

MANAGEMENT OF WATER-SUPPLIES IN THE TISZA RIVER BASIN

I. NAGY

Authority of Water Management for the Middle Course of Tisza,
Szolnok, Hungary
(Received 30 June, 1975)

The waters of the Eastern half of the Carpathian basin are collected by the Tisza and carried into the Danube. The watershed area of the approximately 1,000 km long river is about 157,000 sq.km. Its importance in the life of Hungary is shown by that about the half of the country falls to the watershed area of the Tisza.

The Pannonian sea that used to take up the place of the Hungarian Great Plain, was mostly filled up at the beginning of the Pleistocene with the alluvial deposit of the rivers discharging here from the adjacent ring of mountains. The rivers — thus the Tisza, as well — for lack of a definite gradient, looked for a way meandering vaguely and changing their beds. The floods of the rivers overflowing year by year, together with the rainwater missing any downflow, have increased marshes. That is the cause that in this region, even one and a half centuries ago, but a few hundred thousand people could manage to subsist.

There were these circumstances the Hungarian water-conservancy programme of the Nineteenth Century arose from, having as primary aims the protection against floods, river control, land drainage.

The decisive motive to begin the regular river control works was given by the floods of the Tisza in 1844/45, destroying the town Szeged, as well. Then the Tisza control was taken over by ISTVÁN SZÉCHENYI who considered as a precondition of the economic and cultural development of the country to overcome floods and solve water control. The plan of Tisza control was elaborated by PÁL VÁSÁRHELYI, the excellent water engineer of that age. Works began in 1846. The rivers of the Tisza basin were diverted in regulated beds, the floods were kept within dams by the large water works of the Nineteenth Century — called a second conquest of Hungary. In that way, the land was rendered suitable for cultivation and habitable, and life could begin to move on the way of the economic development. As a result of that, in the Tisza basin about 1,5 million ha. land could be conquered from waters. The reclamation of the affluents and their mouth area and a further development of the system realized took place in our century.

The possibility of land utilization and development has been created in about 20 per cent of the country by the protective system developed in this way.

Today already 40 per cent of the population of our country is living here, concentrating here 42 per cent of the national wealth of the country. Here lies one-third of the cultivated fields of the country. More than 50 per cent of the agricultural

production of the country and 70 per cent of the industrial production of the country come from this region.

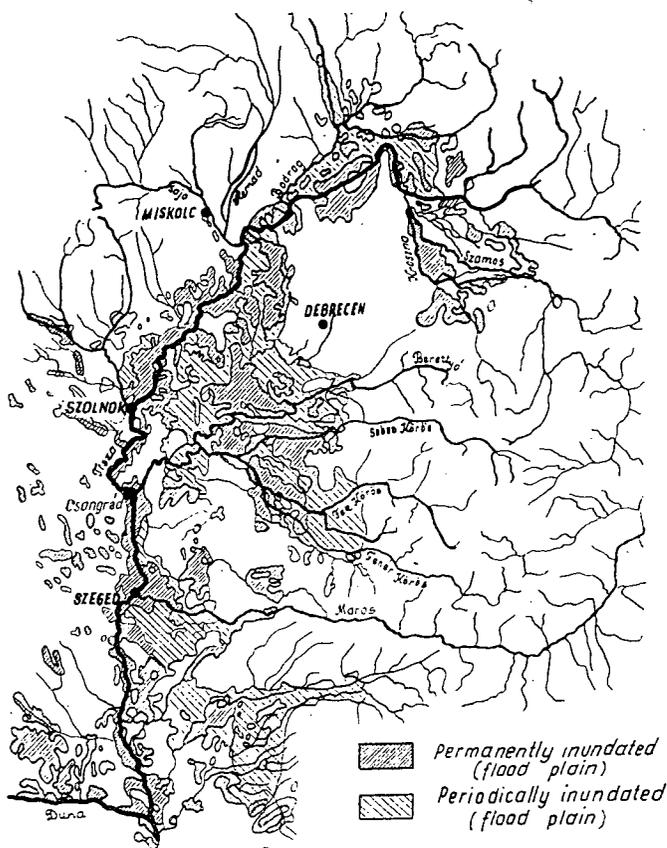


Fig. 1. Hydrographic map of the Tisza basin before the regulation of water-ways

The task of the present century is fundamentally the utilization of the existing stock of water, first of all the agricultural water utilization (irrigation, fish-pond economy), and it becomes more and more necessary, as well, to develop the industrial and drinking-water supply, shipping and river-side health resorts.

The Tisza basin is one of the most favourable regions in the Carpathian basin to agricultural production. But the many years average of precipitation falls short of 600 mm, and in a large part of the region even short of 500 mm.

The average precipitation of the growth season is 300 to 350 mm, falling in certain years even to 175 mm. The average number of sunny hours exceed 2,000. The water deficiency arising from the difference between the possible evaporation and precipitation in the middle region of the Great Plain reaches 175 mm in the average of 50 years. The aridity-factor having a high influence on plant cultivation is formed between 1.2—1.4; the area is, therefore, of droughty character.

In the middle part of the Tisza basin water is a production factor available but to a minimum extent. A precondition of developing the forces of production in this

area is to have water of sufficient quantity and quality and in a distribution of time and space as demanded by development.

Four-fifth of the Great Plain can be supplied with water for irrigation mainly from the Tisza. The annual formation of downflow is unfavourable from the point of view of agricultural production. The water movement in the Tisza is highly extreme. Its water output alternates between 50 to 4700 cc. m/sec. The smallest water outputs are first of all in Summer and late Summer, in the season of irrigation demands.

From this peculiarity of water conditions arises one of the most outstanding tasks of the water economy of the Tisza basin, to equilibrate the fluctuations of water outputs, regulating the discharge of the quickly flowing water with river barrages, bed and flood-plain reservoirs.

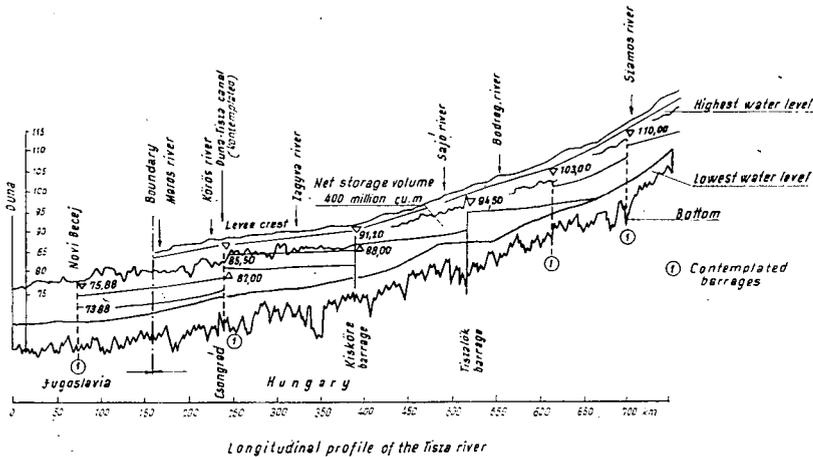


Fig. 2. Longitudinal section of the Tisza canalization

The Conception of Developing the Management of Water-Supplies in the river Tisza, approved by the Government of the Hungarian People's Republic at the beginning of 1973, is providing for canalizing the Tisza by building a series of river barrages.

In the framework of this multipurpose, extensive water-economy programme, there are being built five river barrages in the Hungarian Tisza stretch and one barrage in the Yugoslav stretch. By means of the river-barrage series, the utilization of Tisza water for the aims of the population, industry, agriculture, and for other purposes too, the regulation of natural downflow along the Tisza, and the distribution water in the Tisza basin are made possible. The barrages are creating a continuous water-way, utilizing the hydraulic power of the river — first of all for producing peak energy.

From among the river barrages, the River Barrage at Tiszalök was built first, in 1954. Its fundamental task is to supply with water the irrigation of 150,000 ha. of the Water-Economy System at Tiszalök, to satisfy the water-demand of industry and population and to provide with water the Kőrös basin, through the East-West Main Canal of a total 60 cc.m/sec. water-removal capacity and branching off from the Tisza above this river barrage. The output of the hydroelectric power station is 14 MW, for 55 million kWh annual average production — mostly peak energy. As a result of damming, in the Tisza and Bodrog a 130 km long water-way was produced,

navigable with larger ships, too, and in the river-bed the storage of 10 million cc.m water became possible.

In 1973, as second, the Kisköre River Barrage was put in operation. The next one will be built at Csongrád, and the Danube—Tisza Canal will join the Tisza above that. This canal will serve for the water supply of the Tisza basin from the Danube. It will connect the navigable water-way of the Danube — that will essentially grow wider after creating the Danube—Main—Rhine-canal, — with that in the Tisza, shortening strongly the line of the East-Western water transport, when the Csongrád Water Barrage is built in the developmental period after 1985. The fourth river barrage will be realized in the area of Dombrád, and the fifth in that of Vásárosnamény.

In the Yugoslav Tisza stretch, the river barrage being built at Új-Becse draws to be finished.

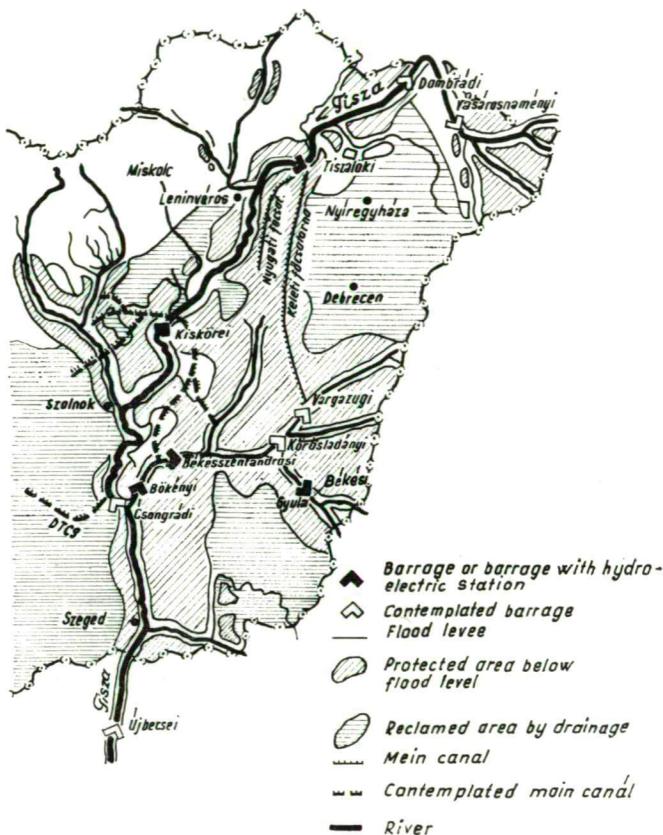


Fig. 3. Major establishments of water economy in the Tisza basin

As a result, a finishing the Tisza canalization and building the Danube—Tisza canal, the widening of the further economic development of the area and a strong development of water traffic are to be expected.

The building of the Kisköre River Barrage and its establishments was ordained — in accordance with the importance of the work — by Act II of 1966 about the Third Five-Year Plan of the people's economy.

The building of the river barrage began in 1968 and it was put in operation in 1973.

In the profile of the river barrage the most significant hydrographic data are the following: the watershed area is 66,000 sq.km, the smallest resp. largest water output observed so far are 56, resp. 3620 cc.m/s, the mean water output is 530 cc.m/s. The large water of 1 per cent probability is 4,032 cc.m/sec.

The aim of the river barrage is:

- to augment the utilizable water supply in the affected stretch of the Tisza, by equalizing the downflow conditions, with 300 million cc.m storing capacity and 144 cc.m/s water output, and later, in the long-range project, with 400 million cc.m storing capacity and 175 cc.m/s water output;
- to satisfy the increasing agricultural and industrial water demands, mostly in gravitational way, solving the water supply of 300,000 ha. area to be irrigated, 12,000 ha. fish-pond, and that of various industrial plants;
- to increase the safety of flood-prevention by means of the strengthened dams of the reservoir, and to protect the areas along the dams, by means of the oozing canal system, from the "springing" waters that earlier went along with floods;
- to product 103 million kWh energy, first of all peak energy, a year;
- to create a 120 km ship-way, suitable for the traffic of 1350 t ships;
- to stop partly the draw-off with pumping installation in the 120 km stretch of the Tisza affected by damming; to decrease the neight of noisting at the remaining installations;
- to establish resting and sporting possibilities by means of the 127 sq.km water surface of the reservoir.

The main parts of the system of establishments are: the river barrage, the river stretch dammed, and the reservoir, as well as the irrigation system in the districts Nagykunság and Jászság in Eastern Hungary.

The river barrage was built in the Tisza section at river-km 404, in a right-bank cutting, on the confines of the community Kisköre. The river barrage consists of three engineering structures built together (water power plant, weir, locking), of the flood-plain dam and of river-side establishments.

The built-in water output of the water power station is 560 cc.m/s, utilized by means of four tube-turbines with 6.3 m design fall, each of them swallowing 140 cc.m/s water and having a horizontal axis of 4.3 m wheel diameter, running at 107 rev. p. m. The utilizable fall is 2.0 to 10.7 m. The rated power of generators is together 28 MW.

The weir has five openings with raised sills, each of them being 24 m broad. The barring gear is a tainter gate with electrically controlled tipping board. The operation of the barrage is controlled from the control point placed at the right bank of the river.

The lock is placed on the left of the weir, in the headwater. The useful ground-space of its chamber is 85 by 12 m, its useful depth is 3 m. Its size corresponds to the international directives concerning the fourth-class shipways.

The reservoir formed — owing to the damming — 40 km long between Kisköre and Tiszabábolna in the flood-plain between the dams, as well as the dammed river stretch (reach) between Kisköre and Tiszalök are connected close to the river barrage, forming integral part of that. The water surface of the reservoir is 127 sq. km, its useful capacity is — in case of a long-range formation of a maximum damming of 91.20 m A. O. D. — 400 million cc.m. Its maximum width is 6 km, average water-

depth 2.5 m. From the reservoir 180 cc.m/s irrigating water can be obtained in 80 per cent of years.

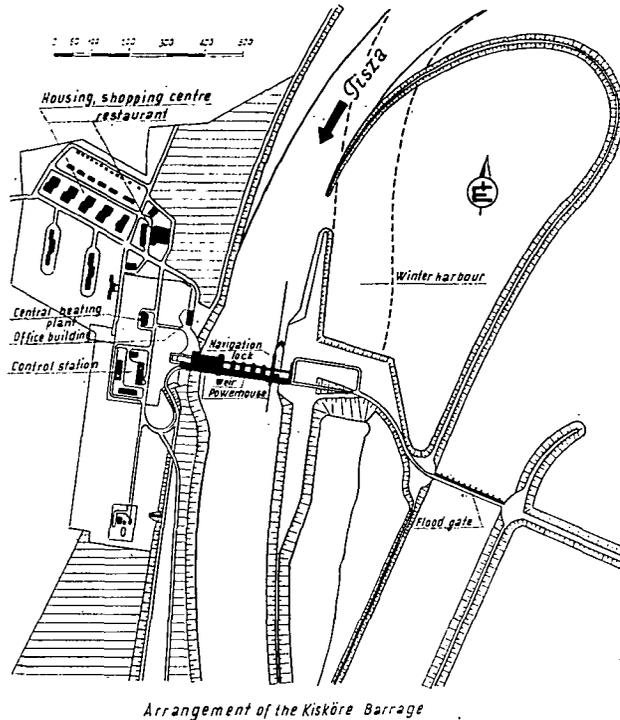


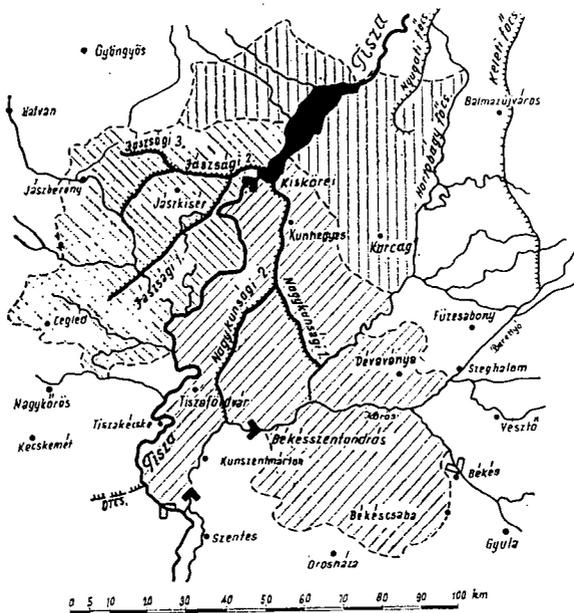
Fig. 4. General plan of the Kisköre River Barrage

The reservoir is created gradually. In the first time the lower section of the reservoir was built, at both river-sides about 19 km long, having begun to operate in 1973. That enables a bed-damming between the levels 87,50 to 88,50 m A. O. D. providing 40 million cc.m storing capacity. At the second step, till 1978, the 88,50 m damming level already reaches the feet of dams in some places, by covering the flood-plain. The complete building of the reservoir is a task of the second and third steps. In this period will also be built the resort and recreation area round the reservoir.

From the left bank of the Kisköre Reservoir, 4 km from the river barrage, the main canal in Nagyunság forks off. Its water transporting capacity is 80 cc.m/s. It provides partly for the irrigation water of 130,000 ha. area, partly for the water supply of the Kőrös basin. The main canal in Jászszág forks off from the right bank of the Tisza, 1 km from the water barrage. Its water transporting capacity is 48 cc.m/s. It supplies with water a 70,000 ha. area, partly in gravitational way.

As we think with justified pride on that this great work will serve for the welfare of the population in this area of Hungary even in the next century, we owe respect at the same time to the memory of István Széchenyi, Pál Vásárhelyi, and their co-workers, to the thousands of reputed and nameless specialists, ingeneers, technicians, workers, builders, excavator-operators and bankers in the reform era who, from the

period of pioneering work till our present days, all contributed to the prosperity of the Tisza basin, realizing by means of their unselfish efforts this great programme of the economy of water-supplies.



▲ Barrage (or barrage with hydroelectric station)

—— Main canal

Fig. 5. General plan of the Kisköre Water Barrage and its main works

In the framework of that nature-transforming programme, the biological equilibrium of the Middle Tisza Region and first of all that of the Reservoir of 127 sq.km size will change. We want to publish our results and establishments, achieved in the course of investigating these, in the present volume of Tiscia.

References

1973: A Kiskörei-vízlépcső (The Kisköre River Barrage). — Hidr. Köz. 1—342.