01-0871

GE
159 Plastics Avenue
Pittsfield, MA 01201
USA

Transmitted Via Federal Express

August 12, 2005

Ms. Sharon Hayes
United States Environmental Protection Agency
One Congress Street, Suite 1100
Boston, MA 02114-2023

Re: GE-Pittsfield/Housatonic River Site
Building 71 and Hill 78 On-Plant Consolidation Areas (GECD200)
2005 Final Cover Construction for Portion of Building 71 OPCA

Dear Ms. Hayes:

On July 15, 2005, the General Electric Company (GE) distributed a letter describing the 2005 final cover construction activities anticipated to be conducted on a portion of the Building 71 On-Plant Consolidation Area (OPCA). Following the U.S. Environmental Protection Agency's (EPA's) review, the EPA provided draft comments to GE in an email dated August 3, 2005.

Following receipt of EPA's comments, a teleconference among representatives of EPA and GE was conducted on August 10, 2005 to discuss the EPA's comments. Based on those discussions, GE has revised certain technical drawings and specifications included with the July 15, 2005 letter. Specifically, the following revisions were made:

- Technical Drawing 4, Detail 5: a tee connection between the inside final cover collection pipe and the outside cover collection pipe at the collection outlet pipe location was included. This tee connection will allow the inside final cover collection pipe to discharge to the perimeter ditch;

- Technical Drawing 4, Detail 5, Note 1: this note now states that the outlet pipe locations are shown on Drawing 2;

- Technical Drawing 5, Detail 1: permanent erosion control mat is required within the mid-slope swales;

- Specification 02200, Part 3.05 A: anchor trench backfill is required to be placed in 8-inch-thick lifts;

- Specification 02212, Part 3.01 D: mulch is required to be installed with tackifier;

- Specification 02232, Part 2.02 B and D: physical material requirements for woven geotextile fabric are included;
- Specification 02413/02526: the section number and title was modified to read Specification 02413 - Geosynthetic Clay Liner;

- Specification 02413/02526, Part 3.02 E: the cover requirements for the geosynthetic clay liner have been modified so that the GCL and overlying geomembrane are required to be deployed on the same day;

- Technical Drawing 4, Details 5 and 6; and Technical Drawing 5, Detail 5: HDPE coil pipes will be used for the 4-inch diameter perforated and solid wall pipes that are installed in the cover system anchor trench;

- Engineering Calculation - Embankment Ditch Design, Page 2 of 3: channel depth has been confirmed throughout the entire length of the ditch and is sufficient under the specified conditions;

- Technical Drawing 4, Detail 6 and Technical Drawing 5, Detail 5: permanent erosion control mat is required within the embankment ditch; and

- Engineering Calculation - Final Cover (Veneer) Stability Analysis: a minimum acceptable factor of safety of 1.5 is used.

The above-listed drawings, specifications, and calculations are attached to this letter for your review and final approval. Lastly, as discussed on the teleconference, GE will provide direct shear interface friction testing of the cover system components (as referenced in comment 12) to the EPA in a future Monthly Status Report.

We trust that these revisions are sufficient to address EPA's comments and the July 15, 2005 letter can be approved. If you have any further questions, please feel free to contact me.

Sincerely,

John F. Novotny /CAA

John F. Novotny, P.E.
Manager, Facilities and Brownfields Programs

CAA/mbg
Attachments

cc: Dean Tagliaferro, EPA
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Anna Symington, MDEP*
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Tom Hickey, Director, PEDA
Mayor James Ruberto, City of Pittsfield
Pittsfield Department of Health
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Michael Carroll, GE*
Andrew Silfer, GE
Roderic McLaren, GE*
James Nuss, BBL
James Bieke, Goodwin Procter
Larry Kirsch, Goodwin Procter
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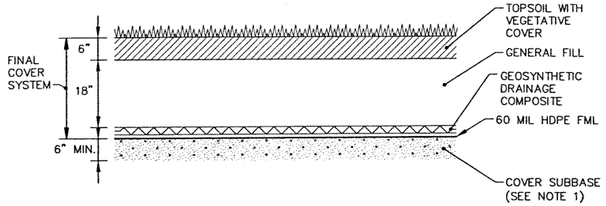
GE Internal Repository

**cover letter only*

Attachments

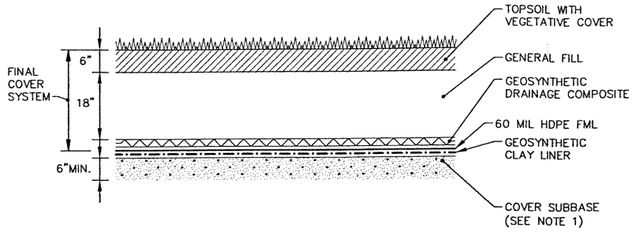
Technical Drawings



NOTE:

1. COVER SUBBASE SHALL CONSIST OF SUITABLE CONSOLIDATED SOIL MATERIAL HAVING A MAXIMUM PARTICLE SIZE OF 3 INCHES OR LESS.

SIDESLOPE FINAL COVER SYSTEM 1



NOTE:

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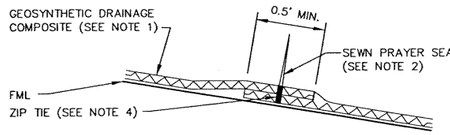
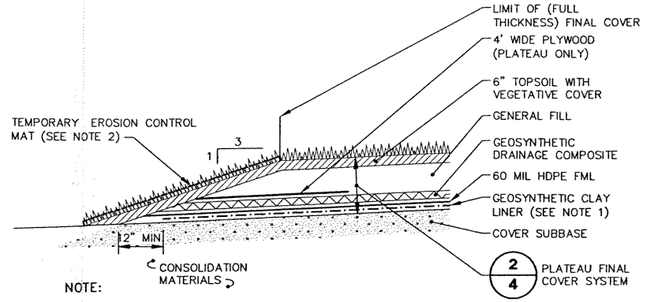
PLATEAU FINAL COVER SYSTEM 2



NOTES:

1. ALL GEOSYNTHETIC DRAINAGE COMPOSITE SHALL SHINGLE DOWNSLOPE AS SHOWN.
2. THE TOP GEOTEXTILE LAYER OF THE GEOSYNTHETIC DRAINAGE COMPOSITE IS TO BE PEELED BACK SO THAT A PRAYER SEAM MAY BE SEWN ABOVE THE GEOCOMPOSITE OVERLAP.
3. IF GEOTEXTILE IS UNABLE TO BE PEELED BACK WITHOUT CAUSING DAMAGE, A PATCH OF GEOTEXTILE SHALL BE HEAT BONDED TO THE TOP GEOTEXTILE LAYER OF THE GEOCOMPOSITES OVER THE SEAM.
4. ZIP TIES SHALL BE PLACED EVERY 5' ALONG ADJACENT PANELS AND EVERY 6" ALONG BUTT SEAMS AND IN ANCHOR TRENCHES.

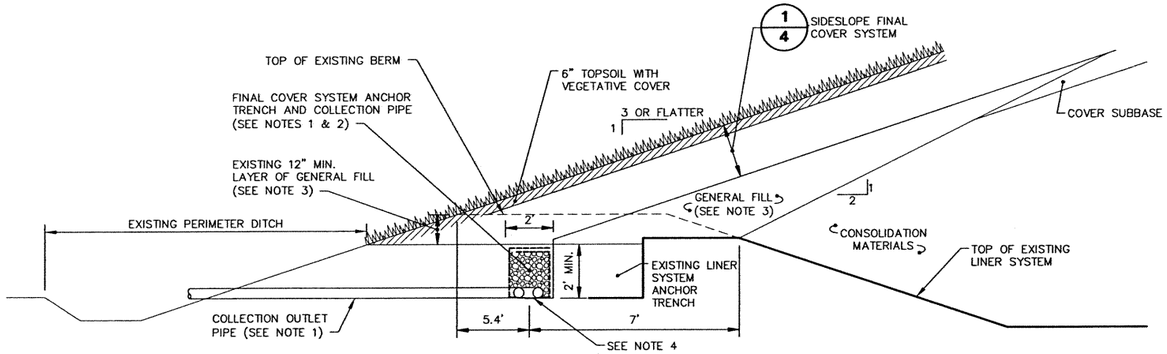
TYPICAL GEOSYNTHETIC DRAINAGE COMPOSITE SEAM 3



NOTE:

1. GEOSYNTHETIC CLAY LINER IS PRESENT ONLY IN THE PLATEAU FINAL COVER SYSTEM.
2. TEMPORARY EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN S150 OR EQUAL.

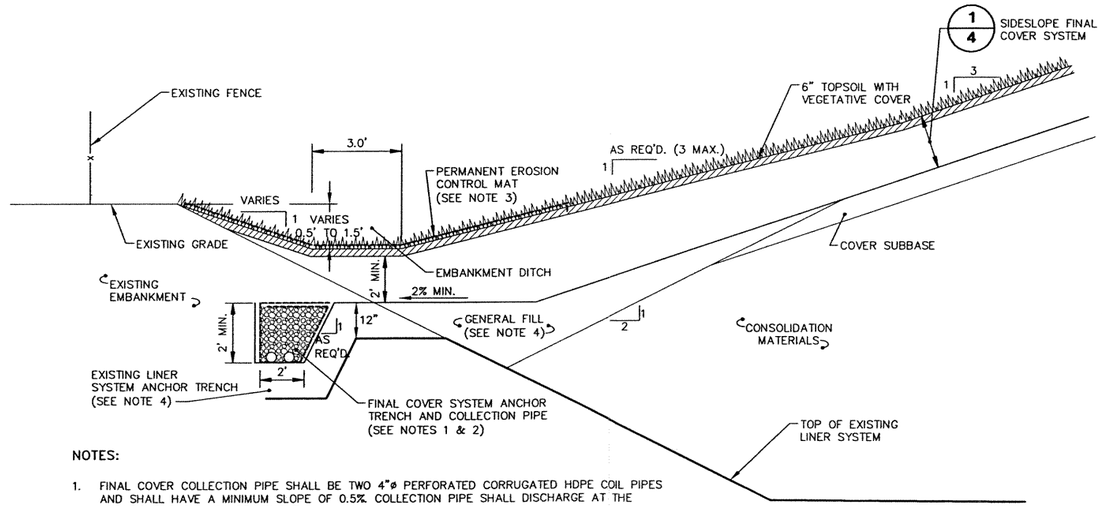
TEMPORARY FINAL COVER TERMINATION 4



NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 4"ø PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5%. COLLECTION PIPE SHALL OUTLET AT THE LOCATIONS SHOWN ON DRAWING 2. OUTLET PIPES SHALL BE TWO 4"ø SOLID CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 1.0%. OUTLET PIPES SHALL TEE INTO THE FINAL COVER COLLECTION PIPE.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.
3. EXISTING LAYER OF SOIL ON PERIMETER BERM TO BE REMOVED/REGRADED AS NECESSARY TO FACILITATE FINAL COVER CONSTRUCTION. CARE SHALL BE TAKEN TO AVOID DAMAGING EXISTING LINER SYSTEM GEOSYNTHETICS.
4. THE INSIDE FINAL COVER COLLECTION PIPE WILL BE CONNECTED TO THE OUTER FINAL COVER COLLECTION PIPE USING A TEE CONNECTION AT THE COLLECTION OUTLET PIPE LOCATION.

PERIMETER BERM FINAL COVER TERMINATION 5



NOTES:

1. FINAL COVER COLLECTION PIPE SHALL BE TWO 4"ø PERFORATED CORRUGATED HDPE COIL PIPES AND SHALL HAVE A MINIMUM SLOPE OF 0.5% COLLECTION PIPE SHALL DISCHARGE AT THE LOCATIONS SHOWN ON DRAWING 3.
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.
3. PERMANENT EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN P300 OR EQUAL.
4. CARE SHALL BE TAKEN TO AVOID DAMAGING EXISTING LINER SYSTEM ANCHOR TRENCH DURING FINAL COVER CONSTRUCTION.

EMBANKMENT FINAL COVER TERMINATION 6

GENERAL NOTES:

1. GEOSYNTHETICS ARE SHOWN AT AN EXAGERATED SCALE FOR CLARITY.

L: ON=*, OFF=REF*
P: PAGESET/SYR-CDL
08/11/05 SYR-BS-KMD LJP KMD
C/20405001/CONSOL/20405G11.DWG

Graphic Scale: NOT TO SCALE

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No.	Date	Revisions	Init

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Professional Engineer's Name: James M. Nuss		
Professional Engineer's No.: 38000		
State: MASS.	Date Signed	
Project Mgr.: WAR	Designed by: CAA	Drawn by: KMD

BBL® BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
BUILDING 71 OPCA PHASE I FINAL COVER

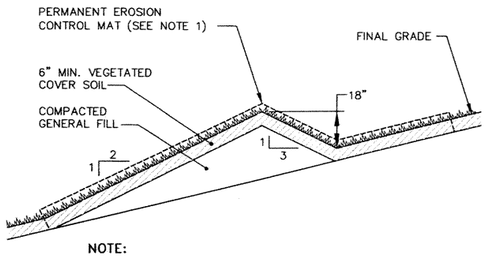
FINAL COVER DETAILS

GENERAL

BBL Project No. 204.05

Date JULY 2005

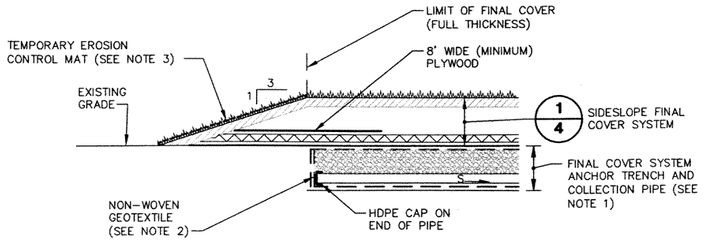
Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120



NOTE:

1. PERMANENT EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN P300 OR EQUAL.

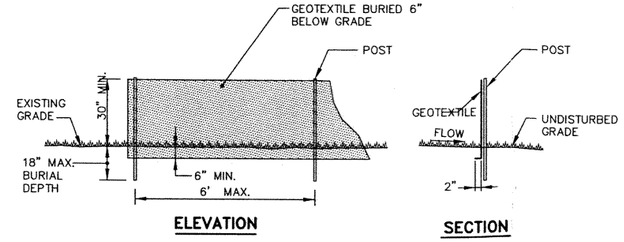
MID-SLOPE SWALE 1



NOTES:

1. REFER TO DRAWING 4 FOR ADDITIONAL INFORMATION PERTAINING TO THE FINAL COVER SYSTEM ANCHOR TRENCH AND COLLECTION PIPE.
2. GEOTEXTILE AT THE END OF THE ANCHOR TRENCH TO BE OVERLAPPED AS SHOWN.
3. TEMPORARY EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN S150 OR EQUAL.

ANCHOR TRENCH COLLECTION PIPE TERMINATION 2

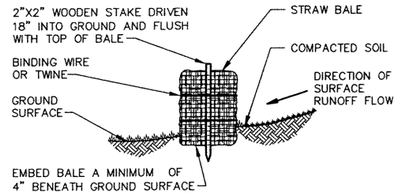


ELEVATION SECTION

NOTES:

1. SEDIMENT DEPOSITS SHALL BE REMOVED AS NECESSARY TO PREVENT DAMAGE TO THE SILT FENCE.
2. THE SILT FENCE WILL REMAIN IN-PLACE UNTIL GRADED AREAS ARE SUFFICIENTLY STABILIZED WITH VEGETATION.

SILT FENCE 3



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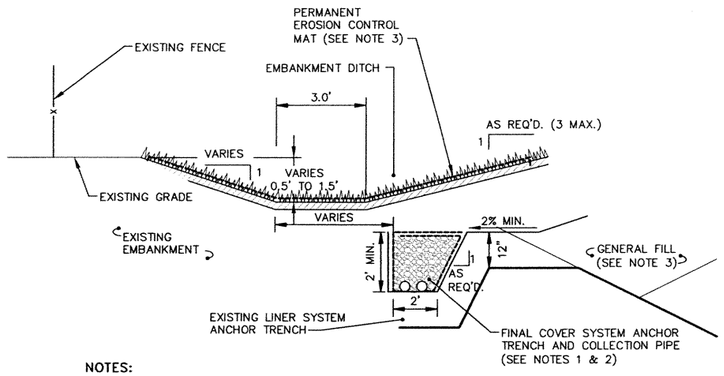
STRAW BALE 4



NOTES:

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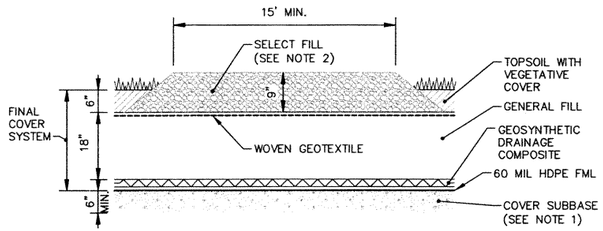
2. FINAL COVER ANCHOR TRENCH TO BE BACKFILLED WITH DRAINAGE STONE WRAPPED IN NON-WOVEN GEOTEXTILE. GEOTEXTILE AT TOP OF ANCHOR TRENCH TO BE OVERLAPPED FULL TRENCH WIDTH AS SHOWN.
3. PERMANENT EROSION CONTROL MAT TO BE NORTH AMERICAN GREEN P300 OR EQUAL.

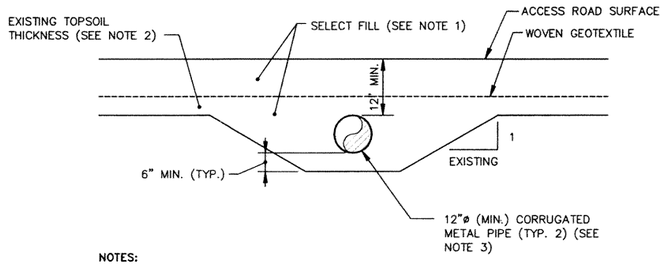
PERIMETER DITCH TRANSITION 5



NOTES:

1. COVER SUBBASE SHALL CONSIST OF SUITABLE CONSOLIDATED SOIL MATERIAL HAVING A MAXIMUM PARTICLE SIZE OF 3 INCHES OR LESS.
2. SELECT FILL SHALL BE COMPACTED DENSE GRADE CRUSHED STONE M2.01.7 OR EQUAL.

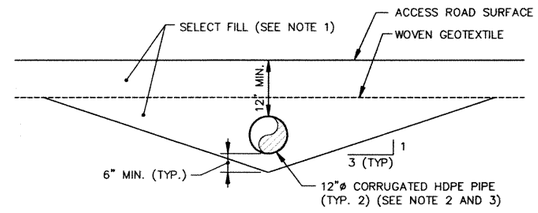
FINAL COVER ACCESS ROAD 6



NOTES:

1. SELECT FILL SHALL BE COMPACTED DENSE GRADE CRUSHED STONE M2.01.7 OR EQUAL.
2. EXISTING TOPSOIL AND VEGETATION TO BE REMOVED BENEATH ACCESS ROAD AND CULVERT PRIOR TO PLACEMENT OF SELECT FILL MATERIAL.
3. CONTRACTOR SHALL INSTALL PIPE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

PERMETER DITCH CULVERT 7



NOTES:

1. SELECT FILL SHALL BE COMPACTED DENSE GRADE CRUSHED STONE M2.01.7 OR EQUAL.
2. CORRUGATED HDPE PIPE SHALL BE ADS N-12 OR EQUIVALENT. CONTRACTOR SHALL INSTALL PIPE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
3. THE INVERT OF THE PIPE SHALL MATCH THE INVERT OF THE MID-SLOPE SWALE AT INLET AND OUTLET ENDS.

MID-SLOPE SWALE CULVERT 8

L: ON=*, OFF=REF
P: PAGESET/SYR-CDL
08/12/05 SYR-85-KMD KMD LAF
C/20405001/CONSOL/20405G12.DWG

Graphic Scale: NOT TO SCALE

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Professional Engineer's Name: James M. Nuss
Professional Engineer's No.: 38000
State: MASS. Date Signed:
Project Mgr.: WAR Designed by: CAA Drawn by: KMD

BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

GENERAL ELECTRIC COMPANY, • PITTSFIELD, MASSACHUSETTS
BUILDING 71 OPCA PHASE I FINAL COVER

MISCELLANEOUS DETAILS

GENERAL

BBL Project No. 204.05
Date JULY 2005

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

5

Specifications

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. All labor, materials, services, and equipment necessary to complete the earthwork activities as depicted on the Technical Drawings and/or as directed by GE or GE's Representative.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02207 - Restoration of Surfaces
B. Section MP-02222 - Soil Fill Materials

1.03 SUBMITTALS

A. Contractor's proposed method(s) of compaction and equipment.

1.04 APPLICABLE CODES, STANDARDS AND SPECIFICATIONS

A. American Society for Testing and Materials (ASTM)

1.05 DEFINITION

A. Earthwork is defined to include, but is not limited to, clearing, pavement removal, rough grading, excavation for subgrades, trenching, handling and disposal of surplus materials, maintenance of excavations, removal of water, backfilling operations, embankments and fills, and compaction.

PART 2 - PRODUCTS

Specified elsewhere.

PART 3 - EXECUTION

3.01 UNAUTHORIZED EXCAVATION

A. The Contractor shall not be entitled to any compensation for excavations carried beyond or below the lines and subgrades prescribed in the Technical Drawings. The Contractor shall refill such unauthorized excavations at its own expense and in conformance with the provisions of this Section.

B. Should the Contractor, through negligence or for reasons of its own, carry its excavation below the designated subgrade, appropriate materials specified in MP Section 02222 - Soil Fill Materials shall be furnished and placed as backfill in sufficient quantities to reestablish the required subgrade surface. Soil fill materials used for backfilling shall be spread and compacted in conformance with the requirements of later subsections of this section. The

cost of any tests required as a result of this refilling operation shall be borne by the Contractor.

C. All material which slides, falls, or caves into the established limits of excavations due to any cause whatsoever, shall be removed and disposed of at the Contractor's expense, and no extra compensation will be paid to the Contractor for any materials ordered for refilling the void areas left by the slide, fall, or cave-in.

3.02 BACKFILL MATERIALS

A. Soil fill material shall be used as specified for backfill, and when excavated material cannot be used as backfill. Requirements for off-site soil fill materials are specified in MP Section 02222 - Soil Fill Materials.

B. If the excavated material on site is approved in advance by GE or GE's Representative for reuse and as being suitable for filling or backfilling purposes, it shall be used as general fill material.

C. On-site material is designated as "native fill" or "existing soil" material.

D. When on-site material is used, the Contractor shall remove all frozen material, boulders (over 6-inch diameter), trash, and debris, from such material prior to placement.

E. If it so elects, the Contractor may, at its own expense, substitute other types of material specified elsewhere in place of native fill material, provided such substitution is approved in advance by GE or GE's Representative and provided that all replaced material is disposed of as specified in the Contractor's Operations Plan.

3.03 GENERAL BACKFILLING REQUIREMENTS

A. Backfill shall be started at the lowest section of the area to be backfilled so that fill is placed in an upslope direction only.

B. Drainage of the areas being backfilled shall be maintained at all times.

C. Areas to be backfilled shall be inspected prior to backfilling operations. All unsuitable materials and debris shall be removed.

D. Backfill material shall be inspected prior to placement and all roots, vegetation, organic matter, or other foreign debris shall be removed.

E. Stones larger than 6 inches in any dimension shall be removed or broken.

F. Stones shall not be allowed to form clusters with voids.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

G. Backfill material shall not be placed when moisture content is too high to allow proper compaction.

H. When material is too dry for adequate compaction, water shall be added to the extent necessary.

I. No backfill material shall be placed on frozen ground nor shall the material itself be frozen or contain frozen soil fragments when placed.

J. No calcium chloride or other chemicals shall be added to prevent freezing.

K. Material incorporated in the backfilling operation that is not in satisfactory condition shall be subject to rejection and removal at the Contractor's expense.

L. If the Contractor fails to stockpile and protect on-site excavated material acceptable for backfill, then the Contractor shall provide an equal quantity of acceptable off-site material at no expense to GE.

M. A minimum soil cushion of 12 inches (measured prior to compaction) shall be maintained between construction equipment and geosynthetics.

N. With the exception of backfill placed directly over geosynthetics, the maximum lift thickness is 12 inches (measured prior to compaction).

O. Extreme care shall be taken to avoid damaging geosynthetic materials during placement of soil material above the geosynthetics.

3.04 METHOD OF COMPACTION

A. General

1. The Contractor shall adopt compaction methods that shall produce the degree of compaction specified herein, prevent subsequent settlement, and provide adequate support.

2. Methods used shall avoid disturbance to underlying soils and to subsurface utilities.

3. Before filling or backfilling is begun, the Contractor shall submit in its Operations Plan the equipment and method for compaction that it proposes to use.

4. Hydraulic compaction by ponding or jetting shall not be permitted.

5. Backfill material shall not be left in an uncompacted state at the close of a day's construction.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

6. Prior to terminating work, the final layer of compacted fill, after compaction, shall be rolled with a smooth-drum roller if necessary to eliminate ridges of soil left by tractors, trucks, or other equipment used for compaction.

7. As backfill progresses, the surface shall be graded such that no ponding of water shall occur on the surface of the fill.

8. Fill shall not be placed on snow, ice, or soil that was permitted to freeze prior to compaction.

9. Unsatisfactory materials shall be removed prior to fill placement.

B. Equipment

1. Generally, equipment for compaction shall be the largest equipment consistent with space limitations of the work areas and the need to protect adjacent facilities and underlying materials.

2. Compaction of fill material in confined areas, such as the base liner anchor trench, shall be accomplished by means of a drum-type, power driven, hand-guided vibratory compactor, or by hand-guided vibratory plate tampers.

3. If the proposed method does not give the degree of compaction required, an alternate method shall be adopted until the required compaction is achieved.

C. Minimum Compaction Requirements

1. Unless specified otherwise on the Technical Drawings or in these specifications, subbase of the final cover (i.e. suitable consolidated materials) and general fill within the cover shall be compacted by proof rolling.

2. Proof-rolling shall be performed prior to placing material over any existing (or native) soils.

3. When proof-rolling existing (or native) soils, the layer shall be acceptable when deformations caused by site equipment (e.g., roller, dump truck) are no deeper than one-inch. All soft or wet materials that continue to deform more than one-inch shall be removed and replaced with suitable material.

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

3.05 BACKFILL FOR ANCHOR TRENCHES

A. General

1. Anchor trench backfill shall be placed in 8-inch-thick loose lifts and thoroughly compacted by approved mechanical methods to ensure firm bedding.

3.06 BACKFILLING EMBANKMENTS AND EXCAVATIONS

A. General

1. Embankment areas shall be cleared and grubbed prior to initiating fill operations.

2. Embankments and excavations shall be formed or backfilled with satisfactory materials placed in successive layers, approximately horizontal, of not more than 12-inches in loose depth for the full width of the embankment or excavation.

3. All materials placed in constructing the embankment shall be free of organic matter, leaves, grass, roots, and other objectionable material.

4. At all times the Contractor shall slope the embankment to provide surface drainage.

5. The materials placed in the layers shall be of the proper moisture content to obtain the prescribed compaction.

6. Wetting or drying the material to secure a uniform moisture content throughout the layer may be required.

B. Compaction

1. Any areas inaccessible to rollers shall be compacted by mechanical tampers.

2. In the construction of embankments, starting layers shall be placed in the deepest portion of the fill, and as placement progresses, layers shall be constructed approximately horizontal, maintaining drainage and keying layers into adjoining slopes.

3. The compaction equipment shall be of such design, weight, and quantity as to obtain the required density.

3.07 GRADING

A. After completing all fill and backfill operations, the Contractor shall grade the site to the lines, grades, and elevations shown on the Technical Drawings, taking into account any subsequent site restoration requirements.

3.08 EXISTING FACILITIES

MATERIALS AND PERFORMANCE - SECTION 02200

EARTHWORK

A. General

1. Existing subsurface facilities may be encountered during construction of the work, or located in close proximity to the work.

2. These facilities may include, but are not necessarily limited to, sewers, drains, water mains, conduits and their appurtenances. These facilities may not be shown on the Technical Drawings. However, the sizes, locations, and heights or depths (if indicated) are only approximate, and the Contractor shall conduct its operations with caution and satisfy itself as to the accuracy of the information given. The Contractor shall not claim nor shall it be entitled to receive compensation for damages sustained by reason of the inaccuracy of the information given or by reason of its failure to properly maintain and support such structures.

3. There may be other subsurface facilities, the existence and/or location of which are not known, such as individual water and gas services, electrical conduits, storm drains, etc. The Contractor shall consult with GE or GE's Representatives of such facilities and, if possible, shall determine, prior to construction, the location and depth of any such facilities that may exist in the area to be excavated.

4. If underground facilities are known to exist in an area but their location is uncertain, the Contractor shall exercise reasonable care in its excavation technique to avoid damage to them.

5. The Contractor shall notify Massachusetts DIGSAFE 72 hours prior to the start of site work and provide/perform required information/activities.

B. Notification and Protection Procedures

1. Except where superseded by state or local regulations, or in the absence of any applicable regulations, the Contractor shall, as a minimum, include the following procedures in its operations:

   a. Prior to Excavating

      1. Determine correct field location of all nearby underground facilities to arrange for Representatives of the utilities to locate them.

      2. Notify owners of nearby underground facilities when excavating is to take place, allowing them reasonable time to institute precautionary procedures or preventive measures that they deem necessary to protect their facilities.

      3. In cooperation with owners of nearby facilities, provide temporary support and protection of those underground facilities that may be

especially vulnerable to damage by virtue of their physical condition or location, or those that could create hazardous conditions if damaged.

b. Immediately notify any utility owner of any damage to its underground facilities resulting from the Contractor's operations, and arrange for repairs to be made as soon as possible.

c. In case of an electrical short, or escape of gas or hazardous fluids (resulting from damage to an underground facility), immediately notify GE and all persons who might be endangered and assist in evacuation of people from the area.

3.09 OTHER REQUIREMENTS

A. Unfinished work

1. When, for any reason, the work is to be left unfinished, all excavations shall be filled and all roadways and watercourses left unobstructed with their surfaces in a safe and satisfactory condition. The surface of all roadways shall have temporary pavement.

B. Hauling Material on Street

1. When hauling material over the streets or pavement, the Contractor shall provide suitable tight vehicles so as to prevent deposits on the streets or pavements. In all cases where any materials are dropped from the vehicles, the Contractor shall clean up the same as often as required to keep the crosswalks, streets, and pavements clean and free from dirt, mud, stone, and other hauled material. Related activities shall be coordinated with GE or GE's representative.

2. When hauling materials that contain PCBs or other hazardous constituents, the Contractor shall abide by all applicable federal, state, and local codes, including, but not limited to, manifesting and placarding (if necessary). Related activities shall be coordinated with GE or GE's representative.

C. Dust Control

1. It shall be the sole responsibility of the Contractor to control the dust created by any and all of its operations to such a degree that it will not endanger the safety and welfare of the general public. Relater activities shall be performed in accordance with applicable Occupational Safety and Health Administration (OSHA) and Project Operations Plan (POP) requirements.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work under this section consists of furnishing and placement of topsoil, fertilizer, seed, and mulch, and maintenance of seeded areas until final acceptance.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02200 - Earthwork
B. Section MP-02207 - Restoration of Surfaces

1.03 SUBMITTALS

A. Analysis of the seed (to demonstrate compliance with the seed mix identified in Section 2.01 of this specification) and fertilizer (to identify chemical composition), and proposed application rates (to demonstrate compliance with the fertilizer application rate identified in Section 3.01B of this specification).

B. Should hydroseed be used, the Contractor shall submit all data including material and application rates.

C. Location of source, and pH and organic content testing of off-site topsoil (if required).

D. Sample of topsoil to be tested by GE for chemical contaminants.

E. The name, location, and quantity of each source and type of soil fill material proposed by the Contractor including a sample of each source and soil fill type to be sampled for PCBs, volatile organic compounds (VOCs), Semi-VOCs, and metals. The results of the analyses will be compared to the appropriate regulatory levels. If such analyses indicate unacceptable chemical characteristics, GE will reject the use of fill materials from the proposed source(s), and the Contractor must identify and submit a sample(s) from another fill source. If a fill source is rejected by GE, analytical testing for one additional fill source will be performed at the expense of GE. If additional fill sources (more than two sources per fill material) are rejected, additional testing will be at the expense of the Contractor.

Soil sampling results previously submitted to, and approved by GE (within the last calendar year), for the proposed sources can be submitted to GE in lieu of additional testing. However, GE reserves the right to request additional verification testing prior to source approval.

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

PART 2 - PRODUCTS

2.01 MATERIALS

A. Any off-site topsoil shall be unfrozen, friable, natural loam and shall be free of clay lumps, brush needs, litter, stumps, stones, and other extraneous matter. The topsoil shall have an organic content between 5% and 20%, and a pH between 5.5 and 7.5.

B. Fertilizer shall be a standard quality commercial carrier of available plant food elements. A complete prepared and packaged material containing a minimum of 5% nitrogen, 10% phosphoric acid and 10% potash.

1. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

C. Seed mixtures shall be of commercial stock of the current season's crop and shall be delivered in unopened containers bearing the guaranteed analysis of the mix.

1. All seed shall meet state standards of germination and purity.

D. Seed mix:

65%	Kentucky Blue Grass
20%	Perennial Rye Grass
15%	Fescue

E. The seed mix used on the interim cover shall be a quick-germinating rye grass.

F. Mulch shall be stalks of oats, wheat, rye, or other approved crops free from noxious weeds and coarse materials.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The topsoil shall be applied in a single loose lift of not less than six-inches. No compaction is required or allowed.

1. Following placement of topsoil and prior to fertilizer application, all stones greater than 1-inch in diameter, sticks, and other deleterious material shall be removed.

B. The fertilizer shall be applied to the surface uniformly at the rate of 20 pounds per 1,000 square feet.

1. Following the application of the fertilizer and prior to application of the seed, the topsoil shall be scarified to a depth of at least 2 inches with a disk or other suitable method traveling across the slope if possible.

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

C. After the soil surface has been fine graded, the seed mixture shall be uniformly applied upon the prepared surface with a mechanical spreader at a rate specified by the seed manufacturer.

1. The seed shall be raked lightly into the surface.

2. Seeding and mulching shall not be done during windy weather.

D. The mulch shall be hand or machine spread to form a continuous blanket over the seed bed, approximately 2 inches in uniform thickness at loose measurement with a minimum of 90% surface coverage. Excessive amounts or bunching of mulch shall not be permitted.

1. Unless otherwise specified, mulch shall be left in place and allowed to decompose.

2. Any mulch that has not disintegrated at time of first mowing shall be removed.

3. The mulch shall be placed with a tackifier.

E. Seeded areas shall be watered as often as required to obtain germination, and to obtain and maintain a satisfactory sod growth. Watering shall be performed in such a manner as to prevent washing out of seed and mulch.

F. Hydroseeding may be accepted as an alternative method of applying fertilizer, seed, and mulch. The Contractor must submit all data regarding materials and application rates to GE or GE's Representative for review.

3.02 MAINTENANCE

A. All erosion rills or gullies within the topsoil layer shall be filled with additional approved topsoil and graded smooth, and reseeded and mulched.

B. The Contractor shall also be responsible for repairs to all erosion of the seeded areas until all new grass is firmly established and reaches a height of not less than 4 inches. All bare or poorly vegetated areas must be reseeded and mulched.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall supply all labor, materials, tools, and equipment required to furnish and install geotextile fabric as specified herein and as shown on the Technical Drawings or as indicated by GE or GE's Representative.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1.	D5261-92	Unit Weight
2.	D4632-91	Grab Tensile and Grab Elongation
3.	D3786	Mullen Burst
4.	D4833-00	Puncture
5.	D4533-91	Trapezoidal Tear
6.	D4355-99	Ultraviolet Resistance

1.03 SUBMITTALS

A. Manufacturer's data for geotextile including, at a minimum, physical properties, packaging, and installation techniques.

B. Manufacturer's quality assurance/quality control program.

C. Certified results of all quality control testing.

D. Contractor's proposed on-site transportation, handling, storage, and installation techniques.

E. Manufacturer's standard warranty provided for the geotextiles.

PART 2 - PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

A. Skaps Industries;
B. Propex Fabrics; or
C. Equal.

2.02 MATERIALS

A. For these specifications and the Technical Drawings, the terms "geotextile" and "geotextile fabric" shall be considered synonymous.

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

B. Geotextile fabric to be used within the anchor final cover system shall be non-woven geotextile. Geotextile fabric to be used beneath the final cover access road shall be woven geotextile.

C. The non-woven geotextile shall be of needle-punched construction and consist of long-chain polymeric fibers or filaments composed of polypropylene, shall be free of any chemical treatment that reduces permeability, and shall be inert to chemicals commonly found in soil.

D. The geotextiles indicated on the Technical Drawings shall have the minimum physical properties listed below:

Woven Geotextile:

Property	Unit of Measure	Test Method	Test Value
Grab Tensile	lbs.	ASTM D4632	315 min.
Grab Elongation	%	ASTM D4632	50 max.
Mullen Burst	psi	ASTM D3786	508 min.
Puncture	lbs	ASTM D4833	113 min.
Trapezoidal Tear	lbs	ASTM D4533	113 min.
UV Resistance	% Retained @ 500 hrs.	ASTM D4355	70 min.
Permittivity	sec^{-1}	ASTM D4491	0.05 min.

Non-Woven Geotextile:

Property	Unit of Measure	Test Method	Minimum Test Value
Grab Tensile	lbs.	ASTM D4632	158
Grab Elongation	%	ASTM D4632	50
Mullen Burst	psi	ASTM D3786	189
Puncture	lbs	ASTM D4833	56
Trapezoidal Tear	lbs	ASTM D4533	56
UV Resistance	% Retained @ 500 hrs.	ASTM D4355	70
Permittivity	sec^{-1}	ASTM D4491	0.05

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE FABRIC

2.03 DELIVERY, STORAGE AND HANDLING

A. The geotextile shall be furnished in a protective wrapping that shall be labeled with the following information: manufacturer's name, product identification, lot #, roll #, and dimensions.

B. The geotextile shall be protected from ultraviolet light, precipitation, mud, soil, excessive dust, puncture, cutting, and/or other damaging conditions prior to and during delivery and on-site storage. The geotextile shall be stored on-site at a location approved by GE or GE's Representative.

2.04 QUALITY ASSURANCE

A. The field-delivered fabric shall meet the specification values according to the manufacturer's specification sheet. The Contractor shall submit written certification that the delivered material meets the manufacturer's specifications. The Contractor shall provide the quality control test results conducted by the manufacturer during the manufacturing of the geotextile fabric delivered to the project site. The results shall identify the sections/panels of field-delivered fabric they represent. The Contractor shall also provide the lot and roll number for the fabric delivered to the site.

B. The manufacturer shall have developed and shall adhere to its own quality assurance program in the manufacture of the geotextile.

C. The installer shall verify, in writing and prior to installation, that the geotextile fabric has not been damaged due to improper transportation, handling, or storage.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to installing the geotextile, placement surfaces shall be leveled and uniformly compacted, as necessary, to provide a stable interface for the geotextile that is as smooth as possible.

3.02 GEOTEXTILE INSTALLATION

The following procedures and requirements will be followed during the geotextile installation.

A. Placement

1. Placement of the geotextile shall not be conducted during adverse weather conditions. The geotextile shall be kept dry during storage and up to the time of deployment. During windy conditions, all geotextiles shall be secured with sandbags

or an equivalent approved anchoring system. Removal of the sandbags or equal shall only occur upon placement of an overlying soil layer.

2. Proper cutting tools shall be used to cut and size the geotextile materials. Extreme care shall be taken while cutting geotextiles.

3. During the placement of geotextiles, all dirt, dust, sand, and mud shall be kept off to prevent clogging. If excessive containment materials are present on the geotextile, it shall be cleaned or replaced as directed by GE or GE's Representative.

4. The non-woven geotextile shall be covered within the time period recommended by the manufacturer, and in no case later than two weeks after its placement.

5. In all cases, seams on sideslopes shall be parallel to the line of slope. No horizontal seams shall be allowed on side slopes.

B. Seaming and Repairing

1. Geotextiles shall be continuously sewn using a polymeric thread with chemical and ultraviolet resistance properties equal to or exceeding those of the geotextile.

2. Repair of tears or holes in the geotextile shall require the following procedures:

a. On slopes: A patch made from the same geotextile shall be double seamed into place; with each seam 1/4-inch to 3/4-inch apart and no closer than 1 inch from any edge. Should any tear exceed 10% of the width of the roll, that roll shall be removed from the slope and replaced.

b. Non-slopes: A patch made from the same geotextile shall be spot-seamed in place with a minimum 24-inch overlap in all directions.

3.03 POST-CONSTRUCTION

A. Upon completing the installation, the Contractor shall submit to GE or GE's Representative:

1. All quality control documentation and the as-built panel drawings.

3.04 WARRANTY

A. The Contractor shall obtain from the manufacturer and submit to GE or GE's Representative, a standard warranty provided for the geotextiles.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The Contractor shall furnish all labor, materials, equipment, tools and appurtenances required to complete the installation of geosynthetic clay liner (GCL) where shown on the Technical Drawings.

B. GCL will be installed as part of the final cover system construction. The following technical specifications present requirements for the manufacturing, testing, transport, storage and installation of the GCL.

1.03 REFERENCES

A. American society for Testing Materials (ASTM)

1. ASTM D4354 Standard Practice for Sampling of Geosynthetics for Testing.

2. ASTM D4632 Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

3. ASTM D4873 Standard Guide for Identification, Storage and Handling of Geosynthetic Rolls and Samples.

4. ASTM D5887 Standard Test Method for Measurement of Index Flux Through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.

5. ASTM D5888 Standard Guide for Storage and Handling of Geosynthetic Clay Liners.

6. ASTM D5889 Standard Practice for Quality Control of Geosynthetic Clay Liners.

7. ASTM D4643 Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.

8. ASTM D5261 Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

9. ASTM D5890 Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.

10. ASTM D5891 Standard Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

11. ASTM D5993 Standard Test Method for Measuring Mass per Unit Area of Geosynthetic Clay Liners.

12. ASTM D 6495 Standard Guide for Acceptance Testing Requirements for Geosynthetic Clay Liners.

Note: The most current version of the specified test method should be followed by the Manufacturer, Contractor or authorized testing laboratory.

1.04 SUBMITTALS

A. The Contractor shall submit to GE's Representative the following items:

1. Prior to Delivery to the Site:

a. A project reference list demonstrating the Contractor's experience on a minimum of 5 significant projects of installed GCL, or as approved by GE.

b. A list of all GCL installation crew personnel and resumes of the Supervisor and QC Manager including prior experience installing GCL. This information shall be submitted at least 30 days prior to the commencement of GCL installation. If the exact crew who will be performing the installation is not known 30 days in advance of the start date, the Contractor shall submit a list of several potential crew members. This information shall be supplied in a timely manner for approval in order to avoid delay of any construction activities. GCL crew staff will be subject to approval by GE.

c. A copy of the Manufacturer's Manufacturing Quality Assurance/ Manufacturing Quality Control (MQA/MQC) Plan for testing GCL.

d. A statement of the GCL Manufacturer's experience in manufacturing GCL, including the manufacturing and supplying company's name, address, and employee contact.

e. A certification from the GCL Manufacturer attesting that the proposed GCL meets the physical, mechanical and manufacturing requirements specified in Part 2 of this Section.

f. Copies of the Manufacturing Quality Control (MQC) certificates for the material to be delivered to the site. The reports shall include the quality control test results of samples obtained during the manufacturing of the material to be delivered to the site. The GCL will be rejected if it does not meet the specified requirements of Part 2 of this Section or if it is found to have defects, rips, holes, flaws, deterioration or other damage deemed unacceptable by GE or GE's Representative.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

g. Summary report including results of MQC testing required by this Section for GCL material to be delivered to the site. The report must clearly demonstrate that the GCL material to be delivered to the site meets the requirements of Part 2 of this Section.

h. Proposed method of GCL panel seaming including overlap distance at sides and end of panels and use of additional material to complete the seal (if any).

i. Internal and interface shear strength test results as required in Section 2.01.

2. Prior to Installation:

a. A schedule of operations including means and methods of installation.

b. The proposed method of deploying material and placement of panels.

c. Proposed method or process by which adjacent panels will be joined to provide a continuous hydraulic barrier.

d. The Installer shall certify in writing that the final surface on which the GCL is to be installed is acceptable.

e. Shop drawings including details of all overlapping attachments and anchoring.

f. Proposed method of protecting installed GCL panels from rain, ponding water or other elements that could over hydrate or damage the GCL.

3. During Installation Submitted Daily:

a. Daily construction progress reports clearly showing GCL panels and GCL roll numbers placed by date.

4. Upon Completion:

a. Record Panel Layout Diagram.

b. Summary and log of all field quality control work completed by the Contractor.

c. Certification that GCL installation is complete and in accordance with these specifications.

d. Statement of material and installation warranties.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall be responsible for the protection of the GCL against damage during transportation to the site, during storage and installation at the site, and prior to placement of subsequent construction materials.

B. GCL labeling, shipment, and storage shall follow ASTM D4873 and D5888, as modified according to this Section.

C. Product labels shall clearly show the manufacturer or supplier name, style name, roll number and roll dimensions.

D. If any special handling is required, it shall be so marked on the outside surface of the wrapping, (i.e., "Do not stack more than three rolls high").

E. The GCL shall be supplied dry (unhydrated, 30% or less moisture content) and be delivered to the site undamaged.

F. Each GCL roll shall be wrapped with a material that will protect the bentonite from moisture and the GCL from damage due to shipment, water, sunlight and contaminants.

G. The protective wrapping shall be maintained during periods of shipment and storage. If the wrapping is damaged prior to installation, the packaging shall be immediately repaired and/or roll tarped to prevent potential additional hydration. The roll shall be set aside and marked for closer inspection upon deployment. Sections of the roll may be rejected if the moisture content of the bentonite has become excessively high as determined by GE's Representative.

H. Storage area should be relatively flat and well drained. During storage, the GCL rolls shall be elevated off the ground utilizing a method which will not damage the GCL. Material that is damaged as a result of the method of storage or handling shall be rejected and replaced at no additional cost to GE. The GCL rolls shall be adequately covered to protect them from the following:

1. Site construction damage;
2. Precipitation and ponded water;
3. Chemicals that are strong acids or bases;
4. Flames or sparks, temperatures in excess of 49°C (120°F); and
5. Any environmental condition that might damage the GCL.

I. The Contractor shall protect the work described in this Section before, during and after installation. Only non-damaged, sufficiently dry material (as determined by GE's Representative) shall be included within the construction.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

J. Roll numbers on partially used rolls shall be maintained such that each GCL roll number can be readily identified just prior to GCL deployment.

K. If GE's Representative determines that the GCL is damaged or excessively hydrated, the Contractor shall make all repairs and replacements in a timely manner to prevent delays in the progress of work. Any material damaged by the Contractor, or damaged by others due to improper delivery, installation and/or storage, as determined by GE's Representative, shall be replaced by the Contractor at no cost to GE.

1.06 QUALITY ASSURANCE SAMPLING, TESTING AND ACCEPTANCE

A. Final Cover GCL Material

1. The GCL shall be subject to conformance sampling and testing to verify that materials meet with this specification.

2. Samples shall be taken across the entire width of the GCL roll. Unless otherwise specified or permitted by GE's Representative, samples shall be three feet long by the roll width. GE's Representative or authorized representative shall mark the machine direction on the samples with an arrow. Unless otherwise specified, samples shall be taken at a frequency of one per 25,000 ft^2 of material delivered to the site. An appropriate number of samples as determined by GE's Representative will be shipped directly to GE's Conformance Testing Laboratory. GE's Representative shall examine the material properties required by this Section against all results from laboratory conformance testing. Non-conforming material will be rejected and bracketed from subsequent rolls from the same product lot.

3. Conformance testing shall be the responsibility of GE. Conformance testing shall be conducted in accordance with ASTM D6495 but shall include the following parameters:

a. Hydraulic Conductivity (ASTM D5887).

b. Mass per Unit Area of Bentonite (ASTM D5993).

c. Mass per Unit Area Upper and Lower Layer Geotextile (ASTM D5261).

d. Bentonite Moisture Content (ASTM D4643).

e. Index Flux of GCL (ASTM D5887).

f. Grab Tensile Strength of GCL (ASTM D4632).

4. The Contractor shall, at no additional cost to GE, provide whatever reasonable assistance GE's Representative may require in obtaining the samples for conformance testing.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

5. The Contractor shall provide quality control data issued by the manufacturer prior to site delivery of the GCL. In the event the material is delivered prior to receipt of the manufacturer's quality control certificates, the GCL without quality control certificates will be stored separate from GCL with quality control certificates. GCL rolls with unacceptable quality control data shall be segregated from approved material and marked for rejection.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. GSE Lining Technology, Inc. (Bentofix® NW);
B. CETCO (Bentomat® DN); or
C. Equal.

2.02 MATERIALS

A. The GCL shall consist of a low permeability sodium bentonite encapsulated between two non-woven geotextiles. The bentonite and finished product requirements are described in the following Parts and include the minimum quality control testing.

B. The Contractor shall obtain a certificate from the GCL manufacturer for MQC testing described in this Part.

2.03 BENTONITE

A. The bentonite used for the production of the GCL shall be low permeability sodium bentonite.

B. The bentonite portion of the GCL shall be granular bentonite.

C. The supplier and/or source of the bentonite shall be included on the MQA results for the bentonite.

2.04 GEOSYNTHETIC CLAY LINER

A. The following table represents the minimum required QC testing that must be conducted by the Manufacturer on the GCL. The GCL shall be tested in accordance with ASTM D5889 as modified by the following table. Testing shall be conducted at the frequencies listed in the manufacturers QA/QC procedures must meet the required values provided:

GEOSYNTHETIC CLAY LINER		
Property	**Method**	**Value**
Hydraulic Conductivity	ASTM D5887	5 x 10^{-9} cm/sec max.
Mass Per Unit Area		

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

GEOSYNTHETIC CLAY LINER		
Property	**Method**	**Value**
1. Bentonite Content	ASTM D5993	0.75 lb/ft^2 dry weight MARV*
2. Geotextile Upper Layer	ASTM D5261	6.0 oz/yd^2 MARV*
3. Geotextile Lower Layer	ASTM D5261	6.0 oz/yd^2 MARV*
Bentonite Moisture Content	ASTM D4643	30% max.
Index Flux [1]	ASTM D5887	1 x 10^{-8} m^3/m^2/sec max.
Grab Tensile Strength[2]	ASTM D4632	90 lbs MARV*

* Minimum Average Roll Value.

1. Test according to manufacturer's recommendations and in compliance with the specified ASTM standard.

2. Tensile testing to be performed in the machine and cross directions.

PART 3 – EXECUTION

3.01 SITE PREPARATION

A. The surface to be covered by the GCL shall be cleared of sharp objects, boulders, sticks, or any materials that may puncture, shear, or tear the GCL. The GCL subgrade shall have a smooth, finished surface, free from pockets, holes, ruts and depressions that could cause bridging and overstress the material in the opinion of GE's Representative.

B. The Contractor shall inspect the subgrade for unsuitable areas or soft spots before the GCL is placed. Additional surface preparation will be required to eliminate any unsuitable areas as determined by GE's Representative.

C. The subgrade/geosynthetic surface below the GCL shall:

1. Be prepared in accordance with the Technical Drawings and Specifications.

2. For GCL deployment over soil surfaces, the prepared soil surface shall have no stones or other protrusions that may be damaging to the GCL as determined by GE's Representative.

3. Be approved, accepted and certified by GE's Representative and Contractor's quality assurance inspector.

3.02 INSTALLATION

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

A. GCL shall not be deployed during periods of excessive rain or winds, which could prevent an acceptable installation as determined by GE's Representative.

B. All GCL materials shall be installed according to the grades and locations presented in the Technical Drawings and in accordance with manufacturer's recommendations.

C. The Contractor shall furnish the roll number and panel number to GE's Representative prior to the installation of each panel.

D. The Contractor shall maintain the GCL in an "as received" condition up to and including the time that the overlying layer of the Final Cover System is documented by GE's Representative. While the GCL will begin to hydrate immediately upon deployment, it is essential that the GCL not become excessively hydrated prior to loading, as placement of material over hydrated bentonite may destabilize a given area. The GCL must have a minimum of 1 foot of general fill in place prior to full hydration. Additional restrictions and guidance with regard to hydrated or wet GCL are as follows:

1. GCL shall not be placed on wet subgrade, as determined by GE's Representative.

2. GCL becoming partially hydrated prior to covering with general fill shall be evaluated by GE's Representative to ascertain the condition of the material and to determine if removal and replacement is necessary.

3. In the event that excessive hydration occurs prior to placement of the overlying materials described above, the GCL material shall be evaluated by GE's Representative to ascertain the condition of the material and to determine if removal is necessary.

E. The Contractor is required to place cover materials as quickly as possible after deployment of GCL. The GCL and overlying membrane shall be deployed on the same day. The cover soil should be placed as soon as possible to avoid exposure to precipitation.

F. Contractor personnel shall not be allowed to wear shoes that can damage the GCL during deployment or placement of subsequent geosynthetic materials.

G. GCL Panels shall be deployed in a direction from the highest elevation to the lowest elevation within the area to be lined. Whenever possible, GCL panels shall be staggered such that cross seams between panels are not continuous throughout the lined area. GCL panels shall be installed free of tension.

H. GCL seams shall be overlapped a minimum of 6 in. on edge seams and minimum of 12 in. on end seams after shrinkage and before placing cover.

I. The GCL rolls shall be handled in a manner that minimizes loss of bentonite along edges during deployment.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

J. The Contractor shall be responsible for protection of the GCL during installation. Unless otherwise approved by GE's Representative, no rubber tire ATV's, tracked vehicles or any other equipment which may pose a risk of puncturing, tearing or otherwise damaging the GCL shall be permitted for use directly over the GCL.

K. The GCL shall not be covered until inspected and approved by GE's Representative.

3.03 REPAIRS

A. Repairs are to be made as soon as possible following deployment of GCL panels.

B. Damage to the GCL shall be repaired in the following manner, unless alternate procedures are proposed by the Contractor and approved by GE's Representative.

1. The damaged area shall be cleared of dirt and debris.
2. A patch of GCL shall be cut to extend a minimum of 12 in. beyond the damaged area in all directions.
3. Granular bentonite shall be placed around the perimeter of the damaged area at a rate of 0.25 pounds per linear foot.
4. The patch shall be placed over the damaged area and may be secured with an adhesive to keep the patch in position during backfilling or other activities over the GCL. The adhesive shall be approved by the Manufacturer and GE's Representative.

PART 4 – QUALITY CONTROL

4.01 GENERAL

A. The Contractor, before installation begins, shall appoint an experienced individual who will be on-site at all times during the installation, to represent the Contractor in all matters to this work. This appointment shall be subject to approval by GE.

B. All of the forms specified and required must be submitted in a timely fashion.

C. Any changes in the proposed method of work, subcontractors to be utilized, GCL or manufacturing must be approved in advance by GE. The Contractor assumes all responsibility relevant to providing an acceptable product.

4.02 QUALITY CONTROL DURING MANUFACTURING

A. The Contractor shall be solely responsible for the quality of the material provided. Should any tests performed on the material yield unsatisfactory results, the Contractor will be responsible for replacing the material with materials that meet project specifications without delay to the project and at no additional cost to GE.

MATERIALS AND PERFORMANCE - SECTION 02413

GEOSYNTHETIC CLAY LINER

4.03 QUALITY CONTROL DURING INSTALLATION

A. GE's Representative and the Contractor shall visually inspect all material to be included in the work for damage incurred during transportation and for uniformity, and compare roll identification numbers with those on the certification provided by the manufacturer to assure delivery of the appropriate material.

B. GE's Representative and Contractor shall also visually inspect the material for any damage incurred as a result of handling or on-site storage.

C. Damage to GCL during installation shall be repaired according to this Section. If GE's Representative determines that the damage is considered un-repairable, the damaged material will be replaced at no additional cost to GE.

- END OF SECTION -

Engineering Calculations

Embankment Ditch Design

CLIENT: General Electric Company PROJECT: Pittsfield, Massachusetts
Prepared By: RLP Date: July 2005
TITLE: OPCA Final Cover Design Calculations
Reviewed By: PHB Date: July 2005
SUBJECT: Embankment Ditch Design

OBJECTIVE:

Demonstrate that the proposed geometry for the embankment ditch provides adequate hydraulic capacity to convey the estimated peak discharge from the 25-year, 24-hour storm event. Demonstrate that stable hydraulic conditions exist in the embankment ditch during the design storm event.

REFERENCES:

1. Building 71 OPCA Phase I Final Cover Construction Design Drawing No. 3 entitled "Final Cover Grading Plan," Blasland, Bouck & Lee, Inc. (BBL), July 2005.

2. Building 71 OPCA Phase I Final Cover Construction Design Drawing No. 4 entitled "Final Cover Details," BBL, July 2005.

3. *Technical Release 55 – Urban Hydrology for Small Watersheds*, p. 2-5, Soil Conservation Service, June 1986 (attached).

4. PondPack for Windows, Version 7.5, hydrology modeling program, Haestad Methods, Inc.

5. North American Green Erosion Control Materials Design Software v. 4.3, 2003.

6. "Stormwater Technical Handbook," MA Department of Environmental Protection, and MA Office of Coastal Zone Management, March 1997.

ASSUMPTIONS:

1. As shown on reference 1, the embankment ditch will be constructed to the east and north of the Phase I Final Cover area perimeter.

2. The embankment ditch will have a minimum invert slope of 2%.

3. As shown on reference 2, the embankment ditch will be trapezoidal, having a base width of 3 feet, an inboard sideslope of 3:1 (maximum, H:V), an outboard sideslope of 2.5:1 (maximum), and a minimum invert depth of 0.5 feet along its entire length (varies from 0.5 feet to 1.5 feet).

4. The design storm is the 25-year, 24-hour event, which produces 5.3 inches of rainfall, based on reference 3.

5. The tributary watershed area for the embankment ditch is based on reference 1. The approximate watershed boundary is shown on the attached watershed area map.

6. A temporary erosion control mat will line the interior surfaces of the embankment ditch to minimize erosion of the unvegetated channel lining. The temporary erosion control mat will degrade over time and is intended to protect the topsoil until vegetation is established.

7. Runoff curve numbers are determined from reference 3. The runoff curve numbers are based on hydraulic soil group C and the following cover types:

   - Newly Graded Condition: newly graded areas, CN = 91; and
   - Vegetated Conditions: open space, fair condition, CN = 79.

   Affects on the hydraulic calculations associated with the final cover access road surface are considered negligible

and therefore are not included.

8. Reference 6 recommends that the channel design be based on the peak discharge from the 10-year, 24-hour storm. In contrast, the embankment ditch design is based on the peak discharge from the 25-year, 24-hour storm and is therefore considered more conservative.

9. The Manning "n" value and the critical and permissible shear stress values are calculated by reference 5 based on the channel lining and the estimated hydraulic conditions of the embankment ditch.

CALCULATIONS:

1. Estimated Peak Discharge

The watershed area contributing to embankment ditch is approximately 0.43 acres. The curve number for the tributary watershed is determined based on cover type and condition as described in Assumption 7. The estimated peak discharge for the contributing watershed area is calculated by reference 4. The following table summarizes the resulting estimated peak discharges:

Condition (Newly Graded or Vegetated)	Curve Number	Time of Concentration [hrs]	Estimated Peak Discharge [cfs]
Newly Graded	91	0.08	1.77
Vegetated	79	0.20	1.19

Supporting output from reference 4 is included as an attachment to this calculation.

2. Estimated Hydraulic Conditions

The resulting hydraulic condition is based on the proposed geometry of the embankment ditch (Assumption 3) and the above-calculated peak discharges immediately following construction and during final conditions once vegetation is established.

The following table summarizes the resulting estimated hydraulic conditions:

Condition (Newly Graded or Vegetated)	Estimated Peak Discharge [cfs]	Manning "n"[1]	Flow Depth [ft]	Flow Velocity [ft/sec]	Shear Stress[1] [psf]	Permissible Shear Stress[1] [psf]	Factor of Safety[2]
Newly Graded	1.77	0.055	0.31	1.51	0.39	1.75	4.5
Vegetated	1.19	0.194	0.49	0.55	0.61	4.20	6.9

Notes:
1- The Manning "n", shear stress, and permissible shear stress values are calculated by reference 5 based on the channel lining and the estimated hydraulic conditions of the channel.
2- The factor of safety is based on a comparison between the permissible shear stress and calculated shear stress.

Because the flow depths for both conditions are less than the depth of the ditch, the proposed ditch configuration provides adequate hydraulic capacity. Additionally, because the critical shear stress is less than the permissible shear stress for both conditions, the ditch lining is considered hydraulically stable.

The hydraulic analysis and output from reference 5 is included as an attachment to this calculation.

CLIENT: General Electric Company PROJECT: Pittsfield, Massachusetts Prepared By: RLP Date: July 2005
TITLE: OPCA Final Cover Design Calculations Reviewed By: PHB Date: July 2005
SUBJECT: Embankment Ditch Design

SUMMARY:

The proposed embankment ditch configuration provides adequate hydraulic capacity to convey the 25-year, 24-hour estimated peak discharges. Stable hydraulic conditions exist in the embankment ditch for both newly graded and vegetated conditions during the design storm event.

Final Cover (Veneer) Stability Analysis

CLIENT: General Electric PROJECT: Pittsfield, MA
TITLE: Building 71 OPCA Phase I Final Cover
SUBJECT: Final Cover (Veneer) Stability Analysis

Prepared By: RAC Date: July 2005
Reviewed By: PAB Date: July 2005

OBJECTIVE

Determine the minimum interface friction angle for the final cover system 3:1 sideslope that will be required to provide an acceptable factor of safety under the following conditions:

(1) Long-Term Stability – using peak and residual shear strengths without construction equipment loadings;
(2) Short-Term Stability – using peak and residual shear strengths with construction equipment loadings;
(3) Seismic Stability – using peak shear strength with an average horizontal seismic coefficient of 0.055;

As indicated above, analyses for peak and residual strengths are provided for long and short-term analyses; however, only a peak strength analysis is included for the seismic case because the short-term nature of a seismic event is not expected to mobilize the residual strength. Additionally, seepage forces are not considered since a geosynthetic drainage composite is provided above the 60-mil HDPE FML primary cover. Testing should be performed on each interface to identify the critical interface and to confirm actual safety factors.

REFERENCES

1. Koerner, Robert M. and T. Soong, "Analysis and Design of Veneer Cover Soils," *Sixth International Conference on Geosynthetics,* 1998.

2. *RCRA Subtitle D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities*, USEPA, EPA/600/R-95/051, April, 1995.

3. *Detailed Work Plan for On-Plant Consolidation Areas,* Blasland, Bouck & Lee, Inc., June 1999 (OPCAs Figure No. 5 entitled "Final Configuration of On-Plant Consolidation Areas"

4. *Peak Acceleration with 2% Probability of Exceedance in 50 Years,* USGS Map, October 2002.

5. General Electric letter dated September 10, 2001 regarding GE-Pittsfield/Housatonic River Site On-Plant Consolidation Areas (GECD210 and GECD220) Geotechnical Testing of In-Place Consolidation Materials.

6. General Electric letter dated August 12, 1999 regarding GE-Pittsfield/Housatonic River Site On-Plant Consolidation Areas – Addendum to June 1999 Detailed Work plan (Figure entitled "Ground Water Elevation Contours" dated June 17, 1999)

7. *Shear Strength Evaluation for Slope Stability Analyses Residuals Management Unit One (RMU-1) Model City Treatment, Storage and Disposal Facility, Model City, New York*, Drs. Robert M. Koerner, Robert B. Gilbert, and Timothy D. Stark and Francis T. Adams, March 2001.

ASSUMPTIONS

1. The minimum acceptable factors of safety for long-term static stability are 1.50 and 1.0 for peak and residual shear strength, respectively. The minimum acceptable factors of safety for short-term static stability are 1.25 and 1.0 for peak and residual shear strength, respectively.

2. The minimum acceptable factor of safety for seismic stability is 1.00.

3. The average slope of the final cover under consideration is 33% and the longest continuous length of the 33% final cover slope is 70 ft.

4. The portion of the final cover system at a 33% slope consists of (from top to bottom), 6 inches of topsoil with vegetative cover, 18 inches of general fill, geosynthetic drainage composite, 60 mil HDPE FML and 12 inches of suitable consolidated soil material having a maximum particle of 3 inches.

5. For the Short-Term Cover Stability Analyses (peak and residual strength) the thickness of the cover soil subjected to equipment loading is 2 feet.

6. Based on procedures outlined in reference 2 and limiting the seismic deformations to less than 0.3 meters (1 ft), a value of 0.085 was calculated for the seismic coefficient, k_s at the top of the landfill. Specifically, the seismic coefficient, k_s is calculated using the following relationship (reference 2):

$$k_s = \frac{a_{max}}{g} \bullet \frac{K_{yield}}{K_{max}}$$

where a_{max} is the peak acceleration at the top of the landfill, g is the acceleration due to gravity, and K_{yield}/K_{max} is a relationship between the yield and maximum acceleration corresponding to a specific permanent displacement (1 ft.). The free field peak acceleration is first calculated for the original ground surface (the base of the landfill) and is dependent upon the average shear wave velocity in the 100 ft. of material below the base of the landfill, which consists of medium stiff sands at the Building 71 OPCA. Therefore, the average conditions are representative of "medium-stiff soil". For medium stiff soil sites, the free field peak ground acceleration is greater than the peak bedrock acceleration (i.e., amplification occurs). The peak bedrock acceleration is 0.116 g (Reference 4), from reference 2, (Figure 4.4(a)) free field peak acceleration at the base of the landfill is 0.13g, and using reference 2, (Figure 4.6 Refuse-Fill 100 ft Height) the peak acceleration, a_{max} at the top of the landfill is 0.17g,. The relationship between the yield and maximum acceleration ratio and permanent seismic displacement (at the top of a landfill) was established by Hynes and Franklin (Reference 2, Figure 6.5). Permanent displacement is limited to less than 12 inches, which yields a K_{yield}/K_{max} ratio of 0.50.

7. Acceleration/deceleration forces are neglected in the analyses, provided soils are pushed up-slope during construction of the final cover.

8. The following parameters are used in the analysis:

Variable	Value
Thickness of cover soil, h (long and short term conditions)	2.0 ft
Assumed adhesion in cover system, C_a (both peak and residual)	0 psf
Unit weight of soil drainage layer, γ (reference 5)	125 pcf
Drainage layer internal friction, ϕ (reference 5)	33°
Cohesion of the soil drainage, c (reference 5)	0 psf
Equipment weight, W_b	38,400 lb
Equipment ground pressure, q	640 psf
Length of each equipment track, w	10 ft
Width of each equipment track, b	3 ft
Minimum acceptable factor of safety (peak strength, long term)	1.50
Minimum acceptable factor of safety (peak strength, short term)	1.25

Variable	Value
Minimum acceptable factor of safety (residual strength, long term and short term)	1.00
Minimum acceptable factor of safety (seismic)	1.00

METHODOLOGY

A procedure developed by Koerner and Soong (Reference 1) was used for the long-term, short-term, and seismic stability calculations. This method is often referred to as the GRI-215 method.

CALCULATIONS

A summary of the calculations used for the three analyses (i.e., long-term, short-term, and seismic) is provided below:

Long-Term Stability

This analysis is performed by evaluating the gravitational forces acting on a finite length of the cover system. As indicated on reference 3, the maximum slope for the final cover β, is 18.4°, and the maximum uninterrupted length measured along the final cover L, is 70 ft. Detailed calculations are provided in Attachment A to supplement the summary provided below:

$$W_A = \gamma h^2 \left(\frac{L}{h} - \frac{1}{\sin\beta} - \frac{\tan\beta}{2}\right)$$

$$N_A = W_A \cos\beta$$

$$W_P = \frac{\gamma h^2}{\sin 2\beta}$$

$$E_A = \frac{(FS)(W_A - N_A\cos\beta) - (N_A\tan\delta + C_a)\sin\beta}{\sin\beta(FS)}$$

$$E_P = \frac{C + WP\tan\phi}{\cos\beta(FS) - \sin\beta\tan\phi}$$

where W_A is the total weight of the active wedge, N_A is the effective force normal to the failure plane of the active wedge, W_P is the weight of the passive wedge, E_A is the interwedge force acting on the active wedge form the passive wedge, E_P is the interwedge force acting on the passive wedge from the active wedge, and FS is the factor of safety. By setting E_A=E_P, the equation can be rearranged in the form of the quadratic equation as follows:

$$a(FS)^2 + b(FS) + c = 0$$

$$a = (W_A - N_A\cos\beta)\cos\beta$$

$$b = -[(W_A - N_A\cos\beta)\sin\beta\tan\phi + (N_A\tan\delta + C_a)\sin\beta\cos\beta + \sin\beta(C + W_P\tan\phi)]$$

$$c = (N_A\tan\delta + C_a)\sin^2\beta\tan\phi$$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

Using the above equations and setting the factor of safety to 1.50 and 1.00, solving for the minimum acceptable peak and residual friction angle results in 20.6° and 16.3° degrees respectively.

Short-Term Stability

The short-term stability calculation is performed in the same way as the long-term stability analysis, except that an additional term is added to the total weight of the active wedge, W_A, and to the effective stress normal to the failure plane of the active wedge, N_A, to account for equipment. This calculation is performed as follows:

$$W_e = qwI$$

$$q = \frac{W_b}{2wb}$$

$$W_{A1} = W_e + W_A$$

$$N_e = W_e \cos\beta$$

$$N_{A1} = N_e + N_A$$

$$F_e = W_e\left(\frac{a}{g}\right)$$

where W_e is the equivalent equipment force per unit width at the critical interface (to be determined). From assumption 7, the acceleration of equipment is zero and the dynamic force per width parallel to the slope at the geomembrane interface is zero. N_e is the effective equipment force normal to the failure plane of the active wedge, I is the influence factor at the secondary liner interface (see Figure 7 from reference 1), q, W_b, w, and b are defined in assumption 8, and W_{A1} and N_{A1} are the modified total weight of the active wedge and modified normal force, respectively. By setting E_A=E_P, the equation can be rearranged in the form of the quadratic equation as follows:

$$E_A = \frac{(FS)((W_{A1})\sin\beta + F_e) - ((N_{A1})\tan\delta + C_a)}{FS}$$

$$E_P = \frac{C + W_p \tan\phi}{\cos\beta(FS) - \sin\beta\tan\phi}$$

$$a = ((W_{A1}\sin\beta) + F_e)\cos\beta$$

$$b = -[(N_{A1}\tan\beta + C_a)\cos\beta + (W_{A1}\sin\beta + F_e)\sin\beta\tan\phi + (C + W_P\tan\phi)]$$

$$c = (N_{A1}\tan\delta + C_a)\sin\beta\tan\phi$$

$$FS = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

Using the above equations and setting the factor of safety to 1.25 and 1.00, solving for the minimum acceptable peak and residual friction angle results in 21.1° and 16.8° degrees respectively.

Seismic Stability

Evaluation of seismic stability for final cover stability consists of two steps. First, a pseudostatic analysis similar to the analyses performed for long-term and short-term conditions is evaluated. If the resulting factor of safety is greater than 1.00, no further evaluation is required. If the factor of safety is less than 1.00, a permanent deformation analysis is

required. The pseudostatic analysis uses the same formulation as presented above, but adds in a seismic force acting horizontally on the active wedge and the passive wedge. As presented below, both the interwedge active and passive forces are modified as compared to the previous analyses, resulting in new formulations for a, b, and c:

$$E_A = \frac{(FS)(C_S W_A + N_A \sin\beta)}{(FS)\cos\beta} - \frac{(N_A \tan\delta + C_a)\cos\beta}{(FS)\cos\beta}$$

$$E_P = \frac{C + W_P \tan\phi - C_S W_P (FS)}{(FS)\cos\beta - \sin\beta \tan\phi}$$

$$a = (C_S W_A + N_A \sin\beta)\cos\beta + C_S W_p \cos\beta$$

$$b = -[(C_S W_A + N_A \sin\beta)\sin\beta \tan\phi + (N_A \tan\delta + C_a)\cos^2\beta + (C + W_P \tan\phi)\cos\beta]$$

$$c = (N_A \tan\delta + C_a)\cos\beta \sin\beta \tan\phi$$

Setting the factor of safety at 1.00 and solving the above equations for the minimum acceptable interface friction angle results in 21.4°.

SUMMARY:

A summary of the minimum acceptable interface friction angles for each case is presented below.

Case	Required Factor of Safety	Minimum Acceptable Interface Friction Angle (C=0 psf)
Long-Term, Peak Strength	1.50	24.8°
Long-term, Residual Strength	1.00	16.3°
Short-Term, Peak Strength	1.25	21.1°
Short Term, Residual Strength	1.00	16.8°
Seismic, Peak Strength	1.00	21.4°

The results of this stability analysis indicates that a minimum peak interface friction angle of 24.8° over a normal load range of 0 to 250 psf is required for the final cover system to achieve acceptable factors of safety for the peak strength long-term stability case, which governs. In addition, a minimum peak interface friction angle of 21.1° over a normal load range of 0 to 900 psf is required for short-term overliner stability based on peak strengths. Although we anticipate that the critical interface will be between the General Fill and the geosynthetic drainage composite, direct shear strength testing (ASTM D6243 and ASTM D5321, as applicable) will be performed on the final cover system to determine the critical interface and actual interface strengths based on the geosynthetic and soil materials that will be used to construct the cover system. Testing will be performed at confining pressures of 200, 400, and 1000 psf to establish the shear strength envelope over the range of anticipated loadings (i.e., soil and equipment loadings) to confirm the suitability of proposed liner products.