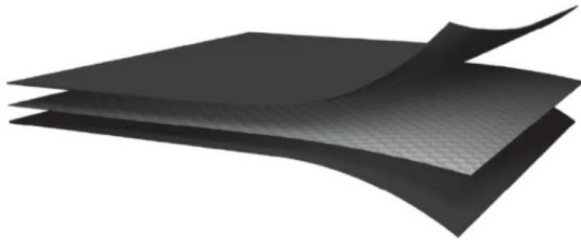


Innovative **GEOMEMBRANE** solutions for Retention and Containment liners and protective covers

High strength custom panels for fast installation.



AquaFuse Liner™ SKIN

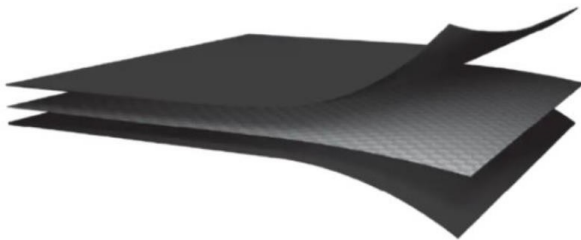


AquaFuse Liner™ MAT

GEOMEMBRANE overview

GEOMEMBRANE overview

AquaFuse Liner™ SKIN



CATEGORY
NAME:

RPE or WCPE

HDPE Woven Scrim w/ LLDPE
Coating on both sides.

AquaFuse Liner™ SKIN = 3 Layer

AquaFuse Liner™ MAT



CATEGORY
NAME:

RCPE

RPE/WCPE Laminated w/ a
LLDPE Film on one side.

AquaFuse Liner™ MAT = 4 Layer

GEOMEMBRANE overview



AquaFuse Liner™ SKIN

AquaFuse Liner™ S-300 – 0.30 mm

AquaFuse Liner™ S-410 – 0.41 mm

AquaFuse Liner™ S-510 – 0.51 mm

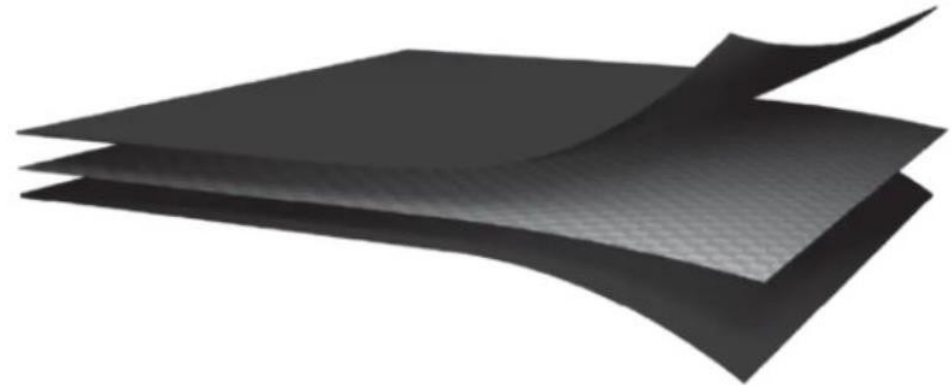
AquaFuse Liner™ S-610 – 0.61 mm

AquaFuse Liner™ S-750 – 0.75 mm

AquaFuse Liner™ SG-750 – 0.75 mm
SG – SAFE-T-GRIP/TEXTURE

AquaFuse Liner™ DS-1000 – 1.00 mm
DS – DOUBLE SCRIM

WCPE - WOVEN COATED POLYETHYLENE RPE - REINFORCED POLYETHYLENE



AquaFuse Liner™ SKIN

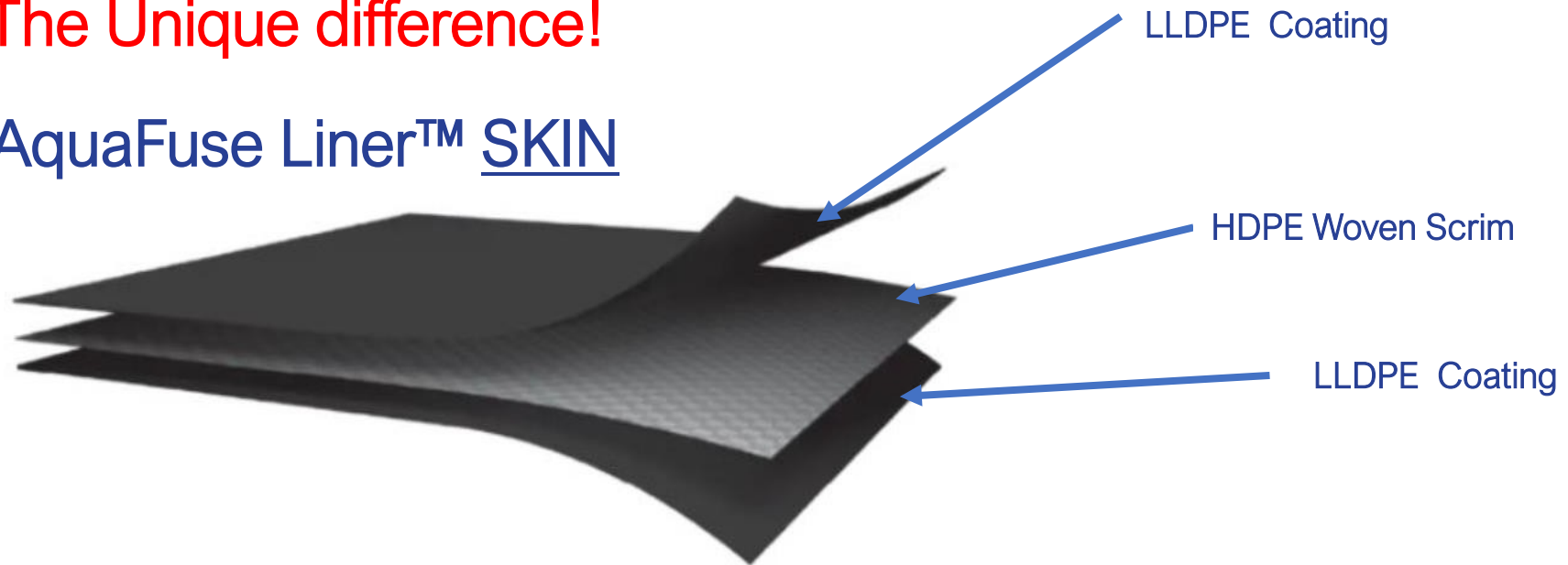
Woven Coated Polyethylene Covers & Liners

- Designed for liner and heavy-duty cover applications
- HDPE woven core provides dimensional stability with impressive tensile and tear strength
- Puncture, abrasion and chemical resistant construction
- Exceptional UV and oxidation resistance

GEOMEMBRANE overview

The Unique difference!

AquaFuse Liner™ SKIN



High puncture and tear resistance is the unique benefit due to the HDPE woven scrim

HDPE = High Density Poly Ethylene
LLDPE = Linear Low Density Polyethylene

GEOMEMBRANE overview

AquaFuse Liner™ SKIN (WCPE – WOVEN COATED POLYETHYLENE)



AquaFuse Liner™ SKIN applications : Top barriers for landfill and covers for Agriculture application.
(AquaFuse Liner™ SKIN have a high tear and puncture resistance which enables re-use for 3-5 years in Agriculture covers)

GEOMEMBRANE overview

AquaFuse Liner™ SKIN (WCPE – WOVEN COATED POLYETHYLENE)



AquaFuse Liner™ SKIN applications : Liner for lakes, ponds and reservoir in Agriculture

GEOMEMBRANE overview



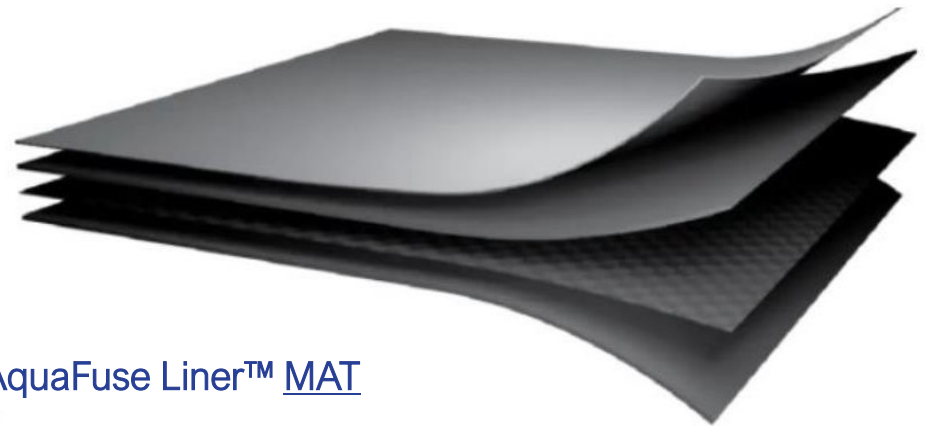
AquaFuse Liner™ MAT

AquaFuse Liner™ M-610 – 0.61 mm

AquaFuse Liner™ M-760 – 0.75 mm

AquaFuse Liner™ M-1000 – 1.00 mm

RCPE - REINFORCED COMPOSITE POLYETHYLENE



AquaFuse Liner™ MAT

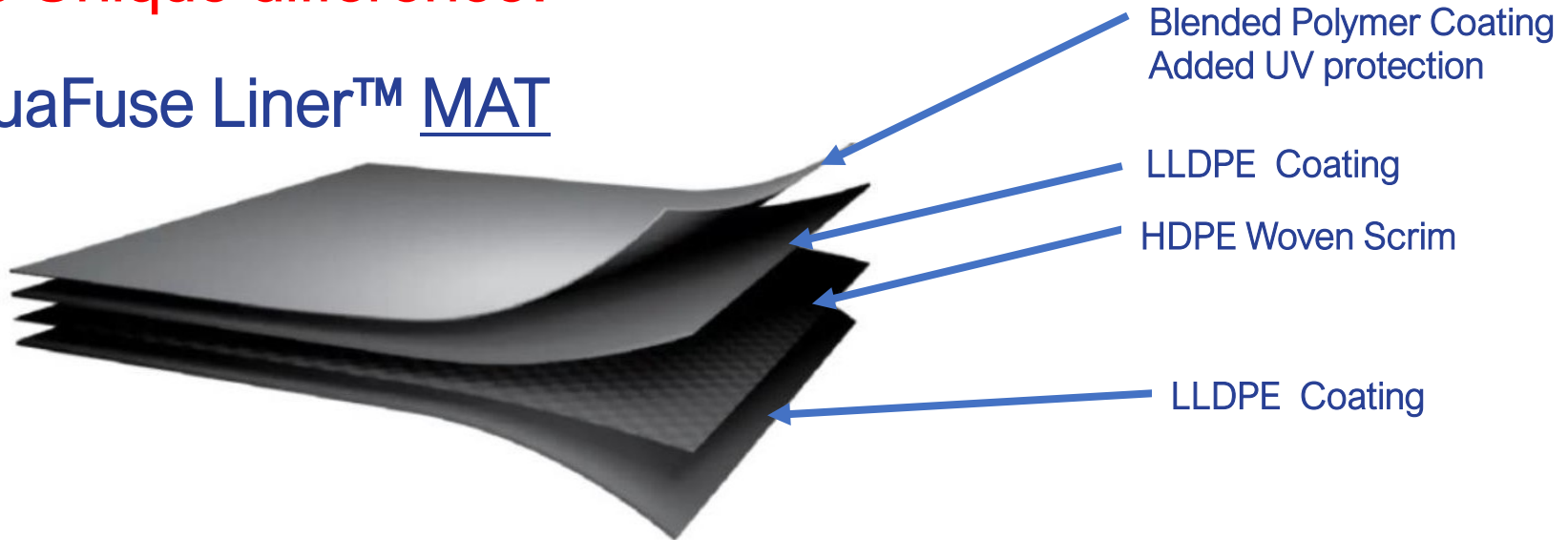
Reinforced Composite Polyethylene Liners and Barriers

- Designed for water containment and retention applications
- Proprietary construction using a HDPE woven core scrim and engineered LDPE/LLDPE coating and film
- HDPE woven core provides dimensional stability with impressive tensile and tear strength
- Excellent hydrostatic resistance and low water vapor permeability
- All layers contain UV protection

GEOMEMBRANE overview

The Unique difference!

AquaFuse Liner™ MAT



High puncture and tear resistance is the unique benefit due to the HDPE woven scrim
Increased UV protection due to extra film layer of LLDPE

HDPE = High Density Poly Ethylene
LLDPE = Linear Low Density Polyethylene

GEOMEMBRANE overview

AquaFuse Liner™ MAT (RCPE) (RCPE – REINFORCED COMPOSITE POLYETHYLENE)



AquaFuse Liner™ MAT applications : Liner for Wastewater, Storm water retention

GEOMEMBRANE overview

AquaFuse Liner™ MAT (RCPE) (RCPE – REINFORCED COMPOSITE POLYETHYLENE)



AquaFuse Liner™ MAT applications : Liner for Wastewater, Storm water retention

GEOMEMBRANE overview

TYPES OF GEOMEMBRANES

UNREINFORCED

HDPE

- Thick & Rigid; No reinforcement layer, lots of thermal expansion & contraction
- Landfill & hazardous waste liners

LLDPE

- More flexible than unreinforced HDPE
- Landfill covers & capping systems

PVC

- Flexible, but susceptible to puncture
- All-purpose liner & water retention

EPDM

- Extremely flexible with moderate strength
- Aquaculture & ornamental ponds

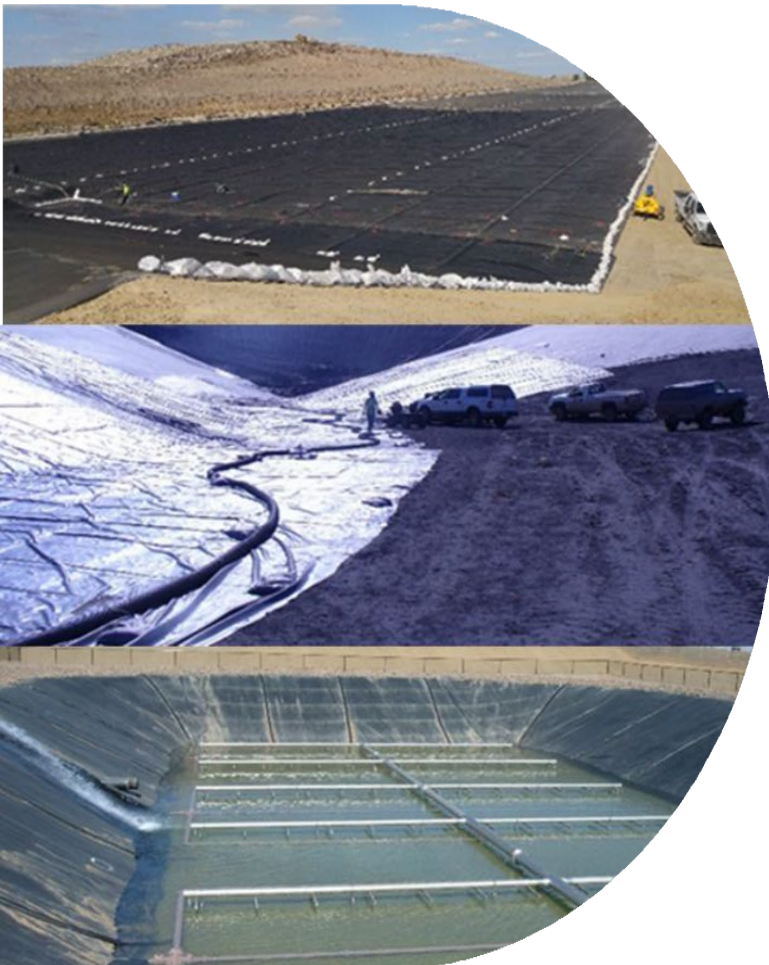
REINFORCED

RCPE/RPE

- Flexible; high puncture resistance with little elongation
- Used in various applications

RPP

- Flexible with moderate strength & durability
- Waste containment liners



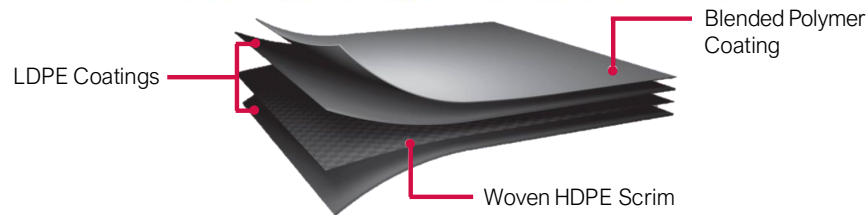
GEOMEMBRANE overview

WHAT IS AN RCPE GEOMEMBRANE?



Geosynthetic Institute

GRI Specifications, Guides and Practices



GM30 - Test Methods, Test Properties and Testing Frequency for Reinforced Composite Polyethylene (RCPE) Geomembranes

- [Complete Written Text](#)
- [Power Point Tutorial](#)

GM19b - Seam Strength and Related Properties of Thermally Bonded Reinforced Polyolefin Geomembranes/Barriers

- [Complete Written Text](#)
- [Power Point Tutorial](#)

<https://geosynthetic-institute.org/specs.htm>

3. Definitions

Reinforced Composite Polyethylene (RCPE) Geomembranes - In geosynthetics, these materials represent composite polymeric sheets that consist of a woven slit film geotextile coated with polyethylene on each side to achieve a lower permeability composite product. RCPE geomembranes may also include additional laminated polyethylene film layers to enhance hydrostatic and UV resistance, as well as seam welding. Materials that fall below 30 mils (0.75 mm) in thickness are defined as barriers, and not geomembranes.

Table 1 – Specification Values for Reinforced Composite Polyethylene (RCPE) Geomembranes

Property and Units ⁽¹⁾	ASTM or GRI Test Methods	Category 1 – Severe ⁽²⁾ (40 mil – nominal)	Category 2 – Moderate ⁽²⁾ (30 mil – nominal)	Testing Frequency
Thickness (mils) (min. ave.)	ASTM D751	36	27	per roll
Weight. (oz/yd ²) (min. ave.)	ASTM D751	18	16	per roll
Strip Tensile Strength ⁽³⁾ (lb/in) (min. ave.)	ASTM D7003	250	225	20,000 lb
Strip Tensile Elongation ⁽³⁾ (%) (min. ave.)	ASTM D7003	20	20	20,000 lb
Tongue Tear ⁽³⁾ (lb) (min. ave.)	ASTM D5884	50	45	20,000 lb
CBR Puncture (lb) (min. ave.)	ASTM D6241	1000	700	45,000 lb
Index Pin Puncture-Resistance (lb) (min. ave.)	ASTM D4833	200	180	45,000 lb
Hydrostatic Resistance (psi) (min. ave.) ⁽¹⁰⁾	ASTM D751	700	500	45,000 lb
Dimensional Stability (% change) (max. ave. of MD or X-MD) ⁽⁸⁾	ASTM D1204	3	3	45,000 lb
Water Vapor Transmission (WVT) (g/m ² -day) ⁽⁴⁾ (max. ave.)	ASTM E96	0.3	0.4	per each formulation
Oxidative Induction Time (OIT) High Pressure (min.) ⁽⁹⁾	ASTM D5885	400	400	per each formulation
UV Resistance (fluorescent light method) ⁽⁵⁾ (a) Strength and Elongation retained after 10,000 light hours ⁽⁶⁾ (b) High Pressure OIT (min. ave.) % retained after 1600 hours ⁽⁷⁾ ⁽⁹⁾	ASTM D7238 ASTM D7003 ASTM D5885	> 50% retained 50%	> 50% retained 50%	per each formulation

Table 3(a) - Seam Strength of Thermally Bonded Coated Polyethylene (cPE) Reinforced Barrier Seams Made According to GRI-GM30⁽²⁾

Property	Test Method	Min. Value	Min. Value	Min. Value
Sheet Thickness • nominal (mils)	D751	24	30	40
Hot Wedge/Air Seams ⁽¹⁾ • shear strength (lb) • peel strength (lb)	D7747	30 10	60 10	90 10
Other Seam Types • shear strength (lb) • peel strength (lb)	D7747	30 10	60 10	90 10

(1) Also for other possible seaming methods, e.g., ultrasonic

(2) Values are based on 1.0 in. (25 mm) wide strip tensile strength per D7747 for laboratory tested specimens

GEOMEMBRANE overview

INDUSTRY STANDARDS FOR RHINOSKIN® (WCPE) & RHINOMAT® (RCPE)

Geomembrane Description and MQC Compliance

- *GRI-GM30, Standard Specification for Test Methods, Test Properties and Testing Frequency for Reinforced Composite Polyethylene (RCPE) Geomembranes*
- *GRI-GM30b, Pending for Woven Coated Polyethylene (WCPE) Geomembranes*

Seam Strength & Non-Destructive Testing of Seams

- *ASTM D4437, Standard Practice for Nondestructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes*
- *ASTM D7747, Standard Test Method for Determining Integrity of Seams Produced Using Thermo-Fusion Methods for Reinforced Geomembranes by the Strip Tensile Method*
- *GRI-GM19b, Table 3a or 3b, Standard Specification for Seam Strength and Related Properties of Thermally Bonded Reinforced Polyolefin Geomembrane/Barriers*

Cold Weather Seaming Practices

- *GRI-GM9, Standard Practice for Cold Weather Seaming of Geomembranes*

GEOMEMBRANE overview

SUBGRADE CONDITIONS & USE OF GEOTEXTILES

Table 3 - Required Degree of Survivability as a Function of Site Conditions*

Subgrade Conditions	Low ground-pressure equipment ≤1 psi (7 kPa)	Medium ground-pressure equipment > 1 psi < 3 psi	Heavy ground-pressure equipment > 3psi (20 kPa)
Subgrade has been cleared of all obstacles. Surface is smooth and level so that any shallow depressions and humps do not exceed 10 mm in depth or height. All larger depressions are filled.	Moderate	Moderate	Severe
Subgrade has been cleared of obstacles larger than 20 mm in size. Depressions and humps should not exceed 20 mm in depth or height. Larger depressions should be filled.	Moderate	Severe	Not Recommended
Subgrade has been cleared of obstacles larger than 30 mm in size. Depressions and humps should not exceed 30 mm in depth or height. Larger depressions should be filled.	Severe	Not Recommended	Not Recommended

Consider using a geotextile for these subgrade conditions

EPA/600/R-93 - Section 3.3.4.1 suggests "...using small pneumatic tire lifting units with maximum tire inflation pressure of 6 lb/sq. in. (40 kPa) is acceptable directly on the geosynthetic during the deployment of the material. This in turn has resulted in allowing contractors to use ATV's or specially adapted construction equipment with low ground contact pressure during the installation process. The following provisions are also recommended in this regard; no sudden stops/starts, no tire spinning, only smooth and clean tires, 90° entrance and exits with protection apron, no excessive turning, no driving over wrinkles, one person per vehicle and no vehicles on slopes.

Geomembranes must be covered before receiving repeated vehicular traffic. A minimum cover soil thickness of 12 in. (300 mm) is recommended by the US EPA where the US Corps of Engineers requires 18 in. (450 mm). This cover soil must be free of stones greater than 0.6 in. (15 mm) in size. Placement of the cover soil over the geomembrane should progress up gradient. It is highly recommended that the geomembrane is protected against puncture from above or below by a geotextile or a GCL.

Reference: GRI-GM30

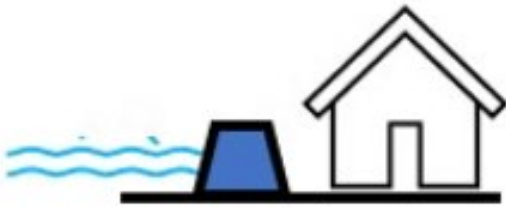
GEOMEMBRANE overview

AquaFuse Liner™ MAT Woven Composite Polyethylene (WCPE) 4 Layer liner	AquaFuse Liner™ SKIN Reinforced Composite Polyethylene (RCPE) 3 layer liner	EPDM Rubber liner 1 layer liner	HDPE Standard HDPE Liner 1 layer
✓ 3x stronger than EPDM/HDPE	✓ 3x stronger than EPDM/HDPE	✓ Very bendable & flexible	✓ Often no underlayment needed
✓ 1/3 the weight of EPDM/HDPE	✓ 1/3 the weight of EPDM/HDPE	✓ DIY seaming with primer & tape	✗ Heavy material, difficult to handle
✓ Custom sizing	✓ Custom sizing	✗ Heavy material, difficult to handle	✗ >500 m2 requires onsite welding
✓ A single-piece up to 6000 m2	✓ A single-piece up to 6000 m2	✗ >500 m2 requires onsite welding	✗ Fish safe, not drinking water safe
✓ Often no underlayment needed	✓ Often no underlayment needed	✗ Covered for best UV protection	✗ Stiffer than EPDM/RCPE
✓ Drinking water safe NSF-61	✓ Drinking water safe NSF-61	✗ Underlayment required	✗ Heat gun required for custom details
✓ Extra UV Protection	✗ Extra UV Protection	✗ Fish safe, not drinking water safe	
✗ Stiffer than EPDM	✗ Stiffer than EPDM	✗ Extra UV Protection	
✗ Heat gun required for custom details	✗ Heat gun required for custom details		

Key Characteristics to check when choosing liners: puncture resistance & tensile strength

PVC sheet are not compared as they are not recommended as geomembranes/liners

Solutions we provide.



Flood Protection



Water Storage



Evaporation control

AS Friis Ltd.