BECO
BERMÜLLER

SYSTEM SOLUTIONS
Product range

beco-bermueller.com

KEY ADVANTAGES
at a glance

Technical consulting

Our technical service provides detailed advice and develops project-specific proposals. This includes, for example, the dimensioning of structures based on the selected system solution, proof of stability, and the dimensioning of geotextile filters etc.

Complete package

On request, we can lay our products for you on site and provide further services related to our system solutions.

Sustainability

Construction methods that ensure a service life of up to 120 years. Ecological construction methods with significant CO_2 savings compared to conventional methods.

Please also request our detailed product documentation.

SYSTEM SOLUTIONS
Product range

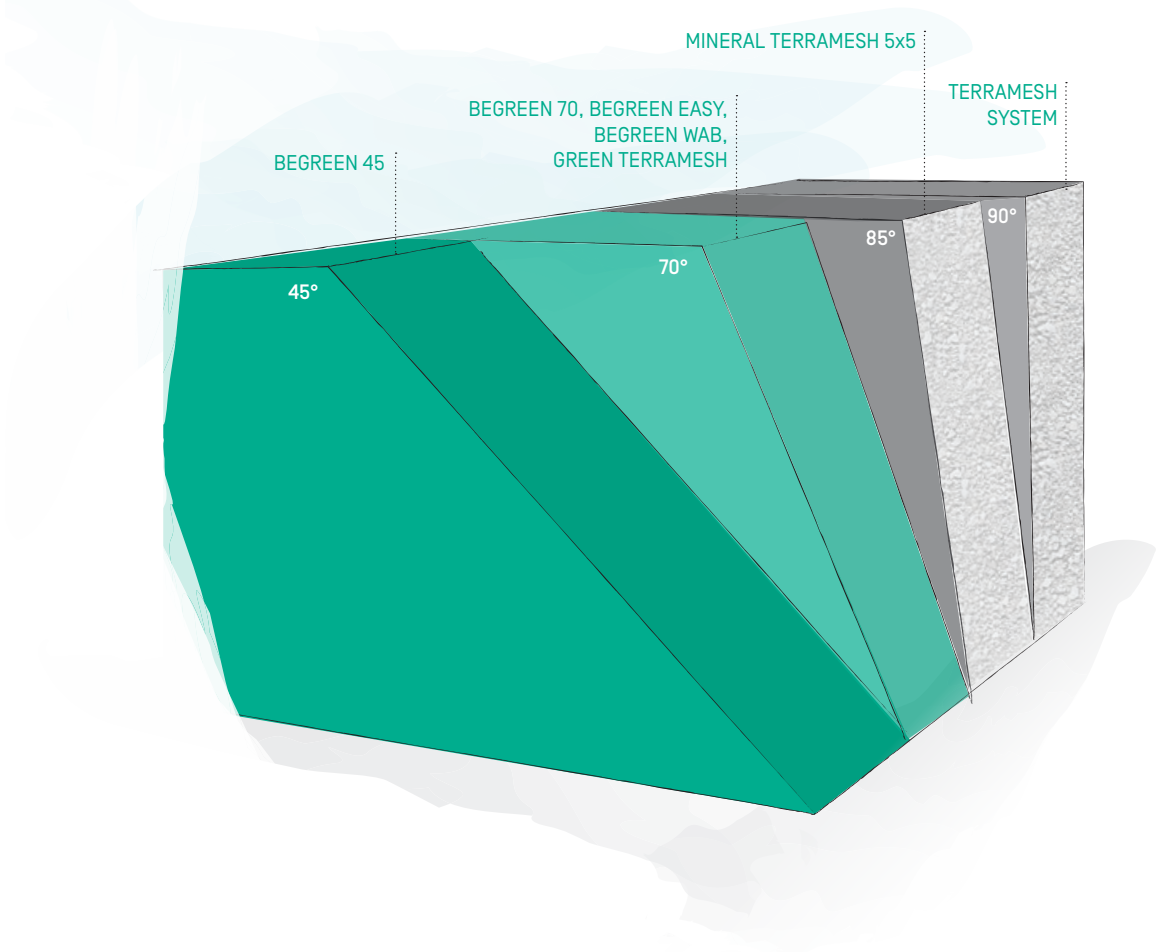
More exacting noise-protection standards and increased land requirements for infrastructure and other developments have become key factors in civil engineering design, particularly in urban areas. Space-saving solutions must therefore be found for steep embankments, wall structures and noise barriers.

As specialists in geosynthetics, we offer a comprehensive range of products and associated services from consultancy during the planning and detailed design phases through to installation and support throughout the construction phase.

SYSTEM SOLUTIONS
at a glance

The construction of embankments, walls and noise barriers requires cost-effective and ecological construction methods and system solutions. The requirements are so complex and the possibilities so multifaceted that it is often difficult for design engineers to find a suitable solution. Our Applications Engineering department can help you here.

Instead of simply supplying specific products, we offer you a system solution that is tailored to your construction task and provide a comprehensive service including consulting, planning, dimensioning and installation as well as support during the construction phase.



The following system solutions cover the widest spectrum of applications, from regular slopes to the maximum system inclination (90°).

BEGREEN 45

geogrids laid in layers – with or without fold-over – with an erosion protection mat to protect the front surface. **For inclinations up to 45°** → Page 06

BEGREEN 70

rear-anchored steep slope system that is suitable for planting and is made up of individual components. Flexible geogrids made of polyester (PET) and dimensioned to suit the specific project are used as the reinforcement material. The system is installed using the fold-over principle. The front slope is formed by a structural steel or galvanised gabion mat and an erosion protection mat. **For inclinations up to 70°** → Page 08

BEGREEN EASY

rear-anchored, **pre-assembled** steep slope system, suitable for planting. Geogrids made of polyester (PET) are usually used as the reinforcement material. The system is installed using the fold-over principle. The front slope is formed by a steel gabion mat and an erosion protection product. **For inclinations up to 70°** → Page 10

BEGREEN WAB

rear-anchored, **pre-assembled** steep slope system, suitable for planting. Geogrids made of polyester (PET) are used as the reinforcement material. The system is installed using the fold-over principle. The front slope is formed by a honeycomb grass grid used as permanent formwork that also protects against erosion. **For inclinations up to 70°** → Page 12

GREEN TERRAMESH

rear-anchored, **pre-assembled** steep slope system, suitable for planting. A steel wire mesh with duplex protection is used as the reinforcement material. The system is installed using the fold-over principle. The front slope is formed by a structural steel mat. **For inclinations up to 70°** → Page 15

MINERAL TERRAMESH 5x5

rear-anchored, **pre-assembled** steep slope system, suitable for planting. A steel wire mesh with duplex protection is used as the reinforcement material. The system is installed using the fold-over principle. The front slope is formed by a galvanised steel gabion mat. **For inclinations up to 85°** → Page 16

TERRAMESH SYSTEM

rear-anchored gabions: Here, the steel wire mesh forms the rear-anchored tail, base, front face and lid of the gabions. **For inclinations up to 90°** → Page 17

BEGREEN 45

Embankment protection system

– Individual components
– Suitable for planting
– Inclinations of up to 45°

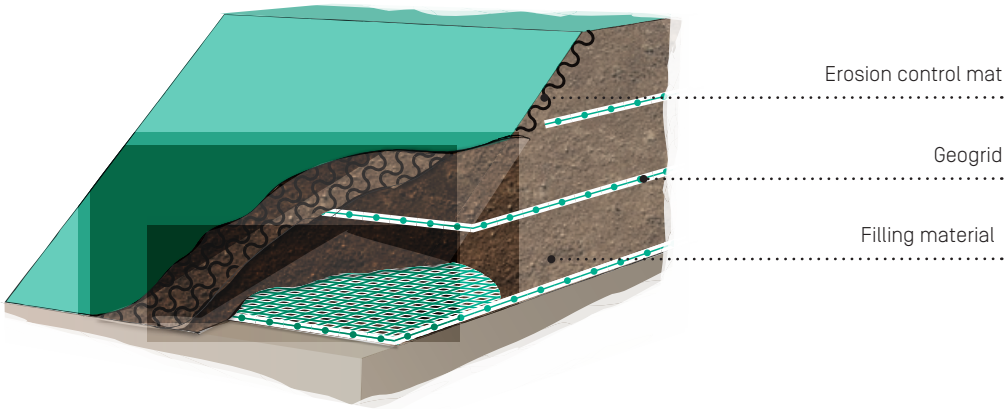
BEGREEN 45 is an embankment protection system for inclinations of up to 45°. The system is based on laying layers of soil and geogrids alternately, whereby the geogrid acts as a structural reinforcement element.

Based on the project requirements and the quality of the available soil, a structural analysis is carried out to determine the necessary qualities of the geogrid, its anchor length and the thickness of the layers.

The soil quality and load transfer are the most important considerations when deciding whether the structure needs to be installed using the envelope method or not.

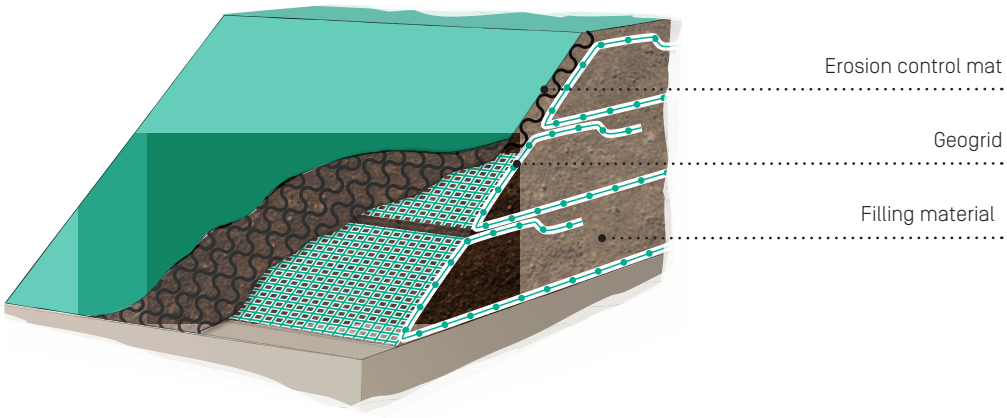
BEGREEN 45 without envelope

This version is used where the structural analysis shows that simply laying the geogrid and soil layers alternately is sufficient, with no enveloping of the soil. The front face of the embankment is then covered with an erosion control mat to prevent the soil from trickling out or being washed out.



BEGREEN 45 with envelope

With the envelope method, the geogrid is wrapped around at the front of the embankment to form a defined envelope that encloses the soil layer being reinforced. Temporary formwork is usually used on site to construct the envelope. This ensures that the inclination and the layer spacing of the structure comply with the structural specifications. The front of the embankment is covered with an erosion control mat.



Top: The slope after installation, compaction and screeding off, but before the erosion control mat has been laid. Bottom: Laid using the fold-over method: rear-anchoring of the geogrid.

BEGREEN 70

Steep slope system

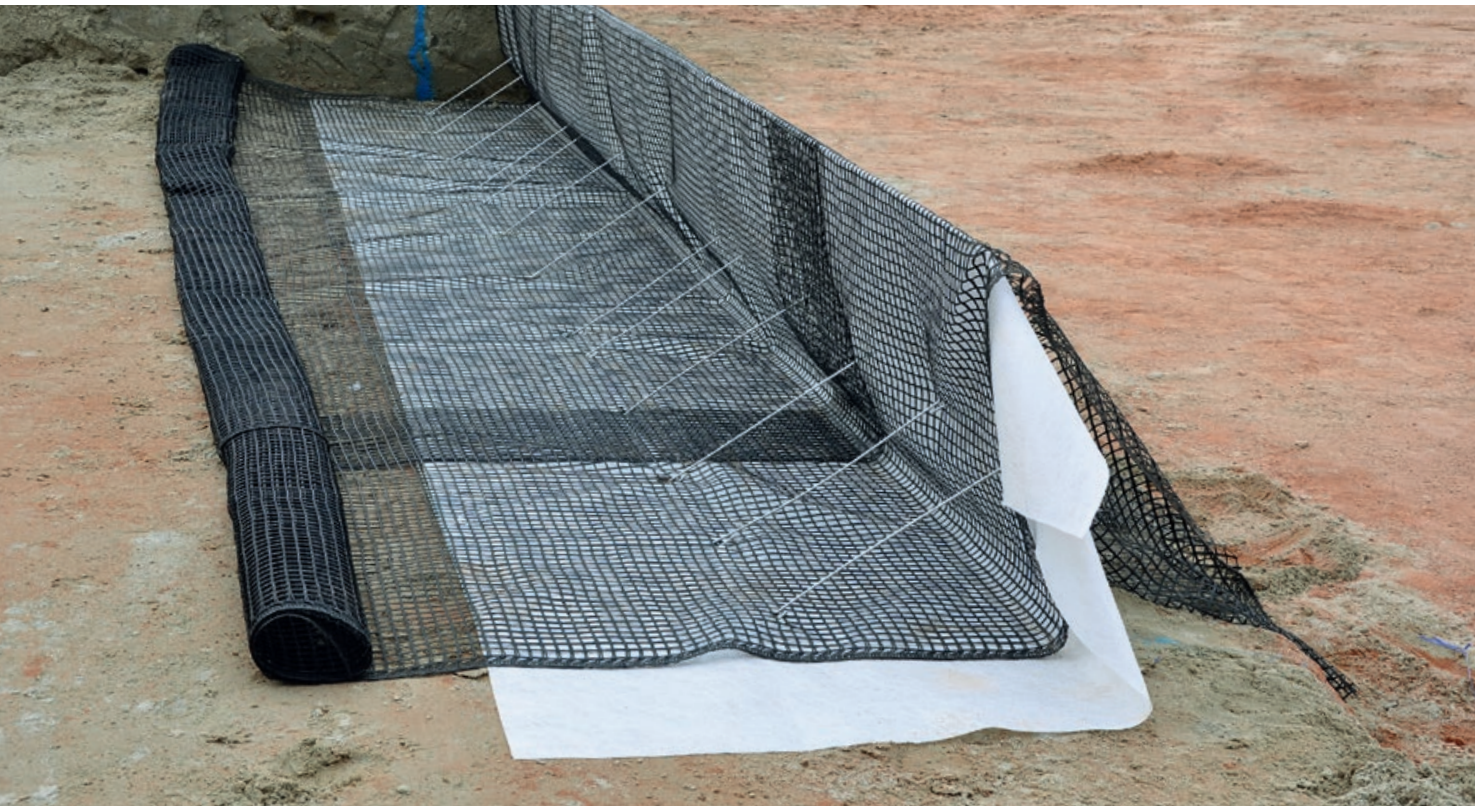
– Individual components
– Suitable for planting
– Inclinations up to 70°

With BEGREEN 70, steep slopes with a front inclination of up to 70° can be constructed. The single component system consists of the reinforcing geogrid, a steel reinforcing mat at the front as permanent formwork with bracing hooks and an erosion control mat.

The primary structural reinforcement is provided by a geogrid, which is made of low-creep polyester (PET) filaments and wraps around the layers of soil using the envelope method. The structural design of the earthwork and of the geogrids used depends on the specific project requirements.

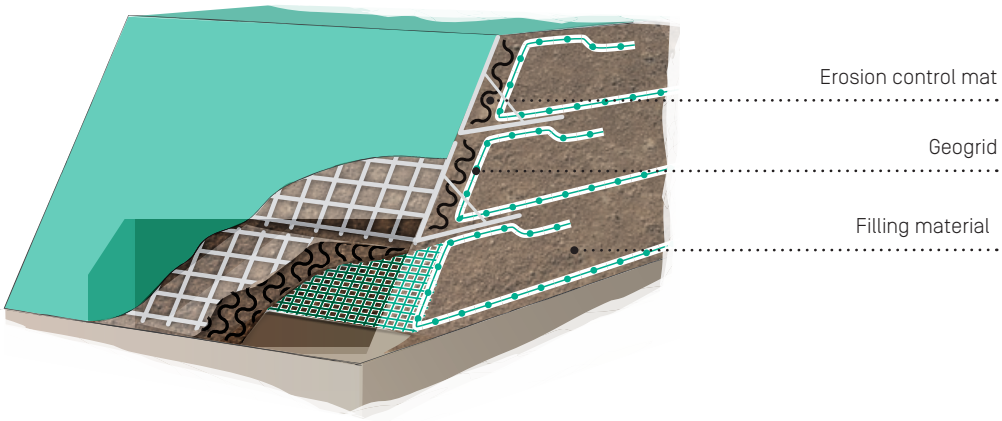
During installation, the geogrids must be folded back at the front of the embankment so that they lie below the subsequent layer of soil and are anchored in the structure. This usually requires the use of formwork. To save time and thus costs, BEGREEN 70 includes permanent formwork. The formwork is braced by bracing hooks. To provide the necessary UV protection for the geogrid and to prevent erosion at the front of the structure, an erosion control mat is installed behind the front reinforcement.

Two versions of BEGREEN 70 are available: one with pre-bent structural steel angles and the other with welded and galvanised steel wire mesh mats.



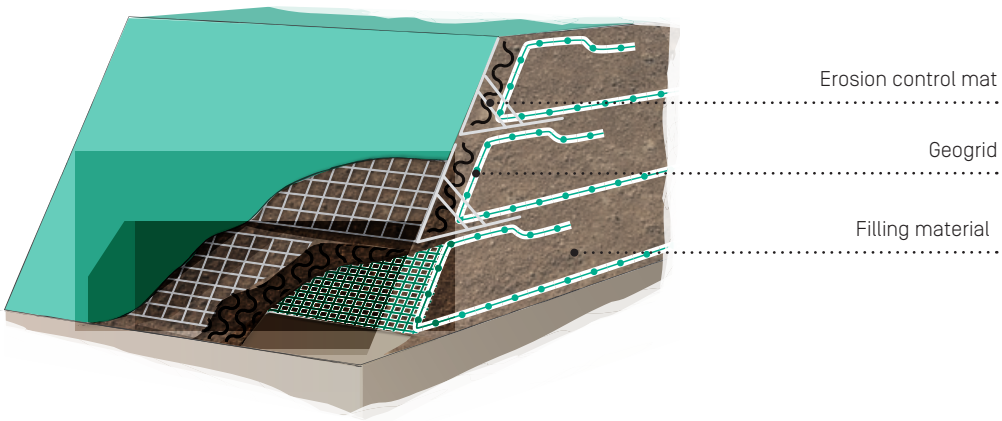
BEGREEN 70 with pre-bent structural steel angles

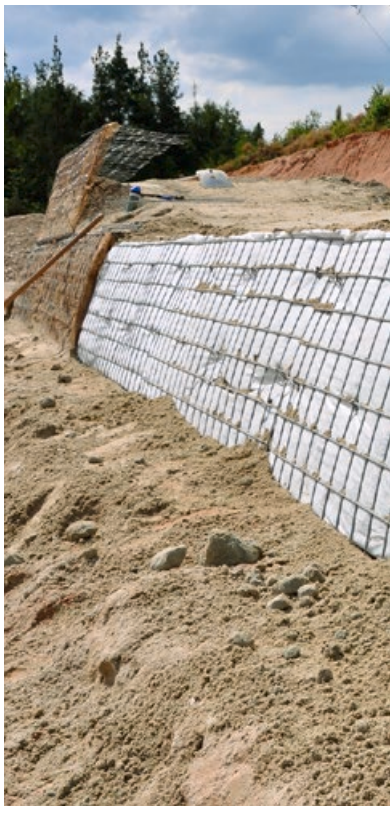
The structural steel angles are pre-bent in the factory according to the layer height and front inclination. An erosion control mat is attached to the inside of the structural steel angle for trickle protection. The geogrid is laid flat and then along the inside of the angle. The structural steel angle is also braced with steel bracing hooks. After the soil layer has been laid, the geogrid is folded back over the soil and integrated into the structure.



BEGREEN 70 with welded and galvanised steel wire mesh mats

Based on welded and galvanised steel wire mesh mats of standard dimensions of width 80 cm and length 2 m, the resulting layer heights are dependent on the front inclination. Versions with mesh sizes of 5 x 5 cm, 5 x 10 cm and 10 x 10 cm are available. On site, the mats are used to create permanent formwork. The front slope is secured with galvanised steel bracing hooks. Construction then proceeds as with the version with pre-bent structural steel angles.





BEGREEN EASY

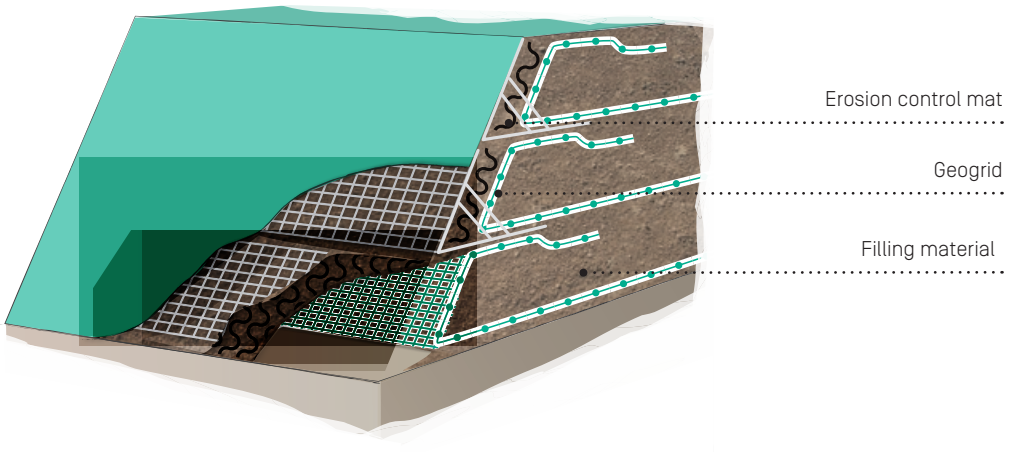
Steep slope system

- Pre-assembled
- Suitable for planting
- Inclinations of up to 70°

BEGREEN EASY can be used to create steep slopes with a front inclination of up to 70°. This system comprises a reinforcing geogrid, a bracing steel gabion mat and a hinged base grid as permanent formwork with bracing hooks and an erosion control mat. The system components are pre-assembled in the factory.

The primary, structural reinforcement is provided by a polyester (PET) geogrid that envelops the layers of soil using the envelope method. The design and dimensions of the earthwork and the geogrids used depend on the specific project requirements.

During installation, the geogrids must be folded back at the front of the embankment so that they lie below the subsequent layer of soil and are anchored in the structure. This requires the use of formwork. To save time and thus costs, BEGREEN EASY includes permanent formwork. The formwork is braced by bracing hooks. To provide the necessary UV protection for the geogrid and to prevent erosion at the front of the structure, an erosion control mat is pre-installed behind the front reinforcement. The standard dimensions of the front mat are 250 x 80 cm.



BEGREEN WAB

Steep slope system

BEGREEN WAB can be used to create steep slopes with a front inclination of

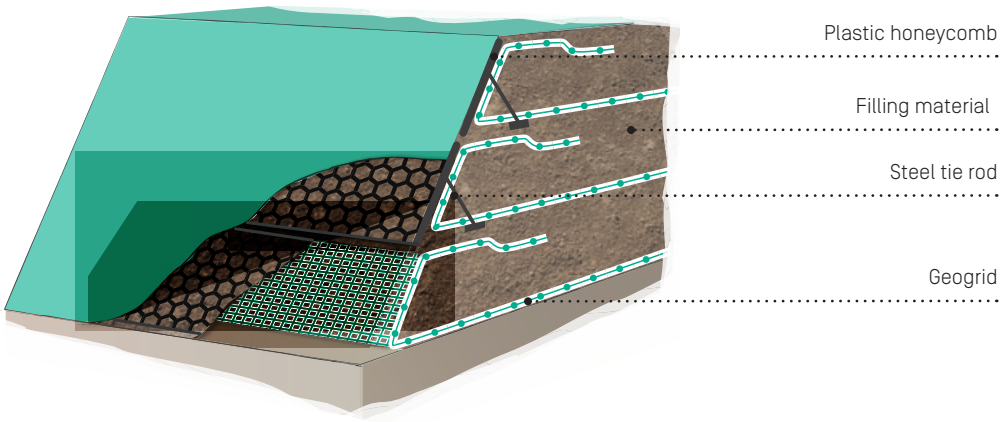
up to 70°. This system comprises a reinforcing geogrid and a three-dimensional honeycomb grass grid as permanent formwork that also braces the structure and protects against erosion. The bracing hooks are fixed to an anchoring crossbar on the ground. The system components are pre-assembled in the factory.

The primary, structural reinforcement is provided by a polyester (PET) geogrid that envelops the layers of soil using the envelope method. The design and dimensions of the earthwork and the geogrids used depend on the specific project requirements.

During installation, the geogrids must be folded back at the front of the embankment so that they lie below the subsequent layer of soil and are anchored in the structure. This requires the use of formwork. In order to save time and thus costs, BEGREEN WAB uses a honeycomb grass grid as permanent formwork. The formwork is braced by bracing hooks. Due to its three-dimensional structure, the honeycomb grass grid also provides permanent erosion control for the front slope.

With a slope of 70°, the vertical element height is 55 cm. This system is particularly suitable for securing verges, whereby the verge slope is structurally stabilised and an additional honeycomb can be laid horizontally for added stability of the verge.

- Pre-assembled
- Suitable for planting
- Inclinations of up to 70°



TERRAMESH

Steep slope systems

– Pre-assembled
– For planting or with gabion front
– Inclinations of up to 70° (GREEN TERRAMESH), 85° (MINERAL TERRAMESH 5x5) or 90° (TERRAMESH SYSTEM)

TERRAMESH system solutions can be used to create steep slopes with a front inclination of up to 90°. The system comprises a reinforcing steel wire mesh with duplex protection, a bracing structural steel mat or steel gabion mat as permanent formwork, hinged inclination triangles as installation aids, bracing hooks, and an erosion control mat. The system components are pre-assembled in the factory.

The primary structural reinforcement is provided by a GalMac galvanised, plastic-coated steel wire that envelops the layers of soil using the fold-over method. The design and dimensions of the earthwork and the steel wire mesh used depend on the specific project requirements.

During installation, the steel wire mesh must be folded back at the front of the embankment so that it lies below the layer of soil above and is anchored in the structure. This usually requires the use of formwork. To save time and thus costs, TERRAMESH includes permanent formwork. The formwork is braced by bracing hooks. To prevent erosion at the front of the structure, an erosion control net is pre-installed behind the front reinforcement.

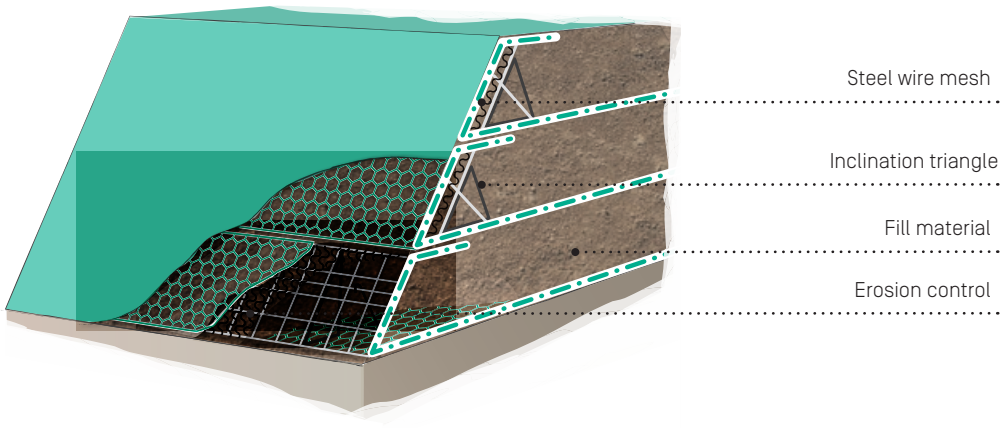
GREEN TERRAMESH

- Pre-assembled
- Suitable for planting
- Includes erosion protection
- Structural steel bracing
- Inclinations up to 70°

All GREEN TERRAMESH systems can be used for a wide range of support structures with a slope face suitable for planting and a resulting inclination of up to 70°. A stepped structure with berms can be constructed to create whatever inclination is required.

The basic components of GREEN TERRAMESH are a double twisted steel mesh with duplex protection, a welded steel grid mat as permanent formwork, pre-bent inclination triangles made of round steel, bracing hooks made of round steel, and an erosion control mat. All of the components are pre-assembled in the factory and can be simply positioned on site, fixed in place and then filled with layers of suitable soil. For subsequent planting, the space behind the permanent formwork of the facing must be filled with vegetative soil.

The elements are 3 m wide. The front panel height is 80 cm, which for a front inclination of 70° results in a layer thickness of 76 cm.



MINERAL TERRAMESH 5x5

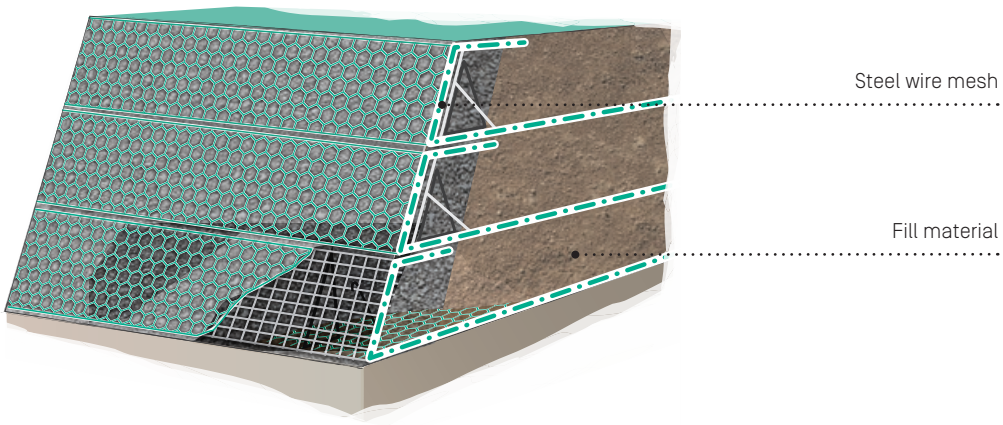
– Pre-assembled
– Stone facing
– Gabion steel bracing
– Inclinations up to 85°

Like the GREEN TERRAMESH, the MINERAL TERRAMESH system comes ready assembled and its main components include a double twisted steel mesh with duplex protection, galvanised steel gabion mats (mesh size 5 x 5 cm) as permanent formwork, inclination triangles, and bracing hooks.

MINERAL TERRAMESH, however, does not require an erosion control net on the front face, since the coarse stone fill material (grain size > 80 mm) and the permanent steel wire mesh protect the face against erosion.

All MINERAL TERRAMESH systems can be used for a wide range of support structures with a gabion appearance and a resulting inclination of up to 85°. A stepped structure with berms can be constructed to create whatever inclination is required.

Each element is 3 m wide. The front panel height is 80 cm, which for a front inclination of 80° results in a layer thickness of 79 cm.



TERRAMESH SYSTEM

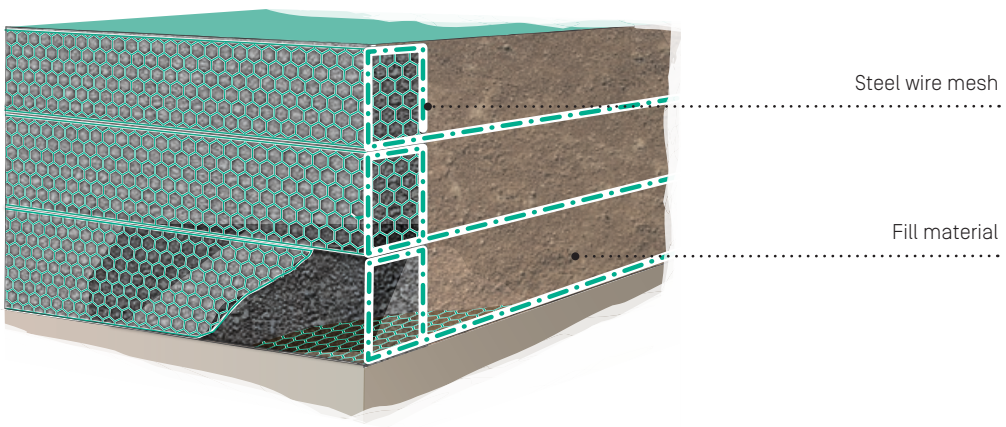
– Pre-assembled
– Stone facing
– Inclinations up to 90°

The TERRAMESH SYSTEM is a pre-assembled steep slope system with an integrated gabion front, which can create a vertical or stepped structure.

The TERRAMESH SYSTEM can be used in place of heavy gabion walls. The front slope remains the same, but the number of gabions required is reduced.

The reinforcement material laid at the base, which is made of twisted steel wire mesh mats with duplex protection, also forms the base, front and lid of the gabions.
The sides and back wall of the gabions are pre-assembled and are simply folded out on site and fixed with C rings. The gabions are then filled. The fill material not only provides overburden for the front face, but also acts in combination with the reinforcement grid to form part of the composite structure.

The TERRAMESH SYSTEM provides a safe, reliable and cost-effective alternative to conventional gabion walls. The elements are 3 m wide and have a vertical height of 50 cm.



SYSTEM SOLUTIONS
compared

Are you still looking for the right solution or do you have questions regarding the application and installation? Our technical experts will be happy to assist you. We support you in your construction project during the design and tendering phase, and assist with briefings, with explaining the construction procedures, and with supervision of the installation on site. The preparation of verifiable structural analyses is just as much a part of our service as the on-site support we provide in order to meet the individual requirements of your construction project. On request, we can also install our products for you on site.

	BEGREEN 45 no fold-over	BEGREEN 45 with fold-over	BEGREEN 70 individual components	BEGREEN WAB
Construction method	No fold-over	Fold-over method with formwork	Fold-over method with permanent formwork	Fold-over method with permanent formwork
Inclination	Up to 45°	Up to 45°	Up to 70°	Up to 70°
Front	Suitable for planting	Suitable for planting	Suitable for planting	Suitable for planting
Reinforcement material	Stretched, non-woven, woven geogrids	Non-woven and woven geogrids	Non-woven and woven geogrids	Non-woven and woven geogrids
System components	Installation	Construction formwork, installation	Installation of individual components on site	Pre-assembled in the factory
Earthworks	End tipping method	End tipping method	End tipping method	End tipping method
Components	Geogrids, erosion control, eco-hooks	Geogrids, erosion control, eco-hooks, construction formwork	Geogrids, erosion control, permanent formwork, bracing hooks	Element pre-assembled in the factory (geogrid, permanent formwork), bracing hooks

We are happy to supply current data sheets, specifications, certificates and technical verifications on request.

BEGREEN EASY	GREEN TERRAMESH	MINERAL TERRAMESH 5x5	TERRAMESH SYSTEM
Fold-over method with permanent formwork	Fold-over method with permanent formwork	Fold-over method with permanent formwork	Fold-over method with permanent formwork
Up to 70°	Up to 70°	Up to 85°	Up to 90°
Suitable for planting	Suitable for planting	Stone facing	Stone facing
Non-woven and woven geogrids	Steel wire mesh*	Steel wire mesh*	Steel wire mesh*
Pre-assembled in the factory	Pre-assembled in the factory	Pre-assembled in the factory	Pre-assembled in the factory
End tipping method	Reinforcement layer can be driven on	Reinforcement layer can be driven on	Reinforcement layer can be driven on
Element pre-assembled in the factory (geogrid, permanent formwork, erosion control), bracing hooks, C rings	Element pre-assembled in the factory (steel mesh, permanent formwork, erosion control), bracing hooks, C rings	Element pre-assembled in the factory (steel mesh, permanent formwork), bracing hooks, C rings	Element pre-assembled in the factory (steel mesh), bracing hooks, C rings

*A hybrid solution with geogrid extension is possible

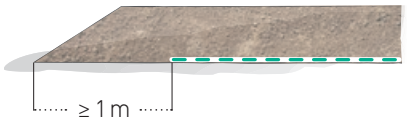
INSTALLATION TECHNIQUES compared

When it comes to reinforced earth system solutions, the most decisive factors are the selection of an appropriate system for the project, the correct construction sequence and the installation technique. The following is therefore intended to provide a brief insight into the different installation techniques for the various systems.

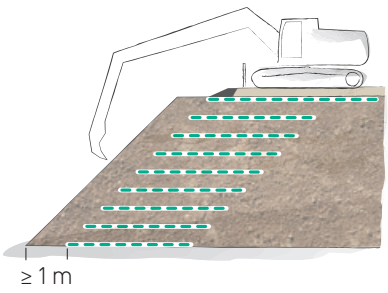
Geogrid layers with no fold-over

Rigid-node, stretched geogrids laid in layers with compactable, mixed-grain soil in accordance with the structural design requirements. As a result of the 1-metre-wide covering layer, the soil is compacted on the grid.

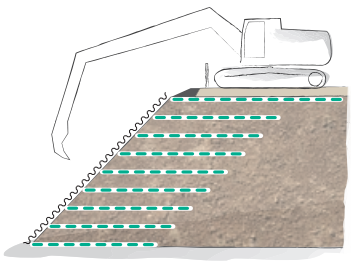
BEGREEN 45 (with no fold-over)



The installed layers (≤ 30 cm) must be at least 1 metre wide and be compacted right up to the edges using suitable compacting machinery.



Once the layer structure is complete, the resulting embankment must be carefully screeded off with the excavator shovel to achieve the desired embankment width. Care must be taken not to damage the reinforcement layers.



The surface of the embankment must be protected with an erosion control mat.

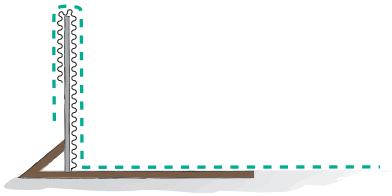
Key: Erosion control Geogrid

System comprising individual components laid with fold-over

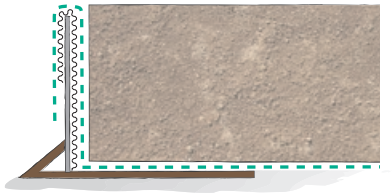
Geogrids and erosion control mats are usually supplied in rolls. The grids and mats must be cut to size on site according to the element dimensions and the structural design requirements. The on-site assembly of the elements must be carried out carefully and precisely. The earth is added in two compactable layers per element.

BEGREEN 45 (with fold-over and construction formwork)

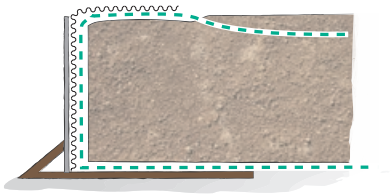
Placement of the construction formwork on the load-bearing formation.



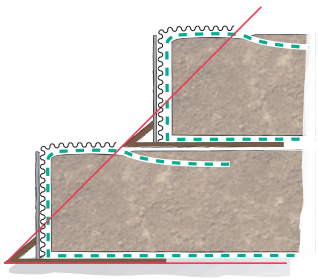
The woven or non-woven geogrid and an erosion control mat are laid.



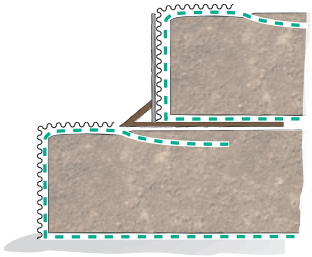
The compactable soil is laid to create compacted layers 40 cm thick.



The geogrid is folded back over the soil above so that it is tied into the earthwork. The erosion control mat is embedded only up to 50 cm behind the front surface.



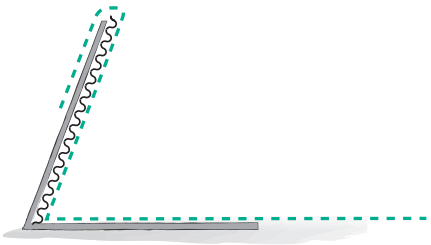
The formwork of layer 2 is set at the required embankment inclination and work continues from Step 2.



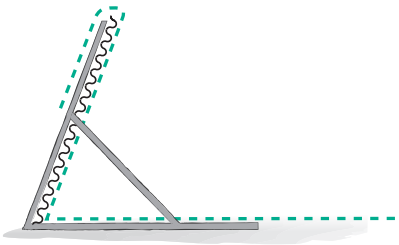
After the second layer has been laid, the formwork of the first layer is removed.

BEGREEN 70

The permanent formwork is placed on the load-bearing formation.



The woven or non-woven geogrid and an erosion control mat at the front are laid manually.

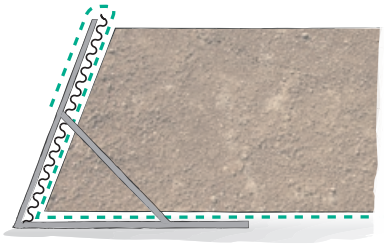


Bracing hooks are used for fixing.

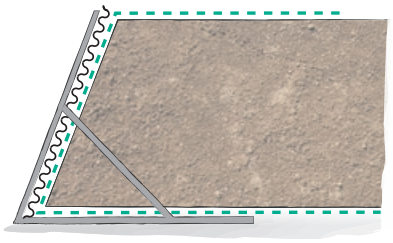
→ Continued overleaf

BEGREEN 70

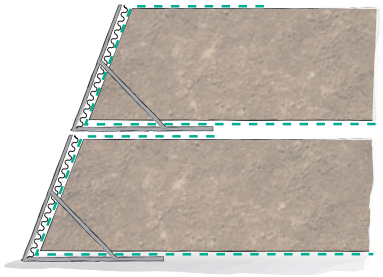
Continued from page 21



The compactable soil is laid in layers, to achieve compacted layers 40 cm thick.



After filling and compaction, the geogrid is folded back over the soil layer.

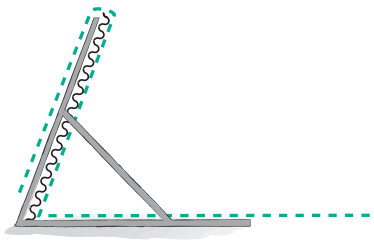


The second layer is installed in the same way.

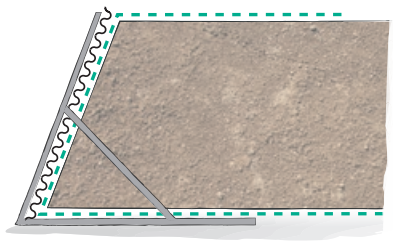
Pre-assembled system with fold-over method

BEGREEN EASY, BEGREEN WAB, TERRAMESH

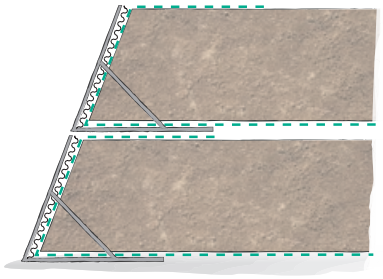
The pre-assembled element is unfolded on site and the front is braced with the bracing hooks. Because the element is pre-assembled, easy and reliable handling on the construction site is ensured. The earth is added in two compactable layers per element.



The pre-assembled elements are set up.



The compactable soil is laid in layers, to achieve compacted layers 40 cm thick.



The second layer is installed in the same way.

Key: Erosion control Geogrid

ADVANTAGES
System solutions

- → Complete system with a long service life
- → Robust materials
- → Complete load transfer without any special connection techniques
- → Safe and reliably encased complete system
- → Quick and easy installation
- → Minimal workforce and machinery required
- → Cost-effective construction method

BECO BERMÜLLER

Bermüller & Co GmbH
Rotterdamer Str. 7
90451 Nuremberg, Germany

Telephone: +49 (0) 911 - 64200 - 0
Telefax: +49 (0) 911 - 64200 - 90

beco-bermueller.com

GEO.20170 | B | 12.2020-EN