PRESENTATION MEMOIRE
TO OBTAIN THE ENVIRONMENTAL PERMIT
Rev. 1

'Increasing the attenuation capacity of the Călinești accumulation and the transit of flashfloods to the border with the Republic of Hungary, Satu Mare County'

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BENEFICIARY: 'Romanian Waters' National Administration, Someș-Tisa Water Basin Administration
Str. Vânătorului, nr. 17, Cluj-Napoca Municipality, Cluj County
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I. PROJECT NAME

The proposed project is entitled **'Increasing the attenuation capacity of the Călinești accumulation and the transit of flashfloods to the border with the Republic of Hungary, Satu Mare County'** and provides for the following categories of measures:

- Rehabilitation and securing of the Călinești dam;
- Execution of one non-permanent accumulation - Dimoșag polder with attenuated volume W = 20.40 mil. m3 at Q1% flow at = 160 m3/s;
- Rehabilitation and securing of the Hodoș and Tămășeni dams;
- Ensuring the calculation heights and providing the defended premises by the elevation of the existing levees and bringing them up to the ground level;
- Protection of the banks of the stream bed on sectors with active erosion and the securing of the levees in the stream sectors with the very small levee-bank shoulder, by means of bank reinforcements at the height of the existing banks;
- Stabilization of the thalweg at the required elevations and securing of bank reinforcements;
- The remeandering and renaturation of the old meanders of Tur River – 5 pieces;
- Creating wetlands (flood cells);
- Resettlement of levees and restoration of floodplain;
- Equipment and fitting specific to the proposed function.

This presentation memoire was prepared following the decision of the initial evaluation phase with no. 354/April 11, 2019 of Satu Mare Environmental Protection Agency (Appendix no.1), according to which it is necessary to start the environmental impact assessment procedure for the proposed project and is prepared according to the provisions of Law 292/2018 on the assessment of the impact of certain public and private projects on the environment.

II. PROJECT OWNER

The Project Owner is the 'Romanian Waters' National Administration - Someș-Tisa Water Basin Administration.

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III. DESCRIPTION OF THE PHYSICAL CHARACTERISTICS OF THE OVERALL PROJECT

This chapter describes the prerequisites for carrying out the proposed project, the justification arguments for its drafting, as well as the location, constructive and operational elements of the proposed works.

III.1 Project Summary

The proposed project provides for the following works:

- **Rehabilitation and securing of the Călinești dam by:**
  - Rehabilitation of hydromechanical equipment, outlet tower with controls and bottom outlet;
  - Rehabilitation of electrical and power supply installations of hydromechanical equipment;
  - Rehabilitation of the spillway;
  - Upgrade and automation of the actuator system of the sluiceways and the cofferlevee;
  - Improvement of the foundation drainage system (self-discharging boreholes);
  - Rehabilitation of the upstream slope protection shield;
  - Weighing down layer of downstream face of dam;
  - Rehabilitation and reconsideration of the AMC system;
  - To increase the degree of safety of the dam and to increase the attenuation capacity of the Călinești Accumulation by 3.0 mil. m3, a concrete parapet (breakwater beam) shall be erected with h=1.0 m throughout the length of the dam.
- **Achievement of non-permanent accumulation - Dimoșag polder with attenuated volume W = 20.40 mil. m3 at Q1% flow at = 160 m3/s;**
- **Rehabilitation and securing of the Hodoș and Tămășeni dam:**
  - Rehabilitation and securing of the Hodoș dam;
  - Rehabilitation and securing of the Tămășeni dam;

- **Ensuring the calculation heights and providing the defended premises by means of:**
  - Levee resettlement – 9,250 m;
  - Elevation of the existing levees - 112,882 m;
  - Sealing of existing levee foundation – 1,500 m;
  - Levee undercrossings with flap gates and sluiceway DN800 made of prefabricated reinforced concrete pipes DN800;
- **Protection of the banks of the stream bed on sectors with active erosion and the securing of the levees in the stream sectors with the very small levee-bank shoulder, by means of bank reinforcements the height of which observes the height of the existing banks:**
  - Removal of obstacles from the riverbed;
  - Vegetative reinforcement with geogrid by planting native seedling and sowing perennial plants;
  - Prism from rip-rap with a height of 2.5 m - 12,135 m;
  - Prism rehabilitation from existing rip-rap with a height of 2.5 m - 1,700 m;
  - Retaining walls of Cyclopean concrete on the Turț and Talna Rivers in the defined urban area of Turț, Vama and Luna settlements in order to be able to ensure the calculation level (levees cannot be built because of the limited space) - 9,000 m;
  - Rehabilitation of existing retaining walls – 115 m;
  - Layout of confluences with rip-rap - 3 pcs.;
  - Rehabilitation of the measurement section at the hydrometric plant.
- **Stabilization of the thalweg at the required elevations and securing of bank reinforcements by means of:**
  - Concrete spillways with a height of 0.40 m - 5 pcs.;
  - Buried low weirs - 35 pcs.;
- **The remeandering and renaturation of the old bifurcations of Tur River:**
- **Creating a wetland (flood cell)** on the right bank of the Tur River in the area of Gherța Mică;
- **Resettlement of levees and restoration of floodplain in the following locations:**
  - The left bank of the Tur River upstream of the confluence with the Turț River;

- 2 resettlements on the right bank of the Tur River in the area of confluence with Hodoș;
- Right bank of Tur River upstream border;

- **Equipment and fitting specific to the proposed function**
  - The hydromechanical equipment shall be replaced or rehabilitated;
  - Electrical and power supply installations of outdated hydromechanical equipment shall be replaced;
  - The actuator system of the outdated sluiceways and the cofferlevee shall be replaced.

The project falls into Appendix no. 2 of Law 292/2018 on the assessment of the impact of certain public and private projects on the environment, at the following sections:

- 10, sub-section f) the construction of inland waterways, other than those provided for in Appendix no. 1, sewerage works and works against flooding;
- 10, sub-section g) dams and other plants designed for long-term water retention or storage, other than those provided for in Appendix no. 1;
- 13 a) Any amendments or extensions, other than those provided for in section 22 of Appendix no. 1, of the projects provided for in Appendix no. 1 or in this Appendix, already authorised, performed or in the process of being performed, which may have significant negative effects on the environment.

The project falls within the scope of Article 28 of the GEO no. 57/2007 on the regime of protected natural areas, the conservation of natural habitats, of wild flora and fauna, as subsequently amended and supplemented, the area covered by the project is partially overlapping with the following protected natural areas:

- The site of community interest ROSCI0214 Tur River, declared by Order no. 1964/2007 on the declaration of special bird protection areas as an integral part of the European ecological network Natura 2000 in Romania;
- Special bird protection area ROSPA0068 Lower valley of the Tur River declared by Government Decision no. 1284/2007 on the declaration of special bird protection areas as an integral part of the European ecological network Natura 2000 in Romania.

The proposed project partially overlaps with the nature reserve the Lower Tur River, designated at national level by Law 5/2000 on the approval of the National Spatial Planning

– Section III – protected areas with code 2.680 and reconfirmed by Government Decision no. 2151/2004 establishing a system of protected natural areas for new areas under heading VII.10 - The Tur River is a natural protected area of national interest, corresponding to category IV of the International Union for Conservation of Nature.

Regarding the classification in the provisions of the Water Law 107/1996 as subsequently amended and supplemented, the proposed project falls within the scope of Article 48, in paragraph (1) of works which are built on water or which are related to water, sections:

- a) works, constructions and plants providing complex water management, including the mitigation of large waters, by changing the natural flow regime, such as: dams, permanent or non-permanent accumulations, hydrotechnical derivations;
- d) defense constructions against the destructive action of water: impoundment, defense and reinforcements of banks and riverbeds, rectification and re-profiling of riverbeds, water management works, fighting against soil erosion, regulating drainage on slopes, corrections of streams, drainage and sanitation, other defence works;
- h) planting and deforestation of wood vegetation, shelterbelts and filters in protection areas or major riverbeds, which are not part of the forestry;
- k) works and plants for hydrological parameter tracking or automatic water quality tracking.

  The proposed work is described in detail in Section III.6.1.

III.2 Design necessity justification

In order to ensure flood protection of the population in the settlements downstream of Călinești accumulation and on the Tur water course and its tributaries on the sector between the accumulation and the border with the Republic of Hungary, the works were designed at a flow rate with the probability of exceeding 1% in the rural environment and 0.5% in the urban environment, respectively. In light of the provisions of the Flood Risk Assessment and Management Directive (2007/60/EC), a high degree of prioritization has been established for the project components.

The works proposed by the project are included in the Flood Risk Management Plan – Someș-Tisa Water Basin Administration, approved by Government Decision no. 972/2016:

- EC code (M31)/code RO_M04-1 - creation of new wetlands;
- EC code (M31)/RO_M04-2 - reconnection and restoration of floodplain;
- EC code (M31)/RO_M04-4 - renaturation of the banks of watercourses (vegetative protection);
- EC code (M33)/RO_M08-3 - increase of the transit capacity of the stream bed through local works of unclogging and re-profiling of the river bed;
- EC code (M33)/RO_M08-4 - resettlement of levees;
- EC code (M35)/RO_M10-1 - increasing the degree of safety of existing hydrotechnical constructions (rehabilitation: modernization, measures to limit infiltrations;
- EC code (M35)/RO_M10-2 – carrying out maintenance works for the safe operation of existing hydrotechnical constructions and related equipment (maintenance and current repair work, upgrades, refurbishments, etc.);
- EC code (M33)/RO_M11-3 - measures to stabilise the river bed – white recalibrations, parapets, retaining walls, bank revetments, stabilisation of the river bed;
- EC code (M35)/RO_M13-4 - maintenance of watercourses riverbeds and removal of bottlenecks, obstacles on watercourses;
- EC code (M41)/RO_M17– improvement of monitoring/forecasting and warning/alarm systems.

The works are in compliance with the Someș-Tisa Hydrographic Basin Management Plan and shall comply with the Water Framework Directive (Water Law 107/1996 as subsequently amended and supplemented), the Environmental Impact Assessment Directive (according to Law 292/2018 and Order no. 863/2002), the Habitats Directive and the Birds Directive according to GEO no. 57/2007 on the regime of protected natural areas, the conservation of natural habitats, of wild flora and fauna.

According to the 'Climate Change Study' prepared for the proposed project, the main climatic events to which the project area is vulnerable in the coming decades are extreme rainfall generating significant floods and flash floods, as well as landslides. The proposed

works themselves consist of measures to adapt to the risk climatic phenomena to which the proposed project area is exposed. Once completed, the project works shall provide protection for a number of 30,612 inhabitants, of which 12,875 direct, 4,753 properties, 131.25 km transport infrastructure and 27 bridges/culverts.

III.3 Investment value

The total value of the proposed investment is: RON 231,772,985.97 including VAT.

III.4 Proposed implementation period

Duration of the proposed works performance is 24 months. The estimated implementation period (of works performance) is: January 2021 – December 2022.

III.5 Drawings representing the boundaries of the project site, including any land area requestd for temporary use

The proposed project is carried out in the Călinești accumulation area, on the Tur water course and its tributaries on the sector downstream of the accumulation and up to the border with the Republic of Hungary, on the territory of 15 administrative units, according to the town planning certificate related to the project (Appendix no. 2) and the Site Plan below.

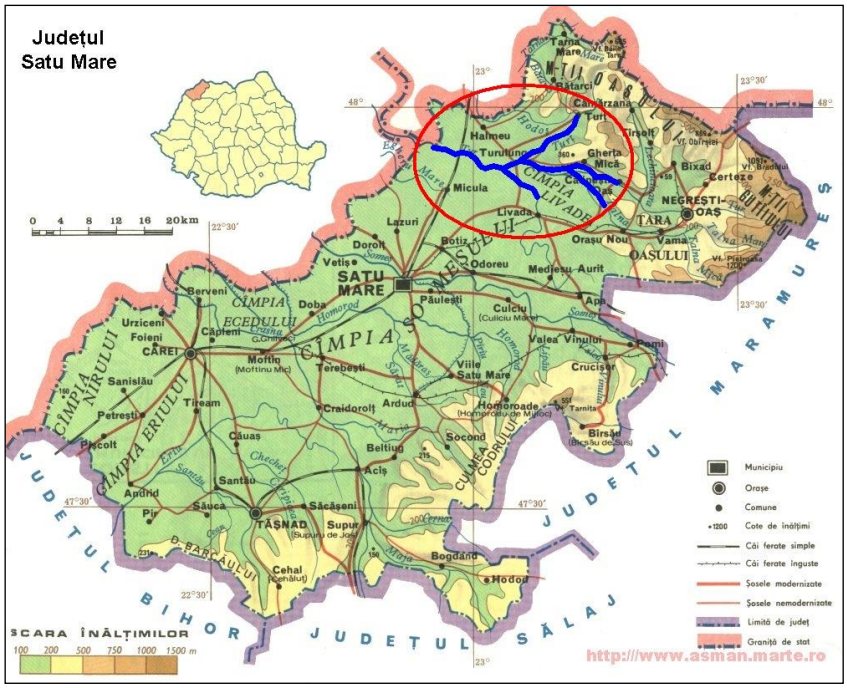

Figure 1. Development Site Plan of the proposed project (Source: Feasibility Study)

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The distribution of the works and the land areas occupied by the proposed works can be found in the site plans attached to the Presentation memoire. Temporarily occupied land areas are those related to the site organizations necessary for the implementation of the proposed project, the areas of the access ramps on the levee and those related to the work sites. The requirements relating to the location of the site organisations and their characteristics are set out in Chapter IX.

III.6 Description of physical characteristics of the whole project, physical forms of the project

Once accomplished, the works proposed in the project shall take the form of specific infrastructure elements for flood protection, namely an accumulation of attenuation of floods with a consolidated dam, two non-permanent accumulations rehabilitated and secured, bank reinforcements, cant of levees and relocated levees, retaining walls, riverbed thresholds, fish ladders, but also green measures to protect against floods in the physical form of a polder, old meander reconnections, plus the creation of wetlands and the restoration of portions of the floodplain of Tur River.

III.6.1 Description of works

The proposed works at the level of each administrative and territorial unit are presented from upstream to downstream, in the following Table:

Table 1. List of proposed works on the 3 upstream to downstream watercourses

No.	Administrative and territorial unit	Work type	Total capacity
Talna watercourse works			
1.	Negrești-Oaș Town, Luna Municipality	Right bank retaining wall	910 m
		Riverbed threshold	3 pcs
		Left bank retaining wall	900 m
		Left bank retaining wall	190 m
2.	Vama Commune, Vama Municipality	Talna Mare right bank retaining wall (rip-rap prism)	945m
		Talna Mare left bank retaining wall	625 m
		Riverbed threshold	2 pcs
		Talna right bank retaining wall	985 m

No.	Administrative and territorial unit	Work type	Total capacity
		Talna left bank retaining wall	1,015 m
		Talna left bank retaining wall	430 m
		Riverbed threshold	4 pcs
3.	Racșa Commune, Orașu Nou Commune	Elevation of the existing levees	6,821 m
		Elevation of the existing levees	5,211 m
		Elevation of the existing levees	2,565 m
		Elevation of the existing levees	1,247 m
4.	Călinești-Oaș Commune, Orașu Nou Commune, Racșa Commune	Elevation of the existing levees	10,260 m
5.	Călinești-Oaș Commune	Dimoșag polder contour levee	
		Elevation of the existing levees	5,548 m
Turț watercourse works			
1.	Turț Commune	Right bank retaining wall	985 m
		Right bank retaining wall	210 m
		Left bank retaining wall	340 m
		Left bank retaining wall	170 m
		Riverbed threshold	2 pcs
		Right bank retaining wall	160 m
		Right bank retaining wall	275 m
		Left bank retaining wall	165 m
		Left bank retaining wall	280 m
		Riverbed threshold	4 pcs
		Right bank retaining wall	215 m
		Right bank retaining wall	200 m
		Right bank rip-rap prism	35 m
		Concrete spillway h=0.4 m	3 pcs
		Right bank rip-rap prism	35 m
		Right bank rip-rap prism	35 m
		Elevation of the existing levees	385 m
		Right bank rip-rap prism	35 m
		Elevation of the existing levees	1,285 m
2.	Turulung Commune	Left bank rip-rap prism	35 m
		Left bank rip-rap prism	35 m
		Elevation of the existing levees	1,670 m
		Elevation of the existing levees	1,045 m
		Left bank rip-rap prism	35 m
		Elevation of the existing levees	895 m
		Left bank rip-rap prism	35 m
		Elevation of the existing levees	2,710 m

No.	Administrative and territorial unit	Work type	Total capacity
		Concrete spillway h=0.4 m	2 pcs
		Right bank rip-rap prism	35 m
		Left bank rip-rap prism	35 m
		Elevation of the existing levees	3,740 m
		Elevation of the existing levees	3,505 m
Tur watercourse works			
1.	Călinești-Oaș Commune	Dam rehabilitation and increasing Călinești accumulation mitigation capacity	
		Elevation of the existing levees	2,800 m
		Elevation of the existing levees	1,315 m
		Rehabilitation of the dam downstream right bank wall	115 m
		Vegetated reinforcement with geogrid	120 m
		Vegetated reinforcement with geogrid	110 m
		Left bank prism rehabilitation	100 m
		Vegetated reinforcement with geogrid	155 m
		Vegetated reinforcement with geogrid	235 m
		Right bank rip-rap prism	120 m
		Right bank rip-rap prism	60 m
		Left bank rip-rap prism	90 m
		Right bank rip-rap prism	25 m
		Riverbed threshold	1 pcs
		Left bank rip-rap prism	25 m
		Right bank rip-rap prism	100 m
		Left bank rip-rap prism	110 m
		Vegetated reinforcement with geogrid	145 m
		Left bank rip-rap prism	120 m
		Riverbed threshold	1 pcs
		Right bank rip-rap prism	25 m
		Vegetated reinforcement with geogrid	175 m
		Elevation of the existing levees	3,630 m
2.	Călinești-Oaș Commune, Gherța Mică Commune	Elevation of the existing levees	5,275 m
3.	Gherța Mică Commune	Elevation of the existing levees	3,685 m
		Elevation of the existing levees	7,600 m
		Right bank rip-rap prism	540 m
		Right bank rip-rap prism	210 m
		Vegetated reinforcement with geogrid	600 m
		Riverbed threshold	2 pcs

No.	Administrative and territorial unit	Work type	Total capacity
		Right bank Gherța Mică wetland	
		Tur – Talna confluence arrangement	
		Vegetated reinforcement with geogrid	150 m
		Vegetated reinforcement with geogrid	235 m
		Vegetated reinforcement with geogrid	730 m
		Right bank rip-rap prism	85 m
		Right bank rip-rap prism	220 m
		Right bank rip-rap prism	260 m
		Right bank rip-rap prism	300 m
		Left bank rip-rap prism	295 m
		Left bank rip-rap prism	100 m
		Left bank rip-rap prism	110 m
		Right bank rip-rap prism	25 m
		Riverbed threshold	1 pcs
		Right bank rip-rap prism	85 m
		Vegetated reinforcement with geogrid	85 m
		Control works	
		Access sluice	200 m
4.	Călinești-Oaș Commune, Livada Commune, Gherța Mică Commune	Dimoșag polder	Vtot=20.4 mil m3
		Dimoșag polder contour levee	9,250 m
		Elevation of the existing levee to 136.55	6,950 m
5.	Gherța Mică Commune, Livada Commune, Turulung Commune	Elevation of the existing levee	7,385 m
6.	Livada Commune	Elevation of the existing levee	1,445 m
		Polder surface spillway	50 m
		Vegetated reinforcement with geogrid	125 m
		Outlet tower with controls and polder bottom outlet	
		Right bank rip-rap prism	25 m
		Left bank rip-rap prism	80 m
		Right bank rip-rap prism	115 m
		Right bank rip-rap prism	90 m
		Vegetated reinforcement with geogrid	195 m
		Vegetated reinforcement with geogrid	125 m
		Vegetated reinforcement with geogrid	180 m
		Riverbed threshold	1 pcs

No.	Administrative and territorial unit	Work type	Total capacity
		Left bank rip-rap prism	230 m
7.	Livada Commune, Turulung Commune	Left bank levee resettlement	2,110 m
		Floodplain restoration	
8.	Turulung Commune	Elevation of the existing levee	3,345 m
		Right bank rip-rap prism	25 m
		Vegetated reinforcement with geogrid	180 m
		Vegetated reinforcement with geogrid	160 m
		Right bank rip-rap prism	130 m
		Right bank rip-rap prism rehabilitation	370 m
		Vegetated reinforcement with geogrid	265 m
		Right bank rip-rap prism	210 m
		Left bank rip-rap prism	25 m
		Right bank prism rehabilitation	55 m
		Right bank prism rehabilitation	350 m
		Vegetated reinforcement with geogrid	800 m
		Right bank levee foundation sealing	800 m
		Right bank levee foundation sealing	700 m
		Right bank rip-rap prism	550 m
		Vegetated reinforcement with geogrid	780 m
		Right bank rip-rap prism	205 m
		Right bank rip-rap prism	310 m
		Left bank rip-rap prism	660 m
		Vegetated reinforcement with geogrid	125 m
		Vegetated reinforcement with geogrid	1030 m
		Vegetated reinforcement with geogrid	275 m
		Left bank rip-rap prism	275 m
		Right bank rip-rap prism	25 m
		Left bank rip-rap prism	180 m
		Left bank rip-rap prism	145 m
		Vegetated reinforcement with geogrid	190 m
		Right bank prism rehabilitation	100 m
		Left bank prism rehabilitation	120 m
		Vegetated reinforcement with geogrid	275 m
		Vegetated reinforcement with geogrid	495 m
		Right bank rip-rap prism	25 m
		Left bank rip-rap prism	325 m
		Vegetated reinforcement with geogrid	315 m
		Vegetated reinforcement with geogrid	260 m
		Left bank rip-rap prism	190 m

No.	Administrative and territorial unit	Work type	Total capacity
		Vegetated reinforcement with geogrid	70 m
		Right bank levee resettlement	1,060 m
		Floodplain restoration	
		Riverbed threshold	8 pcs
		Re-meandering, old meander reconnection	5 pcs
		Rehabilitation of the hydrometric plant section	
		Racta - Tur confluence arrangement works	
		Turț - Tur confluence arrangement works	
		Elevation of the existing levee	780 m
		Right bank rip-rap prism	145 m
		Right bank rip-rap prism	145 m
		Left bank rip-rap prism	130 m
		Left bank rip-rap prism	120 m
		Vegetated reinforcement with geogrid	375 m
		Left bank rip-rap prism	130 m
		Vegetated reinforcement with geogrid	130 m
		Left bank rip-rap prism	345 m
9.	Turulung Commune, Agriș Commune, Micula Commune	Elevation of the existing levee	16,750 m
10.	Agriș Commune	Left bank rip-rap prism	185 m
		Left bank rip-rap prism	175 m
		Left bank rip-rap prism	120 m
		Vegetated reinforcement with geogrid	150 m
11.	Turulung Commune, Halmeu Commune	Right bank levee resettlement	2,960 m
		Floodplain restoration	
12.	Halmeu Commune	Left bank rip-rap prism	160 m
		Right bank prism rehabilitation	220 m
		Riverbed threshold	1 pcs
		Right bank rip-rap prism	25 m
		Left bank rip-rap prism	320 m
		Right bank prism rehabilitation	315 m
		Vegetated reinforcement with geogrid	140 m
13.	Halmeu Commune, Porumbești Commune	Elevation of the existing levee	3,570 m
14.	Porumbești Commune	Right bank levee resettlement	3,390 m
		Right bank wetland	

No.	Administrative and territorial unit	Work type	Total capacity
		Riverbed threshold	5 pcs
		Right bank rip-rap prism	230 m
		Vegetated reinforcement with geogrid	225 m
		Right bank prism rehabilitation	70 m
		Right bank rip-rap prism	200 m
		Vegetated reinforcement with geogrid	205 m
		Right bank rip-rap prism	125 m
		Right bank rip-rap prism	130 m
		Right bank rip-rap prism	285 m
		Right bank rip-rap prism	150 m
		Vegetated reinforcement with geogrid	185 m
		Vegetated reinforcement with geogrid	150 m
		Elevation of the existing levee	1,465 m
		Right bank rip-rap prism	25 m
		Right bank rip-rap prism	200 m
		Right bank rip-rap prism	25 m
		Right bank rip-rap prism	185 m
		Right bank rip-rap prism	25 m
15.	Micula Commune	Left bank rip-rap prism	215 m
		Left bank rip-rap prism	25 m
		Left bank rip-rap prism	150 m
		Vegetated reinforcement with geogrid	245 m
		Left bank rip-rap prism	190 m
		Vegetated reinforcement with geogrid	150 m
		Left bank rip-rap prism	265 m
		Vegetated reinforcement with geogrid	200 m
		Left bank rip-rap prism	190 m
		Left bank rip-rap prism	25 m
		Vegetated reinforcement with geogrid	160 m
		Vegetated reinforcement with geogrid	310 m
		Left bank rip-rap prism	170 m
		Vegetated reinforcement with geogrid	200 m
		Left bank rip-rap prism	315 m
		Vegetated reinforcement with geogrid	330 m
		Left bank rip-rap prism	115 m
		Vegetated reinforcement with geogrid	440 m
		Left bank rip-rap prism	170 m
16.	Turț Commune	Rehabilitation of Hodoș accumulation	
17.	Halmeu Commune	Rehabilitation of Tămășeni accumulation	

2 hydrometric plants are added to the aforementioned, located upstream of Călinești accumulation and 8 undercrossing works of levees with flap gates and sluiceway, made of precast reinforced concrete pipes DN800.

Emptying the Călinești accumulation lake

In order to rehabilitate Călinesti-Oaș dam, it is proposed to partially empty it in the first phase. This is necessary to access the work areas, and work on land is also required. Therefore, it is proposed to build a cofferdam near the dam, throughout its length, in order to maintain in the lake a depth of about 2 m. It is also proposed to pump water from the area between the dam and the cofferdam. Maintaining water in the lake basin is environmentally necessary to create an area with the initial conditions (before draining the lake) to be expanded in the future, after filling the lake. The wetland, in addition to being a store of crustacean, mollusc, algae or insect species, shall also contain fish species. This shall constitute a reserve with a view to restoring biocenosis accumulation relationships under the initial conditions. Due to the impact that emptying and filling of the lake can have, but also keeping it about 90% emptied, it shall be necessary to comply with a set of conservation measures, but also active conservation measures. In order to minimise the negative impact that these works may have (especially the drainage of the lake), the period during which this is allowed should be considered. Furthermore, studies recommend ensuring a steady flow, trying to avoid sudden fluctuations in order to have time to adapt to new conditions or to look for areas where environmental conditions remain somewhat unaltered.

Călinești accumulation works

Concrete protection shield - The concrete protection of the upstream slope shall be rehabilitated as many concrete slabs are destroyed. A new revetment shall be poured over the existing one, which shall be made up to the maximum operation elevation of 147.43. Above this elevation and up to the crown elevation – 148.50, the upstream embankment shall be protected with 'honeycomb' tile revetment. The 0.20 m thick concrete revetment as well as the 'honeycomb' tile revetment shall be placed on a drainage layer of ballast and geotextile (above the 145.00 elevation). The revetment shall rest on the C25/30 class concrete support beam.

Rehabilitation of outlet tower with controls, spillway, bottom outlet and energy dissipation constructions

Following the structural deficiencies and degradations found, the following works should be carried out:

Spill tower

- consolidation/rehabilitation of the spill tower plates at 147.90 mdM and 152.00 mdM elevations - reinforcement works of carbon fiber floors and superconcreting shall be performed in order to ensure the necessary bearing capacity;
- repairs to vertical and horizontal concrete structural elements showing degradation at **the spill tower** shall be performed as follows:
    - in areas where concrete is degraded superficially, without significant degradation, namely without visible reinforcements, local repairs shall be carried out with Sika Monotop 614 mortar or similar - repair type 1;
    - in areas where the concrete is degraded in depth and the reinforcement is visible but undamanged, repairs shall be carried out by shot concrete or by applying special repair mortars type Sika Monotop 614 or similar - repair type 2;
    - in areas where concrete is degraded and reinforcement is corroded, it shall be replaced and repaired by shot concrete or by applying special repair mortars Sika Monotop 614 or similar - repair type 3;
    - in areas where cracks/crevices are present, specific injection products of type Sikadur 52 or similar shall be injected. The outer surface of cracks shall be caulked with special mortar Sikadur 31 or similar – repair type 6;
    - structural elements made of horizontal and vertical reinforced concrete that do not provide sufficient bearing capacity and require reinforcement shall be reinforced with carbon fibre blades and canvases - repair type 8.1 and 8.2.
- considering that the structure of the gangway no longer meets the requirements of resistance and stability and is heavily degraded, it shall be restored by replacing the existing concrete beams with two new prefabricated beams;
- the finishes shall be restored and the degraded metal elements (railings, stairs) shall be replaced;
- a metallic structure shall be made for access to the platform at 152.00 mdM;
- because the hydromechanical equipment is worn-out, it is necessary to replace it, namely to upgrade it;

- in order to perform the intervention/rehabilitation works on the concrete structure and hydromechanical equipment, namely for drying, a dry enclosure shall be made by means of a trapezoidal perimeter cofferlevee with crown of 5.00 m width, 4.00 m height and slope embankment 1:1. Cofferlevee shall be made of local material and shall be waterproofed with bags filled with clay.

  Bottom outlet pipe and downstream energy dissipating device

- repairs to concrete structural elements showing degradation at the **bottom outlet** pipe shall be performed as follows:
  - in areas where concrete is degraded superficially without visible reinforcements local repairs shall be carried out with Sika Monotop 614 mortar or similar - repair type 1;
  - in areas where the concrete is degraded and the reinforcement is visible but undamaged, repairs shall be carried out by shot concrete or by applying special repair mortars type Sika Monotop 614 - repair type 2;
  - in areas where concrete is degraded and reinforcement is corroded, it shall be replaced and repaired by shot concrete or by applying special repair mortars Sika Monotop 614 - repair type 3;
  - in areas where cracks/crevices are present, specific injection products Sikadur 52 or similar shall be injected - repair type 6;
  - repair and sealing works shall be carried out on existing joints degraded with MAXPLUG or similar – repair type 9.
- rehabilitation of concrete structural elements showing degradation at **the downstream energy dissipating device**- foundation plate and walls shall be performed as follows:
  - for the rehabilitation of existing heavily damaged walls and for ensuring the bearing capacity of vertical structural elements made of reinforced concrete, guniting works shall be performed by shot concrete or guniting by formwork concrete casting. Guniting shall be reinforced with welded nets - repair type 4;
  - at horizontal surfaces of reinforced concrete structural elements (foundation plates), rehabilitation works shall be performed by over-concreting. Over-concreting shall be reinforced with welded nets - repair type 5;

- reinforced concrete elements with superficial degradation, the reinforcement being unaffected, the repairs shall be carried out by shot concrete – repair type 7.

– in order to perform the rehabilitation works of concrete structures, dry enclosures shall be performed by means of local material cofferdams.

Surface spillway

– repair/rehabilitation of the existing concrete structure at **the weir, connection channel, connection section, quick channel and energy dissipating device** shall be performed as follows:
  - for the rehabilitation of existing damaged concrete walls/partitions and for increasing the bearing capacity of vertical structural elements made of reinforced concrete (surface spillway walls), guniting works shall be performed by shot concrete or guniting by formwork concrete casting. Guniting shall be reinforced with welded nets - repair type 4;
  - at horizontal surfaces of reinforced concrete structural elements (foundation plates), repair works shall be performed by over-concreting - repair type 5.
– because the downstream face of the dam is modified by providing for a section of ballasting layer / weighing down layer, it is necessary that the walls from the surface spillway be raised by about 1.00 m.

In order to perform the rehabilitation works of the spill tower and the other adjacent constructions, underwater works with divers are necessary in the event in which the lake cannot be completely emptied. In this way, the current state of the submerged concrete structures shall be inspected, sealing works shall be performed, part of the necessary rehabilitation works shall be performed, and the diving teams shall perform the underwater works necessary for dismantling, mounting and fastening the ironworks related to the hydromechanical equipment located below the water level (cleaning the work surfaces with pressurized water jet, immersion of the metallic elements, their positioning, fastening and sealing; drilling holes and fastening screws for clamping).

On a separate note, after drying the constructions, the degree of damage to the resistance structure of the spill tower, bottom outlet pipe, MHC adduction outlet and downstream energy dissipating device shall be inspected and ascertained. If the dam is in operation, the degree of degradation of the submerged structures cannot be estimated. The

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remediation/rehabilitation solutions for these areas can be established concretely only after drying the relevant structural elements, and then depending on the level of degradation of the concrete works and the findings, the most favourable and necessary technical solution, among the above mentioned, shall be adopted.

We mention that following in situ observations and studies made on concrete works in this phase, it was found that it is necessary to repair most visible structural elements, but for structures below water level the final solution shall be established following the findings made after drying them.

Breakwater beam - elevation made of reinforced concrete class C25/30 shall be performed by a rectangular section, with crown 0.4 m width, and 1.0 m height, which supports the reinforced concrete foundation class C25/30 with foundation depth of 0.85 m and width of 1.25 m placed on a ballast layer of 0.10 m. Elevation shall be clad with jointed stone. For access from the crown over the breakwater beam and then to the lake, an access ladder made of reinforced concrete shall be built.

Ballasting layer / weighing down layer of the downstream embankment shall be made of rip-rap placed on an inverted filter to prevent the migration of clay particles from the dam body. The inverted filter shall also be continued at the top of the rip-rap in order to achieve the grassed vegetal layer.

The reservoir shall be filled in such a way that the potential negative impact on aquatic biodiversity be minimized.

Dimoșag polder works

The Dimoșag polder is a peak lateral accumulation achieved by the annular closure of an enclosure located on the left bank of the Tur River, immediately downstream of the confluence with the Talna creek. The closing levee shall have a maximum height of H=6.80 m, crown length of L = 9,250 m, crown width of B=3.50 m and embankment slopes of 1:1.5 both on the upstream face and on the downstream face starting from the crown on the height of 3 m and slope of 1:2 below this height. On the face from the outside of the polder, a berm with a width of 1 m shall be built when changing slopes from 1:1.5 to 1:2.

The levee on the left bank of the Tur River, along the entire length of the polder shall be risen to a height between 0.75 m and 3.20 m (downstream). The levee on the left bank of the Talna creek, along the entire length of the polder shall be risen to a height between 0.3 m and 1.20 m (downstream). The levee shall have crown length of L = 6,950 m, crown

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width of B=3.50 m and embankment slopes of 1:1.5 both on the upstream face and on the downstream face starting from the crown on the height of 3 m and slope of 1:2 below this height. On the face from Tur River, a berm with a width of 1 m shall be built when changing slopes from 1:1.5 to 1:2.

Both the contour levee and the cant of the levee on the left bank of the Tur River (along the entire length of the polder) shall be made of local material stabilized with hydraulic binder. Upstream and downstream face is grassed by sowing a lawn on a layer of vegetal soil of 20 cm thick. Embedding of the dam in the optimal foundation ground is achieved by twinning levels.

The elevation of the polder access area is 134.70, the maximum operation level at 135.00 and the crown level of the levee is 136.55 m, with an attenuated volume of 20.40 million cubic meters.

The polder consists of the following elements:

Polder access area (charging) made of:

- the weir formed of spill field with the elevation at the top of the ridge of 134.70 MdMN;
- dissipating basin of 15.0 m length with reinforced concrete foundation plate of 0.50 m thickness placed on a support layer consisting of simple concrete of 0.15 m and a ballast layer of 0.15 m;
- protection stone below levee g > 1,030 kg/pcs. over a length of 15.00 m.

Bottom outlet is the construction that evacuates the waters from the inside of the polder after the flash flood passes, evacuating a maximum flow of 30.00 m^3/s. It is composed of:

- outlet connection channel;
- outlet tower with controls;
- discharge outlet;
- energy dissipating device.

The outlet access channel with a length of 3.75 m connects the collecting channel that collects the water on the surface of the polder to the entrance to the outlet tower with controls and is composed of a 35 cm thick concrete foundation plate, b=5.00 m placed on a simple concrete support layer and a draining layer of ballast

Outlet tower with controls

The foundation has an area of 1.85 x 5.50 m and a depth of 1.50 m, in the following composition:

- support layer of stone 0.15 m thick;
- reinforced concrete foundation plate C25/30 of 1.50 m thickness.

The exterior and interior walls are provided with reinforced concrete C25/30, with a thickness of 0.50 m.

Discharge manifold

The bottom outlet is a reinforced concrete construction, with three manholes of 1.60 x 1.00 m^2; the thickness of the foundation and walls is 0.50 m.

It is founded on the bedrock, disposing a layer of concrete C8/10, with a thickness of 0.70 m. The outlets (i=1.0%) consist of 4 sections of 6.00 m length each, reinforced concrete C25/30, with permanent joints sealed with PVC sealing band 0-35.

At the outlet exit from the dam body, a tympanum made of reinforced concrete C25/30 with a height of 4.50 m and a length of l = 14.00 m is provided.

The energy dissipating device consists of a dissipating basin having the following characteristics:

- dissipating device depth: d=0.50 m;
- dissipating device length: L_d =12.80 m;
- dissipating device width: l_d =5.00 m;
- slopes: 1:1.5;
- the thickness of the dissipating device board is 0.70 m made of C 25/30.

Berm with the following characteristics:

- berm length: L_r =10.00 m
- berm width at the base: l_r =5.00 m
- the berm is made of rip-rap with a specific weight of g > 1,030 kg/pcs.

Surface spillway

The surface spillway is located in the body of the levee and consists of:

- the spill;
- the rapid channel;
- the energy dissipating device and connection to the natural bed;
- the berm - common with the bottom outlet berm

Weir is made of concrete C25/30, having a length of 50.00 m. The upper elevation of the weir is 135.07 mdMN.

Rapid channel is 11.40 m long. The cross section is trapezoidal, has a bottom width of 50.00 m and slopes of 1:2. The construction is made of reinforced concrete C25/30 and has a thickness of 0.30 m. The foundation plate is placed on a simple concrete layer of 0.15 m thickness. Joints treated with 2.5 cm bituminous mastic are provided.

Energy dissipating device - energy dissipation is performed in a dissipating basin with a length of 6.75 m. The cross section of the dissipating basin is trapezoidal shaped with a bottom width of 50.00 m and embankment slope of 1:1.5. The foundation plate is made of reinforced concrete C25/30 and has a thickness of 0.60 m.

Berm

- berm length: L_r =7.00 m;
- berm width at the base: l_r =50.00 m;
- the berm is made of rip-rap with a specific weight of g > 1,030 kg/pcs.

Rehabilitation and securing of the Hodoș dam involve the performance of the following works:

Spill tower

consolidation/rehabilitation of spill tower plates;

- repairs to vertical and horizontal concrete structural elements showing degradation at **the spill tower** shall be performed as follows:
    - in areas where concrete is degraded superficially, without significant degradation, namely without visible reinforcements, local repairs shall be carried out with Sika Monotop 614 mortar or similar - repair type 1;
    - in areas where the concrete is degraded in depth and the reinforcement is visible but undamaged, repairs shall be carried out by shot concrete or by applying special repair mortars type Sika Monotop 614 or similar - repair type 2;
    - in areas where concrete is degraded and reinforcement is corroded, it shall be replaced and repaired by shot concrete or by applying special repair mortars Sika Monotop 614 or similar - repair type 3;

- in areas where cracks/crevices are present, specific injection products of type Sikadur 52 or similar shall be injected. The outer surface of cracks shall be caulked with special mortar Sikadur 31 or similar – repair type 6;
- structural elements made of horizontal and vertical reinforced concrete that do not provide sufficient bearing capacity and require reinforcement shall be reinforced with carbon fibre blades and canvases - repair type 8.1 and 8.2.;

– considering that the structure of the gangway no longer meets the requirements of resistance and stability and is heavily degraded, it shall be restored by replacement;
– because the hydromechanical equipment is worn-out, it is necessary to replace it.

Downstream energy dissipating device

Rehabilitation of concrete structural elements showing degradation at the downstream energy dissipating device- foundation plate and walls shall be performed as follows:

– for the rehabilitation of existing heavily damaged walls and for ensuring the bearing capacity of vertical structural elements made of reinforced concrete, guniting works shall be performed by shot concrete or guniting by formwork concrete casting. Guniting shall be reinforced with welded nets - repair type 4;
– at horizontal surfaces of reinforced concrete structural elements (foundation plates), rehabilitation works shall be performed by over-concreting. Over-concreting shall be reinforced with welded nets - repair type 5;
– reinforced concrete elements with superficial degradation, the reinforcement being unaffected, the repairs shall be carried out by shot concrete – repair type 7.

Surface spillway

Repair/rehabilitation of the existing concrete structure at **the weir, connection channel and energy dissipating device**. The investment proposed the rehabilitation of the spillway and the resizing of the section of the Hodoș dam, especially the systematization of the crown at the elevation resulting from the project and the rehabilitation of the outlet tower with controls with bottom outlet. Following the assessment of the operational safety status of the dam, rehabilitation and safety works shall be performed consisting of rehabilitation works of degraded concrete structures and replacement of hydro-mechanical equipment.

Systematization of the dam crown at the elevation of 148.00 mdM, rehabilitation of the outlet tower with controls and bottom outlet, as well as of the spillway, in order to ensure smooth transit of the calculation flows and verification in the dam section.

Rehabilitation of the non-permanent accumulation of Tămășeni involves rehabilitation of the outlet tower with controls and energy dissipation constructions.

Spill tower

- consolidation/rehabilitation of spill tower plates;
- repairs to vertical and horizontal concrete structural elements showing degradation at **the spill tower** shall be performed as follows:
    - in areas where concrete is degraded superficially, without significant degradation, namely without visible reinforcements, local repairs shall be carried out with Sika Monotop 614 mortar or similar - repair type 1;
    - in areas where the concrete is degraded in depth and the reinforcement is visible but undamaged, repairs shall be carried out by shot concrete or by applying special repair mortars type Sika Monotop 614 or similar - repair type 2;
    - in areas where concrete is degraded and reinforcement is corroded, it shall be replaced and repaired by shot concrete or by applying special repair mortars Sika Monotop 614 or similar - repair type 3;
    - in areas where cracks/crevices are present, specific injection products of type Sikadur 52 or similar shall be injected. The outer surface of cracks shall be caulked with special mortar Sikadur 31 or similar – repair type 6;
    - structural elements made of horizontal and vertical reinforced concrete that do not provide sufficient bearing capacity and require reinforcement shall be reinforced with carbon fibre blades and canvases - repair type 8.1 and 8.2.
- considering that the structure of the gangway no longer meets the requirements of resistance and stability and is heavily degraded, it shall be restored by replacement;
- because the hydromechanical equipment is worn-out, it is necessary to replace it.

Downstream energy dissipating device

Rehabilitation of concrete structural elements showing degradation at the downstream energy dissipating device- foundation plate and walls shall be performed as follows:

- for the rehabilitation of existing heavily damaged walls and for ensuring the bearing capacity of vertical structural elements made of reinforced concrete, guniting works shall be performed by shot concrete or guniting by formwork concrete casting. Guniting shall be reinforced with welded nets - repair type 4;
- at horizontal surfaces of reinforced concrete structural elements (foundation plates), rehabilitation works shall be performed by over-concreting. Over-concreting shall be reinforced with welded nets - repair type 5;
- reinforced concrete elements with superficial degradation, the reinforcement being unaffected, the repairs shall be carried out by shot concrete – repair type 7.

The investment proposed the rehabilitation of the outlet tower with controls with bottom outlet and the execution of a new spillway with the downstream area. Following the assessment of the operational safety status of the dam, rehabilitation and safety works shall be performed consisting of rehabilitation works of degraded concrete structures and replacement of hydro-mechanical equipment.

The rehabilitation of the outlet tower with controls and bottom outlet, as well as the performance of the new spillway, ensures the safety of smooth transit of the calculation flows and verification in the dam section.

Dam resettlement – 9,250 m

This shall be achieved in sectors where the major riverbed is small in width, and the pressures exerted on the levees are increased, the levees shall be resettled to give more space to the river.

Bringing levees up to the ground level - 112,882 m

In order to ensure the defended premises, some existing levees need to be brought to the ground level or overheight in places by sectors with major subsidence. The embedding of the earthworks to be performed, in the existing section of the levee, shall be dug twinning levels. The material to be deposited in the levee body shall be local, from the beaches excavated from the riverbed or from the borrow pits, and will be deposited in layers of 0.30 m thick and compacted mechanized with the compressor roll, achieving a degree of compaction of 95%. The embankments of the levee as well as the crown shall be protected vegetatively by sowing with perennial herbs. A sewer for the enclosure waters shall be built behind the levee. Access ramps were provided on the levee. The bringing up to the ground level of the existing levee is achieved by taking the following steps, according to the method

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below (according to the sheet 5.1.1 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- pickling the topsoil layer over a depth of 40 cm of the terrain surface in order to ground the cant work;
- pickling the topsoil from the existing levee crown at a depth of 30 cm in order to prepare for the cant;
- the arrangement of twinning levels in the existing structure of the levee;
- making the embankment of the levee body by filling it with compacted local material in successive layers with a thickness of 30 cm;
- application of a 20 cm thick grassy layer to the embankments and crown of the cant levee.

The bringing of the existing levee up to the ground level shall also be achieved by taking the following steps (according to the sheet 5.1.1 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- pickling the topsoil from the existing levee crown at a depth of 30 cm;
- application of a compacted local material filling layer;
- application of a 20 cm thick grassy layer to the embankments and crown surface.

Increasing the leakage capacity in the riverbed and removing obstacles from the riverbed - to ensure the transition of the calculation flow with a probability of exceeding Q1% attenuated on all watercourses studied, slice sizing calculations were performed, checking the capacity of the natural riverbed and the characteristics of a stable section.

The section of Turț River was established at a trapezoidal section with the base of the riverbed b=5-7m, embankments on bank of 1:1.5 or 5:1 in the retaining wall area and the height of the variable riverbed on the leveemed sector. The Talna River section was established at a trapezoidal section with the base of the riverbed b=5-22m, bankments on bank of 1:1.5 or 5:1 on the sector arranged with retaining walls and variable height on the leveemed sector.

On the course sectors with bank erosion or on the sectors with the lower levee-bank, **bank reinforcements** with an anti-erosion role in the form of the rip-rap prism, or the retaining walls (Turt and Talna stream) shall be applied.

Sealing of the existing levee foundation (1,500 m) of which 700 m shall be made with synthetic omega-type sheet piling with a length of 4.00 m, placed in the ground at a

depth of 3.50 m and arranged in a plane at the waterfront foot of the levee and on a length of 800 m with a clay screen at a depth of 3.50 m. The work involves taking the following steps (according to sheet 5.1.2 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- for river sections where the levee-bank shoulder exceeds 20 m:
  - excavation to a depth of 3,50 m on a section with a slope of 1:0.5;
  - reinforcing the foundation by filling it with compacted clay material in successive layers of 30 cm;
- for river sections where the levee-bank shoulder is between 5 and 20 m:
  - placing a synthetic PVC sheet piling g=7.60 mm with a height of 4.00 m at the foundation elevation of 3.50 m.

The cant of the existing levee on the left bank of the Tur River on the Turulung - Border sector is achieved by taking the following steps (according to sheet 5.1.3 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- pickling the topsoil layer over a depth of 40 cm of the terrain surface in order to ground the cant work;
- the arrangement of twinning levels in the existing structure of the levee;
- making the embankment of the levee body by filling it with compacted local material in successive layers with a thickness of 30 cm;
- application of a 20 cm thick grassy layer to the embankments and new crown of the cant levee.

Vegetated reinforcement with geogrid is achieved by taking the following steps (according to sheet 5.1.3 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- excavation of the levee embankment base on a section of 25 cm at a depth of 60 cm;
- placing at the base of the embankment a concrete beam C25/30 of size 25x60 cm and another concrete beam C25/30 of 15x40 cm on the embankment in order to fasten the geogrid;
- placing a separation/filtration geotextile layer on the embankment body;
- application of a plant layer;
- mounting the geogrid against erosion;

- fastening the geogrid against erosion and the filtration geotextile with concrete steel anchors with a diameter of 6 mm and a length of 1.00 m.

The rip-rap prism (12,135 m) shall be performed after a trapezoidal section, with a height of h=2.50 m, the slope of the embankment towards water of 1:1.25, the slope of the embankment towards the bank of 1:1.75 and the width at the crown of 1.00 m. The hardness of the stone in reinforcement shall be g≥440 kg/pcs, which shall be carefully groomed with smaller stone to avoid dislocation. For foundation, the prism shall be built buried at a depth of 75 cm. The work is achieved by taking the following steps (according to sheet 5.1.4 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- excavation of the bank and the bed in order to prepare the foundation bed for the work itself;
- application of a geotextile layer to the surface of the bank to be reinforced;
- placing the rip-rap prism g>440 kg/pcs on the geotextile protected bank.

The rehabilitation of the existing rip-rap prism shall be performed after a trapezoidal section, with a height of h=2.50 m, the slope of the embankment towards water of 1:1.25, and the width at the crown of 1.50 m. The hardness of the stone in reinforcement shall be g≥440 kg/pcs, which shall be carefully groomed with smaller stone to avoid dislocation. For foundation, the prism shall be built buried at a depth of 50 cm. The work involves taking the following steps (according to sheet 5.1.4 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- excavation of the bed in order to prepare the land for the work itself;
- filling the existing prism with rip-rap g>440 kg/pcs.

Stone masonry retaining wall h=2.50m (Turț and Talna Rivers) - 9000 m designed by a trapezoidal section, with crown width of 0.50 m, vertical interior face provided with stone and geotextile drain and 5:1 towards water, with foundation depth of 0.9-1.2 m (inclined sole) and width of 2.10 m. For the evacuation of the waters behind the wall, barbicans (Φ110mm) arranged on two rows at 1.00 m distance were provided.

Rehabilitation of the existing stone retaining walls shall be performed by filling with concrete C25/30 the degraded foundations on a depth of 80 cm under the designed thalweg. The concrete in the foundation shall be reinforced with the mesh made of OB37 Ø 8 concrete bars, 20 cm mesh, which shall be fastened to the existing foundation by means of anchors with Ø 10 diameter.

The elevation face shall be rehabilitated by maintaining its current inclination by filling with concrete C25/30 reinforced with Ø 8 mesh with 10 cm mesh. The mesh shall be fastened to the existing face by means of OB37 steel anchors with Ø 10 diameter.

The wall shall be raised to the level of the bank with reinforced concrete C25/30 and shall be made of concrete reboard with a thickness of 10 cm.

Riverbed thresholds– they are proposed to limit the depth of the piping in the riverbeds, achieving a certain longitudinal profile of the bed stabilized at required elevations, ensuring the uniformity of the slopes or the foundations' elevation for the reinforcement works.

In alignment, the weirs will be built perpendicular to the current direction, in curves they shall tilt to direct the current wires to the convex bank. The angle of inclination of the axle to the tangent to the curves shall be 20-30°. The thalweg of the Tur river bed and the tributaries is stabilized by the bottom outlets buried in the thalweg or the falls of reinforced concrete with rip-rap berm.

The **weir** section consists of spill weir and dissipating basin made of reinforced concrete and rip-rap berm. The fall of 0.4 m height is achieved from a single step with the width of the overflow beam of 0.80-1.10 m. The dissipating basin has a length of 8.00 m being made of reinforced concrete of class C25/30 of 0.30 m thickness per layer of equalization concrete of 10 cm thickness and a layer of gravel of 25 cm. The berm is 7.50 m long and consists of rip-rap g>1030 kg/pcs.

The bottom outlets shall be buried, made of anchorages g≥440 kg/pcs., with a length of 6.00 m at the level of the thalweg and a depth of 1.50 m. The arrangement of the bottom outlets in the rip-rap is achieved by taking the following steps (according to sheet 5.1.5 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- excavation of the bank and the bed in order to prepare the foundation bed for the work itself;
- application of a separation/filtration geotextile layer;
- placing a rip-rap prism g>440 kg/pcs.

Rehabilitation of the measurement section at the hydrometric station (3 pieces) shall be performed by arranging the measurement area with concrete revetment with a height of 2.50 m and a thickness of 20 cm on the banks and reinforced concrete foundation plate with a thickness of 30 cm. At the upstream and downstream ends of the channel with

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revetment, a reinforced concrete beam with a depth of 1.20 m shall be provided. Access stairs shall be rehabilitated and equipped with a handrail. The hydrometric bridge shall be rehabilitated. This is achieved by taking the following steps (according to sheet 5.1.7 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- excavation of the riverbed and bank in order to prepare the land for the work itself;
- application of a sand support layer g=10 cm;
- application of a geotextile layer to the bank;
- mounting of a revetment support beam and reinforced concrete plate C25/30;
- casting a reinforced concrete foundation plate on the bed of the riverbed g=30 cm;
- mounting of reinforced concrete revetment with Ø 8 20x20 cm mesh g=10 cm. The concrete revetment is equipped with PVC barbicans d=110 mm.

The perimeter foundation plate beam at the hydrometric station area (downstream and upstream) is achieved by taking the following steps (according to sheet 5.1.7 Riverbed-type sections of Appendix no. 3 of the Presentation memoire):

- excavation in order to prepare the land for the work itself;
- application of a sand support layer g=10 cm;
- mounting of reinforced concrete weir C25/30;
- filling with rip-rap g>440 kg/pcs behind the concrete weir;
- mounting a reinforced concrete plate with g=30 cm;
- mounting of reinforced concrete revetment with Ø 8 20x20 cm mesh g=10 cm. The concrete revetment is equipped with PVC barbicans d=110 mm.

Confluence arrangement works

The confluences with the 3 main tributaries downstream of accumulation shall be arranged by creating a stone wall revetment channel on the tributary and rip-rap prism and crushed stone foundation plate on the Tour River.

Resettlement of levees and restoration of floodplain in the following locations:

- the left bank of Tur River upstream confluence with Turt;
- 2 resettlements, right bank Tur River in the area of confluence with Hodos;
- right bank Tur River in the area of Porumbesti settlement.

The remeandering and renaturation of old bifurcations

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The remeandering and renaturation of old bifurcations of Tur River is achieved by excavating the stoppers of closing the bifurcations that interrupt the longitudinal connectivity of the river so that the path of the river follows both the current and the meanders course.

Creation of wetlands

Wetlands shall be flooded in controlled periods of high water, and flooding shall be done through the controlled discharge of existing levees.

III.6.2 Raw and auxiliary materials, energy and fuels used

Regarding the materials used, it is proposed to use flexible solutions that allow future adaptation to other calculation assumptions, being made of materials or elements that easily allow for subsequent interventions. Consequently, rip-rap prisms, levees from improved material and other systems that can be reconfigured over time, including in the context of climate change, shall be used.

The main construction materials/equipment required for the proposed works are those of the natural type, namely sand, ballast, gravel, broken stone, rip-rap and artificial vegetal soils, namely concrete and reinforcements. The artificial type materials used are: concrete beams C25/30 15x40 cm and 25x60 cm, concrete slabs C25/30 – 20 cm, concrete slabs C25/30 – 30 cm, geogrid against erorison, concrete steel anchors to fasten the geogrid and separation/filtration geotextile. Vegetative protections shall be applied to maintain ecological balance. The Table below lists the raw materials used to carry out the proposed project.

Table 2. Raw materials used and how to manage them in the proposed project

No.	Raw and auxiliary materials used	Method of use in the project	Material storage method	Estimated quantities
Călinești accumulation works				
1.	Filling soil	Earthworks at the Călinești dam, perimeter levee earthworks	Unloaded directly to the work site.	80,000 cubic meters
2.	Mechanized excavation material	Earthworks at the Călinești dam	Unloaded directly to the work site.	5,600 cubic meters

No.	Raw and auxiliary materials used	Method of use in the project	Material storage method	Estimated quantities
3.	Concrete C25/30 in support beam	Călinești dam constructions	Stored on site within the site organization or unloaded directly to the work site.	2,375 cubic meters
4.	Concrete slabs revetment C25/30-20cm	Călinești dam constructions	Stored on site within the site organization or unloaded directly to the work site.	15,035 sq m
5.	Grassed 'honeycomb' type slab revetment	Călinești dam constructions	Stored on site within the site organization or unloaded directly to the work site.	3,265 sq m
6.	Drainage layer - concrete slab revetment - 30 cm	Călinești dam constructions	Stored on site within the site organization or unloaded directly to the work site.	9,520 sq m
7.	Concrete C25/30 in breakwater beam	Călinești dam constructions	Stored on site within the site organization or unloaded directly to the work site.	1,127 cubic meters
8.	Rip-rap prism (upstream face)	Călinești dam constructions	Stored on site within the site organization or unloaded directly to the work site.	11,100 cubic meters
9.	Downstream side of dam ballasting layer / weighing down layer-rip-rap	Călinești dam constructions	Stored on site within the site organization or unloaded directly to the work site.	38,760 cubic meters
10.	Reverse filter - Downstream side of dam ballasting layer / weighing down layer	Călinești dam constructions	Stored on site within the site organization or unloaded directly to the work site.	41,860 sq m
11.	Vegetal grass layer	Dam earthworks	Unloaded directly to the work site.	5,220 sq m
Rehabilitation of Hodoș dam				

No.	Raw and auxiliary materials used	Method of use in the project	Material storage method	Estimated quantities
1.	Mechanized excavation material	Hodoș dam earthworks	Unloaded directly to the work site.	1,050 cubic meters
2.	Filling soil	Hodoș dam earthworks	Unloaded directly to the work site.	2,315 cubic meters
3.	Vegetal grass layer	Hodoș dam earthworks	Unloaded directly to the work site.	4,500 sq m
Rehabilitation of Tămășeni dam				
1.	Mechanized excavation material	Tămășeni dam earthworks	Unloaded directly to the work site.	14,400 cubic meters
2.	Filling soil	Tămășeni dam earthworks	Unloaded directly to the work site.	36,000 cubic meters
3.	Vegetal grass layer	Tămășeni dam earthworks	Unloaded directly to the work site.	46,800 sq m
4.	Concrete in the spillway	Tămășeni dam constructions	Unloaded directly to the work site.	195 cubic meters
Dimoșag polder				
1.	Plant layer resulting from pickling	Polder perimeter levee body earthworks	Unloaded directly to the work site.	36,960 cubic meters
2.	Filling material	Polder perimeter levee body earthworks	Unloaded directly to the work site.	597,000 cubic meters
3.	Vegetal grass layer	Polder perimeter levee body earthworks	Unloaded directly to the work site.	223,500 sq m
4.	Access ramps	Polder perimeter levee body earthworks	Unloaded directly to the levee access area	5 pcs
5.	Concrete access sluice	Dimosag polder constructions	Unloaded directly to the levee access area	200 m 6,680 cubic meters
6.	Concrete spillway	Dimosag polder constructions	Unloaded directly to the levee access area	1 pcs 923 cubic meters
7.	Concrete bottom outlet	Dimosag polder constructions	Unloaded directly to the levee access area	1 pcs 517 cubic meters

No.	Raw and auxiliary materials used	Method of use in the project	Material storage method	Estimated quantities
8.	Control concrete works	Dimosag polder constructions	Unloaded directly to the levee access area	1 pcs 153 cubic meters
9.	Concrete work levee protection	Dimosag polder constructions	Unloaded directly to the levee access area	200 m 1,720 cubic meters
Works on the 3 watercourses (Tour, Turț, Talna)				
1.	Excavation material in riverbed, pickling of vegetation layer and twinning levels	Works earthworks	Unloaded directly to the work site.	1,437,750 cubic meters
2.	Filling soil for levee embankment additions	levee earthworks	Unloaded directly to the work site.	2,140,000 cubic meters
3.	Access ramps	levee earthworks	Unloaded directly to the levee access area	58 pcs
4.	Vegetation protection	levee earthworks	Unloaded directly to the work site.	1,450,000 sq m
5.	Rip-rap prism	Constructions-protections against erosion	Unloaded directly to the work site.	12,135 m 82,518 cubic meters
6.	Cyclopean concrete retaining wall	Constructions-protections against erosion	Unloaded directly to the work site.	9,000 m 37,800 cubic meters
7.	Vegetation reinforcement with geogrid	Constructions-protections against erosion	Unloaded directly to the work site.	12,000 m
8.	Falling weirs	Thalweg stabilisation	Unloaded directly to the work site.	5 pcs
9.	Rip-rap bottom outlets	Thalweg stabilisation	Unloaded directly to the work site.	410 m 2,735 cubic meters
10.	Confluent arrangement with rip-rap	Thalweg and banks stabilisation	Unloaded directly to the work site.	3 pcs 687 cubic meters
11.	Sealing of levee	Compact filling earthworks	Unloaded directly to the work site.	800 m

No.	Raw and auxiliary materials used	Method of use in the project	Material storage method	Estimated quantities
	foundation with clay			7,840 cubic meters
12.	Sealing of levee foundation with sheet piling	Construction for securing of existing levees	Unloaded directly to the work site.	700 m 2,800 sq m
13.	Undercrossing the levee	Hydrotechnical constructions for discharging rainwater from equipment premises	Unloaded directly to the work site.	8 pcs

Regarding the hazard, the materials used to carry out the proposed works are of a non-hazardous nature.

For the performance of the riverbed fitting works, the following shall be used:

- bulldozers;
- shovels;
- trucks;
- compacting machines;
- concrete mixers.

Other specific equipment/machinery shall be used for the performance of the proposed works, if necessary (concrete preparation mixer, water pumps, containers, etc.).

Electricity at the performance of the works shall be provided by electric generators, no new connections shall be required. The drinking water provided shall be bottled water and the technological water shall be supplied from local sources. Heating shall be provided by electric radiators.

During the performance of the works, motor vehicles and machinery fuels and lubricants shall be used. On the investment site, there are no facilities for the storage of hazardous substances. The refuelling of vehicles, oil replacements, maintenance and repair works of vehicles and machinery shall be carried out at car fuel distribution stations and in specialized workshops.

If necessary, the machinery used in the performance of the works shall be powered by diesel fuel with approved metal tanks, and oils shall be used only for refueling. Diesel fuel and oils shall be supplied as consumption proceeds, without the need for stockpiling/warehousing.

III.6.3 Connection to existing utility networks in the area

With the completion of the works, it is not necessary to connect them to the utilities.

III.6.4 Description of the site restoration works in the area affected by the performance of the investment

Upon completion of the investment for restoring the natural environment, the following measures shall be adopted:

- bringing to the existing natural framework the river sections temporarily affected by the abolition of the temporary works, levelling the embankments and covering the excavations with local material;
- removal of all material debris from banks or riverbeds and transport of waste to authorized sites;
- in the areas of performance of direct works with flow diversion, the riverbed shall be restored to the initial stage;
- areas affected by stripping works shall be restored, by restoring the land to its original state, including restoring vegetation where it is affected, by laying a fertile soil layer on the surface and ensuring natural regeneration with local plant species.
- the land areas intended for the site organization shall be cleared and returned to the natural environment in an unaltered state.

The restoration of the land to its original state shall be progressive as the work sites close.

III.6.5 New access routes or changes to existing ones

Existing access routes shall be used for the access of the machines to the site organizations and for their penetration into the area of the work sites and 63 access ramps shall be arranged on the levee. In addition, in order to facilitate access to the Dimoșag polder, it was proposed to build a road with a length of 350 m. For access to the area of the

levees, some operational roads shall be arranged in the area between the banks and levees for a total length of approximately 11,730 m. These roads shall have a strip of land between 3.5 and 4 m and shall be made of ballast.

III.6.6 Natural resources used in construction and operation

For the performance of the proposed works and for the preparation of the necessary materials, water, broken stone, rough stone, sand, ballast, local soil/material and vegetal soil are used during the performance of the works.

III.6.7 Methods used in construction/demolition

The working methods used in the proposed works are presented below.

The hydrotechnical works foreseen in this project primarily involve important volumes of earthworks, both in terms of putting into operation and movement and transportation of important soil masses. Moreover, the necessary excavations and fillings involve digging and removal, namely the use of soils of different nature.

This project is essentially technological in nature, so it involves a very good organization in terms of starting, completing and alternating execution stages.

Tender documents for filling and material characteristics and compaction must be strictly observed when filling hydrotechnical constructions.

Main technological steps to recalibrate the riverbed

- mechanical/manual excavation with unloading in the vehicle and/or warehouse;
- transport of excavations out of the strip of land for reuse.

Main technological steps for the elevation of the existing levee and the rehabilitation of the eroded levees (new levees)

Levee elevation

- the cant shall be performed above the current crown and the outer and inner embankment at a depth of 30 cm or in the extension of the current crown on the upstream embankment, as applicable;
- removal of the vegetation of the outer embankment of bushes, shrubs, trees, felling of trees and removal of roots; removal from the new strip of land, where applicable;

- preparing the foundation terrain by bulldozer stripping the topsoil layer at a depth of 30 cm from the levee strip of land/crown, transporting it nearby for a maximum distance of 100 m in order to reuse it;
- spreading of the topsoil layer;
- careful checking of the uncovered surface; if cracks or holes are found in the body of the levee, they shall be properly sealed and compacted;
- mechanical scarification of the outer embankment and crown with the scarifier on sections and in layers (twinning levels); embankment fillings are not allowed, even if the embankment is scarified, to prevent the filling from falling due to differences in compaction degree;
- soil loading into dumpers and transporting;
- carrying out the filling to achieve the levee elevation.

Corrections, excavations and fillings

- in order to adequately achieve the profile of the levee, manual excavations and local scattering are carried out in a percentage of approximately 10% of the filling volume; no breaches (interruptions) are allowed for fillings in the levee, compaction being carried out throughout the length of the levee sector started;
- watering by tanker;
- replanting the topsoil layer - after filling, the vegetal layer resulting from stripping is spread, following prior scarification;
- compaction of the topsoil layer with sheepsfoot roller;
- leveling the crown;
- finishing the embankments;
- grass covering, with or without watering, depending on the moisture content of the plant layer.

Eroded levees completions

In order to complete the eroded levees, the following technological steps shall be carried out.

- removal of vegetation of bushes, shrubs, trees, felling of trees and removal of roots from the new strip of land;

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- preparing the foundation terrain by bulldozer stripping the topsoil layer at a depth of 30 cm from the levee strip of land/crown, loading and transporting it nearby for a maximum distance of 100 m in order to reuse it;
- spreading of the topsoil layer;
- careful checking of the uncovered surface; digging is carried out in the foundation soil (if necessary) if cracks or holes are found in the body of the levee, they shall be excavated and rebuilt followed by proper preparation and compaction;
- digging the foundation pit;
- transporting the resulting soil for a maximum distance of 100 m in order to reuse it;
- compaction of the excavation bed;
- embankment in the area of the former foundation pit;
- soil loading into dumpers and transporting;
- carrying out the filling to achieve the levee elevation.

The connection between the levees, at the ends, shall also be made by means of twinning levels.

Main technological steps to construct the bank reinforcements are:

- procurement of rough stone;
- transport to the place of putting into service; it shall be transported by means of motor vehicles over an average distance of 25 km;
- excavation for the preparation of embankments, before the reinforcement components are carried out;
- transporting the volume resulting from the excavation by dump truck to the construction site or on the banks in order to reuse it for filling, a maximum distance of 100 m;
- arrangement of the embankment where applicable by filling with local material resulting from excavation;
- laying the draining geotextile layer on the embankment and the strip of land;
- the performance and layout of the brush mattress;
- fillings shall be performed with local ballast resulting from excavation.

Main technological steps to construct the riverbed thresholds are:

- procurement of rip-rap;
- transport to the place of putting into service over an average distance of 25 km;

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- excavations in order to prepare the foundation of the work. The resulting material shall be loaded into automotive vehicles and transported over an average distance of 200 m in order to reuse it at fillings;
- laying a drainage geotextile layer;
- achievement of the rip-rap weir with a weight between 50 and 400 kg on a ballast layer of 10 cm, which rests on the above-mentioned geotextile; (the role of the ballast layer is to support the rip-rap of the weir and to avoid breaking the geotextile with the edges of the rip-rap).

III.6.8 Execution plan, comprising the construction phase, commissioning, operation, restoration and subsequent use

The construction phase of the proposed project is estimated to run over a period of 24 months. Work on sectors in protected natural areas shall be carried out outside periods of maximum vulnerability of species and habitats of Community interest, as recommended in Chapter XI of this documentation. Călinești accumulation lake shall be emptied by machining, during the period October 1 – February 28, for as short a period as possible. This shall be followed by the performance of works on the dam during the period March 1 – September 30, after which the accumulation shall be filled starting October 1, for as short a period as possible.

During the operation period, the exploitation and maintenance of the structural and non-structured works carried out under the project shall be performed by Someș-Tisa Basin Administration and carried out through its specialized operating structures: the Flood Protection Compartment, the Basin Forecast Service, Hydrology, Hydrogeology within Someș-Tisa Water Basin Administration, as well as the Satu Mare Water Management System.

If during the operation of the works, standardized from 16-24 years in the case of levees and up to 40-60 years in the case of the dam, degradation processes or signs of wear are reported, steps shall be taken to restore them, so that the possible impact of their degradation on environmental factors is prevented or remedied.

III.6.9 Relationship to other existing or planned projects

The works proposed by the proposed project complement the existing flood protection infrastructure at the level of the Tur water course and its tributaries on the surface of the 15 administrative-territorial units. The purpose of proposing these measures is to ensure the protection of the urban population at water flow rates with the probability of exceeding 0.5% in the urban environment and 1% in the rural environment, respectively. The detailed analysis of the alternatives considered and the reasoning that led to the choice of the optimal fit out alternative are described in the following sub-chapter.

From a spatial point of view, the area covered by the works largely overlaps with protected natural areas, so that the proposed measures to manage excess flood flows have been designed in a way that does not conflict with the conservation objectives of species and habitats of national and Community interest. Consequently, some of the measures proposed by the project are green infrastructure works with benefits to wild flora and fauna and which support the management measures proposed by the integrated management plan of the protected natural areas with which the project overlaps. Once exhausting the green infrastructure measures, the project was complemented by structural flood protection works, the vast majority on areas already arranged with works (existing levees).

On the Tur water course are also located a series of fisheries, namely the Bercu Nou fishing facility and the Adrian fishing facilities, Călinești accumulation being also used for fishing purposes. At the same time, downstream of the Calinesti accumulation, the Calinesti-Oaș Small Power Hydroelectric Power Plant is arranged, with an installed power of 655.8 kW. Due to fluctuations in flows during the performance of the works there is a possibility that fishing and hydropower activities may be affected over certain periods of time. Prior to starting the works, the potentially affected factors shall be announced during the development of the project in order to identify optimal solutions regarding the management of water flow fluctuations. The cumulative impact of the proposed project with other projects is presented in subchapter VI.10.

III.6.10 Details of alternatives that have been considered

Three alternatives were considered in the implementation of the proposed project, so as to ensure flood protection at a calculation flow rate with the probability of exceeding 1%

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for the rural environment and 0.5% for the urban environment, respectively. In the Table below, the proposed measures are presented in each of the three design variants studied.

Table 3. Alternatives considered when carrying out the project

Alternative 0	Alternative 1	Alternative 2	Alternative 3	Alternative 4
No action	Rehabilitation and securing of the Călinești dam	Rehabilitation and securing of the Călinești dam	Rehabilitation and securing of the Călinești dam	Rehabilitation and securing of the Călinești dam
	Rehabilitation and securing of the Tămășeni dam	Rehabilitation and securing of the Tămășeni dam	Rehabilitation and securing of the Tămășeni dam	Rehabilitation and securing of the Tămășeni dam
	Rehabilitation and securing of the Hodoș dam	Rehabilitation and securing of the Hodoș dam	Rehabilitation and securing of the Hodoș dam	Rehabilitation and securing of the Hodoș dam
	Building of non-permanent Dimoșag accumulation (polder) with V=17.9 mil. m3	Building of non-permanent Dimoșag accumulation (polder) with V=20.15 mil. m3	Building of non-permanent Dimoșag accumulation (polder) with V=19.80 mil. m3	Building of non-permanent Dimoșag accumulation (polder) with V=22.7 mil. m3
	Building of non-permanent Turț accumulation with V=4.1 mil. m3		Building of non-permanent Turț accumulation with V=4.1 mil. m3	
	Building of non-permanent Brada accumulation with V=2.34 mil. m3	Building of non-permanent Brada accumulation with V=2.34 mil. m3		
	Building of non-permanent Negrești accumulation with V=2.0 mil. m3			
	Creating a wetland on the right bank in the area of Gherța Mică	Creating a wetland on the right bank in the area of Gherța Mică	Creating a wetland on the right bank in the area of Gherța Mică	Creating a wetland on the right bank in the area of Gherța Mică
	Restoring the floodplain and creating a wetland on the left bank upstream of the	Restoring the floodplain and creating a wetland on the left bank upstream of the	Restoring the floodplain and creating a wetland on the left bank upstream of the	Restoring the floodplain and creating a wetland on the left bank upstream of the

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Alternative 0	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	confluence with Turț, S=0.8 km2	confluence with Turț, S=0.8 km2	confluence with Turț, S=0.8 km2	confluence with Turț, S=0.8 km2
	Restoring the floodplain and creating two wetlands on the right bank in the area of the confluence with Hodoș, S=1.9 km2	Restoring the floodplain and creating two wetlands on the right bank in the area of the confluence with Hodoș, S=1.9 km2	Restoring the floodplain and creating two wetlands on the right bank in the area of the confluence with Hodoș, S=1.9 km2	Restoring the floodplain and creating two wetlands on the right bank in the area of the confluence with Hodoș, S=1.9 km2
	Creating a wetland on the right bank upstream of the border, S=2.4 km2	Creating a wetland on the right bank upstream of the border, S=2.4 km2	Creating a wetland on the right bank upstream of the border, S=2.4 km2	Creating a wetland on the right bank upstream of the border, S=2.4 km2
	Reconnection and renaturation of the dead bifurcations of Tur river, downstream of Călinești accumulation, S=0.5 km2	Reconnection and renaturation of the dead bifurcations of Tur river, downstream of Călinești accumulation, S=0.5 km2	Reconnection and renaturation of the dead bifurcations of Tur river, downstream of Călinești accumulation, S=0.5 km2	Reconnection and renaturation of the dead bifurcations of Tur river, downstream of Călinești accumulation, S=0.5 km2
	Fitting work of the riverbed	Fitting work of the riverbed	Fitting work of the riverbed	Fitting work of the riverbed
	Impoundment work	Impoundment work	Impoundment work	Impoundment work
	Cants of existing levees	Cants of existing levees	Cants of existing levees	Cants of existing levees
	Levee undercrossings with flap gates and sluiceway DN800	Levee undercrossings with flap gates and sluiceway DN800	Levee undercrossings with flap gates and sluiceway DN800	Levee undercrossings with flap gates and sluiceway DN800
	Bank reinforcements	Bank reinforcements	Bank reinforcements	Bank reinforcements

From the point of view of the environmental criteria considered, the comparative analysis of the alternatives studied from the point of view of the effects on the environment is shown below. The score of *alternatives has been awarded in accordance with Appendix 8. Guide for the development of the feasibility study for flood risk management projects*, related to the Applicant's Guide to SO 5.1 Reducing the effects and damage to the

population caused by natural phenomena associated with the main risks posed by climate change, mainly flooding and coastal erosion.

Table 4. Analysis of alternatives against relevant environmental targets

Environmental objective	Indicator	Analysis of studied alternatives				
		A0	**A1**	**A2**	**A3**	**A4**
Compliance with objectives of the Water Framework Directive	Number of water bodies at risk of not achieving good ecological status due to hydro-morphological pressures (in terms of flood risk management)	Lack of constraints in meeting water body objectives.	Lack of constraints in meeting water body objectives.	Lack of constraints in meeting water body objectives.	Lack of constraints in meeting water body objectives.	The option contributes in the long term to achieving water body objectives with negligible short-term impact managed through mitigation measures under the Water Framework Directive.
Flood risk reduction of water catchment areas for human consumption	Number and importance of catchment areas at risk of flooding	Flood risk for water catchments shall not be reduced/eliminated.	Reduction or elimination of flood risk for more than 5 water catchments or for a major area of a supply system serving a large population.	Reduction or elimination of flood risk for more than 5 water catchments or for a major area of a supply system serving a large population.	Reduction or elimination of flood risk for more than 5 water catchments or for a major area of a supply system serving a large population.	Reduction or elimination of flood risk for more than 5 water catchments or for a major area of a supply system serving a large population.

Environmental objective	Indicator	Analysis of studied alternatives				
		A0	A1	A2	A3	A4
Reducing the risk of flooding to potential sources of pollution	Number of areas covered by the Industrial Emissions Directive (96/61/EC), the IPPC Directive, the Seveso II Directive (97/271/EEC), the Seveso II Directive (96/82/EC) that are at risk of flooding	Flood risk for potential sources of pollution shall not be reduced/eliminated and such objectives shall not apply in the project area.	Flood risk for potential sources of pollution shall not be reduced/eliminated and such objectives shall not apply in the project area.	Flood risk for potential sources of pollution shall not be reduced/eliminated and such objectives shall not apply in the project area.	Flood risk for potential sources of pollution shall not be reduced/eliminated and such objectives shall not apply in the project area.	Flood risk for potential sources of pollution shall not be reduced/eliminated and such objectives shall not apply in the project area.

Environmental objective	Indicator	Analysis of studied alternatives				
		A0	A1	A2	A3	A4
Compliance with the objectives of the Habitats Directive	No significant damage or alteration to habitats/species that are listed in the Habitats Directive or in sites Natura 2000	No significant damage or alteration to habitats/species that are listed in the Habitats Directive or in sites Natura 2000	Negative impact for the SCI and the SPA or at the level of the natural area of national interest declared at national level, including a delay in the site improvement process, but without impact on its conservation objectives as a result of flood risk management measures, which are technically feasible and for which impact mitigation measures are applied.	Negative impact for the SCI and the SPA or at the level of the natural area of national interest declared at national level, including a delay in the site improvement process, but without impact on its conservation objectives as a result of flood risk management measures, which are technically feasible and for which impact mitigation measures are applied.	Negative impact for the SCI and the SPA or at the level of the natural area of national interest declared at national level, including a delay in the site improvement process, but without impact on its conservation objectives as a result of flood risk management measures, which are technically feasible and for which impact mitigation measures are applied.	Negative impact for the SCI and the SPA or at the level of the natural area of national interest declared at national level, including a delay in the site improvement process, but without impact on its conservation objectives as a result of flood risk management measures, which are technically feasible and for which impact mitigation measures are applied.

Environmental objective	Indicator	Analysis of studied alternatives				
		A0	A1	A2	A3	A4
Avoid changing conservation status to a lower class/ Maintain or improve conservation status in the river basin	Change of conservation status of nationally protected species and habitats to a lower class	No change in the conservation status of nationally protected species and habitats to a lower class, possibly slight degradation of Riparian habitats in coastal erosion areas.	Negative impact on the existing conservation status of natural protected areas as a result of flood risk management measures, which are technically feasible and for which impact mitigation measures are applied.	Decreases in biodiversity or changes in flora/fauna during the development of the project.	Decreases in biodiversity or changes in flora/fauna during the development of the project.	Decreases in biodiversity or changes in flora/fauna during the development of the project.

Environmental objective	Indicator	Analysis of studied alternatives				
		A0	A1	A2	A3	A4
Protection and, where possible, enhancement of fishery resources in the river basin	Maintenance and, if possible, creation of new fisheries habitats, including maintenance or improvement of conditions allowing upstream migration of fish species	Maintenance of fishing habitats, including maintenance of conditions allowing upstream migration of fish species.	Medium- and long-term impact for the fishing habitat	Limited and short-term impact for the fishing habitat.	Limited and short-term impact for the fishing habitat.	Limited and short-term impact for the fishing habitat.

Following the multicriteria analysis of the alternatives studied within the studied project, it resulted that alternative 4 is the most suitable to meet the project objectives, namely flood protection at a calculation flow rate with the probability of exceeding 1% for rural settlements downstream of Călinești accumulation, respectively 0.5% for the urban environment, but also environmental objectives.

Moreover, within the approved alternative of the project, several variants of achieving the rip-rap prism were analyzed, being one of the works that would have the potential to create the highest impact. The prism is proposed to be carried out in the ecotone area (bank-thalweg water course). Negative or positive effects shall be encountered in both environments, so they can affect a wider variety of species than if located in one of the environments.

Consequently, the following variants were analyzed:

- Classic rip-rap prism;
- Rip-rap prism placed on the brush mattress and geomembrane;
- Vegetated rip-rap prism.

The analysis also highlighted benefits, but also certain constraints that may make some variants more viable than others.

The classic rip-rap prism requires a longer period of renaturation, while there is also a chance of invasive species. There is a possibility that grassy species may occur first, and woody species may occur later. The cost of achievement is the lowest.

The rip-rap prism placed on the brush mattress and geomembrane has the highest costs, but it also requires less time to install vegetation. The resulting wood vegetation shall be mainly represented by willow species with the characteristics of a monoculture. It requires a large amount of plant material harvested from natural habitats. Costs are the highest of the options. It also involves the installation of non-degradable materials in the prism structure. The area affected by the type of work is larger, so the associated negative impact is higher.

Vegetated rip-rap prism creates the premises for the emergence of a Riparian habitat represented by various woody and implicitly grassy species. The amount of wood material needed to plant the prism is much smaller than in the previous prism. The affected area of land is smaller, so the related negative impact is smaller (compared to the previous prism variant). The disadvantage of the variant is the high probability of vegetation drying out due to the constant lack of water/moisture in the soil. To prevent the problem, various ways of achieving the prism can be found: by means of the geomembrane placed in a configuration that allows the maintenance of a quantity of water, the shoots founded in the

natural terrain (under prism) or thalweg, the arrangement of areas among the boulders with soil in which the shoots are installed.

Following the analysis, we recommend the development of a plant rip-rap prism, in which the wood plant material shall be represented by different Riparian species from local sources, adapted to the local climate and conditions. Further details on this type of work (species, consistency, periods, shoots arrangements, etc.) shall be mentioned in the appropriate assessment study and environmental impact report.

III.6.11 Other activities that may occur as a result of the project

Once the execution phase of the shall will be completed, the works proposed by the project shall be built and contribute to:

- halting shore erosion in areas where there have been major erosions endangering the safety of coastal communities;
- the protection of coastal communities, housing and other social objectives by the cant of existing levees;
- improving transit capacity through the punctual removal of obstacles and deposits in riverbeds.

Frequent flooding of land areas covered by designated wetlands could lead over time to the development of new ecosystems and to increased ecological value in the area affected by the project. In cases of good practice fostered at European level, it was noted that the development of wetlands contributed, through an integrated vision and with the support of the local administration and the population, to the economic revitalization of the area where this measure was adopted and to the shaping of tourist attractions. Of course, this was not an immediate benefit of the adoption of this measure, but rather a medium and long term one.

III.6.12 Other opinions and agreements required for the project

The steps to regulate the conditions under which the proposed project shall be carried out started with the request of the Town Planning Certificate on the areas covered by the target area.

Whereas the works covered by this documentation overlap with the protected area of national interest VII.10 Tur River, with the site of community interest ROSCI0214 Tur River and with the special bird protection area ROSPA0068 Lower Tur Meadow, by decision of the initial evaluation stage no. 354/April 11, 2019 (Appendix no. 1) the opinion of the custodian and the National Agency for Protected Natural Areas was requested.

In order to obtain the Building Permit for the proposed project, in addition to the regulatory act in the field of environmental protection, the issued Town Planning Certificate requested and obtained the approvals of the town halls of the administrative-territorial units on whose territory the project is carried out, namely the approvals or agreements of the following institutions:

1. Ministry of Interior – Ministry of National Defence – Romanian Intelligence Service;
2. General Staff;
3. National Company of Administration of Road Infrastructure;
4. 'Romanian Waters' National Administration;
5. S.N. C.F.R. Romanian National Railway;
6. Transgaz;
7. Ministry of Culture and National Identity;
8. Transelectrica;
9. Ministry of Agriculture and Rural Development;
10. National Agency for Land Improvements;
11. Administrators of the following subsystems: county road, communal road, operating road, streets, fiber optic and telephone networks, electricity networks, natural gas distribution networks, water and sewerage networks;
12. Agreement of State Inspectorate in Constructions;
13. Agreement of the landowners affected by the proposed works.

Currently, steps are being taken to obtain all the permits and agreements required by the Town Planning Certificate related to the proposed project.

IV. DESCRIPTION OF DEMOLITION WORKS REQUIRED

Not applicable.

V. DESCRIPTION OF THE LOCATION OF THE PROJECT

Tur is a tributary of Tisa and falls with its entire river basin in Satu Mare County. Tur springs from the Igniș Mountains and crosses the mountainous area with high slopes sometimes reaching 20‰, then the lowland of Oaș, with slopes around 2-8‰ and downstream of the confluence with the Rea Valley penetrates the Western Plain, where the slope of the river decreases to 0.1‰. This is where the riverbed becomes unstable, splitting into several bifurcations, to the confluence with Turţ, from where it is impounded. It takes the first order tributaries, the Rea Valley on the right, Talna and Racșa on the left.

The proposed location of the project is delimited to the west by the Oaș Country Depression, extending along the Tur course and its tributaries on the sector of the Livada Plain, a subdivision of the Someș Low Plain with altitude ranges between 101 and 150 m up to the western border. The boundaries of the site of the project and the land areas occupied by the proposed works through the project stem from the overall plan and the site plans of the project (Appendices no. 4 and no. 5).

From an administrative point of view, the proposed project extends over the area of 15 administrative-territorial units in Satu Mare County, according to the Town Planning Certificate no. 4/March 18, 2019 (Appendix no. 2 of this documentation), as follows:

1. Călinești-Oaș Commune;
2. Turulung Commune;
3. Turț Commune;
4. Gherța Mică Commune;
5. The town of Livada;
6. Agriș Commune;
7. Micula Commune;
8. Halmeu Commune;
9. Lazuri Commune;
10. Porumbești Commune;
11. Bătarci Commune;
12. Orașul Nou Commune;
13. Racșa Commune;
14. Vama Commune;

15. Negrești-Oaș Town.

The development site plan of the project including the location of the project site is presented in Appendix no. 5 of the Presentation memoire.

V.1 Distance to borders

The location of the proposed works is in proximity to the north-western border of the country with Ukraine and in proximity to the border area with the Republic of Hungary. Works on the cant of the levee on the right bank of the Tur River end at a distance of approximately 750 m from the border with Ukraine, and works on the cant of the levee on the left bank of the Tur River follows the border with Ukraine at a distance of approximately 1,000 m. As regards proximity to the border with the Republic of Hungary, the cant of the levee on the left bank of the Tur River is carried out at a distance of approximately 2,700 m from the border. With regard to the works in the riverbed, the nearest low weir and the related bank reinforcements are proposed at a distance of approximately 1,000 m in a straight line, respectively 1,700 m on the water course from Ukraine and 2,700 m in a straight line and 5,000 m on the water course from the border with the Republic of Hungary.

V.2 Location of the site in relation to the cultural heritage

Regarding the location of the proposed project in relation to the cultural heritage, the following historical monuments are located in the settlements in the vicinity of the water courses on which the proposed works shall be carried out:

Table 5. List of historical monuments located in the proposed project area

No.	LMI/RAN code	Name	Settlement	Address	Date
1.	SM-I-s-A-05193	Archaeological site of Remetea Oașului, 'Malu Turului' point	Remetea Oașului Village, Orașu Nou Commune	'Malu Turului'	
2.	SM-I-m-A.051193.01	Settlement	Remetea Oașului Village, Orașu Nou Commune	'Malu Turului'	Paleolithic (Gravettian)
3.	SM-I-m-A.051193.02	Settlement	Remetea Oașului Village, Orașu Nou Commune	'Malu Turului'	Paleolithic (Aurignacian)

No.	LMI/RAN code	Name	Settlement	Address	Date
4.	SM-I-m-A.051193.03	Settlement	Remetea Oașului Village, Orașu Nou Commune	'Malu Turului'	Paleolithic (Mousterian)
5.	SM-I-s-B-05198	Archaeological site of Turulung, 'Dealu pustiu, Turulung' point	Turulung Village, Turulung Commune	'Dealu pustiu'	
6.	SM-I-s-B-05198.01	Settlement	Turulung Village, Turulung Commune	'Dealu pustiu'	Sec. VI-VII
7.	SM-I-s-B-05198.02	Settlement	Turulung Village, Turulung Commune	'Dealu pustiu'	Sec. II-III p. Chr.
8.	SM-I-s-B-05198.03	Settlement	Turulung Village, Turulung Commune	'Dealu pustiu'	Neolithic
9.	SM-I-s-B-05199	Settlement	Turulung Village, Turulung Commune	'Canton'	Bronze Age
10.	SM-II-m-B-05295	Grigor's House of Mărcuț Iacob	Călinești-Oaș Village, Călinești-Oaș Commune	331A	1727
11.	137238.01	Archaeological site of Călinești-Oaș - Hurca Hill	Călinești-Oaș Village, Călinești-Oaș Commune		Paleolithic (Gravettian)
12.	SM-II-m-B-05310	'Nativity of the Virgin' Church	Gherța Mică Village, Gherța Mică Commune	Str. Principală 598	1873
13.	SM-II-a-A-05337	Ethnographic Museum of Oaș Country (outdoor section)	Negrești-Oaș Town	Str. Livezilor 3-5	Sec. XIX
14.	SM-II-m-B-05338	'Nativity of the Virgin' Church	Negrești-Oaș Town	Str. Livezilor 2	1848
15.	SM-II-m-B-05351	'Nativity of the Virgin' Church	Racșa Village, Racșa Commune	Str. Principală 340	1858
16.	138404.01	Paleolithic settlement from Racșa-La Cremene. On the village pasture	Racșa Village, Racșa Commune		Paleolithic
17.	SM-II-m-B-05364	'St. Arhangheli Mihail și Gavriil' Church	Turț Village, Turț Commune	Str. Călinețe 240	1836
18.	SM-II-m-B-05365	Perenyi Castle, currently elementary school	Turulung Village, Turulung Commune	Str. Podului 23	Sec. XVIII, transf. 1848
19.	SM-II-m-B-05366	'Virgin Mary' Church	Turulung Village, Turulung Commune	Str. Principală 17	Sec. XVIII
20.	SM-II-m-B-05367	Reformed Church	Turulung Village, Turulung Commune	Str. Principală 18	Sec. XVIII
21.	SM-II-m-B-05373	'St. Arhangheli Mihail și Gavriil' Church	Vama Village, Vama Commune	Str. Principală 709	1840

In general, the sites of works execution are a significant distance from the heritage objectives, therefore the achievement of the proposed project does not have a potential significant negative impact on the above-mentioned elements. In the event that the work sites are located in the vicinity of the heritage objectives, it shall be considered that the performance of the works does not cause disturbances thereon.

V.3 Maps, site photographs that can provide information on the physical characteristics of the environment, both natural and artificial

The development site plan attached to the Presentation memoire presents the territorial distribution of the works proposed by the project.

The visual and aesthetic value of the landscape is given by the combination of structuring factors, namely relief, climate, hydrography, vegetation, fauna, anthropogenic factor. The landscape in the project area is characteristic of meadow and plain areas. Although this landscape is now heavily anthropogenic in some places, areas with very diverse mosaic landscapes, forests, meadows and wetlands are still preserved. Downstream of the Calinesti dam, the land has a low relief energy, and anthropogenic interventions are represented by the levees that protect the settlements in the vicinity of the water course. Increasing the anthroponization level reduces the landscape value in the area, one of the major challenges of the project being the performance of flood protection works in light of preserving or improving the visual and aesthetic value of the landscape, especially as the area is located in a territory with protection status. Outside the impounded area, vegetation is conditioned by existing farming practices and land improvements, the landscape is characterized by the geometry of the cultivated plots.

Pictures of the sites on which the proposed works shall be performed are presented below. They reflect the current state of the sites and justify the necessity of the proposed works:

Table 6. Pictures of proposed sites for works

Site proposed for development	Photos
Dam area	
	

Site proposed for development	Photos
Spillway area	

Site proposed for development	Photos
Levee area	
Floodplain	

Site proposed for development	Photos
Eroded bank proposed for reinforcement	
	

Site proposed for development	Photos
Eroded bank proposed for reinforcement	
ANIF channel area in the proposed area for the polder	

Site proposed for development	Photos
Proposed polder area	
Tămășeni non-permanent accumulation area	

The geographical coordinates of the STEREO 1970 digital projection system site are attached hereto.

VI. DESCRIPTION OF ALL POSSIBLE SIGNIFICANT ENVIRONMENTAL EFFECTS OF THE PROJECT, TO THE EXTENT OF THE INFORMATION AVAILABLE

The proposed project is likely to produce, by its nature, a negative impact on the environmental factors, especially in the stage of the execution of works, but also a positive impact, once the execution of works is completed. This chapter lists potential sources of pollution of environmental factors and identifies the main measures to prevent and mitigate impacts on environmental factors. It is mentioned that all proposed measures shall be adopted at the level of each site and at the level of each site organization arranged during the implementation of the proposed project.

VI.1 Water quality protection

This sub-chapter aims at identifying sources of pollution of the environmental factor water, identifying plants for the treatment or pre-treatment of water and, respectively, measures to prevent or reduce the impact on the environment.

By its nature, the proposed project has a potential significant impact on the water body. In order to assess the magnitude of the impact of the project and how it is related to the achievement of the objectives of the Water Framework Directive, *the Water Impact Assessment Study* for the proposed project is being prepared.

VI.1.1 Sources of pollutants for waters, place of discharge and emissary

During the performance of the works, the element most exposed to impact is represented by the morphology of the riverbed. Thus, the water bodies undergo morphological changes due to the works proposed in the riverbed. At the same time, the physicochemical parameters of water such as temperature and turbidity can be affected during the investment, and upon completion of the works, they shall gradually return to their original state.

In the investment implementation phase, the sources of pollution of surface and groundwater are as follows:

- improper storage of raw materials used in the implementation of the investment;

- leakage of oils and fuels from the operation of emergency equipment in case of breakdowns;
- improper storage of technological waste that may contaminate the environmental factor water and alter the physicochemical properties of the water component;
- inadequate location or damage to sanitary containers within the site organization.

In the investment operating phase, the sources of pollution of surface and groundwater are as follows:

- any damage to the works carried out and intervention activities to remedy the damage.

VI.1.2 Plants for the treatment or pre-treatment of water

During the investment period, no wastewater treatment or pre-treatment facilities shall be used, and this is not necessary when commissioning the performed works and on the date of their operation. There is a water quality monitoring network on the project area.

VI.1.3 Measures to prevent/reduce impact

In order to prevent and reduce the impact **on the environmental factor water during the investment period**, the following measures shall be taken:

- periodic checking of the operating condition of the machines in order to avoid any malfunctions;
- proper management of raw materials, compliance with storage areas (outdoor storage, indoor storage) depending on the physical state of the materials used and the potential impact on the environment;
- arrangement of the platforms/spaces for the storage of the resulting waste (household waste, metal waste, geotextile foil), so as to avoid contact with the water component;
- maintenance and upkeep in a clean and permanently functional condition of sanitary containers.

At the same time, in order to minimize the impact on water bodies, it is recommended that the onshore work sites should not exceed 100 m and those in the riverbed should not exceed 50 m.

In terms of its character, the impact associated with these sources of pollution is direct, potentially negative, short- and medium-term, reversible, low in complexity and extent and with increased likelihood of occurrence.

In order to prevent and reduce the impact **on the environmental factor water during the investment operating period**, the following measures shall be taken:

- rapid intervention and urgent remedy of damage situations of flood protection works;
- periodic monitoring of the operating condition of the performed works in order to intervene as promptly as possible in the event of degradation.

In terms of its character, the impact associated with these sources of pollution is direct, potentially negative, short-term, reversible, low in complexity and extent and with decreased likelihood of occurrence.

In the framework of the Impact Assessment Study on water bodies, which is being developed, the impact assessment of the proposed project on the status of water bodies shall be carried out and measures to mitigate the potential impact shall be established.

VI.2 Air protection:

Under this subchapter, sources of air pollution are inventoried during the investment, systems for the containment and dispersion of air pollutants are described and measures are proposed to prevent/reduce the impact.

VI.2.1 Sources of pollution for air, pollutants including sources of odours

Within the analyzed project, there is a potential impact on the environmental factor air **in the investment implementation phase**, the potential sources of air pollution being as follows:

- emissions of gases from automotive traffic generated by the supply of raw materials to the facility and their handling on the site of the project;
- coagulation of fine particles in the atmosphere due to digging work, passage of excavated soil and handling of raw materials on site;
- gas emissions from potential leaks from pressure vessels (acetylene).

The impact associated with these sources of pollution is indirect, potentially negative, short-term, reversible, low in complexity and extent and with decreased likelihood of occurrence.

Within the analyzed project, there is a potential impact on the environmental factor air **in the investment operating phase**, the potential sources of air pollution being as follows:

- emissions of gases and the formation of particulate matter resulting from automotive traffic generated as a result of maintenance or intervention activities in case of breakdowns.

Regarding the nature of the impact associated with these sources of pollution, it is indirect, potentially negative, short-term, reversible, low in complexity and extent and with decreased likelihood of occurrence.

VI.2.2 Systems for the containment and dispersal of pollutants in the atmosphere

Both in the investment implementation phase and in the investment operating phase, no systems shall be used to contain and disperse pollutants into the atmosphere.

VI.2.3 Measures to prevent/reduce impact

During **the investment implementation period**, the following preventive measures shall be taken:

- clear delimitation of the work performance areas;
- reducing the travel speed of transport vehicles at the entrance to the site;
- spraying water on site to avoid coagulation of fine dust in the atmosphere (in case of dry summers);
- proper storage of powdered waste to avoid coagulation into air masses;
- as a preventive measure, the exclusive use of ISCIR [State Inspection for the Control of Boilers, Pressure Vessels and Hoisting Equipment] verified acetylene containers shall be considered.

During **the investment operation period**, the following measures shall be taken in order to eliminate sources of air pollution:

- reducing the travel speed of transport vehicles used in maintenance activities;

– carrying out maintenance works with machinery of reduced capacity.

VI.3 Protection against noise and vibration

Under this subchapter, sources of noise and vibration associated with the investment are inventoried, facilities and equipment for protection against noise and vibration are described and measures are proposed to prevent/reduce the impact associated with noise and vibration.

VI.3.1 Sources of noise and vibration

Regarding the proposed project, the main sources of noise and vibration are those during **the performance of the works** and are related to the machinery used at this stage (excavators, dumpers, etc.). Noise and vibration generating activities are:

– on-site transportation of the raw material needed to implement the investment;
– handling construction materials, unloading and storing them on site;
– the works carried out on the work sites (excavation of the soil, consolidation works, cant of the levee, lead to increased noise level in the site area);
– compaction of soil and soil deposited in road damping and cant works.

Machinery used and related acoustic power:

– bulldozer Lw ≈ 100 dB(A);
– excavator Lw ≈ 104 dB(A);
– dumper Lw ≈ 107 dB(A);
– concrete mixers Lw ≈ 95 dB(A);
– compactor Lw ≈ 105 dB(A).

The noise level is regulated by STAS, rules for various types of machinery, vehicles, industrial premises, etc., depending on the nature and type of noise. The maximum permissible limits on the basis of which the acoustic state of the environment is assessed are specified in STAS 10009-88 'Urban acoustics - Permissible limits of noise level'. This STAS also lays down restrictions on the operation of heavy machinery. For the intended objective, the noise produced by the machinery and vehicles to be used for on-site

operations shall fall within the following limits: 65 dB at the enclosure limit and 90 dB inside the enclosure, respectively.

The potential impact associated with these sources of pollution is direct, potentially negative, short-term, reversible, low in complexity and extent and with increased likelihood of occurrence.

During **the investment operating period**, the main sources of noise and vibration shall be:

- traffic of vehicles used in intervention activities in emergency situations;
- operation of intervention machinery in failure situations.

In terms of its character, the impact associated with these sources of pollution is direct, potentially negative, short-term, reversible, low in complexity and extent and with increased likelihood of occurrence.

VI.3.2 Arrangements and fittings for protection against noise and vibration

Regarding protection against noise and vibration, no special arrangements shall be made. Consideration shall be given to the adoption of preventive measures, described below.

VI.3.3 Measures to prevent/reduce impact

The main measures to prevent and mitigate noise and vibration **during the implementation of** the proposed project are:

- use of machinery equipped with acoustically shielded engines;
- performing activities only during daytime;
- handling of construction materials (pipelines and other materials) under increased attention, especially at their unloading operations;
- limiting the speed of transport equipment to reduce noise and vibration levels on sites and in the vicinity.

Upon completion of the works, noise sources shall be removed from the sites.

The main measures to prevent and mitigate noise and vibration during **the operating period of** the investment are:

- limiting the speed of vehicles to reduce noise and vibration levels on sites and in the

vicinity;

- use of machinery equipped with acoustically shielded engines.

VI.4 Radiation protection

Not applicable.

VI.5 Soil and subsoil protection

Under this subchapter, sources of soil and subsoil pollution associated with the investment are inventoried, works and equipment for soil and subsoil protection are described and measures are proposed to prevent/reduce the impact on the soil and subsoil.

VI.5.1 Sources of pollutants for soil, subsoil groundwater and deep water

During **the investment implementation period**, soil and subsoil may be affected as a result of:

- the performance of excavation works for the preparation of banks for the building of cants, bank reinforcements and the laying of the low weirs;
- spills of oil products from machinery used on site;
- contact of the resulting technological waste with the edaphic component.

Direct contact with the soil produces a change in its physicochemical properties and changes in the biotic activity in the edaphic layer may occur.

Oil products (diesel, mineral oils) may leak on site from the engines of vehicles transporting construction materials. In case of inappropriate storage directly on the soil, the resulting waste (packaging waste, household waste) may impair the quality of the soil and subsoil.

The quantities of excessive soil from the works carried out on the banks or in the riverbed shall be used for the greening works on site and filling works for cants and impoundment. The fertile soil shall be stored separately from the infertile soil, from which it shall subsequently be reused to restore the area and restore it to its original state. The surplus land shall be stored in areas approved by the local authorities.

The impact associated with these sources of pollution is direct, potentially negative, short-term, reversible, low in complexity and extent and with increased likelihood of occurrence. Physical changes resulting from the performance of the works have a direct, reversible, low impact in complexity, with high extent and likelihood of occurrence.

During the investment implementation period, soil and subsoil may be affected as a result of:

- degradation over time of the works can lead to the decomposition of the materials from which they are made (e.g. concrete structures) and contamination of the soil environment;
- potential spills of oil products from vehicles and machinery used for intervention in failure situations;
- execution of intervention works for possible damage situations.

The impact associated with these sources of pollution is direct, potentially negative, short-term, reversible, low in complexity and extent and with decreased likelihood of occurrence.

VI.5.2 Soil and subsoil protection works and equipment

Regarding the protection of soil and subsoil, no special works and arrangements shall be made. Consideration shall be given to the adoption of preventive measures, described below.

VI.5.3 Measures to prevent/reduce impact

In order to reduce and prevent the impact on the soil and subsoil during **the investment implementation period**, the following measures shall be taken:

- arrangement of the platforms/spaces for the storage of the resulting waste (household waste, metal waste, PVC tubes, etc.), so as to avoid contact with the edaphic component;
- avoiding contact of oil products (diesel, mineral oils) with the soil, subsoil, by periodically checking the operating condition of the machinery and equipment used, and in the event of such leaks, taking measures to remove pollution (spreading

sawdust to prevent soil infiltration, excavation of contaminated soil and disposal through specialized and authorized companies).

In order to reduce and prevent the impact on the soil and subsoil during **the investment operating period**, the following measures shall be taken:

- rapid intervention in the event of damage to the works carried out by the project so that they do not reach an advanced state of degradation and contaminate the environment;
- avoiding contact of oil products (diesel, mineral oils) with the soil, subsoil, by periodically checking the operating condition of the machinery and equipment used;
- in the event of such leaks at the intervention machinery, taking measures to remove pollution (spreading sawdust to prevent soil infiltration, excavation of contaminated soil and disposal through specialized and authorized companies).

VI.6 Protection of terrestrial and aquatic ecosystems

The project is located in the northwest of the country, in an overlapping natural area with 3 protected natural areas: ROSPA0068 Lower Tur Meadow, ROSCI0214 Tur River and nature reserve VII.10 Tur River. Depending on the total number of works and their magnitude, it can be said that around 85% of the total volume of works shall be carried out in the territory of the 3 protected areas. The remaining 15% are not on the territory of protected natural areas, but overlap with wild or anthropogenic (defined urban area) areas, as applicable. It should be noted that the works and their impact on **biodiversity in protected natural areas shall be dealt with in Chapter XI. Information on the relationship of the project with protected natural areas – elements of biodiversity**.

As such, the areas outside the protected natural areas are located to the north and south in the project area, on the territory of the ATUs of Orașu Nou, Racșa, Vama and Negrești-Oaș (south), namely UAT Turulung, Turț, Halmeu and Tămășeni (north).

The proposed works that do not overlap with the protected natural areas and shall be treated as follows:

- Left bank/right bank retaining wall L=1,705 m (Turț ATU);
- Right bank retaining wall L=415 m (Turț ATU);
- Left bank/right bank retaining wall L=880 m (Turț ATU);

- Bringing the left bank levee up to the ground level L=1,670 m (Turț ATU);
- Bringing the left bank levee up to the ground level L=1,045 m (Turț ATU);
- Bringing the right bank levee up to the ground level L=385 m (Turț ATU);
- Bringing the right bank levee up to the ground level L=1,285 m (Turț ATU);
- Bringing the left bank levee up to the ground level L=2,710 m (Turț, Turulung ATU);
- Bringing the right bank levee up to the ground level L=3,740 m (Turulung ATU);
- Bringing the left bank levee up to the ground level L=3,505 m (Turulung ATU);
- Levee resettlement L=2,110 m (Turulung ATU – partially outside the PA);
- Rehabilitation of Tămășeni accumulation (Halmeu and Tămășeni ATU);
- Rehabilitation of Hodoș accumulation (Turț ATU);
- Levee resettlement L=2,960 m (Halmeu ATU – partially outside the PA);
- Levee resettlement L=3,390 m (Porumbești ATU– partially outside the PA);
- Bringing the left bank levee up to the ground level L=5,211 m (Orașu Nou ATU – partially outside the PA);
- Bringing the right bank levee up to the ground level L=10,260 m (Orașu Nou ATU - partially outside the PA);
- Bringing the right bank levee up to the ground level L=6,821 m (Orașu Nou ATU, Racșa, Vama);
- Bringing the left bank levee up to the ground level L=3,812 m (Orașu Nou ATU, Racșa);
- Left bank/right bank retaining wall L=4,000 m (Vama ATU);
- Left bank/right bank retaining wall L=2,000 m (Negrești-Oaș ATU);

VI.6.1 Identification of sensitive areas that may be affected by the project

Regarding environmentally and biodiversity-sensitive areas, also taking into account the specificity of the project and the implementation area, Riparian vegetation and aquatic or semi-aquatic species using the overlapping terrain area with or in proximity to the water body shall be affected.

The abundant vegetation with higher chances of being adversely affected shall be in the built-in/defined urban area, where it is proposed to build retaining walls that shall involve the removal of vegetation from the banks and the performance of works in the riverbed,

including excavations. The works themselves lead to the total loss of habitats with Riparian grassy and woody vegetation, mainly in the area of Luna, Customs and Turț settlements. The negative effects are significant, being areas where vegetation (even Riparian) has an island distribution and plays a significant ecological role. Vegetation is used as a habitat for invertebrates and birds, and for fish it is important by providing microclimate conditions (vegetation in the watercourse bed is a resting place for rabbits or Alevins, shades the water sheen by lowering temperatures and keeping oxygen concentration higher during the warm period and provides a flow of matter and energy due to plant and animal materials that can reach water, etc.).

Instead, in the area of the levees subject to cant, the impact shall be reduced during the implementation period because at this point the levees are maintained and cleaned of vegetation during the installation of the shoots in order to maintain the integrity of the levees and thus the final loss/degradation of the habitats is insignificant. During the performance of the works, the negative impact is well represented, considering that the works are spatially extensive.

VI.6.2 Works, facilities and measures for the protection of biodiversity, nature monuments and protected areas

This documentation proposes a number of measures to prevent or reduce the negative impact on biodiversity. Part of these measures shall also be found in Chapter IX and shall be common to the overall project.

Measures to prevent, reduce or compensate for negative impact on biodiversity

- prohibition of works during nighttime;
- in case of a possible accidental pollution during the activity, immediate measures shall be taken to remove the pollution generating factors and the authorities responsible for environmental protection shall be notified;
- any form of collection, capture, killing, destruction or damage to specimens in their natural environment at any stage of their biological cycle is prohibited;

- the deterioration and/or destruction of breeding or resting places of wild birds is prohibited;
- it is forbidden to enter the natural protected area with dogs and to leave them free throughout the performance of the works;
- monitoring of fauna (especially fish fauna) during the performance of the works and after their completion;
- selection the newest and most efficient oil-/fuel-free machinery with lower pollutant emission and fuel consumption;
- to prevent water pollution, specially designed (concrete) places shall be established to carry out maintenance work on machinery located at least 50 m from water courses;
- the waste shall be discharged through the care of specialized companies; temporary storage shall take place at the level of site organization, in specially arranged spaces more than 50 m away from the riverbed and streams;
- all necessary measures shall be taken to avoid pollution of environmental factors or damage to the health or comfort of the population as a result of dusty and/or noisy activities, it being mandatory to comply with environmental protection rules, standards and legislation;
- waste arising from the performance of the works shall not be burned and shall be taken over by an accredited operator;
- waste observed on the site and in the vicinity of the works shall be collected and transported to compliant landfills;
- it is not permitted to carry out the work at night;
- the work sites are open for a maximum of 100 m on land and 50 m in the riverbed;
- unclogging works shall be carried out without changing the width and depth of the riverbed, only for the punctual elimination of obstacles and waste, but also for the foundation of retaining walls;
- ecological reconstruction of the areas affected by the works (for various accidental reasons and the organization of the site and parking lots) will be performed in compliance with all the legal rules in force and with the use of the plant species specific to the area;

- the planting or subsequent sowing - for regenerative purposes – of species which are not the elements of the local flora is prohibited;
- Household waste shall not be stored in places to which wild animals may have access;
- the performance of the works shall take into account the sensitive periods of the species for which the natural protected area has been established or the presence on the site has been determined; this period is 23 March – 7 July for the reproduction of amphibians and fish and refers only to the works in the riverbed; the works outside the protected areas which take place on land are allowed throughout the project period;
- containers of liquid substances shall be covered in order not to facilitate the penetration of invertebrates;
- sanitation of water courses in the vicinity and on the site of works;
- preservation of existing vegetation along watercourses as far as possible;
- it is forbidden to enter the natural protected area with dogs and to leave them free throughout the performance of the works;
- no intrusion is permitted in the vicinity of black stork (*Ciconia nigra*) or night and day raptor nests during any period of the nesting season (15 March to 30 September) for a minimum distance of 200 m;
- it shall not be permitted to use machinery with loss of fuel or oil or in any condition which carries out the work with impact on the aquatic environment, including large machinery;
- work in the riverbed is permitted only after compliance with all impact prevention measures.

VI.7 Protection of human settlements and other public interest objectives

Under this subchapter, forms of impact on human settlements and other public interest objectives are identified, together with measures proposed to reduce or eliminate them.

VII.7.1 Forms of impact on human settlements and other public interest objectives

During **the investment implementation period** proposed by this project, a number of forms of impact on the population in the vicinity of the site may occur due to the following aspects:

- transport and handling of raw and auxiliary materials, which can cause discomfort through noise and increased concentrations of particulate matter;
- uncontrolled storage of construction waste that may create aesthetic discomfort;
- carrying out the construction works simultaneously with other works carried out locally may create discomfort and hamper road traffic in the project area;
- temporary occupation of public or private land areas in order to carry out the proposed works.

In terms of its character, the impact associated with these sources of pollution is direct, potentially negative, short-term, reversible, low in complexity and extent and with increased likelihood of occurrence. It shall be particularly felt in the densely populated areas, namely in the built-up/defined urban area of the settlements on the territory of which the works are carried out.

During **the period of operation of the investment**, the deterioration of the structure of the works performed can generate an insignificant indirect negative impact on the population, by affecting the water quality on the sector concerned and downstream of it and by impairing the aesthetic value of the area affected by the work. At the same time, during the operation of the investment, the designation of wetlands, the restoration of the proposed floodplain shall affect the landowners on whose lands they are carried out through the potential construction restrictions imposed. However, during the investment operating period the impact associated with the proposed project is directly positive, with high extent and likelihood of occurrence, due to the significant reduction of the risk of flooding in the project area.

VII.7.2 Measures to reduce/prevent impact

Measures to reduce or prevent the impact on the human component at **the project implementation phase** are:

- performing activities during daytime;
- limiting the speed of equipment for materials transporting for noise abatement;
- equipping machinery with acoustically shielded engines;
- periodic checking of the operating condition of the machinery and equipment on site;
- appropriate delimitation and marking of work areas where public access is prohibited;
- daily collection and storage of excavation waste outside the population access areas;
- obtaining the authenticated consent of all the landowners temporarily affected by the performance of the proposed works;
- proper storage of raw materials and materials used on a daily basis only on the site of the works during working time and their transport on the site of the site organization during non-working periods.

In order to prevent negative impacts on the human component **at the investment operating stage**, the following measures are proposed:

- checking the state of operation of the works performed;
- rapid intervention in the detection of malfunctions in the works carried out.

As far as wetlands are designated and any land is temporarily or definitively affected by other project investments, the authenticated consent of the landowners affected by the performance of the works shall be obtained.

VI.8 Site-generated waste management

During the investment works performance period included in the proposed project, hazardous, non-hazardous and inert waste shall result, which must be recovered and/or disposed of according to the provisions of Law 211/2011 on the waste regime, as subsequently amended and supplemented. Spaces appropriately arranged for the preliminary collection and storage of waste generated before the removal from the sites shall be provided on the locations of all the site organizations, during the implementation of the investments provided for in this project. These spaces shall be abolished when the investment works are completed and the site organizations are abolished.

Waste management (collection, transport, recovery, disposal) shall be performed in compliance with the regulations mentioned above.

Main waste coded according to Government Decision no. 856/2002 as subsequently amended and supplemented during the performance of the proposed works are:

Table 7. Site-generated types of waste when carrying out works

Waste code	Generated waste name	Temporary storage method	Proposed management arrangements
17 05 04	Earth and stones from excavation in the riverbed	Temporary storage on location of site organizations	They shall be reused partly as filling material (for the body of levees, behind bank reinforcements, etc.), and partly for the execution of earthworks and for the preparation of concrete.
17 04 05 05	Metallic waste from gabion boxes	Temporary storage on location of site organizations	They shall be provisionally stored in containers located in the areas of the site organizations and shall be handed over to authorized companies for reuse, on a contract basis.
17 01 01	Concrete waste	Temporary storage on location of site organizations	They shall be provisionally stored within the premises of the site organizations; they shall be reused as construction material or shall be disposed of in authorized landfills for construction waste.
20 03 01	Household waste from personnel performing the works	Temporary storage on location of site organizations	They shall be provisionally stored in the bins and shall be taken over by the area sanitation operator on a contract basis.
02 01 07	Tree-grubbing waste	Temporary storage on location of site organizations	To be handed over to the owner/ manager of the relevant land, for reuse
17 09 04	Waste from sanitation of areas to be designated as wetlands	Temporary storage on location of site organizations	To be collected and disposed of through authorized operators

During the operation of the objective proposed by the project, no waste shall result from flood protection works carried out.

VI.9 Management of chemical and hazardous substances

During the investment implementation period, the punctual and exceptional use of air-acetylene flame welding may be considered necessary.

Table 8. Hazardous chemicals used in carrying out the investment

Raw materials	Scope	Origin	Method of storage	Hazardousness
Oxygen	For welding works	From specialized companies	On the location of site organization, pressure tubes on the rack, under lock and key, separated from any other materials	Dangerous
Acetylene	For welding works	From specialized companies	On the location of site organization, pressure tubes on the rack, under lock and key, separated from any other materials	Dangerous

VI.10 Cumulative impact of the proposed project with other projects

In order to assess the cumulative impact of the proposed project with other projects, the town halls of the administrative-territorial units on the territory of which the project is carried out were asked for information on other projects that shall be carried out simultaneously with the estimated period for carrying out the proposed project. Until the drafting of this Presentation memoire, answers were received from 4 ATUs, namely the town of Livada and the communes of Călinești -Oaș, Halmeu and Orașu Nou. Of these, the town of Livada has a number of projects that may overlap temporally with the implementation of the proposed project:

- Water supply in Livada Mică and Dumbrava settlements, Satu Mare County – completion deadline December 2020;
- Extension of domestic sewage in Adrian, Livada Mică and Dumbrava settlements, the town of Livada, completion deadline January 2022;
- Rehabilitation and endowment of the school with 1st to 8th grades and the gym in the town of Livada, Satu Mare County, completion deadline March 2021;
- Thermal rehabilitation of apartment blocks no. 2, 3, 4, 5, 6 in the town of Livada, Satu Mare County, completion deadline September 2020;
- Modernization of streets in the town of Livada, completion deadline December 2020;
- Arrangement of leisure spaces in the town of Livada, completion deadline July 2021;

- Rehabilitation of nursing practice building in the town of Livada, completion deadline January 2020;
- Rehabilitation and modernization of public lighting in the town of Livada, completion deadline January 2020.

Given that the above projects are not carried out in the water courses area, it is not expected that a significant cumulative impact of the proposed project shall occur, especially as the volume of works proposed by the project in the town of Livada is smaller and their location is located outside the built area. However, in the event of time overlap between several projects, an increase in traffic in the area is estimated, due to the transport of raw and auxiliary materials in the area of the site organization (with effects on fine particle emissions, air emissions and noise level).

In addition, the fishing exploitation of SC Piscicola SA in Adrian settlement is in a process of modernization. It is located in the vicinity of the contour levee of the Dimoșag polder. In the event that the two projects overlap in time and space, steps shall be taken to correlate the works, so as to avoid certain conflicts during the construction phase and to minimize their potential cumulative impact.

The projects envisaged are not likely to have a significant negative impact on environmental factors. In the event of overlaps, the cumulative impact of the proposed project consists of creating a temporary discomfort for the inhabitants and fauna in the project area by increasing noise and particulate matter levels and by hindering road traffic in the area.

VI.11 Use of natural resources, in particular soil, land, water and biodiversity

Both materials of natural origin such as soil, stone, soil and artificial materials shall be used in the implementation of the proposed project. By their nature, the works require a high volume of soil, local filling material and natural stone for the execution of earthworks and bank reinforcement works. The water used during the performance of the works shall be that needed for consumption by the staff and shall be bottled. The inventory of the raw and auxiliary materials used to carry out the works is presented in Section III.6.2 of the Presentation memoire.

In order to perform the works on the Călinești dam, it shall be necessary to empty the accumulation. It is recommended that aquatic fauna be exploited, i.e. taking it over for consumption. Details of how the emptying of accumulation shall be achieved are set out in Section XI.4 and XI.5.

VII. DESCRIPTION OF ENVIRONMENTAL ASPECTS LIKELY TO BE SIGNIFICANTLY AFFECTED BY THE PROJECT

Given the nature of the project, the environmental aspects likely to be significantly affected by the project during the performance of the works proposed by the project are the morphology of the riverbed, mainly due to the arrangement of the low weirs and the spillways and the bank reinforcement works aimed at stopping lateral erosion and protecting the infrastructure of the levees, but also biodiversity, disrupted mainly during the performance of the works, by the site activity specific to the works.

VII.1 Nature of impact

The potential pollution effects of environmental factors are those associated with the implementation phase of the proposed investment and may be due on the one hand to interventions undertaken through the proposed work and potential incidents or non-compliances with recommended impact prevention measures. Environmental factors likely to feel a more pronounced impact as a result of the works are water and biodiversity. The potentially negative character of the impact during the execution of the works becomes potentially positive with their completion for the most part. However, it is expected that even after the completion of the works, some effects on environmental factors will remain (e.g. changes in the sediment regime caused by bank reinforcement works that will result in a reduction of the erosion process). For the comprehensive assessment of nature, but also the magnitude of the impact on all environmental factors in general, and in particular on environmental factors water and biodiversity, field investigations have been ongoing since October 2018. Chapters VI and XI set out the sources, installations, measures and nature of impacts on all environmental factors.

VII.2 Extension of impact (geographical area, number of population/habitats/species affected)

During the implementation of the proposed project, the impact associated with the project is potentially negative in the areas directly affected by the works, at the level of the work sites and the site organizations. Regarding the works carried out in the riverbed, changes in turbidity, temperature or degree of oxygenation may also occur downstream of the actual sites of the proposed works. With regard to the population, the impact associated with the performance of the works is one that mainly extends to the level and in the immediate vicinity of the site organizations and the work sites and access routes to the site organizations and the work sites. Section VI.7 presents details on the impact on settlements and population. Since October 2018 investigations are ongoing into the extension of the impact associated with the project and the habitats and species affected during the performance of the works.

During the period of operation of the works proposed by the project, there are not expected to be premises for the production of pollution on environmental factors, the investment implemented is not likely to generate pollution. The effects on the population, however, are beneficial and exceed the area where they were arranged. Once completed, the project works shall provide protection for a number of 30,612 inhabitants, of which 12,875 direct, 4,753 properties, 131.25 km transport infrastructure and 27 bridges/culverts. Chapter VI identifies potential sources of impact on all environmental factors and proposes measures to prevent and reduce them at all stages of the project.

VII.3 Magnitude and complexity, likelihood, duration, frequency and reversibility of the impact

As a consequence of the nature of the proposed works, the impact on environmental factors is characterized by reduced complexity, with moderate extension, with effects both in the short term and in the medium and long term. Furthermore, the impact associated with the project is both direct and indirect, with a low to medium frequency and reversible nature. For each of the environmental factors, the impact associated with the works is distinctly

characterized in Chapter VI. Activities are currently being carried out for the comprehensive impact assessment associated with the proposed project.

VII.4 Measures to avoid, reduce or improve significant environmental impacts

The proposed measures to prevent, mitigate any significant effects on the environment are:

- selection the newest and most efficient oil-/fuel-free machinery with lower pollutant emission and fuel consumption;
- to prevent water pollution, specially designed (concrete) places shall be established to carry out maintenance work on machinery located at least 50 m from water courses, outside protected natural areas;
- the waste shall be discharged through the care of specialized companies; temporary storage shall take place at the level of site organization, in specially arranged spaces more than 50 m away from the riverbed and streams;
- all necessary measures shall be taken to avoid pollution of environmental factors or damage to the health or comfort of the population as a result of dusty and/or noisy activities, it being mandatory to comply with environmental protection rules, standards and legislation;
- waste arising from the performance of the works shall not be burned and shall be taken over by an accredited operator;
- waste observed on the site and in the vicinity of the works, irrespective of the overlap with natural protected areas, shall be collected and transported to compliant landfills;
- it is not permitted to carry out the work at night, the period of activity of the otter;
- monitoring wetlands and floodplains to monitor non-compliant landfilling phenomenon;
- the work sites are open for a maximum of 100 m on land and 50 m in the riverbed;
- unclogging works shall be carried out without changing the width and depth of the riverbed, only for the punctual elimination of obstacles and waste;

- sanitation of the site of the works before the start of the works and after their completion;
- No concrete production, bitumen melting, painting or protection of metal constructions and spills of materials or residues into riverbeds or in the vicinity of water shall be performed;
- toxic chemicals shall not be used in riverbeds and on their banks, as accidental spills may affect the fauna and flora in the area;
- construction materials and waste shall not be stored in riverbeds;
- no material and waste warehouses other than those provided for in the project shall be created. Warehouses shall be arranged on platforms equipped with sealed containers that do not allow leakage or provided with retention tanks for possible discharges;
- all equipment made of iron materials shall be protected against corrosion;
- for the execution of construction-assembly works, corrosion protection systems shall be used, carried out by authorized manufacturers, technically approved for application and which were previously used in similar works. Only paints complying with World Health Organization (WHO) recommendations on personnel and environmental protection shall be accepted;
- maximum avoidance of anti-corrosion protection works for construction elements (primer, dyeing) on site. For such works carried out on site, if strictly necessary, the contractor shall establish a standard procedure for each operation, in compliance with all environmental rules, so that no cases of soil or water pollution with chemical compounds occur (paint, primer, thinner, etc.);
- proper maintenance of the machinery fleet for the work (periodic inspections, current repairs). Modern machinery with low risk of pollution and noise shall be used. The use of machinery with loss of engine oil or fuel is prohibited;
- the means of transport for the materials shall be provided with a tarp to avoid the scattering of particles by wind;
- compliance with machine working schedules on each section;
- choosing and using optimal roads/routes.

The above measures are complementary to those set out in Chapter VI therein.

VII.5 Cross-border nature of impact

As stated in Section V.1, the works proposed by the project are located in the vicinity of the State border. Thus, the existence of a potential impact in a cross-border context due to temporary changes in water turbidity, degree of oxygenation or sediment status during the performance of works in the vicinity of the border is assessed. Given the distance of the works proposed by the project from the State border, it is assessed that the cross-border impact is small in scale and complexity, temporary and reversible, and the cooperation protocol with the Republic of Hungary on border flow is not affected during the performance or the duration of the proposed works.

VII. PROVISIONS FOR ENVIRONMENTAL MONITORING

In order to ensure the protection of environmental factors during the performance of the works, monitoring shall be carried out to identify possible negative effects, establishing measures to mitigate the impact until the specific environmental requirements are met. Thus, during the performance of the works, the following points shall be considered:

- monitoring the condition of the lands both within the site and in adjacent areas;
- permanent control of the state of operation of the technological machinery and equipment, periodical revisions and verifications, according to the provisions of the technical manuals and instructions provided by the manufacturer;
- records of inputs of chemicals used, their use and temporary storage;
- keeping records of packaging waste and how to manage it;
- record of all waste used (type of waste, code, physical condition, quantity generated/unit of measurement, consumed in the unit, reused, discharged at the landfill) in accordance with Government Decision no. 856/2002 on the waste management records, as subsequently amended and supplemented.

Moreover, given the overlap of the project with the protected natural areas of Community and national interest, it is recommended to monitor the biodiversity of the most important and most common/frequent taxonomic groups. As such, plant and habitat species, invertebrate species, fish, amphibians and reptiles, birds and mammals shall be monitored, with the following general considerations, taking into account the specificity of the project

and the area. It should be noted that experts involved in the monitoring of species and habitats of Community and conservation interest shall report to the Beneficiary and to the developer of the works any problems that may adversely affect the environment and shall recommend additional measures to mitigate the impact. The monitoring period is also considered to be the project implementation period for each taxonomic group, unless otherwise stated.

Monitoring of plant habitats and species

Monitoring shall mainly cover Riparian species and habitats, which are likely to be affected by the project. The most common pressures relate to the removal of vegetation from the banks, the levees being mainly cleaned. Field trips during the vegetation period are recommended for the correct identification of species, but also outside it, in order to verify and limit the impact on them during the performance of the works.

Invertebrate species monitoring

This shall also include species of insects, molluscs or aquatic crustaceans, rich and diversely represented in protected natural areas. Emphasis shall be placed on areas where works are proposed in the riverbed, especially if they overlap with hotspots (according to the management plan maps or plans to be carried out in future studies).

Fish species monitoring

Fish species are most likely to be adversely affected by the project in terms of the nature of the project, as these are works in or around the water course. Furthermore, works at the dam leading to the drainage of the lake also cause the need to monitor the ichthyofauna post-implementation. In this respect, it is recommended to monitor the pre-implementation ichthyofauna (to identify fish species resident in the lake or on the watercourses on which works are proposed), but also post-implementation, considering that species reintroductions shall be necessary at the level of the lake to restore normal species and flocks.

Amphibian and reptile species monitoring

The recommended monitoring period overlaps with the period of activity of the herpetofauna and the work ban. It is proposed to identify wetlands and species using these areas so that after the project implementation period, if monitoring has found that the works have affected spawning pools (for amphibians) or sunny areas (for reptiles), habitat

reconstruction or the creation of new areas with the same characteristics or functionality as those affected should be performed.

Bird species monitoring

Given that birds are active throughout the year, including in the cold season overlapping with the period during which work is allowed and winter clusters can be created, the experts involved shall monitor during the implementation of the project the species and the negative impact of the project on the bird species, and shall recommend measures to prevent or reduce the impact and pressure, as necessary.

Mammalian species monitoring

This is necessary to limit and prevent the impact during project implementation on mammalian species, mainly aquatic mammals. Of the most important mammals, *Lutra lutra* - otter, a species of Community interest and protected in Romania by GEO 57/2007, can be observed on the site. Monitoring takes place mainly in the winter period, where the evidence of presence is more obvious, but it is up to the experts involved whether they shall carry out monitoring during the ban period as well.

VIII. CONNECTION TO OTHER REGULATORY ACTS AND/OR PLANS/PROGRAMS/STRATEGIES/PLANNING DOCUMENTS

The proposed works shall follow the measures selected in line with the PMRI objectives, addressing the vision of the European Flood Control Directive. These are performed according to the requirements of Government Decision no. 907/2016 and the methodology for drawing up the feasibility study provided in the Applicant's Guide priority axis 5, specific objective (SO) 5.1. (*Reducing the effects and damage to the population caused by natural phenomena associated with the main risks posed by climate change, mainly flooding and coastal erosion),* LIOP 2014-2018.

At European Union level, due to increasing pressures on water resources, legislative instruments have been promoted to protect and sustainably manage them both qualitatively and quantitatively and in terms of reducing vulnerability to the effects of climate change.

Among these most important instruments are **Framework Directive 2007/60/EC on Flood Risk Assessment and Management and Framework Directive 2000/60/EC establishing a framework for Community action in the field of water policy.** These

regulatory acts provide the necessary framework for effective flood risk management and sustainable water management.

At national level, the Community legislation is transposed by **the Water Law 107/1996, as subsequently amended and supplemented, and Decision no. 846/2010 approving the National Flood Risk Management Strategy in the medium and long term.**

Current national water policies aim at sustainable and efficient management of natural resources with a view to increasing the economic benefits of the population, ensuring sustainable management of river basins, including risk prevention and mitigation of the effects of natural disasters to increase the safety of citizens and their assets.

The National Flood Risk Management Strategy in the medium and long term was approved by Government Decision no. 846/2010 and aims to define the framework for coordinated, cross-sectoral orientation of all actions, with a view to preventing and reducing the consequences of flooding on socio-economic activities, human life and health and the environment. It aims at an integrated management of water and adjacent resources: spatial planning and urban development, nature protection, agricultural and forestry development, protection of transport infrastructure, construction, tourist areas, individual protection.

For flood risk management, the strategy sets out the application of policies, procedures and practices aimed at identifying risks, analyzing and evaluating them, treating, monitoring and reassessing them in order to reduce them, so that human communities and all citizens can live, work and meet their needs and aspirations in a sustainable physical and social environment.

IX. WORKS NECESSARY FOR SITE ORGANIZATION

During the performance of the works, it is necessary to carry out site organizations, where the materials necessary for the performance of the works shall be stored, the waste resulting from the performance and where the mobile locker room container, the container for the gatekeeper, the Fire Protection and Fire Extinction facility shall be located. At the level of the site organizations, an area shall be set up for the garage of vehicles and machinery used in the performance of the works and toilet facilities with ecological toilets shall be located.

IX.1 Description of works necessary for site organization

When establishing the site organizations, consideration shall be given to minimizing the need for covered areas, by dimensioning the works strictly at the level of ensuring the project execution plan, directing and concentrating the activity in the targeted perimeter and using minimum areas occupied with storage.

In order to arrange the site organizations, the vegetal layer shall be stripped on the related surface, after which a ballast layer shall be laid. The arranged enclosure shall be fenced during the performance of the works. Existing access routes shall be strictly used for access to the locations of the site organizations and no additional access shall be created to the site organizations and the work areas.

Material warehouses and waste storage areas shall be arranged on platforms equipped with sealed containers that do not allow leakage or shall be provided with retention tank for possible discharges, as appropriate.

IX.2 Location of site organization

The location of the site organizations shall be established by the Contractor of the works through the technical documentation for the organization of the performance, in accordance with the legal provisions in force. Their locations shall be approved by the local public authorities before the works are started and land areas located outside protected natural areas, which have served this purpose in the past, preferably non-productive land belonging to the public domain, shall be used as far as possible.

IX.3 Description of the environmental impact of site organization works

The main forms of impact of the works related to the site organization are:

- removal of vegetation from the site organization surface;
- modification of the edaphic structure by stripping and ballasting the land surface related to the organization.

IX.4 Sources of pollutants and installations for the containment, evacuation and dispersal of pollutants in the environment during the organization of the site

Sources of pollutants associated with the site organization are represented by:

- particulate matter resulting from stripping and coating of land surfaces with ballast;
- air emissions of the machinery used to carry out the site organization and during its operation;
- fine dusts involved in the process of handling and transporting the materials used to carry out the works;
- noise and vibrations generated by the machines used to carry out the proposed works.

IX.5 Equipment and measures provided for the control of pollutants in the environment

When carrying out the works provided by the project, the following measures shall be taken to control the pollutants in order to prevent/mitigate the impact within the site organizations:

- where temporary storage of soil, stone or ballast on the territory of sites of Community interest is required for the performance of the works, this shall be achieved within storage facilities approved by the site custodian;
- no other types of works shall be performed in riverbeds than those provided for in the project;
- the works shall be carried out outside periods with large and medium waters;
- watercourse interventions shall be carried out in such a way that the duration is kept to a minimum;
- no concrete production, bitumen melting, painting or protection of metal constructions and spills of materials or residues into riverbeds or in the vicinity of water shall be performed;

- chemicals shall not be used in riverbeds or in their immediate vicinity or in the coastal area;
- construction materials and waste shall not be stored in riverbeds;
- in addition to the material and waste landfills provided for in the project, no other surfaces shall be used for the location of construction materials and waste;
- the platform intended for the site organization shall be ballasted;
- waste resulting during the construction period (domestic and technological) shall be collected and temporarily stored in appropriate locations and containers and shall be disposed of or recovered through specialized and authorized companies;
- only means of transport and machinery appropriate to the technical regulations in the field shall be used so as to prevent leakages of fuel or oil from their engines;
- in order to reduce air emissions, fine dust, noise and vibration, it is necessary to avoid to overspeed the engines of the transport vehicles on the location of site organization;
- the maintenance works and any necessary repairs to the means of transport and work equipment shall not be performed at the level of the site organizations;
- the duration of occupancy of the land surfaces with material excavated from riverbeds shall be minimized and its temporary storage shall take place for a very short period until loading into the vehicles;
- the provisions of the hazardous substances safety data sheets relating to storage, handling, transport and use shall be complied with and personnel using the materials concerned shall be adequately trained for effective risk management;
- upon completion of the works all the work perimeters and areas occupied by the site organizations shall be restored to their original natural state;
- works shall be carried out on work sites of a maximum of 100 m on land and 50 m respectively in the riverbed.

After the completion of the works, fencing shall be dismantled, toilets, mobile locker and gatekeeper containers shall be removed, the stripping of the ballast layer from the platform shall take place, being used on other locations for backfilling works, restoring the land surface to its original state.

X. SITE RESTORATION WORKS UPON COMPLETION OF THE INVESTMENT, IN CASE OF ACCIDENTS AND/OR UPON COMPLETION OF THE ACTIVITY

Upon completion of the investment for restoring the natural environment, the following measures shall be adopted:

- bringing to the existing natural framework the river sections temporarily affected by the abolition of the temporary works, levelling the embankments and covering the excavations with local material;
- removal of all material debris and waste from banks or riverbeds and transport of waste to authorized sites;
- in the areas of performance of direct works with flow diversion, the riverbed shall be restored to the initial stage;
- areas affected by stripping works shall be restored, by restoring the land to its original state, including restoring vegetation where it is affected, by laying a fertile soil layer on the surface and ensuring natural regeneration with local plant species.
- the land areas intended for the site organization shall be cleared and returned to the natural environment in an unaltered state.

The restoration of the land to its original state shall be progressive as the work sites close.

XI. INFORMATION ON THE RELATIONSHIP OF THE PROJECT WITH PROTECTED NATURAL AREAS – ELEMENTS OF BIODIVERSITY

In this chapter, the overlaps of the proposed project with the protected natural areas, but also with species and habitats of Community or conservation interest shall be highlighted. The chapter shall also contain an estimate of the impact of the project on biodiversity.

Under the Applicant's Guide to LIOP 2014-2020, Priority Axis 5 – Promoting climate change adaptation, risk prevention and management, Specific Objective 5.1 – Reducing the effects and damage to the population caused by natural phenomena associated with the main risks posed by climate change, mainly flooding and coastal erosion, provides for a number of

green measures, which are the main measures to be financed. If they are found to be ineffective, structural measures complementary to the green ones shall also be implemented. Examples of green measures are: the establishment of slopes and banks of watercourses with vegetative protection, the creation of wetlands, the reconnection of dead bifurcations to the main watercourse, the remeandering of watercourses, the achievement of non-permanent water accumulations, etc.

Through hydraulic modelling, it has been observed that at a flood probability of 1%, the green measures are not effective and do not completely eliminate the impact caused by the flash flood wave, therefore a number of structural measures have also been proposed. Most, however, refer to the cant of the dams and bringing it to a unitary level along the entire length of the river.

The natural protected areas overlapping the project are: ROSPA0068 Lower Tur Meadow, ROSCI0214 Tur River and VII.10 Tur River (Appendix no. 6). They have a management plan approved by **Order no. 1177/2016 approving the Management Plan and the Site Regulation of Community Importance ROSCI0214 Tur River, Special Bird Protection Area ROSPA0068 Lower Tur Meadow, Protected Natural Area of National Interest VII.10 Tur River and Noroieni County nature reserve of interest**.

In the vicinity of the protected areas, on the territory of Romania, there are no other protected areas. By contrast, on the border with Hungary, the Tur River protected area complex borders the Szatmár-Bereg Natural Park, the site of Community importance HUHN 20054 Csaholc-Garbolc and the special bird protection area HUHN 10001 Szatmár-Bereg.

XI.1 Brief description of the proposed project and its location in relation to the protected natural areas of Community interest

This project proposal highlights 2 types of works, namely green works (including green infrastructure) and structural measures. It is worth mentioning that most of the proposed works shall be performed on the territory of the 3 natural protected areas, due to the large extent of the site of community interest ROSCI0214 Tur River and the special poultry protection area ROSPA0068 Lower Tur Meadow, both of which have an area of 20,538 ha, overlapping 100%.

The works consist in the cant of the existing levees or bringing them to a uniform elevation in order to comply with the flood probability of 1%, being carried out for a probability of exceeding 5% and 2%, respectively, depending on the location. The levees on the Tur River total a length of 77.2 km, of which 36.6 km on the right bank and 40.2 km on the left bank.

Thus, these works that also overlap with the protected natural areas are as follows:

Reinforcement works of Călinești accumulation dam for increasing the degree of safety of hydrotechnical constructions and elevation of the dam.

Cant for existing levees or bring them to the elevation in areas with major subsidence. This shall increase the degree of assurance from 5% to 1% probability of overshooting. Cant is proposed on a total length of levees of 112,882 m, on the territory of the protected areas, but also outside them.

Dimoșag polder levees cant work

These are necessary for the Dimoșag polder. The Dimoșag polder is proposed as a location on the left bank, near the confluence with the Talna River, and has a volume of 22.7 million cubic meters. Furthermore, the following types of works are proposed: left levee cant at elevation 135.55 m L=6,955 m, Dimoșag polder contour levee L=9,250 m, control work, access spill L=200 m, outlet tower with controls, bottom outlet and surface spillway L=90 m.

Reinforcement of banks with rip-rap prism

Re-proofing of the riverbed by unclogging works of the water course along the length of the proposed bank reinforcement works. Additionally, in these areas, it is proposed to grub up the vegetation from the river bed in order to increase the transit capacity of the river bed where it exists.

Renaturation of banks of watercourses (vegetation protection) over a length of 12,000 m. They shall be made with willow and alder species on the Tur River.

Wetlands

Two new wetlands with areas of approximately 292 ha and 122 ha respectively are proposed. They are located on the right bank of the Tur River, on the territory of Gherța Mică ATU, respectively Porumbești ATU.

Floodplain restoration

It is proposed to restore the floodplain to the water course (in this case the Tur River) by relocating 3 dams in the meandre areas for a total length of 6,130 m (of which 4,129.4 m on the territory of protected natural areas). One area is located on the left bank on the territory of Turulung and Livada ATU, and the other 2 on the right bank on the territory of Turulung and Halmeu ATU.

Dead bifurcations renaturation

The works shall be carried out in the downstream confluence area of Tur and Turț River, on 5 dead bifurcations that shall be connected to the main course.

XI.2 Presence and number of flocks or areas covered by species and habitats of Community interest in the proposed project area

Given the overlap of the project with the protected natural areas, 2 Natura 2000 sites and a protected natural area of national interest were identified. The protected natural areas are: ROSPA0068 Lower Tur Meadow, ROSCI0214 Tur River and complex nature reserve VII.10 Tur River.

Regarding the reasons for establishing these natural protected areas, it is worth mentioning the extraordinary abundance of species and habitats, the Tur River area being considered as a biodiversity hotspot, even if there is a well-represented anthropogenic influence (levees, access roads/land, agricultural land, sheds and settlements).

For each protected area, there are a high number of species (and habitats for the site of Community interest). Thus, ROSCI0214 Tur River was established by *Order of the Minister of Environment and Sustainable Development no. 1964/2007 on the establishment of a protected natural area regime of sites of Community importance, as an integral part of the European ecological network Natura 2000 in Romania, amended by Order of the Minister of Environment and Forests no. 2387/2011*.

Within the framework of ROSCI0214 priority is given to the protection and conservation of 15 habitats and 40 species of Community interest. Among these, there are a number of vegetation habitats in watercourses or aquatic habitats (3150, 3160, 3270), bushes (40A0), meadows (6120, 6410, 6430, 6440, 6510) or deciduous forests (9130, 91E0*, 91F0, 91M0, 91Y0, 92A0). With regard to the 40 species of Community interest, the standard form provides a correct and up-to-date picture thereof, based on the results of field

studies in the framework of the project for the implementation of the management plan. This management plan is approved within the Ministry of Environment by *Order no. 1177/2016 approving the Management Plan and the Site Regulation of Community Importance ROSCI0214 Tur River, Special Bird Protection Area ROSPA0068 Lower Tur Meadow, Protected Natural Area of National Interest VII.10 Tur River and Noroieni County nature reserve of interest*.

Consequently, the habitats and species of Community interest identified in the territory of ROSCI0214 Tur River and assigned thereto are listed in the following Tables, together with their flocks and conservation status, according to the approved Standard Form and Integrated Management Plan.

Table 9. Habitat types present in Natura 2000 site ROSCI0214 Tur River

Code	Habitat Name	Coverage according to PM (ha)	Preservation status **
91E0*	*Alnus glutinosa* and *Fraxinus excelsior* alluvial forests (*Alno-Padion, Alnion incanae, Salicion albae)*	616	B
9130	*Asperulo-Fagetum* beech forests	1026	B
91F0	Riparian forests mixed with *Quercus robur, Ulmus laevis, Fraxinus excelsior* or *Fraxinus angustifolia*, along the large rivers	1643	B
91M0	Balcano-Pannonian mossy oak and sessile oak forests	410	B
91Y0	Dacian oak and carp forests	2464	B
92A0	Groves of *Salix alba* and *Populus alba*	616	B
3150	Natural eutrophic lakes with *Magnopotamion* or *Hydrocharition* vegetation	410	B
3160	Dystrophic lakes and ponds	616	B
3270	Rivers with muddy banks with *Chenopodion rubri* and *Bidention* vegetation	20	B
40A0*	Peripanonic subcontinental bushes	2	B
6120*	Xeric grasslands on limestone substrate	205	B
6410	*Molinia* grasslands on limestone, turf or muddy soils	205	B
6430	Highly hydrophilic plain and mountain to alpine grass selvedges	410	B
6440	Alluvial meadows of *Cnidion dubii*river valleys	2299	B

Code	Habitat Name	Coverage according to PM (ha)	Preservation status **
6510	Low-altitude grasslands (*Alpecurus pratensis, Sanguisorba officinalis*)	1026	B

Table 10. Species present in Natura 2000 site ROSCI0214 Tur River

Code	Species name	Popular name	Flocks (individuals)	Preservation status **
Mammalian species				
1308	*Barbastella barbastellus*	Barbastelle bat	84-150	B
1310	*Miniopterus schreibersii*	Bent-wing bat	437-500	B
1323	*Myotis bechsteinii*	Bechstein's bat	6-50	C
1307	*Myotis blythii*		50-150	B
1318	*Myotis dasycneme*	Pond bat	15-50	B
1321	*Myotis emarginatus*	Geoffroy's bat	7-100	C
1324	*Myotis myotis*	Greater mouse-eared bat	84-150	B
1304	*Rhinolophus ferrumequinum*	Greater horseshoe bat	3-15	C
1303	*Rhinolophum hipposideros*	Lesser horseshoe bat	1-10	
1355	*Lutra lutra*	Eurasian otter	24-37	A
Amphibian and reptile species				
1166	*Triturus cristatus*	Northern crested newt	1900	A
1993	*Triturus dobrogicus*	Danube crested newt	500	C
1193	*Bombina variegata*	Yellow-bellied toad	3000	B
1188	*Bombina bombina*	Fire-bellied toad	3000	A
1220	*Emys orbicularis*	European pond turtle	2000	A
Fish species				
1149	*Cobitis taenie*	Spined loach	100431	A
1138	*Barbus meridionalis*	Danubian barbel	2492	B
1130	*Aspius aspius*	Aspius	3491	C
1122	*Gobio albipinnatus*	White-finned gudgeon	67342	B
2511	*Gobio kessleri*	Danube gudgeon		B
1145	*Misgurnus fossilis*	Weatherfish		C
1134	*Rhodeus sericeus amarus*	European bitterling	181511	A
1114	*Rutilus pigus*	Danube roach		
1146	*Sabanejewia aurata*	Golden loach	4287	B
1160%	*Zingel streber*	Streber		B
Invertebrate species				
1065	*Euphydryas aurinia*	Marsh fritillary		-

Code	Species name	Popular name	Flocks (individuals)	Preservation status **
1,060	*Lycaena dispar*	Large copper	303-684*	B
4038	*Lycaena helle*		8 7-22*	C C
4036	*Leptidea morsei*	Fenton's wood white		B
1088	*Cerambyx cerdo*	Great capricorn beetle	30-1373*	B/C*
1083	*Lucanus cervus*	Stag beetle	5764-6488*	B
4045	*Coenagrion ornatum*			B
1074	*Eriogaster catax*	Eastern eggar	163-639*	B/C*
1082	*Graphoderus bilineatus*			B
1059	*Maculinea teleius*	Scarce large blue	4090-4654*	B
1037	*Ophiogomphus cecilia*			B
1032	*Unio crassus*	Thick shelled river mussel	958336*	B
Plant species				
4097	*Iris aphylla ssp. hungarica*	Iris	16450-17000	A
1428	*Marsilea quadrifolia*	Four leaved water clover	16000	A
1898	*Eleocharis carniolica*	Spike sedge		B
*Effective and conservation status according to the approved Management Plan **A – excellent conservation, B – good conservation, C – medium or reduced conservation, according to Order 207/2006 on the approval of the content of the Natura 2000 Standard Form and its completion manual				

Together with these species of Community interest, the Custodian's observations also updated the total inventory of species, so that 30 species of conservation interest were listed in the Standard Form. However, the most recent species observed is also the species of Community interest - beaver (*Castor fiber*), but the observation is located upstream of Călinești accumulation. Among them, *Cricetus cricetus* (European hammock), *Dama dama* (fallow deer), *Felis silvestris* (wildcat), *Micromys minutus* (harvest mouse), *Elaphe longissima* (Aesculapian snake), *Pelobates fuscus* (spadefoot toad), *Rana arvalis* (moor frog), *Vipera berus* (European viper), *Fritillaria meleagris* (snake's head fritillary), *Orchis morio*, *Orchis mascula* ssp. *signifera* or *Trapa natans* (water chestnut).

The following Table shows the bird species of Community interest that have been identified on the territory of the site ROSPA0068 Lower Tur Meadow. It should be noted that there are some discrepancies between the flocks and the conservation status of the species in the standard form and those according to the Management Plan. In the forthcoming

analysis in the impact assessment subchapter, if there are differences in flock size and conservation status in the species potentially affected by the project, the information in the management plan shall be used.

Table 11. Bird species present in Natura 2000 site ROSPA0068 Lower Tur Meadow

Code	Species name	Popular name	Flocks	Preservation status **
A086	*Accipiter nisus*	Eurasian sparrowhawk	2-8 i	
	Acrocephalus arundinaceus	Great reed warbler	130-150*	B
A293	*Acrocephalus melanopogon*	Aquatic warbler	5-10 p	B
A296	*Acrocephalus palustris*	Marsh warbler		
A295	*Acrocephalus schoenobanus*	Sedge warbler		
A297	*Acrocephalus scirpaceus*	Reed warbler		
A168	*Actitis hypoleucos*	Common sandpiper	15-20*	B
A247	*Alauda arvensis*	Sky lark	8571-15259*	B
A229	*Alcedo atthis*	River kingfisher	10-20 p 20-40*	B B
A054	*Anas acuta*	Northern pintail		
A056	*Anas clypeata*	Northern shoveler		
A052	*Anas crecca*	Eurasian teal		
A050	*Anas penelope*	Eurasian wigeon		
A053	*Anas platyrhynchos*	Mallard		
A055	*Anas querquedula*	Garganey		
A051	*Anas strepera*	Gadwall		
A041	*Anser albifrons*	Greater white-fronted goose		
A043	*Anser anser*	Greylag goose		
A256	*Anthus trivialis*	Tree pipit		
A089	*Aquila pomarina*	Lesser spotted eagle	2-3 p 4-6*	C C
A028	*Ardea cinerea*	Grey heron	100-120 i	
A029	*Ardea purpurea*	Purple heron	2-4 p 2-6*	C C
A024	*Ardea ralloides*	Squacco heron	1 p	
A221	*Asio otus*	Long-eared owl	12-22 i	
A059	*Aythya ferina*	Common pochard		
A061	*Aythya fuligula*	Tufted duck		
A060	*Aythya nyroca*	Ferruginous duck	4-8 p	B
A021	*Botaurus stellaris*	Eurasian bittern	4-6 p 4-8*	B C

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Code	Species name	Popular name	Flocks	Preservation status **
A215	*Bubo bubo*	Eagle owl	1-2 p 2-4*	B B
A087	*Buteo buteo*	Common buzzard	2-8 i 50-80*	 B
A088	*Buteo lagopus*	Rough-legged buzzard		
A149	*Calidris alpina*	Dunlin		
A147	*Calidris ferruginea*	Curlew sandpiper		
A145	*Calidris minuta*	Little stint		
A366	*Carduelis cannabina*	Linnet		
A364	*Carduelis carduelis*	Goldfinch		
A363	*Carduelis chloris*	Greenfinch		
A136	*Charadrius dubius*	Little ringed plover		
A196	*Chlidonias hybridus*	Whiskered tern	80-120 p 10-20*	B C
A031	*Ciconia ciconia*	White stork	125-175 p 250-350*	B B
A030	*Ciconia nigra*	Black stork	5-8 p 10-14*	C B
A080	*Circaetus gallicus*	Short-toed snake eagle	1-2 p 4-8*	B
A081	*Circus aeurginosus*	Western marsh harrier	15-27 p 30-50*	C C
A084	*Circus pygargus*	Montagu's Harrier	1-2 p 6-8*	B
A373	*Coccothraustes coccothraustes*	Hawfinch		
A207	*Columba oenas*	Stock dove		
A208	*Columba palumbus*	Woodpigeon		
A113	*Coturnix coturnix*	European quail		
A122	*Crex crex*	Corncrake	16-20 p 32-40*	C C
A212	*Cuculus canorus*	Common cuckoo		
A036	*Cygnus olor*	Mute swan		
A253	*Delichon urbica*	House martin		
A238	*Dendrocopos medius*	Middle-spotted woodpecker	180-240 p 244-334*	C C
A429	*Dendrocopos syriacus*	Syrian woodpecker	25-40 p 10-20*	C
A236	*Dryocopus martius*	Black woodpecker	15-25 p 30-50*	B B
A026	*Egretta garzetta*	Little egret	12-18 p	C
A269	*Erithacus rubecula*	Robin		
A099	*Falco subbuteo*	Eurasian hobby	8-12 i	
A096	*Falco tinnunculus*	Common kestrel		

Code	Species name	Popular name	Flocks	Preservation status **
A359	*Fringilla coelebs*	Common chaffinch		
A125	*Fulica atra*	Eurasian coot		
A244	*Galerida cristata*	Crested lark		
A153	*Gallinago gallinago*	Common snipe		
A123	*Gallinula chloropus*	Common moorhen		
A251	*Hirundo rustica*	Swallow		
A022	*Ixobrychus minutus*	Little bittern	25-35 p 20-40*	B C
A233	*Jynx torquilla*	Wryneck		
A338	*Lanius collurio*	Red-backed shrike	400-700 p 1637-3662*	B
A339	*Lanius minor*	Lesser grey shrike	80-150 p 8-14*	B
A459	*Larus cachinnans*	Caspian gull		
A182	*Larus canus*	Common gull		
A176	*Larus melanocephalus*	Mediterranean gull		
A177	*Larus minutus*	Little gull		
A179	*Larus ridibundus*	Black-headed gull		
A156	*Limosa limosa*	Black-tailed godwit		
A291	*Locustella fluviatilis*	River warbler		
A292	*Locustella luscinoides*	Savi's warbler		
A246	*Lullula arborea*	Wood lark	40-60 p 10-20*	B
A271	*Luscinia megarhynchos*	Nightingale		
A070	*Mergus merganser*	Goosander		
A383	*Miliaria calandra*	Corn bunting		
A073	*Milvus migrans*	Red kite	2-4 p	B
A262	*Motacilla alba*	Pied wagtail		
A260	*Motacilla flava*	Yellow wagtail	2461-9382*	B
A319	*Muscicapa striata*	Spotted flycatcher		
A160	*Numenius arquata*	Eurasian curlew		
A023	*Nycticorax nycticorax*	Black-crowned night heron	25-30 p 15-20*	B C
A337	*Oriolus oriolus*	Golden oriole		
A214	*Otus scops*	Scops owl	10-16 i	
A072	*Pernis apivorus*	European honey buzzard	3-4 p 2-4*	C B
A273	*Phoenicurus ochruros*	Black redstart		
A274	*Phoenicurus phoenicurus*	Redstart		
A315	*Phylloscopus collybita*	Chiffchaff		

Code	Species name	Popular name	Flocks	Preservation status **
A314	*Phylloscopus sibilatrix*	Wood warbler		
A234	*Picus canus*	Grey-headed woodpecker	6-9 p 10-15*	B
A140	*Pluvialis apricaria*	European golden plover		
A005	*Podiceps cristatus*	Great crested grebe	30-50 i	
A006	*Podiceps grisegena*	Red-necked grebe		
A118	*Rallus aquaticus*	Water rail		
A336	*Remiz pendulinus*	Penduline tit		
A275	*Saxicola rubetra*	Whinchat		
A276	*Saxicola torquata*	Stonechat		
A155	*Scolopax rusticola*	Eurasian woodcock		
A361	*Serinus serinus*	Serin		
A210	*Streptopelia turtur*	Turtle dove		
A315	*Sturnus vulgaris*	Starling		
A311	*Sylvia atricapilla*	Blackcap		
A310	*Sylvia borin*	Garden warbler		
A309	*Sylvia communis*	Whitethroat		
A308	*Sylvia curruca*	Lesser whitethroat		
A004	*Tachybaptus rufficolis*	Little grebe	10-30 i	B
A164	*Tringa nebularia*	Common greenshank		
A165	*Tringa ochropus*	Green sandpiper		
A163	*Tringa stagnatilis*	Marsh sandpiper		
A162	*Tringa totanus*	Common redshank		
A283	*Turdus merula*	Blackbird		
A285	*Turdus philomelos*	Song thrush		
A284	*Turdus pilaris*	Fieldfare		
A287	*Turdus viscivorus*	Mistle thrush		
A232	*Upupa epops*	Hoopoe		
A142	*Vanellus vanellus*	Northern lapwing	18-33 p 20-40*	B C
*Effective and conservation status according to the approved Management Plan **A – excellent conservation, B – good conservation, C – medium or reduced conservation				

For drafting this documentation, field visits were also carried out identifying species of Community interest, birds as well as amphibians, reptiles, fish or mammals. Part of them shall be found in the following paragraph.

As such, field visits were carried out between October 2018 and April 2019 to identify resident or migratory species that may be affected by the project. Consequently, a number of species were observed on or in proximity to the site, according to the following Table.

Table 12. Species identified on the site or in the vicinity of the proposed site

No.	Scientific name	Popular name	Identified population	Comments
1	*Talpa europaea*	European mole		Mounds
2	*Vulpes vulpes*	Red fox	5	
3	*Lepus europaeus*	European hare	3	
4	*Lutra lutra*	Eurasian otter		Presence traces
5	*Emys orbicularis*	European pond turtle	4	
6	*Natrix tessellata*	Dice snake	1	
7	*Bombina bombina*	Fire-bellied toad	5	
8	*Rana dalmatina*	Agile frog	1	
9	*Pelophylax ridibundus*	Marsh frog	22	
10	*Parus major*	Great tit	4	
11	*Phalacrocorax carbo*	Great cormorant	80	
12	*Egretta alba*	Great egret	31	
13	*Egretta garzetta*	Little egret	1	
14	*Ardea cinerea*	Grey heron	7	
15	*Ciconia ciconia*	White stork	2	
16	*Numenius arquata*	Eurasian curlew	1	
17	*Actitis hypoleucos*	Common sandpiper	5	
18	*Podiceps cristatus*	Great crested grebe	4	
19	*Passer montanus*	Tree sparrow	70	
20	*Phoenicurus phoenicurus*	Redstart	4	
21	*Phoenicurus ochruros*	Black redstart	1	
22	*Anas platyrhynchos*	Mallard	31	
23	*Anas querquedula*	Garganey	12	
24	*Turdus pilaris*	Fieldfare	3	
25	*Turdus merula*	Blackbird	2	
26	*Carduelis carduelis*	Goldfinch	12	
27	*Emberiza citrinella*	Yellowhammer	28	
28	*Fringilla coelebs*	Chaffinch	2	
29	*Motacilla alba*	Pied wagtail	5	
30	*Oriolus oriolus*	Golden oriole	1	
31	*Sturnus vulgaris*	Starling	30	
32	*Buteo buteo*	Common buzzard	5	
33	*Circus aeruginosus*	Western marsh harrier	6	
34	*Circus pygargus*	Montagu's Harrier	1	Female
35	*Falco columbarius*	Merlin	1	
36	*Falco vespertinus*	Common kestrel	3	
37	*Phasianus colchicus*	Common pheasant	6	
38	*Larus ridibundus*	Black-headed gull	15	
39	*Corvus corax*	Common raven	1	
40	*Pica pica*	Magpie	20	

No.	Scientific name	Popular name	Identified population	Comments
41	*Garrulus glandarius*	Eurasian jay	4	
42	*Dendrocopos major*	Great spotted woodpecker	1	
43	*Lanius excubitor*	Great grey shrike	3	
44	*Aegithalus caudatus*	Long-tailed tit	12	
45	*Vanellus vanellus*	Northern lapwing	2	
46	*Cygnus olor*	Mute swan	1	
47	*Tringa ochruros*	Green sandpiper	2	
48	*Carassius gibelio*	Gibel carp	2	Dead in the lake
49	*Unio crassus*	Thick shelled river mussel		
50	*Sympetrum sanguineum*	Ruddy darter	1	
51	*Xylocopa sp.*	Carpenter bee	2	
52	*Gryllus campestris*	European field cricket		Colony on the levee

XI.3 Justification if not directly related or not required for the conservation management of the natural area

Due to the nature of the works and the specific objective of the project, it is unrelated to and not necessary for the conservation management of the protected natural areas with which it intersects. Instead, there are a number of green measures that can indirectly improve the conservation status of species and habitats of Community/conservation interest, including even the creation of potential habitats for a high number of species, areas free from anthropogenic pressures on the management of these lands.

Dead bifurcations reconnections are also proposed and this shall create important aquatic habitats for fish species, invertebrates, birds, amphibians or reptiles, keeping them wet with little chance of drying up (from now on). Moreover, related to habitat creation, it is proposed to reforest the watercourse banks with riparian tree species in areas where the erosion rate is high.

Naturally, there shall be negative pressures on the natural protected areas due to the project, manifested mainly during the performance of the works, including green measures, according to the Applicant's Guide to LIOP 2014-2020 5.1 - Reducing the effects and damage to the population caused by natural phenomena associated with the main risks posed by climate change, mainly flooding and coastal erosion.

XI.4 Estimation of the potential impact of the project on species and habitats of Community interest

By fulfilling the objectives of the project proposal, various types of impact on species and habitats of Community interest, as well as on protected areas in general, are estimated. Consequently, the impact shall be treated according to several characteristics: during the manifestation period (short or long term), directly or indirectly, or type of impact (negative or positive).

The direct impact on protected natural areas is mostly temporary, manifested in the stage of execution of the works. These are additional sources of noise, vibration, particulate matter and nuisance to habitats. Most mobile species (birds, mammals, reptiles or fish) shall most often leave the site and its proximity during the performance period. The emission of pollutants shall also be accelerated, with particulate matter, smoke, toxins, internal combustion results of engines from machinery or dust driven from benthos and substrate. Dust emissions shall, in part, end up depositing in water courses, contributing together with the entrained particles in the river and bank substrate to increased turbidity. During the spawning period of fish species, a high concentration of powders, sands, gravel and others shall favour the death of eggs by covering them. This is true for fish, amphibians and other aquatic organisms that lay egg masses in water. In order to reduce or avoid this kind of impact, it is necessary to observe a number of conservation measures. Likewise, particulate matter in water course risks to settle on fish gills, with negative consequences of asphyxiation.

The short-term effects of the project can be considered to be identical to the direct effects, so most pressures will occur during the actual construction/measures performance period. Part of the negative effects may be cancelled and balanced once the achievement is completed (e.g. reconnection of dead bifurcations, bank renaturation/afforestation, cleaning/releasing of the water course of elements interrupting longitudinal connectivity, floodplain areas, etc.). Green measures accepted by the Applicant's Guide and proposed by this project are likely to improve the conservation status of species and habitats from the point of view of distribution and expansion of habitats, mainly wet ones.

A polder is also proposed, which once achieved shall benefit the area with each flood wave due to the suspended matter it transports (sludge, sand, substrate with leaves, branches, invertebrates and others), energy-important matter. This translates into a possible accelerated growth of vegetation once the flood has passed. In this way, it is created within forests and wetlands that shall become foraging and predatory areas, including for *Ciconia nigra* or amphibian and invertebrate species.

With regard to species and habitats of Community interest that may be affected by the project, in relation to the custodian's database and field observations, we may divide the impact according to periods: performance of works or use of infrastructure.

During the performance of the works, dispersions of wild mobile species (otter, birds) are expected, and possibly replaced by domesticated/partially domesticated species (e.g. stray dogs) that shall seek shelter or food and that are not sheltered from humans or for certain groups of plant species. This shall be especially the result of work proposing the elimination of grassy or woody species and helping to install competitive/ruderal ones. Dispersion shall be caused by the work itself, the presence of humans, additional sources of noise, vibration or nuisance. These areas shall need to be monitored during and after implementation. Measures shall also be taken to prevent their installation or even to eliminate them if this is observed.

Another possible negative impact is caused by nearby or watercourse works. Their installation/performance shall result in a large amount of sediment from the river bents or banks that shall alter the physical (and possibly also chemical) characteristics of the water. These shall eventually be deposited, but may be deposited on fish eggs or amphibian egg masses. If a large enough amount is deposited to cover them even partially, the embryos shall suffocate and that means little reproductive success, even leading to a loss on certain areas of the new generation. Powder deposition shall also be possible on fish gills, leading to suffocation of more sensitive individuals, such as juveniles.

In order to prepare the levees for cant or to bring them to a uniform level, it is possible that one side of the levees may be cleaned of vegetation if it has been installed recently. Depending on the location and distance from the river, the installed vegetation could, in addition to protecting a number of species, slow down the evaporation of water during warm and dry periods by creating shady areas on the water sheen and regulating the temperature.

Due to the impact that emptying and filling of the lake can have, but also keeping it about 90% emptied, it shall be necessary to comply with a set of conservation measures, but also active conservation measures.

In order to minimize the negative impact that these works may have (especially the drainage of the lake), the period during which this is allowed should be considered. Thus, in addition to the massive loss of water from the respective aquatic habitat (correlated with its support capacity), an increased turbidity can manifest downstream, manifested by the resuspension of sediments from the dam or from the river/lake substrate. This can mean the loss of fish egg masses, invertebrates or amphibians if they are covered in sediment. In addition, sediment can have harmful effects on fish gills, especially for sensitive individuals (e.g. juveniles). Furthermore, there is a possibility that the fish are caught in the water stream of the bottom outlet or remain trapped in the ponds created from the substrate of the lake or even on the new dry portion.

Furthermore, studies recommend ensuring a steady flow, trying to avoid sudden fluctuations in order to have time to adapt to new conditions or to look for areas where environmental conditions remain somewhat unaltered.

Instead, the project can also have a positive impact by eliminating erosion points and decreasing turbidity during certain periods on the watercourse involved. Higher water quality shall be in the benefit of aquatic species (fish, birds, invertebrates, amphibians and reptiles) and translates into higher chances of survival or prey for a number of species at the top of the food chain (from the category of predators). Furthermore, it is proposed to renature the banks by planting woody species specific to the climate zone and the associated level (willow, hare, poplar, etc.).

XI.5 Measures to prevent and reduce adverse effects on species and habitats

Measures to prevent, reduce or improve the negative impact on biodiversity are presented below. The list of measures presented is not exhaustive, it is customized and possibly supplemented after the completion of the field investigations.

Measures to prevent, reduce or improve the negative impact on biodiversity in the Calinesti accumulation area

- the lake shall be emptied during the period October 01 – February 28, by machining, for as short a period as possible;
- works on the dam shall be carried out only during the period March 1 – September 30;
- the lake shall be filled during the period October 01 – February 28, for as short a period as possible;
- the exclusive use of small machinery for the works in the riverbed;
- restocking of the lake with native phytophagous fish species (freshwater bream - *Abramis brama,* European carp – *Cyprinus carpio*) and at a distance of 2-3 years restocking with predatory species amounting to 10-15% of the phytophagous fish population (pike-perch - *Sander lucioperca*, wels catfish – *Silurus glanis*, pike - *Exos lucius*);
- native fish species of Community interest trapped on land or in small ponds shall be caught and released into similar unaltered habitats; alien fish species shall be left to birds or other carnivorous species (Eurasian otter - *Lutra lutra*, red fox - *Vulpes vulpes*);
- prohibition of works during nighttime;
- in case of a possible accidental pollution during the activity, immediate measures shall be taken to remove the pollution generating factors and the authorities responsible for environmental protection shall be notified;
- any form of collection, capture, killing, destruction or damage to specimens in their natural environment at any stage of their biological cycle is prohibited;
- the deterioration and/or destruction of breeding or resting places of wild birds is prohibited;
- it is forbidden to enter the natural protected area with dogs and to leave them free throughout the performance of the works;
- monitoring of fauna (especially fish fauna) during the performance of the works and after their completion;
- compliance with the Management Plan and the Regulation of Protected Natural Areas, approved by order of the Minister.

The proposed measures to prevent, mitigate any significant adverse effects on biodiversity

- ecological reconstruction of the areas affected by the works (for various accidental reasons and the organization of the site and parking lots) will be performed in compliance with all the legal rules in force and with the use of the plant species specific to the area;
- the planting or subsequent sowing - for regenerative purposes – of species which are not the elements of the local flora is prohibited;
- in case of a possible accidental pollution during the activity, immediate measures shall be taken to remove the pollution generating factors and the authorities responsible for environmental protection shall be notified;
- any form of collection, capture, killing, destruction or damage to specimens in their natural environment at any stage of their biological cycle is prohibited;
- the deterioration and/or destruction of breeding or resting places of wild birds is prohibited;
- household waste shall not be stored in places to which wild animals may have access;
- the performance of the works shall take into account the sensitive periods of the species for which the natural protected area has been established or the presence on the site has been determined; this period is March 23 - July 7 for the reproduction of amphibians and fish and 16 March – 14 July for the nesting and rearing of the offspring of birds;
- the observed fish remaining in the ponds formed of the emptied lake shall be caught and released downstream of the dam; the exception to this is the fish species of Romania and the ecological area to which the Călinești accumulation belongs;
- containers of liquid substances shall be covered in order not to facilitate the penetration of invertebrates;
- sanitation of water courses in the vicinity and on the site of works.

Lutra lutra

- preservation of existing vegetation along watercourses;

- the deterioration and/or destruction of breeding or resting places is prohibited;
- it is forbidden to enter the natural protected area with dogs and to leave them free throughout the performance of the works;
- it is not permitted to carry out the work at night, the period of activity of the otter;
- sanitation of water courses in the vicinity and on the site of works, especially those in which the presence of otter was found.

Triturus cristatus, Triturus dobrogicus, Bombina variegata, Bombina bombina, Emys orbicularis

- any form of collection, capture, killing, destruction or damage to specimens in their natural environment at any stage of their biological cycle is prohibited;
- the deterioration and/or destruction of breeding places is prohibited; in the case of destruction of breeding places outside the active period of amphibians, it is recommended to dig pits in the vicinity of the site in areas allowing water retention; dimensions: 2-30 m^2 and 10-50 cm deep;
- the performance of the works shall take into account the sensitive periods of the species for which the natural protected area has been established or the presence on the site has been determined between March 23 – July 7, as the reproduction period of amphibians and reptiles.

Proposed measures to prevent or mitigate the impact on bird species

- the deterioration and/or destruction of breeding or resting places of wild birds is prohibited;
- no intrusion is permitted in the vicinity of black stork (*Ciconia nigra*) or night and day raptor nests during any period of the nesting season (15 March to 30 September) for a minimum distance of 200 m;
- limit the cutting/grubbing-up of vegetation in the area of consolidation in order to maintain as much Riparian vegetation as possible above the water sheen for the common kingfisher (*Alcedo atthis*).

Proposed measures to prevent or mitigate the impact on fish species

- the deterioration and/or destruction of breeding places is prohibited;
- the performance of the works shall take into account the sensitive periods of the species for which the natural protected area has been established or the presence on the site has been determined between March 23 – July 7, as the reproduction period of fish.
- it shall not be permitted to use machinery with loss of fuel or oil or in any condition which carries out the work with impact on the aquatic environment, including large machinery;
- work in the riverbed is permitted only after compliance with all impact prevention measures.

The measures shall be implemented during the implementation period and their monitoring shall take place during the same period. Implementation Officer: Project Manager, Environmental Officer, Biologist/Ecologist.

Short-term measures:

It is recommended that the site be inspected prior to operation and the presence of different species highlighted in order to avoid any disturbance.

Medium- and long-term measures:

In order to monitor the species in the project implementation area, the following shall be taken into account:

- monitoring of fauna during the development - operation period;
- seasonal monitoring of species;
- timetable for project implementation;
- the approved Regulation and Management Plan of Protected Natural Areas;
- compliance with the provisions of the opinion of the National Agency for Protected Natural Areas;
- monitoring of the groups of species and habitats affected;
- restocking with native fish species with a view to restoring accumulation biocenosis relationships;

– keeping dams free from woody vegetation in order not to jeopardize their structural integrity or to allow for future interventions without affecting habitats of natural or semi-natural Community interest.

Restoration measures, upon decommissioning

Such measures are not required in the foreseeable future as the investments are not foreseen to be decommissioned. The only remedial measure that is required is that relating to the site organizations in the vicinity of the protected areas, which shall return to their original state, and if oversowing is necessary, they shall be carried out with local flora species. It is not allowed to introduce any allohtone species, e.g. black locust – *Robinia peudoacacia*, false indigo - *Amorpha fruticosa*, honey locust - *Gleditsia triacanthos*.

Scheduling of periods during which the project may be implemented, in conjunction with breeding, migration, of species of Community interest and growing seasons, so that the impact is minimal, within protected natural areas.

Activity implementation period – green

Critical period of species and habitats – red

Table 13. Periods allowed and not allowed to carry out the works proposed by the project

Month/year Group	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Other restrictions
Amphibians													
Fish													
Mammals													
Birds													
Plants													
Invertebrates													
Habitats													

XII. IMPACT ON CLIMATE AND VULNERABILITY OF THE PROJECT TO CLIMATE CHANGE

Regarding the impact of the project on the climate, it is deemed that at the project implementation stage, there may be some small changes in the thermal conditions in the area of the work fronts due to the operation of the machines. Their local effect disappears

when the machines are stopped. The project has benefits in terms of reducing vulnerability to climate change for the population and assets in its area of influence.

The climatic parameters relevant to the investments proposed to be carried out through the project and which have been analyzed in the climate change vulnerability assessment study are:

- Frost days, frost-riven cycles (freeze-thaw);
- Changes in the rainfall regime;
- Extreme rainfall;
- Snow layer;
- Floods;
- Rainfall-river erosion;
- Natural fires;
- Landslides.

Vulnerability assessment against these phenomena was performed in matrix system, according to the methodological recommendations in the field, by combining sensitivity and exposure scores for both current and future exposure.

For the assessment of vulnerability, the results obtained from the multiplication of sensitivity and exposure scores were interpreted using the following system:

- **0 = not vulnerable;**
- **1-2 = low vulnerability;**
- **3-5 = average vulnerability;**
- **6-9 = high vulnerability.**

Vulnerability assessment against climate variables/hazards for current and future climate conditions is presented as follows:

- Current conditions:
  - Average vulnerability: landslides (flood protection works), extreme rainfall, snow cover;
  - High vulnerability: floods;
- Future conditions:
  - Average vulnerability: landslides (flood protection works) and extreme rainfall;
  - Average vulnerability: floods.

Assessment of the project's risk to climate change

The project risk assessment for climate change was carried out for the entire period considered (2014-2050), given that the investments foreseen in the current project and in the specific national and regional strategic plans are the guarantee of adaptation and risk resilience/climate change of the elements of the systems. The risk assessment was performed for project components that have medium and high vulnerability to climate/hazard variables and risks identified in the previous phase, and is presented in Table 14.

Table 14. Assessment of the project's risk to climate change

Hazard and related risk		Risk score		
		Probability (P)	Severity (S)	P x S
Extreme rainfall. Significant floods and river flooding	1.1. Physical damage/ destruction of hydrotechnical works or elements thereof	2. Most basic components of the system are exposed to the risk of degradation. However, being often in contact with flash flood water, defence works are robust structures, based on specific design indices, so it is considered that the future probability of a flash flood occurring that exceeds the calculation/verification volumes/flows is average.	3. If the calculation flows were exceeded, the negative effects may be major, and breaches in dams/levees leading to overflows over extended areas may occur.	6
Landslides	1.2. Partial damage/ destruction of hydrotechnical works	1. No landslides have been reported in the region to destroy flood protection works since the basic components of the system are located/situated in quasi-plane locations not exposed to landslides (riverbeds). On the other hand, there are major uncertainties associated with future forecasts in relation to this parameter.	2. Average impact considering that landslides occur only at an isolated level, and the impact can be solved through specific stabilization works.	2

Table 15 highlights the risk assessment matrix for the study region where the proposed project is located.

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Table 15. Risk assessment matrix for the study region

		Consequences		
Probability		1	2	3
	1		1.2.	
	2			1.1.
	3			

Risk level

	Reduced risk
	Environmental threat
	High risk

Analyzing the results from the risk assessment matrix it can be concluded that there are no major hazards for the project. However, a hazard (Impairment of hydrotechnical works due to significant floods) with average risk has been identified, for which the most appropriate adaptation measures have been established.

Conclusions on adaptation measures and proposed adaptation action plan

Adaptation to the impacts of climate change set out in the National Climate Change Strategy (2013-2020) indicates a number of adaptation methods in case of flood risk management, with reference to:

a) choosing flood protection works at local level for settlements and socio-economic structures instead of protection works against large, extensive floods;

b) choosing the regularization of water courses, the mitigation of floods as they occur, instead of the cant of existing levees or the construction of new levees;

c) using the latest methods and technologies for the rehabilitation/construction of levees and dams and carrying out protection works in correlation with the territorial plans for urban development;

d) the elements of the flood risk management plans shall be periodically reviewed and, where appropriate, updated, taking into account the possible effects of climate change on the occurrence of floods;

e) raising awareness of the flood risk among the exposed population, appropriate measures before and after their occurrence, concluding insurance contracts and others;

f) improving the response capacity of local public administration authorities with responsibilities in the management of emergency situations generated by floods, accidents at hydrotechnical constructions and accidental pollution.

As regards the dams and levees in Romania, it is necessary to pay greater attention to their future safety. This allegation is based on a number of good reasons:

- change of design and construction rules over time;
- age of existing constructions;
- the potential danger to downstream communities in the event of breakage, and last but not least;
- adaptation to forecasted climate change.

In this project, adaptation measures to the effects of climate change are linked to those in the specific national and regional plans and strategies, some of which are integrated into the investments proposed in the project (Table 16).

Table 16. Major risks associated with climate variables/hazards, proposed adaptation measures, residual risk and related cost options

Risks related to climate change	Risk score	Adaptation measures	Residual risk	Cost options	Officer Implementation
Extreme rainfall. Floods and river flooding. Physical damage/destruction of components of hydrotechnical works designed to protect against floods and endanger the safety of goods and people-	6 - average	Securing Călinești Dam	2- low	There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of fillings at the downstream foot of the dam and raising the downstream platform to compensate for underpressures, replacement of electrical equipment and drives affected by physical and moral wear, modernization of the dam behaviour tracking system with AMC, restoration of the downstream warning system	ABA Someș-Tisa
		Carrying out maintenance works for the safe operation of existing		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of maintenance works of equipment and related constructions at	ABA Someș-Tisa

Risks related to climate change	Risk score	Adaptation measures	Residual risk	Cost options	Officer Implement ation
		hydrotechnic al constructions and related equipment		Călinești Oaș dam, maintenance of defence works on Rea Valley L=70 ml (Hm 157-158) and maintenance and repairs of dams on p. Lechincioara, right bank 7.3 km – (Hm 124-200), left bank 10.37 km - (Hm 98-200)	
		Securing non-permanent accumulation dams		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of - PIS Tămășeni (cant works, building of surface spillways) - PIS Hodoș (cant works, building of surface spillways)	ABA Someș-Tisa
		Building new small non-permanent accumulation s to mitigate floods		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of carrying out the following accumulations: Ac. Negrești am. loc. Black Oas on Tur River, V = 1.92 million cubic meters, Ac. Brada am. loc. Luna on Talna Mare River, V = 2.34 million cubic meters, Ac. Turt on Turt River am. loc. Turt, V = 1.34 million cubic meters	ABA Someș-Tisa
		Increasing the degree of safety of existing hydrotechnic al constructions by using the latest suitable methods and technologies		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of carrying out the following works: - sealing of levee on Tur River at Turulung L = 1.5 km (sealing works of the foundation in areas where bark blazer appeared, cants to ensure the transit of floods) - Rehabilitation of the land improvement works from the Turulung-Negrești settlement - Gherța pumping station	ABA Someș-Tisa

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Risks related to climate change	Risk score	Adaptation measures	Residual risk	Cost options	Officer Implementation
		Measures to stabilize riverbeds		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of carrying out the following works: arrangement of Tur and Turț river bed 48 km and reinforcement of Tur bank 15.7 km + Turț bank 4 km	ABA Someș-Tisa
		Increasing the transit capacity of riverbeds		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of carrying out the following works: water course unsilting in place. Turulung l= 0.5 km and Turt stream (at confl.), l = 1 km, unsilting in place. Cămârzana and Târșolț, l = 2.5 km, removal of obstacles in place. Turulung, Mesteacan, Turt, Gherta Mare, Pasunea Mare, Călinești, Tur, Negrești, Vama and Bixad over a length of 18 km and in Cămârzana and Târșolț settlements L=17.67 km by eliminating vegetation bottlenecks	ABA Someș-Tisa
		Design/redesign flood defence works with the probability of exceeding Q1%, in accordance with the provisions of the Flood Risk Management Strategy, in order to protect the population		Costs for design/redesign of flood defence works with probability of exceeding Q1% are included in the project costs	ABA Someș-Tisa

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Risks related to climate change	Risk score	Adaptation measures	Residual risk	Cost options	Officer Implement ation
		and exposed goods more effectively			
		Building polders to mitigate maximum downstream flows		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of carrying out new polders : - Polder Tur, left bank, am. confl. Talna, 5 million cubic meters, Turulung Polder, on the right bank of the Tur River, upstream of the confluence with the Turț stream, 9 million cubic meters	ABA Someș-Tisa
		Creation of new wetlands		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of creating new wetlands with the role of flood wave mitigation and raising the local ecological potential (am. confl. with Talna, S = 2 kmp and right shore in place area. Small Gherta, S = 3 kmp)	ABA Someș-Tisa
		Restoration of floodplains		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of reconnection and restoration of floodplain Tur River, downstream Călinești S accumulation = 0.5 kmp in downstream conf. area Turț and left shore levee relocation, upstream confl. Talna L=3 km and at confl. with Turț L=2 km	ABA Someș-Tisa
		Proper planning of the way of using the land at basin level, in order to mitigate the floods, by increasing		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of forest maintenance and conservation works (22,548.25 ha in Tur basin +1,591 ha in Lechincioara tributary basin)	ABA Someș-Tisa Forest Guards, R.N.P. - Romsilva, Forest Divisions

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Risks related to climate change	Risk score	Adaptation measures	Residual risk	Cost options	Officer Implement ation
		the underground water infiltration and decreasing the surface drainage.		and improvement of their management in the reception basins of A.P.S.F.R. on 1,045.34 ha in the Tur basin + 0.32 ha in the Lechincioara tributary basin)	
		Changes in the use of indoor spaces, by increasing the surface of green spaces, applying porous pavements instead of asphalt and concrete, in order to reduce surface drainage and increase infiltration.		There is no cost to the project. Closer and more efficient collaboration with local, county and regional institutions is needed to include these measures in the specific plans and strategies	Satu-Mare County Council, The municipaliti es of the ATUs concerned by the project, etc.
		Monitoring extreme precipitation and maximum flows in order to manage flood risk as effectively as possible		There is no cost to the project. Monitoring of dangerous hydro-meteorological phenomena at the level of the Tur basin is carried out through measurements from the hydrometeorological network (10 stream gauges, 11 pluviometers, etc.) as well as with modern global radar systems based on which warnings are provided, 'nowcasting'. Operationalization of the entire ROFFG software system for estimating the possibility of producing rapid	ANAR, ABA Someș-Tisa, NMA, CMR Transylvan ia Nord

Risks related to climate change	Risk score	Adaptation measures	Residual risk	Cost options	Officer Implementation
				flash floods in small river basins.	
		Improvement of monitoring/forecasting and warning/alarm systems		There is no cost to the project. Works provided for in PMRI ABA Someș-Tisa, consisting of setting up an automatic pluviometric station in place. Luna Șes	ABA Someș-Tisa
		Raising awareness of the flood risk among the exposed population		There is no cost to the project. ABA Someș-Tisa shall periodically conduct and conduct actions to educate and raise public awareness of the flood risk.	ABA Someș-Tisa
		Improving the response capacity of local public administration authorities with responsibilities in the management of emergency situations generated by floods.		There is no cost to the project.	Ministry of Environment

In addition to the measures listed above, general adaptation measures have been proposed for flood protection infrastructure:

- proper maintenance of defence works;
- ensuring adequate operational measures for flood protection structures;

- regular improvement and refurbishment of existing infrastructure to meet climate change challenges;
- close and efficient collaboration with the relevant authorities (the National Administration of Meteorology, National Forestry Authority), by involving them in updating and adapting the planning and management charts of river basins to forecasted climate change;
- close collaboration with the relevant institutions (municipalities, county councils) to ensure that the proposed adaptation measures are also included in the local, county and regional strategic planning;
- increasing institutional capacity in project design and implementation and reaching funds.

By adopting measures to mitigate the adverse effects associated with climate change, the adaptation of flood protection systems shall be made easier by considering and applying the most appropriate risk mitigation measures induced by these changes, focusing, where appropriate, on non-structural measures, namely adaptive, robust and flexible management, which can be adjusted and evolved in the light of new climate circumstances.

Flood protection systems are unequivocally exposed to climate change challenges. According to projections and predictions, a slight increase in the number of days with heavy rainfall and an increase in spontaneous flash floods in small river basins is expected in the future.

Analyzing the results obtained, it can be uttered that the main forms of impact/risks to which the project has less resilience in the current and future perspective are associated with extreme rainfall and implicitly floods and flooding, which can generate significant damage to hydrotechnical works designed to protect against floods, with repercussions on the exposed population and goods.

In conclusion, it can be mentioned that the project works are exposed overall to an average risk associated with flash floods, which are expected to decrease to an acceptable level through the implementation of the proposed adaptation measures.

XIII. INFORMATION FROM RIVER BASIN MANAGEMENT PLAN

In terms of their location, the proposed works are located in the Someș-Tisa river basin and are carried out at the level of the following surface water bodies:

- Călinești accumulation, ROLW1.1.11_B1;
- Tur – downstream Călinești accumulation - cf. Turț, RORW1.1.11_B3;
- Tur – cf. Turț – border RO – HU, RORW1.1.11_B4;
- Talna – cf. Racșa – cf. Tur, RORW1.1.11.3_B2;
- Talna – springs – cf. Rack and tributaries, RORW1.1.11.3_B1;
- Turț, RORW1.1.11.4_B1;
- Turț – Hodoș, RORW1.1.11.4.2_B1;
- Egher, RORW1.1.10.5_B1.

From the point of view of the location in relation to groundwater bodies, the proposed project overlaps the following groundwater bodies:

- Someș Cone, Holocene Pleistocene inf., ROSO01;
- Upper Tour Plain, ROSO17.

The ecological status/ecological potential and the chemical status of surface water bodies overlapping the proposed project are shown in the Table below.

Table 17. Ecological status/ecological potential of water bodies potentially affected by the project (conf. PMBH Someș-Tisa 2016-2021)

Water body name	Surface water body code	Water body category		Ecological/Potential Status	Chemical status
Călinești accumulation	ROLW1.1.11_B1	LA	Reservoir	Good environmental potential	Good
Tur – downstream Călinești accumulation - cf. Turț	RORW1.1.11_B3	RW	Natural	Good environmental status	Good
Tur – cf. Turț - RO-HU border	RORW1.1.11_B4	RW	Natural	Good environmental status	Moderate
Talna – cf. Racșa – cf. Tur	RORW1.1.11.3_B2	RW	Natural	Good environmental status	Good

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Water body name	Surface water body code	Water body category		Ecological/Potential Status	Chemical status
Talna – springs – cf. Racșa and tributaries	RORW1.1.11.3_B1	RW	Natural	Good environmental status	Good
Turț	RORW1.1.11.4_B1	RW	Natural	Moderate environmental status	Moderate
Turț – Hodoș	RORW1.1.11.4.2_B1	HMWB-RW	CAPM	Moderate environmental status	Good
Egher	RORW1.1.10.5_B1	RW	Natural	Good environmental status	Good

The quantitative status and chemical status of groundwater bodies are shown in Table 18.

Table 18. Quantitative status and chemical status of groundwater bodies potentially affected by the project
(conf. PMBH Someș-Tisa 2016-2021)

Groundwater body name	Groundwater body code	Quantitative status	Chemical status
Someș Cone, lower Holocene Pleistocene inf.	ROSO01	Good status	Good status due to the fact that the surfaces occupied by PO_4 and As exceeding points do not exceed 20% of the surface of the entire water body.
Upper Tur Plain	ROSO17	Good status	Good status, the results of the qualitative mounting indicating an insignificant excess of the threshold value for indicator NH_4.

The environmental objectives of surface water bodies potentially affected by the proposed project specifying the exceptions applied and the related deadlines are presented in the following Table:

Table 19. Environmental objectives of surface water bodies potentially affected by the project (conf. PMBH Someș-Tisa 2016-2021)

Groundwater body name	Surface water body code	Environmental objective		Deadline for reaching the environmental objective		Environmental objective exception type - Ecological status	Environmental objective exception type – Chemical status
		Environmental status	Chemical status	Ecological/Potential Status	Chemical status		
Călinești accumulation	ROLW1.1.11_B1	Good environmental potential	Good chemical status	2013	2013		
Tur – downstream Călinești accumulation - cf. Turț	RORW1.1.11_B3	Good environmental status	Good chemical status	2013	2013		
Tur – cf. Turț - RO-HU border	RORW1.1.11_B4	Good environmental status	Good chemical status	2013	2022 - 2027	Article 4(4) - Technical feasibility	
Talna – cf. Racșa – cf. Tur	RORW1.1.11.3_B2	Good environmental status	Good chemical status	2013	2013		
Talna – springs – cf. Racșa and tributaries	RORW1.1.11.3_B1	Good environmental status	Good chemical status	2013	2013		
Turț	RORW1.1.11.4_B1	Good environmental	Good chemical status	2016 – 2021	2022 – 2027	Article 4(4) - Technical	
Turț – Hodoș	RORW1.1.11.4.2_B1	Good environmental	Good chemical status	2016 – 2021	2013		
Egher	RORW1.1.10.5_B1	Good environmental status	Good chemical status	2013	2013		

The Impact Assessment Study on Water Bodies, through which the magnitude and nature of the impact associated with the proposed project on water bodies shall be predicted, and how it influences the achievement of the environmental objectives of water bodies, is currently ongoing.

XIV. APPENDICES

Appendix 1. Decision of the initial evaluation phase no. 354/April 11, 2019 issued by Satu Mare Environmental Protection Agency;

Appendix 2. Town Planning Certificate no. 4/March 18, 2019;

Appendix 3. Drawn part – standard sections of the works proposed by the project;

Appendix 4. Site plans of the proposed project;

Appendix 5. Development Site Plan of the project;

Appendix 6. Development Site Plan for the proposed project in relation to the natural protected areas.