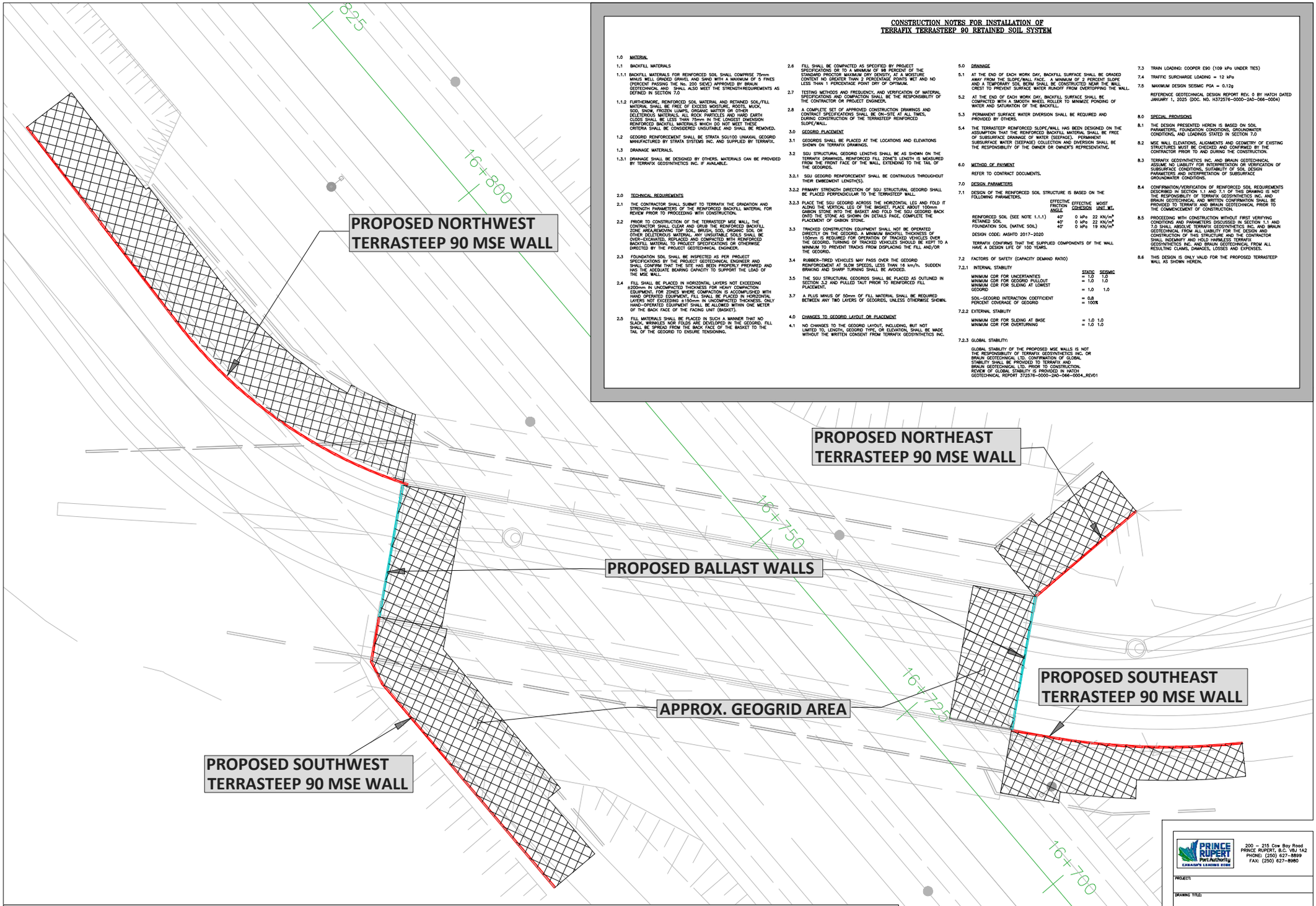

CONSTRUCTION NOTES FOR INSTALLATION OF TERRAFIX TERRASTEEP 90 RETAINED SOIL SYSTEM

1.0 MATERIAL

1.1 BACKFILL MATERIALS

1.1.1 BACKFILL MATERIALS FOR REINFORCED SOIL SHALL COMPRISE 75mm MINUS WELL GRADED GRAVEL AND SAND WITH A MAXIMUM OF 5 FINES (PERCENT PASSING THE No. 200 SIEVE) APPROVED BY BRAUN GEOTECHNICAL AND SHALL ALSO MEET THE STRENGTH REQUIREMENTS AS DEFINED IN SECTION 7.0

1.1.2 FURTHERMORE, REINFORCED SOIL MATERIAL AND RETAINED SOIL/FILL MATERIAL SHALL BE FREE OF EXCESS MOISTURE, ROOTS, MUCK, SOD, SNOW, FROZEN LUMPS, ORGANIC MATTER OR OTHER DELETERIOUS MATERIALS. ALL ROCK PARTICLES AND HARD EARTH CLODS SHALL BE LESS THAN 75mm IN THE LONGEST DIMENSION REINFORCED BACKFILL MATERIALS WHICH DO NOT MEET THESE CRITERIA SHALL BE CONSIDERED UNSUITABLE AND SHALL BE REMOVED.

1.2 GEOGRID REINFORCEMENT SHALL BE STRATA SGU100 UNIAXIAL GEOGRID MANUFACTURED BY STRATA SYSTEMS INC. AND SUPPLIED BY TERRAFIX.

1.3 DRAINAGE MATERIALS.

1.3.1 DRAINAGE SHALL BE DESIGNED BY OTHERS. MATERIALS CAN BE PROVIDED BY TERRAFIX GEOSYNTHETICS INC. IF AVAILABLE.

2.0 TECHNICAL REQUIREMENTS

2.1 THE CONTRACTOR SHALL SUBMIT TO TERRAFIX THE GRADATION AND STRENGTH PARAMETERS OF THE REINFORCED BACKFILL MATERIAL FOR REVIEW PRIOR TO PROCEEDING WITH CONSTRUCTION.

2.2 PRIOR TO CONSTRUCTION OF THE TERRASTEEP MSE WALL, THE CONTRACTOR SHALL CLEAR AND GRUB THE REINFORCED BACKFILL ZONE AREA REMOVING TOP SOIL, BRUSH, SOD, ORGANIC SOIL OR OTHER DELETERIOUS MATERIAL. ANY UNSUITABLE SOILS SHALL BE OVER-EXCAVATED, REPLACED AND COMPACTED WITH REINFORCED BACKFILL MATERIAL TO PROJECT SPECIFICATIONS OR OTHERWISE DIRECTED BY THE PROJECT GEOTECHNICAL ENGINEER.

2.3 FOUNDATION SOIL SHALL BE INSPECTED AS PER PROJECT SPECIFICATIONS BY THE PROJECT GEOTECHNICAL ENGINEER AND SHALL CONFIRM THAT THE SITE HAS BEEN PROPERLY PREPARED AND HAS THE ADEQUATE BEARING CAPACITY TO SUPPORT THE LOAD OF THE MSE WALL.

2.4 FILL SHALL BE PLACED IN HORIZONTAL LAYERS NOT EXCEEDING ±200mm IN UNCOMPACTED THICKNESS FOR HEAVY COMPACTION EQUIPMENT. FOR ZONES WHERE COMPACTION IS ACCOMPLISHED WITH HAND OPERATED EQUIPMENT, FILL SHALL BE PLACED IN HORIZONTAL LAYERS NOT EXCEEDING ±150mm IN UNCOMPACTED THICKNESS. ONLY HAND-OPERATED EQUIPMENT SHALL BE ALLOWED WITHIN ONE METER OF THE BACK FACE OF THE FACING UNIT (BASKET).

2.5 FILL MATERIALS SHALL BE PLACED IN SUCH A MANNER THAT NO SLACK, WRINKLES NOR FOLDS ARE DEVELOPED IN THE GEOGRID. FILL SHALL BE SPREAD FROM THE BACK FACE OF THE BASKET TO THE TAIL OF THE GEOGRID TO ENSURE TENSIONING.

2.6 FILL SHALL BE COMPACTED AS SPECIFIED BY PROJECT SPECIFICATIONS OR TO A MINIMUM OF 98 PERCENT OF THE STANDARD PROCTOR MAXIMUM DRY DENSITY, AT A MOISTURE CONTENT NO GREATER THAN 2 PERCENTAGE POINTS WET AND NO LESS THAN 1 PERCENTAGE POINT DRY OF OPTIMUM.

2.7 TESTING METHODS AND FREQUENCY, AND VERIFICATION OF MATERIAL SPECIFICATIONS AND COMPACTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR OR PROJECT ENGINEER.

2.8 A COMPLETE SET OF APPROVED CONSTRUCTION DRAWINGS AND CONTRACT SPECIFICATIONS SHALL BE ON-SITE AT ALL TIMES, DURING CONSTRUCTION OF THE TERRASTEEP REINFORCED SLOPE/WALL.

3.0 GEOGRID PLACEMENT

3.1 GEOGRIDS SHALL BE PLACED AT THE LOCATIONS AND ELEVATIONS SHOWN ON TERRAFIX DRAWINGS.

3.2 SGU STRUCTURAL GEOGRID LENGTHS SHALL BE AS SHOWN ON THE TERRAFIX DRAWINGS. REINFORCED FILL ZONE'S LENGTH IS MEASURED FROM THE FRONT FACE OF THE WALL, EXTENDING TO THE TAIL OF THE GEOGRIDS.

3.2.1 SGU GEOGRID REINFORCEMENT SHALL BE CONTINUOUS THROUGHOUT THEIR EMBEDMENT LENGTH(S).

3.2.2 PRIMARY STRENGTH DIRECTION OF SGU STRUCTURAL GEOGRID SHALL BE PLACED PERPENDICULAR TO THE TERRASTEEP WALL.

3.2.3 PLACE THE SGU GEOGRID ACROSS THE HORIZONTAL LEG AND FOLD IT ALONG THE VERTICAL LEG OF THE BASKET. PLACE ABOUT 100mm GABION STONE INTO THE BASKET AND FOLD THE SGU GEOGRID BACK ONTO THE STONE AS SHOWN ON DETAILS PAGE. COMPLETE THE PLACEMENT OF GABION STONE.

3.3 TRACKED CONSTRUCTION EQUIPMENT SHALL NOT BE OPERATED DIRECTLY ON THE GEOGRID. A MINIMUM BACKFILL THICKNESS OF 150mm IS REQUIRED FOR OPERATION OF TRACKED VEHICLES OVER THE GEOGRID. TURNING OF TRACKED VEHICLES SHOULD BE KEPT TO A MINIMUM TO PREVENT TRACKS FROM DISPLACING THE FILL AND/OR THE GEOGRID.

3.4 RUBBER-TIRED VEHICLES MAY PASS OVER THE GEOGRID REINFORCEMENT AT SLOW SPEEDS, LESS THAN 16 km/h. SUDDEN BRAKING AND SHARP TURNING SHALL BE AVOIDED.

3.5 THE SGU STRUCTURAL GEOGRIDS SHALL BE PLACED AS OUTLINED IN SECTION 3.2 AND PULLED TAUT PRIOR TO REINFORCED FILL PLACEMENT.

3.7 A PLUS MINUS OF 50mm OF FILL MATERIAL SHALL BE REQUIRED BETWEEN ANY TWO LAYERS OF GEOGRIDS, UNLESS OTHERWISE SHOWN.

4.0 CHANGES TO GEOGRID LAYOUT OR PLACEMENT

4.1 NO CHANGES TO THE GEOGRID LAYOUT, INCLUDING, BUT NOT LIMITED TO, LENGTH, GEOGRID TYPE, OR ELEVATION, SHALL BE MADE WITHOUT THE WRITTEN CONSENT FROM TERRAFIX GEOSYNTHETICS INC.

5.0 DRAINAGE

5.1 AT THE END OF EACH WORK DAY, BACKFILL SURFACE SHALL BE GRADED AWAY FROM THE SLOPE/WALL FACE. A MINIMUM OF 2 PERCENT SLOPE AND A TEMPORARY SOIL BERM SHALL BE CONSTRUCTED NEAR THE WALL CREST TO PREVENT SURFACE WATER RUNOFF FROM OVERTOPPING THE WALL.

5.2 AT THE END OF EACH WORK DAY, BACKFILL SURFACE SHALL BE COMPACTED WITH A SMOOTH WHEEL ROLLER TO MINIMIZE PONDING OF WATER AND SATURATION OF THE BACKFILL.

5.3 PERMANENT SURFACE WATER DIVERSION SHALL BE REQUIRED AND PROVIDED BY OTHERS.

5.4 THE TERRASTEEP REINFORCED SLOPE/WALL HAS BEEN DESIGNED ON THE ASSUMPTION THAT THE REINFORCED BACKFILL MATERIAL SHALL BE FREE OF SUBSURFACE DRAINAGE OF WATER (SEEPAGE). PERMANENT SUBSURFACE WATER (SEEPAGE) COLLECTION AND DIVERSION SHALL BE THE RESPONSIBILITY OF THE OWNER OR OWNER'S REPRESENTATIVE.

6.0 METHOD OF PAYMENT

REFER TO CONTRACT DOCUMENTS.

7.0 DESIGN PARAMETERS

7.1 DESIGN OF THE REINFORCED SOIL STRUCTURE IS BASED ON THE FOLLOWING PARAMETERS.

	EFFECTIVE FRICTION ANGLE	EFFECTIVE COHESION	MOIST UNIT WT.
REINFORCED SOIL (SEE NOTE 1.1.1)	40°	0 kPa	22 KN/m^3
RETAINED SOIL	40°	0 kPa	22 KN/m^3
FOUNDATION SOIL (NATIVE SOIL)	40°	0 kPa	19 KN/m^3

DESIGN CODE: AASHTO 2017-2020

TERRAFIX CONFIRMS THAT THE SUPPLIED COMPONENTS OF THE WALL HAVE A DESIGN LIFE OF 100 YEARS.

7.2 FACTORS OF SAFETY (CAPACITY DEMAND RATIO)

7.2.1 INTERNAL STABILITY

	STATIC	SEISMIC
MINIMUM CDR FOR UNCERTAINTIES	= 1.0	1.0
MINIMUM CDR FOR GEOGRID PULLOUT	= 1.0	1.0
MINIMUM CDR FOR SLIDING AT LOWEST GEOGRID	= 1.0	1.0
SOIL-GEOGRID INTERACTION COEFFICIENT	= 0.8	
PERCENT COVERAGE OF GEOGRID	= 100%	

7.2.2 EXTERNAL STABILITY

MINIMUM CDR FOR SLIDING AT BASE	= 1.0	1.0
MINIMUM CDR FOR OVERTURNING	= 1.0	1.0

7.2.3 GLOBAL STABILITY:

GLOBAL STABILITY OF THE PROPOSED MSE WALLS IS NOT THE RESPONSIBILITY OF TERRAFIX GEOSYNTHETICS INC. OR BRAUN GEOTECHNICAL LTD. CONFIRMATION OF GLOBAL STABILITY SHALL BE PROVIDED TO TERRAFIX AND BRAUN GEOTECHNICAL LTD. PRIOR TO CONSTRUCTION. REVIEW OF GLOBAL STABILITY IS PROVIDED IN HATCH GEOTECHNICAL REPORT 372576-0000-2A0-066-0004_REV01

7.3 TRAIN LOADING: COOPER E90 (109 kPa UNDER TIES)

7.4 TRAFFIC SURCHARGE LOADING = 12 kPa

7.5 MAXIMUM DESIGN SEISMIC PGA = 0.12g

REFERENCE GEOTECHNICAL DESIGN REPORT REV. 0 BY HATCH DATED JANUARY 1, 2025 (DOC. NO. H372576-0000-2A0-066-0004)

8.0 SPECIAL PROVISIONS

8.1 THE DESIGN PRESENTED HEREIN IS BASED ON SOIL PARAMETERS, FOUNDATION CONDITIONS, GROUNDWATER CONDITIONS, AND LOADINGS STATED IN SECTION 7.0

8.2 MSE WALL ELEVATIONS, ALIGNMENTS AND GEOMETRY OF EXISTING STRUCTURES MUST BE CHECKED AND CONFIRMED BY THE CONTRACTOR PRIOR TO AND DURING THE CONSTRUCTION.

8.3 TERRAFIX GEOSYNTHETICS INC. AND BRAUN GEOTECHNICAL ASSUME NO LIABILITY FOR INTERPRETATION OR VERIFICATION OF SUBSURFACE CONDITIONS, SUITABILITY OF SOIL DESIGN PARAMETERS AND INTERPRETATION OF SUBSURFACE GROUNDWATER CONDITIONS.

8.4 CONFIRMATION/VERIFICATION OF REINFORCED SOIL REQUIREMENTS DESCRIBED IN SECTION 1.1 AND 7.1 OF THIS DRAWING IS NOT THE RESPONSIBILITY OF TERRAFIX GEOSYNTHETICS INC. AND BRAUN GEOTECHNICAL AND WRITTEN CONFIRMATION SHALL BE PROVIDED TO TERRAFIX AND BRAUN GEOTECHNICAL PRIOR TO THE COMMENCEMENT OF CONSTRUCTION.

8.5 PROCEEDING WITH CONSTRUCTION WITHOUT FIRST VERIFYING CONDITIONS AND PARAMETERS DISCUSSED IN SECTION 1.1 AND 7.0 SHALL ABSOLVE TERRAFIX GEOSYNTHETICS INC. AND BRAUN GEOTECHNICAL FROM ALL LIABILITY FOR THE DESIGN AND CONSTRUCTION OF THIS STRUCTURE AND THE CONTRACTOR SHALL INDEMNIFY AND HOLD HARMLESS TERRAFIX GEOSYNTHETICS INC. AND BRAUN GEOTECHNICAL FROM ALL RESULTING CLAIMS, DAMAGES, LOSSES AND EXPENSES.

8.6 THIS DESIGN IS ONLY VALID FOR THE PROPOSED TERRASTEEP WALL AS SHOWN HEREIN.

Appendix G - Mechanically Stabilized Earth Walls Structure A

PRINCE RUPERT Port Authority
CANADA'S LEADING ZONE
200 – 215 Cow Bay Road
PRINCE RUPERT, B.C. V8J 1A2
PHONE: (250) 627-8899
FAX: (250) 627-8980

PROJECT:
DRAWING TITLE:
PROJECT NUMBER:
DRAWING NUMBER:
DATE: YY/MM/DD
SCALE: AS NOTED
PAPER:
DRAWN:
CHECKED:
CAD FILE: Structure A MSE Walls Progression Drawing

REV.	BY	APR.	DATE	DESCRIPTION

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