

Part 1 General**1.1 REFERENCE STANDARDS**

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C127, Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.
 - .2 ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .3 ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - .4 ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

1.2 DEFINITIONS

- .1 Corrected maximum dry density is defined as:
 - .1 $D = D1 \times D2 / (F1 \times D2) + (F2 \times D1)$
 - .2 $D = (F1 \times D1) + (0.9 \times D2 \times F2)$
 - .3 Where: D = corrected maximum dry density kg/m³.
 - .1 F1 = fraction (decimal) of total field sample passing 4.75 mm sieve
 - .2 F2 = fraction (decimal) of total field sample retained on 4.75 mm sieve (equal to 1.00 - F1)
 - .3 D1 = maximum dry density, kg/m³ of material passing mm sieve determined in accordance with Method of Method C of ASTM D1557.
 - .4 D2 = bulk density, kg/m³, of material retained on mm sieve, equal to 1000G where G is bulk specific gravity (dry basis) of material when tested to ASTM C127.
 - .4 For free draining aggregates, determine D1 (maximum dry density) to ASTM D4253 when directed by Departmental Representative.

Part 2 Products**2.1 NOT USED**

- .1 Not Used.

Part 3 Execution**3.1 NOT USED**

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

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

1.2 SAMPLES

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

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Divert unused granular materials from landfill to local facility as approved by Departmental Representative.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Transportation and Handling: Handle and transport aggregates to avoid segregation, contamination and degradation.
- .2 Storage: Store washed materials or materials excavated from underwater twenty four (24) hours minimum to allow free water to drain and for materials to attain uniform water content.

Part 2 Products

2.1 MATERIALS

- .1 Granular
 - .1 Granular Backfill:
 - .1 Crushed or screened stone, gravel or sand consisting of hard, durable particles free from clay lumps, cementation, organic material, frozen material or other deleterious materials.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117 and have a smooth curve without sharp breaks when plotted on semi-log charts.
 - .2 Aggregate quality: sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps or minerals, or other substances that would act in deleterious manner for use intended.
 - .3 Flat and elongated particles of coarse aggregate: to ASTM D4791.
 - .1 Greatest dimension to exceed five times least dimension.
 - .4 Fine aggregates satisfying requirements of applicable section to be one, or blend of following:
 - .1 Natural sand.

- .2 Manufactured sand.
- .3 Screenings produced in crushing of quarried rock, boulders, gravel or slag.
- .5 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.
- .6 Submit one (1) copy of quality control test results at least two (2) weeks prior to commencing Work.
- .7 The sieve analysis must be performed by a qualified materials testing laboratory.
- .8 The coarse fraction of the aggregate must have a percent wear by the Los Angeles abrasion test of not more than 50.
- .9 The material passing the 0.4 mm sieve must have a plasticity index of 6 or less.
- .10 The material retained on the 4.75 mm sieve must have at least two fractured faces.
- .11 Granular

Passing Standard Sieve Sizes	Type 'A' - Granular Base	Type 'C' - Granular Sub-Base	Type 'P' - Granular Pit Run	Type 'S' - Granular Bedding Sand
75 mm			100%	
37.5 mm		100%		
19 mm	100%	75 – 85%		
13 mm	70 - 90%			
9.5 mm				100%
4.75 mm	40 – 70%	25 – 70%	25 – 50%	80-100%
2 mm	25 – 55%			40 – 80%
425 mm	15 – 30%	15 – 40%		10 – 40%
75 mm	8 – 15%	6 – 18%	0 – 20%	0 – 3%
Minimum Friable Rock retained on a 4.75 mm sieve	15%	20%		
Maximum LA Abrasion Loss	50%	50%		

2.2 SOURCE QUALITY CONTROL

- .1 Granular
 - .1 Inform Departmental Representative of proposed source of aggregates and provide samples at least four (4) weeks prior to commencing production.
 - .2 If, in opinion of Departmental Representative materials from proposed source do not meet, or cannot reasonably be processed to meet, specified requirements,

locate an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

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

Part 3 Execution

3.1 PREPARATION

- .1 Handling
 - .1 Handle and transport aggregates to avoid segregation, contamination and degradation.
- .2 Stockpiling
 - .1 Stockpile aggregates on site in locations as approved by Departmental Representative. 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 within 48 hours of rejection.
 - .7 During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

3.2 CLEANING

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

3.3 QUALITY ASSURANCE

- .1 Submit samples in accordance with Section 01 45 00 - Quality Control.

3.4 CORRECTED MAXIMUM DRY DENSITY

- .1 Compact to the following densities at optimum moisture content, unless noted otherwise:
 - .1 Type 'A' - Granular Base: 100% corrected maximum dry density.
 - .2 Type 'C' - Granular Sub-Base: 98% corrected maximum dry density.
 - .3 Type 'P' - Granular Pit Run: 98% corrected maximum dry density.
 - .4 Type 'S' - Granular Bedding Sand: 98% corrected maximum dry density

END OF SECTION

Part 1 General

1.1 DEFINITIONS

- .1 Underbrush clearing consists of removal from treed areas of undergrowth and deadwood, and disposing of fallen timber and surface debris.
- .2 Grubbing consists of excavation and disposal of stumps and roots to not less than specified depth below existing ground surface.

1.2 STORAGE AND PROTECTION

- .1 Prevent damage to existing buildings, ramps, railings, utility lines, bench marks, landscaping, and shrubs which are to remain.
 - .1 Repair damaged items to approval of Departmental Representative.

Part 2 Products

2.1 MATERIALS

- .1 Soil Material for Fill:
 - .1 Excavated soil material: free of debris, roots, wood, scrap material, vegetable matter, refuse, soft unsound particles, deleterious, or objectionable materials.
 - .2 Remove and store soil material for reuse.

Part 3 Execution

3.1 PREPARATION

- .1 Inspect Site and verify with the Departmental Representative items designated to remain.
- .2 Clearing and grubbing activities must follow procedures outlined in Section 01 35 43 – Environmental Procedures.
- .3 Locate and protect utility lines: preserve in operating condition active utilities traversing site.
 - .1 Notify Departmental Representative immediately of damage to or when unknown existing utility lines are encountered.
- .4 Notify utility authorities before starting clearing and grubbing.
- .5 Keep roads and walkways free of dirt and debris.

3.2 CLEARING

- .1 Clearing includes trimming of trees into sections and satisfactory disposal of trees and other vegetation designated for removal, including snags, brush, rubbish downed timber, occurring within cleared areas.

3.3 GRUBBING

- .1 Grub out stumps and roots to not less than 300 mm below ground surface.
- .2 Grub out visible rock fragments and boulders, greater than 300 mm in greatest dimension, but less than 0.25 m³.
- .3 Fill depressions made by grubbing with suitable material and to make new surface conform with existing adjacent surface of ground.

3.4 REMOVAL AND DISPOSAL

- .1 Contractor is responsible for removal and disposal of cleared materials not required to be salvaged and grubbed material.

3.5 FINISHED SURFACE

- .1 Leave ground surface in condition suitable for stripping of topsoil to approval of the Departmental Representative.

END OF SECTION

Part 1 General

Part 2 Products

2.1 NOT USED

- .1 Not Used.

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, in accordance with Section 01 35 43 Environmental Procedures.
- .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 Ensure that procedures are conducted in accordance with applicable Provincial requirements.
- .2 Remove topsoil and any other organic materials before construction procedures commence to avoid compaction of topsoil.
- .3 Handle topsoil only when it is dry and warm.
- .4 Remove vegetation from targeted areas by non-chemical means and dispose of stripped vegetation not suitable for reuse.
- .5 Remove brush from targeted area by non-chemical means and dispose of as construction waste.
- .6 Strip topsoil in areas as shown on the Drawings. Anticipated range of topsoil depth is 100 mm to 300 mm.
 - .1 Avoid mixing topsoil with subsoil.
- .7 Pile topsoil by mechanical hoe in berms in locations as approved by Departmental Representative.
 - .1 Stockpile height not to exceed 2.5 m.
- .8 Dispose of unused topsoil as construction waste.
- .9 Protect stockpiles from contamination and compaction.

- .10 Cover topsoil that has been piled for long term storage, with trefoil or grass to maintain agricultural potential of soil.

3.3 PREPARATION OF GRADE

- .1 Verify that grades are correct and notify Departmental Representative if discrepancies occur. Do not begin work until instructed by Departmental Representative.
 - .1 Grade area only when soil is dry to lessen soil compaction.
 - .2 Grade soil establishing natural contours and eliminating uneven areas and low spots, ensuring positive drainage.

3.4 PLACING OF TOPSOIL

- .1 Place topsoil only after Departmental Representative has accepted subgrade.
- .2 Spread topsoil during dry conditions in uniform layers not exceeding 250 mm, over unfrozen subgrade free of standing water.
- .3 Establish traffic patterns for equipment to prevent driving on topsoil after it has been spread to avoid compaction.
- .4 Cultivate soil following spreading procedures.

END OF SECTION

Part 1 General

1.1 EXISTING CONDITIONS

- .1 The Contractor shall confirm the existence of any such lines or objects prior to commencing work and report these to the Department Representative.

1.2 PROTECTION

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

Part 2 Products

2.1 MATERIALS

- .1 Fill material: In accordance with of Section 31 05 16 - Aggregate Materials.

Part 3 Execution

3.1 GRADING

- .1 Rough grade to levels, profiles, and contours allowing for surface treatment as indicated. Tolerance for rough grading is ± 50 mm.
- .2 Prior to placing fill over existing ground, scarify surface to depth of 150 mm. Maintain fill and existing surface at approximately same moisture content to facilitate bonding.
- .3 Compact filled and disturbed areas to corrected maximum dry density as specified in Section 31 05 16 – Aggregate Materials.
- .4 Do not disturb soil within branch spread of trees or shrubs to remain as approved by the Departmental Representative.

3.2 TESTING

- .1 Refer to Section 31 05 16 - Aggregate Materials.

3.3 SURPLUS MATERIAL

- .1 Remove surplus material and material unsuitable for fill, grading or landscaping and dispose of as construction waste.

END OF SECTION

Part 1 General

1.1 CODES AND STANDARDS

- .1 Excavating and backfilling to conform to the following codes and standards:
 - .1 Manitoba Workplace Safety and Health Act and Regulations
 - .2 Local Codes and Bylaws

1.2 DEFINITIONS

- .1 Common Excavation/Trench Excavation: excavation of all materials which are not included under definition of Rock Excavation or Boulder Excavation.
- .2 Rock Excavation: excavation of massive ledge rock, boulders, or bedrock which cannot be removed by a track excavator with a minimum operating weight of 36 tonnes and a minimum bucket capacity of 1.2 m³ without drilling and blasting.
- .3 Boulders: all forms of rock, detached masses of rock, boulders, concrete or masonry, greater than 1000 mm in average diameter, that can be removed by a track excavator with a minimum operating weight of 36 tonnes and a minimum bucket capacity of 1.2 m³ without drilling or blasting.
- .4 Topsoil: material capable of supporting good vegetative growth and suitable for use in top dressing, landscaping, and seeding.
- .5 Borrow material: material obtained from areas outside of immediate work area required for construction of embankments or for other portions of Work.
- .6 Unsuitable Material: very weak, compressible, or saturated materials which in the opinion of the Departmental Representative are not suitable for fill.
- .7 Granular Material: material such as sand, natural gravel, and reclaimed concrete aggregate, free of reclaimed asphalt which meets the specifications.
- .8 Pipe Surround: granular material below the bottom of pipe to a height of above the top of the pipe or as shown on the drawings.
- .9 Pipe Bedding: granular material within the pipe zone that supports the pipe and other appurtenances which meets the specifications set out herein.
- .10 Haunch: portion of the pipe zone from the bottom of the pipe to the springline or midpoint of the pipe.
- .11 Tunnelling: the process of installation of a pipeline by means of coring, augering, or directional drilling where an open cut excavation is not employed.
- .12 Course Stabilizing Gravel (Type 'P'): clean angular material required for stabilization of trench bottom due to over excavation of unsuitable trench bottom conditions.

1.3 SUBMITTALS AND SAMPLES

- .1 Provide sieve analysis for all specified products, and bulk samples for quality assurance testing by the Departmental Representative.

1.4 EXISTING CONDITIONS

- .1 Buried services:
 - .1 Before commencing work verify location of buried services on and adjacent to site.
 - .2 Confirm locations of buried utilities by careful test excavations.
 - .3 Arrange with appropriate authority for relocation of buried services that interfere with execution of work: pay costs of relocating services.
 - .4 Size, depth and location of existing utilities and structures as indicated are for guidance only. Completeness and accuracy are not guaranteed.
 - .5 Maintain and protect from damage, water, sewer, gas, electric, telephone, and other utilities and structures encountered.
 - .6 Where utility lines or structures exist in area of excavation, obtain direction of Departmental Representative before removing or re-routing.
 - .7 Record location of maintained, re-routed, and abandoned underground lines.
 - .8 Confirm locations of recent excavations adjacent to area of excavation.
 - .9 Prior to beginning excavation Work, notify Departmental Representative and authorities having jurisdiction establish location and state of use of buried utilities and structures.
- .2 Existing buildings and surface features:
 - .1 Conduct, with Departmental Representative, condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks, and monuments which may be affected by Work.
 - .2 Protect existing buildings and surface features from damage while Work is in progress. In event of damage, immediately make repair to approval of Departmental Representative.
 - .3 Where required for excavation, cut roots or branches as approved by Departmental Representative.

1.5 SHORING, BRACING AND UNDERPINNING

- .1 Where shoring, bracing, or underpinning is required:
 - .1 Protect existing features in accordance with applicable local regulations.
 - .2 Engage services of qualified professional engineer who is registered or licensed in the province in which work is to be carried out to design and inspect cofferdams, shoring, bracing, and underpinning required for work.
 - .3 Submit design and supporting data at least two (2) weeks prior to commencing work.
 - .4 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the province in which the work is undertaken.

- .5 Professional engineer responsible for design of temporary structures to submit proof of insurance coverage for professional liability except where engineer is employee of contractor, in which case contractor shall submit proof that work by professional engineer is included in contractor's insurance coverage.

1.6 CLASSIFICATION OF WORK

- .1 Common Excavation, Bedding And Backfilling - These shall be classified as follows:
 - .1 Common Excavation -Common Excavation shall include all excavation of clay, silt, sand, gravel, hard-pan, earth, roots, rubble, water, ice, snow, shale, cobbles, boulders (less than one cubic metre), asphalt, concrete pavement, existing underground and surface utilities and works, and any other obstacles which may be encountered, excepting bedrock excavation as defined herein. Common excavation shall include all necessary dewatering.
 - .2 Bedding - Pipe shall be bedded on Class "B" bedding.
 - .3 Backfill -There are two classes of backfill for open cut trenches:
 - .1 Compacted Common;
 - .2 Granular Backfill (Type "P")
- .2 Unless otherwise specified herein or on the construction drawings, the Contractor shall use Compacted Common Backfill in grassed areas. Compacted Granular Backfill shall be used under all roadways, parking areas.

Part 2 Products

2.1 GRANULAR MATERIALS

- .1 Reference Section 31 05 16, Aggregate Materials

2.2 BACKFILL

- .1 Compacted Common Backfill - Compacted common backfill shall consist of unfrozen material excavated from the trench with no lumps or stones exceeding 150 mm in diameter.
- .2 Granular Backfill - Reference Section 31 05 16, Aggregate Materials: Type 'P'

Part 3 Execution

3.1 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.

3.2 STRIPPING OF TOPSOIL

- .1 Commence topsoil stripping of areas after area has been cleared of brush, weeds, and grasses and removed from site.
- .2 Strip topsoil. Do not mix topsoil with subsoil.
- .3 Stockpile in locations as indicated.

3.3 STOCKPILING

- .1 Stockpile fill materials in areas designated. Stockpile granular materials in manner to prevent segregation.
- .2 Excavated material that cannot be piled along the trench is to be stockpiled and returned for backfilling as required.
- .3 Protect fill materials from contamination.

3.4 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

- .1 Where cofferdams, shoring, bracing, or underpinning is required:
 - .1 Obtain permit from authority having jurisdiction for temporary diversion of water course.
 - .2 Construct temporary works to depths, heights, and locations as required.
 - .3 Shall be designed by a registered professional engineer in the province of Manitoba. Provide sealed drawings as per Section – 01 33 00 Submittal Procedures.
 - .4 Install shoring so that it does not extend below the springline of the pipe. Do not locate shoring closer than 150 mm to the widest section of the installed pipe. When it is necessary to place the shoring below the pipe springline, raise the shoring in 600 mm lifts and compact each lift to fill the void left by the raised sheeting.
 - .5 When shoring must be left in place, cut so that no shoring remains closer than 900 mm to the ground surface.
 - .6 Remove shoring in a manner which permits compaction of the backfill.
 - .7 Upon completion of substructure construction:
 - .1 Remove cofferdams, shoring, and bracing.
 - .2 Remove excess materials from site and restore water courses as indicated or as directed by Departmental Representative.

3.5 BRACED AND SHEETED TRENCHES

- .1 The Contractor shall furnish, put in place and maintain such sheeting and bracing as may be required to support the sides and roof of the excavation and to prevent any movement which can in any way;
 - .1 Injure the personnel, pipe or appurtenances.
 - .2 Diminish the necessary width of the excavation.
 - .3 Otherwise injure or delay the work or endanger adjacent structures.

- .2 If the Departmental Representative is of the opinion that at any point inadequate support has been provided, he may order additional supports put in at the expense of the Contractor. Compliance with such order shall not release the Contractor from his responsibility for the adequacy of such supports.
- .3 If voids are formed outside the sheeting, the Contractor shall immediately fill with suitable compacted material. If necessary, additional sheeting shall be driven outside the existing sheeting to prevent settlement of the adjacent ground.
- .4 The Contractor shall leave in place, to be embedded in the backfill of the trench, all sheeting and bracing where so ordered in writing by the Departmental Representative. The Departmental Representative may also direct that timber used for sheeting and bracing be cut off at a specified elevation; in which case, the Contractor shall receive additional compensation. If the Departmental Representative fails to give such orders it shall not relieve the Contractor from any liability should he remove the sheeting and bracing.
- .5 Where sheeting and bracing is to be removed, it shall be done so that adjacent facilities and properties are not damaged. All voids left or caused by the withdrawal of sheeting shall be immediately refilled with suitable material and compacted.
- .6 Where timber or steel used in sheeting, bracing or copper damming has been left in place for the convenience or to subserve the interests of the contractor, the Contractor shall receive no additional payment.

3.6 DISPOSAL OF EXCAVATED MATERIAL

- .1 Surplus excavated material not suitable as backfill shall be stockpiled or spread at the locations designated by the Departmental Representative. The locations where the material is deposited shall be within the City limits. The Departmental Representative shall require the Contractor to stockpile in a separate location, the surplus excavation which the Departmental Representative feels is most desirable for backfill. This material shall be used for fill when required by the Departmental Representative.

3.7 PIPE BEDDING

- .1 The pipe bedding shall be smooth and even to provide full support for the pipe barrel, with cavities provided for flanges, couplings, sleeves or bells.
- .2 CLASS "B" - Bedding sand shall be placed and thoroughly compacted in the trench such that the pipe is supported along its entire length (and under bells and flanges) by a layer of sand, the thickness of which shall be no less than 100 mm. Additional bedding sand shall be placed and compacted around the pipe and 200 mm above the top of the pipe for the entire width of the trench.

3.8 BACKFILL MATERIAL

- .1 Common Backfill – The trench shall be backfilled with common backfill material to the top of the trench. The backfill material shall be consolidated with the wheels or tracks of excavating or grading equipment. The backfilled trench shall be left in a slightly mounded condition to minimize the effects of settlement.

- .2 Compacted Common Backfill -Compacted common backfill shall be placed in layers no greater than 300 mm thick. Each layer shall be compacted by mechanical means to a density equivalent to that of the surrounding in-situ material.
- .3 Granular Backfill (Type 'P') -Where this class of backfill is specified, the trench shall be backfilled entirely with granular backfill material placed in layers no greater than 150 mm thick and compacted to 100% of maximum Standard Proctor Dry Density (ASTM 0698).

3.9 BACKFILLING THE TRENCH

- .1 Trenches or shafts under existing or proposed pavements, driveways or sidewalks shall be backfilled as follows;
 - .1 From the pipe bedding up to the road surface shall be backfilled with granular material (Type 'P')unless otherwise specified. All backfilling shall be done in lifts of 300 mm and each lift compacted to 100% standard proctor.
- .2 Trenches or shafts in boulevards shall be backfilled as follows;
 - .1 From the pipe bedding up to 100 mm below the boulevard surface shall be backfilled with suitable excavated material. Excavated material must have a moisture content that will facilitate compaction as close as possible to the original density. From 100 mm below the boulevard surface to the boulevard surface shall be backfilled with top soil.
- .3 Backfill shall be bladed down the end of the trench so that the backfill material rolls into the trench. The trench shall be filled evenly to prevent displacement of the pipe.
- .4 The backfill shall commence after the pipes are installed as specified and shall be brought up to the level of the existing surface.
- .5 Additional backfill shall be added, at the Contractor's expense, to fill up any depressions in the backfill due to traffic and or/settlement. No additional backfill will be required of the Contractor after the completion certificate has been issued unless depressions have been listed as a deficiency.

3.10 REPLACEMENT OF UNSUITABLE BACKFILL MATERIAL

- .1 The following materials shall be considered as being unsuitable backfill material, and shall not be used as backfill except with the written consent of the Departmental Representative: frozen material, wet silt, muskeg, roots, trees, topsoil, boulders larger than 150mm diameter, or pieces of blasted rock larger than 150 mm in their longest dimension.
- .2 Unsuitable backfill material shall be replaced with one of the following;
 - .1 Type 'P' Granular

3.11 UNSUITABLE SUPPORTING MATERIAL IN THE TRENCH BOTTOM

- .1 If material such as silt, silty clay, muskeg or rock is encountered in any part of the trench bottom and is considered unsatisfactory by the Departmental Representative for the

support of the pipe, the Contractor shall make such further excavation as may be required and shall backfill the extra excavation with suitable compacted material.

.2 This material may be obtained as follows:

.1 Type 'P' granular material imported by the Contractor.

3.12 DEWATERING

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

.2 The Contractor shall dewater the trench so as to permit the proper laying of the pipe on a firm dry foundation. Drainage through watermain or sewer pipes shall not be permitted. The Contractor shall remove water by means of pumps and sand points and shall have sufficient pumping equipment available to maintain a dry and firm trench bottom.

.3 The water discharge from trenches shall be disposed of so that it will not damage the work or any private property. It shall be conveyed to natural drainage channels or to storm sewers. If trench water is to be conveyed to a storm sewer the Contractor will be required to remove all sand and mud by means of settling and no compensation shall be allowed therefore.

.4 The Contractor shall not hold any other party liable for control of leakage from other services whether existing or under construction.

.5 Where requested by Departmental Representative, submit for his review details of proposed dewatering or heave prevention methods, such as dikes, well points, and sheet pile cut offs.

.6 Avoid excavation below groundwater table if quick condition or heave is likely to occur. Prevent piping or bottom heave of excavations by groundwater lowering, sheet pile cut-offs, or other means.

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

.8 Dispose of water in a manner not detrimental to public and private property, or any portion of Work completed or under construction.

.9 When required, provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

.10 All water encountered in the trench to be pumped or bailed out. Do not use pipe to drain water unless approved by the Departmental Representative.

3.13 COMPACTION

.1 Where trenches are under the location of proposed or existing pavement, the backfill, from 300mm above the pipe to grade, shall be compacted by watering and/or by mechanical means. This shall include all trenches, whether for main or service connection pipes.

- .2 The method of compaction shall be subject to the approval of the Departmental Representative.
- .3 The degree of compaction shall be not less than 90 percent of the maximum density test at the optimum moisture content as measured by the standard proctor compaction test and the depth of each successive lift shall be 300 mm.

3.14 EXCAVATION

- .1 Advise Departmental Representative at least seven (7) days in advance of excavation operations.
- .2 Excavate to lines, grades, elevations, and dimensions as indicated or as directed by Departmental Representative.
- .3 Remove concrete, masonry, paving, walks, demolished foundations, rubble, and other obstructions encountered during excavation.
- .4 Excavation must not interfere with 45° angle of bearing from bottom of any footing.
- .5 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw.
- .6 For trench excavation, unless otherwise authorized by Departmental Representative in writing, do not excavate more than 25.0 m of trench in advance of installation operations and do not leave open more than 5.0 m at end of day's operation.
- .7 Dispose of surplus and unsuitable excavated material off site or as approved on site by Departmental Representative.
- .8 Do not obstruct flow of surface drainage or natural watercourses.
- .9 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.
- .10 Remove unsuitable material from trench bottom to extent and depth as directed by Departmental Representative.
- .11 Backfill over excavation to the level of normal bedding with coarse stabilizing gravel material.
- .12 Correct unauthorized over-excavation as follows:
 - .1 Fill under bearing surfaces and footings with concrete specified for footings.
 - .2 Fill under other areas with Type 'P' granular compacted to not less than 100% of Standard Proctor Dry Density.
- .13 The trench bottom is to provide a pipe vertical alignment within ± 5 mm of the grade indicated on the drawings.
- .14 Hand trim, make firm, and remove loose material and debris from excavations. Where material at bottom of excavation is disturbed, compact foundation soil to density at least

equal to undisturbed soil. Clean out rock seams and fill with concrete mortar or grout to approval of Departmental Representative.

- .15 Pile excavation material alongside the trench, provided working space is adequate. Ensure excavation material does not spill onto private properties.
- .16 Remove ledge rock, boulders, and large stones to provide a minimum clearance of 150 mm below the pipe.
- .17 Where the maximum trench width is exceeded provide special bedding as directed by the Departmental Representative.
- .18 Night work, from sunset to sunrise, will only be allowed if written permission is given by the Departmental Representative. Work carried out at night to have adequate lighting to enable the work to be done in a satisfactory manner. No pipe shall be laid nor work done if, in the opinion of the Departmental Representative, there is insufficient light to perform the work safely and satisfactorily.

3.15 TUNNELLING

- .1 Provide straight walled shafts for tunnelling.
- .2 Provide proper shoring and any other means required to ensure safety of workmen and stability of surround soils.
- .3 Obtain the prior approval of the Departmental Representative for size, location, and extent of tunnelling.
- .4 Unless otherwise approved, maintain a minimum 1.0 m clearance from nearest edge of tunnel to pavement or other structures.
- .5 Carry out tunnel excavation and backfill in accordance with the relevant section(s) of the specifications and all safety regulations.
- .6 Provide tunnel which does not exceed the largest dimension of the pipe to be installed by more than 50 mm.
- .7 Carefully establish and maintain line and grade and provide a finished tunnel which does not vary more than 25 mm vertically or 75 mm horizontally from the established grade.
- .8 Recore any hole which exceeds the specified deviation limits.
- .9 Adequately plug the leading end of pipe inserted in the tunnel to prevent damage or entrance of foreign material.
- .10 Provide adequate support of pipe within the tunnel as recommended by the pipe manufacturer and/or as detailed in the contract documents.
- .11 Carry out pipe insertion into tunnel using techniques and equipment recommended by the pipe manufacturer and approved by the Departmental Representative.

3.16 SURFACE MAINTENANCE DURING CONSTRUCTION

- .1 Maintain all trench surfaces and working surfaces affected by construction until the project is accepted by the Departmental Representative.
- .2 Finish berms over trenches as specified prior to acceptance. Provide and place material to fill depressions resulting from the settlement of backfill.
- .3 Maintain gravelled surfaces free of pot holes and washboard conditions. Grade surfaces to eliminate irregularities as often and as soon as they occur.
- .4 Mark locations which cannot be immediately reinstated to the specified standard by approved means to warn traffic of hazards until defects are rectified.
- .5 Maintain all surfaces as required to prevent dust being a nuisance to the public and concurrent performance of other work on-site.

3.17 RESTORATION

- .1 Upon completion of Work, stockpile excess materials on site, remove waste materials and debris, trim slopes, and correct defects as directed by Departmental Representative.
- .2 Replace topsoil as indicated or as directed by Departmental Representative.
- .3 Reinstall pavements and sidewalks and lawns disturbed by excavation to thickness, structure, and elevation which existed before excavation.
- .4 Clean and reinstall areas affected by Work as directed by Departmental Representative.

3.18 TRENCH SETTLEMENT DURING WARRANTY PERIOD

- .1 Replace materials and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls during the warranty period. Refill settled trench areas with specified backfill material.

END OF SECTION