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## Assessment of the impact of bridge infrastructure on the Ner River environment using the River Habitat Survey (RHS) method

**Abstract:** The article examines the application of the River Habitat Survey method to characterize a section of the Ner River. The application of the RHS methodology for river assessments complies with the requirements of the Water Framework Directive, particularly in defining reference conditions, planning catchment management measures, implementing flood protection and restoration strategies. The hydromorphological condition of a river is determined by the presence and proportion of natural and anthropogenic elements, where a predominance of natural features indicates a higher ecological status of the watercourse. Conversely, a dominance of anthropogenic structures reflects significant human-induced alterations to the river environment. This study focuses on the analysis of the Ner River section, with a particular emphasis on evaluating the impact of an anthropogenic structure, the bridge in Puczniew, on the natural environment and demonstrated that the RHS method accurately describes the impact of the bridge on the river environment.

**Keywords:** bridge, environment, RHS, river.

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## 1. INTRODUCTION OF THE RHS METHOD

As mentioned in the abstract this study focuses on the Ner River along the section from Lutomiersk to Puczniew. The research was conducted using the RHS (River Habitat Survey) method. This method was developed in the early 1990s by the British Environmental Agency in accordance with the requirements of the European Committee for Standardization (CEN), which pertain to the Water Framework Directive [1]. In Poland, the RHS method has been applied since the late 1990s and was formally established in 2007 [2], subsequently published as a field manual, with minor modifications introduced in the following years. This method has gained significant popularity as it allows for a detailed description of hydromorphological conditions in selected 500-meter representative river sections.

According to RHS guidelines, the selection of river profiles for analysis should be random [3]. The survey is conducted in two stages. The first stage involves characterizing the fundamental morphological features of the riverbed and banks at ten control profiles, spaced every 50 meters. During this stage, the structure of aquatic and riparian vegetation is also assessed, along with the land use of the river valley.

The second stage of the RHS method includes a synthetic description of the entire studied section, incorporating various morphological features and modifications that were not recorded in the previous stage. Surveys conducted using the RHS method enable the collection of approximately 400 parameters characterizing the hydromorphological status of a given river section. The collected data allow for the calculation of synthetic indices (*HQA*, *HMS*), which aggregate multiple individual parameters to numerically assess the hydromorphological properties of the river [4]. Schematic of river channel cross-section is presented in Fig. 1.

The *HQA* (Habitat Quality Assessment) index measures naturalness, allowing for the evaluation of the diversity of natural elements within the riverbed and valley. The *HMS* (Habitat Modification Score) index, on the other hand, is calculated based on data related to anthropogenic alterations of the river. Individual elements are assigned scores, and their sum determines the classification of the studied river section into a specific category. The best hydromorphological conditions are observed in rivers with high *HQA* values and low *HMS* values.

The *HQA* index reflects the diversity of natural morphological features in the river channel and valley, indicating the extent to which the environment retains characteristics typical of a natural or near-natural state. To determine the *HQA* (Habitat Quality Assessment) index, the numerical values assigned according to the RHS methodology requirements must be summed [3].

To calculate the *HMS* (Habitat Modification Score) index, all forms of modifications recorded during the field survey must be considered. The *HMS* index ranges from 0 to 100, where 0 indicates the absence of any anthropogenic modifications [3]. For the purposes of the Water Framework Directive, a final classification is performed based on the numerical values of the *HQA* and *HMS* indices. Threshold values for these synthetic indices have been established, defining five classes of hydromorphological status [5] described in Table 1.

This method is characterized by its ease of adaptation and application. It is designed in a way that allows specialists from various scientific disciplines to use it effectively. Therefore, the use of simplified scientific terms and commonly recognized descriptions of different environmental elements was both unavoidable and justified.

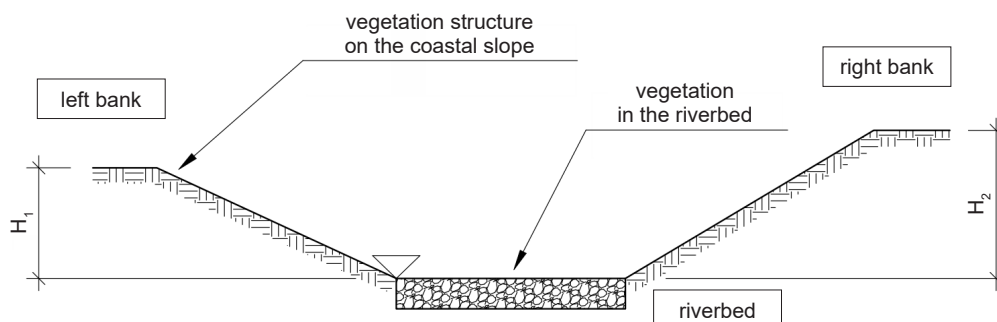


Fig. 1. Cross-section of the river channel for the RHS survey form (according to [4])

Table 1. Hydromorphological classification with RHS classification diagram (according to [5])

		Categories of <i>HQA</i> indicator values				
		109-136	82-108	55-81	28-54	0-27
Categories of <i>HMS</i> indicator values	0-2	I	II	II	III	III
	3-8	II	II	III	III	IV
	9-20	III	III	III	IV	IV
	21-44	III	IV	IV	IV	V
	45-100	IV	IV	V	V	V

A significant advantage of the RHS (River Habitat Survey) method is its accessibility, the comprehensive description of the watercourse along with its river valley (within a 50-meter buffer from the riverbed), and the hydromorphological assessment of selected survey sections along the river. This approach helps avoid economic and logistical challenges associated with evaluating an entire watercourse [6].

It is also worth noting that the RHS method can be used to determine whether river habitat characteristics are a significant factor in explaining the composition of aquatic communities and whether RHS data can be utilized to predict population characteristics in rivers [7-8].

The RHS (River Habitat Survey) field form consists of four pages:

- page 1 includes details about the surveyor and general site characteristics. It documents the dominant valley profile shape, the number of riffles, pools, scour holes, and depositional features, as well as the presence of hydraulic structures (Section D);
- page 2 records data from control profiles, detailing the riverbed substrate, bank characteristics, and adjacent land use. It includes information on the dominant material of the riverbed and banks, flow types, modifications to the riverbed and banks, vegetation structure, and land use patterns;
- page 3 provides a synthetic description of the entire 500-meter surveyed section, summarizing key hydromorphological characteristics;
- page 4 is dedicated to channel dimensions and cross-sectional measurements.

## 2. STUDY AREA: THE NER RIVER

The Ner River is a right-bank tributary of the Warta River, flowing out in Łódź, likely between Pomorska and Henrykowska Streets. It has a total length of 134 km and a catchment area of 1866 km<sup>2</sup>. The Ner is a lowland river within the Oder River drainage basin, contributing to the hydrological system of western Łódź Voivodeship. Within the Łódź Voivodeship, the Ner River catchment encompasses the city of Łódź and the parts of counties of Zgierz, Łódź East, Pabianice, Łask, Zduńska Wola, Poddębice, and Łęczyca.

Looking at the structures of the geological substrate the study area is located within the Łódź Basin, which is part of the Szczecin – Łódź – Miechów Synclinorium. This geological structure originated due to the inversion of the Permian-Mesozoic sedimentary basin, known as the Mid-Polish Basin, which was part of the Danish-Polish Trough extending in a northwest-southeast (NW-SE) direction [8]. The boundaries of these structural units are delineated by fault zones and escarpments aligned with this NW-SE geological trend.

The presence of major structural units in the deep substratum of Łódź, with elevation differences exceeding 100 meters, significantly influenced the geological evolution during the Tertiary and Quaternary periods. Quaternary deposits in the area primarily consist of glacial and glaciofluvial sediments from the Saalian Glaciation, as well as fluvial deposits from the Vistulian Glaciation. The youngest deposits include Holocene sands, silts, and peat formations [9]. Location of Łódź in relation to the geological units is presented in Fig. 2.

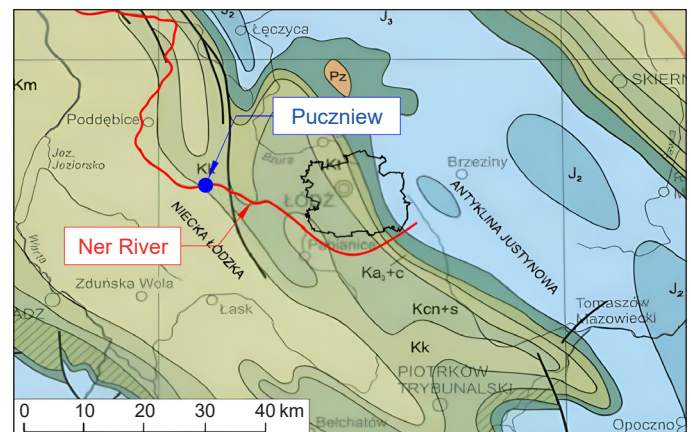


Fig. 2. Location of Łódź in relation to the geological units of the Łódź Voivodeship (after Dadlez R., Marek S., Pokorski J., Geological Map of Poland excluding Cenozoic formations, scale 1:1,000,000 [9])

During the Pleistocene epoch, the continental ice sheet encountered a highly heterogeneous surface composed of rocks with varying resistance to erosion. These geological formations were either subject to glacial erosion or acted as obstacles that impeded the southward advance of the ice mass. As a result of Pleistocene glacial activity, morainic deposits were formed, which are present in the Ner River valley in the vicinity of Puczniew.

Although the Ner River lies within the Łódź Basin, the topography of its catchment area is relatively diverse. The total elevation difference exceeds 195 meters, with an average elevation of approximately 149 meters above sea level (a.s.l.). The highest point within the catchment is located on the first-order watershed near the Dąbrowa district in Łódź, at an elevation of 284.1 m a.s.l., while the lowest point is situated at the mouth of the Ner River, at 88.4 m a.s.l. This results in a total relief of more than 195 meters. The average gradient of the catchment is 4.45‰ [11].

### 3. RHS-BASED DESCRIPTION OF THE NER RIVER

The evaluation of the Ner River between Lutomiersk and Puczniew was conducted in two stages:

- Stage 1: A morphological description was carried out in 10 control profiles of the riverbed and banks. This included an assessment of physical parameters, such as natural morphological features of the banks and riverbed, dominant flow type, substrate composition of the banks and riverbed, sediment accumulation patterns, bank and bed modifications, as well as bank usage and the structure of aquatic and riparian vegetation;
- Stage 2: A synthetic assessment was conducted for the entire 500-meter section. This included measurements of the riverbed dimensions, pools, riffles, point bars, and the number of hydraulic structures [2, 3].

The collected field data allowed for a numerical assessment of the river's hydromorphological conditions [12]. Based on the RHS methodology, two key indices were calculated as the sum of multiple individual parameters:

- *HMS* (Habitat Modification Score). This habitat modification index quantifies morphological alterations in the river. It accounts for all observed anthropogenic modifications in both control profiles and the broader river section, such as weirs, crossings, bank reinforcements,

bank or bed reshaping, embankments, impounded water due to hydraulic structures, and bank mowing [3]. For the Ner River, the *HMS* values for the analyzed segments were: *HMS* = 26, *HMS* = 20, *HMS* = 30;

- *HQA* (Habitat Quality Assessment). This naturalness index measures the presence of natural river valley features [3]. To determine *HQA*, numerical values are assigned based on RHS methodology, considering: Flow types, Substrate composition of the riverbed, Natural morphological elements of the riverbed and banks, Riparian vegetation structure, Aquatic plant groups, Trees and associated morphological features.

Land Use Within a 50-Meter Riparian Buffer Zone Measured from the Top of the Riverbank.

The Habitat Quality Assessment *HQA* index is a quantitative metric used to evaluate the hydromorphological quality of riverine habitats. It ranges from 0 to 136, with values observed in Polish rivers typically falling within the range of 15 to 80. A maximum score of 136 denotes a fully natural watercourse, exhibiting high morphological complexity and structural heterogeneity both within the channel and in its adjacent riparian zone. Conversely, lower scores are indicative of reduced natural hydromorphological attributes, often due to anthropogenic alterations [3, 13, 14].

In the case of the Ner River reach between Lutomiersk and Puczniew, the following *HQA* scores were recorded: 29, 34, and 41. Based on the hydromorphological classification framework, this river segment is assigned to category IV, which is defined by *HQA* values ranging from 28 to 54 and corresponding *HMS* (Hydromorphological Modification Score) values between 21 and 44.

This classification suggests a moderately high hydromorphological integrity of the channel, with natural features predominating over anthropogenic modifications in the evaluated river section.

The Ner River originates in Łódź and flows through several towns mentioned in this study, including Lutomiersk and Puczniew (whole course of the Ner River is presented in Fig. 3). Observations made during the research indicate that the Ner River is regulated along almost its entire length, yet meanders can still be observed. As a result, the river current does not flow in the central part of the channel but instead follows a path closer to the outer bank of the bend. The flow velocity is higher at this outer bank, leading

to continuous erosion, which causes the bank to become steep, and the river reaches its greatest depth at its base.

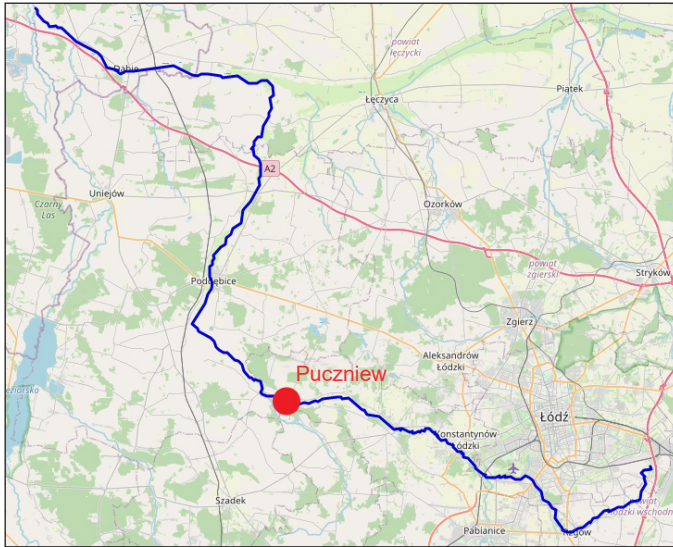


Fig. 3. Course of the Ner River.

Conversely, the inner bank has a gentler slope, facilitating the deposition of sandy material carried by the river. This process leads to the gradual expansion of the inner bank towards the center of the riverbed. The accumulation of sediments on this bank results in the formation of a point bar, which can be observed along the section from Lutomiersk to Puczniew. The development of meanders leads to the gradual lateral migration of the river channel. This process is occasionally interrupted by meander cut-offs or the breaching of the neck of a meander loop, which results in the formation of oxbow lakes, such as Lubczyna Oxbow Lake.

During measurements along the entire studied section, the riverbed was found to be composed of sand, while the banks consisted of soil (according to RHS terminology [3, 15, 16]). The flow was classified as smooth, occasionally becoming swift. The riverbanks are primarily covered with common reed (*Phragmites australis*), stinging nettle (*Urtica dioica*), and reed canary grass (*Phalaris arundinacea*). The landscape along the river is dominated by meadows, agricultural fields, and scattered woodlands. This type of land use is associated with the presence of common bird species such as the skylark (*Alauda arvensis*), yellowhammer (*Emberiza citrinella*), and corn bunting (*Emberiza calandra*). The meadows provide a feeding ground for white storks (*Ciconia ciconia*), flocks of starlings (*Sturnus vulgaris*), and kestrels (*Falco tinnunculus*).

The flora and fauna along the section from Lutomiersk to Puczniew are represented by widespread and common species typical of central Poland (section of the Ner River is presented in Fig. 4).



Fig. 4. Section of the Ner River; photo: B. Lesner

Unfortunately, in the Ner River valley from Lutomiersk to Puczniew, anthropogenic elements can be observed, such as the regulation of the riverbed, especially near settlements. Bridges have a significant impact on the river, with approximately 10 structures along this section. Therefore, it is advisable to redesign existing bridges to minimize their environmental impact. One such example is the reconstruction of the bridge in Puczniew on county road No. 3706E. View of the bridge is presented in Fig. 5. The predominant type of traffic on the bridge consists of passenger vehicles. Traffic on the structure shows an upward trend, driven by the development of single-family housing on the outskirts of the Łódź agglomeration.



Fig. 5. View of the Ner Valley and the bridge in Puczniew from the west; photo: B. Lesner

#### 4. CHARACTERISTICS OF THE BRIDGE STRUCTURE

The bridge in question is located in the village of Puczniew and carries county road No. 3706E over the Ner River. The investment project is situated within the administrative boundaries of the Łódź Voivodeship, in the Pabianice County, within the Lutomiersk Municipality. The bridge reconstruction does not conflict with the provisions of the Study of Conditions and Directions for Spatial Development of the Lutomiersk Municipality (Resolution No. XI/59/15 of the Lutomiersk Municipal Council dated July 23, 2015, regarding amendments to the Study of Conditions and Directions for Spatial Development of the Lutomiersk Municipality).

The existing structure is a two-span reinforced concrete bridge with a monolithic slab load-bearing system. It has a total length of 33 m and a width of 7.56 m, supported without bearings on massive, solid concrete abutments with wing walls. The theoretical span length of the existing sections is 11.75 m. The load-bearing system consists of a continuous reinforced concrete slab with a thickness of 75 cm. The supports are made of massive reinforced concrete. The monolithic abutments comprise front walls and side walls parallel to the road axis. The river pier, constructed as a wall-type structure, has a variable thickness ranging from 1.1 m to approximately 1.5 m. The bridge deck is asphalt-paved. The existing structure

lacks expansion joints and sidewalks. Drainage is surface-based, with water directed onto the embankments beyond the bridge. The bridge was built in 1951.

The new structure is designed as a single-span monolithic frame with a load-bearing system composed of prefabricated T-beams integrated with a reinforced concrete slab. The end supports will be rigidly connected to the load-bearing system. The design complies with the Regulation of the Minister of Infrastructure dated June 24, 2022, on technical and construction regulations for public roads (Journal of Laws 2022, item 1518) and is classified for load class II for vehicular traffic according to the LM1 model (PN-EN 1991-2-1).

Upon completion, the structure will transition from a two-span to a single-span configuration, eliminating the river pier in the Ner. While maintaining a similar length, the bridge will be widened to meet current regulatory requirements and to accommodate pedestrian and bicycle paths.

The load-bearing system will consist of T24 prestressed concrete beams, a monolithic reinforced concrete integration slab, and polymer concrete curb elements. Beams will be spaced 90 cm apart beneath the roadway and the left sidewalk. The reinforced concrete slab will have a constant thickness of 24 cm, with its slope adjusted to match the transverse drainage gradient of the road and sidewalks. Cross section of the new bridge structure is presented in Fig. 6.

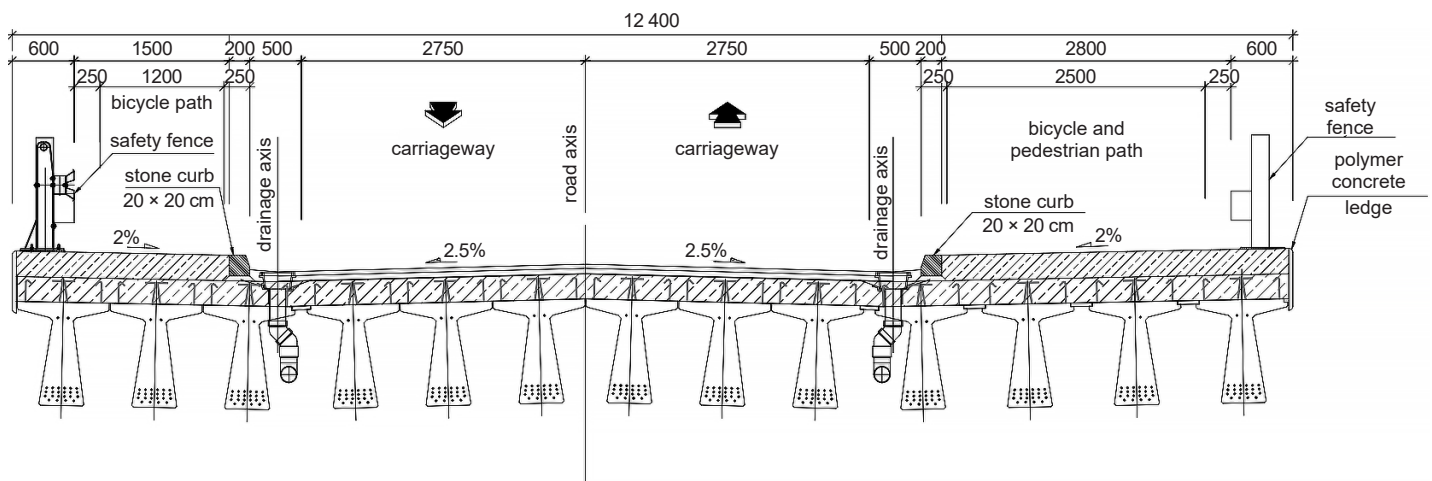


Fig. 6. Cross-section of the load-bearing structure of the new bridge over the Ner River

The supports are designed as massive abutments with monolithic wing walls positioned parallel to the axis of the county road. The support axes will be set at a 90° angle to the axis of county road No. 3706E. The abutments and foundation footings are designed as reinforced concrete structures.

The abutments will consist of bodies with an upper cantilever section designed to support the transition slab. They will be indirectly founded on jet-grouting columns and will be rigidly connected to the bridge deck. To protect the foundation excavation, the use of lost sheet piling is planned.

Below, in the Table 2 is a summary of the key maximum parameters of the bridge structure in its current state and after completion of the project.

Table 2. Cross-section of the load-bearing structure of the new bridge over the Ner River

Comparison of parameters of the existing and designed bridge over the Ner River		
Parameter	Current condition	Parameter designed
Length [m]	33.0	34.55
Deck width [m]	7.56	12.4
Number of spans	2	1
Span length [m]	2 × 11.75	23.66
Clear span [m]	21.55	22.74

The structure will be constructed using monolithic reinforced concrete technology, cast in place on scaffolding or other supporting structures. The structure will have a frame-like form. The construction method does not require specific staging of works.

The upper surface of the load-bearing structure and the transition slab will be protected with a single-layer waterproofing membrane made of weldable bitumen felt, which does not require an additional protective layer. An additional layer of waterproofing will be installed beneath the curbs (extending 10 cm beyond their edge) and turned up onto the transition slab.

The surfaces of foundations, abutment bodies, and wing walls in contact with the ground will be insulated with a coating material based on cold-applied asphalt solution (the number of layers as per the manufacturer's instructions). The rear surface of the abutment walls will also be protected.

The pavement structure on the bridge will consist of a 4 cm thick SMA (Stone Mastic Asphalt) wearing course and a 5 cm thick binder course made of hard asphalt. The sidewalks will have an epoxy-polyurethane surface with a minimum thickness of 5 mm.

The sidewalk curbs will be cast in place and feature external prefabricated cornice boards made of polymer concrete. The thickness of the curbs will be 24 cm. On the roadway side, the curbs will be bordered by stone curbstones with a cross-section of 20 × 20 cm, anchored in the curb concrete and raised 14 cm above the pavement level. The curbstone bedding will be made of low-shrinkage mortar, designed to allow water drainage to the longitudinal drainage system and weep holes (e.g., openings in the bedding). The curbs will be anchored using embedded or bonded steel anchors, ensuring the full transfer of forces from the barrier railing.

Stone curbstones, identical to those used on the structure, will be installed along the length of the wing walls, while tapering curbs will be used on the approach sections. Barrier railing anchors will be embedded within the curbs. Expansion joints will be placed in the curbs at intervals of 4.0 to 6.0 m.

The structure will feature H2 (B) barrier railings with a standardized dynamic deflection of  $D_n < 0.6$  m. The selected system will comply with PN-EN 1317 and the Regulation of the Minister of Infrastructure dated June 24, 2022, concerning technical and construction regulations for public roads (Dz.U. 2022, item 1518).

Protective barriers will also be installed on the approach sections. The effective length of these barriers will be no less than 28 meters and no shorter than the length used in crash tests for compliance with PN-EN 10088-3:2015-1 and PN-EN 1317-5+A2:2012 standards.

The backfill soil behind the abutment is planned to be permeable, non-frost-susceptible, and as homogeneous as possible. The backfill will be placed in uniform layers and carefully compacted. The compaction index must comply with applicable regulations and meet the specified requirements. Water from the foundation footings will be drained via a 3% slope of the footing.

The transition slabs will be designed as monolithic, with a thickness of 0.3 m and a length of 4 m. One edge of the slab will rest on the front wall cantilever, while the other edge will be supported by the embankment soil.

The transition slabs will have a width equal to the clear span between the abutment wing walls. The embankment slopes will be reinforced with gabion mattresses.

As a concrete corrosion protection measure, hydrophobic impregnation has been adopted as the primary surface protection method. The side surfaces of the load-bearing structure will also be hydrophobically impregnated. The sidewalk curb will be protected with a chemically cured surface layer with a minimum thickness of 5 mm. Protective barrier elements will be made of galvanized steel.

To drain rainwater from the designed structure, drainage inlets and weep holes will be installed. Water from the inlets will be directed to a  $\varnothing 200$  collector made of mineral-filled modified polypropylene elements. Water from the weep holes will be discharged into a separate  $\varnothing 50$  collector, running parallel to the inlet collector.

Drainage will be installed along the axis of the drainage system and expansion joints, as well as transversely beneath the sidewalk structure and curbs. Water from the drainage system will be discharged through corrosion-resistant, UV-resistant, and high-temperature-resistant weep pipes.

On the bridge approaches, rainwater will be drained from the roadway onto green areas and into ditches through the sidewalk structure, using linear channel drains with covers. Moreover, in this case single span construction was especially designed to enhance water flow in the river under the bridge.

## 5. IMPACT OF THE DESIGNED BRIDGE ON THE NATURAL ENVIRONMENT

The current bridge structure over the Ner River has a highly negative impact on the environment. The bridge is severely damaged and cracked, with significant corrosion due to atmospheric effects, including carbon dioxide  $\text{CO}_2$  and other chemical compounds present in the air.

Additional destructive factors include biological influences, such as the activity of microorganisms and vegetation. The accumulation of organic contaminants on the surface of the concrete structure accelerates the degradation process. The primary cause is prolonged moisture exposure, which leads to increased water retention within the structure. Furthermore, certain organisms utilize the construction materials as a nutrient source, further contributing to its deterioration.

A meaningful consequence of new construction bridge application is a change of existing construction type from two span platform into single span. A significant destructive factor affecting the structure is the formation of vortices, which cause local scouring around the pier. The pier also obstructs the free flow of water beneath the bridge, hindering the movement of aquatic organisms, such as fish. These vortices are generated due to the obstruction of water flow by the support, increasing water velocity and carrying away particles from the pier's surroundings. The removal of the in-stream pier in the Ner River will facilitate the movement of organisms.

The designed bridge, due to the applied construction technology and adopted technical solutions, will have a minimal impact on the natural environment, including surface and groundwater. The minimization of the bridge's negative effects on soil and land is primarily achieved by limiting the spread of pollutants, particularly heavy metals and petroleum-based substances. The reduction of soil contamination risks from runoff will be ensured through biological filtration in grassed areas.

The bridge in Puczniew serves as a local ecological corridor. Along the banks of the watercourse, there is a 2-3 m strip of dry land. However, the clearance under the existing structure is limited due to the central pier, discouraging most animals from using the passage beneath the road. Additionally, the gentle slope of the road embankments further reduces its accessibility for wildlife.

After the project is completed, some embankments near the bridge will be covered with stone rubble enclosed in gabions to ensure flood protection. This solution will create sheltering spaces between the stones for small animals, while over time, vegetation will naturally grow over the rock structures, further enhancing ecological integration.

The river serves as a migration route for aquatic animals, including fish, as well as for swimming and shoreline-moving species. The Ner Valley, consisting of undeveloped green areas with a predominance of unused land and meadows, acts as a corridor for insect migration.

## 6. SUMMARY AND CONCLUSIONS

Bridges are essential components of transport infrastructure, facilitating the movement of people, goods, and services. However, their construction and operation can have significant impacts on the natural environment. These

effects may include both negative consequences and potential ecological benefits. Here is an overview of the environmental impacts, including both harmful effects and possible advantages:

1. Habitat fragmentation – the construction of bridges and associated road infrastructure can lead to the division of ecosystems, restricting species migration and contributing to population isolation, thereby reducing genetic diversity.
2. Degradation of aquatic ecosystems – bridge piers alter the natural flow of water, potentially causing bank erosion and disrupting riverine ecosystems by modifying hydrodynamic conditions.
3. Environmental pollution – during bridge operation, emissions of harmful substances such as nitrogen oxides, particulate matter, and petroleum-derived compounds occur, which may infiltrate surface waters and soil.
4. Noise and vibrations – road and railway bridges generate high levels of noise and vibrations, which can adversely affect species sensitive to acoustic disturbances, particularly birds and aquatic mammals.
5. Minimization of land environment disruption – bridges facilitate crossings over rivers and valleys without the need for embankments or causeways, thereby reducing the degradation of ecologically valuable areas.
6. Reduction of pressure on other ecosystems – improving transport networks through bridge construction can reduce the necessity for alternative routes, thus limiting further urbanization of high-value natural areas.

7. Implementation of eco-friendly solutions – modern bridges, such as those presented in this study, incorporate ecological considerations, including wildlife corridors, stormwater purification systems, and technologies aimed at reducing pollutant emissions.

The application of the RHS method to assess human impact on the river valley has confirmed its effectiveness in identifying the need for renovation of existing river structures. This study has demonstrated that the RHS method accurately describes the impact of the bridge and other hydrotechnical structures on the river environment. It should be emphasized that this impact is significantly negative, highlighting the importance of designing bridges in a way that minimizes their effect on the river ecosystem.

The work attempted to prove that it is possible to design a bridge with minimal environmental impact. The findings confirm that the negative influence still existing bridge on the Ner River in Puczniew can be reduced. As previously indicated, the proposed bridge, due to the application of appropriate construction technologies, will have a limited impact on the natural environment, particularly on surface water, groundwater, and soil. It is crucial to always consider the hydromorphological characteristics of a river when designing a bridge to minimize its environmental footprint.

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## Ocena wpływu infrastruktury mostowej na środowisko rzeki Ner z wykorzystaniem metody River Habitat Survey (RHS)

**Streszczenie:** W artykule przedstawiono zastosowanie metody RHS (ang. *River Habitat Survey*) do analizy charakterystyki wybranego odcinka rzeki Ner. Wykorzystanie tej metodyki w ocenie rzek odpowiada wymaganiom Ramowej Dyrektywy Wodnej, szczególnie w zakresie definiowania warunków referencyjnych, planowania działań na poziomie zlewni, wdrażania strategii ochrony przeciwpowodziowej oraz działań renaturyzacyjnych. Stan hydromorfologiczny cieków wodnych określany jest na podstawie obecności i udziału elementów naturalnych oraz antropogenicznych, przy czym przewaga cech naturalnych świadczy o wyższym potencjale ekologicznym cieków. Z kolei dominacja struktur antropogenicznych wskazuje na istotne przekształcenia środowiska rzecznej wywołane działalnością człowieka. Niniejsza praca koncentruje się na analizie odcinka rzeki Ner, ze szczególnym uwzględnieniem oceny wpływu obiektu antropogenicznego – mostu w miejscowości Puczniew – na środowisko przyrodnicze. Wykazano, że metoda RHS umożliwia precyzyjne określenie wpływu infrastruktury mostowej na środowisko rzeki.

**Słowa kluczowe:** most, środowisko, RHS, rzeka.