

**1. GENERAL**

**1.1. RELATED REQUIREMENTS**

- .1 Section 33 46 13 – Foundation Drainage

**1.2. REFERENCES**

- .1 ASTM International
  - .1 ASTM D 698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft<sup>3</sup>) (600kN-m/m<sup>3</sup>).
- .2 CSA International
  - .1 CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
  - .2 CSA A3000-08, Cementitious Materials Compendium.
- .3 U.S. Environmental Protection Agency (EPA)/Office of Water
  - .1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

**1.3. ADMINISTRATIVE REQUIREMENTS**

- .1 Co-ordination: arrange with authority having jurisdiction for relocation of buried services that interfere with execution of work.
  - .1 Pay costs of relocating services.

**1.4. ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Site Quality Control Submittals: submit in accordance with Section 01 45 00 - Quality Control.
  - .1 Submit condition survey of existing conditions as described in EXISTING CONDITIONS article.
  - .2 Submit inspection results and report as described in PART 3 - FIELD QUALITY CONTROL.

**2. PRODUCTS**

**2.1. MATERIALS**

- .1 Granular A & M.
  - .1 Granular A and M aggregates shall consist of crushed rock composed of hard, uncoated, fractured fragments, produced from rock formations or boulders of uniform quality, or a mixture of crushed gravel, sand and fines composed of hard, durable, uncoated particles, produced from naturally formed deposits, or crushed slag produced from iron blast furnace or nickel slag.
  - .2 Granular A and M aggregates may also consist of a blend of any combination of: natural aggregates, reclaimed Portland cement concrete, and reclaimed asphalt pavement material. The final blend shall not contain more than 30% percent by mass of asphalt coated particles as determined by percent of asphalt coated particles, LS 621.
  - .3 Steel slag shall not be used. Reclaimed asphalt pavement containing steel slag aggregates will not be accepted.
- .2 Unshrinkable fill: proportioned and mixed to provide:
  - .1 Maximum compressive strength of 0.4 MPa at 28 days.
  - .2 Maximum Portland cement content of 25 kg/m<sup>3</sup> with 40% fly ash replacement: to CAN/CSA-A3000-A5, Type 10 or latest.
  - .3 Minimum strength of 0.07 MPa at 24 hours.
  - .4 Concrete aggregates: to CSA A23.1/A23.2 or latest.
  - .5 Portland cement: Type 10.

- .6 Slump: 160 to 200 mm.

### **3. EXECUTION**

#### **3.1. EXAMINATION**

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

#### **3.2. PREPARATION**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .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 Contract Administrator'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 required to remain undisturbed.
- .3 Removal:
  - .1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.
  - .2 Remove stumps and tree roots below footings, slabs, and paving, and to 600 mm below finished grade elsewhere.
  - .3 Remove obsolete buried services within 2 m of foundations: cap cut-offs.

#### **3.3. EXCAVATION**

- .1 Shore and brace excavations, protect slopes and banks and perform work in accordance with Provincial and Municipal regulations whichever is more stringent.
- .2 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.
  - .1 Stockpile topsoil on site for later use.
- .3 Excavate as required to carry out work.
  - .1 Do not disturb soil or rock below bearing surfaces.
  - .2 Notify Contract Administrator when excavations are complete.
  - .3 If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work.
  - .4 Excavation taken below depths shown without Contract Administrator's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.
- .4 Excavate trenches to provide uniform continuous bearing and support for 150 mm thickness of pipe bedding material on solid and undisturbed ground.
  - .1 Trench widths below point 150 mm above pipe not to exceed diameter of pipe plus 600 mm.
- .5 Excavate for slabs and paving to subgrade levels.
  - .1 In addition, remove all topsoil, organic matter, debris and other loose and harmful

matter encountered at subgrade level.

**3.4. BACKFILLING**

- .1 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.
- .2 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.
- .3 Compaction of subgrade: compact existing subgrade under walks, paving, and slabs on grade, to same compaction as fill.
  - .1 Fill excavated areas with selected subgrade material compacted as specified for fill.
- .4 Placing:
  - .1 Place backfill, fill and base course material in 150 mm lifts: add water as required to achieve specified density.
  - .2 Place unshrinkable fill in areas as indicated: consolidate and level unshrinkable fill with internal vibrators.
- .5 Compaction: compact each layer of material to following densities for material to ASTM D 698:
  - .1 To underside of base courses: 95%.
  - .2 Base courses: 100%.
  - .3 Elsewhere: 90%.
- .6 In trenches:
  - .1 Up to 300 mm above pipe or conduit: sand placed by hand.
  - .2 Over 300 mm above pipe or conduit: native material approved by Contract Administrator.
- .7 Under seeded and sodded areas: use site excavated material to bottom of topsoil except in trenches and within 600 mm of foundations.
- .8 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material
- .9 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.
- .10 Underground tanks: use sand to bottom of granular base courses or to bottom of topsoil, as applicable.

**3.5. GRADING**

- .1 Grade so that water will drain away from buildings, walls and paved areas, to catch basins and other disposal areas approved by Contract Administrator.
  - .1 Grade to be gradual between finished spot elevations shown on drawings.

**3.6. CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Dispose of cleared and grubbed material off site daily.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION.**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM D4791-99, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

**1.2 SAMPLES**

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Allow continual sampling by Contract Administrator during production.
- .3 Provide Contract Administrator with access to source and processed material for sampling.
- .4 Install sampling facilities at discharge end of production conveyor, to allow Contract Administrator to obtain representative samples of items being produced. Stop conveyor belt when requested by Contract Administrator to permit full cross section sampling.
- .5 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.
- .6 See Section 01 29 83 Payment Procedures for Testing Laboratory Services

**Part 2 Products**

**2.1 MATERIALS**

- .1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
- .2 Flat and elongated particles of coarse aggregate: to ASTM D4791.
  - .1 Greatest dimension to exceed five times least dimension.
- .3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
  - .1 Natural sand.
  - .2 Manufactured sand.
  - .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:
  - .1 Crushed rock.
  - .2 Gravel and crushed gravel composed of naturally formed particles of stone.
  - .3 Light weight aggregate, including slag and expanded shale.

**2.2 SOURCE QUALITY CONTROL**

- .1 Inform Contract Administrator of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing production.
- .2 If, in the opinion of Contract Administrator, materials from proposed source do not meet, or

cannot reasonably be processed to meet, specified requirements, locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

- .3 Advise Contract Administrator 4 weeks in advance of proposed change of material source.
- .4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Processing
  - .1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.
  - .2 Blend aggregates, if required, to obtain gradation requirements, percentage of crushed particles, or particle shapes, as specified. Use methods and equipment approved by Contract Administrator.
  - .3 Wash aggregates, if required to meet specifications. Use only equipment approved by Contract Administrator.
  - .4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate.
- .2 Handling
  - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .3 Stockpiling
  - .1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Contract Administrator. Do not stockpile on completed pavement surfaces.
  - .2 Stockpile aggregates in sufficient quantities to meet Project schedules.
  - .3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.
  - .4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.
  - .5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.
  - .6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Contract Administrator with 48 hours of rejection.
    - .1 Stockpile materials in uniform layers not to exceed 1.5 m in thickness.

- .7 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.
- .8 Do not cone piles or spill material over edges of piles.
- .9 Do not use conveying stackers.
- .10 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

**3.2 CLEANING**

- .1 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.
- .2 Leave any unused aggregates in neat compact stockpiles as directed by Contract Administrator.
- .3 For temporary abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

**END OF SECTION.**

## 1. GENERAL

### 1.1 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C117-95, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D422-98, Standard Test Method for Particle Size Analysis of Soils.
  - .4 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft-lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>)
  - .5 ASTM D4318-00, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA)
  - .1 CAN/CSA-A3000-98-A5-98, Portland Cement.
  - .2 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.

### 1.2 DEFINITIONS

- .1 Excavation classes: two classes of excavation will be recognized: common excavation and rock excavation.
  - .1 Rock: any solid material in excess of 0.25 m<sup>3</sup> and which cannot be removed by means of heavy duty mechanical excavating equipment with 0.95 to 1.15 m<sup>3</sup> bucket. Frozen material not classified as rock.
  - .2 Common: excavation of materials of whatever nature, which are not included under definitions of rock excavation.
- .2 Unclassified excavation: excavation of deposits of whatever character encountered in Work.
- .3 Topsoil: Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.
- .4 Waste material: excavated material unsuitable for use in Work or surplus to requirements.
- .5 Borrow material: material obtained from locations outside area to be graded, and required for construction of fill areas or for other portions of Work.
- .6 Unsuitable materials:
  - .1 Weak and compressible materials under excavated areas.
  - .2 Frost susceptible materials under excavated areas.
  - .3 Frost susceptible materials:

- .1 Fine grained soils with plasticity index less than 10 when tested to ASTM D4318, and gradation within limits specified when tested to ASTM D422 and ASTM C136. Sieve sizes to CAN/CGSB-8.2.

- .2 Table

Sieve Designation % Passing

2.00 mm	100
0.10 mm	45-100
0.02 mm	0-80
0.005 mm	0-45

- .3 Coarse grained soils containing more than 20% by mass passing 0.075 mm sieve.
- .7 Unshrinkable fill: very weak mixture of Portland Cement, concrete aggregates and water that resists settlement when placed in utility trenches and capable of being readily excavated.

### 1.3 SUBMITTALS

- .1 Samples:
  - .1 Submit samples in accordance with Section 01 33 00.
  - .2 Inform Contract Administrator at least 4 weeks prior to commencing Work, of proposed source of fill materials and provide access for sampling.
  - .3 Submit 70 kg samples of type of fill specified including representative samples of excavated material.

### 1.4 QUALITY ASSURANCE

- .1 Qualification Statement: submit proof of insurance coverage for professional liability.
- .2 Where Subconsultant is employee of Contractor, submit proof that Work by Subconsultant is included in Contractor's insurance coverage.
- .3 Submit design and supporting data at least 2 weeks prior to commencing Work.
- .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the Province of Manitoba, Canada.
- .5 Keep design and supporting data on site.
- .6 Engage services of qualified professional engineer who is registered or licensed in the Province in which Work is to be carried out to design and inspect cofferdams, shoring, bracing and underpinning required for Work.

### 1.5 PROTECTION OF EXISTING FEATURES

- .1 Protect existing features in accordance with Section 01 56 00 – Temporary Barriers and Enclosures and applicable local regulations.



- .2 Existing buried utilities and structures:
  - .1 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .2 Prior to commencing excavation Work, notify applicable Contract Administrator or Authorities Having Jurisdiction, establish location and state of use of buried utilities and structures. Contract Administrator or Authorities Having Jurisdiction to clearly mark such locations to prevent disturbance during Work.
  - .3 Confirm locations of buried utilities by careful test excavations.
  - .4 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered.
  - .5 Where utility lines or structures exist in area of excavation, obtain direction of Construction Manager before removing/re-routing.
  - .6 Record location of maintained, re-routed and abandoned underground lines.
  - .7 Confirm locations of recent excavations adjacent to area of excavation.
- .3 Existing buildings and surface features:
  - .1 Conduct, with Contract Administrator, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by Work.
  - .2 Protect existing buildings and surface features from damage while Work is in progress. In the event of damage, immediately make repair to approval of Contract Administrator.

**Part 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Type 1 and Type 2 fill: shall conform to properties of the following requirements:
  - .1 Crushed, pit run or screened stone, gravel or sand.
  - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.
  - .3 Table

Sieve Designation	% Passing	
	Type 1	Type 2
75 mm	-	100
50 mm	-	-
37.5 mm	-	-
25 mm	100	-
19 mm	75-100	-
12.5 mm	-	-

9.5 mm	50-100	-
4.75 m	30-70	22-85
2.00 mm	20-45	-
0.425 mm	10-25	5-30
0.180 mm	-	-
0.075 mm	3-8	0-10

- .2 Type 3 fill: selected material from excavation or other sources, approved by Contract Administrator for use intended, unfrozen and free from rocks larger than 75 mm, cinders, ashes, sods, refuse or other deleterious materials.

**Part 3 EXECUTION**

**3.1 SITE PREPARATION**

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

**3.2 STRIPPING OF TOPSOIL**

- .1 Commence topsoil stripping of areas as directed by Contract Administrator after area has been cleared of brush, weeds and grasses and removed from site.
- .2 Strip topsoil to depths as directed by Contract Administrator. Do not mix topsoil with subsoil.
- .3 Stockpile in locations as directed by Contract Administrator. Stockpile height not to exceed 2 m.
- .4 Dispose of unused topsoil as directed by Contract Administrator.

**3.3 STOCKPILING**

- .1 Stockpile fill materials in areas designated by Contract Administrator. Stockpile granular materials in manner to prevent segregation.
- .2 Protect fill materials from contamination.

**3.4 DEWATERING AND HEAVE PREVENTION – Not applicable**

**3.5 EXCAVATION**

- .1 Excavate to lines, grades, elevations and dimensions as indicated.
- .2 Excavation must not interfere with bearing capacity of adjacent foundations.
- .3 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .4 For trench excavation, unless otherwise authorized by Contract Administrator in writing, 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.
- .5 Keep excavated and stockpiled materials a safe distance away from edge of trench as directed by Contract Administrator.
- .6 Restrict vehicle operations directly adjacent to open trenches.

- .7 Dispose of surplus and unsuitable excavated material in approved location on site or off site as directed by Contract Administrator.
- .8 Do not obstruct flow of surface drainage or natural watercourses.
- .9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .10 Notify Contract Administrator when bottom of excavation is reached.
- .11 Obtain Contract Administrator approval of completed excavation.
- .12 Remove unsuitable material from trench bottom to extent and depth as directed by Contract Administrator.
- .13 Correct unauthorized over-excavation as follows:
  - .1 Fill under bearing surfaces and footings with fill concrete.
  - .2 Fill under other areas with fill compacted to not less than 95% of standard maximum dry density. Hand trim, make firm and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Contract Administrator.

### **3.6 FILL TYPES AND BACKFILL**

- .1 A minimum thickness of 150 bedding sand shall be placed prior to the layout of the utilities. Once the utilities have been placed, the pipes should be covered with a minimum 300 mm thickness of said prior to applying compaction effort.
- .2 Native sand materials are considered to be acceptable as backfill. The remainder of the trench to sub-grade elevation to be backfilled and compacted with Type 1 fill. Backfill under slab pavements and sidewalks to be compacted to 98% Standard Proctor Density, in landscaped area to be 90% Standard Proctor Density.

### **3.7 BEDDING AND SURROUND OF UNDERGROUND SERVICES**

- .1 Place and compact granular material for bedding and surround of underground services as indicated.
- .2 Place bedding and surround material in unfrozen condition.

### **3.8 BACKFILLING**

- .1 Do not proceed with backfilling operations until Contract Administrator has inspected and approved installations.
- .2 Areas to be backfilled to be free of debris, snow, ice, water and frozen ground.
- .3 Do not use backfill material which is frozen or contains ice, snow or debris.
- .4 Place backfill material in uniform layers not exceeding 150 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.
- .5 Backfilling around installations:

- .1 Place bedding and surround material as specified elsewhere.
- .2 Do not backfill around or over cast-in-place concrete within 24 hours after placing of concrete.
- .3 Place layers simultaneously on both sides of installed Work to equalize loading. Where temporary unbalances earth pressures are liable to develop on walls or other structures:
  - .1 Permit concrete to cure for minimum 14 days or until it has sufficient strength to withstand earth and compaction pressure and approval is obtained from Contract Administrator, or:
  - .2 If approved by Contract Administrator, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by Contract Administrator.

### **3.9 RESTORATION**

- .1 Upon completion of Work, remove waste materials and debris, trim slopes and correct defects as directed by Contract Administrator.
- .2 Replace topsoil as directed by Contract Administrator.
- .3 Reinstate lawns to elevation which existed before excavation.
- .4 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.
- .5 Clean and reinstate areas affected by Work as directed by Contract Administrator.

**END OF SECTION.**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM D698-00a, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft lbf/ft<sup>3</sup>) (600 kN-m/m<sup>3</sup>).

**1.2 EXISTING CONDITIONS**

- .1 Examine subsurface investigation report which is available for inspection at Contract Administrator's Office.
- .2 Known underground and surface utility lines and buried objects are as indicated on site plan.
- .3 Refer to dewatering in Section 31 23 10 – Excavating, Trenching and Backfilling.

**1.3 PROTECTION**

- .1 Protect and/or transplant existing fencing, tree, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by Contract Administrator. If damaged, restore to original or better condition unless directed otherwise.
- .2 Maintain access roads to prevent accumulation of construction related debris on roads. This will be strictly enforced by the Contract Administrator.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Fill material: Engineered fill in accordance with Paragraph 2.1, Section 31 23 10 – Excavating, Trenching and Backfilling.
- .2 Excavated or graded material existing on site may be suitable to use as fill for grading work, if approved by Contract Administrator.

**Part 3 Execution**

**3.1 GRADING**

- .1 Rough grade to levels, profiles and contours allowing for surface treatment as indicated.
- .2 Rough grade to following depths below finished grades:
  - .1 135 mm for sodded areas.
  - .2 300 mm for flowerbeds.
  - .3 500 mm for shrub beds.
  - .4 600 mm for concrete paving, walks and precast paving units.

- .3 Slope rough grade away from building 1:50 minimum and as indicated or as directed by Contract Administrator.
- .4 Grade ditches to depth as indicated and as directed.
- .5 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.
- .6 Compact filled and disturbed areas to standard maximum dry density as follows:
  - .1 85% under landscaped areas, 90% under non-landscaped areas.
  - .2 95% under paved and walk areas.
- .7 Do not disturb soil within branch spread of trees or shrubs to remain.

### **3.2 TESTING**

- .1 Inspection and testing of soil compaction will be carried out by testing laboratory approved by the Contract Administrator. Costs of tests will be paid by Contractor. Refer to Sections 01 29 83 – Payment Procedures and 01 45 00 – Quality Control.
- .2 Submit testing procedure, frequency of tests, testing laboratory as designated by ULC or certified testing personnel to Contract Administrator for approval.

### **3.3 SURPLUS MATERIAL**

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping off site as directed by Contract Administrator.

**END OF SECTION.**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Materials and installation of polymeric geotextiles used in revetments, breakwaters, retaining wall structures, filtration, drainage structures, roadbeds and railroad beds purpose of which is to:
  - .1        Separate and prevent mixing of granular materials of different grading.
  - .2        Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

**1.2                RELATED SECTIONS**

- .1        Section 31 23 10 - Excavating, Trenching and Backfilling.

**1.3                MEASUREMENT PROCEDURES**

- .1        Measure geotextiles in square metres of surface covered by material. No allowance will be made for seams and overlaps.

**1.4                REFERENCES**

- .1        American Society for Testing and Materials International, (ASTM)
  - .1        ASTM D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
  - .2        ASTM D4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
  - .3        ASTM D4716, Test Method for Determining the (In-Plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
  - .4        ASTM D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
- .2        Canadian General Standards Board (CGSB)
  - .1        CAN/CGSB-4.2 No. 11.2-M89 (April 1997), Textile Test Methods - Bursting Strength - Ball Burst Test (Extension of September 1989).
  - .2        CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.
    - .1        No.2-M85, Methods of Testing Geosynthetics - Mass per Unit Area.
    - .2        No.3-M85, Methods of Testing Geosynthetics - Thickness of Geotextiles.
    - .3        No.6.1-93, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.
    - .4        No.7.3-92, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

- .5 No. 10-94, Methods of Testing  
Geosynthetics - Geotextiles - Filtration Opening Size.
- .3 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-G164-M92 (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .4 City of Winnipeg Standard Construction Specifications
  - .1 Division 2 Section 02529

### **1.5 SUBMITTALS**

- .1 Submit to Contract Administrator following samples at least 4 weeks prior to beginning Work.
  - .1 Minimum length of 2 m of roll width of geotextile.
  - .2 Minimum of 1 m seam with at least 300 mm of geotextile on both sides of seam.
- .2 Submit to Contract Administrator 2 copies of mill test data and certificate at least 4 weeks prior to start of Work.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 During delivery and storage, protect geotextiles from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

### **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.
- .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.
- .4 Fold up metal banding, flatten and place in designated area for recycling.

### **1.8 MATERIAL**

- .1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.
  - .1 Composed of: minimum 85% by mass of polyester with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.
- .2 Physical properties:
  - .1 Thickness: to CAN/CGSB-148.1
  - .2 Mass per unit area: to CAN/CGSB-148.1, No.2.



- .3 Tensile strength and elongation (in any principal direction): to ASTM D4595.
  - .1 Tensile strength: minimum 600 N, wet condition.
  - .2 Elongation at break: maximum 60%.
  - .3 Seam strength: equal to or greater than tensile strength of fabric.
  
- .4 Grab tensile strength and elongation: to CAN/CGSB-148.1, No.7.3.
  - .1 Breaking force: minimum 600 N, wet condition.
  - .2 Elongation at future: maximum 50%.
  
- .5 Ball burst strength: to CAN/CGSB-4.2, No.11.2, minimum 660 N, wet condition.
  
- .6 Bursting strength: to CAN/CGSB-148.1, No.6.1 minimum 1860 kPa, wet condition.
  
- .3 Hydraulic properties:
  - .1 Apparent opening size AOS: to ASTM D4751.
  - .2 Filtration opening size FOS: to CAN/CGSB-148.1 No.10]
  
  - .3 Transmissivity: to ASTM D4716.
  - .4 Permittivity: to ASTM D4491, 0.05 pers.
  
- .4 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600 g/m<sup>2</sup> to CAN/CSA G164.
  
- .5 Factory seams: sewn in accordance with manufacturer's recommendations.
  
- .6 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

## 1.9 **INSTALLATION**

- .1 Place geotextile material by unrolling onto graded surface in orientation, manner and locations indicated and retain in position with pins.
- .2 Place geotextile material smooth and free of tension stress, folds, wrinkles and creases.
- .3 Place geotextile material on sloping surfaces in one continuous length from toe of slope to upper extent of geotextile.
- .4 Overlap each successive strip of geotextile 600 mm over previously laid strip.
- .5 Join successive strips of geotextile by sewing.
- .6 Pin successive strips of geotextile with securing pins at 300 mm interval at mid point of lap.
- .7 Protect installed geotextile material from displacement, damage or deterioration before, during and after placement of material layers.
- .8 After installation, cover with overlying layer within 4 h of placement.

- .9 Replace damaged or deteriorated geotextile to approval of Contract Administrator.
- .10 Place and compact soil layers in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.

**1.10 CLEANING**

- .1 Remove construction debris from Project site and dispose of debris in an environmentally responsible and legal manner.

**1.11 PROTECTION**

- .1 Vehicular traffic not permitted directly on geotextile.

**END OF SECTION.**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 31 63 23 – Bored Concrete Piles

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product Data: submit manufacturer's printed product literature, specifications and datasheet.
- .3            Sub-surface investigation report: when site conditions differ from those indicated, submit written notification to Contract Administrator and await further instructions.
- .4            Submit schedule of planned sequence of pile installation to Contract Administrator for review.
- .5            Spliced piles: when authorized, submit design details of splice complete with signature and stamp of qualified professional engineer registered or licensed in the Province of Manitoba, Canada.
- .6            Equipment:
  - .1            Submit prior to pile installation for review by Contract Administrator, list and details of equipment for use in installation of piles.

**1.3                DELIVERY, STORAGE AND HANDLING**

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

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate waste materials for reuse and recycling in accordance with Section 01 74 19 -Waste Management and Disposal.
- .2            Divert unused, or cut off concrete materials from landfill to local quarry or facility in accordance with Section 01 74 19 – Waste Management and Disposal and Section 01 35 20 – LEED Sustainable Requirements.

**1.5                EXISTING CONDITIONS**

- .1            Sub-surface investigation report is attached to the specifications.

**1.6                SCHEDULEING**

- .1            Provide schedule of planned sequence of installation to Contract Administrator for review, not less than two weeks prior to commencement of pile installation.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Material requirements for piles are specified in Section 31 63 23 – Bored Concrete Piles.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Protection:
  - .1 Protect adjacent structures, services and work of other sections from hazards due to pile installation operations.
  - .2 Arrange sequencing of pile installation operations and methods to avoid damages to adjacent existing structures.
  - .3 When damages occur, remedy damaged items to restore to original or better condition at own expense.
- .2 Ensure that ground conditions at pile locations are adequate to support pile installation operations.
  - .1 Make provision for access and support of piling equipment during performance of Work.
- .3 Install piles only when excavation has been completed.

**3.2 PREPARATION**

- .1 Bored concrete piles have been design for skin friction based on Ultimate Limit States in accordance with Part 4 of the National Building Code of Canada. Allowable design load capacity of pile at factored load is indicated on the drawings.
- .2 Installation of each pile will be subject to review of Contract Administrator.
  - .1 Contract Administrator will be sole judge of acceptability of each pile with respect to criteria used to determine load capacity.
  - .2 Contract Administrator to review final installation of all piles prior to removal of pile equipment from site.

**3.3 OBSTRUCTIONS**

- .1 Where obstruction is encountered that prevents the installation of the pile or deviation from specified tolerances, proceed as directed by the Contract Administrator.

**3.4 REPAIR AND RESTORATION**

- .1 Proceed to remove, repair, replace or augment rejected as directed by Contract Administrator.
- .2 No extra compensation will be made for removing and replacing or other work made necessary through rejection of defective piles.

**3.5 FIELD QUALITY CONTROL**

- .1 Measurement:
  - .1 Maintain accurate records of the installation for each pile, including:
    - .1 Pile size and length, location of pile in pile group, location or designation of pile group.
    - .2 Sequence of installation of piles.
    - .3 As-built survey of centerline of piles and top of pile elevations.
  - .2 Provide Contract Administrator with two copies of records.
  - .3 Contractor to provide full time review of pile foundation installation by a qualified Geotechnical Engineer. Pay the costs as per 01 29 83 – Payment Procedures for Testing Laboratory Services.

**3.6 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION.**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 31 61 13 – Pile Foundations, General Requirements

**1.2                REFERENCES**

- .1            All references to be the latest edition as of the date indicated on the specifications.
- .2            Canadian Standards Association (CSA International)
  - .1            CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2            CAN/CSA-G30.18, Billet Steel Bars for Concrete Reinforcement.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2            Product data: submit manufacturer's printed product literature, specifications and datasheet.
- .3            Shop Drawings:
  - .1            Indicate: pile type, reinforcing size and spacing, pile cap type and reinforcing size and spacing.
  - .2            Submit each drawing complete with signature and stamp of qualified Professional Engineer registered in the Province of Manitoba, Canada.
- .4            Quality assurance submittals:
  - .1            Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2            Instructions: submit manufacturer's installation instructions.
  - .3            Records and reports: submit Mill report and concrete tests as described in PART 2 - SOURCE QUALITY CONTROL.
  - .4            Submit for review by Contract Administrator two copies of pile installation records as described in PART 3 - FIELD QUALITY CONTROL.

**1.4                WASTE MANAGEMENT AND DISPOSAL**

- .1            Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Waste Management and Disposal and Section 01 35 20 – LEED Sustainable Requirements.
- .2            Divert unused metal materials from landfill to metal recycling facility in accordance with Section 01 74 19 - Waste Management and Disposal and Section 01 35 20 – LEED Sustainable Requirements.
- .3            Divert unused concrete materials from landfill to local quarry or facility in accordance with Section 01 74 19 - Waste Management and Disposal and Section 01 35 20 – LEED Sustainable Requirements.

**Part 2 Products**

**2.1 SUSTAINABLE REQUIREMENTS**

- .1 Materials and products in accordance with Section 01 35 20 – LEED Sustainable Requirements.

**2.2 MATERIALS**

- .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Reinforcing steel: to CAN/CSA-G30.18 and in accordance with Section 03 20 00 - Concrete Reinforcing.

**2.3 SOURCE QUALITY CONTROL**

- .1 Mill report: to CAN/CSA-S16.
- .2 Concrete tests: to CSA-A23.1/A23.2

**Part 3 Execution**

**3.1 MANUFACTURER'S INSTRUCTIONS**

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

**3.2 INSTALLATION**

- .1 Bore holes to diameters and lengths as indicated on the drawings. Pile length is calculated from the top of pile elevations and not from the top of grade elevation.
- .2 Protective steel casing:
  - .1 Where required, use steel protective casing approved by Contract Administrator.
    - .1 Ensure penetration of casing to required depths either by self mass or driving.
- .3 Dispose of excavated materials off site.
- .4 Contract Administrator to inspect pile excavation prior to placing of concrete.
  - .1 Remove loose material, foreign matter and water as directed by Contract Administrator.
- .5 Install steel reinforcement in accordance with Section 03 20 00 - Concrete Reinforcing and as indicated.
- .6 Fill pile excavations with concrete to elevations as indicated.
  - .1 Place concrete in one continuous pour in accordance with Section 03 30 00 - Cast-in-Place Concrete.
  - .2 Place concrete immediate upon completion of pile boring. Do not wait for multiple bore holes to be completed prior to placing concrete.

- .7 Steel protective casing may be removed at option of Contractor, unless otherwise specified.
- .8 Where steel protective casing is to be removed, provide concrete with minimum slump of 125 mm and with retarder to prevent arching or setting of concrete.
  - .1 Withdraw casing in conjunction with concrete placing, keeping bottom of casing 600 mm below level of concrete.
  - .2 Do not vibrate concrete internally.
- .9 Where steel protective casing is left in place, fill void space between casing and shaft excavation with concrete.
- .10 Use tremie pipe or concrete pumping with approval of Contract Administrator.
- .11 Contractor to provide steel casing as required to prevent sloughing and squeezing of the bored hole.
- .12 Contractor to remove water from bored hole prior to placing concrete.

### **3.3 DEFECTIVE PILES**

- .1 Cased concrete shaft piles rejected where:
  - .1 Soil has entered casing.
  - .2 Water has entered casing.
  - .3 Casing is damaged, out of tolerance or alignment.
- .2 Defective pile to be removed, repaired, replaced or augmented as directed by Contract

### **3.4 FIELD QUALITY CONTROL**

- .1 Field Records: maintain pile installation record for each pile.
- .2 Complete concrete testing in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .3 Provide as-built drawing of final center of pile locations and final top of pile elevations.

### **3.5 CLEANING**

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

**END OF SECTION.**

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