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Flood issues and climate changes
Country Report for Ukraine

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Abbreviations

AIMS "TISZA"	Joint Ukrainian-Hungarian *Automated Information-Measuring System* for flood forecasting and management in the Tisza River basin in Transcarpathian region
APSFR	Areas with Potentially Significant Flood Risk
CORINE Land Cover	Coordination of Information on the Environment Land Cover, CLC
Danube Transnational Programme (DTP)	The Danube Transnational Programme is a financing instrument of the European. Territorial Cooperation (ETC), better known as Interreg. The Danube Transnational Programme finances projects for the development and practical implementation of policy frameworks, tools and services and concrete small-scale pilot investments
HUF Hydromet	State Hydrometeorological Service of Ukraine
ITRMB Plan	Integrated Tisza River Basin Management Plan
SSES	State Service of Emergency Situations Ukraine

Chapter 1 Introduction

The purpose of this report is to show as far as possible the flood defence activity in the Tisza river basin, the national aspects of Ukrainian part of Tisza basin geographically, geologically, water resources, soil, population, human settlements, land use, economic activities, biodiversity, protected areas, cultural heritage, flood defence infrastructure, flood hazard and risk areas and cooperation which have settled bilaterally between countries, as well as at the level of the international organizations they are part of.

Chapter 2 National responsible institutions for flood management in the Tisza River Basin countries

In **Ukraine** there are two main organizations at national level involved in the flood risk management:

- **State Agency of Water Resources of Ukraine (SAWRU)** which belongs to the system of the Ministry of Ecology and Natural Resources of Ukrane and
- **State Service of Emergency Situations (SSES)**, which belongs to the system of the Ministry of Internal affairs.

SAWRU through its river basin authorities manages and operates flood protection constructions and jointly with SESS in the times of flood. SSES through its Oblast Hydrometeorological services is responsible for prognosis of precipitation and water levels and preliminary flood risk assessment. SSES is designated responsible for the implementation of EU Flood Risk Directive.

Chapter 3 General description of the Tisza River Basin

Geographic characterization

In **Ukraine**, Tisza basin is cut by three groups of mountain range: central is Polonynsky mountains, north from them – Gorgany, south – Vygorlat Gutynsky (volcanic) range. At southern east, there are Hutsul Alps. The mountains show a variation of heights from 2000 m.a.s.l. up to 700-800 m.a.s.l. The Hungarian lowland occupies about 35% of the basin. This area is a flat land with separate ridges and hills.

Geology

In **Ukraine**, Tisza River basin is situated within the new Alpine folding of the Carpathians and covers the central part of the Ukrainian segment of the Folded Carpathians with the Zakarpattya internal trough. The central suture zone (Zakarpattya area or otherwise Perypeninskyi deep-seated fault) divides these two main longitudinal segments.

Two structural levels take part in formation of geological structure of the territory. The lower structural level forms the basement of the Transcarpathian trough and the Folded Carpathians. The intensively deployed sedimentary, volcanogenic and metamorphic formations of the Paleozoic and the Mesozoic-Cenozoic are developed in the basement of the trough. The Folded Carpathians are

formed by the carbonate-terrigenous and terrigenous mesozoic-cenozoic formations, which make several structural-facial zones. They are intensively dislocated and form a package of overlapped structures.

In Ukraine, in general, Tisza river basin has high seismicity.

Climate

Tisza river basin is situated in moderate continental climate with ocean, western, mediterranean and submediterranean influences.

The average air temperature in **Ukraine** in July is about +21 °C and in winter -4 °C (at the high mountain range is about -10 °C). The highest temperature is +40 °C (recorded in 2010), and the absolute minimum is -41 °C (recorded in 1993). The average annual temperature in the lowland areas is about +9.5 °C. The long-time average annual amount of precipitations per year in the upper reach of the mountainous part of the catchment basin of the Tisza River, Teresva, Tereblia and Rika is remarkable and is about 1,200-1,400mm, and in the catchment basins of the Bila Tisza and the Chorna Tisza rivers it is about 1,100-1,200 mm. In the foothills, amount of precipitations is reduced to 800-1,000 mm, and in the flatland to 530-700 mm. Within the mountainous area, amount of precipitations increases to 100mm per day and the rains last for more than 2-3 days and are accompanied by the rapid formation of catastrophic river floods, landslides and floods. The Ruska Mokra is considered as a peculiar “humidity pole” in the Tiachivskyi rayon; average annual amount of precipitations per year is 2,499 mm.

Water Resources

The Tisza River Basin covers territoire from five countries as follows: Ukraine (12,732 km^2), Romania (72,620 km^2), Slovakia (15,247 km^2), Hungary (46,213 km^2) and Serbia (10,374 km^2).

Main tributaries of the Tisza River with cathment areas over 1000 km^2 is provided in Table III.1.

Table III.1 Main tributaries of the Tisza River with cathment areas over 1.000 km^2

Country	Water body name
Ukraine	Bodrog, Latorica, Uzh, Tur, Borzhava, Rika, Teresva

Soil

In **Ukraine**, in the basin within the low-land area, the variety of sod-podzolic soils prevail, mountain-forest and meadow-forest soils prevail in the mountainous area, meadow and meadow gley soils prevail in the flood-plain bench of the rivers.

Within the mountainous area of the territory, the vertical differentiation of soils is clearly monitored. In the high mountain tier, the mountain-meadow brown soils are common at altitudes of 1,100-1,200 m; on small treeless areas - the mountain valleys sod-brown soils are widespread.

Flat mountainous slopes are covered with clay brownified ashen-gray soils. Smooth slopes and river valleys are formed by meadow-brownified soils.

The Zakarpattya lowland is covered with sod-podzolic soils and gley or brownified gley soils. The marsh-gley and meadow-gley soils prevail in the valleys of the rivers Borzhava and Irshava. The clay-coloured forest soils were formed in the river sources of Uzh, Latorica and Rika, and the brown mountain forest soils were formed in the river sources of Borzhava, Tereblia, Teresva, Bila Tisza and

Chorna Tisza. The main soil type in the mouth parts of Uzh, Latorica and Borzhava rivers are sod-podzolic gley soils.

Population and human settlements

Among the major urban agglomerations in Ukraine we mention Uzhorod, Mukachevo, Khust, Beregovo and Chop.

Table III.2 Number of inhabitants in the Tisza River Basin

Aspect	Ukraine
Number of inhabitants in the Tisza River Basin	1,256,900

Land use

The land reserves of the **Ukrainian** territory of TRB are equal to 1,275.3 thousand hectares, of which 451.3 thousand hectares (35.4 percent) are occupied by agricultural land, of which 199.7 thousand hectares are arable land. More than a half of the territory is covered with forest (51 percent).

Economic activity

Regarding economic activity, in the **Ukrainian** part of TRB, the focus is on the development of priority sectors of economy, i.e. agriculture, trade, timber and woodworking industry, consumer goods industry and food industry, near-border cooperation, recreation, and etc. The main attention is paid to attracting domestic and foreign investments into the economy, small and medium enterprises development and efficient use of natural resources potential.

Recreational resources of the oblast comprise 5.2% of the volumetric and 5.1% of the value resource potential of recreation of Ukraine. Zakarpattya Oblast is known as one of the best places in Ukraine for treatment and recreation of people. A network of sanatorium and resort complexes, tourist bases is developed, able to accommodate up to 4000 tourists.

Natural resources (mineral deposits): more than 30 kinds of minerals have been explored in 150 deposits. These are polymetallic, perlites, zeolites, liparites, and deposits of barium ore, kaolin and other, which are uncommon for the country. Extraction of rock salt, marble limestone, dolomite and others is performed.

There are 75 types of mineral waters explored and 38 types of mineral waters included in the state water cadastre of Ukraine with a flow rate of 3.3 thousand m^3 per day that are unique and correspond to the water of the Shayanska, Essentuki, Borjomi types and their chemical composition and curative properties are not inferior to the well-known waters of the Caucasus, the Czech Republic, Poland and France.

Biodiversity and Protected areas

In **Ukraine**, there are 456 sites of the natural-reserved fund. There are 4 national wide sites: the Carpathian Biosphere Nature Reserve, Uzhansky National Nature Park (NNP), the NNP “Synevyr” and the NNP “Zacharovanyi Krai” (6.101 hectares). The NNP “Uzhansky” is a part of the international biosphere reserve “Eastern Carpathians” (213 thousand hectares), which was included by the UNESCO Commission in the World Network of Biosphere Reserves, as well as the Carpathian Biosphere Reserve. The Regional Landscape Park also has two regional landscape parks, i.e. the Prytysianskyi Regional Landscape Park and Syniak Regional Landscape Park, 19 national significance landscape preserves, 47 landscape preserves of the local importance, 9 nature reserves, 9 national

natural monuments and 329 natural monuments of the local importance. There are 8 Ramsar sites (wetlands of international importance): Lake Synevyr (NNP Synevyr), Lake Brebeneskul (Carpathian Biosphere Nature Reserve), Lake Fornosh, the Narcissus Valley (Carpathian Biosphere Nature Reserve), "Druzhba" Cave (Carpathian Biosphere Nature Reserve), "Chorne Bagno" Bog (NNP "Zacharovanyi krai"), the Atak Borzhavske (the Prytysianskyi Regional Landscape Park), the Verkhivia Uzha (the NNP Uzhansky). The identification of the natural biotopes in the Natura 2000 database has begun as defined by the Habitats Directive and the Birds Directive.

Cultural heritage

In **Ukraine** there are 1637 cultural heritage objects in the TRB, including: 494 of archaeology, 523 of history, 93 of monumental art, 302 of architecture and 19 of urban development, 341 of garden art, 175 of landscape, 9 of science and technology. 177 sites among them are of national significance, they include medieval castles and unique objects of sacral wooden architecture. There are 28 public museums with the title "national".

Chapter 4 Flood risk at Tisza River Basin level

Flood protection infrastructure

In **Ukraine**, flood protection infrastructure includes: dams 770.1 km, bank enforcement facilities 318.8 km, canalized water ways, channels 1339 km, hydraulic engineering units 1108, drainage on-site pump stations 30, multi-purpose reservoirs 8, with the total volume capacity 25.3 MCM, water level and discharge measuring stations 69, automatic hydrometeorological stations (AIMS "TISZA") 50, drainage system 318.8 km.

Eight water reservoirs are multi-purpose: for seasonal flow regulation and fish breeding. Four of them belonging to the drainage system of Chornyi Mochar are intended for accumulation of flood flows (9.5 million m^3) and spring runoff (18.6 million m^3) and fish breeding. The largest water reservoir is the Tereble-Ritske. It is used for hydropower, so the Tereble-Ritske HPP does not make any significant influence on the flood transformation. The melioration systems Slavinska, Verkhniolatorytska and Khustska make less significant influence (about 1 million m^3) to the flood protection.

The Scheme of complex flood prevention was developed. It provides comprehensive approach to the flood control with the means of flood protection facilities and polders combined with enhancement and development of flood wall system, river regulation and construction of regulating hydraulic engineering structures (dams and dikes), implementation of forest-protection measures as a general direction to solve the issue of flood prevention.

The flood protection infrastructure at the Tisza River Basin with main elements are presented in Annex IV.1 to Annex IV.7, with some specifications:

- dikes related to the rivers with catchment over 1,000 km^2;
- the permanent reservoirs with the following criteria: height over 15 m and volume over 1 MCM or height between 10 and 15 m and volume over 3 mil.m^3;
- the diversion channels with a derived flow over 1 m^3/s;

- all hydraulic complex facilities in Tisza River Basin.

Drainage systems

There are five drainage systems in **Ukrainian** part of the Tisza basin:

- **Beregove drainage system** is located in Beregove, Uzhgorod and Mukacheve rayons of Zakarpattya Oblast and it is international polder system (Ukraine-Hungary). The advantages of the system is not only that the water from the area of 50.2 thousands ha is drained into Tisza and Latorica, but also because its channels can be filled out with water through the sluice-regulator in Verke channel from Borzhava river;
- **Latorica drainage system** is located in the right bank valley of Latorica within Uzhgorod and Mukachevo rayons. For effective use of meliorated lands, the system protects them from inundation by flood waters, as well as removes excess surface and groundwaters;
- **Salvinska drainage system** is located at right bank of floodplains of Tisza and Salva at the territory of Vynogradiv rayon of Zakarpattya Oblast. In order to protect floodplain lands from inundation by flood waters and establishment of needed conditions for their drainage in the period from 1965 to 2005, river Salva and their tributaries got regulated;
- **Batar drainage system** is located in left bank floodplain of Tisza, which act as water receiver and includes drained lands, located within 11 village councils of Vynogradiv rayon of Zakarpattya Oblast. This system depends on water levels in Tisza, during the floods, the agricultural fields got flooded;
- **Drainage system «Chorny Mochar»** is located in Mukacheve and Beregovo rayons. In old times, this land is mentioned as giant wetland. In the end of XIX – beginning XX century, there is a network of water discharge channels and magistral channel Vysokoberezhny (30 km) to redirect water into Latorica River.

The drainage systems in Tisza River basin are presented in Annex IV.7.

Significant historical floods and Areas with Potentially Significant Flood Risk

On the surface of the Tisza River Basin, floods were recorded in all seasons of the year and can be showery, snowy and snow-flurry by origin, but the most significant are formed in the winter, spring and summer season, the phenomenon being influenced by the moisture intake brought by the air masses.

The floods generated in Ukraine are mainly rapid floods and last from 2-20 days.

Regarding the implementation of the EU Floods Directive in the TRB, Ukraine is about to develop the products for the first cycle.

The schedule of the implementation of the EU Flood Risk Directive, stated in the EU-**Ukraine** Association agreement, is as follows:

- adoption of national legislation and designation of competent authorities (November 2016) - in progress;

- the law *"On Amendments to Some Legal Acts of Ukraine regarding the introduction of integrated approaches in water resources management following the river basin principle"* № 3603 was adopted in autumn 2016 and came in force from 2017. The document gives legal definitions to the number of terms used in Flood Risk Directive (2007/60/EC), namely "flood risk management plan".
- undertaking preliminary risk assessment (Nov 2018) – in progress Order *"On Approving the Methodology of the Preliminary Flood Risk Assessment"* is being drafted;
- preparation of flood risk and flood hazard maps (November 2020) – in progress Order *"On Approving the Methodology of the Flood Risk and Flood Hazard Maps Development"* is being drafted;
- establishment of flood risk management plans (November 2022) – in progress Resolution of Cabinet of Ministers *"On Approving the Procedure for the Development of Flood Risk Management Plans"* is being drafted.

Ukraine is at the stage of legal approximation to the EU Flood Risk Directive, whereas implementation (preparation of flood risk and flood hazard maps and development of the Flood Risk Management Plan) is planned for later.

The long-term observations suggests that significant and heavy flood flows have been observed in **Ukraine** in 1913, 1927, 1933, 1941, 1947, 1948, 1955, 1957, 1968, 1970, 1980, 1992, 1993, 1995, 1998, 2001, provided that the flood flows in 1947, 1957, 1968, 1970, 1992, 1998 and 2001 years had the most catastrophic consequences. The high floods usually are accompanied by negative devastating consequences for the local population and households of Zakarpattya.

For the last two decades (1990-2010), particularly substantial damages were caused by the catastrophic floods in 1998 and 2001 within the territory of the oblast. In the post-war years, the flood flows occurred in the catchment basin of the Tisza River almost every year and even several times per year. In total, more than 150 flood flows took place for the period from 1946 to 2001.

The most catastrophic floods (Annex III.8) during the analysed period (50 years) took place in May of 1970, in October of 1974, in July of 1980, in November of 1998 and in March of 2001 (Figure III.6), in June of 2008 (Figure III.7) and in December of 2010 (Figure III.8).

The March flood in 2001 is one of the most catastrophic for the last 200 years in Zakarpattya Oblast. The water level on the 3-5th of March, 2001 exceeded by 20-75 cm the floods in the Verkhnia Tisza, Teresva and Tereblia in 1998. In the Ukrainian and Hungarian parts of the Tisza River (Vylok-Tisabech-Tivadar), the water level exceeded by 30-40 cm the flood in November of 1998. This was also facilitated by the additional construction of water protection dams within Hungarian territory, and as well as the absence of a breakthrough of dams within Ukrainian territory (as it was in November of 1998 on the site of the Vynohradiv-Vylok). The way of flood flows in the Tisza River accompanied by the breakthrough of the right bank dam on the Tarp-Bodolov area has changed. As a result, the increase in water levels in the area of Vasharoshnamen has stopped. The water level stabilized at the maximum point in 1998. As a result of the breakthrough of the dam, the water outflow of the Tisza River has reached up to 80-90 m^3/s. And the total volume of water entering our territory (Berehove, Mukachevo, Uzhhorod rayons) is equal to 70-90 mln m^3.

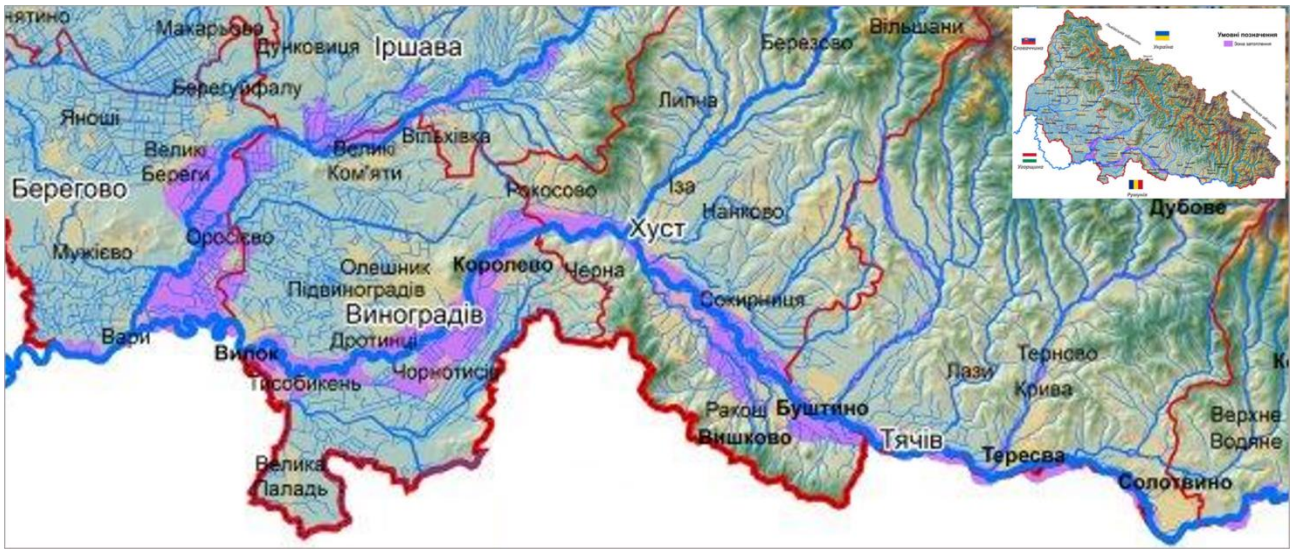

Figure IV.1 Map with significant historical floods in Tisza River Basin in Ukraine in 2001

Figure IV.2 Map with significant historical floods in Tisza River Basin in Ukraine in 2008

Figure IV.3 Map with significant historical floods in Tisza River Basin in Ukraine in 2010

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

According to EU-**Ukraine** Association Agreement, preparation of flood risk and flood hazard maps should be done by November 2020. At present, the Order *"On Approving the Methodology of the Flood Risk and Flood Hazard Maps Development"* is being drafted.
The project *„Identification of zones of possible inundation at rivers of Zakarpattya Oblast"*, was implemented by „Ukrwodproject" in 2009 in frame of implementation of state programme of integrated flood protection in Tisza basin. The project has identified maximum calculated water levels and possible inundation zones in times of floods with 1%, 5% and 10% probability in conditions of future infrastructure projects:

- Tisza from Rakhiv town to state border with Hungary;
- Kisva from Kosivska Polyana village to confluence with Tisza;
- Shopurka from Kobyletska Polyana village to confluence with Tisza;
- Teresva from Ust-Chorna village to confluence with Tisza;
- Teresva from Synervirska Polyana village to confluence with Tisza;
- Borzhava from Kushnyatsya village to confluence with Tisza;
- Irshava from Zagattya village to confluence with Borzhava;
- Uzh River from Kamyanystya village to state border.

Potential adverse consequences

In **Ukraine**, no consequences have been assessed yet, as it was mentioned before, the flood hazard and the flood risk maps will be done by November 2020 and the Flood Risk Management Plans by November 2022.

Ice issues

In 2018 the International Commission for the protection of the Danube River published a report regarding the ice event in 2017 in the Danube River Basin (Danube and its main tributaries).

In January-February 2017 many countries in the Danube Basin faced with the similar situation. On the Danube and some of the main tributaries ice drift appeared and aggregated into ice jams. This event highlighted the need for basin-wide development of technical and human resources for sustainable ice-management.

In 2017 an extremely cold, dry air mass of Siberian origin arrived in the Danube River Basin on the 6th of January 2017, bringing sunny weather and record breaking low temperatures. The cold weather was dominant until the 12th of January, when a cyclone brought warmer and wetter air to the region. From the 15th of January until the very end of the month an anticyclone determined the weather by blocking the cyclones from the west and the colder weather became dominant again.

The ice was reported on the Tisza River in Ukraine, Hungary and Serbia.

During January very cold weather was observed in the Tisza basin in Ukraine: from -200 to -270 C in mountains and from -130 to -180 C in lowlands. The thickness of ice on the rivers was up to 35-40 cm. As a result of a rapid temperature increase and heavy rainfall, snow melts occurred causing

strong ice-breaking and ice-drifting. On the Tisza section in Ukraine the ice drift started on 2-3 February, with water level increasing up to 4.7 m in lowlands. Ice jams formed at more than 50 locations. On 9th February the maximum ice flood level formed, reaching 10 m in Chop (only 30 cm below the water level of the 2001 catastrophic flood).

Ice monitoring and forecasting

The increased and continuous monitoring of the conditions is very important but difficult. Airborne survey or satellite images provide the best perspectives but they cannot replace the manmade visual observations. Moreover the icy conditions could hinder the water level remote sensing and that need to be provided as well.

Ice control measures in the Danube tributaries

In the **Upper-Tisza River** section in **Ukraine** the ice jams broke naturally or were removed by blasting. The pyrotechnical teams performed 58 explosions at 9 ice jams. 17 pumping stations have pumped 28,000 m3 of water during the flood period, draining it out of irrigation systems. The volume of water accumulated in reservoirs was 19.3 million m3. In total 770 persons and 151 machines participated in prevention of ice flood, steaming from the ice jamming. 3500 sandbags were used for flood prevention purposes.

Lessons learned

Ukraine would like to: Improve ice forecast and monitoring; Implement measures foreseen by Complex Plans of actions for safe floods and ice drift passing; Build the capacities on all levels of government to improve information dissemination, communication and notification before, during and after the emergency situations; Enhance the experience on the use of explosives in ice jams blasting.

Estimation of the impact of Climate Change on flood risk

In **Ukrainian** part of Tisza basin, as probably in the other parts of Tisza, for the last twenty years (1991-2010) one can observe the tendency increase of air temperature during the whole year. During this period, the annual average temperature of air increased by 0.7 – 0.8 ^{o}C comparing with the climatic norm of 1961-1990. It is especially seen in summer and winter – their average temperature has increased by 1.4 ^{0}C and 0.8 ^{0}C accordingly.

The change of temperature regime goes hand in hand with change of regime of precipitation. The annual sum of precipitation has changed insignificantly, but it got redistributed differently between seasons: in summer – by 10% less, in autumn – by 20% more. There is also a shift of maximum number of precipitation from June to July.

The number of cases of heavy and very heavy rains got increased as well as the period, during which they reach their maximum. The significant amount of heavy and very heavy rains is observed not only in July, but also in August, during some years in September as well. The number of dangerous rains in cold period increase, especially during the autumn.

The climate affects the hydrological regime of rivers. Reduction of the number of precipitation in summer and significant increase of the air temperature, which lead to increased evaporation, led to the reduction of river flow discharge by 18%. Increase of the river discharge in autumn by 13-24% corresponds to increase of precipitation during this season by 20%. Insignificant (by 5-6% in average in Tisza basin) increase of the average water flow are seen in winter and in spring.

Among months, the most rich for water at present period comparing with 1961-1990 are January, March and November. During these months, river water discharge in different parts of Tisza increased by 5-19%, 15-25% and 36-39%.

Having analysed the number of floods during year for the periods 1961-1990 and 1991-2011, it was found out that there are no significant deviations regarding increase or reduction of their frequency. In modern periods, high maximums are more frequently observed in cold period of the years – in average for 4-5% more, than during warm periods. In winter and spring, the number of floods get almost unchanged, in summer they got reduced by 4-5%, in autumn – increase for the same percentage.

International Cooperation in the Tisza River Basin

Bilateral agreements

Ukraine has acting bilateral agreements with neighbouring countries:

- Agreement between government of Ukraine and government of Slovak Republic on issues of water management in boundary waters – June 15, 1994;
- Agreement between the Government of the Republic of Hungary and the Government of Ukraine on water management issues related to frontier waters – November 11, 1997;
- Agreement between the Government of Ukraine and the Government of Romania on co-operation in the field of water management on transboundary waters – September 30, 1997.

On the occasion of the ministerial meeting of the ICPDR 2004 in Vienna, the Tisza countries signed a Memorandum of Understanding: *"Towards a River basin. Management Plan for the Tisza river supporting sustainable development of the region"*.

On 11 April 2011, the five Tisza River Basin countries Hungary, Romania, Serbia, Slovakia and Ukraine entered a new stage in joint water management to ensure good water quality. The ministers and high-level representatives signed a *Memorandum of Understanding* and endorsed the implementation of the Integrated Tisza River Basin Management Plan (ITRBM Plan), which has been proposed in full compliance with the EU Water Framework Directive.

Transboundary projects on flood risk management for 2014-2020

REVITAL I

The project on 'Environmental Assessment for Natural Resources Revitalization in Solotvyno to prevent the further pollution of the Upper-Tisza Basin through the preparation of a complex monitoring system' is the first activity that aims gradually bringing the environmental proposals for this target into practice.

The main goal of the REVITAL I. is to set the foundation for the establishment of the revitalization process of the Solotvyno mine and surrounding area through deepened cross-border cooperation.

Three specific objectives have been identified:

- to examine and evaluate the current environmental state
- to set up an investigative monitoring and to prepare a future complex monitoring system
- to raise awareness and promote the results of the project on different levels.

Chapter 6 Conclusions

In Ukraine there are two main organizations at national level involved in the flood risk management: State Agency of Water Resources of Ukraine (SAWR) and State Service of Emergency Situations (SSES).

Tisza basin within Ukraine fits to administrative borders of Zakarpattya oblast and is located within two orographic rayons (Carpathian Mountains and Hungarian lowland – about 35% of the basin). There are two structural level that take part in formation of geological structure of the territory (the lower structural level and the Folded Carpathians). The climate is a moderate continental with preponderant influence of the Atlantic. The main tributaries of Tisza with river basin surfaces more than 1000 km^2 are Bodrog, Latorica, Uzh, Tur, Borzhava, Rika, Teresva, Bila Tisza, Chorna Tisza. In the basin within the low-land area, the variety of sod-podzolic soils prevail, mountain-forest and meadow-forest soils prevail in the mountainous area, meadow and meadow gley soils prevail in the flood-plain bench of the rivers.

Zakarpattya Oblast includes 13 rayons and 11 cities, 5 of them are the cities of oblast sub-ordinance, i.e. Uzhhorod, Mukachevo, Khust, Beregovo and Chop and 6 of them are the cities of rayon sub-ordinance, and a total number of 579 rural settlements.

The population from Tisza River sub-basin is about 1.257 million inhabitants. Economic activities comprise branches of industry and agriculture.

Regarding the protected areas, there are 456 sites of the natural-reserved fund, 4 national wide sites, 19 national significance landscape preserves, 47 landscape preserves of the local importance, 9 nature reserves, 9 national natural monuments, 329 natural monuments of the local importance, 8 Ramsar sites.

The cultural heritage is represented by churches, monasteries, museums, cultural monuments etc.

Flood protection infrastructure is constituted from dams of about 770.1 km, bank enforcement facilities - 318.8 km, canalized water ways, channels - 1339 km, 1108 hydraulic engineering units, 30 drainage on-site pump stations, 8 multi-purpose reservoirs with the total volume capacity 25.3 MCM, 69 water level and discharge measuring stations, 50 automatic hydrometeorological stations (AIMS “TISZA”), drainage system - 318.8 km.

The most important floods that occurred in Tisza River sub-basin during the analysed period (50 years) were the ones from May 1970, October 1974, July 1980, November 1998, March 2001, June 2008 and December 2010.

Ukraine is at the stage of legal approximation to the EU Flood Risk Directive, whereas implementation is planned for later (preliminary flood risk assessment – November 2018, preparation of flood risk and flood hazard maps – November 2020 and development of the Flood Risk Management Plan – November 2022).

The conclusions after studying the data from 1961 till now is that the climate affects the hydrological regime of rivers.

Bilateral agreements regarding the water resources management have been signed with Romania, Slovakia and Hungary.

References

- Ukraine

Materials of the Tisza River basin authority
Tisza River Basin Management Plan – national part (2012)

Annex IV.1

Dikes in Ukraine

No.	Dike name	Water course	Dike position[1]	Locality name	Length (m)	Medium height (m)	YFO[2]	Normal operating conditions		Status[3]
								Probability of exceeding (p%)	Q (m^3/s)	
1.	Right bank dike St.Batar	Batar	RB	Korolevo	35200		1970	1%		moderate
2.	Left bank dike Tisza river	Tisza	LB	Korolevo	31900		1954	1%		very good
3.	Right bank dike Latorica river	Latorica	RB	Vinkovo	27840		1939	5%		moderate
4.	Left bank dike St.Batar	Batar	LB	Korolevo	24800		1970	1%		moderate
5.	Right bank dike Tisza river	Tisza	RB	Vylok	23000		1977	1%		moderate
6.	Left bank dike Latorica river	Latorica	LB	Solomonovo	21900		1967	1%		bad
7.	Left bank dike Latorica river	Latorica	LB	Chomonyn	20900		1939	5%		moderate
8.	Right bank dike Tisza river	Tisza	RB	Solomonovo	18400		1893	1%		moderate
9.	Right bank dike Latorica river	Latorica	RB	Palad Komarivtsi	17600		1967	1%		bad
10.	Right bank dike Sernianskyi channel	V. Sernianskyi	RB	Bakosh	13500		1899	5%		moderate
11.	Left bank dike Sernianskyi channel	V. Sernianskyi	LB	Bakosh	13500		1899	5%		moderate
12.	Right bank dike Sypa-Charonda channel	Sypa-Charonda	RB	Geten	13200		1899	5%		moderate
13.	Right bank dike Vysokoberezhyi channel Zhniatyno_1	Vysokoberezhyi	RB	Chomonyn	12930					moderate
14.	Left Bank Cavalier Channel Kidiosh	Kidiosh	LB		11700					
15.	Left bank dike Vysokoberezhyi channel 1 (from Chomonyn to railway bridge)	Vysokoberezhyi	LB	Chomonyn	11330					moderate
16.	Left bank dike Borzhava river Part 2	Borzhava	LB	Bene	11000		1954	1%		moderate
17.	Left bank dike Borzhava river (polder)	Borzhava	LB	Kvasovo	10200		1984	1%		moderate
18.	Right Bank Cavalier Channel Mertse (Mukachevo Rayon)	Mertse	RB		10000					
19.	Left bank dike N.Batar	N.Batar	LB	Pyiterfolvo	9100		1954	1%		moderate
20.	Right bank dike N. Batar	N.Batar	RB	Pyiterfolvo	9100		1954	1%		moderate
21.	Left bank Sypa-Charonda channel	Sypa-Charonda	LB	Petrivka	9000		1967	1%		bad

No.	Dike name	Water course	Dike position[1]	Locality name	Length (m)	Medium height (m)	YFO[2]	Normal operating conditions		Status[3]
								Probability of exceeding (p_c%)	Q (m^3/s)	
22.	Right bank dike Sypa-Charonda channel	Sypa-Charonda	RB	Petrivka	9000		1967	1%		bad
23.	Left bank dike Stara river	Stara	LB	Drahynia	8700		1981	5%		moderate
24.	Right bank dike Tisza river	Tisza	RB	Vary	8600		1954	1%		moderate
25.	Right bank dike Tisza river	Tisza	RB	Vary	8200		1954	1%		moderate
26.	Left bank dike Borzhava river Shalanky	Borzhava	LB	Shalanky	8120		1990	1%		moderate
27.	Left bank dike Teresva river	Teresva	LB	Ternovo	8100		1987	1%		very good
28.	Left bank dike Borzhava river (polder)	Borzhava	LB	Nyzhni Remety	8100		1987	5%		moderate
29.	Right bank dike Borzhava river	Borzhava	RB	Beregy	8000		1968	5%		moderate
30.	Right bank dike Borzhava river Part 2	Borzhava	RB	Bene	7900		1954	1%		moderate
31.	Left bank dike Slatina channel	Slatina	LB	Velyki Geivtsi	7900		1967	1%		moderate
32.	Right Bank Cavalier Channel Kidiosh	Kidiosh	RB		7670					
33.	Right bank dike Slatina channel	Slatina	RB	Velyki Geivtsi	7500		1967	1%		moderate
34.	Right bank dike Iaruga channel	Iaruga	RB	Cherveniovo	7400		1939	5%		moderate
35.	Left bank dike Palad	Palad	LB	Palad	7200		1969	1%		bad
36.	Right bank dike Kamarochi channel	Kamarochi	RB	Palad Komarivtsi	7100		1967	1%		moderate
37.	Left bank dike Kamarochi channel	Kamarochi	LB	Siurte	7100		1967	1%		moderate
38.	Right bank dike Stara river	Stara	RB	Drahynia	7000		1982	5%		moderate
39.	Left bank dike Vysokoberezhnyi channel	Vysokoberezhnyi	LB	V. Dobron	7000		1976	1%		bad
40.	Left bank dike Latorica river Mukachevo (from the Sadova-Monastery Bridge to railway bridge)	Latorica	LB	Mukachevo	6855					moderate
41.	Left bank dike Latorica river Mukachevo (from the railway bridge to the road bridge)	Latorica	LB	Mukachevo	6855					moderate
42.	Left Bank Cavalier Channel Mertse	Mertse	LB		6700					
43.	Right bank dike Irshavka river	Irshavka	RB	Kamianske	6270		1994	5%		moderate
44.	Left bank dike Iaruga channel	Iaruga	LB	Cherveniovo	5900		1966	5%		moderate
45.	Left bank dike Solotvynskyi channel	Solotvynskyi	LB	Dovhe Pole	5900		1967	10%		moderate

No.	Dike name	Water course	Dike position[1]	Locality name	Length (m)	Medium height (m)	YFO[2]	Normal operating conditions		Status[3]
								Probability of exceeding (p_c%)	Q (m^3/s)	
46.	Right bank dike Solotvynskyi channel	Solotvynskyi	RB	Dovhe Pole	5800		1967	10%		moderate
47.	Right bank dike Koropetskyi channel Mukachevo (from the road bridge to Franko Str.)	Koropetskyi	RB	Mukachevo	5580					moderate
48.	Left bank dike Salva river	Salva	LB	Vynogradiv	5500		1954	1%		moderate
49.	Right bank dike Salva river	Salva	RB	Vynogradiv	5500		1934	1%		moderate
50.	Right bank dike Charonda-Latorytsa channel	Charonda-Latorytsa	RB	Chervone	5500		1976	1%		moderate
51.	Left bank dike Charonda – Latorica channel	Charonda-Latorytsa	LB	Chervone	5500		1976	1%		moderate
52.	Left bank dike Turia river	Turia	LB	Rakovo	5300		1986	1%		moderate
53.	Right bank dike Tisza river	Tisza	RB	Tiachiv	5280		2008	1%		very good
54.	Right bank dike N. Sernianskyi channel	N. Sernianskyi	RB	Dobron	5100		1976	1%		moderate
55.	Left bank dike N. Sernianskyi channel	N. Sernianskyi	LB	Demechi	5100		1976	1%		moderate
56.	Right bank dike Latorica river Mukachevo (from the Sadova-Monastery Bridge)	Latorica	RB	Mukachevo	5013					moderate
57.	Left bank dike Polui river	Polui	LB	Chopivtsi	4750		1967	5%		moderate
58.	Left bank dike K-3 channel	K-3	LB	Kamianske	4600		1994	1%		moderate
59.	Right bank dike Stara river	Stara	RB	Zniatsevo	4600		1967	1%		moderate
60.	Right bank dike Vella river	Vella	RB	Serednie	4600		1967	10%		moderate
61.	Left bank dike N. Sernianskyi channel	N. Sernianskyi	LB	Batiovo	4500		1901	5%		moderate
62.	Right bank dike Polui river	Polui	RB	Chopivtsi	4350		1968	5%		moderate
63.	Right bank dike Turia river	Turia	RB	T.Pasika	4220		1987	1%		moderate
64.	Left bank dike Uzh river	Uzh	LB	Storozhnytsa	4200		1967	1%		moderate
65.	Right bank dike Uzh river	Uzh	RB	Nevytske	4180		1967	1%		moderate
66.	Right bank dike Uzh river №2	Uzh	RB	Uzhgorod	4130			5%		moderate

No.	Dike name	Water course	Dike position[1]	Locality name	Length (m)	Medium height (m)	YFO[2]	Normal operating conditions		Status[3]
								Probability of exceeding (p_c%)	Q (m^3/s)	
67.	Left bank dike Koropetskyi channel Mukachevo (from the Palanok road bridge to Franko Str.)	Koropetskyi	LB	Mukachevo	4010					moderate
68.	Right bank dike Vysokoberezhnyi channel	Vysokoberezhnyi	RB	V. Dobron	4000		1976	1%		bad
69.	Right bank dike Borzhava river	Borzhava	RB	Hreblia	3800		1973	1%		moderate
70.	Right bank dike Borzhava river	Borzhava	RB	Verkhni Remety	3750		1983	5%		moderate
71.	Left bank dike Tisza river (upstream the bridge)	Tisza	LB	Vyshkovo	3610		2001	1%		moderate
72.	Right bank dike Tereblia river	Tereblia	RB	Dragovo	3560		2004	1%		very good
73.	Right bank dike Hashparka river	Hashparka	RB	V.Kopania	3500		1987	1%		moderate
74.	Left bank dike Borzhava river V.Komiaty	Borzhava	LB	V.Komiaty	3400		1971	1%		moderate
75.	Left bank dike Charonda-Tisza channel	Charonda-Tisza	LB	Esen	3400		1976	1%		bad
76.	Left bank dike Rika river	Rika	LB	Iza	3390		1995	3%		moderate
77.	Left bank dike Tisza river (downstream the bridge)	Tisza	LB	Vyshkovo	3300		2002	1%		very good
78.	Right bank dike Rika river	Rika	RB	Koshelevo	3300		1985	1%		moderate
79.	Left bank dike Salva river	Salva	LB	Kvasovo	3300		1968	5%		moderate
80.	Right bank dike Charonda -Tisza channel	Charonda -Tisza	RB	Esen	3300		1976	1%		bad
81.	Left bank dike Luzhanka river	Luzhanka	LB	Shyrokyi Lug	3200		1983	1%		very good
82.	Left bank dike Irshavka river	Irshavka	LB	Kamianske	3200		1983	5%		moderate
83.	Right bank dike Turia river	Turia	RB	Simer	3200		2008	1%		very good
84.	Left bank dike Turia river	Turia	LB	Simer	3200		2008	1%		very good
85.	Left bank dike Tisza river	Tisza	LB	Kryva	3152		2010	1%		very good
86.	Right bank dike Tisza river V.Kopania	Tisza	RB	V.Kopania	3000		1986	1%		moderate
87.	Right bank dike №2 Tisza river	Tisza	RB	Velykyi Bychkiv	2930		1963	1%		moderate
88.	Right bank dike Tur river	Tur	RB	Fertesholmash (Zabolottia)	2900		1963	1%		bad
89.	Water reservoir dike “Boroniava”	Boroniava		Boroniava	2900		1970	1%		moderate

No.	Dike name	Water course	Dike position[1]	Locality name	Length (m)	Medium height (m)	YFO[2]	Normal operating conditions		Status[3]
								Probability of exceeding (p_c%)	Q (m^3/s)	
90.	Left bank dike Teresva river	Teresva	LB	Kalyny	2900		2008	1%		very good
91.	Left bank dike Tisza river	Tisza	LB	Iablunivka	2840		2007	1%		very good
92.	Left bank dike Hashparka river	Hashparka	LB	V.Kopania	2800		1987	1%		moderate
93.	Left bank dike Uzh river	Uzh	LB	Zarichevo	2800		2012	1%		very good
94.	Right bank dike Uzh river (state border)	Uzh	RB	Uzhgorod	2770		1967	1%		moderate
95.	Right bank dike Tereblia river	Tereblia	RB	Dylovo	2760		2010	1%		very good
96.	Right bank dike Tisza river	Tisza	RB	Bedevlia	2760		2008	1%		very good
97.	Right bank dike Bezimianka river V.Kopania	Bezimianka	RB	V.Kopania	2750		1989	1%		moderate
98.	Right bank dike Tisza river (Kozari)	Tisza	RB	Khust	2730		2002	1%		very good
99.	Right bank dike №2 Teresva river	Teresva	RB	Vilkhivtsi	2700		1987	1%		moderate
100.	Left bank dike Turia river	Turia	LB	Mokra	2700		1978	1%		moderate
101.	Right bank dike Khustets river	Khustets	RB	Khust	2692		2010	1%		very good
102.	Right bank dike №2 Tereblia river	Tereblia	RB	Tereblia	2645		1993	1%		moderate
103.	Left bank dike Tisza river	Tisza	LB	Veliatyn	2600		1972	1%		moderate
104.	Left bank dike Teresva river	Teresva	LB	Teresva	2600		2008	1%		very good
105.	Right bank dike Shopurka river	Shopurka	RB	Velykyi Bychkiv	2600		1966	1%		bad
106.	Left bank dike Latorica river	Latorica	LB	Bystrytsa	2450		1948	5%		moderate
107.	Right bank dike Tereblia river	Tereblia	RB	Bushtyno	2400		1987	5%		moderate
108.	Right bank dike Teresva river	Teresva	RB	Neresnytsa	2400		2009	1%		very good
109.	Right bank dike Luzhanka river	Luzhanka	RB	Neresnytsa	2400		1987	1%		very good
110.	Left bank dike reclamation channel Vilkhivka	reclamation channel	LB	Vilkhivka	2380		1995	10%		moderate
111.	Left bank dike Tereblia river	Tereblia	LB	Krychevo	2350		2008	1%		very good
112.	Left bank dike Teresva river	Teresva	LB	Hanychi	2300		2008	1%		very good
113.	Right bank dike Rika river (upstream the bridge)	Rika	RB	Lypcha	2200		1970	1%		very good
114.	Right bank dike №1 Tereblia river	Tereblia	RB	Chumalevo	2200		2010	1%		very good
115.	Right bank dike №2 Teresva river	Teresva	RB	Dobrianske	2200		2009	1%		very good
116.	Left bank dike Tereblia river	Tereblia	LB	Bushtyno	2150		1983	5%		moderate

No.	Dike name	Water course	Dike position[1]	Locality name	Length (m)	Medium height (m)	YFO[2]	Normal operating conditions		Status[3]
								Probability of exceeding (p_c%)	Q (m^3/s)	
117.	Right bank dike Tisza river	Tisza	RB	Khust	2140		2003	1%		moderate
118.	Right bank dike Palad	Palad	RB	V.Palad	2100		1969	1%		moderate
119.	Left bank dike Borzhava river Borzhavske	Borzhava	LB	Borzhavske	2000		1986	1%		moderate
120.	Right bank dike Tisza river	Tisza	RB	Teresva	2000		2009	1%		very good
121.	Left bank dike Shopurka river	Shopurka	LB	Velykyi Bychkiv	2000		1966	1%		moderate
122.	Left bank dike Tsyganivka channel	Tsyganivka	LB	Kholmtsi	2000		1967	10%		moderate
123.	Right bank dike Tsyganivka channel	Tsyganivka	RB	Kholmtsi	1900		1967	10%		moderate
124.	Left bank dike Tereblia river	Tereblia	LB	Kolochava	1850		2010	1%		very good
125.	Left bank dike Bezimianka river V.Kopania	Bezimianka	LB	V.Kopania	1820		1989	1%		moderate
126.	Left bank dike Teresva river	Teresva	LB	Kryve	1800		2002	1%		very good
127.	Left bank dike Tereblia river	Tereblia	LB	Ruske Pole	1800		2009	1%		very good
128.	Right bank dike №1 Teresva river	Teresva	RB	Vilkhivtsi	1800		1987	1%		moderate
129.	Right bank dike Uzh river	Uzh	RB	Dubrynychi	1780		1933	5%		bad
130.	Right Bank Cavalier Channel Kvasovo, part 2	reclamation channel	RB		1700					
131.	Left Bank Cavalier Channel Kvasovo, part 1	reclamation channel	LB		1670					
132.	Right bank dike Tisza river (downstream Veliatynskyi bridge)	Tisza	RB	Khust	1640		2003	1%		very good
133.	Right bank dike Teresva river	Teresva	RB	Bilovartsi	1600		1987	5%		very good
134.	Right bank dike Latorica river	Latorica	RB	Kolchyno	1600		1936	5%		moderate
135.	Left bank dike Tereblia river	Tereblia	LB	Dragovo	1440		2004	1%		very good
136.	Right bank dike Rika river (downstream the bridge)	Rika	RB	Lypcha	1320		1985	1%		very good
137.	Right bank dike Borzhava river	Borzhava	RB	V.Komiaty	1300		2001	1%		moderate
138.	Right bank dike Borzhava river	Borzhava	RB	Zarichia	1300		2003	1%		moderate
139.	Right bank dike Osava river	Osava	RB	Koshelevo	1300		1971	1%		moderate
140.	Right bank dike Tereblia river	Tereblia	RB	Vonigovo	1300		1991	5%		moderate
141.	Right bank dike Borzhava river Kvasovo	Borzhava	RB	Kvasovo	1300		1983	5%		moderate
142.	Right bank dike Rika river (Ekoz)	Rika	RB	Khust	1290		1984	1%		moderate
143.	Right bank dike №1		RB	Orikhovytsa	1260		1967	1%		moderate
144.	Left bank dike Borzhava river V.Komiaty №2	Borzhava	LB	V.Komiaty	1254		2009	1%		very good

No.	Dike name	Water course	Dike position[1]	Locality name	Length (m)	Medium height (m)	YFO[2]	Normal operating conditions		Status[3]
								Probability of exceeding (p%)	Q (m^3/s)	
145.	Right bank dike №3 Tiachivets river	Tiachivets	RB	Tiachiv	1200		1986	5%		moderate
146.	Right bank dike Teresva river	Teresva	RB	Kobyletska Poliana	1200		2010	1%		very good
147.	Right bank dike Hlybokyi channel	Hlybokyi	RB	Kholmtsi	1180		1967	10%		moderate
148.	Left bank dike № 1 Tisza river	Tisza	LB	Tiszobyken (Bobove)	1173		2009	1%		very good
149.	Right bank dike №1 Tiachivets river	Tiachivets	RB	Tiachiv	1150		1990	1%		moderate
150.	Left bank dike Boroniavka river	Boroniavka	LB	Khust	1100		1967	1%		moderate
151.	Right bank dike Borzhava river	Borzhava	RB	Zarichia	1100		2003			very good
152.	Right bank dike Teresva river	Teresva	RB	Pidplesha	1100		2008	1%		very good
153.	Right bank dike Teresva river	Teresva	RB	Bedevlia	1100		1993	5%		moderate
154.	Right bank dike №1 Teresva river	Teresva	RB	Dobrianske	1100		2008	1%		very good
155.	Right bank dike №2 Tereblia river	Tereblia	RB	Chumalevo	1080		2010	1%		very good
156.	Left bank dike №3 Tisza river	Tisza	LB	Rakhiv	1050		2000	1%		very good
157.	Right bank dike Tisza river (Khmeliv)	Tisza	RB	Dilove	1022		2010	1%		very good
158.	Left bank dike Tiachivets river	Tiachivets	LB	Tiachiv	1020		1986	5%		moderate
159.	Right bank dike Teresva river	Teresva	RB	Hanychi	1000		2009	1%		very good
160.	Right bank dike №2 Tisza river	Tisza	RB	Rakhiv	1000		1988	1%		moderate
161.	Right bank dike Vela river	Vela	RB	Zniatsevo	1000		1940	5%		moderate
162.	Left bank dike Hlybokyi channel	Hlybokyi	LB	Kholmtsi	1000		1967	10%		moderate

[1]- left bank (LB) or right bank (RB)
[2] – YFO year of function operation
[3] – technical status: very good, moderate, bad /bad.

Annex IV.2

Permanent reservoirs in Ukraine

No.	Reservoir name	Water course	Nearest locality name	Height dam (m)	Type of dam[1]	Volume at NRL (MCM)	Volume at MEL (MCM)	Attenuation volume (MCM)	Use[2]
1	"Gorbok" , Farm «Mochar»	Roman-Potik. Reclamation system "Chornyi Mochar"	village Gorbok, Irshava rayon			3,69		3,69	Short-term regulation during floods, seasonal for horizon

2	"Babichka"	Babichka river. Reclamation system "Chornyi Mochar"	village Zaluzh, Mukachevo rayon			2,9		2,9	
3	Fornosh"	"Fornosh" channel. Reclamation system "Chornyi Mochar	village Liskove, Mukachevo rayon			2,5		2,5	
4	"Mochyla"	Mochyla river	village Pistrialovo, Mukachevo rayon			1,5		1,5	
5	NN	Stara river	village Andriivtsi, Uzhgorod rayon			1,35		1,35	Seasonal regulation
6	"Bobovyschanske	Salva river	Vynogradiv			2,113		2,113	
7	NN	Polui river	village Bobovysche, Mukachevo rayon			1,0		1,0	
8	NN	Boroniava river	village Boroniavo, Khust rayon			1,5		1,5	
9	Water-energy reservoir Tereble-Ritska hydroelectric power station	Tereblia river				24		24	Hydropower

[1] -arch/gravity from concrete/earth/embankment, etc.
[2] – flood protection, water supply, industry, irrigation etc.
NRL normal retention level
MEL – maximum exploitation level

Annex IV.3

Diversion Channels in Ukraine

No.	Name	Locality name	Derived stream	Receiver water course	Length (km)	Derived discharges (m^3/s)
1	Mertse	Hat	Roman Potok	Vysokoberezhnyi	17.0	
2	Babichka	Zaluzhia	Water reservoir "Babichka"	Mochylo	8,6	
3	Mochylo	Pistrialovo	Water reservoir "Mochylo"	Fornosh	6,9	
4	Fornosh	Fornosh	Mochylo	Mertse	6,9	
5	Lypnytsa	Fornosh	Water reservoir "Fornosh"	Fornosh	2,8	
6	Polui	Rakoshyno	Water reservoir "Bobovyschanske"	Stara	13,3	
7	M-3	Makariovo		M-2	6,32	
8	K-II	Makariovo		Fornosh	5,5	
9	GD-1	Chomonyn		150	1,04	
10	GD-1 Vyznytsia	Verkhnia Vyznytsia		Vyznytsa	2,64	
11	K-4	Vinkove		Latorica	8,0	
12	k-4 Serne	Barkasovo – Rafailovo - Chomonyn	MK-1Serne	Nyzhe-Sernianskyi M-1	5,9	
13	Vysokoberezhnyi	Gat-Velyka Dobron	Mertse	Latorica	26.0	

No.	Name	Locality name	Derived stream	Receiver water course	Length (km)	Derived discharges (m^3/s)
14	K-300	Horonda	K-550	Vysokoberezhnyi	7,5	
15	K-500	Shenborn-Nyzhniy Koropets		Mertse	15,4	
16	K-100	Pavshyno-V.Luchky-Chomonyn		Vysokoberezhnyi	20,1	
17	K-150	Kliucharky- V.Luchky-Chomonyn		K-100	12,6	
18	MK-6	Chomonyn	Dobronskyi	Nyzhe-Sernianskyi M-1	3,8	
19	K-1 Drysyno	Nyzhniy Koropets		K-500	4,4	
20	K-4 Drysyno	Dertsen		Fornosh	3,8	
21	Iaruga	Cherveniovo	Iaruga	Stara	3,5	
22	Stara	Zniatsevo	Stara	Latorica	8,8	
23	Dobronskyi	Serne	Vysokoberezhnyi	Nyzhe-Sernianskyi	3,8	
24	Staryi Batar	Vynogradiv rayon, Tisza left bank		Tisza	43	
25	Novyi Batar	Diula-Chepa-Pyiterfolvo	Staryi Batar	Staryi Batar	9,3	
26	Palad	Velyka Palad	Valia-Fekete	Tur	7,2	
27	M.Eger	Diakovo		Fekete-Viz	4,4	
28	Klynovskyi	Diakovo		Staryi Batar	10,0	
29	MK-1 Feketeviz	Diakovo - Pyiterfolvo		Staryi Batar	10,7	
30	MK-1	Tekovo-Sasovo-Chornotiszovo	Village Tekovo	N. Batar	12.5	
31	MK-2	Tekovo-Sasovo-Chornotiszovo	Village Tekovo	N. Batar	11.1	
32	MK-2	Zabolottia – Velyka Palad	Village Zabolottia	MK - 1(river Fok)	6.1	
33	K-8	Gudia- Sasovo-Chornotiszovo	Village Gudia	N. Batar	8	
34	K-3	Sasovo-Chornotiszovo	Village Sasovo	N. Batar	5.5	
35	UK-1	Pyiterfolvo -Zatyszivka - Diakovo	N. Petrovo (river Tisza)	Staryi Batar	7.3	
36	MK-II-0	Tekovo-Sasovo-Chornotiszovo-Chepa	Village Tekovo	N. Batar	9.5	
37	MK-II-2	Sasovo-Chornotiszovo	Village Sasovo	N. Batar	5.1	
38	MK-1	Tekovo-Sasovo-Chornotiszovo	Village Tekovo	N. Batar	12.5	
39	Velia-Fekete	Velyka Palad		Palad	4,7	
40	Boroniava	Boroniava - Khust		Tisza	8,3	
41	MK Semerdek	Pidvynogradiv		Verbovets	8,9	
42	MK Onok	Onok		Salva	5,3	
43	Mk Salva	Vynogradiv		Borzhava	16,5	
44	MK Belva	Vynogradiv		Salva	6,6	
45	K-9	Chornyi Potok		Salva	3,4	
46	Karachynskyi	Matievo, Nove Selo, Perekhestia		Kodach	10,0	
47	K-14	Velyki Komiaty		Borzhava	7,5	
48	Mk-1	Perekhestia		Karachynskyi	4,5	
49	Sypa-Charonda	Horonglab		Charonda - Latorica	11,0	
50	N.Sernizнskyi	Velyka Dobron-Batrad	Vysokoberezhnyi	Charonda - Latorica	16,5	
51	V. Sernizнskyi	Batrad	Mertse	Sypa-Charonda	28,0	
52	Sypa	Borzhava		Charonda (Hungary)	12	
53	Verke	Borzhava	Borzhava	Verkhne-Sernianskyi	36,6	

No.	Name	Locality name	Derived stream	Receiver water course	Length (km)	Derived discharges (m^3/s)
54	Gat-Potok	Horonglab	MK-2	Verkhne-Sernianskyi	8,5	
55	Didivskyi Myts	Dyida		Charonda (Hungary)	7,56	
56	Kosyno-Bovtratskyi	Zapson		Verkhne-Sernianskyi	10,4	
57	Kovach-Potok	Vary		Sypa	7,74	
58	Kodach	Orosievo		Borzhava	11,1	
59	Raffaailivskyi	Rafainovo	HD-1	Verkhne-Sernianskyi	7,5	
60	Barabash-Myts	Koson	Kosyno	Sypa-Charonda	17,65	
61	MK-1	Mala Byigan		Verke	6,67	
62	MK-II "Ukraine"	Bakosh	Hat-Potok	Verkhne-Sernianskyi	7,22	
63	Kidiosh	Kidiosh		Mertse	10,4	
64	K-2	Dyida	Didivskyi Myts	Kosyno-Bovtratskyi	5,14	
65	K-7 "Chornyi Mochar"	Bereguifalu		Kidiosh	7,4	
66	Solotvynskyi	Kholmtsi		Slatyna	5,2	
67	Vella	Serednie		Stara	6,8	
68	K-4	Kholmtsi		Slatyna	7,7	
69	MK-1 Horkogo	Kontsovo	KD-1	Uzh	4,64	
70	Kd-1	Palad-Komarivtsi		Komarochi	4,4	
71	Sypa-Charonda	Petrivka		Charonda -Latorica	5,0	
72	MK-1	Chervone		Charonda -Latorica	9,6	
73	MK "Dobronskyi"	Velyka Dobron		Nyzhe-Sernianskyi	5,4	
74	Charonda-Tisza	Esen	Sypa-Charonda	Tisza	3,34	
75	MK-1	Salovka		Sypa-Charonda	5,89	
76	Charonda -Latorica	Chervone	Sypa-Charonda	Latorica	6,8	
77	Storichia №1 Demichevo	Demechi	Esen-Lonianskyi	MK-2	3,4	
78	Komarochi	Palad-Komarivtsi	KD-1;KD-2	Latorica	7,5	
79	Slatyna	Velyki Geivtsi	Tova	Latorica	5,9	
80	K-1	Tyiglash		Latorica	8,85	
81	K-2	Tyiglash		Karna	8,0	
82	MK-3 Avangard	Salovka		Tisza	4,6	

Annex IV.4

Hydraulic complex facilities in Ukraine

No.	Name	Water course	Locality name	Maximum derived discharges (m^3/s)
1	Drainage pumping station (PS) -17	MK-1	village Barkasovo Mukachevo rayon Latorica drainage system	1.38

No.	Name	Water course	Locality name	Maximum derived discharges (m^3/s)
2	Drainage PS -4	K-5	village Dragynia Mukachevo rayon Latorica drainage system	4.8
3	Drainage PS -18	K-150	village Chomonyn Mukachevo rayon Latorica drainage system	4.1
4	Irrigation PS -6	K-4-1	village Velyki Luchky Mukachevo rayon Latorica drainage system	4.14
5	Drainage PS -29	1-5 GD	village.Chopivtsi Mukachevo rayon Latorica drainage system	2
6	Drainage PS -2	K-2 near the dike	village Tyiglash Uzhgorod rayon Latorica drainage system	4.4
7	Drainage PS -2	MK-3	village Velyka Dobron Uzhgorod rayon Beregovo drainage system	1.19
8	Drainage PS -6	N.Sernianskyi	village Velyka Dobron Uzhgorod rayon Beregovo drainage system	0.67
9	Drainage PS -9 Б	K-1	village Demechi Uzhgorod rayon Beregovo drainage system	0.93
10	Drainage PS -27	K-2 near the dike	village Tyiglash Uzhgorod rayon Latorica drainage system	4.83
11	Drainage PS -5	K-2-2 Heivtsi	village Mali Geivtsi Uzhgorod rayon Latorica drainage system	1
12	Drainage PS -3	K-4	village Geivtsi Uzhgorod rayon Latorica drainage system	4.4
13	Drainage PS -1	K-1-A	village Tyiglash Uzhgorod rayon Latorica drainage system	2.2
14	Drainage PS -7	Kd-1-1(a)	village Solomonovo Uzhgorod rayon Beregovo drainage system	1.54
15	Drainage PS -14	K-1	village Beregyifalu Beregovo rayon Beregovo drainage system	0.97

No.	Name	Water course	Locality name	Maximum derived discharges (m^3/s)
16	Drainage PS -12	K-1	village Kvasovo Beregovo rayon Beregovo drainage system	0.69
17	Drainage PS -13	MK Charonda	village Esen Uzhgorod rayon Beregovo drainage system	8.4
18	Drainage PS -21	MK-1 Salovka	village Solovka Uzhgorod rayon Beregovo drainage system	8.47
19	Drainage PS -1	Charonda -Latorica	village Chervone Uzhgorod rayon Beregovo drainage system	15
20	Drainage PS -8Б	MK-1	village Svoboda Beregovo rayon Beregovo drainage system	2.07
21	Drainage PS -10Б	MK-2 "Ukraine"	village Svoboda Beregovo rayon Beregovo drainage system	1.38
22	Drainage PS -16	K-70	village Batrad Beregovo rayon Beregovo drainage system	5.32
23	Drainage - Irrigation PS -24	Didivskyi Myts	village Dyida Beregovo rayon Beregovo drainage system	2.35
24	Drainage PS -15	MK-II	Beregovo Beregovo drainage system	1.8
25	Drainage - Irrigation PS -26	K-1	village Nyzhni Remety Beregovo rayon Beregovo drainage system	2.31
26	Drainage PS -20	GD-1 "Kolos"	village Nyzhni Remety Beregovo rayon Beregovo drainage system	0.69
27	Irrigation PS Tekivska	river Tisza	village Tekovo Vynogradiv rayon Batar drainage system	4.02
28	Drainage - Irrigation PS Paladska	MK-1	village Velyka Palad Uzhgorod rayon Batar drainage system	2.38
29	Irrigation PS Petrivska	river Tisza	village Pyiterfolvo Vynogradiv rayon Batar drainage system	3.33

No.	Name	Water course	Locality name	Maximum derived discharges (m^3/s)
30	Drainage PS -12 Б	MK-1	village Demechi Uzhgorod rayon Beregovo drainage system	2.2
31	Drainage PS -22	K-3-7	village Kholmtsi Uzhgorod rayon Latorica drainage system	2.76
32	Drainage PS -23	Komarochi	village Palad-Komarivtsi Uzhgorod rayon Latorica drainage system	4.4
33	Drainage PS -11	MK-2	village Chervone Uzhgorod rayon Beregovo drainage system	0.08
34	Drainage PS -28	K-4	village Velyki Geivtsi Uzhgorod rayon Beregovo drainage system	4,8
35	Dam on river Borzhava	Borzhava	village Borzhava Beregovo rayon	

Annex IV.5

Drainage system in Ukraine

No.	Name	Function	Levels	Length (km)	Q (m^3/s)	Art works, confluent, defluent	Purpose
1	Beregovo drainage system	International drainage system (UA-HU)		378.06			Flood protection, drainage, water supply for agriculture
2	Latorica drainage system			177.9			Drainage, flood protection
3	Salva drainage system			118.6			Flood protection
4	Batar drainage system			201.9			Flood management, agriculture
5	Drainage system “Chornyi Mochar”			113.83			Flood regulation in the mountainary part

Annex IV.6

Significant historical floods in Ukraine

No.	Event name	Source, characteristics, mechanism of flood[1]	Date of flood
1	Historical flood at Tisza (from Rakhiv to Vylok) and its right tributaries	Source: snow melting, heavy rains Characteristics: Riverbed Mechanism: Natural exceedance +Exceedance of level of	December 1947 - January 1948

No.	Event name	Source, characteristics, mechanism of flood[1]	Date of flood
		protection + Outburst	
2	Historical flood at Tisza and all its tributaries in Zakarpattya Oblast	Source: snow melting, heavy rains Characteristics: Riverbed Mechanism: Natural exceedance +Exceedance of level of protection	December 1957
3	Catastrophic flood at Tisza and tributaries (Rakhivsky, Tyachivsky, Khust and Vynogradiv rayons)	Source: snow melting, heavy rains Characteristics: Riverbed Mechanism: Natural exceedance +Exceedance of level of protection + Outburst	May 1970
4	Historical flood at Tisza and Uzh and Latorica	Source: snow melting Characteristics: Riverbed Mechanism: Natural exceedance +Exceedance of level of protection	November 1992
5	Catastrophic flood at Tisza and all its tributaries	Source: snow melting, heavy rains Characteristics: Riverbed Mechanism: Natural exceedance +Exceedance of level of protection + Outburst	November 1998
6	Catastrophic flood at Tisza and all its tributaries	Source: snow melting, heavy rains Characteristics: Riverbed Mechanism: Natural exceedance +Exceedance of level of protection + Outburst	March 2001
7	Histrocal flood at Tisza and its tributaries	Source: heavy rains Characteristics: Riverbed Mechanism: Natural exceedance +Exceedance of level of protection	June 2008
8	Historical flood at Tisza and its tributaries	Source: snow melting, heavy rains Characteristics: Riverbed Mechanism: Natural exceedance +Exceedance of level of protection	December 2010

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Associated Partners: Interior Ministry, Hungary | Republic of Serbia Ministry of Agriculture and Environmental Protection – Water Directorate | Secretariat of the Carpathian Convention (SCC), Austria | State Agency of Water Resources of Ukraine | Tisza River Basin Water Resources Directorate, Ukraine

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