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June 1, 2016



Mr. Danny Briggs
Utility Design and Plant Engineer
Water Resources Department
Engineering Division
2602 S. Elm-Eugene Street
Greensboro, North Carolina 27406

Subject: Continuing SCADA Support Services for City of Greensboro
Water Resources Department – Water Supply Division
Proposal for Professional Services

Dear Mr. Briggs:

In accordance with your request, Brown and Caldwell (BC or Consultant) and our subconsultant Chester Engineers (Chester) are pleased to present this proposal to provide continuing SCADA support services for the City of Greensboro (City) Water Resources Department's Water Supply Division (Division). This work is a continuation of efforts undertaken for the SCADA Communications Upgrade Phase 1 for Water Supply, as well as additional services to support the Division's operations. This proposal will provide professional services for five tasks of work for the City:

Task 1 – SCADA Communications Upgrade Phase 2 for Water Supply: Consultant will implement the City's new 3G/4G LTE wireless communication system standards at ten (10) remotely located facilities in the Water Supply Division. Consultant will also implement the City's preferred video surveillance system at 22 remotely located facilities in the Water Supply Division.

Task 2 – Groometown and McLeod Water Booster Pumping Stations: Consultant will provide SCADA System Integration Services of the Groometown and McLeod Pumping Stations.

Task 3 – Development of a SCADA information management protocol: Consultant will develop an information management protocol that documents best management practices and standard operating procedures to be used by Consultant and City staff for the handling of sensitive data.

Summary of Scope of Services

Task 1: SCADA Communications Upgrade Phase 2 for Water Supply

The scope of services described in this task is associated with the City standardizing their remote facility communication protocol to a 3G/4G LTE wireless technology. To implement the new communications system, the existing programmable logic controllers (PLCs) (GE 90-30) shall be replaced with GE Rx3i PLCs. The new 3G/4G LTE wireless shall be the Sierra Wireless GX4xx Series Gateway.

As requested by the City, Brown and Caldwell (Consultant) will provide professional services to implement the new communication system for the City's remotely located facilities in the Water Division:

- | | |
|-------------------|--------------------|
| 1. Knox Road | 4. Aycock |
| 2. McConnell Road | 5. U.S. Highway 70 |
| 3. Air Harbor | 6. Stoney Creek |

- | | |
|----------------|-----------------|
| 7. Lake Daniel | 10. Lake Brandt |
| 8. Burlington | |
| 9. Clifton | |

The Consultant will provide design services to prepare construction documents for the ten (10) sites. The construction documents will be prepared to solicit competitive bids from qualified bidders to install a complete system and will define the scope, extent, and character of the work to be performed and furnished by the Contractor. The construction documents will include drawings and technical specifications covering all items to be furnished by the Contractor. The construction documents will be of a similar format to the Phase 1 bid package. The City will provide their standard front ends for the specifications (e.g. invitation for bids, information for bidders, proposal, contract, performance bonds, labor and material bonds, general conditions, etc.); the Consultant will review and edit as necessary to address the specific requirements of the project. All documents prepared for the project will be submitted to the City in PDF format; the City will produce all hard copies of the construction documents required for bidding purposes.

For purposes of this Agreement, the Consultant anticipates that the upgrades for the ten (10) remotely located facilities will be by a single prime contractor under one bid package, which will also include the Phase 1 bid package prepared previously by Consultant.

Two 3-hour review meetings will be scheduled with City staff to review specific design consideration at each remotely located facility. Each meeting will be held at the City's offices.

In addition to the ten (10) remote located facilities called out above, the construction phase of the project will also include the testing, start-up, commissioning, and punch list tasks for the eleven (11) facilities from the Phase I bid package:

- | | |
|-----------------|------------------|
| 1. High Point | 7. Lee's Chapel |
| 2. Gorrell | 8. Muir's Chapel |
| 3. Winola Court | 9. Highway 421 |
| 4. Regional | 10. Townsend |
| 5. Jessup Grove | |
| 6. Haw River | |

In addition, the Consultant's services will include design, programming, and configuration to assist in the install of a video surveillance system including cameras and remote video monitoring (Longwatch) for all 22 sites. For purposes of this Agreement, Consultant anticipates that the Longwatch systems for the 22 remotely located facilities will also be incorporated into one bid package with the communication upgrades described above.

BC will generate an addendum to the record documents to incorporate the Longwatch system on the existing Phase I communications project contract documents. BC will provide a performance specification along with plan view locations for cameras. Such updates will be added to the Water Supply SCADA Communication Project Phase I and II Bid packages. Deliverables will include Bill of Materials, Site Layouts, Wiring Diagrams, and Network Architecture suitable for public bidding.

During construction, BC will provide the necessary application programming services for the Longwatch system. These include the 22 identified sites in the Communications projects, Phase I and Phase II. These services include the addition of new remote sites to

the Video Control center. Also, SCADA will be programmed with a common fail alarm for each site system and an alert for operations ofsite breaches at the remote workstations.

BC will also prepare process flow diagrams (PFDs) of the critical process-related features of the 20 remote pump stations to aid the City's asset management efforts. The PFDs will generally depict on single-line diagrams the number, type, and arrangement of pumps, piping connectivity, valves, and flow meters that generally define the function of each pump station.

Task 2: Groometown and McLeod Water Booster Pumping Stations

The Groometown and McLeod Water Booster Pumping Stations are each new facilities, grade level pumping stations that will be supplied with new pumping equipment, electrical equipment, chemical feed equipment, and SCADA equipment. The City has retained Chester Engineers (Chester) under a separate agreement to provide engineering design services for the Groometown and McLeod Water Booster Pumping Station Projects. As requested by the City, the Consultant will work with City staff and Chester to provide design, construction, and SCADA system integration services for instrumentation and control elements only of the new Groometown and McLeod Water Booster Pumping Station projects.

The Consultant will also, at the request of the City, support Chester exclusively in an as-needed advisory capacity during their performance of the project. It is understood that Chester will be solely responsible for the performance of the duties assigned under their separate agreement with the City.

To complete the SCADA integration services requested by the City, the Consultant will communicate with, and provide input to, Chester during the construction of the water booster pumping stations.

Task 3 – SCADA Information Handling Protocol

Brown and Caldwell (BC) will provide a Memorandum of Understanding (MOU) that details the handling of the City of Greensboro's (CITY) sensitive data. Such data include control system information, credentials, and sensitive communications. The MOU will also detail policies as to how sensitive information will be stored and protected while on BC servers by BC staff.

Detailed Task Descriptions

Task 1: SCADA Communications Upgrade Phase 2 for Water Supply

Task 1.100 – Design Services

The Consultant will provide a complete bid package for the ten (10) remotely located facilities in Phase 2. The construction documents will be prepared to define the scope, extent, and character of the work to be performed and furnished by the Contractor. The construction documents will include drawings and technical specifications covering all items to be furnished by the Contractor. The construction documents will follow the format used for the Phase 1 bid package and will be combined into one bid package for all 20 sites.

BC will generate an addendum to the record documents to incorporate the Longwatch system on the existing Phase I communications project contract documents. BC will provide a performance specification along with plan view locations for cameras developed using GIS data and aerial photos provided by the City. Such updates will be added to the Water Supply SCADA Communication Project Phase I and II Bid packages. Deliverables will include Bill of Materials, Site Layouts, Wiring Diagrams, and Network Architecture suitable for public bidding. The Consultant will prepare the bid packages using City's contract documents and other CSI Division 1 specifications.

Two (2) 3-hour review meetings will be scheduled with City staff to review specific design consideration at each remotely located facility. Each meeting will be held at the City.

The Consultant will participate in one meeting to review the proposed bid packages at the 90% completion milestone and will revise the design to incorporate the City's comments.

Two (2) cost estimates will be prepared, one (1) each for Phase I and Phase II bid packages, and provided to the City when each design has been completed and prior to bidding.

Deliverables: Construction Documents and Cost Estimates in PDF format

Task 1.200 – Bidding Services

During the bidding of the Phase 2 project the Consultant will attend one (1) pre-bid meeting and up to two (2) MWBE meetings. The Consultant will also be responsible for providing responses to bidder questions prior to the final bid date. Consultant will prepare up to three (3) Addenda for the bid documents. Consultant will attend bid opening and prepare bid tabulations and recommendation for award to a single prime contractor for the construction project. It is assumed the City will be responsible for administering the bidding process, including the reproduction, distribution, and logging of bid packages and addenda to prospective bidders.

Deliverables: Responses to bidder questions, Addendum, sealed bid tabulation, and recommendation for award.

Task 1.300 – Limited Construction Support

1. Consultant will provide engineering service support during the construction of the Phase 2 project. Services will include up to two (2) submittal reviews, up to 12 RFI reviews, up to 12 coordination conference calls with the City and Contractor, and up to 20 coordination/status calls with City Project Manager/Water Supply Manager. One pre-construction meeting will be scheduled with the Consultant to discuss the project in detail with the City and Contractor; the pre-construction meeting will be held at the City.

During the submittal phase of the project the Consultant will review vendor packages, instrumentation and equipment submittals for the necessary requirements related to the SCADA systems. The Consultant will review a single submittal twice after which additional costs will be incurred if additional reviews are required.

Deliverables: Minutes from pre-construction meeting in electronic format.

2. Consultant will be present and conduct a factory acceptance test (FAT) on the completely new PLC panels for Phase 2; this will include the panels for Lake Brandt and Air Harbor. Two days will be budgeted for this work.

Deliverables: Written report on findings of FAT.

3. Consultant will provide onsite inspection at all 20 sites to confirm Contractor installation is in accordance with contract documents. One (1) day per site is assumed.
4. Consultant will provide a punch list for the Contractor for each Phase to address at each site. Once punch list items are complete, Consultant will perform a final walkthrough for each Phase of construction. Four (4) days total is assumed to perform the final walkthrough; two (2) days for each Phase of construction.

Deliverables: Completed punchlists.

Task 1.400 – Programming

Consultant will provide PLC and HMI programming services for the upgraded PLC control panels in Phase 2. Activities include:

1. PLC Programming – Consultant will provide PLC programming for new GE Rx3i PLCs and incorporate the existing control strategies at each facility.
2. SCADA Programming – Consultant will modify HMI SCADA screens to capture the revised PLC programming.
3. Networking – Consultant will coordinate the date and time with all parties for setup and activation of networking hardware.
4. BC will provide the necessary application programming services for the Longwatch system. These include the 20 identified sites in the Communications projects, Phase I and Phase II, plus the Groometown and Mcleod sites. These services include the addition of new remote sites to the Video Control center. SCADA will also be programmed with a common fail alarm for each site system and an alert for operations offsite breaches at the remote workstations.

Task 1.500 – Testing, Start-Up, Commissioning, and Punch List

Consultant will provide testing and start-up support services for the (20) remotely located facilities being upgraded as part of the Phase 1 and Phase 2 bid packages. Activities include:

1. Testing and Start-Up – During the start-up of the upgraded PLC control panels, Consultant will provide support to test and commission the new equipment and place process units back into service. One (1) day for two (2) BC personnel per site is assumed for start-up and commissioning of the communications systems. One additional day for one (1) BC personnel per site is assumed for start-up and commissioning of the Longwatch system.
2. Punch List – After the start-up of the new system at each facility has been implemented, commissioning of the process will run for a period not exceed one month and be observed by the City. After the one month timeframe has expired the City will provide a punch list of programming issues observed and for the Consultant to address. Consultant will address any punch list items within one month of receiving the list. It is anticipated the Consultant will make 7 trips to address punch list items.

When each facility's programming punch list items have been completed and signed off by the City, that facility will be considered completed.

Task 1.600 – Record Drawings, Documentation, and Training

Consultant will review all drawings submitted by the Contractor and keep detailed notes during the start-up of each facility. Any modifications needed to the drawings will be given to the Contractor for inclusion in the Record Drawings prepared by the Contractor.

Documentation for each site will consist of:

1. Control Strategies
2. PLC Program
3. SCADA Screen Shots
4. Network Hardware Configurations

The Consultant will provide the following training for City personnel:

1. Two (2) 4-hour training sessions for the remotely located facilities, conducted at the Mitchell WTP and including site visits to two representative remote facilities. These training sessions will be designed for maintenance personnel.
2. One (1) 2-hour training session will be provided for operations personnel, conducted at the Mitchell WTP

Deliverables: Documentation will be provided on two (2) USB thumb drives.

Task 1.700 – Process Schematic Drawings

BC will prepare process and instrumentation diagrams (P&IDs) of the critical process-related features of the 20 remote pump stations to aid the City's asset management efforts. The P&IDs will generally depict on single-line diagrams the number, type, and arrangement of pumps, piping connectivity, valves, and flow meters that generally define the function of each pump station as well as instrumentation controlling them

Deliverables: Documentation will be prepared using AutoCAD and will be delivered on two (2) USB thumb drives for the City's use in ACAD and PDF formats.

Task 1.800 – Additional SCADA Support Services

The Consultant shall provide additional professional services related to the SCADA communications upgrade at remote sites may be requested by the City to support the City's SCADA equipment and systems for the Water Supply Division. This task is included in this Scope of Services as an allowance that can only be used with prior written authorization from the City. Under no circumstances shall the Consultant proceed with Additional SCADA Support Services without written authorization from the City.

Task 2: Groometown and McLeod Water Booster Pumping Stations

Task 2.100 – Design Services

The Consultant will perform the design of the SCADA system and prepare the required technical specifications and construction drawings for each booster pumping station. Consultant will prepare the SCADA system construction documents for incorporation into the City's Design Engineer's overall construction document package for the booster pumping station projects. Design Engineer will provide Consultant with the specification templates. Consultant will use their own CAD standards for the booster pumping station projects. Design Engineer will provide CAD files of all civil, electrical, instrumentation or mechanical backgrounds required by Consultant to prepare the SCADA design.

Consultant's construction documents will be prepared to define the scope, extent, and character of the work to be performed and furnished by the Contractor for the SCADA system. The construction documents will include drawings and technical specifications covering every item to be furnished by the Contractor for the SCADA system.

For the purposes of this Scope of Services, Consultant will prepare the following construction drawings and specifications:

Construction Drawings. For each pumping station, Consultant will prepare a total of four (4) drawings per booster station, two (2) P&ID drawings (legend and abbreviation and booster pump station process sheets), one (1) SCADA Network Architecture and communications system installation drawing, and one (1) Standard Instrumentation Installation Details drawing. No demolition drawings will be provided. Design Engineer will complete demolition drawings and the electrical design for conduits and wiring required to support the new SCADA equipment and systems.

Technical Specifications. For each pumping station, Consultant will prepare specifications for all instrumentation and control equipment, PLC and communication panels, etc.

The City and Design Engineer will provide Division 0 and Division 1 specifications (i.e. invitation for bids, information for bidders, proposal, contract, performance bonds, labor and material bonds, general conditions, supplemental general conditions, etc.), and Consultant will review and provide written comments as necessary on the Division 0 and Division 1 specifications to address the specific requirements of the SCADA system and equipment. All specifications prepared for the project will be submitted to the City and the design engineer in hard-copy format, as well as MS Word-Windows format.

The construction drawings for the SCADA system will include equipment specifications and bill of materials for the control network architecture and an opinion of construction costs. The construction documents will be sufficiently detailed to allow competitive bidding for construction.

The scope of services includes attending two (2), 2-hour review meetings with City staff and Design Engineer staff for the SCADA system design (50% review and 90% review meetings) held at the City. Consultant included four (4) 1-hour design coordination meetings with Design Engineer.

Deliverables: Construction Documents and Cost Estimates in PDF format

Task 2.200 – Bidding Services

During the bidding of Task 4 pump station project the Consultant will attend one (1) pre-bid meeting. The Consultant will also be responsible for providing responses to Contractor questions related to SCADA prior to the final bid date. Consultant will prepare one (1) Addendum for the bid documents that will be distributed by others. Consultant will attend bid opening. The City or City's Design Engineer will be responsible for preparing bid tabulations and recommendation for award to a single prime Contractor for the construction project.

Deliverables: Responses to Contractor questions, Addendum.

Task 2.300 – Construction Support

1. Consultant will provide engineering service support during the construction of Task 4. Services will include up to four (4) submittal reviews, up to 4 RFI reviews, and up to six (6) progress meetings with the City and Contractor, including one pre-construction meeting.

During the submittal phase of the project the Consultant will review vendor packages, instrumentation and equipment submittals for the necessary requirements related to the SCADA systems. The Consultant will review a single submittal twice after which additional costs will be incurred if additional reviews are required.

2. When construction of water booster pumping station control panels have been completed and tested, the Consultant will conduct a factory acceptance test (FAT) of the control panels at the panel builder's shop. One (1) day will be allotted for both of

the control panel FATs. The FATs will consist of verifying I/O signals from the field terminals to the PLC for each control panel.

Deliverables: Written report on findings of FAT.

3. After the start-up of the PLC control panels the Consultant will provide field acceptance testing and review of the Instrumentation and Controls construction. Up to three (3) days of field acceptance testing and reviews is estimated.
4. Consultant will provide a punch list for the Contractor to address at each site. Once punch list items are complete, Consultant will perform a final walkthrough for each Phase of construction. Two (2) days total is assumed to perform the final walkthrough; one (1) day for each site.

Deliverables: Completed punchlists.

5. The final engineering record drawings will consist of three (3) electronic copies (pdf / AutoCAD) on USB/Memory sticks with:
 - As-Built P&ID Drawing set
 - As-Built Control Descriptions

Deliverables: Final Engineering Record Drawings in electronic format.

Task 2.400 – Application Programming

1. PLC Programming – The Consultant will provide Programmable Logic Controller (PLC) Programming for the new GE PLCs at each water booster pumping station. All programming will be based on the algorithms called for in the control description documents. All PLC programming will be completed in accordance with City's programming standards.
2. OIT Programming – The Consultant will provide Operator Interface Terminal (OIT) Programming for the new GE Quick PanelViews touch screen at each water booster pumping station. All programming will be based on the algorithms called for in the control description documents.
3. Network Equipment Configuration – The Consultant will establish and configure 3G/4G LTE cellular communications between the water booster pumping stations and the NL Mitchell Filter Plant. This task will also include setup of network switches, firewalls and communications between networked equipment at the water booster pumping stations based on the SCADA architecture shown in the contract documents.
4. SCADA Programming – The Consultant will provide modifications to the existing Wonderware (v10.5) SCADA application at the NL Mitchell Filter Plant. Updated SCADA system will provide the functionality as called for in the algorithms described in the control description documents. Revised SCADA application will communicate with the GE PLC system over the new 3G/4G LTE cellular communications system. All SCADA programming will be completed in accordance with City's programming standards.

Task 2.500 –Testing, Start-up and Commissioning

1. Start-Up and Commissioning – During the start-up of the PLC control panel the Consultant will provide PLC, OIT and SCADA software start-up services and commissioning of the new equipment after Owner's Representative confirmed and signed off that all the equipment is installed, terminated and field tested prior to the software testing of each water booster pumping stations. For budgetary purpose the Start-up and Commissioning services are limited to five (5) days for two (2) BC personnel.

Commissioning will begin at the end of the site start-up and will continue for 30 days. At this point, the projects will be substantially complete. During commissioning, critical points of the application programming will be spot checked by the City and questions and issues will be logged by the City.

2. Punch List – At the completion of the 30-day commissioning period, the Consultant will address the defects identified on the punch list for up to one (1) day. The Consultant will investigate and repair punch list items during a four-week period beginning immediately after substantial completion. The City shall witness and sign-off on completed punch list items. Once the punch list items are resolved the project will be considered completed.

Task 2.600 – Training and System Documentation

1. The Consultant will provide system training for the operations, maintenance and management staff (two 2-hour operation training sessions, and one 2-hour maintenance training session) for water booster pumping stations. The 2-hour operations training session will be performed at each of the pumping stations and one 2-hour maintenance training session will be performed at the NL Mitchell Filter Plant. The course will address basics such as system overview, navigation, system maintenance and basic start-up configuration.
2. The Consultant will prepare the final SCADA system documentation which will consist of:
 - PLC Applications
 - OIT Applications
 - SCADA Applications
 - Wireless Network Configurations

Deliverables: Three (3) electronic copies (PDF) on USB thumb drives and update the City's external backup drives.

Task 2.700 – Task 4 Additional SCADA Support Services

The Consultant shall provide additional professional services related to the Groometown and McLeod pump stations project that may be requested by the City to support the City's SCADA equipment and systems for the Water Supply Division. This task is included in this Scope of Services as an allowance that can only be used with prior written authorization from the City. Under no circumstances shall the Consultant proceed with Additional SCADA Support Services without written authorization from the City.

Task 3 – SCADA Information Handling Protocol

Brown and Caldwell (BC) will provide a Memorandum of Understanding (MOU) that details the handling of the City of Greensboro's (CITY) sensitive data. Such data include control system information, credentials, and sensitive communications. The MOU will also detail policies as to how sensitive information will be stored and protected while on BC servers by BC staff.

Deliverable: Memorandum of Understanding documenting the protocols, provided in hard copy and electronic copy (PDF).

Task 4 - Project Management and Administration

Consultant will provide project management of Consultant's staff for the duration of this project.

1. Monthly Progress Reports – Consultant will provide monthly progress reports summarizing activities completed and tasks scheduled for the next month. Progress reports will be submitted with monthly invoices.
2. Kick-off Meeting – Schedule and conduct a project kick-off meeting with the City. Meeting agenda items will include:
 - affirm and review the project scope
 - identify and discuss the project schedule
 - identify and discuss issues related to the project
3. Project Schedule – Prepare and provide monthly updates of project schedule for the project.

Deliverables: Monthly Progress Reports with monthly invoice and Kick-off Meeting Minutes in electronic format.

Task 5 – Additional SCADA Support Services

The Consultant shall include work that may be required for the City's SCADA equipment and systems for the Water Supply Division. This task is included in this Scope of Services as an allowance that can only be used with prior written authorization from the City. Under no circumstances shall the Consultant proceed with Additional SCADA Support Services without written authorization from the City.

Detailed Assumptions, Schedule and Budget

Assumptions

1. The City will be available to assist with field investigations.
2. The City will provide all record drawings and PLC programs of the existing equipment to be upgraded.
3. The City will be available for one (1) day at the Consultants office to discuss PLC algorithms for each project Task.
4. The City will be available during construction to answer questions and make any possible decisions that may arise.
5. The City will redline Townsend PLC panel drawings in conjunction with upgrades. Redlines will be used by Consultant to prepare record panel drawings.
6. Townsend PLC panel drawings provided by Brown and Caldwell will be detailed enough to allow the City to perform the work with guidance from Brown and Caldwell. Record Drawings will be sealed by a registered Engineer.

Schedule

The work defined herein shall begin not more than 30 days after Brown and Caldwell receives written authorization from the City. The estimated time for completion is as broken down below:

- Task1 – Within 270 calendar days of authorization to proceed.
- Task 2 – Is dependent on Design and Contractor Construction schedules, but it is assumed for budgeting purposes to be a 365 calendar day task, with start date after completion of Tasks 1-3.
- Task 3 – Within 45 days of authorization to proceed.

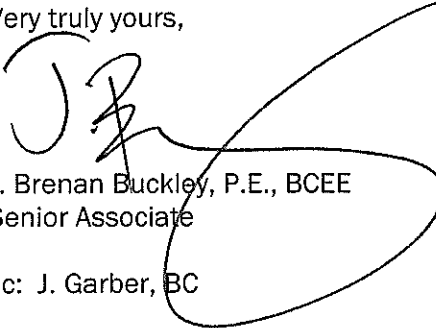
Budget

Compensation for services described in this Agreement shall be on a lump sum basis for Tasks 1 through 5 in the amount of \$725,682. Brown and Caldwell may reallocate compensation between tasks as necessary to complete the scope of work. Compensation for services described in Task 7 shall be on a lump sum basis not to exceed \$40,000. The estimated schedule of values is presented in Table 1.

Task Description	MWBE Fee	Total Lump Sum Fee
Task 1 – SCADA Communications Upgrade Phase 2 for Water Supply	\$115,522	\$402,104
Task 2 – Groometown and McLeod Water Booster Pumping Stations	\$31,410	\$227,456
Task 3 – SCADA Information Handling Protocol	\$0	\$7,442
Task 4 – Project Management and Administration	\$0	\$48,680
Task 5 – Additional SCADA Programming Services	\$0	\$40,000
Total Lump Sum Fee	\$146,932	\$725,682

We look forward to the opportunity to perform the work for you. Please call if you have questions.

Very truly yours,



J. Brennan Buckley, P.E., BCEE
Senior Associate

cc: J. Garber, BC