



TASK ORDER (TO) FORM, TO No. 2015-02
Wastewater Collection System Modeling –
Cabin Creek Basin Phase I
City of Griffin, GA

December 10, 2014

Revised February 3, 2015

Revised June 16, 2015 for Cabin Creek

Background

The City of Griffin (City) maintains and operates a sanitary sewer collection system serving the extent of Griffin corporate limits, with several segments extending beyond into the larger Spalding County area. The existing system is comprised of approximately 5,040 manholes, more than 230 miles of gravity sewer pipe, almost 20 miles of force mains, and 25 lift stations. It is divided into three wastewater treatment plant conveyance basins: Cabin Creek, Potato Creek, and Shoal Creek.

The City is in need of a hydraulic model for use as a decision making tool in maintaining, improving, and expanding the collection system, and wishes to construct the model and evaluate the system in three segments or phases beginning with the Cabin Creek basin then proceeding to the two remaining basins sequentially. This project will provide the City with a calibrated wastewater hydraulic model for the Cabin Creek Basin as Phase I, constructed to evaluate scenarios for key future hydraulic conditions, and to prioritize hydraulic improvements for those scenarios. Treatment plant and condition assessment evaluations are excluded from this scope of work. The intent of this planning effort is to provide the City with a capacity assessment, through calibrated modeling, for the Cabin Creek basin. The Cabin Creek basin study will also include a nutrient (ammonia) analysis using a modeling software's Water Quality Module, under a separate Burns & McDonnell software license. Ultimately, following completion of the remaining two basin studies in Phases II and III, a capacity-driven capital improvements plan will be developed through a 30-year horizon, however that effort is excluded from this Phase I project.

Project Team Members

We propose Rebecca Clay as your Project Manager. Rebecca has over 10 years of experience managing water infrastructure projects for Georgia utilities, and has demonstrated a commitment to providing the City with quality consulting and exceptional expertise. Other key team members, all now familiar to the City, will include:

- Cliff Cate: Cliff leads our national water/wastewater systems group under which hydraulic modeling and collection system condition assessment services fall. He has almost 20 years of experience specifically dedicated to wastewater system master plans, I/I programs, and related sewer system condition and capacity assessments.
- Jim Trimble: Jim has led our current effort with the City in GIS "scrubbing" for import into the water modeling interface, and will do the same for the City in this wastewater plan. Jim has supported similar wastewater modeling projects for Burns & McDonnell for over 10 years.

- Imran Khan: Imran has assisted the City already in navigating options for model software selection. He has over 25 years of experience in hydraulic and hydrologic modeling. In our Systems group, Imran provides quality control and senior level planning experience with a specific focus in collection systems. Imran has also written standard operating protocols (SOPs), developed modeling procedures, and conducted training workshops for the hydraulic models used for his projects.

Resumes of these individuals have been provided alongside this Scope of Services.

Scope of Services

This Scope of Services for the Cabin Creek Basin includes review of field data, asset information and other records as needed to prepare a collection system computer hydraulic model in Task 1, followed by analysis of flow and rainfall monitoring data in Task 2. A computer hydraulic model of the collection system will be constructed in Task 3, and be calibrated and verified to depict current conditions in Task 4. Task 5 performs an analysis of the collection system at current conditions through use of the calibrated model to identify any capacity deficiencies at a selected level of service (design storm event).

Tasks 6 through 10 are not used in this Cabin Creek Basin Phase I of the master plan; Task 6 is a placeholder for an optional additional service of establishing forecasts of future wastewater flows based on anticipated population growth and development within the planning area, and analyzing system performance at the forecasted population growth and development. Task 7 will develop a plan of system improvements to be implemented over time as required to address identified system deficiencies at current and future conditions. All master plan findings, conclusions and recommendations will be documented in a final presentation and report completed by Task 8. Task 9 provides for training your staff in the use of the modeling software, and Task 10 provides follow-on assistance on an as-needed basis. Tasks 6 through 10, excluded from this Scope of Services, are expected to be provided in Phase III following completion of the third and final sewer basin study.

A list of the Tasks is as follows, with Tasks in *italics* reserved for future phases beyond this Scope:

- Task 1: Initial Services and Hydraulic Modeling Software Selection;
- Task 2: Flow and Rainfall Data Analysis;
- Task 3: Hydraulic Model Development;
- Task 4: Hydraulic Model Calibration and Verification;
- Task 5: Existing Conditions System Analysis;
- *Task 6: Future Conditions System Analysis (optional);*
- *Task 7: Capital Improvements Programming;*
- *Task 8: Final Presentation and Report*
- *Task 9: Modeling Software Training*
- *Task 10: On-Call Services*

A description of these services, as applies to the Cabin Creek Basin, is provided in the following paragraphs.

TASK 1 – INITIAL SERVICES AND HYDRAULIC MODELING SOFTWARE SELECTION

Existing Data Collection and Analysis

Burns & McDonnell will review previous reports and data provided by the City:

- wastewater treatment plant and lift station operating records
- mapping information
- facility inventories
- staffing and equipment inventories
- as-built drawings
- user complaint and overflow/backup information
- water and sanitary sewer billing records
- City provided rainfall and flow monitoring data (to be obtained by City)
- available CCTV inspection and line cleaning history
- collection system asset data
- existing population
- any other records relevant to future collection system planning.

We will conduct a kick-off workshop with the City, following initial data review, to address questions and data gaps resulting from the review and to discuss the City's specific concerns and planning status including the wastewater treatment capacity allocation process and current allocations, anticipated developments or target service areas, and treatment plant expansion plans. Task 1 will be completed under the Cabin Creek Basin Analysis for the collection system as a whole, but a supplemental data request will be made for the Potato Creek Basin Analysis and Shoal Creek Basin Analysis upon authorization of those phases, to obtain the most current data.

Hydraulic Modeling Software Selection

As part of the separate Water System Modeling and Planning project, Burns & McDonnell has assisted the City in selecting Bentley SewerGEMS, a dynamic modeling program to be used for the Master Plan and for the City's on-going use after completion of the Master Plan. An allowance of \$30,000 for the SewerGEMS software purchase has been included in this scope of services.

TASK 2 – FLOW AND RAINFALL DATA ANALYSIS

We anticipate that the City will collect rainfall data (approximately 3 months total), in preparation for the first modeling effort in the Cabin Creek basin. Burns & McDonnell will provide the flow monitoring services for each basin, including rental of flow metering equipment and biweekly servicing and download of flow data.

As developed in the strategic flow monitoring map developed under the Water System Modeling and Planning project, we anticipate installing 4 flow metering sites in the Cabin Creek Basin in this Scope of Services, 14 flow monitoring sites in the Shoal Creek Basin (future phase; not in Scope), and 11 in the Potato Creek Basin (future phase; not in Scope), with three months of data collection prior to each basin model development. Burns & McDonnell will also install samplers at each of the Cabin Creek Basin flow

metering sites, for retrieval and laboratory analysis of the samples by the City for ammonium data to support the nutrient modeling. The City will maintain and monitor two rain gauges in the collection system. The flow and rainfall data will require processing for use in the modeling software. If requested by the City, Burns & McDonnell can assist/perform the rainfall monitoring as an additional service.

Data Analysis

Principal components of sanitary sewer system flows will be deconstructed from the flow meter hydrographs in the following general manner:

- Review rainfall interim monitoring data reports provided by the City for adequacy and completeness of data including review of monthly operations reports, project data reports, site evaluation reports, meter calibration reports, and meter scatter graphs.
- Advise the City if conditions necessitate relocation or replacement of a flow meter, rainfall gauge, or ammonium. For flow meter or sampler initial installation and relocation (if required), we have anticipated that one of the City's collection system crew members will be provided to assist Burns & McDonnell's crews in identifying the manhole location and establishing access.
- Provide an analysis of flow metering data to estimate average dry weather flow (ADWF) and peak dry weather flow (PDWF).
- Develop and provide ADWF curves for each metering site. These curves will reflect 15-minute interval variations over time for weekdays and weekends.
- Prepare a table listing approximate tributary area and population for each site, along with the flow parameters (ADWF, average minimum night-time flow, etc.). Population data will be based on the existing population figures provided by the City in Task 1.
- Identify rainfall events for evaluation, and determine wet weather flow vs. rain volumes by calculating wet flow volume (total flow, less ADWF, integrated over time during wet weather impact) as a percentage of rain volume. Based on this effort, identify events (and associated locations) that can be used for hydraulic model calibration and verification.
- Develop scatter graphs of flow depth (in feet) against velocity (in feet per second) for each flow meter.
- Develop normalized peak flow versus rainfall intensity curves for each flow meter. Separate curves will be developed for infiltration/inflow (I/I) and will include projected peak flow for the design storm event. Indicate if the flow meter site is impacted by upstream flow split and/or downstream conveyance performance.
- Estimate groundwater induced infiltration and rainfall dependent inflow for each flow meter site.
- Adjust flow analysis based on hydraulic model calibration results. Review results with the City to address any issues as to data validity, missing data, or other problems.

Conclusions from Data Analysis

Burns & McDonnell will rank system drainage basins (subbasins of each of the three main treatment plant collection basins) by the infiltration and inflow rates per inch diameter-mile of sewer, as determined from the available flow and rainfall monitoring data.

Deliverable: We will provide the City of Griffin a summary memorandum of the flow monitoring data analysis developed by this task, along with a color-coded map of the collection system that depicts the rankings of infiltration and inflow rates for the Cabin Creek drainage basin. We will expand this memorandum in each Basin Study phase, for the respective basin.

TASK 3 – HYDRAULIC MODEL DEVELOPMENT

The City's complete sanitary sewer collection system (including the Cabin Creek, Potato Creek, and Shoal Creek basins) will be incorporated into the initial hydraulic model construction to capture system elements and conductivity, for a functional model. However the Task 3 input efforts required for a complete and representative model, such as pump station structure development, drainage/population characteristics, and data gap analysis will be deferred for the Potato and Shoal Creek basins until those phases are authorized.

Model Construction

Burns & McDonnell will develop a computer model for the sanitary sewer collection system hydraulic components. We will construct the hydraulic model utilizing Bentley SewerGEMs, including the following tasks and approach:

- Physical asset data to be included in the hydraulic model are all gravity sewers (“all pipe model”) excluding abandoned and private sewer lines, and all pump stations and force mains as agreed with City. Asset data contained in the City's existing GIS dataset, sewer maps (CADD), and record drawings will be utilized for hydraulic model development.
- Conduct a data gap analysis. Evaluate the quality and completeness of the source data, organize and classify data for hydraulic model development, and recommend additional data collection as necessary. If data is missing or determined to be unreliable, we will request that the City provide field verification of the missing or questionable data. This may entail manhole inspections and/or other physical inspections. As directed, we can provide the City with a proposal for the necessary field inspections to obtain the data.
- Secure data relevant to the hydraulic modeling effort for each significant pumping station, including data defining the installed pumping units, station firm capacity, wet well dimensions, pump operating control settings, force main size and length, and field-developed system head curves for force mains serving pump stations. Pump station data will be provided by the City.
- Develop drainage area and population characteristics for each tributary sub-basin. Population data will be provided by the City.
- Prepare a model schematic describing the system configuration and include unique designations for each modeled component. Verify configuration by conducting model runs to demonstrate system connectivity.
- Prepare and submit for City review Data Gap Technical Memorandum. Incorporate City review comments and submit final Technical Memorandum.

Deliverable: We will provide the City of Griffin a draft and final Data Gap Technical Memorandum, and the hydraulic model demonstrating system connectivity. This Technical Memorandum will address full system connectivity (all three Basins).

TASK 4 – HYDRAULIC MODEL CALIBRATION AND VERIFICATION

The hydraulic model will be calibrated using flow and rainfall monitoring data. Proper model calibration using measured storm events and verification against additional events is a necessary prerequisite to applying the models to design conditions. After calibration and verification, the hydraulic and hydrologic (H&H) models will be used to predict dry weather flows (average, peak, diurnal patterns), and peak wet weather flows and volumes associated with various rainfall conditions.

Calibration and Verification

We will perform dry and wet weather calibration for each of the City provided flow meter installations. Calibration consists of modifying model parameters to be consistent with monitored, observed flows in the system.

The system connectivity hydraulic model developed in Task 3 will be used for the hydraulic and hydrologic (H&H) calibration of the City's sewer system hydraulic model.

- Perform dry and wet weather calibration for up to 4 flow meters in the Cabin Creek basin, 11 in Potato Creek, and 14 in Shoal Creek, as relevant according to the project phase. Calibration consists of modifying model parameters to be consistent with monitored, observed flows in the system.
- Perform wet weather verification for the flow meters in the relevant basin. Verification will confirm that the calibrated model responds appropriately under a variety of conditions.
- Prepare and submit for City review Model Calibration and Verification Technical Memorandum. Incorporate City review comments and submit final Technical Memorandum.

Deliverable: We will prepare and submit for City review a Model Calibration and Verification Technical Memorandum. We will incorporate your review comments and submit a final Model Calibration and Verification Technical Memorandum. This document will serve as a record for the City of the input calibration parameters and the accuracy of the calibrated model output. We will expand this Memorandum in each Basin Study phase, for the respective basin.

TASK 5 – EXISTING CONDITIONS SYSTEM ANALYSIS

The calibrated and verified hydraulic model produced in Task 4 will be used to evaluate the existing system for hydraulic restrictions and sanitary sewer overflows (SSOs).

System Analysis

We will utilize the calibrated model to estimate existing flows (hydrographs, peak flow rate, flow volume) conveyed by the system at a selected design storm condition.

- Prepare model input describing existing flow conditions.

- Run model using up to one (1) selected design storm condition (typically a 2- or 5-year SCS event). The design storm will be the same systemwide (e.g. for all three basins or project phases).
- Identify issues including flow constrictions, surcharging, and overflows in the system.
- Evaluate up to two alternative measures at each deficient location such as relief sewers, lift station and force main capacity improvements, and infiltration/inflow reduction that are necessary to address capacity issues.

We will review our findings with the City to confirm they are consistent with known conditions of the system.

Nutrient Modeling

For this Cabin Creek Basin Study only (not proposed in Phases II and III), we will incorporate dissolved ammonium (NH_4^+) water quality parameters into the model and assess system ammonium concentrations using the InfoWorks Water Quality Module (under Burns & McDonnell license). This will require export of the SewerGEMS model as a shapefile, then import and adjustment of the model in the InfoWorks platform. The City will provide Burns & McDonnell with monitoring data for ammonium (the charged form of ammonia that is prevalent below pH of 8) and pH at the wastewater treatment plant (WWTP) influent, and Burns & McDonnell will collect the ammonium data concurrent with flow monitoring in the Cabin Creek Basin. The purpose of this modeling effort is to identify the subbasin ammonium contribution to the WWTP to assist in isolating the most substantial source.

Deliverable: We will provide the City of Griffin a Draft Existing Conditions System Analysis Technical Memorandum by electronic submittal, describing the outcome of the evaluation and recommendations. We will incorporate City review comments and submit a final Technical Memorandum. We will expand this Memorandum in each (future) Basin Study phase, to include the respective basin. These Memoranda will ultimately be assimilated into the Task 8 Final Report in Phase III.

TASK 6 – FUTURE CONDITIONS SYSTEM ANALYSIS (Not In Scope)

Optional. Capacity assessment for future conditions or service areas is excluded from this scope of services, but can be provided as additional services under extended authorization.

TASK 7 – CAPITAL IMPROVEMENTS PROGRAMMING (Not In Scope)

Based on the outcomes of the existing conditions system analyses, prepare a list of capital improvement projects.

CIP Development

We will prepare probable cost opinions of the recommended sanitary sewer system project costs, including allowances for construction costs, engineering, administration, and contingencies. These will be feasibility level estimates ($\pm 30\text{-}50\%$) as typical for an extended planning horizon.

We will prepare an implementation schedule prioritizing the recommended improvements. Input will be provided by the City for this task.

Finalize Capital Improvements Program

Based on the foregoing, we will prepare a preliminary Capital Improvements Program document including tabulations of recommended projects along with cost and scheduled needs; and summary descriptions and justifications for each recommended project.

Based on the preliminary CIP and discussions with the City, we will prepare a schedule for implementation that considers items such as funding constraints, affordability, and interrelationships of I/I control efforts and construction of improvements.

Deliverables: We will provide the City of Griffin a preliminary Capital Improvements Program document describing the development of the recommended capital improvements program. We will address City review comments and prepare a final program document. We will expand this CIP document in each Basin Study phase, to include the respective basin.

TASK 8 – FINAL PRESENTATION AND REPORT (Not In Scope)

Task 8 will provide the City with the formal deliverables of the model development and planning efforts from Tasks 1 through 7.

Final Report

Burns & McDonnell will prepare a draft report of the wastewater collection system model development and infrastructure plan, summarizing the results of the tasks indicated above for review. The report will describe how the model was developed and calibrated, and how population and growth forecasts were distributed. It will also present the results of the infrastructure planning, documenting the various flow scenarios and associated recommendations, costs, and priorities for needed improvements. Findings of the Existing Conditions Technical Memorandum will be incorporated into the Final Report. The Report will be divided into three sections, one per major Basin Study, such that sections can be added to the Report in phases.

Burns & McDonnell will provide the draft report to the City for review and comment. After we address all review comments and, upon approval from City staff, we will deliver five copies of the Final Report, a PDF of the Final Report, and a copy of the hydraulic model on a CD.

Deliverable: We will provide the City of Griffin with the Final Report and the calibrated hydraulic model. The model will include the existing conditions analyses only (no future development scenarios). We will expand the Final Report in each Basin Study phase, to include the respective basin.

Final Presentation

We will conduct a final presentation for the wastewater collection system model, reviewing the planning scenarios run, following initial drafting of the Report section for each of the three major Basin Studies. The presentation will summarize our findings and conclusions, and will be prepared for a 1-hour

PowerPoint overview to the City, to supplement the Final Report. The objective of the Presentation is to provide the City of Griffin's stakeholders, who may not be aware of the full content of the Final Report, with an overview of the results specifically as relates to infrastructure capacity needs. We can conduct this Presentation after submittal of the draft report (prior to the Final Report), or as the culmination of the project, at the City's option.

Deliverable: We will provide the City of Griffin with the Final Presentation in native format (ppt).

TASK 9 – MODELING SOFTWARE TRAINING (Not In Scope)

Not used. We have excluded training workshops for City staff on the modeling software with the understanding that the City will not operate the model in-house in the near term, but we can add these services under extended authorization at the City's request.

TASK 10 – ON-CALL SERVICES (Not In Scope)

We will make available appropriate support staff for use by City staff, to run model scenarios or address questions. Support services will be provided on an email and telephone support basis as desired. Telephone inquiries will be considered high priority and email support will be considered lower priority, so that the City can select the level of priority required for our support services.

We will provide these on-call engineering services, with an anticipated time of two (2) hours by telephone and 24 hours by email. These response times are not applicable in cases where engineering services require more than the response time to complete. On-call engineering services will be compensated on an hourly basis in accordance with the terms of our existing agreement.

Assumptions and Exclusions

Our Scope of Services has been developed under the following assumptions and our understandings of the City of Griffin's needs on this project.

- An allowance of \$30,000 for the Bentley SewerGEMS software purchase is included. We will obtain a firm quote for the desired software and options, then purchase the software on the City's behalf. Any unused portion of the \$30,000 allowance will not be billed to the City. Integration of the software into the City's network is not included.
- Purchase of InfoWorks is excluded. We have assumed that the nutrient analysis for Cabin Creek will be completed using Burns & McDonnell licenses, with an output summary (no model files) for this analysis provided to the City.
- Where we have proposed expanding a deliverable in phases for the Potato and Shoal Creek Basins, following the initial Cabin Creek Basin Study deliverable submittal, the intent is that each basin be evaluated discretely and in separate phases, with the Cabin Creek Basin Study constituting this Phase I Scope of Services. No update to prior basin studies or deliverables is proposed, in any given phase of the project.

- Rental of four wastewater samplers, integral to the flow meters, as described in ISCO lease quotation #ISC-155424-1, have been included under an allowance of \$20,000. We have assumed that we will rent and install the samplers along with the meters on behalf of the City of Griffin for use during this project, and that the City will retrieve the samples and analyze each for ammonium as required during the flow and nutrient data gathering phase for Cabin Creek.
- 110-volt (60 Hz) power is required for each of the ammonium probe installations. We have assumed that the City will provide 110 Vac service at each of the monitoring locations, and we will coordinate with the City on adjusting the locations as reasonable to be proximate to a power source while meeting the monitoring objectives.
- We have assumed that Cabin Creek flow and ammonium monitoring and installation of monitoring sites will be conducted concurrently.
- Development of population or flow projections is excluded from this Scope.
- We anticipate that the population/land use data will be provided by the City on the finest disaggregate level available and in a format which relates the population to discrete areas identified in an electronic map format (polygonal geodatabase, shapefile, or ArcInfo coverage).
- We anticipate that the population/land use database encompasses the study area for the master plan.
- In high level review of the City's wastewater GIS network, 584 pipe segments do not have a diameter associated them. We have assumed that the City will update the GIS attributes with data we identify as critical for network connectivity/hydraulic purposes.
- The wastewater collection system model will be constructed from the City's existing GIS database. Refinement is anticipated for connectivity and for limited attribute corrections, as described in this Scope, however it is assumed that the pipe network is complete including survey-grade GIS of invert elevations. No digitizing of the existing pipe network is proposed.
- System elevations will be extracted from the GIS topography, for pipes, and from as-built drawings for pump stations. No survey is proposed. Any field verification or data validation needed to construct the models will be provided by the City.
- The City will provide additional available GIS data including maintenance management history records; planning information (existing land use; population data area boundaries; and base mapping information for use in preparing report exhibits and layout of new sewers including roads and highways, water courses, urban boundaries, and elevation contours.
- We have assumed that customer service connections will be readily geocoded according to Parcel ID. Burns & McDonnell will attempt to reconcile mismatch data using customer address, but assistance from the City's GIS department may be required to manipulate the data where service locations are unclear or where customer address formatting is inconsistent (not a direct match to the parcel database). If available the City will provide an Address Geocoder to allow as accurate address matching as possible.
- The City will provide an electronic copy of rainfall monitoring data collected by the City. No rainfall monitoring is included in our scope of services. However we can provide a unit cost for rainfall monitoring, manhole inspection/GPS, or other field services if requested.
- The City will provide operating records for wastewater lift stations.
- Treatment plant evaluations and CIP planning is excluded. The Scope of this project is limited to the sanitary sewer collection system.



- Construction opinions of cost will be based on examination of aerial routes. Inspection of potential routes on the ground is excluded at this planning level phase.

We will gladly expand this Scope, for commensurate compensation, upon your request.

Schedule

Burns & McDonnell is available to begin with Task 1 for the Cabin Creek Basin upon your authorization to proceed. We anticipate a duration of 12 months for Phase I, the Cabin Creek Basin Study, assuming data is available at the start of Task 1, and prompt coordination of reviews/workshops in remaining tasks. This schedule anticipates flow metering and ammonium monitoring (associated with Task 2) to be underway by October 2015. We will include progress reports with a narrative addressing work completed and the status of the project budget and schedule, as part of monthly invoicing.

We anticipate that the Potato and Shoal Creek Basin Studies will be authorized separately following completion of the Cabin Creek Basin Study, and that the study duration will be similar (approx. 12 months) for each of these phases.

Compensation

Burns & McDonnell proposes to provide these services under the Master Services Agreement with the City of Griffin on a lump sum basis for the Phase I Cabin Creek Basin Study, for an amount of \$180,800 which includes labor and direct expenses. Invoicing will be provided according to a percent of completion.

Additionally, the following lump sum Allowances are provided, and applicable charges under each Allowance will be invoiced to the City as incurred, with unused portions returned to the project for use at the City's discretion:

Allowance Description	Allowance
SewerGEMS software purchase	\$30,000
Water sampling assemblies*	\$25,000
Allowance TOTAL	\$55,000

**water sampling assemblies will be integral to the flow meters installed in the Cabin Creek Basin Study*

Therefore the project total, inclusive of labor and direct expenses plus allowances is **\$235,800**.



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The parties hereto have accepted and executed this Task Order according to the terms of the Master Services Agreement dated June 10, 2014:

OWNER:

City of Griffin, Georgia

ENGINEER:

Burns & McDonnell Engineering Company, Inc.

By:

By:

A handwritten signature in blue ink, appearing to read "John D. Landa", written over a horizontal line.

Title:

Title:

A handwritten title in blue ink, reading "President", written over a horizontal line.

Date:

Date:

A handwritten date in blue ink, reading "6/15/15", written over a horizontal line.