

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Section 32 11 23 Aggregate Base Courses.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C117-17, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D422-63(2007)e1, Standard Test Method for Particle-Size Analysis of Soils.
  - .5 ASTM D698-12, 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>).
  - .6 ASTM D1883-21, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .7 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
  - .1 Standard Specification - Highway Design Division (latest edition).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide the Departmental Representative with the following information before the commencement of the work and at any time during the construction at the request of the Departmental Representative (at no cost to the Owner):
  - .1 Approved testing geotechnical firm to complete the following analyses and collect samples at the proposed site:
    - .1 Source of supply of aggregate
    - .2 Sieve analysis

- .3 Fractured Particles (not to exceed the requirements of Table 3.2.2 (50%) of the NSTIR Standard Specification - Highway Design Division (latest edition) for Type 2 Material)
  - .4 Physical properties as described in Table 3.2.3 of the NSTIR Standard Specification - Highway Design Division (latest edition) for Type 2 Material
  - .5 Standard Proctor and Optimal Moisture values
- .3 When submitting results to the Departmental Representative, the geotechnical testing firm must confirm that the materials meets the Specifications and that it is or is not suitable for the intended use. This is to be in letter report format submitted directly to the Departmental Representative.
- .4 The Owner reserves the right to reject any source of supply of aggregate base on the basis of past field performance, document by the records and experience of the Owner and/or the Departmental Representative with a specific material, regardless of compliance with physical requirements of grading limits.
- .5 Samples:
- .1 Allow continual sampling by Departmental Representative during production if required.
  - .2 Provide Departmental Representative with access to source and processed material for sampling.
  - .3 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials as per NSTIR standards.
- .2 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations and erosion and sedimentation control plan.
  - .2 Replace defective or damaged materials with new.
- .3 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.

#### **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert unused granular material from landfill to local facility to satisfaction of Departmental Representative.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Granular sub-base material: in accordance with NSTIR Standard Specification - Highway Design Division, latest edition, Division 3, Section 2 for Type 2 material and following requirements:
  - .1 Crushed and screened rock or gravel.

- .1 Consisting of clean, hard, sound and durable particles free from soft or disintegrated pieces, mud, dirt, organic or other deleterious materials as described in Division 3, Section 2 of the NSTIR Standard Specification - Highway Design Division (latest edition).
- .2 Aggregate sub-base properties shall meet the requirements of Tables 3.2.2, and 3.2.3 of the NSTIR Standard Specification - Highway Design Division (latest edition) for Type 2 material.
- .3 The crushed rock or crushed gravel when tested in accordance with the NSTIR's method with standard laboratory sieves, will conform to Table 3.2.1 (Type 2 gradation) of the NSTIR Standard Specification - Highway Design Division (latest edition).

## **2.2 SOURCE QUALITY CONTROL**

- .1 If, in the opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source or demonstrate that material from source in questions can be processed to meet specified requirements.
- .2 Advise Departmental Representative 2 weeks minimum in advance of proposed change of material source.
- .3 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.
- .4 Materials shall be considered unsuitable even though particle sizes are within the specified gradation limits if particle shape or any other characteristic precludes satisfactory compaction or fails to provide a suitable sub-base surface.

## **Part 3 Execution**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for granular sub-base installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 PREPARATION**

- .1 Prior to the placing of granular sub-base, shape subgrade properly and compact so as to be firm and able to support the construction equipment without displacement.
- .2 Correct soft or yielding subgrade and make stable before sub-base construction proceeds.
- .3 Remove all ponded water from the area prior to placing any granular sub-base material.

- .4 Maintain sufficient crown at all times during construction to ensure ready runoff of surface water.
- .5 Where the gradation of the subgrade soil and the sub-base are such that mixing of the two materials may occur, place an approved geotextile fabric.

### 3.3 PLACING

- .1 Place granular sub-base after all required piping has been placed and subgrade is inspected and approved by Departmental Representative.
- .2 Placing:
  - .1 Place granular base and sub-base after subgrade is to the satisfaction of the Departmental Representative.
  - .2 Construct granular sub-base to depth and grade in areas indicated and dimensions as shown on the drawings or as directed by the Departmental Representative.
    - .1 Material placed wider or deeper than specified will not be measured for payment.
  - .3 Ensure no frozen material is placed.
  - .4 Place material only on clean unfrozen surface, free from snow or ice.
  - .5 Place granular sub-base materials using methods which do not lead to segregation or degradation.
  - .6 Shape sub-base by means of a blade grader (other than a tractor).
  - .7 Ruts formed by hauling or traffic will be dragged full at least once a day or as often as necessary to prevent cutting through the surface material.
  - .8 Place material to full width in uniform layers not exceeding 300 mm compacted thickness.
    - .1 Departmental Representative may authorize thicker lifts if specified compaction can be achieved.
    - .2 Maximum lift thickness to determined in the field by a test strip, to ensure the maximum effectiveness and compatibility of the compaction equipment with respect to the material being placed for each piece of equipment and each material type. The test strip shall be conducted in the presence of the Departmental Representative and the approved testing company's inspector, and shall occur prior to the placement of any further material in the work.
  - .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
  - .10 When sub-base material is placed over geotextile fabric, carefully place the first layer of sub-base material and spread with a dozer so there is no traffic on the geotextile until the first layer of 300 mm of sub-base has been spread and compacted.
  - .11 Remove and replace portion of layer in which material has become segregated during spreading.

### 3.4 COMPACTION

- .1 Compaction equipment to be capable of obtaining required material densities.
- .2 Compact to density of not less than 98 % maximum dry density in accordance with ASTM D698.

- .3 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .4 Apply water as necessary during compaction to obtain specified density.
  - .1 Make water truck(s) available to apply water for compaction purposes as required, incidental to the work.
- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .7 Compact each layer thoroughly over its entire width before placing the next layer.
  - .1 Operate sufficient compaction equipment at all times to thoroughly compact the material at the rate at which it is being placed.

### **3.5 PROOF ROLLING**

- .1 For proof rolling use a fully loaded tandem truck. Make sufficient passes of proof rolling equipment to subject every point on surface to at least one pass of loaded tire and confirm no greater than 25 mm deflection occurs. Perform proof rolling in the presence of Departmental Representative.
- .2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.
- .3 Proof roll at level in sub-base as indicated.
  - .1 If non-standard proof rolling equipment is approved, Departmental Representative will determine level of proof rolling.
- .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .5 Where proof rolling reveals areas of defective subgrade:
  - .1 Remove sub-base and subgrade material to depth and extent as directed by Departmental Representative.
  - .2 Backfill excavated subgrade with sub-base material and compact in accordance with this section.
  - .3 Replace sub-base material and compact.
- .6 Where proof rolling reveals areas of defective sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace in accordance with this section at no extra cost.
- .7 Maintain the finished aggregate base conditions until asphalt concrete is applied.

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

**3.7 SITE TOLERANCES**

- .1 Finished sub-base surface to be within 10 mm of elevation as indicated but not uniformly high or low.

**3.8 PROTECTION**

- .1 Maintain finished sub-base in condition conforming to this section until succeeding base is constructed, or until granular sub-base is accepted by Departmental Representative.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 00 00.01 Earthwork
- .2 Section 31 23 33.01 Excavating, Trenching and Backfilling
- .3 Section 32 11 16.01 - Granular Sub-base

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C117-17, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .3 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .4 ASTM D698-12, 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>).
  - .5 ASTM D1557-12, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft-lbf/ft<sup>3</sup>) (2,700kN-m/m<sup>3</sup>).
  - .6 ASTM D1883-21, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .7 ASTM D4318-17e1, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .3 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
  - .1 Standard Specification - Highway Design Division (latest edition).

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide the Departmental Representative with the following information before the commencement of the work and at any time during the construction at the request of the Departmental Representative (at no cost to the Owner):
  - .1 Approved testing geotechnical firm to complete the following analyses and collect samples at the proposed site:
    - .1 Source of supply of aggregate
    - .2 Sieve analysis

- .3 Fractured Particles (not to exceed the requirements of Table 3.2.2 (50%) of the NSTIR Standard Specification - Highway Design Division (latest edition) for Type 1 Material)
  - .4 Physical properties as described in Table 3.2.3 of the NSTIR Standard Specification - Highway Design Division (latest edition) for Type 1 Material
  - .5 Standard Proctor and Optimal Moisture values
- .3 When submitting results to the Departmental Representative, the geotechnical testing firm must confirm that the materials meets the Specifications and that it is or is not suitable for the intended use. This is to be in letter report format submitted directly to the Departmental Representative.
- .4 The Owner reserves the right to reject any source of supply of aggregate base on the basis of past field performance, document by the records and experience of the Owner and/or the Departmental Representative with a specific material, regardless of compliance with physical requirements of grading limits.
- .5 Samples:
- .1 Allow continual sampling by Departmental Representative during production if required.
  - .2 Provide Departmental Representative with access to source and processed material for sampling.
  - .3 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials as per NSTIR standards.
- .2 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations and erosion and sedimentation control plan.
  - .2 Replace defective or damaged materials with new.
- .3 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.

#### **1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 Divert unused granular material from landfill to local facility to satisfaction of Departmental Representative.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Granular base: material in accordance with NSTIR Standard Specification - Highway Design Division (latest edition), Division 3, Section 2 and following requirements:
  - .1 Crushed stone:

- .1 To consist of clean, hard, sound and durable particles free from soft or disintegrated pieces, mud, dirt, organic or other deleterious materials as described in Division 3, Section 2 of the NSTIR Standard Specification - Highway Design Division (latest edition).
- .2 Aggregate base properties: to Tables 3.2.2 and 3.2.3 of the NSTIR Standard Specification - Highway Design Division (latest edition) for Type 1 material.
- .3 Under no circumstances will Pit Run material will be accepted as aggregate base.
- .4 The crushed rock or crushed gravel, when tested in accordance with the NSTIR's method with standard laboratory sieves, will conform to Table 3.2.1 (Type 1 gradation) of the NSTIR Standard Specification - Highway Design Division (latest edition).

## **2.2 SOURCE QUALITY CONTROL**

- .1 If, in the opinion of Departmental Representative, materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source or demonstrate that material from source in questions can be processed to meet specified requirements.
- .2 Advise Departmental Representative 2 weeks minimum in advance of proposed change of material source.
- .3 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.
- .4 Materials shall be considered unsuitable even though particle sizes are within the specified gradation limits if particle shape or any other characteristic precludes satisfactory compaction or fails to provide a suitable finished surface.

## **Part 3 Execution**

### **3.1 PREPARATION**

- .1 Prior to the placing of granular base, shape sub-base properly and compact so as to be firm and able to support the without displacement.
- .2 Match sub-base profile to that required to result in the final roadway surface profile and crown when all sub-base, base and pavement materials have been placed.
- .3 Correct soft or yielding sub-base and make stable before base construction proceeds.
- .4 Remove all ponded water from the area prior to placing any granular base material.
- .5 Place approved geotextile fabric where the gradation of the subgrade soil and the sub-base are such that mixing of the two materials may occur.

### **3.2 PLACEMENT AND INSTALLATION**

- .1 Place granular base after sub-base surface is inspected and approved by Departmental Representative.
- .2 Placing:

- .1 Construct granular base to depth and grade in areas indicated. All humps, hollows, and depressions will be eliminated during shaping.
  - .2 For aggregate base material on the tops of dikes, place as final finish when all other work that requires excavation or re-shaping of the dikes has been completed.
    - .1 Areas that have been completed may be done when so authorized by the Departmental Representative.
    - .2 Care shall be taken when placing the aggregate base material that no material runs off the top surface and down the sides of the dike. Any material that runs down the side of the dike shall be removed incidental to the work.
  - .3 Ensure no frozen material is placed.
  - .4 Place material only on clean unfrozen surface, free from snow and ice.
  - .5 Placing on a wet or muddy surface will not be permitted.
  - .6 Place material using methods which do not lead to segregation or degradation of aggregate.
  - .7 Fine grade the surface and ensure it has been graded and compacted as required under this Section.
  - .8 Spread the aggregate base material in a single layer sufficient to give the indicated finished thickness after compaction.
  - .9 Any material that has been contaminated by soil or other materials such that it no longer meets the specifications shall not be reused in the work.
  - .10 The material will be shaped by means of a blade grader (other than a tractor) while being compacted.
  - .11 Exercise proper care in the placing, spreading and compaction of this material to prevent any damage to other structures and/or systems. This shall include but not be limited to dikes, aeration system piping and valves, chambers, manholes, and fencing.
  - .12 Ruts formed by hauling or traffic will be dragged full at least once a day or as often as necessary to prevent cutting through the surface material.
  - .13 When completed, the surface will be smooth, hard, free from ruts, waves, and undulations and competent in the opinion of the Departmental Representative to provide adequate support for the dike surface.
  - .14 Remove and replace that portion of layer in which material becomes segregated during spreading.
- .3 Compaction Equipment:
- .1 Ensure compaction equipment is capable of obtaining required material densities.
- .4 Compacting:
- .1 Compaction equipment to be capable of obtaining required compaction.
  - .2 Compact to density not less than 98% maximum dry density to ASTM D698.
  - .3 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
  - .4 Apply water as necessary during compacting to obtain specified density.
    - .1 Make water truck(s) available to apply water for compaction purposes as required, incidental to the work.

- .5 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved in writing by Departmental Representative.
- .6 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.
- .7 Compact each layer thoroughly over its entire width before placing the next layer.
  - .1 Operate sufficient compaction equipment at all times to thoroughly compact the material at the rate at which it is being placed.
- .5 Proof rolling:
  - .1 For proof rolling use a fully loaded tandem truck. Make sufficient passes of proof rolling equipment to subject every point on surface to at least one pass of loaded tire and confirm no greater than 25 mm deflection occurs. Perform proof rolling in the presence of Departmental Representative.
  - .2 Obtain written approval from Departmental Representative to use non-standard proof rolling equipment.
  - .3 Proof roll at level in granular base as indicated.
    - .1 If use of non-standard proof rolling equipment is approved, Departmental Representative to determine level of proof rolling.
  - .4 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
  - .5 Where proof rolling reveals areas of defective subgrade:
    - .1 Remove base, sub-base and subgrade material to depth and extent as directed by Departmental Representative.
    - .2 Backfill excavated subgrade with sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-Base.
    - .3 Replace sub-base material and compact in accordance with Section 32 11 16.01 - Granular Sub-base.
    - .4 Replace base material and compact in accordance with this Section.
  - .6 Where proof rolling reveals defective base or sub-base, remove defective materials to depth and extent as directed by Departmental Representative and replace with new materials in accordance with this section at no extra cost.
  - .7 Maintain the finished aggregate base conditions until asphalt concrete is applied.

### 3.3 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 15 mm of established grade and cross section but not uniformly high or low.

### 3.4 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.

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

**3.5 PROTECTION**

- .1 Maintain finished base in condition conforming to this Section until succeeding material is applied or until acceptance by Departmental Representative.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 32 11 16.01 Granular Sub-Base.
- .2 Section 32 11 23 Aggregate Base Courses.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C88/C88M-18, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
  - .2 ASTM C117-17, Standard Test Method for Material Finer Than 0.075 (No. 200) mm Sieve in Mineral Aggregates by Washing.
  - .3 ASTM C123/C123M-14, Standard Test Method for Lightweight Particles in Aggregate.
  - .4 ASTM C127-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
  - .5 ASTM C128-15, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.
  - .6 ASTM C131/C131M-20, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
  - .7 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .8 ASTM D698-12, Standard 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>).
  - .9 ASTM D1557-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup>) (2,700 kN-m/m<sup>3</sup>).
  - .10 ASTM D1559-89, Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
  - .11 ASTM D2419-14, Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
  - .12 ASTM D3203/D3203M-17, Standard Test Method for Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures.
  - .13 ASTM D4318-17e1, Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
  - .14 ASTM D4791-19, Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
- .2 Asphalt Institute (AI)
  - .1 AI MS-2-94, Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.

- .2 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.
- .4 Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR)
  - .1 Standard Specification - Highway Design Division, latest edition.

### **1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for asphalt paving mix, aggregate, and coatings and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Job mix formula to be provided in writing to Departmental Representative for approval two weeks prior to the date paving operations are to commence.
  - .1 To be based on the use of aggregate stockpiles which are representative of those to be used for the work
  - .2 Include evidence the proposed mix meets the requirements specified herein.
- .4 Test and Evaluation Reports:
  - .1 Materials to be tested by accredited testing laboratory.
  - .2 Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.

### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements with manufacturer's written instructions.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Granular base and sub-base material: to Section 32 11 16.01 – Granular Sub-Base and Section 32 11 23 – Aggregate Base Courses.
- .2 Supply all materials to meet or exceed all requirements of the NSTIR Standard Specification - Highway Design Division, latest edition, Division 4 - Pavements, unless these Specifications provide otherwise.
  - .1 Asphalt Binder: Performance Grade (PG 58-28) to meet the requirements of AASHTO M320, Table 1.
  - .2 Design ESAL: 0.3 to < 3.
- .1 Asphalt tack coat: anionic emulsified asphalt meeting the requirements of NSTIR Standard Specification - Highway Design Division, latest edition.

- .1 Supply certified producer's test data, manufacturer's certification that the materials supplied meet the specified requirements, or representative samples on request.
- .2 Water: clean, potable, free from foreign matter.
- .2 Anti-stripping admixtures: shall be supplied by the Contractor and incorporated into the mix at 0.5% of the asphalt content in conformance with the NSTIR Standard Specification - Highway Design Division (Division 4), latest edition.
  - .1 Include type and dosage of all asphalt binder anti-stripping on the delivery slip.

## **2.2 EQUIPMENT**

- .1 As per NSTIR Standard Specification - Highway Design Division, latest edition, Division 4 - Pavements.
- .2 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .3 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .4 Vibratory rollers for parking lots and driveways:
  - .1 Minimum drum diameter: 750 mm.
  - .2 Maximum amplitude of vibration (machine setting): 0.5 mm for lifts less than 40 mm thick.
- .5 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
  - .1 Boxes with tight metal bottoms.
  - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.
  - .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
- .6 Suitable hand tools.

## **2.3 MIX DESIGN**

- .1 As per NSTIR Standard Specification - Highway Design Division, latest edition, Division 4 - Pavements, Section 19.
- .2 Water required for the works shall be supplied by the Contractor. The Owner will not supply water and the Contractor will not be permitted to use the Owner's hydrants.
- .3 Job mix formula to be provided in writing to Departmental Representative for approval two weeks prior to the date paving operations are to commence.
  - .1 Include evidence the proposed mix meets the requirements specified herein.
- .4 Make stockpiles of aggregates proposed for use in asphalt concrete for the project available for sampling to permit checking of mix design.
- .5 Do not change job-mix without prior approval of Departmental Representative. When change in material source proposed, new job-mix formula to be reviewed by Departmental Representative.

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**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for asphalt paving installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

**3.2 SUBGRADE SURFACE PREPARATION AND INSPECTION**

- .1 Verify grades of subgrade drains and other items set in paving area for conformity with elevations and sections before placing granular base material.
- .2 Obtain written approval of subgrade by Departmental Representative before placing asphalt.

**3.3 GRANULAR BASE**

- .1 Place granular base material to Section 32 11 23 – Aggregate Base Courses.

**3.4 ASPHALT TACK COAT**

- .1 Apply tack coat in accordance with NSTIR Standard Specification - Highway Design Division, latest edition, Division 4, where existing asphalt has been cut prior to placement of new asphalt next to it.
  - .1 Ensure cut edge is smooth and has been cleaned thoroughly before applying tack to the full face of the area where new asphalt will be placed.

**3.5 PLANT AND MIXING REQUIREMENTS**

- .1 In accordance with ASTM D995.

**3.6 ASPHALT CONCRETE PAVING**

- .1 In accordance with NSTIR Standard Specification - Highway Design Division, latest edition, Division 4, Section 19.
- .2 Obtain written approval of base from Departmental Representative before placing asphalt mix.
- .3 Place asphalt concrete in thicknesses as shown on the Drawings.

**3.7 JOINTS**

- .1 In accordance with NSTIR Standard Specification - Highway Design Division, latest edition, Division 4 - Pavements.

**3.8 TRANSVERSE CONSTRUCTION JOINTS**

- .1 In accordance with NSTIR Standard Specification - Highway Design Division, latest edition, Division 4 - Pavements.

**3.9 LONGTITUDINAL CONSTRUCTION JOINTS**

- .1 In accordance with NSTIR Standard Specification - Highway Design Division, latest edition, Division 4 - Pavements.

**3.10 TESTING**

- .1 Inspection and testing of asphalt pavement will be carried out by an approved testing laboratory in accordance with Section 01 45 00 - Quality Control and NSTIR Standard Specification - Highway Design Division, latest edition, Division 4 - Pavements.

**3.11 CLEANING**

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

**3.12 PROTECTION**

- .1 Keep vehicular traffic off newly paved areas until paving surface temperature has cooled below 38 degrees C.
  - .1 Do not permit stationary loads on pavement until 24 hours after placement.
  - .2 Water required to lower the mat temperature shall be supplied by equipment capable of applying the water at a uniform and evenly distributed rate in such amounts as required and/or as the Departmental Representative may direct.
- .2 Provide access to buildings as required.
  - .1 Arrange paving schedule so as not to interfere with normal use of premises.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-15.1-92, Calcium Chloride.

**1.2 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
  - .1 Supply calcium chloride in quantities and at times as directed by Departmental Representative.
  - .2 Deliver calcium chloride to site in moisture-proof bags. Indicate name of manufacturer, name of product, net weight or mass, and percentage of calcium chloride guaranteed by manufacturer.
- .2 Storage and Handling Requirements:
  - .1 Store bags of calcium chloride in weather-proof enclosures.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Calcium chloride, Type I: to CAN/CGSB-15.1, flake, fine enough to feed readily through the common form spreaders used in roadwork.
- .2 Water: contaminant-free water obtained from a source approved by the regulatory agency. The owner's water is not to be used for this purpose.

**Part 3 Execution**

**3.1 APPLICATION**

- .1 Apply calcium chloride with approved spreader equipment when directed by Departmental Representative. Hand placement is not permitted.
- .2 Apply water with distributors equipped with means of shut-off and with spray system to ensure uniform application.
- .3 Coverage: 300 grams per square meter. Subsequent applications: half of the previous rate, unless otherwise directed by the Departmental Representative.
- .4 No calcium chloride shall be placed within two (2) weeks prior to asphalt placement.
- .5 Do not apply within 8 metres of a water body.

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PWGSC  
SEWAGE TREATMENT  
UPGRADES  
SPRINGHILL INSTITUTION  
SPRINGHILL, NS  
PROJECT NO. R.061876.001

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DUST CONTROL

SECTION 32 15 60  
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**END OF SECTION**

**Part 1 General**

**1.1 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

**1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM).
  - .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-dipped, Zinc-Coated Welded and Seamless.
  - .2 ASTM A90/A90M, Standard Test Method for Weight Mass of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
  - .3 ASTM A121, Standard Specification for Zinc-Coated (Galvanized) Steel Barbed Wire.
  - .4 A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-138.1, Fabric for Chain Link Fence.
  - .2 CAN/CGSB-138.2, Steel Framework for Chain Link Fence.
  - .3 CAN/CGSB-138.3, Installation of Chain Link Fence.
  - .4 CAN/CGSB-138.4, Gates for Chain Link Fence.
  - .5 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
- .3 Canadian Standards Association (CSA).
  - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
  - .2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-A3000, Cementitious Materials Compendium. Includes:
    - .1 CAN/CSA-A23.5, Supplementary Cementing Materials.

**1.3 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit product data including:
  - .1 Fence fabric gauge and finish.
  - .2 Post and rail dimension and finish.
  - .3 Gate frame dimension and finish.

- .4 Anchoring details.
- .5 Required fittings and hardware.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.

### **Part 2 Products**

#### **2.1 MATERIALS**

- .1 Concrete mixes and materials: as indicated on Drawings and in accordance with Section 03 30 00- Cast-in-Place Concrete.
- .2 Chain-link fence fabric: to CAN/CGSB-138.1.
  - .1 Type 1, Class A, medium style, Grade 2.
  - .2 Height of fabric: as indicated.
  - .3 50 mm diamond mesh pattern, constructed of #9 gauge steel wire.
  - .4 Hot-dipped galvanized after fabrication or woven from electro-galvanized wire with an average weight of zinc coating not less than 366 gm/sq.m. (1.2 oz/sq. ft.) of uncoated surface, Type 1, Class A or B, Style 2, 3.5 mm (9ga.) medium.
  - .5 Bottom selvedge: knuckled and reinforced with #9 gauge electro-galvanized steel wire.
  - .6 Where barbed wire is not required, the top selvedge of the fabric shall be twisted.
- .3 Posts, braces and rails: to CAN/CGSB-138.2, galvanized steel pipe. Dimensions as indicated.
- .4 Line posts: 60 mm OD Schedule 40, 4.0 mm minimum wall thickness, minimum mass of 5.45 kg/m, scale-free, hot-dipped galvanized tubular steel pipe.
- .5 Terminal posts (end and corner posts): 89 mm OD, Schedule 40, 5.5 mm minimum wall thickness, minimum mass of 11.28 kg/m, scale free, hot-dipped galvanized steel pipe, complete with stretching bands and bars for attaching fabric to the post and bands for attaching the brace equipment. Posts shall be provided with caps without projections to match the overhand tops.
  - .1 Where barbed wire is required, gate, straining and end post shall be 280 mm higher than the line post and corner posts, and shall have bands for attaching the barbed wire.
  - .2 For gate panels over 8.4 m<sup>2</sup> but less than 13.0 m<sup>2</sup>, a 114 mm OD Schedule 40 post is required.
  - .3 For gates over 13.0 m<sup>2</sup>, a 168 mm OD Schedule 40 post is required.
- .6 Gate stop post: 100 mm OD, Schedule 40, 4.0 mm minimum wall thickness, minimum mass of 5.45 kg/m, scale-free, hot-dipped galvanized tubular steel pipe post, with a latch or hook to permit the gate to be held open without swinging shut.

- .1 Latch shall tolerate movement due to frost or other effects that change the relationship between gate and post by up to 100 mm.
- .2 Post to have a concrete footing the same as specified for corner posts with a Bollardguard cover.
- .3 Post shall extend 1500 mm above the ground surface.
- .7 Top rails: 43 mm OD, schedule 40, 3.6 mm wall thickness, minimum mass of 3.38 kg/m, scale free, hot-dipped galvanized steel pipe connected at the joints with sleeves that allow for construction and expansion.
- .8 Tension wire: to CAN/CGSB-138.2, single strand, galvanized steel wire.
- .9 Tie wire fasteners: aluminum wire.
- .10 Tension bar: to ASTM A653/A653M, 5 x 20 mm minimum galvanized steel.
- .11 Gates: to CAN/CGSB-138.4.
- .12 Gate frames: to ASTM A53/A53M, scale-free, hot dipped galvanized steel pipe, standard weight 43 mm outside diameter pipe for outside frame, 43mm outside diameter pipe for interior bracing.
  - .1 Fabricate gates as indicated with electrically welded joints, vertical and horizontal bracing, and hot-dip galvanized after welding.
  - .2 Vehicle gates shall have a diagonal brace extending from the top corner on the hinged end to the bottom corner on the free end.
  - .3 Fasten fabric to the frame with galvanized steel bands and tension bars.
  - .4 Fasten fence fabric to gate with twisted selvage at top.
  - .5 Furnish gates with galvanized malleable iron hinges, latch and latch catch with provision for padlock which can be attached and operated from either side of installed gate.
  - .6 Furnish double gates with chain hook to hold gates open and centre rest with drop bolt for closed position.
  - .7 Furnish gates topped with 3 strands of barbed wire to match fence.
  - .8 Furnish gates with a galvanized steel post to anchor the gate to when open and complete with galvanized anchor pin on gate. Galvanized steel post shall match the requirements of line posts.
- .13 Fittings and hardware: to CAN/CGSB-138.2, hot-dipped galvanized steel.
  - .1 Tension bar bands: 3 x 20 mm minimum galvanized steel or 5 x 20 mm minimum aluminum.
  - .2 Post caps to provide waterproof fit, to fasten securely over posts and to carry top rail.
  - .3 High strength aluminum alloy overhang tops to provide waterproof fit, to hold top rails and an outward projection to hold barbed wire overhang.
  - .4 Include projection with clips or recesses to hold 3 strands of barbed wire spaced 100 mm apart.

- .5 Projection of approximately 300 mm long to project from fence at 45 degrees above horizontal.
- .6 There will be no overhang of barbed wire installed on the tops of gates. Provide vertical brackets to hold the barbed wire so as to avoid interference with the overhung wire on the fence.
- .7 Turnbuckles to be drop forged.
- .8 Braces: brace end and corner posts by a diagonal brace of the same material as the top rail, from the post to a concrete encased footing, as shown on the Drawings. Corner posts shall be braced in both directions. All other locations shall be braced horizontally between posts using the same material as the top rail.
- .14 Organic zinc rich coating: to CAN/CGSB-1.181 MPI #18.
- .15 Barbed wire: to ASTM A121 2 mm diameter galvanized steel wire, 4 point barbs 125 mm spacing. Minimum galvanized coating: 244 g/m<sup>2</sup> (.8 oz/sq.ft.).
- .16 Barbed wire: to CAN/CGSB-138.2, 2.5 mm diameter.
- .17 Padlocks: supply with each gate assembly, one (1) long style weatherproof padlock, keyed to the Owner's master key system. Provide two 2 sets of keys for each new padlock.
- .18 Stand-alone vehicle gates:
  - .1 Steel gate posts: 150 mm diameter, Schedule 40 hot dipped galvanized steel pipe, filled with 30 MPa concrete after placement, anchored in an 1800 mm long by 300 mm dia. sonotube filled with 30 MPa concrete.
    - .1 Post length: as shown on the Drawings.
  - .2 Vehicle gates: 73 mm OD, hot dipped galvanized Schedule 40 steel pipe.
    - .1 Solid shaft plug: 62 mm OD, hot dipped galvanized Schedule 40 steel pipe.
    - .2 Latch: 6.35 mm thick, hot dipped galvanized steel plate with provision to accept a padlock to lock the gate.
  - .3 Plates for reflective signs: 3.175 mm thick, hot dipped galvanized steel plate and sized in accordance with the drawings.
  - .4 Reflective signs: to be the same size as the plate.
  - .5 Parts, fittings, wire clips, nuts, bolts, etc.: be hot-dipped galvanized steel.
  - .6 Padlocks: long style weather resistant padlock keyed to the Owner's master key system.
    - .1 Provide two sets of keys for each new padlock.
    - .2 Provide one (1) weatherproof padlock per vehicle gate assembly.

## 2.2 FINISHES

- .1 Galvanizing:
  - .1 For chain link fabric: to CAN/CGSB-138.1, Grade 2.
  - .2 For pipe: 550 g/m<sup>2</sup> minimum to ASTM A90.

- .3 For barbed wire: to ASTM A121, Class 2.
- .4 For other fittings: to CAN/CSA-G164.
- .2 Aluminum coating:
  - .1 For barbed wire: to ASTM A121, Class 2.

### **Part 3 Execution**

#### **3.1 GRADING**

- .1 Remove debris and correct ground undulations along fence line to obtain smooth uniform gradient between posts.
  - .1 Compact the ground along the fence line before starting fence erection.
  - .2 Provide clearance between bottom of fence and ground surface of 30 mm to 50 mm.
  - .3 All fence grades and line shall be subject to the approval by the Departmental Representative.

#### **3.2 ERECTION OF FENCE**

- .1 Securely install all fittings and fence components in accordance with the fence manufacturer's recommendations.
- .2 Erect fence along lines as indicated and as directed by Departmental Representative and in accordance with CAN/CGSB-138.3.
- .3 Details of construction are to be in accordance with the Drawings, which forms part of this specification.
- .4 Excavate post holes to dimensions indicated.
- .5 Space line posts 3 m apart, measured parallel to ground surface, and with uniform spacing within each straight run unless noted otherwise on drawings.
- .6 Space straining posts at equal intervals not exceeding 150 m if distance between end or corner posts on straight continuous lengths of fence over reasonably smooth grade is greater than 150 m.
- .7 Install additional straining posts at sharp changes in grade and where directed by Departmental Representative.
- .8 Install end posts and gate and corner posts according to site plan, unless directed otherwise.
- .9 Install corner post where change in alignment exceeds 10° or change in elevation exceeds 1 in 3.
- .10 Install end posts at end of fence and at buildings.
  - .1 Install gate posts on both sides of gate openings.

- .2 If end or gate post adjoins a building wall, install post as close to wall as possible.
- .11 Provide concrete footings for all corner, end, gate posts and diagonal braces, except as may be noted otherwise on the Drawings. Line posts will not be set in concrete unless otherwise indicated.
  - .1 Use forming tubes in granular soils and any other location where the hole does not remain open to the required dimension.
    - .1 Backfill around form tubes with excavated material except in clay or rock where the footing shall be backfilled with gravel.
    - .2 Tamp backfill in layers not greater than 200 mm thick.
  - .2 Minimum depth: 1500 mm.
  - .3 Minimum diameter: 300 mm.
  - .4 Dewater footing excavations before concrete is placed.
- .12 Place concrete in post holes then embed posts into concrete to depths indicated.
  - .1 Center posts in concrete, in line within 6 mm.
  - .2 Extend concrete 50 mm above ground level and slope to drain away from posts.
  - .3 Brace to hold posts in plumb position and true to alignment and elevation until concrete has set.
  - .4 Install gate posts at same elevation regardless of ground contour.
  - .5 When the concrete in the footings is set, install post bands from the top without spreading. The barbed wire bracket shall extend outside the fence unless otherwise specified.
- .13 Line posts and any other posts not set in concrete: drive posts into the soil to a depth of 915 mm.
  - .1 Install posts plumb and in line within 6 mm.
  - .2 If the presence of rock or cobbles prevents driving posts into the soil without damage, excavate holes for the posts.
  - .3 Backfill with excavated material, except in clay or rock, where backfill material will be gravel.
  - .4 Tamp backfill in layers 200 mm thick and compact to 95% of maximum dry density to ASTM D698.
- .14 Install fence fabric after concrete has cured, minimum of 5 days.
- .15 Install brace between end and gate posts and nearest line post, as per detail.
  - .1 Install braces on both sides of corner and straining posts in similar manner.
  - .2 Install diagonal brace at end and corner posts, from the post to a concrete encased footing, as shown on the Drawings. Install horizontal brace between posts at other locations as determined in the field by the Departmental Representative.
- .16 Install overhang tops and caps.
- .17 Install top rail between posts and fasten securely to posts and secure waterproof caps and overhang tops.

- .18 Install bottom tension wire outside the line posts and inside the fabric at the mid-level of the bottom diamond, stretch tightly and fasten securely to end, corner, gate and straining posts with turnbuckles and tension bar bands closed wire ring or twisted wire tie.
- .19 Lay out fence fabric. Stretch tightly to tension recommended by manufacturer and fasten to end, corner, gate and straining posts with tension bar secured to post with tension bar bands spaced at 300 mm intervals. Install fabric on the outside of line posts, top rail and bottom tension wire
  - .1 Knuckled selvedge at bottom.
  - .2 Twisted selvedge or barbed edge at top.
  - .3 The fabric shall be continuous between 89 mm dia. posts. If necessary to join two (2) lengths of fabric, splice using existing fabric wires without altering the diamond mesh pattern. Splicing by overlap will not be permitted.
  - .4 Break fabric at each end, gate and corner post, and secure to the post by a draw bar and a minimum of six (6) evenly spaced offset bands.
- .20 Secure fabric to top rails, line posts and bottom tension wire with tie wires at 450 mm intervals.
  - .1 Give tie wires minimum two twists.
  - .2 The top of the fabric shall not be below the top of the top rail.
- .21 Install three (3) stands of barbed wire, strung tight above the fence fabric, and clip securely to lugs of each projection.
  - .1 Each strand shall be continuous around corners
  - .2 Insert strands in bracket slots in line and corner posts and fasten to each end and gate post by a center band.
- .22 Install grounding rods as indicated.
- .23 Protect fence from damage during the construction period, and assume responsibility for any repairs required throughout the warranty period at no additional cost to the Owner.

### **3.3 INSTALLATION OF GATES**

- .1 Install gates in locations as indicated.
- .2 The nominal gate width is the distance between the inside faces of the gate posts.
- .3 Level ground between gate posts and set gate bottom approximately 75-125 mm above ground surface.
- .4 Determine position of centre gate rest for double gate. Cast gate rest in concrete as directed. Dome concrete above ground level to shed water.
- .5 Install gate stops where indicated.

- .6 Install gate stop post outside all vehicle gates at a point 105° to the closed line of the gate, and 2400 mm from the hinged post of the gate. Ensure post has a latch or hook to permit the gate to be held open without swinging shut. Install post plumb, with height of 1500 mm above the ground surface.

### **3.4 TOUCH UP**

- .1 Clean damaged surfaces with wire brush removing loose and cracked coatings. Apply two coats of organic zinc-rich paint to damaged areas as recommended by the manufacturer. Pre-treat damaged surfaces according to manufacturers' instructions for zinc-rich paint.

### **3.5 CLEANING**

- .1 Clean and trim areas disturbed by operations. Dispose of surplus material as directed by Departmental Representative.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 14 13 - Soil Stripping and Stockpiling.
- .2 Section 31 23 33.01 Excavating, Trenching and Backfilling.
- .3 Section 32 92 19.16 Hydraulic Seeding.

**1.2 REFERENCES**

- .1 Agriculture and Agri-Food Canada
  - .1 The Canadian System of Soil Classification, Third Edition, 1998.
- .2 Canadian Council of Ministers of the Environment
  - .1 PN1340-2005, Guidelines for Compost Quality.

**1.3 DEFINITIONS**

- .1 Compost:
  - .1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.
  - .2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.
  - .3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25) (50)), and contain no toxic or growth inhibiting contaminants.
  - .4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A) (B).

**1.4 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Inform the Departmental Representative of proposed source of topsoil and sod before work begins.
- .3 Quality control submittals:
  - .1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described in PART 2 - SOURCE QUALITY CONTROL.
  - .2 Certificates: submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**Part 2 Products**

**2.1 TOPSOIL**

- .1 Where approved by the Departmental Representative, suitable topsoil recovered from other Contract work and meeting the requirements of this Section may be used.
- .2 Topsoil for seeded areas: mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
  - .1 Soil texture based on The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.
  - .2 Contain no toxic elements or growth inhibiting materials, admixture of subsoil, refuse, roots, stumps, sod, and stones larger than 20 mm.
  - .3 Finished surface free from:
    - .1 Debris and stones over 50 mm diameter.
    - .2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.
  - .4 Consistence: friable when moist.
  - .5 pH: 6.0 to 7.0.
  - .6 Topsoil may be salvaged and stockpiled from other Contract work if approved by the Departmental Representative.
    - .1 Screening required to remove objectionable material shall be done incidental to the work. Topsoil recovered from other Contract work shall not be measured for separate payment.

**2.2 SOIL AMENDMENTS**

- .1 Fertilizer:
  - .1 Fertility: major soil nutrients present in following amounts:
  - .2 Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.
  - .3 Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.
  - .4 Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.
  - .5 Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.
  - .6 Ph value: 6.5 to 8.0.
- .2 Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.
  - .1 Formulating ratio of:  
2:4:1 80% SCU for spring and early fall planting (6-12-3)  
1:4:1 100% SCU for late fall planting (6-24-6)
- .3 Peatmoss:
  - .1 Derived from partially decomposed species of Sphagnum Mosses.

- .2 Elastic and homogeneous, brown in colour.
- .3 Free of wood and deleterious material which could prohibit growth.
- .4 Shredded particle minimum size: 5 mm.
- .4 Sand: washed coarse silica sand, medium to coarse textured.
- .5 Limestone:
  - .1 Ground agricultural dolomitic limestone containing total 85% carbonates.
  - .2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.
- .6 Erosion control agent: emulsified asphalt to CAN/CGSB-16.2, Type 2 or polyvinyl acetate polymer.
- .7 Water: clean, fresh and free from impurities that inhibit plant growth.
  - .1 Provide water at no cost to the Owner.

### **2.3 SOURCE QUALITY CONTROL**

- .1 Contractor is responsible for amendments to supplied topsoil as specified.
- .2 Contractor is responsible for soil testing by recognized testing facility for PH, N, P and K (nitrogen, phosphorous, potassium), and organic matter. If test results indicate amendments are required, work will not commence until corrected and accepted by the Departmental Representative.
  - .1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

## **Part 3 Execution**

### **3.1 PREPARATION OF EXISTING GRADE**

- .1 Verify that grades are correct. If discrepancies occur, notify Departmental Representative and do not commence work until instructed by Departmental Representative.
- .2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.
- .3 Grade areas adjacent to existing finished areas to make a smooth connection with these areas and to ensure proper drainage across finished surfaces.
- .4 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.
  - .1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.
  - .2 Remove debris which protrudes more than 75 mm above surface.
  - .3 Dispose of removed material off site.
- .5 Cultivate entire area which is to receive topsoil to minimum depth of 100 mm.
  - .1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

### **3.2 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL**

- .1 Place topsoil on dry, unfrozen ground free of snow, ice, standing water or very wet and soft conditions after Departmental Representative has accepted subgrade.
- .2 Spread topsoil in uniform layers not exceeding 150 mm.
- .3 For sodded areas keep topsoil 50 mm below finished grade.
- .4 Spread topsoil as indicated.
- .5 Manually spread topsoil/planting soil around trees, shrubs and obstacles.
- .6 Fine grade topsoil to lines and elevations indicated, leaving surface smooth and uniform with a fine loose texture. Obtain approval of topsoil grade and depth before proceeding with seeding.

### **3.3 SOIL AMENDMENTS**

- .1 Apply and thoroughly mix soil amendments into full specified depth of topsoil at following rates:
  - .1 2.2 tonnes of lime per hectare of topsoiled area and as per the following:
    - .1 Rate determined with pH test results as determined by soil analysis.
    - .2 Lime shall be mixed thoroughly into full depth of topsoil prior to application of fertilizer.

### **3.4 FINISH GRADING**

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

### **3.5 ACCEPTANCE**

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

### **3.6 SURPLUS MATERIAL**

- .1 Dispose of materials not required off-site.

### **3.7 CLEANING**

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

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 33.01 Excavating, Trenching and Backfilling.
- .2 Section 32 91 19.13 Topsoil Placement and Grading.

**1.2 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling:
  - .1 Schedule hydraulic seeding to coincide with preparation of soil surface.
  - .2 All disturbed areas requiring hydroseed shall be completed within seven (7) days of area completion.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for seed, mulch, tackifier, fertilizer, liquid soil amendments and micronutrients.
  - .2 Submit 2 copies of WHMIS MSDS in accordance with Section 01 35 29.06 - Health and Safety Requirements.

Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

**1.4 QUALITY ASSURANCE**

- .1 Test Reports: submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Qualifications:
  - .1 Landscape Contractor: to be a Member in Good Standing of provincial Horticultural Trades Association.
  - .2 Landscape Planting Supervisor: Landscape Industry Certified Technician with Softscape Installation designation.
  - .3 Landscape Maintenance Supervisor: Landscape Industry Certified Technician with Turf Maintenance designation.
- .3 Soils Testing:
  - .1 Contractor is responsible for soils testing to determine appropriate ratios and application rates for fertilizer, lime, and any soil amendments that may be required.
  - .2 Soil test report to prescribe ratios and rates for initial applications as well as subsequent applications during establishment and warranty period.

- .3 Submit soil test report to Departmental Representative in accordance with Section 01 33 00 - Submittal Procedures.

## **1.5 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements:
  - .1 Labelled bags of fertilizer identifying mass in kg, mix components and percentages, date of bagging, supplier's name and lot number.
  - .2 Inoculant containers to be tagged with expiry date.
  - .3 Prepared materials such as seed, fertilizer, lime, binder, dyes, etc., brought to the site shall be brought to the site in their factory containers/bags clearly marked as to material and mix components.
- .3 Storage and Handling Requirements:
  - .1 Store fertilizer in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

## **1.6 WARRANTY**

- .1 For seeding, 12 months.
- .2 End-of-warranty inspection will be conducted by Departmental Representative.

## **1.7 SCHEDULING**

- .1 Schedule hydraulic seeding to coincide with preparation of soil surface.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Hydroseeding:
  - .1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
    - .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations" and having a minimum germination of 75% and minimum purity of 97%. Provide Pure Live Seed (PLS) weight certificates for germination and purity.
      - .1 Grass seed mixture: Low maintenance seed mixture:
        - .1 40% Creeping Red Fescue
        - .2 15% Timothy
        - .3 15% Tall Fescue

- .4 10% Kentucky Blue Grass
- .5 10% Alsike Clover
- .6 5% Red Top
- .7 5% Perennial Rye
- .2 Mulch (for seeding): specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:
  - .1 Type I mulch:
    - .1 Made from wood cellulose fibre.
    - .2 Organic matter content: 95% plus or minus 0.5%.
    - .3 Value of pH: 6.0.
    - .4 Potential water absorption: 800-900% (by weight).
  - .2 Type II mulch:
    - .1 Made from newsprint, raw cotton fibre or straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.
- .3 Tackifier: water dilutable, liquid dispersion containing polyvinyl acetate terpolymer emulsion or colloidal polyacharide tackifier, adhering to mulch during manufacturing, non-toxic and without germination or growth inhibiting factors.
- .4 Water: free of impurities that would inhibit germination and growth.
- .5 Fertilizer:
  - .1 To Canada "Fertilizers Act" and Regulations.
  - .2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.
- .6 Inoculants: inoculant containers to be tagged with expiry date.
- .2 Hay mulch (for ground cover or residual seeding): unprocessed form such as bales or rolls of straw or hay in air-dry condition, or other similar material approved by the Departmental Representative, and is substantially free of noxious weed seeds and objectionable foreign matter.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for hydraulic seeding in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied.

### **3.2 INSTALLERS**

- .1 Use installers members in good standing of provincial Horticultural Trades Association.

### **3.3 PROTECTION OF EXISTING CONDITIONS**

- .1 Protect structures, signs, guide rails, fences, plant material, utilities and other surfaces not intended for spray.
- .2 Immediately remove any material sprayed where not intended as directed by Departmental Representative.
- .3 Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.

### **3.4 PREPARATION OF SURFACES**

- .1 Fine grade areas to be seeded free of humps and hollows.
  - .1 Ensure areas are free of deleterious and refuse materials.
- .2 Cultivate areas identified as requiring cultivation to depth of 25 mm.
- .3 Ensure areas to be seeded are moist to depth of 150 mm before seeding.
- .4 Obtain Departmental Representative's approval of grade and topsoil depth before starting to seed.
- .5 Lime soil prior to hydroseed application. Perform soil test to determine pH and other deficient nutrients. Apply additives as per manufacturer's recommendations to correct deficiencies.

### **3.5 FERTILIZING PROGRAM**

- .1 Fertilize prior to fine grading applying fertilizer equally distributed in accordance with the agreed program between Contractor and Departmental Representative.
- .2 Fertilize during establishment and warranty periods applying fertilizer equally distributed in accordance with agreed program between Contractor and Departmental Representative.

### **3.6 PREPARATION OF SLURRY**

- .1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Departmental Representative. Supply equipment required for this work.
- .2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.
- .3 After materials are in seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

### **3.7 HYDRAULIC SEEDING**

- .1 Equipment:
  - .1 Slurry tank.

- .2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.
  - .3 Pumps capable of maintaining continuous non-fluctuating flow of solution.
  - .4 Supplied with not less than 6 spray pattern nozzles.
  - .5 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.
  - .6 Tank volume to be certified by certifying authority and identified by authorities "Volume Certification Plate".
  - .7 Equipment to be furnished with flotation tires so no tire depressions exceeding in 12 mm depth result.
- .2 Slurry mixture applied per hectare.
    - .1 Seed: Grass mixture: Application rate 200 kg/ha or as recommended by manufacturer.
    - .2 Mulch: 1250 kg/ha depending on the slope and as recommended by the supplier.
      - .1 When applied the mulch shall form an absorptive mat, which will allow moisture to percolate into the underlying soil.
      - .2 Rough ground and/or steep slopes require more mulch and binder per hectare than finished and/or flatter ground. Adjust material application quantities as required to ensure that the specified application rates are achieved. The additional quantities of mulch and binder shall be taken into account in the unit price tendered for this work, based on the site conditions.
    - .3 Tackifier: 20 kg, or as recommended by manufacturer.
    - .4 Water: Minimum 30,000 L or quantity as required to form slurry in accordance with manufacturer's recommendations.
    - .5 Fertilizer: apply at rate of 600 kg/ha, ratio 5-20-20 or as required by soils tests, and as recommended by the supplier.
  - .3 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.
    - .1 Using correct nozzle for application.
    - .2 Using hoses for surfaces difficult to reach or irregular to travel upon and to control application.
  - .4 Take reasonable care to prevent application of overspray onto structures or unintended areas. Immediately remove any overspray applications on structures or areas not intended for coverage, in a method approved by the Departmental Representative.
  - .5 Blend application 300 mm into adjacent grass areas or previous applications to form uniform surfaces.
  - .6 Re-apply where application is not uniform.
  - .7 After hydraulic seeding has been applied, roll the area with a roller having a mass of 50 kg/m of width. The roller shall be pulled by equipment with high flotation tires so that no ruts, depressions, or other damage to the work surface results.
  - .8 Remove slurry from items and areas not designated to be sprayed.

- .9 Obtain approval from Departmental Representative prior to carrying out hydraulic seeding after the week of September 30th.
- .10 Hydraulic seeding done between May 1st and Labour Day must produce a satisfactory growth over at least 95% of the area hydroseeded in the growing season of that year.
  - .1 Re-seed areas of poor or no growth which exceed five percent (measured cumulatively) of the area hydroseeded.
- .11 Cover all hydroseed with blown hay if hydroseed is being applied after Labour Day. Hay rate: 4500 kg/ha.

### **3.8 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
  - .1 Leave Work area clean at end of each day.
  - .2 Keep pavement and area adjacent to site clean and free from mud, dirt, and debris at all times.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
  - .1 Clean and reinstate areas affected by Work.

### **3.9 PROTECTION**

- .1 Protect seeded areas from trespass until plants are established.
- .2 Remove protection devices as directed by Departmental Representative.

### **3.10 STRAW / HAY MULCH EROSION CONTROL**

- .1 In addition to the mulch used for hydroseeding, at the discretion of the Departmental Representative, straw / hay mulch may be required.
- .2 Mulch seeded areas within forty-eight 48 hours of the seeding having been placed. Mulch unseeded areas within forty-eight 48 hours of being directed by the Departmental Representative to do so.
- .3 Apply mulch uniformly to the designated areas at a rate of 4500 kg/ha ( $\pm 15\%$ ). Thin or break apart and disperse lumps and thick clumps of mulch.
- .4 Maintenance:
  - .1 Maintain the mulched area under the maintenance requirements of this contract until the work has been accepted by the Owner ("Date of Substantial Completion") or until no longer required as determined by the Departmental Representative.
  - .2 Monitor and maintain the mulched area by repairing all damaged mulch and by re-mulching bare spots resulting from the wind, water or other causes. This will include adding additional mulch as required, using the procedures as specified herein.

**3.11 MAINTENANCE DURING ESTABLISHMENT PERIOD**

- .1 Perform following operations from time of seed application until acceptance by Departmental Representative.
- .2 Grass Mixture:
  - .1 Monitor all seeded areas during the maintenance period. Water grassed and seeded areas adequately to assure continued growth. Control watering to prevent washouts. Water will not be provided by the Owner.
  - .2 Mow grass to height of 60 mm when it first reaches a height of 80 mm. Clippings which could smother grass shall be removed.
  - .3 Do not cut when the site is so wet that mowing will cause ruts in the soil.
  - .4 Fertilize grassed areas after first mowing using a turf starter type fertilizer, at the manufacturer's recommended rate.
  - .5 Carry out subsequent cuttings of the seeded areas until the work has been accepted by the Owner.
  - .6 If, within eight (8) weeks of placement, any seeded areas fail to grow acceptable in the opinion of the Departmental Representative, they shall be re-seeded by the Contractor under the maintenance requirements of this Contract.

**3.12 ACCEPTANCE**

- .1 Seeded areas will be accepted by Departmental Representative provided that:
  - .1 Plants are uniformly established and seeded areas are free of rutted, eroded, bare or dead spots.
  - .2 Areas have been fertilized.
- .2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

**3.13 MAINTENANCE DURING WARRANTY PERIOD**

- .1 Perform following operations from time of acceptance until end of warranty period:
  - .1 Repair and reseed dead or bare spots to satisfaction of Departmental Representative.
  - .2 Fertilize seeded areas as required. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

**END OF SECTION**