


STAND ALONE SEPTIC SYSTEM  
STEPHENVILLE BASE  
STEPHENVILLE, NL

CIVIL SPECIFICATIONS  
ISSUED FOR TENDER  
24 SEPTEMBER 2015

PROVINCE OF NEWFOUNDLAND	
	PERMIT HOLDER Class "A" This Permit Allows
PINNACLE ENGINEERING LIMITED	
To practice Professional Engineering in Newfoundland and Labrador. Permit No. as issued by PEGNL <u>L0331</u> which is valid for the year <u>2015</u> .	



Pinnacle Engineering Limited  
P.N. 15024  
24 September 2015

<b>DIVISION 31</b>	<b>EARTHWORK</b>	
31 22 13	Rough Grading.....	4
31 22 16.13	Reshaping Roadway Subgrade.....	2
31 22 19	Finish Grading.....	2
31 23 16	Excavating .....	5
31 23 17	Rock Removal .....	4
31 23 18	Trenching .....	7
31 23 23	Backfilling .....	4
<b>DIVISION 32</b>	<b>EXTERIOR IMPROVEMENTS</b>	
32 01 11	Pavement Surface Cleaning.....	2
32 11 16.01	Granular Sub-Base.....	5
32 11 23	Aggregate Base Course.....	4
32 12 13.16	Asphalt Tack Coat.....	4
32 12 16	Asphalt Paving.....	10
32 12 37	Asphalt Pavement Sealing.....	2
<b>DIVISION 33</b>	<b>UTILITIES</b>	
33 05 13	Manholes and Catch Basin Structures.....	4
33 31 13	Public Sanitary Utility Sewerage Piping.....	4
33 36 00	Secondary Sewage Treatment Plant .....	3

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Removal of topsoil and subsoil.
- .2            Cutting, grading, filling, rough contouring, compacting the site for site structures, building pads, parking area and access roads.

**1.2                RELATED SECTIONS**

- .1            Section 01 45 00 - Testing and Quality Control
- .2            Section 02 41 16 - Structure Demolition.
- .3            Section 31 14 13 – Soil Stripping and Stockpiling.
- .4            Section 31 05 16- Aggregate Materials.
- .5            Section 31 11 00 – Clearing and Grubbing.
- .6            Section 31 22 19 - Finish Grading.
- .7            Section 31 23 10 – Excavating, Soil Removal and Backfilling.
- .8            Section 31 23 16.26 - Rock Removal.

**1.3                REFERENCES**

- .1            AASHTO T180-09 - Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
- .2            ASTM C136-06 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3            ASTM D698-07e1 - Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/cu ft (600 kN-m/cu m)).
- .4            ASTM D1556-07 - Test Method for Density and Weight Unit of Soil in Place by the Sand-Cone Method.
- .5            ASTM D1557-09 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2,700 kN-m/cu m)).
- .6            ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
- .7            ASTM D2419-09 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
- .8            ASTM D2434-68(2006) - Test Method for Permeability of Granular Soils (Constant Head).

- 1.4 QUALITY ASSURANCE**
- .1 Perform Work to Government of Newfoundland & Labrador Municipal Water, Sewer and Roads Master Construction Specifications.

- 1.5 EXISTING CONDITIONS**
- .1 Examine subsurface investigation report which is available for inspection from Departmental Representative.
  - .2 Known underground and surface utility lines and buried objects are as indicated on site plan.

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

**Part 2 Products**

- 2.1 MATERIALS**
- .1 Fill material: In accordance with Section 31 23 25 – Rock and Gravel Fill.
  - .2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Departmental Representative.

**Part 3 Execution**

- 3.1 EXAMINATION**
- .1 Verify existing conditions before starting work.
  - .2 Verify that survey bench mark and intended elevations for the Work are as indicated.

- 3.2 PREPARATION**
- .1 Identify required lines, levels, contours, and datum.
  - .2 Stake and flag locations of known utilities.
  - .3 Locate, identify, and protect utilities that remain, from damage.
  - .4 Notify Newfoundland Power to remove and relocate utilities.
  - .5 Protect above and below grade utilities that remain.

- .6 Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- .7 Protect any bench marks, survey control point, and paving, from excavating equipment and vehicular traffic.

### 3.3 SUBSOIL EXCAVATION

- .1 Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded.
- .2 Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content.
- .3 When excavating through roots, perform work by hand and cut roots with sharp axe.
- .4 Remove subsoil from site.

### 3.4 FILLING

- .1 Install work in accordance with Newfoundland & Labrador Municipal Water, Sewer and Roads Master Construction Specifications.
- .2 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.
- .3 Fill areas to contours and elevations with unfrozen materials.
- .4 Place fill material on continuous layers and compact.
- .5 Maintain optimum moisture content of fill materials to attain required compaction density.
- .6 Slope grade away from building minimum 2%, unless noted otherwise.
- .7 Make grade changes gradual. Blend slope into level areas.
- .8 Compact filled and disturbed areas to corrected maximum dry density to ASTM D698, as follows:
  - .1 90% under landscaped areas.
  - .2 100% under paved and walk areas.
- .9 Remove surplus fill material and material unsuitable for fill, grading or landscaping from site.

### 3.5 TOLERANCES

- .1 Top Surface of Subgrade: Plus or minus 30 mm from required elevation.

### 3.6 FIELD QUALITY CONTROL

- .1 Section 01 45 00 - Testing and Quality Control.
- .2 Inspection and testing of soil compaction will be carried out by testing laboratory designated by Departmental Representative. Reference to Section 01 45 00 – Testing and Quality Control.

- .3 Submit testing procedure, frequency of tests, to Engineer for approval.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 11 00 - Clearing and Grubbing.
- .2 Section 31 14 13 – Soil Stripping and Stockpiling.
- .3 Section 31 22 13 – Rough Grading
- .4 Section 31 23 16.26 – Rock Removal
- .5 Section 31 23 10 - Excavating, Soil Removal and Backfilling.
- .6 Section 31 24 13 – Roadway Embankments
- .7 Section 32 11 16.01 - Granular Subbase
- .8 Section 32 11 23 – Aggregate Base Course
- .9 Section 32 12 13.16 – Asphalt Tack Coat
- .10 Section 32 16 15 – Concrete Walks, Curbs and Gutters

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM D698-07, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort 600 kN-m/m<sup>3</sup>.

**1.3 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate is acceptable for roadway subgrade reshaping installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental's Representative.
  - .2 Inform Engineer 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's Representative.

### **3.2 SCARIFYING AND RESHAPING**

- .1 Scarify subgrade to full width as indicated and to depth of 300 mm minimum.
- .2 Pulverize and break down scarified material to 150 mm maximum soil clod size, except that stones larger than this size may be left intact as directed by Departmental's Representative.
- .3 Blade and trim pulverized material to elevation and cross section dimensions as indicated.
- .4 Where deficiency of material exists, add and blend additional subgrade material as directed by Departmental's Representative.
- .5 Re-use excess material in areas of material deficiency as directed by Departmental's Representative.

### **3.3 COMPACTING**

- .1 Compact to minimum maximum dry density to ASTM D698.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted subgrade surface.
- .3 Apply water as necessary during compaction to obtain specified density.
- .4 If material is excessively moist, aerate by scarifying with suitable equipment until moisture content is corrected to value not greater than 1% moisture above optimum value for compaction to ASTM D698.

### **3.4 SITE TOLERANCES**

- .1 Reshaped compacted surface to be within plus or minus 10 mm of elevation as indicated.

### **3.5 CLEANING**

- .1 Progress Cleaning: Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 –Cleaning.
- .3 Waste Management: separate waste materials in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

### **3.6 PROTECTION**

- .1 Protect and maintain reshaped surface in condition conforming to this Section until succeeding material is applied or until after receipt of written acceptance from Departmental's Representative.

**END OF SECTION**



**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Final grade topsoil for finish landscaping.

**1.2                RELATED SECTIONS**

- .1            Section 01 45 00 – Testing and Quality Control.
- .2            Section 31 14 13 – Soil Stripping and Stockpiling.
- .3            Section 31 22 13 - Rough Grading.
- .4            Section 31 23 10 – Excavating, Soil Removal and Backfilling.
- .5            Section 32 12 16 - Asphalt Paving.
- .6            Section 32 92 23 - Sodding.

**Part 2            Products**

**2.1                MATERIAL**

- .1            Topsoil: As specified in Section 31 14 13 – Soil Stripping and Stockpiling.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1            Verify building and trench backfilling have been inspected.
- .2            Verify substrate base has been contoured and compacted.

**3.2                SUBSTRATE PREPARATION**

- .1            Eliminate uneven areas and low spots.
- .2            Remove debris, roots, branches, stones, in excess of 13 mm in size. Remove subsoil contaminated with petroleum products.
- .3            Scarify surface to depth of 75 mm where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

**3.3                PLACING TOPSOIL**

- .1            Place topsoil in areas where sodding is required to a nominal depth of 150 mm. Place topsoil during dry weather.

- .2 Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- .3 Remove roots, weeds, rocks, and foreign material while spreading.
- .4 Manually spread topsoil close to building to prevent damage.
- .5 Lightly compact placed topsoil.
- .6 Remove surplus subsoil and topsoil from site.
- .7 Leave stockpile area and site clean and raked, ready to receive landscaping.

**3.4 TOLERANCES**

- .1 Top of Topsoil: Plus or minus 13 mm.

**3.5 PROTECTION OF FINISHED WORK**

- .1 Protect landscaping and other features remaining as final work.
- .2 Protect existing structures, fences, sidewalks, utilities, paving and curbs.

**3.6 SCHEDULES**

- .1 Sod: 50 mm thick.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Excavating for building foundations.
- .2 Excavating for slabs-on-grade and paved landscaped areas.
- .3 Excavating for site structures.

**1.2 RELATED SECTIONS**

- .1 Section 31 22 13 - Rough Grading
- .2 Section 31 23 18 - Trenching.
- .3 Section 31 23 17 - Rock Removal.
- .4 Section 31 23 16 - Excavating
- .5 Section 31 23 23 - Backfilling.
- .6 Section 01 35 43 – Environmental Procedures.
- .7 Section 33 11 16 - Site Water Utility Distribution Piping.
- .8 Section 33 36 00 – Secondary Sewage Treatment Plant

**1.3 EXISTING CONDITIONS**

- .1 Buried services:
  - .1 Before commencing work verify location of buried services on and adjacent to site.
  - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
  - .3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .4 Prior to commencing excavation work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.
  - .5 Confirm locations of buried utilities by careful test excavations.
  - .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
  - .7 Where utility lines or structures exist in area of excavation, obtain direction of Owner's Representative before removing or re-routing.
  - .8 Record location of maintained, re-routed and abandoned underground lines.
  - .9 Confirm locations of recent excavations adjacent to area of excavation.
- .2 Existing buildings and surface features:

- .1 Conduct, with Owner's Representative 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 event of damage, immediately make repair to approval of Owner's Representative.
- .3 Where required for excavation, cut roots or branches as approved by Owner's Representative.

**Part 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify that survey bench mark and intended elevations for the work are as indicated.

**3.2 PREPARATION**

- .1 Identify required lines, levels, contours, and datum locations.
- .2 Locate, identify, and protect utilities that remain from damage.
- .3 Notify utility companies to remove and relocate utilities.
- .4 Protect plant life, lawns, rock outcroppings and other features remaining as a portion of final landscaping.
- .5 Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- .6 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.
- .7 Strip topsoil from within limits of excavation and stockpile as directed by Engineer, for re-spreading after backfilling or for reinstatement in other parts of the work.
- .8 Cut pavement or sidewalk neatly along limits of proposed excavation or as specified in order that surface may break evenly and cleanly.

**3.3 DEWATERING**

- .1 Keep excavations free of water while work is in progress.

- .2 Protect open excavations against flooding and damage due to surface runoff.
- .3 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction. Comply with all requirements of the Department of Environment and other regulatory agencies having jurisdiction regarding disposal of water from excavations.
- .4 Submit for Engineer's review, details of proposed dewatering methods, such as dikes or well points.
- .5 Provide flocculation tanks, settling basins or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.
6. Do not dewater during placing of concrete, or for a period of at least 24 hours thereafter, unless from a pump separated from concrete work by a watertight wall or other effective means.
- .7 Construct all sub-drains, sump holes, wells or the like required for dewatering the excavations so as not to endanger in any way the stability of the Works, and on completion of the work completely backfill and consolidate these excavations

### 3.4 EXCAVATION

- .1 Advise Engineer in advance of excavation operations to enable original cross-sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions indicated.
- .3 Cut pavement or sidewalk neatly in a line along limits of proposed excavation or as specified in order that surface may break evenly and cleanly. The width removed along the normal trench for the installation of the pipe shall not exceed the width of the trench specified by more than 500 mm on each side of the trench. The width and length of the area removed for the installation of gate valves, specials, manholes, or other structures shall not exceed the maximum linear dimensions of such structures by more than 500 mm on each side. Wherever, in the opinion of the Engineer, existing conditions make it necessary or advisable, remove additional pavement, as directed by the Engineer, and receive extra compensation provided such additional work is not shown in the drawings or specified. Removal or damage to pavement or surfaces beyond these limits, shall be replaced or repaired at the expense of the Contractor.
- .4 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation.
- .5 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. Seal cuts with approved tree wound dressing.
- .6 Unless otherwise authorized by Engineer 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.
- .7 Dispose of waste material as indicated in Section 01 74 21 Construction/Demolition Waste Management and Disposal. The Engineer shall define waste material.

- .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 Obtain Engineer approval of completed excavation.
- .11 Remove unsuitable material from trench bottom to extent and depth directed by Engineer.
- .12 Where required due to unauthorized over-excavation, correct as follows:
  - .1 Fill under bearing surfaces and footings with concrete specified for footings.
  - .2 Fill under other areas with approved fill compacted to minimum of 100% corrected maximum dry density, maximum dry density to ASTM D698-78, method D.
- .13 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.
- .14 No extra payment shall be made for measures ordered by the Engineer to correct problems caused by unauthorized over-excavation.
- .15 No extra payment shall be made for construction methods required to keep the trench stable, free from disturbance, or dry, nor for crushed stone or other granular material used to facilitate drainage or dewatering during construction of the pipeline or for any extra excavation related thereto.
- .16 The use of mechanical excavators will be permitted except where their use in the opinion of the Engineer, will cause damage to property or structures above or below ground which property or structures must be preserved in accordance with the contractor. The costs for hand excavation when the proximity of existing structures or other consideration render this necessary are deemed to be included in the Unit Price for trench excavation and backfill in the Unit Price Table.
- .17 Keep all surface materials which, in the opinion of the Engineer, are suitable for re-use in restoring the surface separate from the general excavation material.
- .18 Stockpile suitable material required for trench backfill in approved location.

### **3.5 RESTORATION**

- .1 Remove waste materials and debris, trim slopes, and correct defects noted by Engineer.
- .2 Replace topsoil as indicated or directed by Engineer.
- .3 Reinstate pavement and sidewalks, lawns to condition and elevation which existing before excavation.
- .4 Clean and reinstate areas affected by work as directed by Engineer.
- .5 Reinstate areas affected by equipment outside of planned area to condition which existed prior to commencement of work and leave site in rake-clean condition as directed.

**3.6 FIELD QUALITY CONTROL**

- .1 Section 01 45 00: Testing and Quality Control.
- .2 Provide for visual inspection of bearing surfaces.

**3.7 PROTECTION OF FINISHED WORK**

- .1 Protect installed work.
- .2 Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- .3 Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

**END OF SECTION 31 23 16**

**Part 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Removal of identified and discovered rock during excavation.
- .2 Expansive tools and Explosives to assist rock removal.

**1.2 RELATED SECTIONS**

- .1 Section 01 45 00 – Testing and Quality Control.
- .2 Section 31 22 13 - Rough Grading.
- .3 Section 31 23 16 - Excavating.
- .4 Section 31 23 18 - Trenching.
- .5 Section 31 23 23 - Backfilling.
- .6 Section 31 37 10 - Riprap.

**1.3 REFERENCES**

- .1 NFPA 495 - Explosive Materials Code.

**1.4 DEFINITIONS**

- .1 Site Rock: Solid mineral material with a volume in excess of 0.25 cu m or solid material that cannot be removed with a 0.57 cu m capacity power shovel without drilling or blasting.

**1.5 ADMINISTRATIVE REQUIREMENTS**

- .1 Section 01 14 10: Scheduling and Management of Work.
- .2 Scheduling: Schedule Work to avoid disruption to occupied buildings nearby.

**1.6 SUBMITTALS FOR REVIEW**

- .1 Section 01 33 00: Submittal procedures.
- .2 Blasting Operation
  - .1 Submit to Owner's Representative and local authorities having jurisdiction for approval, written proposal of operations for removal of rock by blasting.
  - .2 Indicate proposed method of carrying out work, types and quantities of explosives to be used, loading charts and drill hole patterns, type of caps, blasting techniques, blast protection measures for items such as flying rock, vibration, dust and noise control. Include details on protective measures, time of blasting and other pertinent details.
  - .3 Submit records to Owner's Representative at end of each shift. Maintain complete and accurate records for drilling and blasting operations.



- .4 Prior to any blasting operations, the contractor shall carry out a pre-blast survey. This survey will be conducted by an independent agency. The survey report will be submitted to the Owner's Representative for review.
- .5 No blasting shall take place without a minimum of 48 hours notice to the Owner's Representative.

#### **1.7 QUALITY ASSURANCE**

- .1 Blasting shall only be performed by experienced powder-man licensed in the Province of Newfoundland and Labrador to use explosives.
- .2 Prevent damage to persons & property by flying rocks, by covering the site of the blasting with blasting mats or other suitable devices. Post guards, sound warnings and display signs when blasting is to take place.
- .3 Carry out trial blasting at the commencement of the blasting work in order to determine the amount of charge required to keep vibrations within safe limits, to the satisfaction of the Engineer. Take seismograph recordings during such trial blasting and at any other time while blasting is continued, as considered necessary by the Contractor for his own protection, or as may be directed by the Engineer. Maximum acceleration during blasting must not exceed 50 mm per sec per sec.
- .4 No increase in charges will be permitted without further trial blasting and seismograph recordings, as described above.
- .5 Repair any damage caused by blasting. Blasting may not be permitted, or may be limited to such an extent as to ensure the safety of structures, if considered necessary by the Engineer. For his protection, the Contractor is advised to engage a qualified inspection company to carry out a pre-blasting survey of buildings in the vicinity of his blasting operation in order to record pre-blasting conditions.

#### **1.8 REGULATORY REQUIREMENTS**

- .1 Conform to applicable code for explosive disintegration of rock and to NFPA 495 for handling explosive materials.
- .2 Obtain permits from authorities having jurisdiction before explosives are brought to site or drilling is started.

#### **1.9 PROJECT CONDITIONS**

- .1 Conduct survey and document conditions of buildings near locations of rock removal, prior to blasting and photograph existing conditions identifying existing irregularities.
- .2 Advise owners of adjacent buildings or structures in writing, prior to executing seismographic survey. Explain planned blasting and seismic operations.
- .3 Obtain a seismic survey prior to rock excavation to determine maximum charges that can be used at different locations in area of excavation without damaging adjacent properties or other work.

**Part 2 PRODUCTS**

**2.1 NOT USED**

- .1 Not used.

**Part 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify site conditions and note subsurface irregularities affecting work of this section.

**3.2 PREPARATION**

- .1 Identify required lines, levels, contours, and datum.

**3.3 ROCK REMOVAL**

- .1 Co-ordinate this Section with Section 01 35 28 - Health and Safety Requirements.
- .2 Remove rock to alignments, profiles, and cross sections as indicated.
- .3 Explosive blasting is not permitted at locations indicated.
- .4 Do blasting operations in accordance with local and provincial codes, requirements of authority having jurisdiction.
- .5 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.
- .6 Excavate rock to horizontal surfaces.
- .7 Scale, pressure wash and broom clean rock surfaces which are to bond to concrete.
- .8 Excavate trenches to lines and grades to minimum of 300 mm below pipe invert indicated. Provide recesses for bell and spigot pipe to ensure bearing will occur uniformly along barrel of pipe.
- .9 Cut trenches to widths as indicated.
- .10 Use pre-shearing, cushion blasting or other smooth wall drilling and blasting techniques directed by Owner's Representative.
- .11 Remove boulders and fragments which may slide or roll into excavated areas.
- .12 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 16: Excavating, Section: 31 23 18 Trenching, and Section 31 23 23: Backfilling.

**3.4 ROCK DISPOSAL**

- .1 Dispose of surplus removed rock off site. Dispose in locations acceptable to authorities having jurisdiction and Owner's Representative.
- .2 Do not dispose removed rock into landfill. Material must be sent to appropriate location as approved by the Owner's Representative.

**3.5 FIELD QUALITY CONTROL**

- .1 Section 01 45 00: Testing and Quality Control.

**END OF SECTION 31 23 17**

**Part 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Excavating trenches for utilities from as indicated on construction drawings.
- .2 Compacted fill from top of utility bedding to subgrade elevations.
- .3 Backfilling and compaction.

**1.2 RELATED SECTIONS**

- .1 Section 01 45 00 – Testing and Quality Control.
- .2 Section 01 50 00 – Temporary Facilities.
- .3 Section 03 30 00 - Cast-in-place Concrete.
- .4 Section 31 05 13 - Soil Materials.
- .5 Section 31 05 16 - Aggregate Materials.
- .6 Section 31 22 13 - Rough Grading.
- .7 Section 31 22 19 - Finish Grading.
- .8 Section 31 23 16 – Excavating.
- .9 Section 31 23 17 - Rock Removal.
- .10 Section 31 23 23 - Backfilling.
- .11 Section 31 37 10 - Riprap.
- .12 Section 33 11 16 - Site Water Utility Distribution Piping.
- .13 Section 33 31 13 - Site Sanitary Sewerage Piping
- .14 Section 33 36 00 - Secondary Sewage Treatment Plant
- .15 Section 33 44 00 - Storm Sewer Water Drains.
- .16 Section 22 13 18 – Drainage Waste and Vent Piping – Plastic
- .17 Section 22 13 19 – Drainage Waste and Vent Piping – Corrosion Resistant.
- .18 Section 26 05 21 – Wires and Cables (0-1000V)
- .19 Section 26 05 34 – Conduits, Conduit Fastenings & Conduit Fittings.

**1.3 REFERENCES**

- .1 AASHTO T180-09 - Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.

- .2 ASTM C136-06 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- .3 ASTM D698-07e1 - 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>)).
- .4 ASTM D1556-07 - Test Method for Density and Weight Unit of Soil in Place by the Sand-Cone Method.
- .5 ASTM D1557-09 - Test Methods 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>)).
- .6 ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

#### **1.4 DEFINITIONS**

- .1 Utility: Any buried pipe, duct, conduit, or cable.

#### **1.5 ADMINISTRATIVE REQUIREMENTS**

- .1 Section 01 14 10: Scheduling and Management of Work.
- .2 Coordination:
  - .1 Coordinate with other work having a direct bearing on work of this section.
  - .2 Verify work associated with lower elevation utilities is complete before placing higher elevation utilities.

#### **1.6 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submittal procedures.

#### **1.7 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Closeout Submittals.

#### **1.8 EXISTING CONDITIONS**

- .1 Buried services:
  - .1 Before commencing work verify location of buried services on and adjacent to site.
  - .2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
  - .3 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
  - .4 Prior to commencing excavation work, notify applicable Owner or authorities having jurisdiction, establish location and state of use of buried utilities and structures. Owners or authorities having jurisdiction to clearly mark such locations to prevent disturbance during work.
  - .5 Confirm locations of buried utilities by careful test excavations.
  - .6 Maintain and protect from damage, water, sewer, gas, electric, telephone and other utilities and structures encountered as indicated.
  - .7 Where utility lines or structures exist in area of excavation, obtain direction of Owner's Representative before removing or re-routing.

- .8 Record location of maintained, re-routed and abandoned underground lines.
- .9 Confirm locations of recent excavations adjacent to area of excavation.
  
- .2 Existing buildings and surface features:
  - .1 Conduct, with Owner's Representative 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 event of damage, immediately make repair to approval of Owner's Representative.
  - .3 Where required for excavation, cut roots or branches as approved by Owner's Representative.

**Part 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Marking Tape:
  - .1 Heavy gauge polyethylene, 150 mm wide indicating the service buried.
  - .2 Detectable metallic underground tape, indicating the service buried, not less than 75 mm wide.
  
- .2 Type 1 bedding: clean, hard durable crushed gravel or stone, free from shale clay, friable materials, organic matter and other deleterious substances and graded within the following limits when tested to ASTM C136-84a and ASTM C117-87 and giving a smooth curve without sharp breaks when plotted on a semi-log chart.

<u>ASTM sieve designation</u>	<u>% Passing</u>
25.000 mm	100
19.000 mm	75 – 100
12.500 mm	-
9.500 mm	50 – 100
4.750 mm	30 – 70
2.000 mm	20 – 45
0.425 mm	10 – 25
0.180mm	-
0.075 mm	3 - 8

- .3 Type 2 bedding: clean, hard, durable sand, gravel or crushed stone, free from shale, clay, friable materials, organic matter and other deleterious substances when tested to ASTM C136-84a and ASTM C117-87 and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart:

<u>ASTM sieve designation</u>	<u>% Passing</u>
9.5 mm	100
4.75 mm	50 – 100
2.00 mm	30 – 90
0.075 mm	0 - 10

**Part 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify that survey bench mark, control point, and intended elevations for the Work are as shown on drawings.

**3.2 PREPARATION**

- .1 Identify required lines, levels, contours, and datum locations.
- .2 Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- .3 Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- .4 Maintain and protect above and below grade utilities which are to remain.
- .5 Cut out soft areas of subgrade not capable of compaction in place. Backfill with Backfill Material and compact to density equal to or greater than requirements for subsequent backfill material.

**3.3 DEWATERING**

- .1 Keep excavations free of water while work is in progress.
  - .1 Protect open excavations against flooding and damage due to surface runoff.
  - .2 Dispose of water in a manner not detrimental to public and private property, or any portion of work completed or under construction. Comply with all requirements of the Department of Environment and other regulatory agencies having jurisdiction regarding disposal of water from excavations.
  - .3 Submit for Engineer's review, details of proposed dewatering methods, such as dikes or well points.
  - .4 Provide flocculation tanks, settling basins or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.
  - .5 Do not dewater during placing of concrete, or for a period of at least 24 hours thereafter, unless from a pump separated from concrete work by a watertight wall or other effective means.
  - .6 Construct all sub-drains, sump holes, wells or the like required for dewatering the excavations so as not to endanger in any way the stability of the Works, and on completion of the work completely backfill and consolidate these excavations

**3.4 EXCAVATION**

- .1 Advise Engineer in advance of excavation operations to enable original cross-sections to be taken.
- .2 Excavate to lines, grades, elevations and dimensions indicated.
- .3 Cut pavement or sidewalk neatly in a line along limits of proposed excavation or as specified in order that surface may break evenly and cleanly. The width removed along the normal trench for the installation of the pipe shall not exceed the width of the trench specified by more than 500 mm on each side of the trench. The width and length of the area removed for the installation of gate valves,

- specials, manholes, or other structures shall not exceed the maximum linear dimensions of such structures by more than 500 mm on each side. Wherever, in the opinion of the Engineer, existing conditions make it necessary or advisable, remove additional pavement, as directed by the Engineer, and receive extra compensation provided such additional work is not shown in the drawings or specified. Removal or damage to pavement or surfaces beyond these limits, shall be replaced or repaired at the expense of the Contractor.
- .4 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation.
  - .5 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. Seal cuts with approved tree wound dressing.
  - .6 Unless otherwise authorized by Engineer 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.
  - .7 Dispose of waste material as indicated in Section 01 74 21: Construction/Demolition Waste Management and Disposal. The Engineer shall define waste material.
  - .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 Obtain Engineer approval of completed excavation.
  - .11 Remove unsuitable material from trench bottom to extent and depth directed by Engineer.
  - .12 Where required due to unauthorized over-excavation, correct as follows:
    - .1 Fill under bearing surfaces and footings with concrete specified for footings.
    - .2 Fill under other areas with approved fill compacted to minimum of 95% corrected maximum dry density, maximum dry density to ASTM D698-78, method D.
  - .13 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.
  - .14 No extra payment shall be made for measures ordered by the Engineer to correct problems caused by unauthorized over-excavation.
  - .15 No extra payment shall be made for construction methods required to keep the trench stable, free from disturbance, or dry, nor for crushed stone or other granular material used to facilitate drainage or dewatering during construction of the pipeline or for any extra excavation related thereto.
  - .16 The use of mechanical excavators will be permitted except where their use in the opinion of the Engineer, will cause damage to property or structures above or below ground which property or structures must be preserved in accordance with the contractor. The costs for hand excavation when the proximity of existing structures or other consideration render this necessary are deemed to be included in the Unit Price for trench excavation and backfill in the Unit Price Table.
  - .17 Keep all surface materials which, in the opinion of the Engineer, are suitable for re-use in restoring the surface separate from the general excavation material.
  - .18 Stockpile suitable material required for trench backfill in approved location.



### **3.5 TRENCH BOTTOM PREPARATION**

- .1 Draw the attention of the Engineer to the nature and condition of the excavated surfaces which are to receive the foundations of the works. If in the opinion of the Engineer, the foundation is unsuitable to receive the structure as shown on the Drawings, the Engineer will issue written instructions for extra excavation, special filling or other extra work required to secure a proper foundation.
- .2 Where required due to removal of unsuitable material and/or unauthorized over excavation, bring bottom of excavation to design grade with approved granular material or rock underbedding as directed by the Engineer.

### **3.6 PRE-INSTALLATION INSPECTION**

- .1 Excavations require inspection and approval prior to commencement of installation of pipe bedding and operations.

### **3.7 BACKFILLING**

- .1 Do not proceed with backfilling operations until Engineer has inspected and approved installations.
- .2 Areas to be backfilled and/or backfill material shall be free from debris, snow, ice, water or frozen ground. Do not use backfill material which is frozen or contains ice, snow or debris.
- .3 Backfill trenches to contours and elevations with unfrozen fill materials.
- .4 Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- .5 Bedding: Place and compact materials in equal continuous layers not exceeding 150 mm compacted depth.
- .6 Backfill Material: Place and compact material in equal continuous layers not exceeding 300 mm compacted depth.
- .7 Employ a placement method that does not disturb or damage foundation perimeter drainage, or utilities in trench.
- .8 Maintain optimum moisture content of fill materials to attain required compaction density.
- .9 Remove surplus fill materials from site.
- .10 Leave fill material stockpile areas completely free of excess fill materials.

### **3.8 TOLERANCES**

- .1 Top Surface of Backfilling Under Paved Areas and Landscaped Areas. Plus or minus 25 mm from required elevations.
- .2 Top Surface of General Backfilling: Plus or minus 25 mm from required elevations.

### **3.9 FIELD QUALITY CONTROL**

- .1 Section 01 45 00: Testing and Quality Control.

**3.10 PROTECTION OF FINISHED WORK**

- .1 Protect installed work.
- .2 Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- .3 Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- .4 Reshape and re-compact fills subjected to vehicular traffic during construction.

**END OF SECTION 31 23 18**

**Part 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Building perimeter site structure, and backfilling to subgrade elevations.
- .2 Site filling and backfilling.
- .3 Fill under slabs-on-grade.
- .4 Fill under paved and landscaped areas.
- .5 Fill for over-excavation.
- .6 Consolidation and compaction as scheduled.

**1.2 RELATED SECTIONS**

- .1 Section 01 43 00 - Quality Assurance.
- .2 Section 31 05 13 - Soil Materials.
- .3 Section 31 05 16 - Aggregate Materials.
- .4 Section 31 22 13 - Rough Grading.
- .5 Section 31 23 16 - Excavating.
- .6 Section 31 23 18 – Trenching.
- .7 Section 31 37 10 - Riprap.
- .8 Section 33 11 16 - Site Water Utility Distribution Piping.
- .9 Section 33 36 00 - Secondary Sewage Treatment Plant.
- .10 Section 03 30 00 - Cast-in-place Concrete.

**1.3 REFERENCES**

- .1 AASHTO T180-09 - Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
- .2 ASTM D698-07e1 - 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>)).
- .3 ASTM D1556-07 - Test Method for Density and Weight Unit of Soil in Place by the Sand-Cone Method.
- .4 ASTM D1557-09 - Test Methods 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>)).
- .5 ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

**1.4 SUBMITTALS FOR INFORMATION**

- .1 Section 01 33 00: Submittal procedures.
- .2 Inform Owner's Representative 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.
- .4 Ship samples as directed by Owner's Representative in tightly closed containers to prevent contamination.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Close Out Submittals.

**Part 2 PRODUCTS**

**2.1 MATERIALS**

- .1 Marking Tape:
  - .1 Heavy gauge polyethylene, 150 mm wide indicating the service buried.
- .2 Backfill Material: In accordance with Section 31 23 25 – Rock and Gravel Fill.

**Part 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- .3 Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.
- .4 Verify structural ability of unsupported walls to support imposed loads by the fill.

**3.2 PREPARATION**

- .1 Compact subgrade to density requirements for subsequent backfill materials.
- .2 Cut out soft areas of subgrade not capable of compaction in place. Backfill with backfill material and compact to density equal to or greater than requirements for subsequent fill material.
- .3 Scarify and proof roll subgrade surface to a depth of 200 mm to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

**3.3 BACKFILLING**

- .1 Backfill areas to contours and elevations with unfrozen materials.

- .2 Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- .3 Backfill Material: Place and compact materials in equal continuous layers not exceeding 200 mm compacted depth to 100% Standard Proctor Density.
- .4 Employ a placement method that does not disturb or damage other work.
- .5 Maintain optimum moisture content of backfill materials to attain required compaction density.
- .6 Backfill against supported foundation walls. Do not backfill against unsupported foundation walls.
- .7 Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- .8 Slope grade away from building minimum 2%, unless noted otherwise.
- .9 Make gradual grade changes. Blend slope into level areas.
- .10 Remove surplus backfill materials from site.
- .11 Leave fill material stockpile areas free of excess fill materials.

### **3.4 TOLERANCES**

- .1 Top Surface of Backfilling Under Paved Areas: Plus or minus 25 mm from required elevations.
- .2 Top Surface of General Backfilling: Plus or minus 25 mm from required elevations.

### **3.5 FIELD QUALITY CONTROL**

- .1 Section 01 45 00: Testing and Quality Control.
- .2 Compaction testing will be performed to ASTM D698.
- .3 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- .4 Proof roll compacted fill surfaces under slabs-on-grade and paving.

### **3.6 PROTECTION OF FINISHED WORK**

- .1 Protect installed work.
- .2 Reshape and re-compact fills subjected to vehicular traffic.

### **3.7 SCHEDULES**

- .1 Fill Under Grass Areas:
  - .1 Fill Type Topsoil, 150 mm below finish grade, compacted to 90% Standard Proctor Density.

- .2 Fill Under Landscaped Areas:
  - .1 Fill Type Topsoil, 150 mm below finish grade, compacted to 90% Standard Proctor Density.
- .3 Fill Under Asphalt and Concrete:
  - .1 Compact subsoil to 100% of its maximum dry density.
  - .2 Fill Type Backfill Material to 500 mm below finish paving elevation, compacted to 100% Standard Proctor Density.
- .4 Fill to Correct Over-excavation:
  - .1 Backfill Material flush to required elevation, compacted to 100% Standard Proctor Density

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1        Street pavement surface cleaning.
- .2        Sidewalk surface cleaning.

**1.2                RELATED SECTIONS**

- .1        Section 01 35 43 - Environment Procedures.
- .2        Section 32 12 16 - Asphalt Paving.
- .3        Section 32 17 23 - Pavement Marking.

**1.3                REGULATORY REQUIREMENTS**

- .1        Conform to applicable code for removed material disposal requirements.

**1.4                ENVIRONMENTAL REQUIREMENTS**

- .1        Section 01 35 43 - Environment Procedures.
- .2        Conform to all relative environment regulations for removed material disposal and waste material disposal.

**Part 2            Products**

**2.1                MATERIALS**

- .1        Surface Cleaning Agent:
  - .1        Suitable for abrasives, solvents or chemical agents used for removal of paint, oil, chewing gum, animal feces, rubber deposits and other common foreign substances.
  - .2        Proprietary products specially designed for pavement cleaning, subject to approval of Consultant.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1        Verify existing conditions before starting work.

**3.2                PREPARATION**

- .1        Areas to be Cleaned: Designated on drawings and/or by Consultant on site.

**3.3 PAVEMENT SURFACE CLEANING**

- .1 Remove joint or pavement repair sealing compound that has protruded above surface.
  - .1 Remove to existing pavement surface level in areas designated.
  - .2 Dispose of removed material as directed by law.
- .2 Remove by approved methods, the following substances from designated areas:
  - .1 Dust, surface dirt, and foreign matter.
  - .2 Paint and foreign contaminants.
  - .3 Loose or bonded foreign materials.
  - .4 Oil and grease.
  - .5 Chewing gum.
  - .6 Animal feces.
- .3 Use rotary brooms, supplemented by hand broom as required.
- .4 Keep surface drainage of liquids clear of loose and waste materials.

**END OF SECTION**



**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 31 22 13 – Rough Grading.
- .2 Section 31 23 10 – Excavating, Soil Removal and Backfilling.
- .3 Section 32 11 23 – Aggregate Base Course.
- .4 Section 32 12 16 – Asphalt Paving.

**1.2 REFERENCES**

- .1 ASTM International
  - .1 ASTM C117-[04], Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C131-[06], 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)], Standard Test Method for Particle-Size Analysis of Soils.
  - .5 ASTM D698-[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>).
  - .6 ASTM D1557-[09], Standard 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>).
  - .7 ASTM D1883-[07e2], Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
  - .8 ASTM D4318-[10], 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.

**1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Handling Requirements:
  - .1 Store materials in accordance with manufacturer's recommendations.
  - .2 Replace defective or damaged materials with new.
- .3 Develop Construction Waste Management Plan related to Work of this Section.

**Part 2 Products**

**2.1 MATERIALS**

.1 Granular base: material (Class "A") to following requirements:

.1 Gradation to be within following limits when tested to ASTM C136-84a and ASTM C117-87. The gradings shall not show marked fluctuations from opposite extremes of the limiting sizes, and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11-87.

<u>ASTM Sieve Designation</u>	<u>% Passing</u>
19.0 mm	100
9.51 mm	55 – 80
4.76 mm	35 – 60
1.20 mm	17 – 35
0.300 mm	7 – 20
0.075 mm	3 – 6 (Pit Source) 3 – 8 (Rock Source)

.2 Liquid Limited ASTM D423-66 (1972) Maximum 25

.3 Plasticity Index ASTM D424-59 (1971) Maximum 0

.4 Los Angeles Abrasion ASTM C131-81 Max. % loss by weight: 35

.5 Crushed Fragments: 50% The percent of crushed particles will be determined by examining the fraction retained on the 4.76 mm sieve and dividing the weight of the crushed particles by the total weight retained on the 4.76 mm sieve.

.6 CBR: A.ASHTO T193-72 Min 100 when compacted to 100% of AASHTO T180-74 Method D.

.2 Granular sub-base material (Class "B") to following requirements:

.1 Gradation to be within following limits when tested to ASTM C136-82 and ASTM C117-80. The gradings shall not show marked fluctuations from opposite extremes of the limiting sizes, having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11-87.

<u>ASTM Sieve Designation</u>	<u>% Passing</u>
50.8 mm	75 – 100
15.9 mm	45 – 80
4.76 mm	25 – 55
1.20 mm	12 – 35
0.300 mm	7 – 20
0.075 mm	3 – 6 (Pit Source) # - 8 (Rock Source)

.2 Other Properties as follows:

- .1 Liquid Limit ASTM D423-66 (1972) Maximum 25
- .2 Plasticity Index ASTM D424-59 (1971) Maximum 0
- .3 Los Angeles Abrasion ASTM C131-81 Max % Loss by Weight 35.
- .4 Crushed fragments: 50% The percent of crushed particles will be determined by examining the fraction retained on the 4.76 mm sieve and dividing the weight of the crushed particles by the total weight retained on the 4.76 mm sieve.
- .5 CBR: AASHTO T193-72 Minimum 100 when compacted to 100% of AASHTO T180-74 Method D

### **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 Engineer 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 Consultant.

#### **3.2 PREPARATION**

- .1 Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- .2 Do not place fill on soft, muddy, or frozen surfaces.

#### **3.3 PLACING**

- .1 Place granular sub-base after subgrade is inspected and approved by Consultant.
- .2 Construct granular sub-base to depth and grade in areas indicated.
- .3 Ensure no frozen material is placed.
- .4 Place material only on clean unfrozen surface, free from snow or ice.
- .5 Begin spreading sub-base material on crown line or high side of one-way slope.
- .6 Place granular sub-base materials using methods which do not lead to segregation or degradation.
- .7 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.
- .8 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.
  - .1 Consultant may authorize thicker lifts if specified compaction can be achieved.
- .9 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .10 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 Efficiency of equipment not specified to be proved at least as efficient as specified equipment at no extra cost and written approval must be received from Consultant before use.
- .3 Equipped with device that records hours of actual work, not motor running hours.
- .4 Compact to density of not less than 98% maximum dry density in accordance with ASTM D698 .
- .5 Shape and roll alternately to obtain smooth, even and uniformly compacted sub-base.
- .6 Apply water as necessary during compaction to obtain specified density.
- .7 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Departmental Representative.
- .8 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

### 3.5 PROOF ROLLING

- .1 For proof rolling use standard roller of 45,400 kg gross mass with four pneumatic tires each carrying 11,350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm maximum.
- .2 Obtain written approval from Engineer 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, Engineer 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 Consultant.
  - .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 and replace in accordance with this section at no extra cost.

### 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 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

**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                SECTION INCLUDES**

- .1    Aggregate base course.

**1.2                RELATED SECTIONS**

- .1    Section 31 05 16 - Aggregate Materials.
- .2    Section 31 22 13 - Rough Grading.
- .3    Section 31 22 19 - Finish Grading.
- .4    Section 31 23 10 – Excavating, Soil Removal and Backfilling
- .5    Section 31 22 19 - Finish Grading.
- .6    Section 31 37 10 - Riprap.
- .7    Section 32 12 16 - Asphalt Paving.
- .8    Section 33 05 13 - Manholes and Catch Basin Structures.

**1.3                REFERENCES**

- .1    AASHTO T180-09 - Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
- .2    ASTM D698-07e1 - Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/cu ft (600 kN-m/cu m)).
- .3    ASTM D1556-07 - Test Method for Density and Weight Unit of Soil in Place by the Sand-Cone Method.
- .4    ASTM D1557-09 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2,700 kN-m/cu m)).
- .5    ASTM D2167-08 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

**1.4                SUBMITTALS FOR INFORMATION**

- .1    Section 01 33 00 - Submittal procedures.
- .2    Provide Engineer with access to source and processed material for sampling and testing.

**1.5                CLOSEOUT SUBMITTALS**

- .1    Section 01 78 00 - Close Out Submittals.

**Part 2 Products**

**2.1 MATERIALS**

.1 Granular base: material (Class 'A') to following requirements:

.1 Gradation to be within following limits when tested to ASTM C136-84a and ASTM C117-87. The gradings shall not show marked fluctuations from opposite extremes of the limiting sizes, and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11-87.

<u>ASTM Sieve Designation</u>	<u>% Passing</u>
19.0 mm	100
9.51 mm	55 – 80
4.76 mm	35 – 60
1.20 mm	17 – 35
0.300 mm	7 – 20
0.075 mm	3 – 6 (Pit Source) 3 – 8 (Rock Source)

.2 Liquid Limited ASTM D423-66 (1972) Maximum 25

.3 Plasticity Index ASTM D424-59 (1971) Maximum 0

.4 Los Angeles Abrasion ASTM C131-81 Max. % loss by weight: 35

.5 Crushed Fragments: 50% The percent of crushed particles will be determined by examining the fraction retained on the 4.76 mm sieve and dividing the weight of the crushed particles by the total weight retained on the 4.76 mm sieve.

.6 CBR: A.ASHTO T193-72 Min 100 when compacted to 100% of AASHTO T180-74 Method D.

.2 Granular sub-base material (Class "B") to following requirements:

.1 Gradation to be within following limits when tested to ASTM C136-82 and ASTM C117-80. The gradings shall not show marked fluctuations from opposite extremes of the limiting sizes, having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11-87.

<u>ASTM Sieve Designation</u>	<u>% Passing</u>
50.8 mm	75 – 100
15.9 mm	45 – 80
4.76 mm	25 – 55
1.20 mm	12 – 35
0.300 mm	7 – 20
0.075 mm	3 – 6 (Pit Source) # - 8 (Rock Source)

.2 Other Properties as follows:

- .1 Liquid Limit ASTM D423-66 (1972) Maximum 25
- .2 Plasticity Index ASTM D424-59 (1971) Maximum 0
- .3 Los Angeles Abrasion ASTM C131-81 Max % Loss by Weight 35.
- .4 Crushed fragments: 50% The percent of crushed particles will be determined by examining the fraction retained on the 4.76 mm sieve and dividing the weight of the crushed particles by the total weight retained on the 4.76 mm sieve.
- .5 CBR: AASHTO T193-72 Minimum 100 when compacted to 100% of AASHTO T180-74 Method D.

### **Part 3 Execution**

#### **3.1 EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify substrate has been inspected, gradients and elevations are correct, and is dry.

#### **3.2 PREPARATION**

- .1 Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- .2 Do not place fill on soft, muddy, or frozen surfaces.

#### **3.3 INSPECTION OF UNDERLYING SUB-BASE OR SUB-GRADE**

- .1 The Contractor shall prepare the road surface in accordance with Section 31 22 13 to the satisfaction of the Engineer before commencing placement of any selected granular base course materials.

#### **3.4 TOLERANCES**

- .1 The Contractor shall place all granular bases in such a manner as to prevent contamination by other materials and to prevent segregation. If in the opinion of the Departmental Representative, the methods and techniques used by the Contractor cannot overcome contamination or segregation, then the Engineer may direct a modification in these methods which may require the use of an approved spreader box or other acceptable device.

#### **3.5 FIELD QUALITY CONTROL**

- .1 Section 01 45 00 – Testing and Quality Control.
- .2 Compaction testing will be performed to ASTM D698.
- .3 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

**END OF SECTION**



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Stand Alone Septic System  
Stephenville Base  
Stephenville, NL

SECTION 32 11 23  
AGGREGATE BASE COURSE  
PAGE 4 OF 4  
Issued for Tender: 24 September 2015

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**Part 1 General**

**1.1 RELATED REQUIREMENTS**

- .1 Section 32 12 16 - Asphalt Paving.

**1.2 REFERENCES**

- .1 American Association of State Highway and Transportation Officials (AASHTO)
  - .1 AASHTO M081-92-UL-[04], Standard Specification for Cutback Asphalt (Rapid-Curing Type).
- .2 ASTM International
  - .1 ASTM D140/D140M-[09], Standard Practice for Sampling Bituminous Materials.
  - .2 ASTM D633-[11], Standard Volume Correction Table for Road Tar.
  - .3 ASTM D1250-[08], Standard Guide for Use of the Petroleum Measurement Tables.
- .3 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-16.2-[M89], Emulsified Asphalts, Anionic Type, for Road Purposes.

**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 tack coat and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Samples:
  - .1 Submit two - 4 L samples of asphalt tack coat material proposed for use in new, clean, airtight, sealed, wide mouth jars to Engineer , at least 2 weeks prior to beginning Work.
  - .2 Sample asphalt tack coat material to: ASTM D140.
  - .3 Provide access on tank truck for Engineer to sample asphalt material to be incorporated into Work to ASTM D140.

**1.4 QUALITY ASSURANCE**

- .1 Upon request from Departmental Representative, submit manufacturer's test data and certification that asphalt prime material meets requirements of this Section.

**1.5 DELIVERY, STORAGE AND HANDLING**

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

- .1 Store materials off ground and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
- .2 Store and protect asphalt tack coats from nicks, scratches, and blemishes.
- .3 Replace defective or damaged materials with new.
- .4 Deliver, store and handle materials in accordance with ASTM D140.
- .5 Provide, maintain and restore asphalt storage area.
- .6 Develop Construction Waste Management Plan related to Work of this Section.

## 1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management And Disposal, and with the Waste Reduction Workplan.

## Part 2 Products

### 2.1 MATERIALS

- .1 The Contractor has the option of using type RC-70 cut back asphalt, a solution of type RS-1k emulsified asphalt or a solution of type SS-1h emulsified asphalt, as the tack coat material, or other materials approved by the Engineer. The Engineer shall be notified in advance as to which type the Contractor intends to use and the tack coat shall meet the following standards:
  - .1 Type RC-70 cut back asphalt shall conform to ASTM D2028-76.
  - .2 Type RS-1k emulsified asphalt shall confirm to ASTM D977-85.
  - .3 Type SS-1h emulsified asphalt shall conform to ASTM D977-86. Water for forming the solution with the SS-1h shall be clean water free from impurities.

### 2.2 EQUIPMENT

- .1 Equipment required for Work of this Section to be in satisfactory working condition and maintained for duration of Work.
- .2 Pressure distributor:
  - .1 Designed, equipped, maintained and operated so that asphalt material can be:
    - .1 Maintained at even temperature.
    - .2 Applied uniformly on variable widths of surface up to 5 m.
    - .3 Applied at readily determined and controlled rates from 0.2 to 5.4 L/m<sup>2</sup> with uniform pressure, and with allowable variation from any specified rate not exceeding 0.1 L/m<sup>2</sup>.
    - .4 Distribute in uniform spray without atomization at temperature required.
  - .2 Equipped with meter, registering travel in metres per minute, visibly located to enable truck driver to maintain constant speed required for application at specified rate.
  - .3 Equipped with pump having flow meter graduated in units of 5 L or less per minute passing through nozzles and readily visible to operator. Pump power unit to be independent of truck power unit.

- .4 Equipped with easily read, accurate and sensitive device which registers temperature of liquid in reservoir.
  - .1 Measure temperature to closest whole number.
- .5 Equipped with accurate volume measuring device or calibrated tank.
- .6 Equipped with nozzles of same make and dimensions, adjustable for fan width and orientation.
- .7 Equipped with nozzle spray bar, with operational height adjustment in increments of 0.6 metres and capable of being raised or lowered.
- .8 Cleaned if previously used with incompatible asphalt material.

### 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 tack coat installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Engineer 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 APPLICATION

- .1 Apply asphalt tack coat only on clean and dry surface.
- .2 Dilute asphalt emulsion with water at 1:1 ratio for application.
  - .1 Mix thoroughly by pumping or other method approved by Departmental Representative.
- .3 Apply asphalt tack coat evenly to pavement surface at rate as directed by Engineer but not to exceed 0.7 L/m<sup>2</sup>.
- .4 Paint contact surfaces of curbs, gutters, headers, manholes and like structures with thin, uniform coat of asphalt tack coat material.
- .5 Apply asphalt tack coat only when air temperature greater than 10 degrees C and when rain is not forecast within 2 hours minimum of application.
- .6 Apply asphalt tack coat only on unfrozen surface.
- .7 Evenly distribute localized excessive deposits of tack coat by brooming as directed by Departmental Representative.
- .8 Where traffic is to be maintained, treat no more than one half of width of surface in one application.
  - .1 Control traffic in accordance with Section 01 35 00.06 - Special procedures for Traffic control.
- .9 Keep traffic off tacked areas until asphalt tack coat has set.
- .10 Re-tack contaminated or disturbed areas as directed by Departmental Representative.

- .11 Permit asphalt tack coat to set before placing asphalt pavement.
- .12 Submit summary report within 7 days minimum of date of application and include information as follows:
  - .1 Total area tack coated.
  - .2 Quantity of tack coat used.
  - .3 Mean application rate.
  - .4 Actual product quantity used when using equipment on pressure distributors.
  - .5 Dipstick measurements or electronic printouts are acceptable.
- .13 Carry out measurements in presence of Engineer upon request.
- .14 Inspect tack coat application to ensure uniformity.
  - .1 Re-spray areas of insufficient or non-uniform tack coat coverage as directed by Departmental Representative.
  - .2 Ensure tack coating performed using hand held devices is consistent in appearance with adjacent areas of machine applied material.

### 3.3 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 Waste Management: separate waste materials for reuse in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

END OF SECTION

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Asphaltic concrete paving, wearing binder or base course.
- .2            Surface sealer.
- .3            Aggregate base course.

**1.2                RELATED SECTIONS**

- .1            Section 32 17 23 – Pavement Markings.
- .2            Section 31 22 13 - Rough Grading.
- .3            Section 31 23 10 – Excavating, Soil Removal and Backfilling
- .4            Section 32 11 23 - Aggregate Base Course
- .5            Section 32 16 15 - Concrete Walks, Curbs, and Gutters
- .6            Section 33 05 13 - Manholes and Catch Basin Structures

**1.3                REFERENCES**

- .1            ASTM D946/D946M-09a - Penetration-Graded Asphalt Cement for Use in Pavement Construction
- .2            AI (Asphalt Institute) - MS-2 - Mix Design Methods for Asphalt (6th Edition).
- .3            AI (Asphalt Institute) - MS-4-2007 – The Asphalt Handbook.
- .4            AI (Asphalt Institute) - MS-19 - Basic Asphalt Emulsion Manual (2nd Edition).
- .5            AI (Asphalt Institute) - MS-22 - Construction of Hot Mix Asphalt Pavements (2nd Edition).

**1.4                SUBMITTALS FOR INFORMATION**

- .1            Section 01 33 00: Submittal procedures.
- .2            Submit asphalt concrete mix design to Engineer for approval.
- .3            Materials to be tested by testing laboratory approved by Departmental Representative.
- .4            Submit test certificates showing suitability of materials at least 4 weeks prior to commencing work.
- .5            Inform Engineer of proposed source of aggregates and provide access for sampling at least 4 weeks prior to commencing work.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Section 01 78 00: Close Out Submittals.

**1.6 QUALITY ASSURANCE**

- .1 Perform Work to Government of Newfoundland & Labrador Municipal Water, Sewer and Road Master Construction Specifications.
- .2 Mixing Plant: Conform to AI MS-4 Manual and Government of Newfoundland & Labrador Municipal Water, Sewer and Roads Master Construction Specifications.
- .3 Obtain materials from same source throughout.

**1.7 REGULATORY REQUIREMENTS**

- .1 Conform to applicable code for paving work on public and private property.

**1.8 ENVIRONMENTAL REQUIREMENTS**

- .1 Section 01 35 43: Environmental Procedures.
- .2 Do not place asphalt when ambient air or base surface temperature is less than 4 degrees C, or surface is wet or frozen.
- .3 Place bitumen mixture when temperature is not more than 8 C degrees below bitumen suppliers bill of lading and not more than maximum specified temperature.

**Part 2 Products**

**2.1 ASPHALT CEMENT**

- .1 Unless otherwise specified, asphalt cement shall conform to the requirements of the Canadian Standards Board Specification Can/CGSB-16.3 M 89 entitled "Asphalt Cement For Road Purposes". The penetration grade of the asphalt cement shall be 150/200, Group B. Asphalt cement conforming to the current version of the Provincial Department of Transportation & Works Specifications Book Section 330 is also acceptable.
- .2 The Contractor shall obtain from the manufacturer and furnish to the Engineer/Architect, in tabular or graphic form, the temperature – viscosity relationship of the asphalt cement to be used.
- .3 The Contractor shall supply the asphalt cement.

**2.2 COARSE AGGREGATES**

- .1 Coarse Aggregates shall consist of hard, durable crushed stone particles of crushed gravel particles reasonably uniform in quality throughout and free from soft or disintegrated pieces. The portion of the material retained on the 4.76 mm sieve shall be known as coarse aggregate.
- .2 Gravel shall be washed if necessary to have clean surface free from coatings of foreign matter.

- .3 Coarse Aggregates shall conform to the physical requirements shown in Table 1.

TABLE 1: Physical Requirements for Coarse Aggregates

Los Angeles Abrasion* (Loss % Maximum)	ASTM C131-81	35
Absorption (% Maximum)	ASTM C127-84	2
Bulk Specific Gravity (Minimum)	ASTM C127-84	2.20
Soundness-Magnesium Sulphate – (5 cycle Max)	ASTM C88-83	15
Crushed Particles (% Minimum)		70
Flat and Elongated** Pieces (% Maximum)		10
Loss by Washing (% Maximum Passing 0.075 mm sieve)	ASTM C117-87	2

\*Material with an abrasion ratio higher than 0.265, for 100-500 revolutions shall not be used without the written permission of the Departmental Representative.

\*\*Flat and elongated pieces are those whose greatest dimension exceeds four times their least dimension.

- .4 In addition to the requirements of Table 1, coarse aggregate proposed for use in surface course pavement will not be acceptable if more than 1% of the particles (expressed as a percentage of the weight of material retained on the 4.75 sieve), absorbs more than 5% by weight of water.
- .5 The aggregates shall be of such nature that a thorough coating of asphalt cement will not strip off upon contact with water as determined by the Standard Method of Test for Coating and Stripping of Bitumen-Aggregate Mixtures (ASTM D1664-85).
- .6 Irrespective of compliance with the physical requirements of Table 1, any aggregate may be accepted or rejected on the basis of past field performance.
- .7 Coarse aggregate shall be supplied by the Contractor.

## 2.3 FINE AGGREGATES

- .1 Fine aggregate shall consist of clean, tough, rough-surfaced grains, free from clay, loam and other foreign matter. As delivered to the mixer it shall be free from clayey lumps or loosely bonded aggregations, and the individual particles shall be free from adhering dust. The portion of the material passing the 4.75 mm sieve shall be known as fine aggregate.
- .2 The aggregate shall be of such nature that a thorough coating of asphalt cement will not strip off upon contact with water as determined by the Standard Method of Test for Coating and Stripping of Bitumen-Aggregate Mixtures (ASTM D 1664-85).
- .3 The physical requires in Table 1 for Coarse Aggregates shall also apply to fine aggregates for abrasion, absorption, bulk specific gravity and soundness.
- .4 Any aggregate may be accepted or rejected on the basis of past field performance.



- .5 Fine aggregates shall be supplied by the Contractor.

**2.4 BLENDING SAND**

- .1 Blending sand shall consist of clean, tough, rough surfaced grains, free from clay, loam, or any foreign matter.
- .2 The gradation of the blending sand shall be such that when used in the asphalt mix, the resulting mix shall meet the requirements of Tables 2 and 3 of this section. In any case, the blending sand shall have 100% (by dry weight) passing the 12.5 mm sieve and at least 50% (by dry weight) passing the 4.25 mm sieve. Blending sand shall be supplied by the Contractor.

**2.5 MINERAL FILLER**

- .1 Where sufficient material passing the 0.075 mm sieve is not available in the aggregate the Contractor shall supply mineral filler approved by the Engineer at no extra cost.
- .2 Mineral filler shall consist of thoroughly dry stone dust, Portland cement, or other artificially or naturally powdered material dust, 65% to 100% of which will pass a 0.075 mm sieve.

**2.6 COMPOSITION OF MIXTURE**

- .1 The mixture shall consist of uniformly graded fine and coarse aggregate and thoroughly mixed with asphalt cement as specified. Blending sand, mineral filler and chemical additives shall be added when required.
- .2 Unless otherwise specified, the aggregates shall be combined in such proportions as to produce a mixture conforming to the grading and asphalt content requirements of Table 2.

TABLE 2: Asphalt Aggregate Mixtures

Sieve Size	Percent Passing by Dry Weight		
	Base Course	Surface Course	Leveling Course
19.0 mm	100	100	100
12.5 mm	80-100	97-100	100
4.76 mm	35-75	55-75	55-75
2.00 mm	20-60	35-55	35-55
0.425 mm	10-35	18-30	18-30
0.075 mm	0-8	0-8	0-8
Asphalt Content (% by weight of total mixture)	5.0-7.0	5.5-7.5	5.5-7.5

- .3 Once an acceptable aggregate gradation is achieved in the crushing operation, the tolerances for subsequent production are as follows:

Tolerance for Production of Asphalt Aggregate

- Aggregate Passing 4.76 sieve 5%
- Aggregate Passing 2.00 mm sieve & 4.25 mm sieve 4%
- Aggregate Passing 0.075 mm sieve 2%
- .4 Aggregate gradation and asphalt cement content of the mixture shall be as specified in the approved mix design. Asphalt cement contents varying from that specified in the mix design by more than 0.25% shall be unacceptable.
- .5 Asphaltic Levelling Course shall consist of asphaltic surface course asphaltic concrete, except on those projects where there is not item for Asphaltic Surface Course, in which case Asphaltic Base Course may be used instead.

**2.7 PHYSICAL REQUIREMENTS FOR MIXTURE**

- .1 The aggregates and the asphalt cement shall be mixed in such proportion as to satisfy the criteria contained in Table 3. These criteria are based on the Standard Marshall Test Procedures and using a compactive effort of 75 blows on each face of the specimen, or other compactive effort found necessary during the mix design.

TABLE 3:Physical Requirements  
Base and Surface Course Paving Mixtures

	Min.	Max.
Marshall Stability kg. at 60°C	550	-
Marshall Flow Index units of 0.25 mm	10	17
% Air Voids	3	5
% Voids in Compacted Mineral Aggregate	15	-

**2.8 EQUIPMENT**

- .1 Pavers: mechanical grade controlled self-powered pavers capable of spreading mix within specified tolerances, true to line, grade and crown indicated.
- .2 Rollers: sufficient number of rollers of type and weight to obtain specified density of compacted mix.
- .3 Vibratory rollers for parking lots and driveway:
  - .1 Minimum drum diameter: 750mm.
  - .2 Maximum amplitude of vibration (machine setting): 0.5mm for lifts less than 40mm thick.
- .4 Haul trucks: of sufficient number and of adequate size, speed and condition to ensure orderly and continuous operation and as follows:
  - .1 Boxes with tight metal bottoms.
  - .2 Covers of sufficient size and weight to completely cover and protect asphalt mix when truck fully loaded.

- .3 In cool weather or for long hauls, insulate entire contact area of each truck box.
  - .5 Suitable hand tools
- 2.9 SOURCE QUALITY CONTROL AND TESTS**
- .1 Section 01 45 00 – Testing and Quality Control.
  - .2 Submit proposed mix design of each class of mix for review prior to beginning of work.
- Part 3 Execution**
- 3.1 EXAMINATION**
- .1 Verify existing conditions before starting work.
- 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 approval of subgrade by Engineer before placing granular base.
- 3.3 GRANULAR BASE AND GRANULAR SUBBASE**
- .1 Place granular base and sub-base material on clean unfrozen surface, free from snow and ice.
  - .2 Place granular base and sub-base to compacted thicknesses as indicated. Do not place frozen material.
  - .3 Place in layers not exceeding 150 mm compacted thickness. Compact to density not less than 98 % maximum dry density in accordance with ASTM D698.
  - .4 Finished base surface to be within 10 mm of specified grade, but not uniformly high or low
- 3.4 ASPHALT- PRIMER**
- .1 Emulsified asphalt:
    - .1 Dilute asphalt emulsion with clean water at 1:1 ratio for application. Mix thoroughly by pumping or other method approved by Departmental Representative.
    - .2 Apply diluted asphalt emulsion at rate directed by Engineer but do not exceed 5 L/m<sup>2</sup>.
    - .3 Apply on damp surface unless otherwise directed by Departmental Representative.
  - .2 Do not apply prime when air temperature is less than 5°C or when rain is forecast within 2 hours.
  - .3 If asphalt prime fails to set within 24 hours, spread sand blotter material in amounts required to absorb excess material. Sweep and remove excess blotter material.

### 3.5 PREPARATION - TACK COAT

- .1 Obtain Departmental Representative's approval of existing surface before applying asphalt tack coat. Clean surface as required.
- .2 Tack coat shall only be placed on surfaces that are clean and dry and then only when the atmospheric temperature is at least 10°C.
- .3 Should the surface to be treated be dirty, then the Contractor shall thoroughly clean the surface by means of a power broom, or equivalent.
- .4 Tack Coat shall be placed on surfaces that have been approved by the Departmental Representative.
- .5 The Contractor shall plan his work so that no more tack coat than is necessary for the days paving operation is applied at one time.
- .6 To avoid nuisance and possible property damage to the travelling public, the Contractor shall install portable traffic lights or other means of directing one-way traffic while working on the adjacent part of the road.
- .7 The type RC-70 tack coat shall be applied at a temperature between 38°C and 80°C and at a rate of 0.25 L/m<sup>2</sup> on old pavement. Care must be exercised not to exceed the recommended application rate. However, on pavement which was placed during the previous construction season the rate of application shall be as directed by the Departmental Representative. The rate will not exceed the rate for old pavement.
- .8 The type RS-1k tack coat shall be applied at a temperature between 38°C and 80°C and at a rate of 0.15 L/m<sup>2</sup> on old pavement. Care must be exercised not to exceed the recommended application rate. However, on pavement which was placed during the previous construction season the rate of application shall be as directed by the Departmental Representative. The rate will not exceed the rate for old pavement.

The type SS-1h emulsion shall be diluted with an equal volume of water prior to the application. The diluted SS-1h emulsion shall be applied at a rate of 0.5 L/m<sup>2</sup> of diluted emulsion on old pavement. Both the mixing temperature and the application temperature shall be between 20°C and 50°C. Care must be exercised not to exceed the recommended application rate. However, on pavement which was placed during the previous construction season the rate of application shall be as directed by the Departmental Representative. The rate will not exceed the rate for old pavement.

### 3.6 PLACING ASPHALT COURSES

- .1 The base on which paving is to take place shall be cleaned of all loose or foreign material before paving may take place.
- .2 The asphaltic mixture shall be laid only upon a base which is dry or at least free from standing water, and when weather conditions are suitable. No paving shall take place during rain.

- .3 No course shall be placed upon a previously laid course less than 12 hours after final compaction of the latter, except with the permission of the Engineer in circumstances where in his opinion this requirement would be impractical.
- .4 No hot mix shall be placed unless the air temperature at the surface of the road is 7°C or above without the written permission of the Departmental Representative.
- .5 The temperature of the mixture immediately after spreading and prior to initial rolling shall not be less than 125°C.
- .6 The width of succeeding courses shall be adjusted by an offset of width of from 150 mm to 300 mm so that longitudinal joints do not coincide.
- .7 The longitudinal joints in the surface course shall correspond to the demarcation between driving lanes, speed change lanes, tapers, etc. indicated in the contract or as directed by the Departmental Representative.
- .8 Immediately after any course is laid and before roller compaction is started the surface and edges shall be checked and any irregularities adjusted by the addition or removal of mixture.
- .9 All pavers which are equipped with a tampering device or other mechanical apparatus designed to aid compaction of the mixture shall have such devices operating continuously when the mixture is being placed unless otherwise directed. Where screed extensions are used, such extensions shall be designed so that the tamping or vibratory action of the screed is effectively transferred to the extensions in such manner as to provide a uniform degree of initial compaction across the full width of the freshly laid mat.
- .10 To ensure continuous operation of the pavers they shall operate at whatever speed necessary to match the output of the plant provided that a consistent and satisfactory mat is being laid. However, in no case shall the speed of the paver exceed 0.7 km/h.
- .11 When two or more pavers are in echelon, pavers following the lead paver shall use the joint shoes, designed for the purpose, which shall ride on the previously placed undisturbed mat. Pavers are considered to be paving in echelon when the lead paver is not more than 60 m in advance of an adjacent succeeding paver.
- .12 Mixtures may be spread by hand only in places inaccessible to the paver. Hand placing shall be from a steel dump board by means of hot shovels. Hand spreading shall be with rakes of suitable design. The mixture shall be spread to the depth required to give the compacted design thickness after rolling.
- .13 No loads of mixtures shall leave the plant so late in the day as to preclude the spreading and compacting of the mixture during daylight.
- .14 End of Paving Season for Asphaltic Concrete:
  - .1 The season for laying asphaltic base course shall end on the 15<sup>th</sup> of November each year, unless extended by the Departmental Representative.
  - .2 The season for laying asphaltic surface course shall end on the 15<sup>th</sup> of October, unless extended by the Departmental Representative.

.15 Joints:

- .1 All joints shall be made in such a manner as to ensure a thorough and continuous bond and to provide a smooth riding surface.
- .2 All foreign material and all loose material, shall be removed from all faces against which joints are to be made. All cold faces against which joints are to be made shall be cut back to full depth to expose a fresh vertical face, and painted with a continuous thin coating of hot asphalt cement.
- .3 Longitudinal joints shall be rolled immediately upon placement of the fresh mixture and before the adjacent strip has completely cooled. The joint shall be set-up with the back of a rake or lute at proper height and grade to receive the required compression under rolling.
- .4 The depth of the newly laid mat shall be adjusted to allow for compaction.
- .5 The paver shall overlap the existing mat by at least 50 mm.
- .6 On surface courses the method of making joints shall be such that the excess material is not scattered on the surface of the freshly laid mat. Such excess material shall be carefully removed and disposed of as directed.
- .7 Transverse joint shall be checked with a straight edge immediately after initial rolling. Any irregularity in the pavement surface at the joint shall immediately be corrected by the addition of or removal of mixture. When possible, the transverse joints shall be initially rolled in a direction perpendicular to the direction of paving.

.16 General Requirements for Compaction:

- .1 The mixture shall be compacted to a density of 97% of the density of the laboratory compacted mixture based on the criteria given in Section 02552.2.4 Physical Requirements for Mixture.
- .2 It is an express condition of this specification that all mixtures be compacted to the specified density immediately following placement, If, during the course of the paving operation, measured insitu densities fall below the specified minimum, the Contractor shall revise his operation by slowing the rate of progress of the pavers, by using additional rollers or by any other means necessary to achieve the specified degree of compaction.
- .3 Rollers should normally operate with the drive wheel forward in the direction of paving. In all cases, the production and placing of mixture shall be controlled so that all rolling shall be completed before sunset.

**3.7 SEAL COAT**

- .1 Apply seal coat to surface course to AI MS-19.

**3.8 TOLERANCES**

- .1 Section 01 73 00: Tolerances.
- .2 Flatness: Maximum variation of 10 mm measured with 3 m straight edge.
- .3 Scheduled Compacted Thickness: Within 10 mm
- .4 Variation from True Elevation: Within 10 mm

**3.9 FIELD QUALITY CONTROL**

- .1 Section 01 45 00: Testing and Quality Control.

**3.10 PROTECTION OF FINISHED WORK**

- .1 Immediately after placement, protect pavement from mechanical injury for one (1) day or until surface temperature is less than 38 degrees C.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Asphaltic concrete pavement sealing.

**1.2                RELATED SECTIONS**

- .1            Section 33 05 13 - Manholes and Catch Basin Structures: Manholes and Catchbasins including frames.

**1.3                REFERENCES**

- .1            AI (Asphalt Institute) MS-19 - Basic Asphalt Emulsion Manual.

**1.4                SUBMITTALS FOR INFORMATION**

- .1            Section 01 33 00: Submittal procedures.

**1.5                CLOSEOUT SUBMITTALS**

- .1            Section 01 78 00: Close Out Submittals.

**1.6                QUALITY ASSURANCE**

- .1            Perform Work to Government of Newfoundland & Labrador Municipal Water, Sewer and Roads Master Construction Specifications.

**1.7                ENVIRONMENTAL REQUIREMENTS**

- .1            Section 01 35 43: Environmental Procedures.
- .2            Do not place asphalt seal coat when ambient air or base surface temperature is less than 4 degrees C, or surface is wet or frozen.

**Part 2            Products**

**2.1                MATERIALS**

- .1            Fine Aggregate: As specified in Section 31 05 16 – Aggregate Materials.
- .2            Seal Coat: AI MS-19fog type.

**Part 3            Execution**

**3.1                EXAMINATION**

- .1            Verify existing base conditions before starting work.



- .2 Verify that compacted asphalt pavement is ready to receive seal coat.

**3.2 SEAL COAT**

- .1 Apply seal coat to surface course in accordance with Government of Newfoundland & Labrador Municipal Water, Sewer and Roads Master Construction Specifications.

**3.3 PROTECTION OF FINISHED WORK**

- .1 Protect installed work.
- .2 Immediately after placement, protect sealed pavement from mechanical injury for one (1) day or until surface temperature is less than 38 degrees.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame covers, anchorage, and accessories.

**1.2                RELATED SECTIONS**

- .1            Section 03 30 00 - Cast-in-place Concrete.
- .2            Section 22 42 01 - Plumbing Specialties: Connection accessories.
- .3            Section 31 23 10 – Excavating, Soil Removal and Backfilling.

**1.3                REFERENCES**

- .1            ASTM A48/A48M-03(2008) - Gray Iron Castings.
- .2            ASTM C55-09 - Concrete Brick.
- .3            ASTM C62-08 - Building Brick (Solid Masonry Units Made From Clay or Shale).
- .4            ASTM C478-09 - Precast Reinforced Concrete Manhole Sections.
- .5            ASTM C923M-08 - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals, ASTM C923-08b - Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
- .6            ASTM D3753-05e1 - Glass-Fibre-Reinforced Polyester Manholes and Wetwells.
- .7            IMIAC (International Masonry Industry All-Weather Council) - Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

**1.4                SUBMITTALS FOR REVIEW**

- .1            Section 01 33 00: Submittal Procedures.
- .2            Shop Drawings: Indicate manhole locations, elevations, manhole diameter, pipe sizes, direction of flow and invert elevations. Product Data: Provide manhole covers, component construction, features, configuration, dimensions.

**1.5                SUBMITTALS FOR INFORMATION**

- .1            Section 01 33 00 - Submittal Procedures.

**1.6                CLOSEOUT SUBMITTALS**

- .1            Section 01 78 00 - Close Out Submittals.

**1.7 QUALITY ASSURANCE**

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.

**1.8 ENVIRONMENTAL REQUIREMENTS**

- .1 Section 01 35 43: Environmental Procedures.
- .2 Maintain materials and surrounding air temperature to minimum 10 degrees C prior to, during, and forty-eight (48) hours after completion of masonry work.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Cast-in-place concrete: to Section 03 30 00 - Cast-in-Place Concrete.
- .2 Concrete reinforcement: to Section 03 20 00 - Concrete Reinforcement.
- .3 Precast manhole units: to ASTM C478M, circular or oval. Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
- .4 Precast catch basin sections: to ASTM C478M.
- .5 Joints: to be made watertight using rubber rings.
- .6 Mortar:
  - .1 Aggregate: to CSA A82.56.
  - .2 Cement: to CAN/CSA-A8.
- .7 Non-shrink grout to Section 03 30 00.
- .8 Frames, gratings, covers to dimensions as indicated and following requirements:
  - .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
  - .2 Gray iron castings: to ASTM A48/A48M, strength class 30B.
  - .3 Castings: coated with two applications of asphalt varnish or cleaned and ground to eliminate surface imperfections.
  - .4 Manhole frames and covers: heavy duty municipal type for road service; Cover cast without perforations and complete with two 25 mm square lifting holes.
- .9 Backfill Material: in accordance with Section 31 23 10 – Excavating, Soil Removal and Backfilling and following requirements:
  - .1 Concrete mixes and materials: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

## 2.2 COMPONENTS

- .1 Ladder rungs: to CAN/CSA-G30.18, No.25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164. Rungs to be safety pattern (drop step type).
- .2 Adjusting rings: to ASTM C478M.
- .3 Concrete Brick: to CAN3-A165 Series.
- .4 Drop manhole pipe: to be same as sewer pipe.
- .5 Steel gratings, I-beams and fasteners: as indicated.
- .6 Safety landings: shall be placed in all manholes having a depth greater than 5 metres as measured from the top of cover to the invert of outlet pipe. They shall be constructed and located as specified by the Departmental Representative.

## 2.3 CONFIGURATION

- .1 As detailed on construction drawings.

## Part 3 Execution

### 3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify items provided by other sections of Work are properly sized and located.
- .3 Verify that built-in items are in proper location, and ready for roughing into Work.
- .4 Verify excavation for manholes is correct.

### 3.2 EXCAVATING AND BACKFILL

- .1 Excavate and backfill in accordance with Sections 31 23 10 – Excavating, Soil Removal and Backfilling.
- .2 Obtain approval of Engineer before installing outfall structures, manholes, catch basins, valve chambers or ditch inlets.
- .3 Do not backfill any manholes or other structures for which a leakage test is required, prior to completion of testing and acceptance of test by Departmental Representative.

### 3.3 CONCRETE WORK

- .1 Do concrete work in accordance with Section 03 30 00 – Cast-in-Place Concrete.
- .2 Place concrete reinforcement in accordance with Section 03 20 00 – Concrete Reinforcement.
- .3 Position metal inserts in accordance with dimensions and details indicated.

**3.4 INSTALLATION**

- .1 Construct units in accordance with details indicated plumb and true to alignment and grade.
- .2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.
- .3 Pump excavation free of standing water and remove soft and foreign material before placing base. Fill any excavation below level of bottom of specified bedding as outlined in Section 31 23 10 - Excavating, Soil Removal and Backfilling.
- .4 Cast base directly on undisturbed ground or when permitted by Departmental Representative, set a precast concrete base on 150 mm minimum of compacted granular material compacted to ASTM D698-78 Method D.
- .5 For precast units:
  - .1 Make each successive joint watertight with approved rubber ring gaskets. Each lifting ring hole shall be grouted with non-shrink grout.
  - .2 Clean surplus grout and joint compounds from interior surface of unit as work progresses.
- .6 Place frame and cover on top section to required elevation. If adjustment required use concrete adjustment ring.
- .7 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.
- .8 Remove existing gratings, frames and store for re-use at locations designed by Departmental Representative.

**3.5 PREPARATION**

- .1 Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

**END OF SECTION**

**Part 1            General**

**1.1                SECTION INCLUDES**

- .1            Sanitary sewerage drainage piping, fittings, accessories, and bedding.
- .2            Connection of building sanitary drainage system to secondary sewerage treatment plant and outfall.

**1.2                RELATED SECTIONS**

- .1            Section 31 05 16 - Aggregate Materials.
- .2            Section 31 23 10 – Excavating, Soil Removal and Backfilling.
- .3            Section 33 05 13 - Manholes And Catch Basin Structures.
- .4            Section 33 41 00 – Storm Utility Drains.

**1.3                REFERENCES**

- .1            AASHTO T180-09 - Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
- .2            AWWA C111/A21.11-07 - Rubber Gaskets Joints For Cast Iron and Ductile Iron Pressure Pipe and Fittings.
- .3            ASTM A74-09 - Cast Iron Soil Pipe and Fittings.
- .4            ASTM A746-09 - Ductile Iron Gravity Sewer Pipe.
- .5            ASTM C12-09 - Standard Practice for Installing Vitrified Clay Pipe Lines.
- .6            ASTM C14M-07 - Concrete Sewer, Storm Drain, and Culvert Pipe, ASTM C14M-07 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- .7            ASTM C76M-10a - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, ASTM C76-10a - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- .8            ASTM C425-04(2009) - Compression Joints for Vitrified Clay Pipe and Fittings.
- .9            ASTM C443M-07 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets, ASTM C443-05ae1 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- .10           ASTM C564-09a - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .11           ASTM C700-09 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- .12           ASTM D698-07e1 - Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/cu ft (600 kN-m/cu m)).

- .13 ASTM D1556-07 - Test Method for Density and Weight Unit of Soil in Place by the Sand-Cone Method.
- .14 ASTM D1557-09 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2,700 kN-m/cu m)).
- .15 ASTM D2321-09 - Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- .16 ASTM D2729-03 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .17 ASTM D2751-05 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- .18 ASTM D3034-08 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .19 ASTM D6938-10 - Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

#### 1.4 DEFINITIONS

- .1 Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

#### 1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submittal Procedures.
- .2 Product Data: Provide data indicating pipe and pipe accessories.

#### 1.6 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittal Procedures.
- .1 Installation Data: Manufacturer's special installation requirements.

#### 1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Close Out Submittals.
- .2 Shop drawings to indicate proposed method for installing carrier pipe for undercrossings.
- .3 Inform Engineer at least 4 weeks prior to beginning Work, of proposed source of bedding materials and provide access for sampling.
- .4 Submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.
- .5 Ensure certification is marked on pipe.
- .6 Record location of pipe runs, connections, manholes, control points, outfall, invert elevations, pipe diameter and pipe slope.

- .7 Identify, indicate, and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

## 1.8 REGULATORY REQUIREMENTS

- .1 Conform to Newfoundland & Labrador Municipal Water, Sewer and Roads Master Construction Specifications.

## Part 2 Products

### 2.1 PIPE MATERIALS

- .1 Smooth wall polyvinyl pipe and fittings to ASTM D3034-80 and ASTM F679. Plastic pipe and fittings: to CAN/CSA B182.1-M92 for 100/125/150 mm sizes, CAN/CSA B-182.2-M90 for 200 mm to 675 mm sizes. Standard Dimensional Ratio (SDR): 35 for mains and SDR 28 for service pipe, unless otherwise indicated on the contract drawings, with locked-in gasket and integral bell system. Nominal lengths: 4 and 6 m.

### 2.2 PIPE ACCESSORIES

- .1 Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, clean-outs, reducers, traps and other configurations required.

### 2.3 BEDDING MATERIALS

- .1 Bedding material, Fill Type 1, to: Section 31 23 10 Excavating, Soil Removal and Backfilling and following requirements;
- .1 Type 1 bedding: clean, hard durable crushed gravel or stone, free from shale clay, friable materials, organic matter and other deleterious substances and graded within the following limits when tested to ASTM C136-84a and ASTM C117-87 and giving a smooth curve without sharp breaks when plotted on a semi-log chart:

<u>ASTM sieve designation</u>	<u>% passing</u>
25.000 mm	100
19.000 mm	75 - 100
12.500 mm	-
9.500 mm	50 - 100
4.750 mm	30 - 70
2.000 mm	20 - 45
0.425 mm	10 - 25
0.180 mm	-
0.075 mm	3 - 8

- .2 Concrete required for cradles, encasement, supports, thrust blocks and cut-off walls all to Section 03 30 00, strength 25 MPa.



**Part 3**

**Execution**

**3.1**

**EXAMINATION**

- .1 Verify existing conditions before starting work.
- .2 Verify that trench cut and excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on construction drawings.

**3.2**

**PREPARATION**

- .1 Clean and dry pipes and fittings before installation.
- .2 Obtain approval of pipes and fittings from Engineer prior to installation.

**3.3**

**TRENCHING**

- .1 Do trenching Work in accordance with Section 31 23 10 – Excavating, Soil Removal and Backfilling.
- .2 Do not allow contents of any sewer or sewer connection to flow into trench.
- .3 Trench alignment and depth require approval of Engineer prior to placing bedding material and pipe.
- .4 Do not backfill trenches until pipe grade and alignment have been checked and accepted and infiltration and exfiltration test results are within the limits specified. If the pipe is backfilled for any reason prior to testing, accept responsibility to meet the tests or to re-excavate and repair the line and pay all costs.

**3.4**

**CONCRETE BEDDING AND ENCASEMENT**

- .1 Do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete. Place concrete to details as directed by Departmental Representative.
- .2 Position pipe on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.
- .3 Do not backfill over concrete within 24 hours after placing.

**3.5**

**GRANULAR BEDDING**

- .1 Place granular bedding materials in accordance with details specified or directed.
- .2 Place bedding in unfrozen condition.
- .3 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth indicated.
- .4 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipe.
- .5 Shape transverse depressions as required to suit joints.

- .6 Compact each layer full width of bed to at least 95 % maximum density to ASTM D698.
- .7 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

### 3.6 INSTALLATION

- .1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .2 Handle pipe using methods approved by Departmental Representative. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Use laser-type instrument to control line and grade for sewers unless otherwise approved by the Departmental Representative.
- .4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Tolerances: 3mm in 3 m.
- .5 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .7 Do not allow water to flow through pipe during construction, except as may be permitted by Departmental Representative.
- .8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Install plastic pipe and fittings in accordance with CSA B182.11.
- .10 Pipe jointing:
  - .1 Install gaskets in accordance with manufacturer's recommendations.
  - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .3 Align pipes before joining.
  - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
  - .5 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted.
  - .6 Complete each joint before laying next length of pipe.
  - .7 Minimize joint deflection after joint has been made to avoid joint damage.
  - .8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
  - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

- .11 When stoppage of Work occurs, block pipes as directed by Engineer to prevent creep during down time.
- .12 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative, set in shrinkage compensating grout.
- .13 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .14 Make watertight connections to manholes or other structures. Provide details of proposed method of installing pipe stubs in structure walls to ensure a watertight joint. In the case of precast manhole bases an integral joint gasket may be cast in the manhole wall to receive the pipe stub. In the case of cast-in-place manholes bases the exterior pipe surface in contact with the structure wall shall be roughened or treated to provide a bond with the concrete. Any grout used to be non-shrink type.
- .15 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes. Joints to be structurally sound and watertight.
- .16 Leave joints and fittings exposed for ex-filtration testing. Provide protection when required. If it is necessary to backfill sections of the sewer prior to testing, take full responsibility and bear all costs for any additional excavation and backfill to expose pipe, fittings or joints that may be necessary.
- .17 When infiltration and ex-filtration test results are acceptable to Departmental Representative, backfill remainder of trench in accordance with Section 31 23 10 Excavating, Soil Removal and Backfilling.

### 3.7 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Engineer has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 1.0 m of pipe.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % maximum density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % corrected maximum density to ASTM D698.
- .7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

**3.8 BACKFILL**

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 100% maximum density to ASTM D698. In other areas, compact to at least 90 % maximum density to ASTM D698.

**3.9 SERVICE CONNECTION**

- .1 Install pipe to CSA B182.11 and manufacturer's instructions and specifications.
- .2 Maintain grade for sewers at 1 vertical to 100 horizontal unless directed otherwise by Departmental Representative.
- .3 Service connection pipe: not to extend into interior of main sewer.
- .4 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of four pipe diameters.
  - .1 Use long sweep bends where applicable.

**3.10 FIELD TESTING**

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 Remove foreign material from sewers and related appurtenances by flushing with water.
- .3 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
- .4 Do infiltration and exfiltration testing as specified herein and as directed by Departmental Representative. Perform tests in presence of Departmental Representative. Notify Engineer 24 h in advance of proposed tests.
- .5 Carry out tests on each section of sewer between successive manholes including service connections.
- .6 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
- .7 Exfiltration test:
  - .1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.
  - .2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.
  - .3 Duration of exfiltration test: 2 hours.
  - .4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.

- .8 Infiltration test:
  - .1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used.
  - .2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
  - .3 Install watertight plug at upstream end of pipeline test section.
  - .4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter.
  - .5 Prevent damage to pipe and bedding material due to flotation and erosion.
  - .6 Place 90 degrees V-notch weir, or other measuring device approved by Engineer in invert of sewer at each manhole.
  - .7 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.
- .9 Infiltration and exfiltration not to exceed 4.63 L per hour per 100 m of pipe, including service connections.
- .10 Repair visible leaks regardless of test results.
- .11 Carry out any retesting of sewer sections which have previously passed ex-filtration and/or infiltration tests, as directed by the Departmental Representative. If any sewer section passes this initial retest, additional payment will be made for such retest of that section. If any sewer section does not pass this initial retest, repair and retest such sewer as required until test results are again within limits specified, at no additional cost to the Contract.
- .12 Television inspections:
  - .1 Television equipment shall consist of a self-contained color camera and a monitoring unit connected by a 3 wire coaxial cable. The camera shall be small enough to ensure passage through a 150 mm sewer, shall be waterproof, and shall have a self-contained remotely controlled lighting system of varying the illumination of the interior of the sewer line for inspection and photographic purposes. Picture quality shall be such as to produce a continuous 600-line resolution picture showing the entire periphery of the pipe. All video tapes must be BHS format, SP mode. An audio description of the inspection must also be provided. The monitor shall be not less than 13 inch color monitor.
  - .2 Carry out inspection of installed sewers by television camera.
  - .3 If defective work is found by such inspections, repair sewer line and repeat television inspections as required until all defective work has been corrected, at no additional cost to the Owner.
  - .4 All tapes of television inspections are to be retained by the Engineer as a permanent record. V.H.S. Format only. Tape references shall be in hours and minutes (not counter number).
  - .5 Carry out television inspections of sewer sections previously not showing defective work as directed by the Departmental Representative. Additional payment will be allowed for such television inspections for sewer sections still free of defects. If defective work is found by such re-inspection repair sewer line and repeat inspection as required until all defective work has been corrected, at no additional cost to the Contract.
- .13 Deflection Test for PVC Pipe

- .1 Carry out a deflection test on all sections of the sewer. The maximum allowable deflection under fully backfilled and compacted trench conditions shall not exceed 5% before 30 days and 7.5% after 30 days.
- .2 Locations with excessive deflection shall be repaired and/or the pipe replaced at the Contractor's expense. The equipment used for the deflection test shall be that as recommended by the manufacturer, and may include an Electronic Deflectometer or a Rigid "Go-No-Go" Device. For the purpose of deflection measurement, the base inside diameters and the deflection mandrel dimensions are provided in the following table. To ensure accurate testing the lines shall be thoroughly cleaned.

Table for Base Inside Diameters and Deflection Mandrel Dimensions PVC SDR-35 (ASTM D3034)			
Nominal Size	Base Inside Diameter (mm)	5% Deflection Mandrel (mm)	7.5% Deflection Mandrel (mm)
200	194.69	185.0	180.0
250	242.90	230.8	224.6
300	288.57	274.0	266.9
375	353.01	335.4	326.6

- .3 For nominal sewer sizes not shown in above table the Mandrel dimensions shall be calculated as follows:

$$\text{Mandrel O.D.} = \frac{(100-Y)}{100} \times \text{Base I.D.}$$

Where Y = Deflection Limit in %

### 3.11 SCHEDULES

- .1 As detailed on Construction Drawings.

END OF SECTION

**Part 1            General**

**1.1                MEASUREMENT FOR PAYMENT INCLUDES**

- .1        Prefabricated Secondary Sewage Treatment Plant: As specified, supplied and placed in the work will be measured as fixed price. Incidentals to the bid price will include, but not limited to, excavation, bedding material, backfill compaction, connection to sewer lines, commissioning and warranty.

**1.2                RELATED SECTIONS**

- .1        Section 31 05 16 - Aggregate Materials.
- .2        Section 31 23 10 – Excavating, Soil Removal and Backfilling
- .3        Section 33 31 13 - Public Sanitary Utility Sewerage Piping.
- .4        Section 33 05 13 - Manholes and Catch Basin Structures.

**1.3                REFERENCES**

- .1        Guidelines for the Design, Construction and Operation of Water and Sewage Systems, published by the Government of Newfoundland & Labrador, Department of Environment & Conservation.

**1.4                SUBMITTALS FOR REVIEW**

- .1        Submit shop drawings in accordance with Section 01 33 00: Submittal Procedures.

**1.5                SUBMITTALS FOR INFORMATION**

- .1        Section 01 33 00: Submittal Procedures.

**1.6                CLOSEOUT SUBMITTALS**

- .1        Section 01 78 00: Submission procedures.
- .2        Provide maintenance data for complete system for incorporation into manual.
- .3        Provide instructions and exploded views of wastewater treatment assemblies.

**1.7                REGULATORY REQUIREMENTS**

- .1        Newfoundland & Labrador regulations for sanitary sewage discharge.

**Part 2            Products**

**2.1                MANUFACTURED UNITS**

- .1        Pre-Engineered packaged wastewater treatment plant for a daily treatment capacity of 23,000 liters.

- .1 Acceptable Products:
  - BMS Blivet
- .2 All systems must meet or exceed the Provincial Department of Environment & Conservation Standards for sanitary sewage discharge.
- .3 Provide certification, signed by Manufacturer's representative, stating that the system has been installed in accordance with manufacturer's recommendations.
- .4 Provide warranty from manufacturer.
- .5 Provide one (1) day on-site commissioning and training from the manufacturer.

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Supply and install unit in location as shown on drawings.
- .2 The Contractor shall furnish and install one complete wastewater treatment plant with all necessary parts and equipment necessary for operation in accordance with manufacturer's specification. The system shall provide primary, secondary and tertiary treatment of the wastewater flow.
- .3 Power requirements to be provided as per manufacturer's specifications. To be coordinated with electrical contractor.
- .4 Excavate for installation of secondary sewage treatment plant as recommended by manufacturers specification. Refer to Section 31 23 16 – Excavating and Section 31 23 23 Backfilling.
- .5 Backfill around sides of tank and tamp in place in accordance with manufacturers specification.
- .6 Protect wastewater treatment plant against floatation.

#### **3.2 FIELD QUALITY CONTROL**

- .1 Section 01 45 00 – Testing and Quality Control..
- 2 Request inspection by Consultant prior to placing aggregate cover over piping.
- .3 If tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- .4 Frequency of Tests: as required.

#### **3.3 PROTECTION OF FINISHED WORK**

- .1 Protect installed work.



- .2 Do not permit vehicular traffic over secondary sewage treatment plant.

**END OF SECTION**