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SHORELINE AS THE BOUNDARY OF A PROPERTY IN THE CADASTRE

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A b s t r a c t

A specific type of property boundary is the boundary of land adjacent to flowing waters, known as the shoreline. This type of boundary is characterized by temporal and spatial variability as a result of natural forces. As a result, there is a need for periodic updates of the cadastre, both in terms of spatial data and subject data. This is due to the fact that lands covered by inland surface waters are often owned by the State Treasury. Such a situation occurs, among other places, in Poland. In the case of a change in the position of the shoreline due to river erosion, there are also changes in the structure of land ownership rights. This article presents the most important legal aspects of determining the shoreline in Poland and compares them with regulations in selected European countries. The main problems related to the implementation of the process of delineating lands under water are discussed. Universal solutions are proposed that can contribute to improving the quality of data on boundaries of plots located in the immediate vicinity of flowing waters.

Keywords: cadastre, parcel, boundary, shoreline, flowing waters

1. INTRODUCTION

Property boundaries generally maintain their permanence over time. Changes to boundaries usually result from administrative and judicial proceedings. However, an exception to this rule is the boundary of natural watercourses, known as the shoreline. Due to the forces of nature, it exhibits temporal and spatial variability, particularly in the case of rivers with unregulated channels. As a result, not only the factual state but also the legal status of the property can change. This is because lands under inland flowing surface waters are generally owned by the State Treasury, as is the case in Poland.

The specificity of the discussed issue necessitates the formulation of appropriate legal regulations that will serve as the basis for administrative proceedings aimed at establishing the shoreline and regulating the legal status of the property. It is worth noting that in the literature there are frequent discussions regarding the practical use of geodetic methods and IT tools for monitoring the shoreline (Kucharzak & Kowalski, 2009), (Donaldson, 2011), (Dragićević et al., 2013), (Hanus et al., 2014),

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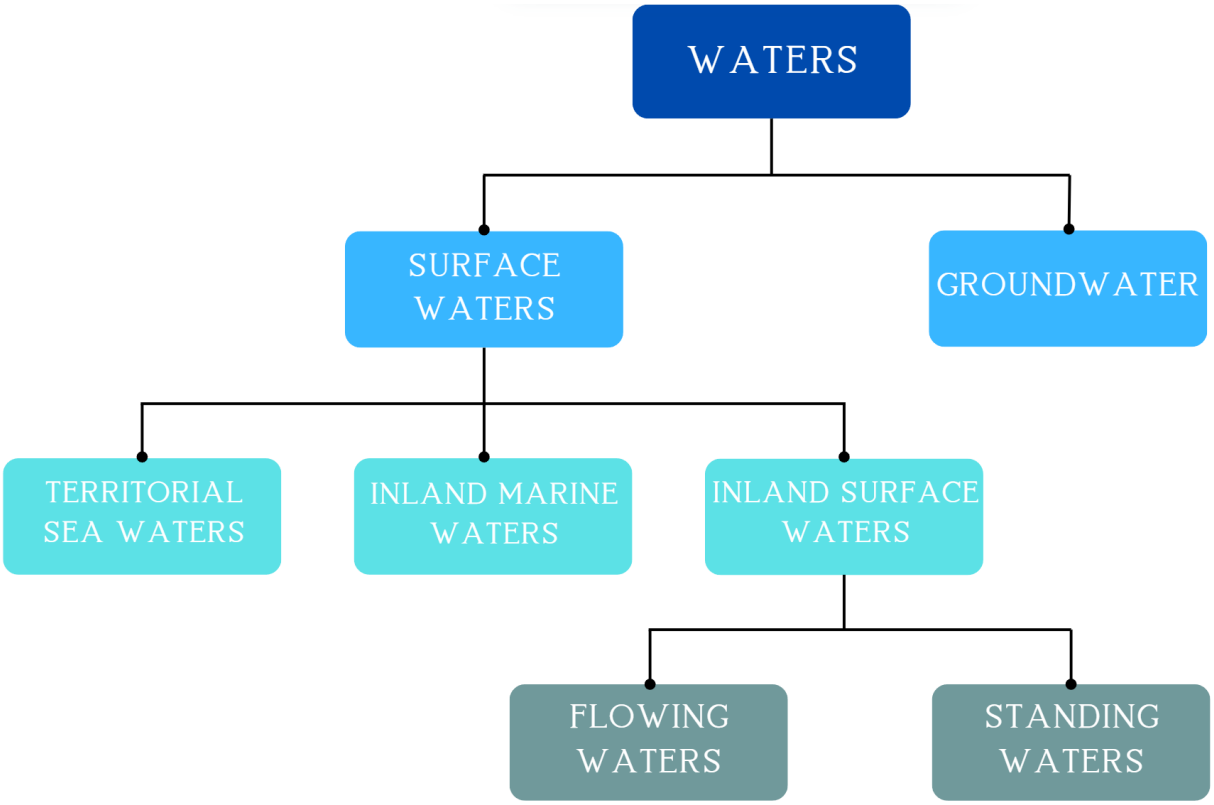
(Thompson, 2015), (Mika et al., 2016), (Dragićević et al., 2017), (Pietrzak, 2017), (Felcenloben, 2017), (Wily et al., 2017), (Mika et al., 2018), (Srebro et al., 2018), (Bazan-Krzywoszanska et al., 2019), (Ghosh & Sahu, 2019), (Jasińska, 2019), (Selamat et al., 2019), (Xu et al., 2019), (Nithu Raj et al., 2019), (Alberdi & Erba, 2020), (Bitner et al., 2020), (Wadowska et al., 2023), (Kwartnik-Pruc & Mączyńska, 2023). The legal aspect, which is equally important, seems to be less frequently considered in this context (Kowalski, 2011), (Hanus & Pęska, 2016), (Mączyńska & Kwartnik-Pruc, 2016), (Felcenloben, 2018), (Pęska-Siwik, 2020), (Kwartnik-Pruc et al., 2022).

This article discusses the method of determining the shoreline from the perspective of Polish legal regulations. It also outlines practical aspects of identifying the boundaries of properties located in the immediate vicinity of watercourses. These principles are compared with other regulations in selected European Union countries. Solutions have been proposed that should contribute to improving the quality of data on plot boundaries in the scope discussed.

2. LAND COVERED BY INLAND SURFACE WATERS IN POLAND

According to the Act of 20 July 2017 on Water Law (Act, 2017), waters in Poland are divided into surface waters and groundwater. A detailed classification of waters in Poland is presented in Figure 1.



Source: own elaboration based on (Act, 2017)

Fig. 1. Classification of waters in Poland

Land covered by territorial sea waters, inland marine waters, and flowing inland surface waters in Poland is owned by the State Treasury. Such land is excluded from civil law transactions, except for cases specified by the law (Act, 2017). The ownership rights to the mentioned surface waters determine

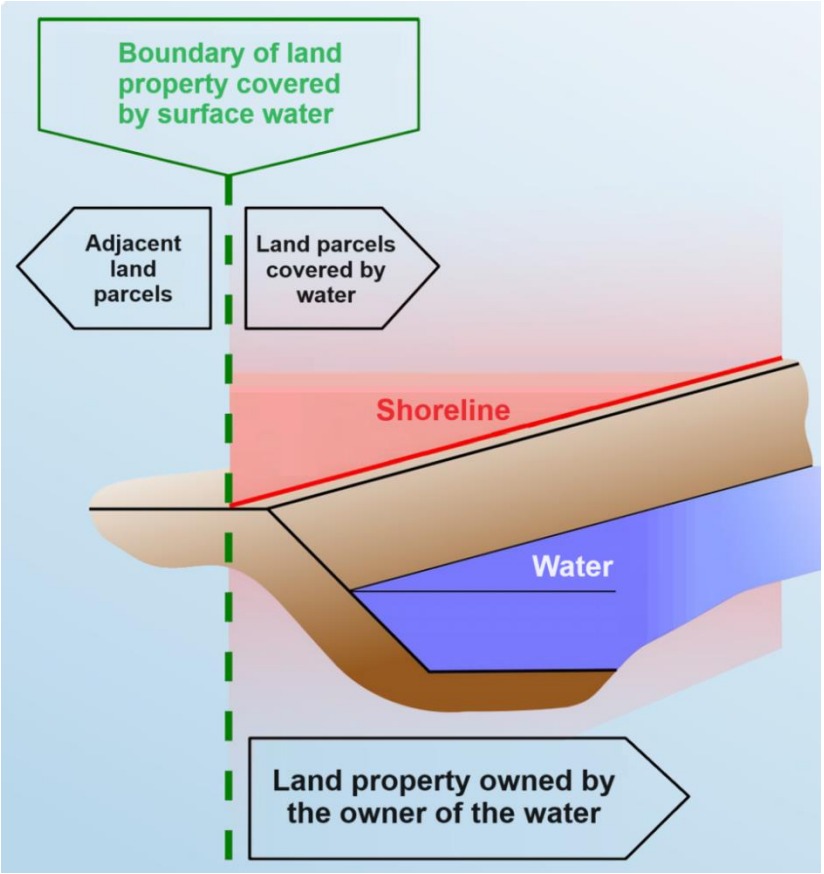
the ownership rights to the land covered by water. The opposite situation applies to standing inland surface waters, which are owned by the owner of the property on which they are located.

For the above reasons, it is particularly important to monitor the boundaries of properties located in the vicinity of watercourses. Erosion leads to the progressive shifting of the riverbed and, consequently, changes in the position of the shoreline in the terrain, as illustrated in Figure 2.

Source: own elaboration based on https://mapy.geoportal.gov.pl

Fig. 2. Examples of outdated data on boundaries of parcels constituting flowing waters

As a result, gradual changes occur in the ownership structure of adjacent land. According to Article 223(1) of the Act (Act, 2017), if inland flowing waters naturally and permanently occupy land that does not belong to the owner of the waters, then that land becomes, by operation of law, the property of the owner of the waters, which is the State Treasury. The previous owner is entitled to compensation. However, the owner of the waters does not acquire rights to land inundated by floodwaters. The relationship between the shoreline and the boundary of the water-covered property with the adjacent land is presented schematically in Figure 3.



Source: own elaboration based on (Kowalski, 2015)

Fig. 3. Shoreline as the boundary of land property covered by surface water

3. ESTABLISHING THE SHORELINE ACCORDING TO POLISH LEGAL REGULATIONS

Delimitation of land under water is an administrative procedure aimed at determining the shoreline. It is initiated upon the request of an entity with a legal or factual interest, most commonly the owner of a plot of land adjacent to flowing waters. The request should be addressed to the Minister responsible for water management. The basis for determining the shoreline is a delimitation project covering the water-covered land and adjacent land, provided by the applicant. The documentation is prepared by a qualified surveyor and is also submitted to the state geodetic and cartographic resource, although this requirement is not explicitly imposed by water law (Act, 2017). If the determination of the shoreline is related to the permanent occupation of land by flowing waters that does not belong to the owner of the waters, the costs of the project are borne by the owner of the waters. The procedure concludes with the issuance of an administrative decision by the Minister responsible for water management. This decision serves as the basis for registration in the real estate cadastre. However, the decision does not specify the amount of compensation. This matter is resolved in a separate procedure in accordance with the principles of the Civil Code (Act, 1964). Claims for compensation become time-barred after 2 years from the occurrence of the damage, which, given the systematic nature of changes caused by river erosion, can

be problematic in practice. Any disputes regarding the amount of compensation are resolved by the courts.

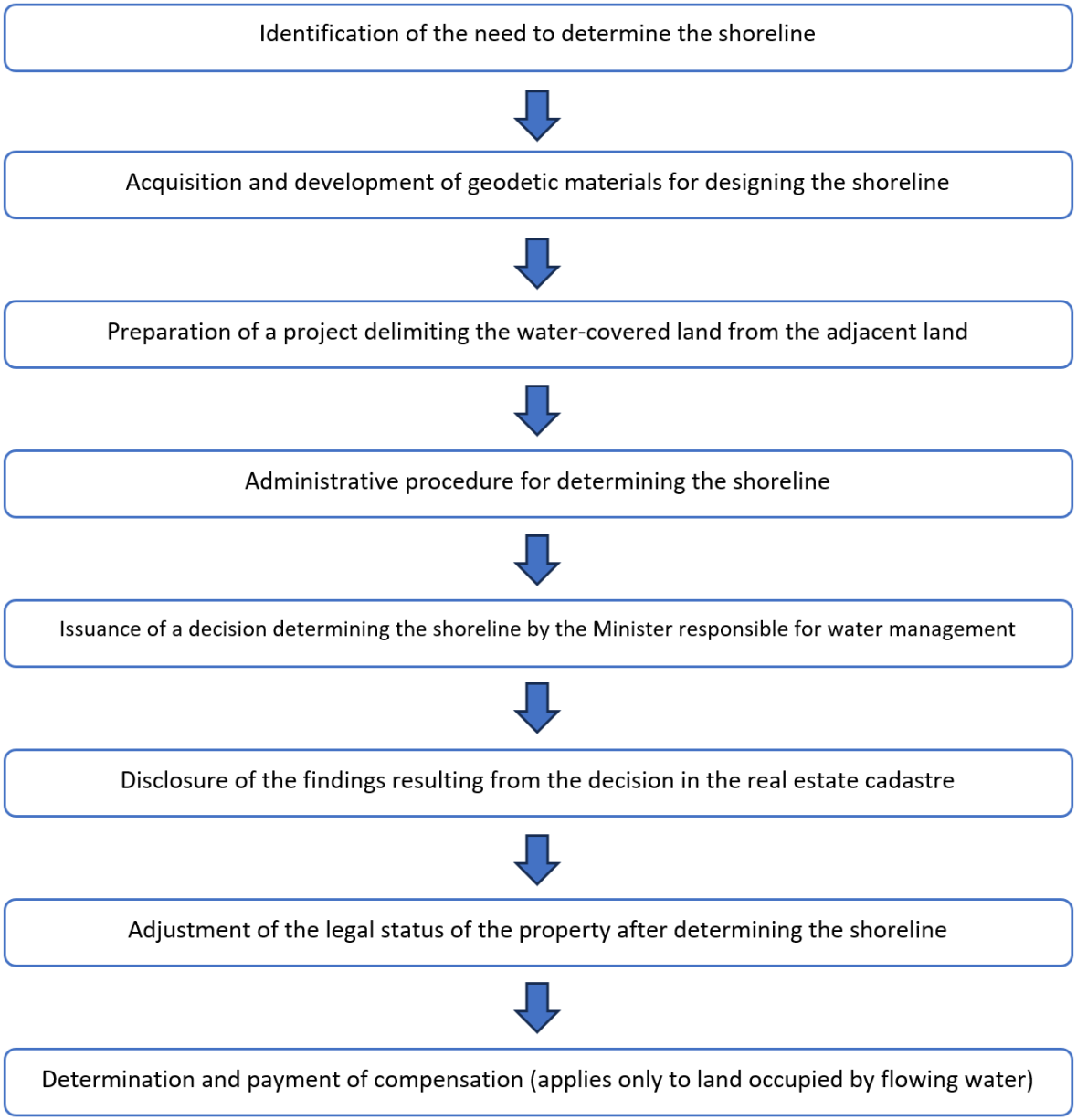
As a general rule, the shoreline should be determined when it is required by either the factual or legal situation. Currently, the applicable legal regulations do not impose an obligation to determine the shoreline of all surface waters. Nevertheless, in geodetic and legal proceedings such as land and building registry modernization, property delimitation, land consolidation and division, land consolidation and exchange, where the boundary of water-covered property and adjacent land is subject to determination, the shoreline should be determined each time. It is worth noting that since December 31, 2013, the shoreline in Poland may also be disclosed in the cadastre as part of technical activities related to the update or modernization of land and building records. The method of determining the course of a watercourse in the field has been linked to the aforementioned Water Law (Act, 2017). However, such registration of the shoreline is transitional in nature and serves as a preparation for the implementation of a procedure compliant with water law. In such cases, there is no change in the registered owner of the property. It is rather a separation of the land occupied by the flowing water from the remaining part.

Currently, two procedures for acquiring information on and disclosing the current course of the shoreline in the real estate cadastre can be distinguished:

1. Technical procedure defined in §33a of the regulation on land and building records (Regulation, 2021), resulting in a temporary registration status requiring future implementation of an administrative procedure;
2. Administrative procedure regulated by the Water Law (Act, 2017), allowing for the update of both the cadastre and land register.

It should be added that in both procedures mentioned above, the identification of the shoreline itself is the same and is determined by Article 220 of the Water Law (Act, 2017).

The general administrative procedure for determining the shoreline, regulated by the Water Law (Act, 2017), is presented schematically in Figure 4.



Source: own elaboration

Fig. 4. Procedure for determining the shoreline in Poland

4. SHORELINE IN SELECTED EUROPEAN UNION COUNTRIES

The legal issues regarding the establishment of the shoreline in European countries are less developed compared to the regulations in force in Poland. In Austria, which historically shared the cadastral system with Poland during the Partition period, according to the Water Rights Act of 1959 (Act, 1959), a distinction is made between public waters and private waters. Public waters include:

a. Rivers, streams, lakes listed in Annex A to the Act (Act, 1959), along with all their tributaries, branches, and canals,

b. Waters that were treated as public before the entry into force of the Act (Act, 1959), subject to a water permit,
c. All other waters, unless explicitly designated as private waters in the Act (Act, 1959).

Additionally, the legislator has specified that public waters retain their legal ownership even in underground sections and when the bed of a given water body does not contain water permanently. Interesting regulations concern the waters mentioned in point b. If these waters had a legal title established before 1870, they are considered private waters under special regulations, although this principle does not apply to the shoreline or the bed of the water body. This is an exceptional situation in which the water owner is not synonymous with the owner of the land occupied by that water.
In addition to the specific regulation mentioned, the Water Rights Act of 1959 (Act, 1959) includes the following as private waters:

a. Groundwater contained on a plot of land and water extracted from the plot,
b. Rainwater collected on the property,
c. Water located in wells, ponds, tanks, or other containers and used for consumption purposes,
d. Lakes not fed by public waters,
e. Discharges from the aforementioned waters until they merge with the public part of the waters.

It is worth noting that unless otherwise specified, private waters listed in points d and e are considered to belong to the owner of the land on which they are located, in accordance with the length of the shoreline of each property. Separate provisions apply, however, to salt springs, cement waters, and mining waters.

Furthermore, the aforementioned Act (Act, 1959) allows for certain possibilities of dealing with public waters. The sale of real estate occupied by public waters is possible, among other cases, when it is determined that it is permanently unnecessary for the purposes related to the implementation of public water resources. It is also possible to grant a right *in rem* other than ownership, but only after obtaining the appropriate administrative decision issued by the governor.

Certain limitations are also imposed on owners of land adjacent to land occupied by surface waters. According to paragraph 48 of the Act (Act, 1959), in the case of water reservoirs within the floodplain area, no investments can be made in devices that would deteriorate the water quality. Additionally, the provincial governor may introduce prohibitions or regulate certain sections of water reservoirs or groundwater areas to the extent necessary for the maintenance and purification of water reservoirs and prevention of water damage. Furthermore, according to paragraph 63 of the Act (Act, 1959), the water management authority may establish opening easements or easements facilitating access to public waters to the necessary extent, as well as grant necessary permits for hydrotechnical projects or restrict or cancel property rights conflicting with a given project. If these actions prove ineffective or insufficient, it is also possible to expropriate the whole or part of the property.

The issue of compensation is regulated by paragraph 26 of the Act (Act, 1959), as well as paragraph 6 of the Act on the Implementation and Maintenance of River Regulations, Stream Dams, Irrigation and Drainage Systems (Act, 1923). The water user is obliged to compensate for damages arising from the existence and operation of a water facility. However, if damage is caused to real estate or a building that already existed at the time of issuing the water permit as a result of a lawful establishment and operation of a device for using water, the water user is only obliged to compensate for the damage if the negative effect was not foreseen at the time of issuing the water permit or was foreseen to a lesser extent. Similar to the legal regulations in Poland, no compensation is paid if the negative effect was caused by *force majeure*.

It is worth noting that in the Water Rights Act of 1959 (Act, 1959), there are no specific provisions for establishing the shoreline. Certain regulations regarding the spatial extent of property rights adjacent to land occupied by surface waters are found in the Austrian Civil Code (Act, 1811), although there are

no clear guidelines for identifying the shoreline as in the Polish Water Law (Act, 2017). These regulations include provisions regarding periodic erosion of the shoreline by water, the right of the adjacent landowner to reinforce the riverbank, and the ownership of islands formed naturally in water bodies. Particularly interesting is paragraph 412, which states that the owner of a property located along the shoreline loses ownership rights to the land occupied by the river only if they do not use it within one year. In comparison, Polish legal regulations do not consider time as a decisive factor, and the transfer of property rights to the State Treasury is based on the permanent occupation of the land by flowing water.

In the Austrian cadastre, similar to the case in Poland, waters constitute one of the categories of land use, as stated in paragraph 10 of the Federal Law on Geodesy and Cadastral Surveys of July 3, 1968 (Act, 1968), which corresponds to the Polish Law on Geodesy and Cartography of May 17, 1989 (Act, 1989). The measurement of property boundaries, according to paragraph 6 of the Federal Minister of Science, Research, and Economy Regulation on Measurements and Plans of 2016 (Regulation, 2016), should be conducted with an accuracy of 5 cm, while Polish technical standards allow for an accuracy of 10 cm (Regulation, 2020).

The above confirms that regulations regarding the shoreline and surface waters are not synchronized within the European Union. Polish and Austrian regulations differ significantly despite some similarities. Furthermore, these regulations are included in separate laws. For example, certain issues related to property rights of land under water are not regulated by the Polish Civil Code, unlike the Austrian context where attempts to establish a legal interpretation of the spatial extent of the shoreline in the provisions have been completely abandoned.

Analyzing the situation in other countries, there are also similarities as well as significant differences in the scope under consideration. For example, in Swedish legal regulations, similar to the case in Poland, the shoreline can be determined based on the average water level over several years. It is also possible to establish the shoreline based on other factors such as topography. It is the norm that land adjacent to the shoreline should remain accessible to the public. Similar provisions can also be found in Italian law. This aspect is regulated by the Building Law (Act, 2001a) and the Italian Civil Code (Act, 1942). According to Italian legal regulations, land that gradually forms due to the natural activity of flowing water remains the property of the State. However, if a river erodes a significant portion of the land and carries it downstream or to the opposite bank, that fragment becomes the property of the landowner to which it attaches. Any islands and land connections formed in riverbeds remain public property. Article 946 of the Civil Code (Act, 1942) also provides for a situation where a watercourse creates a completely new channel, abandoning the old one. In such cases, the abandoned land remains the property of the state. Italy is another example of a country where aspects related to the shoreline are primarily concentrated in the civil code. In Germany and Spain, similar to the case in Poland, these issues are regulated by dedicated water law acts (Act, 2009), (Act, 2001b).

5. DISCUSSION

The lack of international standardization of procedures for determining the shoreline, as well as the absence of regulations in this regard, even in the ISO 19152 LADM standard (Norm, 2012), means that the discussed issue is currently being codified at the local level by the administration of each country. One solution to this problem could be the implementation of a 4D cadastre that would take into account the factor of time. As a result, it would be possible to reconstruct the factual and legal state of the shoreline for a given period. However, such a solution would require the introduction of mechanisms for periodic monitoring of river courses, which would be a costly undertaking. It is emphasized that similar actions are currently being carried out by the relevant local units dealing with hydrological

issues. However, research at the moment focuses primarily on ichthyology and water pollution status. So far, however, it has not been possible to utilize the collected data for environmental protection purposes to supplement the real estate cadastre database. In this context, it is important to note that hydrological data could be used when the shoreline is not clearly identifiable in the field. In typical cases, the topography of the terrain plays the primary role. It would also be necessary to ask in what procedure and over what period of time changes in the ownership structure of lands occupied by naturally flowing waters should be recorded. Claims for compensation are also significant in this context.

Source: https://hydro.imgw.pl/

Fig. 5. River water level monitoring service in Poland conducted by the Institute of Meteorology and Water Management

One possible solution to the problem of monitoring changes in the spatial extent of flowing waters could be periodic photogrammetric campaigns, which would involve obtaining current aerial photographs, creating a stereoscopic model, and studying changes resulting from river erosion. It would also be possible to utilize the research described in the literature regarding shoreline identification for other purposes (Mount et al., 2013), (García-Rubio et al., 2015), (Geleynse et al., 2015), (Siejka et al., 2017), (Wassie et al., 2017), (Cienciała et al., 2021), (Singh et al., 2023). However, this would be a costly solution that may not have economic justification, although it should be mentioned that the photogrammetric method of determining the shoreline is widely used, for example, in the United Kingdom. In Spain as well, the shoreline is constantly monitored and updated, especially based on photogrammetric methods, while direct field measurements are used when the interpretation of aerial photographs proves to be significantly difficult. An example of such a situation is the afforestation of areas around rivers. In such cases, the use of photogrammetry combined with LiDAR technology can also be considered.

It seems that a reasonable direction would be to simplify the entire procedure for determining the shoreline in Poland, making it more transparent and less subjective. The measurement of the boundary determined by the shoreline could be treated as a purely technical activity, leading to the disclosure in

the cadastre of the land use category Wp, which represents the area constituting de facto the ownership of the State Treasury. Formal issues related to regulating property rights and land demarcation under the waters could be carried out only at the time of the sale of a given property, solely at the request of the parties to the sales agreement, or when required by the public interest.

Another solution could be the introduction, in the conceptual model of the cadastre, of textual descriptions of the boundaries of plots adjacent to inland flowing waters. The aforementioned Land Administration Domain Model (Norm, 2012) allows for the possibility of registering the LA_BoundaryFaceString class in the cadastre as a text variable. In this case, it would be possible to disclose information about the spatial extent of the boundary, for example, in the following way: "the boundary runs along the eastern bank of the river." Such a logical construction would allow for the maintenance of up-to-date data on property boundaries over time, without conducting additional geodetic and legal activities. Certainly, it would be crucial to choose the appropriate method of registering the shoreline in a given national cadastre profile, as this information can be used for different purposes in different countries. Nevertheless, the proposed approach would not resolve the issues related to the reduction in the potential of parcels, especially those designated for development, whose area and shape have changed as a result of river erosion. It should be considered whether owners of land adjacent to flowing waters are entitled to compensation in such cases. This issue has already been partially analyzed (Hanus & Benduch, 2023); however, solving the identified problem requires further and more extensive research.

6. CONCLUSIONS

Maintaining up-to-date data in the real estate cadastre regarding the boundaries of plots adjacent to flowing waters is a task that is very important but difficult to accomplish. Changes in the shoreline due to natural forces lead to changes in the ownership structure of adjacent lands. These changes should be properly documented and registered. However, the legal regulations regarding the determination of the shoreline in Poland are quite general. This situation leads to a wide range of interpretations for various factual conditions found on the ground.

The following points list the most important principles of determining the shoreline reflected in the current laws and regulations in Poland:

- The procedure for determining the shoreline is reflected in the registry of the factual state, i.e., the real estate cadastre, both in terms of the boundaries of registered plots and the contours of land use. Furthermore, changes resulting from the determination of the shoreline should also be disclosed in the registry of the legal state, which is the land register. This is because the shoreline represents the boundary of the property covered by water and is also the boundary of the ownership rights of the State Treasury.
- The determination of the shoreline can be carried out based on the provisions of the regulation on land and building registration (Regulation, 2021) as a technical procedure, resulting in a temporary registration state that requires future implementation of an administrative procedure and regulation of the legal state, or directly as an administrative procedure based on the Water Law (Act, 2017), resulting in the update of both the cadastre and land register.
- The basis for determining the shoreline under the Water Law (Act, 2017) is an administrative decision issued by the Minister responsible for water management based on the submitted project of delineating lands under water prepared by a qualified surveyor.
- The shoreline is only determined when required by factual or legal circumstances. The law does not impose an obligation to determine the shorelines of all surface waters.

- The principles of identifying the shoreline in the field remain quite general, which results in a high degree of subjectivity in the entire procedure.
- In the Polish legal framework, the issue of estimating compensation claims for the reduction in property value due to the delineation of lands under water is not sufficiently addressed. Property owners can seek compensation in this regard under the provisions of civil law (Act, 1964), while the Water Law (Act, 2017) regulates only general issues of compensation for lands taken over by the State Treasury due to permanent occupation by inland surface waters.

The legal provisions regarding the determination of the shoreline and the rights of surface waters are not synchronized at the level of the European Union. There are also no appropriate regulations in this regard in the Land Administration Domain Model (Standard, 2012). As a result, legislative actions in this case are undertaken exclusively at the local level by the authorities of individual countries. The discussed aspect is sometimes regulated by separate laws, as is the case in Poland, Spain, and Germany, but also under civil law (Austria) or construction law (Italy). Nevertheless, some similarities have been noted between the regulations applied in Poland and selected European Union countries, particularly regarding the universal access to the shoreline and the ownership structure of lands occupied by inland flowing waters. Apart from the discussed aspects, the approach to the issue of determining the shoreline can vary, as well as the level of detail in specific legal regulations.

Among potential solutions to address the issue of outdated cadastral data regarding property boundaries adjacent to water-covered lands, several options can be considered. These include:

1. Integration with other registries that gather hydrological data to ensure accurate delineation of property boundaries in areas adjacent to flowing waters.
2. Conducting periodic aerial photogrammetry surveys to update and maintain current cadastral information.
3. Streamlining legal procedures for demarcating land boundaries under water bodies, simplifying the process and reducing administrative burdens.
4. Introducing the possibility of registering boundary data in the cadastral system as a text-based variable, allowing for more flexibility in describing complex or changing boundaries.

The selection of appropriate solutions and tools should be tailored to the specific needs for which cadastral data are utilized in individual countries. Therefore, striving for standardization of the discussed issue at the European Union level at this time would be an ill-advised idea. This problem remains both broad and relevant. Its resolution requires further research on a larger scale.

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