Acta Agrophysica, 2002, 67, 189-195

PRINCIPLES OF RENATURALIZATION OF THE NAREW VALLEY BETWEEN RZĘDZIANY-ŻÓŁTKI

W. Mioduszewski

Institute for Land Reclamation and Grassland Farming
Falenty, 05-090 Raszyn, Poland, e-mail: w.mioduszewski@imuz.edu.pl

A b s t r a c t. The article presents a feasibility analysis of restoring hydrological conditions in the Narew River valley to a state prior to the regulation of the Narew channel. The present studies showed that the first step should be to construct weirs in the section of the Narew valley between the settlements of Rzędziany and Żółtki to raise water level in the numerous abandoned river channels, some of which are now frequently without water. Secondly weirs (dikes) in the regulated channel of the Narew to reduce flow volume and direct water into the network of the old river channels should be constructed. The final third step of the restoration would be the blocking of the flow in the regulated Narew channel and stimulating the frequency of spring flooding.

K e y w o r d s: rivers, protection of the natural environment, water management

INTRODUCTION

A major hydro-technical and land improvement project was started in the valley of the Narew River in the 1970s. It was designed to make the valley's natural wetland suitable for agriculture as high-yield hay meadows and pastures by the lowering of groundwater levels in the valley and reducing flood frequency, especially during summer. The regulation work on the channel of the Narew began at the point of its confluence with its tributary, the Biebrza, and was concluded in 1984 in the section at Rzędziany. In the Narew valley downstream of Żółtki, drainage-irrigation systems were constructed. They were equipped with structures and installations to facilitate subirrigation using water drawn from the Narew River.

Upstream of Rzędziany, as far as the Siemianówka Reservoir, the Narew channel and its valley retained their natural character. No hydrotechnical work was ever carried out there. The most valuable section of the valley, between Suraż

and Rzędziany, is now legally protected as the Narew National Park, as provided for in law of 1995.

The most unfavourable situation is noted in the valley section between Żółtki and Rzędziany. In this stretch, the river channel was regulated but drainage-irrigation systems were never installed. The construction of a new wider and deeper channel down the middle of the valley caused a reduction and, in many cases, discontinuation of the flow in the old river channel network. There was a decline in the surface and groundwater levels in the entire area of hydrogenic formations, the frequency of spring and summer flooding was reduced. Out of many harmful processes observed, the most serious are the adverse changes in vegetation, reduction in the number of birds and mineralization and degradation of peat formations [1,3]. It should be noted that changes registered in the valley are unfavourable both for the natural environment and for agriculture [7]. In its present state the stretch of the valley discussed requires an restorative action. As the first step, it is necessary to raise groundwater levels in the valley and restore at least a part of the now nearly defunct old river channels [6].

HYDROGRAPHIC NETWORK AND PROTECTIVE MEASURES TAKEN

The construction of a new deeper and wider river channel caused substantial changes in the hydrographic network and the sinking of the ground surface due to peat subsidence [1,4]. A decline of the groundwater table was registered practically everywhere in the valley. Near the new river channel the groundwater level fell to 1.5 m below the groundsurface, while subsidence of the groundsurface is estimated at 0.3 – 0.4 m. Above the Rzędziany-Pańki dyke, i.e., in the Narew National Park area, a decline of the groundwater table and subsidence of the ground is much smaller thanks to the construction of a "water barrier" along the dyke and high water levels maintained on the weir at Rzędziany [8]. This led to the development of a natural bar in the line of the dyke; in places differences in the groundwater levels upstream and downstream of the dyke may be as much as 1.0 m [3].

Regulation of the Narew channel triggered substantial changes in the hydrographic network. When the dyke was constructed it cut across the old river channels in the area. Only two out of numerous old riverbeds remained in the Pańki-Rzędziany section now equipped with spillways (Fig. 1). The volume of water flowing in them is negligible in comparison to the water flow in the new river channel.

Infrared aerial photographs taken of this stretch of the Narew River in 1997 and data from field inspection were used to assess the situation of the river chan-

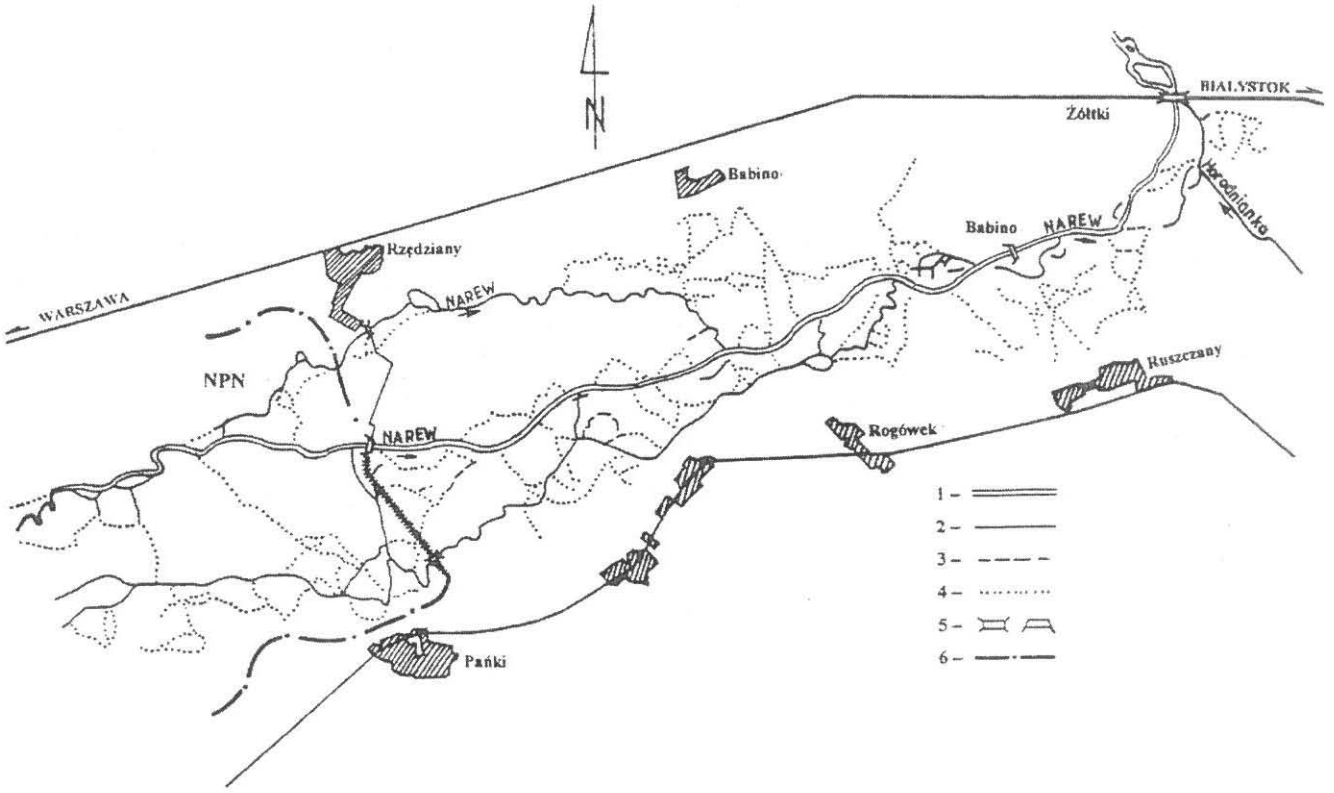

Fig. 1. Hydrographic network in the Narew Valley (Rzędziany-Żółtki section): 1 – The new channel of the Narew river, 2 – Old channels filled with water, 3 – Dry old river channels or filled with a small amount of stagnating water, 4 – Old river channels marked on the 1976 topographic map, 5 – Weirs and gates, 6 – Border of Narew National Park (NPN)

nels. Visible flow was registered basically in largest two of the old channels (Fig. 1). Aerial photograps indicated also that other abandoned channels are in stretches entirely without water or stagnate. Most are choked by vegetation and accumulating silt. They could not be identified in the photographs. In Fig. 1, old river channels have been marked on the basis of a topography map from 1976, and information from aerial photographs from 1997.

After discontinuation of the drainage irrigation project, various attempts were made in the Rzędziany-Żółtki stretch of the Narew Valley to bring it under management. One of the designs was to create a buffer zone in the area bordering the dyke to protect the region within the Narew National Park [9] and use the remaining parts of the valley for agriculture. Another proposal, in addition to the creating the buffer zone, included a construction of a dam in the new river channel (downstream of the Rzędziany weir) as well as on the old river channel Pańki [2]. The site for the dam and its damming height were determined using variant modelling studies [6]. A third study investigated feasibility of regulating soil moisture for agriculture with the help of an existing network of old river channels instead of constructing the usual system of drainage ditches [7].

However, none of the proposed solutions and projects was implemented. It was partly due to a strong resistance from the environment protection movement who maintained that the entire section of the Narew Valley between Żółtki and Rzędziany should be renaturalized as far as possible, its natural hydrographic network and moisture conditions of peat soils restored to what they had been before the river was regulated. With this in mind, the Society for Bird Protection in Białystok (PTOP) purchased over 300 ha of grassland in the valley (mainly on the right bank of the new channel) with an intention to undertake nature restoration projects in the areas no longer used for agriculture. The PTOP constructed a few dams on some old river channels and cleared silt from the old river channel demonstrating that relatively simple methods may be effective in the raising of water level and restoring the old river channels. Nevertheless, full restoration may be achieved only by a comprehensive approach based on hydro-technology, and carried out by specialists in hydraulic structures.

RENATURALIZATION OF THE NAREW VALLEY ASSESSMENT OF FEASIBILITY AND DIRECTIONS

Two decades after the Narew channel was regulated some of the numerous transformations started then, are now irreversible. For example it is not possible to

fully reverse ground subsidence by raising moisture content in the organic formations. Similarly, it will not be easy to fully reconstruct the old river channel network in the valley. All the same, it is still necessary and possible to carry out technical projects to raise moisture content in the valley to a level similar to the one before the regulation of the Narew. One of the possible ways is to make the water level in some places of the new Narew channel and its old riverbeds higher by 1.0 – 1.5 m than at present and inhibit a rapid outflow of water to increase the frequency of spring floods. When planning renaturalization of this part of the Narew valley, it is necessary take into consideration the need to protect the areas upstream the dyke, i.e. in the Narew National Park. Interests of farmers living in the valley who use hay-fields and pasture there should also be considered.

Due to an extensive scope and substantial costs of technical projects like that, difficulties in predicting precisely reaction of the environment in question to measures undertaken and problems relating to ownership issues not fully regulated as yet, it is necessary to plan restoration work in stages. The following three-stage scheme seems most rational:

Stage I. Revival and reconstruction of the old river channels including the constructing a number of weirs to raise water level in the channels of the still viable old riverbeds; removing silt and reviving the flow in some of the nearly defunct channels, as far as possible.

Simple weirs would be constructed; for example small stone or wood dykes made watertight with foil or clay. To achieve an increased water flow volume in the old river channels, a high level of water would have to be maintained on the Rzędziany weir. Damming water in the old river channels will substantially improve moisture conditions in the area within the old river channels and the upland, but the section of the valley bordering on the new Narew channel will remain overdried.

Stage II. Reduction of the draining action in the new Narew channel. This should be achieved by a simultaneous raising the water level in the river channel and reduction of flow velocity. This may be done by the constructing a number of weirs with a constant (not moving) crests. They would be fairly expensive since high resistance of hydro-technical installations is needed; it is also necessary to secure them against damage by floodwater flow. Construction of weirs will allowed to direct more water to the old river beds.

Stage III. Reconstruction of the natural water regime including spring floods in the valley. This stage may be implemented if the basic purpose of water management assumed in this section of the Narew valley, is nature protection. Extensive agricultural use is then admitted but must be adjusted to high moisture content

in soils and occurrence of spring floods in the valley. Reconstruction of the natural water regime will call for a decreasing flow in the new Narew channel almost to zero and increasing the volume of water flowing in the old river beds.

CONCLUSIONS

While renaturalization of the stretch of the Narew valley between Żółtki and Rzędziany is possible, it is a complicated technical project. Substantial reduction of intensive agriculture in the valley is needed. It is too much to hope for a full restoration of the natural conditions before 1970 (i.e., regeneration of deteriorated organic soils). In view of the complicated and costly character of necessary technical measures, it is advisable to carry out the renaturalization project in the Narew valley in three stages:

I - revival and reconstruction of the old river channels,

II - reduction of the draining action of the new (regulated) Narew channel,

III - reconstruction of the natural water regime, including spring flooding.

The range of phenomena observed in the Narew valley are unfavourable both from the point of view of agriculture and natural environment protection. The valley became overdrained by the new deepened and widened channel of the Narew constructed in around 1980. The valley should not be left in its present condition; action is urgently needed to improve moisture conditions.

It is necessary to emphasise the need to set up a monitoring system in the valley section earmarked for renaturalization, to measure groundwater and surface-water levels. Knowledge on the depth of the surface and groundwater table and the scope of changes it should enable a design of more rational technical solutions and precise regulation water conditions needed to for the restoring of the outstanding nature in the Narew Valley.

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KONCEPCJA RENATURYZACJI DOLINY NARWI NA ODCINKU ŻÓŁTKI – RZĘDZIANY

W. Mioduszewski

Instytut Melioracji i Użytków Zielonych, Falenty, 05-090 Raszyn, Polska

S t r e s z c z e n i e. W pracy przedstawiono analizę możliwości odtworzenia stosunków wodnych jakie miały miejsce przed regulacją rzeki Narwi. Wykazano, że na omawianym odcinku niezbędne jest wykonanie w pierwszej kolejności budowli piętrzących dla podwyższenia poziomu wody w licznych, obecnie często suchych starorzeczach. W następnym etapie wskazane jest wykonanie progów w nowym korycie rzeki dla ograniczenia wielkości przepływu w tym korycie i skierowanie wody do sieci starorzeczy. Ostatnim etapem prac renaturyzacyjnych powinno być całkowite zablokowanie przepływu w uregulowanym korycie rzeki i spowodowanie zwiększenia częstotliwości występowania zalewów wiosennych.

S ł o w a k l u c z o w e: rzeki, ochrona środowiska, gospodarka wodna