GEOfabrics®

Landfill Engineering

High-performance geosynthetics

About GEOfabrics

GEOfabrics Limited is a UK manufacturing company established in 1992. From the outset the objective was to manufacture high-performance geosynthetics to the highest possible standards and provide engineering support to ensure a value engineered solution to complex problems within landfill engineering and other civil applications.

The company's ethos is to exceed the expectations of the customer with our products and support services. Product development is achieved by analysing the customer's application, determining the properties that are required of it, manufacturing the solution and testing it to prove it meets those performance criteria. Today the company manufacturers a diverse portfolio of world class-leading geotextiles and geocomposites, supplied into a wide range of civil engineering applications.

GEOfabrics have over 20 years' experience in landfill engineering and offer geosynthetic solutions in many applications:

- Landfill Cap Drainage
- Landfill Cap Membrane Protection
- Gas Collection Below the Cap
- Leachate Management Within the Cell
- Landfill Basal Membrane Protection
- Leak Detection Systems

Landfill Waste Containment Systems

The design of an engineered waste containment system is considered a continuous project, including all operational activity, closure and aftercare. The selection of an appropriate geosynthetic should be considered during the planning and design stage and account for changes that are likely to occur over the whole life of the landfill.

There are a number of challenges that need to be considered by a landfill design engineer when proposing a geosynthetic solution within a landfill development. These include:

1. Establishing the required design life of the materials
2. Establishing the geotechnical design parameters such as vertical and lateral forces, the nature of point loads, shear stresses due to waste settlement and predicting temperatures, chemical and biological stresses
3. Forming an appropriate specification for the geosynthetic within the contract documents
4. Making decisions with regard to the type and frequency of the CQA

Geofabrics is able to offer comprehensive support to engineers and installers to ensure an effective value engineered solution is provided at all stages.

Protecting Basal Liners

When installed, a geomembrane should be protected against puncture, ultraviolet degradation, thermal and localised stress concentrations. These include indentations that lead to stress cracking. The most effective method of protecting a geomembrane has been proven to be a thick geotextile or geocomposite layer. GEOfabrics are market leaders in the manufacture and supply of high-performance geotextiles and geocomposites designed specifically for this application.

Cylinder Test (Environment Agency LFE:2/ BS EN 13719)

The selection of an appropriate geosynthetic protection layer is now made using the Cylinder Test. The Cylinder Test is recognised as the only method for determining the effectiveness of a material in protecting a geomembrane against the long-term effects of static point loads; it is designed to simulate the conditions expected in the base of a landfill.

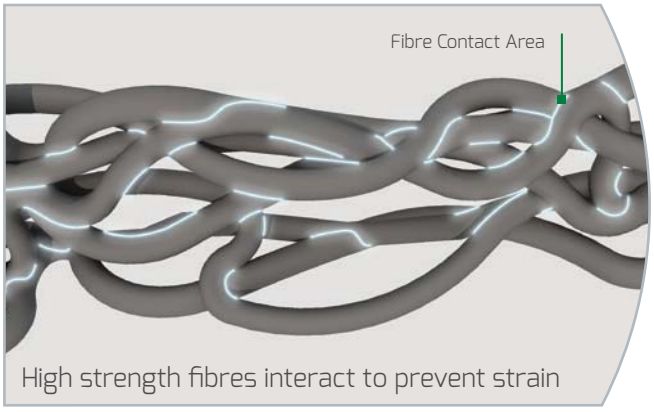
The load applied includes the dead load of the waste mass and any overburden pressure due to the depth of the waste and restoration materials. That is, (depth of waste x waste density x acceleration due to gravity) + (depth of restoration materials x density of restoration materials x acceleration due to gravity). It is known that the HDPE continues to deform under constant load and also at higher temperatures (plastic deformation), therefore a safety factor of 2.5 is incorporated into the test.

GEOfabrics laboratories have conducted thousands of Cylinder Tests and built up a vast library of knowledge over many years. Using this expertise, we are able to assist designers in finding the most effective value engineered solution to leachate management and membrane protection.

HPS Geotextiles

The mechanism by which geotextiles cushion point loads from individual stones is complex, with the geotextile being the top layer in a system that includes the geomembrane and mineral layer underlying the membrane. In addition, the influence of temperature and time (creep) must also be considered.

Protection efficiency can be correlated with strength and modulus, and it is a clear indication that mass does not correlate with an improvement in product performance. Specification that are based on the unit weight of a product are entirely inappropriate. When referring to geotextile protectors, the role of fibre interaction is central to performance.



High strength fibres interact to prevent strain

Benefits

HPS Geotextiles are manufactured using a unique matrix of high tenacity, high surface friction fibres entangled such that a stone receiving a lateral load is transferred to produce an evenly distributed load to the membrane.

- **Isotropic properties: strength in all directions**
- **UV stabilised – active carbon black**
- **100% virgin polymer fibres**

LFX: Basal Drainage and Protection

A Protexia LFX composite replaces half of the granular blanket with a multilayer factory manufactured geosynthetic that combines the drainage and membrane protection functions into one easy to install product.

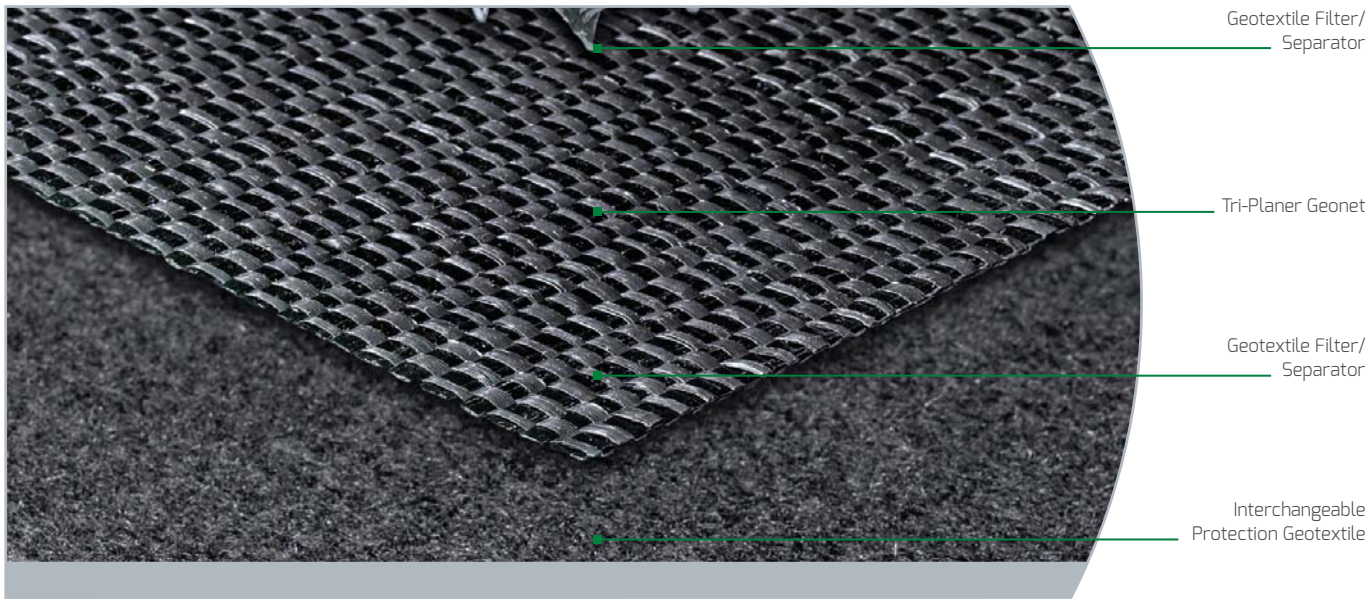
Modern landfill design requires a leachate drainage layer up to 500mm thick at the base of the cell. This fills hard-won void space with equally hard-won primary drainage aggregate. **GEOfabrics LFX** is a composite drainage layer to be used in conjunction with only half the depth of aggregate whilst maintaining the same leachate extraction performance.

LFX provides numerous benefits to landfill engineering:

- Reduces use of expensive and scarce primary aggregate
- Void saving to allow more efficient and productive use of space
- Reduced haulage of construction materials to site – **a single truck of LFX can replace up to 90 trucks of aggregate**

It also benefits the client and contractor:

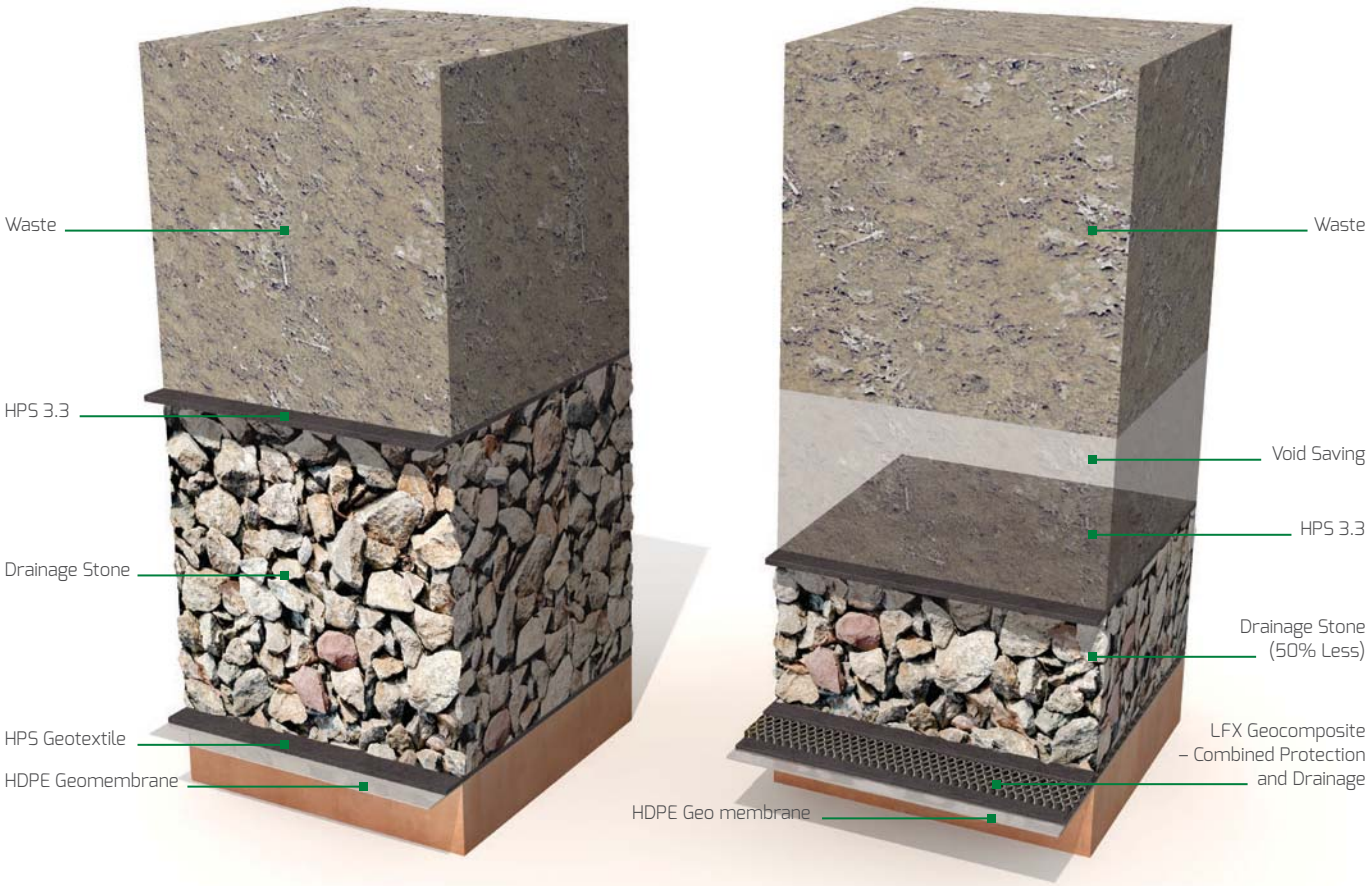
- Using the composite means much lower material, transport and installation costs
- The CQA inspection can be carried out in a factory environment
- The drainage core has a proven flow rate and has been tested up to 1000kPA allowing for use in the deepest landfills



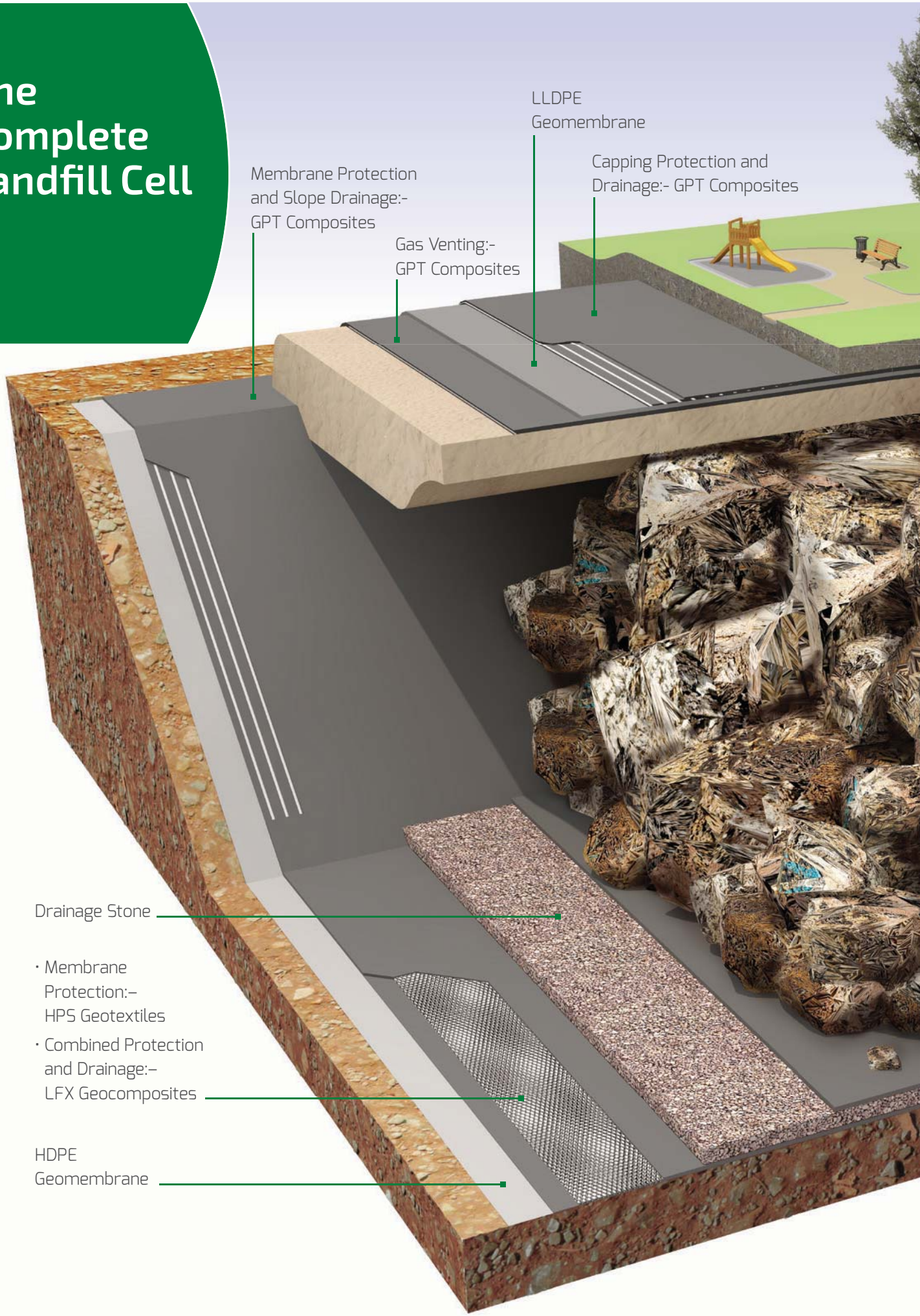
The **LFX** range of geocomposites is a highly researched and tested part of basal drainage within the landfill cell that has full quality assurance for each of the component parts. The lower component is an interchangeable protection geotextile whereby the protection performance can be engineered to meet the specific needs of an individual cell construction (i.e. the strength can be engineered to a specific depth and stone type)

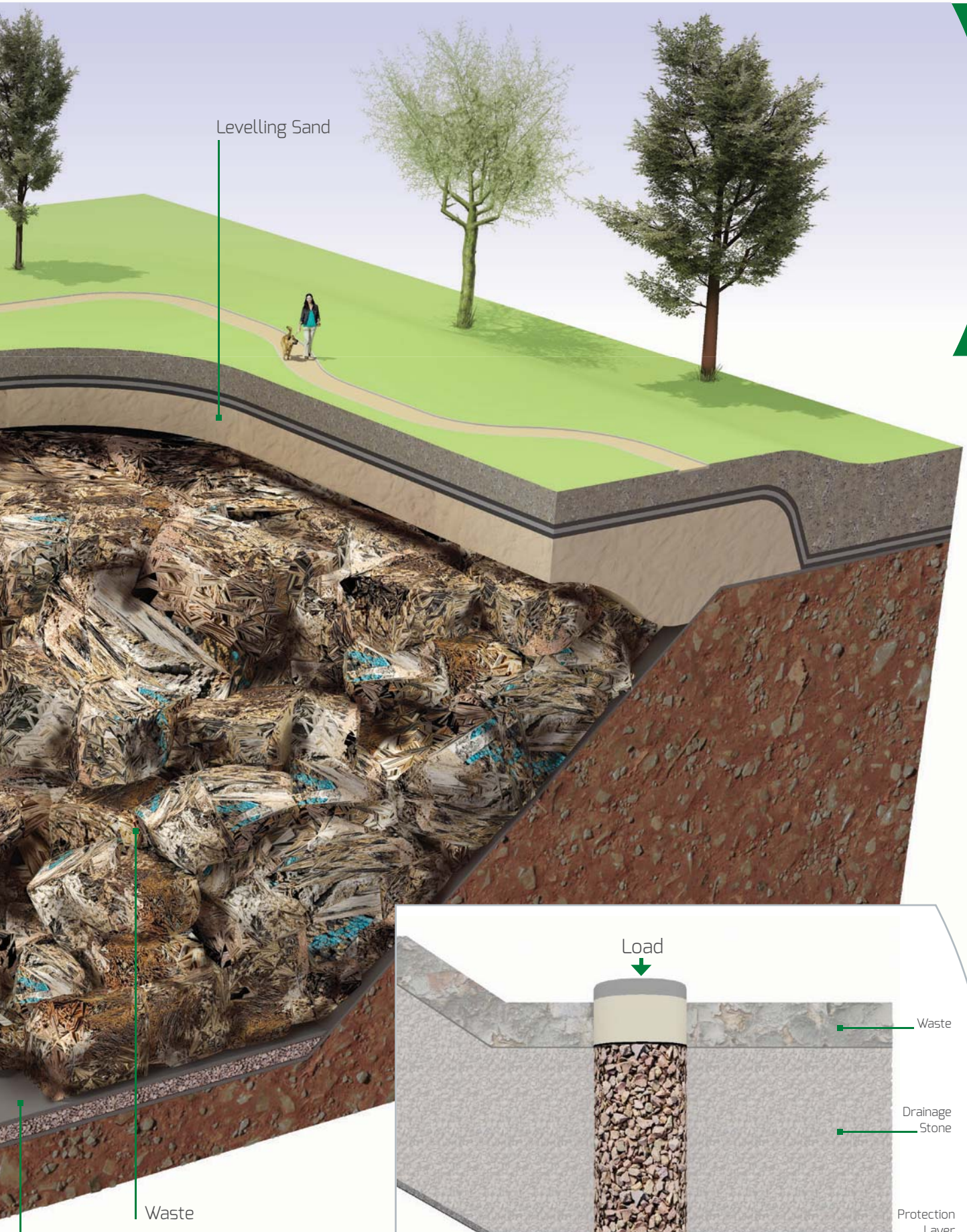
Proven Performance

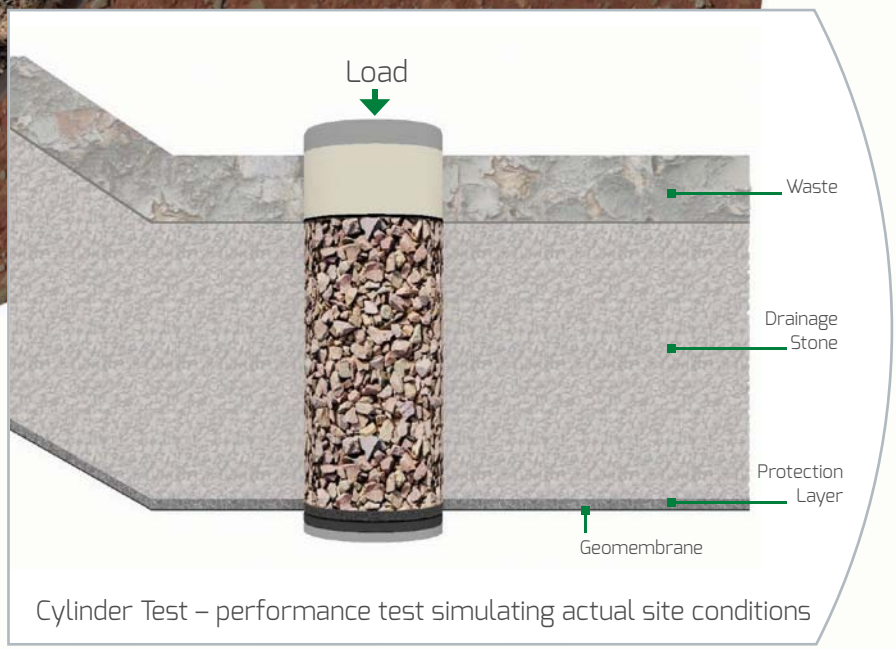
LFX has been in active use across the UK for over a decade and has been proven to provide an effective system for leachate management. The use of this system generates significant savings to landfill operators, working closely with the Environment Agency and leading designers, GEOfabrics has led the way in innovation in landfill engineering using geosynthetics.



The Complete Landfill Cell







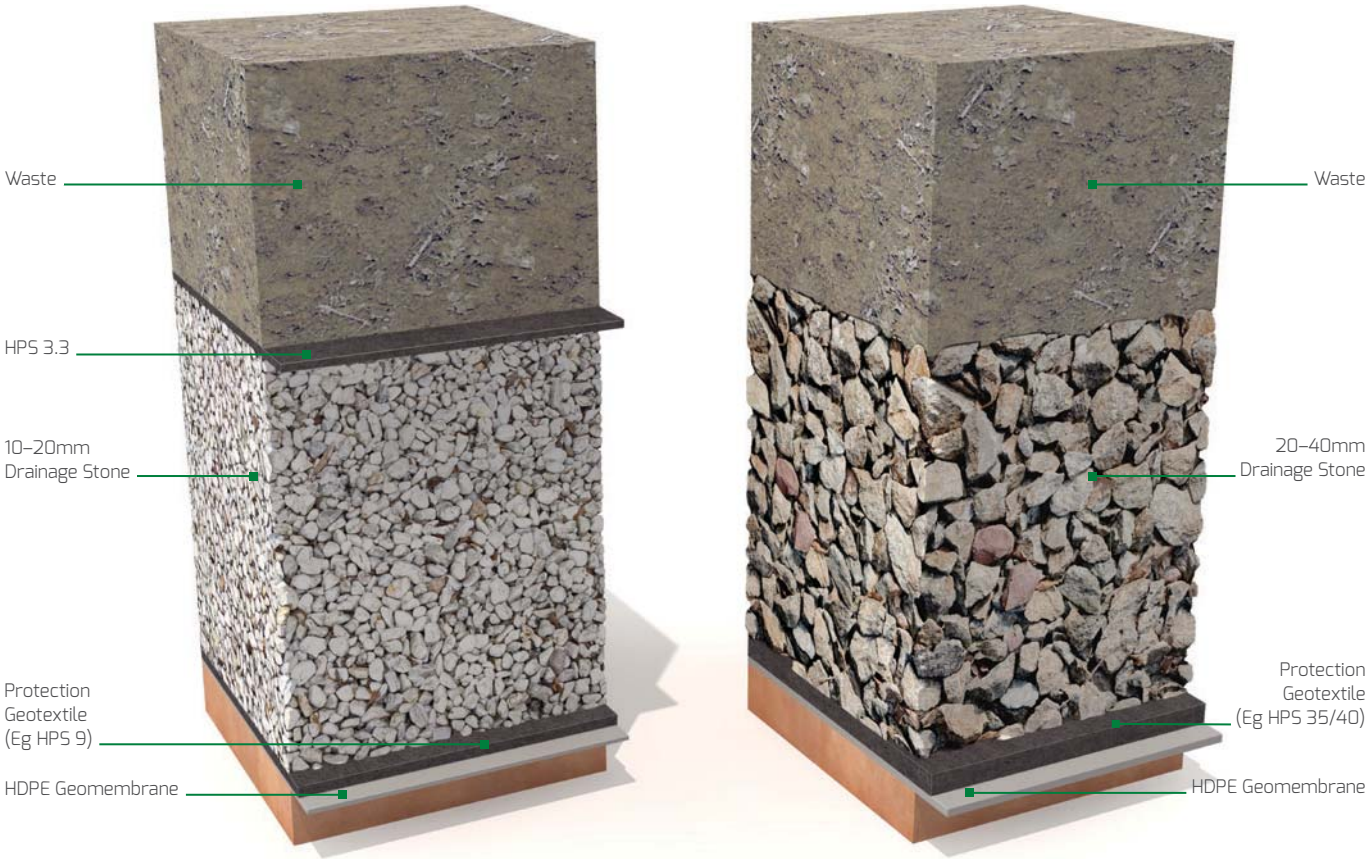
Cylinder Test – performance test simulating actual site conditions

Filtration Above the Drainage Blanket

In order to maintain effective management of the leachate it is important that the basal drainage layer remains free from clogging, it is for this reason that the Environment Agency favour a 20–40mm aggregate.

It is recognised that this is not always a cost effective and practical solution. A 10–20mm aggregate can be used together with a filter geotextile placed between the waste and the leachate drainage blanket as a more effective solution

GEOfabrics HPS 3.3 has been developed specifically to meet this need and complies with all Environment Agency requirements for this application.



Side Slope Drainage

The drainage system within the landfill cell is just as significant in the protection of the exterior environment as the liner system itself, the effective design and management of this is essential for the long-term stability of the waste body.

The main function of the drainage system is the removal of leachate from the waste body to be collected at defined points in order to avoid excessive pressure build up on the lining system.

GEOfabrics GPT range of drainage composites combines synthetic prefabricated strip drains with the protection function of **GEOfabrics HPS** geotextiles. The band drains, located at either 0.5m or 1.0m intervals, collect and convey leachate effectively from the waste body while the thick high strength geotextile ensures that the membrane remains protected through the entire design life.

The **GPT** range is manufactured entirely from 100% prime grade virgin polymer tested to all European durability standards. The use of virgin polymer means that a design engineer can be confident in the long-term durability of the materials and functionality throughout the entire design life of the landfill. The unique design of the composite means that the principal contact surface is the geotextile, therefore providing excellent interface shear resistance.

Final Cover Systems

Once a landfill cell has been filled with waste it needs to be capped with a final cover system that keeps out liquid infiltration and provides effective management of gasses and other volatiles.

The standard components within a final cover system are:

- An Erosion Control Layer (top soil)
- A Protection Layer
- A Drainage Layer
- A Barrier Layer
- A Gas Venting layer
- A Foundation Layer

Design practices vary from site to site and vary as a result of national regulation and local conditions. State-of-the-art design in landfill engineering has evolved from the use of natural soils to factory manufactured geosynthetics which allow for improvements in safety, reduced environmental impact and economic savings.

GEOfabrics offer geotextile and geocomposite solutions used in the following areas:

Protection

GEOfabrics HPS geotextiles can provide essential membrane protection and provide a durable trusted solution to designers.

Drainage

Combined protection and drainage can be achieved using **GEOfabrics GPT composites**, manufactured from 100% prime grade virgin polymer offering proven durability.

Gas Venting

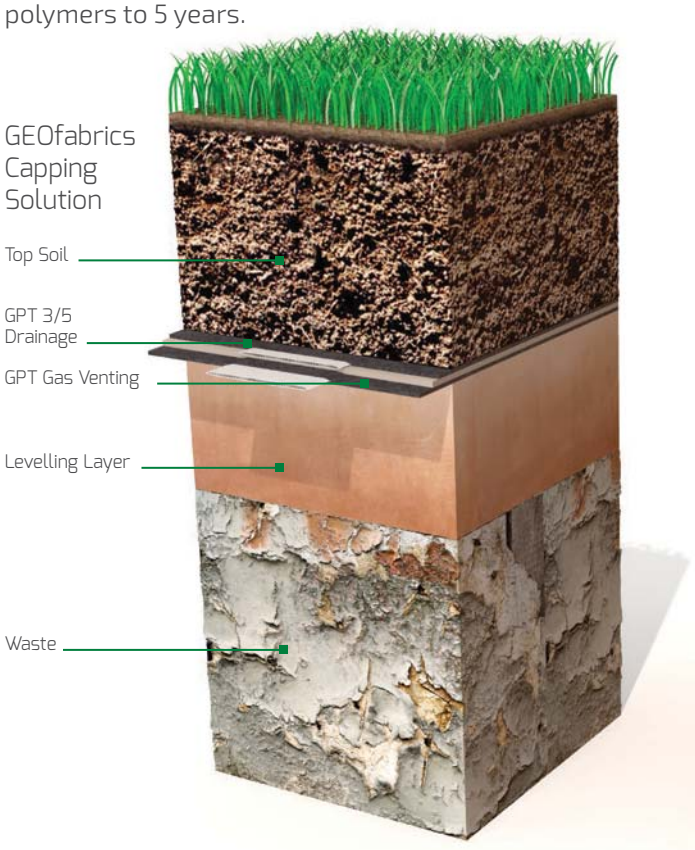
GEOfabrics GPT can be installed below a capping membrane to provide an effective pathway for control and extraction of landfill gasses.

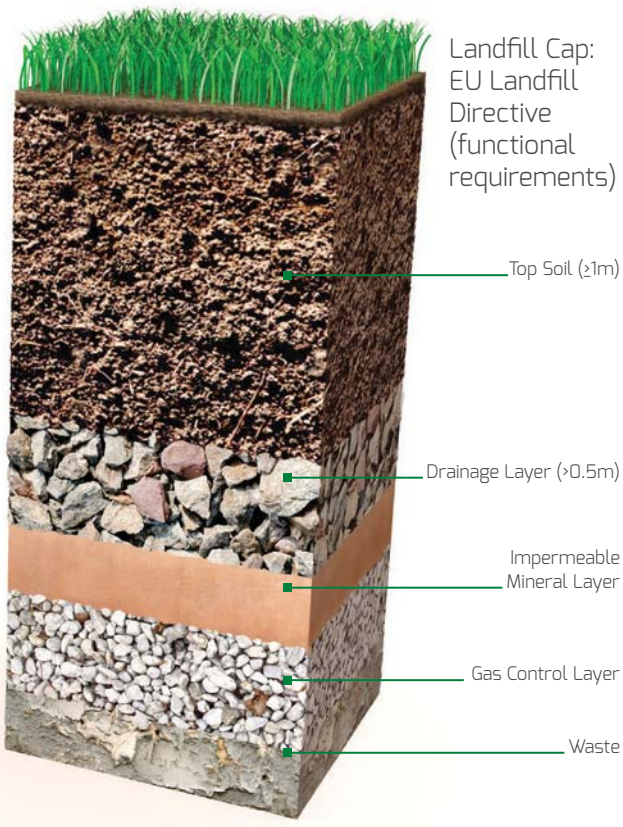
GPT Composites

GPT composites have been designed to provide a combination of membrane protection and drainage, offering a robust passage for both liquids and gasses. Manufactured from **GEOfabrics HPS geotextiles**, with proven performance in the protection of geomembranes and synthetic prefabricated strip drains at 0.5 or 1m. The strip drains are manufactured from 100% prime grade virgin polypropylene with run channels along the whole length on both the upper and lower surface. The drainage core is surrounded by a strong durable filter that combines high permeability with an excellent impassable soil barrier **(only 100% virgin polymer is a guarantee of product durability)**. EN standards for drainage composites limit products containing post-consumer and post-industrial polymers to 5 years.

Benefits

- Guaranteed drainage performance – even with large deformation and soil pressure
- Drains function effectively at great depths >45m
- Excellent durability – guaranteed as 100% prime grade virgin polymer
- Meets all Environment Agency requirements for drainage composites
- Tested to 100 years durability to all EN standards
- Manufactured from **HPS Geotextiles** with proven performance in membrane protection
- Excellent interface friction properties



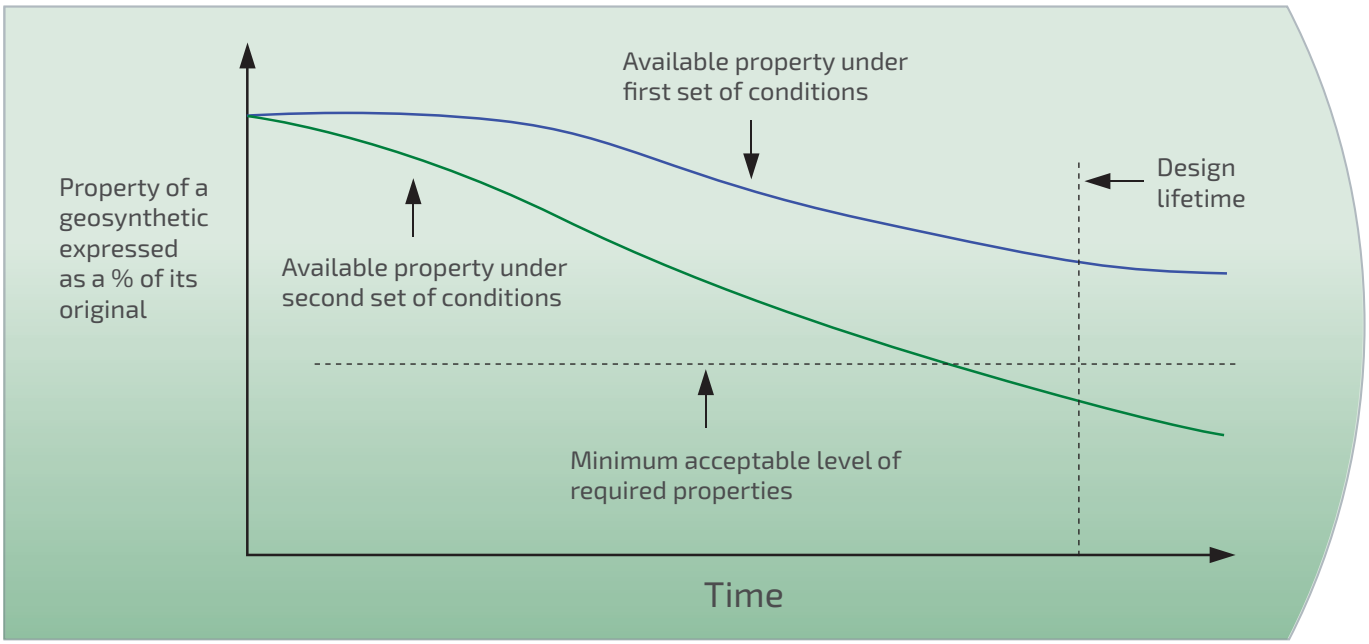


100% Guaranteed Durability

Selecting the correct high quality materials when producing a geosynthetics for landfill construction is critical. It is essential that a geosynthetic performs effectively for the required duration of the design and not just in initial conformance testing on physical characteristics; in regards to landfill this may be in excess of 100 years. In the case of most geosynthetics, the ingredient of paramount importance is the polymer, this will determine to a great extent the quality of the finished material and its suitability for the long-term.

There are a number of factors that will help to determine the durability of a geosynthetic; the physical structure of the material, the nature of the polymer used, the quality and consistency of the manufacturing process, the physical and chemical environment in which the product is placed, the condition in which the product is stored and installed and the different loads that are supported by it.

GEOfabrics HPS, LFX and **GPT** ranges are all manufactured from 100% virgin polymer (PP & HDPE) which have a high resistance to acids, alkalis and most solvents. Both polymers can be considered inert to acid and alkali attack and are suitable for most geotechnical applications.



Available and required properties as a function of time under two different sets of conditions.

Guaranteed as Virgin?

It is possible to manufacture geosynthetics from recycled polymer, both post-consumer and post-industrial. This is a much cheaper option for manufacturers, and for some low-risk short-term applications this is suitable. However, the use of this type of polymer makes it impossible to conduct an accurate assessment of a products durability, essential in landfill engineering.

Before assessing if a geosynthetic is fit for purpose ask:

Is it guaranteed as virgin polymer?

Limited Lifetime:

Limited by EN 13257: 2014:

Geotextiles and geotextile related products for use in Solid Waste disposals. Products which contain PCM (Post Consumer Material) or PIM (Post Industrial Material) are limited to a 5-year durability under new standards for the CE marking of geosynthetics.

Limited by Environment Agency Guidelines:

Using drainage geocomposites in landfill engineering: 'Geocomposites made from post consumer or post-industrial recycled materials should not be used'.

GEOfabrics®

Guarantee of Quality

GEOFabrics HPS Geotextiles

- UV protected
- ***Guaranteed as 100% virgin polymer –*** **100 years durability**

GEOfabrics LFX Geocomposite

- UV protected
- ***Guaranteed as 100% virgin polymer –*** **100 years durability**

GEOfabrics GPT Geocomposite

- UV protected
- ***Guaranteed as 100% virgin polymer –*** **100 years durability**

Only 100% virgin polymer can provide effective durability assessment!

Ask if it is!

Not all geosynthetics are equivalent!

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