



Rely on it.

Waterproofing cover for waste disposal

RENOLIT ALKORGEO

Environmental
structures



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Geomembrane recommended

RENOLIT Group manufactures and markets a complete range of PVC-P, PE or PP geomembranes in response to a wide variety of applications. Experience has shown that the PVC-P geomembrane is the most suitable for waterproofing of landfill cover due to its excellent deformability, which allows it to adapt to all forms of support even with settlements; it has good puncture resistance, weldability, chemical resistance and durability: RENOLIT ALKORPLAN 35053.

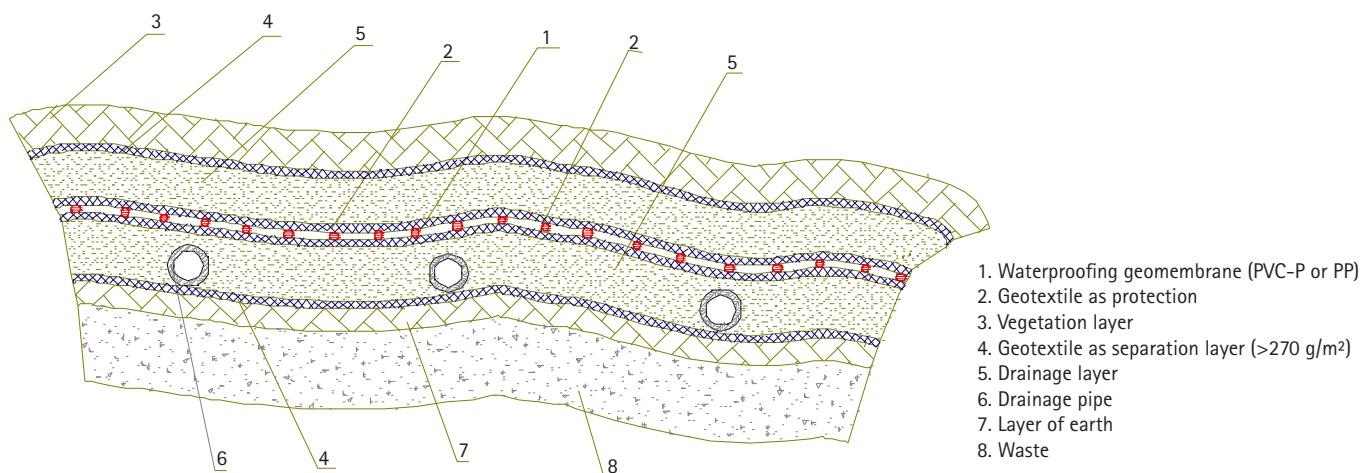
If necessary, this geomembrane can be laminated with a geotextile in polyester or polypropylene (up to 700 g/m²) and receive a reinforcement grid made of polyester or glass.

Installation of lining

Conception of the Waterproofing System

Once the waste disposal is fully loaded it should be slightly compacted to avoid important settlements. Settlements will always occur as waste often changes its form of state through rotting.

In the case of important settlements the waterproofing system has enough reserve to follow these settlements.



1. Waterproofing geomembrane (PVC-P or PP)
2. Geotextile as protection
3. Vegetation layer
4. Geotextile as separation layer (>270 g/m²)
5. Drainage layer
6. Drainage pipe
7. Layer of earth
8. Waste

System for a cover of a waste disposal

Separation Layer

To avoid that granulates of the drainage layer are mixed with the earth cover, both layers have to be separated with a geotextile with a minimum weight of 300 g/m². Waste produces gas (Methane) which has to be evacuated through pipes to the surface; the risk of inflammation of the gas, due to raising temperature, in the disposal is an important point to keep in mind.

This gas can be used to cover the necessary power needed to run the waste disposal.

Gas drainage (lower drainage layer)

The drainage layer should be reinforced with a system of tubes, guiding the gas to the final exit pipes.

Geotextile as protection

Depending on the size of granulates of the drainage layer for gas the weight of the geotextile has to be determined. The task of it is to protect the geomembrane against puncturing.

Geomembrane

Suitable are geomembranes of PVC-P and PP as their mechanical properties with high flexibility and elongation guaranties an adaption to the surface and its settlements.

Recommended thickness of geomembrane: minimum 2,0 mm.



Earth cover

To ensure a good ground layer for the waterproofing system, it has to be covered with earth or similar to create the necessary geometry.

Geotextile as protection

A protective geotextile is placed between the geomembrane and the upper drainage layer to protect it from perforation. Weight of this geotextile depends on granulometry of the drainage layer.

Upper Drainage layer

The upper drainage layer evacuates the rainwater to the drainage pipes positioned on the lowest points of the lining system.

Separation layer

This layer on top of the drainage layer avoids the penetration of earth coming from the vegetation layer.

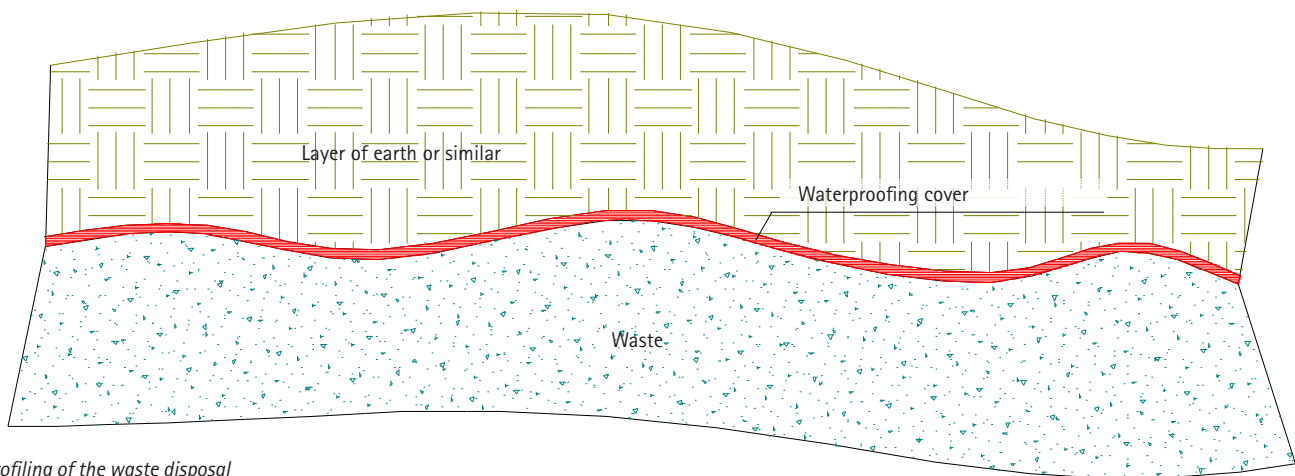
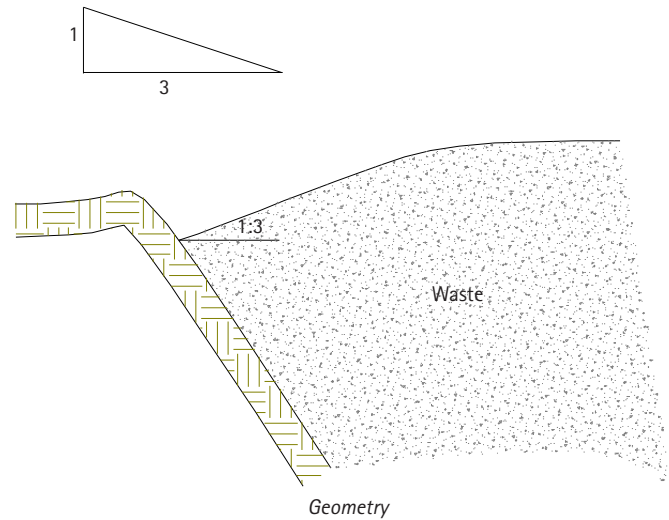
Vegetation layer

Installation

When the waste disposal is completely loaded the waste will be distributed to achieve a regular surface in order to have a balanced thickness of earth over the whole cover.

Geometry

To ensure the stability of the slope and to be able to install the upper drainage and vegetation layer on top of the waterproofing system with machines it is necessary to respect certain geometry.



Profiling of the waste disposal



Placing of the upper drainage layer



Geometry of cover of waste

Installation of separation layer

The geotextile will be unrolled and placed into position with a sufficient overlap to absorb the possible settlements of the support : minimum 70 cm.

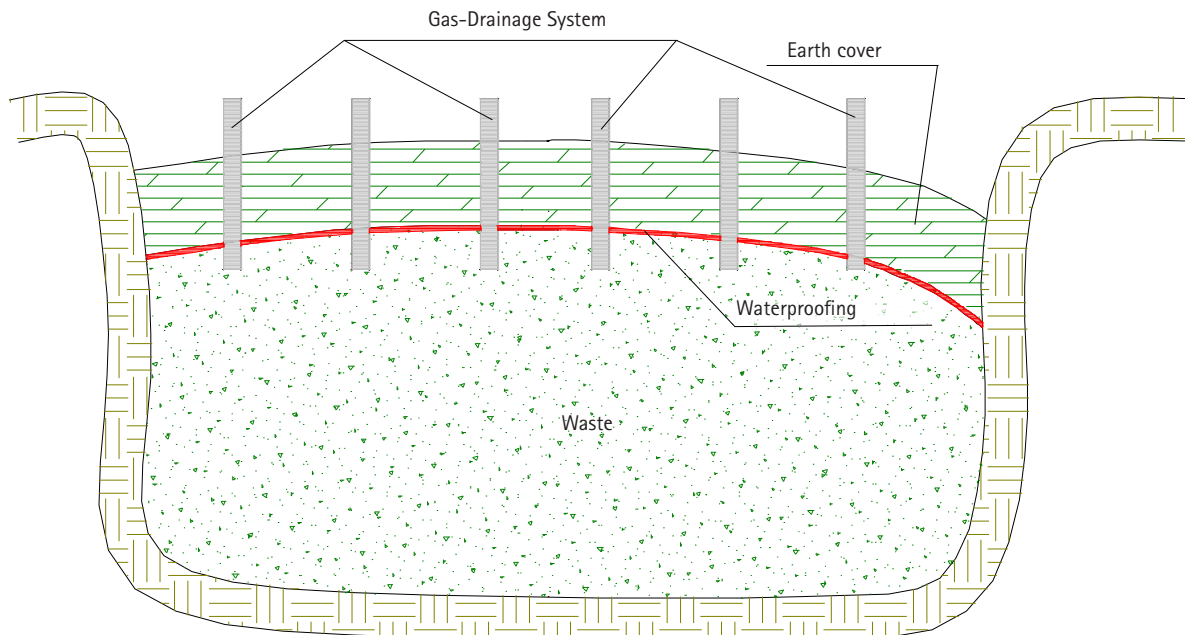
In case of risk of a serious settlement an additional overlap of material will be needed.

No engine may drive on the geotextile!!

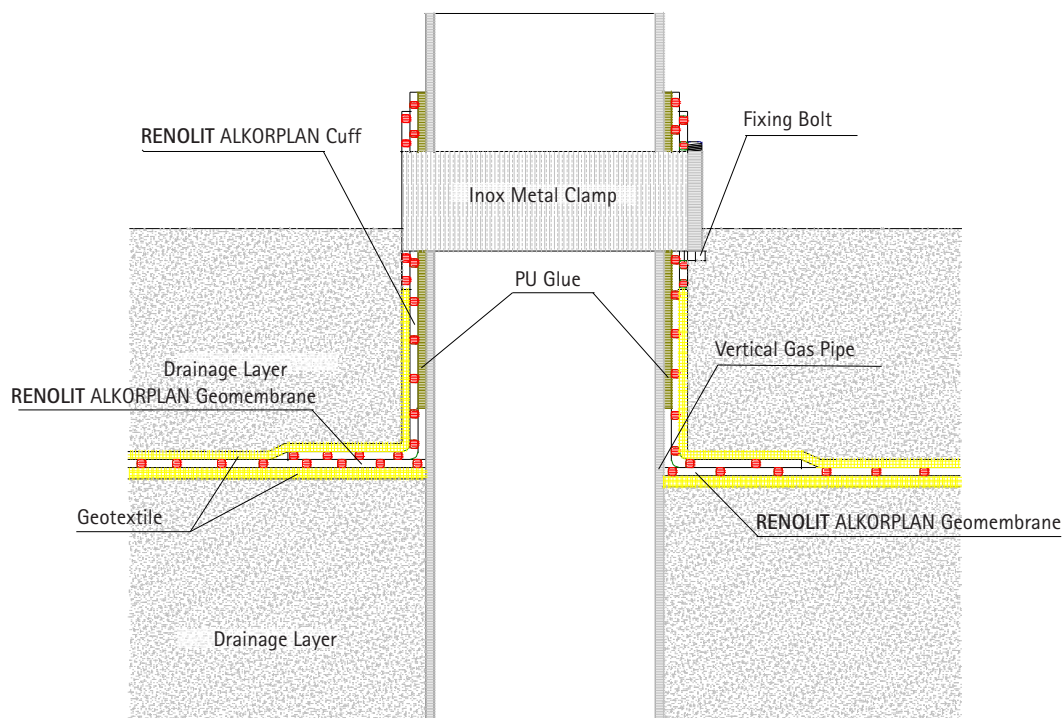
Lower Drainage layer for gas and drainage pipes

The content of water in the material (gravel) must allow for a good distribution of itself. If the material is too wet, it will be difficult to drive on it, also a slight compaction of the material will be very difficult.

After having placed the material, the surface has to be inspected; big stones have to be removed.



System for the evacuation of gas



Connection of geomembrane to vertical gas pipe

Installation of protection layer against puncturing

Depending on the quality of the drainage layers (both lower and upper) the weight of the anti-puncturing geotextile has to be determined.

Installation of the geomembrane

The geomembrane can be installed roll by roll or with prefabricated pieces (etc. 5 rolls of membrane welded together outside of the site). In this case a lifting device is necessary (crane or excavator) in order to be able to place the prefabricated pieces of the membrane. Welding made outside of the site has to be executed with an automatic welding machine (double seam) and carefully controlled (air pressure or similar).

Placing of waterproofing system

Before installing the geomembrane the ground has to be carefully checked. No stones or debris should stay on the protective geotextile which protects the geomembrane against puncturing from the load of earth on top of it.

Precautions have to be taken against the influence of wind, when the membrane is unrolled (by placing sandbags or old tires for example on top of the membrane).

Welding of geomembrane

The quality of welding depends on following parameters:

- Cleanness of the welding area (cleaning with a dry and clean cloth)
- Good adjusting of the machine (temperature, speed and pressure)
- Qualification of personnel.



Welding of the geomembrane

The used machines are hot wedge or hot air machines. This type of machine is suitable for all kinds of materials (PVC-P, PP, PE). Hand welding for the execution of details, connections at the end of panels, based on hot air can only be applied with PVC-P and PP. Extrusion welding is the common technique for the execution of details for PE geomembranes.

Control of double seams

Double seams are controlled through air pressure. The air canal has to be closed on both sides of the testing distance. A testing needle (e.g. type Leister) is introduced into the testing channel. The needle has a conical form to avoid the evacuation of the air under pressure. During the testing time the needle may not be removed or manipulated. The applied testing pressure depends on the thickness of the geomembrane and the outside temperature. The testing has to be carried out one hour after execution of the welding. The applied pressure may decrease more than 20 % for PVC-P (depending on the temperature of the geomembrane).

Control of simple seam

In case of a single seam, a steel pipe connected to a compressor with a diameter of 3 to 4 mm is drawn along the seam under an air pressure of 4 to 5 bar. This kind of testing is only suitable for flexible geomembranes not for PE. Leakages are immediately detected through the developing air bubble due to the applied air pressure.

Anchoring of the waterproofing system.

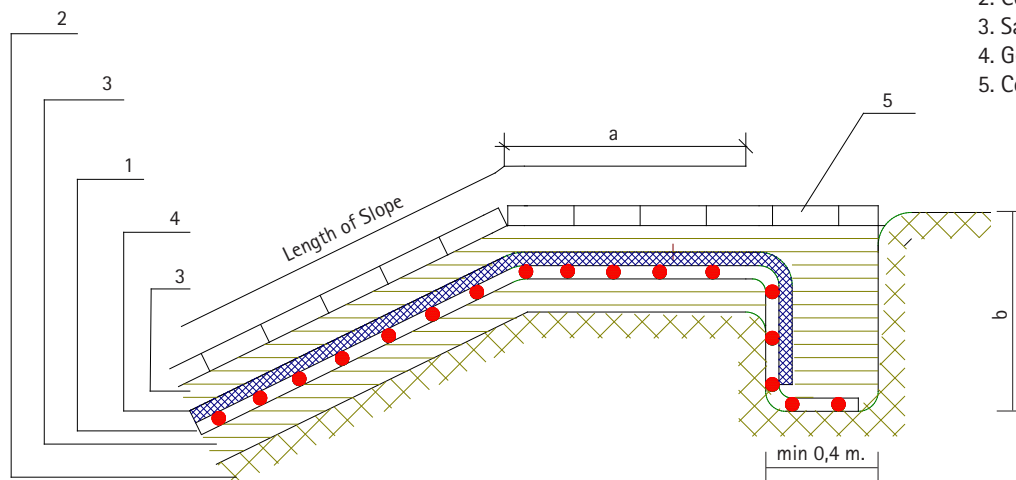
The membrane is placed in an excavated anchor ditch 0.6 m x 0.6 m. The lining system has to be placed into this ditch without tension and filled with small-granulated material. (Clay or similar material is very good, as it only has little permeability).

Connection to concrete structures

Depending on the construction of the waste disposal it might be necessary to connect the waterproofing system to concrete structures. Water may not enter the waste disposal through these fixed structures.

Danger: Concrete structures do not settle, and sometimes only on a small dimension compared to waste. If the lining system has to be fixed to the concrete structure, the lining system could break due to these waste settlements.

Length of Slope	a	b
< 10 m	> 0,5 m	> 0,5 m
10 - 40 m	> 0,8 m	> 0,6 m
> 40 m	> 1,0 m	> 0,8 m

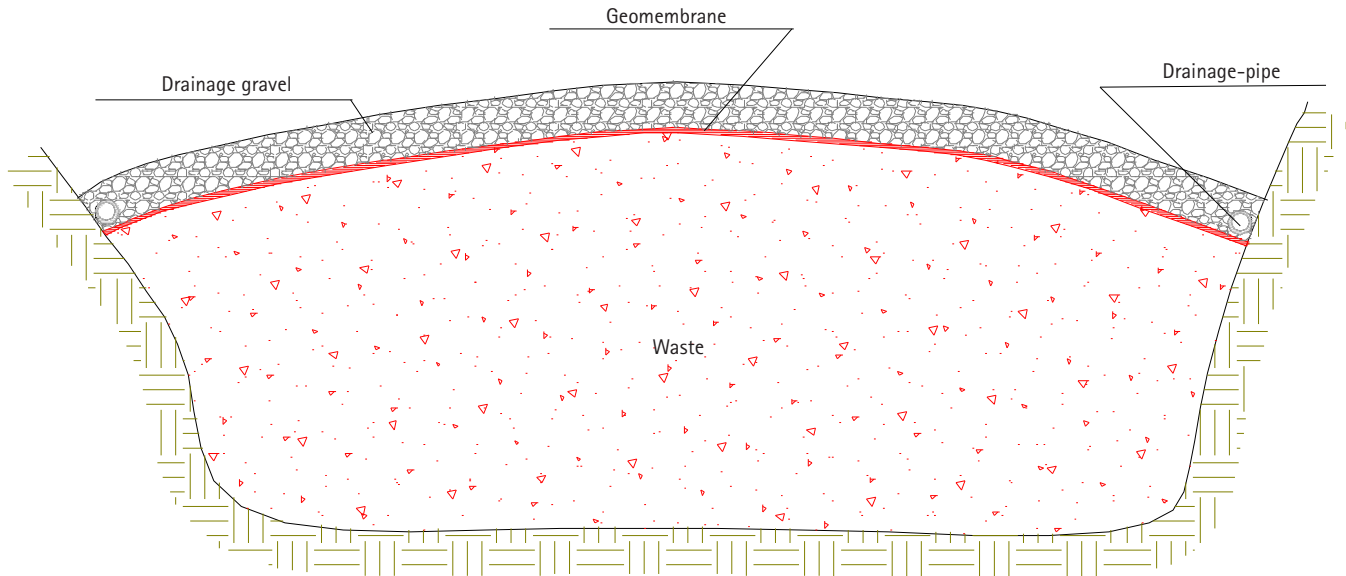


Dimension of Anchor Ditch (Principal Drawing)

1. Geomembrane RENOLIT ALKORPLAN
2. Compacted Subsoil
3. Sand as Protection Layer
4. Geotextile
5. Concrete Slabs

Protection layer for the Waterproofing and upper drainage of waste cover

Rainwater has to be evacuated through a drainage system consisting of drainage pipes – positioned at the deepest point of the cover – and gravel.



Profile of waste disposal

The pipes placed in the upper drainage layer (gravel, sand) are partly perforated in order for water to evacuate. To prevent the holes of the drainage pipes become clogged with the material of the drainage layer, they have to be protected by a geotextile (very important). The pipes have to lie on a slightly continuous slope. In case a drainage layer of sand is applied (diameter <5 mm) the protection layer may not be necessary. Permeability of sand: >10⁻⁴ m/sec.



Protection layer with drainage gravel

Separation and vegetation layer

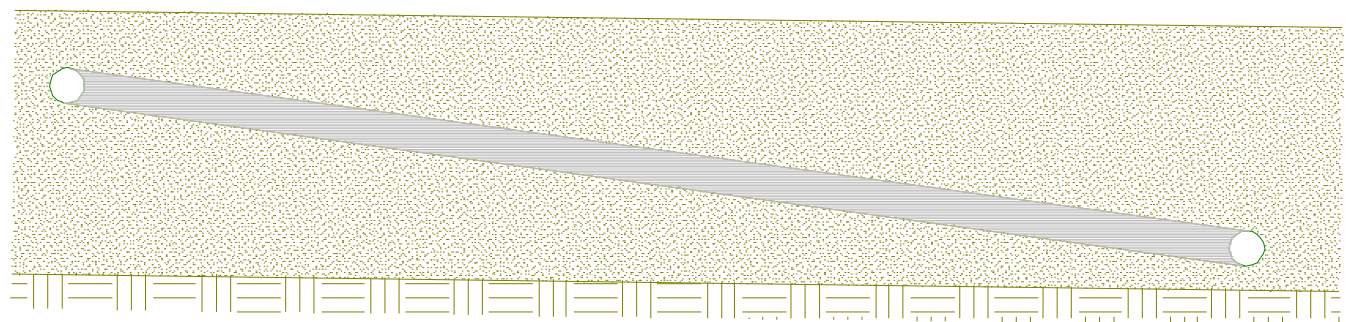
To avoid the vegetation layer contaminating the drainage layer a separation layer has to be placed in between. The earth should not have big debris, should possess sufficient mechanical characteristics to be stable on the slopes and should allow for a good growth for the foreseen plants.

Conclusion

Cover systems for waste disposals are indispensable in our world. They have a very important task to fulfill and must be carefully designed.

The choice of material as waterproofing is crucial. The geomembrane has to be flexible due to the important settlements of the waste. The waterproofing system for the bottom is laid on a very well compacted surface; therefore materials of PEHD are suitable for a secure lining of the waste disposal.

This kind of material has a very high resistance to chemical influences. On the other side it is sensitive to mechanical influences like elongation and punctual attack. This is the reason why other materials like PVC-P, due to its excellent mechanical characteristics, but also PP could be used for cover systems of waste disposals.



Good Position of drainage pipes



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