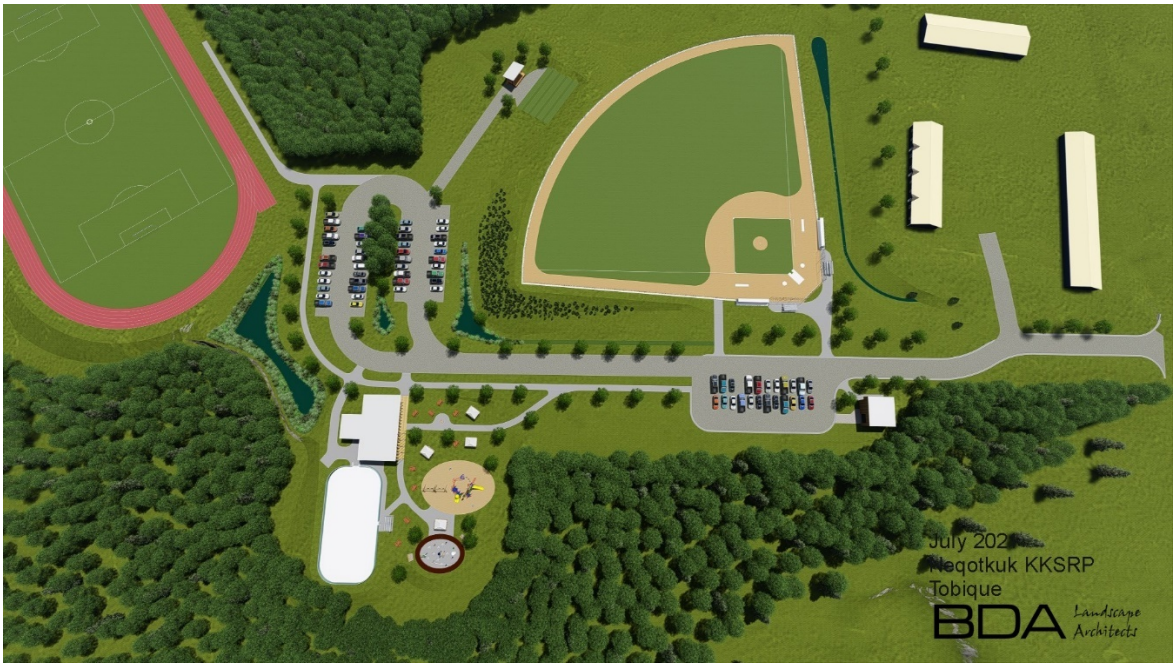
TOBIQUE FIRST NATION




# TECHNICAL SPECIFICATIONS

## NEQOTKUK KCIW KNICANEWEK SPORTS AND RECREATION PARK – PHASE 2

EVOQ project no: 9223-18-00

**ISSUED FOR TENDER**

2021-09-03

## Part 1 General

### 1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures.

### 1.2 REFERENCES

.1 ASTM International

.1 ASTM D4791-[10], Standard Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Samples:

.1 Submit 1 sample for each type of material.

.2 Allow continual sampling by Consultant during production.

.3 Provide Consultant with access to source and processed material for sampling.

.4 Install sampling facilities at discharge end of production conveyor, to allow Consultant to obtain representative samples of items being produced. Stop conveyor belt when requested by Consultant to permit full cross section sampling.

.5 Provide front end loader or other suitable equipment including trained operator for stockpile sampling as necessary. Move samples to storage place as directed by Consultant.

.6 Supply new or clean sample bags or containers appropriate to aggregate materials.

.7 Pay cost of sampling and testing of aggregates which fail to meet specified requirements.

.8 Provide water, electric power and propane to Consultant laboratory trailer at production site.

.9 Owner will only pay for first sample for each type of material. If first sample fails to meet specifications, pay cost of sampling and testing of aggregates for second and all other samples.

### 1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

.2 Transportation and Handling: handle and transport aggregates to avoid segregation, contamination and degradation.

.3 Storage: store washed materials or materials excavated from underwater 24 hours minimum to allow free water to drain and for materials to attain uniform water content.

## Part 2 Products

### 2.1 MATERIALS

.1 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, free from adherent coatings and injurious amounts of disintegrated pieces or other deleterious substances.

.2 Flat and elongated particles of coarse aggregate: to ASTM D4791.

.1 Greatest dimension to exceed 5 times least dimension.

.3 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:

.1 Screenings produced in crushing of quarried rock, boulders, gravel or slag.

.2 Reclaimed asphalt pavement.

.3 Reclaimed concrete material.

.4 Coarse aggregates satisfying requirements of applicable section to be one of or blend of following:

.1 Crushed rock.

.2 Gravel and crushed gravel composed of naturally formed particles of stone.

.3 Light weight aggregate, including slag and expanded shale.

.4 Reclaimed asphalt pavement.

.5 Reclaimed concrete material.

### 2.2 SOURCE QUALITY CONTROL

.1 Inform Consultant of proposed source of aggregates and provide access for sampling 2 weeks minimum before starting production.

.2 If materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements, locate alternative source.

.3 Advise Consultant 2 weeks minimum in advance of proposed change of material source.

.4 Acceptance of material at source does not preclude future rejection if it fails to conform to requirements specified, lacks uniformity, or if its field performance is found to be unsatisfactory.

## Part 3 Execution

### 3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions are acceptable for topsoil stripping.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with topsoil stripping only after unacceptable conditions have been remedied.

**3.2 PREPARATION**

.1 Topsoil stripping:

.1 Begin topsoil stripping of areas after area has been cleared of trees, brush, weeds, and grasses and removed from site.

.2 Strip topsoil to depths necessary to remove all vegetation. Avoid mixing topsoil with subsoil.

.3 Stockpile in locations as indicated unless otherwise indicated by Owner. Stockpile height not to exceed 1.5 m.

.4 Dispose of topsoil off site.

.2 Aggregate source preparation:

.1 Prior to excavating materials for aggregate production, clear and grub area to be worked, and strip unsuitable surface materials. Dispose of cleared, grubbed and unsuitable materials as approved by authority having jurisdiction.

.2 Where clearing is required, leave screen of trees between cleared area and roadways as directed.

.3 Clear, grub and strip area ahead of quarrying or excavating operation sufficient to prevent contamination of aggregate by deleterious materials.

.4 When excavation is completed dress sides of excavation to nominal 1.5:1 slope, and provide drains or ditches as required to prevent surface standing water. Trim off and dress slopes of waste material piles and leave site in neat condition.

.5 Provide silt fence or other means to prevent contamination of existing watercourse or natural wetland features.

.3 Processing:

.1 Process aggregate uniformly using methods that prevent contamination, segregation and degradation.

.2 Blend aggregates, as required, including reclaimed materials that meet physical requirements of specification is permitted in order to satisfy gradation requirements for material and, percentage of crushed particles, or particle shapes specified.

.4 When operating in stratified deposits use excavation equipment and methods that produce uniform, homogeneous aggregate gradation.

.5 Where necessary, screen, crush, wash, classify and process aggregates with suitable equipment to meet requirements.

.6 Stockpiling:

.1 Stockpile aggregates on site in locations as indicated unless directed otherwise by Consultant. Do not stockpile on completed pavement surfaces.

.2 Stockpile aggregates in sufficient quantities to meet project schedules.

.3 Stockpiling sites to be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials and handling equipment.

.4 Except where stockpiled on acceptably stabilized areas, provide compacted sand base not less than 300 mm in depth to prevent contamination of aggregate. Stockpile aggregates on ground but do not incorporate bottom 300 mm of pile into Work.

.5 Separate different aggregates by strong, full depth bulkheads, or stockpile far enough apart to prevent intermixing.

.6 Do not use intermixed or contaminated materials. Remove and dispose of rejected materials as directed by Consultant within 48 hours of rejection.

.7 Stockpile materials in uniform layers of thickness as follows:

.1 Maximum 1.5 m for coarse aggregate and base course materials.

.2 Maximum 1.5 m for fine aggregate and sub-base materials.

.3 Maximum 1.5 m for other materials.

.8 Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

.9 Do not cone piles or spill material over edges of piles.

.10 Do not use conveying stackers.

.11 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

## 3.3 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 Leave aggregate stockpile site in tidy, well drained condition, free of standing surface water.

.4 Leave any unused aggregates in neat compact stockpiles as directed by Consultant.

.5 For temporary or permanent abandonment of aggregate source, restore source to condition meeting requirements of authority having jurisdiction.

.6 Restrict public access to temporary or permanently abandoned stockpiles.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED SECTIONS

.1 Section 31 24 13 – Roadway Embankments.

### 1.2 DEFINITIONS

.1 Grubbing consists of excavation and disposal of stumps, all organic material and roots boulders and rock fragments below existing ground surface.

### 1.3 STORAGE AND PROTECTION

.1 Prevent damage to fencing, trees, landscaping, natural features, bench marks, existing buildings, existing pavement, utility lines, site appurtenances, water courses and root systems of trees which are to remain.

.1 Repair damaged items to approval of Consultant.

.2 Replace trees designated to remain, if damaged, as directed by Consultant.

## Part 2 Products

**Not Applicable.**

## Part 3 Execution

### 3.1 PREPARATION

.1 Inspect site and verify with Consultant, items designated to remain.

.2 Locate and protect utility lines: preserve in operating condition active utilities traversing site.

.3 Notify utility authorities before starting grubbing. Also notify authorities immediately during work if utilities are damaged.

.4 Keep roads and walks free of dirt and debris.

### 3.2 GRUBBING

.1 Grub out stumps and roots to not less than 200 mm below ground surface.

.2 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 $m^3$.

## 3.3 REMOVAL AND DISPOSAL

.1 Remove grubbed materials and place some of the grubbed material onto soccer field site as directed by Consultant. Remaining grubbed material is to be hauled off site to a suitable disposal site.

## 3.4 FINISHED SURFACE

.1 Leave ground surface in condition suitable for immediate grading operations to approval of Consultant.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED REQUIREMENTS

.1 Section 31 23 33.01 - Excavation, Trenching and Backfilling.

### 1.2 REFERENCES

.1 ASTM International

.1 ASTM D698-07e1, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m$^3$ ).

### 1.3 EXISTING CONDITIONS

.1 Examine geotechnical investigation report which is appended.

.2 Known underground and surface utility lines and buried objects are as indicated on site plan.

.3 Establish precise location of underground services before commencing work.

.4 Examine drainage requirements.

### 1.4 PROTECTION

.1 Protect existing site features which are indicated to remain. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris and mud on roads.

.3 Clean affected areas of adjacent municipal roads regularly in accordance with General Requirements.

## Part 2 Products

### 2.1 MATERIALS

.1 Fill material: in accordance with of Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Excavated or graded material existing on site may be suitable to use as fill for grading work if approved by Consultant.

## 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 rough grading installation in accordance with manufacturer's written instructions.

## 3.2 STRIPPING OF TOPSOIL

.1 Commence topsoil stripping of area after area has been cleared of existing structures and debris has been removed from site.

.2 Organize stockpiles in locations within existing limit of contract; locations designated.

.3 Dispose of unused material on site.

.4 Salvaged existing topsoil may only be used for common area topsoil.

## 3.3 GRADING

.1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated.

.2 Rough grade to following depths below finish grades:

- .1 150 mm for common grasses and meadow areas.
- .2 250 mm for running tracks.
- .3 150 mm for playing field outfields.
- .4 250 mm for crusher dust trails and aprons.
- .5 600mm for gravel parking and access road
- .6 850mm for splash pad and rink
- .7 325mm for concrete paving
- .8 Deeper as required to accommodate drainage system indicated.

.3 Grade ditches to depth indicated.

.4 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.

.5 Compact filled and disturbed areas to Modified Proctor density as follows:

- .1 85% under landscaped areas.
- .2 95% under paved and walk areas.

.6 Do not disturb soil within branch spread of trees or shrubs to remain.

## 3.4 TESTING

.1 Inspection and testing of soil compaction will be carried out by testing laboratory designated by ULC. Costs of tests will be paid by Owner.

.2 Submit testing procedure, frequency of tests, testing laboratory as designated by ULC or certified testing personnel to Consultant for review.

## 3.5 QUALITY CONTROL

.1 Refer to Section 01 45 00 Quality Control.

.2 The Contractor shall survey shaped subgrade within area described by the detail playfield layout, along trails and swales upon completion and prior to placement of finish grading material.

.3 Provide results to the Consultant for review.

.4 Make adjustments or revisions as directed by the Consultant.

.5 Provide additional or re-checked grades as required by the Consultant.

.6 Quality control grade survey may be completed in logically organized sections based on approval by the Consultant.

## 3.6 DUST CONTROL

.1 Take necessary measures to minimize air born dust generated.

.2 Take immediate remedial dust control measures upon notification by the Owner or the Consultant.

.3 Manage all operations in a neighbourly manner.

## 3.7 SURPLUS MATERIAL

.1 Keep surplus material and material unsuitable for fill, grading or landscaping on site in areas as directed.

## 3.8 CLEANING

.1 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

## 3.9 PROTECTION

.1 Protect existing trees, landscaping, natural features, bench marks, buildings, pavement, surface or underground utility lines which are to remain as directed by Consultant. If damaged, restore to original or better condition unless directed otherwise.

.2 Maintain access roads to prevent accumulation of construction related debris on roads.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED SECTIONS

.1 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

### 1.2 REFERENCES

.1 Definitions:

.1 Rock: any solid material in excess of 1.0 $m^3$ and which cannot be removed by means of heavy duty mechanical excavating equipment with a horse power of 160 HP and having a bucket size of 1.15 $m^3$. Frozen material not classified as rock.

.2 PPV: peak particle velocity.

### 1.3 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements.

## Part 2 Products

### 2.1 MATERIALS

.1 Not used.

## Part 3 Execution

### 3.1 ROCK REMOVAL

.1 Perform excavation in accordance with Erosion and Sedimentation Control Plan.

.2 Co-ordinate this Section with Section 01 35 29.06 - Health and Safety Requirements.

.3 Remove rock to alignments, profiles, and cross sections as indicated.

.4 Explosive blasting is not permitted.

.5 Use rock removal procedures to produce uniform and stable excavation surfaces. Minimize overbreak, and to avoid damage to adjacent structures.

.6 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.

.7 Cut trenches to widths as indicated.

.8 Remove boulders and fragments which may slide or roll into excavated areas.

.9 Correct unauthorized rock removal at no extra cost, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## 3.2 CLEANING

.1 Clean in accordance with Section 01 74 11 - Cleaning.

.2 Rock Disposal:

.1 Dispose of removed rock off site to a suitable disposal site.

## 3.3 PROTECTION

.1 Prevent damage to surroundings and injury to persons in accordance with Section 01 56 00 - Temporary Barriers and Enclosures.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED REQUIREMENTS

.1 Section 01 53 00 – Traffic Control.

.2 Section 33 05 13 – Manholes and Catch Basin Structures.

.3 Section 33 11 16 – Site Water Utility Distribution Piping.

.4 Section 33 31 13 – Public Sanitary Utility Sewerage Piping.

### 1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM C117, latest revision, Standard Test Method for Material Finer than 0.075 mm (No.200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, latest revision, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D422-63, latest revision, Standard Test Method for Particle-Size Analysis of Soils.

.4 ASTM D1557, latest revision, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700 kN-m/m$^3$).

.5 ASTM D4318, latest revision, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2, latest revision, Sieves, Testing, Woven Wire, Metric.

.3 Canadian Standards Association (CSA International)

.1 CSA-A23.1/A23.2, latest revision, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

### 1.3 DEFINITIONS

.1 Excavation classes: one class of excavation will be recognized; common excavation.

.1 Common excavation: excavation of materials of whatever nature.

.2 Topsoil:

.1 Material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

**.3** Waste material: excavated material unsuitable for use in Work or surplus to requirements. **Waste material becomes property of the Contractor.**

## 1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Quality Control: in accordance with Section 01 45 00 - Quality Control.

## 1.5 EXISTING CONDITIONS

.1 Examine soil report.

.2 Buried services:

.1 Before commencing work establish 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 beginning excavation Work, notify applicable authorities having jurisdiction to establish location and state of use of buried utilities and structures and 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.

.7 Where utility lines or structures exist in area of excavation, obtain direction of Consultant before removing. Costs for such Work to be incidental to the work unless they were not shown on drawings.

.8 Record location of maintained, re-routed and abandoned underground lines.

.9 Confirm locations of recent excavations adjacent to area of excavation.

.3 Existing buildings and surface features:

.1 Conduct 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 as directed by Consultant at no cost to Owner.

.3 Where required for excavation, cut roots or branches as directed by Consultant.

# Part 2 Products

## 2.1 MATERIALS

.1 Type 1 fill: properties to Section 31 05 16 - Aggregate Materials and the following requirements:

.1 Crushed or screened stone.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Table:

| Sieve Designation | % Passing |
|---|---|
| | Type 1 |
| 37.5 mm | - |
| 25 mm | 100 |
| 19 mm | 90 – 100 |
| 12.5 mm | 40 – 80 |
| 9.5 mm | 20 – 40 |
| 4.75 mm | 0 |
| 2.00 mm | - |
| 0.425 mm | - |
| 0.180 mm | - |
| 0.075 mm | - |

.2 Type 3 fill: selected material from excavation or other sources with less than 50% fines, approved by Consultant for use intended, unfrozen and free from rocks larger than 200 mm, cinders, ashes, sods, refuse or other deleterious materials.

.3 Type 4 fill: drainage stone, unfrozen and free from clay lumps, cementation, organic material, and other deleterious materials.

| Sieve Designation | % Passing |
|---|---|
| 60 mm | 100 |
| 50 mm | 90-100 |
| 25 mm | 35-100 |
| 19 mm | 15-85 |
| 12.5 mm | 0-53 |
| 9.5 mm | 0-30 |
| 4.75 mm | 0-4 |
| 1.18 mm | 0-2 |

.4 Type 5 fill: Infield Mix to consist of 8-10% clay, 30-35% silt and 60% double screened sand. No articles shall be larger than 5 mm. The soil texture is sandy loam. Product is suitable as sand amendment after screening out particles over 1.25 mm. The materials are to be blended and mixed and approved by Consultant prior to delivery. Supplier will make necessary modifications to approval of Consultant. Submit test results to confirm consistency. Acceptable supplier: Dunham's Contracting Ltd, 506-363-2108 or approved equivalent.

| Particle Size Diameter (mm) | % Passing Max |
|---|---|
| 5 | 100 |
| 1.25 | 45-80 |
| 0.315 | 3-30 |
| 0.160 | 0-8 |
| 0.080 | 0-2 |

.5 Type 6 fill: Drainage layer, sand, free from clay, shale and organic matter. Remove pebbles over 10 mm dia.

.6 Pitching Area and Batter Box Reinforcement: 100 x 200 x 63mm (nominal) play field reinforcing brick. Field Brick by Mar-Co Clay Products Inc.

.7 Unshrinkable fill: proportioned and mixed to provide:

.1 Maximum compressive strength of 0.4 MPa at 28 days.

.2 Maximum cement content of 25 kg/m.

.3 Minimum strength of 0.07 MPa at 24 h.

.4 Concrete aggregates: to CSA-A23.1.

.5 Cement: Type GU.

.6 Slump: 160 to 200 mm.

## Part 3 Execution

### 3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.2 SITE PREPARATION

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

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

### 3.3 PREPARATION/PROTECTION

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

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

.3 Protect natural and man-made features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.4 Protect buried services that are required to remain undisturbed.

## 3.4 STOCKPILING

.1 Stockpile fill materials in areas designated by Consultant.

.1 Stockpile granular materials in manner to prevent segregation.

.2 Protect fill materials from contamination.

.3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

## 3.5 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01 35 29.06 - Health and Safety Requirements.

## 3.6 DEWATERING AND HEAVE PREVENTION

.1 Keep excavations free of water while Work is in progress.

.2 Provide for Consultant's review details of proposed dewatering or heave prevention methods, including dikes, well points, and sheet pile cut-offs.

.3 Avoid excavation below groundwater table if quick condition or heave is likely to occur.

.1 Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

.4 Protect open excavations against flooding and damage due to surface run-off.

.5 Dispose of water in accordance with Section 01 35 43 - Environmental Procedures in manner not detrimental to public and private property, or portion of Work completed or under construction.

.1 Provide and maintain temporary drainage ditches and other diversions outside of excavation limits.

## 3.7 EXCAVATION

.1 Remove concrete, masonry, paving, walks, roadway culverts, driveway culverts and other obstructions encountered during excavation.

.2 Excavation must not interfere with bearing capacity of adjacent foundations.

.3 Do not disturb soil within branch spread of trees or shrubs that are to remain.

.1 If excavating through roots, excavate by hand and cut roots with sharp axe or saw.

.4 For trench excavation, unless otherwise authorized by Consultant in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 10 m at end of day's operation.

.5 Keep excavated and stockpiled materials safe distance away from edge of trench as directed by Consultant.

.6 Restrict vehicle operations directly adjacent to open trenches.

.7 Dispose of surplus and unsuitable excavated material off site.

.8 Do not obstruct flow of surface drainage or natural watercourses. Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.9 Notify Consultant when bottom of excavation is reached.

.10 Obtain Consultant approval of completed excavation.

.11 Remove unsuitable material from trench bottom including those that extend below required elevations to extent and depth as directed by Consultant.

.12 Correct unauthorized over-excavation as follows:

.1 Fill under with Type 1 fill compacted to not less than 90% of corrected Modified Proctor maximum dry density.

.13 Hand trim, make firm and remove loose material and debris from excavations.

.1 Where material at bottom of excavation is disturbed, compact foundation soil to density at least equal to undisturbed soil.

.2 Clean out rock seams and fill with concrete mortar or grout to approval of Consultant.

.14 The use of a trench box is recommended in trenches exceeding 2.4 metres in depth.

## 3.8 FILL TYPES AND COMPACTION

.1 Use types of fill as indicated or specified below. Compaction densities are percentages of maximum densities obtained from ASTM D1557.

.1 Use Type 3 fill to subgrade level. Compact to 95% of corrected maximum dry density in paving curbs and sidewalk areas and 90% in other areas.

## 3.9 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as specified in Sections 33 05 13, 33 11 16 and 33 31 13.

.2 Place bedding and surround material in unfrozen condition.

## 3.10 BACKFILLING

.1 Do not proceed with backfilling operations until completion of following:

.1 Consultant has inspected and approved installations.

.2 Areas to be backfilled to be free from debris, snow, ice, water and frozen ground.

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

.4 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

.5 Backfilling around installations:

.1 Place bedding and surround material as specified elsewhere.

.2 Do not backfill around or over cast-in-place concrete within 8 hours after placing of concrete.

.3 Place layers simultaneously on both sides of installed Work to equalize loading. Difference not to exceed 150 m.

**.6 When backfilling trenches in areas where cut and waste operations will be performed thereafter, Contractor is to backfill the trenches up to original ground elevation and not to subgrade elevation.**

## 3.11 RESTORATION

.1 Upon completion of Work, remove waste materials and debris, trim slopes, and correct defects as directed by Consultant.

.2 Reinstate lawns to elevation which existed before excavation.

.3 Reinstate pavements and sidewalks disturbed by excavation to thickness, structure and elevation which existed before excavation.

.4 Clean and reinstate areas affected by Work as directed by Consultant.

.5 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

**END OF SECTION**

## Part 1 General

### 1.1 DESCRIPTION OF WORK

.1 The work under this section consists of, but is not limited to the following:

- .1 Excavation of proposed roadway to subgrade as indicated on drawings.
- .2 Disposal of surplus or unsuitable materials.
- .3 Subgrade preparation and compaction.
- .4 Disposal of surplus excavated material off site.
- .5 Supply and placement of borrow material onto soccer field area.

### 1.2 RELATED REQUIREMENTS

.1 Section 32 11 16.01 – Granular Sub-Base.

### 1.3 REFERENCES

.1 Definitions:

- .1 Rock Excavation: NOT APPLICABLE.

.2 Excavation classes: one class of excavation will be recognized, common excavation.

- .1 Common excavation: excavation of materials of whatever nature. Common excavation will have one category.
  - .1 Cut and Waste:
    - .1 Material unsuitable for use in work or surplus to requirements. “Cut and Waste”, of whatever nature, material will belong to the Contractor and is to dispose the material off site to a suitable disposal site.

.3 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping and seeding.

.4 Embankment: material derived from usable excavation and placed above original ground or stripped surface up to subgrade elevation.

.5 Pavement structure: combination of layers of unbound or stabilized granular sub-base, granular base, and asphalt.

.6 Subgrade elevation: elevation immediately below pavement structure.

### 1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

### 1.5 QUALITY ASSURANCE

.1 Regulatory Requirements:

.1 Adhere to Provincial and National Environmental requirements when potentially toxic materials are involved.

## Part 2 Products

### 2.1 MATERIALS

.1 Embankment materials require approval by Consultant.

.2 Material used for embankment not to contain more than 3% organic matter by mass, frozen lumps, weeds, sod, roots, logs, stumps or other unsuitable material.

## Part 3 Execution

### 3.1 EXAMINATION

.1 Verification of Conditions: verify that condition of substrate is acceptable for roadway embankment Work: Visually inspect substrate in presence of Consultant.

.1 Visually inspect substrate in presence of Consultant.

.2 Inform Consultant 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 COMPACTION EQUIPMENT

.1 Compaction equipment: vibratory rollers or vibrating plate compactors capable of obtaining required density in materials on project.

.1 Demonstrate compaction equipment effectiveness on specified material and lift thickness by documented performance of test-strip before start of Work.

.2 Replace or supplement equipment that does not achieve specified densities.

.2 Operate compaction equipment continuously in each embankment when placing material.

### 3.3 WATER DISTRIBUTORS

.1 When required to achieve compaction, apply water with equipment capable of uniform distribution.

### 3.4 EXCAVATING (Cut and Waste)

.1 General:

.1 Notify Consultant when waste materials are encountered and remove to depth and extent directed.

.2 Treat ground slopes, where subgrade is on transition from excavation to embankment, at grade points as directed by Consultant.

.3 Unsuitable materials:

.1 Notify Consultant whenever unsuitable materials are encountered in cut sections and remove unsuitable materials to depth and extent as directed by Consultant.

.2 Unsuitable materials are to be disposed of off site.

**.4 Full width roadway excavation to proposed subgrade will not be permitted at the same time as the pipe installation.**

**.5 The Contractor is to backfill the pipe trenches up to the existing roadway base material grade using Type 3 material as per Section 31 23 33.01 – Excavating, Trenching and backfilling.**

**.6 For the roadway excavation, the Contractor will excavate down to the subgrade elevation for the entire roadway width as specified on the drawings. Place sub-base material in a manner that minimizes the amount of exposed disturbed soil on site (i.e. excavate in sections, removing a portion of soil, placing the sub-base materials before moving on to excavate other areas). Do not excavate a larger area of the roadway that can be rebuilt in any given day. No areas of the subgrade should be left exposed over night or to wet conditions.**

.7 Proposed excavation procedures to be discussed with and approved by Consultant prior to start of work.

.2 Drainage:

.1 Maintain profiles, crowns and cross slopes to provide good surface drainage.

.2 Provide ditches as work progresses to provide drainage.

.3 Construct interceptor ditches as indicated or as directed before excavating or placing embankment in adjacent area.

## 3.5 COMPACTION

.1 Break material down to sizes suitable for compaction and mix for uniform moisture to full depth of layer.

.2 Deposit, spread, and level, embankment material in layers 300 mm maximum thickness before compaction.

.1 Compact each layer of embankment until compaction equipment achieves no further significant consolidation.

.2 Ensure required compaction for each layer before placing any material for next layer.

.3 Use specialized compaction equipment supplemented by routing, hauling, and leveling equipment over each layer of fill.

.4 Compact each layer to minimum 95% maximum dry density: ASTM D1557.

.5 Add water or dry as required to bring moisture content of materials to level required to achieve specified compaction.

## 3.6 FINISHING

.1 Shape entire roadbed to within 50 mm of design elevations.

.2 Finish slopes, ditch bottoms and borrow pits true to lines, grades and drawings where applicable. Scale slope by removing loose fragments, for cut slopes in bedrock steeper than 1:1.

.3 Remove rocks over 150 mm in dimension from slopes and ditch bottoms.

.4 Hand finish slopes that cannot be finished satisfactorily by machine.

.5 Round top of backslope 1.5 m both sides of top of slope.

.6 Run tractor tracks over slopes exceeding 3 m in height to leave tracks parallel to centreline of highway.

.7 Trim between constructed slopes and edge of clearing to provide drainage and free of humps, sags and ruts.

## 3.7 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.

## 3.8 PROTECTION

.1 Maintain finished surfaces in condition conforming to this section until acceptance by Consultant.

.2 Provide silt fences and erosion protection as required to mitigate and prevent impacts to adjacent properties.

**END OF SECTION**

## Part 1 General

### 1.1 SECTION INCLUDES

.1 Materials and installation of polymeric geotextiles used around manholes, in revetments, breakwaters, retaining wall structures, filtration, drainage structures, roadbeds and beds purpose of which is to:

.1 Separate and prevent mixing of granular materials of different grading.

.2 Act as hydraulic filters permitting passage of water while retaining soil strength of granular structure.

### 1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 33 05 13 – Manholes and Catch Basin Structures.

### 1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-4.2 No. 11.2, Textile Test Methods - Bursting Strength - Ball Burst Test.

.2 CAN/CGSB-148.1, Methods of Testing Geotextiles and Complete Geomembranes.

.1 No.2, Methods of Testing Geosynthetics - Mass per Unit Area.

.2 No.3, Methods of Testing Geosynthetics - Thickness of Geotextiles.

.3 No.6.1, Methods of Testing Geotextiles and Geomembranes - Bursting Strength of Geotextiles Under No Compressive Load.

.4 No.7.3, Methods of Testing Geotextiles and Geomembranes - Grab Tensile Test for Geotextiles.

.5 No. 10, Methods of Testing Geosynthetics - Geotextiles - Filtration Opening Size.

### 1.4 SUBMITTALS

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

.2 Submit to Owner's appointed Consulting Engineer following samples at least four (4) weeks prior to beginning Work.

.1 Minimum length of 2 m of roll width of geotextile.

.3 Submit to Owner's appointed Consulting Engineer copies of mill test data and certificate at least four (4) weeks prior to start of Work, and in accordance with Section 01 33 00 - Submittal Procedures.

## 1.5 DELIVERY, STORAGE AND HANDLING

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

# Part 2 Products

## 2.1 MATERIAL

.1 Geotextile: non-woven synthetic fibre fabric, supplied in rolls.

.1 Composed of: minimum 85% by mass of polypropylene with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.

.2 Physical and Hydraulic Properties:

**Table 2.1.2 "Physical and Hydraulic Properties of Geotextiles"**

| **Values are minimum requirements** | | | **Fabric Type** | | | | |
|---|---|---|---|---|---|---|---|
| **Property** | **Unit** | **CAN/CGSB** | **G1** | **G2** | **G3** | **G4** | --- |
| **Tensile Strength** | N | 148.1 No. 7.3-92 | 755 | 900 | 1450 | 2500 | --- |
| **Elongation at Break** | % | 148.1 No. 7.3-92 | 55-85 | 75-100 | 70-100 | 65-95 | --- |
| **Tear Propagation Trapezoid Method** | N | 4.2, No. 12.2-95 | 325 | 375 | 600 | 1050 | --- |
| **Bursting (Mullen)** | KPa | 4.2, No. 11.1-94 | 2250 | 2450 | 3500 | 7000 | --- |
| **Permeability** | $10^{-1}$ cm/sec | 148.1, No. 4-94 | 2.8 | 2.4 | 2.3 | 1.3 | --- |
| **Filtration Opening Size (F.O.S.)** | microns | 148.1, No. 10-94 | 4590 | 44-105 | 40-80 | 40-70 | --- |
| **Thickness** | mm | 148.1, No. 3-85 | 1.4 | 2.6 | 3.5 | 5.8 | --- |

**UTILIZATION GUIDELINES**

Use noted fabric type for the following uses: (Refer to Section 31 37 00 for Rip-Rap gradation)

.1 Type G1: Storm sewer pipe joints, manholes, catch basins and pipe culverts.
.2 Type G2: Placed under "Hand Placed" Rip-Rap (R25).
.3 Type G3: Placed under "Random" and "Heavy" Rip-Rap.
.4 Type G4: Placed under "Armour" Rip-Rap.

.3 Securing pins and washers: to CAN/CSA-G40.21, Grade 300W, hot-dipped galvanized with minimum zinc coating of 600g/$m^2$ to CAN/CSA G164.

.4 Factory seams: sewn in accordance with manufacturer's recommendations.

.5 Thread for sewn seams: equal or better resistance to chemical and biological degradation than geotextile.

.2 Woven geotextile: Terrafix 400W.

## Part 3 Execution

### 3.1 INSTALLATION

.1 For Manholes and Catch Basin Structures, refer to Section 33 05 13.

### 3.2 CLEANING

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

### 3.3 PROTECTION

.1 Vehicular traffic not permitted directly on geotextile.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 – Aggregate Materials.

.2 Section 31 24 13 – Roadway Embankments.

### 1.2 REFERENCES

.1 ASTM International

- .1 ASTM C117, latest revision, Standard Test Methods for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C131, latest revision, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .3 ASTM C136, latest revision, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D422, latest revision, Standard Test Method for Particle-Size Analysis of Soils.
- .5 ASTM D1557, latest revision, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN-m/$m^3$).
- .6 ASTM D1883, latest revision, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
- .7 ASTM D4318, latest revision, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-8.2, latest revision, Sieves, Testing, Woven Wire, Metric.

.3 Ministry of Transportation of Ontario

- .1 MTO LS 614 Freezing and thawing of Coarse aggregate.
- .2 MTO LS 618 The Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

### 1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and 31 05 15 – Aggregate Materials.

## Part 2 Products

### 2.1 MATERIALS

.1 Granular sub-base material: in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

.1 Granular sub-base shall be a crushed rock or gravel composed of clean, hard, durable, uncoated particles free from lumps of clay, organic material or other deleterious substances.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.3 Gradation to:

| Sieve Designation | CRUSHED ROCK | CRUSHED GRAVEL |
|---|---|---|
| | % Passing | % Passing |
| 100 mm | - | - |
| 90 mm | 100 | 100 |
| 75 mm | 95 – 100 | 95 – 100 |
| 63 mm | 85 – 100 | 80 – 100 |
| 50 mm | 73 – 95 | - |
| 37.5 mm | 58 – 87 | 60 – 87 |
| 31.5 mm | - | - |
| 25 mm | - | - |
| 19 mm | 35 – 69 | 34 – 68 |
| 12.5 mm | - | - |
| 9.5 mm | 25 – 54 | 25 – 58 |
| 4.75 mm | 17 – 43 | 17 – 48 |
| 2.36 mm | 12 – 35 | 13 – 39 |
| 1.18 mm | 8 – 28 | 9 – 30 |
| .300 mm | 4 – 16 | 4 – 17 |
| 0.075 mm | 0 - 9 | 0 - 7 |

.4 Other properties as follows:

.1 Liquid Limit: to ASTM D4318, Maximum 25.

.2 Plasticity Index: to ASTM D4318, Maximum 5.

.3 Micro-Deval: to MTO LS-618. Max loss by mass 30%.

.4 Freeze Thaw: to MTO LS-614 – Max 20%.

## 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 Consultant.

.2 Inform Consultant of unacceptable conditions immediately upon discovery.

.3 Proceed with installation only after unacceptable conditions have been remedied to the satisfaction of the Consultant.

### 3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

### 3.3 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 on 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 300 mm compacted thickness.

.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 Compact to density of not less than 95% maximum dry density in accordance with ASTM D1557.

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

.4 Apply water as necessary during compaction to obtain specified density.

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

.6 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 a loader double axle tandem truck with gross weight between 25 000 kg and 30 000 kg.

.2 Proof roll at level in sub-base as indicated by Consultant.

.3 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.

.4 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.

.5 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.

## 3.7 SITE TOLERANCES

.1 Finished sub-base surface to be within 25 mm of elevation as indicated but not uniformly high or low. Finished roadway crown to be within 0.5% $\pm$ of design crown.

**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 Consultant.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED REQUIREMENTS

.1 Section 31 05 16 – Aggregate Materials.

.2 Section 32 11 16.01 – Granular Sub-Base.

### 1.2 REFERENCES

.1 ASTM International

.1 ASTM C117, latest revision, Standard Test Methods for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.2 ASTM C131, latest revision, Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

.3 ASTM C136, latest revision, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.4 ASTM D1557, latest revision, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2,700kN-m/$m^3$).

.5 ASTM D1883, latest revision, Standard Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.

.6 ASTM D4318, latest revision, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.

.3 Ministry of Transportation of Ontario

.1 MTO LS 614 Freezing and thawing of Coarse aggregate.

.2 MTO LS 618 The Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

### 1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

### 1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and Section 31 05 16 - Aggregate Materials.

## Part 2 Products

### 2.1 MATERIALS

.1 Granular base: material in accordance with Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed rock or gravel.

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.2.

.1 Gradation to:

| Sieve Designation | CRUSHED ROCK | CRUSHED GRAVEL |
|---|---|---|
| | % Passing | % Passing |
| 37.5 mm | 100 | 100 |
| 31.5 mm | 95 – 100 | 95 – 100 |
| 25 mm | 81 – 100 | 83 – 100 |
| 19 mm | 66 – 90 | 70 – 90 |
| 12.5 mm | 50 – 77 | 55 – 78 |
| 9.5 mm | 41 – 70 | 45 – 72 |
| 4.75 mm | 27 – 54 | 30 – 57 |
| 2.36 mm | 17 – 43 | 20 – 46 |
| 1.18 mm | 11 – 32 | 14 – 35 |
| 0.30 mm | 4 – 19 | 5 – 19 |
| 0.075 mm | 0 - 8 | 0 - 6 |

.2 Plasticity index: to ASTM D4318, maximum 3.

.3 Micro-Deval: to MTO LS-618 – max 25%.

.4 Crushed particles: at least 40% of particles by mass to have at least 1 freshly fractured face when tested in accordance to ASTM D 5821.

.5 Freeze thaw: to MTO-LS-614 – Max. 20%.

## Part 3 Execution

### 3.1 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.2 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

## 3.2 PLACEMENT AND INSTALLATION

.1 Place granular base after sub-base surface is inspected and approved by Consultant.

.2 Placing:

.1 Construct granular base to depth and grade in areas indicated.

.2 Ensure no frozen material is placed.

.3 Place material only on clean unfrozen surface, free from snow and ice.

.4 Begin spreading base material on crown line or on high side of one-way slope.

.5 Place material using methods which do not lead to segregation or degradation of aggregate.

.6 For spreading and shaping material, use spreader boxes having adjustable templates or screeds which will place material in uniform layers of required thickness.

.7 Place material to full width in uniform layers not exceeding 150 mm compacted thickness.

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

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

.3 Compaction Equipment:

.1 Ensure compaction equipment is capable of obtaining required material densities.

.4 Compacting:

.1 Compact to density not less than 95% maximum dry density to ASTM D1557.

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

.3 Apply water as necessary during compacting to obtain specified density.

.4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers approved by Consultant.

.5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

## 3.3 SITE TOLERANCES

.1 Finished base surface to be within plus or minus 15 mm of established grade and cross section but not uniformly high or low. Roadway crown to be within 0.5% $\pm$ of designed crown.

## 3.4 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

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

## 3.5 PROTECTION

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

**END OF SECTION**

## Part 1 General

### 1.1 RELATED WORK

.1 Section 32 11 23 – Aggregate Base Courses
.2 Section 31 23 13 - Rough Grading.

### 1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM)
  .1 ASTM C 136-96a, Method for Sieve Analysis of Fine and Coarse Aggregates.
  .2 ASTM C 117-95, Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
  .3 ASTM E 11-95, Specification for Wire - Cloth Sieves for Testing Purposes.
  .4 ASTM D 4318-98, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
  .5 ASTM D 698-91, Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49-kg) Rammer and 12-in (304.8-mm) Drop.
.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 PROTECTION

.1 Prevent damage to buildings, landscaping, curbs, sidewalks, trees, fences, roads and adjacent property. Make good any damage.
.2 Provide access to building at all times. Coordinate paving schedule to minimize interference with normal use of premises.

## Part 2 Products

### 2.1 MATERIALS

.1 Granular base:
  .1 As Per Section 32 11 23 – Aggregate Base Courses.
.2 Granular topping:
  .1 Screenings: hard, durable, crushed stone particles, free from clay lumps, cementation, organic material, frozen material and other deleterious materials.
  .2 Gradations: within limits specified when tested to ASTM C 136 and ASTM C 117.
  .3 Table

| Sieve Designation | % Passing |
|---|---|
| 9.5 mm | 100 |

| Sieve Designation | % Passing |
|---|---|
| 4.75 mm | 50-100 |
| 2.00 mm | 30-65 |
| 0.425 mm | 10-30 |
| 0.075 mm | 5-10 |

## Part 3 Execution

### 3.1 SUBGRADE

.1 Ensure that subgrade preparation conforms to levels and compaction required to allow for installation of granular base.

### 3.2 GRANULAR BASE

.1 Granular base material minimum thickness: 200 mm as indicated.

.2 Spread and compact granular base material in uniform layers not exceeding 100 mm compacted thickness.

.3 Compact to a density of not less than 98% Standard Density in accordance with ASTM D 698.

### 3.3 GRANULAR TOPPING

.1 Place granular topping to compacted thickness 100 mm as indicated.

.2 Place in layer of 50 mm compacted thickness. Compact layer to 95% Standard Density in accordance with ASTM D 698.

**END OF SECTION**

## Part 1 General

### 1.1 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-15.1, latest revision, Calcium Chloride.

### 1.2 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.1 Supply calcium chloride in quantities and at times as directed by Consultant.

.2 Deliver calcium chloride to site in moisture-proof bags. Indicate name of manufacturer, name of product, net weight or mass, and percentage of calcium chloride guaranteed by manufacturer.

.3 Storage and Handling Requirements:

.1 Store bags of calcium chloride in weather-proof enclosures.

## Part 2 Products

### 2.1 MATERIALS

.1 Calcium chloride, Type I: to CAN/CGSB-15.1, flake or 35% aqueous solution.

.2 Water: in accordance with Consultant's approval.

## Part 3 Execution

### 3.1 APPLICATION

.1 Apply calcium chloride and water with equipment approved by Consultant.

.2 Apply water or aqueous calcium chloride with distributors equipped with means of shut-off and with spray system to ensure uniform application.

.3 If needed or as required by Consultant, dust control measures will be applied on weekends.

### 3.2 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.

**END OF SECTION**

## Part 1 General

### 1.1 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Submit shop drawings for review by the Consultant indicating all layout, pattern, colors, materials, connections, accessories, dimensions, footings, etc.

.3 Make adjustments as required by the Consultant.

### 1.2 DELIVERY, STORAGE AND HANDLING

.1 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.2 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect materials from damage.

.3 Replace defective or damaged materials with new.

## Part 2 Products

### 2.1 PRIVACY SLATS

.1 LDPE flexible privacy slats, color stabilized.

.2 1 7/8” width, supplied in rolls.

.3 Colors: 4 standard colors to be selected.

.4 Installation: as per manufacturer’s recommendations with brass fasteners.

.5 Pattern: Installed at 45 degree angles as shown on drawings, color pattern to be determined.

.6 Warranty: 5 year warranty under normal conditions.

.7 Pexco Fence Weave, or approved equivalent.

.8 Submit product data and colors for approval.

## Part 3 Execution

### 3.1 INSTALLATION

.1 Install privacy slats on dugout rear and ends as recommended by manufacturer in pattern indicated on drawings.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED REQUIREMENTS

.1 Section 31 22 13 – Rough Grading.

.2 Section 32 92 19.13 – Mechanical Seeding.

.3 Section 32 92 19.16 – Hydraulic Seeding.

### 1.2 REFERENCES

.1 Agriculture and Agri-Food Canada

.1 The Canadian System of Soil Classification, Third Edition, 1998.

.2 Canadian Council of Ministers of the Environment

.1 PN1340 2005, Guidelines for Compost Quality.

### 1.3 DEFINITIONS

.1 Compost:

.1 Mixture of soil and decomposing organic matter used as fertilizer, mulch, or soil conditioner.

.2 Compost is processed organic matter containing 40% or more organic matter as determined by Walkley-Black or Loss On Ignition (LOI) test.

.3 Product must be sufficiently decomposed (i.e. stable) so that any further decomposition does not adversely affect plant growth (C:N ratio below (25)), and contain no toxic or growth inhibiting contaminates.

.4 Composed bio-solids to: CCME Guidelines for Compost Quality, Category (A).

### 1.4 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Provide submittals indicated for review by the Consultant.

.3 Quality control submittals :

.1 Soil testing: submit certified test reports showing compliance with specified performance characteristics and physical properties as described source quality control.

.2 The contractor is responsible for scheduling and the cost of soil testing.

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

## 1.5 QUALITY ASSURANCE

.1 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

## 1.6 INSPECTION AND TESTING

.1 Inspection and testing of topsoil:

.1 Individual tests for pH value, sieve analysis and chemical analysis will be carried out by an approved independent laboratory testing company, and approved by the Consultant.

.2 Test existing to be reused and fabricated topsoil for pH, % organic content, cationic exchange capacity (CEC), nutrient levels for NPK, clay, and silt and sand content. The Contractor is responsible for his own soil testing costs.

.3 Inform Consultant of proposed source of topsoil to be supplied and provide access for sampling. If topsoil test results indicate amendments required, add recommended amendments and re-test soil. The contractor shall not commence work until topsoil is accepted by Consultant.

.4 Submit remedial action plan for amendments to salvaged topsoil prior to placing and spreading.

.2 Inspection and evaluation of topsoil fine grade:

.1 Inspection and evaluation of topsoil finish grade will be carried out by an independent survey technician. Submit results to Consultant for review. Cost of surveyor is the responsibility of the Contractor.

.2 The maximum tolerance from designed finish grade is 50 mm (2 inches) over 10 meters in all directions, on non playing surfaces.

.3 The maximum tolerance from designated finish grade is 13 mm (0.5 inches) over 10 meters in all directions on playing surfaces.

## 1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Divert unused soil amendments from landfill to official hazardous material collections site approved by Consultant

.2 Do not dispose of unused soil amendments into sewer systems, into lakes, streams, onto ground or in locations where it will pose health or environmental hazard.

## Part 2 Products

.1 Mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.2 Submit texture test for review.

.3 Topsoil for seeded areas : mixture of particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Soil texture based on The Canadian System of Soil Classification, to consist of 60 to 70 % sand, minimum 7 % clay, and contain 5 to 10 % organic matter by weight.

.2 Ph Value: 6.5 to 7.5

.3 Contain no toxic elements or growth inhibiting materials.

.4 Finished surface free from:

.1 Debris and stones over 12 mm diameter for playing surface and 25mm for other turn areas.

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

.5 Consistence: friable when moist.

.6 Double screen topsoil for playing surface to remove all stones over 12mm diameter.

.4 Planting Beds and Tree Pits:

.1 Soil texture based on The Canadian System of Soil Classification, to consist of 30 to 70 % sand, 15-30% clay, and contain 5 to 20 % organic matter by weight.

.2 Contain no toxic elements or growth inhibiting materials or debris.

.3 Finished surface free from:

.1 Debris and stones over 50 mm diameter.

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

.4 Consistence: friable when moist.

## 2.2 SOIL AMENDMENTS

.1 Mix all topsoil components and incorporate fertilizer, bone meal, lime, peat or compost and sand thoroughly and evenly. Pass through a 10 mm sieve for ballfield.

.2 Mix fertilizer into tilled existing topsoil at rate of 20kg/ha N at a ratio of 1-1-1.

.3 Compost:

.1 Meet condition 2.1.2.2. Compost must be tested by Agriculture Canada and written test results must be approved by the Consultant before mixing.

.4 Peat moss:

.1 Derived from partially decomposed species of Sphagnum Mosses.

.2 Elastic and homogeneous, brown in colour.

.3 Free of wood and deleterious material which could prohibit growth.

.4 Shredded particle minimum size: 5 mm.

.5 Minimum organic content of 85 percent by weight as determined by loss on ignition (ASTMD 2974-87 Method D).

.6 Ensure peat is moist during the mixing stage to ensure uniform mixing and to minimize peat and sand separation.

.5 Sand: washed coarse silica sand, medium to course textured 100 percent below 1.0 mm, 65 percent below 0.5 mm, 25 percent below 0.25 mm and 5 percent below 0.05 mm.

.6 Limestone:

.1 Ground agricultural limestone containing minimum calcium carbonate equivalent of 85 %.

.2 Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

.3 All limestone in accordance with soil test to bring Ph value between 6.5 and 7.5 for sports field turf.

.7 Fertilizer:

.1 Complete commercial synthetic fertilizer with minimum 65 % insoluble nitrogen.

.2 At time of soil mixing, add 250 g of 0-20-10 fertilizer per cubic metre of mix.

## 2.3 SOURCE QUALITY CONTROL

.1 Advise Consultant of sources of topsoil to be utilized with sufficient lead time for testing.

.2 Site shall be stripped and topsoil shall be stockpiled on site for re-use. Supplemental topsoil shall be imported as required.

.3 Contractor is responsible for amendments to supply topsoil as specified.

.4 Soil testing by recognized testing facility for PH, P and K, and organic matter.

.5 Testing of topsoil will be carried out by testing laboratory designated by Consultant.

.1 Soil sampling, testing and analysis to be in accordance with Provincial standards.

# Part 3 Execution

## 3.1 TEMPORARY EROSION AND SEDIMENTATION CONTROL

.1 Provide temporary erosion and sedimentation control measures around site perimeter and as directed on site to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

## 3.2 STRIPPING OF TOPSOIL

.1 Begin topsoil stripping of areas as indicated after area has been cleared of brush and removed from site.

.2 Strip topsoil to depths as indicated.

.1 Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

.3 Stockpile in locations as indicated.

.1 Stockpile height not to exceed 3 m.

.4 Disposal of unused topsoil is to be in an environmentally responsible manner but not used as landfill.

.5 Protect stockpiles from contamination and compaction.

## 3.3 PREPARATION OF EXISTING GRADE

.1 Verify that grades are correct.

.2 Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

.3 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials.

.1 Remove soil contaminated with calcium chloride, toxic materials and petroleum products.

.2 Remove debris which protrudes more than 75 mm above surface.

.3 Dispose of removed material off site.

.4 Cultivate entire area which is to receive topsoil to minimum depth of 150 mm.

.1 Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

## 3.4 SUB-GRADE APPROVAL

.1 Do not spread topsoil before approval of sub grade by Consultant. Sub-grade must be graded to the specified slope of the playing surface subgrade. The grade will extend from a line down the center of the completed field to the perimeter of the playing surface. Final grade of sub-base must be approved by Consultant.

.2 Do not begin work prior to approval of topsoil by Consultant.

## 3.5 SITE CONDITION

.1 Do not perform work under adverse working conditions, such as frozen ground or ground covered with snow, ice or standing water, or during rainy weather conditions without approval from Consultant.

## 3.6 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

.1 Non Playing Surface:

.1 Follow all directions as outlined for playing surface (see appropriate section) except depth of media is to be a minimum of 100 mm (4 inches).

.2 Playing Surface:

.1 All media must be installed to an equal depth over the entire future playing surface.

.2 Apply topsoil to result in a minimum of 150 mm (6 inches) of "settled" media in one even lift, unless otherwise indicated. As media generally settles 25 mm (1.0 inches) after applied to field, the initial layer should be 175 mm (7 inches) in thickness.

.3 Spread approved media in one uniform layer over approved sub-grade here indicated. Do not place topsoil on frozen sub-grade.

.4 Account for machinery and foot traffic when placed.

.5 Use machinery in such a way as to control (minimize) compaction of media and to achieve proposed gradients.

.6 Ensure that the media is evenly firm but not compacted.

.7 Fine grade to indicated grades and elevations , leaving surface smooth and uniform with fine loose texture.

.8 Settled media shall be flush with infield and warning track surfaces.

.3 Tree pits and Planting Beds:

.1 450 mm depth for planting beds.
.2 Depth as indicated for tree pits.
.3 Manually spread topsoil/planting soil around existing trees, shrubs and obstacles.

## 3.7 SOIL AMENDMENTS

.1 For turf, apply and thoroughly mix soil amendments into topsoil at rate specified and determined from sample testing.

.2 For tree pits and lawn areas: apply and thoroughly mix soil amendments into full specified depth of topsoil.

## 3.8 FINISH GRADING

.1 Grade surface to insure that no rough or uneven areas exist. Insure that final grade will facilitate the removal of excess water from the playing surface during future rainfall, when field is established to turf.

.2 Consolidate topsoil to required bulk density using equipment approved by Consultant. Leave surfaces smooth, uniform and firm against deep footprinting.

## 3.9 ACCEPTANCE

.1 Do not proceed to seeding operation before settlement and approval of finished grades by Consultant including depth, shape, and test results.

## 3.10 SURPLUS MATERIAL

.1 Dispose of materials except topsoil not required on site in areas directed by consultant.

## 3.11 CLEANING

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

**END OF SECTION**

## Part 1 General

### 1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for plant material, plant material to be relocated, accessories, mulch, planting, tree supports, mulching and maintenance.

### 1.2 RELATED SECTIONS:

.1 Section 31 23 13 - Rough Grading.

.2 Section 32 91 19.13 - Topsoil Placement and Grading.

### 1.3 REFERENCES

.1 Agriculture and Agri-Food Canada (AAFC).

.1 Plant Hardiness Zones in Canada-2000.

.2 Canadian Nursery Landscape Association (CNLA).

.1 Canadian Standards for Nursery Stock- 8th Edition (2006), or latest edition.

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Transportation of Dangerous Goods Act (TDGA), 1992, c.34.

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

### 1.4 DEFINITIONS

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

### 1.5 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures

.2 Submit product data for:

.1 Fertilizer.

.2 Mycorrhiza.

.3 Anti-desiccant.

.4 Mulch.

.5 Flexible Ties

.3 Submit samples for:

.1 Mulch.

### 1.6 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with General Requirements

### 1.7 STORAGE AND PROTECTION

.1 Protect plant material from frost, excessive heat, wind and sun during delivery.

.2 Immediately store and protect plant material which will not be installed within 1 (one) hour after arrival at site in storage location approved by Consultant.

.3 Protect plant material from damage during transportation:

.1 When delivery distance is less than 30 km and vehicle travels at speeds under 80 km/h, tie tarpaulins around plants or over vehicle box.

.2 When delivery distance exceeds 30 km or vehicle travels at speeds over 80 km/h, use enclosed vehicle where practical.

.3 Protect foliage and root balls using anti-desiccants and tarpaulins, where use of enclosed vehicle is impractical due to size and weight of plant material.

.4 Protect stored plant material from frost, wind and sun and as follows:

.1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in sand or topsoil and watering to full depth of root zone.

.2 For pots and containers, maintain moisture level in containers. Heel-in fibre pots.

.3 For balled and burlapped and wire basket root balls, place to protect branches from damage. Maintain moisture level in root zones.

.5 Waste Management and Disposal:

.1 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan (WMP).

.3 Separate for reuse and recycling and place in designated containers Steel, Metal, and Plastic waste in accordance with WMP.

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

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

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

.7 Divert discarded plastic plant containers materials from landfill to plastic recycling facility approved by Consultant.

.8 Dispose of unused fertilizer at official hazardous material collection site approved by Consultant.

.9 Dispose of unused anti-desiccant at official hazardous material collections site approved by Consultant.

.10 Divert unused wood and mulch materials from landfill to recycling, composting facility approved by Consultant.

## 1.8 SCHEDULING

.1 Obtain approval from Consultant of schedule 7 (seven) days in advance of shipment of plant material.

.2 Schedule to include:

.1 Quantity and type of plant material.

.2 Shipping dates.

.3 Arrival dates on site.

.4 Planting dates.

**1.9 WARRANTY**

.1 The Contractor hereby warrants that all plant material as itemized on plant list will remain free of defects for 1 (one) year, one time only providing adequate maintenance has been provided.

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

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

.4 Plant material identified to be relocated shall be exempt from warranty provided proper planting procedures have been executed.

## Part 2 Products

**2.1 PLANT MATERIAL**

.1 Type of root preparation, sizing, grading and quality: comply to Canadian Standards for Nursery Stock 8th Edition – 2006, or latest edition.

.1 Source of plant material: grown in Zone 5a in accordance with Plant Hardiness Zones in Canada.

.2 Plant material must be planted in zone indicated as appropriate for its species.

.3 Plant material in location appropriate for its species.

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

.3 Trees: with straight trunks, well and characteristically branched for species except where specified otherwise.

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

**2.2 WATER**

.1 Free of impurities that would inhibit plant growth.

**2.3 STAKES**

.1 T-bar, steel, 40 x 40 x 2440 mm or wood, pointed one end, 64 x 64 x 2400 mm

**2.4 FLEXIBLE TIES**

~~.1~~ Trees shall be secured to stakes using ARBORTIE.

**2.5 PLANTING SOIL**

.1 For planting of trees and shrubs, mix stockpiled topsoil with 20% to 30% compost.

.2 Incorporate into planting soil bonemeal at a rate of 3 kg/$m^3$ of soil mixture.

**2.6 MULCH**

.1 Bark chip: varying in size from 25 (twenty-five) to 50 (fifty) mm in diameter, from bark of coniferous trees.

**2.7 FERTILIZER**

.1 Synthetic commercial type as recommended by soil test report.

**2.8 ANTI-DESICCANT**

.1 Wax-like emulsion.

**2.9 FLAGGING TAPE**

.1 Fluorescent, pink in colour.

**2.10 SOURCE QUALITY CONTROL**

.1 Obtain approval from Consultant of plant material prior to planting.

.2 Imported plant material must be accompanied with necessary permits and import licenses. Conform to Federal, Provincial or Territorial and Municipal regulations.

## Part 3 Execution

**3.1 PRE-PLANTING PREPARATION**

.1 Ensure plant material acceptable to Consultant.

.2 Remove damaged roots and branches from plant material.

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

**3.2 EXCAVATION AND PREPARATION OF PLANTING BEDS**

.1 Establishment of sub grade for planting beds and tree pits as specified in Section 31 22 13 – Rough Grading.

.2 Preparation of planting beds and tree pits is specified in Section 32 91 19.13 - Topsoil Placement and Grading.

.3 For individual planting holes:

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

.2 Excavate to depth and width as indicated.

.3 Remove subsoil, rocks, roots, debris and toxic material from excavated material that will be used as planting soil for trees and individual shrubs. Dispose of excess material under direction of Consultant.

.4 Scarify sides of planting hole.

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

**3.3 PLANTING**

.1 For jute burlapped root balls, cut away top one third of wrapping and wire basket without damaging root ball. Do not pull burlap or rope from under root ball.

.2 For container stock or root balls in non-degradable wrapping, remove entire container or wrapping without damaging root ball.

.3 Plant vertically in locations as indicated. Orient plant material to give best appearance in relation to structure, roads and walks.

.4 For trees and shrubs:

.1 Backfill soil in 150 mm lifts. Tamp each lift to eliminate air pockets. When two thirds of depth of planting pit has been backfilled, fill remaining space with water. After water has penetrated into soil, backfill to finish grade.

.2 Form watering saucer as indicated.

.5 For ground covers, backfill soil evenly to finish grade and tamp to eliminate air pockets.

.6 Water plant material thoroughly.

.7 After soil settlement has occurred, fill with soil to finish grade.

.8 Dispose of burlap, wire and container material in appropriate bins on site or under direction of Consultant.

## 3.4 TREE SUPPORTS

.1 Install tree supports as indicated.

.2 Use two tree supports for deciduous trees less than 3 m and three tree supports for deciduous trees 3 m and greater. Use three tree supports for all evergreens.

.1 Place stakes on prevailing wind side and 150 mm from trunk.

.2 Drive stake minimum 150 mm into undisturbed soil beneath roots. Ensure stake is secure, vertical and unsplit.

.3 Secure to stakes using two opposing flexible ties.

.3 After tree supports have been installed, remove broken branches with clean, sharp tools.

## 3.5 ACCEPTANCE

.1 Plant material will be accepted by Consultant 90 days after planting operation is completed provided that plant material exhibits healthy growing condition and is free from disease, insects and fungal organisms.

.2 Plant material installed less than 90 days prior to frost will be accepted in following spring, 30 days after start of growing season provided that acceptance conditions are fulfilled. The Landscape Architect may extend the Contractors responsibility for another growing season if bud formation is not sufficient to ensure future growth.

## 3.6 MULCHING

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

.2 Spread mulch as indicated.

## 3.7 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following maintenance operations from time of planting to acceptance by Consultant.

.1 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.

.1 For evergreen plant material, water thoroughly in late fall prior to freeze-up to saturate soil around root system.

.2 Remove weeds monthly or as required.

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

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

.5 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Consultant prior to application.

.6 Remove dead or broken branches from plant material.

.7 Keep trunk protection and guy wires in proper repair and adjustment.

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

## 3.8 MAINTENANCE DURING WARRANTY PERIOD

.1 From time of acceptance by Consultant to end of warranty period, perform following maintenance operations.

.1 Water to maintain soil moisture conditions for optimum growth and health of plant material without causing erosion.

.2 Reform damaged watering saucers.

.3 Remove weeds monthly or as required.

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

.5 For non-mulched areas, cultivate monthly to keep top layer of soil friable.

.6 If required to control insects, fungus and disease, use appropriate control methods in accordance with Federal, Provincial and Municipal regulations. Obtain product approval from Consultant prior to application.

.7 Apply fertilizer in early spring as indicated by soil test.

.8 Remove dead, broken or hazardous branches from plant material.

.9 Keep trunk protection and tree supports in proper repair and adjustment.

.10 Remove trunk protection, tree supports and level watering saucers at end of warranty period.

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

.12 Submit monthly written reports to Consultant identifying:

- .1 Maintenance work carried out.
- .2 Development and condition of plant material.
- .3 Preventative or corrective measures required which are outside Contractor's responsibility.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED SECTIONS

.1 Section 31 23 13 - Rough Grading.
.2 Section 32 91 19.13 - Topsoil Placement and Grading.

### 1.2 SUBMITTALS

.1 Product Data. Submit product data in accordance with General Requirements
  .1 Provide product data for:
    .1 Seed.
    .2 Mulch.
    .3 Tackifier.
    .4 Fertilizer.
  .2 Submit in writing to Consultant 7 (seven) days prior to commencing work:
    .1 Volume capacity of hydraulic seeder in litres.
    .2 Amount of material to be used per tank based on volume.
    .3 Number of tank loads required per hectare to apply specified slurry mixture per hectare.

### 1.3 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
.2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

### 1.4 SCHEDULING

.1 Schedule hydraulic seeding to coincide with preparation of soil surface.
.2 Schedule hydraulic seeding using grass mixtures during local growing season when moisture level is available to ensure germination and growth (April-June, September-October).

## Part 2 Products

### 2.1 MATERIALS

.1 Seed: "Canada pedigreed grade" in accordance with Government of Canada Seeds Act and Regulations.
  .1 Grass mixture: "Certified", "Canada No. 1 Lawn Grass Mixture" in accordance with Government of Canada "Seeds Act" and "Seeds Regulations".
    .1 Mixture composition:
      .1 40 % Kentucky Blue Grass
      .2 40% Creeping Red Fescue.

.3 20% Perennial Ryegrass

.2 Seeding rate: 245 kg/hectare.

.2 Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of germination and growth inhibiting factors with following properties:

.1 Type I mulch:

.1 Made from wood cellulose fibre.

.2 Organic matter content: 95% plus or minus 0.5%.

.3 Value of pH: 6.0.

.4 Potential water absorption: 900%.

.2 Type II mulch:

.1 Made from newsprint, raw cotton fibre and straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.

.3 Tackifier: water dilutable, liquid dispersion, water soluble vegetable carbohydrate powder.

.4 Water: free of impurities that would inhibit germination and growth.

.5 Fertilizer:

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations".

.2 Complete synthetic, slow release with 35% of nitrogen content in water-insoluble form.

.1 2:4:1 80% SCU for spring and early fall planting (6-12-3)

.2 1:4:1 100% SCU for late fall planting (6-24-6)

.6 Inoculants: inoculant containers to be tagged with expiry date.

## Part 3 Execution

### 3.1 WORKMANSHIP

.1 Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.

.2 Clean-up immediately, any material sprayed where not intended, to satisfaction of Consultant.

.3 Do not perform work under adverse field conditions such as wind speeds over 10 (ten) km/h, frozen ground or ground covered with snow, ice or standing water.

.4 Protect seeded areas from trespass until plants are established.

### 3.2 PREPARATION OF SURFACES

.1 Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.

.2 Cultivated areas identified as requiring cultivation to depth of 25mm.

.3 Ensure areas to be seeded are moist to depth of 150mm before seeding.

.4 Obtain Consultant's approval of grade and topsoil depth before starting to seed.

### 3.3 FERTILIZING PROGRAM

.1 Fertilize prior to fine grading incorporating fertilizer equally distributed.

.2 Fertilize during establishment and warranty periods as required and as recommended by soil reports.

## 3.4 PREPARATION OF SLURRY

.1 Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Consultant. Supply equipment required for this work.

.2 Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.

.3 After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

## 3.5 SLURRY APPLICATION

.1 Hydraulic seeding equipment:

.1 Slurry tank.

.2 Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and/or mechanical agitation method.

.3 Capable of seeding by 50 m hand operated hoses and appropriate nozzles.

.2 Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.

.1 Using correct nozzle for application.

.2 Using hoses for surfaces difficult to reach and to control application.

.3 Blend application 300 mm into adjacent grass areas, sodded areas or previous applications to form uniform surfaces.

.4 Re-apply where application is not uniform.

.5 Remove slurry from items and areas not designated to be sprayed.

.6 Protect seeded areas from trespass satisfactory to Consultant.

.7 Remove protection devices as directed by Consultant.

## 3.6 MAINTENANCE DURING ESTABLISHMENT PERIOD

.1 Perform following operations from time of seed application until acceptance by Consultant.

.2 Grass Mixture:

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

.2 Mow grass to 50 mm whenever it reaches height of 70 mm. Remove clippings which will smother grass Consultant.

.3 Fertilize seeded areas after first cutting or 10 weeks after germination provided plants have mature true leafs in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

.4 Control weeds by mechanical means utilizing acceptable integrated pest management practices.

.5 Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

## 3.7 ACCEPTANCE

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

.1 Plants are uniformly established.

.2 Seeded areas are free of rutted, eroded, bare or dead spots.

.3 Areas have been mown at least twice.

.4 Areas have been fertilized.

.2 Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

## 3.8 CLEANING

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

**END OF SECTION**

## Part 1 General

### 1.1 RELATED SECTIONS

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

### 1.2 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

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

.3 Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

### 1.3 SCHEDULING

.1 Schedule sod laying to coincide with preparation of soil surface.

.2 Schedule sod installation when frost is not present in ground.

## Part 2 Products

### 2.1 MATERIALS

.1 Number One Turf Grass Nursery Sod: sod that has been especially sown and cultivated in nursery fields as turf grass crop.

.1 Turf Grass Nursery Sod types:

.1 Number One Kentucky Bluegrass Sod - Fescue Sod: Nursery Sod grown solely from seed mixture of cultivars of Kentucky Bluegrass and Chewing Fescue or Creeping Red Fescue, containing not less than 40% Kentucky Bluegrass cultivars and 30% Chewing Fescue or Creeping Red Fescue cultivar(s).

.2 Number One Named Cultivars: Nursery Sod grown from certified seed.

.2 Turf Grass Nursery Sod quality:

.1 Not more than 2 broadleaf weeds or 10 other weeds per 40 square metres.

.2 Density of sod sufficient so that no soil is visible from height of 1500 mm when mown to height of 50 mm.

.3 Mowing height limit: 35 to 65 mm.

.4 Soil portion of sod: 6 to 15 mm in thickness.

.2 Water:

.1 Supplied by Contractor.

.3 Fertilizer:

.1 To Canada "Fertilizers Act" and "Fertilizers Regulations".

.2 Complete, synthetic, slow release with 65 % of nitrogen content in water-insoluble form.

**2.2 SOURCE QUALITY CONTROL**

.1 Obtain approval from Consultant of sod at source.

.2 When proposed source of sod is approved, use no other source without written authorization from Consultant.

## Part 3 Execution

**3.1 PREPARATION**

.1 Verify that grades are correct and prepared in accordance with Section 32 91 19.13 - Topsoil Placement and Grading. If discrepancies occur, notify Consultant and do not commence work until instructed by Consultant.

.2 Do not perform work under adverse field conditions such as frozen soil, excessively wet soil or soil covered with snow, ice, or standing water.

.3 Fine grade surface free of humps and hollows to smooth, even grade, elevations indicated, to tolerance of plus or minus 8 mm, for Turf Grass Nursery Sod and plus or minus 15 mm for Commercial Grade Turf Grass Nursery, surface to drain naturally.

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

**3.2 SOD PLACEMENT**

.1 Lay sod within 24 hours of being lifted if air temperature exceeds 20 degrees C.

.2 Lay sod sections in rows, joints staggered. Butt sections closely without overlapping or leaving gaps between sections. Cut out irregular or thin sections with sharp implements.

.3 Roll sod as directed by Consultant. Provide close contact between sod and soil by light rolling. Use of heavy roller to correct irregularities in grade is not permitted.

**3.3 SOD PLACEMENT ON SLOPES AND PEGGING**

.1 Start laying sod at bottom of slopes.

.2 Peg sod on slopes steeper than 3 horizontal to 1 vertical, within 1 m of catch basins and within 1 m of drainage channels and ditches to following pattern:

- .1 100 mm below top edge at 200 mm on centre for first sod sections along contours of slopes.
- .2 Not less than 3-6 pegs per square metre.
- .3 Not less than 6-9 pegs per square metre in drainage structures. Adjust pattern as directed by Consultant.
- .4 Drive pegs to 20 mm above soil surface of sod sections.

**3.4 FERTILIZING PROGRAM**

.1 Fertilize during establishment and warranty periods as required.

**3.5 MAINTENANCE DURING ESTABLISHMENT PERIOD**

.1 Perform following operations from time of installation until acceptance.

.2 Water sodded areas in sufficient quantities and at frequency required to maintain optimum soil moisture condition to depth of 75 to 100 mm.

.3 Cut grass to 50 mm when or prior to it reaching height of 75 mm. Remove clippings which will smother grassed areas as directed by Consultant.
.4 Maintain sodded areas 95% weed free.
.5 Fertilize areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

**3.6 ACCEPTANCE**

.1 Turf Grass Nursery Sod areas will be accepted by Consultant provided that:
  .1 Sodded areas are properly established.
  .2 Sod is free of bare and dead spots.
  .3 No surface soil is visible from height of 1500 mm when grass has been cut to height of 50 mm.
  .4 Sodded areas have been cut minimum 2 times prior to acceptance.
.2 Areas sodded in fall will be accepted in following spring one month after start of growing season provided acceptance conditions are fulfilled.

**3.7 CLEANING**

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

**END OF SECTION**

# 1 General

## 1.1 RELATED WORK

.1 Section 01 33 00 – Submitted Procedures.

.2 Section 31 23 16.26 – Rock Removal.

.3 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

.4 Section 31 32 19.01 - Geotextiles.

.5 Section 33 31 13 – Public Sanitary Utility Sewerage Piping.

## 1.2 REFERENCES

.1 ASTM A48-83, latest revision, Specification for Grey Iron Castings.

.2 ASTM C478M, latest revision, Specification for Precast Reinforced Concrete Manhole Sections.

.3 ASTM D 1557, latest revision, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2700 kN-m/m$^3$).

.4 CAN/CSA-A5, latest revision, Portland Cement.

.5 CAN/CSA-A23.1, latest revision, Concrete Materials and Methods for Concrete Construction.

.6 CAN/CSA-G30.18, latest revision, Billet Steel Bars for Concrete Reinforcement.

## 1.3 MATERIAL CERTIFICATION

.1 Upon request of Consultant, submit manufacturer's test data and certification.

.2 Certification, date of manufacture and name or trademark of the manufacturer to be marked on manholes and catch basin.

## 1.4 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

## 2 Products

### 2.1 MATERIALS

.1 Precast manhole units: to ASTM C478M, circular. Top sections flat top type with opening offset. Units are to have rubber gaskets at both the inlets and outlet or as indicated in detail drawings. Monolithic bases to be approved by Consultant.

.2 Joints: to be made watertight using rubber rings and bituminous compound.

.3 Mortar:
- .1 Aggregate: to CSA A82.56.
- .2 Cement: to CAN/CSA-A8.

.4 Adjusting rings:
- .1 For fixed frame and covers: manhole adjusting rings.
- .2 For adjustable frame and covers: Not applicable

.5 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 Grey iron castings: to ASTM A48, strength class 30B. Ductile Iron Castings: to ASTM A536 65-45-12.
- .3 Castings: coated with two applications of asphalt varnish, sand blasted or cleaned and ground to eliminate surface imperfections.
- .4 Storm manhole and catch basin frames and grates: minimum 136 kg per set.
- .5 Sanitary manhole frame and covers: minimum 202 kg per set; Bibby Ste-Croix/Laperle Adjustable Frame and Cover, Model # C-50 M1/Autostable. Cover cast without perforations and complete with four 25 mm square lifting holes.

.8 Bedding: Type 1 fill as indicated in Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.9 Geotextile: Refer to Section 31 32 19.01 - Geotextiles.

.10 Sprayed Polyurethane Insulation: 150 mm thick as indicated on Drawings.

.11 Styrofoam SM Insulation: As defined in Section 33 31 13.

.12 Access Hatch for lift station’s wet well: as indicated on Drawings.

.13 Waterproof Foundation Membrane: Blueskin WP200 or approved equal.

.14 Modular Seals: Nitrile rubber resistant to oils, fuel and solvents. To be Model “O” LINK-SEAL Modular Seal or approved equal.

## 3 Execution

### 3.1 EXCAVATION AND BACKFILL

.1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling and as indicated.

.2 Obtain approval of Consultant before installing manholes or catch basins.

### 3.2 CONCRETE WORK

.1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

### 3.3 INSTALLATION

.1 Construct units in accordance with details indicated, plumb and true to alignment and grade.

.2 Dewater excavation to approval of Consultant and remove soft and foreign material before placing concrete base.

.3 Set precast concrete base on 150 mm minimum of granular bedding compacted to 95% maximum density to ASTM D1557.

.4 For sanitary sewer precast units:
- .1 Set bottom section of precast unit in Type 1, 2 or 4 material.
- .2 Make section joints watertight with rubber ring gaskets and bituminous compound.
- .3 Plug lifting holes with precast plugs set in cement mortar or mastic compound.
- .4 Wrap completed unit with geotextile with an overlap of 600 mm.
- .5 Wrap joints with 0.9 m wide waterproof foundation membrane.

.5 Compact granular backfill to 95% maximum density to ASTM D1557.

.6 Set frame and cover to required elevation on either concrete risers (max. 300 mm) and/or rubber “Flex-O-Rings” adjustment rings (max. 75 mm, min. 25 mm) for storm manholes and pro-rings for sanitary manholes.

.7 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

### 3.4 LEAKAGE TEST

.1 Install watertight plugs or seals on inlets and outlets of each new sanitary sewer manhole and fill manhole up to highest level of concrete (including concrete risers) with water. Leakage not to exceed 0.3% per hour of volume of manhole.

.2 If permissible leakage is exceeded, correct defects. Repeat until acceptable to Consultant.

.3 Consultant will issue Test Certificate for each manhole passing test.

**END OF SECTION**

# 1 General

## 1.1 RELATED WORK

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 31 23 16.26 – Rock Removal.

.3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## 1.2 REFERENCES

.1 ANSI/AWWA C153/A21.53, latest revision, Standard for Ductile-Iron Compact Fittings.

.2 ANSI/AWWA B300, latest revision, Water Treatment - Hypochlorites.

.3 ANSI/AWWA B301, latest revision, Water Treatment - Liquid Chlorine.

.4 ANSI/AWWA C509, latest revision, Gate Valves for Water and Sewage Systems.

.5 ANSI/AWWA C600, latest revision, Standard for Installation of Ductile-Iron Water Mains and their Appurtenances.

.6 ANSI/AWWA C800, latest revision, Underground Service Line Valves and Fittings.

.7 ANSI/AWWA C900, latest revision, Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch for Water Distribution.

.8 ASTM B62, latest revision, Specification for Composition Bronze or Ounce Metal Castings.

.9 ASTM B88M, latest revision, Specification for Seamless Copper Water Tube.

.10 ASTM A307, latest revision, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.11 ASTM C136, latest revision, Method for Sieve Analysis of Fine and Coarse Aggregates.

.12 ASTM C117, latest revision, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.13 ASTM C478M, latest revision, Specification for Precast Reinforced Concrete Manhole Sections.

.14 ASTM D1557, latest revision, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2700 kN-m/m$^3$).

.15 CAN/CGSB-8.2, latest revision, Sieves Testing, Woven Wire, Metric.

.16 CGSB 1-GP-12c, latest revision, Standard Paint Colours.

.17 CAN/CGSB-1.59, latest revision, Alkyd, Exterior Gloss Enamel.

.18 CAN/CSA-A8, latest revision, Masonry Cement.

.19 CSA A82.56, latest revision, Aggregate for Masonry Mortar.

.20 CAN/ULC-S520, latest revision, Standard for Fire Hydrants.

.21 ANSI/NSF 14 Plastics Piping System Components and Related Materials.

.22 ANSI/NSF Standard 61: Drinking Water System Components – Health Effects.

.23 ASTM F1483 Standard Specification for Oriented Poly(Vinylchloride), PVCO, Pressure Pipe (PR 200psi).

.24 AWWA C909: Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inch Through 24 Inch (100 mm Through 600 mm) for Water Distribution.

.25 BNQ NQ 3660-950 Safety of Products and materials in Contact with Drinking Water.

.26 CSA B137.3.1 Molecularly Oriented Polyvinylchloride (PVCO) Pipe for Pressure Applications (PR 1620kPa).

.27 FM 1612 Polyvinyl Chloride (PVC) Pipe and Fittings for Underground Fire Protection Services (PC 150psi, 4” through 12”).

## 1.3 SAMPLES

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

.2 Inform Consultant of proposed source of bedding and surround materials and provide access for sampling at least 2 weeks prior to commencing work.

## 1.4 MATERIAL CERTIFICATION

.1 Upon request of Consultant, submit manufacturer's test data and certification.

.2 Certification to be marked on pipe.

## 1.5 SHOP DRAWINGS

.1 Submit shop drawings and product data for all materials to be installed in accordance with Section 01 33 00 – Submittal Procedures.

## 1.6 SCHEDULING OF WORK

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions to Consultant for approval and adhere to interruption schedule as approved by Consultant.

.3 Notify Consultant and affected residents minimum of 24 h in advance of any interruption in service.

.4 Do not interrupt water service for more than 3 h and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.

.5 Notify fire department of any planned or accidental interruption of water supply to hydrants.

.6 Advise local police department of anticipated interference with movement of traffic.

## 2 Products

### 2.1 PIPE, JOINTS AND FITTINGS

.1 PVC Pipes

.1 Polyvinyl chloride pressure pipe DR 18: to ANSI/AWWA C900, pressure class 235, 1 MPa gasket bell end, cast iron outside diameter and to be CSA approved. Pipes are to be capped at both ends upon delivery.

.2 Molecularly Oriented Polyvinyl Chloride (PVCO) pressure pipe meeting the requirements of the latest CSA Standard B137.1 and AWWA Standard C909. PVCO shall be produced with cast-iron-pipe outside diameters (CIOD) in all sizes; 100 mm – 300 mm dia. PVCO pipe wall shall meet minimum thickness requirements for AWWA C909 Pressure Class 235 PSI (PC235). PVCO pipe shall be joined by means of integral-bell elastomeric-gasket joints confirming to ASTM D3139. Spigot ends shall be chamfered by manufacture. Pipe ends shall be capped at the production facility prior to storage and shipping. Manufactured by IPEX Inc. under the trade name “Bionax”.

.3 PVC injection molded gasketed fittings (100 mm to 300 mm ø for PVC pipe): Fittings shall conform to AWWA C907 “Polyvinyl Chloride (PVC) Pressure Fittings for water (100 mm to 300 mm)” and by certified to CSA B137.2 “PVC Injection Molded Gasketed Fittings for Pressure Applications”.

### 2.2 VALVES AND VALVE BOXES

.1 150 mm Diameter

.1 Valves to open counter clockwise.

.2 Gate valves: to ANSI/AWWA C509, standard iron body, resilient seat, to include valve box centering wheel, cast iron wedge vulcanized with rubber compound, valves with non-rising stems, suitable for 1 MPa with mechanical joints. Valves to be "Mueller", "Clow" or “A.V.K.”. The “Mueller” 350 PSI resilient wedge A-2361 (reduced wall body) gate valve to AWWA C515 is also acceptable.

.3 Valve boxes: valve box type to be a "Mueller MVB" composite valve box or Bibby Ste-Croix. Top of box to be marked “WATER”.

.2 400 mm Diameter

.1 Supplied by Owner.

**2.3 SERVICE CONNECTIONS**

.1 Service tubing acceptable products:

.1 Copper tubing: to ASTM B88M, type K, annealed.

.2 PVC tubing: to ASTM F876 and CSA B137.5. Acceptable materials: Municipex by Rehau and Blue 904 SDR9 by Ipex.

.2 Copper tubing joints: compression type suitable for 1 MPa working pressure.

.3 Brass corporation stops: Mueller 300 Ball Type Corporation Stop-Model / B-25008N or Cambridge Brass Ball Main Stops Series 301 – Model / 301 NL-A3H3.

.4 Brass curb stops: Mueller 300 Ball Curb Valve – Model / B-25209N or Cambridge Brass Ball Curb Stops Series 202 – Model / 202NL – H3H3. Curb stops to have adjustable bituminous coated cast iron service box with stainless steel stem and stainless cotter pin. Top of cast iron box marked .WATER.

.5 Service tapped couplings: to AWWA C907 and CSA B137.3.

.6 Service Saddle (For Bleeder Assembly only): Robar 2506 Cast D.I. Service Saddle with Double Stainless Steel Straps.

**2.4 HYDRANTS**

.1 Post type hydrants: compression type hydrant, to CAN/ULC-S250, designed for working pressure of 1150 kPa with two 65 mm threaded hose outlets, one 100 mm threaded pumper connection, 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main. Hydrants to open counter clockwise, threads to local standard. Provide metal caps and chains. Hydrant laterals are to have at least 2.4 m of cover over the top of the pipe.

.2 Hydrant paint: red exterior enamel to CAN/CGSB-1.59.

.3 Hydrants to be Clow, A.V.K. or Mueller (Super Centurion) and are to have drain holes plugged.

**2.5 PIPE BEDDING AND SURROUND MATERIAL**

.1 Type 1 fill as indicated in Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.

## 2.6 BACKFILL MATERIAL

.1 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

## 2.7 PIPE DISINFECTION

.1 Sodium hypochlorite, calcium hypochlorite, liquid chlorine to ANSI/AWWA B300 and ANSI/AWWA B301 to disinfect water mains.

## 2.8 MECHANICAL RESTRAINTS

.1 For C-900 PVC Pipe

Use “Uni-flange Series 1300”, “All Grip Series 3600”, “Megalug Series 2000 PV”, “Ford UFR 1500 Circle Lock”, “SIP EZ-Grip” or “StarGrip 4000 Series” for restraining mechanical joint fitting with P.V.C. piping. Use “Clow” restrainers “Series 1350”, “Uni-flange Series 1350C” or “StarGrip Series 1100C and 1200C” to anchor PVC pipe bell to PVC pipe. Use “Clow” restrainers “Series 1360” or “Uni-flange Series 1360C to restrain C-900 PVC fittings to C-900 PVC pipe.

.2 For C-909PVC Pipe (Bionax)

For pipe-to-pipe and pipe-to-fitting restrainers, use the Bionax PVCO Approved Restraints list below:

PVCO Pipe to PVC Fitting 100 mm (4”) to 300 mm (12”)
- Clow 360c
- Ebaa 2600
- Sigma PV-Lok PWPF
- Star PVC 3500PF
- Star 1200G2 Series
- Star 9200 Series
- Uni-Flange Series UFR 1369

PVCO Pipe Standard Bell-and-Spigot Push-On Joints 100 mm (4”) to 300 mm (12”)
- Clow 390c
- Ebaa 1900
- Sigma PV-Lok PWP
- Star PVC 3500C Series
- Star 1100G2 Series
- Star 9100 Series
- Uni-Flange Series UFR 1399
- Uni-Flange 1559

PVCO Pipe to Mechanical-Joint Fitting 100 mm (4") to 300 mm (12")

Clow 300c
Clow Tyler Dual Wedge Tuf Grip
Clow Typer Tuf Grip
Ebaa 19MJ00
Sigma PWM
Sigma One-Lok SLC
Star PVC 3500 Series
Star PVC 4000 Series
Star PVC 4000G2 Series
Star 1000G2 Series
Star 9000 Series
Uni-Flange 1309
Uni-Flange 1500

.3 For Ductile Iron Pipe

Approved materials: One-Lok by SIGMA, TUFGrip Dual Wedge by Clow, 1100 series by Ebaa Iron, series 3000 and 3100 by Star Pipe Products, UNI Flange series 1300, 1390 by Ford.

## 2.9 CATHODIC PROTECTION

.1 All copper services, hydrant, valves and mechanical restraints will require cathodic protection.

.1 Packaged zinc anodes will include a backfill material as outlined below:

Anode Backfill (Composition by Volume)

| | |
|---|---|
| - Gypsum | 77% |
| - Bentonite | 15% |
| - Anhydrous Sodium Sulphate | 8% |

.2 Packaged zinc anodes to be installed as follows:

| Item | Anode Type |
|---|---|
| Copper services / hydrant laterals | Z-24-48 |
| Uncoated fittings (up to 400 mm ø)/valves | Z-12-24 |

## 2.10 TRANSITION COUPLINGS

.1 "Smith-Blair", "Dresser", "Robar" or "J.CM." couplings are to be used.

## 2.11 RIGID INSULATION

.1 Rigid Insulation: Type 4 as per CAN/ULC S701.

.2 Thermal Resistance: 0.88 RSI minimum as per ASTM C518.

.3 Compressive Strength: 275 kPa (40 psi) minimum as per ASTM D1621.

**2.12 WATER METER**

.1 Water meter to be installed on incoming 2" water line inside controller cabinet. Installation to be coordinated with splash pad equipment installation

.2 Water meter to be Neptune T-10 meter with direct reading or approved equal.

## 3 Execution

**3.1 PREPARATION**

.1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects to approval of Consultant. Remove defective materials from site as directed by Consultant.

**3.2 TRENCHING**

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Trench depth to provide cover over pipe of not less than 2.4 m from finished grade or as indicated.

.3 Trench alignment and depth require Consultant's approval prior to placing bedding material and pipe.

**3.3 CONCRETE BEDDING AND ENCASEMENT**

.1 Concrete bedding and encasement is to be used when spacing between pipes (one over the other) is less than 300 mm.

.2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete. Place concrete to details as indicated or as directed by Consultant.

.3 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.4 Do not backfill over concrete within a minimum of 8 h after placing or until consultants approval.

## 3.4 GRANULAR BEDDING

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to at least 90% maximum density to ASTM D1557.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling with compacted type 3 fill approved by Consultant or Type 1 material as directed by Consultant.

## 3.5 PIPE INSTALLATION

.1 Lay PVC pipes to ANSI/AWWA C605, to manufacturer's standard instructions and specifications. Do not use blocks except as permitted in 3.3.3.

.2 Join pipes in accordance with ANSI/AWWA C605 and manufacturer's recommendations.

.3 Bevel or taper ends of PVC pipe to match fittings.

.4 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.5 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.

.6 Face socket ends of pipe in direction of laying. For mains on a grade of 2% or greater, face socket ends up-grade.

.7 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.8 Keep jointing materials and installed pipe free of dirt and water and other foreign materials. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.9 Position and join pipes with equipment and methods approved by Consultant.

.10 Cut pipes in an approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.11 Align pipes carefully before jointing.

.12 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.13 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed or contaminated shall be removed, cleaned, lubricated and replaced before jointing is attempted again.

.14 Complete each joint before laying next length of pipe.

.15 Minimize deflection after joint has been made.

.16 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.17 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Consultant.

.18 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.19 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.20 Do not lay pipe on frozen bedding.

.21 Prior to testing, a minimum cover of 1.3 m is required over the entire system being tested.

.22 Do leakage test and have results approved by Consultant.

.23 Backfill remainder of trench.

## 3.6 VALVE INSTALLATION

.1 Install valves to manufacturer’s recommendations at locations as indicated.

.2 Support valves located in valve boxes or valve chambers by means of either concrete or wood blocks, located between valve and solid ground. Bedding same as adjacent pipe. Valves not to be supported by pipe.

## 3.7 SERVICE CONNECTIONS

.1 Construct service connections at right angles to watermain unless otherwise directed. Locate curb stops 300 mm inside right-of-way.

.2 Tappings on PVC pipe to be PVC service tapped couplings.

.3 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.

.4 Tap main at 3:00 o'clock or 9:00 o'clock position only; not closer to a joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater.

.5 Leave corporation stop valves fully open.

.6 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.

.7 Install curb stop with corporation box on services NPS 2 or less in diameter. Equip larger services with a gate valve and cast iron box. Set box plumb over stop and adjust top flush with final grade elevation. Leave curb stop valves fully closed.

.8 Connect new service pipe to existing service pipe at property line with proper couplings.

## 3.8 HYDRANTS

.1 Install hydrants at locations as indicated.

.2 Install hydrants in accordance with AWWA Manual of Practice.

.3 Install 150 mm gate valve and MVB valve box on hydrant service leads as indicated.

.4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.

.5 Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.

.6 Drain holes are to be plugged.

.7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

.8 Once contract work has been substantially completed, contractor is to pump water out of all newly installed hydrants.

## 3.9 THRUST BLOCKS

.1 Thrust block can be precast or poured in place.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Consultant.

.3 Keep joints and couplings free of concrete.

.4 Bearing area of thrust blocks to be as indicated on drawings.

.5 Do not backfill over poured concrete within a minimum of 8 h after placing or until consultant's approval.

## 3.10 MECHANICAL RESTRAINTS

.1 Restrainers to be installed as per manufacturer's recommendations and consultant's approval.

## 3.11 PIPE SURROUND

.1 Upon completion of pipe laying and after Consultant has inspected work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material directly over the pipes.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Do not place material in frozen condition.

.5 Compact each layer from pipe invert to underside of backfill to at least 90% maximum density to ASTM D1557.

## 3.12 BACKFILL

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D1557. In other areas, compact to at least 90% maximum density to ASTM D1557.

## 3.13 LEAKAGE TESTING

.1 Provide labour, equipment and materials required to perform leakage tests hereinafter described.

.2 Notify Consultant at least 24 h in advance of all proposed tests. Perform tests in presence of Consultant.

.3 Where any section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.4 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Consultant.

.5 Prior to testing, a minimum of 1.3 m of compacted backfill must be placed over the piping to be tested.

.6 Open valves.

.7 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of test and seal holes with plugs. If there are any air release valves on the section to be tested, ball valve between air release valve and main to be closed prior to testing.

.8 Apply a leakage test pressure of 1050 kPa, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 h.

.9 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 h.

.10 Do not exceed allowable leakage of 0.015 L/mm diameter per 300 m of pipe, including lateral connections, per hour. If test section is greater than 365 m, the length used in this formula to calculate allowable leakage will remain at 365 m.

.11 Locate and repair defects if leakage is greater than amount specified.

.12 Repeat test until leakage is within specified allowance for full length of watermain.

## 3.14 FLUSHING AND DISINFECTING

.1 Contractor is to submit a flushing plan to Consultant for review and approval prior to flushing operations.

.2 Flushing and disinfecting operations shall be witnessed by Consultant. Notify Consultant at least 4 days in advance of proposed date when disinfecting operations will commence.

.3 Flush water mains through available outlets with a sufficient flow of potable water to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear.

.4 Flushing flows shall be as follows:

| Pipe Size NPS | Flow (L/s) Minimum |
|---|---|
| 6 and below | 38 |
| 8 | 75 |
| 10 | 115 |
| 12 | 150 |

.5 Provide connections and pumps for flushing as required.

.6 Open and close valves, hydrants and service connections to ensure thorough flushing.

.7 When flushing has been completed to satisfaction of Consultant, introduce a strong solution of chlorine as approved by Consultant into watermain and ensure that it is distributed throughout entire system.

.8 Disinfect water mains to AWWA C651.

.9 Rate of chlorine application to be proportional to rate of water entering pipe.

.10 Chlorine application to be close to point of filling water main and to occur at same time.

.11 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.12 Flush line to remove chlorine solution after 24 h.

.13 Measure chlorine residuals at extreme end of pipe line being tested.

.14 Perform bacteriological tests on water main, after chlorine solution has been flushed out. Take samples at service connections daily for minimum of two days. Should contamination remain or recur during this period, repeat disinfecting procedure.

.15 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.16 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 h. After 24 h, further samples shall be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

## 3.15 SURFACE RESTORATION

.1 After installing and backfilling over water mains, restore surface to original condition as directed by Consultant.

**END OF SECTION**

# 1 General

## 1.1 RELATED WORK

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 03 30 00 – Cast-In-Place Concrete.

.3 Section 31 23 16.26 – Rock Removal.

.4 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

.5 Section 33 05 13 - Manholes and Catch Basin Structures.

## 1.2 REFERENCES

.1 ASTM C117, latest revision, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.

.2 ASTM C136, latest revision, Method for Sieve Analysis of Fine and Coarse Aggregates.

.3 ASTM D1557, latest revision, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (2700 kN-m/$m^3$).

.4 ASTM D3034, latest revision, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and fittings.

.5 CAN/CSA-B182.2, latest revision, PVC Sewer Pipe and Fittings (PSM Type).

.6 CSA B182.11, latest revision, Recommended Practice for the Installation of Plastic Drain and Sewer Pipe and Pipe Fittings.

.7 CAN/CGSB-8.2, latest revision, Sieves Testing, Woven Wire, Metric.

## 1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 01 00 02 – Standard General Requirements.

## 1.4 SAMPLES

.1 Submit samples in accordance with Section 01 00 02 – Standard General Requirements.

.2 Inform Consultant at least 2 weeks prior to commencing work, of proposed source of bedding materials and provide access for sampling.

## 1.5 MATERIAL CERTIFICATION

.1 Upon request of Consultant, submit manufacturer's test data and certification.

.2 Certification to be marked on pipe.

**1.6 SCHEDULING OF WORK**

.1 Schedule work to minimize interruptions to existing services and to maintain existing sewage flows during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

.3 Notify Consultant and affected residents a minimum of 24 h in advance of any interruption in service.

**2 Products**

**2.1 PLASTIC PIPE**

.3 Type PSM Polyvinyl Chloride (PVC): to CAN/CSA-B182.2.
- .1 Standard Dimensional Ratio (SDR): 35 and 26.
- .2 Locked-in gasket and integral bell system.
- .3 Nominal lengths: 4 m and 6m.

.2 Polyethylene Pipe (HDPE):
- .1 Material designation to ASTM D3350 Type PE 4710 (Iron pipe size (IPS)).
- .2 Density: to ASTM D-1505, 0.960 gm/cm$^3$.
- .3 Melt Density: to ASTM D1238, 0.05 gm/10min
- .4 Tensile Strength: ASTM D638, greater than 3400 psi.
- .5 Vicat softening temperature: to ASTM D1525, 256 Fahrenheit degrees.
- .6 Standard dimensional ratio (S.D.R.): as defined on Drawings.
- .7 Joints: Butt fusions or electrofusion couplings.

**2.3 TRANSITION COUPLINGS**

.1 Use “Fernco” transition couplings and/or approved eccentric reducer bushings when connecting PVC pipe to other pipe types.

**2.4 PIPE BEDDING AND SURROUND MATERIALS**

.1 Type 1 fill as per Section 31 23 33.01 - Excavation, Trenching and Backfilling.

.4 Concrete mixes and materials for cradles, encasement, supports: to Section 03 30 00 - Cast-in-Place Concrete.

**2.5 BACKFILL MATERIAL**

.1 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

**2.6 RIGID INSULATION**

.1 Rigid Insulation: Type 4 as per CAN/ULC S701

.2 Thermal Resistance: 0.88 RSI minimum as per ASTM C518.

.3 Compressive Strength: 275 kPa (40 psi) minimum as per ASTM D1621.

**2.7 THRUST BLOCKS**

.1 Concrete: as defined in Section 03 30 00.

.2 Dimensions: as defined on Drawings.

## 3 Execution

**3.1 PREPARATION**

.1 Clean and dry pipes and fittings before installation.

.2 Obtain Consultant's approval of pipes and fittings prior to installation.

**3.2 TRENCHING**

.1 Do trenching work in accordance with Section 31 23 33.01 - Excavating, Trenching 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 Consultant prior to placing bedding material and pipe.

**3.3 CONCRETE BEDDING AND ENCASEMENT**

.1 Concrete bedding and encasement is to be used when spacing between pipes (one over the other) is less than 150 mm.

.2 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete. Place concrete to details indicated or as directed by Consultant.

.3 Position pipe on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.4 Do not backfill over concrete within a minimum of 8 h after placing or until Consultant's approval.

**3.4 GRANULAR BEDDING**

.1 Place bedding in unfrozen condition.

.2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipe.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 90% maximum density to ASTM D1557.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or piping with compacted bedding material (Type 1, 2 or 4).

**3.5 INSTALLATION**

.1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Consultant.

.2 Handle pipe using methods approved by Consultant. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 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.

.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipe during construction, except as may be permitted by Consultant. Inlets to existing system are to be sealed before the start of work and are to remain until work is completed including flushing and video inspection.

.7 Whenever work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Install plastic pipe and fittings in accordance with CSA B182.11.

.9 Pipe jointing:

.3 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.4 Align pipes before joining.

.5 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.6 Avoid contaminating gaskets with dirt or other foreign material. Gaskets so contaminated shall be cleaned and lubricated before joining is attempted.

.7 Complete each joint before laying next length of pipe.

.8 Minimize joint deflection after joint has been made to avoid joint damage.

.9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.

.10 When any stoppage of work occurs, block pipes as directed by Consultant to prevent creep during down time.

.11 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.

.12 Make watertight connections to manholes. Use shrinkage compensating grout when suitable gaskets are not available.

.13 Use prefabricated PVC tees approved by Consultant, for connecting pipes to existing sewer pipes. Joints to be structurally sound and watertight.

.14 Contractor shall use a laser to set horizontal and vertical alignments of piping. Any section having more than 3 mm in deviation shall be removed and reinstalled.

## 3.6 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated.

.3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material directly over the pipes.

.4 Place layers uniformly and simultaneously on each side of pipe.

.5 Compact each layer from pipe invert to underside of backfill to at least 90% maximum density to ASTM D1557.

## 3.7 THRUST BLOCKS

.1 Restrain bends, tees and fittings using concrete thrust blocks as indicated.

.2 Keep pipe couplings free of concrete.

.3 Bearing area of thrust blocks to be as indicated.

.4 Do not backfill over cast-in-place concrete within a minimum of 8 hrs or until Consultant’s approval.

## 3.8 BACKFILL

.1 Place backfill material in unfrozen condition.

.2 Place backfill material, above pipe surround in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.

.3 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D1557. In other areas, compact to at least 90% maximum density to ASTM D1557.

## 3.9 FIELD TESTING OF FORCEMAIN

.1 Testing of force main to be carried out in presence of Consultant.

.2 Ensure that all fittings have been properly braced to prevent movement when test pressure is applied.

.3 Expel air from force main, by slowly filling main with water. High points to be drilled and tapped and suitable cocks installed to vent air and to be shut when pressure is applied. Remove cocks after satisfactory completion of test and seal holes with tight fitting plugs.

.4 Apply leakage test pressure of 690 kPa based on elevation of lowest point in line and corrected to elevation of test gauge for leakage test.

.5 Apply pressure for 2 h for leakage test.

.6 Define leakage as amount of water supplied from water storage tank, in order to maintain test pressure for 2 h.

.7 Do not exceed allowable leakage as determined by the following formula:

$$L = \frac{ND\sqrt{P}}{130{,}400}$$

Where:

L = allowable leakage, in litres per hour
N = number of joints in the length of pipeline tested
D = nominal diameter of the pipe, in millimetres
P = average test pressure during the leakage test, in kPa.

.8 Locate and repair defects if leakage is greater than amount specified in item 3.10.7.

.9 Repeat test until leakage is within specified allowance for full length of force main.

.10 Complete backfill.

.11 Leakage test not to exceed 365 metres of piping at one time. If test section is greater than 365 metres, the number of joints use in this formula to calculate allowable leakage will remain at the number based on 365 metres.

## 3.10 FIELD TESTING OF SEWER MAIN

.1 Repair or replace pipe, pipe joint or bedding found defective.

.2 When directed by Consultant, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction. Plug must be tied at both ends so it can be pulled from either end in case of blockage.

.3 Remove foreign material from sewers and related appurtenances by using a power flusher.

.4 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.

.5 Do infiltration and exfiltration testing as specified herein and as directed by Consultant. Perform tests in presence of Consultant. Notify Consultant 24 h in advance of proposed tests.

.6 Carry out tests on each section of sewer between successive manholes including service connections.

.7 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.

.8 Water Test.

.1 Exfiltration test:

.9 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 h to ensure absorption in pipe wall is complete before test measurements are commenced.

.10 Immediately prior to test period add water to pipeline until there is a 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.

.11 Duration of exfiltration test: 2 h.

.12 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.

.2 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 commence and during this time, keep thoroughly wet at least one third of pipe invert perimeter.

.13 Prevent damage to pipe and bedding material due to flotation and erosion.

.14 Place 90□ V-notch weir, or other measuring device approved by Consultant in invert of sewer at each manhole.

.15 Measure rate of flow over minimum of 1 h, with recorded flows for each 5 min interval.

.3 Infiltration and exfiltration: not to exceed following limits in L per hour per 100 m of pipe, including service connections.

| Nominal Pipe diameter in mm | PVC pipe |
|---|---|
| 100 | 3.88 |
| 125 | 4.62 |
| 150 | 5.51 |
| 200 | 7.45 |
| 250 | 9.39 |
| 300 | 11.33 |
| 350 | 13.27 |
| 400 | 14.91 |
| 450 | 16.84 |
| 500 | 18.78 |
| 550 | 20.72 |
| 600 | 22.80 |
| 700 | 26.53 |
| 800 | 30.11 |
| 900 | 33.69 |
| 1000 | 37.56 |
| 1100 | 41.29 |
| 1200 | 45.01 |

Values shown in column 2 are in litres per hour per 100 metres of pipe.

.9 Air testing for PVC pipes:

.1 Carry out all tests in the presence of the Engineer. Notify him 48 hours in advance.

.2 Provide all labour, equipment and material required to do air leakage test on pipes.

.3 For pipe less than 1200 mm in diameter, do test between 2 successive manholes.

.4 Test is satisfactory if the time for pressure to drop from 25 kPa to 18 kPa (3.6 psi to 2.6 psi) does not exceed values in following Table.

**TIME REQUIRED FOR LOSS OF PRESSURE**
**from 25 kPa to 18 kPa for size and length indicated**

| Diameter, mm | Minimum Time, min:s | Length for Minimum Time, m | Time for Longer Lengths, s |
|---|---|---|---|
| 100 | 1:53 | 180 | 0.62 x length (m) |
| 150 | 2:50 | 120 | 1.40 x length (m) |
| 200 | 3:47 | 90 | 2.49 x length (m) |
| 250 | 4:43 | 70 | 3.89 x length (m) |
| 300 | 5:40 | 60 | 5.61 x length (m) |
| 375 | 7:05 | 50 | 8.76 x length (m) |
| 450 | 8:30 | 40 | 12.62 x length (m) |
| 525 | 9:55 | 35 | 17.18 x length (m) |
| 600 | 11:20 | 30 | 22.43 x length (m) |

NOTE: Table is intended for use in testing pipe in either dry or wet condition. If groundwater is higher than invert of pipe, adjust internal pressure to counter balance the external pressure:

- 1 m of groundwater above pipe, apply 34.7 kPa and allow to drop to 27.7 kPa
- 2 m of groundwater above pipe, apply 44.4 kPa and allow to drop to 37.4 kPa
- 4 m of groundwater above pipe, apply 63.8 kPa and allow to drop to 56.8 kPa
- interpolate for heights between 1, 2 and 4 m.

.5 Testing Procedures: (Air Tests)

.1 Isolate one section between two manholes.

.2 Slowly let air inside pipe section up to 27.6 kPa (4.0 psi) above average groundwater pressure; but, do not allow pressure to build up above 41.1 kPa (6.0 psi) in any case (unless groundwater is applying external pressure).

.3 Wait minimum of two minutes for air stabilization pressure inside pipe.

.4 Adjust pressure to 25 kPa (3.6 psi).

.5 Measure time required for pressure to drop by 7 kPa (1.02 psi), which means down to 18 kPa (2.6 psi).

**NOTE: If waiting period is greater than allowable and pressure has not dropped to prescribed level, then test is satisfactory.**

.6 While applying internal pressure **EXTREME CARE SHOULD BE TAKEN TO BRACE PLUGS PROPERLY. NO PERSONNEL IS ALLOWED IN MANHOLES DURING ANY TESTS.**

.10 Repair and retest sewer line as required, until test results are within limits specified.

.11 Repair visible leaks regardless of test results.

.12 Closed Circuit Television Inspections:

.1 Contractor will carry out inspection of installed sewers by closed circuit television camera, and Consultant is to be present during inspections.

.2 Contractor will carry out flushing of installed sewers by high powered flusher.

.3 Flushing of sewers to be performed prior to video inspection.

.4 Self-contained camera and monitoring unit of size that shall permit passage through a 150 mm to 1200 mm diameter pipe.

.5 Camera shall have a self-contained, self-propelled, remotely controlled lighting system capable of illuminating the interior of the sewer line for inspection. Distance in metres must always be displayed on video.

.6 Picture quality shall be such to produce a continuous 600 line resolution colour picture showing the entire pipe periphery.

.7 Vehicle must be large enough to accommodate at least two people for viewing the monitor while inspection is in progress.

.8 Written report along with video are to show a clean and properly installed system.

.9 WATER PONDING IN GRAVITY SEWERS that cannot be eliminated by flushing and cleaning will be considered as evidence of pipe settlement. One hundred percent (100%) of the sewers will be video inspected. Any and all defects such as water ponding, leaking joints, sags, improper grade or alignment, deflection in excess of 8%, obstructions, etc. shall be cause for rejection and such defects must be repaired by the Contractor at no expense to the Owner. Any costs for revideo of sewer mains required to inspect repaired defects will be at the Contractor's expense.

.10 A second video inspection will be made by the Contractor ten (10) months after the date of substantial completion. Contractor is to provide a written report of both inspections along with a copy of each video.

**END OF SECTION**

## Part 1 General

### 1.1 RELATED REQUIREMENTS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

### 1.2 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 pipes and include product characteristics, performance criteria, physical size, finish and limitations.

### 1.3 DELIVERY, STORAGE AND HANDLING

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

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations.

.2 Store and protect pipes from damage.

.3 Replace defective or damaged materials with new.

## Part 2 Products

### 2.1 HDPE AND PP PIPE

.1 Polyethylene profile pipe (HDPE) for storm sewers: to ASTM D2306, ASTM F477 and CSA B182.8.

.1 Pipe joint: to ASTM D477 and CSA B182.8.

.2 Fittings: to ASTM D2306 and CSA B182.8.

.3 Pipes to have soil tight gaskets.

.4 Acceptable material: “N-12 ST IB (320 kPa) by ADS and “Solflomax”, Type 1 (320 kPa) by Soleno Inc.

### 2.2 GRANULAR BEDDING

.1 Type 1 fill as indicated in Section 31 23 33.01 – Excavation, Trenching and Backfilling.

**2.3 BACKFILL MATERIAL**

.1 Type 3 fill, in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

**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 pipe culvert installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Consultant of unacceptable conditions immediately upon discovery. Proceed with installation only after unacceptable conditions have been remedied.

**3.2 PREPARATION**

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

**3.3 TRENCHING**

.1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

.2 Obtain Consultant's approval of trench line and depth prior to placing bedding material or pipe.

**3.4 BEDDING**

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.

.2 Place 150 mm minimum thickness of approved granular material on bottom of excavation and compact to 90% minimum of maximum density to ASTM D1557.

.3 Shape bedding to fit lower segment of pipe exterior so that width of at least 95% of pipe diameter is in close contact with bedding, free from sags or high points.

.4 Compact each layer full width of bedding to at least 90% maximum density to ASTM D1557 up to underside of sub-base or backfill material.

.5 Place bedding in unfrozen condition.

## 3.5 INSTALLATION

.1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Consultant.

.2 Handle pipe using methods approved by Consultant. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipes during construction except as may be permitted by Consultant.

.7 Install plastic pipe and fittings in accordance with CSA B182.11.

.8 Joints:

- .1 Support pipes with hand slings or crane as required to minimize lateral pressure and maintain concentricity until pipe is properly positioned.
- .2 Align pipes before joining.
- .3 Maintain pipe joints free from mud, silt, gravel and other foreign material.
- .4 Wrap each pipe joint with a strip of geotextile 600 mm wide and with an overlap of 600 mm.
- .5 Avoid contaminating gaskets with dirt or other foreign material. Gaskets so contaminated shall be cleaned and lubricated 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 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer’s recommendations.

.9 Contractor shall use a **laser** to set horizontal and vertical alignments of piping. Any section having more than 3 mm in deviation shall be removed and reinstalled.

## 3.6 BACKFILLING

.1 Backfill around and over culverts as indicated or as directed by Consultant.

.2 Place backfill material above pipe surround in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.

.3 Compact each layer to 95% maximum density to ASTM D1557 taking special care to obtain required density under haunches.

.4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross.

.1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

.5 Place backfill in unfrozen condition.

## 3.7 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.

**END OF SECTION**

# APPENDIX A

BUTTERNUT TREES MITIGATION
MEMORANDUM

# Memorandum

**Date :** September 2, 2021

**To /Destinataire :**

Jim Sackville

**Project /Projet :**

**KKSRP – Butternut Mitigation for Construction Specs**

**From /Expéditeur :**

**Jon Burtt**
**Roy Consultants**

**File /Référence :** 493-18-4

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**B** For your review /Pour votre revue
**E** For construction /Pour construction

Please include the following mitigation measures related to the management of Butternut within the KKSRP construction limits.

**Live Butternut to remain**:

- Contractors will be made aware of the presence of Butternut and the requirements of the Canadian *Species at Risk Act;*
- Butternut trees are identified with high-visibility flagging tape and tree paint.
- Protection buffers must be established around each Butternut to remain, based on the live crown width (i.e. a tree with a 4 m crown should have a protection buffer of 4m on the ground). This protection buffer is a "no go zone" for heavy machinery.
- Butternut protection buffers will be marked on the ground using high-visibility paint, which will be applied prior to construction in the area of each tree and refreshed as necessary.
- Site supervisor to ensure compliance with this requirement.

**Butternut Removal:**

- Only those Butternut trees identified in the SARA permit are to be removed; if a contractor suspects the discovery of a Butternut not in the SARA permit that requires removal, advise the project management team immediately. Do not remove the tree until approval granted.
- **Where possible, Butternut wood that is suitable for carpentry or ceremonial uses is to be set aside and the Project Manager, Dana Francis, advised.**
- All Butternut slash and unusable wood to be buried or incinerated on site;
- Equipment that comes in contact with Butternut wood or slash is to be disinfected using a bleach or other disinfectant before leaving the work area, to prevent the spread of Butternut Canker.

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# APPENDIX B

GEOTECHNICAL STUDY
FINAL REPORT

ROY CONSULTANTS

ENGINEERING SERVICES D'INGÉNIERIE

# Geotechnical Study
## Final Report

Kciw Knicanewek Sports and Recreation Park
EVOQ Architecture (Phase 2)
Tobique First Nation, NB

Our File No.: 493-18-04-C
July 31, 2021

## Prepared for:

Mr. Dana Francis
**Walastokwik NeGoot - Gook**
**(Maliseet First Nation at Tobique)**
13094, Route 105
Tobique First Nation, NB  E7H 3Y4

## Prepared by:

ROY CONSULTANTS

July 31, 2021

Mr. Dana Francis
**Walastokwik NeGoot - Gook**
**(Maliseet First Nation at Tobique)**
13094, Route 105
Tobique First Nation, NB  E7H 3Y4

**Our File No.: 493-18-04-C**[1]

Dear Mr. Francis:

**Subject: Preliminary Geotechnical Investigation**
**Kciw Knicanewek Sports and Recreation Park**
**Tobique First Nation, New Brunswick**

We are pleased to present you with this FINAL report for the above-mentioned project.

We would like to thank you for your business. Please do not hesitate to contact us should you require further information or assistance.

Yours truly,

**Dylan Hachey, EIT**
CIVIL Engineer-in-Training

**Sylvain Comeau, M.A.Sc., P.Eng.**
CIVIL Engineer
ENV.-GEO. Manager

DH/SC/mh

Enc.

[1] Ref.: Y:\2018\493-18 \498-18-04\C\Geotechnical\Geotechnical Report\493-18-04 Geotechnical Investigation (July 31, 2021) DH

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# 1 INTRODUCTION

## 1.1 Section

Roy Consultants was mandated by Walastokwik NeGoot – Gook (Maliseet First Nation at Tobique) to investigate soil conditions for the new Sports and Recreation Park in Tobique First Nation, New Brunswick (PID 65040297). This site is located on or near a former dump site, west of Reservoir Road and north of Dump Road.

This mandate is for Phase 2 of the project, planned for 2021, which will include the following components of the park: water and sewer services, the construction of an additional unpaved parking lot, a park centre, an ice rink, a lift station and a service building.

The service building slab elevation is expected to be 124.55 m. The park centre building slab elevation is expected to be 119.50 m. The ice hockey rink slab is expected to be 119.40 m. The parking lots final grade elevation ranges between 118.50 m and 119.60 m. If final site conditions vary from the information provided in this report, the author of this report will be advised in order to modify final recommendations included herein.

This report was written by Dylan Hachey, EIT, and reviewed by Sylvain Comeau, P.Eng.

# 2 SOIL INVESTIGATION

Fieldwork was performed June 23, 2021. The geotechnical investigation consisted of eight (8) test pits. All fieldwork was supervised by a Roy Consultants technologist.

## 2.1 Test Pits

All eight (8) test pits were performed using a Link-Belt 145X3 excavator. Refer to the enclosed location plan for test pit locations. Test pits were completed to a depth of 0.80 m to 2.60 m.

Test pits revealed the following soil layers.

**Table No. 1: Test Pit Soil Layers**

| TEST PITS | ELEVATION (m) | SOIL LAYERS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | DEPTHS (m) | | | | | | |
| | | Backfill: Silty Sand, Some Gravel | Topsoil | Sand, Some Silt, Traces of Clay and Gravel | Sandy Gravel, Some Silt, Traces of Clay | Sandy Silt, Some to Traces of Gravel and Clay | Silty Sandy Gravel, Traces of Clay | End of Test Pits on Bedrock |
| TP-1 | 124.569 | | 0.00-0.20 | | | | 0.20-2.20 | 2.20 |
| TP-2 | 120.209 | | 0.00-0.30 | | 0.30-0.60 | | 0.60-1.70 | 1.70 |
| TP-3 | 118.333 | | 0.00-0.25 | | | | 0.25-2.60 | 2.60 |
| PT-4 | 117.502 | | 0.00-0.20 | | | 0.20-1.30 | 1.30-1.90 | 1.90 |
| TP-5 | 118.082 | | 0.00-0.25 | | | 0.25-1.30 | 1.30-1.60 | 1.60 |
| TP-6 | 116.296 | | 0.00-0.30 | | | 0.30-1.70 | 1.70-2.40 | 2.40 |
| TP-7 | 118.173 | | 0.00-0.30 | | | | 0.30-2.00 | 2.00 |
| TP-8 | 123.190 | 0.00-0.15 | 0.15-0.35 | 0.35-0.80 | | | | 0.80 |
| Soil Density or Bedrock Quality | | | | | Compact | Firm | Compact | |

## 2.2 Groundwater

Short-term groundwater conditions were observed in the test pits. The following table presents the depths of observed groundwater.

**Table No. 2: Short-Term Groundwater Conditions**

| Test Pits | Observed Groundwater Depth (m) | Groundwater Elevation (m) |
|---|---|---|
| TP-1 | No groundwater observed | |
| TP-2 | No groundwater observed | |
| TP-3 | 2.60 | 115.733 |
| TP-4 | 1.90 | 115.602 |
| TP-5 | No groundwater observed | |
| TP-6 | 2.30 | 113.996 |
| TP-7 | No groundwater observed | |
| TP-8 | No groundwater observed | |

Groundwater was generally driven by bedrock. It is important to note that groundwater conditions can vary according to precipitation and seasons. Groundwater levels during construction may differ from observations during fieldwork.

## 2.3 Laboratory Program

All soil samples were visually assessed for classification by a civil engineer-in-training. Soil classification followed methods described in ASTM D2488. Soil samples will be stored at our laboratory facility in Bathurst for six (6) months unless otherwise instructed in writing by the client. Three (3) samples, TP-1 SA-3, TP-2 SA-3 and TP-3 SA-4, of this material were analyzed for particle size distribution and water content.

The following sections present a description of various soil layers encountered in the test pits. Detailed test pit log reports and laboratory reports are enclosed.

Backfill

A layer of backfill was encountered at the surface of TP-8. This layer consisted of silty sand with some gravel. The thickness of the backfill layer was 0.15 m.

Topsoil

A layer of topsoil was present at the surface of TP-1 to TP-7. Topsoil was also encountered under the backfill layer in TP-8. The thickness of the topsoil layer ranged between 0.20 m to 0.30 m.

Sand

A layer of sand was encountered under the topsoil layer in TP-8. This material consisted of sand with some silt and traces of clay and gravel. The thickness of the sand layer was 0.45 m.

Sandy Gravel

A layer of sandy gravel was encountered under the topsoil layer in TP-2. This layer consisted of sandy gravel with some silt and traces of clay. The thickness of the silty sand layer was 0.30 m.

Sandy Silt

A layer of sandy silt was encountered in TP-4, TP-5 and TP-6 underneath the topsoil layer. This layer consisted of sandy silt with some to traces of gravel and clay. The thickness of the sandy silt layer ranged between 1.05 m to 1.40 m.

Silty Sandy Gravel

A layer of silty sandy gravel was encountered under the topsoil layer in TP-1, TP-3 and TP-7. It was also encountered under the sandy gravel layer in TP-2, and under the sandy silt layer in TP-4, TP-5 and TP-6. This layer consisted of silty sandy gravel with traces of clay. The thickness of the layer ranged between 0.30 m and 2.35 m.

Three (3) samples, TP-1 SA-3, TP-2 SA-3 and TP-3 SA-4, of this material were analyzed for particle size distribution and water content. Laboratory results indicated the following fractions:

- Gravel: 36.8% to 54.1%;
- Sand: 22.7% to 30.5%;
- Silt and Clay: 23.2% and 32.7%;
- Natural Water Content: 11.1% and 18.1%.

Bedrock

Bedrock was encountered in all test pits. Bedrock was encountered between depths of 0.80 m and 2.60 m.

## 2.4 Survey

Roy Consultants surveyed the location and elevation of each test pit. All elevations stated in this report are geodetic. Test pits identified TP-1 to TP-8 are shown on the enclosed location plan.

# 3 GEOTECHNICAL RECOMMENDATIONS

## 3.1 Parking Lot

### 3.1.1 Common Excavation, Subgrade and Undercut

The parking lot will be constructed north of TP-3. Subgrade materials in the area on site consist of silty sandy gravel with some clay. We recommend removing all topsoil materials, and excavating to the subgrade line in all areas of the proposed parking lot.

If backfill and/or organics are present, we recommend undercutting under the subgrade line to remove all organic materials, backfill materials and debris/waste in the area of the parking lot. If undercutting is required, structural fill material will be required to reach the subgrade elevation. We recommend using Borrow B material up to 300 mm below the subgrade elevation. This material would be placed and compacted in maximum lifts of 300 mm to a dry density of at least 92% of the maximum modified Proctor dry density as per ASTM D1557. The final 300 mm lift to reach subgrade elevation shall consist of granular sub-base or Borrow A material as per Article 121 of the New Brunswick Department of Transportation and Infrastructure (NBDTI) *Standard Specifications for Highway Construction* to grade to the subgrade profile. This material would be placed and compacted in maximum lifts of 300 mm to a dry density of at least 92% of the maximum modified Proctor dry density as per ASTM D1557.

We recommend the bottom of the excavation shall be proof rolled. Any noticeable instabilities when proof rolling shall be removed or repaired. Proof rolling shall be supervised by a geotechnical engineer licensed to practise in New Brunswick.

### 3.1.2 Parking Lot Structure

We recommend that the parking lot structure be constructed with the following layers:

- Aggregate sub-base shall consist of 300 mm of pit run gravel, crushed gravel or screened gravel free of particles larger than 100 mm. This material will be compacted to 95% of the maximum modified Proctor dry density as per ASTM D1557;
- Aggregate base shall consist of 300 mm of 31.5 mm crushed gravel. This material will be compacted to 95% of the maximum modified Proctor dry density as per ASTM D1557.

Granular base and granular subbase shall meet the requirements of the NBDTI *Standard Specifications for Highway Construction* (latest edition).

## 3.2 Underground Services

### 3.2.1 Trench Excavation and Backfill

The following table presents the infrastructure excavation – water main, storm sewer manholes and lift station – depths that will be installed at the locations of test pits.

**Table No. 3: Infrastructure Excavation Depth**

| Test Pits | Excavation Depth (m) | Type of Structure |
|---|---|---|
| TP-1 | 2.50 | Storm Sewer Manhole |
| TP-2 | 5.75 | Lift Station |
| TP-7 | 2.50 | Storm Sewer Manhole |
| TP-8 | 2.75 | Water Main |

Temporary excavation slopes shall meet the requirements of the *New Brunswick Regulation 91-191 (O-0.2) under the Occupational Health and Safety Act (O.C. 91-1035)* Section Part XIII – Excavation and Trenches. Where instabilities are noted, trench walls can be stabilized by tapered slope and/or supported excavation walls.

Based on our observations, groundwater infiltration is not to be expected during excavation work. However, during construction, measures shall be taken to prevent water from entering the excavation. The bottom of excavation materials shall be maintained dry and stable to a minimum thickness of 500 mm.

Based on the test pits, bedrock excavation will be required in all or the majority of areas for the underground services installation. Bedrock excavation may require the use of a hydraulic hammer or blasting.

The width of excavation at its base will be sufficient to allow installation of underground infrastructure and compaction of the surrounding bedding materials.

## 3.3 Concrete Pad

### 3.3.1 Excavation and Subgrade

The ice rink will be constructed in the vicinity of TP-4, TP-5 and TP-6. The pads proposed elevation is 119.40 m. We recommend removing all topsoil materials in the vicinity of the pad. Due to the elevation difference between the existing grades and proposed grade of the pad, structural fill will be required to reach the subgrade line. We recommend using Borrow B material as per Article 121 of NBDTI's *Standard Specifications for Highway Construction* up to 300 mm below the subgrade elevation. This material would be placed and compacted in maximum lifts of 300 mm to a dry density of at least 92% of the maximum modified Proctor dry density as per ASTM D1557. The final 300 mm lift to reach subgrade elevation shall consist of granular sub-base or Borrow A material as per Article 121 of NBDTI's *Standard Specifications for Highway Construction* to grade to the subgrade profile. This material would be placed and compacted in maximum lifts of 300 mm to a dry density of at least 95% of the maximum modified Proctor dry density as per ASTM D1557.

### 3.3.2 Structure

We recommend that the concrete pad be constructed with the following layers:

- Insulation shall be installed at subgrade elevation to protect against frost penetration. Insulation must be designed to be equivalent to 1.80 m of soil cover protection against frost;

- Aggregate sub-base shall consist of 450 mm of pit run gravel, crushed gravel or screened gravel free of particles larger than 100 mm. This material will be compacted to 95% of the maximum modified Proctor dry density as per ASTM D1557;
- Aggregate base shall consist of 150 mm of 31.5 mm crushed gravel. This material will be compacted to 98% of the maximum modified Proctor dry density as per ASTM D1557.

## 3.4 Service Building

### 3.4.1 Excavation and Backfill

The service building will be constructed in the vicinity of TP-1. All topsoil materials shall be excavated and removed from the area of the slab and footings. The proposed slab elevation for the service building is approximately 124.55 m; therefore, the underside of the footings will be approximately 122.5 m. Therefore, excavation for the footings and slab shall reach the bedrock layer.

Temporary excavation slopes shall meet the requirements of the *New Brunswick Regulation 91-191 (O-0.2) under the Occupational Health and Safety Act (O.C. 91-1035)* Section Part XIII – Excavations and Trenches. Where instabilities are noted, trench walls can be stabilized by tapered slopes and/or supported excavation walls.

Based on the test pits, bedrock excavation will be required in order to reach 300 mm below footings of the building. The bedrock slope under footings shall not be greater than 3.0 horizontal to 1.0 vertical within the first metre directly under the footings. Bedrock excavation may require the use of a hydraulic hammer.

Based on our observations, groundwater infiltration is not expected during excavation work. However, during construction, any water shall be redirected away from the work area to maintain the bottom of excavation materials dry and stable to a minimum depth of 0.5 m.

The bottom of excavations shall be horizontal and exempt of boulders and cobbles larger than 150 mm. We recommend that a geotechnical engineer or a qualified representative on the engineer's behalf approve the bottom of excavations.

If required, structural backfill between the bottom of excavations and 300 mm below the proposed slab shall consist of 100 mm calibre pit run, screen gravel and/or crushed stone (aggregate sub-base) as per Article 201 of the NBDTI *Standard Specifications for Highway Construction* (latest edition). This material will be placed in maximum lifts of 300 mm compacted to a dry density of at least 95% of the maximum modified Proctor dry density as per ASTM D1557. **Sandstone sub-base is not considered acceptable for structural backfill.**

We recommend placing a 300 mm-thick bedding layer of crushed rock (aggregate base) as per Article 201 of the NBDTI *Standard Specifications for Highway Construction* (latest edition) underneath the slab and footings. All materials must be compacted to a dry density of at least 95% of the maximum modified Proctor Dry Density as per ASTM D1557. However, if all interior and exterior footings are resting on bedrock, the 300 mm-thick bedding layer cushion can be exempted.

### 3.4.2 Foundation Design

If all preceding conditions are followed, footings would be resting on the bedding above bedrock. The design of the foundation when resting on bedding above bedrock can be calculated using a serviceability limit state-bearing capacity of 500 kPa. Total and differential settlements under this load would be negligible (less than 5 mm). The bearing capacity is defined as the maximal stress that can be applied on in-situ soils at a specified depth.

To promote drainage, we recommend final grades be sloped away from the structure and foundation drains be placed at footing elevation. Backfill surrounding foundation walls shall consist of 100 mm calibre pit run as per Article 201 of the NBDTI Standard Specifications for Highway Construction (latest edition) to a minimum width of 600 mm. This material would be placed and compacted in maximum lifts of 300 mm to a dry density of at least 95% of the maximum modified Proctor Dry Density as per ASTM D1557 in all areas where structural elements would be in contact with the building, e.g. paved areas.

The minimum thickness of soil cover for adequate frost protection is 1.80 m above the underside of the footing in relation to the finish grade. Areas where the bottom of footing is not protected with 1.80 m of soil cover would require insulation to prevent damage due to frost heave.

The site classification for seismic response is Site Class C.

## 3.5 Park Centre Building

### 3.5.1 Excavation and Backfill

The park centre will be constructed in the vicinity of TP-3 and TP-4. All topsoil materials and backfill materials shall be excavated and removed from the area of the slab and footings. The proposed slab elevation for the service building is approximately 119.5 m; therefore, the underside of the footings will be approximately 117.5 m. Therefore, excavation for the footings and slab shall reach the silty sandy gravel layer in TP-3, and the sandy silt layer in TP-4.

Temporary excavation slopes shall meet the requirements of the *New Brunswick Regulation 91-191 (O-0.2) under the Occupational Health and Safety Act (O.C. 91-1035)* Section Part XIII – Excavations and Trenches. Where instabilities are noted, trench walls can be stabilized by tapered slopes and/or supported excavation walls.

Based on our observations, groundwater infiltration may be expected during excavation work. During construction, any water shall be redirected away from the work area to maintain the bottom of excavation materials dry and stable to a minimum depth of 0.5 m.

The bottom of excavations shall be horizontal and exempt of boulders and cobbles larger than 150 mm. We recommend that a geotechnical engineer or a qualified representative on the engineer's behalf approve the bottom of excavations.

Where required, structural backfill between the bottom of excavations and 150 mm below the proposed slab shall consist of 100 mm calibre pit run, screen gravel and/or crushed stone (aggregate sub-base) as per Article 201 of the NBDTI *Standard Specifications for Highway Construction* (latest edition). This material will be placed in maximum lifts of 300 mm compacted

to a dry density of at least 95% of the maximum modified Proctor dry density as per ASTM D1557. **Sandstone sub-base is not considered acceptable for structural backfill.**

We recommend placing a 150 mm-thick bedding layer of crushed rock (aggregate base) as per Article 201 of the NBDTI *Standard Specifications for Highway Construction* (latest edition) underneath the slab and footings. All materials must be compacted to a dry density of at least 95% of the maximum modified Proctor Dry Density as per ASTM D1557.

### 3.5.2 Foundation Design

If all preceding conditions are followed, footings would be resting on the bedding above either the silty sandy gravel layer in TP-3 or the sandy silt layer in TP-4. The design of the foundation when resting on bedding above these layers can be calculated using a serviceability limit state-bearing capacity of 150 kPa. Total and differential settlements under this load would be less than 25 mm. The bearing capacity is defined as the maximal stress that can be applied on in-situ soils at a specified depth.

To promote drainage, we recommend final grades be sloped away from the structure and foundation drains be placed at footing elevation. Backfill surrounding foundation walls shall consist of 100 mm calibre pit run as per Article 201 of the NBDTI Standard Specifications for Highway Construction (latest edition) to a minimum width of 600 mm. This material would be placed and compacted in maximum lifts of 300 mm to a dry density of at least 95% of the maximum modified Proctor Dry Density as per ASTM D1557 in all areas where structural elements would be in contact with the building, e.g. paved areas.

The minimum thickness of soil cover for adequate frost protection is 1.80 m above the underside of the footing in relation to the finish grade. Areas where the bottom of footing is not protected with 1.80 m of soil cover would require insulation to prevent damage due to frost heave.

The site classification for seismic response is Site Class C.

# 4 CLOSURE

This report was prepared by Roy Consultants for the exclusive use of Walastokwik NeGoot – Gook (Maliseet First Nation at Tobique) to present the observations and findings of the geotechnical investigation. This report was prepared in accordance with generally accepted geotechnical engineering practice. The data contained herein may not be republished or relied upon for any other purpose or by any other third party without the express written notice of the author.

Observations and findings presented in this report are based on information collected during the field exploration and laboratory testing program. The conclusion presented in this report represents our interpretation of field conditions based on subsurface conditions observed within test pits and/or test pits at the locations and time these were performed. If conditions encountered during subsequent work differ from those described herein, the conclusion of this report should be reevaluated by Roy Consultants.

# 5 REFERENCES

ASTM D1557-12: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft$^3$ (2,700 kN-m/m$^3$))

ASTM D2488 - 09a: Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)

CANADIAN FOUNDATION ENGINEERING MANUAL. 2006. Fourth Edition, Canadian Geotechnical Society, 488 p.

DTI STANDARD SPECIFICATIONS for HIGHWAY CONSTRUCTION. 2015. Province of New Brunswick Publication, 706 p.

# APPENDICES

# APPENDIX A

## Appendix A – Location Plan

R-SV

H-GPS

R-SV

R-SV

TP-3
ELEV. 118.333

R-SV

TP-2
ELEV. 120.209

TP-8
ELEV. 123.190

PARKING A 24
CARS

TP-1
ELEV. 124.569

W/L

R-SV

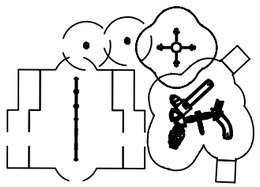
H-GPS

TP-4
ELEV. 117.502

TP-5
ELEV. 118.082

TP-7
ELEV. 118.173

TP-6
ELEV. 116.296



A DETAIL No
No DU DETAIL
B LOCATION DRAWING No
SUR DESSIN No
C DRAWING No
DESSIN No



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| No. | date | revisions | by/par |
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project/projet 493-18-4

design by/design par

check by/verifie par

scale/echelle N.T.S.

date 28/06/2021

drawn by/dessine par

title/titre TEST PIT LOCATION

No.:

rev. A

# APPENDIX B

## Appendix B – Test Pit Log Reports

# TEST PIT LOG REPORT

CLIENT MALISEET FIRST NATION AT TOBIQUE

LOCATION KCIW KNICANEWEK SPORT & RECREATION PARK, TOBIQUE, NB

DATE JUNE 23, 2021 WATER DEPTH N/A

PAGE 1 OF 1

PROJECT No. 493-18-04

TEST PIT No. TP-1

ABBREVIATIONS
SA : SIEVE ANALYSIS
WC : WATER CONTENT

FIELD TESTS AND OBSERVATIONS
FVST : FIELD VANE SHEAR TEST
▼ : WATER LEVEL

STATE OF SAMPLE
DISTURBED ☒ NOT SAMPLED ☐

ELEVATION
☒ GEODETIC
☐ LOCAL GRID

| ELEV. (M) | DEPTH (M) | SOIL DESCRIPTION | STRATA PLOT | WATER LEVEL | STATE OF SAMPLE | SAMPLE NO. | COMMENTS |
|---|---|---|---|---|---|---|---|
| 124.569 | 0 | TOPSOIL | | | | SA-1 | |
| | 0.20 | SILTY SANDY GRAVEL, SOME CLAY, BROWN | | | ☒ | SA-2 | COMPACT<br>SA & WC (18.1%) |
| | 0.70 | | | | ☒ | SA-3 | COMPACT |
| | 1 | | | | | | |
| | 1.70 | | | | ☒ | SA-4 | COMPACT |
| | 2 | | | | | | |
| | 2.20 | END OF TEST PIT AT 2.20 m (REFUSAL ON BEDROCK) | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | | | | | | |
| | 7 | | | | | | |

supervised by D.C drawn by D.H checked by S.C date 25/06/21 rev. 0

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# TEST PIT LOG REPORT

CLIENT MALISEET FIRST NATION AT TOBIQUE

LOCATION KCIW KNICANEWEK SPORT & RECREATION PARK, TOBIQUE, NB

DATE JUNE 23, 2021 WATER DEPTH N/A



PROJECT No. 493-18-04

TEST PIT No. TP-2

ABBREVIATIONS
SA : SIEVE ANALYSIS
WC : WATER CONTENT

FIELD TESTS AND OBSERVATIONS
FVST : FIELD VANE SHEAR TEST
▼ : WATER LEVEL

STATE OF SAMPLE
DISTURBED ☒ NOT SAMPLED ☐

ELEVATION
☒ GEODETIC
☐ LOCAL GRID

| ELEV. (M) | DEPTH (M) | SOIL DESCRIPTION | STRATA PLOT | WATER LEVEL | STATE OF SAMPLE | SAMPLE NO. | COMMENTS |
|---|---|---|---|---|---|---|---|
| 120.209 | 0 | TOPSOIL | | | | SA-1 | |
| | 0.30 | SANDY GRAVEL, SOME SILT, TRACES OF CLAY, BROWN/RED | | | ☒ | SA-2 | COMPACT |
| | 0.60 | SILTY SANDY GRAVEL, TRACES OF CLAY, BROWN | | | ☒ | SA-3 | FIRM<br>SA & WC (16.6%) |
| | 1 | | | | | | |
| | 1.30 | | | | ☒ | SA-4 | FIRM |
| | 1.70 | END OF TEST PIT AT 1.70 m (REFUSAL ON BEDROCK) | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | | | | | | |
| | 7 | | | | | | |

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# TEST PIT LOG REPORT

CLIENT MALISEET FIRST NATION AT TOBIQUE

LOCATION KCIW KNICANEWEK SPORT & RECREATION PARK, TOBIQUE, NB

DATE JUNE 23, 2021 WATER DEPTH 2.6 m

PAGE 1 OF 1

PROJECT No. 493-18-04

TEST PIT No. TP-3

ABBREVIATIONS
SA : SIEVE ANALYSIS
WC : WATER CONTENT

FIELD TESTS AND OBSERVATIONS
FVST : FIELD VANE SHEAR TEST
▼ : WATER LEVEL

STATE OF SAMPLE
DISTURBED ☒ NOT SAMPLED ☐

ELEVATION
☒ GEODETIC
☐ LOCAL GRID

| ELEV. (M) | DEPTH (M) | SOIL DESCRIPTION | STRATA PLOT | WATER LEVEL | STATE OF SAMPLE | SAMPLE NO. | COMMENTS |
|---|---|---|---|---|---|---|---|
| 118.333 | 0 | TOPSOIL | | | | SA-1 | |
| | 0.25 | SILTY SANDY GRAVEL, TRACES OF CLAY, BROWN | | | | SA-2 | FIRM |
| | 0.60 | | | | | | |
| | 1 | | | | | SA-3 | FIRM |
| | 1.10 | | | | | | |
| | 1.80 | | | | | SA-4 | COMPACT<br>SA & WC (11.1%) |
| | 2 | | | | | | |
| | 2.60 | END OF TEST PIT AT 2.60 m (REFUSAL ON BEDROCK) | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | | | | | | |
| | 7 | | | | | | |

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# TEST PIT LOG REPORT

CLIENT MALISEET FIRST NATION AT TOBIQUE

LOCATION KCIW KNICANEWEK SPORT & RECREATION PARK, TOBIQUE, NB

DATE JUNE 23, 2021 WATER DEPTH 1.9 m



PROJECT No. 493-18-04

TEST PIT No. TP-4

ABBREVIATIONS
SA : SIEVE ANALYSIS
WC : WATER CONTENT

FIELD TESTS AND OBSERVATIONS
FVST : FIELD VANE SHEAR TEST
▼ : WATER LEVEL

STATE OF SAMPLE
DISTURBED NOT SAMPLED

ELEVATION
☒ GEODETIC
☐ LOCAL GRID

| ELEV. (M) | DEPTH (M) | SOIL DESCRIPTION | STRATA PLOT | WATER LEVEL | STATE OF SAMPLE | SAMPLE NO. | COMMENTS |
|---|---|---|---|---|---|---|---|
| 117.502 | 0 | TOPSOIL | | | | SA-1 | |
| | 0.20 | SANDY SILT, SOME TO TRACES OF GRAVEL AND CLAY, BROWN | | | | SA-2 | FIRM |
| | 1 | | | | | SA-3 | FIRM |
| | 1.30 | SILTY SANDY GRAVEL, TRACES OF CLAY, BROWN | | | | SA-4 | COMPACT |
| | 1.90 | END OF TEST PIT AT 1.90 m (REFUSAL ON BEDROCK) | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | | | | | | |
| | 7 | | | | | | |

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# TEST PIT LOG REPORT

CLIENT MALISEET FIRST NATION AT TOBIQUE

LOCATION KCIW KNICANEWEK SPORT & RECREATION PARK, TOBIQUE, NB

DATE JUNE 23, 2021 WATER DEPTH N/A



PROJECT No. 493-18-04

TEST PIT No. TP-5

ABBREVIATIONS

SA : SIEVE ANALYSIS

WC : WATER CONTENT

FIELD TESTS AND OBSERVATIONS

FVST : FIELD VANE SHEAR TEST

▼ : WATER LEVEL

STATE OF SAMPLE

DISTURBED ☒ NOT SAMPLED ☐

ELEVATION

☒ GEODETIC

☐ LOCAL GRID

| ELEV. (M) | DEPTH (M) | SOIL DESCRIPTION | STRATA PLOT | WATER LEVEL | STATE OF SAMPLE | SAMPLE NO. | COMMENTS |
|---|---|---|---|---|---|---|---|
| 118.082 | 0 | TOPSOIL | | | | SA-1 | |
| | 0.25 | SANDY SILT, SOME TO TRACES OF GRAVEL AND CLAY, BROWN | | | | SA-2 | FIRM |
| | 1 | | | | | SA-3 | FIRM |
| | 1.30 | SILTY SANDY GRAVEL, TRACES OF CLAY, BROWN | | | | SA-4 | COMPACT |
| | 1.60 | END OF TEST PIT AT 1.60 m (REFUSAL ON BEDROCK) | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | | | | | | |
| | 7 | | | | | | |

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# TEST PIT LOG REPORT

CLIENT MALISEET FIRST NATION AT TOBIQUE

LOCATION KCIW KNICANEWEK SPORT & RECREATION PARK, TOBIQUE, NB

DATE JUNE 23, 2021 WATER DEPTH 2.3 m



PROJECT No. 493-18-04

TEST PIT No. TP-6

ABBREVIATIONS
SA : SIEVE ANALYSIS
WC : WATER CONTENT

FIELD TESTS AND OBSERVATIONS
FVST : FIELD VANE SHEAR TEST
▼ : WATER LEVEL

STATE OF SAMPLE
DISTURBED ☒ NOT SAMPLED ☐

ELEVATION
☒ GEODETIC
☐ LOCAL GRID

| ELEV. (M) | DEPTH (M) | SOIL DESCRIPTION | STRATA PLOT | WATER LEVEL | STATE OF SAMPLE | SAMPLE NO. | COMMENTS |
|---|---|---|---|---|---|---|---|
| 116.296 | 0 | TOPSOIL | | | | SA-1 | |
| | 0.30 | SANDY SILT, SOME TO TRACES OF GRAVEL AND CLAY, BROWN | | | | SA-2 | FIRM |
| | 1 | | | | | | |
| | 1.30 | | | | | SA-3 | FIRM |
| | 1.70 | SILTY SANDY GRAVEL, TRACES OF CLAY, BROWN | | ▼ | | SA-4 | COMPACT |
| | 2 | | | | | | |
| | 2.40 | END OF TEST PIT AT 2.40 m (REFUSAL ON BEDROCK) | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | | | | | | |
| | 7 | | | | | | |

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# TEST PIT LOG REPORT

CLIENT MALISEET FIRST NATION AT TOBIQUE

LOCATION KCIW KNICANEWEK SPORT & RECREATION PARK, TOBIQUE, NB

DATE JUNE 23, 2021 WATER DEPTH N/A



PROJECT No. 493-18-04

TEST PIT No. TP-7

ABBREVIATIONS

SA : SIEVE ANALYSIS

WC : WATER CONTENT

FIELD TESTS AND OBSERVATIONS

FVST : FIELD VANE SHEAR TEST

▼ : WATER LEVEL

STATE OF SAMPLE

DISTURBED ☒ NOT SAMPLED ☐

ELEVATION

☒ GEODETIC

☐ LOCAL GRID

| ELEV. (M) | DEPTH (M) | SOIL DESCRIPTION | STRATA PLOT | WATER LEVEL | STATE OF SAMPLE | SAMPLE NO. | COMMENTS |
|---|---|---|---|---|---|---|---|
| 118.173 | 0 | TOPSOIL | | | | SA-1 | |
| | 0.30 | SILTY SANDY GRAVEL, TRACES OF CLAY, BROWN | | | | SA-2 | COMPACT |
| | 1 | | | | | | |
| | 1.20 | | | | | SA-3 | COMPACT |
| | 2 | END OF TEST PIT AT 2.00 m (REFUSAL ON BEDROCK) | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | | | | | | |
| | 7 | | | | | | |

supervised by D.C drawn by D.H checked by S.C date 25/06/21 rev. 0

ROY CONSULTANTS
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Bathurst (NB) E2A 1P7
T. / 506.546.4484
F. / 506.548.2207

# TEST PIT LOG REPORT

CLIENT MALISEET FIRST NATION AT TOBIQUE

LOCATION KCIW KNICANEWEK SPORT & RECREATION PARK, TOBIQUE, NB

DATE JUNE 23, 2021 WATER DEPTH N/A

PAGE 1 OF 1

PROJECT No. 493-18-04

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STATE OF SAMPLE

DISTURBED ☒ NOT SAMPLED ☐

ELEVATION

☒ GEODETIC

☐ LOCAL GRID

| ELEV. (M) | DEPTH (M) | SOIL DESCRIPTION | STRATA PLOT | WATER LEVEL | STATE OF SAMPLE | SAMPLE NO. | COMMENTS |
|---|---|---|---|---|---|---|---|
| 123.190 | 0 | BACKFILL: SILTY SAND, SOME GRAVEL | | | | SA-1 | |
| | 0.15 | TOPSOIL | | | | SA-2 | |
| | 0.35 | SAND, SOME SILT, TRACES OF CLAY AND GRAVEL, BROWN | | | | SA-3 | COMPACT |
| | 0.80 | END OF TEST PIT AT 0.80 m (REFUSAL ON BEDROCK) | | | | | |
| | 1 | | | | | | |
| | 2 | | | | | | |
| | 3 | | | | | | |
| | 4 | | | | | | |
| | 5 | | | | | | |
| | 6 | | | | | | |
| | 7 | | | | | | |

supervised by D.C drawn by D.H checked by S.C date 25/06/21 rev. 0

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# APPENDIX C

## Appendix C – Laboratory Analyses Reports

ROY CONSULTANTS
ENGINEERING SERVICES D'INGÉNIERIE

# Laboratory report: Soils and Aggregates

| | | |
|---|---|---|
| Client<br>Tobique First Nation | Lot-Station | Project Number<br>493-18-4 |
| Nature of Sample<br>Silty Sandy Gravel, some clay | Proposed Use<br>Geotechnical Study | Sample Number<br>60-21 |
| Pit or Quarry Name | Location | Reference |
| Municipality, County | Sampled by<br>Danny.C<br>Date<br>23/06/21 | Contract |
| Sampling Site<br>TP-1 SA-3 | Tested by<br>M.Boudreau<br>Date<br>05/07/21 | |

## Sieve Analysis

| Sieve Size | % Passing Separated | % Passing Combined | Requirements Low | Requirements High |
|---|---|---|---|---|
| 100 mm | | 100.0 | | |
| 90 mm | | 100.0 | | |
| 75 mm | | 100.0 | | |
| 63 mm | | 100.0 | | |
| 50 mm | | 100.0 | | |
| 37.5 mm | | 100.0 | | |
| 31.5 mm | | 99.1 | | |
| 25 mm | | 92.4 | | |
| 19 mm | | 84.6 | | |
| 12.5 mm | | 74.9 | | |
| 9.5 mm | | 70.9 | | |
| 4.75 mm | 100.0 | 61.1 | | |
| 2.36 mm | 89.2 | 54.5 | | |
| 2.00 mm | 86.7 | 53.0 | | |
| 1.18 mm | 79.6 | 48.7 | | |
| 600 µm | 71.5 | 43.8 | | |
| 425 µm | 67.9 | 41.6 | | |
| 300 µm | 64.5 | 39.5 | | |
| 150 µm | 58.3 | 35.7 | | |
| 75 µm | 52.7 | 32.3 | | |
| | | | | |

**Hydrometer Analysis**

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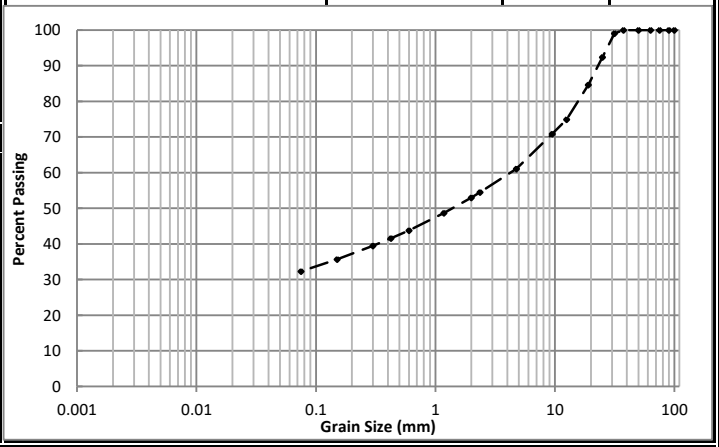
## Various Tests

| | | Requirements Low | Requirements High |
|---|---|---|---|
| % Gravel | 38.9 | | |
| % Sand | 28.8 | | |
| % Silt and Clay | 32.3 | | |
| | | | |
| Atterberg Limits | | | |
| Liquid Limit | | | |
| Plastic Limit | | | |
| Plasticity Index | | | |
| Natural Water Content | 18.1% | | |
| | | | |

| | | |
|---|---|---|
| **Proctor** | Hammer | |
| | Test | |
| | Preparation | |
| | Method | |
| | Maximum Dry Density | |
| | Optimum Water Content | |




Remarks:



Calculated by: Pierre Lanteigne, ing. / P.Eng.
Reviewed by: Pierre Lanteigne, ing. / P.Eng.
Date: 06-07-2021

ROY CONSULTANTS
ENGINEERING SERVICES D'INGÉNIERIE

# Laboratory report: Soils and Aggregates

| | | |
|---|---|---|
| Client<br>Tobique First Nation | Lot-Station | Project Number<br>493-18-4 |
| Nature of Sample<br>Silty Sandy Gravel, some clay | Proposed Use<br>Geotechnical Study | Sample Number<br>61-21 |
| Pit or Quarry Name | Location | Reference |
| Municipality, County | Sampled by<br>Danny.C<br>Date<br>23/06/21 | Contract |
| Sampling Site<br>TP-2 SA-3 | Tested by<br>M.Boudreau<br>Date<br>05/07/21 | |

## Sieve Analysis

| Sieve Size | % Passing Separated | % Passing Combined | Requirements Low | Requirements High |
|---|---|---|---|---|
| 100 mm | | 100.0 | | |
| 90 mm | | 100.0 | | |
| 75 mm | | 100.0 | | |
| 63 mm | | 100.0 | | |
| 50 mm | | 95.5 | | |
| 37.5 mm | | 95.5 | | |
| 31.5 mm | | 92.4 | | |
| 25 mm | | 87.7 | | |
| 19 mm | | 84.9 | | |
| 12.5 mm | | 78.2 | | |
| 9.5 mm | | 73.7 | | |
| 4.75 mm | 100.0 | 63.2 | | |
| 2.36 mm | 89.3 | 56.5 | | |
| 2.00 mm | 86.5 | 54.8 | | |
| 1.18 mm | 78.3 | 49.6 | | |
| 600 µm | 69.7 | 44.2 | | |
| 425 µm | 66.3 | 42.1 | | |
| 300 µm | 63.2 | 40.1 | | |
| 150 µm | 56.7 | 36.0 | | |
| 75 µm | 51.5 | 32.7 | | |
| | | | | |

**Hydrometer Analysis**

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|---|---|---|---|---|
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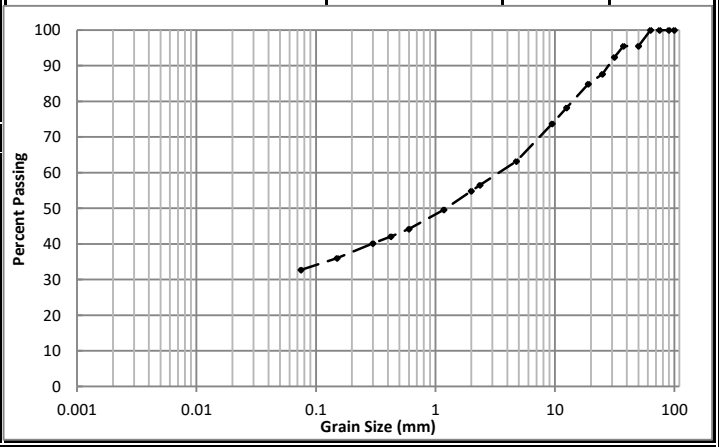
## Various Tests

| | | Requirements Low | Requirements High |
|---|---|---|---|
| % Gravel | 36.8 | | |
| % Sand | 30.5 | | |
| % Silt and Clay | 32.7 | | |
| | | | |
| Atterberg Limits | | | |
| Liquid Limit | | | |
| Plastic Limit | | | |
| Plasticity Index | | | |
| Natural Water Content | 16.6% | | |
| | | | |

| | | |
|---|---|---|
| **Proctor** | Hammer | |
| | Test | |
| | Preparation | |
| | Method | |
| | Maximum Dry Density | |
| | Optimum Water Content | |




Remarks:



Calculated by: Pierre Lanteigne, ing. / P.Eng.
Reviewed by: Pierre Lanteigne, ing. / P.Eng.
Date: 06-07-2021

ROY CONSULTANTS
ENGINEERING SERVICES D'INGÉNIERIE

# Laboratory report: Soils and Aggregates

| | | |
|---|---|---|
| Client<br>Tobique First Nation | Lot-Station | Project Number<br>493-18-4 |
| Nature of Sample<br>Silty Sandy Gravel, traces of clay | Proposed Use<br>Geotechnical Study | Sample Number<br>62-21 |
| Pit or Quarry Name | Location | Reference |
| Municipality, County | Sampled by<br>Danny.C<br>Date<br>23/06/21 | Contract |
| Sampling Site<br>TP-3 SA-4 | Tested by<br>M.Boudreau<br>Date<br>05/07/21 | |

## Sieve Analysis

| Sieve Size | % Passing Separated | % Passing Combined | Requirements Low | Requirements High |
|---|---|---|---|---|
| 100 mm | | 100.0 | | |
| 90 mm | | 100.0 | | |
| 75 mm | | 100.0 | | |
| 63 mm | | 100.0 | | |
| 50 mm | | 85.4 | | |
| 37.5 mm | | 85.4 | | |
| 31.5 mm | | 80.7 | | |
| 25 mm | | 74.3 | | |
| 19 mm | | 68.8 | | |
| 12.5 mm | | 60.7 | | |
| 9.5 mm | | 55.8 | | |
| 4.75 mm | 100.0 | 45.9 | | |
| 2.36 mm | 86.2 | 39.6 | | |
| 2.00 mm | 83.1 | 38.2 | | |
| 1.18 mm | 74.6 | 34.3 | | |
| 600 µm | 66.6 | 30.6 | | |
| 425 µm | 63.4 | 29.1 | | |
| 300 µm | 60.4 | 27.7 | | |
| 150 µm | 54.9 | 25.2 | | |
| 75 µm | 50.5 | 23.2 | | |
| | | | | |

## Hydrometer Analysis

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|---|---|---|---|---|
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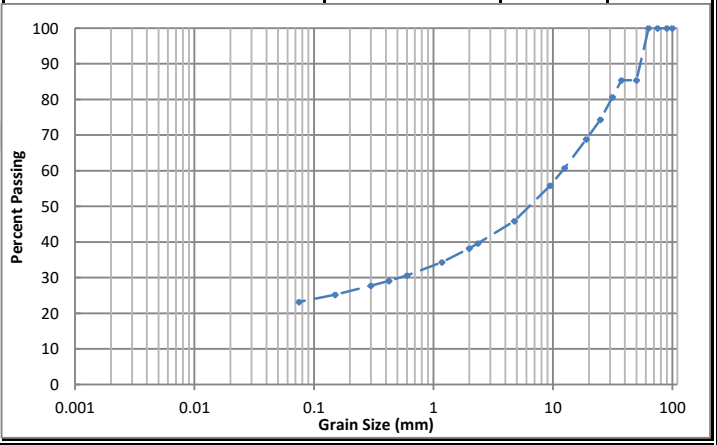
## Various Tests

| | | Requirements Low | Requirements High |
|---|---|---|---|
| % Gravel | 54.1 | | |
| % Sand | 22.7 | | |
| % Silt and Clay | 23.2 | | |
| | | | |
| Atterberg Limits | | | |
| Liquid Limit | | | |
| Plastic Limit | | | |
| Plasticity Index | | | |
| Natural Water Content | 11.1% | | |
| | | | |

| | | |
|---|---|---|
| **Proctor** | Hammer | |
| | Test | |
| | Preparation | |
| | Method | |
| | Maximum Dry Density | |
| | Optimum Water Content | |




Remarks:



Calculated by: Pierre Lanteigne, ing. / P.Eng.
Reviewed by: Pierre Lanteigne, ing. / P.Eng.
Date: 06-07-2021

# APPENDIX D

## Appendix D – Terms and Symbols

## SYMBOLS AND TERMS USED ON TEST BORING REPORT

### ELEVATION AND DEPTH

The information in all columns is plotted to a true elevation and depth scale. The elevation is referenced to the datum shown in the general heading.

### WATER LEVEL MEASUREMENT

The water level in the ground at the time of drilling is indicated to scale by the symbol ▼ for the date shown.

### SOIL DESCRIPTION

TERMINOLOGY DESCRIBING SOIL STRUCTURE:

Dessicated: having visible signs of weathering by evaporation of moisture from cohesive soils, shrinkage, cracks, etc.

Fissured: having cracks, and hence a blocky structure.

Varved: composed of regular alternating layers of silt and clay.

Stratified: composed of alternating layers of different soil types, e.g. silt and sand.

Well Graded: having wide range in grain sizes and substantial amounts of all intermediate particle sizes.

Uniformly Graded: predominately of one grain size.

The standard terminology used to describe the consistency of cohesive soils and the relative density of non-cohesive soils is as follows:

**COHESIVE SOIL**
UNDRAINED SHEAR STRENGTH*

| CONSISTENCY | kPa | Psf. | 'N' VALUE* | FIELD IDENTIFICATION |
|---|---|---|---|---|
| Very Soft | 0-12 | 0-250 | 0-2 | Easily penetrated several cm by the fist |
| Soft | 12-25 | 250-500 | 2-4 | Easily penetrated several cm by the thumb |
| Firm | 25-50 | 500-1000 | 4-8 | Can be penetrated several cm by the thumb with moderate effort |
| Stiff | 50-100 | 1000-2000 | 8-15 | Readily indented by the thumb but penetrated only with great effort |
| Very Stiff | 100-200 | 2000-4000 | 15-30 | Readily indented by the thumb |
| Hard | Over 200 | Over 4000 | Over 30 | Indented with difficulty by the thumbnail |

*NOTE: There is no direct relationship between 'N' values and undrained shear strength.

**NON-COHESIVE SOIL**

| RELATIVE DENSITY | 'N' VALUE | RELATIVE DENSITY % |
|---|---|---|
| Very Loose | 0-4 | Less than 15 |
| Loose | 4-10 | 15-35 |
| Compact | 10-30 | 35-65 |
| Dense | 30-50 | 68-85 |
| Very Dense | Over 50 | Over 85 |

## GRAIN SIZE AND CLASSIFICATION

Terminology used for visually describing soil strata (no laboratory tests) is based on the proportion of individual particle sizes present:

| | |
|---|---|
| Traces | Less than 10% |
| Some | 10-20% |
| Adjective (e.g. silty or sandy) | 20-35% |
| Name (e.g. sand, gravel) | >35% |

Classification of fine and coarse grained soil strata is based on the following particle size distribution:

| | | |
|---|---|---|
| Clay | <0.002 mm | (use Atterberg limits) |
| Silt | 0.002-0.075 mm | (<#200 sieve – use Atterberg limits) |
| Sand | 0.075-4.75 mm | (#200 sieve - #4 sieve) |
| Gravel | 4.75-75 mm | (#4 sieve – 3 in.) |
| Cobbles | 75-300 mm | (3 in. – 12 in.) |
| Boulders | Larger than 300 mm | (Over 12 in.) |

Where laboratory testing has been performed, soils are described according to the Unified Soil Classification System (ASTM D2487-90).

Where visual classification has been performed, soils are described according to the standard practice for description and identification of soils (ASTM D2488). Note that the terms used in this method to identify soils are the same as those used in D2487-90.

## STANDARD PENETRATION TEST REPORTING

Standard Penetration Testing is conducted in accordance with the current version of ASTM D1586. Recovery is reported as the ratio of recovered sample to depth over which the sampler was driven (mm/mm), rounded to the nearest 25 mm or in percentage of the penetration of the sampler.

SPT "N" value is reported as the total number of blows required to advance the sampler 300 mm from 150 mm to 450 mm. In cases where the sampler could not be advanced from 0 to 150 mm, "N" will be recorded as N.A. (no advance). In cases where the sampler can be advanced beyond 150 mm, but not to 450 mm, the "N" will be reported as a fraction, where the numerator represents the number of blows after the initial 150 mm of advance and the denominator represents the depth (mm) over which the numerator value was counted.

Samplers are generally advanced, where possible, 600 mm in order to obtain the maximum size of sample. Blows required to advance the sampler from 0 to 150 mm, or beyond 450 mm are not reported.

EXAMPLE:

Recovery is reported as 150/275 (or 55%).
The sampler was advanced 275 mm and 150 mm of sample were recovered.
"N" is reported as 65/125.
The sampler was advanced 275 mm (150+125). 65 blows were required for the last 125 mm of advance.

## STRATA BOUNDARIES

Strata boundaries shown by a solid line have been established directly from field observations and laboratory examination of samples.

Strata boundaries shown by a dotted line have been indirectly determined from field observations and laboratory classification of samples.

## ROCK DESCRIPTION

The description of bedrock is based on the rock quality desgination (RQD).

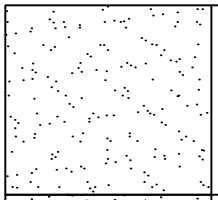
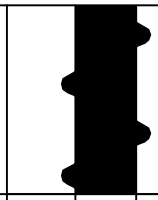
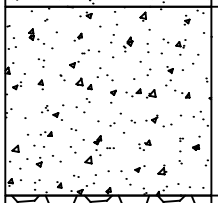
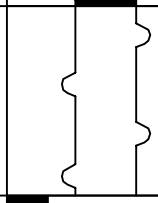
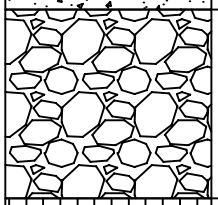
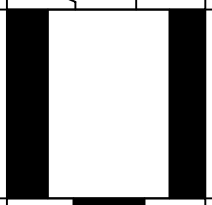
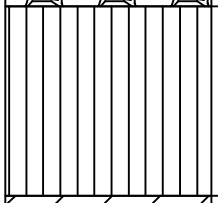
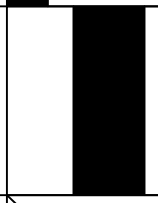
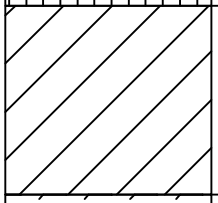
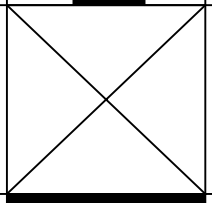
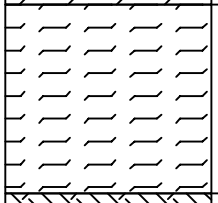
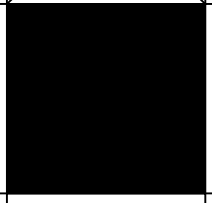
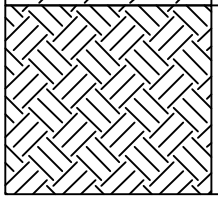
The classification is based on a modified core recovery percentage in which all pieces of sound core 100 mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathered in the rock mass and are not counted. In most cases, RQD logging is run on NXL core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from normal in situ fractures.

| RQD | ROCK QUALITY |
|---|---|
| 90-100 | Excellent – intact, very sound massive |
| 75-90 | Good – moderately jointed or sound |
| 50-75 | Fair – blocky and seamy, fractured |
| 25-50 | Poor – shattered and very seamy or blocky, severely fractured |
| 0-25 | Very poor – crushed, very severely fractured |

## ABBREVIATIONS

| | | |
|---|---|---|
| (SS) Split Spoon | (AU) Auger | (SH) Shelby Tube |
| (CB) Core Barrel | (HS) Hollow Stem | (WC) Water Content |
| (SA) Sieve Analysis | (BH) Borehole | (TP) Test Pit |

# SYMBOLS USED IN BOREHOLE LOGS

| | | | |
|---|---|---|---|
|  | SAND |  | STANDARD AUGER |
|  | GRAVEL |  | HOLLOW STEM AUGER |
|  | BOULDERS AND COBBLES |  | CASING |
|  | SILT |  | CORE BARREL |
|  | CLAY |  | DISTURBED SAMPLE (SPLIT SPOON OR TEST PIT) |
|  | ORGANICS |  | SHELBY TUBE |
|  | BEDROCK | | |

LET'S COLLECTIVELY BUILD

# OUR REGIONS!

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