Landscape-Ecological Study of the Area of European Importance

SKUEV0075 Klátovské Branch

IMPROVEMENT OF THE WETLAND CONDITION OF THE KLÁTOVSKÉ BRANCH NPR ON THE TERRITORY OF SKUEV0075

Ľuboš Jurík et al.

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Aliis alia placent.

//Everyone likes something different.

Fabula docet.

//There is a lesson to be learned from the fable.

PARTNERS

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SLOVENSKÝ VODOHOSPODÁRSKY PODNIK, štátny podnik

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CONTENTS

DOI: https://doi.org/10.15414/2024.9788055227870

1 INTRODUCTION

Most towns and villages in our country and around the world were founded and are still located near rivers or streams, which illustrates their importance for people.

Naturally functioning rivers and floodplains provide many benefits to society including flood control, freshwater supply, creating conditions for tourism/recreation, removing pollution from water, and improving human health.

Many of these benefits, along with biodiversity and habitat, are threatened if the condition of the watercourse is altered by natural development or human intervention.

River restoration projects attract local communities to get involved in addressing the state of their local environment and raise awareness of environmental issues.

River revitalisation is a time-consuming process of managing rivers to restore natural processes to restore biodiversity, to maintain the ability to provide services to people and wildlife. Re-establishing natural processes can reshape rivers to provide the habitat diversity needed for a healthy river ecosystem and ensure their long-term viability by identifying and addressing the root cause of the problem.

Some rivers have been modified to meet societal needs for food production, to withstand flooding, so it is not always possible or desirable to restore them to their original state.

Those that are in many parameters preserving the conditions of an almost undisturbed environment are declared protected areas. In our case, we dealt with an area that lost its natural function by being separated from the Little Danube at the beginning of the 20th century around 1925, and subsequently the area was gradually transformed until it was intensively used for agricultural production until 1990. As production grew, other economic activities also developed, but the villages in the Klátovský river basin also grew and developed. Unfortunately, the water management infrastructure in the villages was neglected. In 1993, the Klátovské Arm was declared a level 5 nature reserve with a level 3 nature protection zone and later a Natura 2000 site.

However, the protection of the area has not yet resolved some of the problems of the past use of the area as well as the ownership relations, and this has led to gradual changes in the status of the Klátovské Arm (in Slovak language: Klátovské rameno). The current solution aimed to document the current state of the aquatic habitat and surrounding wetlands and to develop proposals to increase overall biodiversity and mitigate some of the ongoing problems associated with activities in the area and also climate change.

DOI: https://doi.org/10.15414/2024.9788055227870

Ľuboš Jurík et al

2 CHARACTERISTICS OF THE AFFECTED AREA

The area of the Klátovské Arm (306 hectares) was already a protected area in 1983 during the times of Czechoslovakia.

Thanks to the long-term protection, the landscape around the Klátovské Arm has not changed significantly. Houses have been added in the villages and agriculture has been modernised, but the basic characteristics of the water have remained. It is still clean and clear water. However, the trees and vegetation around the lake have aged and the once trimmed willows have lost their character because nobody does this activity anymore. Fishing, logging, reed harvesting and water extraction, wetland modification, and, as well as disturbing the quiet to protect the animals, almost all of these activities have long been traditionally prohibited here. Nevertheless, the Klátovské Arm is one of the most beautiful parts of the Rye Island (Csallóköz) area. It is the largest river island in Europe, covering an area of up to 1,886 km², 84 km long and 15 to 30 km wide.

During the preparation of the documentary on the entire Danube River area, Jacques-Yves Cousteau's team carried out a survey on the Klátovské Arm in 1991 and it is also part of one of the episodes of the series on the Danube River. Rye Island is home to the largest colony of freshwater sponges in the world. He became convinced that this place is an important location in Europe with beautiful nature.

2.1 SITE DESCRIPTION OF THE NATIONAL NATURE RESERVE

The National Nature Reserve (NNR) was proclaimed in 1993 by Decree 83/1993 Coll. of the Ministry of the Environment of the Slovak Republic of 23 March 1993 on State Nature Reserves.

It protects the habitats of floodplain willow-poplar and alder forests, natural eutrophic and mesotrophic stagnant waters with vegetation of floating and/or submerged vascular plants of Magnopotamion or Hydrocharition type, lowland and foothill mowed meadows, floodplain oak-birch-ash forests and Carpathian and Pannonian oak-hornbeam forests on an area of 306.4 ha. The Klátovské Arm is classified as level 5. As the protection zone of the national nature reserve (Act No 543/2002 Coll. on Nature and Landscape Protection, Section 22(6)) has not been declared according to Section 17(7), it is the area up to 100 m outwards from its boundary and the third level of protection (Section 14) applies there.

Subsequently, the Decree No. 17/2003 Coll. of the Ministry of the Environment of the Slovak Republic, which establishes national nature reserves and publishes the list of nature reserves, published the list of Nature Reserves of Slovakia and under the number

DOI: https://doi.org/10.15414/2024.9788055227870

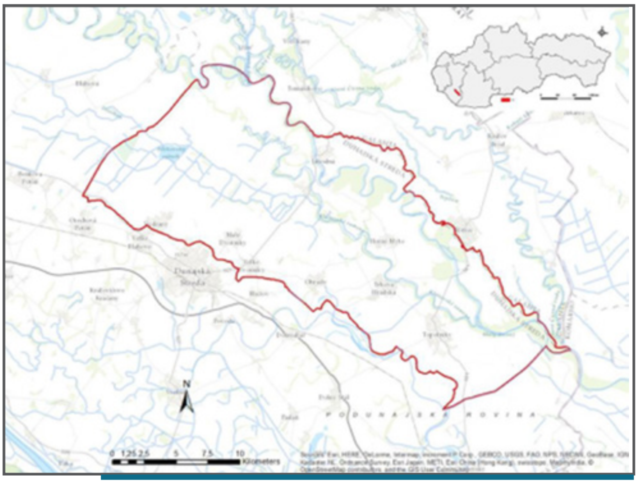

Figure 2.1 The Klátovské Arm – catchment area

85. The Klátovské Arm with no real description of the area (see figure 2.1).

2.2 AREA OF EUROPEAN IMPORTANCE SKUEV0075 KLÁTOVSKÉ RAMENO

The Decree of the Ministry of the Environment of the Slovak Republic No. 3/2004-5.1 of 14 July 2004, which issues the national list of sites of European importance, included the territory of the Klátovské Arm among the sites of European importance with the identification code SKUEV0075 Klátovské rameno (Klátovské Arm).

2.3 HISTORICAL MAPS AND THE KLÁTOVSKÉ ARM ON THE HISTORICAL MAPS

Nowadays, many historical maps are also included in the online environment.

Their content is important for our study because the historical development of the water flow in the Klátovský River is altered. At the turn of the century, namely between the 19th and the 20th century, the water flow changed and the direct connection of the water from the Little Danube to the arm was dammed and the water stopped entering the arm by direct inflow and the source of water became groundwater or groundwater outlets due to the difference in the levels of the Little Danube and the arm itself.

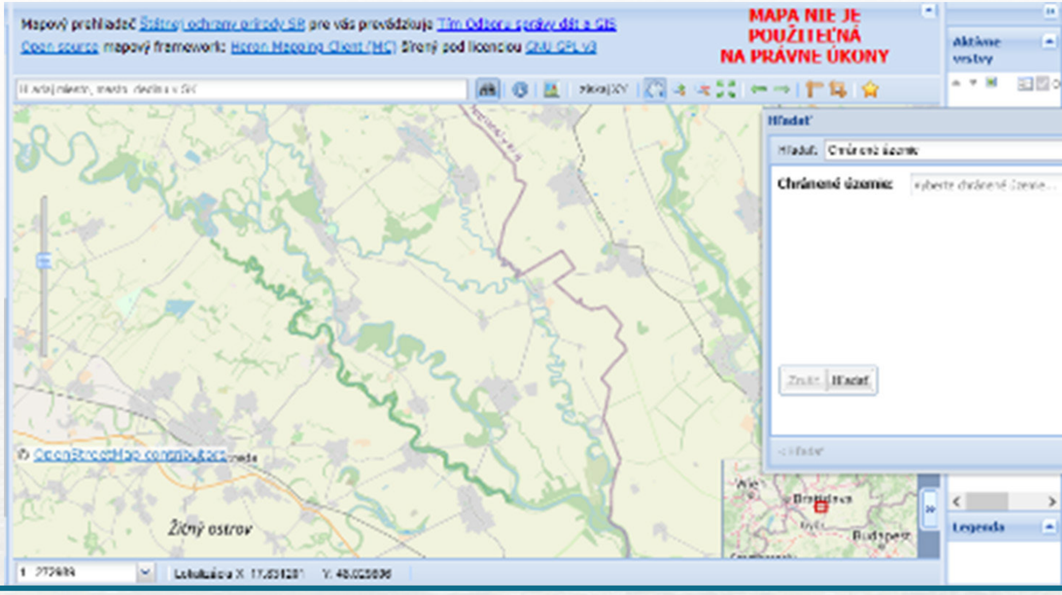

Figure 2.2 The Klátovské Arm – its extent according to Slovak Environmental Agency (SAŽP)

Figure 2.3 Map I. Military Mapping (Source: https://geoportal.gov.sk/maps/historical-maps/)

Even the name of the arm is changing because on some historical maps the Klátovské Arm was referred to as the Little Danube.

Map I is also from this place. Military mapping from 1764 to 1787. The map is quite detailed in the locality of the Klátovské Arm and has a clear representation of the Čótfa branch, but the forest is marked at the site of the Soliare Arm.

Figure 2.4 Historical map from 1863

On this historical map from 1863, a tributary of the complex branching of the Little Danube is still open. Subsequently, there is a very branched channel in the present-day area of Čótfa. But the connection to the Little Danube in the middle part is not obvious.

The newer map is from the Czechoslovak period and shows the area around the Klátovské Arm with Hungarian-Slovak names of the villages. Some of them still have their original names such as Jahodná – Eperjes or Dunajský Klátov – Tőkes. On the map, the branches branching off from the Klátovské Arm are neither Soliari nor Čótfa.

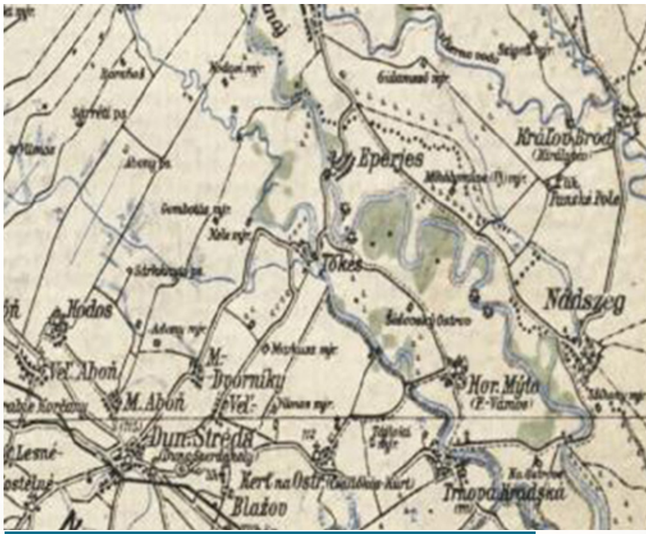

Figure 2.5 Map from 1936

A fundamental change in the mapping of the Klátovské Arm is on the maps of the Topographic Mapping from 1952 to 1957. Here the separation of the Klátovské Branch from the Little Danube is already accurately recorded.

As a consequence of the disconnection, part of the channel has already dried up and is without water at this time, and water appears only after a distance of several hundred metres, and forest cover is already noted on the former channel.

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Figure 2.6 Map of Topographic Mapping from 1952 to 1957

This map also shows in good detail the 5 crossings over the arm which are still on the arm today, unfortunately with no provision for flow in the channel.

DOI: https://doi.org/10.15414/2024.9788055227870

Ľuboš Jurík et al

3 KLÁTOVSKÉ ARM SURVEYS

3.1 CLIMATIC CONDITIONS

The climatic conditions of the Klátov arm have been the subject of interest in the past not only in the area climate of Slovakia (Kurpelová, Coufal and Čulík, 1973; SHMÚ Works XXXIII, 1993), but also in specialized works dealing with special parameters of the atmospheric environment of the given locality.

The main objective of the project, for which this climatic characterization is elaborated, is to improve the condition of the wetlands of The Klátovské Arm National Nature Reserve. There is a need to restore and strengthen the capacity of degraded wetland ecosystems to adapt to climate change and ensure sustainable performance of their ecosystem services, in order to mitigate the negative impacts of climate change on the environment and the quality of life of the inhabitants.

The Klátovské Arm is a national nature reserve with exceptionally clean water and rare flora and fauna. Over time, the tributary from the Little Danube has changed and the original forests with poplars, willows and alders are being replaced by infestations of non-native or invasive trees. The water in the river itself is being silted up and the water is losing circulation, and the underground water outlets have also been reduced. The arm is in need of revegetation controlled by the State Nature Conservancy to maintain the conditions of the original state of the Preserve.

The climate study addressed provides a comprehensive picture of the site and provides a detailed description of the various climatic features.

The climatic conditions of the study area are relatively homogeneous – the area belongs to a warm climatic region. It is a lowland climate, which is characterised by moderate temperature inversions (Tarábek, 1980). Within the area, the territory falls predominantly into a warm, dry district with mild winters and longer sunshine in the growing season of over 1,500 h. The average temperature in January

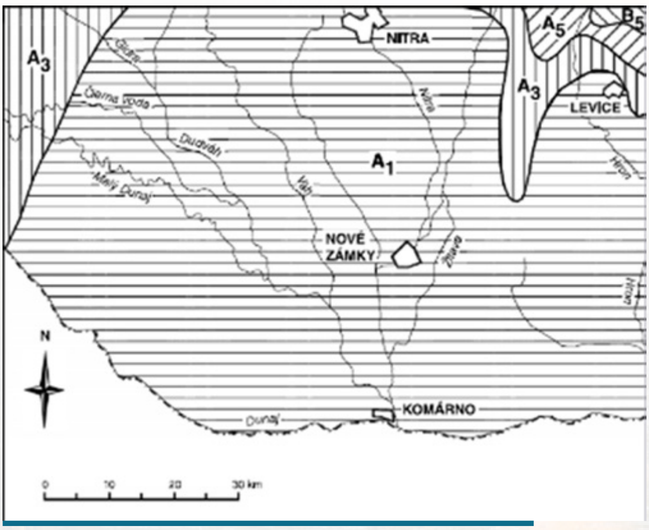

Figure 3.1 Climatic areas and districts of the area of the interest

DOI: https://doi.org/10.15414/2024.9788055227870

is -2.5 °C, in July 20.5 °C. The frost-free period lasts between 180 and 200 days. There are 60 to 70 summer days per year (Tarábek, 1980).

Average annual temperatures in the area range from 9.0 to 10.5 °C. The coldest month of the year is January with temperatures ranging from -1 to -4 °C, the warmest is July with temperatures ranging from 19.5 to 20.5 °C. The warm climate area has a number of summer days per year (with a maximum air temperature of 25 °C and above) of over 50, with annual rainfall of around 530–650 mm. The frost-free period lasts on average between 180 and 200 days, and the number of summer days per year is usually between 60 and 70. The length of the wider growing season is about 6 months (from about 15 March to 15 November), the narrower growing season lasts about 6 months. The cloud cover is characterised by a maximum in December and a minimum in July–September.

The average annual rainfall varies from 530 to 650 mm on average. In long-term averages, January and February are among the least abundant months, with the warmest rainfall occurring in the months of May to July. Just over 50% of the rainfall falls in the growing season, and as the average potential evaporation during this period is greater than 600 mm, the area appears to be a dry, moisture-deficient region. The average number of days with rainfall of 1 mm or more is usually 90 to 100 days per year. In winter, snow prevails, with a maximum snow cover of 25 cm, and the length of the snow cover lasts on average up to 90 days a year.

3.2 SOURCES OF POLLUTION IN THE KLÁTOVSKÉ ARM

The Klátovské Arm is surrounded by a number of potential sources of pollution, both in close proximity to the stream and in the wider area, but these sources may also be important contributors of pollution that may enter the arm via groundwater inflows or overland flow channels or tributaries. The pollution itself can come from a variety of sources, which can be divided into the following categories.

3.2.1 AGRICULTURAL ACTIVITY

The surroundings of the Klátovské Arm are lined with agricultural land. The area of the Klátovské Arm itself has its own protection zone of 100 m, which is classified as level 3 protection, which prohibits activities such as planting or cultivating non-native plant species or ploughing or otherwise removing existing permanent grassland. Therefore, agricultural production in the surrounding land should respect the conservation status.

Machinery is used to farm the soils, which, in the event of failure, can become potential polluters of the stream and surrounding area. Theoretically, pollution of the river can also occur when fertilisers are applied to the soil and further into the groundwater, which can reach the Klátovské Arm.

The potential point source pollution can include agricultural yards and buildings used for crop and livestock production. Such polluters are:

- Malé Blahovo – silage troughs and farmyards,
- Dunajský Klátov – orchard, Búšlak School Farm Ltd.,
- Horné Mýto – agricultural cooperative,
- Topoľníky – farm yard, greenhouses.

As several tributaries flow into the Klátovské Arm, these channels can also be potential pollutants as they can also collect debris along their lengths, such as:

- Soliary – Istropol Solary a. s.,
- Čótfa – farmyard,
- Klátovský Channel – farm buildings Búšlak oil,
- Gabčíkovo Channel – Topoľníky – orchard.

DOI: https://doi.org/10.15414/2024.9788055227870

3.2.2 INDUSTRY

From the industrial sector, the only polluter is the company Partner in Pet Food SK s. r. o., which is active in the production of pet food and may be a polluter of the watercourse. In the wider area, most of the industrial sites are concentrated in the district town of Dunajská Streda.

3.2.3 POPULATION AND RECREATION

The polluters of the Klátovský River may be the inhabitants living near the stream. As the river flows directly in the intravilage through 2 villages, there is a potential threat of pollution in the form of illegal dumping of cesspools, illegal landfills or traffic or illegal damming of the river, thus slowing down the flow of water. Another potential source is possible runoff from roads alongside but also crossing the river arm (bridges) from which runoff can carry untreated water through possible fuel residues. There are a number of isolated villages and settlements in the vicinity of the stream, which may also pose a threat to the water quality of the watercourse if they are too small. Even though there is a ban in place, the local population is still fishing illegally or using the water for bathing in the summer months, which also contributes to the deteriorating water quality.

Recreation – the designed area is an attraction for recreation because of the diverse nature and beautiful natural scenery. At present, there is a thermal swimming pool in the village of Topoľníky directly at the Klátovské Arm, with its own geothermal borehole. Not far from the swimming pool, also close to the arm, is the Hotel Gladius, which may also be a point polluter of the Klátovské Arm.

3.3 ASSESSMENT OF PLANTS IN HABITATS

In the context of assessing the ecological status of streams on the basis of macrophytes, as in other EC countries (e.g. Austria), only the main stream is taken into account (even though it is often regulated and of limited suitability for this type of vegetation) and the reaches that have connectivity with the main stream for most of the year.

General factors determining structure and species composition:

- hydrological regime and water column height,
- light,
- substrate,
- nutrients,
- pollution.

In general terms, the assessment of macrophyte vegetation is also based on the use of knowledge at the species association level, which has been used in Natura 2000. Although the issue of establishing reference conditions under the WFD is broader, it is necessary to use Natura 2000 knowledge as widely as possible. Within the reference conditions of an individual species, we focus on the presence of a certain composition and abundance of each species, with surveys assessing all relevant species.

In higher aquatic plants, we encounter various forms that are from:

1. submersed/submerged vegetation,
2. rooted plants with floating parts (leaves and flowers),
3. emergent/emergent vegetation,
4. free-floating plants,
5. macroscopic algae.

In lowland streams the following impacts can be considered:

- flow velocity,
- flow straightening,

DOI: https://doi.org/10.15414/2024.9788055227870

- sediment flushing during periods of high flows,
- shading,
- low transparency,
- water and sediment quality,
- expansion and invasion of alien vegetation elements,
- organic pollution,
- high nutrient content.

Under ambient environmental conditions, the most important limiting factor in the development of increases in streams is unsuitable light conditions (Fabricius et al., 2003). Lack of sunlight is mainly caused by shading of riparian vegetation and turbidity of the water. In streams with robust riparian vegetation, plant abundance is determined by the proportion of shading and light availability. Under suitable light conditions, the resulting plant community structure is influenced by the type of substrate, flow conditions and their stability, nutrient content and the values of basic physico-chemical parameters.

The same effect on the aquatic plant community is also exerted by the flow velocity and stability of the flow conditions or the fluctuation of the water level during the year.

Increases in macrophytes were found in all section types, although the highest proportion of acrophytes was in sections with shallow water depths, where they gradually overgrow the shallows from early spring onwards and gradually become more abundant as the water level drops above the surface in late summer. The densest vegetation appears in places where there is no strong current, and they are abundantly illuminated. In most cases, these patches are associated with native gravel bottoms or sediments without a layer of organic, undecomposed material. At sites with water depths greater than 50 cm with muddy bottoms, the aquatic vegetation changed to submerged species. E.g. in the vicinity of Klátovský Mill. In places with a very thick layer of organic deposits there are poor oxygen conditions with the possible presence of mud gases such as methane or even sulphane. Such sites occurred mostly in the widened sections of the Clats Arm, where there is a slower water flow and riparian vegetation of older tall trees with a lot of fallen leaves in autumn.

Among the endangered species of flora, occurrences of endangered and vulnerable species such as the celery (*Apium repens*), the reed canary grass (*Hippuris vulgaris*), and the water veronica (*Veronica catenata*) have been recorded in the Klátovské Arm, the foxglove (*Myriophyllum verticillatum*), the common water lily (*Butomus umbellatus*), the yellow water lily (*Nuphar lutea*), the white water lily (*Nymphaea alba*), the tall violet (*Viola elatior*), the meadow oatgrass (*Avenula pratensis*) and the upright cowslip (*Berula erecta*). Other notable plants of the site are *Najas marina* (*Epipactis helleborine*), but also *Potamogeton perfoliatus* and *Sagittaria sagittifolia*.

Figure 3.2 In summer, shallow and almost stagnant pools of water are covered with a mixture of algae and Lemna (*Lemna*)

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Figure 3.3 Shoals gradually overlapping with dense aquatic vegetation

Of the other plants, the most common in the section below Trhová Hradská is probably the simple sparganium (*Sparganium emersum*). It has also managed to colonise the sections affected by construction just before the closure, and the exposed gravelly bottom has offered excellent conditions for their growing.

Shoals are gradually becoming overgrown with dense aquatic vegetation, narrowing the flow area. Shoals also form between fallen dead trees. On the one hand this deteriorates the quality of water, on the other hand the narrowed riverbed can better convey the reduced amount of water and the formed riverbed is probably sufficient for the current flow rate. Enlarging the riverbed by removing sediment could lead to a reduction in velocity and redeposition. A hydraulic study will probably be able to determine the optimum flow area with sufficient entrainment force. Dropped trees allow greater surface screening and thus stronger growth of aquatic plants. Aquatic algae are the first to respond.

But the thermal image of the shoals shows their disadvantage. The excavated parts overheat more and consequently the water in the surroundings. In the previous images, they clearly stand out as warmer areas in the thermal image, and the light blue colour of the water is significantly warmer than the subsequent deeper the Water shown in dark black. The trees themselves are the warmest in the image and their cooling function is quite weak. The Evapotranspiration of trees even sufficiently supplied with water is not able to cool the surrounding air as it is usually reported for greenery in cities.

In Figures 3.5 the vistream bottom is an advanced riverbed clog with a large width and a small velocity. The riverbed siltation is so large that the first trees have taken hold here. Trees are the warmest in the riverbed

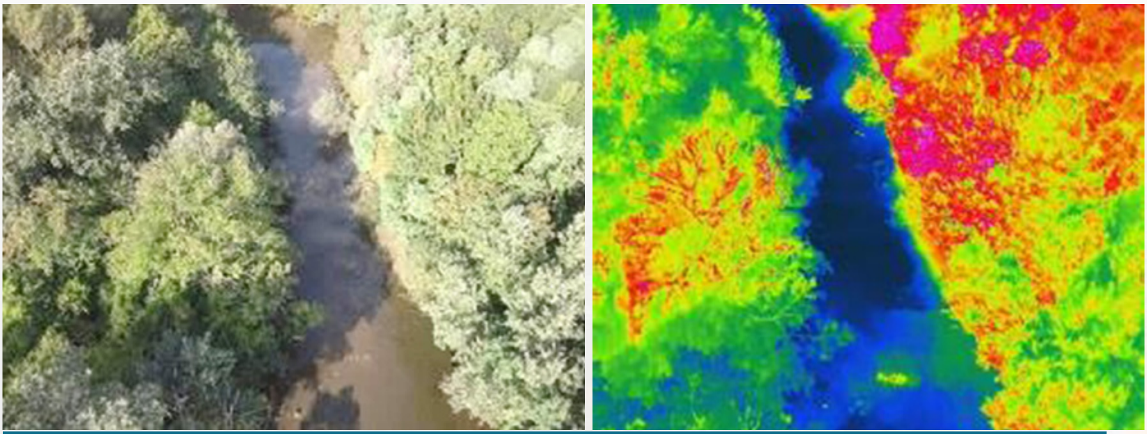

Figure 3.4 Aerial and thermal image of shallows

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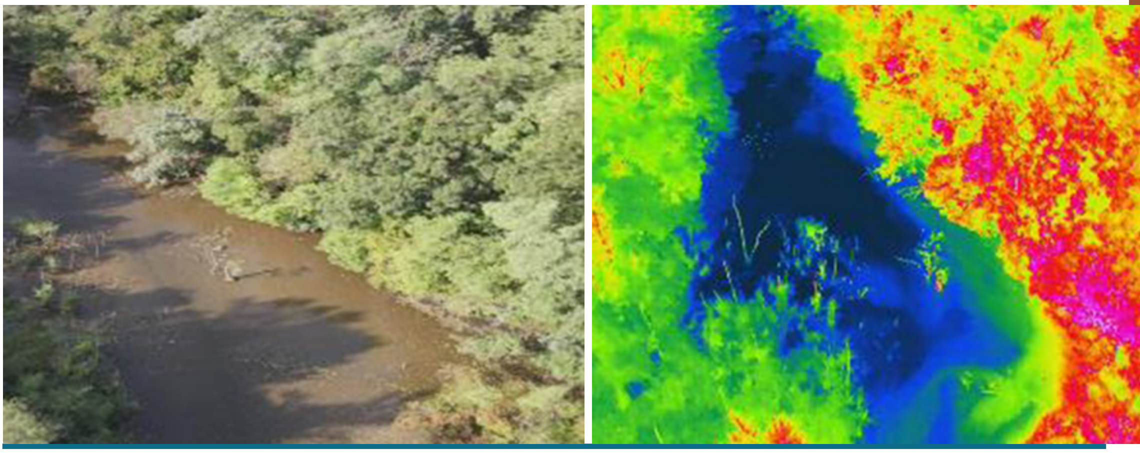

Figure 3.5 Aerial and thermal image of shallows

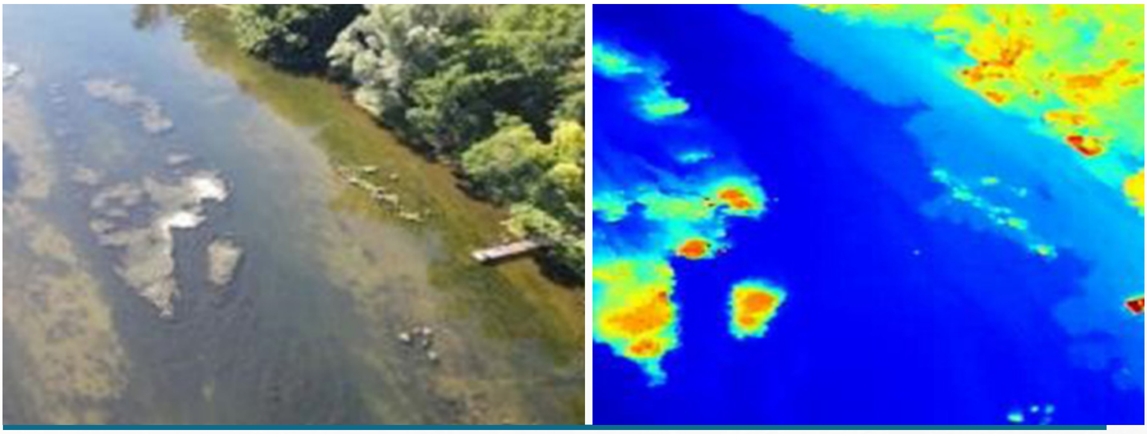

Figure 3.6 Temperature effect of aquatic plants on space temperature

and shoals are overgrown with plants similarly. The cooling of parts of the stream is due to two factors It is the shaded part of the surface and then of course the depth of water.

The impact of the bridges on the Klátovský River's aquatic vegetation varies. Upstream of the actual flow obstruction, velocity was significantly reduced and sediment deposition increased. There is a large amount of plants in the shallows. Subsequently, below the bridge, velocity increases significantly and exposes the original gravel stream bottom on which no plants are holding.

In the upper images, the temperature effect of aquatic plants on the temperature of the space and of water itself is clear. Unshaded shoals overgrown with aquatic plants cause an increase in the temperature of water by absorbing thermal radiation.

Figure 3.7 Diversity of aquatic plants in the bottom of Klátovské Arm

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In figure 3.7 the diversity of aquatic plants in the bottom of Klátovské Arm is very well presented. Basically the entire width of the riverbed is covered with higher or lower aquatic plants. The base is made up of different types of algae and then in well-defined suitable depths higher plants are represented.

3.3 DETAILED PLANT SURVEY IN THE RIVERBANK PART OF KLÁTOVSKÉ ARM

During the year 2023, a field inventory of vegetation was carried out with the participation of the staff of the Institute of Landscape Architecture of the Faculty of Horticulture and Landscape Engineering from the Slovak Agricultural University in Nitra, Slovak Republic, under the leadership of prof. Ing. Viera Paganová PhD. During several recognescences of 6 sites, there were selected in the upper part of the stream – practically in river kilometres 30.5 to 15. Subsequently, a survey was carried out in the lower part of the Branch from the Klátovský mill to the mouth of the Little Danube in the cadastre territory of the village of Topoľníky.

A total of 56 species of trees and shrubs were identified at both sites. We did not conduct an analysis of herbaceous plants due to time constraints, as the diversity of herbaceous communities was many times greater.

The survey methodology consisted of collecting data from a single bottomland characteristic site where a record of the specific species occurrence in the vegetation surveyed was recorded. The record was subsequently analysed and checked from the photo-documentation carried out and the species sorted in the synthetic processing. In addition to the basic habitat data such as location, exposure, the bottom population of the species present was upscaled and assigned an estimated coverage (areal abundance of the populations).

We then produced summary tables from the survey. The tables show the stream bottom of plant occurrence The Braun-Blanquet scale was used to stream bottom tate the occurrence of species. This is a very commonly used stream bottom method in practice, where

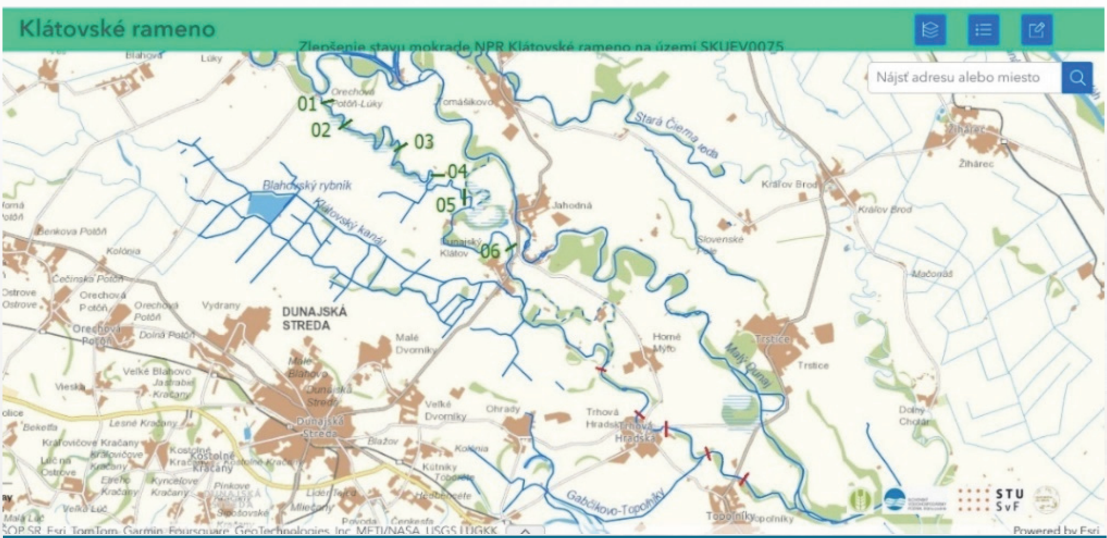

Figure 3.8 Sampling locations – upper part of the branch km 15–30

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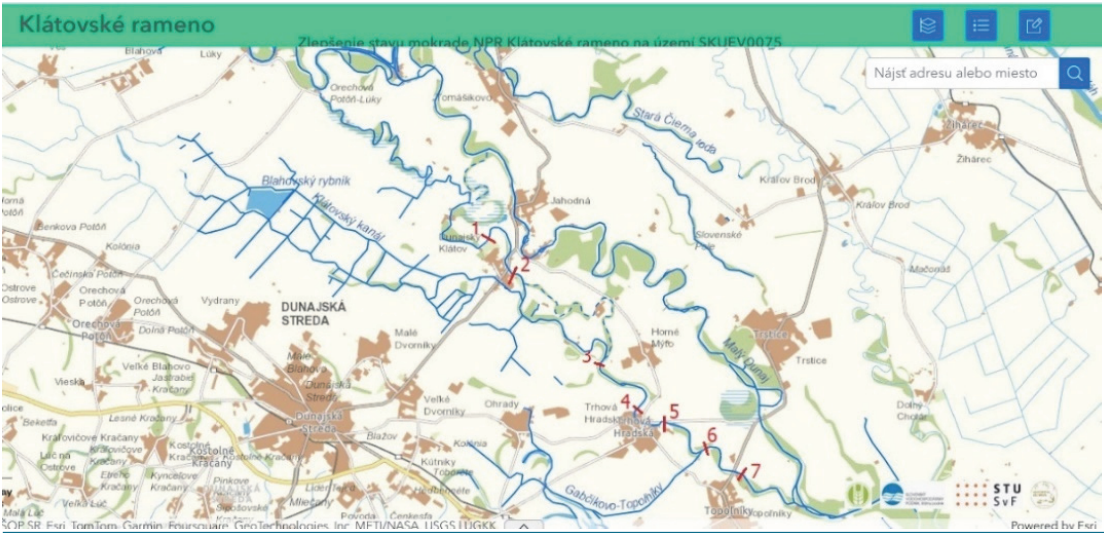

Figure 3.9 Sampling locations – lower part of the branch km 0–15

stream bottom testing character or number is assigned to the species detected. The scale is combined because the stream bottom both the abundance and dominance of species.

The following tables show the stream bottom evaluations for the sites:

- r (-) only one individual, coverage negligible,
- + multiple individuals, coverage small,
- 1 coverage less than 5%,
- 2 coverage 5–25%,
- 3 coverage 25–50%,
- 4 coverage 50–75%,
- 5 coverage 75–100%.

Grey poplar, Agate white, Slender ash and Willow white were identified as the most abundant species.

Originally the species identification was carried out at the site from Dunajský Klátov to the estuary in Topoľníky.

Figure 3.10 Example of planting a monoculture of new production forest near the site 4

Figure 3.11 Vegetation on the island near the site 5

DOI: https://doi.org/10.15414/2024.9788055227870

Table 3.1 Overview of the occurrence of species of trees and shrubs in the lower part of Klátovské Branch Inventory of species composition with quantitative representation Site (15-0 km)

	Species	Site (30-15 km)						Site (0-15 km)						
		1	2	3	4	5	6	11	12	13	14	15	16	17
1	*Acer campestre* L.	3												
2	*Acer pseudoplatanus* L.			+										
3	*Aesculus hippocastanum* L.						1							
4	*Ailanthus altissima* (Mill.) Swingle*							2	+					
5	*Alnus glutinosa* (L.) Gaertn.			2				2						
6	Amorpha fruticosa Thunb.*			1										
7	*Berberis vulgaris* L.					1								
8	*Buddleja davidii* Franchet													r
9	*Catalpa bignonioides* Walter			+										
10	*Clematis vitalba* L.	3		2	2	1								
11	*Cornus mas* L.								1					
12	*Corylus avelana* L.					+								
13	*Crataegus monogyna* Jacq.	3		2	2	2		2	1	1	1			
14	*Euonymus europaeus* L.	3	3											
15	*Frangula alnus* Mill.	2		1	2									
16	*Fraxinus angustifolia* Vahl.	3	3	3	3									
17	*Fraxinus excelsior* L.	4	4	3		3		4	4	3	2			
18	*Ficus carica* L.			+										
19	*Hedera helix* L.					2			2					
20	*Humulus lupulus* L.			1										
21	*Juglans regia* L.	3	2	3	2	2			+	1	1		1	
22	*Ligustrum vulgare* L.							2						
23	*Morus alba* L.			+					+	1	+			
24	*Negundo aceroides* G. Kirchn.*							1		1	1			
25	*Phyllostachys viridiglaucescens* (Carrière) Rivière et C. Rivière										+			
26	*Platanus × acerifolia* (Aiton) Willd.			+										
27	*Populus alba* L.				4	3								3
28	*Populus nigra* L.										2	3		4
29	*Populus tremula* L.	2	4	3										
30	*Populus × canadensis* Moench							4		4	3	4		
31	*Populus* x canescens (Aiton)Smith	4		4		4		4	4	3	3	4	4	4
32	*Prunus avium* (L.) L.					2		2	1					
33	*Prunus cerasifera* Ehrh.		3	2				2				1	1	

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Continuation of Table 3.1

Species		Site (30-15 km)						Site (0-15 km)						
		1	2	3	4	5	6	11	12	13	14	15	16	17
34	*Prunus padus* L.	3				2								
35	*Prunus spinosa* L.										+			
36	*Quercus robur* L.					1								
37	*Rhamnus cathartica* L.			1								1		
38	*Rhus typhina* L.			1										
39	*Rosa canina* L.			1		1								
40	*Robinia pseudoaccacia* L.	3	3	2	2	3		3	4	4	2		3	
41	*Robinia pseudoaccacia* L. – vegetation – monoculture						5							
42	*Rubus fruticosus* L.		3			2								
43	*Salix alba* L.	4		3					3		3	3	2	2
44	*Salix alba* L. 'Tristis'									+				
45	*Salix caprea* L.									1	1	1	1	
46	*Salix erythroflexuosa* I.V.Belyaeva			1										
47	*Salix fragilis* L.	3		2					2		2	2	1	1
48	*Salix* sp. – vegetation – monoculture						5							
49	*Sambucus nigra* L.		2	1		2			1			1	1	
50	*Swida sanquinea* L.	3	3			2		2		1	2	2	2	2
51	*Platycladus orientalis* L.			1										
52	*Tilia cordata* Mill.						1							
53	*Ulmus carpinifolia* Gled.	1		1		1			1					
54	*Ulmus leavis* Pall.					1								
55	*Viburnum opulus* L.	1		2		1		2		1	+			
56	*Viscum album* L.									+	+			

* – invasive species of trees; Braun – blanquet scale of abundance and cover; r – isolated species (the symbol – is also used); + – scattered, coverage negligible; 1 – abundant to scattered, coverage below 5%; 2 – abundant to very abundant, coverage 5–25%; 3 – coverage 25–50%; 4 – coverage 50–75%; 5 – coverage 75–100%

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3.4 SURVEYS BY DRONS

In order to get to know the terrain and to find out details that are not noticed during a normal inspection, the surveys were carried out in three stages.

In the first stage, we surveyed The Territory from the air with a single-bottomed small drone with visual imaging. In this way we were able to penetrate parts of the Klátovské Arm with poor accessibility due to distance from a dirt or paved road or, most often, due to dense to impassable riverbank vegetation.

During a few days of drones flying we got video of the whole route and managed to document a few important things such as it follows:

- oil pollution of water,
- parts of Branch with water pinpointed from parts without of water or with very shallow water,
- pollution from municipal and other waste,
- sites used by waterfowl,
- obstructions to flow rates in the riverbed – both spillways and fallen dead trees,
- extent of vegetation in the riverbed of the stream.

Then, after evaluating the stream bottoms of the classic drone video recordings, we processed them into sections of 1 km in length for a simplification of the work. These we used in solving of the design measures.

The next survey was thermal imagery from a small drone. After processing the conventional images and video, we singled out a few locations that are important for a variety of reasons, and for these locations we processed our own handouts from the thermal camera of the small drone.

We focused on the upstream bottom flow evaluation in shallow and overgrown parts of the beds, also on the thermal regime of the flow in the vicinity of the bridges and obstructions to the flow, and also to find out the thermal relations of water at the confluence points as well as the thermal regime in the vicinity of the thermal baths Topoľníky, which is directly in the protection zone of the Branch and water is discharged directly into the River Branch.

In the figures, there is a difference between a visual survey of water discharge, where thermal changes cannot be identified, and thermal imaging, where we can see not only temperature changes but also their areal changes.

The heat trace then extends far from the source and changes the living conditions

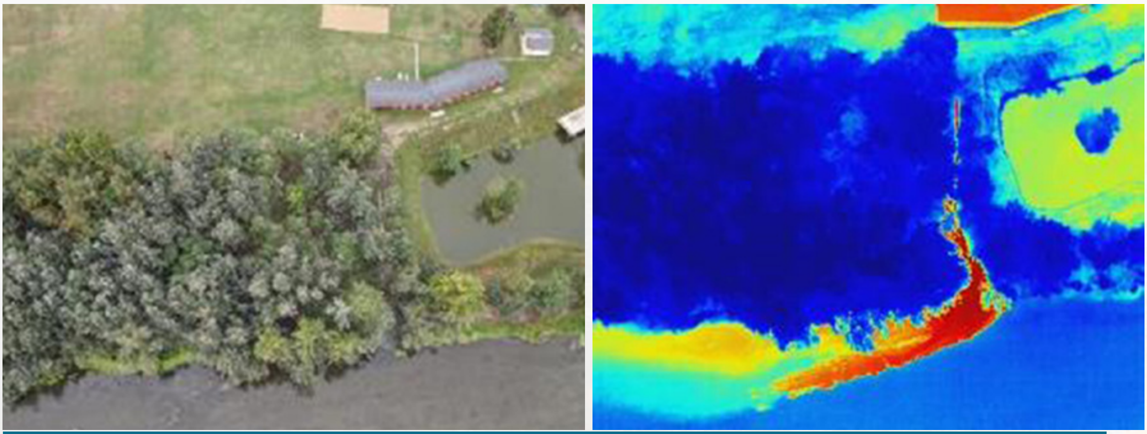

Figure 3.12 Aerial and thermal image of the outflow of water from the Topoľníky Thermal Baths

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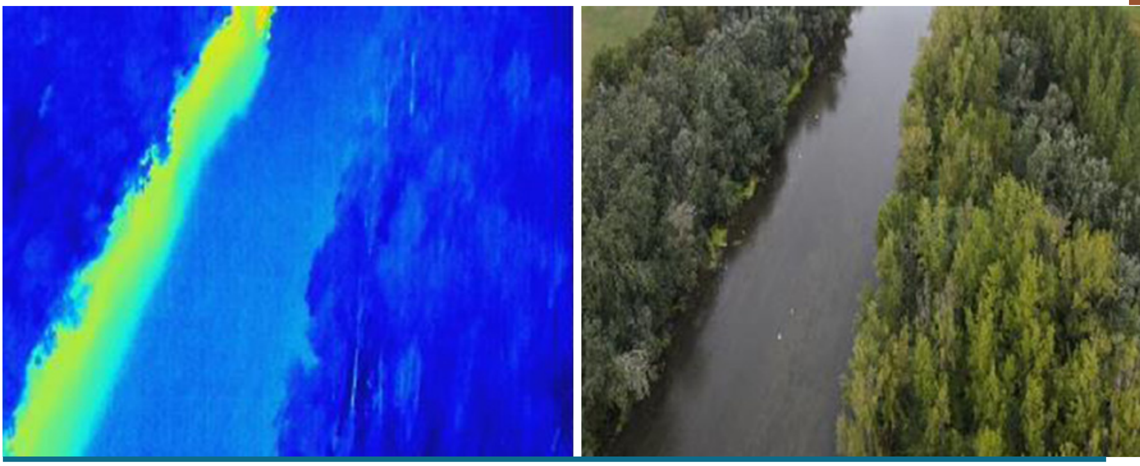

Figure 3.13 Aerial and thermal image of the outflow of water from the Topoľníky Thermal Baths

Figure 3.14 Aerial and thermal image of the confluence of water arm with the Gabčíkovo – Topoľníky Chanel

of the organisms in the water. This research provided the very interesting information. Some of the results are presented in another section of the document. The results of the survey from the thermal bathing area showed large thermal pollution over distances almost up to the fence object from the discharged warm of water.

The survey of the confluence of Klátovské Arm and Klátovský Chanel depicted warmer water in the Chanel due to flow rates through open country without sufficient cover of riverbank and riffle-bottom vegetation. A better representation of the temperature differences is the confluence of the Klátovské Arm and the Gabčíkovo Topoľníky Chanel.

The temperature difference in both streams is very clear and moreover the water quality in both streams is also very different.

3.4.1 SURVEY OF THE KLÁTOVSKÉ ARM BY MULTISPECTRAL AND THERMAL SENSORS

A reconnaissance of the Branch itself and the riverbank and sprieaquatic stands

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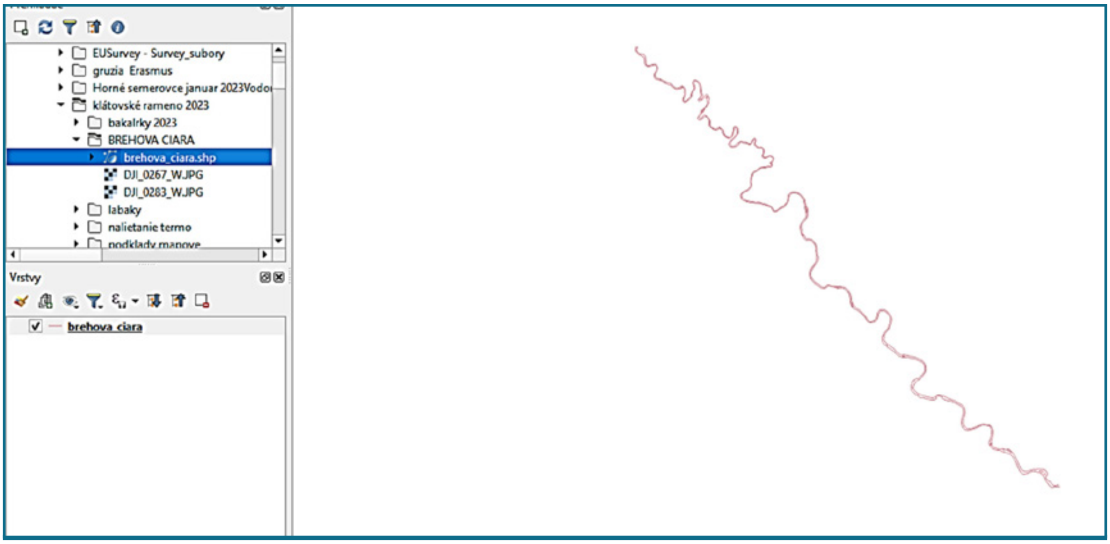

Figure 3.15 Actual refined riverbank line of Klátovské Arm

was conducted by an external firm. Up to three analytical meters were used for the survey – Spectral Camera, Thermal Camera and Lidar.

Lidar was used to accurately identify the measured features as well as the water level. The survey was designed to determine the condition of the stands and their ranges and to locate problem areas. This resulted in an extensive set of documents, which we used to specify problematic sites and

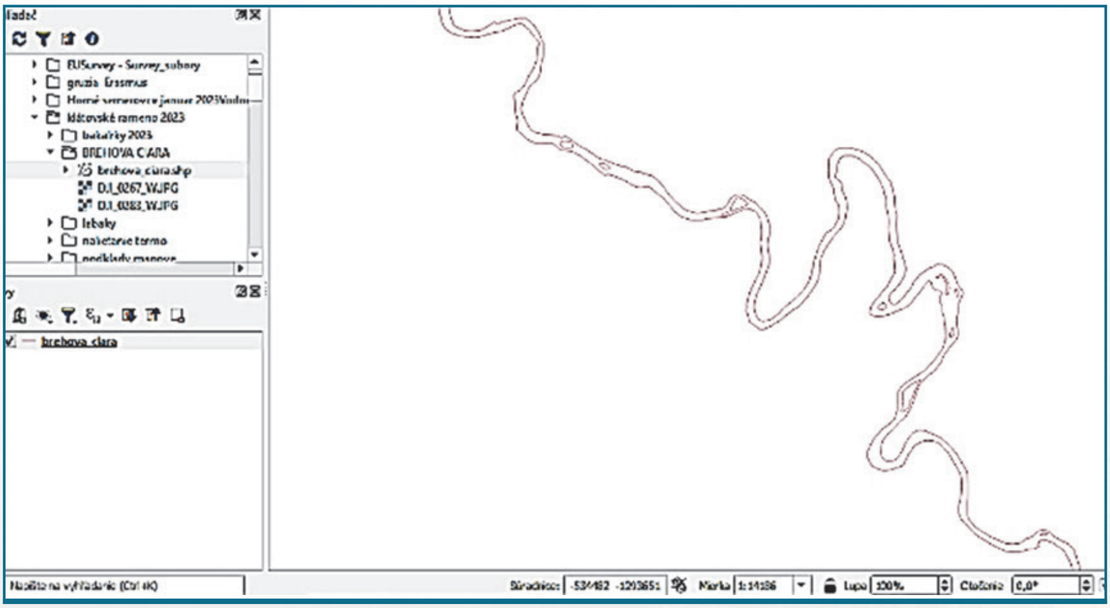

Figure 3.16 Actual refined riverbank line of Klátovské Arm

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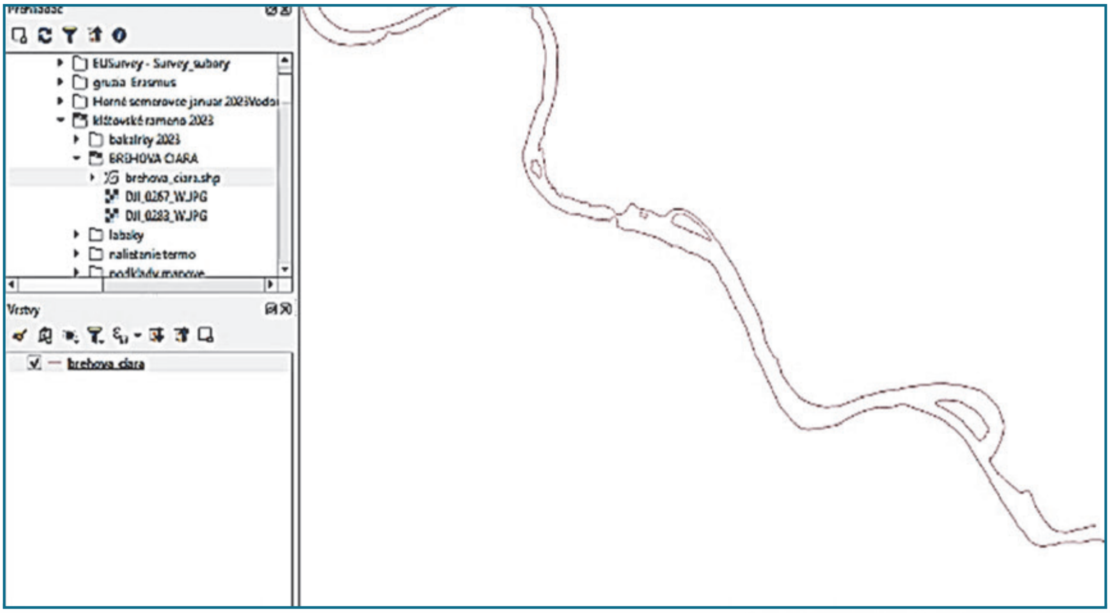

Figure 3.17 Actual refined riverbank line of Klátovské Arm

also to update e.g. the actual riverbank line of Klátovské Arm.

In some areas, the water level gauging provided us with a realistic hostream bottom of the riverbed flow area under a given state of water level.

Such accurate information could not be achieved by other means. Ground tmeasurement was impossible to realize because the much part of the branch was imperviousness.

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Ľuboš Jurík et al

4 PROPOSAL FOR MEASURES IN SECTIONS OF THE KLÁTOVSKÉ BRANCH

According to the water management maps, the Klátovské Branch has a registered length of 30.6644 km and the elevation of the water level at the outlet to the Little Danube is 108.6 m a.s.l. and at the place of the original disconnection or inflow from the Little Danube is 114.4 m a.s.l.

Measures to change the status quo can be divided into several sections.

Km 0.0–1.0

The riverbed in this section u has a balanced width. Only Management of vegetation on the new the island is needed. At the end of section there is already native riverbank vegetation in need of intervention after falling into the stream.

The concave riverbank is quite silted in and a parallel band of vegetation is created parallel to the regular riverbank. Sediment should be removed here.

Km 1.0–2.0

This section is leading riverbed chanela to the village of Topolniki. This section at the chanel has the highest flow rate in the reach because it is section just below the Gabčíkovo Topoľníky chanel outlet.

Management of both vegetation and sediment is required at the section. The concave riverbank is quite silted in and a parallel band of vegetation is created parallel to the regular riverbank. Sediments are gradually silting up the concave riverbank and this is also due to increased vegetation growth in the warm water flow. Throughout section the mixing zone discharges warm water from the thermal swimming pool and just upstream of the Riverbanks Branch there is increased vegetation growth due to the consistently high temperatures throughout the year. The warm water progression and mixing zone in the stream is very heavily overgrown and can be seen in the following figure.

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There is a need to reconsider the permitting of the discharge of water from the thermal bathing area and to create a cooling tank at the bathing area prior to the discharge of water. The water is heavily mineralised and the solute content of the flow increases with mixing.

Km 2.0–3.0

On the section there is a road the bridge on the state road number 561. This bridge, like other transverse obstructions, creates major impediments to both the flow of water and the movement of sediments.

The road bridge constructed in this area circa 1965 has significantly interfered with the flow regime of water in the riverbed and has reduced the flow area to less than half.

Extensive shoals have formed in front of and behind the bridge. If gravel were placed on these sections it would create a zone with a positive cleansing effect and prevent the putrefactive decomposition of organic matter from fallen leaves and other plant debris. A proposal for the location of the gravel benches is shown in the figure 4.1.

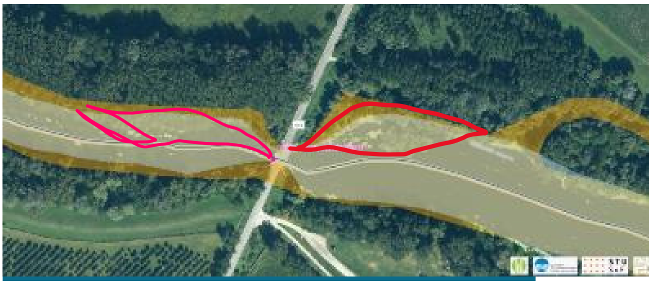

Figure 4.1 Proposal for the placement of gravel benches

At a distance of about 75 m after the bridge, the island with vegetation has already formed and behind it a shallow zone and just before a slight arch to the right is another area with sediments.

Figure 4.2 Proposed location of the islands extension to place sediments

This and similar the islands should be used for Management of sediments. Wood stakes would be hammered at the edge of the siltation as shown in the figure and sediments from the shallow parts of the stream would be moved into the space thus created. This will create a better flow of water and will not change the natural character of the riverbed. The sediments will be naturally covered with shrubs or trees and create new protected nesting opportunities for birds.

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The water in this area is overheating significantly resulting in a reduction in the oxygen content of the water.

Dredging the riverbed by moving sediment will cool the stream and if the original gravel stream bottom is exposed it will also create conditions for fish spawning. Dropped trees in the area also need to be addressed and directed in the direction of the flow of water so that they are not perpendicular to the flow rate.

Deadwood would remain in the stream but so as not to reduce flow rate and increased sedimentation in their vicinity.

At the end of section u is now emerged the island with a small part of the flow rate which was formed on the convex riverbank arch. Settlement in this part of the arch is natural. But due to the condition of the branch, the shape of the island needs to be sculpted to create better bypass conditions and thus safety for nesting birds. As figured the solution is to simply move the sediments and also the dead wood.

Figure 4.3 Proposal for the location of the extension of the islets to the location of the sediments

Km 3.0–4.0

This entire section is made up of a large arch of Klátovské Branch.

The flow of water in the arch brings an unequal distribution of velocities across the riverbed and this has been reflected in the riverbed condition in this section. Almost half of the original flow profile is already clogged with sediment.

The critical condition is in the section of the arch at the top of the figure where the sediment deposits almost completely dam the flow rate in the reach. This condition is probably related to the tributary water from the Gabčíkovo – Topoľníky channel, whose quality is significantly different compared to the quality of water in the arm itself and this causes increased sedimentation. River bed in arch with alluvium forming extensive the island.

At this section, future upstream bottoming is needed to detail the rate of sediment development and the potential for fish barrier formation.

Figure 4.4 Proposed solution for moving sediments in the riverbed

DOI: https://doi.org/10.15414/2024.9788055227870

In the mixing zone of Chanel and Branch, the island is already the island with a stand of trees in the middle of the riverbed that are over 20 years old and therefore this process is likely associated with the annexation of the leachate channel.

This section needs to be solved in a very short time because there is a risk of closing the flow in several places. As a start, it is necessary to redirect the trees in the direction of flow by non-technical methods, e.g. by means of ropes and hand-powered attraction equipment.

Km 4.0–5.0

This section is of great importance for the branch. In km about 4,072 there is a tributary of Gabčíkovo – Topoľníky channel on the right side. It is a very important tributary because the basis of the flow rate is the seepage of water from the feeder channel to Gabčíkovo and the channel flows not only through intensively used countryside but also through many villages.

The difference in the quality of water in the chanel and the branch is significant and therefore the quality of the water in the Klátovské branch deteriorates after the confluence. This is also visible from the drone imagery.

Siltation has shifted the water flow into the concave riverbank as evident in the figures. From this kilometre onwards, wooden fishermen's piers are located on the concave parts of the riverbanks or in the straight sections. There are dozens of them despite the prohibition of fishing in stage 5 protection.

Figure 4.5 Proposal to address the need for sediment transfer in the riverbed

This section has many sustainability issues with the quality of water and also with sediment deposition.

Km 5.0–6.0

It is almost a direct section leading the Branch stream to the village Trhová Hradská.

DOI: https://doi.org/10.15414/2024.9788055227870

Despite the simplicity of the direction, it is a section with significant differences. The section ends in the large the island, one of the largest on the Klátovské Branch, The dimensions of the island are about 210 × 105 m and the area is about 16,800 m².

Figure 4.6 Proposed solution for moving the sediments in the riverbed to the existing the island

In 1950 the water was still flowing to the right of the island, today this part has been covered with sediment and the water flows on the left side. Such a development is also possible on other parts of the Klátovské Branch and the current management of does not allow such a process to be prevented. The water in section u is shallow and brackish and so in this section the water overheats faster. There is a large amount of submerged vegetation in the shallow water over almost the entire area. In several places the vegetation has also already emerged.

Km 6.0–7.0

The section begins and ends in a minor arc. In the middle it is a straight route.

The section is in contact with the village of Trhová Hradská but only on the right riverbank while on the left riverbank is arable land. There is a significant road bridge, similar to the one in Topoľníky, which has one opening. It was built in 1966.

The bridge divides the section into two similarly long parts. The water under the bridge has a relatively high velocity and so no sediment is deposited in the area of the bridge and so there is an exposed gravel stream bottom which, however, after a short section u changes again to a stream bottom with organic matter and sediment.

Sediments greatly affect the flow rate in the reach, which splits into two streams and most of the section u is overgrown with emergent vegetation.

In order to maintain the flow rate and temperature of water, this part of the Branch is suitable for intervening in the distribution of sediments or in the solution of the flow rate in the Branch.

As in the previous the bridge, similar measures are proposed here. The very shallow water in front of and behind the bridge is not of positive importance for the organisms that live in the branch, rather the opposite. Therefore we suggest to fill the three shoals

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near the bridge with gravel or aggregate. This has the significance that the flow rate will be concentrated in the remaining part of the branch and thus the velocity of water will be increased. The water passing through the gravel benches will be in contact with micro-organisms – periphyton, which will settle on the gravel and thus will be purified by filtration but also by the consumption of nutrients and substances by micro and macroorganisms in the gravel benches. This will create a kind of vegetation treatment plant directly in the stream and its area will be large enough to purify the substances that have entered the branch from agriculture or tributaries from the Klátovský Chanel, It

Figure 4.7 Proposed solution for moving sediments in the riverbed and creating gravel benches

will also improve the life of the inhabitants of the village, because in summer the decomposition of organic matter in these shallows causes a smell, which is not pleasant for the inhabitants of the nearest houses.

There are already quite a few fallen trees in section, whose trunks have slowed the flow rate and created a base for sediment deposition.

At the end of section u on the right side of the riverbed are old, long ago built piers for fishermen and also a place from where one can enjoy swimming in deeper water without passing through muddy shoals.

These piers are obviously in violation of the conditions for the 5th level of protection and the riverbed manager as well as the State Nature Conservancy should decide how much longer to leave them. They are causing a slowing of flow and thus increased siltation in their vicinity.

Also important is the fact that in 1960 the village – houses and streets were sufficiently distant from Klátovské Branch but the development of the village was also oriented to the protective area of the nature reserve. It is necessary to compensate for this unfavourable development intervention, e.g. by relocating sediments or creating zones in which the water would be cleaned in this area.

Km 7.0–8.0

The section in this part is quite homogeneous. It is formed by a long and gentle arc from the end of the village of Trhová Hradská towards Horné Mýto.

In almost the entire section the width of the riverbed itself is considerably narrower than in the previous sections. The riverbed is 20 to 25 m wide. Only at the beginning of the section is there a kind of artificial widening and then the flow narrows.

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In such a narrow part of the stream, dropped trees, which are increasing in number, are already becoming a significant obstacle.

The situation is bad in the middle of this section in two places.

Figure 4.8 Suggestion of places to address for the transfer of sediments in the riverbed

Here the flow narrows so significantly that deadwood fallen from trees gradually forms micro-dams. Here the water flow slows down considerably and the riverbed not only becomes silted up but also very narrow.

Km 8.0–9.0

This section is almost straight and is bisected by the island formed by the alluvium.

The width of the riverbed is about 50 m and is fairly shallow with several areas of emergent plants. The riverbed is dammed several times by fallen trees.

Figure 4.9 Proposed solution for moving the sediments in the riverbed to the existing the islet in the riverbed

One of the most critical sections in the first third of the stream. Large number of fallen trees on the left riverbank. They took up over half the width of the riverbed. Slowing of flow rate resulted in the creation of one of the islands. Need to reroute and relocate some of the fallen of trees to restore flow of water throughout the profile. Sediment management should use some of the dead wood to re-shape the islet in the center of the riverbed and then move some of the sediment into this area to create

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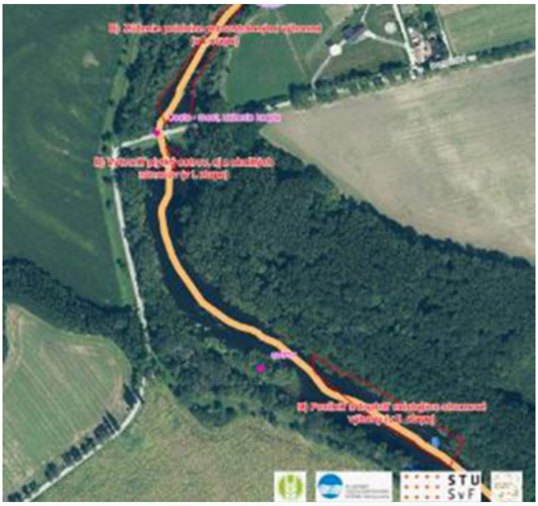
a better flow profile and increase the sediment entrainment. The designs are highlighted in color in the previous figure.

This section is of paramount importance in the management of the entire riverbed in terms of addressing the flow rate.

Km 9.0–10.0

The flow forms an arch of flow to the left from km 10 to km 9.

The stream widens here from about 30 m to 65 m wide and the water is shallow.



At km 9.513 there is a significant feature – the road bridge. Its width is only 10 m and therefore the width of the stream changes substantially here. From a width of about 30 m the flow widens just before the bridge to about 90m and then there is the bridge with a width of 10m and then the original riverbed with a width of about 60m gradually narrows to a riverbed of flow about 20 m wide.

In this section at about km 9,410 we discovered the remains of the original watermill. Only the foundations on the left side of the riverbank remain.

On the opposite side, a large the island has been formed by siltation and over time it joins the right riverbank of the stream. This will reduce its habitat importance for threatening nesting birds.

Figure 4.10 Proposed solution for moving the sediments in the riverbed to the existing the islet

The island needs to be reshaped to create a bypass and space for management of sediments as suggested in the previous figure. The base of the change in form of the island should give a relocated deadwood to retain sediments.

The second place in this section u to revitalize is the transverse the bridge and its surroundings. Like the other the bridges it is from the 1960's and was very insensitively built and has significantly narrowed the riverbed and of course changed the flow rate of water. Replacing the bridge is unrealistic

Figure 4.11 Proposed solution for moving sediments in the riverbed and creating gravel benches

by the measure and therefore it is advisable to create flow conditions by reshaping the riverbed by creating backfill edges in front of and behind the bridge. The stream bed in this area is gravelly and therefore this gravelly bed can be compacted by placing gravel in places as in the following figure. Moving sediment would reduce the importance of the gravel as a self-cleaning area in the water.

It would be advisable to search for documentation or historical photographs of the mill's remains in the archives and to promote its history in the premises of the municipal office or the municipality.

Km 10.0–11.0

The entire one-mile section is an arch riverbed.

The riverbed is uniformly about 20 m wide throughout the section but its riverbank is very irregular and is dependent on the occurrence of trees. There are only a few fallen trees in the section, mostly on the right riverbank.

On the left figure 4.12 is the necessary solution to the fallen of trees. They are directed upstream of water and therefore it would be advantageous to just redirect them by moving the crown in the direction of the flow of water.

The constructed dock for the property on the left riverbank is also an issue as it is an artificial alteration of the riverbed of the protected stream.

The second section in need of revegetation is a very constricted reach in which the riverbank vegetation has grown significantly due to sedimentation and the reach is only a few feet wide. Here it is very important to clear the stream bed down to the original gravel stream bed in order to maintain flow rate capacity in this constricted area.

Figure 4.13 Changing the flow regime in the stream by creating sediments on riverbanks around fallen trees

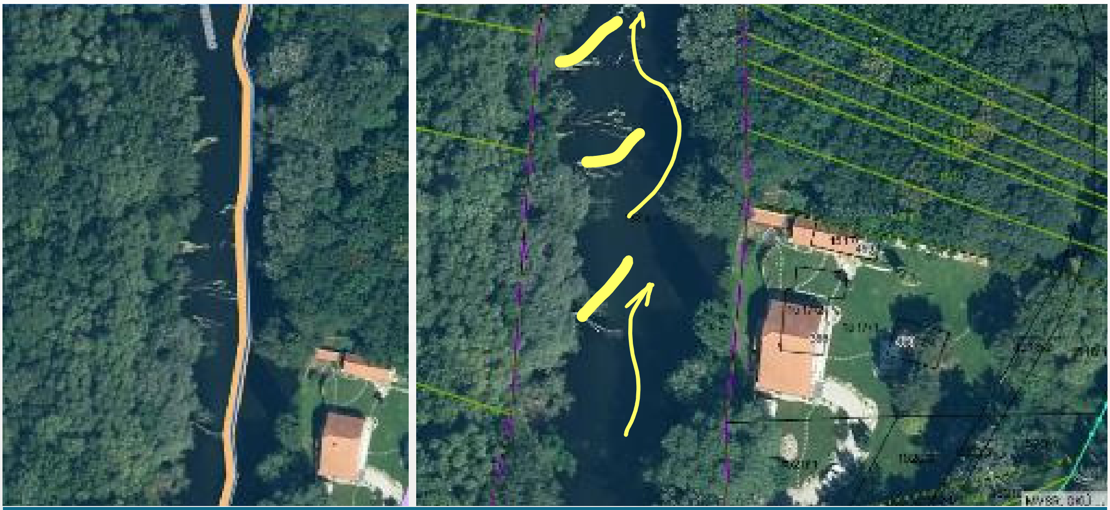


Figure 4.12 Proposal for a solution to the rerouting of dropped wood in the riverbed

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Km 11.0–12.0

This section is practically straight, although at the beginning the previous sheet passes into a straight line.

On both sides of the stream are built residential and economic buildings. All of them are in the protection zone of the 3rd level of nature protection.

Access to these properties is provided by the bridge at km 11,9. The bridge, like all the other bridges, is very narrow and only 10 m wide. The bridge was built before 1950. The bridge increases the velocity of water by narrowing and there are large numbers of fish of all sizes in the area of the bridge. The stream bottom is sediment free in the area of the bridge and is covered with gravel, allowing some fish to spawn.

Revegetation measures in this section are needed as in previous sections in the area of the bridge at about the middle of the section. The bridge does not create as significant a change in the width of the riverbed here.

Km 12.0–13.0

The section is formed by a stretchy gentle arch riverbed flow.

The entire riverbed is heavily shaded and there are many fallen trees in the riverbed. The flow slows considerably and much of the stream is very shallow. Aquatic plants heavily overgrow the water surface in the growing season.

At the top of the ark, the surface widens, the water is shallower and small the islands form, attracting large numbers of waterfowl.

The slowing of the water in front of the bridge has created an almost complete closure of the riverbed by siltation. This is very significant siltation and the new fallen trees are making the situation even worse.

Figure 4.14 Difference in sediment volume between 2012 and 2023 (Google maps)

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This is probably the most important revegetation site on the streambed section near the stream.

As the only option in this section is to move the sediments to one side. Most of the sediment is on the left side of the stream and therefore the right side of the sediment needs to be addressed. The flow regime needs to be addressed here and the last dropped trees need to be rerouted first. This measure is necessary.

Figure 4.15 Difference in sediment volume between 2006 and 2014 (Google maps)

The development of the siltation is quite rapid, because in 2006 as the previous image (Google maps) the main stream flow rate is still evident in the image. In the 2014 image the riverbed is almost closed. Only a few fallen of trees and other sediments have been added to date.

The condition of the riverbed a few hundred metres further on is similarly poor, and the fallen trees are greatly reducing the flow here.

Km 13.0–14.0

This section is divided by sediment into several streams due to the slowing of the flow by fallen trees. Overall, the section is very vulnerable to siltation and will need significant future investigation of siltation progress to prevent the riverbed from closing completely.

The whole section is very similarly formed by an elongated sheet, opposite to the previous section.

Figure 4.16a Difference in sediment volume between 2006 and 2014 (Google maps)

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Figure 4.16b Difference in sediment volume between 2006 and 2014 (Google maps)

Again, comparing the situation in 2006 and today, the differences are substantial and are evidence of the need for revegetation interventions, even in a Level 5 conservation area.

Section is on the border of the cadastral territory of Ohrady and Dunajský Klátov.

Km 14.0–15.0

This section is from the end of the previous section to the beginning of the village of Dunajský Klátov.

There are two interesting influences in this section. Just at the beginning of the section the Klátovský Channel flows into the Klátovské Branch.

It is an artificial drainage channel with a length comparable to the Klátovské Branch.

Its influence on the Klátovské Branch is significant. Despite the confluence and the increase in flow rate, which should increase the stream bottoms carried, the riverbed is already very clogged from the confluence.

The second significant influence on the flow rate and condition of Clats Branch in this section is the Clats Mill. It is a preserved mill as an example of a mill with so-called spostream bottom water. There is a short embankment channel to provide tributary of water to the mill and a sluice gate was constructed long ago to raise the level of water. Today it is no longer functional and the water flow cannot be regulated. As the mill is only a museum, the justification for a sluice gate should be discussed. As a result, it should be determined whether its reconstruction or removal is necessary. From our perspective, the latter alternative is preferable. The second issue is the road crossing over the branch itself.

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Figure 4.17 Difference in riverbed sedimentation between 2006 and 2014 (Google maps)

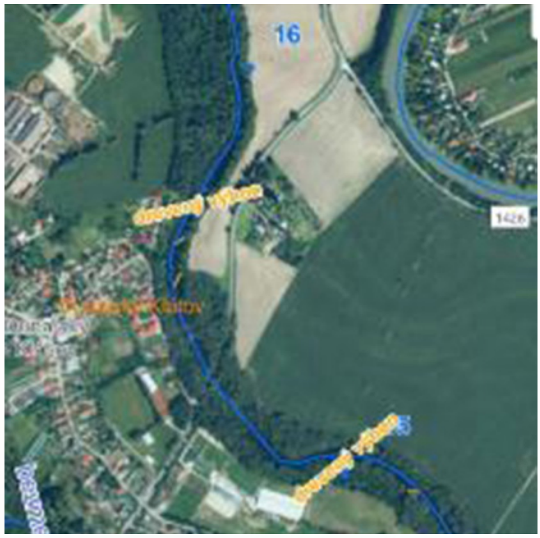
At present, the non-functioning sluice causes a rise of water of about 0.5 m. If the level above the sluice is 111.0 m then below the sluice and mill the level is 110.4 m above sea level.

Beavers have settled on the post-stream bottom of the inflow to Branch Soliare and many large and coarse of trees have fallen into Branch. Branch Soliare is not part of our solution.

Km 15.0–16.0

The section is formed by an arch and is on the edge of the intravillan village Dunajský Klátov.

On section u there is a crossing of the state road 507 by a relatively long the bridge. The bridge is built in a new location because it is a short distance from the original the bridge, of which only the concrete foundation remains. Both the bridges form obstructions to the flow of water. Nevertheless, the flow here is almost impassable because beaver have settled here and have lowered an estimated 25–30 of the trees on the Left Branch riverbank at intervals of about 10 m in succession. Trees need to be moved so they are not perpendicular to the flow but create the opportunity for flow by diverting downstream.



The section is formed by a sheet and is on the edge of the Dunajský Klátov intravillan.

At section u there is a crossing of state road 507 by a relatively long the bridge. The bridge is constructed on a new site because it is a short distance from the original the bridge, of which only the concrete foundation remains. Both bridges form obstructions to the flow of water.

The stream is nevertheless almost impassable here because beavers have settled in and at distances of about 10 m behind have started an estimated 25–30 of trees on the left riverbank Branch. Trees need to be moved so they are not perpendicular to the flow but create the opportunity for flow by diverting downstream.

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The section is formed by a sheet and is on the edge of the Dunajský Klátov intravillan area.

At section u there is a crossing of State Route 507 by a relatively long the bridge. The bridge is constructed on a new site because it is a short distance from the original the bridge, of which only the concrete foundation remains.

Both the bridges form obstructions to the flow of water.

Nevertheless, the flow is almost impassable here because beavers have settled here and at distances of about 10 m each have lowered an estimated 25–30 of trees on the Left Branch Riverbank. Trees need to be moved so they are not perpendicular to the flow but create the opportunity for flow by diverting downstream.

The riverbed below the road the bridge is heavily clogged and also very shallow. The riverbed is heavily section is formed by the sheet and is on the edge of the intravillan of the village of Dunajský Klátov.

At section u there is a crossing of State Route 507 by a relatively long the bridge. The bridge is built on a new location because it is a short distance from the original the bridge, of which only the concrete foundation remains. Both the bridges form obstructions to the flow of water.

Nevertheless, the flow here is almost impassable because beaver have settled here and have lowered an estimated 25-30 of the trees on the Left Riverbank Branch at intervals of about 10 m each. Trees need to be moved so they are not perpendicular to the stream but create the opportunity for flow by diverting downstream.

Both the bridge opening and on the left riverbank are dropped trees from beaver activity in the section.

Further beyond the current the bridge are the ruins of the previous the bridge and cause a large obstruction to the flow of water in the section.

Figure 4.18 A flow blockage formed by the ruins of an old road bridge on the stream

Just beyond the original the bridge is a vistream bottom sediment deposit due to reduced flow rate velocities.

Further downstream, the stream is concurrent with the municipal road. There are several wooden pier structures on the riverbank for swimming or fishing. We observed fishing gear on some of these during almost every visit. This is because of the fishing permit on the whole riverbank issued by the Environment Office in Trnava.

Km 16.0–17.0

The section is formed by a long arc bypassing the intravillan of the municipality of Dunajský Klátov.

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Beavers have settled on the riverbank side and are destroying the older growth there. They are not destroying the younger trees yet and are really only picking the thicker, thicker trees. Damaged of trees are in this section u dozens (hundreds).

Beaver activity is also developing on the opposite riverbank where old trees are being nibbled.

Figure 4.19 Beaver activitie

Many of the trees are infested with mistletoe or are being dragged over by ivy to a considerable height. This is affecting their overall condition and these stands are becoming hazardous to people and the stream.

The riverbed of the stream is very shallow and overgrown virtually the entire width with aquatic submerged plants. The flow rate in the riverbed is concentrated in a very narrow area and the rest of the wide riverbed is just very shallow The Water with aquatic vegetation that overheats very quickly in summer also because of the dark color of the sediments on the bottom. It is a much darker stream bottom compared to the original gravel bottom.

In section u is the already lost area the island, which after the clogging of one part became just an interesting sheet. The water is still moving in the original flow section on the right side of the sheet but this flow rate is very slow. In the 2006 image the flow rate on the right side is still clear.

Figure 4.20 Problematic site with a lot of fallen trees

In the center of the ark is another problematic spot where fallen trees have nearly dammed up the riverbed. Trees have fallen against the sweeping flow of water. Therefore, they need to be moved so that they are in the direction of the flow of water.

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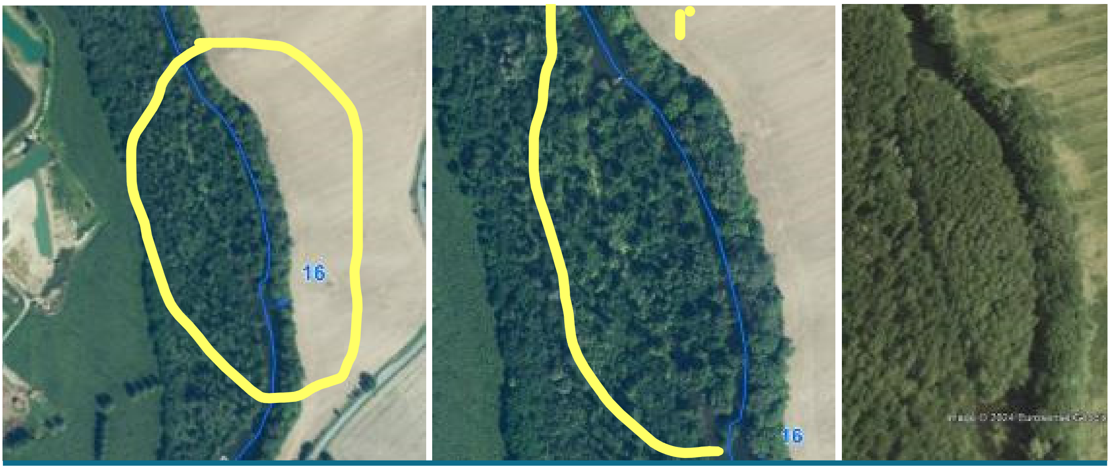

Figure 4.21 Changes in the state of the section from 2006 to the present

Just before the end of the section there is the farm BIFÁR on the left side of the stream.

Km 17.0–18.0

The section is formed by a slight arch that returns the branch stream to the opposite side of the village of Dunajský Klátov.

Just after the beginning of the section there is a crossing of the original stream with the road from the fields behind the chanel to the village of Klátov. The bridge is now closed and due to non-functionality modified for pedestrian crossing only by removing half of the bridge.

Figure 4.22 Stream dammed with fallen trees

The riverbed of the stream in this section u is quite narrow and there are many fallen of trees.

An irrigation system is established for planting fruit of trees with an abstraction facility from the Klátovské Branch.

Revitalisation measures in this section are needed right at the beginning of the section. There is the bridge mentioned and after the bridge the stream widens and forms a shallow part of the riverbed.

Improvements to the riverbed are needed at the end of section u where the stream is dammed by fallen trees.

Km 18.0–19.0

The section is a continuation of the previous part of the large arch and is almost straight, with only a slight arch at the end at km 19.0.

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River bed flow is quite shallow, heavily shaded and in this section there are hundreds of fallen trees into the riverbed. This is probably due to wind and age of trees. Some of the trees standing directly on the riverbank of the riverbed are dry and are likely to become the next fallen trees. There are a number of localised shoals in the whole section overgrown with bottom vegetation.

There are a number of fallen of trees in section u and since the stream is already narrower, tall trees are damming almost the entire riverbed. As a measure there is only management of fallen trees by redirecting them.

Figure 4.23 Management of fallen trees by redirecting them

Km 19.0–20.0

It is a section at the end of the stream in the cadastre of the village of Dunajský Klátov on the border to the cadastre of the village of Jahodná. The section is at the end of a long arch and its condition is expressing the need for revitalization. On section u there is already a small flow rate and also a very large number of fallen trees. The poor condition is complemented by two technical constraints on the stream and these are the crossing bridge to the former farm yard.

The water has a very low velocity and more sediment is deposited at the edges of the stream and the stream slowly narrows and loses flow area.

The revegetation measures are similar to the previous section but the urgency is greater because the stream is much more obstructed by fallen trees.

Km 20.0–21.00

This section is shaped like an inverted C and the riverbed is almost the same width of about 20 m throughout the section.

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A branch called Čótfa joins this section u. At one time it probably branched off the Little Danube but now it starts quite far away and is dry for the most part. The water appears in the Čótfa branch only when it approaches the local road at the end of this section. The Čótfa is about 3.0 km long. The Čótfa Branch is not addressed in our study.

No revegetation measures can be proposed on this section due to private ownership.

Km 21.0–22.00

This section is concurrent with a local road in the Čótfa area. It ends in a narrow meander in the municipal part of the Gudrov cadastre. The riverbed is shallow clogged with a width of 16 to 20.0m. In three places there is a short local widening of the stream on the left side. Slowing of the flow rate has led to the formation of several small islands.

The riverbed is uniformly clogged and the stream channel in the riverbed is almost not developed. It is interrupted by dozens of fallen trees. The riverbed is slowly disappearing and even the flow rate is already very small.

At the end of the section near a few fallen of trees almost completely damming the riverbed.

Management of as in previous sections – deal with the number of fallen trees that almost completely stop the flow of water. Čótfa has almost standing water and not of good quality and therefore its impact on the quality of the branch itself is not positive.

Figure 4.24 Changes in riverbed siltation since 2006

Km 22.0–23.0

The riverbed forms a section ending in a short meander. The overall condition of the riverbed is very poor. The flow in section u is almost stopped. This has two causes. There is a spillway forming a dirt road to the land on its north side. The spillway was created by an unprofessional practice some time ago and only two pipes of about 600 mm diameter are fitted at the flow rate.

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Figure 4.25 The need for sediment and tree management

If management of sediments and of trees is not done in this section, the flow rate in the riverbed will come to a standstill in a few year.

In section u is also a bench just above the water level.

As a revitalization, there are two rather costly issues that need to be addressed in this section.

After decades of making the spillway a road, albeit a dirt road but with a hydraulically and technically resolved culvert. This will certainly be not only a construction problem but also an encroachment on the SVP, although it is no longer possible to accept a decades-old poor solution and think that this poor condition is already part of the protected territory and so will not change. It threatens Klátovské Branch itself and the threats should be addressed. If not otherwise then as the maintenance of the stream by the administrator, which is SVP š.p. Bratislava.

The second problem is really the extreme amount of fallen of trees and their branches, leaves. Their impact is not only on the flow rate but nowadays also on the quality of water in the section, because the captured material is subject to decomposition, often anaerobic, releasing both sulphate and methane into the water. We have also observed decaying leaves and plant debris in the site, which, because of the abundance, were only decomposed by fungi and moulds and released unwanted substances into the of water.

Just before the end of the section u, a tributary from the right is marked on the maps, but this tributary is just a ditch that receives the water during extreme precipitation events and its tributary to Branch is very problematic and the water in the tributary is more likely to infiltrate.

Figure 4.26 Need management sediments and of trees and wooden bench in the stream

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Km 23.0–24.0

This part of Branch is a specific section, because it is formed by a deep meander and the section is actually the section from the beginning to the end of the arch meander.

The stream approaches the road to Čótfa in the middle of the section and more specifically the end of the straight section with the turn to Vermešov majer, where there is a silage storage pit used partly for manure storage.

The riverbed at the beginning of section u is in very poor condition in terms of flow rate. Its width has been reduced again and the dropped trees are able to dam the whole riverbed.

This causes sediments to be deposited in micro islands and also creates small sections between trees with almost zero flow rate.

In the section from the beginning of the section to the middle part to the end of the meander there are two flow rate restrictions.

The slopes here are quite high and these constrictions are natural. Nevertheless, they severely restrict the flow in the riverbed due to their blockage by trees and branches fallen from trees.

The basic problem is as in the previous section with the extreme amount of fallen of trees and their branches, leaves. Their impact is not only on the flow rate but also on the quality of the water in the section because the captured material is subject to decomposition, often anaerobic, releasing both sulphate and methane into the water. We have also observed decaying leaves and plant debris in the site, which, because

Figure 4.27 Problematic flow points in this section of the stream

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of the abundance, were only decomposed by fungi and moulds and released unwanted substances into the of water.

The bottleneck is the Čótfa site itself. There is an open storage site for silage or manure but it does not comply with the legislation relating to the EU Nitrates Directive and our legislation on management in vulnerable areas.

In this section, residues of petroleum products also appeared on the surface and these increased the smell of water.

Km 24.0–25.0

It is only a gently meandering section of stream from the end of the meander to the beginning of another very short meandering section of stream.

The stream continues to narrow in this section and its width is only about 15 m or less. Due to the age of the trees on the riverbanks, the stream is almost completely shaded and the trees have a major influence on the character of the section.

The steady flow rate in the Klátovské Branch also ends at this section. From this point onwards we can speak of a wetland section rather than a watercourse.

The bottom of the stream rises slightly from the sediments and since the level of water is very small, raising the stream bottom stops the flow rate. Subsequently, there is a transition of water to the previous level of water.

The water flow is probably maintained in the hyporheic of the stream where the original gravel layers are located. Sediments will need to be addressed to maintain the flow rate but this may subsequently compromise the wetland habitat created.

In summer after rainfall, this section floods when the level rises and the flow is restored.

Subsequently, the flow reaches a small settlement. The settlement is located in the municipality of. Malé Dvorníky but the road to it leads from the village of Dvorníky. Therefore, it is necessary to cross the road through the Klátovské Branch itself.

The settlement has been preserved and has grown but the road with an inadequate crossing has remained. When the crossing was designed, there was probably no project and so only one bottom small pipe was put into the crossing, even with a sluice and so the water flow was changed to a few litres and gradually a wide riverbed with very shallow water was created above the crossing and even the island was created there.

The water is very shallow and in dry periods it disappears completely.

Figure 4.28 Problem flow points in streams with significant pollution

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In the flow are also in the following part the flow is very shallow and alternate shoals with dry areas.

In addition to the shallowness of the water, its quality is also an issue. Spots from oil products appear on the surface. These are probably the result of the tributary of water from the following parts of the stream, where there are other settlements but also a poultry farm. Once the flow is restored, the section would gradually be rid of its current poor condition.

As revitalization is needed in this section u to address relatively costly but extremely pressing problems.

After decades, make the spillway a road, albeit a dirt road but with a hydraulically and technically solved culvert. This will certainly be not only a construction problem but also an encroachment on the „protected area", although it is no longer possible to accept a bad solution that is decades old and to think that this bad condition is already part of the protected area and so will not change. It threatens Clough Branch itself and the threats should be addressed. If not otherwise then as the maintenance of the stream by the administrator, which is SVP, š.p. Bratislava.

The basic problem is as in the previous section at the extreme amount of fallen of trees and their branches, leaves. Their impact is not only on the flow rate but also on the quality of water in the section, because the captured material is subject to decomposition, often anaerobic, which releases sulphate and methane into the water. In the site, as in the previous section, we also observed decaying leaves and plant fallout, which due to the abundance was only decomposed by fungi and moulds and released unsuitable substances into the of water.

The third problem is oil and its presence also in the stream bottom sediments. This problem needs to be addressed by checking compliance with the Public Water Supply and Sewerage Act in the adjacent settlements.

Km 25.0–26.0

The section begins and ends with a meander and is oriented from south to north. The section also begins and ends with a settlement or isolated houses.

At the beginning of the section at the first settlement the riverbed widens to 40 m and then narrows to 15 m.

The water in section u changes colour seasonally. The golden algae (*Chrysophyta*) are seasonal in the water and are not hazardous apart from signalling a deterioration in the quality of the water.

The trail continues north in a narrow and very shallow riverbed that is only seasonally flooded and therefore the riverbed here is also overgrown in the bottom with young trees.

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Figure 4.29 Problematic dirt road with a spillway crossing a stream without a culve

At the end of the section there is a second settlement to which a local road leads, rather a dirt road from the village of Vydrany. The communication also continues through Klátovské Branch by a classic chanel spillway and thus creates a significant barrier to the flow of water.

At this point there is no pipeline or anything to provide water flow so it can be said that this is currently the end of the flow rate of the Klátovské Branch. The other sections are just separate parts of the flow with no connection to the remaining parts of the Branch providing continuity of flow.

The road through Klátovské Branch itself is in a very bad condition. Above the road a pond with shallow and very polluted water has formed. Just before the damming of the stream there is an inhabited settlement. On the other - north side of the Branch there are remnants of the meandering of the stream in the form of pits which have a level of water corresponding to the level of water in the Klátovské Branch and this place is in the third level of protection as a protection zone of the Branch but it is more of a municipal waste dump. Although this site is about 5–6 km away from the village it is still interesting for disposal of inconvenient waste.

The site needs to be cleaned up and returned to its natural state. This will be one of the next tasks of the local conservationists in cooperation with the stream manager SVP, š.p. Bratislava.

The basic problem is as in the previous section the extreme amount of fallen of trees and their branches, leaves. Their impact is not only on the flow rate but nowadays also on the quality of water in the section, because the captured material is subject to decomposition, often anaero.

Figure 4.30 Places near the arm threatened by human activities – waste

It is necessary to urgently make a road out of the spillway, with a hydraulically and technically solved culvert. It endangers the Klátovské Branch itself from the beginning of its flow rate and other parts of the riverbed are thus impassable.

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The dimensions of the necessary culvert will be solved in the hydraulic study of STU Bratislava.

Km 26.0–27.0

It is a section from one vertex of an ark to the next vertex of a successive ark. It again has a south to north orientation.

The entire riverbed branch is practically hidden in the forest cover. As it is in the water map, the section no longer has continuous water and especially the beginning of the section u is already a wetland section and there are more species surviving waterlogging but only occasional flooding. The water shows more wetland decomposition processes and often the putrefactive process of decomposing organic matter. Unfortunately there are few waste sites in the section. The vicinity of the branch is designated as Bödör.

There are no technical buildings in section u but there is a pedestrian crossing over a shallow wetland and it is probably used by hunters.

Km 27.0–30.6

Klátovské Branch sections without water flow.

Km 27.0–28.0

It is a section copying the forest cover inside the meander. Also this section has water only in some places. On the left is a new forest stand about 34–45 years old. Its composition is quite different from other riverbank or companion stands. It is primarily composed of Black Pine and Scots Pine with an admixture of Scots Oak.

River bed in this section u is with water only on a small section. The water is very shallow with visible pollution, e.g. with stains from petroleum products. Golden algae have multiplied on the bottom and the water has a putrid smell. The water is almost completely devoid of life.

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Figure 4.31 Problematic flow points in a stream with wetland habitat

Km 28.0–29.0

This section is almost entirely straight and is oriented from east to west. The site is named Hangman's Hunt. The stream almost disappears into a stand of trees.

From this section on, Clats Branch is off state property. Therefore, it is problematic to address revitalization measures in this section

The designated Stream section now has 116 owners.

The end of section u is problematic. A dirt road passes through here and its crossing with the stream is just a spillway with no possibility of flow rate of water. The dirt road leads from the village of Vydrany. From the dirt road there is a left turn and it leads to a farm where poultry is kept. The farm is in the protection zone of Klátovské Branch and therefore in the 3rd degree of protection.

Figure 4.32 Problematic point of flow in a stream created by an embankment for a dirt road

Km 29.0–30.0

This section consists of two opposing sheets of poultry farm to dirt road with overcrossing,

Almost all of section branch is surrounded by broad parkland. More than half of the section Branch is free of water or only occasionally flooded.

The portion of the section u crossing the property in the forested area is also mapped as having a vostream bottom area. Someone removed a thick layer of sediment or biological matter on the stream bottom to the gravel stream bottom a long time ago. This actually provided access of water to the stream from groundwater or overflow from the Little Danube and as this water passes through filtration in the gravel environment it is clean water. This section is a clear example of what

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should happen with the rest of the Klátovské Branch.

This section is no longer part of the territory of European importance SKUEV0075 Klátovské Branch. In the new design maps it is included in the territorial protection.

Km 30.0–30.600

It is the section from the dirt road to the original connection to the Small Danube.

It is a unique section. Basically it is free of water. Only at the edge of the woodland can the remnant of the riverbed be identified even today with very detailed surveys in dense vegetation.

Like the previous section, this one is entirely privately owned.

This section is no longer part of the territory of European importance SKUEV0075 Klátovské branch.

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Ľuboš Jurík et al

5 THE PROPOSAL PART

5.1 PROPOSAL FOR A SOLUTION TO SEDIMENTS

The procedure was the same for sediment collection at almost all sites. First we had to get through fresh organic material 10 to 40 cm thick. It was only at this depth that we encountered compact material that was taken in disturbed form into a sampling bag with some of the water, and then we had to get rid of this excess of water in the laboratory.

We used drying of the samples prior to analysis.

This procedure – removing the top layer of organic, undecomposed material – should also be used under field conditions. However, we cannot apply laboratory procedures there.

For Sediment Management, various approved procedures have been used in the past, and even residents use single-bottomed procedures from time to time in the vicinity of subdivisions.

Officially, although there is The Territory of European importance SKUEV0075 Klátovské Branch, the manager of the stream is also the National Nature Reserve Slovenský vodohospodársky podnik, š.p. Bratislava.

Therefore, attempts are being made to improve the condition and flow rate of the riverbed e.g. the Klátovské Branch NPR River Bed Cleaning Project (https://www.klatovskebranch.sk/cistenie-prudnice-riverbed-npr-klatovske-branch).

This resulted in the relocation of large obstructions in the riverbed from of trees to its riverbank.

According to the requirements in Act No. 543/2002 Coll. on Nature and Landscape Protection, almost nothing can be done in the . degree of protection. Certain exceptions can be given by the nature conservation authority at the county seat in agreement with the relevant State Nature Conservation Office.

The complexity lies in the fact that the Act regulates the rights and obligations of all legal entities and natural persons in nature and landscape protection. However, it is not specified whether this legal person is also the stream manager or the State Nature Conservation Service.

Act 543/2002 Coll. For the purpose of knowledge and protection of specially protected parts of nature and landscape, their research, survey, monitoring and other activities aimed at detecting the occurrence and condition of habitats of European importance, habitats of national importance, species of European importance and species of national importance and their habitats, significant geological and geomorphological sites and possible impacts on them are supported.

And so it is probably only possible to arrange the sediments and objects in the riverbed within the riverbed or even to remove

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something, to relocate something outside the riverbed, in the area designated for level 5, level of protection and for the purpose of research.

Dealing with the gradual washing away of material deposited over decades by increased flow rates can either lead to siltation of other parts of the Branch or the movement of organic material can threaten biota, particularly macrozoobenthos but also fish in other parts of the riverbed. Their movement and deposition can also lead to deterioration of water quality after anaerobic decomposition and formation of unsuitable substances or gases.

Therefore, we propose to use a process similar to the laboratory process, but for larger volumes of sediments or rather organic material.

For the Management of sediments, the removal of the thick layer of organic material has to be solved first.

This organic material is mainly leaves, then small but also larger branches or even whole large branches and also whole dropped trees.

The removal of branches and of trees has been addressed in the aforementioned project. What remains to be solved is the organic material.

The most suitable technology is probably the use of filter bags. The bag is placed on the riverbank riverbed and filled with organic material from the stream bottom using a sludge disintegration pump. After dewatering, the larger part of the bag is emptied and the procedure repeated until the material is completely filled. It is then advisable to add the enzymes used in composts to ensure the decomposition of the organic material.

There are already many manufacturers of such bags in the world and their use has been verified, for example, on South Bohemian ponds. The material can be used after decomposition to revitalise riverbanks or to cover the surface to suppress the growth of unsuitable plants or shrubs.

Handling of the wood in the riverbed after it has been released from the organic sediment material will be one bottomspirited and simple hand-held equipment can be used to direct the branches or trees.

5.2 THE WATER IN THE BRANCH

Solutions to improve the quality of the Klátovské Branch aquatic ecosystem have two roles. The first is to improve the quality of water, which will be accomplished by identifying and removing potential polluters listed in the Sources of Pollution chapter of the Klátovské Branch.

Figure 5.1 Proposed solution for the drainage of sediments and organic (https://spillcontainment.com/products/ultra-dewatering-bag/)

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Proposed solution – removal of potential pollution sources and remediation of the polluted part of the stream.

There are a number of dwellings, agricultural and suburban buildings along the Klátovské Branch and it also flows through the intramural areas of two villages. Moreover, some of them are also located in the stream protection zone, where level 3 protection applies, which restricts some activities in this place, but nevertheless they can exist here and negatively affect the quality of water in the branch and the surrounding habitats. Therefore, the first focus should be on identifying the locations where pollution of the stream is occurring. It is imperative to focus on the safe disposal of wastewater from the villages, the bathing area and the farms located along the river. Last but not least, care must be taken to respect the law and to carry out only those activities that are allowed to be carried out in protected territories.

According to the surveys, the quality of water is probably the worst at site 27.9 river kilometres in the village of Vydrany, where the environmental burden in the form of yellow water is probably caused by diesel and/or oil spills from the surrounding area of the stream. This problem is currently being addressed and has been referred to special institutions for analysis of water in accredited laboratories, but the results will not be available until after the deadline for submission of this work. This stream section is not directly connected to other parts of the Branch and is characterized by standing water due to an earthen dam several hundred meters from this location. If we were to impound this section, it would create a risk of contamination of the rest of the branch and would contribute to the death of aquatic animals and plants. The cooperation of several authorities and competent authorities is needed to eliminate this problem with the development of projects to solve it carefully.

The branch itself is about 30 km long but is divided by inappropriate spillways into 4 parts, where the first is free of water and then several parts are separated by chanela backfills to create a passage to the surrounding fields and land. Their connection also requires great care, due to the fact that in each part there is a different The quality of water. It is necessary to carry out analyses of the water in all the separated territories and to design a solution so that very different waters do not mix. Combining these parts would also help the flow rate in the arm and perhaps help sediment washout in the channel as well.

5.3 SEDIMENTS

The second task, which would achieve a higher quality territory, is to solve another fundamental problem of the territory, which is the grounding of the territory due to the siltation of the riverbed by organic matter from the terrestrial environment. This affects the flow capacity of the branch, creating a cycle of problems – slow flow of water makes it impossible to ostream bottoms of stream material and sedimentation, aided by fallen trees which compound the difficulties of stream flow. The sediments themselves also change the flow rate and therefore we suggest a possible solution by removing them at least in certain parts of the stream.

5.4 PROPOSAL TO EXTEND THE ISLANDS

There are several smaller the islands in the Klátovské Branch, where sediments are deposited in the direction of the flow of water. This can be observed at several of them. For this reason, we propose to extend these the islands with collected sediments from

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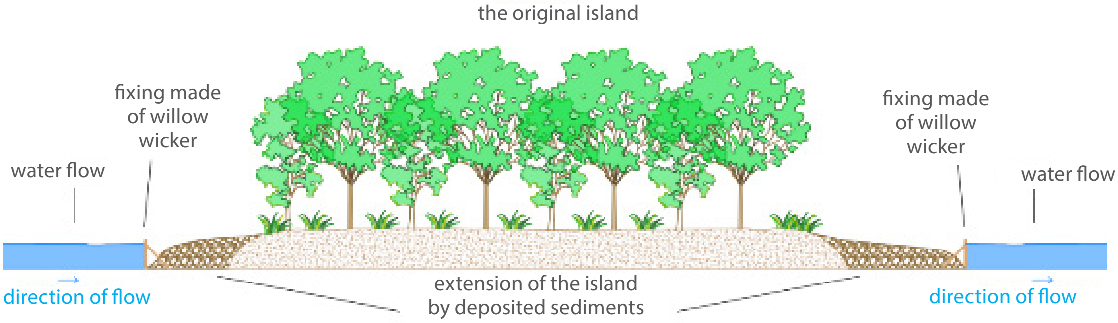

Figure 5.2 Illustration of the island extension – view from the right riverbank (Landczman, 2023)

the surrounding area. The main idea of this solution is to apply sediments to the places in front of and behind the islands where sediments are already observable and thus we would achieve the extension of the riverbanks of the islands in the direction of flow. For a better idea, here is figure 5.2.

In and near the riverbank stands are the so-called head willows, which were trimmed in the past by locals and used by basketmakers and dowsers. Today these trees are unmanaged due to the site being placed in the strictest level of protection and so the branches of these oftrees are just snapping off and falling into the stream. In case of permission from the competent authorities (SOP SR, SPA Danube Meadows) it would be possible to trim these trees and use their branches to create fences and „fence" the surroundings of the island to provide a place where the sediments could be deposited and dried. Desiccated and fallen invasive trees could be used to create fences, also subject to the approval of the authorities following a survey of the area by dendrologists.

An apparatus called a Truxor would be used to apply the sediments. It is a multi-functional amphibious apparatus on belts, which is used to treat ponds, marshes or protected aquatic territories by mowing or carrying away sediments from the stream, it can also be used in reclaiming territories after environmental accidents. After the sediments have been deposited, they would be allowed to dry out and over time these new parts of the island would become overgrown with natural vegetation.

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Ľuboš Jurík et al

6 CONCLUSIONS

The text of the study was written after almost three years of effort to analyze the condition of the Klátovské Branch and its protection zones.

At the beginning, after the project was commissioned, we had an idea of the very beautiful nature of one of the branches of the Danube River and how to improve its condition.

However, after starting the work we found out the reality of the territory. First of all that it is not a stream bottom continuous branch but it is several separated sections. This is the root cause of the deteriorating condition, because the water that enters the separated sections of the riverbed by groundwater seepage cannot flow further and probably infiltrates into the surrounding environment. Removal of the unauthorized spillways that we have uncovered in our investigations is probably the most important task. Unfortunately, this was not known when the project was commissioned and therefore did not make it into the project budget.

Consequently, we expected the territory of the National Nature Reserve to be untouched, but in reality there are two permitted fishing grounds with issued fishing permits. Despite the registration of 5 species of rare fish species.

We also expected that the whole territory is under the state administration, but we found out through surveys that part of the stream is listed as private land. This is contrary to the primary law of the Slovak Republic.

We expected clean and carefully maintained land around the Branch stream in the Conservation Territory with Grade 3 protection. We have constantly encountered waste and pollutants in the stream.

We had not counted on these facts when we started the project. Also agricultural production and economic activities in the protection area are not friendly to the protected area.

Therefore, the solution proposal should be primarily that The Territory should be resolved according to the requirements of the current legislation.

The name of the project addressed was Improvement of the condition of the wetland of the NPR Klátovské Branch on the territory of the territory SKUEV0075, probably because the condition of the watercourse and its surroundings does not correspond to the requirements for the 5^{th} level of protection.

Landscape ecological study of the territory of European importance SKUEV0075 Klátovské Branch evaluated the state of flow rates and sediments and vegetation in this territory.

But it is necessary to solve the fundamental problems of the territory.

First of all, there are fundamental influences on the quality of water, which are also in the fact that the villages except one are not sewered

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and waste water management has fundamental deficiencies. Similarly, the situation is similar in the isolated villages which are directly on the riverbanks of the Klátovské Branch.

The next necessary step is to settle the ownership of the stream and the surrounding land. The only way forward is land readjustment and the villages in the Territory are not on the list for land readjustment in the next few years.

The third basic flow is residents' access to the 5th level of protection. Particularly the behaviour in taking waste to the Branch and also the use of the surrounding land.

A non-negotiable bottom line is also the need for more firmly anchoring protected territory in the land use plans or the Economic and Social Development Plans of the municipalities. It is only enumerated there that there is a protected territory in the cadastre. With no active proposals to protect it.

Our results will bring changes in the state of Klátovské Branch only in synergy with the above mentioned measures.

The quality of water and the quality of stream bottom sediments is only a response of the use of the territory and also the inclusion of chanels from the surrounding countryside.

Solving the problems of the Klátovské Branch is very topical and, in addition to what has been found and done during the project, it is necessary to allocate the attention of the state and regional development to meet the legislative conditions corresponding to the highest level of protection. During the solution, the reassessment of the protection levels of both the Branch and the surrounding lands was also addressed. Their justification will be demonstrated in due course.

Similarly, time will prove whether the implementation of the solution proposals of our study are realized and bring changes in flow rates in the riverbed as well as improvements in the quality of water. The quality of water creates conditions for the persistence of protected species.

A more significant crackdown on invasive species will help maintain native habitats that are threatened by their predation pressure.

The Klátovské Branch is the pearl of the Danube and once attracted the likes of Jacques-Yves Cousteau. It would be sad if his followers found already a completely different territory and the quality of territory.

We hope that the project's activities with children in kindergartens and schools or evening discussions with citizens and mayors of villages in the territory will raise awareness of the protected territory and its conservation.

DOI: https://doi.org/10.15414/2024.9788055227870

7 LITERATURE

Áč, P. 1997. Dunaj, rieka života. Bratislava : Slovart.

Aanes, K. – Daae, C. A. – Killingtveit, Å. 2000. River Restoration in Børselva, Northern Norway Adapting a regulated river to a new flow regime. (Online). Available at: https://www.researchgate.net/publication/299599029_River_Restoration_in_Borselva_Northern_Norway_Adapting_a_regulated_river_to_a_new_flow_regime

ASB. 2020. Zvýšenie bezpečnosti územia proti spätnému vzdutiu Malého Dunaja a Klátovského ramena z Váhu, I. etapa – stavba v súlade s prírodou. (Online). Date of publication 2020-11-30. Available at: https://www.asb.sk/stavebnictvo/inzinierske-stavby/vodohospodarske-stavby/zvysenie-bezpecnosti-uzemia-proti-spatnemu-vzdutiu-maleho-dunaja-a-klatovskeho-Branch-z-vahu-i-etapa-stavba-v-sulade-s-prirodou [cit. 2022-03-31].

Atlas krajiny SR. 2002. (Online mapa). Updated 2022. Available at: https://app.sazp.sk/atlassr/ [cit. 2023-01-23].

bizref.sk. 2023. Klátovské Branch. (Online). Updated 2023. Available at: https://www.bizref.sk/sk/firmy/rodinnedomy-novostavby/1/3920/Vyhody-lokality-Dunajska-Streda-a-okolie/Klatovske-branch/ [cit. 2023-01-21].

Brierley, G. J. – Fryirs, K. A. 2008. River Futures: An Integrative Scientific Approach to River Repair. Washington : Island Press, 2008, 305 p. ISBN 978-1-59726-112-8

Convention on biological diversity. 2006. The Convention On Biological Diversity. (Online). Updated 2006. Available at: https://www.cbd.int/convention/articles/?a=cbd-01 [cit. 2023-03-01].

Danube Islands. 2023. Flóra & fauna tisícich ostrovov. (Online). Updated 2023. Available at: https://danubeislands.sk/priroda [cit. 2023-01-21].

Darby, S. – Sear, D. 2008. River Restoration: Managing the Uncertainty in Restoring Physical Habitat. (Online). Chippenham : Antony Rowe Ltd., 2008, 315 p. ISBN 978-0-470-86706-8. Available at: https://www.google.sk/books/edition/River_Restoration/ijPPcxUu7MsC?hl=sk&gbpv=0 [cit. 2023-03-12].

Deponia system s. r. o, Bratislava. 2000. Integrovaná ochrana podzemných a povrchových vôd Žitného ostrova.

Dušek, P. A. – Velísková, Y. 2014. Hydrogeological conditions at Žitný ostrov channel network area. In Acta Hydrologica Slovaca, vol. 15, thematic issue, pp. 86–95.

Enigma. 2016. Klátovské rameno – národná prírodná rezervácia (blog article). 30-03-2016. Available at: https://www.enigma.sk/blog/klatovske-branch-narostream-bottom-prirostream-bottom-rezervacia [cit. 2023-04-10].

Enpro Consult. 2012. Zvýšenie bezpečnosti územia proti spätnému vzdutiu Malého Dunaja a Klátovského ramena z Váhu. Bratislava : SVP, 2012, 116 p.

DOI: https://doi.org/10.15414/2024.9788055227870

Evaluation of hydrogeological investigation of borehole HK-1 at Dunajská Klátov site. 1989. Bratislava : Vodné zdroje, n. p. závod, 1989.

Fabricius, K. E. et al. 2003. Effects of transparent exopolymer particles and muddy terrigenous sediments on the survival of hard coral recruits. In Estuarine, Coastal and Shelf Science, vol. 57, 2003, no. 4, pp. 613-621. ISSN 0272-7714. https://doi.org/10.1016/S0272-7714(02)00400-6

Fulajtár, E. et al. 1963. Pôdy okresu Dunajská Streda. Bratislava : Lab. pôdoznalectva, 1963, 72 p.

Holčík, J. 2000. Ichtyocenóza NPR Klátovského ramena (správa o výsledkoch ichtyologického prieskumu).

Hydrochemical evaluation of the control system at the Dunajská Klátov site. 1989. Bratislava : Vodné zdroje, n. p. závod, 1989.

Kičinová, T. 1997. Mapovanie makrofytov v koryte rieky Malého Dunaja a Klátovského ramena. Diplomová práca, Bratislava : PFUK, 1997.

Končeк, M. 1980. Klimatické oblasti. In Mazúr, E. (ed). Atlas Slovenskej socialistickej republiky. Bratislava : SAV, SÚGK, 1980.

Kvalita podzemných vôd Žitného ostrova 2020. 1999. Bratislava : Slovenský hydrometeorologický ústav, 1999.

Kurpelová, M. – Coufal, J. – Čulík, K. 1975. Agroclimatic conditions of the Czechoslovakia. Bratislava, 1975.

Landczman, V. 2023. Water management solution of the protected area of wetlands of the Klátovské Branch. Diploma thesis, Nitra : SUA, 2023.
Online: https://opac.crzp.sk/?fn=detailBiblioForm&sid=FC6B5E34E7354FAEF39A7403E140

Lesné hospodárske plány LC Gabčíkovo, Šamorín, Trstice, Sládkovičovo.

Lieskovská, Z. – Lényiová, P. 2023. Správa o stave životného prostredia Slovenskej republiky v roku 2021. Bratislava : Ministerstvo životného prostredia SR, 2023, 211 s. ISBN 978-80-8213-091-4

Macura, V. – Halaj, P. 2013. Úpravy a revitalizácie vodných tokov. Bratislava : STU, 2013, 228 s. ISBN 978-80-227-3925-2

Maxwell, S. L. et al. 2022. Area-based conservation in the twenty-first century. In Nature, vol. 586, 2022, pp. 217-227. Available at: https://doi.org/10.1038/s41586-020-2773-z [cit. 2023-02-25].

Michalko, J. et al. 2014. Pôvod vody v Klátovskom ramene. In 17. slovenská hydrogeologická konferencia „Nové výzvy v oblasti ochrany vôd", Bratislava, 2014.

Miklósová, V. 2017. Hodnotenie ekosystémových služieb v záujmovom území Národnej prírodnej rezervácie Klátovské rameno. Dissertation thetis, (Online). Nitra : UKF, 2017, 188 p. Available at: https://opac.crzp.sk/?fn=detailBiblioFormChildEB9N9&sid=F91B27064E1B8768267221F9EB7C&seo=CRZP-detail-kniha [cit. 2023-01-22].

Mikroregión Klátovské rameno. Tőkési-Ág Kistérség. 2022. O klátovskom ramene. (Online). Updated 2022. Available at: https://www.klatovskebranch.sk/o-kl%C3%A1tovskom-jazere [cit. 2023-01-21].

Oťahelová, H. et al. 2007. Temporal changes of aquatic macrophytes vegetation in a lowland groundwater feed eutrophic course (Klátovské Branch, Slovakia). In Acta Societatis Poloniae, vol. 76, 2007, no. 2, pp. 141–150. Available at: http://dx.doi.org/10.5586/asbp.2007.018 [cit. 2023-01-31].

Regionálne štúdie nerastných surovín okresov Slovenska – okres Dunajská Streda – záverečná správa z úlohy. Banská Bystrica : Envigeo, s. r. o., 1996.

Šíbl, J. et al. 2002. Revitalizácia vodných tokov. 2nd., Nitra : SUA, 2002, 240 p. ISBN 80-8069-024-3

Šugarová, M. 1992. Program sociálneho a ekonomického rozvoja okresu Dunajská Streda. Bratislava : URBION, 1992.

DOI: https://doi.org/10.15414/2024.9788055227870

Šuvada, R. (ed.). 2023. Katalóg biotopov Slovenska. Druhé rozšírené vydanie, State nature protection SR, Banská Bystrica, 2023, 511 p.

Tarábek K. 1980. Geographical magazine. vol. 32, 1980, no. 2–3, 148 p. ISSN 0016-7193

Velísková, Y. – Dulovičová, R. A. – Štekauerová. V. 2010. Vzájomné pôsobenie povrchových a podzemných vôd v krajine. In Životné prostredie, vol. 44, 2010, no. 6, pp. 313–318.

Viadonau. 2017. Life+ Nivy dolnej Moravy: Plánovacie výkony vodohospodárskych opatrení. (Online). Wien : viadonau, 2017, 26 p.
Available at: https://life-march.at/downloads/TechnischerBericht_Wasserbau_SK_souhrn.pdf

Válková, D. 2000. NPR Klátovské rameno – botanický inventarizačný výskum.

Wohl, E. – Lane, S. N. – Wilcox, A. C. 2015. The science and practice of river restoration. In Water Resources Research, vol. 51, 2015, no. 8, pp. 5974–5997. Available at: https://doi.org/10.1002/2014WR016874 [cit. 2023-03-12].

Woo, H. 2014. River Restoration. In Wang, L. and Yang, C. Modern Water Resources Engineering: Handbook of Environmental Engineering. Totowa : Humana Press, 2014, pp. 237–277. ISBN 978-1-62703-595-8

Zákon č. 364/2004 Z. z. zo dňa 13. mája 2004 o vodách a o zmene zákona Slovenskej národnej rady č. 372/1990 Zb. o priestupkoch v znení neskorších predpisov (vodný zákon).

Zákon č. 525/2003 Z. z. zo dňa 5. novembra 2003 o štátnej správe starostlivosti o životné prostredie a o zmene a doplnení niektorých zákonov.

Zákon č. 543/2002 Z. z. zo dňa 25. júna 2002 o ochrane prírody a krajiny.

Zelené dedičstvo – Zöld Örökség. 2022. Rólunk és a Tőkési ágról. (Online). Updated 2022. Available at: https://zoldorokseg.sk/rolunk [cit. 2023-04-10].

DOI: https://doi.org/10.15414/2024.9788055227870

Landscape-Ecological Study of the Area of European Importance

SKUEV0075 Klátovské Branch

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