Detailed Proposal
Prince William County Service Authority

Distribution and Collection SCADA Replacement Project
RFP#SA 2113-DP
April 24, 2013

in association with

CDM Smith

and

SECO
January 16, 2013

To Whom It May Concern:

I had the pleasure of witnessing the programming and start-up work by Josh Gelman and the rest of the CDM Smith programming team on the Corbalis Water Treatment Plant Stage III Expansion project.

Josh and his team truly work in the spirit of cooperation and partnership with their clients. Beginning at project kick-off, Josh established a solid working relationship that continued through construction. He listened and addressed all of our concerns and, in many cases, implemented enhancements to improve the overall system. CDM Smith’s communication with our staff was excellent and it was a pleasure to watch the positive working relationships that developed through the process.

From an operational perspective, the plant start-up and system transition went very smooth with no unplanned outages or impacts to processes. Although the General Contractor was responsible for maintaining operations, in actuality, Josh and the dedicated programming team worked directly with all parties to ensure the plant was running properly at all times.

A true testament to the work performed is that the transition from CDM Smith to Corbalis I&C staff was seamless. To my knowledge, CDM Smith has been called only twice to consult on minor troubleshooting tasks, both of which were solved immediately.

Fairfax Water was very fortunate to have a professional, experienced consultant leading this project. I would recommend CDM Smith for any SCADA project. I have no doubts you will be exceptionally pleased with their work. If you have any questions, please feel free to contact me.

Sonny Ngo
Technology Director
703-289-6521

“Josh and his team truly work in the spirit of cooperation and partnership with their clients. Beginning at project kick-off, Josh established a solid working relationship that continued through construction. He listened and addressed our concerns and, in many cases, implemented enhancements to improve the overall system. CDM Smith’s communication with our staff was excellent and it was a pleasure to watch the positive working relationships that developed through the process.”

Sonny Ngo
Fairfax Water
April 24, 2013

Prince William County Service Authority
Procurement Department
4 County Complex Court
Woodbridge, VA 22192

Subject: Distribution and Collection SCADA Replacement Project, RFP SA 2113

Dear Ms. White:

The CDM Smith team is very pleased to submit our detailed proposal for the Prince William County Service Authority (the Authority) SCADA replacement project. We believe this is the region's most important SCADA project in the last 10 years and we are excited to be part of it.

As introduced in our previous submittal, CDM Smith has assembled the industry's most qualified team for this project. Partnered with Sherwood Logan Associates and Singleton Electric, we offer the Authority a team that is not only experienced and local, but proven. Together, these firms are responsible for positive outcomes on SCADA and technology systems improvements projects for DC Water, the Washington Suburban Sanitary Commission (WSSC), the Upper Occoquan Service Authority (UOSA), and Loudoun Water. We have a strong understanding of and appreciation for one another's strengths and share a commitment to high quality standards and client service excellence.

Led by industry expert Joshua Gelman, P.E., this team is prepared to deliver a true success story for the Authority, like those we have accomplished at Fairfax Water's Corbalis water treatment plant and UOSA's group pump stations. With our guidance, this project will provide you with an affordable, self-sufficient SCADA system that serves as a strong example of effective client-consultant partnership.

This detailed proposal outlines our technical approach to the planning, design, and construction of your SCADA system. We look forward to the opportunity to discuss this in further detail at our interview on May 3, 2013. If you have questions or need any clarification, please contact Josh at 703-691-5433.

Sincerely,

William F. Schafer, P.E., LEED®, AP
CDM Smith Inc.

Brian E. Hagerich, DBIA
CDM Smith Inc.
April 16, 2013

Request For Detailed Proposal
Addendum #1

RFP SA 2113-DP - DISTRIBUTION AND COLLECTION SCADA REPLACEMENT PROJECT

The Request For Detailed Proposal Solicitation is hereby Amended as Follows:

Addendum #1:

a. Proposal Due Date Extension
b. Additional Clarifications to the Solicitation

Acknowledgement: Offerors submitting a proposal for the above named project shall take note of the following changes, additions, deletions, clarification, etc., in the Solicitation Documents, which shall become a part of and have precedence over anything shown or described in the Solicitation Documents, and as such shall be taken into consideration and be included in the Offeror's Proposal. All other terms and conditions of the solicitation shall remain unchanged.

Offerors must acknowledge receipt of this amendment by signing and returning this addendum with the proposal response prior to, or at the proposal due date and time and shall acknowledge the receipt of this addendum where designated.

Authorized Signature

Date

William F. Schafer
Name Printed

Senior Environmental Engineer
Title

CDM Smith
Company Name

Direct all inquiries to: Angela White, Prince William County Service Authority, T: (703)335-7920/ F: (703)335-7954, E-mail: purchasinggrouppemail@pwcsa.org
ADDENDUM NO. 1
TO
DETAILED PROPOSAL SOLICITATION

Project: Distribution and Collection SCADA Replacement Project
Owner: Prince William County Service Authority Woodbridge, Virginia
Solicitation No.: SA 2113-DP
Date: April 16, 2013

• **Proposal Due Date:** The due date of the Detailed Proposal is hereby extended to:
  Wednesday, April 24, 2013 at 10:00 am EST.

• **Additional Clarifications to the Solicitation**

  **Section XVII Submission Requirements:**

  **E. Design and Construction Plans**

  The Service Authority is expecting plan(s) that are generic to the type of facilities visited for the
  pilot. The intent is to show that the Offeror can plan the project activities, understands the risks
  associated with the activities, and knows how to mitigate the risks. The plans will be adapted for
  each specific facility during the design phase of the Interim Agreement.

  **F. Budgeting**

  The comment “Assume Stand Alone Licensing” was meant to convey the Offeror should not
  consider this as an extension of the Wonderware system at our Mooney facility for purposes of
  budgeting. Please provide budget estimates for redundant server licensing under this
  requirement. Please consider the appropriate amount of redundancy versus cost based on your
  experience. The budget provided at this time is not a criterion in the proposal evaluation. The
  Service Authority realizes the detailed proposal is NOT a total design. The intent is to determine
  what each firm feels is important in a system design and a Rough Order Magnitude estimate to
  achieve it.

END OF ADDENDUM #1
Executive Summary

“In my career, I have had the opportunity to oversee four complete control system replacements working with numerous control system integrators, engineers, and contractors. Of all these projects, CDM Smith did one of the most complete and thorough jobs I have ever been part of. I highly recommend them for your automation needs and encourage you to contact me with any questions regarding their services or this recommendation.”

– Diane C. McCormick, P.E.
District of Columbia Water and Sewer Authority
Executive Summary

Prince William County Service Authority (the Authority) is undertaking the replacement of its SCADA system to replace the aging system it currently operates. The size and complexity of the distribution and collection system requires a sophisticated SCADA system to control and monitor the 126 remote sites. The CDM Smith team understands that through a partnership approach, this project will create a new system that is more flexible and reliable. At the end of the project, the Authority will be completely self-reliant to maintain the system themselves.

To meet your needs for this project, we assembled a team that offers local, experienced personnel with strong leadership. This team offers not only strong qualifications in water/wastewater SCADA system design and implementation, but also a history of successful partnerships. With our established working relationships, we will work with the Authority to refine and implement the solutions presented in our Technical Approach (Section 2) and help you create an enduring success story on this project.

A Proven Local Team

CDM Smith, Sherwood Logan Associates, and Singleton Electric have partnered with one another on many successful SCADA and technology systems improvements projects throughout the region. Our team offers the Authority technical expertise, strong water and wastewater engineering qualifications, electrical design insight, and the necessary production capabilities, along with our invaluable history of proven success. Our personnel know and respect one another. We fully understand our capabilities, both technically and regarding staffing. Most importantly, we know they share our values and are dedicated to proper quality control, deliverable excellence, and meaningful client partnerships. Offering a proven team like this one significantly lowers your risk for conflict on the job, thereby minimizing the chance of conflict-related delays or budget exceedances.

Throughout the development of our proposal, the CDM Smith team has demonstrated our potential for an extremely successful partnership on this project. We have conducted several internal workshops and collaborated on innovative solutions for the Authority’s project. The deadline for this technical proposal was tight, but the members of our team showed true commitment to a winning response, submitting their deliverables on schedule and exhibiting open and effective communication with their team members.

We understand the Authority’s interest in establishing a close, collaborative relationship between your staff and the consultant, and with all key CDM Smith staff within 20 miles of your headquarters, we will be a regular, on-site presence and readily available for face-to-face meetings and site visits. This team will be led by industry expert Joshua Gelman, P.E. Josh is a hands-on leader who is repeatedly praised by his clients for his focus on teamwork and client partnership and his ability to foster open communication and meaningful collaboration among members of the client and consultant teams. This focus helped achieve successful

“A true testament to the work performed is that the transition from CDM Smith to Corbalis I&C staff was seamless. To my knowledge, CDM Smith has been called only twice to consult on minor troubleshooting tasks, both of which were solved immediately.”

- Sonny Ngo, Technology Director, Fairfax Water
outcomes on Fairfax Water’s Corbalis water treatment plant (WTP) and UOSA’s group pump stations, two projects where this commitment to teamwork with client staff was critical.

Our key personnel are available and ready to support the Authority on this project. We recognize that for the system to be successful, Josh, as your project manager, must be heavily involved with your staff and his attention cannot be divided by multiple competing priorities. While Josh is currently contributing to several high-profile projects in the region, Table 7 (in Section 2) clearly demonstrates that the majority of his responsibilities will be winding down as this project is kicking off. As the table demonstrates, the key members of this team are available to fully support Josh in his interactions with your staff and in the design and construction planning and implementation. This requirement was our key consideration when organizing our team.

A TESTED APPROACH

The following section presents our technical approach to the PWCSA SCADA replacement. This is a proven approach that has resulted in successful outcomes for the Corbalis WTP, the UOSA group pump stations, and numerous other technology system projects. Two key highlights of our approach are our commitment to interaction with your staff during design and the value-added alternatives presented for your consideration.

CDM Smith offers the Authority strong water and wastewater design qualifications in addition to our SCADA design experience. This will prove valuable as, throughout the design, CDM Smith staff can identify possible improvements to optimize operations for the Authority’s consideration now or in the future. During startup, we have the ability to supplement Authority staff to make the process proceed more smoothly.

A COMMITMENT TO COLLABORATION

As we stated within the Conceptual Stage proposal, we offer to co-locate key staff with the Authority, not just during the programming phase, but during the design as well. Because of the heavy emphasis on staff involvement and collaboration, the design phase requires just as much staff involvement as construction. This approach will engage staff and provide the opportunity for impromptu brainstorming sessions and workshops. This will truly provide a integrated team approach between CDM Smith and the Authority.

VALUE-ADDED ALTERNATIVES

Although the RFP asked for detailed information for both the baseline system and the team’s preferred alternative, CDM Smith has proposed two alternatives for both the top-end SCADSA system (Wonderware) and the remote site PLCs (CompactLogix) for Authority consideration. Although the baseline components are fine solutions, CDM Smith believes that the alternatives may align better with the Authority’s goals and objectives. For each solution, CDM Smith has provided a technical evaluation with comparison criteria that highlights the key features and benefits. Although CDM Smith could make a strong case for each solution, ultimately, we will work with the Authority to select which combination of solutions will work best for you.
January 8, 2013

Mr. Josh Gelman, P.E.
CDM Smith
3201 Jarmanstown Road, Suite 400
Fairfax, VA 22030

RE: City of Falls Church Instrumentation/Telemetry And Software Maintenance Services

Dear Mr. Gelman:

I would like to say thank you to CDM Smith on our successful Instrumentation/Telemetry And Software Maintenance Services program. CDM Smith assisted the City with the upgrades to our water distribution SCADA system with the design, and implementation of a new Wonderware HMI and Madicon PLC system that included leased line and cellular back up communications. When we advertised for assistance in maintaining this system CDM Smith was the obvious choice. Since we started receiving these services in April of 2011 we have had nothing but great customer service. In particular I would like to thank you for all the great work you have been involved with personally. You have done a wide variety of work from making modifications to the HMI as requested by our operators, to during times of emergency when we have called upon your knowledge and excellent trouble shooting abilities to return our system back to service due to communication failures.

We look forward to a successful continuation of this program with CDM Smith, and once again thank you.

Sincerely,

Rodney A. Collins
Rodney A. Collins, P.E.
Chief Engineer

“"When we advertised for assistance in maintaining this system, CDM Smith was the obvious choice. Since we started receiving these services in April of 2011, we have had nothing but great customer service.”

– Rodney Collins, P.E.
City of Falls Church
Section 2
Technical Approach

The CDM Smith team visited the Lake Ridge Service Level Facilities on April 4, 2013, with Authority staff. The team evaluated each site to better understand the scope of the project and to prepare this detailed proposal. This proposal presents an assessment of each site, including the work required. This information is followed by a detailed evaluation of the baseline components, including several alternatives. Detailed design and construction plans outline a recommended transition sequence for the remote sites over to the new SCADA system. Sections on budgetary costs, schedule, and risk are also included. The Project Management Plan explains how CDM Smith handles conflict, control of information, resource management, and quality.

Evaluation
EXISTING SITE CONDITION ASSESSMENTS
Lift Station L15
This lift station is made up of an influent wet well pumped by three constant speed pumps. A bubbler system is used for wet well level measurement. The pumps are controlled automatically by a stand-alone controller manufactured by Contegra located within the MCC/electrical panels. Circular chart recorders are used to log data for historical record-keeping. The HSQ RTU with radio telemetry in located in a 24x24x10 inch fiberglass enclosure. The lift station includes an approximately 50-ft-high antenna mast for the existing radio antenna. This mast may be utilized with future radio telemetry upgrades to the site. The status of existing MCC/ electrical panel schematics, control wiring, and HSQ panel wiring diagrams is unknown. The new PLC-based system, including the cellular telemetry, may be installed inside a NEMA 12 control panel or an alternate location in the room is feasible.

Airport Elevated Storage Tank T03
This fresh water storage tank site includes a HSQ system with radio telemetry inside an underground vault. Access to the vault was not provided; however, the Authority stated that the tank contains two pressure (level) transmitters. At the vault location, a large outdoor electrical box houses two sub-enclosures: one for the existing tone telemetry system and the other for an electrical panel board. An access key pad is located on the large panel at grade level. The support structures for this large panel need to be re-anchored or replaced, should it be retained.

The site includes an approximately 30-ft-high antenna mast for the existing radio antenna. This mast may be utilized with the future radio telemetry upgrades to the site. The status of existing HSQ panel wiring diagrams is unknown. The new PLC-based system, including the cellular telemetry, may be installed at the grade level inside a NEMA 4X control panel.

All existing equipment appears to be in good working order. Most existing conduit is rigid steel, with some minor exposed PVC in some locations. Lighting levels were generally sufficient to perform work. Task lights should be used when needed. An access key pad is located at the front door.

The CDM Smith team has evaluated each Lake Ridge Service Facilities site to prepare our detailed proposal.
Cow Branch Booster Pump Station F07
This fresh water booster station contains two sets of pumps that serve different areas of the distribution system. The local controls for pumps 1 and 2 are located in the MCC/electrical panels. These pumps are automatically controlled using a stand-alone controller manufactured by Contegra located in the MCC/electrical panel. Pumps 3 and 4 are also controlled by a Contegra controller; however, the controls are located in a separate wall mounted pump control panel. An HSQ panel with radio telemetry is located in a 36X30X10 inch fiberglass enclosure.

The site also includes an alarm annunciator panel and the chart recorders panel. The operational status of the alarm annunciator panel and the chart recorders panel are unknown. The MCC/electrical panel, HSQ panel, annunciator panel, chart recorder panel and automatic transfer switch are located in the pump room. A shower curtain has been provided to protect these panels from wetting during maintenance or leakage. The site includes an approximately 30-ft-high antenna mast for the existing radio antenna. This mast may be utilized with future radio telemetry upgrades to the site.

The status of existing MCC/electrical panel schematics, control wiring, and HSQ panel wiring diagrams is unknown. Some of the wiring inside the HSQ panel is labeled. All the wall space in the pump room is occupied by the various electrical and control panels. The new PLC-based NEMA 4X panel including the cellular telemetry may be installed at the current HSQ panel location or an alternate location after removing the annunciator panel and/or chart recorder panel.

All existing equipment appears to be in good working order. Most existing conduit is rigid steel, with some minor exposed PVC in some locations. Lighting levels were generally sufficient to perform work. Task lights should be used when needed. An access key pad is located by the front door.

Nottoway Elevated Storage Tank T28
This fresh water storage tank site includes a HSQ system with radio telemetry in a 24X24X10 inch fiberglass enclosure inside the acceptable grade room under the water tank. Two pressure (level) transmitters were installed and wired to the HSQ system. The radio system is installed in a separate panel and appears to be used as a repeater. The existing radio antenna appears to be installed at the high elevation on the tank. If needed, this site may be utilized as the repeater site with the future radio telemetry upgrades to the site.

The status of existing HSQ panel wiring diagrams is unknown. The new PLC-based system including the cellular telemetry may be installed in the room inside a NEMA 4X control panel.

An access key pad is located at the door to the tank. Intrusion detection on the front door and roll-up door appeared to be installed and wired to the HSQ system for status reporting.

Lake Ridge Booster Pump Station F02
The fresh water booster station contains three pumps that serve water storage tanks T03, T23, and T28. This site also serves metering station 27 (MS27), but was not surveyed. For remote monitoring, the station contains a HSQ system with radio telemetry in a 24X24X10 inch fiberglass enclosure. The local controls and automatic controls for the booster pumps are on a separate pump control panel. There is also a leased line based telemetry panel to receive the level signal from the water tanks. The site includes an approximately 30-ft-high antenna mast for the existing radio antenna. This mast may be utilized with future radio telemetry upgrades to the site.

The status of existing MCC/electrical panel schematics, control wiring, and HSQ panel wiring diagrams is unknown. Some of the wiring inside the HSQ panel is labeled. The pump room has available wall space to install a new panel. The new PLC system, including the cellular telemetry, may be installed inside a NEMA 4X panel.

All existing equipment appears to be in good working order. Most existing conduit is rigid steel, with some minor exposed PVC in some locations. Lighting levels were generally sufficient to perform work. Task lights should be used when needed. An access key pad is located at the front door.

Rollingbrook Booster Pump Station F08/MS14
This site is a combined booster pump and metering site. The site includes an outdoor located HSQ system with radio telemetry in a 24X24X10 inch stainless steel enclosure. The local controls and automatic controls (timer based with pressure interlock) are located in a separate adjacent electrical panel. The electrical panel also includes the starter for the booster pump. An access key pad is located next to the HSQ panel. The site includes an approximately 30-ft-high antenna mast for the existing radio antenna. This mast may be utilized with future radio telemetry upgrades to the site.

The status of the existing HSQ panel wiring diagram is unknown. A hand drawn electrical one line and schematic was found in the electrical panel. Some of the wiring inside the HSQ panel is labeled. The site has available space to mount the new panel. The new PLC system, including the cellular telemetry, may be installed inside a NEMA 4X panel.

Lift Station L1
This lift station is made up of two independent wet wells, each served by three pumps. Two of the pumps are VFD operated and the other pump is constant speed. The station includes an HSQ system with radio telemetry in a 36X30X10 inch fiberglass enclosure. The local controls for the lift station pumps are on the MCC/electrical panels. The pumps are automatically controlled using a stand-alone controller manufactured by ABB. The site includes an approximately 50-ft-high antenna mast for the existing radio antenna. This mast may be utilized with future radio telemetry upgrades to the site.
The status of existing MCC/electrical panel schematics, control wiring, and HSQ panel wiring diagrams is unknown. Some of the wiring inside the HSQ panel is labeled. The wall space is available to mount the new panel. The new PLC-based system including the cellular telemetry may be installed inside a NEMA 4X control panel.

All existing equipment appears to be in good working order. Most existing conduit is rigid steel, with some minor exposed PVC in some locations. Lighting levels were generally sufficient to perform work. Task lights should be used when needed.

Potomac Mills Elevated Storage Tank T23
The CDM Smith team did not visit this site, but understands it closely resembles Nottoway Elevated Storage Tank T28.

Project Work
Based on the recent site visits, CDM Smith understands the work required for the remote pilot sites can be divided into three distinct categories:

- Controls
- Video surveillance
- Access control

Controls
Although each site is different and has unique characteristics, the controls portion can be generally described as follows. First, each site’s existing HSQ equipment will be demolished and replaced with a new PLC panel sized to accommodate the I/O counts provided by the Authority. For this proposal, CDM Smith assumed each PLC panel would be sized with an additional 20-percent I/O spares to accommodate any future expansions. Each PLC panel would be equipped with a new 4G cellular modem provided by the Authority. The modems come equipped with integrated Ethernet ports to network various system components such as the PLC, OIT+PLC unit, video cameras, and access card readers that must communicate over the cellular network. Although the cellular signal strength was marginal at a couple of sites, CDM Smith was instructed to assume that a local stubby antenna attached to the PLC panel would suffice.

When the HSQ panels are being demolished, the existing I/O would be labeled, de-terminated, and then re-terminated into the new PLC panels for remote monitoring. For the sites that have hardwired pump controls, typically located inside MCC buckets, those points would be disconnected and interfaced to the PLC panel to allow for the SCADA to control the sites. For each site, CDM Smith will follow an Authority-approved site cut-over plan that details the steps in the site conversion process. In some cases, the existing radio equipment must be kept operational to allow non-Lake Ridge service area sites to remain functional on the existing SCADA system. The cut-over plan will be discussed later in this proposal.

Video Surveillance
CDM Smith understands that the Authority wants to install IP cameras at each site to allow operations the ability to view the site conditions prior to responding to an alarm or event. For the proposal, CDM Smith included one IP-based HD dome, pan-tilt-zoom (PTZ) camera at each site. Each camera will be powered and networked to the 4G cellular modem for remote communications. Each camera will be fitted with vandal protection and safeguarded with an enclosure suited for the elements at each site. In addition, each camera will be equipped with an SD card for recording purposes. CDM Smith recommends the cameras be configured to record at all times, so that when an event (intrusion, flood, or smoke, etc.) is detected, the Authority can access the camera and use the web browser-controls to playback the entire event.

Access Control
CDM Smith understands that the Authority intends to deploy their organization-standard IP-based access card readers to all of their SCADA sites for a single enterprise solution. For the pilot sites, CDM Smith will remove the existing access keypads and replaced them with new access card readers. Each reader will be wired for power and networked to the new SCADA control panel where it will be linked to the 4G cellular modem. The access card readers will be managed by the Authority; however, a dry contact available on the card reader will be wired into the PLC for monitoring. The PLC will be programmed to toggle a software security status each time the card reader is successfully scanned that, based on security instrumentation, will alert operations of an unauthorized intrusion.

PLANNING
CDM Smith evaluated the following SCADA system platform baseline and alternatives for the top-end system and remote site PLCs. The evaluation includes the following:

SCADA Top-End:
- Wonderware’s ArchestrA System Platform (Baseline)
- Schneider Electric’s SCADA Expert ClearSCADA
- Trihedral’s VTSCADA

Remote PLCs:
- Allen Bradley’s CompactLogix PLC (Baseline)
- Allen Bradley’s MicroLogix PLC
- Modicon’s M340 PLC
Section 2 | Technical Approach

Top-End Control Room

Network Protocol (Site to Central): DNP3 versus Modbus TCP

Both Modbus TCP and DNP3 are both TCP/IP-based communication protocols designed specifically for the industrial automation SCADA industries. Modbus is traditionally used because of its simplicity and availability for a very large range of devices. Modbus accesses PLCs by reading or writing from a range of data types by issuing a request to each device, but has no concept of time. While Modbus is widely used in process control systems, it is not seen as the most efficient method for remote monitoring because any data that is not collected by reading is lost when new field data is updated.

Conversely, DNP3, while more intricate, includes more advanced features that make it attractive for remote SCADA applications. DNP3 supports event-driven data reporting at the device level, time-stamped data, and data quality indicators. The master station can easily process change event data because the polled or report by exception data will include time and date stamp information. In addition, the DNP3 standard includes encryption and security features defined by the IEC. A comparison between Modbus TCP and DNP3 protocols is included in Table 1. Because of the robust and intelligent nature of the protocol, CDM Smith recommends the top-end of the SCADA system be designed around DNP3.

Baseline Configuration – Wonderware ArchestrA System Platform

Drawing I-1 details the various components required for the Wonderware ArchestrA System Platform SCADA baseline configuration. As shown on the drawing, the top-end main control room redundant SCADA servers communicate with the remote distribution and collection system via a 4G cellular communications network through a network firewall.

The network architecture is based on a virtualization concept, which reduces the physical hardware costs and installation space requirements. Below is the proposed critical network infrastructure to implement a VMWare vSphere virtualized Wonderware ArchestrA System Platform high availability redundant SCADA system:

- Two ESXi Host Servers: The VMWare vSphere host servers will host the Wonderware Historian Server, ArchestrA Runtime Server, DNP3 KEPServerEX, InTouch with Terminal Services (TS), Redundant Application Servers, Wonderware Information Server and the Wonderware Historian Client.

- Shared Storage Drive: This RAID 5 protected storage drive will store all historical data, acting as a storage back-up for the two main host servers and critical files from the Engineering Workstation.

- Two Thin Client Operator Workstations: These workstations will be dedicated to operation functions by utilizing the InTouch TS System Platform Interface and the Terminal Server.

- Managed Ethernet Switches: Industrial managed Ethernet switches with redundant power supplies to manage the network connections between the operator workstations, servers and remote WAN connections.

- Engineering Development Workstation: The engineering workstation is dedicated to the System Platform development. This workstation can also act as an InTouch HMI “thick” client in the case where the terminal server was to fail.

- Industrial Firewall/VPN-Router: The firewall/VPN will be used to provide secure access to network infrastructure to remote personnel and to provide secure and controlled IP communications between remote facilities at the protocol level. The firewall is the main network component to secure the SCADA network and will include VPN tunneling features, advanced traffic and protocol filtering, and vulnerability protection.

- Uninterruptable Power Supply: All critical control equipment will be powered by a dual-conversion online UPS. The UPS will include networked power monitoring capabilities.

Wonderware ArchestrA System Platform is a widely used HMI platform in the water/wastewater industry. Not only providing quality and proven software, Wonderware branded software is distributed by a local distribution channel with a reputation of high class customer support, and is well known by a multitude of local systems integrators. System Platform is one cohesive system that provides an easy to use HMI development interface and promises very high uptime, 99.9 percent with the proposed architecture.

While System Platform is a popular and appropriate software, there are two main downsides to its system, cost and RTU connectivity. Wonderware ArchestrA System Platform and associated software packages are typically purchased ad-hoc and can add up to a large capital cost. Also, yearly technical support is based on a percentage of base
ClearSCADA offers a similar package of redundant HMI/reporting/alarmaing software to System Platform, at one-quarter of the capital price. ClearSCADA is also especially suited to the Authority application as it is natively based around the DNP3 protocol for remote applications, with full historian backfilling capabilities.

The main difference in the system architecture is the lack of the need for a Terminal Server. Because ClearSCADA is entirely web-based, the only connection is via Internet Explorer. While this has some downside of not running a dedicated application, it reduces maintenance costs of an additional virtual server and lowers cost because Microsoft CALs are no longer required. The engineering workstation will still have the capability for software development but will not have true full client functionality and will be a thin client as well.

The two servers will host the ClearSCADA View X platform and the redundant install. Included on those same servers is the built in ClearSCADA unlimited tag historian collector, DNP3 and Modbus TCP I/O drivers, ClearSCADA WebServer, ClearSCADA integrated reporting software, alarm dialer and all the associated development software.

**Alternative Configuration – Trihedral VTScada**

Drawing I-3 details the various components required for the Trihedral VTScada alternative solution. VTScada is another redundant HMI platform with an integrated historian and alarm dialer suited to a remote monitoring and control application, reliant on web based runtime. VTScada supports virtualization installations, web client access; historian backfilling through an integrated DNP3 driver, as well as GIS map integration, but at this time does not include security configuration through using a domain controller. While the software also carries a capital cost of approximately 25 percent to that of Wonderware, it has a much smaller installation base within Virginia (less than 10 in the water/wastewater industry), and thus has a much smaller system integrator availability knowledge base. However, CDM Smith is seeing the VTScada system penetrating the market in the Southeast United States. CDM Smith’s Orlando, Florida Automation Group has implemented two VTScada systems recently and had a favorable experience using the product.

VTScada is also a web based client structure so the need for a Terminal Server is also diminished, but the lack of a true back-up thick client is lost on the engineering workstation as well. The host servers will host the VTScada development and runtime server platform. Included on those servers is the built in VTScada historian collector, DNP3 and Modbus TCP I/O drivers, and the associated development software. While VTScada supports virtualization through VMWare, there is little or no benefit in doing so because all software is able to reside on the host server.

A comparison of HMI software platforms and cost breakdown is shown in Tables 2 through 5 below.

**Remote Sites**

Attached Drawing I-4 depicts the major SCADA components at the pilot remote sites. As shown on the drawing, the remote locations communicate with the main control room SCADA servers via a 4G cellular communications network.

The major features of the remote SCADA system, applicable for the baseline and alternative configurations are as follows:

- **A Programmable Logic Controller**: The PLC will be responsible for locally monitoring and controlling each remote site’s equipment, and will support direct communications with the SCADA top-end via a DNP3 protocol.

- **A Local Operator Interface**: The OIT+PLC will support fully redundant backup control of the equipment for local control or use during a PLC or SCADA top-end failure. This redundant control will be accomplished via a Modbus TCP link with the PLC and required remote PLC’s in case of a SCADA HMI failure. It also serves as redundant hardwired I/O wired directly to on-board embedded I/O terminals for hardwired control in case of a PLC failure. The design basis is around the Unitronics 570 PLC+HMI.

- **Integrated Mobile 4G Modem/Router**: The 4G cell modem will act as the primary communications interface for the PLC-SCADA and PLC-PLC communications. The modem will also act as the in-panel Ethernet router for connection of all SCADA and security equipment.

- **Video Surveillance and Access Card Readers**: As previously discussed, each site will have an IP pan-tilt-zoom (PTZ) camera installed for monitoring and a card reader for access control.

- **Battery Backup**: All critical control equipment will be powered by a DIN rail mounted 24VDC power supply and battery backup.
**Section 2 | Technical Approach**

### Table 2: SCADA HMI Software Comparison Chart

<table>
<thead>
<tr>
<th>HMI Feature/Characteristic</th>
<th>Wonderware ArchestrA System Platform</th>
<th>Schneider Electric SCADA Expert ClearSCADA</th>
<th>Trihedral VTScada</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Features</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tag Count</td>
<td>Unlimited; Price per Tag</td>
<td>Unlimited; Price per Tag</td>
<td>Unlimited; Price per Tag</td>
</tr>
<tr>
<td>SCADA Server Redundancy</td>
<td>Yes; Requires Dedicated Cross-over Cable and Server Network Interface, Includes Server Load Sharing</td>
<td>Yes; Supports up to 3 Servers</td>
<td>Yes; Includes Server Load Sharing</td>
</tr>
<tr>
<td>Development Software</td>
<td>Yes; Optional Software</td>
<td>Yes; Standard</td>
<td>Yes; Standard</td>
</tr>
<tr>
<td>Historian</td>
<td>Yes; Optional Software, Price per Tag</td>
<td>Yes; Standard, Unlimited Tags</td>
<td>Yes; Standard, Unlimited Tags</td>
</tr>
<tr>
<td>Reporting and MES Integration</td>
<td>Yes</td>
<td>Yes; Standard Reporting Software</td>
<td>Yes</td>
</tr>
<tr>
<td>Integrated Alarm Dialer</td>
<td>Yes; Optional Software</td>
<td>Yes; Standard</td>
<td>Yes; Optional Software</td>
</tr>
<tr>
<td><strong>System Architecture</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virtualization Support</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Domain Controller Integration</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Object Based Design Interface</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Thin Client Interface</td>
<td>Yes; InTouch TS. True Thin Client, Requires Additional Server</td>
<td>Yes; Web Interface Only</td>
<td>Yes; Web Interface Only, Text Only</td>
</tr>
<tr>
<td>Mobile Device Support</td>
<td>Yes; Requires Remote Desktop/VM Capable Device</td>
<td>Yes; Vector Scalable Graphics Provide “True” Visualization</td>
<td>Yes; Mobile Specific Web Interface Only</td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Modbus TCP</td>
<td>Yes; Standard DAServer</td>
<td>Yes; Standard</td>
<td>Yes; Standard</td>
</tr>
<tr>
<td>DNP3</td>
<td>Yes; Requires 3rd Party Software Driver (KEPServer)</td>
<td>Yes; Standard</td>
<td>Yes; Standard</td>
</tr>
<tr>
<td>DNP3 Subset Level</td>
<td>Level 3 (KEPServer)</td>
<td>Level 3</td>
<td>Level 3</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Support</td>
<td>24/7 Support; Purchased Annually (17% of Purchased Licenses ~$12,000)</td>
<td>24/7 Support; Purchased Annually (~$5,500)</td>
<td>24/7 Support; Purchased Annually (~$4,500)</td>
</tr>
<tr>
<td>PWCSA Prior Experience</td>
<td>Yes (Mooney WRF)</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Regional Install Base</td>
<td>Large</td>
<td>Medium</td>
<td>Small</td>
</tr>
<tr>
<td>Budgetary Cost</td>
<td>~$72,000</td>
<td>~$26,000</td>
<td>~$20,500</td>
</tr>
</tbody>
</table>

### Table 3: Wonderware ArchestrA System Platform Budgetary Cost

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Budgetary Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>ArchestrA System Platform (Application Server SK I/O with 4 Application Server Platforms, Historian Server SK Tag Enterprise Edition, 2 Device Integration Servers, Information Server with 1 IS Advanced CAL)</td>
<td>$24,000</td>
</tr>
<tr>
<td>Development Studio</td>
<td>$13,000</td>
</tr>
<tr>
<td>Remote Response Objects</td>
<td>$3,000</td>
</tr>
<tr>
<td>Thin Client License (5)</td>
<td>$18,000</td>
</tr>
<tr>
<td>2 KEPServer EX Servers</td>
<td>$6,000</td>
</tr>
<tr>
<td>Total (assuming 5 thin clients)</td>
<td>$72,200</td>
</tr>
<tr>
<td>Annual 24/7 Support</td>
<td>$11,500</td>
</tr>
</tbody>
</table>

### Table 4: Schneider Electric SCADA Expert ClearSCADA Budgetary Cost

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Budgetary Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary ClearSCADA ViewX Server (ViewX Server SK I/O, Historian Unlimited Tags, Development Studio, Reporting Software, DNP3 &amp; Modbus TCP Drivers)</td>
<td>$7,950</td>
</tr>
<tr>
<td>Redundant ClearSCADA ViewX Server (ViewX Server SK I/O, Historian Unlimited Tags, Development Studio, Reporting Software, DNP3 &amp; Modbus TCP Drivers)</td>
<td>$7,950</td>
</tr>
<tr>
<td>ViewX Client (1)</td>
<td>$1,950</td>
</tr>
<tr>
<td>WebX Web Client (5)</td>
<td>$5,750</td>
</tr>
<tr>
<td>WebX Web Server (2)</td>
<td>$2,500</td>
</tr>
<tr>
<td>Total (assuming 5 thin clients)</td>
<td>$26,100</td>
</tr>
<tr>
<td>Annual 24/7 Support</td>
<td>$5,445</td>
</tr>
</tbody>
</table>
Table 5: Trihedral VTScada Budgetary Cost

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Budgetary Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTScada Development Server 5K Tags License (Includes DNP3 &amp; Modbus TCP Drivers, Unlimited I/O Historian and development software)</td>
<td>$6,417</td>
</tr>
<tr>
<td>VTScada Redundant Runtime Server</td>
<td>$3,208</td>
</tr>
<tr>
<td>Alarm Dialer/WAP</td>
<td>$2,142</td>
</tr>
<tr>
<td>Thin Client License (5)</td>
<td>$8,673</td>
</tr>
<tr>
<td>Total (assuming 5 thin clients)</td>
<td>$20,440</td>
</tr>
<tr>
<td>Annual 24/7 Support</td>
<td>$4,300</td>
</tr>
</tbody>
</table>

Back-up Radio Communications: As part of a redundant control philosophy, CDM Smith recommends the Authority consider reusing their existing UHF radio infrastructure to provide backup peer to peer communications should the cellular network fails. This solution provides an inexpensive backup solution for the cellular network. If the cellular network were to fail, the radio network will continue transmitting crucial tank data to the pump stations to ensure continuous and uninterrupted operation. This network and the associated peer-to-peer communication is depicted on Drawing I-5 Remote Control System Architecture – Backup Existing Radio Network.

Baseline Configuration – Allen-Bradley CompactLogix

Attached Drawing I-6 details the various components required for the Allen-Bradley CompactLogix baseline configuration. The PLC design is based on the newest CompactLogix series processor, the S370 controller series, in conjunction with the RSLogix5000 programming suite. The CompactLogix is a small to medium sized controller ideally suited to a small pump station or tank application, while also including advanced control features standard with larger and more complex controllers, such as the re-usable Add-On instruction control blocks. The CompactLogix series PLCs are widely deployed and a prevalent controller in the water/wastewater industry and have a strong user base in the region. The CompactLogix also has an expected product support life cycle of 20 or more years.

While the CompactLogix supports the DNP3 Ethernet protocol described previously, it does not do so natively, but can be integrated with the use of an in-rack third party protocol converter. Currently, the ProSoft Technology communications card is an applicable solution for DNP3 communications, but only offers a buffering cache of 400 DNP3 events, defined as any tag change in state or dead band. Rockwell Automation as told CDM Smith that Allen Bradley is currently developing a DNP3 protocol standard on-board the CPU, but no timetable for release is known.

Also, due to the redundant OIT+PLC solution, the main PLC will need to support Modbus TCP. As with the DNP3 protocol, the CompactLogix does not support Modbus TCP natively but can integrate it with a third party communications card. ProSoft Technology is again the design basis for this protocol converter.

Alternative Configuration - Allen-Bradley MicroLogix

Drawing I-7 details the various components and differences required for the Allen-Bradley MicroLogix configuration. The PLC design is based on the Allen-Bradley MicroLogix 1400 series processor, in conjunction with the RSLogix 5000 programming suite. The MicroLogix 1400 is a small sized controller ideally suited to a small pump station or tank application. It is especially attractive for this project because of the cost, which is approximately one-third the cost of the CompactLogix. However, with the reduced capital cost comes less functionality within the RSLogix 5000 programming suite, including no support for AOI blocks. Also included, as a standard component, is on-board support for up to 6,000 DNP3 events and communications, but it cannot support Modbus TCP simultaneously. In order to implement the redundant OIT+PLC solution, a serial Modbus connection to the PLC must be used. The use of serial Modbus loses the backup remote tank polling functionality that would be available if Modbus TCP was used. While the MicroLogix is not the most advanced controller on the market, it is widely used in a remote telemetry application and because the control logic is not overly complex it may be worth the cost savings.

Alternative Configuration – Schneider Electric Modicon M340

Drawing I-8 details the various components and differences required for the Schneider Electric Modicon M340 configuration. The PLC design is based on the Modicon M340 series processor, in conjunction with the Unity programming suite. The M340 is a small to medium sized controller ideally suited to a small pump station or tank application and has comparable functionality to the CompactLogix, including reusable code in the form of derived function blocks (DFBs).

While there is not much of a software functionality difference between the CompactLogix and M340, the Modicon PLC does support both DNP3 and Modbus TCP with an in-rack communications card provided by Modicon. This is a preferred option because of the single point of contact for continuing support as opposed to the Allen Bradley PLC which requires a third-party card. In addition, the M340 DNP3 buffer capacity is 10,000 events, more than 20 times that of the CompactLogix.

A comparison of PLC and software platforms is shown in Table 6 below.

Design and Construction Plans
Design, Review, and Approval Plan
Project Kick-Off

Upon receipt of notice-to-proceed, CDM Smith will schedule a project kick-off meeting with the Authority and the CDM Smith team to initiate the project. The purpose of this meeting is to outline the goals of the project and establish communication procedures, review the scope of work and project schedule, develop site access requirements, identify the initial detailed field investigations, discuss facility operations,
list permits to be obtained, and establish the overall approach to the project. Critical tasks and responsibilities must be assigned to both the CDM Smith team and Authority personnel to ensure that decisions are made in a timely manner to prevent delays to the overall project schedule.

**Documentation Review**

Prior to the detailed site surveys, the CDM Smith team will perform a thorough review of all available documentation on the remote sites. The purpose of this effort is to gain a level of understanding of the sites and to formulate a plan for the site survey data collection task. Useful documentation for review (if available) prior to any site visit includes: site plans, piping details, electrical single-line drawings, P&IDs, RTU termination drawings, I/O lists, hard-wired relay logic panel schematics, and a description of existing operations. Our review of this information will assist in all field efforts.

### Site Survey

To properly plan and implement the pilot SCADA system upgrade, each site must be thoroughly investigated. For each site, the CDM Smith team will prepare detailed P&IDs and as-built wiring termination schedules for each of the existing control panels.

The P&IDs will be developed in accordance with ISA standard 5.1 and CDM Smith standards. The P&IDs will include hardwired interlocks, equipment, instrumentation, local control panels, pipe data, and SCADA inputs and outputs. The P&IDs will be updated throughout the design process as new instrumentation and I/O signals are identified and added to each site.

As-built wiring terminations are required to develop the design package, including demolition drawings, termination schedules, and cut-over plans for the successful upgrade/migration of the new hardware and software for each remote site. For each HSQ RTU panel,

---

**Table 6: PLC Comparison Chart**

<table>
<thead>
<tr>
<th>PLC Feature/Characteristic</th>
<th>Allen Bradley CompactLogix PLC (5370 controller)</th>
<th>Allen Bradley MicroLogix PLC (1400 Controller)</th>
<th>Modicon M340 PLC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Architecture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I/O Capacity</td>
<td>Large</td>
<td>Limited (One PLC will not accommodate large sites)</td>
<td>Large</td>
</tr>
<tr>
<td>Program Backup Require Replaceable Battery</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Product Maturity (Date Introduced to Market)</td>
<td>2012</td>
<td>2008</td>
<td>2007</td>
</tr>
<tr>
<td>Product End of Life (Estimate)</td>
<td>&gt; 20 Years</td>
<td>&gt; 10 Years</td>
<td>&gt; 20 Years</td>
</tr>
<tr>
<td>Software Architecture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programming Software</td>
<td>RSLogix 5000</td>
<td>RSLogix 500</td>
<td>Unity Pro</td>
</tr>
<tr>
<td>Programming Languages</td>
<td>Ladder Diagram</td>
<td>Ladder Logic Only</td>
<td></td>
</tr>
<tr>
<td>Re-usable Logic Blocks</td>
<td>Yes; Add-On Instructions</td>
<td>No</td>
<td>Yes, Derived Function Blocks</td>
</tr>
<tr>
<td>PWCSA Programming Software Experience</td>
<td>Yes (Mooney WRF)</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>Communications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TCP/IP Ethernet</td>
<td>Integrated on CPU</td>
<td>Integrated on CPU</td>
<td>Integrated on CPU</td>
</tr>
<tr>
<td>Modbus TCP</td>
<td>Integrated on CPU</td>
<td>Integrated on CPU</td>
<td>Integrated on CPU</td>
</tr>
<tr>
<td>DNP3 Protocol Availability</td>
<td>Requires 3rd Party Communications Module (ProSoft)</td>
<td>Available on on-board Ethernet port</td>
<td>Requires Additional Communications Module</td>
</tr>
<tr>
<td>Both Modbus TCP and DNP3 (Ethernet) at same time</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>DNP3 Buffering Capacity</td>
<td>400 Events</td>
<td>6,000 Events</td>
<td>10,000 Events</td>
</tr>
<tr>
<td>DNP3 Subset Level (Security)</td>
<td>Level 2 (some features of Level 3)</td>
<td>Level 2</td>
<td>Level 3</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PWCSA Prior Experience</td>
<td>None</td>
<td>Yes</td>
<td>None</td>
</tr>
</tbody>
</table>
D&C SCADA Project Execution

Design Phase Services

the CDM Smith team will field investigate and verify the hardwired inputs using the existing I/O list provided by the Authority. Each signal wire will be labeled and documented on a panel termination schedule. The panel schedule will be used during construction as the HSQ RTU panel will be removed and the wires will be re-located to the new PLC panel. In addition to the HSQ RTU panels, the CDM Smith team will also need to field verify and document the signals located in I/O termination panels and wired to local station controllers. These signals will also need to be routed to the new PLC panels. All wire labeling added to the signal wires will be shown on new PLC panel drawings provided during the detailed design phase. These details will reduce the time required by Authority staff in troubleshooting problems in the field from the panel to the field sensors or final location.

The CDM Smith team will work with Authority staff to identify any instruments or equipment that may not be functioning properly. This will give the Authority ample time to correct any identified issues prior to site cut-over.

Initiate System Design
Design workshops will be held to drive preference and engage the Authority within the project. After each design workshop, workshop minutes will be provided to document the preferences and decisions made. The information compiled from workshops will be used to generate the final design package. A draft design package will be submitted to the Authority for review. Based on the feedback received, CDM Smith will revise the design package and submit it for final approval. The final approved design package will serve as the basis for developing the construction cost estimate.

Design Workshops
To ensure that the Authority is heavily involved throughout the project, CDM Smith will implement a workshop approach, in addition to interim meetings between key people on the Authority and CDM Smith teams. As noted within the response to the Conceptual Proposal questions, CDM Smith prefers shorter duration workshops that focus on a single topic rather than “marathon meetings” that take a lot of time and include multiple topics and issues. This approach provides opportunities for staff to participate in specific topics to allow the most efficient use of everyone’s time.

The following concentrated workshops are anticipated for the pilot design:
- Site Survey Review
- System Architecture
- Control Strategies
- HMI Configuration
- PLC Programming
- PLC Panel Layouts
- Control Room
- Cut-Over Planning
- Testing
- Training
- Documentation
- Cyber Security
- Access Control
- Video Surveillance

Site Survey Review
This workshop will be held after successful completion of the site survey task. The workshop will include the CDM Smith Project Manager and members from the site survey team. The purpose of this workshop is to present the findings and discuss new requirements for each site. The
results of this workshop will be used as a basis for the various design deliverables that will make up the final design package.

**System Architecture**

The System Architecture workshop can take place prior to the completion of the site surveys. The workshop will include members from the design team and walk through the control system/network architectures presented within this proposal. The discussion will be segmented into two parts, where the first portion is focused on the top-end components, including the HMI software, servers and networking components, such as routers, gateways, and switches, and communications protocols. For the top-end system, server types and quantities will be discussed, along with backup power and various networking interfaces. Although security is a major portion of these discussions, a separate cyber security workshop will be scheduled to address the security techniques that will be employed. If the Authority has not made a final decision on the preferred software platform for the top-end, the workshop will also include a discussion of the various software options and present the advantages and disadvantages of each platform under consideration.

The second portion of the workshop will be focused on the remote system architecture, from the cellular “cloud” to each of the remote pilots included within the pilot. The discussions will focus on the local PLC requirements, use of the OIT+PLC for local monitoring and backup control, selection of communication media and protocols, backup power requirements, and incorporation of cellular for primary communications, and any other communications options for backup purposes. If the Authority has not made a final decision regarding the preferred PLC platform, the workshop will also include a discussion of the advantages and disadvantages of each PLC platform under consideration.

**Control Strategies**

Using the Preliminary Control Narratives provided by the Authority, the CDM Smith team will hold dedicated workshops geared toward the refinement of the strategies on a process-specific basis. For the pilot phase, two control strategies workshops will be conducted: one for the Wastewater Lift Stations (L1 and L15) and one for the Fresh Water Booster Pumping Stations (F02, F07, and F08), which will include the Water Storage Tanks (T03, T23, and T28) and the Metering Stations (MS14 and MS27).

CDM Smith’s automation and operations specialists will work closely with the Authority to define the approach for normal operations and plans to handle various failure scenarios, such as loss of communications, major process equipment, and instrumentation. For all scenarios, our team will evaluate opportunities to leverage automation to improve operational efficiency and reduce operating costs.

**HMI Configuration and PLC Programming Workshops**

Several workshops will be dedicated to the discussion and definition of the programming conventions for the development of the HMI and PLC systems. These workshops will be led by CDM Smith’s Applications Engineering staff that will be responsible for the actual programming during the construction phase. For the graphics sessions, both the supervisory HMI and local OIT systems will be discussed. CDM Smith suggests employing the conventions utilized at the Mooney WRF as a starting point for discussions. The workshops will cover standard

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**SUCCESS STORY:**

**A COLLABORATIVE APPROACH AT THE CORBalis WATER TREATMENT PLANT**

This collaborative approach served CDM Smith well during the Corbalis Stage III Expansion project, where Fairfax Water and our staff worked together throughout the entire project to ensure that Fairfax Water’s needs were met. It was through this collaboration that Fairfax Water staff provided regular input on the entire system to ensure that stakeholder expectations would be met.

Since system development was staged initially at the local CDM Smith office, Fairfax Water regularly visited the office to review the development progress and participate in the actual development effort. This process continued when CDM Smith relocated to the Corbalis Plant before system startup, which provided the plant operators an opportunity to interact with the system before any process was brought on line. This approach was validated, as Fairfax Water Operations embraced the system from day one, and now actively maintains the system with in-house resources.

CDM Smith and Fairfax Water received an ASCE award for the Corbalis project. CDM Smith employed the same collaborative approach proposed for this Authority project.
overview screens, process screens, equipment faceplates, alarm handling, and process configurations down to standard individual HMI objects linked directly to PLC tag structures. The workshops will also cover alarm management, trending, and application security.

For the PLC programming, workshops will be used to define the standard tag structures, control instructions, look and feel, subroutines, programming languages, and documentation to provide the Authority with PLC programs that are as consistent as possible across the entire system. This gives PLC maintenance staff an easier program to troubleshoot, a more readable program to interpret, and an integrated control system, from the PLC to the HMI control objects.

PLC Panel Layouts
Sherwood-Logan will lead a dedicated workshop to standardize the panel configurations at the remote SCADA sites. The workshop will focus on establishing common layouts and components for all new PLC panels for the project. The standard panel configurations for the pilot sites will not only function for the SCADA project, but also serve to standardize panels for all future projects.

All PLC panels will be designed based on feedback and preferences from Service Authority staff and will be rated for the environment for which they will be installed. The Authority’s preferred components and construction methods will be used in fabricating the UL labeled panel assemblies.

The control panel thermal requirements will be evaluated during the design phase of the project. Environment and heat load calculations will be performed to determine heating and cooling equipment for each location. The calculations will be documented and provided to the Authority.

Control Room
A series of workshops will be conducted to address how the existing control center is best utilized to support the new system. The control room effort will be led by Timothy L. King, AIA, LEED AP, who recently completed the design of the new laboratory and public education facility at the Mooney WRF and is currently leading the architectural reprogramming of the Mooney C&P Building. Depending on discussions with Authority staff, the control room upgrade could be as simple as reorganizing the existing space with new computers, or it may entail a complete space reprogramming effort with new lighting, flooring, control and technical furniture, computers, and large display panels to support the Authority’s operations, security, and other staff.

Cut-Over Planning
The CDM Smith team will develop a detailed site startup and cut-over plan for the pilot sites outlined in the RFP. Each remote station will have a unique plan for decommissioning the existing RTU system, including communications, and starting up the new PLC panel over cellular. In some cases, the existing radio communications must be kept in operation since they may serve as repeaters for remote sites not included within the pilot.

Details of each plan will be developed in workshops with Authority staff that identifies and quantifies the risk involved in each station startup and performing a “What if” analysis for potential operational problems should station communications and/or a control issue occurs during cut-over. The plan will provide a sequence of construction and startup activities required for each station which will act as a checklist before startup can occur. Each startup plan will include field and SCADA verification of all monitoring points and communication signals being brought on line to the control center to ensure accuracy and alignment of signals between the field instrument and the SCADA system. The plans will also include expected duration of time for each outage to occur and how the equipment will be run in manual mode if required during the switchover process.

Testing
Workshops will be held to discuss the requirements and expectations for formal testing and training of the pilot system. The testing workshop will discuss the parameters of factory, field, and post-startup testing. Although the Sherwood-Logan factory shop is local, CDM Smith prefers that testing be held at PWCSA facilities to minimize overall participant travel and increase Authority participation. Information captured in the testing workshop will be incorporated into the overall testing plan, step-by-step procedures, and formal document sign-off for each test.

Training
A training workshop will be held to discuss the formal training requirements of the Authority. Through the workshop, a customized training plan for the Authority will be developed. The training plan will include:

- Subject matter to be presented
- Delivery styles (classroom versus field training) to most effectively deliver the information
- Class sizes (a maximum seven to 10 participants are desired at most sessions)
- Number of shifts receiving training
Documentation
To allow the Authority to easily maintain their new SCADA system, the CDM Smith team will provide detailed documentation. The documentation will include the necessary information so that those who are not familiar with the system’s design can understand all of the instructions, where they came from, how they are used, and how they can be expanded or modified.

A workshop will be dedicated to the system documentation that will be delivered under the project. An important aspect to this workshop is the incorporation of documentation into the Authority’s document management system.

Cyber Security
A workshop will be held to discuss how cyber security should be addressed for the project. The workshop will be led by the CDM Smith cyber security lead for the project and will include appropriate system design team members. CDM Smith follows the latest and most relevant cyber design guidelines available. Example guidelines from organizations such as ASCE, AWWA, WEF, EWRI, DHS, ICS-CERT, ASCI, and ODVA, are closely reviewed. In addition, we employ our automation group’s national reach, internal automation discipline sites, and forums to ensure best practices and project experience is leveraged for our new cyber security projects.

Although there is no clear blueprint to follow when it comes to cyber security, CDM Smith typically considers the use of the following cyber security elements: firewalls, intrusion detection systems (IDS), virtual private networks (VPN), unified threat management (UTM) solutions, anti-virus, patch management, demilitarized zones (DMZ), and domain servers using Microsoft Active Directory.

Access Control
A half-day workshop will be held to discuss the requirements and control strategies for the access control readers to be installed at each remote site. At the recent site visits, CDM Smith learned that the Authority plans to deploy standardized card readers across the organization. Although the details are unknown, CDM Smith understands the system is IP-compatible and equipped with a dry contact that will be wired directly to the PLC to manage the site security. I/O will be incorporated into the PLC to monitor various security signals at each station. Based on the security level (armed or disarmed) managed by the PLC, the SCADA system will be used to notify SCADA operations when an unauthorized intrusion exists. The exact control strategies will be discussed within this workshop.

Video Surveillance
A half-day workshop will be held to discuss the video surveillance requirements at each remote site. The Service Authority plans to use network cameras for site management purposes, not specifically for security detection. These cameras will “put your eyes on the remote site” prior to dispatching staff. Camera types, locations, and recording details will be discussed within this workshop.

Design Packages
After the site visits, workshops, and collaborative efforts between CDM Smith and the Authority, CDM Smith will produce the formal deliverables that will make up the draft design package. The design package will include the drawings, specifications, and plans required to price and construct the project.

Each remote site will have a unique set of control panel drawings based on standard control panel configurations determined during the PLC panel design workshop. The drawings will depict the specific panel arrangement and labeling for that location, but they will be based on a standard for ease of maintenance at the various sites. Specific I/O assignments will be shown on the control panel electrical schematics. All panel drawings will be dimensioned, and all items identified to match the bill of material. An example PLC panel drawing is included within the drawing supplement for reference.

As part of the design package, CDM Smith will prepare catalog cut-sheets, equipment specifications, and descriptive literature of the proposed hardware and software to be furnished under the project. The Authority will review the proposed hardware and software and provide feedback as necessary. The approved products will be included in the Bill of Material and factored into the project construction cost estimate.

The CDM Smith team will prepare a complete Bill of Material (BOM) for each site included within the pilot system. Each site’s BOM will include the tag, quantity, unit of measure, part number, description, and manufacturer name.

To assist with the remote site cut-over, termination schedules will be developed and provided within the design package. The termination schedule will be created through the site surveys performed at the on-set of the project. The field staff responsible for the system cut-over will reference the termination schedule to determine where the existing wires will be landed within the new PLC panel.

Demolition drawings will be developed for each site and will define which areas and/or equipment will be affected by the project. Site plans will be used to show equipment, instruments, panels, and/or other devices that must remain, be relocated, or removed. As noted in the RFP, all removed equipment will be coordinated with the Authority for salvaging, recycling, or disposal.

For each site, CDM Smith will create a cut-over plan to ensure that there are no unplanned interruptions to remote site operations. The plan will include step-by-step procedures, required durations, and specific steps required to install, commission, and place into operation all new instruments, control panels, networks and appurtenances, PLCs, OITs, and HMI workstations.
Included with the draft design package will be the construction cost estimate prepared by CDM Smith Construction Estimator Frank Adam. The costs will include all costs to procure, install, startup, and test the pilot sites of the system.

After written comments are received from the Authority, CDM Smith will prepare the final design package and professionally sign and seal the documents.

CONSTRUCTION PLAN
After notice to proceed (NTP), the CDM Smith team will begin on system construction. Our applications engineering team will start work on the programming and configuration portion for the pilot system. At the same time, Sherwood-Logan will begin procurement and fabrication of the PLC panels for the pilot sites. In addition, the CDM Smith team will begin assembling all necessary construction permits and coordinating the procurement of the new cellular network with the Authority.

On-Site Programming
The CDM Smith team will first procure the SCADA system hardware and software necessary to program the entire system from the Authority’s offices. The development system will consist of the SCADA servers, operator workstations, a PLC system, an OIT+PLC system, and the switches and firewalls for the network.

After receiving the equipment, the CDM Smith team will deliver and assemble all of the components in a system configuration space at the Authority. CDM Smith’s Fairfax-based staff will work out of the Authority’s facilities on a daily basis working on the PLC programming, HMI programming, and OIT+PLC development. During this time, CDM Smith anticipates a tremendous amount of participation from the Authority. Staff is welcomed to participation during the actual system development like building HMI screens, writing PLC logic, or even testing the system; in fact, we strongly encourage staff to participate in all different elements of the project to improve overall understanding.

After the system has been programmed, CDM Smith will begin system development testing. This informal functionality and communications test will verify that the system is ready for factory testing. CDM Smith will prepare and submit formal system test procedures as defined by the Test Plan developed during the design phase. The approved test procedures will be used at the Factory Acceptance Test.

Procure Communication Services
Under this project, CDM Smith will assist the Authority in coordinating and ordering the new 4G cellular service from Verizon. For this project, CDM Smith recommends that the Authority procure a private, internet restricted service that creates a private cellular network for the SCADA system. CDM Smith will work closely with the Authority and their Verizon Account Manager to select the most appropriate service plan for this project. In addition, the Authority must establish communications from the control center to the cellular network. Most likely, the Authority will use a Multiprotocol Layer Switching (MPLS) connection to the cellular network or an existing dedicated VPN connection from the Authority’s Internet Service Provider (ISP) into the private network. Regardless of the method, CDM Smith will assist as necessary to ensure service is ready for the project.

Construction Permits
Prior to actual field construction, any required permits determined during the design phase will be pulled through Prince William County or the applicable local jurisdiction. The permit requirements will be determined during the design phase based on the work that will take place at each site.

Panel Fabrication and Assembly
Based on the approved design package, Sherwood-Logan will begin procuring and fabricating the PLC panels for the remote sites. The panels will be fabricated in Sherwood-Logan’s panel shop located in Annapolis, Maryland. Authority staff is always welcome to visit the shop at any point during the panel fabrication process.

All panels will be constructed in accordance with UL-508 requirements. Each panel will be rigorously tested by Sherwood-Logan’s in-house team to ensure craftsmanship and operational perfection. Every wired input and output will be thoroughly checked and documented. All panels will be professionally handled using forklifts and wrapped in stretch wrap and banded before shipping.

For most projects, factory testing is typically held at Sherwood-Logan’s facilities; however, for this project, the CDM Smith team recommends staging the Factory Acceptance Test (FAT) at the Authority’s facilities. The primary benefit of testing locally is to increase the Authority’s participation, which allows for informal training opportunities to assist the Authority becoming self-sufficient at the completion of the project. However, prior to shipping the panels, CDM Smith will perform an unwitnessed FAT to check the system.

“In my career, I have had the opportunity to oversee four complete control system replacements working with numerous control system integrators, engineers, and contractors. Of all of these projects, CDM Smith did one of the most complete and thorough jobs I have ever been part of.”

- Diane C. McCormick, P.E., District of Columbia Water and Sewer Authority
Section 2 | Technical Approach

Construction & Configuration Phase Services

Factory Acceptance Test
At the Authority’s facility, CDM Smith and Sherwood-Logan will jointly perform a factory acceptance test. The purpose of this test is for the Authority to witness the functionality, performance, and stability of the entire hardware and software system as a complete integrated system, prior to field installation. The test will follow approved testing procedures and generally include: complete checkout of the fabricated panels, 100 percent I/O point checkout from the PLC control panel to both the HMI and OIT+PLC systems, panel wire pull test, verification of programming, communications, and system backup and failure recovery. Any issues noted during the tests will be addressed immediately and re-tested for final approval.

Site Installation and Startup
After factory testing, the system is ready to be installed and commissioned. An important component of this project is the transitioning process that transfers remote sites operating on the HSQ system over to the new SCADA system—without disruption process operations and the remaining sites operating on the HSQ system. It is important to remember that the Authority will be operating two independent SCADA systems over the course of the entire project.

Overall Site Transition Sequence
CDM Smith has thoroughly reviewed the documentation provided by the Authority and based on the site visits, recommends the following transition sequence for the pilot sites:

1. Lift Station L15
2. Lift Station L01
   The first sites to be transitioned will be the lift stations L15 and L01. These sites do not rely on peer-to-peer (P2P) process data from other sites and operate based on their wet well level. These sites would make excellent candidates to be transitioned first to allow the CDM Smith-PWCSA team to “get their feet wet” for the project.
3. Rollingbrook Booster Pump Station F08 and MS14
   The third site to be transitioned will be the fresh water booster pump station F08. This booster pump station is controlled off of timers, not level, based on the Preliminary Control Narratives (PCNs); thus doesn’t require P2P data from another site. This is the last site that does not require P2P data or affects the existing HSQ radio communications.
4. Potomac Mills Elevated Storage Tank T23
5. Lake Ridge Booster Pump Station F02 and MS27
6. Cow Branch Booster Pump Station F07
7. Airport Elevated Storage Tank T03
8. Nottoway Elevated Storage Tank T28
   The remaining sites consist of two fresh water booster pump stations and three water storage tanks. According to the PCNs, both booster stations operate based off of the T03 tank level; however, both T23, and T28 can be used as backup. Additionally, T28 has a functioning radio that not only transits the tank level two the two booster pump stations, but also serves as a repeater to non-Lake Ridge Service Facilities. This requires the radio at T28 to remain operational throughout the entire pilot project.
   Transitioning T23 first, allows the two booster stations to remain operational using T3, until each is transitioned. After T23 is transitioned, the two booster stations can be each Cut-Over that they will operate over cellular P2P from the T23 tank level. After both booster pump stations, T03 can be transitioned where the two booster pump stations can operate over the primary
tank level. T28 will be last and the radio system must be kept operational after the site is transitioned. Please note that the CDM Smith design includes using the existing radios links between T28 and both F02, and F07 for P2P level redundancy; this functionality cannot be implemented until sites that operate over T28 (as a repeater) are Cut-Over to the new SCADA system during full-system implementation.

CDM Smith will develop Cut-Over Plans for each of the pilot sites. These plans will be discussed and refined during the design workshops prior to construction. Before any site is transitioned, both CDM Smith and the Authority will meet to review how each site will be transitioned and what operational impact or temporary plans must be in place. This is a critical step in ensuring a smooth cut over process. For this proposal, a preliminary cut-over plan for the Lake Ridge Booster Pump Station and Meter Station (F02 and MS27) is included.

Preliminary Cut-Over Plan

Lake Ridge Booster Pump Station - F02 and MS27

A. Equipment to be demolished:
   a. HSQ Panel
   b. Leased Line Communications
   c. Access Keypad

B. Operational Considerations:
   a. Three Constant Speed Pumps
   b. Lead-Lag-Standby control
   c. Level control to storage tanks T03 (primary), T23 and T28

C. Pre-Cut-Over Checks
   a. Cellular modem has been activated, tested, and verified
   b. All signal wires to be transitioned have been properly labeled
   c. Termination schedule and demolition drawings are available
   d. Conduit and cable has been installed between the existing pump controller and the new PLC panel location
   e. Conduit and cable has been installed between the new card reader location and the new PLC panel location
   f. IP camera has been installed and wired to the new PLC panel location
   g. Coordination with Authority operations has been performed

D. Cut-Over Steps

Controls

a. Demolish existing HSQ Panel and remove existing UHF radio equipment.
b. Install a new NEMA 4X PLC panel with new 4G cellular modem and OIT+PLC unit in the location of the old HSQ panel.
c. Install and connect removed UHF radio inside new PLC panel.
d. Interface existing “monitoring only” I/O to new PLC panel.
e. Disconnect exiting control signals from pump control panels.
f. Install terminal blocks and relays in existing pump control panel.
g. Terminate existing pump control signals to new terminal blocks.
h. Terminate new wires from terminal blocks to new PLC panel.
i. Test and commission new system.

Camera

a. Connect the Ethernet cable from the cable to the 4G cellular modem
b. Test camera functionality

Access Control

a. Demolish and replace existing access keypad with new access card reader
b. Connect the Ethernet cable from the cable to the 4G cellular modem
c. Terminate the digital signal from the card reader to the PLC
d. Test access control functionality

Site Acceptance Test

After system startup, each site will undergo a Site Acceptance Test (SAT) which allows the Authority to have full use of the system. During this time, only Authority personnel shall be allowed to operate the SCADA system during this time. During the test, CDM Smith personnel will be present as required to address any potential issues that would impact system operation. Successful completion of the SAT generally requires that the remote site must operate for seven consecutive days without interruption. Throughout the duration of the test, no software or hardware modifications shall be made to the system without prior approval from the Authority.
Training

Formal operator training to be provided during the startup phase of Site Acceptance Testing will include both field and classroom style training. Training will include both CDM Smith team-led sessions and manufacturer-provided training programs. The field training will be held at the pilot sites to present how each site’s operation has been altered as a result of the project.

Informal operator training will be provided throughout the remote-site cut over process. During this time, CDM Smith team will provide a person at the control center capable of answering any of the operator’s questions and concerns during the process. This person will demonstrate the functionality as the Cut-Over process is being performed.

Specific times for delivery of the formal training will be subject to Authority discretion. Initial training generally encompasses a system overview including system and communication architecture, failover and recovery procedures required in case of system power loss. In addition, training will also cover: control logic sequences; specific hands on training on the new HMI screen layouts and functionality of each screen; alarm summary description for each of the remote sites. In addition to control center training, CDM Smith will provide operator training at each remote site to demonstrate the new SCADA equipment including the operation of the site through the OIT+PLC system.

Separate management training will be provided as one or two deliverable sessions depending on availability of staff. This training will provide a high level overview of system design principles, HMI screen operation, control logic sequences and communications techniques used throughout the project.

System administrator training will be held after the last site of the pilot program is commissioned. The training will cover all software configurable aspects of the HMI, PLC, and OIT+PLC systems. Also included will be the cyber security and networking aspects also provided as part of the project. The training will not only focus on how the individual components were programmed and configured, but also focus on troubleshooting techniques and procedures for modifying systems or restoring components after a catastrophic failure.

O&M Manuals

Operations and Maintenance (O&M) Manuals will be provided in accordance with the documentation workshop conducted during the design phase. The O&M manuals will not only include the OEM documentation, but also include the manufacturer, model number, serial number, location, manufacturer phone number, local supplier name, local supplier phone number, replacement cost, and other pertinent data for each device provided under the project. The O&M will also include all original licensed software including serial numbers, license agreements, user registration numbers and related information.

For the Applications Engineering (AE) portion of the project, custom written O&M manuals will be developed by CDM Smith. The AE O&M manual will include programming documentation including troubleshooting guidelines, procedures for downloading program updates to a PLC, procedures for server maintenance and troubleshooting, documented PLC logic programs, and copies of all HMI, PLC, and other configuration files.

All O&M documentation provided for the project will be electronic including final copies of all program files.

As-Builts and Record Documentation

After each site’s successful transition to the new SCADA system, record drawings will be provided to show any deviations made in the field from the original design drawings. At the conclusion of the pilot, CDM Smith will update the complete design package, including all drawings for record purposes. This will provide the Authority with a final deliverable consisting of all product cut sheets, specifications, drawings, and other documents for the project.

Warranty

CDM Smith will provide a 1-year warranty for the work covered under the project. This warranty includes all components provided by the project including both hardware and software. Software defects are covered under the warranty and may include “bugs” inherent within the SCADA software or programmed logic implemented by CDM Smith. CDM Smith has an excellent track record programming SCADA systems, and since the programming team is based in Fairfax, we can quickly mobilize and solve any issue that arises.

All warranty-related items shall be coordinated through CDM Smith’s Project Manager Josh Gelman. If a warranty item is discovered, the Authority should contact Josh to coordinate and share the details. Josh will coordinate the necessary technical resources and develop a plan to address the warranty defect. Josh will formally present a warranty correction plan to the Authority that details how the issue will be resolved and the time frame that issue correction is expected.

After the warranty item is addressed, Josh will provide a warranty completion summary e-mail describing the actions that were taken to remedy the warranty item. If necessary, CDM Smith will issue updated versions of programs or documentation modified during the warranty phase.
BUDGETING
CDM Smith prepared a budgetary level estimate for the items identified in the RFP. The estimate breaks down the price to evaluate the baseline and alternatives for the top-end HMI hardware and software and the remote site PLCs. The pricing for each HMI and PLC combination is included. Our cost estimate is provided in Figure 1.

SCHEDULE
CDM Smith prepared a detailed project schedule, presented in Figure 2, for the entire SCADA pilot program. The schedule includes the anticipated activities included for both the design and construction phases. Per the RFP, the construction phase will not start until the final design package is submitted and approved by the Authority. The schedule is organized by resource type and includes the total man hours anticipated. The schedule will be refined after the detailed scope of work is negotiated with the Authority.

RISK MANAGEMENT
CDM Smith prepared a risk register, presented in Figure 3, for the categories requested by the Authority. Additionally, CDM Smith included some cyber security risks to the register. For each potential risk identified, CDM Smith assigned a scale (High, Medium, and Low) for the magnitude of impact and the probability of occurrence. Finally, mitigation safeguards are listed for consideration.

PROJECT MANAGEMENT PLAN
Strong project management will be critical to achieve an effective, self-sustaining SCADA system for the Authority. CDM Smith and Josh Gelman have employed the management tools and practices highlighted in this section of numerous successful projects, including Fairfax Water’s Corbalis water treatment plant and UOSAs group pump stations.

Conflict Management
Conflict among internal and external team members can have significant negative impacts on a project’s schedule and budget, as well as the overall success and sustainability of the design. CDM Smith believes the key to conflict management is, ideally, avoiding such conflicts altogether. The most effective way to safeguard teams against conflict is careful selection of team members at the outset. This becomes especially important when creating a team with multiple key subconsultants, like the CDM Smith team for this effort.

When Project Manager Josh Gelman began conceptualizing this team, he thought about the ideal SCADA team. If could create a “dream team” that combined technology expertise, water and wastewater know-how, electrical insight, and production capabilities, who would it be? The answer: CDM Smith in partnership with Sherwood-Logan and Singleton. What solidified this grouping as the best solution for this project is the fact that these firms have worked together successfully in the past. Our personnel know and respect one another. We fully understand our capabilities, both technically and regarding staffing. Most importantly, we know they share our values and are dedicated to proper quality control, deliverable excellence, and meaningful client partnerships. Developing a proven team like this one significantly lowers your risk for conflict on the job, thereby minimizing the chance of conflict-related delays or budget exceedances.

Throughout the development of our proposal, the CDM Smith team has demonstrated their potential for an extremely successful partnership on this project. We have conducted several internal workshops and collaborated on innovative solutions for the Authority’s project. The deadline for this technical proposal was tight, but the members of our team showed true commitment to a winning response, submitting their deliverables on schedule and exhibiting open and effective communication with their team members.

Control of Information
The control and distribution of information among internal and external team members is an important aspect of any project, and one CDM Smith takes very seriously. This project will involve a great deal of knowledge sharing and information gathering and dissemination through face-to-face meetings and the multiple workshops outlined in Section C of this approach. In addition to these personal interactions and meetings, our team will employ eRooms to file and share electronic data for the project. The eRoom is easy to master.

eRooms are Web-based “rooms” that offer shared space dedicated to a specific project team. These password-protected sites may be accessed by internal and external team members invited to the room by the site coordinator (in this case, Josh Gelman); depending on their site privileges, team members can view, add, and edit project files. The rooms provide space to store and share the documents regardless of team member locations. They eliminate the need to send large files over e-mail.
Available Resources

As we previously stated, CDM Smith believes the PWCSA SCADA replacement to be the region’s most exciting SCADA project in the past 10 years. This is a strategic pursuit for our firm and, once awarded, this contract will be a key priority until every site is successfully transitioned and the Authority can operate and maintain the system with in-house staff only.

For a project of this importance, we are prepared to dedicate our key technology experts to its success. We recognize that for the system to be successful, Josh must be heavily involved with your staff and his attention cannot be divided by multiple competing priorities. While Josh is currently contributing to several high-profile projects in the region, Table 7 clearly demonstrates that the majority of his responsibilities will be winding down as this project is kicking off. We have also arranged to transfer lower-priority roles and responsibilities to other available staff. We fully recognize that given his role and the complexity of this effort, as well as the level of communication and collaboration desired by the Authority, Josh’s full commitment to this effort is essential. This requirement was our key consideration when organizing our team.

Having completed similar successful SCADA projects from our Fairfax office, we also understand it is critical that Josh is supported by a skilled and available support staff. Table 7 also details the availability of the key personnel from CDM Smith, Sherwood-Logan, and Singleton. These team members’ schedules were also carefully analyzed to determine if they had the time available to fully support Josh in his interactions with your staff and in the design and construction planning and implementation.

Quality Management

For CDM Smith, quality is defined as meeting or exceeding expectations of our clients, as well as the goals we set for ourselves. Project quality management is an integral and mandatory component of each project undertaken by CDM Smith. We have developed and use a formal quality program that is required for all projects.

Basic tenets of our quality management approach include:

- Quality assurance oversees and audits the level of quality control.
- Quality control reviews specific aspects of the project for consistency with established procedures and technical standards.
- There is a focus on quality by all team members in daily decisions and efforts and by all staff, always striving for continuous improvement.

Through this detailed process, CDM Smith’s quality management approach assures high-quality work, keeps quality control constant and consistent throughout the firm, and is fully integrated into every CDM Smith project. Our quality assurance and quality control will be led by David Schwartz, P.E., BCEE, who has been involved in design, construction, and operations projects for the PWCSA. He has worked closely with the Authority on numerous projects, including the H.L. Mooney WRF Expansion and Upgrade design-build project. For this SCADA project, Dave will assure the quality of all deliverables by performing reviews and identifying other senior technical specialists to review the work.
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## CONSTRUCTION

<table>
<thead>
<tr>
<th>Activity</th>
<th>Orig</th>
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<th>Early Start</th>
<th>Early Finish</th>
<th>Budgeted</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>PANEL FABRICATION</td>
<td>6</td>
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<td>12/31/13</td>
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<td>PERMITTING</td>
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<td>PROGRAMMING</td>
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<td>COMPILE/SUBMIT O&amp;MS</td>
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<td>PROCURE COMMUNICATION SVCS</td>
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<td>FACTORY TESTING</td>
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<td>04/07/14</td>
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<tr>
<td>LIFT STATION L15 ELECT. ROUGH-IN</td>
<td>3</td>
<td>0</td>
<td>03/25/14</td>
<td>03/27/14</td>
<td>48.00</td>
<td></td>
</tr>
</tbody>
</table>
## PRELIMINARY OPERATOR TRAINING
- Start: 03/25/14
- Finish: 03/25/14
- Duration: 03/25/14
- Quantity: 16.00

## LIFT STATION L101 ELECT. ROUGH-IN
- Start: 03/31/14
- Finish: 04/03/14
- Duration: 04/03/14
- Quantity: 64.00

## ROLLINGBROOK PS ELECT. ROUGH-IN
- Start: 04/07/14
- Finish: 04/10/14
- Duration: 04/10/14
- Quantity: 64.00

## LIFT STATION L15 PANEL INST.
- Start: 04/11/14
- Finish: 04/14/14
- Duration: 04/14/14
- Quantity: 32.00

## LIFT STATION L15 CUTOVER
- Start: 04/16/14
- Finish: 04/17/14
- Duration: 04/17/14
- Quantity: 48.00

## LIFT STATION L101 PANEL INST.
- Start: 04/16/14
- Finish: 04/17/14
- Duration: 04/17/14
- Quantity: 32.00

## RECORD DWGS/SPECS
- Start: 04/18/14
- Finish: 06/19/14
- Duration: 06/19/14
- Quantity: 80.00

## ROLLINGBROOK PS PANEL INST.
- Start: 04/21/14
- Finish: 04/22/14
- Duration: 04/22/14
- Quantity: 32.00

## LIFT STATION L101 CUTOVER
- Start: 04/21/14
- Finish: 04/22/14
- Duration: 04/22/14
- Quantity: 48.00

## POTOMAC MILLS EL. TK. ELECT. ROUGH-IN
- Start: 04/24/14
- Finish: 04/28/14
- Duration: 04/28/14
- Quantity: 48.00

## ROLLINGBROOK PS CUTOVER
- Start: 04/24/14
- Finish: 04/25/14
- Duration: 04/25/14
- Quantity: 48.00

## LAKE RIDGE PS ELECT. ROUGH-IN
- Start: 04/30/14
- Finish: 05/05/14
- Duration: 05/05/14
- Quantity: 64.00

## POTOMAC MILLS PANEL INST.
- Start: 04/30/14
- Finish: 05/01/14
- Duration: 05/01/14
- Quantity: 32.00

## POTOMAC MILLS CUTOVER
- Start: 05/05/14
- Finish: 05/06/14
- Duration: 05/06/14
- Quantity: 48.00

## COW BRANCH PS ELECT. ROUGH-IN
- Start: 05/07/14
- Finish: 05/12/14
- Duration: 05/12/14
- Quantity: 64.00

## LAKE RIDGE PS PANEL INST.
- Start: 05/07/14
- Finish: 05/08/14
- Duration: 05/08/14
- Quantity: 32.00

## LAKE RIDGE PS CUTOVER
- Start: 05/12/14
- Finish: 05/13/14
- Duration: 05/13/14
- Quantity: 48.00

## AIRPORT ST. TK. ELECT. ROUGH-IN
- Start: 05/14/14
- Finish: 05/16/14
- Duration: 05/16/14
- Quantity: 48.00

## COW BRANCH PS PANEL INST.
- Start: 05/14/14
- Finish: 05/15/14
- Duration: 05/15/14
- Quantity: 32.00

## COW BRANCH PS CUTOVER
- Start: 05/19/14
- Finish: 05/20/14
- Duration: 05/20/14
- Quantity: 48.00

## NOTTOWAY ST. TK. ELECT ROUGH-IN
- Start: 05/20/14
- Finish: 05/22/14
- Duration: 05/22/14
- Quantity: 48.00

## AIRPORT ST. TK. PANEL INST.
- Start: 05/20/14
- Finish: 05/21/14
- Duration: 05/21/14
- Quantity: 32.00

## AIRPORT ST. TK. CUTOVER
- Start: 05/23/14
- Finish: 05/26/14
- Duration: 05/26/14
- Quantity: 32.00

## NOTTOWAY ST. TK. PANEL INST.
- Start: 05/26/14
- Finish: 05/27/14
- Duration: 05/27/14
- Quantity: 32.00

## NOTTOWAY CUTOVER
- Start: 05/29/14
- Finish: 05/30/14
- Duration: 05/30/14
- Quantity: 48.00

---

**Data date**: 04/16/13 12:00PM  
**Start date**: 04/16/13 12:00PM  
**Finish date**: 06/19/14 4:59PM  
**Must finish date**:  
**Target finish date**:  

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## Preliminary Risk Planning Project Risk Log

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loss of SCADA Thin Client</td>
<td>M</td>
<td>L</td>
<td>Additional thin client computers</td>
</tr>
<tr>
<td>2</td>
<td>Loss of SCADA Engineering Workstation</td>
<td>L</td>
<td>L</td>
<td>Maintain up-to-date backups of all programs and files</td>
</tr>
<tr>
<td>3</td>
<td>Loss of Remote Access Laptop</td>
<td>L</td>
<td>L</td>
<td>Use spare laptop computer until current laptop is fixed</td>
</tr>
<tr>
<td>4</td>
<td>Loss of Managed Ethernet Switch-1 (Communications)</td>
<td>H</td>
<td>L</td>
<td>Use redundant switches</td>
</tr>
<tr>
<td>5</td>
<td>Loss of Managed Ethernet Switch-1 (Power Supply)</td>
<td>H</td>
<td>L</td>
<td>Use switches with redundant power supplies</td>
</tr>
<tr>
<td>6</td>
<td>Loss of Managed Ethernet Switch-2 (Communications)</td>
<td>H</td>
<td>L</td>
<td>Use redundant switches</td>
</tr>
<tr>
<td>7</td>
<td>Loss of Managed Ethernet Switch-2 (Power Supply)</td>
<td>H</td>
<td>L</td>
<td>Use switches with redundant power supplies</td>
</tr>
<tr>
<td>8</td>
<td>Loss of SCADA Server-1 or 2 (CPU)</td>
<td>H</td>
<td>L</td>
<td>Use Redundant servers</td>
</tr>
<tr>
<td>9</td>
<td>Loss of SCADA Server-1 or 2 (Power Supply)</td>
<td>H</td>
<td>L</td>
<td>Use redundant power supplies</td>
</tr>
<tr>
<td>10</td>
<td>Loss of Domain Controller Server-1 (CPU)</td>
<td>M</td>
<td>L</td>
<td>Use Redundant servers</td>
</tr>
<tr>
<td>11</td>
<td>Loss of Domain Controller Server-1 (Power Supply)</td>
<td>M</td>
<td>L</td>
<td>Use redundant power supplies</td>
</tr>
<tr>
<td>12</td>
<td>Loss of the Shared Storage Server SAN-1 (Disk Failure)</td>
<td>H</td>
<td>L</td>
<td>Use a disk drive architecture (RAID) that protects the data</td>
</tr>
<tr>
<td>13</td>
<td>Loss of the Shared Storage Server SAN-1 (Power Supply)</td>
<td>H</td>
<td>L</td>
<td>Use redundant power supplies</td>
</tr>
<tr>
<td>14</td>
<td>Loss of Firewall / Virtual Private Network-1</td>
<td>H</td>
<td>L</td>
<td>Keep spare backup ready to deploy</td>
</tr>
<tr>
<td>15</td>
<td>Loss of Firewall / Virtual Private Network-2</td>
<td>H</td>
<td>L</td>
<td>Keep spare backup ready to deploy</td>
</tr>
<tr>
<td>16</td>
<td>Loss of a Programmable Logic Controller (PLC)</td>
<td>H</td>
<td>L</td>
<td>* Use a backup controller (cold, warm, or hot-standby) * Use the OIT+PLC to control site locally and obtain remote level (if required) over Modbus TCP protocol</td>
</tr>
<tr>
<td>17</td>
<td>Loss of PLC Panel Power</td>
<td>H</td>
<td>M</td>
<td>Use a UPS or other battery backed power source</td>
</tr>
<tr>
<td>18</td>
<td>Loss of an Integrated Cellular Modem/Router</td>
<td>H</td>
<td>L</td>
<td>* Use PLC data buffering; *Use backup communications (radio) * Program the PLC (or OIT+PLC) to operate site based on &quot;loss of communications&quot; strategy</td>
</tr>
<tr>
<td>19</td>
<td>Loss of the OIT+PLC</td>
<td>L</td>
<td>M</td>
<td>Maintain a spare backup</td>
</tr>
<tr>
<td>20</td>
<td>Loss of remote tank level (for remote control)</td>
<td>M</td>
<td>L</td>
<td>* Use redundant tank level instruments, * Use additional hydraulically linked tanks for level * Program the PLC (or OIT+PLC) to operate site based on &quot;loss of level signal&quot; strategy</td>
</tr>
<tr>
<td>21</td>
<td>Loss of Pump</td>
<td>L - M</td>
<td>L - M</td>
<td>* Program the PLC (or OIT+PLC) to automatically switch strategy to backup or offline pump</td>
</tr>
<tr>
<td>22</td>
<td>Site Fire, Flood, or other Hazard</td>
<td>H</td>
<td>L - M</td>
<td>* Install and monitor safety instrumentation via PLC * Use IP cameras to assess site prior to entering / responding</td>
</tr>
<tr>
<td>23</td>
<td>Monitor Unauthorized Site Access</td>
<td>H</td>
<td>L</td>
<td>* Use access card readers to determine authorized access * Use IP cameras to assess site prior to entering / responding * Use security instrumentation to detect intrusions</td>
</tr>
<tr>
<td>24</td>
<td>Loss of Verizon 4G Network (Site-to-Central)</td>
<td>H</td>
<td>M</td>
<td>* Data buffering and time stamping (DNP3 protocol) * Backup communications (Future radio network by PWCSA) * Decentralized controls (PLC based) to keep remote site operational</td>
</tr>
<tr>
<td>25</td>
<td>Loss of Verizon 4G Network (Peer-to-Peer)</td>
<td>M</td>
<td>M</td>
<td>* Use another hydraulically linked tank * Use existing radio network to communicate level to site as backup to cellular * Program the PLC (or OIT+PLC) to operate site based on &quot;loss of level signal&quot; strategy</td>
</tr>
<tr>
<td>26</td>
<td>Threat from PWCSA Administrative Network</td>
<td>H</td>
<td>L - M</td>
<td>* Use Firewall/other security device to limit/prevent unauthorized access to SCADA</td>
</tr>
<tr>
<td>27</td>
<td>Threat over Cellular Network</td>
<td>H</td>
<td>L - M</td>
<td>* Use Firewall/other security device to limit/prevent unauthorized access to SCADA * Use secured version of DNP3 (or other) protocol * Use Internet-restricted service from Verizon (or communications provider) * Lock PLC panels to prevent physical access to cellular modem/router</td>
</tr>
<tr>
<td>28</td>
<td>HMI Application Threat</td>
<td>M</td>
<td>M</td>
<td>* Use of Domain Server to manage network authentication and * Use unique usernames * Use HMI auto-logoff feature * Require strong passwords * Disable old user accounts * Require password changes regularly * Establish and enforce computer access policies</td>
</tr>
<tr>
<td>29</td>
<td>Computer Virus/Worm Threat</td>
<td>H</td>
<td>L - M</td>
<td>* Use anti-virus or other security related software * Keep software up-to-date (including antiviruses definitions) * Limit/disable access to external ports * Establish and enforce computer access policies</td>
</tr>
<tr>
<td>30</td>
<td>Operative System Threat</td>
<td>H</td>
<td>L - M</td>
<td>* Restrict user access * Establish patch management program * Disable guest accounts</td>
</tr>
<tr>
<td>31</td>
<td>Programmable Logic Controller (PLC) Threat</td>
<td>H</td>
<td>L</td>
<td>* Use passwords to restrict program access * Lock PLC panels</td>
</tr>
<tr>
<td>32</td>
<td>OIT+PLC Threat</td>
<td>H</td>
<td>L</td>
<td>* Implement application level security from the touch screens * Use HMI auto-logoff feature * Lock the PLC panel to prevent physical access</td>
</tr>
<tr>
<td>33</td>
<td>Networking Equipment such as modems, switches, and routers</td>
<td>H</td>
<td>L</td>
<td>* Change/disable default passwords * Disable unused communication protocols * Lock or disable unused ports</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------------------------------------------------------</td>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------------</td>
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<tr>
<td>SOFTWARE</td>
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<td></td>
<td></td>
<td>* Engage operators in the design workshops</td>
</tr>
<tr>
<td>34</td>
<td>Graphic displays are difficult to use and understand</td>
<td>M</td>
<td>L-M</td>
<td>* Develop graphic standards that are reviewed and accepted by the end-users</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Conduct weekly (or bi-weekly) graphic interface demos with staff on the development system to show graphic progress, explain navigation techniques, and allow users to “play” with the system</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>* Include the operators within the Factory Acceptance Test to work the HMI system to initiate and verify system functionality</td>
</tr>
<tr>
<td>35</td>
<td>Now that control will be available via the SCADA and not through hardwired logic, how do operators learn new control strategies and functionality available through the SCADA system</td>
<td>L</td>
<td>L-M</td>
<td>* Engage operators in the design workshops</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Create on-line “help” that accesses Standard Operating Procedures, control strategy write-ups, or published documentation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Build intuitive graphic control pop-ups that present the different operational modes and meanings.</td>
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<tr>
<td>36</td>
<td>Programming Not Consistent Across Project</td>
<td>M</td>
<td>L</td>
<td>* Establish programming standards</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Perform software development audits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Conduct independent reviews of all programming prior to testing</td>
</tr>
<tr>
<td>37</td>
<td>Errors in coding / scripting / animation</td>
<td>M-H</td>
<td>L</td>
<td>* Use reusable PLC logic code and graphic templates</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Thoroughly test all software components</td>
</tr>
<tr>
<td>38</td>
<td>Programs Not Commented</td>
<td>M-H</td>
<td>L</td>
<td>* Establish best practice documentation for early development effort and distribute to all team member</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Perform software development audits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Conduct independent reviews of all programming documentation prior to testing</td>
</tr>
<tr>
<td>39</td>
<td>Continually Changing User Requirements</td>
<td>M</td>
<td>L</td>
<td>* Conduct design workshops with PWCSA to establish the system requirements and preferences to the new system.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>* Extract details during the Design phase which gets factored into the construction cost estimate</td>
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<tr>
<td>40</td>
<td>Developing Wrong Software Functions</td>
<td>H</td>
<td>L</td>
<td>* Refine preliminary control narratives with the designers and programmers through a collaborative workshop</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Audit programs prior to system development testing</td>
</tr>
<tr>
<td>41</td>
<td>Delivered System is “buggy” All Full of Errors</td>
<td>H</td>
<td>L</td>
<td>* Well defined test plan</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Documented and Witnessed Factory Acceptance Testing</td>
</tr>
<tr>
<td>42</td>
<td>Too many False Alarms during Start-up / Operator Alarm Fatigue</td>
<td>H</td>
<td>L-M</td>
<td>* Well defined alarm points, groups, and priorities</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Train staff on alarm philosophy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Disable all alarms initially and enable as I/O is successfully tested</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Implement alarm suppression and shelving strategies</td>
</tr>
<tr>
<td>43</td>
<td>Trends are difficult to access and use</td>
<td>M</td>
<td>L</td>
<td>* Define trends with user input</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Create buttons and short-cuts directly from screens to access associated trends</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Create standard layout and functionality for all trends to improve overall understanding</td>
</tr>
<tr>
<td>44</td>
<td>Programs / Application is Difficult to Troubleshoot</td>
<td>H</td>
<td>L-M</td>
<td>* Leverage numerous opportunities for informal training</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Use standard tag naming / addressing scheme that allows for sorting and cross reference</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>* Use identifiers to match drawings to trace points from field course, through PLC, to HMI, and on the screen and historical database</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>* Develop base PLC programs for each site type with sections specific to unique aspects</td>
</tr>
<tr>
<td>CONSTRUCTION</td>
<td></td>
<td></td>
<td></td>
<td>Closely coordinate and plan all procurement, fabrication and deliveries as a result of detailed planning, sequencing and scope agreement for all stations with PWCSA, CDM Smith and Major Team Subcontractors and Suppliers. During planning agree to expectations including site sequencing and site specific deliverables.</td>
</tr>
<tr>
<td>45</td>
<td>Project Schedule Delays</td>
<td>M</td>
<td>L</td>
<td>Closely coordinate permitting requirement for each site well in advance to determine all permitting requirements in advance. Obtain phased permitting when feasible and allowable.</td>
</tr>
<tr>
<td>46</td>
<td>Permitting Delays</td>
<td>H</td>
<td>L</td>
<td>Mitigated during proposal phase with selection of Singleton Electric and Sherwood-Logan. These firms bring highly qualified professionals and craft labor as required for the project. Singleton Electric is a major large electric subcontractor that has vast resources that can be pulled on as needed basis.</td>
</tr>
<tr>
<td>47</td>
<td>Labor: Lack of Labor Resources</td>
<td>M</td>
<td>L</td>
<td>The selected team members are well versed in maintaining existing operations of systems similar to the scope anticipated and with advanced planning, close coordination with PWCSA and training of personnel prior to mobilizing on sites, risk of interruption will be low.</td>
</tr>
<tr>
<td>48</td>
<td>Maintenance of existing operations during on-site construction</td>
<td>L</td>
<td>L</td>
<td>Closely coordinate and plan all procurement, fabrication and deliveries as a result of detailed planning, sequencing and scope agreement for all stations with PWCSA, CDM Smith and Major Team Subcontractors and Suppliers. During planning agree to expectations including site sequencing and site specific deliverables.</td>
</tr>
<tr>
<td>GENERAL</td>
<td></td>
<td></td>
<td></td>
<td>Engage operators and end-users starting from project initiation and throughout the entire project</td>
</tr>
<tr>
<td>49</td>
<td>Operator / End-user Resistance to Change</td>
<td>H</td>
<td>L-M</td>
<td>Solicit input and feedback from PWCSA staff</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Foster a culture open to new ideas and concepts</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Promote teamwork and encourage participation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Involve operators and end-users to actively participate in the project</td>
</tr>
<tr>
<td>50</td>
<td>Misunderstanding of the Requirements</td>
<td>H</td>
<td>L-M</td>
<td>Co-locating design team members at PWCSA facilities during design, rather than during the programming phase.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Frequent coordination meetings</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Effective design workshops and detailed meetign minutes capturing decisions and action items</td>
</tr>
<tr>
<td>51</td>
<td>Technology Risks (General)</td>
<td>H</td>
<td>L</td>
<td>Use proven technology, vendors, and design and Implementation practices</td>
</tr>
</tbody>
</table>
### Table 7: Key Personnel Current Assignments and Availability

<table>
<thead>
<tr>
<th>Staff Member</th>
<th>Current Assignments</th>
<th>Ability to Transfer Assignment to Other Staff</th>
</tr>
</thead>
</table>
| **Josh Gelman**       | **Project Name:** Loudoun Water WTP Design Services  
Current Status: 90% Design Milestone  
Expected Completion: July 2013  
Time Commitment: 50%  
**Project Name:** City of Falls Church, VA  
Current Status: On-Call  
Expected Completion: N/A  
Time Commitment: <5%  
**Project Name:** Prince William County Service Authority - Mooney SCADA Enhancements  
Current Status: Task Order  
Expected Completion: June 2013  
Time Commitment: <10%  
**Project Name:** Norfolk Pump Station 88 Construction Services  
Current Status: Shop Drawing Phase  
Expected Completion: Spring 2014  
Time Commitment: <5%  
**Project Name:** Rising Sun, MD WWTP Construction Services  
Current Status: Shop Drawing Phase  
Expected Completion: Winter 2014  
Time Commitment: <5% | No  
No  
No  
Yes  
Yes |
| **Jaime Alba**        | **Project Name:** Prince William County Service Authority - Mooney SCADA Enhancements  
Current Status: Task Order  
Expected Completion: June 2013  
Time Commitment: 25%  
**Project Name:** Loudoun Water WTP Design Services  
Current Status: 90% Design Milestone  
Expected Completion: July 2013  
Time Commitment: 10% | No  
No |
| **Samant Garg**       | **Project Name:** DC Water Main Process Train  
Current Status: Construction  
Expected Completion: Winter 2014  
Time Commitment: 50%  
**Project Name:** West Bank Telemetry Upgrades  
Current Status: Design Kick-Off  
Expected Completion: Winter 2014  
Time Commitment: 20%  
**Project Name:** Loudoun Water WTP Design Services  
Current Status: 90% Design Milestone  
Expected Completion: July 2013  
Time Commitment: 15%  
**Project Name:** Henrico WTP Upgrades  
Current Status: Construction  
Expected Completion: December 2013  
Time Commitment: <5% | No  
Yes  
No  
No |
| **Mike Creighton**    | **Project Name:** DC Water Main Process Train (Electrical Manager)  
Current Status: Construction  
Time Commitment: 60% through 12/13; 50% 1/14 through 5/14  
**Project Name:** DC Water Fort Reno Pump Station  
Current Status: Construction  
Expected Completion: December 2015  
Time Commitment: 100%  
**Project Name:** DC Water Main Process Train  
Current Status: Construction  
Expected Completion: Winter 2014  
Time Commitment: 60% | Resources can be added as required to support Mr. Creighton on these assignments. |
| **Rick Moseley**      | **Project Name:** UOSA - Nutrient  
Current Status: Phase Startup  
Expected Completion: December 2013  
Time Commitment: 10%  
**Project Name:** LaPlata ENR  
Current Status: Submittals Complete  
Expected Completion: December 2013  
Time Commitment: 10%  
**Project Name:** Alexandria Package D  
Current Status: Panel Submittals  
Expected Completion: August 2013  
Time Commitment: 10%  
**Project Name:** Sod Run WWTP  
Current Status: Programming/Startup  
Expected Completion: December 2014  
Time Commitment: 70% | Yes  
Yes  
Yes  
Yes |
| **John Buschman**     |                                                                                     | |

**Notes:**
- Resources can be added as required to support Mr. Creighton on these assignments.