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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) SISIAN-KAJARAN (NORTH-SOUTH CORRIDOR) ROAD PROJECT, ARMENIA

Volume 2. Biodiversity



Source: projections of the proposed road collated from the '3D description of the Sisian-Kajaran Road', Armenian Road Department, 2022 [https://www.youtube.com/watch?v=fu-dgAwjSsU]

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Volume 2. Biodiversity

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An Environmental and Social Impact Assessment (ESIA) is necessarily predictive in that it gets completed well before the project being assessed is actually implemented. The information on which the assessment is based comes from multiple sources including the feasibility report, the detailed design document, reports on studies that were conducted as part of the feasibility investigations, records of meetings, other publications, various databases, data that is collected by the team conducting the ESIA, anecdotal information and others. It is extremely difficult to verify the information that is used other than through testing the logic of that information as well as that can be done. In preparing this document, care has been taken to ensure that whatever information has been available has been accurately reproduced in the ESIA. Should information be found in this document that is incorrect then it is respectfully requested that the incorrect information be brought to our attention so that the ESIA can be updated accordingly. We cannot be held accountable for information that we have accepted and reproduced in good faith regardless of the consequences of such information being incorrect. Anyone reproducing information contained in this ESIA does so entirely at their own risk.

LIST OF ABBREVIATIONS

AA	Appropriate Assessment
ASCI	Areas of Special Conservation Interest (ASCI = Emerald Sites)
ADB	Asian Development Bank
AMSL	above mean sea level
BAP	Biodiversity Action Plan
CITES	Convention on International Trade in Endangered Species
<i>cf.</i>	refer to / consult
E&S	Environmental and social
EBRD	European Bank for Reconstruction and Development
EAAs	Ecologically appropriate areas of analysis
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ES	Ecosystem services
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Environmental and Social Policy (of the EBRD)
ESS	Environmental and Social Standard (of the EIB)
FFS	flora and faunal survey
GIP	good international practice
ha	hectare
IBA	Important Bird Areas
IFC	International Finance Corporation
IFI	International Financial Institution
KBA	Key Biodiversity Area
kph	kilometre per hour
m	metre
MoE	Ministry of Environment of Armenia
NGO	Non-governmental organization
NSRC	North-South Road Corridor
NSRCIP	North-South Road Corridor Investment Project
NTS	Non-Technical Summary
PR	Performance Requirement (of the EBRD)
RA	Republic of Armenia
RF	Restoration Framework
RD	Road Department
SEP	Stakeholder Engagement Plan
SNCO	State Non-Commercial Organization
SPA	Special Protected Area

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PREAMBLE

This document is the **Biodiversity** report for the proposed greenfield Armenian Sisian-Kajaran section of the North-South Road Corridor (NSRC) (the Project). It forms **Volume 2** of the Environmental and Social Impact Assessment Report (ESIA) for the Project.

The ESIA Report consists of several volumes with related Annexes, as follows:

- Volume 1 – Project Definition including Project introduction, context and rationale, project description, alternatives, legal framework, and ESIA methodology;
- **Volume 2 – Biodiversity including baseline analysis, risk / impact assessment (including Critical Habitat Assessment and Appropriate Assessment) and mitigation (this Report);**
- Volume 3 – Physical Environment including baseline analysis, risk / impact assessment and mitigation in relation to air quality and climate, noise and vibration, landscape, etc.
- Volume 4 – Social Environment including social, gender and cultural heritage baseline analysis, risk / impact assessment and mitigation, as well as stakeholder engagement;
- Volume 5 – Cumulative Impact Assessment;
- Volume 6 – Environmental and Social Management Plan (ESMP);
- Volume 7 – Conclusions and Recommendations.

The ESIA was publicly disclosed for the period of over 120 days according to the international lenders' requirements (from 21 July to 1 December 2023). In addition to the ESIA report, the ESIA disclosure package includes:

- Non-technical Summary (NTS) which is a concise and over-arching document summarising the results of the ESIA in non-technical language;
- Stakeholder Engagement Plan (SEP) that guides information disclosure and meaningful engagement with Project stakeholders, as well as a grievance mechanism;
- Resettlement Framework (RF) that guides issues related to Project-induced physical and economic displacement, land acquisition, compensations, and livelihood restoration;
- Biodiversity Action Plan (BAP) that articulates actions that can help ensure the conservation or enhancement of potentially affected habitats and species considered of particular conservation value; and
- Environmental and Social Action Plan (ESAP) that contains actions required to implement the Project in compliance with the international lenders' requirements.

Following the public disclosure, the ESIA Disclosure and Consultation Report was prepared to document and summarise the feedback from stakeholders received and engagement activities completed during the ESIA disclosure period.

The current version of the ESIA package captures the feedback from stakeholders collected during the ESIA disclosure and it will be re-disclosed, together with the ESIA Disclosure and Consultation Report, for the Project life-cycle.

The photos in this Volume are taken by the Consultant unless indicated otherwise.

All maps in this Volume are prepared by the Consultant unless indicated otherwise.

1 INTRODUCTION

This report (Volume 2 of the ESIA) contains an assessment of the biodiversity baseline in the area of the Project and potential biodiversity impacts by the Project. The assessment is based on year-long baseline biodiversity surveys, the results of which are presented in Annex 1 (Biogeotech, 2022).

The Biodiversity Volume 2 comprises:

- **The biodiversity baseline summary and Impact assessment,**
- The biodiversity baseline detailed report (Volume 2, Annex 1),
- Critical Habitat Assessment (CHA) (Volume 2, Annex 2), and
- Appropriate Assessment (AA) (Volume 2, Annex 3),

Where impacts are predicted, mitigation is also presented. The mitigation is included in the Environmental and Social Management Plan (ESMP) for the Project (Volume 6) and BAP.

2 BIODIVERSITY BASELINE

2.1 Study Area

The **biodiversity study area** for the Project includes:

- The Sisian-Shenatagh and Qirs-Kajaran road sections and the Bargushat tunnel and adjacent areas of direct and indirect impact, including the connecting roads;
- Potential locations of spoil disposal areas;
- The southern portal of the Bargushat tunnel and adjoining section of the road that is mostly located in a mountainous area, with high biodiversity and landscape value;
- A 500m corridor centred on the proposed road (250m on each side of the alignment) as a priority for the biodiversity surveys and then widened as required, depending on the biodiversity (e.g., greater for birds and smaller for flora) and the relevant ecologically appropriate areas of analysis (EAAAs) for potential biodiversity priority features¹ (**Figure 2**);

*To note: some of the Project facilities such as a construction camp, quarries, borrow pits, temporary disposal areas, asphalt plant, areas for temporary storage of removed topsoil, locations of the water tanks for the tunnel's fire-lighting system, etc. are not currently defined and will be determined by the Construction Contractor. The SDA sites proposed in the detailed design were assessed resulting in suggested disqualification of some SDAs (see the below section on alternatives and Volume 1). Additionally, no-go areas were preliminarily identified as explained in **Section 2.3.5**.*

Initially biodiversity surveys were based on the direct footprint of the road with a 500m buffer on both sides of the proposed road (*cf.* figure below). If the project was likely to induce indirect impacts on habitats outside the buffer or if ecological functionalities linked to the project were identified outside this buffer, these areas were also included in the biodiversity survey sampling.

¹ This is a specific landscape approach in the framework of the Critical Habitat Assessment. In the Project's mountainous context, the landmarks that helped define the larger area of influence and EAAAs were ridges, water catchments, protected areas and main vegetation units (e.g. forests). Larger areas of influence were defined further for >1km buffer based on the literature review, stakeholder consultations and focused surveys.

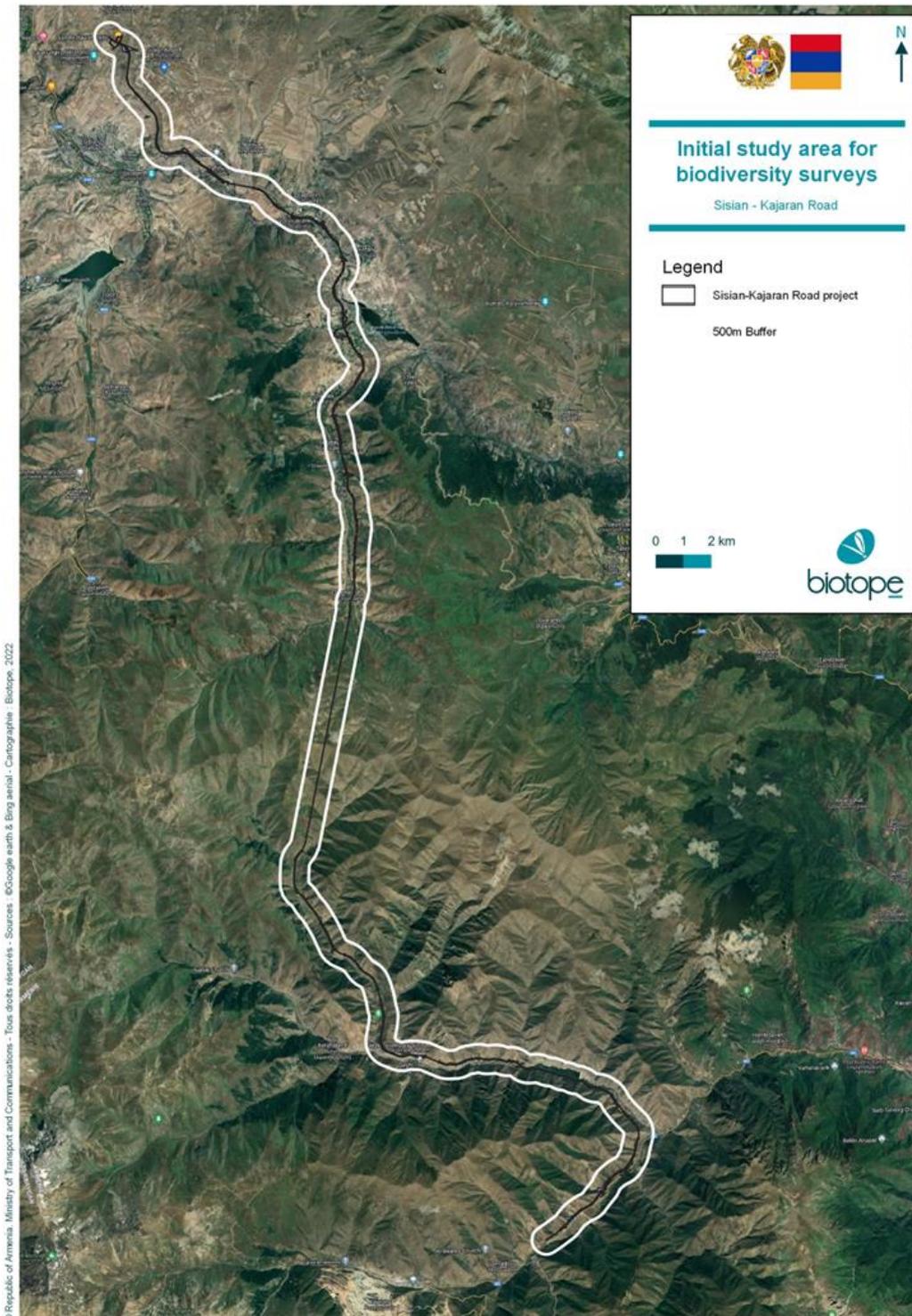
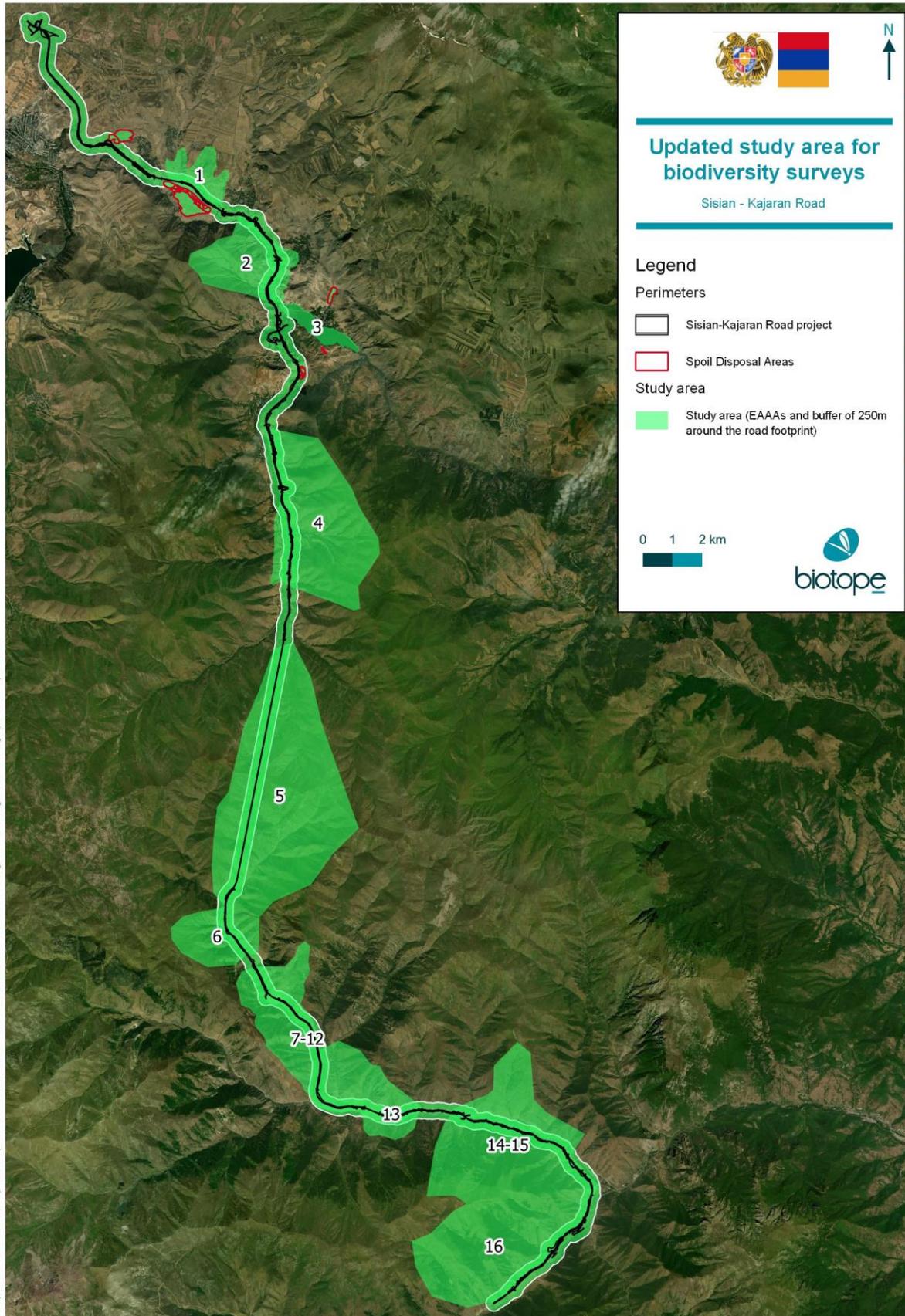


Figure 1. Initial Study Area for Biodiversity Surveys

Following the ESIA scoping, the study area was expanded where required, by the biodiversity experts in order to uphold Ecological Appropriate Areas of Analysis (EAAAs) for features that required additional focused study (*cf.* figure below). At the same time, the buffer was reduced to 250m on both sides of the proposed road.



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Figure 2. Updated Biodiversity Study Area

2.2 Consideration of Alternatives

Biodiversity has been at the heart of all of the major alternatives that have been considered for this project in two key ways. Potential impacts on biodiversity have been a key element of the evaluation of alternatives, and biodiversity has also directly driven additional alternatives not previously considered. First, for example, biodiversity was considered when selecting the preferred route for the road, which resulted in the choice of the C1 route (see also Volume 1 for details and 2016 Multicriteria analysis (Feasibility Study by J/V SPEA Engineering -IRD Engineering)). This alternative was preferable in terms of its comparatively lower potential requirement for land with envisioning the Bargushat tunnel meaning a material reduction in land surface footprint of the road, and associated land transformation. The tunnel also means that direct impacts on the Zangezur Sanctuary are avoided.

Second, alternatives that are directly driven by biodiversity considerations include (see also Volume 1, Section 3):

- a) In the Vaghatin area (8+500 -10+000) the proposed road alignment passes through the canyon (natural habitat), whereas the top of the plateau has degraded habitat. As such it is recommended that the road be re-aligned to cross the plateau. *Note: the technical consultant advises that this is technically feasible, however it requires a design category change for the road which might not be aligned with the objectives of the NSRC.*
- b) In the Shenatagh area a preferable alignment would be the gas pipeline (Iran-Yerevan) servitude to avoid destruction of the cave houses and decrease the impacts on natural areas by using an already degraded area. The gas pipeline has already created a significant visual scar on the landscape and if that could be used for the road there would be a win-win circumstance in both ameliorating the visual impact of the gas line and minimising the loss of natural habitat. *Note: the technical consultant advises that this is technically unfeasible due to the geohazard risks.*
- c) In the Geghi valley the preferred alternative routing would be the existing road alignment rather than the currently proposed new alignment through the Juniperus habitat on the northern side of the mountain ridge. *Note: the technical consultant advises that this is technically feasible but required re-alignment in this section and should be further considered by the RD.*
- d) The current design makes provision for several SDAs along the proposed road alignment. These locations are not ideal in all cases, notably south of the proposed Bargushat tunnel where there are important large mammal movement paths that would be blocked by some of the proposed spoil dumping sites. *Note: Biodiversity risks have resulted in the disqualification of several SDAs, reductions in size of others and proposed new SDA sites, subject to additional E&S and geohazard review.*

On the issue of whether alternatives have been sufficiently examined to warrant destruction or degradation of natural and or critical habitat, it is clear that the C1 alternative route invokes many benefits (see above) but nevertheless routes through an area of important biodiversity with large areas of natural and critical habitat. The alternatives to the C1 route all invoke larger footprint areas. Thus, there are no other viable alternatives for the project in terms of location (e.g. area of the lesser biodiversity value) or design as it has already been adapted to limit impacts on biodiversity and ecosystem services. The use of the existing routes is untenable as they are dangerous and time consuming and do not support the goals of the broader regional cooperation for improved connectivity.

There are some potential route micro-realignment alternatives that may be further investigated in terms of reducing impacts on especially critical habitat. However, based on the reviews conducted within the ESIA process, the constraining terrain/geohazard risk and consideration that all the valleys in the Bargushat mountain range have similar biodiversity values, may limit the suitability of these options. Moreover, the project valley already has a

road at the bottom of the valley while the other valleys of the range between the east side and the west side are mostly smaller and exempt of roads, so it is the best option for linking the areas on either side of this mountain range. The project is of strategic importance for connectivity to Armenia due to political conflicts in the region and unsafe conditions of the existing roads. For any further route optimisation, the Armenian government would need to change the road categorisation to allow for reduced speeds and larger gradients. A change in road categorisation would make it possible to realign the road routing so that to further avoid some areas of critical habitat.

2.3 Baseline Assessment

2.3.1 Methodology

In addition to a **literature review** (e.g. archival studies, available national reports on the environment and biodiversity, preliminary ESIA, IBAT², relevant scientific papers and national and international conservation strategies on the key target species), **biodiversity surveys** were also necessary to compile the biodiversity baseline.

Suitable specialists conducted the fieldwork for different groups (flora and habitats, terrestrial mammals and bats, birds, reptiles and amphibians, fishes, butterflies, cf. list of experts in Volume 2, Annex 1, as well as in Volume 1). Surveys were conducted over a year (four seasons) to cover the variety of ecological cycles of different target species (breeding, wintering, migration), commensurate with the potential Project risks and impacts.

Surveys were conducted for 16-17 days per season, as appropriate for the various groups of animals and plants, *i.e.* all four seasons for birds and mammals, spring-summer for reptiles, etc., as shown in details in the Biodiversity Report (Biogeotech, 2022). A summary of these surveys is provided below. For more details, please refer to the dedicated study (Volume 2 Annex 1, Biogeotech, 2022).

Prior to the ESIA, biodiversity topics were considered and presented during the public hearings as part of the national EIA process held in 2017-2018. The national EIA is currently undertaken by the RD, as the 2018 EIA permit expired. As part of the ongoing EIA, four rounds public hearings covering inter alia, the biodiversity issues are being delivered.

Within this ESIA, 20 engagement events / consultations took place with regards to biodiversity issues. They started in April 2021 and continue to be held with the "Zangezur Biosphere Complex" SNCO (that is subordinate to the MoE and is in charge of Zangezur State Sanctuary and other six SPAs); environmental NGOs in Armenia, including WWF Armenia, Birds of Armenia (BoA); "Hayantar" (ArmForest) SNCO and "Sisian Forestry" and "Kapan Forestry" branches; and the MoE biodiversity/protected areas department. During the ESIA scoping and disclosure stage, one workshop was held with specialised NGOs on biodiversity issues specifically (see Section 4 of ESIA Volume 4).

The results of the consultations were considered in the methodology for baseline studies (e.g., location of the camera traps), baseline analysis (e.g., locally collected medicinal plants), and assessment of impacts and mitigation (e.g., consultations about the locations of wildlife passages and spoil disposal areas). The list of consultation events is presented in ESIA Volume 4, and a summary outcomes / decisions taken during these events are detailed in the AA (Annex 3) and CHA (Annex 2).

² IBAT was generated for the Project area in 2022.

2.3.1.1 Terrestrial mammals

The mammal group is diverse and therefore requires diverse strategies for each mammal type of mammals as described below:

1. For small mammals, trapping methods were used (Gurnell & Flowerdew 1994, Flowerdew *et al.* 2004, Gurnell & Flowerdew 2006), with live traps set up in the surrounding areas along the proposed road within the EAAAs, to cover all habitat types within the study area.
2. For medium and large terrestrial mammals, observations of mountain slopes by binoculars and telescope were implemented (for ungulates such as the Armenian Mouflon and Bezoar goat), along with transects. Along the transects, indications of animals (tracks and droppings) were recorded. As many mammals species are furtive and hard to detect, 9 camera-traps were deployed in the most ecologically sensitive area of the project (excluding the area above the tunnel), south of the Bargushat tunnel (*cf.* details hereafter).

Camera-trapping

Camera traps were used to gather data on large mammal movement and distribution, and to identify corridors, for daily movements and migration (especially for Armenian Mouflon). Nine camera-traps were deployed in key locations between Kitsk and Kajaran (*cf.* map below) for potential presence of large mammal species. Prior to installing, the locations of the camera traps and the optimal periods of keeping them in situ were discussed with the management and staff of Zangezur Biosphere Complex SNCO and WWF Armenia. To optimize data collection, the camera traps were left onsite for several seasons, and represent in total 1,089 camera-trap days (*cf.* the table below). One installed camera-trap (the tenth) encountered a problem and did not trigger (CT010). The results of the camera-traps are presented in the Biodiversity Report.

Table 1. Overview of the Camera-Traps Array Set-up between DK 35+000 & DK 57+500

N° of Camera-trap	Set-up date	Retrieval date	Camera-trap days
1	04.12.2021	04.04.2022	121 days
2	04.12.2021	04.04.2022	121 days
3	04.12.2021	04.04.2022	121 days
4	04.12.2021	04.04.2022	121 days
5	04.12.2021	04.04.2022	121 days
6	04.12.2021	04.04.2022	121 days
7	04.12.2021	04.04.2022	121 days
8	04.12.2021	04.04.2022	121 days
9	04.12.2021	04.04.2022	121 days
Total			1,089 days

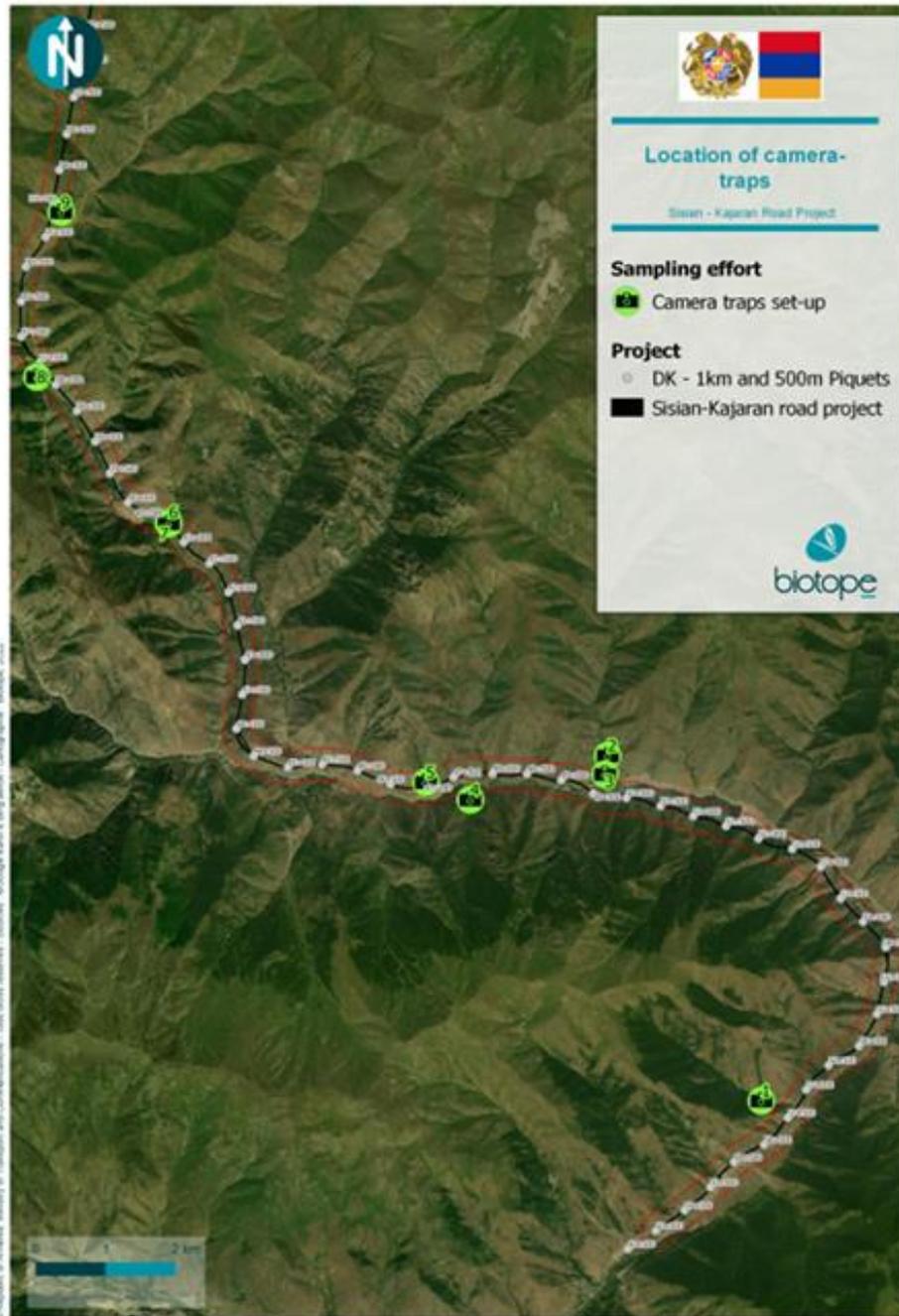


Figure 3. Locations of Camera-traps Set-up in the Framework of the Biodiversity Surveys for the Sisian-Kajaran Road Project

2.3.1.2 Birds

Data on bird species diversity and relative abundance was sourced from:

1. Unstandardized observations, including nest and lek (gathering of male birds) searches and
2. Standardized counts (data collected according to standard methodology).

Both data can be used to create species distribution maps, while the second method can be used for estimates of species' density and numbers.

2.3.1.3 Bats

Two different methodologies were implemented regarding bats:

1. Passive bat detectors (automated bat recorder) near potential feeding areas of bats: one close to Shamb reservoir and one close to Geghavank reservoir (cf. figures below), to document bat species diversity and to define bat activity and utilisation of riparian and aquatic habitats.

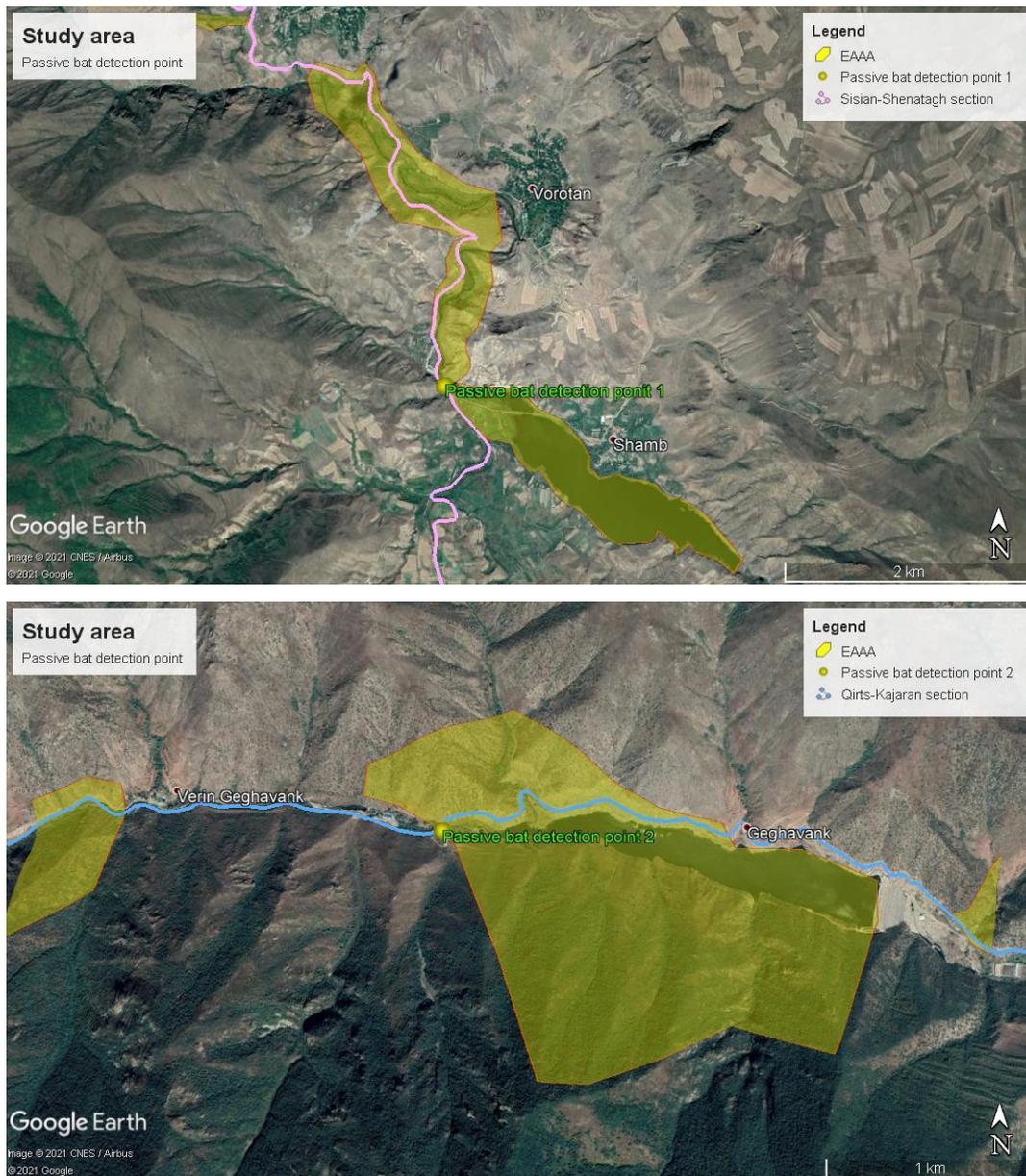


Figure 4. Locations of the Automated Bat Recorders

2. Manual bat detectors: transect surveys using Manual Bat detectors to assess bat species diversity and flight paths in the study area. Roosting and hibernating sites were also sought.

2.3.1.4 Reptiles

Herpetofauna studies were conducted following common methods (Darevsky, 1967 [RUS]; Danielyan, 1972; Arakelyan and Danielyan, 2011; Arakelyan and Danielyan, 2012; Danielyan and Arakelyan, 2016).

Transect surveys were used to identify reptiles. Those that were encountered and locations of permanent shelters were recorded with GPS.

2.3.1.5 Amphibians

Amphibian occurrence was obtained from two different types of observations:

1. Identification of species composition and relative number of amphibians at main water bodies, namely: reservoirs, ponds, rivers and streams. Water bodies were visited and specimens of amphibia examined, species identified, and species numbers determined and recorded. Amphibian surveys were conducted at 23 points, where the road could potentially influence surface water (see figure below).

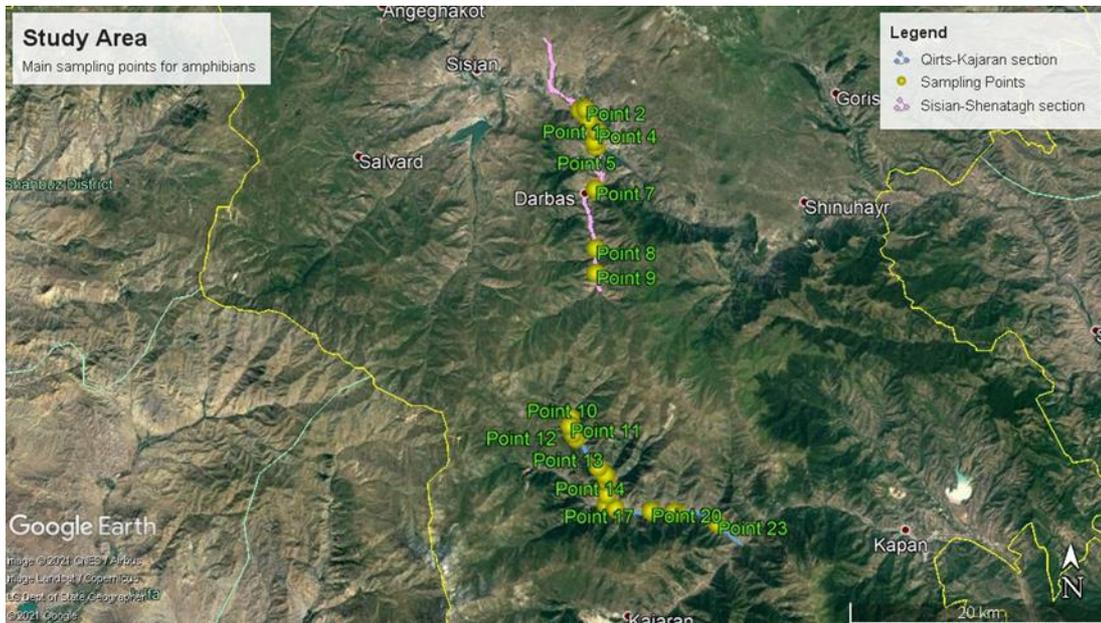


Figure 5. Sampling Sites for Amphibians

2. Night-time transects to record amphibia species migration on the road footprint and vicinity.

2.3.1.6 Fish

Fish were trapped to determine fish species in the study areas. 23 sampling sites within 50-100m of the road were equipped with crayfish device and fishing baskets. Fish were also caught using nets and fishing hooks. Species were determined visually using Pipoyan’s (2021) identification guide.

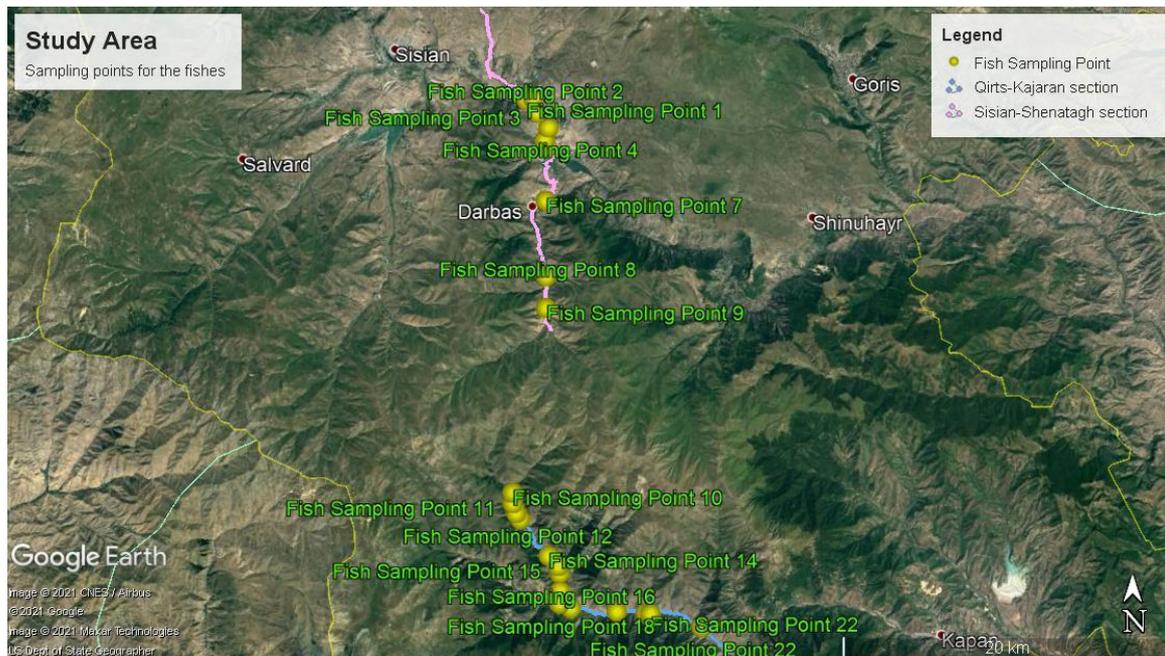


Figure 6. Sampling Points for Fishes

2.3.1.7 Butterflies

Butterfly species diversity was determined via direct observation of species in flight along the bird transect, and in the early mornings at roosting sites.

2.3.1.8 Flora and habitats

Flora surveys targeted diversity of higher vascular plants and especially priority plant species. Data collection parcels were demarcated within the core habitat (squares of 100 x 100 meters). Within the sampling squares, all species were identified. Most plants were identified visually at the sampling sites; with plants requiring laboratory identification collected in herbariums and identified later.

The Flora of Armenia was used (11 volumes, 1954-2009) to identify plant species. Scientific plant names were derived from (Tcherepanov, 1995) and so forth.

Habitats were characterised as follows:

1. Demarcation of land use within a 250m buffer each side of the road.
2. Ground-truthing at selected sites
3. Combining ground-truthing with the land use to define a habitat map using the EUNIS and EU Habitat Directive typology and extrapolating. Vegetation at various sampling points was classified using EUNIS and EU Habitat Directive typology and compared with GIS shape files and the shape files named. Where inconsistencies were identified, GIS shape files were corrected.

2.3.2 Biodiversity Values³

The project site is situated in the Caucasus Ecoregion. This Ecoregion is one of the world's Biodiversity Hotspots - the richest and at the same time most threatened reservoirs of plant and animal life on Earth. Covering an area of 586,800 km² and extending over Armenia, Azerbaijan and Georgia, the North Caucasian part of the Russian Federation, north-eastern

³ For a detailed baseline, please refer to Volume 2. Annex 1.

Turkey, and north-western Iran, the Caucasus hosts 2,791 plant species and 21 genera that are found nowhere else in the world; the level of plant endemism – more than 25% of the region's plant species – is the highest in the temperate world. More than 120 species of vertebrate animals are endemic to the Caucasus Ecoregion ([WWF, 2020](#)).



Figure 7. The Caucasus Ecoregion (WWF, 2020)

A summary of biodiversity values is presented below. The detailed biodiversity baseline is presented in Annex 1, Biogeotech 2022.

2.3.2.1 Habitats

Habitats identified in the project study area, and within the 250 m buffer on either side of the proposed road (see [Figure 8](#) and [Figure 9](#)) are listed in [Table 2](#). They are presented according to 2 habitat typologies, namely EUNIS and EU Habitat Directive Annex I (with flagging of the habitats listed in the Resolution 4 of the Bern convention), in order to be able to reflect all the habitats in the Area of Influence of the project, and to implement the Critical Habitat assessment against EBRD and EIB criteria which includes habitats in the resolution 4 of the Bern Convention and priority habitats listed in the EU Habitat Directive (*cf.* CHA, Annex 2).

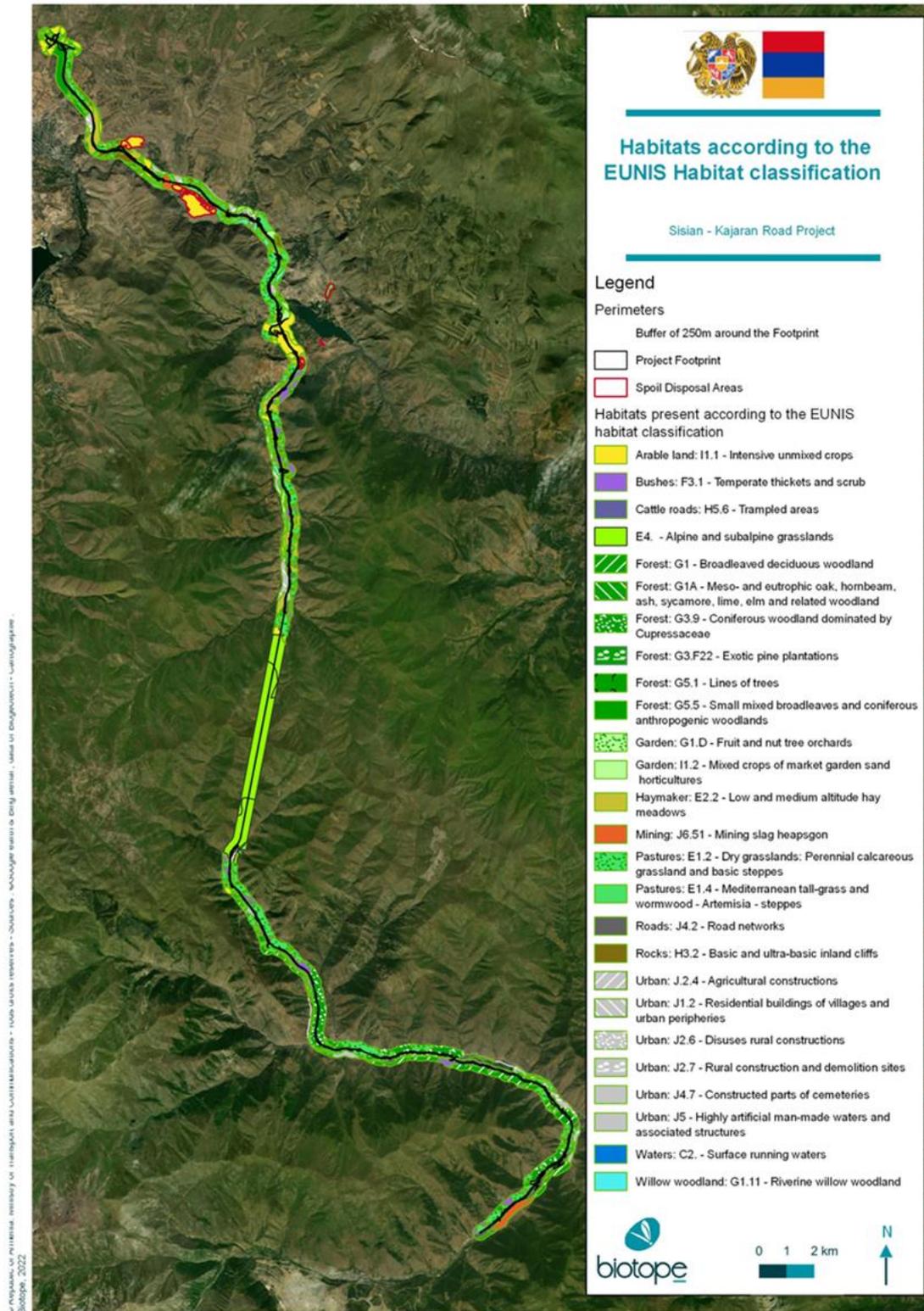


Figure 8. Habitat Map according to EUNIS Habitat Classification in the 250m buffer on both sides of the Proposed Road

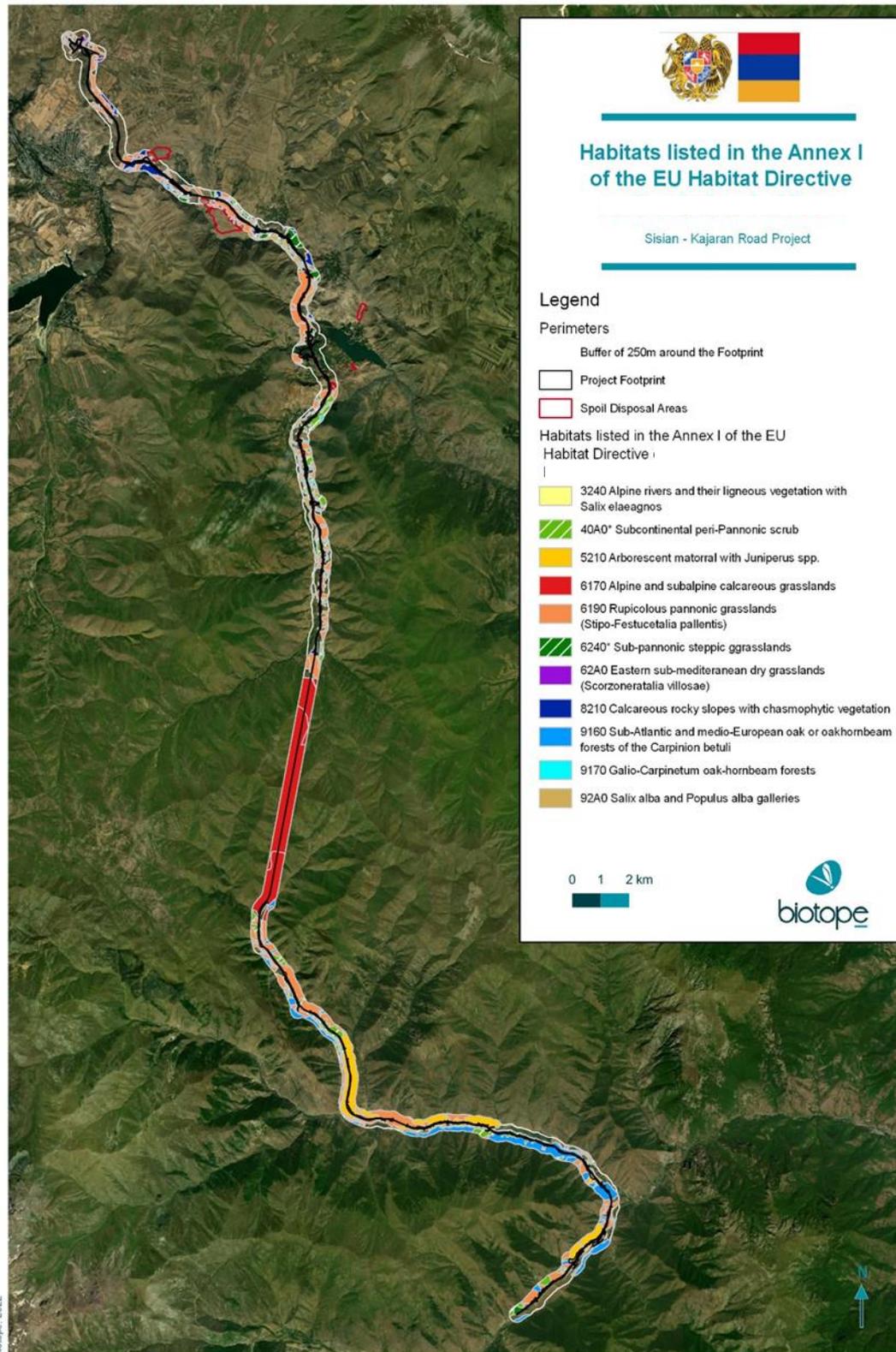


Figure 9. Habitat Map according to Annex I EU Habitat Directive Classification in the 250m Buffer on Both Sides of the Proposed Road

Table 2. List of Habitats present in the Project study area

EUNIS ⁴		EU Habitats Directive ⁵		Area under the footprint ⁶ (ha)	Area in the 250m buffer on both sides of the road ⁷ (ha)
Code	Name of habitat	Code	Name of habitat		
C2.	Surface running waters	3240	Alpine rivers and their ligneous vegetation with <i>Salix elaeagnos</i>	/	1.32
E1.2	Perennial calcareous grassland and basic steppes	6190	Rupicolous pannonic grasslands (<i>Stipo-Festucetalia pallentis</i>)	72.41	632.6
		62A0	Eastern sub-mediterranean dry grasslands (<i>Scorzoneratalia villosae</i>)	1.43	7.61
E1.4	Mediterranean tall-grass and wormwood - Artemisia - steppes	6240*	Sub-Pannonic steppic grasslands	6.61	71.84
E4.	Alpine and subalpine grasslands	6170	Alpine and subalpine calcareous grasslands	15.72	9.77
F3.1.	Temperate thickets and scrub	40A0*	Subcontinental peri-Pannonic scrub	20.72	204.09
G1.	Broadleaved deciduous woodland	9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the <i>Carpinion betuli</i>	15.63	241.41
G1.A	Meso- and eutrophic oak, hornbeam, ash, sycamore, lime, elm and related woodland	9170	Galio-Carpinetum oak-hornbeam forests	2.21	26.33
G1.11.	Riverine willow woodland	92A0	<i>Salix alba</i> and <i>Populus alba</i> galleries	3.27	149.7
G3.9.	Coniferous woodland dominated by Cupressaceae	5210	Arborescent matorral with <i>Juniperus</i> spp.	30.43	221.39
H3.2	Basic and ultra-basic inland cliffs	8210	Calcareous rocky slopes with chasmophytic vegetation	8.54	69.85
Habitats not listed in the Annex I of the Habitat Directive nor in the resolution 4 of Bern convention (crops and urbanization area).				88.60	952.96
TOTAL FOOTPRINT (without tunnels)				265.56	2588.87

The 2 habitats highlighted in bold in the table above namely Sub-Pannonic steppic grasslands (6240*) and Subcontinental peri-Pannonic scrub (40A0*) constitute Critical Habitats (CH) according to the EIB ESS4 Criterion i.a as they are listed as priority habitats in Annex II of the EU Habitat Directive.

After these 2 habitats, 7 other woodland, grassland, steppes and riverine habitats are assessed as Priority Biodiversity Features (PBF) according to the EBRD PR6 Criterion 12 i.a as they are listed in the resolution 4 of Bern Convention:

- Alpine rivers and their ligneous vegetation with *Salix elaeagnos* (3240)
- Rupicolous pannonic grasslands (*Stipo-Festucetalia pallentis*) (6190)

⁴ Habitats in blue correspond to Habitats listed as well in the Resolution 4 of the Bern convention

⁵ Codes with an « * » correspond to priority Habitats in the EU Habitat Directive

⁶ Without considering the tunnels areas

⁷ Without considering the tunnels areas

- Eastern sub-mediterranean dry grasslands (*Scorzoneratalia villosae*) (62A0)
- Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli (9160)
- Galio-Carpinetum oak-hornbeam forests (9170)
- *Salix alba* and *Populus alba* galleries (92A0)
- Arborescent matorral with *Juniperus spp.* (5210).

The map below (cf. **Figure 10**) presents these results detailed in the CHA, which highlight the importance of these habitats regarding the EBRD PR6 and EIB ESS4 international standards (cf. Annex 2 of this Volume 2 for more details).

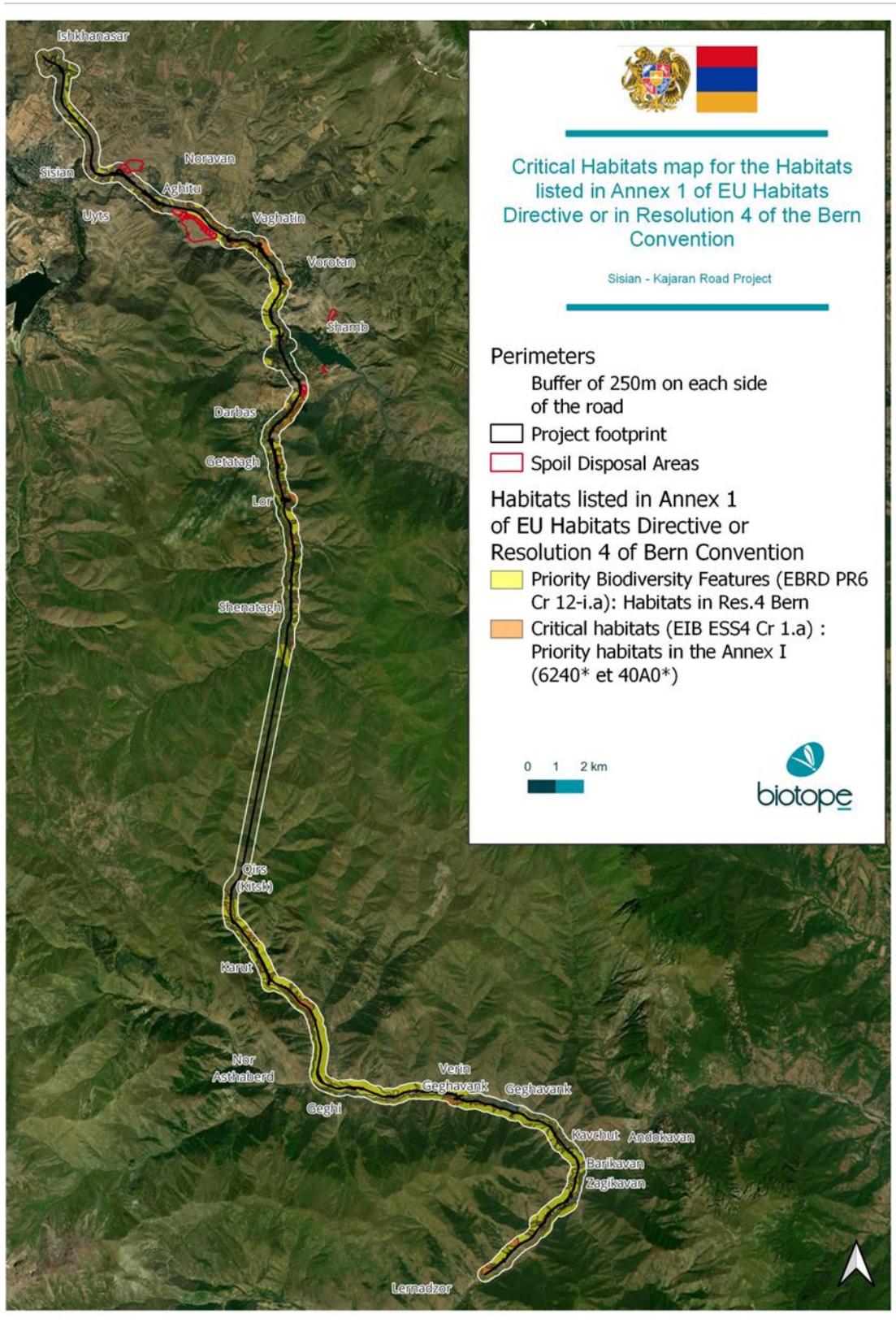


Figure 10. General Map of the Priority Biodiversity Features Triggering Criteria 12.i.a (EBRD, PR6) and Critical Habitats and Criteria 1.a (EIB, ESS4) (for details, refer to Annex 2 of this Volume 2)

2.3.2.2 Species

Only priority species and species of conservation concern identified in the CHA (cf. Volume 2 Annex 2) have been brought for further analysis and impact assessment in the ESIA given the important number of these species and because they constitute umbrella species (species whose conservation confers protection to a large number of naturally co-occurring species). Then mitigation measures that will be applied to these priority species and species triggering critical habitats will be beneficiary as well for the other species sharing the same ecology and/or habitat.

All identified species in the study area during fieldwork or literature review are listed in a separate excel file together with the detailed biodiversity baseline in Annex I (cf. Volume 2 Annex I, Biogeotech, 2022).

Flora

The main taxonomic units of the higher plant species found in the Sisian-Dzagedzor section of the road are listed in **Table 3**.

Table 3. Main Taxonomic Units in the Sisian-Dzagedzor Section of the Road

Main taxa			Families	Genera	Species
Kingdom of plants	Order	Classes			
	Bryopsida	Bryophyta	2	2	2
	Equisetopsida	Equisetophyta	1	1	2
	Pteridopsida	Pteridophyta	5	7	7
	Gymnospermae	Coniferales	2	2	5
		Gnetales	1	1	1
	Angiospermae	Dicotyledones	62	197	302
Monocotyledones		18	41	63	
Total			91	251	382

The following spectrum of biological forms of higher plants was determined at the Sisian-Dzagedzor section of the North-South interstate road: Trees - 53 species (13.9%), Shrubs and semi-shrubs - 43 species (11.2 %), Perennial herbs - 198 species (51.8 %), Biennial herbs - 14 species (3.7 %), Annual-biennial herbs - 13 species (3.4 %), Annual herbs - 61 species (16 %). Four species of herbaceous and semi-shrub liana and four species of parasitic and semi-parasitic plants have also been found in the study area.

Flora is dominated by perennial herbs – 51.8 % (198 species), and biennial and annual herbs – 23.1 % (88 species). Trees constitute 13.9% of the flora (53 species), and shrubs and semi-shrubs together constitute 11.2%, 43 species.

The higher plants of the Sisian-Dzagedzor section of the North-South interstate road are represented by 20 main families. The following plant communities are rich with Red-listed and endemic species: juniper woodland (6 species), forest (4 species), steppe (3 species) and alpine (2 species).

Table 4. Habitats Present in the Study Area and Associated Characteristic Species

EUNIS		EU Habitats Directive ⁸		Characteristic species
Code	Name of habitat	Code	Name of habitat	
C2.	Surface running waters	3240	Alpine rivers and their ligneous vegetation with <i>Salix elaeagnos</i>	<i>CaltFha palustris</i> , <i>Veronica anagallis-aquatica</i> , <i>Ranunculus trichophyllus</i> , <i>Salix elbursensis</i> , <i>Potamogeton pectinatus</i>
E1.2	Perennial calcareous grassland and basic steppes	6190	Rupicolous pannonic grasslands (<i>Stipo-Festucetalia pallentis</i>)	<i>Stipa</i> spp., <i>Festuca valesiaca</i> , <i>Poa badensis</i> , <i>Carex humilis</i> , etc
		62A0	Eastern sub-mediterranean dry grasslands (<i>Scorzoneratalia villosae</i>)	<i>Bothriochloa ischaemum</i> , <i>Festuca valesiaca</i> , <i>Stipa</i> spp., <i>Agropyron</i> spp., <i>Elytrigia</i> spp., etc
E1.4	Mediterranean tall-grass and wormwood - <i>Artemisia</i> - steppes	6240*	Sub-Pannonic steppic grasslands	<i>Artemisia fragrans</i> , <i>Xeranthemum squarrosum</i> ., <i>Taeniatherum crinitum</i> , <i>Ceratocephalus falcatus</i> ., etc
E4.	Alpine and subalpine grasslands	6170	Alpine and subalpine calcareous grasslands	<i>Betonica orientalis</i> , <i>Puschkinia scilloides</i> , <i>Scilla armena</i> , <i>Festuca</i> spp., <i>Alopecurus brevifolius</i> , <i>Bromopsis variegata</i> , <i>Thymus transcaucasicus</i> , etc
F3.1.	Temperate thickets and scrub	40A0*	Subcontinental peri-Pannonic scrub	<i>Cerasus incana</i> , <i>Amygdalus fenzliana</i> , <i>Genista tinctoria</i> , <i>Rhamnus cathartica</i> , <i>Crataegus</i> spp.m etc
G1.	Broadleaved deciduous woodland	9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the <i>Carpinion betuli</i>	<i>Quercus macranthera</i> , <i>Carpinus betulus</i> , <i>Acer platanoides</i> , <i>Acer campestre</i> , <i>Ulmus glabra</i> , etc
G1.A	Meso- and eutrophic oak, hornbeam, ash, sycamore, lime, elm and related woodland	9170	Galio-Carpinetum oak-hornbeam forests	<i>Quercus macranthera</i> , <i>Carpinus betulus</i> , <i>Fraxinus excelsa</i> , <i>Ulmus minor</i> , <i>Acer campestre</i> , etc
G1.11.	Riverine willow woodland	92A0	<i>Salix alba</i> and <i>Populus alba</i> galleries	<i>Salix alba</i> , <i>Salix excelsa</i> , <i>Salix triandra</i> , <i>Salix elbursensis</i> , <i>Populus alba</i> , etc
G3.9.	Coniferous woodland dominated by Cupressaceae	5210	Arborescent matorral with <i>Juniperus</i> spp.	<i>Juniperus polycarpus</i> , <i>Juniperus foetidissima</i> , <i>Juniperus oblonga</i> , <i>Lonicera iberica</i> , <i>Viburnum lantana</i> , etc
H3.2	Basic and ultra-basic inland cliffs	8210	Calcareous rocky slopes with chasmophytic vegetation	<i>Rhamnus pallasii</i> , <i>Hypericum formosissimum</i> , <i>Parietaria elliptica</i> , <i>Sedum</i> sp., <i>Sempervivum</i> sp., etc

Only one location was identified with the species *Ailanthus altissima* (an alien invasive plant) at the proposed road turn-off from Kajaran to Geghi. Other potentially invasive species such as *Acer negundo* and *Robinia pseudoacacia* were not found in the study area but still present a potential for propagation along the proposed road.

A set of flora-related comments were received during the July-December 2023 ESIA disclosure period. Selected comments alongside the clarification provided in response are presented in the below table as they are useful for the understanding of the baseline.

⁸ Codes with an « * » correspond to priority Habitats in the EU Habitat Directive

Table 5. Selected Flora-related Comments and Provided Clarification

<i>Selected comments received from the Specially Protected Areas and Biodiversity Policy Department, Ministry of Environmental of Armenia, letter № 2/16.7/15884, 01.12.2023</i>	<i>Project Response actions and references in the ESIA documents</i>
1. On page 6 of the Plan, in Figure 1 "Location of the Sisian-Kajaran Road Section, Syunik Marz, Armenia", apart from the areas of rural and urban settlements of the Sisian-Kajaran road section and RA Red Book species, additionally the following species listed in the RA Red Book of RA Plants as per the RA Government Decision N 72-N "On approving the Red Book of Plants of the Republic of Armenia" are also grown:	The distribution map in the Red Book of Armenia provides quite approximate data, while the field survey within the ESIA is more detailed and the desk research involved careful work with the herbarium where distribution spots for every specimen with the herbarium where distribution spots for every specimen were checked. The below clarifications have been added to the ESIA documents where relevant.
- <i>Astragalus humilis</i> / Sisian city surroundings / CR category,	In the Sisian Region, this species grows only in the vicinity of the City of Sisian and near Zorakarer. The closest distance from the Sisian-Kajaran section of the highway is 4-6 km.
- <i>Sclerochloa woronowii</i> /Woronov's hard grass/ Sisian / EN category,	In the Sisian Region, it grows near the village of Bnunis. The distribution spots mentioned in the Armenian Red Book (2010) are far from the Sisian-Kajaran road (about 9.3 km away), and the closest station to the footprint was recorded in 1995 by the Project botanist at about 1km from the road alignment, so it is very unlikely that this species might be present under the footprint. However, as a precautionary approach, this species has been now flagged in the Pre-construction biodiversity surveys (RD12) of the BAP, for the botanists to be particularly vigilant about this species, to ensure that it is not present within the footprint, and that it is as well integrated in BAP5 in order to be translocated outside of the project footprint in a favorable habitat, in the unlikely event it would be found.
- <i>Onobrychis meschetica</i> /Korngan mescheti/ Shamb village surroundings /CR category,	In the Sisian Region, it grows near the villages of Shamb and Darbas. The closest distance of its locations in the vicinity of Shamb to the Sisian-Kajaran road is 2-3 km. The location in the vicinity of the village of Darbas to the Sisian-Kajaran road is about 600-800 m to the North-West.
- <i>Potentilla cryptophila</i> / above Darbas village / EN category,	In the Sisian region, it grows in the northwest of the village of Darbas, at about 1-1.5 km from the Sisian-Kajaran highway.
- <i>Psephellus zangezuri</i> / Geghi village / EN category,	It has not been found by us in nature, despite intensive scientific expeditions. The old herbarium data (which do not have GPS coordinates) do not allow determining exact locations, so it is hard to say that the species definitively occur within the 500m buffer zone of the Sisian-Kajaran Road.
- <i>Tulipa confusa</i> / tangled tulip / Kajaran / EN category,	In the Kapan Region, it grows near the village of Pkhrut, which is outside the study area of the Sisian-Kajaran road.
- <i>Polystichum lonchitis</i> / Banpot lance-shaped / Around the toilet / EN category,	In the Kapan Region, it grows on the slopes of Mount Khustup, as well as on Mount Sakkar, not far from the Meghri Pass. <i>Polystichum lonchitis</i> is not found near the planned Sisian-Kajaran Road. The closest distance from the Sisian-Kajaran section is min 2 km.
- <i>Astragalus prilipkoanus</i> / between Kapan and Kajaran / EN category.	In the Kapan Region, it grows near the villages of Pkhrut, Gyard, and Katnarat. The closest location from the Sisian-Kajaran Road is approximately from 700 m to 3 km.
2. The presence of the <i>Tulipa florenskyi</i> species mentioned in the Plan in the Sisian-Kajaran road section or its surroundings needs clarification, because according to the RA Red Book of plants, the latter is found only in the Meghri	<i>Tulipa florenskyi</i> was found by us above the village of Dzagedzor, together with <i>Tulipa sosnovskyi</i> . A small part of the population is located within a 500-m buffer zone of the proposed road. However, it is possible that the " <i>Tulipa florenskyi</i> " specimens (identified based on morphology) are just a variation of <i>Tulipa sosnovskyi</i> , and additional genetic

<p>Selected comments received from the Specially Protected Areas and Biodiversity Policy Department, Ministry of Environmental of Armenia, letter № 2/16.7/15884, 01.12.2023</p>	<p>Project Response actions and references in the ESIA documents</p>
<p>floristic region (Agarak, Meghri, Kartchevan, Shvanidzor, Newvadi).</p>	<p>identification might be necessary. In both cases, it is necessary to collect all the bulbs of these species in the working area, grow them in nurseries, and after the completion of the road work, return them to nature. The necessary actions for <i>Tulipa florenskyi</i> include the measures of translocation of the species and are described in the BAP 5: Experimental translocation of endemic restricted-range plant species.</p>

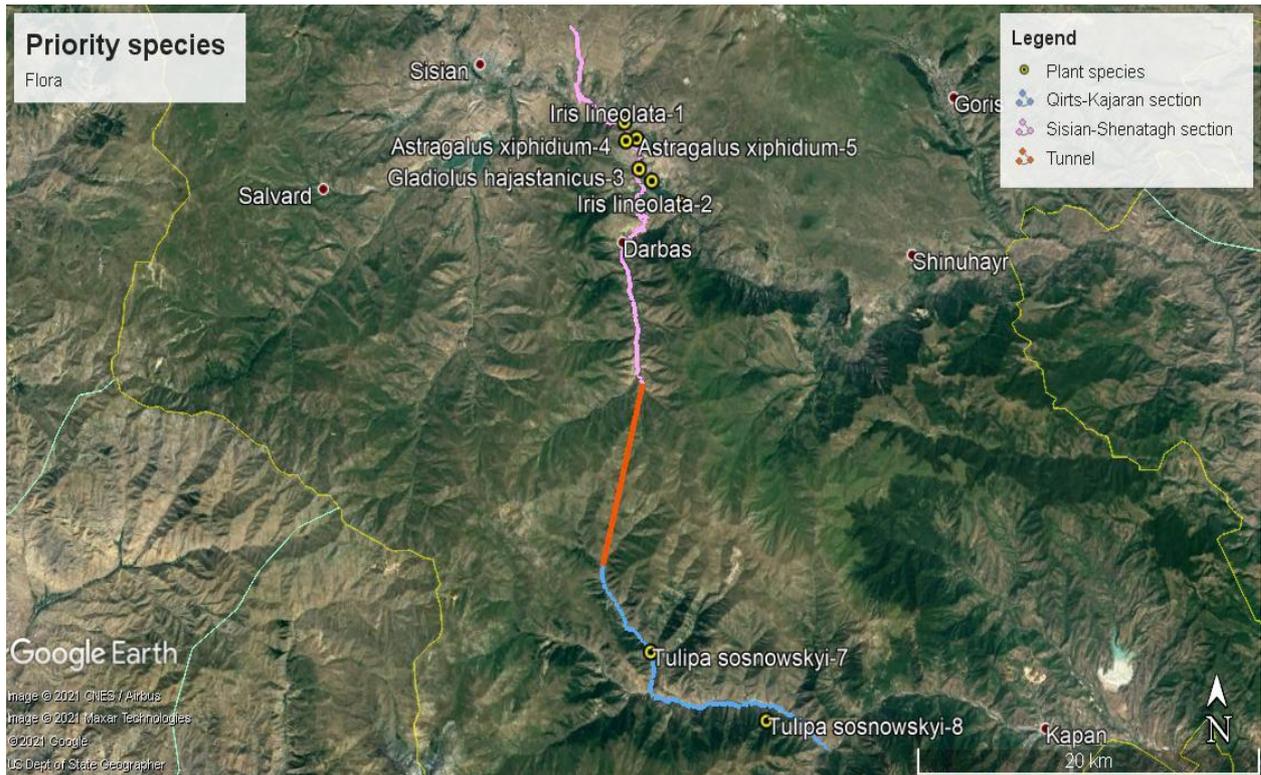


Figure 11. Main Flora Priority Species Observations

Two priority habitats listed in Annex 1 of the EU Habitat Directive are triggering Critical habitat according to the EIB ESS4 cr.1.a: **6240***: Sub-Pannonic steppic grasslands and **40A0***: Subcontinental peri-Pannonic scrub. 7 other habitats listed on the Resolution 4 of the Bern Convention are triggering EBRD PR6 Priority Biodiversity Features (PBF).

Of the 382 flora species observed, 5 species listed as CR or EN in the Armenian Redbook were recorded in the 250m buffer on each side of the road. These species trigger CH according to both EBRD and EIB standards: *Hypericum armenum* (CR), *Astragalus xiphidium* (EN), *Iris lineolata* (EN), *Tulipa sosnowskyi* (EN), *Tulipa florenskyi* (EN). Only *Iris lineolata* was found in the direct project footprint, but the presence of these and other flora species listed as EN or CR on the Armenian redbook and contained in the herbarium (but not recorded during field surveys) will need to be rechecked for presence in the direct project footprint (including access roads, base camps, and so forth which are still to be defined) before stripping vegetation (cf. mitigation measure RD12).

Terrestrial mammals

During fieldwork, representatives of five orders of terrestrial mammals were observed, along with the Chiroptera order. Large mammals were mainly recorded by their vital signs or by camera-traps, and in rare cases the animal itself was directly observed (cf. Figure

12). Small mammals (excluding bats) were predominantly captured using non-lethal traps. Among priority species (listed in Red Data Book of RA) the Indian crested Porcupine (*Hystrix indica*, LC) and Bezoar Goat (*Capra aegagrus*, NT) were recorded in the target area.

The wintering place of Indian Porcupine was identified in the area adjacent to Sisian. Bezoar Goats were recorded mostly in the Kitsk-Karut section, as well as on the rocky mountain ridge in front of Geghi village. Many hares were observed in the target area. Four species of rodents were identified in different sections of the proposed road, represented by widespread species.



Figure 12. Bezoar Goat, *Capra aegagrus* (source: Astghik Ghazaryan)

The nine camera traps installed in the Geghi-Kitsk canyon captured the presence of 5 orders of mammals, represented by 13 species, which include four species listed in the Red Data Book of Armenia (Indian porcupine (*Hystrix indica*, LC), Brown bear (*Ursus arctos*, LC), Wild cat (*Felis silvestris*, LC), and Wild goat (*Capra aegagrus*, NT).

Golden Jackal was detected by camera traps 001-005, with especially large numbers recorded by traps 002 and 005. The presence of jackal was unsurprising as the Geghi canyon seems suitable habitat. No jackals were recorded in Kitsk–Karut part of the canyon. many foxes were recorded by trap 001, and an individual captured in each of traps 002, 004 and 008. A pair of European hares was detected at 005 trap (a couple). Individual hares were also observed at traps 007, 008, 009, 002, 001. Tracks (footprints) of hares, as well as hares themselves were observed during daytime around Karut. For 4 months 1 individual marten was recorded by traps 006, 007, 008. Several individuals were recorded by 002, 001 and 004 traps including the marten was observed with food (mouse). Badgers were recorded by camera traps 001, 002, 005.

Wolves were registered almost everywhere in the target area. The least number of wolves was recorded by trap 001. Packs of wolves were registered at 006, 007, 008 camera traps installed in Kitsk–Karut canyon, mostly represented by mature individuals. A single pack was recorded by trap 002. The packs are mainly located within the ranges of Bezoar Goats and Wild Boars.

Wild boars are widely distributed within the target area. The traps recorded both groups and single animals. All the groups contained males, females, and young. The highest number of groups were recorded by traps 002, 006, 007, 009. The largest group was recorded by trap 007.

Among Red Book of RA species, the Indian Porcupine was recorded in different periods, through camera-traps 001, 002 and 005, but not in Kitsk-Karut canyon.

Brown Bear, *Ursus arctos* (LC) was recorded by traps 002, 003, 005, 007, 009. In December, a mother with 2 cubs were registered by trap 005. Bears were not recorded from January until the end of March. The bears started being registered from 31.03-08.04.2021, both at night and during the daytime. Bear's fresh footprints were also observed in the area of trap 003, in the end of March. European Wildcat was registered by traps 001 and 002. A pair of Lynxes was photographed by trap 001, and single lynxes

recorded by traps 009 and 007. A mother Lynx with two cubs was photographed by traps 004 and 005 (the same individuals).

Bezoar Goats were captured by traps 002, 003, 006, 007, and 008, mainly during daytime. Most recorded only males, while females were captured by trap 006. In addition, male Goats were also visual observed on the slopes, where traps 006 and 007 were located, somewhat above the camera traps.

Finally, it seems that globally there are seasonal distribution pattern changes, with a highest diversity and density of priority species closer to the road in winter as they move away from the heavy snow and cold at altitude.



Figure 13. Example of an Eurasian Lynx, *Lynx lynx* taken by a Camera-trap

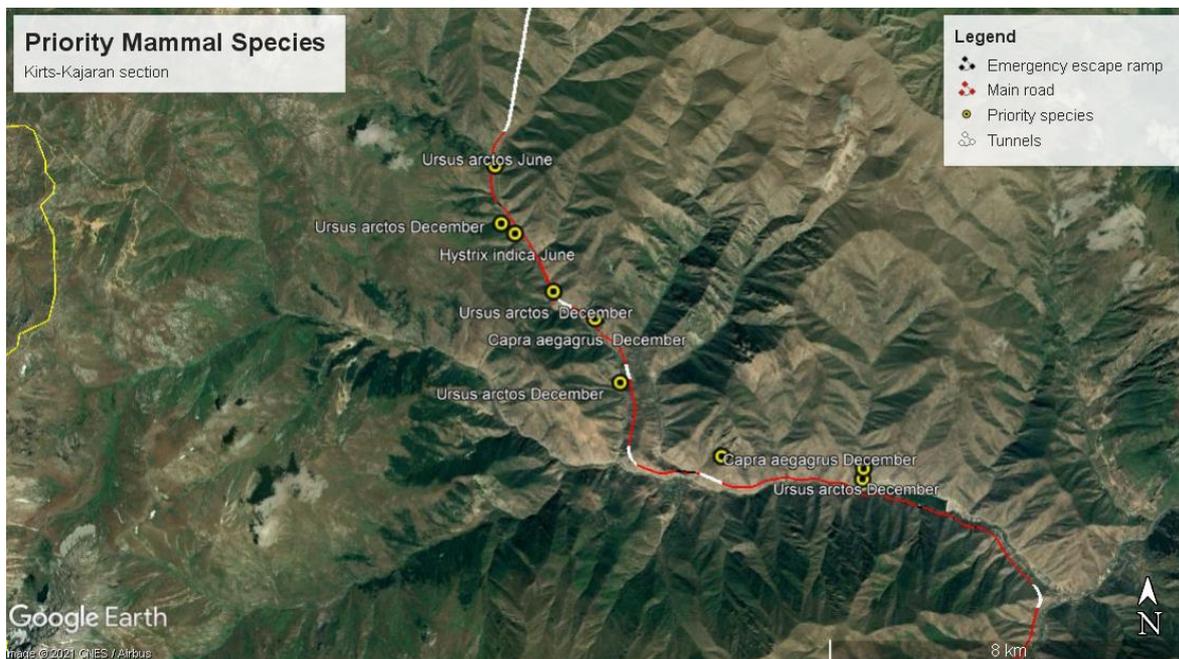


Figure 14. Main Terrestrial Mammal Priority Species Observations

17 species of terrestrial mammals have been recorded in the study area (Figure 2), of which 9 species qualify as CH (cf. CHA, Volume 2, Annex 2), including the Critically

endangered Caucasian Leopard, *Panthera pardus saxicolor* and the endangered Armenian Mouflon, *Ovis orientalis gmelini* in the Armenian Red book.

Bats

There are caves in the Norashen-Shenatagh section where bats form maternal colonies and hibernate, **but they are not located in the area adjacent to the road and are not falling within the area of influence.** Maternity and wintering colonies of bats were found quite far from the study area. Thus the maternity colony of *Plecotus macrotus* was found in the vicinity of Angeghakot village, which is located far from the road project.

At the same time, the Shamb and Geghi water reservoirs serve as feeding and drinking areas for bats, attracting large number of various species, as was detected by automatic recording devices. Among bats only widely distributed species were recorded.

In addition, many *Myotis blythi* (11 individuals) were observed visually in Vorohtnavanq, several individuals of *Pipistrellus kuhli* in Shenatagh village, and only 3 individuals of *Rhinolophus hipposideros* in vicinity of Geghi village.

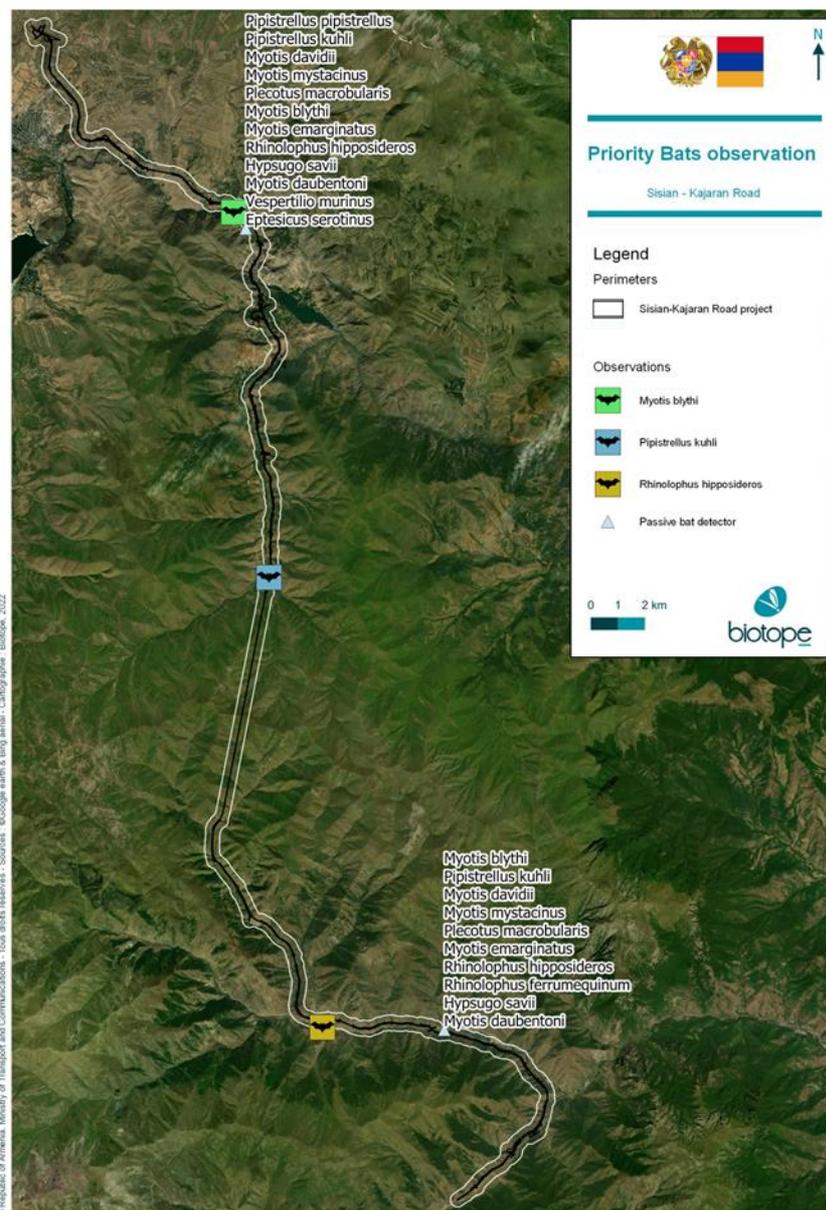


Figure 15. Main bat species observations

Among the 12 species of bats identified, 8 are Priority Biodiversity Features according to PR6 as they are listed in the Resolution 6 of the Bern Convention, which are the: Mehely's horseshoe bat, *Rhinolophus mehelyi* (VU) ; Mediterranean horseshoe bat, *Rhinolophus euryale* (NT); Blasius' horseshoe bat, *Rhinolophus blasii* (LC); Lesser Horseshoe Bat, *Rhinolophus hipposideros* (NT) ; Schreiber's Bat, *Miniopterus schreibersii* (VU) ; Lesser Mouse-eared Myotis, *Myotis blythii* (LC) ; Geoffroy's Bat, *Myotis emarginatus* (LC). Moreover, in the Armenian Red book the Blasius' horseshoe bat is assessed as Endangered and 3 other species are assessed as Vulnerable (*cf.* details in CHA, Volume 2, Annex 2). However, EIB ESS4 dictates that these 8 species trigger CH as their presence in Annex II qualifies them for CH according to this standard (*Cr.* 2d *cf.* [section 2.2.4](#)). The study area is used by bats for foraging. No hibernation sites or nursery colonies were recorded in the study area, but the area is on the migration route of the Lesser Mouse-eared Myotis (which was found resting in the Votnavanq church), and Schreiber's Bat.

Birds

Some 37 families of birds have been observed, with 101 species. There are 14 priority species with 12 species from the Red Book of Animals of Armenia and 2 restricted range species.

The **Caucasian Grouse** should be reported from the mountains that surround the Kitsk area. The lek itself was not found but there are several spots which could serve as lekking sites. Another finding is the **Caspian Snowcock** that breeds in the mountains above Shenatagh village with quite a high density – 3 calling males in about 3 square km. Although several Red-listed raptors were observed in the target area, **Bearded Vulture** (see the photo below) and **Golden Eagle** only seem to use the Kitsk-Karut area regularly hunting and foraging. However, no nests of these raptors were found within the target area and it is assumed that these raptors come from the neighbouring pairs (*cf.* BirdLinks Armenia). The assumption is supported by the time of their observations, e.g., the Bearded Vultures were never observed before 10:30 am. In Southern Armenia the species begins its search in 8:30-9:00 am and for that reason it is assumed that the bird may breed within the target area but comes from nearby territories (NB: the home range of a Bearded Vulture can be up to 750 km²). Another important finding is the high density of forest specialist and restricted range species – the **Green Warbler**.



Figure 16. Bearded Vulture *Gypaetus barbatus*, Kitsk Area

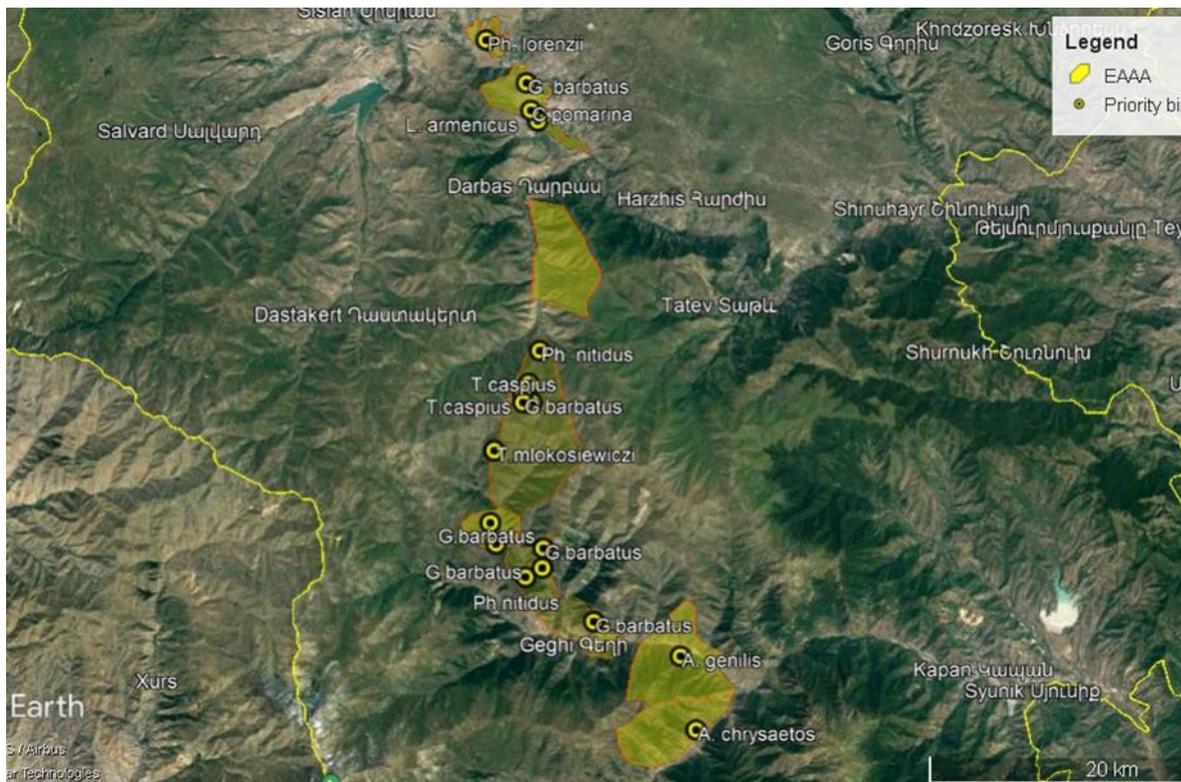


Figure 17. Locations of Priority Bird Species Observations in the Study Area

101 bird species were recorded in the study area, with 26 Priority Biodiversity features according to EBRD PR6 (24 triggering cr 12.ii.a as they are listed in the Resolution 6 of the Bern Convention, of which the Egyptian Vulture, *Neophron percnopterus* (EN) triggers as well the criterion 12.ii.b and 2 lekking species which trigger the criterion 12.iii of significant biodiversity feature identified by a broad set of stakeholders (cf. CHA, Volume 2, Annex 2). The study area is a foraging ground for many raptors but there is no breeding evidence for these species in the area apart for the Northern Goshawk (*Accipiter gentilis*). However, the 2 lekking species are breeding over the Bargushat tunnel area: the Caspian Snowcock, *Tetraogallus caspius* (LC) and the Caucasian Grouse, *Lyrurus mlkosiewiczzi* (NT).

Amphibians

Two amphibian species were recorded (Marsh frog, *Pelophylax ridibundus* and Long-legged wood frog, *Rana macrocnemis*), belonging to one family, but they do not constitute priority species.

Spawning areas of Long-legged wood frog (*Rana macrocnemis*) were discovered close to the southern end of Shenatagh village (cf. figure below). In breeding season, an unusually high density of eggs was recorded, on average 20 eggs per 100 square meters.

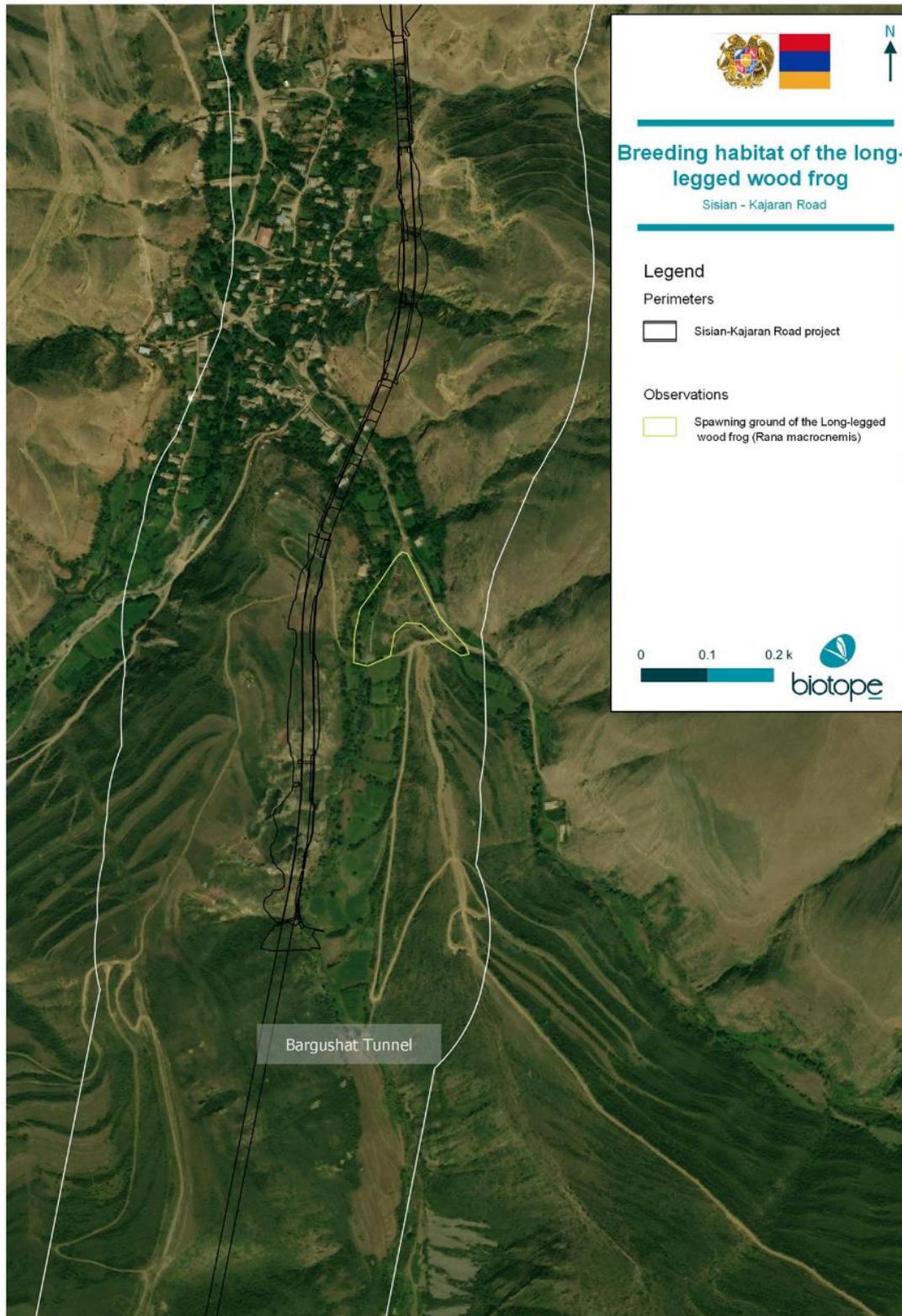


Figure 18. Location of Long-legged Wood Frog (*Rana macrocnemis*) Spawning Area in Shenatagh Village

2 species of amphibians have been recorded in the study area (at ca. 100m from the road footprint) and none of them triggers criteria to qualify as PBF or CH according to the EBRD PR6 or EIB ESS4.

Reptiles

Nine representatives of six reptile families were observed. Among priority species, the wintering ground of *Montivipera raddei* and *Pelias eriwanensis*, was recorded. In the section Geghi to Kitsk and Sisian to Shenatagh, *Macrovipera lebetina*, *Montivipera raddei*, *Pelias eriwanensis*, *Darevskia raddei*, *Lacerta media*, *Lacerta strigata*, *Laudakia caucasica*, *Telescopus fallax* and Geghi to Kitsk: *Zamenis hohenackeri*, *Testudo graeca*, and *Eumeces schneideri* were observed.

The above-mentioned reptile species are found in mountain steppes, rocky slopes (1,700-2,200 MASL) and can migrate up to 5 km for foraging and hibernation. The availability of shelters, hiding places, as well as food are the main factors in the existence of reptiles.



Figure 19. Left picture: Armenian steppe viper, *Vipera eriwanensis* (VU), Vicinity of Kitsk; Right picture: Radde's viper, *Montivipera raddei* (NT), Observed in the Vicinity of Vorotnavank

In addition, in lower parts and surrounding areas of rocky slopes covered with xerophyte biotopes, a rare species of lizard – Twin-striped Skink (*Ablepharus bivittatus*) can be found, and Slow Worn (*Anguis fragilis*) can be observed in mixed forests. In dry steppes, shrubs, and sparse forests, Glass Lizard (*Pseudopus apodus*) can be observed. Among the snakes in dry steppes, shrubs, in open forests areas European blind snake or European worm snake, (*Typhlops vermicularis*), Javelin Sand Boa (*Eryx jaculus*), and Red-bellied Racer (*Dolichophis schmidt*) are recorded.



Figure 20. Mediterranean tortoise, *Testudo graeca* (VU), Observed between Geghi and Kitsk

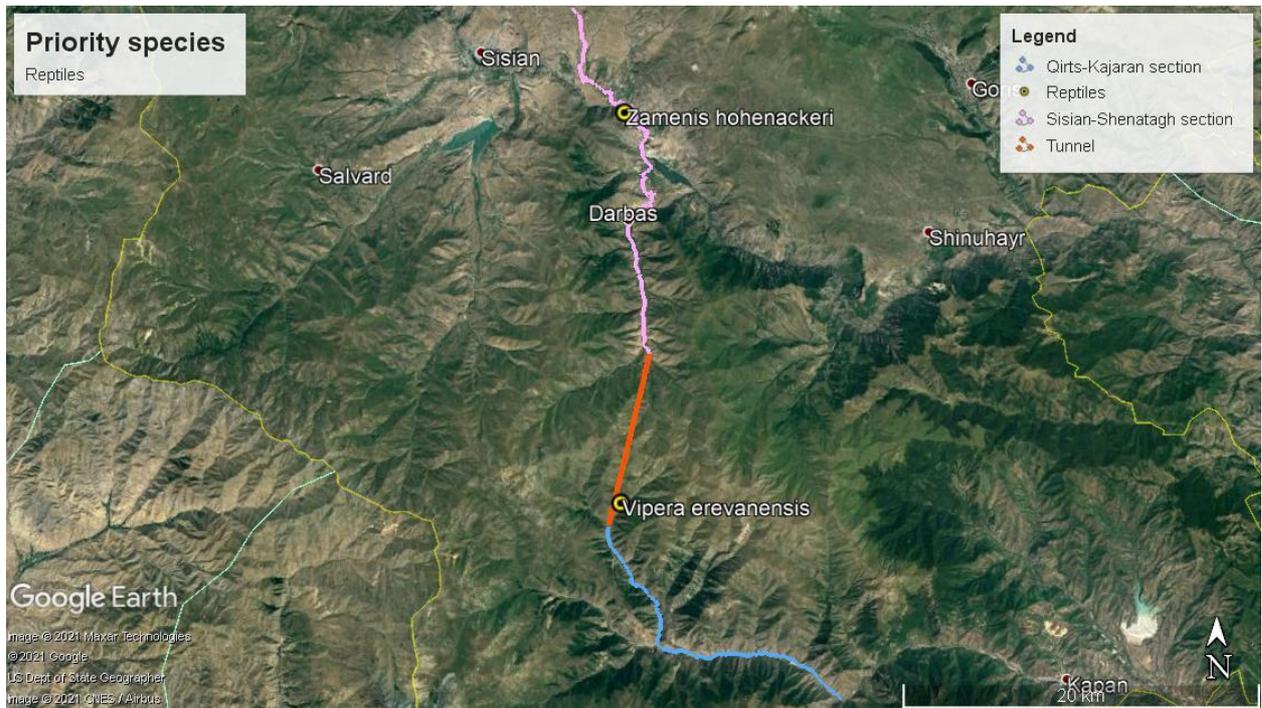


Figure 21. Main Reptile Priority Species Observations

17 species of Reptiles were recorded in the study area, with two being Priority Biodiversity features according to the EBRD PR6, the Armenian steppe Viper, *Vipera erivanensis* (VU) and the Radde’s viper, *Montivipera raddei* (NT) which are range-restricted species (triggering PR6 cr.12.iii.a and as well cr.12 ii.c for the Armenian steppe Viper - Vulnerable on the IUCN Red list). Finally, two species of turtles/ tortoises trigger Critical Habitats for EIB ESS4 standard as they are listed in Annex IV of the EU habitat Directive: the Mediterranean Tortoise, *Testudo graeca* (VU) and the European Pond Turtle, *Emys orbicularis* (NT) (EBRD PR6 Cr.14 ii.a, and EIB ESS4 Cr 2.d cf. CHA, Volume 2, Annex 2).

Fishes

Nine fish species were recorded, belonging to three families, and contain only one culturally priority species for sport fishing or food, the Brown, the Brown Trout, *Salmo trutta fario* (LC).

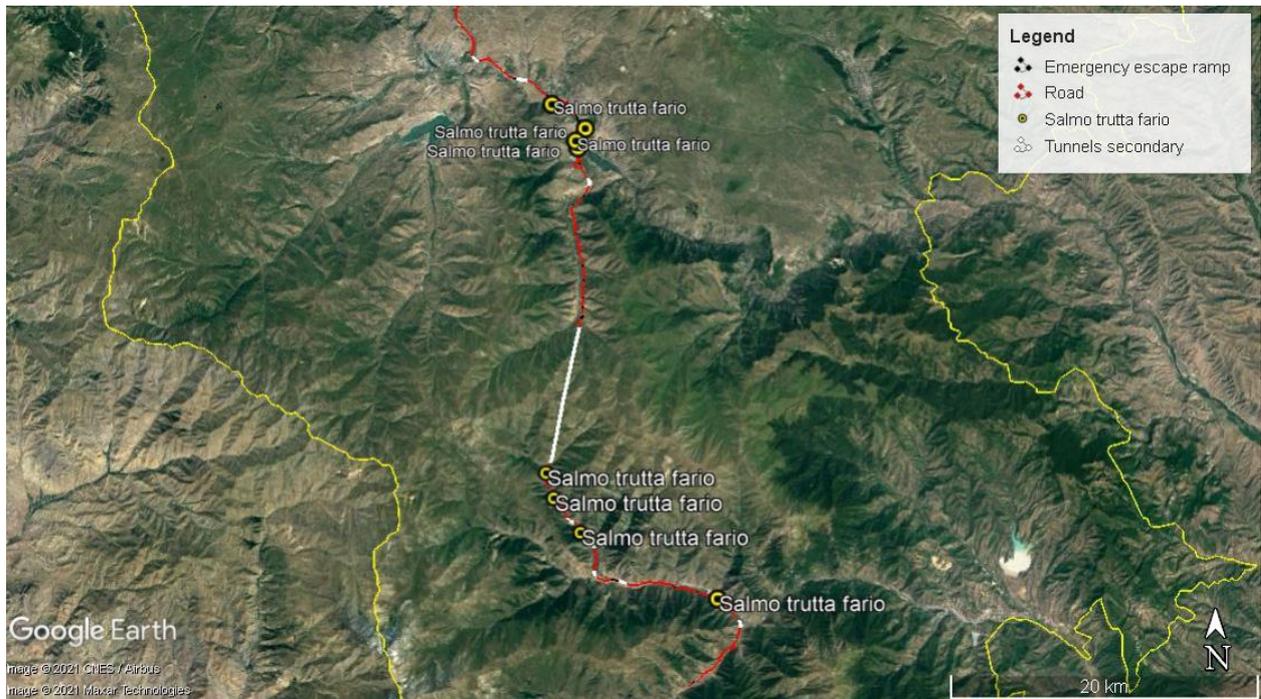


Figure 22. Main Fish Priority Species Observations

9 fish species were recorded in the study area and none triggers PBF or CH criteria according to the EBRD PR6 or EIB ESS4.

Butterflies

Some 5 families of butterflies, with 90 species were recorded in the study area. There are four priority species recorded with three species from Red Book of Animals of Armenia and one restricted range species.

The discovery of **Forster's Blue** (*Polyommatus aserbeidschanus*) in Kitsk area is important as it is a second population of this regional endemic species found in Armenia. Another important finding is a dense population of **Lesser Marbled Fritillary** (*Brenthis ino*), which lives in almost untouched meadows above Shenatagh village (some 100-150 m from the proposed road footprint).

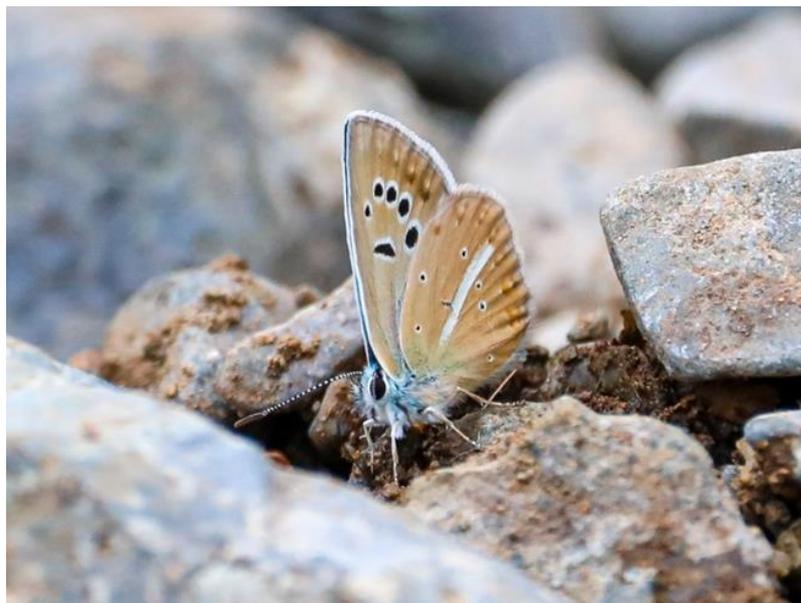


Figure 23. Forster's Blue, *Polyommatus aserbeidschanus*, Kitsk Area

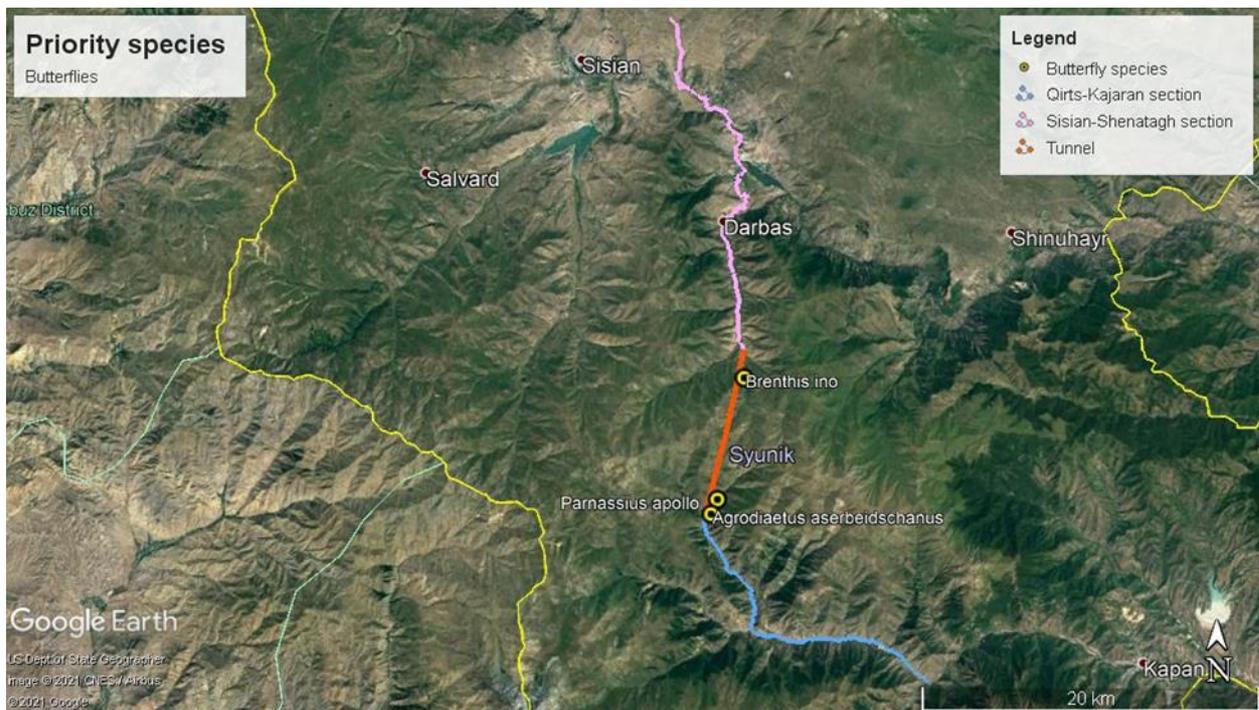


Figure 24. Main Butterflies Priority Species Observations

90 species of butterflies have been recorded in the study area, of which 3 are Critical Habitat triggers according to EIB ESS4: the Apollo butterfly, *Parnassius apollo* (VU), the Large Blue, *Maculinea arion* (NT), all on Annex IV of the EU Habitat Directive so triggering EIB Cr 2.d ; and the Forster's blue, *Polyommatus aserbeidschanus* (NE), triggering EBRD PR6 14.ii.d and EIB ESS4 2.c as it is listed EN in the Armenian Red Book and present in important concentrations in the study area (and is a range-restricted species). The dense population of Lesser Marbled Fritillary (*Brenthis ino*) located close to Shenatagh village should be preserved as well and constitutes a PBF according to EBRD PR6 Cr. 12.iii.

2.3.2.3 Ecosystem services

Ecosystem services (ES) are the benefits that flow from nature to people (MEA, 2005 & Guidance Note PR6, EBRD, 2022), including:

- **provisioning services** (e.g. the supply of food, clean air and water and materials),
- **regulating services** (e.g. hydrologic and local climate regulation, nutrient cycling),
- **cultural and recreation services** (nonmaterial benefits people obtain from ecosystems)
- **supporting services** (natural processes maintaining the other services)

Ecosystem services should be defined in coordination with the social baseline according to 1/Importance to and 2/Dependence on.

As there are no specifications in the EBRD PR6 regarding ES prioritisation, the approach used here follows the GN116, IFC, 2019 which proposes to categorize the ES in 2 types to facilitate the assessment:

- **Type I:** Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and **where impacts on such services may adversely affect communities.**
- **Type II:** Provisioning, regulating, cultural and supporting ecosystem services, over which the client has direct management control or significant influence, and on which the **project directly depends for its operations.**

In the framework of this project, only type I ecosystems are concerned. Livelihoods of the local residents, including use of ecosystem services, and their dependence on these, are discussed in the ESIA Volume 4 for the Project and relied upon in the below assessment.

Table 6. Identification of Ecosystem Services Potentially Impacted by the Project That Could Adversely Affect Local Communities

Ecosystem Services (ES)	Description of adversely effects on communities in case of impact of the project on the ES
Provisioning services	
Groundwater (availability and quality)	Potential spillage of hazardous materials, especially hydrocarbons, if unremedied, may percolate through to the underlying groundwater. More significantly perhaps is possible penetration of the groundwater due to excavations and tunnelling in particular (cf. ESIA Volume 3 for a detailed assessment). There are no bored ground wells, but there are some springs arranged as tabs at the locations close to the existing road and ca. 200-300 m from the proposed road. These are used by the local residents or travellers for occasional collection of water in bottles (the impacts are considered in ESIA Volumes 3 and 4 (for the spring at cultural heritage site 25).
Surface water (quality)	Potential temporary degradation of watercourse of which the local communities depend on for water supply.
Fishing	Several families (5 to 10) in Darbas, Vaghatin and Uyts villages are involved in amateur fishing in the Vorotan and Loradzor rivers. Contamination of water can occur when construction works will be carried out near the water basins of the Vorotan and Loradzor rivers, in particular during the construction of bridge BR005 (over the Vorotan river) as well as road-bed from Darbas to Shenatagh villages.
Agriculture	The residents of all Project affected communities are involved in agricultural activity and crop production to varying extents, and in bee-keeping in Sisian (around 15 000 bee colonies in the community) and Kajaran (1 639 bee colonies). Only few bee-keepers reside in the vicinity of the planned road and specific mitigation measures are proposed to avoid impact on their activities in ESIA Volume 4. Some temporary (during the construction the agricultural land-plots can be contaminated by dust emissions from earthworks and gaseous emissions from construction machinery) and permanent (allocation of land-plots for the Project needs) impacts can occur.
Trees / Forest products	Low as there are not many forested habitats along the road project
Uses of plants properties (medicinal, traditional, and food)	Medicinal plants, <i>Asparagus</i> and <i>rose-hips</i> (notably in Vaghatin, Aghitu, Lernadzor and Gaghi) are used for tea-making by few households that collect them (they drink such tea in winters, to treat colds or when they wish). Herbs and medicinal plants are widespread in the area.
Livestock	The population of all Project affected communities is to various extent engaged in animal husbandry. Some temporary (during the construction the grazing land-plots can be contaminated by air emissions from earthworks and construction machinery as well as access to that lands can be limited) and permanent (access to the grazing lands can be limited due to the Project road alignment) impacts can occur, which will be mitigated via the cattle passages (see Annex 7 of Volume 4 for details).
Hunting	Hunting is regulated in the Zangezour protected area, and the project will probably have mostly a positive impact on hunting species by facilitating access to formerly undisturbed areas (induced impacts through improved access to formerly more remote areas).
Charcoal Production	Land clearance activities will reduce wood availability, but it seems that the local communities do not collecting the wood locally (they buy it from suppliers)
Regulating services	

Ecosystem Services (ES)	Description of adversely effects on communities in case of impact of the project on the ES
Air quality	Dust emissions and pollution from exhaust pipes of the construction machines and excavation/earthworks may result in degraded air quality which can impact populations locally and temporarily.
Climate	Likely contribution to increase of temperature (global warming) through the increase of GHG emissions – for details see Volume 3.
Water control	Change in land uses, possibility of modification of the amplitudes of runoff, floods, recharge of aquifers, water storage potential
Erosion control	Large areas will be cleared during the work, which increases the risk of wind and water erosion
Water quality	The risks of soil degradation and contamination, due to construction work and increased risks of soil erosion and accidental spills are likely to impact the ability of ecosystems and land to filter water and get rid of its contaminants
Disease regulation	Unlikely
Harmful and invasives regulation	/
Pollination	/
Regulation of natural disasters	/
Cultural and recreation services	
Intangible Cultural Heritage: Sacred or spiritual sites	Cross-stones and crosses (in most cases on the top of the hills). Unlikely to be directly impacted. For details refer to Volume 4.
Intangible Cultural Heritage: Areas used for religious purposes	Shrines and cult monuments (should not be directly affected as not under the footprint)
Supporting services	
Soil formation and primary production	The risks of soil degradation and contamination, due to construction work and increased risks of soil erosion, are likely to impact soil formation within the direct area of influence of the project. Moreover, land artificialisation prevent soils producing primary production

2.3.3 Protected Areas and Internationally Recognized Areas of Biodiversity Value

Important Areas for Biodiversity in the vicinity of the Road Project are presented below. A detailed analysis of the impacts of the project on protected areas is given in the Appropriate Assessment (Volume 2, Annex 3).

2.3.3.1 Overview of the protected areas and Internationally Recognized Areas of Biodiversity Value

Protected areas and areas of biodiversity importance in the vicinity of the project area are presented **Table 7**.

Table 7. Protected Areas and Areas of Biodiversity Importance Relative to the Project Area

N°	Name of the Area	IUCN PA Category	Type	Overlap with the project area of influence
1	Arevik	II	National Park	No
2	Shikahogh	Ia	State Reserve	No
3	Zangezur Sanctuary	IV	Sanctuary	Part of the Project Sisian-Kajaran road – namely the tunnel - runs under Zangezur sanctuary through the Bargushat ridge (cf. Figure 25)

N°	Name of the Area	IUCN PA Category	Type	Overlap with the project area of influence
				No outside area overlapped as the project will be underground according to detailed design to date
4	Khustup	-	Sanctuary	No
5	Plane Grove	IV	Sanctuary	No
6	Boghaqar	IV	Sanctuary	No
7	Sev Lich	IV	Sanctuary	No
8	Zangezoor	-	IBA / KBA	Overlap (21.3ha, 0.09% of Zangezur IBA/KBA)
9	Meghri (2002)	-	IBA / KBA	No
10	Meghri (2004)	-	KBA	Overlap (114.3ha, 0.13% of Meghri large KBA)
11	Gorhajk (AM0000013)	-	Emerald Network site ASCI.	No, and about 600m from the road project
12	Zangezur (AM0000015)	-	Emerald Network site ASCI.	Overlap. Part of the Project Sisian –Kajaran road – namely the tunnel - runs under Zangezur ASCI through the Bargushat ridge (cf. Figure 26). No outside area overlapped as the project will be underground according to detailed design to date
13	Tatev (AM0000016)	-	Emerald Network site ASCI.	No, and about 25m from the road project (bridge over the Loradzor river)

2.3.3.2 National sites

The Project region is rich in specially protected areas (SPA, *cf.* figure hereafter) including Arevik National Park; Shikahogh State Reserve; and Zangezur, Khustup, Plane Grove, Boghaqar, and Sev Lich sanctuaries. According to the RA Government decree №1465-N dated 19.12.2013, all these SPAs were merged into the Zangezur Biosphere Complex and managed by the "Zangezur Biosphere Complex" SNCO under the RA Ministry of Environment (MoE) with head office in Kapan. Summary information relating to the SPAs *included in* the Zangezur Biosphere Complex is given in **Table 8**. There is no management plan yet for the Zangezur Biosphere Complex (06/2023).

Table 8. The IUCN Management Categories, Subjects of Protection and Areas of the SPAs Included into the Zangezur Biosphere Complex

No	SPA	IUCN management category	Area, ha	Subject of protection
1	Arevik National Park	II	31,211.2	Conservation of broad-leaved forests and open woodlands of juniper of the Meghri and Zangezur Mountain Ranges. More than 1,500 species of high plants grow in the park, which is also the habitat for more than 245 species of vertebrate animals. The Park area is one of the main habitats of the Caucasian Leopard in Armenia, and a place where representatives of many endemic species of flora and fauna and those recorded in the Red Data Book of Armenia live. Conservation of habitats for Armenian Mouflon.
2	Shikahogh State Reserve	Ia	12,137.1	Protection of oak, hornbeam and oak-hornbeam forests, oriental beech, yew, oriental plane and animals.
3	Zangezur Sanctuary	IV	25,711.6	Protection of the alpine, subalpine and alpine-steppe ecosystems of the area. Conservation of habitats of the species of Armenian Mouflon.

No	SPA	IUCN management category	Area, ha	Subject of protection
4	Khustup Sanctuary		6,946.74	Protection of natural development of ecosystems in the upper part of the Khustup forest zone, meadow-and-steppe and meadow ecosystems. Preservation of landscape and biodiversity, protection of nature monuments, conservation, restoration and reproduction of the natural heritage, as well as sustainable use of the natural resources.
5	Plane Grove Sanctuary	IV	64.2	Protection and preservation of the only Eastern plane grove in the Caucasus.
6	Boghaqar Sanctuary	IV	2,728.0	Protection of the flora and fauna endemic (<i>Sosnovsky rosacea</i> , Takhtajyan ryegrass, etc.) and rare (orchids, Araks oak, saga) species.
7	Sev Lich Sanctuary	IV	240.0	Protection of the natural ecosystem of Sev Lake. The sanctuary is situated on the eastern slope of Mount Ishkhanasar.
Total (Zangezur Biosphere Complex)			79,038.87	

Sources: https://www.wwf.am/en/our_work/wildlife/development_of_the_protected_area_system/ and <http://mnp.am/shriaka-mijavayr/lyndhanur-teghekutyuner>

The tunnel through the Bargushat ridge, runs underneath the Zangezur Sanctuary, with the tunnel’s entry and exit portals being located outside the Sanctuary (Figure 25).

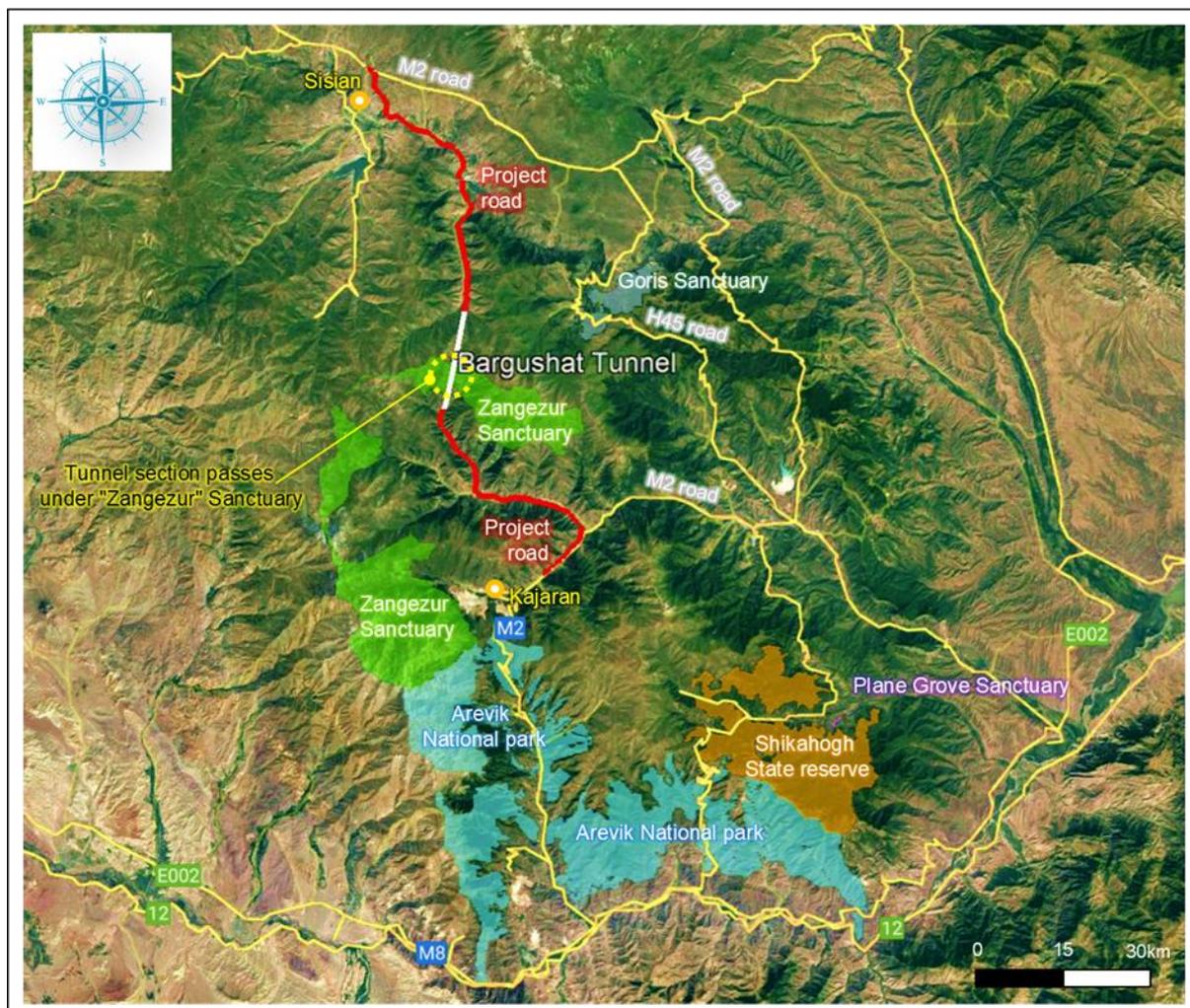


Figure 25. Location of the SPAs in the Vicinity of the Project Footprint

2.3.3.3 Emerald Network Sites (ASCI)⁹

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). Some of the most emblematic species include Persian leopard, *Panthera pardus*, the greater horseshoe bat, *Rhinolophus ferrumequinum*, and the fern leaf peony, *Paeonia tenuifolia*. Four different habitats of European importance, such as the Continental glasswort swards, are present in Armenia.

By June 2023, Armenia had not officially adopted Emerald Network sites. However, 23 sites situated in the RA territory have been officially nominated as *candidate* Emerald Sites. Of these, six are located in Syunik Province:

- "Impassable brushwood" area (Site Code AM0000008) - 274.4 ha (about 30 km away from the project area),
- **"Gorhajk" area (Site Code AM0000013) – 4056,7 ha (about 0.6 km away),**
- "Arevik" National Park (Site Code AM0000014) – 60,804.7 ha (about 6,5 km away),
- **"Zangezur" area (Site Code AM0000015) – 49,066.6 ha (overlapping underground),**
- **"Tatev" area (Site Code AM0000016) – 14,873.1 ha (about 0.025 km away),**
- "Khndzoresk" area (Site Code AM0000018) – 3,425.7 ha (about 22 km away).

The three sites in bold are in the vicinity (less than 5 km) of the proposed project (Figure 26).

The proposed road runs along the Gorhajk Area between the KM 3+000 and KM 5+000 but is no closer than 600m, and the Bargushat tunnel (length of 8,640m, between KM 27+130 and KM 35+770) passes under the Zangezur candidate Emerald Site. Finally, the Sisian-Shenatagh road section near Darpas settlement is adjacent to the candidate Tatev Emerald Site (about 25m away, *cf.* map below).

⁹ Source: <https://www.coe.int/en/web/bern-convention/emerald-network>.

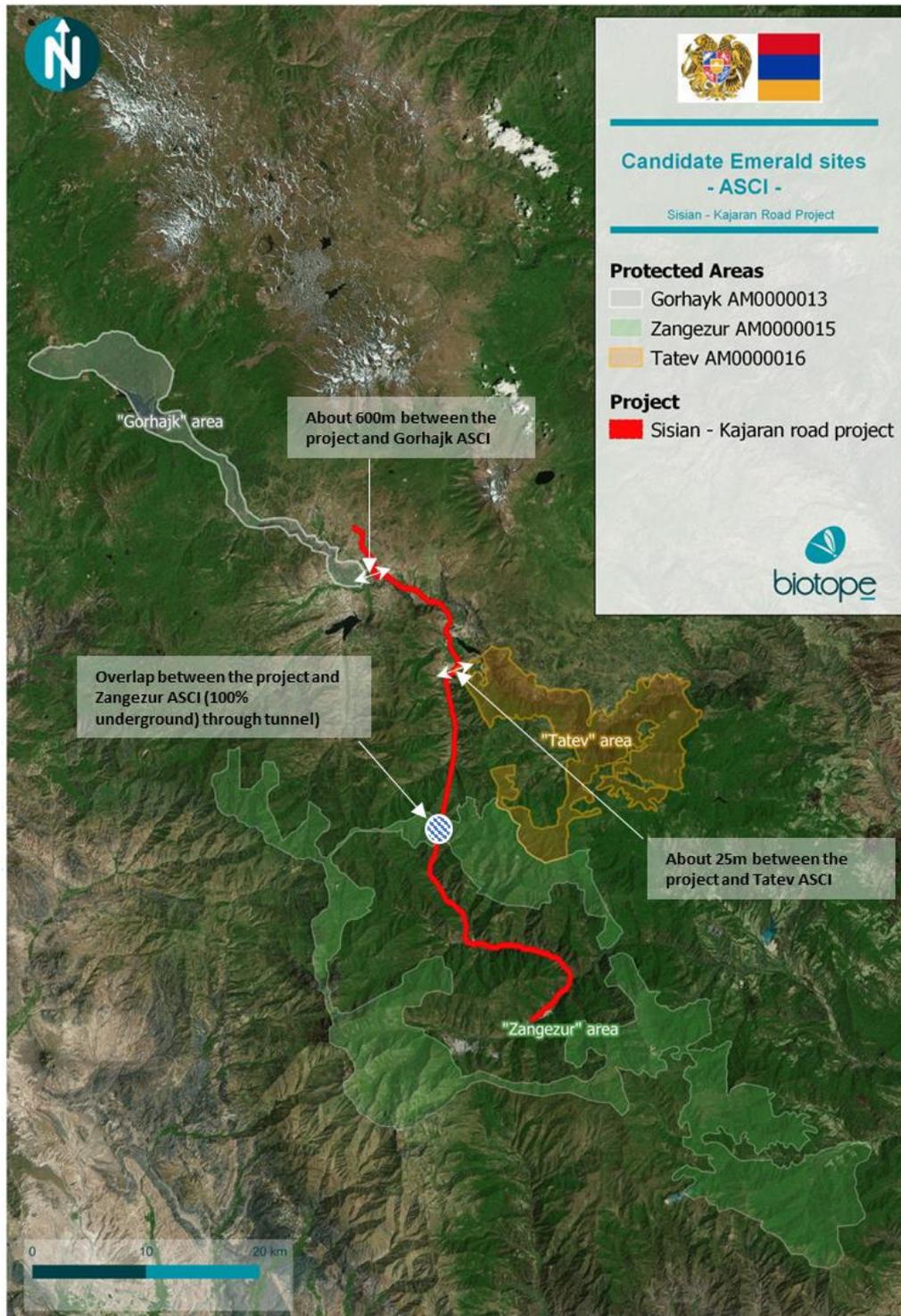


Figure 26. Candidate Emerald Network Sites in the Vicinity of the Sisian – Kajaran Road Project (less than 5km away from the Road Alignment)

The project and associated infrastructure do not overlap **the tentative Gorhajak Emerald network site** (it is 600 m away, **Figure 26**), so it is not presented here.

The tentative Zangezur Emerald Network site occupies 49,066.6 ha and consists of Plane Grove, Shikahogh and Khustup as well as Zangezur Sanctuaries. The site is in an Alpine geographical region. The area contributes substantially to the survival of more than 150 threatened species included in the Armenian Red Book and 50 endemic species. It also supports more than 1,200 plant species and contains important representatives of some locally endangered habitats. The site is important for the protection of rare habitats

and endangered plant and animal species. There are 52 species from Resolution No.6 of the Convention¹⁰ that require specific habitat conservation measures (**Table 9**).

Table 9. Species from Resolution no 6 - Convention on the Conservation of European Wildlife and Natural Habitats, Bern, Contained in the Nominated Zangezur Emerald Network Site

Plants:	<i>Echium russicum, Steveniella satyrioides</i>
Invertebrates:	<i>Callimorpha (Euplagia) quadripunctaria, Cerambyx cerdo</i>
Reptiles:	<i>Mauremys caspica</i>
Birds:	<i>Accipiter brevipes, Aegypius monachus, Alcedo atthis, Anthus campestris, Aquila chrysaetos, Aquila pomarina, Bubo bubo, Buteo rufinus, Caprimulgus europaeus, Ciconia nigra, Circaetus gallicus, Coracias garrulus, Dendrocopos medius, Dendrocopos syriacus, Dryocopus martius, Emberiza hortulana, Falco naumanni, Falco peregrinus, Ficedula parva, Ficedula semitorquata, Gypaetus barbatus, Gyps fulvus, Hieraaetus pennatus, Lanius collurio, Lanius minor, Lullula arborea, Luscinia svesica, Milvus migrans, Neophron percnopterus, Pernis apivorus, Pyrrhocorax pyrrhocorax, Sylvia nisoria</i>
Mammals:	<i>Canis lupus, Capra aegagrus, Lutra lutra, Lynx lynx, Miniopterus schreibersii, Myotis blythii, Myotis emarginatus, Panthera pardus, Rhinolophus euryale, Rhinolophus ferrumequinum, Rhinolophus hipposideros, Ursus arctos</i>

The area of **the nominated Tatev Emerald Network Site** is 14,873.1 ha is mostly situated in an Alpine geographical region with mainly forest habitat. The site is important for conservation of some bird species and habitats. There are 52 species from Resolution No.6 of the Convention that require specific habitat conservation measures (**Table 10**).

Table 10. Species from Resolution no 6 - Convention on the Conservation of European Wildlife and Natural Habitats, Bern, Contained in the Nominated Tatev Emerald Network Site

Plants:	<i>Dactylorhiza chuhensis, Echium russicum, Steveniella satyrioides</i>
Invertebrates:	<i>Callimorpha (Euplagia) quadripunctaria, Cerambyx cerdo, Rosalia alpina</i>
Reptiles:	<i>Emys orbicularis, Mauremys caspica</i>
Birds:	<i>Accipiter brevipes, Aegypius monachus, Alcedo atthis, Anthus campestris, Aquila chrysaetos, Aquila pomarina, Bubo bubo, Buteo rufinus, Calandrella brachydactyla, Caprimulgus europaeus, Circaetus gallicus, Circus cyaneus, Coracias garrulus, Dendrocopos medius, Dendrocopos syriacus, Dryocopus martius, Emberiza hortulana, Falco peregrinus, Ficedula parva, Ficedula semitorquata, Gypaetus barbatus, Gyps fulvus, Hieraaetus pennatus, Lanius collurio, Lanius minor, Lullula arborea, Luscinia svesica, Melonocorypha calandra, Milvus migrans, Neophron percnopterus, Pernis apivorus, Pyrrhocorax pyrrhocorax, Sylvia nisori</i>
Mammals:	<i>Canis lupus, Capra aegagrus, Lynx lynx, Miniopterus schreibersii, Myotis blythii, Myotis emarginatus, Panthera pardus, Rhinolophus blasii, Rhinolophus euryale, Rhinolophus ferrumequinum, Rhinolophus hipposideros, Ursus arctos</i>

It should be noted that the consultation held with the RA Ministry of Environment (MoE) in May 2023 revealed the MoE did not identify any overlaps between the Project and the candidate Emerald sites (see the AA in Annex 3). Thus, no AA is expected by the MoE to be conducted in relation to the proposed Project.

¹⁰Convention on the Conservation of European Wildlife and Natural Habitats, Bern (1979).

2.3.3.4 Important Bird Areas (IBAs)¹¹

There are also 18 Important Bird Areas (IBAs) designated in Armenia and occupying 415,132ha (**Table 11**) with key features of the IBAs listed in **Table 12**. Names, Locations and IBA Criteria of IBAs in Armenia (source: [Aghababayan et al, 2022](#)¹²).

Table 11. Listing of IBAs for Armenia

Region	IBA Site name (alphabetical order)	Area (ha)	Code
Shirak	1. Amasia	7,802	AM006
Ararat	2. Armash fish-farm	4,639	AM004
Lori	3. Dsegh	18,508	AM008
Armenia	4. Gndasar	2,345	AM013
Syunik	5. Gorayk	5,923	AM016
Tavush	6. Haghartsin	6,137	AM009
Vayots Dzor	7. Jermook	9,467	AM015
Ararat	8. Khosrov Reserve	113,100	AM003
Shirak	9. Lake Arpi	3,871	AM001
Gegharkunik	10. Lake Sevan	154,627	AM005
Syunik	11. Meghri	33,331	AM018
Armavir	12. Metsamor	10,296	AM012
Aragatsotn	13. Mount Ara	2,540	AM010
Vayots Dzor	14. Noravank	14,002	AM014
Kotayk-Lori	15. Pombak mountains	56,675	AM002
Armavir	16. Sardarapat	19,363	AM011
Lori	17. Tashir	17,948	AM007
Syunik	18. Zangezoor	23,236	AM017

The Qirs-Geghi section of the proposed road runs through **Zangezoor IBA** (an overlap with the project footprint of 21.3ha). Zangezoor IBA (proclaimed in 2002) occupies 23,236 ha and is characterized by artificial/terrestrial, forest, grassland and rocky (e.g., inland cliffs, mountain peaks) habitats. The Zangezoor IBA trigger species are given in **Table 12**.

Table 12. Populations of IBA Trigger Species

Species	Current IUCN Red List Category	Season	Population estimate	IBA Criteria Triggered
Caspian Snowcock <i>Tetraogallus caspius</i>	LC	breeding	200-300 individuals	A3, B2
Caucasian Grouse <i>Lyrurus mlkosiewiczi</i>	NT	breeding	20-40 individuals	A2, A3, B2
Bearded Vulture <i>Gypaetus barbatus</i>	NT	breeding	1-2 breeding pairs	B2
Egyptian Vulture <i>Neophron percnopterus</i>	EN	breeding	3-5 breeding pairs	A1, B2
Golden Eagle <i>Aquila chrysaetos</i>	LC	breeding	2-4 breeding pairs	B2

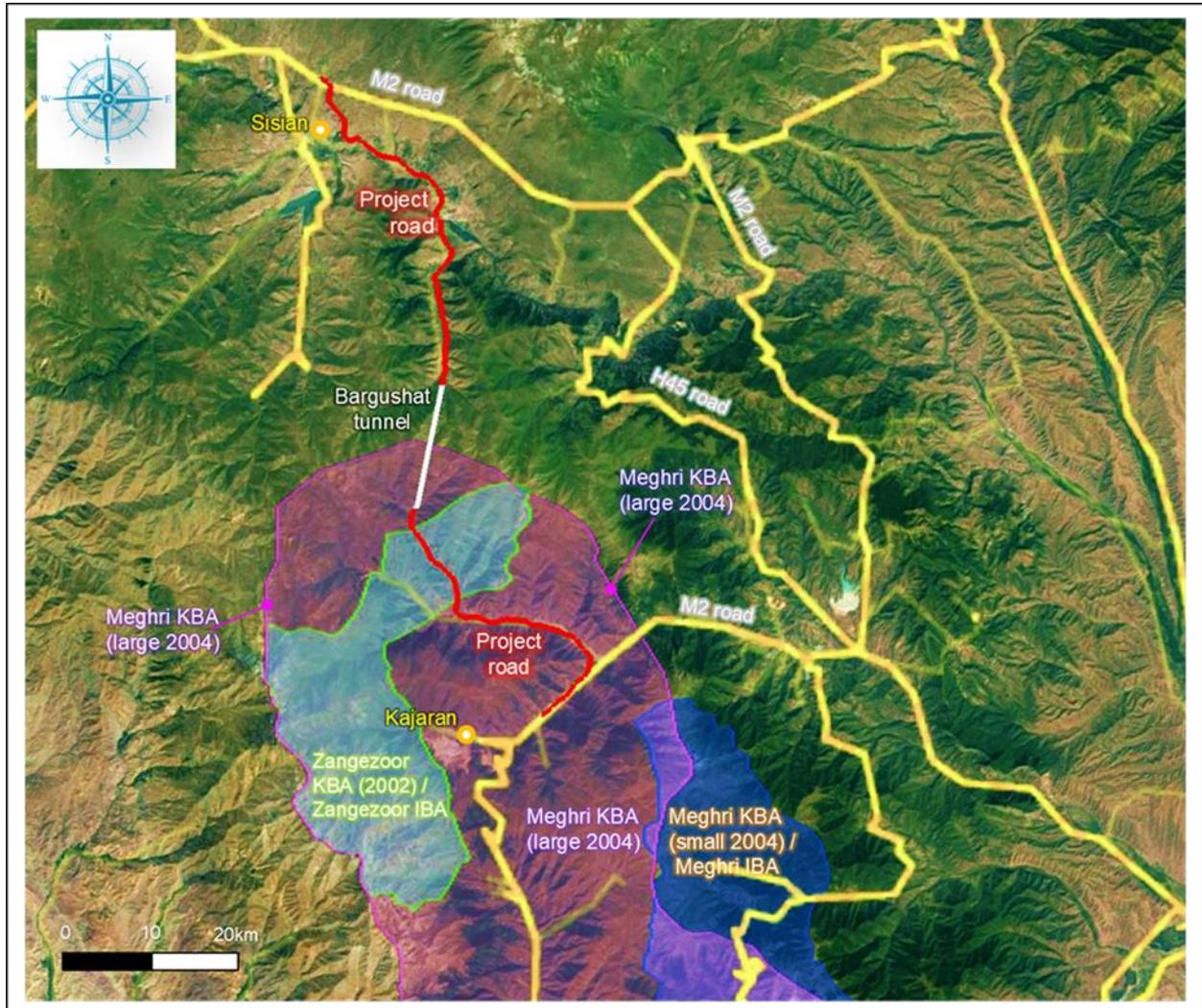
¹¹<http://www.birdlife.org/>

¹² Aghababayan K, Khanamirian G, Khachatryan A, Grigoryan V, Tamazyan T, Baloyan S (2022) Revision of Important Bird and Biodiversity Areas of Armenia. International Journal of Zoology and Animal Biology, Vol 5. Issue 1

* Global IBA criteria:

- A1: Globally threatened species
- A2: Restricted-range species (global range size <50,000 km²)
- A3: Bioregion-restricted assemblage (at least 95% of the global population should be confined to a single bioregion, according to the WWF biome-realm classification)

Regional IBA criteria: Species with most of their range restricted to a region.



Source: prepared by the Consultant.

Figure 27. Important Areas for Biodiversity in the Vicinity of the Road Project (KBAs/IBAs)

2.3.3.5 Key Biodiversity Area (KBA)

Zangezoor KBA¹³ (proclaimed in 2002) exactly matches the Zangezoor IBA (having the same area of 23,268 ha. The biodiversity elements triggering KBA criteria for Zangezoor KBA are the same five bird species listed in [Table 12](#).

The proposed Project is about 4.5 km north-west of **Meghri IBA** (proclaimed in 2002) also identified as **Meghri Key Biodiversity Area (KBA)**¹⁴. The area of this KBA is 33,378 ha

¹³ <http://www.keybiodiversityareas.org/site/factsheet/19768>. Year of assessment 2002.

¹⁴ <http://www.keybiodiversityareas.org/site/factsheet/19761>. Year of assessment 2002.

and 17 bird species trigger IBA and KBA criteria. A larger **Meghri KBA**¹⁵ (123,647 ha) encompasses Zangezoor IBA/KBA almost fully, approximately half of **Meghri IBA**'s area, and a large part of Syunik Region, including the Project area. The species triggering the larger Meghri KBA criteria are *Capra aegagrus*, *Lutra lutra*, *Ovis orientalis*, *Testudo graeca* and *Lyrurus mlokosiewiczzi*. The larger Meghri KBA is described in the CEPF Ecosystem Profile of the Caucasus Biodiversity Hotspot (East lesser Caucasus Hotspot)¹⁶. Both Meghri KBAs as well as Zangezoor KBA need to be reassessed against the global KBA Standard.

2.3.3.6 Other Identified Areas of Biodiversity Conservation Interest

The proposed Project is as well included in the transboundary Eastern Lesser Caucasus Conservation Landscape between Armenia and Azerbaijan, identified in the Ecoregional Conservation Plan for the Caucasus¹⁷.

2.3.3.7 Alliance for Zero Extinction Sites

Only one 'Alliance for Zero Extinction Site' is demarcated in Armenia; i.e., Sevan Lake, which is due east of Yerevan, close to the Azerbaijan border, far away from the Project area.

2.3.4 Critical Habitat Assessment Findings

Among the 11 habitats, 382 flora species, and 146 fauna species identified during biodiversity surveys (cf. **Section 2.3.2**), the following features have been assessed as triggering Priority Biodiversity Feature (PBF) or Critical Habitat (CH) according to the EBRD PR6 & EIB ESS4 (cf. details in the CHA, Annex 2)

Table 13. Summary Table of Priority Biodiversity Features and Critical Habitats Identified in the Study Area as per EBRD PR6¹⁸

N°	Criterion	Features (Habitats/ecosystems/species)
Priority Biodiversity Features as per EBRD PR6 (§12)		
i	12.i.a EAAA is habitat type listed in Resolution 4 of the Bern Convention	<p><u>Habitats (x7)</u></p> <p>3240. Alpine rivers and their ligneous vegetation with <i>Salix elaeagnos</i></p> <p>6190. Rupicolous pannonic grasslands (<i>Stipo-Festucetalia pallentis</i>)</p> <p>62A0. Eastern sub-mediterranean dry grasslands (<i>Scorzoneratalia villosae</i>)</p> <p>9160. Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli</p> <p>9170. Galio-Carpinetum oak-hornbeam forests</p> <p>92A0. <i>Salix alba</i> and <i>Populus alba</i> galleries</p> <p>5210. Arborescent matorral with <i>Juniperus spp.</i></p>

¹⁵ <http://www.keybiodiversityareas.org/site/factsheet/46744>. Year of assessment 2004.

¹⁶ https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEWjgktCwkL_wAhWSmRQKHTCYBpwQFjABeg_QIBBAD&url=https%3A%2F%2Fwww.cepf.net%2Fsites%2Fdefault%2Ffiles%2Ffinal.caucasus.ep_.pdf&usq=AOvVaw3RxW3qMFqt_siqpWnX-VHJa

¹⁷ WWF Caucasus. [https://drive.google.com/file/d/1Jazc5DKPYTj5hbdJkfqGQ0iKZFMHC32p/view.._Zazanashvili,_N.,_Sanadiradze,_G.,_Garforth,_M.,_Bitsadze,_M.,_Manvelyan,_K.,_Askerov,_E.,_Mousavi,_M.,_Krever,_V.,_Shmunk,_V.,_Kalem,_S._and_Devranoğlu_Tavsel,_S.,_eds._\(2020\)._Ecoregional_Conservation_Plan_for_the_Caucasus:_2020_Edition._WWF,_KfW,_Tbilisi](https://drive.google.com/file/d/1Jazc5DKPYTj5hbdJkfqGQ0iKZFMHC32p/view.._Zazanashvili,_N.,_Sanadiradze,_G.,_Garforth,_M.,_Bitsadze,_M.,_Manvelyan,_K.,_Askerov,_E.,_Mousavi,_M.,_Krever,_V.,_Shmunk,_V.,_Kalem,_S._and_Devranoğlu_Tavsel,_S.,_eds._(2020)._Ecoregional_Conservation_Plan_for_the_Caucasus:_2020_Edition._WWF,_KfW,_Tbilisi)

¹⁸ In case a species would trigger several criteria in the PBF and CH, the species is listed in this table only as the highest conservation concern, which is CH. If the species triggers different criteria inside the same category (PBF or CH), the criteria that is the most discriminant is presented (e.g. population proportions, reproductive units). For a full description of the different criteria triggers by a certain species, please refer to the table source file.

N°	Criterion	Features (Habitats/ecosystems/species)
ii	12.ii.a EAAA for species and their habitats listed in the Resolution 6 of the Bern Convention ¹⁹	<p><u>Terrestrial mammal</u> (*6)</p> <p><i>Capra aegagrus</i> (VU) <i>Ursus arctos</i> (LC) <i>Canis lupus</i> (LC) <i>Vormela peregusna</i> (VU) <i>Lutra lutra</i> (NT) <i>Lynx lynx</i> (LC)</p> <p><u>Birds</u> (x23)</p> <p><i>Gypaetus barbatus</i> (NT) <i>Neophron percnopterus</i> (EN) <i>Aegypius monachus</i> (NT) <i>Accipiter brevipes</i> (LC) <i>Aquila chrysaetos</i> (LC) <i>Clanga pomarina</i> (LC) <i>Gyps fulvus</i> (LC) <i>Circaetus gallicus</i> (LC) <i>Circus cyaneus</i> (LC) <i>Caprimulgus europaeus</i> (LC) <i>Coracias garrulus</i> (LC) <i>Alcedo atthis</i> (LC) <i>Anthus campestris</i> (LC) <i>Dendrocopos syriacus</i> (LC) <i>Leiopicus medius</i> (LC) <i>Emberiza hortulana</i> (LC) <i>Ficedula parva</i> (LC) <i>Ficedula semitorquata</i> (LC) <i>Lanius collurio</i> (LC) <i>Lanius minor</i> (LC) <i>Melanocorypha calandra</i> (LC) <i>Pyrrhocorax pyrrhocorax</i> (LC) <i>Sylvia nisoria</i> (LC)</p> <p><u>Bats</u> (x8)</p> <p><i>Rhinolophus mehelyi</i> (VU) <i>Rhinolophus euryale</i> (NT) <i>Rhinolophus ferrumequinum</i> (NT) <i>Rhinolophus hipposideros</i> (NT) <i>Rhinolophus blasii</i> (LC) <i>Miniopterus schreibersii</i> (VU) <i>Myotis blythii</i> (LC) <i>Myotis emarginatus</i> (LC)</p> <p><u>Reptiles</u> (x2)</p> <p><i>Testudo graeca</i> (VU) <i>Emys orbicularis</i> (NT)</p>
ii	12.ii.b EAAA supports < 0.5% of global population OR < 5 reproductive units of a CR or EN species ²⁰	<p><u>Birds</u> (x1, already triggering ii.a and ii.d)</p> <p><i>Neophron percnopterus</i> (EN)</p>
	12.ii.c EAAA supports VU species	<p>2 Species of bats and 1 species of terrestrial mammals already triggering criteria 12.ii.a</p> <p><u>Insects</u> (*1)</p> <p><i>Parnassius apollo</i> (VU)</p> <p><u>Reptiles</u> (*1)</p> <p><i>Vipera erivanensis</i> (VU)</p>
	12.ii.d EAAA for regularly occurring nationally or regionally listed EN or CR species	<p><u>Bats</u> (*1, already triggering cr.12 ii.a)</p> <p><i>Rhinolophus blasii</i> (EN on the Armenian Red book)</p>

¹⁹ Considering that Armenian MoE is still working on the transposition of the EU Habitat and Bird Directives in the Armenian Laws and by-laws in the framework of the Comprehensive and Enhanced Partnership Agreement (CEPA) with EU, the habitats and species were not assessed against the Annex I of the EU Bird Directive and Annex I, II and IV of the Habitat Directive regarding the EBRD PR6.

²⁰ On the global IUCN Redlist

N°	Criterion	Features (Habitats/ecosystems/species)
		<u>Birds</u> (*2) <i>Neophron percnopterus</i> (EN) already triggering cr.12 ii.a and ii.b <i>Aegypius monachus</i> (EN) already triggering cr.12 ii.a <u>Insects</u> (*1) <i>Polyommatus (Agrodiaetus) huberti</i> (EN on the Armenian Red book)
	12.ii.e EAAA for regularly occurring range-restricted species	<u>Reptiles</u> (*2) <i>Vipera erivanensis</i> (VU) already qualifying as 12.ii.d <i>Montivipera raddei</i> (NT) <u>Insects</u> (*1) <i>Polyommatus aserbeidschanus</i> (NE) already qualifying for Cr 14 ii.d
	12.iii Significant biodiversity features identified by a broad set of stakeholders or governments	<u>Insects</u> (*1) <i>Brenthis ino</i> (LC) <u>Birds</u> (*3) <i>Tetrao mlokosiewiczi</i> (NT) <i>Tetraogallus caspius</i> (LC) <i>Accipiter gentilis</i> (LC)
Critical Habitats as per EBRD PR6 (§14)		
	14.ii.d EAAA for important concentrations of a nationally or regionally listed EN or CR species	<u>Terrestrial mammals</u> (*2) <i>Ovis gmelinii gmelinii</i> (NT) <i>Panthera pardus saxicolor</i> (CR on the Armenian Red book) <u>Insect</u> (*1) <i>Polyommatus (Agrodiaetus) aserbeidschanus</i> (EN on the Armenian Redbook) <u>Flora</u> (*5) <i>Hypericum armenum</i> (CR on the Armenian Redbook) <i>Astragalus xiphidium</i> (EN on the Armenian Redbook) <i>Iris lineolata</i> (EN on the Armenian Redbook) <i>Tulipa sosnowskyi</i> (EN on the Armenian Redbook) <i>Tulipa florenskyi</i> (EN on the Armenian Redbook)
iii	14.iii.a EAAA regularly holds $\geq 10\%$ of global population AND ≥ 10 reproductive units of the species***	<u>Flora</u> (*1) <i>Hypericum armenum</i> (CR on the Armenian Redbook) already triggering 14 ii.d

Table 14. Summary Table of Critical Habitats Identified in the Study Area as per EIB ESS4

N°	Criterion	Features (Habitats/ecosystems/species)
Critical Habitats as per EIB ESS4		
1	1.a Priority Habitats listed in Annex I of the Habitats Directive and habitats considered to be their equivalent in countries outside the EU	<u>Habitats</u> (x2) 6240*: Sub-Pannonic steppic grasslands 40A0*: Subcontinental peri-Pannonic scrub
	2.c Nationally or regionally-important concentration of a species listed as endangered or critically endangered on a regional/national IUCN Red List, or equivalent on national/regional listing.	<u>Terrestrial mammals</u> (*2) <i>Ovis gmelinii gmelinii</i> EN on the Armenian redbook also triggering 2.d <i>Panthera pardus saxicolor</i> (VU) <u>Insect</u> (*1) <i>Polyommatus (Agrodiaetus) aserbeidschanus</i> (EN on the Armenian Redbook) <u>Flora</u> (*5) <i>Hypericum armenum</i> (CR on the Armenian Redbook) <i>Astragalus xiphidium</i> (EN on the Armenian Redbook) <i>Iris lineolata</i> (EN on the Armenian Redbook) <i>Tulipa sosnowskyi</i> (EN on the Armenian Redbook) <i>Tulipa florenskyi</i> (EN on the Armenian Redbook)
2	2.d A population of species listed in Annex II and IV of the Habitats Directive	<u>Terrestrial mammals</u> (x8) <i>Ovis gmelinii gmelinii</i> (NT)

N°	Criterion	Features (Habitats/ecosystems/species)
		<i>Capra aegagrus</i> (VU) <i>Ursus arctos</i> (LC) <i>Canis lupus</i> (LC) <i>Vormela peregusna</i> (VU) <i>Lutra lutra</i> (NT) <i>Felis silvestris</i> (LC) <i>Lynx lynx</i> (LC) <u>Bats</u> (x8) <i>Rhinolophus mehelyi</i> (VU) <i>Rhinolophus euryale</i> (NT) <i>Rhinolophus ferrumequinum</i> (NT) <i>Rhinolophus hipposideros</i> (NT) <i>Rhinolophus blasii</i> (LC) <i>Miniopterus schreibersii</i> (VU) <i>Myotis blythii</i> (LC) <i>Myotis emarginatus</i> (LC) <u>Reptiles</u> (*2) <i>Testudo graeca</i> (VU) <i>Emys orbicularis</i> (NT) <u>Insects</u> (*2) <i>Parnassius apollo</i> (NT) <i>Maculinea arion</i> (NT)
3	3.a EAAA regularly holds $\geq 10\%$ of global population AND ≥ 10 reproductive units of the species***	<u>Flora</u> (*1) <i>Hypericum armenum</i> (CR on the Armenian Redbook) already triggering 14 ii.d

Table 15. Synthesis of the Numbers of PBF and CH identified in the EAAA by Groups

Group	EBRD PR6		EIB ESS4
	Biodiversity Priority Features	Critical Habitat	Critical Habitat
Habitats	7 habitats	/	2 habitats
Plants	/	5 species	5 species
Terrestrial Mammals	6 species	2 species	9 species
Bats	8 species	/	8 species
Birds	26 species	/	/
Reptiles	4 species	2 species	2 species
Amphibians	/	/	/
Insects	3 species	1 species	3 species

Table 16. Conclusion Table of Habitats and Species Triggering CH Taking into Account the More Stringent of the Three Lenders Standards (EBRD/EIB/ADB)

N°	Groups	Critical Habitats triggers
1	Habitats (*2)	6240*: Sub-Pannonic steppic grasslands 40A0*: Subcontinental peri-Pannonic scrub
2	Plants (*5)	<i>Hypericum armenum</i> (CR on the Armenian Redbook) <i>Astragalus xiphidium</i> (EN on the Armenian Redbook) <i>Iris lineolata</i> (EN on the Armenian Redbook) <i>Tulipa sosnowskyi</i> (EN on the Armenian Redbook) <i>Tulipa florenskyi</i> (EN on the Armenian Redbook)
3	Terrestrial Mammals (*9)	<i>Ovis gmelinii gmelinii</i> (NT) <i>Capra aegagrus</i> (VU)

N°	Groups	Critical Habitats triggers
		<i>Ursus arctos</i> (LC) <i>Canis lupus</i> (LC) <i>Vormela peregusna</i> (VU) <i>Lutra lutra</i> (NT) <i>Felis silvestris</i> (LC) <i>Lynx lynx</i> (LC) <i>Panthera pardus saxicolor</i> (VU)
4	Bats (*8)	<i>Rhinolophus mehelyi</i> (VU) <i>Rhinolophus euryale</i> (NT) <i>Rhinolophus ferrumequinum</i> (NT) <i>Rhinolophus hipposideros</i> (NT) <i>Rhinolophus blasii</i> (LC) <i>Miniopterus schreibersii</i> (VU) <i>Myotis blythii</i> (LC) <i>Myotis emarginatus</i> (LC)
5	Reptiles (*2)	<i>Testudo graeca</i> (VU) <i>Emys orbicularis</i> (NT)
6	Insects (*3)	<i>Polyommatus (Agrodiaetus) aserbeidschanus</i> (EN on the Armenian Redbook) <i>Parnassius apollo</i> (NT) <i>Maculinea arion</i> (NT)

2.3.5 The Identified No-go Areas

Based on the completed biodiversity baseline surveys and analysis, several no-go areas have been preliminarily identified (Figure 28).



Figure 28. No-go Biodiversity Areas Identified

While these areas are generally important for biodiversity in the area, they have been nominated as no-go areas due to the following reasons:

- Red-lined area near Shenatagh, east of the Bargushat tunnel's northern portal is nominated as a no-go area it is a breeding habitat for the Lesser Marbled Fritillary (*Brenthis ino*), butterfly species qualifying as a priority biodiversity feature according to EBRD PR6. This is the southernmost population of the species in Armenia, with unusually high density.
- White-lined areas at Kitsk and around Karut to Geghi are nominated as no-go areas since they are important breeding and migration habitats for a number of mammals, including threatened species on the Armenian Red book and species listed in the Annex II and/or IV of the EU Habitat Directive and Resolution 6 of the Bern convention, such as bezoar goat, brown bear, grey wolf, and lynx.
- Red-lined area in the Kitsk valley, east of the Bargushat tunnel's southern portal, is nominated as a no-go area as it is an important habitat for the Armenian steppe viper (*Vipera eriwanensis*), reptile species qualifying as PBF according to EBRD PR6 and a breeding habitat for the Forster's Blue (*Polyommatus aserbeidschanus*), triggering CH. For the butterfly, it is a second known spot of its distribution in Armenia.

The no-go areas do not overlap with the proposed road footprint.

3 ASSESSMENT OF POTENTIAL BIODIVERSITY IMPACTS AND RISKS AND MITIGATION MEASURES

3.1 Introduction and AoI

This section contains an assessment of the potential impacts on biodiversity due to the Project-related construction and operations activities. These impacts will occur in the **ecological AoI** (see the figure below) comprising a buffer of 250 m on each side of the road, and the Spoil disposal areas (SDA).

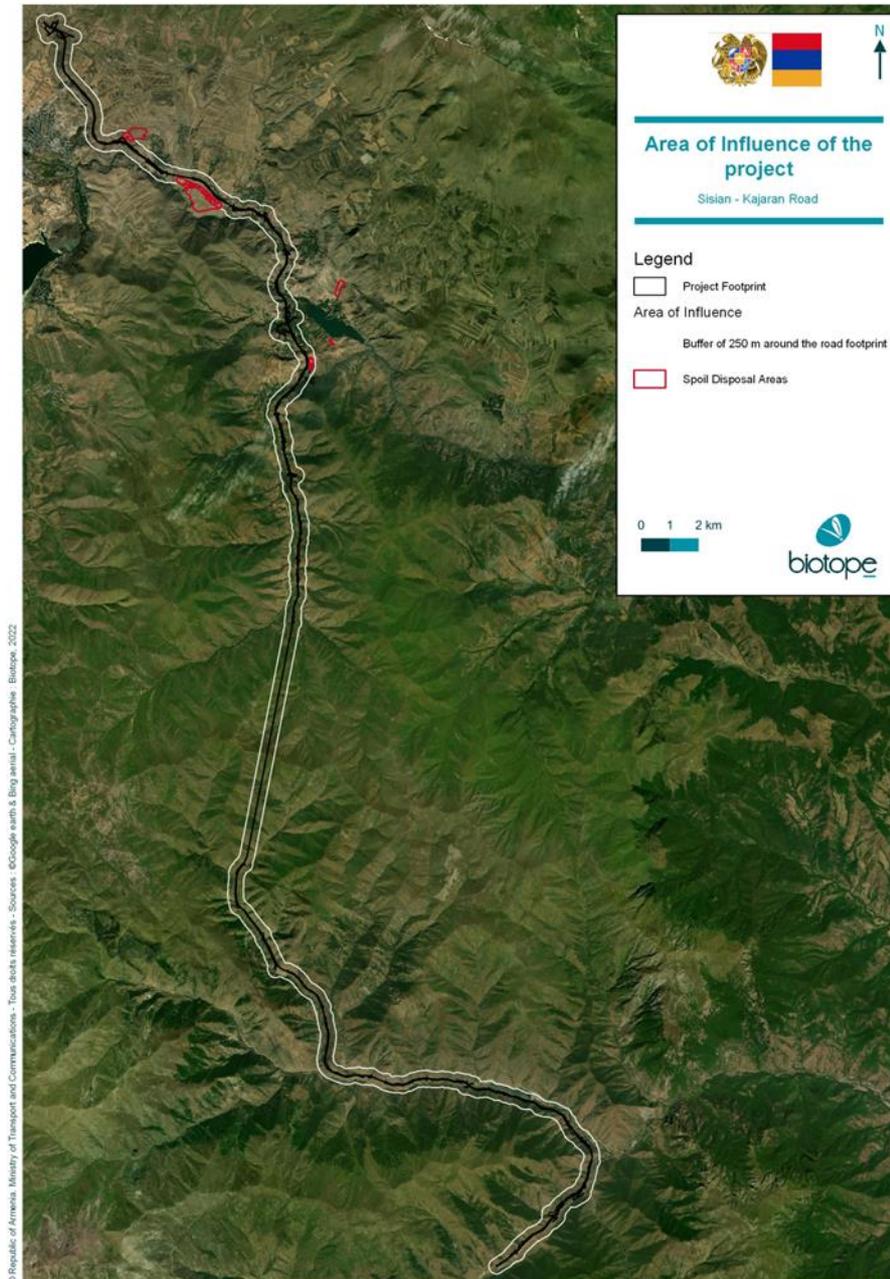


Figure 29. Ecological Area of Influence (AoI) of the Sisian – Kajaran Road Project

3.2 Reference Criteria

For the impact assessment, the baseline conditions are described in Section 2. The impacts are considered in relation to the EBRD PR 6: Biodiversity Conservation and

Sustainable Management of Living Natural Resources (2019); ADB Safeguard Requirements 1: Environment (2009), EIB ESS 4: Biodiversity and Ecosystems (2022), and the applicable national legislation of Armenia ((for details on the requirements see **Section 4 of ESIA Volume 1**).

3.3 Assumptions and Limitations

As noted in the Project Description (**ESIA Volume 1, Section 2**), the Construction Contractor will be responsible for siting some Project components such as laydown areas, construction camps, access roads and other spoil disposal areas. Thus, only impacts linked to the actual project footprint and validated SDA are assessed. Due to uncertainties related to the siting of the SDA, specific recommendations about the no-go areas and additional biodiversity study/assessment for the SDAs are included in the ESMP and ESAP.

3.4 Impacts of the Project

As presented in the sections above, the project will be implemented in an area of fragile ecosystems and associated fauna and flora species, of which many are endemic and/or threatened on the IUCN redlist and/or the Armenian Redbook.

The impacts of the Project on biodiversity will occur during:

- Construction phase, and
- Operation and maintenance phase.

The methodology of impact assessment, including identification of impact magnitude, proposed descriptors and criteria for the sensitivity of receptors, and definition of impact significance are detailed in **Section 5 of ESIA Volume 1**. *Impact significance* is determined as a function of a receptor's *sensitivity* to the Project's pressure and the *impact magnitude* (extent of change to the natural or social environment), which is determined by its spatial extent, duration, potential to occur, and reversibility of expected changes. Receptor sensitivity ranges on a four-level scale from high, medium, low to very low; impact magnitude ranges on a four-level scale from high, medium, low and negligible and additionally can be of 'no-change'. The key significance categories used within the ESIA are major, moderate, minor, and negligible; significance grades were determined for both positive impacts and negative impacts. Potential impacts on biodiversity and ecosystem services (including PBF and CH triggers) derive from:

- Construction phase:
 - Degradation, fragmentation, and destruction (loss) of habitats (vegetation clearance, excavation, risk of soil and/or watercourse pollution, risk of acid rock drainage, etc.)
 - Flora species loss (vegetation clearance and excavation)
 - Disturbance of fauna species by dust, noise, vibration, blasting and light pollution (construction machinery, base camps, traffic, lighting of the infrastructure)
 - Introduction and proliferation of invasive alien species,
 - Disturbance and damage of aquatic fauna species from water contamination (accidental events), sediment resuspension,
 - Loss of ecological connectivity for large mammal species (infrastructure crossing wildlife corridors acting as a barrier effect)
- Operations:
 - Increased mortality of fauna species (collision, loss of species habitats and ecological connectivity, delay in migration patterns, increased poaching pressure, etc.)

- Loss of ecological connectivity for large mammal species (infrastructure crossing wildlife corridors acting as a barrier effect)
- Disturbance of fauna species by noise and light pollution (traffic, lighting of the infrastructures)
- Edge effect
- Induced impacts by increase access to a previously remote natural area (in-migration).

Positive impacts of this project will be socio-economic and the safety and amenity for road users. There are no positive impacts on biodiversity.

As there are many biodiversity receptors (terrestrial and aquatic habitats and species) and many types of impacts on each receptor, no individual impact assessment table have been developed (as in other ESIA volumes). Rather the characteristics of the construction and operation impacts were described together and per group and then the results were synthesised in the aggregate table in **Section 3.9**.

Indeed, the important number of Priority Biodiversity Features and critical habitat triggering species and the fact that they constitute umbrella species (species whose conservation confers protection to a large number of naturally co-occurring species) allows that mitigation measures that will be applied to these species will be beneficiary as well for the other species sharing the same ecology and/or habitat.

3.5 Impacts on Terrestrial Habitats and Species

3.5.1 **Destruction (loss), degradation, and fragmentation of habitats**

Land clearance for the proposed road and associated infrastructure will cause direct habitat loss (direct impacts). Some impacts will be temporary (e.g. Base camps until completion of rehabilitation), and others will be permanent (e.g. the operational road).

Moreover, indirect impacts due to excavation works or vehicles driving on dirt roads (unpaved roads), employees, and so forth are also expected in adjacent areas, creating noise, dust, human presence, habitat fragmentation, change in floral composition, and so forth and will be likely to degrade habitats in these areas. Accidental pollution could also occur if mitigation is not effectively implemented and/or staff are not properly trained and sensitized to biodiversity (e.g. waste disposal in natural habitats). During operations, disturbance may occur beyond the road footprint. To estimate this latter temporary impact, an empirical model predicts a harmful effect gradient as follow (SETRA, 2007²¹):

- A 50 m wide, highly disturbed area, characterized by high noise levels and particulate pollutant deposition; habitat quality is seriously impaired in this area;
- An approximately 100 m wide, ecologically disturbed area (significant exhaust, noise and light emissions).

As a precautionary approach, it is considered that over a buffer of 250 m on each side of the road the degradation will occur at 25%.

²¹ Setra, 2007. Technical Guide. Facilities and measures for small fauna.

Table 17. Synthesis of Habitat Loss and Degradation due to the Project²²

EUNIS ²³		EU Habitats Directive ²⁴		Area under the road footprint ²⁵ (ha)	% of the road footprint	Area under SDAs (ha)	% of the area under SDAs	Area in the 250m*2 buffer ²⁶ (ha)	% in the 250m*2 buffer
Code	Name of habitat	Code	Name of habitat						
C2.	Surface running waters	3240	Alpine rivers and their ligneous vegetation with <i>Salix elaeagnos</i>	/	/	/	/	1.32	0.05
E1.2	Perennial calcareous grassland and basic steppes	6190	Rupicolous pannonic grasslands (<i>Stipo-Festucetalia pallentis</i>)	72.41	27.3	22.3	18.51	632.6	24.44
		62A0	Eastern sub-mediterranean dry grasslands (<i>Scorzoneratalia villosae</i>)	1.43	0.5	/	/	7.61	0.29
E1.4	Mediterranean tall-grass and wormwood - Artemisia - steppes	6240*	Sub-Pannonic steppic grasslands	6.61	2.50	/	/	71.84	2.77
E4.	Alpine and subalpine grasslands	6170	Alpine and subalpine calcareous grasslands	15.72	5.9	/	/	9.77	0.38
F3.1.	Temperate thickets and scrub	40A0*	Subcontinental peri-Pannonic scrub	20.72	7.80	/	/	204.09	7.88
G1.	Broadleaved deciduous woodland	9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the <i>Carpinion betuli</i>	15.63	5.9	/	/	241.41	9.32
G1.A	Meso- and eutrophic oak, hornbeam, ash, sycamore, lime, elm and related woodland	9170	Galio-Carpinetum oak-hornbeam forests	2.21	0.8	/	/	26.33	1.02
G1.11.	Riverine willow woodland	92A0	<i>Salix alba</i> and <i>Populus alba</i> galleries	3.27	1.2	/	/	149.7	5.78
G3.9.	Coniferous woodland dominated by Cupressaceae	5210	Arborescent matorral with <i>Juniperus spp.</i>	30.43	11.5	/	/	221.39	8.55
H3.2	Basic and ultra-basic inland cliffs	8210	Calcareous rocky slopes with chasmophytic vegetation	8.54	3.2	0.04	0.03	69.85	2.70
Habitats not listed in the Annex I of the Habitat Directive nor in the resolution 4 of Bern convention (crops and urbanization area)				88.60	33.4	98	81.46	952.96	36.81
TOTAL FOOTPRINT (without tunnels)				265.56	100%	120.31	100%	2588.87	100%

²² Habitats in bold correspond to Critical Habitats²³ Habitats in blue correspond to Habitats listed in the Resolution 4 of the Bern convention²⁴ Codes with an « * » correspond to priority Habitats in the EU Habitat Directive²⁵ Without considering the tunnels areas²⁶ Without considering the tunnels areas

3.5.2 Flora species destruction (loss)

Several endemic and restricted-range plant species listed in the Armenian red book as EN or CR are known to occur in the area, notably thanks to the National Herbarium. However, only 5 species were observed in the study area as follows: *Iris lineolata* (EN in the Armenian Redbook) ; *Tulipa florenskyi* (EN on the Armenian Redbook) ; *Tulipa sosnowskyi* (EN on the Armenian Redbook) ; *Hypericum armenum* (CR on the Armenian Redbook) and *Astragalus xiphidium* (EN on the Armenian Redbook).

Of these species, 2 were observed directly within the project footprint: *Iris lineolata* and *Tulipa florenskyi* and will be lost during construction. However, as some temporary infrastructure has not been sited, a Pre-Construction Biodiversity Survey (PCBS, cf. measure RD12) will be required to check for other potential priority flora species within footprints that have not yet been assessed. Important plant species must be removed and transplanted from the direct project footprint prior to vegetation stripping.

Specific plant species examples include: *Bromopsis zangezura*, *Pyrus voronovii*, *Dracocephalum botryoides*, *Astragalus prilipkoanus*, *Thlaspi zangezuricum*, *Physoptychis capsica*, *Tragopogon tuberosus*, *Allium derderianum*.



Figure 30. Priority Flora Species Observed within the Direct Project Footprint

3.5.3 Loss of ecological connectivity for large mammals

For large mammals with very large territories, the main impact is the potential loss of ecological connectivity due to the fact the road will be equipped by metal guardrails (disruption of corridors for daily movement or migration) between each side of the valley followed by the project road, especially between DK 35+000 and DK 55+000 (as between DK28 and DK35 the road goes through a tunnel, avoiding possible disruptions of ecological corridors).

3.5.4 Disturbance from light pollution, dust emission, noises, vibration (all species concerned)

Road construction activities may have large atmospheric emissions potential associated with land clearing, drilling and blasting, ground excavation, cut and fill operations (i.e., earth moving), and so forth. Although there are important emissions from the tailpipes of construction vehicles and machinery (combustion emissions) in relative terms these emissions are not as significant as those from an operational roadway. For road construction it is dust that is the major concern (cf. vol 3).

Moreover, during construction, numerous heavy vehicles and equipment will be used along with trucks going back and forth to convey excavated materials (cf. Volume 3), resulting in many disturbances, both during the day and at night. Mostly fauna will be impacted by these disturbances, with less mobile species such as reptiles and amphibians or small mammals being more sensitive to these impacts compared to flying species which can

leave the area and go to a less disturbed carry-over habitats available around the project area.

Apart from dust emissions, the disturbance will continue during operations depending on the intensity of the traffic.

3.5.5 Disturbance from explosion and vibrations from blasting (all species)

Blasting which will be used for the tunnel construction will create percussive noise and vibration that could have an impact on fauna in general, but more particularly on lekking birds in Bargushat range (Caspian Snowcock, *Tetraogallus caspius*, LC & Caucasian Grouse, *Lyrurus mlokosiewiczzi*, NT). There is no significant impacts from Blasting for CHQ Species of reptiles and Bats as there is no location for reptiles near the tunnel and no roosting and breeding sites known in the vicinity of the tunnel. For Birds of prey, it is the same, as there is no breeding site in the vicinity of the blasting location.

3.5.6 Increased mortality of individuals (mammals, reptiles and amphibians mainly)

During operations, there is a risk of collisions and roadkill between traveling vehicles and flying fauna (birds, bats) or other animals trying to cross the road (e.g. mammals, reptiles and amphibians). Even though the road will be equipped by guardrails in like with road safety standards, additional fencing should be implemented in line with the BAP.

3.5.7 Alien Invasive Species proliferation

Even in the absence of alien invasive species along the road project, construction is a source of floral invasive species propagation without mitigation particularly through machine and staff movement along the alignment (e.g. dispersal of seeds in soil on machines, boots of workers, and so forth). According to the botanists, the selected route of the road is one of the best options in terms of avoiding invasive species. The only flora alien invasive species which was observed in the study area is *Ailanthus altissima* – at the proposed road turn-off from Kajaran to Geghi. There is a potential for finding *Acer negundo* and *Robinia pseudoacacia*. However, even with greater dispersal of seeds (e.g. *Ailanthus altissima* being localised currently in the area of the road M2, could spread deeper into Geghi valley), the climatic conditions which are quite dry are unfavourable for the 2 species which need warmer and more humid conditions. Fauna species such as *Rattus norvegicus* (terrestrial mammal) and *Pseudorasbora parva* (fish) are not as closely linked to construction works for dispersal vector (apart from rats that can colonize around base camps). However, as there are mostly existing settlements along the road, rats are already present and regulated by natural predators such as the Red fox, *Vulpes vulpes*, the Stone marten, *Martes foina* or even the Long-eared owl, *Asio otus* which will continue to limit rat populations.

3.5.8 Induced effects: increase in human presence in formerly remote habitats due to population flux

The road project will facilitate access to formerly remote natural areas, *de facto* protected currently, by this lack of accessibility. Even if not direct, these induced effects have to be taken into account as they can increase CH triggering species poaching (large mammals) or land use change from natural habitats to anthropized habitats (e.g. buildings, agriculture and so forth). The extent is somehow limited as there is no interchange planned in the valley between Kitsk and Kavchut, but it is important to limit secondary roads for maintenance and dumping sites between the DK35+000 and DK60+000, as much as possible.

Moreover, the roads in Zangezour protected areas (joining the 2 portals of Bargushat tunnel, between DK28+000 and around DK35+750) are not planned to be used for construction nor for maintenance during road operations (they should also not be used by any stakeholders to limit species disturbance).

3.6 Impacts on Aquatic Habitats and Species

During the construction stage and especially excavation and other earthworks, the redirection of surface runoff will have impact on the watercourses. Interception and movement of runoff from construction sites, as well as changes in the runoff direction and rate because of earthworks may influence the hydrological regime of the Vorotan, Loradzor, Qirs, Geghi and Voghji river basins (*cf.* ESIA, Volume 3).

3.6.1 Degradation of watercourses and water quality (Otter, Eurasian Pond Turtle and Brown Trout)

Construction can lead to riverbank erosion, water quality degradation by increasing sediment resuspension, wastewater discharge, runoff, soil and water pollution (from accidental spills and leaks of chemicals and/or hydrocarbons or poor waste management).

3.6.2 Disrupted ecological continuity for aquatic species (Otter and Trout mainly concerned)

In the detailed design, weirs and dams are not planned for the construction of different facilities, so there is no evidence that there will be disruption of surface water on the basis of the current detailed design.

However, as the design of temporary structures will have to be detailed later by sub-contractors, if any watercourses would finally need to be diverted and/or their flow reduced or stopped to facilitate construction, this could potentially directly (disrupted ecological continuity) or indirectly (*e.g.* sediment suspension) affect potamodromous (migratory) species such as the Brown Trout and other fish species particularly, and aquatic mammals such as the Otter which could experience potential disruption in their ecological corridor. Any watercourse change activity will require the assessment and securing a permit from the MoE.

3.7 Impacts of the Project on Ecosystem Services

The proposed Project does not depend on specific ecosystem services (type II) but could affect (directly and indirectly) other ecosystem services (type I), notably related to provisioning services (water, livestock and agriculture, and fishing). Other impacts on control and support ecosystem services, such as water control, erosion control, air quality, water purification and waste treatment, soil formation and primary production will also potentially affect a community's environment and livelihoods/ health if no measures implemented.

Table 18. Assessment of Project Impacts on Ecosystem Services

Services	Description of the potential impact if existing	Impact Assessment		
		Sensitivity	Magnitude	Relative impact significance
Provisioning services				
Groundwater (availability and quality)	Unlikely	Low	Low	Negligible
Surface water (quality)	Potential temporary degradation of watercourse which local communities depend on for water supply (though very unlikely)	High	Low	Moderate
Fishing	Likely for several families in Darbas, Vaghatin and Uyts administrative units, but temporarily, and fishing is not the primary livelihood source	Low	Low	Negligible
Agriculture	Likely as the residents of all Project affected settlements are to various degree involved in agricultural activity and crop production; some land take is permanent. Agriculture can be a	High	Medium	Major

Services	Description of the potential impact if existing	Impact Assessment		
		Sensitivity	Magnitude	Relative impact significance
	primary livelihood or income source for some families			
Trees / Forest products	There are about 19% of forested habitats in the Area of Influence of the road ²⁷	Low	Medium	Minor
Uses of plants properties (medicinal, traditional, and food)	Medicinal plants, <i>Asparagus and rose-hips</i> (notably in Vaghatin, Aghitu, Lernadzor and Geghi). The picking up activities are limited (mainly for use as tea), and such plants are wide-spread in the area.	Low	Negligible	Negligible
Livestock	Likely as the population of all Project affected settlements are to some extent engaged in cattle breeding. For some families, income from livestock can be a primary livelihood source	High	High	Major
Hunting	Hunting is regulated in the Zangezur protected area, and the project will probably have mostly a positive impact on hunting by facilitating access to formerly undisturbed areas.	Low	Negligible (positive impact on the activity)	Negligible
Charcoal Production	Land clearance activities will reduce wood availability, but it seems that the local communities are not collecting the wood locally (they buy it from suppliers)	Low	Low	Negligible
Regulation services²⁸				
Air quality	Dust emissions and pollution from exhaust pipes of construction machines are likely to have mostly a localised effect that does not extend significantly beyond the road.	High	Medium	Moderate
Climate	Unlikely	Low	Negligible	Negligible
Water control	Change in land uses, possibility of modification of the amplitudes of runoff, floods, recharge of aquifers, water storage potential	High	Medium	Moderate
Erosion control	Large areas will be cleared during the work, which increases the risk of wind and water erosion	High	High	Major
Water quality	The risks of soil degradation and contamination, due to construction work and increased risks of soil erosion and accidental spills are likely to impact the ability of ecosystems and land to filter water and get rid of its contaminants	Medium	Low	Minor
Disease regulation	Unlikely	Low	Negligible	Negligible
Harmful and invasives regulation	/	/	/	/
Pollination	/	/	/	/
Regulation of natural disasters	/	/	/	/
Cultural services²⁹				
Intangible Cultural Heritage: Sacred or spiritual sites	Cross-stones and crosses (in most cases on the top of the hills)	Medium	Low	Minor

²⁷ The number of trees to be cut (as they are falling within the road footprint and which are not covered by the Resettlement Framework) are being counted within the framework of the national EIA procedure.

²⁸ Cf. ESIA, Vol 3.

²⁹ Cf. ESIA, Vol 4. Impact significance varies from minor to major as a function of specific CH sensitivity values and magnitudes of impact

Services	Description of the potential impact if existing	Impact Assessment		
		Sensitivity	Magnitude	Relative impact significance
Intangible Cultural Heritage: Areas used for religious purposes	Shrines and cult monuments (should not be directly affected as not under the footprint)	High	Low (not in the project footprint)	Moderate
Support services				
Soil formation and primary production	The risks of soil degradation and contamination, due to construction work and increased risks of soil erosion, are likely to impact soil formation within the direct area of influence of the project. Moreover, land artificialisation prevent soils producing primary production	Medium	Medium	Moderate

3.8 Impacts on Protected Areas and Internationally Recognized Areas of Biodiversity Value ³⁰

3.8.1 Impacts of the Project on Candidate Emerald Network sites (ASCI)

All details about Protected Areas are provided in the Appropriate Assessment (Annex 3 to this Volume 2). The main findings are summarised below.

The Project is planned in the region where several protected areas of different scales have been designated (*cf.* **Section 2**), including the following Candidate Emerald Network sites:

- Gorhajk Candidate Emerald Network Site (AM0000013 ASCI);
- [Zangezur Candidate Emerald Network site](#) (AM0000015 ASCI);
- Tatev Candidate Emerald Network Site (AM0000016 ASCI).

Gorhajk Candidate Emerald Network Site (AM0000013 ASCI)

Likely effects on the integrity of the site:

The project and associated infrastructure does not overlap this site (*cf.* distances to the project in **Table 7** and **Figure 26**), **so there are no direct effects on habitats, nor indirect or cumulative impacts on the integrity of the site**, especially as the proposed road passes close to the eastern border, which is an urban area, with low ecological sensitivity.

Zangezur Candidate Emerald Network site (AM0000015 ASCI)

Likely effects on the integrity of the site:

Although the road overlaps the Zangezur ASCI for 2,200m, the alignment is within the Bargushat tunnel. The tunnel portals are outside the site, no ventilation shafts are planned that would daylight in the reserve and no access roads are planned between the two portals on the Bargushat range, so **impacts on habitats of community interest are unlikely**.

The closest surface sections of the proposed road will be about ca. 1,200m from Zangezur Emerald site boundaries (on the southern portal side). **However, as §5.1 indicates, blasting activities during the construction of the tunnel might temporarily disturb fauna of community interest such as large mammals, lekking birds and bats, so mitigation measures must be implemented** (see the next section).

³⁰ A dedicated Appropriate Assessment is targeting the Emerald Network Sites overlapping or in the vicinity of the project according to the Article 6(3) of the Habitats Directive 92/43/33C (see Vol 2. Annexe 3)

Tatev Candidate Emerald Network Site (AM0000016 ASCI)

Likely effects on the integrity of the site:

The project and associated infrastructure do not overlap with this site (*cf.* distances to the project in **Table 7** and **Figure 26**), so **there are no direct effects on habitats nor integrity of the site. However, there are potential indirect effects during construction on the Loradzor river and consequently associated aquatic and semi-aquatic species of community interest such as the Eurasian Otter (*Lutra lutra*), the Golden Spined Loach (*Sabanejewia aurata*), the Aral asp (*Aspius aspius*), and the Bulatmai Barbel (*Luciobarbus capito*) through potential water pollution (accidental events), sediment resuspension, and/or disturbance by dust, noise and light pollution.** These four aquatic and semi-aquatic species of community interest are “rare” to “very rare” in Tatev ASCI as a precautionary measure and mitigation must be implemented accordingly.

3.8.2 Impacts of the Project on Other Protected Areas and Internationally Recognized Areas of Biodiversity Value

Zangezur Sanctuary

Cf. section on Zangezur Candidate Emerald Network site above

Zangezoor IBA and KBA

Zangezoor IBA was designated for the following five bird species: Caspian Snowcock *Tetraogallus caspius*, Caucasian Grouse *Lyrurus mlokosiewiczii*, Bearded Vulture *Gypaetus barbatus*, Egyptian Vulture *Neophron percnopterus* and Golden Eagle *Aquila chrysaetos*.

The Caspian Snowcock breeds in the mountains above Shenatagh village with quite a high density – three calling males in about three-square km. As such the Project could have a high potential but temporary negative impact on this species during construction due to blasting of the Bargushat tunnel (noise and vibration). Mitigation is needed to protect this species. A similar risk applies for the Caucasian Grouse, another lekking species observed on the Geghi side in April 2021. The birds are usually not far from lekking sites, so their breeding in this area is very likely.

Although several Red-listed raptors were observed, it appears that only Bearded Vulture and Golden Eagle that use the Kitsk-Karut area regularly for hunting and foraging. A **low impact** on these species and the Zangezoor IBA and KBA (designated for the same five bird species) is anticipated as there are many alternative hunting habitats for these species in the area.

Meghri Large KBA (2004)

The road crosses the large Meghri KBA (2004) from about KM 31+000 until KM 60+000, fragmenting the two mountain chains on each side of the Geghi valley. The project footprint is limited to 0.13% of the site, with negligible impact on habitat. The more important impact is on the ecological corridors between valleys for the *Capra aegagrus* (Bezoar Goat) and *Ovis orientalis* (Armenian Mouflon), where mitigation is required to protect the corridors for these and other large mammal species. *Lyrurus mlokosiewiczii* (Caucasian Black Grouse) breeds in the study area but at altitudes where the road would be in the Bargushat tunnel. Construction blasting could impact the species especially during breeding, requiring mitigation.

There will also be potential impacts during both construction and operation on *Lutra lutra* (Eurasian Otter) in the Geghi valley, so mitigation will also be required to prevent such impacts as well.

The completed Appropriate Assessment (*cf.* Volume 2, Annex 3 for more details) shows that after implementation of proposed mitigation measures, none of the impacts will affect the integrity of these protected areas or internationally recognized areas of biodiversity.

3.9 Synthesis of Impacts of the Project before Mitigation Measures

As there are many biodiversity receptors (terrestrial and aquatic habitats and species) and many types of impacts on each receptor, no individual impact assessments tables have been developed (as in other ESIA volumes). Rather the characteristics of the construction and operation impacts were described together and then the results were synthesised in the following paragraphs and the aggregate table below. Impact significance has therefore been assigned to receptors sharing the same characteristics.

Habitats

The main impacts on habitats will be the permanent loss of habitats that will be taken by the project footprint, as noted below:

- 27.33 ha of 2 critical habitats : **Sub-Pannonic steppic grasslands (6240*, 6.61ha)** and **Subcontinental peri-Pannonic scrub (40A0*, 20.72ha)** marked as “priority habitat type” in Annex I of EU Habitats Directive,
- 149.64 ha of habitats listed in Annex I of EU Habitats Directive qualifying as priority biodiversity features:
 - 0.33ha of 3240 Alpine rivers and their ligneous vegetation with *Salix elaeagnos*;
 - 94.71ha of 6190 Rupicolous pannonic grasslands (*Stipo-Festucetalia pallentis*);
 - 15.72ha of 6170 Alpine and subalpine calcareous grasslands
 - 15.63ha of 9160 Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli
 - 2.21ha of 9170 Galio-Carpinetum oak-hornbeam forests
 - 3.27ha of 92A0 *Salix alba* and *Populus alba* galleries
 - 30.43ha of 5210 Arborescent matorral with *Juniperus spp.*
 - 8.54ha of 8210 Calcareous rocky slopes with chasmophytic vegetation

Under the permanent project footprint.

Additionally, a potential degradation of the habitats in a buffer of 250m around the project footprint, which represents the AoI.

However, within this AoI, the majority of impacts on habitats are limited to a buffer of about 0-100 m around the footprint (please see **Section 3.5.1**) in which:

- Dusting will happen/majority of PM10 will precipitate on ground and nearby plants (distance to the road depending on the surrounding vegetation, wind, etc., with a deposition gradient decreasing with the distance to the road),
- Sedimentation of chemicals during winter maintenance will take place at the edge of the road (<10m).

Flora

Out of the 5 restricted-range flora species observed in the study area during fieldwork, only 2 species have been observed in the AoI of the project and will be lost during construction: *Iris lineolata* and *Tulipa florenskyi*. However, as some temporary infrastructure have not been localised a Pre-Construction Biodiversity Survey (PCBS, *cf.* measure **RD12**) will be required to check for other potential priority flora species within footprints that have not yet been assessed. Important plant species must be removed and transplanted from the direct project footprint prior to vegetation stripping.

Large mammals

The main impact for large mammals with extended territories is the loss of ecological connectivity (disruption of corridors for daily movement or migration) between each side of the valley followed by the project road, especially between DK 35+000 and DK 55+000 (as between DK28 and DK35 the road goes through a tunnel, avoiding possible disruptions of ecological corridors).

Moreover, even no den were found, 3 species are known to breed in the Geghi valley (4km from ridge to ridge on average):

- Eurasian Lynx (*Lynx lynx*, LC): Potentially breeding close to Geghavank reservoir in Geghi valley
- Brown Bear (*Ursus arctos*, LC): Potentially breeding close to Geghavank reservoir in the Geghi valley
- Grey Wolf (*Canis lupus*, LC): Breeding in Geghi valley (camera-trap evidence with an adult carrying pups in its mouth).

Their habitat will be impacted as well, to a lesser extent for habitat loss and degradation considering their large territories, the main impact being the fragmentation of their habitat through loss of ecological connectivity. To note, the proposed road includes safety barriers; additionally metal guardrails will be installed along the entire length of the road (except tunnels) as per the recommendation of the Technical Consultant (Bernard Gruppe) for iRAP Star 3 road.

These species will be as well locally impacted by disturbances due to construction works (e.g. dust, noise, blasting and potentially water pollution in the case of accidental spill), however this impact is limited given that the construction works will be very localized and there are many favourable retreat habitats in the area.

Finally, during the operation phase, there is a risk of collision with vehicles where the road does not have fencing system or wildlife crossing. The proposed guardrails are too low to prevent large animals from entering the road, thus, additional 2m high fencing is recommended as part of mitigation. Considering the extent of the territory of large mammals, the disturbance due to traffic will be limited, even though probably more important in winter period when the animals are going down from the mountains to lower altitudes, and so closer to the roads.

Regarding induced impacts, poaching could increase due to the facilitated presence of humans and activities and increasing access to previously more remote areas.

Aquatic species

During the construction phase, impacts on riverbank erosion, water quality degradation by increasing sediment resuspension, wastewater discharge, runoff, soil and water pollution (from accidental spills and leaks of chemicals and/or hydrocarbons or poor waste management) could lead to degradation of watercourses and water quality particularly for the Otter and the Brown Trout.

Another potential impact could be on the disruption of the ecological continuity for these species following potential temporary diversion of watercourses needed for construction works.

During the operation stage there should not be impacts on aquatic species due to oil separators (as envisioned in the ESMP) and enclosed drainage system, unless there is a large-scale accidental spill which could overflow and bypass the run-off wastewater treatment system.

Bats

The impacts on bats' habitats will be limited as there are no breeding site nor hibernating site in the Aol, so only foraging areas will be impacted, and there are other favourable habitats and foraging areas for bats in study area, EAAA and outside of EAAA. Moreover,

even though breeding or roosting sites are potentially present in the EAAA for the different bat species, as the project footprint concerns less than 0.3% of this large EAAA (“Priority species living at the scale of the valley EAAA”), the impacts will be limited.

During operation, bats can be impacted by roadkill. Compared to mammals, birds and amphibians species, the mortality of bats on roads is generally underestimated, because of the small body size and since roadkilled individuals may be quickly squashed or removed by scavengers. Road impacts on bat activity and roadkill are strongly influenced by landscape features, and areas with short trees have more impact on roadkill. Also, in open areas, bats prefer to forage near roads whereas in woodland areas activity increases with distance from the road³¹.

Birds

- Raptors: the study area is a foraging ground for many raptor species but there is no breeding evidence for these species in the study area apart for the Northern Goshawk (*Accipiter gentilis*, LC). Moreover, as they are wide-range species and there are many favourable habitats in the study area, the impact on their habitat is very limited, both during construction and operation, apart for the Short-toed snake-eagle (*Circaetus gallicus*, LC) who forages notably in all the grassy and rocky areas, including at the bottom of the valley so the impacts on these 2 species are moderate.
- Lekking species: There are 2 lekking species over the Bargushat tunnel area (breeding): the Caspian Snowcock (*Tetraogallus caspius*, LC) and the Caucasian Grouse (*Lyrurus mlokosiewiczzi*, NT) that will be impacted mostly by the explosion and vibrations from blasting activities, mainly closer to the portals as the key blasting and drilling activities will occur in the tunnel, which is about 1km deep.
- Riverine species (e.g. Kingfisher, European Roller): there are no impacts on the birds’ species dependent on rivers.

Reptiles

During construction, the impacts on reptiles priority species (Armenian steppe viper, Radde’s Viper, Mediterranean tortoise, Eurasian Pond Turtle) will be mainly due to disturbances and especially blasting as it can influence stress and reproduction success, but as well during operation potentially due to roadkills for turtle / tortoise species.

Insects

The main impacts on insects (Forster’s Blue, Apollo Butterfly, Large Blue) correspond to the loss of habitats during construction works and disturbances by dust (impact on their host plants and flowers that will in turn influence their breeding opportunities and food resources).

Table 19. Assessment of Impacts on Biodiversity Features

Receptor		Impact identification	Impact Assessment		
			Sensitivity	Magnitude	Relative impact significance
Habitats		Alien Invasive species proliferation (<i>Ailanthus altissima</i>)	Low	Low	Minor
3240	Alpine rivers and their ligneous vegetation with <i>Salix elaeagnos</i>	Habitat degradation (1.32ha*0.25=0.33ha)	Medium	Low	Moderate

³¹ [Ramalho et Aguiar, 2022](#) ; Claireau et al, 2019

Receptor	Impact identification	Impact Assessment			
		Sensitivity	Magnitude	Relative impact significance	
6190	Rupicolous pannonic grasslands (<i>Stipo-Festucetalia pallentis</i>)	Habitat loss (94.71ha)	High	High	Major
		Habitat degradation (632.6ha*0.25=158ha)	Medium	Medium	Moderate
62A0	Eastern sub-mediterranean dry grasslands (<i>Scorzoneratalia villosae</i>)	Habitat loss (1.43ha)	High	High	Major
		Habitat degradation (7.61ha*0.25=2ha)	High	Low	Moderate
6240*	Sub-Pannonic steppic grasslands	Habitat loss (6.61ha)	High	High	Major
		Habitat degradation (71.84ha*0.25=18ha)	High	Low	Moderate
6170	Alpine and subalpine calcareous grasslands	Habitat loss (15.72ha)	High	High	Major
		Habitat degradation (9.77ha*0.25=2.5ha)	High	Low	Moderate
40A0*	Subcontinental peri-Pannonic scrub	Habitat loss (20.72ha)	High	High	Major
		Habitat degradation (204.09ha*0.25=51ha)	High	Low	Moderate
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the <i>Carpinion betuli</i>	Habitat loss (15.63ha)	Medium	High	Major
		Habitat degradation (241.41ha*0.25=60.5ha)	Medium	Low	Moderate
9170	Galio-Carpinetum oak-hornbeam forests	Habitat loss (2.21ha)	Medium	High	Major
		Habitat loss (26.33ha*0.25=6.5ha)	Medium	Low	Moderate
92A0	<i>Salix alba</i> and <i>Populus alba</i> galleries	Habitat loss (3.27ha)	Medium	High	Major
		Habitat loss (149.7ha*0.25=37.5ha)	Low	Low	Minor
5210	Arborescent matorral with <i>Juniperus spp.</i>	Habitat loss (30.43ha)	High	High	Major
		Habitat loss (221.39ha*0.25=55.5ha)	Medium	Low	Moderate
8210	Calcareous rocky slopes with chasmophytic vegetation	Habitat loss (8.54ha)	High	High	Major
		Habitat loss (69.85ha*0.25=17.5ha)	High	Low	Moderate
Flora species	Flora species loss - Loss of 2 locations of CH species that are well distributed in the EAAA.	High	Low	Moderate	
	Disturbance by dust, affects the photosynthesis, potential necrosis of the plant tissue due to impacts to plant stomata.		Low	Moderate	
Large terrestrial mammals and associated habitats <i>Brown Bear, Grey Wolf, Armenian Mouflon, Persian Leopard, Eurasian Lynx, Wildcat, Bezoar Goat, Marbled polecat</i>	Degradation, fragmentation of habitats by the road	High	Medium	Major	
	Loss of ecological connectivity for large mammals		High	Major	
	Increased mortality of individuals (e.g. through collision with vehicles, etc.)		High	Major	
	Disturbance by air, soil, water and light pollution, dust and noise		Low	Moderate	
	Disturbance by explosion and vibration from blasting		High	Major	
	Increasing presence of human settlements and activities and increasing access, including facilitated access to new farmlands, pastures, hunting and fishing areas (and potential poaching)		Medium	Major	
Aquatic species and associated habitats <i>Eurasian Otter</i>	Degradation of watercourses by sedimentation during construction phase	High	Medium	Major	
	Loss of ecological connectivity		Medium	Major	
	Disturbance and damage from water contamination (accidental events) during Construction and possibly during operation phase		Medium	Major	

Receptor	Impact identification	Impact Assessment		
		Sensitivity	Magnitude	Relative impact significance
Bats and their associated habitats Mehely's horseshoe bat, Mediterranean horseshoe bat, Blasius' horseshoe bat, Schreiber's Bat, Greater Horseshoe Bat, Lesser Horseshoe Bat, Lesser Mouse-eared Myotis, Geoffroy's Bat, etc.	Degradation, fragmentation, and destruction of habitats The project footprint corresponds to 0.28% of the EAAA (3.86/1369), so the magnitude is low	High	Low	Moderate
	Increased mortality of individuals (e.g. through collision with vehicles, etc.)	Medium	Medium	Moderate
	Disturbance by air, soil, water and light pollution, dust, noise and vibration from blasting	Medium	Medium	Moderate
Raptors and their associated habitats Bearded Vulture, Black Vulture, Egyptian Vulture, Golden Eagle, Griffon Vulture, Lesser Spotted Eagle, Northern Goshawk, Short-toed Snake-eagle, etc.	Degradation, fragmentation, and destruction of habitats (especially for Short toed Snake-eagle and Northern Goshawk). No impact on habitats for Vultures and Eagles	Medium	Low	Moderate
Lekking bird species and associated habitats Caspian Snowcock, Caucasian Black Grouse	Disturbance by air, soil, water and light pollution, dust, noise and vibration from blasting. Mostly blasting is concerned for those species	High	High	Major
Reptile species and their associated habitats Armenian steppe viper, Radde's Viper, Mediterranean tortoise, Eurasian Pond Turtle, etc.	Increased mortality of individuals through collision with vehicles	Medium	Medium	Moderate
	Disturbance by air, soil, water and light pollution, dust, noise and vibration from blasting. Only blasting is concerned for those species		Medium	Moderate
Insect species Forster's Blue, Jersey Tiger, Apollo Butterfly, Large Blue, etc.	Degradation, fragmentation, and destruction of habitats The project footprint corresponds to 7.35% of the EAAA (0.5km ² /6.8km ²), so the magnitude is medium	Medium	Medium	Moderate
	Disturbance by air, soil, water and light pollution, dust, noise and vibration		Medium	Moderate

3.10 Mitigation Measures

Mitigation measures are required during construction and operations, although there are commitments required for preconstruction, and detailed Project design. More details about recommended measures are provided in the BAP.

Table 20. List of Measures Proposed to Mitigate Project Impacts on Biodiversity as per Mitigation Hierarchy

MITIGATION MEASURES – AVOIDANCE– REDUCTION – RESTORATION	
Design phase and Pre-construction (land clearance)	
AVOIDANCE (AV)	<p>AV01 – Prevent/avoid construction works and/or setting-up dumpsites or any other type of infrastructure inside the Zangezour ASCI (e.g. the portals have been relocated outside of the ASCI, and there will be no ventilation shafts daylighting in the reserve to avoid Annex I habitats loss in the PA).</p> <p>AV02 – Prevent/avoid construction, and/or establishing SDAs or other infrastructure in the transversal valleys between Kitsk and Kajaran in the identified no-go zones and prioritize the use of closed mining tailing south of the M2 between Kavchut and Lerdnazor for SDAs</p> <p>AV03 – Contain all activities within the project footprint and inform all operators on the strict necessity to respect project boundaries. Any clearance or other impacts outside the project footprint must be treated as an environmental incident and immediately restored/remediated. If the incident is in critical habitat, the habitat loss must be added to the offsetting needed to achieve net habitat gain.</p> <p>AV04 – Avoid creating new access routes for project activities and/or local community access. Prioritise existing tracks and access roads for use. Detailed maps of all existing tracks and access roads must be produced along with impact reduction measures (e.g. speed reduction, no hooting, etc. cf. RD02. Development of a Traffic Management Plan on construction Sites) (see ESAP Action 1.2, also the Project’s ESMP).</p> <p>AV05 – Avoid all activities including land clearance, cutting trees and blasting during breeding period and migration period, especially from 15th of March to 10th of June and from 15th of October to 15th of November, to limit impacts of the project on large mammals, bats, avifauna, reptiles and butterflies.</p> <p>AV11 - Adapt the road alignment to preferentially use already degraded habitats and/or existing road instead of destroying natural habitats</p>
REDUCTION (RD)	<p>RD01 – Establish a 200 m buffer zone (100m on each side of the watercourse) on permanent rivers and streams, where activities will be prohibited (apart from where bridges are to be built).</p> <p>RD02 – Develop a Traffic Management Plan on construction Sites containing maps of access to construction sites, and implement training of all the employees to avoid traffic outside of the “off-track” and respect speed limits (< 30km/h), for both human safety and to decrease the risk of wildlife (mammals, reptiles, amphibians, bats, birds and butterflies) collision and disturbance.</p> <p>RD03 – Clearly delineate project boundaries, especially in critical habitats, with relevant signage to inform employees and local communities on biodiversity and potential risks.</p> <p>RD04 – Control access on tracks developed for the Project purpose to limit all access to natural areas and critical habitats, especially south of the Bargushat Tunnel.</p> <p>RD05 – Minimise pesticide use, replacing it with biological methods of pest control and organic maintenance of the road and associated facilities.</p> <p>RD06 – Minimise impacts by adjustments of the location of the annexes following Pre-Construction Biodiversity surveys to preferentially use already degraded habitats and/or existing road instead of destroying natural habitats.</p> <p>RD07 - Design suitable wildlife crossings (preferably overpasses and/or road passing on bridges for large mammals and amphibian tunnels when in the vicinity of conservation-worthy habitats) and establish them in locations to</p>

MITIGATION MEASURES – AVOIDANCE– REDUCTION – RESTORATION	
	<p>restore ecological continuity for large mammals where this could otherwise be impaired by the project (cf. Annex 4 and the BAP).</p> <p>RD08 – Develop a Waste management plan (see ESAP Action 1.2, also the Project’s ESMP). Temporary organic waste storage must be kept dry and no water discharge allowed before treatment in conformity with International and national quality standards. Moreover, the pre-treatment of the waste rocks of the tunnels before disposal should be addressed, detailed, and implemented (risk of acid rock drainage due to the presence of sulphur oxides in the waste rock).</p> <p>RD09 – Develop an Erosion and Sediment Control plan and Spill Prevention Control and Countermeasures plan (see ESAP Action 1.2, also the Project’s ESMP) to limit erosion and sediment resuspension in watercourses (e.g. including installation of separators and treatment facilities to clean water runoff from sediments prior discharge into rivers, regularly inspect repair or maintain drainage structures to avoid sedimentation, etc.).</p> <p>RD10 – Develop an Invasive Alien Species Management Plan (see ESAP Action 1.2, also the Project’s ESMP) to prevent the spread of alien species through vehicle movement. Include dominant species that could also spread and degrade natural or critical habitats such as pseudo-steppes and grasslands (e.g. thistle species, etc.), into the plan.</p> <p>RD11 – Optimize cut to fill ratio to limit the area needed for storage of excavated material.</p> <p>RD12 – Implement pre-construction biodiversity surveys (PCBS) in the final project footprint in areas with a high ecological value (from DK 28+000 till DK 60+000) prior to any type of construction for any type of infrastructure – even Annexes such as base camps, parking, SDAs, etc. and access roads (conducted by experts– e.g. flora, birds, mammals, bats, reptiles and amphibians) in order to check for the presence of CH triggering species, threatened species listed on the Armenian Red book (e.g. <i>Sclerochloa woronowii</i>), and breeding sites (e.g. nests, dens, etc.), the presence of endemic and/or restricted-range plant stations, of Alien Invasive Species (AIS), and so forth. Represent findings on maps and verify the no-go areas (presented in Volume 2 of the ESIA), if needed. Regarding flora AIS, maps of the exact location of the IAS should be prepared to either 1/remove it and dispose of it properly (AIS under the footprint) 2/delineate it to avoid touching it (if at the border of the footprint). Regarding reptiles and amphibians, salvaging actions might be needed if individuals were to be found on the future construction site, so the qualified biodiversity expert needs to obtain/have proper permits for wildlife handling and transport, and in the case of species encounter, he/she should relocate the individuals outside of the area of impact to another nearby suitable site within the same general habitat (e.g. within daily or season movement distances) and including favourable microhabitats/refuges such as stones, piles of rocks, brick piles, woody debris, etc. If needed, install temporary exclusion fencing where relevant to prevent the salvaged individuals from returning to the work area during construction. Upon completion of the project work, remove the fencing.</p>
RESTORATION (RE)	<p>RE01 – Develop a Restoration plan including restoration of temporary project Annexes (restoration of areas degraded by the project and no longer needed – ex. Base camps) and restoration/closure of dumping sites (see ESMP, ESAP Action 1.2.). Restoration must start as soon as possible and be progressively phased.</p>
Construction	
AVOIDING (AV)	<p>AV06 – Prevent contaminated effluent from entering watercourses and streams.</p> <p>AV07 – Protect trees (including their roots) from machinery damage along the right-of-way by marking and prohibiting machinery in the area under the tree crown.</p> <p>AV08 – If found later (for yet unknown locations of construction camps, SDAs), access to the caves (roosting sites for bats) must be prohibited. Install signs at sites close to roads and project facilities to raise awareness about the presence of caves hosting bat populations and necessary conservation measures.</p>

MITIGATION MEASURES – AVOIDANCE– REDUCTION – RESTORATION	
	<p>AV09 – Avoid lighting in the proximity of bat roosting sites and/or raptors nesting sites and prohibit direct night lighting of caves where the presence of bats and nesting raptors would be confirmed.</p> <p>AV10 – Prohibit hunting and natural resource harvesting (consumption of bushmeat by workforce or cutting trees for heating and cooking) within the project area and arrange sharing/capacity building program on the importance and values of priority biodiversity with local communities and employees. Contractors must supply energy in the base camps to prevent wood collection. Prohibit pesticides for control of damage-causing animals, harvesting fish and bushmeat, harvesting animals for traditional medicine, poaching for wildlife products, etc.</p>
REDUCING (RE)	<p>RD13 – Set up temporary culverts for stream crossings and rehabilitate after work is completed.</p> <p>RD14 – Strip topsoil to a depth of 10cm and store separately from remaining topsoil to retain a soil seed bank for use in restoration of natural habitats following suitable protocols to ensure the maintenance of a viable seedbank.</p> <p>RD15 – Monitor the presence of Armenian Mouflon and other large mammals in the vicinity of construction in key crossing areas, and during maintenance phases at the wildlife crossings by setting-up a network of Infra-red cameras that will continuously record (day and night) in real-time wildlife, cattle, and local communities. Monitor the sensitive isolated populations of the priority butterfly species as well, in order to track the potential impact of the road operation on these species, and if necessary, develop further mitigation.</p> <p>RD16 – Define and display clear rules forbidding hunting, poaching and plant collection, on construction sites and in the vicinity of the same.</p> <p>RD17 –Biodiversity specialists to be present at the beginning of construction in sections with high ecological value (from DK 28+000 till DK 60+000) in case of presence of PBF or CH species so that they can be removed prior to site preparation and in that eventuality, to record this data in a global biodiversity database at the scale of the whole alignment.</p> <p>RD18 – Water unpaved roads during construction. Adapt the frequency to the weather conditions, keeping in mind that regular light watering is better than less frequent, heavy watering.</p> <p>RD19 – Biodiversity specialists to review blasting plans for all tunnel areas and facilitate monitoring changes in bat behaviour and/or large mammal and lekking birds behaviour as a result of blasting in order to improve knowledge of the actual impacts on biodiversity. Any updates/changes to the blasting plan should be communicated to Biodiversity specialists of the RD/Project Implementation Unit & Support Consultant, Contractor, and Supervision Engineer as soon as possible.</p> <p>RD20 – Establish fencing of ca. 2m height (and 30-50 cm underground) all along the road or at least 1km before and after every type of crossing (e.g. wildlife, cattle, agricultural crossings) combined with jump-outs or exit ramps (in areas where the road is not on a bridge or in a tunnel or cut in a steep slope) (NB: safety guardrails on both sides of the road for the entire length of the road apart from tunnels are envisioned to be included in the updated detailed design, however these are not sufficient to prevent animals from entering the road).</p>
RESTORATION (RE)	<p>RE02 – Develop a tree nursery (and seed store), containing <i>Juniperus sp.</i> and endemic species impacted by the project, based on PCBS (or other species associated with the natural ecosystems observed in the project footprint) and ensure recovery of forest products from vegetation clearance and establish mechanisms to distribute them among the local population and use for site rehabilitation. The selection of trees (and seeds) and the location of replanting must be validated by a flora expert.</p> <p>RE03 – Implement passive restoration (as per the BAP). Demarcate “no go” areas (based on habitat quality/type) for employees, subcontractors, and communities, within the project area, favouring natural regeneration of plant species and supplement with regular control and monitoring activities to compare with assisted regeneration.</p>
Operations/Maintenance	

MITIGATION MEASURES – AVOIDANCE– REDUCTION – RESTORATION	
REDUCING (RD)	<p>RD21 – Limit fixed-source lighting along the road only to critical areas representing a risk for human safety (e.g. interchanges, tunnels, or intersections if present). Maintain darkness for nocturnal species (such as large mammals, bats and nocturnal birds)</p> <p>RD22 – Maintain fencing to limit the collision risk in association with wildlife crossings</p>
RESTORATION (RE)	RE02; RE03

In addition to this mitigation, additional and experimental measures can be added in the BAP. Moreover, it is crucial to implement universal accompanying measures to ensure the efficiency of the mitigation, such as:

AC01: Training and awareness raising of employees on biodiversity, to ensure they fully understand and respect the rules on the construction sites regarding biodiversity protection (speed limitation, strict respect of the limited project footprint, hunting prohibition, etc.).

AC02: Consult protected area sponsors and managers, affected communities and other stakeholders, to ensure no unexpected impacts may occur.

All the mitigation measures contained in this ESIA and BAP must be cascaded to the Terms of Reference of the Construction Contractor and every relevant subcontractor and in their contractual documents.

The Project Lenders will be kept updated about the progress with the implementation via regular E&S Monitoring Reports (external third-party monitoring, as stipulated in the ESAP).

4 RESIDUAL IMPACT ASSESSMENT

4.1 Assessment

The residual impact, remaining impact after the implementation of the proposed mitigation (*i.e.*, avoidance, minimisation, and restoration) is assessed as follows:

Minor or Negligible residual impact: considered as negligible or minor/acceptable residual impacts for which additional measures are not necessary (no offset measures nor additional conservation actions).

Moderate or Major residual impact: unacceptable unless they can be offset by other positive impacts of the project or controlled through the imposition of permitting conditions and/or specific actions implemented through the project's E&S management and monitoring plan.

In case of Moderate or Major residual impacts on 1/priority biodiversity features, additional measures will be designed to achieve "no net loss" and **on 2/critical habitats** net gain is required (through offsets as per EBRD PR6 and EIB ESS4 definitions).

N.B.: In case of Minor or Negligible residual impacts on CH, the net gains can be achieved through additional conservation actions.

In order to conclude on the final significance of the potential impact after avoidance and reduction measures, the ESIA biodiversity experts have relied on expert opinion based on the experience of impact mitigation for road construction projects.

Table 21. Assessment of Residual Impacts on Biodiversity Features

Receptor		Impact identification	Impact Assessment			Mitigation Measures (Avoiding (Av), reducing (Rd), restoring (Re), Accompanying (Ac))	Residual impact	Offset needed
			Sensitivity	Magnitude	Relative impact significance			
Habitats		Alien Invasive species proliferation (<i>Ailanthus altissima</i>)	Low	Low	Minor	AV01 ; AV02 ; AV03 ; AV04 ; AV05 ; AV06 ; AV07 ; AV11 ; RD01 ; RD02 ; RD03 ; RD04 ; RD05 ; RD06 ; RD08 (WMP) ; RD11 ; RD12 ; RD17 ; RD18 ; RE01 ; RE02 ; RE03	Minor	
3240	Alpine rivers and their ligneous vegetation with <i>Salix elaeagnos</i>	Degradation of habitats (1.32ha*0.25=0.33ha)	Medium	Low	Moderate		Minor	
6190	Rupicolous pannonic grasslands (<i>Stipo-Festucetalia pallentis</i>)	Destruction of habitats (94.71 ha)	High	High	Major		Moderate	Yes (No Net Loss)
		Degradation of habitats (632.6ha*0.25=158ha)	Medium	Medium	Moderate		Minor	
62A0	Eastern sub-mediterranean dry grasslands (<i>Scorzoneratalia villosae</i>)	Destruction of habitats (1.43ha)	High	High	Major		Moderate	Yes (No Net Loss)
		Degradation of habitats (7.61ha*0.25=2ha)	High	Low	Moderate		Minor	
6240*	Sub-Pannonic steppic grasslands	Destruction of habitats (6.61ha)	High	High	Major		Moderate	Yes (Net gain)
		Degradation of habitats (71.84ha*0.25=18ha)	High	Low	Moderate		Minor	
6170	Alpine and subalpine calcareous grasslands	Destruction of habitats (15.72ha)	High	High	Major		Moderate	Yes (No Net Loss)
		Degradation of habitats (9.77ha*0.25=2.5ha)	High	Low	Moderate		Minor	
40A0*	Subcontinental peri-Pannonic scrub	Destruction of habitats (20.72ha)	High	High	Major		Moderate	Yes (Net gain)
		Degradation of habitats (204.09ha*0.25=51ha)	High	Low	Moderate		Minor	
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the <i>Carpinion betuli</i>	Destruction of habitats (15.63ha)	Medium	High	Major		Moderate	Yes (No Net Loss)
		Degradation of habitats (241.41ha*0.25=60.5ha)	Medium	Low	Moderate		Minor	
9170	Galio-Carpinetum oak-hornbeam forests	Destruction of habitats (2.21ha)	Medium	High	Major		Moderate	Yes (No Net Loss)
		Degradation of habitats (26.33ha*0.25=6.5ha)	Medium	Low	Moderate		Minor	
92A0	<i>Salix alba</i> and <i>Populus alba</i> galleries	Destruction of habitats (3.27ha)	Medium	High	Major	Moderate	Yes (No Net Loss)	
		Degradation of habitats (149.7ha*0.25=37.5ha)	Low	Low	Minor	Minor		

Receptor	Impact identification	Impact Assessment			Mitigation Measures (Avoiding (Av), reducing (Rd), restoring (Re), Accompanying (Ac))	Residual impact	Offset needed
		Sensitivity	Magnitude	Relative impact significance			
5210	Arborescent matorral with <i>Juniperus spp.</i>	Destruction of habitats (30.43ha)	High	High	Major	Moderate	Yes (No Net Loss)
		Degradation of habitats (221.39ha*0.25=55.5ha)	Medium	Low	Moderate	Minor	
8210	Calcareous rocky slopes with chasmophytic vegetation	Destruction of habitats (8.54ha)	High	High	Major	Moderate	Yes (No Net Loss)
		Degradation of habitats (69.85ha*0.25=17.5ha)	High	Low	Moderate	Minor	
Flora species triggering CH and PBF 5 EN/CR plant species and/or range-restricted	Flora species destruction	High	Low	Moderate	AV01 ; AV02 ; AV03 ; AV04 ; AV05 ; AV07 ; AV11 RD01 ; RD02 ; RD03 ; RD04 ; RD05 ; RD06 ; RD08 (WMP) ; RD12 ; RD17 RE01 ; RE02 ; RE03	Minor	
			Disturbance from dust emission	Low	Moderate	RD18	Minor
Large terrestrial mammals triggering CH and associated habitats Brown Bear, Grey Wolf, Armenian Mouflon, Persian Leopard, Eurasian Lynx, Wildcat, Bezoar Goat, Marbled polecat	Degradation, fragmentation of habitats by the road	High	Medium	Major	AV01 ; AV02 ; AV03 ; AV04 ; AV05 ; AV06 ; AV07 ; AV10 ; AV11 RD01 ; RD02 ; RD03 ; RD04 ; RD05 ; RD06 ; RD08 (WMP) ; RD11 ; RD15 ; RD18 ; RD19 ; RD20 ; RD 22 RE01 ; RE02 ; RE03	Minor	
			Loss of ecological connectivity for large mammals	High	Major	RD07 ; RD15 ; RD20 ; RD22 RE01 ; RE02 ; RE03	Minor
	Increased mortality of individuals (e.g. through collision with vehicles, etc.)		High	Major	RD02 ; RD04 ; RD07 ; RD08 ; RD16 ; RD17 ; RD12 ; RD10	Minor	
	Disturbance from air, soil, water and light pollution, dust emission, noises		Low	Moderate	RD08 (WMP) ; RD18 ; RD20 ; RD12 ; RD09	Minor	
	Disturbance from explosion and vibrations from blasting		High	Major	RD19	Minor	
	Increasing presence of human settlements and activities and Increasing access for the communities, including facilitated access to new farmlands, pastures, hunting and fishing areas (and potential poaching)		Medium	Major	AV01 ; AV02 ; AV04 ; AV10 RD03 ; RD04 ; RD16 ; RD20	Minor	
Aquatic species triggering CH and associated habitats Eurasian Otter	Degradation of watercourses by sedimentation during construction phase	High	Medium	Major	AV01 ; AV02 ; AV03 ; AV04 ; AV06 ; AV07	Minor	

Receptor	Impact identification	Impact Assessment			Mitigation Measures (Avoiding (Av), reducing (Rd), restoring (Re), Accompanying (Ac))	Residual impact	Offset needed
		Sensitivity	Magnitude	Relative impact significance			
					RD01 ; RD02 ; RD03 ; RD13 ; RD09 ; RD11 ;		
	Loss of ecological connectivity		Medium	Major	RD03 ; RD13 RE01 ; RE03	Minor	
	Disturbance and damage from water contamination (accidental events) during Construction and possibly during operation phase		Medium	Major	AV06 RD01 ; RD05 ; RD09	Minor	
Bats qualifying as CH and their associated habitats <i>Mehely's horseshoe bat, Mediterranean horseshoe bat, Blasius' horseshoe bat, Schreiber's Bat, Greater Horseshoe Bat, Lesser Horseshoe Bat, Lesser Mouse-eared Myotis, Geoffroy's Bat, etc.</i>	Degradation, fragmentation, and destruction of foraging habitats such as gallery forest	High	Low	Moderate	AV01 ; AV02 ; AV03 ; AV04 ; AV05 ; AV06 ; AV07 ; AV08 RD01 ; RD02 ; RD03 ; RD05 ; RD08 ; RD11 ; RD17 RE01 ; RE03	Minor	
	Increased mortality of individuals (e.g. through collision with vehicles, etc.)	Medium	Medium	Moderate	RD01, RD02, RD17, RD20, RD21, RD22	Minor	
	Disturbance from air, soil, water and light pollution, dust emission, noises and vibrations from blasting	Medium	Medium	Moderate	AV06 ; AV09 RD08 ; RD17 ; RD18 ; RD19 ; RD20 ; RD12	Minor	
Raptors qualifying as PBF and their associated habitats <i>Bearded Vulture, Black Vulture, Egyptian Vulture, Golden Eagle, Griffon Vulture, Lesser Spotted Eagle, Northern Goshawk, Short-toed Snake-eagle</i>	Degradation, fragmentation, and destruction of habitats (especially for Short-toed Snake Eagle and Northern Goshawk. No impact on habitats for Vulture and Eagle	Medium	Low	Moderate	AV01 ; AV02 ; AV03 ; AV04 ; AV05 ; AV07 ; AV10 RD01 ; RD02 ; RD03 ; RD04 ; RD05 ; RD11 ; RD19 RE01 ; RE02 ; RE03	Minor	
Lekking bird species qualifying as PBF and associated habitats <i>Caspian Snowcock, Caucasian Black Grouse</i>	Disturbance by air, soil, water and light pollution, dust, noise and vibration from blasting. Mostly blasting is concerned for those species	High	High	Major	AV01 ; AV02 ; AV03 ; AV04 ; AV05 ; RD19	Minor	
Reptile species qualifying as PBF and CH <i>Armenian steppe viper, Radde's Viper, Mediterranean tortoise, Eurasian Pond Turtle</i>	Increased mortality of individuals through collision with vehicles		Medium	Moderate	RD02 ; RD03 ; RD04 ; RD07 ; RD10	Minor	
	Disturbance from air, soil, water and light pollution, dust emission, noises and vibrations from blasting. Only blasting is concerned for those species	Medium	Medium	Moderate	AV06 RD08 ; RD12 ; RD18 ; RD19 ; RD20	Minor	
Insect species qualifying as PBF or CH	Degradation, fragmentation, and destruction of habitats	Medium	Medium	Moderate	AV01 ; AV02 ; AV03 ; AV04 ; AV05 ; AV06 ; AV10 RD01 ; RD02 ; RD03 ; RD04	Minor	

Receptor	Impact identification	Impact Assessment			Mitigation Measures (Avoiding (Av), reducing (Rd), restoring (Re), Accompanying (Ac))	Residual impact	Offset needed
		Sensitivity	Magnitude	Relative impact significance			
Forster's Blue, Apollo Butterfly, Large Blue					; RD05 ; RD11 ; RD12 ; RD17 RE01 ; RE02 ; RE03		
	Disturbance from air, soil and water pollution, dust emission and noises		Medium	Moderate	AV05 RD08 ; RD12 ; RD18	Minor	

Additional measures and offsets to achieve « no net loss » (NNL) and « net gain » (NG) are developed in the BAP.

4.2 Summary of the Mitigation and Conclusions

Key mitigation for the Project includes:

- The avoidance of the Zangezur protected area and tentative Emerald site via the construction of the Bargushat Tunnel, avoiding disrupting important ecological continuity on the ridges within the Zangezur mountain range which connect different large mammal sub-populations within the range, along with other transboundary surrounding ranges contributing to gene flows, maintaining endemic and restricted-range species,
- The selection of Spoil Disposal Areas devoid of critical habitats listed in Annex I of the EU Habitat Directive and not in large mammal corridors on the transversal slopes of the Geghi valley,
- Maintaining ecological corridors for large mammals crossed by the project present in the EAAA through wildlife crossings in close cooperation with the head of Zangezur Biosphere Complex SNCO and following international good practices in wildlife crossing design (see [Annex 4](#), and Wildlife crossings design recommendations in the BAP),
- Decrease wildlife collision risks during operations by fencing (see the BAP) combined with jump-outs or exit ramps in association with the wildlife crossings (see [Annex 4](#)).
- Respect seasonal prohibitions during the construction as per BAP and ESAP.

After implementation of these key measures and the other mitigation, the key residual impacts are the loss of priority habitats in annex I of EU Habitats Directive:

- The loss of 27.33 ha of critical habitats [Sub-Pannonic steppic grasslands \(6240*, 6.61ha\)](#) and [Subcontinental peri-Pannonic scrub \(40A0*, 20.72ha\)](#) marked as “priority habitat type” in Annex I of EU Habitats Directive, under the permanent project footprint.

No residual impacts on fauna are expected, provided that all the mitigation and additional conservation measures are implemented accordingly to this ESIA and the BAP.

A detailed loss and gain calculation is provided in the **Biodiversity Action Plan which will, once implemented, ensure the no net loss (NNL) for PBF and net gain (NG) for CH**, however, a summary of the offsetting strategy is summarised below:

- Regarding CH loss, habitat restoration will be needed to attain Net Gain (NG). The total area to offset must be agreed between the EBRD, EIB, ADB, MoE and the Client (multiplying factor of the directly impacted CH area under the footprint).

Additional conservation actions such as reinforcing anti-poaching patrols in sensitive areas and contributing to the extension of protected areas (sites or network) through averted losses and monitoring of critical habitats and triggering species are as well recommended in order to assess the efficiency of the mitigation measures and offsets implemented. Additional conservation actions for mammals, reptiles and amphibians conservation will help ensure NG/NNL in cases where potential mortality impacts are predicted.

Thus, even though the whole project is situated in critical habitat which corresponds to the distribution of the species dependant on the whole valleys crossed by the project (*cf.* CHA, Vol 2. Annex 2), impacts on critical habitats are not irremediable, and through the implementation of the mitigation hierarchy and enforcement of mitigation measures, only limited offsets for habitats and plant species will have to be implemented for the project.

The alignment of the Project with the requirements of EBRD PR6, ADB, and EIB ESS4 is discussed below:

- *Justification of overriding public interest.* The overriding public interest of the Project was recognized through the [Eminent Domain decree No. 981 – N](#) (adopted by the RA Government on June 30, 2022). The Project is of strategic importance for connectivity to Armenia due to political conflicts in the region and unsafe conditions of the existing roads (see Volume 1 for the Project rationale).
- *Non-availability of other viable alternatives within the region exists for development of the project in habitats of lesser biodiversity value viable alternatives.* All the valleys in this area of the Caucasus mountains have similar biodiversity values. The valley in which the project is planned already has been fragmented by an existing road situated at the bottom of the valley, so it is the less impacting option regarding biodiversity for linking the areas on either side of this mountain range. There are no other viable alternatives for the project in terms of location (e.g. area of the lesser biodiversity value) or design as it has already been adapted to limit impacts on biodiversity and ecosystem services. Minor optimisation and micro-alignments can further be introduced if the road design category is changed, which however may not allow to achieve the concept of the Project (see [Section 2.2](#) with alternatives above).
- *Potential to lead to measurable adverse impacts that will result in any detrimental effect on the ecological and conservation status of the critical habitat.* The Project is located in an area that is considered to be entirely covered by critical habitats triggered by several natural habitats and species. However, all the species and natural habitats that trigger the Critical Habitat have been designated on the basis of several very large Ecologically Appropriate Analysis Areas and the residual impact of the Project does not jeopardise the integrity of these species and habitats at the scale of the EAAA (see the CHA report in Annex 2 and the BAP). Nor are the Project's residual impacts on the habitats/species expected to compromise the viability of this critical habitats and/or habitats of high biodiversity value or their associated features at the scale of the EAAA (or greater).
- *Potential to lead to a net reduction in the population of any endangered or critically endangered species, over a reasonable time period.* The proposed road will have a major impact on movement corridors for threatened large animals. In addition, mitigation measures are planned by applying the Lender's mitigation hierarchy, such as wildlife crossings in areas where there is no tunnel, to ensure that the fauna species will not lose their existing connectivity and migration pathways through the region, including threatened species and species of conservation concern. For other species, the road's right-of-way at the bottom of the valleys does not affect specific patches (group of plants of the same species at a specific location) of threatened species that could lead to a net reduction in their numbers. However, additional conservation measures are planned for the threatened species impacted, to ensure that the project does not result in any net loss. **Overall, the Project does not lead to a net reduction in the population of any vulnerable, endangered or critically endangered species over a reasonable period of time.**
- *Stakeholder consultations as per the Lenders standards.* Stakeholders were consulted in accordance with relevant Standards of the EBRD, EIB and ADB. The key nature protection and biodiversity stakeholders were met during a series of consultative meetings (see the details in [Section 2.3.1](#) and the AA in Annex 3); the potential impacts and mitigation measures were discussed with the managers of the protected areas (under the MoE) and biodiversity NGOs. Further consultations were held during the ESIA disclosure period and local EIA approval process.
- *Permission of the project under applicable environmental laws, recognising the priority biodiversity features.* The EIA process was repeatedly undertaken by the RD as its 2018 EIA Permit (Conclusion) expired. The new EIA Conclusion was obtained in November 2023.
- *Project is designed to deliver net gains for critical habitat impacted by it.* The BAP proposes to implement offset actions with a multiplier of 3 of the surface area of the

critical habitats impacted, which will constitute a net gain when these measures are implemented. The details of these measures will be defined in the Biodiversity Offset Management Plan. Appropriate compensation measures have been defined to ensure positive conservation outcomes at the scale of the transboundary Eastern Lesser Caucasus Conservation Landscape identified in the Ecoregional Conservation Plan for the Caucasus, in collaboration with the Zangezur Biosphere Complex SNCO (Net Positive Impact).

- *Project is designed to ensure No Net Loss and potentially a net gain for Priority Biodiversity Features over the long term.* In this Volume 2 and the BAP, appropriate mitigation measures and additional conservation measures are proposed in accordance with the mitigation hierarchy towards PBF, to ensure no net loss of these habitats and species, to achieve measurable conservation outcomes.
- *A robust, appropriately designed and long-term biodiversity monitoring and evaluation programme aimed at assessing the status of the critical habitat will be integrated into the promoter's adaptive management system.* The BAP provides for several sets of additional conservation measures, as well as specific measures to monitor critical habitat triggers at the scale of the mountain massif, including nearby protected areas. These measures will be implemented by the RD.

Annex 1. BACKGROUND BIODIVERSITY REPORT

Provided as a separate document.

Annex 2. CRITICAL HABITAT ASSESSMENT

Provided as a separate document.

Annex 3. APPROPRIATE ASSESSMENT

Provided as a separate document.

Annex 4. PROPOSED LOCATIONS OF WILDLIFE CROSSINGS

As wildlife crossings require adjustments or changes to design, the following categorisation of changes is used and further work between the designers and local communities is required (see ESIA Volume 1 for explanations):

NB: the possibility to accommodate the Category 0, 1 and 2 actions in the updated detailed design was confirmed by the RD as long as these actions do not require changes in the road design criteria.

Category 0 (Cat 0)	No changes, usage of nearest structures is proposed as is, additional stakeholder engagement will be required (where indicated as *)
Category 1 (Cat 1)	mitigation can be implemented without changing the alignment or design criteria.
Category 2 (Cat 2)	mitigation can be implemented by changing the alignment but without changing the design criteria (e.g., changes to speed or gradient)
Category 3 (Cat 3)	mitigation can be implemented only after changing the design criteria (change of speed, gradient), then changing a vertical or horizontal alignment

Wild animal passages proposed		Existing solutions in the 2019 Detailed Design				Solutions as of 27 Feb 2023 - to be included in the ToR for designers ³²
Station	Reason / justification	Station	Evaluation comments per design	Fulfilled by design?	If no, recommendations of the technical team	
14+400 KM	Desirable as the animal use this pathway, but not critical.	12+850 KM	Bridge (BR005) 12+646-13+200, 66.0x31.40m max. between two piers	yes, bridge sizes large enough, but are not at km	Cattle crossing currently provided at logical location and the bridge is further on. Consider shifting cattle crossing at km 14+250 to km 14+400 and enlarge as necessary	Cat 1: move a cattle crossing envisioned in the original design at km 14+250 to km 14+400*
		14+250 KM	Cattle Crossing (CC002) 5.0x3.0m	14+400		
		14+268 KM	RC Culvert (CB033) 3.0x3.0m			
		15+000 KM	Bridge (BR006) 14+950 - 15+250, 28.0x21.8m max. between two piers			
37+250KM	Proposed wildlife crossing or bridge (Green Bridge - GB5)	37+200KM	CW Culvert (CB069) 1.5x1.5m	no, BR018 does not cover the area	Topography does not lend itself well to a bridge (alignment at valley floor level); consider a wildlife overpass	Cat 2: extend BR18 - to redesign within the existing design criteria, so that the animals can pass under it
		37+242KM	CW Culvert (CB070) 3.0x3.0m			
		37+475KM	Bridge (BR018) 37+425 - 37+525, 48.0x14.8m max. between two piers			
38+760KM	Proposed Green Bridge 4	38+840KM	Cattle Crossing (CC03) 5.0x3.0m, L = 30.09m	no, crossing size for larger animals 15 x 3.5 m recommended; openness index too small (H*B/L) = 0.5	Consider adapting cattle crossing size to create a large underpass and avoid a green bridge	Cat 1: enlarge the cattle crossing envisioned in the original design in 80 m and propose fencing to direct animals to the pass
		38+860KM	CW Culvert (CB074) 3.0x3.0m, L = ?			
39+650KM	Proposed bridge	39+499 KM	CW Culvert (CB075) 2.0x2.0m, L = ?	no, culvert sizes are too small,	Very difficult location to create either a bridge or an underpass due to the steepness of the valley. The road is cut into the side of a steep slope.	Cat 0: The animals will find way to cross over the tunnel that is in 105 m
		39+687KM	CW Culvert (CB076) 2.0x2.0m, L=?			
		39+755KM	tunnel portal T005 North portal			
40+700KM	Proposed Green Bridge 3	40+650KM	Bridge (BR019) 28.0x31.40m max. between two piers	yes, bridge size large enough	None, unless the ESIA Consultant really wants a bridge over the road	Cat 0: BR019 is in 50m and wild animals should be able to pass under it
41+300KM	Proposed Green Bridge 2	41+270KM	CW Culvert (CB078) 1.5x1.5m, L=?	no, culvert sizes are too small	Consider a green bridge over the road	Cat 1 - the closest culvert should be enlarged a bit, no way to have an overpass
43+300KM	Proposed Ecoduc if road at the bottom of	43+430KM	RC Culvert (CB084) 1.5x1.5m (above road)	no, culvert sizes are too small	Road is already descending at the maximum gradient; difficult to amend without a	no options - unless the southern part is lowered - CAT 3

³² In late 2023, the RD confirmed that the FIDIC Yellow Book would be used by the RD to allow to address all proposed mitigation in relation to wildlife passages.

Wild animal passages proposed		Existing solutions in the 2019 Detailed Design				Solutions as of 27 Feb 2023 - to be included in the ToR for designers ³²
Station	Reason / justification	Station	Evaluation comments per design	Fulfilled by design?	If no, recommendations of the technical team	
	the valley to join the rocky areas		alignment?), L = 19.13m		change in design parameters. The road is cut into the side of a steep slope.	Alternative options were further discussed such as a bridge, and the Construction Contractor will look into site-specific solutions
47+850KM	Proposed bridge	47+893KM	RC Culvert (CB094) 1.5x1.5m, L = ?	no, crossing size for larger animals 15 x 3.5 m recommended; openness index too small (H*B/L) = 0.38,	Underpass is possible. Elevated road structure instead of large embankment should be considered	Cat 1 - Adjust the nearest cattle crossing in 70 m to be used by the animals + direct them OR
		47+921KM	Cattle Crossing (CC04) 5.0x3.0m, L = 40.12m			Cat 2 - to move the cattle crossing down the hill by 50m - (re-designing)
48+600KM	Proposed Green Bridge 1	48+598KM	CW Culvert (CB097) 3.0x3.0m , L = ?	no, culvert sizes are too small	Consider an underpass in discussion with ESIA Consultant	Cat 1 - enlarge the culvert to be used by the animals
50+000KM	Proposed bridge	49+452KM	Bridge (BR021) 66.0x30.30m max. between two piers	No	The south side of the alignment is in cut so a bridge on the current alignment is not possible; moving the road out of the hillside would enable a bridge	Cat 1 - Adjust the nearest culvert in 120 m to be used by the animals + measures needed to direct them OR
		49+878KM	R/C Culvert (CB101) 2.0x2.0m (above road alignment?)			Cat 2 – moving the road out of the hillside would enable a bridge