BLE INC.
BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL, ENVIRONMENTAL AND CONSTRUCTION MATERIALS CONSULTANTS
NORTH CAROLINA BUSINESS LICENSE C-1538

October 19, 2015

SWS Rec'd 10/19/2015 DIN 25187
Permit No. 0803-MSWLF-1993

Approved, SWS, JM , 11/11/2016

Republic Services of North Carolina, LLC
5111 Chin Page Road
Durham, North Carolina 27703

Attention: Mr. Matt Einsmann, P.E.
Environmental Manager

Subject: **Report of CQA Monitoring of Repair of Base Liner Geomembrane**
Cell No. 13
East Carolina Regional MSW Landfill
Facility Permit No. 08-03
Bertie County, North Carolina
BLE Project Number J15-1001-80

Dear Mr. Einsmann:

The purpose of this letter is to document CQA monitoring and observations by Bunnell-Lammons Engineering, Inc. (BLE), of the repair of an approximately 13-foot x 63-foot area of damage to the base liner geomembrane (FML). The damage had been inadvertently caused during operational grading of the outside toe of the waste slope on September 23, 2015. The repair is located on the top of the cell edge embankment at the northeast corner of Cell No. 13, at the East Carolina Regional MSW Landfill.

The base liner system consists of a compacted clay liner with a permeability of $k \leq 1 \times 10^{-7}$ cm/s overlain by a minimum 60 mil textured HDPE geomembrane in the area of the repair.

Liner Repair:

The repair was performed by American Environmental Group (AEG) on September 23, 2015. BLE's CQA Technician, Mr. Brian Taylor, was on-site to observe the repair. East Carolina Regional MSW Landfill operations personnel exposed the FML where the damage had occurred, repaired the clay liner surface in the area by back dragging and compacting it with the bucket of a CAT skid steer loader. Granular bentonite was placed over the exposed clay liner surface to fill in surface defects. Two hand auger thickness checks were performed by BLE in the repaired clay liner area and confirmed the clay liner thickness was greater than 24 inches. The hand auger holes were backfilled with a combination of clay liner soils and granular bentonite, and the mixture moistened and compacted.

AEG cut out the damaged FML, cleaned the surface of the FML around the damaged area, and installed a minimum 60-mil HDPE textured geomembrane 13-foot x 63-foot repair patch. The patch was extrusion welded to the base liner. A minimum 60-mil HDPE geomembrane 1 foot wide seam cap was

welded over the extrusion weld of the patch. The minimum 60 mil HDPE geomembrane used for the liner repair was obtained from a stockpile of approved minimum 60-mil FML rolls remaining from construction of Cell No.13. The geomembrane material properties were documented to have met the requirements of the East Carolina Regional MSWLF Construction of Cell No. 13 Specification Section 02750 – HDPE Geomembrane Liner (GRI Test Method GM13) and the CQA Plan. A copy of the FML test data from the construction of Cell No. 13 is attached.

Testing:

Prior to welding, AEG performed a trial weld to qualify the welder and machine. The trial weld and testing for peel and shear (ASTM 6392) were monitored by the CQA Technician. The peel and shear test results achieved in excess of the values required by the site specifications and the CQA Plan and the welder and machine were accepted to perform the repair. The test results are attached. Following the repair, the repair patch and the seam cap were vacuum box tested and the tests were observed as passing. The base liner repair meets the requirements of the Cell No. 13 Specifications and the CQA Plan.

The attached Record of Daily Observations provides further detail of the repair location, observations, photos, and test documentation.

Closing:

In conclusion, it is our opinion that the approximately 13-foot by 63-foot FML repair was performed in accordance to the East Carolina Regional MSW Landfill. Cell No. 13 Construction Plans and Technical Specifications, the Permit, the CQA Plan, the Requirements of NCDENR and Acceptable Engineering Practices.

Please call us if you have questions concerning this report.

Sincerely,

BUNNELL-LAMMONS ENGINEERING, INC.

NORTH CAROLINA PROFESSIONAL SEAL 041611 ENGINEER JONATHAN P. USHER

Jonathan P. Usher, P.E.
Senior Engineer
Licensed, NC #41611

10-20-15

NORTH CAROLINA PROFESSIONAL SEAL 13814 ENGINEER DANIEL B. BUNNELL

Daniel B. Bunnell P.E.
Principal
Registered, NC #13814

10/20/15

Attachments

cc: Mr. Matt Cheek, P.E.
Site Operating Record

Photograph No. 1: Liner damage within Cell No. 13, looking from east to west.

Photograph No. 2: Repaired soil liner area. Thin layer of powdered bentonite over soil repair.

Photograph No. 3: Grinding seam area of the new and existing geomembrane prior to extrusion welding.

Photograph No. 4: Extrusion welding the geomembrane (FML) repair patch.

Photograph No. 5: Vacuum box testing the extrusion weld of the FML repair patch.

Photograph No. 6: Extrusion welding a geomembrane cap over the new extrusion weld of the geomembrane patch.

Photograph No. 7: Vacuum box testing the extrusion weld of the geomembrane seam cap over the geomembrane patch.

Photograph No. 8: Installed geomembrane repair and seam cap.

GEOMEMBRANE DAILY ACTIVITY SUMMARY
EAST CAROLINA REGIONAL MSW LANDFILL
CONSTRUCTION QUALITY ASSURANCE - CELL NO. 13 GEOSYNTHETICS REPAIRS
BERTIE COUNTY, NORTH CAROLINA
BUNNELL-LAMMONS ENGINEERING, INC. PROJECT NO. J15-1001-80
HHNT PROJECT NO. 6703-419-01

CLIENT: REPUBLIC SERVICES OF NORTH CAROLINA

DATE: 9/23/2015
ARRIVAL TIME: 1:50 PM
DEPARTURE TIME: 8:40 PM
WORK HOURS: 7

VISITORS:

NAME	REPRESENTING

ONSITE BLE PERSONNEL: Brian Taylor

WEATHER:

SUNNY	RAIN
PTLY CLOUDY	WINDY
CLOUDY	SNOW

TEMPERATURE:
MORNING LOW: 60 °F
DAYTIME HIGH: 77 °F

GEOMEMBRANE INSTALLER ACTIVITIES (AMERICAN ENVIRONMENTAL GROUP, LTD.):

1) Performed trial seam welds for each welder, machine and type of seam to be welded.
2) Contractor repaired damaged 60 mil Textured Base Liner in Cell No.13. Contractor used (2) Generators, (2) Leisters, (2) Grinders, (2) Extrusion Guns, and Crew. Contractor installed 1ft wide cap strip around extrusion welded repair.
3) Performed vacuum box test on 63-ft x 13-ft extrusion welded repair and 1ft wide cap strip.

PANELS DEPLOYED: **FROM:** N/A **TO:** N/A **(SEE ATTACHED SKETCH)**

DESTRUCTIVE TEST SAMPLES:
IDENTIFIED
CUT
FIELD TESTED

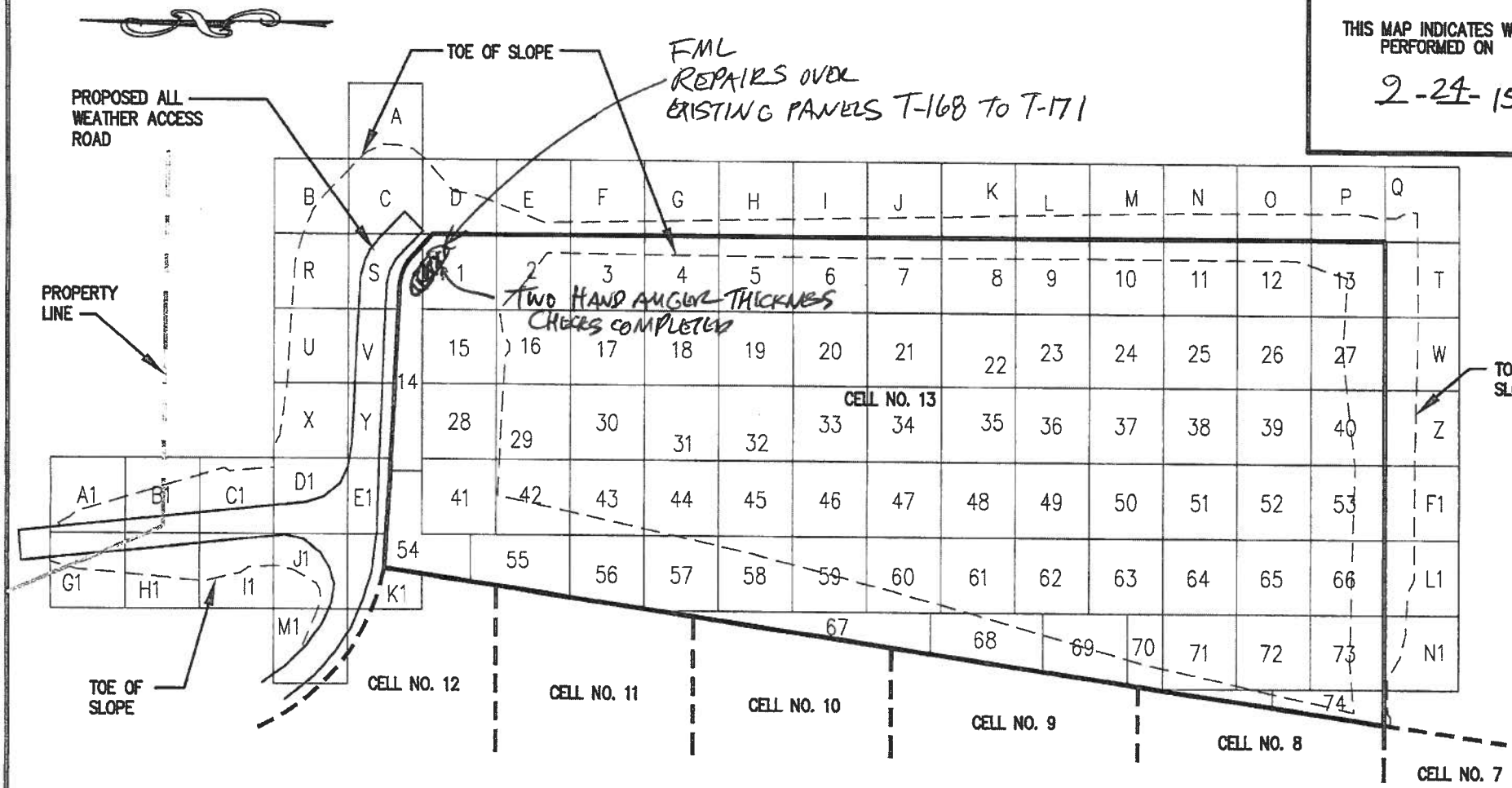
ADDITIONAL COMMENTS:

1) Contractor used roll #401625-13 for repair. Roll #401625-13 was previously approved for use in the construction of Cell No. 13. (See attached documentation.)
2) Republic Services' personnel repaired the clay liner surface by back dragging and compacting it with the bucket of a CAT skid steer loader and spreading granular bentonite across the entire exposed clay liner surface.
3) Mr. Brian Taylor completed two hand auger thickness checks in the repaired clay liner area. The clay liner thickness in both hand auger holes was greater than 24 inches. Both hand auger holes were backfilled with a mixture of clay soils, granular bentonite and water.

REPORT REVIEWED & APPROVED BY: Jonathan Usher, P.E.
Signature

THIS MAP INDICATES WORK PERFORMED ON

2-24-15



LEGEND

20 GRID REFERENCE NUMBER OR LETTER FOR TESTING

20 GRID AREA ≤ 10,000 SF (100' x 100')

TOTAL AREA OF CELL NO. 13
= 730,859 S.F.
= 16.8 ACRES

200 100 0 200 400
APPROXIMATE SCALE IN FEET

REFERENCE:
DRAWING TITLED "TOP OF CLAY LINER GRADING PLAN" BY HODGES, HARBIN, NEWBERRY AND TRIBBLE, INC. DATED 6-27-2012.

DRAWN: ACE	DATE: 10-24-12	BLE INC. BUNNELL-LAMMONS ENGINEERING, INC. 6004 PONDERS COURT GREENVILLE, SOUTH CAROLINA 29615 PHONE: (864)288-1265 FAX: (864)288-4430	FIELD SKETCH – CELL NO. 13 EAST CAROLINA LANDFILL BERTIE COUNTY, NORTH CAROLINA
CHECKED: TWM	CAD: ECLF71-FSC13		FIGURE 3B
APPROVED:	JOB NO: J12-1001-71		

TABLE 2: FIELD TRIAL SEAMS

EAST CAROLINA REGIONAL MSW LANDFILL
CELL NO. 13 GEOSYNTHETICS REPAIRS
BERTIE COUNTY, NORTH CAROLINA
BUNNELL-LAMONS ENGINEERING, INC. PROJECT NO. J15-1081-00
HRINT PROJECT NO. 6780-419-01

CQA TECHNICIANS: BRIAN TAYLOR

DATE: 9/24/15

PAGE: 1

TRIAL SEAM CONFIGURATION:
Weld Strip/Weld Strip = WS/WS
Textured/Textured = TX/TX
Smooth/Smooth = SM/SM
Smooth/Textured = SM/TX
Weld Strip/Textured = WS/TX
Weld Strip/Smooth = WS/SM

* Textured geomembrane with a smooth welding strip along the roll edges noted as WS = Weld Strip

MINIMUM PEEL & SHEAR VALUES:
FUSION WELD: 91 ppi & 120 ppi
EXTRUSION WELD: 78 ppi & 120 ppi

TABLE 2
FIELD TRIAL SEAMS

TRIAL SEAM NO.	GEOMEMBRANE TYPE (circle one)	TRIAL SEAM CONFIGURATION (circle one)	COMMENTS*	SEAMING METHOD (circle one)	AMBIENT TEMP (°F)	WELDER NAME	MACHINE NUMBER	MACHINE PARAMETERS: TIME	PREHEAT TEMP	BARREL TEMP	SPEED	STRENGTH AT BREAK (ppi): PEEL TEST	SHEAR TEST	FTB or NON FTB (circle one)	RESULTS PASS / FAIL (circle one)
1	TEXTURED SMOOTH	WS/WS SM/TX TX/TX WS/TX SM/SM WS/SM		DBL FUSION SNG FUSION EXTRUSION	77	TY	BG	4:25	430	500	–	147 / – 146 / – 137 / – 152 / – 152 / –	155 144 147 157 160	FTB NON FTB	PASS FAIL
2	TEXTURED SMOOTH	WS/WS SM/TX TX/TX WS/TX SM/SM WS/SM		DBL FUSION SNG FUSION EXTRUSION	77	BS	40	4:25	500	500	–	139 / – 118 / – 110 / – 142 / – 126 / –	151 132 137 154 141	FTB NON FTB	PASS FAIL
	TEXTURED SMOOTH	WS/WS SM/TX TX/TX WS/TX SM/SM WS/SM		DBL FUSION SNG FUSION EXTRUSION								/		FTB NON FTB	PASS FAIL
	TEXTURED SMOOTH	WS/WS SM/TX TX/TX WS/TX SM/SM WS/SM		DBL FUSION SNG FUSION EXTRUSION								/		FTB NON FTB	PASS FAIL
	TEXTURED SMOOTH	WS/WS SM/TX TX/TX WS/TX SM/SM WS/SM		DBL FUSION SNG FUSION EXTRUSION								/		FTB NON FTB	PASS FAIL
	TEXTURED SMOOTH	WS/WS SM/TX TX/TX WS/TX SM/SM WS/SM		DBL FUSION SNG FUSION EXTRUSION								/		FTB NON FTB	PASS FAIL

* Note if field trial welds are for geomembrane "Repairs"

TABLE 5: PANEL REPAIR RECORD

EAST CAROLINA REGIONAL MSW LANDFILL
CELL NO. 13 GEOSYNTHETICS REPAIRS
BERTIE COUNTY, NORTH CAROLINA
BUNNELL-LAMMONS ENGINEERING, INC. PROJECT NO. J15-1001-00
HUNT PROJECT NO. 6703-419-01

CQA TECHNICIANS: BRIAN TAYLOR

DATE: 9-24-15

PAGE: 1

V-BOX OPERATOR: TY

TABLE 5
PANEL REPAIR RECORD

REPAIR NUMBER	SEAM BETWEEN PANEL NO.	LOCATION[1]	DESCRIPTION OF DAMAGE	SIZE OF REPAIR[2]	REPAIR (circle one)	RESULTS PASS/FAIL (circle one)
R-486	-1-	T-168, T-169, T-170, T-171 about 10' from anchor trench	PUNCTURED LINER	63'x13'	PATCH EXTRUSION CAP	PASS FAIL
R-487	-1-	T-168, T-169, T-170, T-171 Surrounding R-486	1' Cap Strip	135'x1'	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL
R-	/			X	PATCH EXTRUSION CAP	PASS FAIL

NOTE (1) If the repair is at a Geomembrane Panel Intersection, list Panel Nos in the "LOCATION" column only
In the "DESCRIPTION OF DAMAGE" column, write "Intersection or INT"

NOTE (2) "T" Indicates a T-Weld at the intersection of geomembrane panels

Demtech Services, Inc.

Placerville, California, USA

CALIBRATION CERTIFICATE

Tensiometer Model: Pro-Tester T-0100

Device Calibrated: S-Type load cell
Range: 0 - 750 lbs. Tension
Model No: M2405-750#
Serial No: 668425

Calibration Apparatus:

Pro-Cal unit, model TC-0100/A

A/D Module Model No: T-029
A/D Module Serial No: 2711668425
Channel No: N/A

Dead Weight:		Reference Cell:	
W1	2	R1	2
W2	152	R2	152
W3	302	R3	302

Indicator reading with no load: 0

Offset: 4.971913 Scale: 3.186509

Applied Force lbs.	Cell Response:	Deviation Error:
2	2	0.00
52	52	0.00
102	102	0.00
152	152	0.00
202	202	0.00
252	252	0.00
302	302	0.00

Total Deviation Error (%): 0.00%

Temperature at time of calibration: 73 degrees F
Exitation Voltage: 5 V DC

This calibration conforms to the standards set by ASTM E4 and is traceable to NIST standards

Note: A/D Module and load cell above have been systems calibrated and are considered a matched pair. In general, calibrated A/D Modules and load cells are not interchangeable.

JF

Date: 01/05/15

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BLE INC.
BUNNELL-LAMMONS ENGINEERING, INC.
GEOTECHNICAL, ENVIRONMENTAL AND CONSTRUCTION MATERIALS CONSULTANTS

PROJECT MEMO

CONSTRUCTION OF CELL NO. 13
EAST CAROLINA REGIONAL MSW LANDFILL
BERTIE COUNTY, NORTH CAROLINA
BLE Project No. J12-1001-71
HHNT Project No. 6703-419-01

To: Mr. Matt Einsmann, P.E.

Copy: Mr. Ray Hoffman, P.E.
Mr. Bill Hodges, P.E.
Mr. Matt Cheek, P.E.
Mr. Grant Palmer (Agru)

From: Mr. Tyler Moody, E.I.T
Mr. Daniel Bunnell, P.E.

NORTH CAROLINA PROFESSIONAL SEAL 13814 ENGINEER DANIEL B. BUNNELL
1-23-13

Date: January 23, 2013

Subject: **Recommendation for Acceptance of HDPE Textured and Smooth Geomembrane**

BLE has reviewed CQA (third party) and MQC (manufacturer) conformance test results for the Agru America 60-mil HDPE textured geomembrane (Microspike) and 60-mil HDPE smooth geomembrane to be used for the Cell No. 13 construction at East Carolina Regional MSW Landfill. The test frequencies and values for all 19 rolls of textured geomembrane and all 58 rolls of smooth geomembrane meet the project requirements as detailed in the project specifications, plans and CQA Manual. Therefore, we recommend acceptance of the 19 rolls of 60-mil HDPE textured geomembrane and the 58 rolls of 60-mil HDPE smooth geomembrane for use in construction of Cell No. 13 at the East Carolina MSW Landfill.

The roll numbers currently recommended for acceptance are shown on the roll lists provided by AGRU (attached). The 60-mil HDPE textured geomembrane was produced from lot number H7121062, and the 60-mil HDPE smooth geomembrane was produced from lot numbers H7121062 and H7121069. We understand that this is the full order for the project. The Agru inventories indicate that 18 rolls of textured geomembrane and 57 rolls of smooth geomembrane will be shipped to the project; therefore, one roll of textured and one roll of smooth geomembrane will be held at Agru unless needed for the project.

Attachments:
Summary of Test Frequency Requirement for 60-mil HDPE Textured Geomembrane
Agru America, CQC roll certifications for 60-mil HDPE Textured Geomembrane
CQA conformance test reports by TRI/Environmental for 60-mil HDPE Textured Geomembrane
Summary of Test Frequency Requirement for 60-mil HDPE Smooth Geomembrane
Agru America, CQC roll certifications for 60-mil HDPE Smooth Geomembrane
CQA conformance test reports by TRI/Environmental for 60-mil HDPE Smooth Geomembrane

6004 PONDERS COURT
GREENVILLE, SOUTH CAROLINA 29615

PHONE (864) 288-1265
FAX (864) 288-4430

Cell 13

cust: Republic Services Inc
PO#: tbg East Carolina Env
Dest: Aulander, NC

doc 21015

18 rolls 60 HD micro (505)(min)
57 rolls 60 HD smooth (540)(min)
check weld rod qty (if ordered)
2 samps per lot - sqs + all rolls thk

English Dimensions

roll #	wid	len	area					wgt		resin lot #
201402 .13	23	540.0	12420.0	60HD	smooth	57tot	1	4124		H7121062
201403 .13	23	540.0	12420.0	60HD	smooth	57tot	2	4116		H7121062
201404 .13	23	540.0	12420.0	60HD	smooth	57tot	3	4012		H7121062
201405 .13	23	540.0	12420.0	60HD	smooth	57tot	4	3940	strip	H7121062
201406 .13	23	540.0	12420.0	60HD	smooth	57tot	5	3940		H7121062
201507 .13	23	540.0	12420.0	60HD	smooth	57tot	6	3942		H7121062
201508 .13	23	540.0	12420.0	60HD	smooth	57tot	7	3950		H7121062
201509 .13	23	540.0	12420.0	60HD	smooth	57tot	8	3940		H7121062
201510 .13	23	540.0	12420.0	60HD	smooth	57tot	9	3946		H7121062
201511 .13	23	540.0	12420.0	60HD	smooth	57tot	10	3946	strip	H7121062
201512 .13	23	540.0	12420.0	60HD	smooth	57tot	11	3934		H7121062
201513 .13	23	540.0	12420.0	60HD	smooth	57tot	12	3932		H7121062
201514 .13	23	540.0	12420.0	60HD	smooth	57tot	13	3920		H7121062
201515 .13	23	540.0	12420.0	60HD	smooth	57tot	14	3919		H7121062
201517 .13	23	540.0	12420.0	60HD	smooth	57tot	15	3910		H7121062
201519 .13	23	540.0	12420.0	60HD	smooth	57tot	16	3918		H7121062
201520 .13	23	540.0	12420.0	60HD	smooth	57tot	17	3919		H7121062
201521 .13	23	540.0	12420.0	60HD	smooth	57tot	18	3922		H7121062
201522 .13	23	540.0	12420.0	60HD	smooth	57tot	19	3924		H7121062
201523 .13	23	540.0	12420.0	60HD	smooth	57tot	20	3920		H7121062
201524 .13	23	540.0	12420.0	60HD	smooth	57tot	21	3916		H7121062
201525 .13	23	540.0	12420.0	60HD	smooth	57tot	22	3924		H7121062
201626 .13	23	540.0	12420.0	60HD	smooth	57tot	23	3922		H7121062
201627 .13	23	540.0	12420.0	60HD	smooth	57tot	24	3924		H7121062
201628 .13	23	540.0	12420.0	60HD	smooth	57tot	25	3938		H7121062
201629 .13	23	540.0	12420.0	60HD	smooth	57tot	26	3942		H7121069
201630 .13	23	540.0	12420.0	60HD	smooth	57tot	27	3942		H7121069
201631 .13	23	540.0	12420.0	60HD	smooth	57tot	28	3948		H7121069
201632 .13	23	540.0	12420.0	60HD	smooth	57tot	29	3940		H7121069
201633 .13	23	540.0	12420.0	60HD	smooth	57tot	30	3938	strip	H7121069
201634 .13	23	540.0	12420.0	60HD	smooth	57tot	31	3938		H7121069
201635 .13	23	540.0	12420.0	60HD	smooth	57tot	32	3940		H7121069
201636 .13	23	540.0	12420.0	60HD	smooth	57tot	33	3938		H7121069
201637 .13	23	540.0	12420.0	60HD	smooth	57tot	34	3936		H7121069
201638 .13	23	540.0	12420.0	60HD	smooth	57tot	35	3938		H7121069
201639 .13	23	540.0	12420.0	60HD	smooth	57tot	36	3944		H7121069
201640 .13	23	540.0	12420.0	60HD	smooth	57tot	37	3940		H7121069
201641 .13	23	540.0	12420.0	60HD	smooth	57tot	38	3948		H7121069
201642 .13	23	540.0	12420.0	60HD	smooth	57tot	39	3936		H7121069
201643 .13	23	540.0	12420.0	60HD	smooth	57tot	40	3948		H7121069
201744 .13	23	540.0	12420.0	60HD	smooth	57tot	41	3948	strip	H7121069
201745 .13	23	540.0	12420.0	60HD	smooth	57tot	42	3954		H7121069
201746 .13	23	540.0	12420.0	60HD	smooth	57tot	43	3946		H7121069
201747 .13	23	540.0	12420.0	60HD	smooth	57tot	44	3948		H7121069
201748 .13	23	540.0	12420.0	60HD	smooth	57tot	45	3944		H7121069
201749 .13	23	540.0	12420.0	60HD	smooth	57tot	46	3942		H7121069
201750 .13	23	540.0	12420.0	60HD	smooth	57tot	47	3940		H7121069
201751 .13	23	540.0	12420.0	60HD	smooth	57tot	48	3830		H7121069
201752 .13	23	540.0	12420.0	60HD	smooth	57tot	49	3944		H7121069
201754 .13	23	540.0	12420.0	60HD	smooth	57tot	50	3936		H7121069
201755 .13	23	540.0	12420.0	60HD	smooth	57tot	51	3948		H7121069
201756 .13	23	540.0	12420.0	60HD	smooth	57tot	52	3940		H7121069
201757 .13	23	540.0	12420.0	60HD	smooth	57tot	53	3930		H7121069
201758 .13	23	540.0	12420.0	60HD	smooth	57tot	54	3930		H7121069
201759 .13	23	540.0	12420.0	60HD	smooth	57tot	55	3946		H7121069
201760 .13	23	540.0	12420.0	60HD	smooth	57tot	56	3946		H7121069
201761 .13	23	540.0	12420.0	60HD	smooth	57tot	57	3938		H7121069

extra - for thickness pre-qual ONLY - will NOT ship to site

201762 .13	23	540.0	12420.0	60HD	smooth	extra		3936		H7121069

Cell 13

cust: Republic Services Inc
PO#: tbg East Carolina Env
Dest: Aulander, NC

doc 21015

18 rolls 60 HD micro (505)(min)
57 rolls 60 HD smooth (540)(min)

English Dimensions

roll #	wid	len	area	check weld rod qty (if ordered)	wgt		resin lot #
				2 samps per lot - sqs + all rolls thk			
401403 .13	23	505	11,615.0	60HD micro 18tot 1	4014		H7121062
401404 .13	23	505	11,615.0	60HD micro 18tot 2	4007	sqs	H7121062
401407 .13	23	505	11,615.0	60HD micro 18tot 3	4151		H7121062
401508 .13	23	505	11,615.0	60HD micro 18tot 4	4160		H7121062
401511 .13	23	505	11,615.0	60HD micro 18tot 5	4035		H7121062
401514 .13	23	505	11,615.0	60HD micro 18tot 6	4038		H7121062
401515 .13	23	505	11,615.0	60HD micro 18tot 7	4058	sqs	H7121062
401516 .13	23	505	11,615.0	60HD micro 18tot 8	4062		H7121062
401519 .13	23	505	11,615.0	60HD micro 18tot 9	4044		H7121062
401520 .13	23	505	11,615.0	60HD micro 18tot 10	4049		H7121062
401521 .13	23	505	11,615.0	60HD micro 18tot 11	4026		H7121062
401622 .13	23	505	11,615.0	60HD micro 18tot 12	4031		H7121062
401623 .13	23	505	11,615.0	60HD micro 18tot 13	4034		H7121062
401624 .13	23	505	11,615.0	60HD micro 18tot 14	4033		H7121062
401625 .13	23	505	11,615.0	60HD micro 18tot 15	4030		H7121062
401630 .13	23	505	11,615.0	60HD micro 18tot 16	4090		H7121062
401631 .13	23	505	11,615.0	60HD micro 18tot 17	4096		H7121062
401632 .13	23	505	11,615.0	60HD micro 18tot 18	3914		H7121062
				extra - for thickness pre-qual ONLY - will NOT ship to site			
401633 .13	23	505	11,615.0	60HD micro extra	3916		H7121062

ROLL USED FOR 9-23-15 REPAIR

agru america
quality control dep't

quality certificate

ROLL # **401625-13** Lot #: **H7121062** **Liner Type: Microspike™ HDPE**

Measurement ASTM D5994 (Modified)		METRIC		ENGLISH	
	MIN:	1.53	mm	60	mil
	MAX:	1.69	mm	67	mil
Asperity ASTM D7466: 26/37 mil TOP / BOTTOM	AVE:	1.61	mm	63	mil

Thickness.....	1.5	mm	60 mil
Length.....	153.926	m	505.0 feet
Width.....	7.01	m;	23.0 feet

OIT(Standard) ASTM D3895 minutes **185**

				TEST RESULTS
Specific Gravity ASTM D792	Density	g/cc		.947
MFI ASTM D1238 COND. E GRADE: K307	Melt Flow Index 190°C /2160 g	g/10 min		.23
Carbon Black Content ASTM D4218	Range	%		2.31
Carbon Black Dispersion ASTM D5596	Category			10 IN CATEGORY 1
Tensile Strength ASTM D6693 ASTM D638 (Modified) (2 inches / minute)	Average Strength @ Yield	30 N/mm (kN/m)	172 ppi	2,706 psi
	Average Strength @ Break	38 N/mm (kN/m)	218 ppi	3,439 psi
Elongation ASTM D6693 ASTM D638 (Modified) (2 inches / minute) Lo = 1.3" Yield	Average Elongation @ Yield	%		17.59
Lo = 2.0" Break	Average Elongation @ Break	%		523.7
Dimensional Stability ASTM D1204 (Modified)	Average Dimensional change	%		-0.09
Tear Resistance ASTM D1004 (Modified)	Average Tear Resistance	260.3 N		58.518 lbs
Puncture Resistance FTMS 101 Method 2065 (Modified)	Average Peak Load	459.5 N		103.30 lbs
Puncture Resistance ASTM D4833 (Modified)	Average Peak Load	660.8 N		148.56 lbs
ESCR ASTM D1693	Minimum Hrs w/o Failures	1500 hrs		CERTIFIED
Notched Constant Tensile Load ASTM D5397	pass / fail @ 30%	300 hrs		ONGOING

Customer: **Republic Services Inc**
PO: **tbg East Carolina Env**
Destination **Aulander, NC**

Date: **1/05/2013**

Signature.....
Quality Control Department

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