



**Associated
Engineering**

*GLOBAL PERSPECTIVE.
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CONTRACT DOCUMENTS

Parks Canada

Prince Albert National Park Water Automation Upgrade

June 2017



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CONTRACT SPECIFICATIONS
FOR
PARKS CANADA
PRINCE ALBERT NATIONAL PARK
WATER AUTOMATION UPGRADE
JANUARY, 2017



Seal

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AND GEOSCIENTISTS OF SASKATCHEWAN
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C116
Permission to Consult Held By:
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4786-00-EI-503 Details, PETWA Control Panel
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4786-00-EI-505 Details, Water Tower
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Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

- .1 Work of this Contract comprises primarily a renovation to the automation system for the supply, treatment, storage, and distribution of the potable water at the town of Waskesiu Lake, Saskatchewan, located in Prince Albert National Park. This work includes but is not limited to:
 - .1 Upgrade and replacement of the MicroLogix PLC in the Intake Pump Station to Ethernet based Point I/O. The required control and monitoring logic will be moved to the main Water Treatment Plant (WTP) PLC processor.
 - .2 Upgrade and replacement of the SLC-5 PLC in the main WTP MCC control panel to a CompactLogix based PLC.
 - .3 Upgrade and replacement of the SLC-5 PLC in the Petwa surface water treatment control panel to a CompactLogix based PLC.
 - .4 Upgrade and replacement of the SLC-5 PLC in the Memcor membrane treatment control panel to a CompactLogix based PLC. Upgrade and replacement of the local HMI in that panel.
 - .5 Upgrade and replacement of the MicroLogix PLC in the Water Tower Building to Ethernet based Point I/O. The required control and monitoring logic will be moved to the main WTP PLC processor.
 - .6 Upgrade and replacement of the PC-based SCADA System located in the Lab/Office in the WTP.
 - .7 Upgrade and replacement of the PC-based SCADA System located in the Supervisor's Office in the Compound Building.
 - .8 Supply of PC, and installation of remote monitoring software, for the home use of the WTP Supervisor.
 - .9 Upgrade and replacement of the DH-485 communication system linking the facilities indicated above, with an Ethernet/IP communication system, which will include:
 - .1 Cat 6 cabling and Ethernet star configuration to communications devices within the WTP building, replacing the RS-485 daisy-chain cabling.
 - .2 Ethernet communication from the WTP to the Intake Pumping Station using the existing RS-485 underground cabling and installing Ethernet Extenders.
 - .3 Installation of a fiber optic cable from the WTP to the Water Tower Building, including trenching, laying of conduit, pulling fiber-optic and tracer cable, backfilling, compaction, and marking of route.
 - .4 Design, construct, and commission a wireless radio-based Ethernet system between the Water Tower and the Compound Building.
 - .10 The work includes programming and system integration for the above facilities using the existing control logic as a basis and converting for use in the new control systems.

1.2 CONTRACT METHOD

- .1 Construct Work under stipulated price contract.
- .2 Employ subcontractors assigned by Owner for:
 - .1 Section 25 90 01 – Automation Systems Programming Requirements
 - .2 Section D5050 – Electrical Controls and Instrumentation, Panel Drawings
 - .3 Section D5050 – Electrical Controls and Instrumentation, Radio Communications and Wastewater Communications Options Study
- .3 Relations and responsibilities between Contractor and subcontractors, Contractor and Design-Builder assigned by Owner are as defined in Conditions of Contract. Assigned Subcontractors must, in addition:
 - .1 Furnish to Contractor, bonds covering faithful performance of subcontracted work and payment of obligations thereunder.
 - .2 Purchase and maintain liability insurance to protect Contractor from claims for not less than limits of liability which Contractor is required to provide.

1.3 WORK BY OTHERS

- .1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Consultant.
- .2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Consultant, in writing, any defects which may interfere with proper execution of Work.
- .3 Work of Project executed prior to start of during Work of this Contract, and which is specifically excluded from this Contract: none
- .4 Work of Project which will be executed after completion of Work of this Contract, and which is specifically excluded from this Contract:
 - .1 Upgrade of the Wastewater Automation and Communication Systems

1.4 WORK SEQUENCE AND FACILITY UPTIME REQUIREMENTS

- .1 Construct Work in stages to accommodate Owner's continued use of premises during construction.
- .2 Co-ordinate Progress Schedule and co-ordinate with Owner Occupancy during construction. Arrange a meeting early on in the project to plan the approach to changing over the automation systems with minimal disruption to the water supply, treatment, storage and distribution system.
- .3 Temporary controls may need to be constructed in order to facilitate the change-over.

- .4 Uptime Requirements:
 - .1 During peak season of mid-May to end of September, the maximum down-time for raw water supply and treatment is twenty-four (24) hours.
 - .2 During off-peak season, the maximum down-time for raw water supply and treatment is forty-eight (48) hours.
 - .3 Should the water system require manual operation, the Owner's WTP operator can provide such services to a maximum of eight hours per day. Additional hours required to operate the system manually will have to be provided and paid by the Contractor for a water treatment plant operator, qualified and trained to the level of this plant's designation.
 - .4 The distribution system is never allowed to de-pressurize. There is storage in the Water Tower and in the Reservoir below the WTP. Should the level in the water tower get low, distribution pumps in the WTP must be started either manually or with temporary controls to re-fill the tower.
 - .5 Should the distribution system become de-pressurized, and a boil-water advisory issued, the Contractor shall reimburse local businesses for their additional costs to obtain potable water and for loss of revenue. The Contractor shall pay for costs to flush the distribution lines.
- .5 Background Notes:
 - .1 The Petwa surface water treatment unit and the Memcor membrane treatment unit do not operate concurrently.
 - .2 The Memcor unit only has capacity for winter operation.
 - .3 The Petwa unit can be operated for all capacities.

1.5 CONTRACTOR USE OF PREMISES

- .1 Limit use of premises to allow:
 - .1 Owner occupancy
 - .2 Continued plant operation.
- .2 Co-ordinate use of premises under direction of Consultant and Parks Canada.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Consultant.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.6 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.7 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to normal use of premises. Arrange with Consultant and Parks Canada to facilitate execution of work.

1.8 EXISTING SERVICES

- .1 Notify, Consultant and Parks Canada and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give 48 hours notice to Consultant and Parks Canada for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to operations.
- .3 Provide alternative routes for pedestrian and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Consultant and Parks Canada of findings.
- .5 Submit schedule to and obtain approval from Consultant and Parks Canada for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services as required and when directed by Consultant to maintain operation of critical water systems.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Consultant and Parks Canada and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.
- .11 Construct barriers to alert and protect the public from open trenches.

1.9 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each document as follows:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed Shop Drawings.
 - .5 List of Outstanding Shop Drawings.
 - .6 Change Orders.
 - .7 Other Modifications to Contract.
 - .8 Field Test Reports.
 - .9 Copy of Approved Work Schedule.
 - .10 Health and Safety Plan and Other Safety Related Documents.
 - .11 Other documents as specified.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Parks Canada Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Parks Canada Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

1.2 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to normal use of facilities and systems. Arrange with Consultant and Parks Canada Representative to facilitate execution of work.

1.3 EXISTING SERVICES

- .1 Notify, Supervisor of the WTP, Parks Canada Representative, Consultant and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Supervisor of the WTP forty-eight (48) hours of notice for necessary interruption of mechanical or electrical service throughout course of work. Keep duration of interruptions minimum.

1.4 SPECIAL REQUIREMENTS

- .1 Ensure Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .2 Keep within limits of work and avenues of ingress and egress.

1.5 SECURITY

- .1 Where security has been reduced by Work of Contract, provide temporary means to maintain security.

1.6 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not permitted.

Part 2 **Products**
Not Used.

Part 3 **Execution**
Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

- .1 Submit to Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Do not proceed with Work affected by submittal until review is complete.
- .3 Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4 Where items or information is not produced in SI Metric units converted values are acceptable.
- .5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .6 Notify Consultant, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .7 Verify field measurements and affected adjacent Work are co-ordinated.
- .8 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
- .9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
- .10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .3 Allow Consultant's review of each submission.
- .4 Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

- .5 Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of revisions other than those requested.
- .6 Accompany submissions with transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
- .7 Submissions include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to adjacent work.
- .8 After Consultant's review, distribute copies.
- .9 Submit electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.
- .10 Submit electronic copy of product data sheets or brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.
- .11 Submit electronic copy of reports for requirements requested in specification Sections and as requested by Consultant. Report to be signed and dated by authorized representative of company.

- .12 Submit electronic copies of manufacturers instructions for requirements requested in specification Sections and as requested by Consultant.
- .13 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .14 Submit preliminary electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant. Following Consultant's review and incorporating changes, submit 6 printed bound copies.
- .15 Delete information not applicable to project.
- .16 Supplement standard information to provide details applicable to project.
- .17 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .18 The review of shop drawings by Public Works and Government Services Canada (PSPC) is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that PSPC approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

1.3 MOCK-UPS

- .1 Erect mock-ups in accordance with 01 45 00- Quality Control.

1.4 CERTIFICATES AND TRANSCRIPTS

- .1 Immediately after award of Contract, submit Workers' Compensation Board status.
- .2 Submit transcription of insurance immediately after award of Contract.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Saskatchewan
 - .1 Occupational Health and Safety Act, 1993, S.S. - Updated 2012.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within seven (7) days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operation.
- .3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .4 Submit copies of incident and accident reports.
- .5 Parks Canada Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor.
- .6 Parks Canada Representative's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
- .7 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Parks Canada Representative.
- .8 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with three (3) weeks of contract award.
- .3 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.4 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Parks Canada Representative prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

- .1 Do Work in accordance with applicable Regulatory Requirements.

1.7 PROJECT/SITE CONDITIONS

- .1 Prior to beginning work, arrange visit, escorted by Parks Canada Representative, to scope out specific site conditions.

1.8 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Parks Canada Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.9 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.10 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Regulations, 1996.
- .2 Comply with Occupational Health and Safety Act, General Safety Regulations.
- .3 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.11 UNFORESEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Parks Canada Representative and Consultant verbally and in writing.

- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety co-ordinator and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Consultant and Parks Canada Representative verbally and in writing.

1.12 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities associated with the scope of work.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.13 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Parks Canada Representative.

1.14 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Parks Canada Representative or Consultant.
- .2 Provide Parks Canada Representative and Consultant with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Parks Canada Representative or Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.15 BLASTING

- .1 Blasting or other use of explosives is not permitted.

1.16 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from Parks Canada Representative.

1.17 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 **Products**
Not used.

Part 3 **Execution**
Not used.

END OF SECTION

Part 1 General

1.1 REFERENCE STANDARDS

- .1 Best Management Practices for Service Lines, Section 9 from Model Class Screening Report for Routine Projects. See Appendix A

1.2 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare; unfavourably alter ecological balances of importance to human life; affect other species of importance to humans; or degrade environment aesthetically, culturally and/or historically.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during construction.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Before commencing construction activities or delivery of materials to site, submit Environmental Protection Plan for review by Parks Canada Representative.
- .2 Environmental Protection Plan must include comprehensive overview of known or potential environmental issues to be addressed during construction.
- .3 Address topics at level of detail commensurate with environmental issue and required construction tasks.
- .4 Include in Environmental Protection Plan:
 - .1 Name of person responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Name and qualifications of person responsible for manifesting hazardous waste to be removed from site.
 - .3 Name and qualifications of person responsible for training site personnel.
 - .4 Descriptions of environmental protection personnel training program.
 - .5 Erosion and sediment control plan identifying type and location of erosion and sediment controls to be provided including monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
 - .6 Drawings indicating locations of proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .7 Work area plan showing proposed activity in each portion of area and identifying areas of limited use or non-use.
 - .1 Plan to include measures for marking limits of use areas and methods for protection of features to be preserved within authorized work areas.
 - .8 Non-Hazardous solid waste disposal plan identifying methods and locations for solid waste disposal including clearing debris.

- .9 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, are contained on project site.
- .10 Contaminant Prevention Plan identifying potentially hazardous substances to be used on job site; intended actions to prevent introduction of such materials into air, water, or ground; and detailing provisions for compliance with Federal, Provincial, and Municipal laws and regulations for storage and handling of these materials.
- .11 Historical, archaeological, cultural resources biological resources and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands.

1.4 FIRES

- .1 Fires and burning of rubbish on site is not permitted.

1.5 DRAINAGE

- .1 Develop and submit erosion and Sediment Control Plan (ESC) identifying type and location of erosion and sediment controls provided. Plan to include monitoring and reporting requirements to assure that control measures are in compliance with erosion and sediment control plan, Federal, Provincial, and Municipal laws and regulations.
- .2 Provide temporary drainage and pumping required to keep excavations and site free from water.
- .3 Ensure pumped water into waterways, sewer or drainage systems is free of suspended materials.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.6 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties as indicated.
- .2 Protect trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m minimum.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage.
 - .1 Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated by Parks Canada Representative.

1.7 WORK ADJACENT TO WATERWAYS

- .1 Construction equipment to be operated on land only.
- .2 Use waterway beds for borrow material only after written receipt of approval from Parks Canada Representative.
- .3 Waterways to be kept free of excavated fill, waste material and debris.
- .4 Design and construct temporary crossings to minimize erosion to waterways.

- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Blasting is not allowed.

1.8 HISTORICAL/ARCHAEOLOGICAL CONTROL

- .1 Provide historical, archaeological, cultural resources, biological resources, and wetlands plan that defines procedures for identifying and protecting historical, archaeological, cultural resources, biological resources and wetlands known to be on project site: and identifies procedures to be followed if historical archaeological, cultural resources, biological resources and wetlands not previously known to be onsite or in area are discovered during construction.
- .2 Plan: include methods to assure protection of known or discovered resources and identify lines of communication between Contractor personnel and Parks Canada Representative.

1.9 NOTIFICATION

- .1 Parks Canada Representative will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Parks Canada Representative and Consultant of proposed corrective action and take such action for approval by Parks Canada Representative.
 - .1 Take action only after receipt of written approval by Parks Canada Representative.
- .3 Consultant will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

Part 2 Products

Not Used.

Part 3 Execution

3.1 CLEANING

- .1 Leave Work area clean at end of each day.
- .2 Haul rubbish and waste materials to waste disposal location directed by Parks Canada Representative.
- .3 Ensure public waterways, storm and sanitary sewers remain free of waste and volatile materials disposal.
- .4 Perform final cleaning upon completion.
- .5 Waste Management: separate waste materials for recycling or reuse and haul to location directed by Parks Canada Representative.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Consultant in writing of satisfactory completion Contractor's inspection and submit verification that corrections have been made.
 - .2 Request Consultant's inspection.
 - .2 Consultant's Inspection:
 - .1 Consultant and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates in English that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: programmed tested, adjusted and fully operational.
 - .4 Electrical Inspection Permit: submitted.
 - .5 Operation of systems: demonstrated to Owner's personnel.
 - .6 Training of systems: delivered to Owner's personnel.
 - .7 Commissioning control systems: completed to satisfaction of Consultant.
 - .8 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Consultant.
 - .2 When Work incomplete according to Parks Canada Representative or Consultant, complete outstanding items and request re-inspection.
 - .5 Declaration of Substantial Performance: when Consultant considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.
 - .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance to be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

- .7 Final Payment:
 - .1 When Consultant considers final deficiencies and defects corrected and requirements of Contract met, make application for final payment.
- .8 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit application for payment of holdback amount in accordance with contractual agreement.

1.2 FINAL CLEANING

- .1 Perform a final clean-up.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

Part 2 Products
Not Used.

Part 3 Execution
Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Parks Canada Representative and Consultant, to:
 - .1 Verify Project requirements.
 - .2 Review warranty requirements.
 - .2 Consultant to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Two weeks prior to Substantial Performance of the Work, submit to the Consultant and the Parks Canada Representative final copies of operating and maintenance manuals in English.
- .3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3-'D'-ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by process flow under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide scaled CAD files in dwf format on CD.

1.4 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.5 AS -BUILT DOCUMENTS

- .1 Maintain, at site one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.

- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Consultant.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of drawings, provided by Consultant.
- .2 Use red marking pens for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Actual location of buried cables.
 - .2 Field changes of dimension and detail.
 - .3 Changes made by change orders.
 - .4 Details not on original Contract Drawings.
 - .5 Referenced Standards to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Provide digital photos, if requested, for site records.

1.7 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.

- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Include manufacturer's printed operation and maintenance instructions.
- .7 Include sequence of operation by controls manufacturer.
- .8 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .9 Provide installed control diagrams by controls manufacturer.
- .10 Include testing and verification reports.
- .11 Additional requirements: as specified in individual specification sections.

1.8 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site, place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing Consultant.
 - .5 Obtain receipt for delivered products and submit prior to final payment.

1.9 WARRANTIES AND BONDS

- .1 Conduct joint 9-month warranty inspection, measured from time of acceptance, by Consultant.
- .2 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .3 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Parks Canada Representative or Consultant to proceed with action against Contractor.

Part 2 **Products**
Not Used.

Part 3 **Execution**
Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of substantial performance.
- .2 Owner: provide list of personnel to receive instructions, and co-ordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation.
 - .4 Ensure programming, testing, adjusting, and balancing has been performed in accordance with Section 01 91 13- General Commissioning Requirements and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, at the scheduled time and location.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
 - .5 Allow for two (2) training sessions each of four (4) hour length.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for Consultant's approval.
- .3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .4 Give time and date of each demonstration, with list of persons present.
- .5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
 - .1 Instruct Owner's personnel.
 - .2 Provide written report that demonstration and instructions have been completed.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to performance verification of components, equipment, sub-systems, systems, and integrated systems.
- .2 Acronyms:
 - .1 Cx - Commissioning.
 - .2 PACS – Programmable Automation Control System
 - .3 O&M - Operation and Maintenance.
 - .4 PI - Product Information.
 - .5 PV - Programming Verification.
 - .6 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Contractor's Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with Contract Documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the O&M Manual.
 - .3 Effectively train O&M staff.
- .2 Contractor is responsible to implement the Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet system operational, failure mode recovery, or user requirements.
- .3 Design Criteria: as per client's requirements or determined by designer. To meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

- .1 Submit a Commissioning Plan a minimum of twelve (12) weeks prior to substantial performance.
- .2 Cx to be a line item of Contractor's cost breakdown.

- .3 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .4 Cx is conducted in concert with activities performed during stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built system is constructed and proven to operate satisfactorily under conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .5 Consultant will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Consultant.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the unfunctional system, including related systems as deemed required by Consultant, to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review Contract Documents, confirm by writing to Consultant.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Consultant.
 - .7 Have Cx schedules up-to-date.
 - .8 Ensure systems have been cleaned thoroughly.

- .9 Complete TAB procedures on systems, submit TAB reports to Consultant for review and approval.
- .10 Ensure "As-Built" system schematics are available.
- .4 Inform Consultant in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Consultant before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00- Submittal Procedures.
 - .1 Submit no later than four (4) weeks after award of Contract:
 - .1 Name of Contractor's Cx agent.
 - .2 Draft Cx documentation.
 - .3 Preliminary Cx schedule.
 - .2 Request in writing to Consultant for changes to submittals and obtain written approval at least eight (8) weeks prior to start of Cx.
 - .3 Submit proposed Cx procedures to Consultant where not specified and obtain written approval at least eight (8) weeks prior to start of Cx.
 - .4 Provide additional documentation relating to Cx process required by Consultant.

1.8 COMMISSIONING DOCUMENTATION

- .1 Submit Programming Verification Forms to Consultant a minimum of six (6) weeks prior to substantial performance.
- .2 Consultant to review and approve Cx documentation.
- .3 Provide completed and approved Cx documentation to Consultant.

1.9 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of construction schedule.
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.10 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings:
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 60% construction completion stage call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and subcontractors, addressing delays and potential problems.
 - .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Contractor, who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.11 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.12 WITNESSING OF STARTING AND TESTING

- .1 Provide fourteen (14) days notice prior to commencement.
- .2 Consultant and Parks WTP Supervisor to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.13 MANUFACTURER'S INVOLVEMENT

- .1 Provide services of Manufacturer's technical personnel for configuration of equipment and to provide O&M training, where Contractor or Subcontractor does not have staff available with the required level of expertise.

1.14 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases.
 - .1 Start-up: follow accepted start-up procedures.
 - .2 Operational testing: document equipment performance.
 - .3 System PV: include repetition of tests after correcting deficiencies.
 - .4 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Consultant after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by Consultant. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved Consultant.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved Consultant.
 - .3 If evaluation report concludes that major damage has occurred, Consultant shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.15 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Consultant for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Pre-start-up inspection reports.
 - .2 Signed installation/start-up check lists.
 - .3 Start-up reports,
 - .4 Step-by-step description of complete start-up procedures, to permit Consultant to repeat start-up at any time.

1.16 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit to Consultant for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.17 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.18 START OF COMMISSIONING

- .1 Notify Consultant at least twenty-one (21) days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.19 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.
- .3 Follow equipment manufacturer's operating instructions.
- .4 PACS trending to be available as supporting documentation for performance verification.

1.20 WITNESSING COMMISSIONING

- .1 Parks WTP Supervisor and Consultant to witness activities and verify results.

1.21 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Consultant in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.22 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Consultant for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Consultant's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Consultant deems Contractor's request for second verification was premature.

1.23 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.24 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Consultant.
- .2 Report problems, faults or defects affecting Cx to Consultant in writing. Stop Cx until problems are rectified. Proceed with written approval from Consultant.

1.25 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Consultant.

1.26 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.27 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.28 OCCUPANCY

- .1 Cooperate fully with Parks Canada Representative and Consultant during stages of acceptance and occupancy of facility.

1.29 OWNER'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Parks Canada or Consultant will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This section covers the minimum standards of work related to program development, software installation and configuration and device configuration of programmable logic controllers, HMIs, SCADA Systems and associated equipment indicated by drawings and specifications.
- .2 This project essentially upgrades older SLC and MicroLogix based PLCs to new CompactLogix PLCs, upgrades an HMI and upgrades older Windows XP based SCADA Systems to current SCADA and Windows versions.
- .3 There are several automation devices that will require programming.
 - .1 The main Water Treatment Plant (WTP) PLC located in the control bay section of the Motor Control Center (MCC).
 - .2 The Petwa surface water treatment unit PLC located in a control panel on the Petwa tank in the WTP building.
 - .3 The Memcor membrane treatment unit PLC located in a control panel on the Membrane skid in the WTP building.
 - .4 The Memcor membrane treatment unit HMI located in a control panel on the Membrane skid in the WTP building.
 - .5 The Intake Pumping Station's MicroLogix PLC will be replaced by Point I/O modules and the control logic of that PLC will have to be incorporated into the main WTP PLC.
 - .6 The Water Tower's MicroLogix PLC will be replaced by Point I/O modules and the control logic of that PLC will have to be incorporated into the main WTP PLC.
 - .7 The SCADA System workstation located in the office/lab area of the WTP.
 - .8 The SCADA System workstation located in the Supervisor's office in the Compound Building.

1.2 REFERENCES

- .1 Section D5050 – Electrical Controls and Instrumentation.

1.3 DEFINITIONS

- .1 PLC – Programmable Logic Controller or Programmable Automation Controller
- .2 HMI – Human Machine Interface. For this project this term refers to a local operator interface that primarily interfaces only to a local PLC and provides graphical data, alarming information, and set-point adjustment or operational mode changes.

- .3 SCADA – Supervisory Control and Data Acquisition. For this project this term refers to a desktop personal computer based system that communicates to multiple PLCs and provides a graphical operator interface showing the status of equipment and processes, annunciates alarms, allows operators to change operational modes, acknowledge and reset alarms, and change set-points. This system will include historical data collection and storage of key process values and display of this data in trending screens. It will also log alarm events.

1.4 BACKGROUND DATA AVAILABLE

- .1 Printouts of existing control logic and screens are available in the following Appendixes:
- B. Intake Pumping Station
 - C. Main WTP PLC
 - D. Petwa surface water treatment unit PLC
 - E. Memcor membrane treatment unit PLC and HMI
 - F. Water Tower PLC
 - G. SCADA Screenshots
- .2 The existing program application files will be made available to the successful bidder after award of contract.

1.5 SUBMITTALS

- .1 Examine the existing code, and during conversion to the new PLC code, prepare a detailed Process Narrative document. The purpose of the document is for operators to understand how the control logic functions in both normal operation, and should a piece of equipment fail. The narrative should be of sufficient detail so that a programmer not familiar with the site and application, could quickly learn how the system is intended to function and could troubleshoot or upgrade the control logic. Submit this document to the Engineer a minimum of four weeks prior to scheduled site implementation.
- .2 Provide screenshots of the proposed SCADA and HMI screens. Provide descriptions of how alarming is to be handled, along with the Alarm List. Provide a list of process variables to be historically collected and their sampling rates. Provide a list of variables that are to be trended and how they are grouped onto trending screens. Submit this document to the Engineer a minimum of four weeks prior to scheduled site implementation.
- .3 Submit closeout data in accordance with Section 01 78 00 Closeout Submittals. Following complete project start-up and commissioning, update the documents submitted in items 1 and 2 above and re-submit as “Final”.
- .4 Submit programming documentation portion for inclusion into O&M Manuals.
- .5 The programming code will become the property of Parks Canada. It is not to be considered proprietary. Password protection on the code shall not be implemented. Following complete project start-up and commissioning, submit application files to the Engineer and to the Park on USB flash drives. Resubmit these if subsequent changes are made during the warranty period.

1.6 METHODOLOGY

- .1 It is preferred that the control logic be coded manually, based on the existing code. However if a code conversion utility is used, each rung of logic must be thoroughly examined and tested prior to submission and integration on site.

1.7 FACTORY WITNESS TESTING

- .1 A demonstration of screen layouts, functionality and program simulation shall be witnessed by the Owner and his authorized representative prior to commencement of site programming activities.
- .2 Provide minimum of fourteen (14) days notice for demonstration test date.

1.8 APPROVED PROGRAMMERS AND SYSTEM INTEGRATORS

- .1 The following subcontractors are approved to do the work described in this section.
 - .1 ATAP Infrastructure Management Ltd.
 - .2 Celco Controls
 - .3 Delco Automation
 - .4 SE Panel Products
 - .5 Stockdales Electric

Part 2 Products

Not Used.

Part 3 Execution

3.1 GENERAL

- .1 Programming carried out using latest versions of software applicable to the equipment platforms in use.
- .2 The Contractor is expected to make changes to screen arrangements to suit Engineer and Owner preferences following shop drawing review without changes to the contract price. Likewise, changes to the process narrative and logic shall be made following shop drawing review without changes to the contract price in order to achieve a functional system in-keeping with the design intent.
- .3 During integration and final acceptance testing on-site, the Contractor is expected to make changes to programmed code, equipment tags, descriptions and alarms as required or as instructed by the Engineer without changes to the contract price in order to achieve a functional system in-keeping with the design intent.
- .4 The Contractor is responsible for all coordination activities to determine operation of equipment supplied prior to functional testing of programming.

- .5 The Contractor shall turn over all electronic files pertaining to programming in native format upon acceptance such that updates may be made to account for future changes in infrastructure. Proprietary, password or otherwise protected code shall not be used.
- .6 Programming Language:
 - .1 Code and comments are to be written in English.
 - .2 Programming will generally be accomplished using ladder logic. Function blocks may be used where required.
- .7 I/O Mapping:
 - .1 Each I/O point is to be directly mapped to an internal tag only once in the control program.
 - .2 I/O is to be logically arranged. Separate I/O modules with a NOP rung and pertinent comments.
 - .3 Avoid aliasing.
- .8 Program Structure:
 - .1 The program will utilize a main program task which will call sub-process tasks, each responsible for control of one sub-process identified in this narrative.
- .9 Commenting:
 - .1 Programming is to include comments and labels within the code for ease of troubleshooting:
 - Comments are required for each section and task to explain the purpose of the section.
 - Comments are required for each individual rung to explain the purpose of the rung.
 - Each program file will include a standard header comment stating:
 - Owner.
 - Site Name and Location.
 - Programmer and Contact Information.
 - Process / Sub-process.
 - Program Version and date.
- .10 The facility control systems consist of the equipment shown by Contract documents.

3.2 SCADA and External Communications

- .1 Verify existing configuration of alarm dialler to contact Operator telephone numbers upon activation of identified alarms.
- .2 Following installation of communication equipment such as radios and alarm diallers, the programming Contractor is responsible for mapping and use of I/O points indicated by drawings and as described within this narrative.
- .3 Configure Ethernet switches, routers and individual addressable equipment in accordance with Owner network and address structures. Arrange with the Owner to provide a static IP address on their LAN for remote access and support. Configure firewall so that only authorized personnel have access to the SCADA network.

3.3 ALARMS

- .1 Alarm Tag: Equipment Tag, Equipment Description, Alarm Description.
- .2 Alarm set-points shall be operator adjustable via the SCADA system.
- .3 Alarms shall be displayed on alarm banner and a dedicated alarm history page of the SCADA system. Operator acknowledgement of active alarms shall be permitted from either location.
- .4 The alarm history page will show alarms which are active and those which have been acknowledged and include the following features:
 - .1 Alarm status differentiated by colour in accordance with the following:
 - .1 Red - Indicates an unacknowledged alarm and the time at which the alarm occurred
 - .2 Black - Indicates an acknowledged alarm and the time at which the alarm was acknowledged
 - .3 Blue - Indicates a cleared alarm and the time at which the alarm was cleared
 - .2 Controls to acknowledge and clear alarms as well as to order by description or date.
- .5 The alarm banner will be located on each screen with the exception of the alarm summary page in identical location and configuration showing most recent alarms.
- .6 Latched Alarms
 - .1 Those alarms identified within the Alarm Schedule as being latched will require operator reset. To reset a latched alarm, the alarm condition must no longer exist and the operator must acknowledge the alarm via the SCADA system.
 - .2 Unlatched alarms will not require operator reset. Once the alarm condition no longer exists, the control system will automatically reset the alarm announced by the SCADA system.
- .7 Callout Alarms
 - .1 Those alarms identified within the Alarm Schedule as requiring a callout shall interface with the alarm dialler and result in the operator being advised of the alarm via telephone.
 - .2 Callout alarms shall be provided with the functionality to permit operator disablement of the alarm via the SCADA system. Disablement of a callout alarm shall not inhibit the program controls of the associated components nor prevent the alarm from being displayed by the SCADA system.
- .8 Audible alarms
 - .1 Those alarms identified within the Alarm Schedule as being Audible shall announce the alarm both visually and audibly on the SCADA system.
 - .2 Upon acknowledgement of an audible alarm via the SCADA system, the alarm condition is cleared and audible component is silenced until the alarm condition reoccurs.

- .9 Nominal alarm time delay requirements are to be implemented. Programming Contractor is to adjust alarm timing to suit operation of installed equipment.

3.4 PERMISSIVES AND INTERLOCKS

- .1 Upon receipt of an alarm condition, the SCADA system will control interlocked component(s) in accordance with the Permissive and Interlock Schedule.

3.5 SET-POINTS

- .1 Set-points can be entered or adjusted from either HMI or SCADA.
- .2 Set-points are to be collated on a dedicated page, with the following included features:
 - .1 Set-point Description.
 - .2 Operator entered value.
 - .3 Units.
 - .4 Allowable range
- .3 Only valid set-point values within specified ranges will be accepted by the control system.

3.6 HMI AND SCADA DISPLAYS

- .1 General:
 - .1 The programming contractor is required to map and/or configure all I/O points for purpose of display, monitoring, alarming and control at facility HMI and SCADA Systems.
 - .2 Screens are to provide status and controls of the facility equipment and processes.
 - .3 The programming Contractor shall hold a workshop with the Engineer and Owner operations groups prior to development of screens in order to confirm requirements for equipment symbols, faceplates, pop-ups and general HMI screen layouts. The programming contractor will then develop custom graphic symbols, faceplates and pop-ups based on operator requirements for features, functionality and colour based on workshop outcomes.
- .2 Text:
 - .1 Each component symbol will be shown alongside the respective tag number and description as indicated by single line or P&ID diagrams.
 - .2 Labels for specific components are to be placed in close proximity to the symbol. Labels are to appear in the same position relative to the symbol, preferably below, for each component of the same type.
 - .3 Labels are to be worded consistently such that a component is given the same label wherever it appears on screens or in alarm text.
 - .4 Label text is to follow the Equipment Tag, Equipment Description format, on two lines where practical.
 - .5 Labels are to be separated from one another for ease of component identification
 - .6 Labels and alarm text is to be consistently capitalized

- .7 Text sizes are to be consistent. A maximum of three text sizes are to be used to distinguish between major headings, minor headings, alarms and component labels.
- .8 Labels are to be oriented horizontally
- .9 Labels should include only meaningful words or accepted technical terms indicated. Acronyms should not be used except as included in alarm text or on issued for construction drawings.
- .10 Complete tags are to be used.
- .3 Symbols and lines:
 - .1 System will be represented using 2 dimensional, closed and filled component symbols and lines. Symbols should be simple in design, allowing immediate recognition of component function and should be easily discriminable from other icons and symbols.
 - .2 Symbols are to be shown in the upright orientation.
 - .3 Components are to be logically arranged with spacing, sizes, orientation and direction of process or power flows designed for ease of operator use.
 - .4 Symbols and lines are to be sized for ease of identification with some emphasis on relative size of physical piping such that the main process lines are easily distinguishable from sample lines, drains or other equipment not of critical importance.
 - .5 All symbols are to be accompanied by a text label in addition to any status information required.
- .4 Equipment faceplates:
 - .1 The programming contractor will develop custom graphic symbols, faceplates and pop-ups based on operator requirements for features, functionality and colour based on workshop outcomes.
 - .2 Each active component will have associated pop-up faceplates including display of:
 - .1 Applicable equipment statuses including:
 - .1 Open / Closed / Unknown
 - .2 Opening / Closing
 - .3 % Open position.
 - .4 % Speed.
 - .5 Running / Stopped / Starting / Stopping.
 - .6 Fault / Healthy Status.
 - .7 Not in Auto / Auto Status
 - .2 Permissives and interlock description and status.
 - .3 Operator mode controls:
 - .1 Metering points taken from each device over Ethernet network as indicated.

- .3 Equipment faceplates will utilize a two-step click and confirm process for control operations. Location of confirm button will not overlap location of initial control selection.
- .5 Numbers:
 - .1 Numeric displays of analog signals shall accommodate the variables full numeric range.
 - .2 Numeric displays of analog signals shall include values to one decimal place.
- .6 Scaled Bargraphs:
 - .1 Scales are to be used in 2 dimensional bar format to indicate actual analog values.
 - .2 Scales are to include a numerical value to accompany analog scale.
 - .3 Scales will indicate by use of colour normal, high, high-high, low and low-low operating ranges and alarm set-points.
 - .4 Scales should be linear and allow for display of the full instrument measurement range.
 - .5 Tick marks and grids to be provided at standard intervals of 1,2,10 or multiples of 10. Axis labels are to be clearly labelled with a description of the parameter represented.
- .7 Units:
 - .1 Units are to be used to accompany data where applicable.
 - .2 Units to be SI units unless otherwise indicated in instrument configuration sheets. Units displayed by the HMI screens are to be consistent with units configured at the instrument display.
- .8 Graphical Overview:
 - .1 Key indicators of status of the system are to be indicated using as vertical fixed scale bar graphs on a dedicated screen. Carry all existing status indicators to the new system.
- .9 Colours:
 - .1 Each symbol, label, faceplate and other feature is to be coloured in accordance with the existing colour coding for Water and Waste Water Scada Systems except where existing colours leads to HMI screens to be not legible.
- .10 Provision for Future Equipment:
 - .1 Each HMI screen will be arranged such that space exists for future equipment to be added without modification to the HMI representation of equipment installed in the initial contract.
- .11 Clickable Links:
 - .1 Each screen will include with clickable links on piping to navigate between pages where applicable. Descriptions of links are to match P&ID drawings or as otherwise approved.

- .12 Display Update Times:
 - .1 Sample rates and display update intervals to be as fast as practicable to ensure accurate representation and controllability of the plant.
- .13 Process P&ID Screens:
 - .1 Carry the existing screens which include a graphical representation of the process systems and components to the new HMI's.
 - .2 The process P&ID screens will include the following component symbols:
 - .1 Equipment with status or control I/O
 - .2 Instruments with I/O
 - .3 Piping, tanks, wet wells and similar connected to a system under control or monitored by the control system.
 - .4 Nominal flow direction arrowheads within pipes.
 - .3 The following components are to be omitted from the P&ID representation for clarity:
 - .1 Equipment without status or control
 - .2 Pipe dimension and material data.
 - .3 Instruments without status or control.
 - .4 Drains, swab launches and other piping features without status or control I/O.
 - .5 Flanges, reducers, dismantling joints and mechanical couplings.
- .14 Electrical Screens:
 - .1 Carry the existing systems screens which include a graphical representation of the electrical systems to the new HMI's.

END OF SECTION

Part 1 General

1.1 CODES AND STANDARDS

- .1 Carry out all work in accordance with these drawings and specifications, meet the latest regulations of Canadian Electrical Code and latest applicable Municipal and Provincial Codes and Regulations. In each and every instance of application, the Code, Regulation, Statute, By-law, or these contract documents having most stringent requirement applies.

1.2 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Engineer will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.
- .3 Notify Engineer of changes required by Electrical Inspection Department prior to making changes.
- .4 The contractor will be responsible for coordination and making all arrangements with the utilities for installation. The Owner will pay all fees for utility arrangements.
- .5 The electrical Contractor will obtain and pay for all permits required by laws and regulations.
- .6 After completion of the work, the electrical Contractor will certify to the Owner that the inspection authority having jurisdiction has inspected all work. Provide copies of electrical inspection reports to the Engineer.

1.3 SHOP DRAWINGS

- .1 Submit to the Engineer each shop drawing in electronic format. The Engineer will review and return, also in electronic format. Make sufficient copies of the reviewed set according to Section 01 33 00 - Submittal Procedures.
- .2 Show on shop drawings, details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.
- .3 Where applicable, include wiring, single line and schematic diagrams.
- .4 Wiring drawings showing interconnection with work of other divisions are required.

1.4 OPERATION AND MAINTENANCE DATA

- .1 Include information as follows:
 - .1 Operation and maintenance instructions to be sufficiently detailed with respect to design elements, construction features, component function and maintenance requirements to permit effective startup, operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

- .2 Technical data to be in form of approved shop drawings, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature will not be acceptable.
- .3 Provide as built, 11x17 panel layout drawings, bill of materials, panel power distribution, PLC loop drawings, and communication diagram.
- .4 Provide "As Built" list of parameter settings for all configurable equipment.
- .5 Detail position settings of dip switches or parameter settings that differ from manufacturer default for all equipment.
- .6 Include names and addresses of local suppliers for all items included in maintenance manuals.
- .7 Include a copy of the electrical inspections permit.
- .8 Include certificate of guarantee.
- .9 Material to be English.

1.5 OPERATING AND MAINTENANCE INSTRUCTIONS

- .1 Provide an instructional training session for the owner's operations staff. The session shall commence shortly after project take over. The purpose of the training session shall be to instruct the operations staff on operating and maintenance procedures for equipment installed on this project. The training program shall include but shall not be necessarily limited to the following:
 - .1 SCADA System
 - .2 PLC System
 - .3 HMI(s)
 - .4 Ethernet Communications System
 - .5 Radio Communication System

1.6 DELIVERY AND STORAGE

- .1 Assume complete responsibility for maintaining all materials and equipment delivered to the site in new condition. Repair or replace damaged articles to the satisfaction of the Engineer. Make arrangements as necessary for proper storage and security of materials delivered to the site.

1.7 PROJECT RECORD DOCUMENTS

- .1 Indicate on record drawings, location of all buried services.
- .2 Indicate accurately significant deviations from contract documents caused by site conditions and changes ordered by Engineer.

1.8 QUALIFICATIONS

- .1 Retain a qualified journeyman electrician with experience on related projects to continuously direct and monitor electrical work.
- .2 Attend site meetings.

1.9 DEFECTIVE MATERIALS AND WORKMANSHIP

- .1 After the work is complete but before final payment, the contractor shall give to the owner a written guarantee that all materials and workmanship are in strict accordance with the plans and specifications and for a period of one year, from date of final acceptance at no charge to the owners, replace or repair any defects in material and workmanship not due, in the opinion of the Engineer, to misuse and neglect. This guarantee does not cancel or prejudice other longer guarantees.

Part 2 Products

2.1 GENERAL

- .1 Equipment and material to be new, CSA certified, manufactured to standard quoted, but incorporating additional specified requirements.

2.2 FINISH

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .2 Paint all indoor switchgear and distribution enclosures light grey.
- .3 Clean and touch up surfaces of shop painted equipment scratched or marred during shipment or installation, to match original paint.
- .4 Clean, prime and paint exposed hangers, racks, fastenings, etc. to prevent rusting.

2.3 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment. Hand-painted identification will not be accepted.
- .2 Use phenolic plastic laminate, machine engraved black plate with white letters. Nameplates shall be mechanically attached; self-adhesive types are not acceptable.

Nameplate Sizes (metric)

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	19 x 90 mm	1 line	8 mm high letters
Size 5	19 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

- .3 All identification to be English.
- .4 Nameplates for terminal cabinets to indicate system and/or voltage characteristics.

2.4 WIRING IDENTIFICATION

- .1 Provide permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring. Make uniform phase-to-main lug connection on all equipment, i.e. panelboard, starter, terminal blocks, disconnect switches.

- .2 Maintain identification system at all junction boxes, splitters, cabinets and outlet boxes.
- .3 Phase wiring to be red, black and blue. Neutral conductor to be white. Building ground to be green. Isolated ground to be green with orange tracer.

2.5 CONDUIT IDENTIFICATION

- .1 Label pull boxes and other material components of a system providing information as to name and function. Use Size 2 label. Where concealed, identify all junction boxes with black felt marker indicating circuits and/or system; add a second label to the wall or ceiling surface adjacent.

2.6 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring must be suitable for conductor material used. Copper unless indicated otherwise.

2.7 MANUFACTURER'S AND CSA LABELS

- .1 Manufacturer's nameplates and CSA labels to be visible and legible after equipment is installed.

Part 3 Execution

3.1 INSTALLATION

- .1 The electrical Contractor will be responsible for keeping his work area clean and free from debris and waste material at all time. The interior of all boxes, control panels, etc. will be cleaned of dust, dirt and loose materials, to the satisfaction of the Owner. Any damage caused by the work is to be repaired to the satisfaction of the Owner. Plug and seal all penetrations.
- .2 Work will be scheduled so that the sites will be out of service for the least amount of time possible.

3.2 CONDUIT, SLEEVES AND HOLES

- .1 Holes through exterior walls and roof to be flashed and made weatherproof.
- .2 Make necessary arrangements for cutting of chases, drilling of holes and other structural work required to install electrical conduits, cables, pull boxes and outlet boxes.
- .3 Coordinate with the substructure contractor to insert sleeves where wiring passes through concrete walls and floors.
- .4 Install cables, conduits and fittings neatly and closely to building structure.

3.3 INSULATION RESISTANCE TESTING

- .1 Megger circuits, feeders and equipment up to 350V with a 500V instrument.
- .2 Megger. circuits, feeders and equipment up to 600 V with a 1000V instrument.
- .3 In all cases, ensure that resistance to ground is not less than required by code prior to energizing.

3.4 WIRE CONNECTOR INSTALLATION

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Apply coat of zinc joint compound on aluminum conductors prior to installation of connectors.
 - .2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 C22.2 no. 65.
 - .3 Install fixture type connectors and tighten. Replace insulating cap.

3.5 CUTTING AND REPAIRING

- .1 Include all cutting for installation of material and equipment. Retain the services of appropriate tradesmen on this project. Provide supervision and direction and be fully responsible. Do not cut beams or other structural members without the written permission of the Engineer.
- .2 Coordinate patching and painting of surfaces in areas to be finished by other trades. In areas where no finish is to be applied, assume responsibility for patching and painting of surfaces. Engage qualified tradesmen for all patching and painting. Patching and painting to be in accordance with the specifications governing this work to the satisfaction of the Engineer.

3.6 PAINTING

- .1 Paint all iron or steel structures fabricated and installed for supporting equipment after wirebrushing clean and applying one prime coat of paint. After all equipment is installed and all piping complete provide a touch-up coat of enamel to matching the equipment being supported.
- .2 Paint all conduit, boxes, fittings and equipment installed exposed. Coordinate this work with the painting trade.

3.7 DRAWINGS AND SPECIFICATIONS

- .1 The drawings and specifications are intended to supplement each other and any detail mentioned on one and omitted on the other shall be treated as if included on both.
- .2 The drawings to not show all construction details and any information involving accurate measurements of the building shall be taken from the building drawings or at the buildings.

3.8 BREAKDOWN AND PRICES

- .1 After award of contract and at the request of the Engineer, prepare a breakdown of the contract into major divisions as outlined by the Engineer showing the contract value of each division.
- .2 During the course of construction when requested, submit a price for the performance of additional work, broken down as prescribed by the Engineer, to show the quantity and price of the items of material required to carry out the work together with a separate listing of the labour charges for each item.

3.9 EXISTING CONDITIONS

- .1 Before submitting a tender examine the site and the local conditions affecting the work under this division and verify that the work can be satisfactorily carried out as shown on the plans without changes to the building. Examine also the mechanical drawings and specifications. Should the examination show the requirements for additional work beyond the scope of the drawings and specifications, advise the engineer at least seven days before tenders close. Failure to do so implies acceptance of existing conditions and that all allowances as may be necessary to complete the work are included in the tender.

3.10 CLEANING

- .1 Clean construction materials from wiring devices, cover plates, outlets, cabinets, enclosures, tubs, etc.
- .2 At time of final cleaning, clean all lighting reflectors, lenses, and other lighting surfaces that have been exposed to construction dust and dirt.

3.11 INSPECTION

- .1 Take immediate and direct action to respond to items on deficiency lists during and on completion of project.

3.12 COMMISSIONING

- .1 Make all arrangements to include full participation of manufacturer's technical representatives. Where deemed necessary by the Engineer, arrange for personnel from the factory to contribute to the commissioning process without cost to the owner.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Manufacturer shall ensure product meets standards in accordance with Canadian Standards Association (CSA).

Part 2 Products

2.1 CONTROL WIRING

- .1 Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type with shielding of metallized tapes over each pair and overall covering of PVC jacket and interlocked armour of aluminum strip.
- .2 All panel interior control and terminal interface wiring is to be #16 AWG type TEW 19 strand copper and protected at 5A or less. For 15 A protected circuits wiring is to be #14 AWG TEW.
- .3 Analog circuit wiring to be PVC jacketed mylar foil shielded instrument cable with the following:
 - .1 Individually jacketed and shielded twisted pair conductors.
 - .2 Minimum #18 AWG.
 - .3 PVC insulated.
 - .4 Complete with tinned copper drain wire.
 - .5 Approved Product: ShawFlex shielded 2-conductor or 3-conductor cable.
- .4 Follow the wire colour coding scheme of existing panel, unless I/O wiring is replaced and in this case use the chart below:

<u>Circuit type</u>	<u>Colour</u>
PLC 120 Vac circuits	Blue for inputs, Red for Outputs
Analog signal cables	Red (+ve) Black (-ve)
Power distribution wiring	Black - hot White - neutral Green - ground
24 VDC circuits	Orange - positive Yellow – negative

2.2 FIBER OPTIC CABLES

- .1 6 fiber, single mode 8.3/125µm tight buffered, fiber optic cables with number of colour coded fibers as indicated for use in 1 gigabit industrial Ethernet network.
- .2 Suitable for indoor/outdoor, underground duct installation with operating temperature -40°C to +70°C.
- .3 Comply with ICEA-640, "Standard for Fiber Optic Outside Plant Communications Cables and in accordance with TIA/EIA-568-B.3, "Optical Fiber Cabling Components Standard".

- .4 FT-4 rated, UV resistant jacket.
- .5 Water blocking technology for outdoor installation.
- .6 Approved product: Corning Freedom 006E8F-31131-29, or approved equal.
- .7 Provide tracer wire to be run alongside fiber cable to allow for underground cable locating. Tracer wire to be specified by fiber cable supplier.

2.3 FIBER OPTIC CABLE CONNECTORS

- .1 LC connector, single mode
- .2 Approved product: Corning Unicam connector, or approved equal

2.4 FIBER OPTIC TERMINAL PANEL

- .1 Single panel housing (enclosure) for protection and termination of fiber optic cables. Corning SPH-01P or approved equal.
- .2 6 port panel, LC compatible duplex connector panel that will plug into the interior of the single housing enclosure. Corning CCH-CP06-A9, or approved equal.
- .3 Provide fiber-optic patch cords to connect from the termination panel to the Ethernet switch.

2.5 POST MARKERS FOR UNDERGROUND FIBER OPTIC CABLE LOCATION

- .1 Above ground utility marker post constructed of high density polyethylene (HDPE) topped with dome marker and supplied with anchor.
- .2 Overall length: 1830mm Outer diameter: 89mm
- .3 Dome marker to be Orange in colour marked: "WARNING - BURIED FIBER OPTIC CABLE".
- .4 Approved Product: Promark model PM-303, or approved equal.

2.6 ETHERNET CABLES

- .1 Ethernet cables shall be rated Category 6, industrial grade.
- .2 Approved product: Belden DataTuff 7940A, or approved equal.

Part 3 Execution

3.1 INSTALLATION

- .1 GENERAL
- .2 No conductor is to be drawn into any raceway, or cables placed on tray until all work that may cause injury to cable or conductor insulation has been completed. Care is to be exercised in the pulling of conductors. A competent person is to be stationed at the feed end of any pulling operation to properly guide and feed cables and conductors. Conductors are to be trained and guided to prevent twisting, kinking or looping.

- .3 Conductors emerging from conduits and tray prior to entering power and control equipment panels are to be neatly routed and grouped. Bundles are to be secured with nylon cable ties. Conductors are not to be taped or laced.
- .4 Conductors serving terminal boards are to be neatly dressed into a cable and secured with cable ties. The cable is to be treed with individual conductors looping around the cable and aligning, at right angles to the terminals on the terminal board. Loops are to enable repositioning of any conductor up to four (4) terminals away.
- .5 Use liquid-tight flex conduit and Teck connectors for final connection of cable to equipment as appropriate. Flex conduit is to be a minimum of 300 mm and maximum of 600 mm long.
- .6 Under no circumstances is control wiring to be placed in the same conduit as a power circuit.
- .7 Instrumentation and communication network cables and conduits are to be routed to maintain the maximum possible segregation from power cables.
- .8 At each end of the run, sufficient cable is to be left for termination.
- .9 Splices in cables are not permitted unless approved by the Engineer.
- .10 Instrument cable shields are to be terminated and grounded to clean instrument ground bus at one end only, namely at the control panel.
- .11 Draw conductors into conduit in 30 meter sections or three 90o bends. Provide pull boxes to meet this requirement.
- .12 Lubricant for pulling conductors to be wax base insoluble in water and non-hardening. Lubricants to be approved for the type of conductor insulation.
- .13 All Teck cable to be neatly installed parallel to building lines on channel supports or in cable tray. Single runs may be supported with cable clamps. Installation of cables shall allow maximum free space for future cables. Haphazard installation of Teck cable will not be accepted.
- .14 Provide permanent identification tag on all Teck cables and conduits. Tag to state the feeder name and operating voltage.
- .15 All non-armoured cables run outside of panels shall be installed in conduit, including Ethernet cables.

3.2 UNDERGROUND FIBER OPTIC CABLE INSTALLATION IN CONDUIT

- .1 The Contractor must be experienced in fiber optic installations of the type involved and should be able to provide references for similar work.
- .2 The Contractor is responsible to assess the route carefully to determine the methods of installation and obstacles likely to be encountered prior to installation.
- .3 All fiber optic cables should be installed in accordance with the latest codes, standards and regulations and also in accordance with manufacturer's instructions.
- .4 Install fiber optic cables in rigid schedule 40 PVC conduit. Install tracer wire along with fiber cable to allow for future cable locates.

- .5 The figure eight configuration should be used to prevent kinking or twisting when the cable must be unreeled or beck fed.
- .6 Follow the manufacturer minimum permitted bending radius for fiber optic cables.
- .7 Trench for underground fiber optic cables shall be as straight as possible.
- .8 Fiber cables shall be attached to a pulling line only by methods recommended by the manufacturer of the cable.
- .9 While pulling fiber cables into conduits, the strength member(s) of the cable shall bear all or nearly all of the pulling force. Cable jackets shall not be directly pulled unless designed for the purpose, or unless the run is very short and requires a minimal pulling force. Fiber cables shall not be pulled into place by applying tension directly to the fibers.
- .10 The Contractor shall calculate the pulling tension and determine if pull box(s) are required to keep the pulling tension within the limit of the manufacturer's recommendations. If it is required, the Contractor shall provide and install fiber optic cable pull box(s) at the strategic points in the cable run to reduce the stress on the cable. The Contractor shall submit the calculations and an installation plan to the Engineer for review, a minimum of six weeks prior to the scheduled work.
- .11 When powered pulling equipment is used to install optical cable, tension monitoring equipment or breakaway swivels shall be used. Swivels shall be used when pulling optical cables into conduits. Exceptions shall be made to this requirement only for very short runs, which require a minimum pulling force. The pulling force shall be uniform and consistent; cables shall not be jerked.
- .12 Continuous cable pulls shall be used. Splicing is not acceptable.
- .13 Boxes used with fiber cables shall be designed for the purpose, and shall be equipped with cable supports. Pull boxes shall be sized so that no cables in the box shall be tightly bent. Minimum bending radius to be provided as per manufacturer recommendation.
- .14 A length of free cable shall be provided at each end of a cable pull. Loops of cable (service loops) shall be provided at all intermediate pulling points, such as in manholes and pull boxes. The cable's minimum bending radius shall not be violated.
- .15 Provide and install fiber optic cable warning tape above the cable along the trench.
- .16 Seal the conduits and cables properly to prevent any water entry.
- .17 Provide an exterior pull box for transition from underground to indoor at the Water Tower and at the Water Treatment Plant.
- .18 Run sufficient length of fiber optic cable inside the Water Tower and Water Treatment Plant. Cable shall be run in PVC conduit. Terminate them in the Terminal Panel prior to connection to the Ethernet switches. Provide connectors and patch cords for Ethernet switch terminations.

3.3 POST MARKERS

- .1 Mark cable every 150 m along cable runs and changes in direction.
- .2 Markers shall be installed with the base and anchor 610 mm below grade.

3.4 TESTING

- .1 Test each fiber in all fiber optic cables verification of proper installation.
- .2 The Contractor will perform the following test. Testing is under this section includes but is not necessarily limited to the categories of the work itemized below:
 - .1 Continuity and Polarity Testing
 - .2 Insertion Loss
 - .3 The optical time domain reflectometer (OTDR) testing
- .3 All optical test results shall be thoroughly and accurately documented, and copies of the test results saved in a permanent form (typically in both hard copy and on computer disk). In general, documentation of test results shall include the following information
 - .1 Cable type and length
 - .2 Splice and termination points, pull boxes
 - .3 Fiber type and size
 - .4 Connector types
 - .5 Splice types
 - .6 Cable paths
 - .7 End-to-end losses of completed transmitter-to-receiver links
 - .8 Continuity testing upon delivery of optical cables to the site of installation
 - .9 End-to-end loss testing for each complete transmitter-to-receiver link
 - .10 End-to-end loss testing on each individual link in the system, if transmitter-to-receiver loss is beyond acceptable limits.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 The Manufacturer shall ensure product meets standards in accordance with Canadian Standards Association (CSA) and National Electrical Manufacturers Association (NEMA).

Part 2 Products

2.1 CONDUITS

- .1 Rigid PVC conduit, solvent welded, shall be used unless otherwise noted.
- .2 PVC fittings and boxes to match the conduit system being used.
- .3 Liquid-tight flexible metal conduit shall be used for final connection to equipment, unless Teck cable is used
- .4 Non-metallic flexible conduit is only allowed for running LVT cable to thermostats.
- .5 Electrical metallic tubing (EMT) shall be used in finished office or lab areas, and shall be concealed in walls or ceilings.
- .6 Pull an adequately sized insulated bonding conductor in all conduits.
- .7 All conduits shall be supported independently of junction boxes, fittings, devices, etc.

2.2 SUPPORT CHANNELS

- .1 U-shape, size 41 mm× 41 mm, 2.5 mm thick. Finish shall be galvanized steel. Thomas and Betts Superstrut, Cooper B-Line or approved equal.

2.3 CONDUIT AND CABLE CLAMPS

- .1 Use T&B "Cobra" clamps for fastening conduit and cable to support channels, sized as required.
- .2 Material shall be electro -galvanized steel.

Part 3 Execution

3.1 INSTALLATION

- .1 Use PVC conduit or Teck Cable unless otherwise indicated.
- .2 Underground conduits shall be rigid PVC.
- .3 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .4 Do not install PVC conduits in insulated walls and ceilings. Use EMT for flush mounted outlets, only in office/lab and washroom areas.

- .5 Do not run conduit through attic space.
- .6 Secure equipment to poured concrete with expandable inserts.
- .7 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .8 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
- .9 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support two (2) or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .10 For surface mounting of two (2) or more conduits use channels at 1220 mm oc spacing.
- .11 For fastening of Teck cables on ceilings use channels at maximum 900 mm oc spacing, on walls at maximum 600 mm oc spacing.
- .12 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .13 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .14 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .15 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.
- .16 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Bends are to be parallel radius.
- .3 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .4 Run conduits in flanged portion of structural steel.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

END OF SECTION

Part 1 General

1.1 SCOPE

- .1 This general section refers to the control and communications system upgrade of the project.

1.2 FUNCTIONAL REQUIREMENTS

- .1 These specifications are intended to define the minimum system requirements. The functional requirements of the system shall take precedence over all other information contained in this division.
- .2 It is not the intent of this specification to completely specify all details of design and construction. Suggested changes to these specifications to improve the installation operation or to effect economy of fabrication at no sacrifice in performance will be considered, provided suitable notation is made.
- .3 The selections of all accessories, materials, and methods of fabrication not specifically covered by these specifications but which are necessary to complete the fabrication of the instrumentation and control systems, shall be the responsibility of the vendor and shall be carried out in accordance with good engineering practices.
- .4 In the event of a conflict between this specification and accompanying supplementary documents, the latter shall take precedence
- .5 The drawings are intended to show the major details of the control and instrumentation work, but it shall be the Contractor's responsibility to examine the existing electrical, process, mechanical, structural, and architectural detail at site before beginning the work and report to the Engineer any discrepancies or interferences which exist. No deviations shall be made from the specifications without prior written permission from the engineer. All deviations from the specifications must be identified in writing at time of submission.
- .6 Control and instrumentation system layouts shown on the drawings are generally diagrammatic, and the locations of equipment are approximate. Exact routing of conduits, cables, wiring, tubing and air headers shall be governed by the process, mechanical, structural and architectural conditions which prevail.
- .7 The Contractor is responsible for making all required control and instrumentation connections to equipment supplied under this contract. The control and instrumentation work is to be installed consistent with the architectural, process, mechanical and/or structural conditions that exist at site.
- .8 The Engineer reserves the right to change the location of any piece of equipment without extra payment thereof, provided that the change is requested before installation and that the new location is within 3.0 metres of the original location.
- .9 Internal panel device layouts are not shown in detail. Areas are defined for major panel equipment, and field I/O terminals. Final placement of all internal components is the Contractor's responsibility based on the guidelines provided by the equipment manufacturer.

1.3 WORK INCLUDED

- .1 Supply, installation, connection, configuration and programming of all existing and new communication and controls equipment for Compound Building, Water Tower, Water Treatment Plant and Intake Pump Station.
 - .1 Demolition of existing PLC's, HMI, SCADA workstations, communication modules, communication cabling, modems, and signal convertors as indicated.
 - .2 New PLC Supply, installation, connection, programming and testing of all PLC and HMI systems in each location as indicated.
 - .3 New SCADA computers in the Compound Building and in the Water Treatment Plant Lab. Provide new SCADA computer for home use of WTP Supervisor using remote access software. Return existing computers to the Park.
 - .4 New underground fibre optic cable between Water Treatment Plant and Water Tower including trenching, laying of conduit, cable and tracer installation, testing, backfilling, marking and documentation. Terminate fiber cables at both locations.
 - .5 New Wireless Ethernet Radio Communications System for data communications between the Water Tower and the Compound Building including, Ethernet radios masts, antennae, and all associated wiring. System to be an integrated design-build package.
 - .6 Re-arrangement of existing equipment and terminals in the existing panels as required to fit the new control and communication equipment.
 - .7 Provide programming services according to Section 25 90 01 – Automation System Programming Requirements.
 - .8 Supply, installation, connection, and testing of all control panel components.
 - .9 Supply, installation, connection, configuration and testing of all wired communication systems including but not limited to: Ethernet cabling, connections, and Ethernet managed switches. Work to include commissioning, documentation, training, and warranty services.

1.4 SUBMITTALS

- .1 Shop drawings and product data are to be submitted to the Engineer, as per Section 01 33 00 – Submittal Procedures, and generally include:
 - .1 Data sheets of all new controls and communications equipment components and devices.
 - .2 Wireless Radio Ethernet design report and proposed equipment data sheets.
 - .3 Radio Options Study Report for the future wastewater automation upgrade.
 - .4 Control Panel Drawings
 - .1 The Contractor will mark up two sets of drawings on a daily basis showing all deviations from the drawings. These sets will be available for inspection by the owner or owner's representative at any time during construction. Upon completion of commissioning, forward one set of As-Built drawings to the Engineer for review, and leave one (1) set on site.

- .2 Following the Engineer's review of the As-Built drawing submission, prepare a new set of control panel drawings for each of the modified control panels. Scanned copies of the original drawings with overlays showing replacement components are not acceptable. Complete new drawings shall be made including,
 - .1 Bill of Materials
 - .2 Exterior Panel Layout
 - .3 Interior Back and Side Panel Layouts
 - .4 Power Distribution Wiring Diagrams
 - .5 PLC I/O Wiring Diagrams
 - .6 Communications Wiring Diagrams and Details
- .3 The drawings shall be of sufficient detail so that the existing drawings will not need to be referenced in order to maintain the system, nor to make future changes.
- .4 The drawings shall be provided in pdf format and sized 11" × 17".
- .5 The drawing shall be prepared by approved automation integrators:
 - .1 ATAP Infrastructure Management Ltd.
 - .2 Celco Controls
 - .3 Delco Automation
 - .4 SE Panel Products
 - .5 Stockdales Electric
- .5 Operations and Maintenance Manuals

1.5 TESTING AND CALIBRATION

- .1 Perform factory tests of all panels prior to shipment of assemblies. The Engineer reserves the right to witness the tests. The Contractor is to notify the Engineer at least two (2) full weeks in advance of all testing and calibrating to allow the work to be witnessed.
- .2 Field calibrate and adjust all elements to the specifications as provided by the Engineer during construction.
- .3 Document all testing and calibration on record sheets recording the results and dates of all tests required and performed. Include in operating and maintenance manuals.
- .4 Perform continuity checks on all wiring.
- .5 On completion of continuity checks perform a full operational test of the panel. Operational tests are to be performed by simulating field wiring connections to each panel at the panel(s) terminal blocks.
- .6 Discrete panel inputs and outputs are to be verified with input switch simulation and output test load connections at the terminal blocks.
- .7 Analog inputs to the panel are to be simulated utilizing a 4 -20 mA signal generator. Full span response of all panel analog devices and inputs shall be verified, deviations noted and re-calibration performed where required.

- .8 Analog outputs from a panel are to be simulated by loading output circuits to their maximum impedance, (in 250 ohm multiples) and monitoring the loop current with a current calibrator or high resolution digital meter. Full span capability of any discrete output are to be verified and documented.
- .9 Analog inputs and outputs are to be tested for span and linearity (4-point test) by measurements at 4.0, 12.0, 16.0 mA, and 20.0 mA.
- .10 All test results and calibration data sheets are to be compiled as a Factory Test Report. Copies are to be retained for reference during field commissioning. One copy is to be submitted to the Engineer.
- .11 Testing is to include operation of all field instruments and devices by actuation of their controlling variable where possible (e.g. pressure switches, transmitters, hand-switches, etc.) and monitoring of received signals at the control panels. Similarly, panel outputs to field drives and devices are to be verified by operation of manual mode controls at the control panels. Any rotating equipment or valves, etc., which can not be safely energized by testing of discrete panel outputs, are to be temporarily disconnected, and potential or continuity checks of the output circuits made while energized.

1.6 QUALIFICATIONS

- .1 The work as specified in this division shall be performed by a competent control and instrumentation contractor, specializing in instrumentation and control work and normally employing instrumentation journeymen.

1.7 APPROVAL OF ALTERNATIVES

- .1 All materials and equipment specifically noted by trade name, shall be considered as the standard of quality required. All tenders are to carry, as part of their total tender price, all control and instrumentation system equipment identified as approved hardware.
- .2 No deviation from the specifications will be allowed without prior written permission from the engineer.

1.8 CUTTING AND PATCHING

- .1 No structural members or process piping shall be cut, notched or drilled without written permission from the Engineer.
- .2 All cutting, drilling and patching shall be carried out by qualified tradesmen.
- .3 All finished surfaces to be approved by the Engineer.

1.9 BRACKETS AND SUPPORTS

- .1 Provide all necessary brackets and supports for mounting equipment required for the work.
- .2 Method of attachment to structural surfaces shall be approved by the Engineer.

1.10 PROTECTION AND SECURITY

- .1 Protect all exposed live equipment and wiring during construction from damage and for personnel safety.
- .2 Provide warning signs and security precautions necessary to alert and protect authorized representatives of the Client, Engineer and authorities having jurisdiction.

1.11 MANUFACTURER'S INSTRUCTIONS

- .1 The Contractor is responsible for the correct installation and assembly of all items of equipment. Manufacturer's instructions are to be carefully read and rigidly adhered to in the installation. Any damage resulting from failure to observe the manufacturer's instructions or as a result of proceeding with the work without complete knowledge of a particular component, will be the Contractor's responsibility. Make good any loss or damage resulting from malpractice.

1.12 COORDINATION OF THE WORK

- .1 Coordinate all requirements with other trades for all openings, anchors, hangers or other provisions for the installation of the work in ample time so that proper provision can be made. Additional costs due to failure to comply with this requirement will be the Contractor's responsibility.
- .2 Coordinate the work to ensure that:
 - .1 All components provided under this section are properly installed.
 - .2 The proper type, size and number of control and instrumentation cables are provided and installed.
 - .3 Proper electric power circuits are provided for all components and systems.

1.13 OPERATION AND MAINTENANCE MANUALS

- .1 Provide copies of operating and maintenance manuals to the Engineer at completion of work as specified. In addition to requirements specified elsewhere, the manuals shall include:
 - .1 Trouble-shooting instructions.
 - .2 As-Built set of drawings for system and components schematics, wiring and interconnection diagrams.
 - .3 Technical product data with sizes, options, modifications and assembly for specific equipment installed. (Advertising or sales literature not acceptable).
 - .4 Certified copies of all testing and commissioning results.
 - .5 A description of each panel, its function and internal logic operation and relationship to the system.
 - .6 All system shop drawings.
 - .7 Manufacturers data sheets, installation manuals and parts lists for all panel elements.

- .8 Drawings detailing control equipment dip switch settings.
- .9 Data sheets showing as-built parameter settings of configurable instruments and devices.

1.14 SPARE PARTS

- .1 As specified elsewhere supply a listing of recommended spares.
- .2 To enable functional testing and operation to be performed, a minimum supply of spare parts is to be provided, and include:
 - .1 Ten control fuses of each type and rating used.
 - .2 One Point I/O Ethernet Adaptor Module
 - .3 One CompactLogix PLC processor module of the same type specified.
 - .4 One CompactLogix power supply of the same type specified.

Part 2 Products

2.1 CONTROL WIRING

- .1 Refer to Section 26 05 21 - Wires and Cables (0-1000 V) for material and installation standards for all control wiring.
- .2 Wire identification shall be with typed heat-shrink wire markers, white in colour with black numbers.
- .3 Each end of wire must be marked with a consistent designator, preferably with both the ISA designation and the Terminal Block number they are attached to.
- .4 All panel wiring is to be neatly formed, tie-wrapped and frequently supported. A primary requirement will be neatness. No splices will be allowed. All wiring is to be installed continuous from terminal to terminal.
- .5 Each wire termination at a stud is to have a ring type crimp-on connector. All wiring terminating at tubular screw terminals is to be stripped for full insertion into the terminal. Wiring termination at solder terminals is to be mechanically secure before solder is applied. Resin type solder is to be used.
- .6 Wire looms are to be secure and wire forming shall provide enough length to ensure that there will be no mechanical tension on wire terminations.
- .7 Mechanical checks are to be made to determine if there are any broken parts, wires, mechanical binding, loose screws, and proper soldered connections. Mechanical tolerances are to be checked on all units including contact grip and wires.

2.2 PANEL ENCLOSURES

- .1 Existing control panel enclosures shall be re-used with revised panel layout including existing and new panel equipment accordingly.
- .2 The control panel shall be neatly arranged using plastic wiring duct for routing of internal wiring, and for field wiring to be terminated. Size ducting for maximum final fill of 75%. Wiring harnesses for connection to door-mounted equipment shall be protected with nylon or polyethylene spiral wrap. Provide sufficient cable slack so that cables are not stressed. Protect wiring from any sharp edges using grommets.
- .3 Fasten wire harnesses using nylon tie-wraps. Fasten tie-wrap holders using screws or pop-rivets. Sticky-back holders are not allowed.
- .4 Terminal blocks shall be screw type, torqued to the manufacturer's recommendations. All fusing shall be done with disconnect lever style terminal blocks, Phoenix Contact UT series or Weidmuller ESI series. Provide fusing as shown on the drawings. Also provide fusing for each analog I/O point. Fuses shall be of the time-delay type, sized as required. Provide ten (10) spare fuses for each size used.
- .5 Provide a flexible braided ground strap between the door of the panel and the main body; IlSCO FX series. Provide grounded terminal blocks for termination of shields for each analog signal. Bring all equipment grounds to a copper ground bar of minimum 150 mm length, IlSCO D167. Ground connections to painted surfaces shall have the paint under the screw removed to bare metal, and an internal "star" washer shall be used.
- .6 Wiring, terminals, and equipment shall be clearly marked. Label circuit breakers and provide a legend attached to the back of the panel door. Label relays. Terminal block numbers shall follow a clear and consistent pattern. Wire markers shall be machine printed on heat shrink bands. Wires shall be labeled at each end with the termination information that it connects to, so if a wire is temporarily removed, it can be reinstalled without referring to wiring diagrams. All doors and edges are to be neatly turned in and smooth finished. No visible welding seams will be accepted.
- .7 Cutouts for panel-mounted equipment are to be neatly cut, properly aligned and sized so that the hole is completely covered by the front bezel. Equipment and instrument cases are to be preferably held in place by rear connected fittings. Any front fixing required is to be only by means of chrome plated machine screws. For replacement of front-panel equipment of different size than original, it is permissible to fasten with rivets, an aluminum plate over the original hole and then cut new hole of correct size into aluminum plate. Aluminum plate shall be minimum 12 gauge thickness. Prime and paint aluminum plate to match the existing panel colour.
- .8 All new panel-mounted equipment is to be complete with an engraved legend on black lamacoid nameplate having white letters no smaller than 6 mm. The panel is to have an engraved identification nameplate having letters no smaller than 12 mm. All details of engraved inscriptions are to be approved by Engineer.
- .9 The complete assembled control panel shall be CSA approved or cUL listed.

2.3 CONTROL PANEL POWER DISTRIBUTION

- .1 Circuit breaker terminal blocks for sub circuit power are to be sized based on the circuit requirement, except where otherwise required by the hardware or field devices for manufacturer's recommended protection.
- .2 Circuit breakers shall be UL-489 approved. Acceptable Product: ABB type S201U-K, or approved equal.
- .3 DC control power shall be distributed using disconnectable fused terminal blocks

2.4 CONTROL PANEL GROUNDING

- .1 The single-point grounding method shall be utilized.
- .2 The DIN railing shall be fastened to the back plate of the panel using fasteners that include "star" lock-washers to provide a good ground path through the painted surface.
- .3 The ground wires for panel-mounted equipment shall be terminated in a copper ground bus, ILSCO D167, or equal.
- .4 The door of the panel shall be bonded to the main enclosure using a flexible braid ground strap, ILSCO FX, or equal.
- .5 The ground bus and back-panel shall be bonded to the main enclosure using minimum AWG#6 copper ground wire.
- .6 Run a minimum AWG#6 ground wire from the main enclosure ground stud to the ground bus bar in the Motor Control Centre.

2.5 SET POINTS AND ADJUSTMENTS

- .1 All instrument and control elements are to be supplied with the range, scale and operating configuration as indicated on the specification sheets. Field calibrate and adjust all elements to the specifications as provided by the Engineer during construction.
- .2 Record the final settings and submit with the O&M manuals.

2.6 PROGRAMMABLE LOGIC CONTROLLER

- .1 The PLC system to be based on the Allen Bradley Compact-Logix 1769 series.
- .2 Processors shall have Ethernet IP ports for programming and data communication. Provide a memory card for back-up of the application program.
- .3 Digital Input modules shall be rated for 24 Vdc and 120 Vac to cover all existing and new signals.
- .4 Analog modules shall have isolated channel 4-20 mA inputs and outputs.
- .5 32 point modules shall not be used as the wiring is too congested.
- .6 The PLC power supply shall be supplied from 120 Vac and shall have capacity for the installed system plus 50% spare future capacity.

2.7 DESKTOP SCADA WORKSTAION

- .1 The workstation shall have the following minimum requirements:
 - .1 Intel® Core™ i7-7700 Processor (Quad Core/8MB/8T/3.6GHz/65W)
 - .2 Windows 10 Pro, 64-bit operating system (or as required by SCADA s/w)
 - .3 Microsoft Office Professional 2016
 - .4 8GB (2x4GB) 2400MHz DDR4 RAM
 - .5 AMD Radeon R7 450, 4GB video card
 - .6 1TB 3.5inch Serial ATA (7200 Rpm) Hard Drive
 - .7 Canadian English (QWERTY) Dell Business KB522 USB Keyboard
 - .8 Dell Laser Scroll USB 6 button mouse.
 - .9 24 inch UltraSharp monitor with 1920 x 1200 resolution, 16:10 ratio, and USB 3.0 port.
 - .10 Speaker system
 - .11 Power supply shall be 120 Vac installed to existing UPS receptacle.
 - .12 5-year pro support plus with next business day onsite service.
 - .13 Approved Manufacturer: Dell, Industrial Solutions Inc. or approved equal.
- .2 Provide a total of three workstations.
 - .1 One for the SCADA PC in the WTP lab room
 - .2 One for the SCADA PC in the supervisor's office in the Compound Building
 - .3 One for the Electrical Supervisor's home use and remote communications.

2.8 LAPTOP COMPUTER

- .1 The laptop personal computer shall have the following minimum requirements:
 - .1 Intel® Core™ i7-6820HQ Processor (Quad Core 3.6 GHz, 8MB cache)
 - .2 Windows 10 Pro, 64-bit English Operating System
 - .3 Microsoft Office Professional 2016
 - .4 8GB DDR4-2133 MHz RAM
 - .5 NVIDIA® Quadro® M1000M w/2GB GDDR5 video card
 - .6 Dual-Band Wi-Fi 802.11AC plus Bluetooth card
 - .7 512 GB M.2 PCIe NVMe Class 50 Solid State Drive
 - .8 Internal Backlit Keyboard, English
 - .9 Wireless Mouse, Logitech M325 with USB wireless receiver
 - .10 15.6 inch ultrasharp wide view anti-glare LED-backlit colour LCD monitor with 1920 x 1080 resolution.
 - .11 Camera and microphone built in to monitor, speakers built into keyboard.

- .12 120 Vac adaptor/charger.
 - .13 5-year pro support plus with next business day onsite service.
 - .14 Approved Manufacturer: Dell Precision 15 5000 series, Industrial Solutions Inc. or approved equal.
- .2 The laptop PC is for the Water Systems Operations Supervisor's remote use.

2.9 ALARM PRINTER

- .1 Impact style line printer in wide carriage format using tractor feed fan-fold paper.
- .2 24 pin printer head providing near letter quality printing.
- .3 High reliability, rated at 20,000 hours MTBF.
- .4 USB data port
- .5 120 Vac power
- .6 Approved Product: Okidata Microline model 491 c/w ribbon ink cartridge
- .7 Provide six additional ribbon ink cartridges.

2.10 SCADA SYSTEM SOFTWARE

- .1 SCADA System software to be Rockwell Automation Factory Talk View SE, with both Server and Client on one machine.
- .2 HMI shall perform historical alarm logging, separate alarm annunciation, acknowledgement and reset. One year's worth of data logging and trending of key plant parameters with overwriting of oldest data.
- .3 SCADA shall be licensed for tags/screens for entire control systems, plus 100% spare for future tag/screen additions.
- .4 Logged data shall be stored on hard drive and shall be easily exportable to Excel spreadsheet format.
- .5 Data connection to control system shall be Ethernet/IP based.
- .6 Provided licensed software for both SCADA workstations. These are to operate in parallel, totally independent from one another.

2.11 HUMAN-MACHINE INTERFACE SOFTWARE

- .1 HMI software to be Rockwell Automation Factory Talk View ME.
- .2 Provide licensed software registered to the Park.

2.12 REMOTE MONITORING – REMOTE SUPPORT SOFTWARE

- .1 Provide licensed installation of TeamViewer software. The host computer will be the SCADA workstation at the Compound Building. The remote computers will be the Electrical Supervisor's workstation located at his home, and the Operations Supervisor's laptop PC, normally located at his home. A third remote Team Viewer station will be required for the programmer to provide remote support of all the devices on the network.

- .2 Configure the Ethernet Switch/Router so that the communication connected to the Compound Building Parks Local Area Network cannot access the Water Automation Network.
- .3 Configure the firewall so that Electrical and Operations Supervisors have access to the SCADA system. Configure the firewall so that the programmer has access to the complete Water Automation Network.
- .4 Install and configure the software in the host and remote computers. Include site trips to Prince Albert and Shellbrook if necessary to verify remote operation.
- .5 Provide demonstration and training to the supervisors in how to utilize the software.

2.13 RADIO COMMUNICATIONS

- .1 The Radio communications system between the Compound Building and Water Tower shall be a Design-Build package for wireless industrial Ethernet.
- .2 Determine the required antenna gain, minimum co-ax cable losses and antenna selection and mounting height requirements. Ensure signal strength exceeds 25% of minimum level in worst case conditions. Signal strength not to exceed legal limits. The radios shall preferably be based on 5.8 GHz spread spectrum frequency hopping technology using Redline Communications products. Other frequencies and radios will be considered if this does not show to be a good solution. The design shall include antenna and mast with structural components, for both locations. A design report shall be submitted to the Engineer for review, along with shop drawings for the proposed equipment.
- .3 Supply and install the required antennae, masts, and bases on the Water Tower and Compound Building locations. Ensure that fasteners are secured to structural members and that the water-tightness of the roof is not compromised.
- .4 Provide coaxial lightning arrestors where the antenna cable enters the control panel, but not inside the control panel. Install a separate #6AWG ground conductor from the arrestor to the building ground bus.
- .5 Test and commission the radio communication system.
- .6 Phippen Technical is the approved subcontractor for this work. If the contractor proposes another subcontractor to perform this work, Parks Canada Agency must first approve.

2.14 WASTEWATER COMMUNICATIONS OPTIONS STUDY

- .1 Conduct a radio survey in the Town of Waskesiu Lake for data communications options that will facilitate bringing in the three sewage pumping stations and the lagoon blower building into the SCADA network. The approximate Google Earth coordinates for the locations are:

.1	Water Tower	429,378 m E	5,974,598 m N
.2	SLS#1	428,901 m E	5,975,466 m N
.3	SLS#2	429,030 m E	5,975,958 m N
.4	SLS#3	429,301 m E	5,976,610 m N
.5	Lagoon Bldg.	430,284 m E	5,976,124 m N

- .2 Radio Survey to incorporate a site visit to determine tree heights and tree densities, terrain, and buildings that may interfere with line-of-sight radio paths. It should also determine which frequencies bands would be suitable and not already congested.
- .3 The data that will be transmitted will not require high bandwidth and will be for monitoring and alarming only. It will not be for control of equipment.
- .4 The study should consider options for transmission paths that would reduce the requirement for high towers in residential areas.
- .5 The study should compare unlicensed stand-alone Ethernet radio systems, as well as cellular radio systems. Estimates should be provided for capital cost installation and operating cost projections. The estimates should include engineering & design, equipment purchase and installation costs.
- .6 The study should identify the risks and reliabilities for the different options.
- .7 This study shall be undertaken and completed shortly following contract award.
- .8 Phippen Technical is the approved subcontractor for this study. If the contractor proposes another subcontractor to perform this study, Parks Canada Agency must first approve.

Part 3 Execution

3.1 MOUNTING/CONNECTING CONTROLS, INSTRUMENTS AND ACCESSORIES

- .1 Install instruments in accordance with the manufacturer's instructions and in accordance with the drawings. Mount instruments rigidly supported, level and plumb, and in such a manner as to provide accessibility, protection from damage, isolation from heat, shock and vibration, and freedom from interference with other equipment, piping and electrical work.
- .2 Instruments shall not be installed until construction work adjacent to instrument has been completed to the extent that there shall be no damage to the instrument installation by such construction work. Where not practical, provide mechanical protection for the instrument, to the satisfaction of the Engineer.
- .3 Instrument devices including accessories shall be located where they will be accessible from structural platforms, permanent ladders, or grade. Locally mounted indicating instruments shall face toward, in line of sight and within reading distance of the normal operating area.
- .4 Allow sufficient clearance for removal of equipment such as level displacers and floats, rota-meter floats, control valves and plugs.
- .5 Mount field located items of instrumentation on building columns and walls where such building columns or walls are accessible. Provide pipe stands and/or other means of support where mounting on columns or walls is not practical.

- .6 Identify instruments clearly by means of lamicoid tag.
- .7 Panels, control stations, and other equipment are to be protected against the entrance of dust, dirt and moisture, and protected against mechanical injury while rough, dirty, wet or dusty work is in progress. Damage to equipment, including marring of painted surfaces caused by failure to properly protect the equipment, are to be promptly repaired by the Contractor to the satisfaction of the Engineer.

3.2 COORDINATION OF THE WORK

- .1 Other trades will be installing equipment, which may affect the arrangement of tubing, conduits, and equipment. The Contractor to notify other trades of all openings, anchors, hangers or other provisions for the installation of his work in ample time so that proper provision can be made. Failure to comply with this requirement on the part of the Contractor will not relieve him of the cost of cutting openings, installing brackets, etc., at a later period and subsequent patching.
- .2 Contractor shall provide support and coordination to subcontractors for PLC I/O testing, communications system testing, start-up, commissioning, and training for the control system.

3.3 POWER, CONTROL AND INSTRUMENT CABLE INSTALLATION

- .1 No conductor is to be drawn into any raceway, or cables placed on tray until all work that may cause injury to cable or conductor insulation has been completed. Care is to be exercised in the pulling of conductors. A competent person is to be stationed at the feed end of any pulling operation to properly guide and feed cables and conductors. Conductors are to be trained and guided to prevent twisting, kinking or looping. Only talc, soap, or other CSA approved lubricants are to be used to assist pulling operations. Grease type lubricants will not be permitted.
- .2 Conductors emerging from individual conduits terminating into the open area below a control panel are to be neatly routed and collected into bundles. Bundles are to be secured with nylon cable ties. Conductors are not to be taped or laced.
- .3 Conductors serving terminal boards are to be neatly dressed into a cable and secured with cable ties. The cable is to be treed with individual conductors looping around the cable and aligning, at right angles to the terminals on the terminal board. Loops are to enable repositioning of any conductor up to four (4) terminals away.
- .4 Use liquid-tight flex conduit for final connection of cable to instruments. Flex conduit is to be a minimum of 300 mm and maximum of 600 mm long.
- .5 Under no circumstances is control wiring to be placed in the same conduit as a power circuit.
- .6 Instrumentation and communication network cables and conduits are to be routed to maintain the maximum possible segregation from power cables.
- .7 At each end of the run sufficient cable is to be left for termination.
- .8 Splices in instrumentation cables are not permitted unless approved by the Engineer.
- .9 Cable shields are to be terminated and grounded to clean instrument ground bus at one end only, namely at the Local Control Panel.

3.4 PAINTING

- .1 Painted surfaces which are damaged in any way, i.e. by welding, scraping, cutting, etc., are to be thoroughly cleaned, primed with a rust inhibiting primer and repainted to the original colour. The finished job is to meet or exceed the original painting specification.

3.5 WELDING

- .1 The Contractor is to fabricate and install all brackets, hangers, etc., necessary to complete this contract. All welding and welding materials is to conform to the requirements of the CSA W-59.

3.6 CLEANUP

- .1 The interior of enclosures and boxes is to be cleaned of dust, dirt and loose material, and shall be vacuum cleaned. The use of compressed air to remove debris is not acceptable.
- .2 All fastening screw holes provided in boxes and enclosures are to have a fastening screw installed.
- .3 On completion of work, remove debris from the site, repair any damage and leave the installation in a clean and neat condition to the satisfaction of the Engineer.
- .4 In the event that a final inspection cannot be completed because of an excessive deficiency list or that the plant cannot be placed into operation because of deficient or defective work, the Contractor will be charged by the Client for the additional engineering services, reinspection and later start-up assistance.
- .5 Keep all work areas clean of debris, waste and surplus materials.

3.7 COMPONENT INSTALLATION

- .1 The contractor is responsible for the general arrangement of components to be installed. Equipment is to be mounted to ensure adequate clearance between door mounted and backpan mounted components with the panel door closed. All items are to be clearly identified with an engraved lamicoïd nameplate securely fastened in place.
- .2 All internally mounted equipment is to be arranged for ease of access and removal when necessary. Flexible wiring harnesses with approved terminating connectors at both sides are to be provided for any hinged panel or door mounted equipment and each shall have 20% spare capacity.
- .3 The panel is to be provided with a tapped copper bus bar for panel components and shield grounding, plus 20% spare, unless otherwise approved by the Engineer.
- .4 Relay base and terminal block rails are to be located square to the backpan. Door mounted instruments are to align horizontally and vertically on edges or centrelines as generally indicated.
- .5 Fastening of equipment assemblies to the panel backpans is to be by means of appropriately sized drilled and tapped screw holes. Machine screws only with lockwashers are to be used; self-tapping hardware is not acceptable.

3.8 WIRING METHODS

- .1 Identification ferrules are to be placed at each end of all wires. Wire identification system is to be as specified elsewhere.
- .2 All wiring is to be neatly formed, tie-wrapped and frequently supported. A primary requirement will be neatness. No splices will be allowed. All wiring is to be installed continuous from terminal to terminal.
- .3 Each wire termination at a stud is to have a ring type crimp-on connector. All wiring terminating at tubular screw terminals is to be stripped for full insertion into the terminal. Wiring termination at solder terminals is to be mechanically secure before solder is applied. Resin type solder is to be used.
- .4 Wire looms are to be secure and wire forming shall provide enough length to ensure that there will be no mechanical tension on wire terminations.
- .5 Mechanical checks are to be made to determine if there are any broken parts, wires, mechanical binding, loose screws, and proper soldered connections. Mechanical tolerances are to be checked on all units including contact grip and wires.
- .6 Each panel is to be bonded to the building ground system, with minimum AWG#6 copper wire.
- .7 Current loop isolator terminal blocks are to be used on all analog 4-20mA loops that exit or enter the building to the PLC.

3.9 PROGRAMMING

- .1 Programming shall be performed according to the requirements of Section 25 90 01. – Automation System Programming Requirements.

END OF SECTION

DRAWING INDEX

SHEET	DRAWING NAME	REVISION	DRAWING TITLE	DRAWING DESCRIPTION
GENERAL				
1	4786-00-G-001	0	GENERAL	COVER SHEET AND DRAWING INDEX
INSTRUMENTATION				
2	4786-00-EI-101	0	SITE PLAN	DETAIL
3	4786-00-EI-501	0	DETAILS	INTAKE PUMP HOUSE
4	4786-00-EI-502	0	DETAILS	WATER TREATMENT PLANT
5	4786-00-EI-503	0	DETAILS	PETWA CONTROL PANEL
6	4786-00-EI-504	0	DETAILS	MEMCOR CONTROL PANEL
7	4786-00-EI-505	0	DETAILS	WATER TOWER
8	4786-00-EI-506	0	PLAN, DETAIL	COMPOUND BUILDING
9	4786-00-EI-601	0	DIAGRAM	COMMUNICATIONS

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DATE: 2017-01-11, Kevan Tuma



PARKS CANADA
PRINCE ALBERT NATIONAL PARK
WATER AUTOMATION
SYSTEM UPGRADE

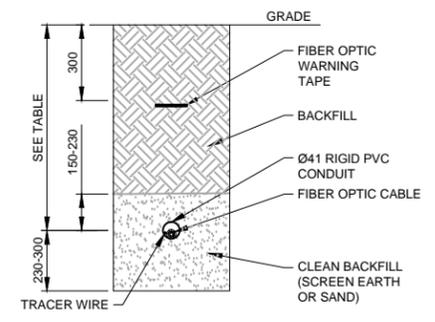
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REV	DATE	DESIGN	DRAWN	DESCRIPTION
0	2017MAR24	P. CENGIZ	K. TUMA	ISSUED FOR TENDER

DRAWING	REVISION	SHEET
4786-00-G-001	0	1 / 9

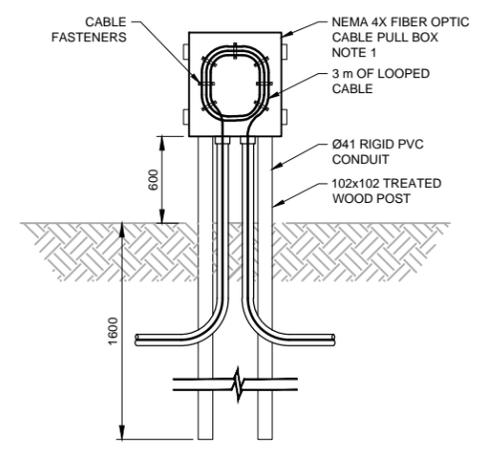


1 PLAN SITE 1:3000



MINIMUM COVER REQUIREMENT TABLE	
IN SOIL:	770
UNDER DITCHES:	910
ROAD CROSSING:	1070

2 DETAIL TRENCH NTS



NOTE 1: PANEL SIZE TO BE DETERMINED BASED ON FIBER OPTIC CABLE BENDING RADIUS.

3 DETAIL PULL BOX NTS

- NOTES:
- SCALE AND LOCATIONS ARE APPROXIMATE. CONFIRM ON SITE.
 - ROUTE SHOWN IS APPROXIMATE. WALK ROUTE WITH PARKS CANADA STAFF TO DETERMINE BEST ROUTE.
 - MARK EXISTING U/G UTILITIES. STAY OUT OF RIGHT-OF-WAYS AND EASEMENTS OR OBTAIN PROPER APPLICATIONS AND PERMISSION.
 - LOCATE PULL BOX(ES) ALONG ROUTE WHERE REQUIRED TO MEET CABLE PULLING TENSION LIMITS.
 - ADHERE TO SECTION 9 PARKS CANADA'S "MODEL CLASS SCREENING REPORT FOR ROUTINE PROJECTS" IN APPENDIX A.

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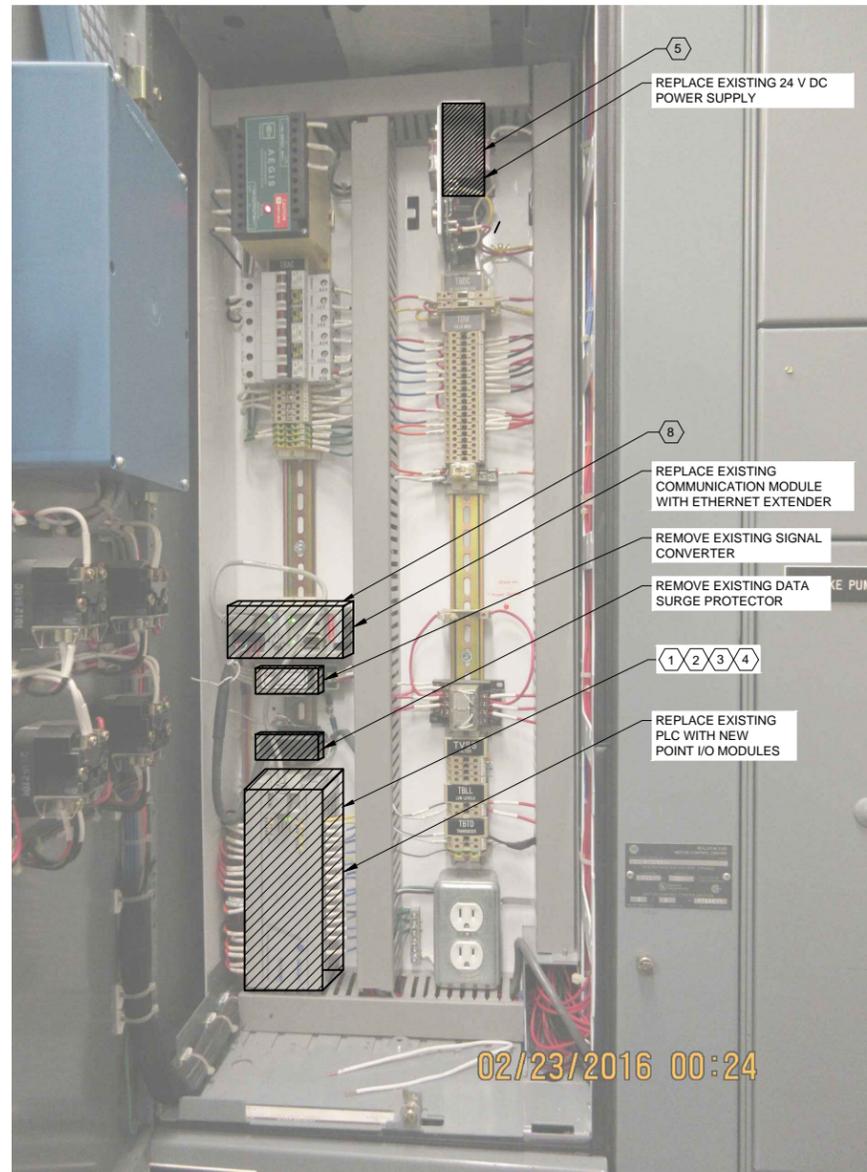


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20164786-00
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DRAWING	REVISION	SHEET
4786-00-EI-101	0	2 / 9



INTAKE PUMP STATION EQUIPMENT LIST			
ITEM	QUANTITY	MODEL NO.	DESCRIPTION
1	1	AB-1734-AENT	ALLEN BRADLEY ETHERNET / IP ADAPTER
2	2	AB-1734-IB8	ALLEN BRADLEY 24 V DC DIGITAL INPUT MODULE
3	3	AB-1734-0W4	ALLEN BRADLEY DIGITAL RELAY OUTPUT MODULE
4	1	AB-1734-IE4C	ALLEN BRADLEY ANALOG INPUT MODULE
5	1	PROMAX	WEIDMULLER 24 V, 3 A DC POWER SUPPLY
6	AS REQUIRED		MOUNTING BASE
7	AS REQUIRED		REMOVABLE TERMINAL BLOCK
8	1	IEX-402-VDSL2	MOXA MANAGED ETHERNET EXTENDER

- NOTES:**
- REFER TO EXISTING CONTROL PANEL DRAWINGS IN APPENDIX B FOR I/O POINTS AND PANEL DETAILS.
 - FEED NEW AB-1734-AENT AND IEX-402-VDSL2 FROM NEW 24 V DC POWER SUPPLY IN THE PANEL USING FUSED TERMINAL BLOCKS.

1 DETAIL NTS
INTAKE PUMP STATION CONTROL PANEL

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DATE: 2017-03-24, Kweia Tuma



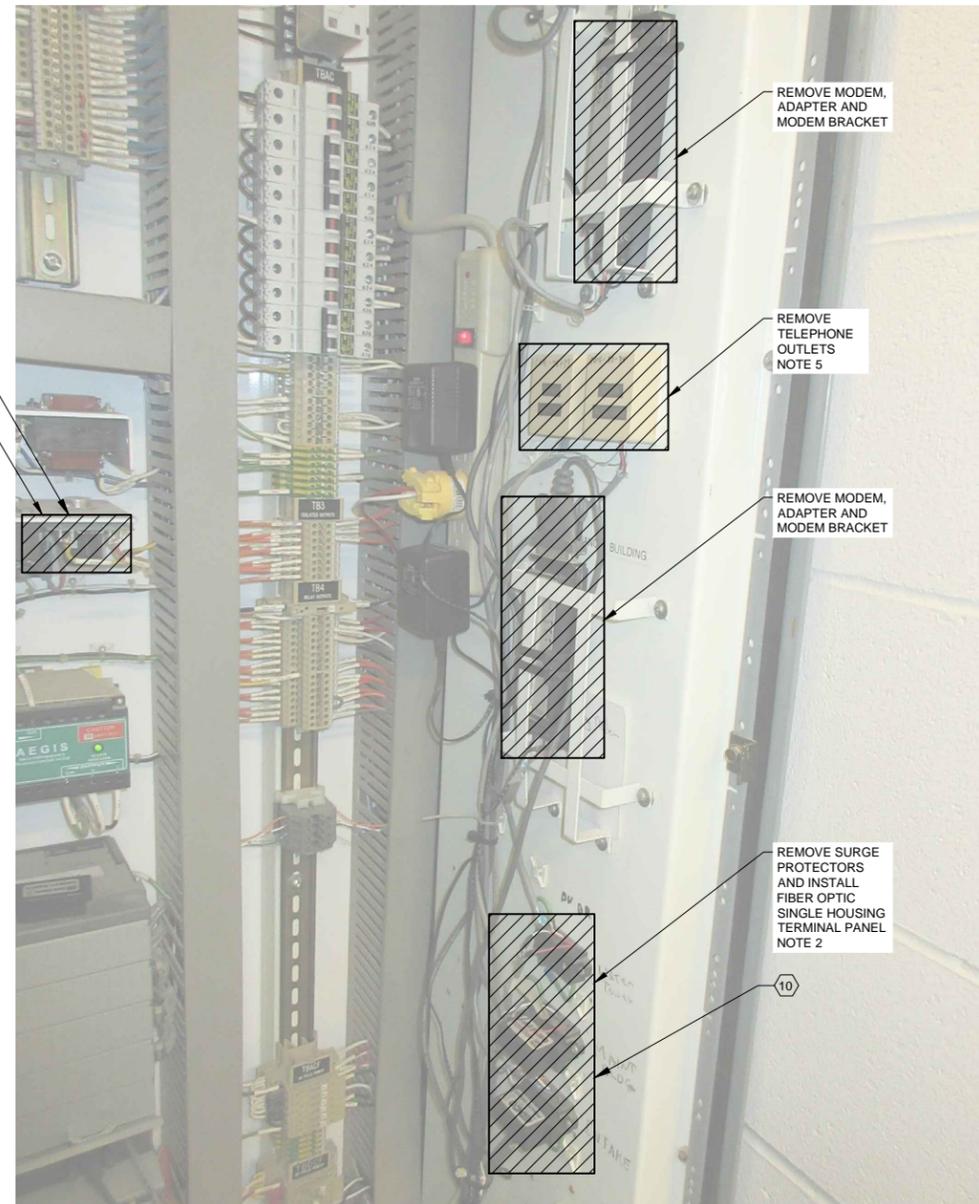
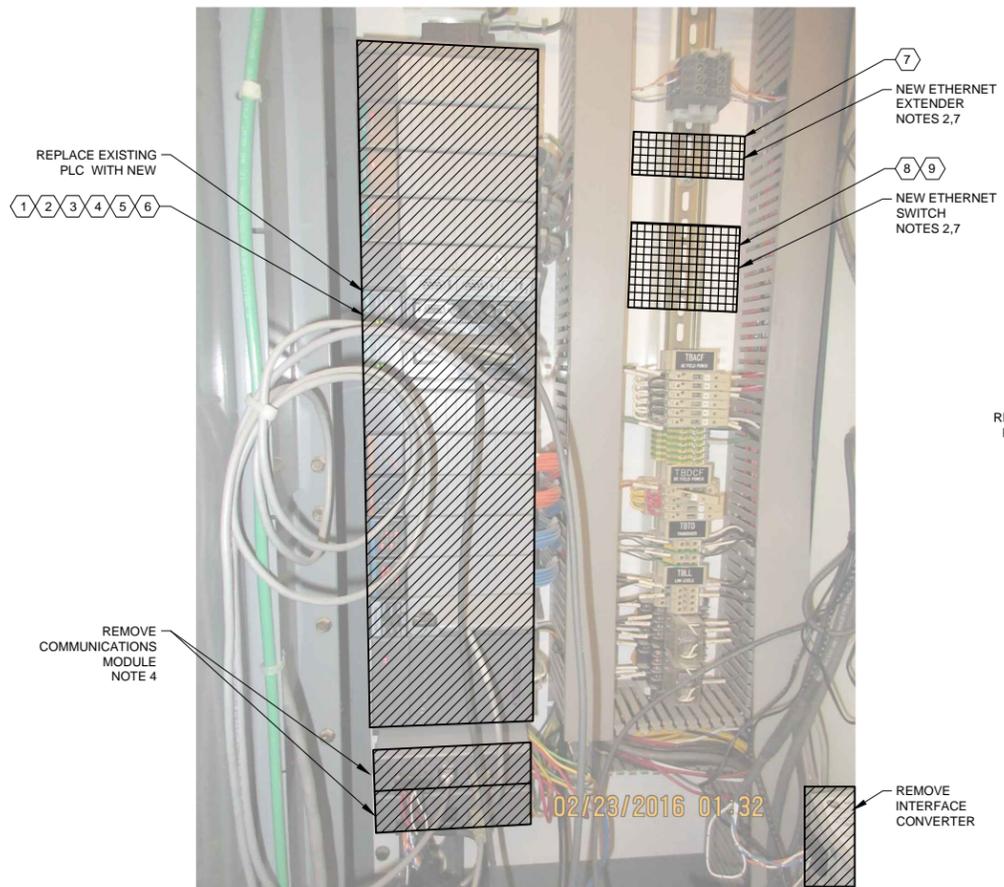
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INSTRUMENTATION DETAILS
INTAKE PUMP HOUSE

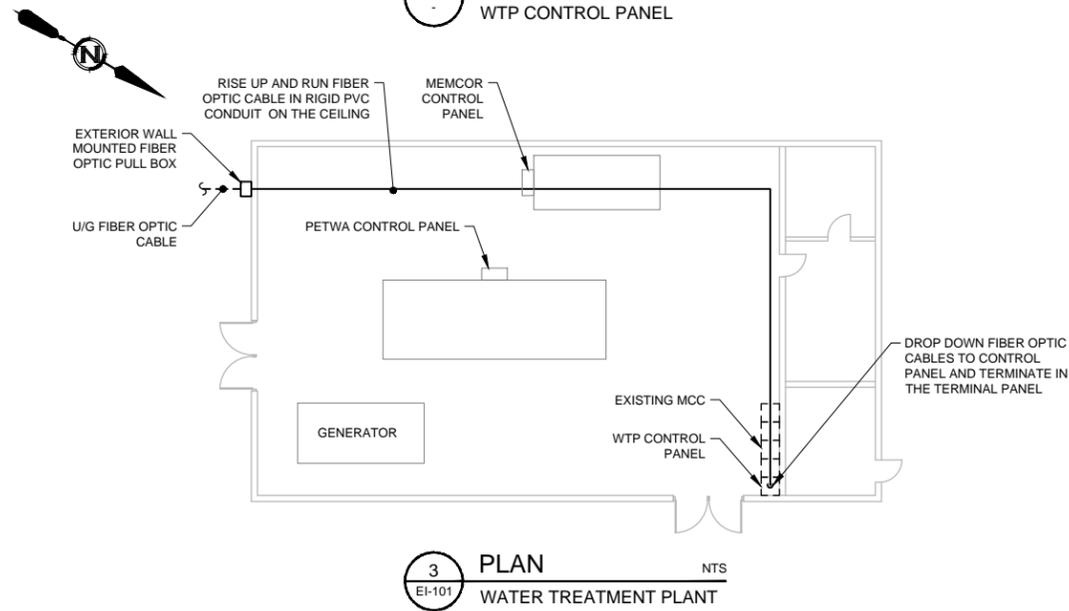
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4786-00-EI-501	0	3 / 9



WATER TREATMENT PLANT EQUIPMENT LIST				
ITEM	QUANTITY	MODEL NO.	DESCRIPTION	
1	1	AB-1769-L33ER	ALLEN BRADLEY COMPACTLOGIX PLC (2 MB)	
2	1	AB-1769-PA4	ALLEN BRADLEY POWER SUPPLY	
3	2	AB-1769-IQ16	ALLEN BRADLEY 24 V DC DIGITAL INPUT MODULE (16 PT.)	
4	1	AB-1769-OW16	ALLEN BRADLEY RELAY OUTPUT MODULE (16 PT.)	
5	1	AB-1769-OW8I	ALLEN BRADLEY ISOLATED RELAY OUTPUT (8 PT.)	
6	3	AB-1769-IF8	ALLEN BRADLEY ANALOG INPUT MODULE (8PT.)	
7	1	IEX-402-VDSL2	MOXA MANAGED ETHERNET EXTENDER	
8	1	AB-1783-MS10T	ALLEN BRADLEY STRATIX 8000 ETHERNET SWITCH	
9	2	AB-1783-SFP1GLX	ALLEN BRADLEY SINGLE MODE SFP MODULE	
10	1	SEE SPECS	CORNING FIBER OPTIC CABLE TERMINAL PANEL	
11	1	PROMAX	WEIDMULLER 24 V, 7.5 A DC POWER SUPPLY	

- NOTES:**
- REARRANGE INSTALLATION IN THE PANEL TO FIT NEW EQUIPMENT AS REQUIRED.
 - USE SIDE PANEL SPACE (GAINED AFTER DEMOLITION) FOR NEW EQUIPMENT AS REQUIRED.
 - PROVIDE PULL BOX ON THE EXTERIOR WALL FOR FIBER OPTIC CABLES TRANSITION FROM OUTSIDE TO THE INSIDE.
 - REMOVE ALL DH-485 CABLING WITH THE EXCEPTION OF THE UNDERGROUND RUN TO THE INTAKE PUMPHOUSE. REMOVE ALL DH-485 INTERFACE DEVICES. REPLACE DH-485 DAISY-CHAINED NETWORK WITH STAR CONFIGURATION ETHERNET IP NETWORK.
 - REMOVE DH-485 CABLING INTERFACE DEVICES AND MODEMS COMMUNICATING WITH SEWAGE LIFT STATIONS 1,2,& 3. COMMUNICATION TO THESE FACILITIES WILL BE DISABLED UNTIL THE FUTURE WASTEWATER AUTOMATION PROJECT IS IMPLEMENTED.
 - COORDINATE WITH PARKS CANADA AND SASKTEL TO REMOVE AND DISCONTINUE LEASED LINES THAT ARE UNUSED AFTER NEW SYSTEM IS COMMISSIONED.
 - FEED NEW ETHERNET EXTENDER AND ETHERNET SWITCH FROM NEW 24 V DC POWER SUPPLY IN THE PANEL USING FUSED TERMINAL BLOCKS.
 - REFER TO EXISTING CONTROL PANEL DRAWINGS IN APPENDIX C FOR I/O POINTS AND PANEL DETAILS.

1 DETAIL NTS
WTP CONTROL PANEL



3 PLAN NTS
WATER TREATMENT PLANT

2 DETAIL NTS
WTP CONTROL PANEL

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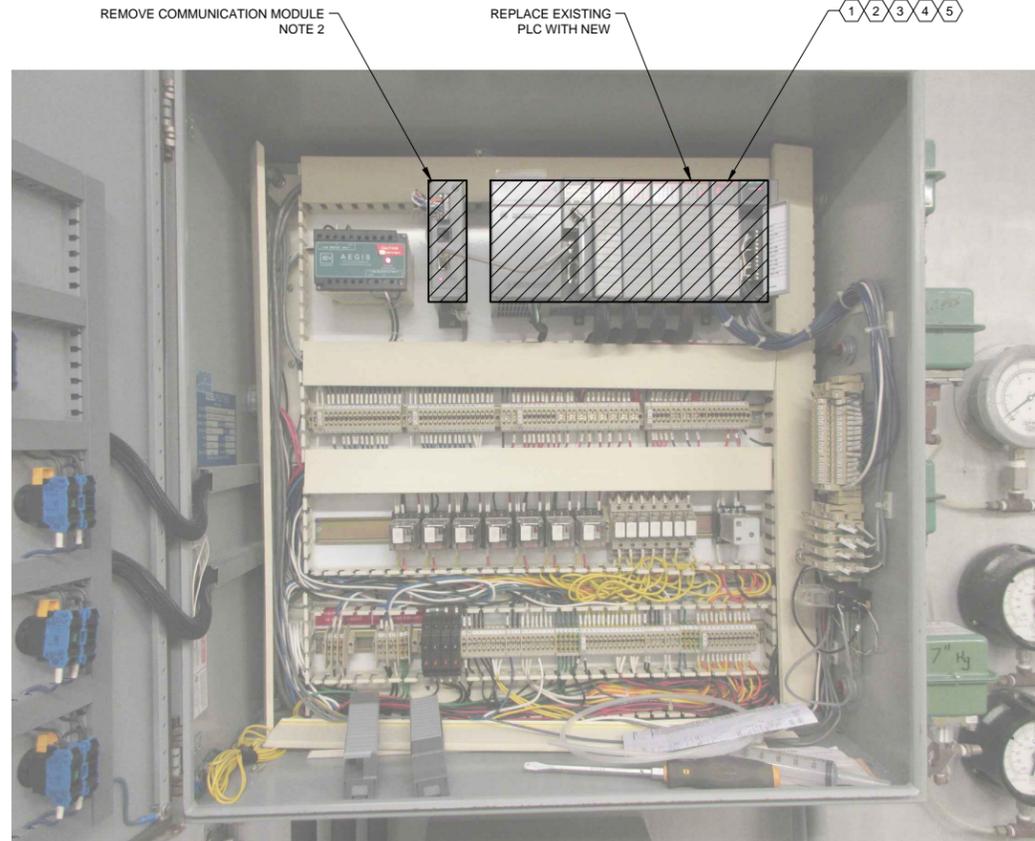


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PRINCE ALBERT NATIONAL PARK
WATER AUTOMATION SYSTEM UPGRADE
20164786-00
SCALE: AS SHOWN

INSTRUMENTATION DETAILS WATER TREATMENT PLANT		
DRAWING	REVISION	SHEET
4786-00-EI-502	0	4 / 9



WTP PETWA EQUIPMENT LIST			
ITEM	QUANTITY	MODEL NO.	DESCRIPTION
1	1	AB-1769-L33ER	ALLEN BRADLEY COMPACTLOGIX PLC (2MB)
2	1	AB-1769-PA4	ALLEN BRADLEY POWER SUPPLY
3	3	AB-1769-IA16	ALLEN BRADLEY 120 V INPUT MODULE (16 PT.)
4	2	AB-1769-OW16	ALLEN BRADLEY RELAY OUTPUT MODULE (16 PT.)
5	1	AB-1769-IF4XOF2F	ALLEN BRADLEY COMPACT COMBINATION ANALOG INPUT / OUTPUT MODULE

- NOTES:**
- REARRANGE INSTALLATION IN THE PANEL TO FIT NEW EQUIPMENT AS REQUIRED.
 - REMOVE EXISTING DH-485 CABLE BETWEEN PETWA AND MEMCOR PANELS AND TO WTP CONTROL PANEL. REPLACE WITH CAT-6 CABLING HOME RUN.
 - REFER TO EXISTING CONTROL PANEL DRAWINGS IN APPENDIX D FOR I/O POINTS AND PANEL DETAILS.

1 DETAIL NTS
WTP PETWA CONTROL PANEL

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DATE: 2017-03-24, Kwana Tuma



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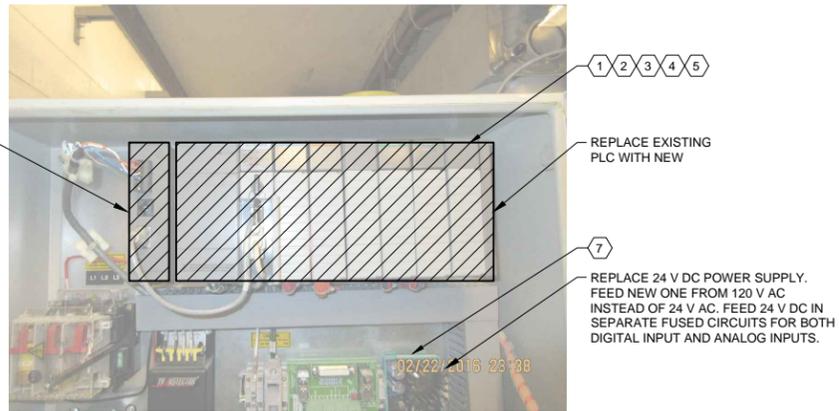
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INSTRUMENTATION DETAILS PETWA CONTROL PANEL		
DRAWING	REVISION	SHEET
4786-00-EI-503	0	5 / 9



1 DETAIL NTS
WTP MEMCOR CONTROL PANEL EXTERIOR



2 DETAIL NTS
WTP MEMCOR CONTROL PANEL INTERIOR

WTP MEMCOR EQUIPMENT LIST			
ITEM	QUANTITY	MODEL NO.	DESCRIPTION
1	1	AB-1769-L33ER	ALLEN BRADLEY COMPACTLOGIX PLC (2MB)
2	1	AB-1769-PA4	ALLEN BRADLEY POWER SUPPLY
3	2	AB-1769-IQ16	ALLEN BRADLEY 24 V DC DIGITAL INPUT MODULE (16 PT.)
4	1	AB-1769-OW16	ALLEN BRADLEY RELAY OUTPUT MODULE (16 PT.)
5	1	AB-1769-IF8	ALLEN BRADLEY ANALOG INPUT MODULE (8PT.)
6	1	AB-2711P-T7C4A8	ALLEN BRADLEY PANEL VIEW PLUS 6 HMI
7	1	PROMAX	WEIDMULLER 24 V, 3 A DC POWER SUPPLY

NOTES:

1. REARRANGE INSTALLATION IN THE PANEL TO FIT NEW EQUIPMENT AS REQUIRED.
2. INSTALL TWO RUNS OF CAT6 ETHERNET CABLING TO ETHERNET SWITCH IN WTP CONTROL PANEL.
3. REFER TO EXISTING CONTROL PANEL DRAWINGS IN APPENDIX E FOR I/O POINTS AND PANEL DETAILS.

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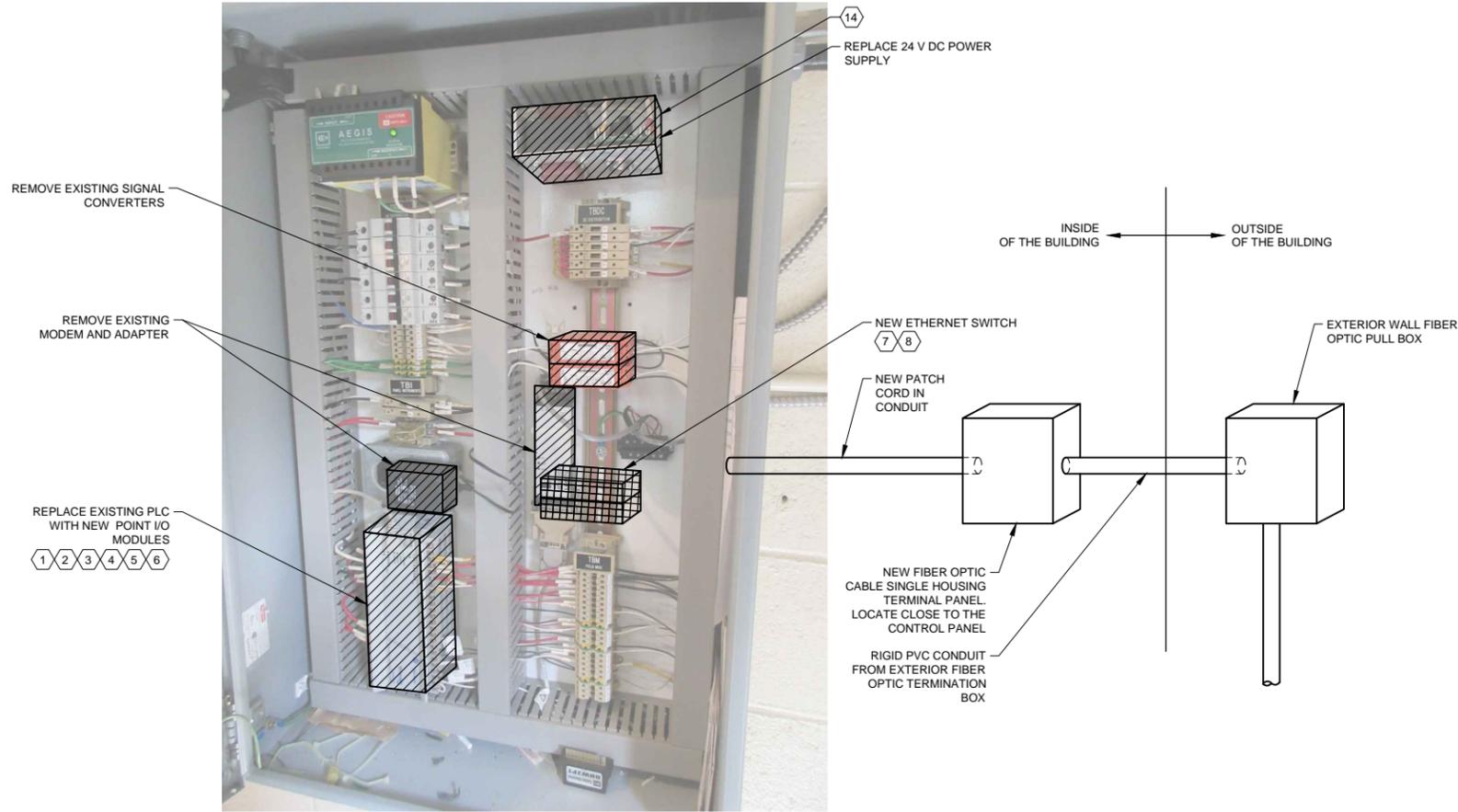
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WATER AUTOMATION SYSTEM UPGRADE
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SCALE: AS SHOWN

INSTRUMENTATION DETAILS
MEMCOR CONTROL PANEL

DRAWING	REVISION	SHEET
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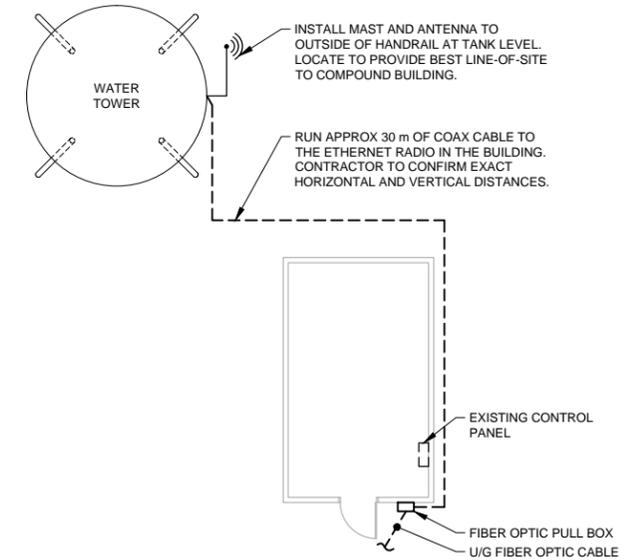


1 DETAIL NTS
WATER TOWER CONTROL PANEL

WATER TOWER EQUIPMENT LIST			
ITEM	QUANTITY	MODEL NO.	DESCRIPTION
1	1	AB-1734-AENT	ALLEN BRADLEY ETHERNET / IT ADAPTER
2	1	AB-1734-IB8	ALLEN BRADLEY 24 V DC DIGITAL INPUT MODULE
3	1	AB-1734-OW4	ALLEN BRADLEY DIGITAL RELAY OUTPUT MODULE
4	1	AB-1734-IE4C	ALLEN BRADLEY ANALOG INPUT MODULE
5	AS REQUIRED		MOUNTING BASE
6	AS REQUIRED		REMOVABLE TERMINAL BLOCKS
7	1	AB-1783-BMS06SA	ALLEN BRADLEY STRATIX 5700 MANAGED ETHERNET SWITCH
8	1	AB-1783-SFP1GLX	ALLEN BRADLEY SINGLE MODE SFP MODULE
9	1	REFER TO SPEC D5050	ETHERNET RADIO
10	1	REFER TO SPEC D5050	SURGE PROTECTOR
11	AS REQUIRED	REFER TO SPEC D5050	COAX CABLE
12	1	REFER TO SPEC D5050	ANTENNA
13	1	REFER TO SPEC D5050	MAST
14	1	PROMAX	WEIDMULLER 24 V, 5 A DC POWER SUPPLY

NOTES:

- REARRANGE INSTALLATION IN THE PANEL TO FIT NEW EQUIPMENT AS REQUIRED.
- PROVIDE PULL BOX ON THE EXTERIOR WALL OF THE WATER TOWER BUILDING FOR FIBER OPTIC CABLES TRANSITION FROM OUTSIDE TO THE INSIDE.
- FEED NEW ETHERNET SWITCH FROM NEW 24 V DC POWER SUPPLY USING FUSED TERMINAL BLOCKS.
- REFER TO EXISTING CONTROL PANEL DRAWINGS IN APPENDIX F FOR I/O POINTS AND POWER DETAILS.



2 DETAIL NTS
SITE

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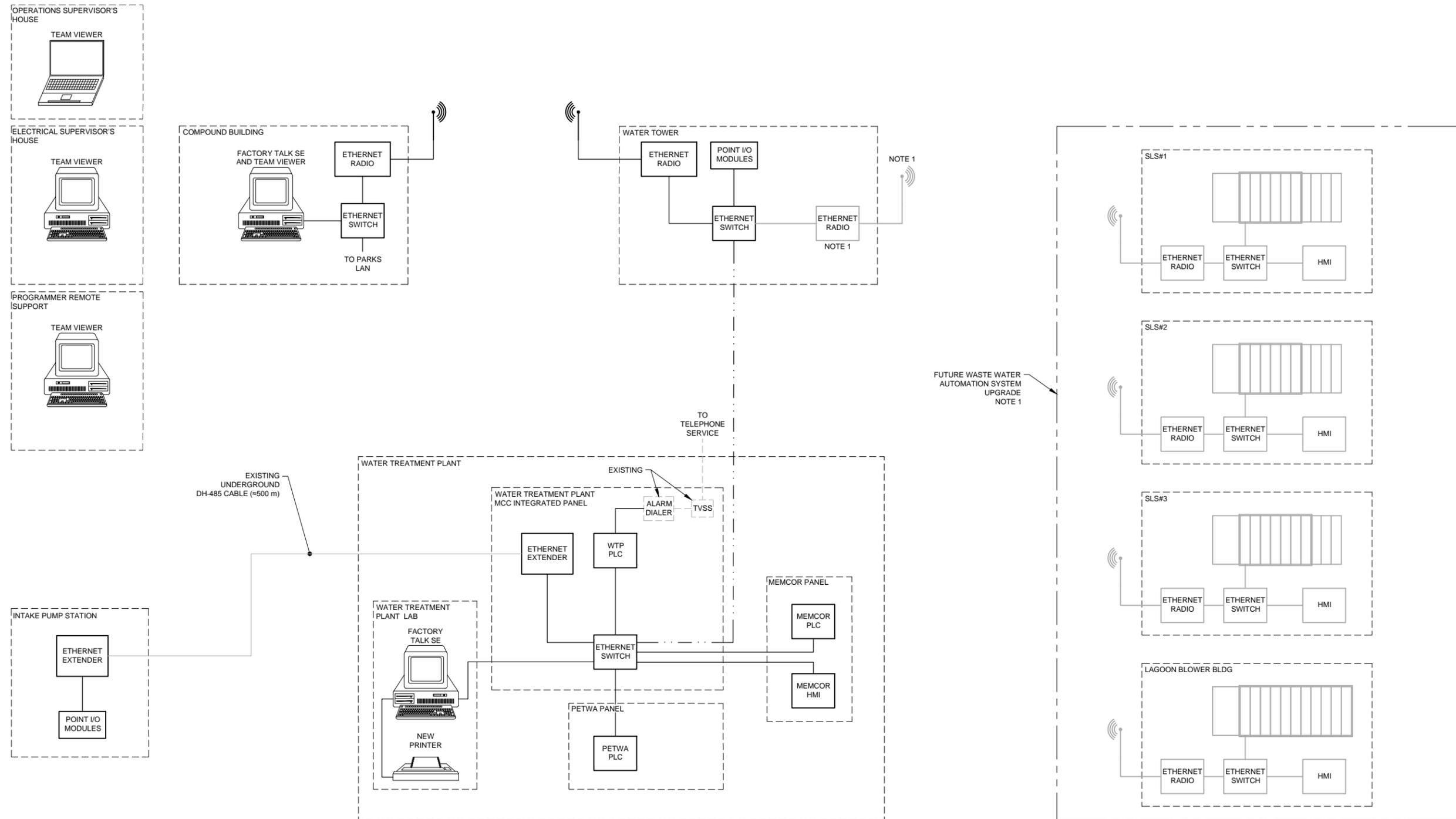
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PRINCE ALBERT NATIONAL PARK
WATER AUTOMATION SYSTEM UPGRADE
20164786-00
SCALE: AS SHOWN

INSTRUMENTATION DETAILS
WATER TOWER

DRAWING	REVISION	SHEET
4786-00-EI-505	0	7 / 9



1 DIAGRAM NTS
COMMUNICATIONS

NOTE 1:
EQUIPMENT SHOWN IS NOT-IN-CONTRACT. PURPOSE IS ONLY FOR COMMUNICATIONS OPTIONS STUDY (RADIO SURVEY).

— Ethernet/IP
- - - Fibre Optic

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WATER AUTOMATION SYSTEM UPGRADE
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INSTRUMENTATION
DIAGRAM
COMMUNICATIONS

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4786-00-EI-601	0	9 / 9