may include, but not limited to, the following:

- Drainage Feature
- Topographic Information

When percolation or groundwater information is desired but missing from existing data, the COUNTY and/or DISTRICT will coordinate to obtain further geotechnical investigation for use in this project. Note collection of this additional geotechnical data is not included in this scope of services.

2.3.1.2 Development of Model Specific Geodatabase

The CONSULTANT shall develop watershed model parameters per the approach defined in Task 2.2.3.3 of Watershed Evaluation. When deemed necessary, the CONSULTANT may use a revised approach for certain parameters. The revised approach shall be documented in a revised version of the Watershed Evaluation report. The

CONSULTANT shall store the parameterization information within a GWIS geodatabase in a format that can be imported into the model framework.

2.3.1.3 Model Setup, Debug, and Stabilization

The CONSULTANT shall transfer model parameters from GWIS geodatabase into the model framework, set up, and debug the model. The following preliminary simulations shall be performed:

- 100-year/1-day Design Storm
- No Rainfall

The CONSULTANT shall also develop the level pool plots for the following:

- Initial Conditions
- 100-year/1-day Floodplain

2.3.1.4 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the results of the Watershed Parameterization and prepare for the upcoming Peer Review. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Updated Watershed Evaluation Report
- Model Input/Output Files
- Project Specific QA/QC Document
- GWIS Geodatabase
- TSDN

2.3.2 Final Approved Watershed Model Parameterization Deliverables

2.3.2.1 Revised Deliverables

Within sixty (60) days of receiving the COUNTY review comments (Task 2.3.1.5), the CONSULTANT shall address and re-submit watershed model parameterization deliverables to the COUNTY.

2.3.2.2 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the updates made to the Watershed Evaluation. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Revised Watershed Model Parameterization Deliverables
- Response to Comments Geodatabase
- Project Specific QA/QC Document

2.3.3 Watershed Model Development and Floodplain Delineation

2.3.3.1 Model Calibration and Verification

The CONSULTANT will calibrate the ICPR model to one (1) of the rainfall events developed in Task 2.2.3.3. If necessary the CONSULTANT will adjust model parameters and rerun the model to verify results. The CONSULTANT will verify the calibration using a second rainfall event.

Model calibration and verification shall consider rainfall spatial distribution. Calibration and verification rainfall will be based on the DISTRICT's Doppler Radar-derived rainfall data at a 2-kilometer grid size.

2.3.3.2 Model Validation

The model simulation results will be assessed for accuracy and reasonableness with historic water levels, if any, corresponding to one of the existing, suitable simulations. The existing, suitable simulations include the calibration event, verification event, or design storm event with similar depth and duration.

2.3.3.3 Design Storm Simulations

The CONSULTANT shall simulate the following design storms:

- 2.33-year, 10-year, 25-year, 50-year and 100-year, 1-day events using the Florida Modified Type II 24-hour distribution
- 100-year, 5-day event using the DISTRICT's 120-hour distribution. This task includes work, if necessary, to run adjacent watershed models to

obtain appropriate boundary conditions for this 5-day storm event.

2.3.3.4 Multi-Day Event Simulations and Rainfall Justification to Project Floodplain

Unless otherwise specified, the CONSULTANT shall simulate the following additional multi-day events:

- 100-year/3-day, 100-year/7-day, and 100-year/10-day events using FDOT rainfall distribution. This task includes work, if necessary, to run adjacent watershed models to obtain appropriate boundary conditions for multi-day storm events.

To delineate the 100-year floodplain, a rainfall event of duration longer than 1-day may be used if compelling evidence presents, such as historic water levels developed in Task 2.2.1.6 of Watershed Evaluation and existing studies.

2.3.3.5 Floodplain Delineation

The CONSULTANT shall delineate the floodplain based on digital topographic information and model predicted peak stages of the 50-year and 100-year storm events. The final product of this task shall be floodplain mapping that meets FEMA standards for updating the existing DFIRMs. Approach of mapping transition zones shall be documented in Task 2.3.4.6 – Floodplain Justification Report. Transition zones will be mapped for the 100-year storm as part of the final floodplain deliverables (Task 2.3.8.1), after draft submittal has been reviewed by COUNTY and comments addressed.

2.3.3.6 Floodplain Justification Report

The CONSULTANT shall document the efforts involved in Tasks 2.3.4.1 through 2.3.4.5 and also merge with Watershed Evaluation report to develop this Floodplain Justification Report.

2.3.3.7 Sea-level Rise (SLR) Scenarios

CONSULTANT shall model scenarios for SLR of the following projections: six (6) inches, one (1) foot, two (2) feet, four (4) feet, and seven (7) feet. Evaluate the 100-year and 25-year 24-hour rainfall in these scenarios for both the near-term and far-term projections. Associated draft, level-pool floodplains will be developed. SLR scenarios will be evaluated using the existing conditions model with updated boundary conditions and rainfall depths.

2.3.3.8 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the watershed model development, floodplain delineation and prepare for the upcoming Peer Review. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Floodplain Justification Report
- 100-Year Flood Depth Grid
- Model Input/Output Files
- Project Specific QA/QC Document
- Updated GWIS Geodatabase

2.3.4 Peer Review of Watershed Model Development and Floodplain Delineation

2.3.4.1 Peer Review Meeting and Presentation

A remote meeting, unless otherwise specified, will be conducted for the CONSULTANT to conduct a PowerPoint presentation (which is a continuation of the presentation from the previous one, i.e., Task 2.3.2.1) to the peer review consultant, the COUNTY, the Cooperator, and other interested parties, by summarizing the work accomplished in Watershed Model Development and Floodplain Delineation with emphasis on approach, effort, and product. The full deliverables shall be transmitted to the peer review consultant at this meeting.

2.3.4.2 Meeting to Present Peer Review Comments

A meeting will be held for the peer review consultant to present draft review comments to the CONSULTANT, the COUNTY, and the Cooperator if needed. The meeting will be in remote format, unless otherwise specified. Peer review deliverables shall be transmitted to the CONSULTANT prior to this meeting.

2.3.4.3 Meeting to Discuss Approach of Responding to Peer Review Comments

A meeting will be held for the CONSULTANT to present the approach to respond to peer review comments. The meeting will be in remote format, unless otherwise specified.

2.3.5 Approved Floodplain Analysis Deliverables for Preliminary Floodplain Open House

2.3.5.1 Revised Deliverables

Within sixty (60) days of the meeting to present peer review comments (Task 2.3.5.2), the CONSULTANT shall address peer review comments, as well as COUNTY review comments (Task 2.3.4.8), and re-submit watershed model development and floodplain delineation deliverables to the DISTRICT.

2.3.5.2 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the updates made to the model development and floodplain delineation. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Responses to Comments Geodatabase
- Revised Deliverables
- Project Specific QA/QC Document

2.3.6 Preliminary Floodplain Open House and Response to Public Comments

2.3.6.1 Preliminary Floodplain Open House

The CONSULTANT will assist the COUNTY with conducting one floodplain open house. Assistance consists of providing up to four (4) professionals, based on the number of impacted parcels and anticipated attendance of the public meeting. The CONSULTANT will assist citizens by responding to questions at the meeting; and operating laptop computers that can display recent aerials, existing flood hazard zones, base map information, parcels, and the preliminary floodplains.

2.3.6.2 Response to Public Comments

Public comment period closes forth-five (45) days after the open house, unless otherwise specified. At the time of the public comment period closure, the COUNTY will provide public comments collected to the CONSULTANT. The public comments will be included in a comments geodatabase. The CONSULTANT shall review and respond to public comments and update Task 2.3.6 deliverables as necessary. Response to public comments will not include providing copies of floodplain maps.

Deliverables:

- Attendance at Public Open House
- Response to Public Comments

2.3.7 Final Approved Floodplain Analysis Deliverables

2.3.7.1 Revised Deliverables

Within thirty (30) days after the public comments on draft deliverables are transmitted to the CONSULTANT, the CONSULTANT shall respond to comments and re-submit the full floodplain analysis deliverables to the COUNTY in final format, including floodplain transition zones.

2.3.7.2 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the updates made to the model development and floodplain delineation. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Sign & Sealed Floodplain Justification Report
- PowerPoint Presentation
- Revised Deliverables
- Project Specific QA/QC Document

2.4 WMP – FPLOS, SWRA, Drainage Improvement Alternatives Analysis and Recommendations

2.4.1 FPLOS Determination

2.4.1.1 FPLOS Methodology Meeting

A meeting will be conducted between the COUNTY, the CONSULTANT, and the Cooperator if needed, to discuss the FPLOS methodology and criteria to be used for this project. It is anticipated that the level-of-service criteria in the COUNTY's Comp Plan will be the basis for the FPLOS determination.

2.4.1.2 FPLOS Determination

The CONSULTANT will determine the floodplain level-of-service (FPLOS) throughout the watershed. FPLOS determinations will be based on the methodology and criterion agreed up during Task 2.4.1.1. The CONSULTANT will create a GWIS feature class documenting the results of the FPLOS analysis. The FPLOS documentation will also include an estimate of the number of habitable structures within floodplain areas by reviewing aerial photography.

2.4.1.3 FPLOS Analysis Report

The CONSULTANT shall document the efforts involved in Tasks 2.4.1.1 through 2.4.1.2 to develop this FPLOS Analysis Report.

2.4.1.4 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the findings of the FPLOS Analysis and select locations to examine during the best management practices task. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- FPLOS Analysis Report
- Flood Depth Grids for LOS Design Storms
- Model Input/Output Files FPLOS
- Geodatabase
- Responses to Comments Geodatabase
- Project Specific QA/QC Document

2.4.2 Surface Water Resource Assessment (Water Quality)

2.4.2.1 Surface Water Resource Assessment Approach

The CONSULTANT will develop an approach to the surface water resource assessment that is specific to the watershed and submit this approach to the COUNTY for approval before beginning the surface water resource assessment analysis task. The CONSULTANT will discuss the recommended approach with the COUNTY project manager to gain consensus on analytical procedures and the development of testable hypotheses related to factor(s) that may affect water quality within the Anclote River and downstream receiving waters. Several waterbody identification (WBIDs) numbers within the Anclote River watershed have been determined to be impaired due to water quality standard exceedances, and the CONSULTANT will identify and review any existing documents dealing with either the impairment assessment or TMDL development and recommend appropriate actions with regard to either the impairment assessment or TMDL. The information compiled will be examined in order to develop recommendations to reduce pollutant loadings (if appropriate) to address relevant impairments and to aid in the implementation of any draft or final TMDLs. These recommendations will be the basis for the development of water quality BMPs to be included in the BMPs Alternatives Analysis. A technical memorandum will be produced, outlining the data compilation and analysis techniques used, the results of the analysis performed, the interpretation of results, and any proposed further actions.

2.4.2.2 Water Quality Assessment

The CONSULTANT will assess water quality data to identify trends, potential impairment risks, and to document any noteworthy water quality, hydrology, or structural issues that may be impacting the water quality. Data sets examined will include the IWR data set used by FDEP, as well as additional data sets – as available – from the County and/or other publically available water quality monitoring efforts. This task may also include a field review of sampling station locations and the physical characteristics of these stations, including the appropriateness of sample sites for characterization of surface water quality. The Anclote River watershed characteristics will also be assessed relative to any known anthropogenic or environmental factors, and physical features within the watershed which may be impacting water quality conditions or sampling results, particularly for the impairment parameters

such as land use types, point and non-point discharges, extent of existing stormwater runoff treatment, and base flow. The assessment will include a comparison against criteria, as well as a discussion of the appropriateness of the criteria including discussion of the recent tidal creeks study and recommendations. The assessment will be used along with the Pollutant Loading Model to guide in the development of water quality BMPs. A technical memorandum will be produced, outlining the data compilation and analysis techniques used, the results of the analyses performed, the interpretation of results, and implications of findings in terms of water quality impairments and any potential BMPs to address valid impairments.

2.4.2.3 Pollutant Loading Estimates

The CONSULTANT will develop pollutant loading estimates for total nitrogen (TN), total phosphorous (TP), biological oxygen demand (BOD), and total suspended solids (TSS) using a spreadsheet, GIS, or similar model. Pollutant loading will take into account the presence and efficiency of BMPs in the watershed. Gross and net pollutant loads will be reported and mapped by subbasin. The Pollutant Loading Model will be used along with the Water Quality Assessment to guide in the development of water quality BMPs.

2.4.2.4 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the findings of the SWRA task and potential projects to evaluate during the BMP analysis. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Meeting to discuss the SWRA approach
- SWRA Water Quality Approach Technical Memorandum
- SWRA Water Quality Assessment Technical Memorandum
- SWRA Pollutant Loading Technical Memorandum
- Geodatabase/Water Quality Assessment Data
- Pollutant Loading Model/GIS files
- Project Specific QA/QC Document

2.4.3 Best Management Practices (BMP) Alternatives Analysis and Recommendations (Drainage Improvements and Water Quality)

2.4.3.1 BMP Analysis, Recommendations and Rankings

The CONSULTANT will conduct a BMP alternatives analysis for up to ten (10) structural BMPs and two (2) non-structural BMPs in the watershed. An alternative BMP Analysis report will be developed. The CONSULTANT will model the selected BMPs using ICPR, if appropriate, and will estimate the pollutant load reductions for the BMPs. A comparison of the estimated pollutant load reductions to any TMDL required load reductions for the watershed will be made. If estimated pollutant load reductions from the selected BMPs do not meet the TMDL required reductions, then general recommendations for future actions to meet the TMDL will be included in the report. The gross cost to meet the load deficit to meet TMDLs will be estimated using a single estimated dollars-per-pound removed per TMDL constituent. The CONSULTANT will rank the alternatives based on a combination of cost and benefit of the project. The ranking may also include an analysis of the proposed project for one of the SLR/Rainfall Depth scenarios in Task 2.3.4.7. The CONSULTANT will not provide construction plans or apply for conceptual ERP permits for the proposed BMPs. A draft alternative analysis and recommendations report will be prepared to summarize the findings of the BMP Analysis. Upon review and comment by the COUNTY, a final report will be issued.

2.4.3.2 Project Management and Quality Assurance/Control

The CONSULTANT will attend a meeting, if necessary, to discuss the findings of the BMP analysis. The CONSULTANT will conduct quality assurance and quality control. Quality control reviews will be documented in the comments geodatabase and in the QA/QC document, as appropriate.

Deliverables:

- Draft Alternative Analysis and Recommendations Report
- Final Alternative Analysis and Recommendations Report
- Ranking of BMP Recommendations
- Flood Depth Grids for Proposed Conditions
- Model Input/Output Files for Alternatives Analysis
- Model Input/Output Files for Proposed Conditions
- Geodatabase
- Pollutant Loading Model/GIS files
- Responses to Comments Geodatabase
- Project Specific QA/QC Document

PERFORMANCE SCHEDULE

The following tasks are to be completed within the number of months indicated below, counted forward from the date the COUNTY issues Notice to Proceed to the CONSULTANT. The COUNTY has up to six (6) months to issue Notice to Proceed to the CONSULTANT.

Task Number	Task Description	Start Month	End Month
2.1	Project Development	1	2
2.2.1	Assembly and Evaluations of Watershed Data	2	8
2.2.2	Hydrologic and Hydraulic Feature Database	2	13
2.2.3	Preliminary Model Features	4	8
2.2.4	Peer Review of Watershed Evaluation	9	11
2.2.5	Final Approved Watershed Evaluation Deliverables	12	15
2.3.1	Watershed Parameterization	11	17
2.3.2	Final Approved Watershed Model Parameterization Deliverables	17	18
2.3.3	Watershed Model Development and Floodplain Delineation	18	20
2.3.4	Peer Review of Watershed Model Development and Floodplain Delineation	21	23
2.3.5	Approved Floodplain Analysis Deliverables for Preliminary Floodplain Open House	24	25
2.3.6	Preliminary Floodplain Open House	25	26
2.3.7	Final Approved Floodplain Analysis Deliverables	27	28
2.4.1	FPLOS Determination	29	30
2.4.2	Surface Water Resource Assessment (Water Quality)	2	29
2.4.3	BMP Alternatives Analysis and Recommendations	30	32
	Project Close-out	33	36

SUBMITTAL REQUIREMENTS (GENERAL)

Each submittal shall be delivered with the associated QA/QC documentation and a transmittal letter signed by the CONSULTANT'S Project Manager stating that the submittal package is complete, and all pertinent calculations and details have been checked for accuracy and completion.

Reviews will be performed by the COUNTY and the DISTRICT to confirm that the submittal is complete. Incomplete submittals shall be returned to the consultant. All final engineering documents must be signed and sealed by a professional engineer registered in the State of Florida. The COUNTY will issue deliverable approval only in writing.

- 4.1.1** Invoicing from the CONSULTANT and payment by the COUNTY shall be directly correlated to submittal completion and approval.
- 4.1.2** The COUNTY and the DISTRICT in no way obligates themselves to check the CONSULTANT'S work and further is not responsible for maintaining project schedules.
- 4.1.3** The actual acceptance by the COUNTY and the DISTRICT of any submittal shall neither constitute nor imply any review or approval by the COUNTY and the DISTRICT of the services performed by the CONSULTANT under the provisions of this AGREEMENT, but shall indicate only the COUNTY and the DISTRICT'S acceptance of the CONSULTANT'S affirmation of compliance with the provisions and intent of this AGREEMENT.
- 4.1.4** The CONSULTANT accepts the responsibility and obligation to correct, to the satisfaction of the Public Works Department Director, and at no additional cost to the COUNTY, any and all deficiencies in the preparation of the project documents resulting from errors or omissions, at such time, and whenever the deficiencies may become known. Final acceptance by the COUNTY and the DISTRICT of the contract documents provided for in this AGREEMENT shall not relieve the CONSULTANT of compliance with the intent of this AGREEMENT to provide the COUNTY and the DISTRICT with documents that are complete in every respect.

DATA PROVIDED BY THE COUNTY OR THE DISTRICT

The COUNTY and the DISTRICT shall provide the following for the CONSULTANT'S use and guidance:

- 5.1.1** Horizontal and Vertical Primary Project Control referenced to the North American Datum (NAD) of 1983/1990 Adjustment and North American Vertical Datum (NAVD) of 1988. The unit of measure shall be the United States Survey Foot. Primary Control points set shall not exceed one half (1/2) mile intervals.
- 5.1.2** Copy of the COUNTY Guide for Professional Survey and Mapping.
- 5.1.3** Copies of all existing drainage studies and plans, inventories, computer information, existing maps, existing aerial photographs, roadway plans, as built construction plans, water quality data and other available information and data pertinent to the

MANAGEMENT PLAN, which the COUNTY and DISTRICT may have in their possession.

5.1.4 Copy of the most recent LIDAR available.

COMPENSATION

The complete PROJECT cost will be \$ 808,760.00. A detailed budget table showing the costs associated for each task is included on the following pages.

APPENDIX B

Project Budget Spreadsheet

COST BREAKDOWN SUMMARY- SCOPE OF SERVICES
Anclo River Watershed Management Master Plan (WMP)

Task	Task Description	Atkins									ESA			Survey	Line Item Total	Project Total
		Principal \$220	Sr. Planner \$185	Sr. Engineer \$160	Project Manager \$170	Engineer \$125	GIS Analyst \$102	Engineering Intern \$95	Survey Technician \$85	Field Technician \$65	Principal \$190	Sr. Envir. Analyst \$170	GIS Analyst \$100			
2.1	Project Development															
2.1.1	Data Collection and Initial Evaluation	0	0	4	2	0	8	8	0	0	0	0	0		\$2,556.00	\$2,556.00
2.1.2	Draft Project Plan	2	0	16	8	0	0	0	0	0	0	0	0		\$4,360.00	\$6,916.00
2.1.3	Kick-off Meeting	0	0	8	8	0	0	0	0	0	0	0	0		\$2,640.00	\$9,556.00
2.1.4	Final Project Plan	0	0	8	4	0	0	0	0	0	0	0	0		\$1,960.00	\$11,516.00
2.2	Watershed Evaluation															
2.2.1	Assembly and Evaluations of Watershed Data															
2.2.1.1	Drainage Pattern and Watershed Boundary	0	0	2	1	0	6	0	0	0	0	0	0		\$1,102.00	\$12,618.00
2.2.1.2	Areas of Development	0	0	0	2	0	8	0	0	0	0	0	0		\$1,156.00	\$13,774.00
2.2.1.3	Initial GIS Processing	2	0	60	24	240	40	240	0	0	0	0	0		\$71,000.00	\$84,774.00
2.2.1.4	Topographic Voids	0	0	4	2	20	0	0	0	0	0	0	0		\$3,480.00	\$88,254.00
2.2.1.5	Hydrologic Characteristics and Percolation	0	8	8	4	12	8	0	0	0	0	0	0		\$5,756.00	\$94,010.00
2.2.1.6	Historical Water Levels	0	0	0	0	4	0	0	0	0	0	0	0		\$500.00	\$94,510.00
2.2.1.7	Data Acquisition Plan	2	0	8	8	24	0	4	4	0	0	0	0		\$6,800.00	\$101,310.00
2.2.1.8	Pre-field Reconnaissance Evaluation	0	0	4	8	24	0	12	0	0	0	0	0		\$6,140.00	\$107,450.00
2.2.1.9	Task Memorandum	0	0	24	16	18	2	0	0	0	0	0	0		\$9,014.00	\$116,464.00
2.2.1.10	Project Management and Quality Assurance/Control	0	0	20	40	0	0	0	0	0	0	0	0		\$10,000.00	\$126,464.00
2.2.2	Hydrologic and Hydraulic Feature Database															
2.2.2.1	Acquisition of Data/Maintenance Assessment	0	0	8	20	20	0	40	120	120	0	0	0	\$50,000.00	\$78,980.00	\$205,444.00
2.2.2.2	HydroNetwork Development	0	0	20	24	120	0	40	0	0	0	0	0		\$26,080.00	\$231,524.00
2.2.2.3	Topographic Information Refinement	0	0	4	2	0	40	0	0	0	0	0	0		\$5,060.00	\$236,584.00
2.2.2.4	Hydrologic Feature Database	0	0	8	4	12	8	0	0	0	0	0	0		\$4,276.00	\$240,860.00
2.2.3	Preliminary Model Features															
2.2.3.1	Additional GIS Processing	0	0	12	4	24	24	0	0	0	0	0	0		\$8,048.00	\$248,908.00
2.2.3.2	Preliminary Model Schematic	0	0	24	12	40	24	0	0	0	0	0	0		\$13,328.00	\$262,236.00
2.2.3.3	Model Parameterization Approach	0	8	8	8	0	0	0	0	0	0	0	0		\$4,120.00	\$266,356.00
2.2.3.4	Watershed Evaluation Report	2	0	40	40	60	12	8	0	0	0	0	0		\$23,124.00	\$289,480.00
2.2.3.5	Project Management and Quality Assurance/Control	0	0	24	40	0	0	0	0	0	0	0	0		\$10,640.00	\$300,120.00
2.2.4	Peer Review of Watershed Evaluation															
2.2.4.1	Peer Review Kick-off Meeting and Presentation	0	0	24	24	16	0	0	0	0	0	0	0		\$9,920.00	\$310,040.00
2.2.4.2	Meeting to Present Peer Review Comments	0	0	8	8	0	0	0	0	0	0	0	0		\$2,640.00	\$312,680.00

COST BREAKDOWN SUMMARY- SCOPE OF SERVICES
Anclo River Watershed Management Master Plan (WMP)

Task	Task Description	Atkins									ESA			Survey	Line Item Total	Project Total
		Principal \$220	Sr. Planner \$185	Sr. Engineer \$160	Project Manager \$170	Engineer \$125	GIS Analyst \$102	Engineering Intern \$95	Survey Technician \$85	Field Technician \$65	Principal \$190	Sr. Envir. Analyst \$170	GIS Analyst \$100			
2.2.4.3	Meeting to Discuss Approach to Peer Review Comments	0	0	8	8	0	0	0	0	0	0	0	0		\$2,640.00	\$315,320.00
2.2.5	Final Approved Watershed Evaluation Deliverables															
2.2.5.1	Revised Deliverables	0	0	16	8	18	8	0	0	0	0	0	0		\$6,986.00	\$322,306.00
2.2.5.2	Project Management and Quality Assurance/Control	0	0	8	8	0	0	0	0	0	0	0	0		\$2,640.00	\$324,946.00
2.3	WMP - Floodplain Analysis															
2.3.1	Watershed Parameterization															
2.3.1.1	Acquisition of Additional Model Parameters	0	0	24	8	24	0	0	0	0	0	0	0		\$8,200.00	\$333,146.00
2.3.1.2	Development of Model Specific Geodatabase	2	0	60	24	160	24	160	0	0	0	0	0		\$51,768.00	\$384,914.00
2.3.1.3	Model Setup, Debug, and Stabilization	4	0	40	8	24	0	0	0	0	0	0	0		\$11,640.00	\$396,554.00
2.3.1.4	Project Management and Quality Assurance/Control	0	0	24	40	0	0	0	0	0	0	0	0		\$10,640.00	\$407,194.00
2.3.2	Final Approved Watershed Model Parameterization Deliverables															
2.3.2.1	Revised Deliverables	0	0	16	8	18	8	0	0	0	0	0	0		\$6,986.00	\$414,180.00
2.3.2.2	Project Management and Quality Assurance/Control	0	0	8	8	0	0	0	0	0	0	0	0		\$2,640.00	\$416,820.00
2.3.3	Watershed Model Development and Floodplain Delineation															
2.3.3.1	Model Calibration and Verification	0	0	24	24	60	0	0	0	0	0	0	0		\$15,420.00	\$432,240.00
2.3.3.2	Model Validation	0	0	24	8	24	0	0	0	0	0	0	0		\$8,200.00	\$440,440.00
2.3.3.3	Design Storm Simulations	0	0	24	4	24	0	0	0	0	0	0	0		\$7,520.00	\$447,960.00
2.3.3.4	Multi-Day Simulations and Rainfall Justification to Project Floodplain	0	0	12	2	36	0	0	0	0	0	0	0		\$6,760.00	\$454,720.00
2.3.3.5	Floodplain Delineation	4	0	40	24	100	80	80	0	0	0	0	0		\$39,620.00	\$494,340.00
2.3.3.6	Floodplain Justification Report	0	0	60	40	24	16	0	0	0	0	0	0		\$21,032.00	\$515,372.00
2.3.3.7	Sea-level Rise (SLR) Scenarios	0	0	24	8	40	12	6	0	0	0	0	0		\$11,994.00	\$527,366.00
2.3.3.8	Project Management and Quality Assurance/Control	0	0	24	40	0	0	0	0	0	0	0	0		\$10,640.00	\$538,006.00
2.3.4	Peer Review of Watershed Model Development and Floodplain Delineation															
2.3.4.1	Peer Review Meeting and Presentation	0	0	16	16	8	0	0	0	0	0	0	0		\$6,280.00	\$544,286.00
2.3.4.2	Meeting to Present Peer Review Comments	0	0	8	8	0	0	0	0	0	0	0	0		\$2,640.00	\$546,926.00
2.3.4.3	Meeting to Discuss Approach to Peer Review Comments	0	0	8	8	0	0	0	0	0	0	0	0		\$2,640.00	\$549,566.00
2.3.5	Approve Floodplain Analysis Deliverables for Preliminary Floodplain Open House															

COST BREAKDOWN SUMMARY- SCOPE OF SERVICES
Anclo River Watershed Management Master Plan (WMP)

Task	Task Description	Atkins									ESA			Survey	Line Item Total	Project Total
		Principal	Sr. Planner	Sr. Engineer	Project Manager	Engineer	GIS Analyst	Engineering Intern	Survey Technician	Field Technician	Principal	Sr. Envir. Analyst	GIS Analyst			
		\$220	\$185	\$160	\$170	\$125	\$102	\$95	\$85	\$65	\$190	\$170	\$100			
2.3.5.1	Revised Deliverables	0	0	16	8	18	8	0	0	0	0	0	0		\$6,986.00	\$556,552.00
2.3.5.2	Project Management and Quality Assurance/Control	0	0	8	8	0	0	0	0	0	0	0	0		\$2,640.00	\$559,192.00
2.3.6	Preliminary Floodplain Open House and Response to Public Comments															
2.3.6.1	Preliminary Floodplain Open House	0	0	24	24	8	0	0	0	0	0	0	0		\$8,920.00	\$568,112.00
2.3.6.2	Response to Public Comments	0	0	24	4	40	16	0	0	0	0	0	0		\$11,152.00	\$579,264.00
2.3.7	Final Approved Floodplain Analysis Deliverables															
2.3.7.1	Revised Deliverables	0	0	24	8	40	24	0	0	0	0	0	0		\$12,648.00	\$591,912.00
2.3.7.2	Project Management and Quality Assurance/Control	0	0	16	16	0	0	0	0	0	0	0	0		\$5,280.00	\$597,192.00
2.4	WMP - FPLOS, SWRA, Drainage Improvement Alternatives Analysis and Recommendations															
2.4.1	FPLOS Determination															
2.4.1.1	FPLOS Methodology Meeting	0	0	8	16	0	0	0	0	0	0	0	0		\$4,000.00	\$601,192.00
2.4.1.2	FPLOS Determination	0	0	24	8	40	40	0	0	0	0	0	0		\$14,280.00	\$615,472.00
2.4.1.3	FPLOS Analysis Report	0	0	16	40	0	0	0	0	0	0	0	0		\$9,360.00	\$624,832.00
2.4.1.4	Project Management and Quality Assurance/Control	0	0	16	24	0	0	0	0	0	0	0	0		\$6,640.00	\$631,472.00
2.4.2	Surface Water Resource Assessment (Water Quality)															
2.4.2.1	Surface Water Resource Assessment Approach	0	8	16	24	0	0	0	0	0	84	80	24		\$40,080.00	\$671,552.00
2.4.2.2	Water Quality Assessment	0	8	16	24	0	0	0	0	0	100	96	16		\$45,040.00	\$716,592.00
2.4.2.3	Pollutant Loading Estimates	0	24	24	16	24	0	0	0	0	16	8	0		\$18,400.00	\$734,992.00
2.4.2.4	Project Management and Quality Assurance/Control	0	0	16	24	0	0	0	0	0	0	0	0		\$6,640.00	\$741,632.00
2.4.3	Best Management Practices (BMP) Alternatives Analysis and Recommendations (Drainage Improvements and Water Quality)															
2.4.3.1	BMP Analysis, Recommendations and Rankings	2	40	80	40	160	24	40	0	0	24	12	2		\$60,488.00	\$802,120.00
2.4.3.2	Project Management and Quality Assurance/Control	0	0	16	24	0	0	0	0	0	0	0	0		\$6,640.00	\$808,760.00

APPENDIX C

Quality Assurance/ Quality Control Plan

Quality Assurance/Quality Control Plan Anclote River Watershed Management Master Plan

Overview:

Quality control procedures for the Anclote River Watershed Management Master Plan will be based on the guidance in the District's "Scope of Work Task Descriptions" text. Per this text, Section 2.1.3, the QA/QC control document will outline who will perform specific tasks, who will perform the QA/QC for specific tasks, and the procedures for the QA/QC. The project specific procedure for the QA/QC will be based on the District's requirement of a comments geodatabase and Atkins North America Inc. (Atkins) QA/QC procedures.

Purpose:

This quality assurance/quality control (QA/QC) plan has been developed to ensure that Atkins delivers a product that meets the client's requirements. The project manager, Andrea Graves, will initiate the quality assurance program and implement the quality control procedures deemed appropriate for the work to be performed. The QC manager, Mark Erwin, will ensure that the Atkins QA policy is implemented.

Quality Objectives:

The quality objectives for the project are to:

- Ensure that all actions assigned to Atkins in the scope-of-work are carried out according to contract requirements.
- Define the work elements thoroughly prior to task initiation to eliminate any rework.
- Identify any problems or conflicts immediately upon recognition and take immediate steps to rectify them.
- Maintain a record of QA/QC activities.

Documentation Procedures:

In keeping with the methods of submitting deliverables in a digital method, project QA/QC documentation will also be kept in a digital format. A comments file will be added to the Comments geodatabase to reflect internal (Atkins) QA/QC documentation. This digital file will include the following information:

Comment: Reviewer's description on issues that need to be addressed

Source: Initials of the reviewer who provided the comment

Addressed: Statement on how the comment/issue has been addressed and/or resolved

Addressed_By: Initials of the person who addressed the comment

Reviewed: Initials of the person who rechecked and accepted the corrections/revisions

Quality Assurance/Quality Control Plan

Checking, Corrective Action and Recheck Procedure

All work will be checked at least once. The QC procedure will take the following path. As soon as the work for a task has been completed or has reached a stage at which the originator thinks a check would be beneficial, the work will be submitted to the project manager. The project manager will either review or assign a reviewer to check the data submitted for the task. All review comments and issues that need to be addressed will be listed in the Comment column of the geodatabase and the reviewer's initials will be listed in the Source column.

The reviewer is responsible for working with the originator to resolve the differences of opinion and to correct mistakes. The reviewer is also responsible for soliciting opinions of other staff members, not necessarily part of the project team, if needed. Returned comments will be reviewed by the originator and project manager and sent back to the reviewer for final approval. The actions taken to address the comment/issue will be listed in the Addressed column of the geodatabase and the initials of the person who addressed the comment will be listed in the Addressed_By column. Once the reviewer and originator have come to an agreement, the reviewer will initial the final check in the Reviewed column of the geodatabase.

Task	Originator	Reviewer
Assembly and Evaluations of Watershed Data	Jon Gale	Andrea Graves
Hydrologic and Hydraulic Feature Database	Jon Gale	Daniel Parsons
Preliminary Model Features	Andrew Sharnprapai	Andrea Graves, Daniel Parsons
Peer Review of Watershed Evaluation	Daniel Parsons	Andrea Graves, Mark Erwin
Final Approved Watershed Evaluation Deliverables	Jon Gale	Andrea Graves, Daniel Parsons
Watershed Parameterization	Andrew Sharnparapi	Andrea Graves, Daniel Parsons
Final Approved Watershed Model Parameterization Deliverables	Jon Gale	Andrea Graves, Daniel Parsons
Peer Review of Watershed Model Development and Floodplain Delineation	Daniel Parsons	Andrea Graves, Mark Erwin
Approved Floodplain Analysis Deliverables for Preliminary Floodplain Open House	Jon Gale	Andrea Graves, Daniel Parsons
Preliminary Floodplain Open House	Daniel Parsons	Andrea Graves, Mark Erwin
Final Approved Floodplain Analysis Deliverables	Jon Gale	Andrea Graves, Daniel Parsons
FPLOS Determination	Jon Gale	Andrea Graves, Daniel Parsons
Surface Water Resource Assessment (Water Quality)	Joe Walter, Emily Keenan	Andrea Graves, Dave Tomakso
BMP Alternatives Analysis and Recommendations	Daniel Parsons	Andrea Graves, Mark Erwin

Quality Assurance/Quality Control Plan

Checking, Corrective Action and Recheck Procedure

At a minimum the QC process will include reviews and checks of the following watershed modeling products. This checklist was developed based on the DISTRICT's engineering reviews of model parameters during previous projects.

- County/District Comments
 - Adequately addressed or “PENDING” for comments that relate to a future project deliverable
- Topology
 - The topology review will be used to check for adequacy of feature setup such as gaps or overlaps in the basin delineation, or deficiencies in link/node connectivity.
- Watershed Delineation
 - ERPs
 - Delineation is consistent with ERP delineation
 - Connectivity is consistent with ERP connectivity
 - Overland weirs are incorporated between modeled elements within the ERP
 - Topographic Voids are identified and data required to address topographic void area is collected appropriately
 - Level of Detail
 - Visual review of the digital elevation model (DEM) to identify areas of significant storage not independently modeled
 - Watershed boundary is consistent with adjacent watershed boundary from existing detailed study
- Basins
 - Land Use consistency with default hydrologic parameters
 - Land use classifications compared to ERP areas and Low Density Residential (LDR), Medium Density Residential (MDR), High Density Residential (HDR), typical of default size, number of houses per acre and imperviousness
 - Time of concentration
 - Correctly drawn flow paths (from furthest point on the watershed boundary to extent of the initial stage inundation area)
 - Calculations reviewed
 - Unit hydrograph shape factor
 - Consistent with terrain slope, shape, and level of development

Quality Assurance/Quality Control Plan

- Nodes
 - Placement
 - Set at the low point in the basin
 - Setup consistent with control volume. (i.e., channel basins situated such that the basin includes ½ of the upstream reach and ½ of the downstream reach)
 - Stage Storage
 - Minimum area consistent with reach inverts
 - Channel volume subtracted from node storage
 - Initial Condition
 - Plot initial condition level pool and visually inspect for reasonableness
 - Spot Check initial condition points
 - Consistent with wetland seasonal high water table (SHWT) for natural areas
 - Consistent with initial elevation for water quantity attenuation volume for permitted outfall structures
 - Consistent with drop structure control elevation
 - Check initial driving head on reaches, check justification for areas projected to flow at time zero.
- Reaches
 - Irregular Weirs
 - Located appropriately
 - Invert matches low point in cross section
 - Review weir coefficients for reasonableness with imagery
 - Weir extends to subbasin boundary
 - All basin connections with anticipated flow are included in the model (no glass walls without connectivity)
 - Pipe and Drop Structures
 - Check source data matches model data
 - Pipe size, shape, material, length
 - Pipe inverts
 - Drop Structure modeled with the correct weir dimensions
 - Datum Conversions (one conversion value will be used for the watershed)
 - Identify and inspect
 - Pipes with an unusually steep slope
 - Irregular or excessively long pipe reaches
 - Non-standard sizes
 - Pipe material appropriately correlated to Manning's n lookup table
 - Review pipes modeled as submerged under initial conditions.
 - Channels
 - Appropriate use of cross sections (ie applying the same cross section dimensions to multiple locations)
 - Cross Section data sources reviewed

Quality Assurance/Quality Control Plan

- Modeled cross section width matches GIS Xsec width
 - Channel length review
 - Channel length will either match GIS length or revised length shown in Channel Length Override shape
 - Exclusion polygon setup
 - Cross section inverts comparison to channel inverts for appropriateness
- Results
 - Model Stability
 - Dry Model Runs
 - Indicator of initial conditions that need to be adjusted
 - Mass Balance Errors
 - Nodes – maxDz check
 - Links – maxDq check
 - Abnormal conditions occurring within the first 6 hrs of the simulation
 - Nodes peaking at time 0 or very early in the storm
 - Initial decrease in stage
 - Connectivity
 - Missing Reaches
 - Weirs extending to subbasin boundary
 - Verification Event to Match
 - Volumes
 - Stage
 - Initial conditions
 - Extent of inundation versus flood aerial imagery and verification high water marks
 - Flow rate
 - Timing
 - Results consistent with rainfall patterns and watershed runoff response
 - Design Storms
 - Initial conditions
 - Extents of the floodplain reasonableness comparison to
 - observed conditions
 - historic conditions
 - adopted water levels
 - Floodplain transitions
 - Watershed Management Plan report
 - Procedures for model development detailed
 - Deviations from standard procedures specifically addressed
 - Verification results documented
 - Multi-day justification/reasonableness of results
 - Floodplain results documented