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HYDROMELIORATION CANALS AND POSIBILITY OF ITS OPTIMALIZATION

Hydromelioration channels in lowland areas of north Panonia lowland are outstanding landscape elements, which weren´t given any attention in the post socialistic era. Nowadays there is a need to have them categorized and to plan their further utilization. There are mentioned in the study some others, mostly biotic functions of hydromelioration canals (hydraulic: stabilization of underground water surface, microclimatic: influence on temperature and moisture regime, trofic: impact of organic detritic drift on the main stream, sanitation: elimination of agriculture nutrients, landscape: diversification and connectivity of landscape, production: production of fish and lant matter, genofond: fauna and flora protection, homeostatic: psychosomatic functions, aesthetic: landscape energy).
Key words: hydromelioration canals, optimalization of canals, structure and function, biota.

Drained land in Slovakia occupies the area over 460 000 ha. Drainage systems have been constructed in order to stabilize the agricultural production. Important elements of drainage systems are drainage canals, which were constructed in 60-80-ies of the last century. The care, respectively the rehabilitation of drainage canals was not realized in the last 22-25 years. Drainage canals play an important role in discharge of inland waters in the framework of drainage and flood protection. The secondary drainage canal network (open) is 5320 km long. It is situated in main hydrological river basins(Danube 1301 km, Váh 990 km, Hron 749 km and Bodrog&Hornád 2280 km). From this amount, 1970 km of secondary drainage canals are directly situated in the East Slovak Lowlands. Since the added value related to function of drainage canals is not paid adequate attention, the timeliness of dealing with this problem is in evaluation of new possibilities of multifunctional use of canals and elaboration of recommendations for their application in practice. Inconnection to re-structuring of agriculture it is necessary to re-evaluate primary and secondary drainage canals also from other viewpoints then the original for which they were designed.

Under the changed socio - economic conditions they should serve strengthening the stability of a landscape, its production potential, agrobiodiversity and biodiversity.

The aim is the forming of balanced homeostatic conditions in a landscape, especially by the elimination of point and nonpoint pollution, recirculation of agricultural nutrients, decrease of impacts of agricultural pests and creation of sustainable stability of agricultural landscape, which will provide benefits also for recreation (e.g. development of fishery, health and aesthetic function).

The drainage canal, as an artificial human element in a landscape, has other specific functions that were paid little attention. Its construction parameters are analogical with the stream. These parameters must be added under concrete condition of an area.

The canals were designed and constructed without taking into account landscape- ecological properties of the landscape and took into account only socialist gross production in agriculture. Already in 80-ties of the last century, this way of construction was criticized by several ecologists and environmentalists (Ružička, M. et al., 1986).

However, canals systems as technical elements remain the part of the landscape. Their maintenance, respectively rehabilitation in fact does not go on, they are gradually choked and are dumping from aerial and point pollution caused by wind and water erosion. They stop to fulfill their basic hydrological function, i.e. discharge of inland waters. The similar situation occurs in several post-socialist countries (Czech Republic, Poland,

Germany, Bulgaria and other (Schleyer, 2009, 2010).

The evaluation of status or potential of water bodies in Slovakia is made according to results from monitoring. With their characters and position in a landscape where an intensive agricultural production took place in the past, drainage canals can be dumping of priority and relevant substances, and thus can be a potential resource of pollution of surface and ground water. Moreover, the occurrence of extreme hydrological and meteorological situations, that are accompanying phenomena of climate change, causes unpredictable hydrological situations and following biotic changes in these line water constructions. These situations affect the whole landscape.

Categorization of drainage canals, which will determine the proposal of measures for improvement of their use from the point of view of particular sectors as well as multifunctional use. It is necessary to transpose the present state of canals into categorization of their properties and basic functions after taking into account landscape ecological functions and subsequently elaborate propositions and proposals of their rehabilitation and improvement, eventually leave them for natural succession processes.

The output of this study will be recommendations, maps, guidance for water managers and farmers for preparation for transition from convectional agriculture to practice of integrated management of ecosystem.

Material and methodic. In the formulation of goals, we came out from holistic understanding of function and structure of a drainage canal. In its study and evaluation we come out from the concept of 4-dimensional system (horizontal, vertical, transversal and temporal), with taking into account the conditions where the ecological continuum of the stream occurs (sensu Roux, A.L., Amoros C., Reygrobellet, J.L., 1987). The objective of the study is elaboration of the concept of extension of possibilities of drainage canals use.

In the period l985-89 we sampled the water monthly in order to determine the physico-chemical and biological properties of the water environment. Moreover, the other ecological properties of the channels and the contiguous territory were observed. In order to evaluate the country development we have utilized various kinds of maps, the historical maps of l78l, the cadaster maps l : 250 000 of, which we have actualized by using of the multispectral photographs of l986.

At present time we are again colect samplers and other hydrological and ecological characteristic of canals.

Results. The development of canal biota is influenced not only by geographic, climatic, hydrologic, and geological features, but also by the construction characteristics (length, the shape of kinet and berm, and flow velocity) and activity of hydrologic-operating gear.

The main source of the water defilement of hydromelioration canals is mainly areal agricultural soil which gets into the canals as recipients by surface or less by subsurface way. Biological defilement is caused mainly by the mass development and dying out of plants and animals developing at high content of nutrients.

The quality of water in canals is determined by geological conditions, form and intensity of the surrounding landscape exploitation as well as by processes in the canals influenced mainly by biota.

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Relative isolation between the quality of the water in canals and under waters was confirmed, and similarly, the relation between geomorphology and the amount of agricultural nutrients in the water was not confirmed although these relations cannot be excluded.

The results show that besides the melioration function the canal system has also other biotic functions the level of which can be increased mainly in relation to the surrounding landscape which is intensively agriculturally exploited (microclimatic and elimination functions, the support of diversity, connectivity, homeostasis).

The bulk of channels in term of hydrobiology is highly productive and with high biological activity manifested by high species richness fauna and flora. High production of organic matter in the aquatic environment

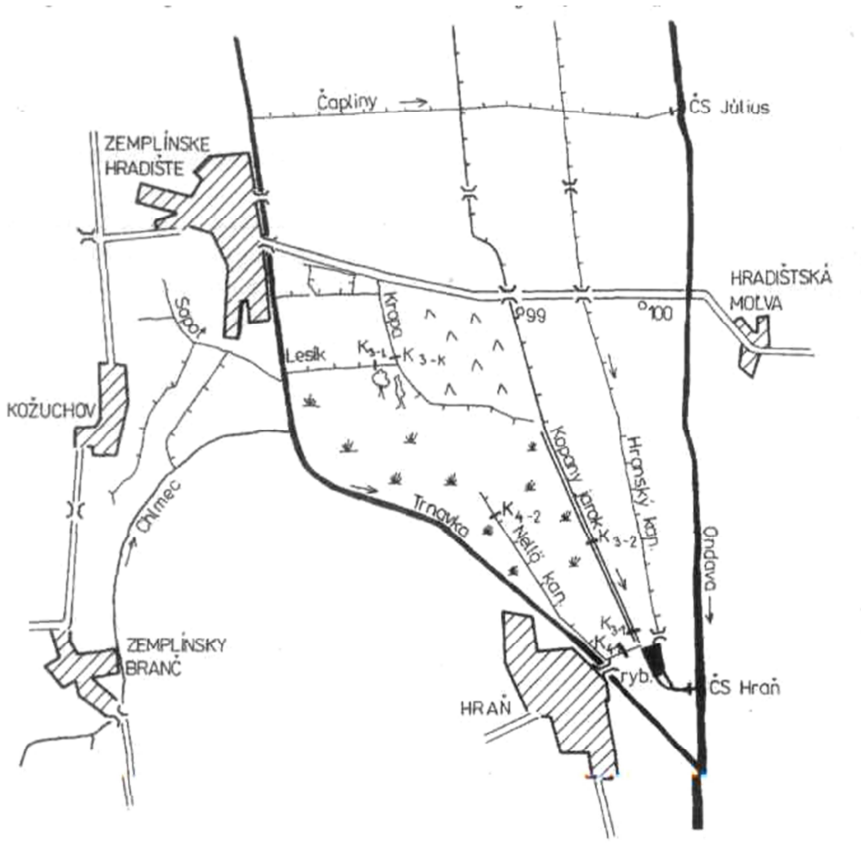

Fig.1. Canal network in Hran region with samplig place.

leads to a situation of emergency and subsequent anaerobic processes (Terek, 1990). This artificial landscape element requires permanent maintenance. As result of colmatage of riparian sections, there is no phreatic zone and often as result hydromelioration canal appears as isolated landscape element. Impact on underground water quantity from neighbouring areas is small and is manifested mainly by hydraulic conditions. Its primary function is to drain water, mainly surface water. Recently there is a need to feed eater into the country because of its large deficit particularly in the dry summer. Optimization measures lead to the prevention of environmental accidents such as overproduction of organic matter and its activity.

The suggestion of optimization measures. At the evaluation of their functions we issue "a priori" from the fact, that they are a strange anthropogenic country element, with the possibility of the regime regulation, which does not take a part of the natural structure, i.e. the presupposed functional influences or relations are often isolated and the feedbacks are not always formed. It brings a great number of phenomena, which are revealed by the other ecological effects and accidents (overgrowing, oversoiling, withering of organisms, toxicity, overproduction, etc.). The preliminary results regarding the channels categorization on the basis of the morphometric characteristics, the macrovegetation dominance and their presupposed functions were published by Terek (l988, l999).

Basic functions of sludges canals:

l - hydraulic: the stabilization of the subsurface waters level, drain off the waters

2 - microclimatic: the influence on the temperature and water regime

3 - trophic: the influence of organic detritus on main stream

4 - decontaminational: the elimination of agricultural nutrients

5 - scenic: the diversification and connectivity if the country, aesthetic function

6 - productional: production of fishes, vegetable material

7 - genopool: the protection of fauna and flora

8 - homoeostatic: psychosomatic functions, energy of country.

Proposition for intensification measure	Improvement of functions							
	1	2	3	4	5	6	7	8
Coming into leaf of berm by woody vegetation	-	+	+	-	+	+	+	+
Expansion of flooded part of berm	+	-	-	-	+	-	+	-
The hollowing of the part of canal bed	+	-	-	+	+	-	+	-
Feeding of water storage reservoirs	+	+	+	+	+	+	+	+

Optimizing measures are taken against the decreasing of the rate of flow of the canals and they are to prevent the origination of ecological disasters, i.e. the overproduction of organic mass, azoity. These tasks can be influenced by measures based on ecological principles, i. e.

- By the changes of construction parametres so that they would ensure the stabilization of underwater, increased diversity of the landscape, and increased biotic functions.

The biological processes, especially self-cleaning ability, ensue from the relation of the level line surface (B) and the other substrates (macrovegetation – M) with the water volume (V), respecting the passage (t). With the purpose of stabilizing, the underground water level and the life in channel, it is desirable to hollow the centre of the channel. It is possible by the other transversal (double trapezoid) and longitudinal (expanded berms, little reservoirs or fens) constructional characteristics to contribute to the creating of conditions for the increasing of species diversity, increasing self-purification ability etc., or to create the conditions for so-called flood zone. It is possible to obtain this by reducing of the slope up to l : 4.

- By the decreasing of solar radiation supply. The special method of the solution is the channel orientation in relation to the sun or shading. At projecting it is desirable to take into account the sun motion and the shading intensity in the vegetation season. The other possibilities are in the water vegetation structure, especially in the portion of natant, submersed and emergent vegetation. Among the tree vegetation the suitable wood species are poplar and alder growth combined with willow. The principles of the coming into leaf issue from the channels taken as a part of the territorial system of ecological stability (sensu Low, l986) and from their intensification function.

- By the structure of water and bank cover. The enhancing of the agricultural nutrients elimination occurs on the basis of the fact, that organisms are capable of accumulating in their bodies the nutrients in greater concentrations than the concentrations in surrounding environment (Seidel, l966). The littoral zone plants significantly take part in it through their roof system. It is the reality, that submerged plants have greater content of ions than emergent plants. The very preliminary results show the importance of great surfaces of submerged plants (Terek, l990), which reach up to 25 m^{-2} per l m^{-2} of bottom. In spite of the fact, that under our conditions it is not possible to fully eliminate the phosphorous compounds by fishes, the possibilities are significant. The fishes part in the total phosphorus content in storage reservoirs varies in dependence on the reservoir depth from l7 to 45 kg. We presuppose that the total phosphorus values can be decreased by 25 kg ha. This value may be significantly increased by the plant growths, with regard to the short period of the turn.

- The optimization of spatial distribution channel-storage reservoir-pumping station. From the power and water landscape-ecological point of view it is especially suitable to construct the storage reservoirs in front of the pumping stations. Their connection to the water service equipment enables us to improve the polyfunctioning of melioration systems (Kravčík,Terek l986), as well as the utilization of high trophic value of water for the

fish breeding. The marginal parts of channels, in accordance with the geomorphological, financial possibilities and requirements of the land owners to construct so-called buffer zones with the purpose of successive reclamation of typical coastal vegetation, which is typical for the streams of this climate-geographic region, i.e. by application of renaturalization principles. It is desirable to analyze all measures in co-operation with the country's ecologists with respect to local conditions.

- Organizationally-technical measures lie in accurate observation of mentioned measures, in elaboration and application of new manipulation rules, which will respect the hydrologically-ecological conditions. Emphasis should be put on the observation of the canal maintenance principles, including the avoiding of plugging under field bridges.

Conclusion. In the paper the other biotic functions of hydromelioration canals are described. On the basis of obtained knowledge the optimization measures were elaborated, directed at functions improving, especially at the avoiding of oversoiling and the accidental situations formation, in relation to the eutrophication effect. Suggested optimizing measures involve construction change of channel parameters, reduce the flow of solar radiation, increase elimination of agricultural nutrients, optimization of spatial arrangement channel – accumulation basin – filling station and technical and organizational measures.

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ГІДРОМЕЛІОРАТИВНІ КАНАЛИ ТА МОЖЛИВОСТІ ЇХ ОПТИМІЗАЦІЇ

Гідромеліоративні канали в низинних районах Північної Паннонії - найважливіші елементи ландшафту, яким не приділялося належної уваги в постсоціалістичну еру. Надзвичайно актуальним є наукове планування їх подальшого використання. При цьому необхідно враховувати велику кількість надзвичайно важливих функцій, в тому числі біотичних, які виконують ці споруди.
Ключові слова: гідромеліоративні канали, оптимізація каналів, структура і функції, біота.

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ГИДРОМЕЛИОРАТИВНЫЕ КАНАЛЫ И ВОЗМОЖНОСТИ ИХ ОПТИМИЗАЦИИ

Гидромелиоративные каналы в низменных районах Северной Паннонии – важнейшие элементы ландшафта, которым не уделялось должного внимания в постсоциалистическую эру. Чрезвычайно актуальным является научное планирование их дальнейшего использование. При этом необходимо учитывать множество важнейших функций, в том числе биотических, которые выполняют эти сооружения.
Ключевые слова: гидромелиоративные каналы, оптимизация каналов, структура и функции, биота.