



ACTION C2: Implementation for demonstration of NWRMs on the catchment level coordinated by municipalities for climate adaptation on the hilly pilot

Milestones:- Report on the implementation of the NWRMs stream

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Brief description: This implementation report presents the natural water retention measures (NWRMs) delivered under the LIFE LOGOS 4 WATERS project in the Szilágyi Creek catchment and related drainage ditches, across Püspökszilágy, Penc, Püspökhatvan, Váckisújfalu, Galgagyörk, Kismémedi, Vácduka, Rád and Kosd. The interventions aim to slow down flash-runoff, reduce sediment transport and channel erosion, and increase local infiltration and temporary storage, lowering flood peaks near settlements and improving drought resilience. Measures follow a multi-step “cumulative” logic: upstream log dams/pile rows and Benjes hedges trap sediment and dissipate energy, while downstream features can provide short-term retention. Operation is event-driven (no permanent water level), so continuous gauging is usually unnecessary; long-term performance relies on regular inspections (especially after heavy rain) and removing accumulated sediment when it reaches the crest level.



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Integrated application of innovative water management methods at river basin by coordination of local governments” project title, LIFE20 CCA/HU/001604 administration number

LIFE LOGOS 4 WATERS project

IMPLEMENTATION REPORT

On the Mountainous and Hilly Water Retention Solutions Implemented in the Püspökszilágy

Catchment Area in the municipalities of Püspökszilágy, Penc, Püspökhatvan, Váckisújfalu,

Galgagyörk, Kisémedi, Vácduka, Rád, and Kosd.



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1. General description

The implementation report provides a summary of the Nature-Based Water Retention Measures (NWRM) carried out within the LOGOS4WATERS intervention area – covering the catchment of the Szilágyi Stream and its associated tributaries, as well as the drainage ditches linked to the surrounding settlements. The common objective of these interventions is to mitigate the problems arising from the extreme hydrological regime of small hilly catchments: to reduce sudden, flash flood-type runoff, decrease sediment transport and channel erosion, and increase local water retention and infiltration. At the same time, the measures contribute to alleviating pressure on downstream sections near settlements (by reducing siltation of culverts, bridges, and ditches, and lowering flood risk), while also supporting climate adaptation by improving soil moisture conditions and groundwater recharge potential.

The catchment is characterised by steeper slopes and erosion gullies where rainfall rapidly concentrates, generating high-energy runoff within a short period of time and transporting significant sediment loads to valley-bottom sections. In the upper, erosion-prone areas, this manifests in channel incision, downcutting, and bank collapse, whereas in the lower-gradient sections closer to settlements it results in siltation, reduced culvert and ditch capacity, and periodic flooding. Land use within the area is mosaic in nature (forests, grasslands, and agricultural fields); however, bare or poorly structured soils – particularly during heavy rainfall events – further accelerate runoff and sediment formation. Therefore, the impacts observed in the area can only be properly understood within a catchment-scale context.

The project logic is based on creating a multi-level, mutually reinforcing (cumulative) impact within the catchment. In the upper sections, structures designed to reduce runoff energy and trap sediment (e.g. single- and double-row log dams, stake rows, brushwood fences (Benjes hedges), and stone placements) were installed. In valley-bottom and transitional zones, solutions aimed at temporary water retention and enhanced infiltration (e.g. water-retaining earthworks and larger backwater structures) were implemented. At certain locations, technical interventions were complemented by habitat and landscape rehabilitation elements (tree and shrub planting), which help stabilise the water retention effect in the longer term and contribute to improving the local microclimate.

The measures are small-scale, based on the use of local materials and nature-friendly design principles. Their operating concept does not aim to maintain a permanent water level, but rather to provide temporary backwater effects and storage linked to rainfall events. The key to sustainable operation lies in regular inspection and maintenance: in particular, monitoring and, if necessary, removing sediment accumulated upstream of the structures, as well as checking structural elements (fixings, side reinforcements, protective measures) after major rainfall events. Accordingly, the chapters of this report present, site by site, the justification, technical content, implementation process, and key maintenance considerations of the interventions.

2. Description of the Implementation of Flow-Attenuation Structures in Püspökszilágy

2.1. Gombás-stream (Muflon-garden)

On the section of the Gombás Stream located outside the administrative area of Püspökszilágy, on property parcel no. 0156, the objective of the intervention was to slow down surface runoff, retain sediment locally, enhance infiltration, and thereby mitigate channel degradation (incision). At this site, intense rainfall events generate significant sediment transport and high-energy runoff. In contrast, during low-flow periods the watercourse becomes intermittent and may nearly dry out in certain sections, which negatively affects habitat conditions. Due to sediment inflow from surrounding areas not designated as

Natura 2000 sites, a perched channel condition has developed along this section of the stream, further weakening its hydrological connection with groundwater.

The intervention area is located within the Western-Cserhát and Naszály (HUDI20038) Natura 2000 Special Area of Conservation; therefore, nature conservation considerations were of primary importance during both planning and implementation. According to the documentation, direct mechanical access to the site was limited due to Natura 2000 constraints and site accessibility conditions; consequently, manual construction methods were recommended, avoiding the creation of temporary access roads that could have increased the flow velocity and erosive energy of runoff arriving from adjacent agricultural lands.

Based on the design plans, two consecutive log check dams with energy-dissipating and sediment-retention functions were installed in the streambed using local materials (Figure 1). The locations of the structures were recorded with EOY coordinates: (1) EOY Y 665751.8; EOY X 270270.2, and (2) EOY Y 665838.4; EOY X 270249.9. The selected structure type is a double-row timber check dam, consisting of two single-row log barriers constructed approximately 0.5 m apart. The gap between the two rows was lined with geotextile and filled and compacted with CP 0–63 graded stone (or, depending on the design variant, local material) (Annex I: As-built design of Püspökszilágy Gombás Stream – “Muflon Garden”). The structural concept relies on sufficiently deep anchoring of vertical posts, lateral tying of horizontal elements into the stream banks, and protection against scour to ensure stability. Through backwater effects, the structures increase water residence time and improve local infiltration conditions.

According to the documentation, the main implementation steps included temporary water diversion, necessary earthworks, driving in the posts, fixing and anchoring the horizontal elements into the stream banks, placing the geotextile, and finally filling and compacting the interstitial space. A key principle was to minimize disturbance to the site through rapid and concentrated work execution, and to ensure that no construction waste remained in the area.

Among the expected positive impacts, the design documentation highlights the reduction of sediment inflow from adjacent arable lands, the attenuation of peak runoff events, and the cumulative effect of the two consecutive structures, which together support the long-term stabilization of the ecological status of the stream section.

With regard to operation and maintenance, the structures function primarily in an event-driven manner (linked to rainfall events). Continuous discharge or water-level monitoring is generally not required. The key to sustainable performance lies in monitoring sediment accumulation behind the structures and removing excess sediment when necessary, as well as regularly inspecting structural elements (anchoring, lateral connections, and scour protection), particularly following major precipitation events.



SEQ ábra * ARABIC 1. ábra Püspökszilágy Gombás-patak felső- és alsó gátja

2.2. Mill

Within the framework of the LIFE LOGOS 4 WATERS project, small-scale, nature-based water retention measures were implemented at the “Malom” (mill) intervention site, in the area of the confluence between the main stream and a side branch. The objective of these measures was to mitigate sudden, flash-flood-type runoff events, increase local water retention, and reduce sediment transport and the erosive energy of flowing water. According to the documented records, the intervention area was precisely delineated using EOVS coordinates and cadastral parcel (hrsz.) references. The side branch confluence and the affected section of the main stream—from the junction point to the administrative boundary—were clearly identified and recorded.

The central element of the intervention is a large-scale log dam (Figure 2), which, during significant precipitation events—particularly flash floods—backs up the increased stream discharge. This reduces flow velocity and alleviates pressure on downstream sections. As a result of the backwater effect, part of the water is allowed to spread in a controlled manner onto the right-bank reed and meadow area. This both attenuates peak runoff and promotes infiltration, thereby supporting soil moisture retention.

According to the site documentation, the trace of an old, meandering streambed can still be identified within the meadow area, providing a natural space for the temporary overflow and retention of water.

In the lower section of the site, complementary habitat enhancement measures were implemented in connection with the water retention structure. These included afforestation and shrub planting, explicitly aimed at increasing biodiversity and stabilising the long-term water retention effect. As a result, the emergence of a newly developing habitat is expected, associated with the periodic presence of water, a more humid microclimate, and a more diverse vegetation structure.

Overall, the interventions at the “Malom” site fit into the broader, catchment-scale logic of the project: the log dam reduces the energy of rapid runoff, increases water residence time, and improves water supply to the right-bank wet habitats, while afforestation and shrub planting enhance the ecosystem services and resilience of the area. Sustainable operation depends on regular monitoring of sediment accumulation and structural conditions around the log dam—particularly after major rainfall events—to ensure that backwater effects and controlled water spreading continue to function as intended and deliver their anticipated benefits.



2. fgiure Püspökszilágy Malom logdam



2.3. Kisköves

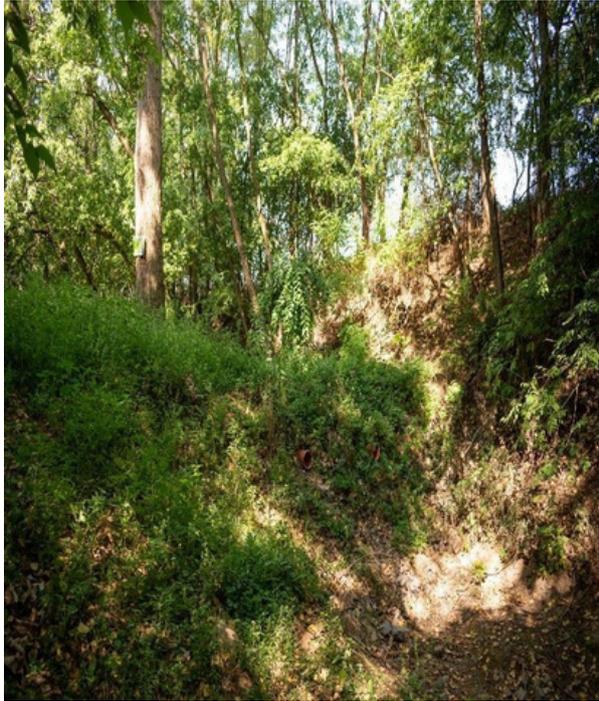
In the Kisköves side branch, the starting point of the intervention was that intense rainfall runoff arriving from the steeper upstream forested areas rapidly concentrates in the temporary gully, carrying a significant amount of sediment from the slopes. This process reinforces incision within the gully, while downstream—closer to utilised land and the settlement area—it increases sediment load and the risk of siltation. The logic behind selecting this site was therefore to capture sediment and reduce flow energy before reaching critical downstream sections, while improving infiltration conditions by retaining part of the water locally.

Implementation was based on establishing a multi-stage, mutually reinforcing system. On the lower, valley-bottom section, one water-retaining earth structure was constructed (Figure 3), designed to slow runoff, facilitate sediment deposition, and temporarily retain water. The planned storage area behind the structure has an approximate water surface of 340 m² and a net storage capacity of around 255 m³. The objective was not to maintain a permanent water body, but rather to allow retained water to infiltrate, thereby supporting soil moisture and stabilising the local water balance. During higher flow events, excess water can be safely conveyed downstream. Erosion protection at the earth structure is ensured by stone riprap reinforced with wire mesh.

Upstream of the earth structure, as a form of “pre-protection,” one double-row log dam was installed (Figure 4). Its function is to reduce flow energy and trap part of the sediment load before water reaches the earth structure, thereby protecting the storage area from rapid sedimentation. The double-row configuration—filled and stabilised between the two log rows in accordance with the design—creates a structure that further reduces flow velocity through backwater effects and promotes sediment deposition (Annex II: Püspökszilágy Kisköves as-built plan). The intervention affects parcels 015/3 and 015/4; the main structures are fixed by EOV coordinates (water-retaining earth structure: 669922.3 / 266956.2; log dam: 669953.3 / 266970.8).

In addition to the main structures, complementary elements were implemented to ensure effectiveness during smaller, more frequent runoff events and to provide a more gradual sediment retention function. Benjes hedges were installed at key points along the gully (Figure 5), slowing sediment-laden runoff and promoting deposition. Behind the second Benjes hedge (Figure 6), at a critical point, a 5-metre-long erosional incision was stabilised with 7 m³ of natural stone riprap, and an additional single-row log dam was installed below the stone structure. This combined solution halts channel degradation, enhances sediment retention, and further reduces flow velocity, while contributing to improved infiltration conditions and beneficial microclimatic effects.

As a result of the intervention, a multi-stage runoff-reducing and sediment-trapping system has been established in the Kisköves side branch. The upstream log dam reduces the energy of incoming water and sediment, while the downstream earth structure provides temporary storage space for water retention and sediment settling. The key to sustainable operation lies in monitoring sediment accumulation in the storage area and managing it when necessary, as well as regularly inspecting the structural elements and protective works—particularly after major rainfall events.



3. Penc helyszínek vízlassító műtárgyak megvalósításának a leírása3.
Description of the Implementation of Runoff-Slowing Structures at the Penc Sites



3.1. Penc Szirota

At the intervention site designated in the Szirota area of Penc (parcel no. Penc 04), located outside the settlement boundary, two consecutive single-row wooden log dams designed to slow runoff and trap sediment were planned and implemented within the framework of the LIFE LOGOS 4 WATERS project (Figure 7). The site is a temporary drainage ditch and does not involve a permanent watercourse. The objective of the intervention was to reduce the energy of sudden surface runoff generated during heavy rainfall events, create short-term in-channel storage, retain sediment locally, and thereby reduce pressure on sections closer to the settlement.

The underlying problem is that during intense rainfall, significant volumes of water and sediment may arrive from areas northwest of the settlement and from the culvert beneath the Penc–Keszeg connecting road (road no. 2107). Currently, runoff spreads across the terrain and then enters the valley-bottom channel branches in an uncontrolled manner. During heavy precipitation, sediment deposition restricts conveyance capacity, potentially causing damage to inhabited and cultivated areas near the village boundary. The intervention was therefore designed to create controlled backwater effects within the channel, allowing the log dams to dissipate flow energy upstream (see Annex I: overview site plan).

The locations of the two structures are fixed by EOV coordinates:

- 1st single-row log dam: 664590.8 / 274039.6
- 2nd single-row log dam: 664505.5 / 274173.4

The crest height of the log dams was determined to ensure that surrounding agricultural land would not be endangered and that backwater storage would remain confined within the channel as temporary in-channel retention. The investment is not connected to the road culvert drainage structures and does not directly link to any existing water infrastructure. According to the environmental data sheet, the intervention does not fall under activities listed in the relevant Environmental Impact Assessment regulation (Khr.), and it does not affect protected areas. However, Natura 2000 sites and ecological network elements are present in the wider surroundings; therefore, minimising disturbance during construction was a key consideration.

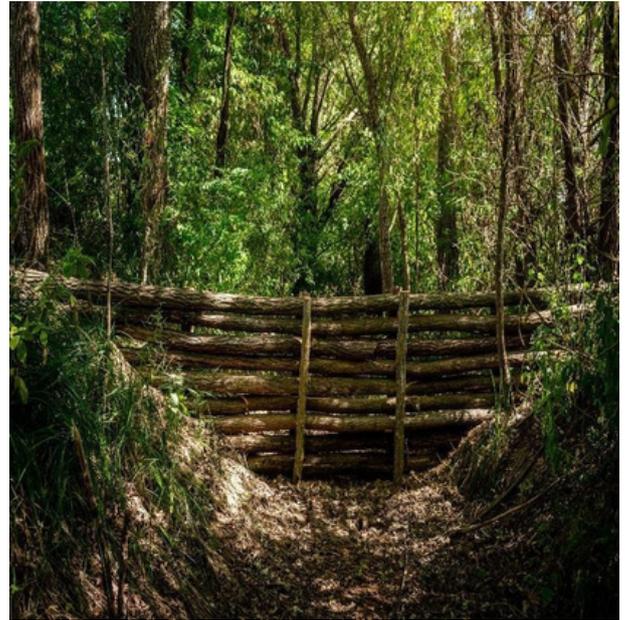
From a technical perspective, each single-row log dam consists of 2–4 vertical posts and horizontally placed logs arranged with gaps. The vertical elements have a minimum diameter of 20 cm and are embedded at least 80 cm into the ground. The horizontal logs are fixed using screws and carpentry staples. During construction, particular importance is given to anchoring the horizontal elements into the channel banks (minimum 50 cm) and ensuring proper wedging and stabilisation against scour. The design ensures overtopping of water above the dam crest, allowing low flows to pass while temporarily backing up higher flows to promote sediment deposition (Annex III: Penc Szirota as-built plan). The implementation followed the approved construction drawings.

From an operational perspective, the structures do not maintain a permanent water level. Their permeable character and overtopping function ensure the safe passage of high flows. Maintenance primarily involves monitoring sediment accumulation in the impoundment area. When sediment deposition reaches the spillway crest level, it must be removed; otherwise, sedimentation may continue downstream. In addition, the condition of the dam body and any protective elements should be inspected at least once per year and, where professionally justified, after major rainfall events.



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7. ábra Penc Szirota helyszínén kihelyezett rönkgátak



3.2. Penc Téglaház

In the outskirts of Penc, along the Penc branch (parcel no. 061/2), on the section behind the Téglaházi major, a small-scale, nature-based water retention and sediment trapping intervention was designed within the framework of the LIFE LOGOS 4 WATERS project. The objective was to slow down sudden runoff during heavy rainfall events, increase the residence time of water within the channel, promote infiltration, and reduce peak flood flows and sediment loads reaching the built-up area. At the site, there is an approximately 10 m deep and 10–25 m wide gully with steep, eroding banks of limited stability. The technical solution consists of the construction of two log dams (Figures 8–9) with complementary, sequential functions (see Annex I: site plan; Annexes II–IV: log dam details and longitudinal profile).

The upper structure is a single-row wooden log dam primarily serving as an energy dissipator, backwater structure, and sediment trap. Its crest height is up to approximately 1.5 m. Under low-flow conditions, water can pass through; during higher flows, the backwater effect promotes sediment deposition. The lower structure is a double-row log dam filled with local material (stone and cohesive soil) and protected by geotextile. The gap between the two rows (approximately 0.5–0.8 m) is filled with compacted material. Its primary function is to enhance longer water retention and strengthen local water storage capacity (Annex IV: Penc Téglaházi major as-built plan).

The locations of the structures are fixed by EOVS coordinates:

- Lower (double-row) log dam: 665235.5 / 274561.2
- Upper (single-row) log dam: 665422.6 / 274494.7

The planning rationale is based on the hydrological characteristics of the catchment. In addition to forested areas, there are exposed surfaces, and in places the valley slopes are steep. As a result, intense rainfall events can lead to rapid runoff concentration and significant sediment transport, which tends to accumulate in the lower-gradient sections closer to the settlement.

According to the environmental screening data sheet, the activity does not fall under the categories listed in Annex 3 of the Environmental Impact Assessment regulation (Khr.), and it does not affect protected areas, buffer zones, or drinking water protection zones. However, ecological network elements are present in the surrounding area, and therefore minimising disturbance and preserving valuable natural features during construction is essential. The documentation specifically highlights that mature, valuable trees located within the channel must be preserved.

From an operational perspective, the structures do not maintain a permanent water level: their permeable character and overtopping design ensure the safe conveyance of flows, while the backwater effect supports local water retention and infiltration, which is also important from a climate adaptation perspective (mitigating drought sensitivity). The key element of maintenance is monitoring sediment accumulation: the siltation of the impoundment area behind the crest must be regularly observed, and when the deposited material reaches crest level, the accumulated sediment must be removed; otherwise, deposition will continue on the downstream sections.

The condition of the dam body/bodies and any associated scour protection elements should be inspected at least once per year and, where professionally justified, after every major rainfall event. Due to the steep and, in places, eroding banks of the site, maintenance activities will predominantly require manual interventions.



8. figure Penc Téglaházi major I. logdam



9. figure Penc Téglaházi major II. logdam

4. Description of the Implementation of Runoff-Slowing Structures at the Püspökhatvan – Takács Hill Site

Within the framework of the LIFE LOGOS 4 WATERS project, nature-based water retention, flow-slowing and sediment-trapping interventions were implemented in the outskirts of Püspökhatvan, in the Takács Hill area, on parcels 0163/19–20. The objective of the development was to reduce the rapidly accumulating surface runoff and the amount of transported sediment arriving from Takács Hill during heavy rainfall events, thereby mitigating flooding and siltation problems occurring in the inner parts of the settlement (particularly in the Szabadság Street – Majorkert – Kőbánya Street area), while also increasing local infiltration through water retention (climate adaptation effect).

The interventions do not affect a permanent watercourse but were established in intermittent valley depressions and erosion gullies. The site selection was justified by the high kinetic energy of runoff descending from the slopes, the sediment transported from arable lands, and the erosion processes developing along the forest–arable land boundary. The documentation highlights that upstream land use (large areas of bare cropland) is one of the main causes of rapid runoff and sediment generation; therefore, the implemented structures primarily serve to mitigate damage (while “source-side” treatment of the problem would require longer-term land-use interventions).

During implementation, five small-scale, locally sourced sediment-trapping and flow-slowing structures were constructed in a cascaded arrangement (Figure 10). Their cumulative effect reduces the hydraulic and sediment load reaching the built-up area.

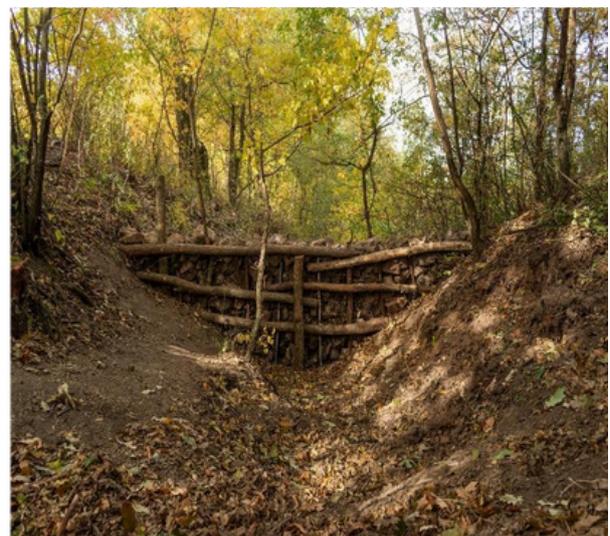
The locations of the structures and their EOV coordinates are as follows:

- Single-row timber log dam – EOV Y: 675408.5; EOV X: 269512.2
- Driven single-row timber stake barrier – EOV Y: 675369.8; EOV X: 269560.6
- Double-row log dam with 0–63 mm stone infill and geotextile protection – EOV Y: 675310.5; EOV X: 269619.9
- Double-row log dam with local inert material infill – EOV Y: 675230.8; EOV X: 269668.2



- Double-row water-retaining log dam made of local material (earthfill-type water retention structure) – EOY Y: 674982.1; EOY X: 269495.6 (Annex V – Püspökhatvan As-Built Plan)

Operation and maintenance: Continuous discharge or water level monitoring is not required for these structures. Maintenance primarily consists of monitoring sediment accumulation in the stilling basin behind the crest. Once the sediment level reaches the spillway crest, the accumulated material must be removed; otherwise, sediment deposition will shift downstream again. The condition of the dam body and any downstream protection works should be inspected at least once per year and, where professionally justified, after every major rainfall event. Due to the steep and locally eroding banks, sediment removal typically requires manual excavation (“kubik” earthwork).



10. ábra Püspökatvan Takács-hegy rönkgátai



5. Description of the implementation of flow-slowing structures at the Vácduka Ditch site

At the northern edge of Vácduka's built-up area, within the intermittent drainage ditch located on plot No. 021 (Vácduka), small-scale, nature-based flow-slowing and sediment-trapping measures were implemented under the LIFE LOGOS 4 WATERS project. The interventions do not affect a permanent watercourse; they are designed exclusively to manage surface runoff occurring during heavy rainfall events. The objective is twofold to reduce the recurring sediment and sludge load at the edge of the settlement (in particular to relieve the road culvert), and to enhance local infiltration by retaining water on site, which is also important from a climate adaptation perspective, especially in relation to local drought sensitivity.

The underlying issue is that during intense rainfall events, surface runoff from the higher-elevation agricultural lands east of the settlement (a sub-catchment of approximately 12 hectares) rapidly concentrates and transports significant amounts of sediment into the ditch. This results in siltation of the channel and overloading of the culvert. Although the phenomenon does not typically cause substantial material damage, it creates recurring maintenance needs and operational difficulties. The documentation emphasizes that the long-term solution lies primarily in upstream land-use management (soil-covering cultivation practices, erosion control measures, or potentially changes in land use). The implemented structures therefore serve to mitigate impacts and provide "time gain" rather than fully eliminate the root cause.

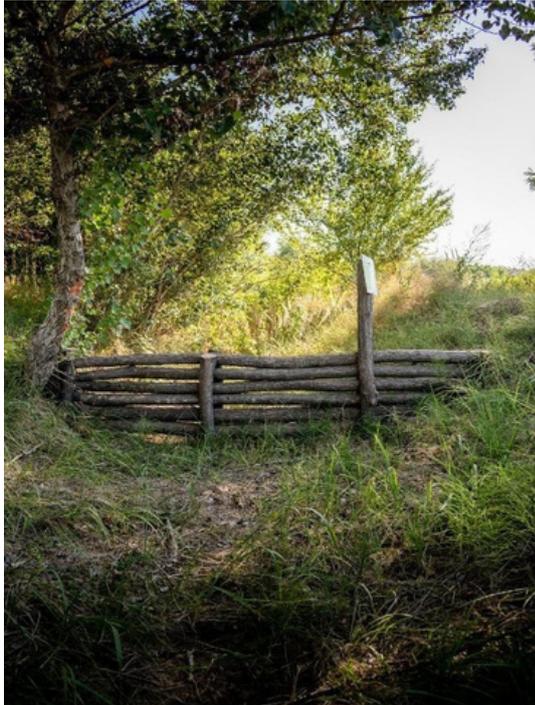
As technical content of the intervention The works included the construction of 2 single-row timber log dams (Figure 11), and a minor dredging of the downstream section of the ditch. The purpose of the log dams is to break the flow energy within the channel, create backwater effects, and promote sediment deposition, while allowing low flows to pass and enabling larger flows to overtop the structure in a controlled manner. The locations of the structures are recorded with EOVS coordinates:

- 1st single-row log dam: 661908.1 / 267407.9
- 2nd single-row log dam: 661872.5 / 267338.4

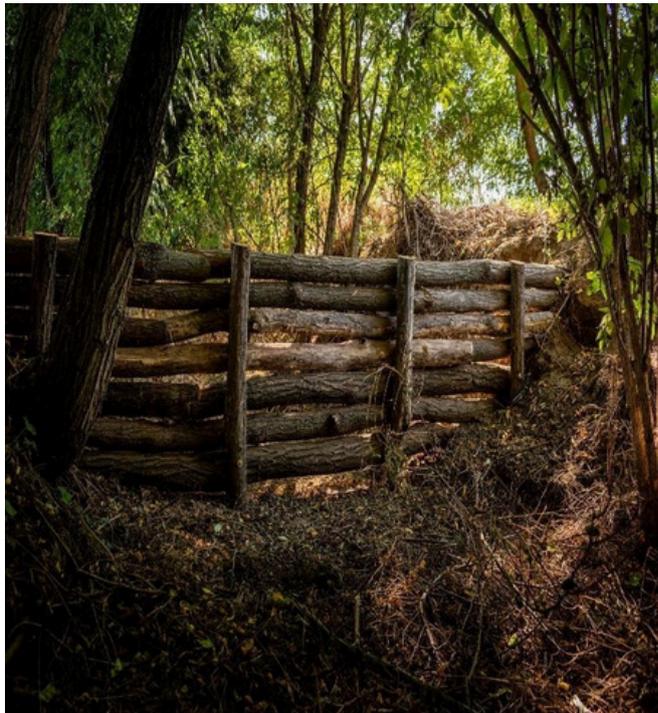
The delineation of the site and the contributing catchment area is shown in the overview site plan (see Annex I).

According to the design drawings, the single-row log dams consist of 2–4 vertical posts and horizontally placed logs installed with gaps between them. The vertical elements have a minimum diameter of 20 cm and are embedded to a minimum depth of 80 cm. The horizontal logs are fixed using screws and carpenter's staples. Key technical requirements include anchoring the horizontal elements into the channel banks (minimum 50 cm), and stabilizing against scour and overturning using wedged stone material reinforced with wire mesh. A minimum overtopping height of 30 cm must be ensured above the structure so that larger flood flows can still pass safely (see Annex VI: As-built plan of the Vácduka Ditch site).

According to the environmental data sheet, the activity does not fall under the categories listed in Annex 3 of the Government Decree on Environmental Impact Assessment (Khr.), and it does not affect protected areas, cave protection zones, or drinking water protection areas. The intervention is small-scale and locally confined in its impact. The documentation also highlights that the preservation of mature trees on the site was a fundamental principle during both construction and dredging. The structures do not maintain a permanent water level (due to their permeable character and overtopping design); therefore, continuous discharge or water-level monitoring is not required. Maintenance primarily consists of monitoring sediment accumulation in the stilling basin behind the dams. Once the accumulated sediment reaches the spillway crest, it must be removed; otherwise, sediment deposition will once again occur in the downstream section that the intervention aims to protect. The condition of the dam bodies and any protective works should be inspected at least once per year and, where necessary, after major rainfall events. Due to the steep and locally eroding banks, dredging and sediment removal typically require manual intervention.



11. ábra Vácduka-árok elkészült rönkgátai



6. Description of the Implementation of Runoff-Slowing Structures at the Kosd–Rád Site

In the outer area of Kosd, within the bed of the Rádi Stream (plot No. 0121/5), one small-scale, nature-based flow-slowing and sediment-trapping structure was implemented under the LIFE LOGOS 4 WATERS project. The purpose of the intervention is to reduce the kinetic energy of flood flows during heavy rainfall events, retain transported sediment locally, and thereby mitigate the recurrent



enundation problems in the northern part of the settlement of Rád, as well as reduce sediment loads affecting in-stream structures within the built-up area. By retaining water locally, the structure also enhances infiltration, which has a beneficial climate adaptation effect during drought periods

The selection of the site is justified by the characteristics of the catchment area. The Rádi Stream has a catchment of approximately 950 hectares. During intense rainfall events, rapid surface runoff from the surrounding hills and large-scale agricultural fields concentrates in the stream, carrying significant amounts of sediment. The documentation identifies insufficient ground cover and extensive contiguous arable land as primary causes of sediment generation. Consequently, the intervention primarily serves a damage mitigation function; long-term conflict reduction would also require upstream land-use changes. Technical description of the structure. The implemented measure consists of a single-row timber log dam (Figure 12), which provides backwater, energy-dissipating, and sediment-trapping effects within the stream channel. low flows pass through the structure, during larger flood events, backwater formation promotes sediment deposition, as a result, the flood peak becomes attenuated (“flattened”), and less sediment reaches downstream urban sections. The location of the structure is recorded with EOV coordinates: 662920.1 / 272954.8

According to the technical design, the log dam consists of 2–4 vertical posts (minimum 20 cm diameter), driven at least 80 cm into the ground. Horizontal logs (minimum 15 cm diameter) are placed with gaps between them, up to a maximum height of 0.8 m. The horizontal elements must be anchored into the channel banks to a minimum depth of 50 cm. Stability against scour and overturning is ensured by wedged stone material stabilized with wire mesh. A minimum overtopping height of 30 cm must be maintained to allow safe conveyance of larger flood flows. (See Annex VII: As-built plan – Kosd/Rád site.)

According to the environmental data sheet, the activity does not fall under Annex 3 of the Government Decree on Environmental Impact Assessment (Khr.), and it does not affect protected areas, cave protection zones, or drinking water protection areas. The intervention is small-scale and locally confined in impact. The area contains valuable mature trees, which must be preserved during construction.

The log dam does not maintain a permanent water level (due to its permeable character and overtopping design), therefore continuous discharge or water-level monitoring is not required. Maintenance focuses on monitoring sediment accumulation in the stilling basin behind the spillway crest. Once accumulated sediment reaches the spillway level, it must be removed; otherwise, sediment deposition will reoccur in the downstream sections that the intervention aims to protect. The condition of the dam body and any protective elements should be inspected at least once per year and, where necessary, after major rainfall events. Due to site conditions, sediment removal and maintenance works are typically manual operations.



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12. figure Kosd/Rád Rádi-stream logdam



7. Description of the Implementation of Runoff-Slowing Structures at the Váckisújfalu Site

Under the LIFE LOGOS 4 WATERS project, two small-scale, nature-based flow-slowing and sediment-trapping structures were implemented on the southern side of the Újtelep district of Váckisújfalu, at the confluence of an intermittent watercourse and a dry channel (plot Nos. 053/7 and 056). The intervention does not affect a permanent watercourse. Instead, it is designed to reduce the kinetic energy of stormwater runoff during heavy rainfall events, create temporary backwater storage, and capture transported sediment before it reaches the settlement.

At the site, runoff from the southern catchment area—particularly from large contiguous arable fields—concentrates in forested gullies during intense rainfall events. This process both accelerates gully erosion and leads to sediment accumulation and overloading of the paved roadside stormwater drainage ditch along Újtelep, regularly causing local flooding and operational challenges. The sub-catchment area is approximately 7.2 hectares. To mitigate these impacts, the planned solution involved the installation of two energy-dissipating, flow-slowing single-row timber log dams at the confluence of the two channels, within forest land (Figures 13–14).

The objectives of the structures are to attenuate the flood peak (“flatten” the flood wave), retain sediment locally, enhance infiltration (thereby reducing drought sensitivity), and relieve the downstream paved drainage ditch by reducing sediment loads entering the municipal stormwater system.

The exact locations of the structures are recorded with EOV coordinates as follows:

- 1st single-row timber log dam: EOV Y 672399.1; EOV X 261996.7
- 2nd single-row timber log dam: EOV Y 672437.9; EOV X 261951.0

According to the technical design, the single-row log dam consists of 4–6 vertical timber posts and horizontally placed logs installed in a spaced arrangement up to a maximum height of approximately 0.8 m. The vertical elements have a minimum diameter of approximately 20 cm and are driven at least 80 cm into the ground. The horizontal logs are fixed using screws and metal staples.

During construction, particular attention must be paid to anchoring the horizontal logs into the channel banks (minimum approx. 50 cm), as well as stabilising the structure against scour and overturning by wedging it with stone material reinforced with wire mesh (VIII. Description of the implementation of flow-retarding structures at the Váckisújfalu site). The structure allows larger flows to overtop in a controlled manner, while the temporary backwater effect promotes sediment deposition upstream of the dam. Complementary elements of the intervention include minimal, maintenance-oriented channel clearing on the upstream side while preserving existing channel vegetation, and cleaning of the lined drainage ditch along Újtelep on the downstream side to ensure proper flow conditions and the long-term functionality of the system. The site is characterised by several deep gullies within the forested area; therefore, both access and the extent of intervention were adapted to local terrain conditions.

According to the environmental data sheet, the activity does not fall under the categories listed in Annex 3 of the Government Decree (Khvr.), and it does not affect protected areas, cave protection zones, or drinking water protection areas. However, valuable mature trees are present on the site, and their preservation is a fundamental requirement. The documentation also notes that parcel 053/7 is designated as managed forest land; therefore, the intervention must be reported to the competent forestry authority and implemented in accordance with the forest management plan. In addition, the lined drainage ditch located on parcel 056 must be restored to good condition and maintained accordingly. Operation and maintenance: the log dams do not maintain a permanent water level (permeable structure + overtopping). Continuous discharge or water level monitoring is therefore not required for water management purposes. Maintenance focuses on monitoring sediment accumulation in the impoundment area behind the dam. When accumulated sediment reaches the crest level, it must be removed to prevent renewed downstream sediment

deposition will reappear on the downstream (settlement) section. In addition, the condition of the structures should be inspected at least once a year and after major rainfall events. The roadside lined drainage ditch should also be cleaned regularly to ensure the proper functioning of the system.



13. figure Väckisújfalu Új telep I. logdam



14. figure Väckisújfalu Új telep II. logdam



8. Description of the Implementation of Runoff-Slowing Structures at the Galgagyörk Site

Within the framework of the LIFE LOGOS 4 WATERS project, one small-scale, nature-based flow-slowing and sediment-retaining structure was implemented on the lower section of the Putri Stream, at the administrative boundary of Galgagyörk and Püspökszilágy, under plot No. 081/1 (Püspökszilágy), in the immediate vicinity of the border road section and the culvert. The objective of the intervention is to protect the Ø80 cm concrete culvert under the road, reduce peak flows during heavy rainfall events, retain sediment locally, and thereby mitigate downstream water and sediment loads toward Galgagyörk, as well as reduce associated flood risks.

The site is characterized by an intermittent, stream-like flow: water appears during heavy rainfall events and the channel subsequently dries out. However, the spontaneously formed valley-bottom channel is suitable for temporary backwater formation, increasing water retention time and enabling partial infiltration. From a climate adaptation perspective, this contributes positively to reducing drought sensitivity. According to the documentation, the sub-catchment area is approximately 280 ha, with valley slopes of around 30%, resulting in rapid runoff and short concentration times. The fast-arriving runoff carries significant sediment loads, which tend to accumulate downstream in lower-gradient sections, ultimately affecting settlement areas.

The implemented structure is a single-row, U-shaped timber log dam installed approximately 3.5 m upstream of the culvert. Main parameters: height: approx. 1.2 m length: approx. 13.5 linear meters, shape: U-shaped configuration

The main section runs perpendicular to the valley bottom and is complemented by two “wing” sections connected at approximately 45° angles, tying into the embankment crossing the valley.

The crest level of the dam was constructed approximately 35 cm below the road crown, ensuring controlled conveyance of high flows while providing sediment retention and energy dissipation to protect the culvert.. Location (EOV coordinates): EOY: 673545, EOX: 266178

According to site plans, the direct footprint of the intervention is small (approx. 28.8 m²). However, the backwater effect creates a periodically wetted zone of approximately 2,800 m² in the valley bottom.

Nature conservation and environmental considerations

The site lies within the Nyugat-Cserhát és Naszály (HUDI20038) Natura 2000 Special Area of Conservation and forms part of the National Ecological Network as an ecological corridor.

The Natura 2000 impact assessment concluded that:

- The intervention is small-scale and locally limited.
- It does not significantly affect designated habitats or species.
- No adverse long-term impacts are expected during operation.
- Potential impacts are mainly limited to the construction phase (noise and disturbance), therefore precautionary measures must be applied.

Operation and maintenance

The most important operational task is the management of sediment accumulation in the upstream sediment trap area behind the dam.

Following heavy rainfall events, accumulated sediment must be removed when necessary—typically through manual excavation (“kubik” work) due to terrain conditions and steep banks.

This ensures that sediment retention continues to occur at the intended location and prevents renewed deposition in downstream sections.



9. Description of the Implementation of Runoff-Slowing Structures at the Kisnémedi Site

Within the framework of the LIFE LOGOS 4 WATERS project, a small-scale, nature-based runoff-slowing and sediment-trapping structure was implemented in the outskirts of Kisnémedi, along the Némedi Stream, on cadastral parcel No. 094/10. The objective of the intervention is to enhance water retention (increase infiltration), reduce the kinetic energy of runoff, and retain transported sediment locally, thereby decreasing sediment load in the inner settlement section and reducing flood risk during heavy rainfall events. According to the documentation, the Némedi Stream has become increasingly intermittent due to climate change. However, during intense rainfall, the stream and its associated gullies regularly cause problems in the northern part of the settlement. Rapid surface runoff and sediment transport lead to siltation of the channel, significant sediment accumulation at inner settlement hydraulic structures (culverts and bridges), and occasional inundation. The approximate catchment area is ~113 hectares, containing several erosion gullies that are several metres deep. Upstream areas under bare arable cultivation contribute to rapid runoff concentration and substantial sediment transport. The plans highlight that long-term mitigation of the conflict also requires soil conservation-oriented land use upstream (e.g. erosion control measures or, where appropriate, land-use change). The present intervention, however, provides tangible damage mitigation and climate adaptation benefits. The intervention consists of the installation of one single-row timber log dam within the streambed, located approximately 45 metres upstream of an existing Ø80 cm culvert (see Figure 15 in the original documentation). The purpose of the structure is to partially backwater the flowing runoff, flatten peak discharge, promote sediment deposition upstream of the dam (“dam yard”), and prevent accelerated siltation directly in front of the culvert (asset protection). The structure’s location is recorded with EOY coordinates: EOY Y: 667,284.0, EOY X: 267,219.2

According to the design documentation, the log dam consists of: 2–4 vertical timber posts, each with a minimum diameter of approximately 20 cm and horizontally placed logs, installed loosely up to a maximum height of approximately 0.8 m. The vertical posts are driven to a minimum depth of approximately 80 cm. The horizontal logs are fixed using screws and carpenter’s staples. Key structural requirements include anchoring the horizontal elements into the stream banks (minimum ~50 cm), stabilisation against scour and overturning using wedged stone material reinforced with wire mesh (as detailed in Annex X – Kisnémedi as-built design documentation).

The structure allows low flows to pass through while acting as an energy dissipator and sediment trap during higher runoff events.

Based on the environmental screening documentation, the activity is not classifiable under Annex 3 of the Hungarian Environmental Impact Assessment Regulation (Khvr.), and it does not affect protected areas, cave protection zones, or water abstraction protection areas.

- Footprint of the structure: ~4.6 m²
- Total area affected by intervention: ~630 m²
- Adjacent land use: predominantly forest, grassland, and arable land

During construction, special emphasis was placed on preserving valuable tree stands and removing invasive species (e.g. black locust, green ash, tree of heaven) in line with nature conservation recommendations.

The structure does not maintain a permanent water level (it functions as a permeable weir with overtopping), therefore continuous discharge or water level monitoring is not required for water management purposes. Maintenance focuses on monitoring sediment accumulation behind the crest. When sediment reaches the crest level, it must be removed to prevent deposition from shifting downstream to the protected inner settlement section. In addition the structural condition of the dam and downstream protection works should be inspected at least annually, additional inspections are recommended after major rainfall events, Sediment removal is typically performed manually due to the confined streambank conditions. Overall, the intervention represents a low-cost, small-scale, nature-based climate adaptation measure that effectively reduces sediment transport and flood risk while maintaining ecological functionality.



15. figure Kisnémedi Némedi-patak single-row logdam

10. “Benjes” hedges

At the Püspökszilágy – Malom site, at the end of the educational trail, an approximately 100 running metre long Benjes hedge was installed (Figure 16), specifically to mitigate sedimentation of the stream and retain transported material locally.

A Benjes hedge (a linear barrier constructed from brushwood and pruned branches) slows down sediment-laden runoff arriving from the slope, filters suspended material, promotes local sediment deposition, reduces the destructive energy of flowing water, and enhances soil moisture retention and infiltration. As a result, the hydrological balance of the valley bottom becomes more stable, and with the gradual re-establishment of vegetation, the microclimate of the area shifts in a favourable direction.

In the valley of the Kiskövesi side branch of the Szilágyi Stream, the Benjes hedges function as pre-protection structures for the log dams and earthworks (Figure 17). Behind the second Benjes hedge, at a critical point, a 7 m³ stone riprap structure was constructed to stabilise an approximately 5-metre-long erosion incision. Below the stone structure, an additional single-row log dam was installed.

Together, this system halts channel degradation, retains sediment locally, and slows runoff in a cascading, mutually reinforcing manner. This combined solution completes the protection of the Kiskövesi branch of the Szilágyi Stream, contributes to improving groundwater conditions, increases infiltration, and supports the maintenance of the newly emerging, more favourable microclimatic conditions.

The protective role of the Benjes hedges is also evident at the settlement level. Above Vácduka, the surroundings of a newly constructed container school had repeatedly been threatened by flash flood inundation during cloudburst events.

To mitigate this risk, an approximately 100 running metre long Benjes hedge was installed along the planned alignment of a future street within a new residential area (Figure 18), which is expected to be developed and provided with utilities only in 8–10 years.

This solution already reduces runoff peaks and prevents sediment from entering the built-up area.

At the same time, as a pre-installed water retention element, it can later be integrated into the new settlement structure, thereby maintaining its function in stormwater management over the long term.



16. ábra Püspökszilágy Malom Benjes hedge



17. ábra Püspökszilágy Kisköves Benjes hedge



18. ábra Vácduka-iskola Benjes hedge

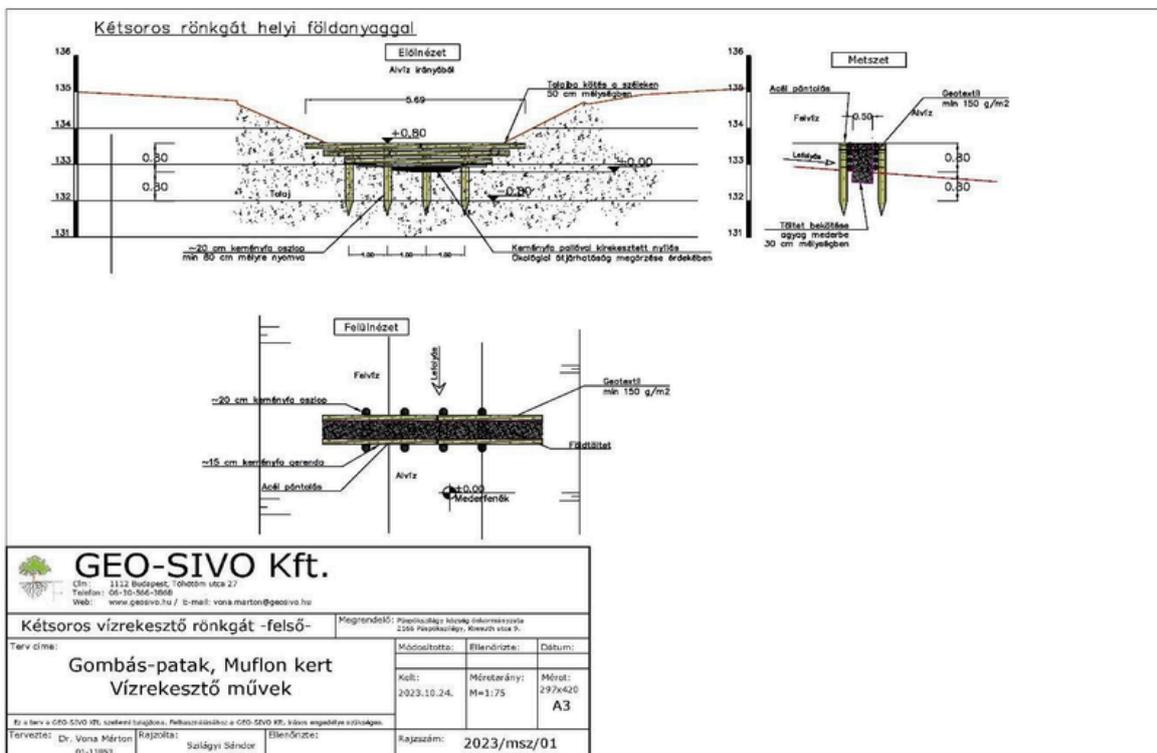
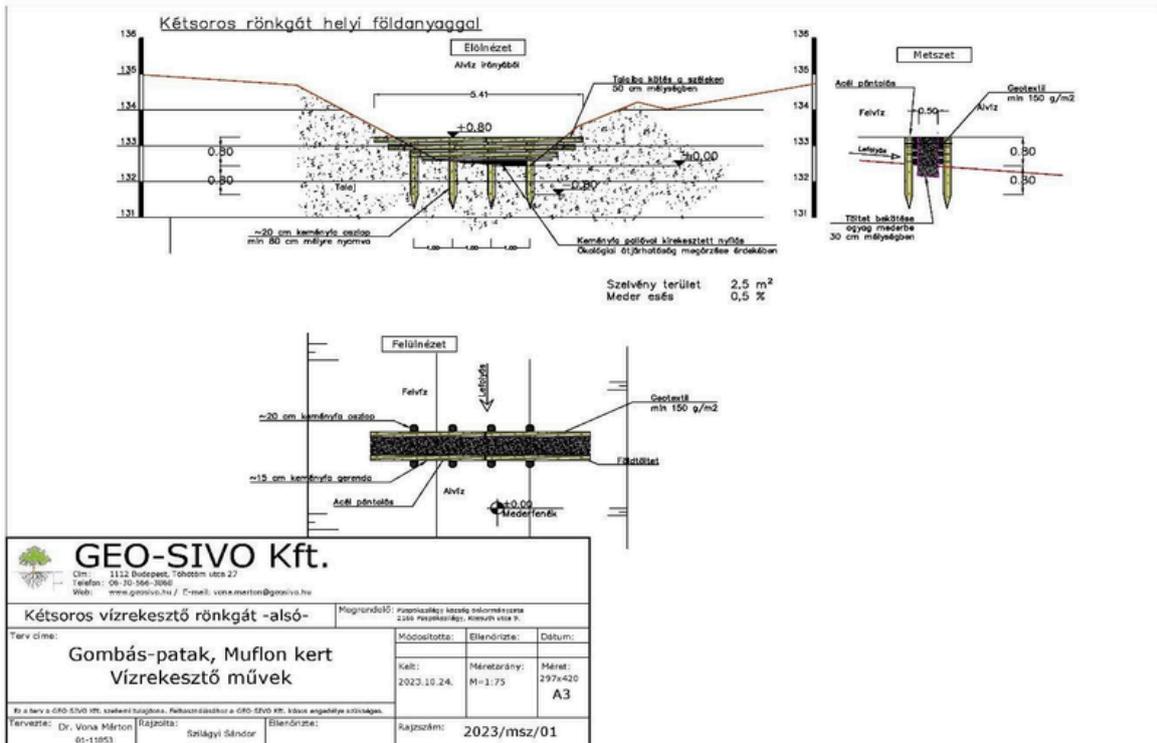


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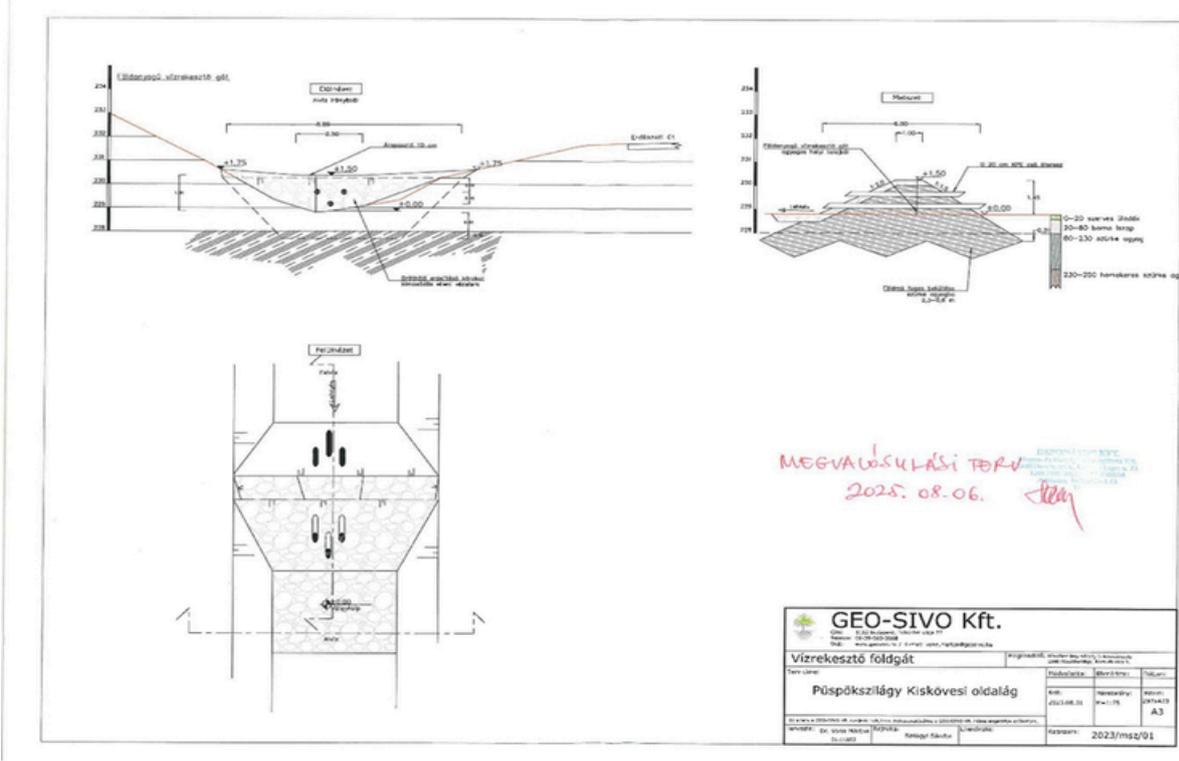
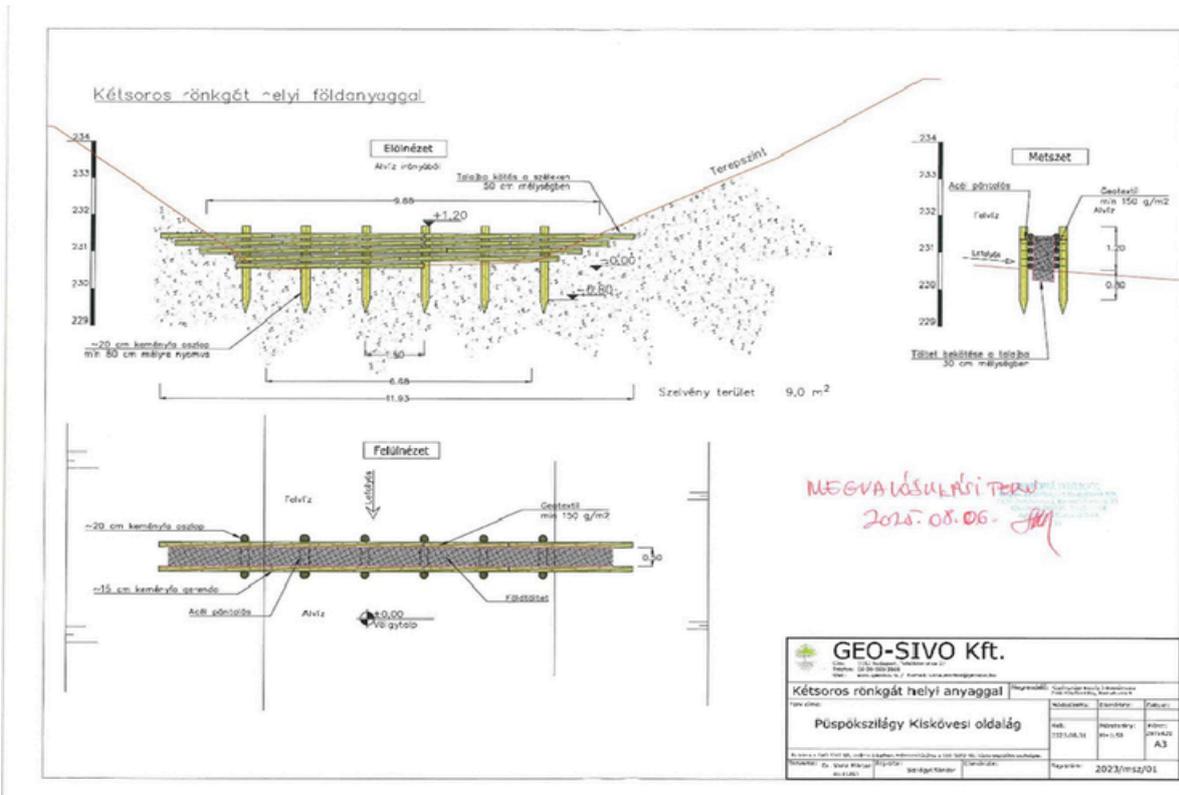
11. Annexes

ANNEX I – AS-BUILT PLAN OF PÜSPÖKSZILÁGY GOMBÁS STREAM (MUFLON GARDEN)





ANNEX II – AS-BUILT PLAN OF PÜSPÖKSZILÁGY KISKÖVES

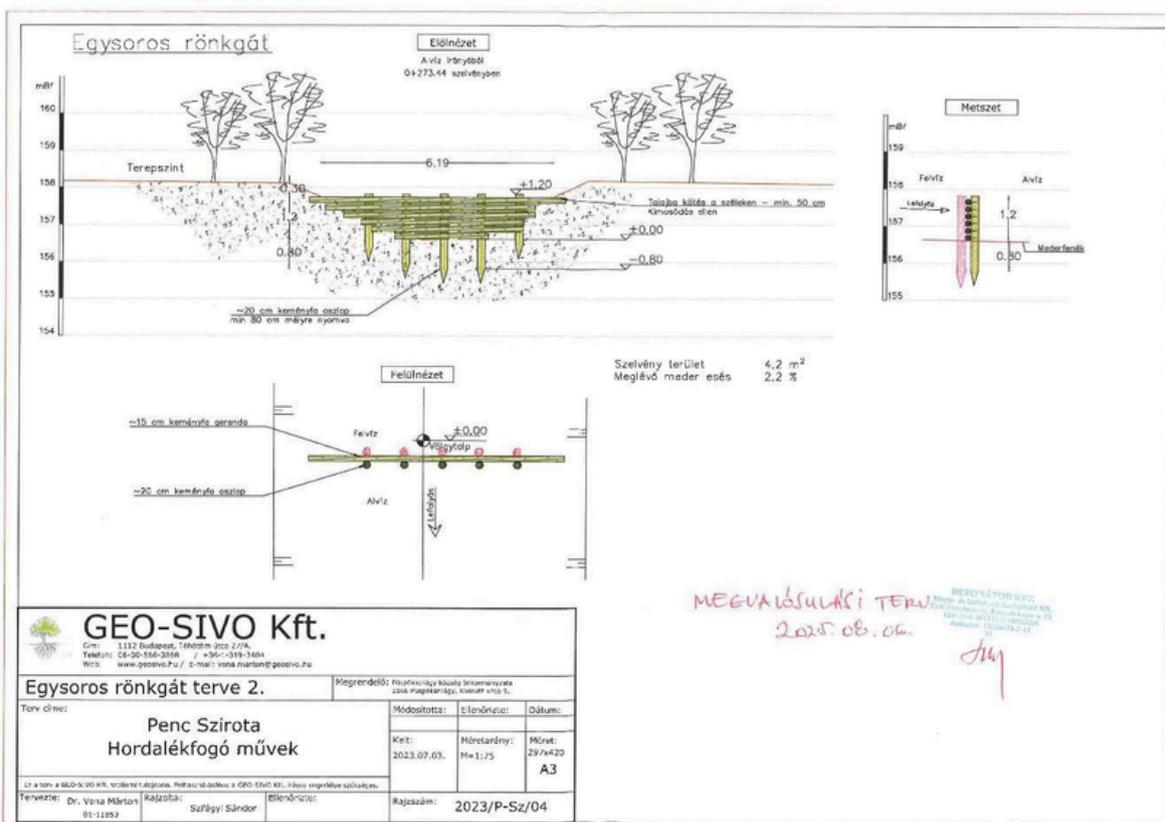
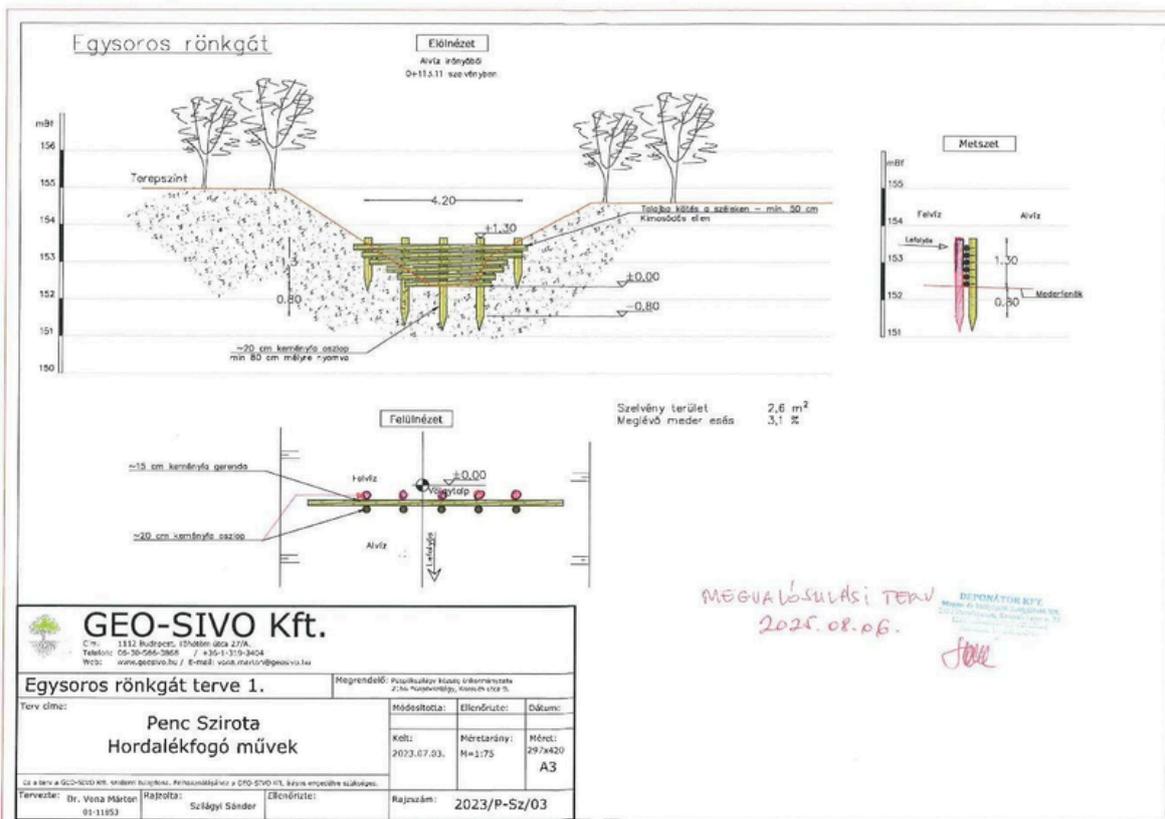




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ANNEX III – AS-BUILT PLAN OF PENC – SZIROTA SITE





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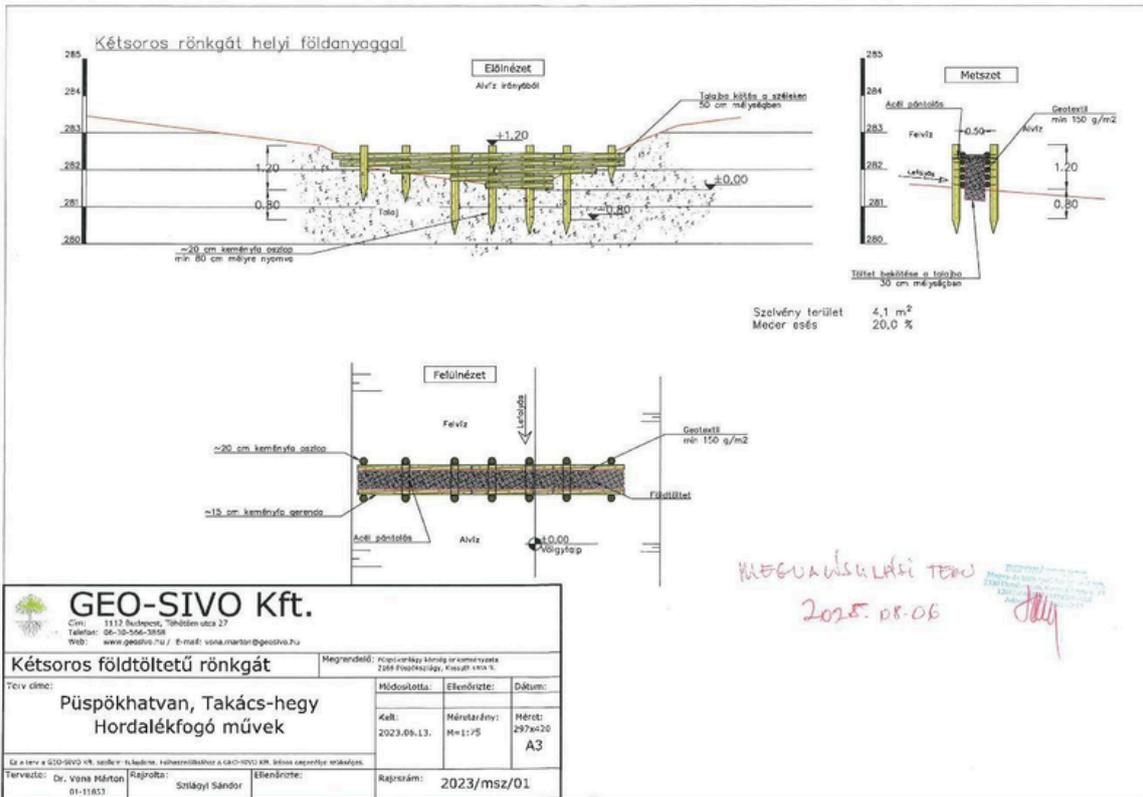
ANNEX IV – AS-BUILT PLAN OF PENC – TÉGLAHÁZI MAJOR SITE



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ANNEX V – AS-BUILT PLAN OF PÜSPÖKHATVAN



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2266 Püspökszilágy, Kossuth utca 9.

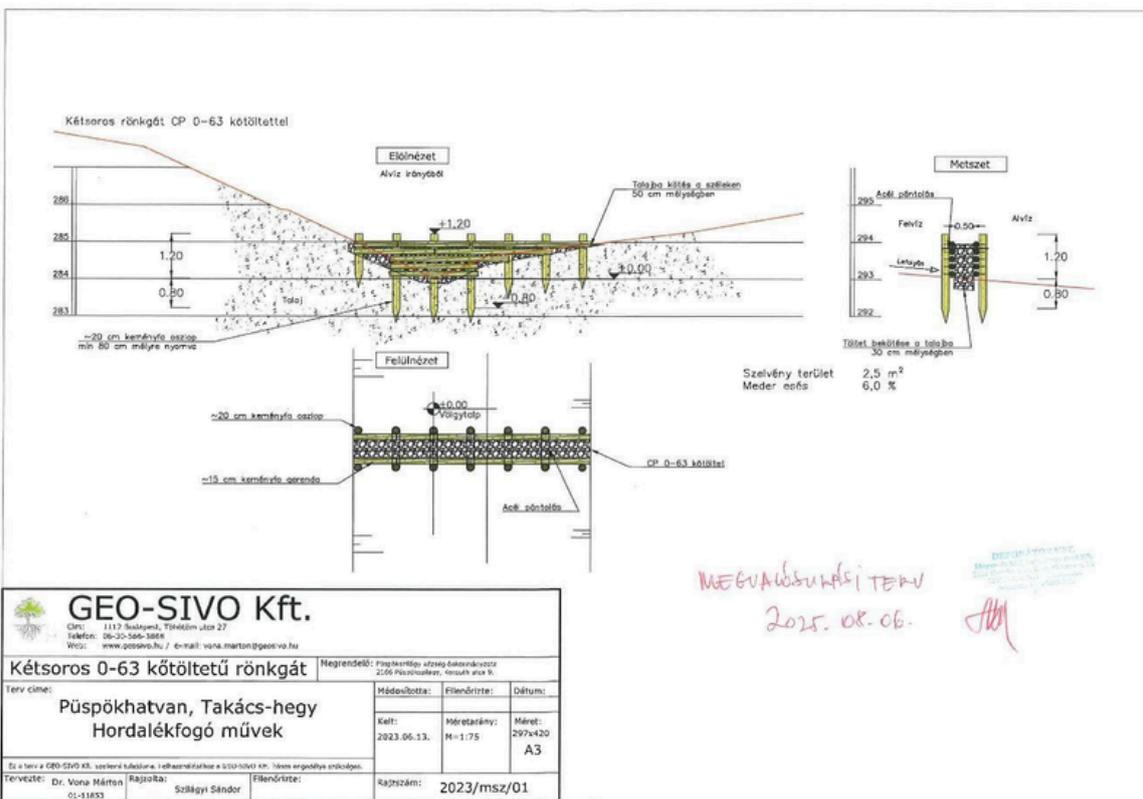
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Működő: Előírt: Dátum:

Kelt: 2023.06.13. Méretarány: M=1:75 Méret: 297x120 A3

Tervező: Dr. Vana Márton Rajzolta: Szilágyi Sándor Ellenőrizte: Rajzszám: 2023/msz/01

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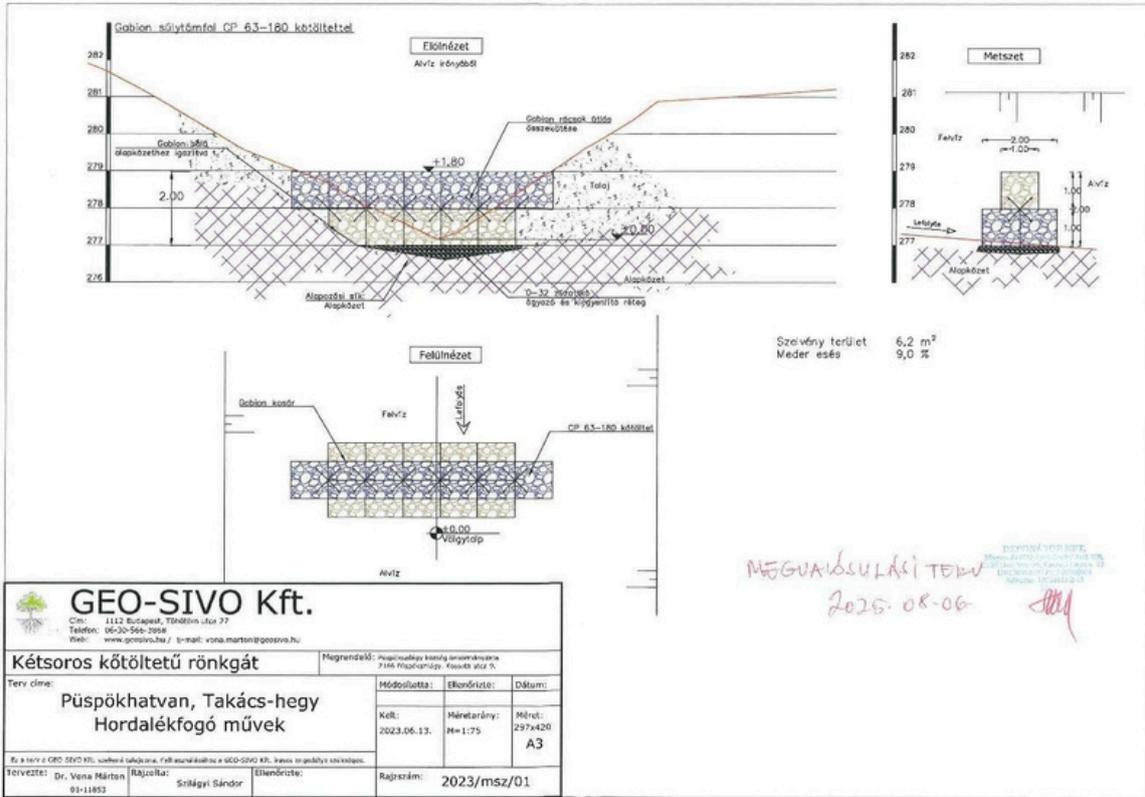
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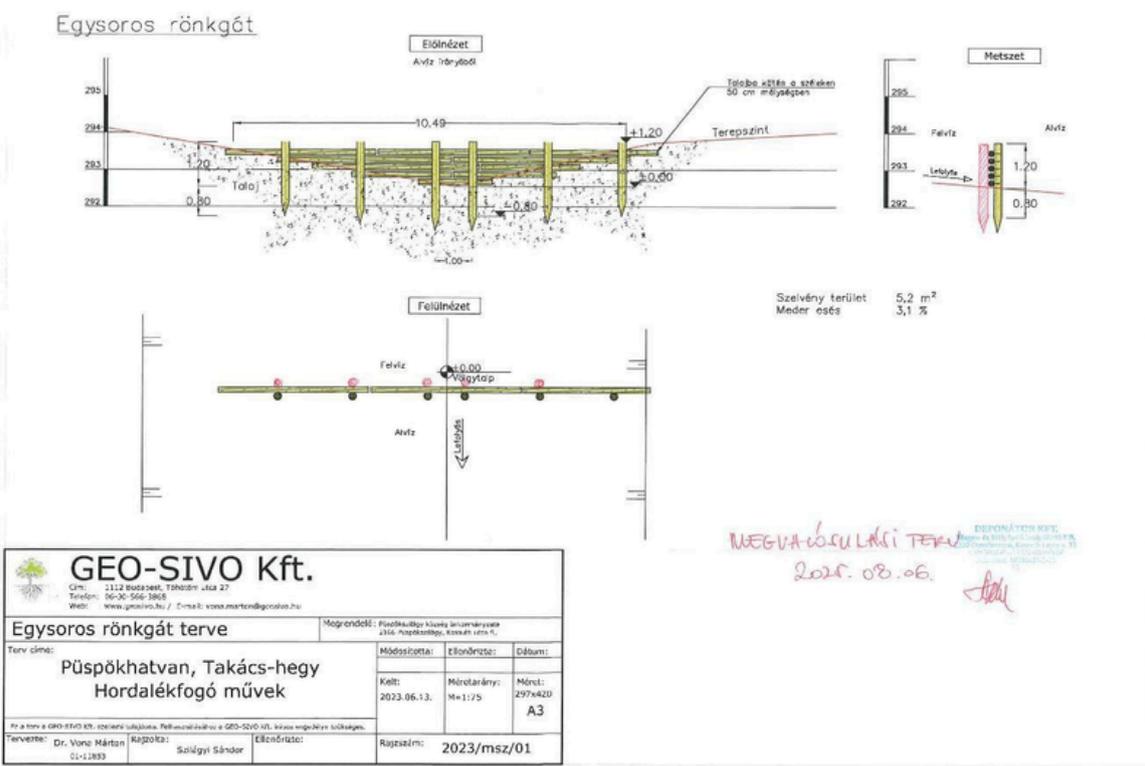
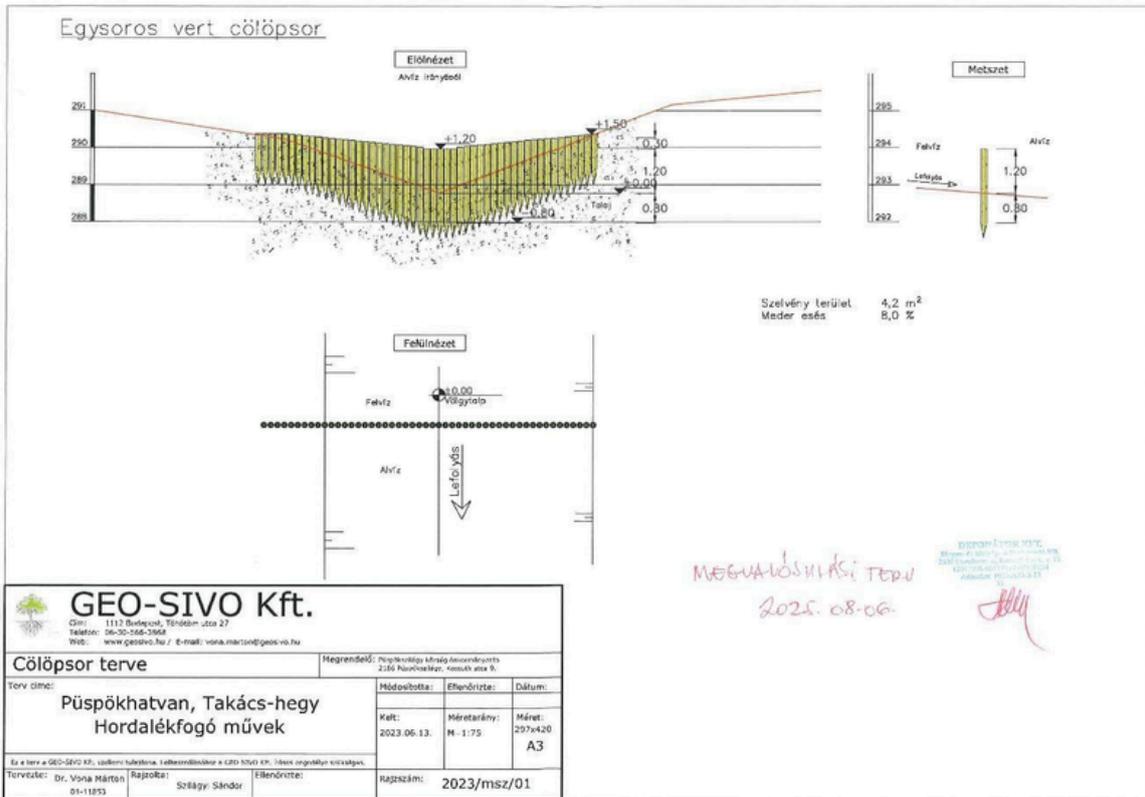
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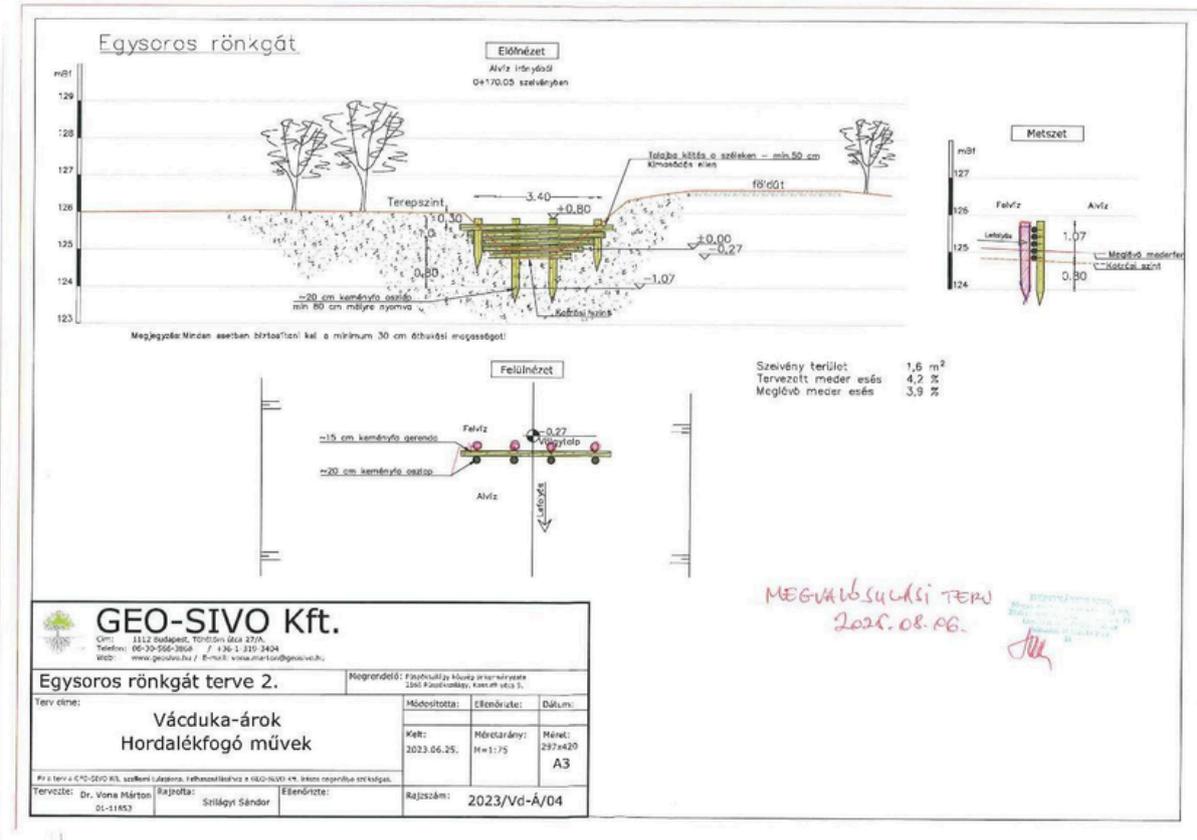
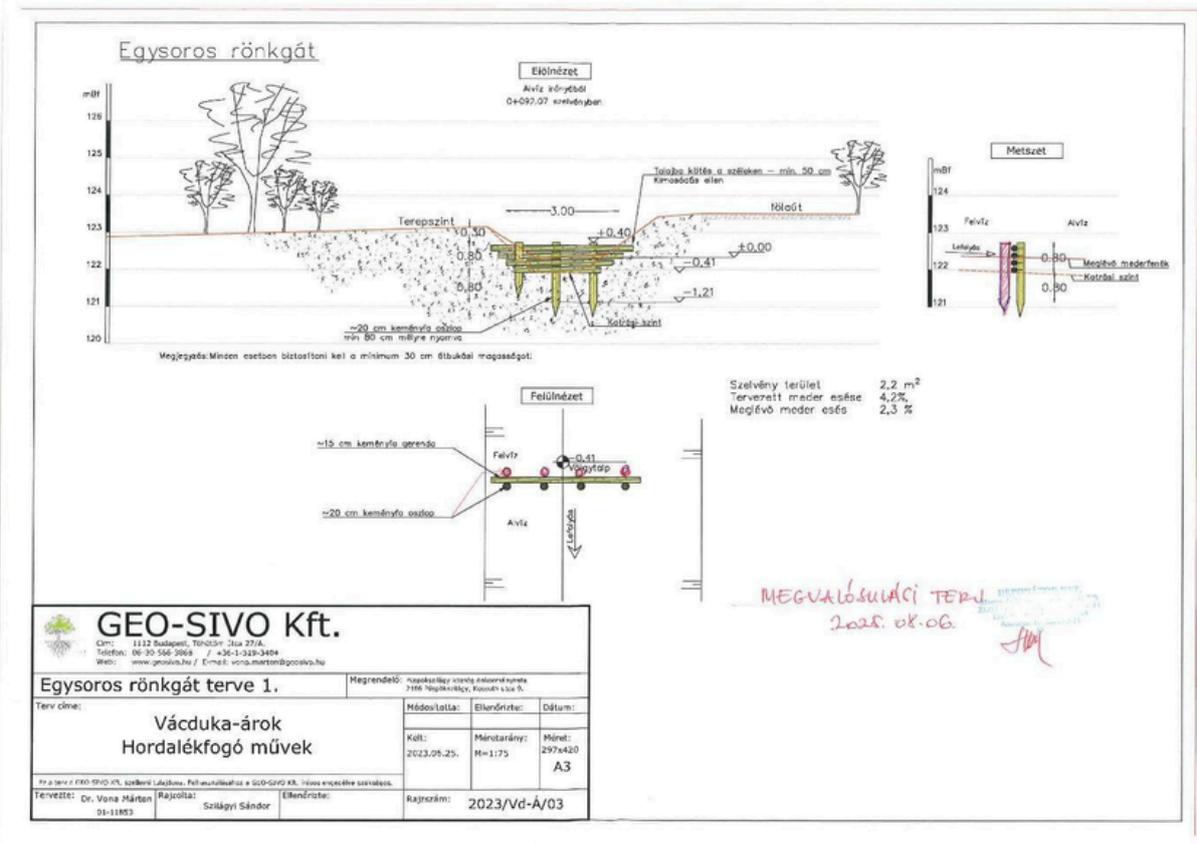




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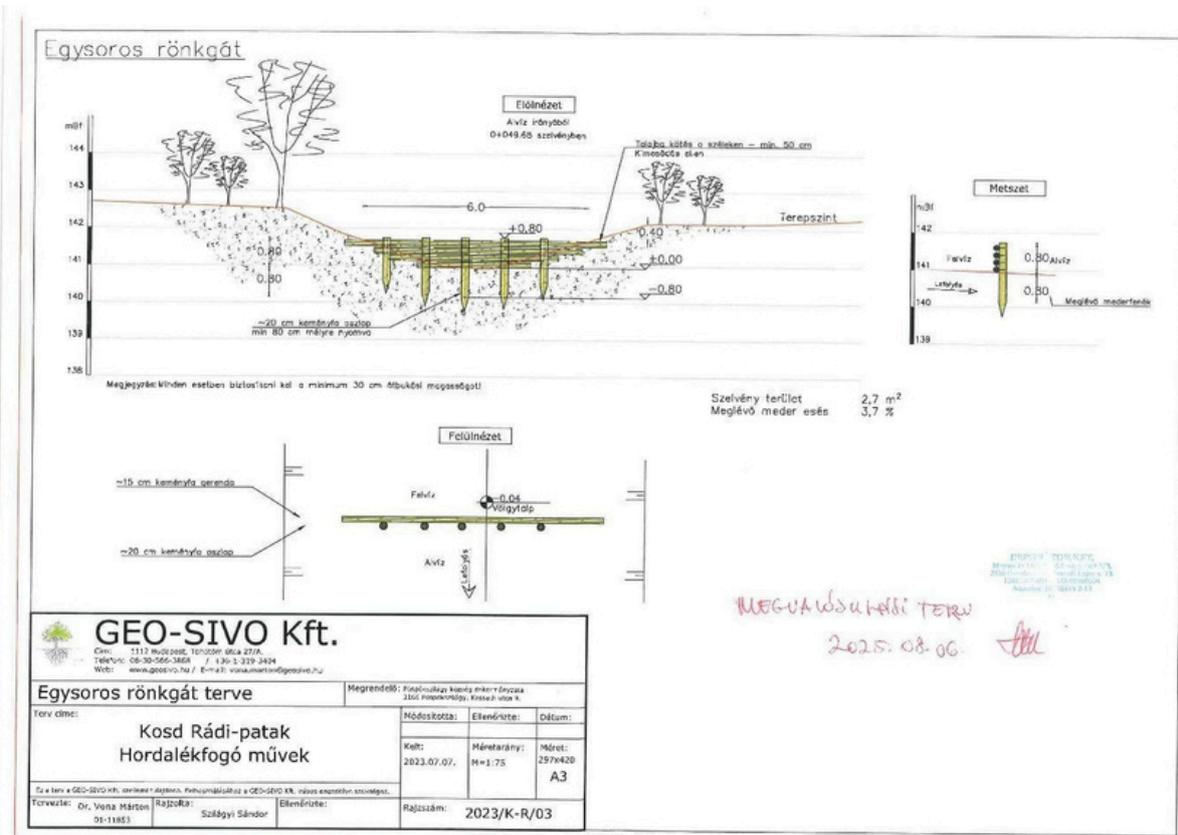
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ANNEX VI – AS-BUILT PLAN OF VÁCDUKA DITCH



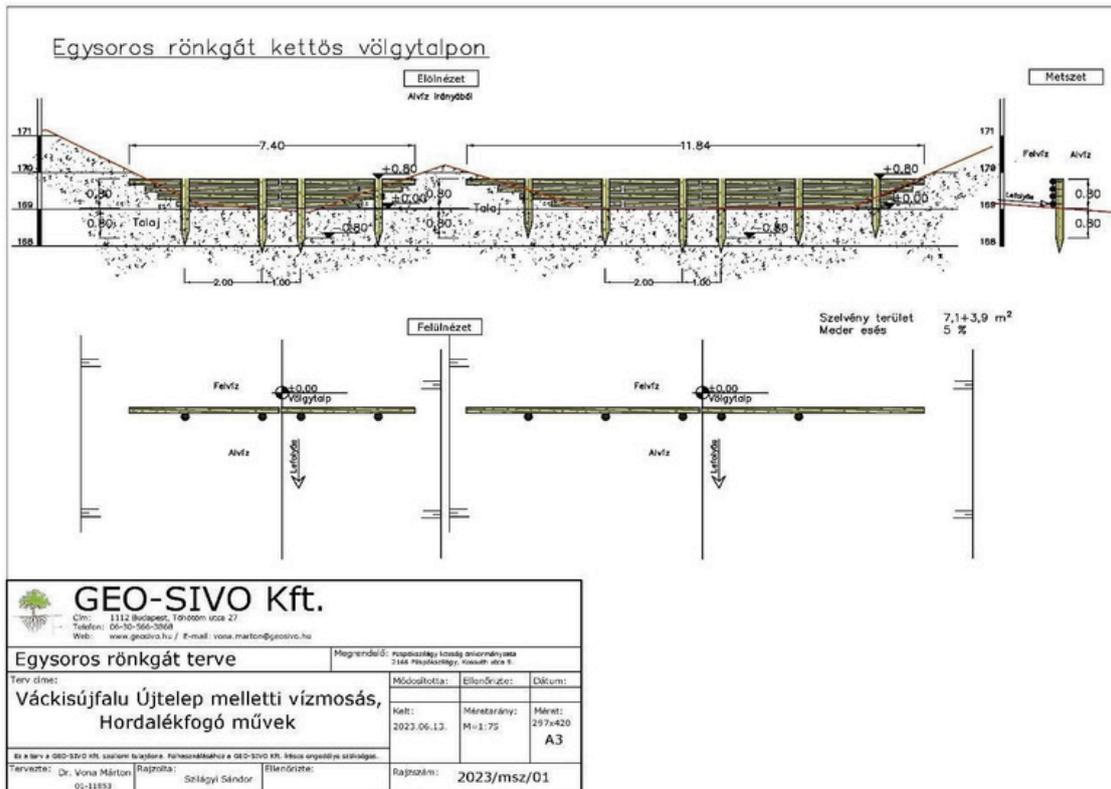


ANNEX VII – AS-BUILT PLAN OF KOSD/RÁD





ANNEX VIII – AS-BUILT PLAN OF VÁCKISÚJFALU





ANNEX X – AS-BUILT PLAN OF KISNÉMEDI

