SKYLINE LANDFILL
CITY OF FERRIS
DALLAS AND ELLIS COUNTIES, TEXAS
TCEQ PERMIT APPLICATION NO. MSW 42D

PERMIT AMENDMENT APPLICATION

PART III – FACILITY INVESTIGATION AND DESIGN
ATTACHMENT D8
FINAL COVER QUALITY CONTROL PLAN

Prepared for

Waste Management of Texas, Inc.

April 2012

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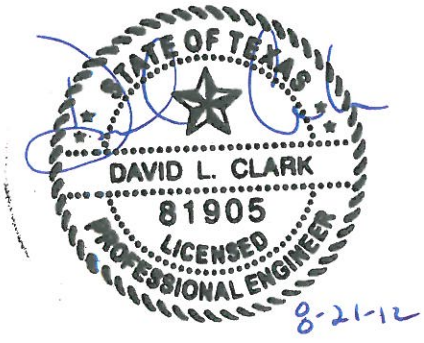

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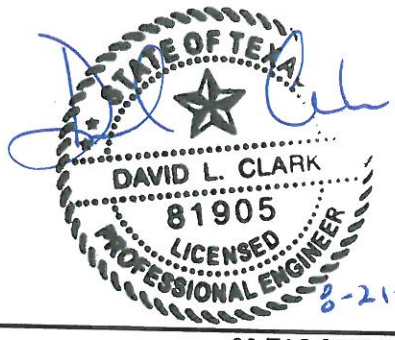

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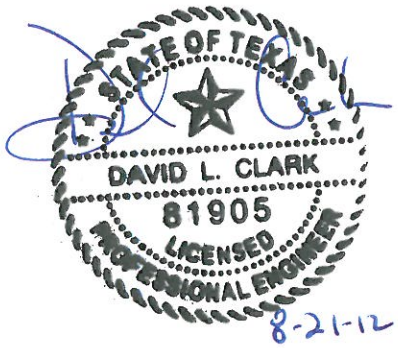

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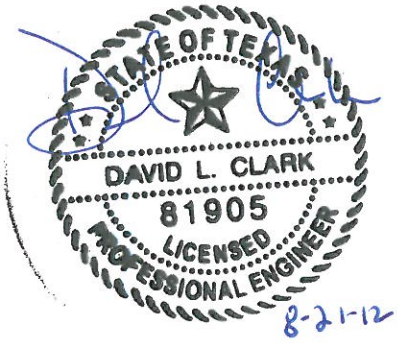

2 FINAL COVER SYSTEM

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2.1 Final Cover System

There are two final cover systems that will be constructed at the Skyline Landfill. The approved alternate final cover system will be installed over the waste fill areas in Phases 1 through 3 and Phase 5 where the waste footprint has not changed. The Subtitle D final cover system will be installed over the expanded waste fill areas in Phase 3.

The alternate final cover system will consist of an infiltration layer, a drainage layer, and an erosion control layer. The infiltration layer will consist of a minimum of 18 inches of compacted soil with a coefficient of permeability of less than or equal to 1×10^{-7} cm/sec. The drainage layer will consist of a double-sided geocomposite. The erosion layer will consist of a minimum of 36 inches of soil, of which the upper 6 inches is capable of sustaining native plant growth. The final cover will be vegetated following the construction of the final cover to minimize erosion.

The Subtitle D final cover system will consist of an infiltration layer, a flexible membrane cover (FMC), a drainage layer, and an erosion control layer. The infiltration layer will consist of a minimum of 18 inches of compacted soil with a coefficient of permeability of less than or equal to 1×10^{-5} cm/sec. The flexible membrane cover will consist of a 40-mil LLDPE geomembrane or a 60-mil HDPE geomembrane placed over the infiltration layer. The drainage layer will consist of a geocomposite on side slopes. A geotextile will be installed as a cushion fabric on top slopes. The erosion layer will consist of a minimum of 36 inches of soil, of which the upper 6 inches is capable of sustaining native plant growth. The final cover will be vegetated following the construction of the final cover to minimize erosion.

The final cover plan is included in Attachment D3 – Construction Design Details, Drawing D3.9. Details of the final cover system are provided in Drawing D3.10. The components of the final cover system are listed from top to bottom in Table D8-1.

Table D8-1
Skyline Landfill
Components of the Final Cover System

ALTERNATE FINAL COVER SYSTEM		
Cover System Component	**Description**	**Thickness**
Erosion Layer	Soil that is capable of sustaining native plant growth	36 inches
Drainage Layer	Double-sided geocomposite	0.2 inches
Infiltration Layer	Compacted soil with a maximum coefficient of permeability less than or equal to 1×10^{-7} cm/sec	18 inches
SUBTITLE D FINAL COVER		
Erosion Layer	Soil that is capable of sustaining native plant growth	36 inches
Cushion Layer	Geotextile on top slopes only	8 oz/yd^2
Drainage Layer	Double-sided geocomposite on side slopes only	0.2 inches
Flexible Membrane Cover (FMC)	Smooth LLDPE or HDPE geomembrane on top slopes Textured LLDPE or HDPE geomembrane on side slopes	40 mils (LLDPE) 60 mils (HDPE)
Infiltration Layer	Compacted soil with a maximum coefficient of permeability less than or equal to 1×10^{-5} cm/sec	18 inches

2.2 Construction Monitoring

Continuous on-site monitoring is necessary to assure that the components of the final cover system are constructed in accordance with this FCQCP. The CQA monitor shall provide continuous on-site observation during the following construction activities:

- Infiltration layer placement, processing, compaction, and testing
- Flexible membrane cover deployment, trial welds, seaming, testing, and repairing
- Drainage layer deployment and seaming
- Erosion layer placement
- Any work that could damage the installed components of the final cover system

The GP will document and certify that the final cover system was constructed in accordance with this FCQCP. The GP shall make sufficient site visits to observe critical construction activities and to verify that the construction and quality assurance activities are performed in accordance with this FCQCP.

3 INTERMEDIATE COVER AND GRADING

§330.165(c)

3.1 General

The proposed landfill completion plan for the Skyline Landfill is provided in Attachment D3 – Construction Design Details, Drawing D3.9. The final lift of waste will be covered by intermediate cover that is placed in accordance with Part IV – Site Operating Plan.

3.2 Materials

Intermediate cover will consist of at least 12 inches of general fill that has not previously come into contact with waste.

3.3 Slopes

The slope stability analyses are provided in Attachment D5 – Geotechnical Design, Appendix D5-B – Slope Stability Analyses. The slope stability analyses are only valid for the conditions that were analyzed. Any changes to the final cover system or landfill completion plan will require that the slope stability analyses be revised to reflect the actual conditions. Interim 3H:1V waste slopes shall not exceed 210 feet in height. Temporary construction slopes shall not be steeper than the interim slopes and concentrated loadings, such as heavy equipment and soil stockpiles, and shall not be placed near the crest of slopes unless additional slope stability analyses are performed.

3.4 Testing and Verification

Intermediate cover placement and grading will be observed and documented by the landfill staff in accordance with Part IV – Site Operating Plan.

4 INFILTRATION LAYER

30 TAC §330.457

4.1 General

The infiltration layer consists of an 18-inch-thick layer of compacted, relatively homogeneous, cohesive material. The CQA monitor shall provide continuous on-site observation during infiltration layer placement, processing, compaction, and testing. The GP shall make sufficient site visits during infiltration layer construction to document the construction activities, testing, and thickness verification in the Final Cover System Report, in accordance with Section 7.

4.2 Materials

Infiltration layer material shall consist of soil that is free from debris, rubbish, frozen materials, foreign objects, and organic material. The required infiltration layer material properties are summarized in Table D8-2.

Table D8-2
Skyline Landfill
Infiltration Layer Material Properties

Test	Standard	Required Property
Plasticity Index	ASTM D 4318	15 or greater
Liquid Limit	ASTM D 4318	30 or greater
Percent Passing No. 200 Mesh Sieve	ASTM D 1140	30 or greater
Percent Passing 1-inch Sieve	ASTM D 422	100
Coefficient of Permeability	ASTM D 5084 or COE EM 1110-2-1906 Appendix VII	Less than or equal to 1×10^{-7} cm/sec (Alternate) Less than or equal to 1×10^{-5} cm/sec (Subtitle D)

Preconstruction testing procedures and frequencies for infiltration layer materials are listed in Section 4.8.1.

4.3 Subgrade Preparation

Prior to placing infiltration layer material, the subgrade should be proof rolled with heavy, rubber-tired construction equipment to detect soft areas. The GP or CQA monitor must observe the proof-rolling operation. Soft areas should be compacted and then be proof rolled again.

The subgrade elevations shall be verified in accordance with the requirements of Section 4.8.3 prior to the placement of infiltration layer.

4.4 Placement and Processing

The infiltration layer subgrade and surface of each lift should be roughened prior to placement of the next lift of the infiltration layer. The infiltration layer material should be placed in maximum 8-inch loose lifts to produce a compacted lift thickness of approximately 6 inches. The material should be processed to a maximum particle size of 1 inch or less before water is added. Rocks and clods less than 1 inch in diameter should not total more than 10 percent by weight.

If additional water is necessary to adjust the moisture content, it should be applied after initial processing but prior to compaction. Water should be applied evenly across the lift and worked into the material. Waste or any objectionable material must not contaminate compaction water.

4.5 Compaction

The infiltration layer shall be compacted with a pad/tamping-foot or prong-foot roller. A footed roller is necessary to bond the lifts, distribute the water, and blend the soil matrix through kneading action. The infiltration layer shall not be compacted with a bulldozer, rubber-tired roller, flat-wheel roller, scrapers, or any track equipment unless it is used to pull a footed roller. The compactor should weigh at least 40,000 pounds. The lift thickness shall be controlled to achieve total penetration into the top of the previously compacted lift; therefore, the lift thickness must not be greater than the pad or prong length. Cleaning devices on the roller must be in place and maintained to prevent the prongs or pad feet from becoming clogged to the point that they cannot achieve full penetration.

The compactor shall make at least four passes across the area being compacted. A pass is defined as one pass of the compactor, front and rear drums. The material should be compacted to a minimum of 95 percent of the maximum dry density determined by standard Proctor (ASTM D 698) at a moisture content at or above optimum moisture. Areas with failing tests shall be reworked, recompacted, and retested, and passing tests must be achieved before another lift is added.

After a lift is compacted, it must be watered to prevent drying and desiccation until the next lift can be placed. If desiccation occurs, the GP must determine if the lift can be

rehydrated by surface application of water or if the lift must be scarified, watered, and recompacted. Following compaction and fine grading of the final lift, the surface of the infiltration layer shall be smooth drum rolled.

4.6 Protection

The completed infiltration layer must be protected from drying, desiccation, rutting, erosion and ponded water until the geocomposite is installed. Areas that undergo excessive desiccation or damage shall be scarified, reworked, recompacted, and retested as directed by the GP.

4.7 Tie In to Existing Covers

The edge of existing infiltration layers shall be cut back on either a slope or step to prevent the formation of a vertical joint. Details for the tie in to existing cover are provided in Attachment D3, Drawing D3.3 – Liner Details.

4.8 Testing and Verification

4.8.1 Preconstruction Testing

Table D8-3 lists the minimum testing required for material proposed for use as the infiltration layer.

Table D8-3
Skyline Landfill
Infiltration Layer Material Preconstruction Tests

Test	Standard	Frequency
Plasticity Index	ASTM D 4318	1 per material type
Liquid Limit	ASTM D 4318	1 per material type
Percent Passing No. 200 Mesh Sieve	ASTM D 1140	1 per material type
Percent Passing 1-inch Sieve	ASTM D 422	1 per material type
Standard Proctor Test	ASTM D 698	1 per material type
Coefficient of Permeability	ASTM D 5084 or COE EM 1110-2-1906 Appendix VII	1 per material type

After the moisture density relationship has been determined for a material type, a soil sample should be remolded to about 95 percent of the maximum dry density at the optimum moisture content. This sample will be tested to determine if the soil can be

compacted to achieve a suitable coefficient of permeability. Either falling head or constant head laboratory permeability tests may be performed to determine the coefficient of permeability. The permeant fluid for testing must be tap water or 0.005N calcium sulfate solution. Distilled or deionized water shall not be used as the permeant fluid.

4.8.2 Construction Testing

Table D8-4 lists the minimum testing required for material used as the infiltration layer.

Table D8-4
Skyline Landfill
Infiltration Layer Material Construction Tests

Test	Standard	Frequency
Field Density	ASTM D 2922	1/8,000 sf per 6-inch lift
Plasticity Index	ASTM D 4318	1 per acre
Liquid Limit	ASTM D 4318	1 per acre
Percent Passing No. 200 Mesh Sieve	ASTM D 1140	1 per acre
Standard Proctor Test	ASTM D 698	1 per material type
Coefficient of Permeability	ASTM D 5084 or COE EM 1110-2-1906 Appendix VII	1 per acre

The Atterberg limits of the in-place infiltration layer must be compared to the Atterberg limits of the Proctor curve sample to assure that the Proctor curve represents the in-place material. Any variance of more than 10 points between the liquid limit or plasticity index of the in-place soil and those of the Proctor curve sample will require that a new Proctor curve be developed.

4.8.3 Thickness Verification

The as-built thickness of the infiltration layer shall be determined by standard survey methods. Prior to the placement of infiltration layer material, the subgrade elevations will be determined at a minimum rate of 1 survey point per 5,000 square feet of lined area. After the infiltration layer is completed, the top of infiltration layer elevations will be determined at the same locations as the subgrade elevations.

5 FLEXIBLE MEMBRANE COVER

30 TAC §330.457

5.1 General

The flexible membrane cover (FMC) component of the final cover system consists of a 40-mil-thick linear low-density polyethylene (LLDPE) or 60-mil-thick high density polyethylene (HDPE) geomembrane placed over the infiltration layer. Smooth FMC will be placed on the top slopes and FMC that is textured on both sides will be placed over the side slopes. The CQA monitor shall provide continuous on-site observation during FMC deployment, trial welds, seaming, testing, and repairing. The GP shall make sufficient site visits during the FMC installation to document the installation and testing in the Final Cover Evaluation Report, in accordance with Section 8.

5.2 Materials

5.2.1 Properties

FMC shall consist of smooth and textured LLDPE or HDPE geomembrane produced from virgin raw materials. Recycled materials are not acceptable. The FMC shall not be manufactured from resin from differing suppliers. The FMC shall meet the requirements in the most current revisions of Geosynthetics Research Institute (GRI) Standard GM13 (HDPE) or GM17 (LLDPE). Copies of GRI GM13 and GRI GM17 are included in Appendix D8-B.

Manufacturer quality control testing procedures and frequencies for FMC are listed in Section 5.5.1. Third party conformance testing procedures and frequencies for FMC are listed in Section 5.5.2.

5.2.2 Delivery and Storage

FMC shall be shipped in rolls labeled with the manufacturer's name, roll number, and lot or batch number. The CQA monitor shall inspect the rolls for shipping damage and complete a geosynthetics receipt log for all materials delivered to the site. Damaged rolls shall be rejected.

The FMC shall be unloaded and handled with equipment that does not damage the rolls. Rolls should not be pushed, slid, or dragged to the storage location. The FMC must not be stored on wet, soft, or rocky subgrade, but must be stored on a stable subgrade. FMC must not be stacked more than five rolls high to avoid crushing the roll cores. The stored FMC must be protected from puncture, grease, dirt, excessive heat, or other damage.

5.3 Preparation

The surface of the infiltration layer shall be protected until the FMC is installed in accordance with Section 4.6. Prior to installation of the FMC the infiltration layer shall be tested and verified in accordance with Section 4.8, and the GP or CQA monitor and geosynthetics installer shall inspect the surface of the infiltration layer to verify that:

- The infiltration layer surface has been smooth drum rolled.
- The infiltration layer surface is free of irregularities, soft areas, or loose soil.
- The infiltration layer surface is free of stones, protrusions, or objects that could damage the FMC.

The geosynthetics installer must accept the condition of the infiltration layer and sign a subgrade acceptance form prior to the installation of the FMC.

5.4 Installation

5.4.1 Deployment and Placement

The following activities must take place prior to FMC deployment:

- The manufacturer's quality control and third party conformance tests should be completed and approved by the GP in accordance with the requirements of Section 5.5.
- The GP or CQA monitor and geosynthetics installer shall approve the subgrade in accordance with the requirements of Section 5.3.
- The geosynthetics installer shall sign the subgrade acceptance form.
- The geosynthetics installer shall submit a drawing showing the proposed panel layout.

FMC shall be deployed by equipment that will unroll the FMC without damaging, crimping, or stretching it and deployment equipment must not damage the underlying compacted infiltration layer. FMC must not be deployed during periods of rain or high winds and shall not be deployed on frozen subgrade. The installer must only deploy the amount of FMC that can be seamed on the same day.

Upon deployment, each panel shall be assigned a unique identification number. All panels must be anchored with adequate ballast to prevent uplift from wind. Smoking and damaging shoes shall not be permitted on the FMC and only low-ground pressure supporting equipment shall be allowed on the FMC. Textured FMC shall be placed on side slopes.

During FMC placement, the CQA monitor must:

- Provide full time observation.
- Perform thickness verification tests on each panel. Thickness verification shall be performed with a micrometer at a minimum of one measurement per 5 feet along the leading edge of the panel. A minimum of five tests is required for each panel. No measurement may be less than 90 percent of the nominal panel thickness.
- Record panel numbers, panel dimensions, and roll numbers on the panel layout drawing.
- Record weather conditions.
- Observe the condition of the subgrade and note any deficiencies. All deficiencies shall be repaired and approved by the CQA monitor.
- Observe the condition of the FMC and note any defects. All defects must be repaired in accordance with the requirements of Section 5.4.4.
- Observe that people working on the FMC do not smoke, wear shoes that could damage the FMC, or engage in activities that could damage the FMC.
- Observe that the deployment method minimizes wrinkles and that the FMC is anchored to prevent movement from wind.
- Observe that no more panels are deployed than can be seamed on the same day.
- Observe that there are no horizontal seams on side slopes.

Any panels that are not deployed in accordance with this section shall be marked by the CQA monitor and repaired in accordance with Section 5.4.4 or be removed and replaced by the installer.

5.4.2 Seaming

Only welding apparatus and operators that have completed approved trial welds, in accordance with Section 5.5.3, shall be allowed to weld panel seams. Each seam shall be assigned a unique number, which is preferably consistent with the panel numbering system. Side slope seams shall be oriented downslope. Prior to welding, the proper panel overlap shall be provided; dirt, grease, and free moisture shall be cleaned from the panel contact area; and wrinkles shall be removed as much as practical. For extrusion welds, oxidation shall be ground from the seam area within one hour of the welding operation and the extrudiate shall be purged from the extrusion welding apparatus. Seaming operations shall not be allowed when the ambient temperature is below 40°F or above 104°F unless trial welds have demonstrated that adequate welds can be achieved outside these limits.

During FMC seaming operations, the CQA monitor must:

- Provide full time observation.
- Record seam numbers on the panel layout drawing.
- Record weather conditions.
- Observe that only approved welding apparatus and operators are allowed to weld seams.
- Observe the condition of the seams and note any defects. All defects must be repaired in accordance with the requirements of Section 5.4.4.
- Observe that people working on the FMC do not smoke, wear shoes that could damage the FMC, or engage in activities that could damage the FMC.
- Observe that the seams are free of grease, dirt, moisture, and wrinkles.
- Observe that welding operations take place within the approved ambient temperature range.
- Observe that seam grinding has been completed less than one hour before extrusion welding and the extrudiate has been purged from extrusion welders.
- Observe that there are no horizontal seams on side slopes.

5.4.3 Anchor Trenches

The FMC anchor trench shall be left open until the seaming is completed. Expansion and contraction of the FMC should be accounted for during deployment. The top corner of the anchor trenches shall be rounded to prevent crimping the FMC. The bottom of the anchor trench shall be dry, stable, and free of loose particles and rocks. Anchor trenches shall be backfilled with compacted general fill that is free of particles larger than 1 inch in diameter. The anchor trenches shall be backfilled and compacted in a manner that does not damage or induce stress to the FMC.

5.4.4 Repairs

Defects in the FMC, defects in seams, failing destructive tests, failing nondestructive tests, holes from nondestructive tests, and destructive test sample locations shall be repaired by one of the following repair techniques:

- Patching - used to repair large holes, tears, large FMC defects, and destructive test locations.
- Extrusion - used to repair small FMC defects, cuts, holes from nondestructive tests, and seam defects less than 1/2-inch long.

- Capping - used to repair failed seams or seams where nondestructive tests cannot be performed.

- Removal - used to replace areas with large defects where other repair techniques are not appropriate.

Patches and caps should extend 6 inches beyond the edge of the defect and the repair surfaces shall be clean and dry. The area to be repaired shall be abraded to remove oxidation and the top edges of patches should be beveled.

5.5 Testing and Verification

5.5.1 Manufacturer's Quality Control Testing

The FMC manufacturer shall test the geomembrane and raw materials in accordance with GRI Standard GM13 or GM17 to assure the quality of the FMC. Material property requirements are provided in Section 5.2.1. Minimum manufacturer's testing requirements are provided in Table D8-5.

5.5.2 Conformance Testing

Conformance samples of the FMC shall be cut across the full width of selected rolls in accordance with the test frequency specified in Table D8-5. Conformance samples may be taken at the manufacturing plant or at the project site and will be forwarded to a third party laboratory for testing. Material property requirements are provided in Section 5.2.1. Minimum conformance testing requirements are provided in Table D8-5.

Table D8-5
Skyline Landfill
FMC Conformance Tests

Test	Standard	Frequency
Sheet Thickness	ASTM D 5199, 1593, or 5994	1 per 100,000 sf and every resin lot
Specific Gravity	ASTM D 1505	1 per 100,000 sf and every resin lot
Carbon Black Content	ASTM D 1603	1 per 100,000 sf and every resin lot
Carbon Black Dispersion	ASTM D 3015 or 5596	1 per 100,000 sf and every resin lot
Tensile Properties	ASTM D 638	1 per 100,000 sf and every resin lot
Direct Shear[1]	ASTM D 5321	Per GM/adjoining material type

[1]Direct Shear Test (ASTM D 5321) will be performed at strain rates, confining pressures and other parameters that simulate the field conditions.

The Direct Shear Tests will be performed on the textured GM/soil interface and the textured GM/geocomposite interface for each material manufacturer that is utilized to confirm stability of the constructed final cover system.

The GP will perform a slope stability analysis using the site-specific Direct Shear Test data. The angle of friction and cohesion values will be acceptable if the results of the site-specific slope stability analysis demonstrate that the factor of safety against sliding is 1.5 or greater.

5.5.3 Trial Welds

Each operator and welding apparatus must be tested to verify that seam welds that meet the specifications can be achieved under the site conditions. Trial welds must be performed at the beginning and midpoint of each day for each operator and apparatus used that day. If welding continues past 6:00 p.m., additional trial welds may be required.

The trial weld samples shall be 3 feet long and 12 inches wide, with the seam centered lengthwise. At least four 1-inch-wide coupons will be cut from each trial weld sample. Two coupons from each sample will be tested for shear and two samples will be tested for peel. Peel test coupons for dual-track welds shall be tested on both sides of the air channel. Each coupon must meet the minimum strength requirements listed in Table D8-6 and exhibit a Film Tear Bond (FTB). If the trial weld fails, two more trial seams must be welded and tested. This process will continue until passing trial welds are achieved.

The CQA monitor must observe the trial welding operations and document the operator's initials, apparatus number, time, date, air temperature, apparatus temperature, and peel and shear test results. If the CQA monitor believes that an operator or apparatus is not functioning properly, or if the weather conditions have substantially changed since the trial welds were performed, new trial welds must be performed.

5.5.4 Construction Testing

Nondestructive Tests

Nondestructive seam tests include vacuum testing and air pressure testing. Nondestructive testing shall be performed for the entire length of each seam by the FMC installer.

Vacuum testing shall be used to test extrusion-welded seams and fusion-welded seams that cannot be tested by air pressure methods. The vacuum box shall be placed over a seam section, which has been thoroughly saturated with a soapy water solution. The rubber gasket on the bottom of the vacuum box must seal against the FMC to prevent leaks. The vacuum box pressure shall be reduced to about 3 to 5 inches of Hg. Soap bubbles will indicate the presence of holes or non-bonded seams. The vacuum box dwell time shall be at least 10 seconds.

Air pressure testing shall be used to test fusion-welded seams that have an air channel. Both ends of the air channel shall be sealed and air shall be pumped into the channel to

at least 30 psi or 1/2 psi per mil of thickness, whichever is greater. The air channel must sustain the pressure for at least five minutes, without more than a 4-psi pressure drop. Following a passing pressure test, the pressure shall be released from the end of the seam that is opposite of the pressure gauge. The pressure gauge must return to zero; if it does not, the seam is probably blocked. After the blockage has been located, the seam shall be pressure tested on both sides of the blockage. All penetration holes shall be sealed after the air pressure testing is completed.

During the nondestructive testing, the CQA monitor must:

- Observe that equipment and operators perform the tests properly.
- Observe that the entire length of each seam is tested and record the results of the test.
- Identify failed seams and inform the installer of any required repairs.
- Record all completed and tested repairs.

Destructive Tests

Destructive testing shall be performed at a frequency of one stratified test location per 500 linear feet of seam. Repairs over 10 feet long shall be included in the total seam length. Destructive test samples should be 45 inches long by 12 inches wide with the seam centered along the length of the sample.

Two coupons should be cut from each end of the sample and the installer must test these coupons with a tensiometer capable of measuring the seam strength. The installer shall test two coupons in shear and two coupons in peel. For double wedge-welded seams, both sides of the air channel shall be tested in peel. The CQA monitor must observe the tests and record the results on the destructive testing log. The minimum requirements for destructive testing are provided in Table D8-6. If one of the coupons fails in either peel or shear, the installer shall reconstruct the entire seam between passed test locations, or take additional samples 10 feet in both directions of the failed test. If the additional tests pass, the contractor shall reconstruct or cap the seam between the passing test locations. If the additional tests fail, the sampling and testing procedure shall be repeated until the length of the faulty seam is established.

If the field test results are satisfactory, the remaining sample shall be divided into three parts: one-third for the installer, one-third for third party laboratory testing, and one-third for the owner to archive. The laboratory shall test five coupons from each sample in shear and test five coupons from each sample in peel (10 when testing both inner and outer welds of dual-track welds). The minimum requirements for destructive testing are provided in Table D8-6. If the laboratory test fails in either peel or shear, the installer shall reconstruct the entire seam between passed test locations, or take additional samples 10 feet in both directions of the failed test. If the additional tests pass, the contractor shall reconstruct or cap the seam between the passing test locations. If the additional tests fail, the sampling and testing procedure shall be repeated until the length

of the faulty seam is established. All seams shall be bracketed by passing laboratory tests; field test results shall not be used for final acceptance.

Table D8-6
Skyline Landfill
FMC Seam Properties

Test	Standard	Frequency	Minimum Criteria
Shear	ASTM D 4437	1 sample per 500 feet of seam	Four of five specimens from each sample must have a shear strength greater than or equal to 95% of sheet strength but not less than 40 ppi (LLDPE) or 120 ppi (HDPE). The average shear strength value of all five specimens must be greater than or equal to 95% of sheet strength but not less than 40 ppi (LLDPE) or 120 ppi (HDPE).
Peel	ASTM D 4437	1 sample per 500 feet of seam	Four of five specimens from each sample must have a peel strength greater than or equal to 62% of sheet strength but not less than 36 ppi (LLDPE) or 78 ppi (HDPE). The average peel strength value of all five specimens must be greater than or equal to 62% of sheet strength but not less than 36 ppi (LLDPE) or 78 ppi (HDPE). Both sides of dual track seams shall meet the minimum criteria. Each track is considered a separate sample. All specimens shall exhibit Film Tear Bond.

During destructive seam testing, the CQA monitor must:

- Select sample locations and observe sample cutting.
- Assign sample numbers and label samples.
- Observe installer-performed tests.
- Record sample locations, sample number, sample purpose, and field test results.

~~5~~6 DRAINAGE LAYER

30 TAC §330.457

~~5.1~~6.1 General

The drainage layer consists of a double-sided geocomposite on all slopes in the alternate final cover system and on the sideslopes in the Subtitle D final cover system. A geotextile will be installed as a cushion fabric on tope slopes in the Subtitle D final cover system. The CQA monitor shall provide on-site observation during geocomposite drainage layer and geotextile installation. The GP shall make sufficient site visits during geocomposite drainage layer and geotextile installation to document the installation in the Final Cover Evaluation Report.

A drainage trench will be constructed at the toe of the final cover slope to collect drainage from the drainage layer and direct it to the perimeter drainage system. Calculations for the drain system are included in Appendix D8-A.

~~5.2~~6.2 Materials

~~5.2.1~~6.2.1 Geocomposite

Double-sided geocomposite (nonwoven geotextile bonded to the top and bottom of HDPE drainage net) will be installed on all slopes. The geocomposite shall have the minimum properties listed in Table D8-5.

Table D8-~~7~~5
Skyline Landfill
Geocomposite Properties

Material	Test	Standard	Required Property
Geotextile	Material		Nonwoven polypropylene or polyester
	Apparent Opening Size	ASTM D 4751	70 sieve
HDPE Drainage Net	Specific Gravity	ASTM D 1505	0.93 g/cm^3
	Thickness	ASTM D 5199	0.2 inch (200 mil)
	Carbon Black	ASTM D 1603	Minimum 2%, maximum 3%
Geocomposite	Transmissivity	ASTM D 4716	5×10^{-4} m^2/sec

* See Appendix D8-A for calculation of geocomposite transmissivity.

Manufacturer quality control testing procedures for geocomposite are listed in Section 5.5.

6.2.2 Geotextile

Nonwoven geotextile will be installed on the top slopes. The geotextile shall have the minimum properties listed in Table D8-8.

Table D8-8
Skyline Landfill
Geotextile Properties

Test	Standard	Required Property
Material		Nonwoven polypropylene or polyester
Unit Weight	ASTM D 5261	8 oz/yd^2

Manufacturer quality control testing procedures for geotextile are listed in Section 6.5.

~~5.2.2~~6.2.3 Delivery and Storage

Geocomposite and geotextile shall be shipped in rolls labeled with the manufacturer's name, roll number, and lot or batch number. The CQA monitor shall inspect the rolls for shipping damage and complete a geosynthetics receipt log for all materials delivered to the site. Damaged rolls shall be rejected.

The geocomposite and geotextile shall be unloaded and handled with equipment that does not cause damage to the geocomposite or geotextile rolls. Rolls should not be pushed, slid, or dragged to the storage location. The geocomposite or geotextile must not be stored on wet, soft, or rocky subgrade, but must be stored on a stable subgrade. Geocomposite or geotextile must not be stacked more than five rolls high to avoid crushing the roll cores. The stored geocomposite or geotextile must be protected from puncture, grease, dirt, excessive heat, or other damage.

~~5.3~~6.3 Preparation

Prior to installation of the drainage layer, the infiltration layer and flexible membrane cover in the Subtitle D final cover system shall be tested and verified in accordance with Section 4.8 and Section 5.5. The CQA monitor shall observe that the surface to receive the geocomposite is free of debris, stones, and dirt and verify that the conformance documentation has been submitted and approved.

~~5.4~~6.4 Installation

Double-sided geocomposite shall be installed on all slopes in the alternate final cover system and on the sideslopes in the Subtitle D final cover system. Geocomposite shall be deployed by equipment that will unroll the geocomposite without damaging, crimping,

or stretching it and deployment equipment must not damage the underlying infiltration layer and flexible membrane cover. All panels must be anchored with adequate ballast to prevent uplift from wind. Smoking and wearing shoes that could damage the geocomposite shall not be permitted on the geocomposite and only low-ground pressure supporting equipment shall be allowed on the geocomposite. Adjacent rolls of geocomposite shall be securely tied through the drainage net with plastic fasteners every 5 feet along the length of the panel and every 6 inches along the ends of the panels.

During drainage layer placement, the CQA monitor must:

- Provide full time observation.
- Record weather conditions.
- Observe the condition of the geocomposite and note any defects. All defects must be repaired or replaced.
- Observe that people working on the geocomposite do not smoke, wear shoes that could damage the geocomposite, or engage in activities that could damage the geocomposite or infiltration layer.
- Observe that the deployment method minimizes wrinkles in the geocomposite.
- Observe that the geocomposite panels have been properly tied and seamed.

Any panels that are not installed in accordance with this section shall be marked by the CQA monitor and be repaired or removed and replaced by the installer.

~~5.5~~6.5 Testing and Verification

The manufacturer shall test the geocomposite to assure the quality of the drainage layer materials. Material property requirements are provided in Section ~~6.2~~7.2. Minimum manufacturer's testing requirements are provided in Table D8-~~6~~9. Manufacturer's testing shall be performed at a minimum frequency of one test per 100,000 sf.

Table D8-~~6~~9
Skyline Landfill
Geocomposite Manufacturer's Tests

Material	Test	Standard
Geotextile	Weight	ASTM D 5261
	Apparent Opening Size	ASTM D 4751
HDPE Drainage Net	Specific Gravity	ASTM D 1505
	Thickness	ASTM D 5199
	Carbon Black	ASTM D 1603
Geocomposite	Transmissivity	ASTM D 4716

~~6~~7 EROSION LAYER

30 TAC §330.457

~~6.1~~7.1 General

The erosion layer consists of a 36-inch-thick layer of soil with the upper six inches capable of sustaining native plant growth. The CQA monitor shall provide continuous on-site observation during erosion layer placement to assure that erosion layer placement does not damage underlying geocomposite or infiltration layer. The GP shall make sufficient site visits during erosion layer placement to document the construction activities and thickness verification in the Final Cover Evaluation Report.

~~6.2~~7.2 Materials

Erosion layer material shall consist of soil that is free from debris, rubbish, frozen materials, foreign objects, and organic material, or any material that could damage the underlying geocomposite. The required erosion layer material properties are summarized in Table D8-7.

Table D8-~~10~~7
Skyline Landfill
Erosion Layer Material Properties

Test	Standard	Required Property
Plasticity Index	ASTM D 4318	15 or greater
Liquid Limit	ASTM D 4318	30 or greater
Percent Passing No. 200 Mesh Sieve	ASTM D 1140	30 or greater

~~6.3~~7.3 Preparation

Prior to placing the erosion layer material, the top of infiltration layer elevations shall be verified in accordance with the requirements of Section 4.8.3 and all testing on the underlying geocomposite shall be completed.

~~6.4~~7.4 Placement

The erosion layer shall be placed in a manner that minimizes the potential to damage the underlying geocomposite. Hauling equipment shall be restricted to haul roads of sufficient thickness to protect the underlying geocomposite. The erosion layer shall be dumped from the haul road and spread by low ground pressure equipment in a manner that minimizes wrinkles and stress in the geocomposite. On side slopes, erosion layer shall be placed from the bottom to the top, not across or down. Erosion layer shall not be placed over geocomposite that are stretched across the toes of slopes. The minimum separation distance between construction equipment and the geocomposite are listed in Table D8-~~8~~11.

The erosion layer will be vegetated following the application of final cover in order to minimize erosion.

Table D8-~~8~~11
Skyline Landfill
Minimum Separation Distance

Equipment Ground Pressure (psi)	Minimum Separation Distance (in)
< 4	12
4 - 8	18
8 - 16	24
> 16	36

Any geocomposite that, in the opinion of the CQA monitor, has been damaged by the erosion layer placement must be repaired and retested in accordance with Sections ~~5~~6 and ~~6~~7.

~~6.5~~7.5 Testing and Verification

~~6.5.1~~7.5.1 Preconstruction Testing

Table D8-9 lists the minimum testing required for material proposed for use as the ~~infiltration~~ erosion layer.

Table D8-~~9~~12
Skyline Landfill
Erosion Layer Material Preconstruction Tests

Test	Standard	Frequency
Plasticity Index	ASTM D 4318	1 per material type
Liquid Limit	ASTM D 4318	1 per material type
Percent Passing No. 200 Mesh Sieve	ASTM D 1140	1 per material type

~~6.5.2~~7.5.2 Thickness Verification

The as-built thickness of the erosion layer shall be determined by standard survey methods. Prior to the placement of erosion layer, the top of infiltration layer elevations will be determined at a minimum rate of 1 survey point per 5,000 square feet of lined area. After the erosion layer is completed, the top of the erosion layer elevations will be determined at the same locations as the top of infiltration layer elevations.

~~7~~8 DOCUMENTATION

After construction of the final cover system, the GP will submit a Final Cover Evaluation Report to the TCEQ on behalf of the owner. The purpose of the Final Cover Evaluation Report is to document that the construction methods and test procedures are consistent with this FCQCP.

At a minimum, the Final Cover Evaluation Report will contain the following:

- A summary of all construction activities
- A summary of all laboratory and field test results
- Sampling and testing location drawings
- A description of significant construction problems and the resolution of these problems
- Record drawings
- A statement of compliance with the FCQCP
- The seal and signature of the GP and assistant GP, if applicable, in accordance with the Texas Engineering Practice Act