

## 1. SCOPE

- THIS SPECIFICATION PROVIDES THE REQUIREMENTS FOR EARTHWORKS INCLUDING STRIPPING, EXCAVATION, MATERIAL PROPERTIES, FILL PLACEMENT INCLUDING BACKFILL.
- SPECIFICATIONS FOR ROCKWORKS, LANDSCAPING, GEOSYNTHETICS, AND CARE OF WATER ARE PROVIDED ON OTHER DRAWINGS.

## 2. GENERAL REQUIREMENTS

- COMPLY WITH ALL REGULATIONS, PERMITS, AND LICENCES INCLUDING NUNAVUT OCCUPATIONAL HEALTH AND SAFETY REGULATIONS. WHERE COMPLETE DIMENSIONS AND DETAILS ARE NOT SHOWN ON THE DRAWINGS, THE REMAINING ASPECTS OF WORK SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH OHS REGULATIONS. ENGAGE THE SERVICES OF A QUALIFIED PROFESSIONAL ENGINEER AS REQUIRED.
- PREVENT SLOUGHING AND LOOSE SOIL FROM FALLING INTO THE EXCAVATIONS. PROVIDE TEMPORARY SHORING, BRACING AND UNDERPINNING, AS REQUIRED. CAREFULLY INSPECT ALL EXCAVATIONS BEFORE DOING ANY WORK IN THE EXCAVATIONS. LOOK FOR SIGNS OF CRACKS ABOVE SLOPES, SEEPAGE, AND ANY OTHER SIGNS OF SLOPE INSTABILITY. REMOVE SOIL BLOCKS, BOULDERS, LOOSE ROCK AND OTHER FRAGMENTS THAT MAY SLIDE OR ROLL INTO THE EXCAVATED AREAS.
- LOCATE AND PROTECT UTILITY LINES, SURVEY REFERENCE POINTS, INSTRUMENTATION, CULVERTS, AND ALL OTHER EXISTING FACILITIES BEFORE COMMENCING EARTHWORKS OPERATIONS.
- SEQUENCE, SCHEDULE, AND PERFORM ALL EARTHWORKS OPERATIONS TO MAXIMIZE AND MAKE THE MOST EFFICIENT USE OF ALL MATERIALS AND PROTECT AND PREVENT SUITABLE MATERIALS FROM BECOMING UNSUITABLE.
- PERFORM EARTHWORKS IN A MANNER THAT PROVIDES FOR POSITIVE DRAINAGE AND AVOIDS PONDING OF WATER FROM RAINFALL AND SNOWMELT, RUN-OFF, AND SEEPAGE. SUSPEND EARTHWORKS OPERATIONS DURING RAIN, SNOW, WET GROUND CONDITIONS, HIGH WINDS, OR OTHER CONDITIONS THAT MAY RESULT IN CONTAMINATION, SEDIMENTATION, EROSION OR LOSS OF MATERIAL. PROVIDE TEMPORARY MEASURES AND SLOPING OF SURFACES TO PREVENT WATER PONDING AND INFILTRATION. REMOVE, REPLACE, OR REWORK ANY FILL MATERIAL OR FOUNDATION IMPACTED BY SUCH CONDITIONS AT NO ADDITIONAL COST TO THE OWNER.

## 3. SUBMITTALS

- SUBMIT THE FOLLOWING IN ACCORDANCE WITH THE CONTRACT REQUIREMENTS AND SCHEDULE.
  - EARTHWORKS PLAN INCLUDING QUANTITY ESTIMATES, EQUIPMENT, STOCKPILE LOCATIONS, IMPORTED MATERIAL SOURCES AND ASSOCIATED TEST RESULTS.
  - WEEKLY PROGRESS REPORT INCLUDING QA/QC INCLUDING IN-SITU AND LABORATORY MATERIAL TESTING RESULTS SUMMARY TABLE, DESCRIPTIONS OF WORK IN PROGRESS AND COMPLETED WORKS, DEFICIENCIES AND MITIGATIVE MEASURES
  - REDLINE DRAWING MARKUPS INDICATING LOCATION AND EXTENT OF MATERIALS USED.
- DO NOT PROCEED WITH WORK ASSOCIATED WITH A SUBMITTAL UNTIL REVIEWED BY THE ENGINEER.
- SUBMITTAL REVIEW BY THE ENGINEER SHALL NOT RELIEVE THE CONTRACTOR FROM THE FULL RESPONSIBILITY OF THE WORK.

## 4. QUALITY ASSURANCE AND CONTROL

- THE FOLLOWING MATERIAL TESTING SHALL BE CONDUCTED AT A MINIMUM RATE OF ONE TEST PER SPECIFIED VOLUME. MORE FREQUENT TESTING SHALL BE DONE AS DEEMED APPROPRIATE BY THE ENGINEER BASED ON THE MATERIAL VARIABILITY AND WORK METHODS USED.
 

TEST	STANDARD	VOLUME
PARTICLE SIZE DISTRIBUTION	ASTM D422	200
MOISTURE-DENSITY RELATIONSHIP	ASTM D698	1000
IN PLACE DENSITY	ASTM D2922	100
IN PLACE MOISTURE CONTENT	ASTM D3017	100
IN PLACE MOISTURE CONTENT VERIFICATION	ASTM D2216	1000
PLASTICITY	ASTM D4318	500
- TESTING SHALL BE CONDUCTED AT UNIFORM SPACING OR REGULAR INTERVALS SO AS TO DEMONSTRATE CONSISTENCY OF THE ENTIRE WORK.
- TESTING SHALL BE COMPLETED BY AN AGENCY MEETING THE REQUIREMENTS OF ASTM D3740 USING CSA CERTIFIED TESTING EQUIPMENT AND QUALIFIED PERSONNEL.
- CO-OPERATE WITH AND PROVIDE ACCESS TO TESTING PERSONNEL AND THE ENGINEER FOR MATERIAL TESTING.
- THE ENGINEER MAY REJECT EARTHWORK MATERIALS AT THE SOURCE, IN TRANSPORT, IN STOCKPILES, OR IN PLACE.
- PROOF ROLLING SHALL CONSIST OF LOADING WITH A RUBBER TIRE VEHICLE HAVING A SINGLE AXLE LOAD OF 12 TO 15 TONNES.
- PROOF ROLL ALL SUBGRADE. IN AREAS EXHIBITING EXCESSIVE DEFLECTION OR FAILURE, REMOVE ANY UNSUITABLE MATERIAL AS INDICATED BY THE ENGINEER AND PREPARE SUBGRADE IN ACCORDANCE WITH THE SPECIFICATIONS. IF PROOF ROLLING FAILS AFTER SUBGRADE REPAIRS, IMPLEMENT ADDITIONAL REMEDIAL MEASURES AS INDICATED BY THE ENGINEER.
- PROOF ROLL ALL FINISHED ROAD SURFACES.

## 5. MATERIALS

- GENERAL
  - MATERIALS SHALL BE SOURCED FROM EXCAVATION, BORROW AREAS APPROVED BY THE ENGINEER, OR IMPORTED MATERIAL.
  - UNLESS OTHERWISE SPECIFIED, ROYALTY PAYMENTS AND PERMITTING ASSOCIATED WITH MATERIALS WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.
  - ALL EARTHWORK MATERIALS SHALL BE FREE OF ROOTS, FROZEN MATERIAL, ORGANICS, AND ANY OTHER DELETERIOUS MATERIALS.
  - UNLESS SPECIFIED OTHERWISE, MATERIALS SHALL BE WELL-GRADED (COEFFICIENT OF CONFORMITY GREATER THAN 4 AND COEFFICIENT OF CURVATURE BETWEEN 1 AND 3) WHEN SAMPLED AND TESTED AFTER PLACEMENT, WITH THE RESULTS OF SIEVE ANALYSES PRODUCING A SMOOTH GRADATION CURVE, FALLING COMPLETELY WITHIN THE UPPER AND LOWER BOUNDS OF THE ENVELOPE, DEFINED BY STRAIGHT LINES DRAWN DIRECTLY BETWEEN THE SPECIFIED POINTS. THERE SHALL BE NO EXCESS OR DEFICIENCY OF ANY PARTICULAR GRAIN SIZE.
  - WHERE BLENDING IS REQUIRED, THOROUGHLY MIX MATERIALS IN A MANNER THAT PRODUCES THE SPECIFIED GRADATION, PRIOR TO PLACING OR STOCKPILING THE MATERIAL.
  - CRUSH, SCREEN, WASH, OR OTHERWISE PROCESS MATERIALS AS SPECIFIED OR REQUIRED.
- COMMON FILL SHALL HAVE A MAXIMUM PARTICLE SIZE OF 150 mm, SMOOTH GRADATION CURVE, LOW TO MEDIUM PLASTICITY, MAXIMUM PLASTICITY INDEX OF 10%, LIQUID LIMIT LESS THAN 40%, PLASTIC LIMIT LESS THAN 20%.
- SEMI-IMPERVIOUS FILL SHALL BE 75 mm MAXIMUM SIZE WITH A MINIMUM OF 25% PASSING THE 80 mm SIEVE. MATERIAL SHALL BE LOW TO MEDIUM PLASTICITY, MINIMUM PLASTICITY INDEX OF 10%, AND LIQUID LIMIT LESS THAN 40%.
- AGGREGATE MATERIALS
  - AGGREGATE MATERIALS SHALL CONSIST OF NON-ARGILLACEOUS, DENSE (SPECIFIC GRAVITY GREATER THAN 2.5), DURABLE, HARD, SOUND, ROCK CLAST FRAGMENTS EXHIBITING LESS THAN 12% WEIGHT LOSS AFTER FIVE (5) CYCLES IN ACCORDANCE WITH CSA A23.2-9A.
  - PIT RUN GRAVEL SHALL BE UNPROCESSED MATERIAL FROM AN ENGINEER APPROVED SOURCE WITH NO GRADATION REQUIREMENTS.
  - FOR COARSE SAND, THE SLOPE OF A PLOT OF THE ACTUAL PERCENT PASSING BY MASS FOR ANY CHOSEN SIEVE SIZE LARGER THAN 630  $\mu$ m AND A SECOND SIEVE SIZE THAT IS FIVE (5) TIMES THE CHOSEN SIEVE SIZE SHALL BE FLATTER THAN 15%.
  - ELECTRICAL INSULATING GRAVEL SHALL BE 5 TO 20 mm SIZE, CRUSHED, WASHED ROCK CLASTS, WITH ALL PIECES HAVING AT LEAST 2 FRACTURED FACES. THE MINIMUM WET RESISTIVITY SHALL BE 3000 ohm-m WITH SUPPORTING TEST RESULTS.
  - ARMOUR ROCK PARTICLES SHALL BE FREE FROM CRACKS, SEAMS, AND OTHER DEFECTS THAT WOULD INCREASE POTENTIAL FOR DEGRADATION FROM FROST AND WATER ACTION.
  - AGGREGATE MATERIALS SHALL HAVE THE FOLLOWING GRADATION REQUIREMENTS

SIEVE SIZE	PERCENT PASSING BY SIZE (%)					
	GRANULAR FILL	STRUCTURAL FILL	COARSE SAND	GRANULAR FILTER	ARMOUR ROCK	SURFACING GRAVEL
200					100	
125	100				60-80	
80						
50	55-100					
40		100				
25	38-100	70-94		100	30-55	
20					15-30	100
16	32-85	55-85		90-100		
12.5						
10		44-74	100	45-75	0-15	30-77
8						
5	20-65	32-62	70-90	0-15	0-5	15-55
1.25		17-43	20-45	0-5		0-30
0.630		12-34				
0.315	6-30	8-26	9-22			
0.160		5-18	5-15			
0.080	0-5	0-5	0-10			0-12
% FRACTURE BY MASS (2 FACES)	-	50%+	-	-	-	50%+

## 6. STRIPPING

- STRIPPING SHALL APPLY TO THE UPPERMOST PART OF THE SOIL, NORMALLY RANGING IN DEPTH FROM 50 mm TO 200 mm. IT CORRESPONDS TO THE SURFACE "A" (ORGANO-MINERAL) HORIZON OF THE SOIL PROFILE AS DEFINED BY THE CANADA SYSTEM OF SOIL CLASSIFICATION DEPARTMENT OF AGRICULTURE PUBLICATION 1646.
- STRIPPING SHALL BE STOCKPILED FOR RECLAMATION.
- OBTAIN ENGINEER APPROVAL PRIOR TO STARTING STRIPPING.
- LIMIT TRAFFIC ON UNDISTURBED AREAS AS REQUIRED FOR THE STRIPPING OPERATION. USE PERMANENT AND TEMPORARY ACCESS ROADS. DO NOT DISTURB NATURAL AREAS.
- DO NOT STRIP FROM AREAS IN ADVANCE OF EXCAVATION AND FILL PLACEMENT OPERATIONS SUCH THAT THE STRIPPED AREA IS SUSCEPTIBLE TO WIND AND WATER EROSION.

## 7. EXCAVATION

- MAINTAIN EXCAVATION SLOPES IN A SAFE AND NEAT CONDITION AT ALL TIMES. DO NOT EXCAVATE TEMPORARY SIDE SLOPES STEEPER THAN 1.5H:1V UNLESS AUTHORIZED BY A PROFESSIONAL ENGINEER.
- IF REQUIRED OR ELECTED, PROCESS EXCAVATION MATERIAL FOR USE AS FILL. PLACE UNSUITABLE AND EXCESS EXCAVATION MATERIAL AS WASTE FILL IN DESIGNATED WASTE AREAS.
- NOTIFY THE ENGINEER WHEN FOUNDATION EXCAVATIONS HAVE ATTAINED THE REQUIRED BOTTOM ELEVATION(S). THE ENGINEER SHALL THEN IDENTIFY UNSUITABLE BEARING SOILS, IF PRESENT, FOR OVER-EXCAVATION AND REMOVAL AND REPLACEMENT WITH SUITABLE FILL MATERIALS.
- WHEN BORROW AREA EXCAVATIONS ARE COMPLETE, SPREAD STOCKPILED UNSUITABLE AND UNUSED MATERIALS AS WASTE FILL, AND BLEND SLOPES TO ACHIEVE NATURAL-LOOKING TOPOGRAPHY AND RE-ESTABLISH NATURAL DRAINAGE PATTERNS. FINAL SIDE SLOPES SHALL BE NO STEEPER THAN 3H:1V. INSTALL NATURAL FEATURES INCLUDING SWALES AND MEANDERS TO PREVENT EROSION. REDISTRIBUTE STRIPPING MATERIAL, SEED, AND PLANT AS DIRECTED BY THE ENGINEER.
- FILL UNAUTHORIZED OVER-EXCAVATION WITH SUITABLE MATERIAL TO THE LINES, ELEVATIONS AND DIMENSIONS INDICATED ON THE DRAWINGS, OR AS MODIFIED BY THE ENGINEER.

## 8. STOCKPILES

- STOCKPILE SITES SHALL BE CLEARED OF ALL VEGETATION, TREES, BRUSH, ROCKS OR OTHER DEBRIS, GRADED TO 2% MINIMUM GRADE WITH DRAINAGE COURSES DIVERTED AWAY FROM THE STOCKPILE LOCATIONS.
- STOCKPILES SHALL BE CONSTRUCTED ONLY IN DESIGNATED AND ENGINEER-APPROVED LOCATIONS AND WHEN COMPLETED, SHALL BE NEAT AND REGULAR IN SHAPE, OCCUPYING AS SMALL AN AREA AS IS PRACTICABLE.
- STOCKPILES SHALL BE BUILT UP IN LAYERS NOT EXCEEDING 1.0 m IN THICKNESS. MATERIAL SHALL NOT BE SPILLED OVER THE EDGES OF THE PILES.
- TAKE ALL NECESSARY MEASURES TO AVOID CONTAMINATION OR EROSION OF STOCKPILED MATERIAL. MAINTAIN A MINIMUM SEPARATION OF 3 m BETWEEN STOCKPILES OF DIFFERENT MATERIALS.
- STRIPPING MATERIAL SHALL BE STOCKPILED ADJACENT TO THE STRIPPED AREA, AND WITHIN THE LIMITS AUTHORIZED BY THE ENGINEER.
- STOCKPILES SHALL NOT INTERFERE WITH DRAINAGE COURSES. KEEP STOCKPILES A MINIMUM DISTANCE OF 30 m FROM A RIVER, STREAM, LAKE, RESERVOIR, OR OTHER SURFACE BODIES OF WATER OR AS REQUIRED BY THE PROJECT CEMP, WHICHEVER IS MORE STRINGENT.
- ENSURE ALL STOCKPILES ARE LEFT IN A SAFE CONDITION SO THAT THE POTENTIAL FOR COLLAPSE OR FALLING MATERIALS IS PREVENTED.

## 9. FILL PLACEMENT

- REMOVE DEBRIS, SNOW, ICE, WATER, AND LOOSE MATERIAL FROM THE RECEIVING SURFACE PRIOR TO STARTING FILL PLACEMENT. DO NOT PLACE FILL MATERIAL WHEN THE MATERIAL OR THE RECEIVING SURFACE IS FROZEN. DO NOT PLACE FILL MATERIAL ON ANY SURFACE UNTIL THE PREPARED SURFACE HAS BEEN INSPECTED BY THE ENGINEER, AND ANY DEFECTS IDENTIFIED BY THE ENGINEER HAVE BEEN RECTIFIED.
- PLACE AND SPREAD FILL MATERIALS IN CONTINUOUS AND APPROXIMATELY HORIZONTAL LAYERS OF UNIFORM THICKNESS IN SUCH A MANNER AS TO PREVENT SEGREGATION AND STRATIFICATION AND TO OBTAIN A HOMOGENEOUS MASS.
- THE LOOSE LIFT THICKNESS SHALL NOT EXCEED 1.5 TIMES THE MAXIMUM PARTICLE SIZE OR 150 mm, WHICHEVER IS GREATER.
- PRIOR TO ANY SUSPENSION OF FILL OPERATIONS, SLOPE THE FILL SURFACE AT 3% TO 5% AND ROLL WITH A SMOOTH CYLINDRICAL ROLLER SO AS TO LEAVE THE SURFACE AREA IN A SMOOTH, EVEN CONDITION FOR DRAINAGE.
- DO NOT PLACE FILL MATERIAL ADJACENT TO CAST-IN-PLACE CONCRETE STRUCTURES SOONER THAN 3 DAYS AFTER PLACEMENT FOR MASS CONCRETE, SEVEN (7) DAYS AFTER PLACEMENT FOR WALLS AND DECK SLABS, OR UNTIL 75% OF THE SPECIFIED COMPRESSIVE CONCRETE STRENGTH HAS BEEN ACHIEVED.
- PLACE FILL MATERIAL EQUALLY ON ALL SIDES OF STRUCTURES TO MINIMIZE UNBALANCED LOADING.
- CONDITION, REWORK, AND RE-COMPACT OR REMOVE, AND REPLACE ANY PORTION OF THE FILL THAT HAS SUFFERED A REDUCTION IN QUALITY TO THE SPECIFIED REQUIREMENTS DUE TO DRYING, FROST, RAIN, OR ANY OTHER REASON BEFORE PLACING SUCCEEDING LAYERS.
- REROUTE CONSTRUCTION TRAFFIC AWAY FROM OR STABILIZE AREAS TO THE SATISFACTION OF THE ENGINEER WHERE THE FILL OR GROUND SURFACES BEGIN TO RUT OR EXHIBIT INSTABILITY.
- UNLESS OTHERWISE AUTHORIZED BY THE ENGINEER, MAINTAIN NO MORE THAN 0.5 m MAXIMUM DIFFERENCE IN ELEVATION BETWEEN ADJACENT FILL ZONES, AND MAINTAIN THE TEMPORARY SLOPES WITHIN FILL ZONES NO STEEPER THAN 2H:1V.
- NO HEAVY CONSTRUCTION EQUIPMENT SHALL TRAVEL OVER BURIED STRUCTURES OR PIPES UNLESS APPROVED BY THE ENGINEER.

FOR CONSTRUCTION