

**BUILDING B - AWP 1:
SITE PREPARATION & PARKING**

Issued for Tender

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PROJECT NO: **1005007-1**

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END OF PLANS AND SPECIFICATIONS

GENERAL INSTRUCTIONS**1 GENERAL****1.1 TAXES**

- .1 Pay all taxes properly levied by law (including Federal, Provincial and Municipal).

1.2 FEES, PERMITS, AND CERTIFICATES

- .1 Pay all fees and obtain all permits excluding City of Ottawa. Provide authorities with plans and information for acceptance certificates. Provide inspection certificates as evidence that work conforms to requirements of Authority having Jurisdiction.

1.3 CONSTRUCTION PROGRESS SCHEDULE

- .1 Schedule and execute work with least possible interference or disturbance to the normal use of premises.
- .2 On award of contract, submit bar chart construction schedule for work, indicating anticipated progress stages within time of completion. When the Departmental Representative has reviewed schedule, take necessary measures to complete work within scheduled time. Do not change schedule without notifying Departmental Representative.
- .3 Carry out work during "regular hour", Monday to Friday from 06:00 to 18:00 hours and on Saturdays, Sundays and statutory holidays.
- .4 Provide minimum 24 hours advance notice of noise generating work to the Departmental Representative and receive acknowledgement prior to proceeding. Comply with Municipal bylaws related to time limitations for noise generating.
- .5 Give the Departmental Representative 48 hours' notice for work to be carried out during "off hours".
- .6 Contractor to add additional workforce to complete work within scheduled timeframe.
- .7 Clearing and grubbing work to be carried out between mid-October and the end of March, inclusively.
- .8 All tree removal must be completed by March 31, 2018.
- .9 Scheduling and Alternate Site Access:
.1 Schedule work to ensure access is maintained to existing adjacent buildings and facilities, and adjacent sites. Other construction will be performed by a separate contractor that will require the use of the intersection of Upper Terrace Main and Upper Terrace West. The contractor is to cooperate, provide access, and coordinate scheduling of this work to comply with the separation of time and space to comply with requirements of the Ontario Occupational Health and Safety Act. During the intersection work by others, the contractor is to use the alternate site access route shown on the drawings.

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1.4 SUBMITTAL PROCEDURES

- .1 Submit promptly to Departmental Representative submittals listed for review, in orderly sequence to not cause delay in work.
- .2 Do not proceed with work affected by submittals until review is complete.
- .3 Shop Drawings:
 - .1 Submit one (1) electronic copy of shop drawings: bearing stamp and signature of qualified Professional Engineer registered or licensed in Province of Ontario.
 - .2 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and coordinated with requirements of Work and Technical Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and shall be considered rejected.
 - .3 The consultant review is for the sole purpose of ascertaining conformance with the general design concept, and does not mean approval of the design details inherent in the shop drawings, responsibility for which shall remain with the Contractor. Such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents.
- .4 Product Data:
 - .1 Submit one (1) electronic copy of product data: manufacturers' catalogue sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products.
 - .2 Cross reference product data information to applicable portions on Contract Documents.
- .5 Samples:
 - .1 Submit samples: examples of materials, equipment, quality, finishes and workmanship.
 - .2 Where colour, pattern or texture is criterion, submit full range of samples.
 - .3 Reviewed and accepted samples will become standard of material and workmanship, against which installed work will be verified.
- .6 CMMS Data Collection Sheets:
 - .1 The Consultant is to ensure that the Contractor completes Computerized Maintenance Management System (CMMS) Inventory forms, provided by BGIS in compliance with PSPC requirements for any new, replaced or deleted equipment. CMMS Forms are to include all product data, serial and model numbers, equipment description and location. See Appendix B – CMMS Data Collection Sheets and Appendix C - Code Tables / Tableaux De Codes for instructions.
- .7 Submit photographs of surrounding properties, objects and structures liable to be damaged or be the subject of subsequent claims.

1.5 REGULATORY REQUIREMENTS

- .1 References and Codes:
 - .1 Materials shall be new, and work shall conform to the minimum applicable standards of the "References" indicated in the specification sections, the National Building Code of

GENERAL INSTRUCTIONS

Canada 2015 (NBC) and all applicable Provincial and Municipal codes. In the case of conflict or discrepancy the most stringent requirement shall apply.

- .2 Building Smoking Environment:
 - .1 Smoking is not permitted in the Building or on site. Obey smoking restrictions on building property.
- .3 Facility Managers' Requirements:
 - .1 Contractor to follow Facility Manager (FM) Protocols; to be handed over to the contractor post tender. Protocols to include but not be limited to: site access, site Health and Safety protocols, notifications of work, and connections to utilities.
- .4 Hazardous Material Discovery:
 - .1 Stop work immediately when material resembling spray or trowel-applied asbestos, Polychlorinated Biphenyl (PCB), mould or other designated substance or hazardous substance is encountered during demolition work.
 - .1 Take preventative measure and promptly notify Departmental Representative.
 - .2 Do not proceed until written instructions have been received from Departmental Representative.

1.6 FIRE SAFETY REQUIREMENTS

- .1 Comply with both the National Building Code of Canada 2015 and the National Fire Code of Canada 2015 for safety of persons in buildings in the event of a fire and the protection of buildings from the effects of fire, as follows:
 - .1 The National Building Code (NBC): for fire safety and fire protection features that are required to be incorporated in a building during construction.
 - .2 The National Fire Code (NFC):
 - .1 The on-going maintenance and use of the fire safety and fire protection features incorporated in buildings.
 - .2 The conduct of activities that might cause fire hazards in and around buildings.
 - .3 Limitations on hazardous contents in and around buildings.
 - .4 The establishment of fire safety plans.
 - .5 Fire safety at construction and demolition sites.
- .2 Welding and cutting:
 - .1 Before welding, soldering, grinding and/or cutting work, obtain a permit as directed by the Departmental Representative. Store flammable liquids in approved CSA containers.
 - .2 At least one week prior to commencing cutting, welding or soldering procedure, provide to Departmental Representative:
 - .1 Notice of intent, indicating devices affected, time and duration of isolation or bypass.
 - .2 Completed welding permit as defined in NFC.
 - .3 Return welding permit to Departmental Representative immediately upon completion of procedures for which permit was issued.
 - .3 "Fire Watchers" as described in NFC shall be assigned when welding or cutting operations are carried out in areas where combustible materials within 15m may be ignited by conduction or radiation.

GENERAL INSTRUCTIONS1.7 QUALITY CONTROL

- .1 Testing Laboratory Services:
 - .1 Departmental Representative will appoint and pay for costs of inspection and testing services, unless indicated otherwise.
 - .2 Provide safe working areas and assist with testing procedures, including provisions for materials or services and co-ordination, as required by testing agency and as authorized by Departmental Representative.
 - .3 Where tests indicate non-compliance with specifications, contractor to pay for initial test and all subsequent testing of work to verify acceptability of corrected work.

1.8 HAZARDOUS MATERIALS

- .1 Hazardous Materials: product, substance, or organism that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.
- .2 Comply with the requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and the provision of Material Safety Data Sheets (MSDS).

1.9 TEMPORARY UTILITIES

- .1 Existing services required for work, excluding power required for space temporary heating, may be used by the Contractor without charge. Ensure capacity is adequate prior to imposing additional loads. Connect and disconnect at own expense and responsibility.
- .2 Maximum power supply of 15 amps, at 120V, single phase, is available and will be provided for general construction usage at no cost. Connect to existing power supply in accordance with Canadian Electrical Code. Installation and removal of connections to power to be executed and paid for by the Contractor. Power provided must not be used for heating. Contractor to provide temporary power for work during shutdowns.
- .3 Notify the Departmental Representative and utility companies of intended interruption of services and obtain requisite permission.
- .4 Give the Departmental Representative one-week notice related to each necessary interruption of any mechanical or electrical service throughout the course of the work. Keep duration of these interruptions to a minimum. Carry out all interruptions after normal working hours of the occupants, preferably on weekends.

1.10 CONSTRUCTION FACILITIES

- .1 Provide temporary Contractor's Site office within limits of site as follows:
 - .1 Locate Contractor site trailer within the "Limits of Site" to the approval of the Departmental Representative.
 - .2 Maximum exterior dimensions: 2438mm wide x 6096mm long
 - .3 Provide space and desk/ chair/2-drawer file cabinet, complete with a power connection for security escort within the Site office.
- .2 Site Storage:

GENERAL INSTRUCTIONS

- .1 Contractor to accommodate storage requirements within the construction area.
 - .2 The Departmental Representative will assign storage space that shall be equipped and maintained by the Contractor.
 - .3 Do not unreasonably encumber site with materials or equipment.
 - .4 Move stored products or equipment that interfere with operations of Departmental Representative or other contractors.
 - .5 Obtain and pay for use of additional storage or work areas needed for operations.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Sanitary facilities: Provide temporary sanitary facilities for work force in accordance with governing regulations and ordinances (minimum one male and one female temporary toilet) on site in locations approved by the Departmental Representative. Maintain supply of paper towels and toilet tissue. Maintain facilities to approval of Departmental Representative. Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition. Relocate sanitary facilities to suit progression of work.
- .5 Signage:
- .1 Provide common-use signs related to traffic control, information, instruction, use of equipment, public safety devices, etc., in both official languages or by the use of commonly understood graphic symbols and to approval of the Departmental Representative.
 - .2 No advertising will be permitted on this project.
 - .3 Maintain approved signs and notices in good condition for duration of project and dispose of off site, on completion of project or earlier, as directed by Departmental Representative.

1.11 TEMPORARY BARRIERS AND ENCLOSURES

- .1 Maintain existing services to site and provide for personnel and vehicle access.
- .2 Fencing:
 - .1 Enclose site area with temporary fencing to define construction area..
 - .2 Provide lockable truck entrance gates and one pedestrian door. Equip gates with locks and keys.
- .3 Protection:
 - .1 Protect work against damage until take-over.
 - .2 Protect adjacent work against the spread of dust and dirt beyond the work areas.
 - .3 Protect operatives and other users of site from all hazards.
- .4 Work Zone Locations and Identifications
 - .1 Be responsible and assume the role of "Constructor" as described in the Ontario Occupational Health & Safety Act and Regulations for Construction Projects.
 - .2 Install proper site separation and identification in order to maintain "Time and Space" at all times throughout the life of the project. When Building Operations staff requires access to site, proper coordination and communication must exist between all parties involved.

GENERAL INSTRUCTIONS

1.12 COMMON PRODUCT REQUIREMENTS

- .1 Quality of Work:
 - .1 Carry out work using qualified licensed workers or apprentices in accordance with Provincial Act respecting manpower vocational training and qualification.
 - .2 Permit employees registered in Provincial apprenticeship program to perform specific tasks only if under direct supervision of qualified licensed workers.
 - .3 Determine permitted activities and tasks by apprentices, based on level of training attended and demonstration of ability to perform specific duties
- .2 Storage, Handling and Protection:
 - .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions.
 - .2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove packaging or bundling until required in work.
- .3 Manufacturer's Instructions: unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.

1.13 EXAMINATION AND PREPARATION

- .1 Examine site and conditions likely to affect work and be familiar and conversant with existing conditions.
- .2 Before commencing work, establish location and extent of services lines in area of work and notify Departmental Representative of findings.

1.14 EXECUTION

- .1 Remove all items so shown or specified.
- .2 Unless otherwise specified, materials for removal become the Contractor's property and shall be taken from site.

1.15 SITE ACCESS

- .1 Only authorized and security cleared personnel will be permitted on site.

1.16 PARKING

- .1 Restricted parking will be permitted on site for contract personnel in designated areas.

1.17 DELIVERIES

- .1 All deliveries of material and equipment to site must be scheduled minimum 24 hours in advance. Provide information confirming, material, delivery agent, and all delivery person's name(s) and DOB. Bill of goods must accompany all deliveries.

1.18 HISTORICAL / ARCHAEOLOGICAL CONTROL

- .1 Should any archaeologically significant items be encountered during work, all work will stop pending assessment by the Departmental Representative.
- .2 Any archaeologically significant items encountered remain the property of the Crown.

1.19 WASTE MANAGEMENT

- .1 Comply with Environmental Protection Act, Ontario Regulations: O. Reg. 102/94 - Waste Audits and Waste Reduction Work Plans; and O. Reg. 103/94 - Industrial, Commercial and Institutional Source Separation Programs; for waste management on construction and demolition projects.
- .2 Conduct "waste audit" to determine what waste will be generated during construction and demolition operations. Prepare written "waste reduction work plan" and implement the principles to reduce, reuse and recycle materials to the extent that is possible.
- .3 Provide a "source separation program" to disassemble and collect in an orderly fashion the following "materials designated for alternative disposal" from the "general waste" stream:
 - .1 Portland cement concrete;
 - .2 cardboard (corrugated);
 - .3 steel; and
 - .4 wood (not including painted, treated or laminated wood).
- .4 Submit complete records of all removals from site for both "materials designated for alternative disposal" and "general waste" including:
 - .1 time and date of removal;
 - .2 description of material and quantities; and
 - .3 proof that materials have been received at an approved Waste Processing Site or certified Waste Disposal Site as required.

1.20 CLOSEOUT SUBMITTALS

- .1 Operational and Maintenance Manuals:
 - .1 Two (2) weeks prior to Substantial Performance, submit to Departmental Representative two (2) draft copies of Operations Data and Maintenance Manual in English,
 - .2 Revise all copies of O&M manuals as per Departmental Representative comments. Submit two (2) final copies of operating and maintenance manuals in both English and French, and one (1) digital copy of operating and maintenance manual in both official languages.
 - .3 Operations Data and Maintenance Manual to be compiled as follows:
 - .1 Bind data in vinyl hard cover 3 "D" ring type loose-leaf binders for 212 x 275 $\frac{1}{2}$ mm size paper. Binders must not exceed 75 $\frac{1}{2}$ mm thick or be more than 2/3 full.
 - .2 Enclose title sheet labelled "Operation Data and Maintenance Manual," project name, date and list of contents. Project name must appear on binder face and spine.
 - .3 Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

GENERAL INSTRUCTIONS

- .4 Include following information plus data specified:
 - .1 Maintenance instruction for finished surface and materials.
 - .2 Copy of hardware and paint schedules.
 - .3 Description: operation of the equipment and systems defining start-up, shut-down and emergency procedures, and any fixed or adjustable set points that affect the efficiency of the operation. Include nameplate information such as make, size, capacity and serial number.
 - .4 Maintenance: use clear drawings, diagrams or manufacturers' literature which specifically apply and detail the following:
 - .1 lubrication products and schedules;
 - .2 trouble shooting procedures;
 - .3 adjustment techniques; and
 - .4 operational checks.
 - .5 Suppliers' names, addresses and telephone numbers and components supplied by them must be included in this section. Components must be identified by a description and manufacturers part number.
 - .6 Guarantees showing:
 - .1 name and address of projects;
 - .2 guarantee commencement date (date of Interim Certificate of Completion);
 - .3 duration of guarantee;
 - .4 clear indication of what is being guaranteed and what remedial action will be taken under guarantee; and
 - .5 signature and seal of Guarantor.
 - .7 Additional material used in project listed under various Sections showing name of manufacturer and source of supply.
- .5 Spare parts: list all recommended spares to be maintained on site to ensure optimum efficiency. List all special tools appropriate to unique application. All parts/tools detailed must be identified as to manufacturer, manufacturer part number and supplier (including address).
- .6 Include one complete set of final shop drawings (bound separately) indicating corrections and changes made during fabrication and installation.
- .2 Records:
 - .1 As work progresses, maintain accurate records to show deviations from contract drawings. Just prior to Departmental Representative's inspection for issuance of final certificate of completion, supply to the Departmental Representative one (1) set of white prints with all deviations neatly inked in. The Departmental Representative will provide two sets of clean white prints for this purpose.
- .3 Guarantees and Warranties:
 - .1 Before completion of work collect all manufacturer's guarantees or warranties and deposit with Departmental Representative.

1.21 CLEANING

- .1 Clean up as work progresses. At the end of each work period, and more often if ordered by the Departmental Representative, remove debris from site, neatly stack material for use, and clean up generally.
- .2 Upon completion remove scaffolding, temporary protection and surplus materials. Make good

GENERAL INSTRUCTIONS

defects noted at this stage.

- .3 Clean manufactured articles in accordance with manufacturer's written instructions.
- .4 Clean areas under contract to a condition equal to what previously existed and to approval of Departmental Representative.

1.22 SECURITY

- .1 All personnel employed on this project will be subject to security clearance. Obtain requisite clearance, as instructed, for each individual required to enter the premises. On notification of award, submit requisite security clearance forms for all personnel to Departmental Representative. Clearance confirmations may require up to 40 working days. Personnel will not be permitted on site prior to confirmation of clearance.
- .2 Personnel will be checked daily at start of work shift and given a pass, which must be worn at all times. Pass must be returned at end of work shift and personnel checked out.
- .3 Use of Electronic devices, (cell phones, cameras) will not be permitted on site except for authorized personnel.

1.23 SECURITY ESCORT

- .1 All personnel employed on this project will be under the observation of a security escort and or remote surveillance by means of CCTV.
- .2 Departmental Representative will provide and pay for Security escorts during normal working hours M-F 0700 to 16:30. Contractor to advise minimum 72 hours in advance for planned work outside of normal hours. For requests submitted within the time mentioned above, the Departmental Representative will pay for the costs of the security escort. The cost incurred by a late request will be charged to the Contractor.
- .3 Any escort request may be cancelled free of charge if notification of cancellation is given at least 24 hours before the scheduled time of the escort. The cost incurred by a late cancellation will be charged to the Contractor.
- .4 The calculation of costs will be based on the average hourly rate of a security officer for a minimum of 8 hours per day for a late service request and 4 hours for late cancellations.

1.24 COST BREAKDOWN

- .1 Before submitting first progress claim, submit breakdown of Contract Amount in detail as directed by Departmental Representative and aggregating the Contract Amount. After approval by Departmental Representative cost breakdown will be used as the basis of progress payments.

1.25 PRECEDENCE

- .1 For Federal Government projects, Division 01 Sections take precedence over technical specification sections in other Divisions of this Project Manual

2 PRODUCTS

2.1 NOT USED

.1 Not used.

3 EXECUTION

3.1 NOT USED

.1 Not Used.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 00 10 - General Instructions.
- .2 Section 31 23 16.26 – Rock Removal

1.2 REFERENCE STANDARDS

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2 Province of Ontario
 - .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990, c.O.1, as amended and O. Reg. 213/91 as amended - Updated 2016
- .3 Canadian Standards Association International (CSA)
 - .1 CSA Z462-15, Workplace Electrical Safety.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Submit site-specific Health and Safety Plan: Within 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 found in work plan.
- .3 Submit 7 copies of Contractor's authorized representative's work site health and safety inspection reports to Departmental Representative and authority having jurisdiction, weekly.
- .4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .5 Submit copies of incident and accident reports.
- .6 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 01 00 01 – General Instructions.
- .7 Departmental Representative will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 7 days after receipt of plan. Revise plan as appropriate and resubmit plan to Departmental Representative within 3 days after receipt of comments from Departmental Representative.
- .8 Departmental 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.

HEALTH AND SAFETY REQUIREMENTS

- .9 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 Departmental Representative.
- .10 Departmental Representative will provide details of on-site Contingency and Emergency Response Plan. Address all standard operating procedures to be implemented during emergency situations as approved by Departmental Representative.

1.4 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

1.5 SAFETY ASSESSMENT

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

1.6 MEETINGS

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

1.7 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 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 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 Contractor will be responsible and assume the role Constructor as described in the Ontario Occupational Health and Safety Act and Regulations for Construction Projects.
- .3 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.

1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act, R.S.O. 1990, c. 0.1 and Ontario Regulations for Construction Projects, O. Reg. 213/91.
- .2 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORSEEN 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 Ontario having jurisdiction and advise Departmental Representative verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - .1 Have site-related working experience specific to activities associated with hazardous materials as identified.
 - .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.

1.12 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 Ontario having jurisdiction, and in consultation with Departmental Representative.

1.13 CORRECTION OF NON-COMPLIANCE

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

1.14 BLASTING

- .1 Blasting or other use of explosives is not permitted without prior receipt of written instruction by Departmental Representative.
- .2 Do blasting operations in accordance with Section 31 23 16.26 – Rock Removal.

1.15 POWDER ACTUATED DEVICES

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

HEALTH AND SAFETY REQUIREMENTS

1.16 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.
- .2 Assign responsibility and obligation to Health and Safety Coordinator to stop or start Work when, at Health and Safety Coordinator's discretion, it is necessary or advisable for reasons of health or safety. Departmental Representative may also stop Work for health and safety considerations.

2 PRODUCTS

2.1 NOT USED

- .1 Not used.

3 EXECUTION

3.1 NOT USED

- .1 Not used.

END OF SECTION

1 GENERAL

1.1 REFERENCE STANDARDS

- .1 Owner's identification of existing survey control points and property limits.

1.2 QUALIFICATIONS OF SURVEYOR

- .1 Qualified registered land surveyor, licensed to practice in the Province of Ontario, acceptable to Departmental Representative.

1.3 SURVEY REFERENCE POINTS

- .1 Existing base horizontal and vertical control points are designated on drawings.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Make no changes or relocations without prior written notice to Departmental Representative.
- .4 Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
- .5 Require surveyor to replace control points in accordance with original survey control.

1.4 SURVEY REQUIREMENTS

- .1 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .2 Establish lines and levels, locate and lay out, by instrumentation.
- .3 Stake for grading, fill and topsoil placement and landscaping features.
- .4 Stake slopes and berms.
- .5 Establish pipe invert elevations.
- .6 Establish finished paved surface elevations.
- .7 Establish lines and levels for mechanical and electrical work.

1.5 EXISTING SERVICES

- .1 Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
- .2 Remove abandoned service lines within 2m of Work. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

EXAMINATION AND PREPARATION

1.6 LOCATION OF EQUIPMENT AND FIXTURES

- .1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.
- .3 Inform Departmental Representative of impending installation and obtain approval for actual location.
- .4 Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.

1.7 RECORDS

- .1 Maintain a complete, accurate log of control and survey work as it progresses.
- .2 On completion of major site improvements, prepare a certified survey showing dimensions, locations, angles and elevations of Work.
- .3 Record locations of maintained, re-routed and abandoned service lines.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit name and address of Surveyor to Departmental Representative.
- .2 On request of Departmental Representative, submit documentation to verify accuracy of field engineering work.
- .3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

2 PRODUCTS

2.1 NOT USED

- .1 Not Used.

3 EXECUTION

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1 GENERAL

1.1 DEFINITIONS

- .1 Demolition: rapid destruction of building following removal of hazardous materials.
- .2 Hazardous Materials: dangerous substances, dangerous goods, hazardous commodities and hazardous products, may include but not limited to: asbestos PCB's, CFC's, HCFC's poisons, corrosive agents, flammable substances, ammunition, explosives, radioactive substances, or other material that can endanger human health or well being or environment if handled improperly.

1.2 SUBMITTALS

- .1 Submittals in accordance with Section 01 00 10 – General Instructions.
- .2 Shop drawings.
 - .1 Submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.
 - .2 Submit drawings stamped and signed by qualified professional engineer registered or licensed in Province of Ontario, Canada.
- .3 Provide description of Hazardous Materials and Notification of Filing with proper authorities prior to beginning of Work as required.
- .4 Prior to beginning of Work on site submit detailed Waste Reduction Workplan in accordance with Section 01 00 10 – General Instructions.

1.3 QUALITY ASSURANCE

- .1 Convene pre-installation meeting one week prior to beginning work of this Section and on-site installations in accordance with Section 01 00 10 – General Instructions. Schedules - Bar (GANTT) Chart to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordinate with other building subtrades.
 - .4 Review manufacturer's installation instructions and warranty requirements.
- .2 Arrange for site visit with Departmental Representative to examine existing site conditions adjacent to demolition work prior to start of Work.
- .3 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Perform Work in accordance with Section 01 00 10 – General Instructions.
- .2 Storage and Protection.
 - .1 Protect excavated materials in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

SELECTIVE SITE DEMOLITION

- .2 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Departmental Representative at no cost.
 - .3 Remove and store materials to be salvaged in manner to prevent damage.
 - .4 Store and protect in accordance with requirements for maximum preservation of material.
 - .5 Handle salvaged materials as new materials.
- .3 Separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions. Divert excess materials from landfill to site approved by Departmental Representative.

1.5 SITE CONDITIONS

- .1 Perform work in accordance with Section 01 00 10 – General Instructions.
- .2 Ensure that selective demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .3 Existing Conditions. Remove contaminated or hazardous materials listed as hazardous as defined by authorities having jurisdiction from site, prior to start of demolition Work, and dispose of at designated disposal facilities in safe manner in accordance with applicable regulatory requirements.

2 PRODUCTS**2.1 EQUIPMENT**

- .1 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

3 EXECUTION**3.1 PREPARATION**

- .1 Inspect site with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.
- .4 Disconnect and cap designated Mechanical Services.
 - .1 Natural Gas Supply Lines: safeguard as directed by Departmental Representative.
 - .2 Other Underground Services: remove and dispose of as indicated and as directed by Departmental Representative.

3.2 REMOVAL OF HAZARDOUS WASTES

SELECTIVE SITE DEMOLITION

- .1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

3.3 REMOVAL OPERATIONS

- .1 Remove items as indicated. Do not disturb items designated to remain in place.
- .2 Removal of Pavements, Curbs and Gutters:
 - .1 Square up adjacent surfaces to remain in place by saw cutting or other method approved by Departmental Representative.
 - .2 Protect adjacent joints and load transfer devices.
 - .3 Protect underlying and adjacent granular materials.
- .3 Prevent contamination with base course aggregates, when removing asphalt pavement for subsequent incorporation into hot mix asphalt concrete paving,
- .4 Excavate rock or sub-grade at least 300 mm below pipe invert, when removing pipes under existing or future pavement area.
- .5 Protect designated trees during demolition.
- .6 Stockpile topsoil for final grading and landscaping.
- .7 Dispose of materials not designated for salvage or reuse on site as instructed by Departmental Representative at authorized facilities approved in Waste Reduction Workplan.
- .8 Trim disposal areas to approval of Departmental Representative.
- .9 Backfill in areas as indicated and in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.4 STOCKPILING

- .1 Label stockpiles, indicating material type and quantity. Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .2 Locate stockpiled materials convenient for use in new construction to eliminate double handling wherever possible.
- .3 Stockpile materials designated for alternate disposal in location which facilitates removal from site and examination by potential end markets, and which does not impede disassembly, processing, or hauling procedures.

3.5 REMOVAL FROM SITE

- .1 Remove stockpiled material as directed by Departmental Representative when it interferes with operations of project.
- .2 Remove stockpiles of like materials by alternate disposal option once collection of materials is complete.

SELECTIVE SITE DEMOLITION

- .3 Transport material designated for alternate disposal using approved haulers and in accordance with applicable regulations.
- .4 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.
 - .1 Disposal Facilities: approved and listed in Waste Reduction Workplan.
 - .2 Written authorization from Departmental Representative is required to deviate from disposal facilities listed in Waste Reduction Workplan.

3.6 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to conditions that existed prior to beginning of Work. Match condition of adjacent, undisturbed areas.
- .2 Use soil treatments and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

3.7 CLEANING

- .1 Remove debris, trim surfaces and leave work site clean, upon completion of Work
- .2 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

END OF SECTION

1 GENERAL

1.2 REFERENCE STANDARDS

- .1 American Association of State Highway and Transportation Officials (AASHTO)
 - .1 AASHTO LRFDLTS-1, LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, 1st Edition with 2017 Interim Revisions.
- .2 ASTM International
 - .1 ASTM A 123/A 123M-15, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .2 ASTM A 276/A276M-17, Standard Specification for Stainless Steel Bars and Shapes.
 - .3 ASTM B 209M-14, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
 - .4 ASTM B 210M-12, Standard Specification for Aluminum-Alloy Drawn Seamless Tubes (Metric).
 - .5 ASTM B 211M-12e1, Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod and Wire (Metric).
- .3 CSA International
 - .1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel, Includes Update No. 1 (2014).
 - .2 CAN/CSA O80 Series-15, Wood Preservation.
 - .3 CSA O121-17, Douglas Fir Plywood.
 - .4 CSA W47.2-11 (R2015), Certification of Companies for Fusion Welding of Aluminum, Includes Update No. 1 (2011), Update No. 2 (2012).
 - .5 CAN/CSA-Z809-16, Sustainable Forest Management.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 - General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for traffic signage, including product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Ontario, Canada.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 - General Instructions and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

TRAFFIC SIGNAGE

- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove as specified in Waste Reduction Workplan and in accordance with Section 01 00 10 - General Instructions.

2 PRODUCTS

2.1 DESIGN CRITERIA

- .1 All signs to be bilingual; French and English.
- .2 Sign supports to be capable of withstanding the combination of wind and ice loads specific to Ottawa, Ontario and in accordance with City of Ottawa Standards.
- .3 For stop signs: Ontario Traffic Manual Book 5 (Regulatory Signs), Type Ra-1.
- .4 For one way signs: Ontario Traffic Manual Book 5 (Regulatory Signs), Type Rb-21.
- .5 For barrier-free signs: Section 3.1.4 and Figures 25-27 of the City of Ottawa Accessibility Design Standards, 2nd edition.
- .6 For handicap parking signs: Parks Canada – Exterior Signage – Standards and Guidelines, Type 6-1-038.
- .7 For support post: Ontario Provincial Standard Drawing (OPSD) 990.110 – Small Sign Support System. Non-Breakaway U-Flange Post System Installation – Single Post Assembly.
- .8 Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals".

2.2 MATERIALS

- .1 Sign supports:
 - .1 Steel posts: to CSA G40.21, 4 m long, flanged "U" shaped in cross section, measuring 65 mm wide x 30 mm deep. Metal thickness: 4.5 mm. Hot dipped galvanized: to ASTM A 123/A 123M, zinc coated.
 - .2 Standard tubular supports for small signs: to ASTM B 210M.
 - .3 Aluminum tubular members: belt ground satin finish.
 - .4 Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminum alloy, or galvanized steel.
- .2 Signboards:
 - .1 Aluminum sheet: to ASTM B 209M, precut to required dimensions.
 - .1 Thickness for signboards: 2.1 mm minimum.
 - .2 T-shape stiffeners for signboards: to ASTM B 210M.
 - .3 Connecting straps and brackets: to ASTM B 209M.

TRAFFIC SIGNAGE

- .4 Aluminum materials: to ASTM B 209M.
- .5 Primer for aluminum: to MPI # 8 , VOC limit of 250 g/L to GS-11.
- .6 Clear varnish protective coat: MPI-EXT 6.4H VOC limit of 350 g/L to SCAQMD Rule 1113.

2.3 FABRICATION

- .1 Supports:
 - .1 Connect aluminum support members by welding in accordance with CSA W47.2.. Flame cutting of members not permitted.
 - .2 Welds to be of same strength as adjacent member or casting.
 - .3 Remove sharp edges and burrs.
- .2 Signboards:
 - .1 Aluminum blanks:
 - .1 Degrease, etch and bonderize with chemical conversion coating.
 - .2 Clean surfaces with xylene thinner. Dry.
 - .3 For non-reflective signs, spray face with one coat vinyl pretreatment coating and two finish coats of required colour.
 - .4 For aluminum signboards that are to be painted before installation, spray and bake face of signboards with two coats of enamel in accordance with MPI-EXT 5.4A.
 - .2 Reflective background sheeting and lettering:
 - .1 Cut and apply in accordance with manufacturer's instructions.
 - .2 Apply adhesive coated material with heat lamp vacuum applicator or by squeeze roll application method. Apply pressure sensitive material with roller or squeegee.
 - .3 Edge wrap sheeting on each extrusion prior to bolting extrusions. Match pieces of sheeting from different rolls for each signboard to ensure uniform appearance and brilliance by day and night.
 - .3 Non-reflective lettering and symbols: cut from vinyl film as specified in CGSB 62-GP-9M, or paint using required colour of finish paint maximum VOC of 250 g/L to GS-11.
 - .4 Clean signboards completely and apply transparent tape over top edge and extending 25 mm minimum down back and front of signboard.
- .3 Sign identification:
 - .1 Apply sign number and date of installation with 25 mm high stencil painted black letters on lower left back face of each signboard with bilingual wording / text:
 - .1 5 x STOP sign.
 - .2 3x ONE WAY sign
 - .3 4 x CHARGING STATION
 - .4 4 x BARRIER-FREE PARKING

3 EXECUTION**3.1 INSTALLATION**

- .1 Sign support:
 - .1 Erect posts plumb and square to details as indicated.
 - .2 Single channel steel posts:

TRAFFIC SIGNAGE

- .1 Drive to required depth without damage to posts.
 - .2 If rock or concrete is encountered, drill hole to required depth and set post in sand.
 - .3 In finished concrete surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.
- .2 Signboard:
- .1 Fasten signboards to supporting posts and brackets as indicated.
 - .2 Fasten lane markers to signboard.

3.2 CORRECTING DEFECTS

- .1 Correct defects, identified by Departmental Representative, in sign message, consistency of reflectivity, colour or illumination. Correct angle of signboard and lighting orientation for optimum performance during night conditions to approval of Departmental Representative.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials for recycling in accordance with Section 01 00 10 - General Instructions.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by traffic signage installation and salvage operations.

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA GROUP.
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
 - .2 CAN/CSA-C22.3 No.1-10, Overhead Systems.
 - .3 CAN3-C235-83(R2010), Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
 - .1 IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

1.2 DEFINITIONS

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

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for all new equipment and devices.
- .3 Shop drawings:
 - .1 Submit drawings stamped and signed by the contractor indicating the submission is in conformance with the drawing and specifications.
 - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
 - .3 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
 - .4 If changes are required, notify Departmental Representative of these changes before they are made.
- .4 Certificates:
 - .1 Provide CSA certified material and equipment.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Permits and fees: in accordance with General Conditions of contract.
 - .4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.

COMMON WORK RESULTS FOR ELECTRICAL

- .5 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Departmental Representative.
- .5 Manufacturer's Field Reports: submit to Departmental Representative manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

1.4 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data.
 - .1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.
 - .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Post instructions where directed.
- .4 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.
- .5 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance.

- .5 Packaging Waste Management: remove for reuse and as specified in Construction Waste Management Plan.

2. PRODUCTS

2.1 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235.
- .2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
 - .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification labels and nameplates for control items in English and French.
- .4 Use one label or nameplate for each language.

2.2 MATERIALS AND EQUIPMENT

- .1 Provide material and equipment in accordance with Section 01 00 10 – General Instructions.
- .2 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

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

2.4 WARNING SIGNS

- .1 Warning Signs: in accordance with requirements of Departmental Representative and as required by code.
- .2 Porcelain enamel signs, minimum size 175 x 250 mm.

2.5 WIRING TERMINATIONS

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

2.6 EQUIPMENT IDENTIFICATION

- .1 Identify electrical equipment with labels and nameplates as follows:
 - .1 Nameplates: lamicaid 3 mm thick plastic engraving sheet , matt white finish face, black core, lettering accurately aligned and engraved into core and mechanically attached with self tapping screws.
 - .2 Sizes as follows:

COMMON WORK RESULTS FOR ELECTRICAL

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

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates to be approved by Departmental Representative prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved "ASSET INVENTORY NO. [_____].
Departmental Representative.
- .7 Material management forms (mms) to be filled out by contractor for each piece of equipment supplied.
- .8 Terminal cabinets and pull boxes: indicate system and voltage.
- .9 Transformers: indicate capacity, primary and secondary voltages.

2.7 WIRING IDENTIFICATION

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT AND CABLE IDENTIFICATION

- .1 Colour code conduits, boxes and metallic sheathed cables.
- .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.
- .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

Type	Prime	Auxiliary
up to 250 V	Yellow	
up to 600 V	Yellow	Green
up to 28 kV	Yellow	Blue
Telephone	Green	
Other Communication Systems	Green	Blue

COMMON WORK RESULTS FOR ELECTRICAL

Emergency Voice	Red	Blue
Other Security Systems	Red	Yellow

2.9 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
 - .1 Paint outdoor electrical equipment "equipment green" finish.

3. EXECUTION**3.1 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CAN/CSA-C22.3 No.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

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

3.3 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 05 32- Outlet Boxes, Conduit Boxes and Fittings.
- .2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

3.4 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical equipment at following heights unless indicated otherwise.
 - .1 Panelboards: as required by Code or as indicated.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

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

3.6 FIELD QUALITY CONTROL

- .1 Load Balance:

COMMON WORK RESULTS FOR ELECTRICAL

- .1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.
- .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .3 Provide upon completion of work, load balance report as directed in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS, phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load, as well as hour and date on which each load was measured, and voltage at time of test.
- .2 Conduct following tests in accordance with Section 01 00 10 – General Instructions.
 - .1 Power distribution and generation system including phasing, voltage, grounding and load balancing.
 - .2 Circuits originating from branch distribution panels.
 - .3 Lighting and its control.
 - .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
 - .5 Insulation resistance testing:
 - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
 - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
 - .3 Check resistance to ground before energizing.
- .3 Carry out tests in presence of Departmental Representative.
- .4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .5 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - ACTION AND INFORMATIONAL SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.7 SYSTEM STARTUP

- .1 Instruct Departmental Representative in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

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

3.8 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL

1.1 RELATED SECTIONS

1. Section 26 05 00 General Requirements

1.2 WORK INCLUDED

- .1 Division 26 shall retain the services of an approved independent test company to prepare the co-ordination study of the entire electrical distribution system, grounding study. Cost of studies shall be included and paid for by this section. Conduct the study in cooperation with the manufacturers of the power distribution equipment to provide selective tripping of all protection devices in the distribution system.
- .2 Division 26 shall provide all services to assist the testing company on-site specialists during the on-site pre-service inspection, testing, calibration, on-site witness testing and Commissioning of the work and as required by the Engineer until the equipment and systems are accepted by the Departmental Representative.

1.3 SHOP DRAWINGS

- .1 Refer to Division 01 General Requirements for details regarding shop drawing submission.

2. PRODUCTS (N/A)

3. EXECUTION

3.1 PRELIMINARY CO-ORDINATION STUDY

- .1 Immediately upon award of the contract, coordinate with Supply Authority for information of the system, short circuit available and protective relays, which affects the coordination study.
- .2 Coordinate with equipment supplier for the information of the equipment provided. Prepare a preliminary short circuit study for the complete distribution system to confirm the rating of the equipment. Submit the short circuit calculation on or prior to the submission of the shop drawing of the power equipment

3.2 CO-ORDINATION STUDY

- .1 Retain the services of an approved engineering services company to prepare the co-ordination study, include a short circuit analysis of the entire electrical distribution system. Cost of study shall be included and paid for by this section. Conduct the study in cooperation with the manufacturers of the transformer, the service entry panel, to provide selective tripping of all protection devices in the distribution system.
- .2 Prepare the co-ordination study on a log-log time-current characteristic sheet approximately 300mm x 460mm.
- .3 Provide the following information on the co-ordination sheets and client owned:
 - .1 Relay settings of Supply Authorities breakers

- .2 HV fuse characteristics
 - .3 Main breaker characteristics 600V
 - .4 Largest feeder breaker characteristics 600V
 - .5 Thermal characteristics of transformers
 - .6 Thermal characteristics of HV cable
 - .7 Thermal characteristics of main LV secondary conductors
 - .8 Indicate available 3 phase and ground fault current at the main HV switchboard
- .4 The co-ordination study shall be submitted as a "Shop Drawing". It shall include the settings and selection of protective devices as noted
- .5 The engineering services company who prepared in the co-ordination study shall conduct a pre-service and in-service testing and checking of the complete distribution system and components as follows:
- .1 Visual inspection of switchboard clearances, barriers, ventilation, grounding, etc.
 - .2 High potential insulation tests
 - .3 Torque checking at busbar joints, cable connections, etc.
 - .4 Mechanical and electrical operation of components and devices
 - .5 Instrumentation transformers, relays and instruments
 - .6 Test overcurrent, voltage and ground fault relays in accordance with manufacturers' recommendations and set devices as per co-ordination study
 - .7 Test HV cables and terminations
 - .8 Test current ratio of transformer on all tap positions, phase angle, insulation resistance, dielectric strength and moisture content of oil
 - .9 Test continuity and resistance of ground system
 - .10 Phase rotation identification
- .6 Following completion of all testing, submit a report prepared by the engineering services testing company to include but not be limited to the following:
- .1 results recorded and referenced
 - .2 comments and recommendations on acceptability of the installation where variations occur within the co-ordination study or accepted testing of performance parameters.
- .7 The Departmental Representative reserves the right to witness the tests or conduct independent verification tests if deemed necessary.
- .8 The testing and co-ordination studies shall be conducted by a qualified engineering services company.
- .9 Provide the services of qualified staff to verify the operation of the equipment supplied and installed.

- .10 Remedy all defects and provide services as long as is required to commission the system. The cost of providing these services is part of this contract.

3.3 ARC-FLASH STUDY

- .1 Provide an arc-flash study of the power distribution as part of the project.
- .2 Arc-flash potential shall be marked on equipment.
- .3 The arc-flash study shall be carried out by a qualified engineering services company.

3.4 GROUNDING STUDY

- .1 Provide a complete study of Ground System. Employ the services of a specialist firm familiar with and experienced in such study.
- .2 Consult the P.U.C. to obtain:
- .i fault current available
 - .ii relay settings
 - .iii fuse curves
- .3 Conduct ground resistivity measurements at the proposed location of the outdoor pad mounted transformer and service entry panel.
- .4 Provide a report to the Consultant, supported by test data and calculations, clearly showing conformance with Rules 36-300 to 36-310 of the Ontario Electrical Safety Code and OESC Bulletin 36-10-1 and IEEE 80.
- .5 Should the report reveal the ground system does not conform upon direction from the Consultant, make necessary extensions to the ground systems and conduct soil treatment to ensure conformance. The costs for design and implementation of the improvements shall be included in the Contract. Provide a final test report to the Consultant showing the improvements result in conformance with the Code.
- .6 Verify completed installation: Verify actual ground resistance measurements at the high voltage substation

END OF SECTION

WIRE AND BOX CONNECTORS (0-1000 V)**1. GENERAL****1.1 REFERENCE STANDARDS**

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.18-98(R2003), Outlet Boxes, Conduit Boxes and Fittings.
 - .2 CAN/CSA-C22.2 No.65-03(R2008), Wire Connectors (Tri-National Standard with UL 486A-486B and NMX-J-543-ANCE-03).
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2-1961, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wire and box connectors and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wire and box connectors for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wire and box connectors from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer and as specified in Construction Waste Management Plan in accordance with Section 01 00 10 – General Instructions.

WIRE AND BOX CONNECTORS (0-1000 V)**2. PRODUCTS****2.1 MATERIALS**

- .1 Pressure type wire connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CAN/CSA-C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for conductors.
 - .2 Clamp for conductors.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper conductors.
 - .5 Sized for conductors as indicated.
- .4 Clamps or connectors for TECK cable flexible conduit, as required to: CAN/CSA-C22.2 No.18.

3. EXECUTION**3.1 INSTALLATION**

- .1 Remove insulation carefully from ends of conductors cables 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 CAN/CSA-C22.2 No.65.
 - .3 Install fixture type connectors and tighten to CAN/CSA-C22.2 No.65. Replace insulating cap.
 - .4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1. GENERAL

1.1 PRODUCT DATA

- .1 Provide product data in accordance with Section 01 00 10 – General Instructions.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Packaging Waste Management: remove for reuse and return by manufacturer in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS

2.1 BUILDING WIRES

- .1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.
- .2 Copper conductors: size as indicated, with 1000 V insulation of cross-linked thermosetting polyethylene material rated RW90 XLPE, RWU90 XLPE, Non Jacketted.

2.2 TECK 90 CABLE

- .1 Cable: in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper, size as indicated.
- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE.
 - .2 Rating: 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: aluminum interlocking.
- .6 Overall covering: thermoplastic polyvinyl chloride, compliant to applicable Building Code classification for this project.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables.
 - .3 Threaded rods: 6 mm diameter to support suspended channels.
- .8 Connectors:
 - .1 Watertight, approved for TECK cable.

2.2 ARMOURED CABLES

- .1 Conductors: insulated, copper, size as indicated.

- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: anti short connectors.

3. EXECUTION

3.1 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Perform tests before energizing electrical system.

3.2 GENERAL CABLE INSTALLATION

- .1 Install cable in trenches in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.
- .2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - (0-1000 V).
- .3 Cable Colour Coding: to Section 26 05 00- Common Work Results for Electrical.
- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 INSTALLATION OF BUILDING WIRES

- .1 Install wiring as follows:
 - .1 In conduit systems in accordance with Section 26 05 34- Conduits, Conduit Fastenings and Conduit Fittings.
 - .2 In underground ducts in accordance with Section 26 05 43.01 – Installation of Cables in Trenches and in Ducts.

3.4 INSTALLATION OF TECK90 CABLE (0 -1000 V)

- .1 Group cables wherever possible on channels.
- .2 Install cable concealed, securely supported by straps or hangers.

3.5 INSTALLATION OF ARMOURED CABLES

- .1 Group cables wherever possible on channels.

END OF SECTION

CONNECTORS AND TERMINATIONS**1. GENERAL****1.1 REFERENCE STANDARDS**

- .1 CSA Group
 - .1 CSA C22.1-12, Canadian Electrical Code, Part 1 (22nd Edition), Safety Standard for Electrical Installations.
 - .2 CSA C22.2 No.41-13, Grounding and Bonding Equipment (Tri-National Standard, with NMX-J-590ANCE and UL 467).
 - .3 CSA C22.2 No.65-13, Wire connectors (Tri-National Standard, with UL 486A-486B NMX-J-543-ANCE).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for connectors and terminations and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Certificates: obtain inspection certificate of compliance covering high voltage stress from inspection authority and Departmental Representative and include it with maintenance manuals.
- .4 Sustainable Design Submittals:
 - .1 Submit project Waste Management Plan highlighting recycling and salvage requirements.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for connectors and terminations for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 00 10 – General Instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

CONNECTORS AND TERMINATIONS

- .2 Store and protect connectors and terminations from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer and as specified in Waste Reduction Workplan in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS

2.1 CONNECTORS AND TERMINATIONS

- .1 Copper or Aluminum compression connectors to CSA C22.2 No.65 as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.
- .3 Joint boxes in accordance with Section 26 05 33- Raceway and Boxes for Electrical Systems.

3. EXECUTION

3.1 INSTALLATION

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2No.41.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

GROUNDING - SECONDARY**1. GENERAL****1.1 REFERENCE STANDARDS**

- .1 American National Standards Institute /Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE 837-02, IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding.
- .2 CSA International
 - .1 Ontario Electrical Safety Code – 2015.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for grounding equipment and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for grounding equipment for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect grounding equipment from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer and as specified in Construction Waste Management Plan in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS

2.1 EQUIPMENT

- .1 Copper conductor: minimum 6 m long for each concrete encased electrode, bare, stranded, tinned, soft annealed, size as indicated.
- .2 Rod electrodes: copper clad steel 19 mm diameter by minimum 3 m long.
- .3 Plate electrodes: copper, surface area 8.35 m², minimum 1.6 mm thick.
- .4 Grounding conductors: bare stranded copper, tinned, soft annealed, size as indicated.
- .5 Insulated grounding conductors: green, copper conductors, size in accordance with the Ontario Electrical Safety Code (OESC).
- .6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Bonding jumpers, straps.
 - .5 Pressure wire connectors.

3. EXECUTION

3.1 INSTALLATION

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using permanent mechanical connectors or inspectable wrought copper compression connectors to ANSI/IEEE 837.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.
- .7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .9 Install separate ground conductor to outdoor lighting standards.
- .10 Connect building structural steel and metal siding to ground by welding copper to steel.

GROUNDING - SECONDARY

- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond single conductor, metallic armoured cables to cabinet at supply end, provide aluminum plate at supply end and non-metallic entry plate at load end.
- .13 Ground secondary service pedestals.

3.2 MAINTENANCE HOLE

- .1 Install conveniently located grounding stud, electrode, size in accordance with the Ontario Electrical Safety Code (OESC) stranded copper conductor in each maintenance hole.
- .2 Install ground rod in each maintenance hole so that top projects through bottom of maintenance hole. Provide with lug to which grounding connection can be made. Confirm ground resistance meets or exceeds Canadian Electrical Code minimum requirements.

3.3 ELECTRODES

- .1 Install rod, plate electrodes and make grounding connections as indicated on drawings.
- .2 Bond separate, multiple electrodes together.
- .3 Use minimum size 2/0AWG copper conductors for connections to electrodes.
- .4 Make special provision for installing electrodes that will give acceptable resistance to ground value as rock terrain prevails.

3.4 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections, secondary <600/347 V/>V system.

3.5 EQUIPMENT GROUNDING

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, cable trays.

3.6 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

3.7 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.

GROUNDING - SECONDARY

- .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

1. GENERAL

1.1 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for hangers and supports and include product characteristics, performance criteria, physical size, finish and limitations.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect hangers and supports from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer and return and as specified in Construction Waste Management Plan in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, suspended or surface mounted or set in poured concrete walls and ceilings.

3. EXECUTION

3.1 INSTALLATION

- .1 Secure equipment to poured concrete with expandable inserts.
- .2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .4 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.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

- .2 Two-hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduit to exposed steel work.
- .5 For surface mounting of two or more conduits use channels.
- .6 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .7 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .8 Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .9 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Departmental Representative.
- .10 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-06, Canadian Electrical Code, Part 1, 20th Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide shop drawings: in accordance with Section 01 00 10 – General Instructions.
 - .1 Submit drawings stamped and signed by the contractor indicating the submission is in conformance with the drawings and specifications.

1.2 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS

2.1 SPLITTERS

- .1 Construction: sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Terminations: main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 Spare Terminals: minimum three spare terminals or lugs on each connection or lug block sized less than 400 A.

2.2 JUNCTION AND PULL BOXES

- .1 Construction:welded steel enclosure.
- .2 Covers Flush Mounted: 25 mm minimum extension all around.
- .3 Covers Surface Mounted: screw-on covers.

2.3 CABINETS

- .1 Construction: welded, weather proof, NEMA3 rated, aluminum hinged door, handle, latch, lock 2 keys and catch

3. EXECUTION

3.1 SPLITTER INSTALLATION

- .1 Mount plumb, true and square to building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor except where indicated otherwise.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install additional pull boxes as required by CSA C22.1.

3.3 IDENTIFICATION

- .1 Equipment Identification: to Section 26 05 00- Common Work Results for Electrical.
- .2 Identification Labels: size 2 indicating system name, voltage and phase or as indicated.

END OF SECTION

OUTLET BOXES, CONDUIT BOXES AND FITTINGS

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CSA C22.1-06, Canadian Electrical Code, Part 1, 20th Edition.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 10 – General Instructions.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions.
- .2 Waste Management and Disposal:
 - .1 Separate waste materials in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.1 GALVANIZED STEEL OUTLET BOXES

- .1 One-piece electro-galvanized construction.
- .2 Flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .3 Utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .4 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .5 Extension and plaster rings for flush mounting devices in finished walls.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry, single and multi gang boxes for devices flush mounted in exposed block walls.

OUTLET BOXES, CONDUIT BOXES AND FITTINGS

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast FD or FS boxes with factory-threaded hubs and mounting feet for surface wiring of devices.

2.6 OUTLET BOXES FOR NON-METALLIC SHEATHED CABLE

- .1 Electro-galvanized, sectional, screw ganging steel boxes, minimum size 76 x 50 x 63 mm with two double clamps to take non-metallic sheathed cables.

2.7 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 35 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.

3. EXECUTION**3.1 INSTALLATION**

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Do not install reducing washers.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 Canadian Standards Association (CSA International)
 - .1 CAN/CSA C22.2 No. 18-98(R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
 - .2 CSA C22.2 No. 45-M1981(R2003), Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83-M1985(R2003), Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2-M1984(R2003), Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 10 – General Instructions.
- .2 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .3 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 01 00 10 – General Instructions.
- .2 Place materials defined as hazardous or toxic waste in designated containers.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.

2. PRODUCTS

2.1 CABLES AND REELS

- .1 Provide cables on reels or coils.
 - .1 Mark or tag each cable and outside of each reel or coil, to indicate cable length, voltage rating, conductor size, and manufacturer's lot number and reel number.

- .2 Each coil or reel of cable to contain only one continuous cable without splices.
- .3 Identify cables for exclusively dc applications.
- .4 Reel and mark shielded cables rated 2,001 volts and above.

2.2 CONDUITS

- .1 Rigid pvc conduit: to CSA C22.2 No. 211.2.
- .2 Flexible metal conduit: to CSA C22.2 No. 56, liquid-tight flexible metal or aluminum.
- .3 Flexible pvc conduit: to CAN/CSA-C22.2 No. 227.3.

2.3 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller.
 - .1 Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits.
- .4 Threaded rods, 6 mm diameter, to support suspended channels.

2.4 CONDUIT FITTINGS

- .1 Fittings: to CAN/CSA C22.2 No. 18, manufactured for use with conduit specified.
Coating: same as conduit.
- .2 Ensure factory "ells" where 90 degrees bends for 25 mm and larger conduits.
- .3 Set screw steel couplings for EMT.

2.5 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable linear expansion as required by the Ontario Electrical Safety Code (OESC).
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.6 FISH CORD

- .1 Polypropylene.

3. EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

1. Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
- .2 Use rigid pvc conduit underground and in areas exposed to weather.
- .3 Use flexible metal conduit for connection to fixtures and work in movable metal partitions.
- .4 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations and in poles to provide separation between systems.
- .5 Use explosion proof flexible connection for connection to explosion proof motors.
- .6 Minimum conduit size for lighting and power circuits: 19 mm.
- .7 Bend conduit cold:
 - .1 Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 19 mm diameter.
- .9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
- .10 Install fish cord in empty conduits.
- .11 Remove and replace blocked conduit sections.
 - .1 Do not use liquids to clean out conduits.
- .12 Dry conduits out before installing wire.

3.3 CONDUITS IN CAST-IN-PLACE SLABS ON GRADE

- .1 Run conduits 25 mm and larger below slab and encase in 75 mm concrete envelope.
 - .1 Provide 50 mm of sand over concrete envelope below floor slab.

3.4 CONDUITS UNDERGROUND

- .1 Slope conduits to provide drainage.
- .2 Waterproof joints (pvc excepted) with heavy coat of bituminous paint.

3.5 CLEANING

- .1 Proceed in accordance with Section 01 00 10 – General Instructions.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 Insulated Cable Engineers Association, Inc. (ICEA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for cables and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect cables from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer and return as specified in Construction Waste Management Plan and in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS

2.1 CABLE PROTECTION

- .1 38 x 140 mm planks pressure treated.

2.2 MARKERS

- .1 Concrete type cable markers: 600 x 600 x 100 mm with words: cable, joint or conduit impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

2.3 MATERIALS

- .1 Use OPSS.MUNI 1004 Mortar Sand for sand bed as per details on drawings

INSTALLATION OF CABLES IN TRENCHES AND IN DUCTS

- .2 Use OPSS.MUNI 1010 Granular A for cover over concrete encased duct bans as per details on drawings.

3. EXECUTION**3.1 GENERAL**

- .1 Provide pull points / precast hand hole every two 90° bends.
- .2 Conduit bend radius to be minimum 10 times raceway over diameter.

3.2 DIRECT BURIAL OF CONDUITS

- .1 After sand bed in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest conduit/
 - .1 Do not pull cable into trench.
- .2 Include offsets for thermal action and minor earth movements.
 - .1 Offset cables 150 mm minimum for each 60 m run, maintaining minimum cable separation and bending radius requirements.
- .3 Make termination and splice only as indicated leaving 1 m minimum of surplus cable in each direction.
 - .1 Make splices and terminations in accordance with manufacturer's written recommendations using approved splicing kits.
- .4 Underground cable splices not acceptable.
- .5 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable or in accordance with manufacturer's written recommendations; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.
- .6 Conduit separation:
 - .1 Maintain 75 mm minimum separation between cables of different circuits.
 - .2 Maintain 300 mm minimum horizontal separation between low and high voltage cables.
 - .3 When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position.
 - .4 At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables.
 - .5 Maintain 300 mm minimum lateral and vertical separation for control cables when crossing other cables, with control cables in upper position.
 - .6 Install treated planks on lower cables 0.6 m minimum in each direction at crossings.

INSTALLATION OF CABLES IN TRENCHES AND IN DUCTS

- .7 After sand protective cover specified in Section 31 23 33.01- Excavating, Trenching and Backfilling, is in place, install continuous row of pressure treated planks and marker tape as indicated to cover length of run.

3.3 CABLE INSTALLATION IN DUCTS

- .1 Install cables as indicated in ducts.
- .2 Do not pull spliced cables inside ducts.
- .3 Install multiple cables in duct simultaneously.
- .4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.
- .5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.
- .6 Before pulling cable into ducts and until cables are properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.
- .7 After installation of cables, seal duct ends with duct sealing compound.

3.4 MARKERS

- .1 Mark cable every 150 m along runs and changes in direction.
- .2 Where markers are removed to permit installation of additional cables, reinstall existing markers.
- .3 Lay concrete markers flat and centred over cable with top flush with finish grade.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Perform tests using qualified personnel.
 - .1 Include necessary instruments and equipment.
- .3 Check phase rotation and identify each phase conductor of each feeder.
- .4 Check each feeder for continuity, short circuits and grounds.
 - .1 Ensure resistance to ground of circuits is not less than 50 megohms.
- .5 Pre-acceptance tests:
 - .1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor for system conductors less than 600 V.
 - .2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.
 - .3 Test primary and secondary cable in accordance with Hydro Ottawa CGC0001 working procedure.

- .6 Acceptance Tests:
 - .1 Ensure that terminations and accessory equipment are disconnected.
 - .2 Ground shields, ground wires, metallic armour and conductors not under test.
 - .3 High Potential (Hipot) Testing.
 - .1 Conduct hipot testing at ICEA/manufacturer's recommendations.
 - .4 Leakage Current Testing:
 - .1 Raise voltage in steps from zero to maximum values as specified by manufacturer/ICEA for type of cable being tested.
 - .2 Hold maximum voltage for specified time period by manufacturer/ICEA.
 - .3 Record leakage current at each step.
- .7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.
- .8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Repair damage to adjacent materials caused by cables installation.

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1 (22st Edition), Safety Standard for Electrical Installations with Ontario Amendments.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for photoelectric devices and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect photoelectric devices from nicks, scratches, and blemishes.
 - .3 Protect metal accessories and trim from being bent or damaged.
 - .4 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer and as specified in Construction Waste Management Plan and in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS

2.1 PHOTOELECTRIC LIGHTING CONTROL

- .1 Photoelectric Lighting Controls: to CSA C22.1.
- .2 Luminaire mounting.
- .3 Voltage variation: plus or minus 10%.
- .4 Temperature range: minus 40 degrees C to plus 40 degrees C.

- .5 Rated for 5000 operations.
- .6 Options:
 - .1 Fail-safe circuit completed when relay de-energized.
 - .2 Twist-lock type receptacle.
 - .3 Terminal strip.
 - .4 Sensitivity adjustment.
- .7 Switching time delay of 30 s.
- .8 Mounting bracket.
- .9 Colour coded leads: size 10 AWG, 460 mm long.
- .10 Field programmable from ground using remote programming device.

3. EXECUTION

3.1 INSTALLATION

- .1 Install photoelectric controls in accordance with manufacturer's written instructions and to CSA C22.1.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
- .2 Leave Work area clean at end of each day.
- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .4 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
- .5 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by lighting control devices installation.

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CAN/CSA-C22.2 No.47-M90(R2007), Air-Cooled Transformers (Dry Type).
 - .2 CSA C9-02(R2007), Dry-Type Transformers.
 - .3 CAN/CSA-C802.2-06, Minimum Efficiency Values for Dry Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for dry type transformers and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 CLOSEOUT SUBMITTAL

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for dry type transformers for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 00 10 – General Instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect dry type transformers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer and return and as specified in Construction Waste Management Plan

2. PRODUCTS

2.1 DESIGN DESCRIPTION

- .1 Design 1.
 - .1 Type: ANN.
 - .2 3 phase, 600 V-120/208 V
 - .3 Voltage taps: standard.
 - .4 Insulation: Class H
 - .5 Basic Impulse Level (BIL): standard.
 - .6 Hipot: standard.
 - .7 Average sound level: standard
 - .8 Impedance at 17 degrees C: standard
 - .9 Enclosure: NEMA 3 rating or as indicated on drawings, removable metal front panel.
 - .10 Mounting: floor.
 - .11 Finish: in accordance with Section 26 05 00- Common Work Results for Electrical.
 - .12 Copper windings.
 - .13 Winding configuration to be as noted on drawings.
 - .14 Harmonic Mitigating Phase Shifting transformers as indicated on drawings.
 - .15 K-Rated Transformers where indicated on drawings.
 - .16 Voltage Regulation to be 4% or better.

2.2 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Label size: 7.

3. EXECUTION

3.1 INSTALLATION

- .1 Mount dry type transformers above 75 kVA on floor.
- .2 Ensure adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections in accordance with wiring diagram.

- .7 Energize transformers after installation is complete.
- .8 Make conduit entry into bottom 1/3 of transformer enclosure.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by dry type transformers installation.

END OF SECTION

1. GENERAL**1.1 REFERENCES**

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - .1 ANSI/IEEE 386, Separable Insulated Connector Systems for Power Distribution Systems Above 600 V.
 - .2 ANSI/IEEE C57.12.00, ANSI/IEEE C57.12.90, ANSI/IEEE C57.91, ANSI/IEEE C57.92 and ANSI/IEEE C37.91.
- .2 Canadian Standards Association (CSA International):
 - .1 CAN/CSA-C2-M91, Single-Phase and Three-Phase Distribution Transformers, Types ONAN and OLAN.
 - .2 CAN/CSA-C227.3, Low-Profile, Single-Phase, Dead Front, Pad-Mounted Distribution Transformers.
 - .3 CSA C227.4-M1978, Three-Phase Dead Front Pad-Mounted Distribution Transformers.
 - .4 CAN/CSA-C802.1-00, Minimum Efficiency Values for Liquid-Filled Distribution Transformers.

1.2 CONTRACTORS

- .1 The work related to the installation and termination of the high voltage cables and power distribution transformers shall be performed by a contractor specialized and experienced in this type of work and authorized by ESA to perform pole maintenance and high voltage work.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 10 General Instructions
- .2 Product data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets for products. Include product characteristics, performance criteria, and limitations.
 - .2 Dimensions showing enclosure, mounting devices, terminals, taps, internal and external component layout.
- .3 Drawings must include the following technical information:
 - .1 kVA rating.
 - .2 Primary and secondary voltages.
 - .3 Frequency.
 - .4 Three phase.

- .5 Polarity or angular displacement.
- .6 Full load efficiency.
- .7 Regulation at unity pf.
- .8 BIL.
- .9 Insulation type.
- .10 Impedance percentage.
- .4 Submit shop drawings and indicate:
 - .1 Anchoring method and dimensioned foundation template.
 - .2 Dimensioned cable entry locations.
 - .3 Dimensioned cable termination and pothead height.
- .5 Identified internal and external component layout on assembly drawing.
- .6 Insulating liquid capacity.
- .7 Submit primary fuse and secondary breaker time-current characteristics.
- .8 Quality Assurance Submittals: submit the following in accordance with Section 01 45 00-Quality Control.
 - .1 Certificates: submit the following certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties:
 - .1 Turn ratio (voltage).
 - .2 Polarity or angular displacement.
 - .3 No load losses.
 - .4 Load losses.
 - .5 Impedance voltage.
 - .6 Dielectric resistance (applied and induced voltage).
 - .7 Excitation current.
 - .8 Resistance.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 The Owner will make available one (1) copy of systems supplier's installation instructions.
- .9 Closeout Submittals:
 - .1 Provide operation and maintenance data for pad mounted distribution transformers for incorporation into manual specified in Section 01 78 00-Closeout Submittals.
- .10 Include insulating liquid maintenance data.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Waste management and disposal:
 - .1 Separate waste materials for recycling in accordance with Section 01 00- General Instructions..

1.5 MAINTENANCE

- .1 Provide maintenance/replacement materials in accordance with Section 01 01 00- General Instructions.
- .2 Provide operating and maintenance instructions for liquid cooled transformer.
- .3 Operating and maintenance instructions must include:
 - .1 Tap changing.
 - .2 Recommended operating conditions.
 - .3 Periodic inspection and maintenance.
 - .4 Bushing replacement.
 - .5 Temperature supervising relay operations.

2. PRODUCTS

2.1 TRANSFORMERS

- .1 Three phase, dead, front pad mounted distribution transformers: to CSA C227.4 and CSA-C2.
- .2 Oil-filled, pad mounted, distribution transformers complete with primary and secondary cable compartments, options and accessories to form complete factory assembled, steel fabricated unit for mounting on concrete pad of type LNAV 55/65°C, with steel core M.O.H. minimum, copper coil, additive polarity.
- .3 High voltage bushing for connection to distribution system through separable insulated connectors for dead front operation to EEMAC.
- .4 Separable insulated connectors, bent to primary, Dead Front.
- .5 Spade type low voltage terminals.

2.2 TRANSFORMER CHARACTERISTICS

- .1 The equipment shall be built in accordance with the requirements specified herein and the applicable CSA standards and CSA C227.4M latest edition.
- .2 The power transformer shall be 500kVA, 3phase, 60Hz, dead front pad mounted distribution transformer.
- .3 Primary voltage: 27.6kV, 60 Hz, grounded wye, 3-phase. 150kV BIL, 25kV Class,
- .4 Secondary voltage: 600 V, wye, 3-phase, 4 wires, solidly grounded neutral, 30kV BIL
- .5 Capacity: 500kVA
- .6 Impedance: 5%
- .7 Sound level to NEMA TR1 Standard

- .8 Efficiency to CSA C802.1
- .9 High voltage bushings – 200A bushing wells with removable studs
- .10 27.6kV, 150kV BIL load break inserts
- .11 100A 5 position tap changer
- .12 Ground straps to all cabinet sides, doors, sills

2.3 VOLTAGE TAPS

- .1 Four-2.5% taps, 2-FCAN, 2-FCBN.

2.4 TAP CHANGERS

- .1 Externally operated off-load tap changer, with provision for padlocking.

2.5 ACCESSORIES

- .1 Load break switching, 15-38kV, 300A rated
- .2 38kV Bayonet Expulsion fuses
- .3 Elbow type lightning arrestors, 25kV class
- .4 Liquid temperature thermometer with two sets of contacts.
- .5 Liquid level gauge with two sets of contacts.
- .6 High-flow decompression vent hole, V.I.A.T. type with spare contact open for wiring in control box.
- .7 Quick Connect 3/8 in. oil sampling connection.
- .8 Terminal connections to secondary (stub) for cables.
- .9 Dielectric protections to cover removable low voltage bars.
- .10 Dismantlable front casing to protect elbows and terminals.
- .11 Entry for all cables below.
- .12 Lifting eyes.
- .13 25 mm filler plug.
- .14 All transformer controls to lead to hinged cabinet and located inside the transformer's low-voltage enclosure.
- .15 Hanger irons and adapter plates.
- .16 Wiring and terminal box for protective devices.
- .17 Flammable insulating liquid sampling device at bottom.
- .18 Factory install accessories.
- .19 Drain valve with plug: 25 mm diameter, with plug.
- .20 Sudden pressure relay with dry contact.
- .21 Vacuum pressure indicator.
- .22 Interior current limiting fuse.

- .23 Metal enclosure separating low and high voltage sections.

2.6 GROUNDING

- .1 Copper grounding bus.
- .2 Connectors for grounding conductors size 4/0 AWG.

2.7 FINISHES

- .1 Finish exterior of unit in accordance with Section 26 05 00- Common Work Results for Electrical.

2.8 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Nameplate showing information in accordance with CSA C2.

2.9 MV CABLES

- .1 MV cable shall be single conductor cable for operation on a 27.6kV grounded public utility system.
- .2 The cable shall have 1/0 AWG stranded aluminum conductors, XLPE insulation, semi-conducting shield, 100% insulation for 27.6kV system, 100% concentric compact stranding neutral and extruded poly jacket.
- .3 The cable shall be suitable for installation in a duct bank or conduit system.

2.10 POLE SWITCH AND ARRESTOR

- .1 Provide fused load interrupter switch at pole top complete with universal fuse holder
 - .1 Provide 27.6kV fuses
- .2 Provide terminator kit for 27.6kV system , outdoor, complete with aerial lug and mounting bracket. Lugs to be suitable for conductors from 1/0 to 4/0 at a minimum.
- .3 Provide Lightning arrestor, 25kV rated

2.11 WARNING SIGNS

- .1 Provide warning signs in accordance with Section 26 05 00- Common Work Results for Electrical.

2.12 SOURCE QUALITY CONTROL

- .1 Submit to Departmental Representative standard factory test certificates of each transformer and type test of each transformer with high voltage accessories in accordance with CSA C2.
- .2 Standard factory tests shall be carried out on the transformer in accordance with the latest revision of ANSI code and will comprise of at a minimum resistance measurements, ratio, polarity and phase rotation test, loss test to determine no-load losses and full load losses, impedance, regulation and efficiency and also dielectric tests. Notify the Departmental Representative in writing of the test results. The transformer shall not be shipped prior to approval of the departmental representative.

3. EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 GROUNDING

- .1 Provide a complete grounding system to ensure the safety of equipment and personnel in the event of faults. Install ground rods with interconnecting loops. The grounding of the high voltage equipment shall be in accordance with the requirements of Hydro Ottawa and CSA 22.1, CEC with Ontario Amendments.
- .2 Grounding and bonding equipment shall be in accordance with requirements of CSA C22.2 No. 41-M1987 (R2004)

3.3 SERVICE FEEDER

- .1 Install duct bank with 100mm ducts as shown on the drawings encased in concrete and reinforced with steel bars from the transformer to the termination pole. The trenching, backfilling and concrete work shall be in accordance with Division 33 and 26 05 43.01 Installation of cables in Trenches and Ducts
- .2 Before pulling the cables into the ducts and until such time the cables are properly terminated, maintain the ends of the cables sealed with moisture tape or compound.
- .3 Terminate the cable at both the overhead line and transformer. Provide all necessary accessories and labour to provide a complete compliant system compliant with the requirements of the inspection authority and local utility..
- .4 After the installation of cables and terminations, seal duct ends with duct sealing compound.

3.4 APPROVAL OF DRAWINGS

- .1 Prepare a layout of the MV/HV equipment and grounding for the equipment as required by the inspection authority. Submit the appropriate copies for approval to ESA. Correct and resubmit the drawings until the requirements of the Inspection Authority are satisfied.

3.5 INSPECTIONS

- .1 Check factory made connections of transformer unit for mechanical security and electrical continuity.
- .2 Check transformer insulating liquid for correct quantity and specification according to manufacturer's instructions.
- .3 Check for insulating liquid leaks and report to Departmental Representative.
- .4 Compare delivered material with delivery slip to ensure nothing is missing.
- .5 Perform visual inspection to check for indication of impact on the transformer and accessories.
- .6 Report any indication of equipment damage to Departmental Representative.

3.6 INSTALLATION

- .1 Ensure concrete pad is fully cured before transformer is installed.
- .2 Set and secure transformer unit in place, rigid, plumb and square.
- .3 Make connections.
- .4 Connect transformer unit ground bus to system ground.
- .5 Wire one set of contacts on liquid temperature thermometer and liquid level gauge to sound alarm when unsafe condition reached; wire second set of contacts to trip transformer circuit interrupter.
- .6 Ensure care is taken to prevent contamination of liquid and components when field filling transformers.
- .7 Use only metal hose when field-filling transformer with oil: do not use rubber hose.
- .8 Set taps to produce rated secondary voltage at no-load.
- .9 Inspect and clean bushings and insulators.
- .10 Connect primary terminations to the high-voltage circuit with elbow cable endings. Provide all elbow connections with adaptors and connection accessories. See ANSI std. 386.
- .11 Use torque wrench to adjust internal connections in accordance with manufacturers' recommended values.
- .12 Ensure transformer overload protective device is set properly.
- .13 Energize transformers and check secondary no-load voltage.

3.7 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Retain an approved independent test company to carry out all testing on installed primary and secondary cables in accordance with Hydro Ottawa GCG0001 – Installation and Testing of Underground Primary and Secondary Power Cables – prior to energization. Provide full test report indicating all parameters noted in standard.
- .3 Carry out following insulation tests using megger with 20,000 megohm scale and resulting insulation resistance corrected to base of 20 degrees C.
 - .1 High voltage to ground with secondary grounded for duration of test.
 - .2 Low voltage to ground with primary grounded for duration of test.
 - .3 High to low voltage.
- .4 Inspect primary and secondary connections for tightness and for signs of overheating.
- .5 Inspect and clean bushings and insulators.
- .6 Check oil level and temperature indicators.
- .7 Set transformer taps to rated voltage as specified.
- .8 Inspect for oil leaks and excessive rusting.
- .9 Inspect oil level.
- .10 Check fuses for correctness of type and size.
- .11 Check for grounding and neutral continuity between primary and secondary circuits of transformer.

3.8 CLEANING

- .1 Proceed in accordance with Section 01 00- General Instructions.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PANELBOARDS BREAKER TYPE

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CSA C22.2 No.29-11, Panelboards and Enclosed Panelboards.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for panelboards and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by the contactor indicating the submission is in conformance with the drawings and specifications.
 - .2 Include on drawings:
 - .1 Electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for panelboards for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 00 10 – General Instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect panelboards from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer and as specified in Construction Waste Management Plan in accordance with Section 01 00 10 – General Instructions.

PANELBOARDS BREAKER TYPE**2. PRODUCTS****2.1 PANELBOARDS**

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 250 and 600 V panelboards: bus and breakers rated as indicated.
- .3 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .4 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.
- .5 Minimum of 2 flush locks for each panel board.
- .6 Two keys for each panelboard and key panelboards alike.
- .7 Copper bus with neutral of same ampere rating of mains.
- .8 Mains: suitable for bolt-on breakers.
- .9 Trim with concealed front bolts and hinges.
- .10 Trim and door finish: baked enamel.
- .11 Isolated ground bus.
- .12 Include grounding busbar with 3 of terminals for bonding conductor equal to breaker capacity of the panel board.

2.2 BREAKERS

- .1 Breakers: to Section 26 28 16.02- Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10 % of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to Departmental Representative.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.

PANELBOARDS BREAKER TYPE

- .4 Complete circuit directory with typewritten legend showing location and load of each circuit, mounted in plastic envelope at inside of panel door.

3. EXECUTION

3.1 INSTALLATION

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards C-Channel Supports.
- .3 Mount panelboards to height specified in Section 26 05 00- Common Work Results for Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.
- .6 Where panels of different systems (i.e. Standard and Vital Power) supply a common patient care area, ground busses in panels to be interconnect with a minimum #6 AWG ground conductor.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by panelboards installation.

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA International
 - .1 CSA C22.2 No.42-10, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CAN/CSA C22.2 No.42.1-00(R2009), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA C22.2 No.55-M1986(R2008), Special Use Switches.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for wiring devices and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by the contractor indicating the submission is in conformance with the drawings and specifications.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for wiring devices for incorporation into manual.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect wiring devices from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section.

WIRING DEVICES

- .5 Packaging Waste Management: remove for reuse by manufacturer and return and as specified in Construction Waste Management Plan in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS**2.1 RECEPTACLES**

- .1 Duplex receptacles, CSA type 5-15 R and 5-20 R, 125 V, 15 A and 20 A, U ground, to: CSA C22.2 No.42 with following features:
 - .1 White urea moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
- .2 Other receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout project.

2.2 COVER PLATES

- .1 Cover plates for wiring devices to: CSA C22.2 No.42.1.
- .2 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .3 Stainless steel, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.
- .4 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
- .5 Weatherproof “while-in-use” cover for duplex receptacles.

2.3 SOURCE QUALITY CONTROL

- .1 Cover plates from one manufacturer throughout project.

3. EXECUTION**3.1 INSTALLATION**

- .1 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00- Common Work Results for Electrical.
 - .3 Install GFI type receptacles as indicated.

- .2 Cover plates:
 - .1 Install suitable common cover plates where wiring devices are grouped.
 - .2 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .3 Repair damage to adjacent materials caused by wiring device installation.

END OF SECTION

ELECTRIC VEHICLE CHARGING STATIONS**1. GENERAL****1.1 REFERENCE STANDARDS**

- .1 Canada Green Building Council (CaGBC)
 - .1 LEED Canada-NC Version 4.0, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations (including Addendum 2017).
 - .2 LEED Canada-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For Design and Construction.
 - .3 LEED Canada-CI Version 1.0-2017, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Commercial Interiors.
 - .4 LEED Canada-EBOM 2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Guide For Existing Buildings: Operations and Maintenance.
- .2 CSA International
 - .1 CAN/CSA C22.2No. 280-16 Electric Vehicle Supply Equipment.
- .3 UL
 - .1 UL 2594 Standard for Safety Electric Vehicle Charging Equipment
- .4 SAE
 - .1 SAE J1772 –SAE Electric Vehicle and Plug In Hybrid

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for electric vehicle charging stations and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Charger data: type and capacity, input power, input power connection requirements, output power, communications protocols and methodology, authentication, cable management, display type.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by electrical contractor and general contractor demonstrating review for conformity with project requirements.
 - .2 Include outline schematic diagrams with dimensions showing arrangement of cubicle, components, meters and controls.

ELECTRIC VEHICLE CHARGING STATIONS**1.3 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Operation and Maintenance Data: submit operation and maintenance data for electric vehicle charging stations for incorporation into manual.
- .3 Operation and maintenance instructions covering design elements, construction features, component functions and maintenance requirements to permit effective operation, maintenance and repair.
- .4 Copy of approved shop drawings.
- .5 Technical description of components.
- .6 Parts lists with catalogue numbers and names and addresses of suppliers.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect electric vehicle charging stations from nicks, scratches, and blemishes
 - .3 Replace defective or damaged materials with new.
- .4 Develop Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 21- LEED Requirements.
- .5 Packaging Waste Management: remove for reuse by manufacturer and return of padding, crates, packaging materials, pallets, and as specified in Waste Reduction Workplan in accordance with Section 01 00 10 – General Instructions

2. PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- .1 Level II Electric Vehicle charging station with dual vehicle connectivity.
- .2 INPUT: 208V single phase, 30A 60hz Input voltage supplied from 208V-40A circuit breaker. 2wire + Ground input
- .3 OUTPUT: 208V, 30A
- .4 Enclosure : NEMA 3R type, weather proof enclosure. Rated for use in temperatures from -30C to 40C.

ELECTRIC VEHICLE CHARGING STATIONS

- .5 Integral Ground fault protection, 5mA with auto reset and test. System to lock out and require manual reset after 4 attempts at reclosure. Ground Fault system to be tested at the start of each charge cycle.
- .6 Authentitaction: contactless credit card.
- .7 Unit Programming through cellular network system or local wireless connection. Any proprietary programming device required is to be supplied as part of the contract to permit future programming by client maintenance staff.
- .8 Connectivity: Unit to be capable of being 'cloud' / internet connected and addressable to permit demand and metering information to be collected remotely.
- .9 Cords and plug.

2.2 ENCLOSURE

- .1 Free standing, Dead front sheet steel CSA Enclosure Type 3R.
- .2 Access from front.
- .3 Convection ventilated.
- .4 Meters, indicating lamps and controls group mounted on front panel.

2.3 EQUIPMENT IDENTIFICATION

- .1 Identify equipment in accordance with Section 26 05 00- Common Work Results for Electrical.
- .2 Use size 5 nameplates for major components such as input breakers, output breaker.
- .3 Use size 3 nameplates for mode lights alarms, meters.

3. EXECUTION**3.1 INSTALLATION**

- .1 Locate and install electric vehicle charging station as indicated.
- .2 Connect input terminals to AC mains.

3.2 TESTS

- .1 Energize battery charger and operate until battery shows full charge.
- .2 Discharge battery to full discharge condition.
- .3 Recharge battery, recording DC voltage and current once per hour for 6-8hours. Test battery to ensure it has reached at least 95% full charge.
- .4 Continue charging to ensure charger changes from bulk rate to float charge rate.
- .5 Demonstrate that automatic timer controls charging and correctly transfers from equalize to float charge after selected period.

ELECTRIC VEHICLE CHARGING STATIONS

- .6 Simulate faults to demonstrate that alarm lights and audible alarms are performing as designed.
- .7 At end of tests, with battery in fully charged condition, operate charger on "float" for minimum period of 24 hours to ensure stable condition is reached and held.

3.3 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.4 PROTECTION

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by battery installation.

END OF SECTION

MOULDED CASE CIRCUIT BREAKERS**1. GENERAL****1.1 REFERENCE STANDARDS**

- .1 CSA International
 - .1 CSA C22.2 No. 5-09, Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, and NMX-J-266-ANCE-2010).

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide invoice from authorized distributor for breaker purchases.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section with manufacturer's written instructions and 01 00 10 – General Instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store circuit breakers in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect circuit breakers from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section.
- .5 Packaging Waste Management: remove for reuse and return by manufacturer and as specified in Construction Waste Management Plan in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS**2.1 BREAKERS GENERAL**

- .1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.
 - .1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

2.2 THERMAL MAGNETIC BREAKERS<ACTION>DESIGN A

- .1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

3. EXECUTION

3.1 INSTALLATION

- .1 Install circuit breakers as indicated.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

ROADWAY LIGHTING

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 CSA Group
 - .1 CSA C22.2 No.206-13, Lighting Poles.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 00 10 – General Instructions.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for roadway lighting and include product characteristics, performance criteria, physical size, finish and limitations.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 00 10 – General Instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect roadway lighting from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Develop Construction Waste Management Plan related to Work of this Section and in accordance with Section.
- .5 Packaging Waste Management: remove for reuse by manufacturer and return as specified in Construction Waste Management Plan and in accordance with Section 01 00 10 – General Instructions.

2. PRODUCTS

2.1 ALUMINUM POLES

- .1 Aluminum poles: to CSA C22.2 No.206 designed for underground wiring and:
 - .1 Mounting on concrete anchor base.
 - .2 Style: square tapered aluminum.
 - .3 Straight for luminaire mounting brackets.
 - .4 Access handhole.
 - .5 Size: as indicated
 - .6 Poles to be factory prepared to accept cameras and Code Blue stations as per drawings.

ROADWAY LIGHTING

- .7 Anchor bolts.
- .8 Finish: semi-lustrous satin by rotary sand process.
- .9 Grounding lug.

2.2 LUMINAIRES

- .1 Luminaire with cast aluminum weatherproof housing and as indicated on drawings.

3. EXECUTION

3.1 INSTALLATION

- .1 Install poles true and plumb, in accordance with manufacturer's instructions.
- .2 Install luminaires on pole.
- .3 Check luminaire orientation, level and tilt.
- .4 Connect luminaire to lighting circuit.
- .5 Perform tests in accordance with Section 26 05 00- Common Work Results for Electrical.
- .6 Install camera mount on pole where indicated.

3.2 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 00 10 – General Instructions.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 00 10 – General Instructions.
- .3 Waste Management: separate waste materials in accordance with Section 01 00 10 – General Instructions.

END OF SECTION

PART 1 GENERAL1.1 RELATED REQUIREMENTS

- .1 Section 26 05 43.01 – Installation of Cables in Trenches and Ducts.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Section 32 12 16.02 – Asphalt Paving for Building Sites.
- .4 Section 32 16 15 – Concrete Walks, Curbs and Gutters.
- .5 Section 33 05 16 – Manholes and Catch Basin Structures.
- .6 Section 33 41 00 – Storm Utility Drainage Piping.

1.2 REFERENCES

- .1 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS.MUNI 1004 (November 2013), Aggregates – Miscellaneous.
 - .2 OPSS.MUNI 1010 (November 2013), Aggregates – Base, Subbase, Select Subgrade and Backfill Material.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of aggregate materials and provide access for sampling.
- .2 Submit documentation verifying that materials conform with the referenced materials of OPSS.MUNI 1010.
- .3 Samples:
 - .1 Allow continual sampling by Departmental Representative during production.
 - .2 Provide Departmental Representative with access to source and processed material for sampling.
 - .3 Install sampling facilities at discharge end of production conveyor, to allow Departmental Representative to obtain representative samples of items being produced. Stop conveyor belt when requested by Departmental Representative to permit full cross section sampling.
 - .4 Supply new or clean sample bags or containers according appropriate to aggregate materials.
 - .5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

- .2 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.
- .3 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension to exceed 5 times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
 - .1 Crushed rock.
 - .2 Gravel and crushed gravel composed of naturally formed particles of stone.

2.2 SOURCE QUALITY CONTROL

- .1 Inform Departmental Representative of proposed source of aggregates and provide access for sampling 3 weeks minimum before starting production. Aggregate sources and operation are to be licensed and approved by authorities having jurisdiction.
- .2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.
- .3 Advise Departmental Representative 2 weeks minimum in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

PART 3 EXECUTION**3.1 PREPARATION**

- .1 Stockpile aggregates on site in locations as directed by Departmental Representative. Do not stockpile on completed pavement surfaces.
- .2 Stockpile aggregates in sufficient quantities to meet project schedules.
- .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
- .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand or gravel base not less than 300mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300mm of pile into Work.
- .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
- .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Departmental Representative within 48 hours of rejection.
- .7 Stockpile materials in uniform layers of thickness as follows:
 - .1 Maximum 2m for all materials.
- .8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .9 Do not cone piles or spill material over edges of piles.
- .10 Do not use conveying stackers.
- .11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Remove any unused aggregates from the site as directed by Departmental Representative.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

1 GENERAL

1.1 MEASUREMENT PROCEDURES

- .1 Measure following items in hectares within limits as indicated:
 - .1 Clearing.
 - .2 Grubbing.
 - .3 Close cut clearing.
 - .4 Underbrush clearing.
- .2 Fixed price payments will be made for:
 - .1 Clearing.
 - .2 Grubbing.

1.2 REFERENCE STANDARDS

- .1 U.S. Environmental Protection Agency (EPA)/Office of Water
 - .1 EPA 832R92005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.
- .2 Ontario Provincial Standard Specifications (OPSS)
 - .1 Construction Specifications for Clearing, Close Cut Clearing, Grubbing and Removal of Surface and Piled Boulders. (OPSS 201)

1.3 DEFINITIONS

- .1 Clearing consists of cutting off trees and brush vegetative growth to not more than 300mm above ground and disposing of felled trees, previously uprooted trees and stumps, and surface debris.
- .2 Underbrush clearing consists of removal from treed areas of undergrowth, deadwood, and trees smaller than 50 mm trunk diameter and disposing of fallen timber and surface debris.
- .3 Grubbing consists of excavation and disposal of stumps and roots boulders and rock fragments of specified size to not less than specified depth below existing ground surface.
- .4 EAB refers to Emerald Ash Borer a non-native, invasive beetle that is highly destructive to ash trees where it occurs.
 - .1 Woodchips in the context of EAB consist of untreated, raw bark and wood fragments broken or shredded from logs or branches. Woodchips are to be less than 2.5cm in at least any two dimensions.
 - .2 Firewood in the context of EAB consists of non-manufactured, solid wood material, with or without bark, cut into sizes less than 1.2m long and less than 25 cm in diameter which may be handled manually.
 - .3 Logs in the context of EAB consist of untreated, raw wood greater than 1.2m in length and greater than 25cm diameter.
 - .4 Enclosed vehicle in the context of EAB consist of any vehicle transporting regulated wood material that is equipped to preclude the loss of materials or the escape of EAB

while in transit.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Provide submittals in accordance with Section 01 00 10- General Instructions
- .2 Samples:
 - .1 Submit one sample of each material listed below for approval prior to delivery of materials to project site.
 - .2 Tree wound paint: one litre can with manufacturer's label.
 - .3 Herbicide: one liter can with manufacturer's label.
- .3 Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- .4 Provide manufacturer's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Safety Requirements: worker protection.
 - .1 Workers must wear gloves, dust masks, eye protection, safety boots and safety vests when clearing and grubbing.

1.6 STORAGE AND PROTECTION

- .1 Prevent damage to fencing, trees, shrubs, landscaping, natural features, existing buildings, existing pavement, utility lines, site appurtenances, water courses and root systems of trees which are to remain.
 - .1 Repair damaged items to approval of Departmental Representative.
 - .2 Replace trees designated to remain, if damaged, as directed by Departmental Representative.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 00 10 - General Instructions.
- .2 Consider felled timber from which saw logs, pulpwood, posts, poles, ties, or fuel wood can be produced as saleable timber.
 - .1 Trim limbs and tops, and saw into saleable lengths to dispose of off site.
- .3 Ash wood mixed with the wood of other species is to all be managed and disposed of as ash wood.

2 PRODUCTS

CLEARING AND GRUBBING

2.1 MATERIALS

- .1 Bituminous based paint of standard manufacture specially formulated for tree wounds.
- .2 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
 - .2 Remove and store soil material for reuse.

3 EXECUTION

3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties, roads and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.2 PREPARATION

- .1 Inspect site and verify with Departmental Representative, items designated to remain.
- .2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
 - .2 When utility lines which are to be removed are encountered within area of operations, notify Departmental Representative in ample time to minimize interruption of service.
- .3 Notify utility authorities before starting clearing and grubbing.
- .4 Keep roads and walks free of dirt and debris.

3.3 APPLICATION

- .1 Manufacturer's instructions: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.4 CLEARING

- .1 Clearing includes felling, trimming, and cutting of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including downed timber, snags, brush, and rubbish occurring within cleared areas.
- .2 Clear as directed by Departmental Representative, by cutting at height of not more than 300 mm above ground.

CLEARING AND GRUBBING

- .3 Cut off branches overhanging area cleared as directed by Departmental Representative.

3.5 UNDERBRUSH CLEARING

- .1 Clear underbrush from areas as indicated to within 300 mm of ground surface.

3.6 GRUBBING

- .1 Remove and dispose of roots larger than 7.5 cm in diameter, matted roots, and designated stumps from indicated grubbing areas.
- .2 Grub out stumps and roots to not less than 200 mm below ground surface.
- .3 Grub out and dispose of visible rock fragments and boulders, greater than 1.2m in greatest dimension, but less than 0.25 m³. Any boulders larger than 1.0m X 1.2m X 0.6m shall be stored in the "designated boulder stock pile areas" specified in the Contract Documents.
- .4 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.7 REMOVAL AND DISPOSAL

- .1 Remove cleared and grubbed materials off site to disposal area designated by Departmental Representative.
- .2 Cut timber greater than 125 mm diameter . Stockpiled timber becomes property of Contractor.
- .3 Dispose of cleared and grubbed materials.
- .4 Remove diseased trees identified by Departmental Representative and dispose of this material to approval of Departmental Representative.
- .5 The Contractor is responsible for monitoring all cut ash wood and firewood until it is properly disposed of as determined by Departmental Representative.

3.8 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for immediate grading operations to approval of Departmental Representative.

3.9 CLEANING

- .1 Proceed in accordance with Section 01 00 10 – General Instructions..
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, flagging tape, tools and equipment.

ADD THE FOLLOWING REQUIREMENTS:

1. In addition to the areas to be cleared and grubbed as illustrated in Drawing AD100, add to the scope of clearing and grubbing as per specifications, an additional approximate area of 7100m² as illustrated in the attached drawing C11, dated 2017-12-08 as issued by DFS Architecture and Design.
2. The area illustrated on drawing C11 has 3 Butternut trees scheduled for removal. The following specific requirements apply to the removal of the Butternut trees.
 - a. Before work begins, the Butternut trees must be flagged by a person knowledgeable in their identification, using fluorescent tape to distinguish them from the other trees.
 - b. Advise the Departmental representative 72 hours in advance of planned cutting to allow for a pre-removal survey to be conducted by a qualified biologist engaged by the Departmental Representative to confirm that there is no protected species or residence of a protected species (active, stick, cavity nests) in or on the Butternut tree. Should any specimen or residence be identified, the Butternut tree shall not be cut down pending direction from the Canadian Wildlife Service through the Departmental Representative.
 - c. All cut material from the cutting of Butternut trees must be incinerated within one week of cutting. Material and debris disposed offsite must be transported in a closed, air-tight container to the incineration site.
 - d. Workers will sterilize the: (a) equipment, (b) tools, and (c) clothing having come into contact with Butternut trees upon completion of the work to avoid transporting Butternut canker pathogens to other locations. Tools, equipment, and clothing must be disinfected by being soaked in a sodium hypochlorite aqueous solution (1:10) or Lysol® solution. Workers will keep a registry that records details of sterilization activities, including: (a) the date(s) completed, (b) solution(s) used, and (c) description of equipment sterilized.
 - e. Time of the tree removal and location of the Butternut cut material incineration must be recorded in a logbook.

END OF SECTION

PART 1 GENERAL1.1 RELATED REQUIREMENTS

- .1 Section 31 11 00 – Clearing and Grubbing.
- .2 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS.MUNI 1010 (November 2013), Aggregates – Base, Subbase, Select Subgrade and Backfill Material.

PART 2 PRODUCTS2.1 MATERIALS

- .1 Subgrade fill material: OPSS.MUNI 1010 Select Subgrade

PART 3 EXECUTION3.1 PREPARATION

- .1 Verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for rough grading installation.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .2 Proceed with installation only after unacceptable conditions have been remedied.

3.2 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.
- .2 Set grades to allow for 40mm of surface course asphalt to be installed in a future contract. Proposed elevations shown on Contract Drawings for top of asphalt include the future 40mm surface course.
- .3 Prior to placing fill over existing ground, scarify surface to depth of 150 mm minimum before placing fill. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

-
- .4 Compact filled and disturbed areas to maximum dry density to ASTM D698, as follows:
 - .1 85% under landscaped areas.
 - .2 95% under paved and walk areas.
 - .5 Do not disturb soil within branch spread of trees or shrubs to remain. .

3.3 TESTING

- .1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by ULC and retained by Departmental Representative. Costs of tests will be paid by Departmental Representative.

3.4 CLEANING

- .1 Leave work area clean at end of each day.
- .2 Upon completion, remove surplus materials, rubbish, tools and equipment.
- .3 Separate waste materials for recycling and reuse. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.5 PROTECTION

- .1 Protect existing trees, fencing, landscaping, natural features, bench marks, buildings, pavement, surface and underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.

END OF SECTION

PART 1 GENERAL1.1 DEFINITIONS

- .1 Rock: any solid material in excess of 0.25 m³ and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m³ bucket. Frozen material not classified as rock.

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 13 – Selective Site Demolition.
- .2 Section 26 05 43.01 – Installation of Cables in Trenches and Ducts.
- .3 Section 31 22 13 – Rough Grading.
- .4 Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .5 Section 32 16 15 – Concrete Walks, Curbs and Gutters.
- .6 Section 32 91 19.13 – Topsoil Placement and Grading.
- .7 Section 32 93 10 – Trees, Shrubs and Ground Cover Planting.
- .8 Section 33 05 16 – Manholes and Catch Basin Structures.
- .9 Section 33 41 00 Storm Utility Drainage Piping.

1.3 ACTION AND INFORMATION SUBMITTALS

- .1 Removal Submittals: submit for approval, written proposal of operations for removal of rock and associated building monitoring during removal operations to Departmental Representative.
 - .1 Submit records to Departmental Representative at end of each shift. Maintain complete and accurate record of rock removal operations.

PART 2 PRODUCTS2.1 MATERIALS

- .1 Not used.

PART 3 EXECUTION

3.1 ROCK REMOVAL

- .1 Remove rock to alignments, profiles, and cross sections as required to achieve required subgrade and trench elevations.
- .2 Explosive blasting is permitted in accordance with Ontario Ministry of Labour requirements.
- .3 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and avoid damage to adjacent structures.
- .4 Excavate rock to horizontal surfaces with slope not to exceed 5%.
- .5 Prepare rock surfaces which are to bond to concrete, by scaling, pressure washing and broom cleaning surfaces.
- .6 Remove boulders and fragments which may slide or roll into excavated areas. Place boulders meeting landscaping requirements in designated boulder stockpile area.
- .7 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.

3.2 CLEANING

- .1 Dispose of removed rock off site.
- .2 Leave work area clean at end of each day.
- .3 Upon completion, remove surplus materials, rubbish, tools and equipment.
- .4 Separate waste materials for recycling and reuse. Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.3 PROTECTION

- .1 Protect existing trees, fencing, landscaping, natural features, bench marks, buildings, pavement, surface and underground utility lines which are to remain as directed by Departmental Representative. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads.
- .3 Provide barriers for protection for personnel at safe limits from rock removal site.

END OF SECTION

PART 1 GENERAL1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ASTM D 698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
- .2 Ontario Provincial Standard Specification (OPSS):
 - .1 OPSS.MUNI 1004 (November 2013), Material Specification for Aggregates – Miscellaneous.
 - .2 OPSS.MUNI 1010 (November 2013), Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

1.2 RELATED REQUIREMENTS

- .1 Section 02 41 13 – Selective Site Demolition.
- .2 Section 26 05 43.01 – Installation of Cables in Trenches and Ducts.
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- .4 Section 31 23 33.01 – Excavating, Trenching and Backfilling.
- .5 Section 32 16 15 – Concrete Walks, Curbs and Gutters.
- .6 Section 32 91 19.13 – Topsoil Placement and Grading.
- .7 Section 32 93 10 – Trees, Shrubs and Ground Cover Planting.
- .8 Section 33 05 16 – Manholes and Catch Basin Structures.
- .9 Section 33 41 00 Storm Utility Drainage Piping.

1.3 REGULATIONS

- .1 Shore and brace excavations, protect slopes and banks, and perform all work in accordance with Provincial and Municipal regulations and geotechnical report recommendations, whichever is more stringent.

1.4 TESTS AND INSPECTIONS

- .1 Testing of materials and compaction of backfill and base material will be carried out by testing laboratory designated and paid for by the Departmental Representative.
- .2 Not later than one week before backfilling or filling, provide to designated testing agency, access for sampling.
- .3 Do not begin backfilling or filling operations until material has been approved for use by Departmental Representative.
- .4 Not later than 48 hours before backfilling or filling with approved material, notify Departmental Representative so that compaction tests can be carried out by designated testing agency.
- .5 Before commencing work, conduct, with Departmental Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

1.5 BURIED SERVICES

- .1 Before commencing work, establish the location of all buried services, existing and proposed, on and adjacent to the site.

1.6 PROTECTION

- .1 Protect excavations from freezing.
- .2 Keep excavations clean, free of standing water, and loose soil.
- .3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.
- .4 Protect buried services that are required to remain undisturbed.

1.7 EROSION AND SEDIMENT CONTROL

- .1 Prior to start of construction, install temporary silt fence barrier at south end of work site as per National Capital Commission Standard Drawing 830.1. Install silt fence barrier around stockpiles of excavated materials.
- .2 During construction, minimize the extent of disturbed areas, the duration of exposure and impacts to existing grading.
- .3 Protect disturbed areas from overland flow by providing temporary swales to the satisfaction of the Departmental Representative. Tie-in temporary swale to existing drainage system.

- .4 Provide temporary cover for bare earth areas consisting of seed and mulch it disturbed area will not be rehabilitated within 30 days.
- .5 Inspect silt fence and other sediment and erosion control measures weekly, and within 24 hours after each rainfall event. Clean and repair when necessary.
- .6 Control wind-blown dust by seeding topsoil piles.
- .7 Clean paved surfaces of sediment from vehicular traffic.
- .8 Provide mud mats of coarse granular material and all exits from the site to paved surfaces.
- .9 Retain all erosion and sediment control measures in place until all disturbed ground surfaces have been stabilized by paving or restoration of vegetative ground cover. Remove all erosion and sediment control measures following approval by the Departmental Representative.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 All imported materials to OPSS.MUNI 1004 and OPSS.MUNI 1010.

PART 3 EXECUTION

3.1 EXCAVATION

- .1 Excavate as required to carry out work, in all materials met. Follow recommendations of geotechnical report. Do not disturb soil or rock below sub-base surface except as directed. Notify Departmental Representative when excavations are complete.
- .2 Remove topsoil and organic stained soils down to the native undisturbed material or bedrock surface.
- .3 Employ an experienced contractor for rock removal. Services shall include a pre-construction survey, and vibration monitoring in accordance with City of Ottawa guidelines.
- .4 Excavate trenches to provide uniform continuous bearing and support for minimum of 200 mm thickness of pipe bedding material on bedrock. Trench widths below point 150 mm above pipe not to exceed diameter of pipe plus 600 mm.

3.2 GRADE RAISE

- .1 Areas to be raised shall be stripped of topsoil and other unsuitable material as designated by the Departmental Representative.
- .2 Fill required to raise grades to design elevations below paved surfaces shall be OPSS.MUNI 1010 Select Subgrade Material, placed and compacted in maximum 300 mm lifts to 95% of the Standard Proctor Maximum Dry Density.

3.3 BACKFILLING

- .1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by Departmental Representative. Proof roll subgrade with a steel drum roller under the observation of the Departmental Representative. Sub-excavate and replace any soft or spongy subgrade areas with approved fill materials.
- .2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .4 In sewer and water trenches:
 - .1 Over 300 mm above pipe to subgrade: OPSS.MUNI 1010 Select Subgrade Material, compacted to at least 95% of Standard Proctor maximum dry density. Requirements of the upper portion of the trench shall match those required for the sub-base and base of the associated surface finish.
 - .2 Provide transition zones in locations where services will be founded partly in bedrock and partly in overburden, under the direction of the Departmental Representative in accordance with geotechnical recommendations. Fill area excavated for the transition with Granular A material, compacted to 100% of the SPMDD.
- .5 In electrical conduit trenches:
 - .1 Pipe bedding and surround material: sand, as indicated, compacted to 95% standard Proctor maximum dry density.
 - .2 Between 300 mm above conduit and the subgrade: OPSS.MUNI 1010 Select Subgrade Material.
- .6 In excavations for catch basins and manholes:
 - .1 .1 Compacted granular material (Granular A) to at least 95% Standard Proctor maximum dry density, with a 3 horizontal to 1 vertical frost taper within the upper 1.2 m.
- .7 For planting: backfill in accordance with Section 32 93 10 – Trees, Shrubs and Ground Cover Planting.
 - .1 Compacted granular material (Granular A) to at least 95% Standard Proctor maximum dry density, with a 3 horizontal to

3.4 ROAD BASE STRUCTURE

- .1 As shown on contract drawings, compacted to 100% Standard Proctor maximum dry density. All existing topsoil and fill shall be removed from the subgrade prior to placement of the base. Where required, subgrade backfill shall consist of OPSS.MUNI 1010 Select Subgrade Material, placed in maximum 300 mm thick lifts, and compacted to at least 95% of Standard Proctor maximum dry density.

3.5 GRADING

- .1 Grade to elevations shown on the drawings. Grade to be gradual between finished spot elevations shown on drawings. Completed subgrade is to allow for future placement of 40mm thick asphalt surface course.

3.6 COMPACTION

- .1 Compact exposed subgrade to 95% Standard Proctor maximum dry density. Compact other materials as noted above.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
- .3 Apply water as necessary during compaction to obtain specified density.

3.7 TOLERANCES

- .1 Surface of subgrade to be within plus or minus 15 mm of specified elevation.

1. GENERAL

1.1 RELATED SECTIONS

- .1 Section 32 92 23 - Sodding.
- .2 Section 32 93 10 – Trees, Shrubs and Ground Cover Planting.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International).
 - .1 CSA G30.5-M1983 (R1998), Welded Steel Wire Fabric for Concrete Reinforcement.
- .2 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Fertilizers Act (R.S. 1985, c. F-10).
 - .3 Fertilizers Regulations (C.R.C., c. 666).
 - .4 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .3 Health Canada - Pest Management Regulatory Agency (PMRA).
 - .1 National Standard for Pesticide Education, Training and Certification in Canada (1995).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).

1.3 DEFINITION

- .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.

1.4 SUBMITTALS

- .1 Make submittals in accordance with Section 01 00 10 - General Instructions.
- .2 Submit monthly written reports on maintenance during warranty period, to Departmental Representative identifying:
 - .1 Maintenance work carried out.
 - .2 Development and condition of plant material.
 - .3 Preventative or corrective measures required which are outside Contractor's responsibility.

1.5 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

TREE AND SHRUB PRESERVATION

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 00 10 - General Instructions.

1.7 SCHEDULING

- .1 Obtain approval from Departmental Representative of schedule indicating beginning of Work.

1.8 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance by Departmental Representative to end of warranty period, perform following maintenance operations.
- .2 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
- .3 Apply pesticides in accordance with National Standard for Pesticide Education, Training and Certification in Canada, Federal, Provincial and Municipal regulations as and when required to control insects, fungus and disease. Obtain product approval from Departmental Representative prior to application.
- .4 Apply fertilizer in early spring at rate of 0.025 kg of nitrogen/m².
- .5 Remove dead, broken or hazardous branches from plant material. Dispose of debris through alternative disposal.

2. PRODUCTS

2.1 MATERIALS

- .1 Fill:
 - .1 Type (A): clean, natural river sand and gravel material, free from silt, clay, loam, friable or soluble materials and organic matter.
 - .2 Type (B): excavated pervious soil, free from roots, rocks larger than 75 mm, building debris, and toxic ingredients (salt, oil, etc). Excavated material shall be approved by Departmental Representative before use as fill.
- .2 Coarse washed stones: 35-75mm diameter clean round hard stone.
- .3 Peatmoss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded minimum particle size: 5mm.
- .4 Fertilizer:
 - .1 To Canada Fertilizer Act and Fertilizers Regulations.

TREE AND SHRUB PRESERVATION

- .2 Complete, commercial, slow release with 35% of nitrogen content in water-insoluble form.
- .5 Anti-desiccant: commercial, wax-like emulsion.
- .6 Filter Cloth:
 - .1 Type 1: 100 % non-woven needle punched polyester, 2.75 mm thick, 240 g/m² mass.
 - .2 Type 2: biodegradable burlap.
- .7 Wood posts: 38 x 89 x 2400mm length, untreated wood.
- .8 Welded wire fabric (WWF): 100 x 100mm, MW 15 x MW 15, to CSA G30.5.

PART 3 EXECUTION**3.1 IDENTIFICATION AND PROTECTION**

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Identify plants and limits of root systems to be preserved as approved by Departmental Representative.
- .3 Protect plant and root systems from damage, compaction and contamination resulting from construction as approved by Departmental Representative.
- .4 Ensure no pruning is done inside drip line. If pruning inside drip line is required consult an arborist or Canadian Certified Horticultural Technician (CCHT) as approved by Departmental Representative.

3.2 TREE PROTECTION FENCING

- .1 Erect tree protection fencing as indicated on landscape drawings.

3.3 SOIL AND ROOT ZONE PROTECTION

- .1 Where equipment and pedestrian access within the dripline is unavoidable, protect critical root zone from compaction as indicated on landscape details.

3.4 ROOT PRUNING TECHNIQUE

- .1 Where trenching and excavation within the dripline / critical root zone is unavoidable, pruning roots as indicated on landscape details.
- .2 Backfill trench / excavation immediately after root pruning and associated work are complete to avoid desiccation.
- .3 If trench / excavation is to be left exposed for a period of time exceeding 24hrs, cover the exposed wall with 2 layers of burlap. Maintain burlap in moist condition to the

satisfaction of the Departmental Representative.

END OF SECTION

PART 1 GENERAL1.1 REFERENCES

- .1 ASTM International
 - .1 ASTM C88-05, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
 - .2 ASTM C117-04, Standard Test Method for Material Finer Than 0.075 (No. 200) mm Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C123-04, Standard Test Method for Lightweight Particles in Aggregate.
 - .4 ASTM C127-07, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - .5 ASTM C128-07a, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
 - .6 ASTM C131-06, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
 - .7 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .8 ASTM D698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).
 - .9 ASTM D995-95b(2002), Standard Specification for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
 - .10 ASTM D1559-89, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
 - .11 ASTM D2419-09, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 - .12 ASTM D3203-05, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
 - .13 ASTM D4318-10, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - .14 ASTM D4791-10, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 Asphalt Institute (AI)
 - .1 AI MS-2-94, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
- .4 Ontario Provincial Standard Specification (OPSS):
 - .1 OPSS.MUNI 1004 (November 2013), Material Specification for Aggregates – Miscellaneous.

- .2 OPSS.MUNI 1010 (November 2013), Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt paving mix and aggregate, and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Samples:
 - .1 Submit asphalt concrete mix design for review.
 - .2 Inform Departmental Representative of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work.
- .3 Test and Evaluation Reports:
 - .1 Materials to be tested by accredited testing laboratory accepted by Departmental Representative.
 - .2 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Granular base to OPSS.MUNI 1010 Granular A. Granular sub-base to OPSS.MUNI 1010 Granular B Type II.
- .2 Asphalt concrete aggregates: to OPSS.MUNI 1004.
 - .1 Asphalt cement: to PG 58-34 or better.

2.2 EQUIPMENT

- .1 Pavers: mechanical self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.

- .3 Vibratory rollers for parking lots and driveways:
 - .1 Minimum drum diameter: 750mm.
 - .2 Maximum amplitude of vibration (machine setting): 0.5mm for lifts less than 40 mm thick.
- .4 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
 - .1 Boxes with tight metal bottoms.
 - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
 - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .5 Suitable hand tools.

2.3 MIX DESIGN

- .1 Job mix formula to be approved by Departmental Representative.
- .2 Design of mix to comply with requirements for HL3 for the surface course, and HL8 for the base courses.
 - .1 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula to be reviewed by Departmental Representative.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied.
- .2 Verify grades of items set in paving area for conformity with elevations and sections before placing granular sub-base and base material.
- .3 Obtain written approval of subgrade by Departmental Representative before placing granular sub-base and base.

3.2 GRANULAR SUB-BASE AND GRANULAR BASE

- .1 Place granular base and sub-base material on clean unfrozen surface, free from snow and ice.
- .2 Place granular sub-base and base to compacted thicknesses as indicated. Do not place frozen material.
- .3 Place in layers not exceeding 150mm compacted thickness. Compact to density not less than 100% maximum dry density in accordance with ASTM D698.
- .4 Finished base surface to be within 10mm of specified grade, but not uniformly high or low.

3.3 ASPHALT CONCRETE PAVING

- .1 Obtain written approval of base from Departmental Representative before placing asphalt mix.
- .2 Place asphalt mix only when base or previous course is dry and air temperature is above 5 degrees C and rising.
- .3 Place asphalt concrete in compacted layers not exceeding 65 mm.
- .4 Minimum 135 degrees C mix temperature required when spreading.
- .5 Maximum 160 degrees C mix temperature permitted at any time.
- .6 Compact each course with roller as soon as it can support roller weight without undue cracking or displacement.
- .7 Compact parking lot and access road asphaltic concrete to density not less than 97% of density obtained with Marshall specimens prepared in accordance with ASTM D1559 from samples of mix being used. Roll until roller marks are eliminated.
- .8 Keep roller speed slow enough to avoid mix displacement and do not stop roller on fresh pavement.
- .9 Moisten roller wheels with water to prevent pick up of material.
- .10 Compact mix with hot tampers or other equipment approved in writing by Departmental Representative in areas inaccessible to roller.
- .11 Finish surface to be within 10mm of design elevation and with no irregularities greater than 10mm in 4.5m.
- .12 Repair areas showing checking, rippling or segregation as directed by Departmental Representative.

- .13 Surface course of asphaltic concrete for new parking lot and new access roads will be placed in a future contract. Asphalt reinstatement for pavement cuts in existing roads requires that both base and surface courses be placed. Provide temporary asphalt ramp at junction where new base course asphalt surface meets with surface at final elevation.

3.4 JOINTS

- .1 Remove surplus material from surface of previously laid strip. Do not deposit on surface of freshly laid strip.
- .2 Paint contact surfaces of existing structures such as manholes, curbs or gutters with bituminous material prior to placing adjacent pavement.
- .3 For cold joints, cut back to full depth vertical face and tack face with hot asphalt.
- .4 For longitudinal joints, overlap previously laid strip with spreader by 25 to 50mm.

3.5 TESTING

- .1 Inspection and testing of asphalt pavement will be carried out by designated testing laboratory.
- .2 Costs of tests will be paid by Departmental Representative. Repeated testing required as a result of Contractor failing to meet the contract requirements will be at the expense of the Contractor.

3.6 CLEANING

- .1 Progress Cleaning: Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
- .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 35 degrees C.
- .1 Do not permit stationary loads on pavement until 24 hours after placement.
- .2 Provide access to buildings as required.
- .1 Arrange paving schedule so as not to interfere with normal use of premises except as permitted in writing by the Departmental Representative.

END OF SECTION

1. GENERAL

1.1 REFERENCE STANDARDS

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C 136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .2 ASTM C 979-99, Standard Specification for Pigments for Integrally Colored Concrete.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA A23.1/A23.2-00, Concrete Materials and Methods of Concrete Construction/Method of Test for Concrete.
 - .2 CSA A179-94, Mortar and Grout for Unit Masonry.
 - .3 CSA-A231.2-95, Precast Concrete Pavers.
 - .4 CSA-CAN3.A231.2 Precast Concrete Pavers.
 - .5 CSA A283-00, Qualification Code for Concrete Testing Laboratories.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit following sampling and testing data:
 - .1 Sieve analysis for gradation of bedding and joint material.
 - .2 Unit paver sampling and testing.
- .2 Samples:
 - .1 Submit full size sample of each type and size pavers.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company or person specializing in precast concrete paver installations with 5 years documented experience.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Mock-ups:
 - .1 Install 6 x 6 m area mock-up.
 - .2 Mock-up will be used:
 - .1 To judge workmanship, operation of equipment and material application.
 - .2 To determine surcharge of bedding layer, joint sizes, lines, laying patterns, colours and texture.
 - .3 For testing to determine compliance with performance requirements.
 - .4 Allow 24 hours for inspection of mock-up before proceeding with work.
 - .5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

- .5 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal, paper, plastic, polystyrene, corrugated cardboard, pallets and other packaging material in appropriate on-site containers for recycling in accordance with Waste Management Plan.
- .4 Unused metal materials are to be diverted from landfill to a metal recycling facility as approved by Departmental Representative.
- .5 Unused or damaged masonry materials must be diverted from landfill to a local facility as approved by Departmental Representative.

2. PRODUCTS

2.1 CONCRETE PAVERS

- .1 Concrete pavers: to CSA-CAN3.A231.2 and as follows:
 - .1 Type 1 Paver:
 - .1 Permeable pavers.
 - .2 Nominal dimensions: 100mm x 200mm x 80mm, including a 4mm joint.
 - .3 38 MPa compressive strength (min. at 14 days), 2200 kg/m3 (min.) dry density.
 - .4 Natural (grey) colour, smooth finish, or approved equivalent.
 - .5 Install in herringbone pattern with single, stacked soldier course at all outer edges of the field.
 - .2 Manufactured in molds, with spacers, suitable for installation and delivered on site in cubes of laying panels, in protective wrapping.
 - .3 Pigment in concrete pavers: to ASTM C 979.

2.2 BEDDING AND JOINT MATERIAL

- .1 Bedding and joint sand: clean, non-plastic, free from deleterious or foreign matter, natural or manufactured from crushed rock or gravel. Do not use limestone screenings or stone dust.
- .2 Gradation: to CSA-A23.1, Table 4 - Grading Limits for Fine Aggregate, and CSA A179 as follows:

Sieve Designation	% Passing for Bedding Sand	% Passing for Joint Sand
10 mm	100	
5 mm	95-100	100
2.5 mm	80-100	95-100
1.25 mm	50-90	60-100

PRECAST CONCRETE UNIT PAVING

Sieve Designation	% Passing for Bedding Sand	% Passing for Joint Sand
630 microns	25-65	
600 microns		35-80
315 microns	10-35	
300 microns		15-20
160 microns	2-10	
150 microns		2-15

2.3 EDGE RESTRAINTS

- .1 Edge restraints shall be manufactured for use in paver installations.
 - .1 Aluminum paver restraint (4.8mm x 41mm), installed per manufacturer's specifications.
 - .2 Anchoring per manufacturer's specifications at 305mm on center.

3. EXECUTION**3.1 MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 STRUCTURAL SURFACE

- .1 Verify that structural surfaces conform to levels and compaction required for installation of unit pavers. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Verify that top of structural surface (top of base) does not exceed plus or minus 10 mm of grade over 3 m straightedge.
- .3 Ensure that structural surface is not frozen or standing water is present during installation.

3.3 INSTALLATION OF EDGE RESTRAINT

- .1 Install restraints true to grade, directly atop structural surface and in accordance with manufacturer's recommendations.

3.4 PLACING OF BEDDING MATERIAL

- .1 Ensure bedding material is not saturated or frozen at all times until installation is complete.
- .2 Spread and screed material on structural surface to achieve 25 mm compacted thickness after vibrating pavers in place. Do not use joint sand for bedding sand.
- .3 Do not disturb screeded material. Do not use bedding material to fill depressions in structural surface.

3.5 INSTALLATION OF CONCRETE PAVERS

- .1 Lay pavers to patterns indicated. Joints between pavers: as recommended by manufacturer.
- .2 Use appropriate end, edge and corner stones. Saw cut pavers to fit around obstructions and at abutting structures.
- .3 Installation by mechanical equipment:
 - .1 Prepare installation sequence and obtain approval of sequence by Departmental Representative.
 - .2 Place paver pallets and other materials without exceeding load bearing capacity, or otherwise detrimentally affecting installations.
 - .3 Run equipment approved for installation only on paving surfaces vibrated in place.
 - .4 Complete installation after placing each 100 square metres.
 - .5 Inspect pavers and remove chipped, broken or otherwise damaged pavers as directed by Departmental Representative.
 - .6 Replace pavers removed without altering layout and structural quality.
- .4 Use a low amplitude, high frequency plate compactor capable of at least 22 kN centrifugal compaction force to vibrate pavers into bedding sand.
- .5 Inspect, remove, and replace chipped, broken and damaged pavers.
- .6 Sweep dry joint sand material into joints.
- .7 Settle sand by vibrating pavers with plate compactor.
- .8 Continue application of joint material and vibrating of pavers until joints are full. Do not vibrate within 1 m of unrestrained edges of pavers.
- .9 Complete installation to within 1 m of laying face, with sand-filled joints, at completion of each work day.
- .10 Sweep off excess joint material when installation is complete.
- .11 Final surface elevations not to exceed plus or minus 10 mm under 3 m long straightedge.
- .12 Surface elevation of pavers: 3 to 4 mm above adjacent drainage inlets, concrete collars or channels.
- .13 Ensure conformance of final elevations.

3.6 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 GENERAL1.1 RELATED REQUIREMENTS

- .1 Section 31 05 16 – Aggregate Materials.
- .2 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.2 REFERENCE STANDARDS

- .1 ASTM International
 - .1 ASTM D698-00ae1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m³).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
- .3 City of Ottawa S.P. F-3512 – Tactile Walking Surface Indicators.
- .4 Ontario Provincial Standard Specification (OPSS):
 - .1 OPSS.MUNI 353 (November 2016), Concrete Curb and Gutter Systems.
 - .2 OPSS.MUNI 1010 (November 2013), Material Specification for Aggregates – Base, Subbase, Select Subgrade, and Backfill Material. .

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Inform Departmental Representative of proposed source of materials and provide access for sampling at least 3 weeks prior to commencing work.
- .2 If materials have been tested by accredited testing laboratory testing laboratory within previous 6 months and have passed tests equal to requirements of this specification, submit test certificates from testing laboratory showing suitability of materials for this project.
- .3 Test and Evaluation Reports:
 - .1 Materials to be tested by accredited testing laboratory accepted by Departmental Representative.
 - .2 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

PART 2 PRODUCTS**2.1 MATERIALS**

- .1 Granular base material: to OPSS.MUNI 1010 Granular A.
- .2 Concrete mixes and materials: in accordance with OPSS.MUNI 353.
- .3 Reinforcing steel: in accordance with Section 03 20 00- Concrete Reinforcing.
- .4 Joint filler and Curing Compound: in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .5 Non-staining mineral type form release agent: chemically active release agents containing compounds that react with free lime to provide water-soluble soap.
- .6 Fill material: to Section 31 05 16- Aggregate Materials.
- .7 Tactile Walking Surface Indicators: Conform to City of Ottawa S.P. F-3512.
- .8 Concrete mix formula to be approved by Departmental Representative.

PART 3 EXECUTION**3.1 GRADE PREPARATION**

- .1 Do grade preparation work in accordance with Section 31 23 33.01- Excavating, Trenching and Backfilling.
- .2 Construct embankments using excavated material free from organic matter or other objectionable materials.
 - .1 Dispose of surplus and unsuitable excavated material off site.
- .3 Place fill in maximum 150mm layers and compact to at least 95% of maximum dry density to ASTM D698.
- .4 Obtain written approval of subgrade by Departmental Representative before placing granular sub-base and base.

3.2 GRANULAR BASE

- .1 Place granular base on clean unfrozen surface, free from snow and ice.

- .2 Place granular base to compacted thicknesses as indicated. Do not place frozen material.
- .3 Place in layers not exceeding 150mm compacted thickness. Compact to density not less than 97% maximum dry density in accordance with ASTM D698. Minimum required thickness of granular base to be 150mm.
- .4 Finished base surface to be within 10mm of specified grade, but not uniformly high or low.

3.3 CONCRETE

- .1 Obtain Departmental Representative's approval of granular base and reinforcing steel prior to placing concrete.
- .2 Do concrete work in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .3 Immediately after floating, give sidewalk surface uniform broom finish to produce regular corrugations not exceeding 2mm deep, by drawing broom in direction normal to centre line.
- .4 Provide edging as indicated with 10mm radius edging tool.
- .5 Slip-form pavers equipped with string line system for line and grade control may be used if quality of work acceptable to Departmental Representative can be demonstrated. Hand finish surfaces when directed by Departmental Representative.
- .6 Finish surfaces to within 3mm in 3 m as measured with 3m straightedge placed on surface.

3.4 EXPANSION, CONTRACTION AND ISOLATION JOINTS

- .1 Install tooled transverse contraction joints in sidewalks after floating, when concrete is stiff, but still plastic, at intervals of 2m.
- .2 Install expansion joints as directed by Departmental Representative at intervals of 6 m.
- .3 When sidewalk is adjacent to curb, make joints of curb, gutters and sidewalk coincide.
- .4 Install isolation joints around manholes and catch basins and along length adjacent to concrete curbs, catch basins, buildings, or permanent structure.
- .5 Install joint filler in isolation joints in accordance with BNQ 1809-500 – Concrete Sidewalks and Curbs.

3.5 TACTILE WALKING SURFACE INDICATORS

- .1 Install Tactile Walking Surface Indicators as indicated in City of Ottawa SP F-3512.

3.6 CURING

- .1 Cure concrete by adding moisture continuously in accordance with CSA-A23.1/A23.2 to exposed finished surfaces for at least 1 day after placing, or sealing moisture in by curing compound as directed by Departmental Representative.
- .2 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
- .3 Apply curing compound evenly to form continuous film, in accordance with manufacturer's requirements.

3.7 CLEANING

- .1 Progress Cleaning: Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.8 BACKFILLING

- .1 Allow concrete to cure for 7 days prior to backfilling.
- .2 Backfill to designated elevations with material as directed by Departmental Representative.
 - .1 Compact and shape to required contours as indicated.

END OF SECTION

PART 1 GENERAL1.1 RELATED REQUIREMENTS

- .1 Section 32 12 16.02 – Asphalt Paving for Building Sites.

1.2 REFERENCE STANDARDS

- .1 Environment Canada (EC)
 - .1 Volatile Organic Compound (VOC) Concentration Limits for Architectural Coatings Regulations, SOR/2009-264.
- .2 Green Seal (GS)
 - .1 GS-11-2013, Standard for Paints and Coatings.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual - current edition.
 - .1 MPI #32 Traffic Markings Paint, Alkyd.
- .5 Ontario Provincial Standard Specification (OPSS):
 - .1 OPSS 710 (November 2010), Pavement Marking.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for pavement markings and include product characteristics, performance criteria, physical size, finish and limitations.
 - .2 Submit 2 copies of WHMIS MSDS.
- .2 Samples:
 - .1 Submit to Departmental Representative following material sample quantities at least 4weeks prior to commencing work.
 - .1 One 1L samples of each type of paint.
 - .2 Sampling to MPI Painting Manual.
 - .2 Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, MPI specification number and formulation number and batch number.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect specified materials from nicks, scratches, and blemishes.
 - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: remove for reuse and recycling.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Paint and Markings:
 - .1 To MPI #32, Alkyd zone/traffic marking.
 - .2 Traffic Marking Coatings: maximum VOC limit 450g/L to SOR/2009-264.
 - .3 Paints: in accordance with MPI recommendation for surface conditions.
 - .4 Colour: to MPI listed, white.
- .2 Thinner: to MPI listed manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrates and surfaces to receive pavement markings previously installed under other Sections or Contracts are acceptable for product installation in accordance with MPI instructions prior to pavement markings installation.
 - .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Pavement surface: dry, free from water, frost, ice, dust, oil, grease and other deleterious materials.
- .3 Proceed with Work only after unacceptable conditions have been rectified.

3.2 EQUIPMENT REQUIREMENTS

- .1 Paint applicator: approved pressure type with positive shut-off distributor capable of applying paint in single, double and dashed lines and capable of applying marking components uniformly, at rates specified, and to dimensions as indicated.

3.3 TRAFFIC CONTROL

- .1 Coordinate timing of application with Departmental Representative and arrange for barricades and necessary signs to protect Work during application and drying periods.

3.4 APPLICATION

- .1 Pavement markings: lay out as indicated on site plan.
- .2 Unless otherwise approved by Departmental Representative, apply paint only when air temperature is above 10 degrees C, wind speed is less than 60km/h and no rain is forecast within next 6 hours.
- .3 Apply traffic paint evenly at rate of 3m²/L.
- .4 Do not thin paint unless approved by Departmental Representative.
- .5 Symbols and letters to dimensions indicated.
- .6 Paint lines of uniform colour and density with sharp edges.
- .7 Thoroughly clean distributor tank before refilling with paint of different colour.

3.5 TOLERANCE

- .1 Paint markings: within plus or minus 12mm of dimensions indicated.
- .2 Remove incorrect markings by grinding without damage to underlying pavement.

3.6 CLEANING

- .1 Progress Cleaning: Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.
- .3 Waste Management: separate waste materials for reuse and recycling.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

3.7 PROTECTION

- .1 Protect pavement markings until dry.
- .2 Repair damage to adjacent materials caused by pavement marking application.

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 00 10 - General Instructions

1.2 ACTION AT INFORMATIONAL SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 01 00 10 - General Instructions.
- .2 Indicate dimensions, sizes, assembly, anchorage and installation details for each furnishing specified.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 00 10 - General Instructions.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .4 Separate for recycling and place in designated containers Steel, Metal and Plastic waste in accordance with Waste Management Plan.
- .5 Fold up metal banding, flatten and place in designated area for recycling.

2. PRODUCTS

2.1 BENCH

- .1 Two-leg, surface-mount model with concealed anchoring system.
- .2 Backed model with end and centre arms.
- .3 Frame, legs and arms to be anodized aluminum.
- .4 Seat and back to be unfinished ipe wood. Seat to be 5 equally sized members and back to be 3 equally sized members.
- .5 Dimensions: 588mm deep x 2400mm long x 834mm high, 178mm wide legs, 127mm wide arms and 440mm seat height.

2.2 LITTER RECEPTACLE

- .1 Single unit with fixed hood style cover, surface-mount model with concealed anchoring system.

- .2 Roto-molded bin with min. 68 litre capacity and 254mm top opening, lift handles, bag hanger and integrated lock.
- .3 Frame to be anodized aluminum.
- .4 Dimensions: 336mm deep x 361mm long x 1184mm high.

3. EXECUTION

3.1 INSTALLATION

- .1 Assemble furnishings as per manufacturer's directions.
- .2 Take measures to ensure that the finish is not damaged during handling, assembly and placement.
- .3 Placement as shown on drawings.
- .4 Mount benches with (4) 5/8-11 threaded anchors and litter receptacles with (2) 1/2-13 anchor bolts to unit pavers or concrete surface per manufacturer's directions.
- .5 Should scratches of finish occur consult with manufacturer for touch-up procedure.

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 00 10 - General Instructions
- .2 Section 01 71 00 – Examination and Preparation

1.2 DEFINITIONS

- .1 **COMPOST:** A mixture of soil and decomposing organic matter used as a fertilizer, mulch, or soil conditioner. Compost is processed organic matter containing 40% or more organic matter as determined by the Walkley-Black or LOI test. Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)), and contain no toxic or growth inhibiting contaminants. Composed bio-solids must meet the requirements of the Guidelines for Compost Quality, Category (A) (B) produced by the Canadian Council of the Ministers of the Environment (CCME), January 1996.

1.3 QUALITY ASSURANCE

- .1 **Test Reports:** certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 **Pre-Installation Meetings:** conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements. Comply with Section 01 71 00 – Examination and Preparation.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 00 10 - General Instructions.
- .2 Divert unused soil amendments from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

2. PRODUCTS

2.1 TOPSOIL

- .1 **Topsoil for seeded areas:** mixture of particulates, microorganisms and organic matter which provides suitable medium for supporting intended plant growth.
 - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70% sand, minimum 7% clay, and contain 2 to 10% organic matter by weight.
 - .2 Contain no toxic elements or growth inhibiting materials.
 - .3 Finished surface free from:

TOPSOIL PLACEMENT AND GRADING

- .1 Debris and stones over 50 mm diameter.
- .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
- .4 Consistence: friable when moist.

2.2 SOIL AMENDMENTS

- .1 Fertilizer:
 - .1 Fertility: major soil nutrients present in following amounts:
 - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
 - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
 - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
 - .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
 - .6 Ph value: 6.5 to 7.5.
- .2 Peat Moss:
 - .1 Derived from partially decomposed species of Sphagnum Mosses.
 - .2 Elastic and homogeneous, brown in colour.
 - .3 Free of wood and deleterious material which could prohibit growth.
 - .4 Shredded particle minimum size: 5mm.
- .3 Sand: washed coarse silica sand, medium to course textured.
- .4 Organic matter: compost Category A, unprocessed organic matter, such as rotted manure, hay, straw, bark residue or sawdust, meeting the organic matter, stability and contaminant requirements.
- .5 Use composts meeting Category B requirements for land fill reclamation and large scale industrial applications.
- .6 Limestone:
 - .1 Ground agricultural limestone.
 - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .7 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

2.3 SOURCE QUALITY CONTROL

- .1 Advise Departmental Representative of sources of topsoil to be utilized with sufficient lead time for testing.
- .2 Contractor is responsible for amendments to supply topsoil as specified.
- .3 Soil testing by recognized testing facility for PH, P and K, and organic matter.
- .4 Testing of topsoil will be carried out by testing laboratory designated by Departmental Representative. Soil sampling, testing and analysis to be in accordance with Provincial

standards. Departmental Representative will pay for cost of tests.

3. EXECUTION

3.1 PREPARATION OF EXISTING GRADE

- .1 Verify that grades are correct. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Remove debris, roots, branches, stones in excess of 25mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 25 mm above surface. Dispose of removed material off site.
- .4 Cultivate entire area which is to receive topsoil to minimum depth of 100mm. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.2 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

- .1 Place topsoil after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 For sodded areas keep topsoil 15mm below finished grade.
- .4 Spread topsoil to minimum depths as indicated on drawings after settlement.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.

3.3 FINISH GRADING

- .1 Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.
- .2 Consolidate topsoil to required bulk density using equipment approved by Departmental Representative. Leave surfaces smooth, uniform and firm against deep footprinting.

3.4 ACCEPTANCE

- .1 Departmental Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading.

3.5 SURPLUS MATERIAL

- .1 Dispose of materials except topsoil not required where directed by Departmental Representative off site.

3.6 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

SODDING

1. GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 32 91 19.13 – Topsoil Placement and Grading.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Samples.
 - .1 Submit:
 - .1 Sod for each type specified.
 - .2 Install approved samples in one square meter mock-ups and maintain in accordance with maintenance requirements during establishment period.
 - 2. Bio-degradable geotextile fabric.
- .2 Obtain approval of samples by Departmental Representative.

1.3 QUALITY ASSURANCE

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements. An RTF SOD CERTIFICATE from the RTF Turf Producers Association is to be provided.
- .3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.4 SCHEDULING

- .1 Schedule sod laying to coincide with preparation of soil surface.
- .2 Schedule sod installation when frost is not present in ground.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials.
- .2 Divert unused fertilizer from landfill to official hazardous material collections site approved by Departmental Representative.
- .3 Do not dispose of unused fertilizer into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

SODDING

2. PRODUCTS

2.1 MATERIALS

- .1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.
 - .1 Turf Grass Nursery Sod type:
 - .1 Rhizomatus Tall Fescue (RTF), as produced by a member of the RTF Turf Producers Association.
 - .2 Turf Grass Nursery Sod quality:
 - .1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.
 - .2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 75 mm.
 - .3 Mowing height limit: 50 to 75 mm.
 - .4 Soil portion of sod: 6 to 15 mm in thickness.
- .2 Sod establishment support:
 - .1 Geotextile fabric: biodegradable, square mesh.
 - .2 Biodegradable starch pegs: 17 x 8 x 200 mm.
- .3 Water:
 - .1 Free of impurities that would inhibit plant growth.
- .4 Fertilizer:
 - .1 To Canada "Fertilizers Act" and "Fertilizers Regulations".
 - .2 Complete, synthetic, slow release with 65 % of nitrogen content in water-insoluble form.

2.2 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative of sod at source.
- .2 When proposed source of sod is approved, use no other source without written authorization from Departmental Representative.

3. EXECUTION

3.1 PREPARATION

- .1 Verify that grades are correct and prepared in accordance with Section 91 19.13 – Topsoil Placement and Grading. If discrepancies occur, notify Departmental Representative and do not commence work until instructed.
- .2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.
- .3 Fine grade surface free of humps and hollows to smooth, even grade, elevations indicated, to tolerance of plus or minus 8 mm, surface to drain naturally.

SODDING

- .4 Remove and dispose of weeds; debris; stones 50 mm in diameter and larger; soil contaminated by oil, gasoline and other deleterious materials; off site as directed by Departmental Representative.

3.2 SOD PLACEMENT

- .1 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.
- .2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.
- .3 Roll sod as directed by Departmental Representative. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

3.3 SOD PLACEMENT ON SLOPES AND PEGGING

- .1 Install and secure geotextile fabric in areas indicated, in accordance with manufacturer's instructions.
- .2 Start laying sod at bottom of slopes.
- .3 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to following pattern:
 - .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
 - .2 Not less than 3 pegs per square metre.
 - .3 Not less than 6 pegs per square metre in drainage structures. Adjust pattern as directed by Departmental Representative.
 - .4 Drive pegs to 20 mm above soil surface of sod sections.

3.4 FERTILIZING PROGRAM

- .1 Fertilize during establishment period as directed by Departmental Representative.

3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following operations from time of installation until acceptance.
- .2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.
- .3 Cut grass to 75 mm when or prior to it reaching height of 100 mm. Remove clippings which will smother grassed areas as directed by Departmental Representative.
- .4 Maintain sodded areas weed free 95%.
- .5 Fertilize areas in as directed by Departmental Representative. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

SODDING

3.6 ACCEPTANCE

- .1 Turf Grass Nursery Sod areas will be accepted by Departmental Representative provided that:
 - .1 Sodded areas are properly established.
 - .2 Sod is free of bare and dead spots.
 - .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 75 mm.
 - .4 Sodded areas have been cut minimum 2 times prior to acceptance.
- .2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

3.7 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

1. GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 00 10 - General Instructions
- .2 Section 01 35 29.06 - Health and Safety Requirements
- .3 Section 32 91 19.13 - Topsoil Placement and Grading.

1.2 REFERENCES

- .1 Agriculture and Agri-Food Canada (AAFC).
 - .1 Plant Hardiness Zones in Canada-2000.
- .2 Canadian Nursery Landscape Association (CNLA).
 - .1 Canadian Standards for Nursery Stock-2001.
- .3 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
 - .2 Transportation of Dangerous Goods Act (TDGA), 1992, c.34.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).

1.3 DEFINITIONS

- .1 Mycorrhiza: association between fungus and roots of plants. This symbiosis, enhances plant establishment in newly landscaped and imported soils.

1.4 SUBMITTALS

- .1 Make submittals in accordance with Section 01 00 10 - General Instructions.
- .2 Submit product data for:
 - .1 Fertilizer.
 - .2 Mycorrhiza.
 - .3 Anti-desiccant.
 - .4 Guying assembly including clamps, collar, guying wire, anchors and wire tightener.
 - .5 Mulch and Tackifier.
- .3 Submit WHMIS MSDS for review.
- .4 Submit samples for:
 - .1 Mulch and Tackifier.
 - .2 Mycorrhiza.

1.5 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.6 STORAGE AND PROTECTION

- .1 Protect plant material from frost, excessive heat, wind and sun during delivery.
- .2 Immediately store and protect plant material which will not be installed within 1 hour after arrival at site in storage location approved by Departmental Representative.
- .3 Protect plant material from damage during transportation:
 - .1 When delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.
 - .2 When delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.
 - .3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.
- .4 Protect stored plant material from frost, wind and sun and as follows:
 - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in sand or topsoil, or mulch and watering to full depth of root zone.
 - .2 For pots and containers, maintain moisture level in containers. Heel-in fibre pots.
 - .3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.
- .5 Safely store and manage hazardous materials.
- .6 Waste Management and Disposal:
 - .1 Separate waste materials for reuse and recycling in accordance with Section 01 00 10 - General Instructions.
 - .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - .3 Collect and separate for disposal paper plastic polystyrene corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).
 - .4 Separate for reuse and recycling and place in designated containers Steel Metal Plastic waste in accordance with WMP.
 - .5 Place materials defined as hazardous or toxic in designated containers.
 - .6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
 - .7 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.
 - .8 Fold up metal and plastic banding, flatten and place in designated area for recycling.
 - .9 Divert discarded plastic plant containers materials from landfill to plastic recycling facility approved by Departmental Representative.
 - .10 Dispose of unused fertilizer at official hazardous material collection site approved by Departmental Representative.

- .11 Dispose of unused anti-desiccant at official hazardous material collections site approved by Departmental Representative.
- .12 Divert unused wood and mulch materials from landfill to recycling composting facility approved by Departmental Representative.

1.7 SCHEDULING

- .1 Obtain approval from Departmental Representative of schedule 7 days in advance of shipment of plant material.
- .2 Schedule to include:
 - .1 Quantity and type of plant material.
 - .2 Shipping dates.
 - .3 Arrival dates on site.
 - .4 Planting Dates.

1.8 WARRANTY

- .1 End-of-warranty inspection will be conducted by Departmental Representative, one year from interim completion date.

2. PRODUCTS

2.1 PLANT MATERIAL

- .1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock.
 - .1 Source of plant material: grown in Zone 5 in accordance with Plant Hardiness Zones in Canada.
 - .2 Plant material must be planted in zone indicated as appropriate for its species.
 - .3 Plant material in location appropriate for its species.
- .2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.
- .3 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.
- .4 Trees larger than 200mm in caliper: half root pruned during each of two successive growing seasons, the latter at least one growing season prior to arrival on site.
- .5 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.
- .6 Collected stock: maximum 40 mm in caliper, with well developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.

2.2 WATER

- .1 Free of impurities that would inhibit plant growth.

2.3 STAKES

- .1 T-bar, steel, 40 x 40 x 5 x 2440 mm.

2.4 WIRE TIGHTENER

- .1 Type 1: galvanized steel, stamped plate type, rod, triangular shape.
- .2 Type 2: turnbuckle, galvanized steel, 9.5mm diameter with 270mm open length.

2.5 GUYING WIRE

- .1 Type 1: steel, 3mm wire.
- .2 Type 2: 1.5mm diameter multi-wire steel cable.
- .3 Type 3: 3mm diameter multi-wire steel cable.

2.6 CLAMPS

- .1 U-bolt: galvanized, 13mm diameter, c/w curved retaining bar and hex nuts.
- .2 Crimp type.

2.7 GUYING COLLAR

- .1 Tube: plastic, 13mm diameter, nylon reinforced.

2.8 TRUNK PROTECTION

- .1 Wire mesh: galvanized, electrically welded 1.4mm wire with 25 x 25mm mesh and fastener.
- .2 Plastic: perforated spiraled strip.
- .3 Burlap: clean, minimum 2.5 kg/m² mass and 150 mm wide, and twine fastener.
- .4 Tar impregnated crepe paper and twine fastener.

2.9 MULCH AND TACKIFIER

- .1 Mulch: Finely shredded Pine mulch, pre-blended with tackifier.
- .2 Tackifier: Organic, bio-degradeable, water-soluble, pre-blended with mulch.

2.10 FERTILIZER

- .1 Synthetic commercial type as recommended by soil test report.
- .2 Add mycorrhiza during planting operation. It is important that new root growth be in contact with mycorrhiza. Use as recommended by manufacturer.

2.11 ANTI-DESICCANT

- .1 Wax-like emulsion.

2.12 FLAGGING TAPE

- .1 Fluorescent, orange colour.

2.13 SOURCE QUALITY CONTROL

- .1 Obtain approval from Departmental Representative of plant material prior to planting.
- .2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial regulations.

3. EXECUTION

3.1 PRE-PLANTING PREPARATION

- .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- .2 Ensure plant material acceptable to Departmental Representative.
- .3 Remove damaged roots and branches from plant material.
- .4 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

3.2 EXCAVATION AND PREPARATION OF PLANTING BEDS

- .1 Preparation of planting beds is specified in Section 32 91 19.13 - Topsoil Placement and Grading.
- .2 For individual planting holes:
 - .1 Stake out location and obtain approval from Departmental Representative prior to excavating.
 - .2 Excavate bed rock to depth and width as indicated.
 - .3 Remove subsoil, rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material.
 - .4 Scarify sides of planting hole.
 - .5 Remove water which enters excavations prior to planting. Notify Departmental Representative if water source is ground water.

3.3 PLANTING

- .1 For bare root stock, place 50mm backfill soil in bottom of hole. Plant trees and shrubs with roots placed straight out in hole.

- .2 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball.
- .3 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.
- .4 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads and walks.
- .5 For trees and shrubs:
 - .1 Backfill soil in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into soil, backfill to finish grade.
 - .2 Form watering saucer as indicated.
- .6 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.
- .7 Water plant material thoroughly.
- .8 After soil settlement has occurred, fill with soil to finish grade.
- .9 Dispose of burlap, wire and container material off site.

3.4 TRUNK PROTECTION

- .1 Install trunk protection on deciduous trees as indicated.
- .2 Install trunk protection prior to installation of tree supports when used.

3.5 TREE SUPPORTS

- .1 Install tree supports as indicated and use alternative tree staking method to provide extra support where bedrock elevation inhibits adequate soil cover to place a single stake.
- .2 Use single stake tree support for deciduous trees less than 3 m and evergreens less than 2 m.
 - .1 Place stake on prevailing wind side and 150 mm from trunk.
 - .2 Drive stake minimum 150 mm into undisturbed soil beneath roots. Ensure stake is secure, vertical and unsplit.
 - .3 Install 150 mm long guying collar 1500 mm above grade.
 - .4 Thread Type 1 guying wire through guying collar tube. Twist wire to form collar and secure firmly to stake. Cut off excess wire.
- .3 Use 3 guy wires and anchors for deciduous trees greater than 3 m and evergreens greater than 2 m.
 - .1 Use Type 2 guying wire with clamps for trees less than 75 mm in diameter and Type 3 guying wire with clamps for trees greater than 75 mm in diameter.
 - .2 Use Type 1 anchors for trees less than 75 mm in diameter and Type 2 anchors for trees greater than 75 mm in diameter.
 - .3 Install guying collars above branch to prevent slipping at approximately 2/3

- height for evergreens and 1/2 height for deciduous trees. Collar mounting height not to exceed 2.5 m above grade.
- .4 Guying collars to be of sufficient length to encircle tree plus 50mm space for trunk clearance. Thread guy wire through collar encircling tree trunk and secure to lead wire by clamp or multi-wraps; cut wire ends close to wrap. Spread lead wires equally proportioned about trunk at 120 degrees.
 - .5 Install anchors at equal intervals about tree and away from trunk so that guy wire will form 45 degree angle with ground. Install anchor at angle to achieve maximum resistance for guy wire.
 - .6 Attach guy wire to anchors. Tension wire and secure by multi-wraps.
 - .7 Install wire tightener ensuring that guys are secure and leave room for slight movement of tree.
 - .8 Saw tops off wooden anchors which extend in excess of 100 mm above grade or as directed by Departmental Representative.
 - .9 Install flagging tape to guys as indicated.
- .4 After tree supports have been installed, remove broken branches with clean, sharp tools.

3.6 MULCHING

- .1 Ensure soil settlement has been corrected prior to mulching.
- .2 Ensure blended mulch and tackifier remains dry prior to installation.
- .3 Under dry conditions, manually or pneumatically spread blended mulch and tackifier to specified compacted depth. Lightly water immediately following installation to activate tackifier.

3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

- .1 Perform following maintenance operations from time of planting to acceptance by Departmental Representative.
 - .1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
 - .1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.
 - .2 Remove weeds monthly.
 - .3 Replace or re-spread damaged, missing or disturbed mulch.
 - .4 For non-mulched areas, cultivate as required to keep top layer of soil friable.
 - .5 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.
 - .6 Remove dead or broken branches from plant material.
 - .7 Keep trunk protection and guy wires in proper repair and adjustment.
 - .8 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

3.8 MAINTENANCE DURING WARRANTY PERIOD

- .1 From time of acceptance by Departmental Representative to end of warranty period (one year from interim completion date), perform following maintenance operations.
 - .1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.
 - .2 Reform damaged watering saucers.
 - .3 Remove weeds monthly.
 - .4 Replace or re-spread damaged, missing or disturbed mulch.
 - .5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.
 - .6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Departmental Representative prior to application.
 - .7 Apply fertilizer in early spring as indicated by soil test.
 - .8 Remove dead, broken or hazardous branches from plant material.
 - .9 Keep trunk protection and tree supports in proper repair and adjustment.
 - .10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.
 - .11 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.
 - .12 Submit monthly written reports to Departmental Representative identifying:
 - .1 Maintenance work carried out.
 - .2 Development and condition of plant material.
 - .3 Preventative or corrective measures required which are outside Contractor's responsibility.

END OF SECTION

PART 1 GENERAL1.1 RELATED REQUIREMENTS

- .1 Section 31 23 33 – Excavation, Trenching and Backfilling.
- .2 Section 33 41 00 – Storm Utility Drainage Piping.

1.2 REFERENCE STANDARDS

- .3 Canadian Standards Association (CSA):
 - .1 CSA A257 SERIES-09, Standards for Concrete Pipe and Manhole Sections.
- .4 Ontario Provincial Standard Specifications (OPSS):
 - .1 OPSS 407 (November 2013), Maintenance Hole, Catch Basin, Ditch Inlet and Valve Chamber Installation.
 - .2 OPSS.MUNI 1010 – Material Specification for Aggregates – Base, Sub-base, Select Subgrade, and Backfill Material.
 - .3 OPSS 1351 (April 2010), Material Specification for Precast Reinforced Concrete Components for Maintenance Holes, Catch Basins, Ditch Inlets and Valve Chambers.
 - .4 OPSS 1850 (April 2013), Frames, Grates, Covers and Gratings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature and data sheets for ditch inlet catch basin.

PART 2 PRODUCTS2.1 MATERIALS

- .1 Precast catch basin sections: to OPSS 407.
- .2 Joints: to be made watertight using rubber rings or cement mortar.
- .3 Adjusting rings: to CSA A257.4.

- .4 Frames, gratings, covers to dimensions as indicated and following requirements:
 - .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
- .5 Granular bedding and backfill: OPSS.MUNI 1010 Granular A.

PART 3 EXECUTION

3.1 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 33.01 – Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing outfall structures, manholes or catch basins.

3.2 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Complete units as pipe laying progresses.
- .3 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.
- .4 Set precast concrete base on 200 mm minimum of OPSS.MUNI 1010 Granular A bedding compacted to a minimum of 95% corrected maximum dry density.
- .5 Precast units:
 - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination thereof.
 - .2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
 - .3 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
- .6 Place frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.
- .7 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

- .8 For sewers:
 - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
 - .2 Compact granular backfill to 95% corrected maximum dry density.

PART 1 GENERAL1.1 RELATED REQUIREMENTS

- .1 Section 31 23 16.26 – Rock Removal.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Section 33 05 16 – Manholes and Catch Basin Structures.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA):
 - .1 CSA B1800-15, Thermoplastic Nonpressure Piping Compendium - B1800 Series (Consists of B181.0, B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7 B182.8, B182.11, B182.13 and B182.14).
- .2 Ontario Provincial Standard Drawings (OPSD)
 - .1 OPSD 802.013 (November 2014) Flexible Pipe Embedment and Backfill, Rock Excavation.
- .3 Ontario Provincial Standard Specifications (OPSS)
 - .1 OPSS 410, (November 2013) Pipe Sewer Installation in Open Cut.
 - .2 OPSS.MUNI 1010 (November 2013), Aggregates – Base, Subbase, Select Subgrade and Backfill Material.
 - .3 OPSS 1840 (April 2011), Non-Pressure Polyethylene (PE) Pipe Products.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of proposed source of bedding, cover and sewer materials and provide access for sampling of bedding materials.
- .2 Certification to be marked on pipe.

PART 2 PRODUCTS2.1 PIPE

- .1 HDPE Dual wall (smooth inside wall) to OPSS 1840.
- .2 Pipe stiffness: 320 kPa.

2.2 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular material in accordance with OPSS.MUNI 1010, Granular A.

2.3 BACKFILL MATERIAL

- .1 Imported fill material in accordance with OPSS.MUNI 1010, Select Subgrade Material.

PART 3 EXECUTION3.1 PREPARATION

- .1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

3.2 TRENCHING

- .2 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Do not allow contents of sewer to flow into trench.
- .4 Departmental Representative to approve trench alignment and depth prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 200 mm compacted thickness. Depth of bedding to be 200mm.
- .3 Shape transverse depressions as required to suit joints.
- .4 Compact each layer full width of bed to at least 95 % corrected maximum dry density.

3.4 INSTALLATION

- .1 Lay and join fittings to pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .2 Install plastic pipe and fittings in accordance with CSA B182.11.

- .3 Joints:
 - .1 Install gaskets as recommended by manufacturer.
 - .2 Maintain joints free from mud, silt, gravel and other foreign material.
 - .3 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.
 - .4 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .4 When any stoppage of Work occurs, restrain pipes to prevent "creep" during down time.
- .5 Cut pipes as required for fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .6 Make watertight connections at catch basins.
- .7 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5 SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative has inspected area, surround and cover pipes and fittings.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Minimum total thickness of cover to be 300mm.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % corrected maximum dry density.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95 % corrected maximum dry density.

3.6 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.
- .3 Compact backfill to at least 95% corrected maximum dry density.

3.7 FIELD TESTING FOR STORM SEWERS

- .1 Repair or replace pipe, pipe joints, fittings, bedding, cover and backfill found defective to the satisfaction of the Departmental Representative.
- .2 When directed by Departmental Representative, draw tapered wooden plug or other accepted device with diameter of 50mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
- .3 Plug abandoned pipe entry locations to downstream manholes. Within manhole, trim abandoned pipe flush with manhole wall. Utilize material conforming to OPSS 1359 for plug. Ensure plug is water-tight and that any voids between the pipe and manhole wall are filled.

END OF SECTION

TEST PIT LOCATIONS & RESULTS TABLE

TEST PIT RESULTS TABLE

A summary of the findings encountered in the 16 test pits excavated at the site is given on Table No. I. Test Pit Nos. 1 and 6 were located within the building area whereas the remaining test pits were excavated within the area of the surface parking area. The description of test pits and related information depicts subsurface conditions only at the specific locations and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time also may result in changes in the conditions interpreted to exist at the locations where sampling was conducted. It should be noted that the soil boundaries indicated on the test pits description are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. A summary of the findings in all the test pits is presented in the Table No. I below:

Table No. I: Summary of Findings in Test Pits									
	Test Pit No.	Ground Surface Elev. (m)	Topsoil	Fill	Top of Weathered Bedrock		Top of Bedrock		Comments
			Thickness (mm)	Thickness (mm)	Depth (m)	Elev. (m)	Depth (m)	Elev. (m)	
Building Area	TP1	110.9	150		0.15	110.75	0.4	110.55	
	TP2	110.98	150		0.15	110.83	0.5	110.52	
	TP3	109.70					0	109.70	Bedrock exposed
	TP4	110.33					0	110.33	Bedrock exposed
	TP5	111.79					-	-	Concrete Pad at surface
	TP6	110.48	100				0.1	110.38	
Parking Area	TP7	109.46	280		0.28	109.18	0.5	109.00	
	TP8	109.94	50				0.1	109.89	Gravel Fill
	TP9	108.35	150				0.2	108.20	
	TP10	108.00	280*	50	0.33	107.67	0.5	107.52	* Granular fill above topsoil
	TP11	109.96					0.0	109.96	Bedrock exposed
	TP12	107.30		50	0.05	107.25	0.3	107.05	
	TP13	106.81					0.0	106.81	Bedrock exposed
	TP14	107.42	250				0.3	107.17	
	TP15	105.60		180			0.2	105.42	Crusher run Limestone fill
	TP16	105.96					0.0	105.96	Bedrock exposed



NOTES :

1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT TEST PIT LOCATIONS. BETWEEN TEST PITS THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL SAMPLES WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. TOPSOIL QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION PROVIDED AT THE TEST PIT LOCATIONS.
4. TEST PIT ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
6. BASE PLAN FROM exp PROJECT OTGE00018368-A0 AND FAIRHALL, MOFFAT & WOODLAND LIMITED TOPOGRAPHICAL SURVEY FOR SITE 1 AND 2, PROJECT W31600, SURVEY COMPLETED AUGUST 29, 2016.

LEGEND

-  TP1
 - G - 110.90
 - R - 110.55
-
-  BH8-06
-
-  TP1-06
-
- BOREHOLE BY TROW ASSOCIATES INC., REPORT NO. OTGE00018368-A0 DATED MAY 18, 2006
- TEST PIT BY TROW ASSOCIATES INC., REPORT NO. OTGE00018368-A0 DATED MAY 18, 2006



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scale	1:1000	PROJECT	PROPOSED BUILDING & PARKING LOT
date	OCT. 2016	TITLE	TEST PIT LOCATION PLAN
drawn by	J.R./M.N.	project no.	OTT-00235273-A0

SECTION A - GENERAL INFORMATION

GENERAL INFORMATION	BUILDING NAME: _____ PROJECT NAME: _____	
	GOC BUILDING NUMBER: _____ PROJECT NUMBER: _____	
	BUILDING ADDRESS: _____ PROJECT MGR: _____	
	<input type="checkbox"/> NEW EQUIPMENT	<input type="checkbox"/> DECOMMISSIONED EQUIPMENT
<input type="checkbox"/> EQUIPMENT UPDATE	<input type="checkbox"/> REPLACED EQUIPMENT	
	<input type="checkbox"/> CRITICAL SPARES	<input type="checkbox"/> TENANT

SECTION B - EQUIPMENT INFORMATION

SYSTEM (PLEASE CHECK THE BOX WHICH APPLIES)

05-Electrical Low Voltage	06-Electric High Voltage	10 - Electrical Auxiliary & Standby Power	15 - Control Monitoring System	20 - Heating	25 - Refrigeration	30 - Ventilation	40-Compress Air, Auxiliary & Process	50-Water Supply	55-Plumbing & Drainage
60 - Fire Protection	65 -Transportation Device	70 - Security	72 - Environmental	75 - Special Purpose	79 - Energy	80-Architectural Structural	85 - Grounds	90-Cafeteria (Excluding Refrigeration)	

BUILDING ITEM CODE ^ V) DESCRIPTION: _____

CLIENT LOCATION: _____ SPECIFIC LOCATION: _____

FIELD ITEM NUMBER: _____ BUILDING ITEM REPLACES: _____

MANUFACTURER: _____ MODEL NUMBER: _____

SERIAL NUMBER: _____ MODEL NAME: _____

PARENT ITEM#: _____

DATE OF INSTALLATION (YY/MM/DD): _____ PURCHASE PRICE (without GST): _____ PURCHASE DATE (YY/MM/DD): _____

SECTION C - SPECIFIC EQUIPMENT INFORMATION

ELECTRICAL VOLTS: _____ PHASE: _____ AMPS/FLA: _____ BTU/WATT: _____ HP/WATT: _____

MECHANICAL: C.F.M/G.P.M _____ Capacity _____ Belt Size _____ Quantity _____ Filter Size _____ Quantity _____ Type _____

RATED CAPACITY (kg): _____ REFRIGERANT TYPE: _____ COOLING CAPACITY (TONS): _____

FIRE SUPPRESSION: TYPE: _____ CAPACITY: _____ MANUFACTURER DATE: _____ (yy/mm/dd)

FUEL STORAGE TANK LOCATION: ___ OUTDOOR ABOVEGROUND ___ UNDERGROUND ___ INDOOR UNIT OF MEASURE (litres): _____

ENERGY SOURCE: ___ DIESEL FUEL ___ NATURAL GAS ___ OIL ___ PROPANE ___ ELECTRIC ___ STEAM ___ HOT WATER ___ COLD WATER

ENVIRONMENT DOCUMENTS ATTACHED: YES NO

SECTION D - WARRANTY

WARRANTOR NAME: _____ WARRANTY START DATE (YY/MM/DD): _____

Maintained during Warranty by: Installer Parts Warranty Date : _____ (yy/mm/dd)

Maintained during Warranty by: Brookfield GIS Labour Warranty Date : (yy/mm/dd) _____

COMMENTS

(yy/mm/dd)

PM SCHEDULING DETAILS

(yy/mm/dd)

MAINTAINABLE: YES ___ NO ___ ANNUAL NEXT DUE: _____ SERVICE PROVIDER/TECH NAME: _____

SPECIAL INSTRUCTIONS: _____

A) PLEASE SEND COMPLETED FORMS TO YOUR CMMS COORDINATOR FOR PROCESSING

B) PLACE COMPLETED FORM IN PROJECT O&M BINDER IF APPLICABLE

RP1/BI1
CHAPTER 2 / CHAPITRE 2

CODE TABLES /
TABLEAUX DE CODES

April 2015 / avril 2015

Table A7.1 System Codes

Tableau A7.1 Codes de système

Referred to in transactions/ Code utilisé pour les transactions :	EITO
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System coding is intended to describe the system in which a piece of equipment is used either as a component or in the performance of a dedicated function. In some cases, the piece of equipment may not be physically attached to the system but is still part of the system itself (example: specialized maintenance equipment).

Les codes des systèmes permettent de définir le système dans lequel un équipement est utilisé en tant qu'élément constitutif ou pour une fonction particulière, qu'il y soit rattaché physiquement ou non (p. ex. : de l'équipement d'entretien spécialisé).

Code	English short description/ <i>Long description</i>	Description abrégée française/ <i>Description détaillée</i>
5	Electrical Service and Distribution Low Voltage (31 – 750V) <i>Includes external power supply entrance to a building such as transformer vault, (including equipment), main distribution panel or switch gear, bus ways, secondary transformers, disconnect switches, distribution panels, splitter troughs, and associated hardware.</i>	Service et distribution d'électricité. Basse tension (31 – 750V) <i>Inclut l'entrée électrique externe à l'immeuble dont la chambre de transformateurs (incluant l'équipement), le panneau de distribution principal ou le panneau de contrôle, les barres blindées, les transformateurs secondaires, les sectionneurs, les panneaux de distribution, les répartiteurs et les accessoires connexes.</i>
6	Electrical Service and Distribution High Voltage (greater than 750V) <i>Includes external power supply entrance to a building such as transformer vault, (including equipment), main distribution panel or switch gear, bus ways, secondary transformers, disconnect switches, distribution panels, splitter troughs, and associated hardware.</i>	Service et distribution électrique haute tension (plus de 750V) <i>Inclut l'entrée électrique externe à l'immeuble dont la chambre de transformateurs (incluant l'équipement), le panneau de distribution principal ou le panneau de contrôle, les barres blindées, les transformateurs secondaires, les sectionneurs, les panneaux de distribution, les répartiteurs et les accessoires connexes.</i>
10	Electrical Auxiliary and Standby Power <i>Includes standby generators (auxiliary power units), wind turbines, solar, uninterruptible power supply (UPS). This includes all related hardware (for example, Robonic switching, supply and exhaust fans). Storage battery systems for emergency lighting will be included in Fire Protection and Alarm Systems (See section 60).</i>	Système électrique auxiliaire et de secours <i>Inclut les génératrices de secours (génératrices auxiliaires), les éoliennes, l'énergie solaire et le système d'alimentation sans interruption (UPS). Ceci inclut tous les équipements –connexes (par exemple, interrupteur type Robonic, ventilateur d'admission et d'évacuation). Les systèmes de batterie d'éclairage de secours seront inclus dans les systèmes de protection et d'alarme-incendie (voir section 60).</i>
15	Control/Monitoring Systems	Systèmes de commande/surveillance

Code	English short description/ Long description	Description abrégée française/ Description détaillée
	<i>Electrical/electronic systems includes remote central or direct control of building systems, equipment or monitoring devices interfaced with panels, field sensors, relays including all interconnecting wiring, cabling, piping, conduit. To include power systems dedicated to this system.</i>	<i>Les systèmes électriques/électroniques incluant les commandes centrales à distance ainsi que les commandes directes des systèmes d'immeuble, équipement et dispositifs de surveillance couplés aux panneaux, capteurs, relais, incluant les câblages, la tuyauterie et les conduits. Comprend également les systèmes d'alimentation pour ce système.</i>
20	Heating <i>Equipment that provides heat to a building/facility such as high and low pressure steam/hot water, etc. along with their associated components (for example, condensate returns, feed water pumps, etc.) DOES NOT INCLUDE POTABLE WATER SUPPLY.</i>	Chauffage <i>L'équipement qui chauffe l'immeuble/l'installation, tel que la chaudière à vapeur ou à l'eau chaude à haute ou basse pression, etc., ainsi que les composants connexes (par exemple, pompe de retour de condensat, d'alimentation, etc.). « EXCLUT L'ALIMENTATION EN EAU POTABLE ».</i>
25	Refrigeration <i>Equipment that uses a mechanical closed loop consisting of an evaporation, compressor, metering device and condenser for the purpose of heat rejection. Examples to be considered are air conditioners, heat pumps, chillers, reach-in/walk-in coolers and freezers and absorption systems.</i>	Réfrigération <i>Équipement qui utilise une boucle mécanique fermée composée d'évaporateurs, de compresseurs, de dispositifs de mesurage et de condenseurs pour évacuer la chaleur. Les climatiseurs, thermopompes, refroidisseurs, réfrigérateurs ou congélateurs plain-pied, et systèmes à absorption en sont des exemples.</i>
30	Ventilation/Air Distribution <i>All equipment primarily designed for the distribution and control of temperature, humidity, cleanliness and movement of air.</i>	Ventilation/Distribution de l'air <i>Tout équipement conçu principalement pour la distribution et le contrôle de la température, de l'humidité, de la propreté et de la circulation de l'air.</i>
40	Compressed Air, Auxiliary & Process <i>Includes equipment such as compressors, air dryers and related pneumatic control equipment.</i>	Air comprimé, auxiliaire et traitement <i>Inclut des équipements tels que les compresseurs, les dessiccateurs d'air et les dispositifs de contrôle pneumatique connexes.</i>
50	Water Supply <i>Hot and cold potable water supply equipment. Equipment to be considered includes drinking fountains, backflow preventers, domestic hot water boilers, etc.</i>	Alimentation en eau <i>Comprend les équipements d'alimentation en eau chaude et eau froide potable. Inclut les fontaines à boire, les dispositifs anti-refoulement, les chauffe-eau domestiques, etc.</i>
55	Plumbing/Drainage <i>Equipment designed for the supply, circulation and/or disposal of water (non-potable) and other fluids. Items include water closets, sump pumps, lavatories, drains, water spouts, etc.</i>	Plomberie et drain <i>L'équipement conçu pour l'alimentation, la circulation et/ou l'évacuation d'eau (non potable) et autres fluides. Ceci inclut les toilettes à eau, les lavabos, les pompes de puisard, les drains, les robinets, etc.</i>
60	Fire Protection & Alarm <i>Equipment/systems designed to warn, to impede and/or stop a fire. It includes, fire alarm panels and components, emergency lighting, voice communications, smoke exhausters, stairwell pressurization fans, sprinkler systems, fire booster, pumps, etc.</i>	Protection contre les incendies et alarme <i>Équipements et systèmes conçus pour signaler, contrôler et/ou arrêter les incendies. Inclut les panneaux avertisseurs et leurs composantes, l'éclairage d'urgence, les évacuateurs de fumée, les ventilateurs de pressurisation d'escaliers, les systèmes de gicleurs, les surfeux, les pompes et autres.</i>

Code	English short description/ Long description	Description abrégée française/ Description détaillée
65	Vertical & Horizontal Transporting Devices <i>All transporting equipment for persons and/or materials. e.g., dock levelers, conveyors, elevators, dumbwaiters, vertical wheelchair lifts, escalators, etc.</i>	Équipements de transport vertical et horizontal <i>Tout l'équipement de transport de personnes et de matériaux tels que plate-formes mobiles de chargement, monte-charges, élévateurs de fauteuils roulants, escaliers mobiles et autres.</i>
70	Security <i>Devices that assist in the physical security of the building/facility such as closed circuit television surveillance systems, photocell, infrared or laser beam systems, key card access, etc.</i>	Sécurité <i>Appareils d'appoint pour la sécurité matérielle de l'immeuble/l'installation tels que les circuits fermés vidéo, les systèmes de surveillance, les détecteurs infrarouge ou laser, le système de cartes d'accès et autres.</i>
72	Environmental <i>Equipment/systems that require management and accountability as per the Canadian Environmental Protection Act (CEPA). Items include PCB storage sites, chemical handling (CFCs & Halon), above and below ground storage tanks, asbestos, pesticides and sewage/solid waste disposal, etc.</i>	Environnemental <i>Équipements et systèmes devant faire l'objet d'une gestion et d'une responsabilisation conformément à la Loi canadienne sur la protection de l'environnement, tels que les sites d'entreposage de BPC, la manipulation de produits toxiques (CFC et Halon), les réservoirs de surface ou enfouis, l'amiante, les pesticides, l'élimination des déchets liquides ou solides et autres.</i>
75	Special Purpose <i>Systems not previously designated and/or client owned equipment which are maintained by the Department.</i>	Usage particulier <i>Systèmes non désignés précédemment et/ou systèmes appartenant aux clients qui sont confiés au Ministère pour entretien.</i>
79	Energy <i>Systems designed for the conservation measurement and recording of energy consumption. Items include electric meters, gas/oil meters, water meters, etc.</i>	Énergie <i>Systèmes conçus pour mesurer l'économie et la consommation d'énergie, tels que compteurs d'électricité, compteurs d'essence/mazout, compteurs d'eau et autres.</i>
80	Architectural/Structural <i>Includes building components other than equipment that requires periodic technical inspection. Items to be considered include roofs, chimneys, stacks, windows, doors, etc.</i>	Architecture/Structure <i>Inclut les composantes d'immeuble autres que les équipements nécessitant une inspection technique périodique, tels que toitures, cheminées, évacuateurs, fenêtres, portes et autres.</i>
85	Grounds <i>Includes exterior items that are associated with the building/facility such as roads, retaining walls, fences, parking areas, access ways, storm drainage, landscaping, etc.</i>	Terrains <i>Inclut les objets extérieurs qui sont associés à l'immeuble/l'installation tels que chemins, murs de soutènement, clôtures, aires de stationnement, sentiers d'accès, égouts pluviaux, aménagements paysagers et autres.</i>
90	Cafeteria (excluding Refrigeration) <i>All major kitchen and service equipment such as coffee urns, deep fat fryers, stoves, etc., which are crown-owned and consequently should be maintained by PWGSC. NOTE: DOES NOT INCLUDE REFRIGERATION EQUIPMENT (see Section 25)</i>	Cafétéria (excluant la réfrigération) <i>Tous les équipements principaux de cuisine et de cafétéria tels que cafétières, friteuses, cuisinières et autres qui appartiennent à l'État et qui sont entretenus par TPSGC. NOTA : EXCLUT L'ÉQUIPEMENT DE RÉFRIGÉRATION (voir section 25)</i>
99	Other tools and equipment <i>Equipment and systems not covered above including Servicing Tools and Workshops</i>	Autres outils et équipement <i>Équipement et systèmes non couverts dans les sections ci-dessus incluant les outils d'entretien et d'atelier.</i>

Table A7.2 Equipment Type Code

Tableau A7.2 Codes des types d'équipement

Referred to in transactions/ Code utilisé pour les transactions :	EITO; PCRO
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The equipment type code is a standard classification of pieces of equipment that are or may be part of the building systems.

Le codage de type de l'équipement permet de classer les équipements qui font ou pourraient faire partie de systèmes de bâtiments.

Code	English description	Description française
5	Filters, Washable and Disposable	Filtres, lavables et jetables
6	Filter – High Efficiency Particulate Aerosol	Filtres, HEPA
7	Filter – Water	Filtres à eau
9	Aerator, Blower	Aérateur/ventilateur
10	Air Compressor	Compresseur d'air
15	Vacuum Pump	Pompe à vide
16	Vacuum Cleaner	Aspirateur (central)
20	Air Conditioner, Built-up	Climatiseur, à éléments séparés
25	Air Conditioner, Packaged	Climatiseur monobloc
30	Air Conditioner, Split	Climatiseur, bibloc
35	Air Conditioner, Window Unit	Climatiseur de fenêtre
36	Air Conditioner, Room	Climatiseur de salle
50	Air Handling Unit	Appareil de traitement de l'air
52	Agitator Bio Waste	Agitateur, déchets organiques
55	Air Valve (vent)	Robinet d'air (évent)
57	Autoclave	Autoclave
58	Ash Removal	Enlèvement des cendres
60	Battery Charger (including batteries)	Batterie et chargeur
65	Backflow Preventer	Dispositif anti-refoulement
70	Boiler	Chaudière
75	Boiler – Steam	Chaudière à vapeur
90	Burner, Oil fired	Brûleur au mazout
91	Burner – Gas/Propane Fired	Brûleur pour gaz ou propane
92	Burner – Combination	Brûleur combiné
93	Bus Way (conductors)	Barre blindée
95	Bus work and Structure Insulators	Isolateurs de barres blindées et de structures
96	Load Break Switch	Interrupteur sous charge
97	Electrical Distribution Systems	Réseau de distribution de l'électricité

Code	English description	Description française
98	Carbon Monoxide Systems	Systèmes de détection du monoxyde de carbone
99	Gas Detection Systems	Détecteurs de gaz et moniteurs
100	Chiller – Absorption	Refroidisseur à absorption
105	Chiller- Centrifugal	Refroidisseur centrifuge
110	Chiller – reciprocating	Refroidisseur à piston
120	Air Circuit Breaker & Breakers	Disjoncteur
123	Excitor	Excitateur
124	Generator – DC	Générateur CC
125	Surge Protection, Transient Voltage Unit	Limiteur de surtension, supprimeur de surtension
126	Voltage Regulator	Régulateur de tension
127	Alternator	Alternateur
128	Capacitor Bank & Capacitors	Groupe condensateur
130	Cooling Coil	Serpentin de refroidissement
135	Heating Coil	Serpentin de chauffage
136	Terminal Hot Water Reheat	Réchauffeur terminal à eau chaude
137	Cold Room	Chambre froide
139	Filter – Electrostatic	Filtre électrostatique
140	Air Purifier	Purificateur d'air
142	Condenser-Evaporative	Condenseur à vaporisation
144	Communications Systems	Système de communication
145	Garbage Compactor	Compacteur d'ordures
147	Compressed Air Dryer	Séchoir à air comprimé
148	Compressor – Refrigeration	Compresseur, réfrigération
150	Condenser – Air Cooled	Condenseur refroidi à l'air
151	Condenser – Water Cooled	Condenseur refroidi à l'eau
152	Controls – Combustion	Commandes, combustion
153	Controls – Electric and Electronic	Dispositifs de commande, électriques et électroniques
154	Energy Management & Controls Systems	Systèmes de commande et de gestion de l'énergie
155	Controls – Pneumatic	Dispositifs de commande pneumatiques et système d'alimentation en air de commande
156	Controls – Water feed	Commandes d'eau d'approvisionnement
158	Controls – Gas Analyser	Commandes d'analyseur de gaz
160	Convactor – Hot water	Convecteur à eau chaude
170	Converter	Convertisseur
172	Conveyor	Convoyeur
180	Cooling Tower	Tour de refroidissement
185	Dust Collector (all types)	Collecteur de poussières (tous types)
186	Dampers	Registres

Code	English description	Description française
190	De-aerator	Dégazeur
195	De-humidifier	Déshumidificateur
199	De-superheater	Désurchauffeur
200	Disconnects (isolating switches)	Disjoncteurs (interrupteurs d'isolement)
205	Disconnect – Main	Disjoncteur principal
210	Distribution Panel	Panneau de distribution
212	Panelboard, lighting and Appliance Branch Circuit	Panneau électrique, circuit de dérivation d'éclairage et d'appareils électriques
215	Splitter -Distribution Splitter	Répartiteur
216	DCC Control Cabinet	Cabinet de commande CND (commande numérique directe)
220	Switchboard – Distribution	Tableau de distribution et de contrôle
223	Sump Pit	Puisard
230	Elevating Docks/Dock Leveller Equipment	Plates-formes élévatrices/niveleurs de quai
235	Drains	Égouts
238	Dumbwaiters	Monte-charge
239	Electric Motor	Moteur électrique
240	Elevator	Ascenseur
245	Economizer	Économiseur
250	Emergency Power System	Système d'alimentation électrique de secours
253	End Devices (sensors, transducers...)	Dispositifs finals (capteurs, transducteurs)
255	Escalator, Moving Walkway	Escaliers roulants/trottoir mobile
257	Heat Exchanger	Condenseur refroidi à l'air
258	Exhaust Air Valve	Valve d'air évacué
259	Expansion Joint – piping	Joint d'expansion, tuyauterie
260	Fans – Supply or return	Ventilateurs (alimentation et retour)
261	Fan – Ceiling and Circulation	Ventilateur de plafond (circulation)
265	Fan – Combustion	Ventilateur, combustion
270	Fan – Exhaust	Ventilateurs (extracteurs)
271	Fan – Exhaust (ashes)	Ventilateur d'échappement (cendres)
272	Fume Hood – System	Hotte
273	Fume Hood – Assembly	Assemblage de hottes
280	Fan Coil Unit – Cabinet heater/cooler	Ventilo-convecteur
281	Fan – Unit Ventilator	Ventilateur d'aération
290	Fire Alarm System – general	Système d'alarme-incendie, généralités
295	Fire Alarm and voice communication – integrated	Réseau d'alarme-incendie/Système de communication phonique (intégré)
300	Fire Dampers and Fire Stops Flaps	Registres et clapets coupe-feu
305	Fire Exit Corridor/Separation (including Doors & Related Hardware)	Corridors de secours en cas d'incendie et séparation coupe-feu (y compris les portes et la quincaillerie)
310	Fire Extinguishers – portable	Extincteurs portatifs

Code	English description	Description française
311	Fire Extinguishers – CO ₂	Système d'extincteur, CO ₂
312	Fire Extinguishers – Dry Chemical	Système d'extincteur, produit chimique
313	Fire Extinguishers – Halon	Système d'extincteur, Halon
315	Fire Hydrant	Prise d'eau d'incendie
325	Fire Pump – Supply, Booster	Pompe à incendie, alimentation/surpression
330	First Aid Kit	Trousse de premiers soins
331	First Aid Eyewash Station	Poste de bain oculaire
332	Emergency Alarms – Washrooms	Alarme-incendie, toilettes
335	Flash Tank	Réservoir de détente
337	Vehicle Lift	Monte-charge pour véhicule
338	Freight Platform Lift	Plate-formes élévatrices pour marchandises
339	Furnace – Warm Air (electric)	Fournaise à air chaud (à électricité)
340	Furnace – Warm Air (Gas or Oil)	Fournaise à air chaud (gaz ou mazout)
341	Heater – Ramp	Appareil de chauffage, rampe
342	Heater – Electric, Duct	Appareil de chauffage électrique, conduit
343	Heater – Electric, Baseboard	Appareil de chauffage, plinthe électrique
344	Heater – Electric Unit	Appareil de chauffage électrique à ventilateur
345	Hoist – Pneumatic or hydraulic	Treuil, pneumatique ou hydraulique
346	Heater Cables	Câbles chauffants
347	Hoist – Manual or Electric	Palan, manuel/électrique
348	Hoist – Overhead and Bridge Crane	Pont roulant
350	Humidifier – Dehumidifier (Water Sprays)	Humidificateur – Déshumidificateur (avec pulvérisateurs)
355	Incinerator	Incinérateur
360	Induction Unit	Éjecto-convecteur (appareil à induction)
361	Sand Trap	Collecteur de sable
362	Interceptor – Grease or Oil	Collecteur de graisse ou d'huile
363	Sediment Trap	Piège à sédiment
364	Interface Panel	Panneau d'interface
365	Irrigation	Irrigation
370	Lighting – Emergency System	Éclairage d'urgence
379	Lighting – Interior (<i>including Ballast</i>)	Éclairage intérieur
380	Lighting – Exterior	Éclairage extérieur
381	Lightning Rod	Parafoudre
383	Master Clock	Horloge principale
384	Metering Equipment	Appareil de mesure
385	Mixing Box	Boîte de mélange
386	Motor Control Centre	Commande centrale de moteurs (CCM)
387	Piping System, Buried	Circuits de tuyauterie (souterraine)
388	Plumbing – Fixtures	Accessoires de plomberie
389	Printer Terminal	Terminal d'imprimante

Code	English description	Description française
390	Power Door Operator	Commande de porte électrique
391	PCB Storage Site	Emplacement de stockage BPC
395	Preheater – Oil	Préchauffage, huile
396	Pressure Regulating Valves	Soupape de régulation de pression
397	Projector – Photo/Slide	Projecteur à diapositives
398	Pressure Reducing Valves	Robinets réducteurs de pression
400	Pump – centrifugal, lobe, gear	Pompe (centrifuge, à galets, à engrenages)
401	Pump – steam	Pompe à vapeur
405	Pump – Condensate (includes storage tank)	Pompe à condensat (incluant le réservoir)
407	Pump – Heat pump	Thermopompe
410	Pump – Sump	Pompe à puisard
411	Pump – Sewage station	Pompe, eaux usées
412	Catch Basins	Puisard, bouche sélective
413	Manhole	Regards
420	Relay Panel	Panneau à relai
422	Recorder (electrical, gaseous, liquid...)	Enregistreur
423	Energy Meter – combined	Compteur, combiné
424	Energy Meter – Chilled Water	Compteur, eau refroidie
425	Energy Meter – Steam	Compteur, vapeur
426	Energy Meter – Electrical	Compteur, électrique
427	Energy Meter – HTHW	Compteur, ECHT
428	Emergency Shower	Douche d'urgence
429	Scrubbers (contaminants)	Épurateurs
430	Sewage Treatment système/ Sewage sterilizer	Système de traitement des eaux usées/ stérilisateur d'effluents
431	Solar Collector (system)	Capteurs solaires (système)
432	Soot Blower	Ventilateur à suie
433	Travelling Screen System (water treatment)	Système de filtration mobile (épuration de l'eau)
439	Smoke Control System	Installations de contrôle des fumées
440	Sprinkler – Automatic – DryPipe	Extincteur automatique sous air
445	Sprinkler – Preaction/Deluge	Extincteur, préaction, déluge
450	Sprinkler – Automatic – Wet Pipe	Extincteur automatique sous eau
455	Sprinkler – Commercial – Cooking Equipment	Extincteur automatique, matériel de cuisine commercial
460	Standpipe and Hose	Canalisation et boyaux d'incendie
470	Starter/Contactor	Démarrateur/contacteur
472	Variable Speed Drive	Variateurs de vitesse
471	Starter, Combination	Démarrateur combiné
479	Superheater	Surchauffeur
480	Tank, Storage – Gravity	Réservoir à gravité

Code	English description	Description française
481	Tank, Storage – Pressurized	Réservoir sous pression
482	Tank – Septic	Fosse septique
483	Tank – Fuel	Réservoir à carburant
484	Tank – Chemical Holding	Réservoir à produit chimique
485	Terminal – Computer	Terminal d'ordinateur
486	Variable Air Volume Boxes	Dispositifs à débit d'air variable (VAV)
487	Transfer Switch – Automatic (electrical)	Commutateur de transfert automatique
490	Transformer – Liquid Cooled	Transformateur BPC et à l'huile (refroidi par liquide)
491	Transformer – Dry Type	Transformateur (sec)
500	Transformer Vault	Salle de transformateurs
502	Gearbox	Engrenage
503	Turbine – Steam	Turbine à vapeur
504	Cyclone (non powered)	Cyclone
505	Agitator	Agitateur
506	Motor – Diesel	Moteur, diesel
507	Turbocharger	Turbocompresseur
510	Traps – Stainers	Purgeurs et crépines
520	Unit Heater	Appareil de chauffage
521	Underground Electrical Services	Services électriques souterrains
523	Valves, Control – pneumatic	Valves, contrôles (pneumatique)
524	Uninterruptible Power Supply	Système d'alimentation sans coupure
526	Valve – Steam, Pressure Reducing	Détendeur de vapeur
530	Water Cooler – Unit	Refroidisseur d'eau
540	Water Cooler – Central Station	Refroidisseur d'eau, poste central
545	Water Softener or demineralizer	Adoucisseur d'eau, déminéraliseur
550	Water Heater – Domestic	Chauffe-eau domestique
559	Recovery Systems – precious metals	Système de récupération (métaux précieux)
560	Water Treatment Systems	Système de traitement d'eau
565	Well Pump	Pompe de puits
601	Overhead Electrical Distribution – exterior	Distribution aérienne
602	Sub-station – exterior (electrical)	Sous-station extérieure (électrique)
603	Grounding System (electrical)	Système de mise à la terre (électrique)
700	Security, Panic Buttons and Motorized Gates	Sécurité, boutons d'alarme, barrières motorisées (électriques/mécaniques)
710	Natural Gas/Propane Distribution components	Système de distribution de gaz naturel/propane
750	Gaseous Fluid systems	Fluides gazeux
755	Cryogenic Fluids Systems	Fluides cryogéniques
800	Building Interior – general	Intérieur, généralités
801	Building Exterior – General	Extérieur, généralités

Code	English description	Description française
805	Areaways (vents, grilles...)	Aires de dégagement
810	Chimneys (Radial Brick and Metal)	Cheminées (briques radiales et métal)
813	Emergency Exit Doors	Sorties d'urgence
814	Doors – Interior	Portes, intérieur
815	Doors – Entrance/Exit	Portes d'entrée/de sortie
820	Stairs and Railings – Exterior	Escaliers extérieurs et rampes
825	Cladding	Parement
830	Foundations, Footings and Supports	Fondations, semelles et appuis
835	Barriers and Fences	Barrières et clôtures
840	Flag Pole	Mât de drapeau
850	Grounds and Approaches	Terrains et accès
851	Roads, Approaches and Parking Areas (paved)	Routes, voies d'accès et stationnements pavés
855	Doors (Overhead, Sectional/Roll-Up)	Portes (basculantes, en sections, enroulées)
857	Protective Plates	Plaques protectrices
860	Painting	Peinture
861	Walls – Interior	Murs intérieurs
862	Floors	Planchers
863	Ceilings	Plafonds
866	Blow-out Panels	Panneaux de surpression (évent anti-explosion)
870	Roof	Toits
871	Anchor points – Permanently suspended platforms	Points d'ancrage, plate-forme suspendue, installation permanente
873	Self Contained Breathing Apparatus	Appareils respiratoires autonomes
875	Shelving	Rayonnages
880	Walls – Stone and Masonry	Murs, pierre et maçonnerie
890	Storm Drainage	Collecteur d'eau pluviale
895	Windows – Exterior	Fenêtres – extérieur
896	Venetian Blinds	Stores vénitiens
897	Draperies	Draperies
900	Cafeteria and Kitchen Appliances – general	Électroménagers de cafétéria et de cuisine, généralités
902	Waste disposal unit	Unité d'élimination des déchets
905	Dishwasher – commercial	Lave-vaisselle commercial
908	Dishwasher – conveyor	Lave-vaisselle à convoyeur
910	Kitchen Range Hood – commercial	Hotte de cuisinière commerciale
912	Ovens – Commercial	Fourneau commercial (gaz/électrique/vapeur)
915	Steam Kettle	Bouilloire
918	Pressure Cooker – Steam	Autocuiseur à vapeur
920	Garbage Refrigerator	Réfrigérateur à déchets
925	Garbage Can Washer	Laveuse de poubelle

Code	English description	Description française
930	Ice Cream Cabinet	Armoire à crème glacée
935	Ice Cube Maker	Appareil à glaçons
940	Food Mixer	Mélangeur à aliments
941	Meat Slicer/Saw	Tranche-viande/scie de boucher
944	Patty Machine	Machine à mouler les galettes de viande
955	Serving Table (heated)	Desserte chauffée
960	Reach In/Pass-through Refrigerator	Armoire-présentoir frigorifique
965	Beverage Dispenser	Distributrice de boissons
970	Vegetable Peeler	Épluche-légumes
980	Walk-in Refrigerator /Freezer	Réfrigérateur/congélateur de plain-pied
990	Building Supplies and Spares	Fournitures d'immeuble et pièces de rechange
991	Building Equipment – Tools and Maintenance Equipment	Matériel d'immeuble – Outils et matériel d'entretien
992	Controllable Assets	Biens contrôlables
993	Office Furnishings	Accessoires de bureau
999	Hazardous Waste Container (including PCB containers)	Réservoir de matériaux dangereux (incluant contenants de BPC)