1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for earthwork Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM D698, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.

.2 ASTM D4253, Test Method for Maximum Index Density and Unit Weight of Soil Using a Vibratory Table.

.3 OPSS, Ontario Provincial Standard Specification.

1.3 **SUBMITTALS**

.1 Product data:
- .1 Submit copies of manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard, characteristics, limitations of insulation boards, vibration isolator, filter fabric and other specified non-granular items.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings:
- .1 Submit shop drawings in accordance with Section 01 30 00 indicating:
  - .1 Adjacent construction, elevations, sections and details, dimensions, and relationship to adjacent construction.
  - .2 Include design calculations, design concept, construction method, sequence and means by which existing structures, utilities and equipment will be protected; Location of in-use, maintained, re-routed and abandoned underground lines.

.3 Reports:
- .1 Submit written laboratory test reports.
- .2 Submit written field inspection and test report results after each inspection.

.4 Submit dewatering methods 30 days in advance for review by Consultant. If well point system is required, Engineer shall design system and supervise installation.

.5 Submit to Consultant details of locations where surplus soils and other materials are to be disposed of or reused. Include each disposal/reuse Site and type of surplus soil or other material, location of the disposal/reuse Site, operator's name and business address, type of license under which Site operates, and criteria used by Site to access suitability of surplus material for disposal.

.6 Submit to Consultant, within 48 hours of a load of surplus soil or other material leaving the Site, a daily register recording the time and place of disposal/reuse of each load signed by a representative of the disposal site. Such documentation must be submitted before payment for excavation will be made.

1.4 QUALITY ASSURANCE

.1 Have shop drawings signed and sealed by a Professional Engineer licensed in Province of Ontario and having experience in design and inspection of shoring, bracing, underpinning and dewatering (if required) required to complete Work.

1.5 SITE CONDITIONS

.1 Geotechnical conditions: For information on subsurface conditions refer to document appended to Section 02 32 00.

.2 Cultural heritage resources: If Cultural Heritage Resources (such as archaeological sites, artifacts, building and structural remains, and/or human burials) are encountered during performance of Work, contact Consultant immediately and suspend Work in immediate area until assessment has been completed by Ministry of Culture, Tourism and Recreation. Perform required measures to mitigate negative impacts on found resources to acceptance of Consultant.

1.6 PROTECTION

.1 Existing buried utilities and structures:
- .1 Size, depth and location of known existing utilities and structures are indicated for guidance only. Completeness and accuracy is not guaranteed.
- .2 Prior to commencing any excavation Work, have authorities stake out utility locations to prevent disturbance during Work.
- .3 Confirm locations of buried utilities by careful test excavations. Hand dig test excavations as necessary.
- .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered. Obtain permission of Consultant before moving or otherwise disturbing utilities or structures.

.2 Existing buildings and surface features:
- .1 Conduct with Consultant, a condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by Work.
- .2 Protect existing buildings and surface features which may be affected by Work from damage while Work is in progress and repair damage resulting from Work.
- .3 Where excavation necessitates root or branch cutting, perform Work in accordance with Authorities having Jurisdiction.
- .4 Confirm with Consultant, condition Survey of buildings and structures undertaken by Consultant.

.3 Temporarily cover local existing catch basins and maintenance holes to prevent entry of earth or debris. Ensure adequate surface drainage in affected area is maintained.

.4 Protect Work or work of other Contracts in progress or completed and protect existing properties, stored Products, services, utilities, trees, landscaping and natural features from damage.

.5 Protect excavations against flooding and damage and install and maintain appropriate warning devices during construction and during time when Work is closed down for any cause.

.6 Protect bottom of excavations that will support foundations, slabs, pavements etc. from frost or freezing.

.7 Keep access roads clear of debris and dirt resulting from Work of this Section to acceptance of Authorities having jurisdiction.

.8 Shoring, bracing and underpinning: Comply with local regulations, authorities having jurisdictions and requirements specified.

2 Products

2.1 **MATERIALS**

.1 Select fill: Subject to approval of Consultant consisting of reusable fill excavated from Site or imported fill that is free of organic matter, rubble and material other than soil. Maximum particle size of half thickness of lift specified, moisture content at time of placing 2% maximum over its optimum moisture content and is either non plastic or has a plasticity index of 25% maximum.

.2 Granular A fill: Imported Granular A fill, free of organic matter and, in accordance with OPSS 1010.

.3 Granular B Fill: Imported Granular B fill free of organic matter and in accordance with OPSS 1010.

.4 Clear Stone fill: 19 mm clear stone in accordance with OPSS 1004, free of organic material.

.5 Unshrinkable fill: 0.7 MPa cement stabilized backfill conforming to requirements of CAN/CSA A23.1/A23.2-M.

.6 Dewatering equipment: Equip submersible pumps with filters and/or screens to prevent ground loss. Maintain filters in good operating condition.

3 Execution

3.1 **EXAMINATION**

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 **LINES AND ELEVATIONS**

.1 Establish lines and elevations from Control Points shown on Contract Drawings.

.2 Have lines and elevations established by Registered Ontario Land Surveyor or qualified Civil Engineer registered in Province of Ontario.

.3 Protect and maintain Control Points and Bench Marks as long as they are required.

3.3 **STRIPPING**

.1 Do not handle topsoil while in wet or frozen condition or in manner in which soil composition is adversely affected.

.2 Strip topsoil from working area in locations shown.

.3 Strip topsoil to depths indicated. Avoid mixing topsoil with subsoil.

.4 Stockpile topsoil in locations directed by Consultant. Stockpile to height not exceeding 2 m. Remove excess topsoil from Site.

3.4 **REMOVAL OF WATER**

.1 Obtain letter of conditional approval from Authorities having Jurisdiction to dispose of ground water into sewer drainage system. Apply for and pay for water disposal permit.

.2 Keep excavations and trenches free of water throughout construction period.

.3 Groundwater removal:

.1 Lower groundwater level and maintain at depth below lowest point of excavation to ensure a dry stable surface.

.2 Dewater to prevent loss of soil and maintain stability of sides and bottom of excavation and of adjacent structures.

.3 Dispose of water in conformance with applicable by-laws and in a manner not detrimental to public and private property, or portion of Work completed or under construction.

.4 Supply and install flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to sewers, water courses or drainage areas in accordance with authorities having jurisdiction. Perform testing on settlement tank discharge to confirm that effluent meets sewer bylaw requirements. Locate tanks to acceptable area determined by Consultant.

.5 Should method of dewatering fail to achieve conditions specified above, Consultant reserves right to revise methods and procedures at no cost to Owner.

.4 Surface water removal:

.1 Remove surface run-off in a manner that will prevent loss of soil and maintain stability of sides and bottom of excavation. Obtain Consultant's approval of dewatering method to be used.

.2 Discharge surface water into existing storm drainage system to acceptance of Consultant and local authorities.

.5 Do not obstruct flow of surface drainage or natural water courses.

3.5 EXCAVATION

.1 Remove concrete, masonry, paving, demolished foundations and rubble and other obstructions encountered during excavation Work.

.2 Do not disturb soil within drip line of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw in a manner acceptable to authorities having jurisdiction.

.3 Excavate to required lines and grades shown on Contract Drawings with allowance for subsequent Work including shoring, bracing and formwork. Make excavation clean and clear of loose material and true to size.

.4 Protect stockpiles of fill against contamination and moisture absorption.

.5 Do not undermine adjacent structures. Where it is necessary to have footings at different levels, found upper footing below imaginary 10-horizontal-to-7 vertical line, or as otherwise indicated, drawn up from base of lower footing. Protect adjacent foundations from frost.

.6 Have excavations in excess of 1200 mm in depth conform to requirements of Occupational Health and Safety Act, and Regulations for Construction Projects.

.7 Do not expose shale at subgrade elevation to drying cycles and in any case, following inspection, cover with minimum 50 mm of lean concrete within 4 hours after exposure.

.8 Fill excavations for foundations which are, through error, carried below elevation shown or approved depth, with 15 MPa concrete, or as directed by Consultant.

.9 Trim, and remove loose material, debris and organic material from excavations. Where material at bottom of excavation is disturbed, remove disturbed material and re-compact to density equal to or better than undisturbed soil or backfill with lean concrete as directed by Consultant.

.10 When excavations are complete, prior to commencement of subsequent Work, request Consultant for inspection of excavation Work.

3.6 TRENCHING

.1 Excavate trenches to lines and grades indicated and to a depth of 75 mm minimum below invert elevation and slope established for pipe, and backfill to invert elevation of pipe with specified granular material.

.2 Unless otherwise authorized by Consultant, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation. Remove unsuitable material from trench bottom to extent and depth as directed by Consultant.

.3 Backfill over-excavation with granular material and compact.

.4 If unstable soil conditions are encountered, excavate trenches to depth directed by Consultant and backfill to correct elevation with backfill material.

.5 Remove loose material from bottom of trenches to ensure granular material is placed against undisturbed soil.

.6 Compact bedding and grade as required for even and uniform support on each length of pipe.

.7 Where excavating is required adjacent to and parallel with and below any footing, submit excavation and backfill procedures to Consultant for review prior to start of excavating.

.8 Keep width of trenches to a minimum to ensure minimum span for pipe to be supported.

.9 Make excavations for fire hydrants of sufficient size and depth to accommodate a minimum 0.75 m^3 of crushed stone. Hand place stone and tamp around and below hydrant elbow to ensure proper drainage of hydrant.

3.7 EXCAVATED MATERIAL DISPOSAL

.1 Except for material to be used as select fill, immediately remove and dispose of excavated material from Site.

.2 Remove and dispose of construction rubble, abandoned gas, water and sewer pipes, valves, valve boxes and fittings, maintenance holes, frames and covers and other material which may be encountered during excavation but not indicated on Contract Drawings.

3.8 **BACKFILLING**

.1 Do not proceed with backfilling operations until walls, slabs, waterproofing and below grade Work has been inspected and accepted by Consultant.

.2 Backfill areas which are free from debris, snow, ice, water and frozen ground.

.3 Do not use backfill material which is frozen or contains ice, snow or debris.

.4 Do not backfill on or against any membrane or protection board covered waterproofing with jagged rock or other sharp objects which might damage waterproofing.

.5 Limit vertical drop of backfill material to 2000 mm.

.6 To avoid pockets and voids, remove sheathing and shoring materials that require removal, as backfilling progresses.

.7 Prior to backfilling or placing concrete on exposed soil subgrade, proof roll subgrade to identify soft or loose areas. Proceed with placing backfill or concrete only after inconsistencies identified by above procedure have been reworked and compacted or excavated, backfilled and compacted as required to eliminate such conditions to acceptance of Consultant.

.8 Place backfill material, grade and compact to levels shown on Contract Drawings.

.9 Place backfill materials in uniform layers 200 mm maximum loose thickness unless specified otherwise.

.10 Ensure each layer is compacted, and accepted by Consultant, before placing succeeding layers.

.11 Unless otherwise indicated, use specified granular material from bottom of trench to 300 mm above top of pipe or 150 mm above top of electrical conduits. Hand place in 150 mm layers and compact carefully to ensure proper backfilling and compaction around bottom quadrants and sides of pipe.

.12 For backfill from 300 mm above top of pipe or 150 mm above electrical conduits to sub-grade level, use select fill unless otherwise noted. Compact either by hand or by machine.

.13 Do not backfill trenches until piping, conduits and cables therein have been inspected, tested, and approved by inspection authorities having jurisdiction and Consultant.

.14 Prior to backfilling of trenches, remove wood block or wedges used to prevent movement of piping during tests.

.15 Where there is a common boundary between select fill and granular fill or unshrinkable fill, place select fill after granular fill has been compacted. Place and compact fill around free standing structures evenly on all sides of structure simultaneously in layers sloping away from structure.

.16 During backfilling, take care to avoid displacing or damaging Utilities Work and Services.

.17 Notify Consultant prior to commencement of backfilling and compacting operations.

3.9 COMPACTION

.1 Compaction densities for select fill, granular fill, and sand fill materials will be determined by ASTM D698. Compaction densities for clear stone and pea gravel will be determined by ASTM D4253.

.2 Add water if necessary to obtain required densities. Correct irregularities or depressions that may develop during compaction by removing or adding material to form a smooth and uniform surface.

.3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.

.4 If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected.

.5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers acceptable to Consultant.

.6 Compact backfill materials as follows:
- .1 Imported fill: 98% standard Proctor maximum dry density (SPMDD).
- .2 Under slabs, walks and pavements: 100% (SPMDD).
- .3 All other areas: 95% (SPMDD).

3.10 GRADING

.1 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.

.2 Place material only on clean unfrozen surface, properly shaped and compacted and free from snow and ice. Ensure no frozen material is used in placing.

.3 Grade as necessary to bring Work areas to required elevations. Supply additional material required to obtain new grade levels. Place and compact as specified.

.4 Grade drainage ditches to elevations indicated on Contract Drawings.

.5 Maintain positive drainage.

.6 Grade materials using methods which do not lead to segregation or degradation of aggregate.

.7 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.

.8 Remove and replace that portion of layer in which material becomes segregated during spreading.

.9 Slope grade away from buildings 1:50 minimum.

.10 Make graded areas smooth to profile, free of debris, with local excavations and depressions filled and compacted.

.11 Do not disturb soil within branch spread of trees and shrubs remaining.

.12 Cultivate entire area which is to receive topsoil to a depth of 100 mm. Repeat cultivation in those areas where equipment used for hauling and spreading has compacted soil.

.13 Remove surface debris, roots, vegetation, branches and stones in excess of 50 mm in diameter.

3.11 UNSHRINKABLE FILL

.1 Place unshrinkable fill in locations indicated on Contract Drawings or where Work area is too limited to permit proper placing and compaction. Obtain Consultants approval prior to placing unshrinkable fill. Place in accordance with supplier's written instructions.

.2 If embedded items occur in area being backfilled, coordinate with appropriate trades to ensure that disturbance of embedded items during backfilling is prevented.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCE STANDARDS

.1 ASTM D698, Standard Proctor Test

.2 ASTM D2321, Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

.3 Occupational Health and Safety Act and Regulations for Construction Projects with respect to trench excavation.

2 Products

2.1 BACKFILL MATERIALS

.1 Primary backfill material:

.1 Granular 'B' material compacted in 150 mm (6") lifts to achieve 95% modified Proctor compaction.

.2 Secondary backfill material:

.1 Granular 'A' material compacted in 150 mm (6") lifts to achieve 95% modified Proctor compaction.

.3 Final backfill material:

.1 Lean course granular material, free of stones larger than 25 mm (1") in size, organics, silt, rubble and clay lumps.

.2 Laid down and compacted in layers of not more than 600 mm (4").

.3 May include native soil, if approved.

2.2 CONCRETE WORK

.1 As specified in Section 03 30 00.

3 Execution

3.1 EXAMINATION

.1 Position and extent of existing underground services and other services shown have been taken from available information. Check field conditions and report any discrepancies before commencing work. Engage services of water supply, drainage, electric supply, telephone, and gas authorities to assist in checking services on and around site.

.2 Perform locates for all existing underground services. Submit report to Owner and Consultant a minimum of five business days prior to commencing excavation.

3.2 EXCAVATION

.1 Saw cut pavements, curbs and sidewalks before proceeding with excavation. Layout cuts for approval before commencing work.

.2 Prepare excavation for underground services of depth and dimensions so that no portion of any pipe bears directly against any rock or other hard surface.

.3 Cut and trim banks of excavations and shore to prevent caving in. Limit width of excavation from "crown" of pipe down to invert to twice outside diameter of pipe for pipe diameters up to 100 mm (12"). For larger sizes limit width of excavation to outside diameter of pipe plus 100 mm (12 inches).

.4 Break up and remove rocks and boulders from excavation. Use drilling and wedging to remove rock encountered in trench. Blasting will not be allowed unless approved and authorized in writing.

.5 Store materials excavated during progress of work to produce minimum of damage or disfigurement of existing ground.

.6 Keep sides and bottoms of excavations from freezing and protect work from damage due to weather conditions. Excavate in limited lengths to enable protective and heating measures to function efficiently during pipe laying, testing and backfilling.

.7 Backfill trenches or provide sheeting, sheet piling or bracing to support trench walls and fence perimeter of work area or cover trench opening with steel plates when work area is not supervised.

3.3 PIPE LAYING AND SUPPORT

.1 Bedding class for buried piping to be as defined in Canadian Pipe Institute, Standard Specification.

.2 Grade bottom of excavations for pipes to achieve specified slope.

.3 Inside building:

.1 Form bottom of trench in earth so that pipe is supported on solid bed of undisturbed earth free from stones or debris exceeding 25 mm (1 inch) in diameter. Shape earth to fit lower one-third segment of pipes and hubs, care being taken to ensure even bearing along barrels.

.4 Outside building:

.1 Form bottom of trench in earth so that pipe is supported on Class "B" bedding.

.2 Support piping installed in unstable or filled ground on Class "A" 15 MPa (2500 lb) concrete bedding.

.5 Grade bottom of excavations for pipes to achieve specified slope. Place pipe and fittings in trench with invert conforming to elevations, slopes and alignment.

.6 On grades exceeding 10 per cent, pipe to be laid uphill with compacted fill "collars" at each joint to prevent line movement in trench.

.7 Support piping, conduits and duct banks passing through backfill at building foundation walls and at manholes and catch basins on 150 mm (6 in) thick reinforced concrete pads. Dowel concrete pads into side of manholes and catchbasins and extend sufficiently to obtain minimum bearing of 600 mm (2 feet) on undisturbed ground.

.8 Where excavation has been carried to greater depth than required, replace with Primary Fill or 10 MPa (1500 lb) concrete, to give bearing value equal to that provided by adjacent undisturbed soil.

.9 Do not lay pipe in standing or running water. Prevent surface run-off from entering trench.

.10 When ground water is present in work area, dewater by bailing or pumping to maintain stability of trench and backfilled areas, and control water level below pipe bedding. Maintain control of water in trench before, during and after pipe installation, and until sufficient backfill has been placed to prevent floatation of pipe.

.11 When pipe laying is interrupted, secure piping against movement and seal open ends to prevent entrance of water, mud, debris or foreign material

3.4 WALL PENETRATIONS

.1 Over excavate trench one and half pipe diameters below invert for distance of 600 mm (2 feet) from face of wall.

.2 Pipe to be fitted through steel sleeve that is minimum 50 mm (2") larger in diameter than pipe.

.3 Fit link seal between sleeve and pipe and tighten.

.4 Backfill over excavated area up to invert of pipe with compacted pea gravel, crushed stone, or crushed gravel with grain size of less than 25 mm (1").

.5 Backfill remainder of trench in accordance with procedures described below.

3.5 BACKFILLING

.1 Do not commence backfilling over services until testing is complete and reviewed and approved by the Building Inspector and/or Consultant.

.2 Do not use frozen material for backfilling nor place any backfilling on or against frozen earth.

.3 Under building floors, roads, curbs, walks, and paved areas:

.1 Backfill trench with Primary Fill brought up to top of trench.

.4 In other locations:

.1 Backfill trench with Primary Fill brought up to level 70% of pipe diameter above invert. Then backfill with Secondary Fill up to height of at least 600 mm (2 ft) above top of pipes. Fill remainder of trench with Final Fill watered and consolidated in one foot layers.

.5 Spaces around manholes, sumps, and catchbasins:

.1 Backfill with Primary Fill brought up to height of at least 600 mm (2 feet) above top of pipes. Fill remainder of trench with Final Fill watered and consolidated in one foot layers. Consolidate material carefully so that walls are not damaged and support provided for piping entering or leaving concrete structure is undisturbed.

.6 Backfill excavation in close proximity to and below any footing level with 10 MPa (1500 lb) concrete to level of top of highest adjacent footing.

.7 Withdraw shoring before backfilling and fill voids left on removal of supports with Primary Fill.

.8 Minimize localized loadings and differential settlement wherever pipe crosses other utilities or subsurface structures, or wherever there are special foundations such as concrete capped piles or sheeting. Provide cushion of Primary Fill bedding between pipe and any subsurface structure.

3.6 RESTORATION OF WORK AREA

.1 Make up settlement of backfill in roads and walks as it occurs so that regular traffic in and around work is not inconvenienced.

.2 After period adequate to reveal settlement has passed fill depressions to restore correct grade.

.3 Remove and dispose of excess excavated material, and leave site clear and unencumbered.

.4 Make good damage to:

.1 Roads, curbs, lawns, walks, and paved areas caused by excavation, backfill, settlement and subsequent restoration.

.2 Existing underground piping, conduit or other services uncovered during excavation.

End of Section

1 General

1.1 **SECTION INCLUDES**

.1 Design, labour, Products, equipment and services necessary for concrete curbs and pavements Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM A185/A185-M, Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.

.2 ASTM C260, Specification For Air-Entraining Admixtures For Concrete.

.3 ASTM C309, Specification For Membrane-Forming Compounds for Curing Concrete.

.4 ASTM C494/C494-M, Specification For Chemical Admixtures For Concrete.

.5 ASTM D994, Specification For Preformed Expansion Joint Filler For Concrete (Bituminous Type).

.6 CAN/CSA A23.1/A23.2-M, Concrete Materials and Methods of Concrete Construction/Methods of Tests For Concrete.

.7 CAN/CSA A3000, Cementitious Materials Compendium.

.8 CAN/CSA G30.18-M, Billet-Steel Bars for Concrete Reinforcement.

.9 CSA O121, Douglas Fir Plywood.

.10 CAN/CSA S269.3-M, Concrete Formwork.

1.3 **DESIGN REQUIREMENTS**

.1 Concrete: 30 Mpa unless otherwise indicated on drawings. Exterior concrete to have 5-7% entrained air.

.2 Design concrete so that material will not segregate and excessive bleeding will not occur.

.3 Comply to the MTC Manual of Uniform Traffic Control Devices for signs and flagging when working within existing road ways. Any requirements to restrict local traffic due to the contractors works, must be reviewed and approved by the Consultant.

1.4 **SUBMITTALS**

.1 Product data:
- .1 Submit duplicate copies of manufacturer's Product data in accordance with Section 01 30 00 for each material indicating:
  - .1 Performance criteria, compliance with appropriate reference standard(s), and characteristics.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Shop drawings: Submit shop drawings in accordance with Section 01 30 00 indicating elevations, sections, details, materials, joint assemblies, finishes and relationships to adjacent construction.

1.5 **QUALITY ASSURANCE**

.1 Inspection and testing:
- .1 Materials: CAN/CSA A23.1/A23.2-M; Inspect and test for conformance to requirements of this Standard and to Specifications.
- .2 Tests will be made in accordance with CAN/CSA A23.2-M.
- .3 Remove defective materials and completed Work which do not conform to the Contract Documents.

1.6 **DELIVERY, STORAGE, AND HANDLING**

.1 Deliver and store materials on Site in accordance with CAN/CSA A23.1/A23.2-M.

1.7 **SITE CONDITIONS**

.1 Conform to CAN/CSA A23.1/A23.2-M.

.2 Do not deposit concrete on frozen ground. When deposited in forms concrete shall have a temperature between 10°C and 30°C and these limits shall be maintained for 72 hours.

2 Products

2.1 **MATERIALS**

.1 Forms: Plywood to CSA O121, G1S; Douglas Fir plywood, seven ply, exterior grade, waterproof glue, edges sealed with oil based sealer.

.2 Form ties: Adjustable snap ties, formed to break 25 mm or more from surface of concrete after form removal, with a minimum working strength of 1360 kg.

.3 Form release agent: 100% biodegradable, chemically active, VOC compliant, 'Bioform' by Universal Building Product or approved alternative.

.4 Reinforcing steel: CAN/CSA G30.18-M; Billet-steel bars, deformed unless indicated otherwise, Grade 400R.

.5 Welded steel wire fabric: ASTM A185/A185-M; Resistance welded in size and spacing shown for smooth wire fabric, in flat sheets only.

.6 Chairs, bolsters, supports, spacers: CAN/CSA A23.1-M with sufficient strength to rigidly support weight of reinforcement and construction loads. Manufactured by NCA/Acrow - Richmond or Dayton Superior.

.7 Cement: CAN/CSA A3000; Portland, Type 10.

.8 Coarse and fine aggregate: CAN/CSA A23.1/A23.2-M.

.9 Water: CAN/CSA A23.1/A23.2-M.

.10 Water reducing admixture: ASTM C494/C494-M, Type A.

.11 Set retarding admixture: ASTM C494/C494-M, Type D.

.12 Air entraining admixture: CAN/CSA A23.1/A23.2-M and ASTM C260.

.13 Pigmented curing compound: ASTM C309, Type 2, Class B; White pigmented resin based.

.14 Joint filler: ASTM D994, Asphalt impregnated; ‘Asphalt Joint Expansion Joint Filler’ by W. R. Meadows Ltd., in thickness shown on Contract Drawings. Furnish kraft paper or polyethylene sheet as bond breaker between sealant and joint filler

.15 Joint Sealant: Two component, non-tracking, chemically reactive urethane/coal tar modified sealant; ‘Sealtight Gardox’ by W. R. Meadows Ltd. or ‘Vulkem 202' by Tremco.

.16 Bonding Agent: Furnish ‘Sika-Dur’ by Sika, or ‘Intralock’ by W. R. Meadows.

2.2 MIXES

.1 Acceptance of any concrete mix proportion or material, does not preclude its future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unacceptable.

.2 Mix concrete and concrete proportions in accordance with CAN/CSA A23.1/A23.2-M.

2.3 ADMIXTURES

.1 Use admixtures for concrete from single manufacturer, unless otherwise acceptable to Consultant.

.2 Have manufacturer certify that admixtures are compatible.

.3 Add admixtures to concrete mix in accordance with manufacturer's recommendations.

.4 Except as specified otherwise, comply with requirements of CAN/CSA A23.1/A23.2-M.

.5 Use of calcium chloride or additional admixtures, other than those specified, is not acceptable.

3 Execution

3.1 **GENERAL**

.1 Give Consultant at least 2 working days notice prior to placement of concrete to permit a review of compaction, placement of formwork, reinforcing steel, and associated items embedded in concrete for conformance to reviewed shop drawings and Contract Documents.

.2 Do not place concrete on surfaces which contain frost, water or debris.

.3 Provide concrete curb cuts and sidewalk handicap access ramps as indicated, in accordance with the authorities having jurisdiction.

3.2 **PREPARATION**

.1 Verify grades of items set in paving area for conformity with elevations and sections before placing granular base and subbase material.

.2 Obtain approval of subgrade by Consultant before placing granular subbase and base.

.3 Set out work from lines and levels shown on drawings.

.4 Prevent damage to adjacent and/or existing buildings and/or properties, and existing curbs, sidewalks and asphalt paving.

.5 Accurately saw-cut and modify existing sidewalks to nearest adjacent dummy/expansion joint as directed on site by Consultant.

.6 Remove and dispose of debris from the work of this section in accordance with authorities having jurisdiction.

.7 Fine grade, shape and compact subgrade to minimum of 95% Standard Proctor Density.

.8 Wet base immediately in advance of concreting to ensure a firm moist surface without ponding.

.9 Repair damage to base resulting from hauling or equipment operations.

3.3 **FORMWORK**

.1 Construct formwork in accordance with CAN/CSA S269.3-M to produce finished concrete conforming to shape, dimensions, locations and elevations indicated. Ensure no lumber remains in concrete.

.2 Set forms true to line and grade, join neatly and tightly, and stake securely to resist concrete pressure and impact from tampers without springing.

.3 Apply release agent by spray in accordance with manufacturer's recommendations. Ensure form surfaces receive a uniform coating.

3.4 REINFORCING

.1 Place reinforcing steel as shown on reviewed shop drawings and in accordance with CAN/CSA A23.1-M. Make bars as long as possible.

.2 Make splices in locations shown on Drawings. Lap lengths in accordance with CSA A23.3 unless otherwise shown.

.3 Lap ends and sides of wire fabric not less than 150 mm.

3.5 PLACING OF CONCRETE

.1 Before placing fresh concrete against set or partially set concrete, clean surfaces to remove dirt, scum, shavings, debris, laitance, etc. on set surfaces, brush generously with bonding agent.

.2 Place concrete in accordance with CAN/CSA A23.1/A23.2-M.

.3 Slope concrete to levels shown on Contract Drawings.

.4 Do not place concrete at such a rate as to endanger formwork or to prevent proper compaction.

.5 Place concrete to prevent cold joints and segregation and vibrate sufficiently to ensure thorough compaction, maximum density in accordance to CAN/CSA A23.1/A23.2-M

.6 Check Work frequently with accurate instruments during placing of concrete.

.7 When completing concrete placement for day, carry placement through to a scheduled joint location.

.8 Where concrete placement is stopped for more than 30 minutes due to breakdowns, weather or any other reasons, construct extra bulkhead and construction joint as directed.

3.6 CONCRETE CURBS

.1 Align concrete curbs with curves and tangents indicated on drawings. Concrete curb to be in accordance to details indicated on drawings.

.2 Where existing curb is met, the contractor must make the required transition to style and grade of existing curb to the satisfaction of the Consultant.

.3 Curbs shall have expansion joints at minimum 4500 mm o.c. and in accordance with authorities having jurisdiction. Place reinforcing bars at top and base of curb, with minimum 50 mm concrete cover.

.4 All restoration of the existing road structure for the transition to existing curb is the responsibility of the contractor.

.5 Finish edges of dummy joints and expansion joints with 3 mm radius edging tool.

3.7 CONCRETE PAVEMENTS

.1 Concrete sidewalk to be in accordance with details indicated on drawings.

.2 Concrete for standard sidewalk to be 150 mm thick, except through entrances where the concrete shall be 200 mm thick with wire mesh. The compacted granular 'A' is to be 150 mm thick at all locations.

.3 Where existing sidewalk is met, make the required transition to grade, to the satisfaction of the Consultant. Furthermore, co-ordinate with the City and Consultant, to insure compatibility of existing and or future adjacent works by City forces.

.4 All structural concrete, such as but not limited to, concrete walkway adjacent to building, concrete pads for loading docks, and concrete slabs for loading areas to be constructed in accordance with reviewed shop drawings.

.5 Dummy joints: 6 mm deep at 1500 mm o.c. Tool joints with 6 mm wide steel trowel, radiusing edges 6 mm.

.6 Expansion joints: 6000 mm o.c. maximum.

.7 Tool edges of sidewalk with 50 mm wide steel trowel, radiusing edges 6 mm.

.8 Install sealant in expansion/isolation joints as shown and specified.

3.8 CONSOLIDATING

.1 Consolidate concrete in accordance with CAN/CSA A23.1/A23.2-M

.2 Work concrete into complete contact with forms and embedded items. Consolidate concrete adjacent to side forms and along entire length of forms to ensure a smooth surface finish after stripping of formwork.

3.9 CURING AND PROTECTION

.1 Cure and protect concrete in accordance with CAN/CSA A23.1/A23.2-M.

.2 Apply curing compound after finishing operations have been completed, at rate recommended by compound manufacturer. Ensure compound application is uniform and continuous over entire area being cured.

3.10 CONSTRUCTION JOINTS

.1 Obtain Consultant's acceptance to install construction joints in locations other than those shown.

.2 Construct construction joints to CAN/CSA A23.1-M and as shown. Supply and install dowels in construction joints unless otherwise detailed.

.3 Joints at building face or other abutments: place 12 mm joint filler keeping top 12 mm below concrete surface; apply kraft paper or polyethylene bond over filler and fill with self-levelling sealant applied in accordance with manufacturer's printed instructions.

.4 For sawn joints:

- .1 Do sawn joints in accordance with drawing details. Prepare sample sawn joint for approval by Consultant.
- .2 Ensure joints are straight. Mark alignment with chalk line or other suitable guide. Layout to be approved by Consultant.
- .3 Saw joints using approved equipment and methods to produce joint dimensions indicated.
- .4 Supply sufficient men and equipment including standby equipment, to maintain a satisfactory sawing schedule.
- .5 Schedule sawing operations on 24 hour basis and consistent with concrete placing.
- .6 Make initial saw cuts in a progressive manner and as soon as possible without excessive ravelling.
- .7 If a crack occurs ahead of saw cut, stop immediately. Move ahead several joints and cut one or more joints before returning to saw intermediate joints. Where cracking persists, make 1060 mm saw cut from one edge and complete sawing from opposite edge. Adjust sawing schedule accordingly.
- .8 If uncontrolled cracking or other surface damage results from inadequate or improper sawing techniques suspend further concrete operations until situation is corrected and immediately remove and replace damaged slabs.
- .9 Immediately on completion of sawing, flush joints with water to remove laitance.

3.11 FINISHING

.1 When striking off concrete surface, maintain a uniform roll of concrete ahead of first screed for it's full length when finishing machine is on first pass.

.2 Where joints are formed rather than sawn, form longitudinal and transverse joints after final pass of finishing machine.

.3 Hand finish areas inaccessible to finishing machine to same quality and surface characteristics as machine finished surfaces.

.4 Finish concrete surface with an approved float at proper time. Operate from edge to edge with a wiping motion while advancing , with each succeeding pass overlapping previous one.

.5 Check surface with approved straightedge 4500 mm long. Correct irregularities exceeding 5 mm before concrete takes initial set.

.6 Finish edges of slabs with edging tool to form a smooth squared surface. Do not patch with cement paste.

3.12 IDENTIFICATION STAMP

.1 For sidewalks in the public right-of-way, mark concrete at each end of the work and at least every 18000 mm or such other places as the Consultant may select.

.2 The stamp shall be located on the centre of the bay of walk, next to and parallel to a transverse joint.

.3 The size and shape of the stamp shall be as shown on City of Brampton Drawings.

.4 The imprint shall be clear and legible and satisfactory to the Consultant.

3.13 BROOM FINISH

.1 Commence texturing immediately after float finishing.

.2 Use soft bristled broom to produce an approved light, non-slip concrete surface finish with fine granular or sandy texture free from disfigurations. Finishes to be approved by Consultant.

.3 Apply broom finish at right angles to curb and parallel to joints. All trowel and tool marks to be removed with broom. Do not contaminate joints by over-brooming.

3.14 REMOVAL OF FORMS

.1 Do not disturb forms until concrete has hardened and developed sufficient strength to safely support its own weight and load on it.

.2 Strip formwork in accordance with CAN/CSA A23.1-M.

3.15 DEFECTIVE CONCRETE

.1 Concrete is defective when:
- .1 Containing excessive honeycombing or embedded debris.
- .2 Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.
- .3 Average 28 day strength of any three consecutive strength tests is less than specified minimum 28 day strength.
- .4 Any 28 day strength test result is less than 80% of specified minimum 28 day strength.
- .5 Surface texturing, joint type and placement and tolerances are unacceptable in the opinion of the Consultant.

.2 Repair of defective concrete work:
- .1 Repair defective areas while concrete is still plastic, otherwise wait until curing is completed. Use repair methods approved by Consultant.
- .2 Grind off high surface variations where directed.

.3 Remove and replace defective concrete where directed.
- .1 Remove minimum 3000 mm of pavement by sawing through concrete across full lane width.
- .2 Replace with new concrete to this specification.
- .3 Construct dummy contraction joint between sawn face of existing concrete and face of new concrete.

3.16 PROTECTION

.1 Do not open concrete pavement to traffic or construction equipment until concrete reaches 70% of specified strength or until approved by Consultant.

END OF SECTION

TREE & SHRUB PRESERVATION

PART 1 GENERAL

1.1 Description of Work

.1 This section specifies the preservation of existing vegetation on the site.

1.2 Related Work

.1	All Division 1	Specification Sections
.2	Section 01561	Environmental Protection
.3	Section 02231	Clearing & Grubbing
.4	Section 02232	Tree Pruning
.5	Section 02311	Site Grading
.6	Section 02315	Excavating, Trenching & Backfilling
.7	Section 02911	Site Topsoil & Finish Grading

1.3 Quality Control (Specific)

.1 Contractor shall have a thorough knowledge of horticulture, being able to identify trees, shrubs and ground covers by both common and botanical nomenclature. All persons overseeing tree work must be trained according to the tree care standards accepted by the International Society of Arboriculture.

1.4 Product Delivery, Storage, and Handling (Specific)

.1 Roots of existing trees to be preserved are not to be driven on.

.2 Surplus soil, equipment, vehicles, debris or materials shall not be placed over root systems of the trees within the protective fencing. No contaminants will be dumped or flushed where feeder roots of trees exist, that is within 1.5 times the diameter of the tree's canopy. No cables of any type shall be wrapped around or installed in trees.

PART 2 PRODUCTS

2.1 Temporary Tree Protective Fencing (Specific)

.1 Existing trees shall be properly protected beyond the drip line with minimum 1.2m high temporary fencing as per City of Brampton standard until Substantial Performance.

.2 Maintain existing grade within drip line of all trees to be preserved.

.3 The area within the protecting fencing shall remain undisturbed and free of debris, building materials and equipment.

.4 Prune dead wood only unless directed otherwise by the Consultant. Do not prune leaders, all cuts greater than 25mm diameter shall be treated with approved dressing as per Section **02232 Tree Pruning**.

.5 Silt control fabric as per layout and extent on drawings.

2.2 Fertilizing Existing Trees

.1 The Work will be carried out between October 15th and November 14th of the fiscal year.

.2 The Contractor will provide 2.7 kg of actual nitrogen in an organic or synthetic organic form or 9 kg of product 30-10-7 per 100 square meters of area or to a 40 cm diameter tree suspended in 225 litres of water. (6 lbs. of nitrogen or 20 lbs. of product in 50 gallons of water).

.3 The Consultant reserves the right to take samples of the mixture used, for analysis.

.4 The Contractor will be responsible for any damage caused to turf, walkways, trees or structures.

PART 3 EXECUTION

3.1 Layout

.1 Stake out and locate any major root systems from existing trees.

.2 All proposed construction Works that may intersect with root systems of existing trees are to be identified and staked out using yellow flags.

.3 Protective fencing location(s) are to be staked out as directed by the Consultant.

3.2 Execution

.1 **Through Existing Root Systems:** Excavation required through existing root systems due to proposed Works is to be excavated by hand. Roots are to be cut with a sharp axe, and all cuts to be sealed with approved Tree Surgeons paint.

.2 **Pruning:** Prune vegetation, loose bark, hazardous wood removal and all dead and broken branches. Prune branches to compensate for root loss then treat with tree paint.

.3 **Grade Change Higher Around Trees:** Place 100mm diameter perforated pipe on the existing grade, radiating a minimum of 8 spokes out from the trunk, to the spread of branches, sloping away from the trunk. Connect tiles and place tiles at the end of each slope. The upright spokes shall be extended to reach the new grade to allow for aeration and watering. Tiles are to be covered with clean crushed rock and fill area covered with the tile system with sandy gravel fill.

.4 **Grade Change Lower Around Trees:** A 1:3 downward slope is be constructed to the new grade. Water is to be applied at least three (3) times during dry summer periods and once prior to freeze-up, until the tree has adapted to the new conditions, or until the project has been certified Substantially Performed.

.5 **Fencing:** Maintain Temporary Tree Protective Fencing until removal which is directed by the Consultant.

.6 **Fertilize**: Fertilize in accordance with good horticulture practises to ensure promotion of root growth for two (2) years after acceptance. Where trees whose roots have been disturbed, within the drip line, drill holes 20mm in dia. and 40mm deep at 1000mm intervals on a square grid pattern under the trees drip line, fill holes with topsoil, and water.

3.3 Trees To Be Replaced

.1 Existing trees to remain as per the Contract Documents that have been severely damage or die as a result of the construction shall be replaced with the same species or as approved by the Consultant. Trees to be removed shall be cut completely flush to ground or as otherwise directed by the Consultant.

3.4 Damage

.1 Contractor to repair or make good any damage to trees or other vegetation, at no additional cost to the Owner.

END OF SECTION - 02901

PLANTING OF TREES, SHRUBS, GROUNDCOVERS & TRANSPLANTING

PART 1 GENERAL

1.1 Description of Work

.1 This section describes the labour, all materials and installation requirements necessary to complete the tree, shrub, and groundcover planting and transplanting as indicated or specified herein.

1.2 Examination

.1 Contractor to report to the Consultant, in writing of any conditions or defects encountered on the site during or before construction upon which Work of this section depends and which may adversely affect its performance.

.2 Do not commence Work until such conditions or defects have been investigated and corrected.

.3 Commencement of Work shall imply acceptance of surfaces and conditions and no claim for damages or extras resulting from such conditions or defects will be accepted thereafter, except in cases where such conditions cannot be known prior to or during the course of construction.

1.3 Testing

.1 Test stockpiled topsoil as specified in Section **02911 Site Topsoil & Finish Grading,** and as noted on the Contract Document drawings, and submit results to the Consultant for review, prior to starting Work on site.

1.4 Related Work

.1 **Establishing Sub-Grade for Planting Beds**
Section 02311 .....Site Grading

.2 **Preparation of Planting Beds**
Section 02911 .....Site Topsoil & Finish Grading

1.5 Submittals

.1 Topsoil: Before delivery of topsoil, provide Contractor with a written statement giving location of properties from which soil is to be obtained, names and addresses of owners, depth to be stripped, and crops during the past two (2) years.

1.6 Reference Standards

.1 Trees, shrubs and ground covers are to be supplied and installed in accordance with the Metric Guide Specification for Nursery Stock Current Edition of the Canadian Nursery Trades Association except where specified otherwise.

1.7 Source Quality Control

.1 Contractor to ensure the all plant material at source is acceptable prior to digging operations;

.2 Imported plant materials must be accompanied with necessary permits and import licenses. Conform to federal and provincial regulations.

1.8 Samples

.1 Provide samples for: Mulch - Canada Red Mulch or Gro-Bark.

1.9 Qualifications

.1 All planting Work described in the Section shall be executed by experienced personnel under the direction of the Contractor.

1.10 Substitutions

.1 All plants shall be supplied as specified in the Contract Documents. Alternates will not be allowed unless approved in writing from the Consultant.

.2 Give timely notice in writing to the Consultant when applying for substitutions.

.3 The Contractor must verify to the Consultant, the lack of availability and source of the specified plant material.

1.11 Delivery, 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 one (1) hour after arrival at site in storage location approved by the Consultant.

.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.

.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 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.

1.12 Warranty

1. The Contractor hereby warrants that plant material as itemized on plant list will remain free of defects for two (2) years from the date of Substantial Performance of the Work.

.2 End-of-warranty inspection will be conducted by the Consultant and Owner.

.3 Consultant reserves the right to extend Contractor's warranty responsibilities for an additional one (1) year if, at end of initial warranty period, plant development and growth is not sufficient to ensure future survival.

1.13 Job Conditions

.1 The Contractor shall receive the site with the planting areas free of waste or debris developed by other trades. Any discrepancy shall be reported to the Contractor prior to planting.

PART 2 PRODUCTS

2.1 Plant Material and Accessories

.1 Type of root preparation, sizing grading and quality: comply with Metric Guide Specification for Nursery Stock, latest addition of the Canadian Nursery Trades Association.

.2 Plant material: free of disease, insects, defects or injuries and structurally sound with strong fibrous root system.

.3 Plant material: root pruned regularly, but not later than one growing season prior to arrival on site.

.4 Trees: with straight trunks, with no bark damage or stump wounds, well and characteristically branched for species except where specified otherwise.

.5 Bare root stock: nursery grown, in dormant stage, not balled and burlapped or container grown.

.6 Collected stock: maximum 40 mm in calliper, with well developed crowns and characteristically branched; no more than 40% of overall height may be free of branches.

.7 Water: potable and free of minerals which may be detrimental to plant growth.

.8 Stakes: T-bar steel stakes 40 x 40 x 5 x 2440 mm drilled to receive # 10 wire and pine or fir wood 38 x 38 x 2400 mm, treated with Pentox preservative.

.9 Black Rubber Hose: 12 mm outside diameter.

.10 Cables and accessories: factory galvanized cables, wire tighteners, eyebolts and turnbuckles. Use turnbuckles with 150 mm long eyebolts and 10 mm diam. threaded opening for tightening.

.11 Guy wires: steel wire strand to CSA G4-M1977 at following sizes:
- .1 Shrubs and trees under 70 mm calliper use l.5 mm diameter wire.
- .2 Trees 70 to l50 mm caliper use 3 mm diameter wire.

.12 Eyebolts: coarse threaded galvanized steel at following sizes:
- .1 Trees l50-500 mm calliper use 10 mm dia.

.13 Flagging: High visibility plastic flagging ribbon 12mm to 25mm width, affixed to midpoint of guy wires.

.14 Tree rings: fabricated from 3 mm galvanized wire encased in two ply reinforced 12 mm dia. rubber garden hose or equivalent.

.15 Wire mesh: galvanized, electrically welded.
- .1 For tree guards use 1.4 mm wire with 25 x 50 mm mesh.

.2 For gunite reinforcing use l.4 mm wire with 50 x 50 mm mesh.

.16 Reinforcing rod: 10 mm bars to CSA G30.12 - Ml977.

.17 Gunite concrete: to ACI 506-66.

.18 Fibreglass fabric: tight woven, min 2.5 kg/m2 mass, 1 m wide.

.19 Root ball burlap: 150 g Hessian burlap.

.20 Tree wrapping material: new, clean, plain burlap strips minimum 2.5 kg/m2 mass 150 mm wide.

2.2 Mulch

.1 Shredded bark wood: varying in size from 25 to 75 mm in length, from coniferous trees or approved alternate, and free of chemicals. "Gro-Bark" or "Canada Red Mulch" is acceptable. Approval of substitutions must be requested in writing prior to commencement of Work.

2.3 Fertilizer

.1 Where topsoil is supplied by the Contractor, the quantities of fertilizers required shall be based on the following minimum rates.

10-6-4 @ 36g/1 mm cal. for trees
12-6-4 @ 890g/m3 of topsoil for shrubs

.2 Fertilizers shall be complete, commercial fertilizers containing not less than 60% urea formaldehyde and the following percentages by weight.

Nitrogen	Phosphoric Acid	Potash
10	6	4
12	6	6

.3 Synthetic commercial type, ratio 5:3:2.

2.4 Anti-Dessicant

.1 Anti-desiccants: wax-like emulsion to provide film over plant surfaces reducing evaporation but permeable enough to permit transpiration.

PART 3 EXECUTION

3.1 Pre-Planting Operations

.1 Ensure plant materials acceptable to the Consultant.

.2 Remove damaged roots and branches from plant material.

.3 Apply anti-desiccant to conifers and deciduous trees in leaf in accordance with manufacturer's instructions.

.4 Remove burlap trunk wrap and notify the Consultant to inspect and accept trees. Re-wrap immediately after inspection.

3.2 Excavation and Preparation of Planting Beds

.1 Establishment of sub-grade for planting beds is specified in Section **02311 Site Grading**.

.2 Preparation of planting beds is specified in Section **02911 Site Topsoil & Finish Grading.**

.3 For individual planting holes:

.1 Stake out location and obtain approval from Consultant prior to excavating.

.2 Stake-out all plant material to be approved prior to planting.

.4 If planting drainage is required:

.1 Excavate to depth and width as indicated.

.2 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.

.3 Scarify subgrade sides of planting hole.

.4 Remove water which enters excavations prior to planting. Notify Consultant if water source is ground water.

3.3 Digging for Plants

.1 All plants shall be dug and delivered to the site as specified on the Plant List, or in the case of relocation of existing plant material on the site, dug according to the following specification.

.2 Plants specified "B/R" shall be moved with bare roots. They shall be dug and moved while dormant, with the major portion of the fibrous root system provided.

.3 Immediately after digging, the root system shall be wrapped or puddle and shall be kept moist to prevent drying out until planted on the site.

.4 All plants specified "B&B" shall be moved with solid balls wrapped in burlap.

.5 No plant shall be used when the ball of earth surrounding the roots has been cracked or broken preparatory to or during the process of planting, or when the burlap and ropes holding the soil ball have been removed prior to planting.

.6 The sizes of root balls for trees shall be as specified below. Ball sizes are minimum and shall be adjusted according to growth habits of plants, and shall be sufficiently large to contain at least 75% of the fibrous root system.

Deciduous Trees

Caliper	Root Ball Diameter
25mm – 40mm	0.60m
50mm	0.75m
75mm	0.90m
100mm	1.05m
125mm	1.35m
150mm	1.50m
200mm	1.80m
250mm	2.50m

Coniferous Trees

Height	Root Ball Diameter
1.8m-2.4m	0.75m
2.4m-3.0m	0.90m
3.0m-3.6m	1.05m
3.6m-4.6m	1.20m
4.6m-5.4m	1.35m

3.4 Handling of Plants

.1 All plants shall be well protected against damage and drying out from the time of digging until they are planted on the site.

.2 All roots shall be cleanly cut; split roots are not acceptable. Where combing is not practised, the roots shall be evenly cut at the edges of the ball. The cut ends of all roots 25 mm in diameter and larger shall be painted with asphalt emulsion.

.3 Plants shall be transported with care taken to prevent damage. Branches shall be carefully tied in such a manner so as not to break or damage trunks. Points of contact with equipment shall be padded.

.4 Plants with broken or abraded trunks or branches are not acceptable.

.5 Root balls, trunks, branches and leaves shall be protected from sun and wind desiccation.

3.5 Planting

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

.2 For burlapped root balls, ensure the wire basket is sitting 100mm + below finished grade. Cut away top one-third 1/3 or of wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball. Cut and remove all nylon rope around tree trunks.

.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 staked and approved. 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 on detail.

.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.

3.6 Trunk Protection

.1 Install trunk protection on deciduous trees as indicated.

.2 Install trunk protection after trees have been inspected and accepted by Consultant.

3.7 Tree Supports

.1 Install tree supports as indicated on detail(s) Deciduous Tree Planting and Coniferous Tree Planting, unless otherwise specified.

3.8 Mulching

.1 Mulch shall be free from deleterious materials and shall be stored as to prevent inclusion of foreign materials.

.2 For fall plantings placing of mulch to occur in following spring after soil thaws and warms up.

.3 Ensure soil settlement has been corrected prior to mulching.

.4 Spread mulch as indicated, minimum 100 mm thick.

3.9 Acceptance

.1 Plant material will be accepted by the Consultant after planting operation is completed provided that plant material exhibits healthy growing condition and is free from disease, insects and fungal organisms after the warranty period.

.2 Plant material installed less than ninety (90) days prior to frost will be accepted in the following spring, thirty (30) days after start of growing season provided that acceptance conditions are fulfilled.

.3 A preliminary inspection will be held sixty (60) days from day of acceptance to determine plant health and overall acceptability. All plants that are not healthy will be noted and shall be removed from the site and replaced with plants of the same species and size as originally specified. The Consultant may extend the warranty period for replacement plants if highly unsatisfactory conditions exists, two

(2) years after acceptance of the replacement planting.

.4 A final inspection of the replacement plants will be conducted at the end of extended warranty period, if any, to determine acceptance or rejection. This will be the final replacement.

3.10 Replacements

.1 All plant materials found dead, or not in a healthy, satisfactory growing condition or which, in any other way, do not meet the requirements of the Specifications, shall be replaced by the Contractor. All costs shall be borne by the Contractor.

.2 All required replacement shall be plants of the same size and species as specified in the Plant List and shall be supplied and planted in accordance with the Contract Document drawings and specifications.

3.11 Maintenance

.1 Perform following maintenance operations from time of planting to Substantial Performance of the work.

.1 Water to maintain soil, moisture conditions for optimum establishment, growth and health of plant material without causing erosion. For all plant material, water thoroughly in late Fall prior to freeze-up to saturated soil around root system.

.2 Remove weeds monthly from planting beds and tree pits to ensure healthy and vigorous plant growth.

.3 Replace or respread damaged, missing or disturbed mulch.

.4 For non-mulched areas, cultivate as required to keep top layer of soil friable.

.5 Ensure plant material is in a healthy, vigorous state at time of Final Acceptance.

.2 Apply pesticides in accordance with Federal, Provincial and Municipal regulations as and when required to control insects, fungus and disease. Obtain product approval from the Consultant prior to application.

.1 Remove dead or broken branches from plant material.

.2 Keep trunk protection and guy wires in proper repair and adjustment. Remove trunk protection, tree supports and level watering saucers at end of two (2) year warranty period, unless sooner as directed by the Consultant.

.3 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

.4 Submit semi-annual written reports to Consultant 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 - 02906

SITE TOPSOIL & FINISH GRADING

PART 1 GENERAL

1.1 Related Work

.1	Section 02311	Site Grading
.2	Section 02315	Excavating, Trenching, & Backfilling
.3	Section 02906	Planting of Trees, Shrubs, Ground Covers & Transplanting
.4	Section 02924	Seeding
.5	Section 02938	Sodding

1.2 Source Quality Control

.1 **Testing of Topsoil**

.1 All topsoil to be used on park sites, sports fields, planting beds, trees etc. must be tested by an approved testing in accordance with General Requirements:

Section 01600 **Materials, Equipment and Workmanship Quality**
Section 01450 **Quality Control & Inspection**

.2 Test topsoil from source prior to stripping and stockpiling for :

.1 Particle size analysis (percentage of sand, silt and clay by Hydrometer Method).

.2 Organic matter, phosphorus (sodium bicarb), potassium, magnesium, calcium, soil pH, buffer pH, percent base saturation and calculated CEC. (Cation Exchange Capacity)

.3 Test for Sulphur, Zinc, Manganese, Iron, Copper, Boron and soluble salts content, and Atrazine.

.3 Use 25mm diameter sampling tube or spade and in the presence of the Consultant, take twenty-five (25) samples per hectare to full depth of topsoil at random across entire area to be stripped. Mix samples together thoroughly before submitting for testing.

.4 Submit 0.5 kg sample of topsoil to testing laboratory and indicate present use, intended use, type of subsoil and quality of drainage. Prepare and ship sample in accordance with provincial regulations and testing laboratory requirements.

.5 The Contractor shall arrange for and assume all costs for such testing of topsoil imported to the site and the amendment

recommendation report. For onsite topsoil stockpiles, unless otherwise provided for in this document, the tests and report shall be arranged and paid for by the Contractor. A City of Brampton Representative must be present for the sample selection. Submit two (2) copies of soil analysis and recommendations for corrections to sustain vigorous plant growth including recommended fertilizer applications to the Consultant prior to commencing of topsoil spreading and topsoil delivery.

.6 Stockpiled topsoil will be amended by shredder as per the recommendations for corrections in the presence of the Consultant.

.7 When the source of such topsoil is exhausted, topsoil from a new source shall not be used until tested and approved.

.8 The Contractor has one (1) growing season from the time of soil testing to implementation on site. Any test result that is older than one (1) growing season may be asked to be retested at the discretion of the Consultant.

1.3 Scheduling of Work

.1 Schedule placing of topsoil and finish grading to permit sodding or seeding operations under optimum conditions.

PART 2 PRODUCTS

2.1 Materials

.1 Topsoil: friable, neither heavy clay nor of very light sandy nature consisting of the following, within 5% +/-: 45% sand, 35% silt, 20% clay and pH of 6.2 to 7.2. Free from subsoil, roots, vegetation, debris, toxic materials, stones over 50 mm diameter, containing four percent (4%) **minimum** organic matter for clay loams and two percent (2%) **minimum** organic matter for sandy loams and must be capable of sustaining vigorous plant growth.

.2 All topsoil whether existing or imported topsoil for use under sodded areas shall be screened topsoil having passed through a 25mm size screen and ensure that it is free from:

.1 Debris and stones over 25 mm diameter.

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.3 Planting Soil for planting of trees, shrubs and ground covers from the stockpile shall be mechanically shredded and amended as per the soil analysis recommendations for corrections. Rototilling or mixing by other means is not acceptable.

.4 Manure: Well-rotted, unleached cattle manure, free from harmful chemicals and other injurious substances and saw dust, shavings, or similar refuse, at least eight (8) months old, but not more than two (2) years old, and with no more than 25% straw, leaves or **other unacceptable materials** for planting use.

.5 Peat Moss: Shall be partially decomposed fibrous or cellular stems and leaves of Sphagnum Mosses with a texture varying from porous fibrous to spongy fibrous, fairly elastic and substantially homogeneous with a pH value of not less than 4.5 and not greater than 6.0. It shall be baled and free of decomposed colloidal residue, wood, sulphur and iron, be brown in colour and finely shredded, suitable for horticultural purposes. Shredded particles shall not exceed 5 mm in size.

.6 Fertilizer: All fertilizer and soil amendment materials and quality to meet recommendations and standards outlined in the soil testing report.

PART 3 EXECUTION

3.1 Soil Preparation of Existing Grade

.1 Grade soil, eliminating uneven areas and depressions, ensuring positive drainage. Remove soil contaminated with toxic materials. Dispose of removed materials as directed by Consultant.

.2 Cultivate entire area which is to receive topsoil to following depths:

.1	Sod:	150mm boulevard areas; 200mm building lots
.2	Seed:	150mm
.3	Flower beds:	300mm
.4	Shrub beds:	450mm
.5	Trees:	as specified or as directed by the Consultant.

.3 Repeat cultivation in those areas where equipment used for hauling and spreading has compacted soil.

.4 Remove surface debris, roots, vegetation branches and stones in excess of 50 mm diameter.

.5 Special Conditions:

1. Environmentally sensitive areas, wetlands, or natural heritage sites where existing soil conditions are sufficient to sustain additional plantings, the Consultant may request that plantings be installed in native, undisturbed soil.

3.2 Soil Amendment Preparation

.1 The Consultant will accept three (3) means of soil amendment preparation for areas seeded, sodded, or planted. These means are as follows:

.1 Mixed and prepared by a mechanical shredder on site.
.2 Mixed and amended on the site.
.3 Pre-mixed soils imported to the site.

.2 The Consultant will be responsible for reviewing soils during the preparation process and clarify in writing to the Owner that the final soil product(s) and installation conforms to the specification.

3.3 Spreading of Topsoil or Planting Soil

.1 Spread topsoil after the Consultant has inspected and certified rough grading.

.2 Spread topsoil with adequate moisture in uniform layers over approved, unfrozen subgrade, where, sodding or seeding is indicated. Irregularities in the surface resulting from topsoiling or other operations shall be corrected to avoid the formation of depressions causing standing water.

.3 Apply topsoil to following minimum depths: 150mm for seeded areas, 100mm for sodded areas.

.4 Apply planting soil to following **minimum** depths:

.1	Sod:	150mm boulevard areas; 200mm building lots.
.2	Seed:	150mm
.3	Flower beds:	300mm
.4	Shrub beds:	450mm
.5	Trees:	as specified or as directed by the Consultant.

5. Manually spread topsoil or planting soil around existing trees, shrubs and obstacles.

6. Where any portion of the surface becomes gullied or similarly damaged,
the Contractor will repair affected area adding topsoil as necessary to restore to the satisfaction of the Consultant.

7. Contractor is to install and maintain erosion control fencing to prevent soil erosion.

3.4 Soil Amendments

.1 Apply soil amendments at rate and number of applications as specified and as determined from soil test and report, including any maintenance recommendations.

.2 Mix soil amendments into full depth of topsoil prior to application of fertilizer.

3.5 Application for Fertilizer

.1 Spread fertilizer uniformly over entire area of topsoil at manufacturer's recommended timing and rate of application.

.2 Mix fertilizer thoroughly to full depth of topsoil.

3.6 Finish Grading

.1 Fine grade and loosen top soil. Eliminate rough spots and low areas to ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.

.2 Roll to consolidate topsoil for areas to be sodded leaving surface smooth, uniform, firm against deep foot printing, and with a fine loose, texture to approval of Consultant.

3.7 Restoration of Stockpile Sites

.1 Restore stockpile sites to a ‘rake clean' condition acceptable to the Consultant.

3.8 Surplus Material

.1 Dispose of materials not required off site or as directed by the Consultant.

END OF SECTION - 02911

SEEDING

PART 1 GENERAL

1.1 Description of Work

.1 This section describes the labour, materials, and installation requirements necessary to complete the seeded turf planting related items as indicated or specified.

1.2 Related Work

.1	All Division 1	Specification Sections
.2	Section 01600	Material, Equipment & Workmanship Quality
.3	Section 02311	Site Grading
.4	Section 02911	Site Topsoil & Finish Grading

1.3 Product Data

.1 Submit product data in accordance with Section **01330 Submittals**.

.2 Provide product data for:

.1 Seed
.2 Mulch
.3 Fertilizer

1.4 Delivery, Storage and Acceptability

.1 All grass seed hydraulic mulch, fertilizers and other related materials, where required, shall be stored in a dry, weatherproof area and shall be protected from damage by heat, moisture, rodents, or other elements until the time of seeding or use. All material shall be labelled by grower or manufacturer as separate items and shall not be removed or defaced.

.2 Bulk deliveries of seed shall be accompanied with delivery tickets specifying percentage germination, purity, and noxious weed seed content.

1.5 Measurement for Payment

.1 Seeding will be measured as per square metre unless otherwise stipulated in the Bid Document – Price Schedule.

1.6 Job Conditions

.1 The turf areas will be free of waste or debris developed by other trades. Any discrepancy from such conditions shall be reported to

the Contractor before beginning construction.

1.7 Grading

.1 The Contractor shall grade all turf areas as noted on the Contract Document drawings;

.2 Fine grade all turf areas eliminating rough or low areas to ensure positive drain age.

PART 2 PRODUCTS

2.1 Grass Seed Mixture

.1 Consult the Consultant to determine specific requirements for seed mixture application. Fertilizer application rates are to be as recommended in the soils test report.

.2 Grass Seed shall be Certified Canada No. 1 Grade to Government of Canada, Seeds Regulations and having minimum germination of 85% and minimum purity of 97%.

.3 Seed mixtures shall be suited to the climate, soil conditions and type, orientation, sun exposure, terrain, establishment and maintenance conditions under which they are to be grown.

.4 The mixture shall be mixed and supplied by a recognized certified seed supplier.

2.2 Seed Labelling

.1 All seed and seed mixes shall be in the original sealed package with the original legible label securely attached.

.2 Labelling shall conform to the requirements of the Canadian Seeds Act and Regulations. Each package shall be labelled to show:

1. The name and address of the seed supplier.
2. The seed species, or the name of the seed mix and the various individual seed species that comprise the seed mix and the percentage by mass.
3. The grade of the seed or seed mix.
4. The supplier’s name and lot designation number.
5. Mass in kilograms
6. Date and location of bagging
7. Year of production

.3 Seeding mix specification for **Upland Naturalization Seed Mix**.

40% Elymus riparius (Riverbank Wild Rye)
25% Oenethera biennis (Evening Primrose)
10% Rudbeckia hirta (Black Eyed Susan)
5% Euthamnia graminifolia (Grass Leaf Goldenrod)
5% Carex granularis (Open Field Sedge)
2% Solidago Canadensis (Canada Goldenrod)
2% Asclepsis syriaca (Common Milkweed)
1% Aster cordifolius (Heart Leaved Aster)
1% Aster novae-angliae (New England Aster)
1% Anenome canadensis (Canada Anenome)
1% Clematis virginiana (Virgins Bower)
1% Monarda fistulosa (Wild Bergamot)

Seed rate to be 26 kg/Ha.

To be spread with Lolium multiflorum cover crop. Cover crop seed rate to be 22 kg/Ha. Ideally seed in Fall.

.4 Seeding mix specification for **Tableland parks**:

48% Creeping Red Fescue
15% Majestic Kentucky Bluegrass
13% Palmer Perennial Rye Grass
11% Gator Perennial Rye Grass
7% Fortress Creeping Red Fescue
6% Yorktown II Perennial Rye Grass

.5 Seed mix specification for **Valleylands**:

10% White Clover
15% Fiesta Perennial Rye Grass
10% Mustang Tall Fescue
10% Creeping Red Fescue
15% Timothy
10% 'Dormie' Kentucky Blue Grass
30% Bird’s Foot Trefoil

.6 Seed mix specification for **Road Buffers:**

25% RFT Tall Fescue (Festuca arundiancea ‘Rhizomatous’)
30% Perennial Rye Grass (Lolium perenne)
25% Creeping Red Fescue (Festuca rubra)
5% Kentucky Blue Grass (Poa pratensis)
5% White Clove (Tripofolium repens)
10% Bird’s Foot Trefoil (Lotus corniculatus)

.7 Seed rate as per manufacturer's recommendation.

.8 Seed will be shipped in containers with original tags from recognized supplier

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2.3 Mechanical Seeding

.1 Use equipment suitable for specified area to approval of Consultant. Where area allows, the "Brillion" type equipment is recommended.

.2 Use manually operated broadcast seeder only for small specific locations and areas inaccessible to "Brillion" seeding.

.3 Sow at the rate of as per manufacturer's recommendation during calm weather and when soil moisture content is adequate for germination.

.4 Sow seed in two directions, 50% of seed in one direction and remaining 50% of seed at right angles to first seeding pattern, using same method of seeding.

.5 Cover broadcasted seed by raking and chain harrowing.

.6 Hydro-Mulching:

.1 Mix fibre mulch with water according to manufacturer's recommendations, and apply to seeded areas at a minimum rate of 1600 kg/ha (16kg/100m2). Apply 2250 kg/ha (22.5 kg/100m2) on areas subject to wind and water erosion.

.2 Add and mix tackifier into slurry of water and fibre mulch and apply as required according to manufacturer's instructions and recommendations.

.3 Using hydro-mulching equipment, apply fibre mulch slurry mixture within twenty-four (24) hours of mechanical seeding. Achieve uniform coverage after application.

.7 Roll seeded grass with roller not exceeding 50 kg where uneven soil conditions warrant.

.8 Water entire area with fine spray after each area has been sown. Apply water only where application of water is practical and will not interfere with other Work.

.9 Apply enough water to ensure penetration of at least 50 mm, avoid

washing out seeds.

2.4 Hydro-Seeding and Mulching

.1 Proceed with hydro-seeding only after final grade has been approved by Contractor.

.2 No Hydro-seeding shall be performed when wind speeds exceed 10 km/h, over frozen soil, or on ground covered in snow, ice or standing water. Hydro-seed only when conditions are favourable for successful seed germination.

.3 Do not spray onto structures, signs guardrails fences, plant material, utilities and other than surfaces intended. Clean-up immediately, any material sprayed where not intended to the satisfaction of the Consultant.

.4 One- Step Hydraulic Seeding and Mulching

.1 Thoroughly mix grass seed, fertilizer, fibre mulch and water to obtain following slurry mixture and application rates per hectare.

1. Grass Seed – 300 kg/ha.
2. Fertilizer – (12-51-0) at 300 kg/ha.
3. Fibre Mulch – minimum 1600 kg/ha or 2250 kg/ha on areas subject to wind and water erosion.
4. Water – minimum 32,000 litres and to fibre mulch manufacturer's recommendations.

.2 Add tackifier directly into slurry mixture and thoroughly mix at rate recommended by manufacturer. Apply tackifier as required according to manufacturer's instructions.

.3 Using appropriate hydraulic hydro-mulching equipment, apply slurry mixture uniformly at optimum angle of application.

.4 Use proper nozzles for application and provide hose extensions to propel mulch slurry to inaccessible areas.

.5 Agitate slurry mix consistently during spraying to keep it homogeneous and avoid blockage to pipes.

2.5 Terra Seeding

.1 Terra Seeding Installation contractor must have three (3) years proven experience in the application of Terra Seeding using a

Blower Truck.

.2 A legible, valid Seed Analysis Certificate from a Seed Testing Laboratory approved by the Canadian Food Inspection Agency (CFIA) for all single seed species and all seed mixtures shall be provided to the Consultant twenty-four (24) hours prior to any seeding operations. The Seed Analysis Report shall stipulate the seed supplier's lot designation numbers.

.3 Test Results from the Seed Analysis Certificate shall specify germination and purity for each seed species of the mix as well as the seed mix composition expressed as a percentage of each see species by mass for each seed mix specified in the contract. Test results shall meet or exceed the value for the various seed mixes as specified by the consultant.

.4 Materials:

.1 Permanent Seed Mixes: Use permanent seed mixes as specified on drawings.

.2 Annual Nurse Crop Seed: Nurse crop seed shall be a cereal grain such as Annual Ryegrass, Fall Rye Grain or Winter Wheat Grain unless otherwise approved by the Consultant.

.3 Fertilizer: Shall comply with the provisions of the Canadian Fertilizers Act and Fertilizer Regulations. Fertilizer shall be supplied in original bags bearing the manufacturer's original label indicating mass and analysis. All fertilizer shall be in granular form, dry, free flowing and free from lumps, and applied at rates specified by the Consultant.

.4 Composted Topsoil: Shall be pre-mixed and shall consist of a minimum 60% compost material. The composted topsoil may be amended by the additional of concrete sand and peat loam. Concrete sand shall be added to improve aeration and soil structure. Peat loam shall be added to adjust the pH of the compost and to make the composted topsoil lighter and easier to blow. Both amendments shall be added at the discretion of the Contractor to ensure that the composted topsoil meets the material specification and is suited for distribution by a pneumatic blower. Once mixed, composted topsoil material shall consist of particles where 100% of the material is able to pass through a 25 mm sieve.

.5 Compost: Shall be derived from a well-composted green organic waste matter from an approved source. All compost

material shall meet the Ontario Ministry of the Environment's Interim Guidelines for the production and Use of Aerobic Compost in Ontario definition for Type A compost and shall be supplied from composting sites certified to meet the Ontario Ministry of the Environment's Compost Regulation 101.

.6 Concrete sand shall have a pH range from 7.7 to 8.0 with a mid-range of 7.8 and shall meet gradation requirements for concrete sand as described in OPSS.

.7 Peat loam shall consist of a minimum 50% organic matter and equal parts sand, silt and clay. Peat loam shall be suitable for horticultural purposes. Shredded particles shall not exceed 16 mm in size.

.5 Equipment:

.1 Pneumatic Blower Truck: Shall be a custom manufactured, fully integrated, truck mounted unit. The blower truck shall be equipped with a computer-calibrated seed injection system and shall be capable of uniformly applying composted topsoil and seed at a rate greater than 0.25 cubic meters of material per minute. The blower truck shall also be equipped with an application hose capable of extended 90 meters from the blower truck unit.

.6 Operational Constraints :

.1 The composted topsoil and seeding operation shall not commence until a legible, valid Seed Analysis Certificate and a legible, valid signed declaration from the compost supplier has been approved by the Consultant.

.2 The composted topsoil and seeding operation shall not commence until the Consultant has approved the surface preparation and the layout of permanent seed mixes.

.3 The composted topsoil and seeding application and or the re-application shall not be carried out under adverse field conditions such as high wind, frozen soil or soil covered with snow, ice or in areas of standing water to a concentrated flow of water.

.4 The Contractor shall maintain the site and control erosion until conditions permit application or re-application of seed and compost topsoil.

.5 The surface shall be prepared not more than seven (7) calendar days before the seeding operation. No seeding or composted topsoil application shall come in contact with the foliage of any trees, shrubs, or other vegetation. No seed or composted soil application shall come in contact with water bodies.

.7 Application Rates for Composted Topsoil:

1. Depending of the slope gradation, depth and composted soil, seed shall be as follows:

0- 5% slope:	10-15 mm. depth
5- 10% slope:	15-20 mm. depth
10-25% slope:	(4:1) 20-25 mm. depth.
25-35% slope:	(3:1) 25-40 mm. depth
35-45% slope	(40-50 mm. depth

2. Composted Topsoil and Seed Application

1. Prior to the application of the composted topsoil and seeding, the Contractor shall ensure that the pneumatic blower has been properly calibrated to provide the specified amounts of seed and that the blower can adequately uniformly apply composted topsoil and seed at a rate greater than .025 cubic meters of material per minute.

2. Once the blower has been calibrated, the Contractor shall apply composted topsoil and seeding uniformly ay specified depths to all areas identified for cover in the contract drawings or as directed by the Consultant.

2.6 Water

.1 Water used should be potable and shall be free of impurities that would inhibit germination and growth or may be harmful to the environment.

2.7 Seed Protection on Slopes and Ditches

.1 Erosion Control Blanket: where applicable, refer to plans for extent.

.1 Bonterra S1 Erosion Control Blanket or approved alternate: 100% weed free wheat straw .50 lb./yd^2. Netting on top side made of photo-degradable polypropylene or alternate with

mesh openings of approximately (13 mm x 13 mm). Blanket sewn with biodegradable or photo-degradable thread on 50 mm centres or approved alternate.

.2 Cover all prepared and seeded slopes 3:1 or steeper with erosion control blanket.

.3 Unroll blanket either horizontally or vertically to the slope without stretching or pulling.

.4 Lay blanket smoothly on soil surface. Overlap adjacent sections of blanket minimum 100 mm and use metal staples.

.5 Secure blanket to ground with staples in accordance with the erosion control blanket manufacturer's instructions.

.6 Minimize damage to seedbed during installation of blanket. Re-grade by hand raking as required, to correct any damage.

.7 In ditches and swales, unroll blanket in the direction of flow. Overlap adjacent sections of blanket minimum of 100 mm with upstream section on top and stapled. Follow manufacturer's installation recommendations.

2.8 Protection of Seeded Areas - General

.1 Immediately after seeding provide adequate protection against erosion, pedestrian and vehicular traffic damages. Protect newly seeded areas along walkways using bright coloured ribbon or fencing when necessary. Remove protection after seeded areas become established or when directed by the Consultant.

.2 Keep site well drained and landscape excavations dry.

PART 3 EXECUTION

3.1 Workmanship

.1 Do not perform Work under adverse field conditions such as frozen ground or ground covered with snow, ice or standing water.

3.2 Preparation of Surfaces

.1 At the time of seeding, all top soiled areas designated for seeding shall be free from erosion and shall have a fine graded, uniform surface free of humps and hollows. The surface shall be uniformly

cultivated with agricultural implements to a minimum depth of 50mm and shall not have surface stones greater than 50mm in diameter, weeds or other unwanted vegetation. Ensure areas are free of deleterious and refuse materials.

.2 Soil to be loose, friable and suitable as a seedbed to germinate seed, free of humps and hollows and deleterious materials.

.3 Obtain approval of topsoil grade and depth from the Consultant before starting seeding.

3.3 Area and Layout

.1 The locations of the different, permanent seed mixtures and composted topsoil shall be staked out on the ground surface in accordance with the contract documents. Stakes shall be used to indicate the limits of each type of seed mix.

3.4 Seeding

.1 Schedule seeding to be carried out when seasonal conditions are likely to ensure successful germination and a continued growth of all species of seed in the grass mixture establishment. All seeding shall be done during calm weather and on soil that is free of frost, snow and standing water.

.2 Seed shall be applied by Mechanical Dry Seeding, Terra Seeding, or Hydraulic Seeding unless otherwise specified.

.3 Sow seed uniformly at the rate as per manufacturer's recommendations.

.4 Seed between August 15th and September 15th, and between April 15th and May 1st unless otherwise directed by the Consultant.

.5 Blend applications into adjacent grass areas or sodded areas previous applications to form uniform surfaces.

.6 Embed seed into soil to depth of 5 mm within one hour of sowing.

.7 Roll area immediately with water ballast type idler prior to watering.

.8 Install Erosion Control Material as per manufactured instructions in areas as shown on plans and details.

.9 Protect seeded areas against damage by using temporary protective hoarding and signage to protect newly seeded areas from damage

including erosion, pedestrian and vehicular traffic or wild life. Remove this protection after lawn areas have been accepted by the Consultant.

3.5 Establishment

.1 Perform following operations from time of seed application until Preliminary Acceptance:

.1 Repair and reseed dead or bare spots to allow establishment of seed prior to Preliminary Acceptance.

.2 Cut grass to 40 mm whenever it reaches height of 60 mm. Remove clippings which will smother grass.

.3 Fertilize seeded areas after first cutting at the recommended rate per hectare as per testing agency. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well. Postpone fertilizing until following spring if application falls within four week period prior to expected end of local growing season.

.4 Eliminate weeds by mechanical means.

3.6 Maintenance

Perform the following operations from time of installation to acceptance and until the end of warranty period:

.1 Apply water in sufficient quantities to maintain optimum soil moisture level for germination and continued healthy growth of grass. Promptly repair and reseed any damage that occurs through washout of soil.

.2 Areas with no irrigation system: supply labour, hoses and attachments necessary to provide adequate watering to prevent grass and underlying soil from drying out.

.3 Provide clean water and water hauling vehicle with proper attachments to provide efficient and adequate watering of seeded areas when necessary.

.4 Provide weed control in newly seeded areas by mowing when required or directed by the Consultant. Cut and maintain weed growth to height of 100 mm. Remove all weed and grass clippings.

.5 Control and eliminate turf damaging pests that appear in newly seeded areas.

.6 Cut lawn grass at regular intervals and maintain minimum height of 60 mm. Cut forage or native type grass at 80 to 100 mm or as directed by the Consultant. Do not cut more than 30% of blade at any one mowing. Remove clippings that will smother grass.

.7 Re-seed areas which show root growth failure, deterioration, bare or thin spots, or which have been damaged by any means or cause, including replacement operations. Overseed areas that show inadequate or improper sowing of seed from Brillion or other methods.

.8 Fertilize seeded areas during establishment period, minimum six (6) weeks after seeding, with 27-14-0 fertilizer or as directed by the Consultant. Spread evenly at rate of 3 kg/100 m^2, water in well.

.9 Maintain daily maintenance log throughout Contract. Submit copy of log data to the Consultant each week for verification. Record all maintenance activities performed on site.

.10 The Consultant may extend maintenance period at no additional cost when Contractor fails to: maintain an accurate log; submit log when required; or when unsatisfactory and inadequate maintenance occurs.

3.7 Preliminary Acceptance

.1 Seeded areas will be accepted by the Consultant provided that:

.1 Areas are uniformly established to minimum of 95% and turf is free of rutted, eroded, bare or dead spots and free of weeds.

.2 Areas have been cut at least twice.

.3 Areas have been fertilized.

.2 Areas seeded in fall which have not received two (2) cuts will be reviewed for Preliminary Acceptance the following spring, one (1) month after start of growing season provided Preliminary Acceptance conditions are fulfilled.

3.8 Restoration

.1 Upon completion of Work, remove all or any surplus materials and

debris off site.

.2 Reinstate pavement and sidewalks, all amenities, etc., at elevation which existed before excavation.

.3 Clean and reinstate areas affected by Work as directed by the Consultant.

.4 Correct any or all deficiencies previously recorded.

3.9 Warranty

.1 Guarantee seeded areas due to faulty material and workmanship for a period of two (2) years from the issue date of the Substantial Performance of the work. Refer to Section **01700** **Contract Closeout, Takeover & Warranties** for submittal requirements.

END OF SECTION - 02924

SODDING

PART 1 GENERAL

1.1 Description of Work

.1 This section describes the labour, materials, and installation requirements necessary to complete the sodding turf planting related items as indicated or specified.

1.2 Related Work

.1	All Division 1	Specification Sections
.2	Section 02906	Planting of Trees, Shrubs, Groundcovers & Transplanting
.3	Section 02911	Site Topsoil & Finish Grading
.4	Section 02924	Seeding

1.3 Scheduling

.1 Scheduled sod laying to coincide with topsoil operations.

.2 Do not lay sod until topsoil finished grade. Obtain approval of topsoil fine grade prior to sodding.

1.4 Certification

.1 The supplier shall provide, upon request of the Contractor, a label or statement certifying the quality of grade, location of sod source and species of grass in the sod, and that the sod meets the specifications or requirements.

1.5 Delivery, Storage, And Acceptability

.1 All sod shall be reviewed by the Contractor at the job site prior to installation. The Contractor reserves the right to refuse the sod if it is deemed unacceptable.

.2 Schedule delivery in order to keep storage on the job site to a minimum without causing delays.

.3 Each palette, flat, or specified group of sod shall be labelled by the grower or manufacturer as separate items.

.4 During delivery, sod materials shall be protected from any drying or contamination by detrimental material.

.5 Deliver sod to site within twenty-four (24) hours of being lifted and lay sod within thirty-six (36) hours of being lifted.

.6 Do not deliver small, irregular, or broken pieces of sod.

.7 Turf materials shall be sprinkled with water and covered with moist burlap, straw, or other approved covering and protected from sun exposure to wind and direct sunlight. Covering shall be such that air can circulate and heating will not develop.

.8 During dry weather protect sod from drying and water sod as necessary to ensure its vitality. Dry sod is to be rejected by the Contractor.

.9 Deliver fertilizers and similar material to the site packed in standard containers, clearly marked with contents, weight, analysis, and name of manufacturer.

.10 Store fertilizer in dry, weatherproof storage areas.

1.6 Alternatives

.1 Should the Contractor proceed to use material not previously approved or materials contrary to the specifications, the Consultant will proceed to have such works rectified at the Contractor's expense.

1.7 Handling

.1 Sod shall not be dropped or dumped from vehicles.

1.8 Source Quality Control

.1 The Contractor shall:

.1 Supervise all work in this section including implementation and all maintenance until Substantial Performance of the Works.

.2 Shall obtain approvals for suppliers, Sub-Contractors, and materials to be used in this section of Work;

.3 Ensure the sod supplier meets the standards and requirements of the "Nursery Sod Growers Association of Ontario"

.4 Shall obtain approvals from Consultant of sod at source and submit proof to the Consultant that the sod delivered to the site was obtained from the approved source and is #1 Nursery Sod.

PART 2 PRODUCTS

2.1 Materials

.1 Turf Grass Nursery Sod: specifically sown and cultivated in a nursery field all in compliance with the specifications published by Nursery Sod Growers Association of Ontario, Number One Grade Turfgrass Nursery Sod.

.1 Broken, dry, discoloured pieces will be rejected by the Consultant.

.2 Size of Sections: Turfgrass shall be cut by able methods by machines designed for that purpose, to the suppliers length and width, plus or minus 12mm in width and plus or minus 5% in length. Broken pieces and torn or uneven ends are not acceptable.

.3 Thickness of cut: Turfgrass sod shall be cut at a uniform soil thickness (excluding top growth and thatch) of 15mm plus or minus 5 min.

.4 Strength of sod: Minimum age of twelve (12) months, with root development that will support its own weight without tearing, when suspended vertically by holding the upper two corners.

.1 Sod shall be strong enough that a nominal sized section can be grasped at one end, picked up and handled without damage.

.2 Sod shall have strong fibrous root system, free of stones, burned or bare spots.

.5 Moisture Content: Turfgrass sod shall not be harvested or transplanted when its moisture content is too low or too high, resulting in potential damage to the sod.

.6 Grass height: The height of the grass in the sod at the time of harvesting shall be between 40mm and 60mm.

.7 Thatch: Turfgrass sod shall be reasonably free from thatch. Up to 10 mm of thatch (uncompressed) is acceptable.

.8 Diseases, Fungi, Nematodes, Insects: Turfgrass sod shall be reasonably free from diseases, fungi, nematodes and soil-born insects, to the extent that with proper installation methods and initial maintenance new turf will not deteriorate due to such causes.

.9 Wire mesh: 40 mm, plastic.

.10 Wooden pegs, 25 x 25 x 250 mm.

.11 Water used should be potable and shall be free of impurities that would inhibit germination and growth or may be harmful to the environment.

.12 Fertilizer: As recommended by testing agency as per topsoil sample.

.13 Herbicide: type, rate, and method of application subject to approval by Consultant.

PART 3 EXECUTION

3.1 Laying of Sod

.1 Prior to sodding, the Contractor is to verify that the finished grade and depth of topsoil is satisfactory.

.2 Fertilizer as per recommendation by testing agency as per topsoil sample. Refer to Topsoil Section **02911, Subsection 3.5 Application for Fertilizer**.

.3 Sodding during excessively wet conditions, at freezing temperatures or over frozen soil is not acceptable.

.4 Lay sod in rows, perpendicular to slope, and with joints staggered. Butt sections closely without over-lapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

.5 Where new sod abuts existing sodded areas/seeded areas, new sod must be knitted to existing with finish grade of new sod same as existing.

.6 Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

.7 Water sod immediately after laying to obtain moisture penetration into top 100 mm of topsoil.

3.2 Laying of Pegged Sod

.1 Place approved mesh on top of topsoil of slopes steeper than 3:1. Secure mesh in place with wooden pegs or staples at maximum intervals of 1000 mm. Cover mesh lightly with topsoil.

.2 Lay sod sections perpendicular to slopes greater than 3:1 (run/rise) and secure with wooden pegs. Place pegs 3 per m2, 100 mm below to edge to prevent shifting of sod and drive pegs flush with top of sod soil.

3.3 Maintenance

.1 Maintain sodded area from the time of installation until the second cut has been completed AND until Substantial Performance of the Work.

.2 Maintenance shall include all necessary measures to establish and maintain grass in a healthy, vigorous growing condition. Maintenance shall include, but not be limited to the following work until Substantial Performance of the Work

.1 Watering: When required in sufficient quantities and at a frequency to prevent sod from drying out and to maintain topsoil under sod continuously moist to a depth of 75 to100 mm. Water sufficiently to ensure that sod has become firmly rooted in the topsoil.

.2 Mowing: Regular intervals to maintain a maximum height of 50 mm. Do not cut more than 1/3 of the grass height at any one mowing. Trim and clip edges. Remove clippings.

.3 Fertilizing: If instructed by the Consultant, sodded areas may be fertilized based on mixtures and rates as per supplier's and manufacturer's instructions and soil test results. Postpone fertilizing until the spring following a fall installation.

.4 Make good any erosion that results from faulty workmanship or material at no extra cost.

.5 Replace any deteriorated or bare spots with new sod.

3.4 Sod Acceptance

.1 Prior to Substantial Performance of the works, the sodded areas shall meet the following criteria:

.1 Sodded areas are properly established and are self-sustaining.

.2 Sod is free of bare and dead spots and without weeds.

.3 No surface soil is visible when grass has been cut to height of 40 mm.

.4 Sodded areas have been cut minimum two (2) times prior to acceptance review.

.2 The Contractor is responsible to arrange review of sod for acceptance review within one (1) week after second cut. Additional cuts will be required if acceptance review meeting doesn't occur in a timely matter.

.3 Areas sodded in fall will be accepted in following spring one (1) month after start of growing season provided acceptance conditions are fulfilled.

.4 The Owner will take over the cutting of the sod following a successful acceptance review.

3.5 Cleaning

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

END OF SECTION - 02938

SITE FURNISHINGS

PART 1 GENERAL

1.1 Related Work

.1 All Division 1 Specification Sections

1.2 Source Quality Control

.1 Supply manufacturer's samples of finishes and anchoring systems and Shop Drawings for approval by the Consultant.

.2 **All furniture to be a City of Brampton approved standard unless otherwise noted in this section.** Refer to the Planning and Infrastructure Services Department website link indicated below for all Streetscape & Parks Construction Standard Details**:** **http://www.brampton.ca/en/Business/planningdevelopment/guidelines-manuals/Pages/Streetscape-Parks-Construction-Standard-Detail.aspx**

.3 Refer to **Section 01095 Referenced Guidelines** for a list of all Streetscape & Parks Construction Standard Details.

1.3 Inspection

.1 Refer to Section **01450 Quality Control & Inspection**

1.4 Shop Drawings and Product Literature

.1 Submit Shop Drawings and product data as requested by the Consultant.

.2 Indicate dimensions, sizes, assembly, anchorage and installation details for each furnishing specified

1.5 Maintenance Data

.1 Provide maintenance data for care and cleaning of site furnishings at the time of project close out as specified in Section **01700 Contract Closeout, Takeover & Warranties**.

PART 2 PRODUCTS

2.1 Site Furnishings

.1	Bench:	Maglin MLB1200W Black powder coat finish Surface mount 1-800-716-5506
.2	Picnic Table:	Maglin MLPT721W Black powder coat Direct burial Umbrella hole 1-800-716-5506
.3	River Pebble Mulch:	Install as per detail on L2

PART 3 – EXECUTION

3.1 Installation

.1 Install site furniture square and plumb as shown on the Contract Document drawings.

.2 Assemble furnishings in accordance with manufacturer's instructions and details as shown on L2.

.3 Touch up damaged finished to the satisfaction of the Consultant.

.4 Anchoring: All site furniture is to be surface mounted to concrete (as per manufacturer's specifications) or into unit paving. Anchoring system is to be drilled and secured with expansion epoxy grout as supplied by approved manufacturer.

.5 Use tamper-proof nuts.

END OF SECTION - 12500

1 General

1.1 **SECTION INCLUDES**

.1 Labour, Products, equipment and services necessary for foundation drainage Work in accordance with the Contract Documents.

1.2 **REFERENCES**

.1 ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

.2 ASTM F449, Standard Practice for Subsurface Installation of Corrugated Polyethylene Pipe for Agricultural Drainage or Water Table Control.

.3 ASTM F667, Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings.

1.3 **SUBMITTALS**

.1 Product data:
- .1 Submit manufacturer's Product data in accordance with Section 01 30 00 indicating:
  - .1 Performance criteria, compliance with appropriate reference standard(s), characteristics, and limitations.
  - .2 Product transportation, storage, handling and installation requirements.

.2 Samples:
- .1 Submit following samples in accordance with Section 01 30 00:
  - .1 Two 300 x 300 mm samples of drainage board.
  - .2 Two 300 mm long samples of perimeter drainage and/or pipe.

2 Products

2.1 **MATERIALS**

.1 Perimeter drainage:
- .1 ASTM D3350 and ASTM F667, 100 mm diameter HDPE, perforated with fittings prewrapped with filter cloth by Ideal Pipe or approved alternative or ‘TREMDrain Total Drain’ by Tremco Inc.
- .2 Perimeter drainage system to be complete with accessories as required for complete installation including but not limited to corner guard pieces and outlet pipe connections.

.2 Drainage board: Three-dimensional dimpled core and geotextile fabric complete with adhesive or fasteners as required for installation. ‘Miradrain 6000’ by Carlisle Coatings and Waterproofing, ‘Delta-Drain 6000’ by Dorken Systems Inc., ‘TREMDrain’ by Tremco Inc. or ‘Mel-Drain 5035' by W. R. Meadows.

.3 Drainage pipe: ASTM D3350 and ASTM F667, 100 mm diameter HDPE by Ideal Pipe or approved alternative, unperforated with fittings, and perforated with fittings prewrapped with filter cloth in locations as indicated on drawings or as specified herein.

.4 Clean outs: 100 mm HDPE outlets , tees, extension pipes, reducers, flush plugs, etc. suitable for use with drainage pipe as manufactured by Canron Inc, Ideal Pipe, or approved alterative.

.5 Foundation drainage Pipe Fill: 19 mm clear stone in accordance with OPSS 1004.

.6 Granular fill: Free draining, sharp, hard, durable, granular material conforming to OPSS 1010, Type A.

.7 Filter cloth: Terrafix 270R as manufactured by Terrafix Geosynthetics Inc. or approved equivalent.

3 Execution

3.1 EXAMINATION

.1 Verify condition and dimensions of previously installed Work upon which this Section depends. Report defects to Consultant. Commencement of Work means acceptance of existing conditions.

3.2 PREPARATION

.1 Verify substrate surfaces are solid, free from surface water, frozen matter, dust, oil, grease, scaling or laitance, projections and any other foreign matter detrimental to installation.

3.3 INSTALLATION

.1 Install perimeter drainage around perimeter of basement and where indicated on Drawings.

.2 Install drainage board in accordance with ASTM F449 and manufacturer's recommendations. Drainage board shall extend full height of foundation wall to top of footing where indicated on Drawings. Install drainage board after installation of waterproofing membrane is complete. Position panel with flat side against wall and filter fabric toward soil/drainage side and attach to foundation wall using manufacturer approved fastening system.

.3 Provide unperforated drainage pipe between perforated drainage pipe and drain connection installed by Division 22 and 23.

.4 Install drainage pipe on a bed of foundation drainage fill, minimum 100 mm deep where pipe is not placed over footing, and surround with same fill 150 mm thick at sides and over top of pipe and for under floor drainage extend fill to under side of slab.

.5 Provide cleanouts on non-perforated pipe at all changes of direction and in pipe runs greater than 15 metres. Provide flush cleanouts where indicated.

.6 Cover foundation drainage fill with filter cloth. Cover filter cloth with sand 300 mm thick at top and sides.

END OF SECTION

1 General

1.1 RELATED REQUIREMENTS

.1 Section 26 05 26 – Grounding and Bonding for Electrical Systems.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)

.1 ASTM A497/A497M-07, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

.2 ASTM D1056-07, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

.2 Canadian Standards Association (CSA)

.1 CAN/CSA-A3000-08, Cementitious Materials Compendium. Includes:

.1 CAN/CSA-A3001-08, Cementitious Materials for Use in Concrete.

.2 CSA-A23.1-09/A23.2-09, Concrete materials and methods of concrete construction/Test methods and standard practices for concrete.

.3 CSA G30.3-M1983(R1998), Cold-Drawn Steel Wire for Concrete Reinforcement.

.4 CSA G30.5-M1983(R1998), Welded Steel Wire Fabric for Concrete Reinforcement.

.5 CAN/CSA-G30.18-92(R2007), Billet-Steel Bars for Concrete Reinforcement.

.3 Ontario Provincial Standard Drawings (OPSD):

.1 OPSD 2100.06, December 1992, Rigid Ducts Encased in Concrete.

.2 OPSD 2101.02, December 1992, Extension of Existing Rigid Ducts Encased in Concrete.

.3 OPSD 2102.01, January 1990, Underground Rigid Duct Connection at Concrete Substructure.

.4 OPSD 2103.030, March 1998, Duct Installation in Existing Paved Area, Unshrinkable Backfill Method.

.5 OPSD 2110.010, February 1996, Electrical Maintenance Hole Cast in Place, 1200 mm x 1200 mm.

.6 OPSD 2110.050, February 1996, Electrical Maintenance Hole Cast in Place, 600 mm x 1450 mm.

.7 OPSD 2110.060, February 1996, Electrical Maintenance Hole Cast in Place, 1800 mm x 2440 mm.

.8 OPSD 2110.070, February 1996, Electrical Maintenance Hole Cast in Place, 1200 mm x 1650 mm.

.9 OPSD 2111.020, February 1996, Electrical Maintenance Hole Precast Concrete, 600 mm x 1450 mm.

.10 OPSD 2111.030, February 1996, Electrical Maintenance Hole Precast Concrete, 1200 mm dia.

.11 OPSD 2111.040, February 1996, Electrical Maintenance Hole Precast Concrete, 1200 mm x 1650 mm.

.12 OPSD 2111.050, February 1996, Electrical Maintenance Hole Precast Concrete, 1800 mm x 2400 mm.

.13 OPSD 2116.01, December 1992, Drainage Facilities for Electrical Maintenance Holes.

1.3 SUBMITTALS

.1 Submit shop drawings for precast maintenance holes in accordance with Section 26 05 00.

2 Products

2.1 PVC DUCTS

.1 PVC ducts, type EB1, encased in reinforced concrete.

2.2 PVC DUCT FITTINGS

.1 Rigid PVC opaque solvent welded translucent pushfit type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation.

.2 Expansion joints.

.3 Rigid PVC 5 degree angle couplings.

2.3 PRECAST CONCRETE MAINTENANCE HOLES

.1 Precast concrete maintenance holes and auxiliary sections fabricated in steel forms.

.2 Aggregates: to CAN/CSA-A23.1/A23.2.

.3 Portland cement with 40% Fly ash10 GU HE HS.

.4 Steel welded wire fabric mesh reinforcing: to ASTM A497/A497M, CAN/CSA-G30.18.

.5 Neoprene gasket seals between maintenance hole sections: to ASTM D1056.

.6 Size: 762 mm clear diameter.

2.4 DRAINAGE

.1 Floor drain fittings in each maintenance hole consisting of floor drain, back water valve, trap and pipe connection to drainage system. Dry sump.

.2 Storm sewer connection: cast iron service saddle consisting of oil resistant gasket, stainless steel clamp and oil resistant O-ring.

.3 Sump pit: 300 mm x 300 mm x 125 mm.

2.5 MAINTENANCE HOLE NECKS

.1 Concrete brick and mortar.

2.6 MAINTENANCE HOLE FRAMES AND COVERS

.1 Cast iron maintenance hole frames and covers.

.2 Bolted on covers to prevent unauthorized entry.

.3 Size: 762 mm clear diameter.

2.7 GROUNDING

.1 Ground rods: in accordance with Section 26 05 26 for cable rack grounding.

2.8 CABLE RACKS

.1 Hot dipped galvanized cable racks and supports.

.2 12 mm x 100 mm preset inserts for rack mounting.

2.9 CABLE PULLING EQUIPMENT

.1 Pulling iron: galvanized steel rods, size and shape as indicated.

.2 Pull rope: 6 mm stranded nylon polypropylene, tensile strength 5 kN, continuous throughout each duct run with 3 m spare rope at each end.

2.10 MARKERS

.1 Concrete type cable markers: 600 mm x 600 mm x 100 mm, with words: "Cable", "Joint", "Conduit" impressed in top surface, with arrows to indicate change in direction of duct runs.

.2 Cedar post type markers: 89 mm x 89 mm square, 1.5 m long, pressure treated with clear coloured, copper napthenate or 5% pentachlorophenol solution, water repellent preservative, with nameplate fastened near post top, on side facing duct.

.1 Nameplate: aluminum anodized 89 mm x 125 mm, 1.5 mm thick mounted on cedar post with mylar label 0.125 mm thick with words "Cable", "Joint", "Conduit" with arrows to indicate change in direction.

3 Execution

3.1 INSTALLATION GENERAL

.1 Install underground duct banks and maintenance holes including formwork.

.2 Build duct bank and maintenance holes on undisturbed soil or on well compacted granular fill not less than 150 mm thick, compacted to 95% of maximum proctor dry density.

.3 Open trench completely between maintenance holes to be connected before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.

.4 Prior to laying ducts, construct "mud slab" not less than 75 mm thick.

.5 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400.

.6 Install base spacers at maximum intervals of 1.5 m levelled to grades indicated for bottom layer of ducts.

.7 Lay PVC ducts with configuration and reinforcing as indicated with preformed interlocking, rigid plastic intermediate spacers to maintain spacing between ducts at not less than [40] [75] mm horizontally and vertically. Stagger joints in adjacent layers at least 150 mm and make joints watertight. Encase duct bank with 75 mm thick concrete cover. Use galvanized steel conduit for sections extending above finished grade level.

.8 Make transpositions, offsets and changes in direction using 5 degree bend sections, do not exceed a total of 20 degree with duct offset.

.9 Use bell ends at duct terminations in maintenance holes or buildings.

.10 Use conduit to duct adapters when connecting to conduits.

.11 Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension.

.12 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.

.13 Allow concrete to attain 50% of its specified strength before backfilling.

.14 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.

.15 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.

.16 Immediately after placing of concrete, pull through each duct steel wooden mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.17 Install four 3 m lengths of 15M 10M reinforcing rods, one in each corner of duct bank when connecting duct to maintenance holes or buildings. Wire rods to 15M 10M dowels at maintenance or building and support from duct spacers. Protect existing cables and equipment when breaking into existing maintenance holes. Place concrete down sides of duct bank filling space under and around ducts. Rod concrete with flat bar between vertical rows filling voids.

.18 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

3.2 MAINTENANCE HOLES

.1 Build cast-in-place maintenance holes.

.2 Install precast maintenance holes.

.3 Place concrete in two lifts with slab and sump in first, walls, roof and neck in second lift. Provide key in walls to slab. Place 100 mm x 6 mm PVC water bar vertically in key. Install ground rod before placing slab and place reinforcing steel, inserts for cable rack, pulling irons, drain, duct outlets, duct run dowels before casting walls. Make maintenance hole to duct connection as indicated.

.4 Provide 115 mm deep window to facilitate cable bends in wall at each duct connection. Terminate ducts in bell-end fitting flush with window face. Provide four 10M steel dowels at each duct run connection to anchor duct run. On runs of 16 ducts and greater, support concrete duct encasement on a 700 mm wide by 75 mm thick concrete pier poured against maintenance hole wall between slab and bottom of duct run, provide dowels for anchoring.

.5 Alternately connect large duct runs by leaving square opening in wall, later pouring duct run and wall opening in one pour, and install 10M x 3 m reinforcing rods in duct run at maintenance hole connection.

.6 Build up concrete maintenance hole neck to bring cover flush with finished grade in paved areas and 40 mm above grade in unpaved areas.

.7 Install maintenance hole frames and covers for each maintenance hole. Set frames in concrete grout onto maintenance hole neck.

.8 Drain floor towards sump with 1 to 48 slope minimum and install drainage fittings as indicated.

.9 Install cable racks, anchor bolts and pulling irons as indicated.

.10 Grout frames of maintenance holes. Cement grout to consist of two parts sand and one part cement and sufficient water to form a plastic slurry.

.11 Ensure filling of voids in joint being sealed. Plaster with cement grout, walls, ceiling and neck.

.12 Spray paint "X" on ceiling of maintenance hole above floor drain or sump pit.

3.3 MARKERS

.1 Mark location of duct runs under hard surfaced areas not terminating in maintenance hole with railway spike driven flush in edge of pavement, directly over run. Place concrete duct marker at ends of such duct runs. Construct markers and install flush with grade.

.2 Mark ducts every 150 m along straight runs and changes in direction.

.3 Where markers are removed to permit installation of additional duct, reinstall existing markers.

.4 Lay concrete markers flat and centered over duct with top 25 mm above earth surface.

.5 Provide drawings showing locations of markers.

3.4 SITE TESTS AND INSPECTIONS

.1 Inspection of duct will be carried out by Consultant prior to placing.

.2 Placement of concrete and duct cleanout to be done when Consultant present.

3.5 WASTE MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 26 05 00.

.2 Remove from site and dispose of all 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.

.4 Divert unused metal materials from landfill to metal recycling facility as approved by Consultant.

.5 Divert unused and broken concrete materials from landfill to local quarry facility as approved by Consultant.

.6 Divert unused aggregate materials from landfill to quarry facility for reuse as approved by Consultant.

.7 Fold up metal banding, flatten and place in designated area for recycling.

End of Section

1 General

1.1 REFERENCES

.1 Canadian Standards Association (CSA)

.1 CSA C22.2 No. 211.1-M1984(R1999), Rigid Types EBI and DB2/ES2 PVC Conduit.

.2 CSA C22.2 No. 211.3-96(R2000), Reinforced Thermosetting Resin Conduit (RTRC) and Fittings (Bi-national standard, with UL 1684).

1.2 SUBMITTALS

.1 In accordance with Section 26 05 00.

.2 Submit WHMIS MSDS - Material Safety Data Sheets acceptable to Labour Canada and Health and Welfare Canada for solvent cement. Indicate VOC content.

2 Products

2.1 PVC DUCTS AND FITTINGS

.1 Rigid PVC duct: to CSA C22.2 No. 211.1, Type DB2/ES2, with fabricated moulded fittings, for direct burial expanded flange ends, Trade size 5. Nominal length: 6 m plus or minus 12 mm.

.2 Rigid PVC split ducts.

.3 Rigid PVC bends, couplings, reducers, bell end fittings, plugs, caps, adaptors same product material as duct, to make complete installation.

.4 Rigid PVC 90° and 45° bends.

.5 Rigid PVC 5° angle couplings.

2.2 SOLVENT WELD COMPOUND

.1 Solvent cement for PVC duct joints.

2.3 CABLE PULLING EQUIPMENT

.1 6 mm stranded nylon pull rope tensile strength 5 kN.

3 Execution

3.1 EXAMINATION

.1 Verification of Conditions:

.1 Before commencing work establish locations of buried services on and adjacent to site.

.2 Evaluation and Assessment:

.1 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.

.2 Before commencing work, conduct, with Departmental Representative, condition survey of existing structures, trees and plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Use temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, in accordance with 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.

.2 Protection of in-place conditions:

.1 Protect excavations from freezing.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Departmental Representative's approval.

.4 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.

.5 Protect buried services that are to remain undisturbed.

.3 Removal:

.1 Remove obsolete buried services within 2 m of foundations. Cap cut-offs.

.2 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

.3 Cut pavement or sidewalk neatly along limits of proposed excavation in order that surface may break evenly and cleanly.

.4 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.

.5 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.

3.3 EXCAVATION

.1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial and Municipal regulations.

.2 Do blasting in accordance with Provincial and Municipal regulations. Repair damage to approval of Departmental Representative. No blasting will be permitted within 3 m of any building and where damage would result.

.3 Topsoil stripping:

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Strip topsoil to depths as directed by Departmental Representative. Avoid mixing topsoil with subsoil.

.3 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.

.4 Stockpile in locations as directed by Owner.

.4 Excavate as required to carry out work, in all materials met.

.1 Do not disturb soil or rock below bearing surfaces. Notify Departmental Representative when excavations are complete.

.2 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.

.3 Fill excavation taken below depths shown without Owner's written authorization with concrete of same strength as for footings.

3.4 INSTALLATION

.1 Install duct in accordance with manufacturer's instructions.

.2 Clean inside of ducts before laying.

.3 Ensure full, even support every 1.5 m throughout duct length.

.4 Slope ducts with 1 to 400 minimum slope.

.5 During construction, cap ends of ducts to prevent entrance of foreign materials.

.6 Pull through each duct steel mandrel not less than 300 mm long and of diameter 6 mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Pull stiff bristle brush through each duct immediately before pulling-in cables.

.7 In each duct install pull rope continuous throughout each duct run with 3 m spare rope at each end.

.8 Install markers as required.

.9 Arrange for inspection of installation by Electrical Inspector prior to commencing backfill.

3.5 BACKFILLING

.1 Reinstate existing conditions.

.2 Start backfilling only after inspection and receipt of written approval of fill material and spaces to be filled from Departmental Representative.

.3 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.

.4 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

.5 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.

.6 Blown rock material, not capable of fine grading, is not acceptable, imported material is to be placed on this type of material.

.7 Against foundations (except as applicable to trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

.8 Underground tanks: use sand to bottom of granular base courses or to bottom of topsoil, as applicable.

3.6 GRADING

.1 Grade to ensure that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by Owner. Grade to be gradual between finished spot elevations as indicated.

3.7 WASTE MANAGEMENT

.1 Separate and recycle waste materials in accordance with Section 26 05 00.

.2 Remove from site and dispose of all 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.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Fold up metal banding, flatten and place in designated area for recycling.

.6 Do not dispose of preservative treated wood through incineration.

.7 Do not dispose of preservative treated wood with other materials destined for recycling or reuse. Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill as approved by Departmental Representative.

.8 Dispose of unused wood preservative material at official hazardous material collections site. Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.

.9 Dispose of unused solvent cement at an official hazardous material collections sites as approved by Departmental Representative. Do not dispose of unused solvent cement into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.

End of Section

1 General

1.1 RELATED REQUIREMENTS

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

.2 Section 31 23 00 – Excavation and Fill.

1.2 REFERENCES

.1 Canadian Standards Association (CSA),

.1 CAN/CSA-A3000, Cementitious Materials Compendium. Includes:

.1 CAN/CSA-A5, Portland Cement

.2 CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.

.3 CSA G30.3, Cold-Drawn Steel Wire for Concrete Reinforcement.

.4 CSA G30.5, Welded Steel Wire Fabric for Concrete Reinforcement.

.5 CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement.

.2 American Society for Testing and Materials (ASTM),

.1 ASTM D1056, Specification for Flexible Cellular Materials – Sponge or Expanded Rubber.

1.3 SUBMITTALS

.1 Submit manufacturer's test data and certification at least 2 weeks prior to commencing work.

.2 Submit manufacturer's information data sheets and instructions.

1.4 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store, and handle materials in accordance with Section 26 05 00.

1.5 CLOSEOUT SUBMITTALS

.1 Record documentation: provide record drawings, including details of pipe and duct bank materials, maintenance and operating instructions.

2 Products

2.1 MANHOLES

.1 Pre-cast or cast-in-place

.2 Designed for heavy traffic (buses) area

.3 Concrete neck between manhole and cover frame

.4 Cast iron covers and frames flush with finished grade

.5 Hot-dipped galvanized steel cable racks and supports

.6 Hot-dipped galvanized steel pulling loops opposite each conduit bank opening

.7 Copper-clad steel ground rod connected to the building perimeter grounding loop

2.2 HANDHOLES

.1 Precast concrete

.2 Designed for heavy traffic areas

.3 Bolt down cast iron covers

.4 Ground all metal components except the cover

3 Execution

3.1 INSTALLATION

.1 Manholes:

.1 Ground all metal components except the cover

.2 Ground incoming as per Alectra/ESA requirements

.3 Provide manholes in conduit banks where the conduit bank changes direction more that 30º and such that no one section of the conduit bank exceeds 50 m.

.2 Handholes

.1 Maximum spacing 45 m.

.2 Separate handholes for power and communications systems. Different communications systems may be combined into single handhole. Power supply for different system of the same voltage may be combined into single handhole.

End of Section