

44-06

**DOCUMENTATION REPORT**

**CONSTRUCTION OF THE  
LANDFILL NO. 6-AREA A  
VALLEY FILL**

**BLUE RIDGE PAPER PRODUCTS, INC.  
CANTON, NORTH CAROLINA**

**SEPTEMBER 2007**

Fac/Perm/Co ID# 44-06  
Date *Carmen Johnson* 6/1/09  
DIN  
Doc ID#  
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**SME**

*Sevee & Maher Engineers, Inc.*  
Waste Management and Hydrogeologic Consultants  
Cumberland Center, Maine





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SOLID WASTE SECTION  
ASHEVILLE REGIONAL OFFICE

September 12, 2007

Mr. James Coffey  
NCDENR, Solid Waste Section  
2090 U.S. Highway 70  
Swannanoa, NC 28778

Subject: Cell VI – Valley Fill and Vertical Extension  
Landfill No. 6, Permit Number 44-06

Dear Mr. Coffey:

Blue Ridge Paper Products, Inc (BRPP) requests approval from the North Carolina Department of Environmental and Natural Resources (NCDENR) to expand the landfill operations in Landfill Number 6, Area A West into the Valley Fill area, and extend Area A West 30-feet above the currently permitted elevation. The Valley Fill area is an easterly extension of Cell VI, lying between Area A West and Area A East.

The construction documentation report for the Valley Fill area is enclosed and shows that construction was performed in accordance with the engineering drawings and specifications. The current version of the Operations Manual that includes the Valley Fill area was provided to the NCDENR in March 2006 as part of the vertical expansion request for Cell VI. It includes the necessary procedures and elevations to incorporate the Valley Fill project and the 30-foot extension.

For continuity of operations we request approval prior to year-end 2007. If you have any questions during your review of the enclosed material, please do not hesitate to contact us.

Sincerely,

Jim Giaque  
Waste Compliance & Landfill Supervisor  
Blue Ridge Paper Products Inc  
[giauqj@blueridgepaper.com](mailto:giauqj@blueridgepaper.com)  
828-646-2028 FAX 828-646-6892

Copy: Derric Brown  
Guy Cote

Enclosure  
file:coffey valley fill 9-12-07

Paul Dickens  
Manager Environmental Affairs  
Blue Ridge Paper Products Inc  
[dickep@blueridgepaper.com](mailto:dickep@blueridgepaper.com)  
828-646-6141 FAX 828-646-6892

Environmental Group  
175 Main Street • PO Box 4000  
Canton, North Carolina 28716 • 828-646-2000

*Raising Your Expectations*

# DOCUMENTATION REPORT

## CONSTRUCTION OF LANDFILL NO. 6-AREA A VALLEY FILL

CANTON, NORTH CAROLINA

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## NARRATIVE SUMMARY

This report contains construction documentation information for the Valley Fill development at the Number 6 Landfill facility owned by Blue Ridge Paper Products, Inc, in Canton, North Carolina (Permit No. 44-06). The Valley Fill area is located between Areas 6A-East and 6A-West, and consists of approximately one acre.

Construction of the Valley Fill area began on June 12, 2007 and was substantially complete on July 14, 2007. The parties involved with the construction of the project are summarized below.

Organization	Responsibility
Blue Ridge Paper Products	Owner
Sevee & Maher Engineers, Inc. (SME)	Project Manager, Designer, and Resident Engineer, Soil Quality Assurance Laboratory
Shamrock Environmental	General Contractor
Hallaton	Geosynthetics Installer
TRI/Environmental	Geosynthetic Quality Assurance Laboratory

Daily construction report minutes were prepared by SME and are provided in the section entitled Daily Reports. These reports discuss the progress made on the project and any changes to the approved plans and specifications that were required to address field conditions. Copies of the photographs providing construction documentation are included in the section entitled Construction Photographs.

The project was divided into three phases: (1) base grade preparation; (2) geomembrane installation; and (3) leachate collection installation. Base grade preparation occurred between June 12, 2007 and July 9, 2007. Shamrock cleared and grubbed the site, installed 1,400 cubic yards of soil (1 inch -minus) to serve as the bedding layer for the geosynthetic clay liner (GCL). Hallaton began installation of the GCL and 60-mil geomembrane on July 10, 2007. Four seam samples were obtained from the geomembrane installation for seam tests and sent to TRI on July 12, 2007. The four samples passed the quality assurance testing requirements for the

project. A copy of the laboratory tests, geosynthetic material submittals, and a panel layout drawing are included in the document.

The geomembrane was overlain with non-woven geotextile and 12 inches of #78 stone for leachate collection. Leachate collection stone placement began on July 12, 2007. Approximately 1,400 cubic yards of leachate collection stone was placed above the geotextile.

The project was complete on July 14, 2007.

**STATEMENT OF COMPLIANCE/  
SUMMARY OF WORK**

**SME**

**Sevee & Maher Engineers, Inc.**  
Waste Management and Hydrogeologic Consultants

STATEMENT OF COMPLIANCE  
WITH APPROVED PLANS AND SPECIFICATIONS

Project Owner: **Blue Ridge Paper Products, Inc.**

Project Title: **Landfill No. 6-Area A Valley Fill Construction**

Project Location: **Canton, North Carolina**

Contractor: **Shamrock Environmental Corp.**

Engineer: **Sevee & Maher Engineers, Inc.**  
**Cumberland, Maine**

The undersigned, registered Professional Engineer in the State of North Carolina and in the employ of Sevee & Maher Engineers, Inc., which is responsible for construction monitoring pursuant to its contract with Blue Ridge Paper Products, Inc, states to the North Carolina Department of Environment and Natural Resources that it is the professional engineering opinion of Sevee & Maher Engineers, Inc., based on monitoring of the contractor's activities, and the quality control/quality assurance test results, that the construction of Landfill No. 6 – Area A Valley Fill in Canton, North Carolina is in general accordance and compliance with the contract, plans, specifications, and conditions as approved by the North Carolina Department of Environment and Natural Resources.

Date: 9/10/07

President: \_\_\_\_\_

*J. Sevee*  
John E. Sevee, P.E.  
Reg. No. 20589



BRPP VF construction-SOC.doc

**DAILY REPORTS**

DATE: June 12, 2007

DAY: Tuesday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: mostly sunny  
 TEMP: 80

AVERAGE FIELD FORCE			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	2	
VISITOR			
Time	Name	Representing	Remarks
EQUIPMENT			
Cat 320			
Tri-axle			
D6			
Roller			
CONSTRUCTION ACTIVITIES			
Small crew on site, still mostly setting project up. Robert Evans (project supt.) setting up GPS base station and has requested additional information on diversion berm location and lined area. All info supplied to Robert by mid afternoon.			
Began to expose the anchor trench on the north end of the project on both east and west sides of the road.			

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BY: P Monroe TITLE : Field Engineer

DATE: June 13, 2007  
 DAY: Wednesday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: mostly cloudy  
 TEMP: 55-72

<b>AVERAGE FIELD FORCE</b>			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	2	
<b>VISITOR</b>			
Time	Name	Representing	Remarks
<b>EQUIPMENT</b>			
Cat 320			
Tri-axle			
D6			
Roller			
<b>CONSTRUCTION ACTIVITIES</b>			
Continues to expose anchor trench on east cell briefly in the morning before switching work to stripping off vegetative soil. Work going very slowly due to the crew size. One man on the dozer stripping material, the other loading the one truck with excavator and also driving truck to stockpile. Dozer operator did drive when stripping activities were caught up to loading. Robert trying to Calibrate GPS but having difficulty finding benchmarks.			
Waiting for water truck to be on site, also second truck and driver scheduled to be on site as well			
Silt fence installed in ditch lines adjacent to work area and culvert inlets closed off.			

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BY: P Monroe

TITLE : Field Engineer



DATE: June 15, 2007

DAY: Friday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: mostly cloudy/pm t. storms  
 TEMP: 53-76

<b>AVERAGE FIELD FORCE</b>			
<b>Name of Contractor</b>	<b>Supervisor</b>	<b>Non-Supervisor</b>	<b>Remarks</b>
Shamrock Environmental	1	3	

<b>VISITOR</b>			
<b>Time</b>	<b>Name</b>	<b>Representing</b>	<b>Remarks</b>

<b>EQUIPMENT</b>			
Cat 320			
(2)Tri-axle			
D6			
Roller			

<b>CONSTRUCTION ACTIVITIES</b>			
Completed berm construction minus seed and mulch			
Began stripping cover soil mid morning, only one truck hauling material until 11:00 when dozer operator temporarily stopped stripping cover to drive the second truck.			
Discussed with Blue Ridge how clean they wanted they wanted the stone to be on the slope of 6A east. It was decided to leave a very fine layer of soil with scattered areas of exposed stone to help control odor, and to minimize the risk of cutting into the waste.			

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BY: P Monroe                      TITLE : Field Engineer

DATE: June 16, 2007

DAY: Saturday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: mostly sunny

TEMP: 55-82

<b>AVERAGE FIELD FORCE</b>			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	
<b>VISITOR</b>			
Time	Name	Representing	Remarks
<b>EQUIPMENT</b>			
Cat 320			
(2)Tri-axle			
D6			
Roller			
<b>CONSTRUCTION ACTIVITIES</b>			
Work resumed on cover soil removal. Work began very slowly with one operator running the excavator and driving one of the trucks			
Until the supervisor (Robert) began running the exc. at 9:00. This allowed both trucks to remain running and the dozer to strip soil			
Without interruption.			

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BY: P Monroe

TITLE : Field Engineer

DATE: June 18, 2007  
 DAY: Monday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: mostly sunny/late t-storm  
 TEMP: 57-85

AVERAGE FIELD FORCE			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	
VISITOR			
Time	Name	Representing	Remarks
EQUIPMENT			
Cat 320			
(2)Tri-axle			
D6			
Roller			
Water Truck			
CONSTRUCTION ACTIVITIES			
Continued with cover soil removal. One truck parked due to Robert being off site for a while in the morning. Southern Maintenance Put a truck on hauling cover soil to a couple other previously closed cells for Blue Ridge Paper. Material is needed to fill low spots That do not allow for positive drainage. The additional truck is a positive for Shamrock by increasing production and a benefit to The mill by eliminating the need to handle the material twice.			
4 rolls of GCL arrived on the site at 10:30.			
Thunder storm hit late in the day, ending work around 6:00pm			

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BY: P Monroe TITLE : Field Engineer

DATE: June 19, 2007  
 DAY: Tuesday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: cloudy am/rain pm  
 TEMP: 58-75

<b>AVERAGE FIELD FORCE</b>			
<b>Name of Contractor</b>	<b>Supervisor</b>	<b>Non-Supervisor</b>	<b>Remarks</b>
Shamrock Environmental	1	3	

<b>VISITOR</b>			
<b>Time</b>	<b>Name</b>	<b>Representing</b>	<b>Remarks</b>

<b>EQUIPMENT</b>
Cat 320
(2)Tri-axle
D6
Roller
Water Truck

<b>CONSTRUCTION ACTIVITIES</b>
Back to only one truck hauling cover soil in the morning. Dozer being used to scrape up stockpile area after the rain that suspended Work last night. Robert resumed digging mid morning to allow for the exc. operator to drive the second truck.
Day was shortened by rain after lunch creating too much mud in the stockpile area to continue. Crew finally suspended work at 3:30

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BY: P Monroe TITLE : Field Engineer

DATE: June 20, 2007  
 DAY: Wednesday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: mostly sunny  
 TEMP: 58-75

<b>AVERAGE FIELD FORCE</b>			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	
<b>VISITOR</b>			
Time	Name	Representing	Remarks
<b>EQUIPMENT</b>			
Cat 320			
(2)Tri-axle			
D6			
Roller			
Water Truck			
<b>CONSTRUCTION ACTIVITIES</b>			
Remaining GCL was on site in the morning, crew was tied up unloading material until 9:00 then resumed cover removal			
Robert Evans reminded again that the borrow source test results for the material that he intended to use below the liner had not been Submitted. This lack of results could impact project schedule if not dealt with soon.			
One of the trucks backed into the other while moving in under excavator. Little damage but is Shamrock policy to have drug test On any employee involved in any accident. Robert and the driver were off site at 3:00pm for that reason leaving only two men Working on the site for the remainder of the day.			

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BY: P Monroe

TITLE : Field Engineer



DATE: June 22, 2007  
 DAY: Friday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: mostly sunny  
 TEMP: 58-80

AVERAGE FIELD FORCE			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	
VISITOR			
Time	Name	Representing	Remarks
EQUIPMENT			
Cat 320			
(2)Tri-axle			
D6			
Roller			
Water Truck			
CONSTRUCTION ACTIVITIES			
16oz fabric arrived on site and was unloaded by Shamrock			
Continued with work of removing soil from the slope of road on the 6A east side. Slow process with significant hand work to Risk of damaging the liner.			
Labor Ready scheduled to supply 2 temporary laborers to assist with the process.			

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BY: P Monroe

TITLE : Field Engineer

DATE: June 23, 2007  
 DAY: Saturday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny am/showers pm  
 TEMP: 60-88

AVERAGE FIELD FORCE			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	+2 temp laborers/labor ready

VISITOR			
Time	Name	Representing	Remarks

EQUIPMENT
Cat 320
(2)Tri-axle
D6
Roller
Water Truck

CONSTRUCTION ACTIVITIES
Continued with cleaning soil and stone from roadway slopes. Started on 6A west, clearing stone. Waste in the center of the cell had to be pulled back to make room for road excavation. Material was moved back further into cell with excavator.
Supervisor off site at 3:00pm to go home for the remainder of the weekend.
Crew continued to work until 5:00pm getting more than half way down the length of 6A east with slope exc.

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BY: P Monroe

TITLE : Field Engineer

DATE: June 25, 2007  
 DAY: Monday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: partly sunny/pm t-storms  
 TEMP: 62-85

<b>AVERAGE FIELD FORCE</b>			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	+2 temp laborers/Labor Ready
<b>VISITOR</b>			
Time	Name	Representing	Remarks
<b>EQUIPMENT</b>			
Cat 320			
(2)Tri-axle			
D6			
Roller			
Water Truck			
<b>CONSTRUCTION ACTIVITIES</b>			
Resumed excavation 6A east slope. Supervisor (Robert Evans) not on site until 10:30 but crew working fine without him			
Reminded Robert that borrow source testing on backfill material had not been submitted.			
At 3:00pm needed to pull Robert aside for a little discussion -- excavation grades that he was laying out for road cut were incorrect. Also was not involved with the excavation work his crew was performing on the road slope of 6A east. He had been relying on SME for direction for crew members.			
Sample of the material that Shamrock intended to use under liner was delivered to the site by Vulcan. Robert to get this to a lab For testing in the morning.			

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BY: P Monroe                      TITLE : Field Engineer

DATE: June 26, 2007  
 DAY: Tuesday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: mostly sunny/pm showers  
 TEMP: 58-88

<b>AVERAGE FIELD FORCE</b>			
<b>Name of Contractor</b>	<b>Supervisor</b>	<b>Non-Supervisor</b>	<b>Remarks</b>
Shamrock Environmental	1	3	+2 temp laborers/Labor Ready
<b>VISITOR</b>			
<b>Time</b>	<b>Name</b>	<b>Representing</b>	<b>Remarks</b>
<b>EQUIPMENT</b>			
Cat 320			
(2)Tri-axle			
D6			
Roller			
Water Truck			
<b>CONSTRUCTION ACTIVITIES</b>			
Slow start to the day. Began the work of cutting the road out on the north end. Robert left the site to deliver the material sample To a lab for testing and was not back on site until 10:00am. Again he was not available to direct crew.			
Cannot get a commitment from Shamrock on the schedule. There has been some discussion about not working over the upcoming Weekend, but nothing confirmed. Also no schedule on the arrival of the liner sub.			
Crew nearly completed the low point at the north end before work suspended early due to rain showers at 5:00pm			

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BY: P Monroe TITLE : Field Engineer

DATE: June 27, 2007  
 DAY: Wednesday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: mostly sunny  
 TEMP: 60-85

AVERAGE FIELD FORCE			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	

VISITOR			
Time	Name	Representing	Remarks

EQUIPMENT
Cat 320
(2)Tri-axle
D6
Roller
Water Truck

CONSTRUCTION ACTIVITIES
Work continued on the road excavation – slow but steady
Robert Evans and one equipment operator went out to the quarry to look at the material that is intended for use under the liner- Still do not have borrow source testing completed. Following visit Robert was concerned about the distance and the round trip times For the trucks.
Decision was made by Shamrock to take the upcoming weekend off.

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BY: P Monroe

TITLE : Field Engineer



DATE: June 29, 2007  
 DAY: Friday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny / pm t storms  
 TEMP: 68-88

<b>AVERAGE FIELD FORCE</b>			
<b>Name of Contractor</b>	<b>Supervisor</b>	<b>Non-Supervisor</b>	<b>Remarks</b>
Shamrock Environmental	1	3	

<b>VISITOR</b>			
<b>Time</b>	<b>Name</b>	<b>Representing</b>	<b>Remarks</b>

<b>EQUIPMENT</b>
Cat 320
(2)Tri-axle
D6
Roller
Water Truck

<b>CONSTRUCTION ACTIVITIES</b>
Road excavation work – subgrade was in very good condition – no damage from the storm yesterday afternoon.
Still no borrow source testing results on backfill material
One equipment operator going on vacation next week no word on if a replacement will be available. This could slow project even further.
Work suspended at noon for the long weekend and is not scheduled to resume until mid day Monday.

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BY: P Monroe

TITLE : Field Engineer



DATE: July 3, 2007  
 DAY: Tuesday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny  
 TEMP: 65-85

<b>AVERAGE FIELD FORCE</b>			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	
<b>VISITOR</b>			
Time	Name	Representing	Remarks
<b>EQUIPMENT</b>			
Cat 320			
(2)Tri-axle			
D6			
Roller			
Water Truck			
<b>CONSTRUCTION ACTIVITIES</b>			
Completed the subgrade excavation on the south end, completed proof rolling the entire subgrade area			
New truck driver on site to increase production.			
Started a little site cleanup			

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BY: P Monroe                      TITLE : Field Engineer

DATE: July 5, 2007  
 DAY: Thursday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny  
 TEMP: 66-80

<b>AVERAGE FIELD FORCE</b>			
<b>Name of Contractor</b>	<b>Supervisor</b>	<b>Non-Supervisor</b>	<b>Remarks</b>
Shamrock Environmental	1	3	

<b>VISITOR</b>			
<b>Time</b>	<b>Name</b>	<b>Representing</b>	<b>Remarks</b>

<b>EQUIPMENT</b>
Cat 320
(2)Tri-axle
D6
Roller
Water Truck

<b>CONSTRUCTION ACTIVITIES</b>
Results on the new soil source still not available, supposed to have been completed by late afternoon, now expected at 8:00 Friday
Crew cleaned up the south end excavation, and cleaned out around the damaged liner at the top of 6A west.
Shamrock hauled in small amount of the borrow material to construct a ramp into the work area. If results comeback with failing Numbers the material will be removed in the morning.

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BY: P Monroe                      TITLE : Field Engineer

DATE: July 6, 2007  
 DAY: Friday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny  
 TEMP: 65-82

<b>AVERAGE FIELD FORCE</b>			
<b>Name of Contractor</b>	<b>Supervisor</b>	<b>Non-Supervisor</b>	<b>Remarks</b>
Shamrock Environmental	1	3	

<b>VISITOR</b>			
<b>Time</b>	<b>Name</b>	<b>Representing</b>	<b>Remarks</b>

<b>EQUIPMENT</b>
Cat 320
(2)Tri-axle
D6
Roller
Water Truck

<b>CONSTRUCTION ACTIVITIES</b>
Borrow material hauled in with a combination of Shamrock trucks and 5 hired trucks.
Test results not available at 8:00am, then not available at 10:00am, Shamrock continued to bring material in expecting to get Good test results. Results did come in at 1:00pm and material was fine. In place samples taken and sent to Sevee & Maher lab To confirm borrow source results.
Completed placement of the bedding material by end of the day.

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BY: P Monroe TITLE : Field Engineer



DATE: July 9, 2007  
 DAY: Monday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny / pm showers  
 TEMP: 65-82

<b>AVERAGE FIELD FORCE</b>			
<b>Name of Contractor</b>	<b>Supervisor</b>	<b>Non-Supervisor</b>	<b>Remarks</b>
Shamrock Environmental	1	2	
<b>VISITOR</b>			
<b>Time</b>	<b>Name</b>	<b>Representing</b>	<b>Remarks</b>
<b>EQUIPMENT</b>			
Cat 320			
Tri-axle			
D6			
Roller			
Water Truck			
<b>CONSTRUCTION ACTIVITIES</b>			
Trimmed back liner materials, and cleaned all loose soils that had fallen onto existing slopes by hand and with shop vac.			
Afternoon shower suspended work a little early.			
Liner crew on site late in the day, will start liner work in the morning.			

- DISTRIBUTION:
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  3. File
  4. N.C.DNR

BY: P Monroe                      TITLE : Field Engineer

DATE: July 10, 2007  
 DAY: Tuesday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny / pm showers  
 TEMP: 65-82

<b>AVERAGE FIELD FORCE</b>			
<b>Name of Contractor</b>	<b>Supervisor</b>	<b>Non-Supervisor</b>	<b>Remarks</b>
Shamrock Environmental	1	2	
Hallaton	1	12	
<b>VISITOR</b>			
<b>Time</b>	<b>Name</b>	<b>Representing</b>	<b>Remarks</b>
<b>EQUIPMENT</b>			
Cat 320			
Tri-axle			
D6			
Roller			
Water Truck			
<b>CONSTRUCTION ACTIVITIES</b>			
Liner crew on site -- started liner deployment mid morning after the site had been given a chance to dry out.			
GCL completed and all geomembrane deployed. All wedge welds completed on panel seams and Extrusion weld started on the Tie-in seams			

- DISTRIBUTION:
1. Proj. Mgr
  2. Client
  3. File
  4. N.C.DNR

BY: P Monroe TITLE : Field Engineer



DATE: July 12, 2007  
 DAY: Thursday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny  
 TEMP: 60-85

AVERAGE FIELD FORCE			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	
Hallaton	1	12	

VISITOR			
Time	Name	Representing	Remarks

EQUIPMENT
Cat 320
Tri-axle
D6
Roller
Water Truck

CONSTRUCTION ACTIVITIES
Liner work was almost completed – crew ran out of extrusion rod. Were not able to complete the final 45 feet of tie in, or the large Repair on 6A west. 16oz fabric was deployed and seamed. Most of the crew will be sent out tonight, supervisor will stay with 2 others to complete the welding Friday morning with rod that is getting shipped over night to the project.
Shamrock stockpiling the #78M on site to allow them to start install after the quarry closes for the day. Liner crew was cleaned up At 3:30pm and stone placement started immediately afterwards.
New dozer operator on site to place stone

- DISTRIBUTION:
1. Proj. Mgr
  2. Client
  3. File
  4. N.C.DNR

BY: P Monroe TITLE : Field Engineer

DATE: July 13, 2007  
 DAY: Friday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny  
 TEMP: 60-85

<b>AVERAGE FIELD FORCE</b>			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	
Hallaton	1	2	

<b>VISITOR</b>			
Time	Name	Representing	Remarks

<b>EQUIPMENT</b>
Cat 320
Tri-axle
D6
Roller
Water Truck

<b>CONSTRUCTION ACTIVITIES</b>
All remaining #78M stone delivered and placed in work area final grading of the stone to be done tomorrow
Extrusion rod arrived late morning Hallaton was able to complete the welding.
End-cap installed on culvert pipe.
Stone on south end shaped with excavator

- DISTRIBUTION:
1. Proj. Mgr
  2. Client
  3. File
  4. N.C.DNR

BY: P Monroe TITLE : Field Engineer

DATE: July 14, 2007  
 DAY: Saturday

PROJECT: 6A Valley Fill  
 JOB NO.: 07074.00  
 CLIENT: Blue Ridge Paper  
 CONTRACTOR : Shamrock Environmental  
 PROJECT MANAGER: Guy Cote

WEATHER: sunny  
 TEMP: 60-85

<b>AVERAGE FIELD FORCE</b>			
Name of Contractor	Supervisor	Non-Supervisor	Remarks
Shamrock Environmental	1	3	
<b>VISITOR</b>			
Time	Name	Representing	Remarks
<b>EQUIPMENT</b>			
Cat 320			
Tri-axle			
D6			
<b>CONSTRUCTION ACTIVITIES</b>			
Final grading of the stone completed			
Additional grading work on the south end completed			
Final cleanup around site			
Project completed			

- DISTRIBUTION:
1. Proj. Mgr
  2. Client
  3. File
  4. N.C.DNR

BY: P Monroe TITLE : Field Engineer

**CONSTRUCTION PHOTOGRAPHS**

BLUE RIDGE PAPER  
6A VALLEY FILL



cover soil removal



cover soil removal north end



stripping cover soil north end

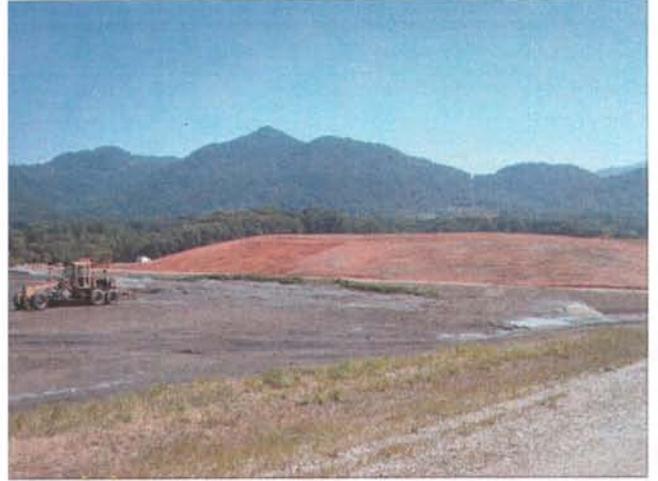


cover soil removal

BLUE RIDGE PAPER  
6A VALLEY FILL



cover soil removal nearing completion



6A East cover soil removed



stripping bottom of slope north end



cover soil removal

BLUE RIDGE PAPER  
6A VALLEY FILL



cover soil removal



stone removal slope of 6A west



cover soil removal



slope excavation 6A east

BLUE RIDGE PAPER  
6A VALLEY FILL



berm construction top of slope



berm construction top of slope



completed berm north end



berm under construction

BLUE RIDGE PAPER  
6A VALLEY FILL



cover soil removal



cover soil removal



cover soil removal



cover soil removal

BLUE RIDGE PAPER  
6A VALLEY FILL



cover soil removal



cover soil removal



cover soil removal



6A east slope excavation

BLUE RIDGE PAPER  
6A VALLEY FILL



exposed liner 6A west



6A east excavation



road excavation north end



road excavation

BLUE RIDGE PAPER  
6A VALLEY FILL



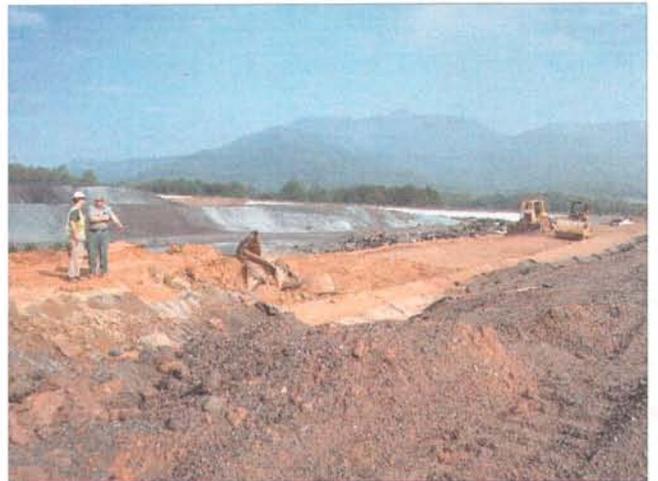
road excavation



road excavation



road excavation



road excavation south end

BLUE RIDGE PAPER  
6A VALLEY FILL



sub-grade prep



waste excavation south end



prepared subgrade



bedding soil placement

BLUE RIDGE PAPER  
6A VALLEY FILL



berm construction north end



berm construction north end



GCL deployment



completed GCL

BLUE RIDGE PAPER  
6A VALLEY FILL



fusion welding liner



tie-in prep 6A west



GCL and partially deployed liner



6A east tie-in

BLUE RIDGE PAPER  
6A VALLEY FILL



geomembrane south end



patch on DT-1



deployed geomembrane



6A west tie-in

BLUE RIDGE PAPER  
6A VALLEY FILL



6A west tie-in



repair on DT-2



repair at panel intersection



6A west tie-in

BLUE RIDGE PAPER  
6A VALLEY FILL



6A east tie-in



extrusion welding 6A east tie-in



extrusion welding 6A east tie-in



start of #78M stone placement

BLUE RIDGE PAPER  
6A VALLEY FILL



completed #78M stone



completed #78M stone north end

**CONSTRUCTION BORROW SOURCE/  
IN-PLACE TESTING**



**Sevee & Maher Engineers, Inc.**  
 Waste Management and Hydrogeologic Consultants  
 Cumberland Center, Maine

PAGE 1 OF 1	
DATE 7-09-07	

**FIELD DENSITY TEST**  
 DRIVE CYLINDER METHOD - ASTM D - 2937

PROJECT 6A Valley Fill
CLIENT BRPP
JOB # 07074.00

MAXIMUM DENSITY INFORMATION		

TEST NO.	LOCATION	T. WT.	S. WT.	WET DENS.	W. WT.	WT. M.	DRY DENS.	MAX DENS.	% COMP.	% REQ.	LIFT
		MOLD	VOL.		D WT.	%M.					
1	Valley Fill	788.3	541.7	115.6	2.52	0.51	92.3	97.5	94.6	90.0	1
	South End	246.6	17.85		2.01	25.3					
2	Valley Fill	776.4	531.0	113.4	1.54	0.28	92.8	97.5	95.1	90.0	1
		245.4	17.85		1.26	22.2					
3	Valley Fill	788.2	538.4	114.9	1.65	0.31	93.3	97.5	95.7	90.0	1
		249.8	17.85		1.34	23.1					
4	Valley Fill	780.5	533.8	114.1	1.94	0.37	92.4	97.5	94.7	90.0	1
		246.7	17.85		1.57	23.5					
5	Valley Fill	769.8	522.8	111.6	1.70	0.33	90	97.5	92.3	90.0	1
		247.0	17.85		1.37	24					
6	Valley Fill	766.7	520.1	111.0	2.03	0.40	89.2	97.5	91.5	90.0	1
	North End	246.6	17.85		1.63	24.5					

COPY TO:	CHECKED BY:	DATE: 7-09-07	TECHNICIAN: PLM
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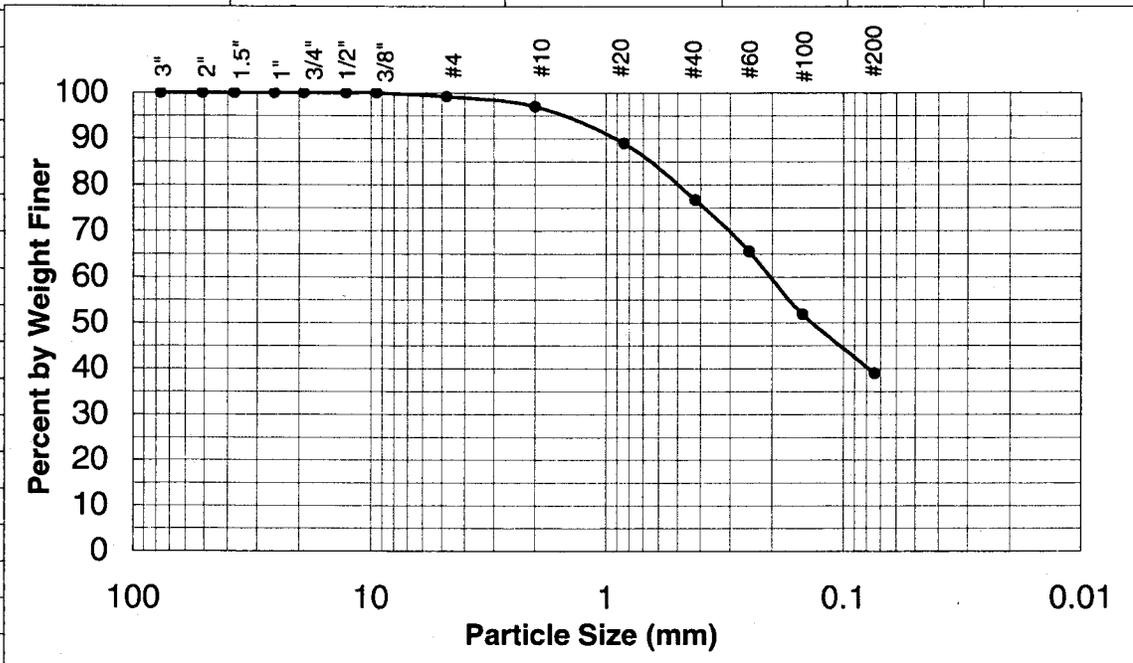
NOTE: All data subject to Engineering review.

**GRAIN SIZE ANALYSIS - ASTM D422**

PROJECT NAME:	Blue Ridge Paper Canton, N. Carolina	PROJECT No:	07074
		DATE:	15-Jul-07
SAMPLE SOURCE:	Valley Fill	SAMPLE No:	BED 1
SAMPLE DESCRIP:	Reddish brown silty m-f SAND		

**DATA**

U.S Std SIEVE (in.)	PARTICLE SIZE (mm)	% by WT. FINER	SPECIFICATION		P/F
			Min	Max	
3	76.2	100.0			
2	50.8	100.0			
1.5	37.5	100.0			
1	25.4	100.0	100	100	P
3/4	19.1	100.0			
1/2	12.7	100.0			
3/8	9.5	100.0			
#4	4.76	99.1			
#10	2.0	97.0			
#20	0.84	89.0			
#40	0.42	76.7			
#60	0.25	65.5			
#100	0.149	51.9			
#200	0.074	39.0	20	100	P



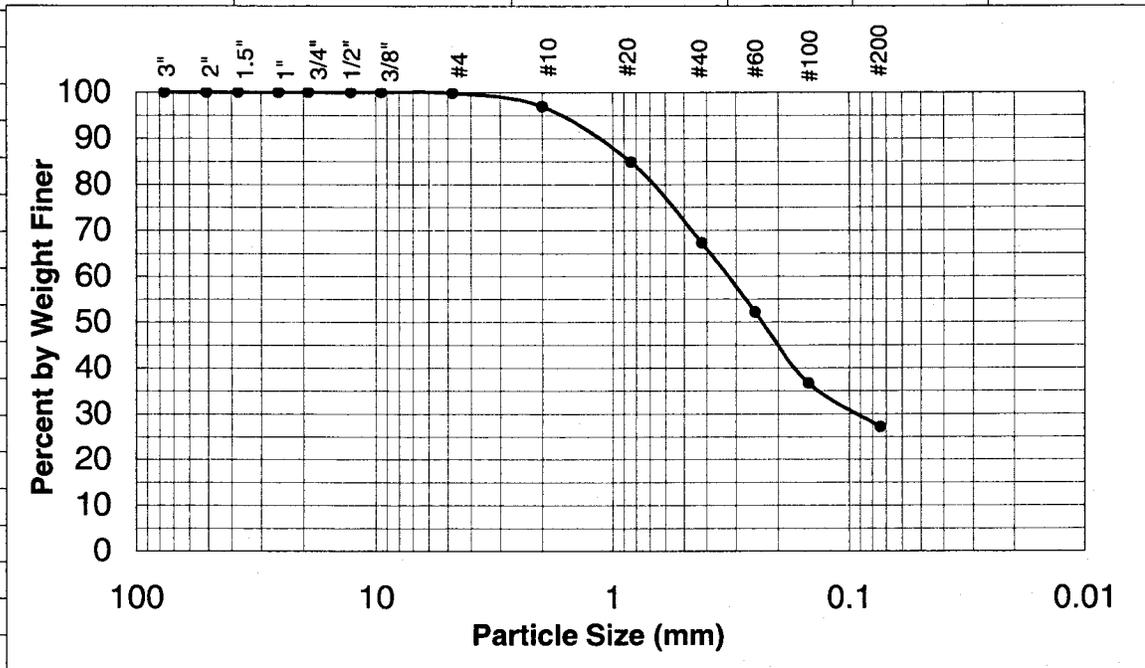
Water Content (%) = 14.8

### GRAIN SIZE ANALYSIS - ASTM D422

PROJECT NAME:	Blue Ridge Paper Canton, N. Carolina	PROJECT No:	07074
		DATE:	15-Jul-07
SAMPLE SOURCE:	Valley Fill	SAMPLE No:	BED 2
SAMPLE DESCRIP:	Reddish brown silty m-f SAND		

#### DATA

U.S Std SIEVE (in.)	PARTICLE SIZE (mm)	% by WT. FINER	SPECIFICATION		P / F
			Min	Max	
3	76.2	100.0			
2	50.8	100.0			
1.5	37.5	100.0			
1	25.4	100.0	100	100	P
3/4	19.1	100.0			
1/2	12.7	100.0			
3/8	9.5	100.0			
#4	4.76	99.8			
#10	2.0	97.0			
#20	0.84	84.9			
#40	0.42	67.3			
#60	0.25	52.2			
#100	0.149	36.7			
#200	0.074	27.1	20	100	P



Water Content (%) = 10.4

**GEOSYNTHETIC THIRD PARTY TEST RESULTS AND MATERIAL  
CERTIFICATIONS**



June 14, 2007

**Mail To:**

**Bill To:**

**Mr. Scott Brinkerhoff**  
**Hallaton, Inc.**  
100 East Pennsylvania Avenue, Ste. 203  
Towson, MD 21286

**<= Same**

email: sbrinkerhoff@hallaton.com  
cc email: kgarber@hallaton.com  
Fax: 410-583-7720

Dear Mr. Brinkerhoff:

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:** **Blue Ridge Paper**

**TRI Job Reference Number:** E2284-27-07

**Material(s) Tested:** 1 Agru 60mil Microspike HDPE Geomembrane(s)

**Test(s) Requested:** Thickness (ASTM D 5994)  
Density (ASTM D 1505)  
Carbon Content (ASTM D 4218)  
Carbon Dispersion (ASTM D 5596)  
Tensile (ASTM D 6693)

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

Sincerely,

Dr. Mansukh Patel  
Sr. Laboratory Coordinator  
Geosynthetic Services Division  
[www.GeosyntheticTesting.com](http://www.GeosyntheticTesting.com)

cc: Sam R Allen, Vice President and Division Manager



**GEOMEMBRANE TEST RESULTS**

TRI Client: Hallaton, Inc.  
Project: Blue Ridge Paper

Material: Agru 60mil Microspike HDPE Geomembrane  
Sample Identification: 414606.07  
TRI Log #: E2284-27-07

PARAMETER	TEST REPLICATE NUMBER										MEAN	STD. DEV.
	1	2	3	4	5	6	7	8	9	10		
<b>Thickness (ASTM D 5994)</b>												
Thickness (mils)	71	65	62	59	60	66	63	62	62	60	<b>63</b> <b>59</b>	4 << min
<b>Density (ASTM D 1505)</b>												
Density (g/cm3)	0.947	0.947	0.947								<b>0.947</b>	0.000
<b>Carbon Black Content (ASTM D 4218)</b>												
% Carbon Black	2.45	2.46									<b>2.46</b>	0.01
<b>Carbon Black Dispersion (ASTM D 5596)</b>												
Rating - 1st field view	1	1	1	1	1							
Rating - 2nd field view	1	1	1	1	1							
<b>Tensile Properties (ASTM D 6693, 2 ipm strain rate)</b>												
MD Yield Strength (ppi)	139	162	159	152	142						<b>151</b>	10
TD Yield Strength (ppi)	175	162	159	167	150						<b>163</b>	9
MD Break Strength (ppi)	181	180	175	177	186						<b>180</b>	4
TD Break Strength (ppi)	198	127	153	179	186						<b>169</b>	29
MD Yield Elongation (%)	22	22	22	22	22						<b>22</b>	0
TD Yield Elongation (%)	18	18	18	18	18						<b>18</b>	0
MD Break Elongation (%)	416	460	448	419	450						<b>439</b>	20
TD Break Elongation (%)	580	431	478	518	631						<b>528</b>	80
MD Machine Direction	TD Transverse Direction											

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.



# quality certificate

ROLL # **414606-07**

Lot #: **MM196121**

Liner Type: **MICROSPIKE™ HDPE**

Measurement		METRIC	ENGLISH	Thickness.....	1.5 mm	60 mil
ASTM D5994	MIN:	1.41 mm	56 mil	Length.....	125 m	410.1 feet
(Modified)	MAX:	1.72 mm	68 mil	Width.....	7.00 m	23.0 feet
Asperity GRI GM12:	35 mil	AVE:	1.55 mm	61 mil		
ODD #: TOP	EVEN #: BOTTOM					

### TEST RESULTS

OIT(Standard) ASTM D3895 minutes **150**

Specific Gravity	Density	g/cc	<b>.946</b>
ASTM D792			

MFI ASTM D1238	Melt Flow Index 190°C /2160 g	g/10 min	<b>.20</b>
COND. E			
GRADE:	<b>7002</b>		

Carbon Black Content	Range	%	<b>2.48</b>
ASTM D4218			

Carbon Black Dispersion	Category	<b>1</b>
ASTM D5596		

Tensile Strength	Average Strength @ Yield	<b>28 N/mm</b>	<b>159 ppi</b>	<b>2,599 psi</b>
ASTM D6693				
ASTM D638 (Modified)				
( 2 inches / minute )				

Average Strength @ Break	<b>30 N/mm</b>	<b>171 ppi</b>	<b>2,802 psi</b>
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Elongation ASTM D6693	Average Elongation @ Yield	%	<b>16.89</b>
ASTM D638 (Modified)			
( 2 inches / minute )			

Lo = 1.3" Yield	Average Elongation @ Break	%	<b>481.9</b>
Lo = 2.0" Break			

Dimensional Stability	Average Dimensional change	%	<b>-.31</b>
ASTM D1204 (Modified)			

Tear Resistance	Average Tear Resistance	<b>231.9 N</b>	<b>52.146 lbs</b>
ASTM D-1004 (Modified)			

Puncture Resistance	Load	<b>430.9 N</b>	<b>96.871 lbs</b>
FTMS 101 Method 2065 (Modified)			

Puncture Resistance	Load	<b>617.0 N</b>	<b>138.71 lbs</b>
ASTM D4833 (Modified)			

ESCR	Minimum Hrs w/o Failures	1500 hrs	<b>CERTIFIED</b>
ASTM D1693			

Notched Constant Tensile Load	pass / fail @ 30%	300 hrs	<b>pass</b>
ASTM D5397			

Customer:  
PO:  
Destination

Date:..... **4-9-07**

Signature..... *[Signature]*  
Quality Control Department

60HDmic.FRM  
REV 03  
12/23/05



# quality certificate

ROLL # **414607-07** Lot #: **MM196121** Liner Type: **MICROSPIKE™ HDPE**

Measurement		METRIC	ENGLISH	Thickness.....	1.5 mm	60 mil
ASTM D5994 (Modified)	MIN:	1.43 mm	56 mil	Length.....	125 m	410.1 feet
	MAX:	1.70 mm	67 mil	Width.....	7.00 m	23.0 feet
Asperity GRI GM12: 27 mil	AVE:	1.53 mm	60 mil	<b>TEST RESULTS</b>		
ODD #: TOP EVEN #: BOTTOM				OIT(Standard) ASTM D3895 minutes	150	

Specific Gravity ASTM D792	Density	g/cc	.946
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MFI ASTM D1238 COND. E GRADE: 7002	Melt Flow Index 190°C /2160 g	g/10 min	.20
--	-------------------------------	----------	-----

Carbon Black Content ASTM D4218	Range	%	2.48
------------------------------------	-------	---	------

Carbon Black Dispersion ASTM D5596	Category		1
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Tensile Strength ASTM D6693 ASTM D638 (Modified) ( 2 inches / minute )	Average Strength @ Yield	27 N/mm	157 ppi	2,599 psi
	Average Strength @ Break	30 N/mm	169 ppi	2,802 psi

Elongation ASTM D6693 ASTM D638 (Modified) ( 2 inches / minute ) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	%	16.89
	Average Elongation @ Break	%	481.9

Dimensional Stability ASTM D1204 (Modified)	Average Dimensional change	%	-31
--	----------------------------	---	-----

Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	231.9 N	52.146 lbs
---	-------------------------	---------	------------

Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	430.9 N	96.871 lbs
--	------	---------	------------

Puncture Resistance ASTM D4833 (Modified)	Load	617.0 N	138.71 lbs
--	------	---------	------------

ESCR ASTM D1693	Minimum Hrs w/o Failures	1500 hrs	<b>CERTIFIED</b>
--------------------	--------------------------	----------	------------------

Notched Constant Tensile Load ASTM D5397	pass / fail @ 30%	300 hrs	<b>pass</b>
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Customer:  
PO:  
Destination

Date:..... 4-9-07

Signature: *[Handwritten Signature]*  
Quality Control Department

60HDmic.FRM  
REV 03  
12/23/05



# quality certificate

ROLL # **414617-07**

Lot #: **MM196121**

Liner Type: **MICROSPIKE™ HDPE**

Measurement  
ASTM D5994  
(Modified)

METRIC ENGLISH  
MIN: **1.48 mm 58 mil**  
MAX: **1.77 mm 70 mil**

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

Asperity GRI GM12: **26 mil**  
ODD #: TOP EVEN#: BOTTOM

AVE: **1.59 mm 63 mil**

OIT(Standard) ASTM D3895 minutes **150** **TEST RESULTS**

Specific Gravity  
ASTM D792

Density

g/cc

**.946**

MFI ASTM D1238  
COND. E  
GRADE: **7002**

Melt Flow Index 190°C /2160 g

g/10 min

**.20**

Carbon Black Content  
ASTM D4218

Range

%

**2.48**

Carbon Black Dispersion  
ASTM D5596

Category

**1**

Tensile Strength  
ASTM D6693  
ASTM D638 (Modified)  
( 2 inches / minute )

Average Strength @ Yield

**28 N/mm**

**163 ppi**

**2,599 psi**

Average Strength @ Break

**31 N/mm**

**175 ppi**

**2,802 psi**

Elongation ASTM D6693  
ASTM D638 (Modified)  
( 2 inches / minute )  
Lo = 1.3" Yield  
Lo = 2.0" Break

Average Elongation @ Yield

%

**16.89**

Average Elongation @ Break

%

**481.9**

Dimensional Stability  
ASTM D1204 (Modified)

Average Dimensional change

%

**-.31**

Tear Resistance  
ASTM D-1004 (Modified)

Average Tear Resistance

**231.9 N**

**52.146 lbs**

Puncture Resistance  
FTMS 101 Method 2065 (Modified)

Load

**430.9 N**

**96.871 lbs**

Puncture Resistance  
ASTM D4833 (Modified)

Load

**617.0 N**

**138.71 lbs**

ESCR  
ASTM D1693

Minimum Hrs w/o Failures

**1500 hrs**

**CERTIFIED**

Notched Constant Tensile Load  
ASTM D5397

pass / fail @ 30%

**300 hrs**

**pass**

Customer:  
PO:  
Destination

Date:..... **4-9-07**

Signature..... *[Signature]*  
Quality Control Department

60HDmic.FRM  
REV 03  
12/23/05



# quality certificate

ROLL # **414618-07** Lot #: **MM196121** Liner Type: **MICROSPIKE™ HDPE**

Measurement		METRIC	ENGLISH	Thickness.....	1.5 mm	60 mil	
ASTM D5994	MIN:	1.46 mm	57 mil	Length.....	125 m	410.1 feet	
(Modified)	MAX:	1.78 mm	70 mil	Width.....	7.00 m	23.0 feet	
Asperity GRI GM12:	38 mil	AVE:	1.64 mm	65 mil			
ODD #: TOP	EVEN #: BOTTOM	OIT(Standard) ASTM D3895 minutes				150	<b>TEST RESULTS</b>

Specific Gravity	Density	g/cc	.946
ASTM D792			

MFI ASTM D1238	Melt Flow Index 190°C /2160 g	g/10 min	.20
COND. E			
GRADE:	7002		

Carbon Black Content	Range	%	2.48
ASTM D4218			

Carbon Black Dispersion	Category	1
ASTM D5596		

Tensile Strength	Average Strength @ Yield	29 N/mm	168 ppi	2,599 psi
ASTM D6693				
ASTM D638 (Modified)				
( 2 inches / minute )				

Average Strength @ Break	32 N/mm	181 ppi	2,802 psi
--------------------------	---------	---------	-----------

Elongation ASTM D6693	Average Elongation @ Yield	%	16.89
ASTM D638 (Modified)			
( 2 inches / minute )			
Lo = 1.3" Yield			
Lo = 2.0" Break	Average Elongation @ Break	%	481.9

Dimensional Stability	Average Dimensional change	%	-.31
ASTM D1204 (Modified)			

Tear Resistance	Average Tear Resistance	231.9 N	52.146 lbs
ASTM D-1004 (Modified)			

Puncture Resistance	Load	430.9 N	96.871 lbs
FTMS 101 Method 2065 (Modified)			

Puncture Resistance	Load	617.0 N	138.71 lbs
ASTM D4833 (Modified)			

ESCR	Minimum Hrs w/o Failures	1500 hrs	<b>CERTIFIED</b>
ASTM D1693			

Notched Constant Tensile Load	pass / fail @ 30%	300 hrs	<b>pass</b>
ASTM D5397			

Customer:  
PO:  
Destination

Date:..... 4-9-07

Signature..... *[Signature]*  
Quality Control Department

60HDmic.FRM  
REV 03  
12/23/05



# quality certificate

ROLL # **414722-07** Lot #: **MM196121** Liner Type: **MICROSPIKE™ HDPE**

Measurement	METRIC	ENGLISH	Thickness.....	1.5 mm	60 mil
ASTM D5994 (Modified)	MIN: 1.53 mm	60 mil	Length.....	125 m	410.1 feet
	MAX: 1.77 mm	70 mil	Width.....	7.00 m	23.0 feet
Asperity GRI GM12: 37 mil	AVE: 1.65 mm	65 mil	<b>TEST RESULTS</b>		
ODD #: TOP EVEN #: BOTTOM			OIT(Standard) ASTM D3895 minutes <b>150</b>		

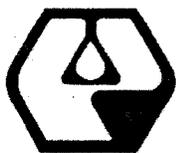
Specific Gravity ASTM D792	Density	g/cc	<b>.944</b>	
MFI ASTM D1238 COND. E GRADE: <b>7002</b>	Melt Flow Index 190°C /2160 g	g/10 min	<b>.20</b>	
Carbon Black Content ASTM D4218	Range	%	<b>2.12</b>	
Carbon Black Dispersion ASTM D5596	Category		<b>1</b>	
Tensile Strength ASTM D6693 ASTM D638 (Modified) ( 2 inches / minute )	Average Strength @ Yield	<b>29 N/mm</b>	<b>163 ppi</b>	<b>2,516 psi</b>
	Average Strength @ Break	<b>28 N/mm</b>	<b>158 ppi</b>	<b>2,428 psi</b>
Elongation ASTM D6693 ASTM D638 (Modified) ( 2 inches / minute ) Lo = 1.3" Yield Lo = 2.0" Break	Average Elongation @ Yield	%	<b>17.12</b>	
	Average Elongation @ Break	%	<b>453.9</b>	
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional change	%	<b>-.31</b>	
Tear Resistance ASTM D-1004 (Modified)	Average Tear Resistance	<b>260.1 N</b>	<b>58.477 lbs</b>	
Puncture Resistance FTMS 101 Method 2065 (Modified)	Load	<b>466.5 N</b>	<b>104.87 lbs</b>	
Puncture Resistance ASTM D4833 (Modified)	Load	<b>649.3 N</b>	<b>145.96 lbs</b>	
ESCR ASTM D1693	Minimum Hrs w/o Failures	1500 hrs	<b>CERTIFIED</b>	
Notched Constant Tensile Load ASTM D5397	pass / fail @ 30%	300 hrs	<b>pass</b>	

Customer:  
PO:  
Destination

Date:..... **4-9-07**

Signature..... *[Signature]*  
Quality Control Department

60HDmic.FRM  
REV 03  
12/23/05



PETROMONT

Petromont and Company, Limited Partnership  
Petromont Inc., Sole General Partner  
10455 Metropolitan East  
Montreal-East, QC, H1B 1A1  
CANADA  
Tel: 514-640-7400  
<http://www.petromont.qc.ca>

Customer information	Quality certificate
AGRU AMERICA 500 GARRISON RD GEORGETOWN SC 29440 USA Contact PALMER GRANT 843-546-0516 Your reference 004491 Your material number	Repeat printout Date 2006/12/29 15:31:38 Delivery item PETROMONT HDPE-7002 Delivery number and item 80109548 000010 Order number and item 29684 000010 Vehicule UNPX 122883

Material : PETROMONT HDPE-7002  
 Batch MM 196121 / Qty 85,280 KG 188,010 lb

Characteristics	Unit	Value	Lower limit	Upper limit
Melt index 190C 2.16 kg	g/10mi	0.204	0.170	
Flow Index 190C 21.6kg	g/10mi	22.5	21.0	27.0
Density Annealed 15C/min	g/cc	0.9380	0.9365	0.9385
Pellet Count	#/g	28	20	35
Oxydative Induction Time	min	159	100	

\*\*\* End \*\*\*

Daniel L'Archevêque  
Quality Control Laboratory  
Authorized representative



Responsible Care  
Beyond what's required.

Petromont certifies that the batch number of the product list above meet its internal manufacturing specifications for the properties listed above.



Date: 6/19/2007

Purchase Order: P6398

ORDER NUMBERS: 022745401, 022745402

Kennedy Garber  
Hallaton  
Suite 203  
Towson, MD 21286  
kgarber@hallaton.com

To Whom it May Concern:

Please find enclosed the MQA/MQC test data package for Geosynthetic Clay Liner shipments to Hallaton. The shipments left our Cartersville, Georgia plant on 06/15/2007.

If you have any questions regarding this information, please contact me at (770) 387-7773.

Sincerely,

A handwritten signature in cursive script that reads "Melanie King".

Melanie King  
Quality Assurance Coordinator  
CETCO Cartersville Plant



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**GEOSYNTHETIC CLAY LINER  
MANUFACTURING QUALITY ASSURANCE DATA PACKAGE**

PROJECT NAME: Shamrock Environmental  
CUSTOMER P.O.: P6398  
ORDER NUMBERS: 022745401, 022745402  
PREPARED FOR: Hallaton

**CONTENTS:**

- Daily production and needle detection certification
- GCL property specifications
- Order packing list
- GCL 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

Fax:

E-Mail: [melanie.king@cetco.com](mailto:melanie.king@cetco.com)



**PRODUCTION CERTIFICATION**

PROJECT NAME: Shamrock Environmental  
CUSTOMER P.O.: P6398  
PREPARED FOR: Hallaton

CETCO affirms that these products meet the physical and chemical criteria listed on the attached GCL property specification sheet.

**NEEDLE REMOVAL AND DETECTION PROCEDURE**

CETCO hereby affirms that all Bentomat<sup>®</sup> 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<sup>®</sup> to be essentially free of broken needles and fragments of needles that would negatively effect the performance of the final product.

A handwritten signature in cursive script, appearing to read "Melanie King", is located below the main text of the document.

Melanie King  
Quality Assurance Coordinator  
Colloid Environmental Technologies Co. ( CETCO )

Ship Date: 06/15/2007

Order Numbers: 022745401, 022745402

Prepared For: Hallaton

The GCL raw materials and GCL finished product manufactured for the above-referenced order number(s) are hereby certified to achieve the properties 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 (3.6 kg/sq m) Min
ASTM D 5890	Bentonite Swell Index	1 per 50 Tons	24 ml/2g Min
ASTM D 4632	GCL Grab Strength	200,000 sq ft (20,000 sq m)	90 lbs (400 N) MARV
ASTM D 6768	GCL Grab Strength	200,000 sq ft (20,000 sq m)	22.5 lbs/in (40 N/cm) MARV
ASTM D 5321	GCL Hydrated Internal Shear Strength	Periodic	500 psf (24 kPa) typ @ 200 psf
ASTM D 5887	GCL Hydraulic Conductivity	Weekly	5 x 10 <sup>-9</sup> cm/ sec Max
ASTM D 5887	GCL Index Flux	Weekly	1 x 10 <sup>-8</sup> m <sup>3</sup> /m <sup>2</sup> /sec Max
ASTM D 6496	GCL Peel Strength	40,000 sq ft (4000 sq m)	2.5 lbs/in (4.4 N/cm) Min
ASTM D 4632	GCL Peel Strength	40,000 sq ft (4000 sq m)	15 lbs (65 N) 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.

**FABRIC SUPPLIER REQUIREMENTS FOR BENTOMAT ST**

Raw Material	test method	mass per area	units
Nonwoven Cover Fabric	ASTM D 5261	6.0	oz/yd <sup>2</sup>
Bentomat ST Woven Base Fabric	ASTM D 5261	3.2	oz/yd <sup>2</sup>

Fabric certifications from our raw material suppliers are on file at our production facility.



CETCO's MQA laboratory is GAI-accredited ([www.geosynthetic-institute.org/gai/lab.html](http://www.geosynthetic-institute.org/gai/lab.html)).

*Melanie King*

Melanie King  
 Quality Assurance Coordinator  
 CETCO Cartersville Plant



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### GCL ORDER PACKING LIST

GCL shipped for certification package number 022745401

Order #	Product	Lot Number	Roll Number	Length (ft)	Width (ft)	Square Ft	Weight (lbs)
022745401	CV-BENTOMAT ST	200724CV	00005001	150	15	2250	2704
022745401	CV-BENTOMAT ST	200724CV	00005002	150	15	2250	2672
022745401	CV-BENTOMAT ST	200724CV	00005003	150	15	2250	2678
022745401	CV-BENTOMAT ST	200724CV	00005004	150	15	2250	2664
022745401	CV-BENTOMAT ST	200724CV	00005005	150	15	2250	2680
022745402	CV-BENTOMAT ST	200724CV	00005006	150	15	2250	2678
022745401	CV-BENTOMAT ST	200724CV	00005007	150	15	2250	2678
022745402	CV-BENTOMAT ST	200724CV	00005008	150	15	2250	2690
022745401	CV-BENTOMAT ST	200724CV	00005010	150	15	2250	2668
022745401	CV-BENTOMAT ST	200724CV	00005012	150	15	2250	2604
022745401	CV-BENTOMAT ST	200724CV	00005013	150	15	2250	2662
022745401	CV-BENTOMAT ST	200724CV	00005014	150	15	2250	2704
022745401	CV-BENTOMAT ST	200724CV	00005015	150	15	2250	2700
022745401	CV-BENTOMAT ST	200724CV	00005016	150	15	2250	2736
022745402	CV-BENTOMAT ST	200724CV	00005017	150	15	2250	2686
022745402	CV-BENTOMAT ST	200724CV	00005018	150	15	2250	2700
022745401	CV-BENTOMAT ST	200724CV	00005019	150	15	2250	2696
022745401	CV-BENTOMAT ST	200724CV	00005020	150	15	2250	2694
022745401	CV-BENTOMAT ST	200724CV	00005022	150	15	2250	2702
022745401	CV-BENTOMAT ST	200724CV	00005023	150	15	2250	2696
Totals:				3000	300	45000	53692
Total Number of Rolls Certified: 20							



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**GCL MQA TRACKING FORM**

Listing of finished and raw materials used to produce certification package number 022745401

GCL			Geotextiles				Clay	
CV-BENTOMAT ST			CV-N/W-WHITE-ST			CV-WOVEN-ST	CV-CG 50-ST	
GCL Lot #	GCL Roll #	Roll # Tested	Cap Lot #	Cap Roll #	Roll # Tested	Base Roll #	Clay Lot #	
200724CV	00005001	00005001	200724CV	00001866	00001865	2008261636	793840A	
200724CV	00005002	00005001	200724CV	00001866	00001865	2008261636	793840A	
200724CV	00005003	00005001	200724CV	00001866	00001865	2008261636	793840A	
200724CV	00005004	00005001	200724CV	00001866	00001865	2008261636	793840A	
200724CV	00005005	00005001	200724CV	00001866	00001865	2008261636	793840A	
200724CV	00005006	00005001	200724CV	00001866	00001865	2008261636	793840A	
200724CV	00005007	00005001	200724CV	00001866	00001865	2008261636	793840A	
200724CV	00005008	00005001	200724CV	00001866	00001865	2008261636	793840A	
200724CV	00005010	00005001	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005012	00005001	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005013	00005001	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005014	00005001	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005015	00005001	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005016	00005016	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005017	00005016	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005018	00005016	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005019	00005016	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005020	00005016	200724CV	00001867	00001865	2008261636	793840A	
200724CV	00005022	00005016	200724CV	00001868	00001865	2008261636	793840A	
200724CV	00005023	00005016	200724CV	00001868	00001865	2008261636	793840A	



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### GCL MANUFACTURING QUALITY CONTROL TEST DATA

The following rolls in GCL certification package number 022745401 have been tested in our production facility lab.

Product	Lot # Tested	Roll # Tested	Mass Area	Grab Strength	Peel Strength
Standard Test Method:			ASTM D 5993	ASTM D 4632	ASTM D 4632
Standard Specification:			0.75 lb/sq ft MARV	90lbs MARV	15lbs MARV
CV-BENTOMAT ST	200724CV	00005001	0.94	336.4	46.5
CV-BENTOMAT ST	200724CV	00005016	0.87	336.4	41.2

ASTM test methods and property specifications per CETCO standard unless non-standard specifications were requested.  
Any non-standard property specifications requested for this order are noted on the attached GCL property specifications sheet.

The logo for CETCO, featuring the word "CETCO" in a bold, stylized font with a horizontal line through the middle of the letters.

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## **BENTONITE CLAY CERTIFICATION**

The Bentonite Clay used to produce Order 022745401 has been certified by CETCO with the following test results

<b>Reference</b>	<b>Moist</b>	<b>Swell</b>	<b>Fluid Loss</b>
Test Method:	ASTM D 2216	ASTM D 5890	ASTM D 5891
Specification:	12% Max	24 Min	18.0% Max
793840A	8.6	25.0	15.4

Tests approved by  
Melanie King  
CETCO  
Quality Assurance Coordinator



**GEOTEXTILE TEST RESULTS FOR RAW MATERIAL SUPPLIED BY A CETCO FACILITY**

The GCL in certification package number 022745401 was manufactured using these geotextiles:

Material	Lot #	Roll #	Mass Area	Grab Strength
CV-NON-WOVEN	200724CV	00001865	6.0	41.6



## GEOTEXTILE TEST RESULTS FROM MATERIAL SUPPLIERS

The GCL in certification package number 022745401 was manufactured with geotextiles which were tested with the following results.

BASE			
Material	Roll Number	Mass Area oz/yd <sup>2</sup>	Grab Strength lbs
PPX 82TEX	2008261636	3.3	168.0

**GEOSYNTHETIC INSTALLATION AND TESTING DOCUMENTATION**



July 12, 2007

**Mail To:**

**Mr. Scott Brinkerhoff**  
**Hallaton, Inc.**  
100 E. Pennsylvania Ave., Ste.203  
Towson, MD 21286

**Bill To:**

**<= Same**

e-mail: sbrinkerhoff@hallaton.com  
cc e-mail: kgarber@hallaton.com  
cc e-mail: jharward@hallaton.com  
Fax: 410-583-7720

Dear Mr. Brinkerhoff:

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:** **Blue Ridge Paper Co.**

**TRI Job Reference Number:** E2284-75-03

**Material(s) Tested:** 1 Heat Fusion Weld Seam(s)  
3 Single Extrusion Weld Seam(s)

**Test(s) Requested:** SAME DAY Peel and Shear  
(ASTM D 6392/GRI GM19/D 4437/NSF 54)

<b>Codes</b>	
AD	Adhesion failure (100% Peel)
BRK	Break in sheeting away from Seam edge
SE	Break in sheeting at edge of seam
AD-BRK	Break in sheeting after some adhesion failure - partial peel
SIP	Separation in the plane of the sheet (leaving the bond intact)
FTB	Film tearing bond (all non "AD" failures)
NON-FTB	100% peel

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

Sincerely,

Melissa Hunter  
Project Manager  
Geosynthetic Services Division  
[www.GeosyntheticTesting.com](http://www.GeosyntheticTesting.com)



**DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS**

TRI Client: Hallaton, Inc.  
Project: Blue Ridge Paper Co.

Material: HDPE  
SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54)  
TRI Log #: E2284-75-03

PARAMETER	TEST REPLICATE NUMBER					MEAN	
	1	2	3	4	5		
Sample ID:	DT-1						
Weld:	Heat Fusion						
Side A	Peel Strength (ppi)	138	130	134	132	142	Peel A 135
	Peel Incursion (%)	<10	<10	<10	<10	<10	
	Peel Locus of Failure Code	SE	SE	SE	SE	SE	
	Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Side B	Peel Strength (ppi)	121	116	120	120	120	Peel B 119
	Peel Incursion (%)	<10	<10	<10	<10	<10	
	Peel Locus of Failure Code	SE	SE	SE	SE	SE	
	Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
	Shear Strength (ppi)	173	173	171	171	170	Shear 172
	Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
Sample ID:	DT-2						
Weld:	Single Extrusion						
	Peel Strength (ppi)	133	137	128	131	144	Peel 135
	Peel Incursion (%)	<10	<10	<10	<10	<10	
	Peel Locus of Failure Code	SE	SE	SE	SE	SE	
	Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
	Shear Strength (ppi)	162	163	163	164	163	Shear 163
	Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	

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.



**DESTRUCTIVE SEAM QUALITY ASSURANCE TEST RESULTS**

TRI Client: Hallaton, Inc.

Project: Blue Ridge Paper Co.

Material: HDPE

SAME DAY Peel and Shear (ASTM D 6392/GRI GM19/D 4437/NSF 54)

TRI Log #: E2284-75-03

PARAMETER	TEST REPLICATE NUMBER					MEAN
	1	2	3	4	5	
<b>Sample ID:</b>	<b>DT-3</b>					
<b>Weld:</b>	<b>Single Extrusion</b>					
Peel Strength (ppi)	94	118	117	111	106	Peel <b>109</b>
Peel Incursion (%)	<10	<10	<10	<10	<10	
Peel Locus of Failure Code	SE	SE	SE	SE	SE	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	FTB	
Shear Strength (ppi)	170	172	167	173	164	Shear <b>169</b>
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
<b>Sample ID:</b>	<b>DT-4</b>					
<b>Weld:</b>	<b>Single Extrusion</b>					
Peel Strength (ppi)	153	135	163	136	*	Peel <b>147</b>
Peel Incursion (%)	<10	<10	<10	<10	*	
Peel Locus of Failure Code	SE	SE	SE	SE	*	
Peel NSF Failure Code	FTB	FTB	FTB	FTB	*	
Shear Strength (ppi)	169	166	169	168	167	Shear <b>168</b>
Shear Elongation @ Break (%)	>50	>50	>50	>50	>50	
* Insufficient amount of material to test required number of specimens						

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.









# HALLATON, INC.

100 E. PENNSYLVANIA AVE., TOWSON, MD 21286

410-583-7700 Fax 410-583-7720

## Repair Log

Project No.: 0719-3407  
 Project Name: Blue Ridge Paper Co.  
 Project Start Date: 7/11/2007  
 Project Location: Canton, N.C.  
 Page: 1 of 2

Material: HDPE T>

Thickness: 60 mi

Repair #	Defect Code	Defect Location	Repair Date	Repair Time	Repair Type	Approx Size	Machine ID	Repair Tech	Vacuum Tes	
									P/F	Dat
R-1	MS	P-1 TOP OLD CELL	7/10/2007	3:00	P	8X26	X19	J.V	P	7/12/07
R-2	MD	P-1 TO OLD CELL 42>TOP	7/10/2007	3:50	P	3X4	X19	J.V	P	7/12/07
R-3	MD	P-1 TO OLD CELL 102>TOP	7/10/2007	4:40	P	2X2	X19	J.V	P	7/12/07
R-4	MD	P-1 TO OLD CELL 149>TOP	7/10/2007	4:50	P	2X2	X19	J.V	P	7/12/07
R-5	MD	P-1 TO OLD CELL 253>TOP	7/11/2007	10:40	P	2X2	X19	J.V	P	7/12/07
R-6	MD	P-1 TO OLD CELL 237>TOP	7/11/2007	10:50	P	3X4	X19	J.V	P	7/12/07
R-7	MD	P-1 TO OLD CELL 275>TOP	7/11/2007	11:05	P	2X3	X19	J.V	P	7/12/07
R-8	MD	P-1 TO OLD CELL 312>TOP	7/11/2007	11:25	P	2X4	X19	J.V	P	7/12/07
R-9	MD	P-1 TO OLD CELL 343>TOP	7/12/2007	7:30	P	1X3	X19	J.V	P	7/12/07
R-10	MD	P-1 TO OLD CELL 368>TOP	7/12/2007	7:35	P	1X3	X19	J.V	P	7/12/07
R-11	MD	P-1 TO OLD CELL 392>TOP	7/11/2007	9:15	P	2X4	X10	J.L	P	7/12/07
R-12	MD	P-5 TO OLD CELL 421>TOP	7/11/2007	9:25	P	2X2	X10	J.L	P	7/12/07
R-13	MD	P-5 TO OLD CELL 460>TOP	7/12/2007	8:10	P	2X4	X19	J.V	P	7/12/07
R-14	MD	P-5 TO OLD CELL 485>TOP	7/12/2007	8:15	P	2X3	X19	J.V	P	7/12/07
R-15	MD	P-5 TO OLD CELL 501>TOP	7/12/2007	8:25	P	2X4	X19	J.V	P	7/12/07
R-16	MD	P-5 TO OLD CELL 528>TOP	7/12/2007	8:40	P	3X5	X19	J.V	P	7/12/07
R-17	MD	P-5 TO OLD CELL 555>TOP	7/12/2007	9:00	P	3X3	X19	J.V	P	7/12/07
R-18	MD	P-5 TO OLD CELL 575>TOP	7/12/2007	9:10	P	2X4	X19	J.V	P	7/12/07
R-19	MD	P-5 TO OLD CELL 608>TOP	7/12/2007	9:25	P	1X1	X19	J.V	P	7/12/07
R-20	AT	P-5-7 Anchor trench	7/12/2007	9:50	P	1X1	X19	J.V	P	7/12/07
R-21	AT	P-7-8 Anchor trench	7/12/2007	9:44	P	1X1	X19	J.V	P	7/12/07
R-22	MD	P-8 TO OLD CELL 23>TOP	7/11/2007	10:07	P	2X3	X10	Slara	P	7/12/07
R-23	MD	P-8 TO OLD CELL 47>TOP	7/11/2007	11:00	P	3X5	X10	Slara	P	7/12/07
R-24	AT	P-8-7	7/11/2007	11:30	P	1X1	X10	Slara	P	7/12/07
R-25	MD	P-7 TO OLD CELL 59>TOP	7/11/2007	11:35	P	2X1	X10	Slara	P	7/12/07
R-26	MD	P-7 TO OLD CELL 71>TOP	7/11/2007	11:40	P	2X5	X10	Slara	P	7/12/07
R-27	MD	P-7 TO OLD CELL 86>TOP	7/12/2007	7:40	P	2X2	X10	Slara	P	7/12/07
R-28	MD	P-7 TO OLD CELL 117>TOP	7/12/2007	7:50	P	2X8	X10	Slara	P	7/12/07
R-29	MD	P-7 TO OLD CELL 145>TOP	7/12/2007	8:10	P	2X8	X10	Slara	P	7/12/07
R-30	AT	P-7-6	7/12/2007	8:24	P	1X2	X10	Slara	P	7/12/07
R-31	MD	P-6 TO OLD CELL 168>TOP	7/12/2007	8:40	P	2X6	X10	Slara	P	7/12/07
R-32	MD	P-6 TO OLD CELL 187>TOP	7/12/2007	8:50	P	3X6	X10	Slara	P	7/12/07
R-33	MD	P-6 TO OLD CELL 221>TOP	7/12/2007	9:13	P	1X3	X10	Slara	P	7/12/07
R-34	MD	P-2 TO OLD CELL 242>TOP	7/12/2007	9:30	P	2X3	X10	Slara	P	7/12/07
R-35	MD	P-2 TO OLD CELL 258>TOP	7/12/2007	9:40	P	1X2	X10	Slara	P	7/12/07
R-36	AT	P-6-7-5	7/12/2007	8:30	P	3X3	X10	J.L	P	7/12/07
R-37	AT	P-1-2-5-6	7/12/2007	9:33	P	2X2	X10	J.L	P	7/12/07
R-38	MD	P-2 TO OLD CELL 283>TOP	7/12/2007	10:00	P	2X3	X10	J.L	P	7/12/07
R-39	MD	P-2 TO OLD CELL 308>TOP	7/12/2007	10:40	P	2X2	X10	J.L	P	7/12/07
R-40	MD	P-2 TO OLD CELL 336>TOP	7/12/2007	11:20	P	2X2	X10	J.L	P	7/12/07

**Defect Code:**

BO - Burn Out  
 CR - Crease  
 DT - Destructive Test Number  
 EE - Earthwork Equipment Damage  
 FM - Fishmouth  
 FT - Pressure Test Cut  
 T - Joint

SI - Soil Surface Irregularity  
 DD - Deployment Damage  
 MD - Material Damage  
 WR - Wrinkle  
 WS - Welder restart  
 FD - Factory Defect  
 AT - Air Test

**Repair Type:** C-Cap Strip  
 P- Patch  
 B-Extrudate Bead  
 GB-Grind & Bead  
 BT-Boot

**Test Result:** P-Pass, F-Fail

**Notations:** BOS or 0-Beginning of Seam/ EOS-End of Seam/ --to an area/ >from an area/ NOAT-No AT



# HALLATON, INC.

100 E. PENNSYLVANIA AVE., TOWSON, MD 21286  
410-583-7700 Fax 410-583-7720

## Certificate of Subgrade Acceptance

Project Name BLUDE Ridge PAPER CU  
Project no. \_\_\_\_\_  
Location CANTON, N.C.

Area to be Accepted IN BETWEEN GAW/GAE 32,895 SF.

I, the undersigned, duly authorized representative of the installer, do hereby accept the soil subgrade surface conditions. I do not accept any responsibility for the conditions or character of the subsurface soil, or any effect the subsurface soil might have on the liner system.

INSTALLER:

Michael Cal QA/QC  
signature title

7-10-07  
date

THIRD PARTY QA/QC:

[Signature] Field Eng  
signature title

7-10-07  
date

**GENERAL CONTRACTOR'S SUBMITTALS**

- **HDPE MATERIAL INSTALLATION**
- **HDPE LINER**
- **GEOSYNTHETIC CLAY LINER**
- **GEOTEXTILE**

**BLUE RIDGE PAPER CO.  
CANTON, NC**

Submittal #1

**Section 10107 High Density Polyethylene (HDPE)  
Geomembrane**

**Hallaton Installation Submittals**

- Hallaton's Sample Warranty- 1 yr
- Proposed Use of Kawasaki Mule 4x4
- Hallaton's QC and Installation Guidelines
- Field QC Forms- Blank
- Crew List and Equipment
- Hallaton Qualifications
- Personnel Qualifications

PREPARED BY:  
Hallaton, Inc.  
100 E. Pennsylvania Ave., Suite 203  
Towson, MD 21286  
May 23, 2007

HALLATON, INC.  
**LIMITED WORKMANSHIP WARRANTY**

Warranty No: \_\_\_\_\_  
Project No: \_\_\_\_\_  
Effective Date: \_\_\_\_\_

PURCHASER NAME: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CITY, STATE, ZIP: \_\_\_\_\_

SAMPLE

PROJECT NAME: \_\_\_\_\_

DESCRIPTION: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CITY, STATE, ZIP \_\_\_\_\_

HALLATON, INC. warrants each LINER SYSTEM installed by HALLATON, INC. to be free from defects in workmanship. This "Workmanship Warranty" shall be in effect from the date the installation of the Liner System is completed and accepted by the Owner for a period of one year of normal use in approved applications.

This Limited Warranty does not include damages or defects in The Liner System resulting from acts of God, casualty or catastrophe including but not limited to: earthquakes, floods, piercing hail, tornadoes or force majeure. The term "normal use" as used herein does not include, among other things, the exposure of The Liner System to harmful chemicals, abuse of The Liner System by machinery, equipment or people, excessive pressures or stress from any source, subsurface or overburdened soil conditions, and total or differential soil settlements and the effect these may have on the liner system.

Should defects or premature loss of use within the scope of the above Limited Workmanship Warranty occur, Hallaton, Inc. will, at its option, repair or replace the Liner on a pro-rata basis at the then current price in such manner as to charge the Purchaser/User only for that portion of the warranted life which has elapsed since purchase of the material. Hallaton, Inc. will have the right to inspect and determine the cause of any alleged defect in the Liner and to take appropriate steps to repair or replace the Liner if a defect exists and is within the term of this Limited Warranty.

Any claim for any alleged breach of this warranty must be made in writing, by certified mail, to the President of Hallaton, Inc. within thirty (30) days after the alleged defect is noticed. Should the required notice not be given, the defect and all warranties shall be deemed to have been waived by the Purchaser, and Purchaser shall have no right of recovery against Hallaton, Inc. In the event repairs and/or replacements are to be effected, said repairs and/or replacements shall not become due until the area subject to repair and/or replacement of The Liner is available to Hallaton, Inc. in a clean, dry, unencumbered condition. This includes, but is not limited to, the area made available for repair and/or replacement of The Liner

to be free from all water, dirt, sludge, residuals, and liquids of any kind.

Hallaton, Inc.'s liability under this warranty shall in no event exceed the replacement cost of the material and installation sold to the Purchaser for the particular installation in which it failed. Further, under no circumstances shall Hallaton, Inc. be liable for any special, direct, indirect, or consequential damages arising from loss of production or any other losses including losses due to personal injuries and product liability owing to the failure of the material or installation and no allowance will be made for repairs, replacements, or alterations made by the Purchaser without the express written consent of Hallaton, Inc.

Hallaton, Inc. neither assumes nor authorizes any person other than an officer of Hallaton, Inc. to assume for it any other or additional liability in connection with the Liner System made the basis of the Limited Warranty. The Limited Workmanship Warranty on the Liner herein is given in lieu of all other possible material warranties, either express or implied, and by accepting delivery of the material, Purchaser waives all other possible workmanship warranties, except those specifically given.

The parties expressly agree that the sale hereunder is for commercial or industrial use only.

Hallaton, Inc. Limited Warranty is extended to the purchaser/owner and is non transferable and non-assignable.

Purchaser acknowledges by acceptance that the Limited Workmanship Warranty given herein is accepted in preference to any and all other possible workmanship warranties.

HALLATON, INC. MAKES NO WARRANTY OF ANY KIND OTHER THAN THAT GIVEN ABOVE AND HEREBY DISCLAIMS ALL WARRANTIES, BOTH EXPRESS OR IMPLIED, OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE

**WARRANTY BECOMES EFFECTIVE UPON RECEIPT OF FINAL PAYMENT**

I hereby state I have read and understood the above and foregoing Limited Warranty and agree to such by signing hereunder.

PURCHASER NAME: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_

TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_

SAMPLE

HALLATON, INC.

\_\_\_\_\_  
President

Sworn before me this \_\_\_\_\_ day of \_\_\_\_\_, 19\_\_\_\_.

\_\_\_\_\_

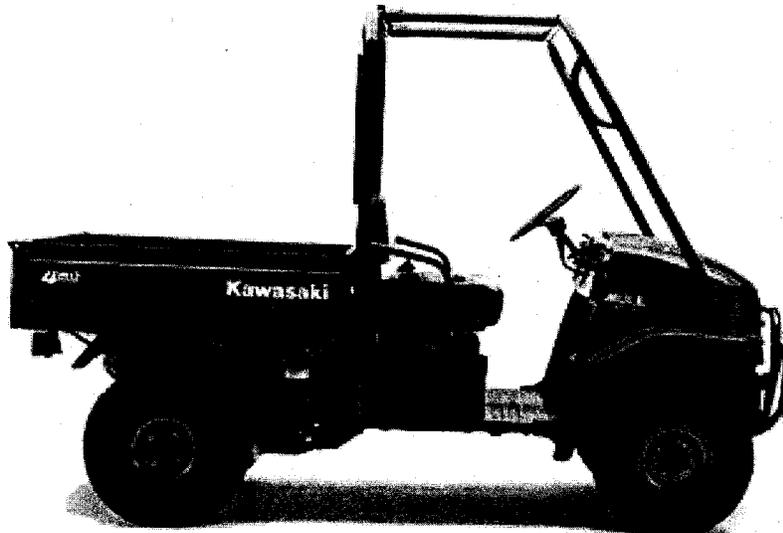
# HALLATON, INC.

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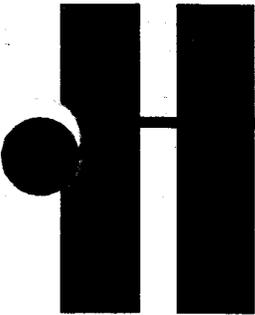
## Proposed Use of Kawasaki Mule 4x4

### Panel Deployment

In deploying Geosynthetic panels, Hallaton Inc. intends to use a low ground pressure Kawasaki Mule 4x4 to pull panels into place. The use of this piece of equipment will be undamaging to the subgrade and Geosynthetics. If damage to the subgrade or Geosynthetics occur, use of the Mule will cease immediately. This piece of equipment will allow for increased job progress and a better finished product.



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## **Geomembrane Installation and QC Procedures**

### **Materials Logistics**

#### **Transportation and On-site Storage**

The geomembrane rolls shall be shipped by trailer truck to job site. A full truckload consists of 12 rolls. The geomembrane shall be stored so as to be protected from puncture, dirt, grease, moisture and excessive heat. The damaged material shall be stored separately for repair or replacement. The rolls shall be stored on a prepared smooth surface (not wooden pallets) and should not be stacked more than three rolls high.

### **Earthwork**

#### **General**

The owner or his representative (soil quality assurance inspector) shall inspect the subgrade preparation. Prior to liner installation the subgrade shall be compacted in accordance with the project specifications. Weak or compressible areas which cannot be satisfactorily compacted should be removed and replaced with properly compacted fill. All surfaces to be lined shall be smooth, free of all foreign and organic material, sharp objects, or debris of any kind. The subgrade shall provide a firm, unyielding foundation with no sharp changes or abrupt breaks in grade. Standing water or excessive moisture shall not be allowed.

The installer, on a daily basis, shall approve the surface on which the geomembrane will be installed. After the supporting soil surface has been approved, it shall be the installer's responsibility to indicate to the inspector any changes to its condition that may require repair work.

#### **Vegetation Control**

The general contractor, if necessary, shall sterilize the area using an effective soil sterilant specifically formulated for vegetation present in the area. The sterilant shall not be harmful to the liner and shall be applied according to the recommendations of its manufacturer.

#### **Anchor Trench**

The anchor trench shall be excavated to the line, grade, and width shown on the project construction drawings, prior to liner system placement. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the geomembrane.



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## Method of Placement

The rolls should be deployed using a spreader bar assembly attached to a loader bucket or by other methods approved by the project engineer.

The installer shall be responsible for the following:

1. Equipment or tools shall not damage the geomembrane during handling, transportation and deployment.
2. Personnel working on the geomembrane shall not smoke or wear damaging shoes.
3. The methods used to unroll the panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil.
4. Adequate loading (e.g., sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under panels).

## Weather Conditions

Geomembrane deployment shall proceed between ambient temperatures of 32° F to 104° F. Placement can proceed below 32° only after it has been verified by the inspector that the material can be seamed according to the specification. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, rain, dew) or in the presence of excessive winds, as determined by the installation supervisor.

## Field Seaming

Approved seaming processes are fusion and extrusion welding. On side slopes, seams shall be oriented in the general direction of maximum slope, i.e., oriented down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized.

No base T-seam shall be closer than 5 feet from the toe of the slope. Seams shall be aligned with the least possible number of wrinkles and "fishmouths." If a fishmouth or wrinkle is found, it shall be relieved and cap-stripped.

## Seam Overlap

Geomembrane panels must have a finished minimum overlap of 4 inches for fusion welding and 6 inches for extrusion welding.



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Cleaning solvents may not be used unless the product is approved by the liner manufacturer.

## **Seaming Equipment and Accessories**

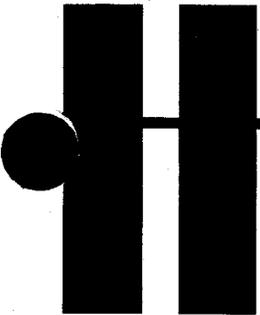
Approved equipment for field seaming are fusion welders and extrusion fillet welders.

1. Fusion Welder, 110 Volt (220 Volt).
2. Extrusion Welder, 220 Volt.
3. High-speed, 10,000 rpm, 4 or 4 ½ inch side grinder with 50-80-grit discs.
4. 6.5 KW Generator, single-phase with 110/220 Volt Outputs.
5. Power Cord, minimum S.O. type, 12 gauge O.S.H.A. approved electrical cord with O.S.H.A. approved twist-type plugs and connections.
6. Vacuum Box Test Equipment for non-destructive seam testing.
7. Air pressure test equipment for non-destructive seam testing.
8. Field Tensiometer, capable of performing quantitative shear and peel tests.

## **Test Seams**

Field test seams shall be conducted on the liner to verify that seaming conditions are satisfactory. Test seams shall be conducted at the beginning of each seaming period and at least once each 5 hours, for each seaming apparatus and personnel used that day. The responsible QC manager will review all trial weld samples and results prior to field production seaming

All test seams shall be made in contact with the subgrade. Welding rod used for extrusion welding shall have the same properties as the resin used to manufacture the geomembrane. The test seam samples shall be 3 feet long for fusion welding and 3 feet long for extrusion welding with the seam centered lengthwise. Five specimens shall be cut from each end of the test seams by the inspector. The technician shall use a tensiometer to test 3 specimens for shear and 3 specimens for peel. Each specimen shall be one inch wide with a grip separation of 4 inches plus the width of the seam. The seam shall be centered between the clamps. The rate of grip separation shall be 2 inches per minute. Test results for seam strength properties shall pass seam acceptance criteria. Shear and peel tests shall result in Film Tearing Bond (FTB), which is a failure in ductile mode of one of the bonded sheets by tearing prior to complete separation in the bonded area. If a test seam fails to meet field seam specifications, the seaming apparatus and/or seamer shall not be used for seaming until the deficiencies are corrected and a successful test seam achieved.



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## **Non-Destructive Seam Testing**

The Installer shall non-destructively test all field seams over their full length utilizing the following methods.

## **Vacuum Box Testing**

Equipment for testing extrusion seams shall be comprised of the following:

1. A vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge.
2. Soapy solution in a plastic bucket with a mop.

The following procedures shall be followed by the installer:

1. Excess sheet overlap shall be trimmed away.
2. Wet a strip of geomembrane approximately 12 inches by the length of the box with the soapy solution.
3. Place the box over the wetted area and compress.
4. Create a vacuum of 3 – 5 psi.
5. Ensure that a leak tight seal is created.
6. For a period of approximately 15 seconds, examine the geomembrane through the viewing window for the presence of animated soap bubbles.
7. If no animated soap bubbles appear after 10 seconds, shut off the vacuum box and move the box over the next adjoining area with a minimum 3 inches overlap and repeat the process.
8. All areas where animated soap bubbles appear shall be marked, repaired and then retested.

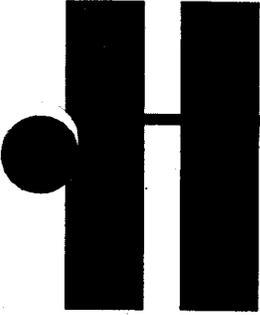
The following procedures shall apply to locations where seams cannot be non-destructively tested.

1. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.
2. If the seam cannot be tested prior to final installation, the seaming operations shall be observed and inspected by the QC manager or the Engineer's field representative.

## **Air Pressure Testing (For Double Fusion Seams Only)**

Equipment for testing double fusion seams shall be comprised of the following:

1. An air pump equipped with pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi.



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2. A pressure gauge equipped with a sharp hollow needle.

The following procedures shall be followed by the installer:

1. Seal on end of the seam to be tested.
2. Insert needle or other approved pressure feed device through the sealed end of the channel created by the double wedge fusion weld.
3. Energize the air pump to verify the unobstructed passage of air through the channel.
4. Seal the other end of the channel.
5. Energize the air pump to a pressure between 25 and 30 psi, close valve, allow 2 minutes for the injected air to come to equilibrium in the channel, and sustain pressure for at least 5 minutes.
6. If loss of pressure exceeds 3 psi, or pressure does not stabilize, locate any faulty area, repair and retest.
7. If pressure does not drop below the acceptable value after five minutes, cut the air channel open at the opposite end from the pressure gauge. The air channel should deflate immediately indicating that the entire length of the seam has been tested.
8. All test locations which have passed air pressure testing shall be marked with the test date, values, and tester initials.

## **Destructive Seam Testing (if required by project specifications)**

Destructive seam testing should be minimized to preserve the integrity of the liner. The installer shall provide the inspector with destructive test samples per project specifications from locations specified by the inspector. Liner panels shall not be covered with any cover material until all destructive samples within that area have been confirmed to have pass the Quality Assurance Laboratory testing.

## **Sampling Procedure**

In order to obtain test results prior to completion of liner installation, samples shall be cut and marked by the installer as the seaming progresses. The installer shall also record the date, location, and pass or fail description. All holes in the geomembrane resulting from obtaining the seam samples shall be immediately patched and vacuum tested.

## **Size and Disposition of Samples**

The samples shall be 12 inches wide by 40 inches long with the seam centered lengthwise. The sample shall be cut into three equal-length pieces (each 12" x 12"), one to be given to the Quality Assurance Laboratory for testing, one to be given to the owner/engineer and one to the installer QC Manager.



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## **Field Testing**

The QC manager shall test one 1-inch wide specimen from each end of the 40-inch sample prior to cutting into three equal pieces, each will be tested for peel strength. Both specimens must pass the project seam requirements before the QAL sample is released for testing.

## **Independent Laboratory Testing by Quality Assurance Laboratory**

The test method and procedures to be used by the independent laboratory shall be as defined in the project specification or as follows.

1. The laboratory shall cut the sample into ten (10) coupons, each one inch wide. Five (5) shall be tested for peel and five (5) shall be tested for shear values. Four of the five coupons shall meet the minimum project specification values for the seam sample to pass.

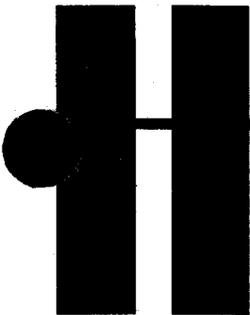
## **Procedures for Destructive Test Failure**

The following procedures shall apply whenever a sample fails the field destructive test:

1. The installer will retrace the welding path to an intermediate location (usually 10 feet on both sides of the location of the failed test sample), and take a sample for an additional destructive sample test. If this test passes, then the seam shall be cap stripped between the locations of the two passed destructive samples. If the test fails, then the process is repeated until a passing sample is found along the seam in question on both sides of the original failed sample.
2. Over the length of seam failure, the installer shall either cut out the old seam, reposition the panel and re-seam, or add a cap strip.
3. All destructive sample tests shall be documented as to the pass/fail result, the location of the sample, and all action taken for failure correction.

## **Defects and Repairs**

All seams and non-seam areas of the geomembrane shall be inspected for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The surface of the geomembrane shall be clean at the time of inspection.



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## Evaluation

Each suspect location in seam and non-seam areas shall be non-destructively tested as appropriate in the presence of the inspector. Each location that fails the non-destructive testing shall be marked by the inspector, and repaired accordingly.

## Repair Procedures

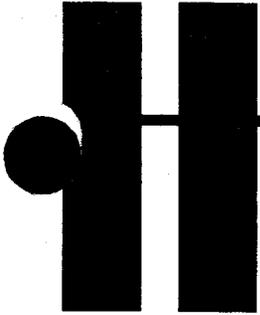
1. Defective seams shall be cap stripped or replaced. Small seam lengths (approximately 3 feet) may be extrusion welded provided there is sufficient overlap between the liner panels.
2. Small holes shall be repaired by extrusion welding. If the hole is larger than  $\frac{1}{4}$  inch, it shall be patched.
3. Tears shall be repaired by patching. Where the tear is on a slope or an area susceptible to stress and has a sharp end, it must be rounded prior to patching.
4. Blisters, large cuts and undispersed raw materials shall be repaired by patches.
5. Patches shall be done by extrusion welding. The weld area shall be ground no more than one hour prior to welding. No more than 5% of the thickness shall be removed by grinding. Welding shall commence where the grinding started and must overlap the previous seam by at least 2 inches. Re-seaming over an existing seam without regrinding shall not be permitted. The welding shall restart by grinding the existing seam and re-welding a new seam.

Patches shall be round or oval in shape, made of the same geomembrane, and extend a minimum of 6 inches beyond the edge of defects.

## Verification of Repairs

Each repair shall be non-destructively tested. Repairs that pass the non-destructive test shall be taken as an indication of an adequate repair. Failed tests indicate that the repair shall be repeated and retested until passing test results are achieved.

The Quality Control manager shall keep daily documentation of all non-destructive and destructive testing. This documentation shall identify all seams that initially failed the test and include evidence that these seams were repaired and successfully retested. Each repair shall be recorded by number, date and test outcome.



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## **Backfilling of Anchor Trench**

The anchor trench shall be backfilled by the earthwork contractor. Trench backfill material shall be placed and compacted in accordance with the project specifications.

Care should be taken when backfilling the trenches to prevent any damage to the geomembrane. If damage occurs, it shall be repaired prior to backfilling.

## **Geomembrane Acceptance**

The installer shall retain all ownership and responsibility for the geomembrane until acceptance by the owner.

Final acceptance is when all the following conditions are met:

1. Installation is finished.
2. Verification of the adequacy of all field seams and repairs, including associated testing, is complete.











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## Certificate of Subgrade Acceptance

Project Name \_\_\_\_\_  
Project no. \_\_\_\_\_  
Location \_\_\_\_\_

Area to be \_\_\_\_\_  
Accepted \_\_\_\_\_  
\_\_\_\_\_

I, the undersigned, duly authorized representative of the installer, do hereby accept the soil subgrade surface conditions. I do not accept any responsibility for the conditions or character of the subsurface soil, or any effect the subsurface soil might have on the liner system.

INSTALLER:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

THIRD PARTY QA/QC:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

# HALLATON, INC.

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## Hallaton Inc. Crew List

### **Supervisors-**

Russell Sanborn  
Arturo Sanchez

Justin Harward

### **Master Seamers-**

Alex Lopez  
Eldizar Rivera  
Hermينو Vasquez  
Ignatio Fernandez  
Juan Rivas  
Saul Martinez

Blas Rivas  
Doroteo Velasques  
Homero Telles  
Jose Ordones  
Mauricio Sanchez  
Trinidad Montes

## Typical Site Trailer Equipment

Equipment Type	Quantity	Description
6000 LB Forklift	2	SkyTrac 6036 or equal, Tool handler
Wedge Welder	4	Dem-Tech Prowedge
Extrusion Welder	3	ProX-2
Generator	5	Honda 6500, Generac 4000 (typical)
Tensiometer	1	Columbine Accura-lite
Handheld Hot air welder	4	Leister
Grinder	4	Various 4, 4.5" disc
Vacuum Box	2	Columbine Vacu-lite
Air pressure test equipment	8	Various Gauges, needles, hardware
Liner Deployment Bar	1	"Z-bar" liner deployment apparatus
Low ground pressure 4x4	1	Kawasaki Mule
Sewing Machines	3	Union Special 2200B

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## Geomembrane Experience Resume - 2006

Material	Quantity	Project	Location	Date	Owner	GC	Engineer
60 mil LLDPE	140,000 SF	Chester County Prison	West Chester, PA	Mar-06	Chester County Government	HT Sweeney & Sons, Inc. Chuck Walther 610-872-8896	URS
12 oz Geotextile	267,000 SF	WWTP Lagoon					
36 mil Hypalon	640 SF	Talbot County WWTP	St. Michaels, MD	Mar-06	Talbot County Government	Bearing Construction Jim Bearing 410-556-6100	
40 mil HDPE	290,000 SF	Modern LF Cap	York, PA	Apr-06	Republic Services Mark Pederson 717-246-2686	Owner	Earth Tech 717-244-2536
250 mil DS Geocomposite	290,000 SF						
10 oz Geotextile	290,000 SF						
60 mil HDPE Textured	85,000 SF	Brown Station LF Cell 2	Upper Marlboro, MD	May-06	Prince Georges County Gov't Russ Yonkers 301-952-7634	Cherry Hill Construction Durant Walters 410-799-3577	EA Engineering Geoff Little 410-771-4950
60 mil HDPE Smooth	482,000 SF						
16 oz. Geotextile	442,800 SF						
Geocomposite	76,000 SF						
60 mil HDPE	103,500 SF	Days Cove LF Cell C	White Marsh, MD	Jun-06	Days Cove Reclamation Co. Bob Oler 410-269-1654	Owner	URS Corp. Jill Voeller 302-791-0700
GCL	102,500 SF						
Geocomposite	52,500 SF						
60 mil HDPE, Tx	10,700 SF	Ritchie Rubble LF Cell 2C	Upper Marlboro, MD	Jun-06	Ritchie Land Reclamation Co. Jim Stewart 301-428-0800	Owner	EA Engineering Geoff Little 410-771-4950
60 mil HDPE, Sm	57,500 SF						
GCL	68,700 SF						
Geocomposite	68,700 SF						
60 mil HDPE, Sm	652,050 SF	Hanes Mill LF Cell 2	Winston-Salem, NC	Jul-06	City of Winston-Salem David Saunders 336-747-7303	Rifenburg Construction Glenn Weiss 919-598-6921	HDR Engineering, Inc. Dean Ferry 704-338-6700
60 mil HDPE, Tx	47,150 SF						
GCL	697,500 SF						
12 oz Geotextile	648,000 SF						
8 oz. Geotextile	631,350 SF						
Composite	47,600 SF						
20 mil HDPE, Sm	680,000 SF						
40 mil LLDPE, Sm	877,500 SF	Hanes Mill LF Cap	Winston-Salem, NC	Jul-06	City of Winston-Salem David Saunders 336-747-7303	Rifenburg Construction Glenn Weiss 919-598-6921	HDR Engineering, Inc. Dean Ferry 704-338-6700
40 mil LLDPE, Tx	966,000 SF						
Composite	1,828,400 SF						
GCL	875,250 SF						
Welding Rod	1,012 LBS						
XR5	16,000 SF	BWI Third Glycol Tank	BWI Airport, MD Fuel Farm	Aug-06	Maryland Aviation Assc. BWI Airport	Keystuct Construction, Inc. Mike Dorgan 717-764-1326	URS Corp. Bernadette Lipari 410-785-7220

Material	Quantity	Project	Location	Date	Owner	GC	Engineer
60 mil HDPE, Sm Composite	1,086,750 SF	Central LF, Cell 4	Newark, MD	Aug-06	Worcester County Dept. of Public Works John Tustin 410-632-3766	Weston Solutions Pat Doran 610-701-3138	GW Griffith & Associates, LLC Gerv Griffin 410-632-1800
40 mil HDPE, Tx Geotextile	448,500 SF	GE LF, Cap	Rome, GA	Aug-06	General Electric Cody Platt 706-291-3120	Compass Environmental Thad Penvel 770-879-4107	ACC Scott Callaway
30 mil HDPE, Sm Geotextile	901,600 SF	York County Rec Complex	Stewartstown, PA	Aug-06	York Co. Solid Waste & Refuse Authority David Vollero	Pavex, Inc. Edgar Rodrigez 717-761-1502	ARM Engineering Jim Warnick
60 mil HDPE - Sm	532,170 SF	Marshall Station LF, Cell	Terrell, NC	Aug-06	Duke Power Aaron Kitzmiller 828-478-7774	Phillips & Jordan, Inc. Bruce Sekaly 336-478-0265	Chas H Sells, Inc Dan Brewer 704-662-0100
60 mil HDPE - Tx GCL	306,590 SF						
Composite Geonet	837,825 SF						
8 oz Geotextile	266,000 SF						
60 mil HDPE, Tx	560,000 SF						
80 oz Geotextile	569,250 SF						
40 mil LLDPE, Tx Tri-planar composite	23,000 SF	Kinder Morgan	Carteret, NJ	Sep-06	Kinder Morgan Joe Van der Veken 732-541-5161, ext.5620	Hallaton, Inc.	N/A
Bi-planar composite	10,000 SF						
Woven Geotextile	2,806,000 SF	Hemwood LF, Cap	Woodstock, MD	Oct-06	Baltimore County Government Steve Lippy 410-887-2009	Pavex Brent Gallagher 717-761-1502	EA Engineering Dani Kolar 410-771-4950
10 oz Geotextile	1,542,340 SF						
GCL	1,245,000 SF						
60 mil LLDPE	188,058 SF	WR Grace LF, Cap	Baltimore, MD	Oct-06	WR Grace & Co.	Entact Kurt Gimbel 484-444-0702	GeoTrans, Inc. Gerald DeMers, PE
60 mil HDPE, Tx	360,000 SF						
16 oz non-woven geotextile	549,000 SF						
12 oz non-woven geotextile	557,550 SF						
Composite	235,750 SF	Shenandoah LF, Cell	Edinburg, VA	Oct-06	Shenandoah County Government Vincent Polling 540-459-6165	Ryan, Inc. Central David Overley 608-754-2291	SCS Engineering Roger Moeller 703-471-6150
	153,000 SF						
	130,500 SF						
	94,500 SF						

Material	Quantity	Project	Location	Date	Owner	GC	Engineer
40 mil LLDPE, Tx Geocomposite	151,800 SF 151,800 SF	New Hanover County LF Cell 3B-5 Closure	Wilmington, NC	Oct-06	New Hanover Government Dan Weaver 910-798-7184	ES & J Enterprises Sherwood Lucas 910-567-6138	SCS Engineering Ed Hilton 813-621-0080
40 mil LLDPE, Tx Geocomposite	484,000 SF 345,000 SF	RB Baker LF, Closure	Queenstown, MD	Nov-06	RB Baker & Sons, Inc. Ted Baker 410-827-8831	David A. Bramble, Inc. Mike Brauer 410-778-3023	Century Engineering, Inc. Mike Armstrong 443-583-2400
40 mil HDPE, Sm Geotextile	37,138 SF 72,000 SF	Tank Lining, 2ndary Containment	Salunga, PA	Nov-06	Kline Services Shawn Perry 717-587-1927	Owner	
60 mil HDPE, Tx 60 mil HDPE, Sm GCL Composite	506,000 SF 1,437,500 SF 24,750 SF 1,290,800 SF	Northern LF, Cell SW-3	Westminster, MD	Dec-06	County Commissioners of Carroll County of MD J. Michael Evans 410-386-2043	Kibler Construction, Inc. Gary Tine 410-833-5345	Gannett Fleming, Inc. Jeffrey Stamm 410-585-1460
GCL 60 mil HDPE, Sm 16 oz Geotextile	404,550 SF 396,000 SF 396,000 SF	Fairmont Rd. LF, Cell	Westover, MD	Dec-06	Somerset County Government Charles Cavanaugh 410-651-9641	Days Cove Reclamation Bob Oler 410-269-1654	MES Charles Peng 410-729-8300
40 mil LLDPE, Tx 8 oz Geotextile	13,800 SF 18,000 SF	LCSWA Bioretention Pond	Lancaster, PA	Dec-06	LCSWA Lancaster, PA	Wohlsen Construction Raleigh Osborne 717-299-2525	Gannett Fleming, Inc. Jeffrey Stamm 410-585-1460
40 mil HDPE, Sm 8 oz Geotextile	14,625 SF 9,000 SF	Mixing Pit Liner, Kline Facility	Salunga, PA	Dec-06	Kliner Services Shawn Perry	Buckwalter & Assoc. John Buckwalter 717-821-1874	

Material	Quantity	Project	Location	Date	Owner	GC	Engineer
45 mil PP	43,000 SF	Idlewild Dredged Material Placement Site Rehab.	Shadyside, MD	Mar-05	Anne Arundel County Ron Eizel 410-222-7575	Ferguson Trenching Chris Rock 410-519-5700	Bayland Consultants 410-694-9401
40 mil LLDPE, TX Geocomposite	253,650 SF 253,650 SF	Harrisburg LF Cap	Harrisburg, PA	Apr-05	City of Harrisburg	Pavex, Inc. Brent Gallagher 717-761-1502	Brinjac Engineering Robert Schopfer 717-233-4502
30 mil PVC	6,672 SF	170/181 Dry Swale	Hagerstown, MD	Apr-05	MD SHA	Concrete General Mark Miller 301-948-4450	Wallace, Montgomery
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05	City of Newark	George & Lynch Michael Hall 302-328-6275	URS Corp. Jill Voeller 302-791-0700
40 mil HDPE, SM	4,550 SF	Westmoreland Site Vapor Barrier	Arlington, VA	Apr-05	Silverwood Homes	Falls Church Constr. Doug Finlayson 703-591-0600	
45 mil PP	107,000 SF	Bivalve Dredged Material Placement Site	Bivalve, MD	Apr-05	Wicomico County	Ray Nomies, Inc. 410-641-0647	Andrews, Miller & Assoc. 410-228-7117
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz Geotextile	129,069 SF 79,106 SF 7,125 SF 6,000 SF	Rocky River WTP	Anderson, SC	May-05	City of Anderson		Design South Profins. Frank Morgan 864-226-6111
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz Geotextile	147,436 SF 90,364 SF 20,340 SF 6,150 SF	Generoslee WTP	Anderson, SC	May-05	City of Anderson	South Atlantic Constr. Tom Underhill 864-229-7531	Design South Profins. Frank Morgan 864-226-6111
60 mil HDPE, TX	41,227 SF	Lucky Stone Site	Fredericksburg, VA	May-05	N/A	JL Kent & Sons, Inc. Bobby Kent 540-898-3359	N/A
60 mil HDPE, TX Geocomposite GCL	993,600 SF 74,200 SF 993,600 SF	Buncombe County LF Cell 6	Alexander, NC	May-05	Buncombe County Jerry Mears 828-645-5311	Thalle Construction Chris Haverstrom 919-245-1490	CDM Chris Gable 703-642-5500
28 oz. Geotextile	993,600 SF						
60 mil HDPE, TX Geocomposite GCL	360,677 SF 200,000 SF 100,000 SF	Modern LF Cell 15B	York, PA	May-05	Republic Services Mark Pedersen 717-246-2686	Owner	Earth Tech 717-244-2536
16 oz. Geotextile	360,377 SF						
40 mil HDPE, TX Geocomposite 10 oz. Geotextile	435,165 SF 443,025 SF 435,165 SF	Modern LF Cap	York, PA	May-05	Republic Services Mark Pedersen 717-246-2686	Owner	Earth Tech 717-244-2536
60 mil HDPE	3,400 SF	Advanced Auto SWMP	Martinsburg, WV	Jun-05	Primax Construction	DL George Dean Beaver 717-765-4700	N/A

Material	Quantity	Project	Location	Date	Owner	GC	Engineer
40 mil HDPE, SM	17,600 SF	Lake Ashburton	Baltimore, MD	Jun-05	City of Baltimore	Allied Contractors	Whitman, Requardt Assoc. 410-235-3450
12 oz Geotextile	17,600 SF	Washwater Lake Rehab.				Gary Simpson 410-852-2650	
XR-5	18,562 SF	Kent County WWTP	Milford, DE	Jun-05	Kent County DPW	Owner	Owner
Geocomposite	16,200 SF				Reinhold Beitschel 302-335-6000		
40 mil HDPE, TX	36,600 SF	Sandy Hill LF	Bowie, MD	Jun-05		Ryan Central Inc, Joe VanRemortal 608-754-2291	GeoSyntec Consultants 410-381-4333
Geocomposite	440,000 SF					Musselman Excavating Jeff Musselman 301-898-7364	Lavelle & Associates 301-695-9727
GCL	200,100 SF	Sun Meadows Ponds	Walkersville, MD	Jul-05			
40 mil HDPE	50,500 SF	Dominion Extraction Plant	Pine Grove, WV	Aug-05	Dominion Extraction	Ryan Environmental Mike Westfall 304-889-3178	N/A
Geocomposite	50,500 SF						
60 mil LLDPE, TX	303,424 SF	Orleans Homes	Downtown, PA	Sep-05	N/A	Intergeo	N/A
10 oz. Geotextile	480,908 SF					Archie Fishil 215-947-8562	
40 mil LLDPE, TX	519,500 SF	Snow Hill Landfill Cap	Snow Hill, MD	Sep-05	Worcester County, MD	Weston Solutions	EA Engineering
Geocomposite	534,000 SF					Pat Doran 610-701-3000	Geoff Little 410-771-4958
10 oz. Geotextile	537,000 SF						
60 mil HDPE, TX	765,000 SF	Millersville LF Cell 8	Severn, MD	Sep-05	Anne Arundel Co. DPW	Pavex, Inc.	Gannett Fleming
60 mil HDPE, SM	270,000 SF					Brent Gallagher 717-761-1502	Steve Krajcsik 717-763-7211
Geocomposite	765,000 SF						
Geonet	270,000 SF						
GCL	10,000 SF						
8 oz. Geotextile	150,000 SF						
Raincover	400,000 SF						
50 mil PVC	810,000 SF	Eastern LF Phase 9	White Marsh, MD	Sep-05	Baltimore Co DPW	Cherry Hill Construction	Earth Tech
Geocomposite	45,000 SF					Paul Brady 410-799-2382	Paul Witty
GCL	807,030 SF						
10 oz. Geotextile	776,718 SF						
16 oz. Geotextile	858,636 SF						
Raincover	841,500 SF						
60 mil HDPE, TX	220,000 SF	Corral Farm LF	Warrenton, VA	Sep-05	Fauquier Co. DES	New Dominion Constr.	Joyce Engineering
10 oz. Geotextile	220,000 SF	Cell 11 Construction			Bobby Smith 540-347-6811	Michael Pascuzzi 724-356-4481	Lawrence Bertolet 804-355-4520
Raincover	164,700 SF						
60 mil HDPE, TX	77,750 SF	Ocean Pines WWTP	Berlin, MD	Oct-05	Worcester County, MD	Bearing Construction	George, Miles & Buhr
GCL	104,945 SF	TBH Concrete Plant SWMP	Martinsburg, WV	Oct-05	DPW Thomas, Bennett, Hunter Kevin Beaver 410-848-9030	Jim Merrell 410-556-6100	N/A

Material	Quantity	Project	Location	Date	Owner	GC	Engineer
40 mil LLDPE, TX Geocomposite	405,000 SF 1,055,700 SF	I-95 Landfill Partial Cap	Lorton, VA	Oct-05	County of Fairfax Ramon Beltran 703-690-6694	Glover Construction 252-536-2660	Draper Aden 804-264-2228 Jeremy Bosdell
60 mil HDPE	800 SF	JM Huber Electric Substation Dike	Havre de Grace, MD	Nov-05	JM Huber	Schemm Electric Bob Schemm 410-557-8550	N/A
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite GCL	133,500 SF 423,000 SF 537,750 SF 269,930 SF	New Hanover Co. LF Cell 6	Wilmington, NC	Nov-05	New Hanover County Ray Church 910-341-4340	ES & J Enterprises David Page 910-567-6138	SCS Engineers Ed Hilton 813-621-0080
40 mil LLDPE, TX Geocomposite 8 oz. Geotextile	168,563 SF 170,563 SF 168,563 SF	New Hanover Co. LF Partial Closure 3B-5	Wilmington, NC	Nov-05	New Hanover County Ray Church 910-341-4340	ES & J Enterprises David Page 910-567-6138	SCS Engineers Ed Hilton 813-621-0080
60 mil HDPE, TX Geocomposite GCL	270,000 SF 270,000 SF 270,000 SF	Beulah LF Cell 4	Hurlock, MD	Nov-05	Dorchester County Robt. Tenanty 410-228-2920	Days Cove Reclamation Bob Oler 410-269-1654	GeoSyntec Brad Anderson 410-808-7388
60 mil HDPE, TX 16 oz. Geotextile	56,700 SF 56,700 SF	CMV Sewer	Felton, PA	Dec-05	CMV Sewer Bob Lyter 717-993-6300	Owner	N/A
40 mil LLDPE, TX Geocomposite GCL	445,625 SF 442,400 SF 450,225 SF 9,000 SF	Pittsylvania LF Phase I Closure	Dry Fork, VA	Dec-05	Pittsylvania County	Thalle Construction Chris Haverstrom 919-245-1490	Dewberry & Davis Shawn Harden 434-797-4497

# Russell Sanborn

## Geomembrane Experience Resume - 2005

Supervisor on the following projects:

Material	Quantity	Project	Location	Date
45 mil PP	43,000 SF	Idlewilde Dredged Material Placement Site Rehab.	Shadyside, MD	Mar-05
40 mil LLDPE, TX Geocomposite	253,650 SF 253,650 SF	Harrisburg LF Cap	Harrisburg, PA	Apr-05
45 mil PP	107,000 SF	Bivalve Dredged Material Placement Site	Bivalve, MD	Apr-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz Geotextile	129,069 SF 79,106 SF 7,125 SF 6,000 SF	Rocky River WTP	Anderson, SC	May-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz. Geotextile	147,436 SF 90,364 SF 20,340 SF 6,150 SF	Generostee WTP	Anderson, SC	May-05
40 mil HDPE, SM 12 oz Geotextile	17,600 SF 17,600 SF	Lake Ashburton Washwater Lake Rehab.	Baltimore, MD	Jun-05
XR-5 Geocomposite	18,562 SF 16,200 SF	Kent County WWTP	Milford, DE	Jun-05
40 mil HDPE, TX Geocomposite	36,600 SF 440,000 SF	Sandy Hill LF	Bowie, MD	Jun-05
40 mil HDPE Geocomposite	50,500 SF 50,500 SF	Dominion Extraction Plant	Pine Grove, WV	Aug-05
60 mil LLDPE, TX 10 oz. Geotextile	303,424 SF 480,908 SF	Orleans Homes	Downingtown, PA	Sep-05
40 mil LLDPE, TX Geocomposite 10 oz. Geotextile	519,500 SF 534,000 SF 537,000 SF	Snow Hill Landfill Cap	Snow Hill, MD	Sep-05
50 mil PVC Geocomposite GCL 10 oz. Geotextile 16 oz. Geotextile Raincover	810,000 SF 45,000 SF 807,030 SF 776,718 SF 858,636 SF 841,500 SF	Eastern LF Phase 9	White Marsh, MD	Sep-05
60 mil HDPE	800 SF	JM Huber Electric Substation Dike	Havre de Grace, MD	Nov-05

# Justin Harward

## Geomembrane Experience Resume - 2005

Supervisor on the following projects:

Material	Quantity	Project	Location	Date
45 mil PP	43,000 SF	Idlewilde Dredged Material Placement Site Rehab.	Shadyside, MD	Mar-05
30 mil PVC	6,672 SF	I70/I81 Dry Swale	Hagerstown, MD	Apr-05
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
40 mil HDPE, SM	4,550 SF	Westmoreland Site Vapor Barrier	Arlington, VA	Apr-05
60 mil HDPE, TX	41,227 SF	Lucky Stone Site	Fredericksburg, VA	May-05
60 mil HDPE, TX Geocomposite GCL 28 oz. Geotextile	993,600 SF 74,200 SF 993,600 SF 993,600 SF	Buncombe County LF Cell 6	Alexander, NC	May-05
60 mil HDPE, TX 10 oz. Geotextile Raincover	220,000 SF 220,000 SF 164,700 SF	Corral Farm LF Cell 11 Construction	Warrenton, VA	Sep-05
60 mil HDPE, TX	77,750 SF	Ocean Pines WWTP	Berlin, MD	Oct-05
40 mil LLDPE, TX Geocomposite	405,000 SF 1,055,700 SF	I-95 Landfill Partial Cap	Lorton, VA	Oct-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite GCL	133,500 SF 423,000 SF 537,750 SF 269,930 SF	New Hanover Co. LF Cell 6	Wilmington, NC	Nov-05

# Arturo Sanchez

## Geomembrane Experience Resume - 2005

Material	Quantity	Project	Location	Date
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
40 mil HDPE, TX Geocomposite 10 oz. Geotextile	435,165 SF 443,025 SF 435,165 SF	Modem LF Cap	York, PA	May-05
60 mil HDPE	3,400 SF	Advanced Auto SWMP	Martinsburg, WV	Jun-05
GCL	200,100 SF	Sun Meadows Ponds	Walkersville, MD	Jul-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite Geonet GCL 8 oz. Geotextile Raincover	765,000 SF 270,000 SF 765,000 SF 270,000 SF 10,000 SF 150,000 SF 400,000 SF	Millersville LF Cell 8	Severn, MD	Sep-05
GCL	104,945 SF	TBH Concrete Plant SWMP	Martinsburg, WV	Oct-05

# Alex Lopez

## Geomembrane Experience Resume - 2005

Material	Quantity	Project	Location	Date
45 mil PP	43,000 SF	Idlewide Dredged Material Placement Site Rehab.	Shadyside, MD	Mar-05
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
60 mil HDPE, TX	41,227 SF	Lucky Stone Site	Fredericksburg, VA	5-May
60 mil HDPE, TX Geocomposite GCL 28 oz. Geotextile	993,600 SF 74,200 SF 993,600 SF 993,600 SF	Buncombe County LF Cell 6	Alexander, NC	May-05
40 mil LLDPE, TX Geocomposite 10 oz. Geotextile	519,500 SF 534,000 SF 537,000 SF	Snow Hill Landfill Cap	Snow Hill, MD	Sep-05
GCL	104,945 SF	TBH Concrete Plant SWMP	Martinsburg, WV	Oct-05
60 mil HDPE, TX Geocomposite GCL	270,000 SF 270,000 SF 270,000 SF	Beulah LF Cell 4	Hurlock, MD	Nov-05
60 mil HDPE, TX 16 oz. Geotextile	56,700 SF 56,700 SF	CMV Sewer	Felton, PA	Dec-05
40 mil LLDPE, TX Geocomposite GCL 8 oz. Geotextile	445,625 SF 442,400 SF 450,225 SF 9,000 SF	Pittsylvania LF Phase I Closure	Dry Fork, VA	Dec-05

# Bias Rivas

## Geomembrane Experience Resume - 2005

Material	Quantity	Project	Location	Date
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
45 mil PP	107,000 SF	Bivalve Dredged Material Placement Site	Bivalve, MD	Apr-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz Geotextile	129,069 SF 79,106 SF 7,125 SF 6,000 SF	Rocky River WTP	Anderson, SC	May-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz. Geotextile	147,436 SF 90,364 SF 20,340 SF 6,150 SF	Generostee WTP	Anderson, SC	May-05
60 mil HDPE, TX Geocomposite GCL 16 oz. Geotextile	360,677 SF 200,000 SF 100,000 SF 360,377 SF	Modern LF Cell 15B	York, PA	May-05
40 mil HDPE, SM 12 oz Geotextile	17,600 SF 17,600 SF	Lake Ashburton Washwater Lake Rehab.	Baltimore, MD	Jun-05
XR-5 Geocomposite	18,562 SF 16,200 SF	Kent County WWTP	Milford, DE	Jun-05
40 mil HDPE, TX Geocomposite	36,600 SF 440,000 SF	Sandy Hill LF	Bowie, MD	Jun-05
40 mil HDPE Geocomposite	50,500 SF 50,500 SF	Dominion Extraction Plant	Pine Grove, WV	Aug-05
60 mil LLDPE, TX 10 oz. Geotextile	303,424 SF 480,908 SF	Orleans Homes	Downingtown, PA	Sep-05
40 mil LLDPE, TX Geocomposite 10 oz. Geotextile	519,500 SF 534,000 SF 537,000 SF	Snow Hill Landfill Cap	Snow Hill, MD	Sep-05
50 mil PVC Geocomposite GCL 10 oz. Geotextile 16 oz. Geotextile Raincover	810,000 SF 45,000 SF 807,030 SF 776,718 SF 858,636 SF 841,500 SF	Eastern LF Phase 9	White Marsh, MD	Sep-05
60 mil HDPE, TX 10 oz. Geotextile Raincover	220,000 SF 220,000 SF 164,700 SF	Corral Farm LF Cell 11 Construction	Warrenton, VA	Sep-05
60 mil HDPE, TX Geocomposite GCL	270,000 SF 270,000 SF 270,000 SF	Beulah LF Cell 4	Hurlock, MD	Nov-05

# Doroteo Velasques

## Geomembrane Experience Resume - 2005

Material	Quantity	Project	Location	Date
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
60 mil HDPE, TX	41,227 SF	Lucky Stone Site	Fredericksburg, VA	May-05
60 mil HDPE, TX Geocomposite GCL 28 oz. Geotextile	993,600 SF 74,200 SF 993,600 SF 993,600 SF	Buncombe County LF Cell 6	Alexander, NC	May-05
60 mil HDPE, TX GCL	77,750 SF 104,945 SF	Ocean Pines WWTP TBH Concrete Plant SWMP	Berlin, MD Martinsburg, WV	Oct-05 Oct-05
40 mil LLDPE, TX Geocomposite	405,000 SF 1,055,700 SF	I-95 Landfill Partial Cap	Lorton, VA	Oct-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite GCL	133,500 SF 423,000 SF 537,750 SF 269,930 SF	New Hanover Co. LF Cell 6	Wilmington, NC	Nov-05
60 mil HDPE, TX Geocomposite GCL	270,000 SF 270,000 SF 270,000 SF	Beulah LF Cell 4	Hurlock, MD	Nov-05
40 mil LLDPE, TX Geocomposite GCL 8 oz. Geotextile	445,625 SF 442,400 SF 450,225 SF 9,000 SF	Pittsylvania LF Phase I Closure	Dry Fork, VA	Dec-05

# Eldizar Rivera

## Geomembrane Experience Resume - 2005

Material	Quantity	Project	Location	Date
45 mil PP	43,000 SF	Idlewilde Dredged Material Placement Site Rehab.	Shadyside, MD	Mar-05
30 mil PVC	6,672 SF	170/181 Dry Swale	Hagerstown, MD	Apr-05
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
40 mil HDPE, SM	4,550 SF	Westmoreland Site Vapor Barrier	Arlington, VA	Apr-05
60 mil HDPE, TX	41,227 SF	Lucky Stone Site	Fredericksburg, VA	5-May
60 mil HDPE, TX Geocomposite GCL 28 oz. Geotextile	993,600 SF 74,200 SF 993,600 SF 993,600 SF	Buncombe County LF Cell 6	Alexander, NC	May-05
60 mil HDPE, TX 10 oz. Geotextile Raincover	220,000 SF 220,000 SF 164,700 SF	Corral Farm LF Cell 11 Construction	Warrenton, VA	Sep-05
60 mil HDPE, TX	77,750 SF	Ocean Pines WWTP	Berlin, MD	Oct-05
GCL	104,945 SF	TBH Concrete Plant SWMP	Martinsburg, WV	Oct-05
40 mil LLDPE, TX Geocomposite	405,000 SF 1,055,700 SF	I-95 Landfill Partial Cap	Lorton, VA	Oct-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite GCL	133,500 SF 423,000 SF 537,750 SF 269,930 SF	New Hanover Co. LF Cell 6	Wilmington, NC	Nov-05
60 mil HDPE, TX Geocomposite GCL	270,000 SF 270,000 SF 270,000 SF	Beulah LF Cell 4	Hurlock, MD	Nov-05

**Herminio Vasquez**  
**Geomembrane Experience Resume - 2005**

Material	Quantity	Project	Location	Date
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
60 mil HDPE, TX Geocomposite GCL 28 oz. Geotextile	993,600 SF 74,200 SF 993,600 SF 993,600 SF	Buncombe County LF Cell 6	Alexander, NC	May-05
60 mil HDPE, TX Geocomposite GCL 16 oz. Geotextile	360,677 SF 200,000 SF 100,000 SF 360,377 SF	Modern LF Cell 15B	York, PA	May-05
60 mil HDPE, TX	77,750 SF	Ocean Pines WWTP	Berlin, MD	Oct-05
40 mil LLDPE, TX Geocomposite	405,000 SF 1,055,700 SF	I-95 Landfill Partial Cap	Lorton, VA	Oct-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite GCL	133,500 SF 423,000 SF 537,750 SF 269,930 SF	New Hanover Co. LF Cell 6	Wilmington, NC	Nov-05

# Homero Telles

## Geomembrane Experience Resume - 2005

Material	Quantity	Project	Location	Date
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
40 mil HDPE, TX Geocomposite 10 oz. Geotextile	435,165 SF 443,025 SF 435,165 SF	Modern LF Cap	York, PA	May-05
60 mil HDPE	3,400 SF	Advanced Auto SWMP	Martinsburg, WV	Jun-05
XR-5 Geocomposite	18,562 SF 16,200 SF	Kent County WWTP	Milford, DE	Jun-05
GCL	200,100 SF	Sun Meadows Ponds	Walkersville, MD	Jul-05
60 mil LLDPE, TX 10 oz. Geotextile	303,424 SF 480,908 SF	Orleans Homes	Downingtown, PA	Sep-05
60 mil HDPE, TX Geocomposite GCL 16 oz. Geotextile	360,677 SF 200,000 SF 100,000 SF 360,377 SF	Modern LF Cell 15B	York, PA	May-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite Geonet GCL 8 oz. Geotextile Raincover	765,000 SF 270,000 SF 765,000 SF 270,000 SF 10,000 SF 150,000 SF 400,000 SF	Millersville LF Cell 8	Severn, MD	Sep-05
GCL	104,945 SF	TBH Concrete Plant SWMP	Martinsburg, WV	Oct-05

**Ignatio Fernandez**  
**Geomembrane Experience Resume - 2005**

Material	Quantity	Project	Location	Date
45 mil PP	43,000 SF	Idlewilde Dredged Material Placement Site Rehab.	Shadyside, MD	Mar-05
40 mil LLDPE, TX Geocomposite	253,650 SF 253,650 SF	Harrisburg LF Cap	Harrisburg, PA	Apr-05
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
60 mil HDPE, TX Geocomposite GCL 16 oz. Geotextile	360,677 SF 200,000 SF 100,000 SF 360,377 SF	Modern LF Cell 15B	York, PA	May-05
40 mil HDPE, TX Geocomposite 10 oz. Geotextile	435,165 SF 443,025 SF 435,165 SF	Modern LF Cap	York, PA	May-05
60 mil HDPE, TX Geocomposite GCL 28 oz. Geotextile	993,600 SF 74,200 SF 993,600 SF 993,600 SF	Buncombe County LF Cell 6	Alexander, NC	May-05
60 mil HDPE	3,400 SF	Advanced Auto SWMP	Martinsburg, WV	Jun-05
GCL	200,100 SF	Sun Meadows Ponds	Walkersville, MD	Jul-05

**Jose Ordones**  
**Geomembrane Experience Resume - 2005**

Material	Quantity	Project	Location	Date
45 mil PP	43,000 SF	Idlewilde Dredged Material Placement Site Rehab.	Shadyside, MD	Mar-05
40 mil LLDPE, TX Geocomposite	253,650 SF 253,650 SF	Harrisburg LF Cap	Harrisburg, PA	Apr-05
30 mil PVC	6,672 SF	I70/I81 Dry Swale	Hagerstown, MD	Apr-05
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
60 mil HDPE, TX	41,227 SF	Lucky Stone Site	Fredericksburg, VA	May-05
60 mil HDPE, TX Geocomposite GCL 28 oz. Geotextile	993,600 SF 74,200 SF 993,600 SF 993,600 SF	Buncombe County LF Cell 6	Alexander, NC	May-05
GCL	104,945 SF	TBH Concrete Plant SWMP	Martinsburg, WV	Oct-05
60 mil HDPE, TX 16 oz. Geotextile	56,700 SF 56,700 SF	CMV Sewer	Felton, PA	Dec-05
40 mil LLDPE, TX Geocomposite GCL 8 oz. Geotextile	445,625 SF 442,400 SF 450,225 SF 9,000 SF	Pittsylvania LF Phase I Closure	Dry Fork, VA	Dec-05

# Juan Rivas

## Geomembrane Experience Resume - 2005

Material	Quantity	Project	Location	Date
40 mil LLDPE, TX Geocomposite	253,650 SF 253,650 SF	Harrisburg LF Cap	Harrisburg, PA	Apr-05
30 mil PVC	6,672 SF	I70/I81 Dry Swale	Hagerstown, MD	Apr-05
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
40 mil HDPE, SM	4,550 SF	Westmoreland Site Vapor Barrier	Arlington, VA	Apr-05
60 mil HDPE, TX	41,227 SF	Lucky Stone Site	Fredericksburg, VA	May-05
60 mil HDPE, TX Geocomposite GCL 28 oz. Geotextile	993,600 SF 74,200 SF 993,600 SF 993,600 SF	Buncombe County LF Cell 6	Alexander, NC	May-05
60 mil HDPE	3,400 SF	Advanced Auto SWMP	Martinsburg, WV	Jun-05
GCL	200,100 SF	Sun Meadows Ponds	Walkersville, MD	Jul-05
40 mil LLDPE, TX Geocomposite	405,000 SF 1,055,700 SF	I-95 Landfill Partial Cap	Lorton, VA	Oct-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite GCL	133,500 SF 423,000 SF 537,750 SF 269,930 SF	New Hanover Co. LF Cell 6	Wilmington, NC	Nov-05
60 mil HDPE, TX Geocomposite GCL	270,000 SF 270,000 SF 270,000 SF	Beulah LF Cell 4	Hurlock, MD	Nov-05

**Mauricio Sanchez**  
**Geomembrane Experience Resume - 2005**

<b>Material</b>	<b>Quantity</b>	<b>Project</b>	<b>Location</b>	<b>Date</b>
60 mil HDPE, TX	77,750 SF	Ocean Pines WWTP	Berlin, MD	Oct-05
GCL	104,945 SF	TBH Concrete Plant SWMP	Martinsburg, WV	Oct-05
40 mil LLDPE, TX	405,000 SF	I-95 Landfill Partial Cap	Lorton, VA	Oct-05
Geocomposite	1,055,700 SF			
60 mil HDPE, TX	133,500 SF	New Hanover Co. LF Cell 6	Wilmington, NC	Nov-05
60 mil HDPE, SM	423,000 SF			
Geocomposite	537,750 SF			
GCL	269,930 SF			
60 mil HDPE, TX	270,000 SF	Beulah LF Cell 4	Hurlock, MD	Nov-05
Geocomposite	270,000 SF			
GCL	270,000 SF			

**Saul Martinez**  
**Geomembrane Experience Resume - 2005**

Material	Quantity	Project	Location	Date
40 mil LLDPE, TX Geocomposite	253,650 SF 253,650 SF	Harrisburg LF Cap	Harrisburg, PA	Apr-05
45 mil PP	107,000 SF	Bivalve Dredged Material Placement Site	Bivalve, MD	Apr-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz Geotextile	129,069 SF 79,106 SF 7,125 SF 6,000 SF	Rocky River WTP	Anderson, SC	May-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz. Geotextile	147,436 SF 90,364 SF 20,340 SF 6,150 SF	Generostee WTP	Anderson, SC	May-05
40 mil HDPE, SM 12 oz Geotextile	17,600 SF 17,600 SF	Lake Ashburton Washwater Lake Rehab.	Baltimore, MD	Jun-05
XR-5 Geocomposite	18,562 SF 16,200 SF	Kent County WWTP	Milford, DE	Jun-05
40 mil HDPE, TX Geocomposite	36,600 SF 440,000 SF	Sandy Hill LF	Bowie, MD	Jun-05
60 mil HDPE Geocomposite	50,500 SF 50,500 SF	Dominion Extraction Plant	Pine Grove, WV	Aug-05
60 mil LLDPE, TX 10 oz. Geotextile	303,424 SF 480,908 SF	Orleans Homes	Downingtown, PA	Sep-05
40 mil LLDPE, TX Geocomposite 10 oz. Geotextile	519,500 SF 534,000 SF 537,000 SF	Snow Hill Landfill Cap	Snow Hill, MD	Sep-05
60 mil HDPE, TX 10 oz. Geotextile Raincover	220,000 SF 220,000 SF 164,700 SF	Corral Farm LF Cell 11 Construction	Warrenton, VA	Sep-05

# Trinidad Montes

## Geomembrane Experience Resume - 2005

Material	Quantity	Project	Location	Date
40 mil LLDPE, TX Geocomposite	253,650 SF 253,650 SF	Harrisburg LF Cap	Harrisburg, PA	Apr-05
60 mil LLDPE, TX 16 oz Geotextile	1,632,000 SF 3,264,975 SF	Newark Water Reservoir	Newark, DE	Apr-05
45 mil PP	107,000 SF	Bivalve Dredged Material Placement Site	Bivalve, MD	Apr-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz Geotextile	129,069 SF 79,106 SF 7,125 SF 6,000 SF	Rocky River WTP	Anderson, SC	May-05
60 mil HDPE, TX 60 mil HDPE, SM Geocomposite 16 oz. Geotextile	147,436 SF 90,364 SF 20,340 SF 6,150 SF	Generostee WTP	Anderson, SC	May-05
40 mil HDPE, SM 12 oz Geotextile	17,600 SF 17,600 SF	Lake Ashburton Washwater Lake Rehab.	Baltimore, MD	Jun-05
XR-5 Geocomposite	18,562 SF 16,200 SF	Kent County WWTP	Milford, DE	Jun-05
60 mil HDPE, TX Geocomposite	36,600 SF 440,000 SF	Sandy Hill LF	Bowie, MD	Jun-05
40 mil HDPE Geocomposite	50,500 SF 50,500 SF	Dominion Extraction Plant	Pine Grove, WV	Aug-05
60 mil LLDPE, TX 10 oz. Geotextile	303,424 SF 480,908 SF	Orleans Homes	Downingtown, PA	Sep-05
40 mil LLDPE, TX Geocomposite 10 oz. Geotextile	519,500 SF 534,000 SF 537,000 SF	Snow Hill Landfill Cap	Snow Hill, MD	Sep-05
50 mil PVC Geocomposite GCL 10 oz. Geotextile 16 oz. Geotextile Raincover	810,000 SF 45,000 SF 807,030 SF 776,718 SF 858,636 SF 841,500 SF	Eastern LF Phase 9	White Marsh, MD	Sep-05
60 mil HDPE, TX 10 oz. Geotextile Raincover	220,000 SF 220,000 SF 164,700 SF	Corral Farm LF Cell 11 Construction	Warrenton, VA	Sep-05
60 mil HDPE	800 SF	JM Huber Electric Substation Dike	Havre de Grace, MD	Nov-05

**BLUE RIDGE PAPER CO.  
CANTON, NC**

Submittal #2

**Section 02771 Geomembrane High Density Polyethylene  
(HDPE)**

- Certified Installer Certificate- Hallaton
- Manufacturer's QA/QC Manual
- Manufacturer's Installation Manual
- Manufacturer's Qualifications
- Product Data Sheet- 60 mil HDPE Microspike- Agru
- Manufacturer's Sample Warranty- 20 yr

PREPARED BY:  
Hallaton, Inc.  
100 E. Pennsylvania Ave., Suite 203  
Towson, MD 21286  
May 23, 2007



Technology in Plastics

### Hallaton, Inc.

Hallaton, Inc. is a well established lining installation company within the Geosynthetic Industry. Hallaton is one of the largest installers of Agru America, Inc.'s products in the Mid Atlantic region and one of our top installers in the United States.

Agru America, Inc. has worked successfully with Hallaton over the years on multiple projects where Hallaton has installed over 5,000,000 square feet of HDPE and LLDPE Smooth/Microspike material. Hallaton is familiar with approved installation procedures and we have recognized them as one of our top-tier "Priority Installers".

Agru America, Inc. does not warrant or guarantee the work of any Approved Installer. Approved installers are independent contractors that provide specific installation services and do not act as agents or representatives of Agru America, Inc.

---

Paul W. Barker  
Technical Director  
Agru America, Inc.

Date: May 2, 2006

**MANUFACTURING QUALITY CONTROL**

**SALES OFFICE:**

**AGRU AMERICA, INC.**

**500 Garrison Road**

**Georgetown, SC 29440**

**Toll Free: (800) 373-2478**

**Telephone: (843) 546-0600**

**Fax: (843) 527-2738**

**[salesmkg@agruamerica.com](mailto:salesmkg@agruamerica.com)**

**[www.agruamerica.com](http://www.agruamerica.com)**

July 23, 2004

## **AGRU AMERICA, INC. - QA/QC**

### **Manufacturing – Quality Assurance/Quality Control**

**AGRU AMERICA, Inc.** extrudes high density polyethylene (HDPE) and linear low density polyethylene (LLDPE) geomembrane at its plant located at 500 Garrison Road, Georgetown, South Carolina, 29440.

Our USA Manufacturing Quality Assurance Program is dependent on the utilization of an in-house laboratory which is, when necessary, complemented with testing performed by certified outside laboratories such as:

- Precision Geosynthetic Laboratories; Anaheim, CA  
Telephone (714) 520-9631; Fax (714) 520-9637
- TRI/Environmental, Inc.; Austin, Texas  
Telephone (512) 263-2101; Fax (512) 263-2558

And other GRI-LAP accredited laboratories.

### **Raw Material – Manufacturer's Certificate of Conformity**

HDPE and LLDPE resin is supplied to our plant in bulk and subjected to the following procedures:

- Prior to shipment, our resin supplier submits a certificate of analysis. Once approved, the resin is released for shipment to our plant.
- One sample is taken from each rail car after arrival and tested as follows:  
Melt Index ASTM D1238 190°C, 2.16kg, and Density ASTM D792.
- Once the tests have been completed and results found to be in compliance with our requirements, the resin is then unloaded into our silo system.
- At this stage, our supplier has performed one battery of tests and Agru America has performed one to verify the manufacturer's certificate of analysis.
- Off specification resin is returned to the supplier.
- The Manufacturer's MFI Test Data is reported on the Quality Certificate (Agru America's MFI Testing is done to verify this data).

### **The Extrusion Process**

The resin is conveyed through a vacuum pump system and flexible hoses to a dryer hopper, feeding the resin by gravity into an 8-inch barrel. This barrel is divided into five heating zones, each heating zone being computer controlled and constantly monitored.

A screw in the barrel turns at a prescribed and monitored speed. It conveys the resin slowly to full plastication, and then the plasticated resin is fed through a manifold into a coat hanger die having a width of approximately 24 feet. The die lips are open to a prescribed distance governed by the thickness of the geomembrane to be extruded.

Exiting the die, the plasticated resin forms a controlled and monitored bead, which feeds into a chrome three-roll stack in a prescribed pattern. Each chrome roll is set at a prescribed temperature, controlled by water circulation.

Exiting the controlled cooling of the roll stack, the geomembrane travels down the take off haulers towards the winder. On the way to the take off, the liner is trimmed to bring the finished width to the applicable standard. Trimmings are granulated.

The trimmed edge of one side of the geomembrane is marked at every 3.28 ft with thickness, Agru America name and year of manufacture. This marking also serves as product identification.

The geomembrane is visually inspected for surface defects as it travels down the take off by both the extruder and the winder operators.

The geomembrane is wound on a recycled HDPE core having 6" ID (150mm), 7" OD (175mm) and 22'8" (6.8m) length. Each smooth roll weighs approximately 3,000 pounds (1360 kg). Microspike<sup>®</sup> rolls weigh approximately 3,200 pounds (1450 kg). All rolls are fitted with two nylon slings when shipped.

### **Post Extrusion Quality Control**

Once start-up conditions are over and commercial extrusion is initiated, post-production quality control comes into operation. A series of test procedures are performed based upon either our Standard Frequency of testing (attached), or frequencies required by customer specifications.

A sample approximately 11" by the full width of the geomembrane is taken from every roll. Based on the specified test frequencies, certain specimens are die cut, tested and the results summarized on the Quality Certificate issued by our Quality Control Department. The certificate is signed electronically

by the Quality Control Manager. The Quality Control Manager reports directly to the President of the Company.

Rolls failing to comply with either Customer Project Specifications and/or our own latest revision to our published data sheets are set aside and re-classified as off-spec (Class B rolls).

Quality Certificates are provided for all rolls of geomembranes (sample smooth & Microspike<sup>®</sup> certificates are attached), with the exception of off-spec (Class B rolls).

Sometimes a third party Quality Assurance representative is mandated by the owner of a project to oversee our manufacturing QA. We gladly subscribe to this procedure and make all our records available 24 hours a day for the duration of the mandate.

The following roll identification items are reported in our Quality Certificate:

**Roll number**

(example)      **203366 -01**

First digit	machine
Second and third digits	week of year
Fourth digit	day of week (Monday=1, Sunday=7)
Last two digits	roll number (first roll of week is 01, etc.)

The two last digits separated from the others indicate the year the roll was produced.

Using the above key:

Roll #203366 -01 was produced on Liner Machine #2 on Wednesday, January 17, 2001.

**Product Description** (liner type: Smooth, Microspike<sup>®</sup>, Drain<sup>®</sup>, Super Gripnet<sup>®</sup>, etc.)

**Roll Length & Width in feet & meters**

**Raw material lot and/or batch number and supplier/product identification** (from Resin Manufacturer's Certificate of Analysis – sample attached)

The following test results are reported in the Quality Certificate, derived from our Standard Test Frequency (attached) and/or supplied raw material manufacturer Certificates of Analysis:

Test / Method	Results Reported & Modifications to Standard (if any)
Thickness †ASTM D5199(Smooth), or †D5994(Textured) <b>(Both Modified)</b>	Minimum, Maximum, and Average Sheet Thickness in mm and mils. <b>Modification from Standard</b> = Measurements are taken upon sample reaching Lab Temperature Equilibrium.
Asperity Height GRI GM12 <b>(Modified)</b> Textured liner only	Asperity height in mils <b>Modifications from Standard</b> = Gage used is accurate to 0.02mm, <u>not</u> 0.25mm. Edge samples are collected from the smooth/textured junction, <u>not</u> 1 foot from edge. ASTM D5994 specimens are used for this test, <u>not</u> direct placement.
Density †ASTM D792	Density in g/cc
Melt Flow Index †ASTM D1238	g/10minutes (Conditions =190°C, 2.16kg). <b>NOTE:</b> <u>Resin Manufacturer's Certificate of Analysis result</u> is reported. Our testing verifies this result.
Carbon Black Content †ASTM D4218	% Carbon Black by weight
Carbon Black Dispersion †ASTM D5596	Category
Tensile Strength †ASTM D6693 †ASTM D638 Both Type IV, 2 inches / minute <b>(Both Modified)</b>	Average Strength @ Yield in psi, ppi, & N/mm Average Strength @ Break in psi, ppi, & N/mm Average Elongation @ Yield in % Average Elongation @ Break in % <b>Modification from Standard</b> = Average of MD & TD results are reported <b>NOTE 1:</b> The D6693 results equate to the following <b>D638 Modifications:</b> Gage Length for Yield = 1.3", for Break = 2" <b>NOTE 2:</b> Yield data not reported for LLDPE
Dimensional Stability †ASTM D1204 <b>(Modified)</b>	Average Dimensional Change in % <b>Modification from Standard</b> = Average Dimensional Change of MD & TD is reported.
Tear Resistance †ASTM D1004 <b>(Modified)</b>	Tear Resistance in Lbs & N. <b>Modifications from Standard</b> = Test is run upon sample reaching Lab Temperature Equilibrium. Average Tear Resistance of MD & TD is reported.
Puncture Resistance †ASTM D4833 †FTMS 101C Method 2065 <b>(Both Modified)</b>	Puncture Resistance in Lbs & N. <b>Modification from Standard</b> = Test is run upon sample reaching Lab Temperature Equilibrium.
Environmental Stress Crack Resistance (ESCR) †ASTM D1693 <b>(CERTIFIED)</b>	This test is n longer run by Agru America, and the result is now certified by Agru America for 1500 hours (Certification letter is attached, as well as GAI-LAP's approval of the certification.)
Notched Constant Tensile Load †ASTM D5397 (Single Point, Appx.)	Pass / Fail at 300 hours (or as required by customer specifications) This test run on HDPE only, and on smooth edge of textured liners.

†GRI-LAP Accredited for this method (INCLUDING Modifications)

The following Test methods are also performed per railcar in our Standard MQC, but results are **not** reported on our Quality Certificates (results can be forwarded if necessary).

Test / Method	Results Reported
Oxidative Induction Time (OIT) ASTM D3895 Standard, 200°C, 1atm. <b>THIS TEST DONE IN-HOUSE BY            AGRU AMERICA</b>	OIT Time in minutes
Low Temperature Brittleness ASTM D746 <b>THIS TEST OUTSOURCED TO AN            ACCREDITED 3<sup>rd</sup> PARTY LAB</b>	Pass / Fail for each specimen (5 specimens in both MD & TD), % of samples passing. <b>NOTE: Standard MQC Temperature tested to is -60°C. Lower Temperatures can be done if required by customer specifications.</b>

**Additional Test Procedures**  
**(Available if Specified from GRI-LAP Accredited Third Party Labs)**

Hydrostatic Resistance	ASTM D751
Volatile Loss	ASTM D1203
Resistance to Soil Burial	ASTM D3083 using ASTM D638 Type IV dumbbell at 2"/min.
Water Absorption	ASTM D570
Coefficient of Thermal Expansion	ASTM D696
Friction Angle Direct Shear Method	ASTM D5321
Moisture Vapor Transmission Rate 100°F - 100% RH	ASTM E96
Transmissivity Various gradients & confining pressure	ASTM D4716
Multi-axial Tensile Strain at Rupture (percent)	ASTM D5617

# Standard Frequency of Testing



## Product Data

Property	Test Method	Frequency of testing (minimum)
Thickness (min. ave.), mil	ASTM D5994/D5199	per roll
Asperity Height (min. ave.), mil	GRI GM-12 (for textured liner)	per roll, alternating top/bottom for dbl sided textured liner only
Density, g/cc, minimum	ASTM D792, Method B	200,000 lbs (railcar)
Tensile Properties (ave. both directions)	ASTM D6693, Type IV	
Strength @ Yield (min. ave.), lb/in width	2 in/minute	
Elongation @ Yield (min. ave.), % (GL=1.3in)	5 specimens in each direction	20,000 lbs
Strength @ Break (min. ave.), lb/in width		
Elongation @ Break (min. ave.), % (GL=2.0in)		
Tear Resistance, lbs. (min. ave.)	ASTM D1004	45,000 lbs
Puncture Resistance, lbs. (min. ave.)	ASTM D4833	45,000 lbs
Carbon Black Content (range in %)	ASTM D4218	20,000 lbs
Carbon Black Dispersion (Category)	ASTM D5596	45,000 lbs
Stress Crack Resistance (NCTL), hours	ASTM D5397, Appendix	200,000 lbs (railcar)
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O <sub>2</sub>	200,000 lbs (railcar) on finished liner
Melt Flow Index, g/10 minutes	ASTM D1238, 190°C, 2.16kg	200,000 lbs (railcar) on incoming resin
Low Temperature Brittleness, °C	ASTM D746, -60°C	200,000 lbs (railcar) on finished liner
Oven Aging	ASTM D5721	
with HP OIT, (% retained after 90 days)	ASTM D5885, 150°C, 500psi O <sub>2</sub>	per resin formulation
UV Resistance	GRI GM11	
with HP OIT, (% retained after 1600 hours)	ASTM D5885, 150°C, 500psi O <sub>2</sub>	per resin formulation
2% Secant Modulus, lb/in. (max.)	ASTM D5323	per resin formulation- <b>for LLDPE liner only</b>
Axi-Symmetric Break Resistance Strain, % (min.)	ASTM D5617	per resin formulation- <b>for LLDPE liner only</b>

These test frequencies meet or exceed GRI's GM-13

\*Theses test frequencies may be changed based on project specifications, and represent the minimum MQC testing performed. Additional costs may be incurred if required testing is greater than listed above

All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, it is the user's responsibility to determine the suitability for their own use of the products described herein. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Agru/America as to the effects of such use or the results to be obtained, nor does Agru/America assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

Executive Offices: 500 Garrison Road, Georgetown, SC 29440 843-546-0600 800-321-1379 Fax: 843-546-0516  
 Sales Office: 700 Rocknead, Suite 150, Kingwood, TX 77339 281-358-4741 800-373-2478 Fax: 281-358-5297  
 email: salesmkg@agruamerica.com

## Certificate of Analysis

Shipped To: AGRU AMERICA INC  
500 GARRISON RD  
GEORGETOWN SC 29440  
USA

CPC Delivery #: 86671544  
PO # 03814  
Weight: 190000 LB  
Ship Date: 07/14/2004  
Package: BULK  
Mode: Hopper Car  
Car #: GOCX058461  
Seal No: 301173

Recipient: GRANT PALMER  
Fax:

Product:  
MARLEX POLYETHYLENE K307 BULK

Lot Number: 8140404

Property	Test Method	Value	Unit
Melt Index	ASTM D1238	0.260	g/10mi
MI Flow Rate	ASTM D1238	22.00	g/10mi
Density	ASTM D1505	0.9380	g/cm3
Pellet Count	P02.08.03	30.000	pel/g
Production Date		3/22/04	

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.**



Jackie Edwards  
Certification Systems Specialist

For CoA questions contact Carol Meza at 713-475-3625



# quality certificate

ROLL # **206769-06**

Lot #

**CSG812000**

Liner Type: **SMOOTH LLDPE**

Thickness Measurement ASTM D5199 (Modified)	MIN:	METRIC	ENGLISH	Thickness	1.5mm	60mil	Length	128	m	420	feet
		MAX:	1.703 mm		67 mil	Width		6.86	m	22.5	feet
	AVE:	1.558 mm	61 mil				OIT(Standard) ASTM D3895	minutes		144	

Specific Gravity ASTM D792      Density      g/cc      .937 **X .94**

MFI ASTM D1238  
COND. E  
GRADE:      7104      Melt Flow Index 190°C /2160 g - g /10 min      .32 **X .1-.3**

Carbon Black Content ASTM D4218      Range      %      2.46 **✓**

Carbon Black Dispersion ASTM D5596      Category      1 **✓**

Tensile Strength ASTM D6693  
ASTM D638 (Modified)  
( 2 inches / minute )      Average Strength @ Break      53 N/mm      300 ppi **✓**      5,005 psi

Elongation ASTM D-6693  
ASTM D638 (Modified)  
( 2 inches / minute )  
Lo = 1.3" Yield  
Lo = 2.0" Break      Average Elongation @ Break      %      931.1 **✓**

Dimensional Stability ASTM D1204 (Modified)      Average Dimensional Change      %      -0.20 **✓**

Tear Resistance ASTM D1004 (Modified)      Average Tear Resistance      204 N      45.966 lbs **✓**

Puncture Resistance FTMS 101 Method 2065 (Modified)      Load      455 N      102.37 lbs **✓**

Puncture Resistance ASTM D4833 (Modified)      Load      550 N      123.56 lbs **✓**

ESCR ASTM D1693      Minimum Hrs w / o Failures      1500 hrs      **CERTIFIED**

Customer:  
PO:  
Destination

Date: **2-13-06**

Signature: *[Handwritten Signature]*  
Quality Control Department

60LLSM.FRM  
REV 02  
12/23/05

## **Geosynthetic Institute**

475 Kedron Avenue  
Folsom, PA 19033-1208 USA  
TEL (610) 522-8440  
FAX (610) 522-8441



June 20, 2005

Mr. Grant Palmer  
Laboratory Director  
Agru-America Inc.  
500 Garrison Road  
Georgetown, SC 29440

Re: GAI-LAP Accreditation

Dear Grant:

The Geosynthetic Institute (GSI) is pleased to acknowledge Agru-America Inc. on its repertoire of Geosynthetic Accreditation Institute's-Laboratory Accreditation Program (GAI-LAP) accredited tests. This letter should serve as notification that Agru-America Inc. located in Georgetown, SC is currently accredited for the following seventeen test methods until June 30, 2006.

1. ASTM D638 Test Method for Tensile Properties of Plastics
2. ASTM D751 Test Methods for Coated Fabrics (thickness),
3. ASTM D792 Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement
4. ASTM D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
5. ASTM D1204 Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
6. ASTM D1238 Test Method for Flow Rates of Thermoplastics by Extrusion Platometer
7. ASTM D1603 Test Method for Carbon Black in Olefin Plastics
8. ASTM D1693 Test Methods for Environmental Stress-Cracking of Ethylene Plastics
9. ASTM D3895 Test Methods for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry

10. ASTM D4218 Test Method for Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique
11. ASTM D4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
12. ASTM D5199 Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
13. ASTM D5397 Test Methods for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes using the Notched Constant Tension Load Test
14. ASTM D5596 Test Methods Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetic
15. ASTM D5994 Test Method for Measuring the Core Thickness of Textured Geomembranes
16. ASTM D6693 Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
17. FTM STD. No. 101c (method 2065-82), Puncture Resistance and Elongation Test (1/8 in. radius probe)

A certificate to this affect has been enclosed, signed and sealed. Any questions regarding your accreditation should be directed to George or Robert Koerner at (610) 522-8440. Once again congratulation and thank you for participating in the GAI-LAP.

Best Regards,



George R. Koerner, Ph.D., P.E. & CQA  
Director Designate GSI



Hallaton, Inc.  
100 E Pennsylvania Ave.  
Suite 203  
Towson, MD 21286

June 15, 2007

Attn: Kennedy Garber

Re: Material Certification for Blue Ridge Paper, Canton, NC (Hallaton's PO# P6399,  
Agru America's doc # 9201

This letter certifies that the material to be supplied to Hallaton for the above project  
will meet or exceed the Modulus of Elasticity ASTM D638 requirement of 80,000  
lb/sqin, as listed in 2.1.3 (table), page 02771-4 of the Project Specifications.

Best Regards,

Grant Palmer  
Quality Manager  
Agru America

Executive Offices: 500 Garrison Road, Georgetown, SC 29440 • 843 546-0600 • 800 321-1379 • Fax 843 546-0518  
Sales Office: 700 Rockmead, Suite 150, Kingwood, TX 77339 • 281 358-4741 • Fax 281 358-5297  
Email: gp-agru@sc.rr.com

Accreditation #:  
GAI-LAP - 261-97  
TEL (610) 522-8440



Geosynthetic Institute  
475 Kestron, Ave  
Folsom, PA 19033

# Agru America Inc.

is granted accreditation  
for designated geosynthetic test methods in accordance with the  
Geosynthetic Accreditation Institute - Laboratory Accreditation Program  
(GAI-LAP), as published in its annual directory.  
This accreditation is valid until June 30, 2006.



Robert M. Koerner, Ph.D., P.E.  
Director



George R. Koerner, Ph.D., P.E. & CQA  
Auditor





**SAMPLE ONLY**  
LIMITED MATERIAL WARRANTY

CUSTOMER NAME:

PROJECT:

TYPE MATERIAL: 40 mil LLDPE Microspike<sup>®</sup>, 40 mil LLDPE Smooth, 60 mil HDPE  
Smooth and 60 mil HDPE Microspike<sup>®</sup>

LOCATION:

The company, referred to herein as AGRU AMERICA, warrants that AGRU AMERICA liners will correspond to the specifications as indicated in AGRU AMERICA technical records, catalogs, guidelines and test certificates at the time when sold.

AGRU AMERICA warrants that the material is faultless and resistant for a period of twenty (20) years, prorated from the point of time sold when properly installed, covered and used for: Landfill.

AGRU AMERICA's liability under this warranty is not applicable when damage is caused by:

Natural phenomena such as thunderstorms, floods, earthquakes, acts of war or other acts of God;

Chemicals which are not suitable for HDPE/LLDPE liners according to chemical resistance guides or from experience.

Further, AGRU AMERICA is not liable for damages due to the misapplication, incorrect installation, and damages resulting from any kind of inadequate handling. In the event that any defects are noticed in the liner, AGRU AMERICA must be notified in writing within thirty (30) days.

AGRU AMERICA shall be given an opportunity to ascertain the cause of damages. AGRU AMERICA reserves the right to decide how damages will be settled.

Under no circumstances will AGRU AMERICA assume liability for consequential damages due to defective liner or incorrect installation. AGRU AMERICA will not be responsible for failures arising from incorrect welding of seams in the installation.

Further, AGRU AMERICA's warranty will be void in the event that the buyer performs repairs or makes alterations without the express approval of AGRU AMERICA in writing. AGRU AMERICA's maximum liability under this warranty will not exceed the purchase price of liner and will only be in force when payment has been made in full and further claims regardless of the legal suppositions are not applicable.

This warranty is only valid on condition that the generally approved technical standards and in particular the guidelines for the installation of the liner are followed.

For AGRU AMERICA, Inc.

---

Authorized Official (Date)

---

Paul W. Barker (Date: Date of Installation)  
Vice President

Corporate Offices: 500 Garrison Road, Georgetown, S.C. 29440 \* 843-546-0600 \* 800-321-1379 \* Fax 843-546-0516  
Sales Office: 700 Rockmead, Suite 150, Kingwood, TX 77339 \* 281-358-4741 \* 800-373-2478 \* Fax 281-358-5297

Email: salesmkg@agruamerica.com

# Standard Frequency of Testing



## Product Data

Property	Test Method	Frequency of testing (minimum)
Thickness (min. ave.), mil	ASTM D5994/D5199	per roll
Asperity Height (min. ave.), mil	GRI GM-12 (for textured liner)	per roll, alternating top/bottom for dbl sided textured liner only
Density, g/cc, minimum	ASTM D792, Method B	200,000 lbs (railcar)
Tensile Properties (ave. both directions)	ASTM D6693, Type IV	
Strength @ Yield (min. ave.), lb/in width	2 in/minute	
Elongation @ Yield (min. ave.), % (GL=1.3in)	5 specimens in each direction	20,000 lbs
Strength @ Break (min. ave.), lb/in width		
Elongation @ Break (min. ave.), % (GL=2.0in)		
Tear Resistance, lbs. (min. ave.)	ASTM D1004	45,000 lbs
Puncture Resistance, lbs. (min. ave.)	ASTM D4833	45,000 lbs
Carbon Black Content (range in %)	ASTM D4218	20,000 lbs
Carbon Black Dispersion (Category)	ASTM D5596	45,000 lbs
Stress Crack Resistance (NCTL), hours	ASTM D5397, Appendix	200,000 lbs (railcar)
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O <sub>2</sub>	200,000 lbs (railcar) on finished liner
Melt Flow Index, g/10 minutes	ASTM D1238, 190°C, 2.16kg	200,000 lbs (railcar) on incoming resin
Low Temperature Brittleness, °C	ASTM D746, -60°C	200,000 lbs (railcar) on finished liner
Oven Aging	ASTM D5721	per resin formulation
with HP OIT, (% retained after 90 days)	ASTM D5885, 150°C, 500psi O <sub>2</sub>	
UV Resistance	GRI GM11	per resin formulation
with HP OIT, (% retained after 1600 hours)	ASTM D5885, 150°C, 500psi O <sub>2</sub>	
2% Secant Modulus, lb/in. (max.)	ASTM D5323	per resin formulation-for LLDPE liner only
Axi-Symmetric Break Resistance Strain, % (min.)	ASTM D5617	per resin formulation-for LLDPE liner only

These test frequencies meet or exceed GRI's GM-13

\*These test frequencies may be changed based on project specifications, and represent the minimum MQC testing performed. Additional costs may be incurred if required testing is greater than listed above

All information, recommendations and suggestions appearing in this literature concerning the use of our products are based upon tests and data believed to be reliable; however, it is the user's responsibility to determine the suitability for their own use of the products described herein. Since the actual use by others is beyond our control, no guarantee or warranty of any kind, expressed or implied, is made by Agru/America as to the effects of such use or the results to be obtained, nor does Agru/America assume any liability in connection herewith. Any statement made herein may not be absolutely complete since additional information may be necessary or desirable when particular or exceptional conditions or circumstances exist or because of applicable laws or government regulations. Nothing herein is to be construed as permission or as a recommendation to infringe any patent.

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email: salesmkg@agruamerica.com

**BLUE RIDGE PAPER CO.  
CANTON, NC**

Submittal #3

**Section 02275 Geosynthetic Clay Liner (GCL)**

- Material Product Data Sheet- Bentomat ST- Cetco
- Manufacturer's Exception- Montmorillonite Content
- Manufacturer's Installation Manual
- Manufacturer's MQC Manual
- Manufacturer's CQA Manual
- Manufacturer's Qualifications

PREPARED BY:  
Hallaton, Inc.  
100 E. Pennsylvania Ave., Suite 203  
Towson, MD 21286  
May 23, 2007



## BENTOMAT® ST CERTIFIED PROPERTIES

MATERIAL PROPERTY	TEST METHOD	TEST FREQUENCY ft <sup>2</sup> (m <sup>2</sup> )	REQUIRED VALUES
Bentonite Swell Index <sup>1</sup>	ASTM D 5890	1 per 50 tonnes	24 ml/2g min.
Bentonite Fluid Loss <sup>1</sup>	ASTM D 5891	1 per 50 tonnes	18 ml max.
Bentonite Mass/Area <sup>2</sup>	ASTM D 5993	40,000 ft <sup>2</sup> (4,000 m <sup>2</sup> )	0.75 lb/ft <sup>2</sup> (3.6 kg/m <sup>2</sup> ) min
GCL Grab Strength <sup>3</sup>	ASTM D 4632 ASTM D 6768	200,000 ft <sup>2</sup> (20,000 m <sup>2</sup> )	90 lbs (400 N) MARV 22.5 lbs/in (40 N/cm) MARV
GCL Peel Strength <sup>3</sup>	ASTM D 4632 ASTM D 6496	40,000 ft <sup>2</sup> (4,000 m <sup>2</sup> )	15 lbs (65 N) min 2.5 lbs/in (4.4 N/cm) min
GCL Index Flux <sup>4</sup>	ASTM D 5887	Weekly	1 x 10 <sup>-8</sup> m <sup>3</sup> /m <sup>2</sup> /sec max
GCL Hydraulic Conductivity <sup>4</sup>	ASTM D 5887	Weekly	5 x 10 <sup>-9</sup> cm/sec max
GCL Hydrated Internal Shear Strength <sup>5</sup>	ASTM D 5321 ASTM D 6243	Periodic	500 psf (24 kPa) typ @ 200 psf 6,500 psf (311 kPa) typ @ 10,800 psf

**Bentomat ST is a reinforced GCL consisting of a layer of sodium bentonite between a woven and a nonwoven geotextiles, which are needlepunched together.**

### Notes

<sup>1</sup> Bentonite property tests performed at a bentonite processing facility before shipment to CETCO's GCL production facilities.

<sup>2</sup> Bentonite mass/area reported at 0 percent moisture content.

<sup>3</sup> All tensile strength and peel strength testing is performed in the machine direction using 4 inch grips per modified ASTM D 4632. Results are reported as minimum average roll values unless otherwise indicated. Upon request, tensile strength can be reported per ASTM D 6768 and peel strength can be reported per ASTM D 6496.

<sup>4</sup> Index flux and permeability testing with deaired distilled/deionized water at 80 psi (551 kPa) cell pressure, 77 psi (531 kPa) headwater pressure and 75 psi (517 kPa) tailwater pressure. Reported value is equivalent to 925 gal/acre/day. This flux value is equivalent to a permeability of 5x10<sup>-9</sup> cm/sec for typical GCL thickness. Actual flux values vary with field condition pressures. The last 20 weekly values prior the end of the production date of the supplied GCL may be provided.

<sup>5</sup> Peak values measured at 200 psf (10 kPa) and 10,800 psf (517 kPa) normal stress for a specimen hydrated for 48 hours. Site-specific materials, GCL products, and test conditions must be used to verify internal and interface strength of the proposed design.

*CETCO has developed an edge enhancement system that eliminates the need to use additional granular sodium bentonite within the overlap area of the seams. We call this edge enhancement, SuperGroove™, and it comes standard on both longitudinal edges of Bentomat® ST. It should be noted that SuperGroove™ does not appear on the end-of-roll overlaps and recommend the continued use of supplemental bentonite for all end-of-roll seams.*



1500 W. Shure Drive Arlington Heights, IL 60004 USA 800.527.9948 Fax 847.577.5571

For the most up-to-date information please visit our website, [www.cetco.com](http://www.cetco.com)

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The information and data contained herein are believed to be accurate and reliable. CETCO makes no warranty of any kind and accepts no responsibility for the results obtained through application of this information.

Revised 09/04  
TR 401-BMST



## Bentomat® & Claymax® Panel & Roll Specifications

### Panel Specifications

PRODUCTS	DIMENSIONS WIDTH x LENGTH	AREA	EFFECTIVE AREA
BENTOMAT® ST	15 ft x 150 ft (4.6 m x 45.7 m)	2,250 ft <sup>2</sup> (209 m <sup>2</sup> )	2,145 ft <sup>2</sup> (200 m <sup>2</sup> )
BENTOMAT SDN	14.5 ft x 150 ft (4.4 m x 45.7 m)	2,175 ft <sup>2</sup> (202 m <sup>2</sup> )	2,071 ft <sup>2</sup> (193 m <sup>2</sup> )
BENTOMAT DN	14.5 ft x 150 ft (4.4 m x 45.7 m)	2,175 ft <sup>2</sup> (202 m <sup>2</sup> )	2,071 ft <sup>2</sup> (193 m <sup>2</sup> )
BENTOMAT CL	15 ft x 150 ft (4.6 m x 45.7 m)	2,250 ft <sup>2</sup> (209 m <sup>2</sup> )	2,145 ft <sup>2</sup> (200 m <sup>2</sup> )
BENTOMAT CLT	15 ft x 150 ft (4.6 m x 45.7 m)	2,250 ft <sup>2</sup> (209 m <sup>2</sup> )	2,145 ft <sup>2</sup> (200 m <sup>2</sup> )
CLAYMAX® 200R	15 ft x 150 ft (4.6 m x 45.7 m)	2,250 ft <sup>2</sup> (209 m <sup>2</sup> )	2,040 ft <sup>2</sup> (190 m <sup>2</sup> )

### Roll Specifications

PRODUCTS	DIMENSIONS Length x Diameter (Avg.)	NOMINAL WEIGHT	ROLLS / TRUCKLOAD
BENTOMAT ST	16 ft x 24 in (4.9 m x 610 mm)	2,600 lbs (1180 kg)	16 rolls per truckload
BENTOMAT SDN	16 ft x 24 in (4.9 m x 610 mm)	2,650 lbs (1200 kg)	15 rolls per truckload
BENTOMAT DN	16 ft x 24 in (4.9 m x 610 mm)	2,650 lbs (1200 kg)	15 rolls per truckload
BENTOMAT CL	16 ft x 25 in (4.9 m x 635 mm)	2,675 lbs (1213 kg)	15 rolls per truckload
BENTOMAT CLT	16 ft x 26 in (4.9 m x 660 mm)	2,950 lbs (1340 kg)	15 rolls per truckload
CLAYMAX 200R	16 ft x 20 in (4.9 m x 510 mm)	2,750 lbs (1250 kg)	14 rolls per truckload

#### Unloading and handling equipment for all GCL products:

- Spreader bar and core pipe: Spreader bar 17 ft (5.2 m) long; core pipe 20 ft (6.1 m) long, nominal pipe size, XXH.
- A solid 3.5 in. (90 mm) O.D. x 14.5 ft (4.4 m) solid steel pipe stinger attachment for a forklift.
- Slings: 2 Polyester slings are required, approximately 12 ft (3.7 m) long x 2 in (50 mm) wide each.
- Vehicle needed: Front end loader or forklift (are typical).

#### Standard Roll Specifications:

- Packaging: U.V. resistant polyethylene sleeve.



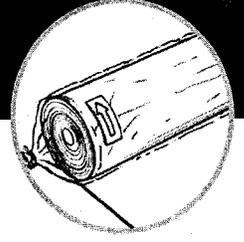
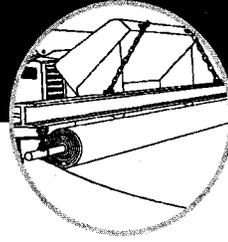
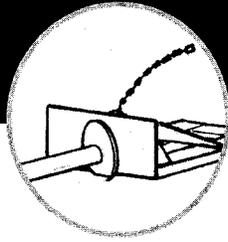
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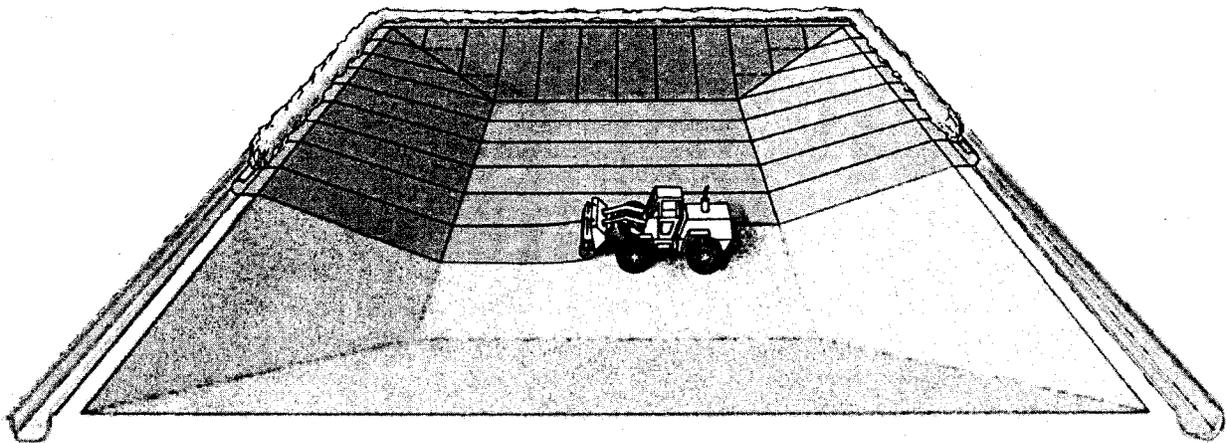
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The information and data contained herein are believed to be accurate and reliable. CETCO makes no warranty of any kind and accepts no responsibility for the results obtained through application of this information.

Revised 06/05



## Installation Guidelines



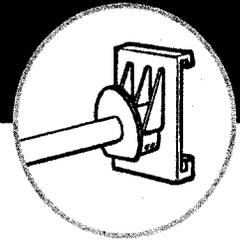
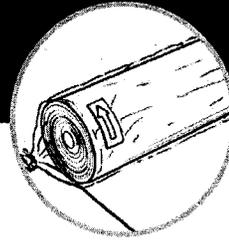
# BENTOMAT<sup>®</sup> CLAYMAX<sup>®</sup>

Geosynthetic Clay Liners

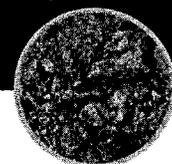
**CETCO<sup>®</sup>**  
LINING TECHNOLOGIE  
800.527.9948 [www.cetco.com](http://www.cetco.com)

**NOTICE:** This document is intended for use as a GENERAL GUIDELINE for the installation of CETCO's GCLs. The information and data contained herein are believed to be accurate and reliable. CETCO makes no warranty of any kind and accepts no responsibility for the results obtained through application of this information. Installation guidelines are subject to periodic changes. Please consult our CETCO Engineering Website @ [www.cetco.com/LTE](http://www.cetco.com/LTE) for the most recent version.

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- 1.1 This document provides procedures for the installation of CETCO's GCLs in a manner that maximizes safety, efficiency, and the physical integrity of the GCL.
- 1.2 These guidelines are based upon many years of experience at a variety of sites and should be generally applicable to any type of lining project using CETCO's GCLs. Variance from these guidelines is at the engineer's discretion.
- 1.3 The performance of the GCL is wholly dependent on the quality of its installation. It is the installer's responsibility to adhere to these guidelines, and to the project specifications and drawings, as closely as possible. It is the engineer's and owner's responsibility to provide construction quality assurance (CQA) for the installation, to ensure that the installation has been executed properly. This document covers only installation procedures.
- 1.4 For additional guidance, refer to ASTM D5888 (Standard Guide For Storage and Handling of Geosynthetic Clay Liners) and ASTM D 6102 (Standard Guide For Installation of Geosynthetic Clay Liners).

## EQUIPMENT REQUIREMENTS

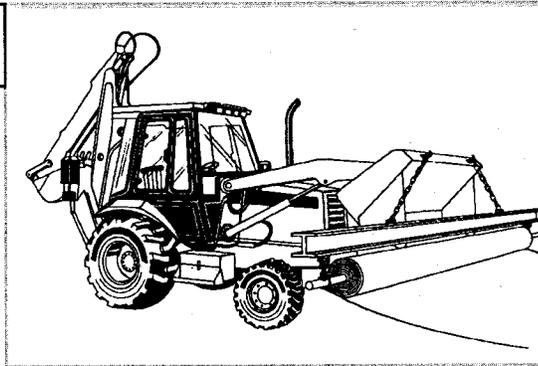
- 2.1 CETCO GCLs are delivered in rolls typically 2,600-2,950 lbs (1180-1340 kg). Roll dimensions and weights will vary with the dimensions of the product ordered. It is necessary to support this weight using an appropriate core pipe as indicated in Table 1. For any installation, the core pipe must not deflect more than 3 inches (75 mm) as measured from end to midpoint when a full GCL roll is lifted.

TABLE 1 CORE REQUIREMENTS

Product(s)	Nominal GCL Roll Size W x Dia. Ft. (m) x in. (mm)	Typical GCL Roll Wt. lbs. (kg)	Interior Core Size, in. (mm)	Core Pipe Length x Diameter ft. x in. (m x mm)	Minimum Core Pipe Strength
Bentomat DN, SDH	16' x 24" (4.9 x 610)	2,650 (1200)	3 3/4 (100)	20 x 2.88" O.D. (6.1 m x 73 mm)	XXH
Bentomat ST	16' x 24" (4.9 x 610)	2,600 (1180)	3 3/4 (100)	20 x 2.88" O.D. (6.1 m x 73 mm)	XXH
Bentomat CL	16' x 26" (4.9 x 660)	2,950 (1340)	3 3/4 (100)	20 x 2.88" O.D. (6.1 m x 73 mm)	XXH
Claymax 200R	16' x 20" (4.9 x 510)	2,750 (1250)	3 3/4 (100)	20 x 2.88" O.D. (6.1 m x 73 mm)	XXH
Bentomat CE	16' x 25" (4.9 x 635)	2,675 (1213)	3 3/4 (100)	20 x 2.88" O.D. (6.1 m x 73 mm)	XXH

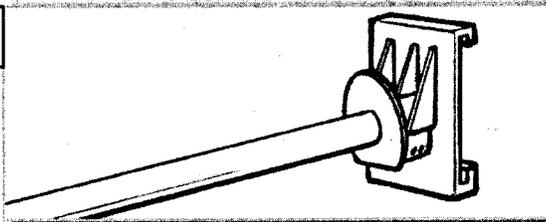
- 2.2 Lifting chains or straps appropriately rated should be used in combination with a spreader bar made from an I-beam as shown in Figure 1.

**FIGURE 1** SPREADER BAR LIFTING ASSEMBLY

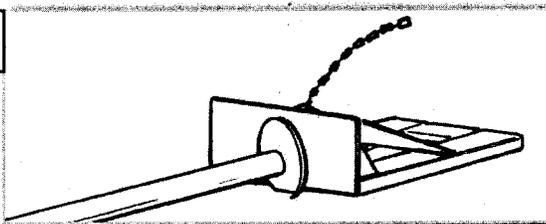


- 2.3 The spreader bar ensures that lifting chains or straps do not chafe against the ends of the GCL roll, allowing it to rotate freely during installation. Spreader bar and core pipe kits are available through CETCO.
- 2.4 A front end loader, backhoe, dozer, or other equipment can be utilized with the spreader bar and core pipe or slings. Alternatively, a forklift with a "stinger" attachment may be used for on-site handling. A forklift without a stinger attachment should not be used to lift or handle the GCL rolls. Stinger attachments (Figure 2-4) are specially fabricated to fit various forklift makes and models.

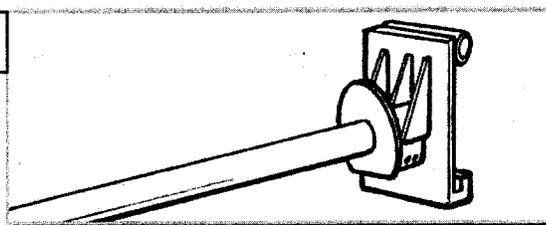
**FIGURE 2** HOOK MOUNT

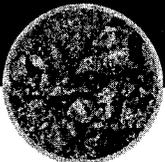


**FIGURE 3** FORK MOUNT (with fork pockets)



**FIGURE 4** PIN MOUNT

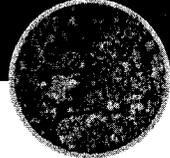


- 
- 2.5 When installing over certain geosynthetic materials, a 4-wheel, all-terrain vehicle (ATV) can be used to deploy the GCL. An ATV can be driven directly on the GCL provided that no sudden stops, starts, or turns are made.
  - 2.6 Additional equipment needed for installation of CETCO's GCLs includes:
    - Utility knife and spare blades (for cutting the GCL).
    - Bentonite mastic (for sealing around structures and details) and/or granular bentonite (for end-of-roll seams of GCLs with needle punched, non-woven geotextiles and for sealing around structures and details). Both are available from CETCO.
    - Waterproof tarpaulins (for temporary cover on installed material as well as for stockpiled rolls).
    - Optional flat-bladed vise grips (for positioning the GCL panel by hand).
  - 2.7 The CETCO Easy Roller™ GCL Deployment System is a preferred method of installing geosynthetic clay liners. Use of the Easy Roller system eliminates the need for spreader bars and heavy core pipes. Installation speed and worker safety are significantly increased. For further details, contact CETCO.

### 3

## SHIPPING, UNLOADING & STORAGE

- 3.1 All lot and roll numbers should be recorded and compared to the packing list. Each roll of GCL should also be visually inspected during unloading to determine if any packaging has been damaged. Damage, whether obvious or suspected, should be recorded and the affected rolls marked.
- 3.2 Major damage suspected to have occurred during transit should be reported immediately to the carrier and to CETCO. The nature of the damage should also be indicated on the bill of lading with the specific lot and roll numbers. Accumulation of small amounts of moisture within roll packaging is normal and does not damage the product.
- 3.3 The party directly responsible for unloading the GCL should refer to this manual prior to shipment to ascertain the appropriateness of their unloading equipment and procedures. Unloading and on-site handling of the GCL should be supervised.
- 3.4 In most cases, CETCO GCLs are delivered on flatbed trucks. There are three methods of unloading: core pipe and spreader bar; slings; or stinger bar. To unload the rolls from the flatbed using a core pipe and spreader bar, first insert the core pipe through the core tube. Secure the lifting chains or straps to each end of the core pipe and to the spreader bar mounted on the lifting equipment. Hoist the roll straight up and make sure its weight is evenly distributed so that it does not tilt or sway when lifted.
- 3.5 At the customer's request, CETCO GCLs may be delivered with two 2" x 12' (50 mm x 3.65 m) Type V polyester endless slings on each roll. Before lifting, check the position of the slings. Each sling should be tied off in the choke position approximately one third (1/3) from the end of the roll. Hoist the roll straight up so that it does not tilt or sway when lifted.

- 
- 
- 3.6 In some cases, GCL rolls will be stacked in three pyramids on flatbed trucks. If slings are not used, rolls will require unloading with a stinger bar and extendible boom fork lift. Spreader bars will not work in this situation because of the limited access between the stacks of GCL. Three types of stingers are available from CETCO (Figures 2-4). To unload, guide the stinger through the core tube before lifting the GCL roll and removing from the truck.
  - 3.7 An extendible boom fork lift with a stinger bar is required for unloading vans. Rolls in the nose and center of van should first be carefully pulled toward the door using the slings provided on the rolls.
  - 3.8 Rolls should be stored at the job site away from high-traffic areas but sufficiently close to the active work area to minimize handling. The designated storage area should be flat, dry and stable. Moisture protection of the GCL is provided by its packaging; however, an additional tarpaulin or plastic sheet is recommended.
  - 3.9 Rolls should be stacked in a manner that prevents them from sliding or rolling. This can be accomplished by chocking the bottom layer of rolls. Rolls should be stacked no higher than the height at which they can be safely handled by laborers (typically no higher than four layers of rolls). Rolls should never be stacked on end.



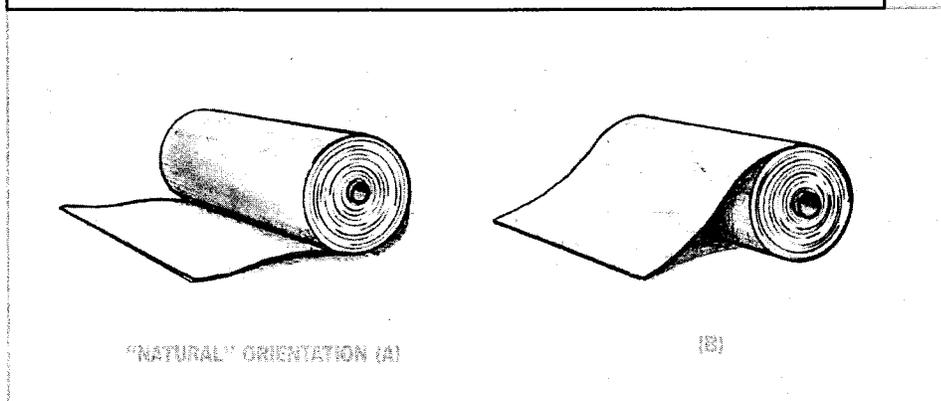
## 4

### SUBGRADE PREPARATION

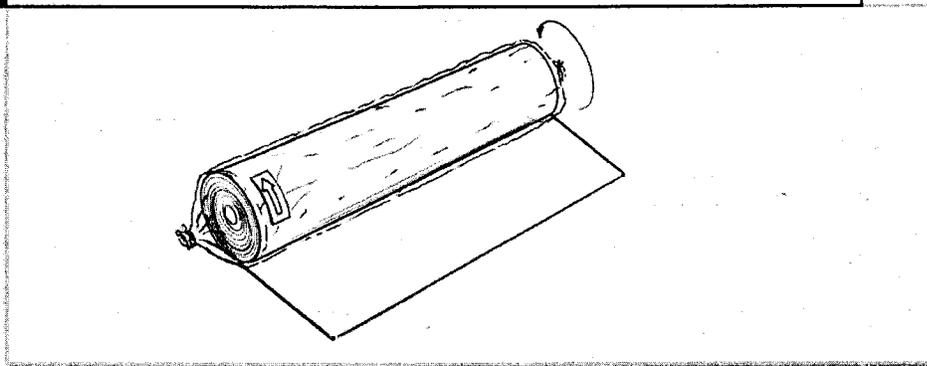
- 4.1 Subgrade surfaces consisting of granular soils or gravel may not be acceptable due to their large void fraction and puncture potential. In high-head (greater than one foot or 30 cm) applications, subgrade soils should possess a particle size distribution such that at least 80 percent of the soil is finer than a #60 sieve (0.250 mm) unless a membrane-laminated GCL (Bentomat CL or Bentomat CLT) is used.
- 4.2 When the GCL is placed over an earthen subgrade, the subgrade surface must be prepared in accordance with the project specifications. The engineer's approval of the subgrade must be obtained prior to installation. The finished surface should be firm and unyielding, without abrupt elevation changes, voids, cracks, ice, or standing water.
- 4.3 The subgrade surface must be smooth and free of vegetation, sharp-edged rocks, stones, sticks, construction debris, and other foreign matter that could contact the GCL. The subgrade should be rolled with a smooth-drum compactor to remove any wheel ruts, footprints, or other abrupt grade changes. Furthermore, all protrusions extending more than 1 inch (25 mm) from the subgrade surface shall be removed, crushed, or pushed into the surface with a smooth-drum compactor. The GCL may be installed on a frozen subgrade, but the subgrade soil in the unfrozen state should meet the above requirements.

- 5.1 GCL rolls should be taken to the work area of the site in their original packaging. The orientation of the GCL (i.e., which side faces up) may be important if the GCL has two different types of geosynthetics. Check with the project engineer in order to determine if there is a preferred installation orientation for the GCL. If no specific orientation is required, allow the roll to unwind from the bottom rather than pulling from the top (Figure 5). The arrow sticker on the plastic sleeve indicates the direction the GCL will naturally unroll when placed on the ground (Figure 6). Prior to deployment, the packaging should be carefully removed without damaging the GCL.

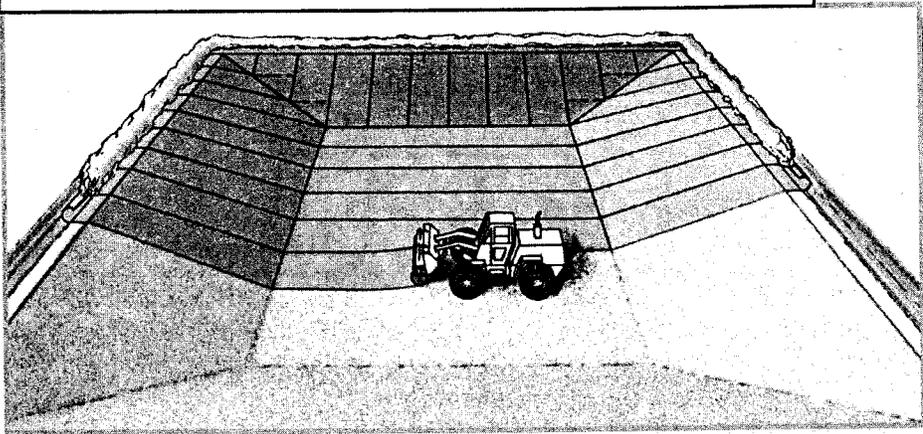
**FIGURE 5** THE GCL CAN BE UNROLLED IN ITS "NATURAL" ORIENTATION (A) OR CAN BE PULLED FROM THE TOP OF THE ROLL (B)



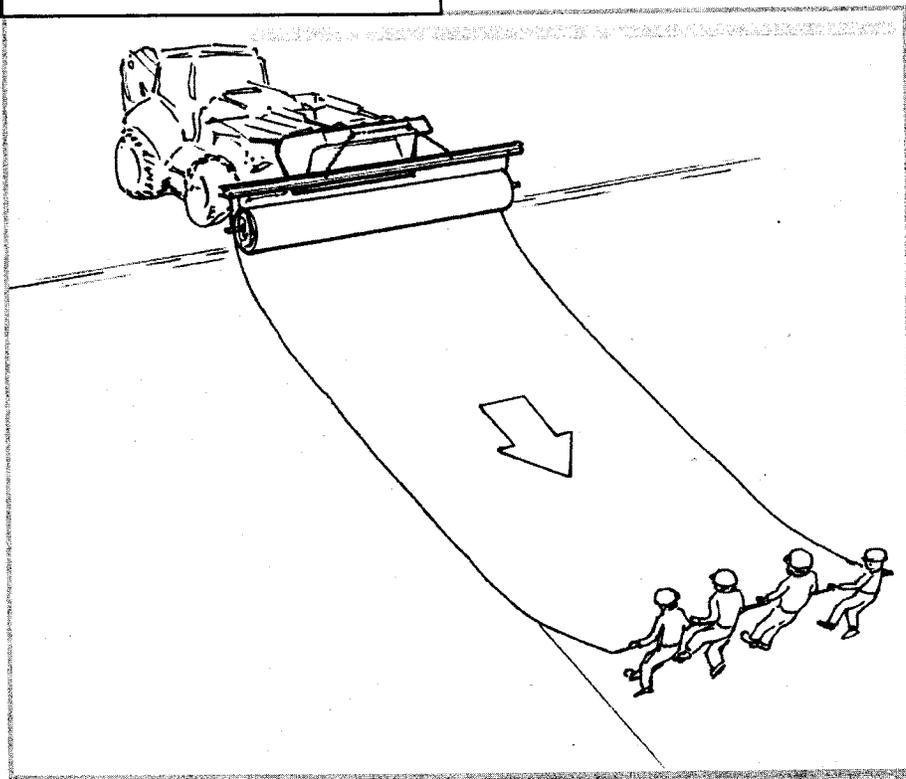
**FIGURE 6** DIRECTION TO UNROLL GCL ON GROUND PER FIGURE 5(A)



- 5.2 Equipment which could damage the GCL should not be allowed to travel directly on it. Acceptable installation, therefore, may be accomplished such that the GCL is unrolled in front of backwards-moving equipment (Figure 7). If the installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.

**FIGURE 7****TYPICAL BENTOMAT®/CLAYMAX® INSTALLATION TECHNIQUE**

- 5.3 If sufficient access is available, GCL may be deployed by suspending the roll at the top of the slope with a group of laborers pulling the material off of the roll and down the slope (Figure 8).
- 5.4 GCL rolls should not be released on the slope and allowed to unroll freely by gravity.
- 5.5 Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. Care must also be taken when adjusting Bentomat CLT panels to avoid damage to the geotextile surface of one panel of GCL by the textured sheet of another panel of GCL. A temporary geosynthetic subgrade covering, commonly known as a slip sheet or rub sheet, may be used to reduce friction damage during placement.

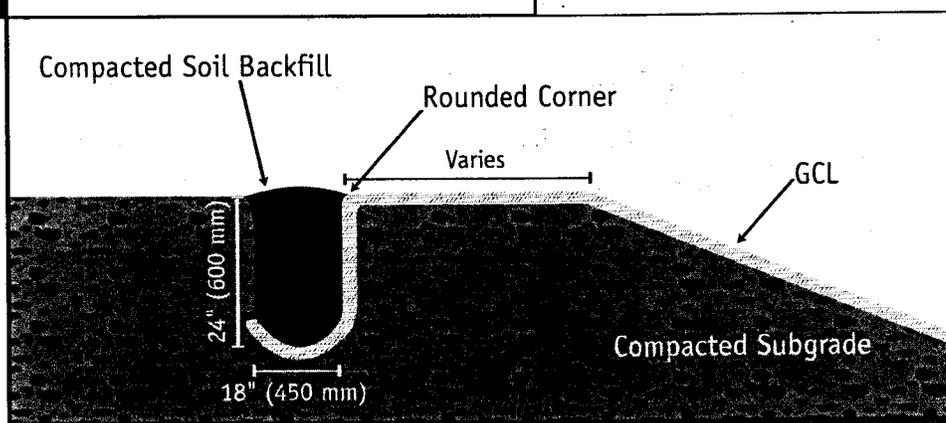
**FIGURE 8****UNROLLING BENTOMAT**

- 5.6 The GCL should be placed so that seams are parallel to the direction of the slope. End-of-panel seams should also be located at least 3 ft (1m) from the toe and crest of slopes steeper than 4H:1V. End-of-roll seams on slopes should be used only if the liner is not expected to be in tension.
- 5.7 All GCL panels should lie flat, with no wrinkles or folds, especially at the exposed edges of the panels. When Bentomat with SuperGroove® is repositioned, it should be gripped inside the SuperGroove by folding the edge.
- 5.8 The GCL should not be installed in standing water or during rainy weather. Only as much GCL shall be deployed as can be covered at the end of the working day with soil, geomembrane, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The project engineer, CQA inspector, and CETCO's TR-312 should be consulted for specific guidance if premature hydration occurs.
- 5.9 For the convenience of the installer, hash marks are placed on Bentomat every 5' (1.5 m) of length.

## 6 ANCHORAGE

- 6.1 If required by the project drawings, the end of the GCL roll should be placed in an anchor trench at the top of a slope. The front edge of the trench should be rounded to eliminate any sharp corners that could cause excessive stress on the GCL. Loose soil should be removed or compacted into the floor of the trench.
- 6.2 If a trench is used for anchoring the end of the GCL, soil backfill should be placed in the trench to provide resistance against pullout. The size and shape of the trench, as well as the appropriate backfill procedures, should be in accordance with the project drawings and specifications. Typical dimensions are shown in Figure 9.

**FIGURE 9** TYPICAL ANCHOR TRENCH DESIGN



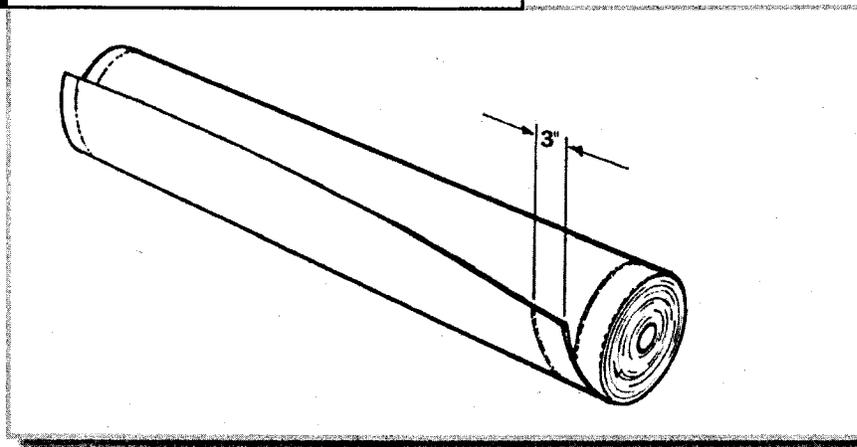
- 6.3 The GCL should be placed in the anchor trench such that it covers the entire trench floor but does not extend up the rear trench wall.
- 6.4 Sufficient anchorage may alternately be obtained by extending the end of the GCL roll back from the crest of the slope, and placing cover soil. The length of this "runout" anchor should be prepared in accordance with project drawings and specifications.

## 7

### SEAMING

- 7.1 GCL seams are constructed by overlapping adjacent panel edges and ends. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris. Supplemental bentonite is not required for Claymax 200R. Bentomat ST, DN, SDN, or YSDN with Supergroove® have self-seaming capabilities in their longitudinal overlaps (Figure 10) without the need for supplemental bentonite. For pond applications, CETCO supplemental bentonite must be used in longitudinal seams regardless of the CETCO GCL used.

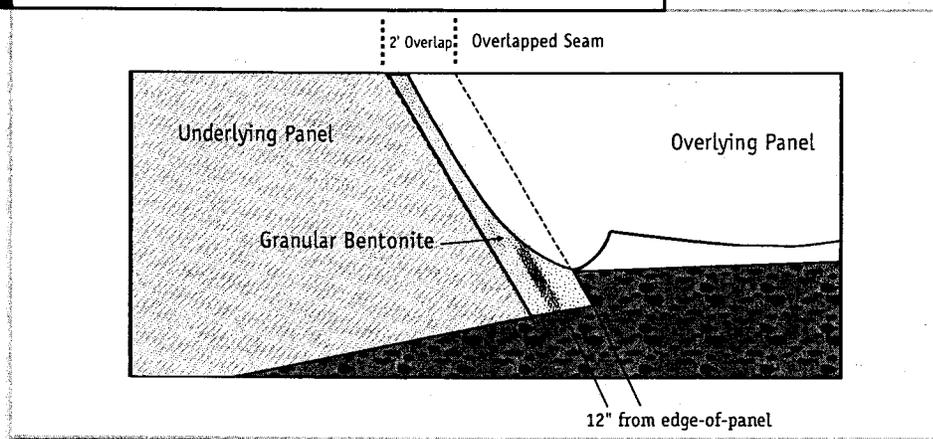
**FIGURE 10** SUPERGROOVE



- 7.2 Longitudinal seams should be overlapped a minimum of 6 inches (150mm) for Bentomat and 12 inches (300mm) for Claymax.
- 7.3 End-of-panel overlapped seams should be overlapped 24 inches (600mm) for Bentomat and 48 inches (1,200mm) for Claymax.
- 7.4 End-of-panel overlapped seams are constructed such that they are shingled in the direction of the grade to prevent runoff from entering the overlap zone. End-of-panel seams on slopes are permissible, provided adequate slope stability analysis has been conducted (i.e., the GCL is not expected to be in tension). Bentonite-enhanced seams are required for all Bentomat end-of-panel overlapped seams.

- 7.5 Bentomat end-of-panel, bentonite-enhanced, overlapped seams are constructed first by overlapping the adjacent panels, exposing the underlying panel, and then applying a continuous bead or fillet of granular sodium bentonite (supplied with the GCL) 12" from the edge of the underlying panel (Figure 11). The minimum application rate at which the bentonite is applied is one-quarter pound per linear foot (0.4 kg/m).
- 7.6 If longitudinal bentonite enhanced seams are required, they are constructed first by overlapping the adjacent panels by a minimum 6-inches (150 mm), exposing the underlying edge and applying a continuous bead of granular bentonite approximately 3-inches (75 mm) from the edge. The minimum application rate for the granular bentonite is one quarter pound per linear foot (0.4 kg/m).

**FIGURE 11 BENTOMAT END-OF-PANEL OVERLAPPED SEAM**

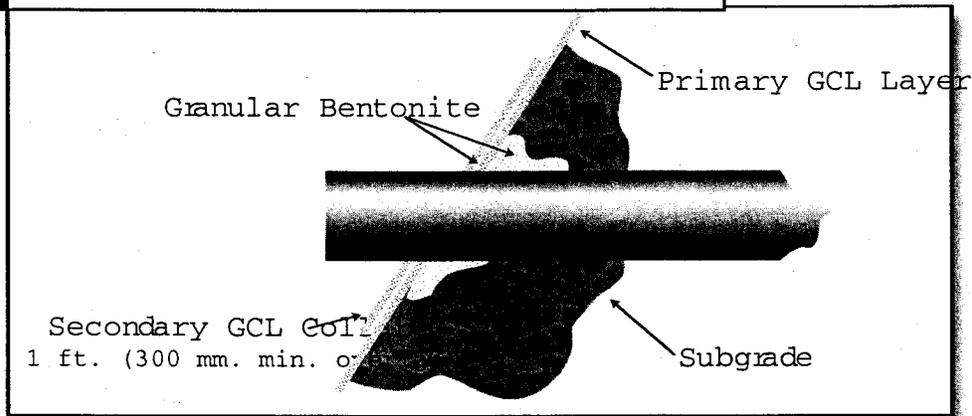


## 8

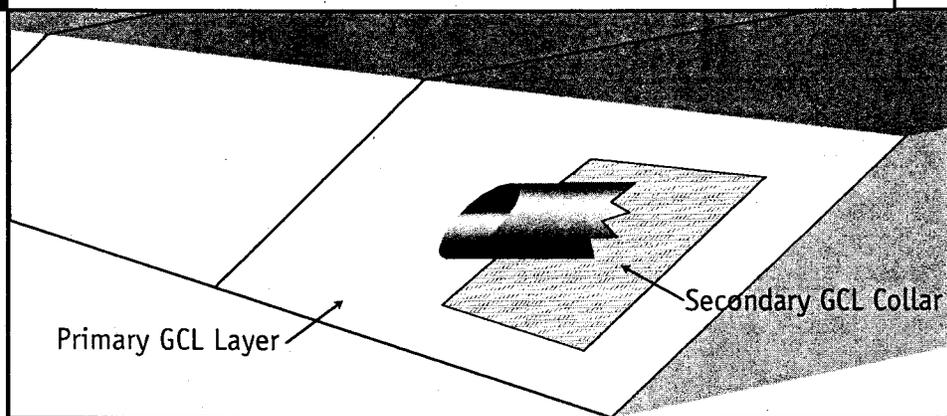
### SEALING AROUND PENETRATIONS AND STRUCTURES

- 8.1 Cutting the GCL should be performed using a sharp utility knife. Frequent blade changes are recommended to avoid irregular tearing of the geotextile components of the GCL during the cutting process.
- 8.2 The GCL should be sealed around penetrations and structures embedded in the subgrade in accordance with Figures 12 through 14. Granular bentonite or a bentonite mastic shall be used liberally (approx. 2 lbs. /ln ft. or 3 kg/m) to seal the GCL to these structures.

**FIGURE 12A** CROSS-SECTION OF A HORIZONTAL PIPE PENETRATION

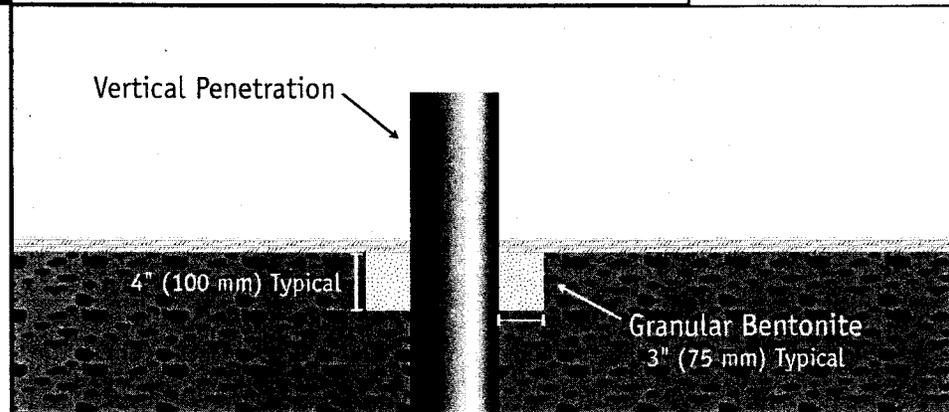


**FIGURE 12B** ISOMETRIC VIEW OF A COMPLETED HORIZONTAL PIPE PENETRATION



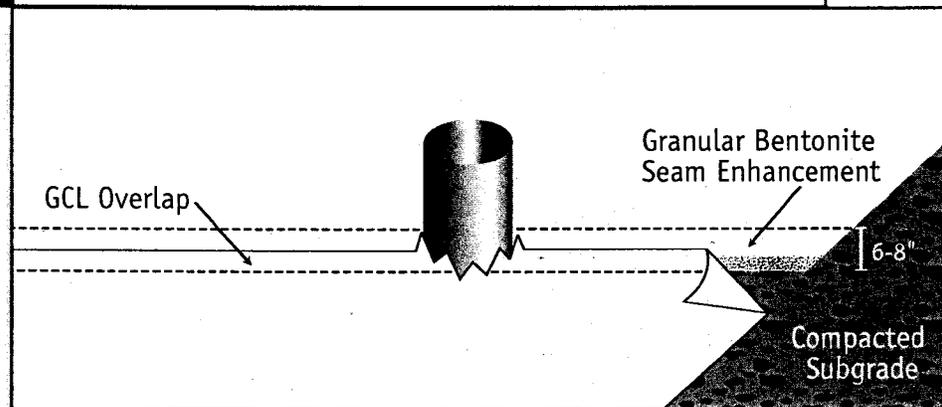
- 8.3** When the GCL is placed over a horizontal pipe penetration, a “notch” should be excavated into the subgrade around the penetration (Figure 12a). The notch should then be backfilled with granular bentonite. A secondary collar of GCL should be placed around the penetration as shown in Figure 12b. It is helpful to first trace an outline of the penetration on the GCL and then cut a “star” pattern in the collar to enhance the collar’s fit to the penetration. Granular bentonite should be applied between the primary GCL layer and the secondary GCL collar.

**FIGURE 13A** CROSS-SECTION OF A VERTICAL PENETRATION



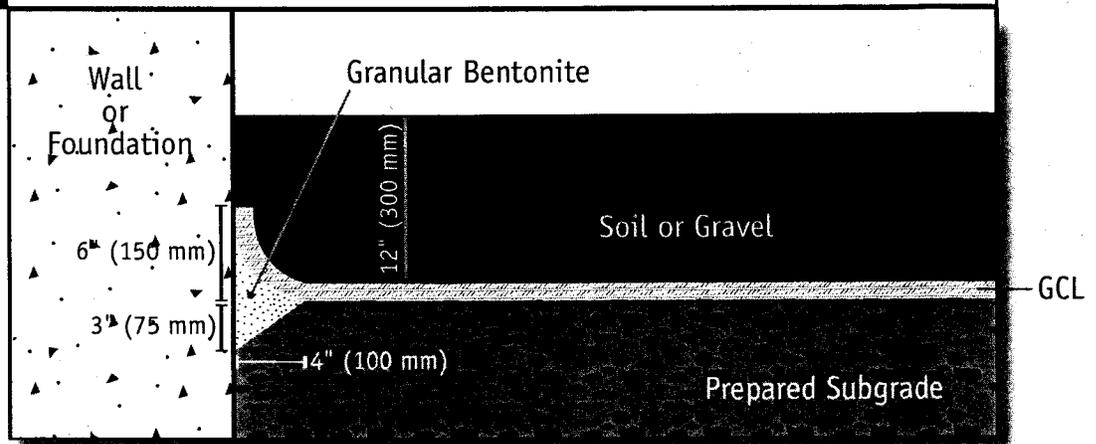
- 8.4 Vertical penetrations are prepared by notching into the subgrade as shown in Figure 13a. The penetration can be completed with two separate pieces of GCL as shown in Figure 13b. Alternatively, a secondary collar can be placed as in Figure 12a or 12b.

**FIGURE 13B** ISOMETRIC VIEW OF THE COMPLETED VERTICAL PENETRATION



- 8.5 When the GCL is terminated at a structure or wall that is embedded into the subgrade on the floor of the containment area, the subgrade should be notched as described in Sections 8.3 and 8.4. The notch is filled with granular bentonite, and the GCL should be placed over the notch and up against the structure (Figure 14). Connection to the structure can be accomplished by placement of soil or stone backfill in this area. When structures or walls are at the top of a slope, additional detailing may be required. Contact CETCO for specific guidance.

**FIGURE 14** CROSS-SECTION OF GCL SEAL AGAINST AN EMBEDDED STRUCTURE OR WALL

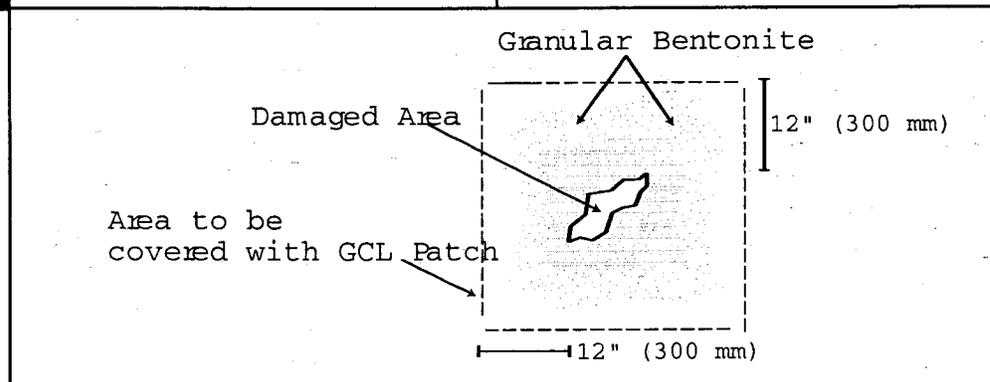


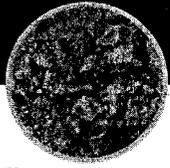
**9**

**DAMAGE REPAIR**

- 9.1 If the GCL is damaged (torn, punctured, perforated, etc.) during installation, it may be possible to repair it by cutting a patch to fit over the damaged area (Figure 15). The patch should be cut to size such that a minimum overlap of 12 inches (300 mm) is achieved around all parts of the damaged area. Granular bentonite or bentonite mastic should be applied around the damaged area prior to placement of the patch. It may be necessary to use an adhesive such as wood glue to affix the patch in place so that it is not displaced during cover placement. Smaller patches may be tucked under the damaged area to prevent patch movement.

**FIGURE 15** DAMAGE REPAIR BY PATCHING



- 
- 10.1 The final thickness of soil cover on the GCL varies with the application. A minimum cover layer must be at least 1 foot (300 mm) thick to provide confining stress to the GCL, eliminate the potential for seam separation and prevent damage by equipment, erosion, etc.
  - 10.2 Cover soils should be free of angular stones or other foreign matter that could damage the GCL. Cover soils should be approved by the Engineer with respect to particle size, uniformity, and chemical compatibility. Consult CETCO if cover soils with high concentrations of calcium (e.g., limestone, dolomite, gypsum, seashell fragments) are present.
  - 10.3 Recommended cover soils should have a particle size distribution ranging between fines and 1 inch (25 mm), unless a cushioning geotextile is specified.
  - 10.4 Soil cover shall be placed over the GCL using construction equipment that minimizes stresses on the GCL. A minimum thickness of 1 foot (300 mm) of cover soil should be maintained between the equipment tires/tracks and the GCL at all times during the covering process. In frequently high-traffic areas or roadways, a minimum thickness of 2 feet (600 mm) is required.
  - 10.5 Soil cover should be placed in a manner that prevents the soil from entering the GCL overlap zones. Soil cover should be pushed up slopes, not down slopes, to minimize tensile forces on the GCL.
  - 10.6 When a textured geomembrane is installed over the GCL, a temporary geosynthetic covering known as a slip sheet or rub sheet should be used to minimize friction during placement and to allow the textured geomembrane to be more easily moved into its final position.
  - 10.7 Claymax must be covered with a geomembrane and/or 12" (300 mm) of cover material within 8 hours of deployment to prevent the potential for shrinkage by desiccation.
  - 10.8 Cyclical wetting and drying of GCL covered only with geomembrane can cause overlap separation. Soil cover should be placed promptly whenever possible. Geomembranes should be covered with a white geotextile and/or operations layer without delay to minimize the intensity of wet-dry cycling. If there is the potential for unconfined cyclic wetting and drying over an extended period of time, the longitudinal seam overlaps should be increased based on the project engineer's recommendations.
  - 10.9 To avoid seam separation, the GCL should not be put in excessive tension by the weight or movement of textured geomembrane on steep slopes. Check with project engineer for the potential for GCL tension to develop.

## HYDRATION

- 11.1 Hydration is usually accomplished by natural rainfall and/or absorption of moisture from soil. However, in cases where the containment of non-aqueous liquid is required, it may be necessary to hydrate the covered GCL with water prior to use.
- 11.2 If manual hydration is necessary, water can be introduced by flooding the covered lined area or using a sprinkler system.



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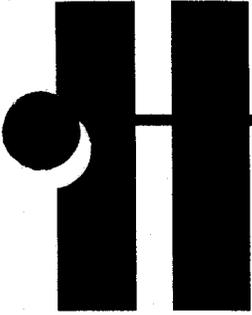
**BLUE RIDGE PAPER CO.  
CANTON, NC**

Submittal #4

**Section 02731 Geotextiles**

- Hallaton's Proposed Geotextile Seaming Method
- Material Product Data Sheet- S1600- Mirafi
- Manufacturer's QC Manual
- Manufacturer's Qualifications

PREPARED BY:  
Hallaton, Inc.  
100 E. Pennsylvania Ave., Suite 203  
Towson, MD 21286  
May 23, 2007



# HALLATON, INC.

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410 583 7700 • Fax: 410 583 7720

## **Geotextile Proposed Seaming Method**

### **Field Seaming**

Hallaton proposes using a dual track thermal fusion welder ("wedge welder") to seam the non woven Geotextile material. Fusion welding is a heat bonded weld fusing the two Geotextile panels together. It allows durability as well as a flat surface on the Geotextile. On side slopes, seams shall be oriented in the general direction of maximum slope, i.e., oriented down, not across the slope.

In areas where the geotextile does not allow room for a wedge welder to pass through a handheld hot air gun will be utilized to heat seam the Geotextile panels together.

### **Seaming Equipment and Accessories**

Seaming will be performed using a Fusion Welder, 110 Volt (220 Volt).

-To avoid malfunctions with Fusion Welders used for seaming the Geomembrane, each crew will carry welders designated for the seaming of Geotextile only.



# TENCATE Mirafi



## Mirafi<sup>®</sup> S1600

Mirafi<sup>®</sup> S1600 is a needle-punched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. S1600 is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value
Weight	ASTM D 5261	g/m <sup>2</sup> (oz/yd <sup>2</sup> )	543 (16.0)
Thickness	ASTM D5199	mm (mils)	4.45 (175)
Grab Tensile Strength	ASTM D 4632	kN (lbs)	1.89 (425)
Grab Tensile Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.64 (145)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	5506 (800)
Puncture Strength	ASTM D 4833	kN (lbs)	1.07 (240)
Apparent Opening Size (AOS)	ASTM D 4751	mm (U.S. Sieve)	0.150 (100)
Permittivity	ASTM D 4491	sec <sup>-1</sup>	0.7
Permeability	ASTM D 4491	cm/sec	0.31
Flow Rate	ASTM D 4491	l/min/m <sup>2</sup> (gal/min/ft <sup>2</sup> )	2036 (50)
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	80

Physical Properties	Unit	Typical Value
Roll Dimensions (width x length)	m (ft)	4.5 x 45 (15 x 150)
Roll Area	m <sup>2</sup> (yd <sup>2</sup> )	209 (250)
Estimated Roll Weight	kg (lb)	127 (279)

**Disclaimer:** TenCate assumes no liability for the accuracy or completeness of this information or for the ultimate use by the purchaser. TenCate disclaims any and all express, implied, or statutory standards, warranties or guarantees, including without limitation any implied warranty as to merchantability or fitness for a particular purpose or arising from a course of dealing or usage of trade as to any equipment, materials, or information furnished herewith. This document should not be construed as engineering advice.



Ten Cate Nicolon

**Quality Control Plan  
Nonwovens**

**THE QUALITY SYSTEM**

The Quality System is for the purpose of continuous improvement of our products and service. The Quality System will be assessed annually through audits and Management Reviews. The Quality Assurance Manager is responsible for establishing, implementing, and maintaining the Quality System.

It is the responsibility of each employee to perform tasks under the quality system assigned to them and to take appropriate actions to ensure that the quality system is followed and that all products of Ten Cate Nicolon conform to specification.

**PERSONNEL**

The Quality Control Lab consists of sufficient staff and testing equipment to properly conduct quality testing on Ten Cate Nicolon products. The QA Manager determines "sufficient staff" based on testing needs. Resource requirements are regularly reviewed during Management Review.

**TRAINING**

A job description is maintained for each job classification. A training form is maintained for each employee in the QC Lab, detailing training activities. The Quality Assurance Manager and/or Human Resources maintain Job descriptions and training forms.

Individuals are qualified based on their abilities, education, on-the-job training, and other special skills.

**OUTSIDE SERVICES AND SUPPLIES**

Ten Cate Nicolon solicits qualified vendors for products and services in order to maintain Quality Control and to make sure that the inspection practices and techniques assure delivery of only high standard quality materials and services.

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Vendors will be verified by the Quality Assurance Manager prior to procurement, for their ability to meet requirements, performance records, and quality history.

## MANUFACTURING QUALITY CONTROL

All testing is accomplished in accordance with documented and controlled test methods. Where methods of inspection are not specified, methods shall be selected that have been published in international or national standards by reputable technical organizations or in relevant scientific texts or journals. Use of selected methods shall be verified and approved by the Quality Assurance Manager.

Testing is carried out under controlled conditions including the following:

Overall management of process control is governed by documented procedures.

Documented test methods and work instructions govern the comprehensive inspection and testing of each lot.

Testing equipment is selected based upon needs and the ability to satisfy specified requirements, and the equipment is suitably maintained.

Training of personnel is adequate and documented.

Appropriate Quality Records are maintained.

Each sample to be tested in the lab is accompanied with a label for that particular roll number. Test results are recorded on Quality Control Test Reports by number and then entered into the computer database by roll number.

All samples are delivered to the Quality Control lab and the sample is tested as delivered to meet minimum specification values. The standard operating procedure for each test is documented and a copy of ASTM procedures are kept in the lab.

Preparation for each sample is conducted in accordance with Standard Operating Procedures and ASTM requirements.

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## TESTING FREQUENCY

Physical Property	Minimum Frequency
ASTM D3786 Mullen Burst Strength	18,000 yd <sup>2</sup> or 1 per lot
ASTM D4491 Flow Rate	36,000 yd <sup>2</sup> or 1 per lot
ASTM D4533 Trapezoidal Tear	18,000 yd <sup>2</sup> or 1 per lot
ASTM D4632 Grab Tensile	18,000 yd <sup>2</sup> or 1 per lot
ASTM D4833 Puncture Resistance	18,000 yd <sup>2</sup> or 1 per lot
ASTM D5199 Thickness	18,000 yd <sup>2</sup> or 1 per lot
ASTM D5261 Mass per Unit Area	18,000 yd <sup>2</sup> or 1 per lot
ASTM D4751 Apparent Opening Size	50,000 yd <sup>2</sup> or 1 per lot

## IDENTIFICATION

All material is identified with a style number, which will correspond to a specification. Individual production runs will be assigned a lot number for the purpose of controlling production, recording production and maintaining records for that lot. Individual rolls within a lot are assigned a roll number in sequential order.

## HANDLING/STORAGE

Handling methods and practices are intended to prevent damage and deterioration to material during the manufacturing process. All geotextile rolls are furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure prior to placement. Each roll is labeled or tagged to provide product identification sufficient for inventory and quality control purposes. Rolls are stored in a manner, which protects them from the elements.

Archived samples are identified by a label and adequately stored to prevent deterioration.

## SUPPORTING DOCUMENTATION

ASTM D-4354 Practice for Sampling of Geosynthetics for Testing  
 ASTM D-4873 Guide for Identification, Storage, and Handling of Geotextiles

## CONTROL OF NONCONFORMING PRODUCT

Ten Cate Nicolon's procedures require the documentation of all nonconformances. Nonconforming material is tagged and/or segregated. The status of nonconforming product is reviewed to determine whether the material

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will be scrapped, reworked, downgraded or continued through processing, reworked material is re-inspected and must meet requirements.

#### CORRECTIVE AND PREVENTATIVE ACTION

Ten Cate Nicolon recognizes that the effectiveness of the corrective and preventative action policy is crucial to the success of the Quality System.

Corrective Action procedures include:

Analyzing customer complaints.

Investigation into the root cause of nonconforming products and system nonconformances.

Determination of corrective action to eliminate the cause of the nonconformance.

The quality system provides for preventative action by reviewing data including: customer complaints, audit results, and past nonconformances to detect and eliminate potential causes of nonconformances

#### STATEMENT OF AUTHORITY

The Quality Assurance Manager has been assigned ultimate responsibility for implementing the Quality System and the authority for assuring its maintenance.

In the absence of the Quality Assurance Manager, the delegation of responsibility will be assigned to persons to act in those instances to ensure continuation of operations.

Responsibility for activities described under each element may be assigned to appropriate supervisors. Delegation of responsibility and authority includes responsibility to ensure all activities described in a procedure are implemented as written.

#### CERTIFICATIONS

All product certifications originate from the Quality Assurance Manager and are supported by test data.

Each shipment of material is certified to meet product specifications and is supported with actual test results. The results of each test, or series of tests, is recorded in a test report or test certificate and contains all the necessary information as follows:

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Report identifiers  
Identification of the test method  
Property values  
Date of issue

The Quality Assurance Manager is responsible for signing reports or designating personnel to sign reports accepting responsibility that content of the report is accurate.

In the event a report or certification is sent to a customer and is determined to have an erroneous result, the QA Manager will amend the report, and the report will reflect a revision.

Where appropriate, statements concerning confidentiality and reproducibility are included.



Mr. Tom Rew  
 TAMA Associates  
 1421 Providence Road  
 Towson, Maryland 21286  
 410-821-8659 fax

RE: Statement of Qualifications for S-Series Nonwoven Geotextile: Hallaton, Inc.

Dear Tom:

Thank you for your continued support of our *MIRAFI*<sup>®</sup> construction products. Please consider the information provided herein confidential. *MIRAFI*<sup>®</sup> has been manufacturing and selling our S-Series nonwoven geotextile products into landfill and other environmental projects for the last twenty years or more. The average sales of our S-Series geotextiles exceed one million square yards annually.-

The projects constructed with our S-series nonwoven geotextiles vary in size and complexity. Environmental applications include liner cushioning, leachate collection and removal systems, capping systems, material separation and other drainage and filtration applications. Our S-Series nonwoven geotextiles have been used in a variety of construction projects in the past five years. Some examples are as follows:

Quantity (sf)	Year	Product	Project
1,098,000	2005	S1600	City of Newark Water Reservoir, Newark, DE (ctd.)
265,000	2005	S1600	Chester County Solid Waste Authority, Lanchester LF Area D (new cell) Honeybrook, PA
839,250	2005	S1600	Dane County Landfill, Dane County, Madison, WI
4,338,000	2004	S1000	Harrison Power Station CBB LF, Shinnston, WV (ctd.)
1,093,500	2004	S800	Shaw Road Landfill Cover, Leighton, AL
1,890,000	2004	S1200	Miramar Landfill, San Diego County, CA
225,000	2004	S800	Prima Desecha LF, County of Orange Sanitation Dist., CA
3,739,500	2003	S1000	Harrison Power Station CBB LF, Shinnston, WV
2,633,000	2003	S1600	City of Newark Water Reservoir, Newark, DE
540,000	2003	S800	Badlands Landfill, Riverside County, Moreno Valley, CA
1,678,500	2002	S1200	Brick Reservoir, Brick, NJ
1,980,000	2001	S1200	McKinney LF, N. TX Municipal Water Auth., McKinney, TX
2,106,000	2000	S800	North Dakota DOT Pipe Underlayment
450,000	2005	S1600	Cross Roads Landfill, Norridgewock, ME
270,000	2005	S600	West Old Town Landfill, Old Town, ME
630,000	2004	S600	Dredge Spoils Cover, Town of Dover, NH
360,000	2004	S1600	The Home Depot, Reading, MA
24,135,750	Total	(approximate minimum square footage for five years continuous production for thirteen completed facilities)	

Thank you very much for giving us the opportunity to present you with this confidential statement of qualifications. Please do not share this information with parties outside the influence of this project due to the sensitive nature of this information. Feel free contact us if you have any questions or comments concerning this information.

Sincerely,  
MIRAFI® Construction Products

Bruce A. Lacina, PE  
Senior Engineer, Technical Services

cc: S. Dull, J. Harris, S. Walker

**CONTRACTOR BORROW SOURCE TESTING**

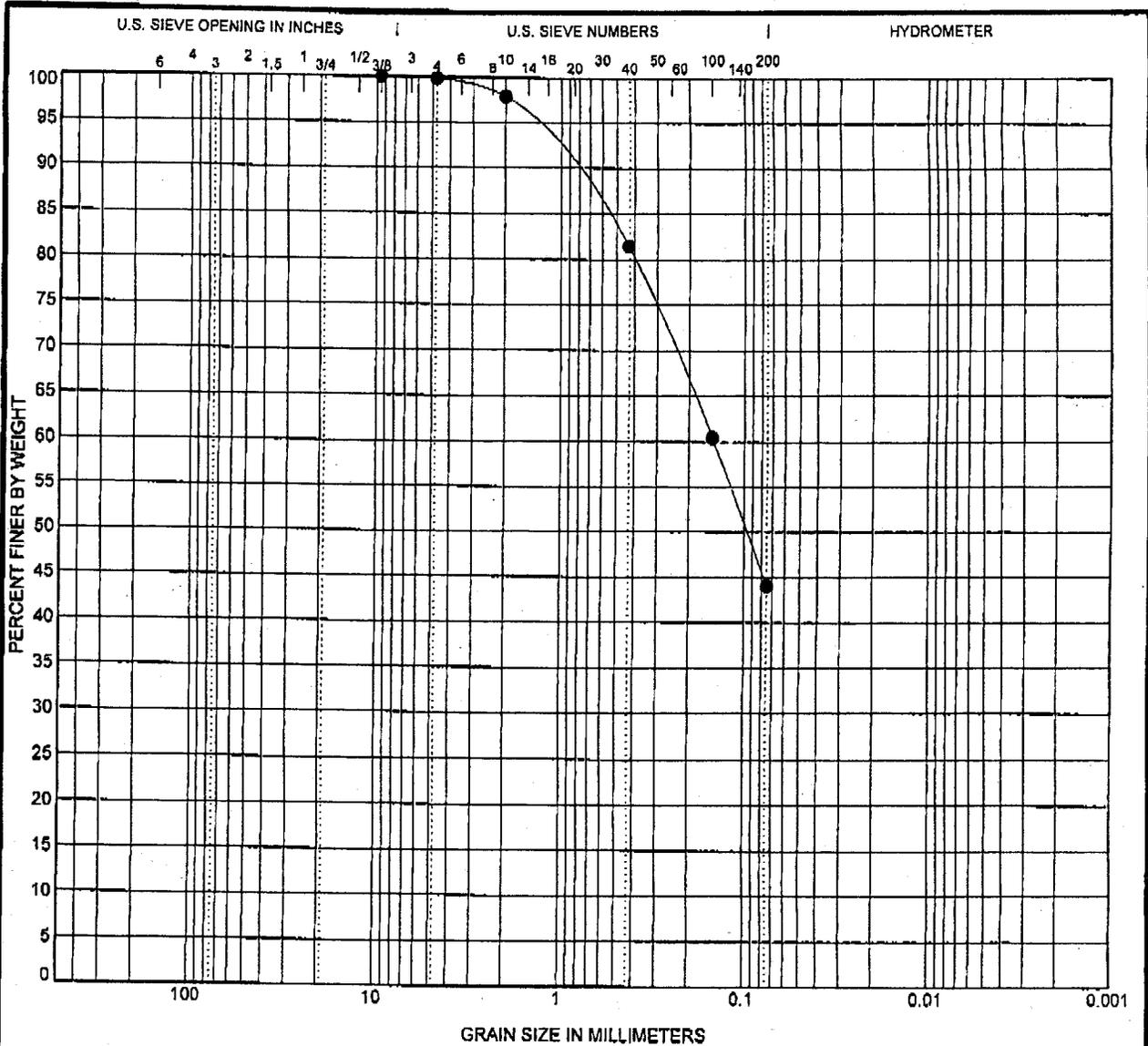
# Laboratory Test Summary Sheet

Boring/ Sample No.	Depth (feet)	LL	PL	PI	% Natural Moisture	% Gravel	% Sand	% Fines	USCS Class.	AASHTO Class.	Maximum Dry Density	Optimum Moisture Content	CBR Value @ 0.1
2	3.0	NP	NP	NP		0.2	55.8	44.1	SM	A-4			



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Lab Test Summary	Sheet 1 of 1
Report No.: J70-082T	Shamrock Environmental
Client: Blueridge Paper Project	Blueridge Paper Project
Location: Vulcan Materials - Enka	Vulcan Materials - Enka
Date: 7-2-07	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Boring No.	Depth	Classification	LL	PL	PI	Cc	Cu
● 2	at 3.0	(A-4)	NP	NP	NP		
	at						
	at						
	at						
	at						

Boring No.	Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 2	at 3.0	9.52	0.147			0.2	55.8	44.1	
	at								
	at								
	at								
	at								

US GRAIN SIZE: AASHITO SHAK/GPI FR&R/GDT 7/6/07



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**GRAIN SIZE DISTRIBUTION**

Report No.: J70-082T  
 Client: Shamrock Environmental  
 Project: Blueridge Paper Project  
 Location: Vulcan Materials - Enka  
 Date: 7-2-07

# COMPACTION TEST REPORT

**Project No.:** J70-082T

**Date:** 07-09-07

**Project:** Shamrock Environmental - Blue Ridge Paper Project

**Location:**

**Elev./Depth:**

**Sample No.** Sample No. 2

**Remarks:** Sample Date: 07-03-07  
Source: unknown

## MATERIAL DESCRIPTION

**Description:** Light Brown Silty SAND (SM)

**Classifications -**

**USCS:** SM

**AASHTO:** A-4

**Nat. Moist =** 19.9 %

**Sp.G. =**

**Liquid Limit =** NP

**Plasticity Index =** NP

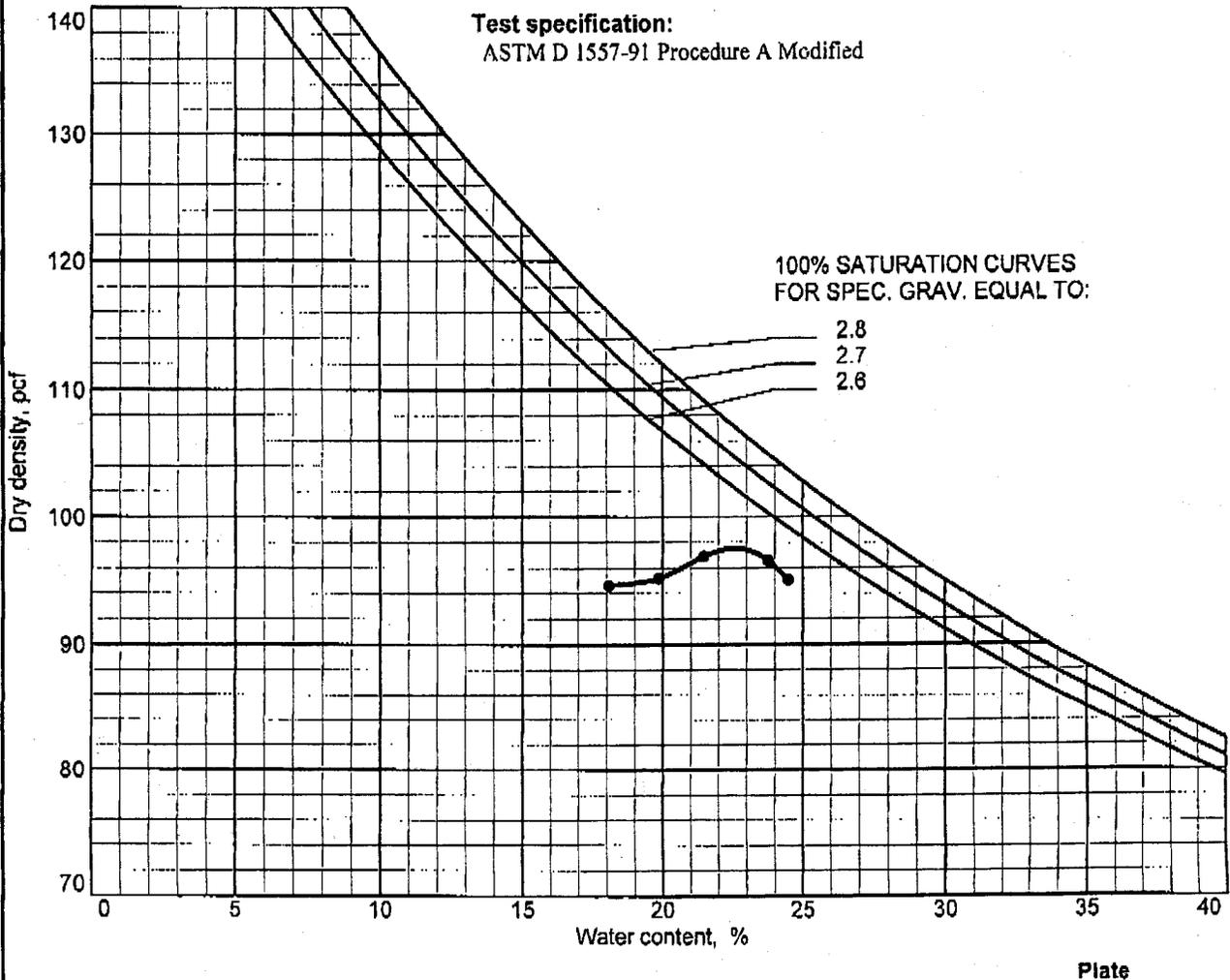
**% > No.4 =** 0.1 %

**% < No.200 =** 44.1 %

## TEST RESULTS

Maximum dry density = 97.5 pcf

Optimum moisture = 22.6 %



**MOISTURE DENSITY TEST DATA**

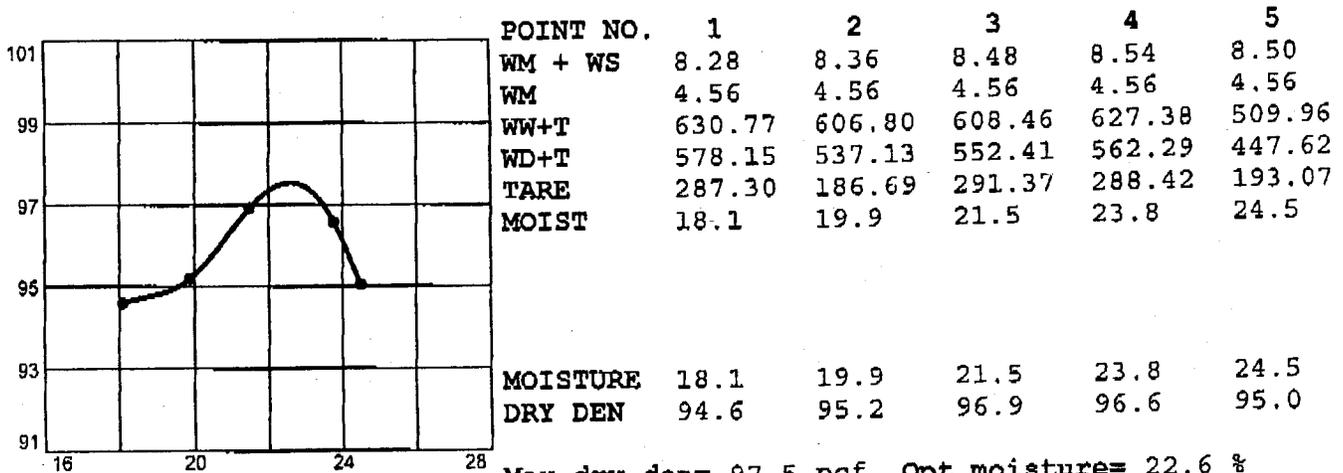
Client: Shamrock Environmental  
 Project: Shamrock Environmental - Blue Ridge Paper Project  
 Project Number: J70-082T

**Specimen Data**

Source:  
 Sample No.: Sample No. 2  
 Elev. or Depth: Sample Length (in./cm.):  
 Location:  
 Description: Light Brown Silty SAND (SM)  
 Liquid Limit: NP Plasticity Index: NP Natural Moisture: 19.9  
 Date: 07-09-07 USCS Classification: SM AASHTO Classification: A-4  
 Testing Remarks: Sample Date: 07-03-07  
 Source: unknown  
 Percent retained on No.4 sieve: 0.1  
 Percent passing No. 200 sieve: 44.1 Specific gravity:

**Test Data And Results**

Type of test: ASTM D 1557-91 Procedure A Modified  
 Mold Dia.: 4.00 in. Hammer Wt.: 10 lb. Drop: 18 in.  
 Layers: five Blows per Layer: 25



Max dry den= 97.5 pcf Opt moisture= 22.6 %

Oversize Correction Not Applied



## Basic Quality Statistical Summary Report

Plant 107-Enka  
 Product 078-NC #78M  
 Specification NC #78M

Sieve/Test	Tests	Average	Target	Specification
3/4" (19mm)	36	100.0		100-100
1/2" (12.5mm)	36	99.5		98-100
3/8" (9.5mm)	36	88.4		75-100
#4 (4.75mm)	36	25.5		20-45
#8 (2.36mm)	36	4.8		0-15



### Statistical Analysis Report

Plant 107-Enka  
 Product 078-NC #78M

Specification NC #78M

Sample Id	Date	3/4" (19mm)	1/2" (12.5mm)	3/8" (9.5mm)	#4 (4.75mm)	#8 (2.36mm)
1332305487	06/05/2007 07:48	100.0	99.5	90.4	23.6	3.4
1422584461	06/08/2007 13:23	100.0	99.6	89.5	26.6	3.5
1612414886	06/13/2007 18:56	100.0	99.2	80.9	20.3	2.9
1948899384	06/22/2007 14:11	100.0	99.6	88.4	24.3	2.7
1879960480	06/26/2007 17:01	100.0	100.0	87.1	22.5	3.3
848656026	07/06/2007 16:36	100.0	99.6	92.5	25.0	3.6
1405012212	07/11/2007 14:32	100.0	100.0	91.0	24.4	3.2
1734923675	07/12/2007 14:36	100.0	99.6	96.4	29.4	3.6

**AS-BUILT CONSTRUCTION DRAWINGS**