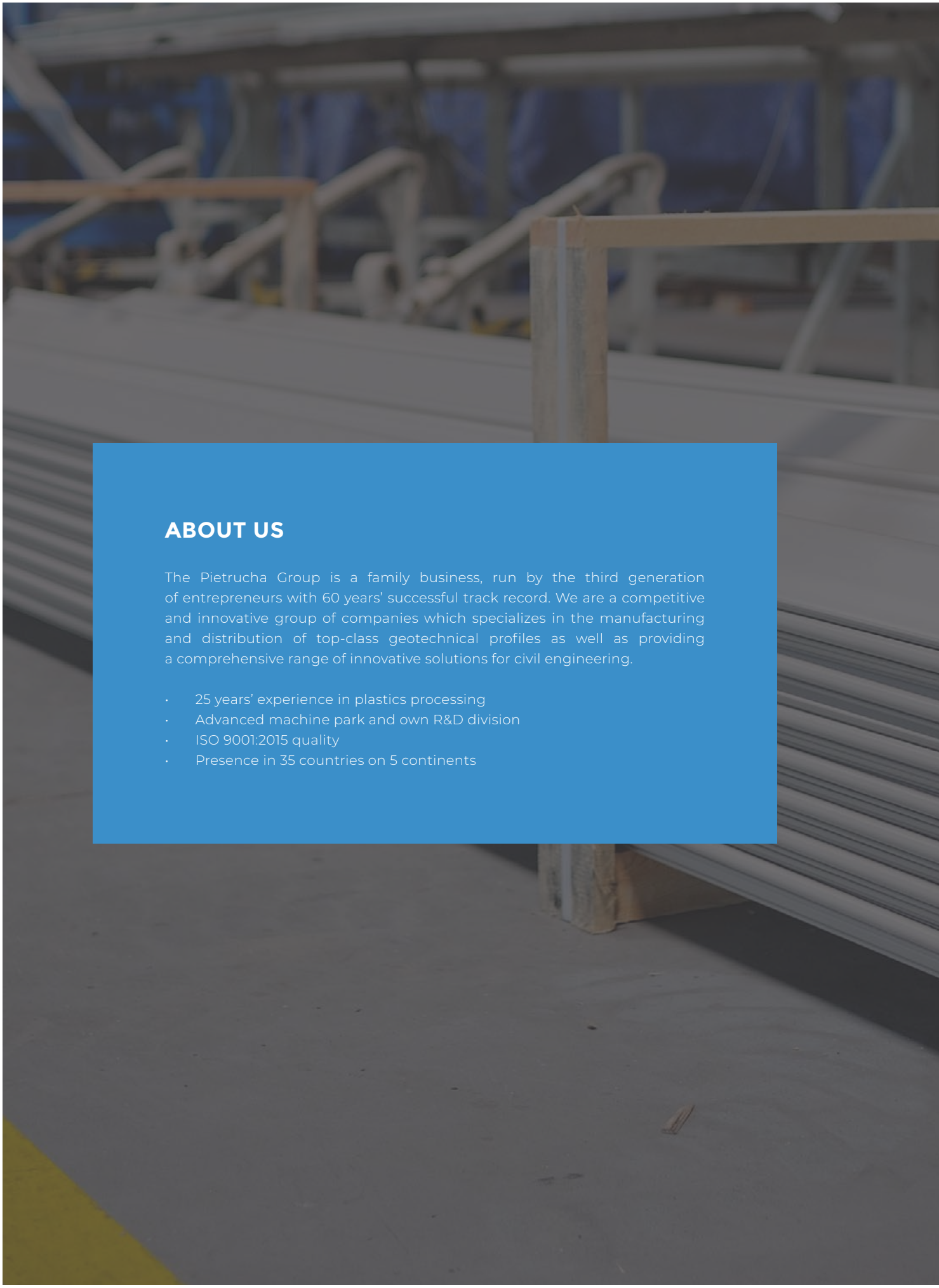
GEOTECHNICAL SOLUTIONS

FOR CIVIL ENGINEERING

- Vinyl Sheet Piling
- Hybrid Sheet Piling
- Sheet Piling with Gaskets
- Flood Protection and Water Retention
- Biaxial Geogrids

Pietrucha
Established 1960



ABOUT US

The Pietrucha Group is a family business, run by the third generation of entrepreneurs with 60 years' successful track record. We are a competitive and innovative group of companies which specializes in the manufacturing and distribution of top-class geotechnical profiles as well as providing a comprehensive range of innovative solutions for civil engineering.

- 25 years' experience in plastics processing
- Advanced machine park and own R&D division
- ISO 9001:2015 quality
- Presence in 35 countries on 5 continents

Pietrucha
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GEOTECHNICAL SOLUTIONS
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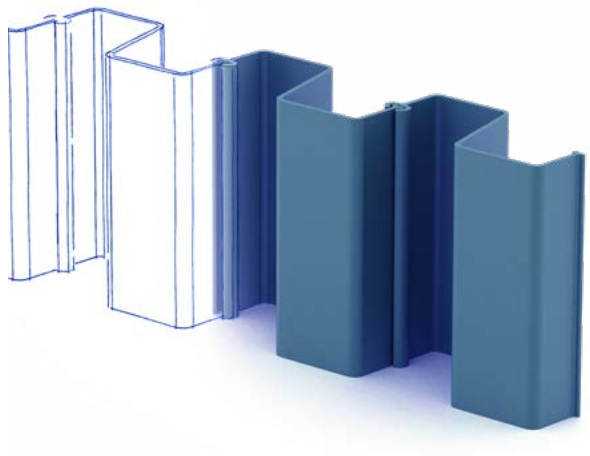
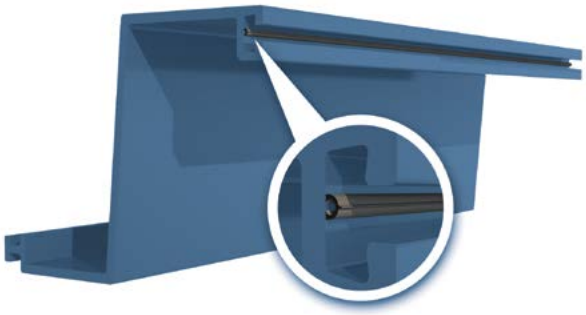
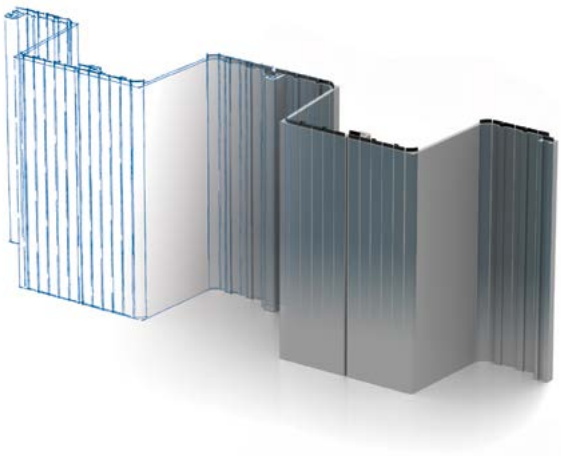


Vinyl Sheet Piling



Vinyl Sheet Piling with gaskets



Hybrid Sheet Piling

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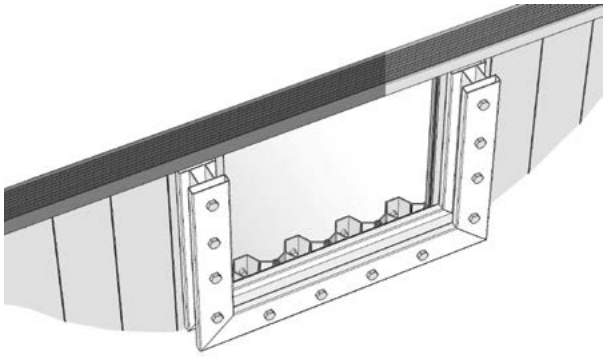
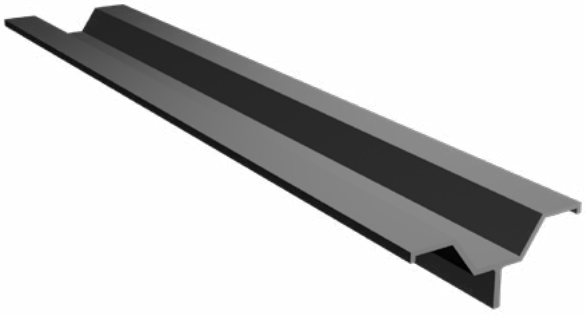


Vinyl small retention sluices



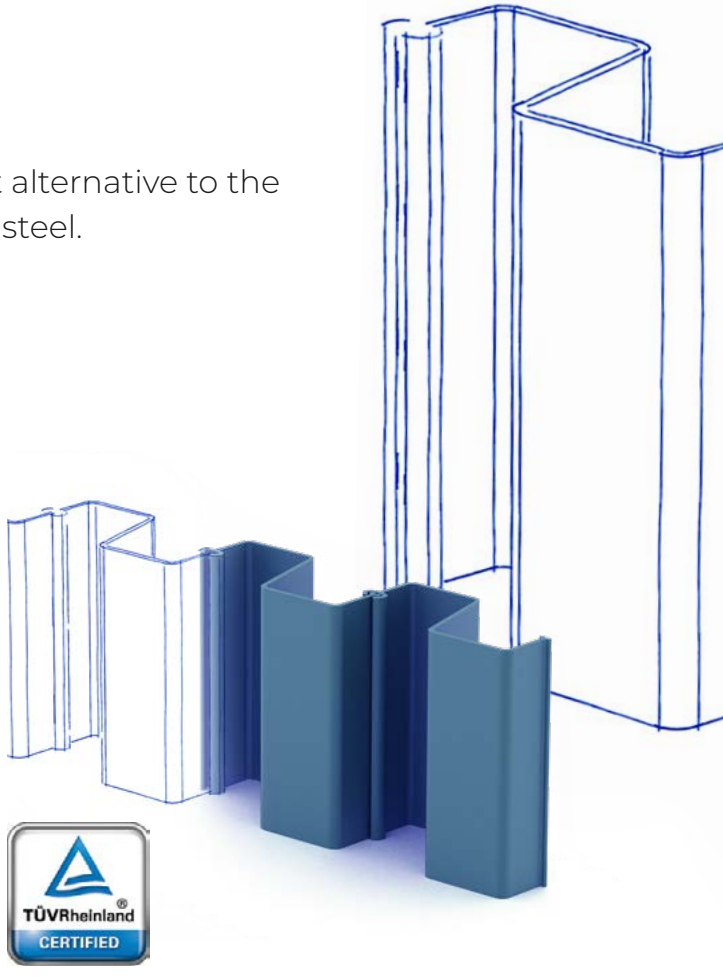
Open top road culverts

Biaxial geogrids

Vinyl sheet piling used as a retaining wall i n a road construction project

SHEET PILING

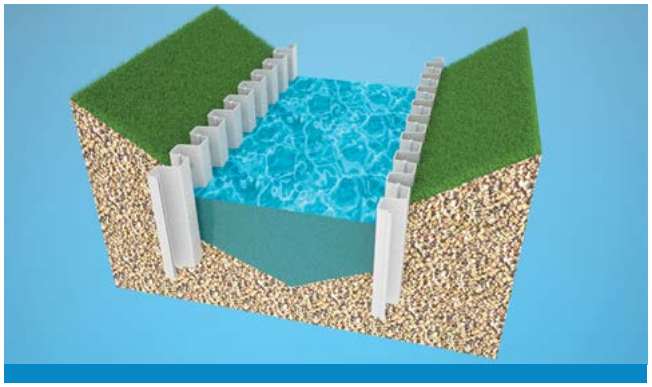
A durable, maintenance-free and costs efficient alternative to the traditional solutions made of wood, concrete or steel.



Vinyl Sheet Piling

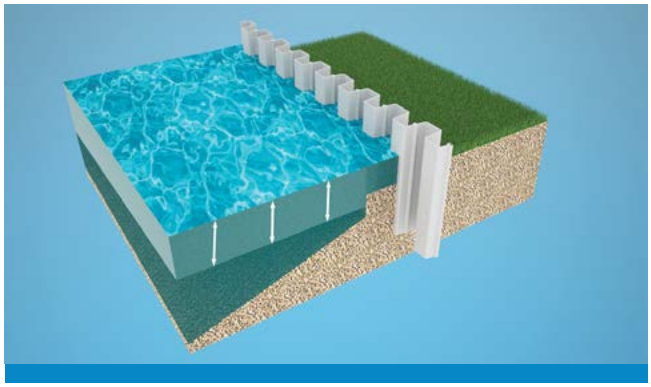
- Highly resistant to corrosion and the impact of atmospheric and biological factors, including UV radiation, extreme temperatures and sea water
- Resistant to mechanical damage, including scratches, cracks and abrasions
- Costs efficient transport and simple installation using standard equipment
- Eco-friendly solution with the material for the piling obtained from recycled PVC that may be recycled further

Aplication



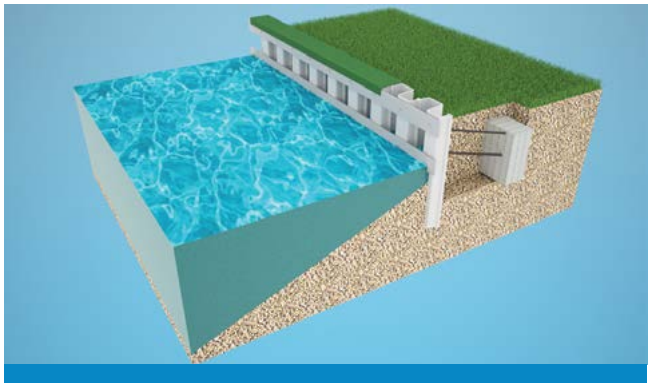
River bank protection and regulation

PVC piling may be used to protect and regulate rivers, ditches or channels. Thanks to their structure, EcoLock piling systems easily adjust to the natural curvatures of the terrain.



Protection of banks with variable water levels

Tightness, combined with aesthetic look, allow for the use of the EcoLock piling to protect the banks with variable water levels. The system always blends in perfectly with the surrounding area.

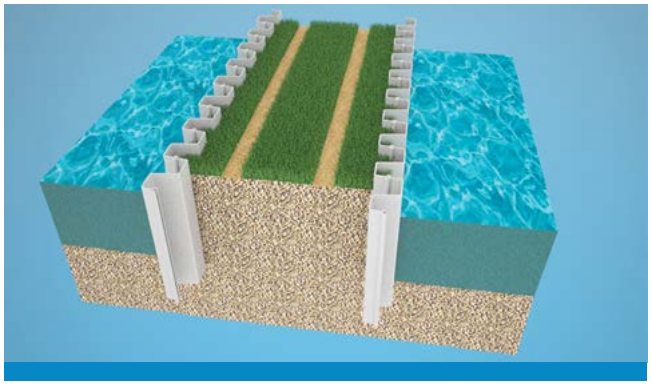


Sheet pilings and cut-off walls with a system of stays

In order to protect the banks of different water reservoirs or rivers they can be used with a special system of stays and anchors, providing additional protection and increasing the durability of the system.

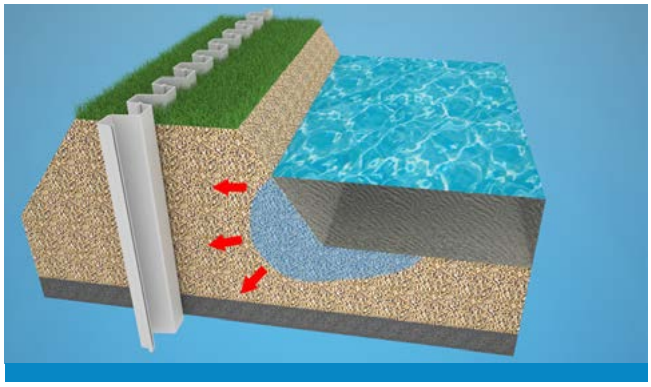
Cut-off walls in ecologically threatened areas

The EcoLock retaining systems may be used to separate water reservoirs or groundwater from environmentally challenged places (for instance, in the vicinity of landfills and factories).



Causeways

The EcoLock used in the construction of causeways at water reservoirs result in their higher durability and better resistance of the whole structure against scouring.



Strengthening of flood walls

PVC solutions are used more and more frequently in the construction of flood walls. They significantly strengthen and increase the durability and tightness of the structure, preventing water leaks during floods.

Installation

HAMMERING

The most commonly used method, in which sheet piles are mechanically embedded into the soil along thepre-installedtemplateswiththeuseofvibratoryhammers, i.e. light equipment with small impact energy. The type of the equipment used depends on the soil type, the depth of the cavity and the durability of the sheet pile. In the case of hard, dense surfaces, or when long elements need to be hammered, steel mandrels are used. Mandrels are special guide bars of a shape and length reflecting the used PVC elements.

ADVANTAGES

- hammering sheet piles in very difficult soil environments (compact silt, clay, gravel)
- installation of long profiles, even up to 12m
- removing obstacles found in soil (roots, stones)
- maintaining straight lines
- ensuring pre-loosening of soil
- significant acceleration of installation work

JETTING

This method is used in cases of very compact or cohesive soil where the force of vibration hammers is not sufficient to embed the vinyl sheet piling to the required depth. Jetting consists in exerting pressure directly under the sheet piles which are being installed, which helps loosen and remove the soil or the obstacles. Special water or air ejectors are used in this technology.

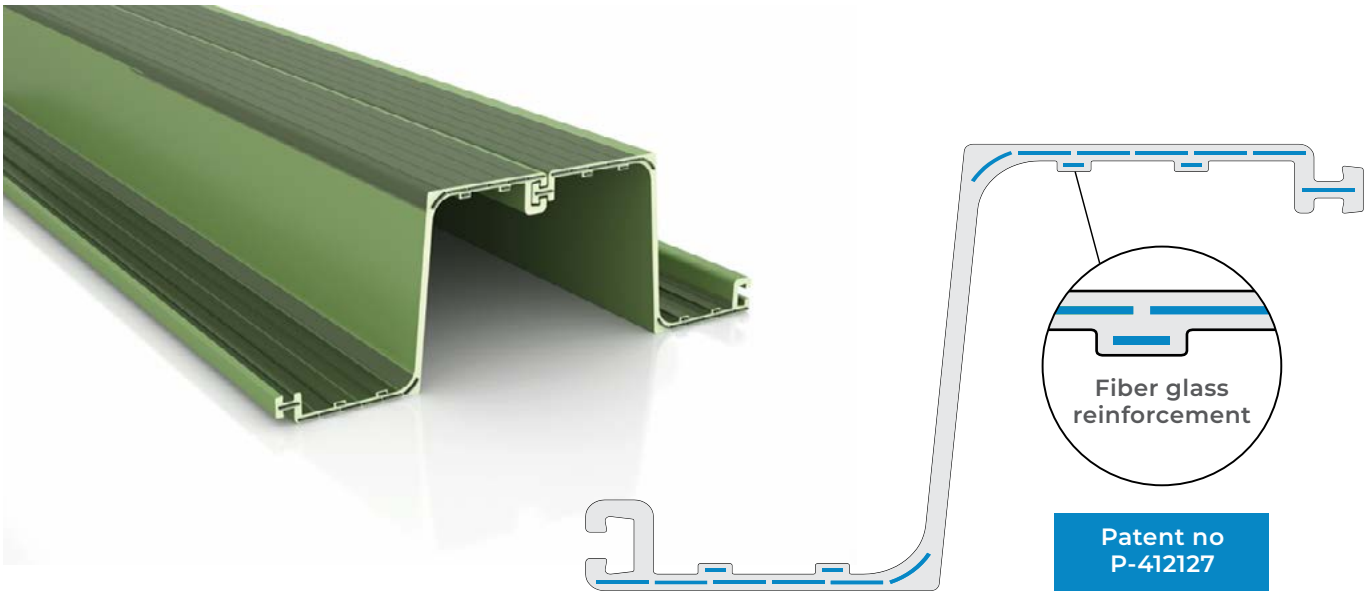
DIGGING

This method is used when the constructed walls are not embedded too deeply into the ground and it consists in the PVC piling being installed in a ditch which is subsequently filled in with a bedding layer selected individually to best meet the requirements of a given project.

Hybrid Sheet Piling

The new generation of plastic piling - mechanical parameters of light steel or composite sheet piling with the price of pvc piling.

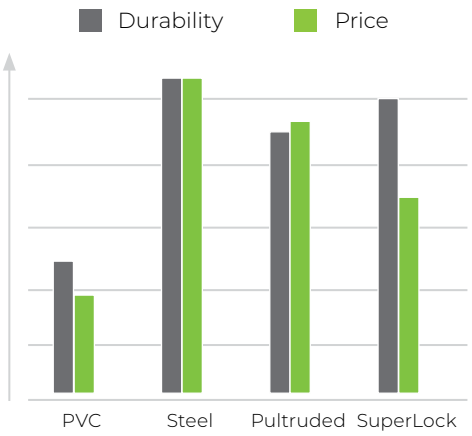
- An innovative hybrid material composed of PVC and fiber-glass sealed together with a thermo-plastic matrix.
- The hybrid sheet piling has significantly higher technical parameters than PVC and a broader scope of application.
- In comparison with PVC, hybrid sheet piling may be used to construct higher walls, in more unfavourable locations.
- Lighter embedding equipment may be used to hammer the profiles and there is no need to use mandrels.



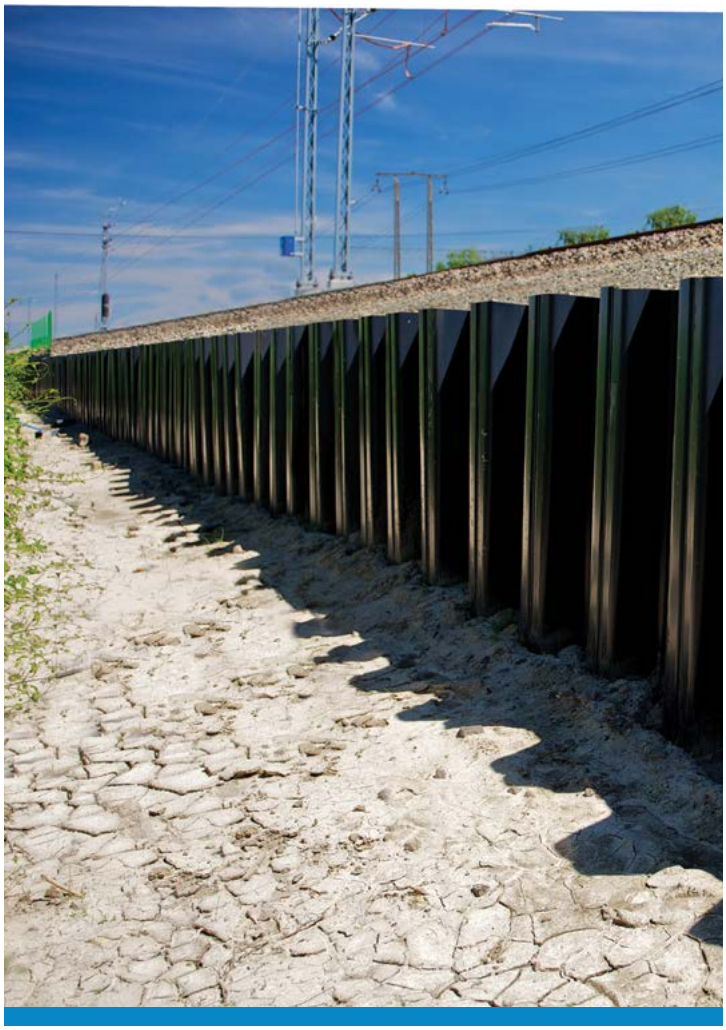
All the qualities of the vinyl sheet piling with higher stiffness and strength

SuperLock hybrid sheet piling is made of PVC reinforced with continuous and consolidated fiber glass inserts using the coextrusion technology. Application of this innovative solution increases both the durability and strength of the profile.

The strength and durability parameters of the SuperLock composite sheet piling are comparable to those of the light steel piling but with the weight and price of the PVC piling.



Higher technical parameters of the hybrid material broadens the scope of application.

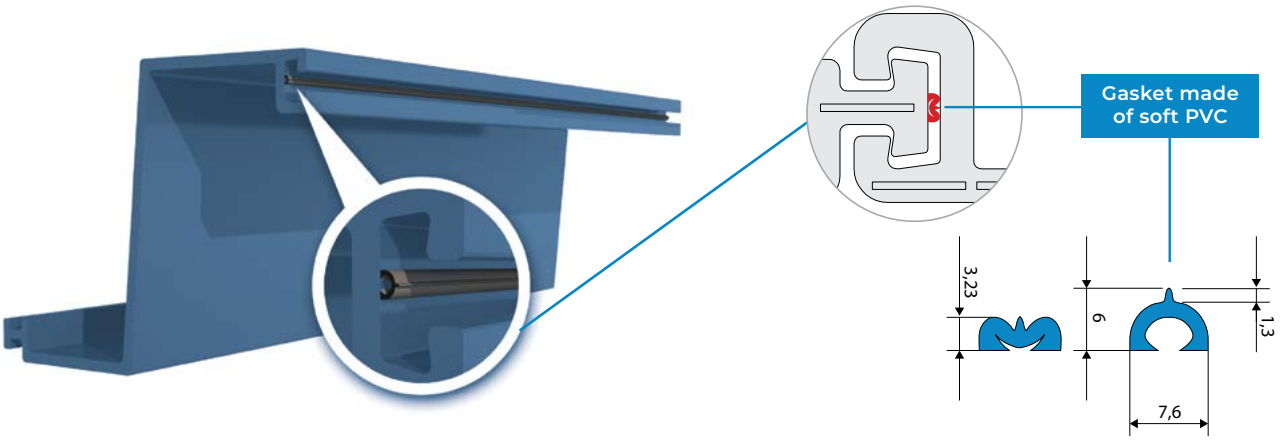


There is no need to use mandrels during installation of hybrid sheet piling.

Hyrid profiles may be used to construct higher walls.

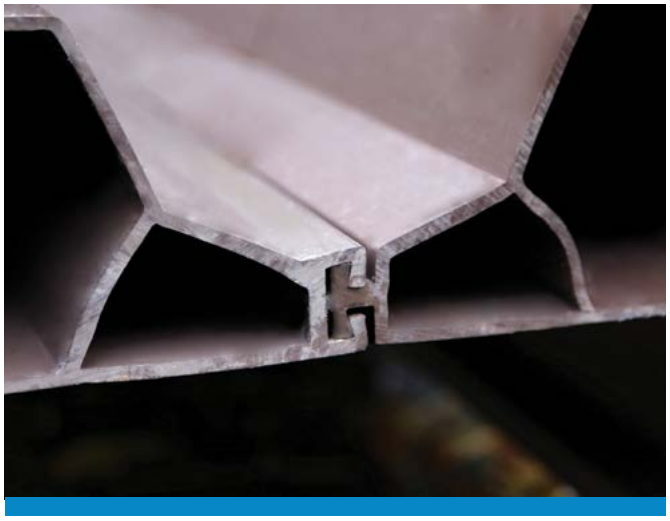
Sheet Piling with Gaskets

Geotechnical profiles for special purposes, where 100 water-tightness is required.



SHEET PILING FOR SPECIAL PURPOSES

Some strategic investment projects require a guarantee of full water-tightness of the vinyl sheet piling constructions. In response to the needs expressed by our customers, the Pietrucha Group R&D depart-ment developed a specialized tightening solution based on the use of gaskets specifically designed for this purpose.



The tightness of locks in the vinyl sheet piling walls depends on the following factors:

- The shape of a lock, which can elongate or reduce the distance travelled by water;
- The width of a single vinyl sheet pile. The wider the section, the lower the number of locks per unit of length of the wall, e.g. by replacing 300 mm (width) piles with 606 mm piles, the leaking factor of the wall will be reduced by the factor of two;
- The hydrostatic pressure affecting the wall. The higher the pressure, the lower the possibility of clogging of locks;
- The stress levels at the locks' contact area. The higher the tighthness and the pressure on the locks' wall surfaces, the smaller the occuring gaps, therefore, rendering the flow of water throught the lock limited.

The „V” type Gasket

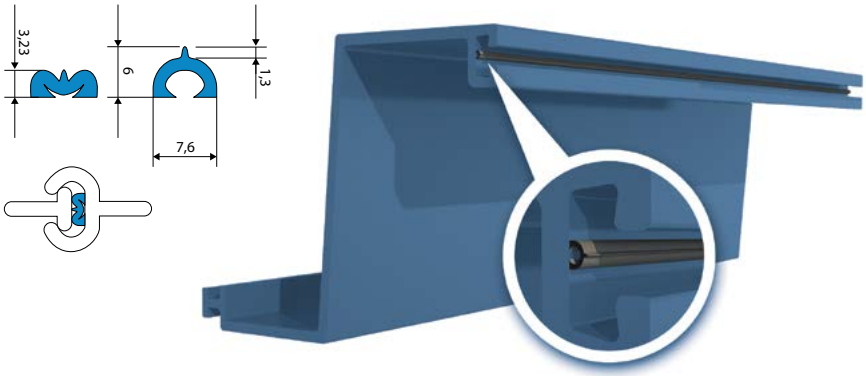
The "V" type gasket is used in the following vinyl sheet piles:

- GW-270,
- GW-537,
- GW-300,
- GW-460,
- GW-610,
- GW-565.

The „C” type Gasket

The "C" type gasket is used in the following vinyl sheet piles:

- GW-458,
- GW-580



Parnu, Estonia: implementation of a filtration screen by a tanning facility chemical wasteyard

Vinyl Sheet Piling:

Taking into account their complete resistance to biological and atmospheric factors, as well as mechanical damage, PVC sheet piling may be used in a wide range of civil engineering projects. The EcoLock sheet piling used in place of steel retaining walls reduces the costs of installation and materials.

completed projects

Pietrucha
Established 1960

As an alternative to wooden solutions, EcoLock ensures higher durability and resistance to external factors.

Częstochowa: strengthening of flood walls using EcoLock vinyl sheet piling system by Pietrucha.

Project description:

DATE: 2015
LOCATION: Częstochowa, Silesian Voivodeship
PRODUCT: Vinyl sheet piling GW-460/5.5

This publication presents a case study involving the use of the EcoLock vinyl sheet piling structure designed and manufactured by the Pietrucha Group in the project of reconstruction and modernisation of flood protection structures in the area of Częstochowa, which began in 2015.

Due to its subsurface and groundwater conditions, the region of Częstochowa is an area at risk of floods. For example, in 2010 and during the so-called Millennium Flood in 1997, all three rivers flowing through the city: Warta, Kucelinka and Stradomka flooded. Among other things, 36 kilometres of roads and several bridges in Częstochowa were damaged. Losses were estimated at PLN 13 million. In Częstochowa Poviat, more than 2,000 residential buildings and 1,520 farm buildings were flooded. Water caused damage to 17 roads and 2 bridges. It was then that attention was drawn to the need for reconstruction and modernisation of the almost century-old flood protection structures in the region. The modernisation works as part of this multi-stage project started in 2015.

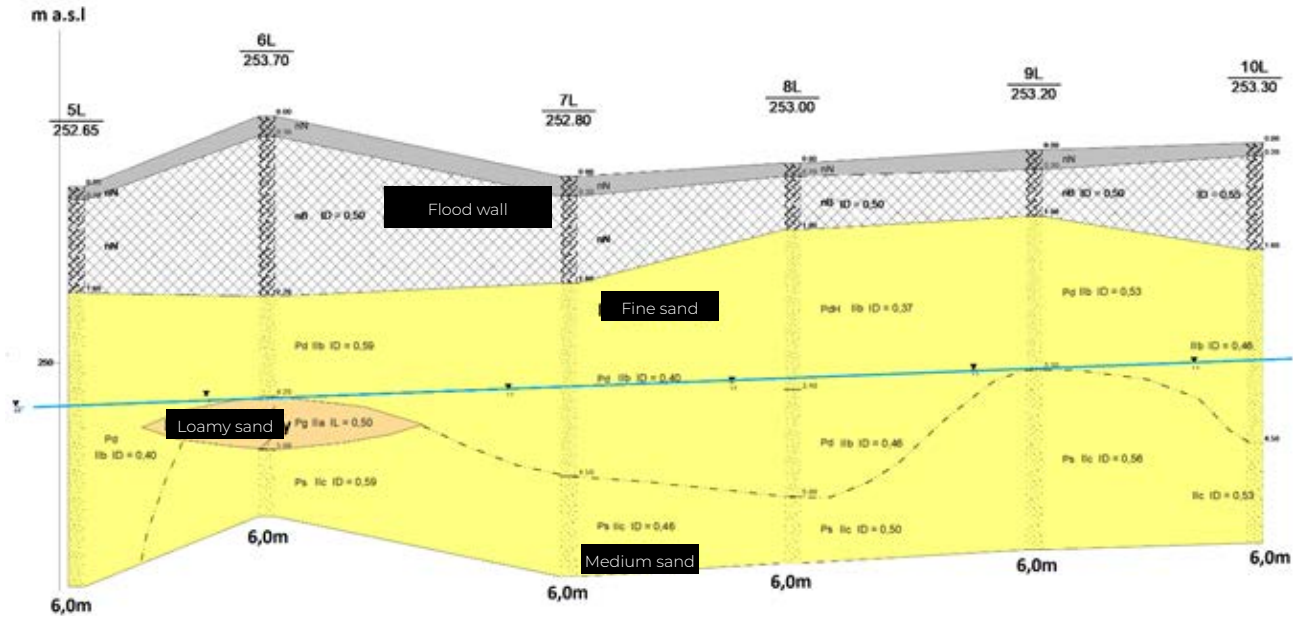
CHALLENGE:

In the area of Częstochowa, the Warta separates into two streams, the left stream – the main river stream with its tributary, the Stradomka, and the right stream – the Kucelinka channel with a length of 6.87 km. Most of the flood walls in the area were built in the 1920s and 1930s from local material. Currently, they do not fulfil their flood protection function due to physical degradation resulting from repeated cycles of soaking, drying and freezing of the body of the wall. Walls are subject to biological degradation as a result of decomposing of root systems of dying plants and related root decay processes as well as colonisation by species of animals using walls as a procreation and residence site. The bilateral embankments of the Warta belong to importance class IV, according to Polish classification; however, following new guidelines,

they should be classified in class II and III. The investment of the flood wall modernisation was divided into several stages, as the total length of embankments to be strengthened is about 19 kilometres. This publication concerns a section with a length of 1.7 km.

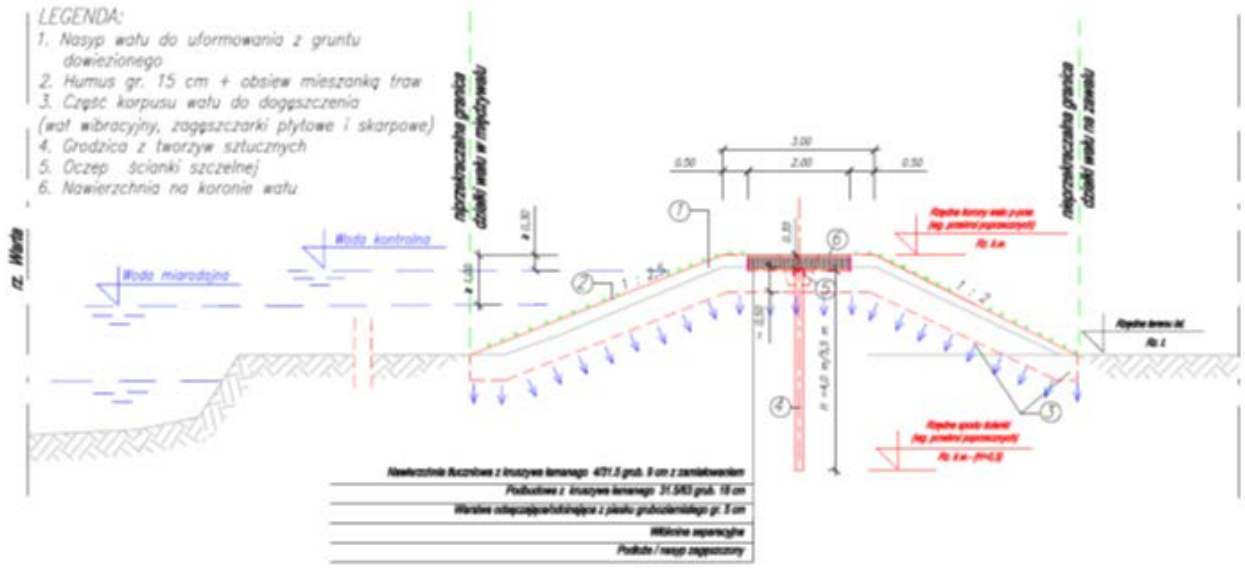
SUBSURFACE AND GROUNDWATER CONDITIONS:

The analysis of the geological conditions confirmed that the walls are made of different kinds of sand and covered with a layer of humus. The substrate under the walls includes mainly fine or medium sand. Dynamic probing conducted revealed that both the wall and the substrate have a low or medium density. The groundwater table is at a depth of about 3.2-4.2 m from the crowning of the wall. A sample geological cross-section along the left wall of the Warta is shown in the figure below.



ACTIONS TAKEN:

To ensure an adequate level of flood protection, the strengthening of the walls involved work such as: grubbing-up of trees and shrubs, removing the humus layer, compaction of the existing walls, supplementing and compaction of soil in order to achieve the desired height of the wall crowning, increasing tightness using vinyl sheet piling with the GW-460/5.5 profile by Pietrucha, construction of a vinyl cap above the sheet piling and construction of an emergency road with a width of 2 m on the crowning of the wall. A typical project cross section through the crowning of the wall is shown in the figure below.



The length (4.0 m or 5.5 m) of vinyl sheet piles was selected so as to improve tightness of the wall but not to prevent the flow of groundwater from external areas towards its natural outlet, the Warta river. It was therefore assumed that groundwater will flow under the structure. In the event of heavy rainfall, this solution will ensure a quick drying of agricultural land and residential areas located east of the river. It is worth noting that the driving of the sheet pile increases the stability of the flood walls due to an additional compaction of soil in areas surrounding the sheet pile. Sheet piling made of Pietrucha sheet piles will also provide additional protection in case of a local landslide (scouring) of the waterside slope of the wall, because it will act as a retaining structure keeping the remaining body of the wall. It will also provide uniform tightness conditions regardless of the type of soil of the body and the subsoil under the body of the wall. Construction work was carried out according to the guidelines of the project. In the described stage, 3,700 sheet piles were installed and the daily progress ranged between 30 and 40 m.

CONCLUSIONS:

The sample project described proved that the EcoLock vinyl sheet pile system by Pietrucha is an effective alternative to common methods for modernising flood walls. Structures made of the Pietrucha vinyl sheet piles are resistant to corrosion, and their efficient installation can shorten the duration of the investment. Thanks to a low weight of sheet piles, already at the stage of transportation investment costs are reduced. The cost of 1 m2 of the PVC sheet pile used in this project together with its installation is several times lower than the cost of a steel sheet pile that could be an alternative in this project. Total savings resulting from the technology of vinyl sheet piles used compared to steel sheet piling amounted to approximately PLN 3 million. Water engineering is still facing new challenges, and Pietrucha delivers solutions tailored to the needs of new realities resulting from the rapidly changing climatic conditions worldwide.

Gizałki: Rebuilding and strengthening flood walls using vinyl sheet piling system

Project description:

DATE: June-September 2019
LOCATION: Gizałki, Września Municipality, Wielkopolska Voivodeship
PRODUCT: vinyl sheet piles GW460/5.5 with a length of 4 m, quantity: 3,120 m^2

PROJECT ASSUMPTIONS:

- Rebuilding the left embankment of the Prosna and development of the adjacent areas
- Compaction of topsoil of the wall body
- Repair of damage to the wall body in the locations of existing wall crossings
- Improving the tightness of part of the body and substrate of the wall

CHALLENGE:

Local damage to the body of the wall, caused by beavers, ruts and local lowering of the crowning of the wall at the wall crossings and ramps. At some sections, the wall crowning is lower by 20 cm compared to the assumed parameters.

CONCLUSIONS:

As a result of work carried out, the flood wall of the Prosna was rebuilt to the parameters of embankment class III. Weakened sections of the flood wall were strengthened and the structure was secured against bursting and flooding of neighbouring areas when the water level of the Prosna is high. Construction work focused primarily on compaction of the body of the wall at some sections and increasing tightness of its body and substrate. Flood protection for the residents and their property was ensured. In addition, the waterside part of the wall was secured against damage caused by rodents.

Wielkopolska: comprehensive retention solutions of the Pietrucha Group in the design of green and blue infrastructure.

Project description:

DATA: February 2019 – April 2020
LOCATION: Dopiewo, Wielkopolska Voivodeship
PRODUCT:

- Vinyl sheet piles GW 610/9 with a length of 3 m in a quantity of 1,090 m^2
- Cap 290-360 lm.
- Mobile flood sluices from the FloodWarden system

PROJECT ASSUMPTIONS:

- Development of the pond area in the vicinity of ul. Strażacka.
- Profiling the embankment of the pond with an area of 6,010 m^2, to restore its recreational function.
- Execution of a continuous palisade of vinyl sheet piling, projecting at a height of 15 cm above the water surface, which protects the banks of the reservoir against landslides of bank slopes.

CHALLENGE:

- Old infrastructure making it impossible to maintain one water level in the reservoir.
- Sliding bank slopes, posing a threat to the safety of users

SOLUTION:

- The edges of the slopes were regulated and sealed by means of walls made of vinyl sheet piles.
- By using a cap, sharp edges of the sheet piles were covered and unevenness was masked, giving the slopes an aesthetic appearance and protecting the structure against the effects of weather.
- To restore the retention functions of the area, the existing water discharge was modernised by installing mobile sluices from the „Flood Warden" system in the existing weir.

CONCLUSIONS:

- Land development not only restored the retention functions of the reservoir, but helped organize the neglected space and adapt it to the needs of different groups of users. A relaxation and leisure site by the water was created.
- The investment carried out also gave a stimulus for further changes. With anglers in mind and to improve the ecosystem, the cleaned pond with silt removed will be stocked with fry and planted with new vegetation.
- Outdoor furniture will be added in the area: a picnic shelter, benches, bins, fire pits, an outdoor gym and lighting.
- An interesting spot for visitors will be an educational trail with interactive information boards.
- An attraction and novelty in the municipality will be a solar tree, which allows charging electronic devices through USB ports.

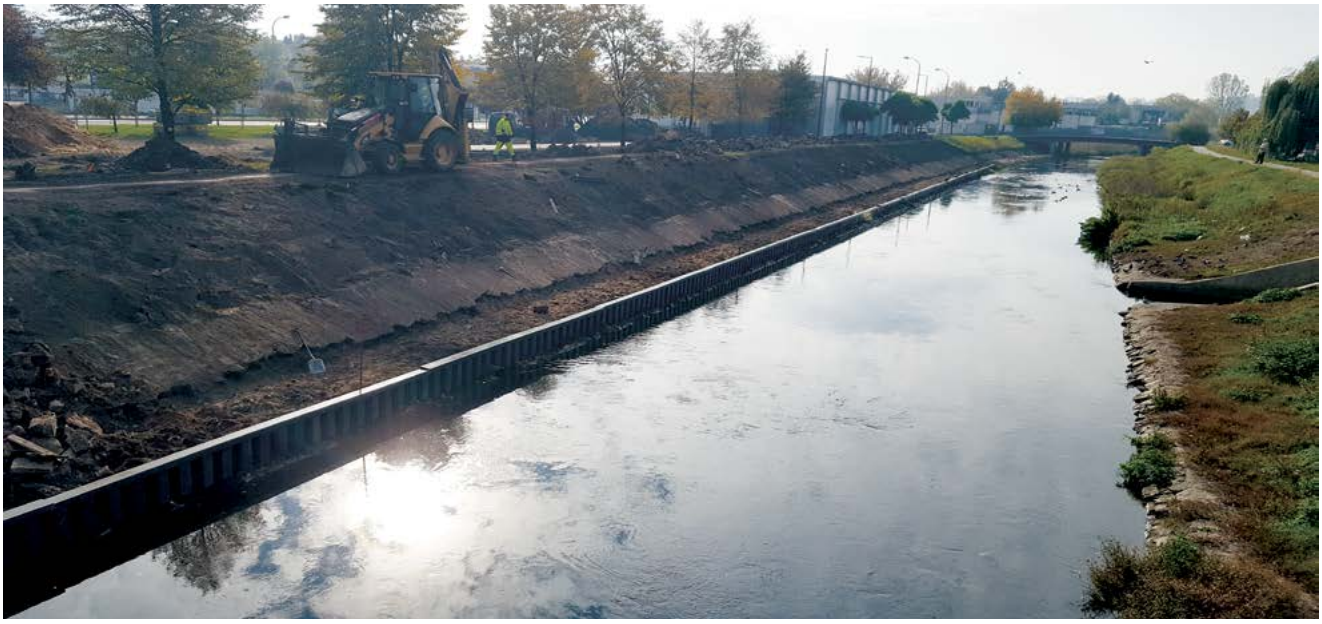
Będzin: vinyl sheet piles in the project of development of the river boulevards.

Project description:

DATE: September 2018
LOCATION: Będzin, Silesian Voivodeship
PRODUCT: Vinyl sheet piles GW300/5.5, with a length of 2 m, in a quantity of 800 m^2

PROJECT ASSUMPTIONS:

- Development of boulevards of the Czarna Przemsza river, creating an area of recreation and active open-air leisure.
- Bank protection structures, allowing the construction of a harbour, enabling leisure activities, including canoeing and water walking ball.



Kąty Rybackie: vinyl sheet piles as an element of storm protection of a fishing port

Project description:

DATE: August 2019
LOCATION: Kąty Rybackie, Pomeranian Voivodeship
PRODUCT: Vinyl sheet piles GW 580/11, with a length of 3 m, in a quantity of 330 m

PROJECT ASSUMPTIONS:

- Construction of a flood protection structure on the east side of the Fishing Port.
- Construction of a cut-off wall with a length of 110 lm, located under the footing of the reinforced concrete wall.

CHALLENGE:

A variable level of water, which depends on the direction of the wind, waves and ice, required the construction of a reinforced retaining and cut-off structure, which can resist the most severe weather phenomena.

SOLUTION:

- The flood protection structure was made of vinyl sheet piling, on which an L-shaped reinforced concrete wall was placed.
- Mechanical compaction of the embankment layer using the technology and equipment that ensure the required effect.
- After completion of the first stage of earthworks, the sheet piling of the cut-off wall was driven, and then the retaining wall was placed on it.
- The crowning of the wall was ground until smooth by chamfering edges. Dilatation was made between the sections.

CONCLUSIONS:

- The solution used will protect the area of Kąty Rybackie against flooding from the Vistula Lagoon, resulting from the powerful winds from the north and east that push water from the sea to the local rivers.
- The eastern part of the port has been protected from the effects of backwater that flooded streets and buildings, including the Vistula Lagoon Museum.

Kutno: vinyl sheet piles in a double role – as flood protection and retention infrastructure element.

Project description:

DATE: October 2018
LOCATION: Kutno, Łódź Voivodeship
PRODUCT: Vinyl sheet piles GW610/6.4, with gaskets, length 3 m, in a quantity of 600 m^2

PROJECT ASSUMPTIONS:

A petrol station, due to its location on a low-lying terrain and unfavourable subsurface and groundwater conditions was exposed to water flow from the surrounding fields.

CHALLENGE:

- Protection of the petrol station against flooding from the surrounding fields
- Extending and setting the direction for the water filtration route to increase the retention capacity of the agricultural land adjacent to the petrol station.
- Protection of the surrounding areas from possible contamination by chemicals.

SOLUTION:

- The area of the petrol station was protected against flooding with sheet piling made of vinyl sheet piles GW610/6.4 with a length of 3 m.
- In order to protect the surrounding agricultural land from contamination and to ensure 100% tightness of the structure made of sheet piles, profiles fitted with gaskets were used.

CONCLUSIONS:

Due to the use of vinyl sheet piles with gaskets, groundwater and rainwater flow down along the sheet piling to the drainage ditches and the storage reservoir next to the station.

HILLWOOD

Gardna Polder: Europe's largest investment using vinyl sheet piles

Project description:

Supply in 2012 of approx. 72,400 m^2 (15,690 lm in length, which is nearly 16 kilometres) of vinyl sheet piles used in the construction of a cut-off wall for the investment titled „Flood Protection of Gardna Polder V-VI." The construction, classified in importance class IV of hydraulic engineering facilities, protects an area of 918 ha against floods.

DATE: 2012
LOCATION: Słowiński National Park, Pomeranian Voivodeship
PROJECT ASSUMPTIONS:

- Extension of the filtration route of groundwater
- Increase of the stability of the wall structure
- Partial reconstruction of existing walls and construction of new walls

CHALLENGE:

Weak subsoil of the wall, mostly consisting of peat and high probability of uncontrolled settlement and erosion of the soil structure of the wall.

SOLUTION:

- The use of the EcoLock GW 270/5.5 vinyl sheet pile profiles made of hard PVC and a length suitable to reach the top layer of fine sands (2.0 – 9.0 m), to be used as an anti-filtration barrier and forming a support to the soil wall body, improving its stability.
- Use of a mix of peat and sand, and sand alone, in the construction of the body of the wall, which allowed the elevation of the crowning of embankments equal to 0.5 m above the water level.

CONCLUSIONS:

- The use of the solution based on EcoLock sheet piles made it possible to prevent water erosion and flooding of an area of 918 hectares.

Szczuczyn: vinyl sheet piles as an element of the retention infrastructure in the project of the construction of the expressway S61

Project description:

DATE: April/May 2020
LOCATION: Szczuczyn, Podlaskie Voivodeship
PRODUCT: Vinyl sheet piles GW458/12, with lengths of 6.5 m and 4 m, in a quantity of 1252 m^2

PROJECT ASSUMPTIONS:

Project to build a ringroad of Szczuczyn, as part of the S61 expressway. Vinyl sheet piles were used in the construction of two storage reservoirs as part of a project to build rainwater draining infrastructure.

Tomaszów Mazowiecki: vinyl sheet piles, as an element of the green and blue infrastructure, protect river banks against erosion

Project description:

DATE: September 2019
LOCATION: Tomaszów Mazowiecki, Poland
PRODUCT: Vinyl sheet piles GW 610/7.2, with a length of 4.5 m, in a quantity of 1120 m^2

PROJECT ASSUMPTIONS:

- Revitalisation of the areas on the Pilica in Tomaszów Mazowiecki.
- Protection of the banks of the Pilica against water erosion.
- The development of green and blue urban architecture, i.a. thanks to the construction of a new canoe dock equipped with launch ramps.

CHALLENGE:

- Due to the erosion of the river banks, areas adjacent to the river were exposed to flooding.
- An unstable and degraded concrete structure of the harbour posed a threat to safety.

SOLUTION:

- Sheet piles were used to protect river banks against water and biological erosion.
- A tight structure was installed along the shoreline and profiled in accordance with the historical shoreline, which for years was washed up by the current of the river.
- The old, degraded infrastructure was replaced with advanced solutions resistant to weather.

CONCLUSIONS:

- The solution used effectively stabilises shore water flow conditions, limiting scouring of the banks of the Pilica.
- Thanks to the revitalisation, a safe place for residents for active open-air recreation was created.

Biestrzynnik: EcoLock vinyl sheet piles in the construction of a water bar on the Libawa in the Oder catchment area.

Project description:

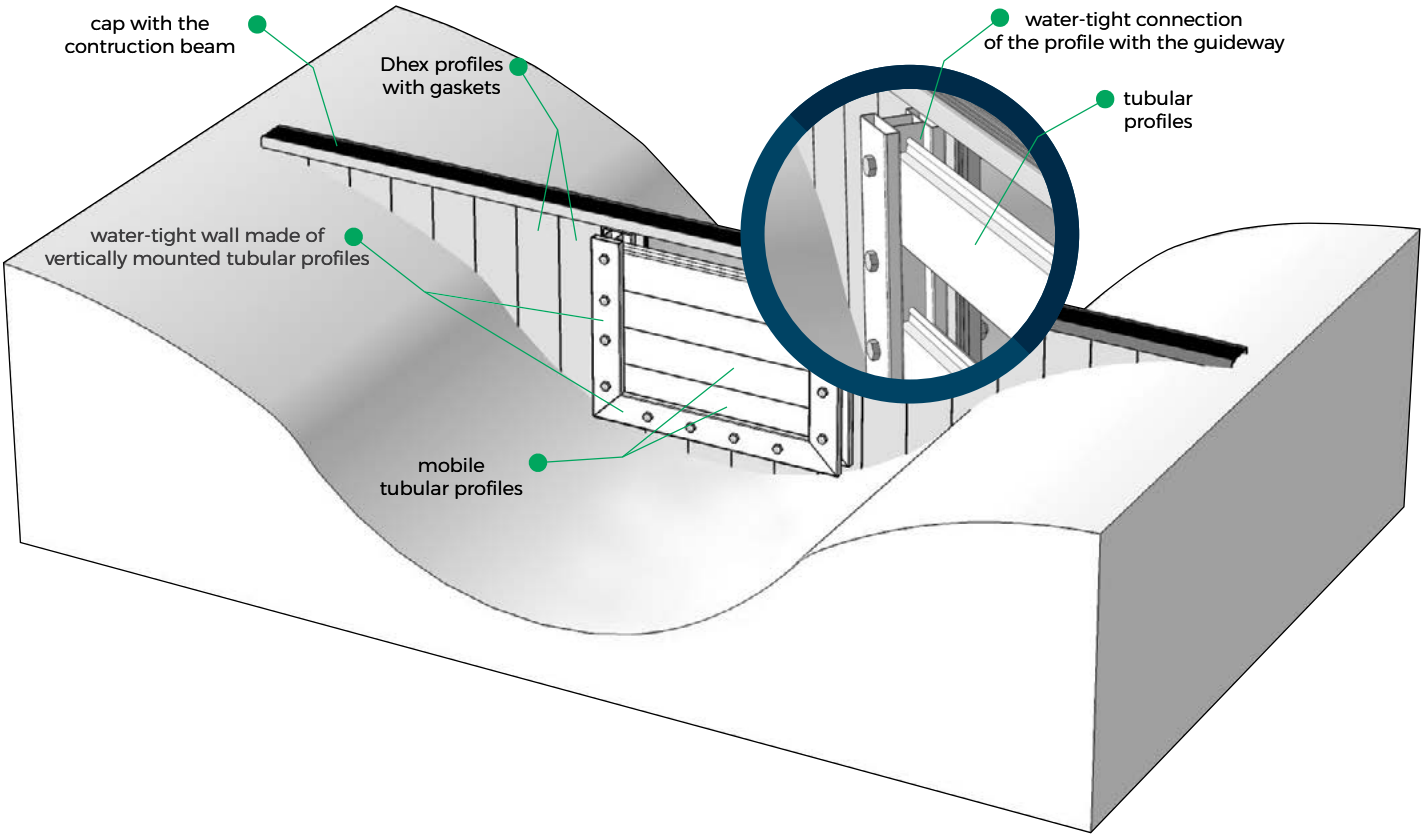
DATE: 2012r.
LOCATION: Biestrzynnik, Opole Voiveodeship
PRODUCT: Vinyl sheet piles GW 300/5.5

FLOOD PROTECTION AND WATER RETENTION

Costs-efficient, eco-friendly, durable and maintenance-free alternatives to solutions made of traditional materials such as concrete, stone or wood, used to protect complete ecosystems against floods and draughts.

Vinyl small retention sluices

- Easy to assemble, handle and maintain
- Light-weight mobile system elements
- No impregnation and maintenance works
- Highly resistant to mechanical, atmospheric and biological factors.
- Natural look in harmony with the surroundings



The small retention sluice gate system is made of tubular profiles in the shape of a honeycomb – Dhex. This profile design guarantees high strength and at the same time lightweight transport and easy assembly in hard access spots. The profiles are connected with locks equipped with valves which guarantee 100% water -tightness of the construction. The walls smooth surface of the walls may be extruded in the form of a tree ring pattern to perfectly melt with the surrounding environment.

When the water level rises, the PVC tubular profiles assembled diagonally fill in with water. The weight of the water inside the profiles makes the locks fit tightly to create water-resistant sluice. The water retaining system based on Dhex profiles is part of vinyl mobile flood protection systems.

Grabów: Comprehensive stream retention system: two types of vinyl sluices within one drainage area.

Project description:

DATE: November/December 2019
LOCATION: Grabów nad Pilicą, Kozienice Poviat, Mazovian Voivodeship
PRODUCT:

- Sheet piling, docking – D-Hex sheet piles with gaskets
- Sheet piling, docking – Cap 7 m, reinforced with a wooden log
- Wall strengthening the treasures and the bottom of the ditch – Sheet pile GW 300/5.5
- Slope strengthening structures – Geogrid with a mesh of 25x35 cm and stone mound
- Sluice straight beams – small retention sluice
- Sluice U-shaped beams – sheet piles GW 580

PROJECT ASSUMPTIONS:

Enhancing the retention capability of the ecosystem by increasing the water level to the height of 1 metre. The need to reduce the permeability in the bed of the object.

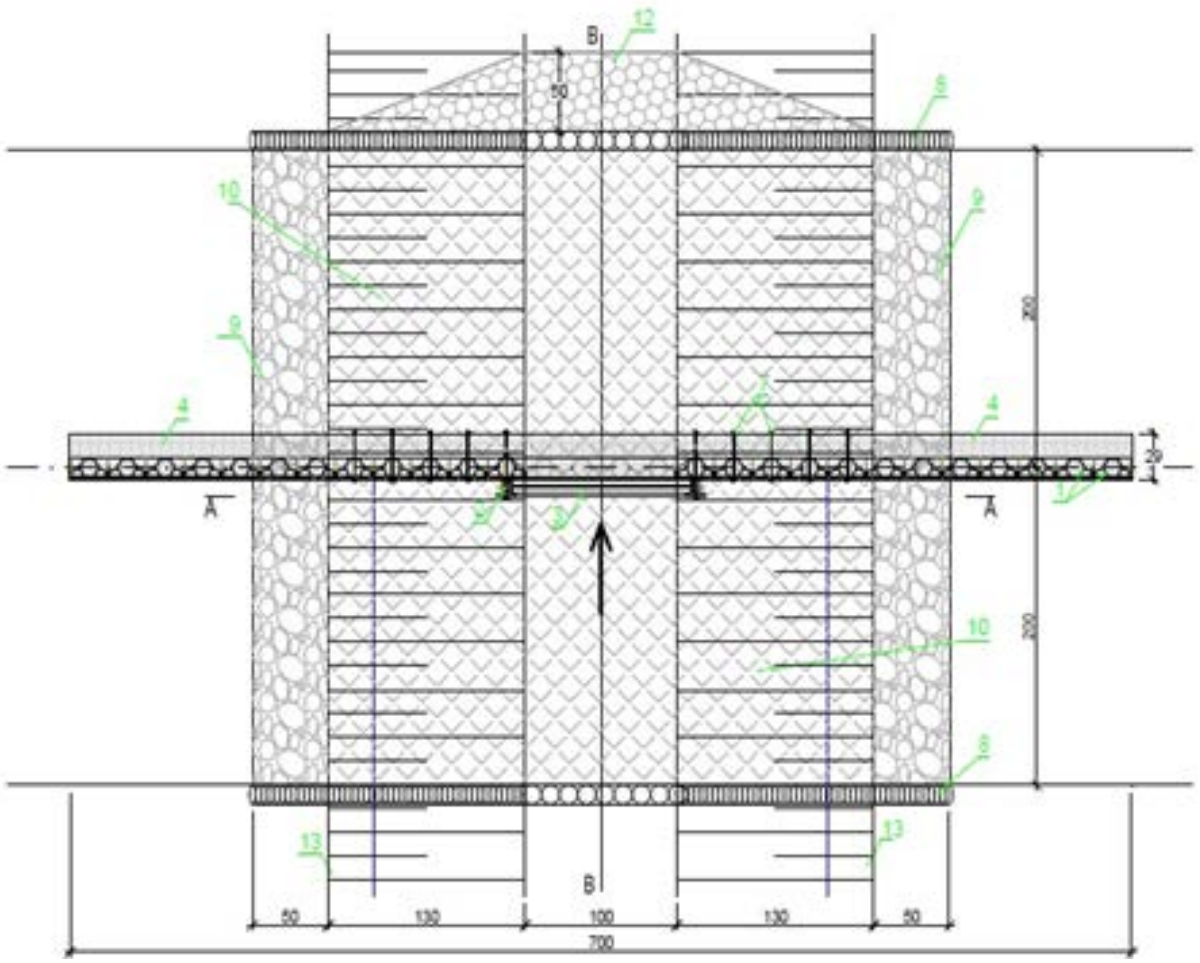
SOLUTION:

The Pietrucha Group has developed and delivered a proprietary solution in terms of stream retention, involving the installation of two types of vinyl sluices that are located within one drainage area. The project was carried out in the basin of the Pilica, and the work was carried out for the INSTITUTE OF TECHNOLOGY AND LIFE SCIENCES in Falenty, within the framework of the project titled „Technological innovation and system of monitoring, forecasting and operational planning of drainage activities for precise water management on a level of a drainage object – INOMEL" – implemented as part of the BIOSTRATEG programme, financed by the National Centre for Research and Development.

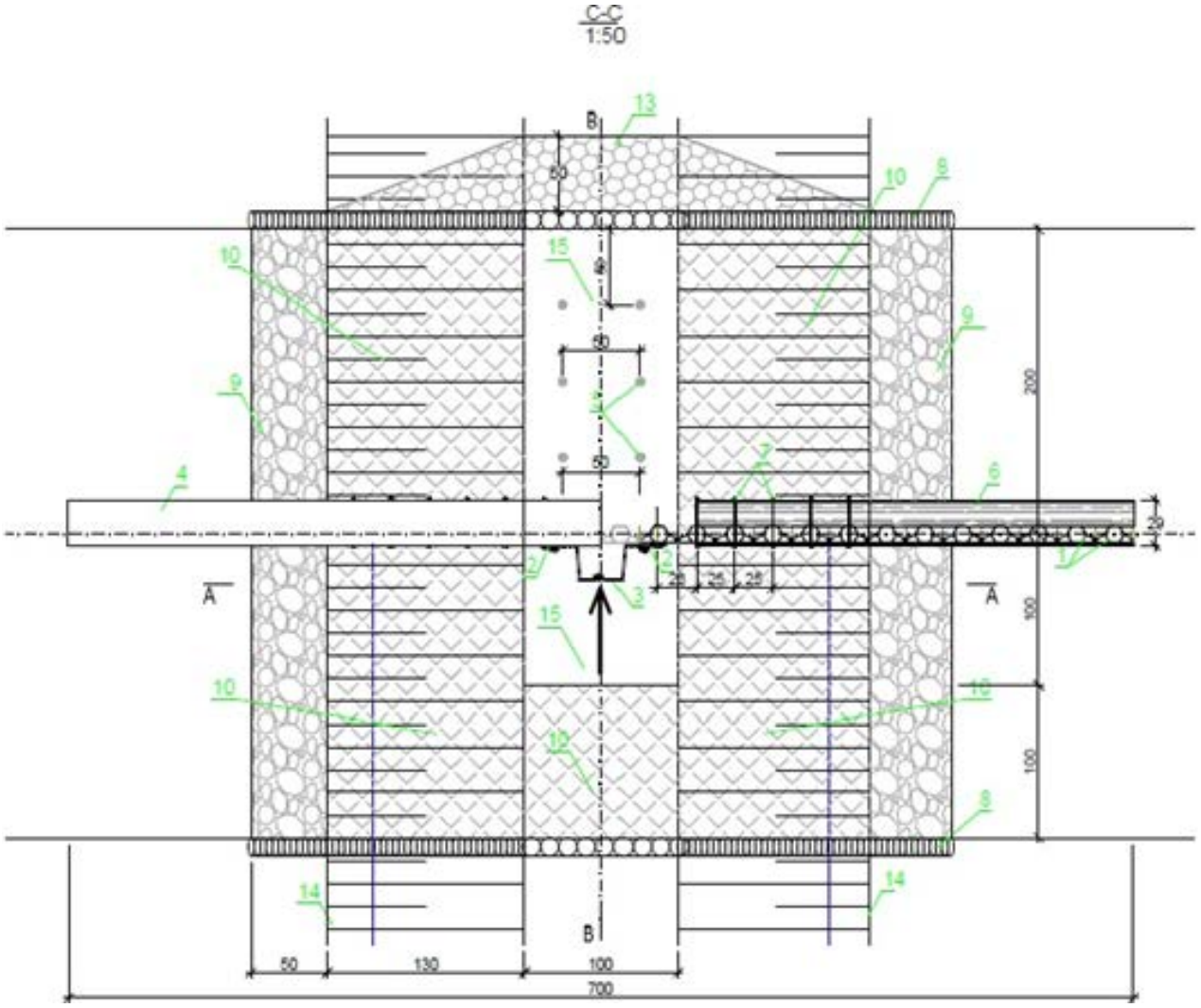
Type I – Sluice with straight beams used in the closure

Top view

1:50



Type II – Sluice with U-shaped beams used in the closure



- Both types of sluices were mounted in a sheet-piling (docking) wall made of D-Hex sheet piles fitted with a gasket. Driving was carried out using an excavator with a vibration hammer installed and a claw mandrel intended for D-Hex sheet piles. Dimensions of sheet piling for both types of sluices are:
  - Height– 130 cm
  - Lenght – 700 cm
  - Depth of immersion – 210 cm
- In the case of the straight sluice, the bottom of the ditch was strengthened with stone mound.
- In addition, in the case of installation of the U-shape sluice, the bottom of the ditch should be strengthened with a monolithic bottom plate made from concrete with a thickness of 15 cm reinforced with a mesh.
- Height of the beams was designed to be 150 mm each. The height of water damming depends on the number of beams in the guides.

CONCLUSIONS:

- The designed straight beam closure allows for damming of water in the flow at a maximum width of 1 metre and a height of 1 metre corresponding to 6 assembled beams fitted with an EPDM adhesive gasket.

- Flowing water is stopped at the height of the beam, and pressing against it, it floods the beam chamber, additionally weighting it with water. The additional weight of water causes the clamping of gaskets on the bottom surface of the beams so that the connection is sealed.

Sweden: First vinyl small retention sluice installed outside Poland

An impressive, double vinyl small retention sluice, manufactured and delivered by the Pietrucha Group, was installed in southern Sweden as part of a system to regulate the water level of a large lake and protect the surrounding ecosystem against drafts.

FIRST POLISH SLUICE INSTALLED ABROAD

Vinyl sluices are modern, durable and easy-to-use alternative to traditionally used wooden solutions. It is also an environmentally friendly solution, due to the use of components from PVC construction recycling, and the possibility of its recycling. One of such sluices, designed, manufactured and delivered by the Pietrucha Group, has just been installed in southern Sweden, as part of a water level regulation system of a large lake. This is the first vinyl sluice installed outside Poland. Thanks to the use of advanced, weather-tight polymer materials, the sluice does not require maintenance; there is also no need to impregnate its elements.

SLUICE DESIGNED FOR SPECIAL TASKS

The sluice installed in southern Sweden will be part of a water level regulation system of a large lake and a protection measure for its ecosystem against droughts. Its task will be to dam water in March and keep it at an elevated level until the end of July.

IMPRESSIVE SIZE AND SPECIAL DESIGN TO MEET THE DEMANDS OF THE PROJECT

The sluice installed in Sweden has impressive dimensions, almost twice the dimensions of sluices previously installed. The length of the top cap of the sluice is almost 10 metres.

The sluice is also unique because of its design, adapted to the hydraulic engineering and geotechnical requirements of the project in Sweden. In order to optimally perform its retentive function, the sluice has been specially designed and has two water passes of the total length of 1.5 metre, which ensures high resistance to the pressure of lake water.

Podanin: vinyl small retention sluice as an element of the protection of a forest ecosystem against droughts

Project description:

DATE: 2018
LOCATION: Podanin, Wielkopolska Voivodeship
PRODUCT:
D-HEX with gasket
- 4 pcs. X 1,5 m
- 8 pcs. X 2,5 m
- 12 pcs. X 2 m

Cap
- Cap 290 – 6 lm
- Cap 130 – 1,2 lm

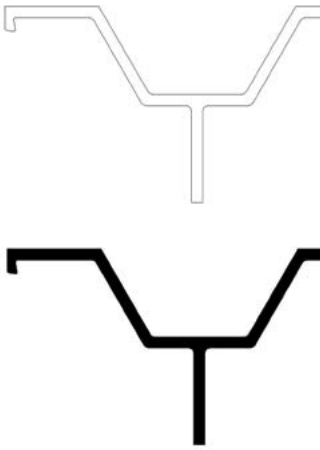
PROJECT ASSUMPTIONS:
Delivery and installation of a vinyl small retention sluice with a width of 6 metres. The vinyl sluice replaced a devastated wooden sluice.

CHALLENGE:
Ensuring a durable and easy-to-use system that would increase the capacity to retain water within a forest ecosystem. Small retention facilities built under a programme titled „Increasing retention capacity and preventing floods and droughts in forest ecosystems in the lowlands," co-financed by the Cohesion Fund, must remain sustainable for a period of 5 years from the completion of the project.

SOLUTION:
Installation of a modern and sustainable sluice made of PVC. The removal of a damaged wooden sluice and installing in its place a retention sluice made of PVC profiles with gaskets.

CONCLUSIONS:
Vinyl small retention sluices guarantee easy service facilitated by light, movable system elements. In addition, they require no maintenance and are resistant to pests, moisture and extreme temperatures.

Open top road culverts



An innovative solution preventing roads against surface runoff.

- Do not require maintenance, impregnation and cleaning.
- Durable and resistant to mechanical pressure.
- Resistant to biological and atmospheric factors.
- Assembly does not require large interference into the load-bearing road structure.

Originally, the road culverts were made of wood, stone or concrete. The traditional materials had their limitations. The average lifetime of wooden culverts is three years and in case of mountain roads bearing load of 40-50 tons, two years. Concrete excludes the traffic load of over 3.5T. Because of the cost and complexity of installation, stone open-top culverts may not be universally used.

The vinyl open-top road culverts are the result of cooperation of the Pietrucha Group R&D Division, academics from the Forrest Faculty of the Warsaw University of Life Sciences - SGGW and the representatives of the State Forests. The vinyl open-top road culverts are a durable and maintenance-free alternative to the traditional road drainage solutions. The vinyl open-road culvert is installed 15 cm deep in the road structure. In case of roads reinforced with geogrids or geocells, vinyl open-road culverts do not breach the load-bearing layer of the road. In case of wooden solutions, geogrid or geocell must be cut at the edge of the culvert. In case of vinyl open-top culverts, the reinforcement runs beneath the vinyl profile.

Wooden culverts cleaned one month ago

Vinyl culvert covered with GlideWax® shield

The GlideWax® hydrophobic shield

The vinyl open-top culverts are covered with the GlideWax® shield using specially selected metal oxide nanoparticles, to enhance the hydrophobic properties of the profile surface. Thanks to the GlideWax® shield the open-top culverts clean themselves of sand, small stones and other material carried by the rainwater or vehicles wheels.

BIAXIAL GEOGRIDS

Top-quality geogrids with stiff nodes used for soil stabilization and separation in order to save costs and time.

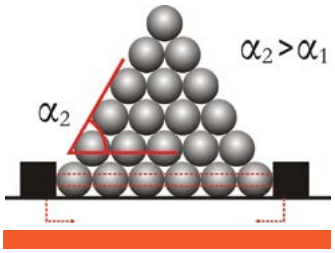
- Thanks to considerable savings on the aggregate, the use of the PolGrid geogrids helps reduce the CO2 emissions caused by construction works.
- The use of the PolGrid geogrids considerably extends the life performance of asphalt
- The PolGrid geogrids have been proven to perform in extreme climate conditions which helps reduce the road maintenance costs

How they work?

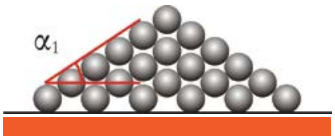
Soil stabilization and separation
Used to reinforce the road structure, geogrids prevent horizontal displacement and penetration (propagation) of aggregate grains into the weak substrate and the loss of stability of the foundation layer.

Saving of costs and time
Effective blocking of the aggregate efficiently reinforces the load-bearing capacity of the structure. By decreasing the soil replacement, geogrids allow for savings on the aggregate of up to 40%. Biaxial geogrids allow for savings on the aggregate layer used to construct a given road, without any impact to its load-bearing capacity.

Extending the life performance of roads
Thanks to a better load and pressure distribution in the road foundation, geogrids considerably reduce the amount of wheel ruts, even in extremely unfavorable soil conditions. It has been proven that over time, geogrids considerably reduce the amount of wheel ruts, even in extremely unfavorable soil conditions.



With geogrid



Without geogrid

The PolGrid Geogrids Application

Tar roads

Reinforcement of aggregate substrate layers, reinforcement of embankments and dykes, geosynthetic layers at the base of embankments.

Railways

Reinforcement of substructures of the railway tracks, strengthening of railway embankments.

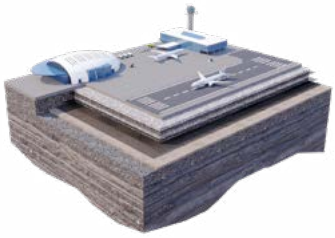
Forrest roads and technological roads

Construction of dirt roads with extended durability and resistant to the creation of wheel-ruts.

Temporary roads and working platforms

Quick construction of temporary roads made of unbound aggregate, i.e. technological roads, access roads to windfarms, working platforms.

Airports and landing pads



Reinforcement of runways, airstrips and technical roads.

Warehouses, carparks

Reinforcement of subsoil requiring higher load-bearing capacity, i.e. under manoeuvring squares, warehouse storage yards, parking lots.

Installation

- The simplified installation consists in spreading the rolls of the geogrid on the prepared soil substrate.
- The PolGrid sheets means geogrid rolls can be handled by two persons.
- Geogrid with stiff integrated nodes do not require pre-tensioning or anchoring, and they work immediately once they are spread on or below t he aggregate layers.
- High endurance of the geogrids guarantees resistance to installation damage.

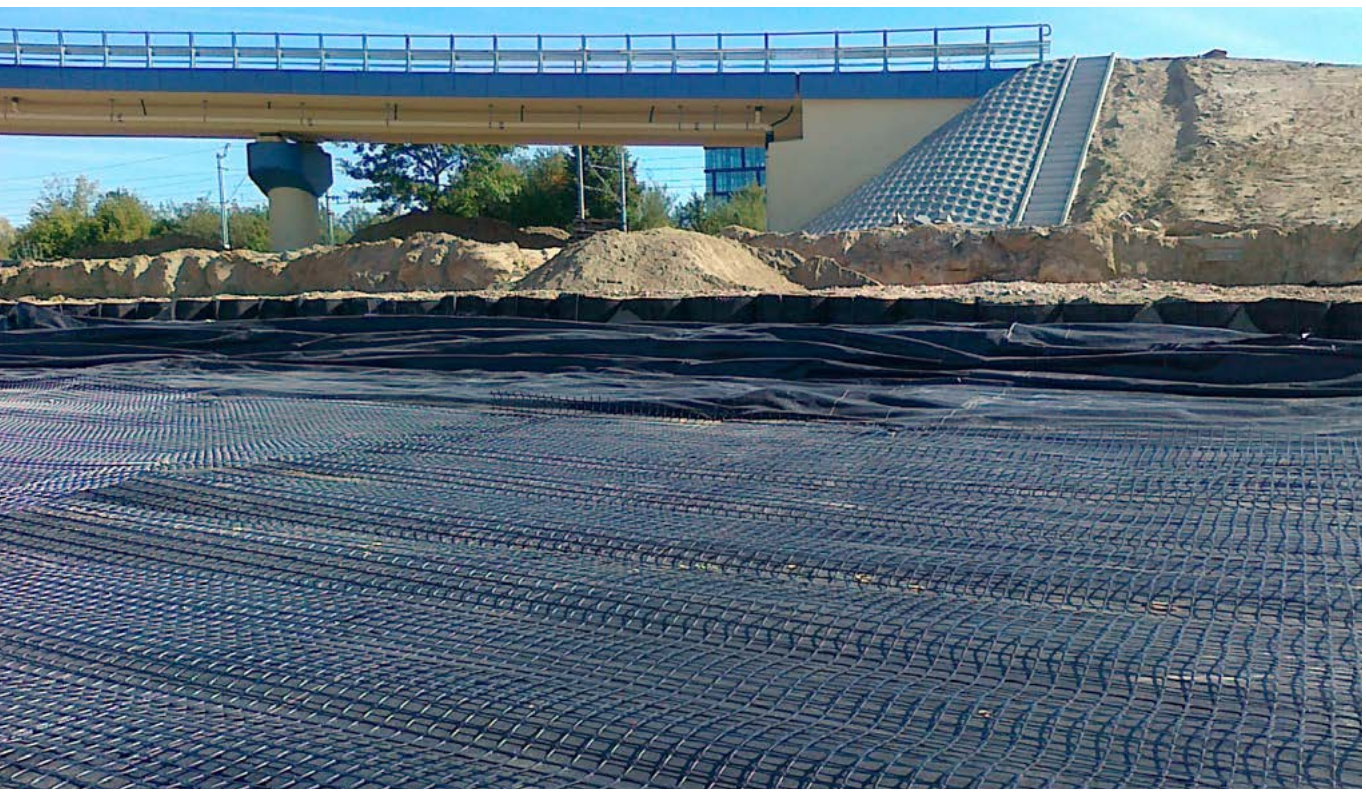
Geocomposites: the advantages of geogrids and non-woven fabric for greater reinforcement

Geocomposites combine the advantages of a geogrids and non-woven geofabric for even higher reinforcement, filtration and separation. They are used on boggy substructures or in case of materials of unfavourable grain size, where the separating function needs to be enhanced. The type of the non-woven geofabric is individually selected to meet the requirements of a given project.

- Thanks to considerable savings on the aggregate, the use of the PolGrid geogrids helps reduce the CO2 emissions caused by construction works.
- The use of the PolGrid geogrids considerably extends the life performance of asphalt
- The PolGrid geogrids have been proven to perform in extreme climate conditions which helps reduce the road maintenance costs
- This method does not require any advanced preparatory earthwork, which reduces the construction time span.

Biaxial Geogrids

The diverse PolGrid product range allows for the optimal selection of a given product to meet the requirements of individual projects and constructions.



Depending on the functionality and the project requirements, a geosynthetic with a given composition and form is selected.

Kalisz: modernisation of blue and green urban infrastructure and reconstruction of flood protection structures

Project description:

DATE: November 2019 – June 2020
LOCATION: Kalisz, Wielkopolska Voivodeship
PRODUCT:

- Vinyl sheet piles GW 610/9 with a length of 3.5 m and 4.5 m, quantity of 5,260 m^2
- PolGrid geocomposite FSR BX30/30 150 PP, a quantity of 5,000 m^2

PROJECT ASSUMPTIONS:

Two types of products by the Pietrucha Group, vinyl sheet piles and geocomposite were used in the project of reconstruction of the left embankments of Bernardyński Channel and the right Main Stream of the Prosna in the City Park in Kalisz. The project also covered revitalisation of the City Park, which included paved paths located on the crowning of the flood wall.

CHALLENGE:

- The investment area under heritage protection based on an entry in the register of monuments.
- Increasing flood protection of the city of Kalisz, in particular buildings of the historic city centre.
- The need to increase tightness of the body and foot of the flood walls to reduce the risk of scouring and bursting during the passage of flood waters.

SOLUTION:

- Reconstruction of the left flood wall of Bernardyński Channel with a length of 928 m and the right flood wall of the main stream of the Prosna with a length of 592 m in the City Park in Kalisz, as a result of which the structure has met the parameters for technical class II.
- The tightness of the flood wall substrate is increased using sheet piling made of vinyl sheet piles GW610/9 with a height of 3.5-4.5 m, elevated 50 cm above the dependable water level.
- The planned construction of pavement on the crowning of the flood walls has been adapted to the vehicle traffic:
  - mineral pavement of aggregate 0/8 mm (3 cm)
  - dynamic layer of aggregate 0/16 mm (5 cm)
  - foundation of crushed aggregate, fraction 0/31.5 mm (30 cm)
  - PolGrid geocomposite FSR BX 30/30 150 PP

CONCLUSIONS:

As part of the reconstruction, the flood wall structure was compacted, depressions were levelled and the wall crowning elevation was reconstructed. The body of the flood wall and its foot were sealed by means of sheet piling made of vinyl sheet piles.

As part of the revitalisation of the City Park, a safe and user-friendly recreational area promoting active leisure was made.

Rumin: Modernisation of the left-bank flood wall on Rumin Polder

Project description:

DATE: September 2019 – November 2019
LOCATION: Rumin, Wielkopolska Voivodeship
PRODUCT: PolGrid geocomposite FSR BX30/30 150 PP in a quantity of 3,400 m^2

PROJECT ASSUMPTIONS:

Geocomposite supplied by the Pietrucha Group was used in a project for modernisation of the left-bank flood wall of the Warta in the section from km 395+400 to km 396+900 in the village of Rumin, Stare Miasto Municipality, Konin Poviat.

CHALLENGE:

Expansion and sealing of flood walls to meet the requirements of technical regulations. In order to ensure favourable conditions for the maintenance and operation of the flood protection system, the planned construction of the wall crowning pavement needed to be adjusted for the vehicle traffic.

SOLUTION:

The wall crowning was strengthened with crushed stone layers with a thickness of 20 cm, which was placed on Polgrid geocomposite FSR BX30/30 150 PP

- Lower layer 10 cm thick crushed stone 31.5/63 mm
- Top layer 10 cm crushed voussoir 5/31.5 mm + grinding 0/5 mm

CONCLUSIONS:

- The wall body has been sealed and expanded to the parameters corresponding to technical regulations.
- The wall crowning width was increased to 3.5 m, with an inclination of slopes of 1:2.
- The strengthening of the wall crowning made it possible to drive vehicles used for maintenance of embankments and to facilitate flood operations.

Szczecin: Design and execution of a cycling trail on the flood wall along the Chełszcząca and Lake Dąbie

Project description:

DATE: July 2017
LOCATION: Szczecin, West Pomeranian Voivodeship
PRODUCT: PolGrid geogrid BX30/30 in a quantity of 72,000 m^2

PROJECT ASSUMPTIONS:

Design and construction of a cycling trail with a length of approximately 23 km located in Western Pomerania, which runs along Lake Dąbie at a section running along the flood walls.

CHALLENGE:

- Cycling trails should be designed in such a way as to make it possible to drive mechanical equipment for mowing wall slopes onto the flood wall without damaging the planned cycling trail.
- Materials that protect against scouring had to be used in the construction of the trail.

SOLUTION:

A cycling trail was constructed with a surface made of geogrid, stabilised with the PolGrid geocomposite and crushed mineral aggregate with a fraction of 0/31.5 mm, with a width of 2.5 m at the crowning of the flood wall. Design:

- foundation of the wall crowning of soil (loamy sand) with a thickness of min. 10 cm (after compaction)
- construction of a compacted levelling and draining layer of sand 10 cm thick
- laying soil reinforcement made of separation and reinforcing geocomposite with a strength of 30 kN/m
- laying a foundation of geogrid with a height of 10 cm together with filling the space with crushed aggregate with a fraction of 0/31.5 mm; thickness of the layer after compaction – 10 cm

CONCLUSIONS:

The project covered the modernisation of the flood protection structures and their protection against water corrosion. A cycling trail was constructed on the flood wall, which increased tourist and recreational assets of the area of Lake Dąbie. The reinforced and paved surface of the flood wall has made it possible to drive wheeled vehicles for the purposes of maintenance of embankments and flood operations.

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