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WATER RESERVOIRS PROJECT - ARMENIA

Environmental and Social Impact Assessment for the Yelpin Reservoir Construction Project

ESIA REPORT

Rev02

December 2025

Prepared for:

European Bank for Reconstruction and Development

and

Water Committee under the Ministry of Territorial Administration and Infrastructure of the Republic of Armenia

ATMS Solutions

www.atms.am

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- **European Bank for Reconstruction and Development**
- **Water Committee under the Ministry of Territorial Administration and Infrastructure of the Republic of Armenia**

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Disclaimer

This Environmental and Social Impact Assessment (ESIA) Report has been prepared at the request of the Client in accordance with applicable national legislation, the European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy (ESP, 2019) and Performance Requirements (PRs) as well as Good International Practices (GIP).

The ESIA is based on information, data, and documentation provided by the Client, third parties, and publicly available sources, as well as site visits and stakeholder engagement activities undertaken at the time of assessment. Reasonable efforts have been made to verify the accuracy and completeness of the information used; however, the consultants do not warrant that such information is complete or free from error. Any reliance placed on this Report by third parties is at their own risk.

This Report reflects the professional judgment of the consultants, taking into account the scope of work agreed with the Client, the conditions prevailing at the time of preparation, and the information reasonably available. Environmental and social conditions, regulatory frameworks, project design, and stakeholder concerns may change over time. Accordingly, the findings, conclusions, and recommendations presented herein may require revision should new information become available or should material changes to the Project occur.

This ESIA Report has been prepared solely for the purposes described above and should not be relied upon for any other purpose, including but not limited to detailed engineering design, legal interpretation, or financial decision-making. The consultants accept no responsibility or liability for the use of this Report, in whole or in part, by any party other than the Client or EBRD, or for any purpose other than that for which it was prepared.

List of Abbreviations

ACL - Admissible Concentration Limits
BAP - Biodiversity Action Plan
BMP - Biodiversity Management Plan
BSMP - Blasting Safety Management Plan
CCSM - Community Climate System Model
CESMP - Construction Environmental and Social Management Plan
CH - Critical Habitat
CJSC - Close Joint Stock Company
CIA - Cumulative Impact Assessment
CN - Construction Norms
CN&R - Construction Norms and Rules
NDC - Nationally Determined Contribution
DSL - Dead Storage Level
EBRD - European Bank for Reconstruction and Development
EIA - Environmental Impact Assessment
EIEC - Environmental Impact Examination Center
EPRP - Emergency Preparadness and Response Plan
ESAP - Environmental and Social Action Plan
ESIA - Environmental and Social Impact Assessment
ESMP - Environmental and Social Management Plan
ESMS - Environmental and Social Management System
ESP - Environmental and Social Policy
EU - European Union
E&S - Environmental and Social
FSL - Full Supply Level
GBVH - Gender-Based Violence and Harassment
GHG - Greenhouse Gas
GPN - Good Practise Note
GRP - Glass-Reinforced Plastic
HMMP - Hazardous Materials Management Plan
ICH - Intangible Cultural Heritage
IFI - International Financial Institution
LLC - Limited Liability Company
LT-LEDS - Long Term - Low Emission Development Strategy
ME - Ministry of Environment
MSDS - Material Safety Data Sheets

MWL - Maximum Water Level
OHS - Occupational Health and Safety
OHSMP - Occupational Health and Safety Management Plan
GA - Government of Armenia
PAP - Project Affected Person
PBF - Priority Biodiversity Features
PE - Polyethylene
PPE - Personal Protective Equipment
PR - Performance Requirement
PSHA - Probabilistic Seismic Hazard Assessment
RA - Republic of Armenia
SDA - Spoil Disposal Area
SDMP - Spoil Disposal Management Plan
SPA - Spoil Disposal Area
SPMP - Spill Prevention and Management Plan
SEP - Stakeholder Engagement Plan
SNCO - State None Commercial Organization
SSESMP - Site-Specific Environmental and Social Management and Monitoring Plan
TLV - Threshold Limit Value
TMP - Tree Management Plan
TsMP - Topsoil Management Plan
ToR - Terms of Reference
VEC - Valued Environmental and Social Component
WB - World Bank
WMP - Waste Management Plan
WUA - Water Users Association

Content

1. Introduction

1.1 Background

The Government of the Republic of Armenia ('RA') plans to construct 17 reservoirs within the EU support initiative 'Recovery, resilience and reform: post 2020 Eastern Partnership priorities' to the Government of Armenia ('GA') to enhance the water and food security level in the country. The European Bank for Reconstruction and Development ('EBRD' or the 'Bank') is considering provision of a loan to the GA to finance the construction of five water reservoirs in different regions (marzes) of Armenia (the 'Project'):

- Kassakh reservoir in Aragatsotn Marz[1],
- Lichk reservoir in Syunik Marz,
- Yelpin reservoir in Vayots Dzor Marz,
- Artik reservoir in Shirak Marz,
- Astghadzor reservoir in Gegharkunik Marz.

The EBRD has categorized this greenfield project as 'A' in line with its Environmental and Social Policy ('ESP') (2019) because it may cause significant environmental and social impacts. This means that a comprehensive Environmental and Social Impact Assessment ('ESIA') report and associated documents must be elaborated, followed by their public disclosure for a minimum period of 120 days.

The Project's implementing agency is the Water Committee under the RA Ministry of Territorial Administration and Infrastructure ('Client' or 'Water Committee' or 'WCRA'). The Water Committee hired a national consultants to carry out Environmental and Social ('E&S') studies, develop Environmental Impact Assessment ('EIA') reports for the Project's five reservoirs in accordance with the relevant national legislation, and obtain environmental expert examination conclusions (permits) from the State Authorized Body (that is, the Environmental Impact Examination Center (EIEC) under the RA Ministry of Environment (ME)).

The national EIA reports for the five reservoirs have passed the national expert examination process and received positive environmental expert examination conclusions. Although the national EIA reports comply with national requirements, they need to be further upgraded to align with the EBRD Environmental and Social Policy (ESP), including the implementation of a series of supplementary E&S studies:

- Spring season field biodiversity surveys and Critical Habitat Assessment,
- Appropriate Assessments and Biodiversity Action Plans (if required),
- Analysis of Project alternatives,
- Cumulative impact assessment,
- Assessment of impacts of the associated facilities,
- Assessment of greenhouse gas emissions and climate change mitigation measures,
- Water infiltration and loss study, water and soil quality surveys, etc.

One of the five reservoirs listed above is planned for construction within the administrative boundaries of Yelpin village, part of the Areni community in the RA Vayots Dzor Marz. The Yelpin Reservoir is designed on the Yelpin River, a right-bank tributary of the Arpa River, to supply irrigation water to 300 hectares of agricultural land in the rural settlements of Yelpin and Chiva.

[1] "Marz" means "Region" in Armenian

This ESIA report presents the key findings of the national EIA report for the Yelpin reservoir, which has been significantly upgraded to incorporate the outcomes of the supplementary studies outlined above as well as restructured and refined to ensure alignment with the EBRD ESP.

The positive environmental expert examination conclusion №197-24 for the Yelpin EIA report was issued by the EIEC under the ME on 23.09.2024. (**Annex 1**).

1.2 Objective and Scope of Works

The objective of the Assignment is to identify and assess any potentially significant future adverse environmental and social impacts associated with the proposed Project, assess compliance with applicable national E&S legislation and the EBRD ESP (2019) and Performance Requirements ('PR'), determine the measures needed to prevent or minimize and mitigate the adverse impacts, and identify potential environmental and social benefits / opportunities, including those that would improve the environmental and social sustainability of the Project.

The scope of work under the Assignment included the following tasks:

1) Reviewing and identifying applicable national E&S legislative requirements, as well as EU substantive environmental standards, Good International Practices ('GIP'), and EBRD Performance Requirements ('PR').
2) Outlining the Project components and associated facilities.
3) Updating the existing E&S baseline data developed during the national EIA studies by incorporating the results of the supplementary studies.
4) Analyzing the outputs of the stakeholder consultation process conducted during the national EIA studies, and identifying key stakeholder concerns and recommendations.
5) Analyzing project alternatives and justifying the selected option.
6) Identifying the Project's footprint and assessing its impacts on the physical, biological, socio-economic, and cultural environments, including potential benefits and opportunities from Project implementation.
7) Cumulative impact assessment and transboundary impact.
8) Proposing E&S management and mitigation measures, and assessing residual impacts.
9) Developing an environmental monitoring plan and site-specific E&S management plans.

1.3 Content of the ESIA Report

This report has been prepared as part of the Project's ESIA study. It is structured in a manner to address the following sections requested by the Project 'ToR':

Chapter 1 - Introduction,
Chapter 2 - Project Description,
Chapter 3 - Project Alternatives,
Chapter 4 - Legal and Regulatory Framework,
Chapter 5 - ESIA Methodology and Approach,
Chapter 6 - E&S baseline,
Chapter 7 - Stakeholder Consultation,
Chapter 8 - E&S Impacts Assessment, Benefits and Opportunities, Mitigation Measures,
Chapter 9 - E&S Management and Monitoring.

1.4 Sources of Information

The key information and data sources used to prepare this ESIA report include:

- Project ToR (issued by the EBRD),
- ToR for the local EIA consultant,
- National EIA report for Yelpin reservoir (in Armenian) (minenv.am),
- Project design document for Yelpin reservoir,
- Information about the Water Committee from its website (scws.am),
- Armenia Water Reservoirs - Technical, Economic and Green Due Diligence Gap Analysis, Draft Final Report, 2023-2024, Ove Arup & Partners,
- Technical, Economic and Green Due Diligence of Water Reservoirs in Armenia Inception Report, March 2024, Ove Arup & Partners,
- Documents/information provided by the Water Committee,
- E&S reports and documents related to the ongoing water sector projects (Vedi and Kaps reservoirs),
- Meetings/consultations with the national EIA Consultant,
- Result of field studies and meetings with the project stakeholders,
- Key findings of supplementary studies,
- Available maps, layouts, reports, etc. related to the project area.

2. Project Description

2.1 Agricultural Problems Specific to the Project Region

The irrigation of agricultural land-plots in Yelpin and Chiva rural settlements of Vayots Dzor Marz is currently carried out intermittently by the Yelpin pump station[2]. During the peak-flow period, the agricultural land-plots in Yelpin are irrigated by gravity through water pipelines and ditches, which are in poor technical conditions and fed by the Yelpin River. In both Yelpin and Chiva, irrigation water is delivered to users through either gravity-fed or pumped systems managed by the Yeghegnadzor Water Users Association (WUA).

During the low-flow vegetation period (July-September), water availability in rivers declines significantly, resulting in insufficient irrigation and reduced crop yields. As a result, farmers are mainly limited to cultivating grains (such as wheat and barley), which can typically be irrigated only once a year, usually in May.

Despite these limitations, a variety of agricultural outputs are still produced in the area, including 80-100 tons of meat, 500-600 liters of milk, 4-5 tons of honey, 250,000-300,000 eggs, 1,000-1,200 tons of grapes, 250-300 tons of fruit, and various types of vegetables.

According to the data provided by the Yeghegnadzor WUA, the actual maximum irrigated area in Yelpin and Chiva over the past five years was 219 ha. Of this, 80 ha were irrigated mechanically, consuming 224.6 ths. kWh electricity. The agricultural land in Chiva is irrigated exclusively through gravity systems.

2.2 Water Demand and Command Area

In the Project area, the irrigation water requirements for agricultural croplands are estimated based on the bulletin 'Norms and Regimes of Crop Irrigation for Irrigated Lands in the Republic of Armenia', approved by a joint decree of the RA Minister of Territorial Administration and the RA Minister of Agriculture in 2007[3].

An irrigation regime is a combination of the cultivated crops, along with the irrigation norms, frequency and timing/period. It depends on such factors as climatic conditions, crop type, and the location of the cultivated land-plots, which determine the irrigation water requirements. The bulletin summarizes the irrigation regimes for agricultural crops according to regional zones and their respective elevations.

The 300 ha command area (Yelpin - 250 ha, Chiva - 50 ha) of the proposed reservoir is located in Vayots Dzor Marz. Based on elevation, the following soil types have been identified there: brown and moderately light, abrasive clayey-sandy soils of medium to high thickness, formed at altitudes between 1200 and 1600 masl.

Over the past five years, a maximum of 29 ha out of 50 in the Chiva rural settlement and 103 ha out of 250 ha in the Yelpin settlement (a total of 132 ha) within the 300-hectare command area of the planned reservoir have been cultivated. Following the construction of the reservoir, the cultivated area is expected to increase by 168 ha (a 56% increase), reaching the full 300 ha, with a focus on high-value crop cultivation (**Table 2.1**).

[2]Preparation of design and cost estimation documents for construction of Yelpin reservoir in Vayots Dzor Marz of the Republic of Armenia, Explanatory Note, 2024
[3]Ibid

Table 2-1. The historical and prospective structure of the cultivated land-plots under the reservoir command area

Type of crops	Occupied area, ha					Maximum, (2022 data) ha	Specific weight, %	Prospective, ha	Specific weight, %
	2018	2019	2020	2021	2022				
Chiva settlement									
Grain	9	9	10	13	15	15	51.7	15	0.3
Perennial grass	1	1	2	2	2	2	6,9	0	0.0
Vegetable	0	0	0	0	0	0	0.0	0	0.0
Grape	0	0	0	0	0	0	0.0	0	0.0
Orchard	16	14	14	12	12	12	41.4	25	0.5
Total in Chiva	**26**	**24**	**26**	**27**	**29**	**29**	**100.0**	**50**	**1.0**
Yelpin settlement									
Grain	10	10	10	12	12	12	0.117	36.0	0.14
Perennial grass	7	2	2	2	2	2	0.019	9.0	0.04
Vegetable	3	3	3	5	5	5	0.049	15.0	0.06
Grape	10	14	14	24	24	24	0.233	65.0	0.26
Orchard	58	55	51	60	60	60	0.583	125.0	0.5
Total in Yelpin	**88**	**84**	**80**	**103**	**103**	**103**	**1.00**	**250**	**1.00**
Chiva and Yelpin settlements									
Grain	19	19	20	25	27	27	0.205	51.0	0.17
Perennial grass	8	3	4	4	4	4	0.030	9.0	0.03
Vegetable	3	3	3	5	5	5	0.038	15.0	0.05
Grape	10	14	14	24	24	24	0.182	75.0	0.25
Orchard	74	69	65	72	72	72	0.545	150.0	0.5
Total	**114**	**108**	**106**	**130**	**132**	**132**	**1.00**	**300.0**	**1.00**

The annual water demand for irrigating the 300 ha of land in Yelpin and Chiva rural settlements within the reservoir command area, taking into account the crop types proposed in **Table 2-1**, is estimated in the Project design document and summarized below in **Table 2-2**.

Table 2-2. Water demand for irrigating the 300 ha of land under the reservoir command area

№	Name of agricultural crop	Area occupied by the crop		Irrigation norm, m^3/ha	Average balanced irrigation norm, m^3 per ha	Water annual demand, mln. m^3
		by ha	by parts			
1	Grain	51	0.17	3400	578.0	
2	Perennial grass	9	0.03	5400	162.0	
3	Vegetable-crop production	15	0.05	6050	302.5	
4	Grape	75	0.25	5400	1350.0	
5	Orchard	150	0.50	2500	1250.0	
Total		**300**	**1.0**	**22750**	**3643**	**1.093**
Net Total					**4857**	**1.457**

The existing Yelpin pump station, constructed on the Hermon-Yelpin water pipeline, will serve as a reserve option and will redirect 90 l/s of water, currently used to meet the irrigation needs of land plots in Yelpin rural settlement, to Rind village to improve irrigation water availability there.

2.3 Key Outputs of the Hydrological Study

The Yelpin River exhibits a monthly flow distribution typical of rivers in Armenia. It is characterized by a well-expressed spring flood period, low-flow conditions in winter and summer, and a secondary, less pronounced autumn flood period. Spring floods are primarily caused by snowmelt and rainfall. Autumn floods may result from rainfall, but they are short-lived and not well-developed. During low-flow periods, the river is mainly fed by mountain springs. The summer low-flow period can occasionally be accompanied by rainfall.

The dataset from the Vernashen hydrometric station on the Gladzor River was used to study the average annual discharges at the Yelpin hydrometric station on the Yelpin River. The application of the Vernashen station as an analogue for the Yelpin station was justified by the fact that the conditions outlined in the associated Construction Norms and Rules (CN&R) №2.01.14-83[4] were met. The common years of observation for both stations cover the period from 1970 to 1980[5].

Figure 2-1 below presents the monthly flow distribution in the Yelpin Reservoir study area for years with average discharges corresponding to 25%, 50%, 75%, and 95% probabilities. The figure clearly shows a period of spring floods during the months of March to May, and low-flow periods in summer (July-September) and winter (November-February).

Figure 2-1. Water flow monthly distribution in the monthly Yelpin reservoir area for years of different probabilities

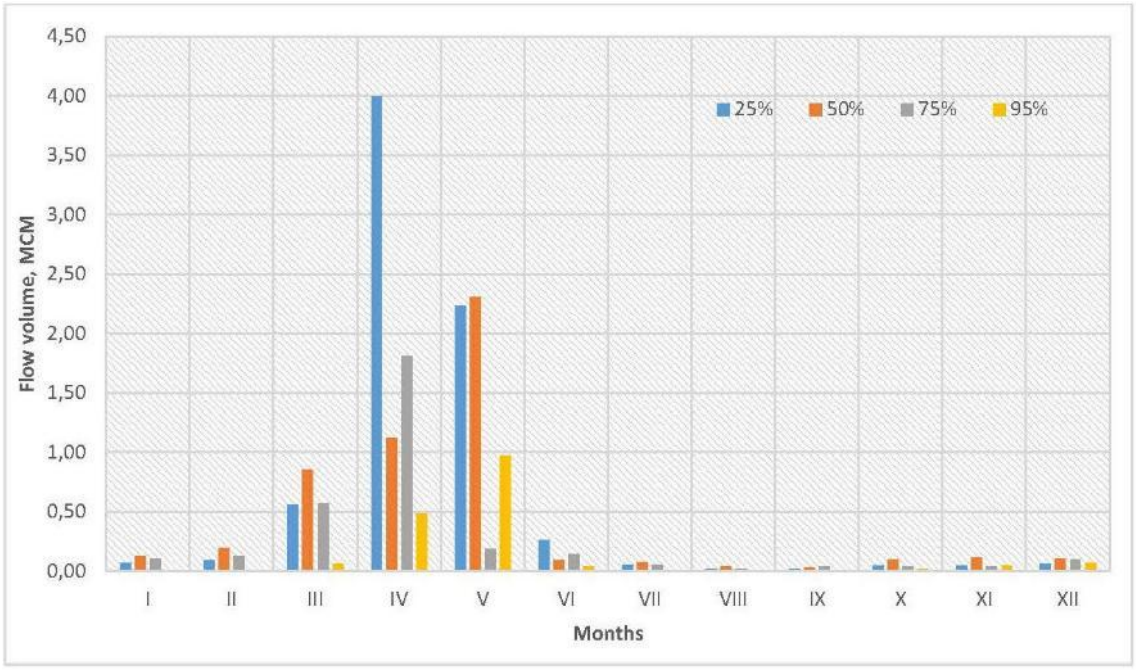


Table 2-3 clearly indicates that, depending on the year's probability, 80–90% of the annual flow occurs during the spring flood period.

Table 2-3. Distribution of monthly flows of years with average discharge and 25%, 50%, 75% and 95% probabilities

Unit	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
1985 - year of maximum flow (25% probability)													
m^3/s	0.03	0.04	0.21	1.54	0.83	0.10	0.02	0.01	0.01	0.02	0.02	0.02	0.24
$mln.m^3$	0.07	0.09	0.56	4.00	2.23	0.26	0.05	0.02	0.02	0.05	0.04	0.06	7.45

[4]CN&R №2.01.14-83 'Definition of Calculated Hydrological Characteristics'
[5]Yelpin reservoir national EIA study report, 2024

Unit	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual
%	0.89	1.25	7.51	53.65	29.98	3.50	0.67	0.27	0.22	0.62	0.60	0.82	100.0
1977 - year that coincides with 50% probability													
m^3/s	0.076	0.190	0.372	0.745	0.334	0.122	0.039	0.009	0.016	0.065	0.052	0.046	0.172
$mln.m^3$	0.204	0.464	0.997	1.931	0.896	0.315	0.104	0.024	0.041	0.173	0.134	0.124	5.407
%	3.95	9.00	19.35	37.45	17.37	6.11	2.01	0.47	0.80	3.36	2.60	2.41	100.0
1975 - year of low flow (75% probability)													
m^3/s	0.04	0.05	0.21	0.70	0.07	0.05	0.02	0.01	0.01	0.01	0.01	0.04	0.1
$mln.m^3$	0.11	0.13	0.57	1.81	0.19	0.14	0.05	0.01	0.04	0.04	0.04	0.10	3.21
%	3.37	3.92	17.73	56.38	5.83	4.35	1.58	0.44	1.16	1.14	1.10	2.98	100.0
1996 - year of minimum flow (95% probability)													
m^3/s	0.00	0.00	0.02	0.18	0.38	0.01	0.00	0.00	0.00	0.01	0.02	0.02	0.05
$mln.m^3$	0.00	0.00	0.06	0.49	0.97	0.04	0.01	0.00	0.00	0.02	0.04	0.06	1.69
%	0.00	0.00	3.51	28.71	57.60	2.31	0.54	0.00	0.00	0.95	2.53	3.85	100.0

It can be concluded from the **Table 2-3**, that total flow volume can reach 5.407 mln. m^3 in years with 50%-probability discharges, 3.21 mln. m^3 in those with 75%-probability discharges, and 1.69 mln. m^3 in minimum flow years with 95% probability.

The findings of the hydrological studies are used to estimate the planned Yelpin Reservoir's capacity, define its command area, and determine the environmental flow.

The findings of the hydrological study are used to assess the water availability, flow characteristics, and seasonal variability of the Yelpin River in order to support the planning and design of the proposed Yelpin Reservoir. These studies provide the necessary data for estimating reservoir capacity, defining the command area, ensuring reliable water supply, and determining the required environmental flow to maintain downstream ecosystem health.

2.4 Environmental Flow

The environmental flow for the reservoir area was calculated in line with the RA Government Decree №57-N, dated 25.01.2018 based on data from the Yelpin and Verin Getashen hydrometric stations. According to the noted Government Decree, the environmental flow for each month is calculated by adding the average of the minimum 10-day discharge values from the winter low-flow period to 33% of the minimum monthly discharge.

At the Yelpin hydrometric station, the minimum 10-day discharge value is 0.006 m^3/s. To calculate the environmental flow at the reservoir site, a coefficient K was applied, as specified in the Government Decree №57-N. This coefficient represents the ratio of average annual discharges between different locations.

The results of the environmental flow calculation for the Yelpin reservoir are presented in **Table 2-4**.

Table 2-4. Environmental flow at Yelpin gauging station and in reservoir area

River section	Months											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Yelpin station minimum discharge	0.02	0.03	0.08	0.26	0.20	0.07	0.02	0.01	0.01	0.01	0.01	0.02
Environmental flow (Yelpin station)	0.013	0.016	0.033	0.093	0.073	0.027	0.011	0.008	0.008	0.008	0.009	0.013

River section	Months											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Environmental flow (reservoir site)	0.010	0.012	0.025	0.071	0.055	0.021	0.008	0.007	0.007	0.007	0.007	0.010

Hence, the minimum environmental flow in the Yelpin reservoir study area shall be 7 l/s during the period from August to November, and the maximum flow shall be 71 l/s in April.

2.5 Sediment Load from the Feeding River

No studies of sediment transport have been conducted for the Yelpin River in the past. Therefore, sediment transport observations from the 'Saliget Shatin' hydrometric station, considered an analogue to the Yelpin River, were used as a reference. These observations were conducted during the years 1964-1970, as well as in 1973 and 1975[6]. According to the data, the average annual sediment transport module is 261 t/km². Based on these measurements, the estimated annual sediment transport to the Yelpin Reservoir area is approximately 4,170 tonnes or 2,780 m³. This represents a relatively high value for the Yelpin River.

To determine the main two components of sediment load, suspended and bedload (bottom) sediments, the turbidity map from the hydrological atlas was used. According to this source, the average annual turbidity is 300 g/m³. This value was then used to calculate the average annual sediment transport using the following formula:

$R=0.16\times300/1000=0.048$ kg/s

Assuming that bulk density of suspended sediments is 1.2 t/m^3, average annual volume of suspended sediments will be:

$W=0.048\times31.54/1.2=1258$ m^3.

In the absence of relevant data, the transport of the second component, bottom sediment, is reasonably assumed to be 50% of the suspended sediment transport. The average annual bottom sediment transport is estimated at 0.024 kg/s. Assuming a bulk density of 2.4 t/m³, the average annual volume will be:

$W_g=0.024\times31.54/2.4=315$ m^3.

The total annual volume of suspended and bottom sediments will be:

$W_{annual} = W+W_g=1258+315=1573$ m^3.

The dead storage volume of sediment in the reservoir was determined for a period of 75 years (up to the year 2100):

$W_{dsv}=75\times W_{annual}=75\times1573\approx120000$ m^3.

2.6 Water Infiltration from the Reservoir Body

Water infiltration from the reservoir body was estimated during the engineering-geological surveys conducted as part of the Project design study. Within this study, the infiltration properties of the upper soil layer in the planned reservoir area were analysed. The main parameter characterizing the soil's infiltration properties is the permeability coefficient (K).

[6]Preparation of design and cost estimation documents for construction of Yelpin reservoir in Vayots Dzor Marz of the Republic of Armenia, Explanatory Note, 2024

The soil/ground structure under the reservoir area is represented by the following layers:

- Gravel and pebbles (K_{ave}=16.8 m/day),
- Pebble-stone mixture (K_{ave}=15.3 m/day),
- Rocky tuff breccias and andesites (K_{ave}=0.8 m/day).

The reservoir body was divided into 3 blocks: i) central area (1st block, along the Yelpin river mouth), ii) left side area (2nd block, left bank of the river) and iii) right side area (3rd block, right bank of the river).

The results of water infiltration calculations from the 3 blocks under the reservoir body are summarised in **Table 2-5**.

Table 2-5. Water infiltration from reservoir body

Parameter	Unit	1st block	2nd block	3th block
Water infiltration	m^3/day	2,290.0	509.0	41.4
	m^3/year	835,850	185,785	15,111
		≈1,036,600		

The water infiltration from the bypasses on either side of the dam is 520 m^3/day and 616 m^3/day, respectively, which amounts to 414,640 m^3/year.

The total annual infiltration from the reservoir body is 1,036,600+414,640=1,451,240 m^3/year, which requires anti-infiltration measures. These include excavating a trench 22 m long and 9-11 m deep in the bed section (central block), constructing a clay-cement curtain with a depth of 17-18 m, and installing a reinforced concrete slab with a thickness of 1.0 m, reducing the permeability coefficient to 0.01 m/day.

As a result of the proposed anti-infiltration measures, the water infiltrations from the reservoir body and dam both side bypasses are shown in **Table 2-6**.

Table 2-6. Water infiltration after implementation of the anti-infiltration measures

Parameter	Unit	1st block	2nd block	3th block	Right bypass	Left bypass
Water infiltration	m^3/day	1.477	2.232	1.8	7.7	6.5
	m^3/year	539.1	814.68	657.0	2,810.5	2,372.5
		7,194				

Temporary infiltration losses from the reservoir body during ground saturation are estimated at 102,098 m^3.

2.7 Project Overview

2.7.1 Background

A feasibility study for the construction of the Yelpin reservoir was conducted in 1971, by the 'Hayjrnakhagits'[7] Design Institute. In 2012, the same Design Institute developed the detailed design for the reservoir, according to which the hydraulic unit can be characterized by the following key features:

[7] ArmWaterProject

1	Dam body material	Pebble-gravel
2	Maximum dam height from foundation	34.5 m
3	Dam length (including crest)	165 m
4	Anti-seepage measure	Central loam core
5	Total storage volume of the reservoir	0.8 mln. m^3
6	Active storage volume of the reservoir	0.7 mln. m^3
7	Floods were calculated for a probability of P=0.5%, resulting in a design flood discharge of Q_{flood}=22 m^3/s. To release floodwaters, an open trench-type spillway was designed along the reservoir shore, incorporating a chute and a flip bucket at its downstream end.	
8	To release construction discharges, a single-branch reinforced concrete square gallery with dimensions of 2.0×2.0 m was designed. A steel pipeline with a diameter of 500 mm will later be installed within the gallery to release irrigation discharges of Q_{irr}=218 l/s from the reservoir.	
9	To convey irrigation water from the reservoir to the irrigable lands, a main water pipeline was designed using Glass-Reinforced Plastic ('GRP') pipes with d=500 mm and d=400 mm diameters and L=2095 m total length. Additionally, a right-side branch was designed using polyethylene ('PE') pipes with d=200 mm and L=1630 m. Seven distributors were designed using PE pipes with diameters ranging from 110 to 200 mm and a total length of 3535 m for water distribution.	

2.7.2 Current Design Study

Based on Contract № JK-BMKhTsZB 22/5-N signed on 22.11.2022 between the Water Committee and Modul LLC design company, the latter was appointed to develop the design documentation for the construction of the Yelpin Reservoir. The previous design studies from 1971 and 2012 were used as baseline data and were supplemented by Modul LLC through their own geodetic, geological, and hydrogeological surveys, as well as seismic microzonation and risk assessment, using state-of-the-art technical and technological equipment.

As a result, significant optimizations were recommended by Modul LLC, including changes to the principal and conceptual approaches to water storage, modernization of the main structures, and proposed solutions aligned with modern construction industry practices. In addition, calculations of the main structures and determination of their dimensions were carried out based on the principle of combining modern studies with alternative solutions to ensure the selection of the most efficient option.

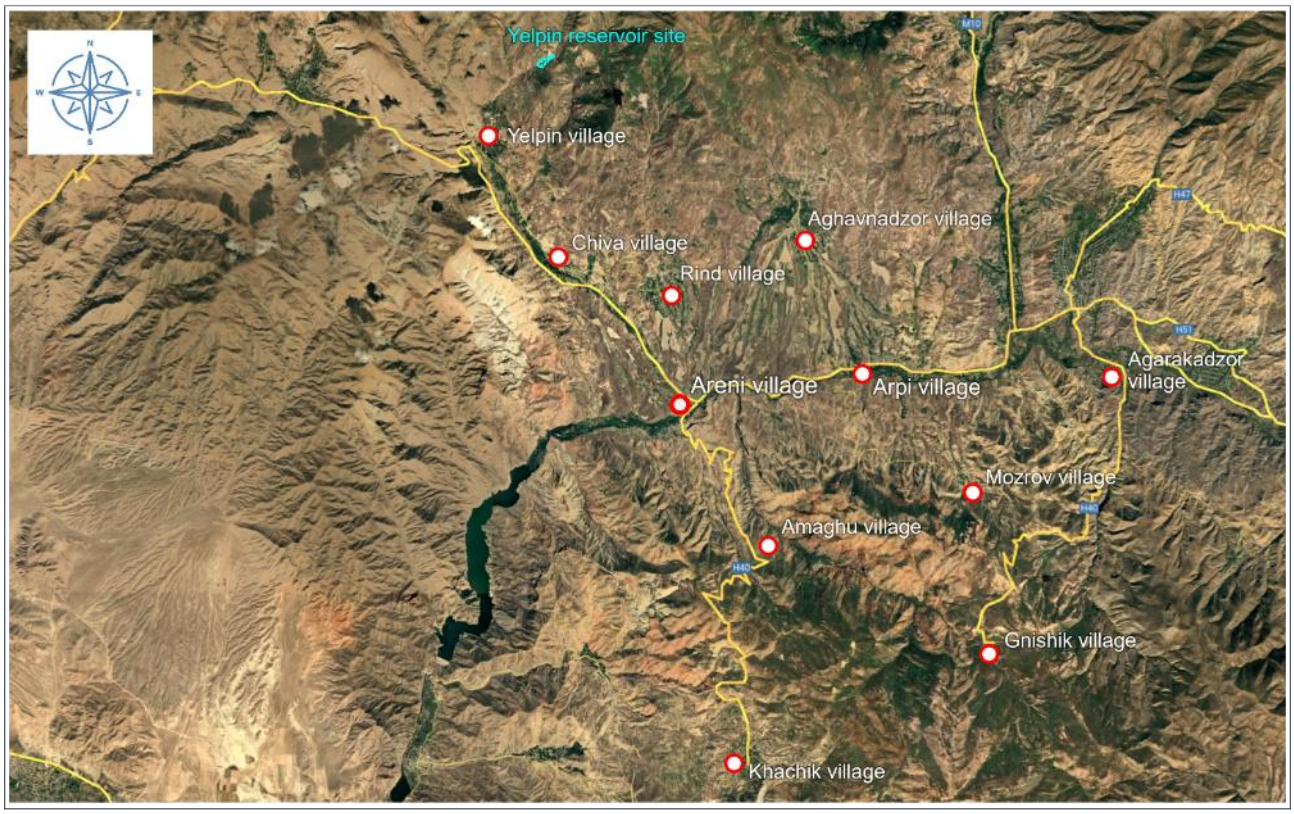
Adjustments were also made to the water demand calculations, taking into account the volumes of water currently supplied to the actually irrigated lands, as well as the proposed composition of prospectively profitable crops and their respective irrigation norms and regimes. The total and active storage volumes of the reservoir, fully covering the water demand as defined by the water balance estimations and corresponding morphometric characteristics (Maximum Water Level (MWL), Full Supply Level (FSL), Dead Storage Level (DSL)), were determined.

2.7.3 Project Location

The planned Yelpin Reservoir will be located within the administrative boundaries of Yelpin village. It is designed to be constructed on the Yelpin River, a right-bank tributary of the Arpa River, at an elevation of 1,650-1,700 meters above sea level (masl). The reservoir will provide irrigation for approximately 300 ha of agricultural land in the Yelpin and Chiva rural settlements. Yelpin village, along with 10 other rural settlements, is part of Areni multi-settlement community (**Figure 2-2**).

Yelpin village is located in the southwest of Vayots Dzor Marz, at an elevation of 1,400-1,545 masl. The distance between Yelpin and Yeghegnadzor, the administrative center of Vayots Dzor Marz, is 26 km, while the road distance to Yerevan, the capital of Armenia, is approximately 100 km. The M-2 interstate highway passes directly through the western part of Yelpin. The Armenian-Azerbaijani contact line, which separates Vayots Dzor from the Nakhchivan Autonomous Republic, runs through the nearby mountains. Yelpin is bordered by the settlement of Zangakatun in Ararat Marz to the northwest, and by the settlements of Chiva and Rind in Vayots Dzor Marz to the southeast.

Figure 2-2. Location of the Yelpin reservoir site and the rural settlements included in the Areni multi-settlement community



2.7.4 Project Components

The Yelpin Reservoir and its associated structures will cover an area of 14.7 ha, of which 8.5 ha will be occupied by the dam and its auxiliary facilities. The reservoir will have a storage capacity of 0.93 mln. m^3. The stored water will be used to irrigate 300 ha of agricultural land in the rural settlements of Yelpin and Chiva during low-flow months.

The reservoir hydraulic unit (**Figure 2-3**) consists of:

1. Dam,
2. Spillway,
3. Construction spilway,
4. Irrigation outlet and main pipeline.

During the preliminary design study phase, two options for the dam construction were considered (**Figure 2-4**):

- Option 1 - Embankment dam (from gravel-pebbles), with central loam core,
- Option 2 - Enbankment dam with loam screen.

The Master Plan of the Project area, indicating Yelpin reservoir, its components, surrounding infrastructure, associated facilities, and the lands of the Yelpin and Chiva rural communities, is provided in **Annex 2** of this ESIA report.

Figure 2-3. Hydraulic unit of the Yelpin reservoir

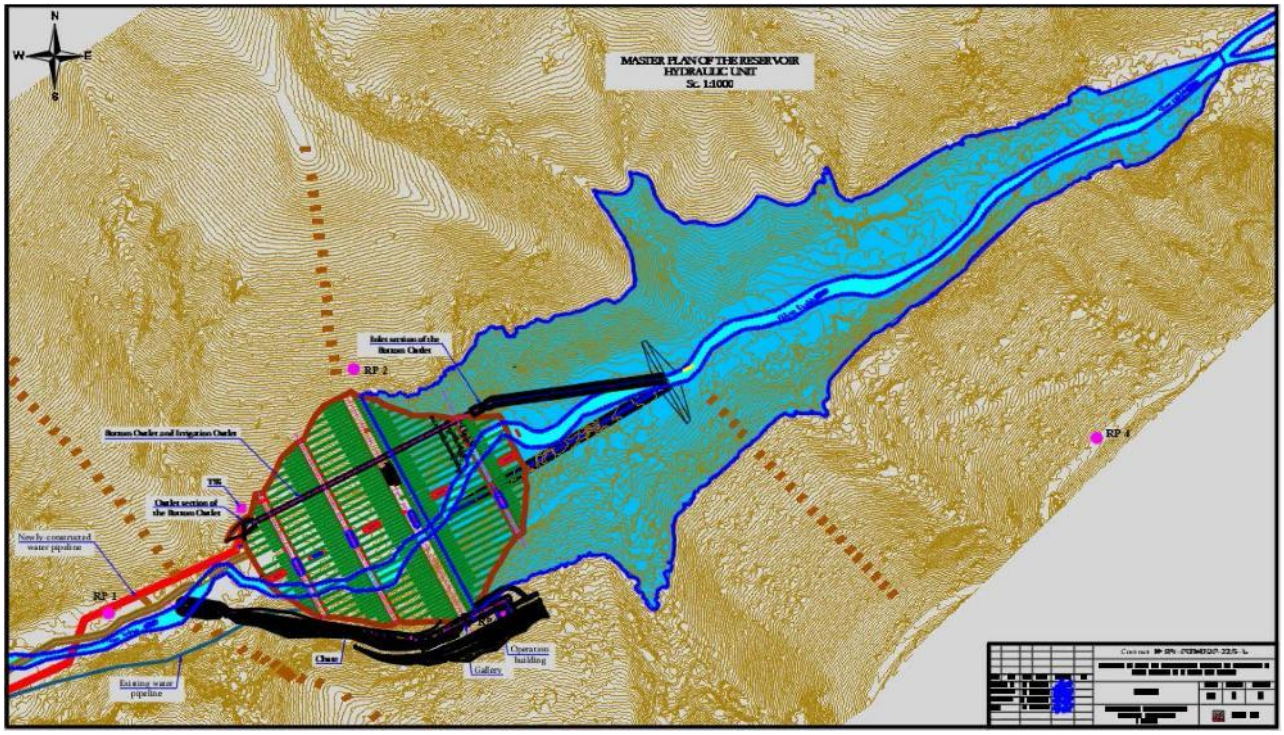
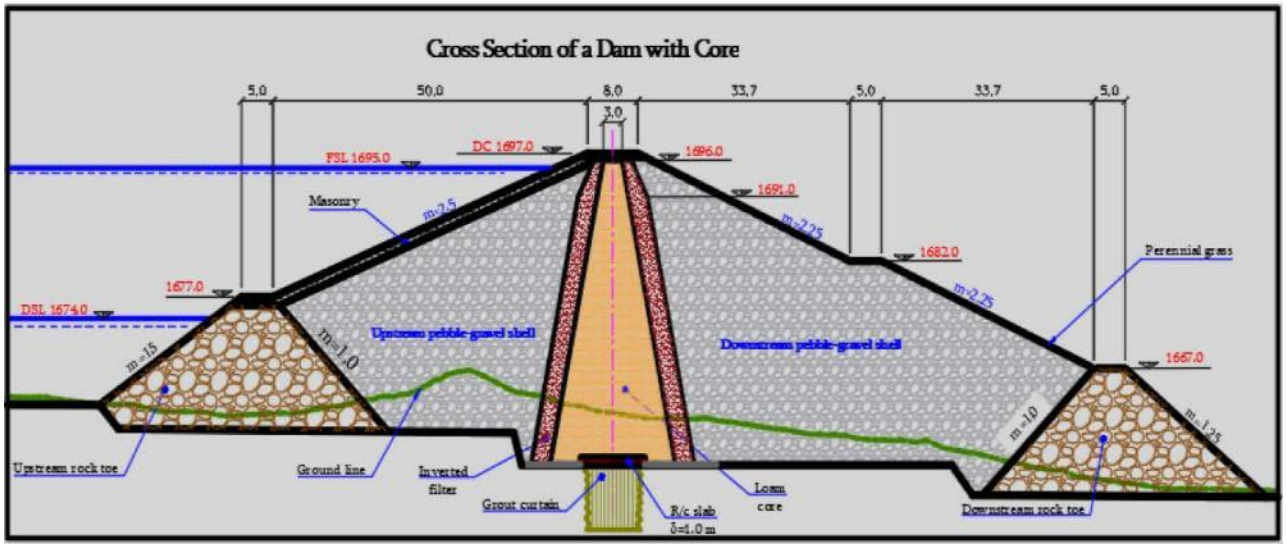
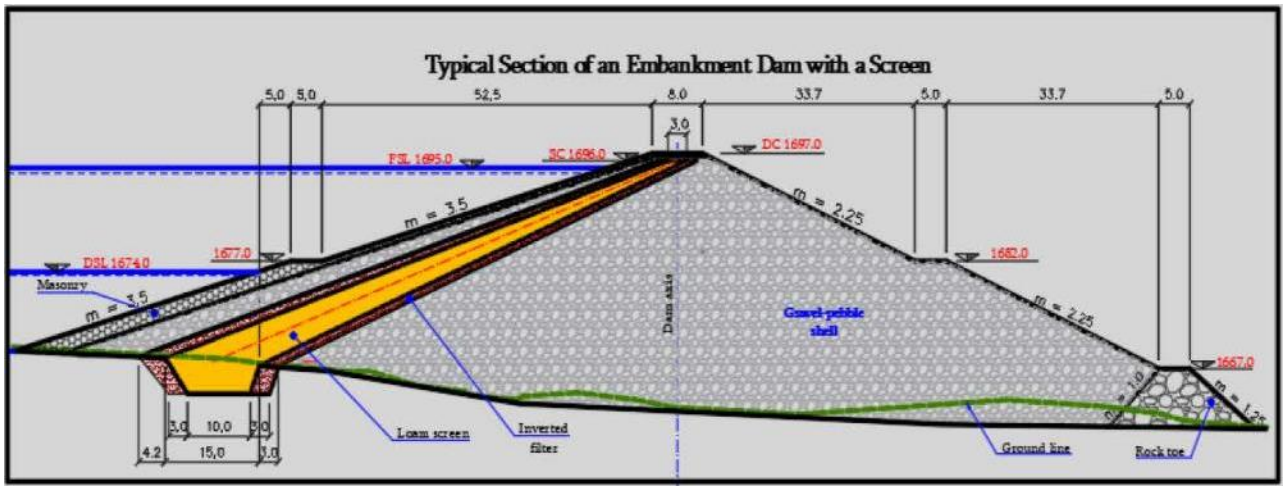


Figure 2-4. Two options of dam construction





2.7.5 Technical Solutions

Dam structure

The dam body is planned to be constructed using local materials, specifically pebble-gravel shells. Anti-seepage protection will be provided by a central loam core. The dam crest elevation has been determined for both the Full Supply Level (FSL) and the Maximum Water Level (MWL), with the MWL calculated at 1693 masl.

The main technical characteristics of the dam are as follows:

- Dam height - 40.0 m,
- Inclination of the upstream slope - 1:2.5,
- Inclination of the downstream slope - 1:2.25,
- Crest width - 8.0 m,
- Dam length - 168 m at an elevation of 1697 masl.

The downstream slope is planned to be turfed or covered with perennial grass. To protect the upstream slope from wave action, it will be stabilized with riprap made of coarse stones excavated from a local quarry.

The rock surface at the dam toe will be treated to gradually reduce steepness, ensuring that the abutment angle of adjacent rock sections does not exceed 20 degrees.

Slope stability for both upstream and downstream faces has been assessed under static and dynamic conditions. The design accounts for a maximum horizontal acceleration (Amax = 0.45g), as established by seismic micro-zoning studies.

The dam of the Yelpin reservoir has been designed as a class II Dam to Armenian legislation. Based on Dam Height and Volume this would be considered a Large High Hazard Dam as defined by ICOLD[8].

The layout of the dam is provided in **Annex 3** of this ESIA report.

The following materials will be used for the construction of the dam body:

- Limestone - 300,000 m^3,
- Sandy clay - 55,000 m^3,

[8]Armenia Water Reservoirs - Technical, Economic and Green Due Diligence Gap Analysis, Draft Final Report, 2023-2024, Ove Arup & Partners

- Rock mass - 58,000 m^3,
- Sand - 30,000 m^3,

It is planned to use sandy clay from two borrow-pit areas adjacent to the planned reservoir as construction material for the dam's anti-filtration element (core).

Borrow-pit №1 is located approximately 3.5 km southwest of the reservoir dam site, on the left side of the road leading to the reservoir. The site was surveyed in 2011 through three phases of geophysical investigation. **Borrow-pit №2** is located about 4.5 km from the dam site. It was investigated in 2011 by drilling three boreholes to depths of 6.0-6.5 m, along with the identification of three vertical geophysical zones.

Limestone alluvial soil can be obtained from the riverine valley area both upstream and downstream of the planned dam on the Yelpin River. The required quantity of sand can be extracted from a 40-50 m wide section of the riverbed, provided it is excavated to a depth of 5.0-7.0 m.

The required volume of rock mass construction material has been investigated within the reservoir basin and on right and left banks. These areas contain extensive deposits of Pliocene-age dacite rock, as well as large chink formations located beneath the reservoir.

There is no sand mine in the studied reservoir area. It is planned to obtain the required quantity and quality of gravel-sand soil for the core reverse filter after screening the gravel-sand mineral extracted from the reservoir basin and washing the clay particles.

Spillway

An open side channel spillway has been designed to discharge flood flows. The spillway will consist of six main components:

1. Side weir,
2. Trench,
3. Transition zone,
4. Gallery beneath the dam crest,
5. Chute,
6. End section of the chute as a flip bucket.

The spillway is designed to handle inflows of Q=32.5 m^3/s, corresponding to a flood event with a 0.1% probability and to safely convey these flows downstream. According to the design, the spillway will be located on the left bank of the reservoir, directly adjacent to the dam. The total length of the spillway will be 188.0 m. It will consist of a trench-type inlet structure, a gallery passing beneath the dam, an open discharge channel, and a chute. After flow transformation, the maximum discharge is expected to be Q_{max}=25.9 m^3/s, which is taken as the design baseline.

The trench-type spillway is a reinforced concrete (r/c) side ogee weir with a widening bottom section. The bottom width is B_o=2.0 m at the inlet section and increases to B_L=5.0 m at the outlet section of the trench. Considering the site conditions, a side channel spillway has been designed with a total weir length of L = 22.0 m, including a 2.0 m headwall. The elevation of the weir sill corresponds to the Full Supply Level (FSL) of 1695.0 masl.

The total depth of the trench is H_1=1.30 m at the inlet section and H_2=2.70 m at the outlet section. The trench walls are inclined and have varying thicknesses at different heights. A 9.0 m long concrete headwall is provided on the left side of the trench inlet to maintain the required roadbed elevation (1697.0 masl) and to prevent seepage losses from that section.

The gallery has a rectangular cross-section. The height of the first 2.0-meter-long section varies between 2.5 m and 2.0 m, while the height of the remaining sections is constant at 2.0 m. To prevent seepage losses from the gallery, a concrete toe is provided at a depth of 80 cm at the intersection of the gallery and the dam axis. The gallery will have a wall thickness of 50 cm and a longitudinal slope of i = 0.02. Wall inclinations will vary depending on the height, with wall thicknesses of 40 cm at the top and 70 cm at the bottom.

Construction spillway

A construction spillway is a temporary structure used during the construction phase of the hydraulic unit to safely divert or release water from the river or catchment area before the permanent spillway is completed. According to the design, river diversion will be carried out through a square-section gallery (2.0×2.0 m) with a length of 165.2 m and a bottom slope of i=0.05. Calculations were performed for a flow with a 10% probability ($Q_{10\%}$=14.07 m³/s).

To divert the river flow during construction and channel it into the gallery, a diversion spillway is planned. From this spillway, an access earthen canal with a depth of 2.0 meters will be constructed. To prevent backflow from the gallery to the construction site, a cofferdam is planned downstream in the form of a rock toe, which will later be integrated into the main dam body

Irrigation outlet and main pipeline

To deliver 188.6 l/s of irrigation water from the reservoir to the users, the installation of a steel pipeline with a diameter of 530 mm and wall thickness of 6 mm (Ø530×6 mm) and a length of 170.0 m is planned within the gallery. The minimum elevation for water abstraction has been set at the Dead Storage Level (DSL) corresponding to the bottom outlet elevation of 1674.0 masl.

A reinforced concrete (R/C) intake well with a metal trash rack is planned at the inlet section of the outlet. To enable sediment removal from the intake well, a 300 mm diameter pipe will be installed through the concrete plug, equipped with a regulation valve. Pipe maintenance and repair will be carried out during reservoir drawdown, as needed.

To regulate the operation of the irrigation outlet, two emergency valves are provided at the inlet section of the pipe, and one regulating valve with a flow meter is installed at the outlet section. To release environmental flows (ranging from 7 to 71 l/s) into the river, a valve with a diameter of 150 mm, equipped with a flow meter and connected to a pipe of the same diameter and approximately 10 meters in length, is installed upstream of the outlet valve, before the flow is discharged from the gallery into the river.

After the reinforced concrete (R/C) gallery, the main irrigation pipeline constructed from polyethylene pipes with a diameter of 500 mm and a total length of 1870 m will begin at the outlet section of the irrigation outlet. A distribution well is provided at section DM 8+40 of the main pipeline equipped with three wedge gate valves of 400 mm diameter. This well is intended to connect to the right branch (to be constructed later) and to enable rapid drawdown of the reservoir in the event of a failure. Another distribution well is also provided at the outlet section of the main pipeline (DM 18+47), which will be connected to the existing pressure pipeline of the Yelpin pump station.

The main technical characteristics of the reservoir and dam are presented in **Table 2-7**.

Table 2-7. Main technical characteristics of the Yelpin reservoir

№	Key technical data	Measurement unit	Details
	Dam		
1	Type		Embankment dam

№	Key technical data	Measurement unit	Details
2	Material of the body		Pebble-gravel
3	Dam type		Rockfill loam core
4	Reservoir volume Active Dead	m^3	930,000 810,000 120,000 (1674.0 m) 75y worth
5	Reservoir Surface Area (at Top water level)	ha	5.43
6	Dam class (Armenian Standards)		II
7	ICOLD - Dam class		H=40m, V<1.0 mln.m^3 High
8	ICOLD - Dam hazard		PHC>200 High-(III)
9	Dam crest level	masl	1697.0
10	Elevation of the bottom	masl	1657.0
11	Dam height	m	40.0
12	Width of the crest	m	8.0
13	Length of the dam with the crest	m	168.0
14	Dam upstream slope		1:2.5
15	Dam downstream slope		1:2.25
16	Stabilization of the upstream slope		Rockfill
17	Stabilization of the downstream slope		Perennial grass
18	Type of drainage		Rock toe
19	Total volume of the dam body	ths. m^3	446.0
20	Volume of the core	ths. m^3	55.0
Reservoir			
21	Type		On-stream
22	Full Supply level (FSL)	masl	1695,0 m
23	Maximum Water Level (MWL)	masl	1695,6 m
24	Dead Storage Level (DSL)	masl	1674.0 m
25	Total storage volume of the reservoir	ths. m^3	930
26	Active storage volume of the reservoir	ths. m^3	810
27	Dead storage volume of the reservoir	ths. m^3	120
28	Surface area of the water horizon at the FSL	m^2	63500
29	Volume of soil excavated from the reservoir basin	ths. m^3	150.0
Spillway			
30	Type of the inlet section		Trench
31	Total discharge	m^3/s	32.5 (P=0,1%)
32	Discharge following transformation	m^3/s	25.9
33	Total length of weir	m	22
34	Type of spillway		Chute
35	Length of spillway	m	166

№	Key technical data	Measurement unit	Details
36	Type of abutment with the riverbed		Funnel
Bottom outlet			
37	Type		Gallery
38	Discharge Q10%	m^3/s	14,07
39	Number of branches	item	1
40	Dimensions of the section	m	2.0 x 2.0
41	Length	m	165.2
Irrigation outlet and main pipeline			
42	Water intake structure		R/c intake well
43	Type of the outlet		Steel pipe 530×6 mm in the gallery
44	Type of the main pipeline		Polyethylene pipe, de 500
45	Total length of the main pipeline	m	1870
46	Irrigated area	ha	300
47	Discharge flow of irrigation water	l/s	188.6

2.7.6 Land Resources Required for the Project

The Yelpin reservoir and its components will cover 14.7 ha, from which dam and its auxiliary structures will occupy 8.5 ha area. It is planned to construct the reservoir in the midstream valley of the Yelpin River, where volcanic andesite-dacites from the secondary period are widespread. These are overlain by alluvial, eluvial, and deluvial formations of the modern age, with a thickness ranging from 5 to 14 m. The abrasive alluvial and terrace deposits are composed of pebble-gravel soils containing up to 30% sand, with a thickness of approximately 12 m. These soils are not suitable for agricultural crop production. The land proposed for the construction of the reservoir is communal and falls within the administrative boundaries of Yelpin rural settlement.

Temporary land use

Two borrow-pits, covering a total area of approximately 2.3 ha, will be established in the vicinity of the Project site to supply clay-sand, pebble, and stone materials for the construction of the reservoir dam. The stone required for the dam's shell will be sourced from rock masses excavated during the construction of the dam foundation, associated structures, and access roads.

The land to be allocated for the borrow-pits is not privatized and lies within the administrative boundaries of the settlement. Upon completion of the reservoir construction, remediation activities will be undertaken at the borrow-pit sites to restore the natural landscape and return the area to the settlement administration.

2.7.7 Description of the Construction Activities

The construction site will cover an area of approximately 12.66 ha, including 1.44 ha along the water main pipeline, 9.5 ha for the dam and reservoir basin construction, 1.5 ha and 0.22 ha for borrow-pits №1 and №2, respectively.

The construction machinery and equipment will be transported via the M-2 highway and from Yelpin village to the construction site using an earthen road. Vehicle movement from the Project's facilities to the construction site, as well as within the site, will be carried out using the following routes:

- An embankment road designed along the water main pipeline,

- Earthen roads connecting the borrow-pits to the construction site,
- An existing earthen road, 2 km long and 6 m wide, leading to the construction site,
- A newly designed earthen road, 317 m long and 6.7 m wide, leading to the dam crest.

During the earthworks and excavation activities, the topsoil from the site will be removed and stored in accordance with existing regulations[9],[10]. According to the Project design study, approximately 1,500 m³ of topsoil will be stripped and removed from the construction site. The topsoil will be stored outside the reservoir area but within the designated protection zone (see **Figure 2-6**), and will later be used for landscaping as part of the Tree Management Plan (TMP).

Based on preliminary estimates, approximately 400,000 m³ of soil will be excavated. A portion of this material will be reused as backfill, while the remaining volume will be transported to Spoil Disposal Areas (SPA) designated and approved by the Areni municipality.

Construction materials (excluding the clay-pebble mixture), such as reinforced concrete, polyethylene and steel pipes, fittings, and others, will be delivered to the construction site from concrete and precast reinforced concrete producers, local suppliers, or, if not available locally, from Yerevan. Deliveries will be made via the M-2 highway and then along the earthen road from Yelpin village to the construction site.

Soft soils of categories II, III, IV, and V will be excavated without preliminary loosening. Soils of categories VI and VII, which belong to the rock class, shall be preliminarily loosened. For rocky soils, the following two preliminary loosening methods shall be considered:

1) Blasting with drilling and explosive charges,
2) Hydraulic hammer.

The blasting method has been adopted in the design. Blasting operations will be carried out at a fixed time of day, preferably in the afternoon or at the end of the working day. People in the vicinity shall be informed in advance about the blasting schedule. All explosive charges will be prepared by a qualified specialist responsible for managing the process. The presence of people in the danger zone will be strictly prohibited, except for personnel responsible for igniting the fuse. Flags shall be placed at a distance of 200 m from the blasting site in all directions, and entry into this zone is prohibited starting 10 minutes before the blast. A warning light is also used as an additional safety measure. Holes for explosives shall be drilled to the required depth at designated locations.

It is proposed to organize two construction camps with appropriate auxiliary structures. The facilities of each construction camp will be installed in their designated areas in parallel with the construction process and placed on unused land allocated for this purpose (**Figure 2-6**). The first camp will serve the dam and its structures, the reservoir basin, and the main pipeline. The second camp will serve the borrow-pits.

The types and approximate quantities of construction machinery to be used during the construction works are determined in the Project design document and summarized below in **Table 2-8**.

Table 2-8. Types and quantities of machinery and equipment to be used during the construction of the Yelpin Reservoir

№	Construction machinery and equipment	Technical parameters	Proposed quantities and units
1	Dumper	Load capacity - 16t and 20t	10

[9]The procedure for topsoil use, approved by the RA Government Decree №1396-N dated 08.09.2011
[10]The requirements for determination of topsoil stripping norms and for stripped topsoil preservation and use, approved by the RA Government Decree №1404-N dated 02.11.2017

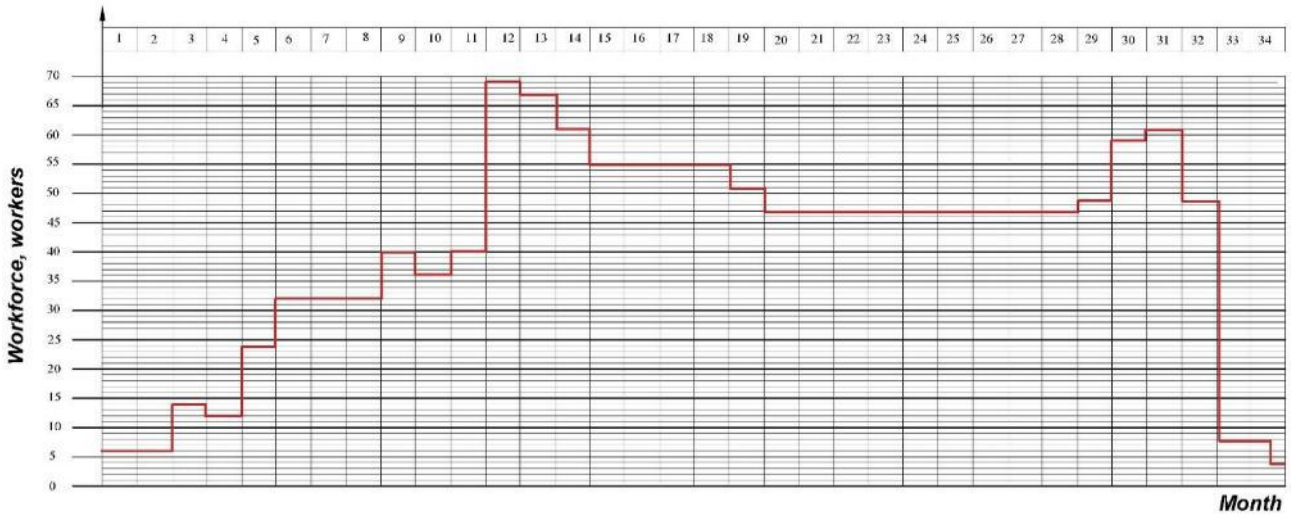
№	Construction machinery and equipment	Technical parameters	Proposed quantities and units
2	Side dumper	Load capacity - 3t	3
3	Auto concrete mixer	Capacity - 4m^3	4
4	Concrete mixer truck		2
5	Crane	Load capacity - 16t	2
6	Bulldozer	Power - 96 kW and 132 kW	4
7	Pneumatic roller or loaded dumper	25t	2
8	Vibration roller	10t	1
9	Motor grader	Power - 79 kW	3
10	Excavator	Capacity - 0.65m^3, 1.25m^3 and 2.5m^3	6
11	Other equipment: perforators, hoist, welding machines, pick hammer, etc.		

Duration of the construction works was determined based on the volume and labour intensity of the main earth/excavation and concrete works, the rational sequencing of tasks, and a consolidated assessment of operational constraints in line with CN&R №1.04.03-85 "Norms for the duration of construction of facilities, buildings, and structures". The construction period was determined according to the Project's implementation timeline (**Figure 2-5**) and amounts to 34 months[11].

The required number of workers will vary throughout the Project implementation period. According to the diagram presented in **Figure 2-5**, the maximum workforce will include 69 workers and technicians, 15 managers and engineers, and 20 officers. In total, 104 workers will be required for the construction stage.

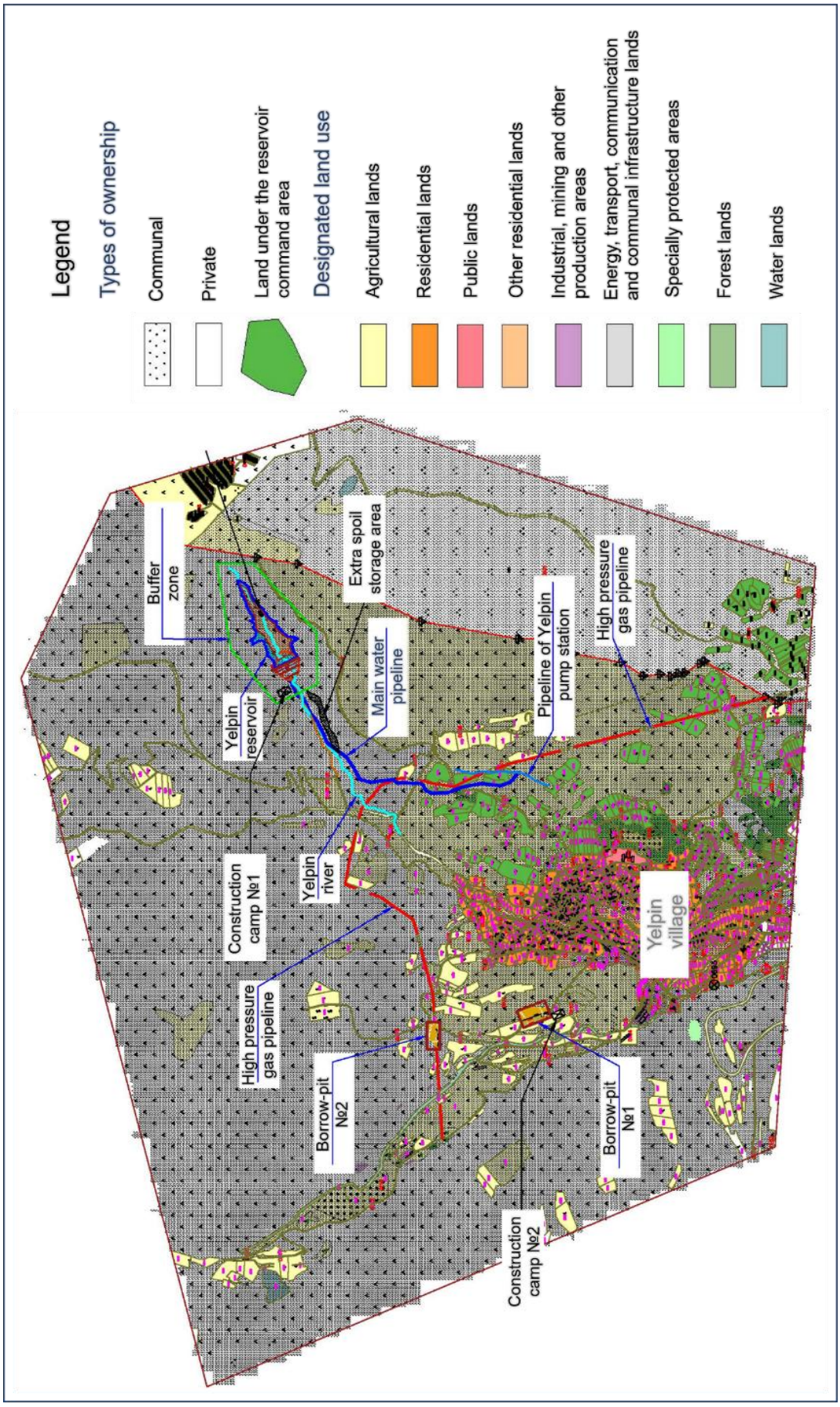
The workforce involved in the construction will primarily consist of highly qualified professionals, including welders, concreters, and blasting specialists. The use of unskilled labour will be minimized to the lowest possible extent. Overall construction management will be carried out by the Site manager and the foremen.

Figure 2-5. Project implementation timeline and required workforce per month



[11]Preparation of design and cost estimation documents for construction of Yelpin reservoir in Vayots Dzor Marz of the Republic of Armenia, Explanatory Note, 2024

Figure 2-6. Master plan of the construction site



2.8 Associated Facilities

According to the EBRD ESP (2019), facilities or activities that are not financed under the Bank's loan agreement but are, in the EBRD's view, significant for the success of the project or for achieving agreed project outcomes are considered **Associated Facilities**[12].

All components of the reservoir, except for the power supply line are included in the Project design documents. Therefore, the power supply line, which will service the operational reservoir and its components, is considered an **Associated Facility** for the Project.

2.9 Project Justification

The GA has prioritised the management of water resources for agricultural use and plans to construct 17 reservoirs within the EU support initiative 'Recovery, resilience and reform: post 2020 Eastern Partnership priorities' to the Government of Armenia to enhance the water and food security level in the country. The Program for the 17 reservoirs construction was developed by the Ministry of Territorial Development an Infrastructure (MTAI) on 2022 and approved by the GA.

The objective of the Program is to implement large-scale reservoir construction in Armenia to regulate surface water flow, manage water resources effectively, and increase both the availability of usable water and the area of agricultural land to be irrigated. The construction of the planned reservoirs will support the conversion of the existing irrigation system to gravity-based operation, which will help reduce power consumption and, consequently, lower the cost of agricultural production.

[12]These are new facilities or activities: (i) without which the project would not be viable, and (ii) would not be constructed, expanded, carried out or planned to be constructed or carried out if the project did not exist

3. Project Alternatives

3.1 Zero Option

Currently, the irrigation of agricultural land-plots in Yelpin and Chiva rural settlements of Vayots Dzor Marz is carried out intermittently by the Yelpin pump station[13]. During the peak-flow period, the agricultural land-plots in Yelpin are irrigated by gravity through water pipelines and ditches, which are in poor technical conditions and fed by the Yelpin River. In both Yelpin and Chiva villages, irrigation water is delivered to users through either gravity-fed or pumped systems managed by the Yeghegnadzor WUA.

The Yelpin Reservoir and its associated structures will cover an area of 14.7 ha, of which 8.5 ha will be occupied by the dam and its auxiliary facilities. The reservoir will have a storage capacity of 0.93 mln. m^3. The stored water will be used to irrigate 300 ha of agricultural land in the rural settlements of Yelpin and Chiva during the low-flow months (July to September), when river water availability declines significantly. This seasonal shortage currently leads to insufficient irrigation and reduced crop yields. As a result, farmers are primarily limited to cultivating grains such as wheat and barley, which typically receive irrigation only once a year, usually in May.

During the low-flow period, approximately 224,500 kWh of electricity is consumed by pumping station to supply irrigation water to Yelpin and Chiva villages. These stations partly rely on groundwater wells. The existing pumping infrastructure is outdated and requires substantial upgrades.

The "Zero Option" of the Project, meaning the reservoir is not constructed or operated, and irrigation in the rural settlements of Yelpin and Chiva continues to rely partly on a gravity system and partly on outdated, ineffective pumping stations, would have the following negative consequences and therefore is not considered as acceptable solution:

1) Annual energy consumption of approximately 224,500 kWh, which indirectly contributes to greenhouse gas (GHG) emissions from power generation facilities,
2) The existing pumping stations, operated by the Yeghegnadzor WUA, are outdated and ineffective, requiring significant investment for rehabilitation or reconstruction,
3) The high operational and maintenance costs of the pumping stations make agricultural production in the planned reservoir's command area economically unfeasible and uncompetitive,
4) The use of pumping stations negatively impacts groundwater, as they partially extract water from underground horizons,
5) Due to the lack of reliable irrigation water, some agricultural land remains underutilized, with cultivation limited mainly to grains such as wheat and barley.

3.2 Analysis of Alternative Capacities of the Reservoir

The capacity of the Yelpin reservoir mainly depends on the following parameters:

- Type of crop production,
- Water flow (availability) in the Yelpin River,
- Precipitation level,
- Water losses from the reservoir,
- Water losses from the irrigation system (≈25%[14]).

[13]Preparation of design and cost estimation documents for construction of Yelpin reservoir in Vayots Dzor Marz of the Republic of Armenia, Explanatory Note, 2024
[14]Ibid

Considering that the crops cultivated in the command area of the reservoir and the water losses from the reservoir are manageable and relatively constant, the main parameters that determine the reservoir capacity are the water inflow into the Yelpin Reservoir and the level of precipitation.

To irrigate the Project-envisioned 300 ha of agricultural land in Yelpin and Chiva rural settlements, 1.446 mln. m^3 of water will be needed, accounting for a 25% loss in the existing irrigation network. This corresponds to a net water requirement of 1.093 mln. m^3.

The analysis of multi-year hydrological data from the Yelpin River and analogous regional watercourses[15] showed that the total flow volume can reach 5.407 mln. m^3 in years with a 50% probability of discharge, 3.21 mln. m^3 in years with a 75% probability, and 1.69 mln. m^3 in minimum-flow years with a 95% probability. According to projected climate change scenarios[16], river flow could decrease by 19.8% (CCSM4 RCP6.0 scenario), 33.7% (CCSM4 RCP8.5 scenario), and 39% (METRAS RCP8.5 scenario).

Based on these assumptions, potential reservoir capacities were determined through water balance estimations for years with 50% and 75% probability of precipitation ($P_{prec.}$) and corresponding 50% and 75% probabilities of the monthly distribution (P_{flow}) of the Yelpin River flow at the dam site (**Table 3-1**).

Table 3-1. Options for the reservoir capacities

Option 1: $P_{prec.}$=50% and P_{flow}=50%	**Capacity of reservoir: 0.8 mln. m^3**
Verification: The total capacity of the reservoir will be 0.8 mln. m^3, with a dead storage volume of 0.120 mln. m^3 and an active storage volume of 0.680 mln. m^3. The annual water volume required for irrigating 300 ha of land is 1.446 mln. m^3, of which 0.644 mln. m^3 will be supplied from the reservoir and 0.802 mln. m^3 from the Yelpin river	
Option 2: $P_{prec.}$=50% and P_{flow}=75%	**Capacity of reservoir: 0.92 mln. m^3**
Verification: Under these conditions, the total storage volume of the reservoir should be 0.920 mln. m^3, with an active storage volume of 0.8 mln. m^3. The annual water requirement for irrigating 300 ha of land is 1.446 mln. m^3, of which 0.753 mln. m^3 will be supplied from the reservoir and 0.693 mln. m^3 from the river.	
Option 3: $P_{prec.}$=75% and P_{flow}=75%	**Capacity of reservoir: 1.17 mln. m^3**
Verification: Under these conditions, the total storage volume of the reservoir should be 1.170 mln. m^3, with a dead storage volume of 0.120 mln. m^3 and an active storage volume of 1.050 mln. m^3. The annual water requirement for irrigating 300 ha of land is 1.730 mln. m^3, of which 0.996 mln. m^3 will be supplied from the reservoir and 0.734 mln. m^3 from the river.	

Taking into account the above estimations, it is recommended that a reservoir with a minimum total storage volume of 0.92 mln. m^3 be constructed. This capacity will fully meet water needs in years with a 50% probability of precipitation and a 75% probability of monthly river flow distribution.

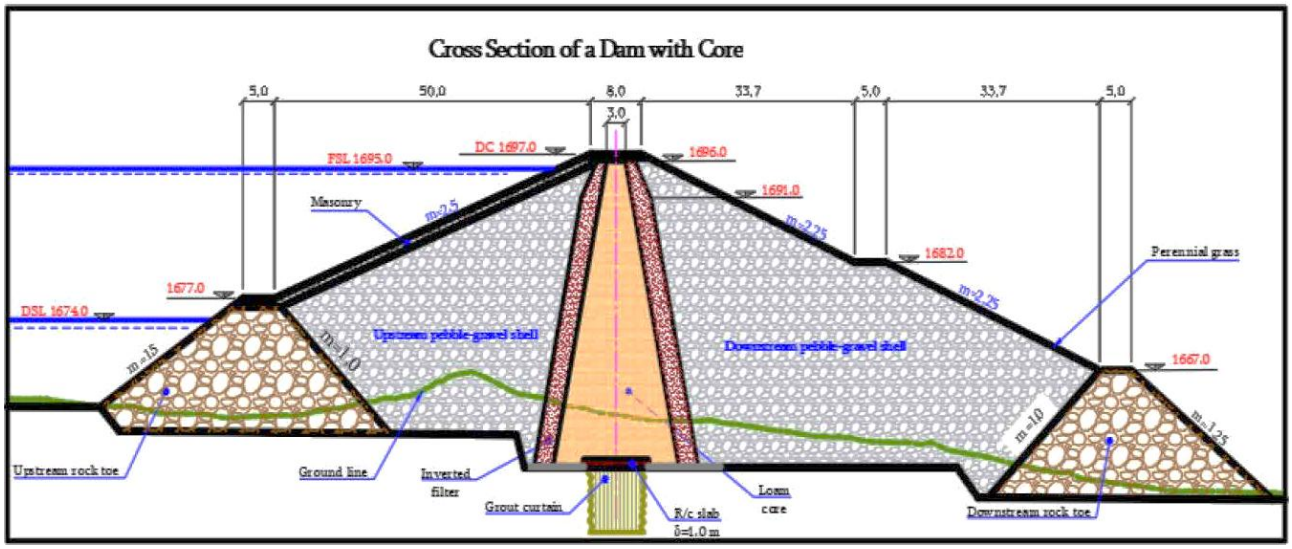
[15]Ibid
[16]Armenia's Fourth National Communication on Climate Change (2020) (https://unfccc.int/sites/default/files/resource/NC4_Armenia_.pdf)

3.3 Analysis of Alternative Types of Dam's Construction Materials

Two types of materials to be used for the construction of the reservoir dam were discussed during the Project design study, including:

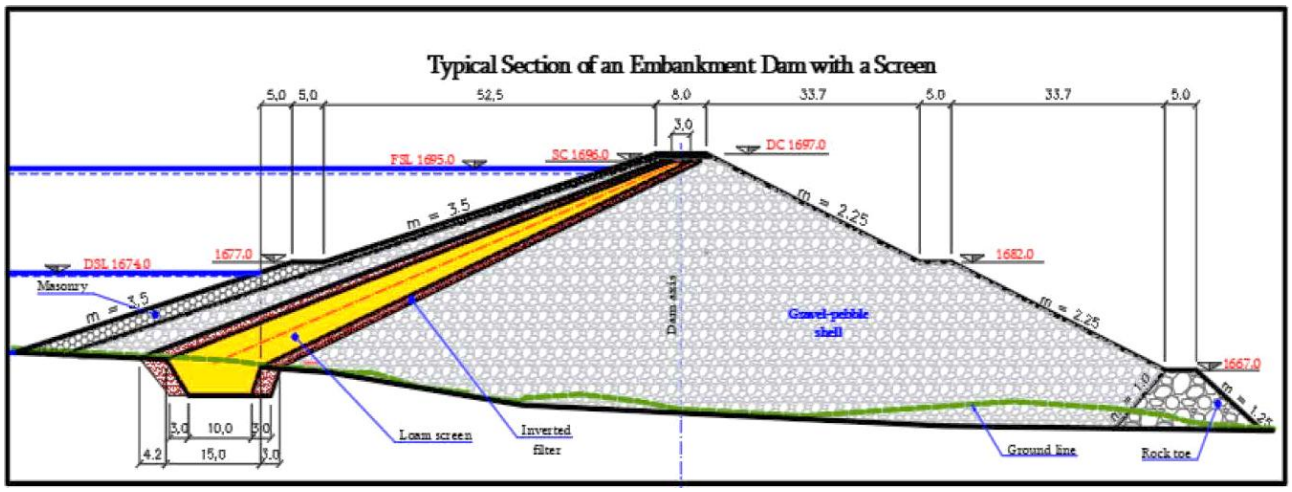
Option 1: Construction of embankment dam (from gravel-pebbles), with central sand-clay (loam) core (**Figure 3-1**).

Figure 3-1. Embankment dam (from gravel-pebbles), with central sand-clay (loam) core



Option 2: Embankment dam with loam screen (**Figure 3-2**).

Figure 3-2. Embankment dam with sand-clay loam screen



Both options are analyzed in terms of the availability of construction materials in the vicinity of the Project site, as well as in light of the estimated budget. For both options, the backfill materials will primarily be sourced from two borrow pits located 3.5 km and 4.5 km from the Project site. Based on the estimated budget (**Table 3-2**), first option (2,968.3 mln. AMD) is less expensive than the second one (3,090.7 mln. AMD) and is therefore selected as the Project solution.

Table 3-2. Estimated budgets for both options depending on the dam's construction materials

№	Item	Cost, mln. AMD	
		Option 1	Option 2
1	Dam and Reservoir	1227.0	1295.0

№	Item	Cost, mln. AMD	
		Option 1	Option 2
2	Construction-irrigation tunnel	250.0	260.0
3	Spillway	170.0	170.0
4	Main canal	149.7	149.7
5	Access road, 2.5km	60.0	60.0
5	Instrumentations	5.0	5.0
6	Service room	12.0	12.0
7	Power supply	14.0	14.0
Total		1887.65	1965.65
Temporary buildings and structures, 3%		56.6	59.0
Winter expenses, 1.6%		30.2	31.5
Technical supervision, 1.2%		75.5	78.6
Design author's supervision, 0.4%		11.3	11.8
Total		2061.3	2146.5
Contingencies, 20%		412.3	429.3
Total		2473.6	2575.8
VAT 20%		494.7	514.9
Total as per summary cost estimate		**2,968.3**	**3,090.7**

3.4 Analysis of Alternative Locations of the Reservoir Dam

3.4.1 Proposed Locations

The entire Yelpin River valley from the "Gndasar" Key Biodiversity Area (KBA) / Important Bird Area (IBA) to the Yelpin rural settlement was considered during the project design study to identify a suitable area for the construction of the Yelpin reservoir. The section of the valley near Yelpin village was deemed unsuitable for reservoir construction due to morphological constraints and its proximity to residential houses. Therefore, only an approximately 2 km-long section of the valley (**Figure 3-3**) was further surveyed, and the following three potential locations for reservoir construction were considered:

- **Option A: Project site (Yelpin reservoir site)** - Area located approximately 300-350 m southwest of the "Gndasar" KBA/IBA,
- **Option B: Area upstream of the Project site** - Located between the reservoir site and the "Gndasar" KBA/IBA,
- **Option C: Area downstream of the Project site.**

The location proposed in Option B, i.e., upstream of the proposed project site, is a potential "no-go" area due to the presence of a landslide and rockfall zone (**Figure 3-4, a)**), followed by the "Gndasar" KBA/IBA. Another landslide and rockfall zone is located on the right slope of the Yelpin valley section proposed as Option C (**Figure 3-4, b)**). Beyond this section, the valley becomes wider and therefore unsuitable for reservoir construction.

Theoretically, both landslide bodies could be removed, but doing so would make the project economically unfeasible and environmentally unacceptable, as parts of the cliffs may be considered natural monuments. Moreover, this would significantly increase the project's negative impact in terms of landscape alteration and visual amenity.

Figure 3-3. Surveyed section of the Yelpin River valley and associated identified hazards

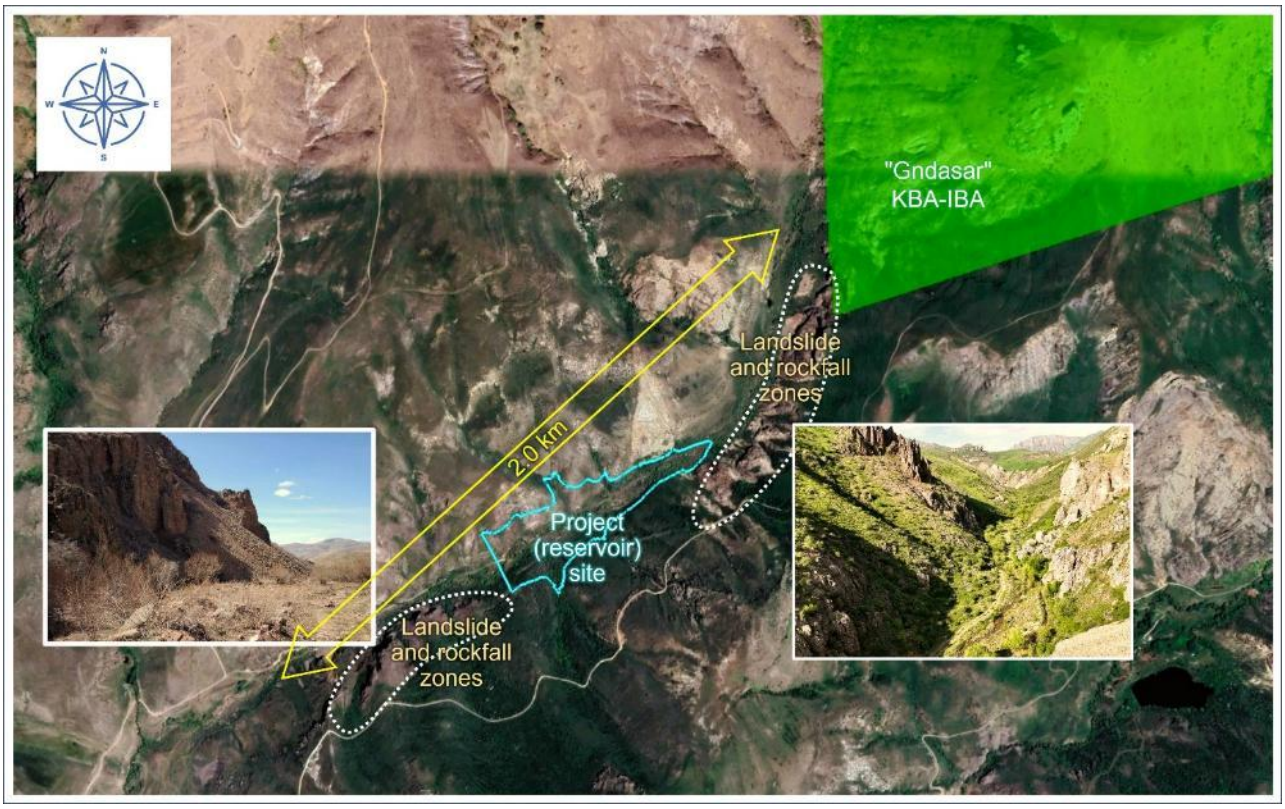


Figure 3-4. Landslide and rockfall zones upstream and downstream of the proposed Project site

a) Landslide zone located upstream reservoir site *b) Landslide zone located downstream reservoir site*

3.4.2 Methodology for the Multi-Criteria Analysis of the Project Alternatives

A Multi-Criteria Analysis (MCA) methodology was developed in the ESIA to analyse the alternative options considered in the Yelpin Reservoir design study. The following common criteria for water reservoir construction projects were applied during the MCA:

- Environmental Impact
- Economic feasibility
- Social Impact
- Technical feasibility
- Water supply reliability
- Flood control and drought mitigation
- Cultural heritage.

All criteria should be measurable, relevant, and aligned with the project's goals and objectives. Each criterion should be assigned a weight that reflects its importance relative to the overall objectives of the project. Weights are typically determined based on expert input or stakeholder consultations and should total 100% (or 1.0 if using decimal values).

Each alternative option should be assessed and rated against the above-mentioned criteria using a consistent scale (e.g., a scale of 1 to 5, where 1 represents the poorest performance and 5 is the best). Ratings should be based on available data, as well as expert and/or stakeholder input.

3.4.3 MCA

The alternative locations for dam construction considered above were analysed using the MCA methodology outlined in the **Section 3.4.2** above. The following alternative dam locations were discussed and assessed (**Table 3-3**):

- **Alternative / Option A** - Project site (Yelpin reservoir site) - Area located approximately 300-350 m southwest of the "Gndasar" KBA/IBA,
- **Alternative / Option B** - Area upstream of the Project site - Located between the reservoir site and the "Gndasar" KBA/IBA,
- **Alternative / Option C** - Area downstream of the Project site.

Table 3-3. Scoring/Rating results of the Project alternative options

№	Criteria	Scale (0-5)		
		Alternative/ Option A	Alternative/ Option B	Alternative/ Option C
1	**Environmental impact**	**3.34**	**3.34**	**3.67**
1.1	Proximity to protected or internationally recognized natural areas	3	4	5
		Alternative B is the closest site to the "Gndasar" KBA/IBA; therefore, its impact on the protected area is expected to be relatively higher compared to Alternatives A and C.		
1.2	Impact on biodiversity, availability and loss of critical habitats	3	3	3
		The impact of all alternative options on the biodiversity and loss of critical habitats will be the same.		
1.3	Environmental impacts during the construction activities (air emissions, contamination of water and soil, waste generation, noise and vibration, etc.)	4	3	3
		The impact of Alternative A on air, as well as water and soil contamination, is expected to be lower than that of the other two options, as it is located far from both Yelpin village and the "Gndasar" KBA/IBA. Alternative B is expected to have a significant indirect impact on the flora and fauna of the "Gndasar" KBA/IBA, while Alternative C would primarily affect the Yelpin rural settlement.		
2	**Economic feasibility**	**3.67**	**3.0**	**4.0**
2.1	Potential capital and operational costs	3	2	3
		Alternative B require modifications to the alignment of several engineering infrastructures, thereby increasing the overall project budget.		
2.2	Land acquisition costs	4	4	4

№	Criteria	Scale (0-5)		
		Alternative/ Option A	Alternative/ Option B	Alternative/ Option C
		In case of all three alternative locations, the land at the reservoir site belongs to the community; therefore, land acquisition costs will be the same.		
2.3	Proximity to the sources and providers of construction materials (borrow pits, suppliers, etc.)	4	3	5
		Alternative C is the closest site to the borrow pits and road infrastructure, while Alternative B is the farthest.		
3	**Social impact**	**3.67**	**2.67**	**3.34**
3.1	Proximity to the settlements / communities	4	3	5
		Alternative C is the closest site to Yelpin and Chiva rural settlements, while Alternative B is the farthest.		
3.2	Impact on affected settlements (e.g., displacement, resettlement, access to water)	3	3	3
		The impact on affected settlements will be the same for all three alternatives.		
3.3	Public opinion, community involvement, and acceptance of the project	4	2	2
		The dam and reservoir location proposed in the design document is the most acceptable for the affected settlements and population.		
4	**Technical feasibility**	**3.34**	**2.34**	**2.34**
4.1	Topographic and geological settings of the site. Seismic, landslide, flood and other risks	4	1	1
		Significant landslide and rockfall zones were identified near the locations proposed for Alternatives B and C.		
4.2	Proximity to water feeding and irrigation infrastructure	3	3	3
		Will be the same for all alternative options.		
4.3	Risks associated with the construction and long-term maintenance	3	3	3
		Will be the same for all alternative options.		
5	**Water supply reliability**	**3.0**	**3.0**	**3.0**
5.1	The volume of water that can be reliably stored and supplied	3	3	3
		Will be the same for all alternative options.		
5.2	The capacity to adapt to climate change and changing demand patterns	3	3	3
		Will be the same for all alternative options.		
6	**Flood control and Drought mitigation**	**3.0**	**3.0**	**3.0**
6.1	The ability of the reservoir to reduce flood risks and store water during dry periods	3	3	3
		Will be the same for all alternative options.		
6.2	Management of peak flow events and water scarcity	3	3	3
		Will be the same for all alternative options.		
7	**Cultural heritage**	**3.0**	**3.0**	**3.0**
7.1	Availability of cultural heritage units within the project direct impact area	3	3	3
		Will be the same for all alternative options.		
7.2	Loss of cultural heritage units as a result of the project implementation	3	3	3
		Will be the same for all alternative options.		

For each alternative options, the weighted scores from all criteria to get the total score are calculated in Table 3-4.

Table 3-4. Calculation of Weighted Scores

№	Criteria	Weight	Alternative A (Score)	Weighted A	Alternative B (Score)	Weighted B	Alternative C (Score)	Weighted C
1	Environmental impact	0.25	3.34	0.835	3.34	0.835	3.67	0.9175
2	Economic feasibility	0.20	3.67	0.734	3.0	0.6	4.0	0.8
3	Social impact	0.15	3.67	0.5505	2.67	0.4005	3.34	0.501
4	Technical feasibility	0.15	3.34	0.501	2.34	0.351	2.34	0.351
5	Water supply reliability	0.10	3.0	0.3	3.0	0.3	3.0	0.3
6	Flood control and drought mitigation	0.10	3.0	0.3	3.0	0.3	3.0	0.3
7	Cultural heritage	0.05	3.0	0.15	3.0	0.15	3.0	0.15
Sum				**3.371**		**2.937**		**3.319**

3.4.4 Conclusion

The MCA was conducted to evaluate and compare three proposed alternatives (Options A, B, and C) for the construction of the Yelpin Reservoir. Each alternative was assessed based on a set of predefined criteria, including environmental and social impacts, economic and technical feasibility, water supply and flood control considerations, and the impact on cultural heritage.

As a result of the MCA, Option A, which proposes locating the reservoir between two landslide zones, received the highest score of 3.371, indicating that it is the most preferable option in terms of environmental and social impacts, as well as technical and economic feasibility. Option B (score: 2.937) and Option C (score: 3.319) are considered acceptable in terms of social impact, water supply reliability, and flood and drought mitigation. However, both are deemed technically infeasible due to the presence of landslide and rockfall zones on the right slopes of the Yelpin Valley. Additionally, Option B faces environmental constraints, as it proposes locating the reservoir near the "Gndasar" KBA-IBA.

4. Legal, Regulatory and Institutional Framework

4.1 Applicable Legal and Regulatory Framework

According to the ***Law on Environmental Impact Assessment and Expert Examination (2014, revised in 2023)***[17], there are two types of documents, which are subject to environmental impact assessment and expert examination. These documents are:

(i) Framework Document - a policy, strategy, concept, scheme of utilization of natural resources, program, master plan, urban development document, which are likely to affect the environment; and

(ii) (ii) Design Document - technical report, feasibility study and construction-engineering design of intended activity.

The Law establishes the general legal and organizational principles for conducting mandatory EIA of various types of activities and concept documents of sectoral development. According to the Article 12 of the Law, the types of activities, which should undergo EIA are divided into "A" and "B" categories depending on their expected environmental impact.

As per the Article 12 the Law, the reservoirs or artificial lakes with 500,000 m^3 and more capacities are subject of national EIA and State expert examination. The roles and authorities of parties engaged in EIA and expert examination processes are set in Chapter 2 of the Law. The procedure for public notification and public discussions is outlined in the ***RA Government Decree №1325-N*** dated 19.11.2014[18].

The ***Water Code (2002)***[19] provides the legal basis for protection of water resources, the provision of water for people and economic sectors through effective management of water resources and ensuring the protection of water resources for future generations. The Water Code includes the following: responsibilities of state/local authorities and public, development of the national water policy and national water program, water cadastre and monitoring system, public access to relevant information, water use and water system use permitting systems, trans-boundary water resources use, water quality standards, safe operation of hydraulic facilities, protection of water resources and state supervision. The quality of surface water in Armenia is monitored as per the principles of EU Water Framework Directive adopted by the ***RA Government Decree №75-N*** dated 27.01.2011[20].

Article 1 of the Water Code among others defines:

- 'Water protection zone' as an area designated to prevent the pollution and depletion of water resources, and to maintain a favourable water regime; such areas are not subject to privatization or confiscation.
- 'Sanitary protection areas of water ecosystems' as an area designated to protect water resources used for drinking, healthcare, domestic services, medical facilities, resorts, and other health-related purposes.

The Criteria for the definition of areas for sanitary protection of water ecosystems, flow formation, groundwater protection, water protection, ecotone and unalienable zones are approved by the ***RA Government Decree №64-N*** dated 20.01.2005[21].

The criteria for defining sanitary protection areas of water ecosystems are:

[17] https://www.arlis.am/documentview.aspx?docid=178468
[18] https://www.arlis.am/documentview.aspx?docid=188071
[19] https://www.arlis.am/DocumentView.aspx?docid=148955
[20] https://www.arlis.am/documentview.aspx?docid=200962
[21] https://www.arlis.am/DocumentView.aspx?DocID=13388

a) areas that are protected for the conservation of biological, hydrological and recreational values of water resources,
b) areas where the quality and quantity of surface and groundwater may be required for human health and well-being, including drinking water and water used for therapeutic and ecological integrity purposes,
c) sanitary protection areas of water ecosystems may include river or lake sections, humid areas, ponds and lakes, as well as adjacent areas that are subject to conservation taking into account their natural conditions as acting healthy environmental systems and areas where a restoration need (in the context of supervision over the contamination, erosion and other adverse impacts caused by floods effect on water quality and quantity) of human activity or natural environment will be raised,
d) sanitary protection areas of water ecosystems are defined with a radius of up to 90 m.

The criteria for defining areas of water protection zones are:

a) areas where the prevention of littering, pollution, eutrophication and depletion of water resources, as well as favourable conditions for the water regime, are ensured,
b) the areas of water protection zones include all areas intended for the conservation of water resources,
c) the areas of water protection zones are defined in the form of a strip up to 32 m long.

The Regulation for reservoirs water protection zones (strips) in the Armenian Soviet Socialist Republic (SSR) approved by the Decision №648 of the Council of Ministers of the Armenian SSR[22] applies to all reservoirs located within the borders of the Armenia, regardless their ownership.

The boundaries of the Water Protection Zone (WPZ) are defined for each reservoir by a **water protection design document,** taking into account the local conditions and methodological recommendations set for the determination of water protection zones (strips) of reservoirs. For new reservoirs the water protection design documents are drafted during the project design stage and included into the environmental measurements section. The commissioning of the newly constructed reservoirs shall be done within the water protection boundaries after implementation of all designed water protection measures.

Design document for the water protection zone of operating reservoirs is drawn up separately. Before drawing up the design of the water protection zone, it is determined by the minimum allowable sizes as follows:

- for the water protection zone - 500 m above the normal elevated water level,
- for the riparian water protection strip - 50-100 m above the normal elevated level[23].

The Riparian Water Protection Strips (RWPS) include islands, peninsulas, islets, etc., regardless of their size.

To prevent the pollution and depletion of the water object and to appropriately use its adjacent areas, the regime of economic activity and land use within the water protection zone of the reservoir is defined by the relevant design document.

Before the establishment of the WPZs, the national economic facilities[24] constructed within their boundaries continue to operate provided that the requirements and conditions set by this regulation as well as water protection measures envisioned by the design document are followed. The sizes of water protection zones, the procedure of land use within the WPZ, water protection and other

[22] https://www.arlis.am/DocumentView.aspx?docid=4965
[23] The term 'normal elevated water level' is not defined in the legal act; however, the Consultant assumes that it corresponds to the 'full supply level'
[24] national economic facility is a term used in the former Soviet Union time, now it means commercial units

measures are determined by specialized design companies in accordance with this regulation and agreed with water use and protection authorities and involved ministries and State bodies.

The objective of the ***Law on RA water national program (2006)***[25] is to meet the needs of the population and the economy through the effective management of usable water resources, ensure ecological stability, establish and use strategic water reserves, protect national water resources, and define measures aimed at addressing the issues outlined in the RA Water Code and the RA Law on the fundamentals of national water policy.

The objective of the ***Law on the fundamentals of national water policy (2005)***[26] is to ensure the availability of water resources in the quantity, regime, and quality necessary to meet human well-being, support the development of the republic's socio-economic system, and address both current and future economic and ecological needs.

The ***Law on lake Sevan (2001)***[27] regulates the relations related to the preservation, restoration, reproduction, natural development and use of the ecosystems of Lake Sevan, its catchment area and economic activity zone.

The ***Land Code (2001)***[28] defines the key provisions for land-use in Armenia. Land is classified as per designated purposes (categories) into: 1) agricultural land, 2) settlement land, 3) industrial, mining and other production designation land, 4) land for energy, transport, communication, utility infrastructure facilities, 5) land for specially protected areas, (6) special designation land, 7) forest land, 8) water land[29], and 9) reserve land. The Land Code also specifies soil preservation principles, objectives and regulations via the following RA Government decrees:

- The procedure for topsoil use, approved by the RA Government Decree №1396-N dated 08.09.2011[30],
- The requirements for determination of topsoil stripping norms and for stripped topsoil preservation and use, approved by the RA Government Decree №1404-N dated 02.11.2017[31],
- The procedure for soil excavation, approved by the RA Government Decree №572-N dated 10.05.2019[32].

The ***Law on surveillance over the land use and land conservation (2008)***[33] provides objectives and types of effective use and conservation of RA lands, inspection related to enforcement of land legislation and institutions, procedures of control, rights and responsibilities of entities controlling land use and protection. The Law applies to all lands of the RA Land Fund, irrespective of purpose, ownership and/or right to use.

The ***Law on waste (2004)***[34] provides the legal and economic basis for collection, transportation, disposal, treatment, re-use of wastes as well as prevention of negative impacts of waste on natural resources, human life and health. It defines the roles and responsibilities of state authorities as well as of waste generator organizations in waste management activities.

[25] https://www.arlis.am/documentview.aspx?docid=166250
[26] https://www.arlis.am/DocumentView.aspx?docid=166244
[27] https://www.arlis.am/documentview.aspx?docid=200928
[28] https://www.arlis.am/documentview.aspx?docid=150513
[29] Water lands - areas occupied by water bodies such as rivers, natural and artificial reservoirs, and lakes, as well as areas designated for hydraulic, water management, and other facilities necessary for the use and protection of these water bodies
[30] https://www.arlis.am/documentview.aspx?docID=71439
[31] https://www.arlis.am/DocumentView.aspx?docID=117360
[32] https://www.arlis.am/documentview.aspx?docid=130889
[33] https://www.arlis.am/DocumentView.aspx?docid=144520
[34] https://www.arlis.am/documentview.aspx?docid=140521

The ***Law on alienation of property for overriding interests of the public (2006)***[35] defines procedures for determining the overriding public interest, for alienating property in order to ensure public interest and for compensation for the alienated property. This law applies to all land ownership (real or movable estate, property rights, equities, etc.) located and registered in Armenia and belonging to physical persons, legal entities and communities. The constitutional conditions for the alienation of property in order to ensure overriding interests of the public are: (i) the alienation must be carried out in exceptional cases defined by the law and in accordance with the procedure established by the law; and (ii) adequate compensation must be paid for the alienated property.

The ***Law on atmospheric air protection (1994, revised in 2022)***[36] regulates air quality as well as public relations in the field of prevention and reduction of adverse chemical, physical and biological impacts on air. The Law also regulates emission permits and provides permissible limits/concentrations for atmospheric air emissions. The RA Government Decree №160-N dated 02.02.2006 defines maximum permissible concentrations of ambient air pollution in residential areas.

The ***Law on flora (1999)***[37] and ***Law on fauna (2000)***[38] outline Armenia's policies for the conservation, protection, use, regeneration and management of natural populations of plants and animals as well as the impact of human activities on biodiversity. These laws are aimed at the sustainable preservation and use of flora/fauna and the conservation of biodiversity. The laws also contain provisions for assessing and monitoring flora and fauna, especially rare and threatened species. The RA Government Decree №71-N and №72-N on approval of the ***RA Red Book of animals***[39] and ***RA Red Book of plants***[40] respectively define the biology of threatened (rare, threatened, endangered, vulnerable) species of flora and fauna as well as their quantity, habitats and variety.

The ***Law on special protected areas of nature (2006)***[41] regulates special protected areas of the RA and eco-systems that have environmental, economic, social, scientific, educational, historical, cultural, healthcare and recreation value. It also outlines the legal basis for state policies regarding sustainable development, restoration, protection, reproduction and use of natural objects and complexes. The Law defines four categories of protected areas in Armenia: (i) State Reserves; (ii) National Parks; (iii) Sanctuaries; and (iv) Nature Monuments. The list of the nature monuments is approved by the RA Government Decree №967-N dated 14.08.2008[42].

The ***Law on protection and use of immovable cultural and historic monuments and historic environment (1998)***[43] provides the legal and policy basis for the protection and use of such monuments in Armenia. Article 15 of the Law describes procedures for discovering and registering monuments, establishing protection zones around them and creating historical and cultural reserves. Article 22 stipulates that the land plots located in historically sensitive areas can be allocated for construction, agricultural and other activities only upon approval of the authorized state body (Department of Historic and Cultural Monuments Preservation). The Law also sets the roles and responsibilities of State bodies engaged in management of cultural and historic monuments through the Procedure for State registration, study, conservation, strengthen, repair, reconstruction and use of immovable historic and cultural monuments, approved by the RA Government Decree №438

[35] https://www.arlis.am/documentview.aspx?docid=153844
[36] https://www.arlis.am/documentview.aspx?docid=146626
[37] https://www.arlis.am/documentview.aspx?docid=120784
[38] https://www.arlis.am/documentview.aspx?docid=120790
[39] https://www.arlis.am/DocumentView.aspx?DocID=56347
[40] https://www.arlis.am/DocumentView.aspx?DocID=56348
[41] https://www.arlis.am/documentview.aspx?docid=140513
[42] https://www.arlis.am/documentview.aspx?docid=157090
[43] https://www.arlis.am/DocumentView.aspx?docid=107521

dated 20.04.2002[44]. The RA Government Decree №2322-N[45], №754-N[46], №80-N[47], №628[48] and №1270-N[49] define the State lists of immovable historical and cultural monuments in the RA Syunik, Gegharqunik, Vayots Dzor, Aragatsotn and Shirak regions respectively, while the Government Decree №385-N approves the list of State owned immovable historical and cultural monuments that are not subject of alienation/acquisition[50].

The ***Law on intangible cultural heritage (2009)***[51] regulates the legal relations arising from the processes of preservation, safeguarding, and development of intangible cultural heritage, including identification, documentation, research, application, recreation, teaching, and dissemination of intangible cultural values, protection of the property rights over such values, maintenance of intangible cultural heritage of Armenia, international cultural cooperation, cultural communication between peoples of foreign countries and those of the RA. Several legal acts have been adopted by the RA to promote the administration of the legal framework of the sector which enables to regulate relations pertaining to preservation, safeguarding, and development of intangible cultural heritage; the activities of communities that create, preserve and transmit intangible cultural values; international cultural cooperation, including: (i) Government Decree №310-A "On Defining the Criteria for Preparing the Lists of Intangible Cultural Values and Approving the List of Intangible Cultural Heritage Values"[52], (ii) Government Decree №36-N "On the Criteria for Preparing the Lists of Intangible Cultural Heritage in Need of Urgent Safeguarding, and the List of Intangible Cultural Heritage Values Based thereon"[53], (iii) Government Decree №241-N "On approving the criteria for defining cultural spaces and published the list of cultural spaces"[54], etc.

The ***Code on subsoil resources (2011)***[55] contains the main provisions in the area of use and protection of mineral resources and underground water, including sanitary protection zones for underground water resources.

The ***Forest Code (2005)***[56] regulates sustainable management of forests: guarding, preserving, rehabilitation, afforestation and rational use of forests and forest lands in Armenia as well as with forest stock-taking, monitoring and control.

The ***Law on environmental oversight (2005)***[57] regulates the organization and enforcement of oversight of national environmental legislation and defines the legal and economic basis underlying the specifics of oversight over the fulfilment of environmental requirements and relations between the parties. The existing legal framework relating to natural resources and environmental includes a range of legal tools. Government decrees are the key legal instruments for implementing environmental laws. The other tools are Presidential orders, Prime-Minister's resolutions, and ministerial decrees.

The RA ***Law on public health (2024)***[58] regulates the organization and implementation of preventive and anti-epidemic measures, immunoprophylaxis of diseases, prevention of the impact of harmful and dangerous environmental factors on the human body (environmental hygiene), epidemiological surveillance, production control, public awareness, dissemination of medical and public health

[44] https://www.arlis.am/documentview.aspx?docid=137204
[45] https://www.arlis.am/DocumentView.aspx?DocID=36406
[46] https://www.arlis.am/DocumentView.aspx?DocID=38081
[47] https://www.arlis.am/DocumentView.aspx?DocID=37837
[48] https://www.arlis.am/DocumentView.aspx?DocID=36898
[49] https://www.arlis.am/DocumentView.aspx?docid=12877
[50] https://www.arlis.am/DocumentView.aspx?docid=55737
[51] https://www.arlis.am/DocumentView.aspx?docid=121003
[52] https://www.arlis.am/DocumentView.aspx?docid=151791
[53] https://www.arlis.am/DocumentView.aspx?docID=157499
[54] https://www.arlis.am/DocumentView.aspx?docID=134827
[55] https://www.arlis.am/documentview.aspx?docid=146898
[56] https://www.arlis.am/DocumentView.aspx?docid=121312
[57] https://www.arlis.am/documentview.aspx?docid=146636
[58] https://www.arlis.am/hy/acts/191172

knowledge and promotion of a healthy lifestyle, teaching public health knowledge, sanitary-epidemiological control in the Republic of Armenia and registration of products (goods) subject to state registration (except for those regulated by the technical regulations of the Eurasian Economic Union), occupational hygiene services and public health expertise, as well as public relations related to the powers of the Government, state administration bodies in the field of public health, the rights and obligations of individuals and legal entities, individual entrepreneurs, the features of population protection in the event of establishing quarantine due to an epidemic that is the basis for a state of emergency, the mechanisms and procedure for exercising the right to health protection.

In addition, there are sanitary-hygienic norms and standards approved by the RA Minister of Health and regulating the sanitary hygienic conditions in public and residential areas viz.:

- Sanitary Norms ("SN") №2-III-11.3. Noise in workplace, residential and public buildings and in the residential construction areas,
- Hygienic Norms ("HN") №2.2.4-009-06. The hygienic norms of the vibration in the workplace, residential and public buildings.

The ***Labour Code (2004)***[59] regulates collective and individual employment relationship; defines the basis and procedure of implementation for the establishment, revision and cessation of that relationship; assigns duties, authorities and responsibilities of the parties of employment relationship, as well as defines conditions for OHS. The Labour Code also recognizes workers' rights to form and to join workers' organizations of their choice, contains provisions for enabling collective bargaining, and prohibits any type of forced labour. Key principles related to ensuring the equal rights and opportunities for men and women are set out in the ***Law №HO-57-N (2013) On ensuring of equal rights and equal opportunities for men and women***[60]. As per Article 6 of this Law, gender discrimination is prohibited, *inter alia*, via setting different levels of wages, changing wages as well as worsening working conditions conditioned by gender. Armenia has ratified 29 Conventions of the International Labor Organization, including eight fundamental ones.

The ***Law on fire safety (2001)***[61] regulates the relations of the state bodies and local self-governing bodies of Armenia, organizations/companies and people in fire safety-ensuring sphere. It defines the basic ways of shaping the state fire safety policies, as well as legal mechanisms of their implementation, such as provision of the populations with effective and reliable fire protection systems. The Law is supplemented by the Fire Safety Rules (Order №595-N of the RA Minister of Territorial Administration and Emergency Situations (2015)[62]).

4.2 Ratified International Agreements

Armenia is a signatory/party to a number of **international agreements and conventions** related to the protection and management of the natural environment, communities, cultural heritage and labour issues.

Table 4.1. List of ratified by the RA international agreements applicable for the project

International agreements (convention or protocol)	Description
Convention on Wetlands of International Importance - (Ramsar 1971)	The Ramsar Convention is an intergovernmental treaty to maintain the ecological character and plan the sustainable use of Wetlands of International Importance. The Convention entered into force in Armenia in 1993.

[59] https://www.arlis.am/documentview.aspx?docid=152137
[60] https://www.arlis.am/DocumentView.aspx?docid=138982
[61] https://www.arlis.am/documentview.aspx?docid=144513
[62] https://www.arlis.am/documentview.aspx?docID=99397

International agreements (convention or protocol)	Description
Paris Convention for the Protection of the World Cultural and Natural Heritage (1972)	The Convention establishes the need to preserve natural and cultural heritage and the balance between the two. Armenia became a State party in 1993.
The Convention on the Conservation of Migratory Species of Wild Animals (1979) (Bonn Convention)	The objective of the Bonn Convention, which was adopted in 1979, is to ensure the conservation of land, marine and air migratory species over the whole of their area of distribution. Armenia is a State party since 2011
Convention on the Conservation of European Wildlife and Natural Habitats, Bern (1979)	The Bern Convention is a binding international legal instrument in the field of nature conservation, covering most of the natural heritage of the European continent and extending to some States of Africa. Ratified by Armenia in 2008.
The Convention on Biological Diversity (1992)	The three main objectives of the Convention are: the conservation of biological diversity; the sustainable use of the components of biological diversity; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. Signed by Armenia in 1993.
European Landscape Convention, Florence (2000)	The European Landscape Convention of the Council of Europe promotes the protection, management and planning of the landscapes and organises international co-operation on landscape issues.
United Nation Framework Convention on Climate Change (UNFCCC) (1992)	The UNFCCC is one of the «Rio Conventions» adopted at the Rio Earth Summit in 1992. The principal objective is to prevent «dangerous» human interference with the climate system. The UNFCCC entered into force in March 1994 and the first Conference of the Parties of the Convention took place in Berlin, 1995. Armenia became a state party in 2002.
Paris Agreement under the United Nations Framework Convention on Climate Change	The aim of the agreement is to decrease global warming through: (a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; (c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. Ratified by Armenia in 2017.
UN Convention to Combat Desertification, Paris (1994)	This Convention is the sole legally binding international agreement linking environment and development to sustainable land management. The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found. Ratified by Armenia in 1997.
UNESCO Convention for the Safeguarding of the	The purposes of this Convention are: (a) to safeguard the intangible cultural heritage; (b) to ensure respect for the intangible cultural

International agreements (convention or protocol)	Description
Intangible Cultural Heritage (2003)	heritage of the communities, groups and individuals concerned; (c) to raise awareness at the local, national and international levels of the importance of the intangible cultural heritage, and of ensuring mutual appreciation thereof; (d) to provide for international cooperation and assistance. Ratified by Armenia in 2006.
Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, Aurhus Convention (1998)	The Aarhus Convention is a multilateral environmental agreement through which the opportunities for citizens to access environmental information are increased and transparent and reliable regulation procedure is secured. Armenia became a State-party in 2001.
Convention on Environmental Impact Assessment in a Transboundary Context, Espoo Convention (1991)	The Convention sets out the obligations of the Parties to carry out an environmental impact assessment of certain activities at an early stage of planning. Before permitting an industrial project, the country to decide on the project («country of origin») must notify any countries which could be affected by the transboundary impacts of a project located in another country («affected parties»). The affected party and the public in the affected area must be able to express their views and comments about the proposed project. This is a separate procedure which is additional to any relevant national permitting process. The permitting state must take these comments into account in its final decision and communicate it to the affected country and the public. The projects subject to consultations under the Convention are those listed in Appendix I including 'large dams and reservoirs'. Ratified by Armenia in 1997.
International Labour Organization (ILO) Conventions	Armenia has ratified 29 ILO conventions including the following fundamental ones: - Forced Labour Convention, 1930 (Ratified 17.12.2004), - Freedom of Association and Protection of the Right to Organize Convention, 1948 (Ratified 02.01.2006), - Right to Organize and Collective Bargaining Convention, 1949 (Ratified 12.11.2003), - Equal Remuneration Convention, 1951 (Ratified 29.07.1994), - Abolition of Forced Labour Convention, 1957 (Ratified 17.12.2004) - Discrimination (Employment and Occupation) Convention, 1958 (Ratified 29.07.1994), - Minimum Age Convention, 1973 (Ratified 27.01.2006), - Worst Forms of Child Labour Convention, 1999 (Ratified 02.01.2006).

4.3 EBRD Requirements

The main requirements of the EBRD for its own activities are formulated in the Bank's ESP (2019), and the requirements for the E&S aspects of the Client-borrower's activities are set out in the PRs[63].

[63]EBRD. 2019. ESP. https://www.ebrd.com/news/publications/policies/environmental-and-social-policy-esp.html.

The ESP sets E&S requirements for the EBRD clients' activities to achieve sustainable results. The PRs applicable to this Project are listed below:

PR1: Assessment and Management of Environmental and Social Risks and Impacts requires the EBRD client (borrower) to conduct an E&S assessment and / or audit. Assessment is carried out for all stages of the project (construction, operation, decommissioning). Based on the assessment and audit, an ESAP, an Environmental and Social Management Plan (ESMP), and other plans are developed. An important feature of the EBRD's requirements is the concept of associated facilities that are not financed by the Bank, and therefore are not part of the project, but which are significant in determining the success of the project[64]. These associated facilities may be carried out by both the client of the Bank and other parties. However, they should be part of the E&S assessment. PR1 is also applicable to contractors involved in project implementation. EBRD also requires borrowers to implement an E&S Management System (ESMS) appropriate to the nature of the project, as well as reporting to EBRD on the project's E&S performance, including compliance with the relevant PRs and the approved ESMP, ESAP, SEP and other documents or commitments.

PR2: Labour and Working Conditions establishes requirements in terms of labour and working conditions, including the prohibition of forced and child labour in the project. The PR2 requirements are based on the conventions of the ILO.

PR3: Resource Efficiency and Pollution Prevention and Control requires efficient use of energy, water and resources, and minimisation of waste, as well as compliance with good international practice (GIP), and application of a mitigation hierarchy. This PR is based on the principles of the EU Industrial Emissions Directive (Integrated Pollution Prevention and Control)[65] and calls for the implementation of EU requirements on the use of BATs and related standards for emissions and discharges.

PR4: Health, Safety and Security requires the client (borrower) to identify and assess community and occupational health and safety risks and implement preventive measures. The focus is on preventing and eliminating risks rather than reducing and minimising them.

PR5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement defines requirements related to project-induced land acquisition, including restrictions on land use and access to assets and natural resources, which may cause physical displacement (relocation, loss of land or shelter), and/or economic displacement (loss of land, assets or restrictions on land use, assets and natural resources leading to loss of income sources or other means of livelihood). The key requirement of PR5 is to avoid or, when unavoidable, minimise, involuntary resettlement via feasible alternative project designs/sites. A resettlement framework (RF), including livelihood restoration where needed, is developed in an early stage of the project to detail resettlement principles and organisational arrangements.

PR6: Biodiversity Conservation and Sustainable Management of Living Natural Resources determines the requirements for the conservation of biological and landscape diversity in the development area. PR6 requires the borrower to characterise the state of biodiversity, identifying sensitive species and habitats, and developing measures to avoid / reduce impacts. PR6 defines criteria for critical habitat screening and requires developing a Biodiversity Action Plan (BAP) where significant adverse impacts on biodiversity are expected.

PR8: Cultural Heritage defines the requirements for the preservation of both tangible and intangible cultural heritage. PR 8 requires exploring the presence / possibility of the presence of objects of cultural heritage in the project's area of influence. Where the assessment identifies that the project

[64]'These are new facilities or activities: i) without which the project would not be viable, and ii) would not be constructed, expanded, carried out or planned to be constructed or carried out' (EBRD ESP. 2019. Section II. Definitions).
[65]Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010L0075.

may have material risks and impacts on cultural heritage, the client is required to develop a cultural heritage management plan.

PR10: Information Disclosure and Stakeholder Engagement. The EBRD requires careful and systematic stakeholder identification, including communities that may be affected by project impacts (affected groups) and groups whose vital interests may be affected by projects (vulnerable groups). The EBRD requirements for organising stakeholder engagement are also set out in its Access to Information Directive66. Meaningful stakeholder consultations are viewed by the EBRD as an ongoing process throughout the project lifecycle. The EBRD's stakeholder engagement requirements are detailed in the draft SEP for the Project.

4.4 Applicable EU Directives

The EBRD PRs require projects to comply with the relevant European Union (EU) environmental requirements in addition to the applicable national laws and regulations. The list of EU Directives that are relevant to the Project is given below.

Directive 2011/92/EU, as amended by Directive 2014/52/EU, on assessment of the effects of certain public and private projects on the environment (the EIA Directive)[67]

The Directive defines the environmental impact assessment (EIA process for certain public and private projects in the Member States to integrate environmental considerations into project preparation and authorisation. It applies to a wide range of projects listed in Annexes I and II. The projects listed in Annex I are considered to have a significant environmental impact (incl. inter alia 'dams and other installations designed for the holding back or permanent storage of water, where a new or additional amount of water held back or stored exceeds 10 million m^{3}'). For projects listed in Annex II, national authorities should determine the need for an EIA using a 'screening procedure'.

The key features of the EIA process are as follows:

- the project developer may request the competent authority to specify what should be covered by the EIA information to be provided (scoping stage);
- the developer must provide information on the environmental impact (in the form of an EIA report drafted in accordance with Annex IV of the Directive);
- the environmental authorities and the public, as well as local and regional authorities (as well as any EU countries that are affected) must be informed and consulted;
- the competent authority decides taking into consideration the results of consultations; this decision also includes a reasoned conclusion on the significant effects of the project;
- the authority informs the public of its decision.

Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) (the Industrial Emissions Directive)[68]

The Directive is the main EU instrument regulating the emission of pollutants from industrial facilities. It aims to protect human health and the environment in general by reducing harmful industrial emissions in the EU, in particular through the use of Best Available Techniques (BAT). It is noted that production facilities carrying out the activities listed in Annex I to the Directive *(including inter*

[66]EBRD. 2019. Access to Information Directive. www.ebrd.com/documents/strategy-and-policy-coordination/access-to-information-policy-directive.pdf?blobnocache=true
[67]Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. https://eur-lex.europa.eu/eli/dir/2014/52/oj. Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (codification). https://eur-lex.europa.eu/eli/dir/2011/92/oj
[68]Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (recast). https://eur-lex.europa.eu/eli/dir/2010/75/oj

alia cement production for dam construction) require a special permit (issued by the authorities in the EU Member States).

Directive 2009/147/EC on the conservation of wild birds (the Birds Directive)[69]

The Directive requires the Member States to protect wild bird species and protect and restore their habitats. Annex I lists wild bird species that shall be the subject to special conservation measures concerning their habitats. It is required to designate special 'protection areas' to avoid significant pollution or deterioration of habitats or any disturbances affecting the birds including birds associated with floodplain habitats to be affected by the Project. Outside these protection areas, it is also required avoid pollution or deterioration of habitats.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive)[70]

The Directive requires the Member States to specify areas that are expected to ensure the conservation of flora and fauna species. It is stipulated the need for designating 'special areas of conservation' which, together with the existing special 'protection areas' established per the Birds Directive, to form a became a coherent European ecological network for protecting species and habitats (Natura 2000).

Directive 2000/60/EC establishing a framework for Community action in the field of water policy (the Water Framework Directive)[71]

The Directive aims to ensure an integrated approach to water management by establishing a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. It envisions water management by river basin approach.

Directive 2008/98/EC on waste (Waste Framework Directive[72])

The Directive defines the priorities and principles of waste management and the basic concepts and requirements for waste recycling, reuse and disposal in a way that does not have a negative impact on the environment or human health. The principle of waste management hierarchy integrated in the Directive envisions the following sequence of priority in selection of waste management methods:

- waste prevention (prevention at the of waste generation at source);
- waste reduction;
- waste reuse;
- application of other methods of waste recovery, e.g. energy recovery;
- final disposal at landfills.

Directive 2003/10/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise)[73]

The Directive defines the physical parameters that serve as risk predictors, such as peak sound pressure, daily noise exposure level and weekly noise exposure level. It sets exposure limit values

[69]Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (Codified version). https://eur-lex.europa.eu/eli/dir/2009/147/oj
[70]Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. https://eur-lex.europa.eu/eli/dir/1992/43/oj
[71]Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. https://eur-lex.europa.eu/eli/dir/2000/60/oj
[72]Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. https://eur-lex.europa.eu/eli/dir/2008/98/oj
[73]Directive 2003/10/EC of the European Parliament and of the Council of 6 February 2003 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (noise). https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:042:0038:0044:EN:PDF

and exposure action values in respect to the daily and weekly noise exposure level as well as peak sound pressure. These exposure limits are to be available for Project construction workers.

Directive 2002/44/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration)[74]

The Directive aims at ensuring health and safety of each worker and at creating a minimum basis of protection for all Community workers by timely detection of adverse health effects arising or likely to arise from exposure to mechanical vibration, especially muscle-skeletal disorders. These exposure limits are to be available for Project construction workers.

4.5 Good Industry Practice (GIP) Guidance

Specific E&S requirements applicable to the Project are set out in the EBRD's Sub-sectoral Environmental and Social Guidelines: Building and Construction Activities (2010)[75]. They elaborate on typical E&S risks related to construction, operation, maintenance and decommissioning of facilities. Other relevant EBRD guiding documents used in the ESIA relate to resettlement; forced labour; gender issues, non-discrimination and equal opportunity; workers' accommodation; and other E&S topics.

The International Finance Corporation (IFC) ***General Environmental, Health and Safety Guidelines (2007)[76]*** (General EHS Guidelines) are technical reference documents with general and industry-specific examples of GIIP. The General EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in facilities by existing technology at reasonable costs.

ICOLD Bulletin 173 (2021) - Integrated Operation of Hydropower Stations and Reservoirs. *This bulletin gives an overview of the main functional and operational aspects relating to cascade hydropower stations and reservoirs, it was formed by reviewing of all the related aspects proposed and case studies provided by committee members.*

ICOLD Bulletin 96 (1994) - Dams and environment - Water quality and climate. *This Bulletin gives an overview of effects of reservoirs on water quality and climate.*

ICOLD Bulletin 86 (1992) - Dams and Environment - Socio-economic impacts. *The present bulletin gives an overview of social and economic problems which may arise before, during or after the construction of a large dam.*

The International Commission on Large Dams (ICOLD) is the leading international professional and academic organization in the field of hydraulic engineering. Its mission is to develop the art and science of dam engineering, and to promote the sustainable development and management of the world's water and hydropower resources. ICOLD has 100 member countries.

4.6 Institutional framework

Several state bodies and their subordinate structures or units are involved in water management in Armenia. The main roles and responsibilities of these bodies in the field of irrigation water management are outlined below:

- **The Ministry of Environment (ME)** is the authorized body responsible for water resources management and protection in Armenia. It is tasked with developing and implementing the

[74]Directive 2002/44/EC of the European Parliament and of the Council of 25 June 2002 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration). https://eur-lex.europa.eu/resource.html?uri=cellar:546a09c0-3ad1-4c07-bcd5-9c3dae6b1668.0004.02/DOC_1&format=PDF%20
[75]https://www.ebrd.com/downloads/about/sustainability/Building_Construction_Activities.pdf
[76]https://www.ifc.org/content/dam/ifc/doc/2000/2007-general-ehs-guidelines-en.pdf

National Water Policy, National Water Program, and river basin management plans; protecting natural water bodies; preparing annual water balances; and overseeing their implementation.

- **The Environmental Impact Expert Examination Center (EIEEC)**, acting on behalf of the Ministry of Environment (ME), is responsible for organizing and implementing the expert examination and related processes for framework and design documents (projects) initiated by state and private entities, as well as individuals. Among other functions, the EIEEC ensures stakeholder participation in public discussions, facilitates the notification and involvement of interested parties in the expert examination process, and issues environmental impact expert examination conclusions.
- **The Water Resources Management Department**, under the ME, is responsible for regulating water resources management issues, including approving surface and groundwater extraction volumes, issuing water use permits, maintaining the State Water Cadastre, and managing water use related data. It also prepares documents for the suspension, amendment, or cancellation of water use permits.
- **The Hydrometeorology and Monitoring Centre** State Non-Commercial Organization (SNCO), under the ME, monitors meteorological, hydrological, and geophysical conditions in Armenia and provides disaster warnings. The Centre also supports the implementation of Armenia's international obligations in these areas.
- **The Ministry of Territorial Administration and Infrastructure (MTAI)**, along with its affiliated authorities and organizations, develops policy and regulations for the overall management of water infrastructure systems.
- **The Water Committee**, under the MTAI, is designated by the Water Code as the Water System Management Body. It is responsible for developing and implementing investment programs and submitting proposals to the Regulatory Commission concerning regulated tariffs and water system use permits.
- Irrigation in Armenia is managed by **"JRAR" Closed Joint-Stock Company (CJSC)** and 15 **Water Users Associations (WUAs)**. JRAR CJSC, a 100% state-owned enterprise, handles water abstraction and delivery, and is responsible for the maintenance and operation of first- and second-category irrigation systems. The WUAs operate reservoirs and distribute irrigation water to end users.
- **The Environmental Protection and Mining Inspection Body** is responsible for supervising and inspecting compliance with regulations related to the use and protection of water resources.

5. ESIA Methodology and Approach

5.1 Introduction

The ESIA is an iterative process that involves the prediction and assessment of potential impacts of the Project on the physical, biological, and cultural components (indicators) of the environment, as well as on social and socio-economic resources/receptors. During the ESIA study, recommendations were developed to eliminate, minimize, reduce, mitigate, or compensate for adverse impacts, while also enhancing expected benefits and opportunities. Appropriate management and monitoring measures have also been proposed.

The main stages of the ESIA study are as follows:

- Screening,
- Scoping,
- Baseline Study,
- Impact Assessment and Mitigation,
- Management and Monitoring,
- Stakeholder Engagement and Public Consultations.

5.2 Screening

Screening is the initial stage of the ESIA that is carried out to determine the level of the impact assessment as well as what legal and other requirements will be applied for the Project.

The construction of the Yelpin Reservoir, with a capacity of 0.93 mln. m³, is a greenfield project that may trigger significant adverse environmental and/or social impacts. The EBRD has classified this project as Category 'A' under its 2019 Environmental and Social Policy (ESP), which means that a comprehensive ESIA report and associated documents must be prepared and publicly disclosed for a minimum of 120 days.

5.3 Scoping

The key task of the E&S scoping process is to determine the content and extent of the matters that should be addressed in the ESIA and its associated documentation. The Scoping process is not intended to provide detailed information about the Project. Rather, it serves as a preliminary overview, aimed at facilitating early engagement with relevant stakeholders and helping to identify potential Project impacts. Scoping is designed to ensure that the ESIA focuses on the most significant impacts, project alternatives, and other key issues.

The scoping process involves a comprehensive analysis of the activities and features associated with each stage of the Project lifecycle, and their potential to positively or negatively interact with environmental (including physical and biological receptors), social, and socio-economic resources and receptors.

5.4 Baseline Study

To provide a context within which the impacts of the Project can be assessed, a description of the physical, biological, and socio-economic (including social, economic, and health and safety) environment expected to prevail in the absence of the Project must be presented. In this regard, it is essential to collect comprehensive baseline data on environmental, social, and socio-economic conditions through the collection of both primary and secondary information.

Secondary baseline data were gathered from documents prepared during the Project design phase and the national EIA study provided by the Water Committee and the National EIA Consultant, as well as from the gap analysis study conducted by the ESIA Consultant. In addition, baseline information related to the Project region, components, and associated facilities was collected by the Consultant from publicly available sources, reports, online databases, and interactions with Project stakeholders. The list of documents and information used during the secondary baseline data collection process is provided in **Section 1.4** of this ESIA report.

Where necessary, or where information is lacking, secondary baseline data should be supplemented with primary data collected during field surveys and investigations. The following field surveys were initially conducted by the National EIA Consultant and subsequently enhanced by the ESIA Consultant to describe the baseline conditions within the Project's footprint and to supplement the baseline chapter (**Chapter 6**) of this ESIA report:

Surveys conducted by the National EIA Consultant
• Biodiversity (flora and fauna) field investigation • Background air quality survey (determination of SO_2, NO_2, CO and dust actual concentration in the atmospheric air within the area of Project influence) • Water and soil quality survey • Ambient noise study (determination of actual noise levels within the Project's area of influence) • Socio-economic data collection and interviews • Archaeological field surveys
Supplementary studies conducted by the ESIA Consultant
• Cumulative impact assessment, • Assessment of impacts of the associated facilities, • Water infiltration and loss study, water and soil quality survey, • Assessment of Greenhouse Gas (GHG) emissions and climate change mitigation measures, • Spring season field biodiversity surveys and Critical Habitat Assessment, • Appropriate Assessment procedure, • Cultural Heritage studies and intangible Cultural Heritage survey

The results of the field surveys are provided in the annexes and summarised in the relevant sections of **Chapter 6**, and are further discussed in **Chapter 8** of this ESIA report.

The baseline outlines the existing E&S conditions and provides the context against which potential impacts will be identified and assessed. Specifically, the baseline aims to provide information to support the following:

1. Identify the key conditions and sensitivities within the zone potentially affected by the Project,
2. Provide baseline data for subsequent prediction and assessment of potential impacts to be generated in the course of Project implementation,
3. Understand stakeholders' concerns and analysis of their perceptions and expectations,
4. Ensure a benchmark to assess future changes resulting from the Project implementation and monitor the effectiveness of mitigation measures.

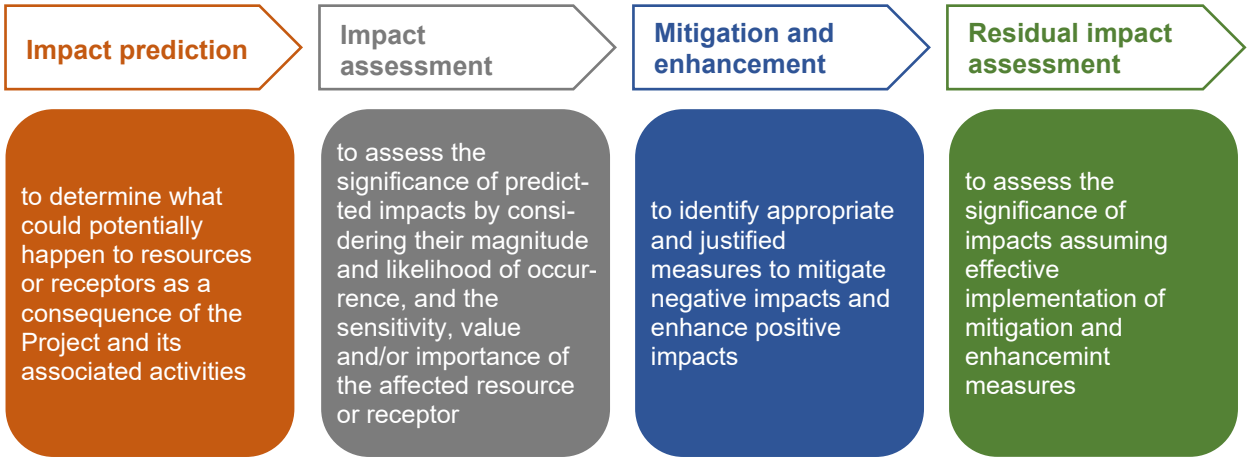
5.5 Impact Assessment and Mitigation

The potentially significant impacts identified during the scoping stage are subject to a full-scale appraisal during the ESIA study. The impact assessment follows a consistent process for the consideration of the following four aspects:

- Impact prediction,
- Impact evaluation,
- Mitigation and enhancement,
- Residual impact evaluation.

The scheme of impact assessment and evaluation process is presented in **Figure 5-1**.

Figure 5-1. Schematic view of impact assessment process



Impact Prediction

Impact prediction is an expert-driven process used to determine the likely consequences of the Project and its associated activities or features on the environment. Impacts on various resources and receptors are identified and assessed based on the potentially significant interactions determined during the scoping phase. Given the diverse range of potential impacts considered in the assessment process, a variety of prediction methods are typically employed, including quantitative, semi-quantitative, and qualitative techniques.

Impact Assessment

E&S impacts arise as a result of Project activities or features interacting directly with receptors, or causing indirect changes to the existing environment. Impacts can be described and quantified in various ways. In the course of this study, impacts on different components of the physical, biological, human, and social environment are assessed throughout the Project's lifecycle in terms of:

- Nature: positive or negative,
- Type: direct, indirect, residual,
- Magnitude: high, medium, low, negligible,
- Likelihood: high, medium, low,
- Duration of the Impact: temporary, short-term, long-term, permanent,
- Reversibility,
- Significance degree: significant, moderate, low, negligible.

The key characteristics of the impacts are defined in **Table 5-1**.

Table 5-1. Impact Characteristics

Impact Characteristics	Description
Type	**Direct impact** resulting from the direct interaction between a project activity and the resource / receptor. **Indirect impact** between the proposed activity and the environment/ receptor as a result of subsequent interactions within it. **Residual impacts** are defined as those impacts that remain following the implementation of the mitigation measures proposed.
Duration of impact	**Temporary (very low duration)** impacts would last for a short duration of six months of less and are reversible and intermittent or occasional in nature. The resource or receptor would return to the previous state when the effect ceases or after a short period of recovery. **Short-term (low duration)**, when impact is likely to be restricted for a duration of up to three years. **Long-term (medium duration**), when impacts would continue for an extended period of time; this is based on the understanding that there will be recovery of the effected environmental component to its best achievable pre-project state over time. **Permanent (high duration)**, when impacts would occur during the lifetime of the Project and cause a permanent change in the affected receptor or resource.
Magnitude	**Negligible**, when the impact having almost no influence on baseline conditions. **Low**, when resulting in slight changes of prevailing baseline conditions. **Medium**, when resulting in changes which are within the benchmark norms or shows some signs of stress on any of the components of environment. **High**, when resulting in changes which affects larger extent or shows signs of stress on receptors in larger extent.
Likelihood	**Low**, when event is unlikely, but may occur at some time during normal operating conditions. **Medium**, when event is likely to occur at some time during normal operating conditions. **High**, when event will occur during normal operating conditions.

Once the magnitude and likelihood of the impact has been characterized, the impact significance degree is assigned using the matrix in **Figure 5-2**.

Figure 5-2. Impact Significance Matrix

		Likelihood / Duration		
		Low	Medium	High
Magnitude	Negligible	Negligible	Negligible	Negligible
	Low	Negligible	Low	Moderate
	Medium	Low	Moderate	Significant
	High	Moderate	Significant	Significant

If the duration of an impact is long-term or permanent, but the likelihood is low or medium, the significance of the impact is evaluated one level higher.

In the case of a positive impact, no magnitude designation, other than 'positive', is assigned. For the purposes of this impact assessment, it is considered sufficient to indicate that the Project is expected to result in a positive impact, without quantifying the exact degree of positive change.

Context of impact significance for E&S resources is provided in **Table 5-2**.

Table 5-2. Context of impact significance

Significance of impacts	Description	
	Environmental resources	Socio-economic resources
Negligible	Impacts practically do not change the environmental baseline conditions, local in extent and temporary or short-term in duration	No significant changes in baseline conditions are expected, in-site in extent and temporary or short-term in duration impact. No significant inconveniences are caused
Low	Site, local and regional impacts which are not accompanied by long-term degradation of sensitive resources; effects are usually reversible and minor (do not require special mitigation measures); usually do not exceed the applicable standards (criteria, i.e. noise, vibration, etc.) in relation to the less sensitive resources	Short-term inconveniences caused by Project implementation to individuals and communities, but with no consequences to long-term change of livelihood or quality of life. Receptors either easily in part adapt to changes brought by the Project or proceed with previous livelihood
Moderate	Site and local environmental impacts, mostly long-term; impacts which do not affect critical resources but result in irreversible loss of biodiversity and habitats; impacts with regional effects persisting from 1 to 3 years; require development of cost reasonable impact mitigation measures	Direct and indirect impacts on livelihood and quality of life of the local communities or individuals. Receptors may undergo some difficulties to adapt to changes and they will be able to return to their former livelihood under condition of some support (for instance, compensation)
Significant	Significant impacts of regional and of the larger scale; medium-term, long-term and permanent impacts resulting in irreversible changes and degradation of baseline conditions; usually having adverse effects exceeding national environmental standards or associated with transnational environmental issues; involving effects of toxic substances and associated with potential emergencies affecting critical resources and sensitive receptors	Widely spread adverse direct and indirect impacts on both individuals and local communities which are practically cannot be mitigated or compensated. Affected receptors are not able to adapt to changes or proceed with previous livelihood
Positive	There will be a beneficial impact to a resource/receptor	There will be a beneficial impact to a resource/receptor

Mitigation and Enhancement

A key component of the ESIA process is to identify practical ways to avoid, reduce, or mitigate the potentially significant impacts identified during the study. These are referred to as mitigation measures and are incorporated into the Project as commitments. The objective of mitigation is to prevent, minimize, or manage significant negative impacts to as low as reasonably practicable, and to optimize and maximize any potential benefits or opportunities of the Project, where applicable.

A hierarchy of mitigation options is considered, with the preferred approach being to avoid the impact at source. The least desirable option is to provide compensation or an offset for residual impacts that cannot be reasonably avoided.

Embedded controls (i.e., physical or procedural controls that are planned as part of the Project design were considered as part of the Project (i.e., prior to the impact assessment stage of the ESIA process) as avoidance measures.

All mitigation measures outlined in the ESIA are summarized in an Environmental and Social Management Plan (ESMP) for the Project, which provides an overview of how these measures will be implemented during the construction and operation stages.

Residual Impact Assessment

Following the identification of potential E&S impacts, their significance is assessed, taking into account the proposed mitigation measures already incorporated into the Project design and, where appropriate, any additional mitigation measures that are considered feasible and justified.

Mitigation measures are applied to reduce impacts to as low as reasonably practicable; however, some impacts may not be eliminated entirely. These remaining impacts are referred to as residual impacts. One objective of the ESIA is to assess the significance of these residual impacts, which will remain after mitigation measures have been incorporated into the Project, and to determine the appropriate monitoring and measurement actions.

5.6 Management and Monitoring

At the final stage of the impact assessment process, basic management and monitoring measures are defined to determine whether: a) residual impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts, and compensatory measures and offsets are reducing effects to the extent predicted.

5.7 Stakeholder Engagement and Public Consultations

International best practices for the implementation of an ESIA, along with the requirements of the EBRD, provide the basis for conducting active consultations with competent supervisory agencies, experts, affected local communities, and other stakeholders. These consultations aim to understand their views on the Project and its impacts, and to incorporate these perspectives into the prediction and evaluation of impacts, as well as the corresponding mitigation measures. Consultation is also valuable for identifying data and information within the studied area.

As part of this ESIA package, a Stakeholder Engagement Plan (SEP) has been developed, including a grievance mechanism, to serve as a structured and systematic approach for stakeholder engagement throughout all stages of Project implementation.

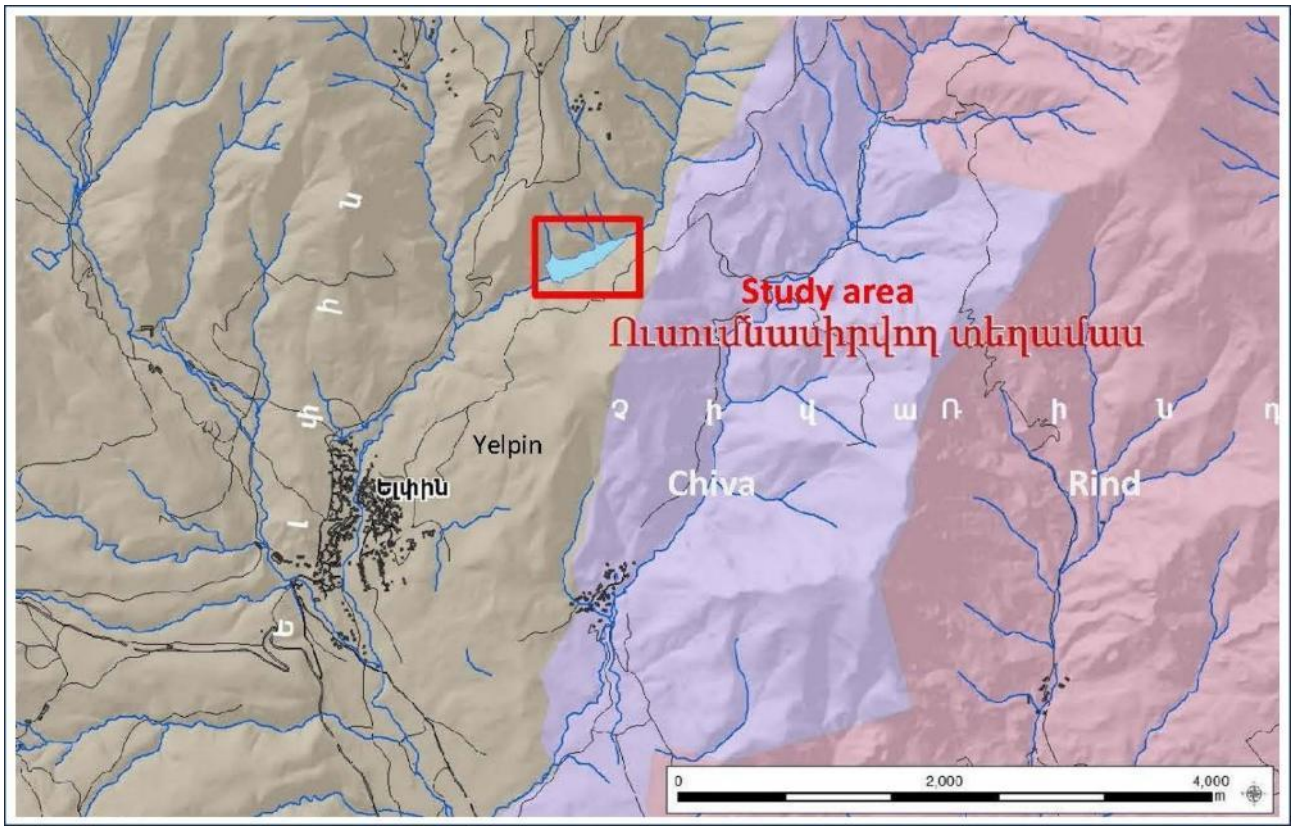
6. Environmental and Social Baseline

6.1 Physical Environment

6.1.1 Geography

The Yelpin Reservoir is planned to be constructed within the administrative territory of Yelpin rural settlement, on the Yelpin River, a right-bank tributary of the Arpa River, at elevations ranging from 1,650 to 1,700 masl. The Project site is situated in the eastern part of the RA Vayots Dzor Marz. The planned reservoir site is located at the distance of 2,500 m northeast to Yelpin settlement (**Figure 6-1**).

Figure 6-1. Situational Plan of the Project region



The lands of Yelpin settlement stretch from 1,400 to 2,800 masl, whereas the settlement itself is located at 1,400-1,545 masl. It is located approximately 100 km from Yerevan, the capital of Armenia, and 26 km from Yeghegnadzor, the administrative center of Vayots Dzor Marz. The M2 'Yerevan-Iranian Border' interstate highway passes directly through the western part of Yelpin village. The Armenian-Azerbaijani contact line, which separates Vayots Dzor from the Nakhchivan Autonomous Republic, runs through the nearby mountains. Yelpin is bordered by the settlement of Zangakatun in Ararat Marz to the northwest, and by the settlements of Chiva and Rind in Vayots Dzor Marz to the southeast.

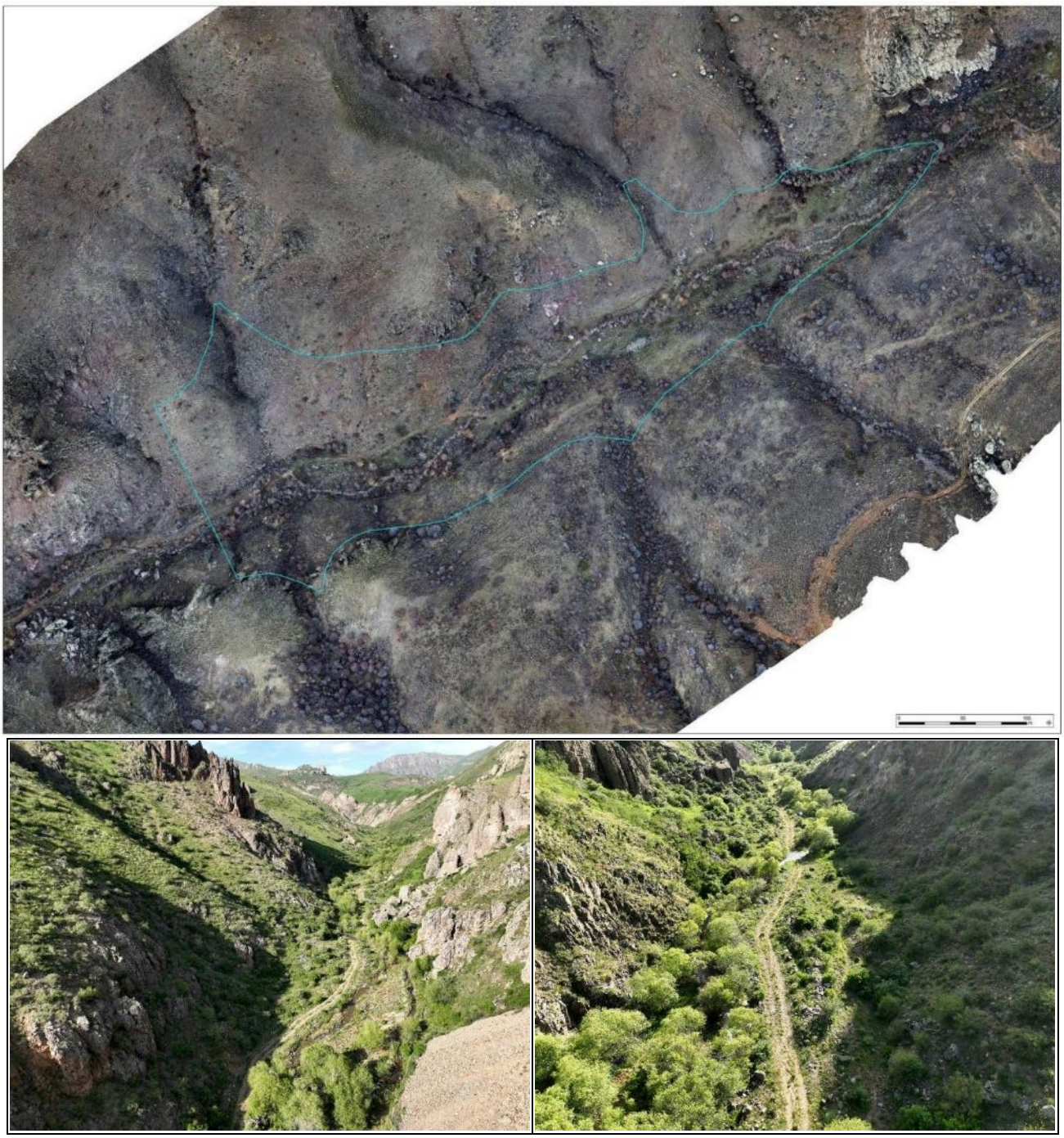
6.1.2 Relief, Landscape and Visual Amenity

The arerial view of the planned Yelpin Reservoir area is presented in **Figure 6-2**.

From a geomorphological point of view, the Project area occupies the southwestern slopes of the Qarkatar Mountains. The entire region is characterized as a typical mountainous area with rugged topography. The terrain features canyons, is intersected by the network of the Yelpin River and

temporary watercourses, and has a general slope directed to the southwest. According to morphological classification, the site is considered highly fragmented.

Figure 6-2. Aerial view of the Project site



The Yelpin River basin covers the following natural landscapes:

- Mountain steppes - at the elevations from 1,400 to 2,200-2,300 m,
- Mountain meadow steppes - at the elevations from 2,200 to 2,600 m,
- High-mountain subalpine zone - at the elevations from 2,400 to 2,800 m,
- High-mountain alpine zone - at the elevations from 2,800 to 3,400 m.

6.1.3 Geology and Hydrogeology

To determine the geological and hydrogeological properties of the Project area, a series of geotechnical and geophysical surveys were conducted in 2023, including:

- Drilling of 14 boreholes (416 linear meters in total) and 3 test pits (15 linear meters in total), soil sampling, laboratory studies of physical and mechanical properties of soils,
- Twelve analyses were carried out to assess the seepage properties of the soils,
- Two-dimensional electrical resistivity tomography (2D ERT) was performed along four profiles.

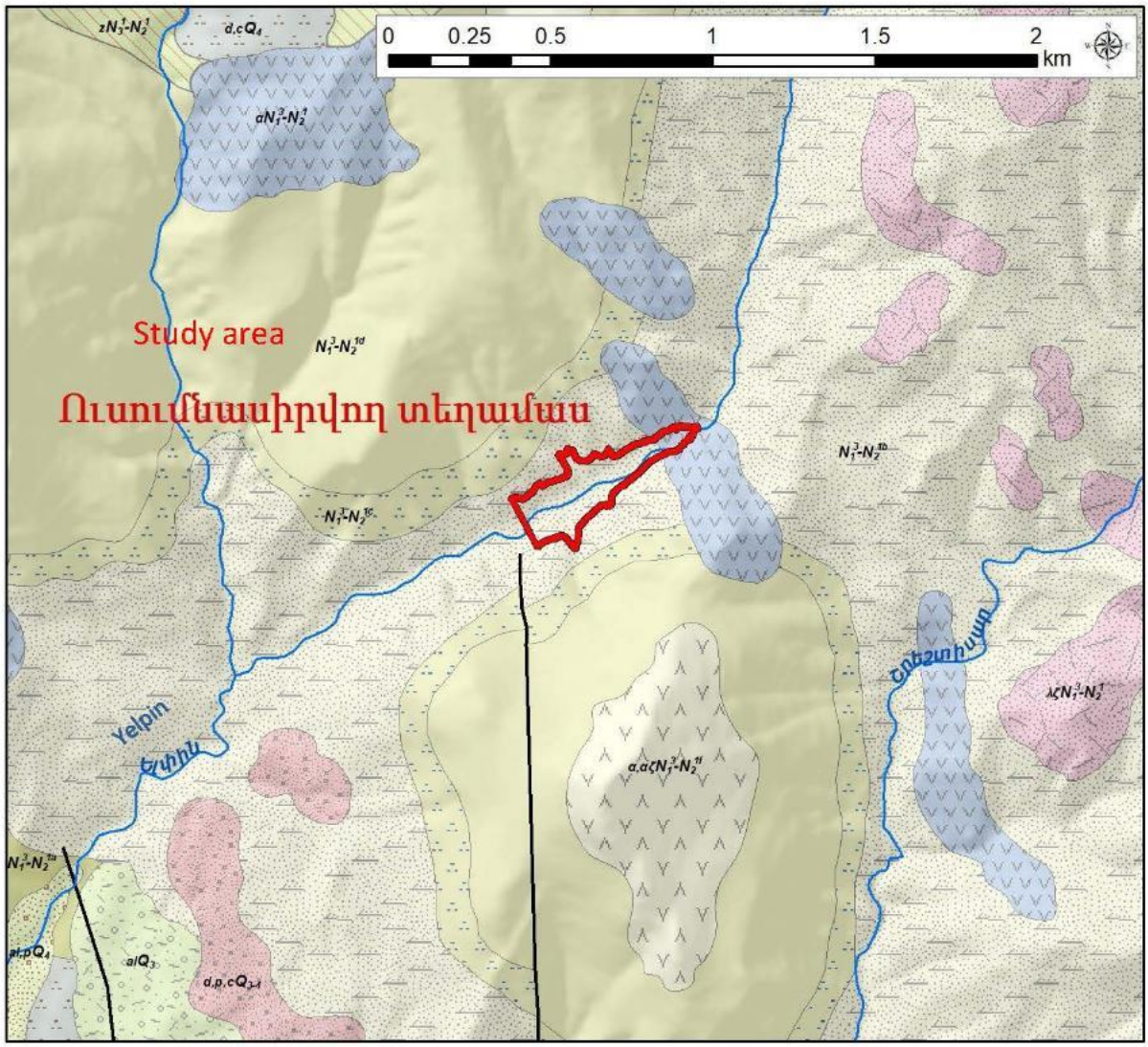
Pliocene (Miocene-Pliocene) formations are widely distributed within the study area. These are represented by a thick stratum of volcanic and volcano-sedimentary rocks, which occupy almost the entire watershed divide. The southern boundary of the stratum is more distinctly expressed than the northern one, taking the form of prominent and extensive undulations, and extends from east to west along the Vardashat-Hortun-Yelpin-Rind-Aghavnadzor-Getap settlements chain (**Figure 6-3**).

In the study area, the geological profile of the rock layer from bottom to top is as follows:

- Above the Upper Eocene and Lower Oligocene sediments lies a layer of white rock, placed with angular unconformity. This layer has a yellowish hue and is composed entirely of sanidine trachyliparite fragments cemented with tuff of the same composition (thickness: ~100 m).
- A layer consisting of tuff breccias and tuff interbedded with andesite and andesite-basalt lava flows (thickness: ~200 m).
- A layer of loose, white acidic tuff containing fragments of intermediate rocks (thickness: 40-50 m).
- A layer of tuff breccias and tuff of andesitic composition (thickness: ~150 m).
- At the top lies a cover of andesites and andesite-dacites (thickness: up to 200 m).

Field studies and laboratory tests in the study area indicate that various genetic types of surface friable debris and rock soils, including eluvial, deluvial, alluvial, proluvial, and transitional, are involved in the geological structure of the planned reservoir.

Figure 6-3. The geological map of the study area



Legend

al, pQ_4.	Pebble, gravel, sand, clay
al Q_3.	Pebble, sand, clay
dQ_4.	Sand, clay sand, loam
d,p,cQ_{3-4}	Fragments, clay sand, loam
N_3-N_1.	Hydrothermal changed andesites, tufa and tifa breccia
N_1.N_2	Acid tufa
N_1.N_2	Andesites
N_1.N_2	Andesites, andesite dacites, dacites
N_1.N_2	Andesites, their tufa and tufa breccia
N_1.N_2	Liparites, dacites
N_1.N_2	Sand trachiliparites, their tufa and tufa breccia
N_1.N_2	Tuffa breccia of average structure of andesites
	Faults

Soil properties

The physical properties of three soil samples taken from the Project site were initially determined in their natural condition. The samples consist of heavy clay with a solid consistency. Due to their location at significant depths, these soils have been compacted and consolidated under high natural pressures, resulting in strength and bearing capacity levels that are uncharacteristically high for clayey soils, approaching those of certain bedrock types under uniaxial compression. However, upon water saturation, which is likely to occur, for example, during reservoir operation, the studied soils lost their strength and developed a plastic structure.

The physical properties of the soil samples after water saturation were also determined. Saturation was performed on cylindrical soil specimens with a height of 35 mm and a diameter of 71 mm, while vertical expansion was restricted. Subsequently, the mechanical properties of the saturated samples were assessed, including the internal friction angle, cohesion, and deformation modulus. The results are presented in tables and in graphs derived from one-dimensional compression and shear resistance tests.

In the study area, the alluvial pebble-gravel soils are characterized by the following composition: particles larger than 2 mm make up 82.6%, including 71% in the 10-200 mm range and 11.6% in the 2-10 mm range. The finer material consists of sand and clayey sand, accounting for approximately 20%.

Hydrogeological conditions

During the field studies, the upper level of the groundwater was recorded in some boreholes at depths ranging from 0.3 to 33.0 m. Atmospheric precipitation and water from the Yelpin River infiltrate through loose debris and pebble-gravel formations, forming perched water tables. Most of the main groundwater is stored above the regional impermeable layer, which consists of Middle Paleogene volcanic rocks. Based on site conditions, recharge, and discharge characteristics, the groundwater is classified as a phreatic (water table) aquifer.

Conclusions

1) The geological profile of the study area is composed of volcanic tuff-breccias and andesites from the Late Miocene - Early Pliocene, overlain by modern eluvial, deluvial, alluvial, and proluvial deposits consisting of clay, sand, crushed stone, sand-crushed stone mixtures, and pebble-gravel.
2) The water table was encountered in several boreholes at depths ranging from 0.3 to 33.0 m, and in some test pits at depths of 3-4 m[77]. Depending on location, recharge, and discharge conditions, the groundwater is classified as either perched or phreatic (main) water table.
3) Field measurements of soil seepage characteristics showed that, based on their seepage coefficients, the soils can be classified as either low-permeability or permeable.
4) Four Geotechnical Elements (GTE) were identified in the study are:
   - GTE-1. Topsoil, embankment soil, loam,
   - GTE-2. Crushed stone-fine crushed stone and pebble-gravel,
   - GTE-3. Tuffa-breccias and andesites, dense, fractured,
   - GTE-4. Tuffa-breccias and andesites, weathered and clayey.

[77]Preparation of design and cost estimation documents for construction of Yelpin reservoir in Vayots Dzor Marz of the Republic of Armenia ,Book 2. Geotechnical surveys, 2024

5) Twenty-five soil samples were taken from fourteen boreholes to investigate the physico-mechanical properties of the soils. These properties were determined in accordance with the Technical Proposal and current regulatory documents of the Republic of Armenia.
6) Geological processes and phenomena in the area include landslides with affected areas of 1.6 ha and 0.05 ha.
7) From the perspective of construction and operation of the Yelpin Reservoir, the geological conditions are generally acceptable.

6.1.4 Tectonics, Seismic Stability and Landslides

From tectonic viewpoint, the area of the planned Yelpin Reservoir lies within a corrugated zone composed of weakly displaced volcanic formations that overlie older structures. From the Yeranos mountain range to the middle course of the Arpa River, the Eocene, Oligocene, and Mio-Pliocene periods are represented by typical sedimentary formations, while in the upper course of the Arpa River, volcanic formations predominate.

The planned Yelpin Reservoir will be located within the aforementioned volcanic layer. The area lies on an anticlinal fold that extends to the northeast. The axis of the anticline runs westward, passing through elevation marks of 2,456.0 m, 2,190.3 m, and 2,320.9 m.

In the core of the anticline, Eocene volcano-sedimentary rocks are exposed and have been intruded by granodiorite bodies. A series of disjunctive faults are observed in this area, with clay gouge zones extending to the northeast and northwest. One prominent fault (or fracture) is present, associated with tectonic movements during the Oligocene-Miocene period. That zone extends from the southeast to the northwest, starting at the ruins of the village of Vrtanes and continuing toward the southern slopes of the Qarkatar Mountains and the eastern slopes of the Gndasar Mountains.

Other faults are also observed in that zone. One of them, the larger fault, runs nearly along the axis of the anticline and dips steeply to the northwest. It is characterized by highly crushed, cemented, and fractured rocks with evidence of rock pulverization.

All rocks are highly fissured, with fissure widths ranging from 0.3 to 2.5 cm. Most of the fissures extend in the northeast and northwest directions. Based on the interpretation of aerial photography materials, the distribution of rock ground fractures was identified. The dam site of the planned reservoir coincides with these fractures.

All the rocks (andesites and tufa-breccias) within the boundaries of the described fault have been almost completely subjected to hydrothermal alteration processes, including sericitization, kaolinization, and pyritization. The hydrothermally altered zones consist entirely of clay-rich material.

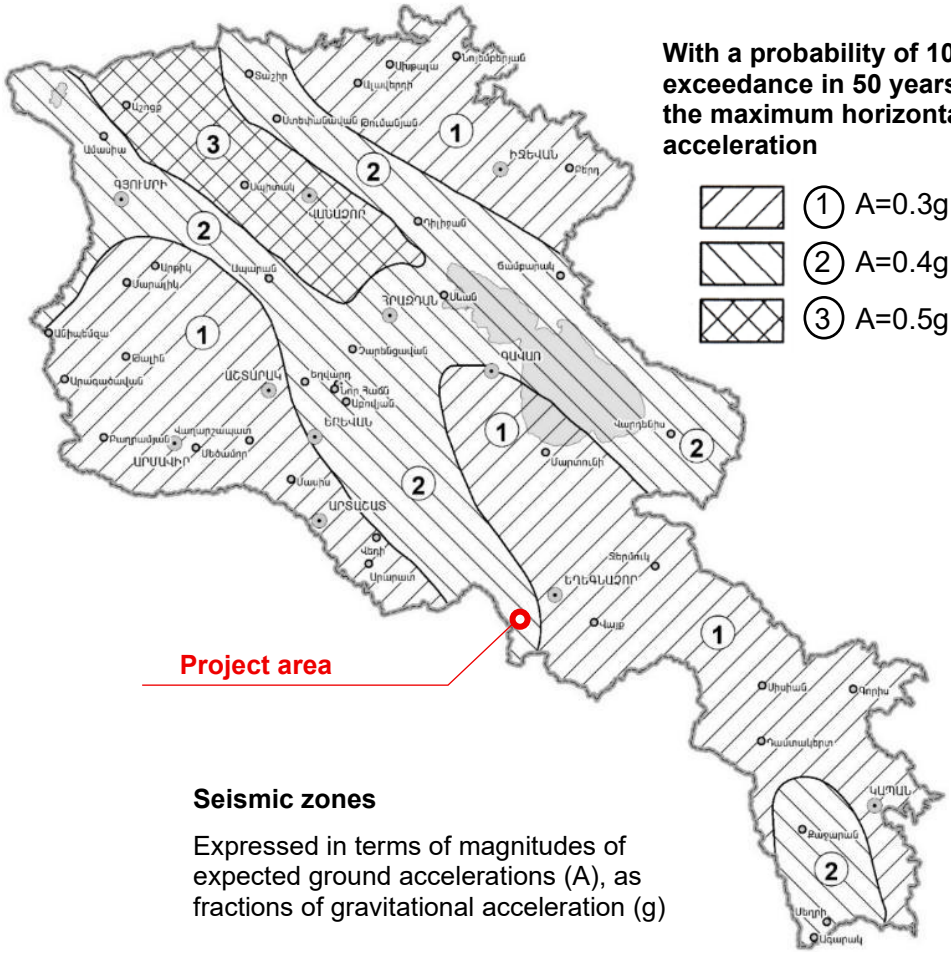
As per the RA CN 20.04 "Earthquake-resistant construction, Design norms"[78], Armenia is divided into 1st, 2nd and 3rd seismic zones, with the last the most seismically hazardous. The magnitudes of expected ground horizontal accelerations per seismic zones are:

Seismic zones	1st	2nd	3rd
Ground horizontal accelerations magnitudes a, cm/sec^2	300	400	500

The project site (Yelpin settlement) is located in Seismic Zone 2 (**Figure 6-4**), where the expected seismic hazard is estimated at Amax = 0.4g. Thus, the Project is not situated within the highest seismic hazard zones of Armenia.

[78] https://www.arlis.am/documentview.aspx?docid=172012

Figure 6-4. Map of zoning of probable seismic risks in the RA territory



The Probabilistic Seismic Hazard Assessment (PSHA) was performed on the planned Yelpin Reservoir dam platform by the "Territorial Service of Seismic Protection" SNCO, Armenian Association of Seismology and Geophysics and "Terraform" LLC[79]. The R-CRISIS software was used for the PSHA, allowing consideration of input data uncertainties through the logic tree approach. Two seismotectonic models were used for the calculations.

The PSHA was conducted for the Yelpin dam site (coordinates: 39.83°N, 45.13°E), assuming a Vs30 value of 760 m/s, representing the shear wave velocity. Within this study, PSHA calculations were performed for annual exceedance probabilities of 2.1×10^{-3} and 1.0×10^{-4}, corresponding to return periods of 475 and 10,000 years, respectively. The results of the PSHA are given in Table 6-1.

Table 6-1. Deterministic and probabilistic assessment of maximum horizontal acceleration values

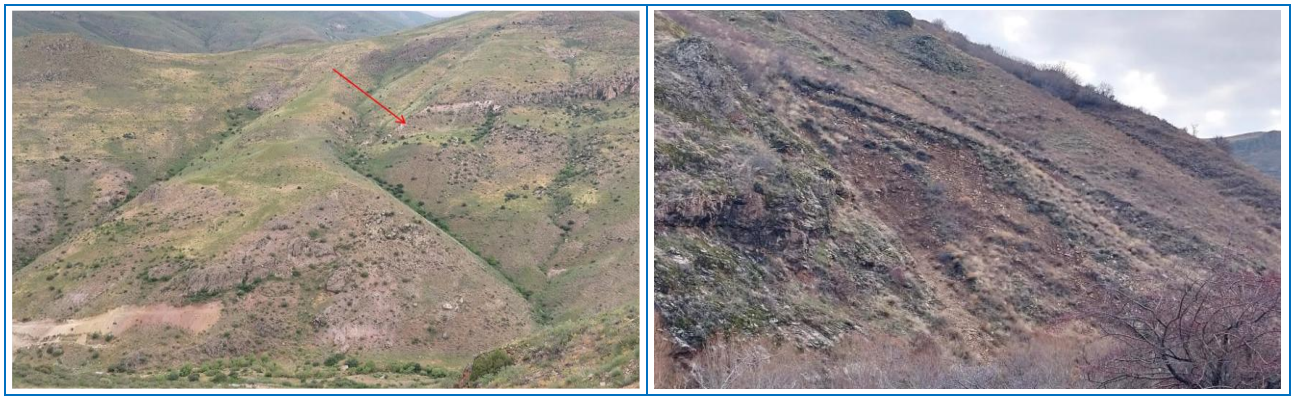
Risk determination methods	Dam	Average value (g)	84%
Deterministic	Yelpin	0.46	0.52
Probabilistic: return period of 475 years (Operating Basis Earthquake, OBE)	Yelpin	0.14	0.16
Probabilistic: return period of 10,000 years (Safety Evaluation Earthquake, SEE)	Yelpin	0.45	0.52

Hazardous physical and geological processes within the project area are represented by two landslide sites: EL-1 and EL-2. The first landslide body, EL-1, with an area of 1.6 ha, is located 200 m north of the planned reservoir and is currently in a stabilized state. The second landslide body, EL-

[79]Report on the Probabilistic Assessment of Seismic Hazard of the designed Yelpin Reservoir Dam Site, 2023

2, covering an area of 0.05 ha, is located 550 m northeast of the planned reservoir (**Figure 6-5**) and, due to its small size, does not pose any risk to the future operation of the reservoir and its dam.

Figure 6-5. Landslide bodies near the reservoir site



Landslide body EL-1 *Landslide body EL-2*

6.1.5 Hydrology (surface and groundwater resources)

Surface water

The Yelpin River has a monthly flow distribution typical of rivers in Armenia. Characteristic of the river is a well-expressed spring flooding period, low-flow winter and summer periods and an autumn flooding period. Spring floods are mostly the result of snowmelt and rainfall. Autumn floods can emerge from rainfall but they are short-lasting and not well expressed. In the low-flow period, the river is mostly fed from springs. The summer low-flow period can sometimes be accompanied by rainfalls.

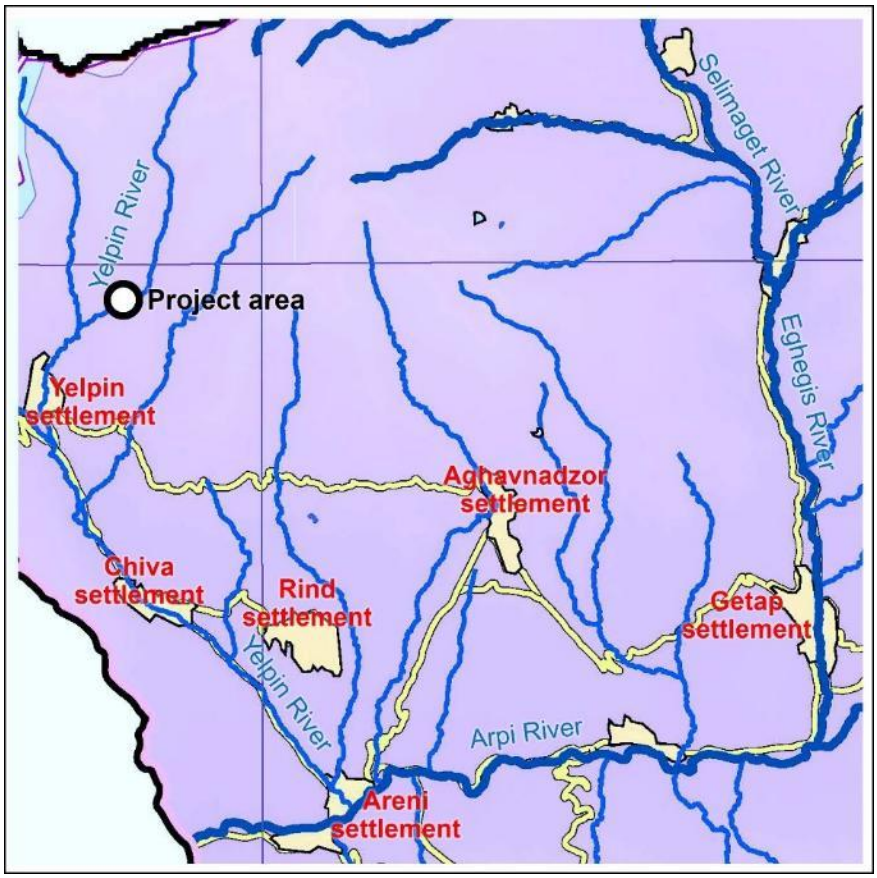
Yelpin is a right tributary of the Arpa River. It originates on the southwestern slopes of the Vardenis Mountains at an altitude of 2,950 masl and flows into the Arpa River near the settlement of Areni. The Yelpin River is 23 km long, with a catchment area of 130 km^2.

The Arpa River originates at an altitude of 3,200 meters from the torrential springs of the Teksar Mountains. Near the city of Jermuk, it bends northeast and flows through the Sharur Plain. In its upper reaches, the river flows slowly, but as it approaches Jermuk, it becomes fast-flowing. Breaking through the slopes of the Vardenis Mountains, it plunges into a deep, forested gorge. Below Jermuk, the Arpa meanders and continues its course, sometimes swift, sometimes gentle, toward the village of Areni. In its lower reaches, the river splits into numerous large and small streams and is used almost entirely for irrigating fields and gardens during the summer months. The Arpa River originates in Vayots Dzor Marz and is left a left tributary of the Arax River. It is 128 km long and has 2,630 km^2 catchment area.

Another relatively large river discharges to the Arpa River is Yeghegis. It originates on the southern slopes of the Vardenis Mountains, at an altitude of 3,200 m. Its length is 47 km, and its catchment area is 516 km. The river valley is predominantly canyon-like. It is fast-flowing, featuring numerous gullies and waterfalls. The river is primary fed by meltwater (49%) and groundwater (39%), with flooding typically occurring from March to June. The Yeghegis River flows around 13 km right to the estuary of Yelpin River.

Another relatively large river that discharges into the Arpa River is the Eghegis. It originates on the southern slopes of the Vardenis Mountains at an altitude of 3,200 meters. The river is 47 km long, with a catchment area of 516 km². Its valley is predominantly canyon-like. The river is fast-flowing, featuring numerous gullies and waterfalls. It is primarily fed by meltwater (49%) and groundwater (39%), with flooding typically occurring from March to June. The map of significant rivers within the Project region and its vicinities is presented in **Figure 6-6**.

Figure 6-6. Rivers in the Project region



The RA Government Decree №75-N specifies the classification (categories) and environmental norms for surface water bodies (rivers). According to that Decree five water quality categories are defined for the river basins of Armenia: Class 1 - Excellent, Class 2 - Good, Class 3 - Fair, Class 4 - Poor, and Class 5 - Bad. The Yelpin River belongs to the Arpa River basin. Therefore, the environmental norms established by the RA Government Decree №75-N for the Arpa River basin were used to assess the water quality of the Yelpin River.

Two samples were taken from the Yelpin River in April 2025: Sample N1 (upstream, before the reservoir site) and Sample N2 (downstream, after the reservoir site). The samples were analyzed at the accredited laboratory of the "Hydrometeorology and Monitoring Centre" SNCO. The results of the water quality analysis and the corresponding water quality categories determined based on the analyzed parameters are summarized in Table 6-2.

Table 6-2. Results of water quality analysis and water determined water quality categories

№	Analysed indicators	Unit	N1		N2	
			Result of analysis	Category	Result of analysis	Category
1	Colour	rank	15	2	20	2
2	Transparency	cm	31	*	31	*
3	Suspended solids	mg/l	74.4	4	68.2	4
4	pH (Hydrogen index)	-	7.76	1	7.68	1
5	Mineralization	mg/l	336	*	307	*
6	El. conductivity	µs/cm	517	2	472	2
7	Alkalinity	mg/l	85	*	85	*
8	COD (Chemical Oxygen Demand)	mgO/l	10	1	10	1

№	Analysed indicators	Unit	N1		N2	
			Result of analysis	Category	Result of analysis	Category
9	Fluoride ion	mg/l	0.363	*	0.345	*
10	Sulphate ion	mg/l	177.043	4	165.637	4
11	Chloride ion	mg/l	2.388	1	2.549	1
12	Nitrate ion	mg/l	1.26	2	1.1	2
13	Nitrite ion	mg/l	<0.013	2	<0.013	2
14	Ammonium ion	mg/l	0.117	2	0.128	2
15	Total inorganic nitrogen	mgN/l	0.376	1	0.348	1

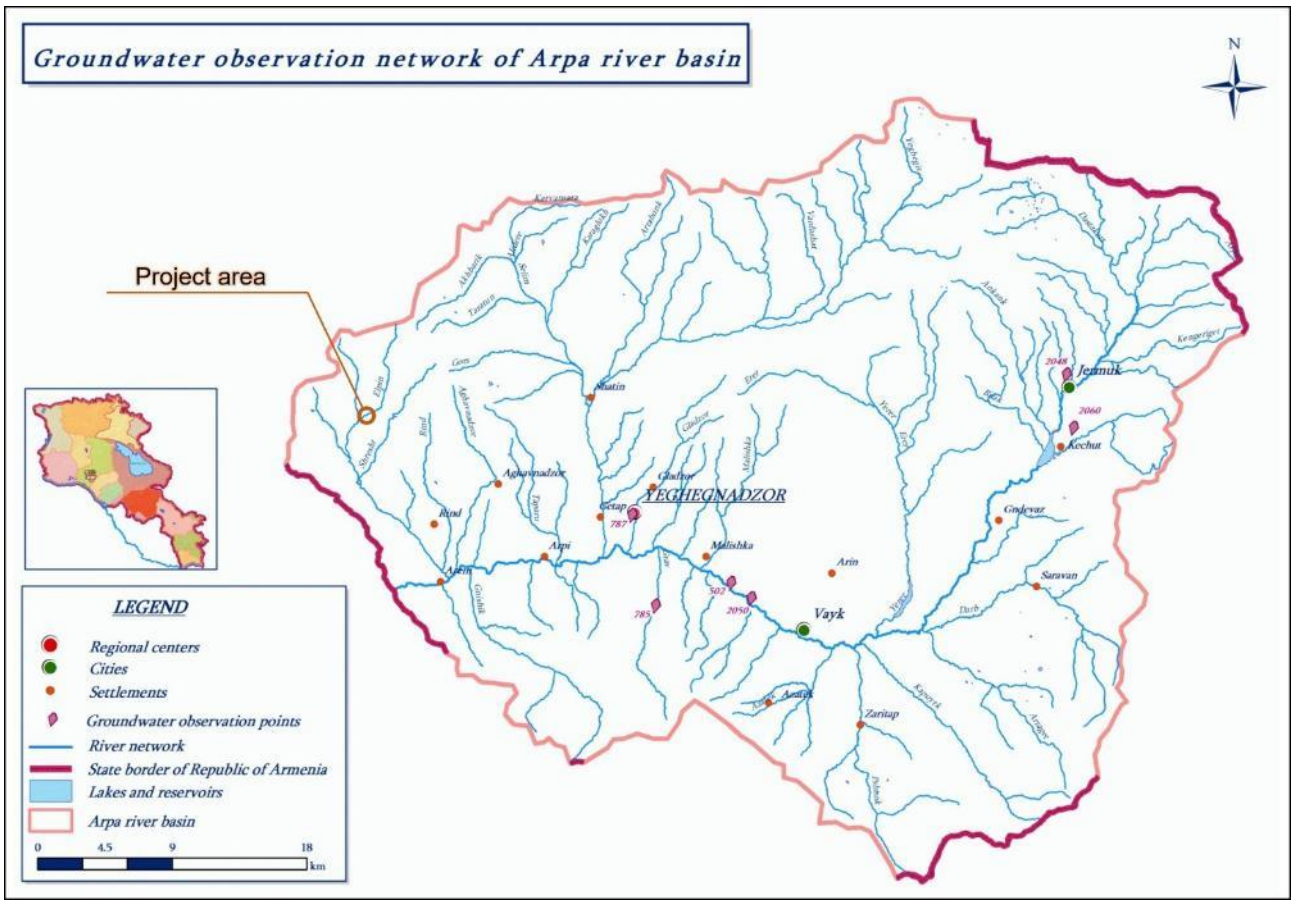
*the environmental norm for this water quality indicator has not been specified

The results of the chemical analyses of water samples taken from the Yelpin River indicate that the water quality mostly complies with the criteria for Class 1 (Excellent) and Class 2 (Good), with the exception of suspended solids and sulphate ion concentrations, which fall under Class 4 (Poor).

Groundwater Resources

According to the map of the groundwater observation network of the Arpa River basin, there are no groundwater monitoring springs or wells in the vicinity of the Project area (**Figure 6-7**). The nearest groundwater monitoring (observation) points are located approximately 9 km and 18 km southwest of the planned Yelpin reservoir site, in Aghavnadzor village (observation point 785) and Yeghegnadzor city (observation point 787), respectively.

Figure 6-7. Map of groundwater observation network of Arpa river basin

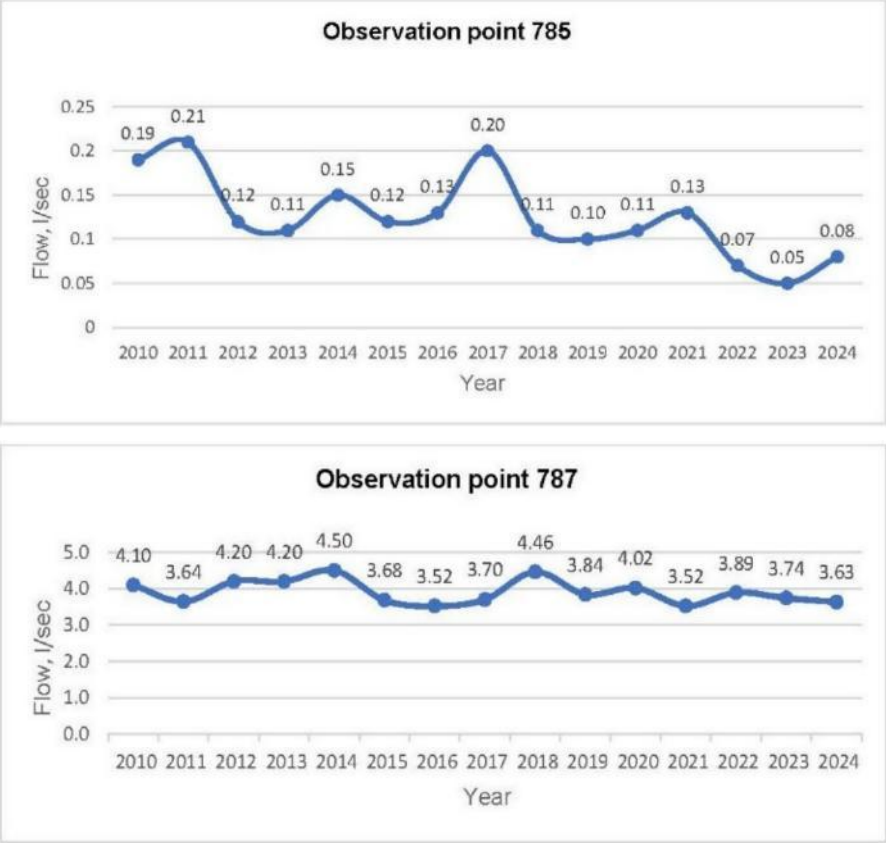


Source: Website of Hydrometeorology and Monitoring Centre

The groundwater monitoring data

The Hydrometeorology and Monitoring Centre under the Ministry of Environment (ME), as the state environmental monitoring body, conducts regular groundwater monitoring in Armenia. According to the *Report on Monitoring of the National Groundwater Network of the RA for 2024*, which also summarizes groundwater monitoring data from 2010 to 2024, the fluctuations in water flow at groundwater observation points 785 and 787 are presented in **Figure 6-8**.

Figure 6-8. Fluctuations of flows in groundwater observation points 785 and 787 for 2010-2024 years

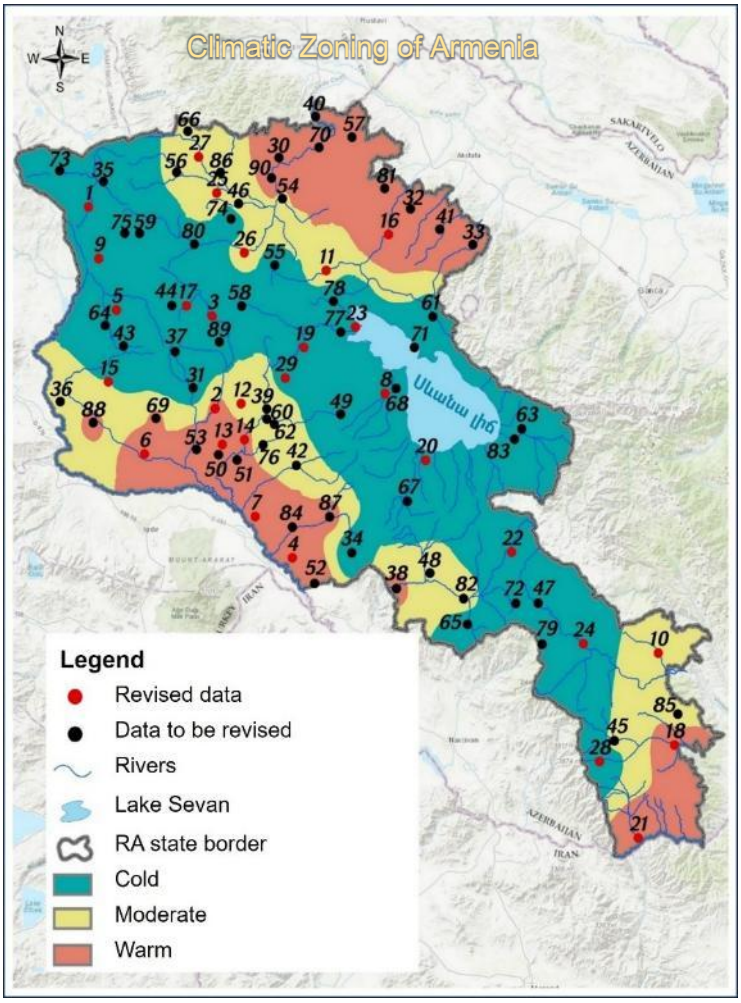


In both cases, fluctuations in groundwater flow were observed. However, at observation point 785, the groundwater flow in 2024 decreased to less than half of its 2010 level, while at observation point 787, the flow in 2024 was reduced by approximately 10% compared to 2010.

During the geotechnical field surveys, the groundwater table was encountered in boreholes BH-1, BH-1b, BH-2, BH-3, BH-6a, BH-7, BH-12, BH-13, and BH-14 at depths ranging from 0.3 to 33.0 m, as well as in some test pits at depths of 3 to 4 m. The locations of the boreholes are provided in **Annex 4**. Water from atmospheric precipitation and the Yelpin River infiltrates through loose debris and pebble-gravel formations, creating a perched water table. Most of the major groundwater is stored above the regional impermeable layer, which is represented by middle Paleogene volcanic rocks.

6.1.6 Climate and Meteorology

According to the RA Construction Norms CN 22-01-2024 "Construction Climatology"[80] the Project site (№38) is located within the warm climatic zone (see map of climatic zoning of Armenia).



The nearest meteorological station is located in Areni community, approximately 11 km from the Project site. Based on data from the Areni meteorological station, the average annual air temperature in the Project region is 12.3°C, with January averaging -2.6°C and August 25.9°C. The annual temperature range is approximately 25°C. The absolute minimum temperature of -24°C was recorded in January, while the absolute maximum of 42°C was observed in July.

The average annual relative humidity is 59%, and total annual precipitation amounts to 385 mm. The highest rainfall occurs between April and October, contributing up to 217 mm. The maximum recorded soil freezing depth is 21 mm. Wind direction data for the project region were derived from the Yeghegnadzor meteorological station, as such data are not recorded at the Areni meteorological station.

The average temperature, relative humidity, precipitation, and snow cover data observed at the 'Areni' meteorological station, as well as wind velocity in different directions recorded at the 'Yeghegnadzor' meteorological station, derived from CN 22-01-2024 "Construction Climatology", are summarized in **Tables 6-3** to **6-7**, respectively.

Table 6-3. Average air temperature

Meteorological station	Average temperature by month, °C												Average annual, °C	Absolute minimum, °C	Absolute maximum, °C
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII			
Areni	-2.6	-0.1	5.7	12.1	17.1	21.9	26.1	25.9	21.1	13.9	6.7	0.1	12.3	-24	42

[80] https://www.arlis.am/DocumentView.aspx?DocID=188846

Table 6-4. Relative humidity

Meteorological station	Air relative humidity by month, %												Average annual	Humidity of the coldest month, %		Humidity of the hottest month, %	
														Average monthly	Average monthly at 3 p.m.	Average monthly	Average monthly at 3 p.m.
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	13	14	15	16	17
Areni	71	68	60	59	57	51	46	46	50	59	67	71	59	71	60	46	34

Table 6-5. Precipitation

Meteoro-logical station	Amount of precipitation by month, mm average monthly daily maximum												Yearly	November-March, mm	April-October, mm
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII			
Areni	30	32	43	56	53	35	18	9	11	35	33	30	385	168	217
	24	31	34	34	45	38	47	27	27	36	23	25	47		

Table 6-6. Snow cover

Meteoro-logical station	Snow cover			
	Maximum ten-day height	The number of days with snow cover in a year	Maximum amount of water in snow, mm	Maximum depth of soil freezing, mm
Areni	58	36	62	21

Table 6-7. Wind

Monitoring station	Months	Repeatability, % Average velocity, m/s, in directions								Tranquility repeatability, %	Average monthly velocity, m/s	Prevailing direction in June-August	Minimum average velocity among the directions in July, m/s	The prevailing direction in December-February	Minimum average velocity among the directions in January, m/s
		Northern	North-Eastern	Eastern	South-Eastern	Eastern	South-Western	Western	North-Western						
Yegheg-nadzor	January	18	4	13	11	6	21	10	17	82	0.5	South-Western	2.4	Western	1.7
		1.4	1.3	1.5	1.8	1.6	1.7	1.7	1.4						
	April	15	12	13	15	8	14	13	10	55	1.6				
		2.1	1.7	2.1	2.2	2.1	2.5	2.8	2.5						
	July	19	10	18	20	6	9	9	9	48	1.8				
		2.8	1.9	2.6	2.4	2.2	2.2	2.5	3.1						
	October	9	3	11	6	7	31	28	5	69	1.1				
		1.7	1.5	1.6	1.9	1.8	2.2	2.4	2.2						

6.1.7 Climate Risk Profile

Background

According to the Armenia's Fourth National Communication on Climate Change (2020)[81] over the past decades a significant increase in temperature has been observed in Armenia. Particularly, over

[81] https://unfccc.int/sites/default/files/resource/NC4_Armenia_.pdf

the period of 1929-1996, the annual mean temperature increased by 0.4°C, during 1929-2007 - by 0.85°C, during 1929-2012 - by 1.03°C, and during 1929-2016 - by 1.23°C. The ambient air temperature change has had different trends in different seasons. During the period of 1966-2016, the average summer temperature increased by about 1.3°C; moreover, over the last century, extremely hot summers were observed in Armenia within the last 20 years.

During the period of 1935-1996, the average annual precipitation decreased by 6% and in 1935-2016 - by about 9%. The spatial distribution of precipitation is quite irregular. During the period of 1935-2016 the climate in the north, south and central regions of the country has become more arid, while precipitations have increased in the Shirak plain, in the Lake Sevan basin and in Aparan-Hrazdan regions.

The frequency and intensity of natural disasters has increased significantly. Over the period of 1975-2016, the total number of observed hazardous phenomena increased by about 40 cases, as compared to the average of 1961-1990 (168 cases). The highest number of hailstorms was observed in the Shirak plain, the maximum number of cases with heavy rainfall occurred in Tashir and Ijevan regions, and frosts - in the Ararat valley and foothill regions. According to drought indices, the number of days with strong and very strong droughts during the period of 2000-2017 increased by 33 days, as compared to the 1961-1990 average (87). In recent years, the upper boundary of the drought zone has expanded and includes mountainous areas, with an earlier timed start of drought.

Climate change scenarios for Armenia

The results of the CCSM4[82] Global Climate Model used and reported in the NC3[83] were reviewed for the projection of changes in air temperature and atmospheric precipitation, as well as high resolution METRAS (12×12 km) regional climate model was applied.

The average annual temperature across the territory of Armenia is projected to increase by up to 1.6°C by 2040, by 3.3°C - by 2070 and by 4.7°C - by 2100, relative to the baseline annual average (5.5°C) for 1961-1990. As for atmospheric precipitations, these are projected to decline by up to 2.7% by 2040, 5.4% - by 2070 and 8.3% - by 2100, relative to the baseline annual average (592 mm) for 1961-1990.

The projected climate change is expected to have negative effects on the country's water resources, energy, agriculture, ecosystems, human health, settlements and infra structures, as well as a number of other climate-sensitive sectors, including tourism.

Water resources

River flow. Analysis of water resources vulnerability in Armenia was carried out using the CCSM4 model data with the emission scenarios of RCP8.5[84] and RCP6.0, as well as the METRAS model with the RCP8.5 scenario. The vulnerability of the river flow to climate change varies across different river basins, due to the differences in natural and climatic conditions of the basins, and the various factors that impact on the flow formation. The vulnerability of the annual river flow assessed with the above-mentioned climate models and scenarios for 2040, 2070 and 2100 are summarized in **Table 6-8**.

Table 6-8. Vulnerability of the river flow to climate change in Armenia

Scenario	Time period	River flow studied, mln. m^3	Change in flow	
			mln. m^3	%
CCSM4	1961-1990	6,279.9	0	0

[82]CCSM4 - Community Climate System Model, version 4
[83]NC3 - Third National Communication
[84]RCP - Representative Concentration Pathway

Scenario	Time period	River flow studied, mln. m^3	Change in flow	
			mln. m^3	%
RCP6.0	2011-2040	5,760.4	-519.5	-8.27
	2041-2070	5,450.5	-829.4	-13.2
	2071-2100	5,037.9	-1,242.0	-19.8
CCSM4 RCP8.5	2011-2040	5,513.5	-766.4	-12.2
	2041-2070	5,148.2	-1,131.7	-18.0
	2071-2100	4,165.1	-2,114.8	-33.7
METRAS RCP8.5	2011-2040	5,433.4	-846.5	-13.5
	2041-2070	4,547.9	-1,732.0	-27.6
	2071-2100	3,832.0	-2,447.9	-39.0

Lake Sevan. The assessment of the water balance of Lake Sevan under the predicted climate change scenarios was implemented through a multifactor correlation analysis of the annual inflow into the Lake and multi annual observation data of atmospheric precipitation and air temperature at the meteorological stations of the basin. Based on the RCP8.5 and RCP6.0 emission scenarios used with the CCSM4 climate model and the RCP8.5 scenario used with the METRAS model, changes in the river inflow into the Lake Sevan for 2040, 2070 and 2100 were projected (**Table 6-9**).

Table 6-9. Projection of the Lake Sevan water balance elements

Scenario	Time period	River flow, mln. m^3	Precipitation, mln. m^3	Evaporation, mln. m^3
CCSM4 RCP6.0	1961-1990	783.8	503.9	1074.5
	2011-2040	712.6	519.0	1194.9
	2041-2070	681.6	513.9	1246.2
	2071-2100	646.4	524.0	1316.9
CCSM4 RCP8.5	2011-2040	693.7	508.9	1203.3
	2041-2070	648.0	529.1	1326.0
	2071-2100	552.8	513.9	1467.1
METRAS RCP8.5	2011-2040	687.5	488.7	1186.1
	2041-2070	597.0	478.7	1335.4
	2071-2100	519.0	463.6	1467.1

The analysis of climate change scenarios shows a negative impact for the Lake's habitat; and under the pessimistic scenario a decrease in the total river inflow into Lake Sevan by about 34% (265 mln. m^3) by 2100 is projected. In addition to the anthropogenic impact, the quality of the Lake water is significantly affected by climate change. Along with the air and water temperature increase, the biomass of phytoplankton in the Lake is increasing, which leads to an abrupt deterioration of the Lake's water quality and the acceleration of eutrophication processes.

Reservoirs. The vulnerability of the river inflow during spring (April-June) months was estimated for the strategically significant reservoirs - Akhuryan, Aparan, Azat and Marmarik, for 2040, 2070, and 2100. The impact of climate change on the river inflow into the reservoirs during spring will be particularly significant for the Akhuryan and Marmarik reservoirs. Based on the assessment by the METRAS model and the RCP8.5 scenario, a decrease of around 60% can be projected for the river inflow during the spring months in 2100.

Agriculture

The vulnerability of the agriculture sector to natural hazards is relatively high, and it considerably varies across land zones and specific crops. It is more evident in low-lying and medium-altitude zones in the country. About 80% of the territory of Armenia is exposed to various degrees of desertification, which is not only the consequence of anthropogenic activity, but is also affected by natural factors, such as water and wind erosion of soils, hot dry spells, drought, lack of humidity, landslides, natural salinization, alkalization, etc. Climate change, along with various anthropogenic phenomena, contributes to the vulnerability of organic carbon reserves in soils. According to climate change forecasts for Armenia over the next 100 years, the following changes are expected in the field of agriculture:

- Decrease in the level of soil moisture by 10-30%, decrease in soil moisture provision for various agricultural crops by 7-13%,
- Shortage of water for irrigation, increase of soil water deficit by 25-30%,
- Reduced productivity of irrigated land by about 24%,
- Degradation of lands and natural pastures; decrease in overall pasture area and productivity by 4-10% by 2030, decrease in pasture yield by 7-10%, decrease in fodder production volumes,
- Crop yield decline by 8-14% by 2030.

Hailstorms, frosts, heat waves, and drought have a particularly significant impact on the loss of agricultural crop yields due to hazardous hydrometeorological phenomena. In recent years, annual damage caused to agriculture by drought, hail, floods, spring frosts and mudflows has been estimated at about 15-30 billion AMD. In particular, the largest share in the damage caused is attributable to hailstorms. According to climate change scenarios, the frequency of thunderstorms and weather fluctuations accompanied by hailstorms is likely to increase in spring and summer.

6.1.8 Soil

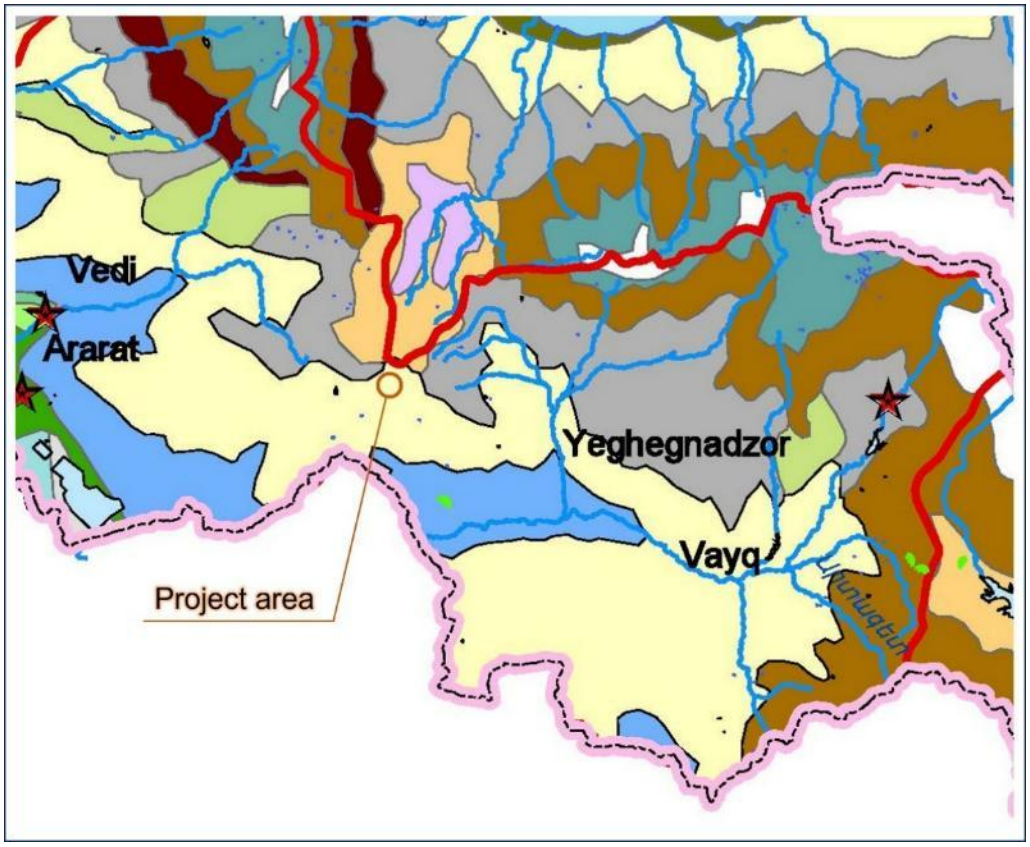
The Project region has the following soil types (**Figure 6-9**), as per the Water Resources Atlas of Armenia.

- Mountain-fulvous soils of dry steppes,
- Meadow saline lands and alkali soils,
- Mountainous carbonated and black soils of moderately humid steppes,
- Desalinated here and there fat mountainous black soils of humid steppes.

During the national EIA study, samples of soil were taken from the area of planned Yelin reservoir on April 2024. Soil samples were analysed using the ISO 17294-2:2016 standard method at the accredited laboratory of the "Hydrometeorology and Monitoring Centre" SNCO. Results of the soil analyses compared to the Admissible Concentration Limits (ACL) for chemical elements in soil set out in the Sanitary Rules and Norms №2.1.7.003-10 "Hygienic requirements for soil quality"[85] are given in **Table 6-10**.

[85] https://www.arlis.am/DocumentView.aspx?docid=146741

Figure 6-9. Map of soil types in the Project region



Source: Water Resources Atlas of Armenia, Yerevan, 2008

Շագանակագույն լեռնա-անտառային հողեր չոր անտառներով և թփուտներով / Brown mountainous-forest soils of dry forests and bushes
Շագանակագույն լեռնա-անտառային հողեր չափավոր խոնավ անտառներով / Brown mountainous-forest soils of moderately humid forests
Տեղ-տեղ անալիացված լեռնային սևահողեր խոնավ տափաստաններով / Desalinated here and there fat mountainous black soils of humid steppes
Գորշ անտառային տեղ-տեղ գիպս պարունակող հողեր և աղուտներ / Gray mountainous here and there gypsiferous & saline soils
Գիպս պարունակող և տեղ-տեղ գունավորված աղուտներ / Gypsiferous and here and there saline colored soils
Սևանա լճի բուսազուրկ հատակային հողեր / Lake Sevan's outcropped bottomlands
Մարգագետնային աղուտներ և ալկալի հողեր / Meadow saline lands and alkali soils
Մարգագետնային – ճահճային հողեր / Meadow-marshy soils
Լեռնային գորշադեղնավուն հողեր չոր տափաստաններով / Mountain-fulvous soils of dry steppes
Լեռնային ածխածնային և սևահողեր չափավոր խոնավ տափաստաններով / Mountainous carbonated and black soils of moderately humid steppes

During the national EIA study, samples of soil were taken from the area of planned Yelin reservoir on April 2024. Soil samples were analysed using the ISO 17294-2:2016 standard method at the accredited laboratory of the "Hydrometeorology and Monitoring Centre" SNCO. Results of the soil analyses compared to the Admissible Concentration Limits (ACL) for chemical elements in soil set out in the Sanitary Rules and Norms №2.1.7.003-10 "Hygienic requirements for soil quality"[86] are given in **Table 6-10**.

Table 6-10. Concentrations of chemical elements in soil samples taken from the Project site compared with the Armenian ACLs

№	Chemical elements	Unit	Results of analysis	ACL of chemicals in soil
1	Lithium	mg/kg	0.0195	-
2	Beryllium	mg/kg	0.00164	-
3	Boron	mg/kg	0.0103	-

[86] https://www.arlis.am/DocumentView.aspx?docid=146741

№	Chemical elements	Unit	Results of analysis	ACL of chemicals in soil
4	Sodium	mg/kg	17.22	-
5	Magnesium	mg/kg	15.049	-
6	Aluminium	mg/kg	83.63	-
7	Total phosphorus	mg/kg	0.653	-
8	Potassium	mg/kg	14.53	-
9	Calcium	mg/kg	60.43	-
10	Titanium	mg/kg	6.991	-
11	Vanadium	mg/kg	0.14	150
12	Chrome	mg/kg	0.123	6
13	Iron	mg/kg	41.86	-
14	Manganese	mg/kg	0.881	1500
15	Cobalt	mg/kg	0.0318	5
16	Nickel	mg/kg	0.1	4
17	Copper	mg/kg	0.0493	3
18	Zinc	mg/kg	0.0848	23
19	Arsenic	mg/kg	0.0132	2
20	Selenium	mg/kg	0.00969	-
21	Strontium	mg/kg	0.257	-
22	Molybdenum	mg/kg	0.00122	-
23	Cadmium	mg/kg	0.000315	-
24	Tin	mg/kg	0.000299	-
25	Antimony	mg/kg	0.000674	4.5
26	Barium	mg/kg	0.332	-
27	Lead	mg/kg	0.00969	32
28	Bismuth	mg/kg	0.000139	-
29	Uranium	mg/kg	0.000895	-

The concentrations of none of the chemical elements in the soil sample exceed the ACLs set by national sanitary rules and norms.

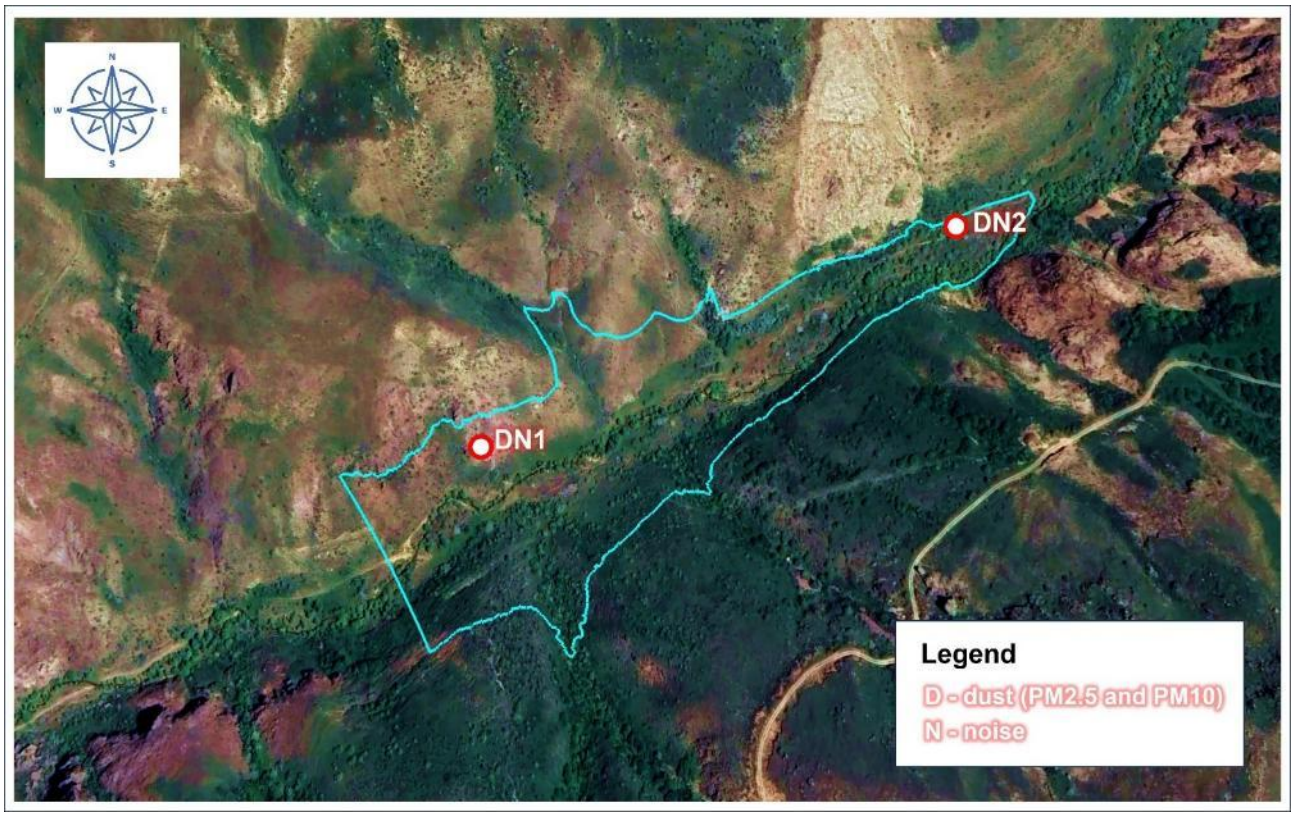
6.1.9 Ambient Air Quality

There are no industrial facilities operating in the Project regions. Hence, the Hydrometeorology and Monitoring Centre does not monitor air quality in the Yelpin and Chiva rural settlements and their surrounding areas. The main sources of gaseous emissions are agricultural machinery and vehicle traffic; however, their influence on air quality is not significant. Dust (PM2.5 and PM10[87]) emissions can occur during land cultivation activities and as a result of traffic. Currently, dust concentrations are negligible, but they are expected to increase significantly during earthworks (excavation activities).

[87]Particle Metters

During the national EIA study, instrumental measurements of dust (PM2.5 and PM10) concentrations as well as eqivalent and maximum noise levels were performed. The map indicating dust and noise measurement points is presented in **Figure 6-10**.

Figure 6-10. Dust (PM2.5 and PM10) and noise measurement points



PM2.5 and PM10 instrumental measurements are carried out during the daytime. Duration of each measurement was 20 minutes. The results of the PM2.5 and PM10 are provided in **Tables 6-11** and **6-12** respectively. Ambient air quality standards for residential areas in Armenia are set by RA Government Decree №160-N and the World Health Organization's (WHO) Air Quality Guidelines - Global Update 2021.

Table 6-11. The results of PM2.5 instrumental measurements (baseline)

Point №	PM2.5 actual concentration, mg/m³	Maximum permissible concentrations (MPC), mg/m³		
		National		IFC/WHO[88]
		Maximum	Daily average	24 hours
DN1	0.007	0.16	0.035	0.025
DN2	0.006			

Table 6-12. The results of PM10 instrumental measurements (baseline)

Point №	PM10 actual concentration, mg/m³	Maximum permissible concentrations (MPC), mg/m³		
		National		IFC/WHO
		Maximum	Daily average	24 hours
DN1	0.009	0.3	0.06	0.05
DN2	0.009			

[88]IFC refers to the World Health Organization (WHO). Air Quality Guidelines Global Update, 2021

6.1.10 Noise and Vibration

Threshold Limit Values (TLVs) for equivalent (average) and maximum noise/sound levels set by the RA Sanitary Norms №2-III-11.3 "Noise in the workplaces, in residential and public buildings and housing in construction areas"[89] are comparable with the IFC Environmental, Health, and Safety General Guidelines (2007)[90] and WHO Guidelines for Community Noise (1999). The national TLVs and IFC/WHO guidelines for noise are presented in **Table 6-13**.

Table 6-13. Threshold limit values (TLV) for noise

№	Premises and territories, receptors		TLV, dBA		
			National		IFC/WHO
			Equivalent to sound level	Maximum sound level	One hour equivalent sound level
1	Workplace		80		85
2	Shops, trading halls, airport and railway stations waiting rooms, drop-off points of public service providers		60	75	
	Industrial, commercial				70
3	Territories adjacent to residential buildings, clinics, ambulatories, rest houses, care homes, disabled persons homes, libraries, kinder gardens, schools and other educational facilities	day-time[91]	55	70	55
		night-time[92]	45	60	45

No man-made sources of noise or vibration were observed in the Project area. Equivalent and maximum noise levels were measured during the national EIA study. The results of the noise measurements are compared with the TLVs established by Sanitary Norms №2-III-11.3; and are summarized in **Table 6-13**.

Table 6-13. Equivalent and maximum noise measurement results (baseline)

Noise №	Sound levels, dB(A)		Threshold limit value, dB(A)		
			National		IFC standards night-time/day-time
	Equivalent to sound level, Leq	Maximum sound level, Lmax	Equivalent to sound level	Maximum sound level	
DN1	53.3	58.8	55	70	45/55
DN2	51.5	54.8	55	70	45/55

Although there are no sensitive receptors located within or in the vicinity of the Project site, the TLVs for residential areas, being the most stringent, are used for comparison with the actual noise data. The measured equivalent and maximum noise levels within the project site (**Figure 6-10**) are below the corresponding TLVs established by national sanitary norms.

6.1.11 Natural Hazards

Armenia is prone to several natural hazards due to its geological, topographical, and climatic conditions. Here are the main natural hazards typical to Armenia:

[89] https://www.arlis.am/hy/acts/163246
[90] https://www.ifc.org/content/dam/ifc/doc/2000/2007-general-ehs-guidelines-en.pdf
[91] between 07:00 and 23:00
[92] between 23:00 and 07:00

1. **Earthquakes**
   - Armenia is located in a seismically active zone (part of the Alpine-Himalayan seismic belt).
   - Strong earthquakes have historically caused significant damage (e.g., the 1988 Spitak earthquake).
   - Earthquake risk is high in northern and central parts of the country.
2. **Landslides**
   - Common in mountainous and hilly areas, especially where there is deforestation, road construction, or heavy rainfall.
   - Southern and northeastern regions are particularly vulnerable.
3. **Floods and Flash Floods**
   - Caused by intense rainfall, rapid snowmelt, or dam breaches.
   - More frequent in spring and early summer.
   - Rivers like the Arpa, Debed, and Vorotan can flood surrounding areas.
4. **Mudflows (Debris flows)**
   - Occur in mountainous river valleys, especially during heavy rains.
   - Common in the Lori, Tavush, Syunik, and Vayots Dzor regions.
5. **Droughts**
   - Particularly affect the Ararat Valley and other agricultural regions.
   - Reduced water availability impacts farming and hydropower.
6. **Hailstorms**
   - Can occur during spring and summer, causing severe damage to crops.
   - Agriculture in regions like Armavir, Ararat, and Shirak is often affected.

6.2 Biological Environment

6.2.1 Biodiversity

The biodiversity baseline presented in this section is based on the key findings of the national EIA report for the Yelpin Reservoir, including data from field surveys conducted in April-May 2024. These findings are integrated with the results of supplementary studies, which included additional field surveys conducted in spring-summer 2025.

6.2.2 Vegetation and Flora

Methods

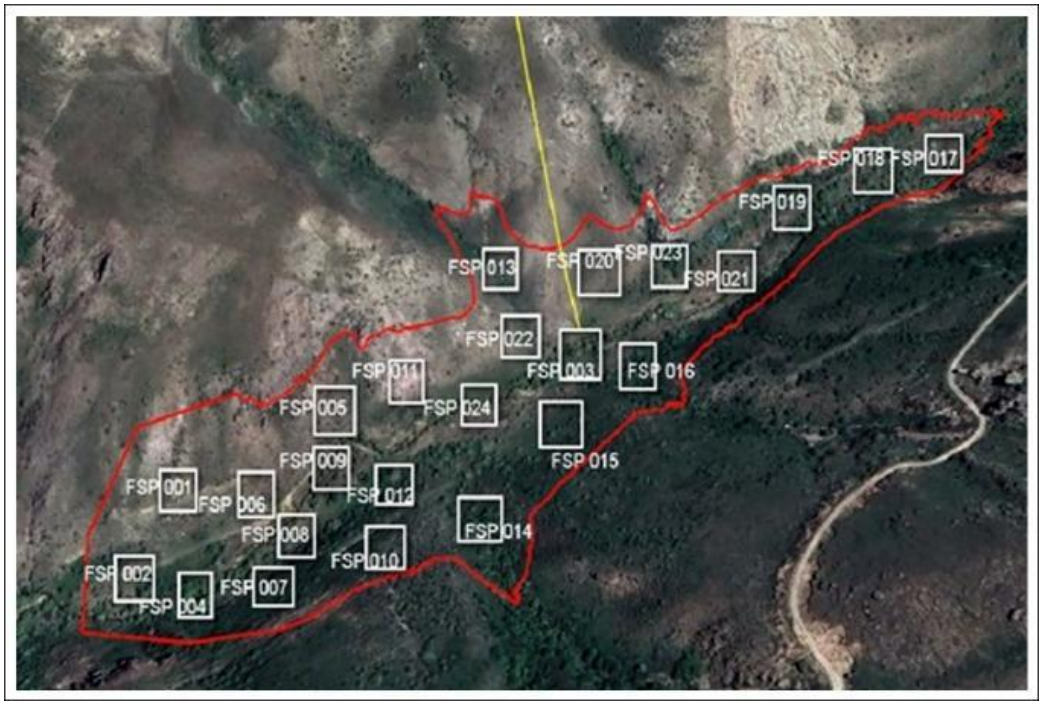
The types of vegetation within the Project-affected area were determined and categorized based on the results of field surveys conducted under the national EIA.

The surveys employed itinerary and semi-stationary geospatial research methods. The study area was divided into sampling plots based on the main biotopes, taking into account the site's terrain and landscape features. A total of 24 flora sampling plots (FSPs), each measuring 100 × 100 meters, were established (see **Figure 6-11**). A complete inventory of plant species was carried out in each FSP, with all habitats and plant species documented and digitally photographed.

Most plant species were identified visually in the field. Speces requiring laboratory identification were collected, preserved in herbariums, and subsequently analyzed. Vegetation descriptions were developed based on these surveys.

The flora study focused on identifying the diversity of higher vascular plants. Species identification was guided by the Flora of Armenia book (11 volumes, 1954-2009). Scientific plant names are presented in accordance with S. Tcherepanov's manual (Tcherepanov, 1995).

Figure 6-11. Flora sampling areas



Vegetation types

Based on the floristic divisions by A.L. Takhtajyan (1954), the proposed site for the Yelpin reservoir falls within the Dareghegis floristic region. The site is situated in the V-shaped valley of the Yelpin River (see **Figure 6-12**). The mountain steppe vegetation is predominant here. The slopes of the Dzorak Mountains are represented by arid, sparse forests with broad-leaved trees with the participation of willow-leaved pear, sedge, and dog rose. Some areas also exhibit rocky outcrops.

In the V-shaped valley of the Yelpin River, there are minor gullies where slopes host broad-leaved deciduous forests and xerophytic communities of sedges.

Certain areas display intrazonal petrophilic vegetation, while the banks of the Yelpin River are lined with riparian and wetland flora. Along the riverbanks, there is a riparian forest predominantly composed of willow species (**Figure 6-13**). There are other types of trees found throughout the Yelpin River valley. The river gorge slopes, often steep and rocky, support xerophilic shrubs and bush-like grass species (**Figure 6-14**).

Figure 6-12. The view of the Yelpin River valley

Figure 6-13. The view of the Yelpin River valley: trees throughout the valley including riparian willow forest

Figure 6-14. The view of the Yelpin River valley: rocky gorge slopes with xerophilic shrubs and bush-like grass species

Flora

Species of the higher vascular plants found in the Project area are listed in **Table 6-14**. The flora is presented by 128 species of 41 families.

Table 6-14. List of plant species registered in the study area

Family (number of species)	Flora sampling plots	Latin names of species
Asteraceae (18)	FSP 10; 11; 15; 22	Achillea millefolium L.
	FSP 10, 20	Serratula coriacea Fisch. et C. Mey.
	FSP 5; 10; 4	Artemisia fragrans Willd.
	FSP 6; 10,21	Artemisia vulgaris L.
	FSP 1; 11, 13	Senecio erucifolium L.
	FSP 2; 7	Senecio leocanthemifolius subsp. Ernalis Valdst. Et Kit.
	FSP 5;11	Chondrilla juncea L.
	FSP 2; 7; 18, 22	Cichorium intybus L.
	FSP 5; 8; 13	Cirsium ciliatum (Murr.) Moench
	FSP 11; 13; 18	Helichrysum graveolens (Bieb.) Sweet
	FSP10; 11; 17; 21	Hieracium cymosum L.
	FSP 4; 16	Inula britannica L.
	FSP 4; 13; 22	Scorzonera rigida Auch. ex DC.
	FSP 3; 18	Tanacetum argyrophyllum (C. Koch) Tzvel.
	FSP 3; 19;	Taraxacum officinale Wigg.
	FSP 3; 19; 22	Tussilago farfara L.
	FSP 7; 16	Xanthium italicum Moretti
	FSP 11; 20	Xeranthemum squarrosum Boiss.
Lamiaceae (11)	FSP 2; 7; 18	Nepeta mussinii Spreng.
	FSP 2; 7; 14	Origanum vulgare L.,
	FSP 11; 13	Ajuga chia Schreb.,
	FSP 3; 12;19; 24	Lamium album L.,
	FSP 3; 12; 19	Mentha longifolia (L.) Huds.,
	FSP 4; 16	Salvia nemorosa L.,
	FSP 2; 4	Salvia viridis L.,
	FSP 1; 5; 7, 15	Stachys inflata Benth.,
	FSP 5; 21	Teucrium polium L.,
	FSP 1; 5; 11	Thymus kotschyanus Boiss. et Hohen.,
	FSP 7; 16	Ziziphora rigida (Boiss.
Fabaceae (10)	FSP 2; 18; 22	Medicago minima (L.) Bartalini), Pall.,
	FSP 10; 15	Lotus caucasicus Kuprian. ex Juz.,
	FSP 12; 14; 16	Medicago sativa L. var parviflora Grossh.,
	FSP 5; 20; 22	Astracantha aureus Willd.,
	FSP 12; 17; 19	Trifolium pratense L.,
	FSP 10; 15	Trifolium arvense L.,
	FSP 2; 7; 16	Trifolium campestre Schreb.,
	FSP 11	Melilotus officinalis (L.)
	FSP 15; 17	Trigonella arcuata C. A. Mey.,
	FSP 1; 6	Trigonella brachycarpa (Fisch.) Moris.
Poaceae (12)	FSP 1; 11	Phleum paniculatum Huds.,
	FSP 1; 3; 16	Phleum pratense L.,

Family (number of species)	Flora sampling plots	Latin names of species
	FSP 6; 12; 18	Poa annua L.,
	FSP 2; 10; 11; 16	Poa bulbosa L.,
	FSP 1; 6; 11	Eremopoa multiradiata (Trautv.) Roshev.,
	FSP 7; 11	Eremopoa persica (Trin.) Roshev.,
	FSP 1; 11; 20	Festuca sclerophylla Boiss. ex Bisch.,
	FSP 14; 17	Hordeum bulbosum L.,
	FSP 15	Aegilops cylindrica Host,
	FSP6; 22	Bromopsis variegata (Bieb.) Holub subsp. variegata,
	FSP 5; 10;	Cynodon dactylon (L.) Pers.,
	FSP 5; 6; 13; 18	Dactylis glomerata L.
Apiaceae (5)	FSP 12; 14	Astrodaucus orientalis (L.) Drude,
	FSP 3; 19	Chaerophyllum aureum L.,
	FSP 7; 22	Daucus carota L.,
	FSP1; 6; 14	Eryngium billardieri Delaroche,
	FSP 15	Prangos ferulacea (L.) Lindl.
Brassicaceae (5)	FSP 11; 18, 20	Alyssum desertorum Stapf.),
	FSP 11; 17	Capsella bursa- pastoris (L.) Medik.,
	FSP 15; 23	Crambe orientalis L.,
	FSP 20	Lepidium vesicarium L.,
	FSP 5; 11	Thlaspi perfoliatum L.
Carypphyllaceae (4)	FSP 13	Dianthus cretaceus Adams,
	FSP 14	Dianthus floribundus Boiss.,
	FSP6; 17	Silene dianthoides Pers.
	FSP 15	Silene italica (L.) Pers.
Rosaceae (12)	FSP 12	Poterium polyganum Waldst. et Kit.
	FSP 2; 14; 18	Pyrus salicifolia Pall.,
	FSP 4	Prunus spinosa L.,
	FSP 2; 20; 22	Rosa spinosissima L.,
	FSP 14	Rosa canina L.,
	FSP1; 6; 23	Amygdalus fenzliana (Fritsch) Lipsky),
	FSP 2; 7; 14	Cerasus incana (Pall.) Spach,
	FSP 16	Cotoneaster integerrimus Medik.,
	FSP 6; 13; 16	Crataegus meyeri Pojark.,
	FSP 8; 13; 20	Մոշենի (Rubus caesius L.),
	FSP 14; 22	Spiraea crenata L.,
	FSP 14	Spiraea hypericifolia L.,
Chenopodiaceae (4)	FSP8; 11	Atriplex tatarica L.,
	FSP 11; 17	Chenopodium album L.,
	FSP 5	Chenopodium botrys L.,
	FSP 5; 13	Salsola ericoides Bieb.,
Crassulaceae (2)	FSP 1, 5	Sedum album L.,
	FSP 5; 20	Sempervivum transcaucasicum Muirhead
Ephedraceae (1)	FSP 20	Ephedra procera Fisch. et C.A. Mey.,
Amaranthaceae (1)	FSP8	Amaranthus retroflexus L.,
Asclepiadaceae (1)	FSP 12	Cynanchum acutum L.,
Euphorbiaceae (2)	FSP11; 17	Euphorbia heteradena Jaub. et Spach,
	FSP 17	Euphorbia orientalis L.,

Family (number of species)	Flora sampling plots	Latin names of species
Rubiaceae (3)	FSP 7, 13	Գետնաստղ գետնատարած (Asperula prostrata (Adams) C. Koch),
	FSP 12	Rubia tinctorum L.,
	FSP 17; 20	Galium aparine L.,
Aceraceae (1)	FSP 4; 13	Acer ibericum Bieb.)
Datiscaceae (1)	FSP 3; 24	Datisca cannabina L.,
Geraniaceae (1)	FSP 12; 13	Erodium cicutarum (L.) L'Her.,
Hypericaceae (1)	FSP 14; 18	Hypericum perforatum L.,
Poligonaceae (5)	FSP 21	Atraphaxis spinosa L.,
	FSP 19	Polygonum convolvulus L.,
	FSP 3; 19; 24	Polygonum aviculare L.,
	FSP 2; 7	Rumex acetoselloides Bal.,
	FSP 7	Rumex crispus L.,
Urticaceae (1)	FSP 3; 12; 19	Urtica dioica L.
Scrophullariaceae (1)	FSP 13; 17	Verbascum oreophilum K. Koch,
Alliaceae (2)	FSP 11; 17	Allium atroviolaceum Boiss.,
	FSP 15	Allium pseudoflavum Vved.,
Boraginaceae (2)	FSP 5; 8; 16	Heliotropium ellipticum Ledeb.
	FSP 5; 17	Onosma setosa Ledeb.
Caparaceae (1)	FSP 8	Capparis spinosa L.
Campanullaceae (1)	FSP 20; 21	Michauxia laevigata Vent.
Caprifoliaceae (1)	FSP 2; 16	Lonicera iberica Bieb.
Ulmaceae (1)	FSP 12; 14	Ulmus minor Mill.
Convolvulaceae (1)	FSP 11; 17	Convolvulus arvensis L.
Cuscutaceae (1)	FSP 5	Cuscuta cesattiana Bertol.
Eleagnaceae (1)	FSP 12	Elaeagnus angustifolia L. var culta Sosn.
Resedaceae (1)	FSP 20	Reseda lutea L.
Malvaceae (2)	FSP 11; 13	Malva neglecta Wallr.
	FSP 14	Alcea rugosa Alef.
Plantaginaceae (1)	FSP 11; 24	Plantago major L.
Portulacaceae (1)	FSP 24	Portulaca oleracea L.
Ranunculaceae (3)	FSP 3; 19	Clematis orientalis L.
	FSP 10; 11; 16	Delphinium orientale J. Gay
	FSP 15	Thalictrum minus L.
Iridaceae (1)	FSP 13; 22	Gladiolus atroviolaceus Boiss.
Solanaceae (1)	FSP 21	Hyoscyamus niger L.
Rhamnaceae (1)	FSP 2; 7; 18	Rhamnus pallasii Fisch. et C.A. Mey.
Salicaceae (3)	FSP 3; 12	Salix excelsa S. G. Gmel.
	FSP 3; 12; 19	Salix triandra L.
	FSP 3	Populus nigra var italica Duroi.
Berberidaceae (1)	FSP 7; 13; 14	Berberis orientalis C. Shneid.

There are 90 plant species included in the RA Red Book (2010)[93] that can be found in the Dareghegis floristic region. Among them, three plant species are found in the vicinity of Yelpin village (**Table 6-15**). These plant species were not found in the site area during the field surveys.

[93]The Red Book (second edition of 2010) includes the Red Book of Animals and Red Book of Plants, are together called the Red Book in this ESIA.

Table 6-15. Protected plant species registered in the vicinity of Yelpin village (according the RA Red Book)

№	Family	Latin name	Category in the IUCN Red List	Category in the RA Red Book
1	Iridaceae	Iris lycotis Woronow	-	EN
2	Carypphyllaceae	Gypsophylla aretioides Boiss.	-	EN
3	Caprifoliaceae	Valerianella kotschyi Boiss.	-	CR

6.2.3 Fauna

Terrestrial mammals

Methods

The data from the previous studies conducted in the area, and the available scientific information related to this region was used during the desktop research, and included articles, reports, and collections of the Armenian Institute of Zoology. Namely, it covered the literature materials at our disposal (Dal 1954, Geptner et al. 1967, Martirosyan & Papanian 1983, Bibikov 1985, Agadzhanyan 1986,1993, Kasabyan 1986, 2001,2014, Popov 2003, Avagyan 2010, RA Red Book (1987, 2010), and the preliminary data for the Emerald network in the RA (2016)).

During the field trips to the site under the national EIA all signs of the animals presence were registered (including footprints, holes, visually seen excrements etc.); in addition some mammals were observed by chance.

Results

Based on the abovementioned sets of data, the list of mammalian species that are found or expected to be found in this area is provided below (**Table 6-16**). Species included in the IUCN Red List and the RA Red Book are marked in red.

Table 6-16. Mammalian species of the study area

№	Armenian Name	English name	Scientific names	1	2	3	4	5	6	7
Erinacedae										
1	Սպիտակափորն ոզնի	Southern white-breasted hedgehog	Erinaceus concolor	+	+					
Soricidae										
2	Սովորական գորշատամ	Common shrew	Sorex araneus	+	-					
Gliridae										
3	Անտառային քնամոլ	Forest dormouse	Dryomys nitedula	+	+					+
Leporidae										
4	Նապաստակ	European hare	Lepus europaeus	+	+					
Suidae										
5	Վայրի խոզ	Wild boar	Sus scrofa	+	-					
Mustelidae										
6	Քարակզաքիս	Beech marten	Martes foina	+	+					
7	Աքիս	Least weasel	Mustela nivalis	+	+					
8	Գորշուկ	Badger	Meles meles	+	+					

№	Armenian Name	English name	Scientific names	1	2	3	4	5	6	7
Ursidae										
9	Գորշ արջ	Brown bear	Ursus arctos	+	-	LC	+	+	+	+
Canidae										
10	Գայլ	Gray wolf	Canis lupus	+	+			+	+	+
11	Չախկալ	Jackal	Canis aureus	-	+					
12	Սովորական աղվես	Red fox	Vulpes vulpes	+	+					
Felidae										
13	Լուսան	Lynx	Lynx lynx	+	-			+	+	+
Cricetidae										
14	Մոխրագույն համստերիկ	Gray dwarf hamster	Cricetulus migratorius	+	-					
15	Սովորական դաշտամուկ	Common vole	Microtus arvalis	+	+					
Gerbillidae										
16	Պարսկական ավազամուկ	Persian jird	Meriones persicus							
Muridae										
17	Փոքր անտառային մուկ	Ural field mouse	Sylvaemus uralensis	+						

Keys to Table 6-16

Column titles:
1- Information from various sources
2 - Data from field studies
3 - IUCN Red List
4 - Red Book of the RA
5 - Resolution 6 of Bern Convention
6 - Annex II of the Habitats Directive
7- Annex IV of the Habitats Directive

Signs:
+ listed or registered
- not registered
no sign - not listed

Conservation status (in - IUCN Red List, column 3):
LC - Least Concern

As shown in **Table 6-16**, the area is home to **17 mammal species** belonging to **11 families**. These species can be grouped into three categories based on their size and lifestyle:

1. Permanent residents of the area, mainly small- and medium-sized species such as rodents, insectivores, and small predators.
2. Temporary visitors, primarily predators like canids and martens, which transit through the area.
3. Very rarely recorded species, including the Lynx, Wild Boar, and Brown Bear.

Regarding the Brown Bear, its presence has been rarely reported by local residents. During field surveys, rocks that appeared to have been overturned by bears, presumably in search of insect larvae, were observed. Fresh bear tracks were also seen in mud near a stream. In addition, during the Consultant's site visit in summer 2024, local shepherds reported that bears were entering Yelpin village and requested action to prevent further incidents.

Of the 17 identified species, three are classified as Priority Biodiversity Features under EBRD PR6, Criterion 12(i), as they are listed in Resolution 6 of the Bern Convention and Annex II of the EU Habitats Directive (see **Table 6-16**). These species and their habitats are also qualified as Critical Habitat under EBRD PR6, Criterion 14(ii), as they are listed in Annex IV of the EU Habitats Directive.

In addition, the Forest Dormouse (Dryomys nitedula) and its habitat is qualified as Critical Habitat on the same basis.

Birds

Methods

Data collection included the methods of transect count and count of breeding pairs.

Transect counts were conducted along routes that were 200 m long and 200 m wide (extending 100 m on each side of the central line). The counts were carried out from 6:00 to 11:00, during which most uniformly distributed species are active.

The count of breeding pairs of large-ranged and colonial species was implemented opportunistically when such species appeared. In such cases, the breeding behaviour of the species was observed to identify the highest possible breeding code (Voříšek et al. 2008).

Data processing included visualization of the bird community in the form of a table that also shows priority species and estimation of their abundance. The priority species are those listed either in the RA Red Book, in the IUCN Red List, in the Resolution 6 of the Bern Convention, in the Annex I of EU Birds Directive, or are considered Restricted Range species[94].

Estimation of the abundance of uniformly distributed species was done through computation of their density per one ha and multiplication of the density on the area of typical habitat. The estimation of abundance of large-ranged and colonial species was done through the direct count of breeding pairs (pairs with high breeding codes).

Results

The bird's diversity of the study area is presented in **Table 6-17** below and includes 70 species. Among those, there are 49 bird species, which breed in the area, 7 species, which breed in proximity to the site and use the area as a part of their foraging range, and 14 species, which pass the area during the seasonal migration.

Among breeding birds, there are two species listed in the RA Red Book and 9 species included in the Resolution 6 of the Bern Convention, and Annex 1 of the EU Birds Directive. The breeding area of the red-listed species Eastern Rock-nuthatch (*Sitta tephronot*) is still questioned.

Among the large-ranged birds, which use the area as a part of their foraging range during the breeding season, there are five species listed in the RA Red Book and six species included in the Resolution 6 of the Bern Convention, and in Annex 1 of The EU Birds Directive.

Among migratory and wintering birds, which use the area for stopover in non-breeding period, there are three species listed in the RA Red Book and two species included in the Resolution 6 of the Bern Convention, and in the Annex 1 of EU Birds Directive.

There are no restricted range species in the area of the planned reservoir.

From the 70 identified species, 20 species are assessed as the Priority Biodiversity Features (PBF) according to the EBRD PR6 criterion 12: 17 species as they are listed in the Resolution 6 of Bern Convention and Annex I of the EU Birds Directive, three species as they are included into the RA Red Book, category Vulnerable(**Table 6-17**). Species included in the RA Red Book are marked in red.

[94]For terrestrial vertebrates and plants, restricted-range species are defined as those species that have an Extent of Occurrence (EoO) of less than 50,000 km^2. Source: Guidance Notes to the EBRD PR 6 (March, 2023)

Table 6-17. Bird species of the Yelpin site area

№	Armenian names	English names	Scientific names	Occurrence Status in Armenia	Occurrence Status within Project site	Unit	Number	IUCN	RDB RA	Bern Res6	BD Annex 1	RR species
				Accipitridae								
1	Կրետակեր	European Honey-buzzard	*Pernis apivorus*	B - regular	Foraging	ind	100-500	LC		+	+	
2	Մորուքավոր անգղ	Bearded Vulture	*Gypaetus barbatus*	Yr - regulal	Foraging	ind	1-2	NT	VU	+	+	
3	Լորաճուռակ	Eurasian Sparrowhawk	*Accipiter nisus*	Yr - regulal	Wintering							
4	Տափաստանային ճուռակ	Long-legged Buzzard	*Buteo rufinus*	Yr - regulal	Breeding	ind	2-3	LC		+	+	
5	Գաճաճ արծիվ	Booted Eagle	*Hieraaetus pennatus*	B - regular	Foraging	ind	1-2	LC	VU	+	+	
6	Քարարծիվ	Golden Eagle	*Aquila chrysaetos*	Yr - regulal	Foraging	ind	1-3	LC	VU	+	+	
				Falconidae								
7	Սովորական հողմավար բազե	Common Kestrel	*Falco tinnunculus*	Yr - regulal	Breeding							
8	Սապսան	Peregrine Falcon	*Falco peregrinus*	Yr - regulal	Foraging	ind	1-2	LC	VU	+	+	
				Phasianidae								
9	Քարակաքավ	Chukar	*Alectoris chukar*	Yr - regulal	Breeding							
10	Լոր	Common Quail	*Coturnix coturnix*	B - regular	Breeding							
11	Մոխրագույն կաքավ	Grey Partridge	*Perdix perdix*	Yr - regulal	Wintering							
				Gruidae								
12	Գեղանի կռունկ	Demoiselle Crane	*Anthropoides virgo*	M - regular	Migratory	ind	500-3000	LC	VU	+	+	
				Columbidae								
13	Թխակապույտ աղավնի	Rock Pigeon	*Columba livia*	Yr - regulal	Breeding							
14	Անտառային աղավնի	Common Woodpigeon	*Columba palumbus*	Yr - regulal	Breeding							
				Cuculidae								
15	Սովորական կկու	Common Cuckoo	*Cuculus canorus*	B - regular	Breeding							
				Strigidae								

№	Armenian names	English names	Scientific names	Occurrence Status in Armenia	Occurrence Status within Project site	Unit	Number	IUCN	RDB RA	Bern Res6	BD Annex 1	RR species
16	Բվեճ	Eurasian Eagle-owl	*Bubo bubo*	Yr - regulal	Foraging	ind	1-2	LC	VU	+	+	
17	Եվրոպական բվիկ	Common Scops-owl	*Otus scops*	B - regular	Breeding							
18	Տնային բվիկ	Little Owl	*Athene noctua*	Yr - regulal	Breeding							
Caprimulgidae												
19	Այծկիթ	Eurasian Nightjar	*Caprimulgus europaeus*	B - regular	Breeding	pair	1-2	LC		+	+	
Apodidae												
20	Սև մանգաղաթև	Common Swift	*Apus apus*	B - regular	Breeding							
Meropidae												
21	Ոսկեգույն մեղվակեր	European Bee-eater	*Merops apiaster*	B - regular	Breeding							
22	Ներկարար	European Roller	*Coracias garrulus*	B - regular	Breeding	pair	1-2	LC	VU	+	+	
Upupidae												
23	Հոպոպ	Eurasian Hoopoe	*Upupa epops*	B - regular	Breeding							
Picidae												
24	Սիրիական փայտփոր	Syrian Woodpecker	*Dendrocopos syriacus*	Yr - regulal	Breeding	pair	1	LC		+	+	
Alaudidae												
25	Անտառային արտույտ	Wood Lark	*Lullula arborea*	B - regular	Breeding	pair	8-13	LC		+	+	
26	Փուփուլավոր արտույտ	Crested Lark	*Galerida cristata*	Yr - regulal	Breeding							
Hirundinidae												
27	Ժայռային ծիծեռնակ	Eurasian Crag-martin	*Hirundo rupestris*	B - regular	Breeding							
28	Գյուղական ծիծեռնակ	Barn Swallow	*Hirundo rustica*	B - regular	Breeding							
29	Քաղաքային ծիծեռնակ	House Martin	*Delichon urbica*	B - regular	Breeding							
Motacillidae												
30	Դեղին խաղտտնիկ	Yellow Wagtail	*Motacilla flava*	B - regular	Migratory							
31	Լեռնային խաղտտնիկ	Grey Wagtail	*Motacilla cinerea*	Yr - regulal	Breeding							

№	Armenian names	English names	Scientific names	Occurrence Status in Armenia	Occurrence Status within Project site	Unit	Number	IUCN	RDB RA	Bern Res6	BD Annex 1	RR species
32	Սպիտակ խաղտտնիկ	White Wagtail	*Motacilla alba*	Yr - regulal	Breeding							
33	Անտառային ձիաթռչնակ	Tree Pipit	*Anthus trivialis*	B - regular	Breeding							
34	Դաշտային ձիաթռչնակ	Tawny Pipit	*Anthus campestris*	B - regular	Breeding	pair	1-2	LC		+	+	
			Cinclidae									
35	Ջրաճնճղուկ	White-throated Dipper	*Cinclus cinclus*	Yr - regulal	Breeding							
			Troglodytidae									
36	Եղնջաթռչնակ	Winter Wren	*Troglodytes troglodytes*	Yr - regulal	Wintering							
			Muscicapidae									
37	Սպիտակափող սոխակ	White-throated Robin	*Irania gutturalis*	B - regular	Breeding	pair	5-7	LC	VU			
38	Հարավային սոխակ	Common Nightingale	*Luscinia megarhynchos*	B - regular	Breeding							
39	Մոխրագույն ճանճորս	Spotted Flycatcher	*Muscicapa striata*	B - regular	Migratory							
40	Կիսասպիտակավիզ ճանճորս	Semicollared Flycatcher	*Ficedula semitorquata*	B - regular	Migratory	ind	5-20	LC	DD	+	+	
41	Սևուկ կարմրատուտ	Black Redstart	*Phoenicurus ochruros*	B - regular	Breeding							
42	Մարգագետնային չքչքան	Whinchat	*Saxicola rubetra*	B - regular	Migratory							
43	Սիբիրյան սևագլուխ չքչքան	Siberian Stonechat	*Saxicola maurus*	B - regular	Breeding							
44	Սովորական քարաթռչնակ	Northern Wheatear	*Oenanthe oenanthe*	B - regular	Breeding							
45	Խայտաբղետ քարակեռնեխ	Rufous-tailed Rock-thrush	*Monticola saxatilis*	B - regular	Migratory							
46	Կապույտ քարակեռնեխ	Blue Rock-thrush	*Monticola solitarius*	B - regular	Breeding							

№	Armenian names	English names	Scientific names	Occurrence Status in Armenia	Occurrence Status within Project site	Unit	Number	IUCN	RDB RA	Bern Res6	BD Annex 1	RR species
			Turdidae									
47	Սև կեռնեխ	Eurasian Blackbird	*Turdus merula*	Yr - regulal	Breeding							
48	Սոսնձակեռնեխ	Mistle Blackbird	*Turdus viscivorus*	Yr - regulal	Wintering							
			Sylviidae									
49	Մոխրագույն շահրիկ	Greater Whitethroat	*Curruca communis*	B - regular	Breeding							
50	Մորու շահրիկ	Lesser Whitethroat	*Curruca curruca*	B - regular	Breeding							
51	Ճուռականման շահրիկ	Barred Warbler	*Curruca curruca*	B - regular	Breeding							
			Paridae									
52	Մեծ երաշտահավ	Great Tit	*Parus major*	Yr - regulal	Breeding							
			Sittidae									
53	Ժայռային մեծ սիտեղ	Eastern Rock-nuthatch	*Sitta tephronota*	Yr - regulal	Uncomfirmed	ind	?	LC	VU			
54	Ժայռային փոքր սիտեղ	Western Rock-nuthatch	*Sitta neumayer*	Yr - regulal	Breeding							
			Laniidae									
55	Ժուլան	Red-backed Shrike	*Lanius collurio*	B - regular	Breeding	pair	3-5	LC		+	+	
56	Սևաճակատ շամփրուկ	Lesser Grey Shrike	*Lanius minor*	B - regular	Breeding	pair	1-2	LC		+	+	
			Corvidae									
57	Անտառային կաչաղակ	Eurasian Jay	*Garrulus glandarius*	Yr - regulal	Breeding							
58	Սովորական կաչաղակ	Black-billed Magpie	*Pica pica*	Yr - regulal	Breeding							
59	Կարմրակտուց ճայ	Red-billed Chough	*Pyrrhocorax pyrrhocorax*	Yr - regulal	Breeding	pair	1	LC		+	+	
60	Մոխրագույն ագռավ	Hooded Crow	*Corvus corone*	Yr - regulal	Breeding							
61	Սև ագռավ	Common Raven	*Corvus corax*	Yr - regulal	Breeding							
			Sturnidae									
62	Սովորական սարյակ	Common Starling	*Sturnus vulgaris*	Yr - regulal	Migratory							

№	Armenian names	English names	Scientific names	Occurrence Status in Armenia	Occurrence Status within Project site	Unit	Number	IUCN	RDB RA	Bern Res6	BD Annex 1	RR species
63	Վարդագույն սարյակ	Rosy Starling	*Pastor roseus*	B - regular	Foraging							
			Passeridae									
64	Ժայռային ճնճղուկ	Rock Sparrow	*Petronia petronia*	Yr - regulal	Breeding							
			Fringillidae									
65	Ամուրիկ	Eurasian Chaffinch	*Fringilla coelebs*	Yr - regulal	Wintering							
66	Կարմրակատար	European Goldfinch	*Carduelis carduelis*	Yr - regulal	Breeding							
67	Կարմրթեւ ոսպնուկ	Crimson-winged Finch	*Rhodopechys sanguineus*	Yr - regulal	Wintering	ind	30-70	LC	VU			
			Emberizidae									
68	Լեռնային դրախտապան	Rock Bunting	*Emberiza cia*	Yr - regulal	Breeding							
69	Սևագլուխ դրախտապան	Black-necked Bunting	*Emberiza melanocephala*	B - regular	Breeding							
70	Կորեկնուկ	Corn Bunting	*Emberiza calandra*	Yr - regulal	Breeding							

Keys to the Table 6-17

Keys to column titles: IUCN - status in IUCN Red List, RDB RA - status in the RA Red Book, Bern Res6 - presence in Resolution 6 of Bern Convention, BD Annex 1 - presence in Annex 1 of the EU Bird Directive, RR - Restricted Range species.

Keys to signs: + listed; no sign – no data or not listed

Key to occurrence status

- b - breeding
- m - migrant
- w - wintering
- yr - year-round resident
- yv - year-round visitor
- a - accidental visitor
- ex - extinct
- un - presence unconfirmed

Key to conservation status

- CR - Critically Endangered
- EN - Endangered
- VU - Vulnerable
- NT - Near Threatened
- LC - Least Concern
- DD - Data Deficient
- NE - Not Evaluated

Key to units

- ind - number of individuals
- pair - number of breeding pairs

Amphibians and Reptiles

Methods

Data from previous studies conducted in the area, along with other available scientific information related to the region, were used during the desktop research. This included articles, reports, and collections from the Armenian Institute of Zoology. Additionally, data from the national EIA report (including field survey results) were also considered. During the field survey, reptiles and amphibians were observed visually. Reptiles were also searched for under stones, while amphibians were additionally surveyed using acoustic methods.

Results

The list of reptiles and amphibians presented in **Table 6-18**. Species included in the IUCN Red List and the RA Red Book are marked in red.

Table 6-18. Reptiles and Amphibians of the study area

№	Armenian name	English name	Scientific names	1	2	3	4	5
Reptilia								
Agamidae								
1	Կովկասյան ագամա	Caucasian agama	Laudakia caucasia	+	+			
Anguidae								
2	Դեղնափորիկ	Pallas's glass lizard	Pseudopus apodus	+	+			+
Lacertidae								
3	Գեղիրան օձագլխիկ	Snake-eyed lizard	Ophisops elegans	+	-			+
4	Վալենտինի ժայռային մողես	Valentin's rock lizard	Darevskia valentini	+	+			
5	Ռադդեի ժայռային մողես	Azerbaijan lizard	Darevskia raddei	+	+			
6	Միջին մողես	Medium Lizard	Lacerta media	+	+			+
Colubridae								
7	Սովորական լորտու	Grass snake	Natrix natrix	+	-			
8	Սովորական պղնձօձ	Smooth snake	Coronella austriaca	+	+			+
9	Անդրկովկասյան սահնօձ	Transcaucasian rat snake	Zamenis hohenackeri	+	+	LC	VU	
Viperidae								
10	Կովկասյան գյուրզա	Levant viper	Vipera (Macrovipera) lebetina	+	+			
Amphibia								
Bufonidae								
1	Կանաչ դոդոշ	Variable toad/ green toad	European green toad Bufo viridis	+	+			+
Ranidae								
2	Լճագորտ	Marsh frog	Rana ridibunda	+	+			
3	Փոքրասիական գորտ	Long-legged wood frog	Rana macrocnemis	+	-			

Keys to the Table 6-18

Column titles:

1 - Information from various sources
2 - Data from field studies
3 - IUCN Red List
4 - Red Book of the RA
5 - Annex IV of the EU Habitats Directive

Signs:

+ listed or registered
- not registered
no sign - not listed

Conservation status (in - IUCN Red List, column 3):

LC - Least Concern

Based on the above, ten species of reptiles can potentially inhabit the area, including five species of lizards, four species of snakes, and three species of amphibians. The species of reptiles and amphibians are unevenly distributed in the study area, which is explained by the different habitats. Thus, lizards are mainly found in rocky areas, amphibians are mainly found in humid, near-stream areas, and snakes are mainly found on slopes with shrub and herbaceous vegetation. Of all the species mentioned, only one species, the Transcaucasian rat snake (*Zamenis hohenackeri*), is included in the RA Red Book of RA.

Of the 10 identified reptilian species, four species and their habitats are qualified as the Critical Habitat according to the EBRD PR 6 criterion 14-ii as they are listed in Annex IV of the EU Habitats Directive (**Table 6-18**). One species of amphibian - European green toad (Bufo viridis) and its habitat is qualified as the Critical Habitat on the same basis.

One reptilian species *(Zamenis hohenackeri*) is qualified as PBF according to the EBRD PR6 criterion 12 (iii) as it is listed in the RA Data Book, category Vulnerable.

Ichthyofauna

The composition of fish species found in the Arpa River, which potentially inhabit the Yelpin tributary of the Arpa River, is presented in **Table 6-19**. This assessment is based on the review and analysis of existing literature, complemented by the field survey observations.

Table 6-19. The composition of fish species

Dadikyan, 1986	Gabrielyan, 2001	Pipoyan, 2021	Pipoyan, Arakelyan, 2021
Trout Salmo trutta fario (=Salmo caspius)	Trout Salmo trutta fario (=Salmo caspius)	Trout Salmo trutta fario (=Salmo caspius)	Sharpbelly Hemiculter leucisculus
Caucasian scraper Capoeta capoeta	Caucasian scraper Capoeta capoeta	Caucasian scraper Capoeta capoeta	-
Kura barbel Barbus cyri	Kura barbel Barbus cyri	Kura barbel Barbus cyri	-
European chub Squalius orientalis	-	European chub Squalius orientalis	-
Kura nase Chndrostoma cyri	-	Kura naseև Chndrostoma cyri	-
Bulatmai barbel Luciobarbus capito	-	Bulatmai barbel Luciobarbus capito	-
Mursa Luciobarbus mursa	Mursa Luciobarbus mursa	Mursa Luciobarbus mursa	
Kura bleakAlburnus filippii	Kura bleakAlburnus filippii	Kura bleakAlburnus filippii	
South Caspian sprilin Alburnoides eichwaldii	South Caspian sprilin Alburnoides eichwaldii	South Caspian sprilin Alburnoides eichwaldii	-
Blackbrow bleak Acanthobrama microlepis	Blackbrow bleak Acanthobrama microlepis	Blackbrow bleak Acanthobrama microlepis	
Asp Leuciscus aspius	Asp Leuciscus aspius	Asp Leuciscus aspius ?	Listed in the RA Red Book
		Wild common carp Cyprinus carpio	

Dadikyan, 1986	Gabrielyan, 2001	Pipoyan, 2021	Pipoyan, Arakelyan, 2021
		Topmouth gudgeon Pseudorasbora parva	
Weisel loach Oxynoemacheilus veyselii	Weisel loach Oxynoemacheilus veyselii	Weisel loach Oxynoemacheilus veyselii	
		Oxynoemacheilus cf. bergianus	
Golden spined loach Sabanejewia aurata	Golden spined loach Sabanejewia aurata		Listed in the RA Red Book
Wels catfish Silurus glanis	Wels catfish Silurus glanis	Wels catfish Silurus glanis	
14 species	11 species	16 species	1 species

Note: Barach (1940) - No ichthyological studies by the referenced author were conducted for Arpa River.

The analysis of the fish populations in the Arpa River over various years reveals the continued presence of the following species: Trout, Caucasian scraper, Kura barbel, European chub, Kura nase, Bulatmai barbel, Mursa, Kura bleak, South Caspian sprilin, Asp, Catfish. The Golden spined loach and Weisel loach have disappeared. Instead, species such as Wild common carp, Topmouth gudgeon, Berg's loach and more recently, Korean Sharpbelly have been observed.

No ichthyological studies have been conducted on the Yelpin River to date. In the early 2000s, unofficial reports indicated that only Kura bleak, South Caspian sprilin, and European chub were caught at the confluence of the Arpa and Yelpin rivers.

Summarizing the data and considering the hydrographic characteristics of the Yelpin River, it is possible to identify the fish species that may migrate from the Arpa River to the upstream of the Yelpin River. These species include Brown trout, Kura bleak, South Caspian sprilin, Korean Sharpbelly and Kur catfish. However, the Yelpin River almost completely dries up during the summer, and at its confluence with the Arpa, it remains dry for most of the year. These conditions do not support the development of a stable fish community in the Yelpin River. Furthermore, ichthyological studies conducted under the EIA in the upper reaches of the Yelpin River, where the Yelpin reservoir is planned, have revealed the absence of fish. This finding is supported by the surveys among recreational anglers, who report that the upper reaches of the Yelpin River do not sustain a native fish population.

Terrestrial invertebrates

Methods

Data collection included a Pollard Walk for butterflies and an active search for visual sightings of beetles in the grass, on the ground, and under stones.

Data processing included visualization of the insects' community in the table form that also shows priority species. The priority species are those listed either in the RA Red Book, in the IUCN Red List, in the Resolution 6 of the Bern Convention, or are considered Restricted Range species.

Results

Results of the invertebrates' diversity survey are presented in **Table 6-20** and include 100 species.

Table 6-20. Terrestrial invertebrates of the study area

№	Latin names	RDB AM	Regional endemic	Bern Res 6
	LEPIDOPTERA			
	Hesperiidae			
1	Erynnis tages			
2	Erynnis marloyi			
3	Carcharodus alceae			
4	Carcharodus lavatherae			
5	Spialia orbifer			
6	Pyrgus melotis			
7	Pyrgus sidae			
8	Pyrgus serratulae			
9	Ochlodes sylvanus			
	Papilionidae			
10	Iphiclides podalirius			
11	Papilio machaon			
12	Papilio alexanor	VU		
	Pieridae			
13	Leptidea sinapis			
14	Anthocharis cardamines			
15	Anthocharis gruneri		X	
16	Euchloe ausonia			
17	Aporia crataegi			
18	Pontia edusa			
19	Pieris pseudorapae			
20	Pieris ergane			
21	Pieris krueperi		X	
22	Pieris rapae			
23	Pieris brassicae			
24	Colias sareptensis			
25	Colias aurorina	VU	X	
26	Colias crocea			
27	Gonepteryx farinosa			
	Lycaenidae			
28	Armenia ledereri		X	
29	Armenia hyrcanica		X	
30	Nordmannia spini			
31	Nordmannia abdominalis		X	
32	Callophrys chalybeitincta			
33	Tomares callimachus			
34	Lycaena phlaeas			
35	Lycaena tityrus			
36	Lycaena thersamon			
37	Lycaena ochimus		X	
38	Cupido osiris			
39	Celastrina argiolus			
40	Pseudophilotes vicrama			

№	Latin names	RDB AM	Regional endemic	Bern Res 6
41	Glaucopsyche alexis			
42	Plebeius argus			
43	Plebejides zephyrinus			
44	Aricia agestis			
45	Ultraaricia crassipuncta		X	
46	Cyaniris bellis			
47	Plebejidea loewii			
48	Kretania eurypilus			
49	Neolysandra coelestina		X	
50	Lysandra bellargus			
51	Lysandra corydonius			
52	Meleageria daphnis			
53	Polyommatus (icarus) icarus			
54	Polyommatus amandus			
55	Polyommatus thersites			
56	Polyommatus (Agrodiaetus) demavendi		X	
57	Polyommatus (Agrodiaetus) eriwanensis	EN	X	
58	Polyommatus (Agrodiaetus) ninae	VU	X	
	Nymphalidae			
59	Libythea celtis			
60	Esperarge climene			
61	Lasiommata megera			
62	Lasiommata maera			
63	Melanargia larissa			
64	Coenonympha pamphilus			
65	Proterebia afra			
66	Hyponephele lycaon			
67	Hyponephele lupina			
68	Maniola jurtina			
69	Hipparchia pellucida			
70	Hipparchia syriaca		X	
71	Hipparchia fatua		X	
72	Arethusana arethusa			
73	Satyrus amasinus		X	
74	Pseudochazara pelopea		X	
75	Pseudochazara schahrudensis		X	
76	Pseudochazara thelephassa			
77	Chazara briseis			
78	Chazara persephone			
79	Chazara bischoffi		X	
80	Thaleropis ionia		X	
81	Limenitis reducta			
82	Neptis rivularis			
83	Vanessa atalanta			
84	Vanessa cardui			
85	Inachis io			

№	Latin names	RDB AM	Regional endemic	Bern Res 6
86	Polygonia c-album			
87	Polygonia egea			
88	Aglais urticae			
89	Argynnis pandora			
90	Argynnis niobe			
91	Issoria lathonia			
92	Euphydryas aurinia **Marsh Fritillary**			X
93	Melitaea didyma			
94	Melitaea persea		X	
95	Melitaea cinxia			
96	Melitaea arduinna			
	Sphingidae			
97	Macroglossum stellatarum			
98	Hemaris fuciformis			
	COLEOPTERA			
	Cerambicidae			
99	Dorcadion scabricolle			
	Carabidae			
100	Cicindela campestris			

Keys to 6-20

Column titles:
RDB AM - Red Book of the RA
Regional endemic - endemic of Caucasus region
Bern Res 6 - Resolution 6 of the Bern Convention

Signs:
X regional endemic of listed in Resolution 6 list of the Bern Convention
no sign - not endemic or not listed

Conservation status (in -Red Book of the RA):
VU - vulnerable
EN - endangered

From the 100 identified species, 21 species are assessed as the Priority Biodiversity Features (PBF) according to the EBRD PR6 criterion 12 (ii) - 20 species as they are range-restricted species of the Caucasian region (three of these are also listed in the RA Red Book), and one species (*Euphydryas aurinia*) as included in the Resolition 6 of the Bern Convention.

One more species (*Papilio alexanor*) is idenified as PBF according to the EBRD criterion 12 (iii) as it is listed in the RA Data Book, category Vulnerable.

6.2.4 Habitats

Habitats identified at the Yelpin water reservoir site are listed in **Table 6-21**. They are presented according to the habitat classification for Armenia, developed based on the EUNIS classification system. The identified habitats are assessed for overlap with those listed in Resolution No. 4 of the Bern Convention and Annex I of the EU Habitats Directive, in order to identify any Priority Biodiversity Features and Critical Habitats.

Seven habitats are identified according to the habitat classification for Armenia (**Table 6-21**). In one case, Armenian habitat Perennial food grasslands and main steppes (E1.2) includes two habitats listed in Annex I of the EU Habitats Directive. One habitat (F5.342–AM, Almond open arid forests) did not correspond to any habitat listed in the EU lists. Each of the other five habitats corresponds to one habitat from the Annex 1 of the EU Habitats Directive (in two cases, to Resolution No.4 of the Bern Convention as well).

Of the seven identified habitats, one (namely Armenian habitat F3.1 Temperate thickets and scrub = 40A0* Subcontinental peri-Pannonic scrub) is assessed as the Critical Habitat according to the EBRD PR 6 criterion 14-i as this is marked as priority habitat in Annex I of the EU Habitats Directive

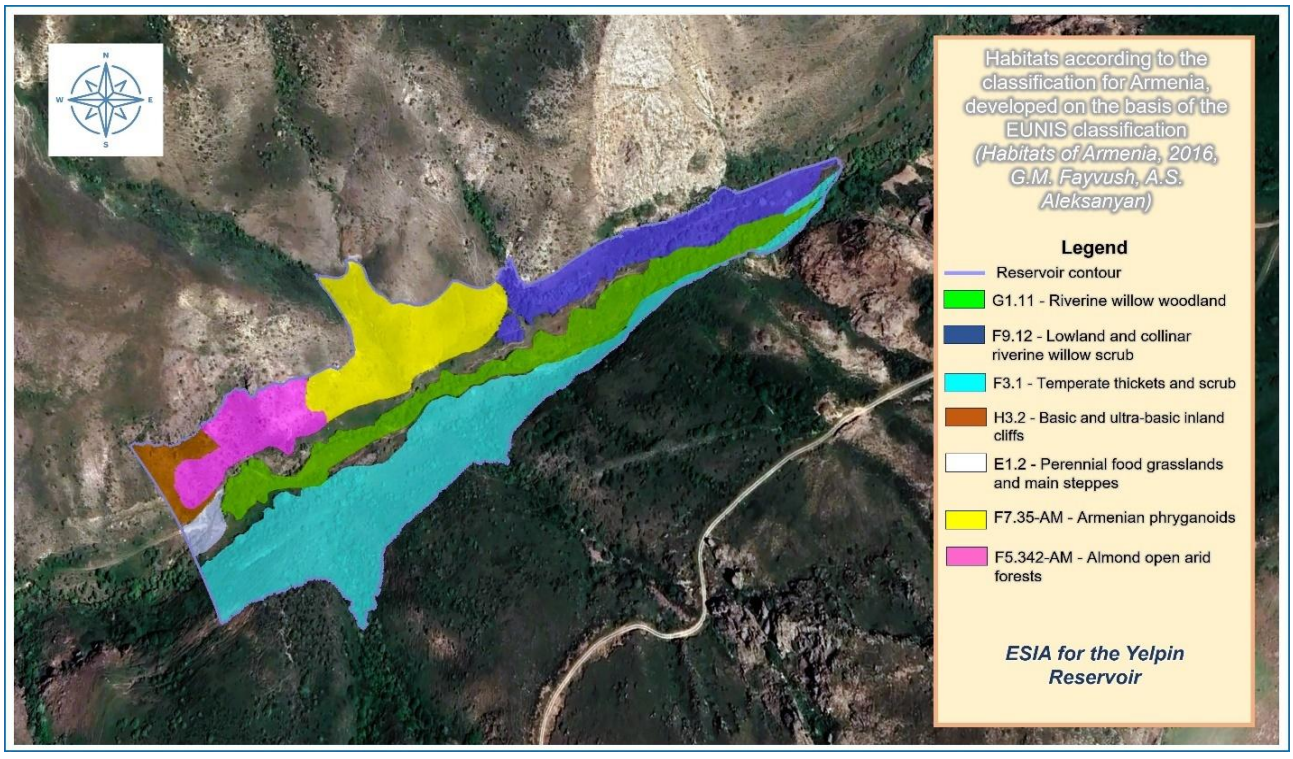
Five habitats (corresponding to the six habitats listed in the EU lists) are assessed as the PBFs according to the EBRD PR6 criterion 12-i, as they are listed in one or both of the lists mentioned above (**Table 6-21**).

Map of the seven identified habitats in the footrpint area is shown in the **Figure 6.15**. Map of the habitats listed in Annex I of the EU Habitats Directive is shown in **Figure 6.16**.

The following areas of the six priority habitats (**Figure 6.16**) are defined in the footprint area (the first name is from the habitat classification for Armenia, the second name – name of similar habitat from Annex I of the EU Habitats Directive):

- E1.2 Perennial food grasslands and main steppes = 6190 Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis) + 61A0 Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)[95], 0.1 ha,
- F3.1 Temperate thickets and scrub = 40A0* Subcontinental peri-Pannonic scrub, 2.14 ha,
- F7.35-AM Armenian phryganoids = 5410 West Mediterranean clifftop phryganas (Astregalo-plantaginetum subulatae), 0.97 ha,
- F9.12 Lowland and collinar riverine willow scrub = 3280 Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of Salix and Populus alba, 0.75 ha,
- G1.11 Riverine willow woodland = 92A0 Salix alba and Populus alba galleries, 1.0 ha,
- H3.1 Basic and ultra-basic inland cliffs = 8210 Calcareous rocky slopes with chasmophytic vegetation, 0.19 ha.

Figure 6.15. Map of the habitats identified in the footprint area



[95]These two habitats (6190 and 61A0) together correspond to one habitat in the Armenia classification; here and further the both habitats are considered together - as one.

Figre 6-16. Map of the habitats in the footrpint area listed in Annex I of the EU Habitat Directive

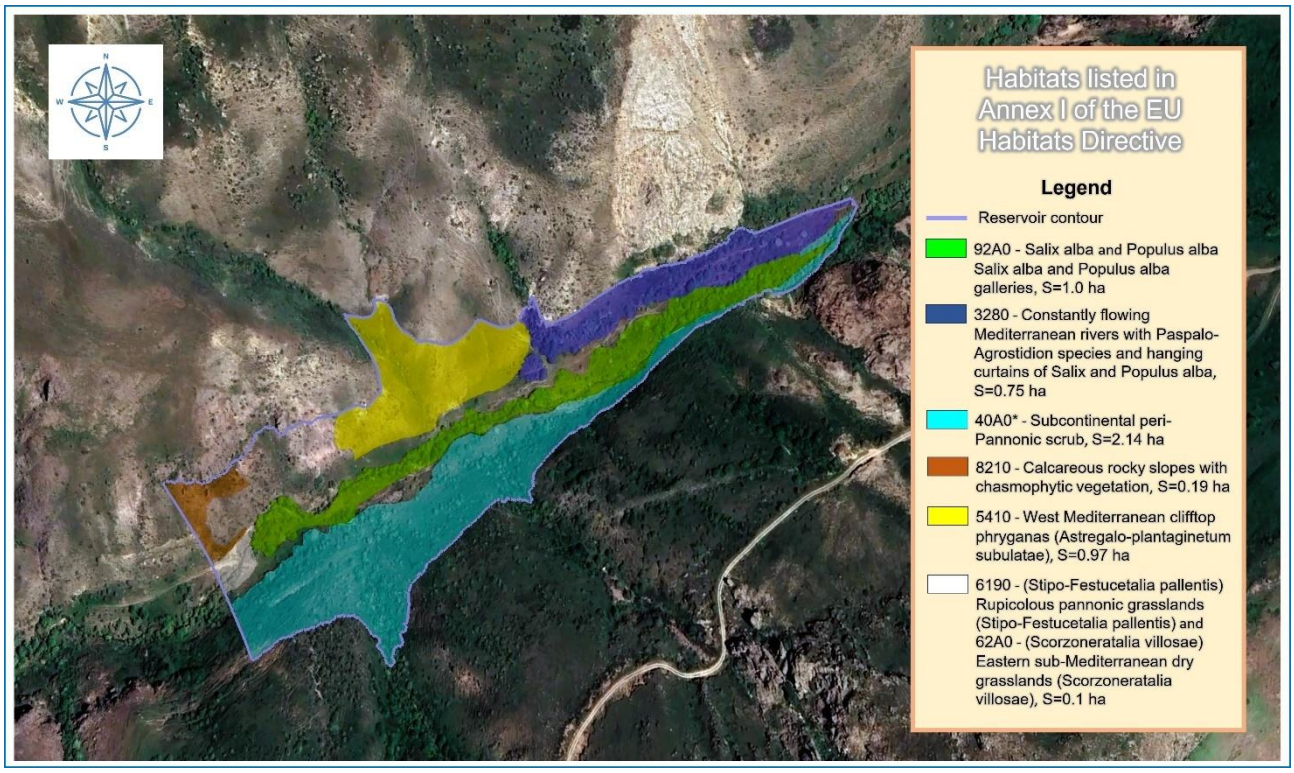


Table 6-21. Habitats identified in the Yelpin site area

Objects	Habitat according to the classification for Armenia, developed on the basis of the EUNIS classification (Habitats of Armenia, 2016, G.M. Fayvush, A.S. Aleksanyan)		Habitat (in accordance with Resolution No. 4 of the Bern Convention)		Habitat (in accordance with Annex 1 of the EU Habitats Directive)		Comments
Yelpin	*Code*	*Name*	*Code*	*Name*	*Code*	*Name*	
	E1.2	Perennial food grasslands and main steppes	-	-	6190	Rupicolous pannonic grasslands (*Stipo-Festucetalia pallentis*)	Stipa ssp., Festuca valesiaca, Poa badensis, Carex humilis, etc
					62A0	Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*)	Bothriochloa ischwemum, Festuca valesiaca, Stipa ssp., Agropyron ssp., Elitrigia ssp., etc
	F3.1	Temperate thickets and scrub	-	-	40A0*	Subcontinental peri-Pannonic scrub	Cerasus incana, Amygdalus fenzliana, Genista tinctoria, Rhwmnus cathwrtica, Crataegus ssp.m etc
	F5.342-AM	Almond open arid forests	-	-	-	-	[Habitats are good represented in Armenia; Amygdalus fenzliana is usually a dominant of the communities. In South Zangezur and Megri floristic regions sometimes A. nairica is a dominant. In Yerevan and Darelegis floristic regions Michauxia laeviagata is very common in these communities]
	F7.35-AM	Armenian phryganoids	-	-	5410	West Mediterranean clifftop phryganas (*Astregalo-plantaginetum subulatae*)	[Habitats are represented in lower and middle mountain belts; Acantholimon spp. and Camphorosma spp. are dominants in the communities. Habitats are good represented in foothills of Ararat valley and in Darelegis and Megri floristic regions].

Objects	Habitat according to the classification for Armenia, developed on the basis of the EUNIS classification (Habitats of Armenia, 2016, G.M. Fayvush, A.S. Aleksanyan)		Habitat (in accordance with Resolution No. 4 of the Bern Convention)		Habitat (in accordance with Annex 1 of the EU Habitats Directive)		Comments
	F9.12	Lowland and collinar riverine willow scrub.	-	-	3280	Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of Salix and Populus alba	
	G1.11	Riverine willow woodland	G1.11	Riverine Salix woodland	92A0	*Salix alba* and *Populus alba* galleries	Salix alba, S. excelsa, Populus alba, P. nigra, P. canescens, Lycopus europaeus, Lysimachia vulgaris և Urtica dioica.
	H3.2	Basic and ultra-basic inland cliffs	H3.2	Basic and ultra-basic inland cliffs	8210	Calcareous rocky slopes with chasmophytic vegetation	Common habitats in Armenia.

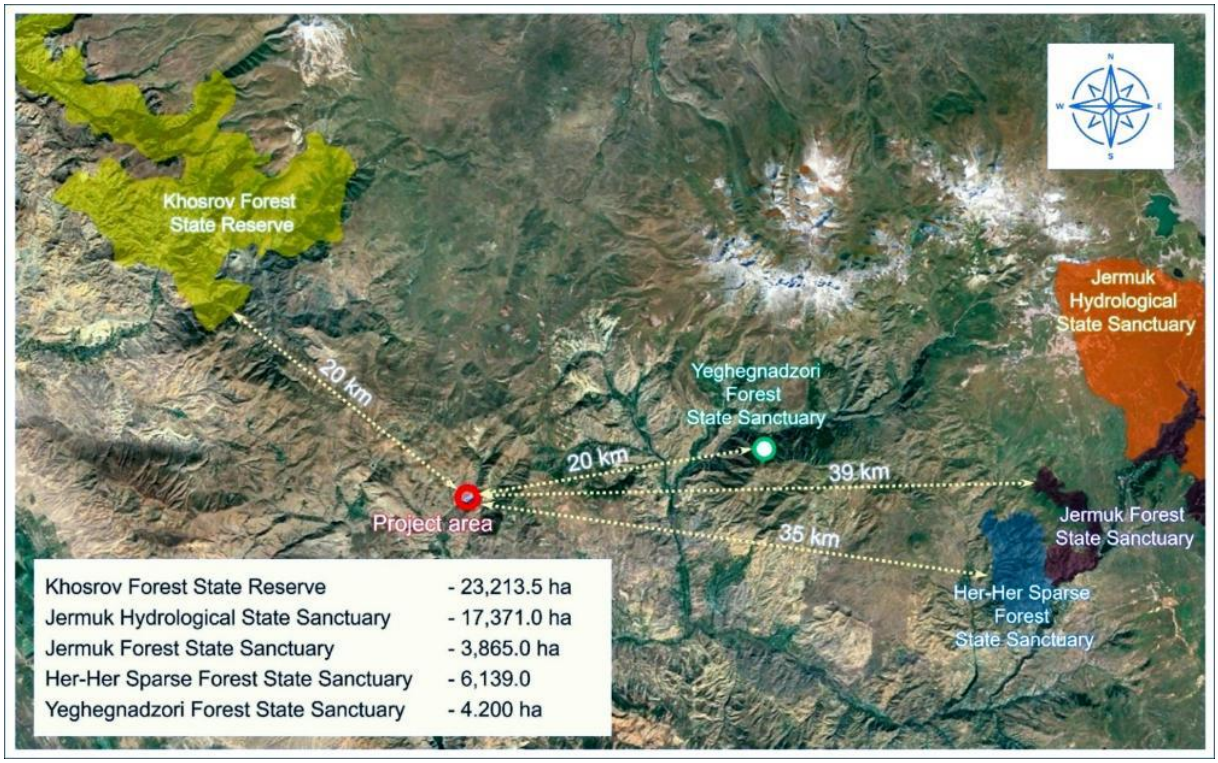
6.2.5 Specially Protected and Internationally Recognized Areas and Forests

National sites

Armenia is rich in Specially Protected Areas of Nature (SPAN). There are 34 officially registered SPANs in Armenia, of which: 3 state reserves - Khosrov Forest, Shikahogh, and Erebuni, occupying a total area of 35,439.6 ha (1.19% of Armenia's territory); 4 national parks - Sevan, Dilijan, Lake Arpi, and Arevik, covering 236,802.1 ha (7.96% of the country's area); 27 state sanctuaries and 232 natural monuments together occupying 114,812.7 ha (3.95% of Armenia's territory).

The planned Yelpin Reservoir site does not fall within any SPANs. The nearest SPANs, Khosrov Forest State Reserve (in Ararat Marz) and Yeghegnadzor Forest State Sanctuary (in Vayots Dzor Marz), are located approximately 20 km from the Project site (**Figure 6-17**).

Figure 6-17 Location of the SPANs in the vicinity of the Project site



According to the RA Government Decree №967-N On Approving the List of Nature Monuments of the Republic of Armenia, there are 49 natural monuments located in Vayots Dzor Marz, of which:

- Geological monuments - 23 units,
- Hydrogeological monuments - 9 units,
- Hydrographic monuments - 10 units,
- Natural historical monuments - 6 units,
- Biological monuments - 1 unit.

There are three natural monuments near the study area: the "Nameless" dyke and a fault structure; both geological monuments located south and west of Yelpin village. The "Vardanis" lake complex, a natural historical monument situated 3.5 to 4 km northeast of Yelpin, near the ruins of the former Vardanes village at an elevation of 1,748 masl.

The first two monuments are located southwest of Yelpin and lie at a significant distance from the study area; therefore, they will not be affected. The "Vardanis" lake complex is situated east of the Project area, within the gorge of the Shresth River. Since the Yelpin and Shresth river gorges are

separated by the 2,089-meter-high Shreshtasar mountain, there will be no negative impact on the "Vardanis" lake complex.

Internationally Recognized Areas

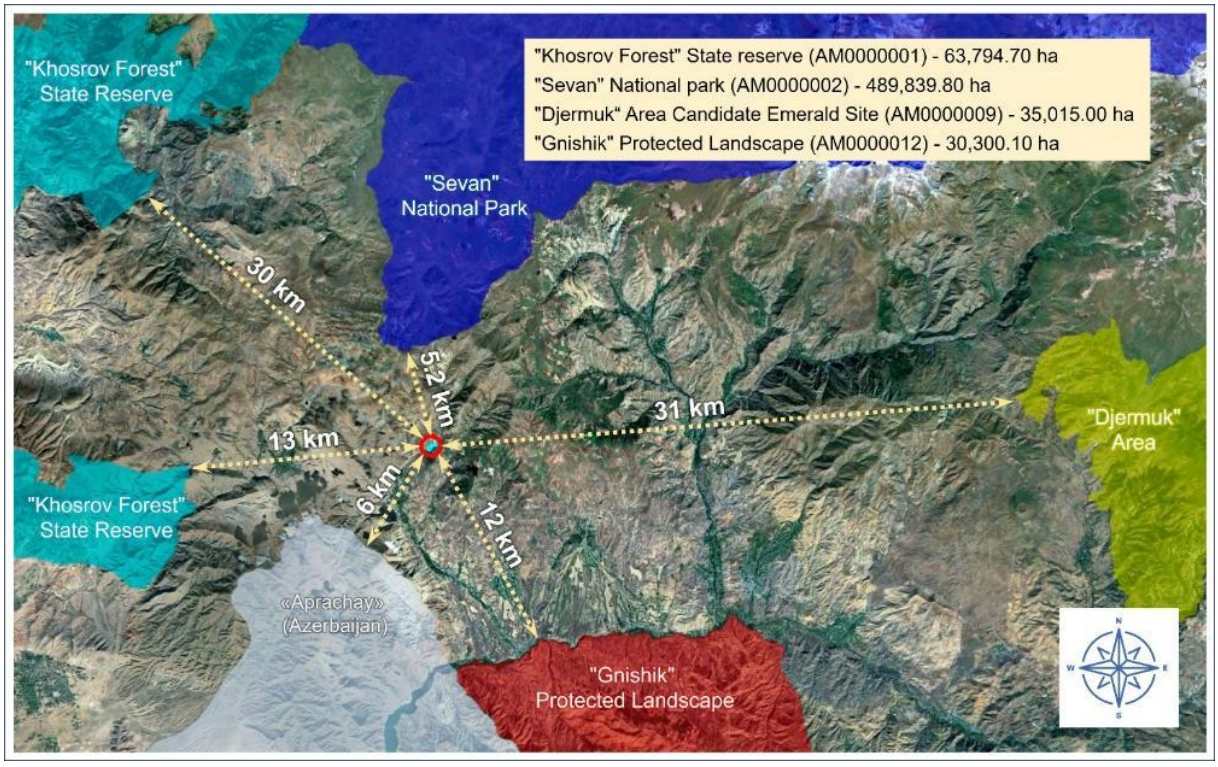
Armenia signed the Bern Convention in 2006 and ratified in 2008. Since then, the country has worked on establishing the Emerald Network and listed more than 110 species requiring protection and habitat conservation, according to the Bern Convention Resolutions №4 (1994) and №6 (1998).

As of June 2025, Armenia had not officially adopted any Emerald Network sites. However, 23 sites within the territory of the Republic of Armenia had been officially nominated as candidate Emerald Sites (last confirmation of the candidate sites list was done at the 44th meeting of the Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats, December 2024)[96].

At the same time, as a reaction to the immediate challenges identified by the Ministry of Environment (MoE), the Emerald Network database was completely revised and optimized by the World Bank under the European Union for Environment (EU4Environment) Action Program[97]. The proposed set consists of 30 Emerald sites, covering 707,739.22 ha (23.8 percent of the national coverage, almost a third less than previously)[98]. But this revision was not agreed yet.

The nearest candidate Emerald Site to the project area is Sevan National Park (AM0000002), located 5.2 km to the north. Three other nominated Emerald Sites, "Gnishik" Protected Landscape (AM0000012), "Khosrov Forest" State Reserve (AM0000001), and "Djermuk" Area (AM0000009), are located approximately 12 km, 13 km, and 31 km from the Project site, respectively. Additionally, the "Aprachay" Candidate Emerald Site (in Azerbaijan) is located approximately 6 km south of the project area (**Figure 6-18**).

Figure 6-18. Location of the Candidate Emerald Areas in the vicinity of the Project site



[96] https://rm.coe.int/pa18e-2024-draft-candidate-list-emerald-network-sites-2779-8956-4427-1/1680b27e33

[97] EU4Environment. 2024. Recommendations for Review of the Candidate Emerald Sites in Armenia. Washington DC: World Bank. https://www.eu4environment.org/app/uploads/2024/11/Recommendations-for-Review-of-the-Candidate-Emerald-Sites-in-Armenia.pdf

[98] Ibid

The nearest internationally recognised area of biodiversity value to the Project site is the Gndasar Key Biodiversity Area (KBA) / Important Bird Area (IBA) (**Figure 6-19**). It is located 320 m north-east of the planned reservoir area and covers approximately 23 km². The area is primarily characterised by shrublands, with additional habitats including grasslands and rocky areas (e.g., inland cliffs and mountain peaks).

Figure 6-19. Location of the KBAs / IBAs in the vicinity of the Project site

Bird species that meet the IBA/KBA criteria in this area include the Caspian Snowcock (*Tetraogallus caspius*) and the Chukar (*Alectoris chukar*) as well as species group – soaring birds/cranes)[99]. In the north-west, the Gndasar KBA/IBA overlaps slightly (0.6%) with the "Lake Sevan" Ramsar Site, a Wetland of International Importance. The distance between the Project site and the "Lake Sevan" Ramsar Site is the same as that of the "Sevan" National Park candidate Emerald Site, at 5.2 km.

6.2.6 Critical Habitat Assessment Findings

Among the seven habitats, 128 flora species, and 200 fauna species identified during biodiversity surveys, the following features (see **Table 6-22)** have been assessed as triggering PBF or Critical Habitat (CH) according to the EBRD PR6.

PBFs include six habitats (according the EU Habitats Directive classification) and 43 species - 20 bird species, one reptile species and 22 invertebrates (insect) species, CHs - one habitat and nine species - four mammal species, four reptile species, and one amphibia.

Table 6-22. Summary Table of Priority Biodiversity Features and Critical Habitats Identified in the footrpint area[100]

№	Criterion	Features (Habitats/species)
Priority Biodiversity Features as per EBRD PR6 (§12)		

[99] https://datazone.birdlife.org/site/factsheet/gndasar

[100] In case a species would trigger several criteria in the PBF and CH, it is listed in this table only once as the highest conservation concern, which is CH.

№	Criterion	Features (Habitats/species)
i	12.i.a EAAA[101] is habitat type listed in Annex I of the EU Habitats Directive and Resolution 4 of the Bern Convention	Habitats (×6 - according to the EU Habitats Directive classification) 6190 Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis), 61A0 Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae), 5410 West Mediterranean clifftop phryganas (Astregalo-plantaginetum subulatae), 3280 Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of *Salix* and *Populus alba,* 92A0 *Salix alba* and *Populus alba* galleries, 8210 Calcareous rocky slopes with chasmophytic vegetation.
ii	12.ii.a EAAA for species and their habitats listed in Annex II of the Habitats Directive, Annex I of the Birds Directive, or Resolution 6 of the Bern Convention	Birds (×17) *Pernis apivorus (LC)* *Gypaetus barbatus (NT)* *Buteo rufinus (LC)* *Aquila chrysaetos (LC)* *Hieraaetus pennatus (LC)* *Falco peregrinus (LC)* *Anthropoides virgo (LC)* *Bubo bubo (LC)* *Lullula arborea (LC)* *Caprimulgus europaeus* (LC) *Coracias garrulus* (LC) *Anthus campestris* (LC) *Dendrocopos syriacus* (LC) *Ficedula semitorquata* (LC) *Lanius collurio* (LC) *Lanius minor* (LC) *Pyrrhocorax pyrrhocorax* (LC) Insects (×1) *Euphydryas aurinia*
iii	12.ii.d EAAA for regularly occurring nationally or regionally listed EN or CR species	Insects (×1, already triggering cr.12 ii.e) *Polyommatus (Agrodiaetus) eriwanensis* (EN)
	12.ii.e EAAA for regularly occurring range-restricted species	Insects (x20) *Anthocharis gruneri* *Pieris krueperi* *Colias aurorina (already triggering cr.12 iii)* *Armenia ledereri* *Armenia hyrcanica* *Nordmannia abdominalis* *Lycaena ochimus*

[101] EAAA - Ecologically Appropriate Area of Analysis

№	Criterion	Features (Habitats/species)
		Ultraaricia crassipuncta *Neolysandra coelestina* *Polyommatus (Agrodiaetus) demavendi* *Polyommatus (Agrodiaetus) eriwanensis (already triggering cr.12 ii.d)* *Polyommatus (Agrodiaetus) ninae (already triggering cr.12 iii)* *Hipparchia syriaca* *Hipparchia fatua* *Satyrus amasinus* *Pseudochazara pelopea* *Pseudochazara schahrudensis* *Chazara bischoffi* *Thaleropis ionia* *Melitaea persea*
	12.iii Significant biodiversity features identified by a broad set of stakeholders or governments	Birds (×3, listed in the Red Book of RA as Vulnerable) *Irania gutturalis* (LC) *Sitta tephronota (LC)* *Rhodopechys sanguineus (LC)* Reptiles (×1, listed in the Red Book of RA as Vulnerable) *Zamenis hohenackeri* Insects (×3, listed in the Red Book of RA as Vulnerable) *Papilio alexanor* *Colias aurorina (already triggering cr.12 ii.e)* *Polyommatus (Agrodiaetus) ninae ((already triggering cr.12 ii.e)*
Critical Habitats as per EBRD PR6 (§14)		
i	14.i.a EAAA is habitat type listed in Annex IV of the EU Habitats Directive	Habitats (×1) 40A0 Subcontinental peri-Pannonic scrub
ii	14.ii.a EAAA for species and their habitats listed in Annex IV of the Habitats Directive	Mammals (×4) *Ursus arctos* *Canis lupus* *Lutra lutra (NT)* *Dryomys nitedula* Reptiles (×4) *Pseudopus apodus* *Lacerta media (Lacerta viridis)* *Coronella austriaca* *Ophisops elegans* Amphibians (×1) *Bufo viridis*

6.3 Social and Socio-Economic Environment

The sections below are informed by the review of primary and secondary sources, such as publications and bulletins of Statistical Committee of the RA, Areni Community Development Plan for 2023-2027, focus group discussion held in August 2024, interview with the head of Yelpin village held in August 2024, and ESIA Consultant's observations during the site visit.

6.3.1 Overview of the Project area

Vayots Dzor Marz is situated in the southeastern part of Armenia. It borders Nakhchivan Autonomous Republic of Azerbaijan from the west and Kalbajar district of Azerbaijan from the east. From the north it borders Gegharkunik Marz, from the northwest - Ararat Marz, and from the southeast - Syunik Marz. Vayots Dzor Marz is surrounded by high mountains, separated with water bodies dividing the region into three mountain ranges.

The Project beneficiaries are Yelpin and Chiva villages. The planned reservoir will be located within the administrative boundaries of Yelpin village. The nearest residential buildings are located 1.9 km and 6 km away from the Project site in Yelpin and Chiva respectively. Both settlements are part of Areni community, rich in historical and cultural monuments, and nature sites.

Yelpin village (**Figure 6-20**) is located in the southwestern part of Vayots Dzor Marz, at an altitude of 1,400-1,545 masl. The village is close to the Armenia-Azerbaijan border, 25 km away from the regional centre Yeghegnadzor, and around 100 km from the contry's capital Yerevan.

Yelpin borders Zangakatun community of Ararat Marz from the west, Chiva village of Areni community from the east, and the Nakhichevan Autonomous Republic of Azerbaijan from the south.

Figure 6-20. Yelpin village of Areni Community, Vayots Dzor Marz[102]

[102]The photo is from the EIA Report for the Construction of Yelpin Reservoir in Areni community of Vayots Dzor Marz prepared by Consecoard LLC in 2024.

Chiva village (**Figure 6-21**) is located in the southwestern part of Vayots Dzor Marz, on the right and left banks of the Yelpin River, at ca. 1120 masl. The village is 23 km away from the regional centre Yeghegnadzor and ca. 100 km from the capital city Yerevan. The village has changed its location several times, rising from the valley to the mountainside.

Figure 6-21. Chiva village of Areni Community,Vayots Dzor Marz[103]

6.3.2 Demography[104]

As of the begininng of 2024, the Vayots Dzor marz population was 48,500 people, of whom around 52% are women. Vayots Dzor Marz is themost sparsely populated province of the RA, and second last in terms of the total population. Areni community had a population of 9,515 people (16% of the marz population) in the same period.

The number of permanent population in Yelpin village as of the begininng of 2024 was 1,239 people, of whom 560 (45%) are women. Around 68% of the residents are 18-63 years old, 20% are children under 18 years old, and 12% are residents over 63 years old. There had been no significant change in the number of permanent population of the village in the recent years, according to the interview with the head of Yelpin village administrative unit.

The population of Chiva as of of the begininng of 2024 was 822 people, of whom 45% are women. Around 69% of the population belong to the age group of 18-63 years old, 18% - to the age group of 0-18 years old, and 13% are over 63 years old. The village is located in a landslide zone, which has caused the migration of rural population to other safer locations in Armenia in the past.

[103]Ibid

[104]Information for this sub-section was mainly extracted from the website of Armstat's publication RA Vayots Dzor Marz in figures, 2024 available at https://armstat.am/en/?nid=984 and Areni Community Development Plan for 2023-2027 available at http://vdzor.mtad.am/files/docs/80209.pdf

6.3.3 Regional and Local Economy

Agriculture is the major economic sector in Vayots Dzor Marz. The Areni community is particularly known for its Areni grapes and wine production. There is a big potential for domestic and international tourism development in the Marz. The annual Areni Wine Festival held at the beginning of October promotes tourism in the region.

The population of Yelpin is mainly engaged in agriculture: cultivation of grain, tobacco, horticulture and animal husbandry. The village head emphasised during the interview that the quality of the crops is impacted by the lack of irrigation water, causing reduced yields and smaller produce. Due to this crop is not sufifcient for selling and is mainly consumed in households (so, does not generate income).

6.3.4 Poverty and Unemployment, Incomes and Expenditures[105]

As per focus group discussions, each household has an additional source of income other than agriculture. There are no large-scale production facilities in the village, there is a small workshop for the cheese production and tasting. Cattle breeding is developed to a certain extent. Furthrmore, there are five registered individual entrepreneurs in the village engaged in retail trade, and one bakery, one agricultural cooperative, and one farm.

The residents of Chiva are primarily engaged in fruit and vegetable growing, beekeeping, and animal husbandry mainly for domestic needs. There are guest houses and four retail trade entrepreneurs in the village.

The average monthly nominal wage in Vayots Dzor Marz reached 171 029 AMD (446 USD). The share of poor population in Vayots Dzor Marz increased from 21.9% in 2020 to 30.9% in 2023. The poverty level in the Marz is higher than the national average (23.7%). It should be noted that in 2023, 0.4% of the Marz population were registered as extremely poor, the population category that had not been identified in the previous years.

The average monthly wage in Yelpin is around 147,624 AMD (384 USD), and 88,421 AMD (230 USD) in Chiva.

In 2024, the minimum consumer basket cost (unofficial) in RA was 75,811 AMD (193 USD) per person per mont, whilethe minimum wage was established at 75,000 AMD (190 USD). For comparison, the average pension is about 43,000 AMD (110 USD), and the minimum is 36,000 AMD (90 USD).

Unemployment rate in Vayots Dzor Marz fell from 20.4% in 2020 to 11.4% in 2023 (RA average - 12.4%). Rural unemployment rate (12.6%) is higher than urban (9.4%). Unemployment rates in Yelpin and Chiva were around 15% in 2024.

According to the head of Yelpin village, labour migration has decreased in the recent years due to extensive state programs for the construction of social infrastructure. The main reasons for migration are, however, pursuit of higher edcuation and work opportunities. There are no permanent residents in 25 houses, some of them return during the summer.

According to the focus group discussions, the main source of household income is state/municipal work or private activity, a part of income comes from viticulture. Agriculture cannot serve as the main source of income because the agricultural lands are only partially cultivated due to water scarcity. Among the main categories of expenditures of the residents are food, utility bills and other services.

[105]Information for this section was mainly extracted from the website of Armstat's publication RA Vayoc dzor Marz in figures, 2024 available at https://armstat.am/en/?nid=984

6.3.5 Ethnic Minorities

The majority of the Vayots Dzor Marz population are ethnic Armenians who belong to the Armenian Apostolic Church. The region hosts small communities of Yezidis, Russians, Assyrians, and other groups.

Yelpin and Chiva villages are populated by ethnic Armenians; the predominant religion is Armenian Apostolic Christianity.

6.3.6 Social Infrastructure

There are 34 pre-school institutions, 48 secondary schools, 19 libraries, seven sports organizations, and one museum in Vayots Dzor Marz[106].

According to the Areni Community Development Plan for 2023-2027[107], poor infrastructure i.e. roads, drinking and irrigation water pipelines, is a typical problem for the area including Yelpin and Chiva villages. Thus, its improvement is of a vital importance to ensure community's socio-economic development.

Both Yelpin and Chiva villages have one secondary school, one medical centre, which provides first aid, and a post office. Villagers have access to electricity, and water. There is no centralised gas supply provided to the households. In addition, both villages are located along the M2 highway which connects to Yerevan in one direction, and towards the Iranian border in the other direction.

6.3.7 Gender Issues

According to the National Statistical Committee, 52% of women in Armenia are not employed and are not seeking employment[108]. A major reason for women's absence from the labour market is their engagement in unpaid household activities. The gender pay gap in Armenia was 39.2% in 2022. The poorest households in the country tend to be women-headed households.

National gender problems such as underrepresentation in labour market and decision-making processes, gender pay gap are relevant in the Project affected villages as well.

In general, women's participation in decision-making at the community level, especially in rural communities, is fairly low. The principal reasons for their limited involvement in community leadership include public opinion, men's lack of acceptance of women's leadership, women's fear of expressing themselves, and a lack of self-confidence among women[109]. Women underrepresentation remains also a problem in Water Users Associations.

According to the focus group discussions, the shortage of water in the area negatively affects women and women-headed households since their opportunities to gain income from agriculture are limited, and there is no other paid work available for them in the village. Furthermore, women collect water from the nearby water sources at night, which poses a safety risk for them. A female focus group participant highlighted that stable supply of water to the community will provide significant benefits for women.

[106]Armstat. Main statistical indicators of the Vayots Dzor Marz, 2019-2023. Available at https://armstat.am/file/Map/Vayots-Dzor.pdf
[107]http://vdzor.mtad.am/files/docs/80209.pdf
[108]European Union. 2024. Country Gender Profile Armenia. Eu4genderequality Reform Helpdesk. Available at: https://euneighbourseast.eu/wp-content/uploads/2024/04/eu4genderhelpdesk_armenia_countrygenderprofile_2024-cgp_v3__compressed.pdf
[109]Ibid

6.3.8 Socially Less Protected / Vulnerable Population

There are 252 households in the Yelpin village, of which 35 (14%) receive social assistance from the government. In addition, there are four families displaced from the Nagorno-Karabakh region in the village, receiving state support. No information is available for Chiva village.

The lack of irrigation water in the villages negatively affects vulnerable households as it restricts their ability to cultivate the land, which worsens their economic situation. As was mentioned during the focus groups discussions, the residents plant the apple, apricot, peach, cherry trees to get a harvest but since there is no water they dry up. One representative of socially vulnerable group raised her hope that if water supply reliability increases in the village, she would be able to rent out her arable land.

6.3.9 Public Health and Safety

Number of doctors per 10,000 population in the Vayots Dzor Marz, similarly to the national level, reduced slightly - from 20.2 in 2020 to 19.2 in 2023 (46.6 in the RA). The same declining tendency is noted in the number of paramedical personnel, that had decreased from 42.6 per 10,000 population in 2020 to 38.8 in 2023 (53.9 in the RA)[110].

There are eight institutions providing primary health care services in the Vayots Dzor Marz.

The largest hospital is located in Yeghegnadzor - the capital of the Marz, which is 25 km away from Yelpin village, and 23 km away from Chiva village.

There is one medical unit operating in Yelpin village which also provides medical services to the resident of Chiva village. Its equipment is largely outdated and hardly serves the needs of the residents and there is only one paramedic employed.

Main chronical diseases of Yelpin and Chiva residents include diabetes, cardiovascular disease, and arthritis.

6.3.10 Land Use Issues

Territory of Vayots Dzor Marz is 231,000 ha, which is 7.8% of the territory of the RA. Agricultural land comprises of 189,530.1 ha, of which 15,860.4 ha is arable land.

The land fund of the administrative territory of Yelpin village is ca. 5,549 ha, of which 4,833 ha is owned by the community, and 716 ha are privately owned. The number of land users/tenants in the village is 150. According to the participants of focus group discussions, all residents of the village have agricultural land.

The total area of Chiva settlement encompasses 3,116.0 ha, of which 2,619.37 ha are agricultural lands.

The structure of the land fund for Yelpin and Chiva villages is outlined in **Table 6-23**.

Table 6-23. Distribution of the land fund for Yelpin and Chiva settlements

Purpose	Land	Settlement	
		Yelpin	Chiva
1. Agricultural	*arable land*	589,22	285,62
	orchard	20,36	22,60

[110]Armstat. RA Vayots Dzor Marz in figures, 2024 available at https://armstat.am/en/?nid=984

Purpose	Land	Settlement	
		Yelpin	Chiva
	vineyard	23,69	-
	meadow land	129,25	56,16
	pasture	3567,09	414,07
	other plots	1095,26	1840,92
	Total	***5424,87***	***2619,37***
2. Residential	residential construction	84,05	68,00
	including household plots	84,05	68,00
3.Ownership	RA citizens (private)	601,40	453,47
	communal	4003,46	1853,62
	state	982,23	808,60

Source: RA Cadastre Committee

The Yelpin Reservoir is proposed to be constructed within the territory of Yelpin village. It will require around 31.5 ha. The view of the Project site is shown in **Figure 6-22**.

Figure 6-22. View at the landscape of the Project site[111]

6.4 Cultural Heritage

6.4.1 Tangible Cultural Heritage

The registered cultural heritage units within the administrative boundaries of Yelpin rural settlement pursuant to the RA Government Decree №754-N are outlined in **Table 6-24**.

[111]Photo by the ESIA Consultant

Table 6-24. List of cultural heritage units located within Yelpin rural settlement

№ as per the RA Government Decree №754-N	Name of the CH unit	Period or age of the site	Location	Potential importance (national, local)	Note
1	Cemetery	14-20th centuries	In the village	Local	
1.1	Cross-stone	14th century		National	In the southern part
2	Cemetery	14-19th centuries	1 km to the southwest	Local	Near the Yelpin-Yeghegnadzor road
2.1	Tukh-Manuk chapel	17-19 centuries		Local	
2.2	Cross-stone	14th century	In the north	National	Near the chapel
3	Church	1908		Local	Semi-destroyed
4	Cross-stone	10th century	0.5 km to the southeast	National	Near the Yelpin-Yeghegnadzor road

In recent years, detailed archaeological surveys have been conducted in the study area by joint Armenian-American and Armenian-Italian expeditions. As a result, the list of archaeological monuments in Yelpin village has significantly expanded. However, none of the newly discovered monuments are located within the area of influence of the planned reservoir construction. The closest cultural heritage site to the Project area is the Harsnakar (Yelpin-2) rock-cut complex, which also lies outside the area that could be affected by the construction activities (**Figure 6-23**).

Figure 6-23. Aerial view of Harsnakar (Yelpin-2) rock-cut complex[112]

During the national EIA study, an archaeological field surveys were conducted in May 2024. As a result, numerous structures made of stone fragments were documented. At the first glance, these appear to be tombs or walls, but they are of natural origin, formed by the movement and

[112]Photo from the archaeological field study report prepared as a part of the national EIA

accumulation of materials during river floods. However, among them, several artificial stone structures were also identified. These likely served a livestock-related function and may date to the late Middle Ages or the Soviet era (**Figure 6-24**).

Figure 6-24. Remains of structures and accumulation of rubble observed within the Project site

6.4.2 Intangible Cultural Heritage

The Intangible Cultural Heritage (ICH) in the context of the Project is considered at both the national (**Sub-section 6.4.2.1**) and community (**Sub-section 6.4.2.2**) levels.

6.4.2.1 National Context

Armenia is one of the oldest countries in the world, known for its ancient history and unique culture. Scientific research, numerous archaeological discoveries, and ancient manuscripts indicate that the Armenian Highlands are one of the Cradles of Civilization. References to Armenia and the Armenian people are preserved in Sumerian, Assyrian, Persian, Egyptian, and other ancient texts. Today, the Republic of Armenia is located in the northeastern part of the Armenian Highland and occupies about one-tenth of its historical territory. Armenia's rich archaeological heritage dates back 2 million years and includes remains from the Paleolithic, Neolithic, and Chalcolithic periods, as well as the Bronze and Iron Ages, Hellenistic period, and Middle Ages. The world's oldest leather shoe (5,500 years old), sky observatory (7,500 years old), depictions of agriculture (7,500 years old), and a wine-making facility (6,100 years old) have all been discovered in Armenia.

Armenia is often referred to as the Land of Noah, based on biblical scriptures. According to the Bible, Noah's Ark came to rest on Mount Ararat, which at that time was part of historical Armenia. Some of

his sons and grandsons are believed to have settled in the region. It is commonly accepted that Armenians are direct descendants of his son Japheth.

Armenia was the first country in the world to adopt Christianity as a state religion in 301 A.D. Since then, Christianity has played a critical role in shaping the Armenian people. Religion has been an essential part of Armenian identity and has significantly influenced the course of the nation's history.

Armenia has eight elements inscribed on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity[113]:

1) **Duduk and its music** (2008): The distinctive Armenian woodwind instrument made of apricot wood, traditionally played in pairs.
2) **Armenian cross-stones art: symbolism and craftsmanship of Khachkars** (2010): carved memorial steles bearing crosses and intricate motifs.
3) **Performance of the Armenian epic "Daredevils of Sassoun" (David of Sassoun)** (2012): oral storytelling of the national heroic epic.
4) **Lavash: the preparation, meaning and appearance of traditional bread** (2014): the communal baking of flatbread in clay ovens.
5) **Kochari, traditional group dance** (2017): a vigorous circle dance embodying bravery and unity.
6) **Armenian letter art and its cultural expressions** (2019): the decorative art of the Armenian alphabet, created by Mesrop Mashtots.
7) **Pilgrimage to the St. Thaddeus Apostle Monastery** (2020): a joint Armenian-Iranian nomination honoring historic religious pilgrimages.
8) **Tradition of blacksmithing in Gyumri** (2023): the local craft of forging iron objects central to Gyumri's identity.

The photos of the Armenian ICH values registered in the UNESCO Representative List of the Intangible Cultural Heritage of Humanity are presented in **Figure 6-25**.

Figure 6-25. Photos of Armenia's elements inscribed on the UNESCO Representative List of the Intangible Cultural Heritage of Humanity

1) 2) 3) 4)

5) 6) 7) 8)

In addition to the eight intangible cultural heritage elements inscribed on UNESCO's Representative List, Armenia also has ICH elements of national significance. According to the latest amendment (dated 31.10.2024) to Annex 2 of RA Government Decision №310-A[114], the national list currently

[113] https://ich.unesco.org/en/state/armenia-AM?info=elements-on-the-lists
[114] https://www.arlis.am/hy/acts/199058

includes 68 ICH elements, including the eight internationally recognized ones. These encompass traditional songs and musical instruments, dances, ethnic cuisine, handicrafts (such as carpet weaving, knitting, embroidery, woodwork, pottery, forging, etc.), winemaking, ceremonies (including weddings, funerals, Christmas, New Year, Easter, baptisms, and more), pilgrimages, regional dialects, and other cultural expressions.

6.4.2.2 Community Context

According to Annex 2 of RA Government Decision №310-A, around ten of the 68 nationally registered Intangible Cultural Heritage (ICH) elements are practiced across all regions of Armenia. These include: (i) the preparation of lavash, inscribed on both the UNESCO and national ICH lists, which is an integral part of Armenian cuisine; (ii) the tradition of producing tondir (underground clay ovens), used for baking lavash and other traditional dishes, recognized as an ICH element of national significance; (iii) the making and playing of the duduk; (iv) the Kochari dance; (v) the celebration of Christmas, New Year, and Easter, among others.

The Areni community is famous for its winemaking and vineyards. The "Areni-1" winery is the world's oldest known winery, discovered in 2007 in the Areni-1 cave complex near the Areni village in Vayots Dzor Marz (**Figure 6-26**). Excavated by a team of Armenian and international archaeologists, the site dates to approximately 4,100-4,000 BC, during the Late Chalcolithic period, making it at least 1,000 years older than the winery unearthed in the West Bank in 1963, which was previously considered the oldest known. The cave's stable microclimate with minimal temperature fluctuations and low humidity preserved organic remains exceptionally well. Archaeologists unearthed a well-preserved winery in the cave's first gallery, including a 60-centimetre-deep (2-foot) fermentation vat, a 1-meter-long clay basin wine press coated with malvidin (a red wine pigment), large storage jars (karases), pottery sherds, and organic remains such as grape seeds, pressed grape skins, desiccated vines, prunes, and walnuts[115], [116].

Figure 6-26. Areni-1 cave and remians of winemaking facilities

Currently, wine in Areni is produced both commercially and using traditional homemade methods. The vineyards and wineries are an integral part of the local landscape and attract tourists to the region not only for sightseeing at the Areni-1 Cave and Noravank Monastery (located nearby) but also for wine tasting tours. Vodka preparation from fruits also popular in the villages of Areni community. The wine and vodka produced in the villages of Areni community is sold at stalls located along the both sides of M-2 highway.

[115]Barnard, H., Dooley, A.N., Areshian, G., Gasparyan, B., & Faull, K.F. (2011). "Chemical Evidence for Wine Production Around 4000 BCE in the Late Chalcolithic Near Eastern Highlands." *Journal of Archaeological Science*, 38(5), 977-984

[116]Owen, James. "Earliest Known Winery Found in Armenian Cave." *National Geographic*. January 10, 2011. Retrieved January 14, 2011

The Areni community is also known for hosting the annual Wine Festival, held during the first week of October. The first festival took place in 2002. Over time, it became so popular that it attracted significant interest not only in Armenia but also from many countries around the world. The goal of the festival is to promote rural tourism, showcase the country's rich history, culture, and national traditions, and highlight tourism development prospects in Areni and the surrounding villages. The festival program always includes winemaking demonstrations, wine tasting, hospitality, and sales, as well as the tasting and sale of other agricultural products (**Figure 6-27**).

Figure 6-27. Photos from the Wine Festival[117]

Christmas, New Year, and Easter are widely celebrated in the settlements of the Areni community, typically with family gatherings at home. The "Trndez" ritual is also included in the national list of ICH elements. Rooted in Armenian pagan tradition, Trndez is celebrated annually on February 13. The purifying qualities of fire were central to pre-Christian Armenian beliefs. According to several sources, people believed that the strength of the fire could drive away the winter cold and ensure fertile land and a prosperous harvest. Couples, especially newlyweds, would jump over the Trndez flames for luck, prosperity, and fertility.

Weddings, funerals, and baptisms in the villages of the Areni community are also carried out with respect to local traditions and customs.

6.4.2.3 Cultural Landscape[118]

Recognized types of cultural landscapes are:

- **Designed** (planned gardens, estates),
- **Associative** (spiritually or culturally meaningful landscapes),
- **Evolved** (traditional agricultural areas like vineyards),
- **Vernacular** or **Ethnographic** (day-to-day or group-specific traditional use),
- **Agricultural** or **Working** (subtype often included under evolved or vernacular landscapes).

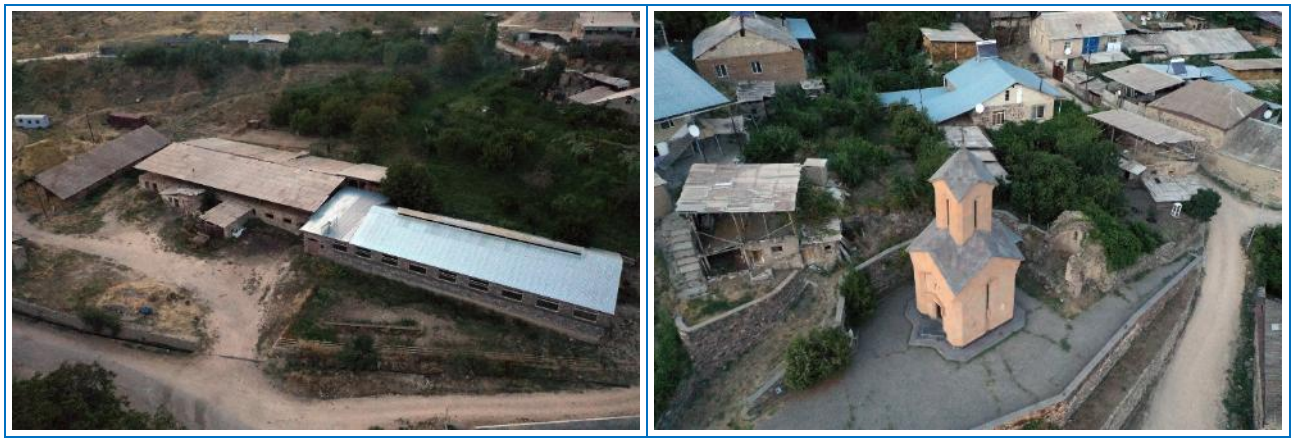
The residential areas within the Yelpin and Chiva rural settlements are characterized by a vernacular cultural landscape (**Figure 6-28**), while the agricultural lands outside the settlement are represented by a combination of organically evolved and working cultural landscapes (**Figure 6-29**). As of 2022 (**Section 2.2**, **Table 2-1**), 24 ha of irrigated agricultural land in Yelpin and Chiva rural settlements

[117] https://armtf.am/festivals/areni-wine-festival/

[118] Cultural landscapes include tangible and intangible characteristics, such as natural systems and features, spatial organization and land use. Cultural landscapes are historically significant places that show evidence of human interaction with the physical environment. Their authenticity is measured by historical integrity, or the presence and condition of physical characteristics that remain from the historic period.

are occupied by vineyards. The implementation of the Project could potentially increase the vineyard area to 75 ha due to improved access to irrigation water. For the same reason, the areas occupied by grain crops and orchards are expected to double. The area used for vegetable seedling cultivation is projected to increase from 5 to 15 ha. The newly cultivated areas may be characterized by a combination of designed and organically evolved cultural landscapes.

Figure 6-28. Vernacular cultural landscape in Yelpin and Chiva rural settlements



a) Yelpin village

a) Chiva village

Figure 6-29. Combination of vernacular, organically evolved and working cultural landscape in Yelpin and Chiva villages

a) Yelpin village *a) Chiva village*

7. Stakeholder Consultation

7.1 Introduction

This chapter provides the overview of the Project stakeholder engagement and consultation activities carried out to date as part of both the national EIA and this ESIA study and summarizes their key findings. The stakeholder identification and engagement process for the Project was initiated in accordance with the RA Law on Environmental Impact Assessment and Expert Examination, the Procedure on Public Notification and Discussions approved by RA Government Decree №1325-N[119], as well as the stakeholder identification approach recommended by the EBRD.

7.2 Stakeholder Identification

The identification of stakeholders relevant to the Project was conducted according to the following criteria:

- **Impact:** the implementation of the Project may significantly affect a certain social group (stakeholders),
- **Influence:** the social group may have the capacity to significantly influence the process of Project implementation,
- **Partnership:** there are opportunities for building partnerships between the Project proponent and the given social group, and
- **Expressed Interest:** a social group or individuals not necessarily directly affected by the Project may (or may not) show interest in it.

On the other hand, the RA Law on Environmental Impact Assessment and Expert Examination defines **stakeholders** or the **stakeholder society** as individuals or legal entities that are directly or potentially affected by Project implementation or who show interest in decisions related to the Project. The same law also defines **participants of the EIA process** as state and local self-government bodies, individuals, and legal entities, including the affected community, affected settlements, and the interested public who in accordance with the Law participate in the assessment or expert examination process.

Stakeholder engagement requires the identification of stakeholders considering the above noted national and international criteria and the definition of appropriate methods for engagement with them. Different stakeholders have varying interests and influence in any project. Generally, those with low interest and low influence are to be kept informed, while those with high interest and high influence should be collaborated with.

The Project stakeholders can be grouped into two major categories: namely, external stakeholders and internal stakeholders (Water Committee, its staff, consultants and contractors).

For the purposes of effective and tailored engagement, the external stakeholders of the Project have been clustered into the following groups:

- Potentially affected parties,
- Vulnerable groups,
- Governmental authorities,
- Local self-governing bodies,

[119]The procedure for public notification and discussions was amended by the RA Government Decree №1343-N, dated 28.12.2023. However, at the time the first public notification was initiated, the previous version of the public notification and discussions procedure was still in force.

- Private sector and business,
- Other interested parties (civil society organizations, mass media, academia, etc.).

7.3 Public Discussions during the National EIA

In accordance with the procedure established by RA Government Decree №1325-N, four public discussions/hearings must be conducted as part of the national EIA and expert examination process in the project-affected community or settlement. The date, location and agenda of each of the four public discussions are outlined below:

1st public discussions

Date: 20.12.2023

Location: Yelpin settlement

Agenda:

- Presentation of the Project objective and main components,
- Environmental and social framework,
- Initial consent of the affected community.

2nd public discussions

Date: 25.03.2024

Location: Yelpin settlement

Agenda:

- Key findings of the preliminary environmental impact assessment,
- Draft Terms of Reference to be issued by the State Authorized Body (ME).

3rd public discussions

Date: 27.05.2024

Location: Yelpin settlement

Agenda:

- Key findings of the EIA studies,
- Recommended mitigation and monitoring measures.

4th public discussions

Date: 06.08.2024

Location: Yelpin settlement

Agenda:

- Main outputs of the EIA report,
- Feedback to the comments raised by the EIA process participants and stakeholders,
- Draft environmental impact expert examination conclusion.

The details and phases, as well as the main concerns and recommendations raised by stakeholders (participants) during the four public discussion events described above, are summarized in **Table 7-1**. These were taken into account by the national EIA developers during both the preliminary and main EIA studies. However, if any concern was not addressed in the national EIA report, it has been reviewed and, if relevant, considered in this ESIA report.

Table 7-1. Summary of public discussion events conducted as a part of national EIA study

Moderation and presentation	Date, time	The place	Number of participants (women)	Participants	Questions and suggestions raised
1st public discussions - Presentation of the Project objective and main components, - Environmental and social framework, - Initial consent of the affected community.					
Discussion moderator: Administrative head of the Yelpin settlement The project was presented by: representatives of design company and EIA developers ('Modul' LLC and 'Consecoard' LLC)	20.12.23 15:00	Residence of the administrative head of the Yelpin settlement, (Areni community, Vayots Dzor Marz)	36 (12)	Administrative head of the Yelpin settlement, representatives of 'Modul' LLC, 'Consecoard' LLC, affected population	- When is the construction of the reservoir planned to begin, and how long is it expected to last? - Why the project implementation is delayed? - Whether the residents can be involved in the construction work. - Is it possible to increase the capacity of the reservoir in the future? - The design company presented quanities and types of land-plots to be irrigated by the planned reservoir. *All voiced questions and concerns were duly addressed.* ***Conclusion:** There were no objections from the participants. They welcomed the project initiation and implementation.*
2nd public discussions - Key findings of the preliminary environmental impact assessment, - Draft Terms of Reference to be issued by the State Authorized Body (ME).					
Discussion moderator: Administrative head of the Yelpin settlement The project was presented by the representatives of EIA developers	25.03.24 14:00	Residence of the administrative head of the Yelpin settlement, (Areni community, Vayots Dzor Marz)	36 (12)	Administrative heads of Yelpin and Rind rural settlements, representatives of the EIEEC, 'Consecoard' LLC and affected population	- Is Chiva rural settlement also considered as affected? - What types of trees and plant species are currently growing in the planned reservoir area, how many trees will be cut, and will compensation be provided for the cut trees? - What is the reservoir's filling level?

Moderation and presentation	Date, time	The place	Number of participants (women)	Participants	Questions and suggestions raised
					- When is construction work planned to begin? - A request was made to start the work as soon as possible. ***Conclusion:*** *The residents requested to begin construction of the reservoir as soon as possible.*
3rd public discussions - Key findings of the EIA studies, - Recommended mitigation and monitoring measures.					
Discussion moderator: Administrative head of the Yelpin settlement The project was presented by the representatives of EIA developers	27.05.24 12:00	Residence of the administrative head of the Yelpin settlement, (Areni community, Vayots Dzor Marz)	11 (2)	Administrative heads of the Yelpin, Rind and Chiva rural settlements, representatives of 'Consecoard' LLC and affected population	- Due to the construction of the reservoir, tree cutting will be carried out, and as compensation, tree planting will be carried out when construction will be completed. - How many trees are planned to be cut and what plant species have been identified in the area? ***Conclusion:*** *There were no objections from the participants. They welcomed the project, emphasizing the importance of starting the reservoir construction as early as possible.*
4th public discussions - Main outputs of the EIA report, - Feedback to the comments raised by the EIA process participants and stakeholders, - Draft environmental impact expert examination conclusion					
Discussion moderator: Administrative head of the Yelpin settlement The project was presented by the representatives	06.08.24 12:00	Residence of the administrative head of the Yelpin settlement, (Areni community, Vayots Dzor Marz)	18 (6)	Administrative head of Yelpin settlement, representatives of the EIEEC 'Consecoard' LLC and affected population	- Are there any landslides in the area? - The need for the construction of a fish pass was emphasized. - Have the potential risks of the reservoir construction been assessed? ***Conclusion:*** *There were no objections from the*

Moderation and presentation	Date, time	The place	Number of participants (women)	Participants	Questions and suggestions raised
of EIA developers					*participants. They emphasized the need to build a reservoir.*

7.4 Consultations with Project Stakeholders during the Socio-Economic Studies

Consultations with the head of Areni community and administrative head of Yelpin rural settlement were held on 22.08.2024 and with the local residents on 23.08.2024. Before the consultation events a letter with a request for socio-economic information was submitted by the Consultant to the head of Areni community, introducing:

i) the Project and its components,
ii) current status of the Project implementation process,
iii) the scope of the environmental and socio-economic studies,
iv) potential land use limitations, land acquisition and compensation issues,
v) the list of officials and groups of Project Affected Persons (PAPs) to be consulted.

The main topics discussed with the head of the Areni community included: the overall socio-economic situation in the Areni community; socio-economic programs to be implemented both in the community as a whole and in the Yelpin settlement in particular over the coming years; the risks and benefits associated with the Project's implementation at the community level; and the main livelihood and income sources of the Project-Affected Persons (PAPs).

The agenda of the consultations conducted with the administrative head of Yelpin rural settlement covered issues related to the village's socio-economic and environmental profile, including:

- The total area of the settlement, types of land, and land use,
- Engagement of residents in the EIA consultations and discussions, and concerns related to environmental impacts,
- Population dynamics, migration trends, residents' main occupations, and vulnerable groups,
- People likely to be affected by the Project's implementation and issues of economic displacement,
- Restrictions within the protection zones around the planned reservoir area.

The attitude of the heads of the Areni community and Yelpin rural settlement toward the Project's implementation is positive. They believe that the Project will create temporary jobs for local residents during the construction phase and permanent employment opportunities during the reservoir's operational stage. The planned reservoir is expected to provide irrigation water for approximately 150 ha of agricultural land.

7.5 Summary of Stakeholders Concerns, Questions and Recommendations

During the public discussion and stakeholder consultation events, participants highlighted the following questions and concerns that may arise from the Project's implementation. Where relevant, these concerns and questions have been addressed in the appropriate sections of this ESIA report:

- Cutting of trees within the planned reservoir footprint,
- Possibility of temporary job opportunities during construction works,
- Whether a fish-pass is required or not,

- Risks of landslides and other construction-related hazards,
- Total area of land plots to be irrigated by the Yelpin reservoir,
- Starting date and duration of the construction works,
- Possibility of increasing the reservoir's capacity in the future,
- Request from the residents to start the Project implementation as soon as possible.

7.6 Planned Stakeholder Engagement

The next stakeholder consultation meetings will be conducted during the 120-day public disclosure period of the ESIA package, which includes the ESIA Report, Non-Technical Summary (NTS), Environmental and Social Management Plan (ESMP), Environmental and Social Action Plan (ESAP), Stakeholder Engagement Plan (SEP), Resettlement Framework (RF), and Biodiversity Action Plan (BAP).

Two public consultation events are planned: one in Yelpin settlement (or Areni municipality, will be discussed later) and another in Yerevan, with the participation of relevant state authorities, NGOs and other project stakeholders. In both cases, the resdents of Chiva village will be invited to the event. These meetigns are tentatively scheduled for the third quarter of 2026. This component will be led by the ESIA Consultant with support from the Water Committee.

The Stakeholder Engagement Programme has been developed as part of the SEP to ensure effective engagement with all identified stakeholders, foster and maintain respectful relationships between the Water Committee and stakeholders, and help prevent potential conflicts. It covers the Project's design, pre-construction, and construction stages.

The Programme will be reviewed and updated at least once a year after the start of the construction stage and again prior to the commissioning of the Yelpin reservoir. It provides a detailed action plan outlining responsibilities and a timeframe for the implementation of the proposed activities. Should there be any changes during Project implementation that necessitate modifications to the engagement mechanisms, or if new stakeholders are identified, the Programme will also be updated accordingly.

Stakeholder engagement will continue in parallel with the ESIA information disclosure process and will include several components aimed at facilitating ongoing meaningful consultation and providing timely information on the Project and its E&S implications.

8. Environmental and Social Impacts, Benefits and Opportunities, Mitigation Measures

8.1 Introduction

This Chapter provides a summary of the environmental and social impacts and benefits identified during the national EIA study, which were further updated through supplementary surveys and analyses conducted by the Consultant. These efforts were undertaken to align this ESIA study report with the requirements of the EBRD ESP and provisions of the applicable GIPs. This process helps ensure that the E&S information used for decision-making presents a comprehensive picture of the potential effects of the proposed Project, including issues of particular concern to affected groups and individuals. The methodology used for the impact assessment and management is described in detail in **Chapter 5** of this ESIA report.

8.2 Environmental Impacts and Benefits, Mitigation Measures

8.2.1 Transboundary Impact

The construction of the Yelpin reservoir is not planned on transboundary water resources. The Yelpin River is a tributary of the Arpa River, which crosses the southern border of Armenia into Nakhichevan, an exclave of Azerbaijan, before joining the Araks River. The Araks River serves as the border between Iran and Nakhichevan, forms part of the border between Armenia and Turkey in the southwest, and also marks the southern border between Armenia and Iran. Hence, the reservoir will be built on a tributary of transboundary river.

The hydrological impact assessment[120] has been undertaken comparing the average and dry year flows at the boundary with relevant neighbouring countries, with and without the project. The hydrology baseline considered for this assessment was that defined using the SWAT+ model established for the purpose of the present study[121]. The main conclusion is that it is unlikely that the Project generates significant hydrological impacts.

In theory, the Yelpin reservoir could contribute to sediment impacts, as it is the most downstream. However, the flow ratio between the reservoir and the corresponding site (approximately 0.8%) indicate that any such impact would be non-significant as well. In conclusion, it is very unlikely that the Project will have significant sediment load and soil stability impacts.

The EIA study of the Yelpin reservoir show a lack of fish and aquatic habitats in the reservoir impounded rivers. In conclusion, it is unlikely that the Project reservoirs will result in impacts on fish resources and aquatic habitats.

A conservative evaluation of the planned reservoir' impacts has been made possible through basic hydrological modelling (SWAT+) and expert judgment. The assessment indicates that the Yelpin reservoir is unlikely to have significant downstream impacts. This conclusion is primarily based on the upstream positions relative to existing lakes or reservoirs, and the relatively small size of the rivers they impound.

[120] SLR Consulting. Armenia reservoirs Project: Transboundary Impact Assessment Report, Revision A, June 2025.
[121] Ibid

8.2.2 GET Assessment[122]

8.2.2.1 Introduction

The Project is assessed as aligned with the goals of the Paris Agreement[123] based on the directly financed methodology. Specific assessments for climate adaptation and climate mitigation have been undertaken for the Yelpin reservoir site and outlined below.

8.2.2.2 Paris Alignment Assessment

Alignment with the mitigation goals of Paris Agreement: general screening

The Project is on the aligned list under the water supply and wastewater category[124]. No Project activities have been identified as on the 'non-aligned list'.

Alignment with the mitigation goals of Paris Agreement: specific assessments

Review against Nationally Determined Contribution (NDC) and Low Emission Development Strategy

In the case of Armenia, the NDC outlines an intention to achieve an unconditional Greenhouse Gas (GHG) emissions reductions target of at most 2.07 t CO2eq/capita by 2050. These are reflected in Armenia's Draft Long Term - Low Emission Development Strategy (LT-LEDS). Armenia's LT-LEDS outlines improvements in water supply and irrigation as a priority area to reduce energy consumption, with an estimated total GHG emissions reduction of 8.946 Gg CO2eq until 2050.

As such, the Project does align with some of the targets outlined in Armenia's draft LT-LEDS and, therefore, the country's NDC in that it is designed to improve water supply and efficiency in irrigation. However, it is noted that GHG emission estimates at this stage show net positive carbon emissions for reservoir over 100 years.

Review against energy policies in Armenia

In 2022, the International Energy Agency, in partnership with the European Union, produced an in-depth review of the energy policies of Armenia which sets the path for the sector's transition through 2040 including guidance on energy efficiency and security of supply. Water supply, construction and agriculture do not feature explicitly in this review. However, the economic assessment identifies that the Project will result in an annual decrease in energy costs due to decreased pumping costs. Therefore, the Project is concluded to align with Armenia's energy transition policies through to 2040.

Carbon lock-in test

Carbon lock-in occurs when technical, economic or institutional factors mean an asset will continue to operate in an emissions-intensive way, even when there are feasible and economically preferable lower carbon options that could replace it. The risk of lock-in is considered low if the project entails investment in assets that will cease to operate in an emissions-intensive way in the near future or the project credibly demonstrates low-carbon readiness.

A review of the Project has not identified (at this stage) the use of any low-carbon alternatives and use of renewable energy sources. However, there are still opportunities to embed low-carbon alternatives into the design of the Project and there are no barriers identified to the use of renewable energy in the operation of the project. Therefore, the risk the Project's overall lock-in risk can be considered low.

[122]This GET Assessment has been prepared based on the Chapter 5 and Section 8.3 of the *Armenia Water Reservoirs - Technical, Economic and Green Due Diligence Gap Analysis, Draft Final Report*, 2023-2024, Ove Arup & Partners

[123]https://unfccc.int/sites/default/files/english_paris_agreement.pdf

[124]Implementing the Green Economy Transition Technical Guide, EBRD, March 2024 and Annexes to Implementing the Green Economy Transition - Technical Guide, EBRD, March 2024

Economic viability test

An economic viability test has not been completed as the CO2 emissions assessment has not identified that any of the individual reservoirs exceeds the 'significant' emissions thresholds outlined in the EBRD Methodology to determine the Paris Agreement alignment of EBRD investments.

Conclusion: The Project is assessed as aligned with the mitigation goals of Paris Agreement (BB1 aligned).

Alignment with the adaptation goals of Paris Agreement

Internal screening of the Project has identified increased heat stress, increased water stress and drought / flooding / sea-level rise / mass movement[125] / forest fires / erosion] as potentially material physical climate risk(s) for the Project location.

A climate risk assessment was undertaken as part of the Project's technical due diligence[126] (**Sub-section 8.2.2.3**). As a response, the Project incorporates adaptation responses to ensure assets are resilient to identified material risks:

- Extreme heat (for the reservoir and dam),
- Heavy precipitation and flooding (for the reservoir, dam and spillway).

The Project is unlikely to undermine climate resilience of the system in which it operates. Although it is noted that uncertainties regarding downstream flood impacts mean that, at this stage, the downstream receptors remain potentially at high risk to heavy precipitation and flooding. This also takes into account the fact that the reservoirs are primarily designed to address future water storages and support agriculture.

Potential high risks are also identified for extreme high temperatures and forest fires for ecological receptors downstream. This is a conservative rating applied in the absence of information on the ecological receptors, and also the vegetation clearing and planting approach for the reservoirs.

8.2.2.3 Climate Change Adaptation and Mitigation Assessment

Climate adaptation (Climate change risk assessment)

Step One: Current and future baseline

To define the current and future baseline the assessment has utilised historical climate data and climate projections from national, regional and site-specific sources, where available. Regional-level climate projections and site-specific climate data provided by "Modul" design company has been used to look in further detail at the current and future climate conditions for the Yelpin reservoir. A summary of the key trends is provided in **Table 8-1**.

Table 8-1. Summary of current and future climate trends for the Yelpin reservoir

Climate hazard	Baseline	Projected change[127]		
		2020-2039	2040-2059	2060-2079
Average temperature	Average annual air temperature is 5.6°C, according to 'Unknown Mountain Pass' meteorological station, which is located at a similar elevation as the proposed Yelpin reservoir. Data from the station is taken in lieu of a station in the study area.	↑ For both the SSP2-4.5 and SSP5-8.5 scenarios average temperatures are projected to increase in the Vayots Dzor region.		

[125]The assessment of mass movement considers it occurring as a result of heavy rainfall/storms, i.e., as a climatic factors. Seismic risk is covered by the technical review

[126]*Armenia Water Reservoirs - Technical, Economic and Green Due Diligence Gap Analysis, Draft Final Report*, 2023-2024, Ove Arup & Partners

[127]Preparation of design and cost estimation documents for construction of Yelpin reservoir in Vayots Dzor Marz of the Republic of Armenia, Explanatory Note, 2024

Climate hazard	Baseline	Projected change[127]		
		2020-2039	2040-2059	2060-2079
Extreme high temperatures	Absolute maximum air temperature is 34°C in July. The extreme heat hazard rating for the Vayk municipality is assigned as low, meaning that there is between a 5% and 25% chance that at least one period of prolonged exposure to extreme heat, resulting in heat stress, will occur in the next five years.	↑ For both the SSP2-4.5 and SSP5-8.5 scenarios average maximum surface air temperatures are projected to increase in the Vayots Dzor Marz, with the greatest increased occurring in July and August.		
Extreme low temperatures	Absolute minimum air temperature of - 25°C was observed in January. For the time period of 1990-2014, the observed annual average minimum temperature in the Vayots Dzor region was 0.81°C with an average number of 165 frost days and 70 ice days.	↓ Future projections for both the SSP2-4.5 and SSP5-8.5 scenarios project that the number of ice and frost days will decrease in future.		
Wildfire & Forest Fires	The wildfire hazard rating for the Vayk municipality is assigned as high.	↑ Modelled projections indicate a likely increase in the frequency of fire weather across Armenia.		
Extreme wind	Data available on wind is limited. Data from the Global Wind Atlas indicates an average wind speed of 3.57 m/s for the top 10% windiest areas in the location of the Yelpin reservoir.	Changes in wind speed as a result of climate change are difficult to predict and are affected by high levels of uncertainty.		
Average precipitation	Annual precipitation ranges between 1007 mm (according to High-mountain Aragats meteorological station), 723 mm (according to Aparan meteorological station) and 382 mm (according to Ashtarak agrometeorological station).	↓ Future projections for both the SSP2-4.5 and SSP5-8.5 scenarios in the Vayots Dzor region project that the average precipitation levels will decrease in comparison to baseline levels.		
Heavy precipitation and flooding	The river flood hazard rating for the Vayk municipality is assigned as low.	↑ For both the SSP2-4.5 and SSP5-8.5 scenarios the projected average largest 5-day cumulative precipitation is projected to increase.		
Drought	The water scarcity hazard rating for the Vayots Dzor Marz is assigned as low, this means that there is up to 1% chance droughts will occur in the coming ten years.	↑ The current low hazard rating for the Vayots Dzor region may increase in the future due to climate change.		
Erosion	Localised data on current and future erosion patterns has not been identified.			
Mass movement	The landslide hazard rating for the Vayk municipality is very low, this indicates that localised landslides are a rare hazard phenomenon. On the basis of the DTM provided by Modul, the reservoir may be located at a lower topography than the surrounding area.	Climate change is likely to alter slope and bedrock stability through changes in precipitation and/or temperature. However, it is difficult to determine future locations and timing of large rock avalanches, as these depend on local geological conditions and other non-climatic factors.		

Step Two: Definitions of exposure of impacts to climate change

Table 8-2 outlines the definitions used to rate the exposure of the Yelpin reservoir to relevant climate hazards. The rating considers current and future climate conditions that may occur across the Project lifecycle. On the basis of the exposure ratings, the mass movement hazard is not considered further.

Table 8-2. Exposure ratings for the Yelpin reservoir

Climate hazard	Exposure rating
Extreme high temperatures	Probable
Extreme low temperatures	Probable
Forest fires	Plausible
Extreme wind	Plausible
Heavy precipitation and flooding	Plausible
Drought and increased water stress	Plausible
Erosion	Plausible
Mass movement	Not likely

Step Three: Definition of sensitivity impacts to climate change

Table 8-3 outlines the definitions used to rate the sensitivity of the Yelpin reservoir to relevant climate hazards. The rating considers current and future climate conditions that may occur across the Project lifecycle.

Table 8-3. Sensitivity ratings for the Yelpin reservoir

Climate hazard	Sensitivity rating		
	Reservoir and Dam	Spillway	Guard house and instrumentation
Extreme high temperatures	Low	Low	Low
Extreme low temperatures	Low	Low	Low
Forest fires	Low	Low	Medium
Extreme wind	Medium	Medium	Low
Heavy precipitation and flooding	High	High	Medium
Drought and increased water stress	Low	Low	Low
Erosion	Medium	Medium	Low

Table 8-4 outlines the definitions used to rate the sensitivity of receptors located downstream of Yelpin reservoir to relevant climate hazards. The rating considers current and future climate conditions that may occur across the project lifecycle.

Table 8-4. Sensitivity ratings for receptors located downstream of the Yelpin reservoir

Climate hazard	Sensitivity rating		
	Agricultural land	Water users (including farmers)	Ecological receptors
Extreme high temperatures	Low	Low	Medium
Extreme low temperatures	N/A - The Project is not anticipated to impact on the sensitivity of the receptors to extreme low temperatures.		
Forest fires	Low	Low	Low
Extreme wind	N/A - The Project is not anticipated to impact on the sensitivity of the receptors to extreme winds.		
Heavy precipitation and flooding	High	High	High
Drought and increased water stress	Low	Low	Medium
Erosion	Low	Low	Medium

Heavy precipitation and flooding hazard

The design company has applied the Armenian dam hazard classification system to select the Safety Check flood as a 1 in 1000-year return period. The safety check should be selected based on the downstream hazard posed by an uncontrolled release of water from the dam. However, at this stage no consequence assessment has been undertaken. Probable Maximum Flood analysis has also not been completed.

The choice of Armenian dam category appears reasonable based on the descriptions in the standard, but is lower than typically expected for the likely consequences when compared with other international dam safety flood standards. An allowance has not been made for climate change in the selection of the Safety Check Flood. This is not unusual for extreme flood events of 1 in 1000 years and above and there is little to no firm guidance on how this should be implemented although it is considered to be good practice.

The design document for the Yelpin reservoir notes that future climate change projections anticipate a decrease in river flows by the year 2100 under multiple climate change scenarios. However, the projections quoted are provided at a national level and in the event that river flows show an overall

decreasing trend, climate change may still increase the frequency and magnitude of flood events that do occur. Therefore, the Yelpin reservoir, dam and spillway and downstream receptors are identified as having a 'High' sensitivity to heavy precipitation and flooding.

Step Four: Definition of a risk assessment level

Table 8-5 outlines the risk ratings for the Yelpin reservoir for relevant climate hazards. The rating considers current and future climate conditions that may occur across the Project lifecycle.

Table 8-5. Risk ratings for the Yelpin reservoir

Climate hazard	Risk rating (Exposure × Sensitivity)		
	Reservoir and Dam	Spillway	Guard house and instrumentation
Extreme high temperatures	High	Medium	Medium
Extreme low temperatures	Medium	Medium	Medium
Forest fires	Low	Low	Medium
Extreme wind	Medium	Medium	Medium
Heavy precipitation and flooding	High	High	Medium
Drought and increased water stress	Low	Low	Low
Erosion	Medium	Medium	Low

Table 8-6 outlines the risk ratings for receptors located downstream of Yelpin reservoir for relevant climate hazards. The rating considers current and future climate conditions that may occur across the Project lifecycle.

Table 8-6. Risk ratings for receptors located downstream of the Yelpin reservoir

Climate hazard	Risk rating (Exposure x Sensitivity)		
	Agricultural land	Water users (including farmers)	Ecological receptors
Extreme high temperatures	Medium	Medium	High
Forest fires	Medium	Medium	Medium
Heavy precipitation and flooding	High	High	High
Drought and increased water stress	Low	Low	Medium
Erosion	Low	Low	Medium

Step Five: Identification of recommended climate resilience measures

For the purpose of this assessment, risks identified as "High" are considered material and accordingly resilience measures are identified to reduce the materiality of these risks.

Reservoir, dam and spillway

To mitigate potential impacts of heat on reservoir and dam structures, construction materials should be selected that have a proven track record in performing under high temperature conditions. During operation, inspections should also be completed more regularly during and immediately after heat wave events to identify and resolve any issues associated heat induced expansion and other impacts.

As part of the risk-based approach, undertake Probable Maximum flood analysis and sensitivity testing to determine how downstream consequences are affected by the occurrence of floods with a

greater magnitude as a result of climate change. Expert judgement should then be applied to determine if an allowance is required for climate change in determining the Safety Check Flood.

Downstream receptors

In relation to extreme high temperatures and ecological receptors, this reflects a conservative approach undertaken in the absence of knowledge of the ecological species located in proximity to the reservoir. This risk should therefore be re-evaluated following ecological surveys and assessment to determine whether it remains material and, if so, what resilience measures should be implemented.

The measures outlined above would address the risks posed to downstream receptors by heavy precipitation and flooding.

Climate change mitigation: CO2e impact analysis

The data inputs to the G-res tool relied on the design document for the reservoir, from which the key information is summarised in **Table 8-7**. The reservoir site and catchment area were delineated in Google Earth Engine for the assessment of upstream catchment and reservoir datasets.

Table 8-7. G-res data inputs for the Yelpin reservoir

Upstream catchment					
Catchment area		15.9		km2	
Population in catchment		289		persons	
Catchment annual runoff		34		mm. yr	
Landcover and mineral soils					
Bare areas	0%	**Croplands**	28.6%	**Forest**	0%
Grassland/ shrubland	71.4%	**Settlements**	0%	**Waterbodies**	0%
River area before impoundment	6.8	km			
Area to be inundated by reservoir					
Climate zone		Temperate			
Reservoir area		5.43		ha	
Reservoir volume		0.93		MCM	
Water level		1695.6		masl	
Maximum depth		40		m	
Annual wind speed		1.3		m/s	
Mean air temperature		5.6		°C	
Reservoir					
Primary service		Irrigation			
Secondary service		Flood control		Environmental flow	
Earth removed		168 000		m^3	

The outputs indicate the post-impoundment emissions rate of CH4 as 7 t CO2e/yr with no pre-impoundment emissions rate of CO2. Pre-impoundment emissions are low due to landcover mainly being grassland. The reservoir emission over 50 years is 3.69 t CO2 e/yr (**Table 8-8**).

Table 8-8. G-res outputs for the Yelpin reservoir

Total net GHG footprint		
Total reservoir emissions per year	37	tCO2e/yr
Total reservoir emissions at year 1	18.2	tCO2e/yr
Total reservoir emissions at year 50	3.69	tCO2e/yr
Reservoir net GHG footprint by pathway		

Total net GHG footprint		
Emission rate of which CO_2	0	$gCO2e/m^2/yr$
Emission rate of which CH_4	35	$gCO2e/m^2/yr$

GET assessment

Table 8-9 outlines the GET outcomes anticipated for the Yelpin reservoir.

Table 8-9. GET CROs for the Yelpin reservoir

GET Outcome	Valorisation of GET CRO[128]	CRO ratio (CRO/Capex)
Increased agricultural potential (€/year)	€758238[129] Excluding consideration of Capex	10.7%
Increased water availability (€/year)	€534558	7.6%

It is considered that there is double counting between the increased agricultural potential and the increased water availability outcomes. Therefore, it is proposed that only the highest of these two figures is reported, i.e. 10.7% for the Yelpin reservoir.

At an earlier stage of the Project, potential was identified for the Project to reduce damage from flooding as a result of improving control of floodwaters. Through further review, it has been identified that whilst the Yelpin reservoir will be designed to attenuate flows to an extent it is not anticipated that this will have any measurable impact on flood risk receptors downstream.

No GET outcomes were identified under the "Other environmental benefits" category at this stage.

8.2.3 GHG Emissions

The CO2e impact analysis relied on the use of the GHG Reservoir Tool (G-res Tool) which is based on the principles agreed on by IPCC[130] for net reservoir emissions. When assessing the CO2e for a reservoir a whole catchment approach was followed to account for the terrestrial areas which act as net carbon sinks. Net GHG emissions caused by a reservoir are the difference between total fluxes of CO2e emissions for the river basin before and after the creation of a reservoir. The G-res tool builds on this principle of calculating the net anthropogenic GHG emissions, that is, what the atmosphere will see when a new, man-made reservoir is introduced into the landscape.

This assessment calculates the net GHG footprint using the following formula:

$$\textit{Net GHG Footprint} = \frac{\textit{Post-impoundment GHG balance from catchment after introduction of reservoir}}{\textit{Pre-impoundment GHG balance of catchment before introduction of reservoir}}$$

The pre-impoundment GHG balance relied on an assessment of the landscape. The G-res tool assesses the overall pre-impoundment GHG balance by multiplying the surface area of each land cover sub-unit with a specific emission factor appropriate for both CO2 and CH4. These are then summed over a 100-year assessment period and averaged to obtain a mean rate over the entire surface area to be occupied by the reservoir.

The post-impoundment GHG balance relies on an analysis of semi-empirical models based on existing datasets. These relate to annual CH4 diffusive emission, predicted gross annual emission and estimating the CO2 emissions rightfully attributed to the reservoir. The post-impoundment emissions are expressed in the G-res as areal emissions (gCO2e/m2/yr) and as reservoir wide

[128]Cumulative Results Overview
[129]Please note this figure accounts for the fact that in the absence of the project there would be an 11% reduction in agricultural potential by 2030 compared to baseline
[130]Intergovernmental Panel on Climate Change

emissions (tCO2e/yr) merged as GHG emissions, but also separately as CO2 and CH4. A global warming potential for 100 years was used to obtain CH4 emissions as CO2e.

The outputs of the G-res calculations indicate the post-impoundment emissions rate of CH4 as 7 tCO2e/yr with no pre-impoundment emissions rate of CO2. Pre-impoundment emissions are low because the project land is covered mainly by grassland. The total GHG emissions from the planned reservoir at year 1 are estimated 18.2 tCO2e/yr, while at year 50 - 3.69 tCO2e/yr (**Table 8-8**).

8.2.4 Impact on Air Quality

Construction phase

During the construction stage the following activities / operations are considered as potential sources (stationary and mobile) of air emissions:

- Site clearance,
- Access road construction and temporary facilities setup,
- Excavation of reservoir basin and spillway channels,
- Dam construction (backfill and concrete works),
- Grading and compaction of soil,
- Loading, transportation and unloading of friable materials,
- Drilling works (for the installation of OTL pillars),
- Welding and painting works,
- Operation of construction equipment and machinery.

Air emissions expected during the Project's construction phase from both stationary and mobile sources, along with their estimated volumes, were calculated and presented in the national EIA report. The calculations were based on the CORINAIR methodology[131] for vehicles and construction machinery, and the guide for calculating unorganized air emissions from the construction industry for dust emissions. The calculated air emissions (in g/sec and ton/year) from the reservoir construction activities are provided in **Table 8-10**.

Table 8-10. Calculated volumes of air emissions

№	Name of emitted substance	Emissions, g/sec	Emissions, ton/year
1	Dust	2.82	25.58
2	Nitrogen dioxide	0.58	5.33
3	Carbon oxide	0.5	4.58
4	Hydrocarbons	0.116	1.06
5	Solid particles	0.06	0.54
6	Sulphur anhydride	0.055	0.5
Total		**4.131 (Max)**	**37.59**

Around 70% of the overall air emissions from the construction activities consist of dust (PM2.5 and PM10). Based on instrumental measurements conducted within the Project site (**Table 6-11** and **Table 6-12**) during the baseline data collection study, the concentrations of dust (PM2.5 and PM10) were approximately 5 to 7 times below the maximum permissible concentrations (MPC) set by both national environmental standards and IFC/WHO guidelines. Therefore, the maximum dust emission rate of 2.82 g/sec expected during the construction phase is unlikely to have a significant impact on dust levels in the ground-level atmosphere. A similar conclusion can be drawn for gaseous

[131]The methodology is based on the classification of vehicles in accordance with the "Core Inventory of Emissions in Europe" (hereinafter referred to as CORINAIR), which is part of the "Base Inventory of Atmospheric Emissions in Europe" methodology

emissions, which are also expected to remain below the acceptable limits and pose minimal risk to ambient air quality. Moreover, the calculated levels of air emissions can be further reduced through the implementation of appropriate mitigation measures (see **Table 8-12**).

Taking into account that the construction activities will last 34 months, the total air emissions are estimated to be 106.505 tons, calculated as 37.59÷12×34.

Operation phase

The potential sources, causes and environmental impacts from the operated reservoir are outlined in **Table 8-11**.

Table 8-11. Sources, causes and impacts from the reservoirs

Source	Cause	Impact
AIR POLLUTANTS		
Volatile Organic Compounds (VOCs)		
Volatile organic compounds are emitted in small amounts from reservoirs, particularly if the water is affected by pollutants or chemicals in the surrounding environment.	VOCs can be released from aquatic plants, algae, or even from chemicals used in water treatment, runoff, or industrial activities near the reservoir.	VOCs can contribute to local air pollution, causing smog formation and having potential health impacts. They also contribute to the formation of ground-level ozone and other secondary pollutants.
Ammonia (NH_3)		
Ammonia can be emitted from water reservoirs, especially if the water quality is influenced by agricultural runoff or other sources of nitrogenous compounds.	Ammonia is often released as a result of the breakdown of organic nitrogen in the water. It can also evaporate from surface waters where nitrogen-rich fertilizers or waste runoff have been deposited.	Ammonia can be toxic to aquatic life at high concentrations and, when released into the atmosphere, can contribute to the formation of fine particulate matter.
Dust and Particulate Matter		
Dust and particulate matter can be emitted from areas surrounding the reservoir, especially in arid or semi-arid regions.	Even wind erosion can cause particulate matter to be emitted from the reservoir's surrounding landscape.	Dust can affect local air quality, contribute to respiratory problems in humans, and have ecological impacts.
Sulphur Compounds (e.g., H_2S)		
In reservoirs with high organic material and low oxygen (anaerobic conditions), sulphur compounds like hydrogen sulphide (H_2S) can form.	Sulphate-reducing bacteria in the water may produce hydrogen sulphide when they break down organic matter in low-oxygen conditions. It may also occur in sediments at the bottom of the reservoir.	Hydrogen sulphide has a foul odor and can be toxic at high concentrations. It may also contribute to the formation of other sulphur-related compounds that can impact air and water quality.
Phosphorus Compounds		
Although phosphorus is typically considered a water pollutant, in some cases, phosphorus compounds can be emitted to the air, particularly in	Phosphorus compounds may volatilize or become airborne when sediment is disturbed or if water quality management practices like aeration are implemented.	Phosphorus itself isn't a greenhouse gas, but it can contribute to nutrient pollution, leading to eutrophication, algal blooms, and subsequent methane emissions.

the form of aerosols or particulates.		
GHG EMISSIONS (discussed in **Section 8.2.3**)		
Methane (CH_4)		
Methane is one of the most significant greenhouse gases emitted from water reservoirs. It is produced through the anaerobic (oxygen-free) decomposition of organic matter at the bottom of the reservoir, where conditions are conducive to methane production.	Organic matter like plants, algae, and other organic material decomposes in the absence of oxygen, producing methane as a byproduct. This is most common in deeper, more eutrophic (nutrient-rich) reservoirs.	Methane is a potent greenhouse gas, with a global warming potential many times higher than carbon dioxide (CO_2). Its release into the atmosphere contributes significantly to climate change.
Nitrous Oxide (N_2O)		
Nitrous oxide is a trace greenhouse gas that can be emitted from reservoirs, typically in areas where nitrogen compounds are present.	N_2O emissions can result from the nitrification and denitrification processes, where nitrogen from agricultural runoff or wastewater undergoes biological transformations. This process often occurs under anaerobic conditions in sediment or water, producing N_2O as a byproduct.	Nitrous oxide is a potent greenhouse gas, with a global warming potential over 250 times that of CO_2. Although it is typically released in smaller amounts than methane, it still plays a role in climate change.
Carbon Dioxide (CO_2)		
Carbon dioxide is another common emission from reservoirs, resulting from aerobic (oxygen-present) decomposition of organic material in the water. It can also be released through respiration by aquatic organisms.	When organic material in the water decomposes in the presence of oxygen, it breaks down into carbon dioxide. Additionally, photosynthesis by aquatic plants and algae can lead to CO_2 release.	While CO_2 is a less potent greenhouse gas than methane, it still contributes to the greenhouse effect and global warming.

The volume of air emissions from the reservoir during the operational phase will be minimal and will primarily depend on the climatic conditions in the Project region. Theoretically, these emissions can be controlled solely through the implementation of a defined operational regime and the application of technical measures; however, given the small quantities of air emissions, such measures are often considered unfeasible. Nevertheless, a set of technical measures that could potentially be considered in the Project design documentation is outlined in **Table 8-12**.

Some minor air emissions may occur during the maintenance activities of the operated reservoir. The types of emissions will be similar to those generated during the construction phase; however, their quantities will be significantly lower and can be considered negligible.

Impact assessment and mitigation measures

Assessment and mitigation of impacts on air quality during the reservoir construction and operation phases are summarised in **Table 8-12**.

Table 8-12. Summary of air emissions impact and mitigation measures for the Project construction and operation phases

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Workers, nearby population, soil and water resources, flora and fauna	Moderate	1) Use modern construction machinery equipped with engines compliant with at least Euro IV standards, with emission control and minimal noise characteristics, 2) Perform regular technical maintenance of used construction machinery and heavy vehicles, 3) While transporting friable materials keep the body of heavy vehicles covered, 4) Minimizing dust from open area sources, including storage piles and top-soil storage areas, by using control measures such as installing enclosures and covers, and increasing the moisture content, 5) Restrict excavation and earthworks during the periods of strong winds, 6) Siting of construction facilities and construction machinery must also consider prevailing wind directions, 7) Apply regular watering to on-site and off-site dirt roads, especially during the excavation and other earthworks, 8) Minimize the period between excavation and backfilling works, 9) Prohibit construction materials and waste burning.	Low
Monitoring: According to the Air, water and soil quality monitoring plan			
OPERATION PHASE			
Nearby population, soil and water resources, flora and fauna	Low	***Maintenance works*** 1) Use modern construction machinery equipped with engines that comply with at least Euro IV standards, featuring emission control systems and low-noise characteristics, 2) Perform regular technical maintenance of all construction machinery, 3) If maintenance services are outsourced, contractors will be required to use modern, well-maintained equipment that complies with all applicable technical requirements. ***The following cost-efficient technical measures should be included in the Project design documentation and maintenance and operational plans for the reservoirs:*** 1) Consider aeration systems to oxygenate water and suppress anaerobic methane production, 2) Install surface aerators or diffused air systems to increase dissolved oxygen, 3) Remove decaying vegetation, crop residues, or debris from the reservoir and inflows,	Negligible

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		4) Keep banks and inflow channels clear to reduce organic loading, 5) Establish buffer zones with vegetation to absorb nutrients before they reach the reservoir.	

8.2.5 Impacts on Landscape and Visual Amenity

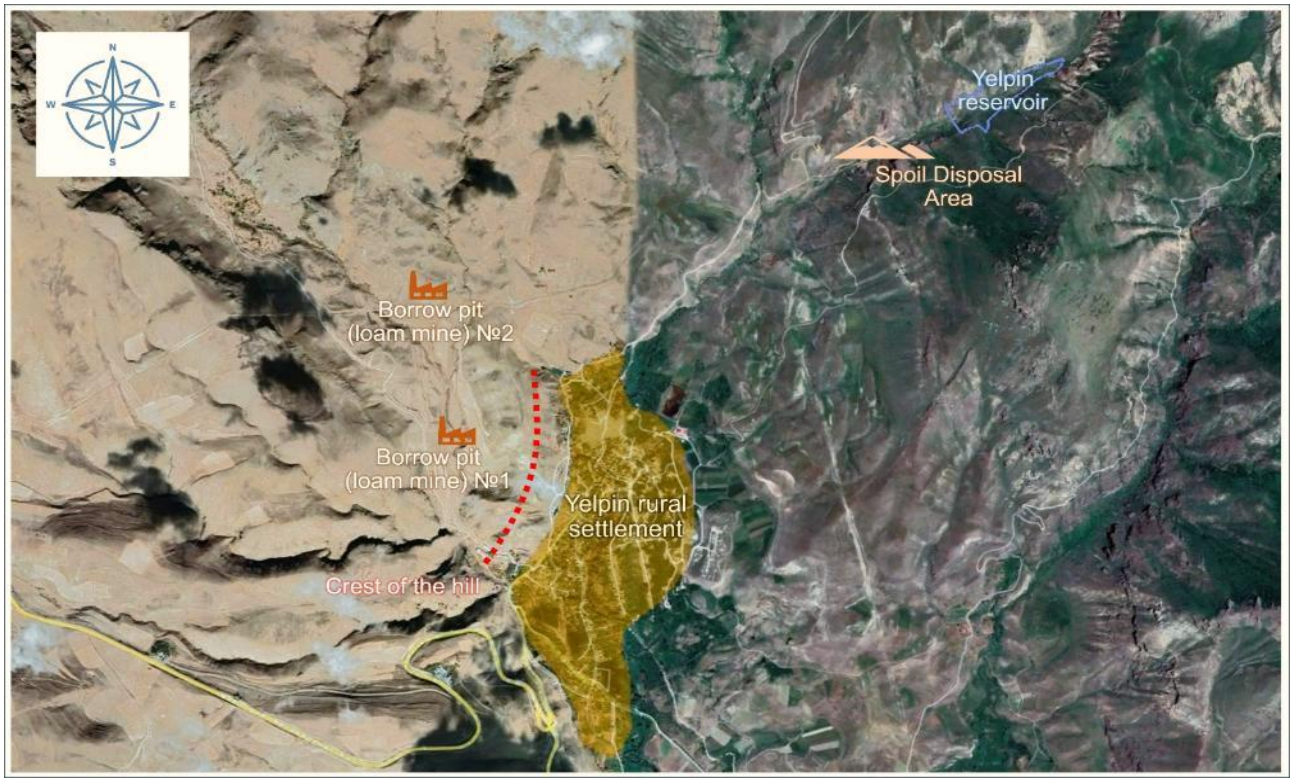
Construction phase

The area designated for the construction of the Yelpin Reservoir is characterized by a typical mountainous landscape with rugged topography, located on the southwestern slopes of the Qarkatar Mountains. The terrain features canyons, is intersected by the Yelpin River and a network of temporary watercourses, and generally slopes to the southwest. The natural landscapes of the Project area are represented by mountain steppes and meadow steppes as well as high-mountain subalpine and alpine zones (**Figure 6-12**).

The planned reservoir area as well as proposed spoil disposal area (located approximately 200-300 m to the southwest of the reservoir dam) are situated at a considerable distance from the Yelpin rural settlement and therefore will not be visible to residents of the village (**Figure 8-1**). It will also not be visible from the regional roads or the M-2 highway.

Borrow pits №1 and №2 will be located at distances of 500 m and 700 m from the Yelpin settlement, hidden behind a hill, and will likewise not be visible from the village (**Figure 8-1**). Only shepherds guiding livestock to and from grazing areas, as well as occasional visitors, may encounter visible landscape changes during the construction phase of the Project. The main aspects of visual disturbance are the construction machinery, heavy vehicles and storage areas of the construction materials and oil products. This impact is unavoidable; however, it is short-term (limited to the construction period).

Table 8-1. Locations of the construction faciities



Prior to the start of construction, the planned reservoir area shall be cleared from all vegetation, including approximately 380 trees. According to calculations conducted in the frames of the national EIA study, around 1300 trees shall be planted as a compensatory measure. This shall be carried out in accordance with the Tree Management Plan, which will be prepared by the construction contractor and implemented during the construction phase.

Operation phase

During the operation phase the landscape of the Project area will experience a permanent transformation due to the formation of the reservoir and the presence of supportive infrastructure. Main impacts include:

1) Permanent change in land cover

The original mountainous terrain, river flow and vegetation will be replaced by a standing water body, altering the natural character and visual identity of the area.

2) New visual elements

The reservoir, dam structure, and supportive facilities will become dominant and permanent features in the landscape.

3) Potential aesthetic value

The reservoir will enhance the visual appeal of the area, depending on how well it integrates with the surrounding environment.

4) Landscape alteration

Natural regeneration and vegetation growth around the reservoir perimeter may gradually soften visual contrasts and help the area blend with the surrounding environment.

Overall, the visual impact during the operation phase is long-term and permanent, but generally more stable and potentially less intrusive than during the construction phase. Effective landscaping and environmental integration can help mitigate negative visual effects.

Over time, the Project's visual impact may even become positive. The irrigation of currently uncultivated land plots using reservoir water is also expected to have an indirect positive effect on the visual amenity of the Project region, by promoting greener and more cultivated landscapes.

As of 2022 (**Section 2.2**, **Table 2-1**), 24 ha of irrigated agricultural land in the Yelpin rural settlement are occupied by vineyards. The implementation of the Project could potentially increase the area covered by vineyards up to 75 ha due to access to irrigation water.

The Project implementation can have positive impact on cultural landscape as well. The vineyards in the Project affected villages are an integral part of the combined rural vernacular and organically evolved landscape, contributing to the perception of Areni as the 'Motherland of Wine' among tourists and visitors. Given the overall touristic appeal of the Areni community, expanding the vineyard area will serve as an additional driver of economic development in the region (see **Sub-section 8.5.2**).

Impact assessment and mitigation measures

Assessment and mitigation of visual impacts during the reservoir construction and operation phases are summarised in **Table 8-13**.

Table 8-13. Summary of visual impact and mitigation measures for the Project construction and operation phases

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Shepards, visitors	Moderate	***Pre-construction phase*** 1) Develop Tree Management (TMP) and obtain approval from the Supervision engineer and the Client. ***Construction phase*** 2) Conduct the planting of 1300 trees in areas agreed upon with the head of Areni Municipality and the administrative head of Yelpin rural settlement, and ensure their aftercare for a period of two years *(aftercare may be carried oud during the reservoir operation phase)*. 3) The proposed types of trees to be planted are: • *Acer campestre* L. • *Amygdalus fenzliana* (Fritsch) Lipsky • *Salix excelsa* S.G. Gmel. • *Salix triandra* L. • *Populus nigra* var. *italica* Duroi • *Elaeagnus angustifolia* L. var. *culta* Sosn.	Low
OPERATION PHASE			
Population, visitors	Significant	Ensure maintenance and aftercare of the planted trees for two years. *Over time, natural regeneration and vegetation growth along the reservoir's perimeter may reduce visual contrasts and facilitate the integration of the area into the surrounding landscape.* *If well integrated with the natural landscape, the reservoir may contribute positively to the area's overall visual character.*	Low Can be positive (after 3-5 years)
Population, landowners, visitors, tourists	Neutral	***Cultural Landscape*** Consult the heads of affected settlements and landowners who will gain access to irrigation water as a result of the project implementation, regarding the design solutions for establishing orchards and vineyards based on modern cultivation and irrigation technologies. *This may transform the organically evolved cultural landscape, characterized by traditional vineyards and orchards, into a designed cultural landscape.*	Positive

8.2.6 Impact on Geology

Construction phase

The main impacts on the geological structure within the Project area are associated with the following construction activities:

1) Vegetation clearance and removal of topsoil,

2) Excavation and earthworks,
3) Soil erossion in the construction site, topsoil temporary and spoil disposal areas.

The impact of vegetation clearance and topsoil removal is minor and is unlikely to generate significant erosion processes as these works deal with the ground surface layer (up to 0.2 m) only.

Excavation and earthworks will involve the movement of a certain amount of soil (including topsoil and excavated subsoil), which may potentially trigger landslides, mass movements, and other erosion processes. Improper practices in the storage and disposal of topsoil and spoil, particularly: (i) excessive height of stockpiles and steep slope gradients, (ii) location of storage sites near watercourses and roads, and (iii) open storage without vegetation cover or protective sheeting, can negatively affect the geology of the Project site and surrounding areas. These aspects and the relevant mitigation measures are discussed in detail in **Section 8.2.8**.

Another potential impact of the Project on geological erosion is the temporary destabilization of disturbed soils due to precipitation and surface runoff. These effects on the soil, along with resulting changes in topography, may create conditions that lead to temporary but harmful erosion and sedimentation. The proposed mitigation measures are presented in **Table 8-14**.

Operation phase

During the operation phase, impacts on the geological conditions of the Project area may result from:

1) Water infiltration from the reservoir body and the dam base, potentially affecting groundwater,
2) Coastal erosion around the entire perimeter of the reservoir due to water encroachment during the initial years of operation.

Water infiltration aspects were considered as part of the Project's engineering-geological study (**Section 2.6**). As part of this study, the infiltration properties of the upper soil layer in the planned reservoir area were analysed. The estimated annual water infiltration from the reservoir body is 1,451,240 m³, which indicates the need for anti-infiltration measures. These measures are described in detail in the Project design documentation. Implementation of the proposed anti-infiltration measures is expected to reduce water infiltration from the reservoir to 7,194 m³/year.

The management and mitigation of the second impact also require technical and technological solutions. Some of these are likely addressed in the Project design documentation; however, additional mitigation measures may be recommended by the Consultant to minimize coastal erosion during the early years of reservoir operation. These measures (**Table 8-14**) can be discussed with the Client and the EPC contractor and incorporated into the Project design documentation, if deemed relevant:

1. **Bioengineering / Vegetative Measures**
   - **Revegetation of reservoir embankment**
   - Planting native grasses, shrubs, and trees to stabilize soil through root systems and reduce erosion,
   - **Use of geotextiles:** Biodegradable or synthetic mats that support vegetation growth while preventing initial soil loss.
2. **Shoreline Stabilization Measures**
   - **Riprap (rock armoring):** Placing layers of large, durable stones along vulnerable shorelines to dissipate wave energy and prevent erosion,
   - **Revetments:** Sloped structures placed on banks to absorb and deflect the energy of incoming water.

3. **Reservoir Operation Management**
   - **Controlled filling rates:** Gradually filling the reservoir to allow shoreline soils to stabilize and minimize sudden saturation that can lead to collapse,
   - **Water level fluctuation control:** Avoiding large, rapid fluctuations in water level during early years to reduce destabilization of new shorelines.
4. **Erosion Monitoring and Adaptive Management**
   - **Regular monitoring:** Using drones, surveys, or satellite imagery to detect early signs of erosion and assess the effectiveness of mitigation measures,
   - **Adaptive management plans:** Revising and enhancing shoreline protection measures based on ongoing monitoring results,
   - **Erosion-sensitive zoning:** Identifying high-risk areas and applying stricter protection or engineering controls there.

Impact assessment and mitigation measures

Assessment and mitigation of impacts on geological conditions during the reservoir construction and operation phases are summarised in **Table 8-14**.

Table 8-14. Summary of geological impacts and mitigation measures for the Project construction and operation phases

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Soil resources	Moderate	1) Diversion ditches or berms: redirect surface runoff away from disturbed areas, 2) Proper grading: ensures slopes are stable and directs water flow in controlled paths, 3) Slope breakers: break long slopes into smaller segments to reduce erosion potential, 4) Phased construction: limits the area of exposed soil at any one time, 5) Avoid earthworks during rainy seasons, where feasible, to reduce erosion risk.	Low
Monitoring: - Regular site inspections: Especially after rainfall, to check for erosion signs and repair damaged controls, - Maintenance of sediment control measures: Ensure ditches, berms and drains are functioning properly.			
OPERATION PHASE			
Soil resources	Moderate	1) Bioengineering / Vegetative Measures - Planting native grasses, shrubs, and trees to stabilize soil through root systems and reduce erosion, - Biodegradable or synthetic mats that support vegetation growth while preventing initial soil loss. 2) Shoreline Stabilization Measures - Placing layers of large, durable stones along vulnerable shorelines to dissipate wave energy and prevent erosion, - Sloped structures placed on banks to absorb and deflect the energy of incoming water.	Low Negligible (after 3-5 years of operation)

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		3) Reservoir Operation Management - Gradually filling the reservoir to allow shoreline soils to stabilize and minimize sudden saturation that can lead to collapse, - Avoiding large, rapid fluctuations in water level during early years to reduce destabilization of new shorelines. 4) Erosion Monitoring and Adaptive Management	
Monitoring: - Using drones, surveys, or satellite imagery to detect early signs of erosion and assess the effectiveness of mitigation measures, - Revising and enhancing shoreline protection measures based on ongoing monitoring results, - Identifying high-risk areas and applying stricter protection or engineering controls there.			

8.2.7 Impact on Water Resources

The potential impacts of the Project on surface water resources during the construction and operation phases are described in **Subsection 8.2.7.1-8.2.7.3**.

8.2.7.1 Water Quality / Water Contamination

Construction phase

The results of water quality analysis of the Yelpin River, compared with the environmental norms set by RA Government Decree №75-N, are presented in **Section 6.1.5** of this ESIA report. The analysis shows that, except for the concentrations of suspended solids and sulphates, the water quality may be categorised as 'excellent' or 'good'. In terms of suspended solids and sulphate content, however, the water quality is classified as 'poor'. The water samples were taken in June, when snowmelt, mixed with soil particles, was feeding the Yelpin River. This phenomenon may explain the relatively high content of suspended solids in the samples.

During the construction phase, contamination of the Yelpin River is expected due to the deposition of dust and exhaust gas emissions (from construction machinery and heavy trucks), spills of hazardous materials, and improper management of storage areas. Surface water quality may also deteriorate as a result of soil erosion and runoff caused by rainfall or snowmelt.

Earthworks, blasting, and improper transportation or storage of topsoil, spoil, friable construction materials, and oil products, as well as loading/unloading operations, can lead to pollutants partially settling into nearby surface watercourses and/or potentially infiltrating into groundwater, thereby degrading overall water quality. Additionally, potential spills or leakages of oil and lubricants from construction machinery may be carried by runoff and discharged into downstream surface waters.

The removal of topsoil, excavation, and other earthworks will disturb the soil and vegetation cover within the Project area, potentially triggering or intensifying soil erosion. This erosion may cause soil to migrate into waterways via surface runoff, increasing turbidity and silting of water bodies, ultimately leading to further deterioration in surface water quality.

In can be concluded that the implementation of mitigation measures presented in **Sections 8.2.4**, **8.2.6** and **8.2.8**, supplemented by the measures proposed in **Table 8-15** will significantly minimise the impact of the construction works on water quality.

Operation phase

During the operation phase, the water quality of the Yelpin River upstream of the reservoir is not expected to change, as the reservoir operation will not cause contamination of upstream watercourses.

Within the reservoir, several natural processes contribute to the self-purification of water. These include sedimentation of suspended solids, adsorption and precipitation of nutrients and metals, microbial degradation of organic matter, and nutrient uptake by aquatic vegetation. Together, these ongoing processes help to maintain and improve water quality, supporting the long-term sustainability of irrigation activities. As a result, the quality of water downstream of the reservoir, including both environmental flow and irrigation water, is expected to improve due to the implementation of the Project.

However, one important precondition must be taken into account: soil erosion along the perimeter (shoreline) of the reservoir, particularly during the early years of operation, as well as stormwater and agricultural runoff into the Yelpin River and reservoir must be minimized (see **Section 8.2.6**). In addition, any manmade inflows from domestic or industrial activities into the reservoir must be eliminated.

8.2.7.2 Changes to Hydrological Regime

The following parameters are characterizing the hydrological regime of the reservoir:

1) Flow Regulation

Before the construction the river flows naturally with seasonal variations, high flows during snowmelt or rainy seasons, and low flows during dry periods. After construction the reservoir regulates flow, reducing peak discharges during floods and augmenting flow during dry periods. Therefore, the regulation of the water flow may benefit irrigation, but affect the natural water flow seasonal fluctuations downstream.

2) Alteration of Flow Timing

Reservoir operation often changes the timing of downstream flows, releasing water based on demand rather than natural cycles. This can shift peak flows from spring (due to snowmelt) to summer or autumn (due to irrigation needs), disrupting ecological processes.

3) Reduction in Peak Flows and Flood Frequency

Controlled releases from the reservoir reduce peak flood events downstream. This can lower the risk of flood damage but also impact floodplain ecosystems that depend on periodic flooding for nutrient cycling and habitat renewal.

4) Evaporation Losses

Large surface areas of reservoirs increase evaporation, especially in arid or semi-arid climates. This can lead to reduced downstream water availability compared to pre-reservoir conditions.

5) Environmental Flow Modification

Without proper planning, minimum environmental flows downstream may not be maintained. Therefore, environmental flow requirements must be included in the reservoir operation plan to support aquatic ecosystems and community needs.

In can be concluded that particularly the operation phase of the Project will significantly alter the hydrological regime of the Yelpin River. These changes include the regulation of natural flow variability, reduction of peak discharges, changes in flow timing, and sediment retention. While these changes support improved water availability for irrigation, they may also impact downstream

ecosystems and groundwater dynamics. To mitigate adverse effects, the implementation of irrigation water and environmental flow releases management plan is recommended.

8.2.7.3 Water losses

Construction phase

No changes in water losses compared to the baseline situation are expected during the construction phase.

Operation phase

Water losses can occur from the reservoir body, the dam, the water irrigation outlet, and the main pipeline. Calculations of water infiltration from the reservoir body and the dam, along with proposed anti-infiltration, are presented in the Project design document and summarised in **Section 2.6** of this ESIA report. It can be assumed that the proposed mitigation measures will reduce water infiltration rate to the acceptable level (7,194 m³/year).

The irrigation outlet is constructed using steel pipes with a diameter of Ø530 mm and a length of 170 m within the gallery, continuing with a Ø500 mm, 1,870 m-long polyethylene irrigation pipeline. Therefore, water losses from the irrigation outlet and main pipeline are unlikely to occur, except in cases of incidents or technological breakdowns, which would require regular technical maintenance of the reservoir's supporting infrastructure in accordance with the Reservoir Operation and Maintenance Plan (see also **Section 8.4**).

Impact assessment and mitigation measures

Assessment and mitigation of impacts on water resources during the reservoir construction and operation phases are summarised in **Table 8-15**.

Table 8-15. Summary of impacts on water resources and mitigation measures for the Project construction and operation phases

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Water resources	Moderate	***Construction phase - Water Contamination*** 1) Construct intermediate collection pools between runoff-generating surfaces and downstream watercourses to regulate flow to water bodies. These pools will allow soil particles to settle at the bottom, thereby reducing the turbidity of the runoff, 2) Limit excavation and other earthworks near the Yelpin River during the rainy season, 3) Prohibit the discharge of any untreated wastewater effluent into surface water bodies, 4) Where practical, construct local perimeter drains around working areas (e.g., storage and parking areas) to collect suspended runoff and prevent its discharge into surface water resources.	Low
Monitoring: According to the Air, water and soil quality monitoring plan			
OPERATION PHASE			
Water resources	Low	***Operation phase - Water Contamination*** 1) Minimize potential stormwater and agricultural runoff release to the Yelpin River,	Positive

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		2) Eliminate manmade inflows from domestic or industrial activities into the reservoir.	
Water resources, irrigation water users, ecosystems downstream the reservoir	Significant	***Pre-operation phase - Hydrological Regime*** Develop irrigation water and environmental flow releases management plan to: - Ensure reliable and efficient delivery of irrigation water to agricultural areas, - Maintain minimum environmental flows to support the health of downstream aquatic and riparian ecosystems, - Prevent over-extraction and degradation of water resources, - Comply with national water use regulations and environmental protection standards. ***Operation phase - Hydrological Regime*** 1) Review the irrigation water and environmental flow releases management plan annually, or after major hydrological events, to incorporate new data, regulatory changes, and operational experience, 2) In the event of low reservoir levels or critical drought conditions, implement a prioritization protocol that protects environmental flows up to a predefined minimum threshold before allocating water for irrigation.	From moderate to low
Monitoring: - Real-time monitoring to adjust schedules based on demand and supply conditions, - Monthly reports on water releases for irrigation and environmental purposes must be submitted to the Water Committee, - Regular ecological monitoring downstream to evaluate the adequacy of flow for habitat maintenance.			
Water resources, irrigation water users,	Low	***Pre-operation phase - Water losses*** Develop Reservoir Operation and Maintenance Plan, ***Operation phase - Water losses*** Carry out technical maintenance of the reservoir's supporting infrastructure to eliminate incidents and breakdown in accordance with the Reservoir Maintenance Plan.	Negligible

8.2.8 Impact on Soil

8.2.8.1 Topsoil Management

Construction phase

Construction works will begin with vegetation clearance and topsoil removal. According to the Project design study, approximately 1,500 m³ of topsoil will be stripped and removed from the construction site. Topsoil may also be removed from areas designated as borrow pits.

If not properly managed, the removed topsoil can be damaged through mixing with subsoil (spoil) and/or other materials. Additionally, the topsoil may lose its physical and biological properties due to

compaction by heavy machinery both within and outside the construction site. Losses may also occur during transportation to temporary stockpile areas, as well as through wind and water erosion while in storage. Furthermore, the quality of the topsoil may deteriorate if the stockpiles are not properly maintained during the storage period.

According to the national legislation, topsoil management shall be regulated by the *Procedure for Topsoil Use*, approved by the RA Government Decree №1396-N, and the *Requirements for Determining Topsoil Stripping Norms and for the Preservation and Use of Stripped Topsoil*, approved by the RA Government Decree №1404-N. These documents define:

- Organizational aspects, including the procedure for permit issuance for soil removal, transportation and storage,
- Technical aspects, such as the prescribed norms (thickness) of topsoil to be stripped and removed,
- Technological and environmental aspects, including conditions and specifications for topsoil storage, preservation and use.

Topsoil removal from the construction site, its transportation, storage, and use operations should be carried out by the construction contractor in accordance with the requirements of the above-mentioned documents and the supplementary mitigation measures proposed in **Table 8-17**. The topsoil will be stored outside the construction site and will later be used for landscaping (**Section 8.2.5**). The construction contractor also shall develop and implement a Topsoil Management Plan (TsMP).

Operation phase

No impacts on topsoil are expected during the Project operation phase.

8.2.8.2 Soil Excavation and Disposal

Construction phase

According to the RA Law on Waste, and in particular the *List of Wastes Generated in the Republic of Armenia*, approved by Order No. 342-N of the RA Minister of Environment, excavated material (subsoil or spoil) is classified as non-hazardous waste. Therefore, the main impacts related to soil excavation and disposal in the designated spoil disposal areas are discussed in **Section 8.2.9**.

Operation phase

No impacts associated with soil excavation and disposal are anticipated during the reservoir operation phase.

8.2.8.3 Management of Hazardous Materials

Construction phase

The list of hazardous materials that may potentially be used during the construction of the reservoir and its infrastructure, along with their associated hazards, is presented in **Table 8-16**.

Table 8-16. Hazardous materials to be used during the reservoir construction, their uses and associated hazards

№	Materials	Use	Hazards
1	Fuels (diesel, petrol)	Powering construction machinery, generators, and heavy trucks.	Flammable, risk of spills leading to soil and water contamination.

№	Materials	Use	Hazards
2	Lubricants and oils	Machinery operation and maintenance (e.g., excavators, loaders, vehicles).	Toxic to aquatic life, potential for soil contamination.
3	Concrete and additives	Enhancing performance of concrete (e.g., accelerators, retarders).	May contain hazardous chemicals (e.g., formates, chlorides), skin and eye irritants.
4	Paints and coatings	Corrosion protection of metal structures, tanks, and pipelines.	May contain solvents and heavy metals; volatile organic compounds (VOCs).
5	Explosives	Blasting during reservoir construction.	High risk if not properly managed, requires strict storage and usage protocols.

Leakages and accidental spills of hazardous materials, along with their management measures, are discussed in **Sub-section 8.2.8.4**. The impacts of hazardous materials on health and safety, as well as fire risks, are outlined in **Section 8.3.6**. Before the commencement of construction works, the construction contractor shall develop a Hazardous Materials Management Plan (HMMP) and Blasting Safety Management Plan (BSMP). Additional mitigation measures are presented in **Table 8-17**.

Operation phase

Only a few types of hazardous materials, and in small quantities, will be used during the maintenance of the reservoir and its infrastructure. Their potential impacts are negligible; therefore, they do not require mitigation measures.

8.2.8.4 Soil Contamination

Construction phase

Accidental spills of friable materials, leakages of oil, fuel, and other liquid chemicals during the field works within the construction site as well as their transportation, storage, and use, may inevitably occur and lead to soil contamination. Improper waste management can also result in littering and further soil pollution (see **Section 8.2.9**). Therefore, the handling of hazardous materials, including their transportation, storage, and use, must be carefully managed.

The use of old or technically outdated construction machinery and heavy trucks for the Project shall be strictly prohibited. Friable materials shall be transported using trucks fitted with waterproof canvas covers. Oil products and chemicals must be stored separately in clearly marked drums or tanks, placed on secondary containment systems or spill trays. During refuelling or the transfer of oil, fuel, or other chemicals, protective berms shall be used (**Figure 8-2**). Excavated spoil and topsoil shall be stored and managed in accordance with the procedures outlined in **Subsection 8.2.8.1**.

Facilities designated for the storage of oil and chemicals, as well as heavy trucks used to transport such materials, shall be equipped with appropriate spill kits (**Figure 8-2**). Construction and other friable materials shall be stored in separately allocated, fenced areas covered with waterproof sheeting. In addition, it is recommended to regularly monitor soil quality near potentially contaminated areas, in accordance with the Air, Water, and Soil Quality Monitoring Plan. All of the specified measures, along with others, shall be consolidated into the Spill Prevention and Management Plan (SPMP).

Figure 8-2. Recommended tools and kits for prevention or mitigation of spillages and leakages

a) Secondary containments or trays for storage and refilling of oil products and chemicals

b) Spill kits for oil products and chemicals

Provided that the measures recommended in **Table 8-17** are implemented, the Project's impact on soil contamination during the construction phase can be assessed as low.

Operation phase

Some small-scale accidental spills of oil products and friable materials can be expected during routine maintenance of the reservoir body, dam, and supporting infrastructure, as well as during regular cleaning of the irrigation channel. These leaks (spills) can be prevented or minimised through the implementation of some administrative and organizational measures, such as outsourcing of the maintenance works to the contractors equipped with modern and technically serviced equipment.

Impact assessment and mitigation measures

Assessment and mitigation of impacts on soil during the reservoir construction and operation phases are summarised in **Table 8-17**.

Table 8-17. Summary of soil impacts and mitigation measures for the Project construction and operation phases

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Soil and water resources, flora and fauna	Moderate	***Pre-construction phase*** 1) Develop Topsoil Management Plan (TsMP) and obtain approval from the Supervising engineer, 2) Obtain required permit for topsoil transportation and storage operations, 3) Develop Hazardous Materials Management Plan (HMMP) and obtain approval from the Supervising engineer, 4) Develop Blasting Safety Management Plan (BSMP) and obtain approval from the Supervising engineer, 5) Develop Spill Prevention and Management Plan (SPMP) and obtain approval from the Supervising engineer and the Client.	Low

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		Construction phase - Topsoil management 1) Carry out the removal, transportation, storage, and use of topsoil in accordance with RA Government Decrees №1396-N and №1404-N, 2) Store topsoil separately to prevent mixing with subsoil, maintaining it in a condition that preserves the natural seed bank, until construction works are completed, 3) Locate topsoil stockpiles at least 50 m away from watercourses to prevent water siltation, 4) Avoid placing topsoil stockpiles near planned excavation areas, 5) Limit the height of stockpiles to a maximum of 3 m, and ensure the slope gradient does not exceed 25º, 6) Clearly label all topsoil stockpiles to ensure easy identification, 7) Cover topsoil stockpiles to prevent soil erosion, where natural revegetation has not occurred, 8) Fence off topsoil stockpiles to prevent unauthorized access and compaction by Project vehicles, 9) Reuse the stored topsoil for landscaping the disturbed areas and/or tree planting within the Project area after the completion of reservoir and dam construction. ***Construction phase - Hazardous materials*** 1) Store all hazardous materials in clearly labeled, secure, and ventilated areas, 2) Hazardous materials containers to be clearly labelled according to contents and hazards, 3) Equip sites with spill response kits and train workers on emergency response, 4) Maintain Material Safety Data Sheets (MSDS) for all hazardous materials on-site, 5) Incompatible hazardous materials must not be stored together, 6) Hazardous materials storage areas will be equipped with eye wash kits and fire extinguishers, 7) Use appropriate PPE. ***Construction phase - Soil contamination*** 1) Transport friable materials using trucks equipped with waterproof canvas covers, 2) Store construction and other friable materials in separately designated areas that are fenced and covered with waterproof tents, 3) Store oil products and chemicals separately, in special drums or tanks placed on secondary containment systems or trays (110% of the volume of the container), 4) Carry out refueling of oil, fuel, and other chemicals only on specially prepared protective berms,	

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		5) Equip storage facilities for oil and chemicals, as well as heavy trucks transporting these materials, with appropriate spill kits, 6) Immediately stop work in the event of uncontrolled spillage of fuel, engine oil, or chemicals. Remediate contaminated soil by removing the affected layer (to be treated as hazardous waste) and replacing it with clean soil, 7) Train all staff on the safe execution of construction works and on response procedures for environmental incidents such as spills and leaks, 8) Ensure spoil piles do not exceed 3 m in height, and maintain slope gradients not exceeding 25º. Manage spoil piles to prevent erosion and runoff.	
Monitoring: According to the Air, water and soil quality monitoring plan			
OPERATION PHASE			
Soil and water resources, flora and fauna	Low	Outsource the maintenance of the operated reservoirs to the contractors equipped with modern and technically serviced equipment.	Negligible

8.2.9 Waste Generation and Management

Construction phase

Typically, the construction of the reservoir, dam, and associated components is accompanied by the generation of industrial and household wastes, including:

- Excavated material (spoil) from excavation and other earthworks,
- Construction waste (residues of concrete, sand, gravel, used wood materials, etc.),
- Used oil and lubricants,
- Oily rags and soil contaminated with oil products,
- Used tires,
- Used lead-acid batteries,
- Ferrous and non-ferrous metal scraps, welding electrode slag,
- Empty containers of fuel, oil products and chemicals,
- Used packaging materials (cardboard and paper),
- Household waste.

Approximately 400,000 m³ of spoil material will be generated during excavation and earthworks, of which around 30,000 m³ will be used as backfill material for the dam. The remaining spoil (370,000 m^3) will be disposed of at the Spoil Disposal Area (SDA) (see **Figure 2-6**) tentatively proposed in the national EIA report. However, the proposed site must be agreed upon with the affected Areni municipality, and a Spoil Disposal Management Plan (SDMP) for the identified area must be developed and approved prior to the start of construction.

There are no information relating to the volumes of household waste to be generated during the construction provided in the design document.

According to the World Bank Project - *Armenia SWM Sector Assessment and Reform Plan, Sector Assessment Report* (2024), the current household waste generation rate is 219 kg/capita/year (or

18.25 kg/capita/month) for Armenian settlements with populations under 40,000 residents. Taking into account that 104 workers (see **Section 2.7.7**) will be engaged in construction activities, it can be assumed that the monthly amount of household waste will be 18.25 × 104 = 1,898 kg (or approximately 1.9 tonnes). Over the entire reservoir construction period (34 months × 1.9 tonnes), around 64.6 tonnes of household waste will be generated. The volumes of other types of waste remain unknown.

The types, hazard classes and codes of industrial and household waste to be generated during the construction phase as well as recommended waste management actions as per waste hierarchy, are presented in **Table 8-18**.

Table 8-18. Types, hazard classes and codes of wastes generated during the construction works

№	Types of waste	Hazard Class	Hazard Code[132]	Recommended management actions
1	Excavated material (spoil)	V (non-hazardous)	31401101 01 00 5	Use as a backfill material, the residual part will be disposed of in the SDA
2	Construction waste	IV	91200601 01 00 4	Use as a backfill material, the residual part will be disposed of in the landfill
3	Used oil and lubricants: - Industrial oil - Engine oil - Hydraulic oil - Diesel oil	III	54100205 02 03 3 54100201 02 03 3 54100213 02 03 3 54100203 02 03 3	Store under special conditions and transfer to the licensed companies specialised in oil refining
4	Oily rags	III	58200600 01 01 4	Store under special conditions and transfer to the licensed companies for the treatment
5	Soil contaminated with oil products	III	31402303 01 03 4	
6	Used tires	IV	57500200 13 00 4	Periodically transfer to the licensed companies for the treatment
7	Used lead-acid batteries	II	92110100 13 01 2	Store under special conditions and transfer to licensed companies for the recycling
8	Ferrous metal scrap, empty metallic containers of fuel, oil products and chemicals	IV	35131100 01 00 4	Can be periodically transferred to specialised companies for the recycling
9	Welding electrode slag	IV	31404800 01 99 4	
10	Non-ferrous metal scrap: - Copper scrap - Aluminium scrap	III V (non-hazardous)	35310301 01 01 3 35310105 01 99 5	Can be transferred to specialised companies for the recycling
11	Used packaging materials: - Cardboard - Paper	V (non-hazardous)	18710202 01 00 5 18710300 01 00 5	Can be transferred to specialised companies for the recycling
12	Household waste	IV	91200400 01 00 4	Shall be disposed of in the landfill

[132]According to the list of waste generated in the Republic of Armenia (https://www.arlis.am/hy/acts/100155)

Proper management of the waste streams to be generated during the construction phase will be ensured through a detailed Waste Management Plan (WMP), to be prepared by the appointed construction contractor prior to the start of construction works. The WMP as a minimum shall include:

- Waste storage locations, containers and conditions,
- Environmental, fire, health and safety of the waste storage facilities,
- Actions to be implemented to ensure the provisions of waste management hierarchy (prevention, minimization, reuse, recycling, energy recovery and disposal, see also Table **8-18**),
- Safe transportation of waste,
- Response to the accidents (leakages of liquid waste, spills of friable materials, etc.) (see also **Section 8.2.10**),
- Requirements and responsibility of the engaged personnel,
- Waste inventory and records, etc.

All required permits and normative documents regulating waste management in Armenia shall be obtained by the construction contractor prior to the commencement of construction. These documents shall include, at a minimum: (i) hazardous waste passports, (ii) waste generation norms, and their disposal limits, (iii) waste generation register, etc., (iv) waste primary registration log-books, etc.

Operation phase

During the Yelpin reservoir operation phase, the main types of waste generated will be associated with the maintenance of the reservoir, dam, and supporting infrastructure (e.g., irrigation channels, spillways, etc.), including:

- Debris and general litter,
- Metal scraps from repair works,
- Used oil and lubricants,
- Sludge (sediment) resulting from dredging operations,
- Household waste (including small quantities of oily rags, which can be collected together with household waste due to their minimal volume).

Currently, it is unclear whether the volume of sediment accumulated in the reservoir will periodically require removal from the reservoir bottom through dredging operations. However, if required, disposal at a landfill or the use of dredged sediment as fertilizer shall be considered.

Although only small volumes of waste are expected to be generated from maintenance operations, they should be properly managed by the operator of the Yelpin reservoir, most likely "Jrar" CJSC under the MTAI. Taking into account that "Jrar" CJSC also manages other first and second category reservoirs[133] in Armenia, the company should have a corporate Waste Management Plan (WMP) in place for the maintenance of all reservoirs under its control.

All waste-related permits required for the construction phase are also applicable to the operation phase and must, therefore, be obtained by "Jrar" CJSC. These provisions will also be included in the Project's Environmental and Social Action Plan (ESAP).

Impact assessment and mitigation measures

[133] *Armenia Water Reservoirs - Technical, Economic and Green Due Diligence Gap Analysis, Draft Final Report*, 2023-2024, Ove Arup & Partners

Assessment and mitigation of the reservoir construction and operation related waste impacts are summarised in Table 8-19.

Table 8-19. Summary of waste-related impact assessment and mitigation measures for the construction and operation phases

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Workers, nearby population, soil and water resources, flora and fauna	Moderate	***Pre-construction phase - Waste management*** 1) Obtain all required permits and regulatory documents regulating waste management in Armenia, as a minimum including: - hazardous waste passports, - waste generation norms, and their disposal limits, - waste generation register, etc., - waste primary registration log-books. 2) Prepare and put into effect the Waste Management Plan (WMP) for the Project, 3) Obtain agreement from Areni Municipality for the use of the selected Spoil Disposal Area (SDA), or propose an alternative SDA, 4) Develop Spoil Disposal Management Plan (SDMP) for the selected SDA and obtain approval from the Supervision engineer and the Client. ***Construction phase - General*** 1) Train the workers engaged in waste management on provisions of the WMP, 2) Apply waste hierarchy approach (prevention, minimization, reuse, recycling, energy recovery, disposal) while implementing the construction activities, 3) Elaborate and implement waste handling procedures for the construction operations, 4) Equip the construction site and construction camps with the waste separate collection / storage containers and locations, 5) Furnish the waste storage / collection facilities with fences, fire extinguishers, secondary containment trays, oil and chemicals spill clean-up kits, etc., 6) Store liquid waste leak-proof, sealed containers. 7) Sign contracts with the licensed waste handling (recycling, treatment, disposal) companies to hand them over the generated wastes. ***Construction phase - Waste transportation*** 1) Transport all types of wastes using adequate, sealed and covered trucks to avoid the leakage or dispersal of the waste on roads and surroundings, 2) Restrict to abandon the wastes on the route and/or to dispose them in unauthorized locations, 3) The routes involving the least risk will be chosen for the transportation from the area of its generation to its storage and recycling / disposal area,	Low

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		4) Instruct the waste truck drivers on waste transportation safety rules. ***Construction phase - Household waste management*** 1) Equip the construction site with household collection containers / bins, 2) Sign a contract with the communal company for the regular removal of household waste from the construction site and construction camps.	
Workers of the construction contractor	Moderate	In addition to the measures listed above: enforce the use of PPE and in particular, the protective clothes, shoes, gloves, respirator / masks for the workers dealing with the waste.	Low
Monitoring: According to the Waste Management Plan and Spoil Disposal Management Plan			
OPERATION PHASE			
Workers of the reservoir operator	Low	1) Obtain all required permits and normative documents relevant to the operation of reservoirs in Armenia, as required by local waste-related legislation (can be done at the corporate level), 2) Develop and implement WMP for the operation and maintenance of the reservoir (can be done at the corporate level), 3) Apply waste hierarchy approach (prevention, minimization, reuse, recycling, energy recovery, disposal) for the generated waste, 4) Equip the site with waste collection and storage containers and areas, 5) Sign contracts with the licensed waste handling (recycling, treatment, disposal) companies to hand them over the generated wastes, 6) Sign a contract with the communal company for the regular removal of household waste from the reservoir site.	Negligible
Monitoring: According to the operation phase Waste Management Plan			

8.2.10 Noise and Vibration Impact

Construction phase

The main sources of noise and vibration during the construction stage are:

1) Operation of construction machinery within the construction site,
2) Movement of heavy trucks along community and regional roads, as well as within the construction site,
3) Operation of the construction camps and borrow pits,
4) Noise-generating activities such as loading and unloading of soil and construction materials.

The dominant source of noise from most construction equipment is the engine, which typically runs on diesel and may lack adequate muffling. However, in some cases, noise generated by construction processes may exceed that produced by the equipment itself. Noise levels during construction will vary depending on the specific activities, schedule, and combination of equipment in use.

There are no residential areas located in the close vicinity of the Project site; therefore, construction noise and vibration are not expected to affect the local population. However, minor noise impacts on the residents of Yelpin rural settlement may occur when heavy trucks transport construction and other materials along community roads to the Project site and construction camps. The construction contractor's staff may be exposed to noise and vibration during work activities. Additionally, construction noise may affect local wildlife and cattle that may graze in the areas surrounding the Project site.

It is evident that the typical noise levels emitted by construction equipment exceed the national hygienic standard of 80 dBA. Therefore, several mitigation measures, including the provision of Personal Protective Equipment ('PPE') for workers, should be implemented (**Table 8-20**). These measures, along with other mitigation efforts, will help reduce noise exposure for workers, shepherds leading cattle to grazing areas, and residents of the Yelpin settlement.

The analysis of similar projects and the Consultant's experience indicate that construction-related vibration impacts are localized and typically limited to within 40 m of the source. Considering that the nearest residential houses and commercial facilities are located in Yelpin rural settlement, at a considerable distance from the Project site, it can be concluded that there will be no vibration impacts on sensitive receptors. Furthermore, construction vibrations will not affect the seismic stability of existing buildings and structures. Only operators of construction equipment and machinery may be exposed to vibration. Therefore, appropriate PPE should be provided to the relevant workers.

Operation phase

No significant noise or vibration exposure is expected from the operation of the reservoir. Only periodic maintenance activities may generate noise, which is anticipated to be negligible.

Impact assessment and mitigation measures

The assessment and mitigation of noise and vibration impacts during the construction and operation phases of the reservoir are summarised in **Table 8-20**.

Table 8-20. Summary of noise and vibration impacts and mitigation measures for the Project construction and operation phases

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Workers, population of Yelpin village, shepherds	Moderate *(in case of heavy trucks movement)* Low *(in case of operation of construction machinery)*	1) Keep all diesel-powered vehicles and equipment (such as generators and air compressors) at a high level of maintenance. This will particularly include the regular inspection and, if necessary, replacement of intake and exhaust silencers, 2) Machinery/vehicles that are used intermittently will be shut down or throttled back during periods when not in use, 3) Whenever possible: enclose noisy equipment, restrict non-stop operation of noisy equipment, avoid simultaneous operation of noise generating equipment, 4) Avoid unnecessary idling times, 5) Minimising the need for equipment to reverse. This will reduce the frequency at which disturbing but necessary reverse warnings will occur,	Low

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		6) Avoid unnecessary horn hooting from the used construction machinery, 7) Limit truck speeds - not to exceed 40 km/h, when driving through local community roads, 8) Inform Yelpin settlement of the schedule and duration of construction activities, particularly where these are likely to generate high noise levels and before the blasting works, 9) Movement of heavy trucks along the communal roads will be strictly prohibited between 10 PM and 6 AM near residential areas.	
Workers of construction company	Moderate	In addition to the measures listed above: 1) Enforce the use of PPE and in particular, the protective devices capable to reduce the sound level at the ear to acceptable levels, 2) Provide employees engaged in 'noisy' operations with additional 15 minutes break per 2 hours.	Low
Monitoring: According to the noise, vibration and blasting monitoring plan			

8.2.11 Traffic Impacts

Construction phase

Access to the planned reservoir area passes through Yelpin village. The road within the settlement is partially asphalt-paved; however, as it approaches the project site, it transitions into an earthen road. The construction activities will significantly increase the movement of heavy trucks due to the transportation of:

- Approximately 400,000 m^3 of spoil materials to the SDA,
- Around 1,500 m^3 of topsoil to the designated temporary storage area,
- Around 300,000 m^3 of limestone from the borrow pits to the construction site,
- Construction materials to the construction site,
- Oil products and chemicals to the construction site,
- Industrial and houshold waste to the landfills or specialised companies, etc.

The communal roads of Yelpin village will also be used to transport workers between the construction camps and the construction site. These roads will also be used to deliver construction machinery to the site.

The Project design document envisions construction of the following access roads:

- An embankment road designed along the water main pipeline,
- Earthen roads connecting the borrow-pits to the construction site,
- An existing earthen road, 2 km long and 6 m wide, leading to the construction site,
- A newly designed earthen road, 317 m long and 6.7 m wide, leading to the dam crest.

The implementation of the Project will have a significant impact on the traffic intensity within the rural settlement of Yelpin. However, the construction of the access roads described above will serve as bypass routes for the transportation of materials, thereby reducing the negative traffic impacts associated with the Project. The increase in traffic intensity is also connected with higher noise

levels; therefore, the mitigation measures proposed in **Section 8.2.10** are partially applicable to traffic-related impacts.

The construction contractor shall develop a Traffic Management Plan, that will be approved by the Supervision engineer and Client as well as relevant regional authorities and road police.

Operation phase

No significant traffic impacts are expected during the reservoir operation phase.

Impact assessment and mitigation measures

The assessment and mitigation of traffic impacts during the construction and operation phases of the reservoir are summarised in **Table 8-21**.

Table 8-21. Summary of traffic impacts and mitigation measures for the Project construction and operation phases

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Population of Yelpin village	Significant	***Pre-construction phase*** 1) Develop a Traffic Management Plan, that will be approved by the Supervision engineer as well as relevant regional authorities and road police, 2) Prior to the commencement of construction works, the condition of community roads to be used for project purposes shall be jointly inspected and documented with the participation of representatives from the affected settlements. In the event that significant damage is caused by the Project, the Construction Contractor shall restore the roads to at least their pre-construction condition. *The TMP shall also cover measures outlined in Sections 8.3.2, 8.3.5 and 8.5.2.* ***Construction phase*** 3) Construct the access roads as envisioned in the Project design document, 4) Implement the Traffic Management Plan, 5) Train drivers of heavy vehicles on the key requirements of the Traffic Management Plan, 6) Inform local residents of anticipated construction traffic impacts at least two weeks prior to the start of construction, 7) Equip roads used by Project vehicles with appropriate road safety signs and posters, 8) Provide additional crossings for cattle where necessary.	Low

8.2.12 Impact on Biodiversity

This sub-section contains an assessment of the potential impacts on biodiversity due to the Project-related construction and operations activities.

Impacts of the Project will occur within footprint areas (dam, reservoir, extra spoil storage area) (see Figure 2.6), temporary roads and sites (construction roads, camps) and within a potential zone of

influence of 500 m around the footprint areas. It is noted though that noise impact from blasting can extend up to several kilometers around the dam location and along the Yelpin River valley.

As the baseline biodiversity studies embraced the footprint areas of the dam and reservoir only, the current assessment covers biodiversity located at these areas as well as the 500 m area around them. Potential consequences of the blasting are assessed too, to the extent possible.

The impacts are considered and assessed taking into account EBRD PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (2019) and Guidance Notes to the EBRD PR 6 (March, 2023), as well as applicable RA national legislation.

8.2.12.1 Impacts of the Project

As presented in the Baseline section, the Project will be implemented in an area of high biodiversity where valued (priority) habitats and species were identified.

The impacts of the Project on biodiversity will occur during the both phases - construction and operation. The construction phase embraces the dam building and reservoir filling. The methodology of impact assessment, including identification of impact characteristics and significance matrix are detailed in **Section 5** "ESIA Methodology and Approach". Due to different perception of the species to different impacts, sensitivity of the species (receptors) was taken into account during assessment.

Potential impacts on biodiversity (including priority biodiversity features and critical habitats) derive from activities during:

1. Construction phase and include:
    - Destruction (loss) of habitats (vegetation clearance, excavation, top-soil removal and transportation, reservoir filling),
    - Flora species loss (vegetation clearance, including trees cutting, excavation, top-soil removal and its transportation, reservoir filling),
    - Disturbance of fauna species by blasting, noise, vibration and light pollution (construction machinery, traffic, lighting of the building area),
    - Destruction of sedentary animals' habitats and a risk of their death (excavation, top-soil removal and its transportation, reservoir filling),
    - Loss of foraging habitats for medium and large mammals (excavation, top-soil removal and its transportation, reservoir filling),
    - Loss of breeding and foraging habitats for birds (excavation, top-soil removal and its transportation, reservoir filling),
    - Loss of breeding, foraging and wintering habitats of invertebrates and a risk of death of their overwintering stages (vegetation clearance, excavation, removal of top-soil and its transportation, reservoir filling),
    - Impact on protected areas and internationally designated areas.
2. Operational phase and include:
    - Emergence of new habitats (water, riparian),
    - Increased access to the area.

The negative impacts occur mainly at the construction phase; they are caused by the dam building and flooding of the reservoir footprint area.

Some positive impacts on biodiversity occur during the operational phase; they are connected with emergence of the new habitats - large water surface and coastal vegetation which will attract some species of animals.

The assessment is completed for each predicted impact at the construction and operation phases and per group of the biodiversity receptors, which were combined based on their ecological characteristics; in some cases, where it is possible, impacts on individual species are assessed.

8.2.12.2 Construction phase

Destruction (loss) of habitats

Land clearance, excavation, top-soil removal and blasting will result in full destruction of the habitats located within the dam and reservoir footprints (with a total area of 9.5 ha according to the Project description)[134]. At first, habitats will be lost during clearance of the dam footprint area, then - by top-soil removal and movement, blasting and building of the dam. Subsequently, habitats located in the flooded part of the river valley will be lost during the reservoir filling.

Priority habitats, with indication of lost areas, comprise the following (in brackets – code and name of habitat in accordance with Annex 1 of the EU Habitats Directive):

Five Priority Biodiversity Features (PBF):

- E1.2 Perennial food grasslands and main steppes (6190 Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis), 61A0 Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae), 0.1 ha,
- F7.35-AM Armenian phryganoids (5410 West Mediterranean clifftop phryganas (Astregalo-plantaginetum subulatae), 0.97 ha,
- F9.12 Lowland and collinar riverine willow scrub (3280 Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of Salix and Populus alba, 0.75 ha,
- G1.11 Riverine willow woodland (92A0 Salix alba and Populus alba galleries), 1.0 ha,
- H3.1 Basic and ultra-basic inland cliffs (8210 Calcareous rocky slopes with chasmophytic vegetation), 0.19 ha.

and **one Critical Habitat (CH):**

- F3.1. Temperate thickets and scrub, 2.14 ha.

The total area of thet habitats loss is estimated at 5.15 ha. Currently, the habitats are not disturbed, they are in natural conditions.

The riverine habitats will be fully lost as a result of the reservoir filling; however, these habitats (or rather similar to them) will restore along the reservoir coasts. Other habitats will be lost within the boundaries of the dam and reservoir, but will similar habitas are present and will remain higher up the slopes.

Flora species loss

Land clearance, excavation, top-soil removal and blasting will result in vegetation clearance at the same areas where habitats will be lost (see above). According to the national EIA report, 380 trees of six species (*Acer campestre L., Amygdalus fenzliana (Fritsch) Lipsky, Salix excelsa S. G. Gmel., Salix triandra L., Populus nigra var italica Duroi., Elaeagnus angustifolia L. var culta Sosn.*) will need to be cut during the construction of the reservoir. No protected (nationally or internationally) plant species are registered in the Project area.

Disturbance of fauna species

[134]The actual area of the destructed habitats will be larger as habitats are located on the slopes of the river valley.

Terrestrial animals can be divided in two groups in relation to their reaction to disturbance - those that run away from disturbance areas and those that hide where they live. Below, the identified mammals, birds, reptiles, and amphibians are analysed in terms of their reaction to disturbance.

According to the baseline study, the identified terrestrial mammals were classified into three groups by size and lifestyle. The first group includes species permanently inhabiting the area, such as small - and medium-sized representatives, mainly rodents, insectivores and small predators. The second group includes temporary presnet species that transit through the area, such as predators, mainly canids and martens. Lastly, the third group is animals that are very rarely recorded within the area, and includes rare species: lynx, wild boar, and brown bear.

Small species permanently inhabiting the area (rodents, insectivores) usually hide (in burrows, for example) in response to disturbances, they do not run away from their homes. This behavior in the context of the Project is poses risk of mortality of the animals due to the destruction of the homes; potential impacts on this group of animals are considered in the sub-section below.

Other two mammal groups of temporary and rare visitors usually move away or avoid anxiety areas.

Identified birds (classified in three groups - i) breeding in the Project area, those ii) breeding in proximity to the site and using the area as a part of their foraging range, and iii) passing the area during the seasonal migration) will also move away or avoid disturbance zones.

Identified reptiles and amphibians permanently inhabit the area; they would choose the same hiding strategy as the small sedentary mammals (see above), so they will be in danger of dying. Potential impacts on this group of animals are considered below.

Noise and soil vibration caused by cutting trees and clearance, as well as beginning of building works, will be the first impact factors in the Project area. Impact distance (for noise) can vary from about 100 m to 500 m and more, depending on species sensitivity[135, 136]. As a result, the dam footprint area and parts of the reservoir footprint area and adjoined territories (about 500 m around) will be abandoned by the most of animals.

Blasting produces such impact factors as flying rocks, air pollution, ground vibration and air-blast; their magnitude depends on explosion power, soil content and geological structure. The first three factors manifest at a distance of up to several hundred meters. As the most of the animals at the dam area will leave the area at the beginning of the construction works[137], these factors will not affect them.

Air-blast (sound wave) can extend up to several kilometers along the Yelpin river valley, especially reflecting from the valley slopes. Accordingly, the most sensitive species, such as predators, will move even further beyond the dam and reservoir areas.

After the blasting is completed, the construction process will involve the dam filling; thus, such impact factors as vibration, noise, dust, lighting will occur. As the most of the animals will have already left the area by this time, these factors will affect only an insignificant number of animals.

Loss of sedentary animals' habitats and a risk of their death

[135]Senzaki, M., Yamaura, Y., Francis, C. et al. Traffic noise reduces foraging efficiency in wild owls. Sci Rep 6, 30602 (2016). https://doi.org/10.1038/srep30602

[136]Shilling, F.; Collins, A.; Louderback-Valenzuela, A.; Farman, P.; Guarnieri, M.; Longcore, T., et al. (2018). Wildlife-Crossing Mitigation Effectiveness with Traffic Noise and Light. UC Davis: National Center for Sustainable Transportation. Retrieved from https://escholarship.org/uc/item/8893d8zw

[137]We assume that the blasting will not be part of the first / site preparatory stage of the works; otherwise, some animals may die as they will not have time to leave

There are two groups of permanent residents which were identified - small mammals (rodents, insectivores) and reptiles and amphibians. Animals of the both groups use different kind of shelters (e.g., holes, rocks, hollows, etc.) and hide there in case of danger or disturbance. Such impact as noise will make them hide. Intensive vibration can drive the animals out of their shelters, but they will not run far away trying to find temporary shelter and come back when the impact disappears.

Thus, these two groups are mostly likely to be destructed during the construction works at the dam footprint area. Blasting can further destruct those that have remained alive.

The same negative impact can occur during the filling of the reservoir area - the shelters can be flooded and most of animals would die. The shelters of Forest dormouse (*Dryomys nitedula*) located on trees can be destructed during tree cutting in the reservoir area.

The following seven biodiversity values were identified among sedentary species (in brackets - approximate number of individuals affected and whose habitats will be destructed or reduced):

Mammals

- Forest dormouse (*Dryomys nitedula*), CH (about 16-22 individuals),

Reptilia

- Pallas's glass lizard *Pseudopus apodus*, CH (at least 5 individuals),
- Snake-eyed lizard *Ophisops elegans*, CH (at least 30 individuals),
- Medium Lizard *Lacerta media*, CH (at least 10 individuals),
- Smooth snake *Coronella austriaca,* CH (at least 2 individuals),
- Transcaucasian rat snake *Zamenis hohenackeri*, RDB of RA (at least 3 individuals),

Amphibia

- Variable toad/ green toad *Bufo viridis*, CH (the flooded area will increase the periphery of the coastline and thus, will increase the habitat of the species).

Regarding mitigation measures, it is suggested to begin planting some indigenous species of wild plum and pear to address the habitat loss of the Forest dormouse. Then, immediately before beginning the flooding, it is suggested to capture as many individuals as possible, and to move them to the new habitats.

To compensate the reduction of the habitats for the mentioned five reptile species, it is suggested to provide additional rocky outcrops in the proximity of the flooded area, to increase the number of native bush species, and before the flooding to catch and relocated as many individuals of the mentioned species as possible. It is also suggested to introduce a sustainable grazing practice in the areas that surround the planned reservoir, as the improved quality of the habitats can provide higher and diverse food supply for the species, thus supporting the increase in the density of these snake and lizard species.

Such permanent residents of the first group of mammals, as badger and red fox, do use burrows; however, they can leave them in case of disturbance and move to other habitats. To avoid killing such animals it is necessary to find their burrows before the construction works begin and monitor if they leave the shelters; if not, special measures to scare them away have to be implemented.

Loss of foraging habitats for medium and large mammals

Animals of two mammal groups (i.e., temporary and rare inhabitants) will move away or avoid disturbance once the site clearance and construction work start. The main deterrent impact is noise.

The following three biodiversity values were identified among these groups:

- Brown bear *Ursus arctos* - CH,
- Gray wolf *Canis lupus* - CH,
- Lybx *Lynx lynx* - CH.

It is expected that the Project will decrease the riparian zone with the wild fruit trees and berry bushes, thus decreasing the food supply for the Brown Bears at the initial stage of the project. However, within a year, the blackberry bushes will grow again along the shore of the water reservoir starting to return the volume of the food supplies. Regarding mitigation measures, it is suggested to begin planting some indigenous species of wild fruit trees to address the loss of habitat of the Brown bear.

The other two species (grey wolf and lynx) pass through the area, maybe with some occasional hunting. Development of the waterbird society at the filled reservoir might increase food supply for lynx. There are no impacts predicted on these two species, and, therefore, no mitigation measures are required.

Loss of breeding and foraging habitats for birds

Of the 70 bird species registered in the Project area, 20 are classified as biodiversity values - 17 species are protected under the Bern Convention and Birds Directive (seven of them have category Vulnerable in the Red Book of the RA too) and 3 species are protected under the Red Book of the RA (see the Baseline Chapter).

Due to the anticipated flooding of the territory with water, the loss of breeding habitats[138] is expected for the following numbers of the species (breeding pairs), protected under the Bern Convention (marked as Res 6) and Red Book of Armenia (marked as RDB AM):

1. Syrian Woodpecker *Dendrocopos syriacus* 1 pair (Res 6),
2. Tawny Pipit *Anthus campestris* 1-2 pairs (Res 6),
3. Wood Lark *Lullula arborea* 8-13 pairs (Res 6),
4. White-throated Robin *Irania gutturalis* 5-7 pairs (RDB AM),
5. Red-backed Shrike *Lanius collurio* 3-5 pairs (Res 6),
6. Lesser Grey Shrike *Lanius minor* 1-2 pairs (Res 6).

The breeding of another red-listed species Eastern Rock-nuthatch *Sitta tephronota* (RDB AM) in the area is disputable.The flooding will restrict the individual breeding territories for the following numbers of the species, protected under the Bern Convention (marked as Res 6) and Red Book of Armenia (marked as RDB AM):

1. European Roller *Coracias garrulus* 1-2 pairs (Res 6 & RDB AM),
2. Red-billed Chough *Pyrrhocorax pyrrhocorax* 1 pair (Res 6).

Another priority species is Eurasian Nightjar *Caprimulgus europaeus* (Res 6), which is most probably represented by one pair. The impact on it is expected to be negligible. Even if the breeding sites of the species are located within the flooding zone, it is anticipated that the species can easily shift its breeding sites above the reservoir. At the same time, the existence of the reservoir will increase the fauna of dipterous insects, thus increasing the food supply for Eurasian Nightjar.

The area of the proposed reservoir does not contain any restricted range species.

[138]Any activity of the Project has to be implemented before the breeding season or after, and thus we do not assume that any birds will die.

The flooding is not expected to affect large ranged and colonial species, protected under the Bern Convention and Red Book of the RA:

1. European Honey-buzzard *Pernis apivorus,*
2. Bearded Vulture *Gypaetus barbatus,*
3. Long-legged Buzzard *Buteo rufinus,*
4. Booted Eagle *Hieraaetus pennatus,*
5. Golden Eagle *Aquila chrysaetos,*
6. Peregrine Falcon *Falco peregrinus,*
7. Eurasian Eagle-owl *Bubo bubo,*
8. Rosy Starling *Pastor roseus.*

No impact is predicted due to the following reasons: 1) the flooded area plays a negligible role in their foraging range, as the surroundings have enough colonial insects (for Honey Buzzard), rodents (for the Long-legged Buzzard, Booted Eagle, and Eurasian Eagle-owl), Orthoptera insects (for Rosy Starling); 2) number of birds has a potential to increase after the development of the reservoir (which is essential for Peregrine Falcon and Booted Eagle), and 3) Golden Eagle and Bearded Vulture just pass that area and usually do not hunt/search for the carcasses here.

The flooding will not affect the migratory and wintering species, protected under the Bern Convention and the Red Book of the RA, including those which make relatively high congregations during the migration:

1. European Honey Buzzard *Pernis apivorus*,
2. Demoiselle Crane *Anthropoides virgo,*
3. Semicollared Flycatcher *Ficedula semitorquata,*
4. Crimson-winged Finch *Rhodopechys sanguineus.*

No impact is predicted due to the following reasons: 1) European Honey Buzzard and Demoiselle Crane mostly do not stop at the area and fly over it, 2) Semicollared Flycatcher makes stopover points in the bushes along the river and in the future will be able to make stopover points in the vegetation along the shore of the reservoir, 3) Crimson-winged Finch makes vertical movement from the higher elevation and moves around with the small groups and the flooded area does not play any critical role for it.

The following mitigation measures are suggested for the priority species:

1. Planting additional indigenous species of Poplar, Willow, and Walnut trees for Syrian Woodpecker,
2. Consider the introduction of sustainable grazing practices in Yelpin community, which can improve the quality of grassland habitat, increase the number and diversity of invertebrates, and support the necessary food supply for European Roller, Tawny Pipit, Wood Lark, White-throated Robin, Red-backed Shrike, Lesser Grey Shrike, and Red-billed Chough, which may support some increase in their density,
3. Plant additional thorny bush species as breeding spots for White-throated Robin, Red-backed Shrike, and Lesser Grey Shrike, helping them to discover new breeding sites.

The quantitative parameters should be considered for the restoration of the habitats of the priority species. The numbers given below are preliminary, and if this approach to be applied the additional study is required.

1. Syrian Woodpecker *Dendrocopos syriacus* 1 pair (Res 6), roughly about 3-5 ha per individual breeding range, with a tree density of at least 40-50 per ha,

2. Tawny Pipit *Anthus campestris* 1-2 pairs (Res 6), 1-2 pairs, roughly about 2-3 ha per individual breeding range,
3. Wood Lark *Lullula arborea* 8-13 pairs (Res 6), roughly about 1-2 ha per individual breeding range,
4. White-throated Robin *Irania gutturalis* 5-7 pairs (RDB AM), roughly about 2-3 ha per individual breeding range (orchards),
5. Red-backed Shrike *Lanius collurio* 3-5 pairs (Res 6), roughly about 2-3 ha per individual breeding range,
6. Lesser Grey Shrike *Lanius minor* 1-2 pairs (Res 6), roughly about 2-5 ha per individual breeding range.

Accordingly, totally about 26 ha (calculated from maximum Wood Lark pairs and necessary area for them: 13 pairs x 2 ha = 26 ha) of complex habitats for these species have to be created/conserved along the reservoir shoreline and up the slopes. They should include trees, shrubs and rocky plots at the top of the valleys' slopes (not flooded). Required area can be part (or fully included) of the buffer/protection zone around the reservoir.

Loss of breeding, foraging and wintering habitats of invertebrates and a risk of death of their overwintering stages

The planned reservoir will partially destroy the habitats of 22 species – restricted-range (RR), included in the Resolution 6 of the Bern Convention (Res 6) and listed in the Red Data Book of the RA (RDB):

1. Anthocharis gruneri (RR)
2. Pieris krueperi (RR)
3. Colias aurorina (RR)
4. Armenia ledereri (RR)
5. Armenia hyrcanica (RR)
6. Nordmannia abdominalis (RR)
7. Lycaena ochimus (RR)
8. Ultraaricia crassipuncta (RR)
9. Neolysandra coelestina (RR)
10. Polyommatus (Agrodiaetus) demavendi (RR)
11. Polyommatus (Agrodiaetus) eriwanensis (RR)
12. Polyommatus (Agrodiaetus) ninae (RR)
13. Hipparchia syriaca (RR)
14. Hipparchia fatua (RR)
15. Satyrus amasinus (RR)
16. Pseudochazara pelopea (RR)
17. Pseudochazara schahrudensis (RR)
18. Chazara bischoffi (RR)
19. Thaleropis ionia (RR)
20. Melitaea persea (RR)
21. Euphydryas aurinia (Res 6)
22. Papilio alexanor (RDB).

If the construction works start in May-August butterflies will leave the disturbance areas to look for other places for foraging and breeding; it is important that suitable habitats are to be created in

vicinity. But if the works start in October - April, overwintering stages of butterfly (caterpillar or pupa) can be affected by Project works and die.

The mitigation measures for the priority invertebrate species include several major steps:

1. To implement a study of the habitat requirements of the priority species and estimate areas of the habitats, which are lost by these species,
2. To conserve or develop similar habitats of proportionate size in the areas not to be flooded, in close vicinity of the existing populations (first of all, in the protection/buffer zone), securing habitat connectivity (primarily includes planting forage plants for the species and in some cases improving soil conditions),
3. In addition, the introducing of the sustainable grazing practices can improve habitat quality and diversity.

Impact on protected areas and internationally designated areas

Due to large distances, there will be no negative impact on the nationally protected areas and Candidate Emerald sites.

A relatively short distance (320 m) between north-eastern edge of the planned reservoir and Gndasar KBA/IBA allow to assume some impact. The most considerable impact will be due to noise during the blasting. Birds which inhabit the Gndasar KBA/IBA (in south-western part of the area) will migrate further up the valley, but will come back after the blasting is finished. Thus, this impact is short-terms and not irreversible.

8.2.12.3 Operation phase

Emergence of new habitats (water, riparian)

The flooding will create additional water and riparian habitats, which can be colonized by some water birds, as well as water invertebrates and fishes. Therefore, it can be expected that the bird fauna can be enriched with such species as Green Sandpiper *Tringa ochropus*, Common Sandpiper *Actitis hypoleucos*, Common Kingfisher *Alcedo atthis* (Res 6), and possibly some ducks, herons, egrets, and other shorebirds.

Furthermore, additional foraging opportunities will be created for some of the existing priority species, such as:

1. European Roller *Coracias garrulus,*
2. Peregrine Falcon *Falco peregrinus,*
3. Rosy Starling *Pastor roseus.*

In addition, better stopover conditions can be created for migrant species, such as:

1. Demoiselle Crane *Anthropoides virgo*,
2. Semicollared Flycatcher *Ficedula semitorquata.*

Some birds can migrate from the Gndasar KBA/IBA to the new habitats.

Increased access to the area

Increase in waterbird diversity and numbers can attract hunters. Therefore, the biodiversity management plan should consider possible increase of illegal hunting in the area, which can affect not only game birds, but also priority bird species.

Impact assessment and mitigation measures

Assessment and mitigation on biodiversity during the construction and operation phases are summarized in **Table 8-22**. According to the mitigation hierarchy[139] four types of measures are applied – avoidance, minimization, restoration and offset. Excluding avoidance (as construction of the dam and reservoir at the footprint areas is already approved by the government) the measures are presented in the table.

Table 8-22. Summary of impacts on biodiversity and mitigation measures for the Project construction and operation phases

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
Overarching action: Develop a Biodiversity Action Plan (BAP)[140] during the pre-construction phase so that it embraces mitigation activities of the pre-construction, construction, and operation phases. BAP will outline and provide guidance for such components as the of the Biodiversity Management Plan, Riverine Habitats Construction Plan, Offset Program. The below-listed mitigation and/or management measures shall be included in the BAP.			
PRE-CONSTRUCTION AND CONSTRUCTION PHASE			
1. Habitats	Significant	***Pre-construction phase*** 1) Study the priority habitats (five PBFs, one CH) in the Project area, their plant composition and ecological structure, specify areas, 2) Develop a Riverine Habitats Construction Plan to plan support, construction and maintenance of the following two habitats (PBFs) along the reservoir's banks: *F9.12 Lowland and collinar riverine willow scrub (3280 Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of Salix and Populus alba,* *G1.11 Riverine willow woodland (92A0 Salix alba and Populus alba galleries),* 3) Study the reservoir protection/buffer area and areas along the river, upstream and downstream (including Gndasar KBA/IBA) to define existing habitats similar to the following: *E1.2 Perennial food grasslands and main steppes (6190 Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis), 61A0 Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae),* *F7.35-AM Armenian phryganoids (5410 West Mediterranean clifftop phryganas (Astregalo-plantaginetum subulatae),* *H3.1 Basic and ultra-basic inland cliffs (8210 Calcareous rocky slopes with chasmophytic vegetation),* *F3.1. Temperate thickets and scrub (40A0* Subcontinental peri-Pannonic scrub).*	Moderate (after offset - no net loss / a net gain)

[139] Guidance Notes to the EBRD PR 6 (March, 2023)

[140] Biodiversity Action Plan is developed and approved prior the tendering process for the Construction Contractor. Other Biodiversity plans developed by the Construction Contractor prior to construction. Some specified mitigation measures are implemented at the pre-construction phase and some – throughout construction.

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		4) Develop an offset project to provide conservation of the habitats in the most suitable for conservation areas. *<u>Preliminary quantative assessment</u>* *Total lost area of the two riverine habitats (F9.12 and G1.11) is 1.75 ha. The reservoir perimeter potentially suitable for the riverine habitats, according our estimation, is about 1.5 km. To achieve «no Net Loss» (multiplier = 1) a width of the shoreline strip for the riverine habitats construction should be about 12 m. Additionally 0.37 ha of the natural riverine habitats located upstream the reservoir in the protection/buffer zone, that will not be flooded, can be conserved thereby rising the miltiplier up to 1.24.* *Lost area of the PBF habitats (E1.2, F7.35-AM, H3.1) is 1.26 ha. Lost area of the CH habitat (F3.1) is 2.14 ha. At the same time, area of the reservoir protection/buffer zone that can be used for conservation of these four habitats is about 21.8 ha. Accrdingly, there are enough area in the protexction/buffer zone to apply «Net Gain» approach for conservation of these habitats.* *Proposals for the construction and conservation of the habitats, including multipliers, should be developed in BAP.*	
OPERATIONAL PHASE			
Habitats	No new impact, but the mitigation continues:	1) Implement the Riverine Habitats Construction Plan: construct and maintain the following two habitats (PBFs) along the reservoir's banks: *F9.12 Lowland and collinar riverine willow scrub (3280 Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of Salix and Populus alba),* *G1.11. Riverine willow woodland (92A0 Salix alba and Populus alba galleries).* 2) Implement the offset project to conserve the following four priority habitats: *E1.2 Perennial food grasslands and main steppes (6190 Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis), 61A0 Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae),* *F7.35-AM Armenian phryganoids (5410 West Mediterranean clifftop phryganas (Astregalo-plantaginetum subulatae),* *H3.1 Basic and ultra-basic inland cliffs (8210 Calcareous rocky slopes with chasmophytic vegetation),* *F3.1. Temperate thickets and scrub (40A0* Subcontinental peri-Pannonic scrub)*.	-
Monitoring: according to the Riverine Habitats Construction Plan and the monitoring chapter of the offset program (project).			

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
PRE-CONSTRUCTION AND CONSTRUCTION PHASE			
2. Flora	Significant	***Pre-construction phase*** 1) Study plant composition and structure of the priority riverine habitats, 2) Develop a Riverine Habitats Construction Plan based on indigenous plant species, 3) Develop a Tree Management Plan (TMP). ***Construction phase*** 4) Plant 1300[141] trees and ensure their aftercare for a period of two years (aftercare may be carried out during the reservoir operation phase), The proposed types of trees to be planted are: - *Acer campestre L.* - *Amygdalus fenzliana (Fritsch) Lipsky* - *Salix excelsa S.G. Gmel.* - *Salix triandra L.* - *Populus nigra var. italica Duroi* - *Elaeagnus angustifolia L. var. culta Sosn*.	Moderate (after offset - no net loss / a net gain)
OPERATION PHASE			
Flora	No new impact, but the mitigation continues	Construct and maintain the two riverine habitats along the reservoir's banks based on indigenous plant species (see above - this *Table Section 1. Habitats*)	Low
Monitoring: according to Riverine Habitats Construction Plan, TMP			
PRE-CONSTRUCTION AND CONSTRUCTION PHASE			
3. Fauna (other than those listed below)	Significant	***Pre-construction phase*** 1) Develop the Worker Code of Conduct for employees of the construction company to prevent poaching, ***Construction phase*** 2) Plan and begin construction works from one edge of the Project (dam) area (namely, from the western edge) moving up to the valley; this approach will allow animals to leave, 3) Begin the construction works before or after the breeding season - prior to April or after August; this will prevent mortality of of animals including offspring, 4) Limit charges for explosion by the minimum demands of the building works; implement all required safety measures during blasting to minimize the impacted area, 5) Monitor compliance with the Worker Code of Conduct of employee of the building company to prevent poaching,	Low

[141]According to calculations conducted in the frames of the national EIA study, these trees shall be planted as a compensatory measure; there were used 1:1 ratio when cut tree trunk diameter (D) <10 cm and 1:6 ratio when D>10cm. Total multiplier is 3.42 (1300/380). Meanwhile, as the species to which the 380 loosing trees belong are not priority species, “no Net Loss” and “Net Gain” approaches are not mandatory to be applied.

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		6) Develop the Worker Code of Conduct for the operator of the reservoir to prevent poaching.	
OPERATION PHASE			
Fauna	Moderate	Monitor compliance of the reservoir's operator with the Worker the Code of Conduct to prevent poaching during operations.	Negligible
Monitoring: according to the Biodiversity Management Plan			
PRE-CONSTRUCTION AND CONSTRUCTION PHASE			
4. Sedentary animals	Significant	***Pre-construction phase*** 1) Identify existing forest and rocky habitats which are potential habitats for relocation of Forest dormouse, snakes, and lizards in the vicinities of the flooded area 2) Plant some indigenous tree species (for example, wild plum and pear) to address the loss of habitats of Forest dormouse, 3) Provide additional rocky outcrops in the vicinities of the flooded area to increase the number of native bush species (snakes, lizards), 4) Survey the area to map inhabited burrows of badger and other burrowing animals, ***Construction phase*** 5) Before tree cutting in the reservoir area, examine each tree to check whether Forest dormouse inhabits it; if so, capture individuals and relocate them to safe habitats identified during the pre-construction phase, 6) Before filling the reservoir, survey the reservoir site and capture as many individuals as possible including such species as Forest dormouse (if remained), snakes, lizards, and to move them to the safe habitats identified and/or arranged during the pre-construction phase, 7) Before filling the reservoir, check the mapped residential burrows of badger and other animals; if they remain, to capture them and relocate to the safe habitats.	Low
OPERATION PHASE			
Sedentary animals	No new impact, but the mitigation continues	1) Introduce/support a sustainable grazing practice in the areas that surround the planned reservoir, as the improved quality of the habitats can provide higher and diverse food supply for reptilians, thus supporting in the increase of the density of the protected snake and lizard species, 2) Maintain forest and rocky habitats which are habitats for relocation of Forest dormouse, snakes and lizards in the vicinities of the flooded area. *These habitats have to be included into the conserved priority habitats with trees, thickets and scrub (see above - this Table Section 1. Habitats).*	Low
Monitoring: according to the Biodiversity Monitoring Plan			

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
PRE-CONSTRUCTION AND CONSTRUCTION PHASE			
5. Large mammals	Moderate	Plant some indigenous species of wild fruit trees in the vicinities of the Project area to address the loss of habitat of Brown bear.	Low
OPERATION PHASE			
Large mammals	No new impact, but the mitigation continues	Maintain planted indigenous wild fruit trees in the vicinities of the Project area to address the loss of habitat of Brown bear for at least two first years of operations.	-
Monitoring: according to the Biodiversity Monitoring Plan			
PRE-CONSTRUCTION AND CONSTRUCTION PHASE			
6. Birds	Moderate	***Pre-construction phase*** 1) Plant additional indigenous species of Poplar, Willow, and Walnut trees for Syrian Woodpecker in the vicinities of the Project area, 2) Plant additional thorny bush species in the vicinities of the Project area as breeding spots for White-throated Robin, Red-backed Shrike, and Lesser Grey Shrike, helping them to discover new breeding sites, *These spots should include trees, shrubs and rocky plots at the top of the valleys' slopes. The spots have to be included into the constructed habitats under the Riverine Habitats Construction Plan and conserved habitats with thickets/scrub and cliffs (see this Table Section 1. Habitats).* *Preliminary quantitative assessment* *The total area of the protection/buffer zone that is suitable for the constructed habitats under the Riverine Habitats Construction Plan and conserved habitats with thickets/scrub, cliffs, grasslands, Armenian phryganoids is about 24 ha.* *The minimum area (multiplier 1 - of the "no Net Loss" approach) for compensation of the lost habitats of the priority bird species is 26 ha (see above the sub-section Loss of breeding and foraging habitats for birds). To secure this area or larger one (if the "Net Gain" approach applied), additional area is required.* *The Gndasar KBA/IBA located 320 m from the Project site, upstream the river, can be used for conservation of the additional areas necessary for the birds (most of the IBA area is not protected).* *Proposals for the use of constructed and conserved habitats in the protection/buffer zone, as well as conservation of additional habitats, including multipliers and calculation, should be made in the BAP.* ***Construction phase*** 3) Maintain the planted trees and bush species.	Low
OPERATION PHASE			

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
Birds	No new negative impact, but the mitigation continues Positive impact could manifest	1) Introduce/support sustainable grazing practices in Yelpin settlement, which can improve the quality of grassland habitat, increase the number and diversity of invertebrates, and support the necessary food supply for European Roller, Tawny Pipit, Wood Lark, White-throated Robin, Red-backed Shrike, Lesser Grey Shrike, and Red-billed Chough, which may support in some increase of their density, 2) Maintain the planted trees and bush species for at least two first years of operations.	Low
Monitoring: according to the Biodiversity Monitoring Plan			
PRE-CONSTRUCTION AND CONSTRUCTION PHASES			
7.Invertebrates	Significant	***Pre-construction phase*** 1) Study the habitat requirements of the 22 priority species and estimate areas of the habitats, lost by these species, 2) Develop similar habitats in unflooded areas and in close vicinity of the existing populations, securing habitat connectivity (primarily requires planting forage plants, including herbaceous plants, for the species and in some cases improving soil conditions), *These habitats have to be included to the constructed habitats under the Riverine Habitats Construction Plan and conserved habitats with thickets/scrub, cliffs, grasslands, Armenian phryganoids (see this Table Section 1. Habitats).* ***Construction phase*** 3) Maintain created habitats, primarily the species forage plants.	Low
OPERATION PHASE			
Invertebrates	Moderate	1) Introduce/support sustainable grazing practices in communities around the reservoir, which can improve quality of grassland habitat, increase the number and diversity of invertebrates, 2) Maintain developed habitats with the priority species forage plants.	Low
Monitoring: according to the Biodiversity Management Plan			

8.3 Social Impacts and Benefits, Mitigation Measures

8.3.1 Impacts on the Local/Regional Economic Growth, Employment and Business / Investment Opportunities

Construction phase

The closest settlements to the planned construction site are Yelpin and Chiva villages of Areni Community. As of early 2024, the combined permanent population of these villages is 2,061 people (1,239 in Yelpin and 822 in Chiva). Residents are expected to benefit from new employment

opportunities during the Project's construction phase, which, together with ongoing agricultural activities, may contribute to increased household income.

There are two labour accommodation camps planned for the construction of the reservoir - one in Yelpin village, and the other one near the reservoir construction site. Thus, the residents and local businesses will have an opportunity to be engaged in the service sector, namely meal preparation and delivery, as well as housekeeping and other services.

Local and regional businesses may join the project supply chain - in areas including transportation, and provision of goods and services.

All local employment and procurement matters shall be managed through a Local Employment and Procurement Plan (LEPP). At a minimum, the LEPP shall include: (i) local employment targets and commitments; (ii) provisions for the procurement of goods, works, and services from local suppliers where feasible; (iii) requirements for labour standards and social safeguards in accordance with applicable EBRD PR2; (iv) monitoring and reporting procedures; and (v) measures for integrating these requirements into procurement and contractual documentation.

An influx of construction workers can also increase the risks of Gender Based Violence and Harassment (GBVH). Women, young people and economically disadvantaged residents are most vulnerable, particularly in rural communities with limited health infrastructure. However, given the traditional, family-oriented lifestyle that characterizes rural settlements in Armenia, the incidence of STDs among the local population is expected to be negligible (see also **Sub-section 8.3.5**).

Operation phase

According to economic and financial analysis[142] Yelpin reservoir makes a strong case for investment. The proposed investment in the Yelpin reservoir is expected to generate a positive economic return. The estimated payback period is 14 years.

In Vayots Dzor Marz, irrigation costs account for around 30-40% of the overall crop cultivation expenses, which puts a burden on the local farmers. By contrast, irrigation costs in other regions range from 10 to 12% of the crop cultivation expenses. Farmers will not invest in the water saving technologies if the water supply is not reliable, or if the incentives for saving water, energy and labour are not strong enough[143]. Consequently, reliable water supply will incentivise farmers to invest in modern irrigation systems and water-saving technologies, making the irrigation system more sustainable. In addition, stable water availability will lead to cultivation of additional land, diversification of crops, increase of agricultural produces thereby enhancing economic opportunities for the local community.

8.3.2 Impacts on Public Facilities and Infrastructure

Construction phase

An additional pressure on local infrastructural facilities including power lines, roads, and healthcare facilities might occur due to the Project construction activities.

The construction machinery and equipment will be transported via the M-2 highway and earthen road from Yelpin village to the construction site. It is necessary to identify sensitive receptors (schools, hospitals, residential areas, other social infrastructure) along the transportation routes and develop mitigation measures where necessary (including avoidance, timing adjustments, additional

[142]Armenia Water Reservoirs - Technical, Economic and Green Due Diligence Gap Analysis, Draft Final Report, 2023-2024, Ove Arup & Partners.
[143]Facon T. 2013. Investing in irrigation and drainage in the context of water policy and institutional reform. FAO. https://www.fao.org/4/ac623e/ac623e0a.htm

traffic signs, reinforcement of the speed limit etc.). Therefore, a Traffic Management Plan (see **Section 8.2.11**) should be developed, and transportation routes should be disclosed to the public.

Regarding the healthcare facilities, the medical center in Yelpin village has limited capacities, both in terms of the personnel and equipment, to serve the Project workforce. Therefore, Yeghegnadzor Medical Centre, located 25 km away from Yelpin village, should be considered for emergency situations. In addition, the need for a constant presence of the ambulance at the construction site or agreement with the sign an agreement with the Yeghegnadzor Medical Centre to ensure emergency response when medical services shall be considered for the contractor's workers. This should take into account the 20-25 minutes ambulance response time.

The household waste of the settlement is disposed in Areni municipal landfill.

Operation phase

No impacts on public facilities and infrastructure are envisioned during the Project operation stage.

Impact assessment and mitigation measures

The assessment and mitigation of impact on public facilities and infrastructure traffic impacts during the construction and operation phases of the reservoir are summarised in **Table 8-23**.

Table 8-23. Summary of impact assessment on and mitigation measures for public facilities and infrastructure

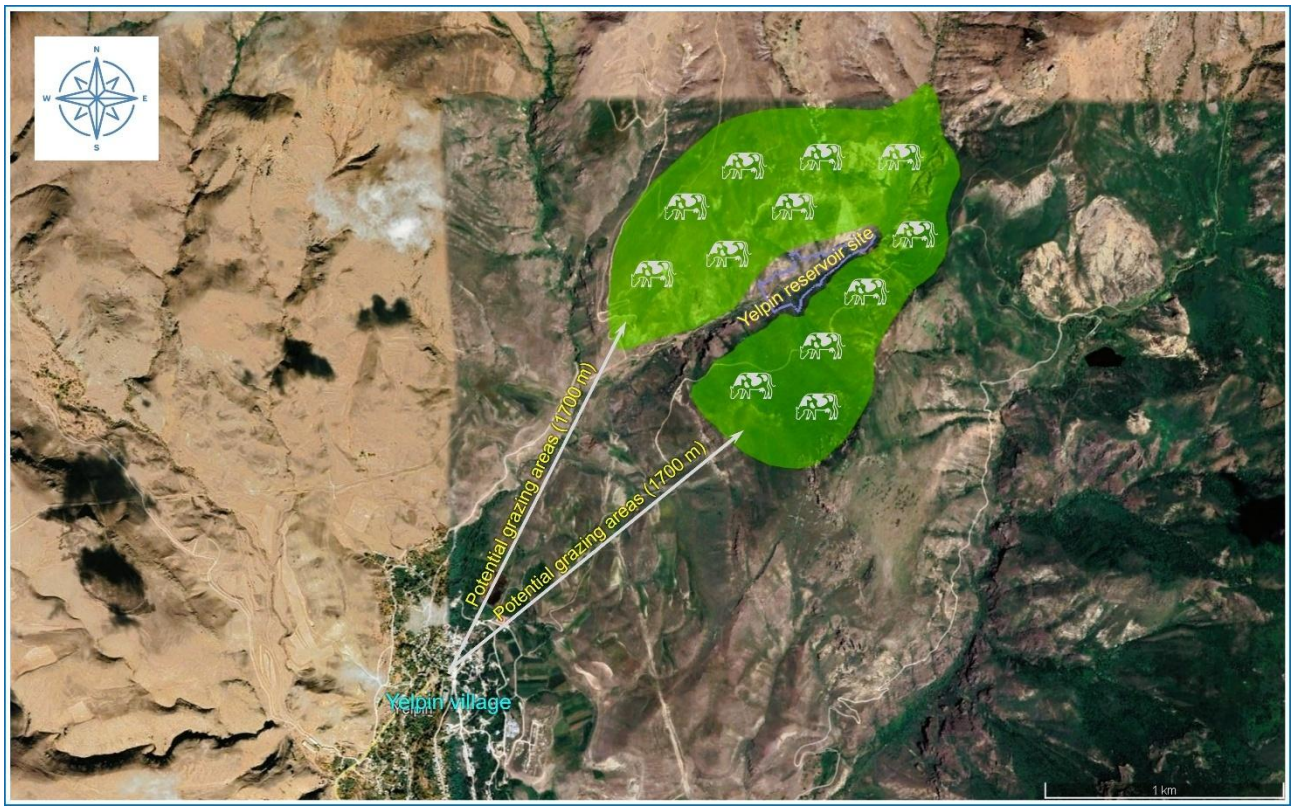
Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Local and regional public facilities and infrastructure	Moderate	1) Oblige the construction contractor to set up a medical post at least at one of the labour accommodation camps. 2) Consider the need for a constant presence of the ambulance at the construction site or sign an agreement with the Yeghegnadzor Medical Centre to ensure emergency response when medical services are required for the contractor's workers.	Low

8.3.3 Land Tenure Impacts

Within the territory allocated for the construction of the reservoir (including within the buffer zone) there is no land in private ownership, all land is in communal ownership (with the intended purpose of pasture).

According to the interview with the head of community, at present, the territory under the reservoir is practically not used as a pasture, due to the lack of suitable vegetation. If there is an interest among Yelpin villagers to use the community land for grazing, alternative pastures can be made available to them. There is no lack of alternative pasture land in Yelpin. That is, 3567.09 ha of communal land have been allocated for pasture land in Yelpin. Only approximately 31.5 ha of land are allocated for the needs of the project, so the reduction in the pasture land in the village is insignificant (less than 1%).

Figure 8-3. Available grazing land within the boundaries of Yelpin rural settlement



No residential houses are located on land required for the Project implementation. Thus, the Project will not result in physical displacement of PAPs (relocation or loss of housing).

As the community-owned land is to be withdrawn for the Project, it will be necessary to prepare a Resettlement Plan in line with the Project's Resettlement Framework to valuate the community lands and pay the due compensation prior to the start of any works on site.

Impact assessment and mitigation measures

The assessment and mitigation of land tenure impact during the construction and operation phases of the reservoir are summarised in **Table 8-24**.

Table 8-24. Summary of land tenure impact assessment and mitigation measures

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION AND OPERATION PHASE			
Residents of Yelpin village	Low	Ensure that all users (if any) of the pasture land to be withdrawn for the Project needs will be provided with alternative land of the same or better characteristics for the cattle grazing.	Low to Negligible
Community land	Moderate	Develop and implement the Resettlement Plan in line with the provisions of the RF to ensure that the compensation for community land is fully provided prior to any construction works on site.	Low

8.3.4 Impact on Vulnerable Groups

The construction of the reservoir will have positive effect on the families' standards of living, including socially vulnerable households. The Project implementation will support food security in the

households engaged in the subsistence agriculture and might enable accumulation of a larger surplus for sale. At the same time, the price of the irrigation services should account for the affordability to the low-income households.

Furthermore, stable availability of water will benefit women who play an essential role in the provision, use and management of water in the households. However, women can face barriers in the access to the irrigation infrastructure due to their limited involvement in the decision-making processes. Thus, vulnerable persons in the context of the Project are mainly female-headed households engaged in the argicultural sector who might be not well informed and equipped to connect to the infrastructure. Similar issues might be faced by the households made of elderly people/ pensioners. Overall, it is important to regulate and ensure equal access to the Project benefits for women and elderly. Equal employment opportunities for men and women should also be ensured during the Project construction stage in accordance with the LEPP (see **Section 8.3.1**).

Impact assessment and mitigation measures

Table 8-25. Risk that information about the Project opporunities and benefits would not reach vulnerable households, especially female-headed and elderly ones: impact assessment and mitigation measures

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION AND OPERATION PHASES			
Female-headed and elderly households engaged in agricultural activities	Low	Implement the SEP to ensure that information about the Project and its opportunities is widely available and communicated to the female-headed and elderly households engaged in agricultural activities.	Negligible

8.3.5 Impact on Community Health and Safety

Construction stage

Taking into account the distance to the Project construction site, physical factors such as air and noise emissions, soil contamination, and wastewater discharge are unlikely to affect the health and safety of Yelpin village residents.

Construction areas present physical hazards, including the risk of falls, injuries, and drowning, particularly for vulnerable groups such as children. There is also a risk of children, animals or livestock entering the construction site and falling into excavations or other hazardous zones. Unauthorized access to the area further increases the likelihood of accidents. These risks should be mitigated through the implementation of controlled access measures, installation of fencing and warning signage, and continuous community awareness activities to inform residents about potential hazards and safety requirements during construction.

Two construction camps are planned for the construction of Yelpin reservoir, one will serve the borrow pits and the other one near the planned reservoir. Therefore, labour influx might increase the risk of the local community exposure to diseases, including socially significant diseases, as well as safety and security risks.

Furthermore, an influx of construction workers can increase the risks of GBVH. Women, young people and economically disadvantaged residents are most vulnerable, particularly in rural communities with limited health infrastructure. However, given the traditional, family-oriented lifestyle

that characterizes rural settlements in Armenia, the incidence of STDs among the local population is expected to be negligible.

Possible road accidents caused by the increased traffic of the Project related vehicles on the local roads involving Project-related vehicles and local population. Lastly, emergency situations pose risks to the community both during construction and operation stages and further discussed in **Chapter 8.4**.

Operation phase

Potential impacts during the Project operation stage can occur during the maintenance works and emergency situations that exceed the limits of the Project site and can have significant impacts on the downstream communities. Therefore, an Emergency Preparedness and Response Plan (EPRP) should be in place, and potentially affected communities should be informed and trained accordingly.

Table 8-26. Summary of community health and safety impact assessment and mitigation measures

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Residents of Yelpin village	Moderate	***Pre-construction phase*** Develop Emergency Preparedness and Response Plan (EPRP) for the whole project lifecycle (**Chapter 8.4**). ***Construction phase*** 1) Implement the Emergency Preparedness and Response Plan, 2) Screen worker influx for communicable disease and provide treatment, as appropriate, to reduce exposure to local population, 3) Conduct information campaigns on STDs among the workers and local community, 4) Implement controlled access measures, including the installation of appropriate fencing and warning signage, and conduct ongoing community awareness activities to inform residents of potential hazards and safety requirements during the construction phase, 5) Supplement the Traffic Management Plan with the following topics related to community health and safety: - Optimised routes and times of the day for transporting materials to site, especially bulky equipment parts (e.g., pipes) agreed with the traffic police and local administrations. - Identification of the sensitive receptors (schools, hospitals, residential areas, other social infrastructure) along the transportation routes and development of the mitigation measures where necessary. 6) Implement and communicate the grievance mechanism for communities and external stakeholders in line with EBRD's requirements, to include, inter alia, anonymous and confidential grievance channels and redress.	Low

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		The enhanced GM shall be communicated to workers and communities and become fully operational prior to commencement of construction.	
OPERATION PHASE			
Residents of Yelpin village	Moderate	1) Monitor the technical conditions of the reservoir, provide timely maintenance, 2) In case if heavy machinery or large number of vehicles is needed for the performance of the maintenance works, a Traffic Management Plan should be developed, accounting for the recommendation outlined above, 3) Develop an Emergency Preparedness and Response Plan covering the Project operation stage (**Chapter 8.4**).	Low

8.3.6 Occupational Health and Safety Impact

Construction phase

The main health and safety risks during the Project construction are associated with earthworks and excavation activities, blasting operations, use of the construction machinery and equipment, and delivery of construction materials to the site (see **Chapter 2.7.7** for the detailed description of the construction activities).

Some of the major physical hazards include: falls from heights when working on scaffolding, or steep slopes around the dam site; trips and slips on wet, uneven, or muddy surfaces; entrapment or impact from the operation of the construction machinery, such as cranes, bulldozers, concrete mixers, etc; exposure to increased noise levels due to machinery and blasting operations. Additional risk to workers laying water pipes is posed by the presence of other underground services such as electric cables or gas pipes. Inadequate human resource practises and isolation from family can contribute to mental strain, causing fatigue and stress and should also be considered by the workforce managers. Among natural hazards are extreme weather events, contact with the wildlife (snakes, insects).

To prevent accidents at the construction site, an OHS Management Plan (OHSMP) should be developed by the Construction contractor. It should at least cover the following:

- Allocation of OHS roles and responsibilities,
- Identification of OHS risks relevant to the Project,
- Development of OHS procedures for different types of work / professions,
- Workers' regular OHS briefing / training,
- Performance of the high-hazard activities, inter alia: earthworks, works at height, with high voltage etc.,
- Provision of workers (including sub-contractors) with Personal Protective Equipment (PPE),
- Initial and periodic medical examination of workers, including the staff of sub-contractors,
- Recording and investigation of safety accidents.

Additionally, the contractor must define proper management procedures for the following activities:

- Storage and handling of materials and chemicals, including hazardous,
- Fire prevention and the maintenance of the firefighting equipment,

- Provision of the first aid,
- Heat stress management,
- Blasting safety management,
- Prohibition of drugs use and alcohol consumption,
- Site safety signs, posters and registers,
- Monitoring of construction noise, vibration and air emissions.

Site-specific hazards should be considered in the OHSMP, such as exposure to extreme weather temperatures, works on or close to the open waterbodies, works with pressurized systems, as well as the risk of the spread of waterborne diseases and other.

Regular monitoring of the safety performance of the construction workers should be conducted. It should cover both monitoring of work practises, and the working environment.

Operation phase

OHS risks during the Project operation stage are associated with the workers performing maintenance and repair works. The OHS maintenance and repair works procedure/instruction should be developed and followed. The procedure should be based on the applicable risks identified for the construction stage, and lessons learned from the OHS performance during the construction activities.

Impact assessment and mitigation measures

The assessment and mitigation of the OHS impacts during the construction and operation phases of the reservoir are summarised in **Table 8-27**.

Table 8-27. Summary of occupational health and safety impact assessment and mitigation measures

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Project workforce	Moderate	***Pre-construction phase*** 1) Develop an Occupational Health and Safety Management Plan (OHSMP), covering the key elements of the OHS performance management during the construction stage, including: - Allocation of OHS roles and responsibilities - Identification of OHS risks and hazards, - Briefing, training and knowledge check, - OHS procedures and regulations, - Medical examination, - Emergency response, - Management of hazardous materials, chemicals and oil / fuel, - Fire safety and emergency response, - Performance of high hazard tasks - Use of PPE, - Supervision of sub-contractors, - Investigation of safety accidents, - Responsibilities for non-compliance, etc. 2) Develop a Blasting Safety Management Plan (BSMP) and obtain the necessary approvals from the	Low

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
		Supervision Engineer, the Client, and the relevant regional authorities. ***Construction phase*** 1) Implement the provisions of the Occupational Health and Safety Management Plan, 2) Implement the provisions of the Blasting Safety Management Plan, 3) Conduct regular audits of the construction site to monitor the OHS performance of the contractors.	
Monitoring: *OHS daily, weekly and monthly inspections and monitoring as per the OHSMP (to be performed by the Construction contractor, the Supervision engineer, the Client and invited consultants)*			
OPERATION PHASE			
Workers performing technical maintenance of the reservoir and related structures	Moderate	1) Develop an OHS procedure/instruction for the maintenance and repair works, 2) Comply with the requirements of the relevant national OHS legislation.	Low

8.3.7 Workers' Rights and Working Conditions Related Impacts

Construction phase

The Project Implementation Unit (PIU) should require compliance with the national labour regulations and EBRD PR2 requirements from the contractors via contractual clauses. The compliance with the EBRD PR2 shall be included in the tendering documentation and contract with the construction contractor and its subcontractors. Two construction camps are planned for the construction of Yelpin reservoir (see **Section 2.7.7**), and the maximum number of workers that can be on the site (both camps) is about 70 (for the most time, around 45-55 are expected to be working). Therefore, monitoring of the human resources practices should be performed among the workers on site (work schedule and shift duration, full rest days, provision of paid sick leave, payments above the minimum required level etc.), and in the labour accommodation camps (freedom of movement, availability and conditions of sanitary facilities, sufficient private space, dining facilities etc.) as well as availability of rest and sanitary facilities at the work areas, if distant from the accommodation camps. The provisions of the *Workers' accommodation: processes and standards - a guidance note by IFC and the EBRD shall be applied*[144].

The contractor should be obliged to maintain the workers grievances mechanism, including an opportunity to submit anonymous complaints. In case of doubt, the PIU should extend their grievance mechanism to contractors' workers (the responsibility for responding to the grievances in this case stays with the direct employer).

Operation phase

N/A

Impact assessment and mitigation measures

[144] http://documents.worldbank.org/curated/en/604561468170043490

The assessment and mitigation of the impacts on workers' rights and working conditions during the construction and operation of the reservoir are summarised in Table 8-28.

Table 8-28. Summary of workers' rights and working conditions related impacts assessment and mitigation measures

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Project workforce	Moderate	***Pre-construction phase*** • Include requirements related to the compliance with the national labour regulations and EBRD PR2 in the contractual clauses with the Construction contractor, • Develop a Labour and Working Conditions Management Plan (at least a month before the construction) and implement it, • Develop and implement a Construction Camp Management Plan, including Sub-plans for Camp Code of Conduct and Camp Management, with requirements for worker accommodation in compliance with the Armenian labour, sanitary and health standards, EBRD PR 2 requirements, Workers' accommodation: processes and standards - a guidance note by IFC and the EBRD, ILO Workers' Housing Recommendation 1961 (No. 115), and gender-specific provisions. ***Construction phase*** Set up and maintain grievance mechanisms available to all project workforce, including the opportunity for anonymous complaints.	Low
Monitoring: Daily, weekly and monthly inspections and monitoring of the human resource practises, as well as working and living conditions at the construction site and construction camps (to be performed by the Construction contractor, the Client and invited consultants). Points to be monitored should include, among others: work schedule and shift duration, full rest days and shift breaks, provision of payments above the minimum required level, availability and conditions of sanitary facilities, as well as living conditions in the labour accommodation camps (freedom of movement, sufficient private space, dining facilities etc.).			
OPERATION PHASE			
Project workforce	Moderate	If a large-scale maintenance is planned, oblige the Maintenance Contractor to develop a Labour and Working Conditions Management Plan and Worker Code of Conduct (if needed) in line with Armenian labour laws and EBRD PR2 at least a month before any maintenance works, and implement it.	Low

8.3.8 Gender-Based Violence and Harassment

Construction phase

As one of the construction camps is planned in Yelpin village, local women might be exposed to the risks and impacts from labour influx.

A Worker Code of Conduct and Gender-Based Violence and Harassment (GBVH) Policy should be developed and conveyed to all construction workers and contractors. A grievance mechanism with

a specific mandate on GBVH should be developed and disclosed, a dedicated person to manage / oversee it should be appointed.

Operation phase

As discussed in **Chapter 8.3.4**, women (especially single women headed households) can face obstacles in the access to the irrigation infrastructure due to their limited involvement in the decision-making processes. Related GBVH cases might occur, and therefore the Project's implementing agency and the local governing authorities should employ appropriate measures to monitor and prevent such cases.

Impact assessment and mitigation measures

The assessment and mitigation of the GBVH impact during the construction and operation phases of the reservoir are summarised in **Table 8-29**.

Table 8-29. Summary of GBVH impact assessment and mitigation measures

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Female residents of Yelpin village	Moderate	***Pre-construction phase*** Develop GBVH Policy and assign focal points responsible for handling GBVH incidents within the workforce and beyond. ***Construction phase*** 1) Conduct mandatory and regular training for workers on required lawful conduct in local community, the Code of Conduct and GBVH Policy and consequences for failure to comply with the above, 2) Maintain a grievance mechanism, which includes a specific mandate on GBVH, 3) Organize information and awareness raising campaigns for community members, specifically women and girls, 4) Provide information to communities on how to use the grievance mechanism to report GBVH issues.	Low
OPERATION PHASE			
Female residents of Yelpin and Chiva villages	Moderate	1) Monitor access to the irrigation infrastructure following the Project completion. 2) Maintain the grievance mechanism during the Project operation, including the GBVH cases.	Low

8.4 Emergency Situations and Response

Various emergency situations can occur during the reservoir construction, cased by nature hazards, use of hazardous materials, in particular during the blasting operations, or other man-made accidents and disasters.

In accordance with the World Bank's (WB's) Good Practise Note (GPN) on Dam Safety (2020)[145], emergencies include flow release that can threaten downstream life, property, or economic activities that depend on river flow levels, intentional or accidental water release, and dam failure.

The GPN requires development of the Emergency Preparedness Plan (EPP) and Emergency Response Plan (ERP) during construction of the High Dam (Yelpin reservoir dam is classified as High Dam)[146]. The EPRP should be prepared not less than one year before starting reservoir filling. An effective EPP should provide clear and concise guidance on emergency actions: (a) how to identify an emergency as early as possible, (b) how to classify the emergency, and (c) how to respond to the emergency. Furthermore, the EPP should be coordinated with other key entities, such as the national and regional emergency or disaster management agencies and downstream districts and communities.

In addition to the above, the Operation and Maintenance Plan is required under the WB's GPN, which should cover reservoir operation procedure, structural dam safety assurance (periodic inspection and dam safety review), as well as downstream notification and warning procedure.

Impact assessment and mitigation measures

The assessment and mitigation of the emergency situations during the construction and operation phases of the reservoir are summarised in **Table 8-30**.

Table 8-30. Summary of emergency situations impact assessment and mitigation measures

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Workers and residents of Yelpin settlement	Moderate	Firefighting equipment and first aid kits should be available and maintained at all construction sites and project-related delivery vehicles. Selected workers should be trained on their usage.	Low
OPERATION PHASE			
Residents of the downstream communities	Moderate	1) Conduct Dam Integrity Risk Assessment, 2) After completion of the dam integrity risk assessment and flood safety check, consider the need of an early-warning system and provision of the life-saving equipment in the local communities, with the requirement of regular maintenance and emergency evacuation drills.	Low
Monitoring: *According to the Emergency Preparedness and Response Plan*			

8.5 Cultural Heritage Impact

8.5.1 Impact on Tangible Cultural Heritage

Construction phase

According to RA Government Decree №754-N on the approval of the state list of historical and cultural tangible monuments in Vayots Dzor Marz of the Republic of Armenia, none of the four

[145]Good Practice Note on Dam Safety and Technical Notes (WB 2020). Available at: https://www.worldbank.org/en/topic/watersupply/publication/good-practice-note-on-dam-safety-new-guidance-on-managing-risks-associated-with-dams

[146]It is proposed by the Consultant to combine EPP and ERP into Emergency Preparedness and Response Plan (EPRP) (see also **Section 8.3.5**)

officially registered cultural heritage sites/units and their sub-components (see **Table 6-24**) are located within the area of direct influence of the Project.

As a result of recently conducted detailed field investigations and designated on-site surveys carried out as part of the national EIA study in May 2024, the list of archaeological monuments in the Yelpin settlement has been extended. However, none of the newly discovered monuments are located within the planned Yelpin reservoir site.

Several structures consisting of stone fragments were observed within the Project site during the field surveys. These are of natural origin, formed by the movement and accumulation of materials during river floods. Among them, several artificial stone structures were also identified. These likely served a livestock-related function and may date to the late Middle Ages or the Soviet era.

Before the commencement of construction works, additional field investigations focused on the identified artificial stone structures shall be conducted by the construction contractor to verify their age and function. In addition, cultural heritage field surveys must be carried out both within and around the areas designated for construction camps and borrow pits. As of now, the Project's impact on cultural heritage is considered low. The residual impact is expected to be negligible, provided that the measures recommended in **Table 8-31** are implemented.

Operation phase

No adverse impacts on tangible cultural heritage sites/units are anticipated during the Project's operation phase. On the contrary, the presence of the reservoir may generate positive synergistic effects by enhancing the attractiveness of the area and potentially increasing visitor interest in the historical monuments located within Yelpin rural settlement.

Impact assessment and mitigation measures

The assessment and mitigation of the tangible cultural heritage impacts during the construction and operation phases of the reservoir are summarised in **Table 8-31**.

Table 8-31. Summary of tangible cultural heritage impact assessment and mitigation measures

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Local communities and site visitors	Low	***Pre-construction phase*** 1) Develop a Chance Finds Procedure (CFP) for the Project prior to the commencement of construction works, 2) Hire a qualified cultural heritage to be present during the construction works and implement archaeological surveillance for all construction sites and help implement all heritage focused mitigations, if required, 3) Conduct additional field investigations focused on the identified artificial stone structures to verify their age and function. If necessary, protective (safeguard) excavations shall be carried out by the construction contractor under the supervision of qualified specialists, 4) Carry out cultural heritage field surveys both within and around the areas designated for construction camps and borrow pits, as well as along the main irrigation pipeline running to Yelpin.	Negligible

		Construction phase Train relevant personnel in the implementation of the CFP to ensure that workers are able to identify potential chance finds, suspend work in the affected area, and notify site management promptly. Maintain an up-to-date training log and include relevant information in regular monitoring reports.	
OPERATION PHASE			
Local communities and site visitors	Neutral	The presence of the reservoir may generate positive synergistic effects by enhancing the attractiveness of the area and potentially increasing visitor interest in the historical monuments.	Positive

8.5.2 Impact on Intangible Cultural Heritage

Construction and operation phase

The implementation of the Project will not have any negative impact on intangible cultural heritage elements registered in both the UNESCO and national lists of ICH. During the construction phase, the local population will need to plan celebrations such as Christmas, New Year, Easter, and Trndez, as well as weddings and baptisms, with consideration for increased traffic along the community roads of Yelpin village. However, this impact is expected to be temporary and negligible provided that the provisions of the Traffic Management Plan are communicated with the local residents.

The Project will not negatively impact local traditions and rituals associated with winemaking and wine tasting tours (so called "Areni Wine Route" claster), including the annual Areni Wine Festivals held in Areni community. On the contrary, the Yelpin reservoir could become an additional sightseeing destination alongside Noravank Monastery and the Areni-1 cave, where the remains of 6,000 year old winemaking facilities were discovered. As a result, certain ICH elements, such as Lavash baking, duduk crafting and performance, can be promoted, contributing to the development of tourism and local trade in the Project region.

To support this potential, discussions should be held with the heads of the Areni community and adjacent villages, as well as with local cultural NGOs, tourism organizations, the "Areni Fest" Foundation (organizer of the Areni Wine Festival), and other relevant stakeholders.

The assessment of the Project impact on cultural landscapes is embedded in **Section 8.2.5** 'Impacts on Landscape and Visual Amenity'.

Impact assessment and mitigation measures

The assessment and mitigation of the intangible cultural heritage impacts during the construction and operation phases of the reservoir are summarised in **Table 8-32**.

Table 8-32. Summary of intangible cultural heritage impact assessment and mitigation measures

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
CONSTRUCTION PHASE			
Local residents	Low	Communicate the provisions of the Traffic Management Plan to the population of Yelpin settlement to help them plan Christmas, New Year, Easter, Trndez, weddings, and other celebrations and to avoid additional nuisance.	Negligible
OPERATION PHASE			

Receptor	Assessed Impact	Mitigation / management measures	Residual impact
Local residents, tourists and visitors, cultural NGOs, tourism organizations, heads of settlements	Neutral	Discuss with local cultural NGOs, tourism organizations, the heads of the Areni community and affected settlements, and other relevant stakeholders the possibility of including the Yelpin reservoir in the potential list of sightseeing sites along the "Areni Wine Route".	Positive

8.6 Cumulative Impact Assessment

8.6.1 Introduction

This section presents the findings of the Cumulative Impact Assessment (CIA), which considers the E&S impacts of the Project, as well as those of other projects or activities that are currently being implemented or planned in the near future within the Project's area of influence. The CIA takes into account human developments for which sufficient publicly available information exists to identify potential interactions with the Project over time and/or space and to assess the resulting cumulative effects.

The CIA methodology follows a step-by-step process outlined in the IFC *Cumulative Impact Assessment and Management - Guidelines for the Private Sector in Emerging Markets* (2013)[147], and is aligned with the requirements of the EIA Directive. In accordance with these Guidelines, the CIA is carried out in six steps:

Step 1 - Identification of Valued Environmental and Social Components (VEC)[148], establishment of spatial and temporal assessment boundaries,

Step 2 - Identification of other projects / activities affecting VECs included into the assessment,

Step 3 - Collecting data on and establishment of the baseline conditions of the identified VECs (this information is presented in Chapter 6 and is not repeated in the current section,

Step 4 - Assessment of the cumulative impacts on the identified VECs,

Step 5 - Assessment of significance for the predicted cumulative impacts,

Step 6 - Management of the cumulative impacts.

8.6.2 Step 1 - Identification of VECs, and Establishing Spatial and Temporal Assessment Boundaries

VECs are valuable or sensitive processes and components whose viability or sustainability might be affected by the Project; the focus of CIA is on 'ultimate recipients of impacts' (IFC, 2013). For this CIA, the VECs are defined as E&S receptors of Project's impacts identified in **Chapter 8**. Only VECs associated with adverse residual impacts of low to moderate significance and positive residual impacts are likely to be affected by cumulative effects and included into CIA.

The VECs identified for the CIA include:

[147] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_cumulativeimpactassessment.

[148] VECs may include: a) physical features, habitats, wildlife populations, b) ecosystem services, natural processes (e.g., water flow, microclimate), c) social conditions (e.g., health, income), or d) cultural aspects (e.g., recreation habits, local traditions).

- **Surface water resources (Yelpin River)** in terms of:
  - Potential adverse impact on the Yelpin River water quality of contaminated surface runoff from the construction sites,
  - Positive impact on river water quality river water quality downstream the reservoir at the operation phase,
  - Change of the hydrological regime of the Yelpin River and the Arpa River[149] where Yelping enters at the operation phase,
- **Soil resources** due to soil cover disturbance and risk of soil contaminations as a result of waste generation and accumulation at the construction sites,
- **Vegetation** / flora of the Project sites that will be destructed and lost as a result of construction works,
- **Wildlife** of the Project sites that will be relocated to the safe area (sedentary species) or forced to migrate off the Project sites and their vicinities (large mammals and birds) at a result of construction works; during the operations negative impacts are predicted to be low,
- **Terrestrial habitats** at the Project sites that will be destructed or lost due to construction works. Compensation and offsetting measures will be implemented to ensure that the Project achieves no net loss and net gain (this will be clarified once the biodiversity impact assessment section is updated based on the Stage 2 supplementary studies),
- **Landscape** of the territory between Yelpin village and the reservoir site and the reservoir site surroundings, which will be modified by creation of new landscape forms and presence of industrial facilities during the construction phase,
- **Construction workers** exposed to:
  - Occupational safety risks associated with:
    - performing high-hazard works at the constructuin sites (earthworks, works at height, with high voltage, explosives, outdoors works at extremely hot weather conditions, works on or close to the open waterbodies, works with pressurized systems, explosive handling),
    - Handling of chemical and materials including hazardous ones (e.g. explosives) at the construction sites,
    - road accident risks related to transportation between the construction camps and construction sites.
  - Occupational health risks associated with:
    - dust and ICE emissions and polluted air in the work zone,
    - noise and vibration from operation of the construction machinery and equipment,
    - potential spread of waterborne diseases (If construction activities disrupt the river and result in areas of stagnation water that favor the growth of bacterial pathogens),
    - potentially insufficient sanitation at the construction sites / construction camps.
- **Maintenance workers** exposed to:
  - Occupational safety risks associated with e.g. outdoors works at extremely hot weather conditions, works on or close to the open waterbodies,

[149]Aquatic biota is not identified as a VEC as there are no stable native biocenoses in these rivers.

- **Yelpin village residents**:
  - Occasional visitors of the vicinities of the Project sites to be affected by noise and vibration and visual effects of the construction works,
  - Residents of streets used for transportation of construction materials and equipment to the Project sites, who are affected by the emissions and noise from heavy vehicles,
  - All village residents particularly the elderly and children to be affected by increased road safety risks related to Project-related traffic across the village at the construction phase,
  - All village residents affected by the increased risk of exposure to diseases including socially significant diseases related to migrant worker influx at the construction phase,
  - Female residents of the village exposed to security risks related to migrant worker influx at the construction phase,
  - All village residents exposed to safety risks related to use and storage of explosives at the reservoir construction site,
- **Irrigation water users** (including farmers) from Yelpin and Chiva villages who would benefit from the sustainable supply of irrigation water for agriculture production;
- **Residents of downstream communities** exposed to the risk of accidental flow release can threaten downstream life, property, or economic activities;
- **Users of roads** comprising the main Project transportation routes (M-2 road, a road from M-2 road to Yelpin village, and earthen road from the village to the reservoir construction site) exposed to increased risks of road traffic accidents as these roads are Project transportation routes at the construction phase;
- **Local and regional infrastructure facilities** to be exposed to additional loads related to the Project activities at the construction phase; the following elements is the infrastructure will be affected:
  - Power supply lines - by temporary increase in electricity consumption at construction sites and operation of the two construction camps,
  - Healthcare facilities - by influx of migrant workers engaged to high-hazard works and potential increase in demand for medical service in the Project area,
  - Roads comprising the main Project transportation routes: M-2 road, road from M-2 to Yeplin village, communal roads of Yelpin village, and an earthen road from the village to the reservoir construction site - by increased traffic of heavy vehicles used for transportation of construction materials and equipment which lead to road deterioration; communal roads of the village will be also used for transportation of construction workers between the construction camps and the construction site.
- **Local workforce** that would benefit from Project-related new employment opportunities for skilled, semi-skilled, and unskilled construction workers during the construction phase,
- **Local and regional economies** that would benefit from:
  - Increased demand for certain goods and services is expected to allow some local and regional businesses to become Project suppliers at the construction phase (e.g. provide the meal preparation and delivery and housekeeping services to construction camps residents, provide construction machinery maintenance and repair service, construction waste transportation service, etc.);
  - Due to reliable irrigation water supply local farmers are expected to cultivate additional land, diversify crops and thus increase agriculture production, which would enhance economic opportunities for the local communities.

- Increased attractiveness of Yelpin village vicinity for tourists (as the created reservoir may become a spot for water sports, fishing, hiking, and/or camping); increased tourist flow into the Project area would create additional oppotunities for development of the service sector (e.g. accommodation, caterinng, guide service, etc) in the Project area.

- **Intangible cultural heritage** (incl. local cuisine and vine-making traditions) that would be acknowledged and promoted by tourists attracted to the Project area by a newly created reservoir.

The following VECs **were not included into** CIA as the residual significance of the Project impacts on them is predicted to be negligible or low to negligible:

- Groundwater resources to be affected by water infiltration from the reservoir body dam base,
- Tangible cultural heritage (unknown archaeological assists) that may be affected by excavation works,
- Workers of the reservoir operator,
- Yelpin village residents (at the operation phase),
- Shepherds from Yelpin village that can currently use reservoir site area as pasture land but do not use it due to low quality of vegetation.

The CIA **spatial boundaries** are assumed to coincide with the boundaries of Vayots Dzor Marz.

The CIA **temporal boundaries** are assumed to include Project construction and operation phases. The duration of the construction phase is estimated as 34 months.

In general, well-designed and properly maintained reservoirs can have a lifespan of several decades to over a century. For the purposes of the current CIA, the duration of the operation phase is assumed to be 50 years.

8.6.3 Step 2 - Identification of Other Activities/Projects for the Inclusion in the CIA

The current CIA will consider interaction of the Project with the existing and planned activities, which overlap with the Project temporarily and spatially, or affect the same selected VECs as the Project does. The following other projects/activities were identified and reviewed:

1. **Associated facilities (**see **Section 2.8** for details):

   1.1. Construction of a power line supply line / substation to ensure continuous electricity supply to the dam facilities (gates, valves, monitoring instruments, and security systems); at the moment, neither connection point to the power grid nor the route of the proposed power line are determined.

2. **Concurrent projects in Yelpin village:**

   The sources of information on such activities were as follows:

   - A database on EIAs for projects to be implemented in Project region,
   - Five-year development programme of Areni Community for 2023-2027,
   - Vayots Dzor Marz Development Strategy (2017–2025),
   - Media search for any planned development activities in Vayots Dzor Marz and Areni Community in particular.

   The list of identified concurrent construction Projects includes planned construction / reconstruction of the following social and communal infrastructure facilities:

2.1. Construction of a kindergarten in Yelpin settlement (2023-2027),

2.2. Reconstruction of the cultural centre in Yelpin settlement (It is planned to construct in 2027),

2.3. Construction of a park in Yelpin settlement (2024-2026),

2.4. Construction of a tented picnic area in Yelpin settlement (2023-2027),

2.5. Construction of external and internal gas supply network in Yelpin settlement (2024-2027).

At the time of writing specific locations of sites / routes of the concurrent activities are not known. It is assumed they are scattered within the village area.

3. Local and regional development projects/programmes:

3.1. World Bank-supported Tourism and Regional Infrastructure Improvement Project (2025-2030)[150] which envisions the development of a touristic cluster in Areni Community,

3.2. American University of Armenia's Turpanjian Rural Development Program[151] (ongoing) being implemented *inter alia* in Vayots Dzor Marz, which offers practice-oriented education and advise for rural entrepreneurs including farmers; in addition, it also assists them in obtaining bank loans for development of their businesses.

The proposed route of the power line to the reservoir dam will start close to the reservoir site. The power line needs to be built by the beginning if the Project's operation phase, i.e. it is supposed to be built during the Project construction phase. Therefore, there would be both spatial and temporal overlaps between the Project and this associated activity.

The planned construction and reconstruction of social and communal infrastructure in Yelpin (see para 2.1-2.5 above) will take place within the village area while all Project facilities including construction camps are located at a considerable distance (1.5 km minimum) from the village. Therefore, no direct spatial between onsite construction works of the Project and other concurrent construction projects is expected. At the same time, communal roads of the village will be used for transportation of construction materials and machinery by the Project and parallel activities. The implementation timeline of these small-scale projects partly overlaps with the Project construction phase as the start of the Project construction works is tentatively planned for the second half of 2026.

Both development programs (para 3.1 and 3.2) would have temporal overlaps with the Project construction phase and potentially with its operation phase. There is no spatial overlap between each of these two initiatives and the Project but they definitely have common target VECs:

- Local farmers / irrigation water users (in case of the Project and Turpanjian Rural Development Program), and
- Local economy (namely its touristic sector) in case of the Project and Tourism and Regional Infrastructure Improvement Project.

Therefore, all the activities listed above are included into the current CIA.

8.6.4 Step 3 - Collecting data on and establishment of the baseline conditions of the identified VECs

This information is provided in **Chapter 6** and is therefore not repeated in the current section.

[150] https://projects.worldbank.org/en/projects-operations/project-detail/P504282
[151] https://trdp.aua.am/about/

8.6.5 Steps 4 and 5 - Assessment and Evaluation of the Key Cumulative Impacts

Construction phase

During the construction phase, cumulative impacts may result from the overlap between Project activities and concurrent projects related to the construction/reconstruction of infrastructure facilities in Yelpin village and its vicinity.

The current CIA indicates that many of the Project's impacts are not significantly amplified by those of other activities or projects. As a result, the cumulative impacts are expected to be of a similar level of significance as the Project's residual impacts. These impacts include:

- Impacts of low significance:
    - Cumulative adverse impact on the water quality of the Yelpin River due to contaminated surface runoff from the reservoir site, the proposed power line route, the Project construction camp near the reservoir, and potentially from concurrent construction sites within Yelpin village,
    - Cumulative adverse impacts on soil resources and vegetation cover at the reservoir site, borrow pit areas, along the power line route, and at Project construction camp locations,
    - Cumulative adverse impacts on wildlife resulting from habitat disturbance at the reservoir site, borrow pits, power line route, and Project construction camp sites,
    - Cumulative visual impacts due to landscape transformation in the area between Yelpin village and the reservoir site, including the proposed power line route and the construction camp near the reservoir,
    - Occupational health and safety risks for construction workers across all Project facilities and the route of the proposed power line,
    - Community safety risks associated with the use and storage of explosives at the reservoir construction site,
    - Increased load on the power supply infrastructure due to aggregated demand from the Project and concurrent construction activities;
    - Impact on sedentary animals due to destruction of their habitats as a result of constuction works at the Project sites and the route of the proposed power line (after the relocation of animals from the Project site to safe areas);
    - Disturbance of fauna species by constructuin works at the Project sites and the route of the proposed power line;
    - Impact on birds and large mammals due to destruction of foraging and/or breeding habitats as a result of constuction works at the Project sites and the route of the proposed power line.
- Impacts of moderate significance:
    - Loss of habitats as a result of constuction works at the Project sites and the route of the proposed power line
    - Loss of flora species as a result of constuction works at the Project sites and the route of the proposed power line.

      Note: after biodiversity offset applicartion no net loss / a net gain is expected.

In addition, there are cumulative impacts resulting from the amplification of Project-related impacts by those of other activities or projects. The significance of these cumulative impacts is assessed as low to moderate. These impacts include:

- Cumulative adverse impact on residents of Yelpin living along community roads used for the transportation of construction materials and equipment, due to nuisance from emissions and noise generated by heavy vehicles. This impact arises from activities at the reservoir site, the proposed power line route, the Project construction camp near the reservoir, and construction sites of concurrent projects within Yelpin village,
- Road safety risks for Yelpin residents, particularly the elderly and children, due to increased traffic of heavy vehicles passing through the village,
- Risk of road traffic accidents for all users of the roads designated as main transportation routes for both the Project and concurrent activities,
- Cumulative adverse impact on the condition of roads used as primary transportation routes by the Project and concurrent construction activities,
- Positive aggregated impact on the local workforce, through the creation of new employment opportunities for skilled, semi-skilled, and unskilled construction labor.
- Positive aggregated impacts on local and regional economic development, driven by increased demand for goods and services provided by local and regional businesses (e.g., meal preparation and delivery for construction workers, maintenance and repair of construction machinery, transportation of construction waste, etc.).

Operation phase

During the operational phase, the following cumulative impacts may arise from the overlap between Project operations and local/regional development programs. These are expected to be positive cumulative impacts:

- Promotion of agricultural business development in Yelpin and Chiva villages: the Project reservoir will ensure a stable supply of irrigation water, while the Turpanjian Rural Development Program will provide knowledge transfer on effective and efficient agricultural practices and assist with obtaining bank loans for business development.
- Promotion of tourism business development in Yelpin village: the Project reservoir may become a new tourist attraction (e.g., water sports, fishing, hiking, and camping), while the Tourism and Regional Infrastructure Improvement Project will support individuals interested in starting or expanding tourism-related businesses.

8.6.6 Step 6 - Cumulative Impacts Management

As explained above, possible cumulation of impacts on the VECs included into CIA either did not change only slightly changed the significance of the residual impacts of the Project. **The CIA did not identify neither moderate nor high adverse cumulative impacts.**

Recommended Impact Prevention / Mitigation Measures to Reduce Adverse Cumulative Impacts

- The routes for the Project-related transportation have not been determined at this stage of the Project development. The Construction Contractor will identify such routes based on consultations with the traffic police and local administrations of affected communities. Afterwards, the Construction Contractor should:
    - Arrange reconnaissance drives along the selected routes to evaluate and document current road conditions and identify sensitive receptors (schools, hospitals, residential areas, other social infrastructure facilites);

- Select optimised dalily time slots for transporting construction materials / equipment to the Project site, especially bulky equipment parts (e.g., pipes) based on consultations with the traffic police and local administrations;
- Develop a Construction Traffic Management Plan, informed by the abovementioned studies, which would consider traffic flows of concurrent activities to minimise overlapping. The Plan should propose specific mitigation measures to reduce cumulative traffic effects on identified sensitve receptors including avoidance (where possible), timing adjustments, additional traffic signs, reinforcement of the speed limits, etc. The Plan should be ap by traffice police.
- Disclose/Explain the proposed transportation routes to the public as envisioned in the SEP.

The implementation of these measures **will reduce the significance of adverse cumulative impacts related to construction traffic to minor**.

8.7 Summary of E&S Impacts, Benefits and Opportunities

1) The Yelpin River is a tributary of the Arpa River, which ultimately joins the Araks River. The Araks River serves as the border between Iran and Nakhichevan, forms part of the border between Armenia and Turkey in the southwest, and also marks the southern border between Armenia and Iran.
2) A conservative evaluation of the planned reservoir's impacts has been made possible through basic hydrological modelling (SWAT+) and expert judgment. The assessment indicates that the Yelpin Reservoir is unlikely to have significant downstream impacts. This conclusion is primarily based on the upstream location of the reservoir relative to existing lakes and reservoirs, and the relatively small size of the rivers it impounds.
3) The Project is assessed as aligned with the goals of the Paris Agreement and is included on the aligned list under the water supply and wastewater category. No project activities have been identified on the 'non-aligned list'. The Project is also assessed as aligned with the mitigation goals of the Paris Agreement (BB1 aligned).

   The Project does align with some of the targets outlined in Armenia's draft LT-LEDS and, therefore, the country's NDC in that it is designed to improve water supply and efficiency in irrigation. However, it is noted that GHG emission estimates at this stage show net positive carbon emissions for reservoir over 100 years. The total GHG emissions from the planned reservoir at year 1 are estimated 18.2 tCO2e/year, while at year 50 - 3.69 tCO2e/year.
4) Approximately 70% of the total air emissions from construction activities are expected to consist of dust (PM2.5 and PM10). According to air emissions calculations, the maximum dust emission rate during the construction phase is estimated at 2.82 g/sec, which is unlikely to have a significant impact on ground-level atmospheric dust concentrations. A similar conclusion applies to gaseous emissions, which are also expected to remain below acceptable limits and pose minimal risk to ambient air quality. There are no residential houses in the immediate vicinity of the construction site, construction camps and borrow-pits. Therefore, air pollutants, as well as noise and vibration from construction machinery and operations, are not expected to affect the local population, although some negative impact on workers employed by the contractors may occur.

   The air emissions from the operated reservoir will be minimal and will primarily depend on the climatic conditions in the Project region. The noise and vibration impact during the Project operation phase is negligible.

5) Taking into account that construction site and borrow pits are expected to not visible from the Yelpin village and M-2 highway, the main aspects of visual disturbance are the construction machinery, heavy vehicles and storage areas of the construction materials and oil products in the construction site and camps. This impact is unavoidable; however, it is short-term (limited to the construction period).

   As a result of the Project implementation, the landscape of the Project area will undergo a permanent transformation due to the formation of the reservoir and the presence of associated infrastructure. The main impacts include: Permanent change in land cover, New visual elements, Potential aesthetic value and Landscape alteration. Overall, the visual impact during the operation phase is long-term and permanent. However, effective landscaping and environmental integration measures can help mitigate negative visual effects. Over time, the Project's visual impact may even become positive.

   During the construction phase, the main sources of visual disturbance will include construction machinery, heavy vehicles, and storage areas for construction materials and oil products. However, the construction site will not be visible from the village and the M-2 highway. While this impact is unavoidable, it is considered short-term and limited to the construction period.

6) Project implementation may also have a positive impact on the cultural landscape. It has the potential to transform the organically evolved cultural landscape, characterized by traditional vineyards and orchards, into a more designed cultural landscape. This transformation could contribute to the perception of the region as the "Motherland of Wine" among tourists and visitors, potentially serving as an additional driver of regional economic development.

7) Excavation and earthworks involve the movement of certain amount of soil, including topsoil and excavated subsoil. These activities can potentially trigger landslides, mass movements, and other erosion processes. Additionally, disturbed soils may become temporarily destabilized due to precipitation and surface runoff, increasing the risk of geological erosion. The combined effects on soil stability and changes in topography can create conditions that lead to temporary but harmful erosion and sedimentation. These impacts necessitate the implementation of appropriate mitigation measures.

8) According to the results of the engineering-geological study, the estimated annual water infiltration from the reservoir body is significant, indicating the need for anti-infiltration measures, which are described in detail in the project design documentation. Implementation of the proposed measures is expected to reduce water infiltration from the reservoir to an acceptable level of 7,194 m³ per year.

9) During the construction phase, contamination of the Yelpin River is expected due to dust deposition, exhaust gas emissions from construction machinery and heavy trucks, spills of hazardous materials, and improper management of storage areas. The construction of the reservoir may also alter the hydrological regime of the Yelpin River. While these changes can improve water availability for irrigation, they may reduce streamflow to downstream ecosystems and affect groundwater dynamics. To mitigate adverse effects, the implementation of an irrigation water and environmental flow release management plan is recommended.

10) Approximately 400,000 m^3 of spoil material will be generated during excavation and earthworks, of which around 30,000 m³ will be used as backfill material for the dam. The remaining spoil (370,000 m^3) will be disposed of at the Spoil Disposal Area tentatively proposed in the national EIA report. However, the proposed site must be agreed upon with the affected Areni municipality, and a Spoil Disposal Management Plan for the identified area must be developed and approved prior to the start of construction. Proper management

of the waste streams to be generated during the construction phase will be ensured through a detailed Waste Management Plan.

11) The negative impacts on biodiversity occur mainly at the construction phase; they are caused by the dam building and flooding of the reservoir footprint area. Some positive impacts on biodiversity occur during the operational phase; they are connected with emergence of the new habitats - large water surface and coastal vegetation which will attract some species of animals.

12) Blasting, excavation, and land clearance will destruct the habitats located within the dam and reservoir footprints. Habitat biodiversity values embrace 5 priority biodiversity features (E1.2 Perennial food grasslands and main steppes, F7.35-AM Armenian phryganoids, F9.12 Lowland and collinar riverine willow scrub, G1.11. Riverine willow woodland, H3.2 Basic and ultra-basic inland cliffs; and one critical habitat: F3.1. Temperate thickets and scrub.

13) Due to the anticipated flooding of the territory with water, the loss of breeding habitats is expected for the following numbers of the species (breeding pairs), protected under the Bern Convention (marked as Res 6) and Red Book of Armenia: 1) Syrian Woodpecker *Dendrocopos syriacus* 1 pair, 2) Tawny Pipit *Anthus campestris* 1-2 pairs, 3) Wood Lark *Lullula arborea* 8-13 pairs, 4) White-throated Robin *Irania gutturalis* 5-7 pairs, 5) Red-backed Shrike *Lanius collurio* 3-5 pairs, 6) Lesser Grey Shrike *Lanius minor* 1-2 pairs.

14) Due to large distances, there will be no negative impact on the nationally protected areas and Candidate Emerald sites. A relatively short distance (320 m) between north-eastern edge of the planned reservoir and Gndasar KBA/IBA allow to assume some impact. The most considerable impact will be due to noise during the blasting. Birds which inhabit the Gndasar KBA/IBA (in south-western part of the area) will migrate further up the valley, but will come back after the blasting is finished.

15) The implementation of the Project will have a significant impact on the traffic intensity within the rural settlement of Yelpin. However, the construction of the access roads will serve as bypass routes for the transportation of materials, thereby reducing the negative traffic impacts associated with the Project. A Traffic Management Plan shall be developed for the Project.

16) The Project impacts on the socio-economic receptors of the Project area are mostly positive during both construction and operation phases. The residents might be positively impacted by the new employment opportunities during the Project construction phase, thereof increasing the households' income. The residents and local businesses will have an opportunity to be engaged in the service sector, namely meal preparation and delivery, as well as housekeeping and other services. Local and regional businesses may join the project supply chain - in areas including transportation, and provision of goods and services.

17) Reliable water supply from the Yelpin reservoir will incentivise farmers to invest in modern irrigation systems and water-saving technologies, making the irrigation system more sustainable. In addition, stable water availability will lead to cultivation of additional land, diversification of crops, increase of agricultural produces thereby enhancing economic opportunities for the local community.

18) The construction of the reservoir will have positive effect on the families' standards of living, including socially vulnerable households. The Project implementation will support food security in the households engaged in the subsistence agriculture and might enable accumulation of a larger surplus for sale. At the same time, the price of the irrigation services should account for the affordability to the low-income households.

19) Within the territory allocated for the construction of the reservoir (including within the buffer zone) there is no land in private ownership, all land is in communal ownership (with the intended purpose of pasture). No residential houses are located on land required for the

Project implementation. Thus, the Project will not to result in physical displacement of PAPs (relocation or loss of housing).

20) Physical factors such as air and noise emissions, soil contamination, and wastewater discharge are unlikely to affect the health and safety of Yelpin village residents. Labour influx might increase the risk of the local community exposure to diseases, including socially significant diseases, as well as safety and security risks. Emergency situations pose risks to the community both during construction and operation stages. The construction works must be performed in accordance with an Occupational Health and Safety Management Plan.

21) The Project Implementation Unit (PIU) should require compliance with the national labour regulations from the contractors via contractual clauses. Monitoring of the human resources practises should be performed among the workers on site (work schedule and shift duration, full rest days, provision of paid sick leave, payments above the minimum required level etc.), and in the labour accommodation camps (freedom of movement, availability and conditions of sanitary facilities, sufficient private space, dining facilities etc.).

22) A Worker Code of Conduct and Gender-Based Violence and Harassment (GBVH) Policy should be developed and conveyed to all construction workers and contractors. A grievance mechanism with a specific mandate on GBVH should be developed and disclosed, a dedicated person to manage / oversee it should be appointed.

23) As a result of recently conducted detailed field investigations and designated on-site surveys carried out as part of the national EIA study in May 2024, the list of archaeological monuments in the Yelpin settlement has been extended. However, none of the newly discovered monuments are located within the planned Yelpin reservoir site. The closest cultural heritage site to the Project area is the Harsnakar (Yelpin-2) rock-cut complex, which also lies outside the area potentially affected by construction activities.

24) The implementation of the Project will not have any negative impact on intangible cultural heritage elements registered in both the UNESCO and national lists of ICH. The Project will not negatively impact local traditions and rituals associated with winemaking and wine tasting tours. On the contrary, the Yelpin reservoir could become an additional sightseeing destination alongside Noravank Monastery and the Areni-1 cave, where the remains of 6,000 year old winemaking facilities were discovered.

25) The implementation of the Project will not have any negative impact on elements of intangible cultural heritage registered on both the UNESCO and national ICH lists. It will neither adversely affect local rituals associated with wedding and baptism ceremonies nor traditions related to winemaking and wine tasting tours. On the contrary, the Yelpin Reservoir could become an additional sightseeing destination, complementing attractions such as Noravank Monastery and the Areni-1 cave, where 6,000-year-old winemaking facilities were discovered.

26) The Cumulative Impact Assessment prepared for the Project did not identify any major negative cumulative impacts.

27) E&S Monitoring Plans for construction and operation phases will be developed, agreed with the Supervision engineer and Lenders, and implemented by the Construction contractor (during construction phase) and the Client (during the operation phase). Both observational and instrumental monitoring will be conducted as per the Monitoring Plans. Appropriate human and material resources for their implementation will be allocated.

9. Environmental and Social Management and Monitoring

9.1 Introduction

The Project's Environmental and Social Management Plan (ESMP) is a standalone document associated with this ESIA Report. It comprises a set of mitigation and management measures, criteria for their effective implementation, and institutional arrangements to be undertaken throughout the Project's life cycle to prevent, reduce and compensate adverse E&S impacts to acceptable levels. The ESMP has been prepared based on the findings of this E&S appraisal to ensure that the Project is implemented in compliance with applicable national E&S laws and regulations, the EBRD ESP (2019), relevant EU directives, and Good International Practices (GIP).

The ESMP is a key document that outlines the E&S requirements, including those related to cultural heritage (both tangible and intangible), land tenure, emergency situations, and community and occupational health and safety risks, and specifies the operational procedures necessary to manage significant issues that may arise during Project implementation.

The ESMP will be implemented during the construction (including pre-construction) and operation (including maintenance) phases of the Project. As such, it can be used as a standalone document throughout the different phases of the Project by key stakeholders, including:

- **Construction contractor(s)** - during the pre-construction and construction phases,
- **The Supervision engineer** - during the construction phase,
- **The Client (Water Committee with its PIU)**, in its capacity as Project owner and developer - throughout the Project construction phase,
- **"Jrar" CJSC**, in its capacity as reservoir operator - throughout the Project operation phase,
- **The Contractors** engaged by the Client or reservoir operator ("Jrar CJSC" under the MTAI) - during the maintenance phase,
- **EBRD** - during the active period of the loan agreement,
- **Other governmental authorities** (MTAI, ME) and inspection bodies,
- **Local self-governmental bodies** - Areni municipality, administrative head of Yelpin rural settlement.

The Client holds the overall responsibility for the implementation and supervision of the E&S management and mitigation measures outlined in the Project's ESMP. The further development and effective implementation of these measures prior to and during the construction phase will be delegated to the Construction contractor(s) and supervised by the Supervision engineer, who will be appointed by the Client. The Client or the water reservoir operator - "Jrar" CJSC, will be responsible for and take ownership of the measures relevant to the operation and maintenance phase of the Project.

This chapter outlines the key objectives and fundamental principles of the ESMP, as well as its structure and content.

9.2 Objectives of Environmental and Social Management

E&S management and monitoring measures represent the primary outputs of the Project's ESIA process. They are intended to address identified E&S impacts and risks and to reduce them to acceptable levels in line with national regulatory and EBRD ESP requirements. The key objectives of the E&S management/monitoring are to:

- **Integrate environmental and social considerations** into all phases of Project design, construction and operation (maintenance),
- **Ensure compliance** with national legal requirements, EBRD PRs, and other applicable international standards,
- **Avoid, minimize, or mitigate adverse impacts** on the environment, workers, and affected communities through effective planning and implementation of mitigation measures,
- **Establish clear roles, responsibilities, and procedures** for the implementation of E&S mitigation and monitoring measures, as outlined in the Project's ESMP,
- **Promote continuous improvement** in E&S performance through adaptive management, regular monitoring, and corrective actions,
- **Enhance transparency and accountability** by ensuring timely reporting to the Client, EBRD, competent authorities, and other relevant stakeholders,
- **Facilitate stakeholder engagement** by ensuring that the concerns and expectations of affected communities and other stakeholders are considered and addressed throughout the Project life cycle.

9.3 Principles of Environmental and Social Management across the Project Life Cycle

Pre-construction Phase

Any requirement arising from the process of obtaining specific Project-related decisions (such as approvals, permits, or consents) from national and/or local self-governmental bodies (e.g., ministries, communities, inspection bodies, agencies) and/or the Client and EBRD during the pre-construction stage will be incorporated into the final construction documentation.

Construction Phase

In principle, the implementation of the key E&S mitigation measures related to the construction phase will be delegated to the Construction contractor(s). This delegation will be governed by the ESMP, which will form part of the tender documents, procurement process, and the Construction contractor's contract.

The Construction contractor(s) will develop their own Construction Environmental and Social Management Plans (CESMP), which must be aligned with this ESIA Report and the associated ESMP. The CESMP will include Site-Specific Environmental and Social Management and Monitoring Plans (SSESMPs) or procedures to address E&S issues during the construction period. The Supervision engineer, appointed by the Client, shall review and approve these documents.

It will be the responsibility of the appointed construction contractor(s) to further elaborate on the issues addressed in the ESMP as the Project planning progresses, both prior to and during construction. This includes, but is not limited to, the establishment of construction zones, temporary facilities for the workforce, details for storing construction and other materials, traffic and transport management, environmental protection and waste management, labour management, occupational and community health and safety, emergency preparedness, and other relevant matters.

Operational Phase

The operation phase will commence following the full commissioning of the reservoir and supporting infrastructure. At that stage, all works will have been handed over by the Construction contractor to the reservoir operator ("Jrar" CJSC), who will be responsible for implementing the majority of E&S management measures to ensure continued compliance with the Project's mitigation strategy. These

measures will be managed through "Jrar" CJSC's Environmental and Social Management System (ESMS), in alignment with applicable regulations and guidelines.

In addition, the implementation of key E&S mitigation measures related to maintenance activities may be delegated to a designated contractor (i.e. the reservoir maintenance contractor). Such delegation will be governed by specific contractual arrangements.

All mitigation measures specified in **Chapter 8** of this ESIA report are included in the relevant sections of the ESMP prepared for the Project.

9.4 Site-Specific Environmental and Social Management and Monitoring Plans

The Consultant recommends a set of specific operational, management, and monitoring plans that should be prepared by the construction contractor in line with the Project's ESMP and implemented during the pre-construction and construction phases to effectively manage E&S impacts. At a minimum, the proposed SSESMPs shall include:

- Traffic Management Plan,
- Tree Management Plan,
- Topsoil Management Plan,
- Spoil Disposal Management Plan,
- Hazardous Materials Management Plan,
- Blasting Safety Management Plan,
- Spill Prevention and Management Plan,
- Waste Management Plan,
- Occupational Health and Safety Management Plan,
- Labour and Working Conditions Management Plan,
- Local Employment and Procurement Plan,
- Construction Camp Management Plan, including Sub-plans for Camp Code of Conduct and Camp Management,
- Worker Code of Conduct;
- Borrow Pit Management Plan,
- Chance Find Procedure,
- Air, Water, and Soil Quality Monitoring Plan,
- Noise, Vibration and Blasting Monitoring Plan,
- Stakeholder Management Plan (that shall be updated at least once a year).

9.5 Organizational Structure of Environmental and Social Management

The organizational structure of the Project's E&S management is presented in the **Figure 9-1**.

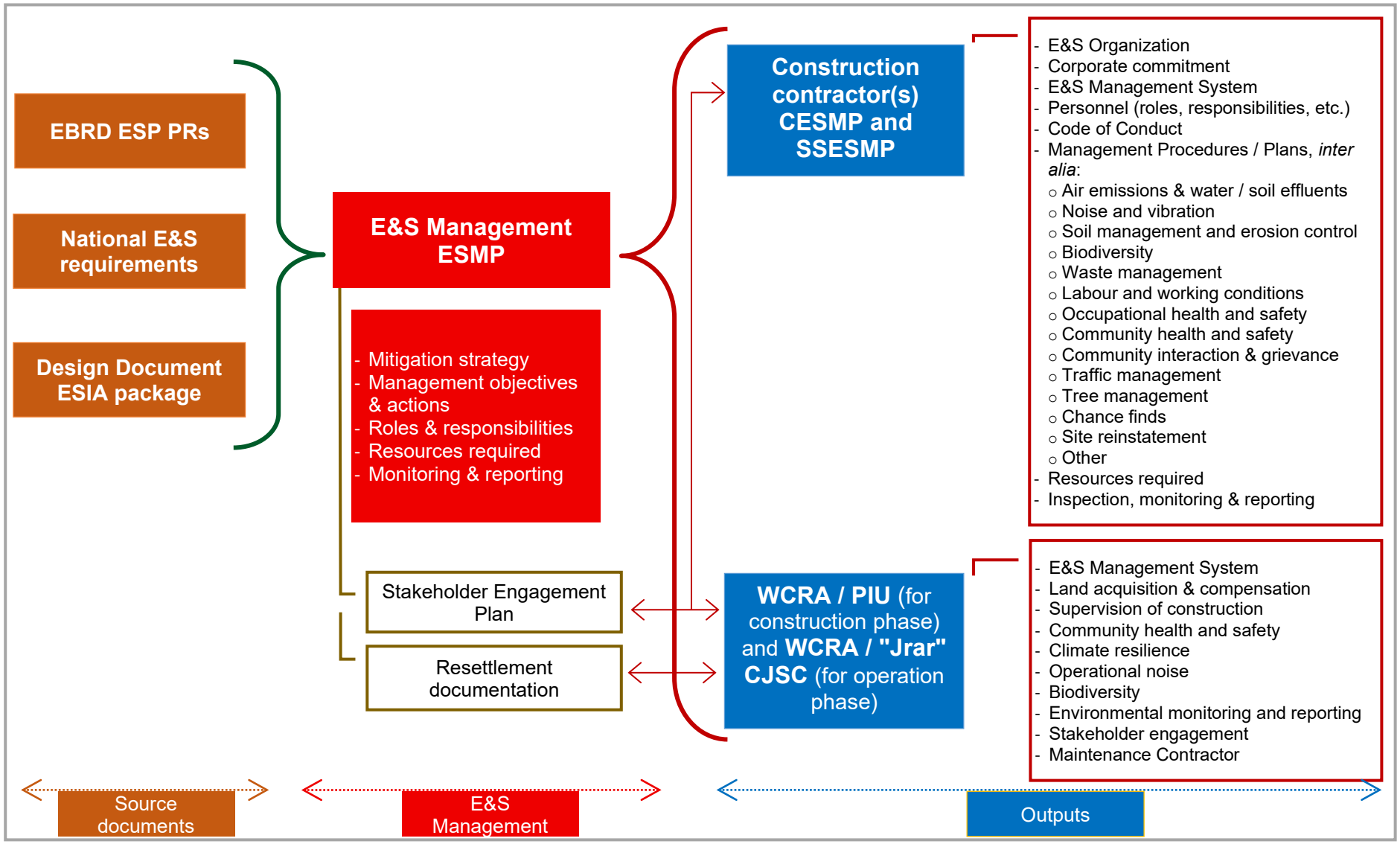
The source documents include:

- National legal act and regulations,
- EBRD ESP, applicable EU directives and GIPs,
- Design documents - to be prepared to meet national regulations as well as the best international practice,
- ESIA report (this document) and the accompanying documents (ESIA package), and upcoming updates.

The output documents are:

- The CESMP and SSESMPs to be prepared by the Construction contractor(s) to achieve the E&S performance objectives during the Project's construction phase,
- The Client's or PIU's ESMS, required to implement and monitor the management actions described in the ESMP,
- Detailed E&S management procedures necessary to address the mitigation and compensation measures identified through this E&S assessment, and
- Various documents to be produced and disclosed during Project implementation to provide information on construction and operation activities, as well as the results of E&S monitoring.

Figure 9-1. Structure and organization of the Project's Environmental and Social Management



10414

Annex 1

ՀԱՍՏԱՏՈՒՄ ԵՄ՝
Շրջակա միջավայրի նախարարի
պարտականությունները կատարող
Արամ Մելյմարյան

«23» 09 2024թ.

ՊԵՏԱԿԱՆ ՓՈՐՁԱՔՆՆԱԿԱՆ ԵԶՐԱԿԱՑՈՒԹՅՈՒՆ

ՇՐՋԱԿԱ ՄԻՋԱՎԱՅՐԻ ՎՐԱ ԱԶԴԵՑՈՒԹՅԱՆ ՓՈՐՁԱՔՆՆՈՒԹՅԱՆ

ԲՓ № 197 - 24

Նախաձեռնող՝ **«Քոնսեկոարդ» ՍՊԸ**
ք. Երևան, Սեբաստիայի փողոց 31/2

Գործունեությունը՝ **Ելփինի ջրամբարի կառուցում**
Վայոց ձորի մարզ

Առդիր՝ 8 թերթ

ՊԵՏԱԿԱՆ ՓՈՐՁԱՔՆՆԱԿԱՆ ԵԶՐԱԿԱՑՈՒԹՅՈՒՆ

ՇՐՋԱԿԱ ՄԻՋԱՎԱՅՐԻ ՎՐԱ ԱԶԴԵՑՈՒԹՅԱՆ ՓՈՐՁԱՔՆՆՈՒԹՅԱՆ

ԲՓ № 197 - 24

«23» մայիսի 2024թ.

Վայոց ձորի մարզի Արենի համայնքում Ելփինի ջրամբարի կառուցման շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվություն

Նախաձեռնող՝	«Քոնսեկոարդ» ՍՊԸ
Ներկայացված նյութեր՝	Շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվություն, նախագիծ
Գործունեության տեսակ	«Բ» կատեգորիա
Տեղադրման վայրը՝	Վայոց ձորի մարզ, Արենի համայնք, Ելփին բնակավայր

Ներածական մաս. «Քոնսեկոարդ» ՍՊ ընկերության /այսուհետ՝ Ընկերություն/ կողմից փորձաքննության ներկայացված նախագծային փաթեթով նախատեսում է Վայոց ձորի մարզի Արենի համայնքի Ելփին բնակավայրի վարչական տարածքում կառուցել Ելփինի ջրամբարը: Ներկայացվող ծրագրի պատվիրատուն ջրային կոմիտեն է, որը ֆինանսավորվում է Վերակառուցման և զարգացման եվրոպական բանկի /ՎԶԵԲ/-ի կողմից :

Համաձայն «Շրջակա միջավայրի վրա ազդեցության գնահատման և փորձաքննության մասին» (ՀՕ-150-Ն) օրենքի 12-րդ հոդվածի՝ 4-րդ մասի 3-րդ կետի ա ենթակետի նախատեսվող գործունեությունը հանդիսանում է «Բ» կատեգորիայի գործունեության տեսակ: Նախատեսվող գործունեության համար հիմք է հանդիսացել պատվիրատուի հայտը, Վայոց ձորի մարզի Արենի համայնքի ղեկավարի կողմից 30/03/2023թ-ին տրված ճարտարապետահատակագծային առաջադրանքը:

Նկարագրական մաս. ՀՀ Կառավարությանը ԵՄ աջակցության շրջանակներում «Վերականգնում, դիմակայունություն և բարեփոխում. Արևելյան գործընկերության առաջնահերթությունները 2020թ-ից հետո» նախաձեռնության «Լրացուցիչ «Բ» նախաձեռնության» շրջանակներում նախատեսվում է՝ կառուցել 17 ջրամբարներ: Ծրագրի իրականացման արդյունքում ոռոգման համակարգերը մեխանիկականից կփոխարինվեն ինքնահոսի՝ ինչը կնպաստի 1 մ³ ոռոգման ջրի ինքնարժեքի զգալի նվազեցմանը, որն իր դրական ազդեցությունը կունենա գյուղատնտեսական արտադրության վրա: Ելփինի ջրամբարը, նախատեսվում է կառուցել Վայոց ձորի մարզի Արենի համայնքի Ելփին բնակավայրի վարչական տարածքում, Ելփին բնակավայրից 2600 մետր հյուսիս-արևելք, Արփա գետի աջափնյա վտակ Ելփին գետի վրա՝ Ելփին և Չիվա բնակավայրերի 300հա գյուղատնտեսական հողատեսքերը ոռոգման ջրով ապահովելու նպատակով:

02543163 ՓՈՐՁԱՔՆՆԱԿԱՆ ԵԶՐԱԿԱՑՈՒԹՅՈՒՆ ЗАКЛЮЧЕНИЕ ЭКСПЕРТИЗЫ COMMISSION OF EXPERTS

Ներկայացվող ծրագիրն իրականացվում է Կառավարության քաղաքականության և որոշումների հիման վրա, ուստի քննարկվել են ջրամբարի ցուցանիշների և կառուցման եղանակների տարբերակները: Ինչպես վերը նշվել է՝ Ելփինի ջրամբարը նախատեսվում է կառուցել Վայոց ձորի մարզի, Եղեգնաձորի տարածաշրջանի Ելփին համայնքի վարչական տարածքում, Արփա գետի աջափնյա վտակ Ելփին գետի վրա՝ 1650-1700 բացարձակ նիշերի սահմաններում: Ջրամբարը ծառայելու է գետի հեղեղային ելքերը կուտակելու և սակավաջուր ամիսներին Վայոց ձորի մարզի Ելփին և Չիվա համայնքների 300հա գյուղատնտեսական հողատարածքների կայուն ոռոգումն իրականացնելու համար: Ջրամբարի հիմնական հիդրոտեխնիկական կառույցը՝ պատվարն է: Դիտարկվել է պատվարի կառուցման երկու տարբերակ՝

- քարահողային պատվար (կոպճա-ճալաքարային բնահողից), կենտրոնական ավազակավե միջուկով:
- քարահողային պատվար ավազակավե էկրանով:

Երկու տարբերակների համար կազմվել է նախնական խոշորավված նախահաշիվ: 1-ին տարբերակի դեպքում ջրահամակարգի կառուցման շինմոնտաժային աշխատանքների նախահաշվային արժեքը կազմում է մոտ 2,968 մլրդ ՀՀ դրամ, իսկ 2-րդ դեպքում՝ մոտ 3,091 մլրդ ՀՀ դրամ: Յուրաքանչյուր տարբերակի համար կատարվել են տնտեսական նպատակահարմարության հաշվարկներ և ստացված ցուցիչների ամփոփման արդյունքում որպես նախագծային ընտրվել է 1-ին տարբերակը:

Ջրամբարի լրիվ ծավալը 930 հազ մ^3 է, օգտակար ծավալը՝ 810 հազ մ^3, մեռյալ ծավալը՝ 120 հազ մ^3,պատվարի բարձրությունը 36 մ: Ելփինի ջրամբարի, պատվարի և նրա օժանդակ կառուցվածքների տակ ընկնում է 14.7 հա հողատարածք, որից ջրամբարի բոլոր հիդրոտեխնիկական կառույցների տակ՝ 8.5 հա:

Ջրամբարի ջրածածկման տարածքի կորդինատները՝ ARM WGS-84 կորդինատային համակարգով հետևյալն է՝

Հ/Հ	X [մ]	Y [մ]
1	4410149.3995	8511073.3926
2	4410290.9629	8510999.3030
3	4410293.2190	8511003.3632
4	4410364.5390	8511175.3409
5	4410427.5964	8511171.5827
6	4410425.7712	8511328.6592
7	4410518.0218	8511550.6274
8	4410511.0280	8511554.7917
9	4410447.9885	8511506.9316
10	4410353.4352	8511361.2647
11	4410278.8222	8511299.2016
12	4410149.5337	8511188.6619
13	4410213.8124	8511204.0691
14	4410185.4731	8511147.4916

Նախատեսվող ջրամբարի տարածքը գտնվում է բնական վիճակում, որոշ տարածքներ օգտագործվել են որպես բնական արոտավայրեր: Տարածքը հիմնականում քարքարոտ է , ծալքավոր: Գեոմորֆոլոգիական տեսանկյունից հետազոտվող տեղամասը զբաղեցնում է Քարկատարի լեռների հարավ-արևմտյան լանջերը: Շրջանի ողջ տարածքը բնութագրվում է

որպես տիպիկ լեռնային շրջան ՝ կտրտված ռելիեֆով: Ռելիեֆը ձորակային է, հատված է Ելփին գետի գետային ցանցով և ժամանակավոր ջրահոսքերով, ունի դեպի հարավ-արևմուտք կողմնորոշված ընդհանուր թեքություն: Տարածքում լայն տարածում ունեն պլիոցենի գոյացումները: Տեկտոնիկայի առումով Ելփինի ջրամբարի շրջանը գտնվում է ծալքավոր գոտում, որը ներկայացված է թույլ տեղախախտված հրաբխածին գոյացումներով, ջրամբարը գտնվելու այդ հրաբխածնային ստվարաշերտում:

Մթնոլորտային տեղումները և Ելփին գետի ջրերը, փուխր բեկորային և ճալաքարակոպճային գոյացումների միջոցով ներթափանցելով առաջացնում են միջմակերեսային ջրային հորիզոն: Հիմնական ստորգետնյա ջրերի մեծ մասը կուտակվում է միջին պալեոգենի հրաբխային ապարներով ներկայացված՝ տարածաշրջանային ջրամերժ շերտի վերևում:

Կլիման պատվարի հատվածում չափավոր է, երկարատև տաք ամառներով և ցուրտ ձմեռներով: Օդի միջին տարեկան ջերմաստիճանը 12,3^{0}C է, հունվարին՝ -2,6^{0}C, օգոստոսին՝25,9^{0}C: Օդի միջին տարեկան հարաբերական խոնավությունը 59 է, տեղումների միջին տարեկան քանակությունը 385մմ, որը հիմնականում թափվում է ապրիլ-հոկտեմբեր ամիսներին:

Ջրամբարի տեղամասում հիդրոլոգիական հաշվարկների կատարման համար որպես բազային տվյալներ վերցվել են Գլաձոր գետի Վերնաշեն դիտակետի տվյալները, քանի որ վերջինս ունի շուրջ 58 տարվա դիտարկումների շարք, ինչպես նաև Ելփին գետի Ելփին դիտակետի տվյալները, քանի որ գտնվում է ջրամբարի պատվարի տեղամասից մի փոքր ներքև:

Ելփին գետն ունի ՀՀ գետերին բնորոշ հոսքի ներտարեկան բաշխում: Գետն ունի հստակ արտահայտված գարնանային վարարումների փուլ, ձմեռային և ամառային սակավաջրության փուլ և աշնանային հորդացումների փուլ: Գարնանային վարարումներն առավելապես առաջանում են ձնհալի և անձրևների շնորհիվ, աշնանային հորդացումները կարող են լինել տեղումների արդյունքում, այն էլ կարճ՝ ոչ հստակ արտահայտությամբ: Սակավաջուր սեզոնին գետն հիմնականում սնվում է աղբյուրներից: Ելփինի ջրամբարի հատվածում տարեկան հոսքի ծավալի 80-90%-ն անցնում է գարնանային վարարումների ընթացքում:

Նախատեսվող գործունեության տարածաշրջանում գերակշռում են շականակագույն խճաքարային տեղ-տեղ կարբոնատային ցեմենտացած հողային տիպերը: Տարածաշրջանին բնորոշ են դելյուվիալ և դելյուվիալ-պրոլյուվիալ նստվածքային տիպերը՝ արտահայտված խճաքարա-խճավազային ապար կարբոնատա-կրաքարային, ավազաքարային կավավազային լցվածքներով: Հողերի էրոզվածության աստիճանը 6-րդ կարգի է՝ 70%-ից ավել: Անմիջապես գործունեության տարածքում հողային ծածկույթը հիմնականում քարքարոտ է, տեղ-տեղ գետի ափամերձ հատվածներում մուգ շականակագույն հողեր են: Ըստ նախնական հաշվարկների՝ հանվող հողագրունտի ծավալը կկազմի 0,4 մլն մ^3, որն ամբողջությամբ տեղադրվելու է պատվարի մարմնում, ավելցուկայինի բնահողը կօգտագործվի ռեկուլտիվացիայի համար:

Ելփինի ջրամբարի կառուցման համար նախատեսվող տարածքն անմիջական սահմաններ ԲՀՊՏ-ների հետ չունի: Ջրամբարի շինարարության ազդեցության գոտում չկան պատմամշակութային հուշարձաններ:

Նախատեսված ջրամբարի կառուցմամբ ամբարվող ջրածավալով հնարավորություն է ընձեռնվում լուծել հետևյալ հիմնական խնդիրները

- իրականացնել Ելփին և Չիվա համայնքներում ոռոգման ջրի սակավության պատճառով անմշակ մնացած նվազագույնը 168 հա հողերի ինքնահոս ոռոգում,

- օգտագործելով գործող պոմպակայանի մղման ճնշումային խողովակաշարը՝ մեխանիկական ոռոգումը վերափոխել ինքնահոսի և խնայել տարեկան առնվազն 224.5 հազ. կՎտ-ժամ էլեկտրաէներգիա,
- բարձրացնել ներկայումս ոռոգվող 132 հա հողերի ջրաապահովվածությունը՝ ապահովելով մշակաբույսերի բերքատվության աճին:

Քանի որ ծրագրում ընդգրկված Չիվա համայնքի 50 հա հողերը և Ելփին համայնքի հողերի մոտ 10%-ը ներկայումս ոռոգվում են ինքնահոս եղանակով, ինչպես նաև Հերմոն – Ելփին ջրատարի վրա կառուցված Ելփին պոմպակայանը թողնվելու է որպես ռեզերվային: Պոմպակայանով Ելփին համայնքին մատակարարվող 90լ/վ ջուրն ուղղվելու է Ռինդ համայնքի ոռոգելի հողատարածքների ջրապահովվածության բարձրացմանը: նախատեսված 930 հազ. մ^3 ընդհանուր ծավալով ջրամբարի կառուցումը ամբողջությամբ կապահովի մթնոլորտային տեղումների 50% և գետահոսքի ներտարեկան բաշխման 75% ապահովվածության տարիների ջրապահանջը: Սակավաջուր տարիներին Չիվա համայնքի 15հա հացահատիկի, 25հա պտղատու և 10հա խաղողի այգիներին, ինչպես նաև Ելփինի 9հա բազմամյա խոտաբույսերի հողատարածքների ոռոգումն իրականացնել նախկին եղանակով կամ անհրաժեշտ չափով դոտացիա ստանալ Ելփինի պոմպակայանից:

Նախատեսվող գործունեությունն իր ազդեցությունները կունենա շրջակա միջավայրի վրա, որոնք կկրեն ժամանակավոր բնույթ:

Շինարարության փուլում մեծ ծավալի հողային գրունտ կհանվի և կտեղափոխվի: Հողային աշխատանքներ իրականացնելիս՝ կառաջանա փոշի, որը կարող է ցրվել քամու միջոցով փորման աշխատանքների տեղամասից 100 մ տարածքի վրա: Օդի որորշակի աղտոտում տեղի կունենա նաև շինարարական նյութերի փոխադրման ընթացքում՝ մանրախճով պատված մոտեցող ճանապարհներով, բեռնատար մեքենաների տեղաշարժից: Շահագործման փուլում օդի որակի վրա ազդեցություն չի լինի:

Մեխանիզմների և տրանսպորտային միջոցների աղմուկի մակարդակը շինարարության ընթացքում էականորեն տարբերվում է և կախված է առաջացող աղմուկի տեսակից և գործունեության մակարդակից: Շահագործման փուլում աղմուկի ազդեցությունը կլինի աննշան:

Շինարարության փուլում ջրային ռեսուրսների վրա (մակերևույթային/ստորերկրյա ջրեր) կլինեն հետևյալ հնարավոր ազդեցությունները՝

- Ստորգետնյա ավազանի աղտոտում՝ շինհրապարակից հոսող կեղտաջրերի միջոցով,
- Մակերևույթային ջրերի հոսքի և դրանց որակի փոփոխություններ՝ աղտոտիչների արտահոսքի պատճառով,
- Գետի ջրի որակի փոփոխություն ոչ պատշաճ կերպով պահված շինարարական նյութերի և թափոնների, կենցաղային թափոնների արտանետումների, վառելիքի արտանետումների, յուղերի և քսանյութերի արտահոսքից:

Շինարարության փուլում հողի աղտոտման պատճառ կարող են հանդիսանալ նավթամթերքի արտահոսքը, նավթամթերքի ոչ ճիշտ պահեստավորումը, նավթի և վառելիքիչհեռացված թափոնները, ներառյալ օգտագործված յուղերի, հիդրավլիկ թունավոր հեղուկների, դատարկ նավթի տարրաների ոչ պատշաճ հեռացումը: Թափոնների վատ կառավարումը կարող է հանգեցնել հողի աղտոտման: Բույսերի կորուստը շինհրապարակի մաքրման հետևանքով կարող է հանգեցնել բնական միջավայրի և կենդանական աշխարհի տեսակների կորուստի:

Շինարարական աշխատանքների իրականացման ժամանակ ջրամբարի թասի տարածքում հատվելու են մոտավորապես 380ծառ: Հասցված վնասը փոխհատուցելու

նպատակով հատված ծառերի փոխարեն համայնքի կողմից տրամադրված վայրերում կիրականացվի ծառատունկ մեկը երկուսի հարաբերակցությամբ:

Ջրամբարի կառուցման շինարարական աշխատանքների ընթացքում նախատեսվում է իրականացնել **բնապահպանական ազդեցությունները մեղմող հետևյալ միջոցառումները՝**

Շինարարական հրապարակում առաջացած փոշու և աղմուկի նվազեցման նպատակով նախատեսվում է՝

- շինարարական նյութերի և թափոնների տեղափոխման համար անհրաժեշտ է օգտագործել փակ կամ ծածկով բեռնատար մեքենաներ,
- հողային աշխատանքներն ըստ հնարավորության՝ կատարել փոշեորսիչով կահավորված տեխնիկական միջոցներով և սարքավորումներով,
- տրանսպորտային միջոցները և տեխնիկան պետք է պարբերաբար ստուգել, կարգավորել և զինել համապատասխան խլացուցիչ սարքերով,
- շինարարական տարածքը և մոտեցող ճանապարհները պետք է պարբերաբար ջրվեն պահեստավորված խիճը և տեղափոխվող հողային զանգվածները խոնավեցվեն՝ փոշին նվազեցնելու նպատակով:

Ջրային ռեսուրսների վրա հնարավոր բացասական ազդեցությունները շինարարության ընթացքում մեղմելու կամ կանխարգելելու վնասակար նյութերի արտահոսքը բացառելու համար նախատեսվում է՝

- փոշենստեցման համար ջրցանը կատարել ըստ անհրաժեշտության՝ հնարավորինս չառաջացնելով մակերևույթային հոսքեր,
- անձրևաջրերի և արտադրական հոսքաջրերի հեռացման և հավաքման համար նախատեսել ժամանակավոր պարզարաններ,
- շինարարական տրանսպորտային միջոցների և սարքավորումների սպասարկումը կատարել մոտակա մասնագիտացված կետերում,
- դեպի Ելփին գետ կեղտաջրերի արտահոսքը կանխելու նպատակով շինարարության փուլում աշխատողների համար տարածքում տեղադրել կեղտաջրերի հավաքման հոր կամ բիոզուգարան, որոնց մաքրումը կատարել համապատախան մասնագիտացված կառույցների կողմից՝ պայմանագրային հիմունքներով:

Կենսաբազմազանության վրա ազդեցությունը մեղմելու նպատակով նախատեսվում է՝

- ըստ հնարավորության բացառել ծառահատումները, առկա թփերի մաքրումը կատարել մասնագետների մասնակցությամբ,
- հատված ծառերի վնասը հատուցելու նպատակով համայնքի կողմից հատկացված վայրերում կազմակերպել ծառատունկ և դրանց խնամք, տնկել մոտավոր 1300 ծառ, որի համար կպահանջվի 2,08 հա տարածք:
- Գործունեության և հարակից տարածքներում ՀՀ Կարմիր գրքերում գրանցված բուսատեսակների նոր պոպուլյացիաների կամ կենդանիների բնադրավայրերի հայտնաբերման դեպքում՝ դադարեցնել շինարարական աշխատանքները,
- շինարարական աշխատանքներն իրականացնել ցերեկային ժամերին՝ որոշ կենդանիների կենսակերպի վրա ազդեցությունից խուսափելու համար, և նվազեցնել տարածքի գիշերային լուսավորությունը՝ կենդանիների որոշ տեսակների բնականոն վարքին չխանգարելու նպատակով:
- շինարարական նպատակով առանձնացնել պահպանվող գոտիներ,
- Ժամանակավորապես սահմանափակել առանձնացված պահպանվող գոտիներում գործունեության որոշ տեսակներ, որոնք կարող են ազդել բուսատեսակների աճման, պահպանման վրա:

Նախատեսվող շինարարական աշխատանքների իրականացման ընթացքում, ծրագրի ազդակիր տարածքում առաջացող տարբեր տեսակի թափոնները կարող են բացասաբար անրադառնալ շրջակա միջավայրի վրա՝ առաջացնելով լանդշաֆտի փոփոխություն, աղտոտել ջրային և հողային ռեսուրսները և մթնոլորտային օդը, ինչպես նաև ազդել մարդկանց առողջության վրա:

Իրականացվող ծրագրի տեղամասերում աշխատանքների մեկնարկն իրականացվելու է հնագետի հսկողությամբ: Շինարարական աշխատանքների ընթացքում որևէ անհայտ հնագիտական շերտի, անհայտ ծագման իրերի, բնության հուշարձանի հայտնաբերման դեպքում շինարարական ախատանքներն անմիջապես դադարեցվելու են և տեղակացվելու է համապատասխան պետական մարմնին, հետագա գործողությունները ՀՀ գործող օրենսդրության համաձայն կազմակերպելու համար:

Հանվող հողային զանգվածը (բերիի հողաշերտ և գրունտ), որն առաջանալու է ջրամբարի թասի փորման ընթացքում, պահեստավորվելու է տեղում հատկացված վայրերում: Ըստ նախնական գնահատման հողագրունտային զանգվածը կկազմի 400000 մ^3, հանվող բուսահողի ծավալը՝ 1500 մ^3: Ջրամբարի թասից դուրս՝ պաշտպանիչ գոտում կազմակերպվելու է բերրի հողի պահեստներ՝ ծածկի տակ շրջանցող առուներով: Բերրի հողը ամբողջությամբ օգտագործվելու է տարածքի բարեկարգման և կանաչապատման նպատակով:

Հողային ռեսուրսների վրա հնարավոր ազդեցությունները և վերջինիս մեջ վտանգավոր նյութերի և քսայուղերի ներթափանցումը կանխելու նպատակով նախատեսվում է՝

- ճանապարհից դուրս տեղակայվող սարքավորումների վայրում փռել ավազ կամ մանրախիճ,
- բուն գործունեության տարածքում յուղի, վառելիքի կամ այլ վտանգավոր հեղուկների պահման տեղամասեր չնախատեսել,
- շինարարական նյութերը տեղադրել հատուկ տակդիրների վրա
- հողային գրունտը տարածքում պահպանել ծածկված վիճակում՝ անջրաթափանց թաղանթով,
- առաջացող շինաղբը տեղափոխել Արենի համայնքի կողմից նախատեսված աղբավայր,
- հանվող հողային զանգվածն օգտագործել հետլիցքի և տարածքի բարեկարգման համար,
- շինարարության փուլում օգտագործվող տրանսպորտային միջոցների լիցքավորումը և տեխնիկական սպասարկումը կատարել տարածքից դուրս՝ հատուկ մասնագիտացված կազմակերպություններում,
- շինհրապարակից դեպի գյուղամիջյան ասֆալտապատ և միջպետական Մ2 ավտոճանապարհ դուրս եկող ավտոտրանսպորտային միջոցները պարտադիր պետք է իրականացնեն անիվների լվացում:

Ռիսկերի նվազեցումը կարելի է ապահովել իրականացնելով մի շարք բնապահպանական և սոցիալական միջոցառումներ, որոնց արդյունավետության ապահովման նպատակով պետք է կազմակերպել աշխատանքների մշտադիտարկումներ:

Հաշվի առնելով նախատեսվող ջրամբարի տարածքի ռելիեֆային և բնահողային պայմանները, նախատեսվող պատվարի բարձրությունը (36մ), ինչպես նաև ձկնաբանի կողմից իրականացված ուսումնասիրությունները և տրված եզրակացությունը (որոնք առկա են գնահատման հաշվետվության մեջ,) և այն հանգամանքը՝ որ ջրամբարը նախատեսվում է կառուցել ոռոգման նպատակով, հետևաբար ջրի հորիզոնը կլինի փոփոխական ուստի նախագծող կազմակերպության կողմից հիմնավորվել է ձկնուղի լինելու անհնարիությունը:

Պատճառաբանական մաս. ՀՀ օրենսդրությանը համապատասխան՝ հանրային ծանուցումը և քննարկումները կատարվել են Վայոց ձորի մարզի Արենի համայնքի Ելփին բնակավայրում: Ելփին վարչական շրջանի ղեկավարի նստավայրում, անցկացված հանրային քննարկումներում գործունեության իրականացումը մասնակիցների կողմից արժանացել է հավանության: Հայտի վերաբերյալ փորձաքննական գործընթացում ստացվել են կարծիքներ՝ առողջապահության, ներքին գործերի, կրթության, գիտության, մշակույթի և սպորտի նախարարություններից, քաղաքաշինության կոմիտեից, կադաստրի կոմիտեից, ինչպես նաև շրջակա միջավայրի նախարարության ստորաբաժանումներից: Ստացված դիտողությունները և առաջարկությունները հաշվի են առնվել գնահատման հաշվետվության լրամշակումներում: Ամփոփելով հայտի բնապահպանական և սոցիալական ազդեցությունների վերլուծությունները՝ կարելի է եզրահանգել, որ նախատեսվող գործունեության իրականացման արդյունքում շրջակա միջավայրի վրա հնարավոր բացասական ազդեցությունները, որոնք առնչվում են շինարարական աշխատանքների հետ, կկրեն ժամանակավոր և տեղայնացված բնույթ և կլինեն թույլատրելի նորմայի սահմաններում: Դրանք կարող են բացառվել կամ մեղմվել գործունեության ընթացքում բնապահպանական միջոցառումների արդյունավետ իրականացմամբ:

Ներկայացված ծավալով ջրամբարի կառուցմամբ հնարավոր կլինի ապահովել սակավ ոռոգման ջրի կայուն և արդյունավետ օգտագործում՝ խթանելով գյուղատնտեսության զարգացումը, ինչպես նաև նվազեցնելով թիրախային խմբի խոցելիությունը կլիմայական փոփոխությունների ազդեցության հանդեպ: Ջրամբարի կառուցումը հնարավորություն կտա լուծել մի շարք արմատական խնդիրներ՝

- կուտակել գետի օգտագործելի հոսքի մի մասը, կարգավորել ջրահոսքերը՝ ապահովելով բնապահպանական թողքերը:
- հրաժարվել մեխանիկական եղանակով ոռոգման ջրի մատակարարումից և 150 հա հողերի ոռոգումը փոխադրել ինքնահոս եղանակի, խնայել զգալի չափով էլեկտրաեներգիա, կրճատելով շահագործման և պահպանման ծախսերը:
- բարձրացնել ներկայումս ինքնահոս եղանակով ոռոգվող 150 հա ոռոգելի հողերի ջրապահովվածությունը՝ ապահովելով կայուն ջրամատակարարում ողջ ոռոգման շրջանում:

Փորձաքննական պահանջներ

1. Աշխատանքների իրականացման ընթացքում անհրաժեշտ է առաջնորդվել ՀՀ կառավարության 2002 թվականի ապրիլի 20-ի N 438 որոշման 43-րդ կետի պահանջով՝ աշխատանքների կատարման ժամանակ պատմական, գիտական, գեղարվեստական և այլ մշակութային արժեք ունեցող հնագիտական և մյուս օբյեկտների հայտնաբերման պահից դադարեցնել աշխատանքները և դրա մասին անհապաղ հայտնել լիազորված մարմնին:
2. Շինարարության ընթացքում ապահովել բնապահպանական կառավարման և մոնիթորինգի պլաններում նախատեսված միջոցառումների իրականացումը սահմանված ժամանակահատվածում:
3. Շինարարական աշխատանքների իրականացման ընթացքում առաջացող մնացորդային գրունտի, շինաղբի և տարբեր տեսակի թափոնների հեռացումն ու տեղափոխումն անհրաժեշտ է իրականացնել ՀՀ օրենսդրությամբ սահմանված կարգով՝ տեղական ինքնակառավարման մարմինների կողմից հատկացված վայր:
4. Կանաչապատումն անհրաժեշտ է իրականացնել տարածաշրջանին և տեղի կլիմայական

պայմաններին բնորոշ ծառաթփային բուսականությամբ՝ Կառավարության 2018 թվականի փետրվարի 8-ի N108-Ն որոշման պահանջներին համապատասխան:
5. Կառուցապատման աշխատանքների ընթացքում պահպանել «Մթնոլորտային օդի պահպանության մասին» օրենքի 11-րդ հոդվածով սահմանված պահանջները:
6. Առաջնորդվել ՀՀ կառավարության 2005 թվականի հունվարի 20-ի «Ջրաէկո–համակարգերի սանիտարական պահպանման, հոսքի ձևավորման, ստորերկրյա ջրերի պահպանման, ջրապահպան, էկոտոնի և անօտարելի գոտիների տարածքների սահմանման չափորոշիչների մասին» N 64-Ն որոշման պահանջներով:
7. Հողաբուսական շերտի (հողի բերրի շերտ) հեռացումը բացահանքի տարածքիցկատարել ՀՀ կառավարության 08.09.2011թ-ի թիվ 1396-ն և 02.11.2017թ-ի թիվ 1404-ն որոշումների պահանջներին համապատասխան:

ԵԶՐԱՓԱԿԻՉ ՄԱՍ

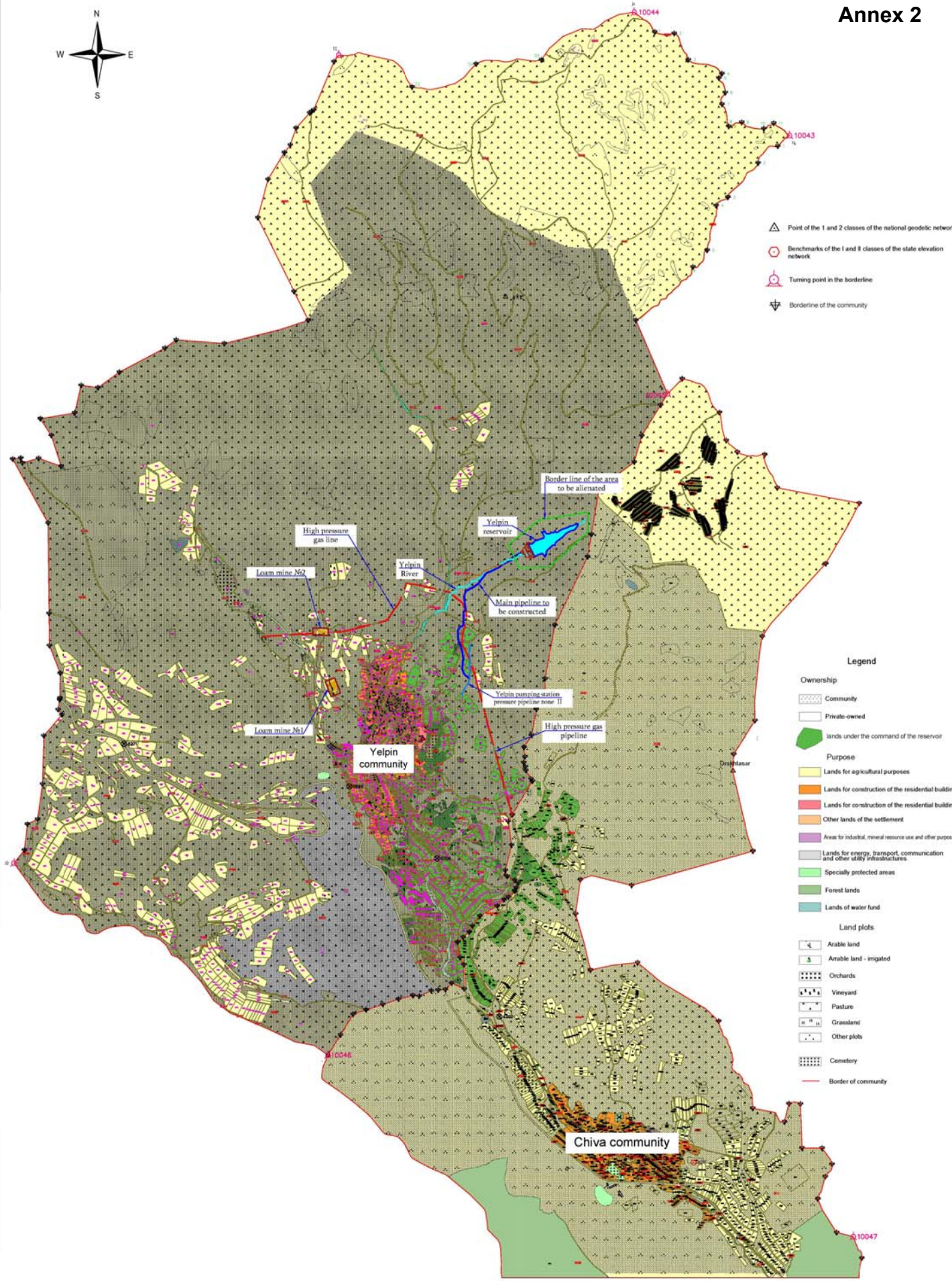
Վայոց ձորի մարզի Արենի համայնքում Ելփինի ջրամբարի կառուցման շրջակա միջավայրի վրա ազդեցության գնահատման հաշվետվությանը տրվում է դրական եզրակացություն՝ վերը նշված փորձաքննական պահանջների պարտադիր կատարման պայմանով:

Շրջակա միջավայրի վրա ազդեցության փորձաքննական կենտրոն» ՊՈԱԿ-ի տնօրեն՝ Խաչիկ Մարտիրոսյան

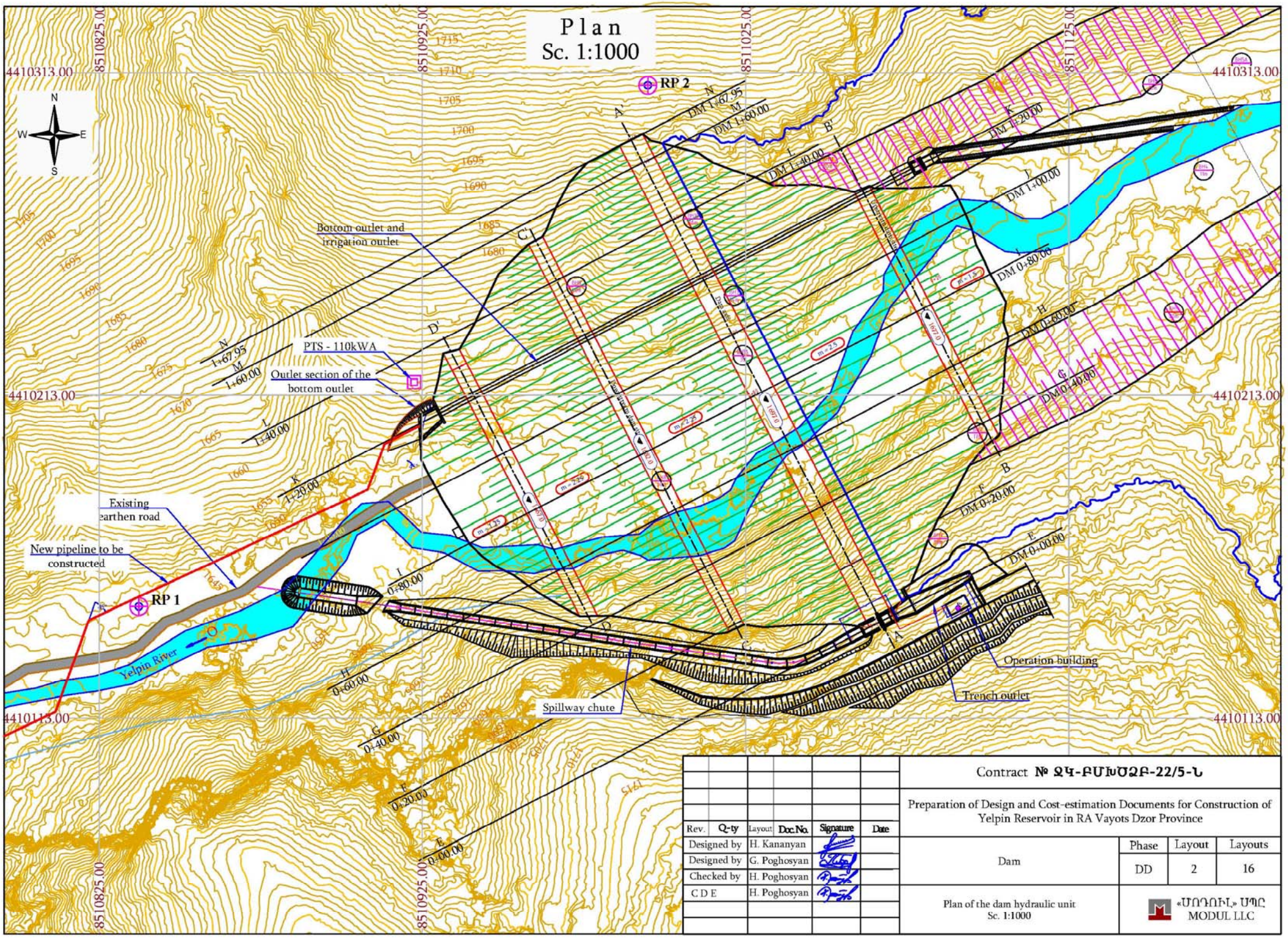
«Շրջակա միջավայրի վրա ազդեցության փորձաքննական կենտրոն» ՊՈԱԿ-ի տնօրենի տեղակալ՝ Հերիքնազ Մկրտչյան

«Շրջակա միջավայրի վրա ազդեցության փորձաքննական կենտրոն» ՊՈԱԿ-ի գլխավոր մասնագետ՝ Հովակիմ Ֆրունզիկյան

Annex 2



						Contract № ՋԿ-ԲՄՆՍՁԲ-22/5-Ն	
						Preparation of Design and Cost-estimation Documents for Construction of Yelpin Reservoir in RA Vayots Dzor Province	
Rev.	Գ.Գ	Layout	Doc.No.	Signature	Date	General data	Phase / Layout / Layouts
Designed by	H. Kasamyan						DD / 2 / 2
Designed by	G. Poghosyan						
Checked by	H. Poghosyan						
C.D.E	H. Poghosyan					Situational plan, Sc. 1:20000	«ՄՊՐՈՄՈՒ ՄՈԴ» Modul LLC



Rev.	Q-ty	Layout	Doc.No.	Signature	Date
Designed by		H. Kananyan			
Designed by		G. Poghosyan			
Checked by		H. Poghosyan			
C D E		H. Poghosyan			

Contract № ՋԿ-ԲՄԽՄՁԲ-22/5-Ն

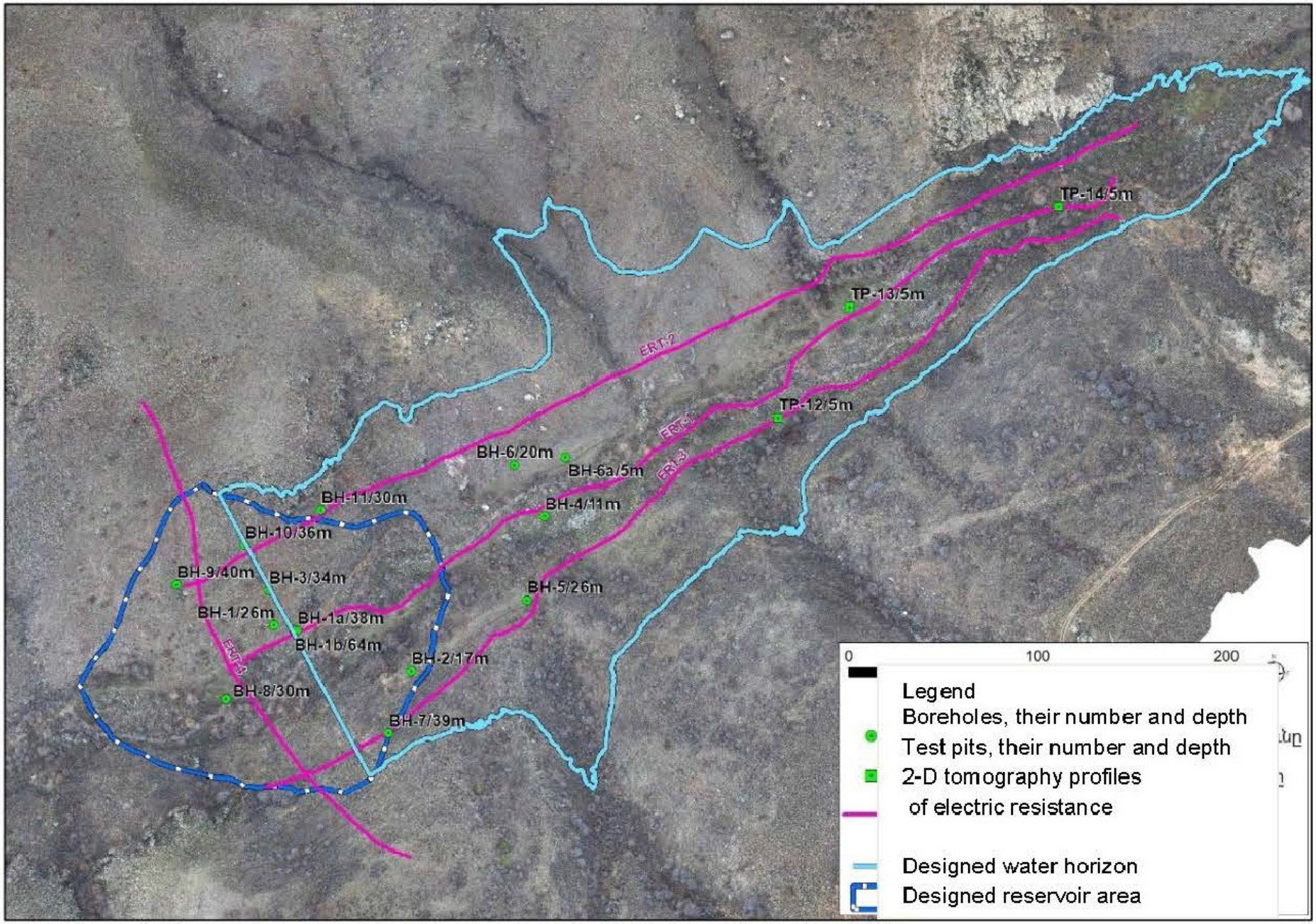
Preparation of Design and Cost-estimation Documents for Construction of Yelpin Reservoir in RA Vayots Dzor Province

Dam	Phase	Layout	Layouts
	DD	2	16

Plan of the dam hydraulic unit
Sc. 1:1000

«ՄՈԴՈՒԼ» ՍՊԸ
MODUL LLC

Annex 3


TP-14/5m
TP-13/5m
TP-12/5m
ERT-2
ERT-1
ERT-3
ERT-4
BH-6/20m
BH-6a/5m
BH-11/30m
BH-4/11m
BH-10/36m
BH-9/40m
BH-3/34m
BH-5/26m
BH-1/26m
BH-1a/38m
BH-1b/64m
BH-2/17m
BH-8/30m
BH-7/39m
0
100
200
Legend
Boreholes, their number and depth
Test pits, their number and depth
2-D tomography profiles
of electric resistance
Designed water horizon
Designed reservoir area

Annex 4