APPENDIX A

New Test Sections
Material Data Sheets

Exposed 40-mil Wet-applied Polyurethane Geocomposite
Liquid Polyurethane Resin
Geotextile is Typar 3301 non-woven spunbonded polypropylene geotextile

Exposed 45-mil Reinforced Metallocene (mPE)

Exposed 160-mil Coletanche NTP 2 ES

Exposed 60-mil White Textured HDPE
Geotextile is a 10-oz needle-punched nonwoven (Synthetic Industries 1071)

Exposed 20-mil EVA Geomembrane

TYPAR®® 3301 Non-Woven Geotextile

PROPERTY	TEST METHOD	MARV
Grab Tensile Strength (lbs)	ASTM D4632	120
Grab Elongation (%)	ASTM D4632	60
Trapezoid Tear (lbs)	ASTM D4533	35
Puncture (lbs)	ASTM D4833	25
Mullen Burst (psi)	ASTM D3786	90
Permittivity (sec^{-1})	ASTM D4491	0.8
Permeability (cm/sec)	ASTM D4491	0.02
A.O.S. (U.S. Sieve)	ASTM D4751	50
UV Resistance @500 hrs (%)	ASTM D4355	70
Mass/Area (Typical)(oz/sy)	ASTM D5261	3.0
Water Flow Rate (gpm/ft^2)	ASTM D4491	50

English

Reinforced Metallocene (mPE)

Serrot's mPE is a reinforced flexible polypropylene geomembrane produced from first quality resins. Serrot mPE contains a weft-inserted, polyester scrim reinforcement, which enhances tear and puncture resistance without reducing environmental stress crack resistance. Such properties make mPE ideal for floating covers and any applications requiring exceptional support in high-tensioned areas. mPE geomembranes are very flexible, durable, and have been formulated to be resistant to chemicals, ultraviolet degradation, and aging. mPE is formulated to be welded directly to HDPE or LLDPE. Serrot mPE is manufactured in black/black and tan/black. [6,7]

Property	Test Method	Frequency[1]	RPP36	RPP45
Thickness (nominal)[2] (mils) Thickness (minimum)[3] (mils)	D751/D5199	per roll	36 34	45 41
Weight per Unit Area (g/sf)	D5261	50,000 SF	68	82
Tensile Properties • Grab Strength (lb/4") • Grab Elongation (%)	D751	50,000 SF	 225 22	 250 22
Tear Resistance[4] (min. ave.) (lb)	D5884 (2 ipm)	50,000 SF	65	65
Ply Adhesion[4] (lb or FTB)	D413	50,000 SF	20	20
Puncture Resistance (min. ave.) (lb)	D4833 FTMS 101B/ Method 2031[5]	50,000 SF Certified	85 200	90 250
Dimensional Stability (max) (%)	D1204	Resin Batch	±1.0	±1.0
Hydrostatic Resistance (psi)	D751 Method A, Proc. 1	Certified	300	350
Low Temp Flexibility	D2136 1/8" Mandrel, 4 Hrs	Certified	-40°F	-40°F
Stress Crack Resistance (hrs)	D1693	Certified	5,000	5,000
UV Resistance (hrs)	QUV	Certified	5,000	5,000
Reinforcing Scrim	9 x 9, 1000 denier weft-inserted polyester for all material thicknesses			

[1]Testing frequencies are rounded to the nearest full roll.
[2]Nominal thickness is based on no coupon being less than 10% under specified thickness. Average thickness may be less than specified thickness.
[3]Minimum thickness is based on average thickness being equal to or greater than specified thickness
[4]Peak value.
[5]FTMS 101b has been replaced with D4833. Value shown for comparison purposes only.
[6]RPP black/black and tan/black is available in accordance with ANSI/NSF 61 standard and can be used for both potable and industrial applications.
[7]Allow four (4) months lead time to fully evaluate long term UV resistance of the color.

The information contained herein has been compiled by Serrot International, Inc. and is, to the best of our knowledge, true and accurate. This information is offered without warranty. Final determination of suitability for use contemplated is the sole responsibility of the user. This information is subject to change without notice. RPPE 10/25/00

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TESTS ON BITUMINOUS GEOMEMBRANE Colétanche NTP 2 ES

Type of test and measured properties	Standard	Unit	Test results
Mass per unit area	ASTM D 5261		
Mass per unit area		g/m²	5306
Nominal thickness	ASTM D 5199		
Nominal thickness at 20 kPa		mm	4.41
Tensile	ISO 1421		
Longitudinal direction			
Break strength		kN/m	26.6
Strain at break		%	61.7
Transversal direction			
Break strength		kN/m	20.5
Strain at break		%	69.3
Tear	ASTM D 751		
Longitudinal direction			
Tear resistance		N	164
Transversal direction			
Tear resistance		N	181
Static puncture (CBR method)	EN ISO 12236		
Puncture strength		kN	3.6
Coefficient of variation		%	4.2
Dimensional stability	ASTM D 1204		
Longitudinal direction			
Size variation		%	- 0.12
Transversal direction			
Size variation		%	- 0.02
Cold bending	UNI 8202/15		
Longitudinal direction			
Upper face			
Lowest temperature (°C) to wrap on a mandrel (ϕ 20 mm)		°C	- 25
Bottom face			
Lowest temperature (°C) to wrap on a mandrel (ϕ 20 mm)		°C	- 15
Transversal direction			
Upper face			
Lowest temperature (°C) to wrap on a mandrel (ϕ 20 mm)		°C	- 25
Bottom face			
Lowest temperature (°C) to wrap on a mandrel (ϕ 20 mm)		°C	- 10
Water vapour transmission	ASTM E 96		
Permeance		g/m² · 24h	0.155
Permeability coefficient		m/s	3.66×10^{-14}

ENEL
RICERCA - POLO IDRAULICO E STRUTTURALE
NUCLEO TERRE, ROCCE E TECNOLOGIE COSTRUTTIVE
(A. Zaninetti)

GSE®

GSE White Textured*

Light Reflective, Textured HDPE Geomembrane

GSE White Textured is the textured version of GSE White*. It is a high quality, high density polyethylene (HDPE) geomembrane with one or two coextruded, textured surfaces. It has a UV-stabilized, white upper surface that is approximately 3 mils (0.125 mm) thick. This layer is part of the total thickness, the remainder of which is a carbon black stabilized primary layer. The light reflective surface improves detection of post-installation damage and reduces heat buildup on the liner by reflecting solar energy. Reducing liner temperature leads to fewer wrinkles and less subgrade desiccation. This textured product provides enhanced interface friction with adjoining materials.

TESTED PROPERTY	TEST METHOD	MINIMUM VALUES		
Thickness, mils (mm)	ASTM D 5994	36 (0.91)	54 (1.4)	72 (1.8)
Density, g/cm^3	ASTM D 1505	0.94	0.94	0.94
Tensile Properties (each direction)[1]	ASTM D 638, Type IV			
Strength at Break, lb/in-width (N/mm)	Dumbell, 2 ipm	60 (11)	90 (16)	120 (21)
Strength at Yield, lb/in-width (N/mm)		84 (15)	130 (23)	173 (30)
Elongation at Break, %	G.L. = 2.0 in (51 mm)	150	150	150
Elongation at Yield, %	G.L. = 1.3 in (33 mm)	13	13	13
Tear Resistance, lb (N)	ASTM D 1004	30 (133)	45 (200)	60 (267)
Puncture Resistance, lb (N)	ASTM D 4833	72 (320)	108 (480)	144 (641)
Carbon Black Content[2], %	ASTM D 1603	2.0	2.0	2.0
Carbon Black Dispersion	ASTM D 5596	Cat. 1 or 2	Cat. 1 or 2	Cat. 1 or 2
Notched Constant Tensile Load[3], hrs	ASTM D 5397, Appendix	400	400	400

REFERENCE PROPERTY	TEST METHOD	NOMINAL VALUES		
Thickness, mils (mm)	ASTM D 5994	40 (1.0)	60 (1.5)	80 (2.0)
Roll Length (approximate), ft (m)		730 (223)	420 (158)	400 (122)
Low Temperature Brittleness, °F (°C)	ASTM D 746, Cond. B	<-107 (<-77)	<-107 (<-77)	<-107 (<-77)
Oxidative Induction Time, minutes	ASTM D 3895, 200 °C Pure O_2, 1 atm	>100	>100	>100
Dimensional Stability (each direction), %	ASTM D 1204, 100 °C, 1 hr	±2	±2	±2

GSE White Textured is available in rolls approximately 22.5 ft (6.9 m) wide and weighing about 3,700 lb (1,678 kg). Other material thicknesses are available upon request.

[1]The combination of stress concentrations due to coextrusion texture geometry and the small specimen size results in large variation of test results. Therefore, these tensile properties are minimum average values.

[2]GSE White Textured may have an overall ash content greater than 3.0% due to the white layer.

[3]Note: NCTL is conducted on representative smooth membrane samples.

This information is provided for reference purposes only and is not intended as a warranty or guarantee. GSE assumes no liability in connection with the use of this information. Check with GSE for current, standard minimum quality assurance procedures.

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SYNTHETIC INDUSTRIES - GEOSYNTHETIC PRODUCTS DIVISION
GEOTEX™ NONWOVEN NEEDLEPUNCHED STAPLE FIBER SPECIFICATIONS
(FOR GPD INTERNAL USE ONLY)

			GEOTEX™ 1071			GEOTEX™ 1101		
Physical Properties	**Test Method**	**Units**	**Minimum[3]**	**MARV[2]**	**Typical[1]**	**Minimum[3]**	**MARV[2]**	**Typical[1]**
Mass Per Unit Area	ASTM D5261	oz/yd^2 (g/m^2)	9.6 (325)	10.0 (335)	10.8 (365)	10.0 (335)	10.3 (345)	11.0 (370)
Thickness	ASTM D5199	mils (mm)	95 (2.4)	105 (2.6)	120 (3.0)	100 (2.5)	110 (2.7)	125 (3.1)
Tensile Strength	ASTM D4632	lb (N)	245 (1090)	260 (1155)	285 (1265)	260 (1155)	275 (1220)	300 (1335)
Elongation	ASTM D4632	%	50	50	60	50	50	60
Trapezoidal Tear	ASTM D4533	lb (N)	90 (400)	100 (445)	115 (510)	95 (420)	105 (465)	120 (530)
Mullen Burst	ASTM D3786	psi (kPa)	485 (3340)	520 (3580)	565 (3895)	500 (3445)	535 (3685)	585 (4030)
Puncture Strength	ASTM D4833	lb (N)	170 (755)	180 (800)	200 (890)	150 (665)	170 (755)	190 (845)
AOS	ASTM D4751	US Sieve (mm)	100 (0.150)	100 (0.150)	120 (0.125)	100 (0.150)	100 (0.150)	120 (0.125)
Permittivity	ASTM D4491	sec^{-1}	n/a	1.2	1.5	n/a	1.2	1.4
Permeability	ASTM D4491[4]	cm/sec	n/a	0.30	0.40	n/a	0.30	0.40
Flow Rate	ASTM D4491	gpm/ft^2 (lpm/m^2)	n/a	85 (3460)	100 (4070)	n/a	85 (3460)	100 (4070)
UV Resistance	ASTM D4355	% Retained	n/a	70	n/a	n/a	70	n/a
Wide Width Tensile	ASTM D4595	lb/in (kN/m)	n/a	105 (18.3)	125 (21.8)	n/a	105 (18.3)	125 (21.8)

Notes:

1. Typical value indicates the average or mean value obtained from test data. By definition 50% of all tested values will exceed the mean.
2. MARV indicates minimum average roll value. This is calculated as the mean minus two standard deviations. Statistically, it yields a 97.7% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
3. Minimum values are calculated as the mean minus three standard deviations. Statistically, it yields a 99.8% degree of confidence that any samples taken from quality assurance testing will exceed the value reported.
4. ASTM D4491 permeability is calculated using typical thickness times the appropriate permittivity.
5. "n/a" indicates data not available.

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9/24/98

GeoComp

GeoComp, Inc.

PRODUCT SPECIFICATION

COMPOSITION: 20 mil EVA Geomembrane with 8 oz/yd2 PET geotextile bonded to both sides

PRODUCT STYLE: GC-8208VA

PHYSICAL PROPERTIES

PROPERTY	TEST METHOD	UNITS	VALUE	S.I. VALUE	S.I. UNITS
Weight	ASTM D-3776	oz/yd2	40	1333	gm/m2
Thickness	ASTM D-5799	mils	200	5.06	mm
Grab Tensile	ASTM D-4632	lbs	500	2.225	KN
Grab Elongation	ASTM D-4632	%	150	150	%
Wide Width Tensile	ASTM D-4595	f lb/in			
		MD	120	21.06	KN/m
		TD	160	28.02	KN/m
Puncture Strength	ASTM D-4833	lbs	260	1.56	KN
Puncture Strength*	FTM 101 B METHOD 2031	lbs	450	1.973	KN
Trapezoid Tear	ASTM D-4533	lbs	125	0.556	KN
Mullen Burst	ASTM D-3786	psi	700	47.95	KPa

ENDURANCE PROPERTIES

Abrasion Resistance ***	ASTM D-4886/4632	%	70	70	%
U.V. Resistance **	ASTM D-4355	%	70	70	%
Peel Strength	ASTM D-4545	lbs	n/a	n/a	KN

STD. ROLL PUTUP

WIDTH	LENGTH
n/a	n/a

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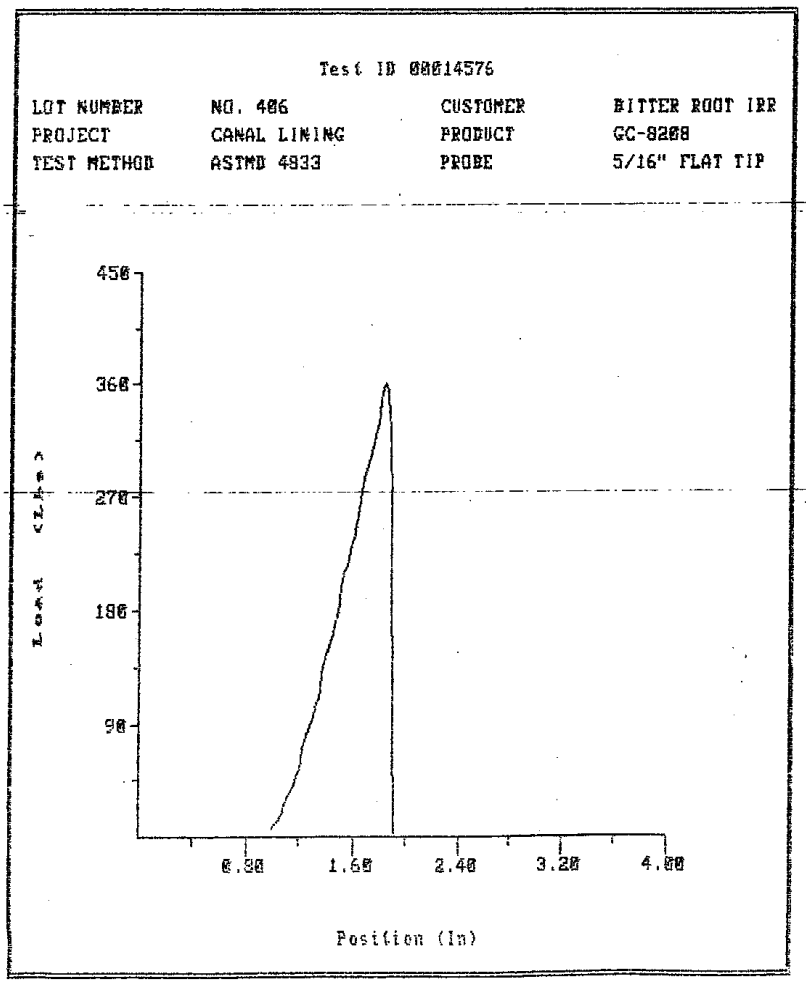
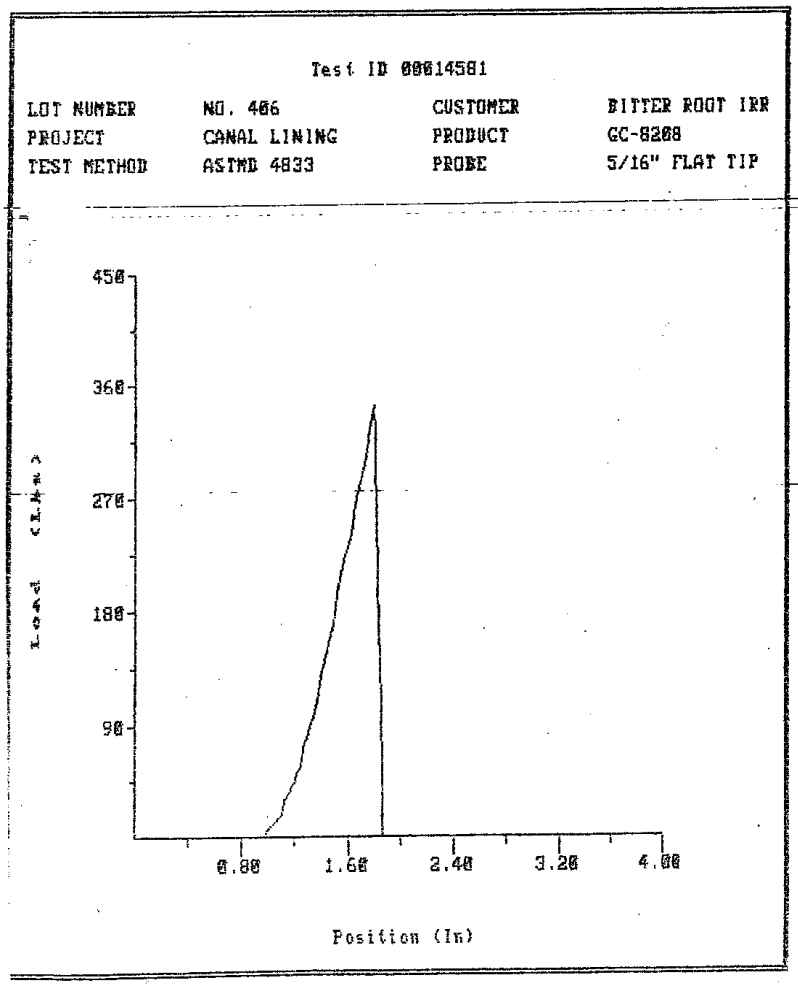
LOT NUMBER	NO. 406	CUSTOMER	BITTER ROOT IRR
PROJECT	CANAL LINING	PRODUCT	GC-8208
TEST METHOD	ASTMD 4833	PROBE	5/16" FLAT TIP

Test ID	00014576		Specimen Area	0.00015400	In^2
Peak Load	361.0	Lbs	Valley Load	-1.0	Lbs
Peak Position	1.902	In	Valley Position	-0.188	In
Peak Stress	2344000	PSI	Valley Stress	-6000	PSI
Test Time	00:00:43				



LOT NUMBER	NO. 406	CUSTOMER	BITTER ROOT IRR
PROJECT	CANAL LINING	PRODUCT	GC-8208
TEST METHOD	ASTMD 4833	PROBE	5/16" FLAT TIP

Test ID	00014581		Specimen Area	0.00015400	In^2
Peak Load	344.0	Lbs	Valley Load	0.0	Lbs
Peak Position	1.855	In	Valley Position	0.000	In
Peak Stress	2234000	PSI	Valley Stress	0	PSI
Test Time	00:00:20