

THE PRESENT CONDITION OF SMALL WATER RETENTION AND THE PROSPECTS OF ITS DEVELOPMENT USING THE EXAMPLE OF THE PODLASKIE VOIVODESHIP

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ABSTRACT

The necessity and purposefulness of the investments related to water retention are justified mostly due to the preservation of the environment equilibrium as well as due to its farming, anti-flood, landscape and recreation aspects. Reasonable water management where various forms of retention are used gives large chances for the mitigation of the effects of unfavorable phenomena related to its insufficient amount. The creation of plans regarding the formation of reservoirs accumulating water is not necessarily synonymous with their realization. The reason of problems connected with the implementation of plans regarding the formation of new reservoirs lies mainly in financial measures and in problems with obtaining them. Water deficit in Poland is the reason for which the principles of its national usage need to be complied with. Realization of plans at both Voivodeship and municipality level that are focused on small retention will contribute to considerable increase in the retention capacity and will enable considerable increase in available resources in hydrographic catchments of both the characterized area and the entire country. The paper presents the characteristics of the present state and assumes the perspective development of small water retention in the Podlaskie Voivodeship using the example of the Podlaskie Voivodeship.

Keywords: small water retention, water reservoirs, small retention programs, Podlaskie Voivodeship.

INTRODUCTION

Small water retention means accumulation of water in small reservoirs as the consequence of retardation or deceleration of water flow in the situation of simultaneous conservation and diversification of the natural landscape. In low-lying areas small retention denotes mainly increasing the possibilities of retention and also counteracting drought and flood. In mountainous areas the aim of small retention is counteracting the effects of outflow of precipitation waters. The positive impact of small retention reactions which cause increase in the retention possibilities of small catchments on the water balance does not raise any doubts and is widely accepted. However, its role in shaping global water resources on the country level is slight,

whereas as the type of non-steerable retention it has small significance for anti-flood protection. Its asset is the totality of local impacts which have considerable influence on farming, forestry and natural environment.

Apart from the improvement of the water balance of catchments, small retention objects perform also various economic functions, mostly on the local level, such as: small water power engineering, breeding of fish, source of water irrigations in farming and forestry and also in recreation. Not only do catchments serve accumulation of water, but they also have impact on increase in the retention of surface water in adjoining areas and perform numerous functions related to the environment and nature. The main functions include: improvement of water quality, reduction in the water erosion of soils and watercourses,

increase in biological diversity and also the improvement of landscape values and microclimatic conditions. One of the possibilities of having rational water management of the region are development programs devoted to small retention for a certain area, Voivodeship or river catchment.

Small retention programs constitute the basis for undertaking complex investment activities in planning and realization of activities which can be carried out using a relatively small number of measures and the purpose of which is to construct various forms of small retention. The realization of the assumptions of small retention development programs is the task for Voivodeship self-governments and also for the Regional Water Management Boards and for the Boards of Melioration and Water Systems of particular regions. However, the activities related to the shaping of water resources are unfortunately not the investments that yield income in a direct way.

WATER RESOURCES OF PODLASKIE VOIVODESHIP

The resources of surface waters in the Podlaskie Voivodeship include running water of rivers, canals and, periodically, also of ditches as well as lakes, reservoirs, fish-breeding ponds, swamps and marshy areas. The river system in Podlaskie Voivodeship is well developed, yet its configuration is mainly the result of the landform and is related to the Narew river. The occurrence of groundwaters is, to a large degree, dependent on the structure and origin of rocks, hypsometry, deposition of scarcely permeable layers and on the granulation. The most hydrated areas are the river basins of Narew and Biebrza [1]. The Northern part of the Voivodeship is abounding with natural reservoirs of stagnant waters. The total number of lakes in the following three districts: Augustowski, Suwalski and Sejneński is 250. Water systems enrich ponds, canals and dam reservoirs, among which Siemianówka reservoir is the largest one [2]. The remaining area does not have large reservoirs of stagnant water. The largest canal in the Voivodeship is Augustowski canal (more than 100 km of length), which connects Augustowskie lake district with Biebrza river. At present, melioration facilities in Podlasie require large financial outlays in order to function properly. However, most facilities need to be modernized or exchanged for new ones [3].

Extreme phenomena, which are caused by water factors, such as flood or drought are of natural type. Rising watercourses or periods with small atmospheric precipitation and low flows are nothing new in nature. It is only in combination with man's activity related to improper water management and when natural changeability of water resources in space and time is taken into consideration that real dangers can appear [4]. The prevention of drought effects as well as anti-flood protection are the tasks for both governmental and local administration. One of the basic prevention activities focused on the protection from such dangers are retention reservoirs. They are becoming a crucial, yet frequently underestimated element both in the situation of drought and flood. The key purpose of forming retention reservoirs, irrespective of various assumptions, will always be the expansion of water resources. The most important tasks of small retention include also:

- formation of groundwaters by increasing their surface, which results also in larger dampness of habitats,
- regulation and control of water circulation in the environment,
- increase in the amount of water by means of storing it, i.e. protection and renewal of water resources,
- water supply for people,
- obtainment of energy,
- flood protection through taking over a certain capacity of flood wave and decelerating its rapid travel down the river,
- fire protection,
- usage as a watering place for both wild and farm animals,
- improvement of aesthetic, landscape and ecological qualities of the environment,
- stoppage of pollutions in typically farming catchments,
- recreation and decoration functions,
- breeding of fish or waterfowl, i.e. farming functions [5].

Poland's accession to the European Union has changed the approach to the formation of large and small water reservoirs. As the basic purpose there was taken water management at the source of forming water resources, i.e. in forests and on farmlands. It has crucial impact on the quality and quantity of these resources. The experience gained till that moment shows that they did not

ensure good results at all times [6]. For that reason it is necessary to implement new methods in the management of water resources, whereas the shift in the approach to this issue was caused by Poland's entry into the EU. The new approach to water management ensues from the resolutions of the "Water Law" act as well as from the recommendations of the Framework EU Water Directive. Both documents focus on the necessity of water management at the level of a particular catchment as well as on the aspiration to achieve "good ecological status of waters" – as the main aim of the Framework Water Directive of the European Union [7].

The actions taken in connection with small retention constitute one of the elements that meet the requirements of the Water Directive. The obtainment of good status of waters and the improvement of water quality and natural amenities is possible only as regards the development of small retention.

THE PRESENT STATE OF SMALL RETENTION IN SELECTED MUNICIPALITIES OF THE VOIVODESHIP

In Podlaskie Voivodeship one of the largest water area in Poland, Siemianówka reservoir is located. The crucial aspect regarding retention structures is the economic profitability of projects. Numerous economic analyses conducted in this domain reveal considerable advantage of small investments, such as "small retention" over large retention reservoirs. In accordance with the data presented by the Coordination Centre for Environmental Projects the cost of storing 1 m³ of water in large reservoirs oscillates around 15–40 PLN, whereas in case of small retention reservoirs the cost is only 2–5 PLN. Not only does "small retention" have considerable advantage in economic terms, but it also has many merits in environmental aspect which is difficult to estimate [8].

In Podlaskie Voivodeship the total area of flooded areas amounts to approximately 175 km². The number of households that are exposed to flood and the owners of which could possibly be evacuated is 654 and 88 buildings in the urban areas, i.e. 2670 people (230 from towns and 2440 from the countryside) [9]. In accordance with the prepared plans regarding the enlargement of small retention reservoirs in the Podlaskie Voivodeship, 12 reservoirs have been completed since 1995.

The 22 reservoirs described below include not only 12 reservoirs which have been completed in the recent years, but also other 10 reservoirs which were formed in the previous years. Retention reservoirs are not located in a uniform manner. Most of them are localized in the southern and central part of the Voivodeship. The approximate locations of retention objects in the Voivodeship were presented in Figure 1. Consecutive points on the map correspond with certain retention reservoirs located in the Voivodeship:

1. Complex of retention reservoirs in Siemiatycze.
2. Small water retention reservoir Grodzisk.
3. Water reservoir in Ciechanowiec.
4. Small water retention reservoir Otapy-Kiersnówek.
5. Small water retention reservoir Repczyce.
6. Water reservoir in the village named Lady.
7. Small water retention reservoir Trywieża.
8. Small water retention reservoir Narewka.
9. Water reservoir Siemianówka.
10. Small water retention reservoir Michałowo.
11. Small water retention reservoir Zarzeczany.

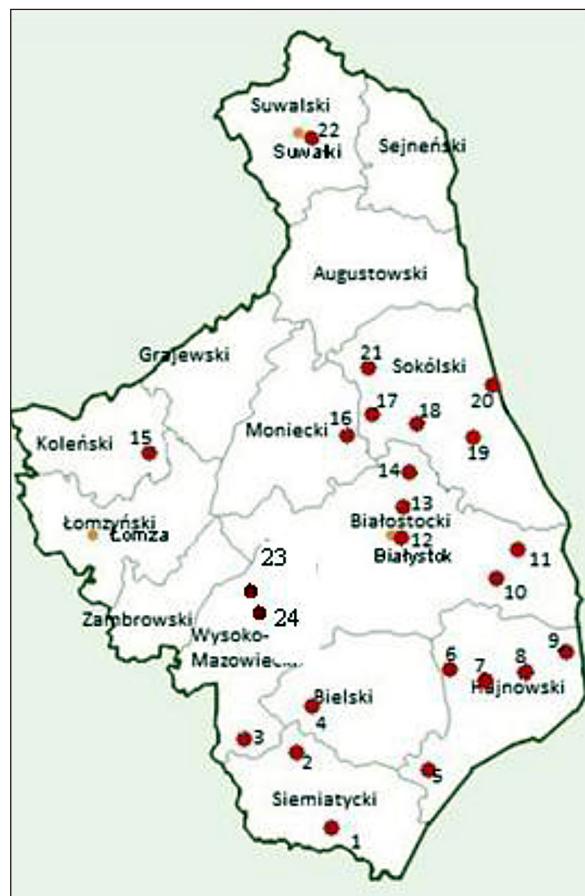


Figure 1. The map of Podlaskie Voivodeship presenting the locations of retention reservoirs

12. Dojlidycreek.
13. Wasilkówcreek.
14. Small water retention reservoir Czapielówka.
15. Small water retention reservoir Stawiski.
16. Small water retention reservoir Jasionówka.
17. Small water retention reservoir Korycin.
18. Small water retention reservoir Sitawka.
19. Creek in Sokółka.
20. Small water retention reservoir Kuźnica.
21. Small water retention reservoir Suchowola.
22. Arkadia creek in Suwalski.

Most of the aforementioned reservoirs were formed after 1995 because in that year there was signed the agreement regarding the plans of undertaking actions including the reconstruction of old and formation of new small retention reservoirs in particular Voivodeships of Poland. It was at that time that in the Podlaskie Voivodeship the following reservoirs were either formed or renewed: Zarzeczany, Sitawka, Grodzisk, Jasionówka, Kuźnica, Repczyce, Korycin, Suchowola, Trywieża, Narewka, Michałowo and Otapy-Kiersnowek.

PERSPECTIVES OF THE DEVELOPMENT OF SMALL WATER RETENTION IN SELECTED MUNICIPALITIES OF THE VOIVODESHIP

In Podlaskie Voivodeship there has been observed in the recent years an increasing demand for the investments that contribute especially to larger attractiveness of farmland areas and to larger activity of municipalities in terms of tourism, which is undoubtedly caused by the formation of small retention reservoirs. So far it has been decided that in our Voivodeship 12 objects of small water retention will be formed or reconstructed. These include: reservoir "Suchowola" in the municipality Suchowola, "Bobra Wielka" in the municipality Nowy Dwór, "Szumowo-Olszanka" in the municipality Korycin, "Dzierzbia" in the municipality Stawiski, "Choroszcz" in the municipality Choroszcz, "Turośń" in the municipality Turośń Kościelna, "Kalinowo Solki" and "Wnory Wiechy" in the municipality Kulesze Kościelne, "Czyżew" in the municipality Czyżew- Osada, "Hajnówka" in the municipality Hajnówka, "Studziwody" in the municipality Bielsk Podlaski and "Chanie-Chursy" in the municipality Nurzec-Stacja (Figure 2).

Small water retention "Suchowola" will be located in Suchowola, in the municipality Suchowola, on the Olszanka river. The information obtained from the municipality office entails that this will be a water region having the area of 1ha and the depth of 1.5 m. The total cost of the investment is estimated at 1 500 000 PLN, the completion of the enterprise is planned for the year 2014.

Another planned investment is the small water retention reservoir "Bobra Wielka" which will be situated in Bobra Wielka, in the municipality Nowy Dwór, on the Biebrza river. The actions are planned to include the reconstruction of the retention reservoir in the location of the existing carp ponds. The water area is planned to have the water surface of 13.5 ha and the retention capacity of 130 000 m³ of water. The completion date of the enterprise realization: September 2014.

A subsequent small retention reservoir will be situated in Szumowo-Olszynka, in the municipality of Korycin, on the Kumialka river. The water area is supposed to have the total area of 6 ha. The completion of the enterprise realization was planned for the end of 2013, yet it was postponed for one year.

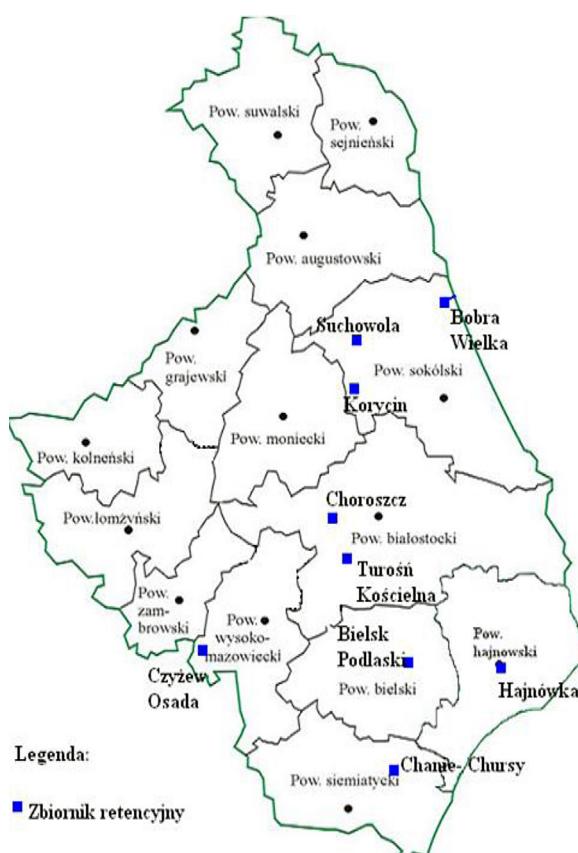


Figure 2. The map of Podlaskie Voivodeship presenting the locations of planned retention reservoirs

During the realization of the tasks aiming at the improvement of water management in the municipality Stawiski in 2010 it was decided to create a project involving the reconstruction of a small water retention reservoir on the Dzierzba river in Dzierzba (the eastern part of the municipality). The reservoir will be located approximately in the section 5.194–5.432 km of the river. The plan of the reservoir reconstruction entails the formation of a man-made instantaneous reservoir having the area of 2.35 ha and the maximum capacity of 46 650 m³ and it is still in the process of realization.

Another small retention reservoir is planned for the town Choroscz, in the municipality Choroscz, its planned area will be 5.5 ha and the capacity – 99 000 m³ of water, and it is intended to be formed on the Horodnianka river. However, the date of the enterprise completion has still not been specified due to the fact that there is lack of financial measures necessary for purchasing the land required for the investment.

Turośń Kościelna, in the municipality of Turośń Kościelna, is planned to be the location for forming a reservoir having the area of 8.2 ha and the capacity of 94 500 m³ of water. The investment realization started in 2000 and the completion was scheduled for 2012, but it was postponed for the turn of the years 2014/2015.

With the object of improving the aesthetics and landscape amenities of the municipality Kulesze Kościelne there were created two projects regarding the reconstruction and organization of water reservoirs in the following villages: Wnory Wiechy and Kalinowo Solki. The village Kalinowo Solki is situated in the eastern part of the municipality Kulesze Kościelne. The plot on which the actions related to the investment will be conducted is in the possession of the municipality and occupies the area of 23 000 m², where the area of stagnant water is 9400 m². Presently there is located an instantaneous trench overgrown with plants and filled with a small amount of water. Another object designed for renovation is the reservoir in the village Wnory Wiechy located several kilometers south from the village Kulesze Kościelne. Similar to the village Kalinowo Solki, the investment area is the possession of the Municipality Office. The total area of the object is 0.55 ha, where the water surface area is 2500 m². It is difficult to specify precisely the completion date of the enterprise realization because presently tenders are being organized for renovation works.

Small retention reservoir will be situated in Czyżew-Osada, in the municipality of Czyżew-Osada along the right side of the Brok river. The water area is intended to have the area of 2.43 ha and the maximum retention capacity of 33 973 m³ of water. The investment is in the process of realization.

In Hajnówka in the municipality Hajnówka there is a melioration ditch in the fragmentary catchment of the Leśna Prawa river which is planned to become the location for the formation of a small retention reservoir. The water area is supposed to have the area of 5.1 ha and the maximum retention capacity of 106 600 m³ of water. The completion date of the enterprise realization has not still been specified.

What is more, for the town Bielsk Podlaski in its district Studziwody, in the municipality Bielsk Podlaski there is a plan to form another small retention reservoir – on the right side of the Biała river. The water area is supposed to have the water surface of 3.06 ha and the maximum retention capacity of 57 000 m³ of water. The planned spatial concept of forming the retention reservoir was prepared and positively assessed in 2006, but due to the lack of funds the investment is unlikely to be realized.

A small water retention reservoir will be situated in the village Chanie – Chursy, in the municipality Nurzec Stacja in the catchment of Nurzec river. The water area is planned to occupy the area of 1.1 ha and have the retention capacity of 13 920 m³ of water.

SUMMATION

The necessity and purposefulness of the investments related to water retention are justified mostly due to the preservation of the environment equilibrium as well as due to its farming, anti-flood, landscape and recreation aspects. Reasonable water management where various forms of retention are used gives large chances for the mitigation of the effects of unfavorable phenomena related to its insufficient amount.

Human activity, infrastructure development and elimination of natural water objects caused by earmarking areas for other purposes contributed to considerable acceleration of surface confluence and to reduction in natural retention.

The available resources of Podlaskie Voivodeship are sufficient to meet the basic needs of in-

dustry, municipal economy and farming, however, they are not equally set in time and space perspective. The activities regarding small water retention were undertaken mainly with focus on reservoir retention, whereas less attention was paid to melioration ditches or to increase in the natural soil retention. Retention reservoirs which are planned for the Voivodeship are supposed to perform a number of functions including mainly those related to farming, recreation and landscape. The more and more frequent phenomenon of drought causes deficiencies of water for both farming and population and small retention will enable its reserves in the periods of low amounts. It is of particular importance when into consideration is taken the fact that Podlasie is the area of primarily agricultural use.

So far there have been formed 11 plans regarding the construction and modernization of small retention objects. Most of them were set in the Southern part of the Voivodeship. The reason of such situation is deficiency of stagnant water in this area when compared with the Northern part.

In the following districts: Suwalski, Sejneński, Augustowski, Grajewski, Moniecki, Łomżyński and Zambrowski, in accordance with the statements of the municipality workers responsible for spatial management and water management, there is no need to modernize or construct small retention objects. At the same time in the following districts: Sokólski, Kolneński, Białostocki, Wysokomazowiecki, Bielski, Hajnowski and Siemiatycki it has already been planned to either renovate or construct new objects.

The creation of plans regarding the formation of reservoirs accumulating water is not necessarily synonymous with their realization. The reason of problems connected with the implementation of plans regarding the formation of new reservoirs lies mainly in financial measures and in problems with obtaining them.

In order to expand the available water resources of good quality it is necessary to manage properly the water resources in smaller hydrographic catchments. Complex retention of surface waters, mainly in rural areas, has many advantages as it enables more universal usage of water resources without causing changes in the natural water regime. Small retention introduces only corrections which improve water balance but do not cause violation of the ecosystem biological equilibrium.

Simultaneous improvement of water quality and landscape amenities aims not only at attract-

ing tourists and focusing on agrotourism, but it also is aimed at improving the living standard of the local community.

Water deficit in Poland is the reason for which the principles of its national usage need to be complied with. Realization of plans at both Voivodeship and municipality level that are focused on small retention will contribute to considerable increase in the retention capacity and will enable considerable increase in available resources in hydrographic catchments of both the characterized area and the entire country.

CONCLUSIONS

1. In Podlaskie Voivodeship the establishment of 12 small retention reservoirs has been planned by the year 2015.
2. Realization of the investments causes expansion of the area of stagnant waters in the Voivodeship by approximately 47 ha.
3. Presently two objects are being realized: Turośń Kościelna (municipality Turośń Kościelna) and Czyżew Osada (municipality Czyżew Osada).
4. In the municipality Hajnówka (town Hajnówka) the realization of the investment came to a halt at the stage of coming into the possession of the lands allocated for the formation of the reservoir.
5. In the municipality Suchowola (town Suchowola) and Korycin (town Szumowo–Olszanka) there are continued works on preparing complete documentation.
6. For the following objects: Wnory Wiechy and Kalinowo Solki (municipality Kulesze Kościelne) tenders for renovation works are presently organized.
7. In the municipality Nowy Dwór, in the village of Bobra Wielka the works connected with the realization of the investment were delayed for technical reasons. There is concern whether the dyke left there and separating the upper and lower water area will stand the water pressure.

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