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3.1 SECTION 1 - CLEARING

3.1.1 DESCRIPTION

Clearing consists of the removing or the cutting off, at the heights described herein or at such heights as approved by the Engineer, trees, stumps and brush, the removal of all fallen timber, fallen branches and other surface litter from within the right-of-way, borrow pits, gravel pits, haul roads, disposal areas and other areas shown on the Drawings or designated by the Engineer and shall include the disposal of all in accordance with this Specification. Shrubs and other vegetation that can be cut with a brush scythe or mowing machine will not be considered as clearing.

Clearing must be carried out in accordance with the regulations and requirements of the Northwest Territories *Forest Protection Act*, where applicable.

3.1.2 MATERIALS

Not applicable.

3.1.3 CONSTRUCTION

3.1.3.1 General

a) Clearing shall consist of the removal and disposal of all trees, stumps and brush, fallen timber, fallen branches and other surface litter, except for trees and shrubs that are designated for preservation. These trees and shrubs shall be protected from scarring, barking or other injury during the construction operations.
b) Comply with the federal *Migratory Birds Convention Act* and the federal *Species at Risk Act*, as outlined in Division 2.
c) The Contractor shall provide the survey for clearing limit markers for the clearing operations. The Contractor shall provide notice to the Engineer to review the clearing limit markers in advance of the clearing operation.
d) The right-of-way clearing operation shall be completed at least 2 km ahead of the earth moving operation. Except as may otherwise be approved or directed by the Engineer in advance and in writing, borrow pit areas shall not be cleared in advance of excavation by more than one week.
e) Where designated by the Engineer, all merchantable timber shall be salvaged. Merchantable timber is defined as any tree having a stump diameter 130 mm or greater measured at breast height. The diameter will be calculated to the nearest 10 mm, from the measured circumference of the tree. The merchantable timber shall be trimmed, cut to 2.5 m lengths and neatly stockpiled at locations designated by the Engineer.

3.1.3.2 Clearing Methods

Machine clearing will generally be permitted for clearing of the right-of-way, borrow pits, gravel pits, haul roads and where roadway excavations are proposed. Hand clearing shall be performed in areas designated by the Engineer and may be required for the salvage of merchantable timber and in areas where machine clearing may cause damage to culverts, signs, survey monuments, utility lines and fences. All necessary precautions shall be taken to protect such items from damage. Clearing shall consist of cutting all trees and brush to within 100 mm of original ground surface and shall be carried out in a manner that will not damage the existing insulation of organic material. Unless otherwise specified, the use of machinery to pile and dispose of the clearing debris will be permitted.

3.1.3.3 Minimal Disturbance Clearing

Minimal Disturbance Clearing shall be performed in specific areas designated by the Engineer. Minimal

Disturbance Clearing shall consist of cutting to within 200 mm of the original ground surface all trees, brush and existing stumps and placing this material, together with deadfalls and other surface debris in a flattened uniform layer over the embankment areas as directed. Cutting and placing operations along embankment sections must be performed in such a manner that the existing insulation of fibrous material is not damaged.

3.1.3.4 Disposal

a) Debris piles consisting of trees, rubbish and/or organic material existing from previous clearing operations shall be removed and disposed of by the Contractor.
b) Unless otherwise specified, all clearing and associated debris shall be disposed of by piling and burning. Generally, the disposal of right-of-way debris shall consist of chipping or piling and burning within the limits of the right-of-way and the placing of any unburned debris in disposal pits or disposal areas designated and/or approved by the Engineer. Surplus material from disposal pits shall be disposed of as directed by the Engineer. A minimum of 600 mm of mineral soil is required over the buried debris. The ground surface shall be restored and leveled.
c) Burning of clearing debris shall be carried out at such times and in such a manner as to comply with the Territorial Land Use Regulations. If burning is prohibited at the time of the clearing, the material shall be placed in disposal areas which are not visible from the right-of-way, for burning at a later date. The disposal area shall be large enough to accommodate the pile of clearing debris and a fire guard with a minimum of 12 m between the cleared debris pile and the standing trees.
d) Burning operations shall be under the Contractor's constant supervision and shall be completed in accordance with the regulations and requirements of the Northwest Territories *Forest Protection Act*. All precautions shall be taken to prevent the spreading of fire to adjacent forests. This shall include the maintaining of a safe distance between the forest edge and the fire to act as a fire guard.
e) The Contractor shall obtain the necessary burning permit and carry out all burning as soon as possible. Any restrictions caused by changes in the conditions of the burning permit and any effect this may have on construction operations and scheduling shall be the responsibility of the Contractor.
f) The disposal of clearing debris into "push-off" or "push-out" areas will not be permitted.
g) Deadfalls, windfalls, overhanging trees, limbs or snags which lie partially within the right-of-way shall be removed and burned. The pushing of these outside of the right-of-way will not be permitted.
h) Unless otherwise specified, for the clearing of borrow pits, the Contractor will generally be permitted to place the clearing debris into a section of the pit where excavation is completed or along the outside edge of the pit and trim such debris to a condition acceptable to the Engineer.

3.1.3.5 Land Use

All clearing Work shall be carried out in accordance with the *Northwest Territories Lands Act*. It shall be the Contractor's responsibility to familiarize itself with these regulations and conditions. The Contractor is responsible for all Work required to comply with these regulations. No extra payment will be made to the Contractor for any clean-up Work required.

3.1.4 MEASUREMENT

a) The quantity of Clearing to be measured for payment shall be the number of hectares computed to the nearest 0.1 hectares determined from horizontal measurements, acceptably cleared in accordance with the Specifications. Measurements for Clearing will be based upon the full overhang of the timber or brush. Unless otherwise specified, cleared lines, ponds, lakes and rock outcrops having a surface area of 0.1 hectares or more without trees, stumps and brush, fallen timber, fallen branches and other surface litter which are within the area flagged for clearing, which shall not be included in the measurement for clearing. The removal of stumps and remaining clearing debris on areas cleared by

others will not be measured separately for payment and shall be considered incidental to the clearing operation; or,

b) The quantity of Clearing to be measured for payment shall be the kilometres of right-of-way along the centreline computed to the nearest 0.1 kilometres. Unless noted in the Special Provisions, the highway right-of-way is 60 m wide for the purposes of Clearing.

c) Shrubs and other similar vegetation that can be cut with a brush scythe or mowing machine will not be measured separately for payment and shall be considered incidental to the Work.

d) Earth material removed along with the clearing debris during the clearing operations will not be measured separately for payment and shall be considered incidental to the clearing operation.

e) The construction of disposal pits will not be measured separately for payment and shall be considered incidental to the clearing operation.

3.1.5 BASIS OF PAYMENT

a) Payment for Clearing will be at the Contract unit price per hectare; or,

b) Payment for Clearing will be at the Contract unit price per kilometre of highway right of way.

c) The unit price shall be compensation in full for clearing, removing, cutting, windrowing, piling, salvaging if required, burning permit, burning, disposal, removal of all trees, stumps, brush, fallen timber, fallen branches and other surface litter, construction of disposal pits and restoring and leveling the ground surface over the buried debris and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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3.2 SECTION 2 - GRUBBING

3.2.1 DESCRIPTION

Grubbing consists of the removal of all stumps, roots, embedded logs, duff, surface boulders and other objectionable material from the areas designated to be grubbed. Duff is defined as the partly decayed and accumulated vegetable growth on the forest floor.

3.2.2 MATERIALS

Not applicable.

3.2.3 CONSTRUCTION

a) Debris from the grubbing operation shall not be used in the construction of embankments.

b) Generally, the area to be grubbed shall extend to a width of 1.5 m outside excavations and embankment slope lines. Unless otherwise approved by the Engineer in advance and in writing, grubbing will not be required under embankment thickness of 1.5 m or more.

c) The grubbed material shall be piled and burned. The portion of the debris which cannot be burned may be buried in disposal pits at locations approved by the Engineer. Surplus material from disposal pits shall be disposed of as approved by the Engineer. A minimum of 600 mm of mineral soil is required over the buried debris. The ground surface shall be restored and levelled.

d) Debris piles consisting of trees, surface boulders, rubbish and/or organic materials existing from previous grubbing operations shall be removed and disposed of by the Contractor.

e) For the grubbing of borrow pit areas, the Contractor will generally be permitted to place the grubbing debris into a section of the pit where excavation is completed or along the outside edge of the pit and to flatten, cover with waste excavation and trim such debris to a condition acceptable to the Engineer. Generally, the Contractor may perform clearing and grubbing in one operation, subject to the prior approval of the Engineer.

f) Except as may otherwise be approved by the Engineer in advance and in writing, borrow pit areas shall not be cleared and grubbed in advance of excavation by more than one week.

g) Burning of grubbing debris shall be carried out at such times and in such a manner as to comply with the Territorial Land Use Regulations. If burning is prohibited at the time of grubbing, the material shall be placed in disposal areas which are not visible from the right-of-way for burning at a later date.
The disposal area shall be large enough to accommodate the pile of grubbing debris and fireguard with a minimum of 12 m between the grubbing debris pile and the standing trees.
The Contractor shall obtain the necessary burning permits and carry out all burning as soon as possible.

h) Disposal of the grubbing debris into "push-off" and "push-out" areas will not be permitted.

i) All grubbing Work shall be carried out in accordance with the *Northwest Territories Lands Act*, and the Northwest Territories *Forest Protection Act* where applicable. It shall be the Contractor's responsibility to familiarize itself with these regulations and conditions. The Contractor is responsible for all Work required to comply with these regulations. No extra payment will be made to the Contractor for any clean-up Work required.

3.2.4 MEASUREMENT AND PAYMENT

Payment for Grubbing will be incidental unless there is a separate bid item in the Unit Price Table. Payment for Grubbing will be at the Contract lump sum price bid. The unit price shall be compensation in full for piling, windrowing, burning, removing, disposing, construction of disposal pits, burying, backfilling, compacting and levelling of disposal pits and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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3.3 SECTION 3 – ROADWAY EXCAVATION

3.3.1 DESCRIPTION

Roadway Excavation consists of excavating the roadway and satisfactorily removing and disposing of all materials taken from within the limits of the Work except borrow and other excavation not included in this Specification section. The Work shall include all excavation necessary to construct or alter side ditches, offtake ditches, interceptor ditches and inlet and outlet ditches to drainage structures. The Work shall also include sloping and shaping necessary to prepare, alter, construct and complete embankments, shoulders, gutters, ditches, roadway and driveway intersections all strictly to the proposed alignment, grade, and typical cross-sections shown on the Drawings or plans, or as designated by the Engineer.

3.3.2 MATERIALS

Roadway Excavation will be paid for under one of the following two classes:

3.3.2.1 Roadway Excavation Common

Roadway Excavation Common shall consist of all other material of whatever nature, including dense tills, hardpan and frozen materials (including permafrost) that do not come under the classification of Roadway Excavation Rock.

Material excavated from stockpiles within the right-of-way and redistributed over disturbed areas will also be classified as Roadway Excavation Common.

3.3.2.2 Roadway Excavation Rock

Roadway Excavation Rock is defined as:

a) Material in solid beds or masses consisting of igneous, metamorphic and sedimentary rock which cannot be excavated without blasting.
b) Boulders or rock fragments having a volume of 2 m^3 or greater.

3.3.2.3 Geotextile

Geotextile shall be placed directly upon the subgrade surface prior to the placement of any subbase materials as per the Drawings and/or Engineer's direction. The requirement for use of geotextile will be determined by the Engineer on-site and it should be noted that the Engineer will limit the use of geotextile when and where possible. The geotextile material shall conform to the requirements as described below, or as specified on the Drawings.

Minimum Woven Geotextile Properties

Test Parameter	Required Specification	ASTM Test Method (Or Approved Equal)
Grab Tensile (N)	1300 min	D4632
Elongation (%)	15 max	D4632
Tear (N)	500 min	D4533
CBR Puncture (N)	4400 min	D6241
UV Resistance (%)	70 min	D4355
Flow Rate ($l/m/m^2$)	160 (min)	D4491
Permittivity (sec^{-1})	0.05	D4491

Minimum Non-Woven Geotextile Properties

Test Parameter	Required Specification	ASTM Test Method (Or Approved Equal)
Grab Tensile (N)	1300 min	D4632
Elongation (%)	50 max	D4632
Tear (N)	500min	D4533
CBR Puncture (N)	2200 min	D6241
UV Resistance (%)	70 min	D4355
Flow Rate ($l/m/m^2$)	3000 min	D4491
Permittivity (sec^{-1})	1.0 min	D4491

3.3.2.4 Geogrid

The Contractor shall supply and install geo-grid material in accordance with the Drawings for the roadway on the area identified by Engineer. The supply shall clearly show labeling of the shipment, and materials storage shall follow ASTM D4873. Each roll of the supplied product labeling shall clearly show the manufacturer or supplier's name, style, roll number and manufacturing date. The Contractor shall provide to the Engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition, SDS data sheet and others pertinent information and documents to fully describe geosynthetic and MARV requirements (Minimum Average Roll Value) of the Specifications evaluated under the manufacturer's quality control program. This certification and product labeling shall bind the manufacturer for environmental, safety requirements, and warranty obligation for their product.

The geogrid shall be made of Polypropylene Geosynthetics and meet following specific requirements detailed in the table below.

Properties	Verifying test method	Units	Typical Value
Grid Aperture (min-max)	Nominal Dimension Measured	mm	25mm - 40mm
Roll Dimension	Nominal Dimension Measured	m	(3-4) x (50-75)
Roll Area (minimum)	Effective Square area	m^2	200
Rib Thickness (minimum)	Average	mm	1.7
Resistance to Long Term Damage	ASTM D5818 and D6637	%	100
Tensile strength (minimum)@ 5% strain	ASTM D6637	kN/m	11.0
Ultimate Tensile (minimum) Strength	ASTM D6637	kN/m	16
Flexural Stiffness (minimum)	ASTM D7748	mg-cm	250000
Installation Damage resistance		%SC/%SW/%GP	95/93/90

3.3.3 CONSTRUCTION

3.3.3.1 General

a) Roadway Excavation shall include all excavation required for construction of contiguous roadway ditches, embankments and the removal and disposal of unsuitable materials.

b) All suitable materials excavated shall be placed in roadway embankments except as otherwise directed by the Engineer. Embankment construction shall be carried out in accordance with "Embankment Construction" (Division 3, Section 6).

c) All materials, which in the opinion of the Engineer are unsuitable for embankments shall be disposed of at locations and in a manner approved by the Engineer. Generally, all surplus excavated and waste material shall be used to uniformly widen embankments or flatten slopes or deposited in such other places and for such purposes as the Engineer may direct. No excavation material shall be wasted without the Engineer's permission, and when such material is to be wasted, it shall not be left in an unsightly pile but shall be so placed that it will present a neat appearance and not be an injury to abutting property. In no case shall material be deposited above the grade of the adjacent roadway unless directed in writing by the Engineer, nor shall the edge of the waste bank be less than 3 m from the top of the cut slope.

d) All roadway excavation shall be carried out in a manner so as to minimize disturbance to the natural ground cover on adjacent areas. In permafrost and/or swampy areas, construction shall be performed in a manner that the existing natural insulation of fibrous material over the adjacent areas is not damaged.

e) Where the subgrade is in transition from excavation to embankment, sub-excavation shall be carried out in the transition area in accordance with the Drawings or as designated by the Engineer.

f) Where unsuitable material is encountered at the grade level of a cut, the subgrade shall be sub-excavated to the depth determined by the Engineer.

g) When unsuitable material is encountered below the natural ground surface in embankment areas, the material shall be excavated and disposed of as indicated on the Drawings, the Special Provisions or as designated by the Engineer.

h) Where suitable material is encountered at the grade level of a cut, except where the cut is in an existing road surface, the subgrade shall be excavated to a depth of 500 mm below the design subgrade surface. The exposed surface shall be thoroughly compacted by means of tamping rollers or other approved equipment and the excavated material utilized or disposed of as directed by the Engineer. Where utilized, the material shall be shaped to conform with the lines, grades and cross-sections as designated by the Engineer. The material shall be compacted in accordance with "Embankment Construction" (Division 3, Section 6).

   When directed by the Engineer, approved material shall be added to restore true grade and cross-section.

   When material varies from optimum moisture content, it shall be treated in the following manner: When a deficiency in moisture content exists, the material shall be watered and thoroughly mixed until the optimum moisture content is attained. When an excess in moisture content exists, the material shall be worked and aerated until the optimum moisture content is attained.

   Shaping and compacting shall be done with blade graders and tamping rollers, or other such equipment as designated or approved by the Engineer. The finished surface shall be firm and uniform, true to grade and cross-section and shall be approved by the Engineer prior to the placement of subsequent layer material thereon. Subgrade that does not conform to the requirements as to grade, cross-section or density shall be reworked until such requirements are met.

   Where required, the subgrade shall be prepared to a depth exceeding 500 mm on sections of the roadway as designated by the Engineer. When such work has been ordered, it shall be carried out in

layers not exceeding 150 mm in depth and requirements for density and optimum moisture content as specified above will apply to each layer.

Subgrade ramps, of whatever nature, at approaches to railway crossings, bridge structures or adjacent to fixed obstructions, shall be removed to the lines, grades and cross-sections as designated by the Engineer.

i) The subgrade surface in excavations shall be shaped and finished by means of a blade grader. The surface and slopes of all excavations shall be shaped to a uniform smooth surface and graded, if required, to ensure positive drainage. Roadway excavation shall not vary from the grades shown on the Drawings or as designated by the Engineer by more than 60 mm. In addition, the difference between the constructed grade and the designated grade shall not vary by more than 30 mm.

3.3.3.2 Solid Rock Excavation

a) Where material conforming to the classification of Roadway Excavation Rock is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and take such measurements and cross-sections, at the Engineer's discretion, to compare with the Contractor's measurements and surveys. No allowance will be made for Roadway Excavation Rock before such measurements or cross-sections have been made.

b) Rock shall be drilled and blasted in such a manner that material excavated will be usable for embankment construction.

c) Where solid rock is encountered at the grade level of a cut, the subgrade shall be sub-excavated as shown on the Drawings or as designated by the Engineer and backfilled with material approved by the Engineer.

d) The Contractor shall notify the Engineer a minimum of 24 hours in advance of their blasting operations.

e) The Contractor shall notify all applicable Airport Offices and/or Air Carriers, Utility Companies, RCMP Detachments, Hospital/Health Centres and vicinity residents a minimum of 24 hours in advance of their blasting operations.

f) The Contractor shall at all times observe and comply with the provisions and regulations of the Northwest Territories *Explosives Use Act* and the Federal *Explosives Act*.

g) All overburden shall be removed prior to drilling and blasting. This Work shall be carried out sufficiently in advance of drilling and blasting operations to allow rock cross-sections to be taken by the Contractor's surveyor.

h) The Contractor shall provide the Engineer with a pre-blast survey, post-blast survey and the final quarry excavation surveys along with a copy of the drill hole survey stating the quarried quantities within 10 days of the blast and a copy of the final topographic survey of the quarry shall be provided within 21 days of the removal or final mucking of the quarried materials. Final topographic survey will have contours lines drawn at least 20 m past the final edge/face of blast. All survey records shall reference the North American Datum of 1983 (NAD 83). The elevation reference datum shall be Mean Sea Level. Final survey submission shall be in a digital (AutoCAD or ASCII text file) and hardcopy format. Pre-blast and post-blast surveys will be considered incidental to the Work and will not be measured separately for payment.

i) Bedrock shall be blasted in such a manner as to reduce oversize rock and to minimize fly-rock. Where fly-rock may result in personal injury or damage to property or work, the rock to be blasted shall be covered with approved blasting mats, soil or equally serviceable material, to prevent fly-rock. The requirement for and method of blast suppression shall be the responsibility of the Contractor.

j) Rock fragments littering the areas surrounding a blast site shall be removed to the satisfaction of the

Engineer. All natural timber damaged as a result of the blast (e.g. leaners, broken trees etc.) shall be cut down and disposed in accordance with the land use requirements and to the satisfaction of the Engineer.

k) Where specified, the Contractor shall pre-shear rock faces to produce a smooth, solid and stable face.
l) The Contractor shall slope the excavated quarry walls and faces in accordance with the appropriate regulatory authorities during the operational phases and upon final clean up and site abandonment.
m) All rock slopes and cuts shall be excavated to the lines and grades designated by the Engineer, with no rock projecting within the true slopes. The rock slopes shall be carefully scaled down, to the satisfaction of the Engineer, during or immediately after the excavation operations so that rock so obtained may be incorporated within the embankment. Scaling shall consist of the removal of all loose rock and debris by scaling bar or other means. All rock, boulders and fragments, either on or outside the excavated area, liable to slide or roll down the slope shall be removed to the satisfaction of the Engineer.
n) A minimum of 300 mm of rock shatter below the design rock grade for the full width of the rock-cut, including ditch bottoms, is required.
o) All finished rock embankments, including sideslopes, shall be surface dense and chinked with small rock fragments. The chinked rock embankment shall conform to the lines and grades shown on the Drawings or as designated by the Engineer and shall be uniform and free from any ruts or irregularities. Trimming and chinking of rock embankments will not be measured separately for payment and shall be considered incidental to the Work.
p) Surplus blast-rocks shall be removed from the active rock face and stockpiled in a location directed by the Engineer. Surplus blast rock shall become the property of the Department.
q) In solid rock cuts, where pockets which will not drain are formed below the design roadway elevation by blasting, the Contractor shall, at their own expense, provide drainage by ditching to a free outlet as determined by the Engineer, and backfill both the pockets and the trench to an elevation 300 mm below embankment grade with broken rock or coarse gravel.
r) Detour construction, dewatering and the clean-up of rock drilling and blasting sites will not be measured separately for payment and shall be considered incidental to the Work.

3.3.3.3 Geotextile Installation

a) The surface onto which the geotextile is placed shall be graded smooth and free from angular rocks, debris, and protrusions.
b) Do not begin installation of the geotextile until the surface on which the geotextile is to be placed has been approved by the Engineer.
c) Place geotextile smooth and free of tension stress, folds, wrinkles, and creases.
d) Overlap each successive strip of geotextile a minimum 600 mm lap length over previously-laid strip. Overlap will be not measured separately for payment.
e) Employ sufficient temporary anchorage to hold geotextile in place during backfilling.
f) Protect installed geotextile material from displacement and damage until, during, and after placement of additional material layers.
g) Repair rips or tears with a patch that covers a minimum of 1 meter on each side of the rip or tear.
h) Place fill material immediately after laying geotextile.
i) Place fill material so as to avoid damage to the geotextile.
j) Maximum drop height for fill directly onto geotextile is 0.6 meter.
k) No vehicle shall be permitted to pass directly on top of the geotextile at any time.

3.3.3.4 Geogrid Installation

Once subgrade or subbase preparation is complete and prior to geogrid installation, the Contractor shall perform a proof rolling test over the subgrade or subbase surface in order to select areas for geogrid to be installed as per the direction of the Engineer. This proof rolling will not be measured separately for payment and shall be considered to be incidental to the line item of geogrid work. The requirement for use of geogrid will be determined by the Engineer onsite and it should be noted that the Engineer will limit the use of geogrid when and where possible.

a) Contractor's installation shall not contradict the procedure recommended by the manufacturer.
b) The surface onto which the geogrid is placed shall be graded smooth and free from angular rocks, debris and protrusions.
c) Do not begin installation of the geogrid until the surface on which the geogrid is to be placed has been approved by engineer.
d) Place geogrid smooth and free of tension stress, folds, wrinkles, and creases.
e) Overlap each successive strip of geogrid a minimum of 300 mm overlap previously-laid strip and all over lapping part must be anchored to keep Geogrid in place. Overlap will not be measured separately for payment.
f) Employ sufficient anchorage to hold geogrid in place during backfilling materials on top.
g) Protect installed geogrid material from displacement and damage until, during, and after placement of additional materials layers.
h) Repair rips or tears with a patch that covers a minimum of 1 m on each side of rip or tear.
i) Place fill materials immediately after laying geogrid.
j) Place fill materials so as to avoid damage to geogrid.
k) No vehicle shall be permitted to pass directly on top of the geogrid at any time.

Prior to backfilling the Contractor must handle the geogrid and material with care. Geogrid laid on the road must be anchored in every square meter (m^2) using only the manufacturer's supplied anchors and as directed by the Engineer.

Backfill material shall be placed in lifts and compacted as per the Specifications. Fill material shall be compacted in such a manner as to minimize the development of wrinkles in and / or movement of the geogrid. During the operation of any tracked vehicles on the fill material over the geogrid, the vehicle must move at low speeds below 10 km/hour. Sudden breaking and turning of vehicles shall be avoided. Damages to the geogrid or deficient installations shall be replaced and corrected by the Contractor prior to proceeding at no additional material or cost to Owner.

3.3.3.5 Survey, Layout, Staking and Grading Requirements

a) The Contractor shall provide and pay for qualified personnel to carry out all surveying required for the accurate control of roadway excavation operations. Surveying shall include the provision of an adequate number of stakes and grades every 20 metres along the roadway to ensure construction of roadway excavation areas and any adjacent embankments in accordance with the Specifications, unless otherwise specified in the Special Provisions or directed by the Engineer in advance and in writing.

   The Contractor's survey requirements may also include, but are not limited to, establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, trim staking and referencing.
b) The Contractor shall carry out the grading of roadway excavation areas as required to ensure that the

roadway excavation areas, including contiguous ditches and backslopes and any adjacent embankments and sideslopes are constructed to the lines, grades and cross-sections indicated on the Drawings. Grading shall include the surveying, staking and setting of grades every 20 metres along the roadway, or other such length as specified in the Special Provisions.

The Contractor shall blade and shape the roadway excavation areas such that the finished surfaces are smooth, uniform and true to design grade and cross-sections on the Drawings.

The finished surfaces shall not deviate by more than 30 mm from the Engineer's specified grade and cross-sections.

c) The Contractor shall notify the Engineer when the roadway excavation areas have been completed in accordance with the Specifications and shall provide ample opportunity for the Engineer to take cross-sections of the completed roadway excavation areas and any adjacent embankments.

The Engineer will not take cross-sections of roadway excavation areas at any time prior to notification by the Contractor that these areas have been completed in accordance with the Specifications, nor will the Engineer be obliged to notify the Contractor of any deficiencies after the cross-sections have been completed. The completion of roadway excavation area cross-sections by the Engineer shall in no way constitute acceptance of these areas by the Engineer.

d) As soon as any section of subgrade/embankment, subbase and base courses is constructed, the Contractor shall perform as-built cross-sectional surveys for these surfaces at 20 m interval and provide to Engineer for verification with the specifications and drawings prior to placing subsequent layer thereon. Production and supply of as built data will be incidental to the Work and will not be measured separately for payment. The topographic survey data shall include the Elevation (m) (left shoulder, center line, the right shoulder of the roadway), Cross Fall % (left side and right side of the center line of the roadway), Side Slope % (left side and right side) and Road Width (m).

e) The Contractor shall prepare as-built info for every 20 metres along the roadway for the completed subgrade/embankment, subbase and base course and send to the Engineer for verification in the following format:

   a. Electronic ASCII text file on the standard USB in the format Point Number, Northing, Easting, Elevation, Description (Point descriptions shall be self-explanatory)
   b. File names shall refer to as-built item and date of survey,
   c. Hard copy (paper) showing station, offset, and elevation derived at 20 metre intervals and referenced to design centerline shall be made available to the Engineer upon request,
   d. Survey data shall reference the same datum as the design layout information, which normally would be North American Datum 1983 (horizontal) and Mean Sea Level (vertical).
   e. The electronic cross-section file shall be industry-standard ASCII Civil Cad cross-section data capable of being uploaded into Softree RoadEng.

3.3.4 MEASUREMENT

3.3.4.1 Roadway Excavation Common

a) The quantity of Roadway Excavation Common to be measured for payment will be the number of cubic metres of material in its original position, acceptably excavated and placed in accordance with these Specifications. The volume will be determined using the "Average End Area Method", except that culvert, ditch block and approach excavations may be determined from the average length, width, and depth, unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance. There will be no measurement for payment of material excavated beyond the lines shown on the Drawings or plans or as stated by the Engineer.

b) In areas cleared and/or grubbed, original cross-sections for excavation measurements will be taken after the clearing and/or grubbing operations are complete.
c) If material is excavated as unacceptable foundation material as specified in Sections 3.3.3.1 e), f), g), the volume of excavated material will be determined from the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance.

3.3.4.2 Roadway Excavation Rock

a) The quantity of Roadway Excavation Rock to be measured for payment will be the number of cubic metres of material in its original position acceptably excavated and placed in accordance with these Specifications. Original cross-sections will be taken on top of the exposed rock surface. Volume will be determined by the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance.
b) There will be no measurement for payment of material excavated beyond the lines shown on the Drawings or plans or as stated by the Engineer. Drilling and shattering below subgrade will not be measured for payment. Measurement for payment will be made for the actual quantity involved within the lines and grades as staked by the Engineer. Excess material from overbreak, when placed in the embankment, will be measured for payment as Roadway Excavation Common. Excess material from overbreak, when not placed in the embankment, will not be measured for payment.

3.3.4.3 Geotextile/Geogrid

Measurement of geotextile/geogrid shall be by in place area in square meters, (excluding the quantity used for the installation of culverts).

3.3.5 BASIS OF PAYMENT

3.3.5.1 Roadway Excavation Common

Payment for Roadway Excavation Common will be at the Contract unit price per cubic metre.

The unit price shall be compensation in full for removing and disposing of unsuitable materials, unclassified rubbish, shrubs and vegetation, excavating, loading, hauling, dumping, spreading and blading Roadway Excavation Common, scarification and disposal of boulders, shaping and trimming of slopes and surfaces, all surveying, including establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, trim staking, as-built and referencing, traffic control and accommodation and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

If the Contract unit price includes a density requirement for embankments, the unit price will also be compensation in full for compacting embankments and sub-cuts.

3.3.5.2 Roadway Excavation Rock

Payment for Roadway Excavation Rock will be at the Contract unit price per cubic metre.

The unit price shall be compensation in full for material, equipment and work required for drilling and blasting, pre-shearing if required, blast suppression, detour construction, dewatering, excavation, loading, hauling, dumping and spreading rock material, forming embankments, shaping and trimming and chinking slopes and surfaces, scaling, clean-up, all surveying, including establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, trim staking, as-built and referencing, traffic control and accommodation, permitting, and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

If the Contract unit price includes a density requirement for embankments, the unit price shall also be compensation in full for compacting embankments and sub-cuts.

3.3.5.3 Geotextile/Geogrid

Payment at the Contract unit price for the above bid item shall be full compensation for geotextile/geogrid material, all labour for handling and installation and required equipment to perform the Work.

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3.4 SECTION 4 – BORROW EXCAVATION

3.4.1 DESCRIPTION

Borrow excavation consists of the excavation and placing of material obtained from locations outside of the cleared right-of-way when the amount of embankment exceeds the amount of excavation.

3.4.2 MATERIALS

Borrow Excavation material shall consist of earth or other excavation as approved by the Engineer. Borrow Excavation will be paid for under one of the following two classes:

3.4.2.1 Borrow Excavation Common

Borrow Excavation Common shall consist of all other materials of whatever nature, including dense tills, hardpan and frozen materials (including permafrost) that do not come under the classification of Borrow Excavation Rock.

3.4.2.2 Borrow Excavation Rock

Borrow Excavation Rock is defined as:

a) Material in solid beds or masses consisting of igneous, metamorphic and sedimentary rock which cannot be excavated without blasting.
b) Boulders or rock fragments measuring 2 m^3 or more in volume.

3.4.2.3 Geotextile/Geogrid

a) Refer to Division 3, Section 3 for the Specifications, installation, measurement and payment requirements for geotextile and geogrid.

3.4.3 CONSTRUCTION

a) Unless otherwise specified, the Department shall be responsible for the selection of borrow sources and selection of corresponding haul roads required for embankment construction. The development and use of such sources and haul roads shall be subject to the prior approval of the applicable Land Use Authority. The Contractor is responsible at their sole expense for obtaining and adhering to any permits or restrictions that apply to such haul. The Contractor shall construct the haul roads to the details as follows unless modified in the Special Provisions. Haul roads from borrow pits shall consist of one two-way road having a maximum cleared right-of-way width of 12 m or two one-way haul roads each having a maximum cleared right-of-way width of 9 m each. Haul roads shall be dog-legged such that only a short section is visible from the highway. Haul roads and borrow areas shall be constructed in such a manner that drainage patterns are not unduly restricted. If drainage impacts cannot be avoided, the Contractor shall propose temporary drainage accommodation for review and acceptance by the Engineer.

   Where trees are present, a minimum thirty 30 m belt of trees shall be left standing between the edge of the right-of-way and the edge of the borrow area.
b) The actual location, dimension and depths for excavation of borrow sources shall be subject to the prior approval of the applicable Land Use Authority. The Contractor shall provide a pre-blast survey, blasting details and drill hole logs to the Engineer and Land Use Authority, as per the quarry permit and land use permit requirements.
c) All suitable materials excavated shall be placed in roadway embankments except as otherwise approved by the Engineer. Embankment construction shall be as specified in "Embankment Construction" (Division 3, Section 6).
d) Unsuitable material excavated from borrow pits shall generally be disposed of by placing it as

approved by the Engineer or Land Use Authority, immediately adjacent to the borrow pit in such a location as not to interfere with the natural ground drainage from or into the borrow pit. The disposal material shall be trimmed as approved by the Engineer. For certain borrow excavations the Engineer may direct that all or part of the unsuitable material be placed back into the excavation area upon completion of the borrow excavation.

If during excavation, material appearing to be unsuitable is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and to make such measurements as are necessary to determine the volume of the material in question to compare to the Contractor's measurements.

e) If during excavation, material appearing to conform to the classification of Borrow Excavation Rock is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and to make such measurements as are necessary to determine the volume of the material in question to compare to the Contractor's measurements.

f) Rock shall be drilled and blasted in such a manner that all materials excavated will be usable for embankment construction. The method of drilling and blasting of borrow areas shall be in accordance with Clause 3.3.3.2.

g) The method of clearing and grubbing of borrow areas, haul roads and any other such areas shall be in accordance with "Clearing" (Division 3, Section 1) and "Grubbing" (Division 3, Section 2).

h) Borrow pits shall be excavated to regular lines as shown on the Drawings and shall be left in a neat condition with uniform slopes and the area within the slopes suitably graded and drained with all dead trees, stumps, weeds, brush, roots, stones, boulders and other objectionable material disposed of to the satisfaction of the Engineer.

i) Slopes of the excavated borrow pits shall not be steeper than 2:1 for Borrow Excavation Common and 1/4:1 for Borrow Excavation Rock, unless otherwise directed by the Engineer. Staging to be provided on the excavated quarry walls.

j) The Contractor will generally be permitted to place the clearing and grubbing debris into a section of the pit where excavation is completed or along the outside edge of the pit and to flatten, cover with waste excavation and trim such debris to a condition acceptable to the Engineer and the Land Use Authority.

k) Temporary fencing may be required around excavated borrow pits at the discretion of the Engineer. If required, the cost of erecting and removing temporary fences associated with excavated borrow pits shall be considered incidental to the Work, and no separate or additional payment will be made.

l) Haul roads shall be neatly and uniformly trimmed to the satisfaction of the Engineer. Approaches and accesses to borrow areas within the right-of-way shall be removed and all existing drainage ditches shall be restored to their original condition by the Contractor at their sole expense.

3.4.4 MEASUREMENT

a) Borrow Excavation Common will not be measured separately for payment.

Measurement will be made in accordance with "Embankment Construction" (Division 3, Section 6), for the quantity of compacted material in cubic metres in the final in-place position.

b) Borrow Excavation Rock will not be measured separately for payment. Measurement will be made in accordance with "Embankment Construction" (Division 3, Section 6) for quantity of compacted material in cubic metres in the final in-place position.

3.4.5 BASIS OF PAYMENT

a) There will be no separate payment for Borrow Excavation Common. Payment will be made in

accordance with "Embankment Construction" (Division 3, Section 6), for the quantity of material in cubic metres in the final in-place position. There will be no additional compensation should frozen materials be encountered in borrow areas.

b) There will be no separate payment for Borrow Excavation Rock. Payment will be made in accordance with "Embankment Construction" (Division 3, Section 6) for quantity of compacted material in cubic metres in the final in-place position.

c) The unit price shall also include all work required to comply with the provisions of the *Northwest Territories Lands Act*.

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3.5 SECTION 5 – CHANNEL EXCAVATION

3.5.1 DESCRIPTION

Channel Excavation consists of the excavation required for permanently deepening, widening and relocating water channels, the construction of ditches other than contiguous roadway ditches; clearing and grubbing of the channel site; loading, hauling within the free haul distance, placing or disposing and trimming of materials in accordance with these Specifications and to the lines and grades shown on the Drawings or as designated by the Engineer. Except for interceptor ditches running generally parallel to the roadway embankment but not contiguous with it, channel excavation will be designated beyond a distance of 4.6 m from the staked toe of the embankment, or as specified by the Engineer.

3.5.2 MATERIALS

3.5.2.1 Channel Excavation Rock

Channel Excavation Rock is defined as:

a) Material consisting of igneous, metamorphic and sedimentary rock which cannot be excavated without blasting.
b) Boulders or rock fragments having a volume of 2 m^3 or greater.

3.5.2.2 Channel Excavation Common

Channel Excavation Common will consist of the excavation of all other materials of whatever nature including dense tills, hardpan and frozen materials (including permafrost) that do not come under the classification of Channel Excavation Rock.

3.5.3 CONSTRUCTION

a) All materials excavated shall be disposed of as shown on the Drawings or as directed by the Engineer. Suitable material shall be used in the roadway embankment, where considered practical by the Engineer. When excavated material is placed near the banks of a channel or ditch, provisions will be made to ensure proper flow of water from adjacent land to this waterway. The excavation will be neatly finished and the disposed of material will be shaped and trimmed to a condition satisfactory to the Engineer. The excavation equipment is subject to prior approval by the Engineer.
b) All Channel Excavation will be carried out in a manner as not to damage the natural ground cover on adjacent areas.
c) Clearing of the channel site will be carried out in areas designated by the Engineer in accordance with the Specifications for "Clearing" (Division 3, Section 1).
d) If during excavation, material appearing to conform to the classification of Channel Excavation Rock is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and to make such measurements as are necessary to determine the volume of material in question.
e) Rock shall be drilled and blasted in such a manner that all materials excavated will be usable for embankment construction.

3.5.4 MEASUREMENT

3.5.4.1 Channel Site Clearing

Measurement for payment for clearing of the channel site will be in accordance with the Specifications for "Clearing" (Division 3, Section 1).

3.5.4.2 Channel Excavation Common

The quantity of Channel Excavation Common to be measured for payment shall be the number of cubic metres of material determined by the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance, in its original position, acceptably excavated and placed in accordance with these Specifications.

3.5.4.3 Channel Excavation Rock

The quantity of Channel Excavation Rock to be measured for payment shall be the number of cubic metres of material, determined by the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance, in its original position, acceptably excavated and placed in accordance with these Specifications.

Measurement for payment of material excavated beyond the lines shown on the Drawings or staked by the Engineer will not be made except that for Channel Excavation Rock where, in the opinion of the Engineer, unavoidable overbreak occurs.

Measurement for payment will be made of the actual quantities involved, provided the overbreak quantity does not exceed 10% of the actual quantity of rock within the lines and grades as staked by the Engineer between the established station intervals where the overbreak occurs. Channel Excavation Rock beyond the allowable overbreak will not be measured for payment.

3.5.5 BASIS OF PAYMENT

3.5.5.1 Channel Site Clearing

Payment for clearing of the channel site will be in accordance with the requirements for "Clearing" (Division 3, Section 1).

3.5.5.2 Channel Excavation Common

Payment for Channel Excavation Common will be at the Contract unit price per cubic metre, measured as provided above.

The unit price will be compensation in full for the Channel Excavation Common required for permanently deepening, widening and relocating water channels, the construction of ditches other than contiguous roadway ditches, grubbing of the channel site, loading, hauling within the free haul distance, placing or disposing and trimming of materials and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

3.5.5.3 Channel Excavation Rock

Payment for Channel Excavation Rock will be at the Contract unit price per cubic metre, measured as provided above.

The unit price will be compensation in full for material, equipment and work required for drilling and blasting, excavation, loading, hauling except for overhaul, dumping and spreading rock material, forming embankments, shaping and trimming slopes and surfaces and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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3.6 SECTION 6 – EMBANKMENT CONSTRUCTION

3.6.1 DESCRIPTION

Embankment Construction consists of the construction of embankments for highways, haul roads and access roads and the backfilling of structures and sub-excavated areas in accordance with these Specifications and to the lines, grades and cross-sections shown on the Drawings or plans or as designated by the Engineer.

3.6.2 MATERIALS

The materials shall consist of acceptable earth and/or rock, free from wood, brush, roots, organic matter and other deleterious material. All materials shall be subject to the approval of the Engineer prior to use in embankment construction.

3.6.2.1 Geotextile/Geogrid

a) Refer to Division 3, Section 3 for the Specifications, installation, measurement and payment requirements for geotextile and geogrid.

3.6.3 CONSTRUCTION

3.6.3.1 General

a) The embankment shall be constructed to the lines, grades and cross-sections shown on the Drawings or plans or as designated by the Engineer.
   If an embankment is constructed beyond the designated lines, grades or cross-sections, the excess material shall be removed by the Contractor and placed where the embankment is below grade level. If the excess material cannot be acceptably used in embankment construction, it shall be disposed of at a location and in a manner approved by the Engineer.
b) Embankment material shall not be placed if frozen, nor shall frozen soils, ice or snow be placed in any embankment. Any frozen material in the embankment shall be removed and disposed of at the Contractor's expense prior to the continuance of Embankment Construction operations.
c) Sufficient crown shall always be maintained on the embankment surface during construction to ensure surface water runoff.
d) The Contractor shall maintain completed embankment surfaces to the specified grade and cross-section and to the required density until the application of subsequent material thereon or until the Work is accepted by the Engineer.

3.6.3.2 Quality Control

General

Refer to Division 2 for the Contractor’s responsibilities for quality control. Quality control and quality control testing are the responsibility of the Contractor throughout every stage of the Work, from the excavation of embankment construction materials to the final accepted product. The Contractor’s quality control Work is considered incidental and no separate payment will be made.

Compaction Testing Requirements

The Contractor's quality control and quality control testing program shall include the carrying out of all compaction density and moisture testing required for the construction of embankments in accordance with the Specifications.

The Contractor shall establish the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698, for each source and type of material incorporated into the Work. Original copies of all worksheets and laboratory test results shall be submitted to the Engineer prior to

the commencement of embankment construction operations.

The Contractor shall carry out compaction testing utilizing nuclear equipment in accordance with the latest edition of AASHTO T 310 or ASTM D6938, at a sufficient frequency and in such a manner that each layer of the embankment is thoroughly and adequately tested.

All compaction test results for completed sections of the embankment shall be submitted to the Engineer for verification of compliance with the Specifications, prior to the application of subsequent layer material thereon.

Embankment compaction inspection shall be carried out as per Specification and the Contractor's approved quality control plan until such time that grading and shaping has been completed.

For quality control purpose, the Contractor will submit a report for compaction of the embankment in which an engineering company retained by the Contractor will verify that they have witnessed the compaction process of the embankment and confirm that embankment is compacted as per Specifications. Retaining an engineering company to witness the compaction and reporting will be incidental to the embankment construction and will not be paid separately.

Compaction inspection will consist of field witnessing of the number of passes performed and production of compaction reports, at a minimum. Information to be contained in the compaction report will include, but not be limited to: ambient conditions, mass and force of vibratory rollers, number of passes performed, distance of drum overlap, lift thickness, description of aggregates, number and types of vibratory rollers and any other information that the Engineer may determine to be of value.

All compaction test results for completed sections of the embankment shall be submitted to the Engineer on a daily basis for verification of compliance with the specifications, prior to the application of subsequent material thereon.

Quality Acceptance

Within this Specification, certain requirements, limits and tolerances are specified regarding the quality of materials and workmanship to be supplied. Compliance with these requirements, limits and tolerances may be measured and the Work accepted or rejected based on Department's quality assurance test results.

The Engineer and their representatives reserve the right to sample, test, inspect and monitor the quality of material being utilized and incorporated into the Work by the Contractor at any time and as often as they deem necessary. The Contractor shall cooperate with the Engineer and their representatives for such sampling, testing, inspecting and monitoring. The Engineer is under no obligation to provide the Contractor with test results and this testing shall in no way relieve the Contractor of their responsibility to construct embankments that meet the Specifications in all respects.

The Contractor shall provide, at their own expense, such stands, sampling devices and other facilities as the Engineer may require to safely obtain representative samples of the materials being utilized and incorporated into the Work.

The materials testing laboratory provided by the Professional Engineering services company utilized by the Department to carry out quality assurance testing will not be located at the project site. Quality assurance test results will therefore not be completed for approximately 10 days from the date of sampling.

3.6.3.3 Survey, Layout, Staking and Grading Requirements

a) The Contractor shall provide and pay for qualified personnel to carry out all surveying required for the

accurate placement and control of embankment construction operations, including the control of overbuilding and the quantity of embankment material placed beyond the specified grading tolerances. Surveying shall include the provision of an adequate number of stakes and grades every 20 metres along the roadway to ensure construction of the embankment and any adjacent roadway excavation areas in accordance with the Specifications and the Drawings. The Contractor's survey requirements may also include, but are not limited to, establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, shoulder and trim staking and referencing. The Contractor shall provide advanced notice to the Engineer to perform quality assurance survey of the original ground and embankment cross-sections prior to the commencement of Embankment Construction operations.

b) It shall be the Contractor's responsibility to identify any material placed beyond the specified grading tolerances and to remove this material from the embankment, prior to notifying the Engineer that the embankment has been completed in accordance with the Specifications and the Drawings. The grading tolerance for each sideslope in Embankment Construction is defined as the minimum being the Contract standard and the maximum being the Contract standard plus 150 mm measured horizontally.

c) Prior to the application of subsequent layer material thereon, the Contractor shall carry out the grading of the embankment surface as required to ensure that the embankment surface is placed to the lines, grades and cross-sections indicated on the Drawings. Grading shall include the surveying, staking and setting of grades every 20 m along the roadway.

   The Contractor shall blade and shape the embankment such that the finished surface is smooth, uniform, true to the specified grade and cross-section and suitable for the application of subsequent material thereon.

   The finished surface shall not deviate more than 30 mm from the specified grade and cross-section. The tolerance for the cross fall will be +/- 0.3% (upper limit 3.3% & lower limit 2.7%) or as specified by the Engineer.

d) The Contractor shall prepare as-built information as per the Department’s Standard Drawing for every 20 meters along the roadway for the completed embankment including side slopes and send to the Engineer for verification prior to the application of subsequent layer material thereon. Production and supply of as built data will be incidental to the embankment construction and will not be measured separately for payment. The Contractor shall notify the Engineer when the embankment has been completed in accordance with the Specifications and Drawings with advance notice to allow the Engineer to perform quality assurance surveys of cross-sections of the completed embankment prior to the application of subsequent layer material thereon. The completion of embankment cross-sections by the Engineer shall in no way constitute acceptance of the embankment by the Engineer.

e) As soon as any section of subgrade/embankment, subbase and base courses is constructed, the Contractor shall perform as-built cross-sectional surveys for these surfaces at 20 m interval and provide to Engineer for verification with the specifications and drawings prior to placing subsequent layer thereon. The topographic survey data shall include the Elevation (m) (left shoulder, center line, the right shoulder of the roadway), Cross Fall % (left side and right side of the center line of the roadway), Side Slope % (left side and right side) and Road Width (m).

f) The Contractor shall prepare as-built info for every 20 metres along the roadway for the completed subgrade/embankment, subbase and base course and send to the Engineer for verification in the following format:

   a. Electronic ASCII text file on the standard USB in the format Point Number, Northing, Easting, Elevation, Description (Point descriptions shall be self-explanatory)

b. File names shall refer to as-built item and date of survey,
c. Hard copy (paper) showing station, offset, and elevation derived at 20 metre intervals and referenced to design centerline shall be made available to the Engineer upon request,
d. Survey data shall reference the same datum as the design layout information, which normally would be North American Datum 1983 (horizontal) and Mean Sea Level (vertical).
e. The electronic cross-section file shall be industry-standard ASCII Civil Cad cross-section data capable of being uploaded into Softree RoadEng.

3.6.3.4 Preparation of Existing Ground

Fill Sections

Unless otherwise specified, where the existing ground surface is less than 1.0 m below the embankment design subgrade surface, unsuitable material shall be excavated and disposed of as directed by the Engineer. The exposed surface shall be bladed and compacted.

Where exposed surfaces, other than the existing road surface, are less than 0.5 m below the embankment design subgrade surface, excavation shall be carried out to 0.5 m below the design subgrade surface, or to the elevation as directed by the Engineer. The exposed surface shall be bladed and compacted, and the excavated material utilized or disposed of as directed by the Engineer.

Where the existing ground surface is more than 1.0 metre below the embankment design subgrade surface, excavation and disposal of unsuitable material shall be carried out only if directed by the Engineer.

Cut Sections

Where the embankment design subgrade surface is in a cut, except where the cut is in an existing road surface, excavation shall be carried out to a depth of 0.5 m below the design subgrade surface. The exposed surface shall be bladed and compacted and the excavated material utilized or disposed of as directed by the Engineer.

3.6.3.5 Embankment Widening

Where existing roadbeds are being widened or extended, the existing embankment sideslopes and affected ditch bottoms shall be denuded of all grass, vegetation and other unsuitable materials and benched to obtain bonding between the existing embankment and new embankment. Benching shall be carried out in accordance with Standard Drawing SD-300-06-01 "Benching for Embankment Widening".

Where directed by the Engineer, unsuitable material shall be excavated from the existing embankment and replaced with material approved by the Engineer. The unsuitable material shall be disposed of as directed by the Engineer.

3.6.3.6 Hillside Benching

Where an embankment is to be constructed on a hillside or slope which, in the opinion of the Engineer, will preclude a proper bond between the existing and newly placed materials, the existing ground on which the embankment is to be placed shall be denuded of all grass, vegetation and other unsuitable materials and benched in accordance with Standard Drawing SD-300-06-01 "Benching for Embankment Widening". Otherwise, the existing ground on which the embankment is to be placed shall be scarified to obtain bonding between the new material and the existing ground.

3.6.3.7 Embankment Placed on Existing Road

Prior to the placement of embankment material on an existing roadbed, material within the roadbed designated as unsuitable by the Engineer shall be excavated and replaced with material approved by the Engineer. The

unsuitable material shall be disposed of as directed by the Engineer.

To obtain bonding between the existing and new embankment materials on sideslopes, the existing embankment sideslopes shall be denuded of all grass, vegetation and other unsuitable materials and benched in accordance with Standard Drawing SD-300-06-01 "Benching for Embankment Widening".

Where embankment material of 0.30 m or less in depth is placed on an existing road that is not surfaced with asphalt material, the existing road surface shall be scarified to a depth of 0.15 m bladed and prepared to the lines, grades and cross-section as per the Drawings prior to placing embankment materials. The moisture content in this scarified material shall be adjusted as required, and the material compacted to the density requirements in accordance with the applicable sections of the Specifications.

3.6.3.8 Use of Rock Material

a) Embankments constructed principally of rock shall be formed by distributing the materials in successive uniform layers not exceeding 600 mm of loose thickness and shall be formed of layers of a lesser thickness when the size of the rock will permit, as determined by the Engineer.
b) The maximum dimensions of rock placed in the embankments shall not exceed 300 mm and shall be well graded.
c) The rock shall be placed in the embankment by end dumping or dozing over the advance face of the fill. The embankment shall be constructed to full width and true to the required cross-section as the Work progresses. No dumping over the side slopes of the embankment will be permitted.
d) The rock shall be carefully distributed, and the interstices filled with finer material to form a dense compact mass. Each layer shall be compacted using suitable equipment to achieve sufficient compaction to the satisfaction of the Engineer.
e) Each embankment layer is to be compacted using single drum, vibratory, smooth steel drum rollers, with a minimum static drum weight of 8 tonnes (8000 kilograms) and minimum operating dynamic force of 150 kilo-newton. 100% roller pass coverage with a minimum number of eight passes shall be provided. Additional passes may be required, as determined by the Engineer. Each roller pass shall overlap the coverage of the preceding pass by a minimum of 0.5 m.
f) All finished rock embankments, including sideslopes, shall be surface dense and chinked with small rock fragments. The chinked rock embankment shall conform to the lines and grades shown on the Drawings or as designated by the Engineer and shall be uniform and free from any ruts or irregularities. Trimming and chinking of rock embankments will not be measured separately for payment and shall be considered incidental to the Work.

3.6.3.9 Construction on Muskeg, Yielding Ground or Permafrost

a) When the roadway embankment is to be constructed on muskeg or other unstable materials containing excessive moisture, deleterious materials shall not be excavated.
b) Minimize disturbance of the organic mat.
c) Where it is not possible to place the initial layer of embankment material in a 150 mm compacted depth, the Contractor may, subject to the Engineer's approval, construct the initial layer to a depth sufficient to support construction equipment. All subsequent layer embankment construction shall be carried out in layers not exceeding 150 mm compacted depth.
d) Drainage ditches shall be constructed and functioning as far in advance as possible of embankment construction operations.
e) The placing of embankment in permafrost areas shall be carried out in such a manner that the existing natural insulation of fibrous material under the embankment and adjacent areas is not damaged.

f) In swampy, muskeg or permafrost areas, a suitable earth mat may be required to be laid over embankment areas prior to the placing of boulders and/or rock fill.

g) Remove as much snow and ice as practical without disturbing the organic mat prior to placing material. Snow and ice removal will be considered incidental to Embankment Construction and no separate measurement or payment will be made.

3.6.3.10 Layer and Density Requirements

a) Embankments shall be formed by distributing materials in successive uniform layers not exceeding 150 mm compacted depth to the full width of the cross-section. However, layers of compacted depth less than 150 mm shall be placed if required to obtain the specified density and layers of compacted depth greater than 150 mm may be permitted providing the specified density is obtained.
Sidehill embankments may be permitted to be constructed by dumping excessive loads in uniformly distributed layers until the embankment is wide enough to allow the use of compacting equipment, after which the remainder of the embankment shall be constructed as specified.
When the original ground will not support the weight of the compaction equipment, the lower part of the embankment may be constructed by dumping successive loads in uniformly distributed layers of thickness not greater than that necessary to support the equipment, after which the remainder of the embankment shall be constructed as specified.

b) Embankment material placed below 300 mm from the top of the subgrade shall be compacted to 98% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698, except that if such material contains over 50% rock of maximum dimension larger than 150 mm it shall be compacted until there is visible evidence of no further consolidation during compaction to the satisfaction of the Engineer.

c) All embankment material and material in cuts within the top 300 mm shall be compacted in layers not exceeding 150 mm compacted depth to 100% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698.

d) Material used in the final 150 mm lift of embankment, shall be selected by the Contractor to ensure a minimum of boulders or stone fragments having dimensions larger than 150 mm. After placing the final 150 mm lift, all stones, boulders or rock fragments having a major dimension greater than 150 mm shall be removed from the material and disposed of at locations approved by the Engineer. Boulders which are not placed in the subgrade shall be removed and/or disposed as directed by the Engineer. The boulders shall be disposed in such a manner as not to be visible from the right-of-way.

3.6.3.11 Moisture Content Adjustments for Compaction

Water for Compaction

Where moisture content tests indicate the material for embankment is below optimum moisture, water shall be added to increase the moisture content of the soil to optimum moisture conditions within the ranges identified in these Specifications. The material shall be thoroughly disced and broken down, water added in amounts as required, and the material thoroughly worked to mix the water uniformly throughout the soil prior to commencing compaction operations.

Drying

In the event embankment material is too wet for compaction as specified herein, the Contractor shall allow it to become sufficiently dry before being compacted. Manipulation of such wet material to speed drying will be permitted by scarifying with suitable equipment until the moisture content is corrected. If the Contractor elects to excavate and waste suitable embankment material which has an excessive moisture content, rather than

drying and utilizing the material, the excavation and waste of the material, and its replacement with the corresponding required quantity of suitable embankment construction material will not be measured separately for payment.

3.6.3.12 Embankment Adjacent to Structures

Embankment at Bridge Approaches

The permission of the Engineer must be obtained before any fill is placed against concrete arches, abutments, or wing walls. Approach fills within the lines shown on the Drawings or as directed by the Engineer shall be constructed of approved granular material placed in layers not exceeding 150 mm compacted depth and compacted to 100% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698.

In cases of arch and rigid frame structures, the embankment shall be placed simultaneously at uniform elevations on both sides of the structure.

Embankment at Culverts

Embankment materials around culverts shall be selected by the Engineer and placed to the limits shown on the Drawings or as designated by the Engineer.

All backfill material shall be placed in layers not exceeding 150 mm in depth. Each layer shall be compacted alternately on each side of the culvert to not displace the culvert during installation. Compact layers by means of pneumatic or other mechanical tamping equipment to 100% of the standard Proctor maximum dry density at the optimum moisture content in accordance with the latest edition of ASTM D698. Special attention is required to obtain the required compaction under the haunches. Compaction equipment shall be operated parallel to the longitudinal axis of the culvert. The Contractor shall correct any culvert displacements at their sole expense, to the satisfaction of the Engineer.

Fill - Retaining Walls

The permission of the Engineer must be obtained before any fill is placed behind a retaining wall. The fill behind the walls shall consist of approved material placed in layers not exceeding 150 mm in compacted depth and compacted as directed by the Engineer. In the case of cell type retaining walls, the fill behind the wall shall be tamped and kept near but not above the level of the compacted material within the cells.

Where fill is to be placed on a sloping surface, the surface must first be benched to reduce the load on the retaining structures.

3.6.3.13 Construction Equipment

The completed embankment shall be sound and stable and shall not exhibit excessive deflection or consolidation, as determined by the Engineer, under construction equipment loading.

The Contractor shall be responsible for any damage to the existing embankment, design embankment or subsequent layers of material placed thereon caused by their construction equipment or activities. There will be no compensation for any delays in productivity resulting from such damage or for its repair.

3.6.4 MAINTENANCE OF WORK AND DUST CONTROL

Maintenance and dust control of the entire roadway shall be carried out in accordance with "Execution of Work, Maintenance of Work and Dust Control During Construction" (Division 2, Section 4).

3.6.5 MEASUREMENT

a) The volume of embankment will be measured in cubic metres in the final in-place position.
The volume will be determined as the number of cubic metres approved and placed between the original ground cross-section (top of grubbing) and the embankment design cross-section.
Where the Contractor has been required to carry out sub-excavation, the final in-place volume of subsequent embankment backfill material will be added.
There will be no measurement for any embankment material placed outside of the limits of the embankment design cross-section unless authorized by the Engineer.
The quantity of embankment fill material required between the original ground surface (top of grubbing) and the surface beneath the grubbing will not be measured separately for payment and shall be considered incidental to the embankment construction operation.
The volume will be determined by the "Average End Area Method", unless otherwise specified in the Special Provisions or directed by the Engineer in writing and in advance.

b) Work described in Section 3.6.3.1 will not be measured separately for payment and shall be considered incidental to the embankment construction operation.

c) The removal and disposal of stones, boulders or rock fragments as described in Section 3.6.3.10 (d) will not be measured separately for payment and shall be considered incidental to the embankment construction operation.

d) The addition of water to the embankment material, in order to obtain the specified density, will not be measured separately for payment and shall be considered incidental to the embankment construction operation.

e) The drying of embankment materials in order to obtain the specified density will not be measured separately for payment and shall be considered incidental to the embankment construction operation.

f) The preparation of the ground following grubbing, benching of the existing embankment sideslopes and the scarifying and compacting of the existing road surface to obtain bonding will not be measured separately for payment and shall be considered incidental to the embankment construction operation.

3.6.6 BASIS OF PAYMENT

Payment for Embankment Construction will be at the Contract unit price per cubic metre in the final in-place position. There will be no payment for any embankment material placed outside of the limits of the embankment design cross-section unless authorized by the Engineer.

The unit price shall be compensation in full for clearing, grubbing and stripping of borrow areas and haul roads, upgrading or construction of haul roads, removing and disposing of unsuitable materials, unclassified rubbish, shrubs and vegetation, trimming of all slopes and surfaces in borrow areas and haul roads, the restoration of all existing drainage ditches, grubbing, stripping, benching and widening, scarifying, excavating, loading, hauling, dumping, spreading and blading borrow materials, forming and compacting embankments, the disposal of clearing and grubbing debris, the supply and application of water, drying, trimming and grading of all embankment surfaces, all surveying, including establishment of benchmarks, baseline layout, slope staking, grade staking and grading, ditch alignment staking and grading, shoulder and trim staking, as-built and referencing, quality control and quality control testing, reporting and certification, maintenance and dust control of the Work and haul roads, traffic control and accommodation and the supply of all equipment, labour, tools and incidentals necessary to complete the Work in accordance with the Specifications.

The unit price shall also include all work required to comply with the provisions of the *Northwest Territories Lands Act*.

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3.7 SECTION 7 – RIGHT-OF-WAY GRADING AND CLEANUP

3.7.1 DESCRIPTION

Right-of-Way Grading and Cleanup consists of the grading, shaping, contouring and cleanup of the road right-of-way to the satisfaction of the Engineer.

3.7.2 MATERIALS

Not applicable.

3.7.3 CONSTRUCTION

a) As a conditional requisite for acceptance of the project, the Contractor shall grade, shape, contour and clean-up the entire road right-of-way in a manner which results in a smooth, uniform, neat and tidy condition, suitable for mowing operations, to the satisfaction of the Engineer and the Land Use Authority.
b) Connect new ditches to existing ditches to facilitate proper drainage and prevent ponding of surface runoff. Abandoned ditches shall be contoured to prevent water ponding.
c) The entire right-of-way shall be made free from ruts and ridges and all surface debris, including any clearing, grubbing and stripping debris, clods, stumps, roots, weeds and trash. All boulders which would interfere with mowing operations shall be removed and disposed of and the resultant cavities, if any, backfilled.
d) The manner and location(s) of the disposal of Right-of-Way Grading and Cleanup debris and boulders will be subject to the approval of the applicable Land Use Authority.

3.7.4 MEASUREMENT AND PAYMENT

a) Payment for Right-of-Way Grading and Cleanup will be incidental unless there is a separate bid item in the Unit Price Table.
b) Payment for Right-of-Way Grading and Cleanup will be at the Contract unit price per kilometer or hectare.
c) The unit price shall be compensation in full for grading, contouring, blading, piling, windrowing, burning, removing, disposing, construction of disposal pits, burying, backfilling, compacting and levelling of disposal pits, disposal of boulders, removing ruts and ridges and surface debris, including clearing, grubbing and stripping debris, contouring of abandoned interceptor ditches, dragging, spreading, levelling, shaping, contouring, trimming and the supply of all equipment, labour, materials, tools and incidentals necessary to complete the Work in accordance with the Specifications.

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3.8 SECTION 8 - WATERING ON THE ROAD

3.8.1 DESCRIPTION

Watering on The Road consists of loading, transporting and distributing water required for the construction of highway embankment or the placing of road surfacing materials, and/or for dust control to ensure the safety of the travelling public, all in accordance with these Specifications.

3.8.2 MATERIALS

The Contractor shall supply the water and obtain the necessary licenses or permits. The water shall be free from undesirable quantities of organic matter, mineral salts, hazardous or toxic wastes and other materials that are harmful to the natural environment. The water quality will be subject to the approval of the Engineer.

If water is supplied from hydrants, the Contractor shall conform to all regulations set forth by municipal authorities or the relevant Land Use Authority. The Contractor shall supply any special equipment required for obtaining water from hydrants, at no direct expense to the Department.

3.8.3 CONSTRUCTION

a) Watering equipment shall consist of water-tight tank(s) mounted on adequately powered trucks. The water shall be applied through a spray bar or nozzle of such design as to provide a uniform unbroken spread of water over a minimum width of 2.5 m. A suitable device for positive shut-off of the spray bar shall be located as to permit control from the cab of the truck.
b) The Contractor will determine the quantity of water to be applied and the rate of application.
c) When water is required for the construction of highway embankment or the placing of road surface materials, the water shall be distributed only if equipment is available to mix the materials or when the compaction operation is in progress.
d) The Contractor shall be responsible for determining areas requiring water application for dust control to ensure adequate safety of the traveling public. In addition, the application of water for dust control may also be carried out at specific locations as directed by the Engineer.

3.8.4 MEASUREMENT AND PAYMENT

Watering on The Road shall be considered incidental to the work and will not be measured separately for payment.