34th Street Pump Station Improvements Project
SAWS Job No. 13-6004
Solicitation No. CO-00072-RA

ADDENDUM No. 3

October 18, 2016

This addendum, applicable to work designated above, is an amendment to the specification documents and as such shall be a part of and included in the Contract. Acknowledge receipt of this addendum by entering the addendum number and issue date on the space provided in submitted copies of the bid proposal.

1. Modifications to the Specifications

1.1. Section 17400

Add Section 17400 titled **Instrumentation and Controls – Control Loop Descriptions** in its entirety.

ACKNOWLEDGEMENT BY BIDDER

Each respondent is requested to acknowledge receipt of this Addendum by his/her signature affixed hereto and to file same and attach with his/her proposal.

The undersigned acknowledges receipt of this Addendum and the proposal submitted herewith is in accordance with the information and stipulations set forth.

Date

Signature

Tetra Tech, Inc.
Texas Registered Engineering Firm F-3924
700 N. Saint Mary's Street, Ste. 300
San Antonio, TX 78205

END OF ADDENDUM

SECTION 17400

INSTRUMENTATION AND CONTROLS - CONTROL LOOP DESCRIPTIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This specification section describes the process control loop descriptions for the equipment being operated at the SAWS 34th Street Pump Station facility. The Control Loop Descriptions are not intended to be an exhaustive list of all software components required to execute control strategies. Rather they are a supplement to the drawings, schedules, and other specification sections.

B. The Application Services Programmer (ASP) will provide the Programmable Logic Controller (PLC) programming, Human Machine Interface (HMI) graphics development, HMI software configuration, database development, report development (as required), and startup/training activities associated with the new equipment provided and with the existing SAWS Control Center.

C. The Control Loop Descriptions specified herein are performance-based and defines the minimum requirements for the ASP. Coordination of the various programs will be the responsibility of the ASP. Auxiliary and accessory programming structures necessary for proper system operation, performance and failure contingency, for all I/O, shall be included whether or not they are shown or described in the Contract Documents.

D. Additional programming responsibilities are detailed in Section 17300 and Section 17305.

1.02 RELATED WORK

A. Process Division

B. Mechanical Division

C. Section 17300 I&C - General Provisions

D. Section 17302 I&C - Testing

E. Section 17303 I&C - Training

F. Section 17305 I&C - Application Services

1.03 SUBMITTALS

A. Submittal Process

1. Submittals will be made in accordance with the requirements of Sections 17300 and 17305 and as specified herein.

2. Submittals require information on related programming to be furnished under this Specification, and described in the related Sections listed in the Related Work paragraph above. Incomplete submittals not containing the required information on the related equipment will be returned un-reviewed.

B. Submittal Content

1. The ASP will create shop drawings, including all diagrams. All shop drawings will bear the ASP's logo, drawing file numbers, and will be maintained on file in the ASP's

archive file system. Photocopies of the Engineer's Diagrams or specifications are unacceptable as shop drawings.

2. Refer to Section 17305 I&C – Application Services for additional submittal requirements.

1.04 SYSTEM DESCRIPTION

A. The Control Loop Descriptions provide the functional requirements of the equipment represented in the Contract Documents. Descriptions are provided as follows:

1. Control system overview and general description
2. Major equipment to be controlled
3. Major Field mounted instruments (does not include local gages)
4. Manual control functions
5. Automatic control functions/interlocks
6. Major indications provided at local control panels and motor starters / VFD
7. Remote indications and alarms

B. The Control Loop Descriptions are not intended to be an inclusive listing of all elements and appurtenances required to execute loop functions, but are rather intended to supplement and complement the drawings and other specification sections. The control loop descriptions shall not be considered equal to a bill of materials.

C. Provide descriptions of instrumentation hardware and/or software as necessary to describe the performance of control functions specified herein and shown on drawings.

D. The existing SCADA Control System (SCS) is a Transdyne Dynac software package. The SCS will monitor/control the 34th Street over a new 4.9 GHz subscriber radio system. In addition, the Security and CCTV system will be configured to utilize the same radio system. The following is a summary of control system functionality:

a. All magnetic flow meters will utilize a protocol converter to communicate with PLC-34SPS over Modbus in addition to utilizing 4-20ma hardwired flow signals.

b. All power monitor's will utilize Ethernet communications to monitor electrical parameters.

c. A new Supervisor Control Panel (SPS) will provide Operators the ability to monitor and/or control locally.

d. The new RIO-Enclosure will also provide Operators the ability to monitor (via local Indicators) Chemical residuals and flows.

e. The Wells will be controlled by PLC-34SPS to maintain the Ground Storage Tank Level when in the automatic mode of operation.

f. The new Fluoride System will be monitored and/or controlled by PLC-34SPS.

g. The Vendor supplied Sodium Hypochlorite Generator's No.1 and No.2 (OSHG) System will be monitored and/or controlled by the vendor provided PLC-OSHG-1, PLC-OSHG-2 and Common Control Panel.

h. PLC-34SPS and/or SCS will monitor the OSGH System.

i. PLC-34SPS will monitor and/or control the Sodium Hypochlorite metering pumps.

j. PLC-34SPS will monitor miscellaneous devices.

1.05 SYSTEM CONTROL PANELS

A. The control panels provided by the PCSI under this contract include the following list. The PCSI and ASP will coordinate programming interface requirements with other vendor's panels.

1. Supervisor Control Panel (SPS) which includes PLC-34SPS
2. RIO-CHEM Enclosure
3. Ground Storage Tank Level Relay Panel
4. Main Security Cabinet (Provided by Integrated Security Vendor, Section 17550)
5. Expansion Security Cabinet (Provided by Integrated Security Vendor, Section 17550)
6. OSGH No.1 Enclosure (Provided by OSGH Vendor, Section 11)
7. OSGH No.2 Enclosure (Provided by OSGH Vendor, Section 11)
8. Common Control Panel for OSGH System (Provided by OSGH Vendor, Section 11)

B. Programming of the new PLC-34SPS and Plant graphical user interface modifications will be performed by the ASP. The programming is intended to incorporate the control descriptions as specified herein. Coordination of the various programs will be the responsibility of the ASP.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS AND DEFINITIONS

The following represent the requirements for all control loops. These process control descriptions shall be used in conjunction with all project drawings.

A. General

1. All PLC programming, graphical user interface configuration will be done in accordance with SAWS Standards. Where conflicts exist between this specification and established SAWS Standards and Conventions, the ASP will issue a Request for Information (RFI) for clarification.
2. All calculations, alarms, and/or shutdown point determinations based on analog values, timer functions, numeric manipulations, etc. will be accomplished in the PLC and not in the graphical user interface (HMI, OIT, etc.) software.

B. Safety, Monitoring and Control Features

1. Alarms

a. All open/close valves and motors monitored by the PLC system will have a maximum time value allowed to either open/close or start/stop. Failure to achieve the control function within this maximum time value will result in a discrepancy alarm for each piece of equipment. An alarm will be calculated in the PLC and shown in the HMI software for indication of the control function failure (e.g. Pump

XX-XXXXX-X FAIL TO START, Valve XX-XXXXX-X FAIL TO CLOSE, etc.). These time delay values will be set during startup and are not operator configurable.

b. The integrity of all analog signals will be verified within the PLC. An alarm will be calculated in the PLC and displayed on the graphical user interface for any analog signal that is beyond range or otherwise invalid (high or low). The Operator will acknowledge, correct the situation, and reset the loop alarm in order for control to revert back to normal.

1) Process Variable Bad Alarm

2) Rate of Change Alarm

c. When the PLC program VFD pump control speed does not match the VFD pump speed feedback within tolerance after a certain time delay, an alarm will be calculated in the PLC and displayed in the graphical user interface software for indication of the control function failure. Engineer level security login credentials needed to adjust the tolerance and time delay at the graphical user interface. These values will be initially set during startup by the ASP working with Plant Operations.

d. Other specific alarms are designated in the control loop descriptions.

e. All alarms will be latched at the control level where they are originated (e.g. alarms that are determined in the PLC are latched in the PLC). All latched alarms can be reset from the graphical user interface.

f. All analog input points will have High-High, High, Low, and Low-Low alarms calculated in the PLC. Each of these will further be independently enabled and disabled as well as have the alarm set points settable from the graphical user interface. The individual field device will have an overall enable disable function interlocked with the alarm enable disables such that in the event of a faulty signal the operator from the SCS can disable the reading. This action will hold last value and auto disable all four alarms. When the operator re-enables the signal the updates will resume and alarms will again be re-enabled. An alarm reset function will be included for these latched alarms.

2. Totalize all pump run times in the PLC and monitor on the graphical user interface. There are to be two run times maintained:

a. Cumulative Resettable.

b. Cumulative Non-Resettable.

3. "Interlock" is a field status point that is hardwired directly to a local control panel or motor starter. This condition must be satisfied in order for the associated machine to be operated and to remain in operation. This point may be wired in parallel to the PCS for remote monitoring, but the safety control functionality does not require PLC intervention. An example is a High Discharge Pressure that will cause a pump to stop if it is running, and will not allow the pump to start if the condition is preexisting. In specific situations, an interlock may involve peer-to-peer communications between PLCs instead of hardwiring if specifically defined as such.

4. "Permissive" can be either a field status point that is hardwired directly to a local control panel or it can be a logical control point from the PCS. It is a requirement to start a machine, but is not necessary for the machine to continue operation once it is started. An example is a high sump level switch that will start a sump pump, but the sump pump will continue operating even after the high sump level switch is cleared. Typically, the sump

pump would continue operating until a low sump level switch is opened to stop the pump. In this case, the low sump level switch could be considered an "interlock" depending on how it is connected.

5. PLC Diagnostics and Cabinet Alarms are to be incorporated into the graphical user interface following existing SAWS conventions and standards. These will include such points as power supply alarms, door intrusion alarms, network communication status, and other alarms as are typical for this Plant.

C. Control Modes

1. Computer (Remote) Manual: In this mode, all automatic functions associated with a specific control loop are disabled except for safety interlocks and alarms. Provisions will be provided to allow Operations staff to access the following functions from the graphical user interface:
    a. Start/Stop Motors
    b. Open/Close Valves – All valves that are electrically actuated are to have the ability to be manually controlled from the Plant SCADA System whether there is any automatic control or not.
    c. Adjust Variable Motor Speeds.
    d. Adjust Modulating Valve Positions.
    e. The following list summarizes the safety monitoring and control features active in this mode:
        1) Permissives (Conditions that must be met in order for a machine to begin operation)
            a) Field equipment HOA Switch must be in AUTO position.
            b) Computer Mode (software switch) must be in MANUAL.
        2) Interlocks (Conditions that must be met in order for a machine to begin or continue operation)
            a) No active alarms.
            b) Additional interlocks are dependent on each individual loop. See individual loop descriptions below.
        3) Alarms Displayed on graphical user interfaces (HMI)
            a) Fail to Operate (Open, Close, Start, Stop, Discrepancy, etc.).
            b) Additional alarms are dependent on each individual loop. See individual loop descriptions below.
2. Computer (Remote) Auto: In this mode, all automatic functions associated with a specific control loop are controlled by the PLCs automatic logic. Operations staff can only adjust the following functions from the graphical user interface:
    a. Control Mode.
    b. PID Loop Set points (Level Set points, Timer Values, etc.).
    c. Pump Lead/Lag Settings.

d. The following list summarizes the safety monitoring and control features active in this mode:

1) Permissives (Conditions that must be met in order for a machine to begin operation)

a) HOA Switch must be in AUTO position

b) Computer Mode (software switch) must be in AUTOMATIC.

2) Interlocks (Conditions that must be met in order for a machine to begin or continue operation)

a) No active alarms

b) Additional interlocks are dependent on each individual loop. See individual loop descriptions below.

3) Alarms Displayed on graphical user interfaces (HMI)

a) Fail to Operate (Open, Close, Start, Stop, etc.).

b) Additional alarms are dependent on each individual loop. See loop individual descriptions below.

3. Local Manual: This mode is available only with those pieces of equipment (motors, valves, etc.) that have an HOA, LOR, or similar switch. In this mode, all remote control (remote manual or remote auto) functions associated with that piece of equipment are disabled, including any PLC-based safety Permissive. Operations staff will set or adjust the following functions from the local control devices (e.g. pushbuttons, hand switch, etc.):

a. Start/Stop Motors

b. Open/Close Valves

c. Adjust Variable Motor Speeds

d. Adjust Modulating Valve Positions

e. The following list summarizes the safety monitoring and control features active in this mode:

1) Permissive (Conditions that must be met in order for a machine to begin operation)

a) HOA Switch must be in HAND position

2) Interlocks (Conditions that must be met in order for a machine to begin or continue operation)

a) Additional interlocks are dependent hardwired points associated with each individual loop. See individual loop descriptions below.

3) Alarms Displayed on graphical user interfaces (HMI, OIT, etc.)

a) Fail to Operate (Open, Close, Start, Stop, etc.) are disabled.

b) UNAVAILABLE will be displayed in the HMI when a piece of monitored equipment is not in AUTO.

c) Additional alarms are dependent on each individual loop and may still be active in the HMI. See loop individual descriptions below.

4. Motor control programming in the PLC will incorporate bump less transfer such that switching the motor controller HOA (or LOR) switch from HAND (or LOCAL) to AUTO (or REMOTE) results in a smooth transition without upset to running status or speed. When the PLC is communicating peer-to-peer with an individual motor controller PLC, incorporate bump less transfer but include logic to ensure that when communications are lost between the motor controller and the PLC, the motor block reestablishes the existing conditions of the motor controller before it is given remote control. This should alleviate the chance of the motor block accidently shutting down a motor when communications are restored.

3.02 INDIVIDUAL CONTROL LOOP DESCRIPTIONS

A. Ground Storage Tank (GST) Level Relay Panel and Continuous Level Transmitter

1. Overview

   The existing GST level probes will be replaced with new level probes along with a new GST Level Relay Panel. A new sensing electrode holder will be installed on the existing GST to hold seven flexible level sensing probes. Six electrodes are held at different levels inside the tank. The seventh electrode acts as a common ground. The exact length of the probes shall be field coordinated and set to the same length as the existing level probes being removed. The GST Level Relay Panel will be installed in a NEMA 12, painted steel enclosure within the Electrical Building Control Room. The GST Level Relay Panel will be designed and wired as shown on the electrical drawings. The PLC-34SPS GST Level Relay Panel alarm and status inputs will be visible on the SCS graphical interface. In addition, the status inputs will be indicated on the SCP enclosure.

   The level probe signals are wired to PLC-34SPS and will be utilized to start and stop wells when the Well(s) are in Computer Automatic Mode of operation. See Well Pump Operation.

2. Drawing: I-102 and I-201

Loop Number	Description
100	Ground Storage Tank Level Probes (LSLL-100, LSH-100-01, -02, -03, -04, LSHH-100)
100	Ground Storage Tank Level (PE/LIT-100)

   a. Alarm Status
   Ground Storage Tank Low-Low Level (LSLL-100)
   Ground Storage Tank High-High Level – Stop All Pumps (LSHH-100)

   b. Event Status

   Ground Storage Tank High Level - Start Lag3 Well, (LSH-100-4)
   Ground Storage Tank High Level - Start Lag2 Well, (LSH-100-3)
   Ground Storage Tank High Level - Start Lag1 Well, (LSH-100-2)
   Ground Storage Tank High Level - Start Lead Well, (LSH-100-1)

   c. A pressure sensing level indicating transmitter (PE/LIT-100) will be installed on the High Service Suction Header to provide for continuous GST Level. The GST Level will be continuously monitored and shall be displayed at the SCP Enclosure, SCS, and historically stored/trended at the SCS.

B. Well Pumps and Associated Flow Meter

1. Overview

   There are four existing Well Pumps. The Well Pumps are operated to maintain the water level within the GST. These Pumps are:

Equipment ID	Description
WP-1	Raw Water Well Pump #1
WP-2	Raw Water Well Pump #2
WP-3	Raw Water Well Pump #3
WP-4	Raw Water Well Pump #4

Each Well Pump will have an E-Stop pushbutton located at the Well Pump Local Control Panel and an E-Stop Lockout pushbutton at the Well Pump MCC bucket. When either is depressed, the Well Pump will be hardwired to stop and locked out from operation regardless of the mode of operation.

Each Well Pump's running status is used to calculate the equipment runtime. There are three sets of values maintained:

- Accumulated Total Runtime (never reset)
- Maintenance runtime and Starts (resettable by maintenance). The date and time the values were reset is recorded.
- Operations Runtime (resettable by the operator). The date and time the value was reset is recorded.

Raw Water is discharged from each Well Pump through an existing Magnetic Flow Meter. Each of the Well Flow Meter transmitters are being modified to provide both Modbus RTU/Ethernet communications through a protocol converter to PLC-34SPS and a 4-20ma hardwired signal wired directly to PLC-34SPS. The design intent is to pass the flow totals and instantaneous flows through the Modbus RTU/Ethernet communications to PLC-34SPS which in turn will pass to SCS. And to utilize the 4-20ma hardwired signals for Analog output signals to the SCP local indicators and Well Pump No Flow failure calculations.

Whenever a Well Pump is operating, in any mode of operation, a minimum flow rate is required. When the Flow is calculated to be less than a predetermined flow set point, after an initial time delay, an alarm is generated at the PLC and indicated at the SCS notifying the Operator of a No Flow condition. Whenever the Well Pump is running in the Remote Manual or Automatic Mode and a No Flow condition becomes present the Well Pump is commanded to stop and soft locked out from operation. The Operator must initiate a soft reset to allow the Well Pump to continue Manual or Automatic Mode of operation.

a. **Local Manual Mode**

   Each Well Pump has a "Hand/Off/Auto" (HOA) switch located on the Well Pump MCC bucket located at the HSP Building. Each Well Pump can be controlled locally in a manual mode by placing the HOA switch in "Hand" position and then manually starting/stopping the Well Pump from either the Local Control Panel (located at the Well Pump) or from the

MCC bucket (located at the HSP Building). When in Local Manual, all control actions are inhibited from the SCP Panel or SCS.

b. **Remote Manual Mode**

Each Well Pump can be controlled manually by the SCP or SCS by placing the Well Pump HOA switch in "Auto" and placing the Well Pump in Manual Mode. The operator can then manually start the Well Pump at the SCS or Stop/Reset the Well Pump from either the SCP or SCS.

c. **Remote Automatic Mode**

The Operator may select which Well Pump is Lead, Lag1, Lag2 or Lag3 from the SCS graphical interface.

Each Well Pump can be controlled automatically by placing the HOA switch in "AUTO" and then placing the Well Pump in Automatic Mode. In Auto Mode, the Well Pump will start and stop based on the GST Level Probe Lead, Lag1, Lag2 and Lag3 Start/stop signals.

C. **High Service Pumps**

1. Overview

The existing 34th Street Pump Station is equipped with five constant speed High Service Pumps. For each High Service Pump there is a low pressure switch on the suction side and a corresponding Flow Meter on the discharge side. These Pumps are:

Equipment ID	Description
HSP No.1	High Service Pump #1
HSP No.2	High Service Pump #2
HSP No.3	High Service Pump #3
HSP No.4	High Service Pump #4
HSP No.5	High Service Pump #5

Each of the High Service Flow Meter transmitters will provide both Modbus RTU/Ethernet communications through a protocol converter to PLC-34SPS and a 4-20ma hardwired signal wired directly to PLC-34SPS. The design intent is to pass the flow totals and instantaneous flows through the Modbus RTU/Ethernet communications to PLC-34SPS which in turn will pass to SCS. And to utilize the 4-20ma hardwired signals for Analog output signals to the SCP local indicators and High Service Pump No Flow failure calculation.

Whenever a High Service Pump is operating, in any mode of operation, a minimum flow rate is required. When the Flow is calculated to be less than a predetermined flow set point, after an initial time delay, an alarm is generated at the PLC and indicated at the SCS notifying the Operator of a No Flow condition. Whenever the High Service Pump is running in the Remote Manual Mode and a No Flow condition is present the High

Service Pump is commanded to stop and soft locked out from operation. The Operator must initiate a soft reset to allow the High Service Pump to continue Remote Manual operation.

Each pump has a discharge valve that is hardwired interlocked with the High Service Pump control circuitry. When the High Service Pump is commanded to operate, the pump will start and the discharge valve will be commanded to open. When running and the pump is requested to stop, the valve will be commanded to close. When the valve is confirmed closed the High Service Pump will then be requested to stop.

Each High Service Pump suction header is monitored, regardless of the mode of operation, for Low Suction Pressure by a Low Pressure Switch. During a startup sequence a delay timer will be initiated. During the starting sequence time delay the Low Pressure switch will be ignored. When the timer expires and the Low Pressure switch is still energized, an alarm is generated at the PLC, indicated at the SCS notifying the Operator of a Low Suction Pressure condition, the High Service Pump is requested to stop and soft locked out from operating. While the High Service Pump is running in the Remote Manual Mode and the Low Suction Pressure alarm is active an alarm is generated at the PLC, indicated at the SCS notifying the Operator of a Low Suction Pressure condition, the High Service Pump will be commanded to stop and soft locked out from operation. Once the Operator investigates the Low Suction Pressure condition and clears it, the Operator must reset the High Service Pump at the SCS graphical interface to allow operation.

Whenever a High Service Pump is operating, in any mode of operation, a minimum GST level is required. When the GST Level (PE/LIT-100) drops below a predetermined level set point, after an initial time delay, an alarm is generated at the PLC and indicated at the SCS notifying the Operator of a Low Level GST condition. Whenever, a High Service Pump is running in the Remote Manual or Automatic Mode and the Low Level GST condition is present the High Service Pumps are commanded to normally stop and soft locked out from operation. Once the Level rises above the Low Level GST set point, plus a deadband, the Operator must re-initiate the operation of a High Service Pump in Remote Manual Mode. When in Remote Automatic Mode High Service Pumps, and are required to run based on the automatic strategy, then the High Service Pumps will be sequence on with time delays. The design intent is to keep multiple High Service Pumps from starting at the same time.

Each High Service Pump's running status is used to calculate the equipment runtime. There are three sets of values maintained:

- Accumulated Total Runtime (never reset)
- Maintenance runtime and Starts (resettable by maintenance). The date and time the values were reset is recorded.
- Operations Runtime (resettable by the operator). The date and time the value was reset is recorded.

a. **Local Manual Mode**

Each High Service Pump has Local Manual Control capability at the Pump MCC and at the Pump Station SCADA Control Panel (SCP).

To allow Local Manual Control of a High Service pump at the MCC, the Operator must place the SCP/MCC switch at the SCP in the MCC position and the

COMP/MAN switch at the SCP in the MAN position. The Operator may then start and stop the High Service pump at the MCC.

To allow Local Manual Control of a High Service Pump at the SCP, the Operator must place the SCP/MCC switch at the SCP in the SCP position and the COMP/MAN switch at the SCP in the MAN position. The Operator may then start and stop the High Service Pump at the SCP.

Each High Service Pump Discharge Valve Local Manual Control capability is available at the Valve Local Control Station (LCS).

To allow Manual Control of the valve at the Valve LCS, the Operator must place the Local/Remote switch at the Valve LCS in the Local position. The Operator may then open and close the valve at the Valve LCS.

b. **Remote Manual Mode**

Each High Service Pump has Remote Manual Control capability at the SCS.

To allow Remote Manual Control of a High Service Pump at the SCS, the Operator must place the SCP/MCC switch at the SCP in the SCP position, place the COMP/MAN switch at the SCP in the COMP position and place the High Service Pump control mode on the process graphic in the Remote Manual Mode. The Operator may then remotely start and stop the High Service Pump at the SCS by clicking on the High Service Pump symbol and selecting START or STOP commands on the graphical interface.

c. **Remote Automatic Mode**

The High Service Pumping discharge header manually operated cross valves are required to be configured in the following manner:

Normally Open Valves – 200-BFV-15, 200-BFV-16, 200-BFV-17, 200-BFV-19, 200-BFV-20, 100-BV-6.

Normally Closed Valves – 200-BFV-18, 200-BFV-21.

Distribution Zone 3 (McMullen EST)

To allow Remote Automatic Control of High Service Pumps No.4 and 5 at the SCS, the Operator must place the SCP/MCC switch at the SCP in the SCP position, place the COMP/MAN switch at the SCP in the COMP position for each High Service Pumps No.4 and 5 and place the High Service Pumps No.4 and 5 control mode on the process graphic in the Remote Automatic Mode.

SAWS Headquarters will relay the McMullen EST Level from the McMullen EST PLC over SCADA to the 34th Street PLC at 5 minute intervals. A watchdog algorithm will be implemented to determine the validity of the level signal. Should the level signal be determined to be invalid, then an alarm will be generated at the PLC, sent to the HMI notifying plant Operators of the signal loss and that the remote automatic control strategy is holding the last known valid level.

The Operator may select which High Service Pump (No.4 or 5) is Lead or Lag from the SCS graphical interface.

The 34th Street PLC will operate High Service Pumps No.4 and 5 based on Distribution Zone 3 (McMullen EST level signal) as follows:

1) When the McMullen EST Level drops to an Operator adjustable set point (initially set at 35 feet), the Lead High Service Pump will be requested to run.

2) When the McMullen EST Level drops to an Operator adjustable set point (initially set at 32 feet), the Lag High Service Pump will be requested to run.

3) When the McMullen EST Level rises above an Operator adjustable set point (initially set at 39 feet), the Lag High Service Pump will be requested to stop.

4) When the McMullen EST Level rises above an Operator adjustable set point (initially set at 40 feet), the Lead High Service Pump will be requested to stop.

Distribution Zone 4 (Broadview EST)

To allow Remote Automatic Control of High Service Pumps No.1, 2 and 3 at the SCS, the Operator must place the SCP/MCC switch at the SCP in the SCP position, place the COMP/MAN switch at the SCP in the COMP position for each High Service Pumps No.1, 2 and 3 and place the High Service Pumps No.1, 2 and 3 control mode on the process graphic in the Remote Automatic Mode.

SAWS Headquarters will relay the Broadview EST Level from the Broadview EST PLC, over SCADA, to the 34th Street PLC at 5 minute intervals. A watchdog algorithm will be implemented to determine the validity of the level signal. Should the level signal be determined to be invalid, then an alarm will be generated at the PLC, sent to the HMI notifying plant Operators of the signal loss and that the remote automatic control strategy is holding the last known valid level.

The Operator may select which High Service Pump (No.1, 2 or 3) is Lead, Lag1 or Lag2 from the SCS graphical interface.

The 34th Street PLC will operate High Service Pumps No.1, 2 and 3 based on the Distribution Zone 4 (Broadview EST level signal) as follows:

1) When the Broadview EST Level drops to an Operator adjustable set point (initially set at 36 feet), the Lead High Service Pump will be requested to run.

2) When the Broadview EST Level drops to an Operator adjustable set point (initially set at 33 feet), the Lag1 High Service Pump will be requested to run.

3) When the Broadview EST Level drops to an Operator adjustable set point (initially set at 30 feet), the Lag 2 High Service Pump will be requested to run.

4) When the Broadview EST Level rises above an Operator adjustable set point (initially set at 37 feet), the Lag2 High Service Pump will be requested to stop.

5) When the Broadview EST Level rises above an Operator adjustable set point (initially set at 38 feet), the Lag1 High Service Pump will be requested to stop.

6) When the Broadview EST Level rises above an Operator adjustable set point (initially set at 39 feet), the Lead High Service Pump will be requested to stop.

D. **Discharge Pressure Reducing and Sustaining Valve Operation**

1. Overview

The PRV will be hydraulically operated. When the pressure in the low pressure zone drops below the downstream set point, the valve will open to allow flow from the high pressure zone to the low pressure zone thus maintaining a constant downstream pressure. If the pressure in the low pressure zone rises above the downstream set point, the valve will close to reduce the flow from the high pressure zone to the low pressure zone.

a. **Local Manual Mode**

Local Manual Control capability for the PRV valve is available at the PRV Local control panel. To allow Manual Control of the PRV valve the Operator may select the PRV Valve to Open or Close at the Local Control Panel.

b. **Remote Manual Mode**

To allow Remote Manual Control of the PRV valve at the SCS, the Operator must place the PRV Valve OCA switch at the valve Local Control Panel in the "Auto" position and the PRV valve control mode on the process graphic must be in the Manual Mode. There are two operating modes of the PRV valve. Normal and Override close.

When the Operator selects the Normal Mode of operation (Solenoid de-energized) the PRV valve will hydraulically modulate to maintain the downstream pressure local pressure setting on the PRV valve.

When the Operator selects the Override Mode of operation (Solenoid energized) the PRV valve will hydraulically close.

c. **Computer Automatic Control**

There is no Automatic Control associated with the PRV Valve.

E. **Fluoride Chemical System**

1. Overview

Fluoride Storage Tank

Fluoride is stored in a single 3,000 Gallon Bulk storage tank. The Fluoride storage tank is monitored for level. Fluoride is then metered to the process injection point through three metering pumps that are configured in parallel. One Metering Pump is considered the Duty Pump and the other two Metering Pumps are considered Standby Pumps. Fluoride may be delivered to a Primary or Secondary location. The piping is manually redirected by the Operator by moving a flexible tube to the desired injection point and opening a manual valve. Once the delivery injection point is configured the Operator must select the Injection point at the SCS graphical interface. The selection of the injection point changes the flow pacing signal for the Duty Metering Pump.

The Fluoride Storage Tank discharge supply will be monitored for High-High Flow by a Thermal High Flow Switch. In addition, a Fluoride Storage Tank discharge supply Isolation valve will be provided to close upon a detection of High-High Flow. Furthermore, regardless of the mode of control, the Fluoride Metering Pumps will be commanded to stop.

The Fluoride Storage Tank Discharge Valve will operate as follows:

a. **Local Manual Mode**

The Fluoride Storage Tank Discharge Valve Local Manual Control capability is available at the Discharge Valve Local control panel. To allow Local Manual Control of the Discharge Valve the Operator may select the Discharge Valve to "LOCAL" at the Local Control Panel. The Operator may then Open or Close the Discharge Valve at the Local Control Panel.

b. **Remote Manual Mode**

The Discharge Valve Remote Manual Control capability is available at the SCS. To allow Remote Manual Control, the Operator must place the Discharge Valve to "REMOTE" at the Local Control Panel and place the Discharge Valve to Manual Control at the SCS graphical interface. The Operator may then Open or Close the Discharge Valve at the SCS graphic interface.

c. **Computer Automatic Mode**

To allow Remote Automatic Control of the Fluoride Storage Tank Discharge Valve, the Operator must place the Discharge Valve to "REMOTE" at the Discharge Valve Local Control Panel and select the Discharge Valve to Automatic Control at the SCS graphical interface. When in this mode of operation, the Discharge Valve will operate as follows:

Upon detection of a High-High Fluoride Storage Tank Discharge Flow, an alarm is generated at the PLC and indicated at the SCS notifying the Operator of a High-High Flow condition, the Discharge Valve is requested to close and a soft permissive command sent to the Fluoride Metering Pumps to stop/soft interlock all Metering Pumps. Once the Operator investigates the High-High Discharge Flow condition and clears it, the Operator must reset the High-High Flow condition at the SCS graphical interface thus allowing operation of the Discharge Valve and Metering Pumps.

<u>Fluoride Metering Pumps</u>

There are three Fluoride Metering Pumps.

Equipment ID	Description
27-MP-1	Fluoride Metering Pump #1
27-MP-2	Fluoride Metering Pump #2
27-MP-3	Fluoride Metering Pump #3

Each Metering Pump discharge is monitored, regardless of the mode of operation, for High Pressure by a High Pressure Switch. When the High Pressure Switch is energized a timer will be initiated. The High Pressure Switch must be maintained while the timer is operating or the timer will reset. When the timer times out an alarm is generated at the PLC and indicated at the SCS notifying the Operator of a High Discharge Pressure condition. Whenever, a Metering Pump is running in the Remote Manual or Automatic Mode and the High Discharge Pressure alarm is generated the Metering Pump will be

commanded to stop and soft locked out from operation. Once the Operator investigates the High Discharge Pressure condition and clears it, the Operator must reset the Metering Pump at the SCS graphical interface to allow operation.

Upon detection of a High-High Fluoride Storage Tank Discharge Flow, see Fluoride Storage Tank above, a soft permissive command is sent to the Fluoride Metering Pumps to stop/soft interlock all Metering Pumps. Once the Operator investigates the High-High Discharge Flow condition and clears it, the Operator must reset the High-High Flow condition at the SCS graphical interface thus allowing operation of the Metering Pumps

A single Fluoride discharge flow meter will be monitored at the SCS graphical interface, at the SCP Enclosure and at the RIO-CHEM Enclosure.

The Fluoride Metering Pumps will operate as follows:

a. **Local Manual Mode**

Each Metering Pump Local Manual Control capability is available at the Metering Pump Local control panel. To allow Manual Control of the metering pump the Operator may select the Metering Pump to "LOCAL" at the Local Control Panel. The Operator may then Start or Stop and adjust the speed of the Metering Pump at the Local Control Panel. The Operator may also monitor the operational status and alarm conditions at the SCS graphical interface.

b. **Remote Manual Mode**

Each Metering Pump Remote Manual Control capability is available at the SCS. To allow Remote Manual Control, the Operator must place the Metering Pump to "REMOTE" at the Local Control Panel and place the Metering Pump to Manual Control at the SCS graphical interface. The Operator may then Start or Stop and adjust the speed of the Metering Pump at the SCS graphic interface.

c. **Computer Automatic Mode**

To allow Remote Automatic Control of the Metering pump, the Operator must place the Metering Pump to "REMOTE" at the Local Control Panel and select the Metering Pump to Automatic Control at the SCS graphical interface. When in this mode of operation, the Metering Pump will operate as follows:

<u>Injection Point Selected to Pre-GST</u>

When a Well Pump is confirmed running the Duty Metering Pump will be requested to run. The feed rate of the Metering Pump will vary based on the following calculation:

Feed Rate = [(Dosage Set-point x Discharge Flow Pacing Signal x 3,786)] / [(1,440) x (% Concentration x Sfg.)*]

Where:

Feed Rate = Pump controlled rate in milliliter/minute.

Dosage Set-point = Operator entered set-point in milligram/liter range 0.0 to 10.0

Discharge Flow = Flow Pacing Signal (in MGD) (Sum of all Running Well Pump Flows)

(*) %Concentration x Sfg. = Operator entered parameter for Fluoride percent concentration multiplied by Fluoride specific gravity.

Injection Point Selected to Post-GST

When a High Service Pump is confirmed running the Duty Metering Pump will be requested to run. The feed rate of the Metering Pump will vary based on the following calculation:

Feed Rate = [(Dosage Set-point x Discharge Flow Pacing Signal x 3,786)] / [(1,440) x (% Concentration x Sfg.)*]

Where:

Feed Rate = Pump controlled rate in milliliter/minute.

Dosage Set-point = Operator entered set-point in milligram/liter range 0.0 to 10.0

Discharge Flow = Flow Pacing Signal (in MGD) (Sum of all Running High Service Pump Flows)

(*) %Concentration x Sfg. = Operator entered parameter for Fluoride percent concentration multiplied by Fluoride specific gravity.

F. **On-site Sodium Hypochlorite Generation (OSGH) System**

Sodium Hypochlorite will be generated by two on-site generation systems. The two on-site generation system will use salt (Sodium chloride), water and power to produce a 0.8% sodium hypochlorite solution with hydrogen gas as a byproduct. Each generation system will separately produce sodium hypochlorite and deliver to a respective Sodium Hypochlorite Storage Tank.

The on-site generation system is located at the Chemical Building and will include the following major equipment:

- Two Power Transformer Rectifiers
- Two Electrolytic Cells
- Two Brine metering pumps
- Hydrogen Vent Blowers
- Hydrogen Dilution Blowers
- Brine Storage Tank
- Water Softeners and Hardness Monitor
- Hydrogen Detector

The OSGH Systems are provided by a Vendor's packaged equipment and are provided with a PLC based Local Control Panel. Each of the OSGH System Local Control Panels will communicate with the SCS via Ethernet communications to provide monitoring of each system. In addition, each of the OSGH Systems will operate to maintain sufficient chemical in the Sodium Hypochlorite storage tanks.

G. **Sodium Hypochlorite System**

1. Overview

There are three Sodium Hypochlorite Metering Pumps.

Equipment ID	Description
30-MP-1	Sodium Hypochlorite Metering Pump #1
30-MP-2	Sodium Hypochlorite Metering Pump #2
30-MP-3	Sodium Hypochlorite Metering Pump #3

Sodium Hypochlorite is stored in two Bulk storage tanks. The Sodium Hypochlorite storage tanks are monitored for level. Sodium Hypochlorite is then metered to the process injection point through three metering pumps that are configured in parallel. One Metering Pump is considered the Duty Pump and the other two Metering Pumps are considered Standby Pumps. Sodium Hypochlorite may be delivered to a Primary or Secondary location. The piping is manually redirected by the Operator by opening or closing manual valves. Once the delivery injection point is configured, the Operator must select the Injection point at the SCS graphical interface. The selection of the injection point changes the flow pacing signal for the Duty Metering Pump.

Each Metering Pump discharge is monitored, regardless of the mode of operation, for High Pressure by a High Pressure Switch. When the High Pressure Switch is energized a timer will be initiated. The High Pressure Switch must be maintained while the timer is operating or the timer will reset. When the timer times out an alarm is generated at the PLC and indicated at the SCS notifying the Operator of a High Discharge Pressure condition. Whenever, a Metering Pump is running in the Remote Manual or Automatic Mode and the High Discharge Pressure alarm is generated the Metering Pump will be commanded to stop and soft locked out from operation. Once the Operator investigates the High Discharge Pressure condition and clears it, the Operator must reset the Metering Pump at the SCS graphical interface to allow operation.

A single Sodium Hypochlorite discharge flow meter will be monitored at the SCS graphical interface, at the SCP Enclosure and at the RIO-CHEM Enclosure.

a. **Local Manual Mode**

Each Metering Pump Local Manual Control capability is available at the Metering Pump Local control panel. To allow Manual Control of the metering pump the Operator may select the Metering Pump to “LOCAL” at the Local Control Panel. The Operator may then Start or Stop and adjust the speed of the Metering Pump at the Local Control Panel. The Operator may also monitor the operational status and alarm conditions at the SCS graphical interface.

b. **Remote Manual Mode**

Each Metering Pump Remote Manual Control capability is available at the SCS. To allow Remote Manual Control, the Operator must place the Metering Pump to “REMOTE” at the Local Control Panel and place the Metering Pump to Manual Control at the SCS graphical interface. The Operator may then Start or Stop and adjust the speed of the Metering Pump at the SCS graphic interface.

c. **Computer Automatic Control**

To allow Remote Automatic Control of the Metering pump, the Operator must place the Metering Pump to "REMOTE" at the Local Control Panel and select the Metering Pump to Automatic Control at the SCS graphical interface. When in this mode of operation, the Metering Pump will operate as follows:

Injection Point (Prior to GST)

When a Well Pump is confirmed running the Duty Metering Pump will be requested to run. The speed of the Metering Pump will vary based on the following calculation:

Feed Rate = [(Dosage Set-point x Discharge Flow Pacing Signal x 3,786)] / [(1,440) x (% Concentration x Sfg.)*]

Where:

Feed Rate = Pump controlled rate in milliliter/minute.

Dosage Set-point = Operator entered set-point in milligram/liter range 0.0 to 10.0

Discharge Flow = Flow Pacing Signal (in MGD) (Sum of all Running Well Pump Flows)

(*) %Concentration x Sfg. = Operator entered parameter for Sodium Hypochlorite percent concentration multiplied by Sodium Hypochlorite specific gravity.

Injection Point (Post GST)

When a High Service Pump is confirmed running the Duty Metering Pump will be requested to run. The speed of the Metering Pump will vary based on the following calculation:

Feed Rate = [(Dosage Set-point x Discharge Flow Pacing Signal x 3,786)] / [(1,440) x (% Concentration x Sfg.)*]

Where:

Feed Rate = Pump controlled rate in milliliter/minute.

Dosage Set-point = Operator entered set-point in milligram/liter range 0.0 to 10.0

Discharge Flow = Flow Pacing Signal (in MGD) (Sum of all Running High Service Pump Flows)

(*) %Concentration x Sfg. = Operator entered parameter for Sodium Hypochlorite percent concentration multiplied by Sodium Hypochlorite specific gravity.

H. **Miscellaneous Equipment**

The following signals are monitored only, and are not used in any of the control strategies.

Equipment ID / Loop No	Type	PLC/RIO	Description
UPS-34SPS	DI	PLC-34SPS	UPS-34SPS Loss of Incoming Power
UPS-34SPS	DI	PLC-34SPS	UPS-34SPS On Bypass
UPS-CHEM	DI	RIO-CHEM	UPS-CHEM Loss of Incoming Power
UPS-CHEM	DI	RIO-CHEM	UPS-CHEM On Bypass
EW-01	DI	RIO-CHEM	EEWS Hypo Generation Rm - Indoor
EW-02	DI	RIO-CHEM	EEWS Hypo Generation Rm - Outdoor
EW-03	DI	RIO-CHEM	EEWS Hypo Bulk Storage - Outdoor
EW-04	DI	RIO-CHEM	EEWS Hypo Metering Pump Rm - Indoor
EW-05	DI	RIO-CHEM	EEWS Fluoride Building - Indoor
LSH-350	DI	RIO-CHEM	Chemical Piping Common Leak Alarm
LSH-330	DI	RIO-CHEM	Chlorine/Fluoride Analyzer Enclosure Flood
AE/AIT-320	AI	RIO-CHEM	Raw Water Chlorine Residual
AE-AIT-310	AI	RIO-CHEM	Raw Water Fluoride Residual
PIT-200	AI	PLC-34SPS	Distribution System Zone No.3 Pressure
PIT-201	AI	PLC-34SPS	Distribution System Zone No.4 Pressure
PIT-204	AI	PLC-34SPS	PRV Upstream Pressure
PIT-206	AI	PLC-34SPS	PRV Downstream Pressure
FE/FIT-206	AI	PLC-34SPS	PRV Station Flow
Duplex Sump Pump Control Panel	DI	PLC-34SPS	High Service Building Basement Flood
LSH-310	DI	RIO-CHEM	Fluoride Storage Containment Area Flood
LE/LIT-311	AI	RIO-CHEM	Fluoride Storage Tank Level

LSH-328	DI	RIO-CHEM	Sodium Hypochlorite Storage Containment Area Flood

I. **Power Quality Meters**

P&ID: I-003

LOOPS: N/A

1. *Overview*

Power Quality Meters (PQMs) and Motor Protection Relays (MPRs) are connected directly to the Control System network as shown in the Drawings. At a minimum, the alarms and statuses listed below will be displayed at the SCS for each Power Monitor Meter.

a. Voltage
b. Current
c. Voltage Imbalance
d. Current Imbalance
e. kW
f. kvar
g. kVA
h. kWh
i. kvarh
j. kVAh
k. Power Factor
l. Frequency
m. kW Demand
n. kvar Demand
o. kVA Demand
p. Amps Demand
q. Amps THD
r. Volts THD
s. Crest Factor

END OF SECTION