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Conference  
**BYDGOSZCZ**

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**Challenges between ecology and economic use**  
**- sustainable revitalisation of canals focusing on nature**

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Challenges between ecology and economic use - sustainable revitalization of canals  
focusing on nature

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## ***Plenary Session***

### ***Part 1***

## **BYDGOSZCZ, A CITY BY THE RIVER**

*Łukasz Krupa*

Deputy Mayor of Bydgoszcz, lukasz.krupa@um.bydgoszcz.pl

Bydgoszcz is the capital and biggest city of the region, an important center of business, industry, higher education, sports and culture, located between Gdańsk and Poznań, in the border area between two historical and geographical regions, Pomerania and Kuyavia.

The city serves as a crossing of inland waterways of the west and east of Europe – including a navigable transport route known as Waterway E40 (connecting the Baltic Sea and the Black Sea) and E70, which runs from Antwerp, Belgium to Klaipeda, Lithuania!

The beautiful Brda River runs through the center of the Old Town; a little bit further we can find the historical Bydgoszcz Canal, and in the district of Fordon we can find the impressive Vistula, known as the “Queen of Polish rivers.” In addition, several smaller streams and creeks run through the city, creating a unique water atmosphere. Those who are not yet satisfied can look at this topic from a broader perspective, not only to the city, but also its environs. Along with the suburban water system, Bydgoszcz rivers and canals form the Bydgoszcz Water Junction, with the waterfront stretching for more than 100 km. To say that it is a perfect place for boating enthusiasts would be something of an understatement!

**Keywords:** Bydgoszcz, Brda River, Bydgoszcz Canal

**INLAND WATERWAYS INTERNATIONAL AND THE ANNUAL WORLD  
CANALS CONFERENCE: SHARING WATERWAY HERITAGE  
AND INNOVATION ON A GLOBAL SCALE**

*Sharon Leighton*

Inland Waterways International, USA, [President@inlandwaterwaysinternational.org](mailto:President@inlandwaterwaysinternational.org)

The significant role that waterways play in every aspect of life is undeniable. Connecting inland waterways, both old and new, can enhance regional connections, stimulate economic development, and provide numerous opportunities for healthy, sustainable communities. At international events like WCC 2024 in Bydgoszcz, IWI serves as the platform that brings together experts from around the world to share experience, expertise, and new ideas for managing, preserving, and promoting canals and inland waterways. Instead of isolated, case by case solutions, IWI creates a collaborative environment where canal and inland waterway stakeholders can share strategies for educating the public and policymakers on the role of inland waterways in achieving development objectives at every level.

**Keywords:** Inland Waterways International

## **BYDGOSZCZ CANAL - 250TH ANNIVERSARY OF ITS CONSTRUCTION**

*Tomasz Izajasz*

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The Bydgoszcz Canal is a unique monument of hydrotechnical idea. Launched in 1774, it was an extremely long-awaited investment of the then Prussian king, Frederick II, on whose orders its construction began in the spring of 1773. Over the 250 years of its existence, it has been modernized many times and its role has also changed. The original purpose changed over time, due to, among other things, neglect on this waterway. Today, this artery, which was once an important link in water transport, does not play any role in transport, but its old section in particular is slowly becoming a tourist destination, a place for meetings, recreation and relaxation. This purpose refers in particular to the function that the Bydgoszcz Canal served before World War II.

**Keywords:** Bydgoszcz Canal history, Bydgoszcz Canal

## **CELEBRATING CROSS-BORDER HISTORY**

*Hartmut Ginnow-Merkert*

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Poland and Germany not only share an often complicated and painful history. They also share a historic waterway whose economic and, above all, tourist potential is not even close to being exhausted.

Both the Bydgoszcz Canal and the Finow Canal emerged more than 250 years ago from the desire for a navigable waterway between the cities of Berlin and Bydgoszcz, the core of today's International Waterway E70. This was the subject of a joint EU project in 2017/18, the aim of which was to explore the opportunities and requirements for international boat tourism. This presentation shows where the project ended and what remains to be done.

**Keywords:** tourism, History, opportunities

## **PROMOTING SUSTAINABLE DEVELOPMENT AMONG CANAL CITIES**

*Huijun Wang*

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World Historic and Cultural Canal Cities Cooperation Organization (WCCO), ([www.Wcco.org.cn](http://www.Wcco.org.cn)) was registered at the Ministry of Civil Affairs of China in Sep. 2009, with secretariat located in Yangzhou, Jiangsu Province, China.

Taking Grand Canal as a link, WCCO exerts her efforts in establishing a bridge for communication and cooperation among the world's canal cities through promoting economic and cultural communication, sharing development experience and facilitating mutual beneficial cooperation. Since her establishment, WCCO has consecutively held 16 sessions of the World Canal Cities Forum, with special emphasis on promoting the protection and utilization of the World Canal City Cultural Heritage and intangible cultural heritage.

In order to promote the sustainable development of the Canal City, WCCO and the United Nations Development Programme (UNDP) worked together and established the world's first Index System for Canal City Sustainable Development, as well as completing the Canal City Implementing the United Nations 2030 Sustainable Development Agenda - Yangzhou Sustainable Development Report”.

WCCO attaches great importance to the emotional connection between the world's teenagers and canals, and believes that only when they love canals and the protection and development of canal heritage, can the world's canals and canal cities have a better future and sustainable development.

WCCO attaches great importance to the construction of media platforms, and specially built her own Canal News Agency - Grand Canal Media. Our goal is to become a professional media for world canal news reporting, and an international media to tell the Chinese story to the world and let the world canal known to the world.

**Keywords:** Canal-Newsagency, sustainable, linking



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## ***Plenary Session***

### ***Part 2***

**PLANS FOR THE DEVELOPMENT OF INLAND WATERWAYS  
IN POLAND IN THE CONTEXT OF NATIONAL MASTERPLAN  
OF INLAND NAVIGATION BY 2030**

*Monika Niemiec-Butryn*

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The aim of the speech is to present issues related to the development of inland navigation and inland waterways in Poland until 2030. The basis for the discussion on plans for inland navigation will be the National Masterplan of Inland Navigation by 2030 (NMIN2030), the main planning document for this sector. It diagnoses the current state of inland navigation, indicates its most important problems and outlines a possible scenario that will enable the development of inland water transport. The main goal of the document is to increase the role of the inland navigation sector at national and local levels.

The first part of the report will present the plans of the Ministry of Infrastructure related to the development of inland waterways and the potential of the industry. It should be emphasized that the activities of the Ministry of Infrastructure do not focus only on investments in hydrotechnical structures. For the development of this branch of transport, it is also extremely important to ensure the smooth functioning of the entire area and to maintain and increase the market competitiveness of its participants. Therefore, the actions specified in NMIN2030 concern both horizontal and strictly investment issues.

The diagnosis of the state of the sector and the scope of intervention indicated in NMIN2030 will be briefly discussed. The most important activities and milestones necessary to be achieved before 2030 will be presented. We will also present planned investments on inland waterways used for transport and issues regarding their financing.

The next part of the speech will concern activities currently implemented by the inland navigation administration aimed at supporting inland navigation and the implementation of the strategic document - NMIN2030. Selected examples of activities and the current effects of the work of the Ministry of Infrastructure will be discussed.

The last part of the speech will focus on the activities carried out since the beginning of the second quarter of this year aimed at updating the NMIN2030 assumptions, including public pre-consultations completed in May 2024. In this context, possible future scenarios will be discussed.

**Keywords:** inland waterways development

## **IMPROVING ACCESS TO NEW YORK'S CANALS FOR HUMAN- POWERED WATERCRAFT**

*Duncan Hay*

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New York's 843 km (534 mile) Canal System is experiencing a dramatic growth in use by human-powered watercraft including canoes, kayaks, stand-up paddleboards (SUPS), and rowing craft. About 80% of Upstate New York's population lives within 40km (25 miles) of a navigable waterway. The four branches of the Canal System run through the region's largest cities and many small villages with long stretches of agricultural and forested lands in-between. Most people use the canals for day trips, launching and returning to the same location. Others launch at one site and take-out downstream, sometimes camping overnight along the way. A few adventurous individuals paddle the 563 km (350 mile) Erie Canal end-to-end and some of those continue another 250 km (155 miles) to New York City on the tidal Hudson River.

Some communities have installed racks and lockers where paddlers can secure their boats and gear while they visit town. One business established self-service rental kiosks where people can reserve and pay for a kayak online, pick it up at one location and return it at another.

Canal recreation by boat or on the trail alongside is appealing to people with a wide range of physical abilities and disabilities. Rental companies now stock adaptive paddlecraft and cycles to meet that demand.

Canals and other engineered waterways pose access challenges. Tall vertical concrete walls at locks and in village centers make it difficult for small boat users to launch, retrieve, board, and exit their craft. Yet those walls need to be kept clear for large commercial and canal maintenance vessels and motor yachts that use the system to travel between the Atlantic and Great Lakes. Fluctuating water levels, swift currents, ice, and floating debris take a toll on launch facilities in canalized river segments while land-cut segments are drained during the winter.

In 2021 Erie Canalway National Heritage Corridor, the New York State Canal Corporation, and the National Park Service's Rivers, Trails & Conservation Assistance Program worked with paddlers, representatives of the disability community and equipment manufacturers to develop guidelines for construction and improvement of hand-launch facilities tailored to the special conditions on New York's Canal System. The publication is available for free download and provides recommendations and examples for launches that are safe, durable, low-maintenance, cost-effective, and accessible to wheelchair users and others with a wide range of physical abilities. Several new launches have been built and some of the existing 66 hand-launch sites on the system have been significantly upgraded based on those guidelines.

**Keywords:** Access, paddler, watercraft

**CONSTRUCTION AND RECONSTRUCTION OF STORM SEWAGE  
SYSTEMS AND ADAPTATION OF THE STORM SEWAGE SYSTEM  
TO CLIMAT CHANGES IN THE CITY OF BYDGOSZCZ**

*Stanisław Drzewiecki*

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The Bydgoszcz way to create a sponge city started many years ago. The first milestones were well-thought-out investments focused on reorganization of the entire water and sewage system in the city. Activities undertaken in the early 2000s were complex in their nature, originating the later projects aimed at modernization of the system for conveying, retention and management of rainwater in Bydgoszcz and adjustment of the rainwater management system in the city to climate change. It also involved tremendous engineering effort related to analyses of complex data sets concerning precipitation over the past five decades, development of precipitation models, flood simulations, and creation of a project cofinanced from EU funds entitled “Construction and reconstruction of stormwater drainage and its adjustment to climate change in the City of Bydgoszcz.” What distinguishes our project? First of all, it is an innovative and comprehensive approach to the rainwater problem throughout the city. It comprises 108 tasks, which included construction of 34 tight retention tanks, 5 of which with watering function, 3 infiltration tanks, and 1 open tank. In addition, 6 existing ponds were adjusted to effectively handle excess rainfall from sewers. These projects are under constant surveillance, and the first results have already been noticed.

The Bydgoszcz way is a transition from a system based almost exclusively on conveyance of rainwater via drains to rivers to a sustainable system based on rainwater retention and recycling, monitoring and intelligent system control.

**Keywords:** a sponge city, stormwater drainage, rainwater retention

## UNLEASHING THE TRANSFORMATION OF NET ZERO COMMUNITIES IN CANAL CITIES

*Shi Wang*

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Wang Shi initiated the global canal rowing as a major campaign for zero carbon and clean water, involving over 10,000 people worldwide, particularly youth engagement, at the communities of canal cities around the globe. IWI has been a strong partner in this campaign and brought the voice of canal waterway to the table of United Nations, jointly staging major discussions of global canal cities and climate actions at COP (COP26, COP27, COP28).

Communities are the forefront of the climate crisis and its solutions. This is particularly true for many canal cities which are experiencing real devastating impacts from climate change. Wang Shi has been leading the pilot projects in Chinese canal cities on net zero communities, focusing on four dimensions: renewable energy, waste recycling, building efficiency and lifestyle. Biosphere 3 projects in Shenzhen stand as an iconic example of his leadership, catalyzing technology innovation, green finance, and economic models to empower community decarbonization at the local level. Biosphere 3 has created a global coalition of net zero communities that brings together Dubai, Abu Dhabi, London but also underdeveloped regions in Southeast Asia, to pursue environmental sustainability and local socio-economic resilience.

A new perspective on ESG of private sector companies has been introduced to make the business case for the transformation of canal city communities. For example, we initiated a working grouping of corporate leaders and practitioners from DuPont, Nestle, Swarovski to promote waste recycling and public engagement at the community level. These companies also became partners to WWF's global program on clean water and wetland conservation system- which contributed to transformation of eco-systems of inland rivers in China but also Mekong River communities in Laos, Cambodia and Vietnam. Wang Shi would like to share the thought leadership and best practices from these visionary private sector leaders and seek to construct a holistic approach to unravel the challenges and opportunities in canal cities.

**Keywords:** Net zero communities, Climate actions, Canal cities

## **IMPLEMENTATION OF THE RIS SYSTEM IN POLAND**

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This presentation focuses on the implementation of the River Information Services (RIS) in Poland, in compliance with the requirements of the European Parliament Directive 2005/44/EC. The discussion provides a detailed account of the development and implementation of RIS, exemplified by the Lower Oder River, beginning with the pilot project initiated in 2011, leading to a more extensive future system expansion. The presentation addresses various functional aspects of RIS such as navigation safety, traffic optimization, river infrastructure management, as well as coordination of rescue operations and statistical data management. A broad range of benefits that the system provides to society, operators, and water administration is also highlighted, including improved safety, transport efficiency, and intermodal transport cooperation. Finally, the role of RIS in reducing operational costs and enhancing the competitiveness of inland navigation compared to other transport modes is emphasized.

**Keywords:** Inland Navigation, Infrastructure Management, River Information Services (RIS)

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***General Session 1***

## WHY LOWER VISTULA RIVER IS SO DIFFICULT FOR NAVIGATION

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Lower Vistula was regulated during the Prussia time at the end of XIX c. using the contemporary civil engineers knowledge gained on Rhine and Elbe rivers. Regulation works did not take in to account the nature of the river with a large variability of flow and high sediment transport. The river channel was straightened and narrowed making a thalweg of the river very unstable. The aim of regulation was not completed, navigation conditions on the Lower Vistula river during the low flow are very difficult. Sentinel 2 satellite images can be used to study the dynamics of the sandbars movement and may be useful as a navigation aid.

**Keywords:** Lower Vistula, Sentinel satellite images



## **WHY THE NEW SEINE-NORD EUROPE CANAL IS A GOOD CHOICE FOR THE ENVIRONMENT**

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Europe's first major new canal since the Main-Danube Canal was opened in 1992 is now under construction, and should be opened by 2030, subject to meeting a few conditions to obtain authorisation by the French Government's Environmental Council. This body gave the green light for the first section, from Compiègne on the Oise to Noyon, 19 km and one new lock. It has recently recommended approval of the other three sections, including 5 more locks with water-saving basins, and a 1300m long aqueduct crossing the valley of the river Somme.

The author has been collaborating with Voies Navigables de France and the Société du Canal Seine-Nord Europe in various ways for many years, as consultant and cartographer, and IWI itself campaigned for the new canal by writing to the then French Minister of Transport Dominique Bussereau in 2003.

The paper focuses on the detailed design of the works throughout the canal, and on the engineering solutions adopted to make it work for the environment, including biodiversity throughout the 107km corridor. Particular attention is paid to the canal's water consumption, which is designed to be resilient to climate change.

Useful lessons can be learned from the way the canal's owner – the Hauts-de-France region – and builder (SCSNE) are defending the canal's contributions to the regional economy and employment. Opposition to the project continues to be expressed, by France's Green Party in particular. The Greens are joined by various other movements that are opposed to the model of economic development based on massification of transport flows, for which inland water transport is ideally suited.

Tourism is an added benefit of the new infrastructure, and the paper examines the components of the overall project that will improve the region's offer in waterway tourism, alongside its prime function of transporting freight.

**Keywords:** environment, new canals, transport

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***Man and human activities***

***part 1***

## **SOCIAL ASPECTS OF HYDROTECHNICAL INVESTMENTS IN RURAL AND URBAN AREAS**

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The implementation and management of facilities of a strategic nature, including but not limited to hydraulic structures, should be carried out taking into account the opinions of local communities. These opinions result from social attitudes defined as an expression of a person's cognitive-emotional state associated with a certain propensity to act. The aim of this study was to investigate social attitudes towards historical and contemporary hydraulic structures located in both urban and rural areas. Qualitative social research methods and field methods were used to achieve the set objectives. The degree of involvement and participation of local communities in spatial management was analysed, as well as the social attitudes of the population living in areas adjacent to hydraulic facilities. The research showed that involving the local community in decision-making processes influences their attitudes.

**Keywords:** social participation, hydrotechnical investments

## **RESTRICTION OF USE IN THE PROTECTED LANDSCAPE AREA ON THE ŁYNA RIVER AND THE EXERCISE OF OWNERSHIP**

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In Poland, the Nature Protection Act of 2004 establishes 10 forms of nature protection, including protected landscape areas, which results in restrictions on the use of these areas and, consequently, on the exercise of ownership. According to Article 24 of this Act, it is prohibited to construct new buildings within a 100-meter-wide strip from the shorelines of rivers, lakes, and other natural bodies of water. Protected landscape areas often occur on private land, and these areas interact with each other. This study highlights this mutual relationship – the presence of protected landscape areas on real estate contributes to the restriction of the exercise of ownership rights, but it is the exercise of ownership rights that can affect the natural elements that are the subject of their protection.

The research was carried out on the example of the Middle Łyna River Valley protected landscape area, located in the Warmian-Masurian Voivodeship, with an area of approximately 15,164.74 hectares. The studied area is mainly non-urbanized (except for the areas of two cities - Olsztyn and Dobre Miasto), and mostly forested. The part of the course of the Łyna River located in the Middle Łyna River Valley protected landscape area is roughly 52.48 kilometers or nearly 20% of the entire course of the river. The Łyna River in the protected landscape area covers approximately 167.76 hectares just over 1%. In the protected landscape area, it is not possible to build new structures within 100 meters of the shoreline of the river. However, a number of buildings in the study area were found to be located closer (due to exemptions or other special regulations), i.e. not following the regulations of the Nature Protection Act – the research revealed 2,141 land parcels within 100 meters of the shores of the Łyna River, as well as 798 buildings. 210 of these buildings are also within the range of the Middle Łyna Valley protected landscape area.

The inability to develop buildings within 100 meters of the shoreline of the water bodies may be negative for the property owner. On the other hand, the lack of such development will contribute to the protection of natural elements (species and habitats) located in the area. Therefore, it is important to find the balance between protecting nature and protecting the owner's rights to use his property.

**Keywords:** protected landscape area, property owner, river

**FORMER PLANS AND FUTURE PROSPECTS  
FOR THE DEVELOPMENT OF INLAND WATERWAYS IN BYDGOSZCZ,  
POLAND**

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Built in the 18th century, the Bydgoszcz Canal made a significant economic impact by connecting Vistula and Odra watersheds, enabling a large-scale transport of goods between eastern and western parts of Central Europe. It also influenced Bydgoszcz economic and spatial growth.

Despite several upgrades, including construction of the New Bydgoszcz Canal section, its capacity became insufficient at the beginning of the 20th century. As it cannot be upgraded due to its route through the city center, plans were made to build a Bydgoszcz Bypass Canal through the city's outskirts. Those plans from the 1940s, 70s, and 80s haven't been fulfilled, and in the 1990s inland navigation decline in Poland made them obsolete. Now, the ratification of the AGN Agreement makes question of upgrading the Vistula-Odra waterway, as part of the International Waterway E70, relevant again, but former plans need to be reevaluated, due to rapid urbanization. At the same time as the debate on the Bypass Canal went on, Bydgoszcz went through the phase of neglecting waterfronts, which is a common experience for many cities. As a result, in the 1960s a part of the Old Bydgoszcz Canal has been infilled to make room for the arterial road. Now, due to increased demand for livable and resilient cities, especially in the face of climate change, many urban waterways are being restored, which brings a question, is the same possible in case of the Bydgoszcz Canal? This presentation is a synthesis of the author's research on possible solutions for both: the Bypass Canal and Old Bydgoszcz Canal reconstruction. Research methods included archival query, field works, analysis of the environmental, spatial, and legal conditions, and social research in a form of public survey and interviews. Results of these analyses, combined with a review of case studies of similar projects, allowed to prepare conceptual designs, that showcase a possibility for both investments.

**Keywords:** inland navigation, Bydgoszcz Canal, waterway restoration

## CHANGES IN THE HYDROGRAPHIC NETWORK OF THE DOLNA NOTEĆ RIVER OVER THE LAST 200 YEARS

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Transformations of the hydrographic network occur as a result of the interaction of natural and anthropogenic processes. For centuries, man has adapted the natural environment to his needs. Water was the greatest asset and obstacle to economic development in lowland areas. Rivers were one of the factors in the development of society and the economy. However, extensive wetlands hindered the development of the settlement and communication network and agriculture. Currently, it is difficult to find hydrographic networks in which humans have not interfered. The Noteć Valley is mentioned among the areas with the greatest degree of transformation of water conditions.

Both the riverbed and its valley were subjected to intensive hydrotechnical works. The aim of the research was to determine the degree of transformation of the hydrographic network as a result of human activity.

The Noteć, the longest tributary of the Warta River, is a lowland river with a length of 388 km and a catchment area of 17,300 km<sup>2</sup>. The analyses carried out focus on its lower section, running through the wide Toruń-Eberswald ice-marginal valley. The total length of the research area is 187 km, from the connection with the Bydgoszcz Canal in Nakło nad Notecią to the mouth in Santok.

The slight slope of both the river and its valley, numerous oxbow lakes, and a network of water mills favored water retention. There are 14 barrages in the analyzed section, the functioning of which affects not only the course of the river itself but also the stabilization of water levels.

The basis for analyzing changes in the hydrographic network were archival cartographic materials: Schroetter maps from the turn of the 18th and 19th centuries, Mestischblatt maps from the turn of the 19th and 20th centuries, and the contemporary Map of the hydrographic division of Poland. Calculations were made using QGIS software ver. 3.22, rectifying the source materials to the PUWG 1992 metric system, digitizing the hydrographic network, and performing basic spatial analyses using vector processing algorithms.

The analyses carried out indicate high dynamics of changes in the hydrographic network in the Dolna Noteć catchment. The determined values of the river development coefficient and its sinuosity indicated significant interference in the fluvial system. The transformations resulted mainly from two goals: agricultural development of the valley and the navigability of the river. The idea of building a network of drainage canals was to drain the swampy valley and transform it into pastures. However, regulatory works on the river were aimed at enabling freight transport from the Vistula waterway westwards to Szczecin and Berlin, thanks to the functioning Bydgoszcz Canal (1773-1774).

**Keywords:** hydrographic network, Noteć river

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## ***Water, Heritage and Tourism***

### ***part 1***

**THE VOICE OF CULTURAL INSTITUTIONS IN THE DISCOURSE  
ON THE CITY-FORMING ROLE OF RIVERS**

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In the presentation authors explore the pivotal role of cultural institutions in shaping the modern discourse surrounding the city-forming role of rivers. Anchored in the context of current practices, United Nations 2030 Agenda or the Brisbane Declaration, we delve into how cultural institutions may function as translators and interpreters, elucidating the intricate relationships between humans and rivers. Drawing on examples from global and Poland-based practices, the authors analyze the diverse strategies. Examining the influence of cultural institutions across education, curating art, interpretations of heritage, discussion on sustainability, popularization of scientific and ecological knowledge, and the social and solution spheres, this study elucidates the nuanced ways in which culture may contribute to the holistic understanding of rivers as dynamic elements within urban landscapes, fostering heightened awareness and societal engagement with the critical issues at the intersection of urban development. Through a comprehensive analysis, the study aims to unveil the multifaceted impact of cultural institutions on fostering a sustainable and symbiotic coexistence between cities and rivers.

**Keywords:** Rivers, Cultural institutions, Heritage



## CURRENT CONDITION OF PISZ - WARSAW WATERWAY

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The paper describes the field studies that were performed by the researchers of the Department of Water and Hydro Engineering in 2018. The study considered the waterway between Warsaw and Pisz (located in the Masurian Lakes District). The waterway itself has very high touristic potential as it connects the capital of Poland with the largest lake district of the country. The main aim of the study was to assess the current state of the waterway.

The Pisz - Warsaw waterway connects the complex of the Great Masurian Lakes with the reach of Vistula River. Water bodies composing the waterway are Pisa River, Narew River, Zegrze Reservoir and Żerański Canal. According to archival relations the waterway is not popular, with wild character and with low accessibility of sailing infrastructure.

The main goal of the conducted field study was to assess the current state of the waterway by measuring the depth of the waterway. It was organized in September and October 2018, downstream the waterway – from Pisz to Warsaw. Bathymetric measurements were conducted with the use of Raytheon DE-719 echosounder correlated with Trimble GeoXT Series 2005 GPS receiver. The study was performed during flows that did not exceed the level of mean low water. The depth measurements were conducted every 0,5 m along the way. This resulted in about 530 000 points containing the information about location and depth.

Basing on the results of the bathymetric measurements and the observations made during the field study it can be stated that the Pisz-Warsaw waterway is navigable. Although the study was performed in difficult conditions of very low flows. It must be underlined that the study was performed downstream the waterway, in the typical direction at this time of the year. The reverse direction of the trip would not be possible, as it would demand deeper draught of the boat. To fully assess the navigability of the Pisa and Narew waterway from Pisz to Warsaw, it is necessary to perform analogous study in the spring and summer period. This corresponds to the period of intensified tourist traffic associated with the beginning of the sailing season and the transport of vessels to the routes of the Great Masurian Lakes.

The assessment of the current condition of the Pisz - Warsaw waterway shows that it is not the depth of the shipping route that is the cause of the decline in tourist traffic, but rather the lack of broadly understood touristic infrastructure. The basic condition for the resumption of sailing and motorboat traffic is the creation of marinas located approximately every 40 km, equipped with all the necessary amenities.

**Keywords:** bathymetric measurements, Masurian Lakes District

**HISTORY OF THE BYDGOSZCZ CANAL IN THE CONTEXT  
OF SOURCES FROM THE THE SECRET STATE ARCHIVES PRUSSIAN  
CULTURAL HERITAGE IN BERLIN-DAHLEM (GEHEIMES  
STAATSARCHIV PREUßISCHER KULTURBESITZ IN BERLIN-  
DAHLEM)**

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Constructed between 1773 and 1774, the Bydgoszcz Canal (26,077 km long, originally with 10 wooden locks) connected the Vistula and Oder rivers through their tributaries: the Brda, Noteć and Warta. It is the oldest still functioning inland waterway in Poland, and it forms part of the E70 International Waterway. The creation of the Bydgoszcz Canal contributed to the dynamic development of the city as a thriving industrial and commercial centre. Between 1908 and 1915, the so-called New Canal was built, including the unique locks of Czyżkówko and Okole. In 1920, the Bydgoszcz Canal and the City of Bydgoszcz (also known as 'the City on the Brda River') returned to the independent state of Poland. The Bydgoszcz Canal is now 24,7 km long and has 6 operational locks. In 2024, we are celebrating the 250th anniversary of the construction and inauguration of the Bydgoszcz Canal. To mark this anniversary, the author of this paper, as employee of the Sebastian Malinowski Museum of the Bydgoszcz Canal, is preparing a publication on the history and role of this unique 18th century hydrotechnical monument.

Between the months of March and April 2024, archive and library searches have been carried out. This has been accomplished by the compiling and interpretation of many new unknown documents and sources from the Geheimes Staatsarchiv Preußischer Kulturbesitz (The Secret State Archives Prussian Cultural Heritage) in Berlin.

The Berlin archives hold valuable sources, which are key to research and activities focused around the history and role of the Bydgoszcz Canal over the past few centuries. The opportunity to carry out research in Germany provides with access to many unique and, until now, largely unknown sources and it provides with a chance to explore important cartographic collections.

The Prussian Secret State Archives contain some important sources and files, especially those covering years 1772 to 1806, and 1815 to 1920 (known as "the Prussian period" in the history of Bydgoszcz). These include construction documents, information regarding the rebuilding and maintenance of the locks on the Bydgoszcz Canal, statistical data and correspondence between the Ministry of Public Works and the various City authorities. Additionally, the files from Prussia's General Directorate and the Department of Water Management, as well as extensive cartographic collections, are of significance.

The results of the archival and library searches and a discussion of the files and sources from the Geheimes Staatsarchiv Preußischer Kulturbesitz, will be presented by the speaker at the World Canals Conference 2024.

**Keywords:** sources, Bydgoszcz Canal, Prussian Secret State Archives

## **THE IMPACT OF HYDROLOGICAL CONDITIONS ON THE FUNCTIONING OF INLAND NAVIGATION IN POLAND**

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The importance of waterways and inland transport in the world has changed over the centuries along with the socio-economic development of regions. Rapid industrialization and development of other types of transport, including: road, rail or air have made inland waterway transport less important. Poland has a convenient hydrographic network system used by inland waterways. Despite this, in recent years a marginal share of cargo transport in Poland's water transport has been observed. The decline in the share of inland navigation is the result of many factors, but the most important are natural conditions resulting from changing climatic conditions, which lead to low water levels. This study analyzes the impact of water levels in rivers that are part of international waterways. The study area covers the lower section of the Vistula from Włocławek to the mouth of the sea, together with the estuary section of the Brda River and the branches of the Vistula (Nogat, Szkarpa, Martwa Wisła). Daily values of water levels at hydrological stations were analyzed based on the Threshold Level Methods (TLS), i.e. cutting off hydrographs below characteristic levels, i.e. mean low water (SNW), high low water (WNW), mean medium water (SSW) and mean high water (SWW). The obtained results allowed us to determine the time during the year that navigation on the Vistula was impossible or difficult due to unfavorable hydrological conditions. The study showed that inland navigation is characterized by significant seasonality, the largest share of vessels passing locks took place in the summer months (from June to August). In the months from November to March, inland navigation is usually impossible due to ice phenomena. An analysis of the type of vessels passing through the locks indicates an advantage of tourist vessels (sports, recreational, kayaks) over cargo vessels (barges, pushers, tugs). This is especially visible at locks located close to city centers (Miejska Lock in Bydgoszcz, Przegalina Południowa Lock in Gdańsk). Freight traffic, in turn, depends on water levels in the river. At water levels below average low, the number of cargo units passing through the locks is small. Restrictions on the navigation of cargo vessels result mainly from too small depths of the waterway. The duration of low water levels is much longer and in extremely dry years with little precipitations, it can last up to several months. Restrictions on navigation during high water levels result mainly from the occurrence of navigational obstacles in the form of bridges and power lines, which are characterized by very diverse technical parameters. Increasing the share of inland navigation in transport in the future requires ensuring appropriate transit depths of the waterway, especially for freight transport.

**Keywords:** water level, inland navigation, freight and tourist traffic

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## ***Ecology and Technologies***

### ***part 1***

## **SUSTAINABLE STRUCTURAL SOLUTIONS OF BOSPHORUS BRIDGES**

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Bosphorus bridges, situated in Turkey are structures which ensures transportation benefits, economic development and exchange of humanity culture. Asia and Europe that have different cultures, technologies and industrial products are connected by Bosphorus bridges, demonstrates a significant role on development of civilization. Bosphorus can be intended as fabulous nature and human creation thanks to mix of green colour of forests and blue colour of sea and historical artistic structures such as mosques, mansions and palaces. Particularly, Bosphorus bridges expose significant feature on reduce on transportation cost by providing shorter route for highway transportation and based on this benefit, occurs decreasing of CO<sub>2</sub> emission. Sustainability materials such as are popular application against to environmental pollution, climate change and economic circle. These materials can be exemplified as waste materials, steel, precast concrete, glass and aluminium etc. Another topic that should be exhibited importance for mega structures are sustainable revitalization method which leads on optimization of social, economic and environmental benefits of Land Revitalization Process. Hence, Bosphorus bridges may be presented as representative of sustainable revitalized structure due to have been constructed by sustainable materials and not harming nature, historical artistic structures during the period of construction, besides by ensuring excellent economic and social impacts.

**Keywords:** Bosphorus Bridges, Sustainable structural solutions, sustainable revitalisation

**DEVELOPMENT OF INNOVATIVE TECHNOLOGIES  
FOR HOUSEBOATS WITH INCREASED ENERGY AND LIVING  
AUTONOMY**

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Houses on the water (so-called houseboats) are becoming more and more popular. Most often, a facility of this type can function like a typical house but requires appropriately adapted infrastructure: a developed waterfront with connections to the water and sewage system and the electricity network. Currently, these are not only original, but also functional, even mobile residential buildings that use renewable energy sources (RES) installations to increase energy efficiency - even the energy and living autonomy of such units. Additionally, such facilities are equipped with systems ensuring living independence in the form of sewage and water treatment systems.

Until recently, houses on the water existed mainly in Western Europe, especially in the Netherlands, which is rich in canals and is considered their homeland. We have also been seeing them in Poland for several years, thanks to increasingly better infrastructure and domestic companies that build such facilities and implement original, original solutions in the field of material and construction technologies as well as energy and living systems. Increasingly, investors and manufacturers of such systems are beginning to analyze the construction of not only individual houses, but also facilities such as restaurants, hotels or even entire housing estates.

The article analyzes the development trends in technologies used to increase energy and living autonomy in house systems on water. They were assessed due to their technical maturity and economic profitability. Selected good practices in this area and own research analyzes on a selected experimental facility were presented.

Another important issue is energy self-sufficient houses - this direction in construction is associated not only with the desire to reduce operating costs, but also with the use of renewable energy sources and contribution to sustainable development. That is why the structures and technical solutions of houses on the water are evolving towards objects with increasingly higher parameters in terms of energy and living autonomy. This is due to the fact that functioning on water opens up a number of possibilities in the field of energy production from renewable energy sources (kinetic energy of water flow, wind energy, thermal energy of water, thermal energy of air). The conditions for the development of such residential systems will be dynamically ensured developing technologies in the field of renewable energy and storage of electricity and heat energy in the short and long term: lithium-ion electric energy storages, day-night heat storage, seasonal heat

energy storage. They are becoming an important element of a favorable energy balance heat recovery technologies from sewage are becoming more and more common. However, this requires accurate cost-effectiveness calculations. An important aspect of using a house on the water is the use of an advanced management system for such a facility, in terms of functionality and energy - these systems increasingly include artificial intelligence and machine learning systems.

The analyzes presented in the article use the research results obtained under research projects POIR.01.01.01-00-1174/18: HOUSEBOAT with electric drive and renewable energy system and POIR.01.01.01-00-1063/21: Ecological house on the water, which was implemented by LaMare sp. z o.o.

**Keywords:** houseboat, renewable energy sources, energy efficiency

## **USING OPERATIONAL CHANGES AT HISTORIC INFRASTRUCTURE TO MITIGATE THE SPREAD OF INVASIVE SPECIES**

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Aquatic Invasive Species (AIS) present a unique challenge for historic inland waterways. Canals that were originally built to promote commerce across geological barriers and multiple disconnected watersheds are now a vulnerable pathway for the spread of AIS. When faced with the threat of a new species, structural modifications to historic structures can take many years of planning and regulatory approvals before they are implemented. Effective short-term operational measures can help slow or prevent the spread of AIS while larger and more permanent solutions are developed. Operational measures also allow for greater flexibility in their modification and implementation as conditions change or as new data are developed.

Round goby (*Neogobius melanostomus*) is a current species of concern to Lake Champlain in New York and Quebec, Canada. Round goby are currently present in the Hudson River south of Lake Champlain, where the historic Champlain Canal provides a potential pathway for the goby to migrate into Lake Champlain. The New York State Canal Corporation and its partners have implemented a Rapid Response Plan for the round goby that includes operational changes at the navigation locks to prevent or deter the continued migration of round goby into Lake Champlain. These operational changes include adjustments to the procedure for vessels to use the locks, adjustments to the seasonal removal of a tainter gate dam at the facility, and a change from “on-demand” to scheduled lock operations to control the number of lock operations each day. These changes have been in effect for two navigation seasons, with additional studies and research ongoing. The operational changes were originally designed to address known biological characteristics of the round goby, such as maximum swimming velocity, endurance, and seasonal movement patterns. Additional ongoing research includes monitoring the effectiveness of the operational controls with biological sampling as well as developing potential piscicide treatments for small pioneer populations that are able to enter the canal locks.

**Keywords:** Infrstructure, Operations, Invasive



## **DISTRIBUTION OF LNG AS A WATER TRANSPORT FUEL ON SEA AND INLAND WATERWAYS**

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Due to the developing maritime transport in the world, which contributes to the intensive increase in environmental pollution, legal standards have been developed to improve its quality. In this work, a universal model for the distribution of LNG as a marine fuel will be proposed.

Based on the analysis of data from the IALA IWRAP Mk2 system and the Central Statistical Office in Szczecin, the LNG fleet and:

- the intensity of ship traffic was analyzed in terms of their size and technical parameters;
- maritime transport demand for LNG was determined;
- the distribution volume of LNG as a marine fuel for various sizes of ships was developed;
- the fuel demand for ships entering Polish ports, which can use liquefied natural gas as a propulsion system, was calculated;
- the size of LNG distribution ranges in seaports was examined;
- ports have been identified that will be able to cover the demand for LNG for units arriving at these ports and for units moving on the main shipping routes in their vicinity.

Five ports were identified for which a model was developed in which the genetic algorithm used, based on the capacity of LNG-fueled units and their distance from the port, determines solutions with the shortest service time of these units and generates solutions characterized by the lowest cost of LNG bunkering operations and presents charts regarding:

- number of LNG bunkers used;
- number of LNG-powered units serviced;
- the volume of demand for LNG as a marine fuel;
- service time;
- the route covered by the LNG bunker.

Conducting simulations based on the built LNG distribution model as a marine fuel was possible by implementing it using the Matlab R2019a program.

A method has been developed to optimize the distribution of LNG as a marine fuel in terms of the costs associated with LNG distribution. LNG storage facilities were located in such a way that the fleet of LNG bunkers, covering the shortest route, could cover the demand for LNG in a given water area in the shortest possible time.

**Keywords:** distribution of LNG, liquefied natural gas

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***Man and human activities***

***part 2***

## **URBANIZATION AND FLOODING EVENTS, A BIUNIVOCAL RELATION? THE SEVESO RIVER CASE STUDY (N-ITALY)**

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Seveso River is one of the three main rivers inflowing the city of Milan, Lombardy region, Northern-Italy. His original watercourse was deeply modified since Roman times and nowadays the river has a torrential character. In particular, 114 flooding events were recorded from 1976 up to 2020 with considerable damages and inconveniences for residents in the Milan city (PGRA, 2020). The last flooding event was recorded on 31 October 2023 after 36 mm h<sup>-1</sup> precipitation. Significant impact was observed in the northern part of the Milan causing problems to urban roads and metro.

From here the aim of this study is to: i) assess the geomorphological changes of the Seveso River watercourse through a dedicated multi-temporal historical and GIS analysis, ii) correlate the flooding events with the surface sealing and the human impact, iii) assess the river disturbance as well as the hydrological alteration of one of the most human-influenced river system, and iv) evaluate the percentage of the population potentially subject to Seveso's flooding.

The Seveso River's evolution was studied using GIS analysis, encompassing historical maps from the 6th-3rd centuries BC, up to modern cartographic representation through data available from (Geoportal of Lombardia) and 'Istituto Nazionale di Statistica' (ISTAT, 2023). The results highlight differences in the riverbed's position and changes in the river's geomorphology. Moreover, from the land use (LU) data analysis (1954-2021) is clear that the LU was significantly changed in the area passing from natural to anthropic conditions.

By employing the RHS Toolbox 1.5 (River Habitat Survey) methodology (EA, 2003), a field survey covering a 500-meter stretch of the Seveso River was conducted near Milan city on December 15, 2023. The results indicate a poor ecological status (WFD score 3) and a high level of anthropogenic modification in the researched area (HMS class 5).

To determine changes in the hydrological regime of the Seveso River the Indicators of Hydrologic Alteration (IHA) method was proposed by Richter et al. (1996). IHA results showed that in the longitudinal profile of Seveso defining a great influence of human activities in the river regime transformation, which give a direct impact on channel processes.

In addition using freely available data on population and risk areas acquired directly from the ISTAT, the 'Piano Gestione Rischio Alluvioni', as well as the Municipality of Milan, it was possible to determine that 11% of the Milan-based population resides in an area classified as at hydrogeological risk from flooding of the Seveso River.

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In conclusion, the increase of urbanization with the consequent deep alteration of the hydrological condition of the river is combined nowadays with more frequent extreme rainfall events able to cause serious flooding problems in the city of Milan. However, a system of large lamination tanks, dedicated to containing millions of cubic meters of flood water to be released after the flood event has passed (CONAF, 2023) it is being built as risk mitigation strategies in order to reduce hydrogeological risk that will hopefully lead the territory to suffer less floods in the near future.

**Keywords:** River habitat Survey (RHS), Flooding risk assessment, Land use change

## **FLUVIAL PROCESSES ON THE RIVER CHANNEL BELOW THE DAM**

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Fluvial processes result from the circulation of matter and energy in the catchment. They include processes related to erosion, transport, and accumulation of sediments in the river channel. Their dynamics are determined by two factors environmental and human activity. The first group is related to the natural characteristics of the catchment, which include, e.g. geological structure, elevation, soil cover, climate or vegetation, etc. The second group is human activity, directly and indirectly, related to the fluvial system, including e.g. multidirectional changes in land cover in the catchment – deforestation/afforestation, urban areas increasing, development/limitation of arable land, also point and/or nonpoint sources of water and soil pollution, etc. This group also includes pressures that determine the strongest fluvial system transformations, e.g. dam construction (single and/or cascade), weirs, canalization, etc.

Dammed rivers have a change in the fluvial processes course of the section above and below the dam. In the twentieth century, over 45 thousand of this type of construction in the world were built. This is a huge challenge in terms of climate change and related environmental problems. After the dam is built, the part of the river channel below it becomes extremely sensitive to environmental conditions. The research aimed to determine the dynamics of fluvial processes below dams on selected rivers and canals, e.g. the Vistula River (Włocławek Reservoir), the Dnieper River (Kaniv Reservoir), the Brda River (the Lower Brda Cascade).

The construction of the dam primarily affects the change of the water regime. The reservoir creation decreases the discharge above the dam, increasing the river channel retention, especially within the reservoir, and in the river valley (increasing the groundwater table, possibly damming tributary waters). Below the dam, regime changes are even more noticeable, often resulting from the operation system of the hydropower plants. Depending on the hydropeaking or run-of-river regime, we observed fluctuations in the discharge below the hydropower plant, causing the hungry water phenomenon.

The sediment transport dynamics, closely related to discharge, are changing dramatically. In the lacustrine part and the reservoir, there is an intensive sediment accumulation, especially bedload, and suspended to a lower extent. The reservoir siltation processes occur by the sediment supply from the catchment, which disturbs the sediment continuum. However, below the dam, due to the sediment lack, the river intensive erodes, contributing to the degradation of the river channel. Depending on the morphogenetic zone and the operating regime, we detected vertical and/or lateral erosion processes. In the case of cascade reservoirs, changes in the water regime and sediments continuum within the cascade may be smoothed.

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The discharge fluctuation, which takes place in the lacustrine part of the next reservoir, reduces the spatial impact of the hungry water phenomenon.

Recognizing the fluvial processes dynamics below dams is one of the most essential research problems in hydrology, contributing to the identification of hydromorphological transformations of river results from human activity, related to the environmental goals of the EU Water Framework Directive, and the determination of sustainable water-sediment management.

**Keywords:** dam, fluvial processes, river channel

## **MORPHOLOGICAL EVOLUTION OF THE HOOGLHY ESTUARY AND ITS IMPLICATIONS ON SHIPPING CHANNELS**

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There are 111 officially designated Inland National Waterways in India intended for inland water transport. During 2021–22, the National waterways in India managed over 100 million tonnes (MT) of cargo and are anticipated to grow in the next decade. The Hooghly (Hugli) River estuary is a crucial transportation route, connecting the sea (Bay of Bengal) and the Kolkata port. Our study has examined the changes in the shape of the land that occurred at the Hooghly (Hugli) River estuary, where the Ganges River meets, and how these changes have impacted shipping routes and the estuarine port of Haldia. Using remote sensing techniques, satellite imageries were analyzed over the past four decades to identify changes in the estuary's shape. The study revealed that the increasing flow of sand and mud from upstream sources leads to more significant sediment buildup along the western section of the estuary. There are two visible effects of this increased sedimentation. Firstly, Haldia Port, located on the estuary's western bank, and its connecting channels, namely Eden and Jellingham channels, are at risk of being blocked due to the high level of sedimentation. Secondly, due to sedimentation the merging of Balari Bar with Nayachara Island, both situated near each other across the estuary, is causing the shipping route from Haldia to Kolkata Port to narrow, making it very challenging for cargo ships, particularly during tides. However, the direct shipping route, the Auckland channel, which connects to the Kolkata port and is located on the eastern section, is now directly threatened by sedimentation.

**Keywords:** Sedimentation, Hugli Estuary, Remote Sensing

## **REVITALIZING NEW YORK'S HISTORIC ERIE CANAL FOR ITS THIRD CENTURY OF OPERATION**

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In 2025, the Erie Canal In New York State, United State, will celebrate the bicentennial anniversary of its completion. The historic inland waterway ushered in the Industrial Revolution by connecting the Atlantic Ocean to the Great Lakes, and the young American West beyond. The construction of the Erie Canal was financed with \$7 million (USD) in bonds. By 1837, only about a decade after its completion, the entire debt was paid off through the collection of tolls.

Success is a term that is relative to the context of the time and social constructs under which it is declared. Just as the Erie Canal was one of the great successes of the 19th century because of its influence on commerce and settlement, today it is evaluated in the context of climate change and the societal value placed on ecological preservation. Stewarding the historic Erie Canal requires a balance between the Canal Corporation's statutory mandate to maintain the system for commercial and recreational navigation against the growing threat of climate change and an increasing focus on environmental resilience.

In this presentation, two examples of balancing the operating Erie Canal against environmental and ecological imperatives will be discussed including the following:

1. Due to increased variability and intensity of precipitation because of climate change, the Erie Canal has increasingly faced the need to operate its structures not only for navigation, but to manage flooding across its 843-kilometer system. Water management is only effective when it is managed at a system-level, which requires coordination across a wide range of stakeholders including local authorities as well as private hydroelectric generators. In addition to technological interventions to structures like dams and spillways, policy interventions are also necessary to remove vulnerable structures from the floodplain and to prevent new development in flood-prone areas.
2. Over 200 linear kilometers of the Erie Canal is comprised of earthen embankment dams. Industry best practices prescribe the removal of trees and other woody vegetation from these structures, but many communities oppose clearing due to the value they place on ecological habitat. Balancing the maintenance of water-impounding structures against community preferences is key to maintaining a safe and operable canal system. Program designs, including modifications for high-value habitat, will be discussed.

The presentation will include examples of policy and public relations tactics that the Canal Corporation has employed to advance progress in the dynamic areas of vegetation management on earthen embankment dams and on flood mitigation in areas of persistent flooding.

**Keywords:** Embankments, Flooding, Vegetation management



## **ADMINISTRATION OF INLAND WATERWAYS IN POLAND**

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State Water Holding Polish Waters (SWH PW) is the authority managing inland waterways. Its task is to ensure appropriate conditions for ship traffic and safe navigation on various routes. The basic role of SWH PW is to create and maintain appropriate standards applied throughout the country and to coordinate activities of inland waterway services. Thanks to these tasks, navigation standards of waterways in other European countries are also implemented in Poland.

Managing of inland navigation routes requires various tasks, especially due to the wide variety of waterway classes and their functions. The total length of inland waterways in Poland is over 3,750 km. There are almost 130 locks along as well as 5 ship lifts. Parts of three inland waterways of international importance also run through Polish territory: E-30, connecting the Baltic Sea with the Danube River in Bratislava, E-40, connecting the Baltic Sea in Gdańsk with the Black Sea in Odessa and E-70, running from the Netherlands to Lithuania. All waterways require maintenance and investment activities adapted to local conditions.

The different characteristics of inland waterways in Poland require constant adaptation of activities related to maintaining safe navigation conditions. This obligation is fulfilled through the following activities: detecting and removing navigation obstacles, determining the course of navigation routes, appropriately setting and systematically correcting the position of navigation signs, conducting measurements showing the current transit depth, but also publishing information about current navigation conditions in the form of navigation updates and another information. All these activities are necessary to effectively respond to the dynamics of changes on waterways, ensuring an appropriate level of safety and comfortable navigation.

The diversity of Polish inland waterways does not exclude the use of uniform standards for marking routes throughout the country. Currently, SWH PW is working on the gradual replacement of navigation markings, gradually adapting the navigation routes to navigation at night at the same time. Many sections of waterways in Poland have already been equipped with reflective buoys and shore signs, and in places that are difficult to navigate - signs with special lighting, making navigation safer. SHW PW is adapting other sections of inland waterways to navigation at night.

Shipping safety also means ensuring high-quality communication with the users of inland waterways, who must have unlimited access to information about current navigation conditions on the navigation routes. The role of SHW PW is to constantly monitor the situation and publish navigation updates about any navigation difficulties, renovation works, transit depths, and operating hours of locks. SHW PW uses various communication channels. One of the most important is organizing meetings, during which users of inland waterways can take an active part in making decisions about the development of inland navigation in Poland.

**Keywords:** inland waterways, administration, shipping

## TO CONNECT THE WORLD'S YOUTH THROUGH THE "CANALS ON CLOUD"

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Canal is like a hub connecting rivers to the sea, like an encyclopedia with tremendous and valuable contents, and like the internet, with powerful connecting and communicating capabilities.

I Initiated the programme of Grand Tours on the Grand Canal (GTGC) in 2015, aiming to make the Canal and the cities along it a unique setting for youth development. The GTGC initiative encourages youths to explore the Canal cities and experience the Canal culture and technology, promoting engagement and preservation of the canals.

Digital toolset is used to gather Chinese and global youth to the Canal subjects by establishing the Grand Canal National Cultural Park Study Platform, namely The Grand Canal on Cloud, a digital cloud platform providing online and offline services and helping young people to access the Grand Canal resources much easier, more efficient, more engaging, and more rewarding. Currently, the Grand Canal on Cloud Platform (GCOCP) has over 200,000 enrolled users, with more than 7 million cases of online studies.

The necessity and possibility of connecting every canal and every canal city around the world is considered by us and we hope to make it a globally shared subject of study and travel destinations, and establishing a global cloud platform for the purpose by extending the GCOC.

It is the time to explore the worldwide canals and canal cities in an innovative way, enabling global youth and families to experience and study canals more creatively. We believe this represents a rare opportunity for every canal city and a stroke of fortune for each canal. Here, I would like to invite global partners to work collectively to make this exciting mission into reality.

Finally, We put forward a collaboration proposals.

1. The inherent communication function of canals has instilled in us the spirit of freedom, openness, and interconnectivity among canal cities.
2. In line with this spirit, we propose the creation of the World Canal Cities Study Tour Cloud Platform (WCCSTCP) by the canal cities worldwide.
3. We appeal to governments, educational institutions, enterprises, and social organizations to lend their strong support and assistance to the construction of this platform.
4. The World Canal Cities Study Tour Cloud Platform will delve deeply into canal cultures worldwide, develop international canal courses, and transform every canal city into a classroom, a spiritual home, and a practical base to assist the growth of young people.
5. The World Canal Cities Study Tour Cloud Platform can, bring new opportunities to every canal city, connecting the growth of every canal city with that of its youth and every family.

**Keywords:** Communication-sprite, education-tour, Canal-sharing

## **CORRIDOR STUDY OF THE INTERNATIONAL WATERWAY E70 ON THE ODER-VISTULA SECTION**

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The Polish section of the International Waterway E70 (MDW E70), from Antwerp to Klaipeda, includes: the Oder section from the Havel Canal, the Warta, the Noteć, the Bydgoszcz Canal, the Brda, the Vistula, the Nogat and the Vistula Lagoon. When in 2017 Poland adopted the European Agreement on Main Inland Waterways of International Importance (AGN), it undertook to adapt the Polish sections of the MDW to min. Class IV.

The studies carried out so far show that due to operational conditions, natural values, development of riverside areas, historic hydrotechnical buildings with the Bydgoszcz Canal at the forefront, the MDW E70 Odra-Vistula section, in its existing course, should remain Class II waterway and perform mainly tourist and recreational functions. On the other hand, for its course in Class IV, another solution should be sought.

The Oder and Vistula sections are covered by governmental solutions and programmes, whereas no such document exists for the Oder-Vistula section, despite (or perhaps because of) the fact that it has the largest number of circumstances.

Taking the above into account, as well as the spatial, environmental, infrastructural and legal effects that need to be recognised and taken into account in regional strategic documents, an interdisciplinary study-document entitled **CORRIDOR STUDY OF THE INTERNATIONAL WATERWAY E70 ON THE ODER-VISTULA SECTION**.

In order to speed up the study, the provincial governments of the provinces through which this section runs (Lubuskie, Wielkopolskie and Kujawsko-Pomorskie Voivodships), have developed input materials, titled Conditions, consisting of: Analysis of conditions for the operation of the Oder-Vistula waterway and its adaptation to the requirements of the AGN Convention, and Analysis of environmental, spatial and infrastructural conditions, which will be the substantive basis for commissioning and drawing up the above-mentioned STUDY.

**Keywords:** Canal Vistula Oder

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## ***Water, Heritage and Tourism***

### ***part 2***

## **DAI CHUNLIN, AN INTANGIBLE CULTURAL HERITAGE BORN BY THE CANAL**

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The Grand Canal of China, starting from Yangzhou and spanning over 2500 years, has gradually grown into a 3200 kilometer canal, connecting 35 famous cities in China and became the world's longest canal.

Yangzhou, China, which is the origin city of the Grand Canal in China. The World Canal Conference has been held here twice, and Marco Polo served as the administrative officer here.

Mr. Dai Chunlin, the ancestor of our family, was once a doctor of the emperor and lived by the Grand Canal. He researched and manufactured Dai Chunlin cosmetics, which is the earliest recorded Cosmetics brand in the world, named after himself.

After more than 400 years of development, Dai Chunlin cosmetics have become intangible cultural heritage along Grand Canal in China.

Mr. Dai Chunlin, the ancestor of our family, was once a doctor of the emperor and lived by the Grand Canal. He researched and manufactured Dai Chunlin cosmetics, which is the earliest recorded Cosmetics brand in the world, named after himself.

In 1628 AD, in the Ming Dynasty of China, Mr. Dai Chunlin developed various high-quality skin care products and cosmetics in Yangzhou with the water from the canal, pearls from the Taihu Lake, and plants transported from the canal. These products not only focus on quality, but also are natural, environmentally friendly, and healthy.

In the Ming and Qing dynasties, Dai Chunlin cosmetics were shipped along the canal and became a favorite of ancient Chinese royal families for 300 years. They were loved by empresses and nobal consorts. In the famous Chinese novel "Dream of the Red Chamber", Dai Chunlin are the first choice for those aristocratic ladies .

Now, my father and I are the 17th and 18th generations of inheritors of Dai Chunlin cosmetics. We still protect this brand and have opened over 100 Dai Chunlin stores in China along the canal. Now, we have opened shops to Hong Kong and to Spain in Europe. We have obtained GMP certification of the factory and testing reports from Europe shows that our quality is fully in compliance with European standard. We are also honored to have been featured in European fashion magazines ELLE and VOGUE. We believe there are enormous space for cooperation between Dai Chunlin and Europe. Any kind of cooperation, including opening shops etc. are welcomed.

The Grand Canal gave birth to Dai Chunlin cosmetics, and we hope to use the connection of the canal to let more canal cities around the world know about Dai Chunlin and love it.

**Keywords:** Ming-Dynasty, Intangible-Heritage, Cosmetics

## WHAT MAKES CANALS SUCCESSFUL TOURIST ATTRACTIONS?

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If inland waterways and canals are to retain—or regain—their status as valuable economic assets, they must be like other recreational outlets and cater to popular tastes and patterns of tourism. If properly conceived and equipped, they can also serve as new assets for urban commuting and environmental control.

To enhance and rebuild canals—these great public assets that are too often in disrepair—we must give them new economic and environmental utility. Just as when they were first built, canals and inland waterways can again become vital elements of healthy, livable communities.

Recreational canals must have adequate size and capacity—longer ones attract cyclists and hikers when well-isolated from motor vehicle traffic and well-integrated with inter-urban transit networks. Shorter, isolated stretches of water have far less utility and appeal.

Canals rich with artifacts from the past attract history enthusiasts and sightseers. Historic elements—locks, towpaths, trestles, aqueducts, bridges, and footbridges—must be restored or replaced, maintained, and clearly designated. Services and equipment must cater to visitors and be well-marked. Canals need the water and shade trees that formed their original character.

Successful water landscapes offer activities and events to give them life. Former industrial waterways need new equipment and facilities to support such events. Many canal communities build programs around long weekends and vacation periods, with activities both day and night.

Paths exist on water as well as on land, and some will attract canoes and kayaks. When water becomes ice, the nature of its uses also changes. Towpaths have varying characteristics—some surfaces are better for cycling, others for walking or horseback riding. It is essential to consider all potential uses and users, making appropriate choices of materials and facilities.

Recreational canals must offer places for service and replenishment, just as when they were first built. They often intersect with roads and rail paths, which can serve as new entry points. Small and large communities can attract and canal users by catering to their needs and interests. Signs are essential for these purposes, and too often overlooked.

We can also increase the value and importance of canals in coping with flooding and rising sea levels, the products of extreme weather and changing climate conditions, by resurrecting and improving upon techniques that have worked for centuries.

Just as when they were first built, inland waterways and canals can again become vital, lively places at the centers of viable communities. We know how to ensure that - and we must.

**Keywords:** Architecture Planning Design

## **FUN, FUN, FUN WITH WATER SINCE THE ROMAN TIMES**

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This paper aims at presenting how the ancient Romans had a lot of fun with nautical activities on waterways and artificial lakes. The emperors loved to play the tourists on rivers like Vitellius on the Rhone, they enjoyed nautical sports on a river like the emperor Trajan or dinners near an artificial lake (like these around Leipzig) for Nero. But also the high officers liked to take their time using a canal to enjoy the slow rhythm before business as one can see with the poet Horace and his friend the minister Maecenas, or with Piso. The ancient Roman way to make tourism on waterways has been partly studied by Brian Campbell (*Rivers and the Power of Rome*), but a synthesis on nautical activities on waterways and artificial lakes could be welcome.

**Keywords:** waterways, tourism, Romans

## **MODERN INLAND VESSELS AS HERITAGE CARRIERS**

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The subject of designing watercraft architecture at the Academy of Fine Arts in Gdansk has had a programmatic continuity since the 1950s. Thanks to the Ship Architecture Design Studio, the didactic programme has always reflected the so-called naval reality. Initially strongly associated with the shipbuilding industry in the 1980s it was directed towards smaller objects - yachts, houseboats, and smaller inland vessels. Then, at the end of the 20th century, in response to socio-economic changes and a resurgent shipbuilding industry, the programme focused on educating ship architects and designers - active participants in industrial design processes. Currently, the goals of the studio are related to the Design degree programme. Therefore, an indispensable scope is to recognize ships not only as floating machines but as components of local culture and historical and technical heritage. In our program, we develop concepts of ships addressed to specific city spaces or even permanently accompanying waterfront buildings as elements of public spaces - carriers of the phenomenon of place.

Developments in technology are already making it possible to create dedicated mobile land-water systems. With growth, these possibilities will increase. Thus, technologies originally aimed at other sectors (e.g. related to autonomous mobility) can be incorporated into strictly architectural or urban regeneration plans. Water vessels in the city space do not have to (should not) be treated as separate (independent) products of ship engineering. Nowadays, it is necessary to link them with the contexts of the city or region's space - in the full range of their functional, utilitarian, historical, social, environmental, aesthetic and symbolic meanings. Nowadays, it is necessary to link them with the contexts of the city or region's space - in the full range of their functional, utilitarian, historical, social, environmental, aesthetic and symbolic meanings. Thanks to this, the implementations of naval architecture - based on the needs of local communities - have a chance to become a non-accidental component of the fabric of the city waterfront - growing out of it and simultaneously embedded in it.

**Keywords:** culture, historical, technical heritage



## **RIVERS AND CANALS AS ART ELEMENTS: OBSERVING THE PAINTINGS IN A GEOMORPHOLOGICAL PERSPECTIVE**

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Which is the most famous painting in the world? ‘Monna Lisa’ by Leonardo da Vinci, ‘The Fighting Temeraire, tugged to her last berth to be broken up’ by William Turner, or again the ‘Starry Night Over the Rhône’ by Vincent van Gogh? Obviously, art is subjective but, certainly, it is a way to communicate cultural messages, and it can be a means to represent and explore beauty, even nature, through the representation and interpretation of landscape forms and features.

Waterways have been historically represented in thousands of paintings, highlighting both complex natural and anthropic systems, fully showing the intrinsic geomorphological value of the landscape.

An evocative painting that illustrates the beauty of the natural geomorphological landscape is ‘View from Mount Holyoke, Northampton, Massachusetts, after a Thunderstorm’. The painting shows a meander of the Connecticut River (Massachusetts) with a thinned neck, surrounded by cultivated fields, forests, and hills. However, a few years after its realization, the area depicted in the painting underwent an important morphological evolution, which subsequently led to the renaming of the painting into ‘The Oxbow’.

Channelized rivers are part of the urban geomorphic system and have been often painted due to the socio-economic impact on human life as well as their natural appeal in an anthropized context. Whilst cities like Venice, Burges, or Amsterdam have always depended on artificial waterways, cities like Milan or Bydgoszcz like hundreds of others, which were deeply influenced by canals in the past, are nowadays less dependent, even if the urban architecture is clearly linked to an aquatic development of these cities.

Artists represented the peculiarities of these waterways in significant paintings from centuries, showing urban geomorphic conditions as well as the applicative usages of these channels. Therefore, in this work, we explored the historical evolution of pictorial representation of rivers and canals, from the Sixteenth Century up to nowadays. Thus, landscape features painted in famous, as well as less famous, pieces of art have been described and interpreted from a geomorphological viewpoint, using remotely sensed data, GIS technologies, as well as historical documentation and maps. Based on the geomorphological interpretation of painted landscapes, this work aims to highlight the importance of artworks in landscape change assessment on a historical timescale.

**Keywords:** Landscape interpretation, Urban geomorphology, painting

## **CHALLENGES AND SOLUTIONS FOR THE FUTURE OF RECREATIONAL BOATING IN GERMANY**

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The Federal Waterways and Shipping Administration (WSV) is a subordinate body of the Federal Ministry for Digital Affairs and Transport (BMDV). The WSV is divided into the Federal Waterways and Shipping Agency (GDWS), based in Bonn, and the Waterways and Shipping Offices as well as the Waterways Construction Offices in the regions.

In order to enable our general task of smoothly flowing and therefore economical shipping traffic, we operate and maintain the federal waterways and the associated facilities (locks, weirs, ship lifts, bridges, etc.) and expand them as required. We also advise, support and direct shipping traffic through our specialist staff in the traffic and district centers.

The federal waterways include around 7,300 km of inland waterways and 23,000 km<sup>2</sup> of sea waterways. The WSV maintains and operates for example 315 lock systems and three Ship's Hoist (Niederfinow/Scharnebeck), from which a great part is used mainly or exclusively from recreational boating.

In 2019 the governing parties in Germany agreed to establish new priorities for federal waterways that are only used for tourism or sporting purposes, in accordance with their navigability. In addition, it has been decided that new strategies for individual waterways are to be developed together with the federal states and the regions.

Water-based tourism on federal waterways is an important economic factor. It generates a gross turnover of more than 4 billion euros. That shows that Germany has established itself internationally as an important destination for water tourism. With some 7,300 kilometers of inland waterways, the extensive tributaries and countless lakes, Germany has a particularly attractive network of waterways. In fact, the Müritz, Havel and Spree region (including the federal states of Mecklenburg-Western Pomerania, Brandenburg and Berlin) is the largest interconnected water sports destination in Europe.

While automation and digitalization are becoming increasingly important, the unfavorable age structure and many years of investment shortfalls mean that the infrastructure is in urgent need of structural maintenance and replacement. Against this background, the Recreational Boating Masterplan was developed and introduced in 2021. It plots the course to be taken by recreational waterways going forward in five action areas: Infrastructure, Boating, Digitalization, Environment, Communication and Cooperation. Furthermore, the latest amendment of the Federal Waterways Act in 2021 has elevated the status of recreational shipping.

The presentation will show the ongoing challenge, but also the progress and new solutions since the Masterplan were introduced to ensure safe and reliable recreational boating in the future.

**Keywords:** Waterborne Tourism, Recreational Boating Masterplan

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## ***Ecology and Technologies***

### ***part 2***

## **WATER QUALITY OF BYDGOSZCZ CANAL – THE STATE ENVIRONMENTAL MONITORING**

*Damian Cieplowski*

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The Bydgoszcz Canal, as an artificial part of water, is subject to research as part of state environmental monitoring. Two measurement and control points were designated there - Bydgoszcz Canal - mouth to the Noteć, Występ and Bydgoszcz Canal - mouth to the Brda, Bydgoszcz.

The basis for determining its ecological potential are biological elements - phyto-benthos, macrophytes, benthic invertebrates and ichthyofauna. The research results are presented in the form of biological indices taking into account the occurrence of plants and indicator organisms.

Auxiliary indicators for biological research include hydromorphological and physicochemical elements (physical condition, oxygen conditions, salinity conditions, acidification status, nutrients conditions), river basin specific pollutants (synthetic and non-synthetic) and priority hazardous substances.

The presented work contains a summary of selected indicators from individual years at the research site in Bydgoszcz. The results of biological tests are described and results of laboratory analyses. Water samples were collected and field measurements were carried out with a frequency of 8 to 12 times a year. The annual average concentrations of nutrients, five-day biochemical oxygen demand (BOD<sub>5</sub>), dissolved oxygen and electrolytic conductivity for the years 2002-2022 were compared. Analysis of the results allows for demonstrating trends in changes in monitored concentrations. Among the presented indicators, the concentrations of nitrogen and phosphorus have been showing a clear downward trend over the years, while the concentration of dissolved oxygen has been showing an upward trend.

**Keywords:** water quality, state environmental monitoring

**THE VISTULA WATERWAY AS A WATER SOURCE FOR WATER  
SUPPLY PROJECTS. CASE STUDY OF THE IMPLEMENTATION  
OF THE WATER FOR KUJAWY - FOOD FOR POLAND PROJECT**

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Due to its parameters, the Vistula River is the most important communication artery in the waterway transport network in Poland. The water drainage from its basin constitutes an important economic resource - it carries over 30 km<sup>3</sup> of water annually. Due to investment negligence, the navigation parameters of this river are low, which is why it is used as a waterway only for water transport of oversized cargo. However, the river can be a source of water supply in areas of rainfall deficit and high demand by strategic industrial plants. Therefore, the concept of transferring approximately 1% of the water from the Vistula River to the Kujawy area was created. The concept assumes the implementation of water transfer using three newly built pipelines with a capacity of approx. 1.0 m<sup>3</sup>/sec – the transit of 200 million m<sup>3</sup> of water per year. The aim of creating a water transfer from the Vistula is to improve Poland's economic security by eliminating the risk of loss of crops in agricultural areas by stabilizing hydrological conditions, restoring habitats in areas degraded by open-pit mining and increasing production security by the chemical industry in Inowrocław, which will gain access to water from the Vistula, without prejudice to the hydrological situation in Kujawy. The implementation of the measures will have a positive effect on accelerating the recultivation of the lignite open-pit mine in Tomisławice. It will allow for the large-scale development of small retention systems on watercourses in the project area. Water for industrial needs will be supplied from the Vistula River instead of the current intake from lakes located in the Noteć catchment area. In the first stage, the reconstruction of micro and mini reservoir retention in the implementation area is planned. In economic terms, the project is profitable because, according to calculations from 2021, the cost of implementing the project would be PLN 2.5 billion. For comparison, if Kujawy were irrigated according to the project, the annual increase in the value of crops could amount to PLN 2.25 billion. The Nadwiślański Association of Employers LEWIATAN coordinates the project and results from a broad team of experts created by the scientific community, state administration responsible for water management, economic circles, the non-governmental sector and local government administration.

**Keywords:** irrigation, waterway, water supply

## **BIOURBANISM - CITIES AS A NATURE**

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The biourbanism model consists of five bio and five urban systems being: citizens, food, water, waste - economy, energy, infrastructure, mobility and technology.

**Keywords:** Biourbanism, cities, nature

**AN ECO-STUDY FOR A FEASIBLE PROJECT: “TORUN AND ITS  
VISTULA STRETCH—AN IMPORTANT GREEN NAVIGATION SPOT  
ON A BLUE INLAND WATERWAY”**

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This paper aims to present the main trends of an eco-study for a possibly challenging future inland waterway transportation project. The study will prove if Torun and its Vistula stretch represent a viable and profitable spot on this inland waterway, and its outcomes will constitute a sound baseline that can be used for the project itself but also for many scientific, educational and economic purposes. The eco-multilayer research will comprise the following elements: hydrology and biology of the Torunian Vistula (TV) stretch, and water quality; a public opinion survey; the urban functions of the TV segment (social, educational, urban planning, aesthetic, recreational, cultural, utilitarian and economical). The conclusion is that the eco-research and the project will improve Torun City's image as a Green Urban Space, in terms of respect towards the environment, a sustainable form of transport, and attractive ways of relaxation and spending leisure time by Torun's population and visitors. The eco-study and the project will contribute to promoting the Torun region by supporting the possibility of watching beautiful landscapes (sightseeing tours) spread along the Vistula River. The project itself will have a positive impact on the Torunian economy and on the lifestyle of Torun's citizens.

**Keywords:** Torun, inland waterway transportation, Vistula

## **ABOUT PEE AND POO AND WHAT TO DO – PREVENTING POLLUTION BY SHIPS SEWAGE WATER**

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Wastewater treatment on land has been regulated in the EU since 1991, while treating sewage from passenger vessels on inland waterways, with a capacity > than 50 passengers, was regulated in 2005. A discharge ban for vessels with more than 12 passengers (or berths) will come into force on 1 January 2025. Owners of small recreational craft are mostly obliged to use holding tanks and authorities encourage users to use pump-out facilities. In practice, many pump-outs are out of order, hardly accessible or there are simply none. As a result, unwanted discharge in canals and lakes is still common practice, affecting water quality and posing health risks due to the presence of e-coli and enterococcus and blue algae. During warm summer days the water starts smelling and the holiday is spoiled. At a macro level polluted and smelly water leads to loss of reputation and tourists could even avoid certain waterways because of their poor water quality.

It is for this reason that NOAH started the development of a compact treatment system to be placed onboard the boats. NOAH has conducted fundamental research on a compact treatment system based on electrocoagulation-flotation (ECF). In electrocoagulation a direct current (DC) is applied to electrodes submerged in an aqueous solution (in this case sewage water). As a result, coagulants are generated in-situ on the anode and gas bubbles on the cathode. The coagulants enable clumping-together of pollutant particles into flocs, which subsequently float to the solution surface aided by the gas bubbles. The research at University of Ghent delivered good results on high concentrated black water (COD > 5000mg/L), as well as more common communal wastewater. During the tests disinfection rates from Log 2 (99%) up to Log 6 (99.9999%) were achieved.

There are many technical aspects which need consideration in an on-board situation, as well as the human interference. Currently long-term tests are ongoing in a floating house to bring all the knowledge in practice. Later in 2024 a pilot will start on a Dutch heritage ship for longer testing onboard. The advantages of electrocoagulation for these applications include environmental compatibility, energy efficiency, minimalized sludge production, compactness, cost effectiveness and avoiding the formation of greenhouse gasses. An onboard treatment system improves the sustainable operation of the ships and is a marketing tool for the owner.

**Keywords:** disinfection, electro-coagulation, on-board sewage treatment



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***General Session 2***

## THE IMPORTANCE OF WATER FOR FOOD SECURITY

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The Kuyavian-Pomeranian Voivodeship is one of the most important host areas in Poland. Agricultural farms are among the leaders in the country in terms of the level of modernity and efficiency. The agricultural production of the voivodeship in many aspects exceeds 10% of the production of the entire Poland and places the voivodeship among the 2-4 most important in this respect in the country. Based on agricultural production, supported by well-developed consulting, higher education and the research and development sector, a high-quality processing sector has developed.

Unfortunately, the agricultural potential of the region is increasingly threatened due to problems with insufficient rainfall during the growing season. Agricultural drought disasters are already a common phenomenon, they occur almost every year and result in very large losses for farmers, unpredictability of the scale of production and instability of the financial situation of producers, as well as fluctuations in food prices that are important for consumers and processors.

An area of the voivodeship with a particularly unfavorable situation is its southern part (Kuyavia), which also extends to the neighboring Wielkopolskie and Łódzkie voivodeships. This is the area with the lowest total rainfall in Poland, and in addition, some parts are areas of depression craters related to open-pit mining of lignite. The latest research indicates that the area of agricultural drought is expanding and the drought phenomenon itself is becoming more and more intense. The consequence of climate change that has been observed here for several decades is, of course, also changes in areas not used for agriculture, but having a very large impact on the conditions of this production - and therefore also on the decline of water levels in lakes, disappearance of streams and wetlands, and impoverishment of ecosystems.

That is why planning activities to provide water for agriculture is so important. They can and should be varied, depending on locally observed needs and environmental conditions. One of the new initiatives is the Water for Kujawy - Food for Poland project, which aims to irrigate up to 200,000 ha using water transferred through pipelines from the Vistula River to agricultural areas in the southern part of the voivodeship. When creating the project hydrological, technical, natural and social assumptions were analyzed. The interdisciplinary team agreed that the project should be implemented due to the expected large benefits and lack of significant side effects.

**Keywords:** water, drought, agriculture

## **SCOTLAND'S CANALS: RESCUED, REPURPOSED AND DELIVERING FOR SCOTLAND**

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Since they were first carved through the heart and highlands of the nation more than 250 years ago, Scotland's canals have been home to a unique fusion of art and engineering.

During their 19th century heyday as transport thoroughfares that stoked the fires of the Industrial Revolution, visionary engineers such as Thomas Telford – the Colossus of Roads – ensured they were arteries of artistry as well as commerce. The glory days of Scotland's canals continued for more than a century before the birth of rail travel sounded their death knell. By the 1960s, the canals had fallen into decline and had been transformed from bustling arteries into unloved backwaters. However, fast forward almost 50 years and the dawning of a new millennium presented a unique opportunity to reverse this decline; the largest waterway regeneration project ever undertaken in Britain brought Scotland's canals back to life. Restoring them to become not only attractive tourist destinations, but creating an inland of blue/green space to enrich better lives by water. Ambition and creativity delivered The Millennium Link Project with an investment of £83.4m when two canals were reconnected with the largest civil engineering project in Scotland taking place to create The Falkirk Wheel, the world's only rotating boat lift, to The Kelpies – the world's largest equine sculptures. Canal regeneration continued across Scotland making way for tourism to flourish and water-based activities to flow. The Forth & Clyde Canal in Glasgow is now home to Pinkston Watersports, Scotland's only artificial whitewater course. The enhancement of land around The Forth & Clyde canal continued with the creation of Hamiltonhill Claypits local nature reserve. Once an industrial hub linked to the canal now a much-loved green place in the heart a city community. In 2022 Scottish Canals opened Stockingfield Bridge, in Glasgow, a £13.7m project which reconnected three communities. The development of the foot and cycle bridge represented a significant active travel improvement on the Forth & Clyde Canal. The canals of Scotland continue to transform towards a sustainable corridor ensuring their relevance for the 21st Century and beyond. Through collective investment alongside partners, Scottish Canals has developed Europe's first smart canal, "The Glasgow Smart Canal". The smart canal uses predictive weather management systems to lower the canal by up to 10cm in anticipation for rainfall. The drainage system has unlocked over 110 hectares of land in North Glasgow to redevelopment and paved the way for 3,000 new houses. As we continue our journey to repurpose our canal network we look to the future with ambition. We are looking at opportunities for renewable energy on the canal corridor, utilising the canal to support major pump storage schemes, further widening the concept of Smart Canals, and even looking at the potential to build a new modern canal to transport water and unlock leisure, regeneration and health opportunities. The presentation will share with the World Canal Conference our story of how we have rescued canals, repurposed them and future proofed them for the people of Scotland.

**Keywords:** Rescued Repurposed Delivering

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***Man and human activities***

***part 3***

## **BLUE AND GREEN ŁÓDŹ. HOW RIVERS SPEED**

### **UP THE CITY TODAY**

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In the era of climate change, building city's resilience to rapid changes is crucial for our future. The best way to succeed is to create a blue-green network. In Łódź, with over 20 rivers flowing through the city, this task seems to be easy. Unfortunately, due to specific history of urban development of the city, most of them are hidden underground and make themselves known only during heavy rains. That led us to an idea to uncover (literally) and discover (figuratively speaking) rivers in Łódź. Our first step was to work with Lamus River – the project we are currently developing is aimed at uncovering the section of the Lamus River flowing through Kiliński Park in city's sewage system for almost 100 years now. In addition to investment activities, the project also involves building awareness and knowledge about water in the city and Łódź's rivers. The Lamus project is a huge challenge, and we hope that the experience will provide us with answers to the questions: how to restore water in the river and maintain a functioning ecosystem, how to use its potential in adapting the city to the aftermath of climate change, or how to build awareness of rivers flowing under our feet.

**Keywords:** blue-green network, river discovery, NBS

**EDUCATIONAL PROCESS IN THE FIELD OF INLAND NAVIGATION  
ON MARITIME UNIVERSITY OF SZCZECIN**

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The topic of the speech is to present the training process in inland navigation at the Maritime University of Technology in Szczecin. The use of a modern teaching base, including simulators of the bridge of a seagoing ship and an inland vessel, simulators of the engine room, laboratories and professional teaching staff allows for the training of both maritime and inland personnel. Introducing current knowledge about traffic and river information systems, electronic maps and electronic systems that are equipped with modern inland vessels into the study programs allows for full training of crews. An important element of the training process are also internships that students undergo on sea and inland ships as well as in maritime and inland administration.

**Keywords:** inland navigation education

## **TOURISM BAROMETER: IMPLEMENTATION POSSIBILITIES ON A WATERWAY**

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Modern tourism management requires advanced tools for monitoring and analyzing tourist traffic. The tourism barometer is an innovative tool designed to track tourist activity in real-time on various routes, including waterways. Its primary aim is to provide accurate data on the number of tourists, traffic intensity, and preferred route segments, which will enable better management of resources and tourist infrastructure.

The presentation will focus on the possibilities of implementing the tourism barometer on a waterway using AI cameras. These cameras, equipped with advanced artificial intelligence algorithms, allow for precise counting of floating units and identification of types of tourist activities, such as kayaking, sailing, and fishing. This technology enables real-time image analysis, translating to quick and efficient management of tourist traffic.

During the presentation, practical aspects of implementing the tourism barometer on selected waterways will be discussed. The benefits of using AI cameras will also be presented, as well as potential challenges, including technical issues.

The goal of the presentation is to demonstrate how modern technologies can support the development of sustainable water tourism and contribute to better management of natural resources. The implementation of the tourism barometer on waterways can become a key element in tourism development strategies, combining environmental protection with tourist satisfaction.

**Keywords:** inland water tourism, tourist traffic

## **BRIDGES AND FOOTBRIDGES OF THE BYDGOSZCZ CANAL**

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In the second half of the 18th century, the Bydgoszcz Canal connected the basins of the two largest Polish rivers: the Vistula and the Odra.

The presentation presents the history of the construction of bridges and footbridges over the Bydgoszcz Canal, including passages through the canal locks.

The presentation is divided into three historical periods:

- bridges and footbridges built in the period until 1915, when the construction of the new section of the canal was completed,
- bridges and footbridges in the period from 1915 to 1971, when a section of the old canal was filled in,
- bridges and footbridges in the period from 1971 to 2024.

The construction of the Bydgoszcz Canal in 1772-1774 resulted in the need to build bridges along the existing communication routes. In the initial period, these were structures with wooden or brick and stone spans.

In the 19th century, there was technological development in communication construction and the possibility of using more durable materials in the construction of bridge crossings. Steel began to be widely used, and at the turn of the 19th and 20th centuries, reinforced concrete was also used.

As a result of the reconstruction of the canal and the development of road infrastructure in the 20th century, some of the bridges and footbridges were demolished or rebuilt, and in the 21st century new bridges and footbridges were built and a section of the old canal was revitalized.

**Keywords:** canal, lock, bridge, footbridge



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***Water, Heritage and Tourism***

***part 3***

## THE ELBLAG CANAL LOG RAFTING (FLIS)

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Rafting wooden logs along routes that today form the Elblag Canal began in the 14th century during teutonic settlement. However, Elblag Canal has not seen rafting in 60 years. Whatever happened? The rafting event of June 2022 answered this very question. The assumption was for it to be a historical reenactment, and to carry it out took several years of effort by two groups: The Navicula Association of Elblag Canal Admirers and the Polish Raftsmen, Boatbuilders and Helmsmen Guild.

After a long absence log rafts returned to the canal route. Our venture was built of modules:

- rafting as a historical reenactment along the route of Elblag Canal lumber mills
- culinary heritage, culinary shows by raftsmen and regional chefs
- cultural heritage, film, photo album and a science conference, recording for posterity.

The 1st Elblag Canal Log Rafting event was the first Elblag Canal holiday of this kind. It was inspired by the National Geographic 6th issue of 1928. There was a photograph, taken from a cruise ship, that provided a fountain of information about the rafting.

Let numbers tell the story of the First Elblag Canal rafting. As an event, it was a complex, multifaceted project, lasting continuously for 19 days, including 14 days of rafting.

According to the cautious estimates of the organizers, no less than 50,000 people watched rafters on route and at the festivals, up close, from one of the 38 bridges overlooking the raft. At one of them, in Liksajny, we visited the monument of rafters killed during World War I. The raft was propelled along the entire route by 14 people and 1 horse. In cooperation with local authorities, 5 festivals with many attractions were held. 30 exhibitors appeared at the fairs in 4 locations. The raft was constructed at the only existing water timber yard (binduga) in Glimy, from 70 cubic meters of the legendary Tabor pine, reaching a length of 100 meters in 7 panels, making it the longest vessel on the Elblag Canal. Approximately 5,000 m of rope was used to connect the raft, tow it by people and horses, and for the hoist. Over 100 volunteers and over 60 local authorities and businesses were directly involved in the organization. 7 institutions took patronage over it.

The Flis concluded with a conference prepared by the Elblag City Library presenting a historical perspective on the Elblag Canal rafting and a mobile exhibition of archive photographs. Flis, as a historical reconstruction, was recorded in approximately 4,000 photographs and 2 films available with subtitles in many languages. A period song of the 18th century rafters was recreated and performed by the Camerata choir.

Rafting is a spiritual event for rafters, so three unusual masses were held, two field masses on a raft in Glimy and Małydyty and the final mass in the Elblag Cathedral by the rafters' altar. The day the Flis was launched concluded a 400-day preparation period, after having observed many formalities, permits and notifications from 11 different institutions.

**Keywords:** rafting, historical reenactment, Elblag canal

## **ECONOMIC MEANING OF OLD AND NEW BYDGOSZCZ CANAL FOR THE CITY**

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Waterways these natural and these artificial always been significant for development of urban centers. The importance is also reflected in the whole country perspective. Example for that is Bydgoszcz. During early period of the city development it was a river, natural watercourse, which made the influence on the castle and later on the city. However, after wars damage it was a built of Bydgoszcz Canal in XVIII century that played an important role during the city development. New emerged waterway opened the city for new directions and enabled direct cruises to the west reducing time travel. Thanks to that opportunity to the city began to arrive not only new goods but also technical innovations. City in some way was depended on the waterways. Unfortunately every failure of Bydgoszcz Canal caused movement restrictions and what follows – decrease of city importance and economic development. These problems were supposed to be solved by constructing newer, better and more modern section of the Canal – and so it happened. After an opening of New Canal Bydgoszcz gained new opportunities for the second time. That time barge unit tonnage also increased. More goods flowed through the city but also were loaded and unloaded from the barges. Thanks to that plenty of industry sectors developed including the most important for the waterways – shipbuilding. City development and its significance in case of depending on the waterways is difficult. In that case many factors must be considered. One of them is a technical condition of an artery. We have to find the answer if these factors are important in economy meaning or have a meaning only for the quantity and quality of goods, which we are going to transport.

**Keywords:** waterways, history, economy

## **WATERSCAPES AND WATERWAYS IN DANTE'S COMMEDIA**

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Dante Alighieri (1265-1321), Poet and Politician. Exiled from his city in 1301, spent the last 20 years of his life traveling widely in Central and Northern Italy, mostly in Tuscany, Emilia and Veneto. By that time, a large part of Tuscany was marshes and wetlands, largely bonified in the following centuries. The life of the many urban centers of Northern Tuscany was strictly linked to rivers, and in the plains of Northern Italy, marshes were even more relevant. Some cities, such as Mantova and Ravenna, were surrounded by marshes for defense. Marshes were used for fishing and hunting, reeds were used by artisans. In Dante's time the greatest part of transports was performed by boat on internal waterways.

On the other hand, the urban society saw marshes as nobody's land, waiting only to be bonified and cropped, and the population of marshes was considered by well educated classes as coarse, arrogant and brutal. Boatmen, in particular, were considered as avid and quarrelsome, and as a matter of fact they were often involved in riots (sometimes using oars as weapons), also because river banks were often overcrowded.

This negative opinion is reflected in literary sources, including Dante's *Commedia*: in fact, two of the devils, (and two very well drawn figures), act as boatmen in the hell's rivers, and their interaction with the Poet reflects all the stereotypes about boatmen.

In addition, Dante mentions rivers quite often, not only for their symbolic role, but also in their materiality, using often naturalistic images derived from direct observation of marshes' life, or mentioning the river boats used in Veneto. These naturalistic aspects of Dante's poem have been mostly neglected, yet they can help to focus attention on environmental knowledge and about travels in Dante's time.

About 1966 rivers stopped being used for work both in Tuscany and in Veneto (apart for the river Po) in consequence of floodings, and the interest about wetlands decreased, being recovered only in recent years, largely for purposes related to environmental education; and, in fact, environmental issues are the core of narrations about marshes, wetlands or rivers. References to history are scarce, to literature are absent. In Florence, Dante is used as an icon, «commodified» to promote tourism (even boat trip on Arno river), but with no references to his travels, or to his interest in rivers.

**Keywords:** waterways, tourism, Poetry

**FRIENDLY SAILING ON THE POLISH SECTION  
OF THE INTERNATIONAL WATERWAY E70**

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The Polish section of the IWW E70 is a picturesque and diverse one, with over 600 km in length. It connects Odra river with the Vistula River via the rivers of Warta, Noteć, Brda, and the Bydgoski Canal. IWW E70 runs down the Nogat River and meets the Vistula Lagoon. Sailing on inland waterways has its unique specificity. On rivers and canals, you do not feel the power of the water element as you do in seas or large lakes. Here, you are sailing at the contact point with the land, which interacts with the water, creating a symbiosis, often shaped over hundreds or even thousands of years. This value attracts many sailing enthusiasts. The use of the Polish section of the MDW E70 to serve the needs of tourism impacts on the economic activation of regions located in the vicinity of rivers and canals. Almost along its entire length, the route is currently the site of dynamic investments that are significantly improving sailing infrastructure.

**Keywords:** International waterway E70, sailing

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## ***Ecology and Technologies***

### ***part 3***

**POTENTIAL ENVIRONMENTAL POSSIBILITIES OF CONSTRUCTING  
A LATERAL NAVIGATION CANAL ON THE CZARNKÓW - KRZYŻ  
WIELKOPOLSKI PART OF THE NOTEĆ RIVER**

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Historically, inland waterways were an extremely important element of socio-economic development in Poland. The essential navigation routes connected with naturally flowing rivers include the Vistula River and the Odra River. However, the construction of the Bydgoszcz Canal in 1772-1774 made it possible to connect these river basins with the inland waterways of Western Europe, at the same time enabling ships to reach Eastern Europe. The effects of economic changes, especially the strong development of road transport and many years of neglect of inland waterway infrastructure, resulted in a reduction in the importance of inland transport in Poland. This is particularly visible in the example of the Noteć River waterway, which currently hardly serves as a tourist route.

The research aimed to determine the potential possibilities of constructing a lateral navigation canal on the section between Czarnków and Krzyż Wielkopolski of the Noteć River. This is the bottleneck of the E70 international waterway, connecting Antwerp and Rotterdam with ports located on the Vistula Lagoon. The navigable route covers the Noteć River, located at the Toruń-Eberswald urstromtal. Water management in the study area is controlled by 8 weirs and locks.

So far, research has focused on the conceptual possibilities and economic, and ecological effects of creating a new navigation route. The novelty of our research is the proposal of a variant course of the lateral channel, based on the analysis of morphometric factors of the Noteć River valley, based on a digital terrain model and spatial analyses performed in the System for Automated Geoscientific Analyses (SAGA v.2.3.2) software. Environmental indicators were calculated, which enabled the selection of the most advantageous lateral route in terms of environmental characteristics and navigation conditions, by the applicable normative provisions regarding navigation classes. At the same time, a real inventory of infrastructural (including roads and bridges, electric power lines, buildings, and heritage) and established forms of nature protection was carried out. The result of the research was the two variants of the lateral canal course, taking into account the real morphometric possibilities of the terrain, the features of the natural environment, existing infrastructure, and heritage. An attempt was made to estimate ecosystem services for the proposed variants, referring to similar investments in water management in Poland. The research makes it possible to start a discussion based on the real environmental and economic costs of creating a new lateral channel based on climatic, ecological, social, and economic future challenges.

**Keywords:** Noteć river, inland navigation canal, ecological services

## **ECO-DUCTILE CEMENT COMPOSITES MODIFIED BY RCS AND FA AS SUSTAINABLE MATERIAL FOR WATER CANAL STRUCTURES**

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As known water canals are built to provide agricultural water demand and transportation as human made. The canals which have low flow speed ensured to ships lesser transport route, hence the benefits are obtained on transportation issue. In addition canals expose economic improvement and contribute community welfare. Because of acting significant role, canal structures have to be built meticulously in order to assure long-term service life. The canal structures and materials should be designed due to most unfavorable conditions such as freeze-thaw cycles, abrasion, chemical attacks, compression and flexural. Particularly, canal walls and covering are affected by these negative attacks, thus, the weakness on mechanical properties, mass loss and crack formation. The conventional cement composites can be improved against to negative conditions with addition of waste materials and can be achieved greater performance by use of optimum rate. However, high rate usage may exhibit similar properties to ordinary cement composite properties. Thanks to use of waste materials, both environmental impact and better performance can be achieved. Recycled concrete sand (RCS) is produced from waste concrete as grinding process and based on literature, can be incorporated as aggregate for conventional concrete. Fly ash (FA) is obtained from thermic plant chimney by method of keeping and causes environmental pollution. Fly ash additive application is very common in modified concrete progress. PVA fiber is called as polyvinyl alcohol fiber. PVA fiber contributes improvement of ductility features of concrete elements. Particularly, PVA fiber modified concretes demonstrate higher ductile property than other fiber modified concretes. In this experimental study, cement was replaced with fly ash in rate of 20% and raw recycled concrete sand was incorporated instead of natural sand in rate of 0, 20, 40, 60, 80 and 100%. Moreover, in order to achieve improvement on ductility PVA fiber was added into mixture which contains 100% recycle concrete sand. On fresh mortars, unit weight and flow table, on hardened samples, unit weight, ductility, ultrasonic pulse velocity and compressive strength experiments were carried out. Besides, the durability of modified cement composites was investigated by freeze-thaw and water absorption tests. Experimental results reveal that, the best properties were observed on 20% fly ash and 20% raw recycled concrete sand after control. During to freeze-thaw experiment, the strength improvement was obtained samples which contains up to 60% raw recycle concrete sand and necessary properties can be actualized by using raw recycle concrete sand-fly ash.

**Keywords:** Eco-ductile cement composites, Water canal structures, Sustainable material



## **EMPOWERING WATERWAYS - THE BLUE CHARGE WAY**

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In an era marked by sustainability, the transition to clean and efficient mobility extends beyond land-based transport and is already reaching our waterways.

BlueCharge, a pioneering venture, is dedicated to propelling the transition on the water by providing innovative solutions for electric charging infrastructure tailor-made for marine environments.

Our session proposal, Empowering Waterways – The BlueCharge Way, aligns with the theme of the World Canal Conference 2024 – The sustainable revitalization of canals with a focus on nature.

Through our presentation, we will explain the leading role of electric charging infrastructure to enable electric mobility on our waterways., as well as why we believe electric mobility is crucial to fostering the ecological and economic sustainability of inland waterways.

### 1. Status quo and objective

- Recognition of the global growth of electric vehicles on waterways worldwide, particularly suited for short distances as on inland waterways
- Significant potential of electric propulsion systems to enhance water-based tourism and recreational Mobility
- Addressing the current challenges in the charging process, where conventional marine infrastructure often results in extended charging times of up to 24 hours
- Why photovoltaic systems alone are not sufficient to empower a vehicles electric propulsion
- Goal of establishing a charging network on waterways, enabling vehicles to recharge after 4 hrs, sufficient to deliver a maximum 8 hrs cruising

### 2. Ecology and Technologies:

- Showcase of our charging solution „The Plug One“ designed specifically for marine applications
- Advantage of bilateral plug-system with Type-2 or CEE 32 A / 400V, to charge propulsion batteries, always supplemented by a CEE 16A / 230V to charge electrical systems
- Demonstration of complementary technologies used by BlueCharge to minimize environmental and climatic impact and optimize energy efficiency
- Significant cost savings in electricity purchasing, example is through installing photovoltaic systems landside buildings.

### 3. Use case / Projects:

- Presentation of BlueCharge's project introducing the first charging solution in the Mecklenburg lake district, aiming to promote the adoption of electric mobility on european and international waterways
- Collaborative effects between ecological preservation and economic viability through self-generated energy

BlueCharge invites all attendees to join us in this discussion on advancing the waterway mobility transition. Our aim is to understand and meet the needs and interests of all parties affected by this transformation. Our session aims to inspire collaborative action towards a sustainable future on our waterways.

**Keywords:** electric mobility, charging infrastructure, sustainable waterways

## SELECTED PROJECTS IMPLEMENTATIONS ON Odra WATER WAY WEIRS

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We are presenting the design solutions for navigation locks on the canalized section of the Odrzańska River Waterway (ODW). Reconstruction of the existing water gates Januszkowice and Krapkowice and their ports. It is an important element of the implementation of the assumptions for inland development plans waterways in Poland for 2016-2020 with a perspective until 2030. This is a part of the adaptation of Odra Waterway (ODW) to class V as an inland waterway. The newly designed and constructed locks are reinforced concrete structures with an intermediate head and a separate chamber for small vessels. To regulate the water level in the lock chambers, short circulation channels built in the heads were used. Water flow through the channels is regulated by closing and opening steel gates. The new locks meet the requirements of class Vb inland waterways. An important element of the project was a sustainable approach to shaping the space around the facility while minimizing the effects of the building's impact on the environment.

**Keywords:** navigation lock, Odra Waterway, landscape engineering

World Canals Conference 2024  
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focusing on nature

***Man and human activities***

***part 4***

## **CONNECTED RIVER PROJECT : IMPROVING THE COHABITATION OF USES ON THE WATERWAYS**

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The Connected River project is an EU-funded transnational innovation project which aims to tackle challenges related to shared waterways and waterfronts. They are vital for the economy, ecology, and quality of life in the North Sea region. However, their changing and increasing shared use causes a decrease in safety, accessibility, and livability. Connected River addresses those issues by, mobilizing multi-stakeholder ecosystems, conducting user centric, agile innovation, and accelerating the uptake of digital/smart solutions. Based on the lessons learned out of 6 local pilot areas, the project delivers a playbook on the approach called Flow Forward and a road map on how to integrate this into innovation strategies.

There is a need for new, participatory innovation approaches that can adapt flexibly to problems and opportunities. Emerging digital solutions can play a crucial role in this regard. Adapting to these changes requires a transformation of organizations, in its role, assets, and people, as well as in collaboration with other organizations and users.

To move the Connected River project forward, a strong and experienced partnership has been established, comprising of host partners, that are responsible for hosting and conducting the pilot projects, approach partners that provide expertise, methodologies and a strong knowledge network, and solution partners that will contribute to business and subject knowledge to accelerate the project findings within the North Sea region.

In the World Canal Conference, we want to present to the audience some first outputs from our pilots areas as well as some of the methodologies developed in the project, as it could help the audience to face similar challenges.

The pilot of Nijmegen (Netherlands) is a good example of how to tackle challenges related to water and nature protection as well as safety regarding the different uses of the water.

The river Spiegelwaal was created to achieve safe water levels to prevent flooding in combination with meeting water quality standards. It has since then become a bustling hub for water recreation. With a new water sports center and the addition of a festival compound, crowds are only growing.

The key challenge related to this area is how to facilitate shared use of the river by different users, so that all can enjoy it at the same time and ensure safety, accessibility, and biodiversity. The pilot team is working on how to engage unusual users and how to monitor and present the real time information of the condition of the waterway.

Other pilots like Lille (France) and Vordingborg (Denmark) are also good examples of river revitalization through continuous engagement with the local stakeholders, with the use of culture while guaranteeing safety improvement on the waterways.

Through this presentation, we would like to collect feedback to further improve and develop our methodology. We also wish to engage the audience on how they could benefit from this experience and apply it in their own context. We would be glad to then engage a dialogue with other interested port and local authorities on this topic.

**Keywords:** Innovation, Cooperation, Citizen engagement

## **DISTRICTS OF BYDGOSZCZ ON THE TRAIL OF BYDGOSZCZ CANAL**

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Impact of the creation and operation of Bydgoszcz Canal for districts of Bydgoszcz: Wilczak, Okole, Flisy, Czyżkówko, Miedzyń, Prądy i Osowa Góra. How has the changed in terms of: infrastructure, economy, social and recreational activities? The case presented in the period from the time the Canal was built (1774) to the present day.

**Keywords:** Bydgoszcz Canal, Districts of Bydgoszcz

## **EDUCATING STUDENTS IN THE AWARENESS OF THE IMPORTANCE OF WATERFRONTS IN CITY LIFE**

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This presentation aims to show how, at the Department of Interior Architecture at the Faculty of Design Arts of the Bydgoszcz University of Science and Technology, we try to increase students' awareness of the importance of Bydgoszcz waterfronts, not only now but also as an initial part of Bydgoszcz heritage. Nowadays, the authorities of many European and global urban centers are rediscovering the potential that the rivers and canals in the city offer in the sphere of tourism, which currently is the best alternative to the departing industrial-based economies. A fresh perspective on the problem is needed, which can be provided by young design arts students. There will be presented student works created at the Department of Interior Design since its creation 14 years ago. These works show the variety of functions - from houseboats and the adaptation of barges for public functions, through public and residential interiors open to and connected with urban waterfronts, to urban interiors containing the revitalization of the Bydgoszcz Canal and Brda waterfront. The presentation will be accompanied by an exhibition available to visitors during WCC Bydgoszcz 2024.

**Keywords:** interior design, urban interiors, waterfronts

**FEASIBILITY ASSESSMENT FOR THE ODRA RIVER  
AS AN INTERNATIONAL WATERWAY**

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The Odra river being one of the largest rivers in Europe-belongs to the so-called 'trunk waterways', the most badly missing link in the European network. It suffers from the lack of good navigation conditions as a result of worsening of hydrologic conditions, limiting the flow depths and navigation period, and infrastructure degradation. Recently, striving for more energy efficient and environment friendly transportation modes, conform with the EU politics, has led to a debate and actions for the development of international waterways in Poland. Moreover, Poland signed in 2017 the European Agreement on Main Inland Waterways of International Importance (AGN), committing itself to develop the Odra waterway (OWW) to an international standard.

This presentation will be on the current status of the Odra river as a waterway and on planning actions of the last years trying to improve the navigability conditions to achieve the navigability class Va with a transit depth of 2,8 m. Obtaining this parameter requires a significant regulation of the river channel, modernisation/reconstruction of the existing hydraulic infrastructure and building a series of new barrages on the free flowing river section. For this a concept has been elaborated exploring an idea to combine navigational and ecological improvement of the river. Relevant aspects and dilemmas regarding the revitalization and development of the OWW will also be discussed.

**Keywords:** The Odra waterway, navigational and ecological improvement

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## ***Water, Heritage and Tourism***

### ***part 4***



## VISTULA MARSHLANDS, A CREATION OF MAN AND NATURE

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The formation of Żuławy Wiślane (Vistula Marshlands) was a long-term process of transforming the deep bay of the Vistula River estuary into fertile polders - a process occasionally and faultily interrupted by human intervention. It is a story about a man's struggle with nature, with many subplots. When we go back 3,000 years, we can see the funnel-shaped mouth of the Vistula near today's Grudziądz, and today's Gdańsk Bay, reaching far south of its current shore. The so-called Vistula River glaciation ended the Ice Age that lasted approximately 200,000 years and covered most of today's Poland in ice. Sediments then brought from Scandinavia and the bottom of the Baltic Sea flow back into the sea to this day, forming, among others, the Vistula Delta.

In this story, we see the intertwining and competing functions of communication of open water and eventual canals, drainage functions closely related to the creation of polders and their necessary drainage, trade, crafts, agriculture and defense. This story presents a fragment of the permanent exhibition entitled Elkamera located in the Elbląg Library, operating continuously since 1601. The first traces of settlement of the bay shores date back to 2500 BC and ever since then the area combined agricultural functions with commercial exchange via water. In the 8th century, the Vikings arrived and founded the powerful settlement of Truso, the first trade and craft center of this significance, maintaining extensive economic contacts with the West Pomeranian Slavic tribes, Prussian tribes and Scandinavia. Through several historical reconstructions of maps of this area, one can trace the dawn of important centers of this region, their hardships and their decline. Arduously shaped environment created so-called polders, i.e. embanked islands of fertile land lying below sea level. Various concepts for their construction and maintenance caused differences which can be seen in the landscape today. Geopolitical conditions, both European and regional, shifts of borders and land owners brought not always desirable changes or even damage. Only the arrival of the Mennonites allowed the full potential of this swampy area to be used and the agrarian culture to flourish. A change in the approach of subsequent residents to the way of taming nature and the technologies used will be discussed. Żuławy is a cultural melting pot in which every resident nation has left its lasting mark. It is fascinating to track changes and the mutual influence of political conditions, human migration, technical conditions and vagaries of the weather. Currently, it is a network of 15,000 km of drainage canals, all kayak-accessible, and nearly 500 km of navigable routes currently used in tourism as the so-called Żuławy Loop. This is an area perfectly connected with the E70 waterway, the Elbląg Canal and, through a ditch, even with the Baltic Sea. Attempts to do the latter have been made numerous times since the closure of the spit at this location in the 15th century.

**Keywords:** Vistula, Marshlands

**ASSISTIVE TECHNOLOGIES AND INCLUSIVE PRACTICES  
IMPROVING ACCESSIBILITY OF WATER EDU-TOURISM AMONG  
THE BLIND AND VISUALLY-IMPAIRED STUDENTS IN THE AREA  
OF BYDGOSZCZ WATER CANAL AND BYDGOSZCZ HYDROGRAPHIC  
NODE**

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Education and tourism give the tools, knowledge and skills, for building the appropriate image of the world and then provide us an opportunity to verify it, basing on our own experience. This is especially important organizing tourism and associated educational impacts for special needs and disabled students. Water tourism and those aspects of education related to the waterways are important part in such activities. In that situation, in the city on Brda and Vistula rivers, phenomena of Bydgoszcz Canal and Water Node cannot be omitted.

We present a wide panorama of local measures to improve the accessibility of edu-tourism on the example of the actions undertaken by the Louis Braille Center for the Blind in Bydgoszcz. We consider both, the historical and contemporary dimensions, incorporate accessible activities and assistive technologies, referring to the documents of our school practice (eg. learning aids, texts, photos, movies, maps, design files, etc.).

Bydgoszcz is called the city shaped by water and industry. It is also known as the mainstay of the blind – center, where they receive multidirectional support, including possibility to practice tourism. Both the waterways and the special education (typhlological) heritage have shaped the cultural identity of the city, being a tourist attraction at the same time. The convenient location for transport and readiness to take challenges contributed in the dynamic development and prosperity of the city Bydgoszcz making it an important player in new prominent areas. In the 19th century its growing importance, influenced the Prussian authorities of the Province of Posen to establish new and unique school for the blinds in the district's capital, on the Brda river – exactly a century after

Bydgoszcz Canal had been constructed. In the 1920s in Poland the local net of support institutions for the blind was spreading, eg. nearby the No 5 Lock a famous guide dog training center was organized. Nowadays, Louis Braille Special Educational Centre in Bydgoszcz (K-P SOSW no 1), located only about 600 m from the Brda banks, bond a range of innovative efforts focused on the visually-impaired in Kuyavian-Pomeranian Region.

To present the case as multifaceted, we review 4 aspects of local accessible water edu-tourism: 1) inland waterways in local educational system – from the Prussian school „Realia” subject to Polish school modern Science, History, Foreign languages and vocational education, as curriculum and after-school activities; 2) assistive technologies and methods to create haptic typhlographics, 3D models and tactile typhlomap (manual and craft techniques, computer-aided design and 3D printing, using the swelling paper and tactile image enhancer/heater or braille paper and braille embosser); 3) open-air tourist and recreation activities – accessibility (hiking along the waterfront, school trips, cruises and canoeing on the Brda, as a platform for local and international students meetings, hydrographical city characteristics and riverside settlement town district sightseeing, and valuable rehabilitation option; 4) indoor tourist activities – accessibility (Bydgoszcz „water” museums and expositions adaptation screening, exploring by touch, audiodescription and braille facilities, accessible culture project “Culture Without Barriers” in Rother’s Mills Centre in Bydgoszcz).

Bydgoszcz is the facility especially predestined to provide water edu-tourism in accessible way. Considering institutional conditions and students-tourists bio-psycho-social background, popularization of Bydgoszcz water heritage is quite a challenge and a real need. Thanks to regional Braille Centre and other stakeholders involved much work has been undertaken for accessibility. There are, however, certain areas that require reinforcement or continuation.

**Keywords:** water edu-tourism, blindness & visual impairment, accessibility & assistive technologies

## SELECTED DYNAMIC CHARACTERISTICS OF LONDON'S MILLENNIUM BRIDGE AND BYDGOSZCZ'S ESPERANTO BRIDGE

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The construction of pedestrian bridges is an indispensable part of modern urban infrastructure, serving to ensure the safety and fluidity of pedestrian traffic in contact with the water barrier. Often, pedestrian bridges become significant tourist attractions. Their design requires not only an aesthetically pleasing approach and integration with the environment, but also a deep analysis of the dynamic properties, which are key to ensuring stability and safety of users. It is on this aspect that this presentation will focus, explaining the essence of dynamic studies using two notable examples: Millennium Bridge in London and Esperanto Bridge in Bydgoszcz. Starting with the issue of structural resonance, it is worth citing the example of Millennium Bridge. Structural resonance, although it may appear to be a rare problem, is a significant hazard that must be taken into account at the design stage. It occurred after the opening of this footbridge, as a result of which it had to be closed immediately due to unexpected rhythmic swaying caused by pedestrians. Analysis of this phenomenon revealed that the cause was the synchronization of pedestrians' steps with the bridge's natural vibration frequencies, which led to an increase in the amplitude of the movements – a phenomenon known as synchronous resonance. This event highlights how crucial it is to consider the dynamic interaction between people and the structure in the design process. Solutions used by the researchers, such as traffic dampers, will be presented, which helped mitigate the problem and reopen the bridge to the public. The use of dynamic studies allows a thorough analysis of how the bridge structure will respond to a variety of dynamic loads, such as pedestrian traffic, the impact of weather conditions or even the impact of vehicle traffic in close proximity. Through these studies, it is possible to identify potential structural resonances and take steps to eliminate them or minimize their impact on safety and comfort. A case study of the Esperanto Bridge over the Brda River in Bydgoszcz shows the effects and conclusions of the dynamic studies. The Esperanto Bridge, although smaller and less well-known, is an example in which dynamic studies also play an important role at the design stage as well as in operation to avoid resonance problems. Knowledge of the dynamic properties of the Esperanto Bridge and the solutions used can serve as a basis for creating even safer and more stable pedestrian bridges. The conclusion of the speech on the analysis of the two bridges is to emphasize the importance of the dynamic properties of pedestrian bridges in the context of ensuring their safety.

**Keywords:** pedestrian bridges, dynamic analysis, resonance

**BUILDING ON SOCIETAL CHANGES TO DEVELOP WATERWAY  
TOURISM IN CENTRAL BOHEMIA (CZECH REPUBLIC)**

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The Central Bohemian Region is experiencing a boom in water tourism. Within the Czech Republic, 500 km of waterways and rivers located in the Central Bohemian Region are visited by more than 200 000 water tourists per year. In this region, we can observe great social changes, which are reflected in the increasing interest in water tourism, documented by the increase in registered vessels. Central Bohemian rivers have a very diverse character and use – from the lowland flow of the Elbe River, the vast reservoirs of the Vltava River to the romantic canyons of Sázava, Berounka or Jizera rivers. The Elbe-Vltava Waterway is open for recreational motor boating (waterway classes I, IV and V) and offers also many trips on passenger and hotel boats, while the Berounka, Sázava and Jizera rivers are suitable for canoes or rafts. Rivers represent the backbone of Central Bohemian tourism, therefore Central Bohemia Tourist Board started for seasons 2024-2025 a marketing campaign "PUSTIT K VODĚ" (Let's go to the water). The goal of the campaign is to offer an active stay on the water and attract new tourists. The campaign is supported by regional government subsidies for water tourism infrastructure such as new recreational ports and moorings, which complement the larger state investments of the Waterways Directorate of the Czech Republic.

**Keywords:** waterway, water tourism, infrastructure, marketing

**BYDGOSZCZ WATER, INDUSTRY AND CRATFS TRAIL - TEH<sub>2</sub>O SAILS  
OFF ON A CRUISE!**

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A short presentation of twenty photos and graphics will tell a „water story” about the Bydgoszcz tourist theme trail - TeH<sub>2</sub>O. The TeH<sub>2</sub>O trail is an association of twenty institutions, some of which are directly connected with the history of rivers and canals in Bydgoszcz. To give just several examples: the Museum of the Bydgoszcz Canal, Rother’s Mills and the Museum of Skippers’ Legends. The last one is located on an old river barge which dates back to 1937 and is one of the most precious remnants of the lives of skippers – local sailors and captains of small trading vessels. The TeH<sub>2</sub>O Trail is currently working on a new project - rennovation of a tug boat constructed in Bydgoszcz at the end of the nineteenth century and recently rescued from sinking and transported back here from Germany.

**Keywords:** trail, TeH<sub>2</sub>O, water

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## ***Ecology and Technologies***

### ***part 4***

**THE IMPACT OF CANALS ON THE INCREASE IN BIODIVERSITY  
OF AQUATIC ORGANISMS (ZOOPLANKTON) THE EXAMPLE  
OF THE BYDGOSZCZ CANAL**

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Canals are essential in connecting rivers to form a sizeable inland water system. Like natural waterways, they are characterised by specific environmental conditions, including hydrological regimes. The main criteria for determining these conditions are species diversity, the quantitative ratio and the biological productivity of organisms. Canals, including planktonic microorganisms, can be essential in transporting alien and invasive species. The study aimed to compare the zooplankton diversity in two artificial waterways against that of a natural river. We hypothesised that spatial community structure during the growing season would depend on differences in environmental (hydrological) and biological conditions and their influence on food availability (algal growth) and the creation of ecological niches for zooplankton (macrophytes growth).

The study was conducted during the growing seasons from April to October 2019, 2021 and 2022 in the Bydgoszcz Canal, the Noteć Canal and the Brda River. The Bydgoszcz Canal is the oldest active water canal in Poland. It was built from 1773 to 1774 by King Frederick II of Prussia. A total of 144 qualitative and quantitative zooplankton samples were collected.

A high number of 98 zooplankton species were recorded, and the average zooplankton density was 320 ind/L. The same zooplankton species dominated at all sites: *Keratella cochlearis* among rotifers and the Cladocera *Bosmina longirostris* among crustaceans. Rotifers dominated qualitatively and quantitatively over crustaceans. The number of zooplankton species, density and biomass were higher in the Bydgoszcz Canal than in the Brda River or the Noteć Canal. During studies, the significance of the variables related to primary production, i.e., oxygen concentration, water pH, and chlorophyll concentration, was observed in the Bydgoszcz Canal and Noteć Canal. The primary production variables shaped the zooplankton community, especially the density and biomass of rotifers in the studied canals.

The Bydgoszcz Canal is richer in zooplankton (density, biomass, and number of species) than the Brda River or the Noteć Canal. The reason may be different hydrological conditions, e.g., slower water flow (in Bydgoszcz Canal) directly influencing zooplankton development by creating more stable growth conditions. The studied canals provided good conditions for developing a high diversity of zooplankton.

**Keywords:** biodiversity, zooplankton, Bydgoszcz Canal



## **PROTECTION OF ICHTIOFAUNA IN NAVIGABLE RIVERS**

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Navigable rivers are most often channelised, baffled by water stages equipped with locks and used for power generation. Such a stage system requires damming to be made available for fish migration. To this end, various passages are built to allow fish to cross the dammed water. These are usually natural passes, technical passes, fish locks and lifts.

In order for fish to use the passages, however, they must be guided to them. If it is not possible to generate a current to attract fish naturally, they must be directed, using behavioural barrier systems.

The topic of the paper will be the electrical-electronic barrier NEPTUN, designed by PROCOM SYSTEM S.A., where the author is employed. The NEPTUN barrier was the subject of the author's doctoral thesis and was tested within the framework of the EU project entitled "Research on the effectiveness of devices for controlling fish behaviour at inlets to water intakes and fish ladders", realised by the University of Life Sciences in Wrocław and co-financed by the European Union and the state budget within the Sectoral Operational Programme, Fisheries and Fish Processing 2004-2006.

The NEPTUN barrier is implemented both nationally and internationally (e.g. NEPTUN is deployed both nationally and internationally (e.g. at the Grands-Malades and Ampsin hydroelectric power stations in Belgium, at the Brzeg Dolny barrage, at the Hirschhorn hydroelectric power station in Germany, at the Machadinho hydroelectric power station in Brazil, at the Januszkowice, Wróblin and Zwanowice barrages, behind the Otmuchow reservoir, at the Gideabacka power station outlet in Sweden, at the Krępa, Groszowice and Dobrzeń weirs), including on navigable rivers such as the Oder, Meuse and Neckar.

The NEPTUN barrier generates, between a set of positive electrodes and a set of negative electrodes, an ascending non-linear electric field intensity in the aquatic environment. The correct choice of power supply in the form of low-voltage current pulses and the appropriate selection of parameters such as pulse duration, frequency and filling factor allow the barrier to have an ecological and physically safe effect on fish.

In 2019, a barrier was installed at the upper position of the Grands-Malades hydroelectric power station on the Meuse River to prevent fish, mainly eels, from entering the hydroelectric turbines and directing them to the damming weir. And in 2022, another barrier was installed at the upper position of the Ampsin hydroelectric power station to direct fish to the weir and, in the future, to the fish ladder. These projects were carried out for EDF Luminus as part of the EU Life4Fish project and their effectiveness was tested by the independent company Profish Technology.

The longest barrier installed on the Oder River is the NEPTUN barrier at the Brzeg Dolny barrage, which totals more than 200 m in length. The depth at the barrier site

is between 5.5 m and 8.5 m. Two barriers were installed at SW Brzeg Dolny, one on the upstream side and one on the downstream side, mainly to guide fish to the inlet/outlet of the fish ladder. Tests on their effectiveness were carried out using sonar and by conducting 24 hour fish observations with the barriers on and off. A success rate of 88% was achieved in the upper water and over 90% in the lower water.

NEPTUN barriers play a very important role in protecting ichthyofauna on navigable rivers by blocking their entry into hydroelectric turbines and guiding them to damming weirs or fish ladders.

**Keywords:** protecting, ichthyofauna, barrier

**WATERWAYS IRELAND: ADVANCEMENT OF A DEDICATED  
ECOLOGY UNIT FOR THE MANAGEMENT AND ENHANCEMENT  
OF BIODIVERSITY AND NATURAL HERITAGE**

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Waterways Ireland has established a dedicated Ecology Unit within the Climate Action, Environment and Heritage Section, recognising the need for an increased focus on sustainable management of the natural environment within its waterway network. This team is tasked with the oversight and development of ecologically sustainable management practices, review and compliance with legislative requirements relating to biodiversity, and the provision of a dedicated professional in-house resource for ecological surveys and reporting. The need for such technical capacity reflects the understanding that all aspects and elements of our waterways remit are intrinsically connected to ecology and ecological impacts, including navigations within designated conservation sites. Therefore, sustainable management and development requires robust evaluation of the ecological receptors potentially affected.

The Ecology Team has been instrumental in undertaking complex, multi-disciplinary ecological surveys, both terrestrial and aquatic, minimizing a reliance on external consultants. Historical habitat mapping and species survey data are being updated by the team, with a range of bespoke baseline surveys to identify high-value ecologically sensitive areas and occurrences of protected species. We enable environmentally-informed works across maintenance and capital projects through: pre-works ecological surveys; development of robust mitigation including Construction Environmental Management Plans (CEMPs); and Ecological Clerk of Works (ECOW) monitoring during construction.

A large component of our in-house capacity is an advisory role, including technical review of proposals from third-parties, consultants, and contractors to ensure the biodiversity value and ecological integrity of the WI property assets are maintained. This includes professional review of design, reporting, and assessments provided for large infrastructure projects. We also contribute technical expertise on emerging legislation, national policy, and representation on national working groups.

As part of awareness building and integration of sustainable management approaches and work practices across the organisation, we are undertaking the roll-out of environmental and biodiversity management training for all staff, providing task-appropriate learnings for all grades. This includes embedding environmental protocols and work practices into regular operational maintenance. We are also prioritising high-level training for senior staff on the legislative requirements, case law, planning requirements and best practice guidance for delivering projects in the aquatic environment. The evolving obligations for statutory bodies arising from case law with regard to the Habitats Directive Article 6(3) requirements

(Appropriate Assessment), has had direct implications for capital and maintenance works. We have been proactive in providing explanatory advices and specific efforts in ensuring the organisation maintains our obligations with regard to emerging biodiversity and nature protection legislation. This includes integrating advancements in biodiversity protection measures arising from Ireland's newly adopted National Biodiversity Action Plan (2023).

The talk will highlight the value of having dedicated and experienced ecology professionals within an organisation, and how Waterways Ireland has taken this opportunity to integrate this into their organisational structure. The Ecology Team fulfil a crucial role, embedding ecological expertise within waterway management, thus helping deliver on a range of the organisation's strategic objectives, active projects, and ongoing maintenance.

**Keywords:** Aquatic, Assessment, Ecology

**AUTONOMOUS FERRIES FOR THE CITY OF GDAŃSK**  
**“MOTŁAWA 4.0”**

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Gdansk waterway is a part of the local economy, history and culture – a heritage that in the Authors' opinion may also become the future of comfortable and sustainable urban transportation. It is an ideal platform for developing a new, although historically well-established, concept of autonomous ferries supplementary to modern public transport in Gdansk. The Authors focused on advancing the key parameters for the concept of a water transport system which will perform a flexible, easy-to-reach ferry connection. Available in two modes – interval or on request – ferries are designed for pedestrians and cyclists only. Our goal is to develop a system solution for double-ended small electric ferries based on one technological platform and the same shape and construction of the hull (developed by Gdansk University of Technology). It would enable the Authors to create foundations for different, optimized and adapted for various areas versions of a boat. The basic ferry design will be an autonomous (or remotely controlled) solution, but at the same time, it will remain fully integrated with the city shipping monitoring system. We want this project to both stimulate the districts of Gdansk that are located near the water passage and stay in harmony with the urban manner so it could become a new hallmark for passenger vessels in Gdansk.

**Keywords:** urban transportation, heritage

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