

Article

# Potential Impact of Waterway Development on Cultural Landscape Values: The Case of the Lower Vistula

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## Abstract

The northern (“lower”) section of the Vistula is on the route of two international waterways—E70 and E40. However, the current condition of the riverbed prevents larger vessels from passing through. Plans for the waterway date back to the beginning of the 20th century. Following Poland’s ratification of the European Agreement on Main Inland Waterways of International Importance in 2017, the general concept has been transformed into more concrete studies and has found its place in the national development policy. The scientific and political discourse primarily addresses the potential benefits of river regulation in the field of transport and energy. Against this background, studies on the impact of investments on the natural environment are published less frequently. Meanwhile, the Vistula has for centuries influenced the formation of a unique cultural landscape, which will be severely transformed if the river is regulated. On the other hand, insufficient transit depths of the waterway result in the loss of the function of the historic transport corridor, which also changes the character of parts of the area dependent on the river—in particular, the riverside areas of towns. This article aims to indicate the need for a qualitative landscape assessment of how the impact of investments is assessed and the best solution chosen. Using the assumptions of the historic urban landscape, the author analyses the potential impact of the planned investment in the lower Vistula on the surrounding cultural landscape. The potential scope for change in two dimensions is indicated at the scale of the lower Vistula and the individual towns. The possible impact of the investments on the panoramas is illustrated for selected cases.

## Keywords

heritage; historic urban landscape; river regulation; UNESCO

## Issue

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## 1. Introduction

The Vistula is considered one of the last unregulated rivers in Europe (Angiel & Angiel, 2015), but this does not mean that its riverbed has not been transformed. Great floods have influenced the development of the dyke system since the Middle Ages. However, their entire system with sluices and pumping stations was not developed until the 19th century, perpetuating human interference in the functioning of the fluvial system (e.g., Makowski, 1997; Starkel, 2001). At the end of the 1840s, the old Vistula estuary in Gdansk was regulated (Samól et al., 2023). In the following decades, a ditch to the sea (1890)

was built to protect Gdansk from the encroachment of flood waves. In the case of the main river, the Vistula, regulation mainly concerned the construction of dikes. This intervention has accelerated the flow of water and transport of debris and contributed to a decrease in retention (Starkel, 2001). The adverse effects of past transformations are raised as an argument for further regulation, the next stage of which is to be the Lower Vistula Cascade (LVC; Babiński, 2005; Babiński & Habel, 2013).

The concept of creating a system of water barrages on the Vistula was conceived in the interwar period by Tillinger (1919). The first barrage along the Vistula (Goczałkowskie Lake) was created in its upper reaches,

on the border of Silesia in 1956. It was created based on Stalin's 6-year plan—the communist state's development strategy of 1950–1955. This plan also assumed the canalisation of the lower Vistula in the Warsaw-Gdansk section (Sejm of the Republic of Poland, 1950). The devastation of the war meant that the potential for constructing hydroelectric power plants was not yet recognised in this river. The approach to the Vistula changed in the late 1950s and early 60s when the Tellingier concept was revisited. This decision resulted in the construction of the Włocławek barrage, which was put into operation in 1970. The erection of the barrage was accompanied by the creation of an extensive reservoir, which permanently transformed the landscape east of the city along a stretch of about 37 km. The concept of cascading returned as a political project in 1978. The resolution adopting so-called *Vistula Programme* included the pathetic declaration, in keeping with the era's spirit, "Let us make the Vistula a symbol of the blossoming of socialist Poland, a trail leading into the future" (Plenum of the Central Committee of the Polish United Workers' Party, 1978). Announced amid an unfolding economic crisis and already criticised by environmental circles, the project did not live to see its implementation (Jermaczek, 2017).

Over the following years, it was revisited with updated concepts for the LVC. The arguments in favour of the investment are primarily to restore the navigational potential of the river, which would provide a link between the two international waterways (IWWs) E40 and E70, providing inland waterway access to the ports of Gdansk and Gdynia, whose joint handling volume in 2022 was around 95 million T (Port of Gdansk, 2023; Port of Gdynia, 2023). The discussion has intensified following Poland's ratification of the European Agreement on Main Inland Waterways of International Importance (AGN) in 2017. Currently, most of the lower Vistula is characterised by Class I (up to 400T) or Class II (up to 650T) navigability. Only small sections meet the parameters of Class IV (up to 1,500T) and Class V (up to 3,000T) navigability (Council of Ministers, 2002, 2020). In order to meet the standards of an IWW, a minimum of Class IV navigability should be ensured, which means that the river could be navigated freely by vessels with a tonnage of 1,500T, a length of up to 85 m, a width of 9.5 m, and a draught of 2.5 m (Dziubińska & Weintrit, 2014). Indirect reference to the investment was made in the draft *National Shipping Programme till 2030* (NSP; Ministry of Infrastructure, 2022). The programme aims to restore the conditions for reliable and efficient transport on the main inland waterways in Poland. The programme does not hard-code the realisation of the entire LVC. However, it indicates "support in the preparation of the Vistula River Waterway Development Programme" and "continuation for the construction of the Siarzewo waterway degree" (Ministry of Infrastructure, 2022, p. 42). Although none of the water barrages is included in the indicative list of projects, the programme softly indicates raising the navigability class of the section from Nieszawa to Tczew to Class IV.

In addition to the anticipated logistical benefits, the energy argument is often cited (e.g., Kosiński & Zdulski, 2013; Woś et al., 2022). The LVC would be expected to enable an average annual energy production of between 3428.4 GWh and 4221.1 GWh (Szydłowski et al., 2015). In addition, the literature also argues for an alleged positive impact of the investment on tourism development (Brenda, 2013; Wojewódzka-Król, 2017) and flood prevention (Babiński & Habel, 2013).

Although the approach to environmental protection has changed dramatically since the first appearance of the concept of building reservoirs on the Vistula River, the scientific articles to date (including quite contemporary ones), as well as the studies conducted, mostly overlook the issue of numerous forms of nature conservation or classify them as an obstacle (e.g., Szymkiewicz, 2017). There needs to be more research on the impact of investments on heritage and landscape. Although a reference to landscape issues was included in the legally required environmental impact assessment for the NSP, no actual impact analysis was carried out there. The theme is very general and only two-dimensional. Even worse is the situation of cultural heritage, which has been reduced to listed monuments located in the area of the planned investment. Other forms of conservation, such as the register of monuments, protected landscape areas, etc., have been ignored.

Therefore, the presented article aims to analyse the impact of the LVC on the landscape and, in a broader sense, to show how the experience of the transformed waterways should influence the sensibility of the proposed engineering solutions.

## 2. Theoretical Framework

A planning condition that has become programmatically more important at the beginning of the 21st century is the context of landscape management. The European Landscape Convention introduces the notion of a "landscape policy," on which the concepts of "landscape management" and "landscape planning" appear alongside "landscape conservation." It was also groundbreaking in its stipulation that every landscape should be managed, and that the assessment of landscapes should take into account the specific values attributed to them by the parties and the population concerned (Council of Europe Landscape Convention, 2000). This was in response to a strand of anthropological work on the landscape as a cultural process (Hirsch & O'Hanlon, 1995). Starting from a heritage conservation perspective, the multifaceted importance of landscape was developed by UNESCO. In 2005, the Vienna Memorandum proclaimed that the evolving notion of cultural heritage required updated integrative approaches and methodologies for urban conservation and development in a territorial context that could respond to local cultural contexts and value systems (UNESCO, 2005). In 2011, UNESCO recommended the application of the historic urban landscape



(HUL) recommendation to historic urban areas and their wider geographical environment (UNESCO, 2011). Fundamental to this recommendation was an emphasis on landscape protection while treating the city as a whole and integrating heritage protection into the broader context of urban management—taking into account both cultural and natural features (Ginzarly et al., 2019; van Oers, 2014). In addition to assessing its physical characteristics, the urban landscape should be considered as a lived space that is infused with sociocultural values and is a subjective mental representation of the environment that changes over time and space (Thompson, 2018).

None of the above approaches assumes the immutability of the urban landscape; on the contrary, they assume the possibility of a certain transformation of the urban landscape if it aims at sustaining tangible and intangible cultural values as an element of sustainable development (van Oers, 2014).

This integral treatment of the landscape aligns with the European Landscape Convention. The HUL recommendation implies not only an integrative approach to the urban landscape but also to its wider context (UNESCO, 2011). Large rivers flowing through cities play an essential role in constructing their identity. This happens through factors that we can identify as resulting from the topography, which often determines the location of a city (wide vantage point and defensibility, location on a trade route, ability to locate a port, etc.) and the economic and cultural stratifications, the material and immaterial manifestations of which have developed based on a waterside identity. These factors changed according to the development of the art of war, transport technologies, and methods of manufacturing goods.

Large hydro projects have long been the subject of keen attention by UNESCO. In addition to their impact on the landscape of the valleys surrounding cascading rivers, they can affect the catchment landscape (Jo et al., 2022). The threat to the Abu Simbel temples in Egypt threatened by the construction of the Aswan Dam prompted a series of international campaigns in 1959 (Taylor, 2018). The World Heritage Committee has decided that the construction of dams with large reservoirs is never considered compatible with world heritage status (UNESCO World Heritage Committee, 2016).

In the development of the HUL methodology, it has been assumed that planning for recommendation-based development should involve six steps: mapping, consensus, vulnerability, integration, prioritisation, and partnership (Bandarin & van Oers, 2014; Gravagnuolo & Girard, 2017). Given that the official public discussion of the LVC has so far been reduced to a consultation on a general document such as the draft NSP and its Environmental Impact Assessment (Ministry of Infrastructure, 2022), there is still room to supplement the concept of the LVC with in-depth studies on the cultural landscape and its valorisation. In this text, I will focus on mapping and identifying potential spheres of

vulnerability while identifying fields for further action in line with HUL's recommendation.

### 3. Methods

Taking into account the possibility of visually experiencing the cultural landscape, three dimensions of the potential impact of the development on the perception of the selected urban landscapes were assumed: disruption of the perception within the land part of the urban complex (Cullen, 2012), disruption of the possibility of water perception, and disruption of the perception of the skyline (Otero et al., 2009). Bearing in mind that the HUL also considers natural values, these will be indicated in the case studies. The presence of cultural and natural values is considered to be the occurrence of sites and spaces that, due to their quality, have been subject to various forms of legal protection. The limitation of this approach is that valuable elements not yet under such forms of protection are not taken into account, but it does allow a preliminary assessment to be made and areas particularly predisposed to further research of a qualitative nature to be identified.

The impact of cascading will first be simulated in the QGIS software using a numerical terrain model and data from the National Institute of Cultural Heritage (2022) and the General Directorate of Environmental Protection (2022). The foundations of heritage objects were assigned elevation data in the form of a centroid generated inside the polygon, which made it possible to locate them in relation to the water table (current water levels are presented in Table 1). In addition, the boundaries of the spatial forms of heritage and nature conservation in relation to the water table were verified. Changes in the perceptual possibilities of the city skylines were also identified. A numerical land cover model on a scale of 1:5000 was used as the basis for the simulations. The water barrage parameters and the water table's expected elevation were taken from an article by Szydłowski et al. (2014; Table 2).

The study mentions that water barrages will result in the creation of reservoirs, but their form is not specified. The concept of the Siarzewo water barrage, made available by the State Water Holding Polish Waters, assumes the construction of a damming threshold. The reservoir will be created only within the natural channel with embankments (State Water Holding Polish Waters, 2021). Therefore, the article considers the impact on the landscape if two scenarios for reservoir formation—spilling and capped by an embankment within the limits approximating the current river channel—are implemented. In the case of the spillway, the normal damming level was taken as the water table level after cascading (Table 2). In the case of embankment construction, the maximum damming level (Table 2) was taken as the minimum height of the embankment crest, adding 2 m for earth structures and 1.5 m for concrete structures (see Ministry of Environment, 2007, p. 5340). In both



**Table 1.** Current water level according to numerical terrain model.

Town	Gniew	Nowe	Grudziądz	Świecie	Chełmno	Fordon	Solec Kujawski	Toruń	Ciechocinek	Nieszawa
Water level (m a.s.l.)	9.0	13.5	17.9	21.4	22.3	28.6	30.8	36.6	39.4	41.3

**Table 2.** Parameters of water barrages in the LVC concept were adopted for analysis by Szydłowski et al. (2014).

Water barrage	River (km)	Normal damming level (m a.s.l.)	Maximum damming level (m a.s.l.)	Minimum damming level (m a.s.l.)
Tczew	903,500	11	12.5	10.5
Gniew	876,300	18.5	20	18
Grudziądz	829,500	25.5	27	25
Chełmno	801,500	32.5	34	32
Solec Kujawski	758,000	41	42.5	40.5
Siarzewo	707,900	46	46.5	45.3
Włocławek	674,850	57.3	58.5	56.5
Płock	618,000	64	65.5	63.5
Wyszogród	584,000	70.5	72	70
Warsaw	539,500	81	82.5	80.5

cases, the embankment system will need to be extended, with the former being lower. In the case of some of the towns in question, it may be that the height of the existing embankments or the natural elevations of the land means that raising the embankments will not be necessary. It should be borne in mind that due to the scale of the analysis, a simplified model has been used in this study. The actual height may vary and is calculated on a case-by-case basis at the design stage taking into account, among other things, the effect of wind and levelling between the water barrages. Thus, as the height of the embankments is assumed based on the less favourable variant (Ministry of Environment, 2007) it must be assumed that the target height of the embankment crest may be higher than that assumed based on the maximum damming level and the embankment material. In the descriptive layer, the results of the spatial analyses for individual cities will be supplemented with essential information on historical conditions based on literature research.

This simplified simulation of the spillway (taking into account the existing embankments) was carried out for the entire section from Tczew to Włocławek, while the variant of the construction of the embankments was simulated for selected localities with different characters, where the widening of the river would lead to the violation of important public spaces. In these cases, an additional qualitative analysis showing the likely impact of the investment on the skyline was applied. The water level in the illustrations was taken as the normal damming level. To illustrate the change more clearly, reference objects will be indicated in the analysed panoramas.

### 3.1. Study Area

The Vistula is the longest Polish river, whose course is divided into three main hydrological sections: Upper Vistula (from its sources in the Silesian Beskid to Zawichost), Middle Vistula (to the mouth of the Narew River) and Lower Vistula (to the Baltic Sea; Ceran et al., 2014). The lower section connects Warsaw with Gdansk and indirectly the port, flowing through several smaller industrial centres (Płock, Włocławek, Bydgoszcz, Toruń, Grudziądz, Świecie, Tczew). The E40 IWW is located along this section, which, from Bydgoszcz to the Vistula Delta, connects with the E70 IWW (Figure 1). There are numerous areas of natural value—most of the river's length is covered by the Natura 2000 system. However, other large-scale forms of nature conservation, such as landscape parks and protected landscape areas, are also present. There is also no shortage of sites of outstanding natural value in the river valley—reserves—which are concentrated mainly around Grudziądz and in the section between Włocławek and Płock (General Directorate of Environmental Protection, 2022; Figure 2).

The lower Vistula Valley area is also characterised by a great richness and diversity of forms of archaeological heritage and tangible cultural heritage. The latter group also includes two sites inscribed on the UNESCO World Heritage List. There are two ensembles inscribed on the UNESCO World Heritage List in the area in question—the Teutonic Castle in Malbork and the Medieval Urban Complex of Toruń (National Institute of Cultural Heritage, 2022; Figure 2). Both complexes were inscribed in 1997. The Malbork Teutonic Castle is located on the Nogat River in the Vistula delta. For strategic purposes, the site has an extensive exposure foreground, and its proposed





**Figure 1.** Vistula River divided into upper, middle, and lower courses and in conjunction with other IWWs.

extensive buffer zone (not yet approved) extends to the Vistula River in the section south of Tczew. Toruń, on the other hand, is located directly on the Vistula River, and the buffer zone of the medieval town covers both sides of the river.

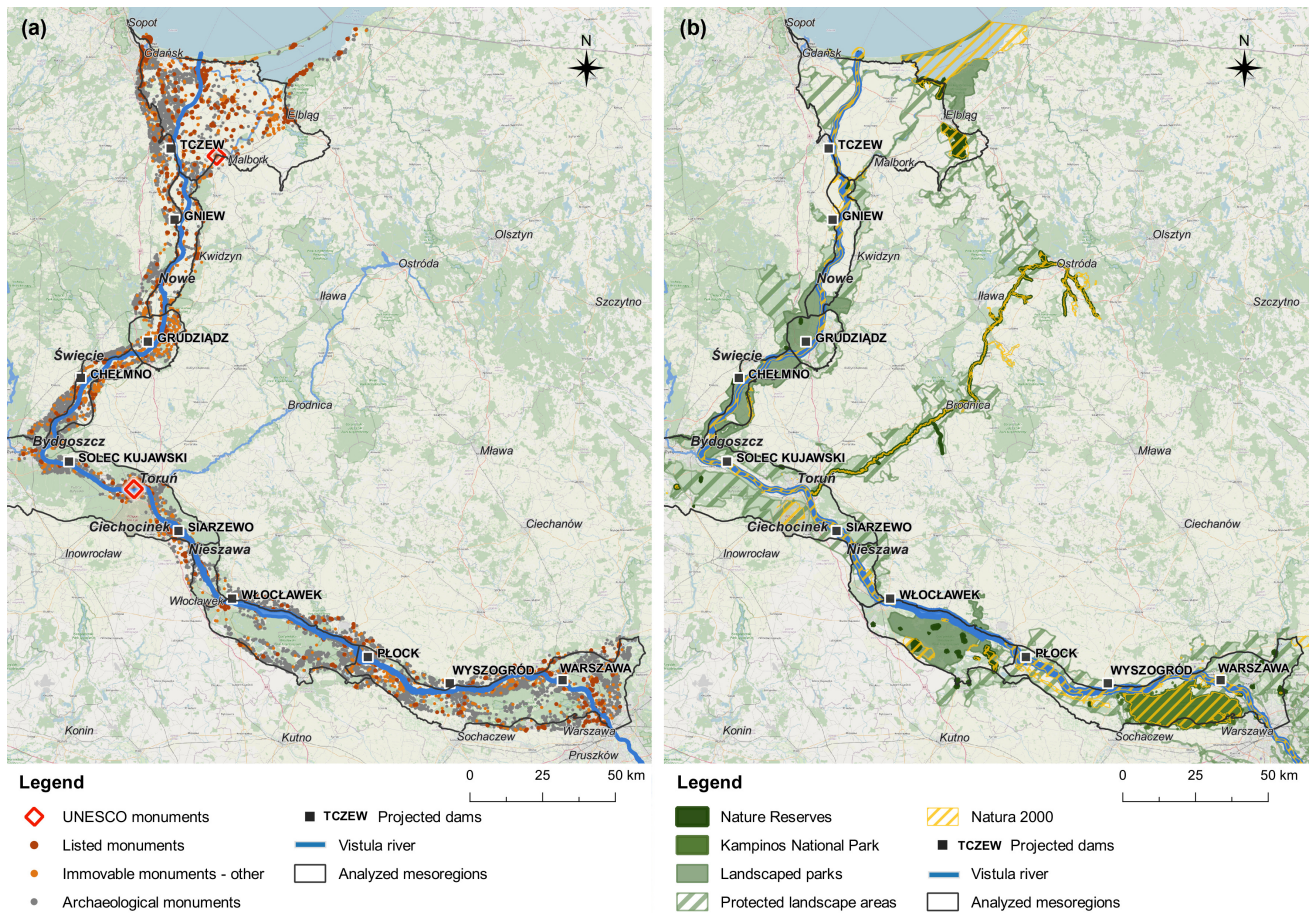
In addition to the above-described ensembles on the UNESCO World Heritage List, the historic urban complexes of Tczew, Gniew, Nowe, Grudziądz, Świecie, Chełmno, Fordon (now part of Bydgoszcz), Toruń, Nieszawa, Włocławek, Dobrzyń on the Vistula, Płock, and Wyszogród are valuable and distinctive elements of the Vistula River landscape. A settlement of medium cultural value but directly linked to the river is Solec Kujawski. Further landscape linkage with the mainstream of the lower Vistula River also applies to Gdansk, Elbląg, Malbork, Kwidzyn, Bydgoszcz, and Ciechocinek.

Delimitation of the area involved several barrages. First, the area to be analysed was delimited primarily based on the boundaries of geomorphological units (Solon et al., 2018). Where an urban complex is placed directly behind a geomorphological unit bound-

ary, which is also included in the analysis. In this area, a preliminary identification of the presence of natural and cultural values confirmed by the granting of forms of conservation was performed (Figure 2). An in-depth analysis with a simulation of water level rise was carried out for the section from Tczew (water barrage) to Włocławek, i.e., from the first of the planned barrages to the existing reservoir, including the water barrage in Siarzewo, treated as a priority. This section was considered to represent a significant variation in the valley's width while having the potential to impact the buffer zones of both UNESCO-listed communities. In addition, this section is identified as a priority for the restoration of navigation in the draft NSP. It is also noteworthy that the entire section of the river is included in the Natura 2000 bird area (Figure 2).

#### 4. Results

For reasons of urban flood safety, the barrages have been located upstream of the settlements; however, the



**Figure 2.** Forms of conservation: (a) monuments and historic sites and (b) nature.

water reservoirs may mostly affect landscapes located to the south of the site—including cities and tributaries of the Vistula River. Beginning with a general assessment of the section under consideration, it should be noted that the water barrages in Chełmno and Solec Kujawski will have the greatest impact on the landscape. The barrages in Tczew, Gniew, and Grudziądz, due to the shape of the valley and previously constructed embankments, will have little impact on the town’s public spaces and panoramas (Figure 3). The more detailed contexts are described below.

**Gniew:** The steep slopes of the valley means that the Tczew water barrage will not have a significant impact on the skyline of the town nor its public spaces. It may have a minor impact on the Wierzyca River Protected Landscape Area, which is a tributary of the Vistula (Figure 4).

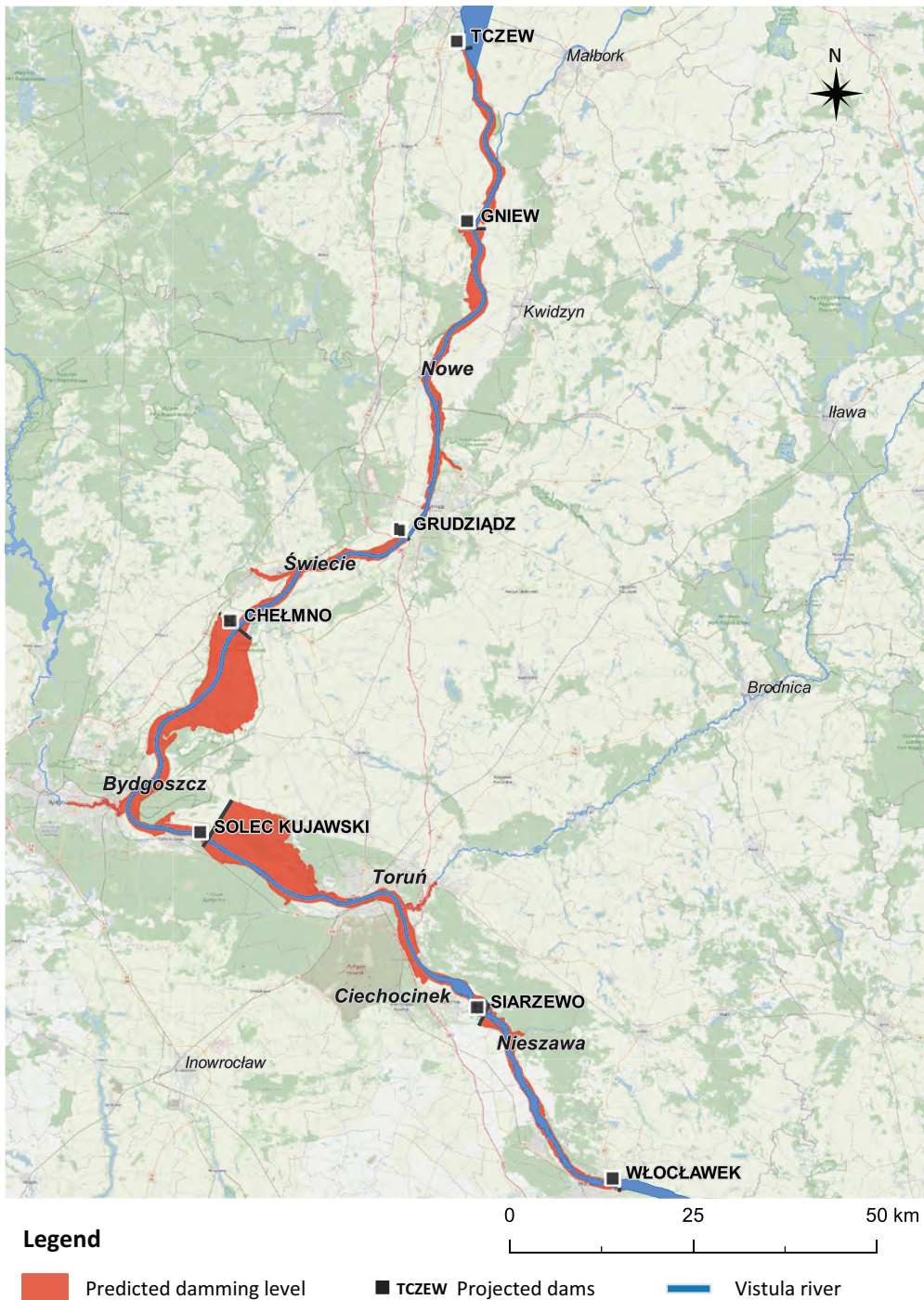
**Nowe:** A well-preserved medieval town layout at the foot of which, on the Vistula, are the remains of a Teutonic Castle. The tributary located at the foot of the castle—the Małtawa—is already separated from the Vistula by a system of pumping stations. Due to the possibility of containing new damming levels within the already existing embankments, the realisation of the LVC would not affect the landscape of the town or its exposure from the other bank (Figure 4).

**Grudziądz:** The narrowing of the Vistula riverbed facilitated the crossing, and this factor probably determined the development of the settlement. Between 1880 and 1892, the Vistula was regulated. A harbour was built on the river (Sieradzan & Kozieł, 1997). This was to open Grudziądz to the industrial era. During World War I, the Vistula slopes were the site of fortifications. The lay of the land means that the realisation of the investment will not affect the landscape of the town or its exposure from the other bank (Figure 4).

**Świecie:** The town is located at the confluence of the River Wda with the Vistula. Since the 1820s, as a result of regulatory works on the Vistula riverbed, the flood risk has increased significantly. The translocation plan submitted by the magistrate in 1830 envisaged the foundation of a new town in the suburbs between the Bydgoszcz–Gdańsk road, built between 1825 and 1827, and the left bank of the Vistula. Between 1846 and 1857, a new district was established in the suburbs on the left bank of the Wda, called the New Town (Czaja, 2012).

The construction of the reservoir will encroach on the Vistula Landscape Park, which includes the town’s suburbs, and the Chełmno Landscape Park on the opposite side of the river (Figure 4).

**Chełmno:** The area of the upland on which the town is situated has a form similar to a peninsula, bounded

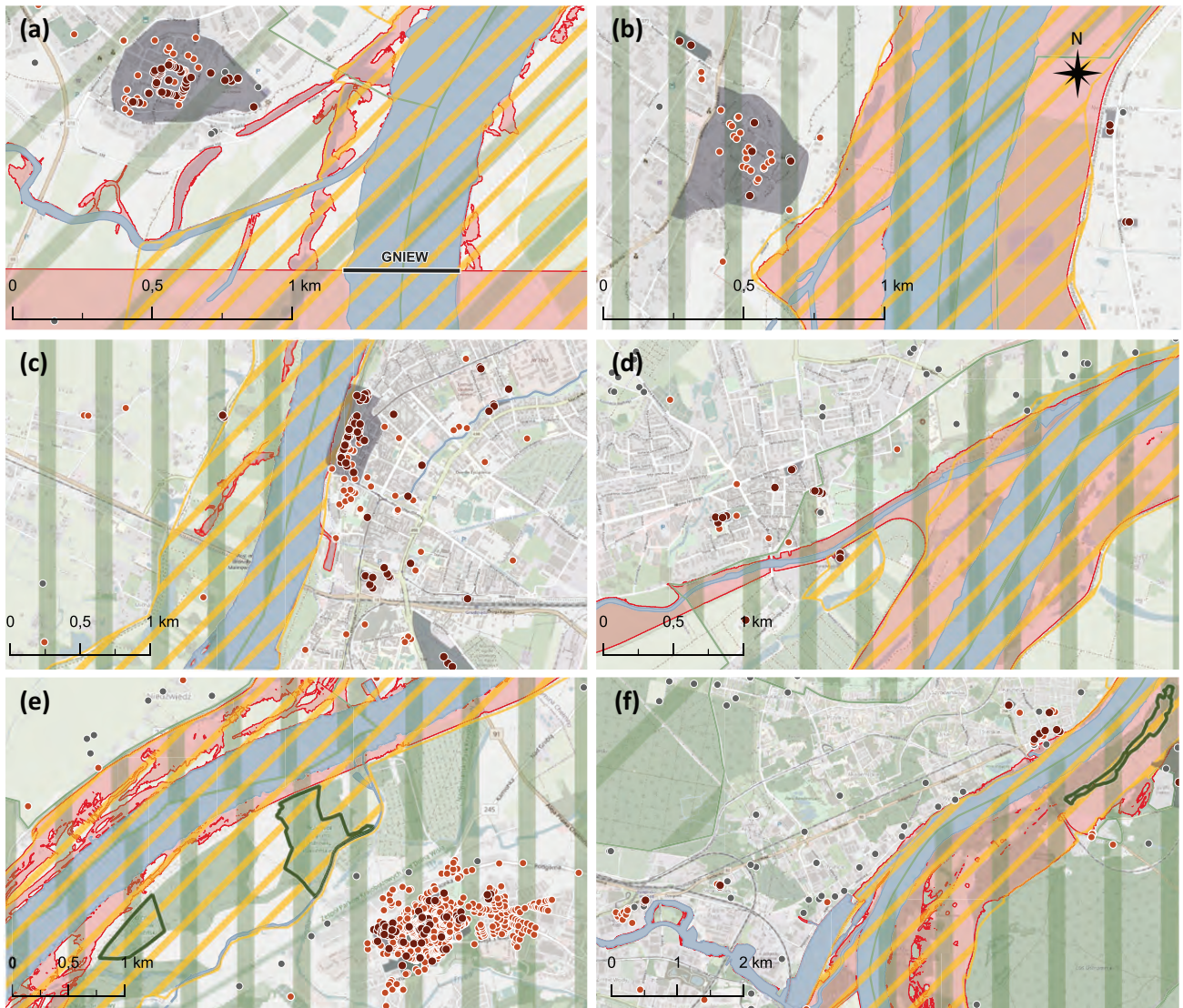


**Figure 3.** Spatial effects of the LVC: spillway variant.

from the west by the north slope of the Vistula River, from the south by the slope of the Browina River, and by a trough stretching from the south-east. A series of oxbow lakes form the floodplain beneath the town. The town was founded in the 13th century, initially to the north of the present town centre in the place of the later fishing suburb; it was probably moved to its present location in the middle of the 13th century, and the reasons for this decision are not known (Czacharowski, 1999). The picturesque location, however, contributed to the town's marginalisation in the age of industrialisation. The lack of

a bridge crossing over the Vistula limited accessibility to the main transport routes and thus weakened the town's competitive position (Czacharowski, 1999). The implementation of the LVC would not affect the town's landscape or its exposure from the other bank (Figure 4).

**Bydgoszcz:** The analyses carried out indicate that the implementation will have no particular impact on the physical elements of the city's cultural landscape—with the exception of Fordon, described below, which was incorporated into the borders of Bydgoszcz in the 1970s.



**Legend**

- Listed monuments
- Immovable monuments — other
- Archaeological monuments
- Historical sites
- ▭ Nature Reserves
- ▨ Landscaped parks
- ▨ Protected landscape areas
- ▨ Natura 2000
- Projected dam
- Predicted damming level

**Figure 4.** Impact of the LVC implementation (spillway variant): (a) Gniew, (b) Nowe, (c) Grudziądz, (d) Świecie, (e) Chełmno, and (f) Fordon.

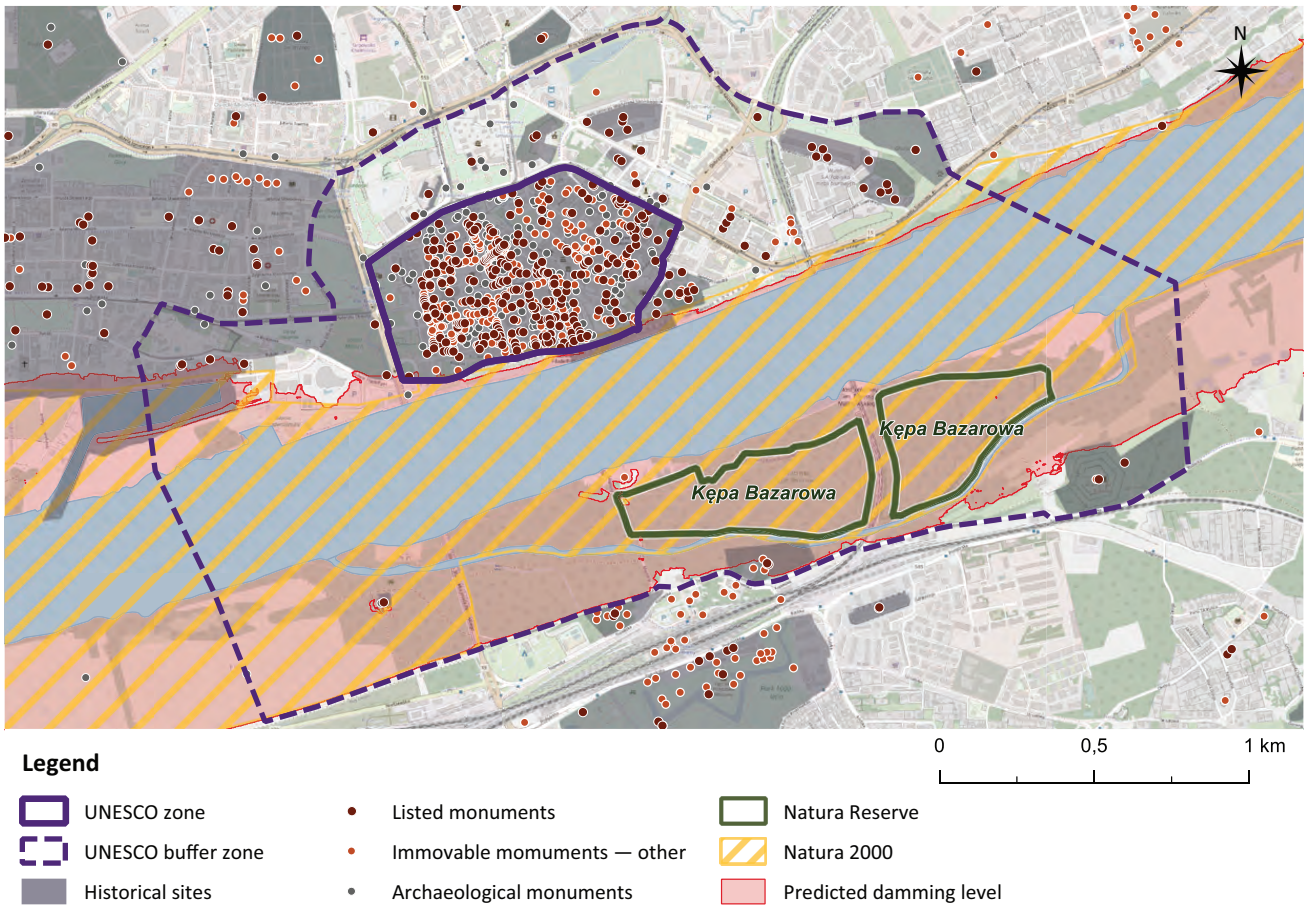
Fordon: Located in the southern part of the Lower Vistula River Valley, known as the Fordon Valley. To the north-west, the edge of the valley is the Swiecko Upland, with slopes reaching almost 60 m in height. The medieval town lies on the bank of the Vistula, below the mouth of the Brda River, on a terrace rising about 10–15 m above the level of the Vistula (Okoń et al., 2016). The implementation of the LVC through the construction of embankments may slightly affect the access to the water from the side of the town. Here, the public spaces are elevated to between 34.1 and 35.8 m, with an assumed maximum accumulation level of 34 m a.s.l. However, the investment will affect the Nadwiślański Landscape Park on the

opposite side. Once the project is implemented, the dike will separate the area from the water or water will absorb part of it resting on the upland. (Figure 4).

Solec Kujawski: The historic layout of the old town would not be compromised by the project. There is, however, a possible impact on the area at its foot containing remnants of a Dutch settlement (Figure 5)—similar to that in Żuławy.

Toruń: The city’s structure now spans both banks of the river, with the UNESCO World Heritage-listed Old and New Town complex located on its northern bank. Toruń is an exceptionally well-preserved example of a medieval commercial and administrative centre





**Figure 5.** Impact of the LVC implementation (spillway variant): Toruń.

of European importance (UNESCO, n.d.). The layout reaches the river, creating a distinct and vibrant waterfront along its banks. On the opposite side, in the area of the former fortifications, there is the Kępa Bazarowa reserve and the remains of the relocated town of Nieszawa (Czaja et al., 2019). This valuable natural and cultural area offers an attractive panoramic view of the complex while at the same time acting as its buffer zone. The implementation of the LVC would raise the level of the Vistula at this location by 4–6 m. This would mean that the popular boulevards would have to be protected with embankments, limiting the perception of the water. The perception of the skyline would also be altered—both assuming (here unlikely) a free spillway and the construction of embankments (Figure 5). The historic park on the old riverbed would also need to be protected.

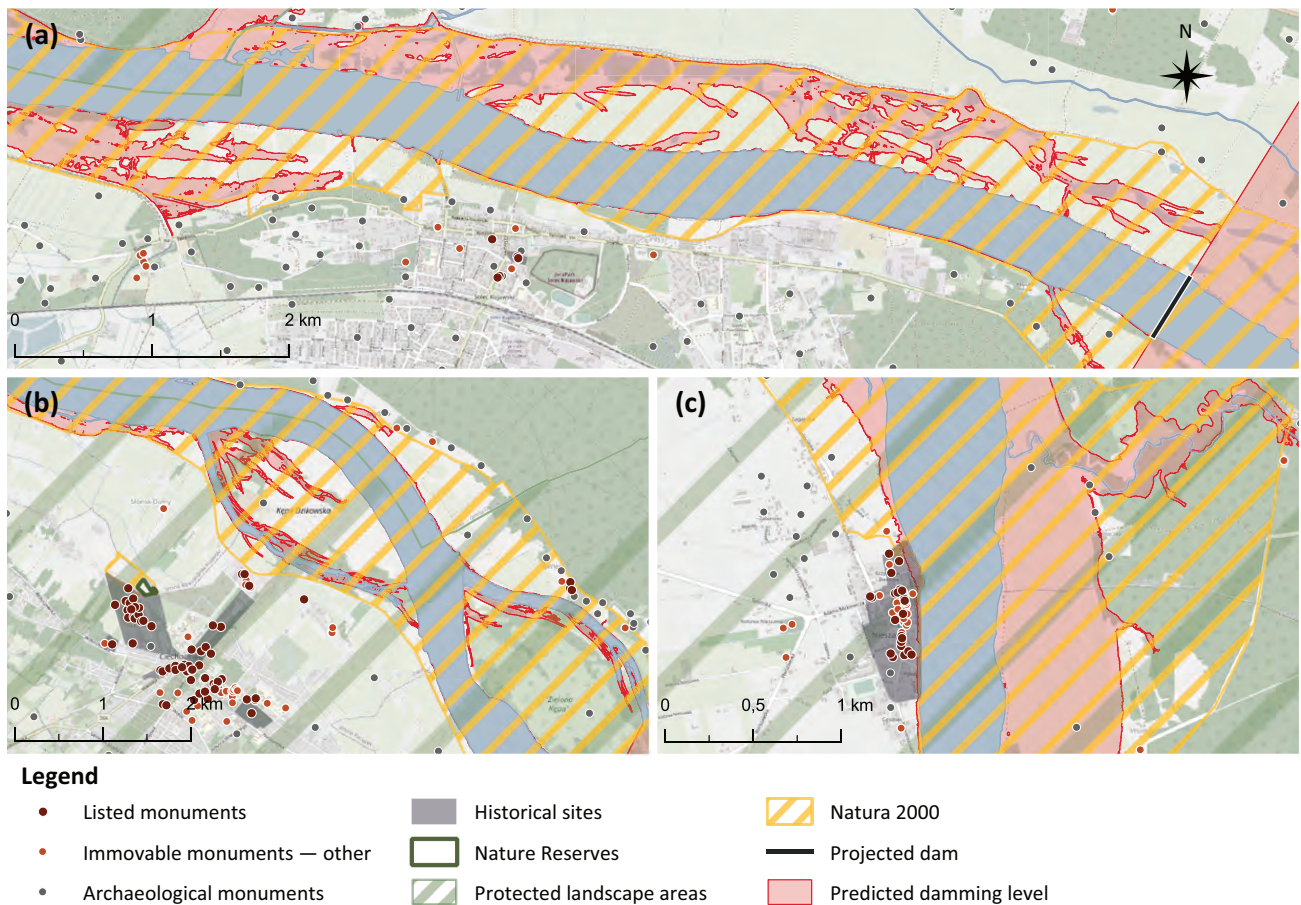
In the context of the wider environment, it should be pointed out that the implementation of the LVC would affect the Drwęca valley, which marks the current southern boundary of the city. This meandering tributary of the Vistula is an area of very high natural value—it contains a reserve, a Natura 2000 habitat, and a Protected Landscape Area.

**Ciechocinek:** A historic health resort whose most valuable element is a complex of graduation towers. Due to the town's location in the highlands, it is not directly

threatened by the implementation of the LVC. However, the investment would affect the Ciechocinek Lowlands Protected Landscape Area and the Natura 2000 areas located there (Lower Vistula Valley and Nieszawa Vistula Valley), in particular Kępa Dzikowska, located at the foot of the town (Figure 6).

**Nieszawa:** The town is located in the so-called Ciechocinek basin. It was founded in its present location in 1460, and the main axis of the present urban layout originates from that time (Czyżniewska, 1984). In the northern part of the town, in the quarter delimited by the streets and the Vistula escarpment, the Gothic St. Jadwiga Church is located. It is assumed that the construction of the Siarzewo water barrage will have a real impact on the public space in the area of the church by physically limiting or partially obscuring the view of the river, and with the spillway variant, on the possibility of viewing its panorama by significantly distancing the viewpoint on the opposite side of the Vistula (Figure 6).

Based on the previous identification, another qualitative analysis was carried out—a simulation of a perspective view of the skyline. Two settlements of different scales—Toruń and Nieszawa—were selected for this. In order to harmonise with the current character of the development, it was assumed that a concrete (north side) and earth (south side) embankment was used in the first case and an earth embankment in the second.



**Figure 6.** Impact of the LVC implementation (spillway variant): (a) Solec Kujawski, (b) Ciechocinek, and (c) Nieszawa.

In the case of Torun, the minimum height of the dike crest should be 44 m a.s.l. (north side) and 44.5 m a.s.l. (south side). The existing one by the historic Old and New Town is located 40–42 m a.s.l., while the embankments by Kępa Bazarowa reach 43 m a.s.l. This means that the crest would be a minimum of 2 m above the boulevard, while the existing embankment on the south side would have to be raised by a minimum of 1.5 m. The medieval Mostowa (Bridge) Gate was chosen as the reference site. It is located 41.47 m a.s.l., meaning it would be partially obscured if the embankment were built (Figure 7).

In the case of Nieszawa, the minimum height of the dike crest should be 48.5 m a.s.l. (both sides). At present, the boulevard is at a level of approximately 43 m a.s.l., while the old town buildings are located at approximately 46.5 m a.s.l. In this case, the medieval St. Hedwig’s Church and the eyot on the Vistula were taken as reference sites. The building is at an elevation of 48 m a.s.l., meaning it would be partially covered if the embankment were built and the eyot would disappear (Figure 8).

### 5. Discussion

Against the background of the current plans for the LVC, it is worth noting that, with few exceptions, the con-

struction phase of large hydro-engineering projects on rivers in developed countries ended in the 1970s. In addition to the saturation of this type of infrastructure, it should be noted that awareness of the impacts caused by river regulation on the natural environment (e.g., Hauer & Lorang, 2004; Nilsson & Dynesius, 1994), and the hydrological system (e.g., Grill et al., 2015; Kondolf, 1997), has increased significantly since then. The report of the World Commission on Dams (2000) also sent a strong signal pointing out the inadequacies of the existing approach. Currently, mainly in Europe and North America, the removal of barriers of various scales and the cessation of reservoir filling is occurring. The motives for such actions vary, but they are often economically motivated (Habel et al., 2020). The Water Framework Directive has identified restoration as a desirable direction for managing EU rivers (Directive 2000/60/EC, 2000). Looking at the cases of the heavily regulated rivers Danube and Rhine, it is noted that this is a very complex and challenging process to implement (e.g., Hohensinner et al., 2011; Muhar et al., 2016). In addition to the ecological and hydrological effects, studies also point to the negative impact of the strong conversion of river sections on the aesthetic quality of the landscape (Hermes et al., 2018). This raises the question of whether the arguments behind realising the LVC a century ago remain

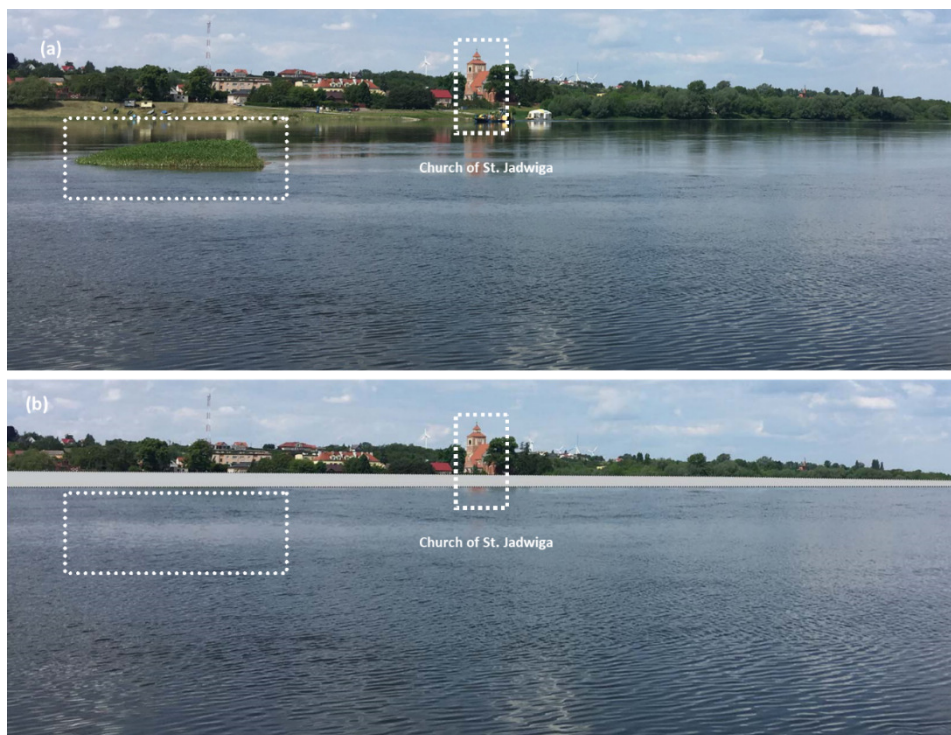


**Figure 7.** Impact of the LVC on a panorama of Toruń: (a) before and (b) after.

valid in the face of contemporary conditions, knowledge, and experience.

Given that the draft NSP in the 2030 perspective talks about further documentation for the Vistula waterway, this article demonstrates the need to consider cul-

tural landscape issues in subsequent works and in the strategic decision on whether and how to implement this project. The draft environmental impact assessment for the NSP cites the landscape valorisation of Poland by Śleszyński (2007), in which most of the landscapes of the



**Figure 8.** Impact of the LVC on a panorama of Nieszawa: (a) before and (b) after.

Lower Vistula were assessed as having average values, and the Vistula delta was assigned low values. It is worth noting that experts differ significantly in their assessment depending on the criteria adopted. For example, in the study by Kistowski et al. (2006), whose methodology emphasised the uniqueness and integrity of landscapes, the Vistula delta was indicated as a landscape of high value. It is a unique polder landscape in which the waterway provides the most interesting perspectives of layered and coexisting natural and cultural elements (Lipińska, 2012; Nowicka, 2022; Nyka, 2017). Moreover, the cited project lacks a visualisation of the impact of the investment on the landscape, not to mention considering the impact on specific riverside urban landscapes (see Cengiz, 2013).

The article primarily undertakes a general assessment of the visual impact of the construction of the core section of the LVC based on available assumptions. This does not exhaust the full spectrum of activities envisaged in the HUL recommendation, but as visual information has a 76% impact on urban environmental satisfaction (Jeon & Jo, 2020), it provides an important reference point for subsequent activities. Collisions of investments with areas considered of natural value, which are part of the urban landscapes analysed, are also presented for context. The analysis also cites the most relevant elements of the intangible waterfront heritage of these cities, for which the construction of the LVC could have a broader relational dimension.

The potential impact of the development on the latter element requires wider recognition. The draft NSP ascribes benefits resulting from the activation of the port function to the following localities: Gdansk, Elbląg, Bydgoszcz, Warsaw; reloading: Włocławek, Płock, Chełmno, Korzeniewo (a suburb of Kwidzyn), and Tczew, while the greatest rationality of port development is indicated in the ports indicated in the AGN—Bydgoszcz-Solec Kujawski and Gdansk. However, the document does not specify the estimated amount of reloading, or the scale of economic activation triggered by the investment. In view of so many uncertainties, the implementation of the LVC may represent both an opportunity and a threat to intangible cultural heritage. On the one hand, the creation of conditions conducive to the restoration of economic links with the river may favour the maintenance of disappearing professions or traditions; on the other hand, the question arises whether current technical and organisational requirements will fit harmoniously into the historical context or become a threat to it.

The HUL recommendation does not provide a simple answer on how to resolve development dilemmas when they concern investments of supra-local importance. In the case of towns and cities whose brand is to be built on a site inscribed or aspiring to be inscribed on the UNESCO World Heritage List, an essential argument for giving high priority to the HUL recommendation is the risk of losing or not gaining the title. However, the decision itself is subject to the decision of the central

authorities, who are the ones who direct the candidacy and are responsible for meeting the standards (UNESCO, 2021), which does not necessarily include the involvement and acceptance of the local community. A question worth developing is how to use the HUL in the context of both local and supra-local development plans—primarily regional and national. Here, the European Landscape Convention indicates the need for a common continental policy on the landscape that simultaneously respects the relationship with the landscape of its users (Olwig, 2019) but does not indicate specific multi-level management tools to help resolve conflicts. As the change in approach has come at a time when large-scale cascading projects are no longer taking place in Europe, it is difficult to identify good practices that could become a reference for the LVC. One current implementation is the Ilişu Dam in Turkey. However, the decision to implement it has been criticised due to the primacy of political and economic objectives over environmental criteria (Dinler & Özçakır, 2022).

## 6. Conclusions

The article discusses the potential impact of the LVC on HULs. This issue needs to be added to the academic and political discussion on the planning and implementation of the development in question. The landscape is formed by coexisting natural and cultural values. The extent of the protection to which it should be subjected derives from these two components. The implementation of large-scale developments must take an equally strong account of the impacts they have. Historically, this has not always been the case, but the awareness of the human impact on the environment today versus 70 years ago is obviously different.

The analysis presented here shows that, in terms of environmental impact assessment, the landscape must be studied both holistically (area-wise) and qualitatively (characteristic views, panoramas, etc.). A lack of awareness of the impact (or analysis of the landscape area-wise, i.e., two-dimensionally) may result in unawareness of a number of natural and cultural values that are present in the landscape. This may consequently mean their loss.

In this light, the impact of the LVC on the landscape of the Lower Vistula is beyond doubt. What is an open question, however, is the price that society and nature may pay for the implementation of the mega-investment. Answering this question is beyond the scope of this article.

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## Conflict of Interests

The author declares no conflict of interests.

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