

Traces of former mill races in Krnov: Possibilities of revitalization and interpretation

Juraj Illés^{1*} 

Viera Joklová²

Agnieszka Jaszczak³ 

^{1,2} Slovak University of Technology, Faculty of Architecture and Design, Institute of Urban Design and Planning, Bratislava, Slovakia

³University of Warmia and Mazury, Faculty of Agriculture and Forestry, Department of Landscape Architecture, Olsztyn, Poland, and Vytautas Magnus University, Faculty of Bioeconomy Development, Department of Business and Rural Development Management, Kaunas, Lithuania

*Corresponding author
E-mail: juraj.illes@stuba.sk

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Abstract:

Mill races were an integral part of many towns in the past. But when they lost their economic importance, they were mostly filled and buried underground. Although we can now find them in their original form in a few cases only, their spatial corridors have often been preserved in the urban structure. The research aims to detect the historical trace of the former mill races in Krnov, a small town in the district of Bruntál in the Moravian-Silesian region of the Czech Republic, and investigate the possibilities of their interpretation and revitalization. The research focuses on the identification of the remnants and traces of the former mill races using historical maps, literary and visual sources, and subsequently on the investigation of the state of their current existence in the urban structure, according to current orthophoto maps, real estate cadastre records, and field research. During the 19th century, the mill race system in Krnov and its surrounds consisted of four mill race channels. Two of them have been preserved with water flow to the present day. The other two mill races were filled. Research shows, however, that the footprint of their corridors is legible in the urban structure even today, and its presentation in new forms could significantly contribute to regenerate the urban fabric and revitalize public spaces. The mill races represent historical and cultural heritage, and the presentation and interpretation of their values, even those that have disappeared, can significantly help increase the quality and attractiveness of urban public spaces for residents and tourists.

Keywords:

mill race, industrial heritage, extinct heritage, urban revitalization, placemaking

INTRODUCTION

In innovative and sustainable development efforts and in creative planning approaches, the transformations of the relations between the city and water are becoming the key issue in urban renewal strategies (Baker, 2009; Carta, Ronsivalle 2022; Benkő, Gregor, Vitková, 2019; Chochrunová, 2018; Bašová, 2011; Bašová, Sopiřová, 2018; Kristianová, 2018; Shangi, Tanvir, Imtiaz, 2020; Dal Cin, Hooimeijer, Matos Silva, 2021; Joklová, Furdík, 2015). The presence of water in various forms ever was and still is a prerequisite for the birth and existence of human settlements. On the one hand, water was a friend, a source of sustenance, but on the other, a dangerous enemy, an element that threatened human lives with floods (Bostenaru Dan, Dill, 2018; Kristianová, Kaisheva, Bostenaru Dan, 2019). These multifaceted aspects of the communities' relationship to water were dynamically reflected in the characteristics behind the formation of the urban structure in different historical periods and represent specific values for towns and cities.

In the past, mill races were a characteristic and influential element of the infrastructure of many urban settlements. They enabled the use of water energy for various economic purposes.

They powered water mills and mechanical processes of grinding, rolling, and hammering, enabling the production of many material goods – flour, textiles, lumber, and paper. They were important in mining and the production of metal products. Later, with the invention of the steam engine and the expansion of the use of other sources of energy, they began to lose their importance. Although with the technological development of water turbines some mill races and old mills were adapted for the production of electricity, yet they usually could not compete sufficiently with the necessary capacities (Illés, Kristianová, Joklová, 2022). Thus, in many cases, mill races have not been preserved in the urban structure of settlements to the present day. Impacts of collectivization, nationalization of mills, and new regulation of rivers all contributed to the disappearance of mill races. In the urban structure of towns, mill races were often perceived as an obstacle to modern building development. They were filled, buried, or channelled underground.

Although we can find them in their original form in a few cases only, their spatial corridors have often been preserved in the urban structure. Regeneration of settlements' urban structure can significantly be advanced by finding a new use and presentation for the historical traces of former mill race corridors. At

the same time, the mill races represent a historical cultural heritage (Kristianová, Gécová, Putrová, 2015), and the presentation and interpretation of their values, even those that have disappeared, can significantly help increase the quality and attractiveness of the urban public spaces for residents and tourists (Illéš, Kristianová, Jaszczak, Pochodyla, 2022).

Several remarkable examples of preserved and revitalized mill water channels point to their significant benefits and contributions to the urban structure of settlements in Czech towns. For example, a successful project based on residents' suggestions is the revitalization of a mill race in Chrudim, carried out in individual stages from 1995 to 2009. The watercourse flowing in the neighbourhood of the historic town centre got its new attractive form of a morphologically varied stream with a whole range of natural river elements (Tomášková, 2020). A unique example is the modified water course of Nečitz, which flows through the central square under the town hall tower in Litovel, and forms a significant urban compositional axis of the town (Augustinková, Páclová, 2013). Another example worth mentioning is the reminder of a defunct mill race restored along with an artificial water area and a park arrangement in the city of Plzeň (Pilsen) (Damec, Wilhelmová, 2007), which won the Park of the Year Award in 2010.

Our research aims to survey the historical traces of former mill races in Krnov, a town located in the district of Bruntál in the Moravian-Silesian region of the Czech Republic, and investigate the approaches to the possibilities of their new interpretation and use. Krnov provides a suitable case study for examining the current state of mill races in the urban structure and approaches to their possible presentation and revitalization, given its past as a town of textile production closely tied to the existence of mill races.

BACKGROUND

Krnov lies in the Moravian-Silesian Region, where the Czech Republic borders Poland (Fig. 1). The town lies between the rivers Opava and Opavica, which flow through Krnov and merge into a single watercourse of the Opava River, continuing towards the Opava town. The town has a rich history associated with textile production. The cloth workers guild founded in 1570 was one of the oldest in Krnov. At the turn of the 18th and 19th centuries, woven woollen cloth-making was one of the town's most important crafts in the location. And it was the mill races that were an important source of energy and water for manufactories, water-powered fulling mills, spinning, and dyeing, and for driving machines connected with the fabric production. In 1824, 276 cloth makers, 9 cloth cutters, 70 weavers, and 15 knitters worked in the town. The cloth-making industry reached its peak at the beginning of the 19th century, and subsequently, other crafts related to textile production, such as weaving and yarn production, also developed. Even in today's Krnov you can see former textile factories or representative villas of factory owners (Ryšková, 2008; Šperková, 2019).

The site of the Alois Larisch and Sons textile factory, which has been preserved to this day, is one of the most important in the town and its buildings are listed as national cultural monuments. It is located near the now-defunct mill race in the central part of the town. The history of the textile factory Alois Larisch and Sons illustrates the transition in the powering of production processes from using a water wheel to steam engines and the transition from a manufactory to industrial processing of cloth. Alois Larisch's business reflects the development of the entire cloth-making industry in the town. He became a clothier in 1831, and in 1832 he established a manufactory, which consisted of a handloom, a laundry, and a cloth dyeing plant. Ten years

later, he established a mechanical spinning mill when he bought a fulling mill with water rights from the tanners' guild. Driving by water wheels was also used in other enterprises in Krnov until the time when steam engines took over. The first steam engine in Krnov was put into operation in 1862 in the Larisch factory.



Fig. 1. Location of Krnov in the Czech Republic. (Source: Illéš, 2023)

The period after 1870 stands out as the era of a rapid development of the textile industry in Krnov. In 1870 there were 8 industrial spinning mills working in the town, while raw wool was imported from Hungary, Russia, England, and the Netherlands. Weaving remained handmade-based for a longer time. Mechanical looms replaced manual looms in the 1870s. The connection of Krnov to the railway network in 1872 contributed to further development of production. In 1895, there were 49 businesses in Krnov, with only 16 cloth factories and 4 spinning mills able to survive the economic crisis later in the 1930s. After World War II and nationalization, part of the wool factories merged into a national enterprise Karnola Krnov. The other part of them disappeared, taken over by other companies. Karnola continued the production until 1997 when it closed, and this was the end of the famous cloth-making tradition in Krnov. Haberdashery production continued in the national enterprise producing ribbons, braids, elastic fabrics, and elastic yarns; today operating as PEGA-VEL (Ryšková, 2008).

The history of many other textile factories in Krnov also confirms the importance of water channels for the development of cloth production in this town. For example, the woollen goods factory, Josef Alscher and Sons was built on a mill race that separates a place called the Island from the Opava River, in the early 1850s. A spinning mill and a fulling mill were built here, powered by water wheels. In 1858, a second water wheel was installed (Ryšková, 2008). In 1862, the factory was expanded with a steam plant, and in 1930, a turbine was put into operation (Ryšková, 2008). Another woollen goods factory, taken over by its founder Franz Czerny from the cloth workers guild in 1863, also used a water wheel (Schulig, 1923; Ryšková, 2008; Klívar, 2010). On the opposite bank of the mill race there stood a fulling mill. In 1890, the water wheel was replaced by a turbine (Ryšková, 2008). In 1912, the operation was ensured by a pair of aggregates – a water turbine and a steam engine, each with a power of 30 HP (Klívar, 2010). In 1919 a stronger turbine was installed to supply energy to the Municipal Power Plant in Krnov later (Ryšková, 2008).

The Krnov textile mills, their buildings, and their premises, even in the poor condition in which they have been preserved to this day, stand as unique testimonies to the history of Krnov. Many of them are protected monuments. They shape the town's genius loci, its specific local identity. The mill races were also integral to this identity, representing a part of the historical heritage

of the town (Illéš, 2021). It is necessary to pay attention to their research, to the possibilities of their protection, revitalization, new interpretation, and use.

MATERIALS, DATA AND METHODS

In the first stage, the research focused on identifying the routes of the mill races using historical maps, and historical literary and visual sources. The maps of the first, second, and third military mapping were used: the First Military Survey of Duchy of Upper Silesia (1763), the Second Military Survey of the Habsburg Empire – Moravia (1836–1842), and the Third Military Survey of the Habsburg Empire (1869–1887), through the Arcanum Maps portal. The main map sources were the historical cadastral maps – the Imperial Obligatory Imprints of the Stable Cadastre – Moravia and Silesia accessed by the Geobrowser of the Archive of Czech Office for Surveying, Mapping, and Cadastre.

The Stable Cadastre became the basis for tax assessment in Bohemia in 1860. The mapping was carried out between 1826 and 1843. The Stable Cadastre is an excellent source for identifying the routes of mill races, mills, and other water-related objects. The number of water wheels is often indicated on the map, but this information is not always reliable. Very important parts are the land register maps and water register maps on a scale of 1:2880. In them, we can find details about the ownership of individual parcels or the management of sections of watercourses and the exercise of water rights, e.g., mill rights (vodnimlynny.cz, 2017; Štěpán, Urbánek, Klimešová, 2008; Pekař, 1932).

Subsequently, in the second stage, we conducted a survey of the current existence of mill races in the urban structure of Krnov from an urban planning point of view, according to the current orthophoto maps, current records of the real estate cadastre, and our own survey in the field. Finally, in the third stage, the results of the research were evaluated from the landscape-architectural and urban-planning points of view. Various poten-

tial possibilities for the revitalization and use of the spatial corridors of the former mill races to interpret the preserved tangible, as well as intangible and extinct cultural heritage values, were analysed.

RESULTS

The routes of the mill races during the development of the urban structure of Krnov are documented in various historical map sources. Four mill races can be seen on the map of the Imperial Obligatory Imprints of the Stable Cadastre from 1826–1843; these formed a system of mill races in the town and its surroundings in the past (Fig. 2). At present, the bed of the Opava River in Krnov is directionally maintained in a constant route by modifications made before 1945. The largest adjustment dates back to 1919, followed by a modification beyond the confluence with the Opavica River from 1988–1989 (Vodní toky: Krnov, 2019). Of the original four mill races, only two have been preserved to this day, the other two were filled up (Fig. 3).

The first mill race: Past, present and possibilities of revitalization and interpretation in urban structure

The first mill race belongs to the preserved torso of the original mill race system in the territory of Krnov. It is an approximately 2 km long, artificially constructed watercourse. It begins at the Kostelec weir on the right side of the Opava River, on km 75. Kostelec (Weisskirch) was once an independent village and it was joined to Krnov in 1921. In the past, a flour mill was located on the mill race in the area of the former village Chářová (Krotendorf) (Fig. 4). Later, the area became more urbanized and joined to Krnov. Krnov Starch Company and Karnola textile plant were established in the area of former small factories. Nowadays, after textile production terminated, the buildings of the former Karnola premises are rented for other types of production and for commercial, administrative and storage purposes. Passing through the Karnola premises and towards the flow into the Opava River, the mill race is piped (Fig. 5).

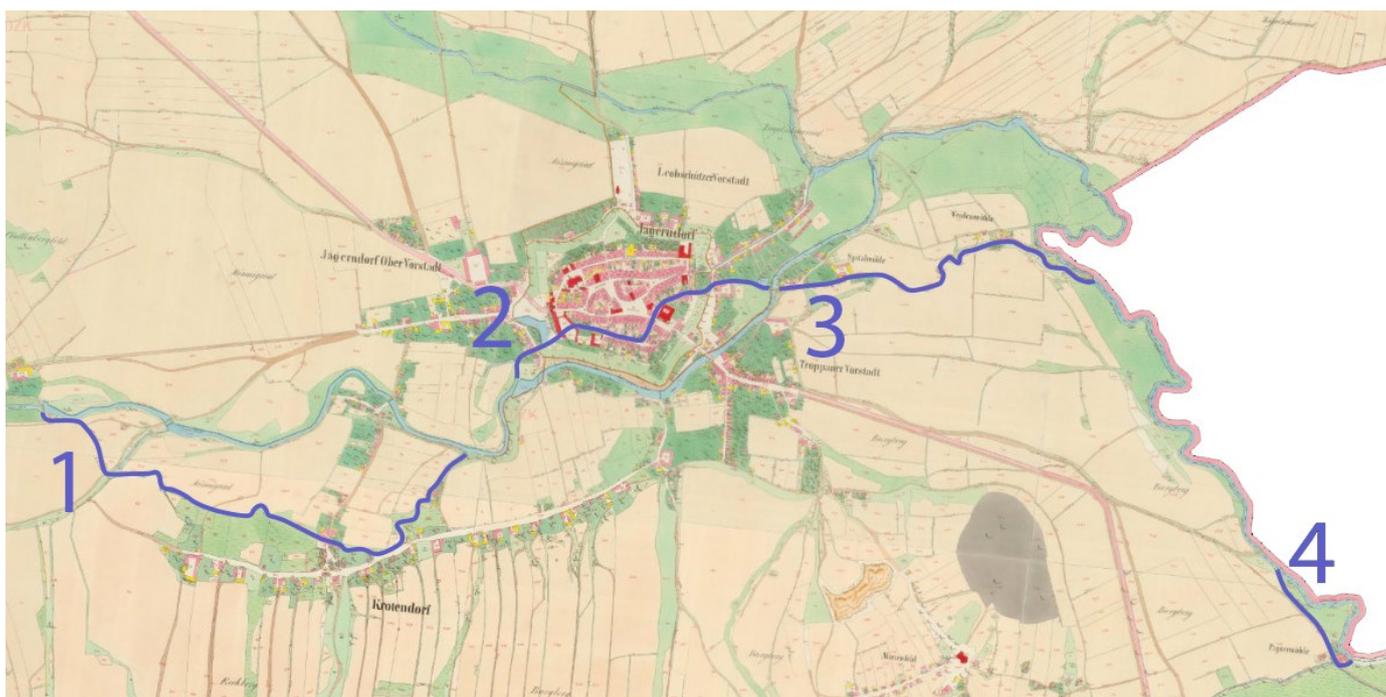


Fig. 2. Historical routes of four mill races in Krnov and its surroundings. (Source: Illéš based on the map of Imperial Obligatory Imprints of the Stable Cadastre 1826–1843, ČÚZK, c, 2010; 2023)

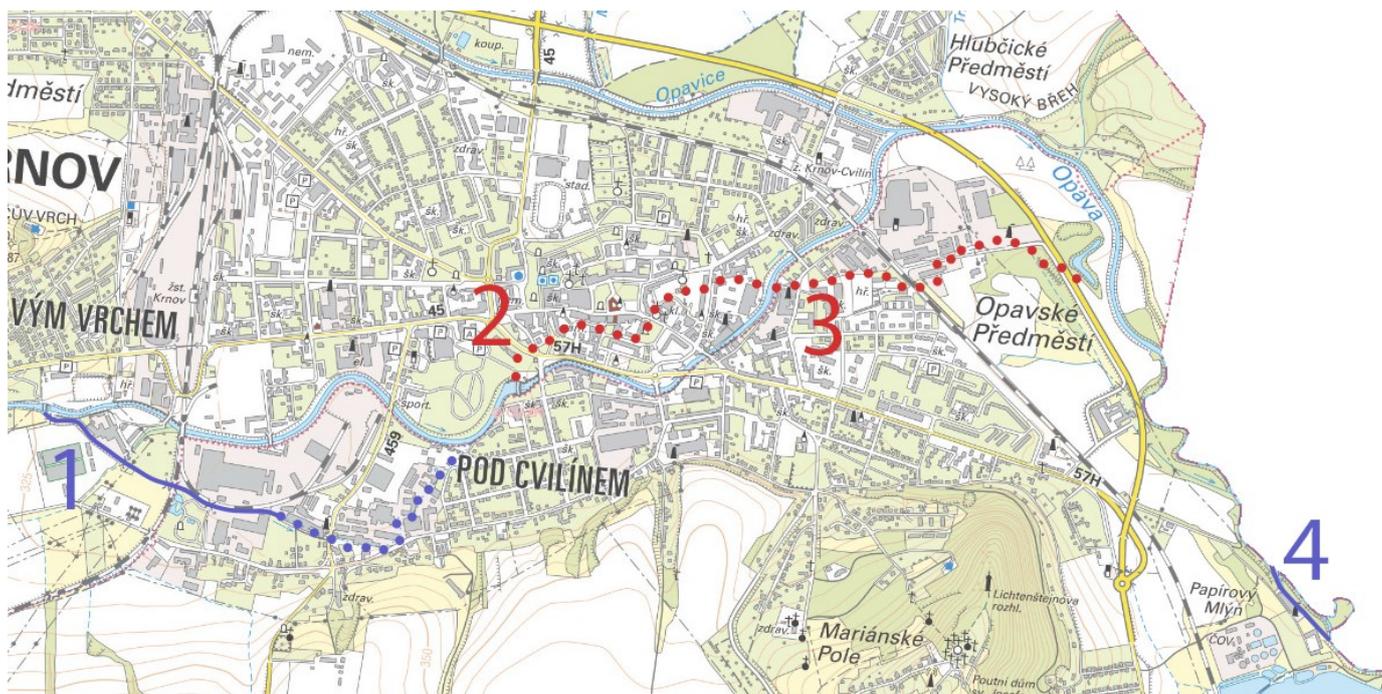


Fig. 3. Routes of mill races at the present time. (Source: Illés based on the current Base map of Czech Republic 1:10 000, ČÚZK, a, 2010; 2023)

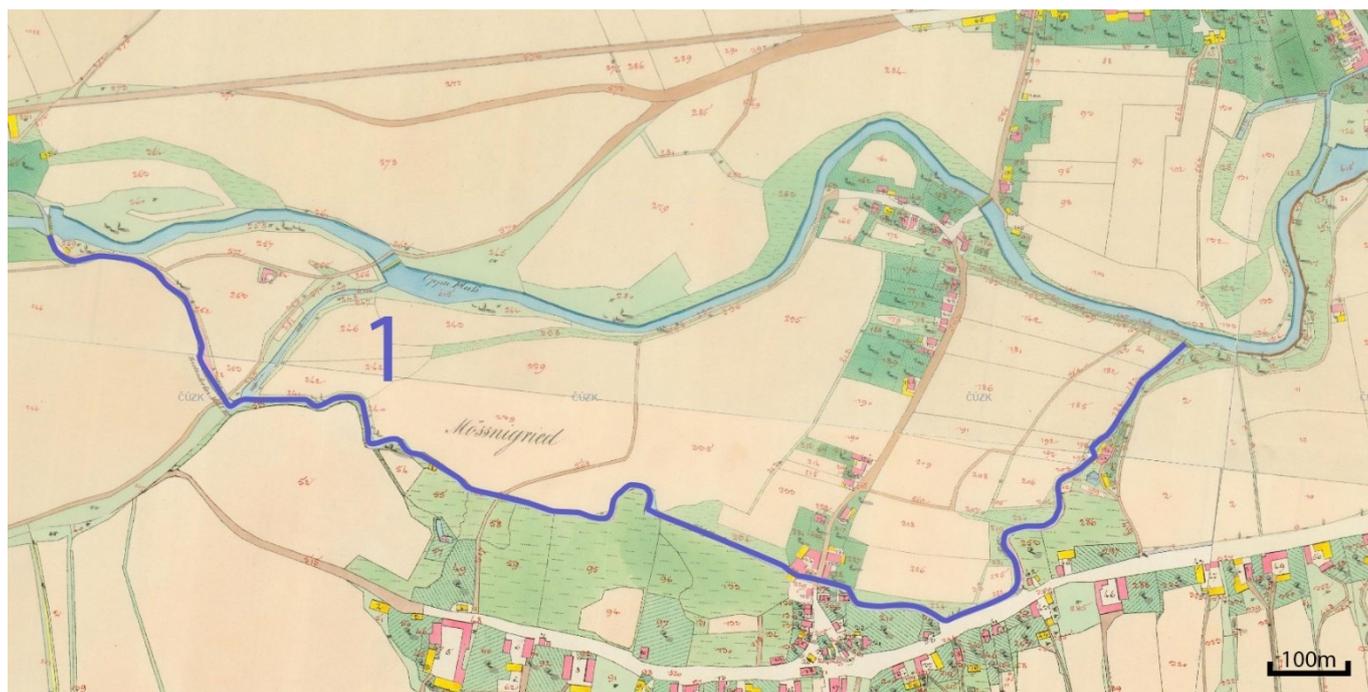


Fig. 4. The first mill race with mills in the 19th century. (Source: Illés based on the map of Imperial Obligatory Imprints of the Stable Cadastre 1826-1843, ČÚZK, c, 2010; 2023)

The urban structure offers spatial possibilities such as reopening the buried parts of the mill race or its presentation in other forms by landscape design solutions. This approach can be applied in some parts of the Karnola area and mainly in the public space along Tyršova street towards the inflow of the mill race to the Opava River. The possibility to present this part of the mill race is enabled also by the fact that this part of the mill race's spatial corridor is a municipal property according to the Cadastre of Real Estate (Fig. 6). In this case, the municipality of Krnov recognized the revitalization potential of the buried part of the mill race. As part of the 'River for All' initiative, the municipality commissioned an architectural study 'Krnov – River in

Town', which included a proposal to open the mill race in this part, construct a footbridge, and create an interesting public space. The study includes architectural, landscape, and water management improvements that will strengthen the ecological functions of the river, make the river corridor more accessible, and create lively public areas with recreational, social, and cultural significance (Círová, 2022; Machovský, Ondruška, Havlíček, Řiháček, 2019). The project works and municipal activities are coordinated with the activities of a state-owned enterprise Povodie Odry within the framework of planning anti-flood measures in Horná Opava (Machovský, Ondruška, Havlíček, Řiháček, 2019).

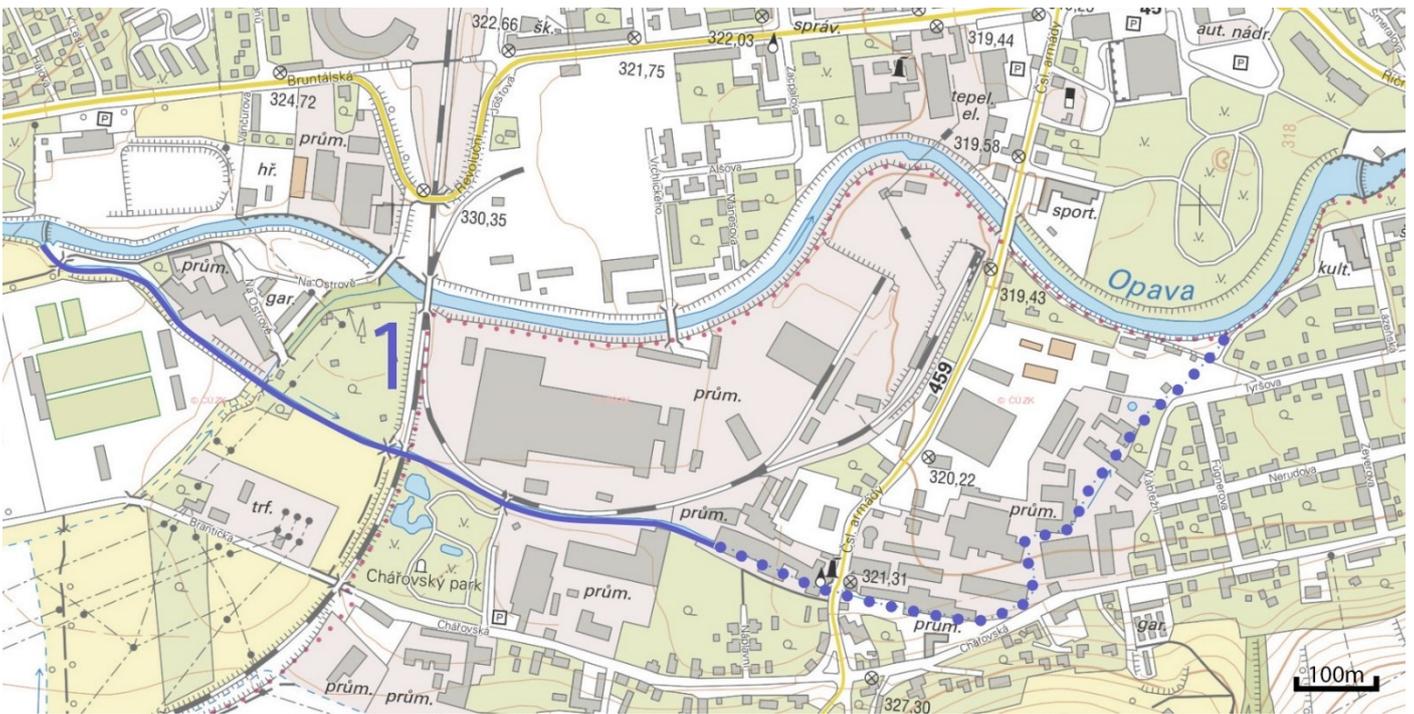


Fig. 5. The first mill race and its piped part today. (Source: Illéš based on the current Base map of Czech Republic 1:10 000, ČÚZK, a, 2010; 2023)



Fig. 6. Spatial and ownership preconditions for revitalizing the mill race along Tyršova street. (Source: Cadastral map, ČÚZK, b, 2010)

When evaluating the potential of this mill race, it is also necessary to pay attention to its route in the area of the former Karnola plant. This territory is undergoing a transition and can also be understood as a bluefield, a type of brownfield located near the water source, with its former functions closely related to the use of water (Pinch, Munt, 2002; Turečková, 2021). The part of the mill race deserves conversion – appropriate modification for a new use. The presentation of the mill race in this part of the territory would further contribute to recalling the genius loci and the values of the industrial heritage.

The second mill race: Past, present and possibilities of revitalization and interpretation in urban structure

The second mill race passed through the town's historic centre, through the fortification walls and the castle courtyard. It was fed from the weir on the Opava River, km 73.3. The upper and lower mill buildings were on the mill race, which was also adjacent to the premises of the Larisch textile factory (Fig. 7). The mill race was filled up during the 1950s. Today there is a small hydroelectric plant with two turbines that reach a total installed

power of 52 kW, to be found at the weir where once used to be the place of inflow into the mill race. The trace of the former drive is not visible at first glance in the current urban structure,

but spatial conditions for presenting its route remained available in many places (Fig. 8).

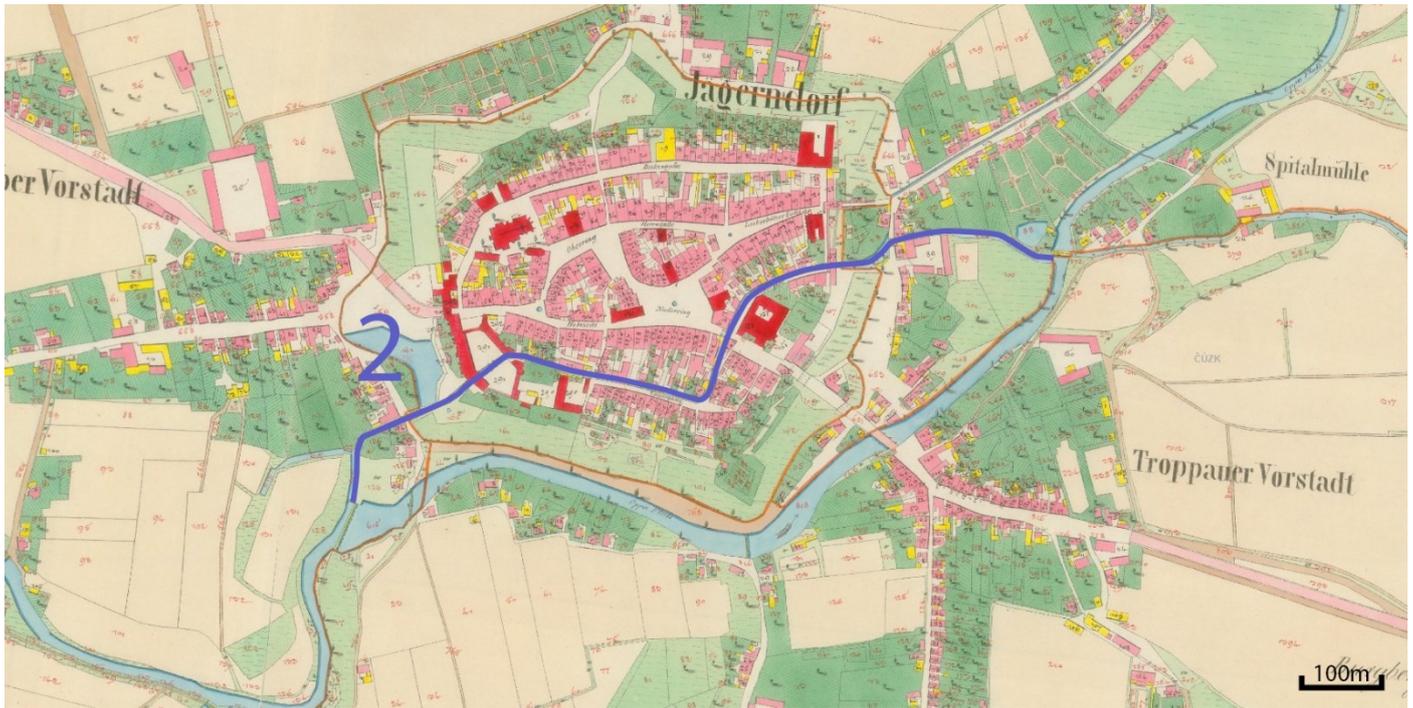


Fig. 7. The second mill race in the 19th century. (Source: Illéš based on the map of Imperial Obligatory Imprints of the Stable Cadastre 1826-1843, ČÚZK, c. 2010; 2023)

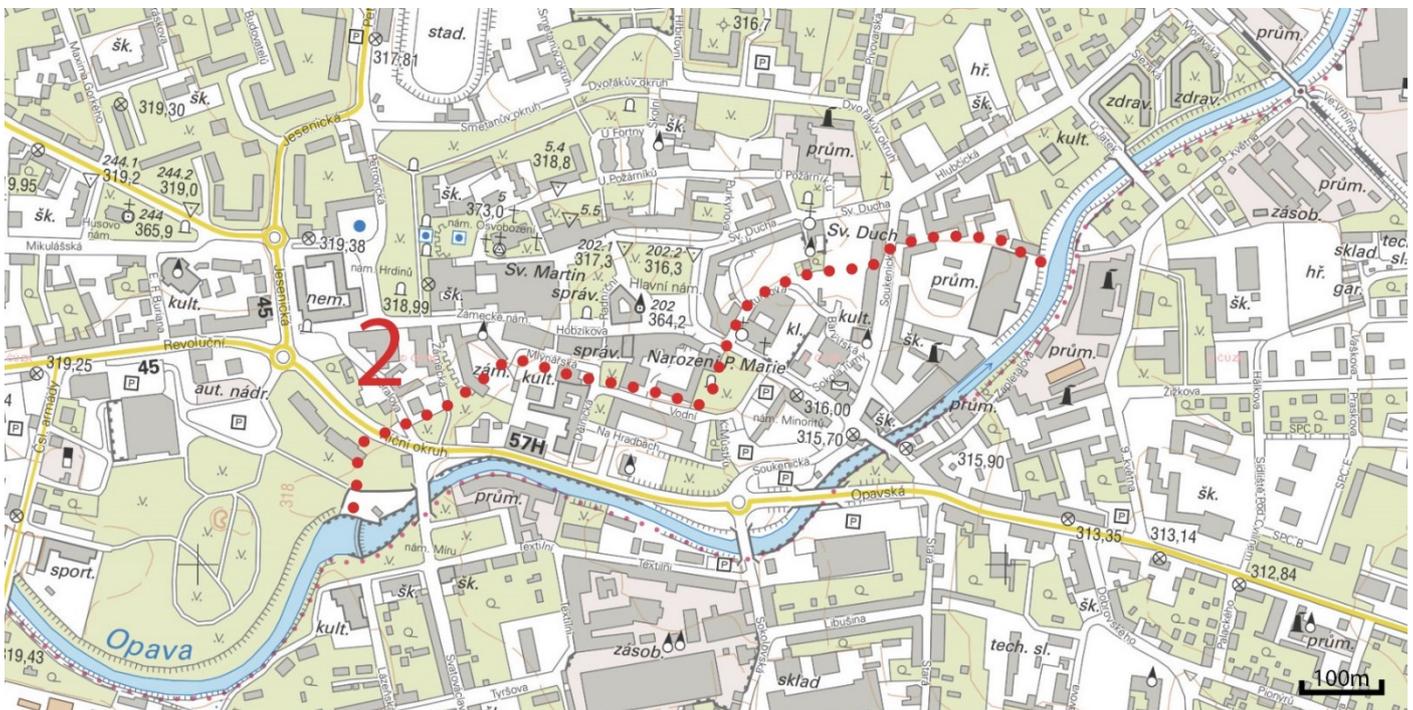


Fig. 8. The route of the extinct mill race in the historical centre of the town. (Source: Illéš based on the current Base map of Czech Republic 1:10 000, ČÚZK, a. 2010; 2023)

Such places include some parts of the town park, the castle courtyard, and the areas along today's Mlynářská and Vodní streets, which names refer to the route of the mill race. Here the urban structure offers spatial possibilities for landscaping solutions to comprise a reminder of the mill race, e.g., in the form of stormwater retention ponds or swales with the planting of

plants, which support the need and importance of water in the urban environment within the demands of adaptation to climate change. The location in the central area of the historical town offers the assumption that the presentation of the mill race is likely contribute to strengthening its specific identity and increasing the quality and attractiveness of public spaces for resi-

dents and tourists. Some studies (Kolarz 2006; Illéš, 2021) proposed the possibility of restoring and interpreting the mill race in this part of the city (Fig. 9).



Fig. 9. The proposal for the mill race interpretation in the historical centre: in the park, in the castle courtyard and behind the A. Larisch factory. (Source: Illéš, 2021)

Archaeological research by the Czech National Institute of Monuments near the Church of the Holy Spirit uncovered the remains of a dyehouse and a mill race with an arched vault through which the water flew through the town walls. The findings were presented to visitors in the form of guided tours (Kohutová, 2016). A part of these findings is presented in the revitalized park (Mathiasová, 2018). Although the archaeological findings i.e. the fortification wall, the dyehouse, and the vault of the mill race were buried, they are presented on the surface. The route of the mill race is interpreted by a pavement from granite blocks. The place of the former bridge over the mill race is remembered by a wooden pavement (Mach, 2017). Information panels are also installed, as well as two 3D bronze models depicting the former historical urban structure from 1779 and the turn of the 19th and 20th centuries (Fig. 10).



Fig. 10. Archaeological findings presentation in public space: the dyehouse and the mill race. (Source: Mlčák, 2022)

When evaluating the current approach to the presentation of the heritage of this former mill race in the town's urban structure

from the landscape-architectural and urban planning points of view, it is necessary to say that it would be beneficial to apply more solutions that would contribute to strengthening the green and blue infrastructure of the town. Even when it is unfeasible to revive the water flow in the mill race in its entirety, it is possible to return the phenomenon of water to public spaces in other ways. In those places along the former mill race route, where spatial possibilities and ownership relations allow, for example, in the municipal park or along Mlynárska and Vodná streets, it is possible to remind today's people of the route in the form of retention ponds, rain gardens, or ditches for collecting rainwater, with plantings of moisture-loving plants. Such landscaping would improve the urban microclimate and could also support pedestrian or cycling ways in the spatial corridor of the former mill race and enliven and increase the quality of public spaces for residents and visitors of the town.

The third mill race: Past, present and possibilities of revitalization and interpretation in urban structure

The third mill race started at the weir, on the opposite side, where the second mill race entered the Opava River. In the past, it was an undeveloped agricultural area outside the city. There were two mills on the mill race – Spital mill (Spitalmühle) and Willow mill (Weidenmühle) (Fig. 11). Currently, the mill race does not exist, it has been filled. (Fig. 12). In the current cadastral map, only the shape of the subdivision of plots and the name of the street Ve Vrbině remind people of the former mill race route. In the places where the mill race flowed into the Opava River, there are still wet places, a part of the dead arm with woody vegetation. The history of the place and the route of the former mill race could be presented in a few locations in this area. Its route passes the edge of an elementary school campus, where its interpretation could pursue educational goals related to history or environmental education on the importance of water in an urban environment. Partially there is a potential to present the route along Ve Vrbině street and to commemorate the places of Spital and Willow mills.

The fourth mill race: Past, present and possibilities of revitalization

The fourth mill race in Krnov belongs to those that have been preserved (Fig. 13, 14). It was built at the weir on the Opava River, km 68.2. A paper mill for the production of hand-made paper operated here, in 1863 owned by Ludwig and Heinrich Schrader (Klívar, 2010). At the turn of the century, a water power plant was also built in the location. Its later owner was Gustav Gröger junior, the owner of the Pflanzenöl – Werke Gröger factory founded in 1905. At that time there was a soap factory in the paper mill. After the Second World War, the factory premises belonged to the factory Stanislav Kostka Neumann Works. The mill race is still functional today, it is used by the Papírový Mlýn Hydroelectric Power Plant. The hydroelectric power plant uses the slope created by a 140 m-long derivation channel, led from the dam reservoir. One turbine in the engine room of the power plant has an installed power of 125 kW. The small power plant annually produces electricity of an average of 0.252 GWh, enough to supply about 90 households (TV-ADams, 2021). The water channel supplies Peter's fish pond, too (Fig. 14). The location of the fourth and still functional mill race has tourism potential. The cycling route Krnov – Opava leads along the river, so the presentation of the history of the place could attract visitors and enhance tourism in the region.

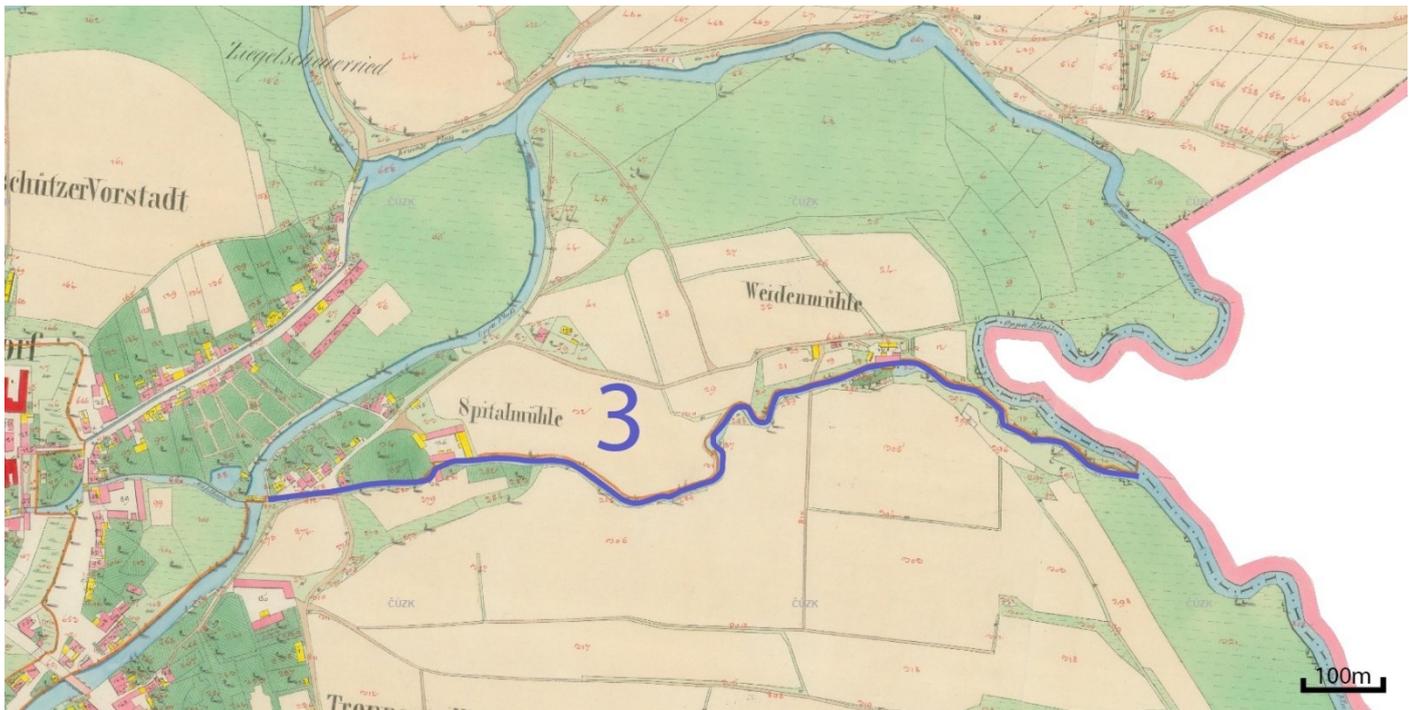


Fig. 11. The third race with two mills in the 19th century. (Source: Illéš based on the map of Imperial Obligatory Imprints of the Stable Cadastre 1826-1843, ČÚZK, c, 2010; 2023)

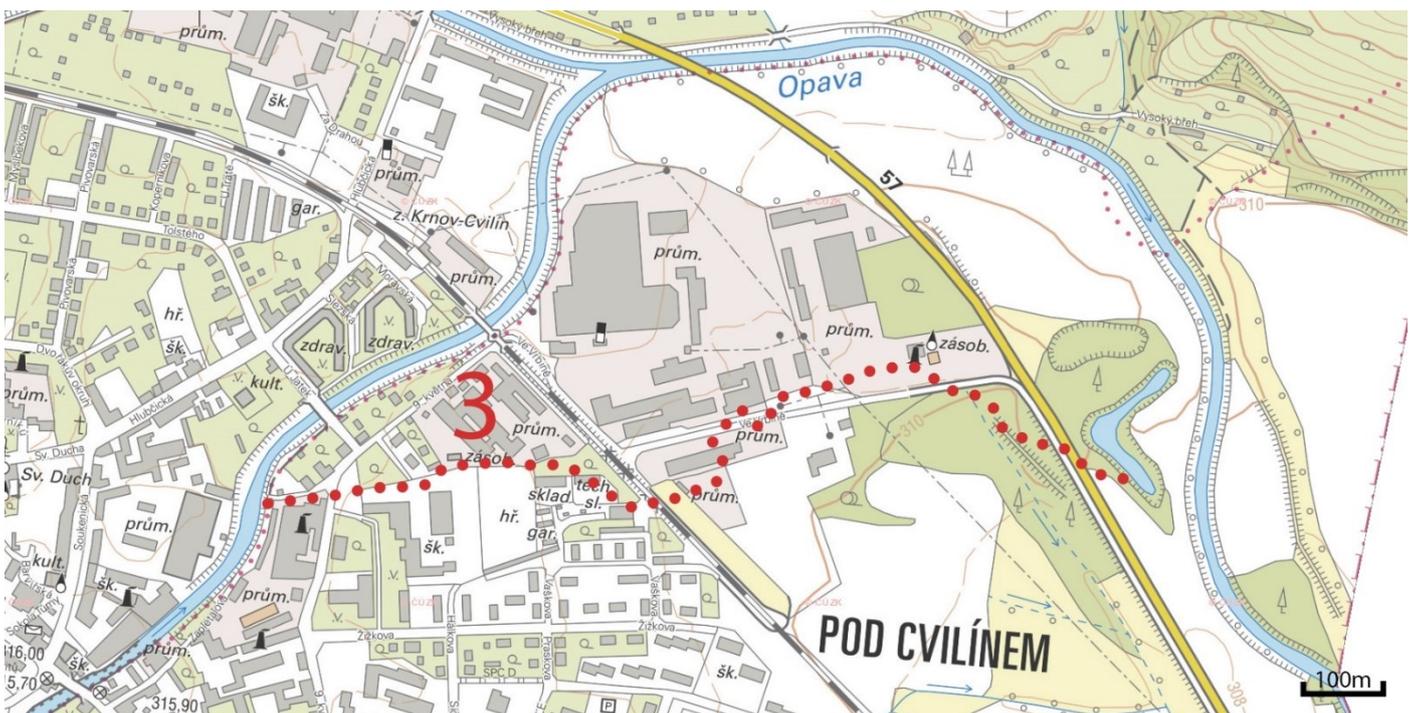


Fig. 12. The extinct third mill race in the urban structure today. (Source: Illéš based on the current Base map of Czech Republic 1:10 000, ČÚZK, a, 2010; 2023)



Fig. 13. The first mill race with mills in the 19th century. (Source: Illéš based on the map Imperial Obligatory Imprints of the Stable Cadastre 1826-1843, ČÚZK, c, 2010; 2023)



Fig. 14. The first mill race with mills in the 19th century. (Source: Illéš based on the current Base map of Czech Republic 1:10 000, ČÚZK, a, 2010; 2023)

DISCUSSION AND CONCLUSION

Weirs and mill races are important water management constructions that alter the flow and the river bed and must be designed to operate satisfactorily in all flow conditions. They need constant maintenance to preserve the optimal water flow and to prevent the risks associated with their neglect, such as loss of water and habitat quality or possible flood dangers. For example, in Krnov, during the flood in July 1997, the weir on the Opava River and the inlet to the mill race in Kostelec were extensively damaged (Vodní toky: Krnov, 2019). Weirs are physical barriers across the width of a river. They alter the flow regime of the rivers and can affect the local ecology and migration of species. A requirement today is to build fish ladders into the design of a weir that ensures that fish can bypass the barriers.

Several examples of preserved mill races from other towns as well as examples of two preserved mill races in Krnov show that the maintenance and operation of historic mill races is beneficial for the town and its public spaces. They bring social, recreational and environmental benefits of green and blue infrastructure to the urban environment. The presented historical and cultural heritage of mill races can indeed increase the attractiveness of the town and its public spaces for residents and tourists. The revitalization of the piped parts of the Krnov mill race and the presentation of the heritage of the defunct races in various forms can be encouraged by spatial conditions available thanks to the town's urban structure and convenient municipal property ownership relations.

Archaeological findings of the mill race drive near the Church of the Holy Spirit and the idea of their presentation in public space met with a positive response from the residents (Mathiasová, 2018). The current forms of presentation of the extinct and intangible historical heritage can include various presentation forms through virtual reality, mobile applications, and games. In Krnov, for example, many stories about Wassermann characters are associated with the mill races. The most famous Krnov Wassermann used to live under the weir on the Opava River near today's Mír cinema. The citizens were on good terms with him thanks to his two pretty daughters who liked to dance to the

music with the local boys. At the confluence of the Opava and Opavica Rivers, 'fiery' men often wandered at night.

The most popular was the one from around the vicinity of the Paper Mill. He often lit up the way to a lonely pilgrim, but badly punished the impolite ones who failed to thank him (Košťátek, 1989). To present these stories the forms of interactive animated virtual storytelling can be used as they become popular and effective in presenting the intangible cultural heritage (Huseinovic, Turcinhodzic, Rizvic, 2013). Mill races in Krnov represent a historical heritage, even if they are not subject to monument protection. It is often civic associations, enthusiastic individuals or groups of people who map, promote, and present the values of forgotten heritage (e.g., historical water mills in the Czech Republic are mapped by the website vodnimlyny.cz, 2017).

The case study of mill races in Krnov shows the importance of this specific phenomenon in the past and also its importance today. The extinction of the mill race channels from the urban structure of towns translates as the loss of cultural identity and, in the context of current threats of climate change, also as the loss of environmental benefits provided by the blue infrastructure (Illéš, Kristianová, Joklová, 2022). The Krnov example shows that the municipality of Krnov and its citizens actively initiate activities aiming to revitalize and interpret the unused heritage of the mill race system. Even though not every opportunity is used, such as the solutions that would strengthen the aspects of building green and blue infrastructure or greenways for pedestrian and bicycle movement. The mill races represent a historical and cultural heritage and the presentation and interpretation of their values, even those that have disappeared, can greatly contribute to increasing the quality and attractiveness of urban public spaces for residents and tourists, proving beneficial for the development of town and region (Illéš, Kristianová, Jaszczak, Pochodyla, 2022).

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