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McGill ASSOCIATES

February 9, 2011

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SOLID WASTE SECTION
ASHEVILLE REGIONAL OFFICE

Mr. Allen Gaither
Regional Engineer
Solid Waste Permitting Section
Division of Waste Management
North Carolina Department of Environment and Natural Resources
2090 U.S. Highway 70
Swannanoa, North Carolina 28778

RE: Construction Quality Assurance Certification Report – MSW Phase 3
White Oak MSW Landfill Permit # 44-07
Haywood County, North Carolina

Dear Mr. Gaither:

On behalf of Haywood County, McGill Associates is pleased to submit the following updates to the Construction Quality Assurance Certification Report for the construction of the MSW Phase 3 Cell at the White Oak MSW Landfill, Permit #44-07, Haywood County, North Carolina. The updates pertain to the certification of the work associated with the repair of the Phase 2 leachate sewer collection line under the Phase 3 Cell area. Please find the following enclosures submitted for insertion into the original CQA Certification Report dated June 2010:

- Outer Cover Page – Revised October 2011
- Professional Engineering Design Certification – Revised October 2011
- Inner Cover Page – Revised October 2011
- Table of Contents – Revised October 2011
- Certification Report – Revised October 2011
- Table of Contents – Sections – Revised October 2011
- Section 5 – Construction Quality Assurance Report, Prepared by Joyce Engineering, Inc., May 2010, Revised June 2010, Revised February 2011 to include:
  - Certification Letter – Phase 2 Leachate Sewer and Liner Repair, October 28, 2010
  - Construction Quality Assurance Report - Outer Cover – Revised October 2011
  - Construction Quality Assurance Report – Table of Contents – Revised October 2011
  - Appendix IX
- Section 11 – Phase 2 Leachate Sewer and Liner Repair

McGill Associates, P.A. • P.O. Box 2259, Asheville, NC 28802 • 55 Broad Street, Asheville, NC 28801
828-252-0575 • FAX 828-252-2518

In addition to the printed copies listed above, please find enclosed a digital version of Construction Quality Assurance Certification Report, dated June 2010, revised February 2011. This digital version is a complete copy of McGill Associates portion of the report and has been updated to include the enclosures referenced above.

We appreciate your assistance throughout the permitting and construction phases of this project. Should you have any questions or if we can be of further assistance, please give us a call.

Sincerely,
McGILL ASSOCIATES, P.A.

JEFFREY R. BISHOP, PE
Director of Solid Waste Services

Enclosure

cc: Mr. Marty Stamey, County Manager, Haywood County, w/o enc
Mr. David Francis, Director, Haywood County Tax Administration, w/o enc
Stephen King, Haywood County Solid Waste Director, w/o enc

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White Oak MSW Landfill
Haywood County, North Carolina
Permit No. 44-07

CONSTRUCTION QUALITY ASSURANCE CERTIFICATION REPORT MSW PHASE 3

JUNE 2010
REVISED: FEBRUARY 2011

McGill ASSOCIATES

PROFESSIONAL ENGINEERING DESIGN CERTIFICATION

In accordance with the Solid Waste Management Rules, 15A NCAC 13 B, Section .1600, I certify that the construction of the White Oak MSW Landfill, Permit 44-07, MSW Phase 3 has been constructed in substantial accordance with the approved plans and specifications, as presented in the Permit to Construct approved on May 5, 2009 and subsequently modified on October 7, 2009.

Jeffrey R. Bishop, PE
Director of Solid Waste Services
McGill Associates, P.A.
North Carolina PE Registration #23574

CONSTRUCTION QUALITY ASSURANCE CERTIFICATION REPORT

WHITE OAK MSW LANDFILL
MSW PHASE 3
HAYWOOD COUNTY, NORTH CAROLINA

PERMIT NO. 44-07

Submitted To:

North Carolina Department of
Environment And Natural Resources,
Division of Waste Management,
Solid Waste Section
2090 US Highway 70
Swannanoa, North Carolina 28778

June 2010
Revised: February 2011

Prepared By:

McGill Associates, P.A.
55 Broad Street
Asheville, North Carolina 28801
828-252-0575

TABLE OF CONTENTS

SECTIONS

CERTIFICATION REPORT
FOR
WHITE OAK MSW LANDFILL
MSW PHASE 3
PERMIT NO. 44-07
HAYWOOD COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

This Report, prepared by McGill Associates on behalf of Haywood County, North Carolina addresses the quality assurance procedures and activities performed during the construction of the MSW Phase 3 cell at the White Oak MSW Landfill. The documents comprising this report were compiled in general conformance with North Carolina Solid Waste Management Regulations, 15A NCAC 13B and the General Permit Conditions of Permit #44-07. The project generally consisted of the construction of approximately 8.8 acres of lined landfill, including earthwork, soil liner, geosynthetic clay liner (GCL), high density polyethylene liner, leachate collection system, leachate pumping stations, leachate force main and gravity sewer, improvements to the existing leachate storage lagoon, access roads, and erosion control measures.

On May 5, 2009 a **Permit to Construct** Municipal Solid Waste Landfill Phase 3 was issued by the North Carolina Department of Environment and Natural Resources (NCDENR). On October 7, 2009 the NCDENR issued a modification to the May 5, 2009 **Permit to Construct** to allow the addition of a geosynthetic clay liner (GCL) alternative base liner system. A copy of the May 5, 2009 and the October 7, 2009 **Permit to Construct** is included in Section 1 of this Report.

A copy of the Technical Specifications portion of the Conformed Documents for the White Oak MSW Landfill, MSW Phase 3, Haywood County, North Carolina is included in Section 2 of this Report for reference. The Site Specific Construction Quality Assurance Plan (SSCQAP) for this project is included in Section 3 of this Report. A copy of the Contract Drawings, issued for construction, is included in Section 4 of this Report.

Joyce Engineering Inc. was contracted by Haywood County, North Carolina to be the Construction Quality Assurance (CQA) Engineer to perform specific quality assurance procedures and activities relative to the construction of the landfill cell itself. Their specific duties included the soil subgrade foundation, low permeability soil liner, geosynthetic clay liner, high density polyethylene geomembrane liner, geotextile cushion, and the aggregate drainage layer. A copy of their certification report titled Construction Quality Assurance Certification Report, dated May 2010 for the White Oak Landfill, Phase 3 Construction, NCDENR Permit #44-07 is included in Section 5 of this Report.

2.0 WELL ABANDONMENT

Prior to commencing construction activities for the construction of the Phase 3 cell, various piezometers/monitoring wells installed and utilized during the design phase of the project that were in conflict with the proposed construction were abandoned. These piezometers/monitoring wells were abandoned in accordance with the applicable section of the North Carolina Well Construction Standards Rule 15A NCAC 2C. This activity was performed under the supervision of Bunnell-Lammons Engineering, Inc. A copy of the Report of Well Abandonment for the Phase 3 & 4 Expansion, dated July 9, 2009 is included in Section 6.

3.0 SOIL SUBGRADE FOUNDATION

3.1 Removal of Unsuitable Material

In the lower elevations of the Phase 3 cell an area containing unsuitable materials was discovered during the design phase of the project. Plans were developed and included in the construction drawings to remove this material, install an under drain system as needed and replace with suitable compacted material. Approximately 8,000 cubic yards of unsuitable material was removed and replaced under the supervision of the CQA Engineer. The specific quantities of material removed and the areas from which it was removed are included in Appendix 1 of the Construction Quality Assurance Certification Report included in Section 5 of this report. In addition to the undercutting, approximately 900 linear feet of under drain was installed per the contract documents.

3.2 Existing Leachate Sewer Lines

Existing leachate sewer lines from Phase 1, Cell 4 and Phase 2 were removed and replaced as a part of the construction of the Phase 3 Cell. These lines were replaced as dual contained HDPE gravity sewer lines with a minimum separation of four feet maintained between the top of the pipe and the bottom elevation of the proposed soil liner material. These two gravity sewer lines discharged to a new manhole constructed as a part of the construction for eventual discharge in the existing leachate lagoon. These pipes were pressure tested on August 19, 2009. A copy of the pressure test is included in Section 7.

3.3 Rock Pinnacles

During the construction of the subgrade of Phase 3 rock pinnacles were encountered along the northern half of the western edge of the cell, near the tie-in with the proposed Phase 4 cell. These pinnacles could not be removed by conventional excavation methods. Rock pinnacles were also encountered in sediment basin #6. A request to

allow the removal of the rock pinnacles through the use of explosives was submitted to NCDENR and was approved on September 15, 2009. Drilling and blasting operations were performed under the supervision of a licensed blaster under contract to the site contractor. Blasting operations were completed on or about October 23, 2009. In accordance with the conditions of the approval to blast, the site was inspected by a licensed geologist following completion of blasting activities. A report evaluating the possible impact on the area's hydrology was prepared by Bunnell-Lammons Engineering, Inc. and is included in Section 8. The findings in the report concluded the blasting activities had no impact on the area's hydrology and therefore no modification to the facility's groundwater monitoring plan was necessary. A copy of the blasting plan and associated correspondence is also included in Section 8 of this report. The CQA Engineer observed the excavation to confirm the rock had been removed to sufficient depth and the backfilling of the excavated area as a part of the overall observation of the preparation of the subgrade.

3.4 Soil Subgrade Certification

The CQA Engineer observed the soil subgrade preparation and issued a subgrade certification letter on November 19, 2009. A copy of this certification letter is included in Appendix VII of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report. A certified survey of the subgrade elevations for Phase 3 (titled "As-Built For Cell Subgrade") is included as "Drawing #1 Subgrade" in Appendix VIII of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

4.0 LOW PERMEABILITY SOIL LINER

Following the completion of the subgrade construction the Contractor proceeded with construction of the low permeability soil liner. Initially the Contractor constructed a test pad, in the southwest corner of Phase 3 along the sloped cell floor in accordance with the Contract Documents. The test pad measured approximately 100 feet by 150 feet. Low permeability soil from an identified on-site borrow source was used for the test pad. Four lifts, each approximately 8 inches thick, were placed/spread with a dozer and compacted with a sheep's foot roller/compactor. The Contractor made repeated efforts to work the soil to obtain the required minimum permeability of 1x10E-7 cm/sec. This effort was repeated numerous times utilizing varying moisture levels and compactive efforts. The CQA Engineer observed this operation and performed in-situ permeability tests to confirm the results. After repeated attempts, it was determined that the on-site borrow source, previously identified as a source of low permeability soil liner, would apparently not meet the minimum required permeability of 1x10E-7 cm/sec. The Contractor proposed the use of a geosynthetic clay liner (GCL) in lieu of a low permeability soil liner meeting the minimum requirements of 1x10E-7 cm/sec. McGill

Associates prepared and submitted to NCDENR a permit modification to allow the use of 18 inches of low permeability soil liner meeting a minimum permeability of 1x10E-5 cm/sec and a GCL with a permeability of approximately 1x10E-9 cm/sec. The top elevation of the low permeability soil liner (1x10E-5 cm/sec) would remain the same as the designed top elevation of the original low permeability soil liner (1x10E-7 cm/sec). This permit modification was approved by NCDENR on October 7, 2009, a copy of which is included in Section 1 of this report. Following the approval of the permit modification, the alternate low permeability soil liner was constructed in three lifts for a total thickness of 24 inches. In-situ permeability testing was performed by the CQA Engineer to confirm the top 18 inches met the minimum permeability of 1x10E-5 cm/sec. The results of this testing protocol are included in Appendix I of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report. A certified survey of the low permeability soil liner elevations for Phase 3 (titled "As-Built For Cell Clay Liner") is included as "Drawing #2 Soil Liner" in Appendix VIII of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

The leachate lagoon berm, raised in elevation as a part of this project, was also constructed of the same low permeability soil material as the Phase 3 alternate low permeability soil liner approved in the aforementioned permit modification. The CQA Engineer observed the placement of this material and performed the quality assurance testing as required by the Contract Documents. The final results of the field and laboratory testing for the leachate lagoon berm expansion are included in Appendix 1 of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

5.0 GEOSYNTHETIC CLAY LINER (GCL)

With the approval of the Permit Modification dated October 7, 2009, a copy of which is included in Section 1 of this report, the Contractor placed the GCL across the entire floor of the Phase 3 Cell. Prior to the placement of the GCL panels the Geosynthetics Contractor inspected and completed the subgrade acceptance form for the applicable work area. Copies of the subgrade acceptance forms are included in Appendix III of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report. The GCL panels were placed simultaneously with the placement of the HDPE Geomembrane Liner and all GCL panel material was covered with HDPE Geomembrane Liner each day. The particular panels utilized for this project were manufactured by CETCO and were supplied with a proprietary Winning Edge Super Grove™ allowing a more direct contact of bentonite clay with the adjacent panel. Adjacent GCL panels were overlapped a minimum of 6 inches and end-of-rolls were overlapped and shingled a minimum of 24 inches. The Contractor applied accessory sodium bentonite between the end-of-roll overlaps as required in the Contract Documents. The CQA Engineer observed the placement of the GCL panels to ensure placement in accordance with the Contract Documents. The manufacturer's quality certifications (MQC) are contained in

Appendix II of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

The GCL panels were also utilized for the expansion of the leachate lagoon berm. These panels were deployed in the same fashion as the GCL panels for the Phase 3 Cell. Adjacent GCL panels were overlapped a minimum of 6 inches and end-of-rolls were overlapped and shingled a minimum of 24 inches. The Contractor applied accessory sodium bentonite between the end-of-roll overlaps as required in the Contract Documents. The CQA Engineer observed the placement of the GCL panels for the leachate lagoon expansion to ensure placement in accordance with the Contract Documents. The manufacturer's quality certifications (MQC) are contained in Appendix II of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

6.0 HIGH DENSITY POLYETHYLENE GEOMEMBRANE (HDPE) – PHASE 3 CELL

The primary HDPE Geomembrane was deployed in the Phase 3 Cell immediately following the deployment of the GCL panels. Sufficient HDPE Geomembrane Liner was deployed in the Phase 3 Cell area during each installation cycle to completely cover the GCL panels. Once the HDPE Geomembrane panels were placed and properly positioned the Geosynthetics Contractor undertook the task of seaming the joints and overlaps in accordance with the Contract Documents. The CQA Engineer observed the placement and seaming of all HDPE Geomembrane Liner to ensure conformance with the Contract Documents and testing protocol. The installation records and QA/QC data for the HDPE Geomembrane Liner installed in the Phase 3 Cell area are included in Appendix III of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report. The as-built HDPE Geomembrane panel layout drawing for the Phase 3 Cell, noting all seams, repairs, etc. is included as "Drawing #4 Geomembrane" in Appendix VIII of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

7.0 GEOTEXTILE CUSHION

The geotextile cushion, consisting of a 16 oz/sy nonwoven geotextile, was placed to cover and protect the HDPE Geomembrane Liner once all seaming and QA/QC activities had been completed. The geotextile cushion was placed with all adjacent seams and end-of-roll seams overlapped a minimum of 6 inches. The individual geotextile panels were smoothed out and heat bonded together to form a contiguous geotextile cushion over the entire lined Phase 3 Cell area. The CQA Engineer observed the placement and heat seaming of all geotextile material. Manufacturer certificates and material conformance test results are included in Appendix IV of

the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

8.0 GEOCOMPOSITE

A geocomposite was placed between the existing HDPE Geomembrane Liner and the new HDPE Geomembrane Liner as a part of the expansion of the leachate lagoon. The CQA Engineer observed the placement and seaming of the geocomposite panels. Manufacturer certificates and material conformance test results are included in Appendix IV of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

9.0 HIGH DENSITY POLYETHYLENE GEOMEMBRANE (HDPE) – LEACHATE LAGOON EXPANSION

The primary HDPE Geomembrane deployed as a part of the leachate lagoon expansion was placed immediately following the deployment of the GCL panels and the geocomposite. Sufficient HDPE Geomembrane Liner was deployed in the leachate lagoon during each installation cycle to completely cover the GCL panels and the geocomposite. Once the HDPE Geomembrane panels were placed and properly positioned the Geosynthetics Contractor undertook the task of seaming the joints and overlaps in accordance with the Contract Documents. The CQA Engineer observed the placement and seaming of all HDPE Geomembrane Liner and pipe boots to ensure conformance with the Contract Documents and testing protocol. The installation records and QA/QC data for the HDPE Geomembrane Liner installed as a part of the leachate lagoon expansion is included in Appendix III of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report. The as-built HDPE Geomembrane panel layout drawing for the leachate lagoon expansion, noting all seams, repairs, etc. is included as "Drawing #4 Geomembrane" in Appendix VIII of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

10.0 LEACHATE COLLECTION REMOVAL SYSTEM

The leachate collection removal system consisted of the placement of 6 inch and 8 inch perforated HDPE pipe (SDR 17) surrounded by 12 inches of NCDOT #5 washed stone wrapped in a 6 oz/sy nonwoven geotextile fabric. The leachate collection removal system was placed in the lower reaches of the cell and strategically along portions of the sloped sides of the cell to facilitate the collection and transportation of the collected leachate to the sump area for ultimate removal from the cell. Cleanouts were installed along the western edge of the Phase 3 Cell as well as in the vicinity of the sump area. The leachate collection removal system sump consisted

of depressed collection area with two 24 inch HDPE riser pipes (SDR 17) set within the depressed area and extending up the adjacent side slope to a point just outside the lined area of the cell. The portions of the 24 inch riser pipes in the sump area were perforated to allow the inflow of leachate to the leachate pumping system. Solid 24 inch HDPE pipe extended up the side slope. The perforated portions of the 24 inch HDPE riser pipes were interconnected with an 8 inch HDPE perforated cross pipe to facilitate the flow of leachate. The perforated portion of the 24 inch HDPE riser pipes were also interconnected with the associated leachate collection removal system installed throughout the cell floor area. The depressed portion of the sump area was backfilled with NCDOT #5 washed stone and overlain with an 8 oz/sy nonwoven geotextile over which a 2 foot thick layer of aggregate drainage material was placed. The leachate pumping system consisted of a stainless steel pump, flexible discharge line and associated appurtenances installed in each riser pipe. The pumps and control systems were specifically designed for use in landfill leachate removal operations and were equipped to operate automatically on alternate pumping cycles or manually should the need arise. The pumps were set within the perforated section of the riser pipe. The installation of the leachate removal collection system was observed by the Engineer who also performed tests on the pumping system to ensure proper operation in accordance with the Contract Documents. An as-built drawing of the leachate collection removal system titled "Record Drawing for White Oak MSW Landfill, Phase 3" under the file name "White Oak MSW record drawing.pdf" is included in Section 9 of this report.

11.0 AGGREGATE DRAINAGE LAYER

Once the geotextile cushion was placed, and in conjunction with the installation of the leachate collection removal system, a 2 foot thick aggregate drainage layer comprised of NCDOT #57 washed stone meeting the gradation and calcium carbonate requirements of the Contract Documents was installed. The placement of the aggregate drainage layer was initiated on the southern end of the Phase 3 Cell and systematically worked toward the sump area at the northern end of the cell. As the placement of the aggregate drainage layer progressed in a northerly direction, care was taken to push the stone material in an uphill fashion to avoid undue stress on the soil/synthetic interface. The aggregate drainage layer was placed using a GPS guided dozer to ensure a consistent thickness was maintained over the synthetic liner material and the leachate collection removal system. Material pre-construction and construction testing results are contained in Appendix I.C of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report. A certified survey of the aggregate drainage layer elevations for Phase 3 (titled "As-Built For Cell Protective Cover") is included as "Drawing #3 Aggregate Drainage Layer" in Appendix VIII of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

12.0 STORMWATER CONTROL LINER

Upon completion of the placement of the aggregate drainage layer a geomembrane stormwater cover was installed and secured by the Geosynthetic Contractor. The stormwater control liner will assist in minimizing the volume of leachate generated within the Phase 3 Cell until such time as the cell is completely floored in with waste. As the placement of waste progresses from the southern end of the Phase 3 Cell to the north, the stormwater control liner will be systematically removed to allow intimate contact between the waste mass and the aggregate drainage layer thereby ensuring the capture and removal of all leachate. The Engineer observed the placement and anchoring of the stormwater control liner.

13.0 SUMMARY OF CQA FIELD DATA

A summary of the CQA field data collected and tabulated by Joyce Engineering, Inc., the CQA Engineer hired by Haywood County to perform specific CQA activities during the construction of the Phase 3 Cell at the Haywood County MSW Landfill, is discussed in 3.0 Summary of CQA Field Data in the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

14.0 DEVIATION FROM THE CONTRACT DOCUMENTS – PHASE 3 TIE-IN TO PHASE 1, CELL 4 AND PHASE 2

As construction progressed along the tie-in between the Phase 3 Cell and the existing Phase1, Cell 4 and Phase 2 Cell it became apparent that existing conditions along that connection point would make the anchor trench and liner tie-in detailed in the Contract Drawings difficult to construct. The Contractor suggested a change in the anchor trench and liner tie-in design to avoid excavating existing soil material below the elevation of the adjacent waste mass prior to placement of the low permeability soil liner material. McGill Associates reviewed the Contractor's request and provided a revised anchor trench and liner connection detail for use along this connection point. A drawing of the proposed revised anchor trench and liner connection detail, titled "09 1103 – Liner Tie-in Detail – Phase 3 to Phase 1 & 2.pdf" is included in Section 10 of this report. A key component of this detail required that once the anchor trench was excavated; Shelby tube samples would be taken a minimum of 18 inches deep through the bottom of the anchor trench at intervals not to exceed 250 feet. The purpose of the tests was to confirm a minimum of 18 inches of low permeability soil below the bottom of the anchor trench meeting a minimum permeability of 1x10E-5 cm/sec. Four samples (S-1 through S-4) were collected by CQA Engineer along the Phase 3 Cell tie-in with Phase 1, Cell 4 and Phase 2. Test sample S-2, along the Phase 2 Cell connection, failed to meet the required minimum permeability. A re-sample, S-2A (laboratory sample PH2B), was taken in the anchor trench approximately 100 feet to the west of failed sample S-2. This sample met the minimum thickness and permeability requirements. The anchor trench soil tests and locations are included

in Appendix I.B – Construction Testing in the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report. As a result of the existing soil material below the anchor trench failing to meet the minimum permeability requirements of the low permeability soil liner (Sample S-2), McGill Associates prepared a detail of the proposed repair and submitted it by e-mail to NCDENR on December 11, 2009. A copy of the e-mail titled "09 1211 – E-mail to AG – Additional GCL.pdf" and its associated attachments is included in Section 10 of this report. The repair required the Contractor to place an additional GCL panel over the section of anchor trench affected by the failure. On April 14, 2010 an e-mail was sent to the Contractor providing a blow-up detail of the existing conditions and the suggested repair. This e-mail, titled "10 0414 – E-mail to KV – Install GCL.pdf", and its associated attachments drawings is included in Section 10 of this report. To accomplish this repair, the Contractor removed the aggregate drainage layer along the specified area requiring repair to expose the synthetic liner material initially installed over the anchor trench. The geotextile cover and HDPE Geomembrane flap initially installed over the anchor trench were pulled back and the soil anchor in the anchor trench was checked and regraded to promote positive drainage into the Phase 3 Cell area. A single GCL panel, approximately 14.5 feet wide by 150 feet long was placed over the affected area by the Geosynthetic Contractor followed by a HDPE Geomembrane flap of sufficient size to cover the GCL and extend over the break in the adjacent slope leading into the Phase 3 Cell. A geotextile cushion layer was then installed over the HDPE Geomembrane flap and the aggregate drainage layer replaced over the affected area. The overall dimensions of the modified tie-in were approximately 22 feet wide by 203 feet long. The CQA Engineer observed the work done as a part of the modified tie-in procedure. There was some initial concern that the aggregate drainage layer had become slightly contaminated with fine soil material washing from the Phase 2 Cell area; however, after the aggregate drainage layer was removed and observed, the CQA Engineer determined the contamination was minimal and should not affect the flow of leachate to the Phase 3 Cell area. A drawing showing the area along the Phase 3/Phase 2 connection where the additional GCL and HDPE Geomembrane was installed is included in Appendix III.C – Installation of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report. The as-built HDPE Geomembrane panel layout drawing for the Phase 3 Cell also defines this modified tie-in area and is included as "Drawing #4 Geomembrane" in Appendix VIII of the Construction Quality Assurance Certification Report prepared by Joyce Engineering, Inc. included in Section 5 of this report.

15.0 PHASE 3 LEACHATE COLLECTION LINE / PHASE 2 LEACHATE SEWER LINE VIDEO INSPECTION

In early August 2010, the main 8-inch (8") leachate collection system trunk lines serving the Phase 3 Cell area were video inspected by the Contractor. Copies of the inspections were digitally recorded along with the footage traveled by the camera as it moved along the pipe. Prior to beginning the video process, any liquid remaining in the lower reaches of the leachate collection system (i.e., sump area, etc.) was removed in order to provide clear pictures of the

interior of the pipe system. The videos of the 8-inch leachate collection system trunk lines were submitted to the Engineer for review. Based on the visual evidence recorded on the submitted videos, the 8-inch leachate collection system trunk lines, serving the Phase 3 Cell area, appear to be installed in general conformance with the Contract Documents. These pipe systems should function as leachate collection trunk lines for the Phase 3 Cell disposal area.

The Phase 2 leachate sewer collection line (Line LP-4), which was installed below the Phase 3 Cell liner system, was also video inspected in early August 2010. Prior to inspecting this line, it was jet cleaned to remove any sediment that may have entered the line during construction or prior to it being connected to the discharge line from the Phase 2 Cell sump area. The video of this line was digitally recorded along with the footage traveled by the camera as it moved along the pipe. The video of the inspection of the Phase 2 leachate sewer collection line was submitted to the Engineer for review. A review of this video by the Engineer revealed an apparent sag in the line at or about station 13+23 and extending approximately seventy-seven feet (77') to station 14+00. The Contractor was notified of the problem and instructed to prepare a schedule and work plan for correcting the apparent sag in the Phase 2 leachate sewer collection line. The repair of the Phase 2 leachate sewer collection line (Line LP-4) is discussed in the following paragraph.

16.0 PHASE 2 LEACHATE SEWER AND LINER REPAIR

The location of the segment of pipe (Line LP-4) requiring repair is in the northeastern quadrant of the Phase 3 Cell area approximately 110 feet west of the liner tie-in with the Phase 1 Cell and approximately 250 feet south of the north end of the cell. The slope of the cell floor in this area is approximately 3:1 down hill from east to west. The stationing of the apparent sag in line LP-4 begins at approximately station 13+23 and ends at approximately station 14+00. The stationing is based on the camera's recorded travel footage as shown on the video inspection recording. The exact location and footage of pipe requiring repair will be determined in the field once the line is uncovered and the elevations confirmed by field survey. The CQA testing/certification for the proposed leachate collection line repair is included in Appendix IX, Phase 2 Leachate Sewer and Liner Repair, of the Construction Quality Assurance Certification Report as prepared by Joyce Engineering, Inc. dated May 2010, revised June 2010 and October 2010, included in Section 5 of this report.

On September 28, 2010 the Contractor mobilized to the site to initiate the repair of the apparent sag in the Phase 2 leachate sewer collection line. In order to access the repair site, the contractor entered the cell area from the western side with the small track backhoe that would be used to remove the stone drainage layer and excavate the soil covering the leachate collection pipe. Prior to entering the site a small strip of the temporary rain cover system was carefully removed in order to allow equipment access with out damaging the rain cover material. The segment of pipe was field located and a portion of the rain cover was removed to expose a work area measuring approximately 7,800 square feet. The two-feet of stone drainage layer was removed

and stockpiled within the work area. The exposed liner materials, comprised of the 16-oz. nonwoven fabric, 60-mil HDPE geomembrane and the geosynthetic clay liner (GCL), were removed and eventually discarded due to damage sustained during the removal process. The pipe segment in question was uncovered with careful attention paid to the location and segregation of the stockpiled soil material so as not to contaminate the surrounding stone drainage layer. The elevations of the exposed pipe segment were checked by field survey and the extent of the proposed repair length adjusted to ensure positive flow before, through and after repaired pipe segment. The elevations of the pipe segment were adjusted under the observation of the Engineer's representative. Once the pipe adjustments were complete, the excavated material was placed and compacted in lifts in much the same order as it was removed. The placement and compaction of the soil material was observed by the Engineer's representative. The CQA Engineer arrived on site on September 30, 2010 and conducted soil density tests on the compacted clay liner portion of the backfilled pipe excavation prior to the placement of the liner system. New GCL, 60-mil textured HDPE geomembrane and nonwoven geotextile were delivered to the site and utilized in the repair. The CQA Engineer observed the placement of the GCL and the 60-mil textured HDPE geomembrane over the area of the repair. The following day the CQA Engineer observed the seaming/welding of the new geomembrane liner system to the existing liner system and the field testing of the seams/welds to ensure compliance with the Contract Documents. Following completion of the geomembrane liner system, the CQA Engineer observed the placement of the nonwoven geotextile fabric and the initial placement of the stone drainage layer on the textile covered repair area. The remaining stone drainage layer was replaced and the equipment removed from the repair area. The rain cover was reinstalled across the repair area and the equipment access route. Appendix IX of the Construction Quality Assurance Certification Report, prepared by Joyce Engineering, Inc. and submitted to McGill Associates for review, is a compilation of the CQA data and submittals associated with the repair of the Phase 2 leachate collection pipe. The Phase 2 leachate sewer collection line (Line LP-4) should function as a drain line for the sump system associated with the Phase 2 Cell area.

A review of the CQA Report revealed that an apparent 10-oz. nonwoven geotextile fabric had been placed as a protective cover over the 60-mil HDPE geomembrane in the repair area. The 10-oz nonwoven fabric utilized in lieu of the 16-oz. nonwoven geotextile fabric specified in the Contract Documents was apparently placed in error. The Contractor was notified of the situation. Discussions were held to determine the best way to remedy the situation without risking damage to the cell's liner system. It was decided that in lieu of removing the stone drainage layer and adding to or replacing the nonwoven geotextile fabric in the repair area, the Contractor would be allowed to provide an engineering certification stating that the installed 10-oz. nonwoven geotextile would provide adequate protection for the geomembrane liner material. The Contractor opted to pursue this remedy. McGill Associates provided the Contractor with minimum design criteria for conducting the evaluation of the 10-oz. nonwoven geotextile's use in lieu of the specified 16-oz nonwoven geotextile fabric. A copy of the design requirements provided by McGill Associates is included in Section 11, Phase 2 Leachate Sewer and Liner Repair, of this report. The Contractor engaged the services of Joyce Engineering, Inc. to evaluate the suitability of the 10-oz. nonwoven geotextile in lieu of the specified 16-oz.

nonwoven geotextile. The evaluation was performed and the findings transmitted to the Contractor in a letter from Joyce Engineering, Inc. dated December 15, 2010. The Contractor officially transmitted the evaluation to McGill Associates in a letter dated December 29, 2010. Joyce Engineering, Inc. provided an opinion and a certification prepared by a professional engineer, registered in the State of North Carolina, that the 10-oz. nonwoven geotextile fabric will deliver an adequate factor of safety (3.2) against puncture based on the loading scenario provided by McGill Associates. Copies of the December 15, 2010 letter from Joyce Engineering, Inc. to Thalle Construction Company and the December 29, 2010 letter from Thalle Construction Company to McGill Associates are included in Section 11, Phase 2 Leachate Sewer and Liner Repair of this report. McGill Associates reviewed the engineering evaluation for conformance with the evaluation criteria and general engineering standards and practices.

In conclusion, the opinion is the 10-oz. nonwoven geotextile fabric, used as a cushion material for the geomembrane liner as a part of the repair of the Phase 2 leachate collection line, will meet the performance standards for the project relative to the required factor of safety against liner puncture. The factor of safety against puncture is based on the loading criteria for this particular location within the Phase 3 Cell area.

END

SECTIONS

SECTION 1: PERMIT TO CONSTRUCT

SECTION 2: TECHNICAL SPECIFICATIONS

SECTION 3: SITE SPECIFIC CONSTRUCTION QUALITY ASSURANCE PLAN

SECTION 4: CONTRACT DRAWINGS

SECTION 5: CONSTRUCTION QUALITY ASSURANCE CERTIFICATION REPORT
Prepared by: Joyce Engineering, Inc.
May 2010, Revised June 2010,
Revised October 2010

SECTION 6: WELL ABANDONMENT

SECTION 7: LEACHATE SEWER LINE PRESSURE TEST RESULTS

SECTION 8: ROCK PINNACLE BLASTING OPERATIONS

SECTION 9: LEACHATE COLLECTION REMOVAL SYSTEM

SECTION 10: PHASE 3 / PHASE 2 ANCHOR TRENCH MODIFICATIONS

SECTION 11: PHASE 2 LEACHATE SEWER AND LINER REPAIR

JOYCE ENGINEERING, INC.

Waste Industry Experts

Joyce Engineering, Inc.
2211 West Meadowview Rd
Suite 101
Greensboro, NC 27407

tel: **336/323-0092**
fax: **336/323-0093**

www.JoyceEngineering.com

October 28, 2010

Mr. Jeff Bishop, P.E.
McGill Associates
55 Broad Street
Asheville, NC 28801

RE: Construction Quality Assurance Certification Report Revision
White Oak Landfill, Phase 3 Expansion
NC DENR Permit #44-07
Haywood County, North Carolina
JEI Project No. 801.0900.11, Task 01

Dear Jeff:

This letter to my knowledge and belief certifies the Haywood County Phase 3 MSW Landfill has been constructed in conformance with the plans and specifications.

The enclosed revision Appendix 9 to the Phase 3 Certification Report presents an accumulation of field, laboratory, and other quality assurance data for the leachate sewer and liner repair construction. It is our understanding that the enclosed construction quality assurance documentation was compiled in accordance with North Carolina Solid Waste Regulations, 15A NCAC 13B and fulfills the submittal requirements in the General Permit Conditions of Permit 44-07, and modification to the Permit to Construct for the MSW landfill unit Phase 3 (October 7, 2009).

The leachate sewer and liner repair work CQA services were conducted as continuation with our agreement with Haywood County, and the Appendix 9 to the CQA report will be part of the final submittal to the North Carolina DENR following the completion of the project. We appreciate the opportunity to work together with McGill Associates on this project. If you have any comments regarding the report, please feel free to contact us.

Sincerely,
JOYCE ENGINEERING, INC.

Evan Andrews, P.E.
Project Manager

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER EVAN E ANDREWS
10/29/31

Enclosure

Copy: Mr. Stephen King, Director, (Haywood County),

P:\Haywood White Oak LF\Phase 3\CQA\Repair\Certification letter October 2010.docx

Prepared for:
Haywood County
Department of Solid Waste
278 Recycle Road
Clyde, NC 28721

WHITE OAK LANDFILL
PHASE 3 CONSTRUCTION
NC DENR PERMIT # 44-07

CONSTRUCTION QUALITY ASSURANCE CERTIFICATION REPORT

May 2010
Revised June 2010
Revised October 2010

Prepared by:

11/1/10

JOYCE ENGINEERING, INC.

2211 West Meadowview Road,
Boone Bldg, Suite 101
Greensboro, North Carolina 27407
JEI Project No. 801.0900.11, TASK 01
NC Corporate License: C-0782

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Appendix IX

APPENDIX IX.A

Narrative – Leachate Sewer and Liner Repair

Appendix IX - Phase 2 Leachate Sewer and Liner Repair

During the last week of September 2010 McGill Associates directed the Contractor to correct a segment of the Phase 2 leachate sewer drain line. Thalle Construction Company opened the area identified by the engineer and reinstalled the segment of pipe to provide positive flow. A field representative of Geotechnics observed the soil liner rework and provided in place moisture and density testing utilizing a nuclear density gauge. The field test results and daily activity report are included in Appendix IX. Table 3, Soil Liner Construction Testing Results, has been amended to include the rework test results.

Hallaton Inc. mobilized to conduct the geosynthetic liner repair following the completed soil liner rework. Geotechnics representative observed the Geosynthetic Clay Liner (GCL) installation, the HDPE geomembrane repair over the GCL and placement of the geotextile. Extrusion welder trial weld peel/shear field testing results and the geosynthetic materials certificates and conformance testing results are included in Appendix IX.

APPENDIX IX.B

Geotechnics Daily Activity Log

Day: Thursday
Date: 9.30.10
Log No.:
Page: 1

Geotechnics
INTEGRITY IN TESTING

Daily Field Activity Log

Project Name:	White Oak MSW LF Phase III	**Project No.:**	2009-666
Client Name:	Joyce Engineering	**Client Contact:**	Hannu Kemppinen
Site Location:	Haywood County,North Carolina	**Time on Site:**	**Arrived:** 7:00am **Departed:** 6:00pm
General Contractor:	Thalle Construction	**Superintendent:**	Keith Vess

Other Firms / Sub-Contractor Represented On Site

Firm / Sub-Contractor	Representative's Name and Title
Hallaton	
McGill & Assoc.	David Pasko
McGill & Assoc.	Jeff Bishop

Weather Conditions:	LT RAIN	**Temperature:**	60's
Contractor's Equipment:	1 Deere 120C track hoe, Wacker RTSC2 trench compactor, 1 CAT skid steer		
Contractor's Personnel:	1 foreman, 2 operators / 1 liner foreman, 2 installers		

Description of Daily Activities & Events

- Geotechnics Rep arrived onsite.
- Work performed prior to Geotechnics representative arrival to the site was observed by David Pasko of Mc Gill and Assoc.
- Thalle had placed structural fill and compacted clay liner prior to Geotechnics rep arrival. Nuclear density testing was conducted on the compacted clay liner in the repair area (see CCLND-11 for results). No shelby tubes were pushed, Jeff Bishop stated that the density testing should be adequate since the soil material was tested during the initial liner construction.
- Hallaton placed 7 panels of GCL, 14' wide by 25' long, parallel to the slope with 1'-2' overlap on all sides. Granulated bentonite was spread in the overlapping seams.
- Hallaton placed 1 panel of HDPE, 22' wide by 90' long, perpendicular to the slope. Liner was thermal bonded in place by lyster. HDPE edges over lapped 1'-2' of exsisting HDPE liner.
- Geotechnics Rep returned to motel.

Prepared By: David Wright Date: 9.30.10 **Checked By:** MMS Date: 10-28-10

2200 Westinghouse Boulevard • Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460

Day: Friday
Date: 10.1.10
Log No.:
Page: 1

Geotechnics
INTEGRITY IN TESTING

Daily Field Activity Log

Project Name:	White Oak MSW LF Phase III	**Project No.:**	2009-666
Client Name:	Joyce Engineering	**Client Contact:**	Hannu Kemppinen
Site Location:	Haywood County,North Carolina	**Time on Site:**	**Arrived:** 7:00am **Departed:** 10:30am
General Contractor:	Thalle Construction	**Superintendent:**	Keith Vess

Other Firms / Sub-Contractor Represented On Site

Firm / Sub-Contractor	Representative's Name and Title
Hallaton McGill & Assoc.	Jeff Bishop

Weather Conditions:	SUNNY	**Temperature:**	60's
Contractor's Equipment:	1 Deere 120C track hoe, Wacker RTSC2 trench compactor, 1 CAT skid steer		
Contractor's Personnel:	1 foreman, 2 operators / 1 liner foreman, 2 installers		

Description of Daily Activities & Events

- Geotechnics Rep arrived onsite.
- Hallaton started extrusion welding of patched repair area. Lystered edges were ground to ensure a proper adhesion of the weld. Welding was done within 5 minutes of seem being scarified. Visual inspection and vaccum testing was conducted after the repair was welded. Air testing showed no leaks in the repaired area.
- Geotextile was placed over the repair area and thermal bonded together by lyster. Remaining original textile was cleaned of debri above and beneath it. The new and original textile was thermal bonded together. Repair area, 26' x 93' in size with 7 panels placed parallel with the slope.
- Thalle started placement of stone on the textile covered repair area.
- Geotechnics Rep met up with Jeff Bishop to discuss any questions or concerns. Jeff Bishop stated he was satisfied with the information gathered for the overall repair.
- Geotechnics Rep returned to lab.

Prepared By: David Wright **Date:** 10.1.10 **Checked By:** MPS **Date:** 10-20-10

2200 Westinghouse Boulevard • Suite 103 • Raleigh, NC 27604 • Phone (919) 876-0405 • Fax (919) 876-0460

Client: Joyce Engineering
Project Name : White Oak MSW LF Phase III
Project Number : 2009-666

Geotechnics
INTEGRITY IN TESTING

Field Density Test Report

Report Number :	Underdrain Repair	Geotechnics Representative : David Wright	Page : 1 of 1
Date (s) :	9.30.10	Reviewed By : [signature]	Date : 10-5-10

Contractor :	Thalle Construction	Borrow Source :	Previously placed clay liner

Compaction Equipment :	Wacker RTSC2 trench compactor

Test Number	Test Location	Elevation/ Lift	Rod Depth	Proctor I.D. No.	Proctor Data		Measured In Place			Compaction		Comments
					MDD pcf	Opt. %M	WD (pcf)	% M	DD (pcf)	% C	% Req.	
CCLND 1	SE COR. REPAIR	SG	6"	666-02-06	98.8	22.0	122.2	26.2	96.8	98.0%	95.0%	
CCLND 2	SW COR. REPAIR	SG	6"	666-02-06	98.8	22.0	129.6	24.7	103.9	105.2%	95.0%	
CCLND 3	NW COR. REPAIR	SG	6"	666-02-06	98.8	22.0	118.9	24.1	95.8	97.0%	95.0%	
CCLND 4	NE COR REPAIR	SG	6"	666-02-06	98.8	22.0	121.7	25.8	96.7	97.9%	95.0%	
CCLND 5	SE COR. REPAIR	SG	12"	666-02-06	98.8	22.0	120.7	23.4	97.8	99.0%	95.0%	
CCLND 6	SW COR. REPAIR	SG	12"	666-02-06	98.8	22.0	126.1	24.6	101.2	102.4%	95.0%	
CCLND 7	NW COR. REPAIR	SG	12"	666-02-06	98.8	22.0	123.9	26.3	98.1	99.3%	95.0%	
CCLND 8	NE COR REPAIR	SG	12"	666-02-06	98.8	22.0	121.6	23.3	98.6	99.8%	95.0%	

Gauge Number	Gauge Model	Density Count	Moisture Count
33260	3440	2579	715

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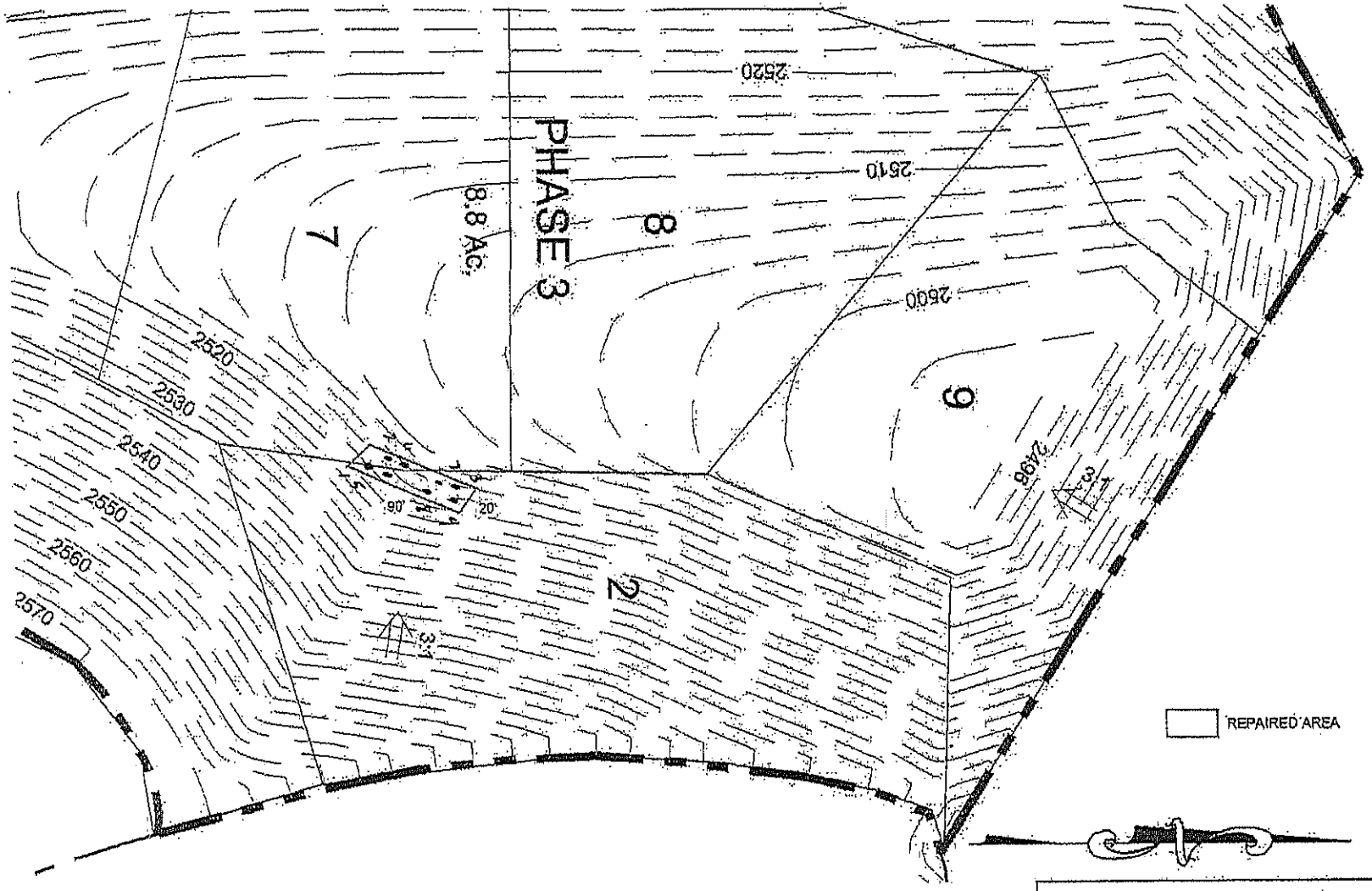


WHITE OAK MSW LANDFILL PHASE 3 CONSTRUCTION	
DATE: 9/29/10 TO 10/1/10	PREPARED BY: D. WRIGHT
FDR: DFR	SCALE: NOT TO SCALE
LOCATION: HAYWOOD COUNTY, NC	geotechnics

Geotechnics
INTEGRITY IN TESTING

Project Name: White Oak MSW LF Phase III
Project Location: Haywood County, NC
Geosynthetics Installer: Hallaton
Material: 60 mil HDPE
CQA Technician: D. Wright
Day and Date: Friday 10.1.10
Page: 1 of 1

Primary Geomembrane Trial Seam Log

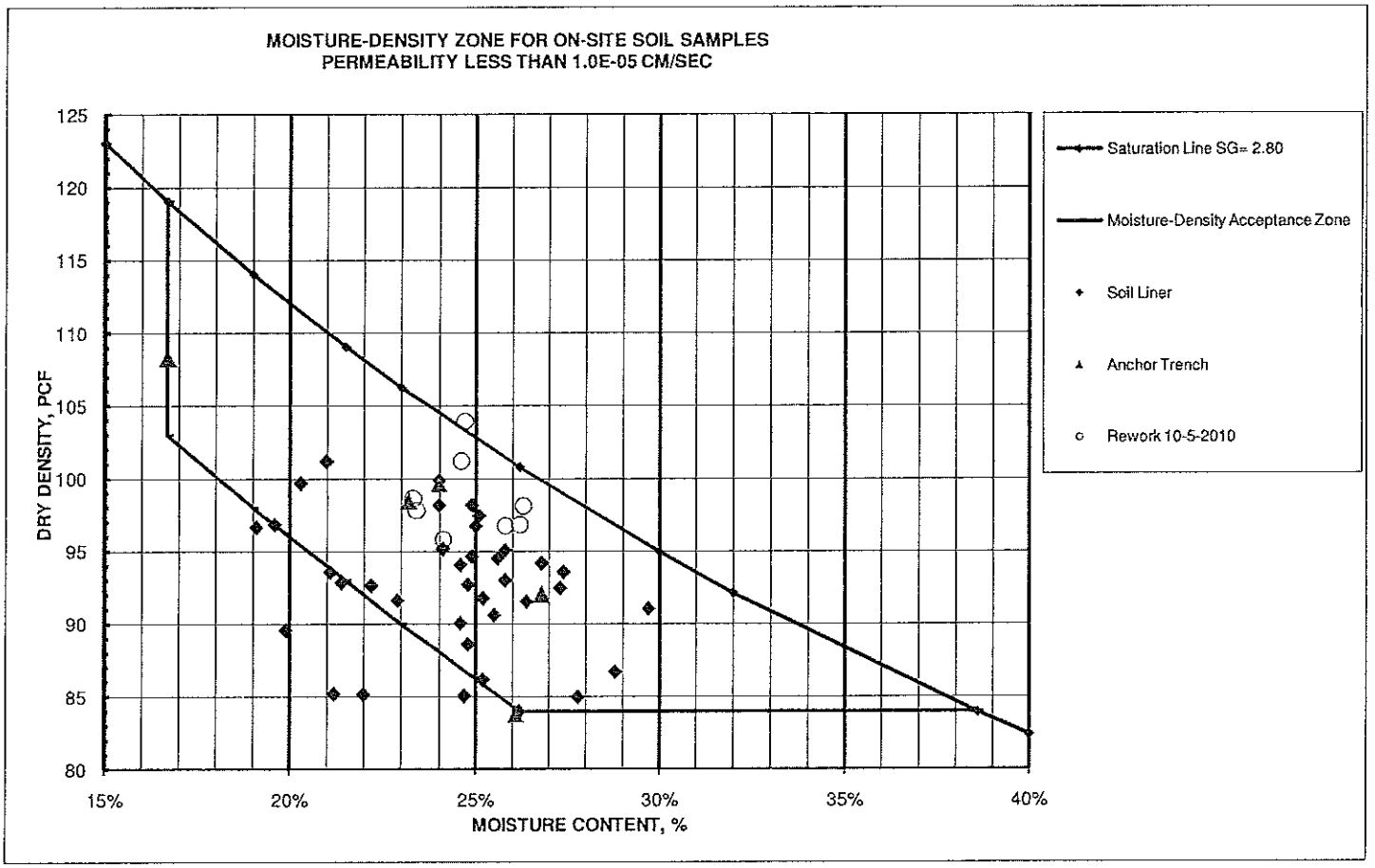
Project Seam Requirements: (Fusion) Peel 91 ppi Shear 120 ppi
Project Seam Requirements: (Extrusion) Peel 78 ppi Shear 120 ppi

Prerequisites				Test Results, ppi				
Sample	Time	Amb.Temp.	Welder ID	Peel		Shear	Pass or Fail	Notes
TS-01	7:00AM	60	EXT X9	99	96	145	PASS	
Wedge		Extruder		101	114	161	PASS	
Temp.	Speed	Preheat	Temp.	121	119	158	PASS	
NA	NA	510	600					
Sample	Time	Amb.Temp.	Welder ID	Peel		Shear	Pass or Fail	Notes
Wedge		Extruder						
Temp.	Speed	Preheat	Temp.					
Sample	Time	Amb.Temp.	Welder ID	Peel		Shear	Pass or Fail	Notes
Wedge		Extruder						
Temp.	Speed	Preheat	Temp.					
Sample	Time	Amb.Temp.	Welder ID	Peel		Shear	Pass or Fail	Notes
Wedge		Extruder						
Temp.	Speed	Preheat	Temp.					
Sample	Time	Amb.Temp.	Welder ID	Peel		Shear	Pass or Fail	Notes
Wedge		Extruder						
Temp.	Speed	Preheat	Temp.					

APPENDIX IX.C

Revised Table 3 Soil Liner Construction Testing Results

TABLE 3
SOIL LINER CONSTRUCTION TESTING RESULTS



		SOIL LINER Construction started on September 11, 2009												
Lab ID	Tube	ACRE	LIFT	WD	MC	DD	K cm/sec	LL	PL	PI	USCS	Gravel	Sand	Silt/Clay
No.	No.	Ref.		pcf	%	pcf						%	%	%
666-06-01	ST-9	A1	L1	119.9	20.3%	99.7	1.7E-07	45	31	14	ML	5.15	33.21	61.64
666-06-02	ST-10	A1	L2	122.4	21.0%	101.2	4.5E-07	47	34	13	ML	2.93	41.66	55.41
666-07-05	ST-15	A1	L3	118.1	24.1%	95.2	5.7E-07	40	35	5	ML	3.49	47.20	49.31
666-07-01	ST-11	A2	L1	115.8	19.6%	96.8	1.4E-06	43	35	8	ML	3.54	46.65	49.81
666-07-03	ST-13	A2	L2	118.1	29.7%	91.1	1.7E-07	49	38	11	ML	1.01	36.45	62.54
666-07-06	ST-16	A2	L3	118.7	25.6%	94.5	3.4E-07	46	34	12	ML	0.92	47.58	51.50
666-08-01	ST-18	A3	L1	121.9	25.1%	97.4	3.4E-07	50	41	9	MH	3.37	41.10	55.53
666-08-02	ST-19	A3	L2	120.9	25.0%	96.7	1.8E-07	48	35	13	ML	4.78	39.32	55.90
666-09-01	ST-20	A3	L3	123.8	24.0%	99.8	3.0E-07	45	37	8	ML	5.46	43.97	50.57
666-10-06	ST-32	A4	L1	112.2	24.6%	90.0	4.2E-06	48	38	10	ML	0.58	34.32	65.10
666-09-07	ST-33	A4	L2	113.2	22.2%	92.6	7.2E-06	47	39	8	ML	0.08	40.02	59.90
666-12-03	ST-34	A4	L3	117.2	24.6%	94.1	4.7E-06	45	39	6	ML	0.27	41.94	57.79
666-09-05	ST-24	A5	L1	119.2	27.4%	93.6	4.3E-07	45	35	10	ML	0.53	36.36	63.11
666-09-10	ST-29	A5	L2	110.6	24.8%	88.6	2.7E-06	48	42	6	ML	1.03	35.81	63.16
666-10-05	ST-30	A5	L3	113.3	21.1%	93.6	9.5E-06	44	39	5	ML	0.24	38.41	61.35

Lab ID	Tube	ACRE	LIFT	WD	MC	DD	K cm/sec	LL	PL	PI	USCS	Gravel	Sand	Silt/Clay
No.	No.	Ref.		pcf	%	pcf						%	%	%
666-09-02	ST-21	A6	L1	121.7	24.0%	98.1	1.8E-07	55	33	22	MH	0.45	37.06	62.49
666-09-03	ST-22	A6	L2	112.7	21.4%	92.8	2.4E-05	37	32	5	ML	3.38	42.02	54.60
666-09-03	ST-22B	A6	L2B	115.1	19.1%	96.6	3.9E-05	37	32	5	ML	3.38	42.02	54.60
666-10-03	ST-22A	A6	L2R	115.7	24.8%	92.7	2.3E-06	49	41	8	ML	0.45	38.94	60.61
666-09-04	ST-23	A6	L3	111.7	28.8%	86.72	5.7E-06	45	38	7	ML	0.50	38.85	60.65
666-11-01	ST-23A	A6	L3R	108.6	27.8%	85.0	2.8E-06	45	38	7	ML	0.15	36.03	63.82
666-09-06	ST-25	A7	L1	115.7	26.4%	91.5	1.4E-06	47	39	8	ML	2.16	43.03	54.81
666-09-08	ST-27	A7	L2	103.9	22.0%	85.2	1.5E-05	47	43	4	ML	0.22	38.28	61.50
666-10-04	ST-27A	A7	L2	119.4	26.8%	94.2	1.3E-06	44	38	6	ML	0.79	53.63	45.58
666-12-04	ST-35	A7	L3	106.1	24.7%	85.1	3.2E-05	47	39	8	ML	3.87	40.50	55.63
666-14-01	ST-35A	A7	L3R	107.4	19.9%	89.6	5.6E-06	49	41	8	ML	6.3	34.36	59.34
666-09-07	ST-26	A8	L1	117.7	27.3%	92.5	1.4E-06	43	34	9	ML	1.65	36.33	62.02
666-09-09	ST-28	A8	L2	103.3	21.2%	85.2	8.8E-05	45	40	5	ML	0.56	44.67	54.77
666-12-02	ST-28A	A8	L2R	117.0	25.8%	93.0	4.9E-06	47	37	10	ML	1.58	36.19	62.23
666-12-01	ST-31	A8	L3	106.0	26.2%	84.0	3.7E-06	47	39	8	ML	0.13	41.27	58.60
666-07-02	ST-12	A9A	L1	119.6	25.8%	95.1	8.0E-07	47	36	11	ML	5.26	44.17	50.57
666-07-04	ST-14	A9A	L2	113.7	25.5%	90.6	2.1E-06	46	36	10	ML	3.12	44.41	52.47
666-07-07	ST-17	A9A	L3	122.6	24.9%	98.2	1.1E-07	49	33	16	ML	1.67	39.61	58.72
666-13-01	ST-36	A9B	L1	114.9	25.2%	91.8	3.3E-05	46	36	10	ML	0.17	43.19	56.64
666-13-01	ST-36A	A9BR	L1	112.6	22.9%	91.6	8.0E-06	50	36	14	MH	4.21	43.69	52.10
666-13-02	ST-37	A9B	L2	107.9	25.2%	86.2	9.9E-06	51	43	8	MH	0.53	43.87	55.60
666-13-03	ST-38	A9B	L3	118.2	24.9%	94.6	2.8E-06	51	43	8	MH	0.99	38.1	60.91
PERIMETER ANCHOR TRENCH														
666-10-01	ST-1	PH1 CCH3		121.3	23.2%	98.5	5.3E-07	45	33	12	ML	0.39	42.53	57.08
666-10-02	ST-2	PH2		105.7	26.1%	83.8	1.0E-04	37	35	2	ML	0	46.81	53.19
666-10-02	ST-2R	PH2 B		116.7	26.8%	92.0	9.3E-05	37	35	2	ML	0	46.81	53.19
666-13-04	ST-3	PH1		126.4	16.7%	108.3	4.0E-07	49	31	18	ML	5.78	57.89	36.33
666-13-05	ST-4	PH1		123.6	24.0%	99.7	1.0E-05	43	32	11	ML	8.22	68.68	23.10
REWORKED SOIL LINER OCTOBER 5-2010														
				Proctor		Measured in Place			Compaction					
Field ID	Tube	Acre	Lift	MDD	OMC	WD	%M	DD	%C	%R				
CCLND 1	NA	A2	L3	98.8	22.0%	122.2	26.2%	96.8	98.0	95				
CCLND 2	NA	A7	L3	98.8	22.0%	129.6	24.7%	103.9	105.2	95				
CCLND 3	NA	A2	L3	98.8	22.0%	118.9	24.1%	95.8	97.0	95				
CCLND 4	NA	A2	L3	98.8	22.0%	121.7	25.8%	96.7	97.9	95				
CCLND 5	NA	A2	L2	98.8	22.0%	120.7	23.4%	97.8	99.0	95				
CCLND 6	NA	A7	L2	98.8	22.0%	126.1	24.6%	101.2	102.4	95				
CCLND 7	NA	A2	L2	98.8	22.0%	123.9	26.3%	98.1	99.3	95				
CCLND 8	NA	A2	L2	98.8	22.0%	121.6	23.3%	98.6	99.8	95				

Notes:
ST = Shelby Tube
A = Acre designation
L = Lift designation
L2B = Lift 2 backup sample
L2R = Lift 2 reworked and resampled
9A = Acre 9 berm construction
9B = Acre 9 sump and floor constrcution
Moisture-Density Acceptance Zone defined to include most passing results.
%C = Percent Compaction
%R = Percent Required

APPENDIX IX.D

CETCO Manufacturer Certification (MQA/MQC)

CETCO®

GAI-LAP accredited

Date: 9/30/2010
Purchase Order: P7256
ORDER NUMBER: 000266492

Kennedy Garber/ Ann Gibson
Hallaton

Sparks, MD 21152
kgarber@hallaton.com cc. agibson@hallaton.com

To Whom it May Concern:

Please find enclosed the MQA/MQC test data package for Geosynthetic Clay Liner shipments to Hallaton.

The enclosed data package includes results of all the MQC tests required by ASTM D5889, with the exception of index flux/hydraulic conductivity. This test, which is run according to ASTM D5887, is normally performed once per production lot (once per week), unless a higher frequency is required by the project specifications. Because of the GCL's low permeability, this test can take several weeks to complete. The index flux/hydraulic conductivity results associated with this lot of material will be provided under separate cover as soon as they are available.

Although the index flux/hydraulic conductivity test results are not yet available, CETCO accepts responsibility for our GCL should the index flux/hydraulic conductivity tests produce unacceptable results. If, upon delivery and prior to installation, individual rolls of GCL are found to be nonconforming to accepted project specifications, CETCO will replace the nonconforming material at no charge.

Questions regarding this information should be directed to Chris Athanassopoulos, Technical Support Engineer, at (847) 851-1831.

Sincerely,

Melanie King

Melanie King
Quality Assurance Coordinator
CETCO Cartersville Plant

GEOSYNTHETIC CLAY LINER
MANUFACTURING QUALITY ASSURANCE DATA PACKAGE

PROJECT NAME: Hallaton
CUSTOMER P.O.: P7256
ORDER NUMBER: 000266492
PREPARED FOR: Hallaton

CONTENTS:

- Product Certifications
- GCL Order packing list and MQA tracking form
- GCL manufacturing quality control test data
- Bentonite clay certification
- Raw material test results

PREPARED BY: Melanie King
Quality Assurance Coordinator
CETCO
218 Industrial Park

Cartersville, GA 30121
Telephone: (770) 387-7773
E-Mail: melanie.king@cetco.com

CETCO

PRODUCT CERTIFICATIONS

PROJECT NAME: Hallaton
CUSTOMER P.O.: P7256
ORDER NUMBERS: 000266492
PREPARED FOR: Hallaton

The GCL manufactured for the above-referenced order number(s) is certified to meet the values listed in the tables below:

GCL PROPERTY SPECIFICATIONS FOR BENTOMAT ST

Test Method	Test Method Property	Test Frequency	Certified Value
ASTM D 5891	Bentonite Fluid Loss	1 per 50 Tons	18 ml Max
ASTM D 5993	Bentonite Mass/Area	40,000 sq ft (4000 sq m)	0.75 lb /sq ft Min
ASTM D 5890	Bentonite Swell Index	1 per 50 Tons	24 ml/2g Min
ASTM D 6768	GCL Grab Strength	200,000 sq ft (20,000 sq m)	30 lbs/in MARV
ASTM D 6243	GCL Hydrated Internal Shear Strength	Periodic	500 psf typ @ 200 psf normal load
ASTM D 5887	GCL Hydraulic Conductivity	Weekly	5.0E-9 cm/s Max
ASTM D 5887	GCL Index Flux	Weekly	1.0E-8 m3/m2/s Max
ASTM D 6496	GCL Peel Strength	40,000 sq ft (4000 sq m)	3.5 lbs/in Min

Bentonite property tests are performed at a bentonite processing facility before shipment to CETCO's production facility.
All tensile testing is in the machine direction using ASTM D 6768. All peel strength testing is performed using ASTM D 6496. Upon request tensile and peel results can be reported per modified ASTM D 4632 using 4 inch grips.

NEEDLE DETECTION AND REMOVAL PROCEDURE

CETCO hereby affirms that all Bentomat® geosynthetic clay liner material manufactured for this project is continually passed under a magnet for needle removal and then screened with a metal detection device. CETCO certifies Bentomat® to be essentially free of broken needles and fragments of needles that would negatively effect the performance of the final product.

Melanie King

Melanie King
Quality Assurance Coordinator

CETCO

GCL PACKING LIST AND MQA TRACKING FORM

Listing of finished and raw materials used to produce certification package number 000266492

GCL								Geotextiles				Clay
CV-BENTOMAT ST								N/W-WHITE			WOVEN	CV-CG 50
Order	GCL Lot #	GCL Roll #	Length	Width	weight	sq ft	Roll # Tested	Cap Lot #	Cap Roll #	Roll # Tested	Base Roll #	Clay Lot #
000266492	200951CV	11167	133	15	2306	1995	11153	2020552642			2020502211	937017B
000266492	201023CV	3542	135	15	2405	2025	3536	201023CV	00002214	00002205	2020884888	963165B
000266492	201029CV	5924	135	15	2764	2025	5918	201029CV	00002857	00002857	2020826953	971292A
000266492	201032CV	7106	111	15	2072	1665	7103	2021090619			2021105900	975453A
000266492	201032CV	7338	118	15	2146	1770	7338	201032CV	00003349	00003349	2021090911	975451A
000266492	201038CV	8713	200	15	3502	3000	8712	201038CV	00004108	00004104	WEA015835-13	979991B
						Total sq ft:	12480				Total Number of Rolls Certified: 6	

GCL MANUFACTURING QUALITY CONTROL TEST DATA

The following rolls in GCL certification package number 000266492 have been tested in our production facility lab.

Product	Lot # Tested	Roll # Tested	Mass Area	Grab Strength	Peel Strength 6496
		ASTM Test Method:	D 5993	D 6768	D 6496
		Required Value:	0.75 lb /sq ft Min	30 lbs/in MARV	3.5 lbs/in Min
CV-BENTOMAT ST	200951CV	11153	0.87	52.9	6.4
CV-BENTOMAT ST	201023CV	3536	0.88	83.3	6.7
CV-BENTOMAT ST	201029CV	5918	0.86	35.9	6.1
CV-BENTOMAT ST	201032CV	7103	0.88	83.5	5.8
CV-BENTOMAT ST	201032CV	7338	0.88	77.1	13.2
CV-BENTOMAT ST	201038CV	8712	0.85	66.8	7.4

BENTONITE CLAY CERTIFICATION

The Bentonite Clay used to produce package 000266492

has been tested by American Colloid Company and yielded the following test results.

Clay Lot #	Moist	Swell	Fluid Loss
ASTM Test Method:	D 2216	D 5890	D 5891
Required Value:	12% Max	24 ml/2g Min	18 ml Max
937017B	10.90	27.00	15.80
963165B	9.60	25.00	14.60
971292A	10.40	26.00	14.80
975453A	8.30	33.00	16.80
975451A	10.30	33.00	14.60
979991B	8.75	24.00	17.78

GEOTEXTILE TEST RESULTS FROM MATERIAL SUPPLIERS

The GCL in certification package number 000266492 was manufactured with geotextiles which were tested with the following results.

BASE GEOTEXTILE			
Material	Roll Number	Mass Area oz/yd2	Grab Strength lbs
PPX 82TEX	2020502211	3.3	169.5
PPX 82TEX	2020826953	3.5	152.7
PPX 82TEX	2020884888	3.4	165.2
PPX 82TEX	2021090913	3.6	161.1
PPX 82TEX	2021105900	3.3	177.3
MATTEX	WEA015835-13	3.5	180.3

COVER GEOTEXTILE			
Material	Roll Number	Mass Area oz/yd2	Grab Strength lbs
PPX 650	2020552642	7.9	147.0
PPX 650	2021090619	7.5	112.4
CV-NON-WOVEN	00002205	6.5	54.0
CV-NON-WOVEN	00002857	6.6	43.6
CV-NON-WOVEN	00003349	6.5	42.8
CV-NON-WOVEN	00004104	6.3	35.4

Certifications from our suppliers are on file at our production facility.

An '*' or 'PT' indicates supplier certifications were unavailable prior to shipping so testing was performed at a CETCO lab.

APPENDIX IX.E

AGRU Manufacturer Certification (MQA/MQC)

microspike liner
HDPE
60 mil

Hallaton Midshore II LF doc 12181
Easton, MD
154 rolls 60 HD microspike | 154 | left
20 spools 5mm HD weld rod

PO# P6885

	roll #	METRIC DIMENSIONS width	length	area						
	(K)230228 .09	7	125	875	Hallaton MidShore II	154tot	1	3006	Stage sqs + 2Ft	7190232
	(K)230229 .09	7	125	875	Hallaton MidShore II	154tot	2	2995		7190232
	(K)230230 .09	7	125	875	Hallaton MidShore II	154tot	3	3004		7190232
	(K)230231 .09	7	125	875	Hallaton MidShore II	154tot	4	3006		7190232
	(K)230232 .09	7	125	875	Hallaton MidShore II	154tot	5	3002		7190232
	(K)230233 .09	7	125	875	Hallaton MidShore II	154tot	6	3009		7190232
	(K)230234 .09	7	125	875	Hallaton MidShore II	154tot	7	3012		7190232
	(K)230235 .09	7	125	875	Hallaton MidShore II	154tot	8	3020		7190232
	(K)230236 .09	7	125	875	Hallaton MidShore II	154tot	9	3098		7190232
	(K)230237 .09	7	125	875	Hallaton MidShore II	154tot	10	3027		7190232
	(K)230238 .09	7	125	875	Hallaton MidShore II	154tot	11	3023		7190232
	(K)230239 .09	7	125	875	Hallaton MidShore II	154tot	12	3026		7190232
	(K)230240 .09	7	125	875	Hallaton MidShore II	154tot	13	3018		7190232
	(K)230241 .09	7	125	875	Hallaton MidShore II	154tot	14	3021		7190232
	(K)230242 .09	7	125	875	Hallaton MidShore II	154tot	15	3023		7190232
	(K)230343 .09	7	125	875	Hallaton MidShore II	154tot	16	3020		7190232
	(K)230344 .09	7	125	875	Hallaton MidShore II	154tot	17	3009		7190232
	(K)230345 .09	7	125	875	Hallaton MidShore II	154tot	18	3024		7190232
	(K)230346 .09	7	125	875	Hallaton MidShore II	154tot	19	3016		7190232
	(K)230347 .09	7	125	875	Hallaton MidShore II	154tot	20	3009		7190232
	(K)230348 .09	7	125	875	Hallaton MidShore II	154tot	21	3009		7190232
	(K)230349 .09	7	125	875	Hallaton MidShore II	154tot	22	3004	SQS	7190232
	(K)230350 .09	7	125	875	Hallaton MidShore II	154tot	23	3015		7190232
	(K)230351 .09	7	125	875	Hallaton MidShore II	154tot	24	3020		7190230
	(K)230352 .09	7	125	875	Hallaton MidShore II	154tot	25	3029		7190230
	(K)230353 .09	7	125	875	Hallaton MidShore II	154tot	26	3034		7190230
	(K)230354 .09	7	125	875	Hallaton MidShore II	154tot	27	3014		7190230
	(K)230355 .09	7	125	875	Hallaton MidShore II	154tot	28	3010		7190230
	(K)230356 .09	7	125	875	Hallaton MidShore II	154tot	29	2998		7190230
	(K)230357 .09	7	125	875	Hallaton MidShore II	154tot	30	2995		7190230
	(K)230358 .09	7	125	875	Hallaton MidShore II	154tot	31	2990		7190230
	(K)230359 .09	7	125	875	Hallaton MidShore II	154tot	32	2983		7190230
	(K)230360 .09	7	125	875	Hallaton MidShore II	154tot	33	2993		7190230
	(K)230361 .09	7	125	875	Hallaton MidShore II	154tot	34	2991		7190230
	(K)230362 .09	7	125	875	Hallaton MidShore II	154tot	35	3018		7190230
	(K)230363 .09	7	125	875	Hallaton MidShore II	154tot	36	3022		7190230
	(K)230364 .09	7	125	875	Hallaton MidShore II	154tot	37	3018		7190230
	(K)230465 .09	7	125	875	Hallaton MidShore II	154tot	38	3018		7190230
	(K)230466 .09	7	125	875	Hallaton MidShore II	154tot	39	3007		7190230
	(K)230467 .09	7	125	875	Hallaton MidShore II	154tot	40	3022		7190230
	(K)230468 .09	7	125	875	Hallaton MidShore II	154tot	41	3023		7190230
	(K)230469 .09	7	125	875	Hallaton MidShore II	154tot	42	3028		7190230
USED AT WHITE OAK LF	(K)230470 .09	7	125	875	Hallaton MidShore II	154tot	43	3023	SQS	7190230
	(K)230471 .09	7	125	875	Hallaton MidShore II	154tot	44	3043		7190230
	(K)230472 .09	7	125	875	Hallaton MidShore II	154tot	45	3039		7190230
	(K)230473 .09	7	125	875	Hallaton MidShore II	154tot	46	3035		7190230
	(K)230474 .09	7	125	875	Hallaton MidShore II	154tot	47	3018		7190230
	(K)230475 .09	7	125	875	Hallaton MidShore II	154tot	48	3005		7190230
	(K)230476 .09	7	125	875	Hallaton MidShore II	154tot	49	2960		7190230
	(K)230477 .09	7	125	875	Hallaton MidShore II	154tot	50	2947		7190230
	(K)230478 .09	7	125	875	Hallaton MidShore II	154tot	51	2964		7190230
	(K)230479 .09	7	125	875	Hallaton MidShore II	154tot	52	2970		7190230
	(K)230480 .09	7	125	875	Hallaton MidShore II	154tot	53	3015		7190230
	(K)230481 .09	7	125	875	Hallaton MidShore II	154tot	54	3018		7190230
	(K)230482 .09	7	125	875	Hallaton MidShore II	154tot	55	3038		7190230
	(K)230483 .09	7	125	875	Hallaton MidShore II	154tot	56	3033		7190230
	(K)230484 .09	7	125	875	Hallaton MidShore II	154tot	57	3034		7190230

microspike liner
HDPE
60 mil

Hallaton Midshore II LF doc 12181
Easton, MD
154 rolls 60 HD microspike 154 left
20 spools 5mm HD weld rod

PO# P6885

roll #	METRIC DIMENSIONS width	length	area						
(K)230485 .09	7	125	875	Hallaton MidShore II	154tot	58	3028		7190230
(K)230486 .09	7	125	875	Hallaton MidShore II	154tot	59	3044		7190230
(K)230487 .09	7	125	875	Hallaton MidShore II	154tot	60	3042		7190230
(K)230588 .09	7	125	875	Hallaton MidShore II	154tot	61	3046		7190230
(K)230589 .09	7	125	875	Hallaton MidShore II	154tot	62	3044		7190230
(K)230590 .09	7	125	875	Hallaton MidShore II	154tot	63	3038		7190230
(K)230591 .09	7	125	875	Hallaton MidShore II	154tot	64	3041	SQS	7190230
(K)230592 .09	7	125	875	Hallaton MidShore II	154tot	65	3038		7190230
(K)230593 .09	7	125	875	Hallaton MidShore II	154tot	66	3039		7190230
(K)230594 .09	7	125	875	Hallaton MidShore II	154tot	67	3039		7190230
(K)230595 .09	7	125	875	Hallaton MidShore II	154tot	68	3041		7190230
(K)230596 .09	7	125	875	Hallaton MidShore II	154tot	69	3028		7190230
(K)230597 .09	7	125	875	Hallaton MidShore II	154tot	70	3018		7190230
(K)230598 .09	7	125	875	Hallaton MidShore II	154tot	71	3006		7190230
(K)230599 .09	7	125	875	Hallaton MidShore II	154tot	72	2998		7190230
(K)230500 .09	7	125	875	Hallaton MidShore II	154tot	73	2994		7190230
(K)230501 .09	7	125	875	Hallaton MidShore II	154tot	74	3024		7190230
(K)230502 .09	7	125	875	Hallaton MidShore II	154tot	75	3020		7190230
(K)230503 .09	7	125	875	Hallaton MidShore II	154tot	76	3025		7190230
(K)230504 .09	7	125	875	Hallaton MidShore II	154tot	77	3029		7190230
(K)230505 .09	7	125	875	Hallaton MidShore II	154tot	78	3021		7190230
(K)230506 .09	7	125	875	Hallaton MidShore II	154tot	79	3029		7190230
(K)230507 .09	7	125	875	Hallaton MidShore II	154tot	80	3035		7190230
(K)230508 .09	7	125	875	Hallaton MidShore II	154tot	81	3038		7190230
(K)230609 .09	7	125	875	Hallaton MidShore II	154tot	82	3025		7190228
(K)230610 .09	7	125	875	Hallaton MidShore II	154tot	83	3033		7190228
(K)230611 .09	7	125	875	Hallaton MidShore II	154tot	84	3032		7190228
(K)230612 .09	7	125	875	Hallaton MidShore II	154tot	85	3025	SQS	7190228
(K)230613 .09	7	125	875	Hallaton MidShore II	154tot	86	3026		7190228
(K)230614 .09	7	125	875	Hallaton MidShore II	154tot	87	3023		7190228
(K)230615 .09	7	125	875	Hallaton MidShore II	154tot	88	3023		7190228
(K)230616 .09	7	125	875	Hallaton MidShore II	154tot	89	3029		7190228
(K)230617 .09	7	125	875	Hallaton MidShore II	154tot	90	3030		7190228
(K)230618 .09	7	125	875	Hallaton MidShore II	154tot	91	3024		7190228
(K)230619 .09	7	125	875	Hallaton MidShore II	154tot	92	3000		7190228
(K)230620 .09	7	125	875	Hallaton MidShore II	154tot	93	2998		7190228
(K)230621 .09	7	125	875	Hallaton MidShore II	154tot	94	2964		7190229
(K)230622 .09	7	125	875	Hallaton MidShore II	154tot	95	2970		7190229
(K)230623 .09	7	125	875	Hallaton MidShore II	154tot	96	2971		7190229
(K)230624 .09	7	125	875	Hallaton MidShore II	154tot	97	2971		7190229
(K)230625 .09	7	125	875	Hallaton MidShore II	154tot	98	2980		7190229
(K)230626 .09	7	125	875	Hallaton MidShore II	154tot	99	3040		7190229
(K)230627 .09	7	125	875	Hallaton MidShore II	154tot	100	3045		7190229
(K)230628 .09	7	125	875	Hallaton MidShore II	154tot	101	3055		7190229
(K)230629 .09	7	125	875	Hallaton MidShore II	154tot	102	3060		7190229
(K)230630 .09	7	125	875	Hallaton MidShore II	154tot	103	3060		7190229
(K)230731 .09	7	125	875	Hallaton MidShore II	154tot	104	3060		7190229
(K)230732 .09	7	125	875	Hallaton MidShore II	154tot	105	3055		7190229
(K)230733 .09	7	125	875	Hallaton MidShore II	154tot	106	3060		7190229
(K)230734 .09	7	125	875	Hallaton MidShore II	154tot	107	3060	SQS	7190229
(K)230735 .09	7	125	875	Hallaton MidShore II	154tot	108	3050		7190229
(K)230736 .09	7	125	875	Hallaton MidShore II	154tot	109	3045		7190229
(K)230737 .09	7	125	875	Hallaton MidShore II	154tot	110	3045		7190229
(K)230738 .09	7	125	875	Hallaton MidShore II	154tot	111	3050		7190229
(K)230739 .09	7	125	875	Hallaton MidShore II	154tot	112	3060		7190229
(K)230740 .09	7	125	875	Hallaton MidShore II	154tot	113	3055		7190229
(K)230741 .09	7	125	875	Hallaton MidShore II	154tot	114	3050		7190229

microspike liner
HDPE
60 mil

Hallaton Midshore II LF doc 12181
Easton, MD
154 rolls 60 HD microspike
20 spools 5mm HD weld rod

PO# P6885
154
left

roll #	METRIC DIMENSIONS width	length	area						
(K)230742 .09	7	125	875	Hallaton MidShore II	154tot	115	3035		7190229
(K)230743 .09	7	125	875	Hallaton MidShore II	154tot	116	3025		7190228
(K)230744 .09	7	125	875	Hallaton MidShore II	154tot	117	3010		7190228
(K)230745 .09	7	125	875	Hallaton MidShore II	154tot	118	3025		7190228
(K)230746 .09	7	125	875	Hallaton MidShore II	154tot	119	3030		7190228
(K)230747 .09	7	125	875	Hallaton MidShore II	154tot	120	3035		7190228
(K)230748 .09	7	125	875	Hallaton MidShore II	154tot	121	3045		7190228
(K)230749 .09	7	125	875	Hallaton MidShore II	154tot	122	3050		7190228
(K)230750 .09	7	125	875	Hallaton MidShore II	154tot	123	3055		7190228
(K)230751 .09	7	125	875	Hallaton MidShore II	154tot	124	3045		7190228
(K)230752 .09	7	125	875	Hallaton MidShore II	154tot	125	3060		7190228
(K)231102 .09	7	125	875	Hallaton MidShore II	154tot	126	3045		7190228
(K)231103 .09	7	125	875	Hallaton MidShore II	154tot	127	3055		7190228
(K)231104 .09	7	125	875	Hallaton MidShore II	154tot	128	3060	sqs	7190228
(K)231105 .09	7	125	875	Hallaton MidShore II	154tot	129	3050		7190228
(K)231110 .09	7	125	875	Hallaton MidShore II	154tot	130	3050		7190228
(K)231111 .09	7	125	875	Hallaton MidShore II	154tot	131	3055		7190228
(K)231112 .09	7	125	875	Hallaton MidShore II	154tot	132	3045		7190228
(K)231113 .09	7	125	875	Hallaton MidShore II	154tot	133	3045		7190228
(K)231114 .09	7	125	875	Hallaton MidShore II	154tot	134	3040		7190228
(K)231115 .09	7	125	875	Hallaton MidShore II	154tot	135	3015		7190228
(K)231116 .09	7	125	875	Hallaton MidShore II	154tot	136	3035		7190228
(K)231117 .09	7	125	875	Hallaton MidShore II	154tot	137	3045		7190228
(K)231118 .09	7	125	875	Hallaton MidShore II	154tot	138	3040		7190228
(K)231119 .09	7	125	875	Hallaton MidShore II	154tot	139	3050		7190231
(K)231120 .09	7	125	875	Hallaton MidShore II	154tot	140	3055		7190231
(K)231121 .09	7	125	875	Hallaton MidShore II	154tot	141	3070		7190231
(K)231122 .09	7	125	875	Hallaton MidShore II	154tot	142	3065		7190231
(K)231223 .09	7	125	875	Hallaton MidShore II	154tot	143	3070		7190231
(K)231224 .09	7	125	875	Hallaton MidShore II	154tot	144	3065		7190231
(K)231225 .09	7	125	875	Hallaton MidShore II	154tot	145	3055		7190231
(K)231230 .09	7	125	875	Hallaton MidShore II	154tot	146	3060		7190231
(K)231231 .09	7	125	875	Hallaton MidShore II	154tot	147	3055		7190231
(K)231232 .09	7	125	875	Hallaton MidShore II	154tot	148	3055		7190231
(K)231233 .09	7	125	875	Hallaton MidShore II	154tot	149	3050	sqs	7190231
(K)231234 .09	7	125	875	Hallaton MidShore II	154tot	150	3045		7190231
(K)231235 .09	7	125	875	Hallaton MidShore II	154tot	151	3035		7190231
(K)231236 .09	7	125	875	Hallaton MidShore II	154tot	152	3040		7190231
(K)231237 .09	7	125	875	Hallaton MidShore II	154tot	153	3045		7190231
(K)231238 .09	7	125	875	Hallaton MidShore II	154tot	154	3050		7190231

agru america
quality control dept

quality certificate

ROLL # **230470-09** Lot #: **7190230** **Liner Type: MICROSPIKE™ HDPE**

Measurement ASTM D5994 (Modified)		METRIC	ENGLISH
	MIN:	1.44 mm	57 mil
	MAX:	1.65 mm	65 mil
Asperity ASTM D7466: 29 mil	AVE:	1.55 mm	61 mil

ODD # : TOP EVEN #: BOTTOM

Thickness.....	1.5 mm	60 mil
Length.....	125 m	410.1 feet
Width.....	7.00 m;	23.0 feet

OIT(Standard) ASTM D3895 minutes 175

					TEST RESULTS	
Specific Gravity ASTM D792	Density		g/cc		.948	
MFI ASTM D1238 COND. E GRADE: K307	Melt Flow Index 190°C /2160 g		g/10 min		.21	
Carbon Black Content ASTM D4218	Range		%		2.14	
Carbon Black Dispersion ASTM D5596	Category				10 In Cat 1	
Tensile Strength ASTM D6693 ASTM D638 (Modified) (2 inches / minute)	Average Strength @ Yield	27	N/mm (kN/m)	154 ppi	2,525	psi
	Average Strength @ Break	34	N/mm (kN/m)	195 ppi	3,190	psi
Elongation ASTM D6693 ASTM D638 (Modified) (2 inches / minute) Lo = 1.3" Yield	Average Elongation @ Yield		%		21.48	
Lo = 2.0" Break	Average Elongation @ Break		%		484.5	
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional change		%		-0.59	
Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	239.0	N		53.735	lbs
Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	417.5	N		93.854	lbs
Puncture Resistance ASTM D4833 (Modified)	Load	618.1	N		138.95	lbs
ESCR ASTM D1693	Minimum Hrs w/o Failures	1500 hrs			CERTIFIED	
Notched Constant Tensile Load ASTM D5397	pass / fail @ 30%	300 hrs			ONGOING	

Customer: **Hallaton, Inc.**
PO: **P6885 Midshore II Landfill**
Destination **Easton, MD**

Date: 7-23-09

Signature.....

Quality Control Department

60HDmic.FRM
REV 03
12/23/05

Chevron Phillips Chemical Company LP

CoA Date: 02/19/2009

Certificate of Analysis

Shipped To: AGRU AMERICA:RAINS
MILEPOST SH317
RAINS SC 29589
USA

Recipient: PALMER
Fax:

CPC Delivery #: 87816172
PO #: 4960
Weight: 193900 LB
Ship Date: 02/19/2009
Package: BULK
Mode: Hopper Car
Car #: CITX703383
Seal No: 263059

Product:
MARLEX POLYETHYLENE K307 BULK

Lot Number: 7190230

Property	Test Method	Value	Unit
HLMI Flow Rate	ASTM D1238	21.00	g/10mi
Density	ASTM D1505	0.9380	g/cm3

The data set forth herein have been carefully compiled by Chevron Phillips Chemical Company LP.
However, there is no warranty of any kind, either expressed or implied, applicable to its use, and the user assumes all risk and liability in connection therewith.

Troy Griffin
Quality Systems Coordinator

For CoA questions contact Customer Service Representative at +1-832-813-4637

APPENDIX IX.F

SKAPS Manufacturer Certification (MQA/MQC)

SKAPS Industries (Nonwoven Division)
335, Athena Drive
Athens, GA 30601 (U.S.A.)
Phone (706) 354-3700 Fax (706) 354-3737
E-mail: info@skaps.com

Sales Office:
Engineered Synthetic Product Inc.
Phone: (770)564-1857
Fax: (770)564-1818

July 13, 2010
Hallaton, Inc.
1206 Sparks Road
Sparks, MD 21152
Ref : DuPont Hay Road Landfill
PO : P7132

Dear Sir/Madam:

This is to certify that SKAPS GE110 is a high quality needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, randomly networked to form a high strength dimensionally stable fabric. SKAPS GE110 resists ultraviolet deterioration, rotting, biological degradation. The fabric is inert to commonly encountered soil chemicals. Polypropylene is stable within a pH range of 2 to 13. SKAPS GE110 conforms to the property values listed below:

PROPERTY	TEST METHOD	UNITS	M.A.R.V. Minimum Average Roll Value
Weight	ASTM D 5261	oz/sy (g/m^2)	10.00 (339)
Grab Tensile	ASTM D 4632	lbs (kN)	230 (1.02)
Grab Elongation	ASTM D 4632	%	50
Trapezoidal Tear	ASTM D 4533	lbs (kN)	95 (0.42)
Puncture Resistance	ASTM D 4833	lbs (kN)	120 (0.53)
UV Resistance	ASTM D 4355	%/hrs	70/500

Notes:
* At the time of manufacturing. Handling may change these properties.

ANURAG SHAH
QUALITY CONTROL MANAGER

Product : GE110-15

ROLL # ASTM METHOD UNITS TARGET	WEIGHT D5261 oz/sq yd 10.00	MD TENSILE D4632 lbs. 230	MD ELONG D4632 % 50	XMD TENSILE D4632 lbs 230	XMD ELONG D4632 % 50	MD TRAP D4533 lbs. 95	XMD TRAP D4533 lbs 95	PUNCTURE D4833 lbs. 120
16050.001	10.13	276	72	285	85	107	123	168
16050.002	10.13	276	72	285	85	107	123	168
16050.003	10.13	276	72	285	85	107	123	168
16050.004	10.13	276	72	285	85	107	123	168
16050.005	10.68	284	76	293	87	107	123	168
16050.006	10.68	284	76	293	87	107	123	168
16050.007	10.68	284	76	293	87	107	123	168
16050.008	10.68	284	76	293	87	107	123	168
16050.009	10.68	284	76	293	87	107	123	168
16050.010	10.18	278	70	281	83	111	131	172
16050.011	10.18	278	70	281	83	111	131	172
16050.012	10.18	278	70	281	83	111	131	172
16050.013	10.18	278	70	281	83	111	131	172
16050.014	10.18	278	70	281	83	111	131	172
16050.015	10.41	282	78	290	89	111	131	172
16050.016	10.41	282	78	290	89	111	131	172
16050.017	10.41	282	78	290	89	111	131	172
16050.018	10.41	282	78	290	89	111	131	172
16050.019	10.41	282	78	290	89	111	131	172
16050.020	10.11	275	74	286	81	109	125	166
16050.021	10.11	275	74	286	81	109	125	166
16050.022	10.11	275	74	286	81	109	125	166
16050.023	10.11	275	74	286	81	109	125	166
16050.024	10.11	275	74	286	81	109	125	166
16050.025	10.64	285	80	294	86	109	125	166
16050.026	10.64	285	80	294	86	109	125	166
16050.027	10.64	285	80	294	86	109	125	166
16050.028	10.64	285	80	294	86	109	125	166
16050.029	10.64	285	80	294	86	109	125	166
16050.030	10.30	277	71	288	84	113	133	174
16050.031	10.30	277	71	288	84	113	133	174
16050.032	10.30	277	71	288	84	113	133	174
16050.033	10.30	277	71	288	84	113	133	174
16050.034	10.30	277	71	288	84	113	133	174
16050.035	10.43	281	77	292	88	113	133	174

*All values are MARV.

Product : GE110-15

ROLL # ASTM METHOD UNITS TARGET	WEIGHT D5261 oz/sq yd 10.00	MD TENSILE D4632 lbs. 230	MD ELONG D4632 % 50	XMD TENSILE D4632 lbs 230	XMD ELONG D4632 % 50	MD TRAP D4533 lbs. 95	XMD TRAP D4533 lbs 95	PUNCTURE D4833 lbs. 120
16050.036	10.43	281	77	292	88	113	133	174
16050.037	10.43	281	77	292	88	113	133	174
16050.038	10.43	281	77	292	88	113	133	174
16050.039	10.43	281	77	292	88	113	133	174
16050.040	10.15	279	73	283	82	105	127	165
16050.041	10.15	279	73	283	82	105	127	165
16050.042	10.15	279	73	283	82	105	127	165
16050.043	10.15	279	73	283	82	105	127	165
16050.044	10.15	279	73	283	82	105	127	165
16050.045	10.66	283	79	287	90	105	127	165
16050.046	10.66	283	79	287	90	105	127	165
16050.047	10.66	283	79	287	90	105	127	165
16050.048	10.66	283	79	287	90	105	127	165
16050.049	10.66	283	79	287	90	105	127	165
16050.050	10.34	276	75	285	84	115	135	171
16050.051	10.34	276	75	285	84	115	135	171
16050.052	10.34	276	75	285	84	115	135	171
16050.053	10.34	276	75	285	84	115	135	171
16050.054	10.34	276	75	285	84	115	135	171
16050.055	10.45	280	77	289	86	115	135	171
16050.056	10.45	280	77	289	86	115	135	171
16050.057	10.45	280	77	289	86	115	135	171
16050.058	10.45	280	77	289	86	115	135	171
16050.059	10.45	280	77	289	86	115	135	171
16050.060	10.19	278	70	280	81	108	122	167
16050.061	10.19	278	70	280	81	108	122	167
16050.062	10.19	278	70	280	81	108	122	167
16050.063	10.19	278	70	280	81	108	122	167
16050.064	10.19	278	70	280	81	108	122	167
16050.065	10.62	284	76	292	89	108	122	167
16050.066	10.62	284	76	292	89	108	122	167
16050.067	10.62	284	76	292	89	108	122	167
16050.068	10.62	284	76	292	89	108	122	167
16050.069	10.62	284	76	292	89	108	122	167
16050.070	10.28	275	72	284	83	112	132	173

Conformance Tested — 16050.051

Used at White Oak LF — 16050.053

Conformance Tested — 16050.057

*All values are MARV.

Product : GE110-15

ROLL # ASTM METHOD UNITS TARGET	WEIGHT D5261 oz/sq yd 10.00	MD TENSILE D4632 lbs. 230	MD ELONG D4632 % 50	XMD TENSILE D4632 lbs 230	XMD ELONG D4632 % 50	MD TRAP D4533 lbs. 95	XMD TRAP D4533 lbs 95	PUNCTURE D4833 lbs. 120
16050.071	10.28	275	72	284	83	112	132	173
16050.072	10.28	275	72	284	83	112	132	173
16050.073	10.28	275	72	284	83	112	132	173
16050.074	10.28	275	72	284	83	112	132	173
16050.075	10.55	282	78	294	87	112	132	173
16050.076	10.55	282	78	294	87	112	132	173
16050.077	10.55	282	78	294	87	112	132	173
16050.078	10.55	282	78	294	87	112	132	173
16050.079	10.55	282	78	294	87	112	132	173
16050.080	10.17	278	74	286	85	106	126	169
16050.081	10.17	278	74	286	85	106	126	169
16050.082	10.17	278	74	286	85	106	126	169
16050.083	10.17	278	74	286	85	106	126	169
16050.084	10.17	278	74	286	85	106	126	169
16050.085	10.70	285	80	290	89	106	126	169
16050.086	10.70	285	80	290	89	106	126	169
16050.087	10.70	285	80	290	89	106	126	169
16050.088	10.70	285	80	290	89	106	126	169
16050.089	10.70	285	80	290	89	106	126	169
16050.090	10.36	276	71	281	80	114	134	175
16050.091	10.36	276	71	281	80	114	134	175
16050.092	10.36	276	71	281	80	114	134	175
16050.093	10.36	276	71	281	80	114	134	175
16050.094	10.36	276	71	281	80	114	134	175
16050.095	10.58	281	77	285	86	114	134	175
16050.096	10.58	281	77	285	86	114	134	175
16050.097	10.58	281	77	285	86	114	134	175
16050.098	10.58	281	77	285	86	114	134	175
16050.099	10.58	281	77	285	86	114	134	175
16050.100	10.21	279	73	283	84	105	128	166
16050.101	10.21	279	73	283	84	105	128	166

*All values are MARV.

APPENDIX IX.G

TRI Geomembrane Conformance Test Results

August 6, 2009
August 21, 2009 Updating NCTL

Mail To:

Mr. Doug Murphy
Geosyntec Consultants

Bill To:

<= Same

email: dmurphy@geosyntec.com

Dear Mr. Murphy:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Midshore II**
TRI Job Reference Number:	E2330-88-05
Material(s) Tested:	1 Agru 60 mil Microspike HDPE Geomembrane(s)
Test(s) Requested:	Thickness (ASTM D 5994) Asperity Height (GRI GM 12) Density (ASTM D 1505) Carbon Content (ASTM D 4218) Carbon Dispersion (ASTM D 5596) Tensile (ASTM D 638/GRI GM13) Puncture Strength (ASTM D 4833) Updating==> SP-NCTL Stress Crack Resistance (ASTM D 5397, App)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

MPatel

Dr. Mansukh Patel
Sr. Laboratory Coordinator
Geosynthetic Services Division
www.GeosyntheticTesting.com

cc: Sam R. Allen, Vice President and Division Manager

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax: 512 263 2558

GEOMEMBRANE TEST RESULTS

TRI Client: Geosyntec Consultants
Project: Midshore II

Material: Agru 60 mil Microspike HDPE Geomembrane
Sample Identification: 230470.09
TRI Log #: E2330-88-05

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.	PROJ. SPEC.
Thickness (ASTM D 5994)													60 avg 57 min avg
Thickness (mils)	60	61	63	63	65	62	63	64	62	61	62 60	2 << min	8 of 10, 54 min 51 min
Asperity Height (GRI GM 12)													
Asperity Height (mils) - Side A	34	32	34	30	28	31	30	32	33	33	32	2	10 min
Asperity Height (mils) - Side B	29	30	28	29	28	32	26	28	32	29	29	2	10 min
Density (ASTM D 1505)													
Density (g/cm3)	0.944	0.944	0.944								0.944	0.000	0.940 min
Carbon Black Content (ASTM D 4218)													
% Carbon Black	2.24	2.24									2.24	0.00	2 - 3%
Carbon Black Dispersion (ASTM D 5596)													
Rating - 1st field view	1	1	1	1	1								9 Cat 1, 2
Rating - 2nd field view	1	1	1	1	1								1 Cat 3
Tensile Properties (ASTM D 638/GRI GM 13, 2 ipm strain rate, Type IV specimen)													
MD Yield Strength (ppi)	179	162	161	165	178						169	9	126 min
TD Yield Strength (ppi)	174	175	185	175	197						181	10	126 min
MD Break Strength (ppi)	203	197	236	199	226						212	18	90 min
TD Break Strength (ppi)	175	165	194	165	205						181	18	90 min
MD Yield Elongation (%)	21	21	21	21	21						21	0	12 min
TD Yield Elongation (%)	17	17	16	17	17						17	0	12 min
MD Break Elongation (%)	444	495	466	448	431						457	25	100 min
TD Break Elongation (%)	536	501	566	499	575						536	35	100 min
Puncture Resistance (ASTM D 4833)													
Puncture Strength (lbs)	141	147	143	144	144						144	2	90 min

MD Machine Direction TD Transverse Direction

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax: 512 263 2558

GEOMEMBRANE TEST RESULTS

TRI Client: Geosyntec Consultants
Project: Midshore II

Material: Agru 60 mil Microspike HDPE Geomembrane
Sample Identification: 230470.09
TRI Log #: E2330-88-05

PARAMETER	TEST REPLICATE NUMBER 1	2	3	4	5	6	7	8	9	10	MEAN	STD. DEV.	PROJ. SPEC.
SP-NCTL Stress Crack Resistance (ASTM D 5397, App)													
SURFACTANT:	CO-630												
EXPOSURE PERIOD:	400 hrs												
DATE TEST STARTED:	4-Aug-09												
TEST TEMPERATURE:	50C												

Transverse direction yield stress: 2815 (psi)
x 30% 845 (x 0.30)
x hinge thickness (in) 0.055 (80% of thickness)
x specimen width 0.124 (0.124")
Load 5.78 (lbs)

Mechanical Advantage 5
Lever Weight 0.3 (lbs)
Grip Weight 0.09 (lbs)

Applied load = (Load - Lever Weight + Grip Weight)/Mechanical Advantage = 1.11 lbs = 506 grams

Replicate No.:	1	2	3	4	5	MEAN	PROJ. SPEC.
No. Hours to Failure:	>400	>400	>400	>400	>400	>400	400 min

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax: 512 263 2558

APPENDIX IX.H

TRI Geotextile Conformance Test Results

July 26, 2010

Mail To:

Mr. Kennedy Garber
Hallaton, Inc
1206 Sparks Road
Sparks, MD 21152

email: kgarber@hallaton.com

Bill To:

<= Same

Dear Mr. Garber:

Thank you for consulting TRI/Environmental, Inc. (TRI) for your geosynthetics testing needs. TRI is pleased to submit this final report for laboratory testing.

Project:	**Dupont Hay Road Landfill**
TRI Job Reference Number:	E2343-37-02
Material(s) Tested:	9 Skaps GE110 Non Nonwoven Geotextile(s)
Test(s) Requested:	Mass/Unit Area (ASTM D 5261) Grab Tensile (ASTM D 4632) Puncture Strength (ASTM D 4833) Trapezoidal Tear (ASTM D 4533)

If you have any questions or require any additional information, please call us at 1-800-880-8378.

Sincerely,

MPatel

Dr. Mansukh Patel
Sr. Laboratory Coordinator
Geosynthetic Services Division
www.GeosyntheticTesting.com

cc: Sam R. Allen, Vice President and Division Manager

GEOTEXTILE TEST RESULTS

TRI Client: Hallaton, Inc
Project: Dupont Hay Road Landfill

Material: Skaps GE110 Non Nonwoven Geotextile
Sample Identification:16050.051
TRI Log #: E2343-37-02

PARAMETER	TEST REPLICATE NUMBER										MEAN	STD. DEV.	PROJ. SPEC.
	1	2	3	4	5	6	7	8	9	10			
Mass/Unit Area (ASTM D 5261)													
5" diameter circle (grams)	4.89	4.67	4.57	4.96	4.74	4.70	4.97	5.38	4.66	4.45	**4.80**	0.26	
Mass/Unit Area (oz/sq.yd)	11.37	10.86	10.63	11.54	11.03	10.93	11.56	12.51	10.84	10.35	**11.16**	0.61	10 min
Grab Tensile Properties (ASTM D 4632)													
MD - Tensile Strength (lbs)	385	52.4	416	337	360	349	331	384	381	334	**364**	29	230 min
TD - Tensile Strength (lbs)	393	322	313	337	418	416	342	340	382	354	**362**	38	230 min
MD - Elong. @ Max. Load (%)	95	88	81	90	101	89	81	93	89	95	**90**	6	
TD - Elong. @ Max. Load (%)	112	114	124	103	118	113	115	130	118	108	**116**	8	
Puncture Resistance (ASTM D 4833)													
Puncture Strength (lbs)	179	155	128	173	169	139	141	162	161	175	**156**	15	120 min
	148	142	156	164	153								
Trapezoidal Tear (ASTM D 4533)													
MD - Tear Strength (lbs)	132	157	123	151	150	128	132	137	179	148	**144**	17	95 min
TD - Tear Strength (lbs)	138	168	173	152	149	138	178	157	187	152	**159**	17	95 min

MD Machine Direction TD Transverse Direction NA Not Available

The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose of the material. TRI observes and maintains client confidentiality. TRI limits reproduction of this report, except in full, without prior approval of TRI.

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax 512 263 2558

GEOTEXTILE TEST RESULTS

TRI Client: Hallaton, Inc
Project: Dupont Hay Road Landfill

Material: Skaps GE110 Non Nonwoven Geotextile(s)
Sample Identification:16050.057
TRI Log #: E2343-37-02

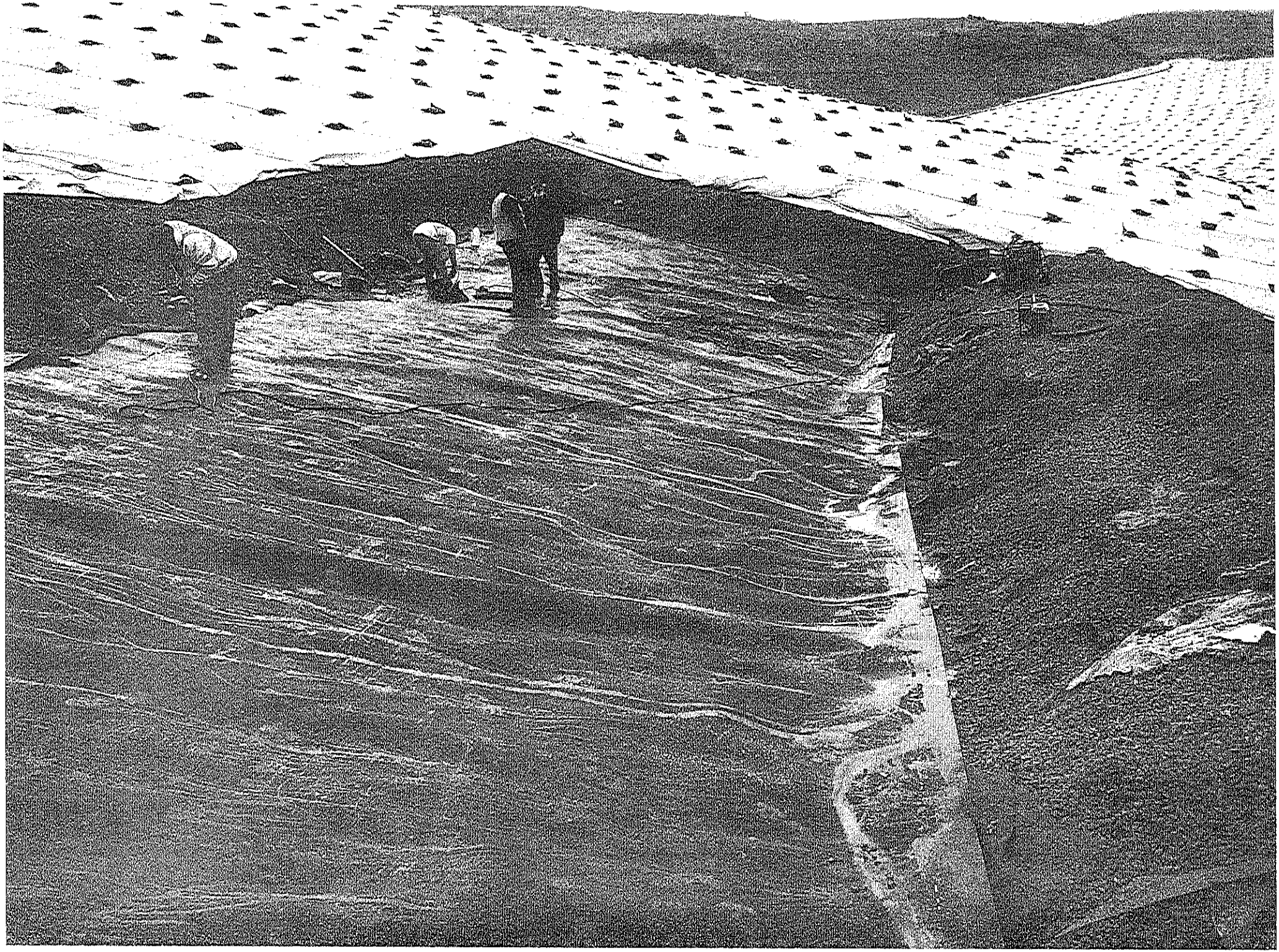
PARAMETER	TEST REPLICATE NUMBER										MEAN	STD. DEV.	PROJ. SPEC.
	1	2	3	4	5	6	7	8	9	10			
Mass/Unit Area (ASTM D 5261)													
5" diameter circle (grams)	4.85	4.61	4.51	4.83	4.56	4.57	4.73	4.71	4.85	4.55	4.68	0.13	
Mass/Unit Area (oz/sq.yd)	11.28	10.72	10.49	11.23	10.61	10.63	11.00	10.96	11.28	10.58	10.88	0.31	10 min
Grab Tensile Properties (ASTM D 4632)													
MD - Tensile Strength (lbs)	381	367	370	356	379	391	327	331	366	388	366	22	230 min
TD - Tensile Strength (lbs)	438	348	406	386	374	418	367	325	434	429	392	39	230 min
MD - Elong. @ Max. Load (%)	97	95	91	93	97	95	87	96	96	95	94	3	
TD - Elong. @ Max. Load (%)	127	132	121	116	111	119	121	119	121	121	121	6	
Puncture Resistance (ASTM D 4833)													
Puncture Strength (lbs)	182	188	161	177	207	199	177	171	157	175	171	21	120 min
	169	167	139	124	169								
Trapezoidal Tear (ASTM D 4533)													
MD - Tear Strength (lbs)	137	110	120	137	163	156	155	161	149	160	145	18	95 min
TD - Tear Strength (lbs)	190	183	150	200	174	167	211	160	152	151	174	22	95 min

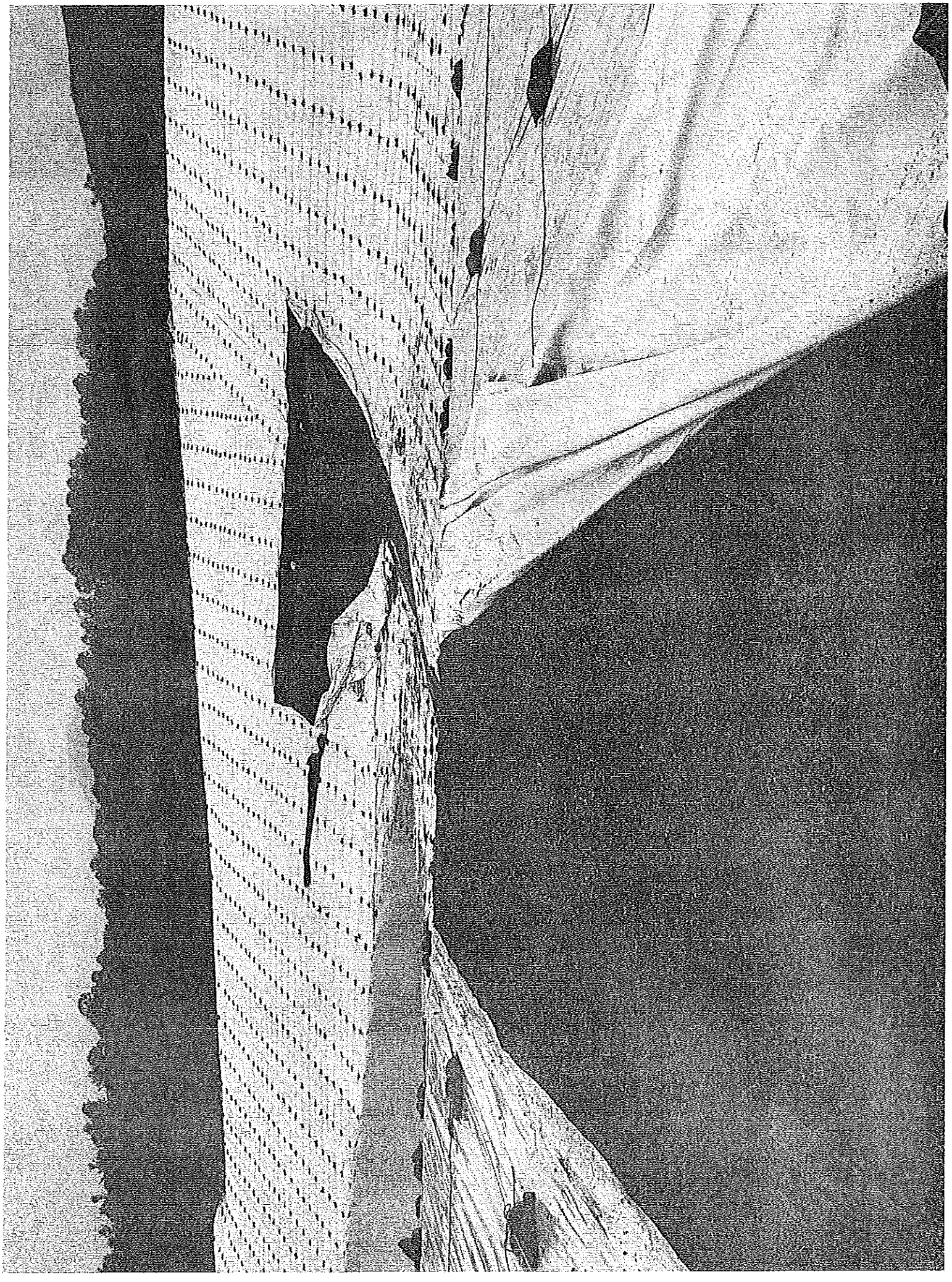
MD Machine Direction TD Transverse Direction NA Not Available

GeosyntheticTesting.com
9063 Bee Caves Road / Austin, TX 78733 / 512 263 2101 / fax 512 263 2558

APPENDIX IX.I

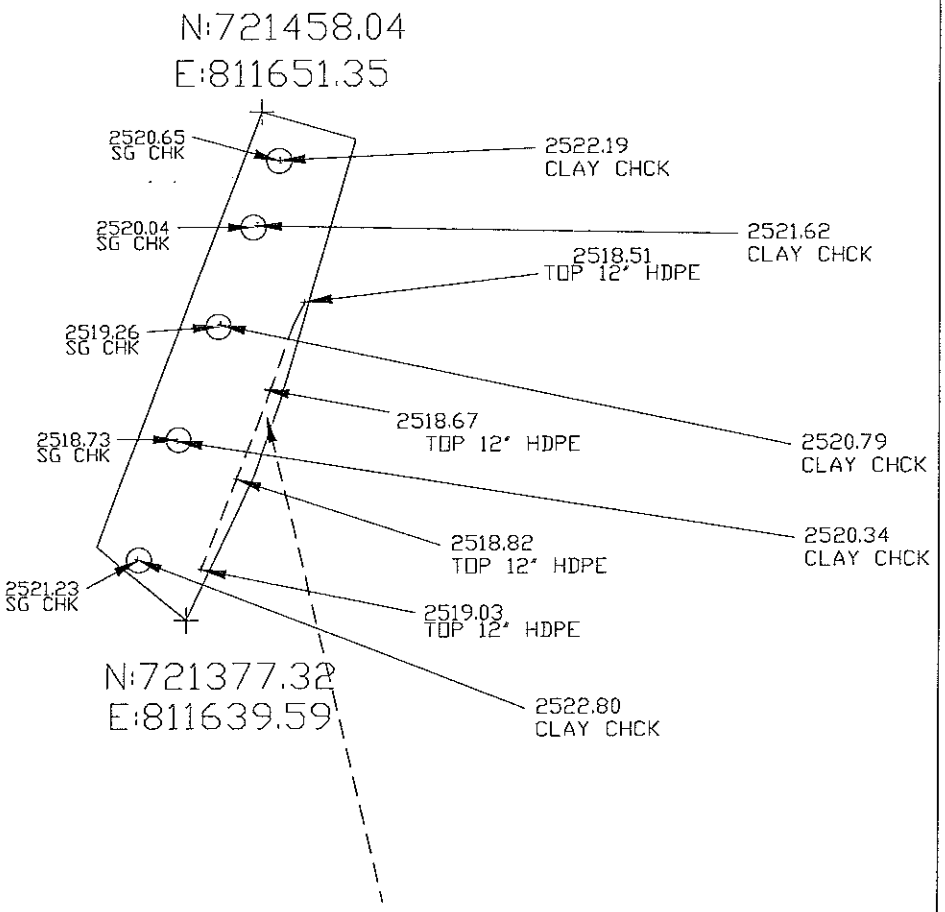
Repair Area Photos





APPENDIX IX.J

Repair Area Survey



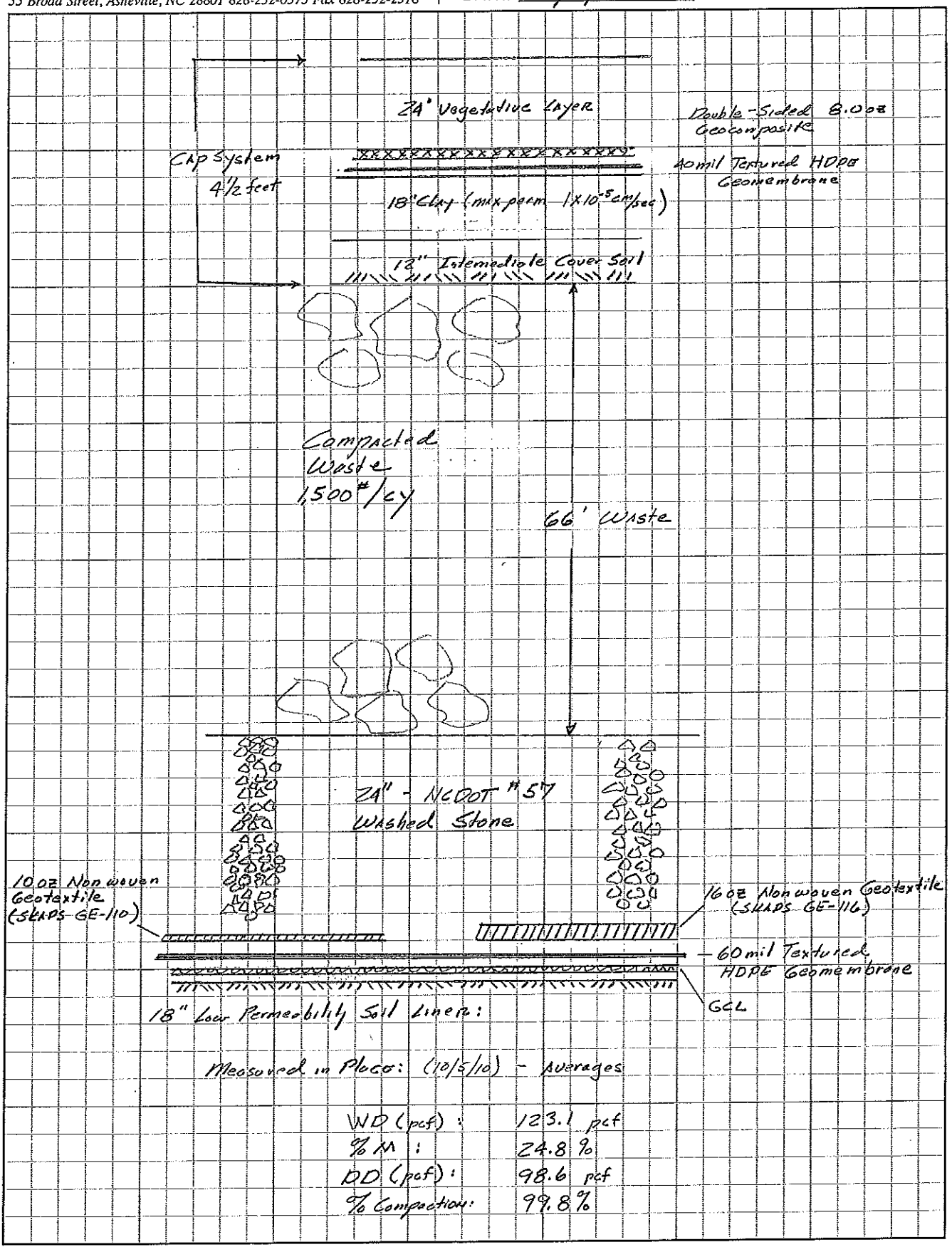
DUAL CONTAINED HDPE LEACHATE GRAVITY SEWER
12" SECONDARY, 8" CARRIER PIPE

THALLE INC		
DRAWN ESM	DATE 09/30/10	GRAVITY REPAIR
APPROVED	DATE	
SCALE NTS	SHEET NTS	PROJECT NO. 943 WHITE OAK LANDFILL

Section 11

McGill ASSOCIATES
Engineering • Planning • Finance
McGill Associates, P.A. P.O. Box 2259, Asheville, NC 28802
55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: White Oak LF - Phase 3
PROJECT NO.: 07518
DESCRIPTION: LF Section over Pipe Repair
CALCULATED BY: WHS CHECKED BY:
DATE: 11/10/10 SHEET NO. 1 OF 2



Measured in Place: (10/5/10) - Averages

WD (pcf):	123.1 pcf
% M:	24.8 %
DD (pcf):	98.6 pcf
% Compaction:	99.8%

McGill ASSOCIATES
Engineering • Planning • Finance
McGill Associates, P.A. P.O. Box 2259, Asheville, NC 28802
55 Broad Street, Asheville, NC 28801 828-252-0575 Fax 828-252-2518

PROJECT: White Oak LF - Phase 3
PROJECT NO.: 07518
DESCRIPTION: LF Section over Pipe Repair
CALCULATED BY: WHS CHECKED BY:
DATE: 11/10/10 SHEET NO. 2 OF 2

Conditions:

1. Minimum Factor of Safety of 1.5.
2. Thoroughly explain, in detail, any assumptions, formulas, calculations, etc. List all Reference documents, papers, etc.
3. Technical Specifications for 60 mil Textured HDPE Geomembrane, SKAPS 16oz Nonwoven Geotextile should be those approved as a part of the submittal Process
4. Technical Specifications for the SKAPS 10oz Nonwoven geotextile should be those submitted as used as a part of the pipe Repair
5. Gradation for the NCDOT #57 washed stone should be the same as approved as a part of the submittal process.

Required:

Provide certified analytical analysis/data that the 10 oz nonwoven geotextile will meet the physical protection requirements for the 60-mil geomembrane from the materials installed/placed directly above (Stone drainage Layer i waste mass). Must have a minimum factor of safety of 1.5.

Any other certifiable documentation that may be available that will strengthen the case for allowing the single layer of 10oz nonwoven geotextile to remain in place in lieu of the originally specified 16 oz. Nonwoven geotextile Material.

Certification letter from Thalle Construction Company and Hallaton that use of the 10 oz nonwoven geotextile will in no way void or affect the geomembrane warranty/overall Landfill warranty or any other overall responsibility of either or both parties. Must be signed by a corporate officer with notary seal.

THALLE
CONSTRUCTION COMPANY

ESTABLISHED 1

December 29, 2010

Mr. Jeff Bishop
McGill Associates
55 Broad Street
Asheville, NC 28801

Re: White Oak Landfill- Phase 3
Haywood County, NC
10 oz Geotextile Information
Application for Payment #11

Dear Mr. Bishop,

Attached are the hardcopies for the evaluation of the 10 oz/sy geotextile used in the repair of LP-4. The evaluation was performed by Joyce Engineering on behalf of Thalle/Hallaton. The evaluation demonstrates that the 10 oz/sy geotextile provides a factor of safety of 3.2, more than twice the minimum required by McGill Associates. A copy of this evaluation was forwarded on 12/15/10 for your review and comment. Since we have not received any comment, it is understood the evaluation is acceptable.

In addition to the evaluation of the 10 oz/sy geotextile, McGill Associates further requested confirmation from Thalle/Hallaton on the warranty in relation to the repair. Attached is the letter from Hallaton confirming their warranty is in no way affected by the repair or use of the 10 oz/sy geotextile. Let this letter further confirm that Thalle Construction also certifies that the repair and use of the 10 oz/sy geotextile in no way affects our contractual warranty and /or responsibilities under the contract.

In McGill Associates letter dated 9/16/10, Application for Payment #11(dated 5/25/10) was returned with no action taken by McGill Associates due to LP-4. Application for Payment #11 is hereby enclosed and re-submitted for immediate action by McGill Associates.

Sincerely,

Christopher Haverstrom
Sr. Project Manager

CC: Mr. Stephen King, Haywood County
Mr.Mark Shumpert, Haywood County

900 NC Hwy 86 North, Hillsborough NC 27278 Phone: 919.241.1604 Fax: 919.245-1516
www.thalle.com

JOYCE
ENGINEERING, INC.

Waste Industry Experts

Joyce Engineering, Inc.
2211 West Meadowview Rd
Suite 101
Greensboro, NC 27407

tel: **336/323-0092**
fax: **336/323-0093**

www.JoyceEngineering.com

December 15, 2010

Mr. Chris Haverstrom, P.E.
Thalle Construction Company
900 NC 86 North
Hillsborough, NC 27278

RE: Evaluation of 10 oz Geotextile Fabric Performance as Cushioning Material
White Oak Landfill, Phase 3 Expansion
Haywood County, North Carolina
JEI Project No. 801.0900.11, Task 01

Dear Chris:

Please find the attached evaluation of the suitability for the use of a 10 oz/sq yd non-woven geotextile filter fabric.

Due to the relatively low waste height in the area where the fabric has been placed and relatively small diameter of stone used in the drainage layer, this material will deliver a more than adequate factor of safety against puncture with the loading given by McGill Associates.

I have enclosed an excerpt of our design reference that indicates that a 10 oz geotextile is not a recommended application for puncture resistance. It is my opinion that in this instance, the material will perform adequately for the following reasons:

1. The 10 oz fabric was only used in a relatively narrow strip within the cell, while the prescribed 16 oz material was used in the majority of the landfill liner. I would agree with the design reference that a 10 oz fabric is not suitable over a large area, but ina repair situation it should be adequate.
2. The alternatives to leaving the material in place would be to re-excavate the entire area and replace with a 16 oz fabric or an additional 10 oz on top of the installed material. In my opinion, it would be very difficult to excavate and remove 100% of the aggregate drainage layer on top of the liner or existing fabric to install a new layer due to the current weather restrictions and possibility of affecting the underlying HDPE liner. In this instance, there is no certainty the repair attempts will provide any measureable increased protection to the liner and may, in fact, introduce an opportunity for further damage due to exposure, construction methods or stone infiltration under or between geotextile layers.

If you have any questions or concerns regarding this evaluation, please feel free to contact me at (336) – 323 – 0092.

Sincerely,
JOYCE ENGINEERING, INC.

Evan Andrews, P.E.
Project Manager

Enclosures

P:\Haywood White Oak LF\Phase 3\CQA\Repair\thalle 10 oz eval letter.docx

JOYCE ENGINEERING, INC.

JOYCE ENGINEERING, INC.

Job:	White Oak Landfill - Phase 3 Expansion
Job Number:	801.0900.11 Task 01
Calculated By:	HMAK Date: 11/19/2010
Checked By:	EEA Date: 12/15/2010
Subject:	Puncture Resistance - Waste
Sheet:	1 of 1

Determine maximum diameter stone by comparing allowable pressure to pressure exerted.

Given:
Use a 10 oz./sq yd geotextile for a geotextile cushion above the FML.
Use maximum height of waste of 73 feet and unit weight of landfill of 75 pcf.

Find:
Determine an acceptable factor of safety (above 1.5) for given conditions to evaluate the performance of a 10 oz fabric as a cushion layer.

$$Pallow = (1/(MF_S \times MF_{PD} \times MF_A \times FS_{CR} \times FS_{CBD})) \times (50 + 0.00045 \times (M/H^2))$$

MF_S	=	mod. factor for protusion shape (angular for worst case)	=	1.0
MF_{PD}	=	mod. factor for packing density (largest stone 2")	=	0.5
MF_A	=	mod. factor for soil arching	=	0.25
FS_{CR}	=	partial factor of safety for creep (worst case)	=	1.0
FS_{CBD}	=	partial factor of safety for chemical/biological degradation	=	1.5
M	=	mass per unit area of geotextile	=	10 oz/yd^2
				339.1 g/m^2
H	=	height of protrusion (maximum diameter stone)	=	1.5 inches
				0.0381 m

$$Pallow = 827.3 \text{ kPa}$$

$$Preqd = Hw * \rho w$$

Hw	=	maximum height of waste	=	73 feet
				22.2504 meters
ρw	=	unit weight of landfil	=	75 pcf
				11.8 kN/m^3

$$Preqd = 262.2 \text{ kPa}$$

Factor of Safety = Pallow/Preqd = 3.2

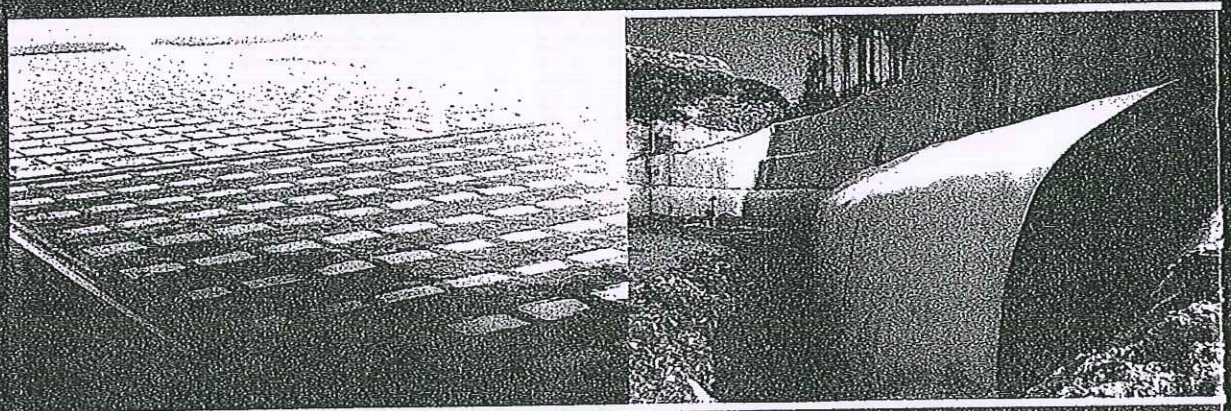
Therefore, use of a 10 oz/sy geotextile produces an adequate factor of safety for liner puncture due the the given loading.

NORTH CAROLINA PROFESSIONAL SEAL 27446 ENGINEER EVAN E ANDREWS 12/15/10

Reference:
Koerner, R.M. (2005).Designing with Geosynthetics, 5th Edition, Pearson Education, Inc., Pearson Prentice Hall, Upper Saddle River, NJ.

DESIGNING WITH GEOSYNTHETICS

FIFTH EDITION



ROBERT M. KOERNER

Example 5.18

Obtain the required thickness of a smooth HDPE primary geomembrane beneath a 50 m high landfill containing solid waste of unit weight 12.5 kN/m^3. The localized subsoil settlement is estimated to result in a liner deformation angle of 20°. Drainage sand is above the geomembrane and a geonet is below it.

Solution: The necessary information for solving the design equation is

(a) For out-of-plane tension testing, the yield-stress of HDPE (from Table 5.5c) is conservatively estimated as 20,000 kPa.
(b) The mobilization distance for HDPE at 50 × 12.5 = 625 kPa (from Figure 5.10a) is approximately 80 mm.
(c) The friction angle (from Table 5.7) for smooth HDPE against Ottawa sand (δ_U) is 18°.
(d) The friction angle for HDPE against a geonet (separate test results) (δ_L) is 10°.
(e) These values give the required geomembrane thickness:

$$t = \frac{(625)(0.080)[\tan 18 + \tan 10]}{(20{,}000)[\cos 20 - (\sin 20)(\tan 10)]}$$

$$= \frac{25.1}{17600}$$

$$= 0.00143 \text{ m}$$

$$t = 1.43 \text{ mm}$$

Thus the regulated values of 1.5 mm in the United States or 2.0 mm in compliance with German regulations would control in this situation. Furthermore, the regulated values would be used since they also exceed the *very high* survivability value in Table 5.13 of 1.00 mm thickness.

5.6.7 Puncture Protection

There are many circumstances where geomembranes are placed on or beneath soils containing relatively large-sized stones — for example, poorly prepared clay soil subgrades with stones protruding from the surface or resting on the surface, soil subgrades over which geomembranes (particularly textured) have been dragged dislodging near-surface stones, and all cases where gravel drainage layers are placed above the geomembrane. All of these situations, particularly the last (which is unavoidable since it is a design situation), should use a protective geotextile to avoid puncturing of the geomembrane. Note that if the soil subgrade is a CCL, a geotextile cannot be used and the isolated stones must be physically removed. For the drainage layer case, which is common to all landfills, a nonwoven needle-punched geotextile can provide excellent puncture protection (recall Figure 5.8). However, the issue of required mass per unit area of the geotextile becomes critical.

In a series of papers, Wilson-Fahmy, Narejo and Koerner [76, 77, 78] have presented a design method that focuses on the protection of 1.5 mm thick HDPE geomembranes. The method uses the conventional factor of safety equation:

$$\text{FS} = \frac{p_{\text{allow}}}{p_{\text{reqd}}} \tag{5.32}$$

where

FS = factor of safety (against geomembrane puncture),
p_{reqd} = required pressure due to the landfill contents (or surface impoundment), and
p_{allow} = allowable pressure using different types of geotextiles and site-specific conditions

Based on a large number of ASTM 5514 experiments, an empirical relationship for p_{allow} has been obtained, as shown in equation (5.33). It requires the use of modification factors and reduction factors as given in Table 5.18. Note that in Table 5.18 all MF values ≤ 1.0 and all RF values ≥ 1.0.

$$p_{allow} = \left(50 + 0.00045\frac{M}{H^2}\right)\left[\frac{1}{MF_S \times MF_{PD} \times MF_A}\right]\left[\frac{1}{RF_{CR} \times RF_{CBD}}\right] \quad (5.33)$$

where

p_{allow} = allowable pressure (kPa),
M = geotextile mass per unit area (g/m^2),
H = protrusion height (m),

TABLE 5.18 MODIFICATION FACTORS AND REDUCTION FACTORS FOR GEOMEMBRANE PROTECTION DESIGN USING NONWOVEN NEEDLE-PUNCHED GEOTEXTILES

Modification Factors (all ≤ 1.0)

MF_s		MF_{PD}		MF_A	
Angular	1.0	Isolated	1.0	Hydrostatic	1.0
Subrounded	0.5	Dense, 38 mm	0.83	Geostatic, shallow	0.75
Rounded	0.25	Dense, 25 mm	0.67	Geostatic, mod.	0.50
		Dense, 12 mm	0.50	Geostatic, deep	0.25

Reduction Factors (all ≥ 1.0)

		RF_{CR}			
		Mass per Unit Area	Protrusion Height (mm)		
RF_{CBD}		(gm/m^2)	38	25	12
Mild leachate	1.1	Geomembrane alone	N/R	N/R	N/R
Moderate leachate	1.3	270	N/R	N/R	>1.5
Harsh leachate	1.5	550	N/R	1.5	1.3
		1100	1.3	1.2	1.1
		>1100	≅1.2	≅1.1	≅1.0

Abbreviations: N/R = not recommended

MF_S = modification factor for protrusion shape,
MF_{PD} = modification factor for packing density,
MF_A = modification factor for arching in solids,
RF_{CR} = reduction factor for long-term creep, and
RF_{CBD} = reduction factor for long-term chemical/biological degradation.

The situation can be approached from a given mass per unit area geotextile to determine the unknown FS value, or from an unknown mass per unit area geotextile and a given FS value. Example 5.19 uses the latter approach.

Example 5.19

Given a coarse-gravel (subrounded with $d_{50} = 38$ mm) leachate collection layer to be placed on a 1.5 mm HDPE geomembrane under a 50 m high landfill, what geotextile mass per unit area is necessary for a FS value of 3.0? Assume that the solid waste weighs 12 kN/m^3.

Solution: Use $H = 25$ mm $= 0.025$ m, which is an estimate since the gravel particles are not isolated but are adjacent to one another, $MF_S = 0.5$ for shape, $MF_{PD} = 0.83$ for packing density, $MF_A = 0.25$ for arching $RF_{CR} = 1.5$ for creep and $RF_{CBD} = 1.3$ for long-term degradation Now calculate the value of P_{allow} using equation (5.32):

$$\text{FS} = p_{\text{allow}} p_{\text{reqd}}$$
$$3.0 = p_{\text{allow}}(50)(12)$$
$$p_{\text{allow}} = 1800 \text{ kN/m}^2$$

Calculate the required mass per unit area of the geotextile using equation (5.33):

$$p_{\text{allow}} = \left(50 + 0.00045\frac{M}{H^2}\right)\left[\frac{1}{\text{MF}_S \times \text{MF}_{PD} \times \text{MF}_A}\right]\left[\frac{1}{\text{FS}_{CR} \times \text{FS}_{CBD}}\right]$$
$$1800 = \left[50 + 0.00045\frac{M}{(0.025)^2}\right]\left[\frac{1}{0.5 \times 0.83 \times 0.25}\right]\left[\frac{1}{1.5 \times 1.3}\right]$$
$$M = 436 \text{ g/m}^2; \text{ use } 500 \text{ g/m}^2$$

The isolated value of 50 kPa in the above equation represents the puncture resistance of the 1.5 mm HDPE geomembranes by itself. Other thicknesses of HDPE or other types of geomembranes will give proportionately different values.

5.6.8 Runout and Anchor Trenches

The terminus of geomembranes is a short horizontal runout at the top of the slope (recall Figure 5.27), and then (usually) a short drop into an anchor trench (recall Figure 5.28). The anchor trench is backfilled with soil and suitably compacted. Concrete anchor trenches with full fixity to the liner should generally not be used since geomembrane pullout is probably more desirable than geomembrane failure, although both should obviously be avoided.

The design method is explained and illustrated in Section 5.3.6 and will not be repeated here. Both analyses (runout alone and runout plus anchor trench) are applicable, with the latter being the most common. Alternatively, a V-trench configuration is also possible.