Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00 - Common Work Results for Electrical.

1.2 REFERENCES

.1 Definitions:

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

.2 Reference Standards:

.1 Canadian Standards Association (CSA)

.1 CSA C22.1-15, Canadian Electrical Code, Part 1 (23rd Edition), Safety Standard for Electrical Installations.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS in accordance with Construction and Hazardous Materials Section.

.3 Shop drawings:

.1 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.

.2 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.

.4 Certificates:

.1 Provide CSA certified equipment and material.

.2 Where CSA certified equipment or material is not available, submit such equipment and material to authority having jurisdiction for approval by a certified agency of Standard Council of Canada (SCC) before delivery to site.

.3 Submit test results of installed electrical systems and instrumentation.

.4 Permits and fees: in accordance with General Conditions of contract.

.5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.

.5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work of electrical

system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

.1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

.2 In addition to technical data the Electrical Contractor shall also include:

.1 Names, addresses and phone numbers of local supplier for items included in the maintenance manual

.2 Copy of reviewed shop drawings.

.3 Names, addresses and phone numbers of Electrical Sub-contractors.

.4 Inspection certificates and verification reports.

.5 Letter or certificate of warranty.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material Delivery Schedule: Provide Departmental Representative with schedule within 2 weeks after award of contract for all long delivery items.

.3 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.4 Storage and Handling Requirements:

.1 Store materials indoors, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect materials from damage to finish or material.

.3 Replace defective or damaged materials with new.

1.6 ADDENDA AND REVISIONS

.1 All addenda, instructions and revisions issued during the tendering period shall become part of the Contract Documents and shall be included in the Tender, and shall take precedence over the previous instructions.

.2 The Owner and Engineer reserve the right to make revisions to the drawings during the period of construction and these shall take precedence over previously issued drawings. All revisions to the work shall be executed by duly authorized change orders with the amount of addition or deduction to the contract amount approved by the Owner before the execution of any work associated with the revision is undertaken.

1.7 SUBSTITUTIONS

.1 It is the intent of these drawings to establish the required quality of materials. Where manufacturer names or catalogue references are used, it is done in order to establish the required quality, style, size or function. Products of other manufacturers will not be permitted after the signing of the contract. The decision as to suitability shall rest with the Engineer.

.2 Should the contractor propose to furnish material and equipment other than those specified, they shall submit a written request for any or all substitutions prior to the tender closing date. Such a request shall be accompanied by a complete description including manufacturer, brand name, catalogue number and technical data for all items. If requested by the Engineer, the contractor shall submit for inspection a sample of the proposed item.

.3 All material not meeting the specifications above shall not be allowed on the project site.

.4 Substitutions affecting the design will not be permitted. Additional costs to any other trade as a result of a change or substitution by this contractor shall the responsibility of this contractor.

.5 The listing of a manufacturer as acceptable does not imply acceptance of all products of that manufacturer and only products meeting the specifications will be accepted.

1.8 SCOPE OR WORK

.1 The Electrical Contractor shall furnish all labour, material, tools, appliances and equipment to entirely complete and provide the operation of the process systems.

.2 The overall intention is to provide a functioning complete electrical installation in all aspects, and all items reasonably inferable as called for by the drawings and specifications, and by normally accepted good practice, notwithstanding that every item necessarily required may not be particularly mentioned. This Contractor shall fulfill his obligation and not take advantage of any unintentional errors or omissions, should any exist, to the detriment of the Owner's interest. The work shall include but not be limited to:

.1 Expand on existing Process Control Delta control system on site and furnish all components, controllers, modules, software upgrades and modifications, etc. required to meet design intent.

.2 Delta system controller

.3 Power supplies

.4 Gateways

.5 Ethernet network switch

.6 Cabinets

.7 Wire ducts for cable management within cabinets

.8 Low voltage conduit and wiring

.9 Terminal blocks

.10 CAT 5e patch cables

.11 Coordination with other trades. See also Mechanical specifications and drawings (process controls).

1.1 LOCAL PROGRAMMING

.1 Only Controls and Equipment of Saint John, certified to work on existing Delta Controls System will be acceptable. This will help to ensure that the specified project requirements are interpreted, designed and applied successfully for this project.

.2 Minor changes as requested by the Engineer, such as setpoint adjustment, minor sequences modifications and graphic site shall be performed at no additional charge during system verifications.

1.2 ELECTRICAL DRAWINGS

.1 The electrical drawings which constitute an integral part of this contract shall serve as working drawings. They indicate the general layout of the complete electrical system arrangements of feeders, circuits, outlets, switches, controls, panelboards, service equipment, communications, fire alarm systems, underground duct banks, power center, etc..

.2 Field verification of scale dimensions on drawings is directed since actual locations, distances, and levels will be governed by the field conditions.

.3 All discrepancies related to the electrical work shall be promptly brought to the attention of the Engineer for clarification.

1.3 EXISTING CONDITION AND EXAMINATION OF DRAWINGS

.1 The Electrical Contractor shall become completely familiar with the drawings and specifications, as well as construction methods of other trades related to the work to avoid possible interferences on the project. Should drastic changes be necessary to resolve such conflicts, this Contractor shall notify the Engineer and secure written approval and agreement on the necessary adjustments before the installation is started.

.2 Before submitting the tender, this Contractor shall visit the site and become familiar with site conditions, availability of storage space and all other factors that might influence the tender submittal.

.3 The contractor shall determine all working conditions and rigidly comply. Conditions that require special consideration include but not limited to: Dust, Noise, Vibration, Water, Working hours, Continuity of power, Access to area of work, Physical protection of Owner’s facility and equipment.

.4 No extras will be allowed due to failure to account for site conditions or working conditions.

.5 The exact rough in dimensions and connection points shall be determined from shop drawings and on site measurements.

1.4 DISCREPANCIES

.1 Bidders in preparing their tender, finding any errors, omission, or discrepancies in the drawings, specifications or other documents, or having any doubt in the intent or meaning of any part thereof, shall immediately notify the Engineer, who will send written instructions or clarification to all bidders. Where such discrepancies exist and it is evident that this Contractor could not have properly tendered without clarifications and where such clarification was not requested, not extra to the contract will be considered in order to have the installation properly made. The Owner and Engineer will not be responsible for oral instruction.

Part 2 Products

2.1 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Language operating requirements: provide identification nameplates and labels for control items in English and French.

.4 Use one nameplate or label for both languages.

2.2 MATERIALS AND EQUIPMENT

.1 Provide material equipment in accordance with Section 01 61 00 - Common Product Requirements.

.2 Material and equipment to be CSA certified. Where CSA certified material and equipment are not available, for approval by a certified agency of Standard Council of Canada (SCC) before delivery to site and submit such approval as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.3 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Control wiring conduit: in accordance with Section 26 05 34 – Conduit, Conduit Fastenings and Conduit Fittings. All wiring and connections below 50 V which are related to control systems specified in mechanical sections or as shown on mechanical drawings shall not be the responsibility of this contractor unless otherwise noted.

2.4 WARNING SIGNS

.1 Warning Signs: in accordance with requirements from inspection authorities and Departmental Representative.

.2 Decal signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

.1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates as follows:

.1 Nameplates: plastic laminate lamacoid 3 mm matt white finish face, black core, lettering accurately aligned and engraved into core mechanically attached with self-tapping screws.

Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.

.3 Wording on nameplates to be approved by Departmental Representative prior to manufacture.

.4 Allow for minimum of twenty-five (25) letters per nameplate.

.5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, numbered on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

.1 Colour code conduits, boxes and metallic sheathed cables.

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour. Confirm colour coding scheme with owner.

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment green" finish.

.2 Paint indoor switchgear and distribution enclosures light gray to EEMAC-2Y-1.

2.10 PROCESS INTEGRATION

.1 The Contractor will be responsible to add the following new screens for the operation of the new facilities and equipment to the EMCS system interface. Refer to control drawings for full list of equipment:

.1 Quarantine Chlorination Lab:

.1 UV pumps
.2 Level sensors
.3 Chlorine tank floats
.4 Chlorine tank high level
.5 Chlorine tank low level
.6 Chlorine monitor loop pumps
.7 All flow meters
.8 Water reservoir, including animated statuses, I/O and alarms.
.9 Chlorine Analyzer, Water Quality
.10 Electronic actuator position
.11 Transfer pumps
.12 Chlorine and dechlorination pumps

.2 The Contractor shall incorporate sketches representing the new equipment. Sketches shall be based on actual site configuration, size of equipment. The positioning of the various elements in the EMCS interface shall reflect the actual site condition and be in relationship with the actual conditions.

.3 The EMCS system shall be developed to trend the level or flow measurements for the system, including but not limited to the following:

.1 Water Reservoir – Level;
.2 Chlorine Tank Levels;
.3 Flow meter – flow and totalized;
.4 Transfer pumps – flow
.5 Chlorination and dechlorination pumps - flow

.4 The Contractor shall at least incorporate into its EMCS interface the list of data to be monitored, as indicated herein and as shown on the drawings.

.5 Electrical pressure gauge, hours of pump operation, running amps of pumps, water quality measurements, and UPS.

.6 The new equipment sketches shall be dynamic. The following color-coding shall be used:

.1 Green: Equipment is in operation;
.2 Yellow: Equipment is not in operation or on standby (not in fault);
.3 Red: Equipment is in fault.

.7 Sketches of system shall be dynamic. Liquid elevation shall be in relationship with the site conditions (liquid elevation on the EMCS interface will fluctuate with the actual

elevations). Liquid shall be represented in blue. Liquid for but not limited to the following:

.1 Water Reservoir Level;

.2 Chlorine Tank Levels;

.8 Any changeable data / set point (for alarm purposes) shall be password protected (operator identification and password required to modify data) and be monitored in the existing event log.

.9 Require programming to record alarms in the existing alarm log and to record events in the existing event log shall be done by the Contractor. In addition, the Contractor will be responsible to program the EMCS software for alarm calling.

.10 The corresponding equipment information shall be included on the page (Voltage, HP, Serial Number, installation date, etc.). This information shall be changeable by the Owner's Staff and password protected.

.11 In addition of the sketches, the recoded data shall be displayed on the page. Trend of the recorded data (or trend page) shall be obtained by clicking on the equipment display or selected from the page manager.

.12 The Contractor will be responsible to provide proper training of the Owner's staff on all EMCS functions related to the addition of the new equipment.

2.11 CONTROL PANEL

.1 Provide a control panel to control and monitor the wet well, pumps and related sensors, and interface to the main DCS system.

.2 The control panel shall contain the following components:

.1 Industrial panel mount UPS.

.2 Industrial panel mount 24 volt DC switched mode power supply as required.

.3 Programmable Distributed Control System (DCS) to provide control and monitoring.

.4 Control relays, plastic wiring duct and other accessories as required.

.5 Terminal blocks for the termination of all external wiring.

.6 Unmanaged industrial Ethernet switches as required.

.7 Gateways as required

.3 The control panel enclosure shall be a NEMA type 12/4X painted stainless steel enclosure with inner panel with hinged door and ¼ turn latches. Enclosure shall be sized to fit all components as specified and to ensure all minimum clearances are maintained for heat dissipation of power supply, DSC, UPS and other components.

.4 Set points for the reservoir pressure level transmitter shall provide on/off control for the UV pumps.

.5 Set point for the chlorine analyzer shall provide on/off control for the chlorine pumps. Also feedback process loop to control pacing of chlorine pumps.

.6 The following alarms including but not limited shall be monitored;

.1 Electronic Pressure Gauge; High/Low Alarm

.2 Chlorine Analyzer; High/Low Alarm

.3 Chlorine Tank Level Alarm

.4 Electronic actuator: Alarm

.7 The Distributed Control System (DCS) hardware for the DCS station control panel shall be Delta Controls enteliBUS to meet the specified I/O requirements.

.1 Controller with required 24V DC digital inputs, required quantity of relay digital outputs, required quantity of serial ports, Ethernet port, real time clock, PID, LCD, battery back-up, 10K user program, 10K configurable user data space, 128K data logging.

.2 Quantity of analog I/0 input modules for current 4-20 mA inputs.

.3 Quantity of analog I/O output module for current 4-20 mA outputs.

.4 Quantity of discrete I/O module for 12 - 24Vdc inputs.

.5 Programming software to be compatible with DCS system software.

.8 Provide an industrial, DIN rail mount 24 volt DC switched mode power supply with rated output power of 120 watts to supply the 24 volt DC required. Power supply shall be Allen-Bradley Bulletin 1606-XL or equivalent.

.9 Provide a hardwired surge filter rated at 5 amps for the 120V supply. Surge filter shall be Cutler-Hammer type AEGIS-HW or equivalent.

.10 Provide an industrial, panel-mount, line interactive Uninterruptible Power Supply (UPS) with rated output power of 1500VA and with hardwired input and output terminals. UPS shall have a battery run time of 9 minutes at full load. Connect the alarm output relays to the indicate when the UPS is on battery and low battery. UPS shall be Liebert cat. no. GXT4-1500RT-230E or equivalent.

.11 Pilot devices shall be NEMA rated 30mm, panel mount, LED illumination type with type 4/4X/13 degree of protection.

.12 Provide DCS programming software. Licenses as required for the above noted locations and tags as required.

.13 Control Panel shall be certified to meet CAN/CSA C22.2 No. 14-10.

.14 The Control Panel manufacturer’s representative shall test and commission the Control Panel at the site and shall do all programming which is required and make all necessary adjustments.

.15 The Control Panel manufacturer’s representative shall provide training and user manuals at the site for the Owner’s personnel on the operation and maintenance of the equipment.

Part 3 Execution

3.1 INSTALLATION AND PROGRAMMING

.1 The input devices for the DCS system shall be as follows:

.1 Reservoir level transmitter – WL

.2 Flow meter transmitter – FM
.3 Chlorine tank level – TL1,TL2
.4 Chlorine analyzer – CA1
.5 Chlorine analyzer – CA2
.6 Chlorine analyzer – CA3
.7 Electronic valve actuator – EV1
.8 Electronic valve actuator – EV2
.9 Electronic valve actuator – EV3
.10 UV lamp bank 1 – UV1
.11 UV lamp bank 2 – UV2
.12 Speed of VFD - %Speed

.2 The control of the station will operate the pumps with variable frequency drive to maintain the WL. The VFD will be set with a maximum speed of 60Hz and minimum speed of 30Hz.

.1 The % speed of VFD will vary to maintain the total flow the operator selects. Pump VFD to receive commands and communicate feedback with DCS using Ethernet connection. Contractor to confirm actual scaling required with operator and Departmental Representative for auto fill, auto pressure and maintained pressure values prior to fully commissioning system.

.2 For manual mode the DCS panel has no control over VFD % speed, it just records the OF based on the pump operating as manual. Operator shall be able to adjust % speed at VFD for manual operation and manually. Manual mode to override any Ethernet commands to the drive.

.3 Flow Meter scaling shall be 0-8L/s. Contractor to confirm exact values on site prior to commissioning system.

.4 Chlorine injection system shall be proportional to the flow from the ‘Pumping Station Flow Meter’ and any fault shall be sent to the DSC system.

.5 All instruments to be monitored by DSC including trending, graphs and alarm history.

.6 Data Acquisition for this station shall be as follows:

.1 VFD: Running Amps, % Speed, Voltage, hours of operation, and faults/alarms;
.2 Water reservoir level transmitter – WL
.3 Low level switches for chlorine barrels;
.4 High level switch for chlorine barrels;
.5 Chlorination pumps;
.6 Dechlorination pumps;
.7 Transfer pumps;
.8 Chlorine analyzers;
.9 Level pressure sensor;
.10 Electronic actuators;
.11 UV lamp - Intensity

.12 Flow meter transmitter – FM

.7 These data points shall be illustrated on main process control computer that will categorize data for the DSC operator. Suggested screens shall be pump, Process flows and building status, as well as alarm screens and main screen shall be added to allow operator accessibility.

.8 The following list of alarms shall be added to the DSC and reported to EMCS mainframe to be assessed:

.1 Pump alarm from data acquisition including VFD faults and high pump faults;

.2 Low water level alarm;

.3 High water level alarm;

.4 VFD running amps not matching flow range (pump malfunction)

.5 Chlorine Tank Level low alarm;

.6 Electronic actuator malfunction alarm;

.7 Loss of communication with Station.

.9 All alarms to be coordinated with operators to ensure priority levels are set and alarms call forwarded for high priority alarms are in place.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete.

.1 Sleeves through concrete: schedule 40 steel pipe sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings embedded or plastered over, close to building structure so furring can be kept to minimum.

3.4 CO-ORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.

3.5 CO-ORDINATION WITH OTHERS

.1 Electrical contractor shall co-ordinate the installation of equipment to minimize inconvenience to Owner and other sub-contractors.

.2 Work by other contractors will be done concurrently with work in this contract. This contractor shall schedule and arrange the work and store materials in co-operation so as to avoid interference with others.

3.6 FIELD QUALITY CONTROL

.1 Qualifications: Electrical work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction and as per the conditions of Provincial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician to perform specific task.

.2 Permitted activities: determined based on the training level attained and demonstration of ability to perform specific duties

.2 Health and Safety Requirements: Complete construction in accordance with occupational health and safety regulations.

.3 Conduct following tests in accordance with Section 01 45 00 - Quality Control.

.1 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.2 Systems: fire alarm communications.

.3 EMCS communications:

.1 Ensure all alarms and screens are active and refreshed at EMCS mainframe.

.2 Test alarm notifications with paging system to ensure operators receive alarms.

.3 Test sequences of operation for controlled and non-controlled plants. Test sequence in fail safe mode during a DSC failure and/or normal power failure.

.4 Carry out tests in presence of Departmental Representative.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.6 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.7 SYSTEM STARTUP

.1 Instruct Departmental Representative and operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

3.8 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11.

3.9 RECORD DRAWINGS

.1 Refer to Division 1 - General Requirements.

Two sets of white prints shall be maintained for the exclusive purpose of recording deviations from that shown on the contract drawings. One set shall be kept up to date at all times. At the completion of the project the information shall be transferred to the second set of drawings. Both sets shall be turned over to the Owner.

3.10 GUARANTEE

.1 Guarantee material and workmanship to be free from defect for a period of one (1) year or longer where specified otherwise, after issuing of the certificate of substantial completion.

Make good, at the Owner’s convenience, all defects covered by this guarantee without additional cost to the Owner.

END OF SECTION