

# Flood issues and climate changes

## Country Report Slovakia

Final version, 23 May 2017



Project co-funded by the European Union (ERDF, IPA funds)

## Acknowledgements

Lead author	<b>Daniel Kindernay</b> , SLOVAK WATER MANAGEMENT ENTERPRISE, state enterprise, Slovakia
Contributing authors	<b>Zuzana Hiklová</b> , SLOVAK WATER MANAGEMENT ENTERPRISE, state enterprise, Slovakia <b>Katarína Farbiaková</b> , SLOVAK WATER MANAGEMENT ENTERPRISE, state enterprise, Slovakia <b>Ján Wagner</b> , SLOVAK WATER MANAGEMENT ENTERPRISE, state enterprise, Slovakia <b>Robert Slížik</b> , SLOVAK WATER MANAGEMENT ENTERPRISE, state enterprise, Slovakia <b>Ján Špiner</b> , SLOVAK WATER MANAGEMENT ENTERPRISE, state enterprise, Slovakia

The information and views set out in this publication are those of the author(s) (DTP project Lead Partners and partners) and do not necessarily reflect the official opinion of the European Union/Danube Transnational Programme. Neither the European Union/Danube Transnational Programme institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.



# Contents

<b>CHAPTER 1 INTRODUCTION .....</b>	<b>3</b>
<b>CHAPTER 2 GENERAL DESCRIPTION OF THE TISZA RIVER BASIN .....</b>	<b>4</b>
RELIEF.....	4
GEOLOGY .....	5
CLIMATE .....	5
WATER RESOURCES .....	5
SOIL .....	6
POPULATION AND HUMAN SETTLEMENTS .....	7
LAND USE .....	7
ECONOMIC ACTIVITY .....	8
BIODIVERSITY AND PROTECTED AREAS .....	9
CULTURAL HERITAGE.....	9
<b>CHAPTER 3 FLOOD RISK AT TISZA RIVER BASIN LEVEL.....</b>	<b>10</b>
FLOOD PROTECTION INFRASTRUCTURE.....	10
DRAINAGE SYSTEMS.....	25
SIGNIFICANT HISTORICAL FLOODS AND AREAS WITH POTENTIALLY SIGNIFICANT FLOOD RISK.....	28
NATIONAL FLOOD HAZARD MAPS AND FLOOD RISK MAPS FOR TISZA RIVER BASIN .....	36
POTENTIAL ADVERSE CONSEQUENCES .....	39
ESTIMATION OF THE IMPACT OF CLIMATE CHANGE ON FLOOD RISK.....	51
INTERNATIONAL COOPERATION IN THE TISZA RIVER BASIN .....	52
<b>ABBREVIATIONS .....</b>	<b>54</b>
<b>REFERENCES .....</b>	<b>55</b>

## Chapter 1 Introduction

Flood protection in the Slovak Republic is regulated by the Act. 7/2010 Coll. on flood protection. This Act, in accordance with § 1, provides:

- a) flood protection measures and obligations to on the assessment and management of flood risks in order to reduce the adverse effects of floods on human health, the environment, cultural heritage and economic activity,
- b) planning, organization and management of flood protection,
- c) obligations and rights of state administration bodies, flood protection authorities, higher territorial units and municipalities,
- d) obligations and rights of legal persons, natural persons - entrepreneurs and natural persons (hereinafter referred to as "the person") in the field of flood protection.

Flood protection is defined in § 3:

(1) Flood protection includes activities aimed at reducing the risk of floods on the area threatened by floods, at preventing flooding caused by floods, and at the mitigation of adverse consequences of floods for human health, environment, cultural heritage and economic activity.

(2) Flood protection is carry out by:

- a) flood protection authorities in accordance with § 22,
- b) other bodies of state administration,
- c) authorities of territorial self-government,
- d) flood commissions,
- e) water management authority of significant watercourses and water management authorities of small watercourses,
- f) owners, land managers and users of land, buildings, facilities or structures located in a watercourse or floodplain,
- g) construction builders, which intervene with the watercourse or floodplain,
- h) other persons.

Management and ensuring flood protection:

(1) Flood protection authorities are:

- a) ministry,
- b) district offices at the seat of a Region,
- c) district offices.

(2) Flood protection is managed and ensured by municipalities.

(3) The government, flood protection authorities and municipalities established the flood commissions as its advisory and executive body. The flood commissions are:

- a) central flood commission,
- b) regional flood commission,
- c) district flood commission,
- d) flood commissions of municipalities.

(4) District Office and district office at the seat of a Region may during the III. level of the flood activity, declared by the § 11, establish an operational flood protection group.

The operational flood protection group shall be governed by the working guideline of the operational group, which approves:

- a) head of the district office for the operational flood protection group within the district office,
- b) head of the district office at the seat of a Region for the operational flood protection group within the district office.

## Chapter 2 General description of the Tisza River Basin

### Relief

The Slovak part of the Tisza River Basin consists of 4 sub-basins:

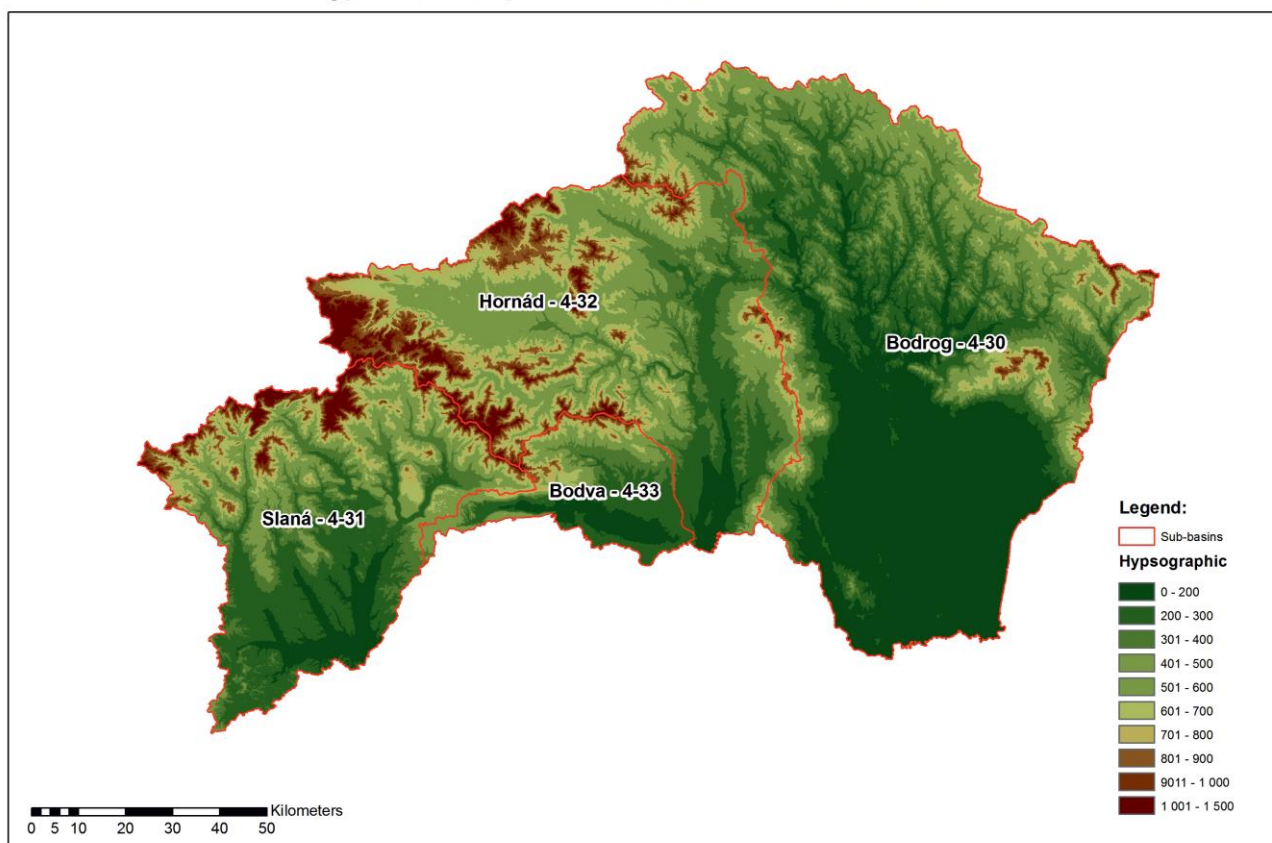
- Slaná river sub-basin
- Bodva river sub-basin
- Hornád river sub-basin
- Bodrog river sub-basin

In Slovakia, the Tisza River Basin can be orographically incorporate to the subassembly of Carpathy and in the eastern region to the subassembly of Pannonia, the provinces of the Western and Eastern Carpathians, in the eastern part of the area also to the East Pannonia.

Area of the Tisza River Basin can be characterized as dissected terrain with different relief. From the morphological - morphometric types of relief dominate the lowlands and the hillsides in the south of the area, the highlands and the mountains dominate mainly in the central and northern part of the area. The largest part of the basin area lies at altitude of 300-500 m. asl. and the smallest area takes up an altitude from 1000 to 1500 m. asl.

Significant particularity in the southern part of the basin is Slovenský kras, which is formed by a system of karst highlands separated by deep valleys. The result of the karsovatence is an extensive system of over 1000 caves and chasms.

**Hypsometric map of the Tisza River Basin in Slovakia**



**Figure 2.1 Hypsometric map of the Tisza River Basin in Slovakia**

## Geology

In the Tisza River Basin in Slovakia are following geological structures:

Neogene represent the deposits with young volcanites. There are also andesites, basalts, agglomerates and tuffs and sandstones. The horizon of volcanoclastic rocks represent epiclastic and pyroclastic andesites. On the upper and middle flows are crystalline slates, granitoids and Mesozoic rocks, while the lower flows are modelled by tertiary deposits.

The older palaeozoic rocks, whose original character before the metamorphosis was pelitic-psammitic, respectively volcanic with intergranular permeability are characterized by fissure permeability. Medium triassic limestones and dolomites have a very low permeability. Quaternary deluvium of loamy-clay character form an impermeable barrier, similar as Neogene deposits. Silty, respectively clayey loam with organic admixture in overburden are laying.

Paleozoic rocks are represented by granite rocks, gneiss and paragneiss. Basal layers are formed by conglomerates, breccias, limestones, sandstones and sandy clay. Neogen is formed by deposits of miocene and pliocene on which the neovolcanic are situated. These are the layers of clay, among which there are waterlogged layers of sand, gravel and sandy-clay. The volcanic neogene rocks are formed by andesites, rhyolites, tuffs and tuffites that are only slightly waterlogged. Of the quaternary deposits, the most widespread are proluvial gravels with a thickness of several meters. Fluvial sandy gravel form a bottom panel and low river terraces.

Tertiary is represented by deposits of paleogene, neogene and neogene volcanites. Changing of sandstones and clays, alternatively conglomerates, predetermines the intergranular permeability. The volcanic rocks are consist mainly from andesites or volcanoclasts.

## Climate

The Tisza River Basin covers a variety of climatic areas, from a warm area with a dry and cold winter, through slightly warm with slightly wet or wet and cold winter to coldest area. Lower altitude area, ie. from 100 m asl. it belongs to a warm, dry area with a cold winter. Areas with the altitude of 400 m till 800 m asl. belongs to a slightly warm, slightly wet to wet areas. In areas with higher altitude (from 800 m asl.) begins a cold area with higher humidity.

Long-term average annual air temperature in the The Tisza River Basin ranging from 4 °C in higher and northern locations, up to 10 °C in lower southern locations. In the middle part of the basin, the long-term average annual temperature ranging from 6 to 8 °C.

Total long-term average annual precipitation in the The Tisza River Basin ranging from 550 to 700 mm in the southern lower locations, 700-900 mm in the middle and 1 000 mm in the highest locations.

## Water resources

In the Tisza River Basin are 4 main watercourses with their tributaries:

**Slaná** spring at 1280 m asl.

Tributaries: Dobšinský potok (57,316 km<sup>2</sup>; length: 14,77 km), Kobeliarovský potok (15,651 km<sup>2</sup>; length: 6,76 km), Súľovský potok (57,656 km<sup>2</sup>; length: 13,11 km), Betliarský potok (17,064 km<sup>2</sup>; length: 7,73 km), Rožňavský potok (42,304 km<sup>2</sup>; length: 13,34 km), Honský potok (26,233 km<sup>2</sup>; length: 9,16 km), Čremošná (140,243 km<sup>2</sup>; length: 26,73 km), Štítňík (225,471 km<sup>2</sup>; length: 32,36 km), Muráň (386,578 km<sup>2</sup>; length: 42,91 km), Turiec (305,188 km<sup>2</sup>; length: 44,77 km), Lúčka (16,666 km<sup>2</sup>; length: 7,65 km), Rimava (1 378,426 km<sup>2</sup>; length: 83,12 km).

**Bodva** (865,523 km<sup>2</sup>; length: 46,99 km) springs at 890 m asl.



Tributaries: Zlatná (24,582 km<sup>2</sup>; length: 8,83 km), Ida (380,654 km<sup>2</sup>; length: 51,52 km), Drieňovec (61,745 km<sup>2</sup>; length: 11,86 km) and Turňa (179,337 km<sup>2</sup>; length: 25,02 km).

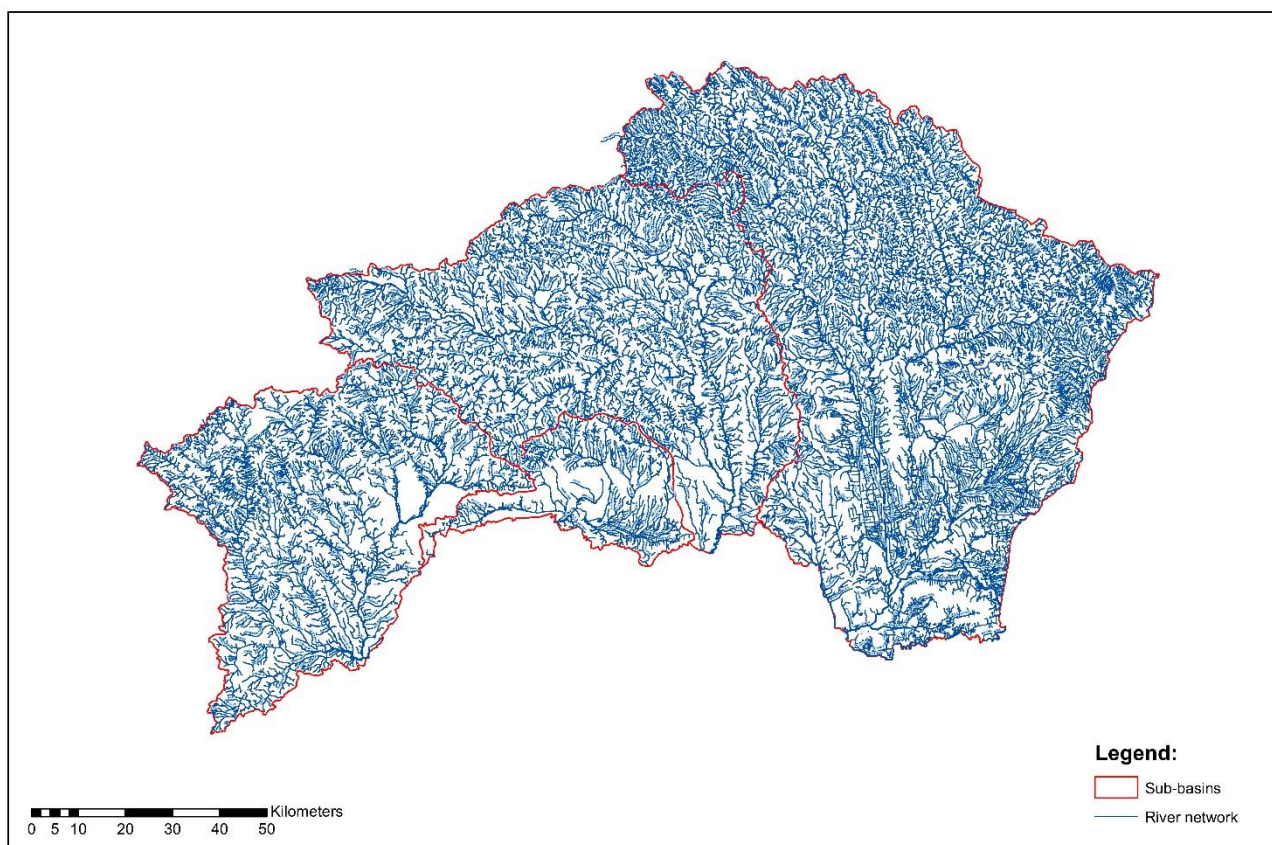
Bodva flows over the state border and enters into the area of Hungary, where it flows into the Slaná River.

**Hornád** springs at 1050 m asl.

Tributaries: Biely potok (23,558 km<sup>2</sup>; length: 9,16 km), Brusník (57,360 km<sup>2</sup>; length: 16,58 km), Levočský potok (153,277 km<sup>2</sup>; length: 27,35 km), Teplický potok (25,038 km<sup>2</sup>; length: 5,22 km), Rudniansky potok (23,889 km<sup>2</sup>; length: 7,64 km), Lodina (48,003 km<sup>2</sup>; length: 18,14 km), Peklisko (10,356 km<sup>2</sup>; length: 6,40 km), Klčovský potok (33,901 km<sup>2</sup>; length: 18,38 km), Branisko (111,926 km<sup>2</sup>; length: 15,83 km), Dolinský potok (32,417 km<sup>2</sup>; length: 9,69 km), Hnilec (654,900 km<sup>2</sup>; length: 90,90 km), Belá (72,509 km<sup>2</sup>; length: 13,46 km), Sopotnica (38,451 km<sup>2</sup>; length 15,55 km), Svinka (344,560 km<sup>2</sup>; length: 49,91 km), Uhrinče (10,800 km<sup>2</sup>; length: 5,25 km), Myslavský potok (59,665 km<sup>2</sup>; length: 19,49 km), Torysa, Olšava (341,294 km<sup>2</sup>; length: 49,39 km). Border line of Hornád is 11,07 km long. In Hungary, Hornád flows into the Slaná River.

**Bodrog** (11 966,351 km<sup>2</sup>; length: 14,94 km) is formed by the confluence of Latorica (31,6 km) and Ondava rivers. Bodrog tributaries are Somotorský kanál and Roňava (1 476,660 km<sup>2</sup>; length: 39,30 km). Main tributaries of Ondava and Latorica are Uh, Laborec and Topľa. Bodrog flows into the Tisza River on the southeastern outskirts of village Tokaj in Hungary.

**Tisza River Network in Slovakia**



**Figure 2.4. Tisza River Network in Slovakia**

## Soil

In western part of the Tisza River Basin there are soil types from chernozem to podzolic soil. Mainly haplic luvisols, rendzic leptosols and calcaric cambisols, podzolic soils and podzols represented by humus podzols, associated rankers, podzolic luvisols, locally peaty soils on weathered acidic rocks.



In southern part of river basin are dominating alluvial soils, alluvial gleysols, also areas of illimerized gleysols with associated haplic luvisols and rendzic leptosols, shallow layers of terra calcis, acidic luvisols unsaturated and podzolic haplic luvisols. In small area is located a strip of degraded chernozem on loess.

In central part of river basin are dominating acidic variants of cambisols with rankers. The sorptive complex of these soils is unsaturated, they are very skeletal and occur in deluvial deposits in a morphologically dissected terrain (associate extreme soils, rankers and podzols). Smaller representation have eutric cambisols and dystic cambisols, eutric andosols, rankers sporadically stagni-eutric cambisols, rendzic leptosols and rendzina cambisol are on the carbonate complex, alluvial soils, calcareous fluvisols.

Eastern part of river basin is represented by cambisols with rankers. Saturated cambisols – arable soils are dominating. Very expanded is stagni-eutric cambisol. In the flat part of the area there are mainly eutric fluvisols and gleyic eutric fluvisols and vertic fluvisols. Smaller extension have eutric planosols. There are also haplic luvisols and luvi-haplic chernozems.

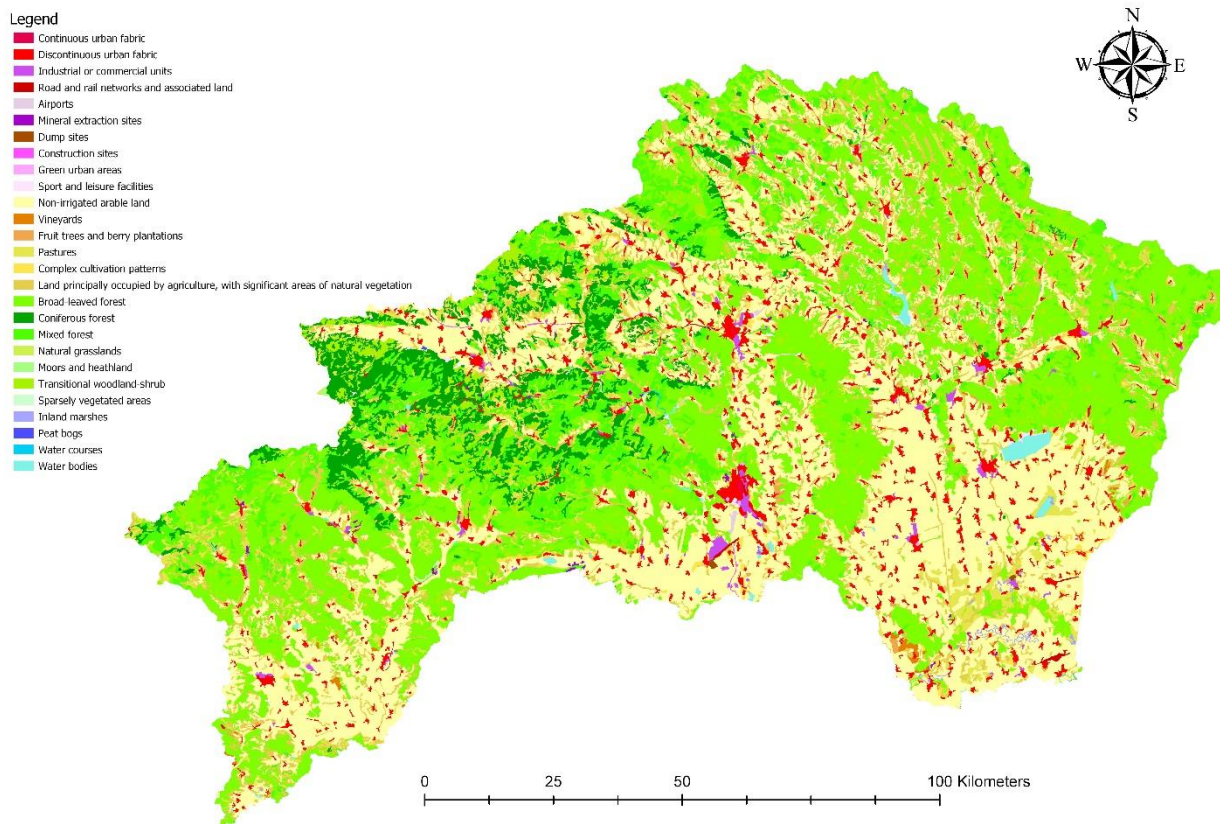
## Population and human settlements

The Slovak area of the Tisza River Basin is inhabited by 1 502 890 inhabitants, with the highest concentration of population in the middle part of the basin and with the lowest concentration in its peripheral areas. In the river basin there are 6 bigger cities - Košice (233 886 inhabitants), Prešov (90 835 inhabitants), Michalovce (39 322 inhabitants), Humenné (34 620 inhabitants), Bardejov (33 362 inhabitants), Trebišov (23 521 inhabitants). There are almost 500 000 inhabitants in these cities. Total urbanized areas of the Tisza River Basin in Slovakia achieve 4.3%. The river basin is located in the area of 3 regional towns, Banskobystrický county in the western part of the basin, Košický county in the southern part and Prešov county in the northern part of the river basin. There are 1 175 municipalities in the river basin.

## Land use

The area of the Tisza River Basin is predominantly forested. Forests represent almost half (45.6%) of the river basin. Important parts are protected areas. There are 4 protected landscape areas and 5 national parks. The forestry sector mainly uses the northern and northeastern part of the river basin. The southern and central Tisza River Basin is used extensively for agricultural purposes (48.7%) – mainly arable soil (30%) and other agricultural areas (8.7%), next formed by shrubs and with grasslands (9.4%), permanent crops (0.4%) and artificial vegetation (0.2%). Smaller representation have an industry (0.8%), mainly in the Central and Eastern Region. The rest of the area consists of urbanized areas (4.3%), water areas and wetlands (0.6%).

## Land use in Tisza River Basin in Slovakia



**Figure 2.8. Land use in Tisza River Basin in Slovakia**

## Economic activity

Industry in the Tisza River Basin is diverse without significant orientation on some industries. An important representation have metalworking, woodworking, food, construction, electrotechnic, engineering, chemical industry, textile and clothing sector. The industry is concentrated mainly in larger cities. In the area of the Slovenské Rudohorie is developed the mining and metallurgy.

Business activities of the population influence on the conditions and possibilities created in the area. In the area of the Tisza River Basin are many firms, entrepreneurs and self-employers. They mainly focus on trade, professional and technical activities, construction industry and industrial production. The most numerous group by number of employees are small enterprises followed by medium-sized enterprises and the smallest numerous group by number of enterprises in this area are large enterprises.

A significant part of Tisza River Basin is an agricultural land. It is mainly arable land, where especially cereals, forages, oil crops and potatoes are growing. Livestock production predominates in bovine cattle breeding. A large area of forests is managed in the river basin.

The natural beauties of the area and appropriate climatic conditions have created positive conditions for the development of tourism. Among the most visited sites are national parks, Bardejov city, Levoča city and Spiš Castle as a part of UNESCO sites and others.

## Biodiversity and Protected areas

In the area of the Tisza River Basin are 9 protected areas, ie. 4 protected landscape areas (PLA Cerová vrchovina, PLA Latorica, PLA Vihorlat, PLA Východné Karpaty) and 5 national parks (NP Muránska planina, NP Poloniny, NP Slovenský kras, NP Slovenský raj, NP TANAP).

Protected and endemic plant species are represented in these protected areas. These species include, for example *Iris pumila*, *Pulsatilla pratensis* subsp. *Bohemica*, *Tithymalus sojakii*, *Dahpne arbuscular*, *Ranunculus carpaticus*, *Scorzonera rosea*, *Onosma viridis*, *Ligularia sibirica*, *Saxifraga paniculata*, *Dryas octopetala*, *Cochlearia tatarae*, *Gentiana frigida*, *Linaria alpine*, *Dianthus glacialis* etc.

The area also includes protected animal species such as *Lacerta viridis*, 26 species of bats, *Merops apiaster*, *Aquila chrysaetos*, *Aquila pomarina*, *Falco peregrinus*, *Falco tinnunculus*, *Bubo bubo*, *Tichodroma muraria*, *Rupicapra rupicapra tatrica*, *Marmota marmota latirostris*, *Ursus arctos*, *Canis lupus*, *Lynx lynx*. From the area of the adjacent Bieszczady National Park in Poland, it goes to the area *Bison bonasus* and *Alces alces*. Also worth mentioning is the glacial relic *Duvalius szaboi* ssp. *Szaboi*.

In the Tisza River Basin are NATURA 2000 sites. During the creation of NATURA 2000 system the European Union membership countries are in accordance with:

- Council Directive 79/409/EEC on the conservation of wild birds (Birds-directive),
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitat-directive).

The Slovak Republic enacted duties consequent to both directives in the Act No. 543/2002 on nature and landscape protection and appendix No. 16 of executive order of the Ministry of the Environment of the Slovak Republic No. 24/2003 Coll. Special protected areas (SPAs) are included in § 26 as protected bird areas and Special areas of conservation (SACs) are included in § 28 as areas of European interest.

In the Tisza River Basin are 13 protected bird areas and 118 areas of European interest.

## Cultural heritage

Act no. 208/2009 Coll. of 28 April 2009 amending and supplementing Act. no. 49/2002 Coll. on the protection of the Monument Fund, as amended by Act No. 479/2005 Coll. regulates the conditions for the protection of cultural monuments, monuments area, archaeological finds and archaeological sites in accordance with scientific knowledge and international treaties on the European and world cultural heritage of which the Slovak Republic is bound to fulfill.

In the Tisza River Basin, in sections of watercourses with a potentially significant flood risk, there are 3819 national cultural monuments (rated municipalities with 6 national cultural monuments), 9 monument zones and 4 monument reservations. The highest concentration of cultural heritages is mainly in the middle part of the Tisza River Basin.

UNESCO - The Slovak Republic acceded to the Convention on the Protection of the World Cultural and Natural Heritage on March 31, 1993. The World Heritage Committee, elected by the Member States at the General Assembly, approved and registered 7 World Heritage Sites from the Slovak Republic. 5 sites are located in the Tisza River Basin. These are the following locations:

- Wooden temples in the Slovak part of the Carpathian Arc,
- The historic core of Bardejov city,
- Levoča city, Spiš Castle and monuments of the surrounding area,
- Carpathian beech forests and German old beech forests,
- Caves of the Slovak republic and Aggtelek Karst.

## Chapter 3 Flood risk at Tisza River Basin Level

### Flood protection infrastructure

Table 3-7 is a list of dikes in the Slovak part of the Tisza River Basin. The total length of the dikes in the Slovak part of the Tisza River Basin is 748,32 km. Dikes were put into operation within years 1931 -2015 and the status of these dikes is predominantly "in operation". Most of the dikes in Tisza River Basin are dimensioned to  $Q_{100}$ .

In the table 3-1 are listed the large (total volume higher than 1 mn.  $m^3$ ) permanent reservoirs in the Tisza River Basin. The sum of these reservoirs is nearly 660 mn. $m^3$ . The largest of this reservoirs is Zemplínska Šírava with total volume 325 mn. $m^3$ . The highest dam has Ružín I reservoir with 63 m. Most of dams of large permanent reservoirs in Slovakia have earth dams, except two, which are from concrete.

Our explanation for water levels are shown on the attached picture in the note below the table 3-1.

Table 3-3 is a list of polders (dry reservoirs). In the Tisza River Basin there are 6 polders with a total volume nearly 53,4 mn. $m^3$ . The largest polder - Beša (53 mn. $m^3$ ) is located in the southern part of the basin.

The pumping stations (25) and hydraulic structure (1) are listed in the table 3-5 "Hydraulic complex facility". The value of maximum derived discharge of pumping stations is from 0,02 to 18,90  $m^3/s$ . The highest value of maximum derived discharge has pumping station Stretávka and pumping station Streda nad Bodrogom. The highest number of pumping stations is on the Ondava watercourse.

Table 3- 7 Dikes

Crt. nr.	Dike name	Water course	Dike position (rkm)	Length (km)	Medium high (m)	YCO	Normal operating conditions		Status
							Probability of exceeding (pc%)	Q <sub>100</sub> (m <sup>3</sup> /s)	
1		Slaná	RB 1,470 - 23,000	4,740		1962	1	355	insufficient capacity (not transfer current Q <sub>100</sub> )
1		Slaná	RB 6,210 - 16,005	9,795			1	336	lower part of the segment has insufficient capacity, the dyke need to be increased
1		Slaná	RB 16,005 - 18,047	2,042		1962	1	275	insufficient capacity, the dyke need to be increased
1		Slaná	RB 18,047 - 23,216	5,169		1970	1	245	insufficient capacity, the dyke need to be increased
1		Slaná	RB 23,216 - 26,250	3,034			1	220	insufficient capacity, the dyke need to be increased
1		Slaná	RB 26,250 - 28,820	2,570			1	180	insufficient capacity, the dyke need to be increased
1		Slaná	RB 28,820 - 30,139	1,319			5	Q <sub>20</sub> =130 m <sup>3</sup> /s	insufficient capacity
1		Slaná	RB 30,139 - 30,699	0,560			1	220	insufficient capacity
1		Slaná	RB 31,451 - 35,786	4,335			1	140	insufficient capacity
1		Slaná	RB 35,786 - 49,312	13,526		1982	1	145	lower part of the segment has insufficient capacity
1		Slaná	RB 44,801 - 49,865	5,064			1	192	sufficient capacity

1		Slaná	RB 50,166 - 56,340	6,174			1	120	insufficient capacity
1		Slaná	RB 66,925 - 67,160	0,235			1	35 -70	r.km 56,340-78,312 - partial modifications with capacity 35-70 m <sup>3</sup> /s
1		Slaná	LB 0,625 - 1,965	1,340		1963	1	510	sufficient capacity
1		Slaná	LB 1,470 - 6,210	4,740		1962	1	355	insufficient capacity (not transfer current Q <sub>100</sub> )
1		Slaná	LB 6,210 - 16,005	9,795			1	336	lower part of the segment has insufficient capacity, the dyke need to be increased
1		Slaná	LB 16,005 - 18,047	2,042		1962	1	275	insufficient capacity, the dyke need to be increased
1		Slaná	LB 18,047 - 23,216	5,169		1970	1	245	insufficient capacity, the dyke need to be increased
1		Slaná	LB 23,216 - 26,250	3,034			1	220	insufficient capacity, the dyke need to be increased
1		Slaná	LB 26,520 - 28,820	2,570			1	180	insufficient capacity, the dyke need to be increased
1		Slaná	LB 30,139 - 30,699	0,563			1	220	insufficient capacity
1		Slaná	LB 34,986 - 35,786	0,800			1	175	insufficient capacity
1		Slaná	LB 35,786 - 49,312	13,526			1	145	lower part of the segment has insufficient capacity
1		Slaná	LB 49,312 - 50,166	0,854			1	192	sufficient capacity
1		Slaná	LB 50,166 - 52,990	2,824		1971	1	120	insufficient capacity
1		Slaná	LB 66,925 - 69,352	2,427			1	35 – 70	insufficient capacity
2		Muráň	RB 0,000 - 0,349	0,349			1	68	insufficient capacity
2		Muráň	RB 9,470 - 10,824	1,354		1978			insufficient capacity
2		Muráň	RB 22,067 - 23,306	1,239			1	110	insufficient capacity



2		Muráň	LB 0,000 - 0,349	0,349			1	68	insufficient capacity
2		Muráň	LB 22,067 - 23,533	1,486			1	110	insufficient capacity
3		Turiec	RB 0,000 - 0,349	3,490		1962-1968			insufficient capacity
3		Turiec	RB 0,000 - 1,652	1,652			1	76	insufficient capacity
3		Turiec	RB 1,652 - 4,630	2,978			1	110	sufficient capacity
3		Turiec	LB 0,000 - 0,349	3,490		1962-1968			
3		Turiec	LB 0,000 - 1,652	1,652			1	76	insufficient capacity
3		Turiec	LB 1,652 - 4,630	2,978			1	110	sufficient capacity
4		Blh	RB 0,000 - 9,153	9,153			1	82	sufficient capacity
4		Blh	RB 9,153 - 17,406	8,253			1	73	sufficient capacity
4		Blh	RB 17,406 - 20,485	3,079			1	65	sufficient capacity
4		Blh	RB 30,650 - 31,165	0,515		1980			
4		Blh	LB 0,000 - 9,153	9,153			1	82	sufficient capacity
4		Blh	LB 9,153 - 17,406	8,253			1	73	sufficient capacity
4		Blh	LB 17,406 - 20,485	3,079			1	65	sufficient capacity
4		Blh	LB 30,650 - 31,165	0,515		1980			
5		Rimava	RB 1,993 - 2,550	0,557		1961-1964	1	160	insufficient capacity
5		Rimava	RB 2,550 - 18,323	15,773		1961-1964 1972-1975	1	to 17,265 r.km Q <sub>100</sub> =160, from 17,265 r.km Q <sub>100</sub> =140	insufficient capacity
5		Rimava	RB 18,323 - 22,455	4,132		1972-1975	1	140	insufficient capacity
5		Rimava	RB 22,455 - 27,100	4,645		1972-1976	1	140	insufficient capacity
5		Rimava	RB 30,614 - 30,765	0,151		1974-1976	1	140	insufficient capacity
5		Rimava	RB 30,795 - 32,413	1,618			1	to r.km 31,198 Q <sub>100</sub> =140, from r.km 31,198 Q <sub>100</sub> =206	
5		Rimava	RB 40,308 - 40,491	0,183		1980-1982	1	160	
5		Rimava	RB 42,057 - 42,787	0,730		1931			

5		Rimava	RB 51,036 - 51,459	0,423		1971 to r.km 51,385	1	115	insufficient capacity
5		Rimava	LB 0,000 - 0,150	0,150		1960-1961	1	200	
5		Rimava	LB 0,240 - 1,765	1,525		1961-1964	1	160	insufficient capacity
5		Rimava	LB 3,540 - 7,995	4,455		1961-1964	1	160	insufficient capacity
5		Rimava	LB 11,683 - 15,250	3,567		1961-1964	1	160	insufficient capacity
5		Rimava	LB 15,897 - 18,323	2,426		1961-1964 1972-1975	1	to 17,265 r.km Q <sub>100</sub> =160, from 17,265 r.km Q <sub>100</sub> =140	insufficient capacity
5		Rimava	LB 18,923 - LB 22,455	3,532		1972-1975	1	140	insufficient capacity
5		Rimava	LB 22,455 - LB 27,655	5,200		1972-1976	1	140	insufficient capacity
5		Rimava	LB 30,614 - LB 32,665	2,051		1974-1981	1	to 31,198 r.km Q <sub>100</sub> =140, from r.km 31,198 Q <sub>100</sub> =206	insufficient capacity
5		Rimava	LB 34,449 - LB 37,727	3,278		1978-1980	1	140	insufficient capacity
5		Rimava	LB 36,123 - LB 37,411	1,288		1978-1980	1	140	insufficient capacity
5		Rimava	LB 40,308 - LB 40,491	0,183		1980-1982	1	140	insufficient capacity
5		Rimava	LB 51,036 - LB 52,677	1,641		1971 to r.km 51,385	1	115	insufficient capacity
6		Bodva	LB 0,320 - 10,000	9,680	2,4	1964	2	150-85	in operation
6		Bodva	RB 0,000 - 10,300	10,300	2,4	1964	2	150	in operation
6		Bodva	LB 10,300 - 13,800	3,500	2,4	1964	2	68	in operation
6		Bodva	RB 10,300 - 13,800	3,500	2,4	1964	2	68	in operation
6		Bodva	RB 17,600 - 18,600	1,000	2,4	1964	2	38	in operation
6		Bodva	RB 18,750 - 19,310	0,560	2,0	1980	2	38	in operation
7		Ida	LB 11,400 – 12,000	0,600	2,0	1988	2	67	in operation
8		Turňa	RB 0,000 – 1,200	1,200	2,0		2	80	in operation
8		Turňa	LB 0,000 – 1,200	1,200	2,0		2	80	in operation

9		Hornád	RB 9,000 - 17,000	8,000	2,4		1	700	in operation
9		Hornád	RB 22,700 - 25,200	2,500	2,4		1	550	in operation
9		Hornád	LB 12,900 - 21,300	8,400	2,4		1	550	in operation
9		Hornád	RB 29,100 - 38,500	9,400	2,4		1	507-572	in operation
9		Hornád	LB 22,700 - 37,900	15,200	2,4		1	550-572	in operation
9		Hornád	RB 133,343 - 135,003	1,660	2,0		5	225	in operation
10		Svinka	LB 28,555 - 28,974	0,419	2,0		5	110	in operation
10		Svinka	LB 28,066 - 28,189	0,123	2,0		5	110	in operation
10		Svinka	LB 27,000 - 27,311	0,311	2,0		5	110	in operation
11		Sekčov	RB 0,645 – 1,090	0,445	2,0	1981	5	225	in operation
12		Torysa	RB 9,100 – 9,560	0,460	2,4		5	360	in operation
12		Torysa	RB 49,500 – 50,100	0,600	2,0		5	410	in operation
12		Torysa	RB 49,250 - 51,846	2,596	2,0 2,0		5	410	in operation
12		Torysa	RB 52,670 – 53,849	1,179	2,0		5	410	in operation
12		Torysa	RB 62,850 – 63,934	1,084	2,0		5	300	in operation
12		Torysa	RB 73,450 – 75,000	1,550	2,0		5	283	in operation
12		Torysa	RB 92,200 – 93,180	0,980	2,0		5	200	in operation
12		Torysa	LB 77,294 – 78,555	1,261	2,0		5	341	in operation
12		Torysa	RB 77,294 – 78,555	1,261	2,0		5	341	in operation
12		Torysa	LB 78,555 - 79,055	0,500	2,0		5	341	in operation
13		Latorica	LB 0,000 – 32,084	32,084	4,0	1971	1	730	in operation
13		Latorica	RB 0,000 – 29,249	29,249	2,4	1971	1	730	in operation
14		Laborec	RB 0,000 – 36,400	36,400	2,4	1967	1	320	in operation
14		Laborec	LB 0,000 – 36,400	36,400	2,4	1967	1	320	in operation
14		Laborec	LB 39,950 - 40,310	0,360	2,0	1967	1	320	in operation
14		Laborec	RB 36,000 - 36,400	0,400	2,0	1967	1	320	in operation

14		Laborec	RB 44,690 – 47,981	3,291	2,4	1967	1	320	in operation
14		Laborec	RB 58,050 – 60,150	2,100	2,4	1967	1	320	in operation
14		Laborec	RB 39,950 - 40,250	0,300	2,0	1967	1	320	in operation
14		Laborec	LB 58,050 - 59,150	1,100	2,4	1967	1	320	in operation
14		Laborec	LB 65,000 - 66,730	1,730	4,0	1936	1	730	in operation
14		Laborec	RB 65,950 - 66,775	0,825	4,0	1936	1	730	in operation
14		Laborec	LB 67,140 - 67,520	0,380	4,0	1936	1	730	in operation
14		Laborec	RB 67,161 – 69,075	1,914	4,0	1936	1	730	in operation
14		Laborec	RB 83,300 – 83,600	0,300	4,0		1	440	in operation
14		Laborec	RB 99,964 – 101,125	1,161	2,0		1	240	in operation
14		Laborec	LB 109,000 – 111,700	2,700	2,0		1	240	in operation
14		Laborec	RB 109,000 – 111,700	2,700	2,0		1	240	in operation
15		Udava	RB 14,900 – 15,700	0,800	2,0		1	240	in operation
15		Udava	LB 4,300 – 4,940	0,640	2,4		1	300	in operation
16		Cirocha	RB 22,100 – 26,472	4,372	2,4		1	230	in operation
16		Cirocha	LB 22,100 – 26,472	4,372	2,4		1	230	in operation
17		Ulička	LB 1,740 - 1,875	0,135	1,0	1967	1	205	in operation
17		Ulička	LB 1,875 - 2,693	0,818	1,0	1967	1	205	in operation
17		Ulička	RB 1,155 - 1,455	0,300	3,0	1967	1	205	in operation
17		Ulička	RB 1,455 – 1,875	0,420	2,0	1967	1	205	in operation
17		Ulička	RB 1,875 – 2,765	0,890	1,0	1967	1	205	in operation
17		Ulička	LB 9,150 – 9,300	0,150	2,0	1967	1	205	in operation
18		Kanál Veľké Revištia - Bežovce	RB 0,000 – 23,600	23,600	2,4	1964	1	46	in operation

18		Kanál Veľké Revištia - Bežovce	LB 0,000 – 23,600	23,600	2,4	1964	1	46	in operation
19		Okna	LB 0,650 - 0,664	0,014	2,0	1974	1	48	in operation
19		Okna	RB 0,650 - 0,654	0,004	2,0	1974	1	48	in operation
19		Okna	RB 1,990 - 2,000	0,010	2,0	1974	1	48	in operation
19		Okna	LB 2,550 - 2,780	0,230	2,0	1974	1	48	in operation
19		Okna	RB 3,017 - 3,200	0,183	2,0	1974	1	48	in operation
19		Okna	RB 4,150 - 4,175	0,025	2,0	1974	1	48	in operation
19		Okna	LB 4,250 - 4,500	0,250	2,0	1974	1	48	in operation
19		Okna	LB 5,126 - 5,139	0,013	2,0	1974	1	48	in operation
20		Čierna voda	RB 0,000 - 6,100	6,100	2,4	1964	2	65	in operation
21		Uh	RB 0,000 – 21,500	21,500	2-4, 4	1967	1	1310	in operation
21		Uh	LB 0,000 – 18,500	18,500	2,4	1967	1	1310	in operation
22		Ondava	RB 0,000 – 26,000	26,000	2-4, 4	1967	5	830	in operation
22		Ondava	LB 0,000 – 37,300	37,300	2-4, 4	1967	5	830 (710)	in operation
22		Ondava	LB 106,900 – 107,500	0,600	2,4		5	513	in operation
22		Ondava	LB 116,960 - 118,850	1,890	2,4		5	320	in operation
23		Ladomírka	RB 0,000 – 3,700	3,700	2,4		20	270	in operation
23		Ladomírka	LB 0,000 – 1,150	1,150	2,4		20	270	in operation
24		Chotčianka	LB 9,250 – 10,025	0,775	1,2	1987	5	245	in operation
25		Kamenec	LB 0,000 - 0,220	0,220	2,4	1968	5	24	in operation
26		Topľa	RB 0,000 – 6,150	6,150	2, 2-4		5	560	in operation
26		Topľa	RB 19,000 – 19,922	0,922	2,4	1973	5	685	in operation
26		Topľa	LB 19,000 – 19,922	0,922	2,4	1973	5	685	in operation
26		Topľa	LB 60,000 – 60,712	0,712	2,4	1979	5	500	in operation

26		Topľa	RB 103,550-105,010	1,460	1,2	2015	1	330	in operation
26		Topľa	LB 103,550-105,010	1,460	1,2	2015	1	330	in operation
27		Chlmec	RB 0,000 – 3,800	3,800	2,4		1	45	in operation
27		Chlmec	LB 0,000 – 3,800	3,800	2,4		1	45	in operation
27		Chlmec	RB 4,000 – 10,108	6,108	2,4	1967	1	38	in operation
27		Chlmec	LB 4,000 – 10,108	6,108	2,4	1967	1	38	in operation
28		Trnavka	RB 0,000 – 23,200	23,200	2,4		5	87	in operation
28		Trnavka	LB 0,000 – 22,500	22,500	2,4		5	87	in operation
29		Bodrog	RB 0,000 – 6,200	6,200	2-4, 4	1963	1	1 480	in operation
29		Bodrog	LB 0,000 – 13,925	13,925	2-4, 4	1963	1	1 480	in operation
30		Roňava	LB 0,000 – 0,860	0,860	2,4		1	60	in operation

<sup>1</sup> left bank (LB) or right bank (RB)

<sup>2</sup> Year of Commissioning

<sup>3</sup> technical status: very good, satisfying, non- satisfying/bad.

**Table 3 - 1 Permanent reservoirs (permanent reservoirs on the water courses)**

Crt. nr.	Reservoir name	Water course	Nearest locality name	High dam (m)	Type of dam <sup>1</sup>	Volume at NRL (m <sup>3</sup> )	Volume at MEL <sup>3</sup> (m <sup>3</sup> )	Attenuation volume (m <sup>3</sup> )		Use <sup>2</sup>
1	Miková	Slaná	Revúca	7,1	E-HO	1100000	949520	0	150480	water reservoir
2	Klenovec	Slaná	Rimavská Sobota	32,5	E	8431443	7473387	0	958056	water reservoir
3	Gemerský Jablonec	Slaná	Rimavská Sobota	9,0	E	2490000	2049514	0	440486	water reservoir
4	Hostice	Slaná	Rimavská Sobota	6,6	E	1010000	774930	0	235070	water reservoir
5	Teplý Vrch	Slaná	Rimavská Sobota	14,1	E	5282000	4757000	0	525000	water reservoir
6	Bukovec	Bodva	Košice-okolie	56,0	Se-E/LS	21760000	20780000	0	980000	water reservoir
7	Palcmanská Maša	Hornád	Rožňava	34,0	C-G	10354936	10360000	0	0	water reservoir
8	Ružín I	Hornád	Košice-okolie	63,0	Se-E/LS	49451400	49145000	0	3500000	water reservoir
9	Ružín II	Hornád	Košice-okolie	27,0	C-G	4430000	3770000	0	780000	water reservoir
10	Starina	Bodrog	Snina	50,0	E-HO	56950000	48790000	0	8170000	water reservoir
11	Zemplínska Šírava	Bodrog	Michalovce	12,0	E-HO	324889000	269000000	35000000	65000000	water reservoir



12	Veľká Domaša	Bodrog	Vranov nad Topľou	35,0	E-HO	172722000	157520000	0	20760000	water reservoir
13	V. Ozorovce	Bodrog	Trebišov	9,3	E-HO	1158100	973500	0	0	water reservoir

(E-Earth, Se-Stone embankment, C-concrete, HO-homogenous, HE-heterogenous)

G-Gravity, LS-with loam seal

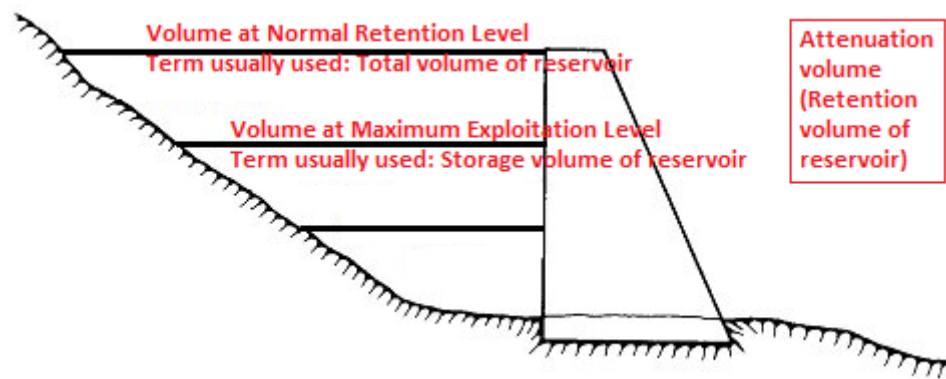
<sup>1</sup> – arch/gravity from concrete/earth/embankment, etc.

<sup>2</sup> – flood protection, water supply, industry, irrigation etc.

<sup>3</sup> Normal Retention Level

<sup>4</sup> Maximum Exploitation Level

*Note: Explanation for water levels*



**Table 3 - 2 Temporary reservoirs (Any relevant temporary reservoirs)**

Crt. nr.	Reservoir name	Water course	Type of dam	High dam (m)	Total volume (attenuation volume) (mn.m <sup>3</sup> )
Text table	Text table	Text table	Text table	Text table	Text table

**Table 3 - 3 Polders (Dry reservoirs)**

Crt nr.	Polder name	Water course	Locality name	Dike type <sup>1</sup>	Length (km)	High dike (m)	Total surface (ha)	Total volume (attenuation volume) (m <sup>3</sup> )
1	Beša	Laborec in km 6,800	c. a. Beša (Veľké Raškovce, Oborín)	Earthy left shore perimeter dike. Right shore protection dike of Laborec. Protection dike of Latorica perimeter dike. Dividing dike.	6,200 2,660 3,200 6,800	4,5 3,5	1 568,00	53 000 000
2	Vranov nad Topľou polder nr. 1	Vranovský potok nr. 1 in km 2,106	c. a. Vranov nad Topľou	Earthy homogenous dike	0,035	6,6	0,77	8 612
3	Vranov nad Topľou polder nr. 2	Vranovský potok nr. 1 in km 2,309	c. a. Vranov nad Topľou	Earthy homogenous dike	0,033	8,8	0,40	13 000
4	Frička	Kamenec in km 12,800	c. a. Frička	Earthy homogenous dike	0,093	9,4	2,05	78 700
5	Vyšný Tvarožec	Sveržovka in km 5,800	c. a. Vyšný Tvarožec	Earthy homogenous dike	0,117	11,3	1,90	68 900
6	Borša	Boršiansky potok in km 0,000	c. a. Borša	Earthy perimeter dike	0,578	2,0	12,99	207 900

<sup>1</sup> lateral/contour/partition/perimeter/enclosure etc.

Note: c. a. = cadastral area

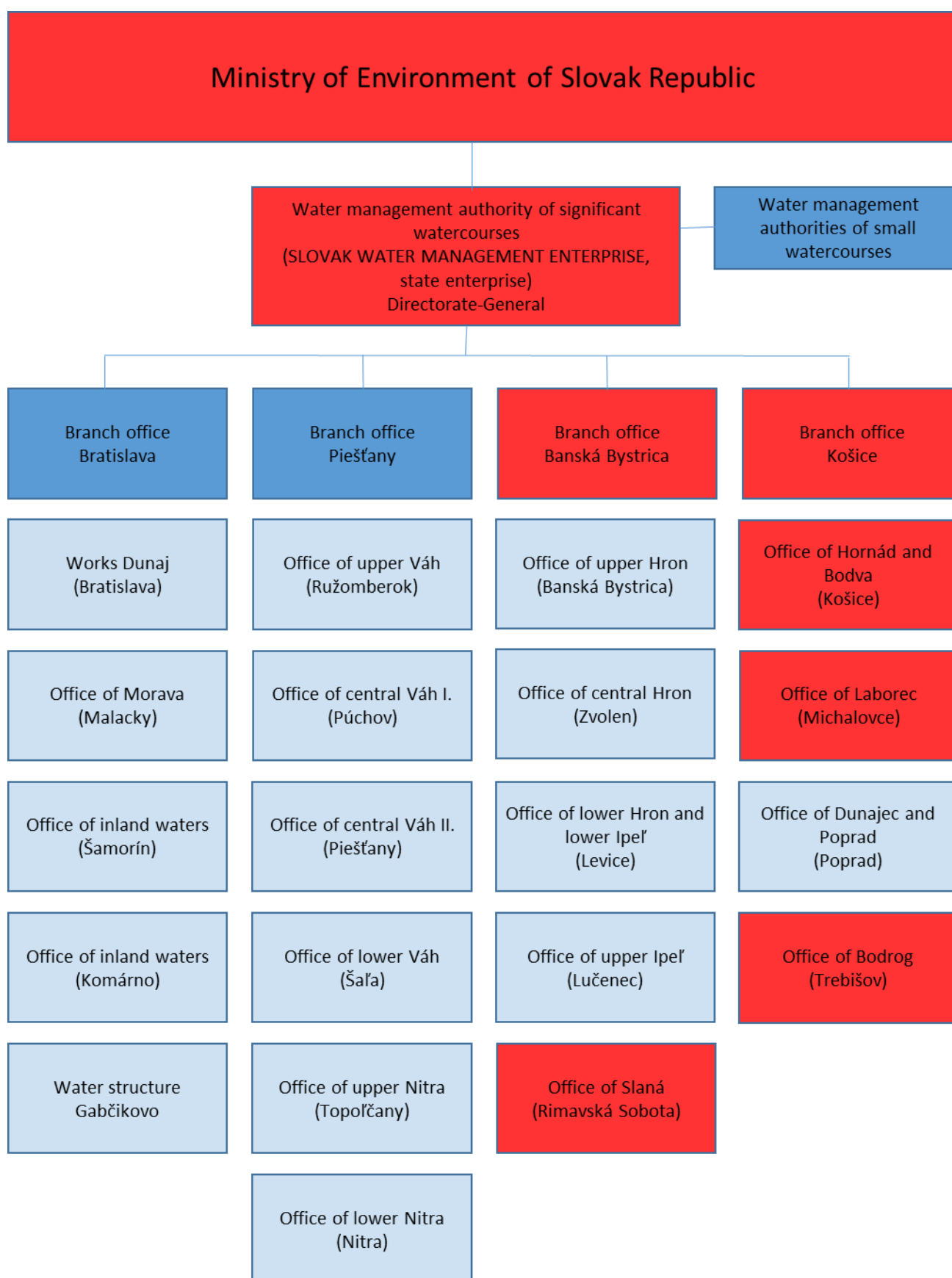
*Table 3 - 4 Diversion canals (Any relevant canals)*

Crt. nr.	Name	Locality name	Derived stream	Receiver water course	Length (km)	Derived discharges (m <sup>3</sup> /s)
Text table	Text table	Text table	Text table			

*Table 3 - 5 Hydraulic complex facility*

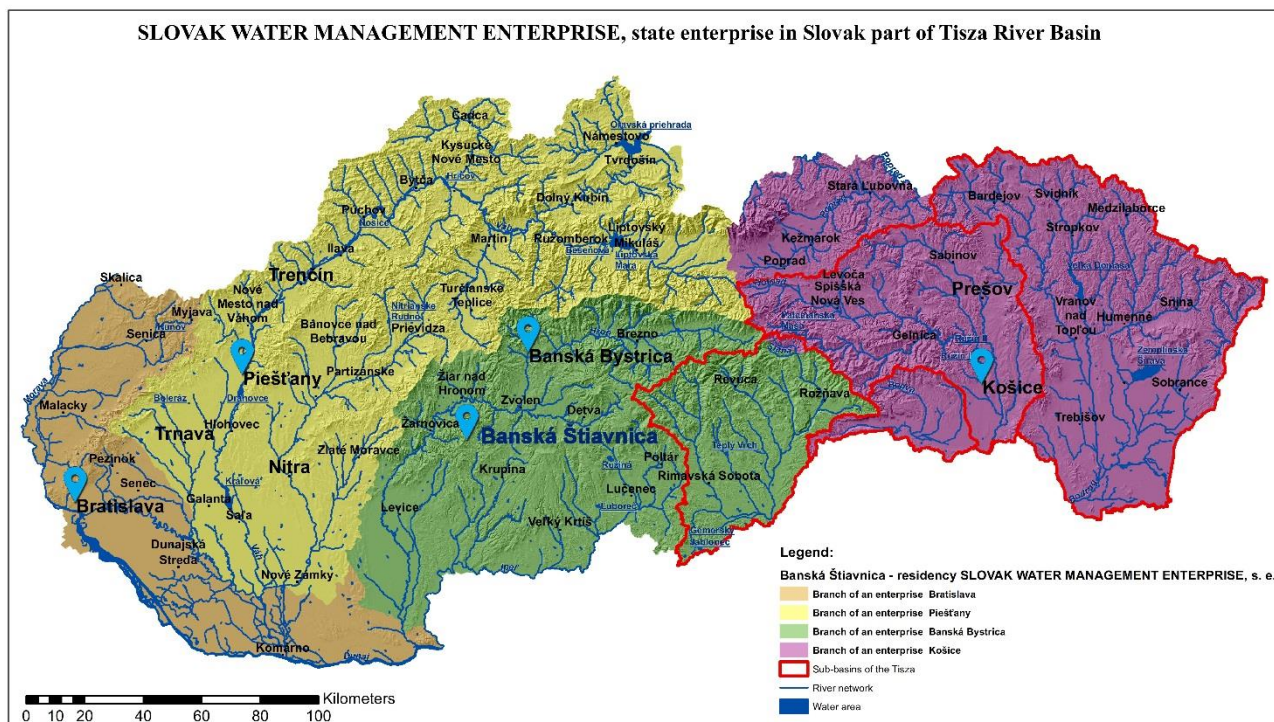
Crt. nr.	Name	Water course	Locality name	Maximum derived discharges (m <sup>3</sup> /s)
1	Pumping station Jenkovce I	Kanál V.Revištia-Bežovce	Jenkovce	1,60
2	Pumping station Jenkovce II	Kanál V.Revištia-Bežovce	Jenkovce	0,88
3	Pumping station Bežovce	Kanál V.Revištia-Bežovce	Bežovce, Záhor	2,00
4	Pumping station Stretávka I	Uh	Stretávka	18,90
5	Pumping station Stretávka II	Uh	Pavlovce nad Uhom	
6	Pumping station Veľké Raškovce I.	Duša	Veľké Raškovce	11,50
7	Pumping station Veľké Raškovce II.	Duša	Veľké Raškovce	
8	Pumping station Zalužice I	Waste channel	Zalužice	0,88
9	Pumping station Zalužice II	Waste channel	Zalužice	0,88
10	Pumping station Beša	Laborec	Veľké Raškovce	0,08
11	Pumping station Kamenná Moľva	Latorica	Kucany	10,81
12	Pumping station Hraň	Ondava	Hraň	8,20
13	Pumping station Streda nad Bodrogom	Bodrog	Streda nad Bodrogom	16,40
14	Pumping station Boľ	Latorica	Boľ	5,50
15	Pumping station Čičarovce	Latorica	Čičarovce	10,00
16	Pumping station Pavlovo	Bodrog	Zemplín	6,80
17	Pumping station Milhostov	Trnávka	Milhostov	0,19
18	Pumping station Ladislav	Ondava	Hradištská Moľva	5,50
19	Pumping station Július	Ondava	Trebišov	5,50
20	Pumping station Ptrukša	Latorica	Ptrukša	6,20
21	Pumping station Pavlovce nad Uhom	Oxbow of Laborec	Vojany	4,00
22	Pumping station Brehov I (old)	Ondava	Brehov	0,20
23	Pumping station Brehov II (new)	Ondava	Brehov	0,16

24	Pumping station Nová Kelča	Ondava	Nová Kelča	0,02
25	Pumping station Bžany	Ondava	Bžany	0,04
26	Hydraulic structure Palcmanská Maša (Hornád River Basin)	Hnilec	Rožňava	50
		Slaná		9



Note: Marked with red are responsible offices for Tisza River Basin management.

**Figure 3.1. Water management scheme in Tisza River Basin in Slovakia**



**Figure 3.1.1. SLOVAK WATER MANAGEMENT ENTERPRISE, state enterprise in Slovak part of Tisza River Basin**

According to Act no. 364/2004 about waters § 11 is the competent authority, for the river basin management in the Slovak Republic, the Ministry of the Environment.

Management of watercourses according to § 48 of this Act carried out:

- Water management authority of significant watercourses, which is the state professional organization of the Ministry,
- Water management authorities of small watercourses, which are the managers of the water management of significant watercourses and state organizations to which the administration was transferred according to § 51 of this Act.

**The management of watercourses is delegated to the water management authority of significant watercourses - Slovak Water Management Enterprise, state enterprise. (Figure 3.1., Figure 3.1.1.)**

Act no. 7/2010 on Flood Protection defines the activities provided by the water management authority of significant watercourses in the sense of Act no. 364/2004 about waters.

Flood protection according to § 3 of this Act carry out by:

- flood protection authorities in accordance with § 22,
- other bodies of state administration,
- authorities of territorial self-government,
- flood commissions,
- water management authority of significant watercourses and water management authorities of small watercourses,
- owners, land managers and users of land, buildings, facilities or installations located in a watercourse or floodplain,



- g) construction builders, which intervene with the watercourse or floodplain,
- h) other persons.

Everyone is obliged to implement measures allowing the normal run-off on land, buildings, objects and devices which it owns, is in administration or in use.

A person who detects a flood hazard or flood is obliged to immediately report it to the Integrated Rescue System Coordination Center on the European emergency number 112. Coordination Center of Integrated Rescue System shall promptly inform the flood protection authority, the flood affected municipality, water management authority of significant watercourses, or water management authorities of small watercourse.

Flood protection authorities are:

- a) ministry,
- b) district offices at the seat of a Region,
- c) district offices.

Flood protection is managed and ensured by municipalities.

The government, flood protection authorities and municipalities established the flood commissions as its advisory and executive body. The flood commissions are:

- a) central flood commission,
- b) regional flood commission,
- c) district flood commission,
- d) flood commissions of municipalities.

District Office and district office at the seat of a Region may during the III. level of the flood activity, declared by the § 11, establish an operational flood protection group.

The operational flood protection group shall be governed by the working guideline of the operational group, which approves:

- a) head of the district office for the operational flood protection group within the district office,
- b) head of the district office at the seat of a Region for the operational flood protection group within the district office.

## Drainage systems

In the Slovak part of the Tisza River Basin there are 14 drainage systems in total. Their primary function is the removal of internal waters. All drainage systems are in the level range of 92,5 – 103,5 m asl. According to the table 3-7 the total length of the drainage systems in the Slovak part of the Tisza River Basin is approximately 218 km. The drainage system in the Tisza River Basin has a flow capacity of 1,6 to 18,9 m<sup>3</sup>/s.

Table 3- 7 Drainage system

Cr nr.	Name	Function	Levels	Length (km)	Q (m³/s)	Works of Art, confluent, defluent	Purpose
1	Somotorský kanál	Discharging of internal waters	92,56 m asl. (inflow into PS)	26,48	16,4	km 3,600 – Road bridge km 12,600 – Road bridge km 13,000 – Road bridge km 15,513 – Railway bridge km 24,700 – Road bridge km 27,100 – Road bridge	
2	Pavlovský kanál (Divý kanál, northern Radešský kanál)	Discharging of internal waters	93,60 m asl. (inflow into PS)	7,22	6,8	km 0,188 – Road bridge	
3	Eastern Leleský kanál	Discharging of internal waters	95,30 m asl. (inflow into PS)	16,26	5,5	km 8,500 – Road bridge	
4	Udoč	Discharging of internal waters	95,60 m asl. (inflow into PS)	15,24	10,0	km 2,900 – Road bridge km 5,050 – Road bridge km 5,100 – Railway bridge km 6,500 – Railway bridge km 6,600 – Road bridge	
5	Oxbow of Latorica (Ptrukšiansky kanál)	Discharging of internal waters	96,40 m asl. (inflow into PS)	Oxbow of Latorica - 0,04 Ptrukšiansky kanál - 10,00	6,0	Ptrukšiansky kanál: km 8,200 – Road bridge	
6	Approaching canal + Lower canal	Discharging of internal waters	96,00 m asl. (inflow into PS)	2,94	4,0		
7	Confluence of drainage canals Kopaný jarok a Hranský kanál Length of inlet part–50 m	Discharging of internal waters	96,30 m asl. (inflow into PS)	Kopaný jarok - 15,79 Hranský kanál to Julov kanál – 5,90	8,2	Kopaný jarok: km 4,360 – Road bridge km 5,460 – Road bridge km 11,800 – Road bridge km 12,200 – Railway bridge	

						Hranský kanál: km 4,200 – Road bridge km 5,200 – Road bridge	
8	Julov kanál	Discharging of internal waters	96,00 m asl. (inflow into PS)	1,20	5,5		
9	Canals – Moľviansky kanál, Brehovský kanál, Kuciansky kanál	Discharging of internal waters	94,42 m asl. (inflow into PS)	Moľviansky kanál – 19,50 Brehovský kanál – 25,65 Kuciansky kanál – 8,19	10,9	Moľviansky kanál: km 2,800 – Road bridge km 10,000 – Road bridge km 19,300 – Railway bridge Brehovský kanál: km 5,800 – Road bridge km 12,300 – Road bridge km 22,200 – Railway bridge km 22,500 – Railway bridge km 24,100 – Road bridge	
10	Interconnection canal- Ladislav	Discharging of internal waters	96,10 m asl. (inflow into PS)	1,20	5,7		
11	Čierna voda	Discharging of internal waters	96,60 m asl.	23,00	18,9	Gas pipeline 8 x Road bridge	
12	Duša	Discharging of internal waters	97,49 m asl.	28,80	11,5	Gas pipeline rkm 1,100 Oil pipeline rkm 6,28 20 x Road bridge 3 x Railway bridge	
13	Canal along intercepting canal above Jenkovce	Discharging of internal waters	103,50 m asl.	2,33	1,6	1 x Road bridge	
14	Canal along intercepting canal under Jenkovce, Bežovský kanál	Discharging of internal waters	103,40 m asl.	3,51 5,20	2,0	1 x Road bridge 2 x Road bridge	

## Significant historical floods and Areas with Potentially Significant Flood Risk

Description of significant historical floods in Tisza River Basin in Slovakia is in “Table 3– 8 Significant historical floods”. Below “Table 3- 8” is a legend with detailed description of the individual codes.

*Table 3- 8 Significant historical floods*

Event name	Source, characteristics, mechanism of flood			Date of flood
	Source	Characteristics	Mechanism of flood	
Chminiansky potok - Chmiňany	data unavailable			1395
Rivering floods on Hornád, Hnilec, Torysa a Bodva	data unavailable			1813
Rivering floods on Hnilec, Torysa a Bodva	data unavailable			1845
Rivering flood on Svinka	data unavailable			july 1998
Rivering floods on Hornád, Torysa, Topľa, Ondava	data unavailable			july 2004
May floods on Slaná, Torysa, Hornád, Ondava, Topľa	A11;A12	A31;A36;A37	A21;A22;A23;A25	may 2010
June floods on Slaná, Torysa, Hornád, Ondava, Topľa	A11;A12;A13	A31;A36;A37	A21;A22;A25	june 2010

### Legend - 1. Type of Flood

#### 1. Source of Flooding:

A11=Fluvial: Flooding of land by waters originating from part of a natural drainage system, including natural or modified drainage channels. This source could include flooding from rivers, streams, drainage channels, mountain torrents and ephemeral watercourses, lakes and floods arising from snow melt.

A12=Pluvial: Flooding of land directly from rainfall water falling on, or flowing over, the land. This source could include urban storm water, rural overland flow or excess water, or overland floods arising from snowmelt.

A13=Groundwater: Flooding of land by waters from underground rising to above the land surface. This source could include rising groundwater and underground flow from elevated surface waters.

#### 2. Characteristics of Flooding:

A31=Flash Flood: A flood that rises and falls quite rapidly with little or no advance warning, usually the result of intense rainfall over a relatively small area.

A36=Debris Flow: A flood conveying a high degree of debris.

A37=High Velocity Flow: A flood where the floodwaters are flowing at a high velocity.

#### 3. Mechanism of Flooding

A21=Natural Exceedance: Flooding of land by waters exceeding the capacity of their carrying channel or the level of adjacent lands.

A22=Defence Exceedance: Flooding of land due to floodwaters overtopping flood defences.

A23=Defence or Infrastructural Failure: Flooding of land due to the failure of natural or artificial defences or infrastructure. This mechanism of flooding could include the breaching or collapse of a flood defence or retention structure, or the failure in operation of pumping equipment or gates.

A25=Other: Flooding of land by water due to other mechanisms, for instance windsetup floods.

Map with significant historical floods in Tisza River Basin in Slovakia

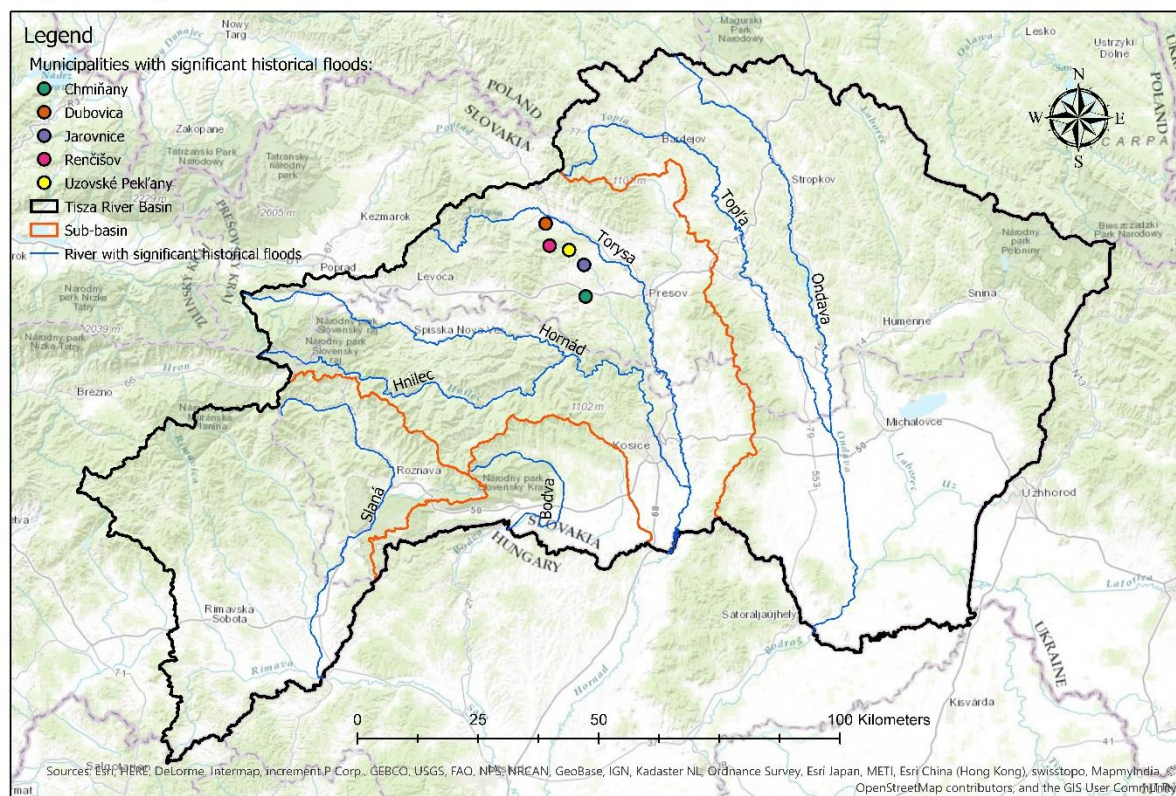


Figure 3.2. Map with significant historical floods in Tisza River Basin in Slovakia

A table with APSFR is proposed below:

Table 3- 9 Areas with Significant Potentially Flood Risk

APSFR name	Representation type	Length/Surface (km)/(km <sup>2</sup> )
Slaná - Betliar	existing	1,20
Slaná - Brzotín	probable	1,90
Slaná - Slavec	probable	3,40
Slaná - Plešivec	existing	2,60
Slaná - Gemerská Hôrka	probable	2,21
Slaná - Čoltovo	probable	0,81
Slaná - Bretka	probable	1,10
Slaná - Gemerská Panica	probable	1,98
Slaná - Gemer	probable	2,30
Slaná - Tornaľa	probable	5,50
Blh - Rovné	existing	1,80



Blh - Potok	existing	0,60
Blh - Drienčany	existing	0,80
Blh - Teplý Vrch	existing	1,05
Blh - Veľký Blh	existing	2,10
Blh - Uzovská Panica	existing	1,20
Blh - Bátka	existing	2,30
Blh - Žíp	existing	0,90
Blh - Čakov	existing	0,70
Blh - Ivanice	existing	1,80
Rimava - Hnúšťa	existing	3,25
Rimava - Rimavské Brezovo	existing	2,10
Rimava - Rimavské Zalužany	existing	1,40
Rimava - Kociha	existing	0,80
Rimava - Rimavská Sobota	existing	5,40
Rimava - Pavlovce	existing	1,30
Rimava - Jesenské	existing	2,20
Rimava - Širkovce	existing	2,00
Rimava - Šimonovce	existing	1,00
Rimava - Rimavská Seč	existing	1,50
Rimava - Vlkyňa	existing	0,50
Ida - Košice - Šaca	probable	3,00
Ida - Veľká Ida	probable	2,50
Bodva - Medzev	existing	4,00
Bodva - Jasov	existing	2,70
Bodva - Moldava nad Bodvou	probable	5,00
Brusník - Letanovce	existing	0,80
Brusník - Smižany	existing	3,20
Levočský potok - Levoča	existing	3,00
Levočský potok - Harichovce	existing	3,00
Levoský potok - Spišská Nová Ves	existing	0,40
Levočský potok - Markušovce	existing	1,00
Branisko - Spišské Vlachy	existing	2,00
Hnilec - Hnilec	existing	4,40
Hnilec - Nálepokovo	existing	6,50
Hnilec - Švedlár	existing	4,00
Hnilec - Mníšek nad Hnilcom	existing	3,00
Hnilec - Helcmanovce	existing	1,60
Hnilec - Prakovce	existing	3,00
Hnilec - Gelnica	existing	4,70
Hnilec - Jaklovce	existing	2,50
Kučmanovský potok - Šarišské Dravce	existing	2,20
Kučmanovský potok - Torysa	existing	0,40
Šebastovka - Prešov	existing	3,20
Torysa - Haniska	existing	1,40
Torysa - Kendice	existing	5,50
Torysa - Drienovská Nová Ves	existing	2,00
Torysa - Drienov	existing	4,50
Torysa - Bretejovce	existing	2,00
Torysa - Ploské	existing	0,60
Torysa - Kráľovce	existing	1,00



Torysa - Vajkovce	existing	1,20
Torysa - Beniakovce	existing	1,00
Torysa - Rozhanovce	existing	2,50
Torysa - Košické Olšany	existing	0,80
Torysa - Sady nad Torysou	existing	1,30
Torysa - Košická Polianka	existing	1,60
Torysa - Vyšná Hutka	existing	1,20
Torysa - Nižná Hutka	existing	2,10
Trstianka - Trstany	existing	1,00
Trstianka - Ďurďošík	probable	1,50
Olšava - Kecerovce	existing	1,30
Olšava - Olšovany	existing	1,50
Olšava - Vyšný Čaj	existing	0,60
Olšava - Blažice	existing	0,70
Olšava - Nižný Čaj	existing	0,90
Olšava - Bohdanovce	existing	0,50
Olšava - Nižná Myšľa	existing	2,00
Hornád - Vikartovce	existing	1,50
Hornád - Spišský Štiavnik	existing	2,70
Hornád - Betlanovce	existing	1,80
Hornád - Hrabušice	existing	1,00
Hornád - Spišská Nová Ves	existing	6,00
Hornád - Markušovce	existing	3,50
Hornád - Matejovce nad Hornádom	existing	1,70
Hornád - Chrasť nad Hornádom	existing	1,70
Hornád - Vítkovce	existing	0,50
Hornád - Olcnavá	existing	1,00
Hornád - Spišské Vlasy	existing	1,50
Hornád - Kolinovce	existing	1,80
Hornád - Krompachy	existing	4,00
Hornád - Richnava	existing	2,00
Hornád - Kluknava	existing	3,70
Udava - Osadné	existing	2,80
Udava - Nižná Jablonka	existing	1,20
Udava - Vyšný Hrušov	existing	1,50
Udava - Udavské	existing	3,00
Pčolinka - Pčoliné	existing	2,10
Pčolinka - Snina	existing	3,00
Cirocha - Snina	existing	0,70
Cirocha - Dlhé nad Cirochou	existing	7,30
Ublianka - Ublľa	existing	3,00
Sobrancecký potok - Sobrance	existing	3,20
Kanál Veľké Revištia-Bežovce - Nižná Rybnica	existing	1,00
Kanál Veľké Revištia-Bežovce - Sobrance	existing	3,00
Kanál Veľké Revištia-Bežovce - Bežovce	existing	5,80
Ladomirka - Krajná Poľana	existing	1,30
Ladomirka - Hunkovce	existing	1,50
Ladomirka - Ladomirová	existing	2,00
Ladomirka - Svidník	existing	2,70
Chotčianka - Bukovce	existing	1,90
Chotčianka - Chotča	existing	2,00

Chotčianka - Stropkov	existing	3,00
Sitnička - Závada	existing	1,50
Sitnička - Ruská Poruba	existing	1,00
Sitnička - Vyšná Sitnica	probable	1,60
Sitnička - Nižná Sitnica	existing	1,20
Olka - Olka	probable	1,50
Olka - Ruská Kajňa	existing	0,20
Olka - Pakostov	existing	0,50
Olka - Košarovce	existing	2,00
Olka - Žalobín	existing	1,00
Ondavka - Turcovce	existing	1,70
Ondavka - Baškovce	probable	1,40
Ondavka - Ohradzany	existing	2,00
Ondavka - Slovenská Volová	existing	1,50
Ondavka - Závadka	probable	1,00
Ondavka - Topoľovka	probable	2,00
Ondava - Vyšná Polianka	existing	1,00
Ondava - Varadka	existing	1,20
Ondava - Nižná Polianka	existing	0,50
Ondava - Mikulášová	existing	1,00
Ondava - Cigla	probable	0,50
Ondava - Dubová	probable	1,00
Ondava - Vyšný Orlík	probable	1,20
Ondava - Nižný Orlík	probable	1,20
Ondava - Svidník	probable	3,50
Ondava - Stročín	probable	2,20
Ondava - Duplín	probable	1,60
Ondava - Tisinec	existing	1,40
Ondava - Stropkov	existing	2,90
Ondava - Breznica	existing	1,90
Ondava - Miňovce	existing	1,00
Slatvinec - Kríže	existing	1,40
Slatvinec - Bogliarka	existing	0,90
Slatvinec - Kružlov	existing	2,30
Kamenec - Petrová	existing	1,70
Kamenec - Sveržov	existing	0,70
Kamenec - Tarnov	existing	1,00
Šibská voda - Šiba	existing	1,40
Šibská voda - Bardejov	existing	6,50
Kamenec - Bardejov	existing	3,90
Radomka - Šarišský Štiavnik	existing	0,70
Radomka - Radoma	existing	1,00
Radomka - Okružle	existing	1,70
Radomka - Matovce	existing	1,20
Radomka - Gíraltovce	existing	2,50
Lomnica - Vechec	existing	2,60
Lomnica - Vranov nad Topľou	existing	1,50
Topľa - Livovská Huta	existing	0,90
Topľa - Livov	existing	0,90
Topľa - Lukov	existing	1,30
Topľa - Gerlachov	existing	2,50

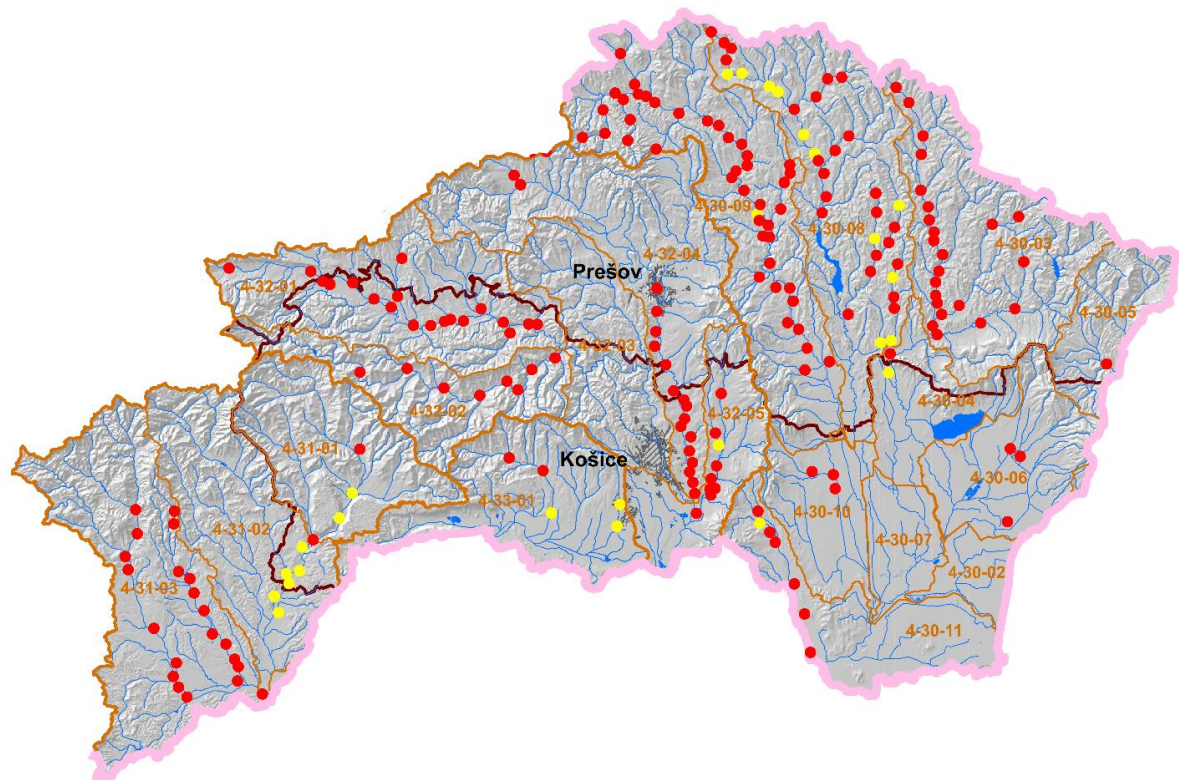
Topľa - Tarnov	existing	1,40
Topľa - Rokytno	existing	0,50
Topľa - Mokroluh	existing	1,00
Topľa - Bardejov	existing	5,30
Topľa - Bardejov	existing	1,50
Topľa - Komárov	existing	1,30
Topľa - Hrabovec	existing	1,50
Topľa - Poliakovce	existing	0,80
Topľa - Dubinné	existing	2,00
Topľa - Kurima	existing	2,70
Topľa - Kučín	existing	1,00
Topľa - Porúbka	existing	1,00
Topľa - Harhaj	existing	0,70
Topľa - Marhaň	existing	2,00
Topľa - Brezov	existing	1,30
Topľa - Kalnište	probable	1,50
Topľa - Lužany pri Topli	existing	2,50
Topľa - Giraltove	existing	3,00
Topľa - Železník	existing	0,50
Topľa - Mičakovce	existing	1,50
Topľa - Ďurďoš	existing	2,00
Topľa - Hanušovce nad Topľou	existing	2,00
Topľa - Bystré	existing	1,00
Topľa - Skrabské	existing	1,20
Topľa - Vyšný Žipov	existing	1,50
Topľa - Hlinné	existing	2,30
Topľa - Jastrabie nad Topľou	existing	
Topľa - Čaklov	existing	2,00
Topľa - Vranov nad Topľou	existing	4,00
Trnávka - Sečovce	existing	5,00
Trnávka - Hriadky	existing	0,80
Trnávka - Vojčice	existing	1,50
Terebľa - Kalša	probable	1,80
Terebľa - Slivník	existing	1,30
Roňava - Slanské Nové Mesto	existing	1,50
Roňava - Slivník	existing	1,20
Roňava - Kuzmice	existing	2,00
Roňava - Michalany	existing	1,80
Roňava - Čerhov	existing	1,00
Roňava - Slovenské Nové Mesto	existing	1,70
Laborec - Čertižné	existing	2,20
Laborec - Habura	existing	2,30
Laborec - Medzilaborce	existing	7,50
Laborec - Krásny Brod	existing	1,50
Laborec - Čabiny	existing	3,30
Laborec - Volica	existing	1,20
Laborec - Radvan nad Laborcom	existing	3,00
Laborec - Brestov nad Laborcom	existing	1,20
Laborec - Hrabovec nad Laborcom	existing	1,00
Laborec - Zbudské Dlhé	existing	1,00
Laborec - Koškovce	existing	1,50

Laborec - Hankovce	existing	1,50
Laborec - Ľubiša	existing	1,50
Laborec - Veľopolie	existing	1,00
Laborec - Udavské	existing	1,30
Laborec - Kochanovce	existing	1,30
Laborec - Lackovce	existing	0,70
Laborec - Brekov	existing	1,00
Laborec - Strážske	probable	2,50

<sup>1</sup> type of representation can be: line or polygon.

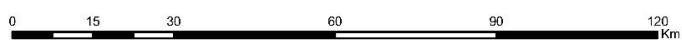
A figure with map representing the APSFR:

## GEOGRAPHIC AREAS WITH POTENTIALLY SIGNIFICANT FLOOD RISK



### Legend:

- geographic areas with an existing potentially significant flood risk
- geographic areas with a probable occurrence of potentially significant flood risk
- boundary of the sub-basin
- boundary of the basin
- 4-32-01 hydrological number of the basin
- watercourse with a river basin area > 10 sq km
- water area
- state border
- region border
- capital of the region



M = 1 : 1 100 000

**Figure 3.3. Map with APSFR in Tisza River Basin in Slovakia**

## National Flood Hazard Maps and Flood Risk Maps for Tisza River Basin

On 26 November 2007 it has entered into force Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks. Transposition of the Directive 2007/60/EC into the legal order of the Slovak Republic is the Act No. 7/2010 on the flood protection, which is in the force in the Slovak republic since February 1st 2010.

Directive 2007/60/EC requires the Member States of the European Union to carry out activities, which will permanent reviewed and if necessary updated:

1. To make a preliminary flood risk assessment in the territory of the State by 22 December 2011 at the latest to identify areas for which that potential significant flood risks exist or might be considered likely to occur. The preliminary flood risk assessment shall be reviewed, and if necessary updated, by 22 December 2018 and every six years thereafter.
2. For areas where significant flood risk has been identified and areas where might be considered likely to occur, must be made by 22 December 2013 at the latest, then to 22 December 2019 and every 6 years to review and if necessary update:
  - a) flood hazard maps, which show the extent of the floods of territory with different times of repetition,
  - b) flood risk maps, which show the likely consequences of floods displayed on the flood hazard maps for population, economic activity, cultural heritage and the the environment.
3. For areas where an existing or potential significant flood risk has been identified, on the basis of the information from preliminary flood risk assessment, flood hazard maps and flood risk maps, establish appropriate objectives for the management of flood risks and then to 22 December 2015 at the latest draw up flood risk management plans, which will include specific measures to reduce the adverse consequences associated with floods according to the urgency of their implementation. The flood risk management plans shall be reviewed, and if necessary updated by 22 December 2021 and every six years thereafter.

According to the Act no. 7/2010 Coll. on flood protection, the development of the first flood risk management plans and their followed revaluation and updates will take place coordinated with revaluating and updating of river basin management plans, elaborated according to the Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for Community action in the field of water policy), which is transposed into law no. 364/2004 Coll. on water and the Amendment of the Act of the Slovak National Council no. 372/1990 Coll. about offenses as amended (water act) and will be incorporated into them.

The SLOVAK WATER MANAGEMENT ENTERPRISE, state enterprise is responsible for ensuring an elaboration of flood hazard and flood risk maps in the Slovak Republic.

Flood hazard maps and flood risk maps use as a tool for integrated flood risk management and spatial planning aimed to reducing adverse consequences of floods and for guidance of activities in floodplain areas using mathematical hydrodynamic model of steady and uneven water flow simulation.

Flood hazard maps was elaborated for the geographic areas, in which the preliminary flood risk assessment identified the existence of a potential significant flood risk and areas where probable occurrence of significant flood risk can be assumed. On the maps is displayed the flood range, which could cause floods with an average return period from once in 5 years to once in 1000 years, or other flood with a exceptionally dangerous.

Flood risk maps contain data of potential negative consequences of floods, which are displayed on flood hazard maps. On the maps are mentioned data about estimated number of potential affected inhabitants by floods and other economic activities in flood potential endangered areas. If they are displayed on the flood risk maps of geographical area, then the following additional data are included:

- locations with industrial activities, which may cause accidental pollution of water during flood,



- location of potential endangered areas for water collection for human consumption and for recreational activities,
- locations with water for swimming,
- information on other significant sources of potential water pollution during floods,
- areas, which form the national system of protected areas and the European system of proposed and declared protected areas (NATURA 2000).

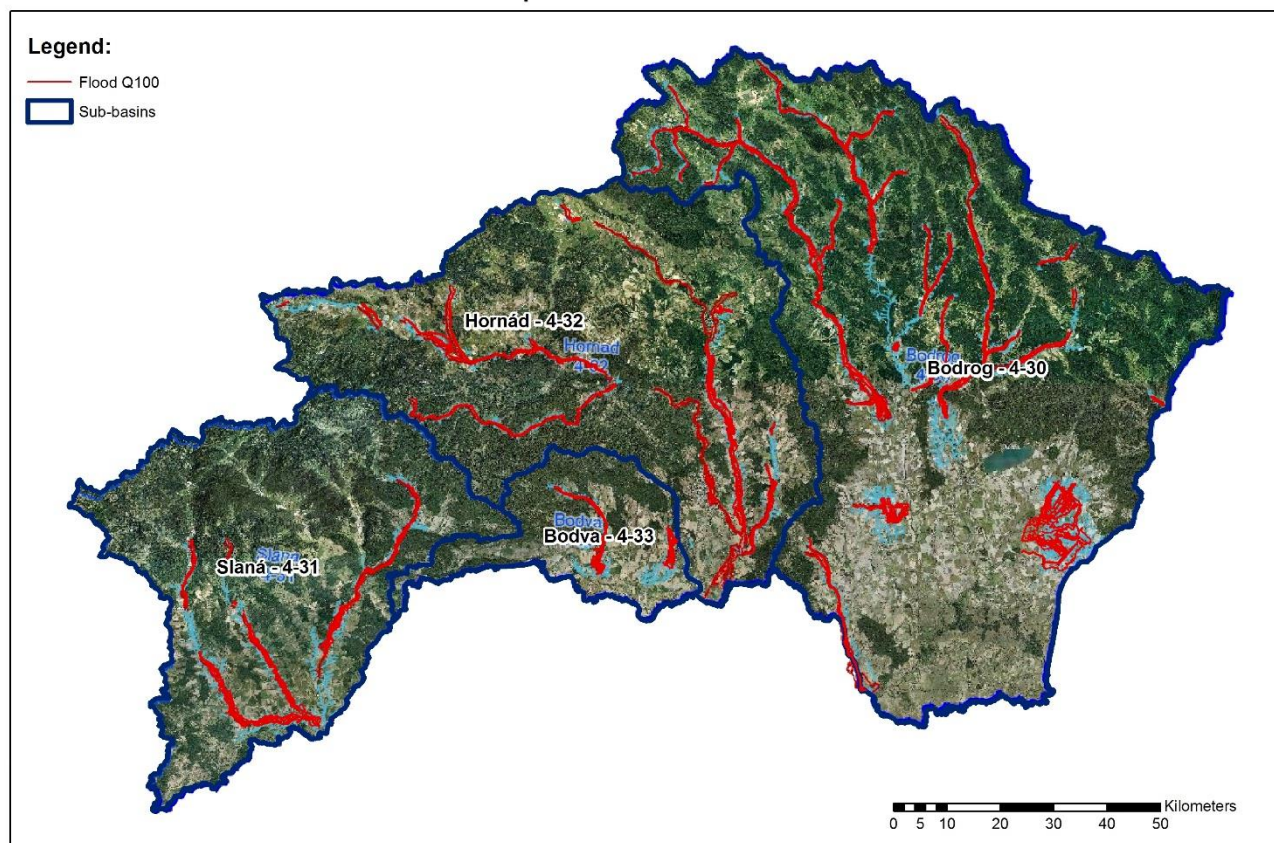
Flood hazard maps and flood risk maps (after clicking):

- Slaná river sub-basin:  
<http://mpomprsr.svp.sk/Default.aspx?zoom=2&lat=6154337.0188807&lon=2164241.5452543&layers=Ortofotomapa>
- Bodva river sub-basin:  
<http://mpomprsr.svp.sk/Default.aspx?zoom=2&lat=6206627.1337736&lon=2331047.3578866&layers=Ortofotomapa>
- Hornád river sub-basin:  
<http://mpomprsr.svp.sk/Default.aspx?zoom=2&lat=6256101.0835661&lon=2339958.0495302&layers=Ortofotomapa>
- Bodrog river sub-basin:  
<http://mpomprsr.svp.sk/Default.aspx?zoom=1&lat=6258085.4625349&lon=2428329.0596055&layers=Ortofotomapa>



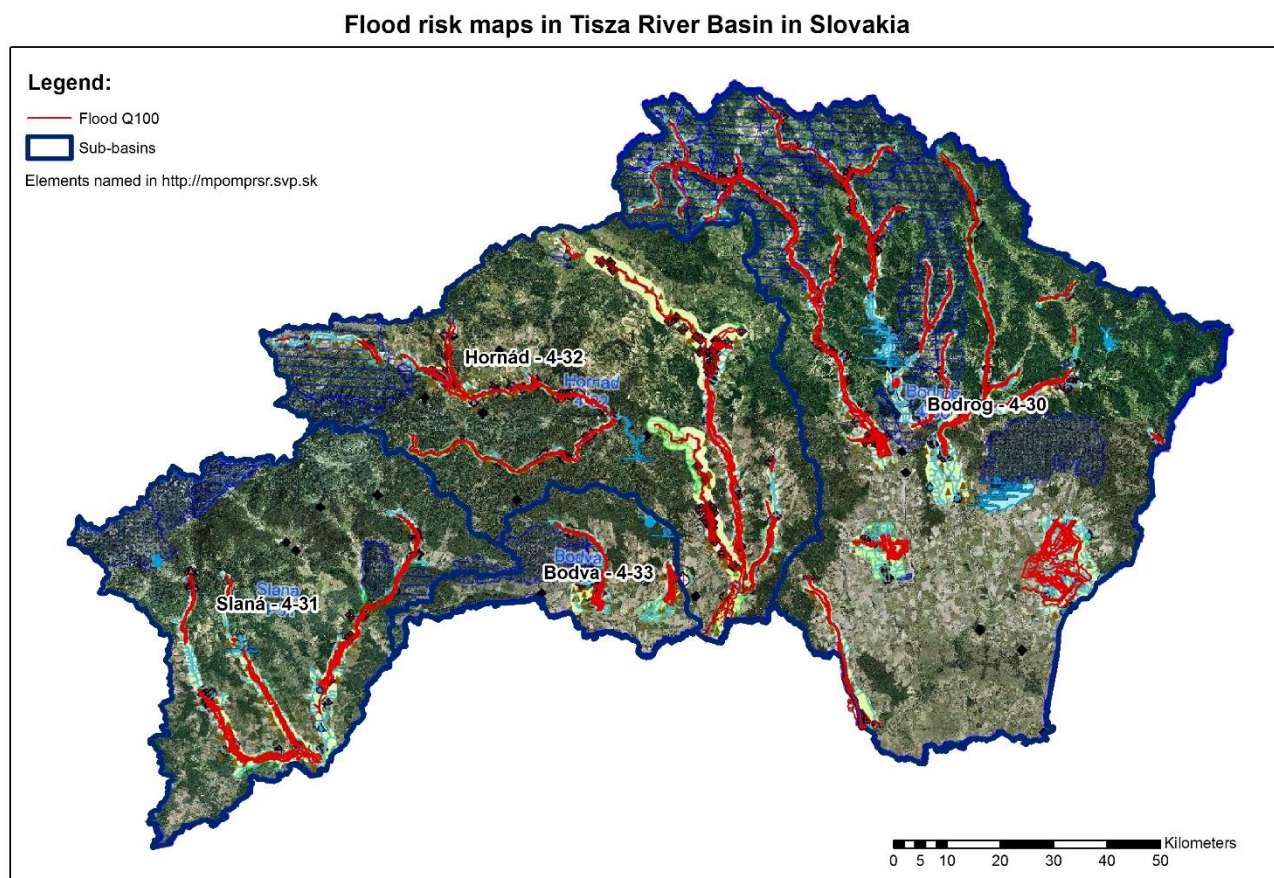
A figure with map representing the flood hazard.

**Flood hazard maps in Tisza River Basin in Slovakia**



**Figure 3.4. Flood hazard map in Tisza River Basin in Slovakia**

A figure with map representing the flood risk.



**Figure 3.4. Flood risk map in Tisza River Basin in Slovakia**

## Potential adverse consequences

Description of statistical risk indicators that describe the principal potential adverse consequences in Tisza River Basin in Slovakia is in “Table 3– 10 Statistical risk indicators” with legend to individual codes.

A table with statistical risk indicators at the Tisza River Basin level is proposed below:

*Table 3- 10 Statistical risk indicators*

Locality	Potential adverse consequences				Cunatification (number/lenght/etc.)
	Economic	Social	Environment	Cultural heritage	
Slaná - Betliar	B41;B42;B43;B44	B14	B23	B31	data unavaible
Slaná - Brzotín	B41;B42;B43;B44	B14	B23	B34	data unavaible
Slaná - Slavec	B41;B42;B43;B44	B14	B23	B34	data unavaible
Slaná - Plešivec	B41;B42;B43;B44	B14	B23	B34	data unavaible

Slaná - Gemerská Hôrka	B41;B42;B43;B44	B14	B23	B31	data unavaible
Slaná - Čoltovo	B41;B42;B43;B44	B14	B23	B34	data unavaible
Slaná - Čoltovo	B41;B42;B43;B44	B14	B23	B34	data unavaible
Slaná - Bretka	B41;B42;B43;B44	B14	B23	B34	data unavaible
Slaná - Gemerská Panica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Slaná - Gemer	B43	B14	B25	B34	data unavaible
Slaná - Tornaľa	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Rovné	B42;B43	B14	B25	B34	data unavaible
Blh - Rovné	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Rovné	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Potok	B42;B43	B14	B25	B34	data unavaible
Blh - Potok	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Potok	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Drienčany	B42;B43	B14	B25	B34	data unavaible
Blh - Drienčany	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Drienčany	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Teplý Vrch	B42;B43	B14	B25	B34	data unavaible
Blh - Teplý Vrch	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Teplý Vrch	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Veľký Blh	B42;B43	B14	B25	B34	data unavaible
Blh - Veľký Blh	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Veľký Blh	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Uzovská Panica	B42;B43	B14	B25	B34	data unavaible
Blh - Uzovská Panica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Uzovská Panica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Bátka	B42;B43	B14	B25	B34	data unavaible
Blh - Bátka	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Bátka	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Žíp	B42;B43	B14	B25	B34	data unavaible
Blh - Žíp	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Žíp	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Cakov	B42;B43	B14	B25	B34	data unavaible
Blh - Cakov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Cakov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Ivanice	B42;B43	B14	B25	B34	data unavaible
Blh - Ivanice	B41;B42;B43;B44	B14	B23	B34	data unavaible
Blh - Ivanice	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Hnúšťa	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Hnúšťa	B41;B42;B43;B44	B14	B23	B34	data unavaible

Rimava - Rimavské Brezovo	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Rimavské Brezovo	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Rimavské Zalužany	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Rimavské Zalužany	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Kociha	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Kociha	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Rimavská Sobota	B42;B43	B14	B25	B34	data unavaible
Rimava - Rimavská Sobota	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Rimavská Sobota	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Pavlovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Pavlovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Jesenské	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Jesenské	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Širkovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Širkovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Šimonovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Šimonovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Rimavská Seč	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Rimavská Seč	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Vlkyňa	B41;B42;B43;B44	B14	B23	B34	data unavaible
Rimava - Vlkyňa	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ida - Košice - Šaca	B41;B42;B43;B44	B14	B25	B34	data unavaible
Ida - Veľká Ida	B41;B42;B43	B14	B25	B34	data unavaible
Ida - Veľká Ida	B41;B42;B43	B14	B25	B34	data unavaible
Bodva - Medzev	B42	B14	B25	B34	data unavaible
Bodva - Medzev	B42	B14	B25	B34	data unavaible
Bodva - Medzev	B42;B43	B14	B25	B34	data unavaible
Bodva - Medzev	B41;B42;B43	B14	B25	B34	data unavaible
Bodva - Medzev	B41;B42;B43	B14	B25	B34	data unavaible
Bodva - Jasov	B42;B43	B14	B25	B34	data unavaible
Bodva - Jasov	B41;B42;B43	B14	B25	B34	data unavaible
Bodva - Jasov	B41;B42;B43	B14	B25	B34	data unavaible
Bodva - Moldava nad Bodvou	B42;B43	B14	B25	B34	data unavaible



Bodva - Moldava nad Bodvou	B41;B42;B43	B14	B25	B34	data unavaible
Bodva - Moldava nad Bodvou	B41;B42;B43	B14	B25	B34	data unavaible
Brusník - Letanovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Brusník - Smižany	B42	B14	B25	B34	data unavaible
Brusník - Smižany	B41;B42;B43;B44	B14	B23	B34	data unavaible
Levočský potok - Levoča	B41;B42;B43;B44	B14	B23	B34	data unavaible
Levočský potok - Harichovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Levočský potok - Harichovce	B42;B43	B14	B25	B34	data unavaible
Levočský potok - Spišská Nová Ves	B41;B42;B43;B44	B14	B23	B30	data unavaible
Levočský potok - Markušovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Branisko - Spišské Vlachy	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hnilec - Hnilec	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hnilec - Nálepko	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hnilec - Švedlár	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hnilec - Švedlár	B41;B42;B43	B14	B25	B34	data unavaible
Hnilec - Mníšek nad Hnilcom	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hnilec - Helcmanovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hnilec - Prakovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hnilec - Gelnica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hnilec - Jaklovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kučmanovský potok - Šarišské Dravce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kučmanovský potok - Torysa	B41;B42;B43;B44	B14	B25	B34	data unavaible
Šebastovka - Prešov	B41;B42;B43;B44;B45	B14	B23	B34	data unavaible
Torysa - Haniska	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Kendice	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Kendice	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Drienovská Nová Ves	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Drienov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Drienov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Bretejovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Ploské	B41;B42;B43;B44	B14	B23	B34	data unavaible

Torysa - Kráľovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Vajkovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Beniakovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Rozhanovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Košické Oľšany	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Sady nad Torysou	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Košická Polianka	B41;B42;B43;B44	B14	B23	B34	data unavaible
Torysa - Vyšná Hutka	B41;B42;B43;B44;B45	B14	B23	B34	data unavaible
Torysa - Nižná Hutka	B41;B42;B43;B44;B45	B14	B23	B34	data unavaible
Torysa - Nižná Hutka	B41;B42;B43;B45	B14	B25	B34	data unavaible
Torysa - Lipany	B42;B43;B44	B14	B25	B34	data unavaible
Torysa - Rožkovany	B41;B42;B43	B14	B25	B34	data unavaible
Torysa - Jakubova Voľa	B41;B42;B43	B14	B25	B34	data unavaible
Torysa - Pečovská Nová Ves	B41;B42;B43;B44	B14	B25	B34	data unavaible
Torysa - Sabinov	B41;B42;B43	B14	B25	B34	data unavaible
Torysa - Ostrovany	B42;B43;	B14	B25	B34	data unavaible
Torysa - Šarišské Michaľany	B42;B43;B44	B14	B25	B34	data unavaible
Torysa - Veľký Šariš	B42	B14	B25	B34	data unavaible
Torysa - Prešov	B41;B42;B43	B14	B25	B34	data unavaible
Sekčov - Prešov	B42	B14	B25	B34	data unavaible
Sekčov - Fintice	B42	B14	B25	B34	data unavaible
Trstianka - Trstfany	B41;B42;B43;B44	B14	B23	B34	data unavaible
Trstianka - Ďurďošík	B41;B42;B43;B44	B14	B23	B34	data unavaible
Trstianka - Ďurďošík	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olšava - Kecerovce	B42	B14	B25	B34	data unavaible
Olšava - Kecerovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olšava - Olšovany	B42	B14	B25	B34	data unavaible
Olšava - Olšovany	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olšava - Vyšný Čaj	B42;B45	B14	B25	B34	data unavaible
Olšava - Vyšný Čaj	B41;B42;B43;B44;B45	B14	B23	B34	data unavaible
Olšava - Vyšný Čaj	B41;B42;B43;B44;B45	B14	B23	B34	data unavaible
Olšava - Blažice	B42	B14	B25	B34	data unavaible
Olšava - Blažice	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olšava - Nižný Čaj	B42	B14	B25	B34	data unavaible
Olšava - Nižný Čaj	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olšava - Nižný Čaj	B41;B42;B43;B44	B14	B23	B34	data unavaible

Olšava - Bohdanovce	B42	B14	B25	B34	data unavaible
Olšava - Bohdanovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olšava - Bohdanovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olšava - Nižná Myšľa	B42;B45	B14	B25	B34	data unavaible
Olšava - Nižná Myšľa	B41;B42;B43;B44;B45	B14	B23	B30	data unavaible
Olšava - Nižná Myšľa	B41;B42;B43;B44;B45	B14	B23	B34	data unavaible
Hornád - Vikartovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Spišský Štiavnik	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Betlanovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Betlanovce	B41;B42;B43;B44	B14	B23	B30	data unavaible
Hornád - Hrabušice	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Hrabušice	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Spišská Nová Ves	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Markušovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Markušovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Matejovce nad Hornádom	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Matejovce nad Hornádom	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Chrást nad Hornádom	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Vítkovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Olcnavá	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Spišské Vlachy	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Kolinovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Kolinovce	B41;B42;B43	B14	B25	B34	data unavaible
Hornád - Krompachy	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Richnava	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Kluknava	B41;B42;B43;B44	B14	B23	B34	data unavaible
Hornád - Kluknava	B41;B42;B43	B14	B23	B34	data unavaible
Hornád - Malá Lodina	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Veľká Lodina	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Obišovce	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Kysak	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Trebejov	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Sokol	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Kostolány nad Hornádom	B42;B43;B44	B14	B25	B34	data unavaible



Hornád - Družstevná pri Hornáde	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Košice	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Kokšov-Bakša	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Nižná Myšľa	B42;B43	B14	B25	B34	data unavaible
Hornád - Čaňa	B41;B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Ždaňa	B41;B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Gyňov	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Trstené pri Hornáde	B41;B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Seňa	B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Kechnec	B41;B42;B43;B44	B14	B25	B34	data unavaible
Hornád - Milhošť	B41;B42;B43;B44	B14	B25	B34	data unavaible
Udava - Osadné	B41;B42;B43;B44	B14	B23	B34	data unavaible
Udava - Nižná Jablonka	B41;B42;B43;B44	B14	B23	B34	data unavaible
Udava - Vyšný Hrušov	B41;B42;B43;B44;B45	B14	B23	B34	data unavaible
Udava - Udvské	B41;B42;B43;B44;B45	B14	B23	B34	data unavaible
Pčolinka - Pčoliné	B41;B42;B43;B44	B14	B23	B31	data unavaible
Pčolinka - Snina	B42;B43	B10	B25	B34	data unavaible
Cirocha - Snina	B41;B42;B43	B10	B25	B34	data unavaible
Cirocha - Dlhé nad Cirochou	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ublanka - Ublá	B41;B43;B44	B10	B25	B34	data unavaible
Sobrancecký potok - Sobrance	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kanál Veľké Revišťa-Bežovce - Nižná Rybnica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kanál Veľké Revišťa-Bežovce - Nižná Rybnica	B41;B42;B43	B14	B25	B34	data unavaible
Kanál Veľké Revišťa-Bežovce - Sobrance	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kanál Veľké Revišťa-Bežovce - Sobrance	B41;B42;B43	B14	B25	B34	data unavaible
Kanál Veľké Revišťa-Bežovce - Bežovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kanál Veľké Revišťa-Bežovce - Bežovce	B41;B42;B43	B14	B25	B34	data unavaible
Ladomirka - Krajná Poľana	B41;B42;B43;B44	B14	B23	B31	data unavaible

Ladomirka - Hunkovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ladomirka - Ladomirová	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ladomirka - Svidník	B41;B42;B43;B44	B14	B23	B34	data unavaible
Chotčianka - Bukovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Chotčianka - Chotča	B41;B42;B43	B14	B25	B31	data unavaible
Chotčianka - Stropkov	B42	B10	B25	B34	data unavaible
Sitnička - Závada	B41;B42;B43;B44	B14	B23	B34	data unavaible
Sitnička - Ruská Poruba	B41;B42;B43;B44	B14	B23	B34	data unavaible
Sitnička - Vyšná Sitnica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Sitnička - Nižná Sitnica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Sitnička - Nižná Sitnica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olka - Olka	B42	B10	B25	B34	data unavaible
Olka - Ruská Kajňa	B41;B42;B43;B44	B14	B23	B31	data unavaible
Olka - Pakostov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olka - Košarovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olka - Žalobín	B41;B42;B43;B44	B14	B23	B34	data unavaible
Olka - Žalobín	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondavka - Turcovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondavka - Baškovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondavka - Ohradzany	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondavka - Slovenská Volová	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondavka - Závadka	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondavka - Topoľovka	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondava - Vyšná Polianka	B41;B42;B43	B10	B25	B34	data unavaible
Ondava - Varadka	B41;B42;B43	B10	B25	B34	data unavaible
Ondava - Nižná Polianka	B41;B42;B43	B10	B25	B34	data unavaible
Ondava - Mikulášová	B43	B10	B25	B34	data unavaible
Ondava - Cigla	B43	B10	B25	B34	data unavaible
Ondava - Dubová	B43	B10	B25	B34	data unavaible
Ondava - Vyšný Orlík	B42;B43	B10	B25	B34	data unavaible
Ondava - Nižný Orlík	B43	B10	B25	B34	data unavaible
Ondava - Svidník	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondava - Stročín	B43	B10	B25	B34	data unavaible
Ondava - Duplín	B43	B10	B25	B34	data unavaible

Ondava - Tisinec	B41;B42;B43	B14	B25	B34	data unavaible
Ondava - Stropkov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondava - Stropkov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Ondava - Breznica	B42	B10	B25	B34	data unavaible
Ondava - Miňovce	B42	B10	B25	B34	data unavaible
Slatvynec - Kríže	B41;B42;B43;B44	B14	B23	B34	data unavaible
Slatvynec - Bogliarka	B41;B42;B43;B44	B14	B23	B34	data unavaible
Slatvynec - Kružlov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kamenec - Petrová	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kamenec - Sveržov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kamenec - Tarnov	B41;B42	B10	B25	B34	data unavaible
Šibská voda - Šiba	B41;B42;B43;B44	B14	B23	B34	data unavaible
Šibská voda - Šiba	B41;B42;B43	B14	B25	B34	data unavaible
Šibská voda - Bardejov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Kamenec - Bardejov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Radomka - Šarišský Štiavnik	B41;B42;B43	B14	B25	B34	data unavaible
Radomka - Radoma	B41;B42;B43;B44	B14	B23	B34	data unavaible
Radomka - Radoma	B41;B42;B43	B14	B25	B34	data unavaible
Radomka - Okružle	B41;B42;B43;B44	B14	B23	B34	data unavaible
Radomka - Okružle	B41;B42;B43;B44	B14	B23	B34	data unavaible
Radomka - Okružle	B41;B42;B43	B14	B25	B34	data unavaible
Radomka - Matovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Radomka - Matovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Radomka - Gíraltovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Radomka - Gíraltovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Lomnica - Vechec	B41;B42;B43;B44	B14	B23	B34	data unavaible
Lomnica - Vranov nad Topľou	B41;B42	B10	B25	B34	data unavaible
Topľa - Livovská Huta	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Livov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Livov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Lukov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Lukov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Gerlachov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Tarnov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Rokytov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Mokroluh	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Bardejov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Bardejov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Komárov	B41;B42;B43;B44	B14	B23	B34	data unavaible

Topľa - Hrabovec	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Poliakovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Dubinné	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Kurima	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Kučín	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Porúbka	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Harhaj	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Marhaň	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Brezov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Kalnište	B41;B42;B43	B10	B25	B34	data unavaible
Topľa - Lužany pri Topli	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Giraltovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Giraltovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Železník	B41;B42;B43	B10	B25	B34	data unavaible
Topľa - Mičakovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Mičakovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Ďurďoš	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Ďurďoš	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Hanušovce nad Topľou	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Bystré	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Skrabské	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Vyšný Žipov	B41;B42;B43;B44;B45	B14	B23	B34	data unavaible
Topľa - Hlinné	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Jastrabie nad Topľou	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Jastrabie nad Topľou	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Čaklov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Čaklov	B41;B42;B43	B14	B25	B34	data unavaible
Topľa - Vranov nad Topľou	B41;B42;B43;B44	B14	B23	B34	data unavaible
Topľa - Vranov nad Topľou	B41;B42;B43;B44	B14	B23	B34	data unavaible
Trnávka - Sečovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Trnávka - Sečovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Trnávka - Hriadky	B41;B42;B43;B44	B14	B23	B34	data unavaible
Trnávka - Hriadky	B41;B42;B43;B44	B14	B23	B34	data unavaible
Trnávka - Vojčice	B41;B42;B43;B44	B14	B23	B34	data unavaible
Terebľa - Kalša	B41;B42;B43;B44	B14	B23	B34	data unavaible
Terebľa - Kalša	B41;B42;B43;B44	B14	B23	B34	data unavaible
Terebľa - Slivník	B41;B42;B43;B44	B14	B23	B34	data unavaible

Terebňa - Slivník	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Slanské Nové Mesto	B42	B14	B25	B34	data unavailable
Roňava - Slanské Nové Mesto	B42;B43	B14	B25	B34	data unavailable
Roňava - Slanské Nové Mesto	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Slanské Nové Mesto	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Slivník	B42	B14	B25	B34	data unavailable
Roňava - Slivník	B42;B43	B14	B25	B34	data unavailable
Roňava - Slivník	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Slivník	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Slivník	B41;B42;B43	B14	B25	B31	data unavailable
Roňava - Kuzmice	B42	B14	B25	B34	data unavailable
Roňava - Kuzmice	B42;B43	B14	B25	B34	data unavailable
Roňava - Kuzmice	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Kuzmice	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Kuzmice	B41;B42;B43	B14	B25	B34	data unavailable
Roňava - Michaľany	B42	B14	B25	B34	data unavailable
Roňava - Michaľany	B42;B43	B14	B25	B34	data unavailable
Roňava - Michaľany	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Michaľany	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Michaľany	B41;B42;B43	B14	B25	B34	data unavailable
Roňava - Čerhov	B42	B14	B25	B34	data unavailable
Roňava - Čerhov	B42;B43	B14	B25	B34	data unavailable
Roňava - Čerhov	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Čerhov	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Čerhov	B41;B42;B43	B14	B25	B34	data unavailable
Roňava - Slovenské Nové Mesto	B42	B14	B25	B34	data unavailable
Roňava - Slovenské Nové Mesto	B42;B43	B14	B25	B34	data unavailable
Roňava - Slovenské Nové Mesto	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Slovenské Nové Mesto	B41;B42;B43;B44	B14	B23	B34	data unavailable
Roňava - Slovenské Nové Mesto	B41;B42;B43	B14	B25	B34	data unavailable
Laborec - Čertižné	B41;B42;B43;B44	B14	B23	B34	data unavailable
Laborec - Habura	B41;B42;B43;B44	B14	B23	B34	data unavailable
Laborec - Medzilaborce	B41;B42;B43;B44	B14	B23	B34	data unavailable

Laborec - Krásny Brod	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Čabiny	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Volica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Volica	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Radvaň nad Laborcom	B41;B42;B43;B44	B14	B23	B31	data unavaible
Laborec - Radvaň nad Laborcom	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Brestov nad Laborcom	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Hrabovec nad Laborcom	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Zbudské Dlhé	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Koškovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Hankovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Ľubiša	B41;B42;B43;B44	B14	B23	B31	data unavaible
Laborec - Veľopolie	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Udavské	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Kochanovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Lackovce	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Brekov	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Strážske	B41;B42;B43;B44	B14	B23	B34	data unavaible
Laborec - Strážske	B41;B42;B43;B44	B14	B23	B34	data unavaible

## Legend: Type of Consequence

### 1. Type Economic

B40=Economic

B41=Property: Adverse consequences to property, which could include homes.

B42=Infrastructure: Adverse consequences to infrastructural assets such as utilities, power generation, transport, storage and communication.

B43=Rural Land Use: Adverse consequences to uses of the land, such as agricultural activity (livestock, arable and horticulture), forestry, mineral extraction and fishing.

B44=Economic Activity: Adverse consequences to sectors of economic activity, such as manufacturing, construction, retail, services and other sources of employment.

B45=Other

B46=Not applicable

### 2. Type Human Health

B10=Human Health (Social)

B14=Not applicaple

### 3. Type Environment

B23=Pollution Sources: Sources of potential pollution in the event of a flood, such as IPPC and Seveso installations, or point or diffuse sources.

B25=Not applicable

### 4. Type Cultural Heritage

B30=Cultural Heritage

B31=Cultural Assets: Adverse consequences to cultural heritage, which could include archaeological sites / monuments, architectural sites, museums, spiritual sites and buildings.

B34=Not applicable

## Estimation of the impact of Climate Change on flood risk

In the evaluation of the assessment of climate change impacts, the Slovak Republic (SR) is preparing the National Communication of the Slovak Republic on Climate Change every four years. The Slovak Republic fulfills these obligations in accordance with Articles 4 and 12 of the UN Framework Convention on Climate Change, The Kyoto Protocol and the current decision of the Conference of the Parties to the Convention.

The Fifth National Communication of the Slovak Republic on Climate Change states that between 1881 and 2008, the average annual air temperature in Slovakia increases by 1.6 °C. In the same period 1881 to 2008 in Slovakia, the average annual rainfall decreased by 3.4%. Since 1900, there has been a significant decrease of air humidity, which is about 5% in the southern regions of the country and less than 5% elsewhere and also a decrease in snow cover in locations below 1 000 m asl. In the south of Slovakia, such days were recorded in the first decade of the 21st century, with their average annual number oscillating around 6 days. The number of such days could increase two to three times, and it can be assumed that by the end of the 21st century the number of such days would rise to 45 days a year. The rise of air temperature increases the total rainfall not only during heavy storms in warm parts of the year but also throughout of the whole year. It can be assumed that the total precipitation during extreme precipitation events with a probability of repetition once every 50 years and less will often be 20 to 25% higher than they were in the first decade of the 21st century. According to the analysis of the results, higher total precipitation in several areas in Slovakia each year it will exceed 150 mm and an average once in 50 years 400 mm.

In the northern Slovakia and in the mountains, an increase of total precipitation by about 30% may be expected even in the winter, and at the same time an increasing of the air temperature of 4 °C should also be expected. By the end of the 21st century, there should be a significant increasing in precipitation in locations between altitude of 800 and 1000 m asl. (mainly liquid precipitation). Because of warming would be more common winter floods. If the air temperature is increased by 4 °C, it should not be endangered an occurrence of snow and snow cover in locations with an altitude above 1200 m asl.

In the Fifth National Communication of the Slovak Republic on Climate Change, the results of the modeling according to the CCCM97 scenario are presented and according to them it is possible, despite the possibility of increasing the amount of precipitation, to expect a decrease in runoff from the whole area of Slovakia.

In comparison with the reference period from 1951 to 1980, it can be assumed, that in 2030 it will be 21% and in 2075 84% of the area of Slovakia in the zone of decreased of the long-term average runoff from -5 to - 20%. The assessment of runoff scenarios over the year indicates that, in contrast with the reference period from 1951 to 1980, changes in the distribution of long-term average monthly runoff across the whole Slovakia may be expected over the 2075 (2051-2100) horizon:

1. In western part of Slovakia – increase runoff in winter and spring, in december and january ranging from 30 to 60% and in july a decrease runoff from -20 to -40%.
2. In northern part of Central Slovakia - increase in winter and spring runoff, from november to march, with the highest increase in february or January from 80 to 120%. In the Dunajec river sub-basin and Poprad river sub-basin, can be expected increasing of runoff from 20 to 40%. On the contrary, the decrease in runoff can



be expected in the period from april to september, with the largest decreasing in may, in the Dunajec and Poprad river sub-basins in april and july from -20 to -40%.

3. In southern regions of central Slovakia will be shorter periods of runoff in winter and spring, but the period of long-term decrease of average monthly runoff will be longer. The largest increase in runoff can be expected in februar from 20 to 90% and the most significant decrease could be in july and august from -30 to -70%.

Tab. Peak N – Annual flows in water hydrometric stations within the Tisa River Basin

Watercourse/Hydrometric station	River basin area km <sup>2</sup>	Number of years (N)						
		1	2	5	10	20	50	100
		m <sup>3</sup> .s <sup>-1</sup>						
Slaná/Lenartovce	1829,65	86	130	190	235	280	340	400
Rimava/Vlkyňa	1377,41	55	75	105	125	145	170	190
Bodva/Hosťovce	863,70	36	57	87	105	125	152	170
Hnilec/Jaklovce	606,32	49	72	105	132	160	192	220
Torysa/Košické Olšany	1298,30	89	127	180	218	260	315	360
Hornád/Ždaňa	4232,20	220	320	480	600	720	880	1000
Latorica/Veľké Kapušany	2915,50	150	210	290	380	460	620	736
Uh/Lekárovce	1989,50	460	600	800	980	1150	1400	1600
Laborec/Ižkovce	4364,20	380	540	720	860	970	1130	1250
Ondava/Horovce	2885,80	240	330	440	530	620	740	830
Topľa/Hanušovce	1050,10	110	165	230	290	350	430	500
Bodrog/Streda nad Bodrogom	11474,30	500	680	860	1000	1130	1300	1400

## International Cooperation in the Tisza River Basin

Bilateral cooperation of the Slovak Republic on the border sections of the rivers – valid intergovernmental treaties and agreements:

1. Intergovernmental agreement between Czechoslovak Socialist Republic and People's Republic of Hungary on the regulation of water management issues at the border waters (signed 31 May 1976 in Budapest, valid since 31 July 1978, inherited with partners after the formation of the SR in 1993, Treaty between SR and Republic of Hungary currently in the ratification process).

\*\*\* An example is polder Beša, which is only flooded in extreme flood situations in Medzibodrožie and when the territory is in risk in the Bodrog river basin in the Republic of Hungary. According to the bilateral agreement between the Slovak Republic and Republic of Hungary, the polder is flooded when the height of the Bodrog river in Streda nad Bodrogom reaches 936 cm (equivalent 101.10 m asl. - Adriatic)

2. Intergovernmental agreement between SR and Ukraine on the water management issues at the border waters (signed 14 June 1994 in Bratislava, valid since 15 December 1995).

The Slovak Republic uses various funding instruments for the environment and climate action e. g.: Danube Transnational Programme, INTERREG, Horizon 2020, LIFE, SOUTH EAST EUROPE PROGRAMME etc.

The Slovak Republic also joined to several international conventions such as: Ramsar Convention on Wetlands, Carpathian Convention, Convention on the Protection and Use of Transboundary Watercourses and International Lakes.

For the implementation of the EU Biodiversity strategy by 2020, EU commission has launched new biogeographic process-non formal process with EU member states aimed at exchanging information and

experience, good practice and improving cross-border cooperation for the management of Natura 2000 sites, in which the Slovak Republic is also involved.

Flood protection issues on transnational level are coordinated within the frame of the specific bodies – Border Waters Commission and within the Danube River Basin within ICPDR.

## Abbreviations

DTP	Danube Transnational Programme
EU	European Union
ICPDR	The International Commission for the Protection of the Danube River
NP	National park
PLA	Protected landscape area
SACs	Special protected area
SPAs	Special area of conservation
SR	Slovak Republic
UNESCO	United Nations Educational, Scientific and Cultural Organization

## References

- Ministry of Culture of the Slovak Republic. *UNESCO*. [cit. 2017-04-06]. Bratislava, 2017. URL: <<http://www.culture.gov.sk/posobnost-ministerstva/medzinarodna-spolupraca/odbor-europskych-zalezitosti/unesco-103.html>>.
- Ministry of Environment of the Slovak Republic. *Flood maps*. [cit. 2017-04-06]. Bratislava, 2017. URL: <<http://www.minzp.sk/sekcie/temy-oblasti/voda/ochrana-pred-povodnami/manazment-povodnovych-rizik/povodnove-mapy.html>>.
- Ministry of Environment of the Slovak Republic. *Management of flood risks*. [cit. 2017-04-06]. Bratislava, 2017. URL: <<http://www.minzp.sk/sekcie/temy-oblasti/voda/ochrana-pred-povodnami/manazment-povodnovych-rizik/>>.
- Ministry of Environment of the Slovak Republic. 2011. *The preliminary flood risk assessment in Slaná river sub-basin*. 121 p.
- Ministry of Environment of the Slovak Republic. 2011. *The preliminary flood risk assessment in Bodva river sub-basin*. 103 p.
- Ministry of Environment of the Slovak Republic. 2011. *The preliminary flood risk assessment in Hornád river sub-basin*. 137 p.
- Ministry of Environment of the Slovak Republic. 2011. *The preliminary flood risk assessment in Bodrog river sub-basin*. 157 p.
- Ministry of Environment of the Slovak Republic. 2015. *Flood risk management plan in Slaná river sub-basin*. 314 p.
- Ministry of Environment of the Slovak Republic. 2015. *Flood risk management plan in Bodva river sub-basin*. 191 p.
- Ministry of Environment of the Slovak Republic. 2015. *Flood risk management plan in Hornád river sub-basin*. 611 p.
- Ministry of Environment of the Slovak Republic. 2015. *Flood risk management plan in Bodrog river sub-basin*. 826 p.
- Ministry of Environment of the Slovak Republic. 2015. *Slaná river sub-basin management plan*. 205 p.
- Ministry of Environment of the Slovak Republic. 2015. *Bodva river sub-basin management plan*. 188 p.
- Ministry of Environment of the Slovak Republic. 2015. *Hornád river sub-basin management plan*. 212 p.
- Ministry of Environment of the Slovak Republic. 2015. *Bodrog river sub-basin management plan*. 197 p.
- State Nature Conservancy of the Slovak Republic. *National parks*. [cit. 2017-04-06]. Banská Bystrica, 2017. URL: <<http://www.sopsr.sk/web/index.php?cl=13>>.
- State Nature Conservancy of the Slovak Republic. *PLA (protected landscape areas)*. [cit. 2017-04-06]. Banská Bystrica, 2017. URL: <<http://www.sopsr.sk/web/index.php?cl=14>>.
- Statistical Office of the Slovak Republic. *Regional statistics*. [cit. 2017-04-06]. Bratislava, 2016. URL: <[https://slovak.statistics.sk/wps/portal/ext/themes/regional/!ut/p/z1/jZLBboMwDIYfKQYCCceUtSFTxhICtPNl4jQhbW0PVZ9\\_EWPbac58s\\_x\\_jn87DNmJ4Xm-](https://slovak.statistics.sk/wps/portal/ext/themes/regional/!ut/p/z1/jZLBboMwDIYfKQYCCceUtSFTxhICtPNl4jQhbW0PVZ9_EWPbac58s_x_jn87DNmJ4Xm-)

L2\_zbbmc5\_eYv2D1Olknd7tMgRZDBqbrwjhJXzy1GTuuAi\_Ml0B2\_R7MojzuH3kGvGQYy4fgclVz3Tz0z4dYbnIZb  
JUDfPOEAln3vdj4RquWCwsgrS7BqHbsa18UoAqS\_5kf\_ggF\_-  
N\_\_ZcCoiCMAFPQaihJ3lUbTxhEuv0xdSCk7dF8HJCa3-YJPgqS-  
8NVQl0w5QFTnwypLfpa0IL1imQHx9n1Y9ziBlTzZCcoluep/dz/d5/L2dJQSEvUUt3QS80TmxFL1o2X1E3SThCQjFB  
MDg1NzAwSU5TVTAwVINHQVQ1/>.

Prepared shape files of the next items:

- Water resources
- Land use (Corine Land Cover 2012)
- Flood protection infrastructures
- Drainage systems
- Historical floods
- Areas with Potentially Significant Flood Risk
- Flood hazard
- Flood risk

.....  
Signature

Banská Štiavnica / Slovakia 10.07.2017  
.....

Place and date

Ing Stanislav Gáborík  
(Director General)  
.....

Title of the Signatory

Official stamp of  
SLOVAK WATER MANAGEMENT ENTERPRISE,  
state enterprise