CW 2030 - EXCAVATION BEDDING AND BACKFILL

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1. DESCRIPTION

1.1 General

.1 This specification covers excavation, trenching, disposal of excess or unsuitable excavated material, shoring, foundations, bedding, backfilling and compaction required for the installation of Underground Works.

1.2 Definitions

.1 Excavation will include trenches and shafts.

.2 Shaft means a vertical or inclined opening excavated below ground level.

.3 Trench means an excavation having a depth which exceeds its width measured at the bottom.

.4 Shoring will include, bracing, sheeting, planking, circular steel sleeves and trench cages.

.5 Solid rock and concrete excavation is defined as boulders, rock, concrete rubble and foundations greater than 0.5 cubic metres in volume as well as bedrock, consolidated glacial till or hardpan and buried concrete pavements that requires blasting, drilling, splitting or breaking with additional equipment before being removed from excavations using normal mechanical excavation equipment.

.6 Frozen material will not be considered rock excavation.

.7 Trenchless installation methods are methods of installing pipe inside a hole that has been made between shafts by coring, boring, horizontal directional drilling, jacking, tunnelling and extraction of an existing pipe or similar methods with minimal excavation and surface disruption.

1.3 Referenced Standard Construction Specifications

.1 CW 1120 - Existing Services, Utilities and Structures
.2 CW 1130 – Site Requirements
.3 CW 2160 – Concrete Underground Structures and Works
.4 CW 3230 - Full-Depth Patching of Existing Slabs and Joints
.5 CW 3235 - Renewal of Existing Miscellaneous Concrete Slabs
.6 CW 3240 - Renewal of Existing Curbs

1.4 Referenced Standard Details

.1 SD-001 – Standard Pipe Bedding Classes
.2 SD-002 – Standard Trench and Excavation Backfill Classes
.3 SD-003 - Jetting Nozzle Insertion Locations

2. MATERIALS

2.1 Bedding and Backfill

.1 Type 1 material is to consist of well graded pit-run material conforming to the grading requirements of Table CW 2030.1

.2 Type 2 and Type 3 material is to consist of sound, hard, crushed rock or crushed gravel free from organic or soft material that would disintegrate through decay or weathering, well graded throughout conforming to the grading requirements of Table CW 2030.1. Type 2 material is to have a 100% crush content and be well graded throughout.

.3 Material passing the 315 micrometre sieve is to have a liquid limit not greater than 25 and a plasticity index not greater than 6.

.4 Sand is to be clean and free running conforming to the grading requirements of Table CW 2030.1. Use dry sand when freezing conditions occur.

.5 Type 1, Type 2 and Type 3 material is to have a loss of not more than 35% when subjected to abrasion testing in accordance with Grading B of ASTM C131.

TABLE CW 2030.1 - GRADING REQUIREMENTS FOR IMPORTED BACKFILL

Canadian Metric Sieve Size	Percent of Total Dry Weight Passing Each Sieve			
	Type 1 Material	Type 2 Material	Type 3 Material	Sand
75 000	90% - 100%			
28 000	80% - 100%		100%	
20 000		100%		
10 000				100%
5 000	40% - 80%	40% - 70%	0% - 5%	90% - 100%
2 500		25% - 60%		
630				25% - 60%
315	10% - 35%	8% - 25%		
80	5% - 30%	6% - 17%		0% - 3%

.6 Imported clay material is to be low to medium plastic clays with liquid limit <50 or mixtures of clay and sand suitable for compaction and is to be free of silt, rock, concrete rubble and organic materials. Material is to be approved by the Contract Administrator before placing in excavations.

2.2 Cement-Stabilized Fill

.1 Cement-stabilized fill to be in accordance with Table CW 2160.1 of CW 2160.

2.3 Flowable Cement-Stabilized Fill

.1 Flowable cement-stabilized fill is to be in accordance with Table CW 2160.1 of CW 2160.

2.4 Concrete Bedding

.1 Concrete bedding to be in accordance with Table CW 2160.1 of CW2160.

2.5 Material Testing Methods

.1 Imported bedding and backfill material will be subject to inspection and testing by the Contract Administrator or by the testing laboratory designated by the Contract Administrator. Notify the Contract Administrator at least 7 days before construction starts of sites where imported backfill material will be obtained. Provide material samples for testing at no cost to the Contract Administrator. Replace imported backfill materials that do not conform in whole or in part to this specification.

.2 Standard Proctor Density for materials used for bedding and backfill will be determined in accordance with ASTM D698. Field density of materials will be calculated as a percentage of Standard Proctor Density.

.3 Field density of unexcavated and compacted backfill materials will be verified by field density tests in accordance with ASTM Standard D2922.

.4 Frequency and number of tests will be determined by the Contract Administrator.

.5 Fill holes made by the removal of testing samples from compacted backfill and unexcavated material promptly with appropriate material and compact to match adjacent compacted material.

3. CONSTRUCTION METHODS

3.1 Site Drainage and Excavation Dewatering

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

.2 Maintain existing site drainage around excavations.

.3 Protect open excavations from flooding and damage due to rainfall and surface run-off.

.4 Do not direct drainage water from ground surface or excavations into existing sewer system without written approval of the Contract Administrator.

3.2 Pavement Removal

.1 Remove existing pavement in accordance with specifications CW 3230, CW 3235 and CW 3240.

3.3 Excavation

.1 Perform excavation in accordance with Province of Manitoba "W210 The Workplace Safety and Health Act" and "Guidelines for Excavation Work".

.2 Excavate to the lines, grades, elevations and dimensions shown on the Drawings and set in the field by the Contract Administrator.

.3 Excavate the additional depth required for bedding and foundation material in accordance with SD-001 and the Drawings.

.4 Ensure the bottom of the excavation is smooth, free from depressions, lumps and protruding objects.

.5 Maximum trench width from the underside of the pipe bedding and foundation to 600 millimetres above the top of the pipe to be the greater of 1200 millimetres or the outside diameter of the pipe plus 750 millimetres.

.6 Where the maximum trench width is exceeded due to unstable soil conditions or over-excavation, the Contract Administrator will review the external loading condition on the pipe to determine if the class of bedding and pipe type or strength specified needs to be upgraded.

.7 Remove unsuitable soil from bottom of excavation as directed by the Contract Administrator.

.8 Fill over-excavation to required elevation with Type 1, Type 2 or Type 3 material as directed by the Contract Administrator and compact to at least 95% of Standard Proctor Density.

3.4 Solid Rock and Concrete Excavation

.1 Over-excavate solid rock and concrete an additional 150 millimetres below the underside of the required bedding for full width of trenches and 300 millimetres beyond largest outside dimension of manholes, catch basins and structures unless otherwise indicated in the Drawings, and Specifications or directed by the Contract Administrator.

.2 Where blasting is required, retain a certified blaster who is qualified to handle and use explosives to supervise preparations, precautions and perform rock blasting operations. Carry out rock blasting in accordance with local regulations, Province of Manitoba Workplace, Health and Safety Act W210 and Federal Explosives Act.

.3 Fill over-excavation to underside of required bedding with Type 2 or Type 3 material as directed by the Contract Administrator compacted to at least 95% of Standard Proctor Density.

3.5 Shoring

.1 Provide shoring in accordance with Province of Manitoba "W210 The Workplace Safety and Health Act" and "Guidelines for Excavation Work".

.2 Use suitable type of shoring for soil conditions.

.3 Provide shoring design stamped, signed and dated by a Professional Engineer experienced in shoring design and licensed to practice in Province of Manitoba when required in the Specifications.

.4 Install shoring in a manner to support sides of excavation and prevent ground movement that may damage pipes and structures being constructed and cause damage to existing adjacent pavements, buildings and other structures.

.5 Use type or method of shoring that will not disturb the compacted foundation and bedding when being removed.

.6 Arrange with the Professional Engineer who designed the shoring system to inspect the shoring system during construction and certify, in writing to the Contract Administrator, that construction is in conformance with the approved design.

.7 Leave the shoring system in place until such time as the Professional Engineer who designed the shoring system has provided written approval to remove. Provide a copy of the written approval to the Contract Administrator before removal.

.8 Remove shoring from excavations as backfilling proceeds unless otherwise indicated in the Specifications or directed by the Contract Administrator to leave shoring permanently in place. Cut-off shoring permanently left in place 1.2 metres below grade unless otherwise indicated in the Specifications or directed by the Contract Administrator.

.9 Repair pavements, boulevards, pipes, utilities and structures as directed by the Contract Administrator that are damaged or disturbed by shoring failure or when removing shoring.

3.6 Disposal of Unsuitable or Surplus Excavated Material

.1 Dispose of unsuitable and surplus excavated material in accordance with Specification CW 1130.

3.7 Foundation, Bedding and Backfill

.1 Remove boulders, rocks or concrete larger than 50 millimetres in size, ice, snow, frozen material, organic material, or debris from bottom of excavation before placing foundation or bedding material.

.2 Provide a foundation consisting of Type 3 material over the entire bottom of shafts made for trenchless installation in accordance with SD-001. Compact to a density of at least 95% of Standard Proctor Density. Foundations will not be required in shafts for watermains unless directed otherwise by the Contract Administrator.

.3 Place bedding material in excavations and under pipe haunches in accordance with SD-001. Compact to a density of at least 95% of Standard Proctor Density.

.4 Type 2 and Type 3 material can be substituted for sand where sand is specified for the bedding and initial backfill material.

.5 Place specified initial backfill around and over the pipe to the height shown on SD-001 and compact to a density of at least 95% of Standard Proctor Density using methods and equipment that will not damage the pipe.

.6 Backfill the remainder of the excavation as follows with specified class of backfill in accordance with Section 3.8 of this specification and SD-002.

.1 Trenches and excavations located within existing paved areas and areas proposed to be paved: Class 1, Class 2 or Class 3 Backfill as indicated on the Drawings and Specifications or as directed by the Contract Administrator.

.2 Trenches and excavations within 1 metre of a paved area: Class 3 Backfill.

.3 Trenches and excavations located within a boulevard or grassed area: Class 4 or Class 5 Backfill as indicated on the Drawings and Specifications or as directed by the Contract Administrator.

.7 Ensure adequate cover is provided over the pipe to protect it from being damaged by backfill placed and equipment used for compaction.

.8 Repair pavements, boulevards, pipes, utilities and structures as directed by the Contract Administrator that are damaged or disturbed by settlement of backfill in trenches and excavations.

3.8 Classes of Backfill

.1 Class 1 Backfill

.1 Backfill the excavation with Type 1 material compacted in accordance with Clause 3.8.2 or 3.8.3 of this specification to within 1 metre of the underside of pavement**.** Fill the remainder of the excavation with cement-stabilized fill to the required depth below finished pavement in accordance with the Drawings and Specifications or as directed by the Contract Administrator.

.2 Class 2 Backfill

.1 Backfill the excavation with Type 1 material in maximum 300 millimetre thick layers to the grade required for backfill in accordance with the Drawings and Specifications or as directed by the Contract Administrator. Compact each layer with a vibratory compactor to at least 95% of Standard Proctor Density. Obtain approval from the Contract Administrator before proceeding with next layer.

.3 Class 3 Backfill

.1 Backfill the excavation with Type 1 material to grade required for backfill in accordance with the Drawings and Specifications or as directed by the Contract Administrator. Compact backfill material by jetting, flooding and tamping in accordance with Section 3.9 of this specification.

.4 Class 4 Backfill

.1 Backfill the excavation with suitable excavated material in maximum 600 millimetre thick layers to the grade required for backfill in accordance with the Drawings and Specifications or as directed by the Contract Administrator. Compact each layer by mechanical means to a density equivalent to that of the surrounding unexcavated material. Obtain approval from the Contract Administrator before proceeding with next layer.

.5 Class 5 Backfill

.1 Backfill the excavation with suitable excavated material to the grade required for backfill in accordance with the Drawings and Specifications or as directed by the Contract Administrator. Compact backfill material by jetting, flooding and tamping in accordance with Section 3.9 of this specification.

3.9 Jetting, Flooding and Tamping of Backfill

.1 Make arrangements for water supply source in accordance with Specification CW 1120.

.2 Use a minimum 25 millimetre diameter rigid pipe of suitable length for jetting excavations.

.3 Insert the jetting pipe into the backfill to within 1 metre of the top of the pipe allowing the water jetting action to determine the rate at which the jetting pipe is worked through the backfill.

.4 Locate jetting insertions in accordance with SD-003.

.5 Continue jetting until water rises above top surface of backfill and begins to pond.

.6 Tamp backfill with a backhoe mounted vibratory plate compactor once surface water has sufficiently dried.

.7 Place and compact additional specified backfill material to maintain top surface of backfill at required elevation.

3.10 Excavation and Backfill Where New Pipes Cross Existing Pipes

.1 New pipes being installed in a trench cross above an existing pipe trench.

.1 Excavate to 600 millimetres below bottom of new pipe or to top of existing pipe whichever is lesser for a length along the existing pipe of 1500 millimetres or the existing pipe diameter plus 600 millimetres which ever is greater.

.2 Backfill to the underside of the bedding required for new pipe with Class 2 Backfill unless

indicated otherwise in the Drawings and Specifications or directed by the Contract Administrator.

.2 New pipes being installed in a trench cross below an existing pipe trench.

.1 Support or remove and replace a section of the existing pipe to allow installation of new pipe.

.2 Backfill the excavation for the new pipe with Class 2 Backfill to the underside of bedding required for existing pipe unless indicated otherwise in the Drawings and Specifications.

.3 Bed the new pipe and backfill the remainder of the excavation in accordance with Clause 3.7.6 of this specification unless indicated otherwise in the Drawings and Specifications or directed by the Contract Administrator.

3.11 Excavation and Backfill of Parallel Pipes

.1 Support and protect the higher pipe as required where excavation of the lower pipe will disturb the ground under the higher pipe.

.2 Backfill the lower pipe excavation to the invert of the higher pipe with Class 2 Backfill unless indicated otherwise in the Drawings and Specifications or directed by the Contract Administrator.

.3 Bed the new pipe and backfill the remainder of the excavation in accordance with Clause 3.7.6 of this specification unless indicated otherwise in the Drawings and Specifications or directed by the Contract Administrator.

3.12 Filling Underground Voids With Cement Stabilized Fill

.1 Fill underground voids as indicated in the Drawings and Specifications or directed by the Contract Administrator with cement-stabilized fill. Obtain approval from the Contract Administrator to make additional excavations to accommodate the placement of cement-stabilized fill.

3.13 Restoration

.1 Restore surfaces in accordance with the Drawings and Specifications, applicable By-Laws if the work being done under a Permit or as directed by the Contract Administrator.

4. MEASUREMENT AND PAYMENT

4.1 Site Drainage and Excavation Dewatering

.1 Site drainage and excavation dewatering will be included with construction of the underground works.

4.2 Excavation

.1 Excavation and disposal of surplus excavated material will be included with construction of the underground Works.

.2 Upgrading of bedding, pipe type and strength as directed by the Contract Administrator due to over excavation beyond the specified limits will be at own expense.

4.3 Excavation of Unsuitable Material

.1 Excavation and disposal of unsuitable material will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Excavation of Unsuitable Material". Volume to be paid for will be the total number of cubic metres of unsuitable material excavated and disposed of in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Excavated material will be measured by cross sections in its original position and the volume computed using the method of Average End Areas.

.3 Upgrading of bedding, pipe type and strength as directed by the Contract Administrator due to unsuitable soil conditions will be paid for as an authorized Change in Work.

4.4 Solid Rock and Concrete Excavation

.1 Excavation and disposal of solid rock and concrete will be measured on a volume basis and paid for at the Contract Unit Price per cubic metre for "Solid Rock and Concrete Removal". Volume to be paid for will be the total number of cubic metres of solid rock and concrete excavated and disposed of in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Solid rock and concrete removal will be measured by cross sections in its original position and the volume computed using the method of Average End Areas.

.3 Over excavation of solid rock and concrete beyond the specified limits will be at own expense.

4.5 Backfill Material to Replace Rock and Unsuitable Material

.1 Backfill material required to replace rock and unsuitable material will be measured on a volume basis for each type of backfill and paid for at the Contract Unit Price per cubic metre for "Backfill Material". Volume to be paid for will be the total number of cubic metres of Backfill supplied, placed and compacted in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Backfill material will be measured by cross sections in its compacted position and the volume computed using the method of Average End Areas.

.3 Backfill material required for over excavation beyond specified limits will be at own expense.

4.6 Shoring

.1 Supply, installation and removal of shoring will be included with construction of the underground work.

.2 Repair of damage to existing pavements and structures adjacent to the excavation caused by careless installation and removal of shoring will be at own expense.

.3 Replacement and re-compaction of bedding disturbed by removal of shoring will be at own expense.

4.7 Shoring Left in Place

.1 Shoring specified or directed to be left in place will be measured on an area basis and paid for at the Contract Unit Price for "Shoring Left in Place". Area to be paid for will be total number of square metres of shoring installed and left in place in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement will be made by multiplying the height of the shoring left in place by the perimeter of the excavation.

4.8 Foundation, Bedding and Backfill

.1 Supply and installation of foundation, bedding and backfill for pipe and other structures will be included with construction of the underground works.

.2 Where granular or cement-stabilized backfill material is directed by the Contract Administrator to be used in place of the specified backfill material it will be measured on a volume basis for each type of backfill and paid for at the Contract Unit Price per cubic metre for "Granular Backfill Material" and "Cement-Stabilized Backfill Material". Volume to be paid for will be the total number of cubic metres of Backfill supplied, placed and compacted in place in accordance with this specification, accepted and measured by the Contract Administrator.

.3 The unit price provided for granular or cement-stabilized backfill material used in place of the specified backfill will be the incremental cost of the material above and beyond the cost of the volume of the specified backfill being replaced.

.4 Repair of damage to pavements, boulevards, pipes, utilities and structures resulting from settlement of excavations will be at own expense.

4.9 Jetting, Flooding and Tamping of Backfill

.1 Jetting, flooding and tamping of backfill will be included with construction of the underground works.

4.10 Filling Underground Voids With Cement Stabilized Fill

.1 Filling underground voids with cement-stabilized fill will be measured on a volume basis and paid for at the Contract Unit Price for "Filling Underground Voids With Cement-Stabilized Fill". Volume to be paid for will be the total number of cubic metres of cement stabilized fill supplied and placed in accordance with this specifications, accepted and measured by the Contract Administrator.

.2 Measurement for cement stabilized fill will be made by calculating the volume of the void being filled.

4.11 Backfill for Parallel Pipes

.1 Backfill for parallel pipes will be measured on a length basis and paid for at the Contract Unit Price for "Backfill for Parallel Pipes". Length to be paid for will be the total number of linear

metres of backfill supplied and placed in accordance with this specification, accepted and measured by the Contract Administrator.

.2 Measurement of backfill for parallel pipes will be made horizontally at grade along the centreline of the trench of the lower pipe.