This specification outlines the requirements for trench excavation and backfill for the installation of pipe lines, conduits and appurtenances together with the requirements for backfilling and compacting material in trenches after the removal of pipe or after the placing of pipe and bedding.

PART 1 REFERENCES

This specification refers to the following standards, specifications, or publications:

ASTM International

C117	Standard Test Method for Materials Finer than 75-µm (No.200) Sieve in Mineral Aggregates by Washing
C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
D698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft·-lbf/ft^3 (600 kN·-m/m^3))

PART 2 GENERAL

2.1 SUBMITTALS

.1 Inform Owner at least four (4) weeks prior to commencing work, of proposed source of fill materials and provide access for sampling.

.2 Submit 70 kg samples of type of fill specified including representative samples of excavated material.

.3 Ship samples as directed by Owner in tightly closed containers to prevent contamination.

2.2 QUALITY ASSURANCE

.1 Submit design and supporting data at least two (2) weeks prior to commencing work.

.2 Design and supporting data submitted to bear stamp and signature of qualified professional engineer registered or licensed in the province of Newfoundland and Labrador.

.3 Keep design and supporting data on site.

.4 Engage services of qualified professional engineer who is registered or licensed in Province of Newfoundland and Labrador to design and inspect cofferdams, shoring, bracing and underpinning required for work.

.5 Do not use soil material until written report of soil test results are reviewed and approved by Owner.

2.3 EXISTING CONDITIONS

.1 Buried services:

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

.2 Existing buildings and surface features:

.1 Conduct, with Owner condition survey of existing buildings, trees and other plants, lawns, fencing, service poles, wires, rail tracks, pavement, survey bench marks and monuments which may be affected by work.
.2 Protect existing buildings and surface features from damage while work is in progress. In event of damage, immediately make repair to approval of Owner.
.3 Where required for excavation, cut roots or branches as approved by Owner.

PART 3 PRODUCTS

3.1 MATERIALS

.1 Marking Tape:

.1 Heavy gauge polyethylene, 150 mm wide indicating the service buried.

.2 Detectable metallic underground tape, indicating the service buried, not less than 75 mm wide.

.2 Granular bedding shall be the type #1, #2, or #3 material as specified in the MERX Schedule of Quantities and Prices.

~~.2~~.3 Type 1 bedding: clean, hard, durable crushed gravel or stone, free from shale, clay, friable materials, organic matter and other deleterious substances and graded within the following limits when tested in accordance with ASTM C136 and ASTM C117 and giving a smooth curve without sharp breaks when plotted on a semi-log chart:

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

~~.3~~.4 Type 2 bedding: clean, hard, durable sand, gravel or crushed stone, free from shale, clay, friable materials, organic matter and other deleterious substances when tested to ASTM C136 and ASTM C117 and giving a smooth curve without sharp breaks when plotted on a semi-log grading chart:

ASTM sieve designation	**% passing**

9.5 mm	100
4.75 mm	50 – 100
2.00 mm	30 – 90
0.075	0 – 10

~~.4~~.5 Type 3 bedding: uniformly graded, clean granular material free from mud lumps, cinders, sods, refuse of other deleterious substances. The maximum particle size shall be 25 mm and the gradation and fines content shall be such that the material can be well compacted and will not become unstable and lose its pipe bearing ability upon exposure to water or ground water movement. Type 3 bedding shall be selected, whenever possible, from excavated material at the same point of trench excavation or from other points of trench excavation where suitable material is available. The bedding shall be approved by the Owner. No payment will be made for the direct reuse of the approved trench material if screening is not required by the Owner. When the excavated trench material is screened as directed by the Owner and used for bedding, payment will be made at the unit price bid for Type 3 bedding in the MERX Schedule of Quantities and Prices. When the excavated trench material is deemed insufficient for bedding as directed by the Owner and borrow~~imported~~ material from outside the limits of the contract is required, payment will be made at the unit price bid for Type 3 borrow~~imported~~ bedding in the MERX Schedule of Quantities and Prices".

~~.5~~.6 Backfill Material: selected material from excavation or other sources, approved by the Owner for use intended, unfrozen and free from rocks larger than 200 mm, cinders, ashes, sods, refuse or other deleterious materials.

~~.6.1 Granular bedding shall be the type #1, #2, or #3 material as specified in the MERX Schedule of Quantities and Prices.~~

.7 Rock underbedding: Crushed stone consisting of durable crushed rock approximately 100 mm maximum size and consisting of angular fragments obtained by breaking and crushing solid or natural rock, reasonably free from thin, flat elongated or other objectionable pieces and fines. Material not to contain any organic soil or objectionable matter with not more than 10 % by mass passing the #63 Canadian Metric sieve, including parties adhering to larger stone particles.

~~.7~~.8 Geotextile (filter fabric) in accordance with Section 02897 – Geotextile (Filter Fabric). Type as indicated in Contract Documents.

PART 4 EXECUTION

4.1 SITE PREPARATION AND PROTECTION

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

.2 Strip topsoil from within limits of excavation and stockpile as directed by the Owner, for re-spreading after backfilling or for reinstatement in other parts of the work. Protect stockpile materials from contamination.

~~.2~~.3 Implement sufficient erosion and sediment control measures to prevent sediment release off construction boundaries and into water bodies.

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

.5 Protect existing features in with hoarding or other barricades as indicated and in accordance with applicable local regulations.

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

.7 Where soil is subject to significant volume change due to change in moisture content, cover and protect to Owner approval.

.8 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.

~~.3~~.9 Protect buried services that are required to remain undisturbed.

4.2 COFFERDAMS, SHORING, BRACING AND UNDERPINNING

.1 Maintain sides and slopes of excavations in safe condition by appropriate methods and in accordance with Section 01545 – Safety Requirements and Occupational Health and Safety Act for the Province of Newfoundland and Labrador.

~~.1~~.2 Obtain permit from Authority Having Jurisdiction for diversion of water course.

~~.2~~.3 Construct temporary works to depths, heights and locations as indicated or directed by the Owner.

~~.3~~.4 During backfill operation:

.1 Unless otherwise indicated or directed by the Owner, remove sheeting and shoring from excavation.

.2 Do not remove bracing until backfilling has reached respective levels of such bracing.

.3 Pull sheeting in increments that will ensure compacted backfill is maintained at an elevation at least 500 mm above toe of sheeting.

~~.4~~.5 When sheeting is required to remain in place, cut off tops at elevations indicated or directed by the Owner.

~~.5~~.6 Upon completion of substructure construction:

.1 Remove cofferdams, shoring and bracing.
.2 Remove excess materials from site and restore water courses to conditions indicated or as directed by the Owner.

4.3 DEWATERING AND HEAVE PREVENTION

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

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

.3 Dispose of water in accordance with Section 01560 – Environmental Requirements and in a manner not detrimental to public and private property, or any portion of work completed or under construction. Comply with all requirements of the Department of Environment and Conservation and other regulatory agencies having jurisdiction regarding disposal of water from excavations.

.4 Submit for the Owner's review, details of proposed dewatering or heave prevention methods, such as dikes, ~~or~~ well points, and sheet pile cut-offs.

.5 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.

~~.5~~.6 Provide flocculation tanks, settling basins, or other treatment facilities to remove suspended solids or other materials before discharging to storm sewers, water courses or drainage areas.

~~.6~~.7 Do not dewater during placing of concrete, or for a period of at least 24 hours thereafter, unless from a pump separated from concrete work by a watertight wall or other effective means.

~~.7~~.8 Construct all sub-drains, sump holes, wells or the like required for dewatering the excavations so as not to endanger in any way the stability of the Works, and on completion of the work completely backfill and consolidate these excavations.

4.4 EXCAVATION

.1 Advise the Owner ten (10) business day prior to excavation operations to enable original cross sections to be taken.

.2 Before commencing any excavation, take levels and cross-sections of the original ground surface and agree upon them with the Owner.

~~.1~~.3 Excavate to lines, grades, elevations and dimensions indicated.

~~.2~~.4 ~~Cut pavement or side walk neatly in a line along limits of proposed excavation or as specified in order that surface may break evenly and cleanly.~~ The width removed along the normal trench for the installation of the pipe shall not exceed the width of the trench specified by more than 500 mm on each side of the trench. The width and length of the area removed for the installation of gate valves, specials, maintenance holes, or other structures shall not exceed the maximum linear dimensions of such structures by more than 500 mm on each side. Wherever, in the opinion of the Owner, existing conditions make it necessary or advisable, remove additional pavement, as directed by the Owner and approved by the Regional Engineer, and receive extra compensation provided such additional work is not shown in the drawings or specified. Removal or damage to pavement or surfaces beyond these limits, shall be replaced or repaired at the expense of the Contractor.

~~.3~~.5 Remove concrete, masonry, paving, walks, demolished foundations and rubble and other obstructions encountered during excavation in accordance with Section 02070 – Sitework Demolition & Removal of Structures.

~~.4~~.6 Do not disturb soil within branch spread of trees or shrubs that are to remain. If excavating through roots, excavate by hand and cut roots with sharp axe or saw. Seal cuts with approved tree wound dressing.

~~.5~~.7 For trench excavation, u~~U~~nless otherwise authorized by the Owner in writing, do not excavate more than 30 m of trench in advance of installation operations and do not leave open more than 15 m at end of day's operation.

.8 Keep excavated and stockpiled materials a safe distance away from edge of trench or as directed by the Owner.

.9 Restrict vehicle operations directly adjacent to open trenches.

~~.6~~.10 Dispose of surplus, unsuitable, and waste material in accordance with Section 01005– General Requirements. The Owner shall define types of ~~waste~~ material.

~~.7~~.11 Do not obstruct flow of surface drainage or natural watercourses.

~~.8~~.12 Earth bottoms of excavations to be undisturbed soil, level, free from loose, soft or organic matter.

.13 Notify Owner when bottom of excavation is reached.

~~.9~~.14 Obtain Owner approval of completed excavation.

~~.10~~.15 Remove unsuitable material from trench bottom to extent and depth directed by the Owner.

~~.11~~.16 Where required due to unauthorized over-excavation, correct as follows:

.1 Fill under bearing surfaces and footings with concrete specified for footings.

.2 Fill under other areas with approved fill compacted to minimum of 95 % corrected maximum dry density, where the maximum dry density is determined in accordance with ~~to~~ ASTM D698 and corrected as specified in Section 02501 – Corrected Maximum Dry Density.~~, Method D~~.

~~.12~~.17 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.

~~.13~~.18 No extra payment shall be made for measures ordered by the Owner to correct problems caused by unauthorized over-excavation.

~~.14~~.19 No extra payment shall be made for construction methods required to keep the trench stable, free from disturbance, or dry, nor for crushed stone or other granular material used to facilitate drainage or dewatering during construction of the pipeline or for any extra excavation related thereto.

~~.15~~.20 The use of mechanical excavators will be permitted except where their use, in the opinion of the Owner, will cause damage to property or structures above or below ground where property or structures must be preserved in accordance with the contract. The costs for hand excavation when the proximity of existing structures or other considerations render this necessary are deemed to be included in the Unit Price for trench excavation and backfill in the MERX Schedule of Quantities and Prices.

~~.16~~.21 Keep all surface materials that, in the opinion of the Owner, are suitable for re-use in restoring the surface separate from the general excavation material.

~~.17~~.22 Stockpile suitable material excavated, including rock excavation, required for trench backfill in approved location.

4.5 TRENCH BOTTOM PREPARATION

.1 Draw the attention of the Owner to the nature and condition of the excavated surfaces that are to receive the foundations of the works. If in the opinion of the Owner, the foundation is unsuitable to receive the structure as shown on the Drawings, the Owner will issue written instructions for extra excavation, special filling or other extra work required to secure a proper foundation.

.2 Where required due to removal of unsuitable material and/or unauthorized over excavation, bring bottom of excavation to design grade with approved granular material or rock underbedding as directed by the Owner.

4.6 PRE-INSTALLATION INSPECTION

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

4.7 GEOTEXTILE (FILTER FABRIC)

.1 As required for installation.

4.8 BEDDING AND SURROUND OF UNDERGROUND SERVICES

.1 Place and compact granular material for bedding and surround of underground services as indicated.

.2 Place bedding and surround material in unfrozen condition.

4.7~~4~~.9 BACKFILLING

.1 Vibratory compaction equipment: approved by Owner.

~~.1~~.2 Do not proceed with backfilling operations until the Owner has inspected and approved installations.

~~.2~~.3 Areas to be backfilled and/or backfill material shall be free from debris, snow, ice, water or frozen ground. Do not use backfill material that is frozen or contains ice, snow or debris.

~~.3~~.4 Backfilling around installations:

.1 Place bedding as specified and as detailed on the contract drawings.

.2 Do not backfill around or over cast-in-place concrete within 24 hours after placing.

.3 Place layers simultaneously on both sides of installed work to equalize loading. Difference not to exceed 600 mm.

.4 Where temporary unbalanced earth pressures are liable to develop on walls or other structures.

.1 Permit concrete to cure for minimum of seven (7) calendar days or until it has sufficient strength to withstand earth and compaction pressure and approval obtained from the Owner or:

.2 If approved by the Owner, erect bracing or shoring to counteract unbalance, and leave in place until removal is approved by the Owner.

.5 Place material by hand under, around and over installations until 600 mm of cover is provided. Dumping material directly on installations will not be permitted.

~~.4~~.5 Place backfill material in uniform layers not exceeding 300 mm compacted thickness up to grades indicated. Compact each layer before placing succeeding layer.

~~.5~~.6 Do not place backfill in freezing weather without written permission of the Owner.

~~.6~~.7 The foundation or underside of all structures and installations, including pipe bedding for pipes in trench shall bear on undisturbed ground or prepared surfaces as reinstated and approved by the Owner.

~~.7~~.8 Granular backfill materials:

.1 Place granular backfill material ~~B~~beneath paved highways or within 1.5 metres of the edge of pavement and beneath paved areas, curbs, driveways or sidewalks use granular backfill materials compacted to a minimum 95 ~~%~~percent of the maximum dry density as determined by ASTM D698 ~~Method D~~. Compact using approved mechanical tamping devices.

.9 Place fill in areas as indicated.

~~4.8~~4.10 RESTORATION

.1 Remove waste materials and debris, trim slopes, and correct defects noted by the Owner.

.2 Replace topsoil as indicated or directed by the Owner.

.3 Reinstate pavement, sidewalks and lawns to condition and elevation that existed before excavation.

.4 Clean and reinstate areas affected by work as directed by the Owner and in accordance with Section 01710 – Reinstatement and Cleaning.

.5 Use temporary plating to support traffic loads over unshrinkable fill for initial 24 hours.

~~.4~~.6 Protect newly graded areas from traffic and erosion and maintain free of trash or debris.

~~.5~~.7 Reinstate areas affected by equipment outside of planned area to condition that existed prior to commencement of work and leave site in rake-clean condition as directed.

PART 5 PAYMENT

5.1 MEASUREMENT FOR PAYMENT

.1 Trench excavation to be measured in cubic metres in their original position and based on theoretical trench conditions.

~~.2 Before commencing any excavation, take levels and cross-sections of the original ground surface and agree upon them with the Owner.~~

~~.3~~.2 Trench length for measurement purposes will be measured continuously through maintenance holes and other appurtenances except in the case of sewage lift stations and any extra excavation required for their construction outside the specified measurement trench width will be deemed to be included in the contract unit price for these structures and appurtenances.

~~.4~~.3 Theoretical trench conditions: Excavated quantities measured to be theoretical volume removed within the following limits unless otherwise detailed in this specification:

.1 Depth: Measured vertically from original ground surface, less a deduction of ~~150 mm~~ when grubbing or ashpalt removal is required, to the bottom of the trench excavation, including the depth required for bedding material, ~~installed grade at bottom of trench~~ as shown on the drawings.

.1 In areas of specified mass excavation, trench depth will be measured from the new ground elevation established after mass excavation..

.2 Main Trench Width:

.1 ~~Subject to subsection 2.1.6.3 of this specification~~Single pipe trench:~~, the width of main trench allowed for measuring purposes shall be~~ the sum of the nominal diameter~~s~~ of the single pipe, plus the thickness of any specified pipe insulation, and 300 mm each side (i.e. ~~in the trench plus pipe insulation plus~~ 600 mm) for working space.

.2 Combined trench:

.1 Two sewer pipe trench: ~~In the case of service pipes the width of trench allowed shall be 1000 mm. In the case of a combined gravity sanitary sewer and storm~~

~~sewer the width of trench allowed for measuring purposes shall be~~ the sum of the nominal diameters of the pipes, plus the thickness of any specified pipe insulation, and 300 mm separation between pipes and on each side (i.e. ~~1050~~ 900 mm) for working space.

.2 Water main and one or more sewer mains: the sum of the nominal diameters of the pipes, plus the thickness of any specified pipe insulation, and 600 mm plus required distances between pipes, including 300 mm between sewer mains if applicable.

.3 The minimum width of a main trench with multiple pipes shall be:

.1 1500 mm where the average depth is 0 to 4 m;

.2 2000 mm where the average depth is greater than 4 m to 6 m;

.3 ~~-~~2500 mm where the average depth is greater than 6 m.

~~.1~~.4 The average depth shall be calculated between maintenance holes on sewer line or at 100 m intervals along water main only trench.

~~.2~~.3 When concrete pipe is used the outside diameter of the pipe rather than the nominal diameter shall be used to determine the trench width.

.3 Service Trench Width:

~~.1 In the case of service pipes T~~the width of trench allowed shall be 1000 mm.

~~.3~~.2 The width of service trench shall increase by 500 mm where the average depth is greater than 4 m and by an additional 500 mm where the average depth is greater than 6 m.

~~.5~~.4 Extra excavation required for maintenance holes and/or the deflection of water mains and/or storm sewer pipes at maintenance holes or other structures will be deemed to be included in the Contract Unit Price for trench excavation and backfill as detailed above. Trench width for measurement purposes will be that required for the number and size of pipes as specified~~,~~ and assumed as one trench passing continuously through the maintenance hole or other structures. Deflected pipes at or around structures will not be considered as separate trenches for measurement and payment purposes.

~~.6~~.5 When rock is exposed by stripping the common material, the rock surface will be profiled. When rock is to be excavated by drilling from ground level, then rock will be measured by inspection of the sides of the excavation by measuring the height of the over-burden on top of the rock.

~~.7~~.6 Borrow~~Imported~~ common backfill including compaction to be measured in cubic metres based on theoretical paylines for trenching.

~~.8 Excavation and disposal of waste material to be paid under common excavation.~~

~~.9~~.7 Sheeting and bracing left in place on direction of the Owner will be measured in square metres of surface area of plane surface of sheeting.

.8 Granular pipe bedding will be measure by the cubic metre for each type of material required.

~~.10~~.9 Rock underbedding will be measured compacted in place according to theoretical paylines specified and depth required. Payment includes all additional costs associated with type of materials and greater excavation depths required.

~~.11~~.10 ~~Supply and placement of filter fabric will be measured in accordance with Section 02897.~~

~~.12~~.11 Trucking, handling, stockpiling, filling, and conditioning at the direction of the Owner of otherwise competent material that is too wet for immediate reuse when removed from the trench shall be measured in accordance with subsection Theoretical trench conditions 5.1.4~~2.1.6~~ of this specification.

~~.13~~.12 Supply and placement of marking tape will be paid for by the metre.

~~.14 Where the Owner requires excavation or borrow materials be hauled in excess of two (2) kilometres, additional payment for overhaul will be made in accordance with Section 1005.~~

5.2 BASIS OF PAYMENT

.1 All costs associated with the work outlined in this specification, including labour, materials, and equipment use to carry out the work shall be deemed to be included in the appropriate unit and lump sum prices quoted as outlined in the Measurement for Payment subsection of this section and as included in the MERX Schedule of Quantities and Prices.

.2 Payment for common excavation shall include backfill with excavated trench material, compaction, disposal of waste material off site, placing of excavated material at another location on site and all other items as outlined in this section.

~~.2~~.3 Shoring, bracing, trench boxes, cofferdams, underpinning and de-watering of excavation will be incidental to work and will not be measured separately.

.4 Where the Owner requires excavation or borrow materials be hauled in excess of two (2) kilometres, additional payment for overhaul will be made in accordance with Section 01005 – General Instructions.

.5 Reinstatement will be paid for in accordance with Section 01710 – Reinstatement and Cleaning.

~~.3~~.6 Mass excavation and~~/or mass~~ borrow common backfill will be paid for~~measured~~ in accordance with Section ~~02215~~02224 – Roadway Excavation, Embankment & Compaction.

~~.4~~.7 Excavation and backfill of sewage lift stations will be paid for under this section in accordance with the measurement limits defined under Section 02650 – Maintenance Holes, Catch Basins, & Ditch Inlets.

~~.5~~.8 When separate payment is specified or indicated in the MERX Schedule of Quantities and Prices for granular materials for pipe bedding and backfill, measurement widths shall be the theoretical trench width and lengths shall be as specified for trench excavation, bedding and backfill. Measurement depth shall be actual depth installed up to limits shown on the contract drawings or as specified in this specification. Bedding volumes shall be adjusted in accordance with Sections 02409 - Storm Utility Drainage Piping, 02702 – Public Sanitary Sewerage Gravity Piping, and ~~Section~~ 02713 - Water Mains.

.9 Geotextile (filter fabric) will be paid for~~measured~~ in accordance with Section 02897 - Geotextile (Filter Fabric).